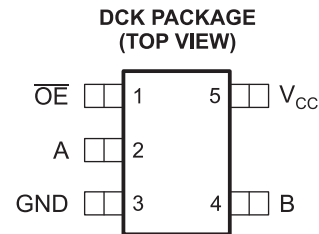


具有 5V 容差的电平转换器的单路 FET 2.5V/3.3V 低电压总线开关

 查询样品: [SN74CB3T1G125-Q1](#)

特性

- 符合汽车应用要求
- 输出电压转换跟踪 V_{CC}
- 在所有数据 I/O 端口上支持混合模式信号运行
 - 通过 3.3 V V_{CC} 提供 5 V 输入与低至 3.3 V 的输出电平转换
 - 通过 2.5 V V_{CC} 提供 5 V/3.3 V 输入与低至 2.5 V 的输出电平转换
- 支持器件上电与断电的 5 V 容差 I/O
- 支持近零传播延迟的双向数据流
- 低导通阻抗 (r_{on}) 特性 ($r_{on} = 5 \Omega$ 典型值)
- 低输入 / 输出电容可最大限度地减少加载 ($C_{io(OFF)} = 5 \text{ pF}$ 典型值)
- 数据与控制输入提供负脉冲信号钳位二极管
- 低功耗 ($I_{CC} = 20 \mu\text{A}$ 最大值)
- V_{CC} 工作电压范围: 2.3 V 至 3.6 V
- 数据 I/O 支持 0 至 5 V 信号级 (0.8 V、1.2 V、1.5 V、1.8 V、2.5 V、3.3 V、5 V)
- 可通过 TTL 或 5 V/3.3 V CMOS 输出驱动控制输入
- I_{off} 支持部分断电模式工作
- 支持数字应用: 电平转换、USB 接口、总线隔离
- 是低功耗便携式应用的理想选择



说明

SN74CB3T1G125-Q1 是支持低导通电阻 (r_{on}) 的高速 TTL 兼容 FET 总线开关, 支持最小传播延迟。该器件提供可跟踪 V_{CC} 的电压转换, 能够在所有数据 I/O 端口上全面支持混合模式信号运行。SN74CB3T1G125-Q1 支持系统使用 5 V TTL、3.3 V LVTTTL 与 2.5 V CMOS 开关标准, 以及用户定义开关电平 (见图 1)。

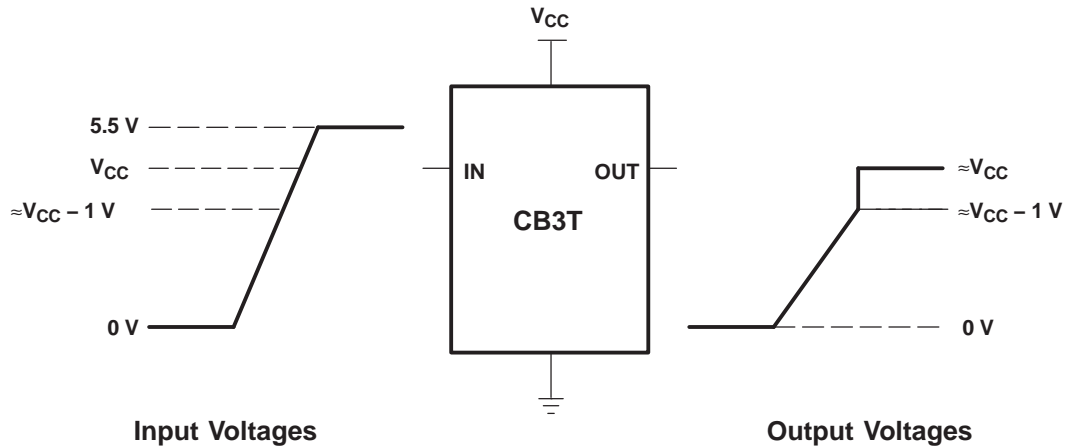
SN74CB3T1G125-Q1 是一个具有单一输出使能 (\overline{OE}) 输入的 1-位总线开关。 \overline{OE} 为低时, 总线开关打开, A 端口连接至 B 端口, 可在两个端口之间实现双向数据流。 \overline{OE} 为高时, 总线开关关闭, A 与 B 端口之间存在高阻抗状态。

该器件的技术规格针对采用 I_{off} 的部分断电应用而全面拟订。 I_{off} 特性可在断电时防止损坏电流通过器件回流。该器件可在关闭时提供隔离。

为了确保加电或断电期间的高阻抗状态, \overline{OE} 应通过一个上拉电阻器连接至 V_{CC} ; 该电阻器的最小值由驱动器的电流吸收能力来决定。



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NOTE A: If the input high voltage (V_{IH}) level is greater than or equal to $V_{CC} - 1\text{ V}$, and less than or equal to 5.5 V , then the output high voltage (V_{OH}) level will be equal to approximately the V_{CC} voltage level.

图 1. 典型 DC 电压转换特点

ORDERING INFORMATION

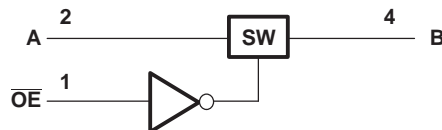
T_A	PACKAGE ⁽¹⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING ⁽²⁾
-40°C to 125°C	SOT (SC-70) – DCK	Reel of 3000	CCB3T1G125QDCKRQ1	72_

- (1) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
- (2) The actual top-side marking has one additional character that designates the assembly/test site.

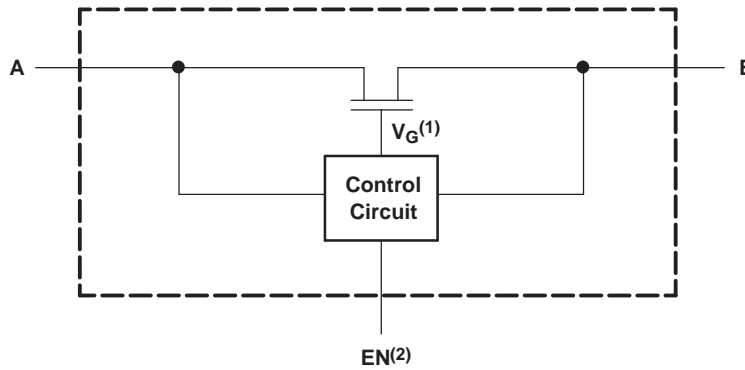
FUNCTION TABLE

INPUT \overline{OE}	INPUT/OUTPUT A	FUNCTION
L	B	A port = B port
H	Z	Disconnect

LOGIC DIAGRAM (POSITIVE LOGIC)



SIMPLIFIED SCHEMATIC, EACH FET SWITCH (SW)



- (1) Gate voltage (V_G) is equal to approximately $V_{CC} + V_T$ when the switch is ON and $V_I > V_{CC} + V_T$.
 (2) EN is the internal enable signal applied to the switch.

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
V_{CC}	Supply voltage range	-0.5	7	V
V_{IN}	Control input voltage range ^{(2) (3)}	-0.5	7	V
$V_{I/O}$	Switch I/O voltage range ^{(2) (3) (4)}	-0.5	7	V
I_{IK}	Control input clamp current	$V_{IN} < 0$		-50 mA
$I_{I/OK}$	I/O port clamp current	$V_{I/O} < 0$		-50 mA
I_{IO}	ON-state switch current ⁽⁵⁾			±128 mA
	Continuous current through V_{CC} or GND			±100 mA
θ_{JA}	Package thermal impedance ⁽⁶⁾	DCK package		252 °C/W
T_{stg}	Storage temperature range	-65	150	°C

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
 (2) All voltages are with respect to ground, unless otherwise specified.
 (3) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
 (4) V_I and V_O are used to denote specific conditions for $V_{I/O}$.
 (5) I_I and I_O are used to denote specific conditions for $I_{I/O}$.
 (6) The package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS⁽¹⁾

		MIN	MAX	UNIT	
V_{CC}	Supply voltage	2.3	3.6	V	
V_{IH}	High-level control input voltage	$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.7	5.5	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	2	5.5	
V_{IL}	Low-level control input voltage	$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	0	0.7	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	0	0.8	
$V_{I/O}$	Data input/output voltage	0	5.5	V	
T_A	Operating free-air temperature	-40	125	°C	

- (1) All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

ELECTRICAL CHARACTERISTICS⁽¹⁾

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT	
V_{IK}		$V_{CC} = 3\text{ V}$, $I_I = -18\text{ mA}$			-1.2	V	
V_{OH}		See Figure 3 and Figure 4					
I_{IN}	Control inputs	$V_{CC} = 3.6\text{ V}$, $V_{IN} = 3.6\text{ V to } 5.5\text{ V or GND}$			±10	µA	
I_I		$V_{CC} = 3.6\text{ V}$, Switch ON, $V_{IN} = V_{CC}$ or GND	$V_I = V_{CC} - 0.7\text{ V to } 5.5\text{ V}$		±20	µA	
			$V_I = 0.7\text{ V to } V_{CC} - 0.7\text{ V}$		-40		
			$V_I = 0\text{ to } 0.7\text{ V}$		±5		
I_{OZ} ⁽³⁾		$V_{CC} = 3.6\text{ V}$, $V_O = 0\text{ to } 5.5\text{ V}$, $V_I = 0$, Switch OFF, $V_{IN} = V_{CC}$ or GND			±10	µA	
I_{off}		$V_{CC} = 0$, $V_O = 0\text{ to } 5.5\text{ V}$, $V_I = 0$			10	µA	
I_{CC}		$V_{CC} = 3.6\text{ V}$, $I_{IO} = 0$, Switch ON or OFF, $V_{IN} = V_{CC}$ or GND	$V_I = V_{CC}$ or GND		20	µA	
			$V_I = 5.5\text{ V}$		20		
ΔI_{CC} ⁽⁴⁾	Control inputs	$V_{CC} = 3\text{ V to } 3.6\text{ V}$, One input at $V_{CC} - 0.6\text{ V}$, Other inputs at V_{CC} or GND			300	µA	
C_{in}	Control inputs	$V_{CC} = 3.3\text{ V}$, $V_{IN} = V_{CC}$ or GND			3	pF	
$C_{io(OFF)}$		$V_{CC} = 3.3\text{ V}$, $V_{IO} = 5.5\text{ V}$, 3.3 V , or GND, Switch OFF, $V_{IN} = V_{CC}$ or GND			5	pF	
$C_{io(ON)}$		$V_{CC} = 3.3\text{ V}$, Switch ON, $V_{IN} = V_{CC}$ or GND	$V_{IO} = 5.5\text{ V or } 3.3\text{ V}$		4	pF	
			$V_{IO} = \text{GND}$		12		
r_{on} ⁽⁵⁾		$V_{CC} = 2.3\text{ V}$, TYP at $V_{CC} = 2.5\text{ V}$, $V_I = 0$	$I_O = 24\text{ mA}$		5	10	Ω
			$I_O = 16\text{ mA}$		5	10	
		$V_{CC} = 3\text{ V}$, $V_I = 0$	$I_O = 24\text{ mA}$		5	9	
			$I_O = 16\text{ mA}$		5	9	

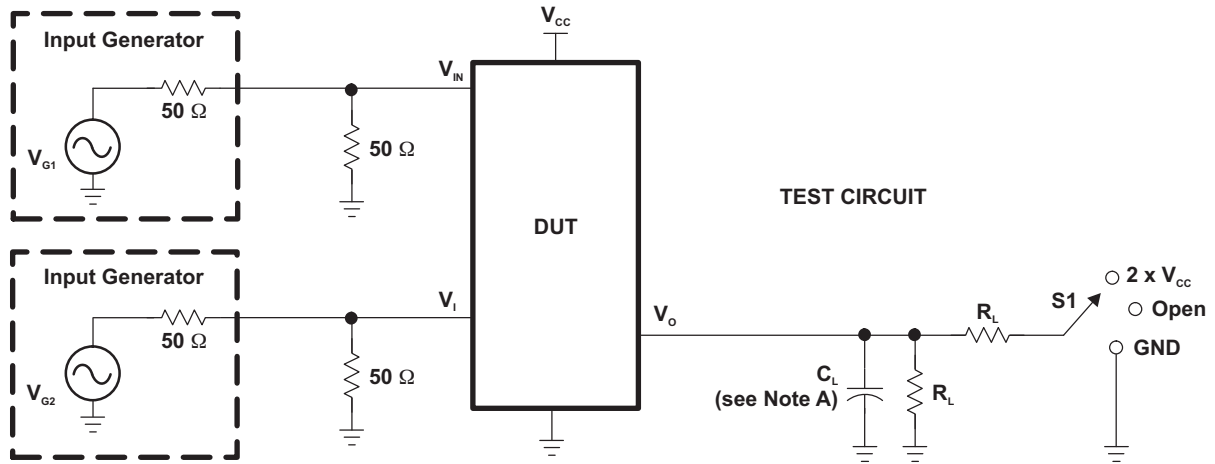
(1) V_{IN} and I_{IN} refer to control inputs. V_I , V_O , I_I , and I_O refer to data pins.(2) All typical values are at $V_{CC} = 3.3\text{ V}$ (unless otherwise noted), $T_A = 25^\circ\text{C}$.(3) For I/O ports, the parameter I_{OZ} includes the input leakage current.(4) This is the increase in supply current for each input that is at the specified TTL voltage level, rather than V_{CC} or GND.

(5) Measured by the voltage drop between A and B terminals at the indicated current through the switch. ON-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

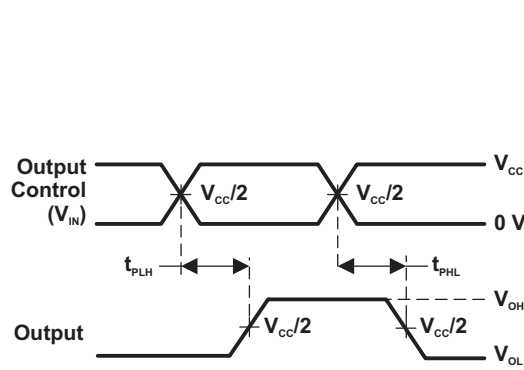
SWITCHING CHARACTERISTICSover recommended operating free-air temperature range (unless otherwise noted) (see [Figure 2](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	
t_{en}	\overline{OE}	A or B	1	10.5	1	9.5	ns
t_{dis}	\overline{OE}	A or B	1	8.5	1	9	ns

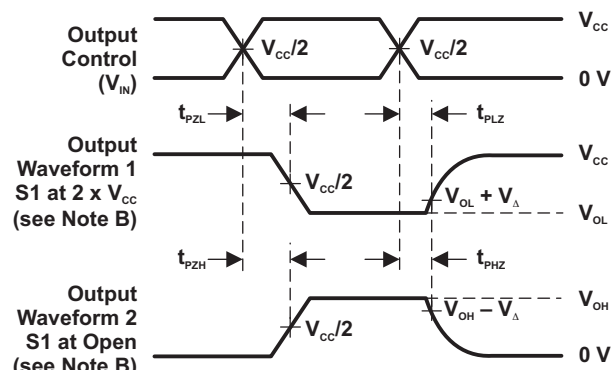
PARAMETER MEASUREMENT INFORMATION



TEST	V _{CC}	S1	R _L	V _I	C _L	V _Δ
t _{pd(s)}	2.5 V ± 0.2 V	Open	500 Ω	3.6 V or GND	30 pF	
	3.3 V ± 0.3 V	Open	500 Ω	5.5 V or GND	50 pF	
t _{PLZ} /t _{PZL}	2.5 V ± 0.2 V	2 x V _{CC}	500 Ω	GND	30 pF	0.15 V
	3.3 V ± 0.3 V	2 x V _{CC}	500 Ω	GND	50 pF	0.15 V
t _{PHZ} /t _{PZH}	2.5 V ± 0.2 V	Open	500 Ω	3.6 V	30 pF	0.15 V
	3.3 V ± 0.3 V	Open	500 Ω	5.5 V	50 pF	0.15 V



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES (t_{pd(s)})



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES

- NOTES: A. C_L includes probe and jig capacitance.
 B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
 C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_o = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns.
 D. The outputs are measured one at a time, with one transition per measurement.
 E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
 F. t_{PZL} and t_{PZH} are the same as t_{en}.
 G. t_{PLH} and t_{PHL} are the same as t_{pd(s)}. The t_{pd} propagation delay is the calculated RC time constant of the typical ON-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).
 H. All parameters and waveforms are not applicable to all devices.

Figure 2. Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

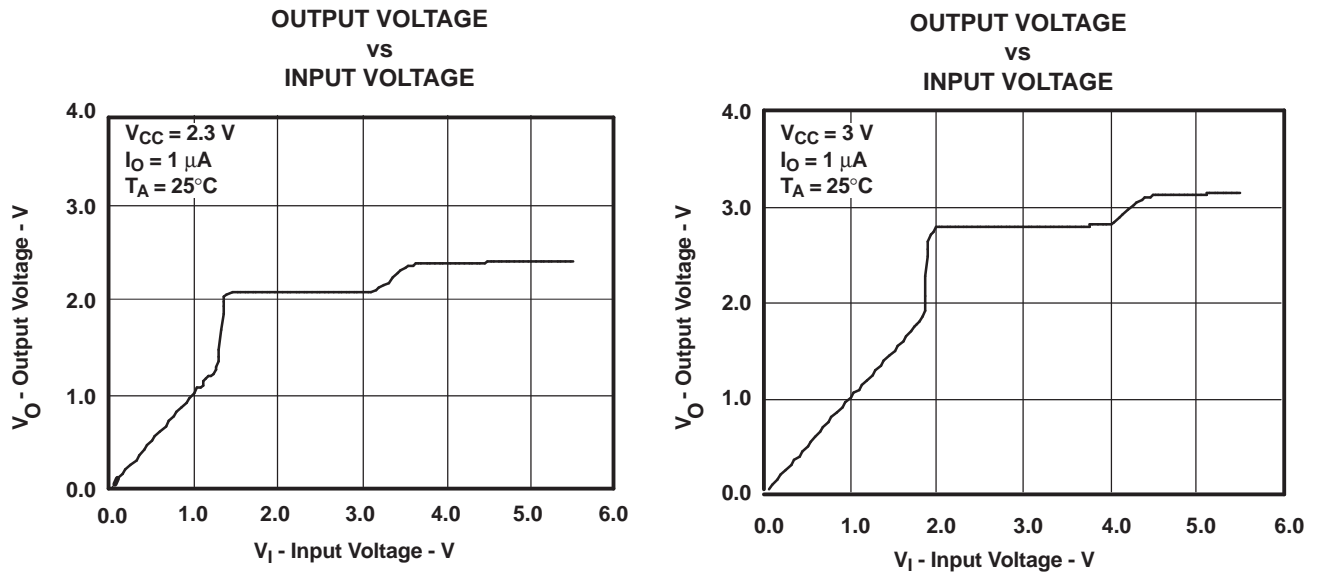


Figure 3. Data Output Voltage vs Data Input Voltage

TYPICAL CHARACTERISTICS

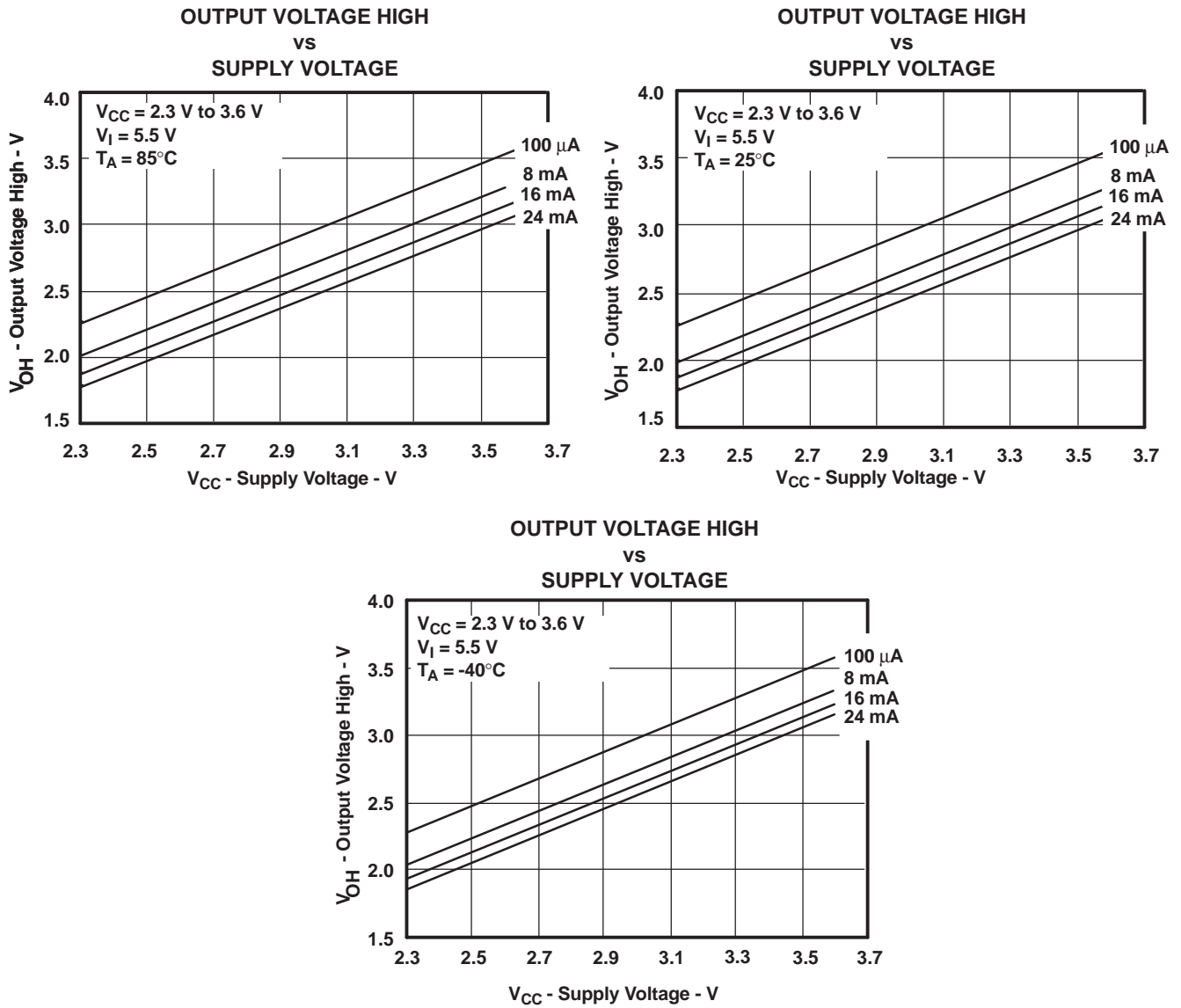


Figure 4. V_{OH} Values

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CCB3T1G125QDCKRQ1	ACTIVE	SC70	DCK	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	72R	Samples

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSELETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

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EXAMPLE BOARD LAYOUT

DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X



SOLDER MASK DETAILS

4214834/E 06/2024

NOTES: (continued)

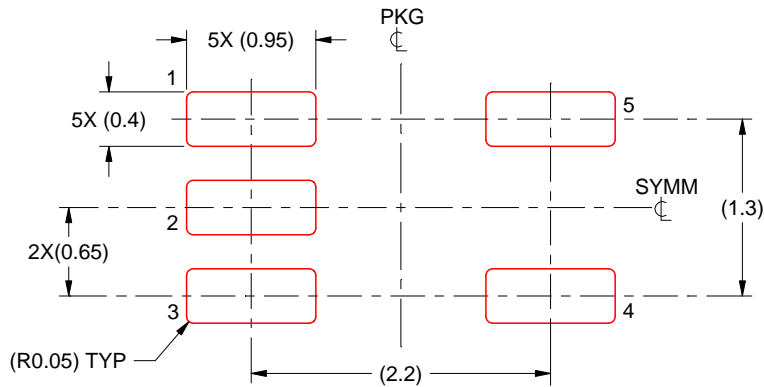
- 7. Publication IPC-7351 may have alternate designs.
- 8. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



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

4214834/E 06/2024

NOTES: (continued)

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

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