

CSD19538Q3A 100-V N-Channel NexFET™ Power MOSFET

1 Features

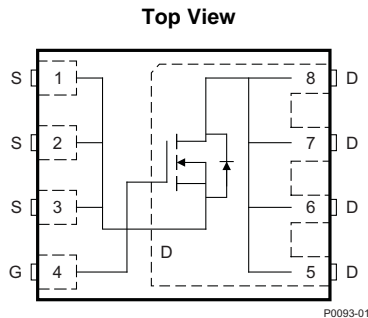
- Ultra-Low Q_g and Q_{gd}
- Low-Thermal Resistance
- Avalanche Rated
- Lead Free
- RoHS Compliant
- Halogen Free
- SON 3.3-mm × 3.3-mm Plastic Package

2 Applications

- Power Over Ethernet (PoE)
- Power Sourcing Equipment (PSE)
- Motor Control

3 Description

This 100-V, 49-mΩ, SON 3.3-mm × 3.3-mm NexFET™ power MOSFET is designed to minimize conduction losses and reduce board footprint in PoE applications.



Product Summary

$T_A = 25^\circ\text{C}$		TYPICAL VALUE		UNIT
V_{DS}	Drain-to-Source Voltage	100		V
Q_g	Gate Charge Total (10 V)	4.3		nC
Q_{gd}	Gate Charge Gate to Drain	0.8		nC
$R_{DS(on)}$	Drain-to-Source On Resistance	$V_{GS} = 6\text{ V}$	58	mΩ
		$V_{GS} = 10\text{ V}$	49	
$V_{GS(th)}$	Threshold Voltage	3.2		V

Device Information⁽¹⁾

DEVICE	MEDIA	QTY	PACKAGE	SHIP
CSD19538Q3A	13-Inch Reel	3000	SON	Tape and Reel
CSD19538Q3AT	7-Inch Reel	250	3.30-mm × 3.30-mm Plastic Package	

(1) For all available packages, see the orderable addendum at the end of the data sheet.

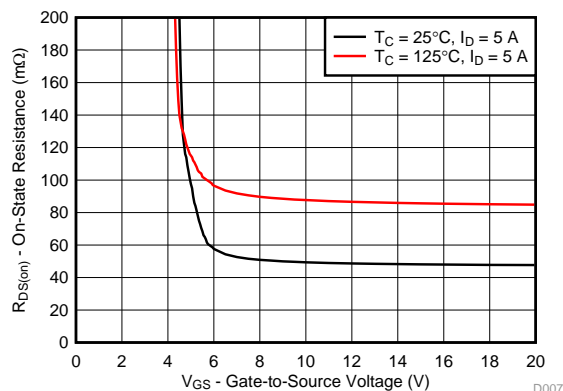
Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage	100	V
V_{GS}	Gate-to-Source Voltage	±20	V
I_D	Continuous Drain Current (Package Limited)	15	A
	Continuous Drain Current (Silicon Limited), $T_C = 25^\circ\text{C}$	14	
	Continuous Drain Current ⁽¹⁾	4.9	
I_{DM}	Pulsed Drain Current ⁽²⁾	37	A
P_D	Power Dissipation ⁽¹⁾	2.8	W
	Power Dissipation, $T_C = 25^\circ\text{C}$	23	
T_J, T_{stg}	Operating Junction Temperature, Storage Temperature	–55 to 150	°C
E_{AS}	Avalanche Energy, Single Pulse $I_D = 12.7\text{ A}$, $L = 0.1\text{ mH}$, $R_G = 25\text{ }\Omega$	8.1	mJ

(1) Typical $R_{\theta JA} = 45^\circ\text{C/W}$ on a 1-in², 2-oz Cu pad on a 0.06 in thick FR4 PCB.

(2) Max $R_{\theta JC} = 5.5^\circ\text{C/W}$, pulse duration ≤ 100 μs, duty cycle ≤ 1%.

$R_{DS(on)}$ vs V_{GS}



Gate Charge

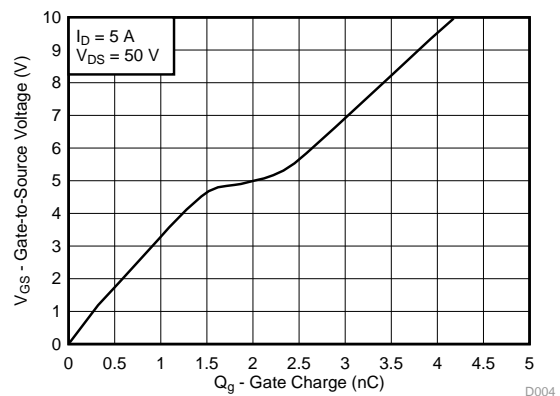


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4 Revision History

Changes from Original (May 2016) to Revision A	Page
• Changed the test voltage V_{DS} in Gate Charge curve from 100 V : to 50 V	1
• Changed the test voltage V_{DS} in Figure 4 from 100 V : to 50 V	5
• Added Receiving Notification of Documentation Updates section to <i>Device and Documentation Support</i> section.....	7

5 Specifications

5.1 Electrical Characteristics

 $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
STATIC CHARACTERISTICS						
BV _{DSS}	Drain-to-source voltage	V _{GS} = 0 V, I _D = 250 μA	100			V
I _{DSS}	Drain-to-source leakage current	V _{GS} = 0 V, V _{DS} = 80 V			1	μA
I _{GSS}	Gate-to-source leakage current	V _{DS} = 0 V, V _{GS} = 20 V			100	nA
V _{GS(th)}	Gate-to-source threshold voltage	V _{DS} = V _{GS} , I _D = 250 μA	2.8	3.2	3.8	V
R _{DS(on)}	Drain-to-source on resistance	V _{GS} = 6 V, I _D = 5 A	58		72	mΩ
		V _{GS} = 10 V, I _D = 5 A	49		59	
g _{fs}	Transconductance	V _{DS} = 10 V, I _D = 5 A	6.1			S
DYNAMIC CHARACTERISTICS						
C _{iss}	Input capacitance	V _{GS} = 0 V, V _{DS} = 50 V, f = 1 MHz		349	454	pF
C _{oss}	Output capacitance			69	90	pF
C _{rss}	Reverse transfer capacitance			12.6	16.4	pF
R _G	Series gate resistance		4.6	9.2		Ω
Q _g	Gate charge total (10 V)	V _{DS} = 50 V, I _D = 5 A	4.3			nC
Q _{gd}	Gate charge gate-to-drain		0.8			nC
Q _{gs}	Gate charge gate-to-source		1.6			nC
Q _{g(th)}	Gate charge at V _{th}		1			nC
Q _{oss}	Output charge	V _{DS} = 50 V, V _{GS} = 0 V	12.3			nC
t _{d(on)}	Turnon delay time	V _{DS} = 50 V, V _{GS} = 10 V, I _{DS} = 5 A, R _G = 0 Ω	5			ns
t _r	Rise time		3			ns
t _{d(off)}	Turnoff delay time		7			ns
t _f	Fall time		2			ns
DIODE CHARACTERISTICS						
V _{SD}	Diode forward voltage	I _{SD} = 5 A, V _{GS} = 0 V	0.85		1	V
Q _{rr}	Reverse recovery charge	V _{DS} = 50 V, I _F = 5 A, di/dt = 300 A/μs	94			nC
t _{rr}	Reverse recovery time		32			ns

5.2 Thermal Information

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

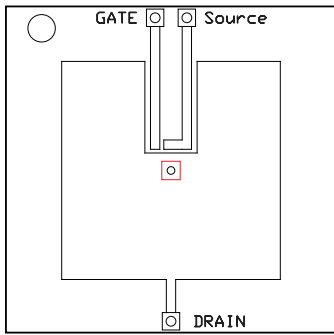
THERMAL METRIC		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction-to-case thermal resistance ⁽¹⁾			5.5	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-ambient thermal resistance ⁽¹⁾⁽²⁾			55	$^\circ\text{C}/\text{W}$

- (1) $R_{\theta JC}$ is determined with the device mounted on a 1-in² (6.45-cm²), 2-oz (0.071-mm) thick Cu pad on a 1.5-in × 1.5-in (3.81-cm × 3.81-cm), 0.06-in (1.52-mm) thick FR4 PCB. $R_{\theta JC}$ is specified by design, whereas $R_{\theta JA}$ is determined by the user's board design.
- (2) Device mounted on FR4 material with 1-in² (6.45-cm²), 2-oz (0.071-mm) thick Cu.

CSD19538Q3A

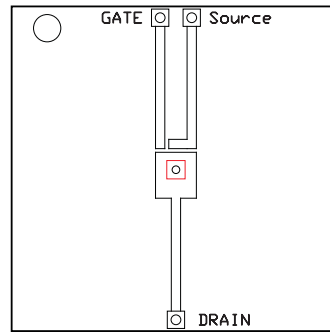
SLPS583A –MAY 2016–REVISED MARCH 2017

www.ti.com



M0161-01

Max $R_{\theta JA} = 55^{\circ}\text{C/W}$
when mounted on 1-in²
(6.45-cm²) of 2-oz
(0.071-mm) thick Cu.



M0161-02

Max $R_{\theta JA} = 195^{\circ}\text{C/W}$
when mounted on a
minimum pad area of
2-oz (0.071-mm) thick
Cu.

5.3 Typical MOSFET Characteristics

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

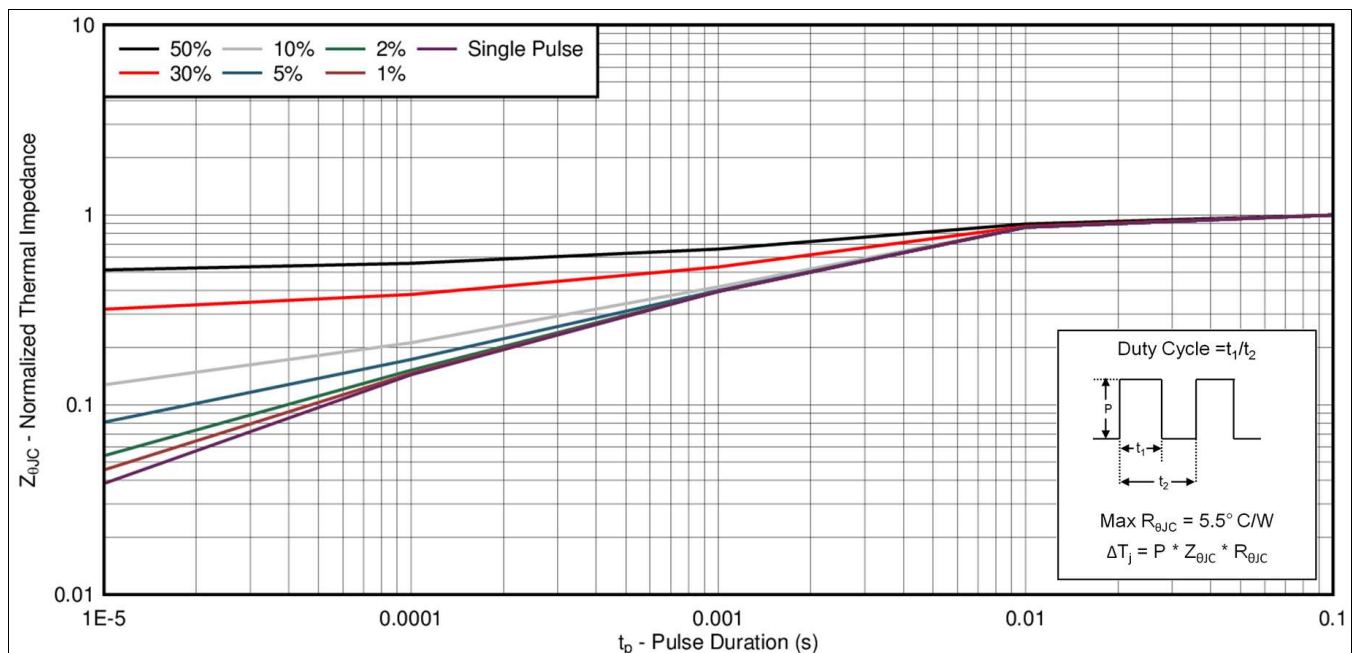


Figure 1. Transient Thermal Impedance

Typical MOSFET Characteristics (continued)

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

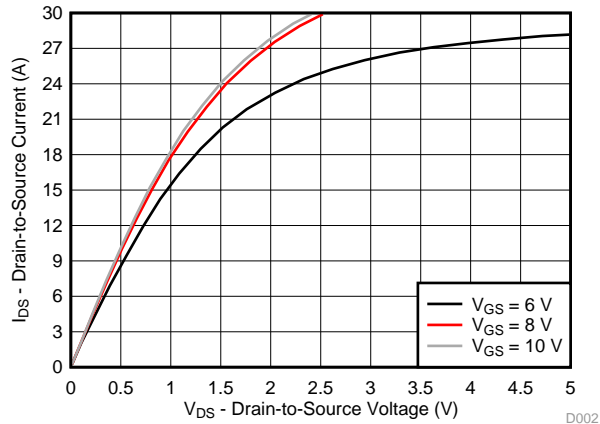


Figure 2. Saturation Characteristics

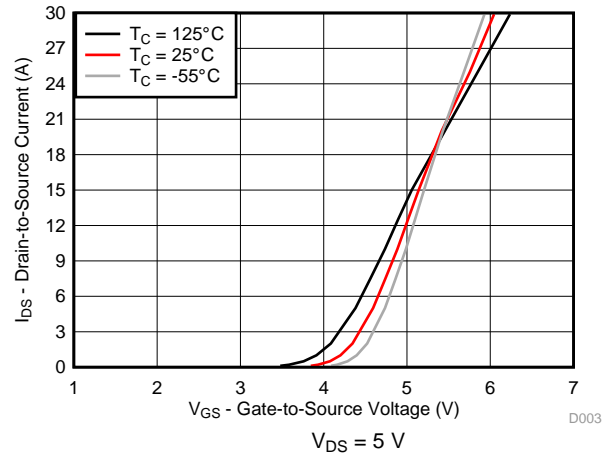


Figure 3. Transfer Characteristics

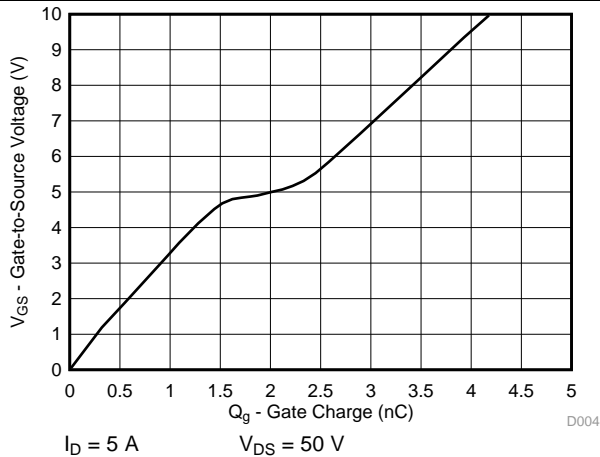


Figure 4. Gate Charge

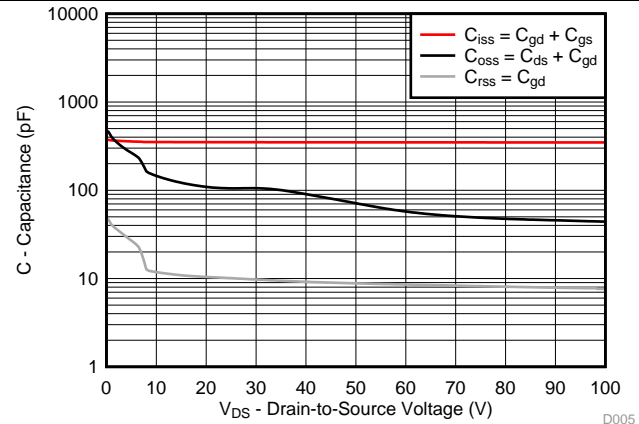


Figure 5. Capacitance

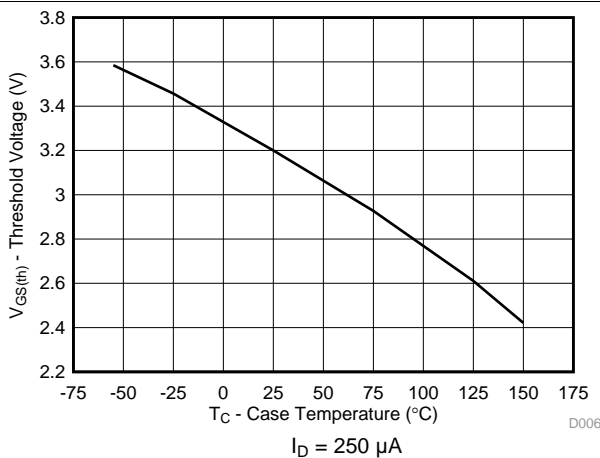


Figure 6. Threshold Voltage vs Temperature

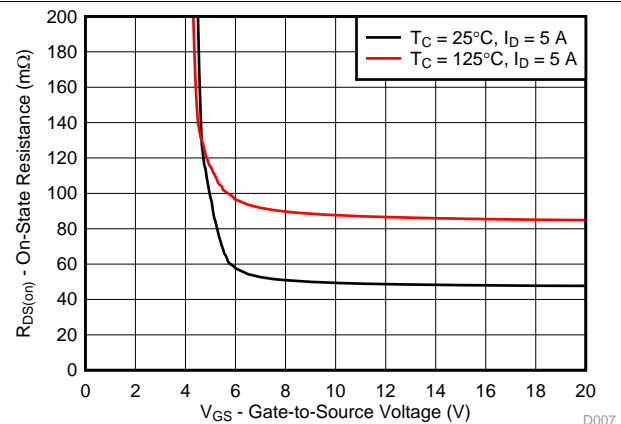


Figure 7. On-State Resistance vs Gate-to-Source Voltage

Typical MOSFET Characteristics (continued)

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

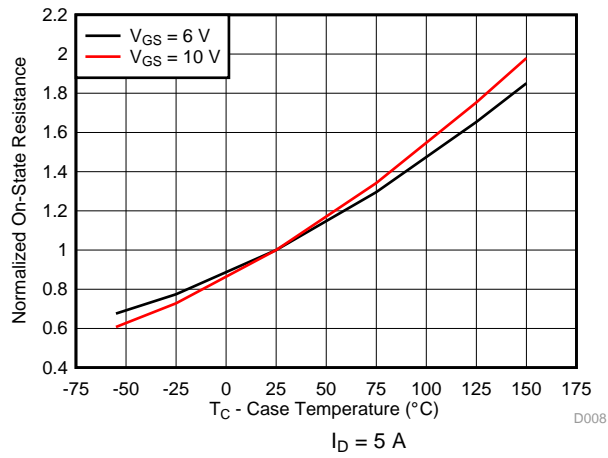


Figure 8. Normalized On-State Resistance vs Temperature

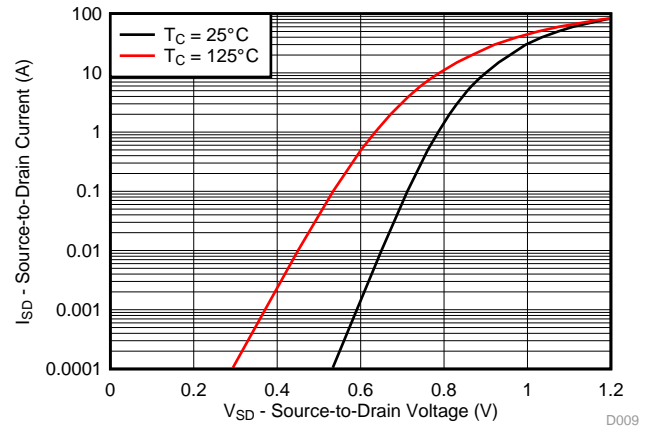


Figure 9. Typical Diode Forward Voltage

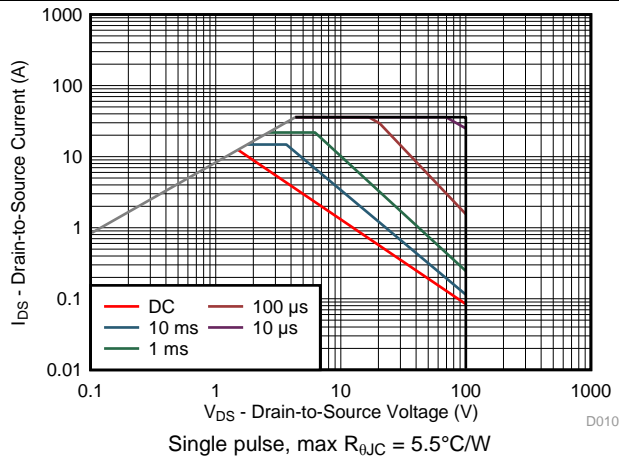


Figure 10. Maximum Safe Operating Area

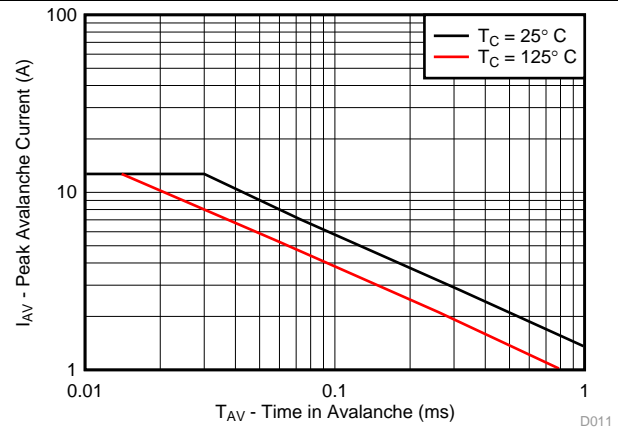


Figure 11. Single Pulse Unclamped Inductive Switching

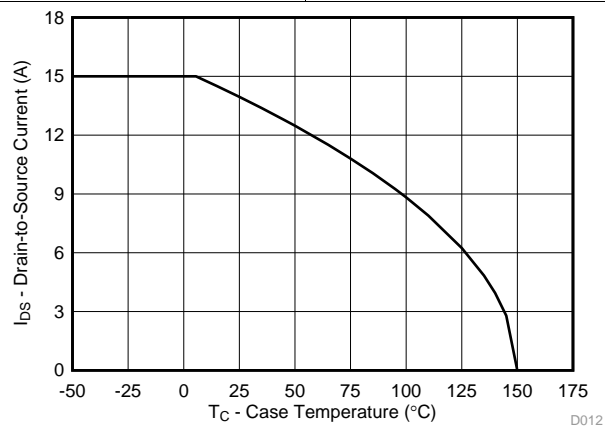


Figure 12. Maximum Drain Current vs Temperature

6 Device and Documentation Support

6.1 Receiving Notification of Documentation Updates

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

6.2 Community Resources

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.

6.3 Trademarks

NexFET, E2E are trademarks of Texas Instruments.
All other trademarks are the property of their respective owners.

6.4 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

6.5 Glossary

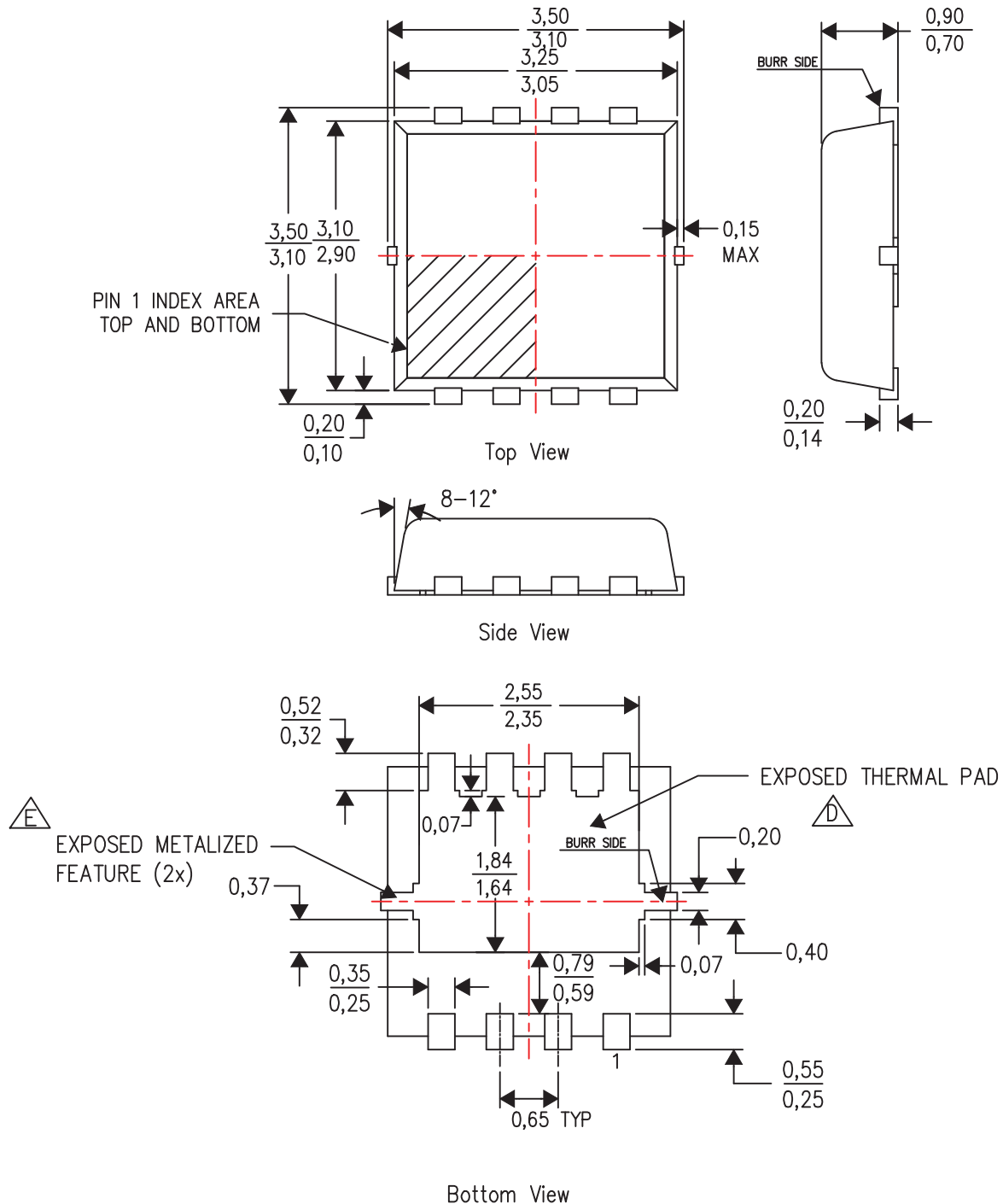
[SLYZ022](#) — *TI Glossary*.

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

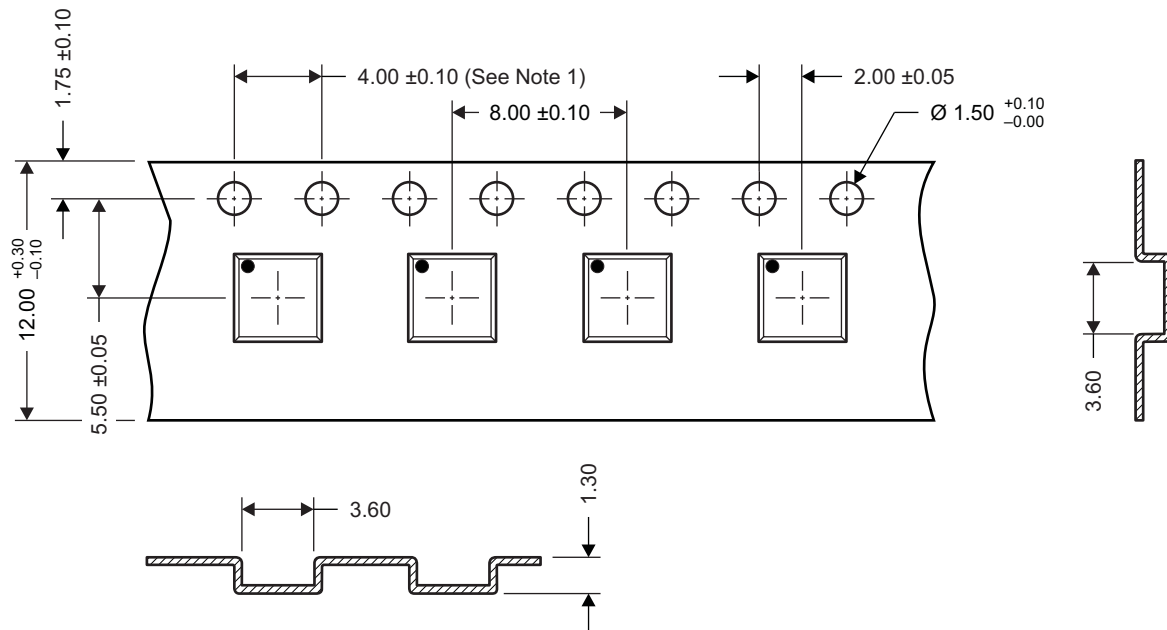
7 Mechanical, Packaging, and Orderable Information

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.

7.1 Q3A Package Dimensions



7.4 Q3A Tape and Reel Information



M0144-01

- Notes:
1. 10-sprocket hole-pitch cumulative tolerance ± 0.2 .
 2. Camber not to exceed 1 mm in 100 mm, noncumulative over 250 mm.
 3. Material: black static-dissipative polystyrene.
 4. All dimensions are in mm, unless otherwise specified.
 5. Thickness: 0.3 ± 0.05 mm.
 6. MSL1 260°C (IR and convection) PbF-reflow compatible.

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)
CSD19538Q3A	Active	Production	VSONP (DNH) 8	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-55 to 150	19538
CSD19538Q3A.B	Active	Production	VSONP (DNH) 8	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-55 to 150	19538
CSD19538Q3AT	Active	Production	VSONP (DNH) 8	250 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-55 to 150	19538
CSD19538Q3AT.B	Active	Production	VSONP (DNH) 8	250 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-55 to 150	19538

⁽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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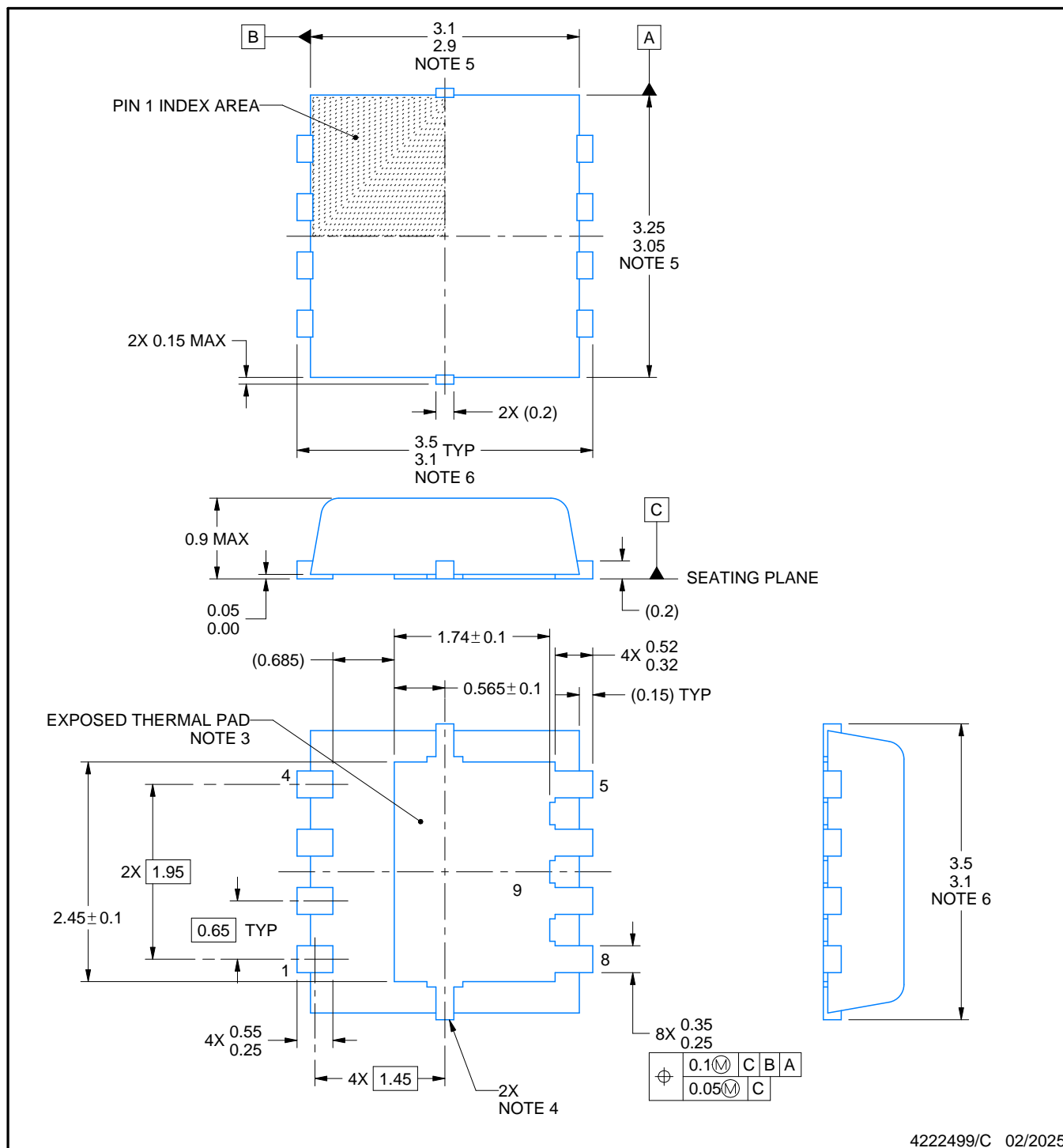
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DNH0008A

PACKAGE OUTLINE

VSONP - 0.9 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



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NOTES:

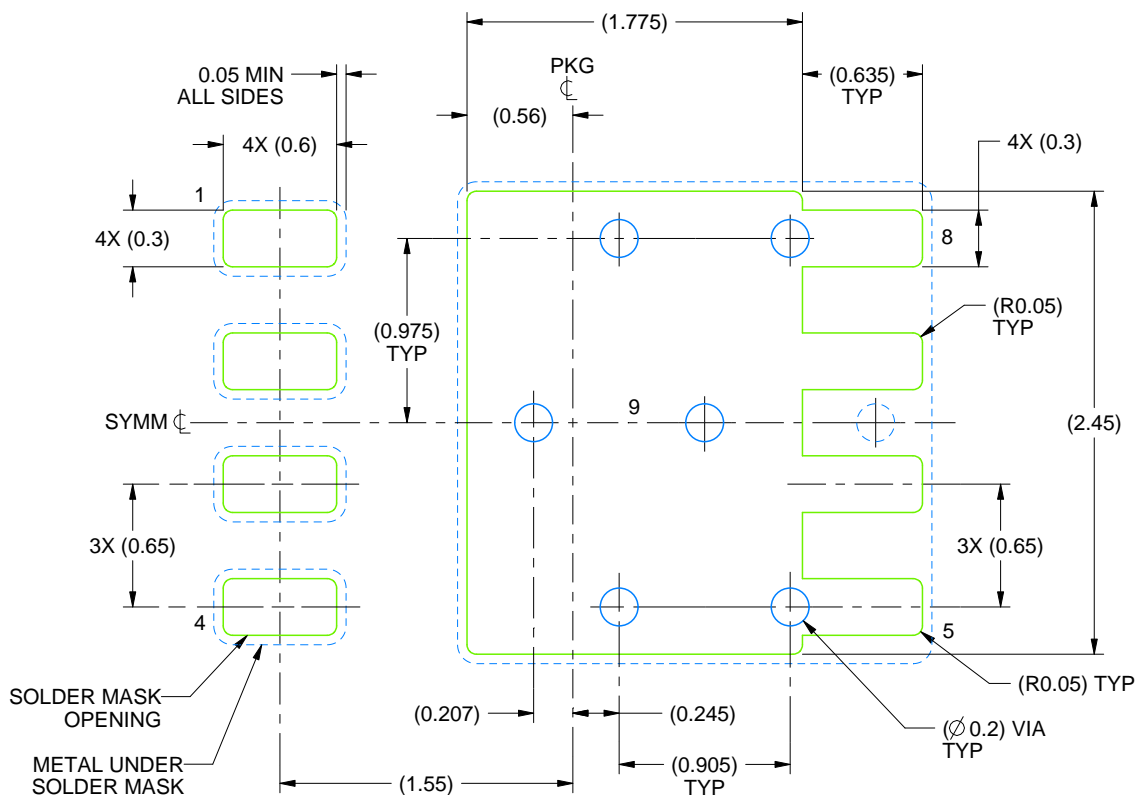
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.
4. Metalized features are supplier options and may not be on the package.
5. These dimensions do not include mold flash protrusions or gate burrs.
6. These dimensions include interterminal flash or protrusion. Interterminal flash or protrusion shall not exceed 0.25 mm per side.

EXAMPLE BOARD LAYOUT

DNH0008A

VSONP - 0.9 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
SOLDER MASK DEFINED
SCALE: 25X

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NOTES: (continued)

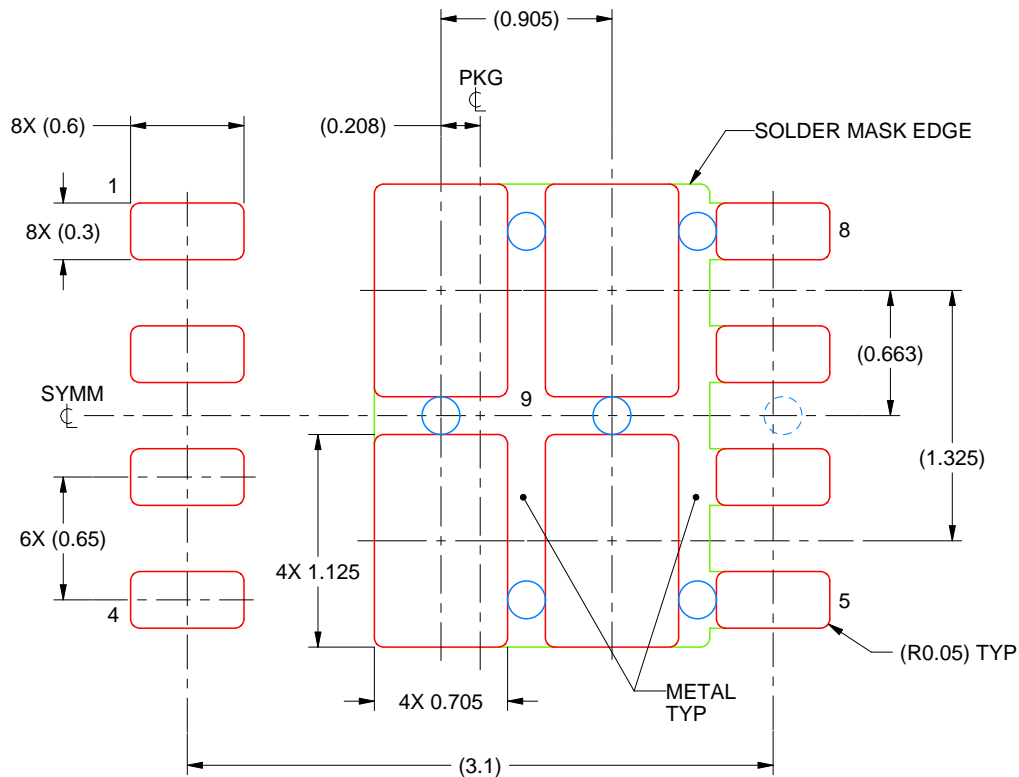
- This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/sluea271).
- Vias are optional depending on application, refer to device data sheet. If some or all are implemented, recommended via locations are shown.

EXAMPLE STENCIL DESIGN

DNH0008A

VSONP - 0.9 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 9:
76% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE: 25X

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NOTES: (continued)

9. 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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