60V N-Channel NexFET™ Power MOSFETs

Check for Samples: CSD18531Q5A

FEATURES

- **Ultra Low Qg and Qgd**
- **Low Thermal Resistance**
- **Avalanche Rated**
- **Logic Level**
- **Pb Free Terminal Plating**
- **RoHS Compliant**
- **Halogen Free**
- **SON 5-mm × 6-mm Plastic Package**

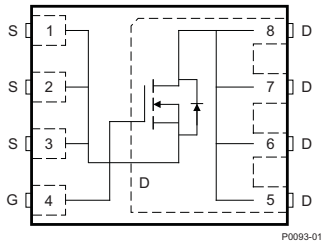
APPLICATIONS

- **DC-DC Conversion**
- **Secondary Side Synchronous Rectifier**
- **Battery Motor Control**

DESCRIPTION

The NexFET™ power MOSFET has been designed to minimize losses in power conversion applications.

Figure 1. Top View



PRODUCT SUMMARY

Typical Values at 25°C unless otherwise stated		TYPICAL VALUE		UNIT
V_{DS}	Drain to Source Voltage	60		V
Q_g	Gate Charge Total (4.5V)	18		nC
Q_{gd}	Gate Charge Gate to Drain	5.9		nC
$R_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 4.5V	4.4	mΩ
		V_{GS} = 10V	3.5	mΩ
$V_{GS(th)}$	Threshold Voltage	1.8		V

ORDERING INFORMATION

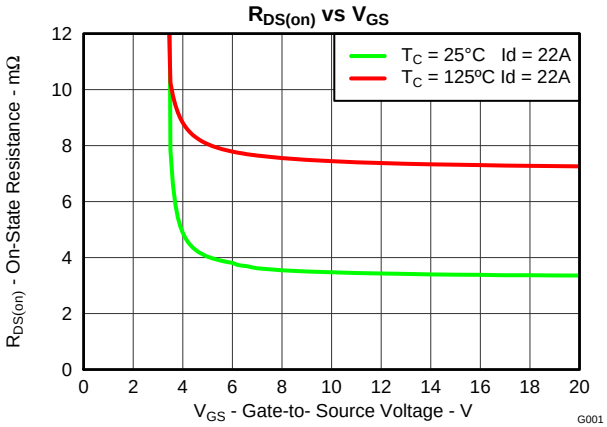
Device	Package	Media	Qty	Ship
CSD18531Q5A	SON 5-mm × 6-mm Plastic Package	13-Inch Reel	2500	Tape and Reel

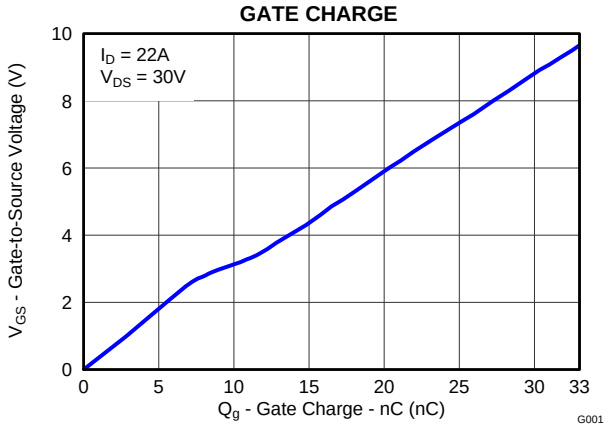
ABSOLUTE MAXIMUM RATINGS

T_A = 25°C unless otherwise stated		VALUE	UNIT
V_{DS}	Drain to Source Voltage	60	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	134	
	Continuous Drain Current, T_A = 25°C(1)	19	
I_{DM}	Pulsed Drain Current, T_A = 25°C(2)	122	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 = 67A, L = 0.1mH, R_G = 25Ω	224	mJ

(1) Typical $R_{\theta JA}$ = 40°C/W on a 1-inch², 2-oz. Cu pad on a 0.06-inch thick FR4 PCB.

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





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)

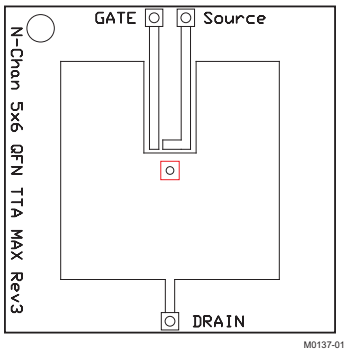
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics						
BV_{DSS}	Drain to Source Voltage	V_{GS} = 0V, I_D = 250µA	60			V
I_{DSS}	Drain to Source Leakage Current	V_{GS} = 0V, V_{DS} = 48V			1	µA
I_{GSS}	Gate to Source Leakage Current	V_{DS} = 0V, V_{GS} = 20V			100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{DS} = V_{GS}, I_D = 250µA	1.5	1.8	2.3	V
$R_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 4.5V, I_D = 22A		4.4	5.8	mΩ
		V_{GS} = 10V, I_D = 22A		3.5	4.6	mΩ
g_{fs}	Transconductance	V_{DS} = 30V, I_D = 22A		128		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DS} = 30V, f = 1MHz		3200	3840	pF
C_{oss}	Output Capacitance			380	456	pF
C_{rss}	Reverse Transfer Capacitance			11	14	pF
R_G	Series Gate Resistance			1.2	2.4	Ω
Q_g	Gate Charge Total (4.5V)	V_{DS} = 30V, I_D = 22A		18	22	nC
Q_g	Gate Charge Total (10V)			36	43	nC
Q_{gd}	Gate Charge Gate to Drain			5.9		nC
Q_{gs}	Gate Charge Gate to Source			6.9		nC
$Q_{g(th)}$	Gate Charge at Vth			5.2		nC
Q_{oss}	Output Charge	V_{DS} = 30V, V_{GS} = 0V		32		nC
$t_{d(on)}$	Turn On Delay Time	V_{DS} = 30V, V_{GS} = 10V, I_{DS} = 22A, R_G = 0Ω		4.4		ns
t_r	Rise Time			7.8		ns
$t_{d(off)}$	Turn Off Delay Time			20		ns
t_f	Fall Time			2.7		ns
Diode Characteristics						
V_{SD}	Diode Forward Voltage	I_{SD} = 22A, V_{GS} = 0V		0.8	1	V
Q_{rr}	Reverse Recovery Charge	V_{DS}= 30V, I_F = 22A, di/dt = 300A/µs		100		nC
t_{rr}	Reverse Recovery Time			40		ns

THERMAL CHARACTERISTICS

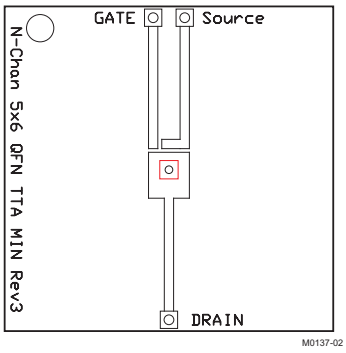
(T_A = 25°C unless otherwise stated)

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Thermal Resistance Junction to Case(1)			1	°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 $R_{\theta JA}$ = 121°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)

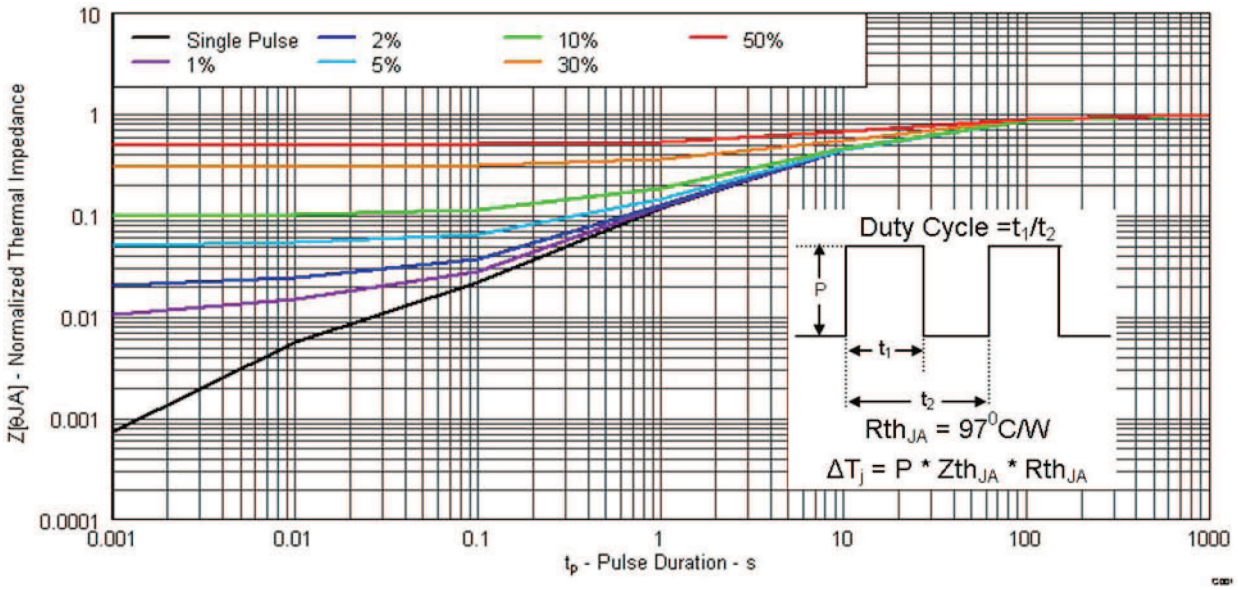


Figure 2. Transient Thermal Impedance

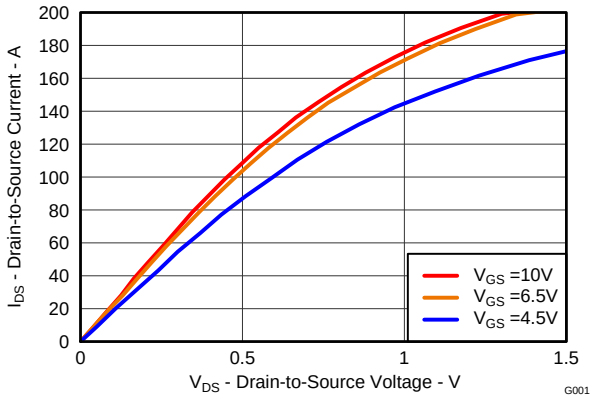


Figure 3. Saturation Characteristics

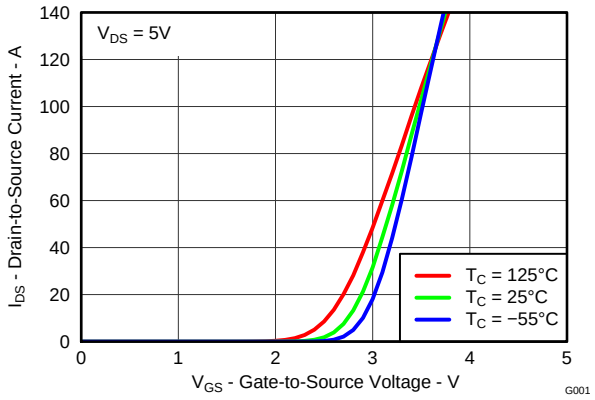


Figure 4. Transfer Characteristics

TYPICAL MOSFET CHARACTERISTICS (continued)

(T_A = 25°C unless otherwise stated)

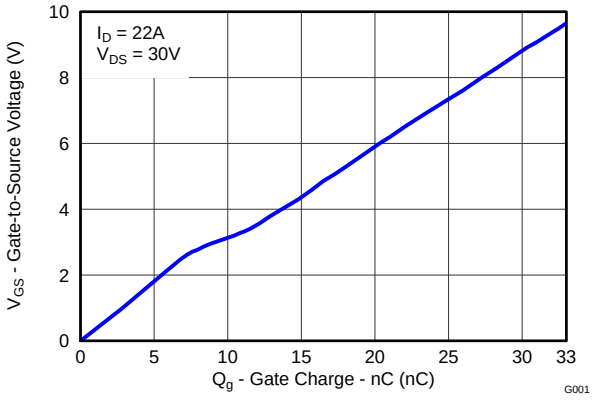


Figure 5. Gate Charge

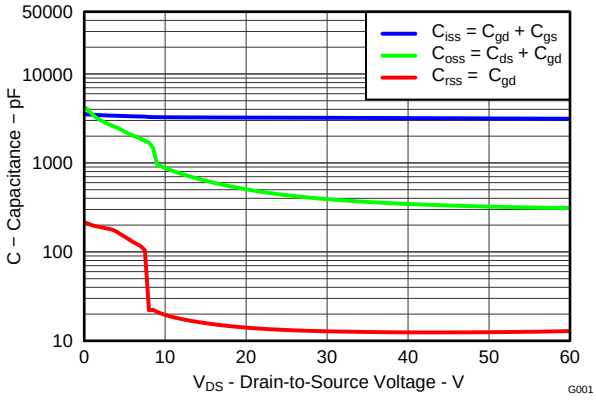


Figure 6. Capacitance

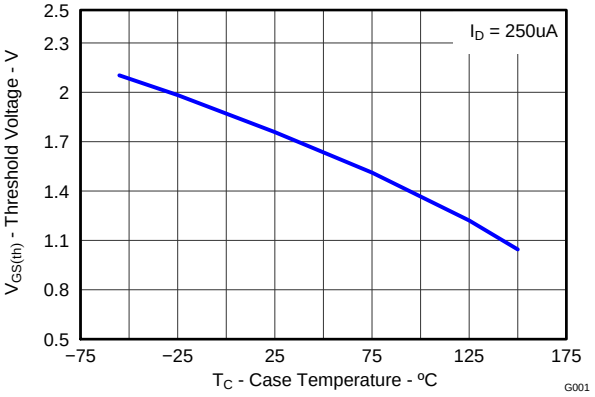


Figure 7. Threshold Voltage vs. Temperature

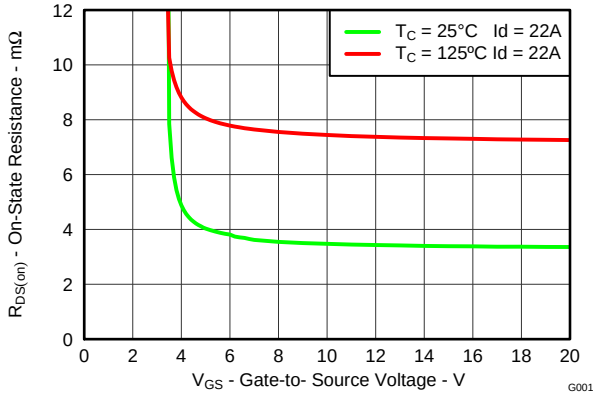


Figure 8. On-State Resistance vs. Gate-to-Source Voltage

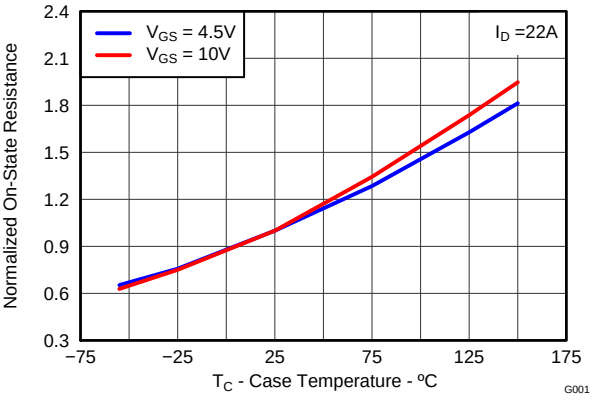


Figure 9. Normalized On-State Resistance vs. Temperature

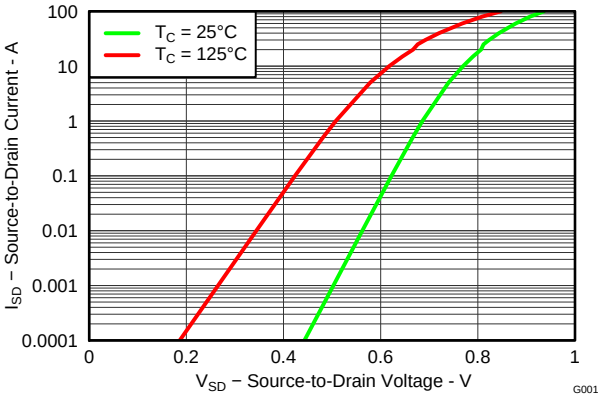


Figure 10. Typical Diode Forward Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

(T_A = 25°C unless otherwise stated)

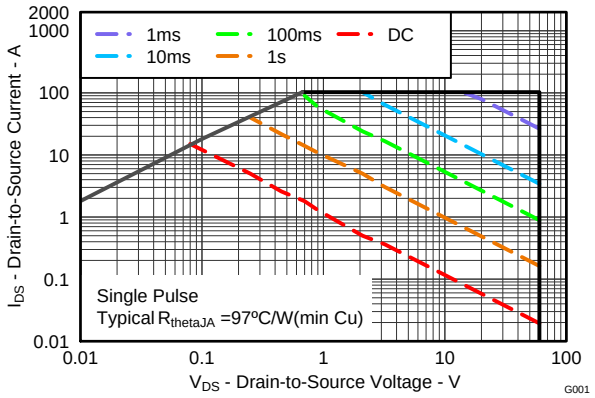


Figure 11. Maximum Safe Operating Area

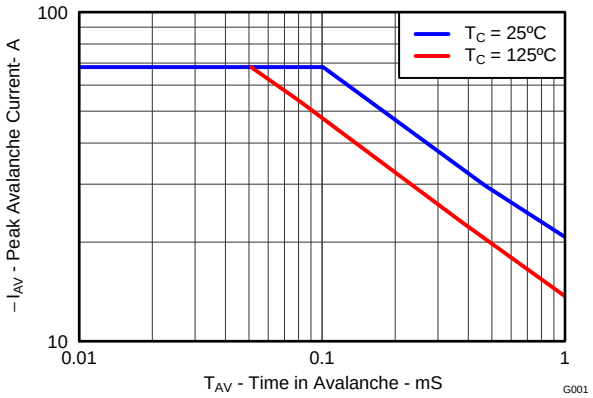


Figure 12. Single Pulse Unclamped Inductive Switching

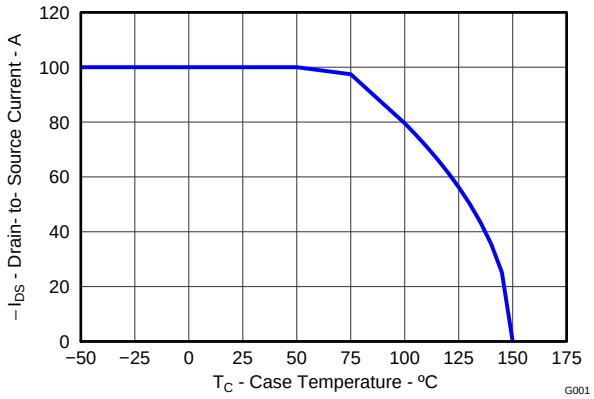
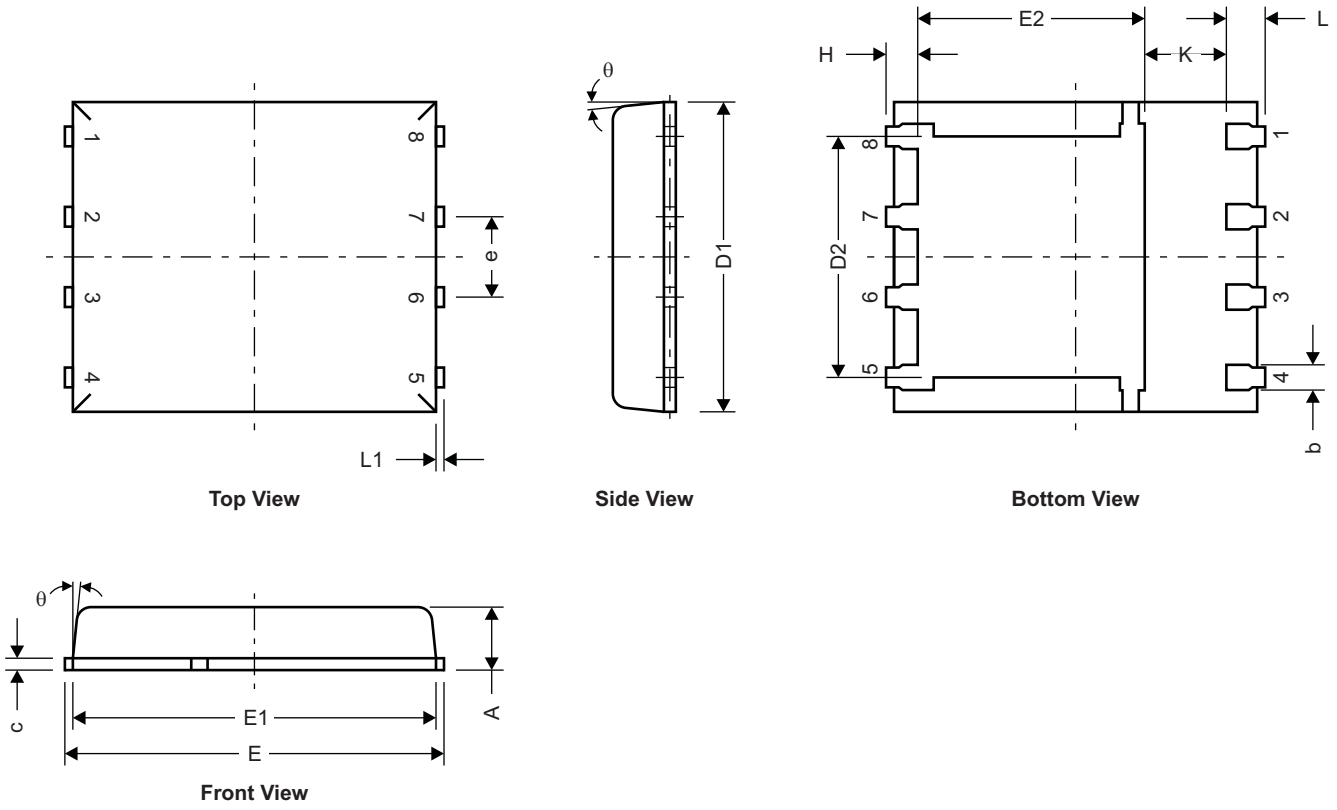


Figure 13. Maximum Drain Current vs. Temperature

MECHANICAL DATA

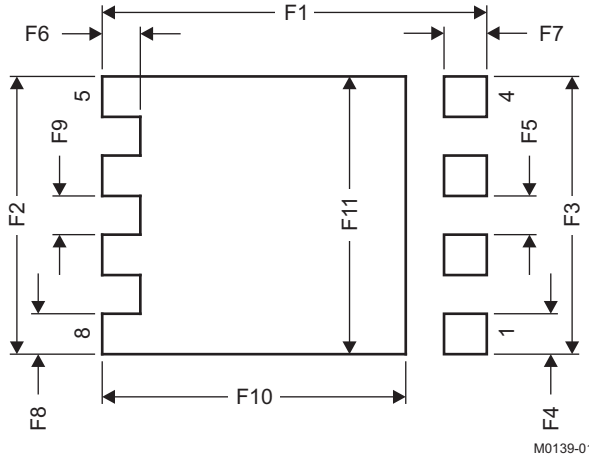
Q5A Package Dimensions



M0135-01

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
b	0.33	0.41	0.51
c	0.20	0.25	0.34
D1	4.80	4.90	5.00
D2	3.61	3.81	4.02
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.38	3.58	3.78
e	1.17	1.27	1.37
H	0.41	0.56	0.71
K	1.10		
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
θ	0°		12°

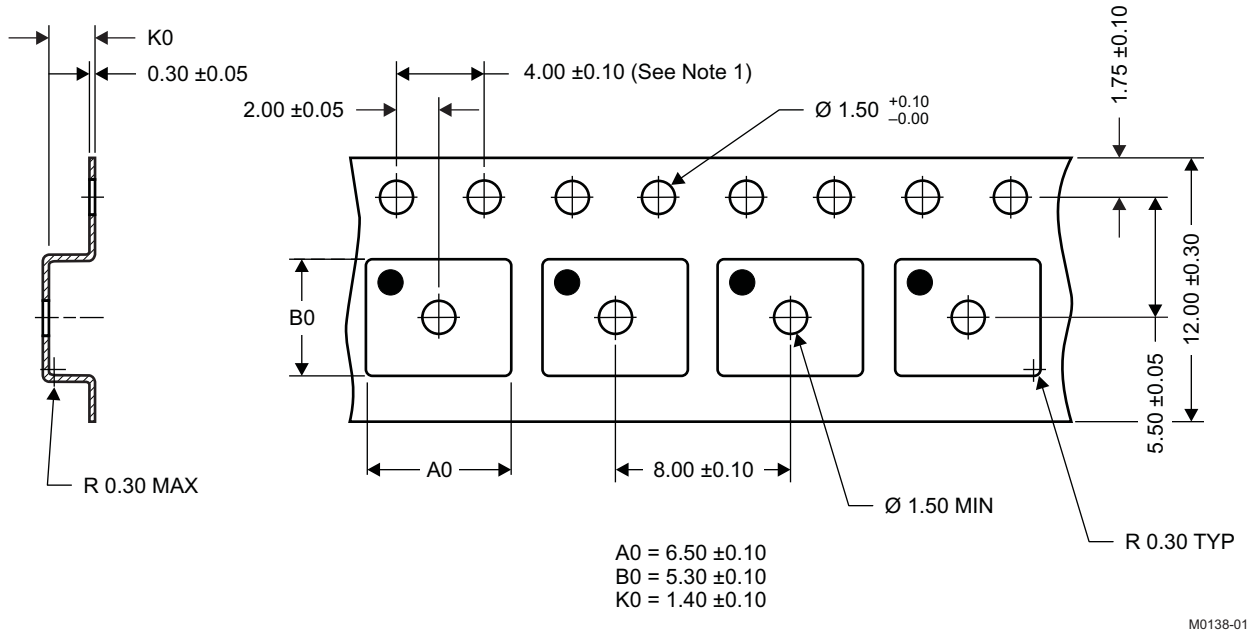
Figure 14. Recommended PCB Pattern



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
F1	6.205	6.305	0.244	0.248
F2	4.46	4.56	0.176	0.18
F3	4.46	4.56	0.176	0.18
F4	0.65	0.7	0.026	0.028
F5	0.62	0.67	0.024	0.026
F6	0.63	0.68	0.025	0.027
F7	0.7	0.8	0.028	0.031
F8	0.65	0.7	0.026	0.028
F9	0.62	0.67	0.024	0.026
F10	4.9	5	0.193	0.197
F11	4.46	4.56	0.176	0.18

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

Q5A 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 (June 2012) to Revision A **Page**

- Added "Typical Values at 25°C unless otherwise stated" to the Product Summary table 1

Changes from Revision A (June 2012) to Revision B **Page**

- Changed the Transconductance TYP value From: 177 S To: 128 S. 2
- Changed the Turn On and Turn Off Delay Time, Rise and Fall Time Test Conditions From: I_{DS} = 22A, R_G = 2Ω To: I_{DS} = 22A, R_G = 0Ω 2
- Changed the Q_{rr} Reverse Recovery Charge TYP value From: 68 nC To: 100 nC 2

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/ Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
CSD18531Q5A	ACTIVE	SON	DQJ	8	2500	Pb-Free (RoHS Exempt)	CU SN	Level-1-260C-UNLIM	

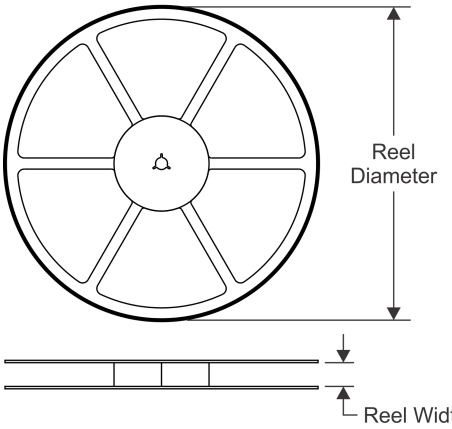
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, 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)

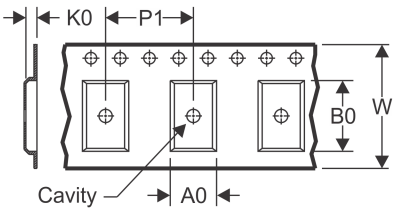
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

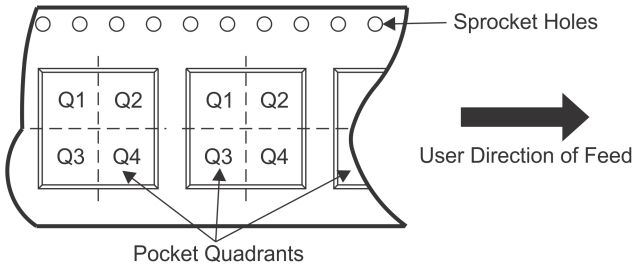


TAPE DIMENSIONS



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

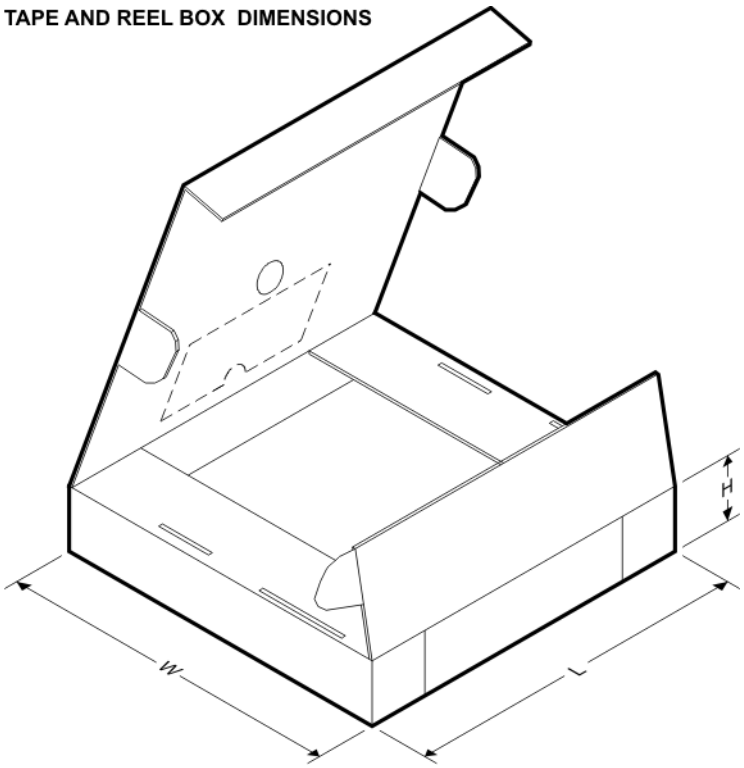
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
CSD18531Q5A	SON	DQJ	8	2500	330.0	12.4	6.3	5.3	1.2	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)
CSD18531Q5A	SON	DQJ	8	2500	340.0	340.0	38.0

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TI has specifically designated certain components which meet ISO/TS16949 requirements, mainly for automotive use. Components which have not been so designated are neither designed nor intended for automotive use; and TI will not be responsible for any failure of such components to meet such requirements.

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265