TEXAS INSTRUMENTS
TLV6713
JAJSEJ7B – JANUARY 2018 – REVISED JULY 2018

TLV6713 400mV基準電圧搭載マイクロパワー36Vコンパレータ

1 特長

- 広い電源電圧範囲: 1.8V～36V
- スレッショルドを変更可能: 最低400mV
- スレッショルドの高い精度
  - 0.25% (標準値)
  - 温度範囲全体で最大0.75%
- 低い静止電流: 7µA (標準値)
- オープン・ドレイン出力
- 内部ヒステリシス: 5.5mV (標準値)
- 温度範囲: －40℃～＋125℃
- パッケージ: Thin SOT-23-6

2 アプリケーション

- ノートPCおよびタブレット
- スマートフォン
- デジタル・カメラ
- ビデオゲーム・コントローラ
- リレーおよびサーキット・ブレーカ
- ポータブル医療機器
- ドアまたは窓のセンサ
- 携帯用およびバッテリ駆動の製品

3 概要

TLV6713高電圧コンパレータは、1.8V～36Vの電源電圧範囲で動作します。高精度コンパレータと400mVの基準電圧に加え、低電圧検出用に定格25Vのオープン・ドレイン出力を内蔵しています。監視対象の電圧は外付け抵抗により設定できます。

SENSEピンの電圧が負のスレッショルドを下回るとOUTがLOWになり、正のスレッショルドを上回るとHIGHになります。TLV6713のコンパレータにはノイズ除去のヒステリシスが組み込まれているため、誤ったトリガが発生せず、安定した出力動作が確保されます。

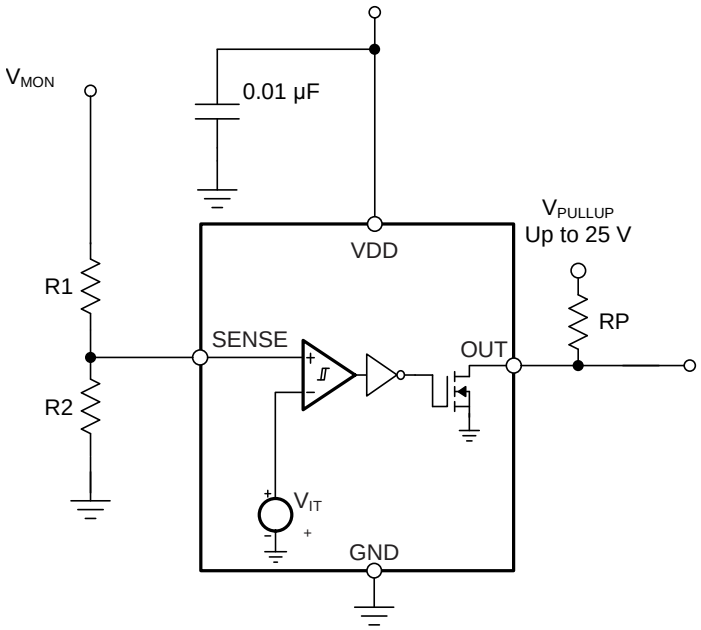
TLV6713はThin SOT-23-6パッケージで供給され、－40℃～＋125℃の接合部温度範囲で動作が規定されています。

製品情報 (1)

型番	パッケージ	本体サイズ(公称)
TLV6713	SOT-23 (6)	2.90mm×1.60mm

(1) 利用可能なすべてのパッケージについては、このデータシートの末尾にあるパッケージ・オプションについての付録を参照してください。

代表的なアプリケーション



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4 改訂履歴

Revision A (April 2018) から **Revision B** に変更 **Page**

- 代表的なアプリケーションの図でプルアップ抵抗のテキストを36Vから25Vに 変更 ... 1

2018年1月 発行のものから更新 **Page**

- 事前情報から量産データに 変更 ... 1

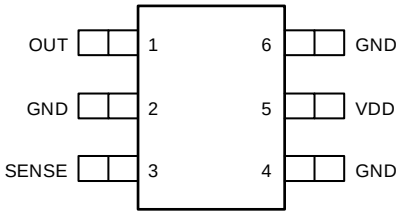
5 Device Comparison Table

Table 1. TLV67xx Integrated Comparator Family

PART NUMBER	CONFIGURATION	OPERATING VOLTAGE RANGE	THRESHOLD ACCURACY OVER TEMPERATURE
TLV6700	Window	1.8 V to 18 V	1%
TLV6703	Non-Inverting Single Channel	1.8 V to 18 V	1%
TLV6710	Window	1.8 V to 36 V	0.75%
TLV6713	Non-Inverting Single Channel	1.8 V to 36 V	0.75%

6 Pin Configuration and Functions

DDC Package
6-Pin SOT-23-Thin
Top View



Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
GND	2, 4, 6	—	Ground. Connect all three pins to ground.
OUT	1	O	Comparator open-drain output. This pin is driven low when the voltage at this comparator is less than $V_{IT–}$. The output goes high when the sense voltage rises above V_{IT+}.
SENSE	3	I	Comparator input. This pin is connected to the voltage to be monitored with the use of an external resistor divider. When the voltage at this pin drops below the threshold voltage $V_{IT–}$, OUT is driven low.
VDD	5	I	Supply-voltage input. Connect a 1.8-V to 36-V supply to VDD to power the device. It is good analog design practice to place a 0.1-µF ceramic capacitor close to this pin.

7 Specifications

7.1 Absolute Maximum Ratings(1)

over operating junction temperature range (unless otherwise noted)

		MIN	MAX	UNIT
Voltage (2)	V_{DD}	–0.3	40	V
	V_{OUT}	–0.3	28	
	V_{SENSE}	–0.3	7	
Current	Output pin current		40	mA
Temperature	Operating junction, T_J	–40	125	°C
	Storage, T_{stg}	–40	125	

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) All voltages are with respect to network ground terminal.

7.2 ESD Ratings

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

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

7.3 Recommended Operating Conditions

over operating junction temperature range (unless otherwise noted)

		MIN	NOM	MAX	UNIT
V_{DD}	Supply pin voltage	1.8		36	V
V_{SENSE}	Input pin voltage	0		1.7	V
V_{OUT}	Output pin voltage	0		25	V
V_{PULLUP}	Pullup voltage	0		25	V
I_{OUT}	Output pin current	0		10	mA
T_J	Junction temperature	–40	25	125	°C

7.4 Thermal Information

THERMAL METRIC (1)		TLV6713 DDC (SOT-23) 6 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	201.6	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	47.8	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	51.2	°C/W
ψ_{JT}	Junction-to-top characterization parameter	0.7	°C/W
ψ_{JB}	Junction-to-board characterization parameter	50.8	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	°C/W

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

7.5 Electrical Characteristics

Over the operating temperature range of T_J = –40°C to +125°C, 1.8 V ≤ V_{DD} < 36 V, and pullup resistor RP = 100 kΩ (unless otherwise noted). Typical values are at T_J = 25°C and V_{DD} = 12 V.

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{(POR)}$	Power-on reset voltage(1)	V_{OL} ≤ 0.2 V			0.8	V
$V_{IT–}$	SENSE pin negative input threshold voltage	V_{DD} = 1.8 V to 36 V	397	400	403	mV
V_{IT+}	SENSE pin positive input threshold voltage	V_{DD} = 1.8 V to 36 V	400	405.5	413	mV
V_{HYS}	SENSE pin hysteresis voltage (HYS = V_{IT+} – $V_{IT–}$)		2	5.5	12	mV
V_{OL}	Low-level output voltage	V_{DD} = 1.8 V, I_{OUT} = 3 mA		130	250	mV
		V_{DD} = 5 V, I_{OUT} = 5 mA		150	250	
I_{IN}	Input current (at SENSE pin)	V_{DD} = 1.8 V and 36 V, V_{SENSE} = 6.5 V	–25	+1	+25	nA
		V_{DD} = 1.8 V and 36 V, V_{SENSE} = 0.1 V	–15	+1	+15	
$I_{D(leak)}$	Open-drain leakage current	V_{DD} = 1.8 V and 36 V, V_{OUT} = 25 V		10	300	nA
I_{DD}	Supply current	V_{DD} = 1.8 V – 36 V		8	11	µA
UVLO	Undervoltage lockout(2)	V_{DD} falling	1.3	1.5	1.7	V

(1) The lowest supply voltage (V_{DD}) at which output is active; $t_{r(VDD)}$ > 15 µs/V. If less than $V_{(POR)}$, the output is undetermined.
(2) When V_{DD} falls below UVLO, OUT is driven low. The output cannot be determined if less than $V_{(POR)}$.

7.6 Timing Requirements

			MIN	NOM	MAX	UNIT
$t_{pd(HL)}$	High-to-low propagation delay(1)	V_{DD} = 24 V, ±10-mV input overdrive, R_L = 100 kΩ, V_{OH} = 0.9 × V_{DD}, V_{OL} = 250 mV		9.9		µs
$t_{pd(LH)}$	Low-to-high propagation delay(1)	V_{DD} = 24 V, ±10-mV input overdrive, R_L = 100 kΩ, V_{OH} = 0.9 × V_{DD}, V_{OL} = 250 mV		28.1		µs
$t_{d(start)}$(2)	Startup delay	V_{DD} = 5 V		155		µs
t_r	Output rise time	V_{DD} = 12 V, 10-mV input overdrive, R_L = 100 kΩ, C_L = 10 pF, V_O = (0.1 to 0.9) × V_{DD}		2.7		µs
t_f	Output fall time	V_{DD} = 12 V, 10-mV input overdrive, R_L = 100 kΩ, C_L = 10 pF, V_O = (0.9 to 0.1) × V_{DD}		0.12		µs

(1) High-to-low and low-to-high refers to the transition at the input pin (SENSE).
(2) During power on, V_{DD} must exceed 1.8 V for at least 150 µs (typical) before the output state reflects the input condition.

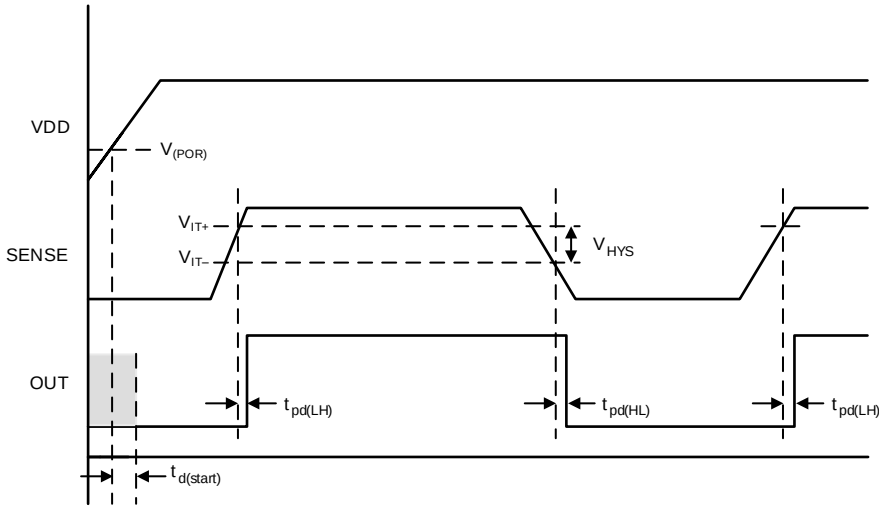


Figure 1. Timing Diagram

7.7 Typical Characteristics

at T_J = 25°C and V_{DD} = 12 V (unless otherwise noted)

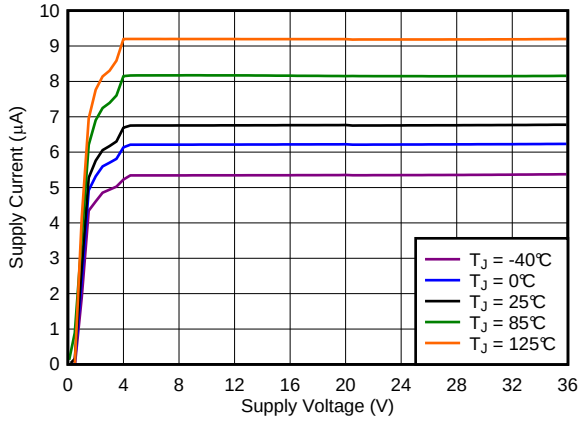
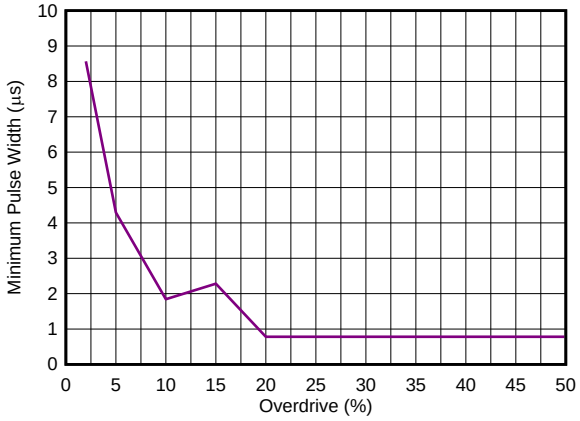


Figure 2. Supply Current vs Supply Voltage



V_{DD} = 24 V, minimum pulse duration required to trigger output high-to-low transition, SENSE = negative spike below V_{IT-}

Figure 3. Minimum Pulse Duration vs Threshold Overdrive Voltage

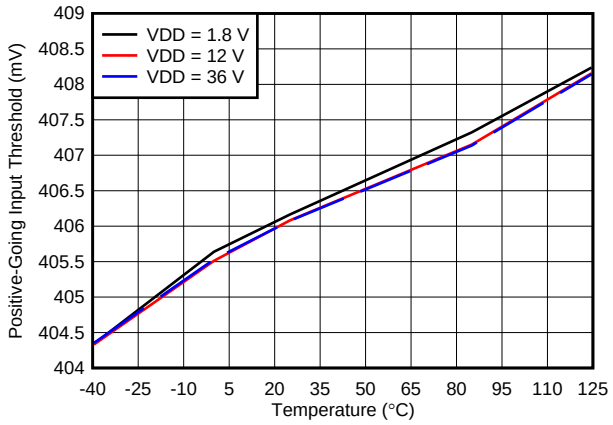


Figure 4. SENSE Positive Input Threshold Voltage (V_{IT+}) vs Temperature

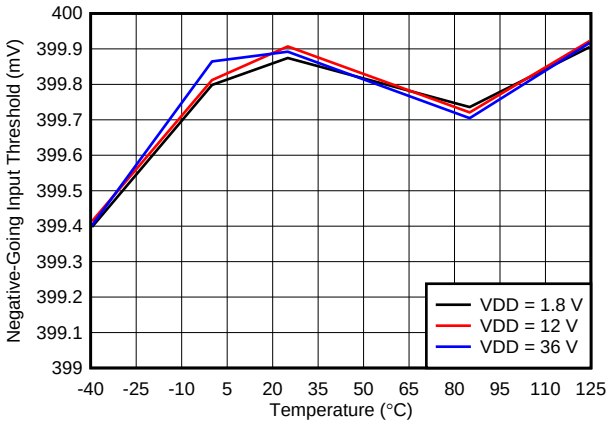


Figure 5. SENSE Negative Input Threshold Voltage (V_{IT-}) vs Temperature

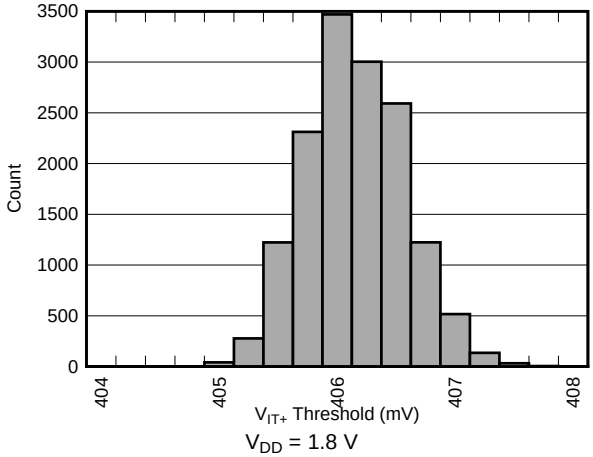


Figure 6. SENSE Positive Input Threshold Voltage (V_{IT+}) Distribution

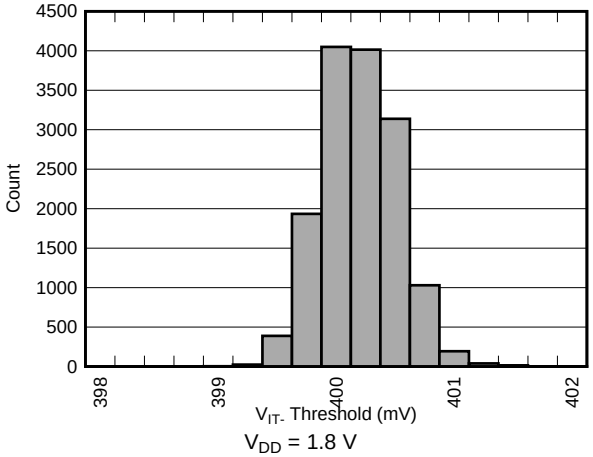
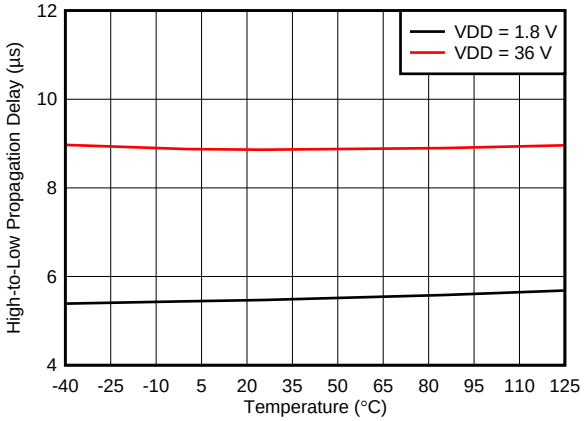


Figure 7. SENSE Negative Input Threshold Voltage (V_{IT-}) Distribution

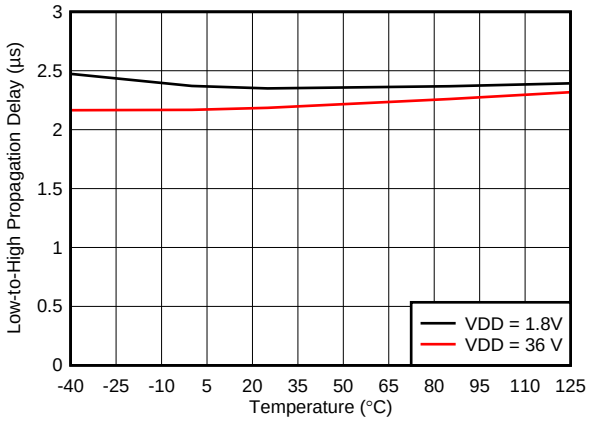
Typical Characteristics (continued)

at T_J = 25°C and V_{DD} = 12 V (unless otherwise noted)



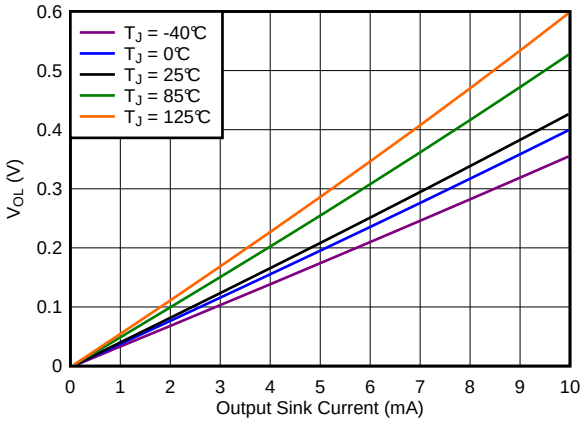
Input step ±200 mV

Figure 8. Propagation Delay vs Temperature (High-to-Low Transition at SENSE)



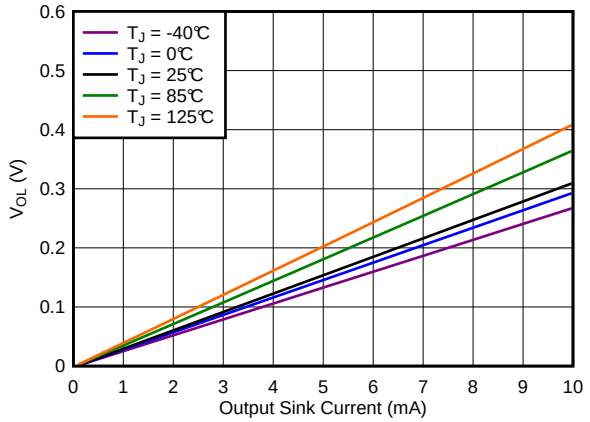
Input step ±200 mV

Figure 9. Propagation Delay vs Temperature (Low-to-High Transition at SENSE)



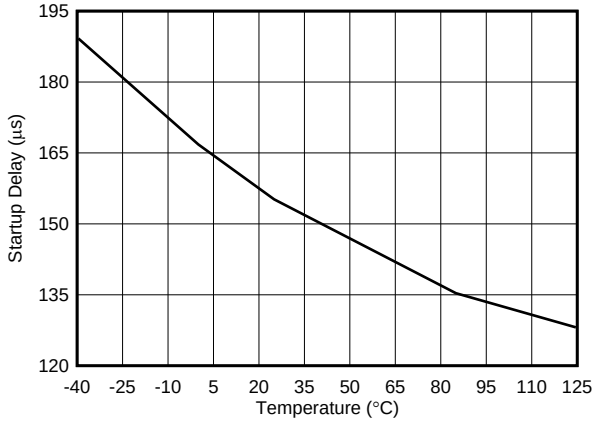
V_{DD} = 1.8 V

Figure 10. Output Voltage Low vs Output Sink Current



V_{DD} = 12 V

Figure 11. Output Voltage Low vs Output Sink Current



V_{DD} = 5 V

Figure 12. Start-up Delay vs Temperature

8 Detailed Description

8.1 Overview

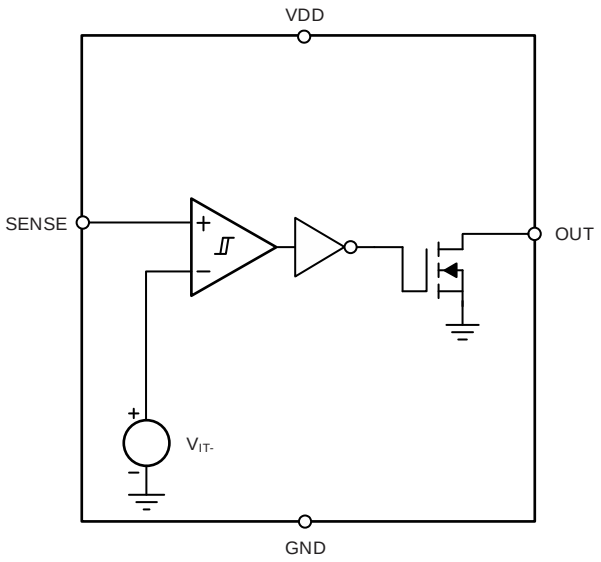
The TLV6713 combines a comparator and a precision reference for undervoltage detection. The TLV6713 features a wide supply voltage range (1.8 V to 36 V) and a high-accuracy threshold voltage of 400 mV (0.75% over temperature) with built-in hysteresis. The output is rated to 25 V and can sink up to 10 mA.

Set the input pin (SENSE) to monitor any voltage above 0.4 V by using an external resistor divider network. SENSE has very low input leakage current, allowing the use of a large resistor divider without sacrificing system accuracy. The relationship between the input and the output is shown in Table 2. Broad voltage thresholds are supported that enable the device to be used in a wide array of applications.

Table 2. Truth Table

CONDITION	OUTPUT	OUTPUT STATE
SENSE > V_{IT+}	OUT high	Output high impedance
SENSE < V_{IT-}	OUT low	Output sinking

8.2 Functional Block Diagram



8.3 Feature Description

8.3.1 Input Pin (SENSE)

The TLV6713 combines a comparator with a precision reference voltage. The comparator has one external input and one internal input connected to the internal reference. The falling threshold on SENSE is designed and trimmed to be equal to the reference voltage (400 mV). This configuration optimizes the device accuracy. The comparator also has built-in hysteresis that proves immunity to noise and ensures stable operation.

The comparator input swings from ground to 1.7 V (7 V absolute maximum), regardless of the device supply voltage used. Although not required in most cases, it is good analog design practice to place a 1-nF to 10-nF bypass capacitor at the comparator input for noisy applications to reduce sensitivity to transient voltage changes on the monitored signal.

For the comparator, the output (OUT) is driven to logic low when the input SENSE voltage drops below V_{IT-}. When the voltage exceeds V_{IT+}, OUT goes to a high-impedance state; see Figure 1.

8.3.2 Output Pin (OUT)

In a typical TLV6713 application, the output is connected to a GPIO input of the processor (such as a digital signal processor [DSP], central processing unit [CPU], field-programmable gate array [FPGA], or application-specific integrated circuit [ASIC]).

The TLV6713 provides an open-drain output (OUT) rated to 25 V, independant of supply voltage, and can sink up to 40 mA.. A pullup resistor is required to hold the line high when the output goes to a high-impedance state. Connect this pullup resistor to a voltage rail that meets the logic requirements of the downstream device. To ensure the proper voltage level, give some consideration when choosing the pullup resistor value. The pullup resistor value is determined by V_{OL}, output capacitive loading, and the open-drain leakage current ($I_{D(leak)}$). These values are specified in the *Electrical Characteristics* table.

Table 2 and *Input Pin (SENSE)* describe how the output is asserted or high impedance. See Figure 1 for a timing diagram that describes the relationship between threshold voltage and the respective output.

8.4 Device Functional Modes

8.4.1 Normal Operation (V_{DD} > UVLO)

When the voltage on VDD is greater than 1.8 V for at least 155 µs, the OUT signal corresponds to the voltage on SENSE, as listed in Table 2.

8.4.2 Undervoltage Lockout ($V_{(POR)} < V_{DD} <$ UVLO)

When the voltage on VDD is less than the device UVLO voltage, and greater than the power-on reset voltage, $V_{(POR)}$, the OUT signal is asserted regardless of the voltage on SENSE.

8.4.3 Power On Reset ($V_{DD} < V_{(POR)}$)

When the voltage on VDD is lower than the required voltage to internally pull the asserted output to GND ($V_{(POR)}$), OUT is in a high-impedance state.

9 Application 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. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

The TLV6713 is used as a precision voltage supervisor in several different configurations. The monitored voltage (V_{MON}), VDD voltage, and output pullup voltage can be independent voltages or connected in any configuration. The following sections show the connection configurations and the voltage limitations for each configuration.

9.1.1 Input and Output Configurations

Figure 13 and Figure 14 show examples of the various input and output configurations.

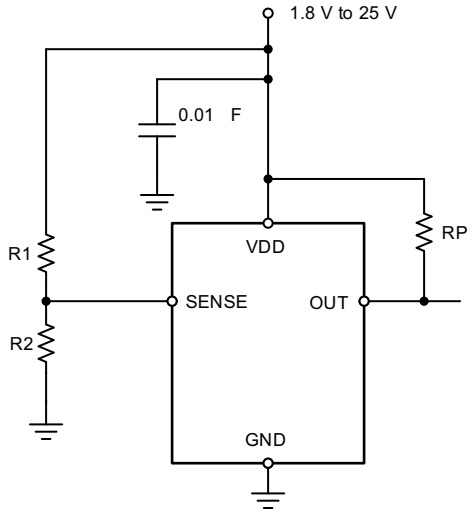
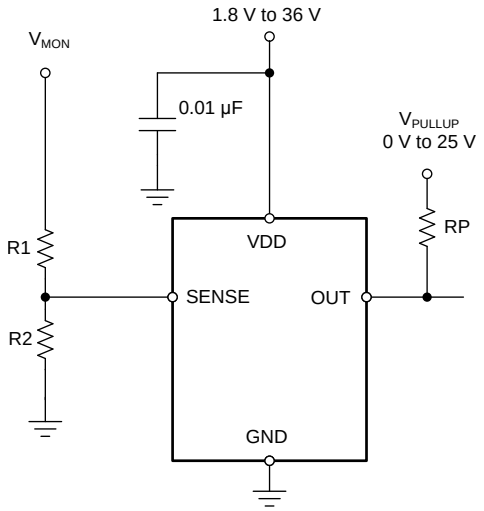


Figure 13. Monitoring the Same Voltage as V_{DD}

Application Information (continued)



NOTE: The input can monitor a voltage higher than V_{DD} (maximum) with the use of an external resistor divider network.

Figure 14. Monitoring a Voltage Other than V_{DD}

9.1.2 Immunity to Input Pin Voltage Transients

The TLV6713 is immune to short voltage transient spikes on the input pin. Sensitivity to transients depends on both transient duration and amplitude; see Figure 3, *Minimum Pulse Duration vs Threshold Overdrive Voltage*.

9.2 Typical Application

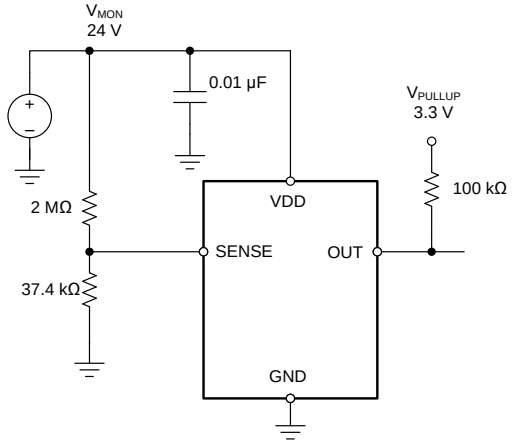


Figure 15. 24-V, 10% Comparator

Typical Application (continued)

9.2.1 Design Requirements

This typical voltage detector application is designed to meet the parameters listed in Table 3:

Table 3. Design Parameters

PARAMETER	DESIGN REQUIREMENT	DESIGN RESULT
Monitored voltage	24-V nominal, falling ($V_{MON(UV)}$) threshold 10% nominal (21.6 V)	$V_{MON(UV)}$ = 21.8 V ±2.7%
Output logic voltage	3.3-V CMOS	3.3-V CMOS
Maximum current consumption	30 µA	24 µA

9.2.2 Detailed Design Procedure

9.2.2.1 Resistor Divider Selection

The resistor divider values and target threshold voltage can be calculated by using Equation 1 to determine $V_{MON(UV)}$.

$$V_{MON(UV)} = \left(1 + \frac{R1}{R2}\right) \times V_{IT-} \quad (1)$$

where

- R1 and R2 are the resistor values for the resistor divider on the SENSE pin
- $V_{MON(UV)}$ is the target voltage at which an undervoltage condition is detected

Choose an R_{TOTAL} (= R1 + R2) so that the current through the divider is approximately 100 times higher than the input current at the SENSE pin. Use resistors with high values to minimize current consumption (as a result of low input bias current) without adding significant error to the resistive divider. For details on sizing input resistors, refer to *Optimizing Resistor Dividers at a Comparator Input*, available for download from www.ti.com.

9.2.2.2 Pullup Resistor Selection

To ensure the proper logic-high voltage level (V_{HI}), select a pullup resistor value where the pullup voltage divided by the pullup resistor value does not exceed the sink-current capability of the device. Confirm this voltage level by verifying that the pullup voltage minus the open-drain leakage current ($I_{D(leak)}$) multiplied by the resistor is greater than the desired V_{HI}. These values are specified in the *Electrical Characteristics*.

Use Equation 2 to calculate the value of the pullup resistor.

$$\frac{V_{HI} - V_{pullup}}{I_{D(leak)}} \le RP \le \frac{V_{pullup}}{I_{OUT}} \quad (2)$$

9.2.2.3 Input Supply Capacitor

Although an input capacitor is not required for stability, for good analog design practice, connect a 0.1-µF low equivalent series resistance (ESR) capacitor across the VDD and GND pins. A higher-value capacitor may be necessary if large, fast rise-time load transients are anticipated, or if the device is not located close to the power source.

9.2.3 Application Curve

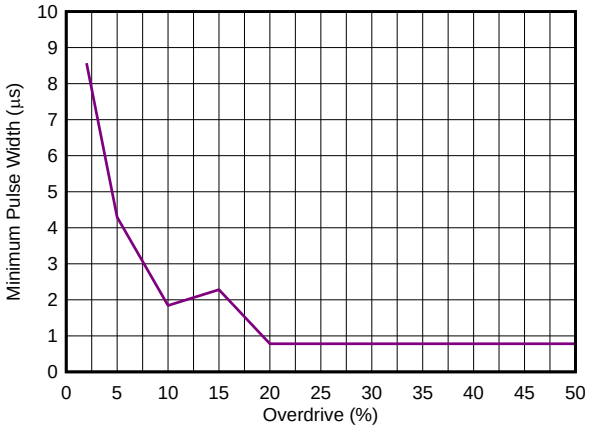


Figure 16. 24-V Window Monitor Output Response

10 Power Supply Recommendations

The TLV6713 has a 40-V absolute maximum rating on the VDD pin, with a recommended maximum operating condition of 36 V. If the voltage supply that provides power to VDD is susceptible to any large voltage transient that may exceed 40 V, or if the supply exhibits high voltage slew rates greater than 1 V/µs, then place an RC filter between the supply and VDD to filter any high-frequency transient surges on the VDD pin. In these cases, a 100-Ω resistor and 0.01-µF capacitor are required, as shown in Figure 17.

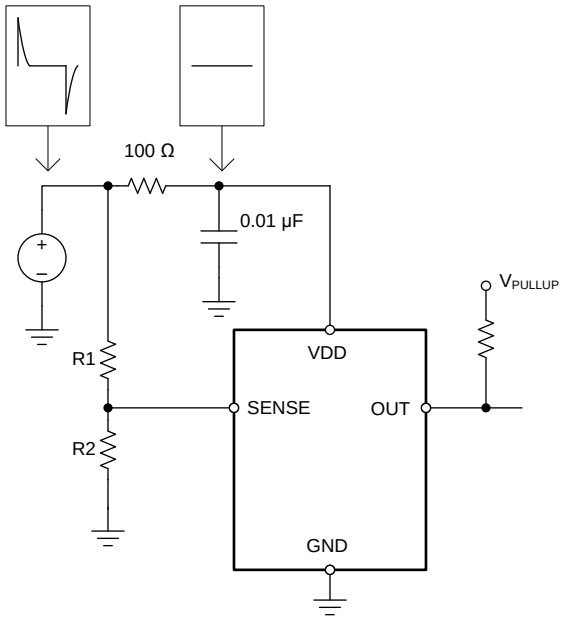


Figure 17. Using a RC Filter to Remove High-Frequency Disturbances on V_{DD}

11 Layout

11.1 Layout Guidelines

- Place R2 and R2 close to the device to minimize noise coupling into the SENSE node.
- Place the VDD decoupling capacitor close to the device.
- Avoid using long traces for the VDD supply node. The VDD capacitor (C_{VDD}), along with parasitic inductance from the supply to the capacitor, might form an LC tank and create ringing with peak voltages above the maximum VDD voltage. If long traces are unavoidable, see Figure 17 for an example of filtering VDD.

11.2 Layout Example

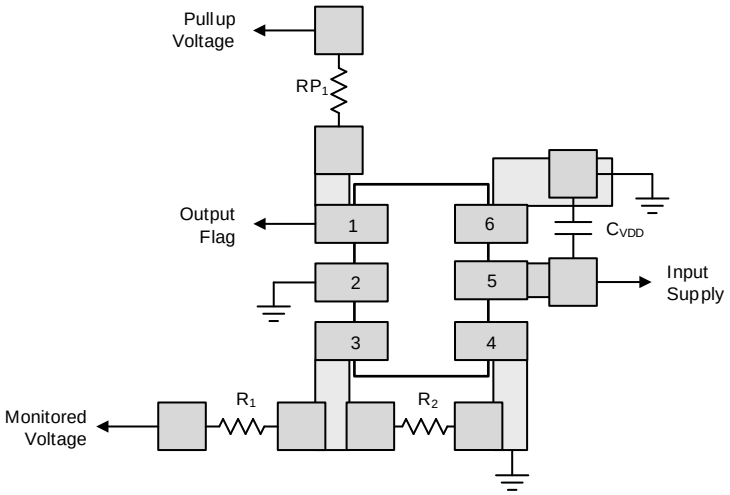


Figure 18. Recommended Layout

12 デバイスおよびドキュメントのサポート

12.1 デバイス・サポート

12.1.1 開発サポート

*DIPアダプタ評価モジュール*では、SOT-23-6パッケージを標準のDIP-6ピン配置に変換して、プロトタイプ製作とベンチ評価を簡単に行うことができます。

12.2 ドキュメントの更新通知を受け取る方法

ドキュメントの更新についての通知を受け取るには、ti.comのデバイス製品フォルダを開いてください。右上の隅にある「*通知を受け取る*」をクリックして登録すると、変更されたすべての製品情報に関するダイジェストを毎週受け取れます。変更の詳細については、修正されたドキュメントに含まれている改訂履歴をご覧ください。

12.3 コミュニティ・リソース

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

TI E2E™オンライン・コミュニティ ***TIのE2E（Engineer-to-Engineer）コミュニティ。エンジニア間の共同作業を促進するために開設されたものです。e2e.ti.comでは、他のエンジニアに質問し、知識を共有し、アイディアを検討して、問題解決に役立てることができます。***

設計サポート ***TIの設計サポート*** **役に立つE2Eフォーラムや、設計サポート・ツールをすばやく見つけることができます。技術サポート用の連絡先情報も参照できます。**

12.4 商標

E2E is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

12.5 静電気放電に関する注意事項

すべての集積回路は、適切なESD保護方法を用いて、取扱いと保存を行うようにして下さい。

静電気放電はわずかな性能の低下から完全なデバイスの故障に至るまで、様々な損傷を与えます。高精度の集積回路は、損傷に対して敏感であり、極めてわずかなパラメータの変化により、デバイスに規定された仕様に適合しなくなる場合があります。

12.6 Glossary

SLYZ022 — *TI Glossary*.

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

13 メカニカル、パッケージ、および注文情報

以降のページには、メカニカル、パッケージ、および注文に関する情報が記載されています。この情報は、そのデバイスについて利用可能な最新のデータです。このデータは予告なく変更されることがあり、ドキュメントが改訂される場合もあります。本データシートのブラウザ版を使用されている場合は、画面左側の説明をご覧ください。

PACKAGING INFORMATION

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)
TLV6713DDCR	Active	Production	SOT-23-THIN (DDC) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	1II1
TLV6713DDCR.A	Active	Production	SOT-23-THIN (DDC) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	1II1
TLV6713DDCT	Active	Production	SOT-23-THIN (DDC) | 6	250 | SMALL T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	1II1
TLV6713DDCT.A	Active	Production	SOT-23-THIN (DDC) | 6	250 | SMALL T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	1II1
TLV6713DDCTG4	Active	Production	SOT-23-THIN (DDC) | 6	250 | SMALL T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	1II1
TLV6713DDCTG4.A	Active	Production	SOT-23-THIN (DDC) | 6	250 | SMALL T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	1II1

(1) **Status:** For more details on status, see our product life cycle.

(2) **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.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **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.

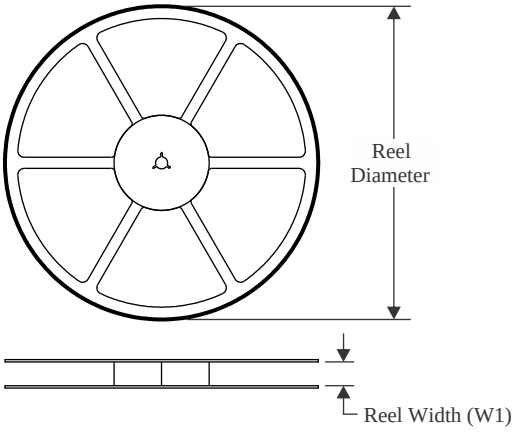
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will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

(6) **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.

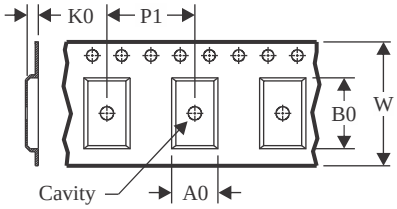
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

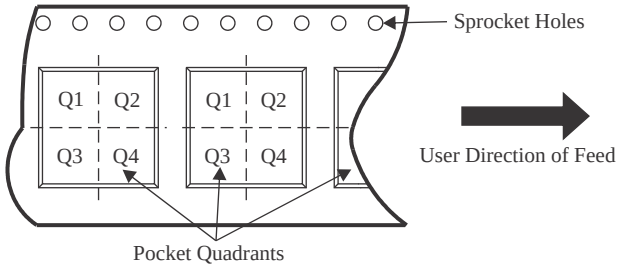


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

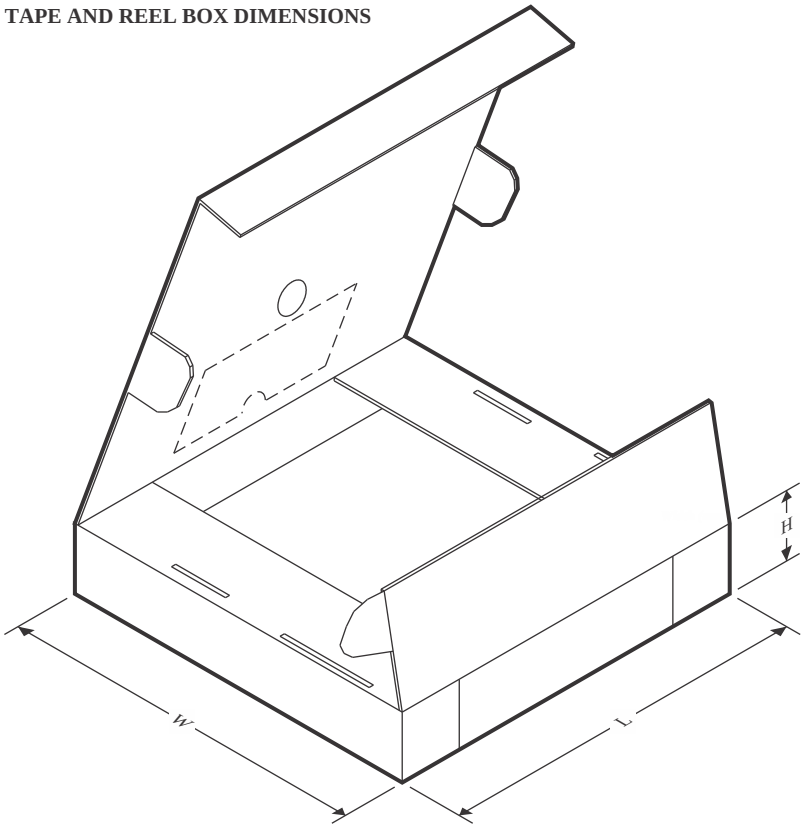
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TLV6713DDCR	SOT-23-THIN	DDC	6	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV6713DDCT	SOT-23-THIN	DDC	6	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV6713DDCTG4	SOT-23-THIN	DDC	6	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

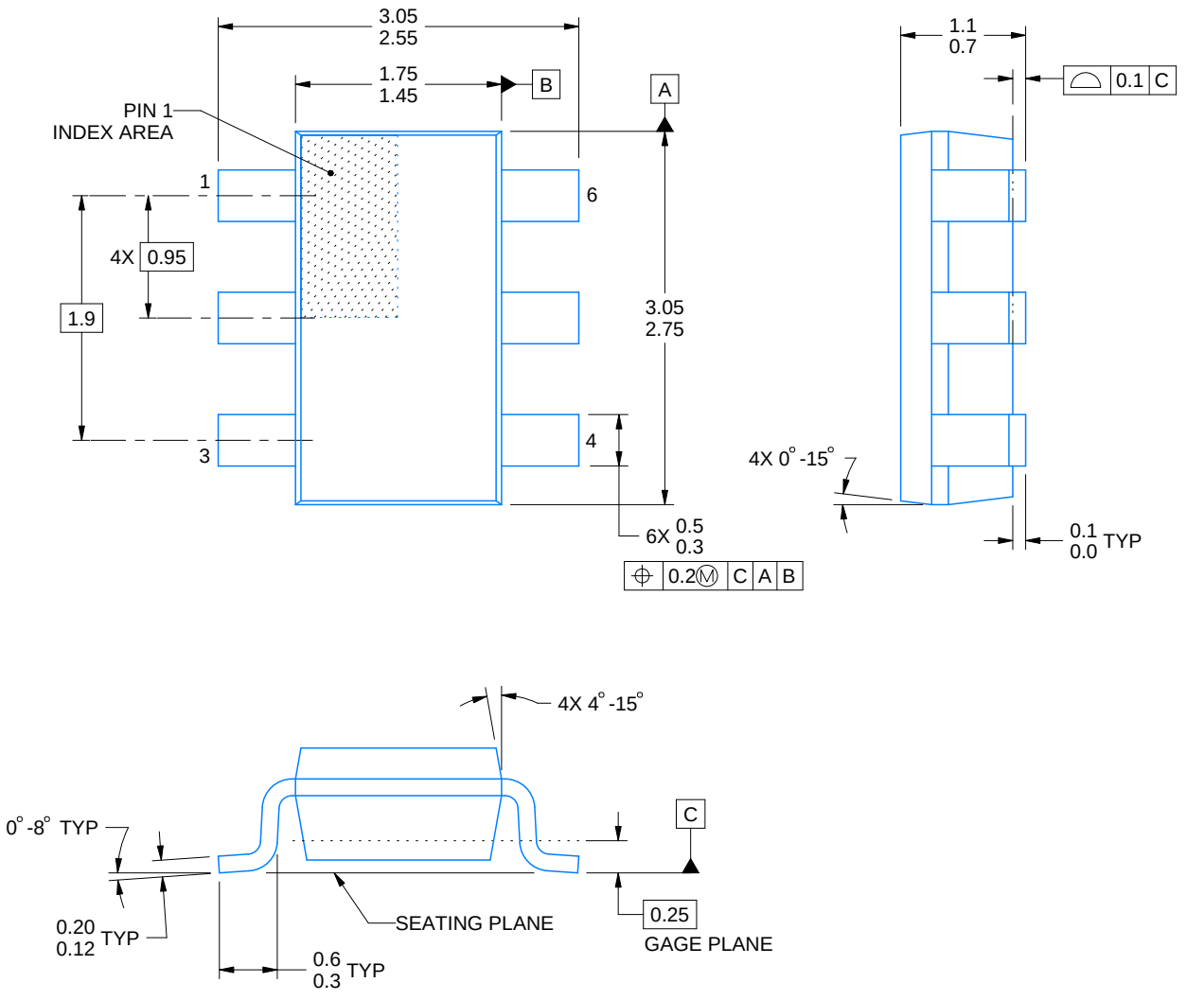
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLV6713DDCR	SOT-23-THIN	DDC	6	3000	213.0	191.0	35.0
TLV6713DDCT	SOT-23-THIN	DDC	6	250	213.0	191.0	35.0
TLV6713DDCTG4	SOT-23-THIN	DDC	6	250	213.0	191.0	35.0

PACKAGE OUTLINE

DDC0006A

SOT-23 - 1.1 max height

SMALL OUTLINE TRANSISTOR



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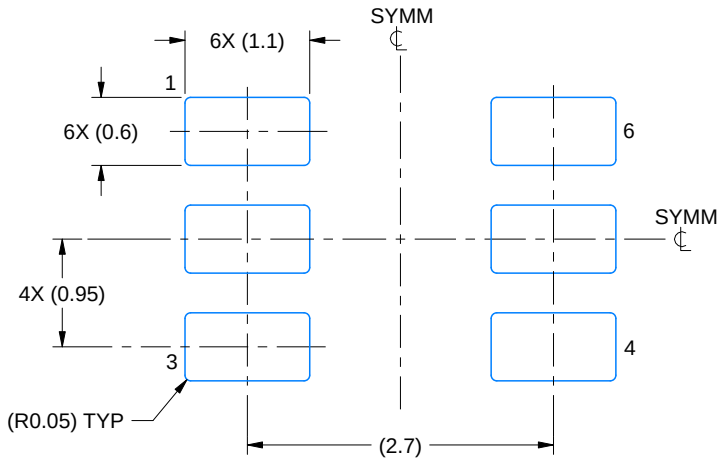
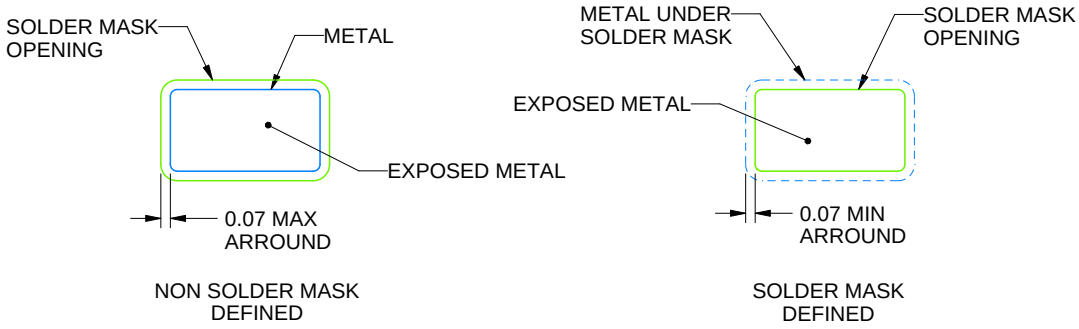
NOTES:

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 MO-193.



LAND PATTERN EXAMPLE
EXPLOSED METAL SHOWN
SCALE:15X



SOLDERMASK DETAILS

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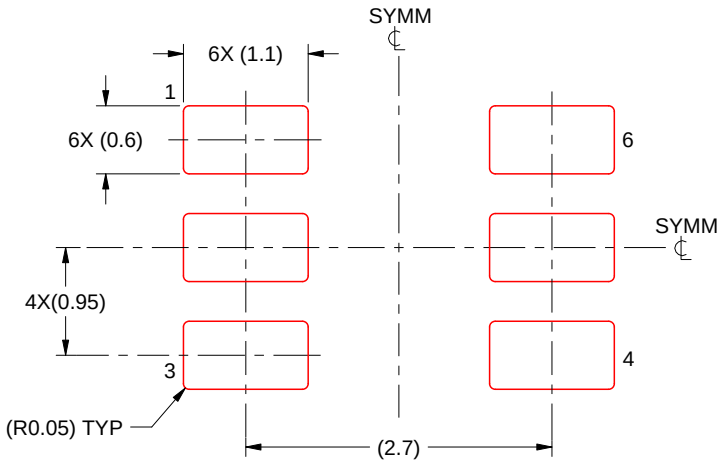
NOTES: (continued)

4. Publication IPC-7351 may have alternate designs.
5. 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:15X

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NOTES: (continued)

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

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