

# LM4040 Precision Micropower Shunt Voltage Reference

## 1 Features

- Fixed output voltages of 2.048V, 2.5V, 3V, 4.096V, 5V, 8.192V, and 10V
- Tight output tolerances and low temperature coefficient
  - Maximum 0.1%, 100ppm/°C – A Grade
  - Maximum 0.2%, 100ppm/°C – B Grade
  - Maximum 0.5%, 100ppm/°C – C Grade
  - Maximum 1.0%, 150ppm/°C – D Grade
- Low output noise: 35μV<sub>RMS</sub> typical
- Wide operating current range: 45μA typical to 15mA
- Stable with all capacitive loads; no output capacitor required
- Available in extended temperature range: –40°C to 125°C

## 2 Applications

- [Data-Acquisition Systems](#)
- [Energy Infrastructure](#)
- [Analog Input Module](#)
- [Field Transmitters](#)
- [Precision Audio](#)
- [Automotive Electronics](#)

## 3 Description

The LM4040 series of shunt voltage references are versatile, easy-to-use references that cater to a vast array of applications. The 2-pin fixed-output device requires no external capacitors for operation and is stable with all capacitive loads. Additionally, the reference offers low dynamic impedance, low noise, and low temperature coefficient to maintain a stable output voltage over a wide range of operating currents and temperatures. The LM4040 uses fuse and Zener-zap reverse breakdown voltage trim during wafer sort to offer four output voltage tolerances, ranging from 0.1% (maximum) for the A grade to 1% (maximum) for the D grade. Thus, a great deal of flexibility is offered to designers in choosing the best cost-to-performance ratio for their applications.

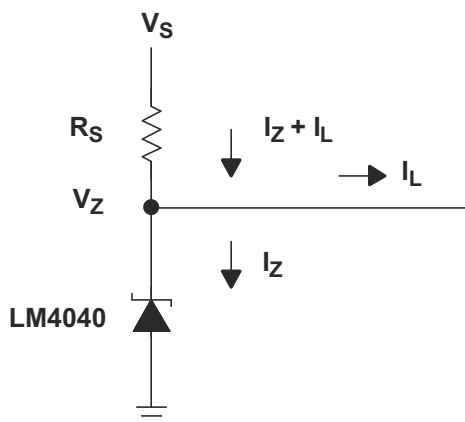
Packaged in space-saving SC-70 and SOT-23-3 packages and requiring a minimum current of 45μA (typical), the LM4040 also is designed for portable applications. The LM4040xI is characterized for operation over an ambient temperature range of –40°C to 85°C. The LM4040xQ is characterized for operation over an ambient temperature range of –40°C to 125°C.

### Device Information

| PART NUMBER | PACKAGE (PIN) <sup>(1)</sup> | BODY SIZE (NOM) <sup>(2)</sup> |
|-------------|------------------------------|--------------------------------|
| LM4040      | SOT-23 (3)                   | 2.92mm × 1.30mm                |
|             | SC70 (6)                     | 2.00mm × 1.25mm                |

(1) For all available packages, see the orderable addendum at the end of the data sheet.

(2) The package size (length × width) is a nominal value and includes pins, where applicable.



**Simplified Schematic**



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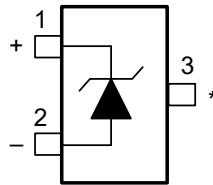
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## 4 Device Comparison Table

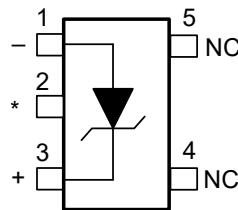
| T <sub>A</sub> | DEVICE GRADE                                                                | V <sub>KA</sub> | ORDERABLE <sup>(1)</sup> PART NUMBER |
|----------------|-----------------------------------------------------------------------------|-----------------|--------------------------------------|
| –40°C to 85°C  | A grade:<br>0.1% initial accuracy and<br>100 ppm/°C temperature coefficient | 2.048V          | LM4040A20I                           |
|                |                                                                             | 2.5V            | LM4040A25I                           |
|                |                                                                             | 3V              | LM4040A30I                           |
|                |                                                                             | 4.096V          | LM4040A41I                           |
|                |                                                                             | 5V              | LM4040A50I                           |
|                |                                                                             | 8.192V          | LM4040A82I                           |
|                |                                                                             | 10V             | LM4040A10I                           |
|                | B grade:<br>0.2% initial accuracy and<br>100 ppm/°C temperature coefficient | 2.048V          | LM4040B20I                           |
|                |                                                                             | 2.5V            | LM4040B25I                           |
|                |                                                                             | 3V              | LM4040B30I                           |
|                |                                                                             | 4.096V          | LM4040B41I                           |
|                |                                                                             | 5V              | LM4040B50I                           |
|                |                                                                             | 8.192V          | LM4040B82I                           |
|                |                                                                             | 10V             | LM4040B10I                           |
| –40°C to 85°C  | C grade:<br>0.5% initial accuracy and<br>100 ppm/°C temperature coefficient | 2.048V          | LM4040C20I                           |
|                |                                                                             | 2.5V            | LM4040C25I                           |
|                |                                                                             | 3V              | LM4040C30I                           |
|                |                                                                             | 4.096V          | LM4040C41I                           |
|                |                                                                             | 5V              | LM4040C50I                           |
|                |                                                                             | 8.192V          | LM4040C82I                           |
| –40°C to 85°C  | D grade:<br>1.0% initial accuracy and<br>150 ppm/°C temperature coefficient | 10V             | LM4040C10I                           |
|                |                                                                             | 2.048V          | LM4040D20I                           |
|                |                                                                             | 2.5V            | LM4040D25I                           |
|                |                                                                             | 3V              | LM4040D30I                           |
|                |                                                                             | 4.096V          | LM4040D41I                           |
|                |                                                                             | 5V              | LM4040D50I                           |
| –40°C to 125°C | C grade:<br>0.5% initial accuracy and<br>100 ppm/°C temperature coefficient | 8.192V          | LM4040D82I                           |
|                |                                                                             | 10V             | LM4040D10I                           |
|                |                                                                             | 2.048V          | LM4040C20Q                           |
|                |                                                                             | 2.5V            | LM4040C25Q                           |
|                | D grade:<br>1.0% initial accuracy and<br>150 ppm/°C temperature coefficient | 3V              | LM4040C30Q                           |
|                |                                                                             | 5V              | LM4040C50Q                           |
|                |                                                                             | 2.048V          | LM4040D20Q                           |
|                |                                                                             | 2.5V            | LM4040D25Q                           |
|                |                                                                             | 3V              | LM4040D30Q                           |
|                |                                                                             | 5V              | LM4040D50Q                           |

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).

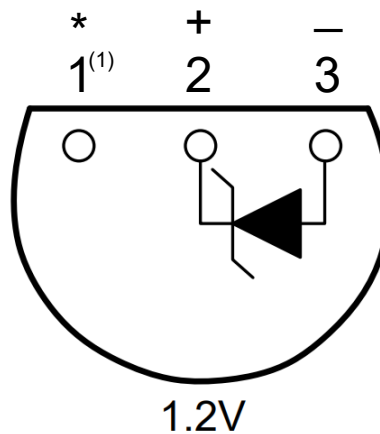
## 5 Pin Configuration and Functions



**Figure 5-1. DBZ Package  
3-Pin SOT-23  
Top View**



**Figure 5-2. DCK Package  
5-Pin SC70  
Top View**



**Figure 5-3. LP Package  
3-Pin TO-92  
Bottom View**

### Pin Functions

| NAME    | PIN |      |       | TYPE | DESCRIPTION                                     |
|---------|-----|------|-------|------|-------------------------------------------------|
|         | DBZ | DCK  | TO-92 |      |                                                 |
| CATHODE | 1   | 3    | 2     | I/O  | Shunt Current/Voltage input                     |
| ANODE   | 2   | 1    | 3     | O    | Common pin, normally connected to ground        |
| NC      | —   | 4, 5 | —     | I    | No Internal Connection                          |
| *       | 3   | 2    | 1     | I    | Must float or connect to anode <sup>(1)</sup> . |

(1) In applications with high electromagnetic interference (for example, when placed near transformers or other electromagnetic sources) or significant high-frequency switching noise, TI recommends connecting this pin to the anode.

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|           |                                        | MIN | MAX | UNIT |
|-----------|----------------------------------------|-----|-----|------|
| $I_Z$     | Continuous cathode current             | –10 | 25  | mA   |
| $T_J$     | Operating virtual junction temperature |     | 150 | °C   |
| $T_{stg}$ | Storage temperature range              | –65 | 150 | °C   |

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under [Section 6.3](#) is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

### 6.2 ESD Ratings

|             |                         |                                                                                          | VALUE | UNIT |
|-------------|-------------------------|------------------------------------------------------------------------------------------|-------|------|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins <sup>(1)</sup>              | ±2000 | V    |
|             |                         | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins <sup>(2)</sup> | ±500  |      |

- (1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.  
(2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

### 6.3 Recommended Operating Conditions

|       |                      |            | MIN            | MAX | UNIT |
|-------|----------------------|------------|----------------|-----|------|
| $I_Z$ | Cathode current      |            | <sup>(1)</sup> | 15  | mA   |
| $T_A$ | Free-air temperature | LM4040xxxI | –40            | 85  | °C   |
|       |                      | LM4040xxxQ | –40            | 125 |      |

- (1) See parametric tables

### 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                        | LM4040 |        | UNIT |
|-------------------------------|----------------------------------------|--------|--------|------|
|                               |                                        | DBZ    | DCK    |      |
|                               |                                        | 3 PINS | 5 PINS |      |
| $R_{\theta JA}$               | Junction-to-ambient thermal resistance | 206    | 252    | °C/W |

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

## 6.5 LM4040A20I, LM4040B20I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040A20I |          |           | LM4040B20I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 2.048    |           |            | 2.048    |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | -2         |          | 2         | -4.1       |          | 4.1       | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | -15        |          | 15        | -17        |          | 17        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 45       | 75        |            | 45       | 75        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 80        |            |          | 80        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 100$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.3      | 0.8       |            | 0.3      | 0.8       | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 1         |            |          | 1         |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 2.5      | 6         |            | 2.5      | 6         |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 8         |            |          | 8         |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.3      | 0.8       |            | 0.3      | 0.8       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 35       |           |            | 35       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:
- A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$
- The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:
- C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
 D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$
- Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.6 LM4040C20I, LM4040D20I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                  | $T_A$                | LM4040C20I |          |           | LM4040D20I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                  |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                           | $25^{\circ}\text{C}$ |            | 2.048    |           |            | 2.048    |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                           | $25^{\circ}\text{C}$ | -10        |          | 10        | -20        |          | 20        | mV                         |
|                                 |                                                                  |                                                                                                  | Full range           | -23        |          | 23        | -40        |          | 40        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                  | $25^{\circ}\text{C}$ |            | 45       | 75        |            | 45       | 75        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                  | Full range           |            |          | 80        |            |          | 80        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                              | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                               | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
|                                 |                                                                  |                                                                                                  | Full range           |            |          | $\pm 100$ |            |          | $\pm 150$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                           | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                            | $25^{\circ}\text{C}$ |            | 0.3      | 0.8       |            | 0.3      | 1         | mV                         |
|                                 |                                                                  |                                                                                                  | Full range           |            |          | 1         |            |          | 1.2       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                 | $25^{\circ}\text{C}$ |            | 2.5      | 6         |            | 2.5      | 8         |                            |
|                                 |                                                                  |                                                                                                  | Full range           |            |          | 8         |            |          | 10        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ , $I_{AC} = 0.1 I_Z$                                     | $25^{\circ}\text{C}$ |            | 0.3      | 0.9       |            | 0.3      | 1.1       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$                                  | $25^{\circ}\text{C}$ |            | 35       |           |            | 35       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ , $T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ , $I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                      |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:
- A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$
- The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:
- C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
 D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$
- Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.7 LM4040C20Q, LM4040D20Q Electrical Characteristics

at extended temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040C20Q |          |           | LM4040D20Q |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 2.048    |           |            | 2.048    |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | -10        |          | 10        | -20        |          | 20        | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | -30        |          | 30        | -50        |          | 50        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 45       | 75        |            | 45       | 75        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 80        |            |          | 80        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 150$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.3      | 0.8       |            | 0.3      | 1         | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 1         |            |          | 1.2       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 2.5      | 6         |            | 2.5      | 8         |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 8         |            |          | 10        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.3      | 0.9       |            | 0.3      | 1.1       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 35       |           |            | 35       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:  
A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:  
C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.8 LM4040A25I, LM4040B25I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040A25I |          |           | LM4040B25I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 2.5      |           |            | 2.5      |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | -2.5       |          | 2.5       | -5         |          | 5         | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | -19        |          | 19        | -21        |          | 21        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 45       | 75        |            | 45       | 75        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 80        |            |          | 80        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 100$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.3      | 0.8       |            | 0.3      | 0.8       | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 1         |            |          | 1         |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 2.5      | 6         |            | 2.5      | 6         |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 8         |            |          | 8         |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.3      | 0.8       |            | 0.3      | 0.8       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 35       |           |            | 35       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:  
A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:  
C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.9 LM4040C25I, LM4040D25I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040C25I |          |           | LM4040D25I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 2.5      |           |            | 2.5      |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | -12        |          | 12        | -25        |          | 25        | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | -29        |          | 29        | -49        |          | 49        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 45       | 75        |            | 45       | 75        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 80        |            |          | 80        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 150$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.3      | 0.8       |            | 0.3      | 1         | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 1         |            |          | 1.2       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 2.5      | 6         |            | 2.5      | 8         |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 8         |            |          | 10        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.3      | 0.9       |            | 0.3      | 1.1       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 35       |           |            | 35       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:  
A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:  
C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.10 LM4040C25Q, LM4040D25Q Electrical Characteristics

at extended temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                                                                                    | TEST CONDITIONS                                                                                  | $T_A$                | LM4040C25Q |          |           | LM4040D25Q |          |           | UNIT                       |
|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                                                                              |                                                                                                  |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$ Reverse breakdown voltage                                                              | $I_Z = 100\mu\text{A}$                                                                           | $25^{\circ}\text{C}$ |            | 2.5      |           |            | 2.5      |           | V                          |
| $\Delta V_Z$ Reverse breakdown voltage tolerance                                             | $I_Z = 100\mu\text{A}$                                                                           | $25^{\circ}\text{C}$ | -12        |          | 12        | -25        |          | 25        | mV                         |
|                                                                                              |                                                                                                  | Full range           | -38        |          | 38        | -63        |          | 63        |                            |
| $I_{Z,\text{min}}$ Minimum cathode current                                                   |                                                                                                  | $25^{\circ}\text{C}$ |            | 45       | 75        |            | 45       | 75        | $\mu\text{A}$              |
|                                                                                              |                                                                                                  | Full range           |            |          | 80        |            |          | 80        |                            |
| $\alpha_{VZ}$ Average temperature coefficient of reverse breakdown voltage (2)               | $I_Z = 10\text{mA}$                                                                              | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           | ppm/ $^{\circ}\text{C}$    |
|                                                                                              | $I_Z = 1\text{mA}$                                                                               | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
|                                                                                              |                                                                                                  | Full range           |            |          | $\pm 100$ |            |          | $\pm 150$ |                            |
|                                                                                              | $I_Z = 100\mu\text{A}$                                                                           | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ Reverse breakdown voltage change with cathode current change | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                            | $25^{\circ}\text{C}$ |            | 0.3      | 0.8       |            | 0.3      | 1         | mV                         |
|                                                                                              |                                                                                                  | Full range           |            |          | 1         |            |          | 1.2       |                            |
|                                                                                              | $1\text{mA} < I_Z < 15\text{mA}$                                                                 | $25^{\circ}\text{C}$ |            | 2.5      | 6         |            | 2.5      | 8         |                            |
|                                                                                              |                                                                                                  | Full range           |            |          | 8         |            |          | 10        |                            |
| $Z_Z$ Reverse dynamic impedance                                                              | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ , $I_{AC} = 0.1 I_Z$                                     | $25^{\circ}\text{C}$ |            | 0.3      | 0.9       |            | 0.3      | 1.1       | $\Omega$                   |
| $e_N$ Wideband noise                                                                         | $I_Z = 100\mu\text{A}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$                                  | $25^{\circ}\text{C}$ |            | 35       |           |            | 35       |           | $\mu\text{V}_{\text{RMS}}$ |
| Long-term stability of reverse breakdown voltage                                             | $t = 1000\text{h}$ , $T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ , $I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$ Thermal hysteresis(1)                                                      | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                      |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\max\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\max\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\max\Delta T = 65^{\circ}\text{C}$  is shown below:  
 A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 The total overtemperature tolerance for the different grades in the extended temperature range where  $\max\Delta T = 100^{\circ}\text{C}$  is shown below:  
 C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
 D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
 Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.11 LM4040A30I, LM4040B30I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040A30I |          |           | LM4040B30I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 3        |           |            | 3        |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | –3         |          | 3         | –6         |          | 6         | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | –22        |          | 22        | –26        |          | 26        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 47       | 77        |            | 47       | 77        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 82        |            |          | 82        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 100$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.6      | 0.8       |            | 0.6      | 0.8       | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 1.1       |            |          | 1.1       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 2.7      | 6         |            | 2.7      | 6         |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 9         |            |          | 9         |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.4      | 0.9       |            | 0.4      | 0.9       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 35       |           |            | 35       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:  
A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:  
C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.12 LM4040C30I, LM4040D30I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040C30I |          |           | LM4040D30I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 3        |           |            | 3        |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | –15        |          | 15        | –30        |          | 30        | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | –34        |          | 34        | –59        |          | 59        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 45       | 77        |            | 45       | 77        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 82        |            |          | 82        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 150$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.4      | 0.8       |            | 1.4      | 1         | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 1.1       |            |          | 1.3       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 2.7      | 6         |            | 2.7      | 8         |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 9         |            |          | 11        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.4      | 0.9       |            | 0.4      | 1.2       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 35       |           |            | 35       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:  
A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:  
C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.13 LM4040C30Q, LM4040D30Q Electrical Characteristics

at extended temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040C30Q |          |           | LM4040D30Q |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 3        |           |            | 3        |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | –15        |          | 15        | –30        |          | 30        | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | –45        |          | 45        | –75        |          | 75        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 47       | 77        |            | 47       | 77        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 82        |            |          | 82        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 150$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 15$ |           |            | $\pm 15$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.4      | 0.8       |            | 0.4      | 1.1       | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 1.1       |            |          | 1.3       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 2.7      | 6         |            | 2.7      | 8         |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 9         |            |          | 11        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.4      | 0.9       |            | 0.4      | 1.2       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 35       |           |            | 35       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:  
A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:  
C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.14 LM4040A41I, LM4040B41I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                  | $T_A$                | LM4040A41I |          |           | LM4040B41I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                  |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                           | $25^{\circ}\text{C}$ |            | 4.096    |           |            | 4.096    |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                           | $25^{\circ}\text{C}$ | -4.1       |          | 4.1       | -8.2       |          | 8.2       | mV                         |
|                                 |                                                                  |                                                                                                  | Full range           | -31        |          | 31        | -35        |          | 35        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                  | $25^{\circ}\text{C}$ |            | 50       | 83        |            | 50       | 83        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                  | Full range           |            |          | 88        |            |          | 88        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                              | $25^{\circ}\text{C}$ |            | $\pm 30$ |           |            | $\pm 30$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                               | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
|                                 |                                                                  |                                                                                                  | Full range           |            |          | $\pm 100$ |            |          | $\pm 100$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                           | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                            | $25^{\circ}\text{C}$ |            | 0.5      | 0.9       |            | 0.5      | 0.9       | mV                         |
|                                 |                                                                  |                                                                                                  | Full range           |            |          | 1.2       |            |          | 1.2       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                 | $25^{\circ}\text{C}$ |            | 3        | 7         |            | 3        | 7         |                            |
|                                 |                                                                  |                                                                                                  | Full range           |            |          | 10        |            |          | 10        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ , $I_{AC} = 0.1 I_Z$                                     | $25^{\circ}\text{C}$ |            | 0.5      | 1         |            | 0.5      | 1         | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$                                  | $25^{\circ}\text{C}$ |            | 80       |           |            | 80       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ , $T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ , $I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                      |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:
- A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$
- The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:
- C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
 D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$
- Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.15 LM4040C41I, LM4040D41I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040C41I |          |           | LM4040D41I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 4.096    |           |            | 4.096    |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | -20        |          | 20        | -41        |          | 41        | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | -47        |          | 47        | -81        |          | 81        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 50       | 83        |            | 50       | 83        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 88        |            |          | 88        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 30$ |           |            | $\pm 30$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 150$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.5      | 0.9       |            | 0.5      | 1.2       | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 1.2       |            |          | 1.5       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 3        | 7         |            | 3        | 9         |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 10        |            |          | 13        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.5      | 1         |            | 0.5      | 1.3       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 80       |           |            | 80       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:  
A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:  
C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.16 LM4040A50I, LM4040B50I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040A50I |          |           | LM4040B50I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 5        |           |            | 5        |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | –5         |          | 5         | –10        |          | 10        | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | –38        |          | 38        | –43        |          | 43        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 65       | 89        |            | 65       | 89        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 95        |            |          | 95        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 30$ |           |            | $\pm 30$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 100$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.5      | 1         |            | 0.5      | 1         | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 1.4       |            |          | 1.4       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 3.5      | 8         |            | 3.5      | 8         |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 12        |            |          | 12        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.5      | 1.1       |            | 0.5      | 1.1       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 80       |           |            | 80       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:  
A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:  
C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.17 LM4040C50I, LM4040D50I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040C50I |          |           | LM4040D50I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 5        |           |            | 5        |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | –25        |          | 25        | –50        |          | 50        | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | –58        |          | 58        | –99        |          | 99        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 65       | 89        |            | 65       | 89        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 95        |            |          | 95        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 30$ |           |            | $\pm 30$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 150$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.5      | 1         |            | 0.5      | 1.3       | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 1.4       |            |          | 1.8       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 3.5      | 8         |            | 3.5      | 10        |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 12        |            |          | 15        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.5      | 1.1       |            | 0.5      | 1.5       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 80       |           |            | 80       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 100\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:
- A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$
- The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:
- C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
 D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$
- Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.18 LM4040C50Q, LM4040D50Q Electrical Characteristics

at extended temperature range, full-range  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                              | $T_A$              | LM4040C50Q |          |           | LM4040D50Q |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------------------------------|--------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                              |                    | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 100\mu\text{A}$                                                                       | $25^\circ\text{C}$ |            | 5        |           |            | 5        |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 100\mu\text{A}$                                                                       | $25^\circ\text{C}$ | –25        |          | 25        | –50        |          | 50        | mV                         |
|                                 |                                                                  |                                                                                              | Full range         | –75        |          | 75        | –125       |          | 125       |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                              | $25^\circ\text{C}$ |            | 65       | 89        |            | 65       | 89        | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                              | Full range         |            |          | 95        |            |          | 95        |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                          | $25^\circ\text{C}$ |            | $\pm 30$ |           |            | $\pm 30$ |           | ppm/ $^\circ\text{C}$      |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                           | $25^\circ\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
|                                 |                                                                  |                                                                                              | Full range         |            |          | $\pm 100$ |            |          | $\pm 150$ |                            |
|                                 |                                                                  | $I_Z = 100\mu\text{A}$                                                                       | $25^\circ\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                        | $25^\circ\text{C}$ |            | 0.5      | 1         |            | 0.5      | 1         | mV                         |
|                                 |                                                                  |                                                                                              | Full range         |            |          | 1.4       |            |          | 1.8       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                             | $25^\circ\text{C}$ |            | 3.5      | 8         |            | 3.5      | 8         |                            |
|                                 |                                                                  |                                                                                              | Full range         |            |          | 12        |            |          | 12        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ , $I_{AC} = 0.1 I_Z$                                 | $25^\circ\text{C}$ |            | 0.5      | 1.1       |            | 0.5      | 1.1       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 100\mu\text{A}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$                              | $25^\circ\text{C}$ |            | 80       |           |            | 80       |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ , $T_A = 25^\circ\text{C} \pm 0.1^\circ\text{C}$ , $I_Z = 100\mu\text{A}$ |                    |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$                                      |                    |            | 0.08%    |           |            | 0.08%    |           | —                          |

- Thermal hysteresis is defined as the difference in voltage measured at  $25^\circ\text{C}$  after cycling to temperature  $-40^\circ\text{C}$  and the  $25^\circ\text{C}$  measurement after cycling to temperature  $125^\circ\text{C}$ .
- The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^\circ\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^\circ\text{C}$  is shown below:  
 A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^\circ\text{C} \times 65^\circ\text{C}$   
 B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^\circ\text{C} \times 65^\circ\text{C}$   
 C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^\circ\text{C} \times 65^\circ\text{C}$   
 D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^\circ\text{C} \times 65^\circ\text{C}$   
 The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^\circ\text{C}$  is shown below:  
 C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^\circ\text{C} \times 100^\circ\text{C}$   
 D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^\circ\text{C} \times 100^\circ\text{C}$   
 Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.19 LM4040A82I, LM4040B82I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040A82I |          |           | LM4040B82I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 150\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 8.192    |           |            | 8.192    |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 150\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | -8.2       |          | 8.2       | -16        |          | 16        | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | -61        |          | 61        | -70        |          | 70        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 67       | 106       |            | 67       | 106       | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 110       |            |          | 110       |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 40$ |           |            | $\pm 40$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 100$ |                            |
|                                 |                                                                  | $I_Z = 150\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.6      | 1.3       |            | 0.6      | 1.6       | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 2.5       |            |          | 2.5       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 7        | 10        |            | 7        | 10        |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 18        |            |          | 18        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.6      | 1.5       |            | 0.6      | 1.5       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 150\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 130      |           |            | 130      |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 150\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:
- A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$
- The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:
- C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
 D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$
- Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.20 LM4040C82I, LM4040D82I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                  | $T_A$                | LM4040C82I |          |           | LM4040D82I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                  |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 150\mu\text{A}$                                                                           | $25^{\circ}\text{C}$ |            | 8.192    |           |            | 8.192    |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 150\mu\text{A}$                                                                           | $25^{\circ}\text{C}$ | –41        |          | 41        | –82        |          | 82        | mV                         |
|                                 |                                                                  |                                                                                                  | Full range           | –94        |          | 94        | –162       |          | 162       |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                  | $25^{\circ}\text{C}$ |            | 67       | 106       |            | 67       | 111       | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                  | Full range           |            |          | 110       |            |          | 115       |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                              | $25^{\circ}\text{C}$ |            | $\pm 40$ |           |            | $\pm 40$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                               | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
|                                 |                                                                  |                                                                                                  | Full range           |            |          | $\pm 100$ |            |          | $\pm 150$ |                            |
|                                 |                                                                  | $I_Z = 150\mu\text{A}$                                                                           | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                            | $25^{\circ}\text{C}$ |            | 0.6      | 1.3       |            | 0.6      | 1.7       | mV                         |
|                                 |                                                                  |                                                                                                  | Full range           |            |          | 2.5       |            |          | 3         |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                 | $25^{\circ}\text{C}$ |            | 7        | 10        |            | 7        | 15        |                            |
|                                 |                                                                  |                                                                                                  | Full range           |            |          | 18        |            |          | 24        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ , $I_{AC} = 0.1 I_Z$                                     | $25^{\circ}\text{C}$ |            | 0.6      | 1.5       |            | 0.6      | 1.9       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 150\mu\text{A}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$                                  | $25^{\circ}\text{C}$ |            | 130      |           |            | 130      |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ , $T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ , $I_Z = 150\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                      |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:
- A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$
- The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:
- C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
 D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$
- Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.21 LM4040A10I, LM4040B10I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040A10I |          |           | LM4040B10I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 150\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 10       |           |            | 10       |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 150\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | -10        |          | 10        | -20        |          | 20        | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | -75        |          | 75        | -85        |          | 85        |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 75       | 120       |            | 75       | 120       | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 125       |            |          | 125       |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 40$ |           |            | $\pm 40$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 100$ |                            |
|                                 |                                                                  | $I_Z = 150\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.8      | 1.5       |            | 0.8      | 1.5       | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 3.8       |            |          | 3.8       |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 8        | 14        |            | 8        | 14        |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 24        |            |          | 24        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.7      | 1.7       |            | 0.7      | 1.7       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 150\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 180      |           |            | 180      |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 150\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:
- A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$
- The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:
- C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
 D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$
- Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.22 LM4040C10I, LM4040D10I Electrical Characteristics

at industrial temperature range, full-range  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (unless otherwise noted)

| PARAMETER                       |                                                                  | TEST CONDITIONS                                                                                        | $T_A$                | LM4040C10I |          |           | LM4040D10I |          |           | UNIT                       |
|---------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|------------|----------|-----------|------------|----------|-----------|----------------------------|
|                                 |                                                                  |                                                                                                        |                      | MIN        | TYP      | MAX       | MIN        | TYP      | MAX       |                            |
| $V_Z$                           | Reverse breakdown voltage                                        | $I_Z = 150\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | 10       |           |            | 10       |           | V                          |
| $\Delta V_Z$                    | Reverse breakdown voltage tolerance                              | $I_Z = 150\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ | –50        |          | 50        | –100       |          | 100       | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           | –115       |          | 115       | –198       |          | 198       |                            |
| $I_{Z,\text{min}}$              | Minimum cathode current                                          |                                                                                                        | $25^{\circ}\text{C}$ |            | 75       | 120       |            | 75       | 130       | $\mu\text{A}$              |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 125       |            |          | 135       |                            |
| $\alpha_{VZ}$                   | Average temperature coefficient of reverse breakdown voltage (2) | $I_Z = 10\text{mA}$                                                                                    | $25^{\circ}\text{C}$ |            | $\pm 40$ |           |            | $\pm 40$ |           | ppm/ $^{\circ}\text{C}$    |
|                                 |                                                                  | $I_Z = 1\text{mA}$                                                                                     | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | $\pm 100$ |            |          | $\pm 150$ |                            |
|                                 |                                                                  | $I_Z = 150\mu\text{A}$                                                                                 | $25^{\circ}\text{C}$ |            | $\pm 20$ |           |            | $\pm 20$ |           |                            |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change     | $I_{Z,\text{min}} < I_Z < 1\text{mA}$                                                                  | $25^{\circ}\text{C}$ |            | 0.8      | 1.5       |            | 0.8      | 2         | mV                         |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 3.8       |            |          | 4         |                            |
|                                 |                                                                  | $1\text{mA} < I_Z < 15\text{mA}$                                                                       | $25^{\circ}\text{C}$ |            | 8        | 14        |            | 8        | 18        |                            |
|                                 |                                                                  |                                                                                                        | Full range           |            |          | 24        |            |          | 29        |                            |
| $Z_Z$                           | Reverse dynamic impedance                                        | $I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ ,<br>$I_{AC} = 0.1 I_Z$                                        | $25^{\circ}\text{C}$ |            | 0.7      | 1.7       |            | 0.7      | 2.3       | $\Omega$                   |
| $e_N$                           | Wideband noise                                                   | $I_Z = 150\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                     | $25^{\circ}\text{C}$ |            | 180      |           |            | 180      |           | $\mu\text{V}_{\text{RMS}}$ |
|                                 | Long-term stability of reverse breakdown voltage                 | $t = 1000\text{h}$ ,<br>$T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ ,<br>$I_Z = 150\mu\text{A}$ |                      |            | 120      |           |            | 120      |           | ppm                        |
| $V_{\text{HYST}}$               | Thermal hysteresis(1)                                            | $\Delta T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$                                            |                      |            | 0.08%    |           |            | 0.08%    |           | —                          |

- (1) Thermal hysteresis is defined as the difference in voltage measured at  $25^{\circ}\text{C}$  after cycling to temperature  $-40^{\circ}\text{C}$  and the  $25^{\circ}\text{C}$  measurement after cycling to temperature  $125^{\circ}\text{C}$ .
- (2) The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance  $\pm[(\Delta V_R/\Delta T)(\text{max}\Delta T)(V_R)]$ . Where,  $\Delta V_R/\Delta T$  is the  $V_R$  temperature coefficient,  $\text{max}\Delta T$  is the maximum difference in temperature from the reference point of  $25^{\circ}\text{C}$  to  $T_{\text{MIN}}$  or  $T_{\text{MAX}}$ , and  $V_R$  is the reverse breakdown voltage. The total overtemperature tolerance for the different grades in the industrial temperature range where  $\text{max}\Delta T = 65^{\circ}\text{C}$  is shown below:
- A-grade:  $\pm 0.75\% = \pm 0.1\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 B-grade:  $\pm 0.85\% = \pm 0.2\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 C-grade:  $\pm 1.15\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$   
 D-grade:  $\pm 1.98\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 65^{\circ}\text{C}$
- The total overtemperature tolerance for the different grades in the extended temperature range where  $\text{max}\Delta T = 100^{\circ}\text{C}$  is shown below:
- C-grade:  $\pm 1.5\% = \pm 0.5\% \pm 100\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$   
 D-grade:  $\pm 2.5\% = \pm 1.0\% \pm 150\text{ppm}/^{\circ}\text{C} \times 100^{\circ}\text{C}$
- Therefore, as an example, the A-grade 2.5V LM4040 has an overtemperature Reverse Breakdown Voltage tolerance of  $\pm 2.5\text{V} \times 0.75\% = \pm 19\text{mV}$ .

## 6.23 Typical Characteristics

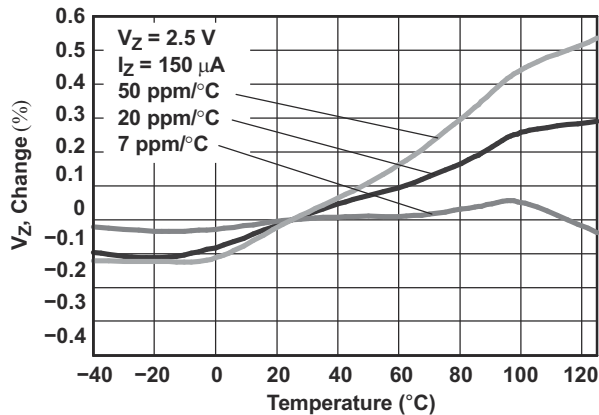


Figure 6-1. Temperature Drift for Different Average Temperature Coefficients

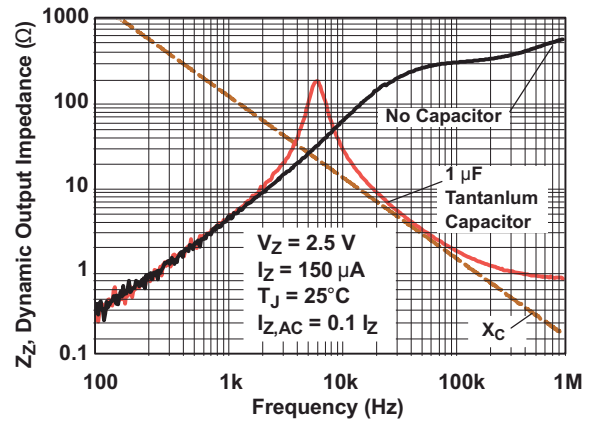


Figure 6-2. Output Impedance vs Frequency

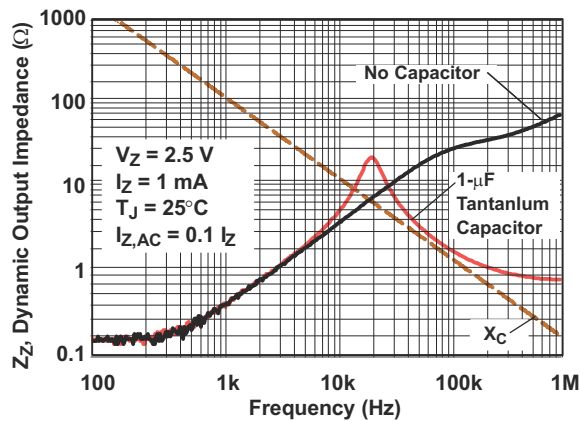


Figure 6-3. Output Impedance vs Frequency

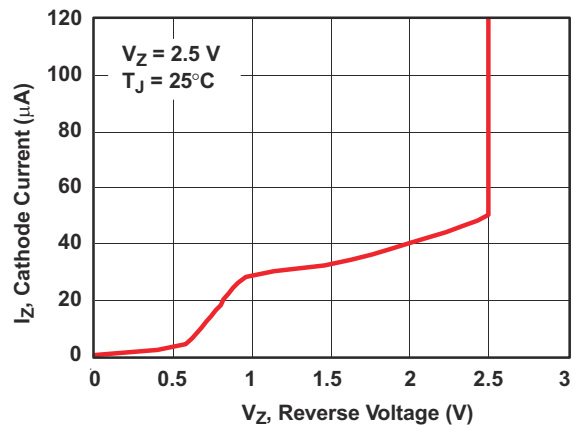


Figure 6-4. Cathode Current vs. Reverse Voltage

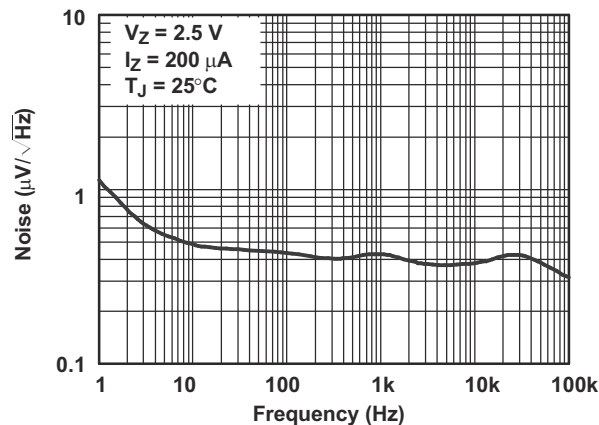


Figure 6-5. Noise Voltage vs Frequency

## 7 Detailed Description

### 7.1 Overview

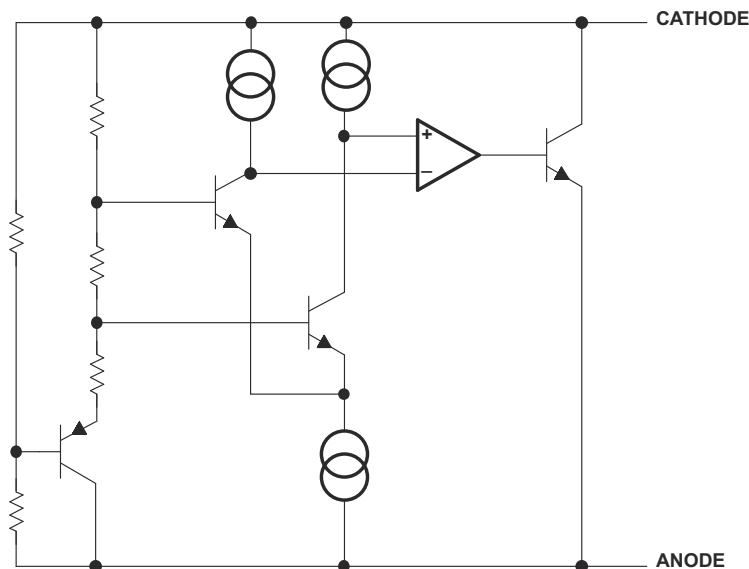
The LM4040 is a precision micro-power curvature-corrected bandgap shunt voltage reference. The LM4040 has been designed for stable operation without the need of an external capacitor connected between the “+” pin and the “–” pin. If, however, a bypass capacitor is used, the LM4040 remains stable.

LM4040 offers several fixed reverse breakdown voltages: 2.048V, 2.500V, 3.000V, 4.096V, 5.000V, 6.000, 8.192V, and 10.000V. The minimum operating current increases from 60µA for the LM4040-N-2.048 and LM4040-N-2.5 to 100µA for the 10.0V LM4040. All versions have a maximum operating current of 15mA.

Each reverse voltage options can be purchased with initial tolerances (at 25°C) of 0.1%, 0.2%, 0.5% and 1.0%. These reference options are denoted by A (0.1%), B (0.2%), C (0.5%) and D for (1.0%).

The LM4040xxxI devices are characterized for operation from –40°C to 85°C, and the LM4040xxxQ devices are characterized for operation from –40°C to 125°C.

### 7.2 Functional Block Diagram



### 7.3 Feature Description

A temperature compensated band gap voltage reference controls high gain amplifier and shunt pass element to maintain a nearly constant voltage between cathode and anode. Regulation occurs after a minimum current is provided to power the voltage divider and amplifier. Internal frequency compensation provides a stable loop for all capacitor loads. Floating shunt design is useful for both positive and negative regulation applications.

### 7.4 Device Functional Modes

#### 7.4.1 Shunt Reference

LM4040 does not operate in one mode, which is as a fixed voltage reference that cannot be adjusted. LM4040 does offer various Reverse Voltage options that have unique electrical characteristics detailed in [Section 6](#).

For a proper Reverse Voltage to be developed, current must be sourced into the cathode of LM4040. The minimum current needed for proper regulation is denoted in [Section 6](#) as  $I_{Z,min}$ .

## 8 Applications and Implementation

### Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

### 8.1 Application Information

LM4040 is a well known industry standard device used in several applications and end equipment where a reference is required. Below describes this device being used in a data acquisition system. Analog to Digital conversion systems are the most common applications to use LM4040 due to the devices low reference tolerance which allows high precision in these systems.

### 8.2 Typical Applications

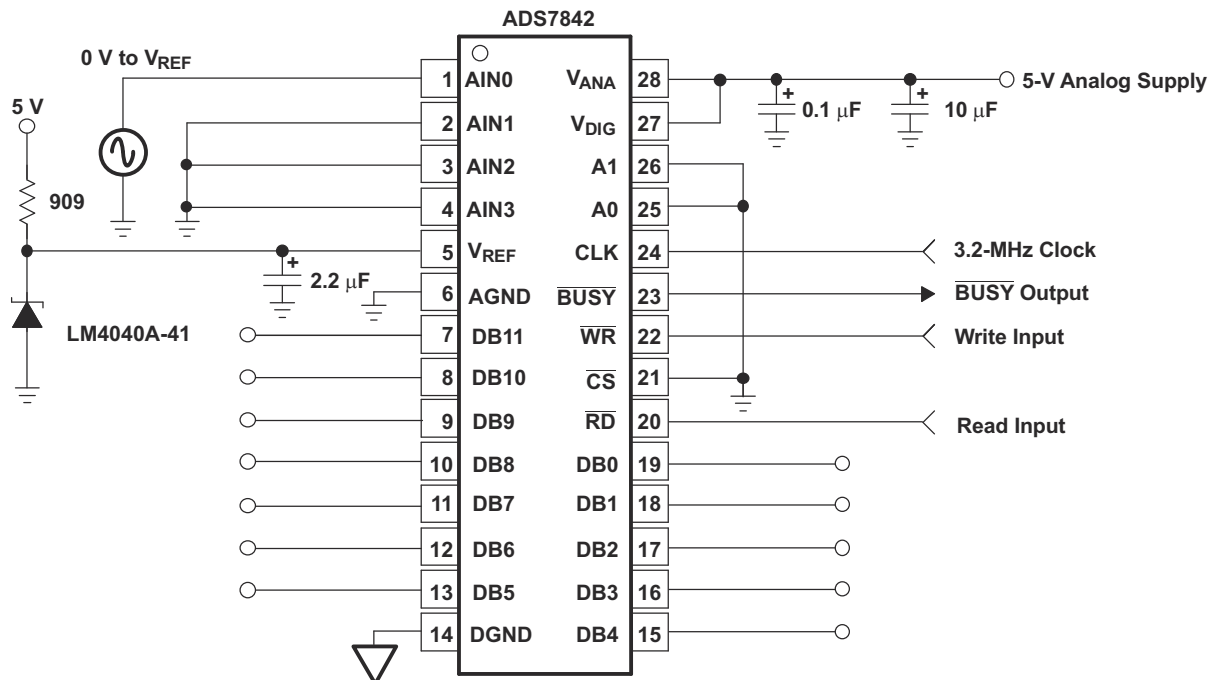


Figure 8-1. Data-Acquisition Circuit With LM4040x-41

#### 8.2.1 Design Requirements

For this design example, use the parameters listed in Table 8-1 as the input parameters.

Table 8-1. Design Parameters

| DESIGN PARAMETER           | EXAMPLE VALUE |
|----------------------------|---------------|
| ADC FSR (Full Scale Range) | 4.096         |
| ADC Resolution             | 12 Bits       |
| Supply Voltage             | 5V            |
| Cathode Current (Ik)       | 100μA         |

## 8.2.2 Detailed Design Procedure

When using LM4040 as a comparator with reference, determine the following:

- Input voltage range
- Reference voltage accuracy
- Output logic input high and low level thresholds
- Current source resistance

### 8.2.2.1 LM4040 Voltage and Accuracy Choice

When using LM4040 as a reference for an ADC, the ADC's FSR (Full Scale Range), Resolution and LSB must be determined. LSB can be determined by:

$$\text{LSB} = \text{FSR} / (2^N - 1)$$

With N being the resolution or Number of Bits. FSR and Resolution can be determined by the ADC's data sheet.

Vref can be determined by:

$$\text{Vref} = \text{FSR} + \text{LSB}$$

Though modern data converters use calibration techniques to compensate for any error introduced by a Vref's inaccuracy, use the highest accuracy available. This is due to errors in the calibration method that can allow some non-linearity introduced by the Vref's initial accuracy.

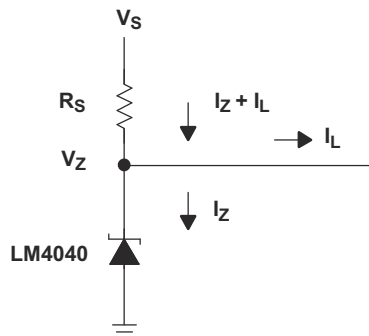
A good example is the LM4040x-41 that is designed to be a cost-effective voltage reference as required in 12-bit data-acquisition systems. For 12-bit systems operating from 5V supplies (see [Figure 8-1](#)), the LM4040A-41 (4.096V, 0.01%) only introduces 4 LSBs (4mV) of possible error in a system that consists of 4096 LSBs.

### 8.2.2.2 Cathode and Load Currents

In a typical shunt-regulator configuration (see [Figure 8-2](#)), an external resistor,  $R_S$ , is connected between the supply and the cathode of the LM4040.  $R_S$  must be set properly, as  $R_S$  sets the total current available to supply the load ( $I_L$ ) and bias the LM4040 ( $I_Z$ ). In all cases,  $I_Z$  must stay within a specified range for proper operation of the reference. Taking into consideration one extreme in the variation of the load and supply voltage (maximum  $I_L$  and minimum  $V_S$ ),  $R_S$  must be small enough to supply the minimum  $I_Z$  required for operation of the regulator, as given by data-sheet parameters. At the other extreme, maximum  $V_S$  and minimum  $I_L$ ,  $R_S$  must be large enough to limit  $I_Z$  to less than the maximum-rated value of 15mA.

$R_S$  is calculated according to [Equation 1](#):

$$R_S = \frac{(V_S - V_Z)}{(I_L + I_Z)} \quad (1)$$



**Figure 8-2. Shunt Regulator**

### 8.2.2.3 Output Capacitor

The LM4040 does not require an output capacitor across cathode and anode for stability. However, if an output bypass capacitor is desired, the LM4040 is designed to be stable with all capacitive loads.

### 8.2.2.4 SOT-23 Connections

There is a parasitic Schottky diode connected between pins 2 and 3 of the SOT-23 packaged device. Thus, pin 3 of the SOT-23 package must be left floating or connected to pin 2.

### 8.2.2.5 Start-Up Characteristics

In any data conversion system, start-up characteristics are important, as to determine when to safely begin conversion based upon a steady and settled reference value. As shown in [Figure 8-4](#) allow  $>20\mu\text{s}$  from supply start-up to begin conversion.

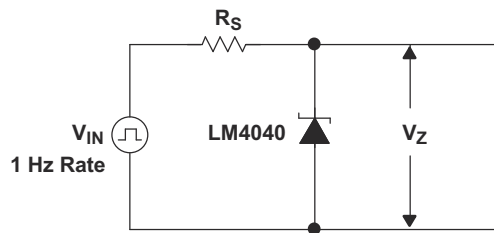


Figure 8-3. Test Circuit

### 8.2.3 Application Curve

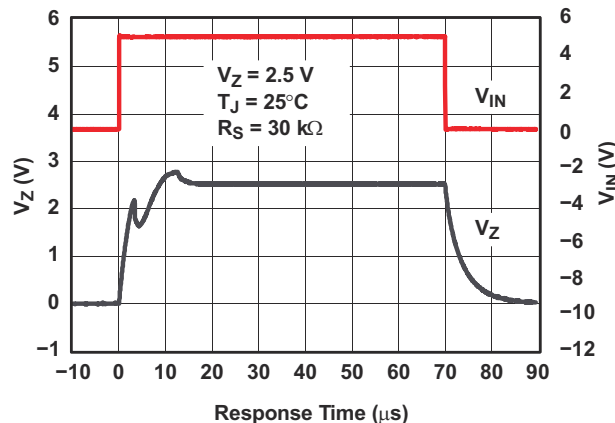


Figure 8-4. Startup Response

## 8.3 Power Supply Recommendations

To not exceed the maximum cathode current, be sure that the supply voltage is current limited.

For applications shunting high currents (15mA max), pay attention to the cathode and anode trace lengths, adjusting the width of the traces to have the proper current density.

## 8.4 Layout

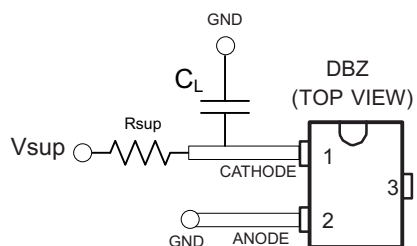
### 8.4.1 Layout Guidelines

[Figure 8-5](#) shows an example of a PCB layout of LM4040XXDBZ. Some key  $V_{\text{ref}}$  noise considerations are:

- Connect a low ESR, 0.1 $\mu\text{F}$  ( $C_L$ ) ceramic bypass capacitor on the cathode pin node.
- Decouple other active devices in the system per the device specifications.
- Using a solid ground plane helps distribute heat and reduces electromagnetic interference (EMI) noise pickup.

- Place the external components as close to the device as possible. This configuration prevents parasitic errors (such as the Seebeck effect) from occurring.
- Do not run sensitive analog traces in parallel with digital traces. Avoid crossing digital and analog traces if possible and only make perpendicular crossings when absolutely necessary.

### 8.4.2 Layout Example



**Figure 8-5. DBZ Layout example**

## 9 Device and Documentation Support

### 9.1 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to order now.

**Table 9-1. Related Links**

| PARTS   | PRODUCT FOLDER             | ORDER NOW                  | TECHNICAL DOCUMENTS        | TOOLS & SOFTWARE           | SUPPORT & COMMUNITY        |
|---------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| LM4040A | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |
| LM4040B | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |
| LM4040C | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |
| LM4040D | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |

### 9.2 Trademarks

All trademarks are the property of their respective owners.

### 9.3 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 9.4 Glossary

[TI Glossary](#)

This glossary lists and explains terms, acronyms, and definitions.

## 10 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision O (June 2024) to Revision P (March 2025)              | Page               |
|-----------------------------------------------------------------------------|--------------------|
| • Updated pinout diagrams .....                                             | <a href="#">4</a>  |
| • Updated CDM ESD ratings.....                                              | <a href="#">5</a>  |
| • Updated reverse breakdown voltage change with cathode current change..... | <a href="#">22</a> |
| • Updated reverse breakdown voltage change with cathode current change..... | <a href="#">23</a> |

| Changes from Revision N (October 2017) to Revision O (June 2024)                                     | Page              |
|------------------------------------------------------------------------------------------------------|-------------------|
| • Updated the numbering format for tables, figures and cross-references throughout the document..... | <a href="#">1</a> |

| Changes from Revision M (January 2015) to Revision N (October 2017)                                         | Page              |
|-------------------------------------------------------------------------------------------------------------|-------------------|
| • Changed generic part number to include shorter list (LM4040A/B/C/D).....                                  | <a href="#">1</a> |
| • Added Average temperature coefficient of reverse breakdown voltage footnote to all electrical tables..... | <a href="#">6</a> |
| • Changed Thermal hysteresis in electrical characteristics tables.....                                      | <a href="#">6</a> |

| Changes from Revision L (January 2009) to Revision M (January 2015)                                                                                                                                                                                                                     | Page |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| • Added <i>Applications</i> , <i>Device Information</i> table, <i>Pin Functions</i> table, <i>ESD Ratings</i> table, <i>Thermal Information</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power</i> |      |

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|                                                                                                                                                                                         |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <i>Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section..... | 1 |
| • Deleted <i>Ordering Information</i> table.....                                                                                                                                        | 1 |

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## 11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

## PACKAGING INFORMATION

| Orderable part number             | Status<br>(1) | Material type<br>(2) | Package   Pins   | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|-----------------------------------|---------------|----------------------|------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">LM4040A10IDBZR</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NQ3, 4NQU)        |
| <a href="#">LM4040A10IDBZR1G4</a> | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NQ3, 4NQU)        |
| <a href="#">LM4040A10IDBZT</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NQ3, 4NQU)        |
| <a href="#">LM4040A10IDCKR</a>    | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | PHU                 |
| <a href="#">LM4040A20IDBZR</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | (4MC3, 4MCU)        |
| <a href="#">LM4040A20IDBZT</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4MC3, 4MCU)        |
| <a href="#">LM4040A20IDCKR</a>    | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | MSU                 |
| <a href="#">LM4040A25IDBZR</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   SN   NIPDAU                 | Level-1-260C-UNLIM                | -40 to 85    | (4NG3, 4NGU)        |
| <a href="#">LM4040A25IDBZT</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4NG3, 4NGU)        |
| <a href="#">LM4040A25IDCKR</a>    | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | P2U                 |
| <a href="#">LM4040A30IDBZR</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   SN   NIPDAU                 | Level-1-260C-UNLIM                | -40 to 85    | (4M63, 4M6U)        |
| <a href="#">LM4040A30IDBZT</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4M63, 4M6U)        |
| <a href="#">LM4040A30IDCKR</a>    | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | P9U                 |
| <a href="#">LM4040A41IDBZR</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | (4M23, 4M2U)        |
| <a href="#">LM4040A41IDBZT</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4M23, 4M2U)        |
| <a href="#">LM4040A41IDCKR</a>    | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | P4U                 |
| <a href="#">LM4040A50IDBZR</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | (4NA3, 4NAU)        |
| <a href="#">LM4040A50IDBZT</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4NA3, 4NAU)        |
| <a href="#">LM4040A50IDCKR</a>    | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | N5U                 |
| <a href="#">LM4040A82IDBZR</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NL3, 4NLU)        |
| <a href="#">LM4040A82IDBZT</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NL3, 4NLU)        |
| <a href="#">LM4040A82IDCKR</a>    | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | PDU                 |
| <a href="#">LM4040B10IDBZR</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NR3, 4NRU)        |
| <a href="#">LM4040B10IDBZT</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NR3, 4NRU)        |
| <a href="#">LM4040B10IDCKR</a>    | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | PJU                 |
| <a href="#">LM4040B20IDBZR</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4MD3, 4MDU)        |
| <a href="#">LM4040B20IDBZT</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4MD3, 4MDU)        |
| <a href="#">LM4040B20IDCKR</a>    | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | (MTS, MTU)          |
| <a href="#">LM4040B25IDBZR</a>    | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4NH3, 4NHU)        |

| Orderable<br>part number         | Status<br>(1) | Material type<br>(2) | Package   Pins   | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|----------------------------------|---------------|----------------------|------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">LM4040B25IDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4NH3, 4NHU)        |
| <a href="#">LM4040B25IDCKR</a>   | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | P3U                 |
| <a href="#">LM4040B30IDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4M73, 4M7U)        |
| <a href="#">LM4040B30IDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4M73, 4M7U)        |
| <a href="#">LM4040B30IDCKR</a>   | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | PAU                 |
| <a href="#">LM4040B30IDCKRG4</a> | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | PAU                 |
| <a href="#">LM4040B41IDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4M33, 4M3U)        |
| <a href="#">LM4040B41IDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4M33, 4M3U)        |
| <a href="#">LM4040B41IDCKR</a>   | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | P5U                 |
| <a href="#">LM4040B50IDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NB3, 4NBU)        |
| <a href="#">LM4040B50IDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4NB3, 4NBU)        |
| <a href="#">LM4040B50IDCKR</a>   | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | MXU                 |
| <a href="#">LM4040B82IDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NM3, 4NMU)        |
| <a href="#">LM4040C10IDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NS3, 4NSU)        |
| <a href="#">LM4040C10IDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NS3, 4NSU)        |
| <a href="#">LM4040C10IDCKR</a>   | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | PKU                 |
| <a href="#">LM4040C10ILP</a>     | Obsolete      | Production           | TO-92 (LP)   3   | -                     | -           | Call TI                              | Call TI                           | -40 to 85    | NFC10I              |
| <a href="#">LM4040C10ILPR</a>    | Active        | Production           | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFC10I              |
| <a href="#">LM4040C20IDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4MQ3, 4MQU)        |
| <a href="#">LM4040C20IDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4MQ3, 4MQU)        |
| <a href="#">LM4040C20IDCKR</a>   | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | MVU                 |
| <a href="#">LM4040C20ILP</a>     | Active        | Production           | TO-92 (LP)   3   | 1000   BULK           | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFC20I              |
| <a href="#">LM4040C20ILPR</a>    | Active        | Production           | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFC20I              |
| <a href="#">LM4040C20QDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | (4MW3, 4MWU)        |
| <a href="#">LM4040C20QDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | (4MW3, 4MWU)        |
| <a href="#">LM4040C25IDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4MU3, 4MUU)        |
| <a href="#">LM4040C25IDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4MU3, 4MUU)        |
| <a href="#">LM4040C25IDCKR</a>   | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | MUU                 |
| <a href="#">LM4040C25IDCKT</a>   | Active        | Production           | SC70 (DCK)   5   | 250   SMALL T&R       | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | MUU                 |
| <a href="#">LM4040C25ILP</a>     | Active        | Production           | TO-92 (LP)   3   | 1000   BULK           | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFC25I              |
| <a href="#">LM4040C25ILPR</a>    | Active        | Production           | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFC25I              |

| Orderable<br>part number         | Status<br>(1) | Material type<br>(2) | Package   Pins   | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|----------------------------------|---------------|----------------------|------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">LM4040C25QDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | (4MA3, 4MAU)        |
| <a href="#">LM4040C25QDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | (4MA3, 4MAU)        |
| <a href="#">LM4040C30IDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4M83, 4M8U)        |
| <a href="#">LM4040C30IDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4M83, 4M8U)        |
| <a href="#">LM4040C30IDCKR</a>   | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | PBU                 |
| <a href="#">LM4040C30ILP</a>     | Active        | Production           | TO-92 (LP)   3   | 1000   BULK           | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFC30I              |
| <a href="#">LM4040C30ILPR</a>    | Active        | Production           | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFC30I              |
| <a href="#">LM4040C30QDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 125   | (4NJ3, 4NJU)        |
| <a href="#">LM4040C30QDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | (4NJ3, 4NJU)        |
| <a href="#">LM4040C41IDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4M43, 4M4U)        |
| <a href="#">LM4040C41IDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4M43, 4M4U)        |
| <a href="#">LM4040C41IDCKR</a>   | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | P6U                 |
| <a href="#">LM4040C41ILP</a>     | Active        | Production           | TO-92 (LP)   3   | 1000   BULK           | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFC41I              |
| <a href="#">LM4040C41ILPR</a>    | Active        | Production           | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFC41I              |
| <a href="#">LM4040C50IDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NC3, 4NCU)        |
| <a href="#">LM4040C50IDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | (4NC3, 4NCU)        |
| <a href="#">LM4040C50IDCKR</a>   | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | MZU                 |
| <a href="#">LM4040C50ILP</a>     | Active        | Production           | TO-92 (LP)   3   | 1000   BULK           | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFC50I              |
| <a href="#">LM4040C50ILPR</a>    | Active        | Production           | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFC50I              |
| <a href="#">LM4040C50QDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | (4NE3, 4NEU)        |
| <a href="#">LM4040C50QDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | (4NE3, 4NEU)        |
| <a href="#">LM4040C82IDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NN3, 4NNU)        |
| <a href="#">LM4040C82IDCKR</a>   | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | PFU                 |
| <a href="#">LM4040C82IDCKRG4</a> | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | PFU                 |
| <a href="#">LM4040C82ILP</a>     | Obsolete      | Production           | TO-92 (LP)   3   | -                     | -           | Call TI                              | Call TI                           | -40 to 85    | NFC82I              |
| <a href="#">LM4040C82ILPR</a>    | Active        | Production           | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFC82I              |
| <a href="#">LM4040D10IDBZR</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NT3, 4NTU)        |
| <a href="#">LM4040D10IDBZT</a>   | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NT3, 4NTU)        |
| <a href="#">LM4040D10IDCKR</a>   | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | PLU                 |
| <a href="#">LM4040D10IDCKRG4</a> | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | PLU                 |
| <a href="#">LM4040D10ILP</a>     | Obsolete      | Production           | TO-92 (LP)   3   | -                     | -           | Call TI                              | Call TI                           | -40 to 85    | NFD10I              |

| Orderable part number            | Status (1) | Material type (2) | Package   Pins   | Package qty   Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|----------------------------------|------------|-------------------|------------------|-----------------------|----------|--------------------------------|-----------------------------|--------------|------------------|
| <a href="#">LM4040D20IDBZR</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 85    | (4MV3, 4MVU)     |
| <a href="#">LM4040D20IDBZT</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 85    | (4MV3, 4MVU)     |
| <a href="#">LM4040D20IDCKR</a>   | Active     | Production        | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes      | NIPDAU   SN                    | Level-1-260C-UNLIM          | -40 to 85    | MWU              |
| <a href="#">LM4040D20ILPR</a>    | Active     | Production        | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes      | SN                             | N/A for Pkg Type            | -40 to 85    | NFD20I           |
| <a href="#">LM4040D20QDBZR</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 125   | (4MY3, 4MYU)     |
| <a href="#">LM4040D20QDBZT</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 125   | (4MY3, 4MYU)     |
| <a href="#">LM4040D25IDBZR</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes      | NIPDAU   NIPDAU                | Level-1-260C-UNLIM          | -40 to 85    | (4ME3, 4MEU)     |
| <a href="#">LM4040D25IDBZT</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 85    | (4ME3, 4MEU)     |
| <a href="#">LM4040D25IDCKR</a>   | Active     | Production        | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 85    | MEU              |
| <a href="#">LM4040D25IDCKT</a>   | Active     | Production        | SC70 (DCK)   5   | 250   SMALL T&R       | Yes      | NIPDAU   SN                    | Level-1-260C-UNLIM          | -40 to 85    | MEU              |
| <a href="#">LM4040D25ILP</a>     | Active     | Production        | TO-92 (LP)   3   | 1000   BULK           | Yes      | SN                             | N/A for Pkg Type            | -40 to 85    | NFD25I           |
| <a href="#">LM4040D25ILPR</a>    | Active     | Production        | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes      | SN                             | N/A for Pkg Type            | -40 to 85    | NFD25I           |
| <a href="#">LM4040D25QDBZR</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 125   | (4MB3, 4MBU)     |
| <a href="#">LM4040D25QDBZT</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 125   | (4MB3, 4MBU)     |
| <a href="#">LM4040D30IDBZR</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes      | NIPDAU   NIPDAU                | Level-1-260C-UNLIM          | -40 to 85    | (4M93, 4M9U)     |
| <a href="#">LM4040D30IDBZT</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 85    | (4M93, 4M9U)     |
| <a href="#">LM4040D30IDCKR</a>   | Active     | Production        | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 85    | PCU              |
| <a href="#">LM4040D30IDCKRG4</a> | Active     | Production        | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 85    | PCU              |
| <a href="#">LM4040D30ILP</a>     | Active     | Production        | TO-92 (LP)   3   | 1000   BULK           | Yes      | SN                             | N/A for Pkg Type            | -40 to 85    | NFD30I           |
| <a href="#">LM4040D30ILPR</a>    | Active     | Production        | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes      | SN                             | N/A for Pkg Type            | -40 to 85    | NFD30I           |
| <a href="#">LM4040D30QDBZR</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 125   | (4NK3, 4NKU)     |
| <a href="#">LM4040D41IDBZR</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 85    | (4M53, 4M5U)     |
| <a href="#">LM4040D41IDBZT</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 85    | (4M53, 4M5U)     |
| <a href="#">LM4040D41IDCKR</a>   | Active     | Production        | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes      | NIPDAU   SN                    | Level-1-260C-UNLIM          | -40 to 85    | P7U              |
| <a href="#">LM4040D41ILP</a>     | Active     | Production        | TO-92 (LP)   3   | 1000   BULK           | Yes      | SN                             | N/A for Pkg Type            | -40 to 85    | NFD41I           |
| <a href="#">LM4040D41ILPR</a>    | Active     | Production        | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes      | SN                             | N/A for Pkg Type            | -40 to 85    | NFD41I           |
| <a href="#">LM4040D50IDBZR</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 85    | (4ND3, 4NDU)     |
| <a href="#">LM4040D50IDBZT</a>   | Active     | Production        | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 85    | (4ND3, 4NDU)     |
| <a href="#">LM4040D50IDCKR</a>   | Active     | Production        | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes      | NIPDAU                         | Level-1-260C-UNLIM          | -40 to 85    | M4U              |
| <a href="#">LM4040D50ILP</a>     | Active     | Production        | TO-92 (LP)   3   | 1000   BULK           | Yes      | SN                             | N/A for Pkg Type            | -40 to 85    | NFD50I           |
| <a href="#">LM4040D50ILPR</a>    | Active     | Production        | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes      | SN                             | N/A for Pkg Type            | -40 to 85    | NFD50I           |

| Orderable part number          | Status<br>(1) | Material type<br>(2) | Package   Pins   | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|--------------------------------|---------------|----------------------|------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">LM4040D50QDBZR</a> | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | (4NF3, 4NFU)        |
| <a href="#">LM4040D50QDBZT</a> | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | (4NF3, 4NFU)        |
| <a href="#">LM4040D82IDBZR</a> | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NP3, 4NPU)        |
| <a href="#">LM4040D82IDBZT</a> | Active        | Production           | SOT-23 (DBZ)   3 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | -40 to 85    | (4NP3, 4NPU)        |
| <a href="#">LM4040D82IDCKR</a> | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | PGU                 |
| <a href="#">LM4040D82ILP</a>   | Obsolete      | Production           | TO-92 (LP)   3   | -                     | -           | Call TI                              | Call TI                           | -40 to 85    | NFD82I              |
| <a href="#">LM4040D82ILPR</a>  | Active        | Production           | TO-92 (LP)   3   | 2000   LARGE T&R      | Yes         | SN                                   | N/A for Pkg Type                  | -40 to 85    | NFD82I              |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

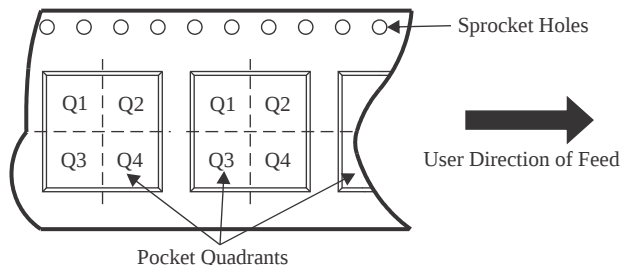
<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

| Device            | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LM4040A10IDBZR    | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040A10IDBZR    | SOT-23       | DBZ             | 3    | 3000 | 179.0              | 8.4                | 3.15    | 2.95    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040A10IDBZR1G4 | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040A10IDBZR1G4 | SOT-23       | DBZ             | 3    | 3000 | 179.0              | 8.4                | 3.15    | 2.95    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040A10IDBZT    | SOT-23       | DBZ             | 3    | 250  | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040A10IDBZT    | SOT-23       | DBZ             | 3    | 250  | 179.0              | 8.4                | 3.15    | 2.95    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040A10IDCKR    | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040A20IDBZR    | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040A20IDBZT    | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040A20IDCKR    | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040A20IDCKR    | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040A25IDBZR    | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040A25IDBZT    | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040A25IDCKR    | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040A25IDCKR    | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040A30IDBZR    | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |

| Device           | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LM4040A30IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040A30IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040A41IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040A41IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040A41IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040A41IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040A50IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040A50IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040A50IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040A50IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040A82IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040A82IDBZT   | SOT-23       | DBZ             | 3    | 250  | 179.0              | 8.4                | 3.15    | 2.95    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040A82IDBZT   | SOT-23       | DBZ             | 3    | 250  | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040A82IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B10IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040B10IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 179.0              | 8.4                | 3.15    | 2.95    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040B10IDBZT   | SOT-23       | DBZ             | 3    | 250  | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040B10IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B20IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040B20IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040B20IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B20IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B25IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040B25IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040B25IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B25IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B30IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040B30IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040B30IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B30IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B30IDCKRG4 | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B41IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040B41IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040B41IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B41IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B50IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040B50IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040B50IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B50IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040B82IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040C10IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 179.0              | 8.4                | 3.15    | 2.95    | 1.22    | 4.0     | 8.0    | Q3            |

| Device           | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LM4040C10IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040C10IDBZT   | SOT-23       | DBZ             | 3    | 250  | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040C10IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040C20IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C20IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C20IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040C20IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040C20QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C20QDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C25IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C25IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C25IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040C25IDCKT   | SC70         | DCK             | 5    | 250  | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040C25IDCKT   | SC70         | DCK             | 5    | 250  | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040C25QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C25QDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C30IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C30IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C30IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040C30IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040C30QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C30QDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C41IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C41IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C41IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040C41IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040C50IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C50IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C50IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040C50QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C50QDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040C82IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 179.0              | 8.4                | 3.15    | 2.95    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040C82IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040C82IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040C82IDCKRG4 | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D10IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 179.0              | 8.4                | 3.15    | 2.95    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040D10IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040D10IDBZT   | SOT-23       | DBZ             | 3    | 250  | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040D10IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D10IDCKRG4 | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D20IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |

| Device           | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LM4040D20IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D20IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D20IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D20QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D20QDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D25IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D25IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D25IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D25IDCKT   | SC70         | DCK             | 5    | 250  | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D25IDCKT   | SC70         | DCK             | 5    | 250  | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D25QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D25QDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D30IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D30IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D30IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D30IDCKRG4 | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D30QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D41IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D41IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D41IDCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.3     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D41IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D50IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D50IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D50IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LM4040D50QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D50QDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0              | 8.4                | 2.9     | 3.35    | 1.35    | 4.0     | 8.0    | Q3            |
| LM4040D82IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 179.0              | 8.4                | 3.15    | 2.95    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040D82IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040D82IDBZT   | SOT-23       | DBZ             | 3    | 250  | 178.0              | 9.2                | 3.15    | 2.77    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040D82IDBZT   | SOT-23       | DBZ             | 3    | 250  | 179.0              | 8.4                | 3.15    | 2.95    | 1.22    | 4.0     | 8.0    | Q3            |
| LM4040D82IDCKR   | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device            | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LM4040A10IDBZR    | SOT-23       | DBZ             | 3    | 3000 | 180.0       | 180.0      | 18.0        |
| LM4040A10IDBZR    | SOT-23       | DBZ             | 3    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040A10IDBZR1G4 | SOT-23       | DBZ             | 3    | 3000 | 180.0       | 180.0      | 18.0        |
| LM4040A10IDBZR1G4 | SOT-23       | DBZ             | 3    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040A10IDBZT    | SOT-23       | DBZ             | 3    | 250  | 180.0       | 180.0      | 18.0        |
| LM4040A10IDBZT    | SOT-23       | DBZ             | 3    | 250  | 203.0       | 203.0      | 35.0        |
| LM4040A10IDCKR    | SC70         | DCK             | 5    | 3000 | 203.0       | 203.0      | 35.0        |
| LM4040A20IDBZR    | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040A20IDBZT    | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040A20IDCKR    | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040A20IDCKR    | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040A25IDBZR    | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040A25IDBZT    | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040A25IDCKR    | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040A25IDCKR    | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040A30IDBZR    | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040A30IDCKR    | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040A30IDCKR    | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |

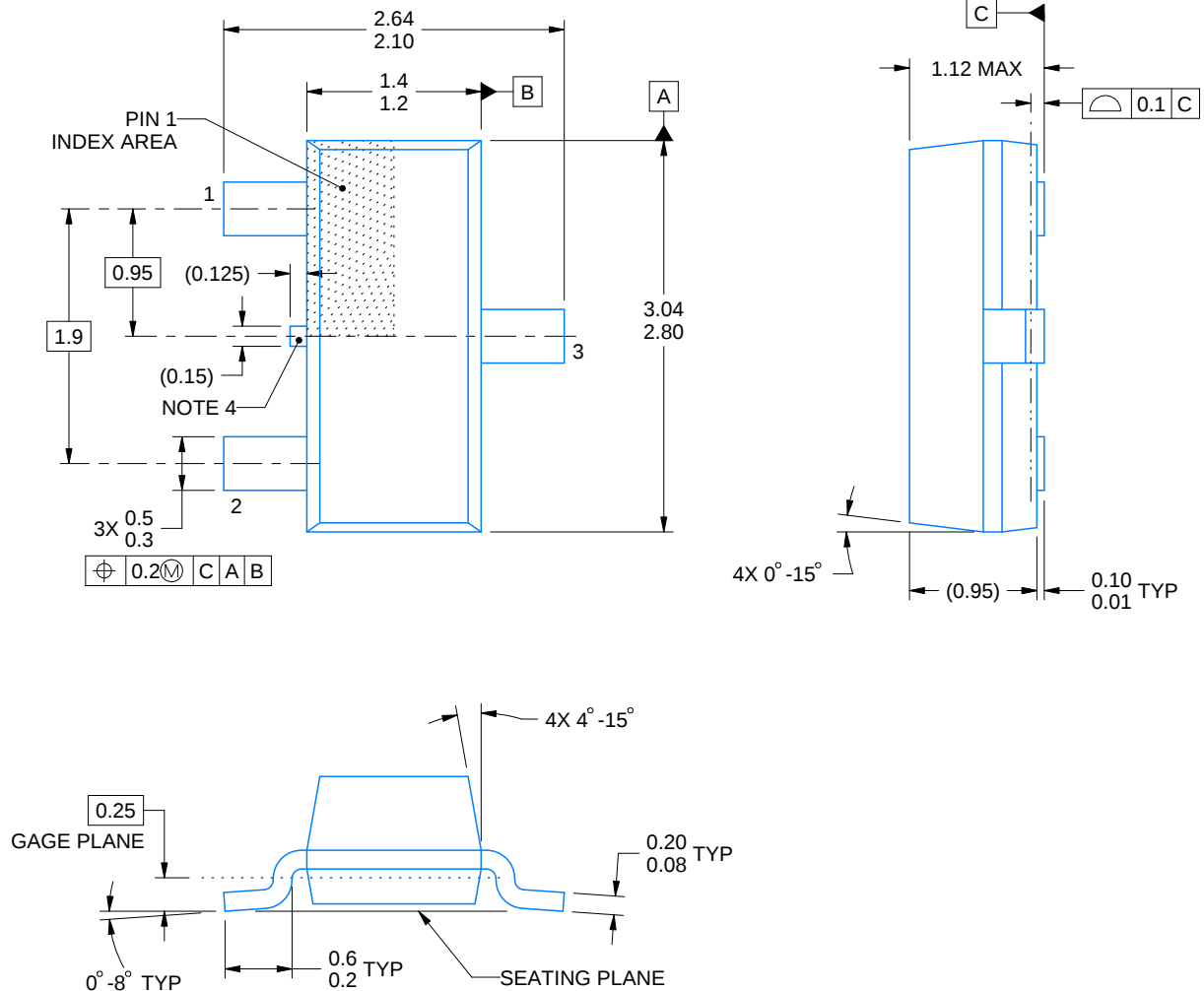
| Device           | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LM4040A41IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040A41IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040A41IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040A41IDCKR   | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040A50IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040A50IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040A50IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040A50IDCKR   | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040A82IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0       | 180.0      | 18.0        |
| LM4040A82IDBZT   | SOT-23       | DBZ             | 3    | 250  | 200.0       | 183.0      | 25.0        |
| LM4040A82IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0       | 180.0      | 18.0        |
| LM4040A82IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040B10IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0       | 180.0      | 18.0        |
| LM4040B10IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040B10IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0       | 180.0      | 18.0        |
| LM4040B10IDCKR   | SC70         | DCK             | 5    | 3000 | 203.0       | 203.0      | 35.0        |
| LM4040B20IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040B20IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040B20IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040B20IDCKR   | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040B25IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040B25IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040B25IDCKR   | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040B25IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040B30IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040B30IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040B30IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040B30IDCKR   | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040B30IDCKRG4 | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040B41IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040B41IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040B41IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040B41IDCKR   | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040B50IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040B50IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040B50IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040B50IDCKR   | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040B82IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0       | 180.0      | 18.0        |
| LM4040C10IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040C10IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0       | 180.0      | 18.0        |
| LM4040C10IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0       | 180.0      | 18.0        |
| LM4040C10IDCKR   | SC70         | DCK             | 5    | 3000 | 203.0       | 203.0      | 35.0        |
| LM4040C20IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |

| Device           | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LM4040C20IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040C20IDCKR   | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040C20IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040C20QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040C20QDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040C25IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040C25IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040C25IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040C25IDCKT   | SC70         | DCK             | 5    | 250  | 200.0       | 183.0      | 25.0        |
| LM4040C25IDCKT   | SC70         | DCK             | 5    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040C25QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040C25QDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040C30IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040C30IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040C30IDCKR   | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040C30IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040C30QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040C30QDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040C41IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040C41IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040C41IDCKR   | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040C41IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040C50IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040C50IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040C50IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040C50QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040C50QDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040C82IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 203.0       | 203.0      | 35.0        |
| LM4040C82IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0       | 180.0      | 18.0        |
| LM4040C82IDCKR   | SC70         | DCK             | 5    | 3000 | 203.0       | 203.0      | 35.0        |
| LM4040C82IDCKRG4 | SC70         | DCK             | 5    | 3000 | 203.0       | 203.0      | 35.0        |
| LM4040D10IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040D10IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0       | 180.0      | 18.0        |
| LM4040D10IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0       | 180.0      | 18.0        |
| LM4040D10IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040D10IDCKRG4 | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040D20IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040D20IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040D20IDCKR   | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040D20IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040D20QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040D20QDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040D25IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |

| Device           | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LM4040D25IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040D25IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040D25IDCKT   | SC70         | DCK             | 5    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040D25IDCKT   | SC70         | DCK             | 5    | 250  | 200.0       | 183.0      | 25.0        |
| LM4040D25QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040D25QDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040D30IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040D30IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040D30IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040D30IDCKRG4 | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040D30QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040D41IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040D41IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040D41IDCKR   | SC70         | DCK             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040D41IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040D50IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040D50IDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040D50IDCKR   | SC70         | DCK             | 5    | 3000 | 200.0       | 183.0      | 25.0        |
| LM4040D50QDBZR   | SOT-23       | DBZ             | 3    | 3000 | 210.0       | 185.0      | 35.0        |
| LM4040D50QDBZT   | SOT-23       | DBZ             | 3    | 250  | 210.0       | 185.0      | 35.0        |
| LM4040D82IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 203.0       | 203.0      | 35.0        |
| LM4040D82IDBZR   | SOT-23       | DBZ             | 3    | 3000 | 180.0       | 180.0      | 18.0        |
| LM4040D82IDBZT   | SOT-23       | DBZ             | 3    | 250  | 180.0       | 180.0      | 18.0        |
| LM4040D82IDBZT   | SOT-23       | DBZ             | 3    | 250  | 203.0       | 203.0      | 35.0        |
| LM4040D82IDCKR   | SC70         | DCK             | 5    | 3000 | 203.0       | 203.0      | 35.0        |

**DBZ0003A****PACKAGE OUTLINE****SOT-23 - 1.12 mm max height**

SMALL OUTLINE TRANSISTOR



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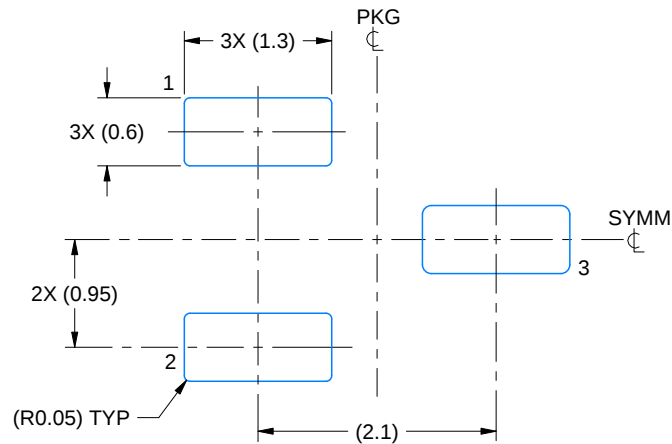
**NOTES:**

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-236, except minimum foot length.
4. Support pin may differ or may not be present.
5. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side

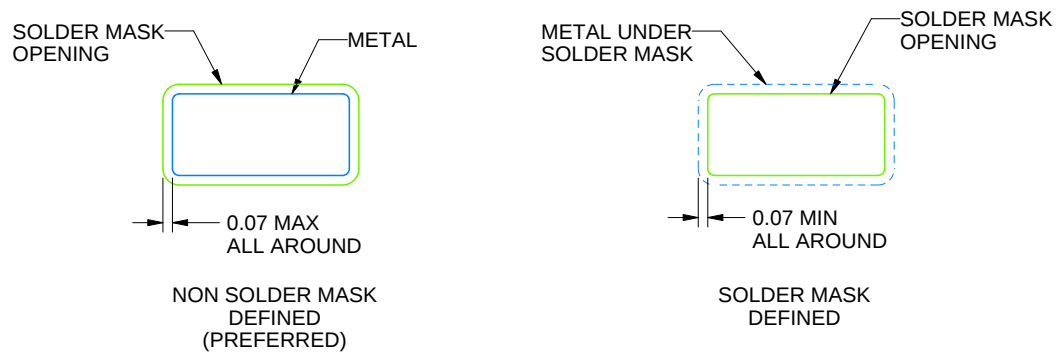
**DBZ0003A**

**SOT-23 - 1.12 mm max height**

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
SCALE:15X



## SOLDER MASK DETAILS

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NOTES: (continued)

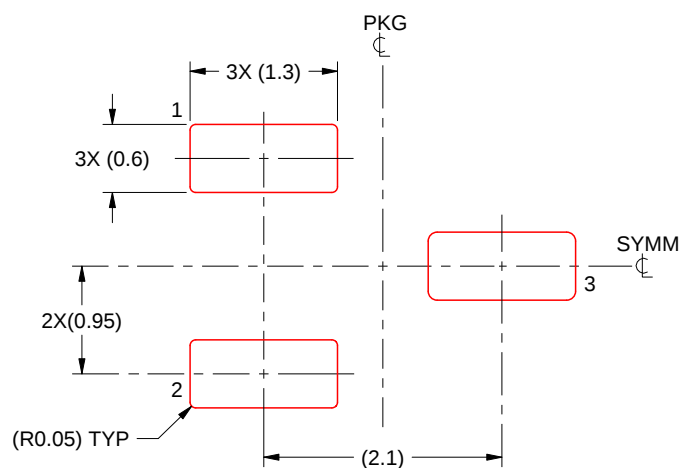
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR

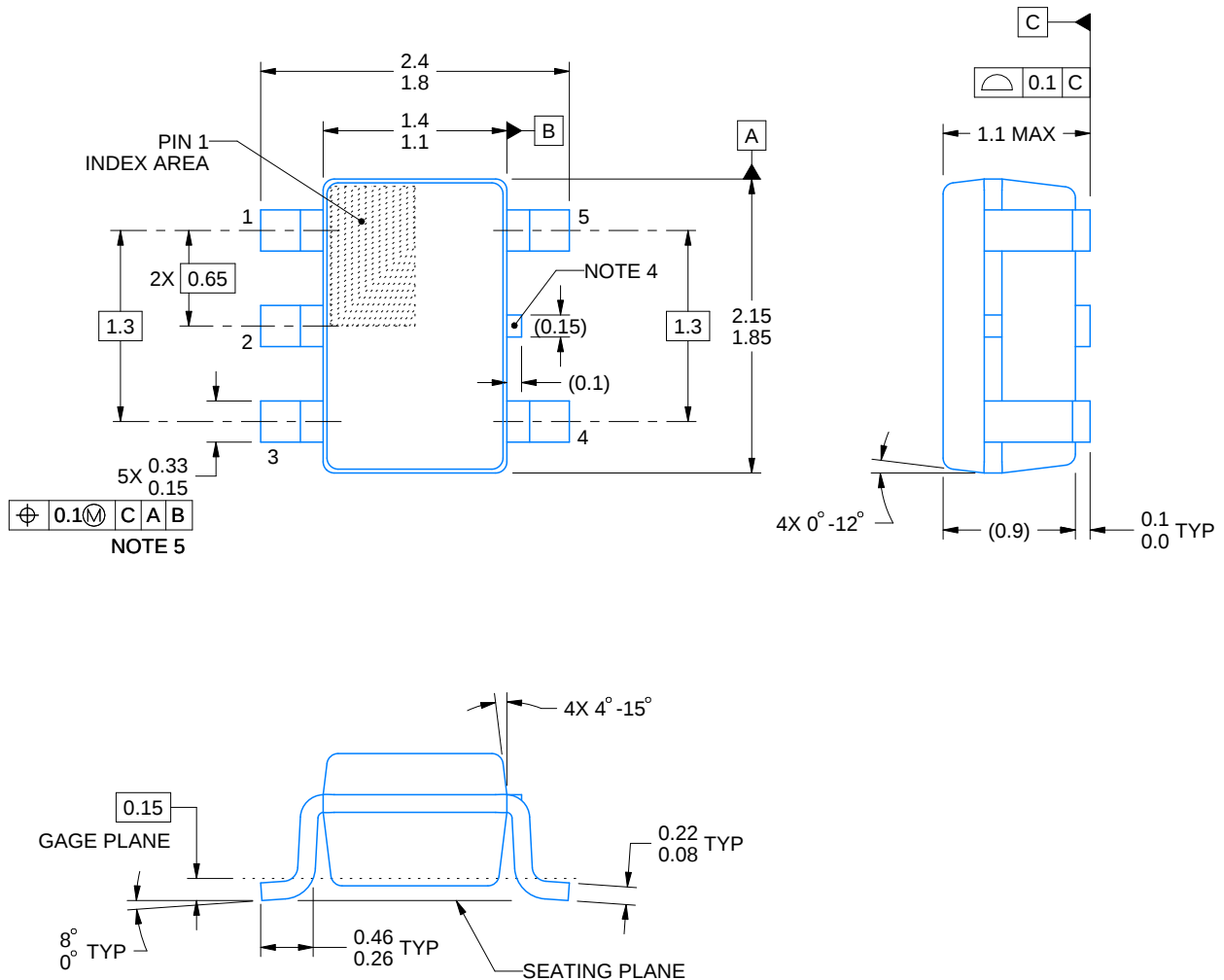


SOLDER PASTE EXAMPLE  
BASED ON 0.125 THICK STENCIL  
SCALE:15X

4214838/F 08/2024

NOTES: (continued)

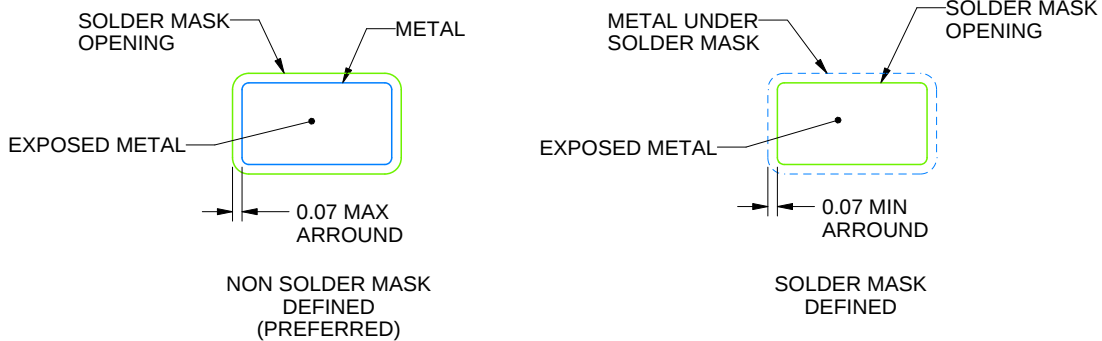
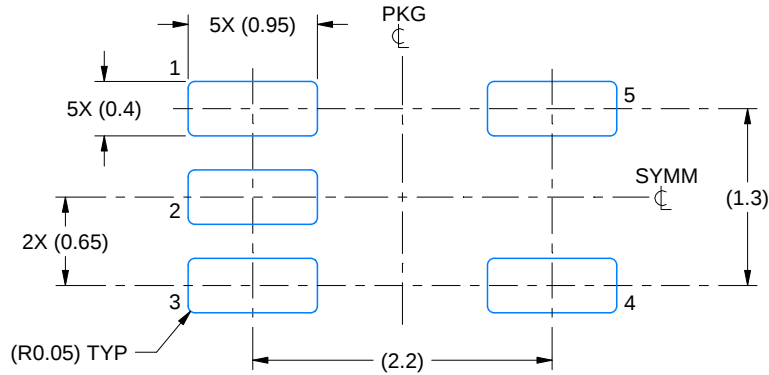
7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.



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## NOTES:

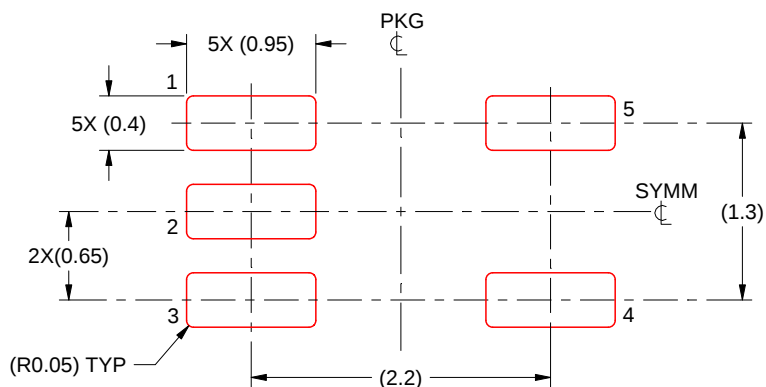
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC MO-203.
4. Support pin may differ or may not be present.
5. Lead width does not comply with JEDEC.
6. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side



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NOTES: (continued)

7. Publication IPC-7351 may have alternate designs.
8. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE  
 BASED ON 0.125 THICK STENCIL  
 SCALE:18X

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NOTES: (continued)

9. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
10. Board assembly site may have different recommendations for stencil design.

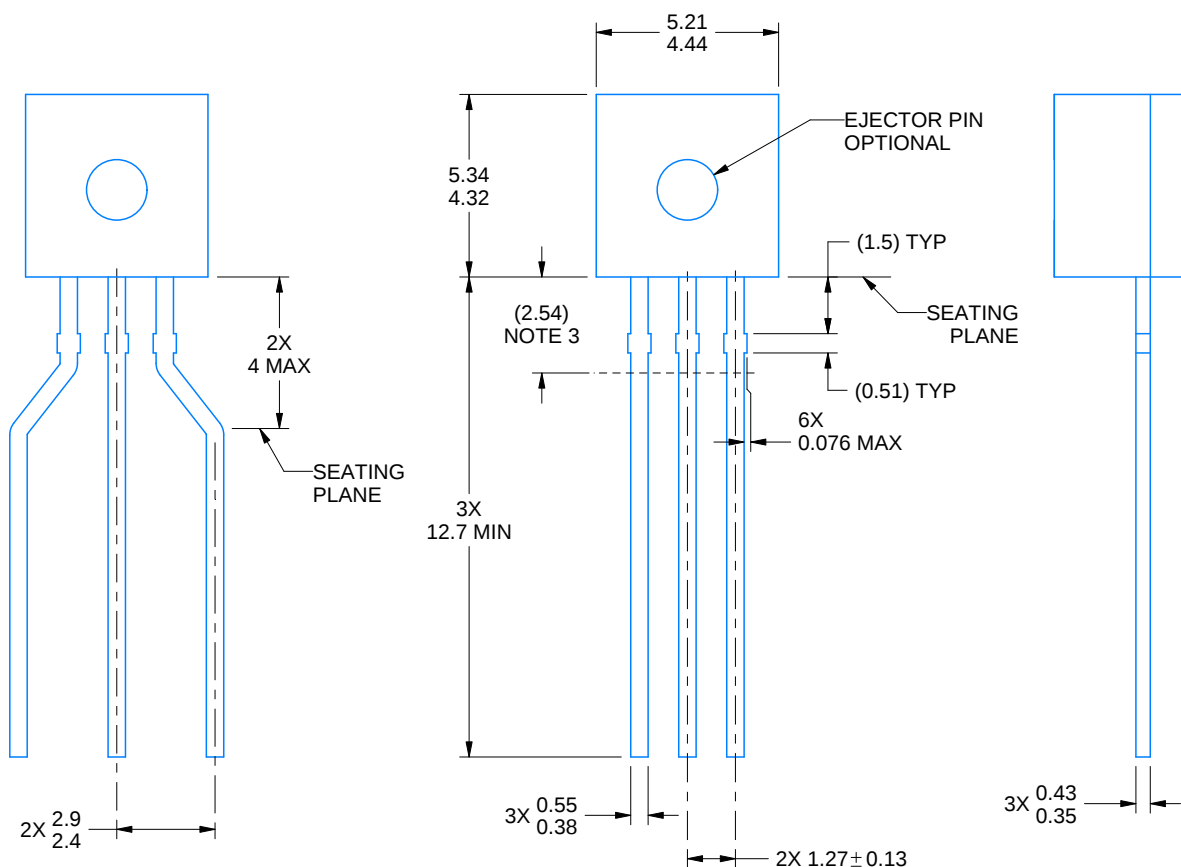
LP0003A



# PACKAGE OUTLINE

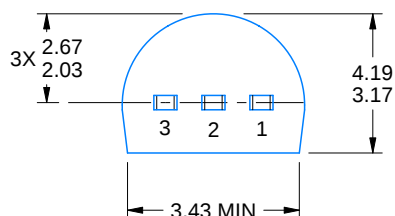
TO-92 - 5.34 mm max height

TO-92



FORMED LEAD OPTION  
OTHER DIMENSIONS IDENTICAL  
TO STRAIGHT LEAD OPTION

STRAIGHT LEAD OPTION



4215214/C 04/2025

## NOTES:

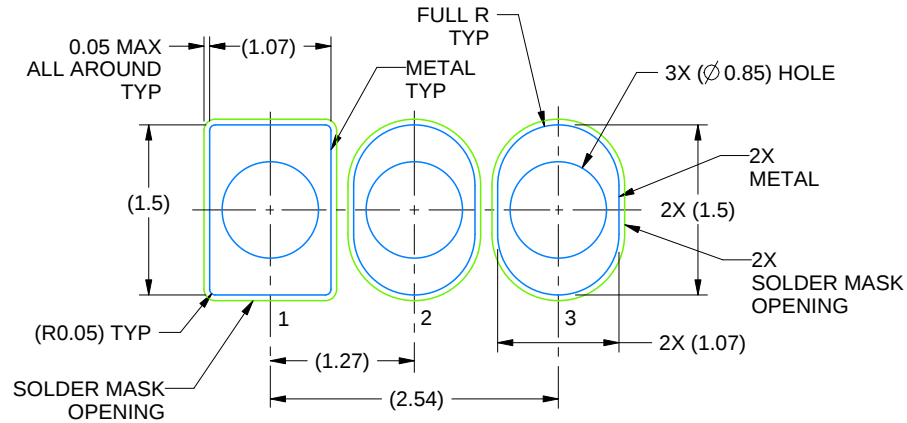
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Lead dimensions are not controlled within this area.
4. Reference JEDEC TO-226, variation AA.
5. Shipping method:
  - a. Straight lead option available in bulk pack only.
  - b. Formed lead option available in tape and reel or ammo pack.
  - c. Specific products can be offered in limited combinations of shipping medium and lead options.
  - d. Consult product folder for more information on available options.

# EXAMPLE BOARD LAYOUT

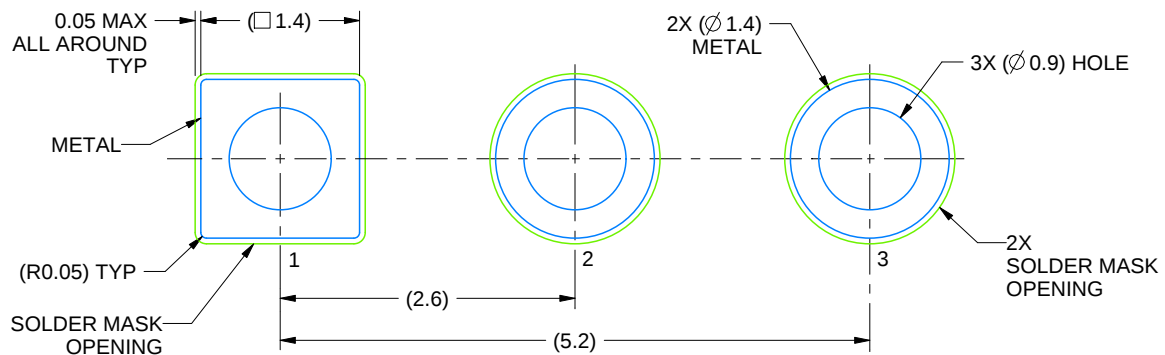
LP0003A

TO-92 - 5.34 mm max height

TO-92



LAND PATTERN EXAMPLE  
STRAIGHT LEAD OPTION  
NON-SOLDER MASK DEFINED  
SCALE:15X



LAND PATTERN EXAMPLE  
FORMED LEAD OPTION  
NON-SOLDER MASK DEFINED  
SCALE:15X

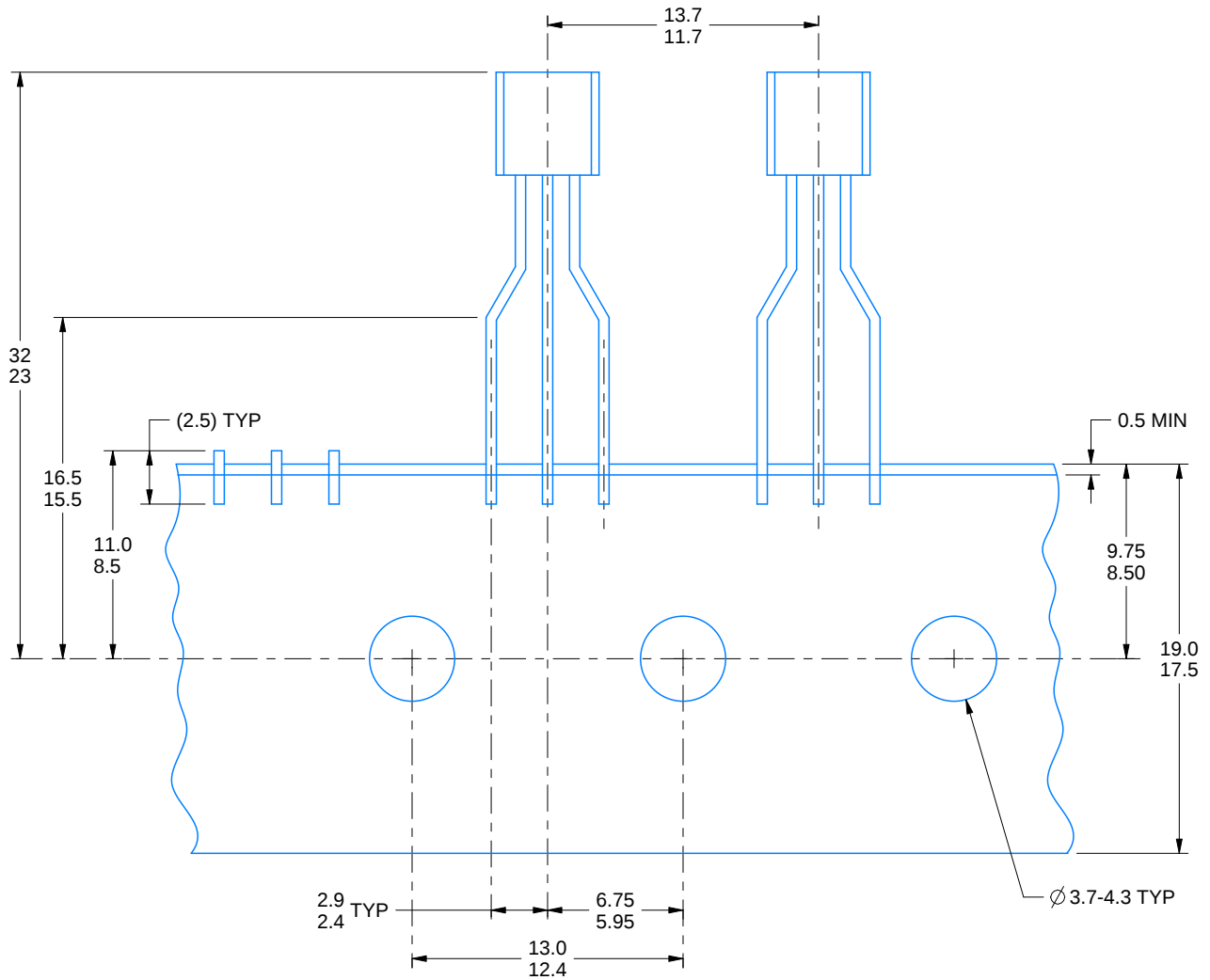
4215214/C 04/2025

# TAPE SPECIFICATIONS

LP0003A

TO-92 - 5.34 mm max height

TO-92



FOR FORMED LEAD OPTION PACKAGE

4215214/C 04/2025

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