TPS3700-Q1 過電圧および低電圧監視用の基準電圧を内蔵した車載用高電圧 (18V) ウィンドウ電圧検出器

1 特長

- 車載アプリケーション用に認定済み
- 下記内容で AEC-Q100 認定済み:
  - デバイス温度グレード 1:-40℃～125℃の周囲動作温度範囲
  - デバイス HBM ESD 分類レベル H2
  - デバイス CDM ESD 分類レベル C6
- 機能安全対応
  - 機能安全準拠のシステム設計に役立つ資料を利用可能
- 広い電源電圧範囲:1.8V～18V
- 可変スレッショルド:400mV まで下降
- 過電圧および低電圧検出用のオープン・ドレイン出力
- 低い静止電流:5.5μA (標準値)
- スレッショルドの高い精度:
  - 温度範囲全体で 1%
  - 0.25% (標準値)
- 内部ヒステリシス:5.5mV (標準値)
- ThinSOT23-6 と WSON の各パッケージで供給されます

2 アプリケーション

- 先進運転支援システム (ADAS)
- ADAS ドメイン・コントローラ
- デジタル・コックピット
- 車載用インフォテインメントおよびクラスタ
- HEV/EV OBC およびワイヤレス・チャージャ
- 産業用ロボット

簡略回路図

3 概要

TPS3700-Q1 は電源電圧範囲の広いウィンドウ電圧検出器で、1.8V～18V の範囲で動作します。このデバイスには高精度コンパレータが 2 つ、内部的な 400mV の基準電圧、および過電圧と低電圧検出用の 18V 定格のオープン・ドレイン出力が 2 つ内蔵されています。TPS3700-Q1 はウィンドウ電圧検出器としても、2 つの独立した電圧モニタとしても使用でき、監視対象の電圧は外付け抵抗により設定できます。最大 65V の入力電圧に対応できるより広い範囲については、TPS37A-Q1 デバイスまたは TPS38A-Q1 デバイスを参照してください。

OUTA ピンは、INA+ ピンの電圧が ($V_{IT+} – V_{hys}$) より低くなると LOW に駆動され、対応するスレッショルド (V_{IT+}) より高い電圧に戻ると HIGH に復帰します。OUTB ピンは、INB– ピンの電圧が V_{IT+} より高くなると LOW に駆動され、対応するスレッショルド ($V_{IT+} – V_{hys}$) より低い電圧に戻ると HIGH に復帰します。TPS3700-Q1 デバイスのコンパレータは両方とも、短時間のグリッチを除去するためヒステリシスが組み込まれているので、誤ったトリガが発生せず、安定した出力動作が保証されます。

TPS3700-Q1 デバイスは Thin SOT-6 および 1.5mm × 1.5mm の WSON-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

発注型番	パッケージ (1)	本体サイズ
TPS3700-Q1	SOT23 (6)	2.90mm × 1.60mm
	WSON (6)	1.50mm × 1.50mm

(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注文情報を参照してください。

出力と入力のスレッショルドとヒステリシスの関係

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4 Revision History

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

Changes from Revision B (July 2017) to Revision C (March 2021) — **Page**

- 「機能安全対応」デバイスの箇条書き項目を追加 ... 1
- TI.com アプリケーション・ページへのリンクを追加 ... 1
- ドキュメント全体にわたって表、図、相互参照の採番方法を更新、製品情報の型番を GPN に訂正 ... 1
- Moved Storage temperature range here in the Absolute Maximum Ratings from the section previously called handling ratings (which also included ESD ratings) when the ESD ratings section was updated per the latest format ... 4
- Corrected table formatting, descriptions and the notes in ESD Ratings section per the latest standards ... 4
- Corrected Input Voltage Max on INA+, INB- from 6 V to 6.5 V to match the device capability ... 4
- Added missing Thermal Information for the DSE package ... 4
- Added the missing max start-up delay spec and corrected corresponding note 2 ... 5

Changes from Revision A (April 2014) to Revision B (July 2017) — **Page**

- 「製品情報」表に WSON パッケージを追加 ... 1
- Added WSON Package to Pin Configuration and Function table ... 3

Changes from Revision * (March 2014) to Revision A (April 2014) — **Page**

- デバイスのステータスを「製品プレビュー」から「量産データ」へ変更 ... 1

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5 Pin Configuration and Functions

図 5-1. DDC Package SOT-6 Top View

図 5-2. DSE Package WSON-6 Top View

表 5-1. Pin Functions

PIN			I/O	DESCRIPTION
NAME	DDC	DSE		
GND	2	5	—	Ground
INA+	3	4	I	This pin is connected to the voltage to be monitored with the use of an external resistor divider. When the voltage at this terminal drops below the threshold voltage (V_{IT+} – V_{HYS}), OUTA is driven low.
INB–	4	3	I	This pin is connected to the voltage to be monitored with the use of an external resistor divider. When the voltage at this terminal exceeds the threshold voltage (V_{IT+}), OUTB is driven low.
OUTA	1	6	O	INA+ comparator open-drain output. OUTA is driven low when the voltage at this comparator is below (V_{IT+} – V_{HYS}). The output goes high when the sense voltage returns above the respective threshold (V_{IT+}).
OUTB	6	1	O	INB– comparator open-drain output. OUTB is driven low when the voltage at this comparator exceeds V_{IT+}. The output goes high when the sense voltage returns below the respective threshold (V_{IT+} – V_{HYS}).
VDD	5	2	I	Supply voltage input. Connect a 1.8-V to 18-V supply to VDD to power the device. Good analog design practice is to place a 0.1-µF ceramic capacitor close to this pin.

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6 Specifications

6.1 Absolute Maximum Ratings

Over operating temperature range (unless otherwise noted)[(1)]

		MIN	MAX	UNIT
Voltage[(2)]	V_{DD}	–0.3	20	V
	OUTA, OUTB	–0.3	20	V
	INA+, INB–	–0.3	7	V
Current	Output terminal current		40	mA
Operating junction temperature, T_J		–40	125	°C
Storage temperature range, T_{stg}		-65	150	°C

(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.

6.2 ESD Ratings

			VALUE	UNIT
V_{ESD}	Electrosatic discharge	Human body model (HBM), per AEC Q100-002[(1)]	±2500	V
		Charge device model (CDM), per AEC Q100-011	±1000	

(1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

6.3 Recommended Operating Conditions

Over operating temperature range (unless otherwise noted)

			MIN	MAX	UNIT
V_{DD}	Supply voltage		1.8	18	V
V_I	Input voltage	INA+, INB–	0	6.5	V
V_O	Output voltage	OUTA, OUTB	0	18	V

6.4 Thermal Information

THERMAL METRIC[(1)]		TPS3700-Q1		UNIT
		DDC (SOT)	DSE (WSON)	
		6 pins	6 pins	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	174.0	160.7	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	81.5	101.9	
$R_{\theta JB}$	Junction-to-board thermal resistance	47.2	68.8	
ψ_{JT}	Junction-to-top characterization parameter	22.0	5.4	
ψ_{JB}	Junction-to-board characterization parameter	46.9	68.6	
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	N/A	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.

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6.5 Electrical Characteristics

Over the operating temperature range of T_J = –40°C to 125°C, and 1.8 V < V_{DD} < 18 V, unless otherwise noted. Typical values are at T_J = 25°C and V_{DD} = 5 V.

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{DD}	Supply voltage range		1.8		18	V
$V_{(POR)}$	Power-on reset voltage[1]	V_{OL}max = 0.2 V, $I_{(OUTA/B)}$ = 15 µA			0.8	V
V_{IT+}	Positive-going input threshold voltage	V_{DD} = 1.8 V	396	400	404	mV
		V_{DD} = 18 V	396	400	404	mV
$V_{IT–}$	Negative-going input threshold voltage	V_{DD} = 1.8 V	387	394.5	400	mV
		V_{DD} = 18 V	387	394.5	400	mV
V_{hys}	Hysteresis voltage (hys = V_{IT+} – $V_{IT–}$)			5.5	12	mV
$I_{(INA+)}$ $I_{(INB–)}$	Input current (at the INA+ or INB– terminal)	V_{DD} = 1.8 V and 18 V, V_I = 6.5 V	–25	1	25	nA
		V_{DD} = 1.8 V and 18 V, V_I = 0.1 V	–15	1	15	nA
V_{OL}	Low-level output voltage	V_{DD} = 1.3 V, I_O = 0.4 mA			250	mV
		V_{DD} = 1.8 V, I_O = 3 mA			250	mV
		V_{DD} = 5 V, I_O = 5 mA			250	mV
$I_{lkg(OD)}$	Open-drain output leakage-current	V_{DD} = 1.8 V and 18 V, V_O = V_{DD}			300	nA
		V_{DD} = 1.8 V, V_O = 18 V			300	nA
I_{DD}	Supply current	V_{DD} = 1.8 V, no load		5.5	11	µA
		V_{DD} = 5 V		6	13	µA
		V_{DD} = 12 V		6	13	µA
		V_{DD} = 18 V		7	13	µA
	Startup delay[2]			150	450	µs
UVLO	Undervoltage lockout[4]	V_{DD} falling	1.3		1.7	V

(1) The lowest supply voltage (V_{DD}) at which output is active; $t_{r(VDD)}$ > 15 µs/V. Below $V_{(POR)}$, the output cannot be determined.
(2) During power on, V_{DD} must exceed 1.8 V for 450 µs (max) before the output is in a correct state.
(3) High-to-low and low-to-high refers to the transition at the input terminals (INA+ and INB–).
(4) When V_{DD} falls below UVLO, OUTA is driven low and OUTB goes to high impedance. The outputs cannot be determined below $V_{(POR)}$.

6.6 Timing Requirements

Over operating temperature range (unless otherwise noted)

			MIN	TYP	MAX	UNIT
t_{PHL}	High-to-low propagation delay(3)	V_{DD} = 5 V, 10-mV input overdrive, R_P = 10 kΩ, V_{OH} = 0.9 × V_{DD}, V_{OL} = 400 mV See 図 6-1		18		µs
t_{PLH}	Low-to-high propagation delay(3)	V_{DD} = 5 V, 10-mV input overdrive, R_P = 10 kΩ, V_{OH} = 0.9 × V_{DD}, V_{OL} = 400 mV See 図 6-1		29		µs

6.7 Timing Diagram

図 6-1. Timing Diagram

6.8 Switching Characteristics

Over operating temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_r	Output rise time	V_{DD} = 5 V, 10-mV input overdrive, R_P = 10 kΩ, V_O = (0.1 to 0.9) × V_{DD}		2.2		µs
t_f	Output fall time	V_{DD} = 5 V, 10-mV input overdrive, R_P = 10 kΩ, V_O = (0.1 to 0.9) × V_{DD}		0.22		µs

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6.9 Typical Characteristics

At T_J = 25°C and V_{DD} = 5 V, unless otherwise noted.

図 6-2. Supply Current (I_{DD}) vs Supply Voltage (V_{DD})

図 6-3. Rising Input Threshold Voltage (V_{IT+}) vs Temperature

図 6-4. Hysteresis (V_{hys}) vs Temperature

図 6-5. Propagation Delay vs Temperature (High-to-Low Transition at the Inputs)

図 6-6. Propagation Delay vs Temperature (Low-to-High Transition at the Inputs)

INA+ = negative spike below V_{IT-}

INB– = positive spike above V_{IT+}

図 6-7. Minimum Pulse Width vs Threshold Overdrive Voltage

6.9 Typical Characteristics (continued)

At T_J = 25°C and V_{DD} = 5 V, unless otherwise noted.

図 6-8. Supply Current (I_{DD}) vs Output Sink Current

図 6-9. Output Voltage Low (V_{OL}) vs Output Sink Current (–40°C)

図 6-10. Output Voltage Low (V_{OL}) vs Output Sink Current (0°C)

図 6-11. Output Voltage Low (V_{OL}) vs Output Sink Current (25°C)

図 6-12. Output Voltage Low (V_{OL}) vs Output Sink Current (85°C)

図 6-13. Output Voltage Low (V_{OL}) vs Output Sink Current (125°C)

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7 Detailed Description

7.1 Overview

The TPS3700-Q1 device combines two comparators for overvoltage and undervoltage detection. The TPS3700-Q1 device is a wide-supply voltage range (1.8 to 18 V) device with a high-accuracy rising input threshold of 400 mV (1% over temperature) and built-in hysteresis. The outputs are also rated to 18 V and can sink up to 40 mA.

The TPS3700-Q1 device is designed to assert the output signals, as shown in 表 7-1. Each input terminal can be set to monitor any voltage above 0.4 V using an external resistor divider network. With the use of two input terminals of different polarities, the TPS3700-Q1 device forms a window voltage detector. Broad voltage thresholds can be supported that allow the device to be used in a wide array of applications.

表 7-1. TPS3700-Q1 Truth Table

CONDITION	OUTPUT	STATUS
INA+ > V_{IT+}	OUTA high	Output A not asserted
INA+ < V_{IT-}	OUTA low	Output A asserted
INB– > V_{IT+}	OUTB low	Output B asserted
INB– < V_{IT-}	OUTB high	Output B not asserted

7.2 Functional Block Diagram

7.3 Feature Description

7.3.1 Inputs (INA+, INB–)

The TPS3700-Q1 device combines two comparators. Each comparator has one external input (inverting and noninverting); the other input is connected to the internal reference. The comparator rising threshold is designed and trimmed to be equal to the reference voltage (400 mV). Both comparators also have a built-in falling hysteresis that makes the device less sensitive to supply rail noise and ensures stable operation.

The INA+ and INB- inputs can swing from ground to 6.5 V, 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 extremely noisy applications in order to reduce sensitivity to transients and layout parasitics.

For comparator A, the corresponding output (OUTA) is driven to logic low when the input INA+ voltage drops below (V_{IT+} – V_{hys}). When the voltage exceeds V_{IT+}, the output (OUTA) goes to a high-impedance state; see 図 6-1.

For comparator B, the corresponding output (OUTB) is driven to logic low when the voltage at input INB– exceeds V_{IT+}. When the voltage drops below V_{IT+} – V_{hys} the output (OUTB) goes to a high-impedance state; see

図 6-1 . Together, these comparators form a window-detection function as discussed in the *セクション 7.3.3* section.

7.3.2 Outputs (OUTA, OUTB)

In a typical TPS3700-Q1 application, the outputs are connected to a reset or enable 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]) or the outputs are connected to the enable input of a voltage regulator (such as a DC-DC or low-dropout regulator [LDO]).

The TPS3700-Q1 device provides two open-drain outputs (OUTA and OUTB). Pullup resistors must be used to hold these lines high when the output goes to high impedance (not asserted). By connecting pullup resistors to the proper voltage rails, the outputs can be connected to other devices at the correct interface-voltage levels. The TPS3700-Q1 outputs can be pulled up to 18 V, independent of the device supply voltage. To ensure proper voltage levels, some thought should be given while choosing the pullup resistor values. The pullup resistor value is determined by V_{OL}, sink-current capability, and output-leakage current ($I_{lkg(OD)}$). These values are specified in the セクション 6.5 table. By using wired-AND logic, OUTA and OUTB can merge into one logic signal.

表 7-1 and the *セクション 7.3.1* section describe how the outputs are asserted or de-asserted. See 図 6-1 for a timing diagram that describes the relationship between threshold voltages and the respective output.

7.3.3 Window Voltage Detector

The inverting and noninverting configuration of the comparators forms a window voltage detector circuit using a resistor divider network, as shown in 図 7-1 and 図 7-2. The input terminals can monitor any system voltage above 400 mV with the use of a resistor divider network. The INA+ and INB– terminals monitor for undervoltage and overvoltage conditions, respectively.

図 7-1. Window Voltage Detector Block Diagram

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図 7-2. Window Voltage Detector Timing Diagram

7.3.4 Immunity to Input Terminal Voltage Transients

The TPS3700-Q1 device is relatively immune to short voltage transient spikes on the input terminals. Sensitivity to transients is dependent on both transient duration and amplitude; see the *Minimum Pulse Width vs Threshold Overdrive Voltage* curve (図 6-7) in the セクション 6.9 section.

7.4 Device Functional Modes

The TPS3700-Q1 has a single functional mode, which is on when V_{DD} is greater than 1.8 V.

8 Application and Implementation

8.1 Application Information

The TPS3700-Q1 device is a wide-supply voltage window voltage detector that operates over a V_{DD} range of 1.8-V to 18-V. The device has two high-accuracy comparators with an internal 400-mV reference and two open-drain outputs rated to 18 V for overvoltage and undervoltage detection. The device can be used either as a window voltage detector or as two independent voltage monitors. The monitored voltages are set with the use of external resistors.

8.1.1 V_{PULLUP} to a Voltage Other Than V_{DD}

The outputs are often tied to V_{DD} through a resistor. However some applications may require the outputs to be pulled up to a higher or lower voltage than V_{DD} in order to correctly interface with the reset and enable the terminal of other devices.

図 8-1. Interfacing to Voltages Other Than V_{DD}

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8.1.2 Monitoring V_{DD}

Many applications monitor the same rail that is powering V_{DD}. In these applications the resistor divider is simply connected to the V_{DD} rail.

図 8-2. Monitoring the Same Voltage as V_{DD}

8.1.3 Monitoring a Voltage Other Than V_{DD}

Some applications monitor rails other than the one that is powering V_{DD}. In these types of applications the resistor divider used to set the desired thresholds in connected to the rail that is being monitored.

NOTE: The inputs can monitor a voltage higher than V_{DD}max with the use of an external resistor divider network.

図 8-3. Monitoring a Voltage Other Than V_{DD}

8.1.4 Monitoring Overvoltage and Undervoltage for Separate Rails

Some applications may want to monitor for overvoltage conditions on one rail while also monitoring for undervoltage conditions on a different rail. In those applications two independent resistor dividers will need to be used.

NOTE: In this case, OUTA is driven low when an undervoltage condition is detected at the 5-V rail and OUTB is driven low when an overvoltage condition is detected at the 12-V rail.

図 8-4. Monitoring Overvoltage for One Rail and Undervoltage for a Different Rail

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8.2 Typical Application

図 8-5. Typical Application Schematic

8.2.1 Design Requirements

8.2.1.1 Input Supply Capacitor

Although an input capacitor is not required for stability, connecting a 0.1-µF low equivalent series resistance (ESR) capacitor across the V_{DD} terminal and GND terminal is good analog design practice. 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.

8.2.1.2 Input Capacitors

Although not required in most cases, for extremely noisy applications, placing a 1-nF to 10-nF bypass capacitor from the comparator inputs (INA+, INB–) to the GND terminal is good analog design practice. This capacitor placement reduces device sensitivity to transients.

8.2.2 Detailed Design Procedure

Use 式 1 through 式 4 to calculate the resistor divider values and target threshold voltage.

$$R_T = R_1 + R_2 + R_3 \tag{1}$$

Select a value for R_T such that the current through the divider is approximately 100-times higher than the input current at the INA+ and INB– terminals. The resistors can have high values to minimize current consumption as a result of low-input bias current without adding significant error to the resistive divider. See the application note *Optimizing Resistor Dividers at a Comparator Input* (SLVA450) for details on sizing input resistors.

Use 式 2 to calculate the value of R_3.

$$R_3 = \frac{R_T}{V_{MON(OV)}} \times V_{IT+} \tag{2}$$

where

- $V_{MON(OV)}$ is the target voltage at which an overvoltage condition is detected

Use 式 3 or 式 4 to calculate the value of R_2.

$$R_2 = \left(\frac{R_T}{V_{MON}\,(\text{no UV})} \times V_{IT+} \right) - R_3 \tag{3}$$

where

- $V_{MON(no\ UV)}$ is the target voltage at which an undervoltage condition is removed as V_{MON} rises

$$R_2 = \left(\frac{R_T}{V_{MON(UV)}} \times (V_{IT+} - V_{hys}) \right) - R_3 \tag{4}$$

where:

$V_{MON(UV)}$ is the target voltage at which an undervoltage condition is detected

•

8.2.3 Application Curves

T_J = 25°C

図 8-6. Startup Delay (Outputs Pulled Up to V_{DD})

図 8-7. Startup Delay (Outputs Pulled Up to V_{DD})

9 Power Supply Recommendations

These devices are designed to operate from an input voltage supply range between 1.8 V and 18 V.

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10 Layout

10.1 Layout Guidelines

Placing a 0.1-µF capacitor close to the V_{DD} terminal to reduce the input impedance to the device is good analog design practice. The pullup resistors can be separated if separate logic functions are needed (see 図 10-1) or both resistors can be tied to a single pullup resistor if a logical AND function is desired.

10.2 Layout Example

図 10-1. TPS3700-Q1 Layout Example

11 Device and Documentation Support

11.1 Documentation Support

11.1.1 Related Documentation

For related documentation see the following:

- *Using the TPS3700 as a Negative Rail Over- and Undervoltage Detector*, SLVA600
- *Optimizing Resistor Dividers at a Comparator Input*, SLVA450
- *TPS3700EVM-114 Evaluation Module*, SLVU683

11.2 Trademarks

すべての商標は、それぞれの所有者に帰属します。

11.3 静電気放電に関する注意事項

この IC は、ESD によって破損する可能性があります。テキサス・インスツルメンツは、IC を取り扱う際には常に適切な注意を払うことを推奨します。正しい ESD 対策をとらないと、デバイスを破損するおそれがあります。

ESD による破損は、わずかな性能低下からデバイスの完全な故障まで多岐にわたります。精密な IC の場合、パラメータがわずかに変化するだけで公表されている仕様から外れる可能性があるため、破損が発生しやすくなっています。

11.4 用語集

TI 用語集　　この用語集には、用語や略語の一覧および定義が記載されています。

12 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.

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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)
TPS3700QDDCRQ1	Active	Production	SOT-23-THIN (DDC) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	PD7Q
TPS3700QDDCRQ1.A	Active	Production	SOT-23-THIN (DDC) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	PD7Q
TPS3700QDSERQ1	Active	Production	WSON (DSE) | 6	3000 | LARGE T&R	Yes	NIPDAUAG	Level-2-260C-1 YEAR	-40 to 125	5O
TPS3700QDSERQ1.A	Active	Production	WSON (DSE) | 6	3000 | LARGE T&R	Yes	NIPDAUAG	Level-2-260C-1 YEAR	-40 to 125	5O
TPS3700QDSERQ1.B	Active	Production	WSON (DSE) | 6	3000 | LARGE T&R	Yes	NIPDAUAG	Level-2-260C-1 YEAR	-40 to 125	5O

(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.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF TPS3700-Q1 :

- Catalog : TPS3700

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

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
TPS3700QDDCRQ1	SOT-23-THIN	DDC	6	3000	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS3700QDSERQ1	WSON	DSE	6	3000	179.0	8.4	1.8	1.8	1.0	4.0	8.0	Q2

TAPE AND REEL BOX DIMENSIONS

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS3700QDDCRQ1	SOT-23-THIN	DDC	6	3000	213.0	191.0	35.0
TPS3700QDSERQ1	WSON	DSE	6	3000	213.0	191.0	35.0

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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.

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.

LAND PATTERN EXAMPLE
SCALE:40X

SOLDER MASK DETAILS

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NOTES: (continued)

3. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:40X

NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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