30V N-Channel NexFET™ Power MOSFETs

Check for Samples: CSD17556Q5B

FEATURES

- **Extremely Low Resistance**
- **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**

APPLICATIONS

- **Point-of-Load Synchronous Buck in Networking, Telecom, and Computing Systems**
- **Synchronous Rectification**
- **Active ORing and Hotswap Applications**

DESCRIPTION

The NexFET™ power MOSFET has been designed to minimize losses in synchronous rectification and other power conversion applications.

PRODUCT SUMMARY

T_A = 25°C unless otherwise stated		TYPICAL VALUE		UNIT
V_{DS}	Drain to Source Voltage	30		V
Q_g	Gate Charge Total (4.5V)	30		nC
Q_{gd}	Gate Charge Gate to Drain	7.5		nC
$R_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 4.5V	1.5	mΩ
		V_{GS} = 10V	1.2	mΩ
$V_{GS(th)}$	Threshold Voltage	1.4		V

ORDERING INFORMATION

Device	Package	Media	Qty	Ship
CSD17556Q5B	SON 5-mm × 6-mm Plastic Package	13-Inch Reel	2500	Tape and Reel

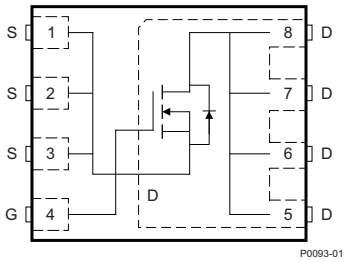
ABSOLUTE MAXIMUM RATINGS

T_A = 25°C unless otherwise stated		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), T_C = 25°C	100	A
	Continuous Drain Current (Silicon limited), T_C = 25°C	215	
	Continuous Drain Current(1)	34	A
I_{DM}	Pulsed Drain Current, T_A = 25°C(1)(2)	214	A
P_D	Power Dissipation(1)	3.1	W
T_J, T_{STG}	Operating Junction and Storage Temperature Range	–55 to 150	°C
E_{AS}	Avalanche Energy, single pulse I_D = 100A, L = 0.1mH, R_G = 25Ω	500	mJ

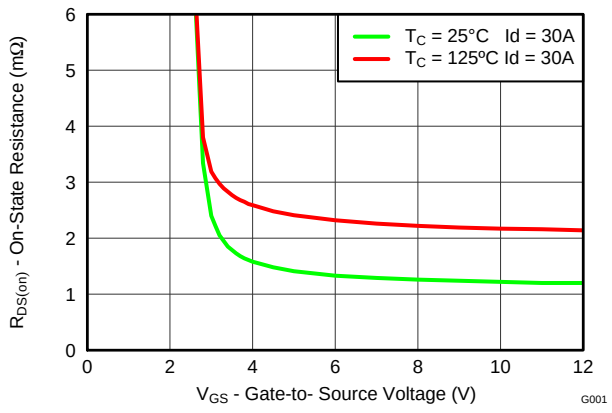
(1) Typical $R_{\theta JA}$ = 42°C/W on 1-inch^2 (6.45-cm^2), 2-oz. (0.071-mm thick) Cu pad on a 0.06-inch (1.52-mm) thick FR4 PCB.

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

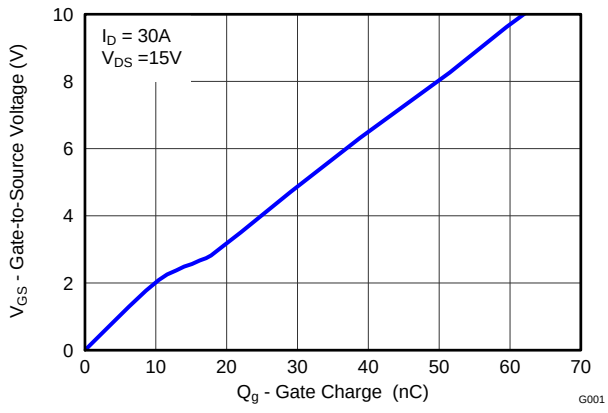
Top View



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



GATE CHARGE



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

NexFET is a trademark of Texas Instruments.

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.

ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

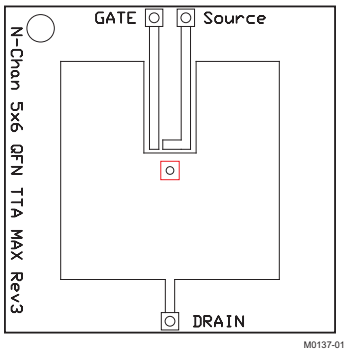
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics						
BV_{DSS}	Drain to Source Voltage	V_{GS} = 0V, I_{DS} = 250μA	30			V
I_{DSS}	Drain to Source Leakage Current	V_{GS} = 0V, V_{DS} = 24V			1	μA
I_{GSS}	Gate to Source Leakage Current	V_{DS} = 0V, V_{GS} = 20V			100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{DS} = V_{GS}, I_{DS} = 250μA	1.15	1.4	1.65	V
$R_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 4.5V, I_{DS} = 40A		1.5	1.8	mΩ
		V_{GS} = 10V, I_{DS} = 40A		1.2	1.4	mΩ
g_{fs}	Transconductance	V_{DS} = 15V, I_{DS} = 40A		197		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DS} = 15V, f = 1MHz		5400	7020	pF
C_{oss}	Output Capacitance			1770	2310	pF
C_{rss}	Reverse Transfer Capacitance			68	88	pF
R_G	Series Gate Resistance			0.7	1.4	Ω
Q_g	Gate Charge Total (4.5V)	V_{DS} = 15V, I_{DS} = 40A		30	39	nC
Q_{gd}	Gate Charge Gate to Drain			7.5		nC
Q_{gs}	Gate Charge Gate to Source			11		nC
$Q_{g(th)}$	Gate Charge at Vth			6.1		nC
Q_{oss}	Output Charge	V_{DS} = 15V, V_{GS} = 0V		48		nC
$t_{d(on)}$	Turn On Delay Time	V_{DS} = 15V, V_{GS} = 4.5V, I_{DS} = 40A,R_G = 2Ω		14		ns
t_r	Rise Time			26		ns
$t_{d(off)}$	Turn Off Delay Time			27		ns
t_f	Fall Time			12		ns
Diode Characteristics						
V_{SD}	Diode Forward Voltage	I_{SD} = 40A, V_{GS} = 0V		0.8	1	V
Q_{rr}	Reverse Recovery Charge	V_{DD}= 15V, I_F = 40A, di/dt = 300A/μs		68		nC
t_{rr}	Reverse Recovery Time			36		ns

THERMAL CHARACTERISTICS

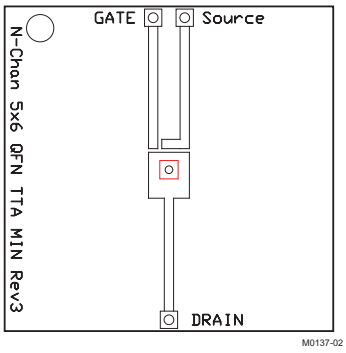
(T_A = 25°C unless otherwise stated)

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Thermal Resistance Junction to Case(1)			1.3	°C/W
$R_{\theta JA}$	Thermal Resistance Junction to Ambient(1)(2)			50	°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.



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



Max $R_{\theta JA}$ = 125°C/W when mounted on a minimum pad area of 2-oz. (0.071-mm thick) Cu.

TYPICAL MOSFET CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

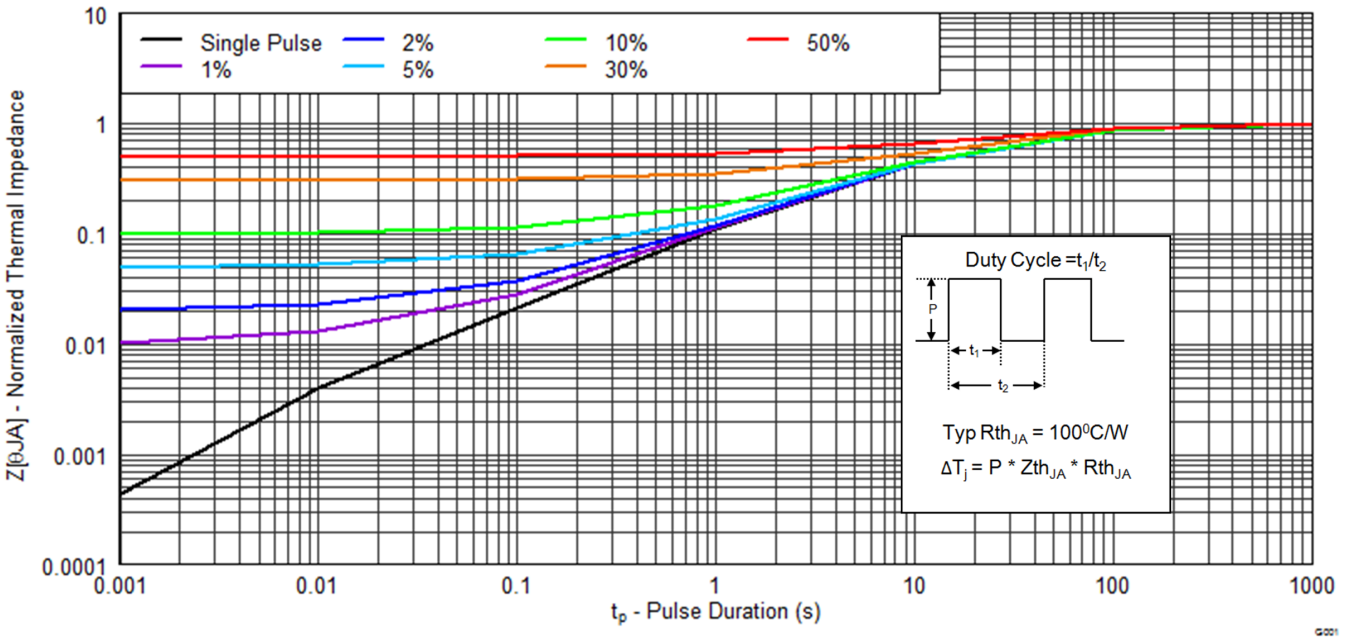


Figure 1. Transient Thermal Impedance

TYPICAL MOSFET CHARACTERISTICS (continued)

(T_A = 25°C unless otherwise stated)

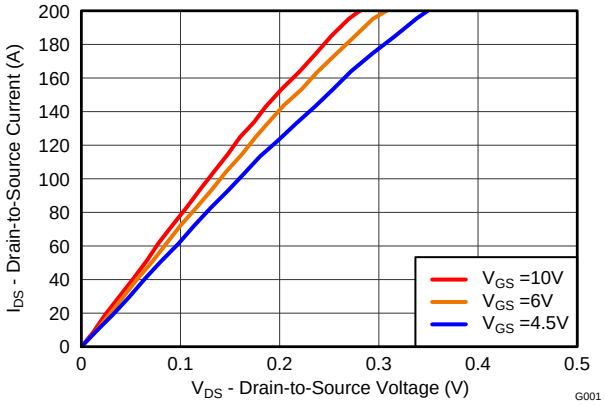


Figure 2. Saturation Characteristics

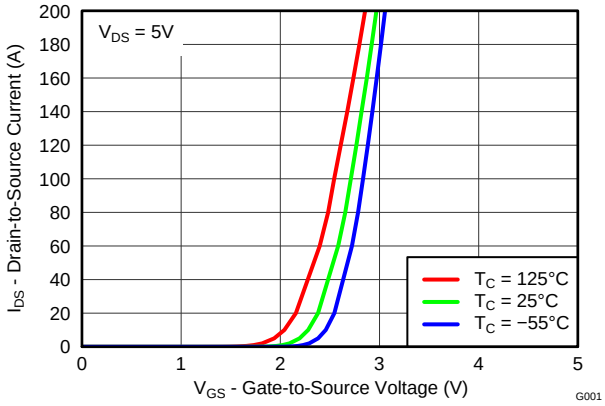


Figure 3. Transfer Characteristics

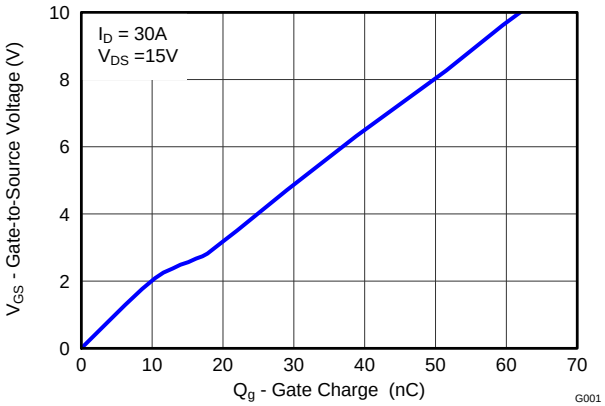


Figure 4. Gate Charge

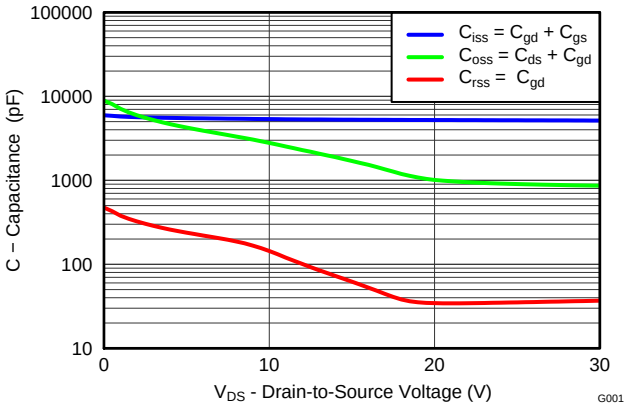


Figure 5. Capacitance

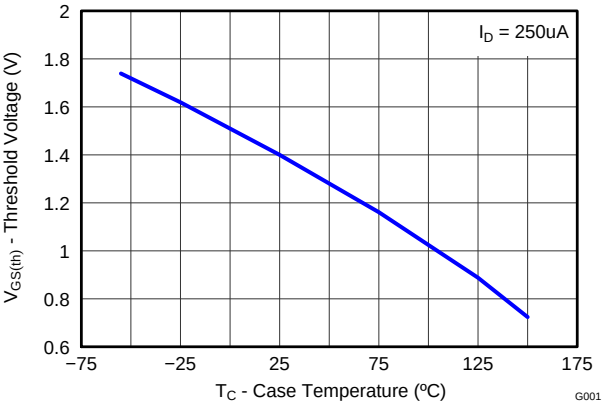


Figure 6. Threshold Voltage vs. Temperature

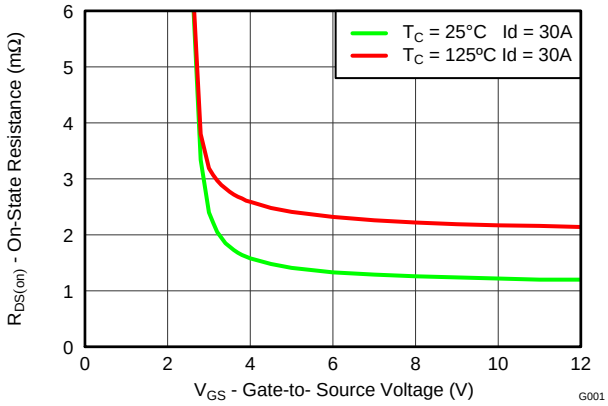


Figure 7. On-State Resistance vs. Gate-to-Source Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

(T_A = 25°C unless otherwise stated)

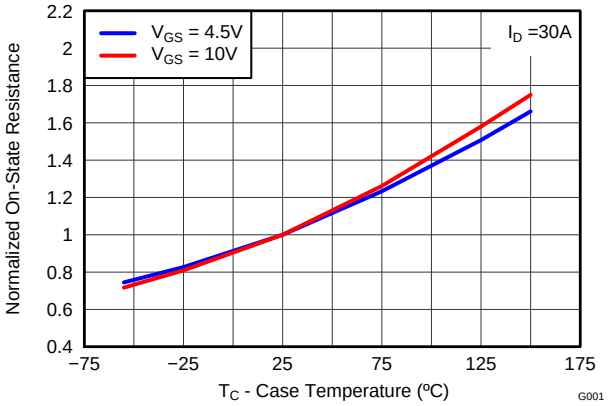


Figure 8. Normalized On-State Resistance vs. Temperature

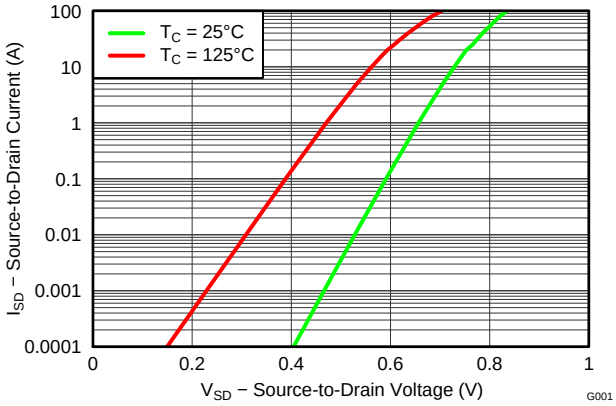


Figure 9. Typical Diode Forward Voltage

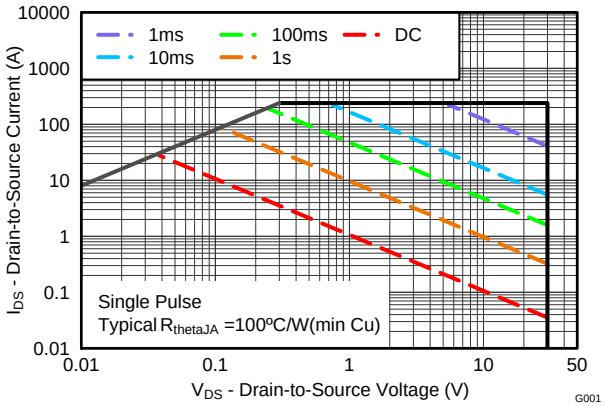


Figure 10. Maximum Safe Operating Area

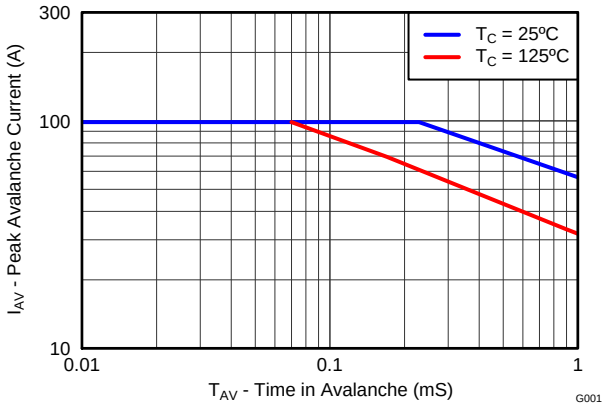


Figure 11. Single Pulse Unclamped Inductive Switching

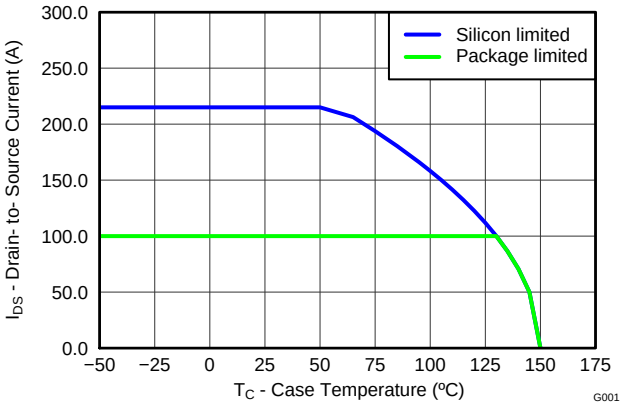
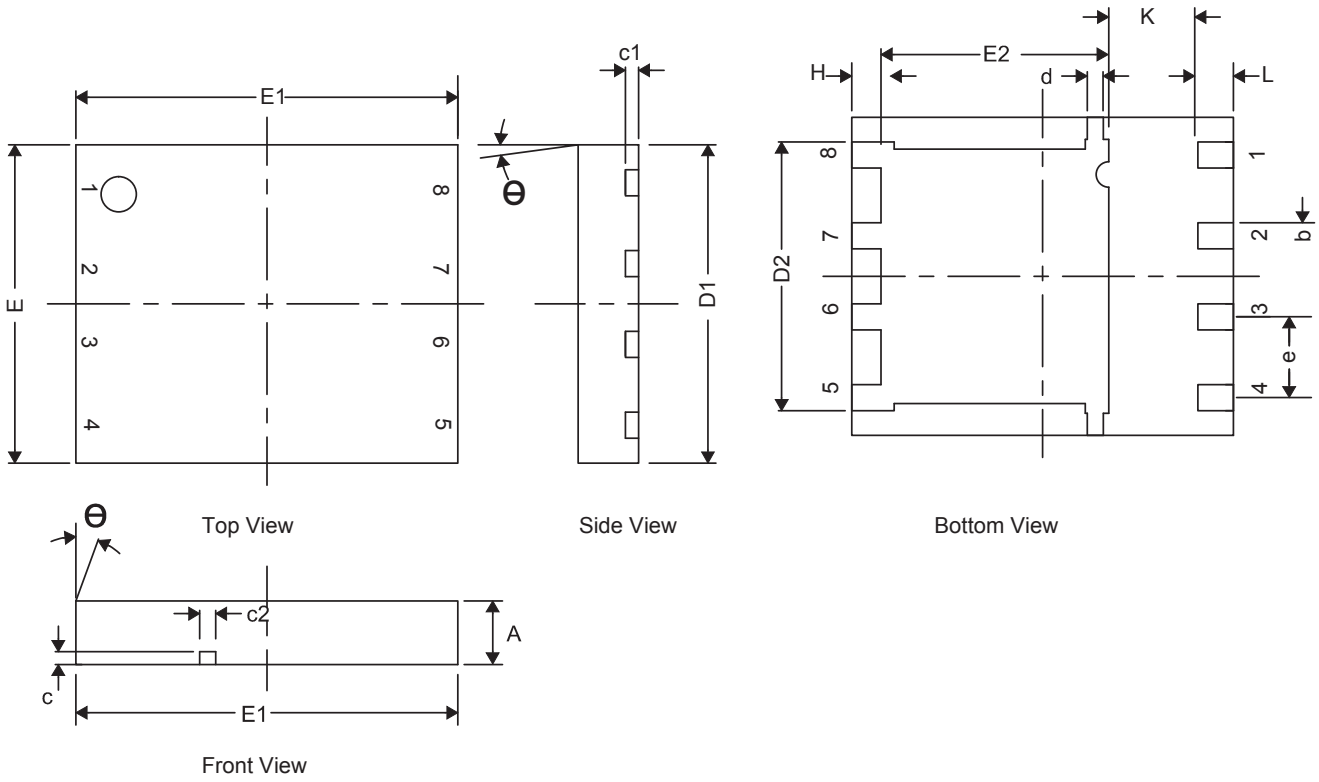


Figure 12. Maximum Drain Current vs. Temperature

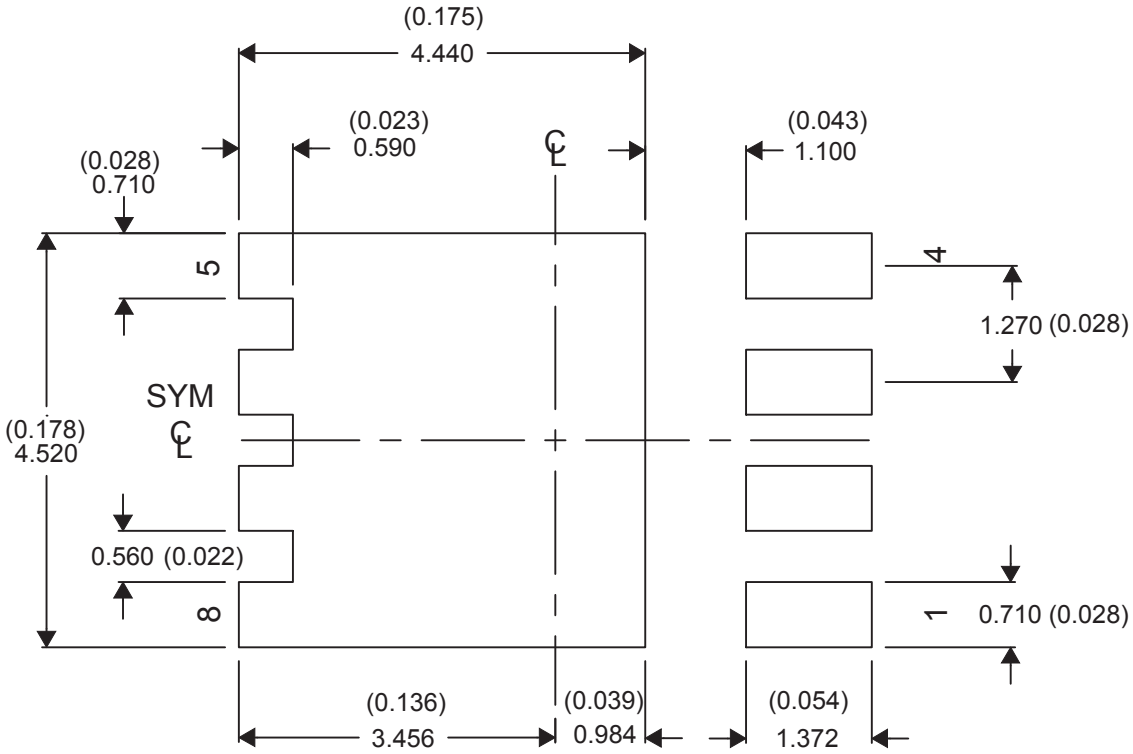
MECHANICAL DATA

Q5B Package Dimensions



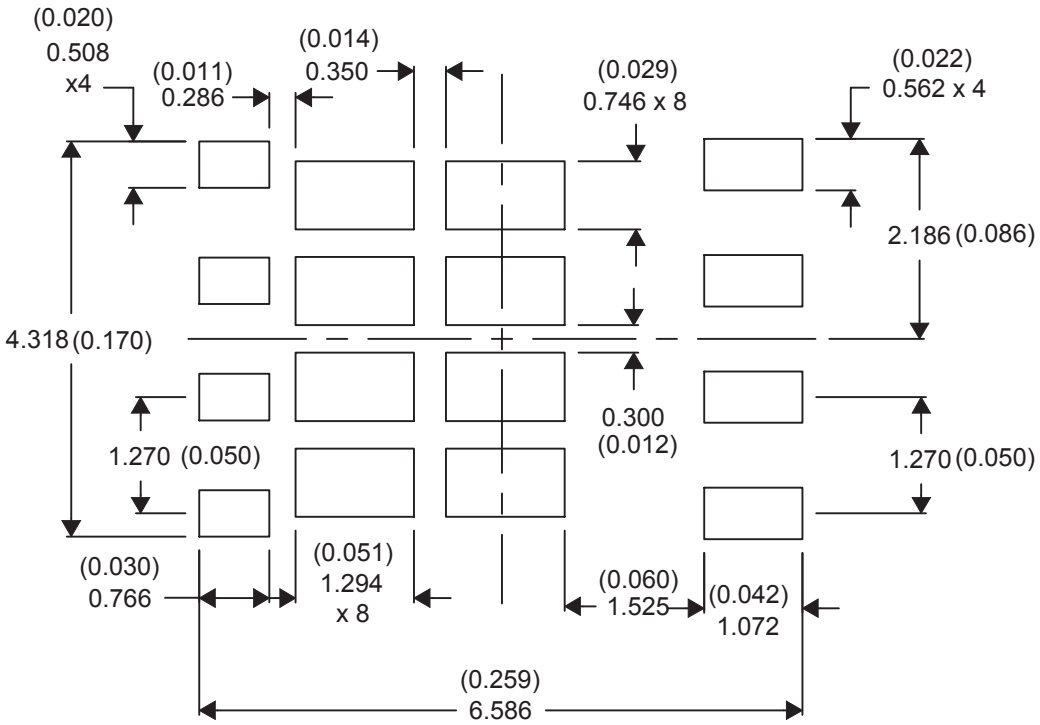
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.80	1.00	1.05
b	0.36	0.41	0.46
c	0.15	0.20	0.25
c1	0.15	0.20	0.25
c2	0.20	0.25	0.30
D1	4.90	5.00	5.10
D2	4.12	4.22	4.32
d	0.20	0.25	0.30
E	4.90	5.00	5.10
E1	5.90	6.00	6.10
E2	3.48	3.58	3.68
e	1.27 TYP		
H	0.360	0.460	0.560
L	0.46	0.56	0.66
θ	0°	-	-
K	1.40 TYP		

Recommended PCB Pattern

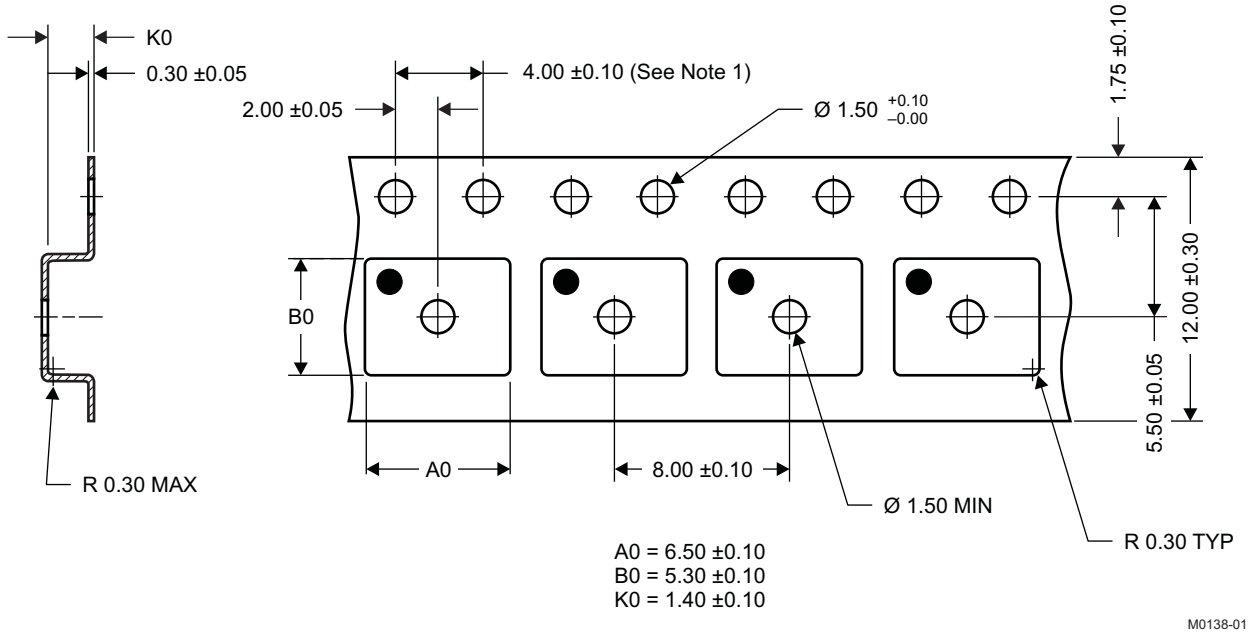


For recommended circuit layout for PCB designs, see application note SLPA005 – *Reducing Ringing Through PCB Layout Techniques*.

Recommended Stencil Pattern



Q5B Tape and Reel Information



Notes:

1. 10-sprocket hole-pitch cumulative tolerance ±0.2
2. Camber not to exceed 1mm in 100mm, noncumulative over 250mm
3. Material: black static-dissipative polystyrene
4. All dimensions are in mm (unless otherwise specified)
5. A0 and B0 measured on a plane 0.3mm above the bottom of the pocket

REVISION HISTORY

Changes from Original (March 2013) to Revision A	Page
• Updated the Dimensions table in the Mechanical Data Section to include DIM "H" values	6

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CSD17556Q5B	ACTIVE	VSON	DNK	8	2500	Pb-Free (RoHS Exempt)	CU SN	Level-1-260C-UNLIM	-55 to 150	CSD17556	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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

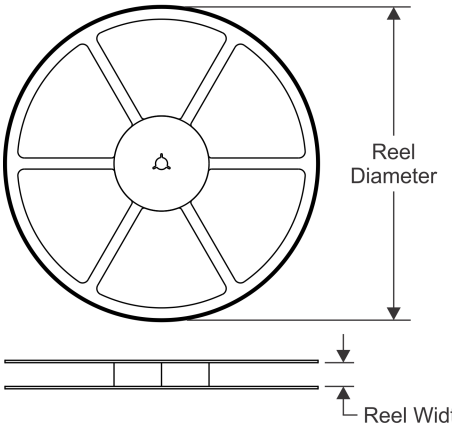
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

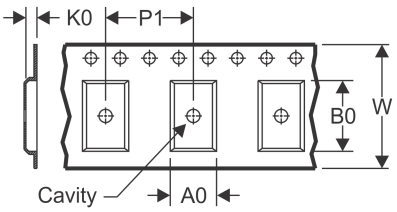
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

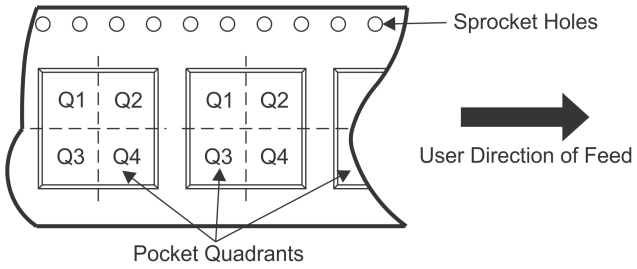


TAPE DIMENSIONS



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

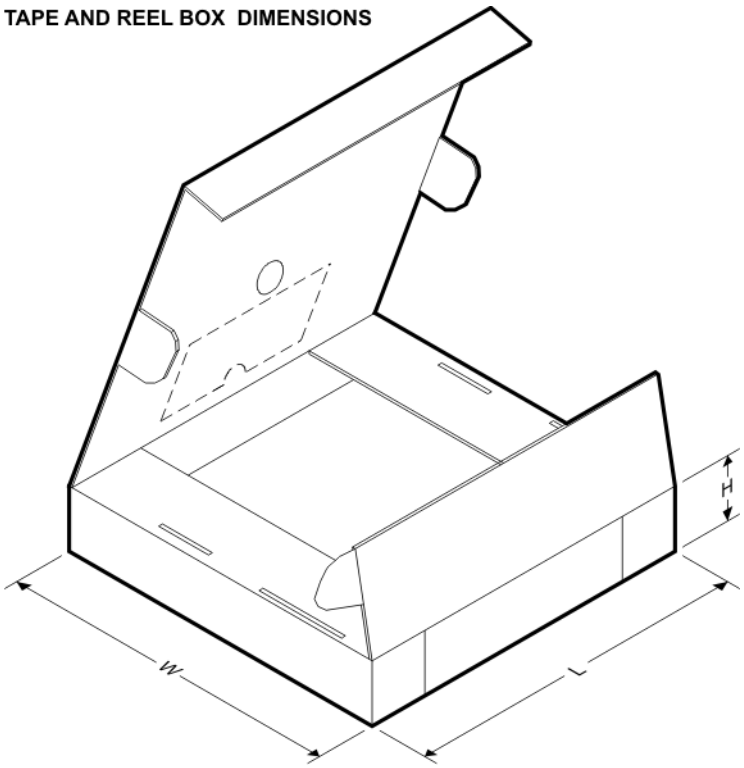
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
CSD17556Q5B	VSON	DNK	8	2500	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)
CSD17556Q5B	VSON	DNK	8	2500	335.0	335.0	32.0

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TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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