# 60-V, N-Channel NexFET™ Power MOSFETs

**Check for Samples: CSD18534KCS**

## FEATURES

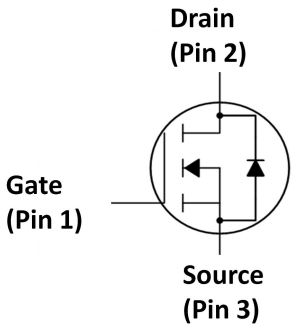
- **Ultra Low Qg and Qgd**
- **Low Thermal Resistance**
- **Avalanche Rated**
- **Logic Level**
- **Pb Free Terminal Plating**
- **RoHS Compliant**
- **Halogen Free**
- **TO-220 Plastic Package**

## APPLICATIONS

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

## DESCRIPTION

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




## PRODUCT SUMMARY

| $T_A$ = 25°C | | TYPICAL VALUE | | UNIT |
|---|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | 60 | | V |
| $Q_g$ | Gate Charge Total (10V) | 19 | | nC |
| $Q_{gd}$ | Gate Charge Gate to Drain | 3.1 | | nC |
| $R_{DS(on)}$ | Drain to Source On Resistance | $V_{GS}$ = 4.5V | 10.2 | mΩ |
| | | $V_{GS}$ = 10V | 7.6 | mΩ |
| $V_{GS(th)}$ | Threshold Voltage | 1.9 | | V |

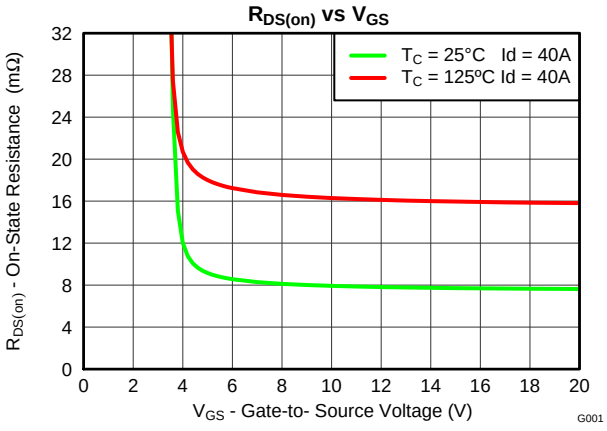
## ORDERING INFORMATION

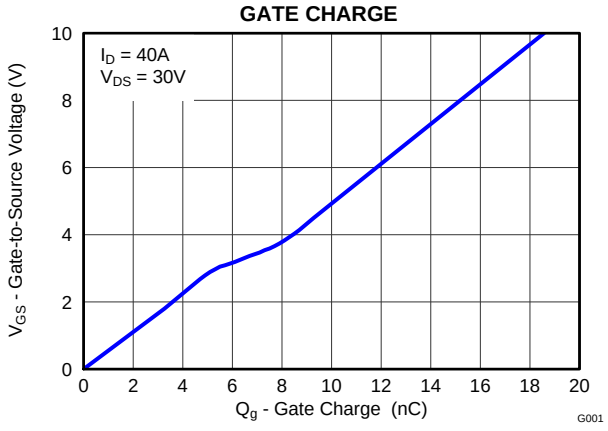
| Device | Package | Media | Qty | Ship |
|---|---|---|---|---|
| CSD18534KCS | TO-220 Plastic Package | Tube | 50 | Tube |

## ABSOLUTE MAXIMUM RATINGS

| $T_A$ = 25°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°C | 100 | A |
| | Continuous Drain Current (Silicon limited), $T_C$ = 25°C | 71 | |
| | Continuous Drain Current (Silicon limited), $T_C$ = 100°C | 45 | |
| $I_{DM}$ | Pulsed Drain Current (1) | 108 | A |
| $P_D$ | Power Dissipation | 98 | W |
| $T_J$, $T_{STG}$ | Operating Junction and Storage Temperature Range | –55 to 150 | °C |
| $E_{AS}$ | Avalanche Energy, single pulse $I_D$ = 38A, L = 0.1mH, $R_G$ = 25Ω | 72 | mJ |

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

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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 | 1.9 | 2.3 | V |
| $R_{DS(on)}$ | Drain to Source On Resistance | $V_{GS}$ = 4.5V, $I_D$ = 40A | | 10.2 | 13.3 | mΩ |
| | | $V_{GS}$ = 10V, $I_D$ = 40A | | 7.6 | 9.5 | mΩ |
| $g_{fs}$ | Transconductance | $V_{DS}$ = 30V, $I_D$ = 40A | | 100 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V, $V_{DS}$ = 30V, f = 1MHz | | 1500 | 1880 | pF |
| $C_{oss}$ | Output Capacitance | | | 164 | 205 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 5.0 | 6.5 | pF |
| $R_G$ | Series Gate Resistance | | | 1.5 | 3.0 | Ω |
| $Q_g$ | Gate Charge Total (4.5V) | $V_{DS}$ = 30V, $I_D$ = 40A | | 9.3 | 12 | nC |
| $Q_g$ | Gate Charge Total (10V) | | | 19 | 24 | nC |
| $Q_{gd}$ | Gate Charge Gate to Drain | | | 3.1 | | nC |
| $Q_{gs}$ | Gate Charge Gate to Source | | | 4.8 | | nC |
| $Q_{g(th)}$ | Gate Charge at Vth | | | 3.3 | | nC |
| $Q_{oss}$ | Output Charge | $V_{DS}$ = 30V, $V_{GS}$ = 0V | | 18 | | nC |
| $t_{d(on)}$ | Turn On Delay Time | $V_{DS}$ = 30V, $V_{GS}$ = 10V, $I_{DS}$ = 40A, $R_G$ = 0Ω | | 4.2 | | ns |
| $t_r$ | Rise Time | | | 4.8 | | ns |
| $t_{d(off)}$ | Turn Off Delay Time | | | 10.4 | | ns |
| $t_f$ | Fall Time | | | 2.4 | | ns |
| **Diode Characteristics** | | | | | | |
| $V_{SD}$ | Diode Forward Voltage | $I_{SD}$ = 40A, $V_{GS}$ = 0V | | 0.8 | 1 | V |
| $Q_{rr}$ | Reverse Recovery Charge | $V_{DS}$= 30V, $I_F$ = 40A, di/dt = 300A/µs | | 68 | | nC |
| $t_{rr}$ | Reverse Recovery Time | | | 49 | | ns |

## THERMAL CHARACTERISTICS

($T_A$ = 25°C unless otherwise stated)

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


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## TYPICAL MOSFET CHARACTERISTICS

($T_A$ = 25°C unless otherwise stated)

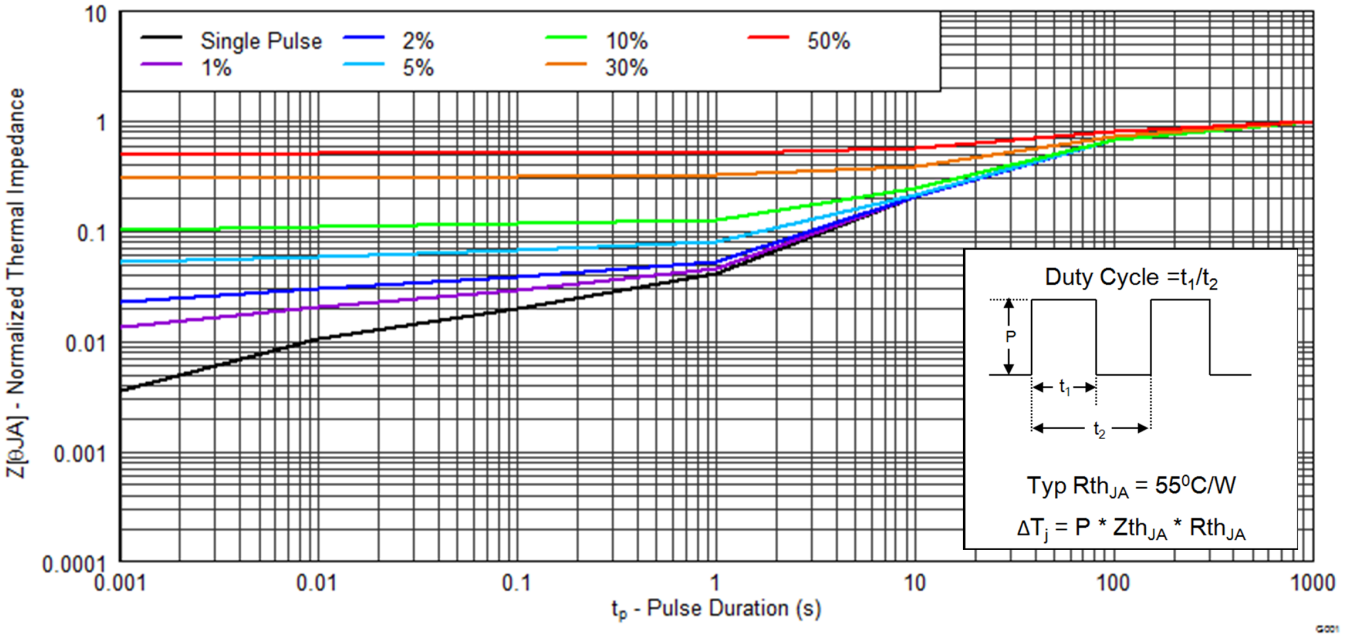


**Figure 1. Transient Thermal Impedance**

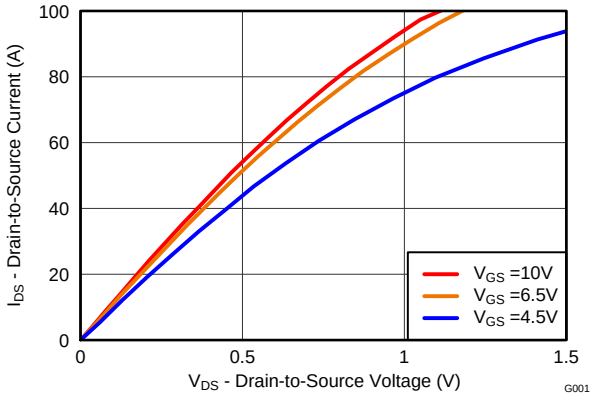


**Figure 2. Saturation Characteristics**

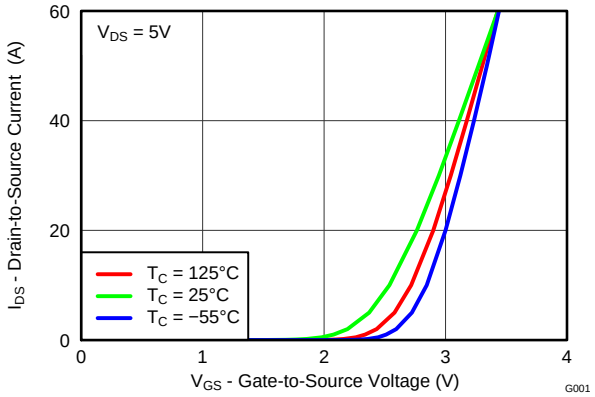


**Figure 3. Transfer Characteristics**

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## TYPICAL MOSFET CHARACTERISTICS (continued)

($T_A$ = 25°C unless otherwise stated)

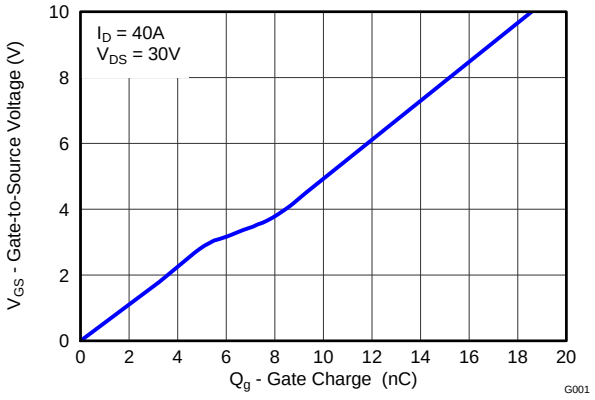


**Figure 4. Gate Charge**

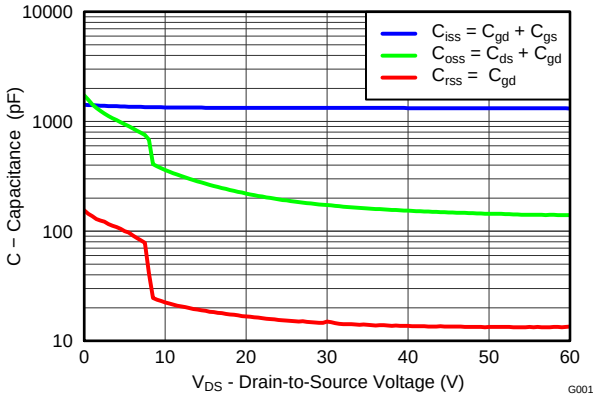


**Figure 5. Capacitance**

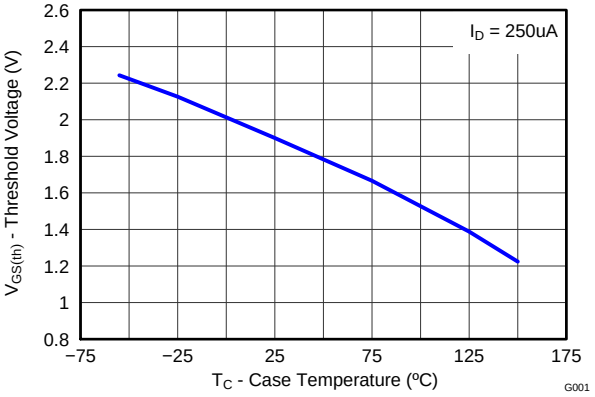


**Figure 6. Threshold Voltage vs. Temperature**

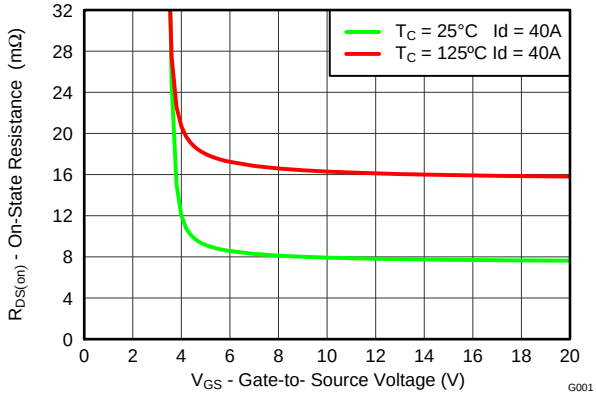


**Figure 7. On-State Resistance vs. Gate-to-Source Voltage**

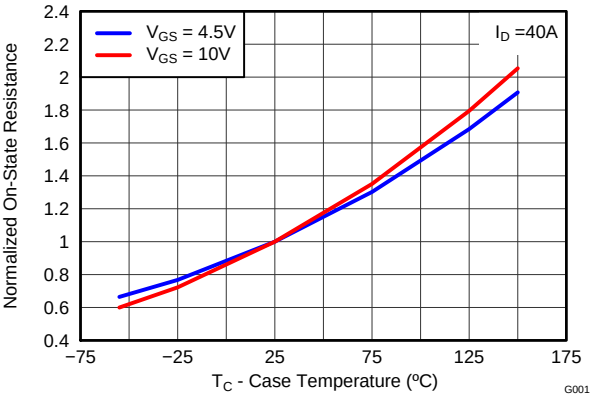


**Figure 8. Normalized On-State Resistance vs. Temperature**

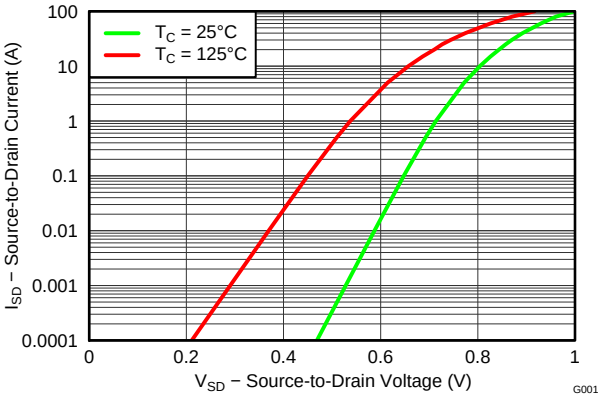


**Figure 9. Typical Diode Forward Voltage**


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## TYPICAL MOSFET CHARACTERISTICS (continued)

($T_A$ = 25°C unless otherwise stated)

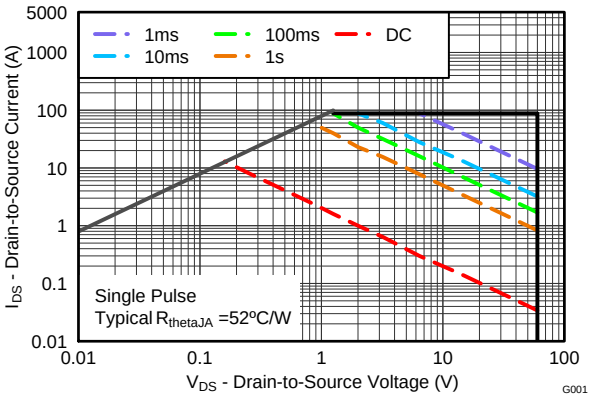



**Figure 10. Maximum Safe Operating Area**

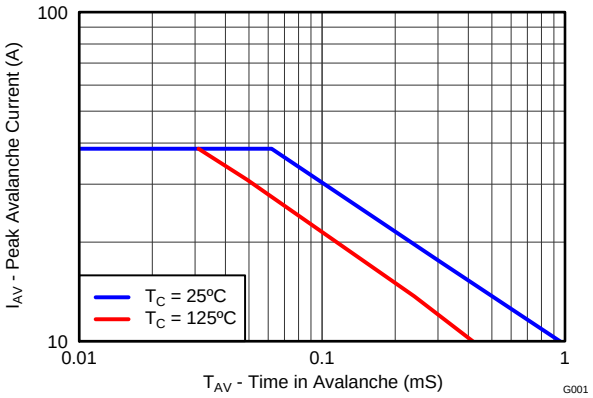



**Figure 11. Single Pulse Unclamped Inductive Switching**

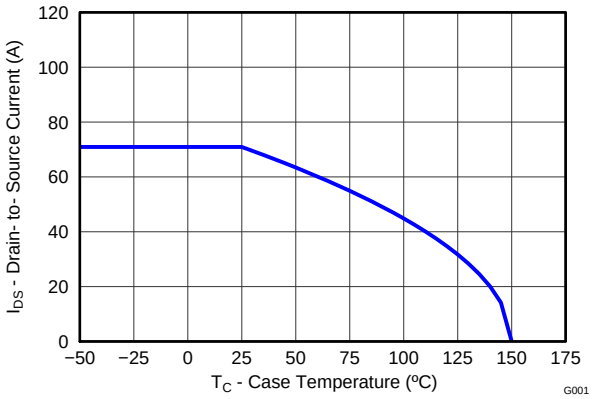
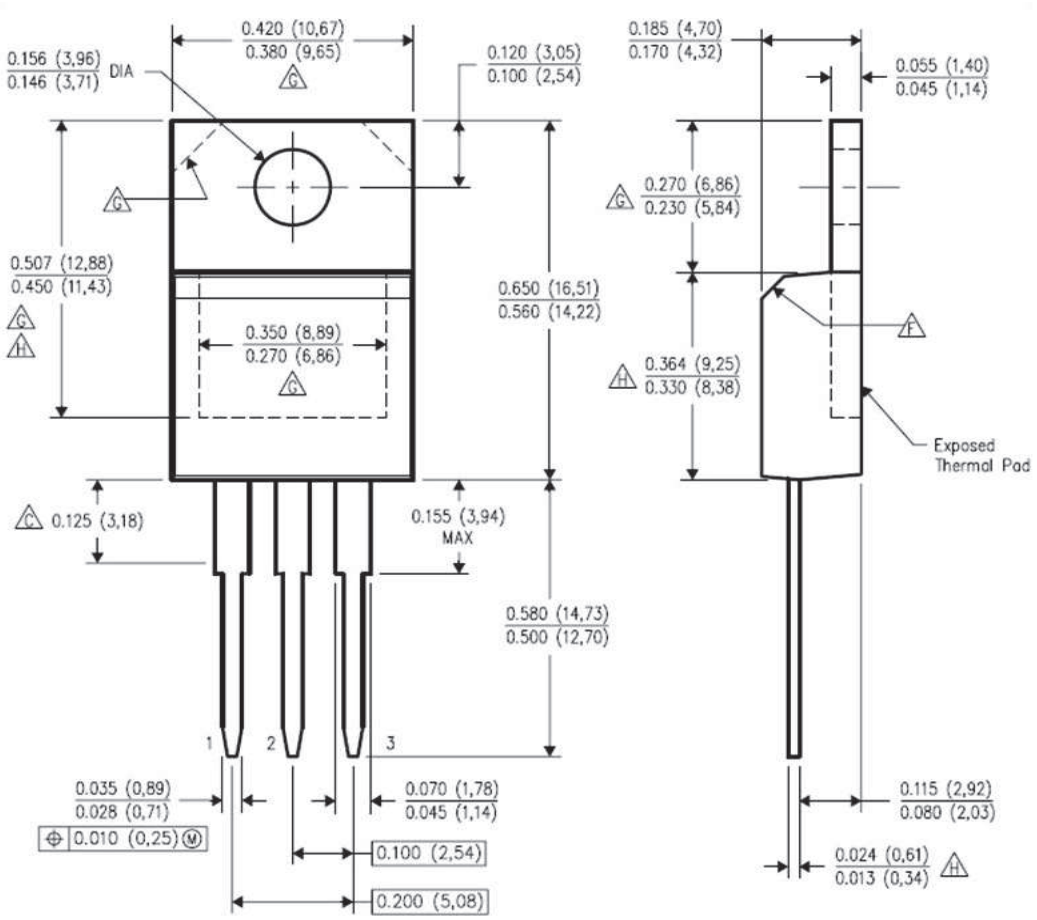



**Figure 12. Maximum Drain Current vs. Temperature**

## MECHANICAL DATA

### 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.

**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 | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| CSD18534KCS | ACTIVE | TO-220 | KCS | 3 | 50 | Pb-Free (RoHS Exempt) | CU SN | N / A for Pkg Type | |

(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.

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