

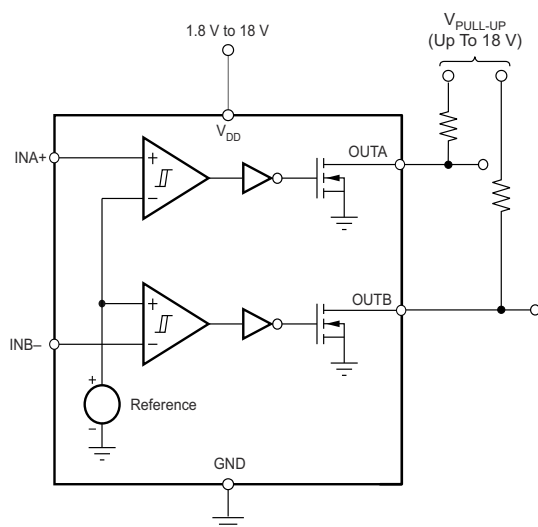
# TLV6700-Q1 400mV 基準電圧搭載のマイクロパワー、18V ウィンドウ・コンパレータ

## 1 特長

- 車載アプリケーション向けに認定済み
- 下記内容で AEC-Q100 認定済み:
  - デバイス温度グレード 1:  $-40^{\circ}\text{C}$ ~ $125^{\circ}\text{C}$ の動作時周囲温度範囲
  - デバイス HBM ESD 分類レベル H2
  - デバイス CDM ESD 分類レベル C6
- 広い電源電圧範囲: 1.8V~18V
- スレッシュホールドを変更可能: 最低 400mV
- 高いスレッシュホールド精度:
  - $25^{\circ}\text{C}$ で最大 0.5%
  - 温度範囲全体で最大 1.0%
- 低い静止電流: 5.5 $\mu\text{A}$  (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:  $-40^{\circ}\text{C}$ ~ $125^{\circ}\text{C}$
- パッケージ:
  - Thin SOT-23-6
  - リードレス WSON-6

## 2 アプリケーション

- 緊急通話 (eCall)
- 車載ヘッド・ユニット
- インストルメント・クラスタ
- オンボード・チャージャ (OBC) / ワイヤレス・チャージャ



ブロック概略図

## 3 概要

TLV6700-Q1 は、1.8V~18V の電源電圧範囲で動作する高電圧ウィンドウ・コンパレータです。高精度コンパレータを 2 つ搭載し、400mV の基準電圧のほかに、定格 18V のオープン・ドレイン出力を 2 つ内蔵しています。TLV6700-Q1 はウィンドウ・コンパレータとしても、2 つの独立したコンパレー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。

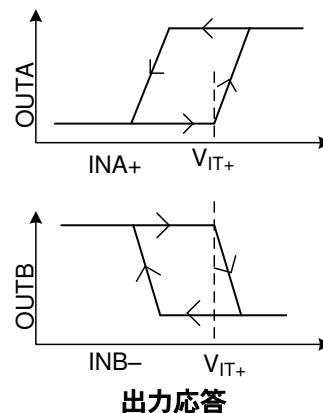
OUTA は、INA+ の電圧が ( $V_{ITP} - V_{HYS}$ ) より低くなると Low に駆動され、対応するスレッシュホールド ( $V_{ITP}$ ) より高い電圧に戻ると High に復帰します。OUTB は、INB- の電圧が  $V_{ITP}$  より高くなると Low に駆動され、対応するスレッシュホールド ( $V_{ITP} - V_{HYS}$ ) より低い電圧に戻ると High に復帰します。TLV6700-Q1 のコンパレータは両方とも、短時間のグリッチを除去するためヒステリシスが組み込まれているので、誤ったトリガが発生せず、安定した出力動作が確保されます。

TLV6700-Q1 は、Thin SOT-23-6 とリードレス WSON-6 で供給されます。コンパレータは、接合部温度  $-40^{\circ}\text{C}$ ~ $125^{\circ}\text{C}$  の範囲で動作が規定されています。

### 製品情報 (1)

部品番号	パッケージ	本体サイズ (公称)
TLV6700-Q1	SOT-23 (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。



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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。

DATE	REVISION	NOTES
November 2020	*	Initial Release

## 5 Device Comparison Table

**表 5-1. Industrial TLV67xx Comparator Family**

PART NUMBER	CONFIGURATION	OPERATING VOLTAGE RANGE	THRESHOLD ACCURACY OVER TEMPERATURE
<a href="#">TLV6700</a>	Window	1.8 V to 18 V	1%
<a href="#">TLV6703</a>	Non-Inverting Single Channel	1.8 V to 18 V	1%
<a href="#">TLV6710</a>	Window	1.8 V to 36 V	0.75%
<a href="#">TLV6713</a>	Non-Inverting Single Channel	1.8 V to 36 V	0.75%

## 6 Pin Configuration and Functions

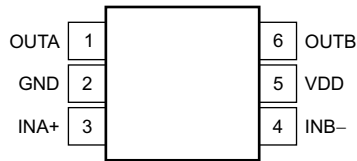


图 6-1. DDC Package, SOT-23-6, Top View

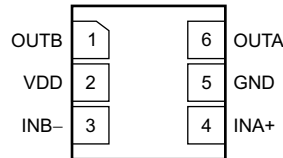


图 6-2. DSE Package, WSON-6, Top View

表 6-1. Pin Functions

NAME	PIN		I/O	DESCRIPTION
	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 ( $V_{ITP} - V_{HYS}$ ), 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 ( $V_{ITP}$ ), 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 ( $V_{ITP} - V_{HYS}$ ). The output goes high when the sense voltage returns above the respective threshold ( $V_{ITP}$ ).
OUTB	6	1	O	INB- comparator open-drain output. OUTB is driven low when the voltage at this comparator exceeds $V_{ITP}$ . The output goes high when the sense voltage returns below the respective threshold ( $V_{ITP} - V_{HYS}$ ).
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- $\mu$ F ceramic capacitor close to this pin.

## 7 Specifications

### 7.1 Absolute Maximum Ratings

over operating temperature range (unless otherwise noted)<sup>(1)</sup>

		MIN	MAX	UNIT
Voltage <sup>(2)</sup>	V <sub>DD</sub>	-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 <sub>J</sub>		-40	125	°C
Storage temperature, T <sub>stg</sub>		-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.

### 7.2 ESD Ratings

		VALUE	UNIT
V <sub>(ESD)</sub> Electrostatic discharge	Human body model (HBM), per AEC Q100-002 <sup>(1)</sup>	±2500	V
	Charged-device model (CDM), per AEC Q100-011	±1000	

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

### 7.3 Recommended Operating Conditions

over operating temperature range (unless otherwise noted)

		MIN	NOM	MAX	UNIT
V <sub>DD</sub>	Supply voltage	1.8		18	V
V <sub>I</sub>	Input voltage	0		6.5	V
V <sub>O</sub>	Output voltage	0		18	V

### 7.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		DDC (SOT)	DSE (WSO)	UNIT
		6 PINS	6 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	204.6	194.9	°C/W
R <sub>θJC(top)</sub>	Junction-to-case (top) thermal resistance	50.5	128.9	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	54.3	153.8	°C/W
ψ <sub>JT</sub>	Junction-to-top characterization parameter	0.8	11.9	°C/W
ψ <sub>JB</sub>	Junction-to-board characterization parameter	52.8	157.4	°C/W
R <sub>θJC(bot)</sub>	Junction-to-case (bottom) thermal resistance	N/A	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  $T_J = -40^\circ\text{C}$  to  $125^\circ\text{C}$ , and  $1.8\text{ V} < V_{DD} < 18\text{ V}$ , unless otherwise noted.

Typical values are at  $T_J = 25^\circ\text{C}$  and  $V_{DD} = 5\text{ V}$ .

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{(POR)}$	Power-on reset voltage <sup>(1)</sup>	$V_{OLmax} = 0.2\text{ V}$ , $I_{(OUTA/B)} = 15\ \mu\text{A}$			0.8	V
$V_{IT+}$	Positive-going input threshold voltage	$V_{DD} = 1.8\text{ V}$ and $18\text{ V}$ , $T_J = 25^\circ\text{C}$	398	400	402.5	mV
		$V_{DD} = 1.8\text{ V}$ and $18\text{ V}$ , $T_J = -40^\circ\text{C}$ to $125^\circ\text{C}$	396		404	
$V_{IT-}$	Negative-going input threshold voltage	$V_{DD} = 1.8\text{ V}$ and $18\text{ V}$ , $T_J = 25^\circ\text{C}$	391.6	394.5	397.5	mV
		$V_{DD} = 1.8\text{ V}$ and $18\text{ V}$ , $T_J = -40^\circ\text{C}$ to $125^\circ\text{C}$	387		400	
$V_{hys}$	Hysteresis voltage ( $hys = V_{IT+} - V_{IT-}$ )			5.5	12	mV
$I_{(INA+)}$	Input current (at the INA+ terminal)	$V_{DD} = 1.8\text{ V}$ and $18\text{ V}$ , $V_I = 6.5\text{ V}$	-25	1	25	nA
$I_{(INB-)}$	Input current (at the INB- terminal)	$V_{DD} = 1.8\text{ V}$ and $18\text{ V}$ , $V_I = 0.1\text{ V}$	-15	1	15	nA
$V_{OL}$	Low-level output voltage	$V_{DD} = 1.8\text{ V}$ , $I_O = 3\text{ mA}$			250	mV
		$V_{DD} = 5\text{ V}$ , $I_O = 5\text{ mA}$			250	
$I_{(kg(OD))}$	Open-drain output leakage-current	$V_{DD} = 1.8\text{ V}$ and $18\text{ V}$ , $V_O = V_{DD}$			300	nA
		$V_{DD} = 1.8\text{ V}$ , $V_O = 18\text{ V}$			300	
$I_{DD}$	Supply current	$V_{DD} = 1.8\text{ V}$ , no load		5.5	11	$\mu\text{A}$
		$V_{DD} = 5\text{ V}$		6	13	
		$V_{DD} = 12\text{ V}$		6	13	
		$V_{DD} = 18\text{ V}$		7	13	
	Start-up delay <sup>(2)</sup>			150	450	$\mu\text{s}$
UVLO	Undervoltage lockout <sup>(3)</sup>	$V_{DD}$ falling	1.3		1.7	V

(1) The lowest supply voltage ( $V_{DD}$ ) at which output is active;  $t_{r(VDD)} > 15\ \mu\text{s/V}$ . Below  $V_{(POR)}$ , the output cannot be determined.

(2) During power on,  $V_{DD}$  must exceed  $1.8\text{ V}$  for  $450\ \mu\text{s}$  (max) before the output is in a correct state.

(3) When  $V_{DD}$  falls below UVLO, OUTA is driven low and OUTB goes to high impedance. The outputs cannot be determined below  $V_{(POR)}$ .

## 7.6 Timing Requirements

over operating temperature range (unless otherwise noted)

		MIN	NOM	MAX	UNIT
$t_{PHL}$	High-to-low propagation delay <sup>(1)</sup>		18		$\mu\text{s}$
$t_{PLH}$	Low-to-high propagation delay <sup>(1)</sup>		29		$\mu\text{s}$

$V_{DD} = 5\text{ V}$ , 10-mV input overdrive,  $R_P = 10\text{ k}\Omega$ ,  $V_{OH} = 0.9 \times V_{DD}$ ,  $V_{OL} = 400\text{ mV}$ , see [Figure 7-1](#)

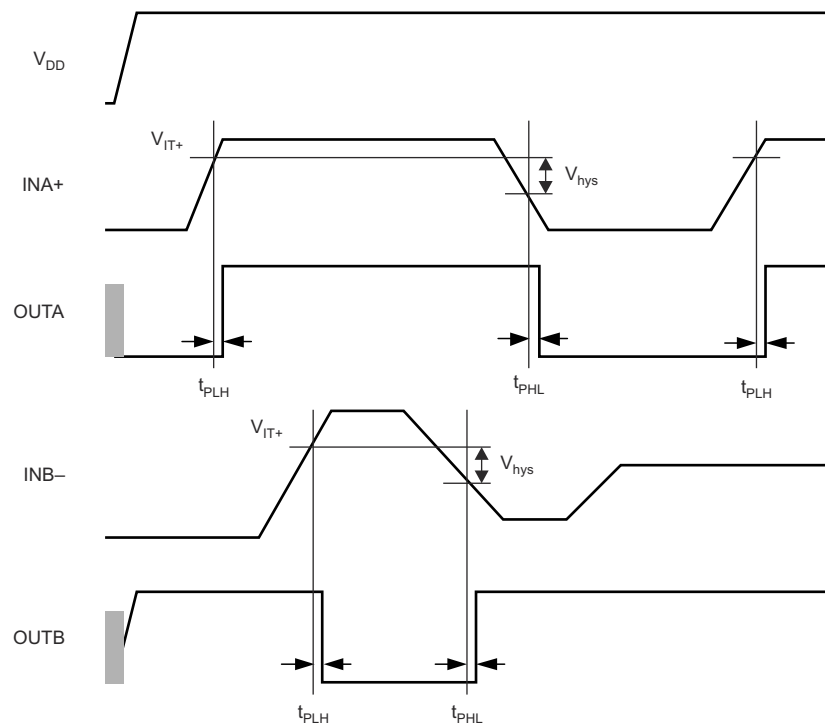
(1) High-to-low and low-to-high refers to the transition at the input terminals (INA+ and INB-).

## 7.7 Switching Characteristics

Over operating temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_r$	Output rise time $V_{DD} = 5\text{ V}$ , 10-mV input overdrive, $R_P = 10\text{ k}\Omega$ , $V_O = (0.1\text{ to }0.9) \times V_{DD}$		2.2		$\mu\text{s}$
$t_f$	Output fall time $V_{DD} = 5\text{ V}$ , 10-mV input overdrive, $R_P = 10\text{ k}\Omega$ , $V_O = (0.1\text{ to }0.9) \times V_{DD}$		0.22		$\mu\text{s}$

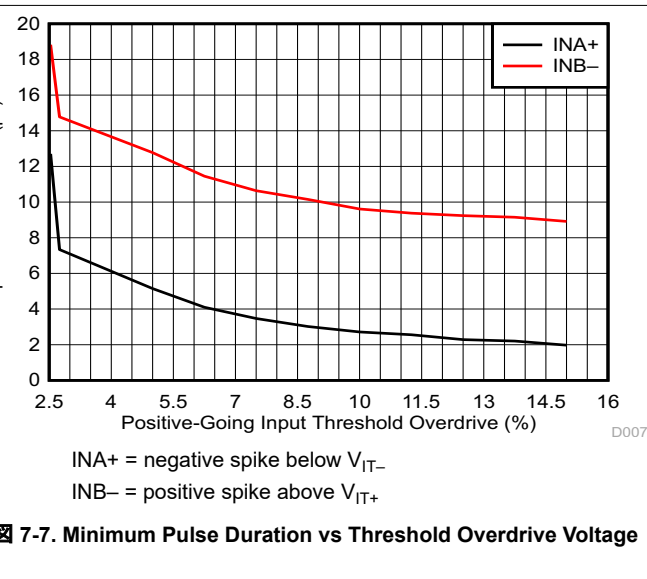
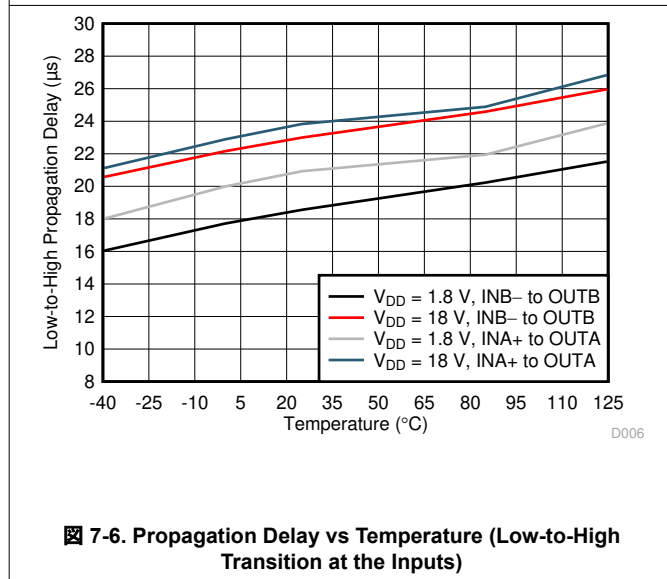
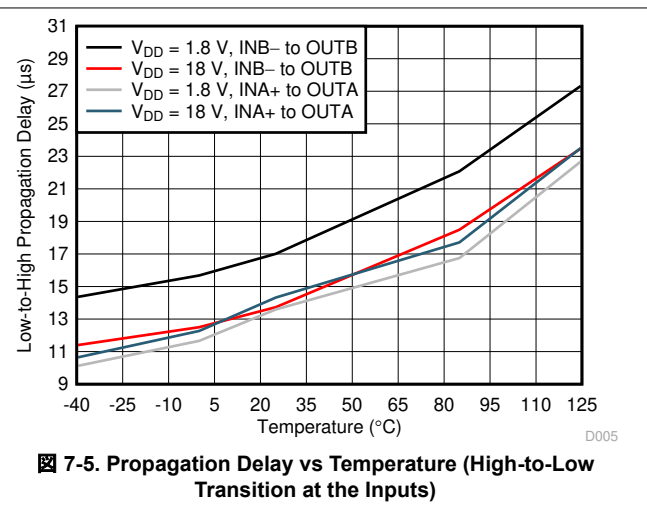
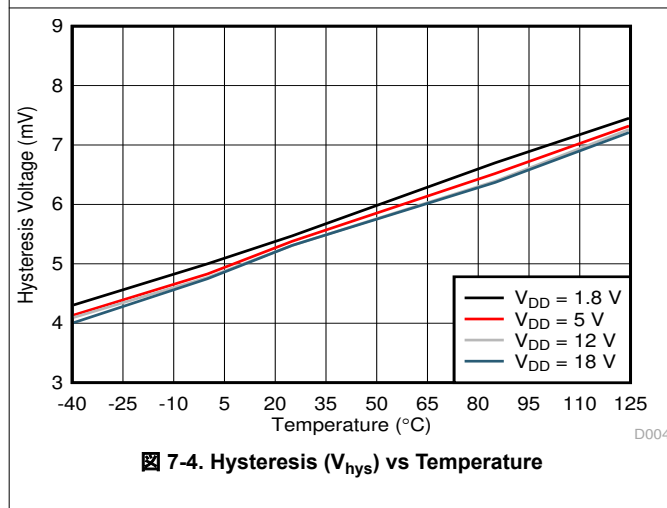
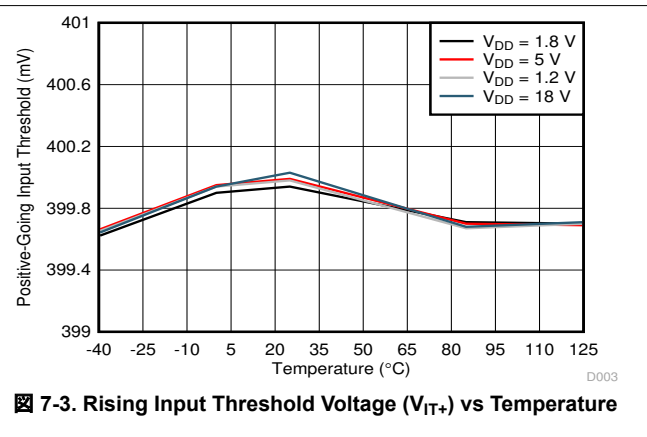
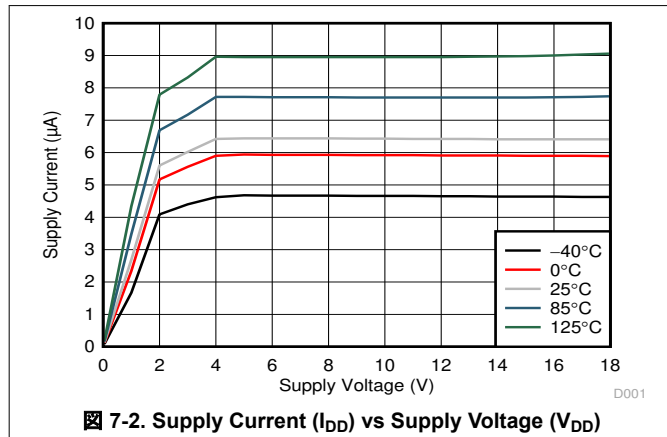
## 7.8 Timing Diagrams



**Figure 7-1. Timing Diagram**

## 7.9 Typical Characteristics

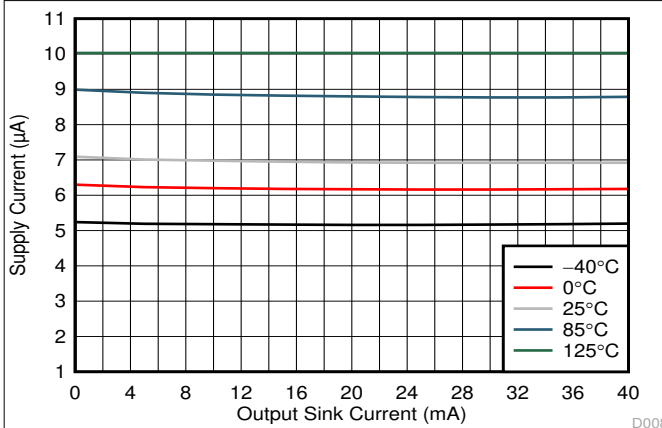
at  $T_J = 25^\circ\text{C}$  and  $V_{DD} = 5\text{ V}$  (unless otherwise noted)





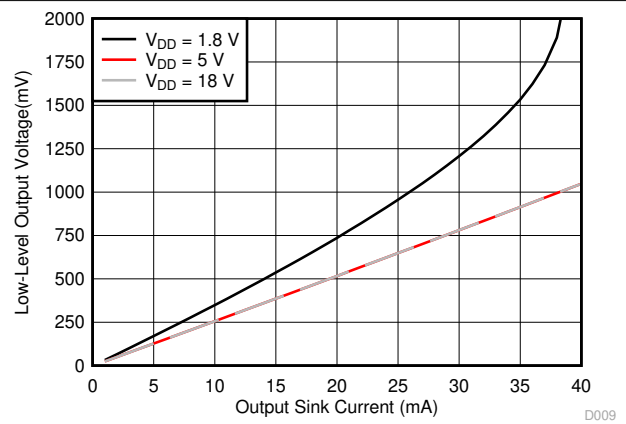
## 7.9 Typical Characteristics (continued)

at  $T_J = 25^\circ\text{C}$  and  $V_{DD} = 5\text{ V}$  (unless otherwise noted)



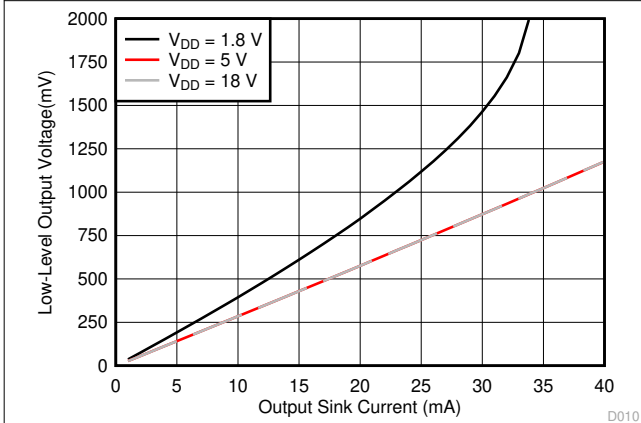
**7-8. Supply Current ( $I_{DD}$ ) vs Output Sink Current**

D008



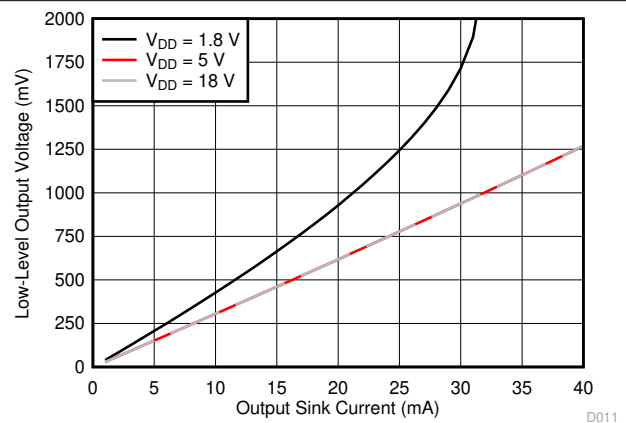
**7-9. Output Voltage Low ( $V_{OL}$ ) vs Output Sink Current ( $-40^\circ\text{C}$ )**

D009



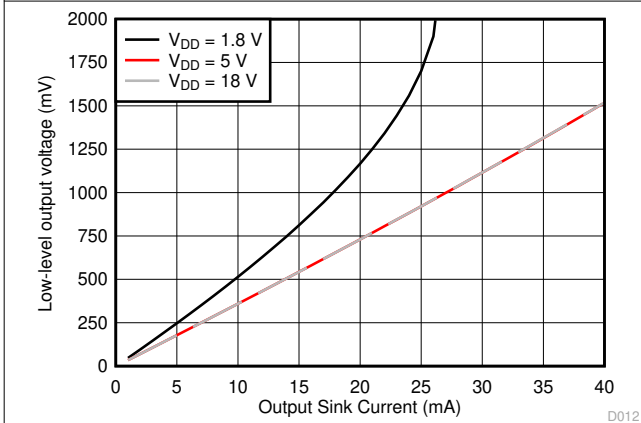
**7-10. Output Voltage Low ( $V_{OL}$ ) vs Output Sink Current ( $0^\circ\text{C}$ )**

D010



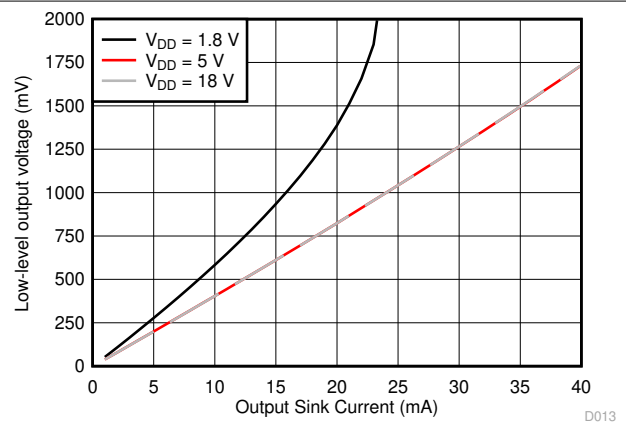
**7-11. Output Voltage Low ( $V_{OL}$ ) vs Output Sink Current ( $25^\circ\text{C}$ )**

D011



**7-12. Output Voltage Low ( $V_{OL}$ ) vs Output Sink Current ( $85^\circ\text{C}$ )**

D012



**7-13. Output Voltage Low ( $V_{OL}$ ) vs Output Sink Current ( $125^\circ\text{C}$ )**

D013

## 8 Detailed Description

### 8.1 Overview

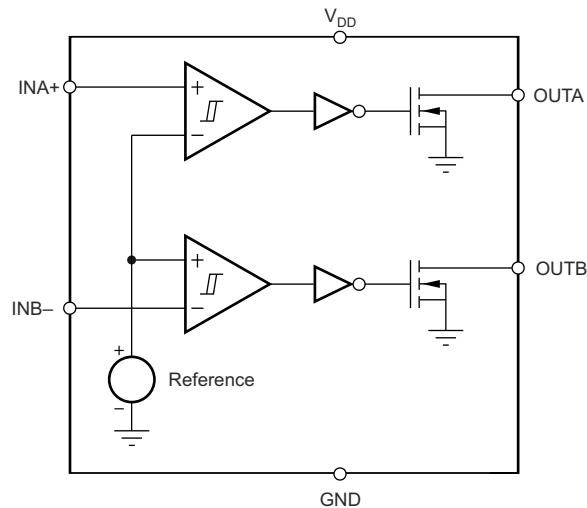
The TLV6700-Q1 device combines two comparators for overvoltage and undervoltage detection. The TLV6700-Q1 has a wide-supply voltage range (1.8 V to 18 V) with a high-accuracy rising-input threshold of 400 mV (1% over temperature) and built-in hysteresis. The outputs are also rated to 18 V, independent of supply voltage, and can sink up to 40 mA.

The TLV6700-Q1 is designed to assert the output signals, as shown in 表 8-1. Each input terminal can be set to monitor any voltage above 0.4 V using an external resistor divider network. Each input pin has very low input leakage current, allowing the use of large resistor dividers without sacrificing system accuracy. With the use of two input terminals of different polarities, the TLV6700-Q1 forms a window comparator. The relationship between the inputs and the outputs is shown in 表 8-1. Broad voltage thresholds can be supported that allow the device to be used in a wide array of applications.

表 8-1. TLV6700 Truth Table

CONDITION	OUTPUT	OUTPUT STATE
$INA+ > V_{IT+}$	OUTA high	Output A high impedance
$INA+ < V_{IT-}$	OUTA low	Output A sinking
$INB- > V_{IT+}$	OUTB low	Output B sinking
$INB- < V_{IT-}$	OUTB high	Output B high impedance

### 8.2 Functional Block Diagram



### 8.3 Feature Description

#### 8.3.1 Inputs (INA+, INB-)

The TLV6700-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 comparator inputs can swing from ground to 6.5 V, regardless of the device supply voltage used. Although not required in most cases, good analog design practice is to place a 1-nF to 10-nF bypass capacitor at the comparator input for extremely noisy applications 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 图 7-1.

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 7-1](#). Together, these comparators form a window-detection function as discussed in the [セクション 8.3.3](#) section.

### 8.3.2 Outputs (OUTA, OUTB)

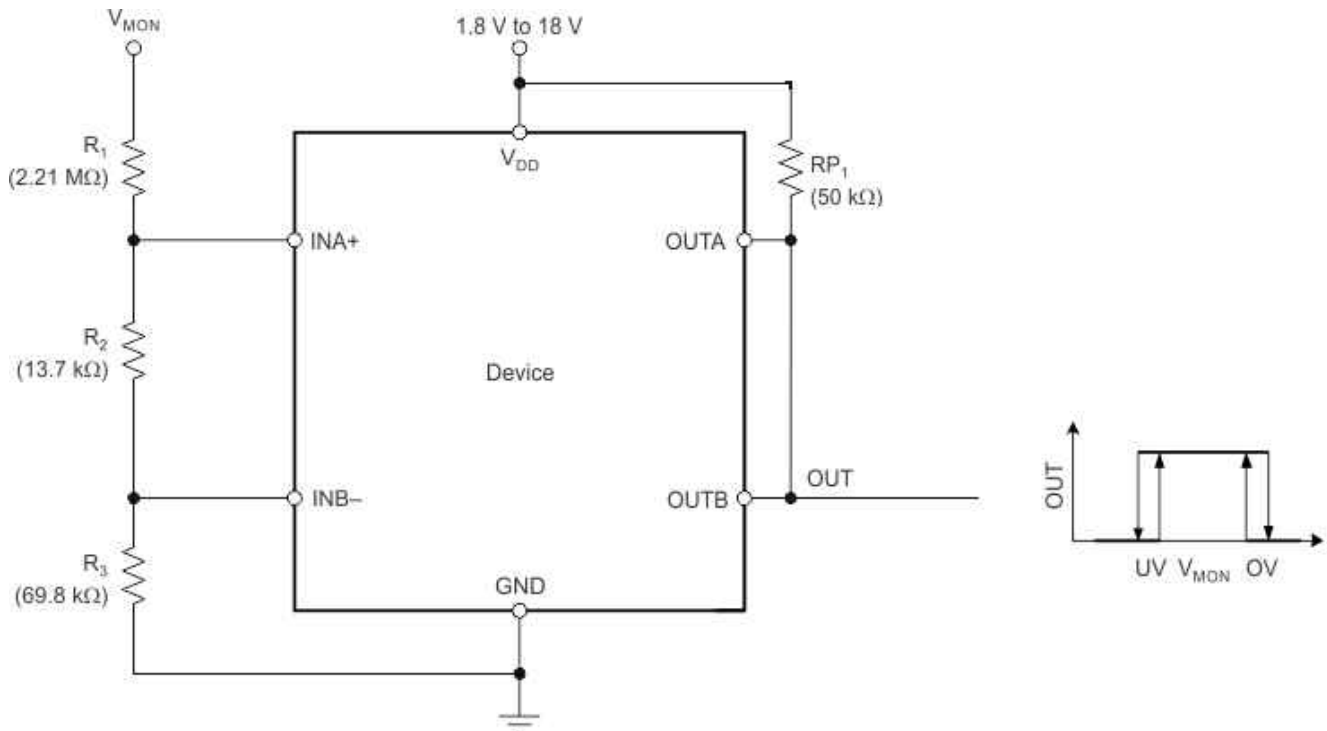
In a typical TLV6700-Q1 application, the outputs are connected to a GPIO input of the processor (such as a digital signal processor [DSP], central processing unit [CPU], field-programmable gate array [FPGA], or application-specific integrated circuit [ASIC]).

The TLV6700-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 TLV6700-Q1 outputs can be pulled up to 18 V, independent of the device supply voltage. By using wired-OR logic, OUTA and OUTB can merge into one logic signal that goes low if either outputs are asserted because of a fault condition.

[表 8-1](#) and the [セクション 8.3.1](#) section describe how the outputs are asserted or deasserted. See [図 7-1](#) for a timing diagram that describes the relationship between threshold voltages and the respective output.

### 8.3.3 Window Comparator

The inverting and noninverting configuration of the comparators forms a window-comparator detection circuit using a resistor divider network, as illustrated in [図 8-1](#) and [図 8-2](#). 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 8-1. Window Comparator Block Diagram**

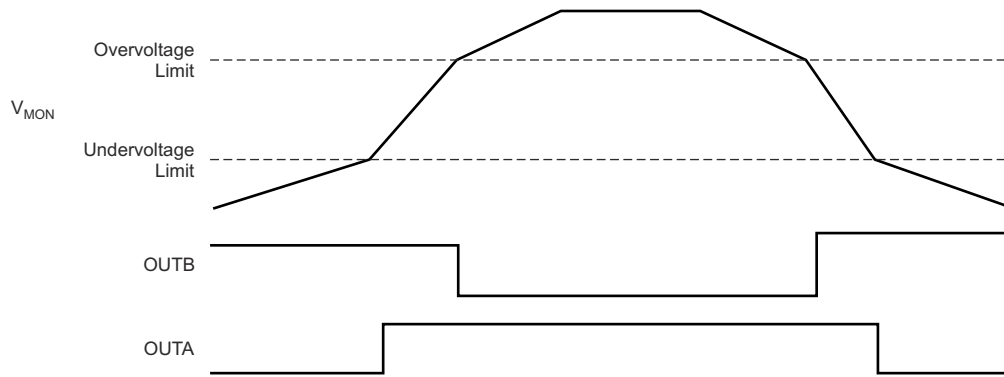


図 8-2. Window Comparator Timing Diagram

### 8.3.4 Immunity to Input Terminal Voltage Transients

The TLV6700-Q1 device is relatively immune to short voltage transient spikes on the input terminals. Sensitivity to transients depends on both transient duration and amplitude; see the *Minimum Pulse Duration vs Threshold Overdrive Voltage* curve (図 7-7) in the [セクション 7.9](#) section.

## 8.4 Device Functional Modes

### 8.4.1 Normal Operation ( $V_{DD} > UVLO$ )

When the voltage on  $V_{DD}$  is greater than 1.8 V for at least 150  $\mu$ s, the OUTA and OUTB signals correspond to the voltage on INA+ and INB– as listed in [表 8-1](#).

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

When the voltage on  $V_{DD}$  is less than the device UVLO voltage, and greater than the power-on reset voltage,  $V_{(POR)}$ , the OUTA and OUTB signals are asserted and high impedance, respectively, regardless of the voltage on INA+ and INB–.

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

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

## 9 Application and Implementation

### 注

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### 9.1 Application Information

The TLV6700-Q1 device is a wide-supply voltage window comparator 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 comparator or as two independent voltage monitors. The monitored voltages are set with the use of external resistors.

#### 9.1.1 $V_{PULLUP}$ 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  $V_{DD}$  to correctly interface with the input terminals of other devices.

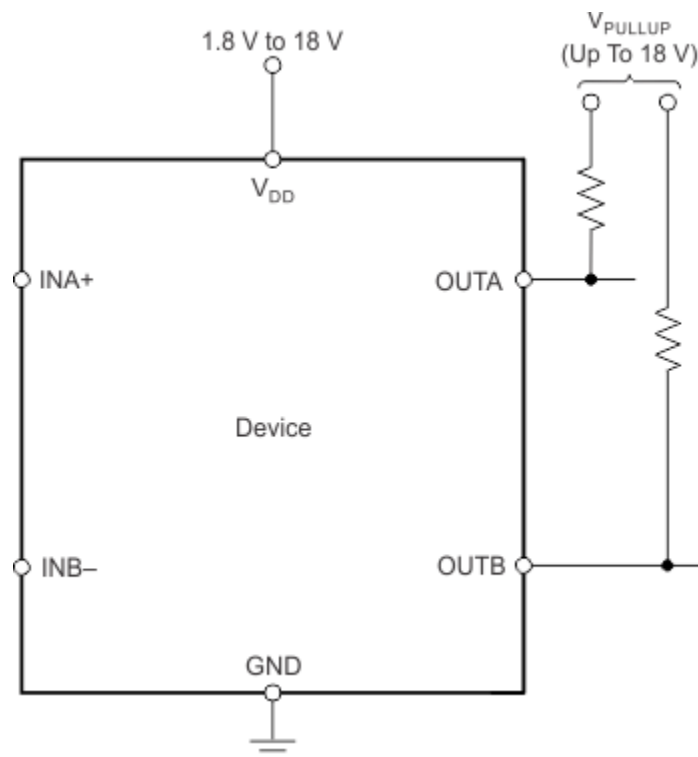
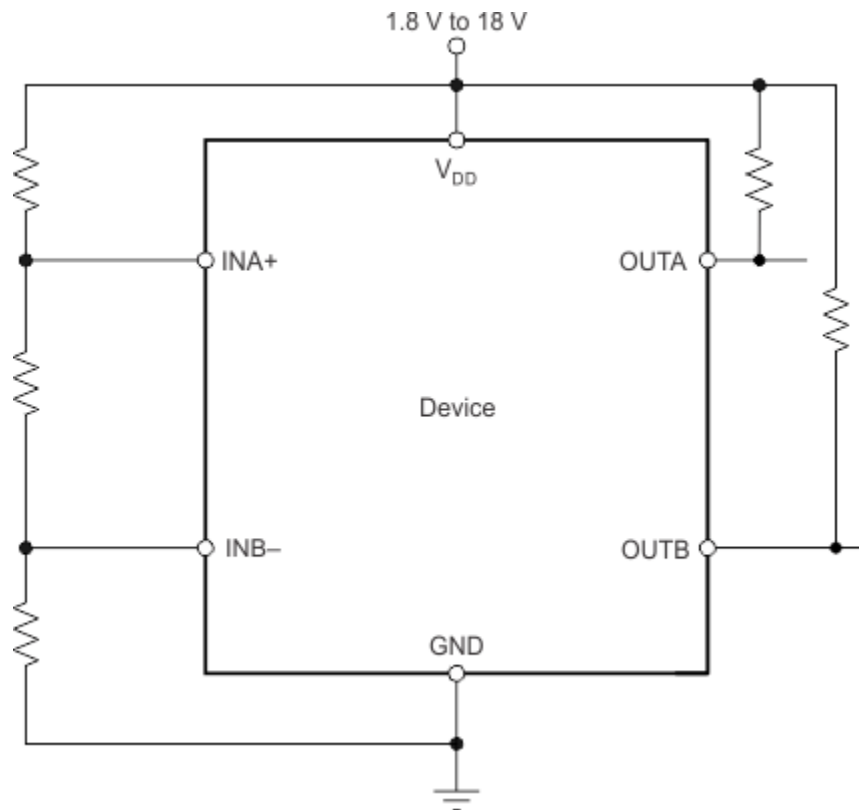


図 9-1. Interfacing to Voltages Other Than  $V_{DD}$

### 9.1.2 Monitoring $V_{DD}$

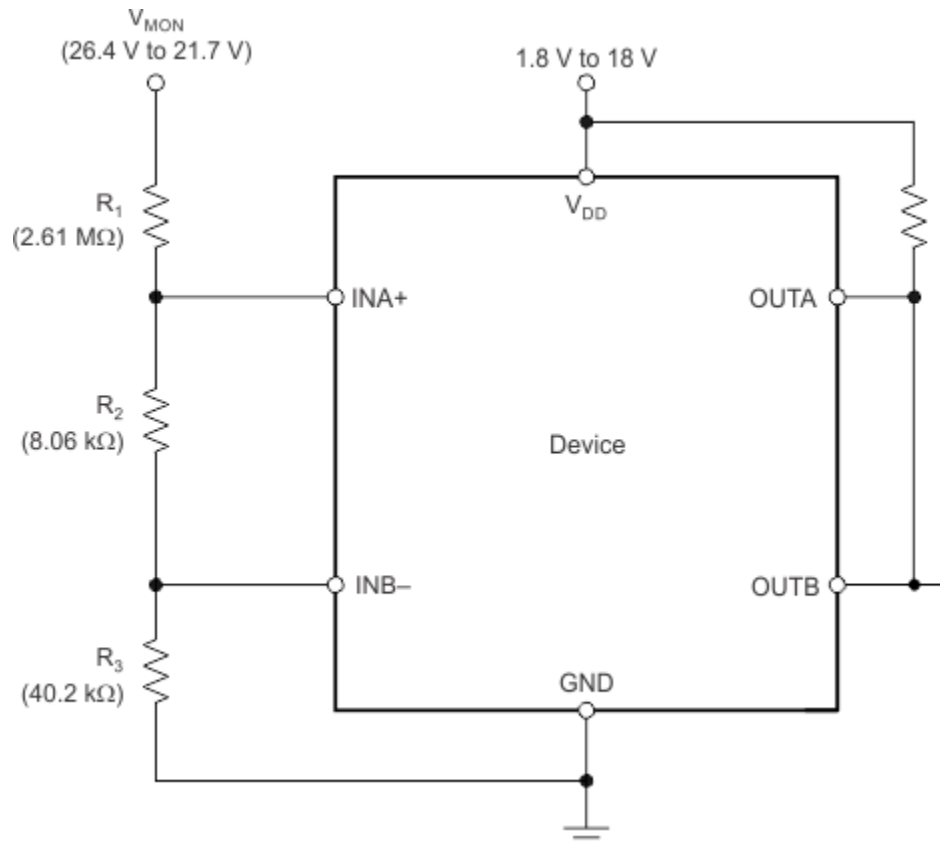
Many applications monitor the same rail that is powering  $V_{DD}$ . In these applications the resistor divider is simply connected to the  $V_{DD}$  rail.



**9-2. Monitoring the Same Voltage as  $V_{DD}$**

### 9.1.3 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 is connected to the rail that is being monitored.



The inputs can monitor a voltage higher than  $V_{DDmax}$  with the use of an external resistor divider network.

**图 9-3. Monitoring a Voltage Other Than  $V_{DD}$**

## 9.2 Typical Application

The TLV6700-Q1 device is a wide-supply voltage window comparator that operates over a  $V_{DD}$  range of 1.8 to 18 V. The monitored voltages are set with the use of external resistors, so the device can be used either as a window comparator or as two independent overvoltage and undervoltage monitors.

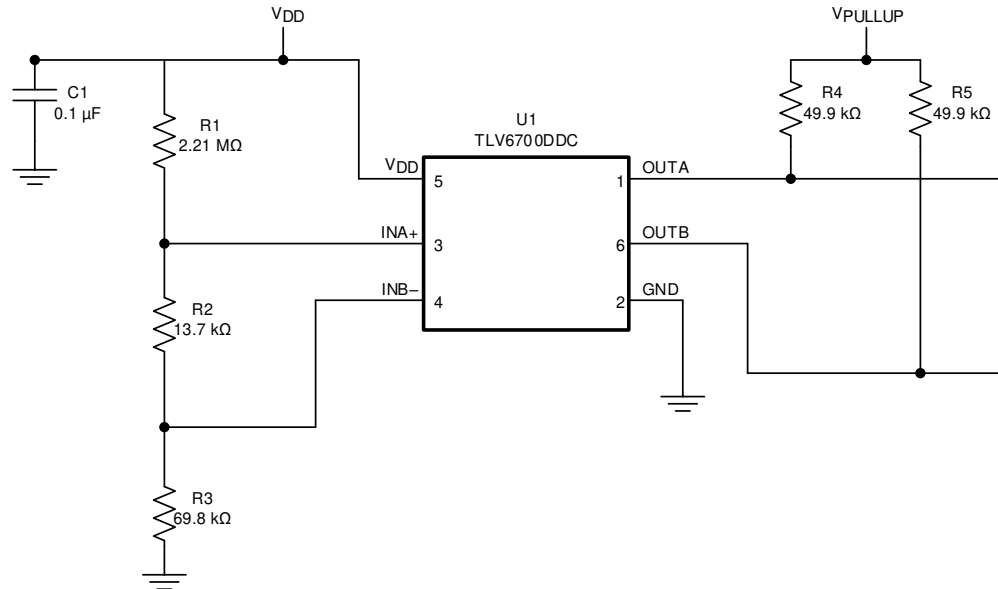


图 9-4. Typical Application Schematic

### 9.2.1 Design Requirements

For this design example, use the values summarized in 表 9-1 as the input parameters.

表 9-1. Design Parameters

PARAMETER	DESIGN REQUIREMENT	DESIGN RESULT
Monitored voltage	12-V nominal rail with maximum rising and falling thresholds of $\pm 10\%$	$V_{MON(UV)} = 10.99 \text{ V (8.33\%)} \pm 2.94\%$ , $V_{MON(OV)} = 13.14 \text{ V (8.33\%)} \pm 2.94\%$

### 9.2.2 Detailed Design Procedure

#### 9.2.2.1 Resistor Divider Selection

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

$$R_T = R_1 + R_2 + R_3 \quad (1)$$

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  $R_3$ .

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

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  $R_2$ .

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

where:

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

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

where:

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

The worst-case tolerance can be calculated by referring to Equation 13 in application report [SLVA450, Optimizing Resistor Dividers at a Comparator Input](#) (available for download at [www.ti.com](#)). An example of the rising threshold error,  $V_{\text{MON(OV)}}$ , is given in 式 5.

$$\% \text{ ACC} = \% \text{ TOL}(V_{\text{IT+(INB)}}) + 2 \times \left[ 1 - \frac{V_{\text{IT+(INB)}}}{V_{\text{MON(OV)}}} \right] \times \% \text{ TOL}_R = 1\% + 2 \times \left[ 1 - \frac{0.4}{13.2} \right] \times 1\% = 2.94\% \quad (5)$$

### 9.2.2.2 Pullup Resistor Selection

To ensure proper voltage levels, the pullup resistor value is selected by ensuring that the pullup voltage divided by the resistor does not exceed the sink-current capability of the device. This confirmation is calculated by verifying that the pullup voltage minus the output-leakage current ( $I_{\text{kg(OD)}}$ ) multiplied by the resistor is greater the desired logic-high voltage. These values are specified in the [セクション 7.5](#) table.

Use 式 6 to calculate the value of the pullup resistor.

$$\frac{(V_{\text{HI}} - V_{\text{PU}})}{I_{\text{kg(OD)}}} \geq R_{\text{PU}} \geq \frac{V_{\text{PU}}}{I_{\text{O}}} \quad (6)$$

### 9.2.2.3 Input Supply Capacitor

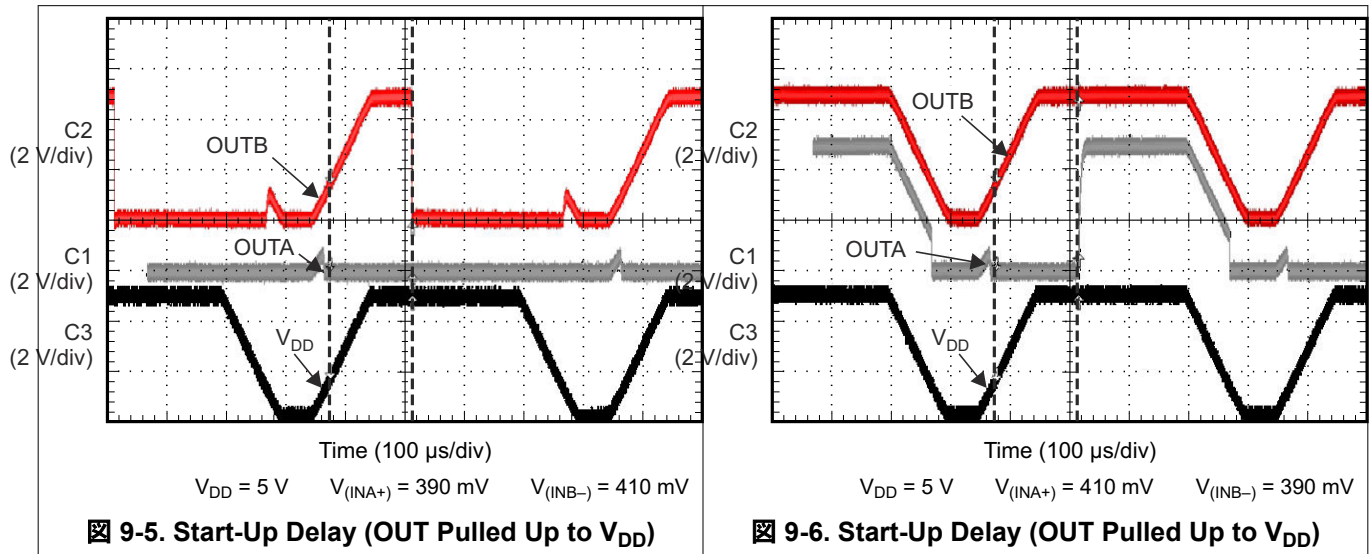
Although an input capacitor is not required for stability, connecting a 0.1- $\mu\text{F}$  low equivalent series resistance (ESR) capacitor across the  $V_{\text{DD}}$  terminal and GND terminal is good analog design practice. A higher-value capacitor may be necessary if large, fast rise-time load transients are anticipated, or if the device is not located close to the power source.

### 9.2.2.4 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.

### 9.2.3 Application Curves

At  $T_J = 25^\circ\text{C}$



### 9.3 Do's and Don'ts

It is good analog design practice to have a 0.1- $\mu\text{F}$  decoupling capacitor from  $V_{DD}$  to GND.

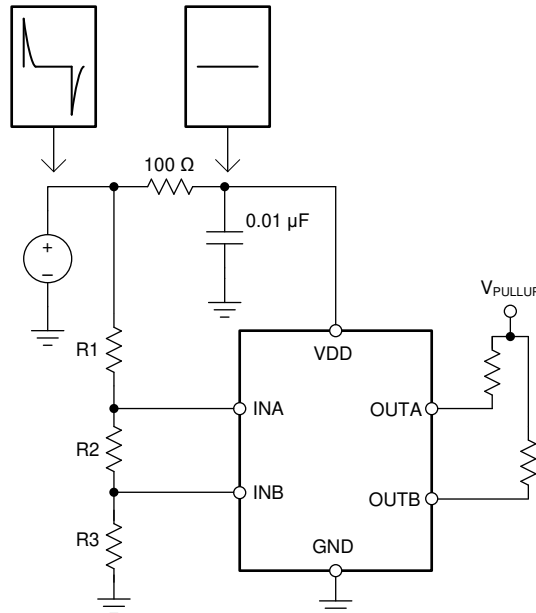
If the monitored rail is noisy, connect decoupling capacitors from the comparator inputs to GND.

Do not use resistors for the voltage divider that cause the current through them to be less than 100 times the input current of the comparators without also accounting for the effect to the accuracy.

Do not use pullup resistors that are too small, because the larger current sunk by the output then exceeds the desired low-level output voltage ( $V_{OL}$ ).

## 10 Power Supply Recommendations

The TLV6700-Q1 has a 20 V absolute maximum rating on the VDD pin, with a recommended operating condition of 18V. If the voltage supply that is providing power to VDD is susceptible to any large voltage transient that may exceed 20 V, or if the supply exhibits high voltage slew rates greater than 1 V/ $\mu$ s, take additional precautions. Place an RC filter between the supply and VDD to filter any high-frequency transient surges on the VDD pin. A 100- $\Omega$  resistor and 0.01- $\mu$ F capacitor is required in these cases, as shown in [Figure 10-1](#).



**Figure 10-1. Using an RC Filter to Remove High-Frequency Disturbances on VDD**

## 11 Layout

### 11.1 Layout Guidelines

Placing a 0.1- $\mu$ F 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 (as shown in [Figure 11-1](#)) or both resistors can be tied to a single pullup resistor if a logical AND function is desired.

### 11.2 Layout Example

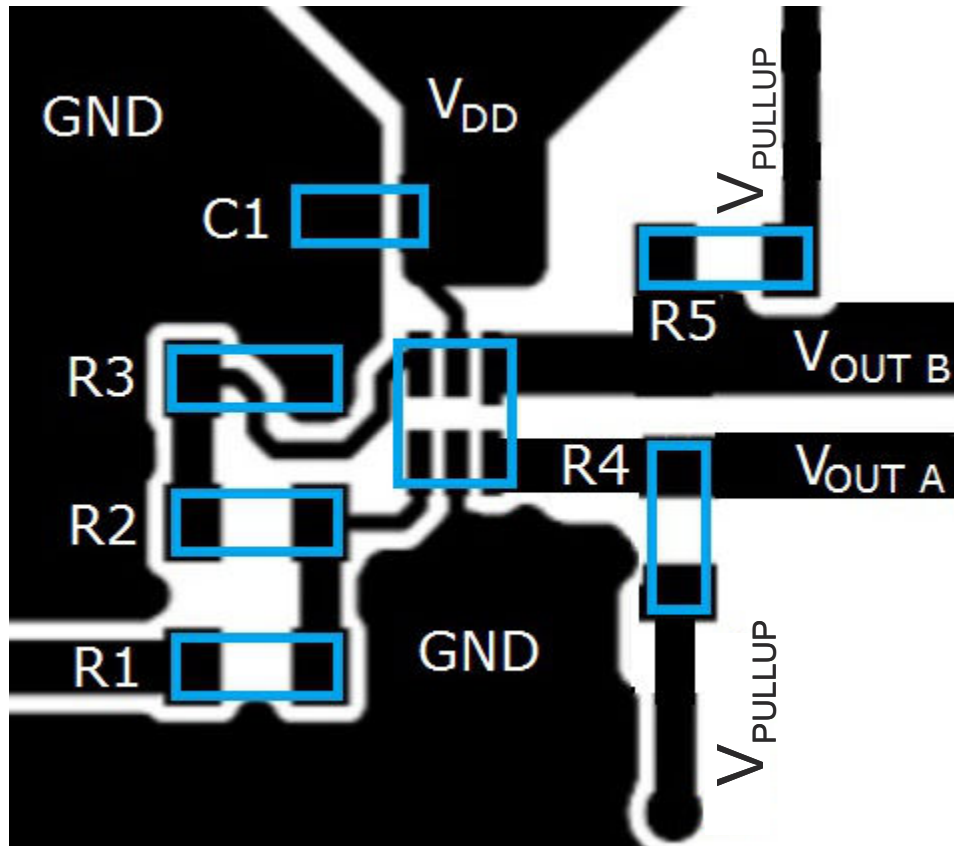


Figure 11-1. TLV6700 Layout Schematic

## 12 Device and Documentation Support

### 12.1 Device Support

#### 12.1.1 Development Support

The [DIP Adapter Evaluation Module](#) allows conversion of the SOT-23-6 package to a standard DIP-6 pinout for ease of prototyping and bench evaluation.

#### 12.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

#### 12.3 サポート・リソース

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#### 12.6 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。

## 13 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 (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="#">TLV6700QDDCRQ1</a>	Active	Production	SOT-23-THIN (DDC)   6	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	2D11
TLV6700QDDCRQ1.A	Active	Production	SOT-23-THIN (DDC)   6	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	2D11
<a href="#">TLV6700QDSERQ1</a>	Active	Production	WSON (DSE)   6	3000   LARGE T&R	Yes	NIPDAUAG	Level-2-260C-1 YEAR	-40 to 125	K6
TLV6700QDSERQ1.B	Active	Production	WSON (DSE)   6	3000   LARGE T&R	Yes	NIPDAUAG	Level-2-260C-1 YEAR	-40 to 125	K6

(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.

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**OTHER QUALIFIED VERSIONS OF TLV6700-Q1 :**

- Catalog : [TLV6700](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

**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
TLV6700QDDCRQ1	SOT-23-THIN	DDC	6	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV6700QDSERQ1	WSON	DSE	6	3000	180.0	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)
TLV6700QDDCRQ1	SOT-23-THIN	DDC	6	3000	213.0	191.0	35.0
TLV6700QDSERQ1	WSON	DSE	6	3000	213.0	191.0	35.0

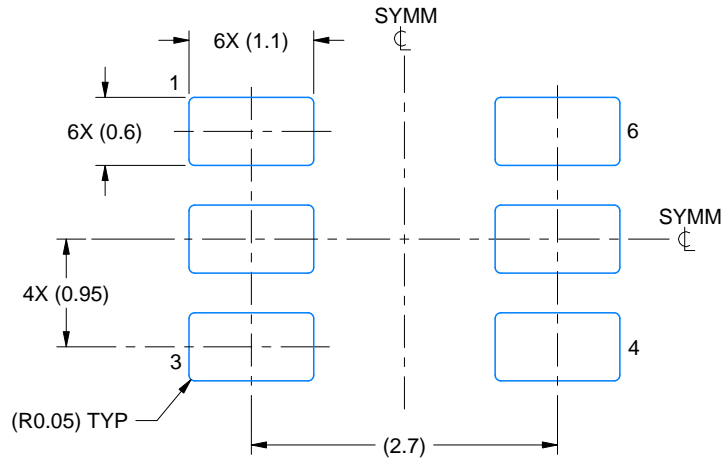


# EXAMPLE BOARD LAYOUT

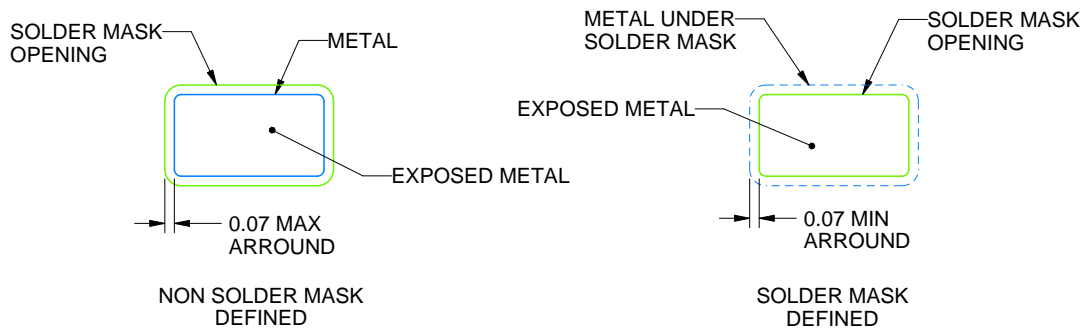
DDC0006A

SOT-23 - 1.1 max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPLODED METAL SHOWN  
SCALE:15X



SOLDEMASK DETAILS

4214841/E 08/2024

NOTES: (continued)

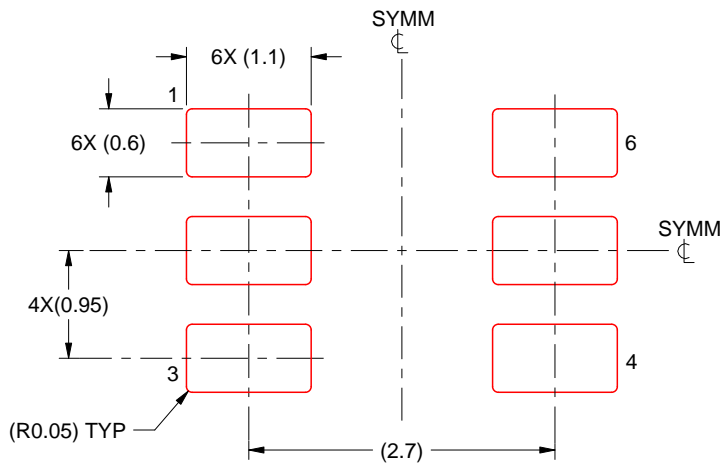
- 4. Publication IPC-7351 may have alternate designs.
- 5. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DDC0006A

SOT-23 - 1.1 max height

SMALL OUTLINE TRANSISTOR

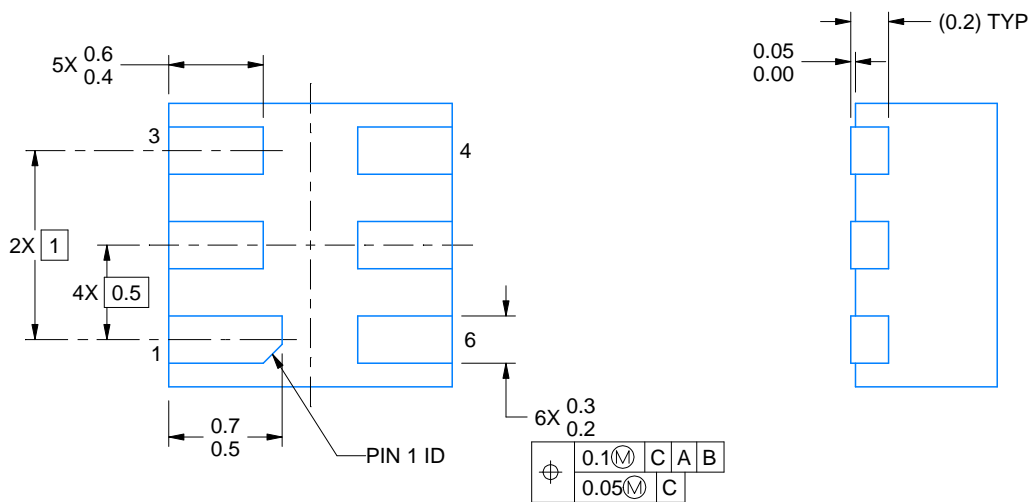
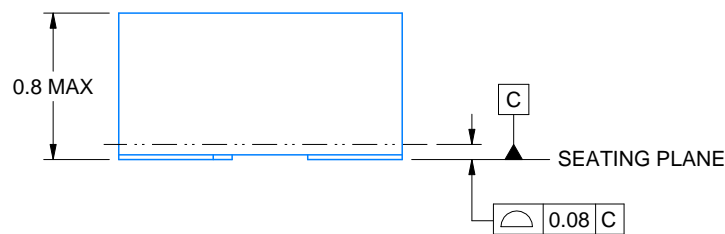
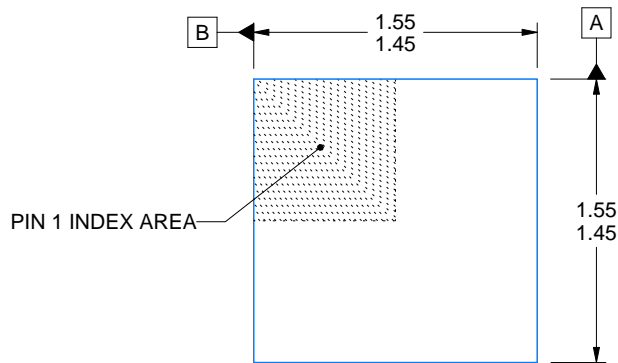


SOLDER PASTE EXAMPLE  
BASED ON 0.125 THICK STENCIL  
SCALE:15X

4214841/E 08/2024

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.



4220552/B 01/2024

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.

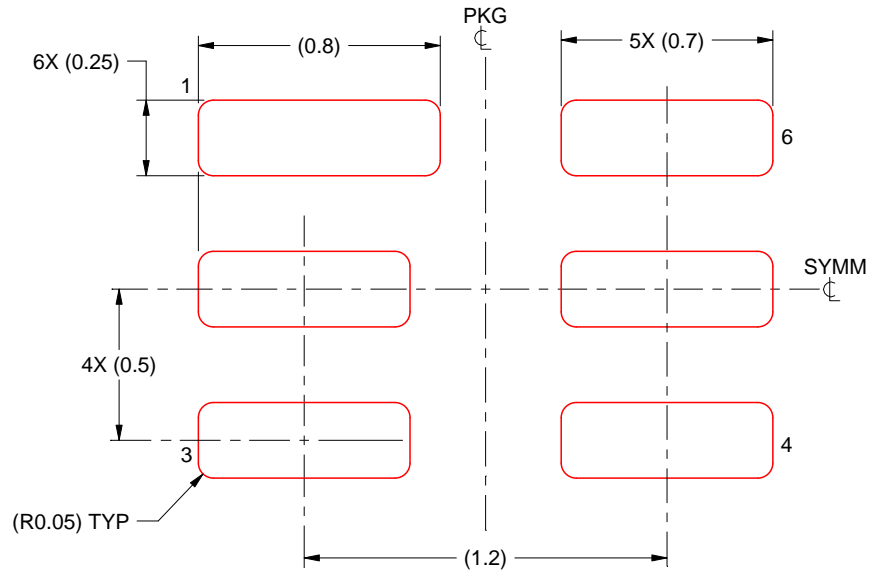


# EXAMPLE STENCIL DESIGN

DSE0006A

WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



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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