

N-Channel NexFET Power MOSFETs

1 Features

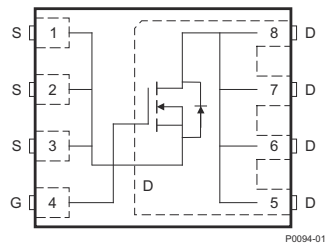
- Optimized for 5 V Gate Drive
- Ultralow Q_g and Q_{gd}
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 5-mm × 6-mm Plastic Package

2 Applications

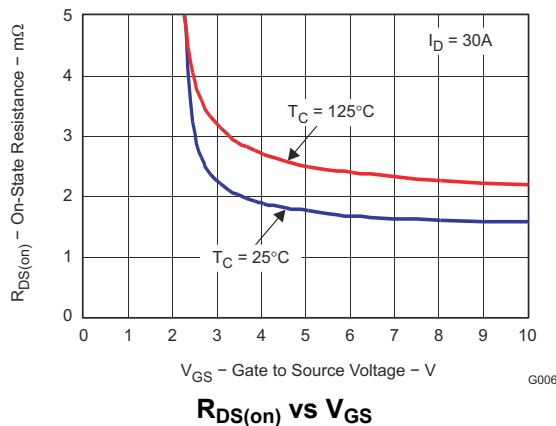
- Point-of-Load Synchronous Buck in Networking, Telecom and Computing Systems
- Optimized for Synchronous FET Applications

3 Description

The NexFET™ power MOSFET has been designed to minimize losses in power conversion applications and optimized for 5 V gate drive applications.



Top View



Product Summary

| | | | |
|--------------|-------------------------------|-------------------------|--------|
| V_{DS} | Drain to Source Voltage | 25 | V |
| Q_g | Gate Charge Total (4.5 V) | 18 | nC |
| Q_{gd} | Gate Charge Gate to Drain | 3.5 | nC |
| $R_{DS(on)}$ | Drain to Source On Resistance | $V_{GS} = 3\text{ V}$ | 2.1 mΩ |
| | | $V_{GS} = 4.5\text{ V}$ | 1.7 mΩ |
| | | $V_{GS} = 8\text{ V}$ | 1.5 mΩ |
| $V_{GS(th)}$ | Threshold Voltage | 1.1 | V |

Ordering Information

| Device | Package | Media | Qty | Ship |
|------------|---------------------------------|--------------|------|---------------|
| CSD16325Q5 | SON 5-mm × 6-mm Plastic Package | 13-Inch Reel | 2500 | Tape and Reel |

Absolute Maximum Ratings

| $T_A = 25^\circ\text{C}$ unless otherwise stated | | VALUE | UNIT |
|--|---|------------|------------------|
| V_{DS} | Drain to Source Voltage | 25 | V |
| V_{GS} | Gate to Source Voltage | +10 / -8 | V |
| I_D | Continuous Drain Current, $T_C = 25^\circ\text{C}$ | 100 | A |
| | Continuous Drain Current ⁽¹⁾ | 33 | A |
| I_{DM} | Pulsed Drain Current, $T_A = 25^\circ\text{C}$ ⁽²⁾ | 200 | A |
| P_D | Power Dissipation ⁽¹⁾ | 3.1 | W |
| T_J, T_{STG} | Operating Junction and Storage Temperature Range | -55 to 150 | $^\circ\text{C}$ |
| E_{AS} | Avalanche Energy, single pulse $I_D = 100\text{ A}, L = 0.1\text{ mH}, R_G = 25\ \Omega$ | 500 | mJ |

- Typical $R_{\theta JA} = 38^\circ\text{C/W}$ on 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu pad on a 0.06-inch (1.52-mm) thick FR4 PCB.
- Pulse duration $\leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$

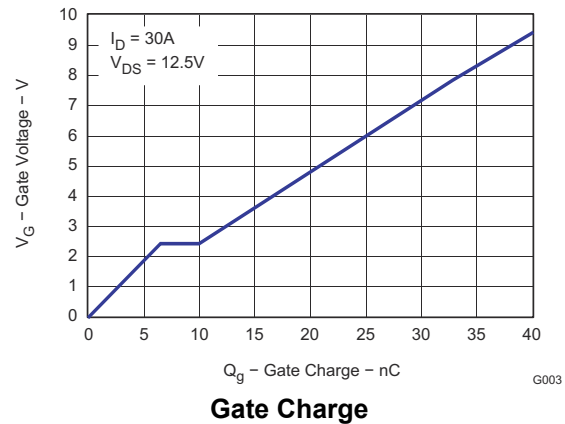


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Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision C (April 2010) to Revision D (October 2023) | Page |
|--|-------------|
|--|-------------|

- | | |
|---|----------|
| • Updated the numbering format for tables, figures, and cross-references throughout the document..... | 1 |
|---|----------|

| Changes from Revision B (April 2010) to Revision C (April 2010) | Page |
|--|-------------|
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- | | |
|--|----------|
| • Changed $R_{DS(on)}$, $V_{GS} = 3\text{ V}$ in the Electrical Characteristics table From: 2.7 to 2.9 in the max column..... | 3 |
|--|----------|

4 Electrical Characteristics

(T_A = 25°C unless otherwise stated)

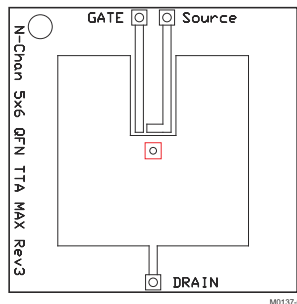
| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-------------------------|----------------------------------|---|------|-----|------|------|
| Static Characteristics | | | | | | |
| BV _{DSS} | Drain to Source Voltage | V _{GS} = 0 V, I _D = 250 μA | 25 | | | V |
| I _{DSS} | Drain to Source Leakage Current | V _{GS} = 0 V, V _{DS} = 20 V | 1 | | | μA |
| I _{GSS} | Gate to Source Leakage Current | V _{DS} = 0 V, V _{GS} = +10/−8 V | 100 | | | nA |
| V _{GS(th)} | Gate to Source Threshold Voltage | V _{DS} = V _{GS} , I _D = 250 μA | 0.9 | 1.1 | 1.4 | V |
| R _{DS(on)} | Drain to Source On Resistance | V _{GS} = 3 V, I _D = 30 A | 2.1 | | 2.9 | mΩ |
| | | V _{GS} = 4.5 V, I _D = 30 A | 1.7 | | 2.2 | mΩ |
| | | V _{GS} = 8 V, I _D = 30 A | 1.5 | | 2 | mΩ |
| g _{fs} | Transconductance | V _{DS} = 15 V, I _D = 30 A | 159 | | | S |
| Dynamic Characteristics | | | | | | |
| C _{iss} | Input Capacitance | V _{GS} = 0 V, V _{DS} = 12.5 V, f = 1 MHz | 3070 | | 4000 | pF |
| C _{oss} | Output Capacitance | | 2190 | | 2850 | pF |
| C _{rss} | Reverse Transfer Capacitance | | 120 | | 150 | pF |
| R _G | Series Gate Resistance | | 1.6 | | 3.2 | Ω |
| Q _g | Gate Charge Total (4.5 V) | V _{DS} = 12.5 V, I _{DS} = 30 A | 18 | | 25 | nC |
| Q _{gd} | Gate Charge – Gate to Drain | | 3.5 | | | nC |
| Q _{gs} | Gate Charge – Gate to Source | | 6.6 | | | nC |
| Q _{g(th)} | Gate Charge at V _{th} | | 3.3 | | | nC |
| Q _{oss} | Output Charge | V _{DS} = 13 V, V _{GS} = 0 V | 43 | | | nC |
| t _{d(on)} | Turn On Delay Time | V _{DS} = 12.5 V, V _{GS} = 4.5 V, I _{DS} = 30 A, R _G =2 Ω | 10.5 | | | ns |
| t _r | Rise Time | | 16 | | | ns |
| t _{d(off)} | Turn Off Delay Time | | 32 | | | ns |
| t _f | Fall Time | | 12 | | | ns |
| Diode Characteristics | | | | | | |
| V _{SD} | Diode Forward Voltage | I _{DS} = 30 A, V _{GS} = 0 V | 0.8 | | 1 | V |
| Q _{rr} | Reverse Recovery Charge | V _{DD} = 10 V, I _F = 30 A, di/dt = 300 A/μs | 63 | | | nC |
| t _{rr} | Reverse Recovery Time | V _{DD} = 10 V, I _F = 30 A, di/dt = 300 A/μs | 47 | | | ns |

5 Thermal Characteristics

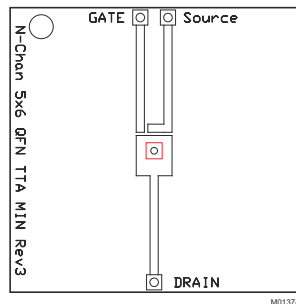
(T_A = 25°C unless otherwise stated)

| PARAMETER | | MIN | TYP | MAX | UNIT |
|------------------|---|-----|-----|-----|------|
| R _{θJC} | Thermal Resistance Junction to Case ⁽¹⁾ | | | 1 | °C/W |
| R _{θJA} | Thermal Resistance Junction to Ambient ^{(1) (2)} | | | 50 | °C/W |

- (1) R_{θJC} is determined with the device mounted on a 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu pad on a 1.5-inch × 1.5-inch (3.81-cm × 3.81-cm), 0.06-inch (1.52-mm) thick FR4 PCB. R_{θJC} is specified by design, whereas R_{θJA} is determined by the user's board design.
- (2) Device mounted on FR4 material with 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu.



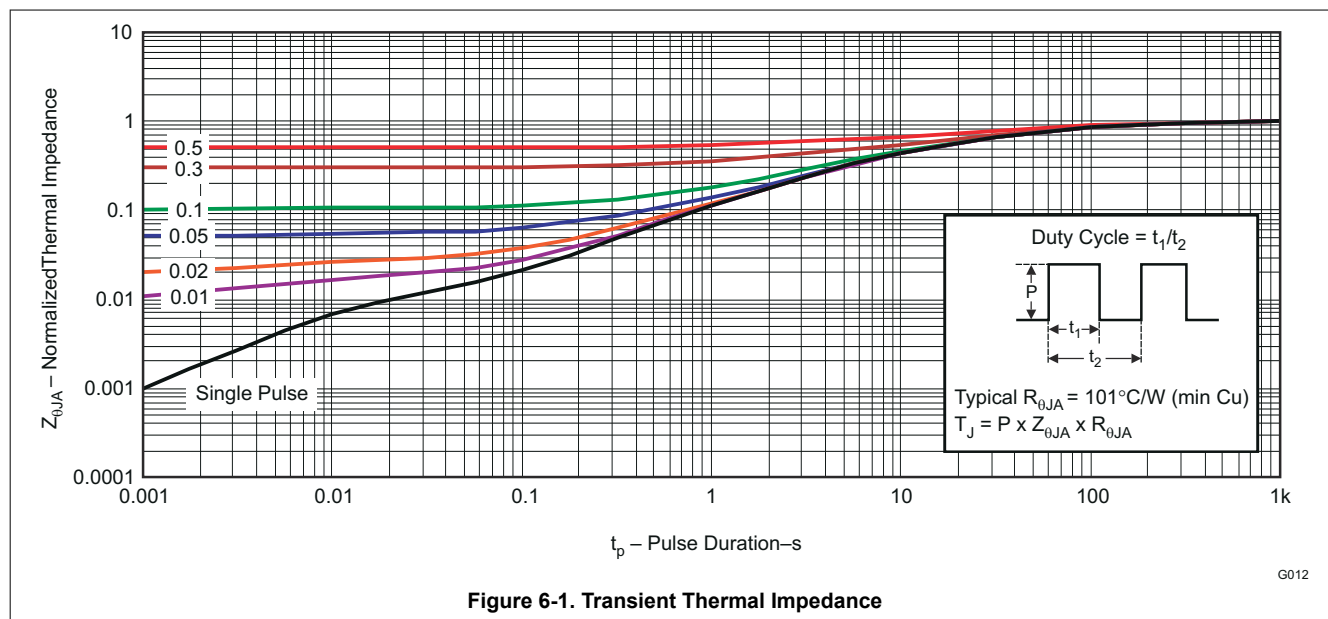
Max $R_{\theta JA} = 50^{\circ}\text{C/W}$
when mounted on 1 inch²
(6.45 cm²) of 2-oz. (0.071-mm thick) Cu.



Max $R_{\theta JA} = 126^{\circ}\text{C/W}$ when
mounted on minimum pad
area of 2-oz. (0.071-mm
thick) Cu.

6 Typical MOSFET Characteristics

($T_A = 25^{\circ}\text{C}$ unless otherwise stated)



6 Typical MOSFET Characteristics

($T_A = 25^\circ\text{C}$ unless otherwise stated)

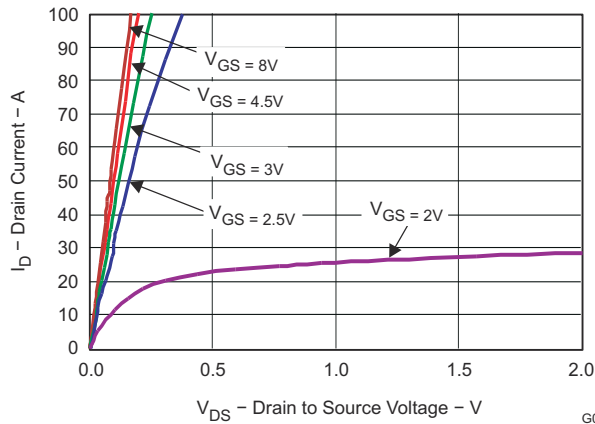


Figure 6-2. Saturation Characteristics

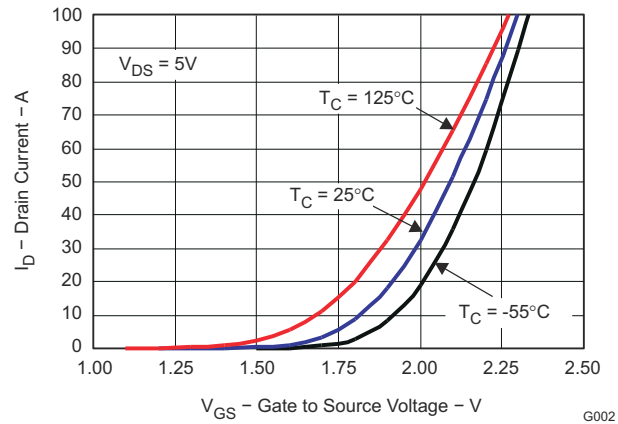


Figure 6-3. Transfer Characteristics

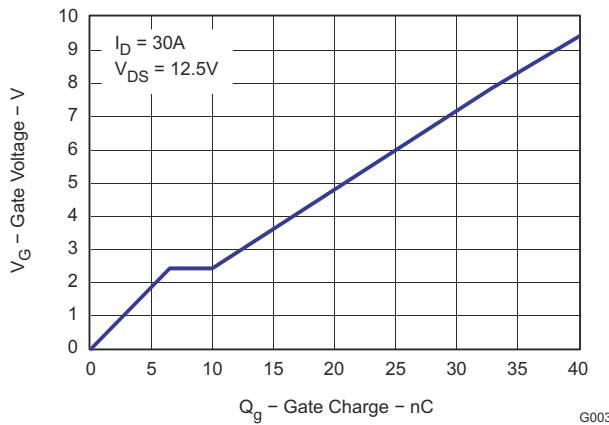


Figure 6-4. Gate Charge

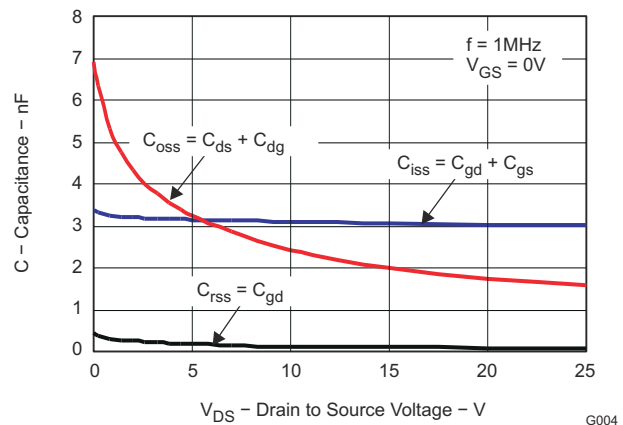


Figure 6-5. Capacitance

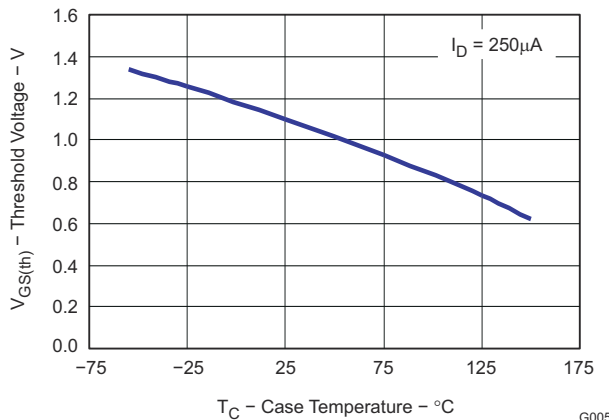


Figure 6-6. Threshold Voltage vs. Temperature

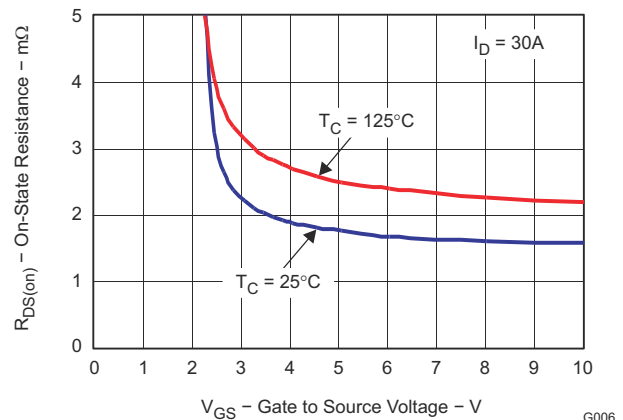


Figure 6-7. On-State Resistance vs. Gate to Source Voltage

6 Typical MOSFET Characteristics (continued)

($T_A = 25^\circ\text{C}$ unless otherwise stated)

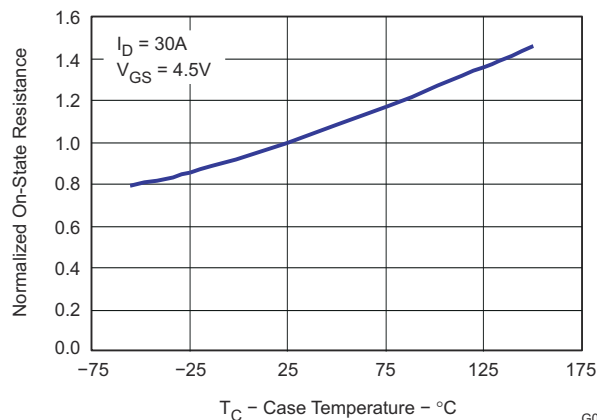


Figure 6-8. Normalized On-State Resistance vs. Temperature

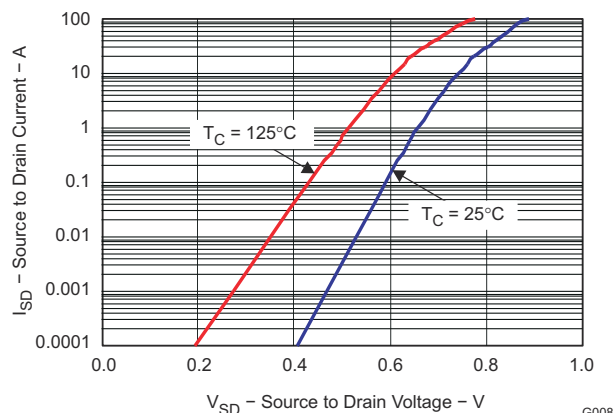


Figure 6-9. Typical Diode Forward Voltage

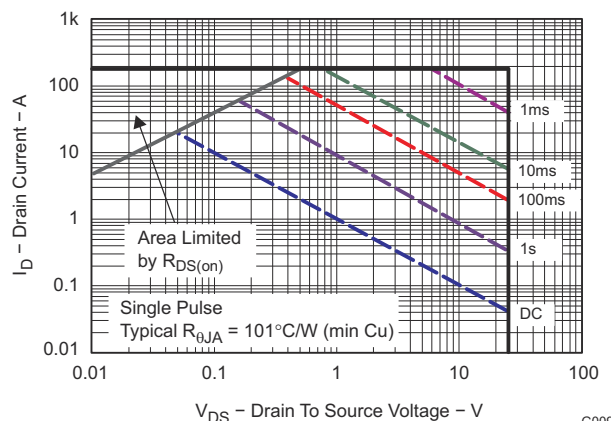


Figure 6-10. Maximum Safe Operating Area

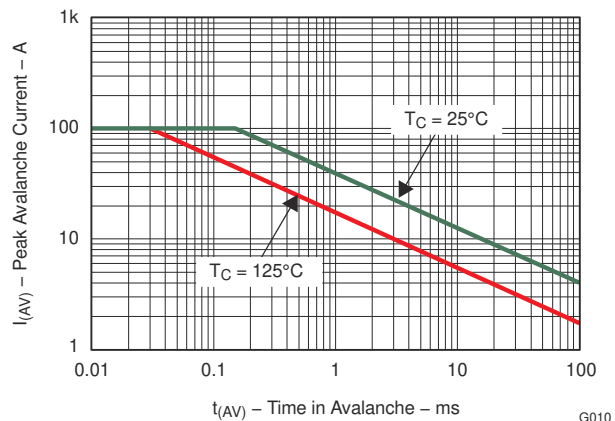


Figure 6-11. Single Pulse Unclamped Inductive Switching

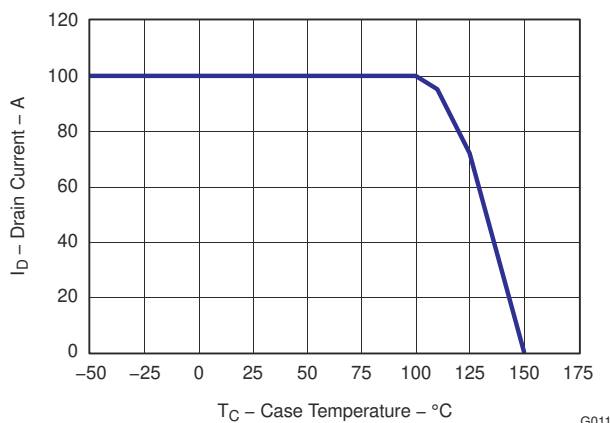


Figure 6-12. Maximum Drain Current vs. Temperature

7 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) |
|----------------------------|---------------|----------------------|---------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| CSD16325Q5 | Active | Production | VSON-CLIP (DQH) 8 | 2500 LARGE T&R | ROHS Exempt | SN | Level-1-260C-UNLIM | -55 to 150 | CSD16325 |
| CSD16325Q5.B | Active | Production | VSON-CLIP (DQH) 8 | 2500 LARGE T&R | ROHS Exempt | SN | Level-1-260C-UNLIM | -55 to 150 | CSD16325 |

⁽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.

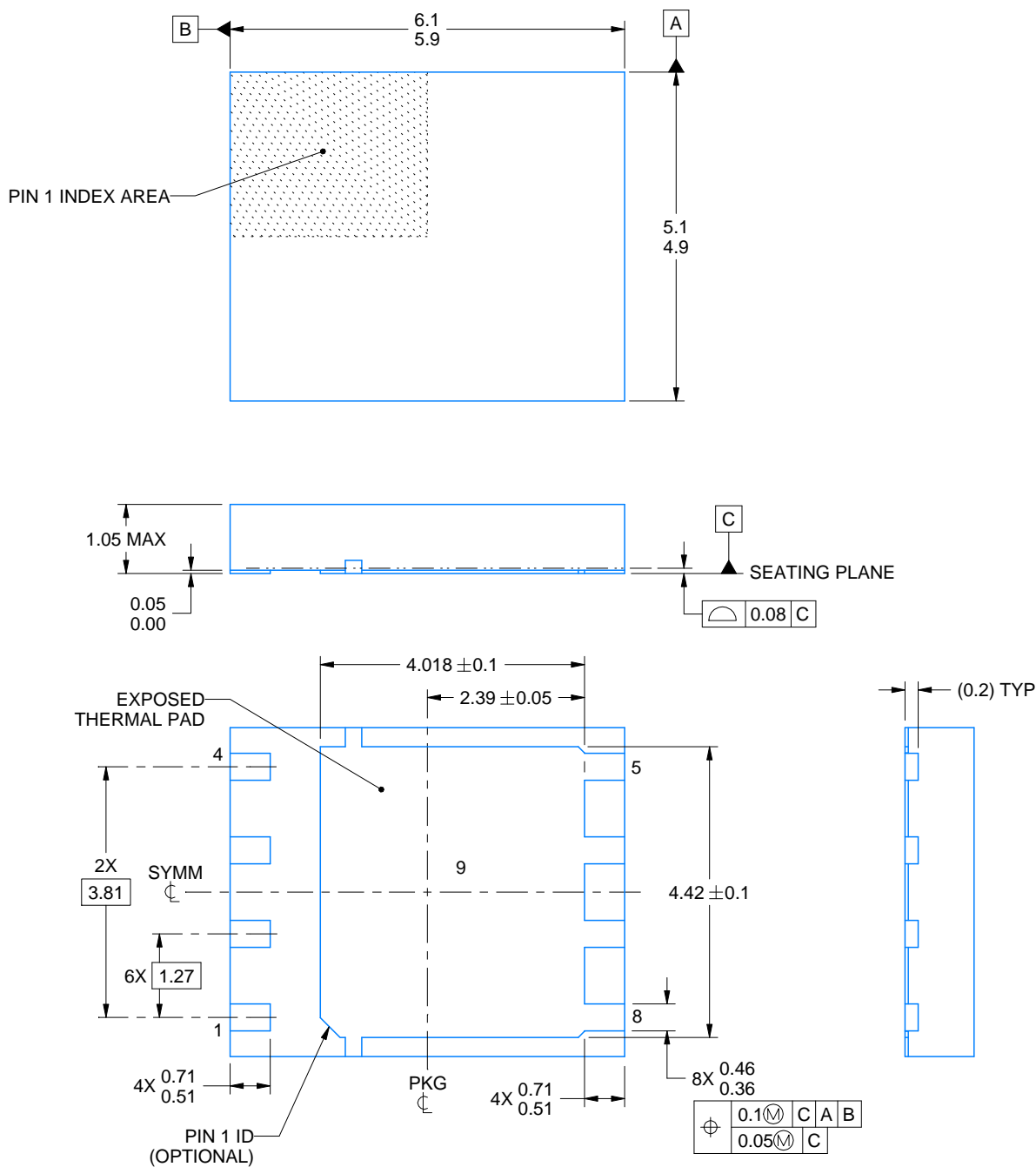
⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will 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.

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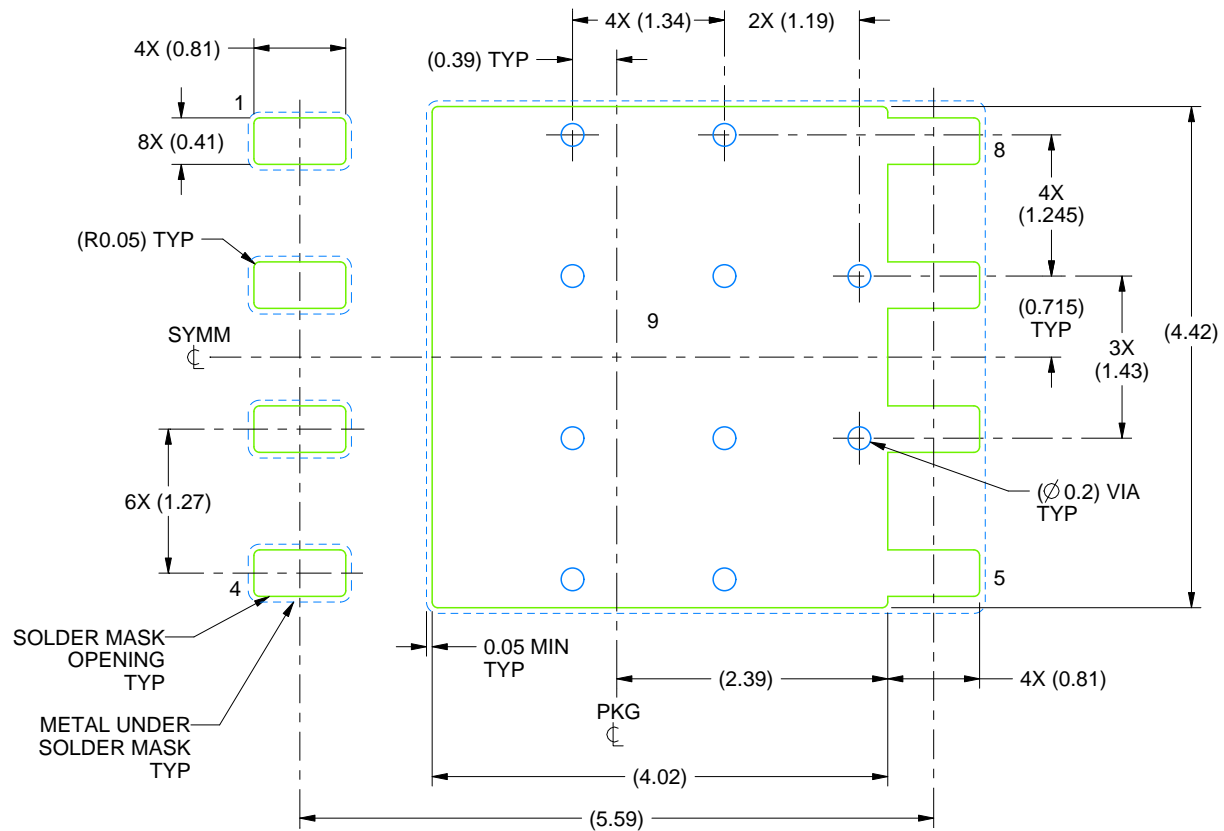
NOTES:

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

DQH0008A

VSON-CLIP - 1.05 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
SOLDER MASK DEFINED
SCALE:15X

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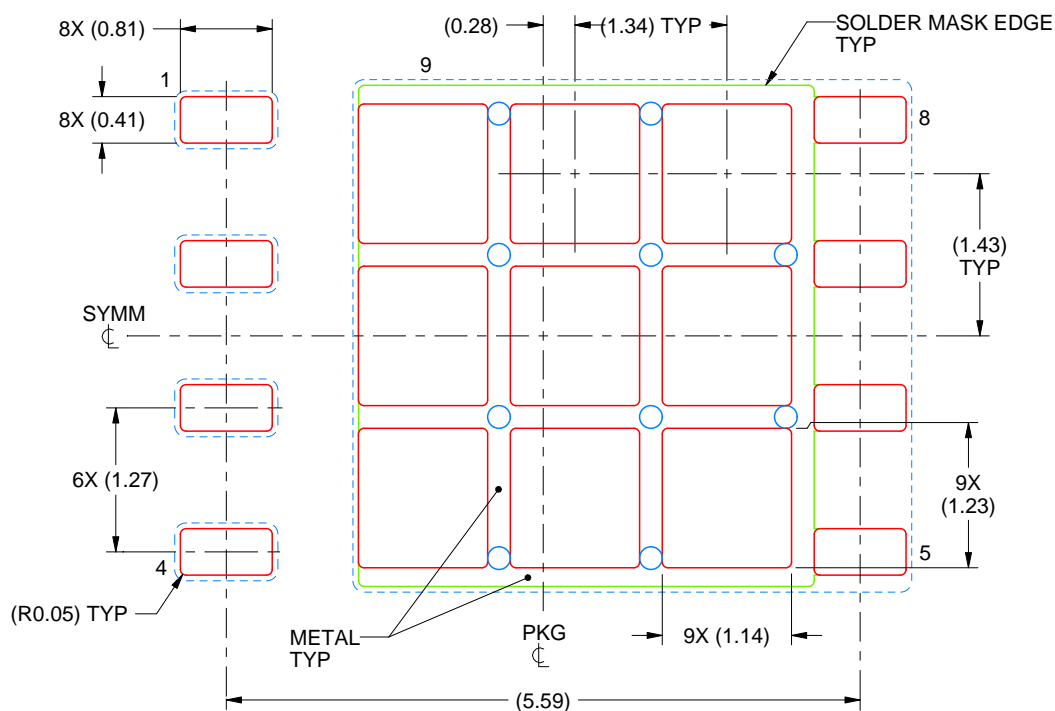
NOTES: (continued)

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 some or all are implemented, recommended via locations are shown.

DQH0008A

VSON-CLIP - 1.05 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 9:
71% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:15X

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NOTES: (continued)

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

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