

TPS3809x 3 引脚电源电压监控器

1 特性

- 3 引脚 SOT-23 封装
- 电源电流为 $9\mu\text{A}$ (典型值)
- 精密电源电压监控器：
2.5V、3V、3.3V、5V
- 与 MAX 809 引脚对引脚兼容
- 温度范围：-40°C 至 +85°C

2 应用

- 工厂自动化
- 无线音箱
- 电机驱动器
- 服务器
- 电器
- 电表
- 楼宇自动化

3 说明

TPS3809 系列监控电路主要为 DSP 及基于处理器的系统提供电路初始化和计时监控功能。新款 TLV809E 器件是具有相同引脚、功能和电气参数的替代产品。

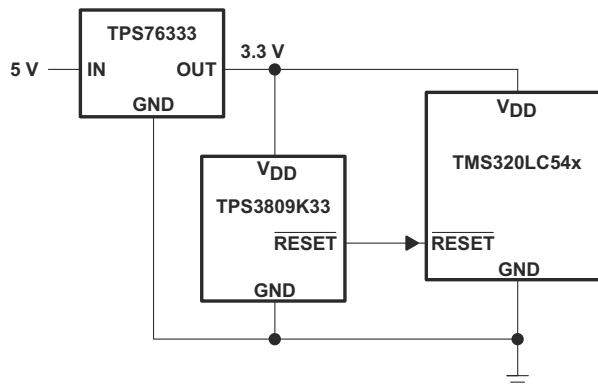
上电期间，如果电源电压 V_{DD} 大于 1.1V， $\overline{\text{RESET}}$ 就会生效。因此，只要 V_{DD} 保持在阈值电压 V_{IT} 以下，监控电路就会监测 V_{DD} ，并使 $\overline{\text{RESET}}$ 保持有效状态。内部计时器将会延迟输出恢复至无效状态（高电平）的时间，以确保系统正常复位。延时时间 $t_{d(\text{typ})} = 200\text{ms}$ ，从 V_{DD} 上升至高于阈值电压 V_{IT} 后开始计时。电源电压降至阈值电压 V_{IT} 以下时，输出再次变为有效状态（低电平）。无需外部组件。该系列所有器件均具有由内部分压器设定的固定检测阈值电压 V_{IT} 。

该产品系列旨在用于 2.5V、3V、3.3V 和 5V 电源电压。这些电路都采用 3 引脚 SOT-23 封装。TPS3809 器件的工作温度范围为 -40°C 至 +85°C。

器件信息

器件型号	封装 ⁽¹⁾	封装尺寸 (标称值)
TPS3809	SOT-23 (3)、DBV	2.90mm × 1.60mm

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。



典型应用



Table of Contents

1 特性.....	1	7.3 Dissipation Ratings.....	5
2 应用.....	1	7.4 Electrical Characteristics.....	5
3 说明.....	1	7.5 Timing Requirements.....	6
4 Revision History.....	2	7.6 Switching Characteristics.....	6
5 Device Comparison.....	3	7.7 Timing Diagram.....	6
6 Pin Configuration and Functions.....	4	7.8 Typical Characteristics.....	7
7 Specifications.....	5	8 Detailed Description.....	9
7.1 Absolute Maximum Ratings ^{(1) (2)}	5	9 静电放电警告.....	9
7.2 Recommended Operating Conditions.....	5		

4 Revision History

Changes from Revision C (October 2013) to Revision D (January 2021)	Page
• 更新了整个文档中的表格、图和交叉参考的编号格式.....	1
• 在说明部分添加了有关新款 TLV809E 的描述.....	1
• Added the pinout and pin function table.....	4
• Changed VDD from 7 to 6.5 in <i>Absolute Maximum Ratings</i>	5
• Changed V _{OL} @ 500 μ A from 0.2 to 0.3V and corrected header of the table from TPS3800-xx, TPS3801-xx, TPS3802-xx to TPS3809xx in <i>Electrical Characteristics</i>	5
• Changed t _w pulse duration from 3 to 10 μ s in <i>Timing Requirements</i>	6
• Changed t _{PHL} from 1 to 10 μ s in <i>Switching Characteristics</i>	6
Changes from Revision B (July 2012) to Revision C (October 2013)	Page
• 更改了首页和页面流程，以便匹配当前标准外观.....	1
• Changed "Operating junction temperature range" to "Operating free-air temperature range" in Absolute Maximum Ratings (typo).....	5
Changes from Revision A (October 2010) to Revision B (July 2012)	Page
• Changed the Pull-up resistor value, $\overline{\text{RESET}}$ To: $\overline{\text{RESET}}$ current sink during startup in the Recommended Operating Conditions Table.....	5
Changes from Revision * (August 1999) to Revision A (October 2010)	Page
• Added Pull-up resistor value, $\overline{\text{RESET}}$ to the Recommended Operating Conditions Table.....	5

5 Device Comparison

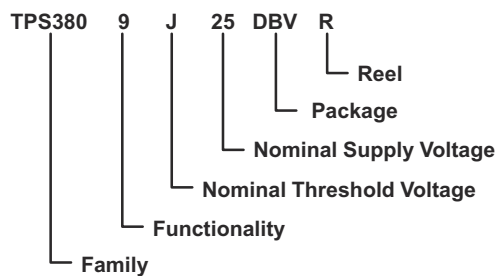
表 5-1. Device Comparison Table

T _A	DEVICE NAME		THRESHOLD VOLTAGE	MARKING
– 40°C to 85°C	TPS3809J25DBVR	TPS3809J25DBVT	2.25 V	PCZI
	TPS3809L30DBVR	TPS3809L30DBVT	2.64 V	PDAI
	TPS3809K33DBVR	TPS3809K33DBVT	2.93 V	PDBI
	TPS3809I50DBVR	TPS3809I50DBVT	4.55 V	PDCI

FUNCTION/TRUTH TABLE, TPS3809

V _{DD} >V _{IT}	RESET
0	L
1	H

ORDERING INFORMATION



6 Pin Configuration and Functions

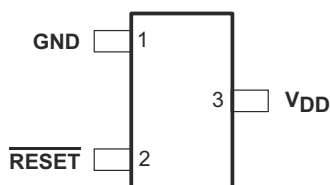


图 6-1. Pin configuration

表 6-1. Pin Functions

PIN		I/O ⁽¹⁾	DESCRIPTION
NAME	NO.		
GND	1	-	This pin should be connected to ground with a low-impedance connection.
RESET	2	O	RESET is an active low signal, asserting when V_{DD} is below the threshold voltage. When V_{DD} rises above V_{IT} , there is a delay time (t_d) until RESET deasserts. RESET is a push-pull output stage.
VDD	3	-	Supply voltage pin. A 0.1- μ F ceramic capacitor from this pin to ground is recommended to improve stability of the threshold voltage

7 Specifications

7.1 Absolute Maximum Ratings ⁽¹⁾ ⁽²⁾

Over operating free-air temperature range (unless otherwise noted).

	UNIT
Supply voltage, V_{DD}	6.5 V
All other pins	– 0.3 V to 6.5 V
Maximum low-output current, I_{OL}	5 mA
Maximum high-output current, I_{OH}	– 5 mA
Input-clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{DD}$)	±20 mA
Output-clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{DD}$)	±20 mA
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A	– 40°C to 85°C
Storage temperature range, T_{stg}	– 65°C to 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 voltage values are with respect to GND. For reliable operation, the device should not be operated at 6.5 V for more than $t = 1000h$ continuously.

7.2 Recommended Operating Conditions

	MIN	MAX	UNIT
Supply voltage, V_{DD}	2	6	V
RESET current sink during startup		50	μA
Operating free-air temperature range, T_A	– 40	+85	°C

7.3 Dissipation Ratings

PACKAGE	$T_A < 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A < 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING
DBV	437 mW	3.5 mW/°C	280 mW	227 mW

7.4 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	TPS3809xx			UNIT
			MIN	TYP	MAX	
V _{OH} High-level output voltage		V _{DD} = 2.5 V to 6 V I _{OH} = - 500 μ A	V _{DD} - 0.2			V
		V _{DD} = 3.3 V I _{OH} = - 2 mA	V _{DD} - 0.4			
		V _{DD} = 6 V I _{OH} = - 4 mA	V _{DD} - 0.4			
V _{OL} Low-level output voltage		V _{DD} = 2 V to 6 V, I _{OL} = 500 μ A			0.3	V
		V _{DD} = 3.3 V, I _{OL} = 2 mA			0.4	
		V _{DD} = 6 V, I _{OL} = 4 mA			0.4	
Power-up reset voltage ⁽¹⁾		V _{DD} ≥ 1.1 V, I _{OL} = 50 μ A			0.2	V
V _{IT} - Negative-going input threshold voltage ⁽²⁾	TPS3809J25	T _A = - 40°C to 85°C	2.2	2.25	2.3	V
	TPS3809L30		2.58	2.64	2.7	
	TPS3809K33		2.87	2.93	2.99	
	TPS3809I50		4.45	4.55	4.65	
V _{hys} Threshold hysteresis	TPS3809J25			30		mV
	TPS3809L30			35		
	TPS3809K33			40		
	TPS3809I50			60		

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

PARAMETER		TEST CONDITIONS	TPS3809xx			UNIT
			MIN	TYP	MAX	
I_{DD} Supply current		$V_{DD} = 2\text{ V}$, output unconnected		9	12	μA
		$V_{DD} = 6\text{ V}$, output unconnected		20	25	
C_i Input capacitance		$V_i = 0\text{ V}$ to V_{DD}		5		pF

- (1) The lowest supply voltage at which $\overline{\text{RESET}}$ becomes active. $t_r, V_{DD} \geq 15\text{ }\mu\text{s/V}$.
 (2) To ensure the best stability of the threshold voltage, a bypass capacitor (0.1- μF ceramic) should be placed near the supply terminals.

7.5 Timing Requirements

at $R_L = 1\text{ M}\Omega$, $C_L = 50\text{ pF}$, $T_A = 25^\circ\text{C}$

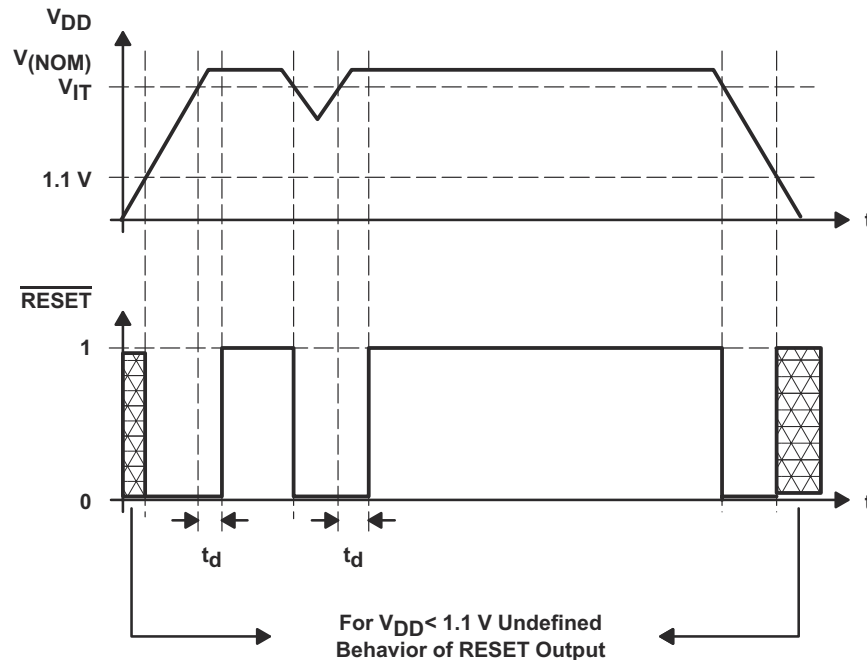
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_w Pulse width	at V_{DD}	$V_{DD} = V_{IT-} + 0.2\text{ V}$, $V_{DD} = V_{IT-} - 0.2\text{ V}$	10			μs

7.6 Switching Characteristics

at $R_L = 1\text{ M}\Omega$, $C_L = 50\text{ pF}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_d Delay time		$V_{DD} \geq V_{IT-} + 0.2\text{ V}$, See timing diagram	120	200	280	ms
t_{PHL} Propagation (delay) time, high-to-low-level output	V_{DD} to $\overline{\text{RESET}}$ delay	$V_{IL} = V_{IT-} - 0.2\text{ V}$, $V_{IH} = V_{IT-} + 0.2\text{ V}$		10		μs

7.7 Timing Diagram



7.8 Typical Characteristics

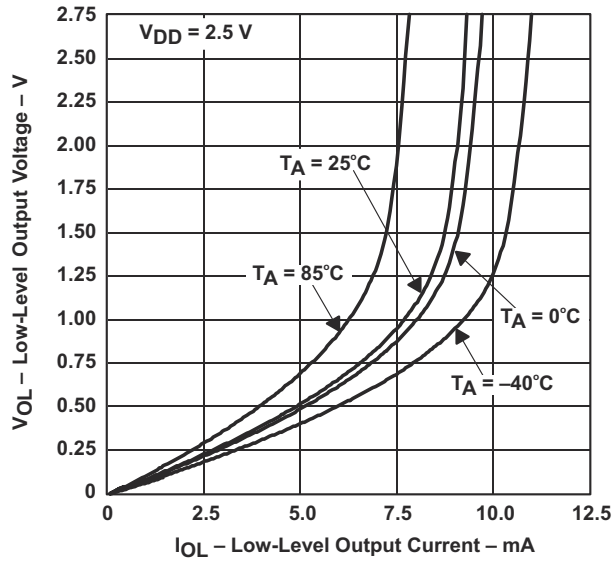


图 7-1. LOW-LEVEL OUTPUT VOLTAGE vs LOW-LEVEL OUTPUT CURRENT

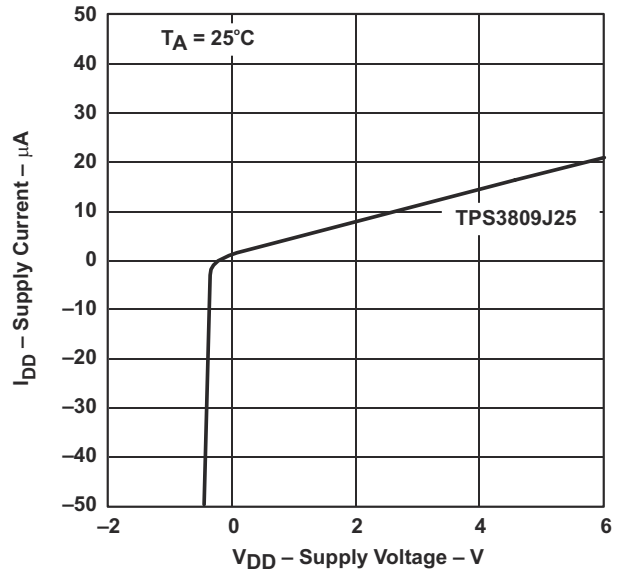


图 7-2. SUPPLY CURRENT vs SUPPLY VOLTAGE

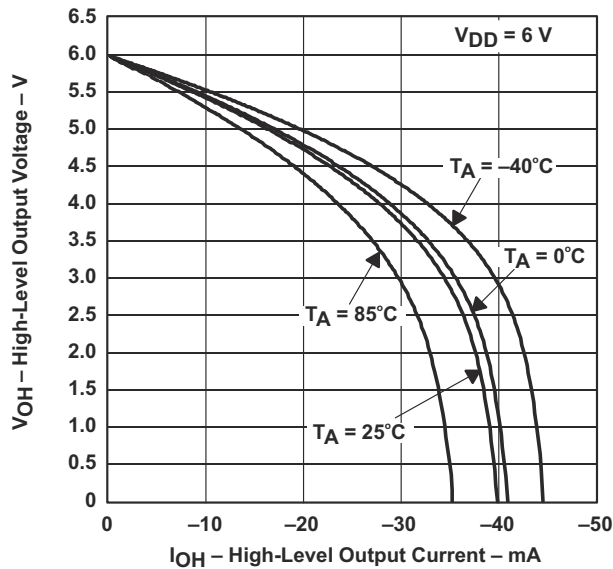


图 7-3. HIGH-LEVEL OUTPUT VOLTAGE vs HIGH-LEVEL OUTPUT CURRENT at $V_{DD}=6\text{V}$

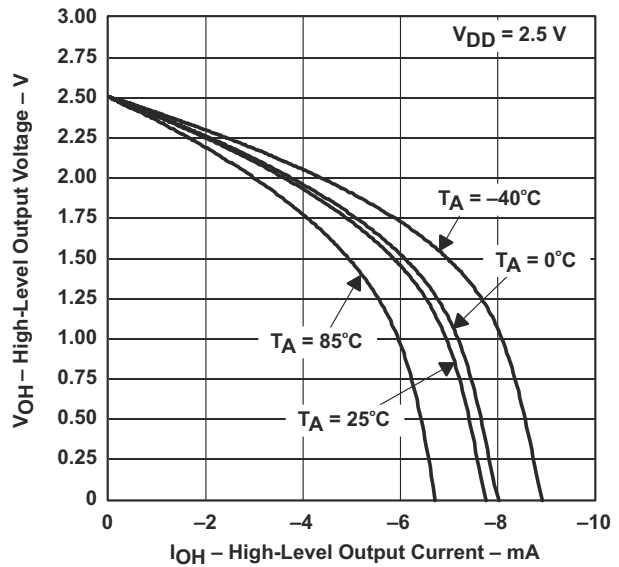


图 7-4. HIGH-LEVEL OUTPUT VOLTAGE vs HIGH-LEVEL OUTPUT CURRENT at $V_{DD}=2.5\text{V}$

7.8 Typical Characteristics (continued)

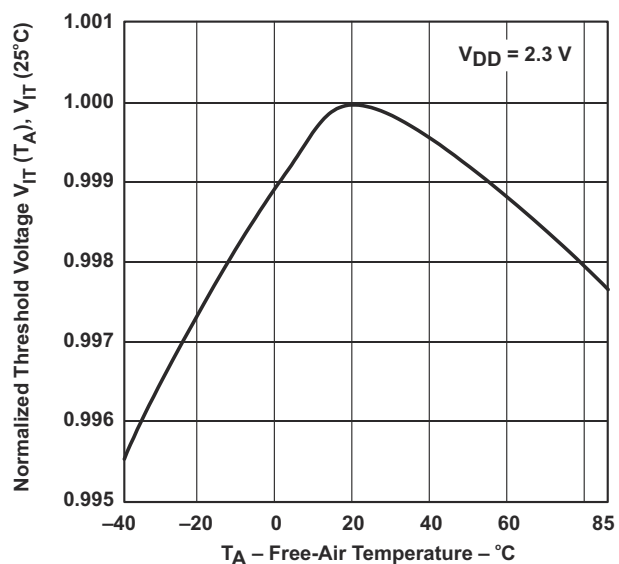
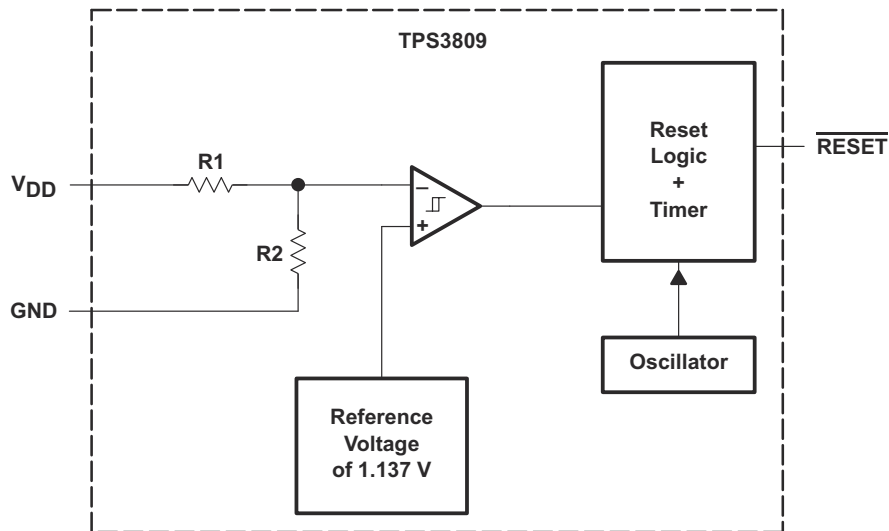


图 7-5. NORMALIZED INPUT THRESHOLD VOLTAGE vs FREE-AIR TEMPERATURE AT $V_{DD}=2.3\text{V}$

8 Detailed Description



9 静电放电警告



静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

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
TPS3809I50DBVR	ACTIVE	SOT-23	DBV	3	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	PDCI	Samples
TPS3809I50DBVRG4	ACTIVE	SOT-23	DBV	3	3000	TBD	Call TI	Call TI	-40 to 85		Samples
TPS3809I50DBVT	ACTIVE	SOT-23	DBV	3	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	PDCI	Samples
TPS3809J25DBVR	ACTIVE	SOT-23	DBV	3	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	PCZI	Samples
TPS3809J25DBVT	ACTIVE	SOT-23	DBV	3	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	PCZI	Samples
TPS3809K33DBVR	ACTIVE	SOT-23	DBV	3	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	PDBI	Samples
TPS3809K33DBVRG4	ACTIVE	SOT-23	DBV	3	3000	TBD	Call TI	Call TI	-40 to 85		Samples
TPS3809K33DBVT	ACTIVE	SOT-23	DBV	3	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	PDBI	Samples
TPS3809L30DBVR	ACTIVE	SOT-23	DBV	3	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	PDAI	Samples
TPS3809L30DBVRG4	ACTIVE	SOT-23	DBV	3	3000	TBD	Call TI	Call TI	-40 to 85		Samples
TPS3809L30DBVT	ACTIVE	SOT-23	DBV	3	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	PDAI	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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OTHER QUALIFIED VERSIONS OF TPS3809 :

- Automotive : [TPS3809-Q1](#)
- Enhanced Product : [TPS3809-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

TAPE AND REEL INFORMATION



*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
TPS3809I50DBVR	SOT-23	DBV	3	3000	178.0	9.0	3.3	3.2	1.4	4.0	8.0	Q3
TPS3809I50DBVT	SOT-23	DBV	3	250	178.0	9.0	3.3	3.2	1.4	4.0	8.0	Q3
TPS3809J25DBVR	SOT-23	DBV	3	3000	178.0	9.0	3.3	3.2	1.4	4.0	8.0	Q3
TPS3809J25DBVT	SOT-23	DBV	3	250	178.0	9.0	3.3	3.2	1.4	4.0	8.0	Q3
TPS3809K33DBVR	SOT-23	DBV	3	3000	178.0	9.0	3.3	3.2	1.4	4.0	8.0	Q3
TPS3809K33DBVT	SOT-23	DBV	3	250	178.0	9.0	3.3	3.2	1.4	4.0	8.0	Q3
TPS3809L30DBVR	SOT-23	DBV	3	3000	178.0	9.0	3.3	3.2	1.4	4.0	8.0	Q3
TPS3809L30DBVT	SOT-23	DBV	3	250	178.0	9.0	3.3	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)
TPS3809I50DBVR	SOT-23	DBV	3	3000	180.0	180.0	18.0
TPS3809I50DBVT	SOT-23	DBV	3	250	180.0	180.0	18.0
TPS3809J25DBVR	SOT-23	DBV	3	3000	180.0	180.0	18.0
TPS3809J25DBVT	SOT-23	DBV	3	250	180.0	180.0	18.0
TPS3809K33DBVR	SOT-23	DBV	3	3000	180.0	180.0	18.0
TPS3809K33DBVT	SOT-23	DBV	3	250	180.0	180.0	18.0
TPS3809L30DBVR	SOT-23	DBV	3	3000	180.0	180.0	18.0
TPS3809L30DBVT	SOT-23	DBV	3	250	180.0	180.0	18.0

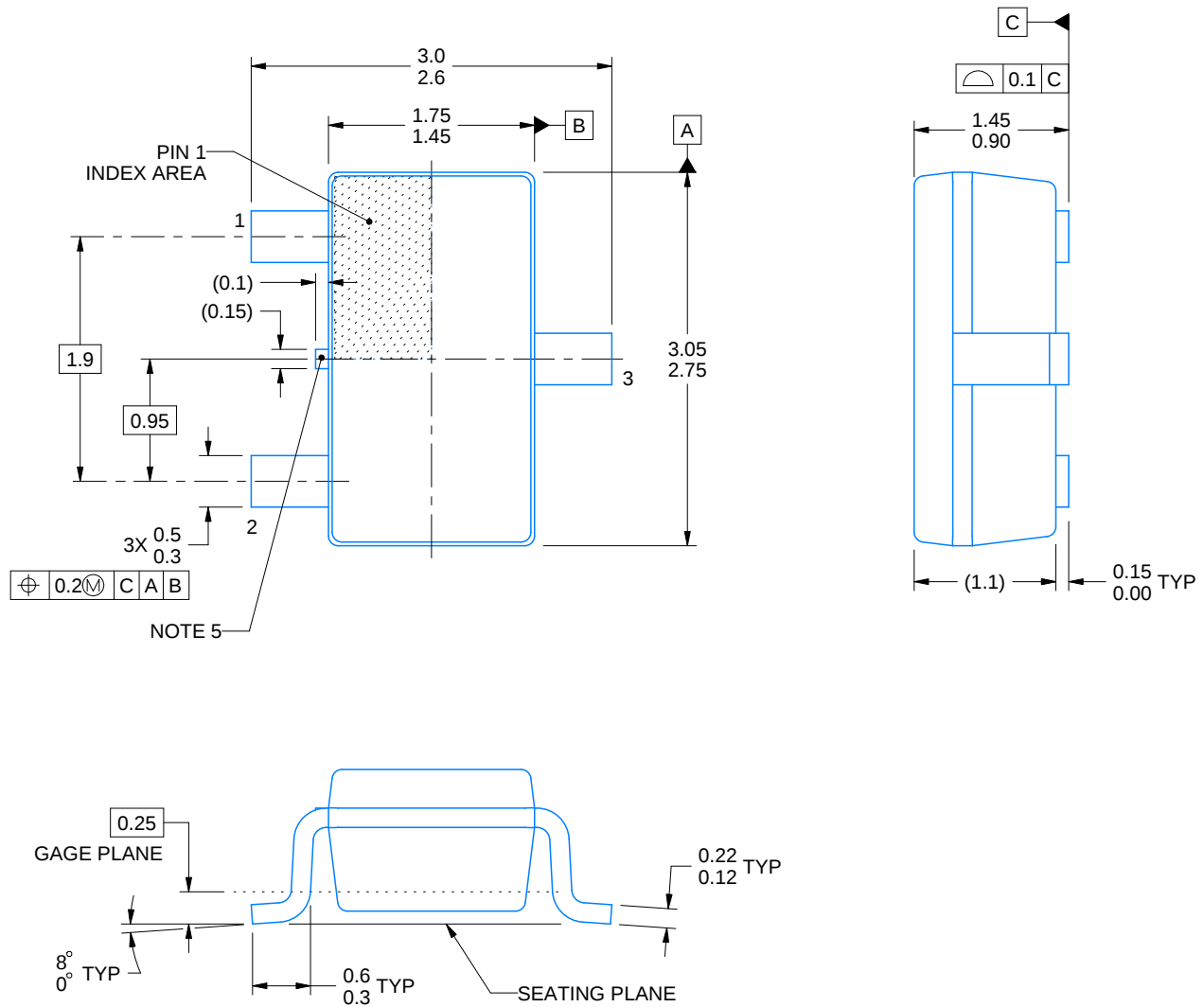
DBV0003A



PACKAGE OUTLINE

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



4220743/B 03/2023

NOTES:

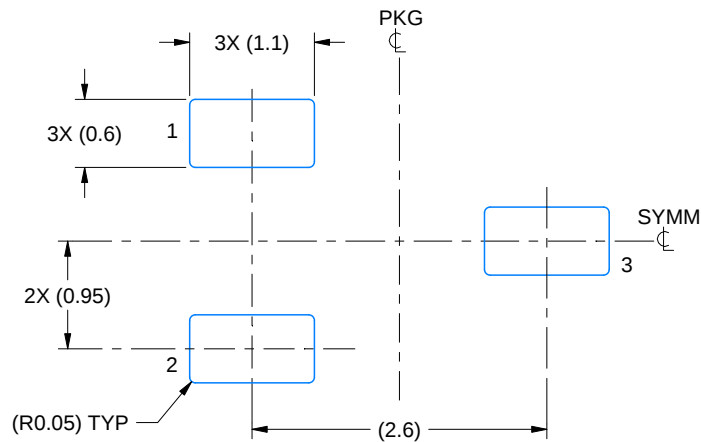
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC MO-178.
4. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25 mm per side.
5. Support pin may differ or may not be present.

EXAMPLE BOARD LAYOUT

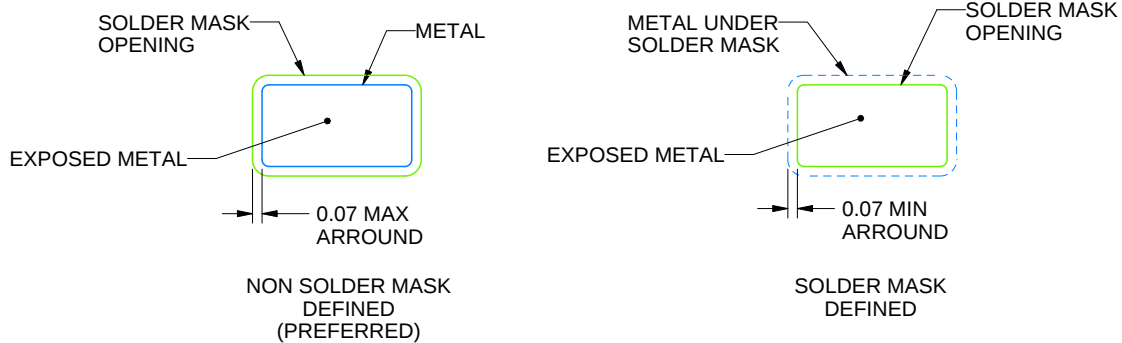
DBV0003A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

4220743/B 03/2023

NOTES: (continued)

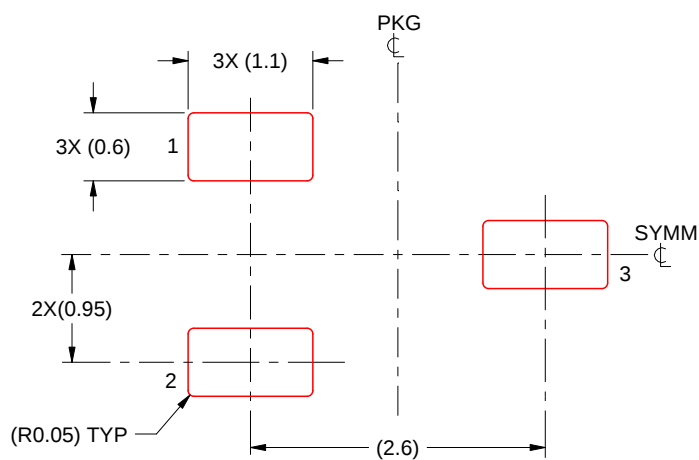
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBV0003A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



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

4220743/B 03/2023

NOTES: (continued)

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

重要声明和免责声明

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