

# CSD17577Q3A 30 V N-Channel NexFET™ Power MOSFET

## 1 Features

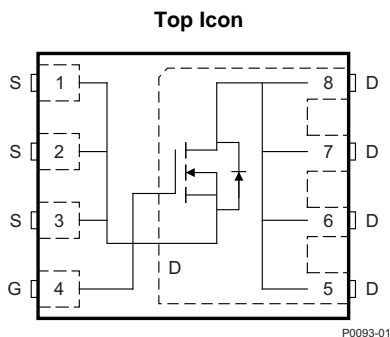
- Low  $Q_g$  and  $Q_{gd}$
- Low Thermal Resistance
- Avalanche Rated
- Pb Free
- RoHS Compliant
- Halogen Free
- SON 3.3 mm x 3.3 mm Package

## 2 Applications

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

## 3 Description

This 30 V, 4.0 mΩ, SON 3.3 mm x 3.3 mm NexFET™ power MOSFET is designed to minimize resistance in power conversion applications.



### Product Summary

$T_A = 25^\circ\text{C}$		TYPICAL VALUE		UNIT
$V_{DS}$	Drain-to-Source Voltage	30		V
$Q_g$	Gate Charge Total (4.5 V)	12		nC
$Q_{gd}$	Gate Charge Gate-to-Drain	2.5		nC
$R_{DS(on)}$	Drain-to-Source On-Resistance	$V_{GS} = 4.5\text{ V}$	5.3	mΩ
		$V_{GS} = 10\text{ V}$	4.0	mΩ
$V_{GS(th)}$	Threshold Voltage	1.4		V

### Ordering Information<sup>(1)</sup>

DEVICE	QTY	MEDIA	PACKAGE	SHIP
CSD17577Q3A	2500	13-Inch Reel	SON 3.3 x 3.3 mm Plastic Package	Tape and Reel
CSD17577Q3AT	250	7-Inch Reel		

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

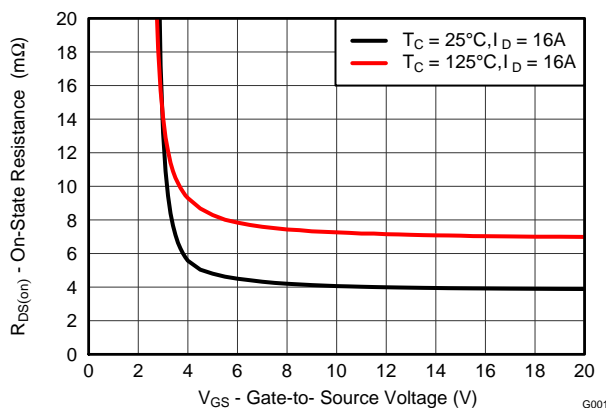
### Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$		VALUE	UNIT
$V_{DS}$	Drain-to-Source Voltage	30	V
$V_{GS}$	Gate-to-Source Voltage	±20	V
$I_D$	Continuous Drain Current (Package limited)	35	A
	Continuous Drain Current (Silicon limited), $T_C = 25^\circ\text{C}$	83	
	Continuous Drain Current <sup>(1)</sup>	19	
$I_{DM}$	Pulsed Drain Current <sup>(2)</sup>	239	A
$P_D$	Power Dissipation <sup>(1)</sup>	2.5	W
	Power Dissipation, $T_C = 25^\circ\text{C}$	53	
$T_J, T_{sig}$	Operating Junction Temperature, Storage Temperature	-55 to 150	°C
$E_{AS}$	Avalanche Energy, single pulse $I_D = 28\text{ A}, L = 0.1\text{ mH}, R_G = 25\ \Omega$	39	mJ

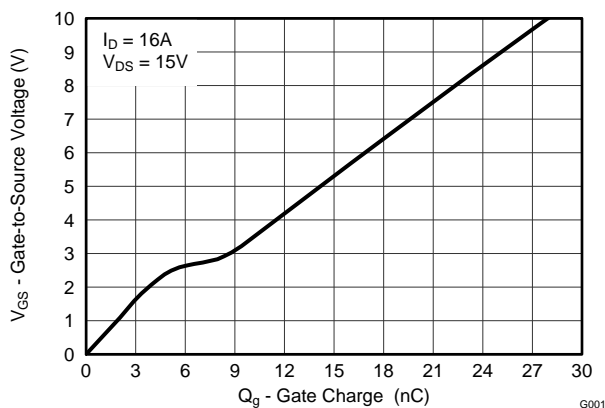
(1) Typical  $R_{\theta JA} = 50^\circ\text{C/W}$  on a 1 inch<sup>2</sup>, 2 oz. Cu pad on a 0.06 inch thick FR4 PCB.

(2) Max  $R_{\theta JC} = 3.0^\circ\text{C/W}$ , pulse duration  $\leq 100\ \mu\text{s}$ , duty cycle  $\leq 1\%$

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



**Gate Charge**



## Table of Contents

<b>1 Features</b> .....	<b>1</b>	6.1 Community Resources.....	<b>7</b>
<b>2 Applications</b> .....	<b>1</b>	6.2 Trademarks .....	<b>7</b>
<b>3 Description</b> .....	<b>1</b>	6.3 Electrostatic Discharge Caution .....	<b>7</b>
<b>4 Revision History</b> .....	<b>2</b>	6.4 Glossary .....	<b>7</b>
<b>5 Specifications</b> .....	<b>3</b>	<b>7 Mechanical, Packaging, and Orderable Information</b> .....	<b>8</b>
5.1 Electrical Characteristics.....	<b>3</b>	7.1 Q3A Package Dimensions .....	<b>8</b>
5.2 Thermal Information .....	<b>3</b>	7.2 Q3A Recommended PCB Pattern .....	<b>9</b>
5.3 Typical MOSFET Characteristics.....	<b>4</b>	7.3 Q3A Recommended Stencil Pattern .....	<b>9</b>
<b>6 Device and Documentation Support</b> .....	<b>7</b>	7.4 Q3A Tape and Reel Information .....	<b>10</b>

## 4 Revision History

<b>Changes from Original (August 2014) to Revision A</b>	<b>Page</b>
• Updated Power Dissipation value in <i>Absolute Maximum Ratings</i> table .....	<b>1</b>
• Added <a href="#">Community Resources</a> section .....	<b>7</b>
• Updated Package Dimensions drawing. ....	<b>8</b>
• Updated PCB drawing. ....	<b>9</b>
• Updated Stencil Pattern drawing .....	<b>9</b>

## 5 Specifications

### 5.1 Electrical Characteristics

(T<sub>A</sub> = 25°C unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>STATIC CHARACTERISTICS</b>						
V <sub>DSS</sub>	Drain-to-source voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	30			V
I <sub>DSS</sub>	Drain-to-source leakage current	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 24 V			1	μA
I <sub>GSS</sub>	Gate-to-source leakage current	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 20 V			100	nA
V <sub>GS(th)</sub>	Gate-to-source threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.1	1.4	1.8	V
R <sub>DS(on)</sub>	Drain-to-source on-resistance	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A		5.3	6.4	mΩ
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 16 A		4.0	4.8	mΩ
g <sub>fs</sub>	Transconductance	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 16 A		76		S
<b>DYNAMIC CHARACTERISTICS</b>						
C <sub>iss</sub>	Input capacitance	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 15 V, f = 1 MHz		1780	2310	pF
C <sub>oss</sub>	Output capacitance			208	270	pF
C <sub>rss</sub>	Reverse transfer capacitance			79	103	pF
R <sub>G</sub>	Series gate resistance			1.4	2.8	Ω
Q <sub>g</sub>	Gate charge total (4.5 V)	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 16 A		13	17	nC
Q <sub>g</sub>	Gate charge total (10 V)			27	35	nC
Q <sub>gd</sub>	Gate charge gate-to-drain			2.8		nC
Q <sub>gs</sub>	Gate charge gate-to-source			5.1		nC
Q <sub>g(th)</sub>	Gate charge at V <sub>th</sub>			2.5		nC
Q <sub>oss</sub>	Output charge		V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V		6	
t <sub>d(on)</sub>	Turn on delay time	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>DS</sub> = 16 A, R <sub>G</sub> = 0 Ω		4		ns
t <sub>r</sub>	Rise time			31		ns
t <sub>d(off)</sub>	Turn off delay time			20		ns
t <sub>f</sub>	Fall time			4		ns
<b>DIODE CHARACTERISTICS</b>						
V <sub>SD</sub>	Diode forward voltage	I <sub>SD</sub> = 16 A, V <sub>GS</sub> = 0 V		0.8	1	V
Q <sub>rr</sub>	Reverse recovery charge	V <sub>DS</sub> = 15 V, I <sub>F</sub> = 16 A, di/dt = 300 A/μs		8.2		nC
t <sub>rr</sub>	Reverse recovery time			8.6		ns

### 5.2 Thermal Information

(T<sub>A</sub> = 25°C unless otherwise stated)

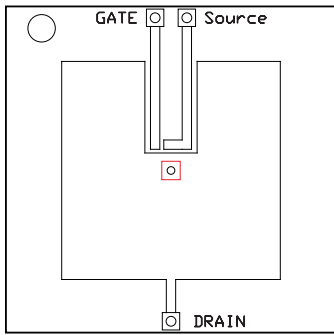
THERMAL METRIC		MIN	TYP	MAX	UNIT
R <sub>θJC</sub>	Junction-to-case thermal resistance <sup>(1)</sup>			3.0	°C/W
R <sub>θJA</sub>	Junction-to-ambient thermal resistance <sup>(1)(2)</sup>			55	°C/W

- (1) R<sub>θJC</sub> is determined with the device mounted on a 1 inch<sup>2</sup> (6.45 cm<sup>2</sup>), 2 oz. (0.071 mm thick) Cu pad on a 1.5 inches × 1.5 inches (3.81 cm × 3.81 cm), 0.06 inch (1.52 mm) thick FR4 PCB. R<sub>θJC</sub> is specified by design, whereas R<sub>θJA</sub> is determined by the user's board design.
- (2) Device mounted on FR4 material with 1 inch<sup>2</sup> (6.45 cm<sup>2</sup>), 2 oz. (0.071 mm thick) Cu.

**CSD17577Q3A**

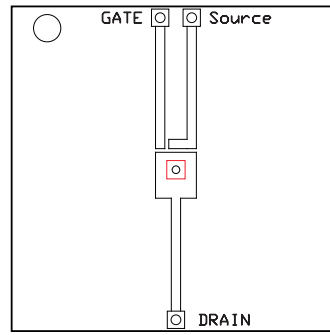
SLPS515A – AUGUST 2014 – REVISED JANUARY 2016

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M0161-01

Max  $R_{\theta JA} = 55^{\circ}\text{C/W}$   
when mounted on  
1 inch<sup>2</sup> (6.45 cm<sup>2</sup>) of  
2 oz. (0.071 mm thick)  
Cu.



M0161-02

Max  $R_{\theta JA} = 190^{\circ}\text{C/W}$   
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)

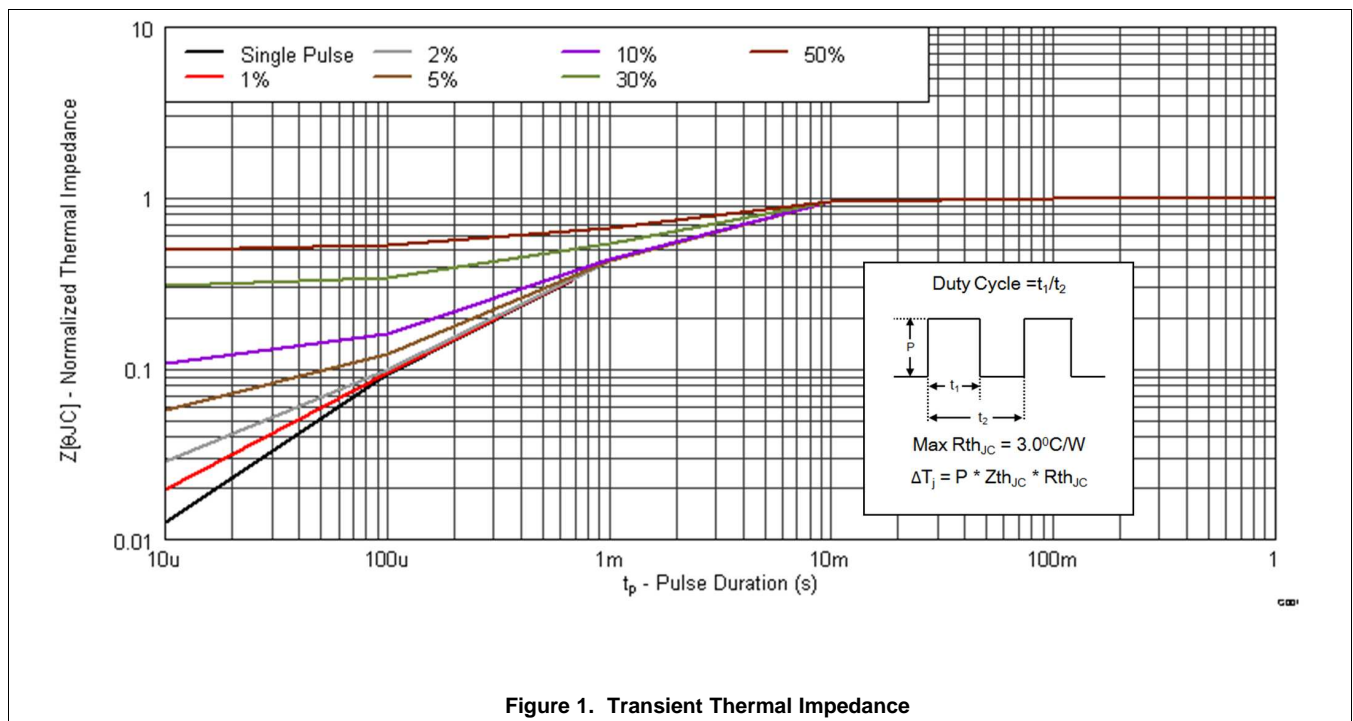
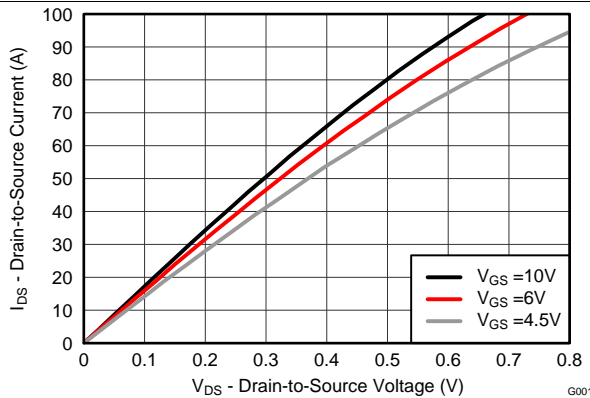


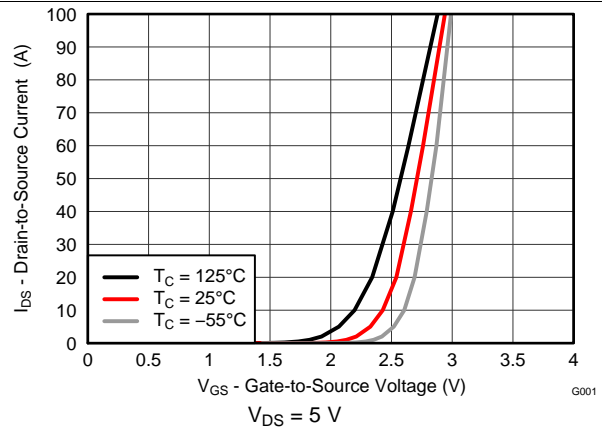
Figure 1. Transient Thermal Impedance

**Typical MOSFET Characteristics (continued)**

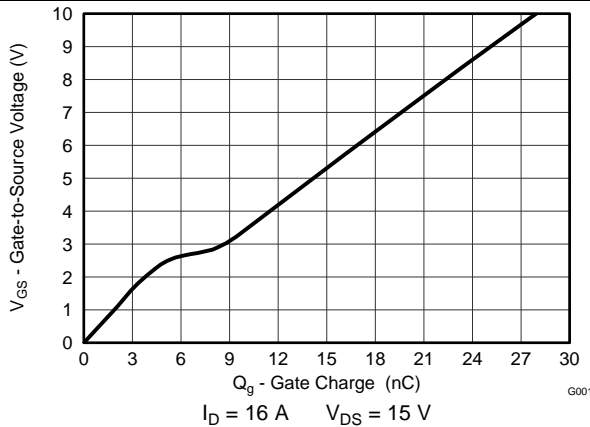
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



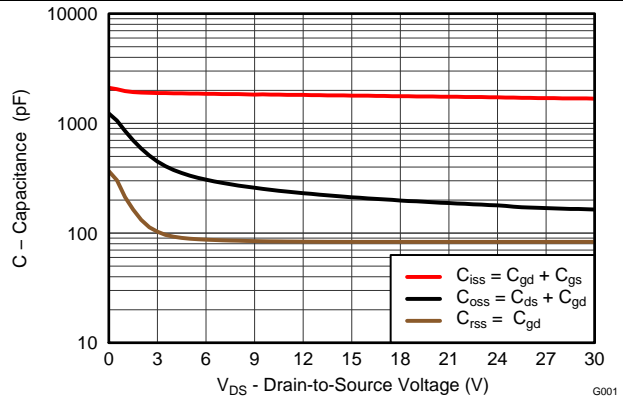
**Figure 2. Saturation Characteristics**



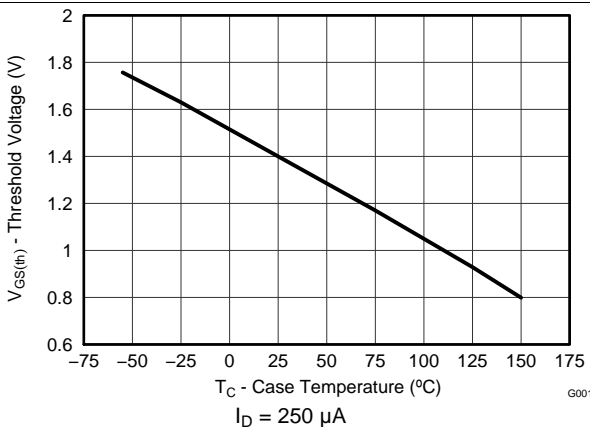
**Figure 3. Transfer Characteristics**



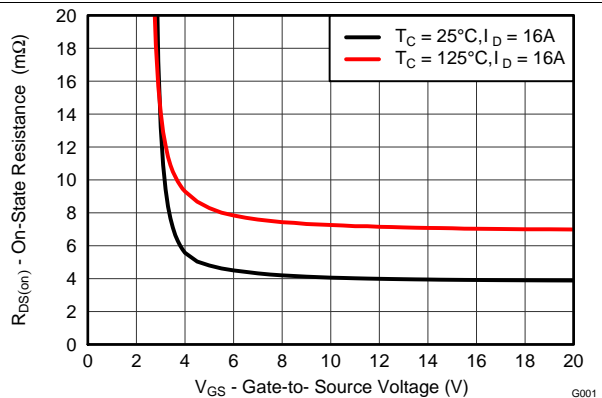
**Figure 4. Gate Charge**



**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)

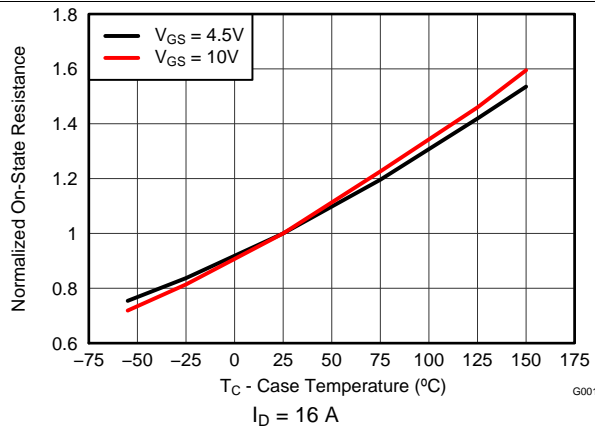


Figure 8. Normalized On-State Resistance vs Temperature

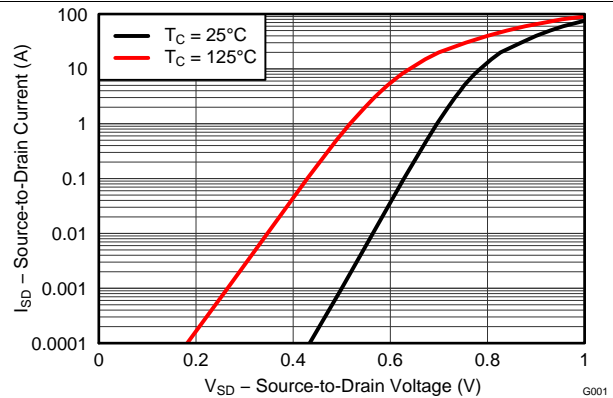


Figure 9. Typical Diode Forward Voltage

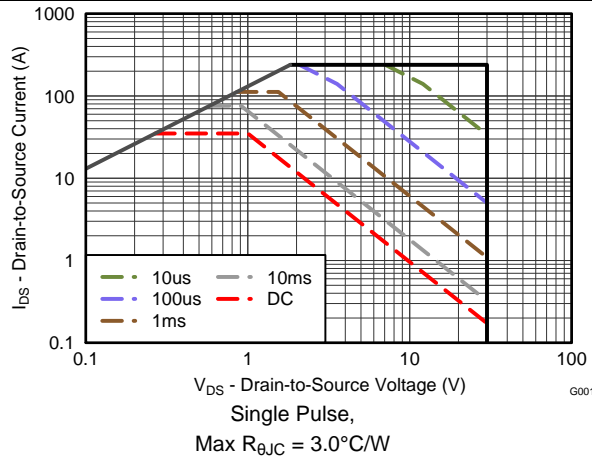


Figure 10. Maximum Safe Operating Area

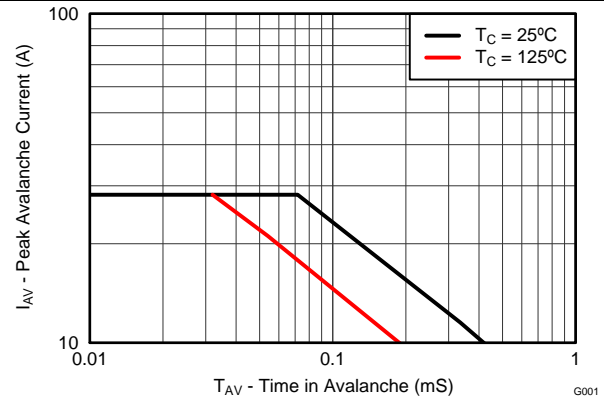


Figure 11. Single Pulse Unclamped Inductive Switching

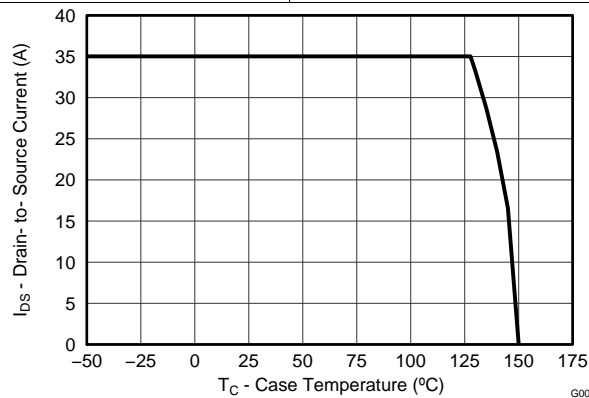


Figure 12. Maximum Drain Current vs Temperature

## 6 Device and Documentation Support

### 6.1 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](http://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.

### 6.2 Trademarks

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

### 6.3 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.

### 6.4 Glossary

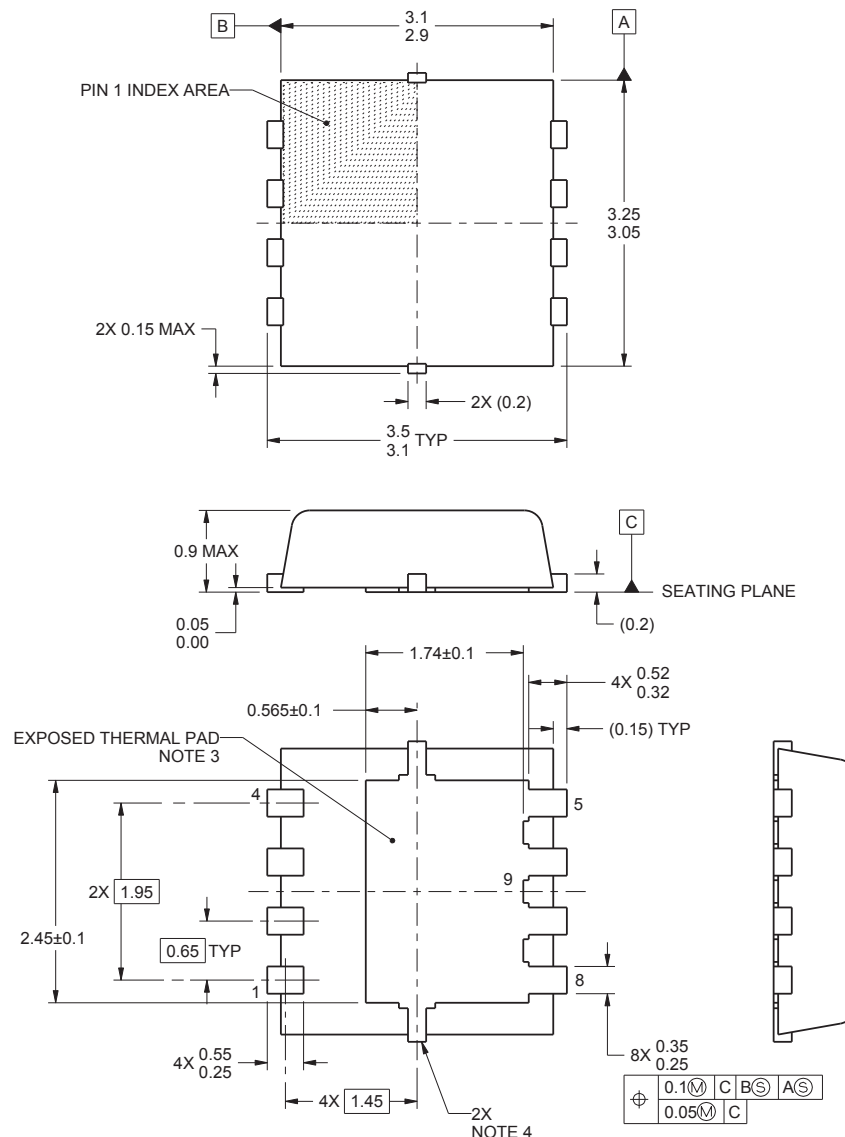
[SLYZ022](#) — *TI Glossary*.

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.

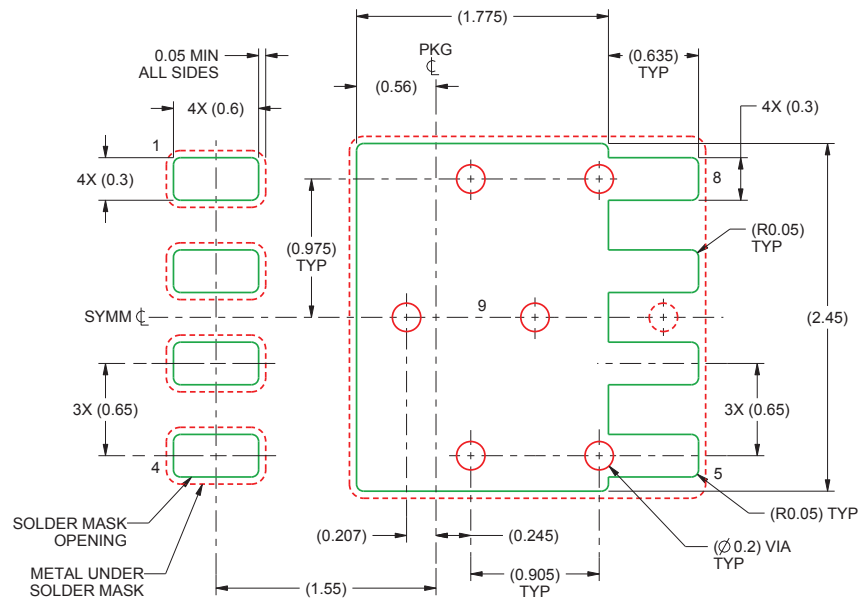
### 7.1 Q3A Package Dimensions



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. All dimensions do not include mold flash or protrusions.



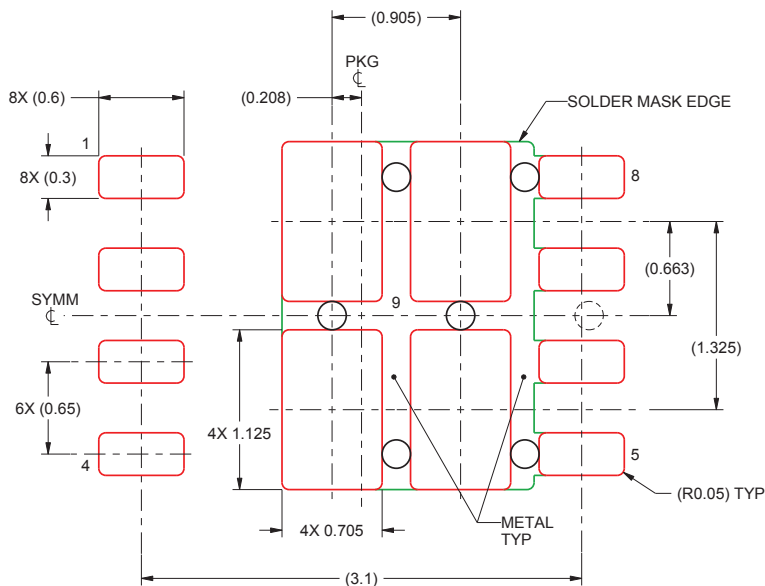
## 7.2 Q3A Recommended PCB Pattern



1. This package is designed to be soldered to a thermal pad on the board. For more information, see *QFN/SON PCB Attachment* application report, [SLUA271](#).
2. Vias are optional depending on application, refer to device data sheet. If some or all are implemented, recommended via locations are shown.

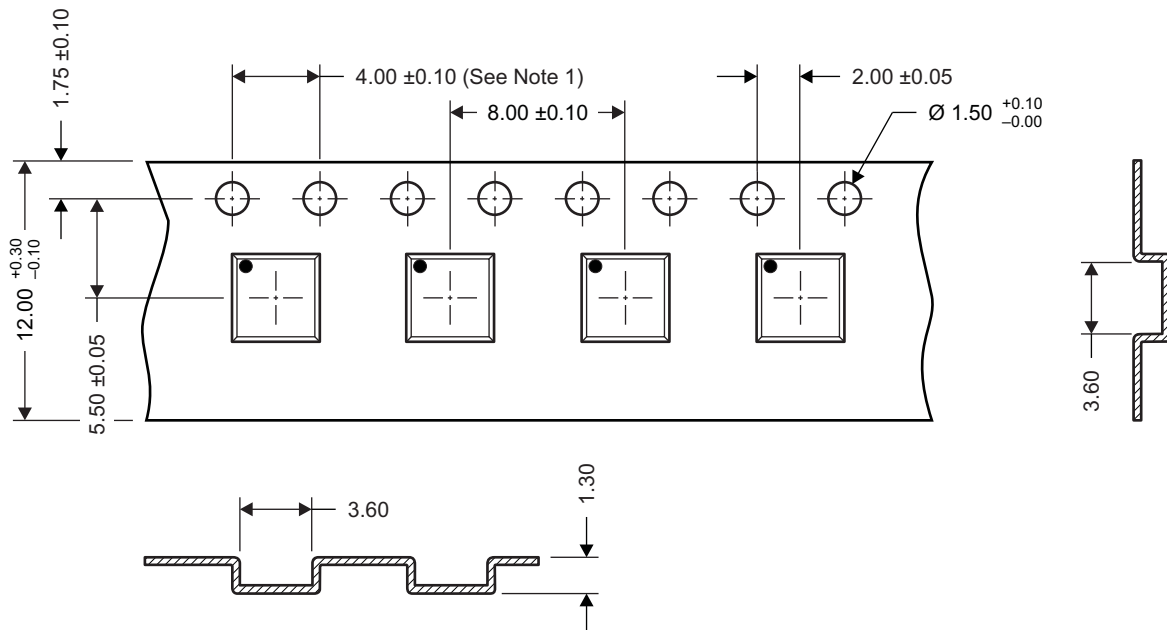
For recommended circuit layout for PCB designs, see application note [SLPA005 – Reducing Ringing Through PCB Layout Techniques](#).

## 7.3 Q3A Recommended Stencil Pattern



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

## 7.4 Q3A Tape and Reel Information



M0144-01

- Notes:
1. 10-sprocket hole-pitch cumulative tolerance  $\pm 0.2$
  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:  $0.30 \pm 0.05$  mm
  6. MSL1 260°C (IR and convection) PbF-reflow compatible

**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
CSD17577Q3A	ACTIVE	VSONP	DNH	8	2500	RoHS & Green	SN	Level-1-260C-UNLIM	-55 to 150	17577	<a href="#">Samples</a>
CSD17577Q3AT	ACTIVE	VSONP	DNH	8	250	RoHS & Green	SN	Level-1-260C-UNLIM	-55 to 150	17577	<a href="#">Samples</a>

(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.

**OBSOLETE:** 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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