CSD88539ND, Dual 60 V N-Channel NexFET™ Power MOSFETs

1 Features

- Ultra-Low Q_g and Q_{gd}
- Avalanche Rated
- Pb Free
- RoHS Compliant
- Halogen Free

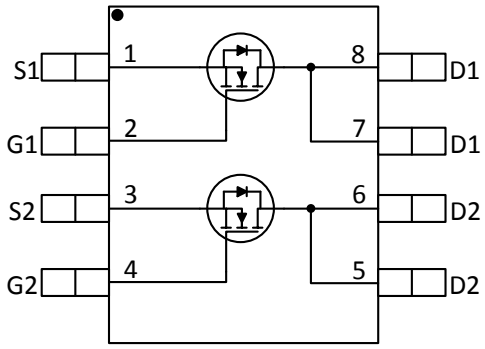
2 Applications

- Half Bridge for Motor Control
- Synchronous Buck Converter

3 Description

This dual SO-8, 60 V, 23 mΩ NexFET™ power MOSFET is designed to serve as a half bridge in low-current motor control applications.

Top View



Product Summary

T_A = 25°C		TYPICAL VALUE		UNIT
V_{DS}	Drain-to-Source Voltage	60		V
Q_g	Gate Charge Total (10 V)	7.2		nC
Q_{gd}	Gate Charge Gate to Drain	1.1		nC
$R_{DS(on)}$	Drain-to-Source On Resistance	V_{GS} = 6 V	27	mΩ
		V_{GS} = 10 V	23	mΩ
$V_{GS(th)}$	Threshold Voltage	3.0		V

Ordering Information

Device	Qty	Media	Package	Ship
CSD88539ND	2500	13-Inch Reel	SO-8 Plastic Package	Tape and Reel
CSD88539NDT	250	7-Inch Reel		

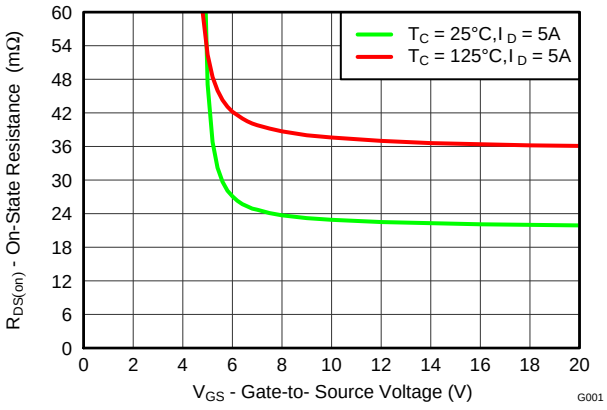
Absolute Maximum Ratings

T_A = 25°C		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage	60	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°C	11.7	
	Continuous Drain Current(1)	6.3	
I_{DM}	Pulsed Drain Current (2)	46	A
P_D	Power Dissipation(1)	2.1	W
T_J, T_{STG}	Operating Junction and Storage Temperature Range	–55 to 150	°C
E_{AS}	Avalanche Energy, single pulse I_D = 22 A, L = 0.1 mH, R_G = 25 Ω	24	mJ

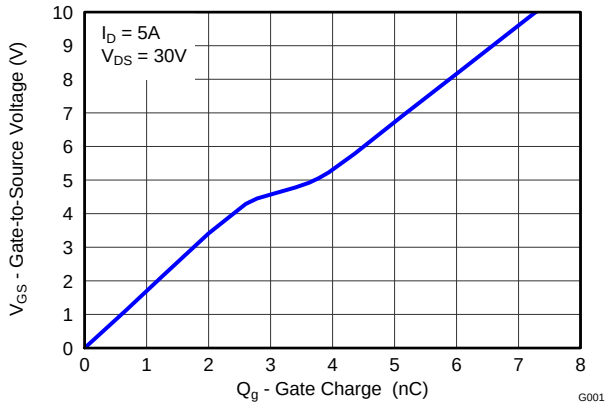
(1) Typical $R_{\theta JA}$ = 60°C/W on a 1-inch^2, 2-oz. Cu pad on a 0.06-inch thick FR4 PCB

(2) Pulse duration ≤ 300 µs, duty cycle ≤ 2%

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



Gate Charge



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.

4 Specifications

4.1 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	60			V
I_{DSS}	Drain-to-Source Leakage Current	V_{GS} = 0 V, V_{DS} = 48 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	2.6	3.0	3.6	V
$R_{DS(on)}$	Drain-to-Source On Resistance	V_{GS} = 6 V, I_D = 5 A		27	34	mΩ
		V_{GS} = 10 V, I_D = 5 A		23	28	mΩ
g_{fs}	Transconductance	V_{DS} = 30 V, I_D = 5 A		19		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 30 V, f = 1 MHz		570	741	pF
C_{oss}	Output Capacitance			70	91	pF
C_{rss}	Reverse Transfer Capacitance			2.0	2.6	pF
R_G	Series Gate Resistance			6.6	13.2	Ω
Q_g	Gate Charge Total (10 V)	V_{DS} = 30 V, I_D = 5 A		7.2	9.4	nC
Q_{gd}	Gate Charge Gate to Drain			1.1		nC
Q_{gs}	Gate Charge Gate to Source			2.7		nC
$Q_{g(th)}$	Gate Charge at V_{th}			1.8		nC
Q_{oss}	Output Charge	V_{DS} = 30 V, V_{GS} = 0 V		9.6		nC
$t_{d(on)}$	Turn On Delay Time	V_{DS} = 30 V, V_{GS} = 10 V, I_{DS} = 5 A, R_G = 0 Ω		5		ns
t_r	Rise Time			9		ns
$t_{d(off)}$	Turn Off Delay Time			14		ns
t_f	Fall Time			4		ns
Diode Characteristics						
V_{SD}	Diode Forward Voltage	I_{SD} = 5 A, V_{GS} = 0 V		0.8	1	V
Q_{rr}	Reverse Recovery Charge	V_{DS}= 30 V, I_F = 5A, di/dt = 300A/µs		37		nC
t_{rr}	Reverse Recovery Time			21		ns

4.2 Thermal Characteristics

(T_A = 25°C unless otherwise stated)

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JL}$	Junction-to-Lead Thermal Resistance(1)			20	°C/W
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance(1)(2)			75	°C/W

(1) $R_{\theta JC}$ is determined with the device mounted on a 1-inch^2 (6.45-cm^2), 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. $R_{\theta JC}$ is specified by design, whereas $R_{\theta JA}$ is determined by the user's board design.
(2) Device mounted on FR4 material with 1-inch^2 (6.45-cm^2), 2-oz. (0.071-mm thick) Cu.

Copyright © 2014, Texas Instruments Incorporated

4.3 Typical MOSFET Characteristics

(T_A = 25°C unless otherwise stated)

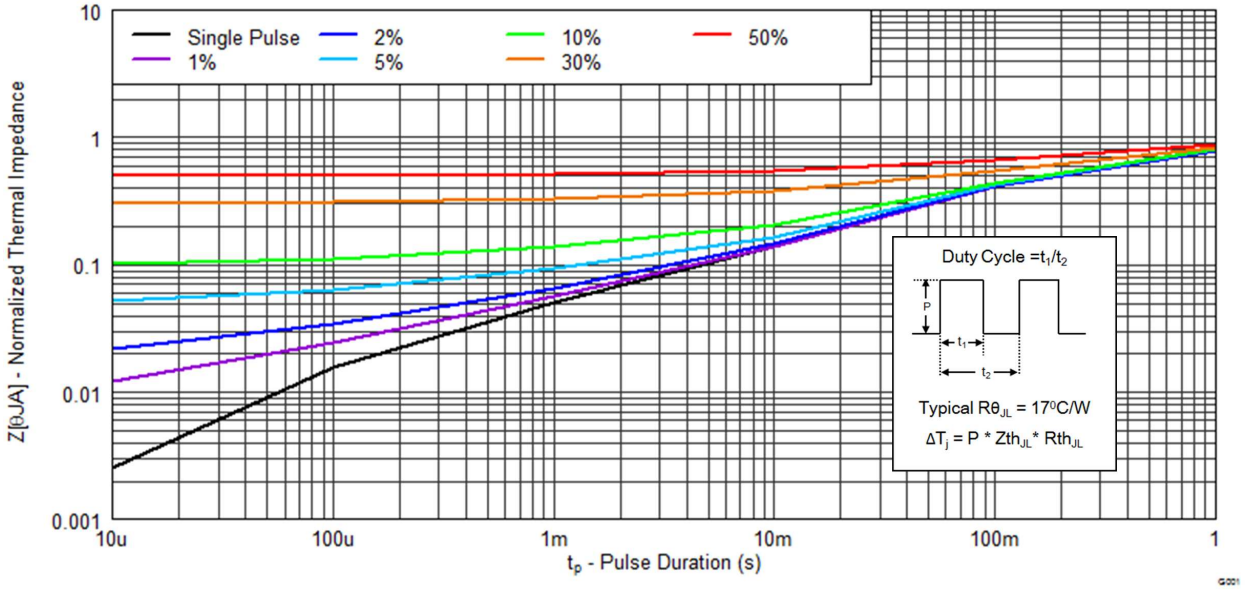


Figure 1. Transient Thermal Impedance

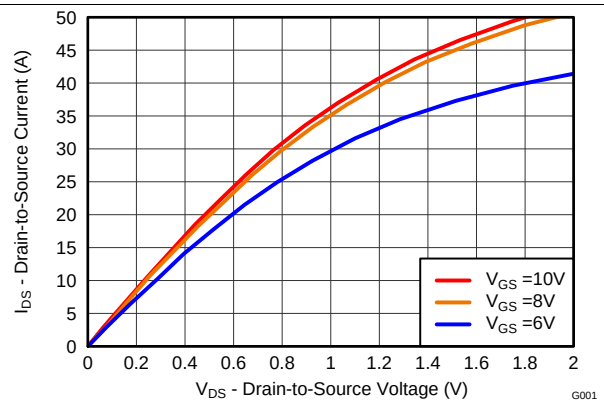


Figure 2. Saturation Characteristics

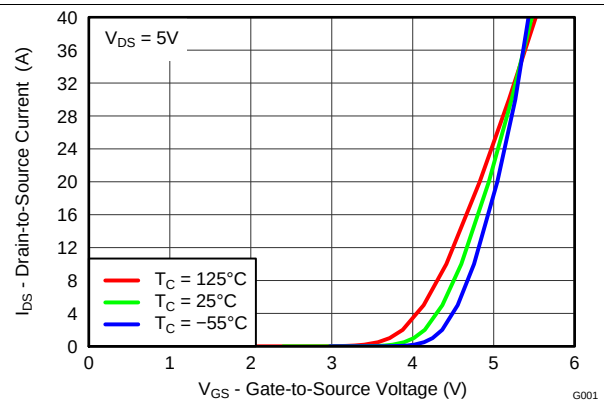


Figure 3. Transfer Characteristics

Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

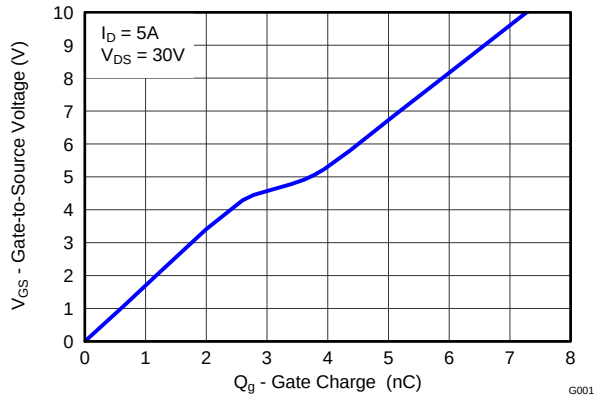


Figure 4. Gate Charge

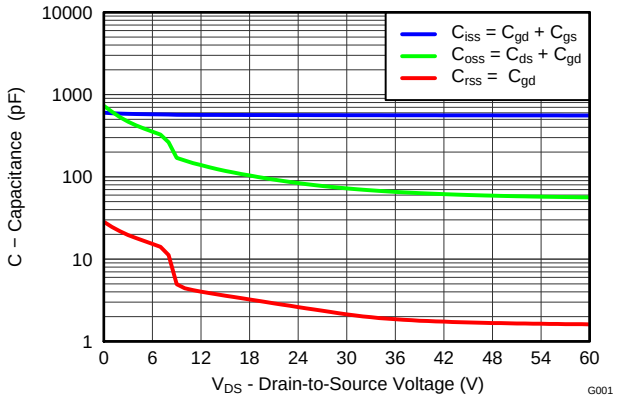


Figure 5. Capacitance

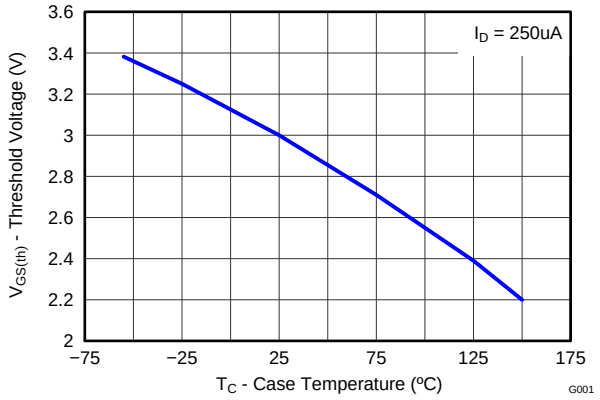


Figure 6. Threshold Voltage vs Temperature

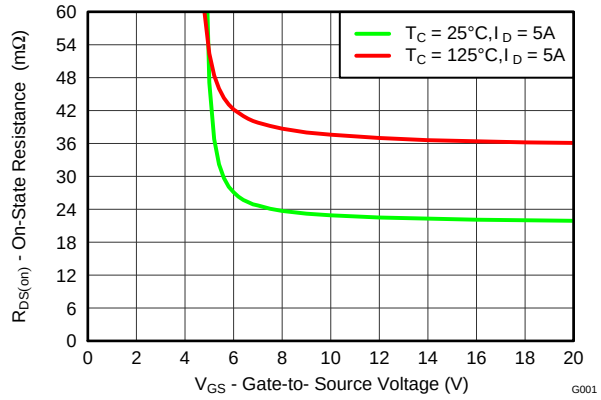


Figure 7. On-State Resistance vs Gate-to-Source Voltage

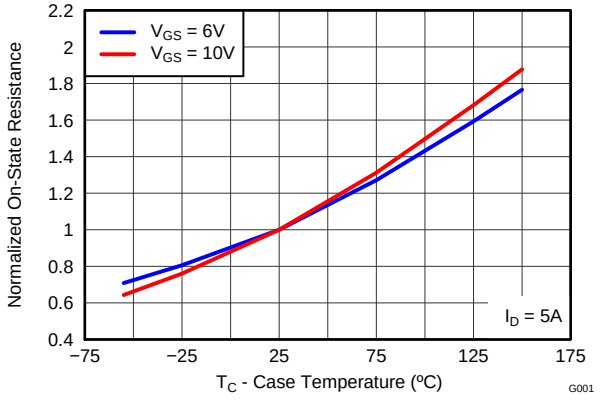


Figure 8. Normalized On-State Resistance vs Temperature

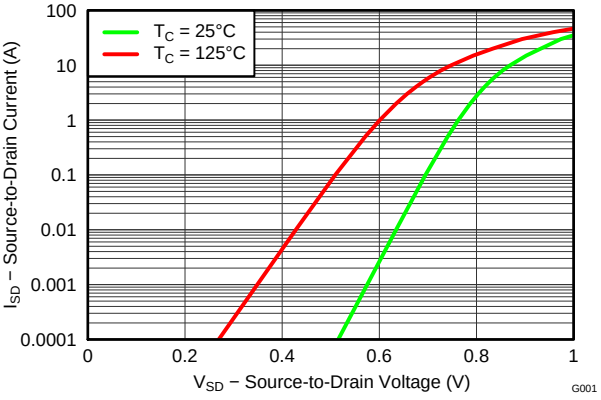


Figure 9. Typical Diode Forward Voltage

Copyright © 2014, Texas Instruments Incorporated

Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

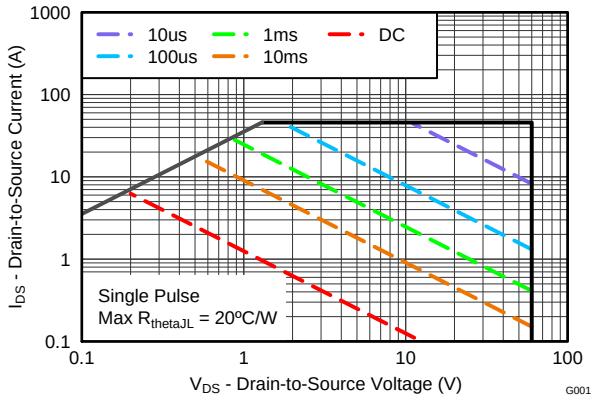


Figure 10. Maximum Safe Operating Area

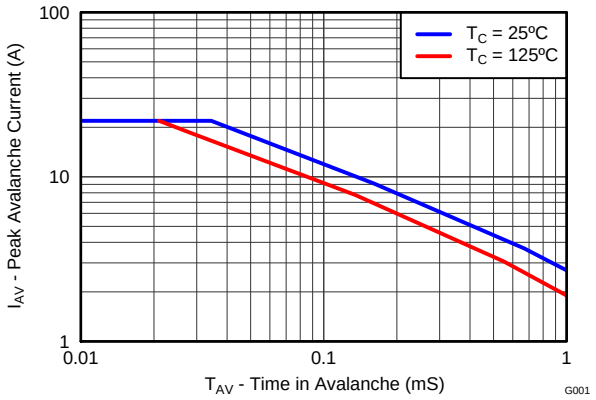


Figure 11. Single Pulse Unclamped Inductive Switching

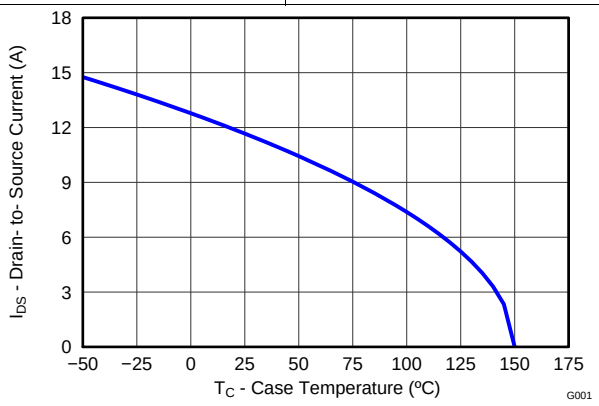
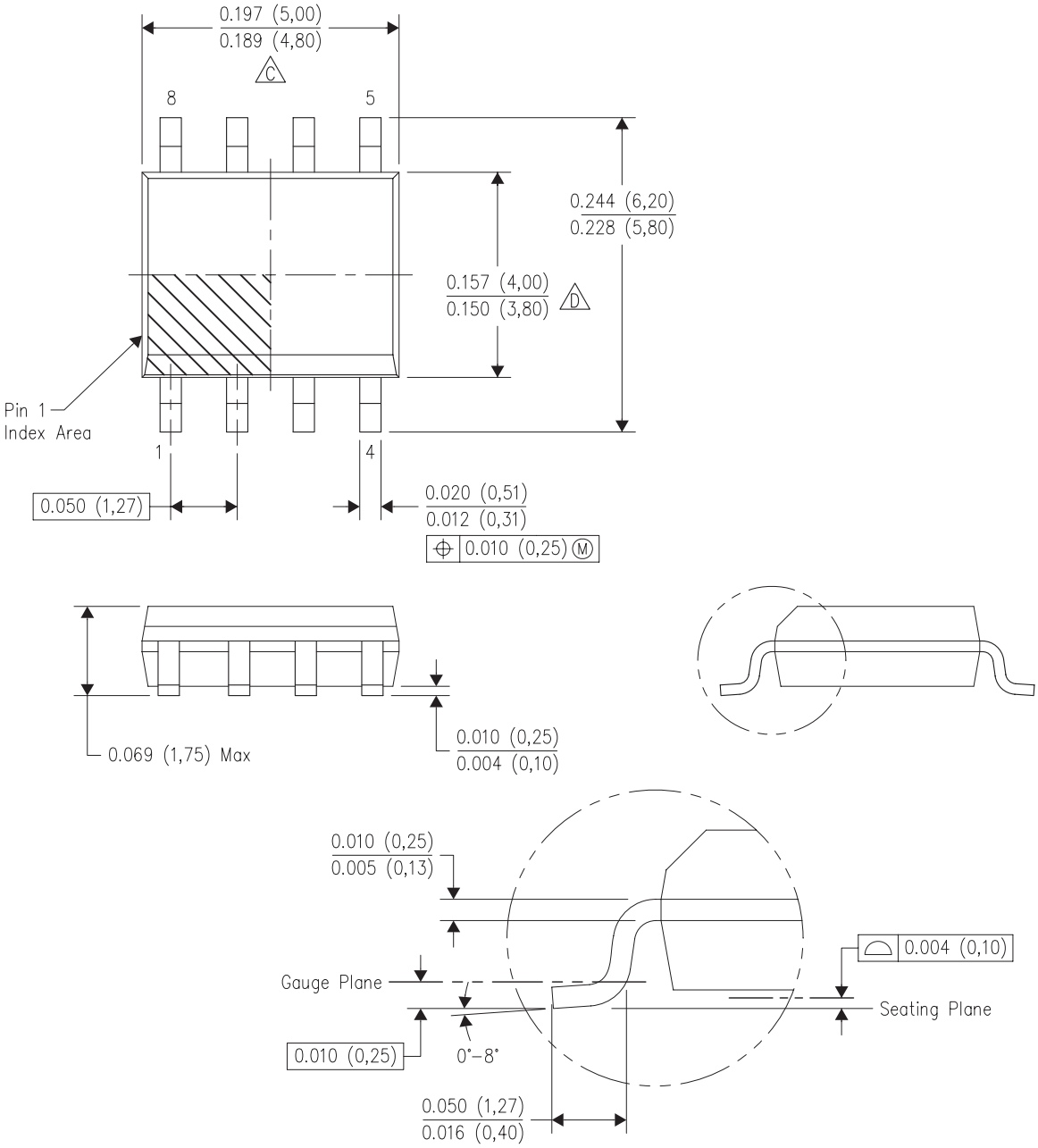


Figure 12. Maximum Drain Current vs Temperature

5 Mechanical Data

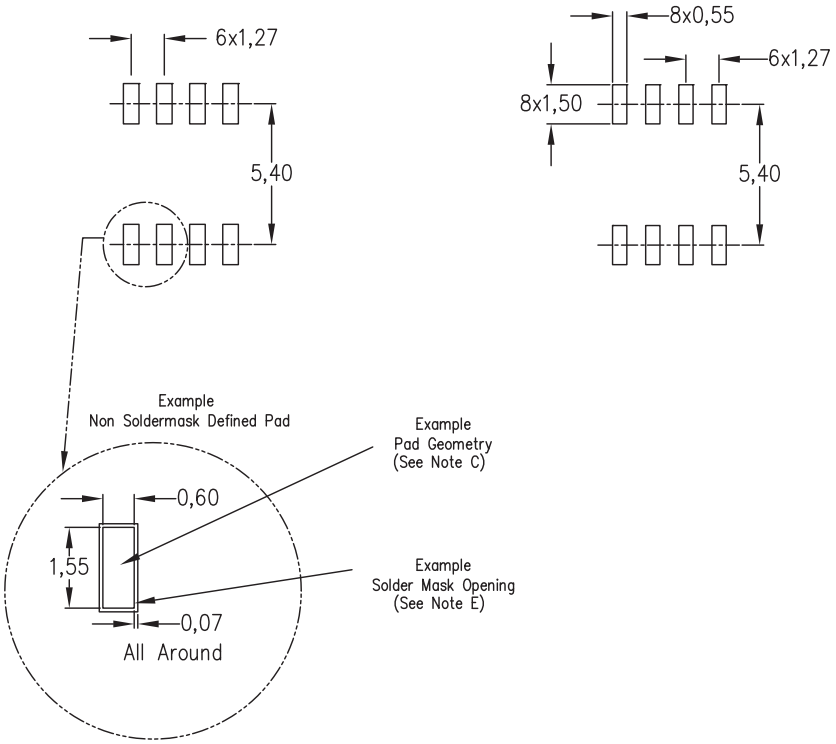
5.1 SO-8 Package Dimensions



1. All linear dimensions are in inches (millimeters).
2. This drawing is subject to change without notice.
3. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
4. Body width does not include interlead flash. Interlead flas shall not exceed 0.017 (0,43) each side.
5. Reference JEDEC MS-012 variation AA.

Copyright © 2014, Texas Instruments Incorporated

5.2 Recommended PCB Pattern and Stencil Opening



1. All linear dimensions are in millimeters.
2. This drawing is subject to change without notice.
3. Publication IPC-7351 is recommended for alternate designs.
4. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
5. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

Copyright © 2014, Texas Instruments Incorporated

6 Device and Documentation Support

6.1 Trademarks

NexFET is a trademark of Texas Instruments.

6.2 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.

Copyright © 2014, Texas Instruments Incorporated

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
CSD88539ND	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-55 to 150	88539N	Samples
CSD88539NDT	ACTIVE	SOIC	D	8	250	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-55 to 150	88539N	Samples

(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.

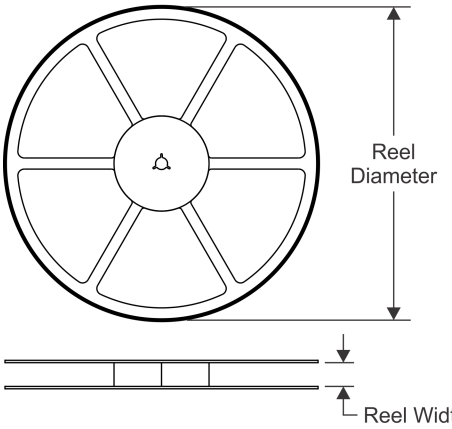
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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.

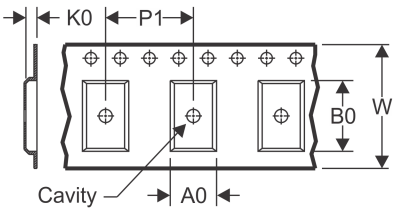
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

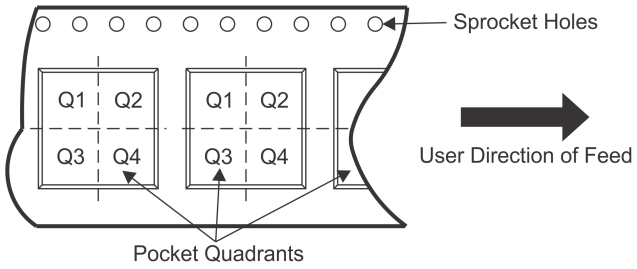


TAPE DIMENSIONS



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

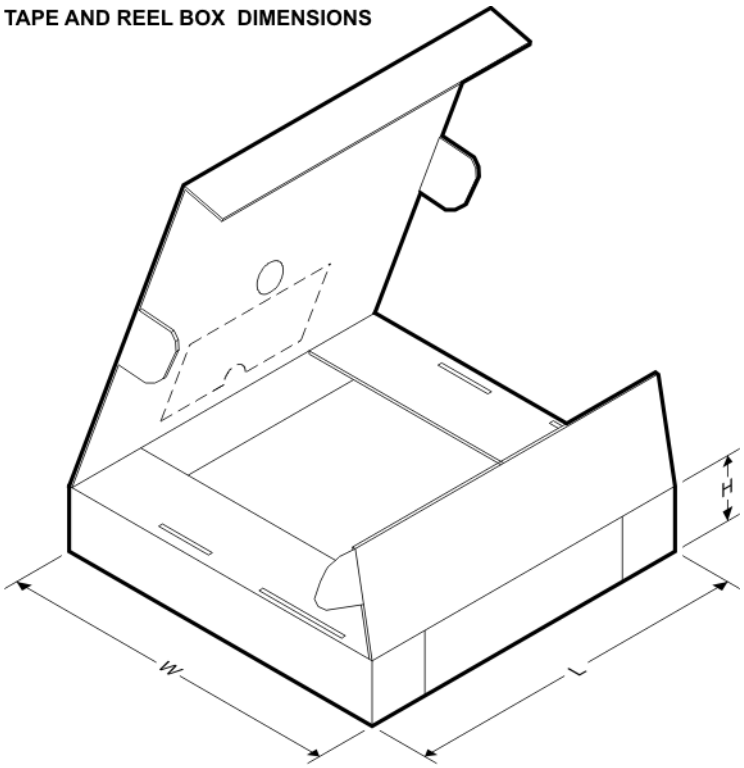
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
CSD88539ND	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
CSD88539NDT	SOIC	D	8	250	178.0	12.4	6.4	5.2	2.1	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)
CSD88539ND	SOIC	D	8	2500	336.6	336.6	41.3
CSD88539NDT	SOIC	D	8	250	210.0	210.0	52.0

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale (www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2020, Texas Instruments Incorporated