

LM25101 3A、2A 和 1A 80V 半桥栅极驱动器

1 特性

- 独立的高侧和低侧驱动器逻辑输入
- 自举电源电压高达 100V DC
- 可驱动高侧和低侧 N 沟道金属氧化物半导体场效应晶体管 (MOSFET)
- 短暂传播时间 (典型值为 25ns)
- 可以 8ns 的上升和下降时间驱动 1000pF 负载
- 优异的传播延迟匹配 (典型值为 3ns)
- 支持电源轨欠压锁定
- 低功耗
- 与 HIP2100 和 HIP2101 引脚兼容

2 应用

- 由电机控制的驱动器
- 半桥和全桥电源转换器
- 同步降压转换器
- 双开关正向电源转换器
- 有源钳位正激转换器
- 48V 服务器电源
- 太阳能 DC-DC 和 DC-AC 转换器

3 说明

LM25101 高电压栅极驱动器专为驱动采用同步降压或半桥配置的高侧和低侧 N 沟道 MOSFET 而设计。版本 A 提供高达 3A 的栅极驱动，而版本 B 和 C 分别提供 2A 和 1A 的栅极驱动。输出由 TTL 输入阈值独立控制。该器件集成了一个高压二极管，用于对高侧栅极驱动自举电容进行充电。稳健可靠的电平转换器同时拥有高运行速度和低功耗特性，并且可提供从控制逻辑到高侧栅极驱动器的干净电平转换。该器件在低侧和高侧电源轨上提供了欠压锁定功能。

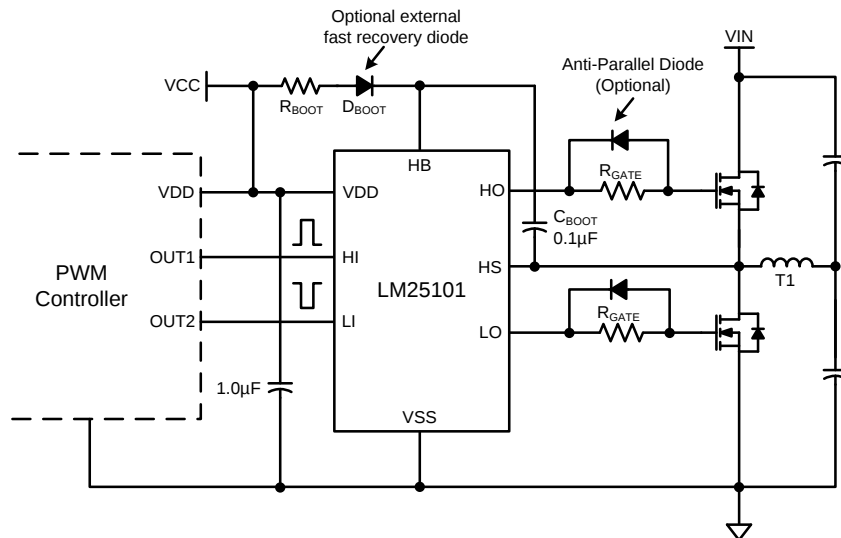
这些器件采用标准 8 引脚 SOIC、8 引脚 SO-PowerPAD、8 引脚 WSON、10 引脚 WSON 以及 8 引脚 MOSP PowerPAD 封装。

器件信息⁽¹⁾

器件型号	封装	封装尺寸 (标称值)
LM25101	MSOP PowerPAD (8)	3mm x 3mm
	WSON (8)	4mm x 4mm
	WSON (10)	4mm x 4mm
	SO PowerPAD (8)	3.9mm x 4.89mm
	SOIC (8)	3.91mm x 4.9mm

(1) 要了解所有可用封装，请见数据表末尾的可订购产品附录。

简化应用示意图



Copyright © 2016, Texas Instruments Incorporated



目录

1	特性	1	8.3	Feature Description	12
2	应用	1	8.4	Device Functional Modes	13
3	说明	1	9	Application and Implementation	14
4	修订历史记录	2	9.1	Application Information	14
5	Device Options	3	9.2	Typical Application	14
6	Pin Configuration and Functions	3	10	Power Supply Recommendations	16
7	Specifications	4	11	Layout	17
7.1	Absolute Maximum Ratings	4	11.1	Layout Guidelines	17
7.2	ESD Ratings	5	11.2	Layout Example	18
7.3	Recommended Operating Conditions	5	12	器件和文档支持	19
7.4	Thermal Information	5	12.1	接收文档更新通知	19
7.5	Electrical Characteristics	6	12.2	社区资源	19
7.6	Switching Characteristics	7	12.3	商标	19
7.7	Typical Characteristics	8	12.4	静电放电警告	19
8	Detailed Description	12	12.5	Glossary	19
8.1	Overview	12	13	机械、封装和可订购信息	19
8.2	Functional Block Diagram	12			

4 修订历史记录

注：之前版本的页码可能与当前版本有所不同。

Changes from Revision B (March 2013) to Revision C	Page
• 已添加 ESD 额定值表，特性 描述部分，器件功能模式，应用和实施部分，电源相关建议部分，布局部分，器件和文档支持部分以及机械、封装和可订购信息部分。	1
• Added Thermal Information table	5

Changes from Original (March 2013) to Revision A	Page
• 已更改 国家半导体数据表的布局至 TI 格式	1

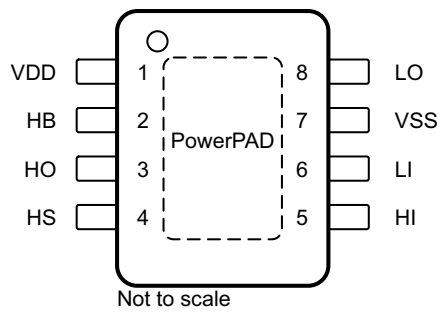
5 Device Options

Table 1. Input/Output Options

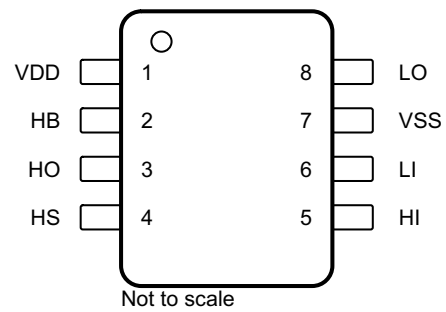
Part Number	Input Thresholds	Peak Output Current
LM25101A	TTL	3 A
LM25101B	TTL	2 A
LM25101C	TTL	1 A

6 Pin Configuration and Functions

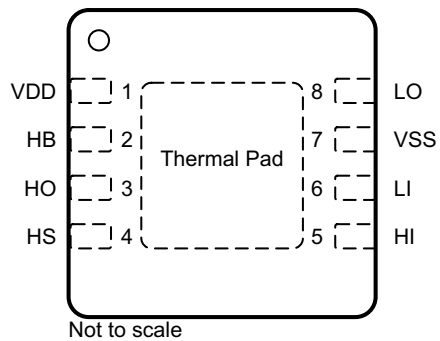
**DGN and DDA Packages
8-Pin MSOP and SO PowerPAD
Top View**



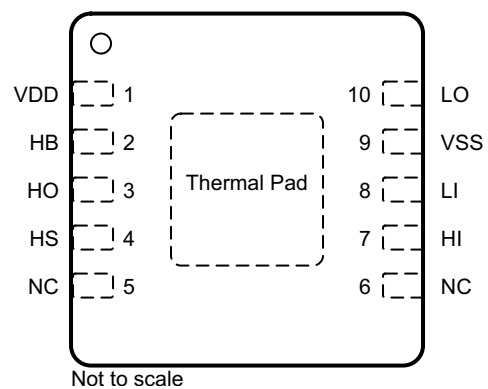
**D Package
8-Pin SOIC
Top View**



**NGT Package
8-Pin WSON
Top View**



**DPR Package
10-Pin WSON
Top View**



Pin Functions

NAME	PIN					TYPE	DESCRIPTION
	MSOP PowerPAD	WSON (8)	WSON (10)	SO PowerPAD	SOIC		
HB	2	2	2	2	2	PWR	High-side gate driver bootstrap rail. Connect the positive terminal of the bootstrap capacitor to HB and the negative terminal to HS. The bootstrap capacitor should be placed as close to the IC as possible.
HI	5	5	7	5	5	I	High-side driver control input. The LM25101 inputs have TTL type thresholds. Unused inputs should be tied to ground and not left open.
HO	3	3	3	3	3	O	High-side gate driver output. Connect to the gate of high-side MOSFET with a short, low inductance path.
HS	4	4	4	4	4	GND	High-side MOSFET source connection. Connect to the bootstrap capacitor negative terminal and the source of the high-side MOSFET.
LI	6	6	8	6	6	I	Low-side driver control input. The LM25101 inputs have TTL type thresholds. Unused inputs should be tied to ground and not left open.
LO	8	8	10	8	8	O	Low-side gate driver output. Connect to the gate of the low-side MOSFET with a short, low inductance path.
NC	—	—	5, 6	—	—	—	No connection
VDD	1	1	1	1	1	PWR	Positive gate drive supply. Locally decouple to VSS using a low ESR and ESL capacitor located as close to the IC as possible.
VSS	7	7	9	7	7	GND	Ground return. All signals are referenced to this ground.
Thermal Pad	PowerPAD	Thermal Pad	Thermal Pad	PowerPAD	—	—	Solder to the ground plane under the IC to aid in heat dissipation. ⁽¹⁾

- (1) TI recommends that the exposed thermal pad on the bottom of the applicable packages is soldered to ground plane of the PCB, and the ground plane should extend out from beneath the IC to help dissipate heat.

7 Specifications

7.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

	MIN	MAX	UNIT
VDD to VSS	−0.3	18	V
HB to HS	−0.3	18	V
LI or HI Input	−0.3	$V_{DD} + 0.3$	V
LO Output	−0.3	$V_{DD} + 0.3$	V
HO Output	$V_{HS} - 0.3$	$V_{HB} + 0.3$	V
HS to VSS ⁽²⁾	−5	100	V
HB to VSS		100	V
Junction temperature, T_J		150	°C
Storage temperature, T_{stg}	−55	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. For performance limits and associated test conditions, see the *Electrical Characteristics* tables.
- (2) In the application the HS node is clamped by the body diode of the external lower N-MOSFET, therefore the HS node will generally not exceed −1 V. However, in some applications, board resistance and inductance may result in the HS node exceeding this stated voltage transiently. If negative transients occur, the HS voltage must never be more negative than $V_{DD} - 15$ V. For example, if $V_{DD} = 10$ V, the negative transients at HS must not exceed −5 V.

7.2 ESD Ratings

				VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	All pins except 2, 3, and 4	±2000	V
			Pins 2, 3, and 4	±1000	
		Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾		±250	
		Machine model (MM)		±100	

(1) The Human Body Model (HBM) is a 100-pF capacitor discharged through a 1.5-kΩ resistor into each pin.

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

7.3 Recommended Operating Conditions

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

			MIN	MAX	UNIT
V _{DD}	Supply voltage	VDD	9	14	V
V _{HS}	Voltage	HS	–1	100 – V _{DD}	V
V _{HB}	Voltage	HB	V _{HS} + 8	V _{HS} + 14	V
	HS slew rate			50	V/ns
T _J	Junction temperature		–40	125	°C

7.4 Thermal Information

THERMAL METRIC ⁽¹⁾		LM25101A, LM25101B				LM25101C			UNIT
		D (SOIC)	DDA (SO PowerPAD)	NGT (WSON)	DPR (WSON)	D (SOIC)	DPR (WSON)	DGN (MSOP PowerPAD)	
		8 PINS	8 PINS	8 PINS	10 PINS	8 PINS	10 PINS	8 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	108.2	46.1	38.2	37.8	111.5	39.8	54.1	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	50.6	53.5	36.3	35.8	54.2	39.1	55.9	°C/W
R _{θJB}	Junction-to-board thermal resistance	49.1	13.8	15.2	15.0	52.3	17.1	15.1	°C/W
ψ _{JT}	Junction-to-top characterization parameter	7.6	4.2	0.3	0.3	9.0	0.4	2.4	°C/W
ψ _{JB}	Junction-to-board characterization parameter	48.5	13.9	15.4	15.3	51.7	17.3	15.1	°C/W
R _{θJC(bot)}	Junction-to-case (bottom) thermal resistance	—	3.9	4.5	4.4	—	6.1	4.6	°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

Typical values apply for $T_J = 25^\circ\text{C}$ only. Minimum and maximum limits apply for $T_J = -40^\circ\text{C}$ to 125°C .⁽¹⁾ Unless otherwise specified, $V_{DD} = V_{HB} = 12\text{ V}$, $V_{SS} = V_{HS} = 0\text{ V}$, No Load on LO or HO.

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
SUPPLY CURRENTS						
I_{DD}	VDD quiescent current	$V_{LI} = V_{HI} = 0\text{ V}$		0.25	0.4	mA
I_{DDO}	VDD operating current	$f = 500\text{ kHz}$		2.0	3	mA
I_{HB}	Total HB quiescent current	$V_{LI} = V_{HI} = 0\text{ V}$		0.06	0.2	mA
I_{HBO}	Total HB operating current	$f = 500\text{ kHz}$		1.6	3	mA
I_{HBS}	HB to VSS current (quiescent)	$V_{HS} = V_{HB} = 100\text{ V}$		0.1	10	μA
I_{HBSO}	HB to VSS current (operating)	$f = 500\text{ kHz}$		0.4		mA
INPUT PINS						
V_{IL}	Input voltage threshold	Rising Edge	1.3	1.8	2.3	V
V_{IHYS}	Input voltage hysteresis			50		mV
R_I	Input pulldown resistance		100	200	400	k Ω
UNDER VOLTAGE PROTECTION						
V_{DDR}	VDD rising threshold		6.0	6.9	7.4	V
V_{DDH}	VDD threshold hysteresis			0.5		V
V_{HBR}	HB rising threshold		5.7	6.6	7.1	V
V_{HBH}	HB threshold hysteresis			0.4		V
BOOT STRAP DIODE						
V_{DL}	Low-current forward voltage	$I_{VDD-HB} = 100\text{ }\mu\text{A}$		0.52	0.85	V
V_{DH}	High-current forward voltage	$I_{VDD-HB} = 100\text{ mA}$		0.8	1	V
R_D	Dynamic resistance	$I_{VDD-HB} = 100\text{ mA}$		1.0	1.65	Ω
LO AND HO GATE DRIVER						
V_{OL}	Low-level output voltage	$I_{HO} = I_{LO} = 100\text{ mA}$	A version	0.12	0.25	V
			B version	0.16	0.4	
			C version	0.28	0.65	
V_{OH}	High-level output voltage	$I_{HO} = I_{LO} = 100\text{ mA}$ $V_{OH} = V_{DD} - V_{LO}$ or $V_{OH} = V_{HB} - V_{HO}$	A version	0.24	0.45	V
			B version	0.28	0.60	
			C version	0.60	1.10	
I_{OHL}	Peak pullup current	HO, $V_{LO} = 0\text{ V}$	A version	3		A
			B version	2		
			C version	1		
I_{OLL}	Peak pulldown current	HO, $V_{LO} = 12\text{ V}$	A version	3		A
			B version	2		
			C version	1		

(1) Minimum and maximum limits are 100% production tested at 25°C . Limits over the operating temperature range are specified through correlation using Statistical Quality Control (SQC) methods. Limits are used to calculate Average Outgoing Quality Level (AOQL).

7.6 Switching Characteristics

Typical values apply for $T_J = 25^\circ\text{C}$ only. Minimum and maximum limits apply for $T_J = -40^\circ\text{C}$ to 125°C .⁽¹⁾ Unless otherwise specified, $V_{DD} = V_{HB} = 12\text{ V}$, $V_{SS} = V_{HS} = 0\text{ V}$, No Load on LO or HO.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{LPHL}	LO turnoff propagation delay		22	56	ns
t_{LPLH}	LO turnon propagation delay		26	56	ns
t_{HPHL}	HO turnoff propagation delay		22	56	ns
t_{HPLH}	HO turnon propagation delay		26	56	ns
t_{MON}	Delay matching		4	10	ns
t_{MOFF}	Delay matching		4	10	ns
t_{RC}, t_{FC}	Either output rise and fall time		8		ns
t_R	Output rise time (3 V to 9 V)	$C_L = 0.1\text{ }\mu\text{F}$	A version	430	ns
			B version	570	
			C version	990	
t_F	Output fall time (3 V to 9 V)	$C_L = 0.1\text{ }\mu\text{F}$	A version	260	ns
			B version	430	
			C version	715	
t_{PW}	Minimum input pulse duration that changes the output		50		ns
t_{BS}	Bootstrap diode reverse recovery time	$I_F = 100\text{ mA}$, $I_R = 100\text{ mA}$	37		ns

(1) Minimum and maximum limits are 100% production tested at 25°C . Limits over the operating temperature range are specified through correlation using Statistical Quality Control (SQC) methods. Limits are used to calculate Average Outgoing Quality Level (AOQL).

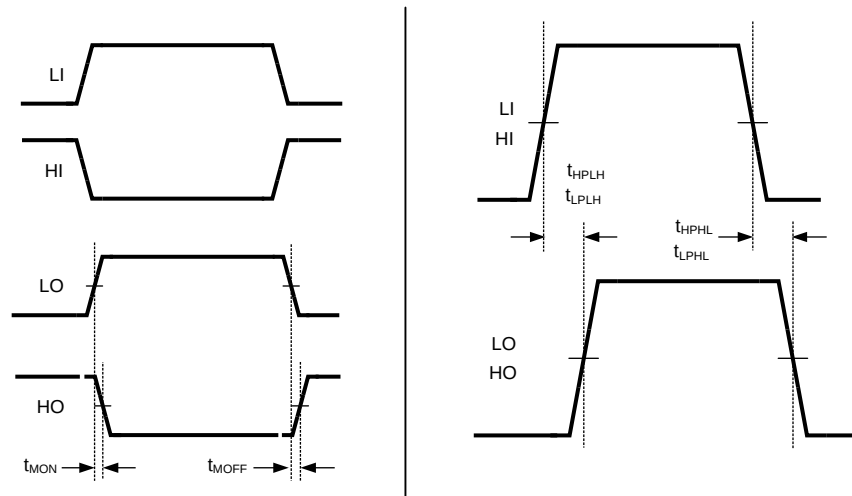


Figure 1. Timing Diagram

7.7 Typical Characteristics

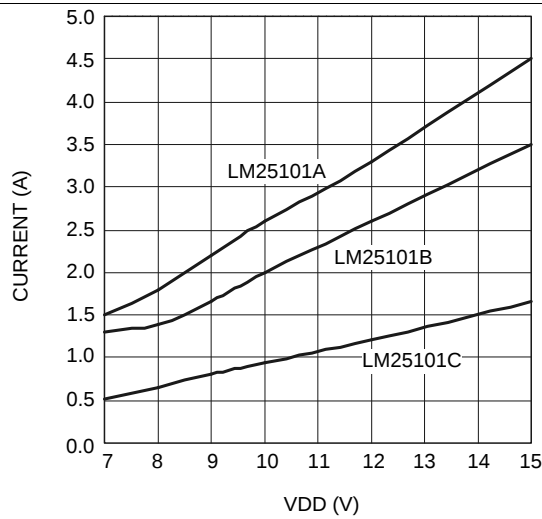


Figure 2. Peak Sourcing Current vs Supply Voltage

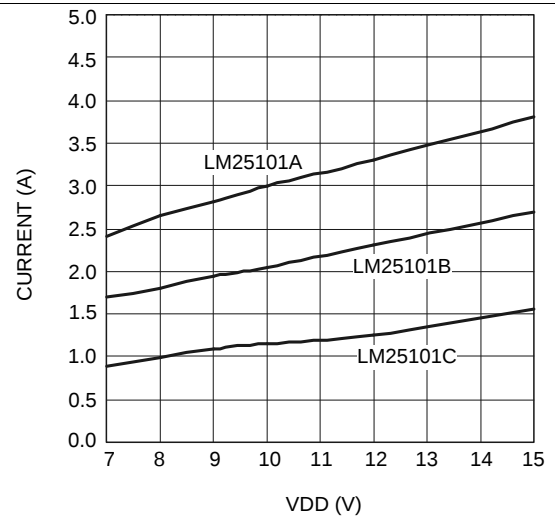


Figure 3. Peak Sinking Current vs Supply Voltage

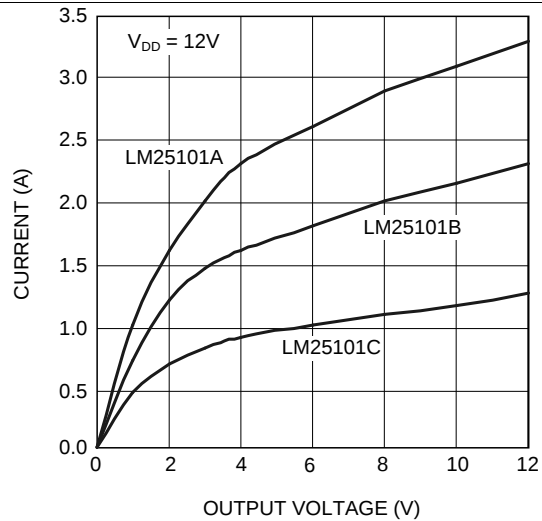


Figure 4. Sink Current vs Output Voltage

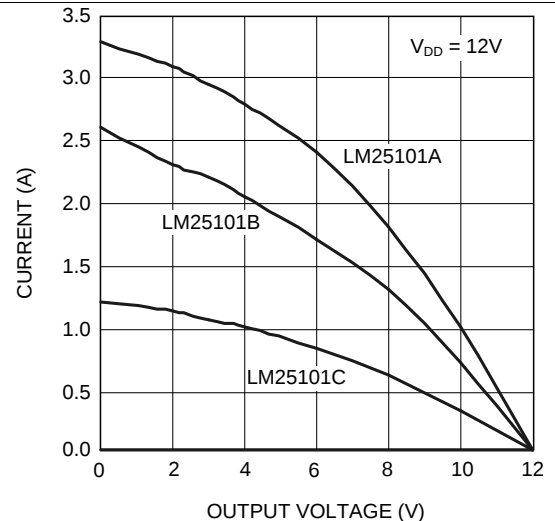


Figure 5. Source Current vs Output Voltage

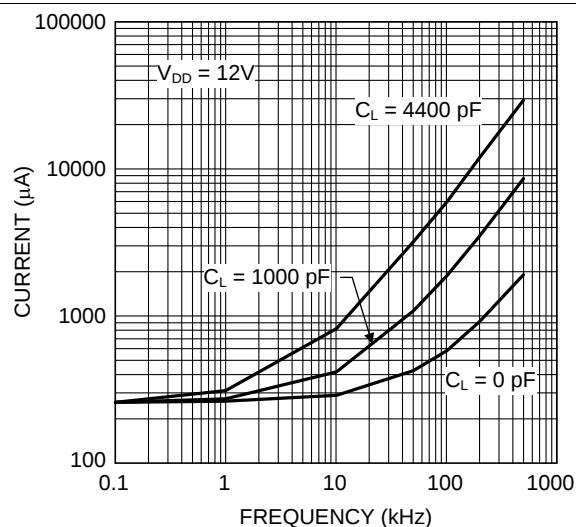


Figure 6. I_{DD} vs Frequency

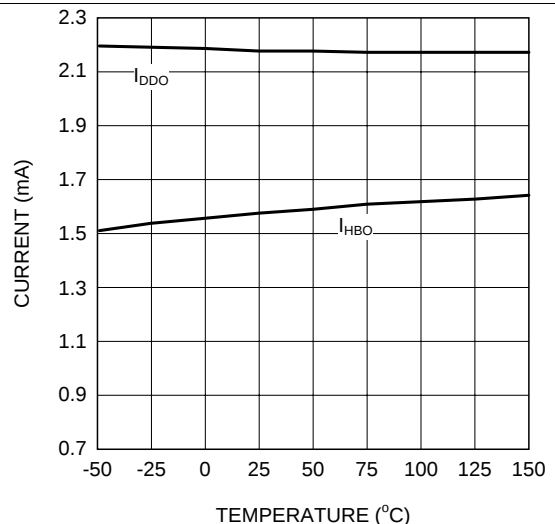


Figure 7. Operating Current vs Temperature

Typical Characteristics (continued)

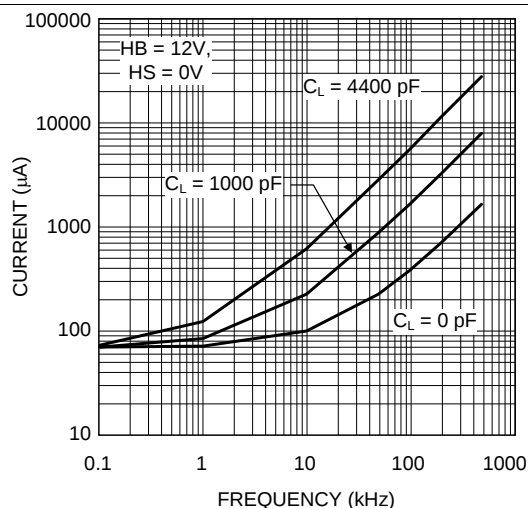


Figure 8. I_{HB} vs Frequency

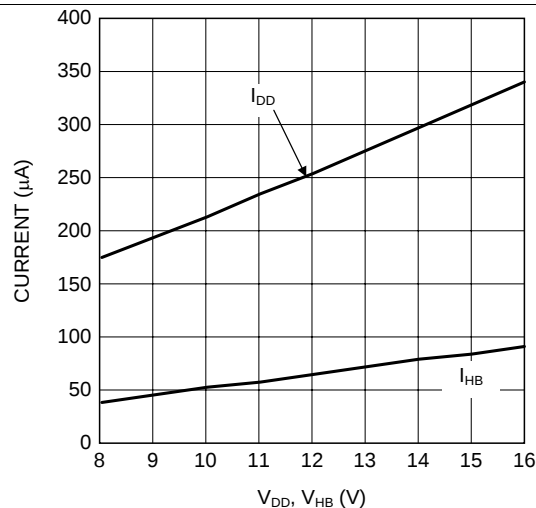


Figure 9. Quiescent Current vs Supply Voltage

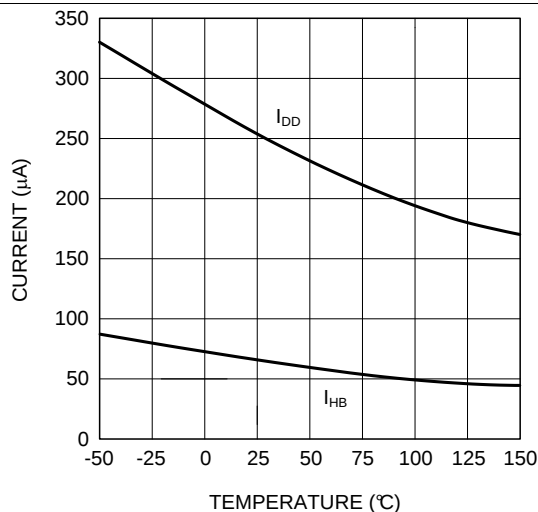


Figure 10. Quiescent Current vs Temperature

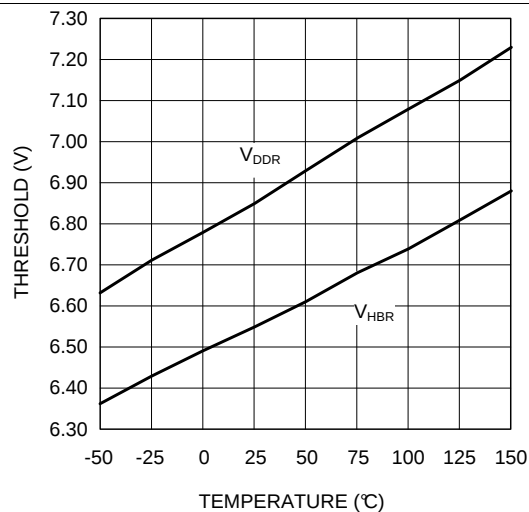


Figure 11. Undervoltage Rising Thresholds vs Temperature

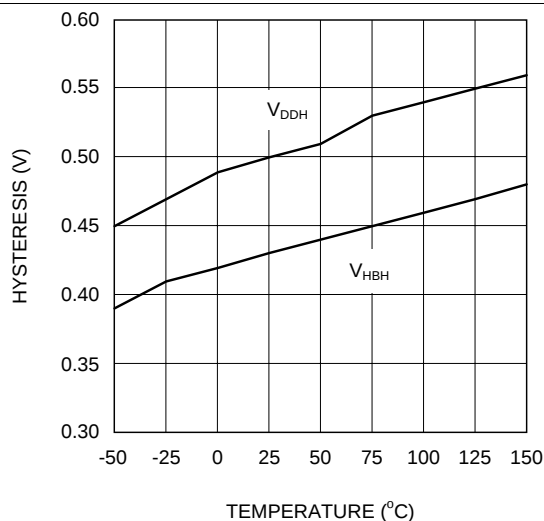


Figure 12. Undervoltage Threshold Hysteresis vs Temperature

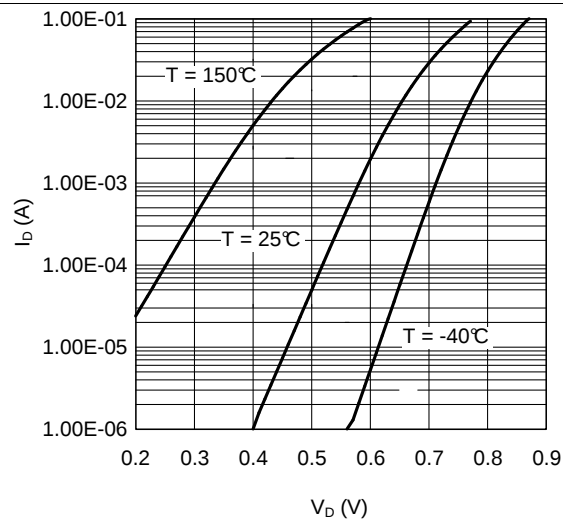


Figure 13. Bootstrap Diode Forward Voltage

Typical Characteristics (continued)

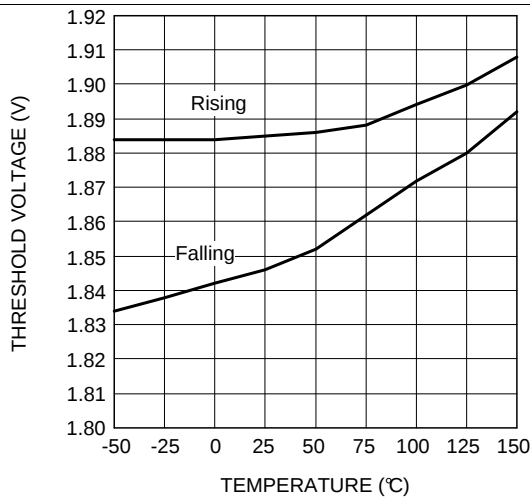


Figure 14. Input Threshold vs Temperature

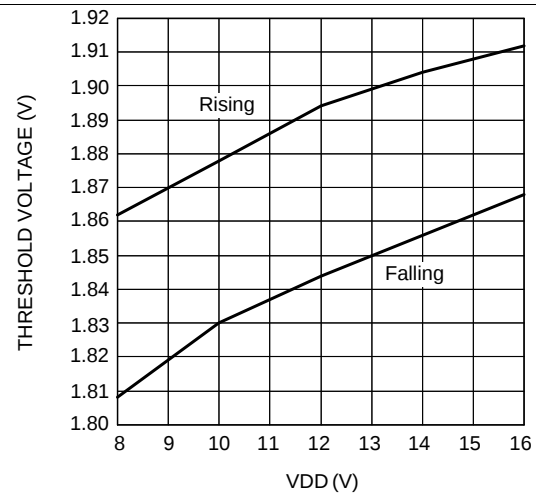


Figure 15. Input Threshold vs Supply Voltage

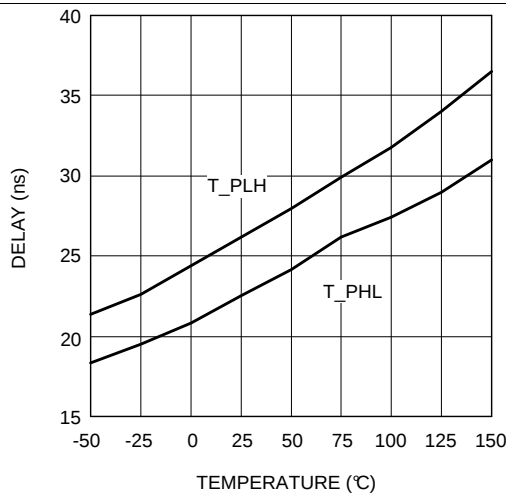


Figure 16. Propagation Delay vs Temperature

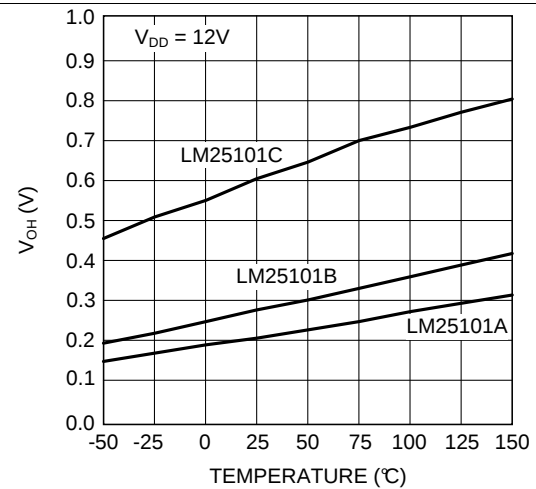


Figure 17. LO and HO Gate Drive:
High Level Output Voltage vs Temperature

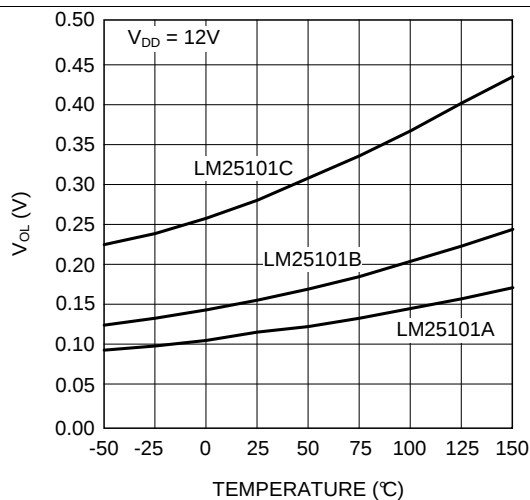


Figure 18. LO and HO Gate Drive:
Low Level Output Voltage vs Temperature

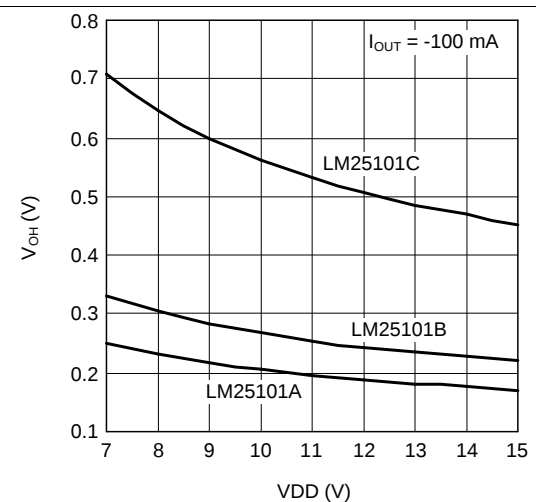
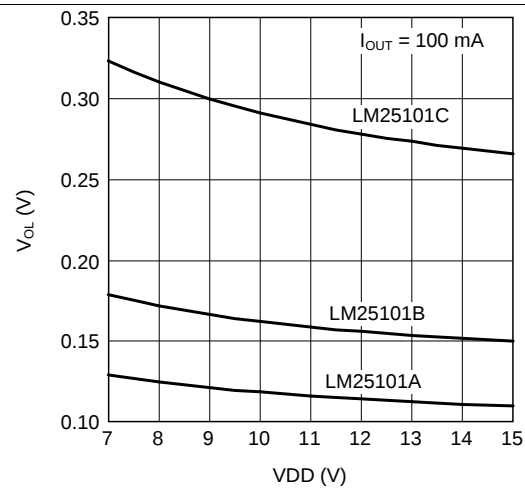


Figure 19. LO and HO Gate Drive:
Output High Voltage vs Supply Voltage

Typical Characteristics (continued)



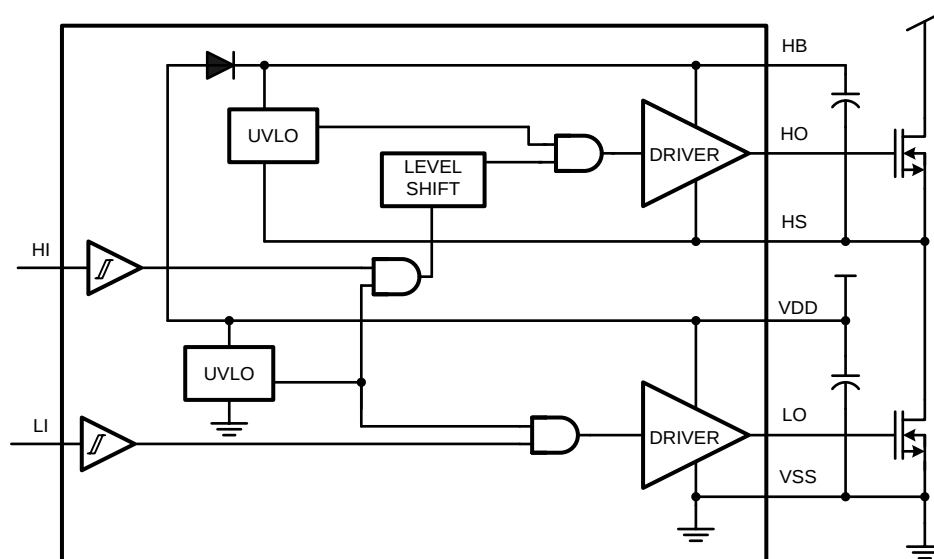
**Figure 20. LO and HO Gate Drive:
Output Low Voltage vs Supply Voltage**

8 Detailed Description

8.1 Overview

To operate fast switching of power MOSFETs at high switching frequencies and to reduce associated switching losses, a powerful gate driver is employed between the PWM output of controller and the gates of the power semiconductor devices. Also, gate drivers are indispensable when it is impossible for the PWM controller to directly drive the gates of the switching devices. With the advent of digital power, this situation is often encountered because the PWM signal from the digital controller is often a 3.3 V logic signal which cannot effectively turn on a power switch. Level shift circuitry is needed to boost the 3.3-V signal to the gate-drive voltage (such as 12 V) in order to fully turn on the power device and minimize conduction losses. Traditional buffer drive circuits based on NPN or PNP bipolar transistors in totem-pole arrangement prove inadequate with digital power because they lack level-shifting capability. Gate drivers effectively combine both the level-shifting and buffer-drive functions. Gate drivers also find other needs such as minimizing the effect of high-frequency switching noise (by placing the high-current driver IC physically close to the power switch), driving gate-drive transformers and controlling floating power-device gates, reducing power dissipation and thermal stress in controllers by moving gate charge power losses from the controller into the driver.

8.2 Functional Block Diagram



Copyright © 2016, Texas Instruments Incorporated

8.3 Feature Description

8.3.1 Start-Up and UVLO

Both top and bottom drivers include UVLO protection circuitry which monitors the supply voltage (V_{DD}) and bootstrap capacitor voltage (V_{HB-HS}) independently. The UVLO circuit inhibits each output until sufficient supply voltage is available to turn on the external MOSFETs, and the built-in UVLO hysteresis prevents chattering during supply voltage variations. When the supply voltage is applied to the VDD pin of the LM25101, the top and bottom gates are held low until V_{DD} exceeds the UVLO threshold, typically about 6.9 V. Any UVLO condition on the bootstrap capacitor (V_{HB-HS}) will only disable the high-side output (HO).

Table 2. VDD UVLO Feature Logic Operation

CONDITION ⁽¹⁾	HI	LI	HO	LO
$V_{DD} - V_{SS} < V_{DDR}$ during device start-up	H	L	L	L
$V_{DD} - V_{SS} < V_{DDR}$ during device start-up	L	H	L	L
$V_{DD} - V_{SS} < V_{DDR}$ during device start-up	H	H	L	L
$V_{DD} - V_{SS} < V_{DDR}$ during device start-up	L	L	L	L
$V_{DD} - V_{SS} < V_{DDR} - V_{DDH}$ after device start-up	H	L	L	L
$V_{DD} - V_{SS} < V_{DDR} - V_{DDH}$ after device start-up	L	H	L	L
$V_{DD} - V_{SS} < V_{DDR} - V_{DDH}$ after device start-up	H	H	L	L
$V_{DD} - V_{SS} < V_{DDR} - V_{DDH}$ after device start-up	L	L	L	L

(1) $V_{HB-HS} > V_{HBR}$

Table 3. VHB-HS UVLO Feature Logic Operation

CONDITION ⁽¹⁾	HI	LI	HO	LO
$V_{HB-HS} < V_{HBR}$ during device start-up	H	L	L	L
$V_{HB-HS} < V_{HBR}$ during device start-up	L	H	L	H
$V_{HB-HS} < V_{HBR}$ during device start-up	H	H	L	H
$V_{HB-HS} < V_{HBR}$ during device start-up	L	L	L	L
$V_{HB-HS} < V_{HBR} - V_{HBH}$ after device start-up	H	L	L	L
$V_{HB-HS} < V_{HBR} - V_{HBH}$ after device start-up	L	H	L	H
$V_{HB-HS} < V_{HBR} - V_{HBH}$ after device start-up	H	H	L	H
$V_{HB-HS} < V_{HBR} - V_{HBH}$ after device start-up	L	L	L	L

(1) $V_{DD} > V_{DDR}$

8.3.2 Level Shift

The level shift circuit is the interface from the high-side input to the high-side driver stage which is referenced to the switch node (HS). The level shift allows control of the HO output which is referenced to the HS pin and provides excellent delay matching with the low-side driver.

8.3.3 Output Stages

The output stages are the interface to the power MOSFETs in the power train. High slew rate, low resistance, and high peak current capability of both outputs allow for efficient switching of the power MOSFETs. The low-side output stage is referenced to VSS and the high-side is referenced to HS.

8.4 Device Functional Modes

The device operates in normal mode and UVLO mode. See [Start-Up and UVLO](#) for more information on UVLO operation mode. In normal mode when the V_{DD} and V_{HB-HS} are above UVLO threshold, the output stage is dependent on the states of the HI and LI pins. Unused inputs should be tied to ground and not left open.

Table 4. INPUT and OUTPUT Logic Table

HI	LI	HO ⁽¹⁾	LO ⁽²⁾
L	L	L	L
L	H	L	H
H	L	H	L
H	H	H	H

(1) HO is measured with respect to the HS pin.

(2) LO is measured with respect to the VSS pin.

9 Application and Implementation

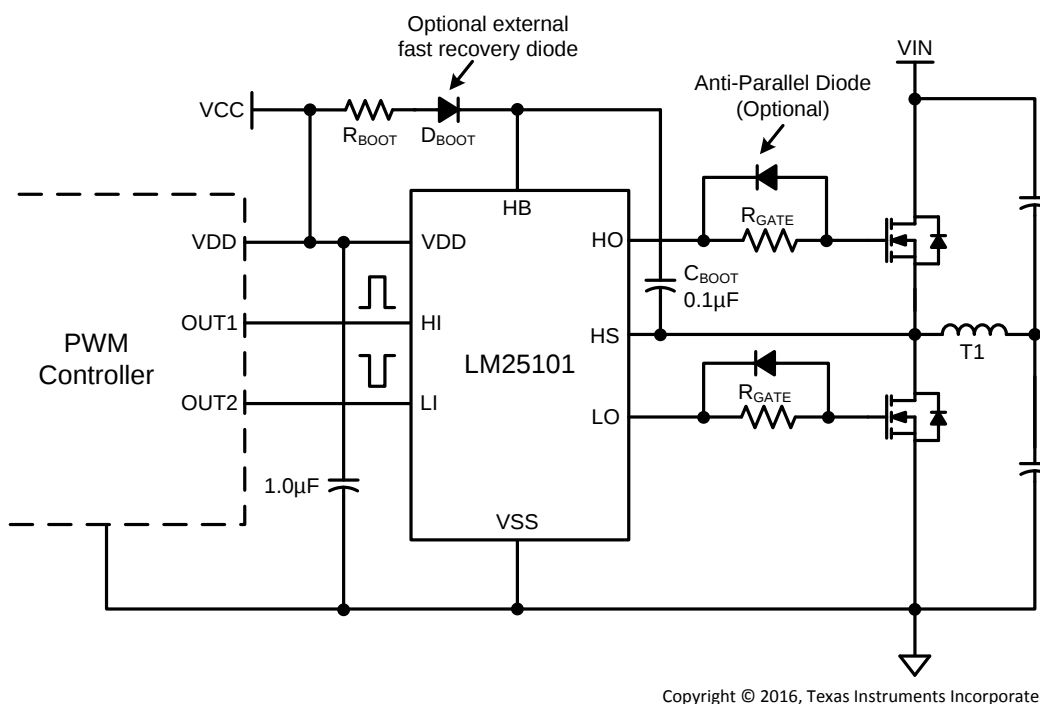
NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

The LM25101 is a high voltage gate driver designed to drive both the high-side and low-side N-Channel MOSFETs in a half or full bridge configuration or in a synchronous buck circuit. The floating high side driver is capable of operating with supply voltages up to 100 V. This allows for N-Channel MOSFETs control in half-bridge, full-bridge, push-pull, two switch forward, and active clamp topologies. The outputs are independently controlled. Each channel is controlled by its respective input pins (HI and LI), allowing full and independent flexibility to control the state (ON and OFF) of the output.

9.2 Typical Application



Copyright © 2016, Texas Instruments Incorporated

Figure 21. Application Diagram

9.2.1 Design Requirements

For this design example, use the parameters listed in [Table 5](#) as the input parameters.

Table 5. Design Parameters

PARAMETER	EXAMPLE VALUE
Gate driver	LM25101 (C version)
MOSFET	CSD19534KCS
V_{DD}	10 V
Q_G	17 nC
f_{SW}	500 kHz

9.2.2 Detailed Design Procedure

9.2.2.1 Selecting External Gate Driver Resistor

External gate driver resistor (R_{GATE}) is sized to reduce ringing caused by parasitic inductances and capacitances and also to limit the current coming out of the gate driver.

Peak HO pullup current is calculated using [Equation 1](#).

$$I_{OHH} = \frac{V_{DD} - V_{DH}}{R_{HOH} + R_{Gate} + R_{GFET_Int}} = \frac{10V - 1.0V}{1.1V / 100mA + 4.7\Omega + 2.2\Omega} \approx 0.5A$$

where

- I_{OHH} is the peak pullup current
- V_{DH} is the bootstrap diode forward voltage drop
- R_{HOH} is the gate driver internal HO pullup resistance ⁽¹⁾
- R_{Gate} is the external gate drive resistance
- $R_{(GFET_Int)}$ is the MOSFET internal gate resistance, provided by the transistor data sheet

Similarly, Peak HO pulldown current is calculated using [Equation 2](#).

$$I_{OLH} = \frac{V_{DD} - V_{DH}}{R_{HOL} + R_{Gate} + R_{GFET_Int}}$$

where

- R_{HOL} is the HO pulldown resistance

Peak LO pullup current is calculated using [Equation 3](#).

$$I_{OHL} = \frac{V_{DD}}{R_{LOH} + R_{Gate} + R_{GFET_Int}}$$

where

- R_{LOH} is the LO pullup resistance

Peak LO pulldown current is calculated using [Equation 4](#).

$$I_{OLL} = \frac{V_{DD}}{R_{LOL} + R_{Gate} + R_{FET_Int}}$$

where

- R_{LOL} is the LO pulldown resistance

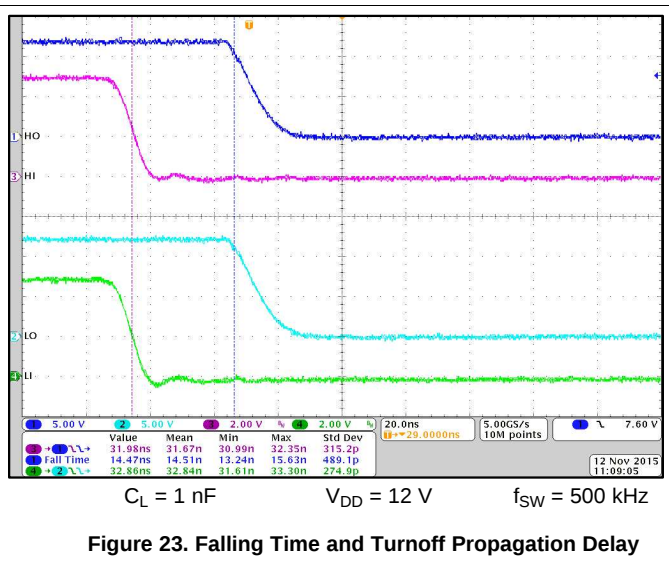
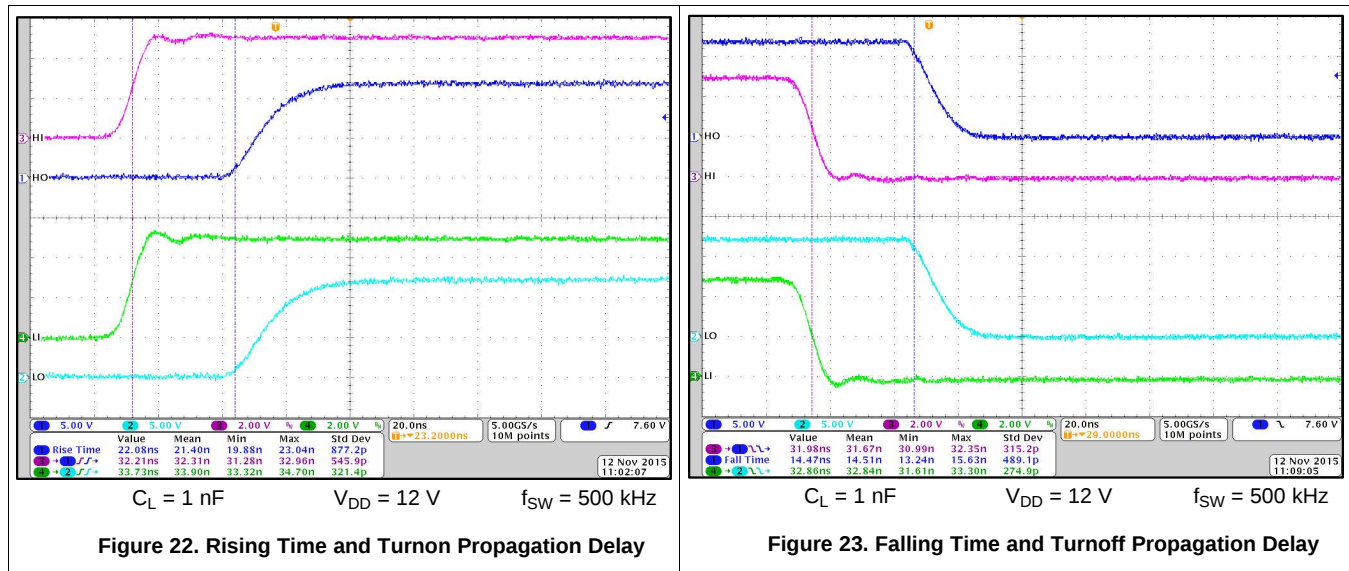
If the application requires fast turnoff, an anti-paralleled diode on R_{Gate} may be used to bypass the external gate drive resistor and speed up the turnoff transition.

(1) This value is either provided directly by the data sheet or is estimated from the testing conditions using $R_{HOH} = V_{OHH} / I_{HO}$.

9.2.3 Application Curves

Figure 22 and Figure 23 show the rising and falling time and turnon and turnoff propagation delay testing waveform at room temperature. Each channel (HI, LI, HO, LO) is labeled and displayed on the left hand of the waveform.

The HI and LI pins are shorted together for these test waveforms. Therefore, the propagation delay matching between the channels can be measured and inspected.



10 Power Supply Recommendations

The total IC power dissipation is the sum of the gate driver losses and the bootstrap diode losses. The gate driver losses are related to the switching frequency (f), output load capacitance on LO and HO (CL), and supply voltage (VDD), which can be roughly calculated using Equation 5.

$$P_{DGATES} = 2 \times f \times C_L \times V_{DD}^2 \quad (5)$$

There are some additional losses in the gate drivers due to the internal CMOS stages used to buffer the LO and HO outputs. Figure 24 shows the measured gate driver power dissipation versus frequency and load capacitance. At higher frequencies and load capacitance values, the power dissipation is dominated by the power losses driving the output loads and agrees well with Equation 5. Figure 24 can be used to approximate the power losses due to the gate drivers.

The bootstrap diode power loss is the sum of the forward bias power loss that occurs while charging the bootstrap capacitor and the reverse bias power loss that occurs during reverse recovery. Since each of these events happens once per cycle, the diode power loss is proportional to frequency. Larger capacitive loads require more energy to recharge the bootstrap capacitor resulting in more losses. Higher input voltages (VIN) to the half bridge result in higher reverse recovery losses. Figure 25 was generated based on calculations and lab measurements of the diode recovery time and current under several operating conditions and can be used to approximate the diode power dissipation.

The total IC power dissipation can be estimated from these plots by summing the gate drive losses with the bootstrap diode losses for the intended application.

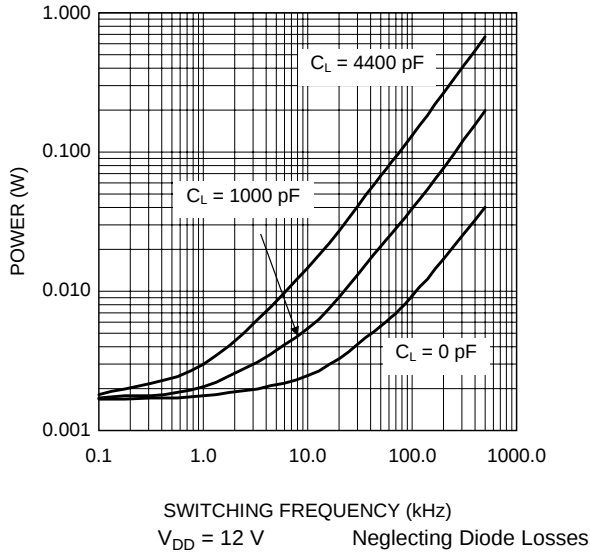


Figure 24. Gate Driver Power Dissipation (LO + HO)

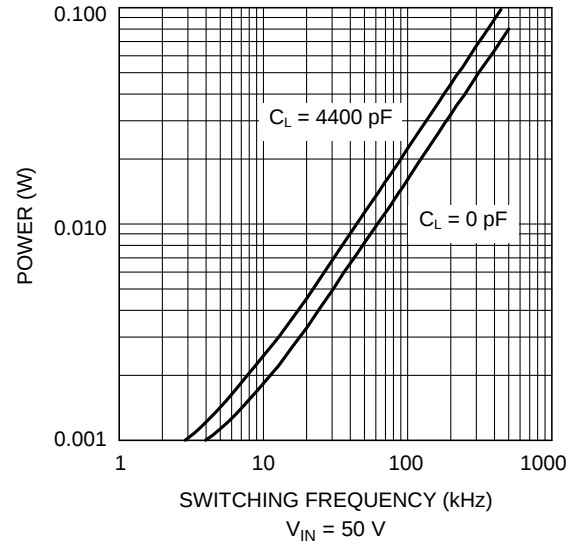


Figure 25. Diode Power Dissipation

11 Layout

11.1 Layout Guidelines

The optimum performance of high and low-side gate drivers cannot be achieved without following certain guidelines during circuit-board layout.

- Low ESR and ESL capacitors must be connected close to the IC, between the VDD and VSS pins and between the HB and HS pins to support the high peak currents being drawn from VDD during start-up of the external MOSFET.
- To prevent large voltage transients at the drain of the top MOSFET, a low ESR electrolytic capacitor must be connected between the MOSFET drain and ground (VSS).
- To avoid large negative transients on the switch node (HS pin), the parasitic inductances must be minimized in the source of the top MOSFET and in the drain of the bottom MOSFET (synchronous rectifier).
- Grounding Considerations:
 - The first priority in designing grounding connections is to confine to a minimal physical area the high peak currents that charge and discharge the MOSFET gate. This decreases the loop inductance and minimizes noise issues on the gate terminal of the MOSFET. The MOSFETs should be placed as close as possible to the gate driver.
 - The second high current path includes the bootstrap capacitor, the bootstrap diode, the local ground referenced bypass capacitor, and low-side MOSFET body diode. The bootstrap capacitor is recharged on a cycle-by-cycle basis through the bootstrap diode from the ground referenced VDD bypass capacitor. The recharging occurs in a short time interval and involves high peak current. Minimizing this loop length and area on the circuit board is important to ensure reliable operation.

Figure 26 shows a recommended layout pattern for the driver. If possible a single layer placement is preferred.

11.2 Layout Example

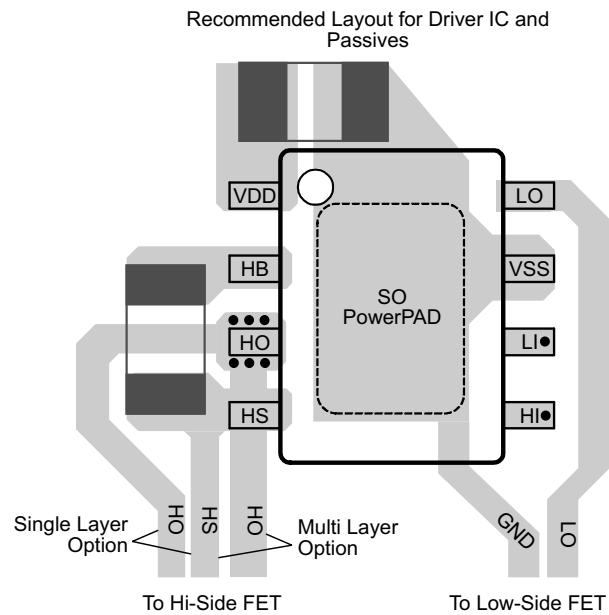


Figure 26. Recommended Layout Pattern

12 器件和文档支持

12.1 接收文档更新通知

如需接收文档更新通知，请访问 www.ti.com.cn 网站上的器件产品文件夹。点击右上角的提醒我 (Alert me) 注册后，即可每周定期收到已更改的产品信息。有关更改的详细信息，请查阅已修订文档中包含的修订历史记录。

12.2 社区资源

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

TI E2E™ Online Community *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

12.3 商标

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

12.4 静电放电警告



ESD 可能会损坏该集成电路。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措施和安装程序，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。

12.5 Glossary

[SLYZ022](#) — *TI Glossary*.

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

13 机械、封装和可订购信息

以下页中包括机械、封装和可订购信息。这些信息是针对指定器件可提供的最新数据。这些数据会在无通知且不对本文档进行修订的情况下发生改变。欲获得该数据表的浏览器版本，请查阅左侧的导航栏。

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)
LM25101AM/NOPB	Obsolete	Production	SOIC (D) 8	-	-	Call TI	Call TI	-40 to 125	L25101 AM
LM25101AMR/NOPB	Obsolete	Production	SO PowerPAD (DDA) 8	-	-	Call TI	Call TI	-40 to 125	L25101 AMR
LM25101AMRX/NOPB	Active	Production	SO PowerPAD (DDA) 8	2500 LARGE T&R	Yes	SN	Level-3-260C-168 HR	-40 to 125	L25101 AMR
LM25101AMRX/NOPB.A	Active	Production	SO PowerPAD (DDA) 8	2500 LARGE T&R	Yes	SN	Level-3-260C-168 HR	-40 to 125	L25101 AMR
LM25101AMRX/NOPB.B	Active	Production	SO PowerPAD (DDA) 8	2500 LARGE T&R	Yes	SN	Level-3-260C-168 HR	-40 to 125	L25101 AMR
LM25101AMX/NOPB	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	L25101 AM
LM25101AMX/NOPB.A	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	L25101 AM
LM25101AMX/NOPB.B	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	L25101 AM
LM25101ASD-1/NOPB	Active	Production	WSON (NGT) 8	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101A1
LM25101ASD-1/NOPB.A	Active	Production	WSON (NGT) 8	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101A1
LM25101ASD-1/NOPB.B	Active	Production	WSON (NGT) 8	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101A1
LM25101ASD/NOPB	Active	Production	WSON (DPR) 10	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101A
LM25101ASD/NOPB.A	Active	Production	WSON (DPR) 10	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101A
LM25101ASD/NOPB.B	Active	Production	WSON (DPR) 10	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101A
LM25101ASDX-1/NOPB	Active	Production	WSON (NGT) 8	4500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101A1
LM25101ASDX-1/NOPB.A	Active	Production	WSON (NGT) 8	4500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101A1
LM25101ASDX-1/NOPB.B	Active	Production	WSON (NGT) 8	4500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101A1
LM25101ASDX/NOPB	Active	Production	WSON (DPR) 10	4500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101A
LM25101ASDX/NOPB.A	Active	Production	WSON (DPR) 10	4500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101A
LM25101ASDX/NOPB.B	Active	Production	WSON (DPR) 10	4500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101A
LM25101BMA/NOPB	Active	Production	SOIC (D) 8	95 TUBE	Yes	SN	Level-1-260C-UNLIM	-40 to 125	L25101 BMA
LM25101BMA/NOPB.A	Active	Production	SOIC (D) 8	95 TUBE	Yes	SN	Level-1-260C-UNLIM	-40 to 125	L25101 BMA

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)
LM25101BMA/NOPB.B	Active	Production	SOIC (D) 8	95 TUBE	Yes	SN	Level-1-260C-UNLIM	-40 to 125	L25101 BMA
LM25101BMAX/NOPB	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	L25101 BMA
LM25101BMAX/NOPB.A	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	L25101 BMA
LM25101BMAX/NOPB.B	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	L25101 BMA
LM25101BSD/NOPB	Active	Production	WSO (DPR) 10	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101B
LM25101BSD/NOPB.A	Active	Production	WSO (DPR) 10	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101B
LM25101BSD/NOPB.B	Active	Production	WSO (DPR) 10	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101B
LM25101BSDX/NOPB	Active	Production	WSO (DPR) 10	4500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101B
LM25101BSDX/NOPB.A	Active	Production	WSO (DPR) 10	4500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101B
LM25101BSDX/NOPB.B	Active	Production	WSO (DPR) 10	4500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101B
LM25101CMA/NOPB	Obsolete	Production	SOIC (D) 8	-	-	Call TI	Call TI	-40 to 125	L25101 CMA
LM25101CMAX/NOPB	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	L25101 CMA
LM25101CMAX/NOPB.A	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	L25101 CMA
LM25101CMAX/NOPB.B	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	L25101 CMA
LM25101CMY/NOPB	Active	Production	HVSSOP (DGN) 8	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	CMYN
LM25101CMY/NOPB.A	Active	Production	HVSSOP (DGN) 8	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	CMYN
LM25101CMY/NOPB.B	Active	Production	HVSSOP (DGN) 8	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	CMYN
LM25101CMYE/NOPB	Active	Production	HVSSOP (DGN) 8	250 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	CMYN
LM25101CMYE/NOPB.A	Active	Production	HVSSOP (DGN) 8	250 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	CMYN
LM25101CMYE/NOPB.B	Active	Production	HVSSOP (DGN) 8	250 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	CMYN
LM25101CMYX/NOPB	Active	Production	HVSSOP (DGN) 8	3500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	CMYN
LM25101CMYX/NOPB.A	Active	Production	HVSSOP (DGN) 8	3500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	CMYN
LM25101CMYX/NOPB.B	Active	Production	HVSSOP (DGN) 8	3500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	CMYN
LM25101CSD/NOPB	Active	Production	WSO (DPR) 10	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101C
LM25101CSD/NOPB.A	Active	Production	WSO (DPR) 10	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101C

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)
LM25101CSD/NOPB.B	Active	Production	WSO (DPR) 10	1000 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101C
LM25101CSDX/NOPB	Active	Production	WSO (DPR) 10	4500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101C
LM25101CSDX/NOPB.A	Active	Production	WSO (DPR) 10	4500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101C
LM25101CSDX/NOPB.B	Active	Production	WSO (DPR) 10	4500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	25101C

⁽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.

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
LM25101AMRX/NOPB	SO PowerPAD	DDA	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM25101AMX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM25101ASD-1/NOPB	WSO	NGT	8	1000	177.8	12.4	4.3	4.3	1.3	8.0	12.0	Q1
LM25101ASD/NOPB	WSO	DPR	10	1000	177.8	12.4	4.3	4.3	1.3	8.0	12.0	Q1
LM25101ASDX-1/NOPB	WSO	NGT	8	4500	330.0	12.4	4.3	4.3	1.3	8.0	12.0	Q1
LM25101ASDX/NOPB	WSO	DPR	10	4500	330.0	12.4	4.3	4.3	1.3	8.0	12.0	Q1
LM25101BMAX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM25101BSD/NOPB	WSO	DPR	10	1000	177.8	12.4	4.3	4.3	1.3	8.0	12.0	Q1
LM25101BSDX/NOPB	WSO	DPR	10	4500	330.0	12.4	4.3	4.3	1.3	8.0	12.0	Q1
LM25101CMAX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM25101CMY/NOPB	HVSSOP	DGN	8	1000	177.8	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM25101CMYE/NOPB	HVSSOP	DGN	8	250	177.8	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM25101CMYX/NOPB	HVSSOP	DGN	8	3500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LM25101CSD/NOPB	WSO	DPR	10	1000	177.8	12.4	4.3	4.3	1.3	8.0	12.0	Q1
LM25101CSDX/NOPB	WSO	DPR	10	4500	330.0	12.4	4.3	4.3	1.3	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

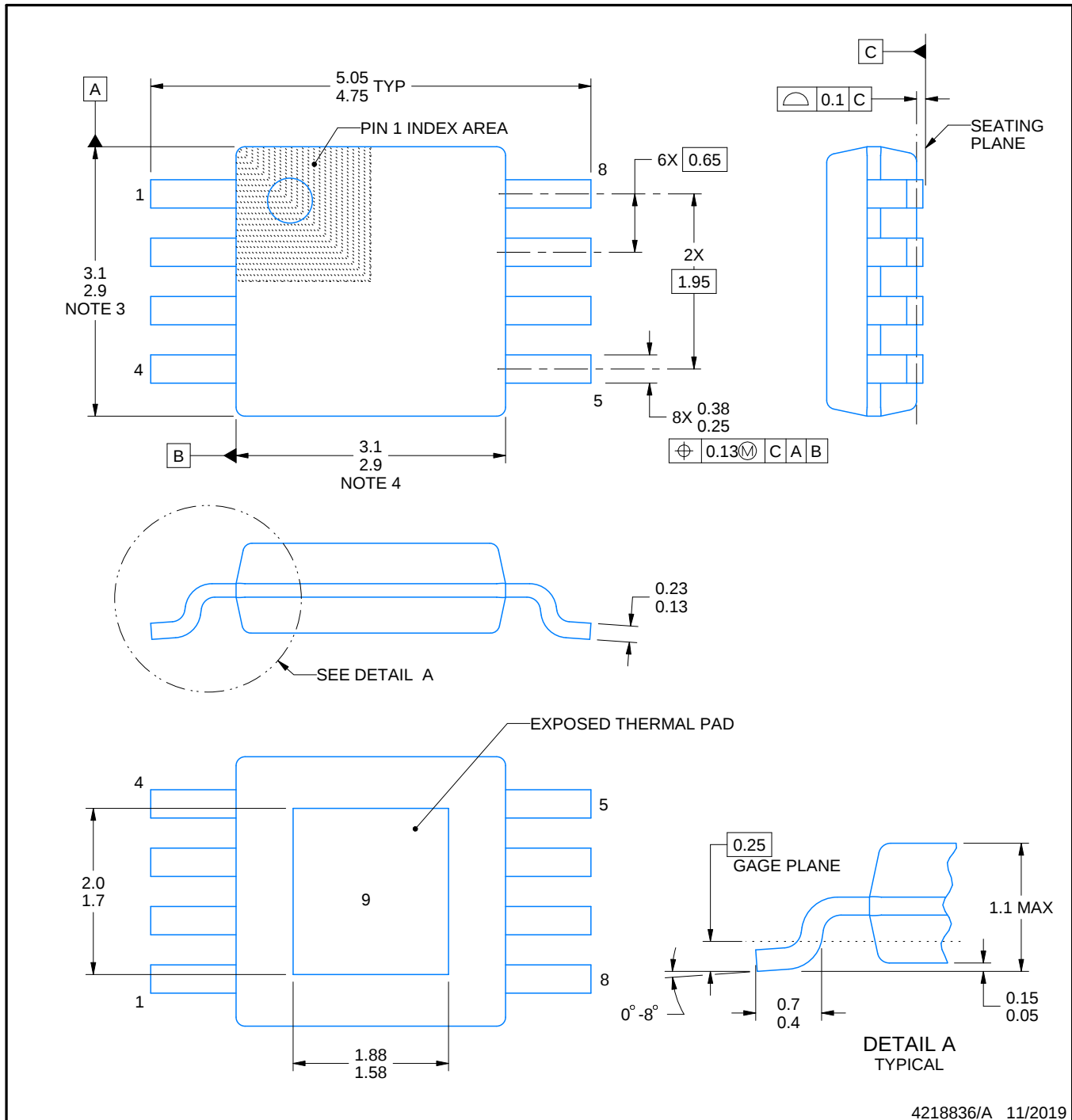
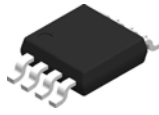
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM25101AMRX/NOPB	SO PowerPAD	DDA	8	2500	356.0	356.0	36.0
LM25101AMX/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM25101ASD-1/NOPB	WSON	NGT	8	1000	210.0	185.0	35.0
LM25101ASD/NOPB	WSON	DPR	10	1000	210.0	185.0	35.0
LM25101ASDX-1/NOPB	WSON	NGT	8	4500	367.0	367.0	35.0
LM25101ASDX/NOPB	WSON	DPR	10	4500	367.0	367.0	35.0
LM25101BMAX/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM25101BSD/NOPB	WSON	DPR	10	1000	210.0	185.0	35.0
LM25101BSDX/NOPB	WSON	DPR	10	4500	367.0	367.0	35.0
LM25101CMAX/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM25101CMY/NOPB	HVSSOP	DGN	8	1000	210.0	185.0	35.0
LM25101CMYE/NOPB	HVSSOP	DGN	8	250	210.0	185.0	35.0
LM25101CMYX/NOPB	HVSSOP	DGN	8	3500	367.0	367.0	35.0
LM25101CSD/NOPB	WSON	DPR	10	1000	210.0	185.0	35.0
LM25101CSDX/NOPB	WSON	DPR	10	4500	367.0	367.0	35.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
LM25101BMA/NOPB	D	SOIC	8	95	495	8	4064	3.05
LM25101BMA/NOPB.A	D	SOIC	8	95	495	8	4064	3.05
LM25101BMA/NOPB.B	D	SOIC	8	95	495	8	4064	3.05



4218836/A 11/2019

NOTES:

PowerPAD is a trademark of Texas Instruments.

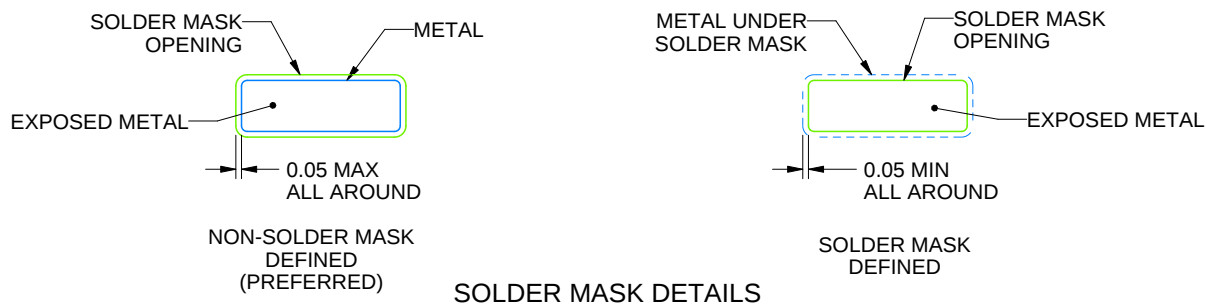
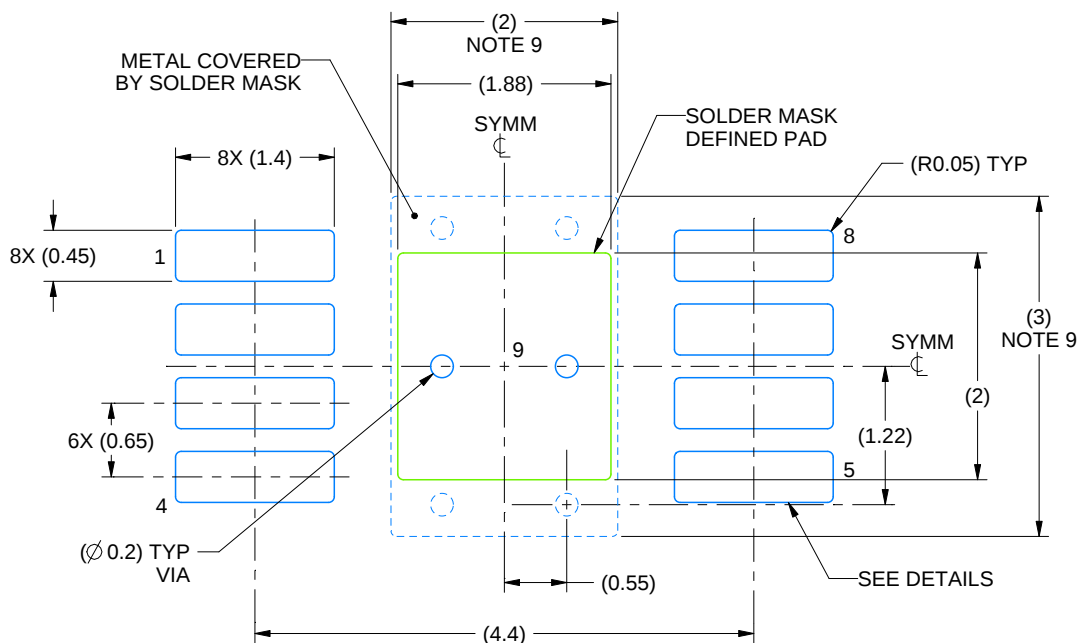
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-187.

EXAMPLE BOARD LAYOUT

DGN0008A

PowerPAD™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



4218836/A 11/2019

NOTES: (continued)

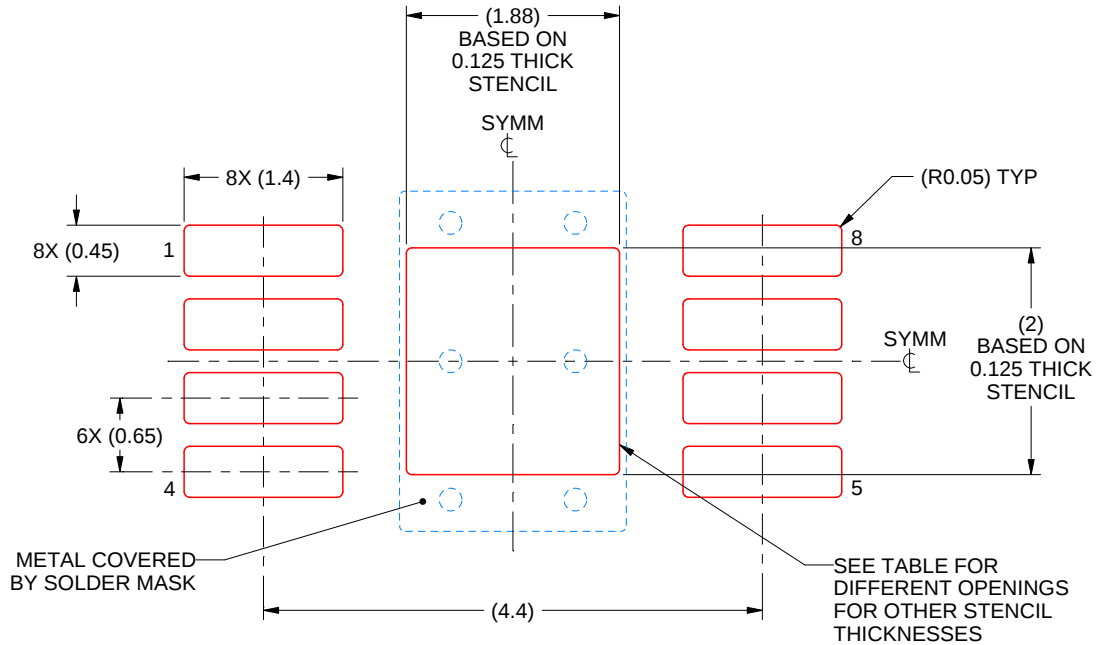
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.
9. Size of metal pad may vary due to creepage requirement.

EXAMPLE STENCIL DESIGN

DGN0008A

PowerPAD™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



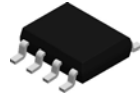
SOLDER PASTE EXAMPLE
EXPOSED PAD 9:
100% PRINTED SOLDER COVERAGE BY AREA
SCALE: 15X

STENCIL THICKNESS	SOLDER STENCIL OPENING
0.1	2.10 X 2.24
0.125	1.88 X 2.00 (SHOWN)
0.15	1.72 X 1.83
0.175	1.59 X 1.69

4218836/A 11/2019

NOTES: (continued)

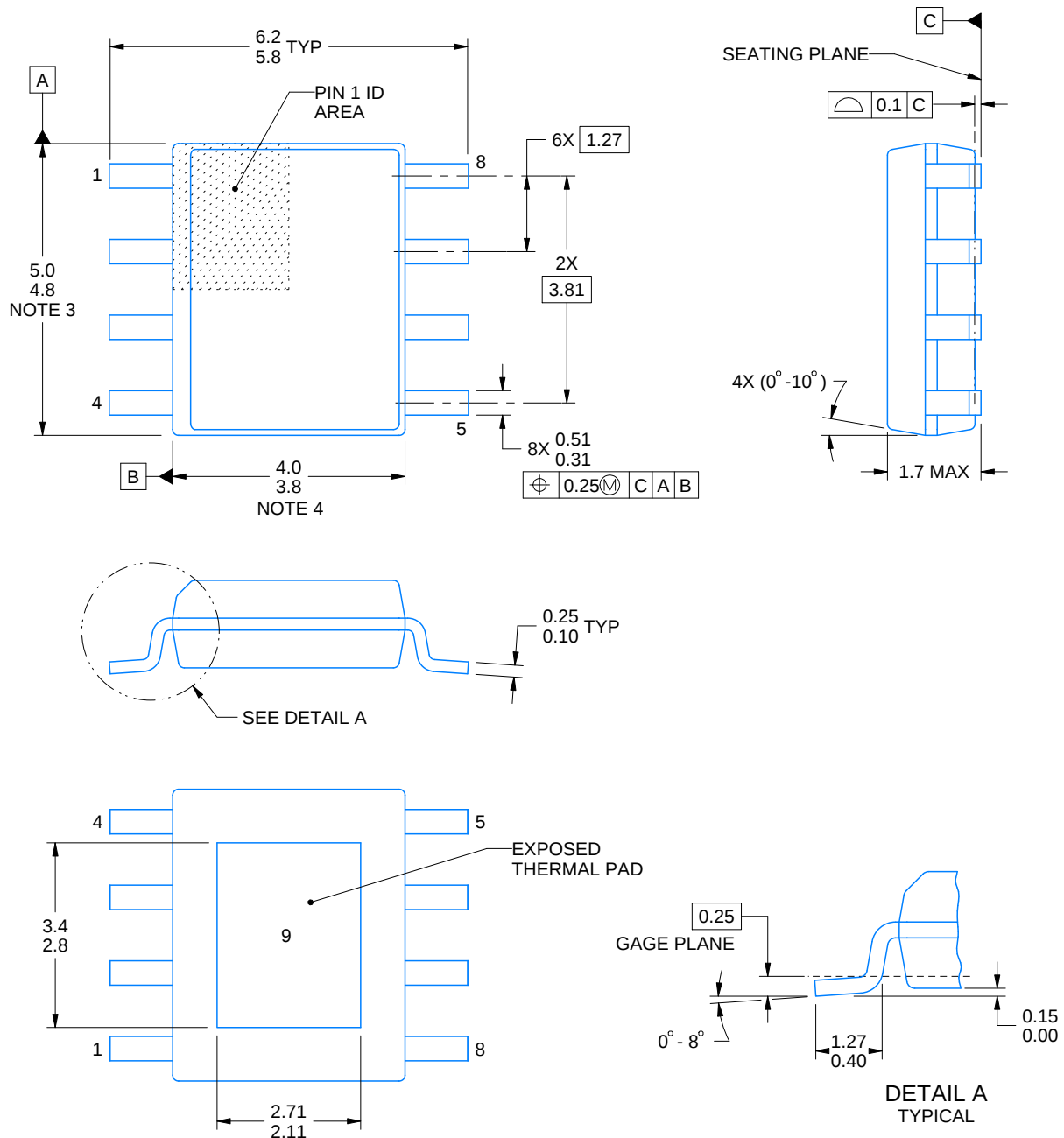
10. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
11. Board assembly site may have different recommendations for stencil design.

DDA0008B

PACKAGE OUTLINE

PowerPAD™ SOIC - 1.7 mm max height

PLASTIC SMALL OUTLINE



4214849/B 09/2025

NOTES:

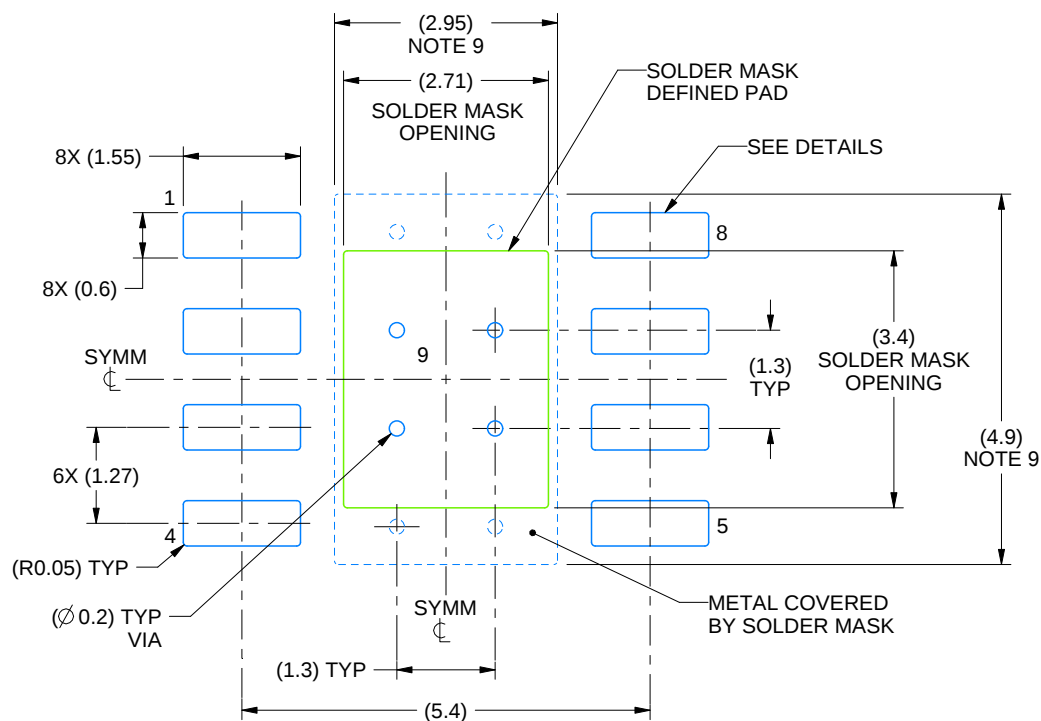
PowerPAD is a trademark of Texas Instruments.

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. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MS-012.

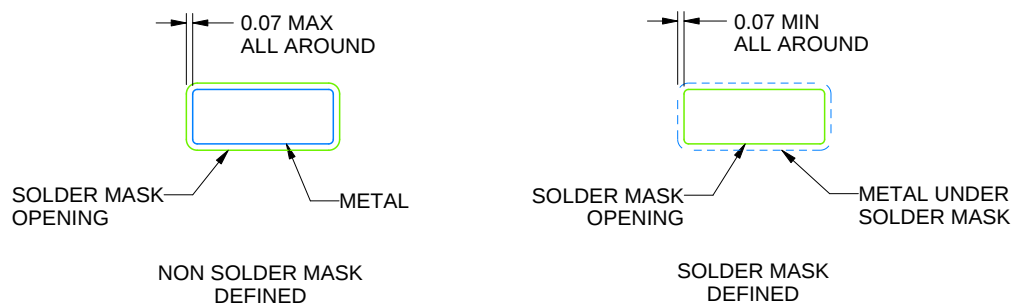
DDA0008B

PowerPAD™ SOIC - 1.7 mm max height

PLASTIC SMALL OUTLINE



LAND PATTERN EXAMPLE
SCALE:10X



SOLDER MASK DETAILS
PADS 1-8

4214849/B 09/2025

NOTES: (continued)

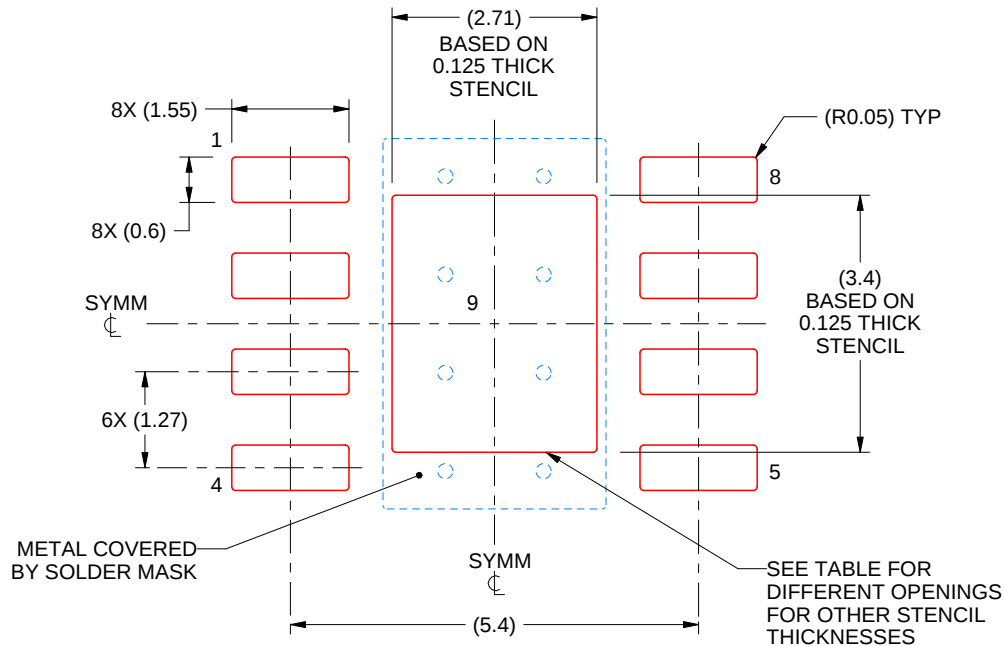
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature numbers SLMA002 (www.ti.com/lit/slma002) and SLMA004 (www.ti.com/lit/slma004).
9. Size of metal pad may vary due to creepage requirement.
10. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

DDA0008B

PowerPAD™ SOIC - 1.7 mm max height

PLASTIC SMALL OUTLINE



SOLDER PASTE EXAMPLE
EXPOSED PAD
100% PRINTED SOLDER COVERAGE BY AREA
SCALE:10X

STENCIL THICKNESS	SOLDER STENCIL OPENING
0.1	3.03 X 3.80
0.125	2.71 X 3.40 (SHOWN)
0.150	2.47 X 3.10
0.175	2.29 X 2.87

4214849/B 09/2025

NOTES: (continued)

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



WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD

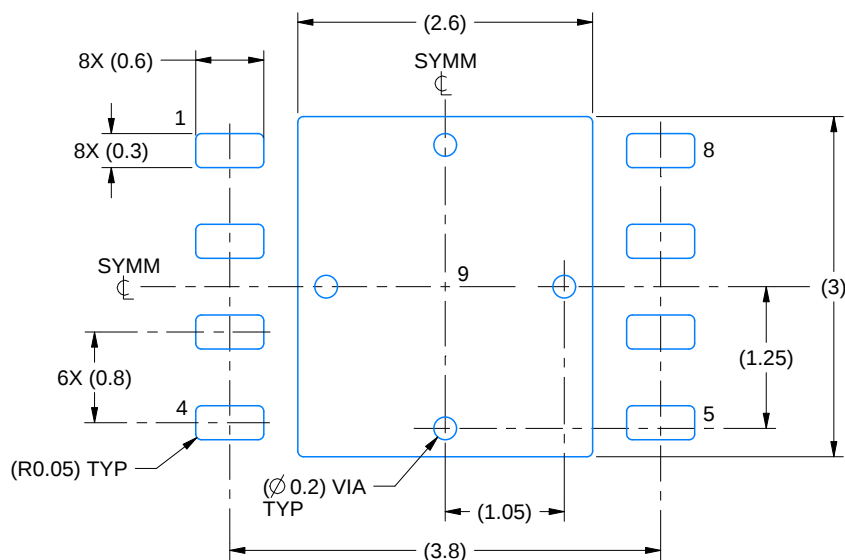


1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

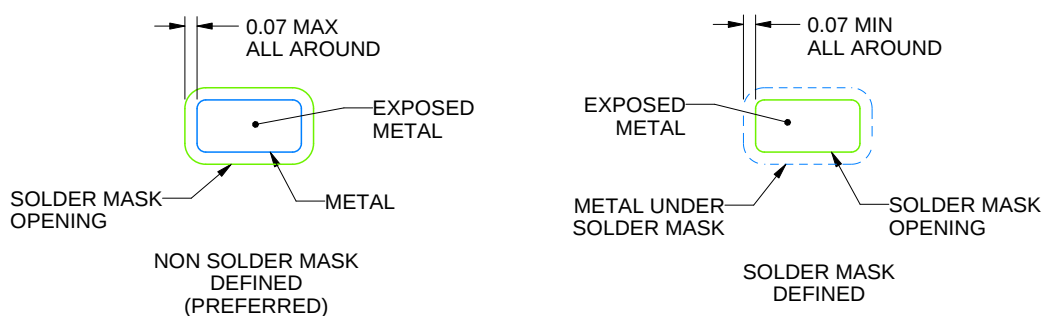
NGT0008A

WSN - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

4214935/A 08/2020

NOTES: (continued)

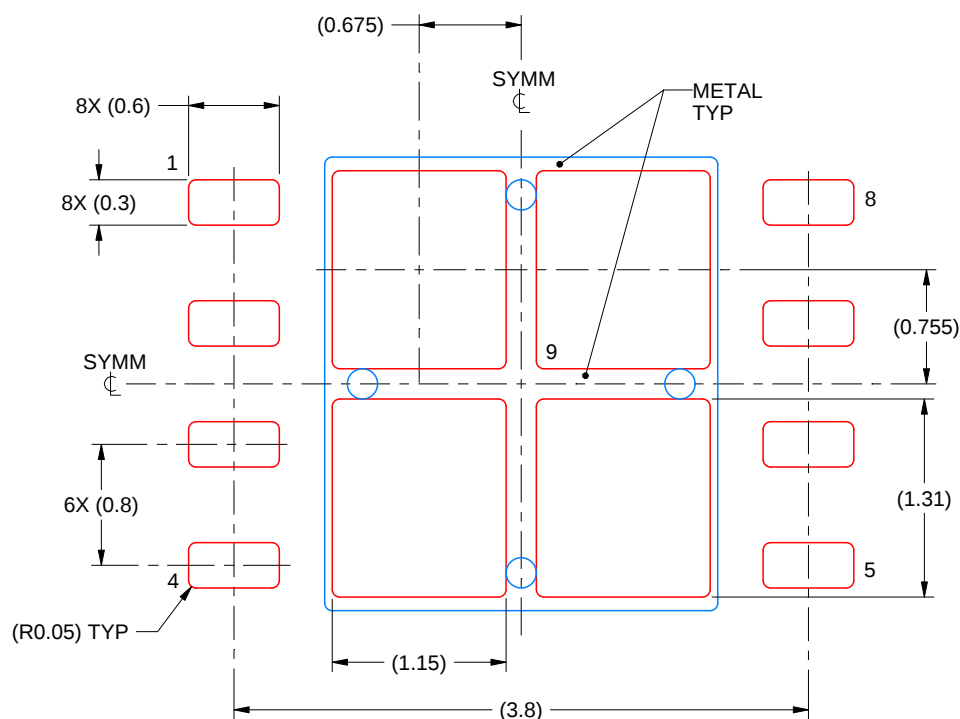
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

NGT0008A

WSN - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



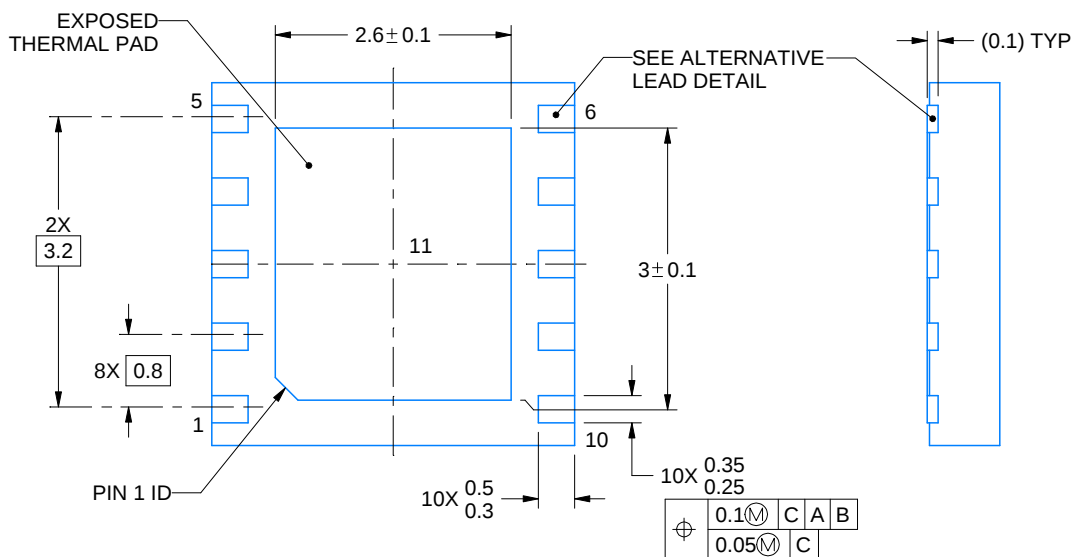
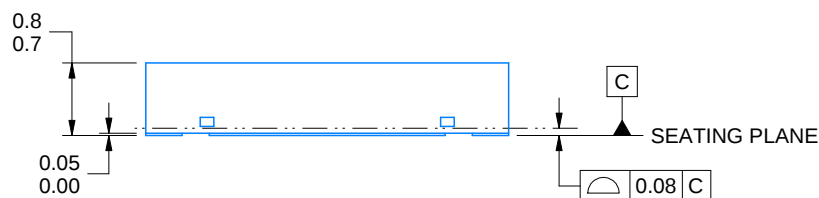
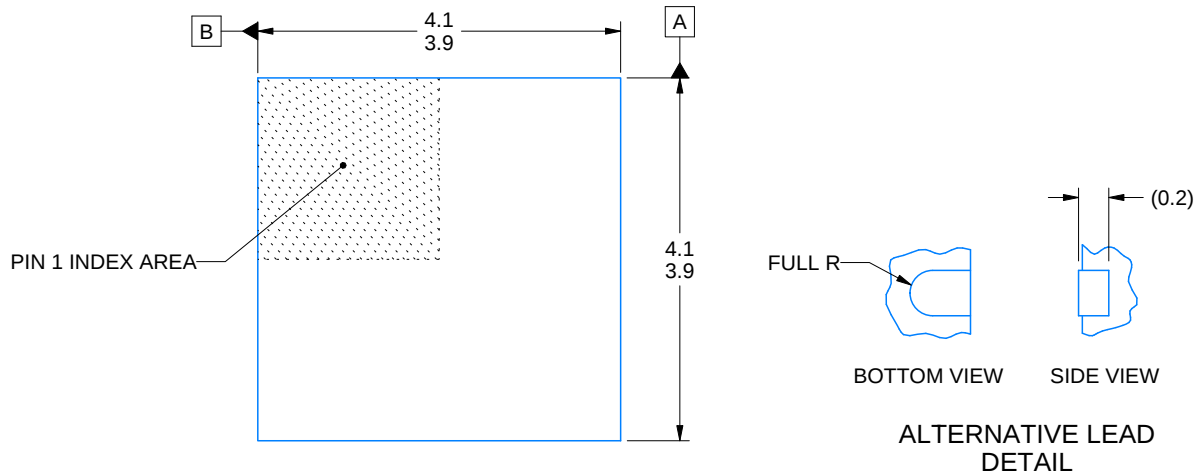
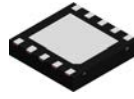
SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 9:
77% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:20X

4214935/A 08/2020

NOTES: (continued)

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



4218856/B 01/2021

NOTES:

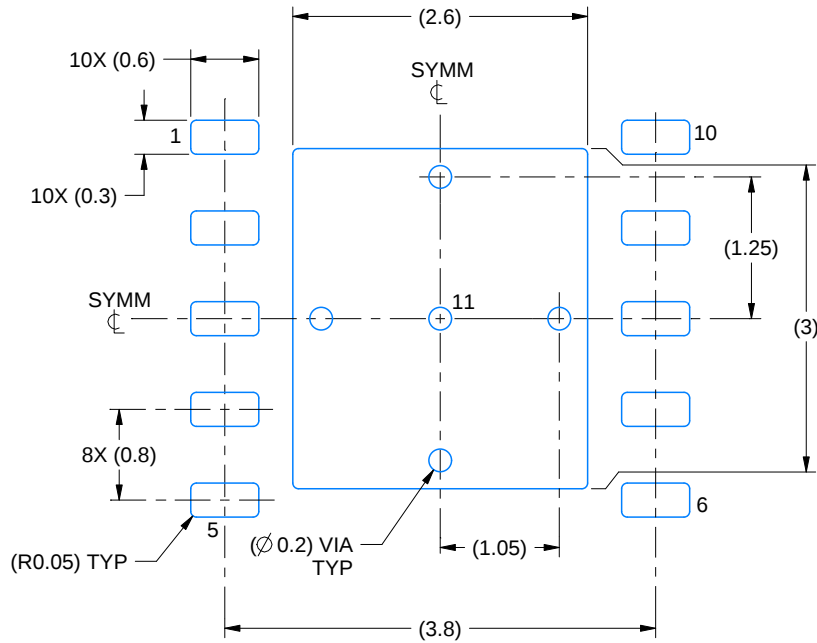
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

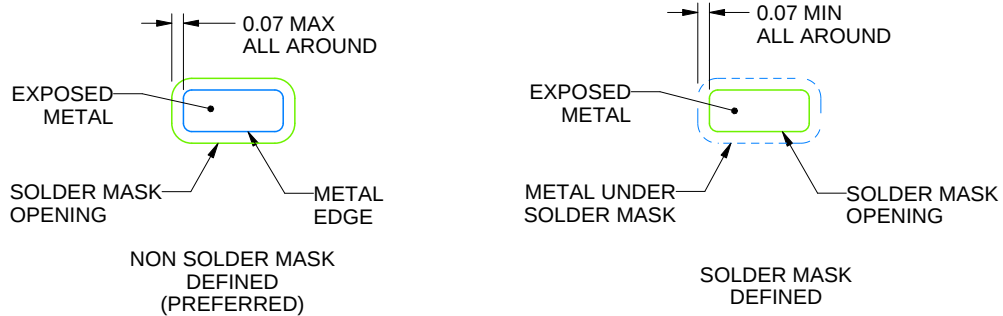
DPR0010A

WSN - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

4218856/B 01/2021

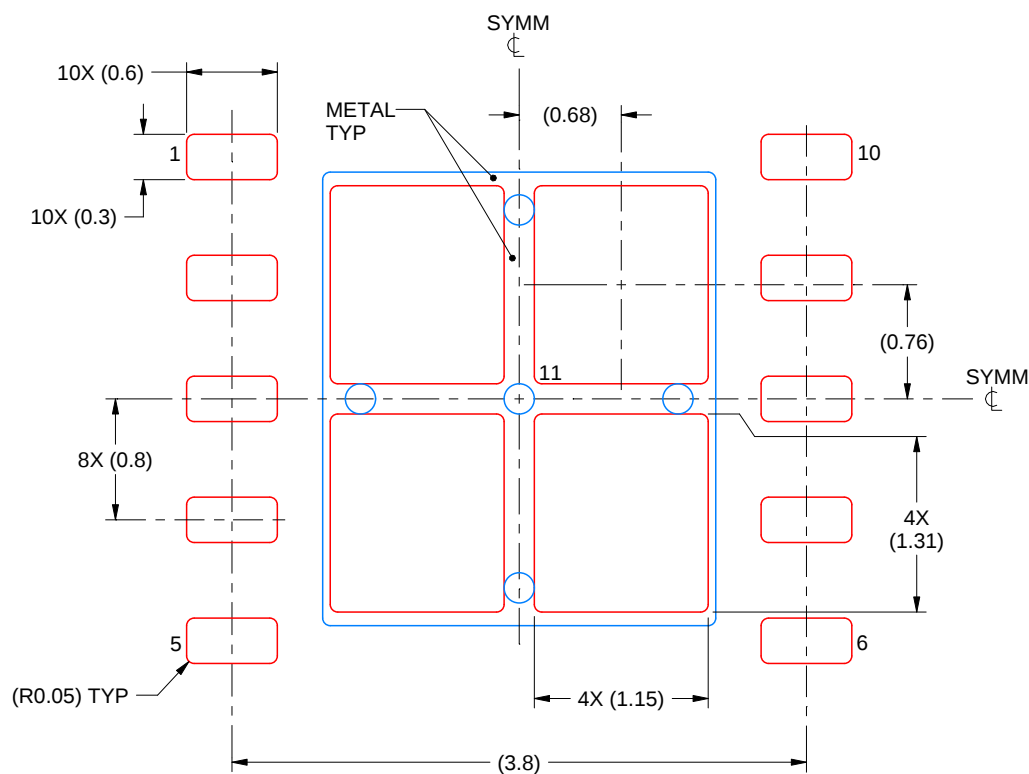
NOTES: (continued)

- This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

DPR0010A

WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 11:
77% PRINTED SOLDER COVERAGE BY AREA
SCALE:20X

4218856/B 01/2021

NOTES: (continued)

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

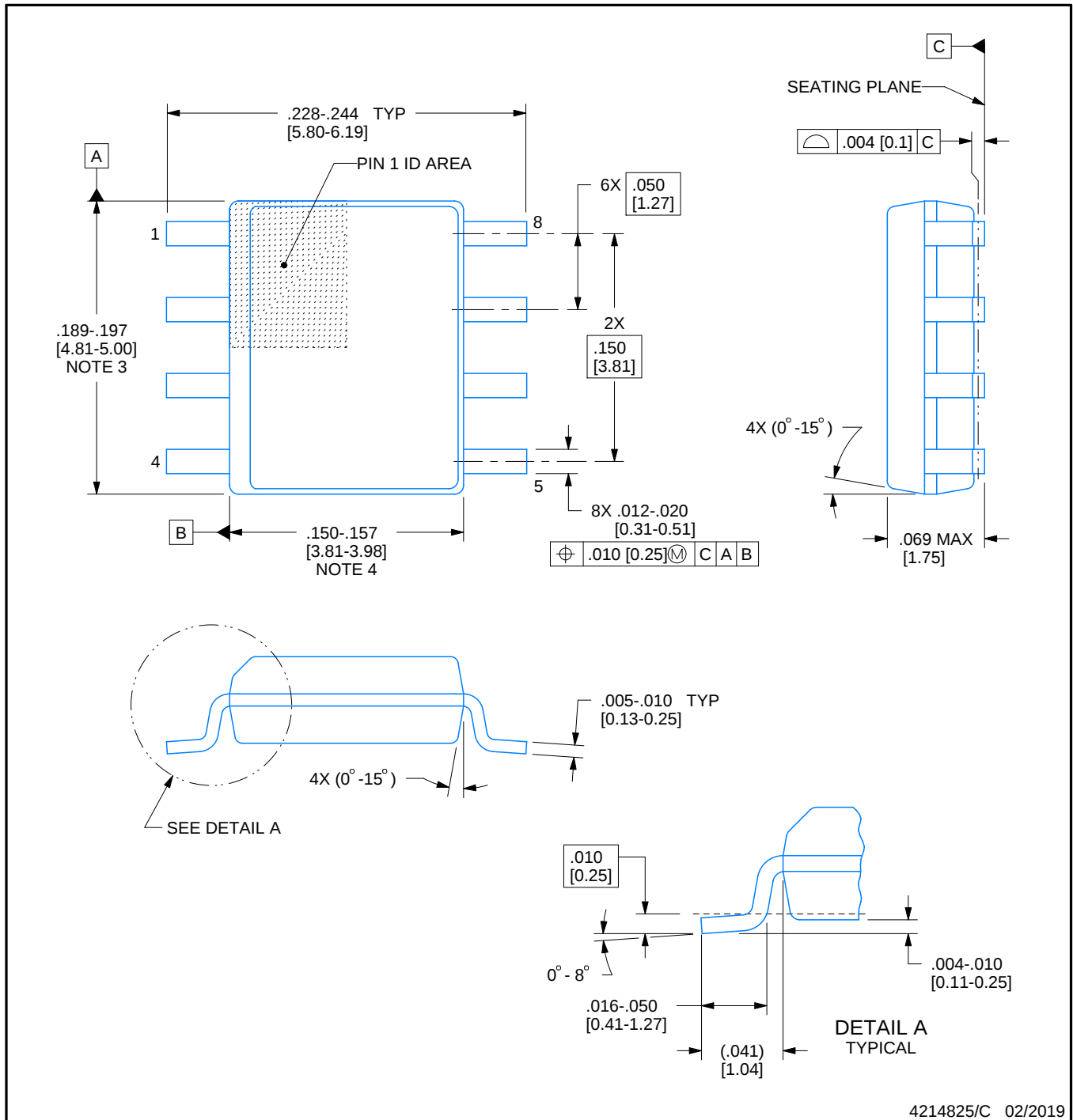


D0008A

PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.

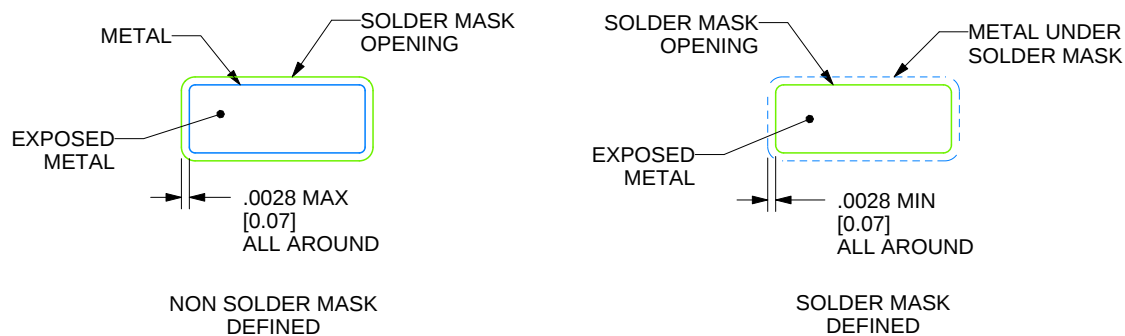
D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

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

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X

4214825/C 02/2019

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.

重要通知和免责声明

TI“按原样”提供技术和可靠性数据（包括数据表）、设计资源（包括参考设计）、应用或其他设计建议、网络工具、安全信息和其他资源，不保证没有瑕疵且不做任何明示或暗示的担保，包括但不限于对适销性、与某特定用途的适用性或不侵犯任何第三方知识产权的暗示担保。

这些资源可供使用 TI 产品进行设计的熟练开发人员使用。您将自行承担以下全部责任：(1) 针对您的应用选择合适的 TI 产品，(2) 设计、验证并测试您的应用，(3) 确保您的应用满足相应标准以及任何其他安全、安保法规或其他要求。

这些资源如有变更，恕不另行通知。TI 授权您仅可将这些资源用于研发本资源所述的 TI 产品的相关应用。严禁以其他方式对这些资源进行复制或展示。您无权使用任何其他 TI 知识产权或任何第三方知识产权。对于因您对这些资源的使用而对 TI 及其代表造成的任何索赔、损害、成本、损失和债务，您将全额赔偿，TI 对此概不负责。

TI 提供的产品受 [TI 销售条款](#)、[TI 通用质量指南](#) 或 [ti.com](#) 上其他适用条款或 TI 产品随附的其他适用条款的约束。TI 提供这些资源并不会扩展或以其他方式更改 TI 针对 TI 产品发布的适用的担保或担保免责声明。除非德州仪器 (TI) 明确将某产品指定为定制产品或客户特定产品，否则其产品均为按确定价格收入目录的标准通用器件。

TI 反对并拒绝您可能提出的任何其他或不同的条款。

版权所有 © 2026，德州仪器 (TI) 公司

最后更新日期：2025 年 10 月