CSD18504KCS 40 V N-Channel NexFET™ Power MOSFET

1 Features

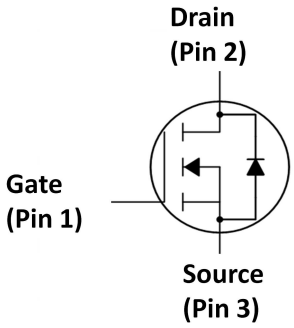
- Ultra Low Qg and Qgd
- Low Thermal Resistance
- Avalanche Rated
- Logic Level
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- TO-220 Plastic Package

2 Applications

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

3 Description

This 40 V, 5.5 mΩ, TO-220 NexFET™ power MOSFET is designed to minimize losses in power conversion applications.



Product Summary

T_A = 25°C		TYPICAL VALUE		UNIT
V_{DS}	Drain-to-Source Voltage	40		V
Q_g	Gate Charge Total (10 V)	19		nC
Q_{gd}	Gate Charge Gate-to-Drain	3.5		nC
$R_{DS(on)}$	Drain-to-Source On-Resistance	V_{GS} = 4.5 V	8.0	mΩ
		V_{GS} = 10 V	5.5	mΩ
$V_{GS(th)}$	Threshold Voltage	1.9		V

Ordering Information(1)

Device	Package	Media	Qty	Ship
CSD18504KCS	TO-220 Plastic Package	Tube	50	Tube

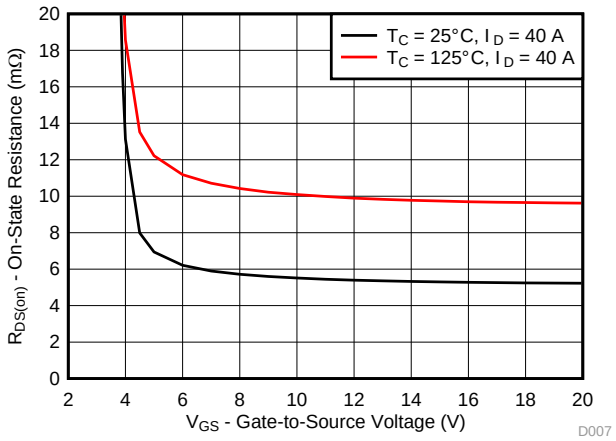
(1) For all available packages, see the orderable addendum at the end of the data sheet.

Absolute Maximum Ratings

T_A = 25°C		VALUE	UNIT
V_{DS}	Drain to Source Voltage	40	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	89	
	Continuous Drain Current (Silicon limited), T_C = 100°C	63	
I_{DM}	Pulsed Drain Current (1)	238	A
P_D	Power Dissipation	115	W
T_J, T_{stg}	Operating Junction and Storage Temperature Range	–55 to 175	°C
E_{AS}	Avalanche Energy, single pulse I_D = 42 A, L = 0.1 mH, R_G = 25 Ω	88	mJ

(1) Max $R_{\theta JC}$ = 1.3°C/W, pulse duration ≤100 µs, duty cycle ≤1%

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



Gate Charge

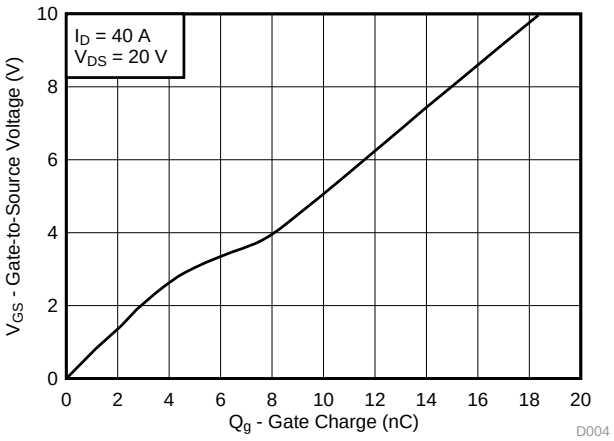


Table of Contents

4 Revision History

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

Changes from Original (October 2012) to Revision A	Page
• Added part number to title	1
• Increased the T_C = 25º continuous drain current to 89 A	1
• Increased the T_C = 125º continuous drain current to 63 A	1
• Increased the pulsed drain current to 238 A	1
• Increased the max power dissipation to 115 W	1
• Increased the max operating junction and storage temperature to 175º	1
• Updated the pulsed current conditions	1
• Updated Figure 1 from a normalized $R_{\theta JA}$ to an $R_{\theta JC}$ curve	4
• Updated Figure 6 to extend to 175°C	5
• Updated Figure 8 to extend to 175°C	5
• Updated the SOA in Figure 10	6
• Updated Figure 12 to extend to 175°C	6

5 Specifications

5.1 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	40			V
I_{DSS}	Drain-to-Source Leakage Current	V_{GS} = 0 V, V_{DS} = 32 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	1.5	1.9	2.3	V
$R_{DS(on)}$	Drain-to-Source On-Resistance	V_{GS} = 4.5 V, I_D = 40 A		8	10	mΩ
		V_{GS} = 10 V, I_D = 40 A		5.5	7	mΩ
g_{fs}	Transconductance	V_{DS} = 20 V, I_D = 40 A		72		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 20 V, f = 1 MHz		1380	1800	pF
C_{oss}	Output Capacitance			320	416	pF
C_{rss}	Reverse Transfer Capacitance			8	10.4	pF
R_G	Series Gate Resistance			1.5	3	Ω
Q_g	Gate Charge Total (4.5 V)	V_{DS} = 20 V, I_D = 40 A		9.2	12	nC
Q_g	Gate Charge Total (10 V)			19	25	nC
Q_{gd}	Gate Charge Gate-to-Drain			3.5		nC
Q_{gs}	Gate Charge Gate-to-Source			4.4		nC
$Q_{g(th)}$	Gate Charge at Vth			3		nC
Q_{oss}	Output Charge	V_{DS} = 20 V, V_{GS} = 0 V		19		nC
$t_{d(on)}$	Turn On Delay Time	V_{DS} = 20 V, V_{GS} = 10 V, I_{DS} = 40 A, R_G = 0 Ω		4.4		ns
t_r	Rise Time			5.2		ns
$t_{d(off)}$	Turn Off Delay Time			11.2		ns
t_f	Fall Time			4.2		ns
DIODE CHARACTERISTICS						
V_{SD}	Diode Forward Voltage	I_{SD} = 40 A, V_{GS} = 0 V		0.8	1	V
Q_{rr}	Reverse Recovery Charge	V_{DS}= 20 V, I_F = 40 A, di/dt = 300 A/µs		46		nC
t_{rr}	Reverse Recovery Time			33		ns

5.2 Thermal Information

(T_A = 25°C unless otherwise stated)

THERMAL METRIC		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction-to-Case Thermal Resistance			1.3	°C/W
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance			62	

5.3 Typical MOSFET Characteristics

(T_A = 25°C unless otherwise stated)

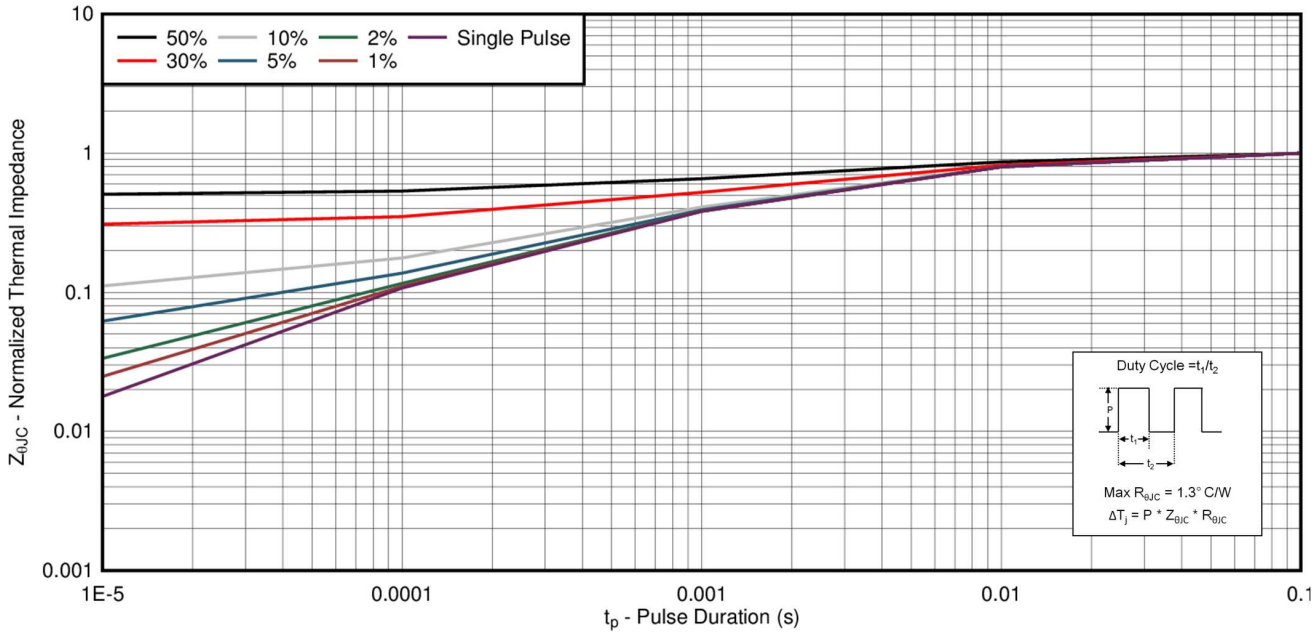


Figure 1. Transient Thermal Impedance

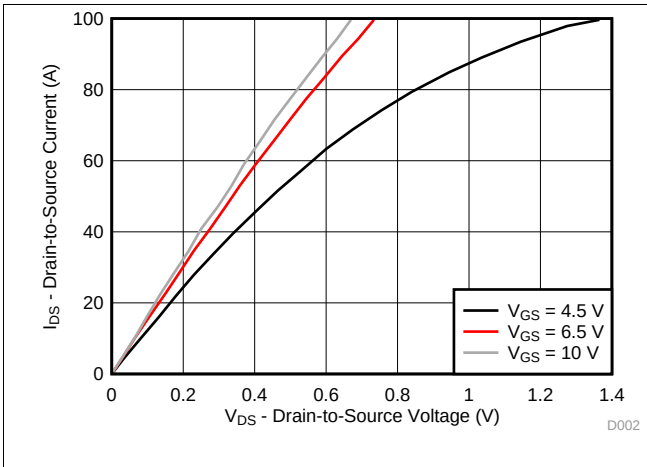


Figure 2. Saturation Characteristics

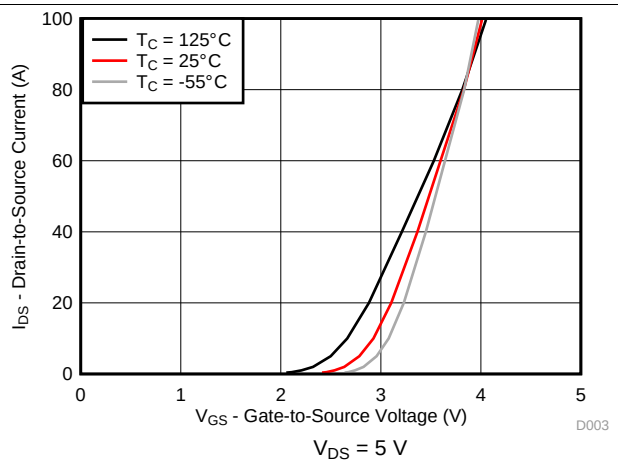


Figure 3. Transfer Characteristics

Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

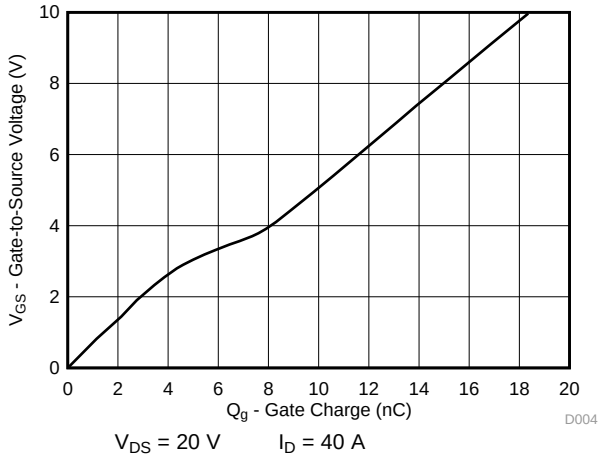


Figure 4. Gate Charge

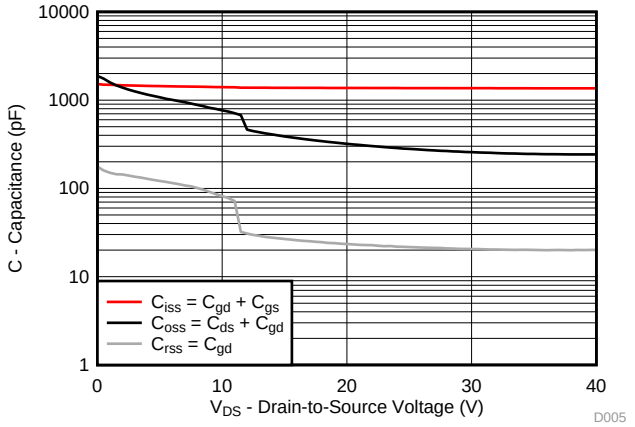


Figure 5. Capacitance

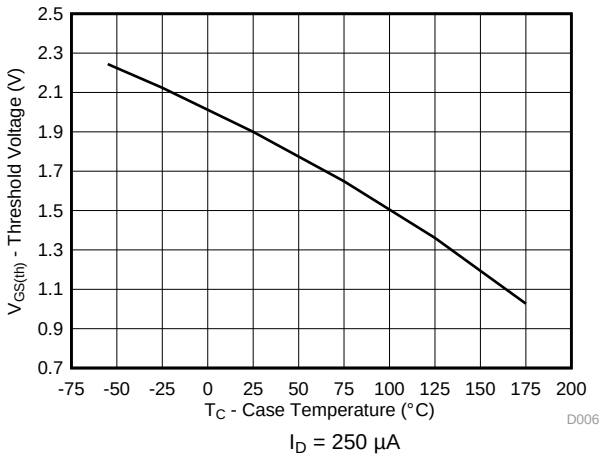


Figure 6. Threshold Voltage vs Temperature

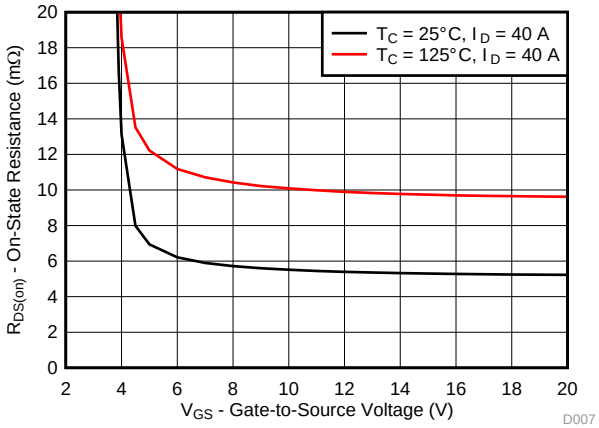


Figure 7. On-State Resistance vs Gate-to-Source Voltage

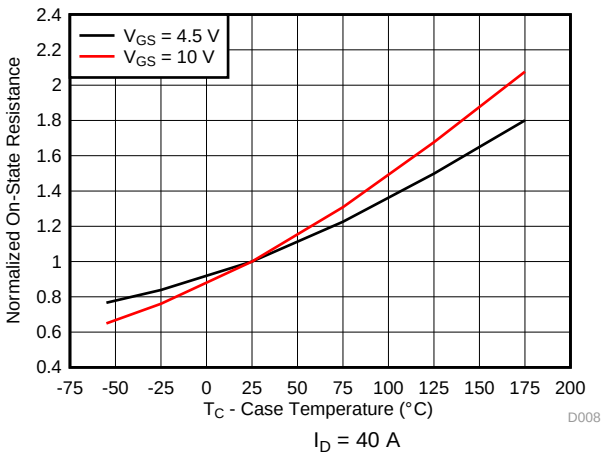


Figure 8. Normalized On-State Resistance vs Temperature

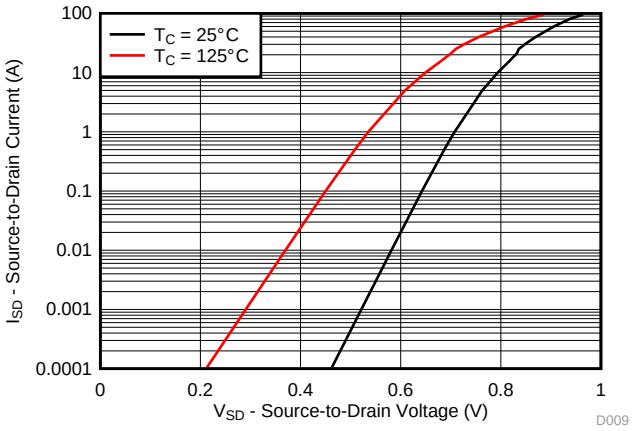


Figure 9. Typical Diode Forward Voltage

Typical MOSFET Characteristics (continued)

(T_A = 25°C unless otherwise stated)

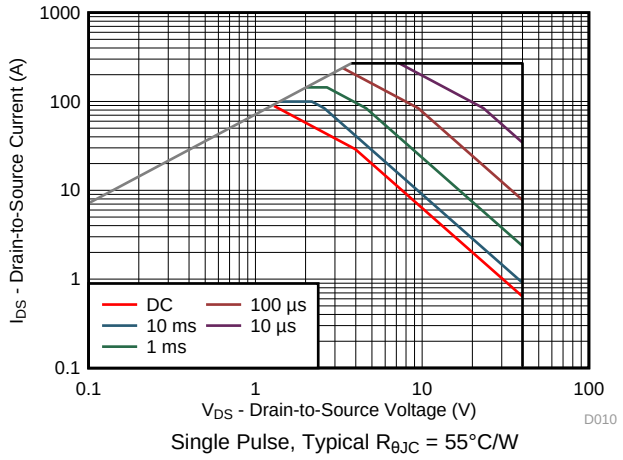


Figure 10. Maximum Safe Operating Area

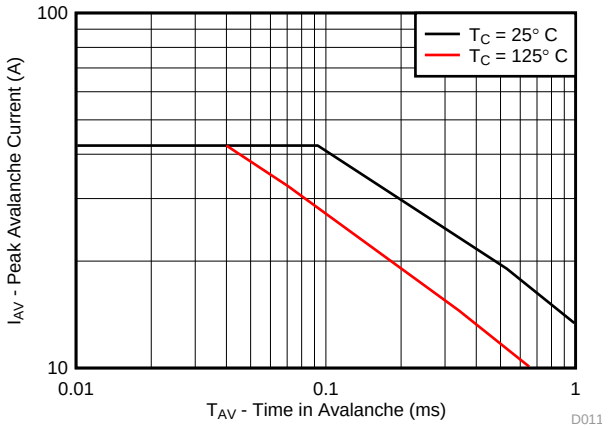


Figure 11. Single Pulse Unclamped Inductive Switching

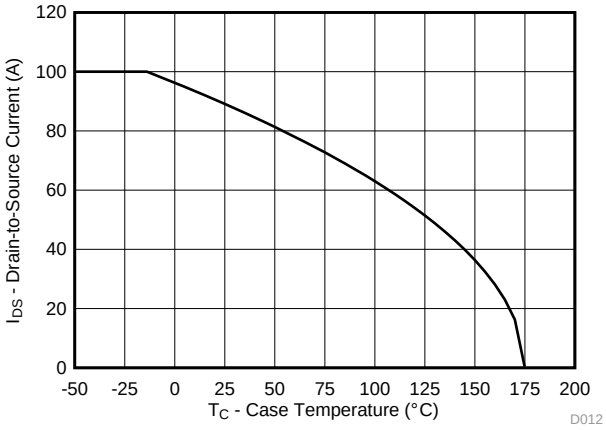


Figure 12. Maximum Drain Current vs Temperature

6 Device and Documentation Support

6.1 Trademarks

NexFET is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

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.

6.3 Glossary

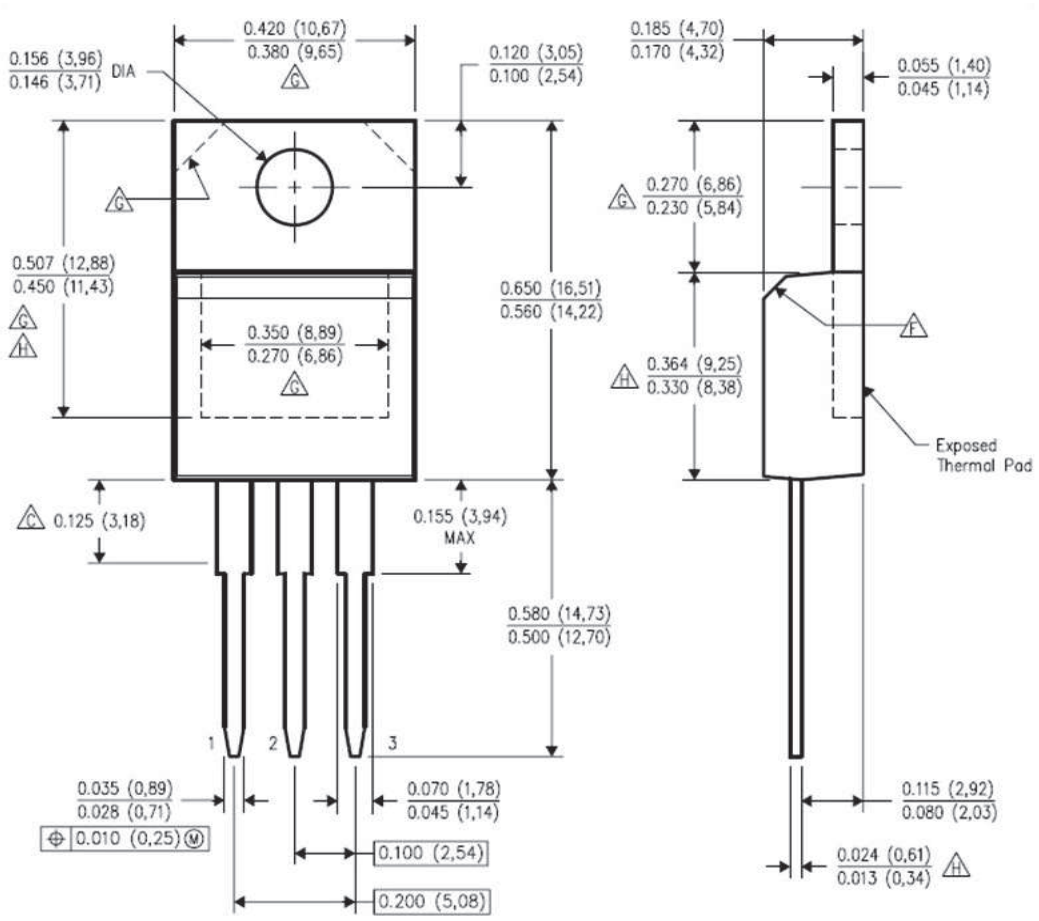
SLYZ022 — *TI Glossary*.

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 KCS Package Dimensions



Notes:

1. All linear dimensions are in inches
2. This drawing is subject to change without notice
3. Lead Dimensions are not controlled within "C" area
4. All lead dimensions apply before solder dip
5. The center lead is in electrical contact with the mounting tab
6. The chamfer at "F" is optional
7. Thermal pad contour at "G" optional with these dimensions
8. "H" Falls within JEDEC TO-220 variation AB, except minimum lead thickness, minimum exposed pad length, and maximum body length.

Pin Configuration

Position	Designation
Pin 1	Gate
Pin 2 / Tab	Drain
Pin 3	Source

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
CSD18504KCS	ACTIVE	TO-220	KCS	3	50	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-55 to 150	CSD18504KCS	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.

(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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