



## CSD18532KCS 60-V N-Channel NexFET™ Power MOSFET

### 1 Features

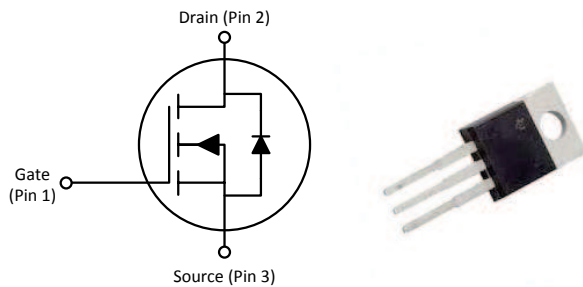
- Ultra-Low  $Q_g$  and  $Q_{gd}$
- Low Thermal Resistance
- Avalanche Rated
- Logic Level
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- TO-220 Plastic Package

### 2 Applications

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

### 3 Description

This 60 V, 3.3 mΩ, TO-220 NexFET™ power MOSFET is designed to minimize losses in power conversion applications.



#### 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)	44		nC
$Q_{gd}$	Gate Charge Gate-to-Drain	6.9		nC
$R_{DS(on)}$	Drain-to-Source On Resistance	$V_{GS} = 4.5\text{ V}$	4.2	mΩ
		$V_{GS} = 10\text{ V}$	3.3	mΩ
$V_{GS(th)}$	Threshold Voltage	1.8		V

#### Ordering Information<sup>(1)</sup>

Device	Package	Media	Qty	Ship
CSD18532KCS	TO-220 Plastic Package	Tube	50	Tube

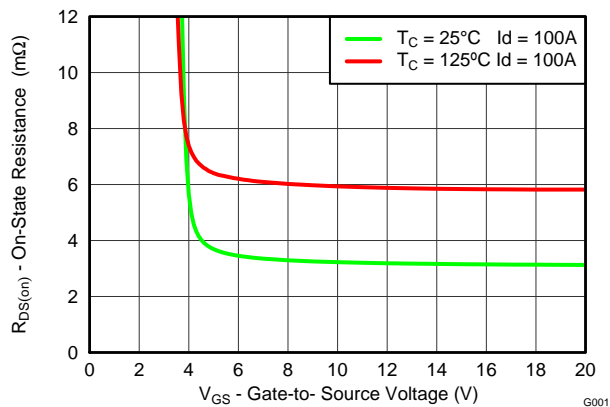
(1) For all available packages, see the orderable addendum at the end of the data sheet.

#### Absolute Maximum Ratings

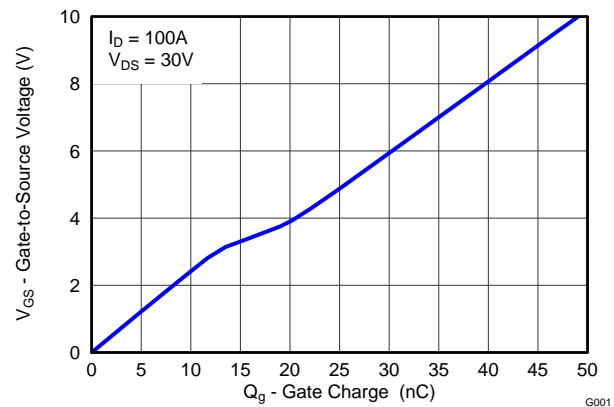
$T_A = 25^\circ\text{C}$		VALUE	UNIT
$V_{DS}$	Drain-to-Source Voltage	60	V
$V_{GS}$	Gate-to-Source Voltage	±20	V
$I_D$	Continuous Drain Current (Package limited), $T_C = 25^\circ\text{C}$	100	A
	Continuous Drain Current (Silicon limited), $T_C = 25^\circ\text{C}$	169	
	Continuous Drain Current (Silicon limited), $T_C = 100^\circ\text{C}$	116	
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	400	A
$P_D$	Power Dissipation	250	W
$T_J, T_{stg}$	Operating Junction and Storage Temperature Range	–55 to 175	°C
$E_{AS}$	Avalanche Energy, single pulse $I_D = 75\text{ A}$ , $L = 0.1\text{ mH}$ , $R_G = 25\text{ }\Omega$	281	mJ

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

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



Gate Charge



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## 4 Revision History

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

<b>Changes from Revision A (October 2012) to Revision B</b>	<b>Page</b>
• Increased $I_D$ at $T_C = 100^\circ\text{C}$ to 116 A .....	<b>1</b>
• Increased $I_{DM}$ to 400 A .....	<b>1</b>
• Increased max operating junction and storage temperature to $175^\circ\text{C}$ .....	<b>1</b>
• Updated <a href="#">Figure 1</a> from a normalized $R_{\theta JA}$ to an $R_{\theta JC}$ curve .....	<b>4</b>
• Updated <a href="#">Figure 6</a> to extend to $175^\circ\text{C}$ .....	<b>5</b>
• Updated <a href="#">Figure 8</a> to extend to $175^\circ\text{C}$ .....	<b>5</b>
• Updated the SOA in <a href="#">Figure 10</a> .....	<b>6</b>
• Updated <a href="#">Figure 12</a> to extend to $175^\circ\text{C}$ .....	<b>6</b>

<b>Changes from Original (August 2012) to Revision A</b>	<b>Page</b>
• Changed the Transconductance TYP value From: 146 S To: 187 S .....	<b>3</b>
• Changed $R_{\theta JA}$ From: MAX = $62^\circ\text{C/W}$ To: MAX = $65^\circ\text{C/W}$ .....	<b>3</b>
• Changed <a href="#">Figure 2</a> .....	<b>4</b>

## 5 Specifications

### 5.1 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
STATIC CHARACTERISTICS						
BV <sub>DSS</sub>	Drain-to-Source Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	60			V
I <sub>DSS</sub>	Drain-to-Source Leakage Current	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 48 V			1	μA
I <sub>GSS</sub>	Gate-to-Source Leakage Current	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 20 V			100	nA
V <sub>GS(th)</sub>	Gate-to-Source Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.5	1.8	2.2	V
R <sub>DS(on)</sub>	Drain-to-Source On Resistance	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 100 A	4.2		5.3	mΩ
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 100 A	3.3		4.2	mΩ
g <sub>fs</sub>	Transconductance	V <sub>DS</sub> = 30 V, I <sub>D</sub> = 100 A	187			S
DYNAMIC CHARACTERISTICS						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 30 V, f = 1 MHz	3900		4680	pF
C <sub>oss</sub>	Output Capacitance		470		564	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		11		14	pF
R <sub>G</sub>	Series Gate Resistance		1.3	2.6		Ω
Q <sub>g</sub>	Gate Charge Total (4.5 V)	V <sub>DS</sub> = 30 V, I <sub>D</sub> = 100 A	21		25	nC
Q <sub>g</sub>	Gate Charge Total (10 V)		44		53	nC
Q <sub>gd</sub>	Gate Charge Gate-to-Drain		6.9			nC
Q <sub>gs</sub>	Gate Charge Gate-to-Source		10			nC
Q <sub>g(th)</sub>	Gate Charge at V <sub>th</sub>		7.3			nC
Q <sub>oss</sub>	Output Charge	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V	52			nC
t <sub>d(on)</sub>	Turn On Delay Time	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 10 V, I <sub>DS</sub> = 100 A, R <sub>G</sub> = 0 Ω	7.8			ns
t <sub>r</sub>	Rise Time		5.3			ns
t <sub>d(off)</sub>	Turn Off Delay Time		24.2			ns
t <sub>f</sub>	Fall Time		5.6			ns
DIODE CHARACTERISTICS						
V <sub>SD</sub>	Diode Forward Voltage	I <sub>SD</sub> = 100 A, V <sub>GS</sub> = 0 V	0.8		1	V
Q <sub>rr</sub>	Reverse Recovery Charge	V <sub>DS</sub> = 30 V, I <sub>F</sub> = 100 A, di/dt = 300 A/μs	127			nC
t <sub>rr</sub>	Reverse Recovery Time		57			ns

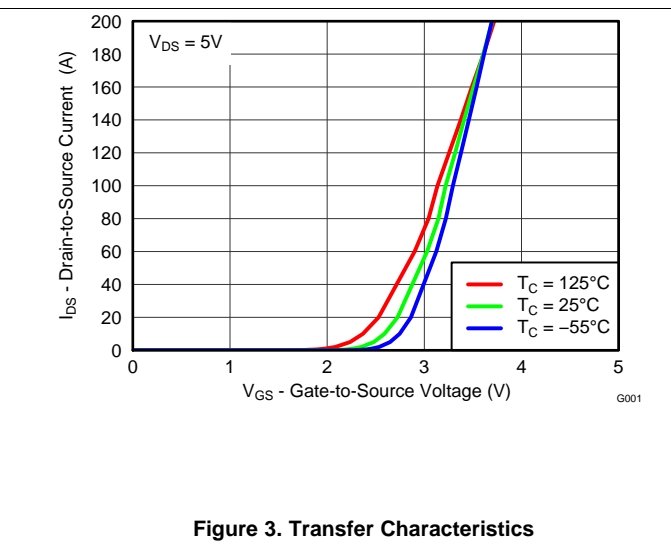
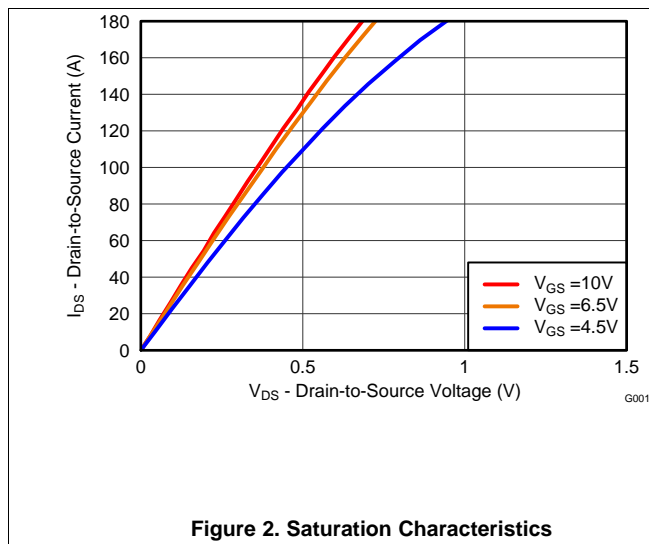
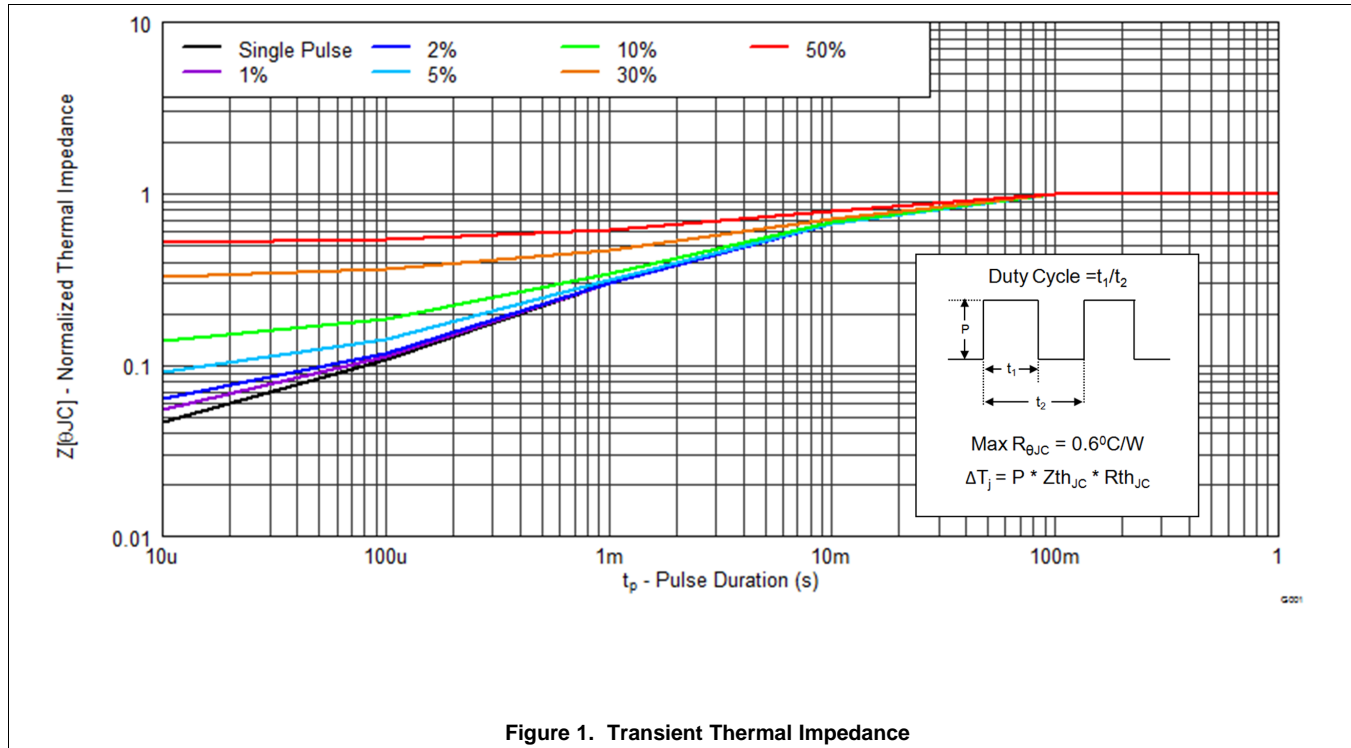
### 5.2 Thermal Information

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

THERMAL METRIC		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction-to-Case Thermal Resistance			0.6	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance			62	

### 5.3 Typical MOSFET Characteristics

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



## Typical MOSFET Characteristics (continued)

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

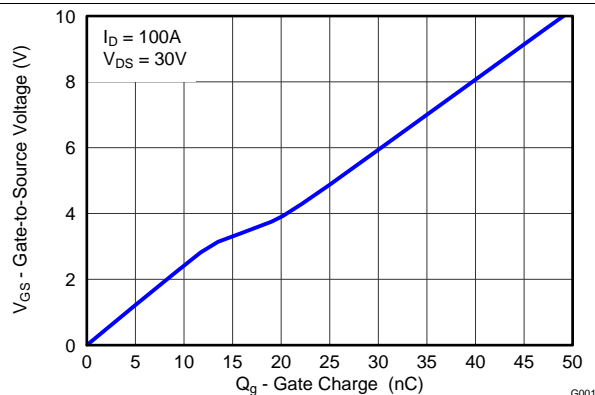


Figure 4. Gate Charge

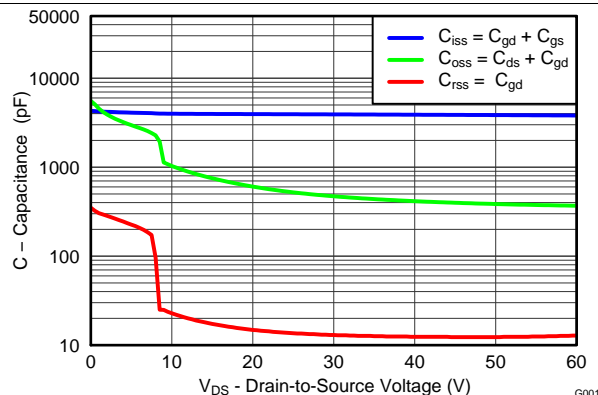


Figure 5. Capacitance

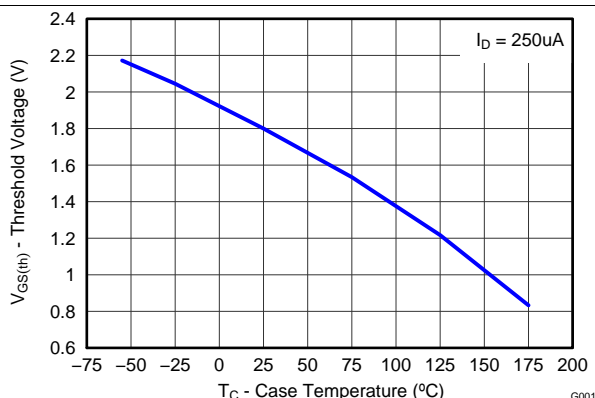


Figure 6. Threshold Voltage vs Temperature

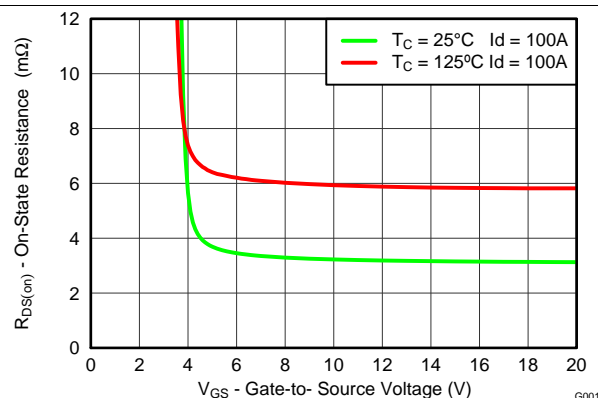


Figure 7. On-State Resistance vs Gate-to-Source Voltage

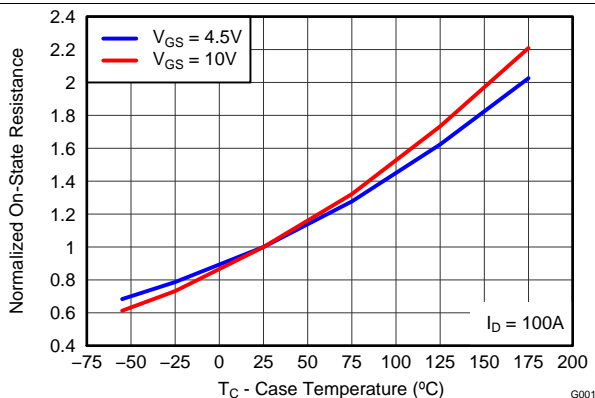


Figure 8. Normalized On-State Resistance vs Temperature

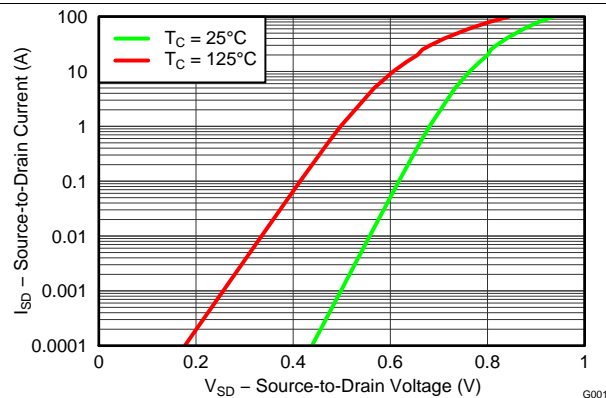
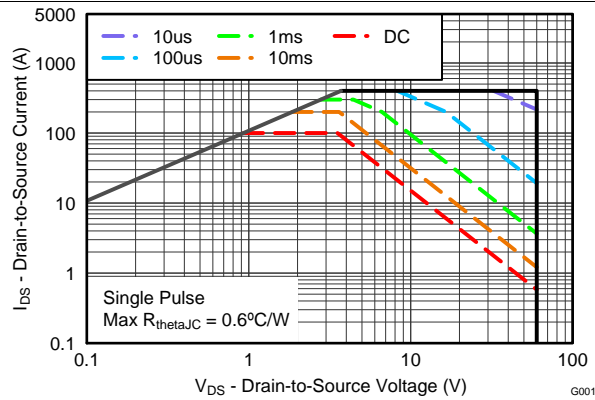


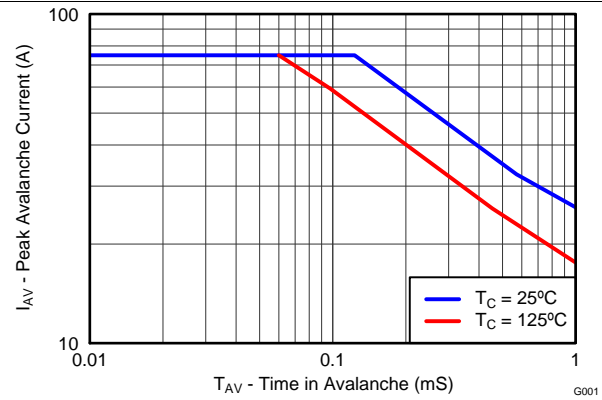
Figure 9. Typical Diode Forward Voltage

## Typical MOSFET Characteristics (continued)

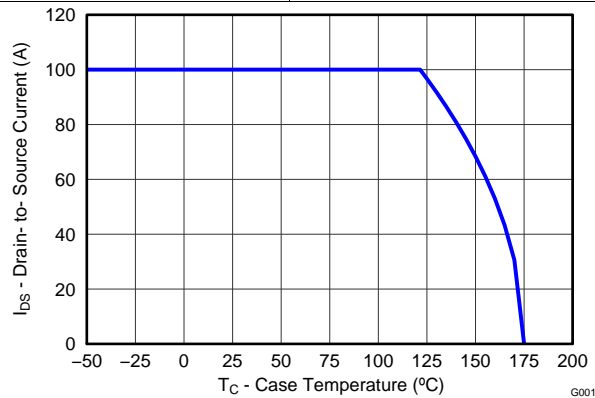
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



**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.

### 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

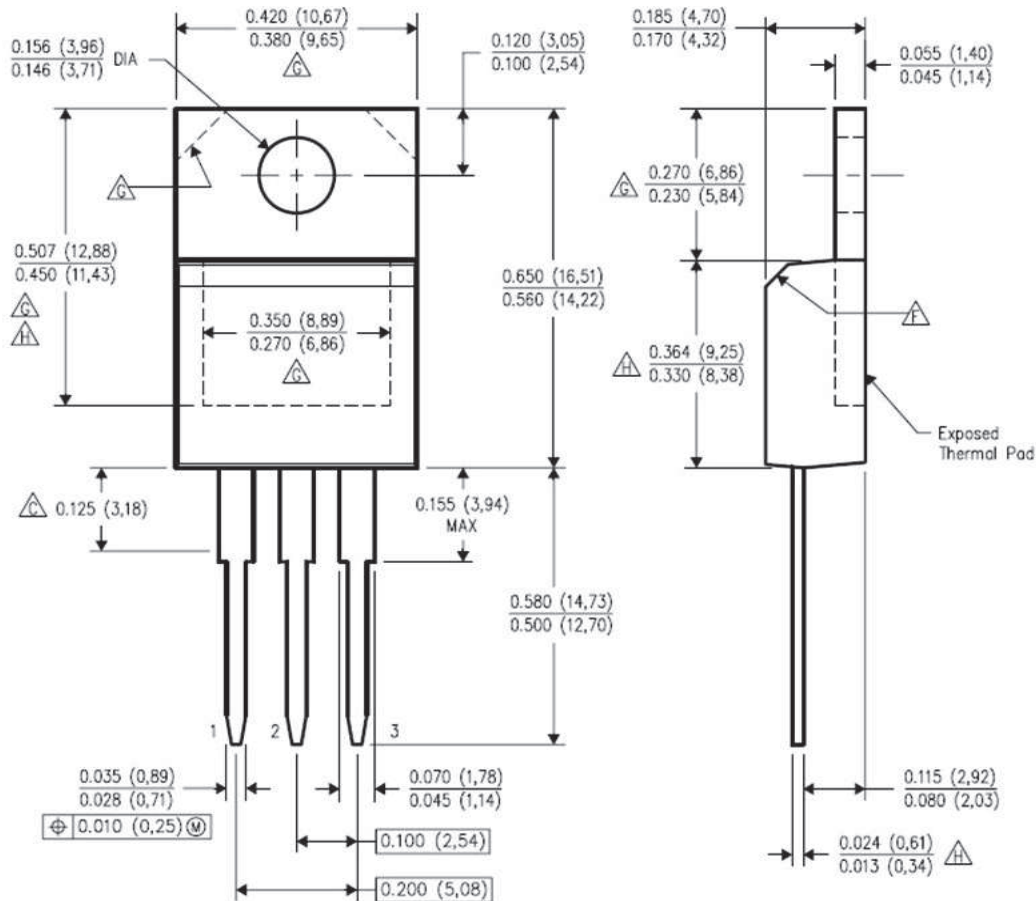
[SLYZ022](#) — *TI Glossary*.

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

## 7 Mechanical Data

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
CSD18532KCS	ACTIVE	TO-220	KCS	3	50	Pb-Free (RoHS Exempt)	CU SN	N / A for Pkg Type	-55 to 150	CSD18532KCS	<a href="#">Samples</a>

(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.

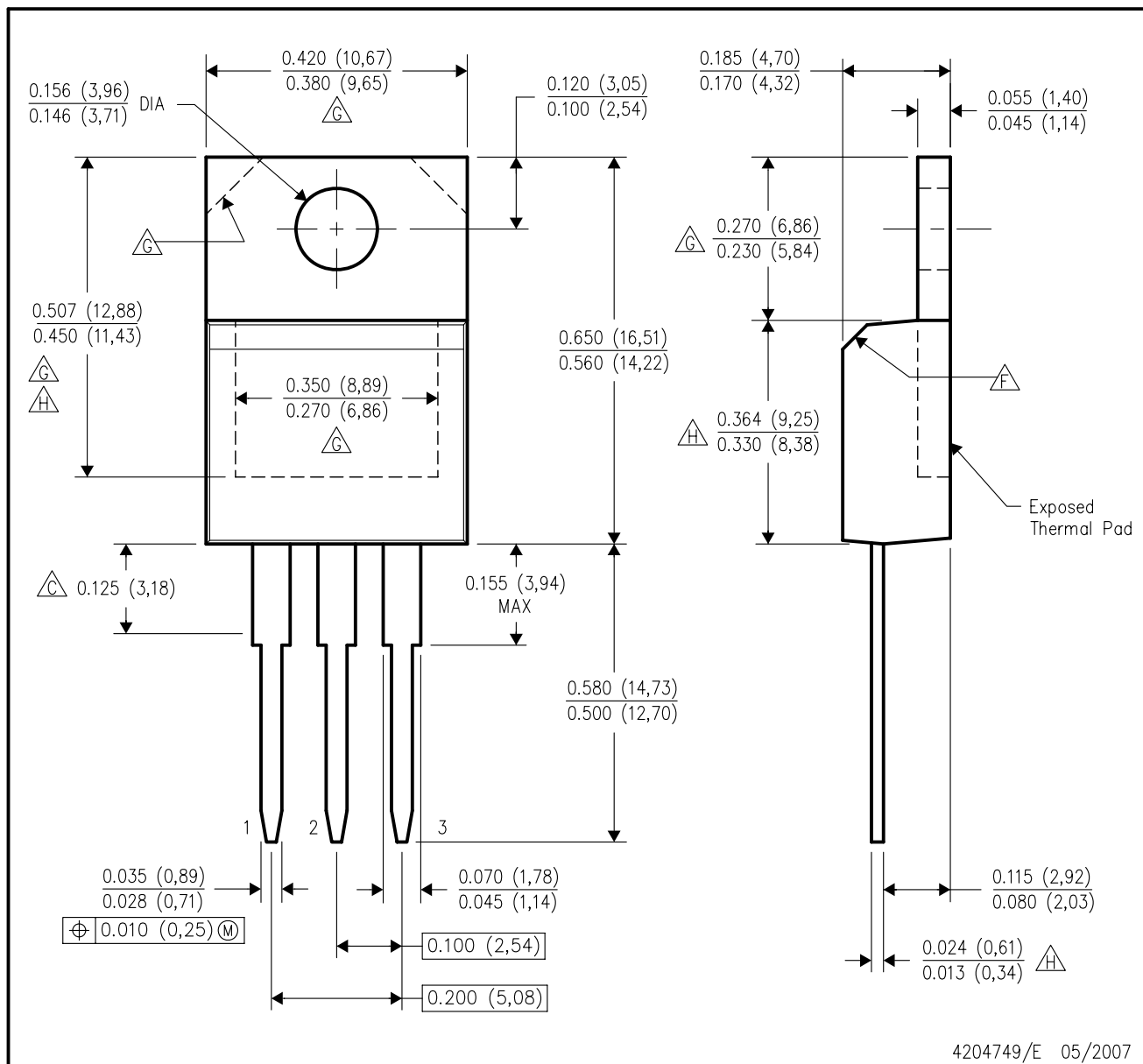
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## KCS (R-PSFM-T3)

## PLASTIC FLANGE-MOUNT PACKAGE



4204749/E 05/2007

## NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Lead dimensions are not controlled within this area.
- D. All lead dimensions apply before solder dip.
- E. The center lead is in electrical contact with the mounting tab.
- F. The chamfer is optional.
- G. Thermal pad contour optional within these dimensions.
- H. Falls within JEDEC TO-220 variation AB, except minimum lead thickness, minimum exposed pad length, and maximum body length.

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DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
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### Applications

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Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
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