

# CSD18532NQ5B 60 V N-Channel NexFET™ Power MOSFET

## 1 Features

- Ultra-Low  $Q_g$  and  $Q_{gd}$
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 5 mm x 6 mm Plastic Package

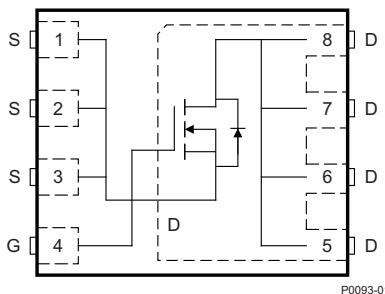
## 2 Applications

- DC-DC Conversion
- Secondary Side Synchronous Rectifier
- Isolated Converter Primary Side Switch
- Motor Control

## 3 Description

This 60 V, 2.7 mΩ, 5 x 6 mm SON NexFET™ power MOSFET has been designed to minimize losses in power conversion applications.

Top View



P0093-01

## Product Summary

$T_A = 25^\circ\text{C}$		TYPICAL VALUE	UNIT
$V_{DS}$	Drain-to-Source Voltage	60	V
$Q_g$	Gate Charge Total (10 V)	49	nC
$Q_{gd}$	Gate Charge Gate to Drain	7.9	nC
$R_{DS(on)}$	Drain-to-Source On-Resistance	$V_{GS} = 6\text{ V}$ $V_{GS} = 10\text{ V}$	$3.5\text{ m}\Omega$ $2.7\text{ m}\Omega$
$V_{GS(th)}$	Threshold Voltage	2.8	V

## Ordering Information

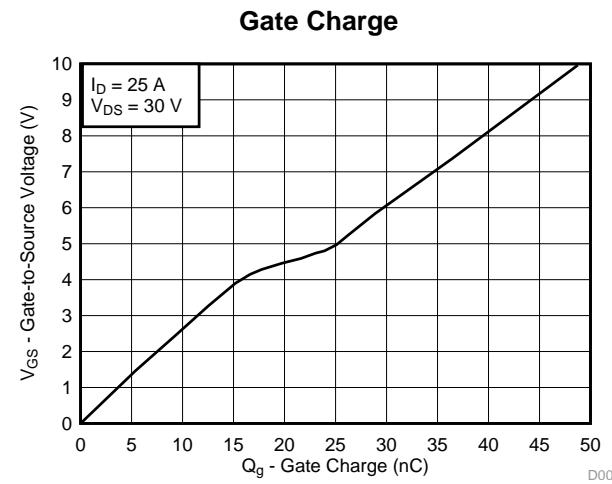
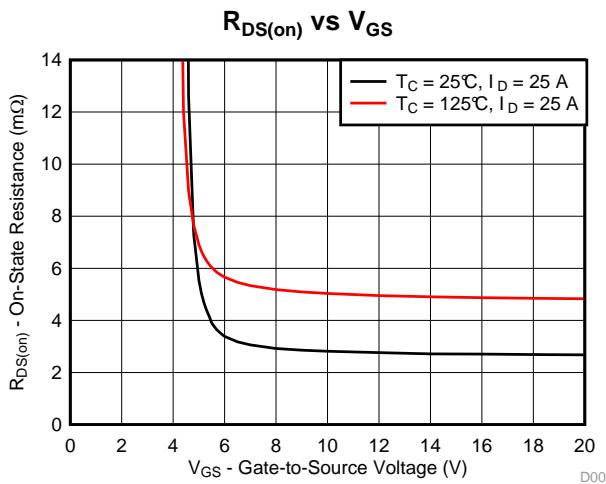
DEVICE	QTY	MEDIA	PACKAGE	SHIP
CSD18532NQ5B	2500	13-Inch Reel	SON 5 mm x 6 mm Plastic Package	Tape and Reel
CSD18532NQ5BT	250	7-Inch Reel		

## Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$		VALUE	UNIT
$V_{DS}$	Drain to Source Voltage	60	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Continuous Drain Current (Package limited)	100	
	Continuous Drain Current (Silicon limited), $T_C = 25^\circ\text{C}$	151	
	Continuous Drain Current <sup>(1)</sup>	21	
$I_{DM}$	Pulsed Drain Current <sup>(2)</sup>	400	A
$P_D$	Power Dissipation <sup>(1)</sup>	3.1	
	Power Dissipation, $T_C = 25^\circ\text{C}$	156	
$T_J$ , $T_{stg}$	Operating Junction Temperature, Storage Temperature	-55 to 150	°C
$E_{AS}$	Avalanche Energy, single pulse $I_D = 85\text{ A}$ , $L = 0.1\text{ mH}$ , $R_G = 25\text{ }\Omega$	360	mJ

(1) Typical  $R_{fJA} = 40^\circ\text{C/W}$  on a 1 inch<sup>2</sup>, 2 oz. Cu pad on a 0.06 inch thick FR4 PCB.

(2) Max  $R_{fJC} = 0.8^\circ\text{C/W}$ , Pulse duration  $\leq 100\text{ }\mu\text{s}$ , duty cycle  $\leq 1\%$ .



An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

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## 4 Revision History

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

Changes from Revision A (December 2015) to Revision B	Page
• Added <i>Receiving Notification of Documentation Updates</i> section. ....	7
• Changed the dimension between pads 3 and 4 from 0.028 inches: to 0.050 inches in the <i>Recommended PCB Pattern</i> section diagram. ....	9

Changes from Original (June 2014) to Revision A	Page
• Added part number to title. ....	1
• Added 7" reel to <i>Ordering Information</i> . ....	1
• Updated pulsed current conditions. ....	1
• Added line for Power Dissipation, $T_C = 25^\circ\text{C}$ in <i>Absolute Maximum Ratings</i> table. ....	1
• Updated <a href="#">Figure 1</a> to show $R_{\theta\text{JC}}$ curves. ....	4
• Updated SOA in <a href="#">Figure 10</a> . ....	6
• Added <i>Device and Documentation Support</i> section. ....	7
• Updated <i>Mechanical, Packaging, and Orderable Information</i> and mechanical drawings. ....	8

## 5 Specifications

### 5.1 Electrical Characteristics

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

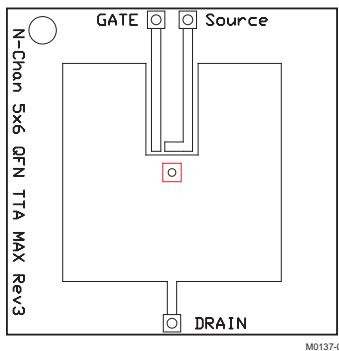
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>STATIC CHARACTERISTICS</b>					
$\text{BV}_{\text{DSS}}$	Drain-to-source voltage $V_{\text{GS}} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$	60			V
$\text{I}_{\text{DSS}}$	Drain-to-source leakage current $V_{\text{GS}} = 0 \text{ V}$ , $V_{\text{DS}} = 48 \text{ V}$		1		$\mu\text{A}$
$\text{I}_{\text{GSS}}$	Gate-to-source leakage current $V_{\text{DS}} = 0 \text{ V}$ , $V_{\text{GS}} = 20 \text{ V}$		100		nA
$V_{\text{GS}(\text{th})}$	Gate-to-source threshold voltage $V_{\text{DS}} = V_{\text{GS}}$ , $I_D = 250 \mu\text{A}$	2.4	2.8	3.4	V
$\text{R}_{\text{DS}(\text{on})}$	$V_{\text{GS}} = 6 \text{ V}$ , $I_D = 25 \text{ A}$		3.5	4.4	$\text{m}\Omega$
	$V_{\text{GS}} = 10 \text{ V}$ , $I_D = 25 \text{ A}$		2.7	3.4	$\text{m}\Omega$
$\text{g}_{\text{fs}}$	Transconductance $V_{\text{DS}} = 30 \text{ V}$ , $I_D = 25 \text{ A}$		140		S
<b>DYNAMIC CHARACTERISTICS</b>					
$\text{C}_{\text{iss}}$	Input capacitance	$V_{\text{GS}} = 0 \text{ V}$ , $V_{\text{DS}} = 30 \text{ V}$ , $f = 1 \text{ MHz}$	4100	5340	pF
$\text{C}_{\text{oss}}$	Output capacitance		495	644	pF
$\text{C}_{\text{rss}}$	Reverse transfer capacitance		16	21	pF
$\text{R}_G$	Series gate resistance		1.2	2.4	$\Omega$
$\text{Q}_g$	Gate charge total (10 V)	$V_{\text{DS}} = 30 \text{ V}$ , $I_D = 25 \text{ A}$	49	64	nC
$\text{Q}_{\text{gd}}$	Gate charge gate to drain		7.9		nC
$\text{Q}_{\text{gs}}$	Gate charge gate to source		16		nC
$\text{Q}_{\text{g}(\text{th})}$	Gate charge at $V_{\text{th}}$		11		nC
$\text{Q}_{\text{oss}}$	Output charge	$V_{\text{DS}} = 30 \text{ V}$ , $V_{\text{GS}} = 0 \text{ V}$	69		nC
$t_{\text{d}(\text{on})}$	Turn on delay time	$V_{\text{DS}} = 30 \text{ V}$ , $V_{\text{GS}} = 10 \text{ V}$ , $I_{\text{DS}} = 25 \text{ A}$ , $\text{R}_G = 0 \Omega$	8.2		ns
$t_r$	Rise time		8.7		ns
$t_{\text{d}(\text{off})}$	Turn off delay time		20		ns
$t_f$	Fall time		2.7		ns
<b>DIODE CHARACTERISTICS</b>					
$\text{V}_{\text{SD}}$	Diode forward voltage	$I_{\text{SD}} = 25 \text{ A}$ , $V_{\text{GS}} = 0 \text{ V}$	0.8	1	V
$\text{Q}_{\text{rr}}$	Reverse recovery charge	$V_{\text{DS}} = 30 \text{ V}$ , $I_F = 25 \text{ A}$ , $\text{di}/\text{dt} = 300 \text{ A}/\mu\text{s}$	139		nC
$t_{\text{rr}}$	Reverse recovery time		64		ns

### 5.2 Thermal Information

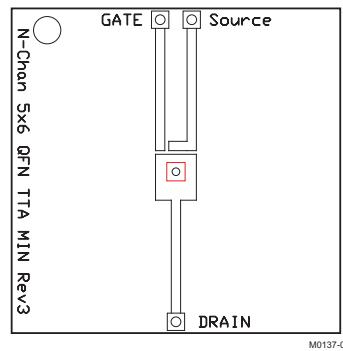
( $T_A = 25^\circ\text{C}$  unless otherwise stated)

THERMAL METRIC		MIN	TYP	MAX	UNIT
$\text{R}_{\theta\text{JC}}$		Junction-to-case thermal resistance <sup>(1)</sup>		0.8	$^\circ\text{C}/\text{W}$
$\text{R}_{\theta\text{JA}}$		Junction-to-ambient thermal resistance <sup>(1)(2)</sup>		50	$^\circ\text{C}/\text{W}$

(1)  $\text{R}_{\theta\text{JC}}$  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 inch  $\times$  1.5 inch (3.81 cm  $\times$  3.81 cm), 0.06 inch (1.52 mm) thick FR4 PCB.  $\text{R}_{\theta\text{JC}}$  is specified by design, whereas  $\text{R}_{\theta\text{JA}}$  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.



Max  $R_{\theta JA} = 50^{\circ}\text{C}/\text{W}$   
when mounted on  
1 inch<sup>2</sup> (6.45 cm<sup>2</sup>) of 2  
oz. (0.071 mm thick)  
Cu.



Max  $R_{\theta JA} = 125^{\circ}\text{C}/\text{W}$   
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)

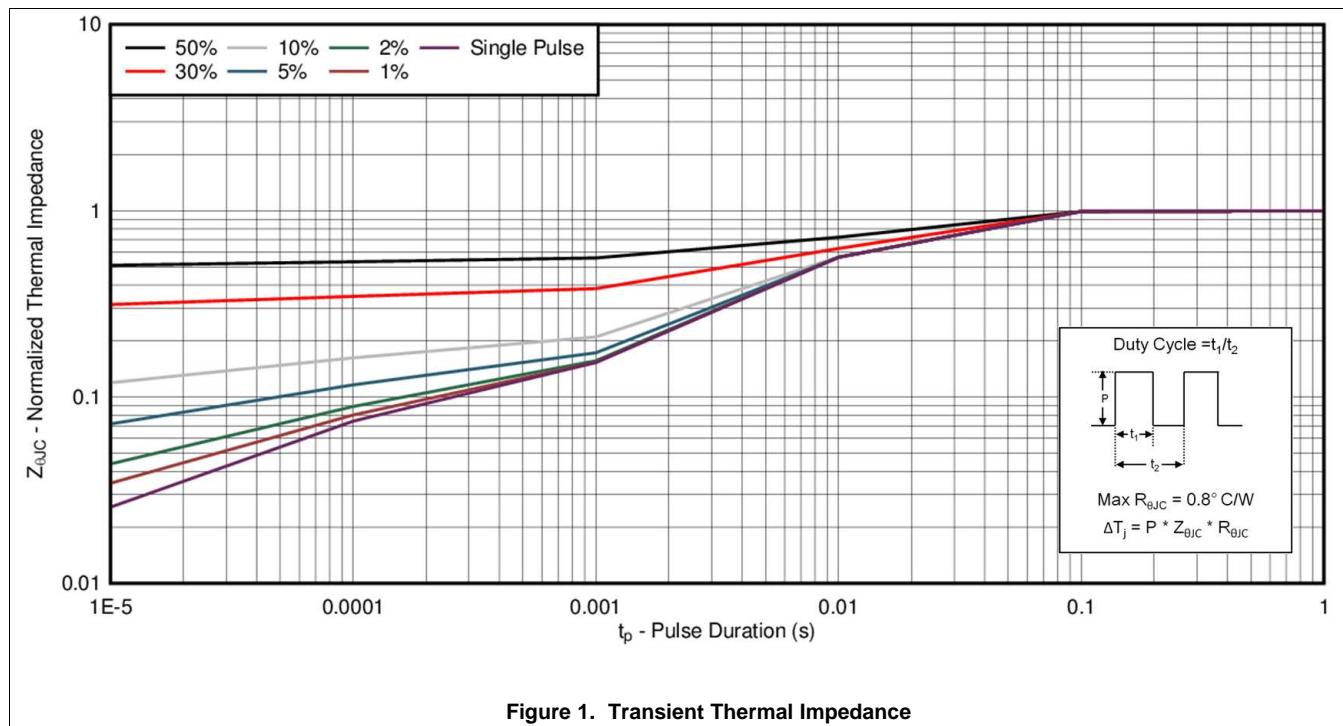
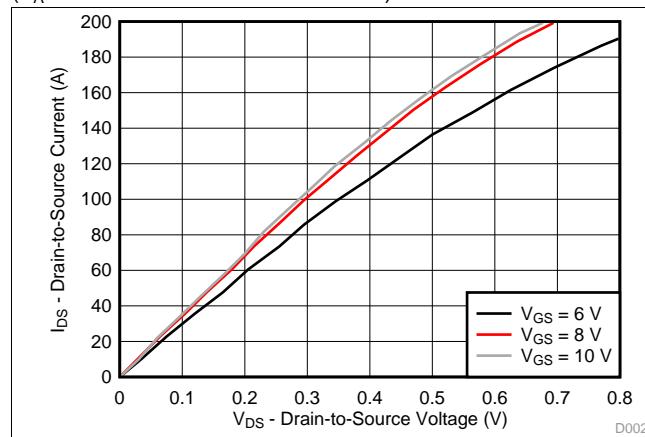


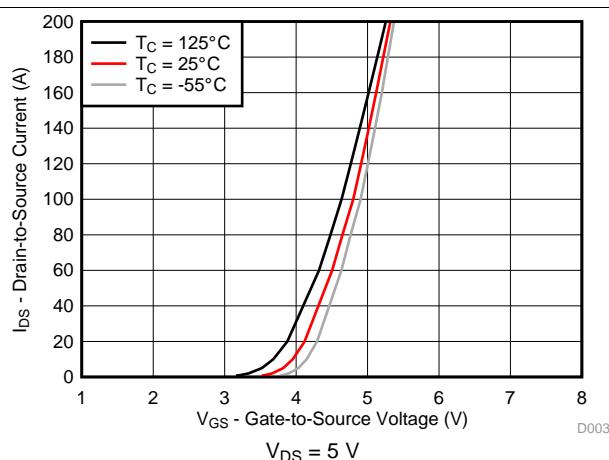
Figure 1. Transient Thermal Impedance

## Typical MOSFET Characteristics (continued)

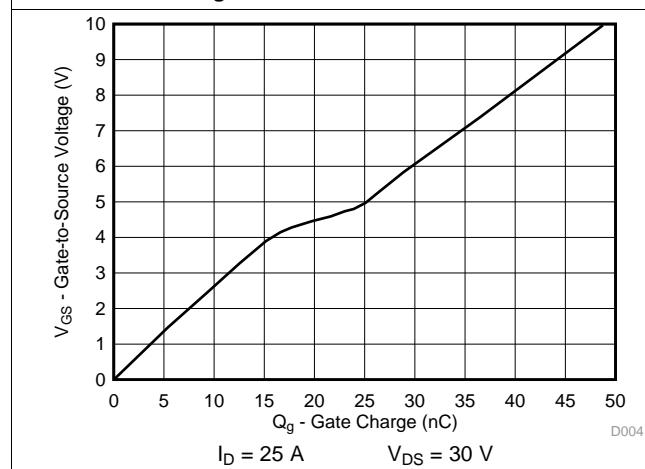
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



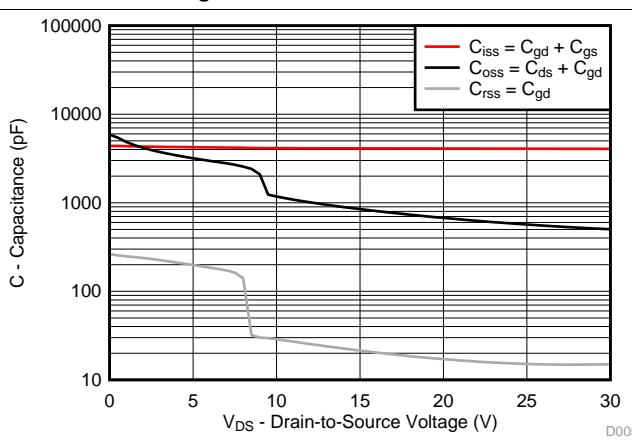
**Figure 2. Saturation Characteristics**



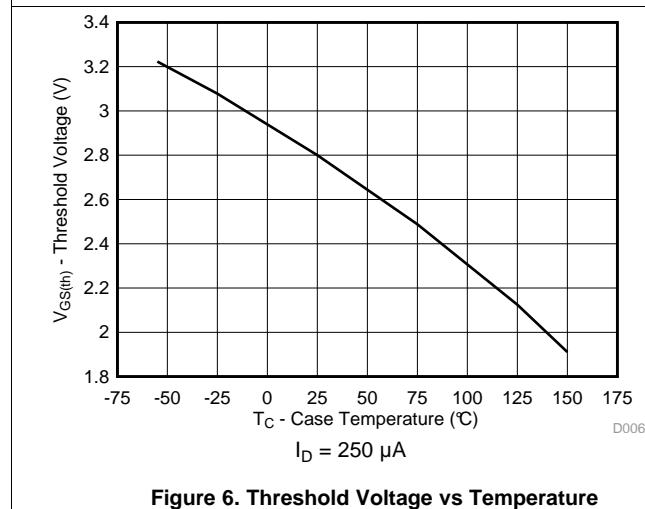
**Figure 3. Transfer Characteristics**



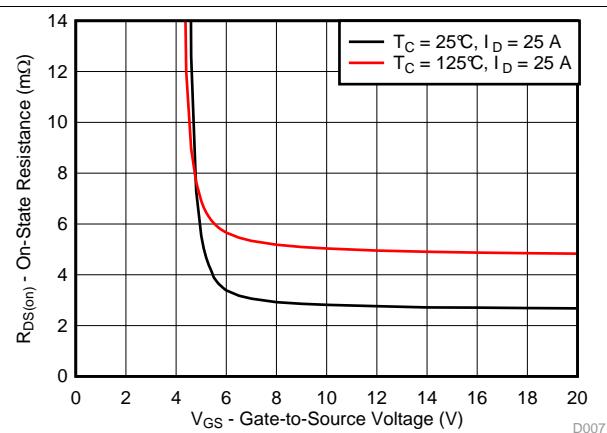
**Figure 4. Gate Charge**



**Figure 5. Capacitance**



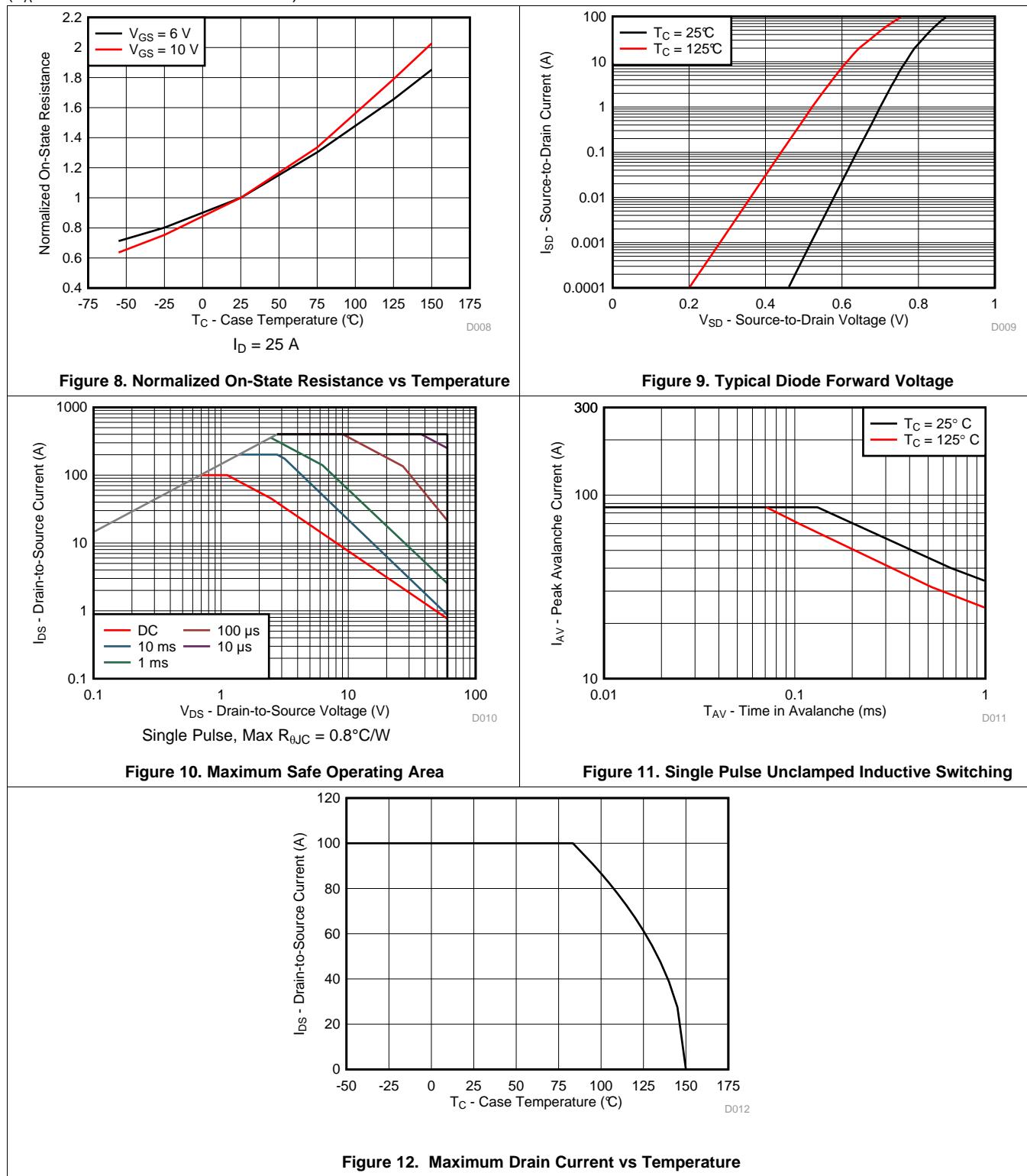
**Figure 6. Threshold Voltage vs Temperature**



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

## Typical MOSFET Characteristics (continued)

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



## 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](http://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](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.

### 6.3 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

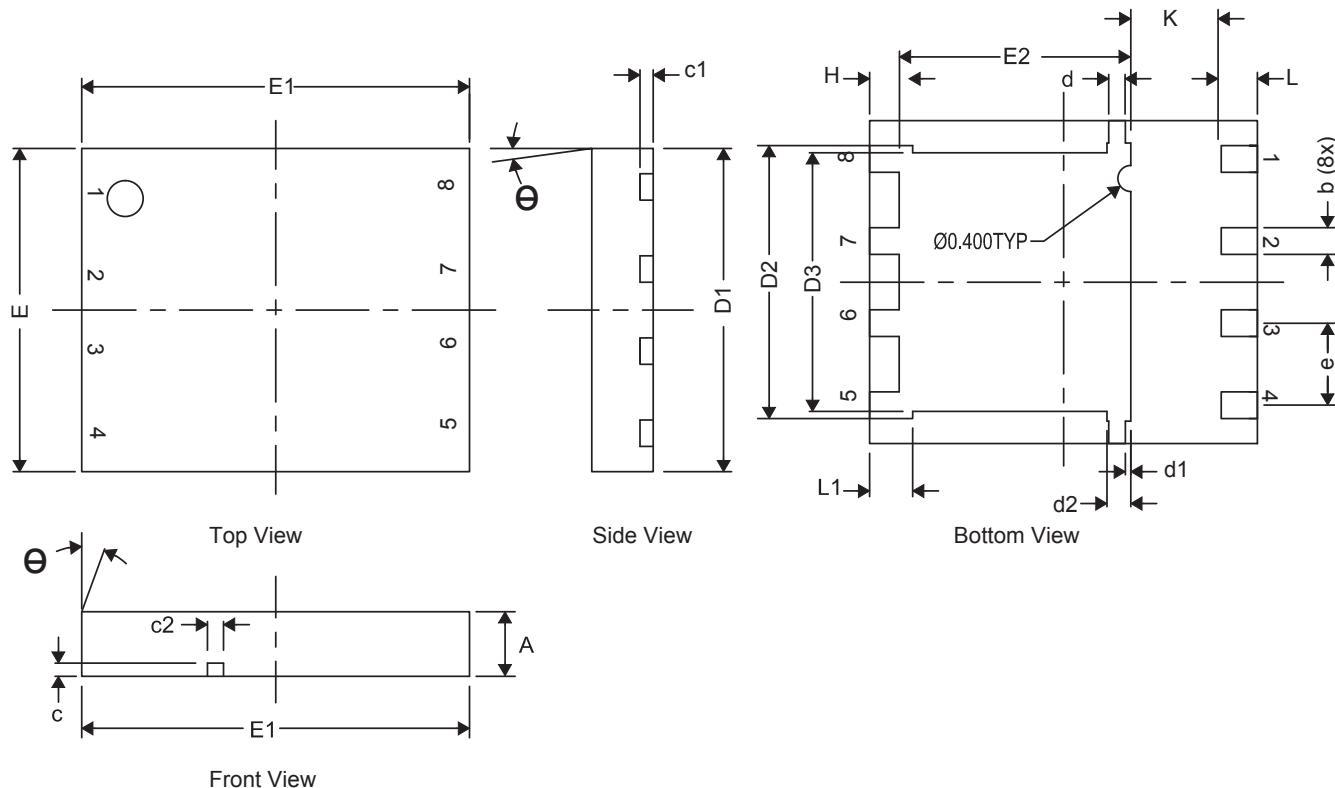
[SLYZ022 — TI Glossary](#).

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

## 7 Mechanical, Packaging, and Orderable Information

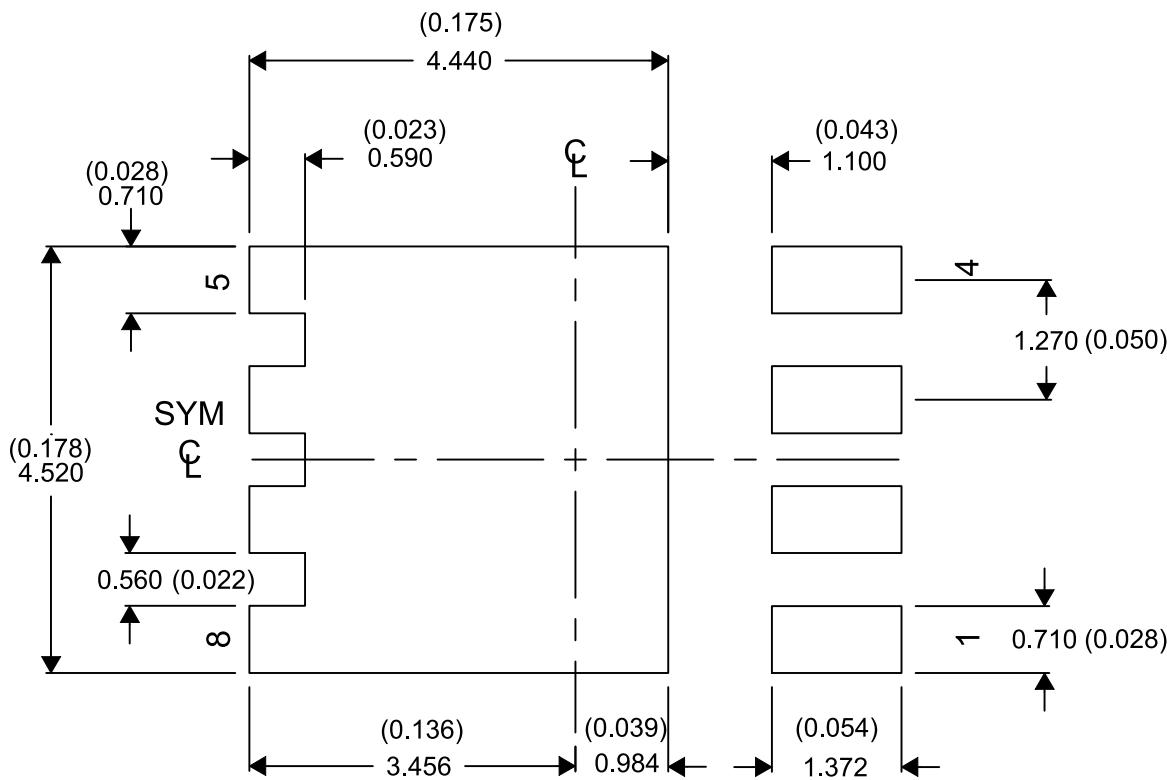
The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

### 7.1 Q5B Package Dimensions



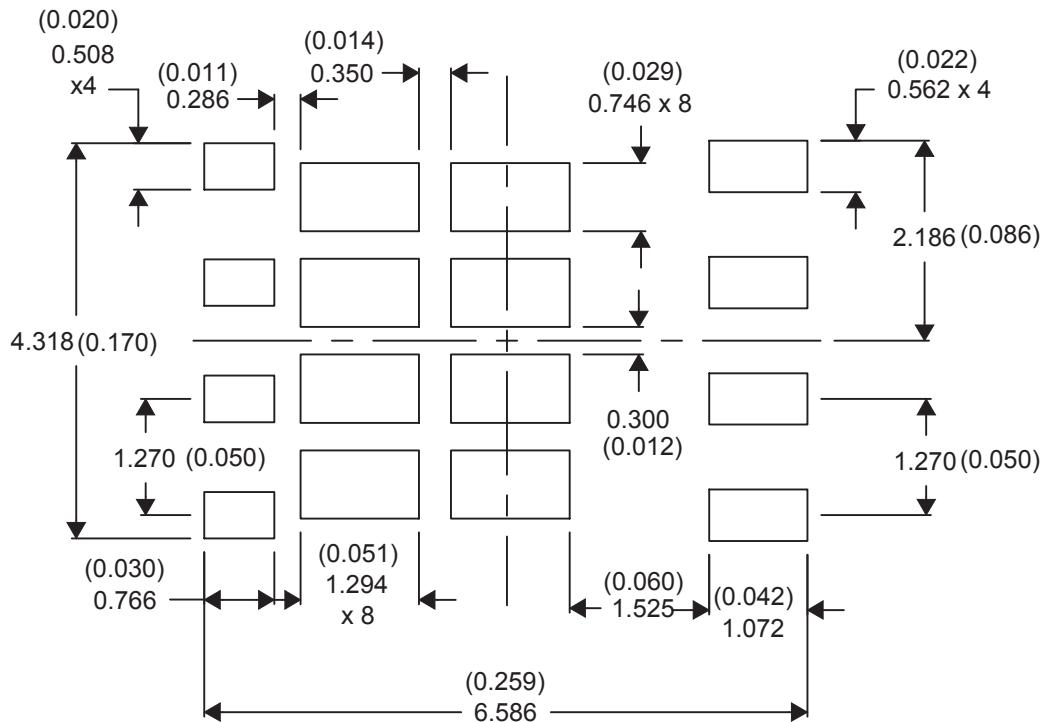
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.80	1.00	1.05
b	0.36	0.41	0.46
c	0.15	0.20	0.25
c1	0.15	0.20	0.25
c2	0.20	0.25	0.30
D1	4.90	5.00	5.10
D2	4.12	4.22	4.32
d	0.20	0.25	0.30
E	4.90	5.00	5.10
E1	5.90	6.00	6.10
E2	3.48	3.58	3.68
e	1.27 TYP		
L	0.46	0.56	0.66
$\theta$	0°	—	—
K	1.40 TYP		

## 7.2 Recommended PCB Pattern

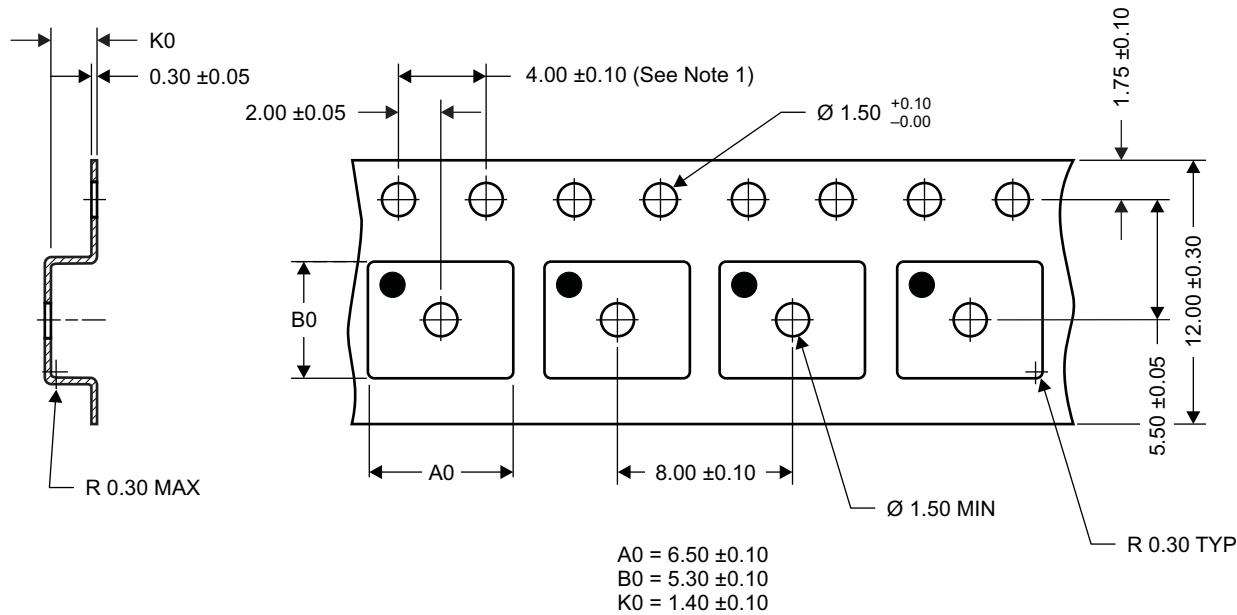


For recommended circuit layout for PCB designs, see application note [SLPA005 – Reducing Ringing Through PCB Layout Techniques](#).

## 7.3 Recommended Stencil Pattern



## 7.4 Q5B Tape and Reel Information



M0138-01

**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. A0 and B0 measured on a plane 0.3 mm above the bottom of the pocket

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CSD18532NQ5B	ACTIVE	VSON-CLIP	DNK	8	2500	Pb-Free (RoHS Exempt)	CU SN	Level-1-260C-UNLIM	-55 to 150	18532N	<b>Samples</b>
CSD18532NQ5BT	ACTIVE	VSON-CLIP	DNK	8	250	Pb-Free (RoHS Exempt)	CU SN	Level-1-260C-UNLIM	-55 to 150	18532N	<b>Samples</b>

(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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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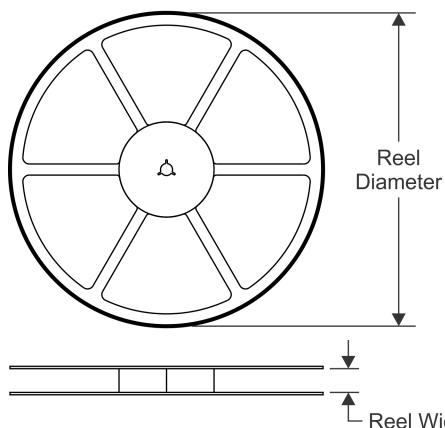
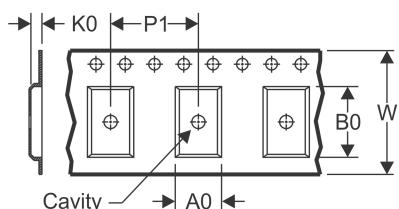


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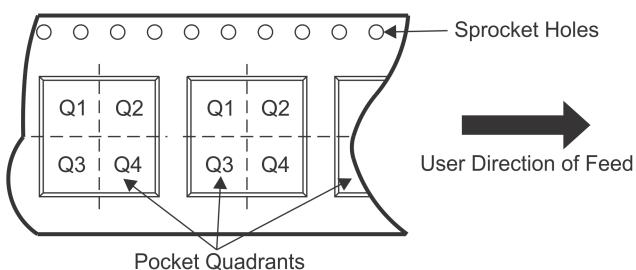
## PACKAGE OPTION ADDENDUM

17-May-2017

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**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*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
CSD18532NQ5B	VSON-CLIP	DNK	8	2500	330.0	12.8	6.5	5.3	1.4	8.0	12.0	Q1
CSD18532NQ5BT	VSON-CLIP	DNK	8	250	330.0	12.8	6.5	5.3	1.4	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)
CSD18532NQ5B	VSON-CLIP	DNK	8	2500	335.0	335.0	32.0
CSD18532NQ5BT	VSON-CLIP	DNK	8	250	335.0	335.0	32.0

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