CSD19531KCS 100-V N-Channel NexFET™ Power MOSFET

1 Features

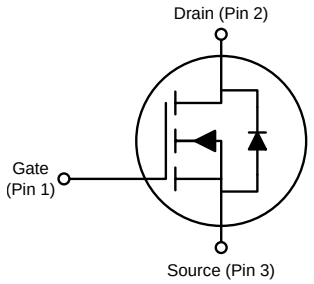
- Ultra-Low Q_g and Q_{gd}
- Low-Thermal Resistance
- Avalanche Rated
- Lead-Free Terminal Plating
- RoHS Compliant
- Halogen Free
- TO-220 Plastic Package

2 Applications

- Secondary Side Synchronous Rectifier
- Hot Swap Telecom
- Motor Control

3 Description

This 100-V, 6.4-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	100		V
Q_g	Gate Charge Total (10 V)	37		nC
Q_{gd}	Gate Charge Gate-to-Drain	7.5		nC
$R_{DS(on)}$	Drain-to-Source On Resistance	V_{GS} = 6 V	7.3	mΩ
		V_{GS} = 10 V	6.4	
$V_{GS(th)}$	Threshold Voltage	2.7		V

Device Information(1)

DEVICE	PACKAGE	MEDIA	QTY	SHIP
CSD19531KCS	TO-220 Plastic Package	Tube	50	Tube

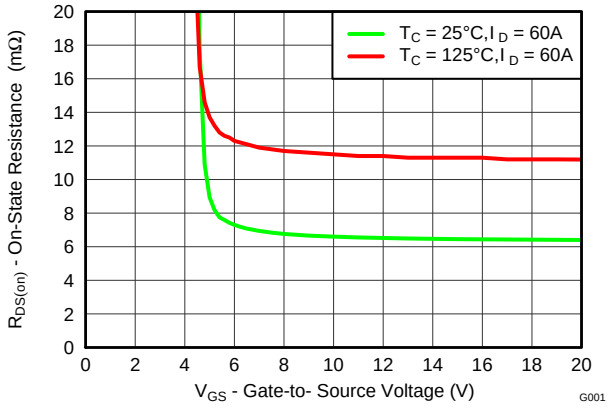
(1) For all available packages, see the orderable addendum at the end of the data sheet.

Absolute Maximum Ratings

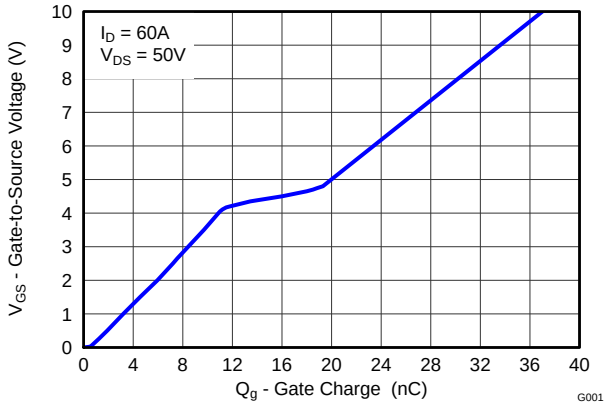
T_A = 25°C		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage	100	V
V_{GS}	Gate-to-Source Voltage	±20	V
I_D	Continuous Drain Current (Package Limited)	100	A
	Continuous Drain Current (Silicon Limited), T_C = 25°C	110	
	Continuous Drain Current (Silicon Limited), T_C = 100°C	78	
I_{DM}	Pulsed Drain Current(1)	285	A
P_D	Power Dissipation	214	W
T_J, T_{stg}	Operating Junction, Storage Temperature	–55 to 175	°C
E_{AS}	Avalanche Energy, Single Pulse I_D = 60 A, L = 0.1 mH, R_G = 25 Ω	180	mJ

(1) Max $R_{\theta JC}$ = 0.7º C/W, pulse duration ≤ 100 µs, duty cycle ≤ 1%.

$R_{DS(on)}$ 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.

Table of Contents

1 **Features** ... 1
2 **Applications** ... 1
3 **Description** ... 1
4 **Revision History** ... 2
5 **Specifications** ... 3
5.1 Electrical Characteristics ... 3
5.2 Thermal Information ... 3
5.3 Typical MOSFET Characteristics ... 4
6 **Device and Documentation Support** ... 7
6.1 Receiving Notification of Documentation Updates ... 7
6.2 Community Resources ... 7
6.3 Trademarks ... 7
6.4 Electrostatic Discharge Caution ... 7
6.5 Glossary ... 7
7 **Mechanical, Packaging, and Orderable Information** ... 8
7.1 KCS Package Dimensions ... 8

4 Revision History

Changes from Revision B (June 2014) to Revision C **Page**

- Added *Receiving Notification of Documentation Updates* section and *Community Resources* section to the *Device and Documentation Support* section ... 7
- Changed package drawing in *KCS Package Dimensions* section ... 8

Changes from Revision A (May 2014) to Revision B **Page**

- Added value for max Q_g ... 3

Changes from Original (September 2013) to Revision A **Page**

- Updated the silicon limited currents to reflect increase in device operating temperature range ... 1
- Increased pulsed current to reflect new conditions ... 1
- Increased max power dissipation to reflect new conditions ... 1
- Increased operating and junction temperature range to 175ºC ... 1
- Updated the pulsed drain current conditions ... 1
- Changed Figure 1 from a normalized $R_{\theta JA}$ curve to a normalized $R_{\theta JC}$ curve ... 4
- Updated Figure 6 to reflect increase in device operating temperature range ... 5
- Updated Figure 8 to reflect increase in device operating temperature range ... 5
- Updated Figure 10 to reflect measured SOA data ... 6
- Updated Figure 12 to reflect increase in device operating temperature range ... 6

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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	100			V
I_{DSS}	Drain-to-source leakage current	V_{GS} = 0 V, V_{DS} = 80 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	2.2	2.7	3.3	V
$R_{DS(on)}$	Drain-to-source on resistance	V_{GS} = 6 V, I_D = 60 A		7.3	8.8	mΩ
		V_{GS} = 10 V, I_D = 60 A		6.4	7.7	
g_{fs}	Transconductance	V_{DS} = 10 V, I_D = 60 A		137		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input capacitance	V_{GS} = 0 V, V_{DS} = 50 V, f = 1 MHz		2980	3870	pF
C_{oss}	Output capacitance			560	728	pF
C_{rss}	Reverse transfer capacitance			13	17	pF
R_G	Series gate resistance			1.3	2.6	Ω
Q_g	Gate charge total (10 V)	V_{DS} = 50 V, I_D = 60 A		38	49	nC
Q_{gd}	Gate charge gate-to-drain			7.5		nC
Q_{gs}	Gate charge gate-to-source			11.9		nC
$Q_{g(th)}$	Gate charge at V_{th}			7.3		nC
Q_{oss}	Output charge	V_{DS} = 50 V, V_{GS} = 0 V		98		nC
$t_{d(on)}$	Turnon delay time	V_{DS} = 50 V, V_{GS} = 10 V, I_{DS} = 60 A, R_G = 0 Ω		8.4		ns
t_r	Rise Time			7.2		ns
$t_{d(off)}$	Turnoff delay time			16		ns
t_f	Fall time			4.1		ns
DIODE CHARACTERISTICS						
V_{SD}	Diode forward voltage	I_{SD} = 60 A, V_{GS} = 0 V		0.9	1	V
Q_{rr}	Reverse recovery charge	V_{DS}= 50 V, I_F = 60 A, di/dt = 300 A/µs		270		nC
t_{rr}	Reverse recovery time			83		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			0.7	°C/W
$R_{\theta JA}$	Junction-to-ambient thermal resistance			62	°C/W

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5.3 Typical MOSFET Characteristics

T_A = 25°C (unless otherwise stated)

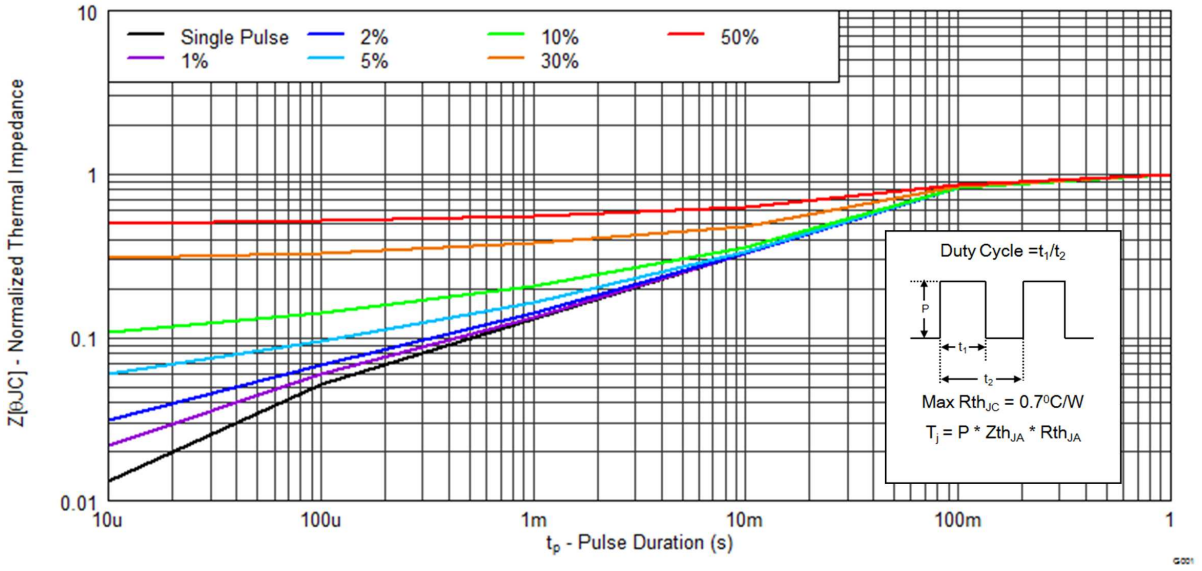

Figure 1. Transient Thermal Impedance

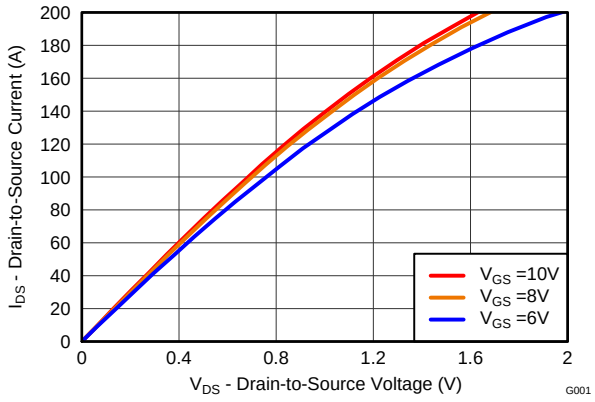

Figure 2. Saturation Characteristics

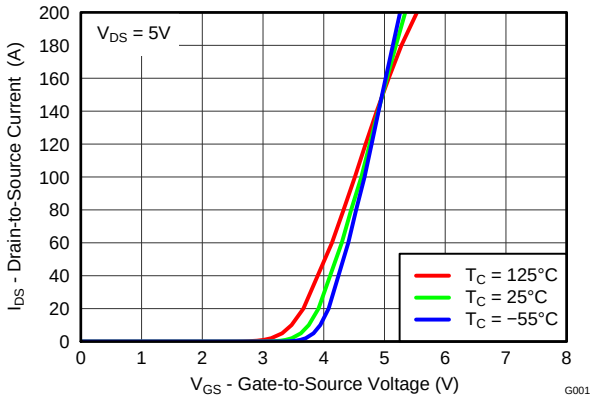

Figure 3. Transfer Characteristics

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Typical MOSFET Characteristics (continued)

T_A = 25°C (unless otherwise stated)

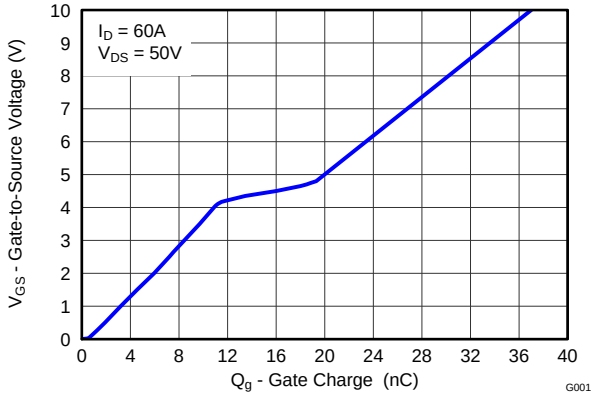

Figure 4. Gate Charge

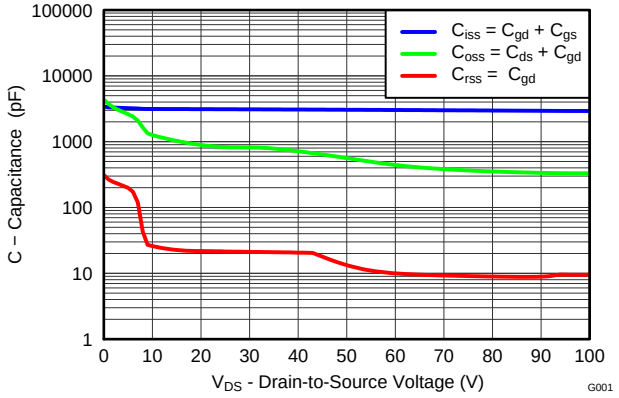

Figure 5. Capacitance

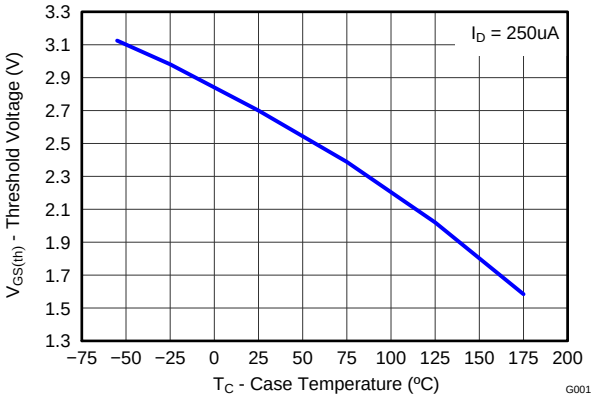

Figure 6. Threshold Voltage vs Temperature

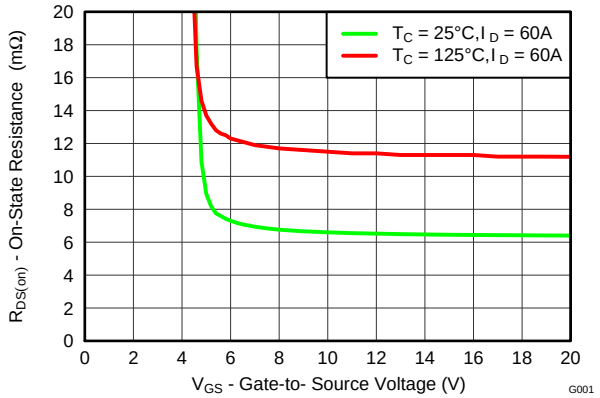

Figure 7. On-State Resistance vs Gate-to-Source Voltage

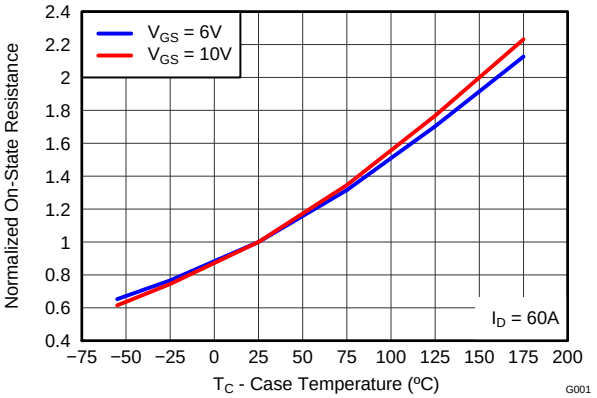

Figure 8. Normalized On-State Resistance vs Temperature

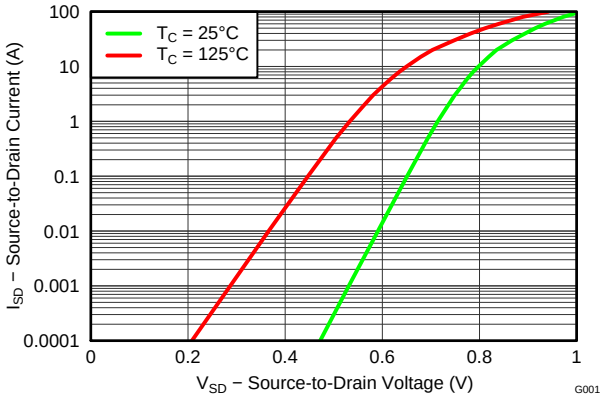

Figure 9. Typical Diode Forward Voltage

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Typical MOSFET Characteristics (continued)

T_A = 25°C (unless otherwise stated)

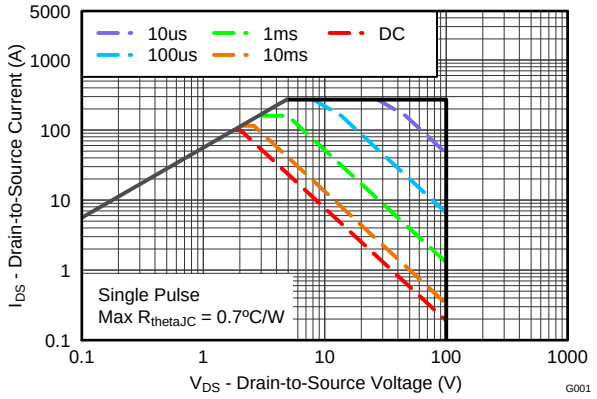

Figure 10. Maximum Safe Operating Area

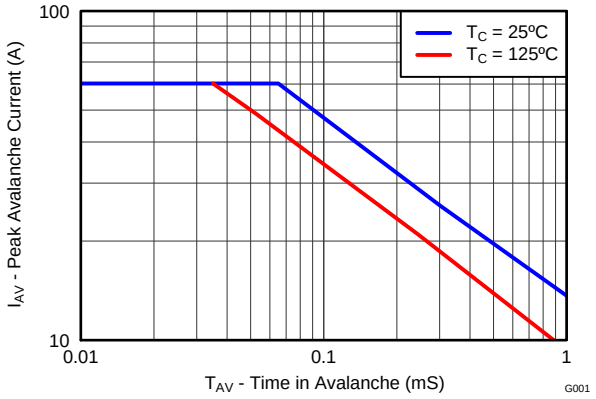

Figure 11. Single Pulse Unclamped Inductive Switching

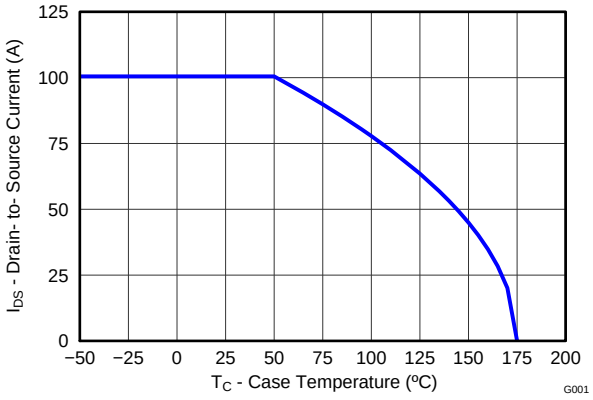

Figure 12. Maximum Drain Current vs Temperature

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6 Device and Documentation Support

6.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

6.2 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

TI E2E™ Online Community ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

6.3 Trademarks

NexFET, E2E are trademarks of Texas Instruments.
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6.4 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.

6.5 Glossary

SLYZ022 — *TI Glossary*.

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

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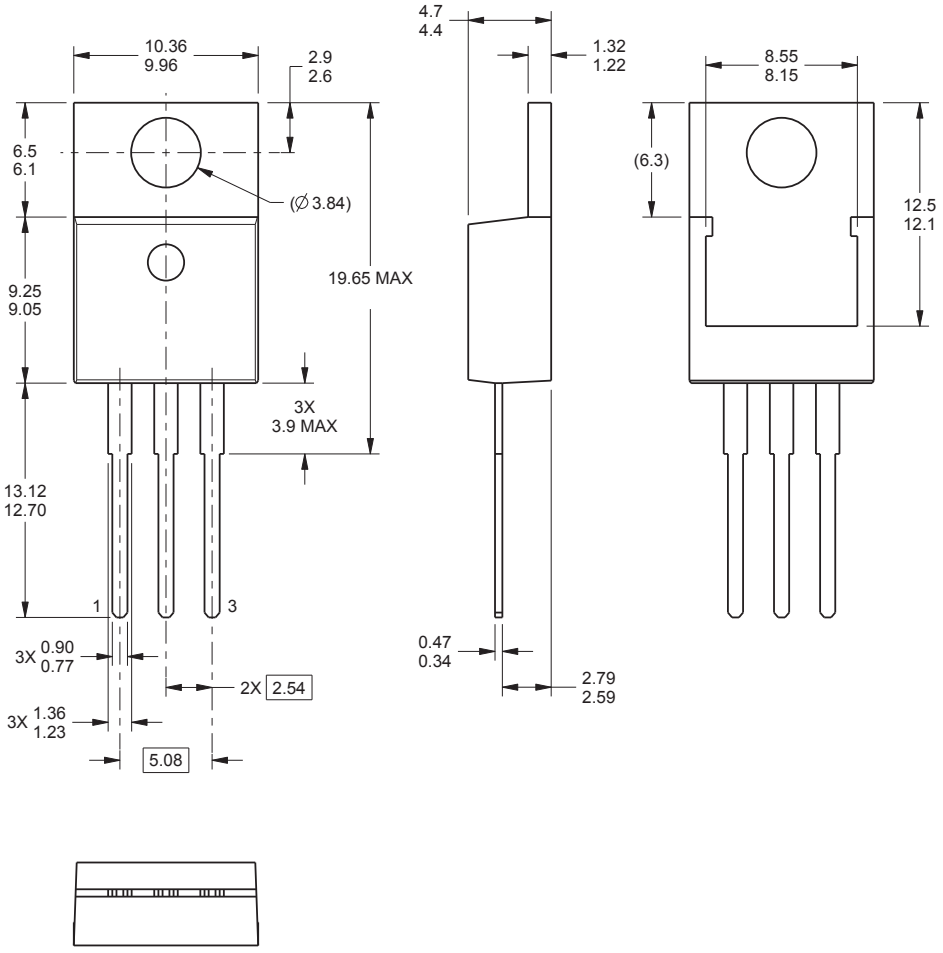
7 Mechanical, Packaging, and Orderable Information

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



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Notes:

1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-220.

Table 1. Pin Configuration

POSITION	DESIGNATION
Pin 1	Gate
Pin 2 / Tab	Drain
Pin 3	Source

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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
CSD19531KCS	ACTIVE	TO-220	KCS	3	50	Green (RoHS & no Sb/Br)	SN	N / A for Pkg Type	-55 to 175	CSD19531KCS	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.

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