

2SK2199-TL-E-VB Datasheet

Power MOSFET

| PRODUCT SUMMARY | | |
|---------------------------|------------------------|------|
| V_{DS} (V) | 250 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 10\text{ V}$ | 0.64 |
| Q_g (Max.) (nC) | 14 | |
| Q_{gs} (nC) | 2.7 | |
| Q_{gd} (nC) | 7.8 | |
| Configuration | Single | |

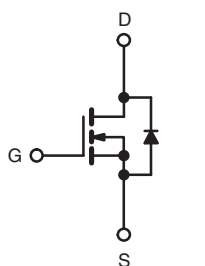
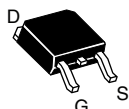
FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Available in Tape and Reel
- Fast Switching
- Ease of Paralleling



RoHS
COMPLIANT
HALOGEN
FREE
Available

**DPAK
(TO-252)**



N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C, unless otherwise noted) | | | | | |
|---|-------------------------|-------------------------|-----------------------------------|---------------|------|
| PARAMETER | | | SYMBOL | LIMIT | UNIT |
| Drain-Source Voltage | | | V _{DS} | 250 | V |
| Gate-Source Voltage | | | V _{GS} | ± 20 | |
| Continuous Drain Current | V _{GS} at 10 V | T _C = 25 °C | I _D | 4.5 | A |
| | | T _C = 100 °C | | 3.0 | |
| Pulsed Drain Current ^a | | | I _{DM} | 16 | |
| Linear Derating Factor | | | | 0.33 | W/°C |
| Linear Derating Factor (PCB Mount) ^e | | | | 0.020 | |
| Single Pulse Avalanche Energy ^b | | | E _{AS} | 130 | mJ |
| Repetitive Avalanche Current ^a | | | I _{AR} | 4.5 | A |
| Repetitive Avalanche Energy ^a | | | E _{AR} | 5.2 | mJ |
| Maximum Power Dissipation | T _C = 25 °C | | P _D | 45 | W |
| Maximum Power Dissipation (PCB Mount) ^e | T _A = 25 °C | | | 2.5 | |
| Peak Diode Recovery dV/dt ^c | | | dV/dt | 4.8 | V/ns |
| Operating Junction and Storage Temperature Range | | | T _J , T _{stg} | - 55 to + 150 | °C |
| Soldering Recommendations (Peak Temperature) ^d | for 10 s | | | 260 | |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50\text{ V}$; starting $T_J = 25\text{ }^\circ\text{C}$, $L = 14\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 3.8\text{ A}$ (see fig. 12).
- $I_{SD} \leq 3.8\text{ A}$, $dI/dt \leq 90\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$.
- 1.6 mm from case.
- When mounted on 1" square PCB (FR-4 or G-10 material).

THERMAL RESISTANCE RATINGS

| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
|--|------------|------|------|------|
| Maximum Junction-to-Ambient (PCB Mount) ^a | R_{thJA} | - | 50 | °C/W |
| Maximum Junction-to-Ambient | R_{thJA} | - | 110 | |
| Maximum Junction-to-Case | R_{thJC} | - | 3.0 | |

Note

a. When mounted on 1" square PCB (FR-4 or G-10 material).

SPECIFICATIONS ($T_J = 25^\circ\text{C}$, unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
|---|----------------------------------|--|---|------|------|-------|------|
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V _{DS} | V _{GS} = 0 V, I _D = 250 μA | | 250 | - | - | V |
| V _{DS} Temperature Coefficient | ΔV _{DS} /T _J | Reference to 25 °C, I _D = 1 mA | | - | 0.36 | - | V/°C |
| Gate-Source Threshold Voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 250 μA | | 2.0 | - | 4.0 | V |
| Gate-Source Leakage | I _{GSS} | V _{GS} = ± 20 V | | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} = 250 V, V _{GS} = 0 V | | - | - | 25 | μA |
| | | V _{DS} = 200 V, V _{GS} = 0 V, T _J = 125 °C | | - | - | 250 | |
| Drain-Source On-State Resistance | R _{DS(on)} | V _{GS} = 10 V | I _D = 2.3 A ^b | - | 0.64 | - | Ω |
| Forward Transconductance | g _{fs} | V _{DS} = 50 V, I _D = 2.3 A ^b | | 1.5 | - | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5 ^c | | - | 260 | - | pF |
| Output Capacitance | C _{oss} | | | - | 77 | - | |
| Reverse Transfer Capacitance | C _{rss} | | | - | 15 | - | |
| Total Gate Charge | Q _g | V _{GS} = 10 V | I _D = 4.4 A, V _{DS} = 200 V, see fig. 6 and 13 ^{b, c} | - | - | 14 | nC |
| Gate-Source Charge | Q _{gs} | | | - | - | 2.7 | |
| Gate-Drain Charge | Q _{gd} | | | - | - | 7.8 | |
| Turn-On Delay Time | t _{d(on)} | V _{DD} = 125 V, I _D = 4.4 A, R _G = 18 Ω, R _D = 28 Ω, see fig. 10 ^{b, c} | | - | 7.0 | - | ns |
| Rise Time | t _r | | | - | 13 | - | |
| Turn-Off Delay Time | t _{d(off)} | | | - | 20 | - | |
| Fall Time | t _f | | | - | 12 | - | |
| Internal Drain Inductance | L _D | Between lead, 6 mm (0.25") from package and center of die contact | | - | 4.5 | - | nH |
| Internal Source Inductance | L _S | | | - | 7.5 | - | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous Source-Drain Diode Current | I _S | MOSFET symbol showing the integral reverse p - n junction diode | | - | - | 3.8 | A |
| Pulsed Diode Forward Current ^a | I _{SM} | | | - | - | 15 | |
| Body Diode Voltage | V _{SD} | T _J = 25 °C, I _S = 3.8 A, V _{GS} = 0 V ^b | | - | - | 1.8 | V |
| Body Diode Reverse Recovery Time | t _{rr} | T _J = 25 °C, I _F = 4.4 A, dI/dt = 100 A/μs ^b | | - | 200 | 400 | ns |
| Body Diode Reverse Recovery Charge | Q _{rr} | | | - | 0.93 | 1.9 | μC |
| Forward Turn-On Time | t _{on} | Intrinsic turn-on time is negligible (turn-on is dominated by L _S and L _D) | | | | | |

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
 b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

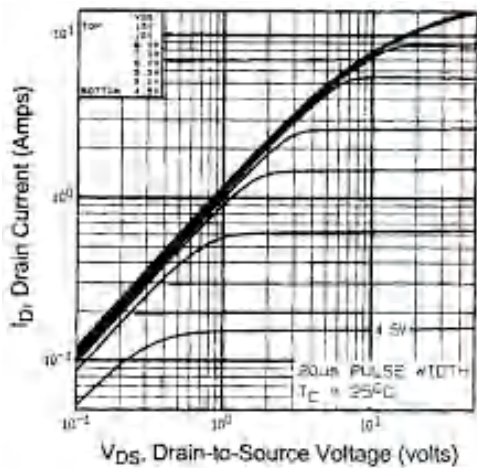


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^{\circ}\text{C}$

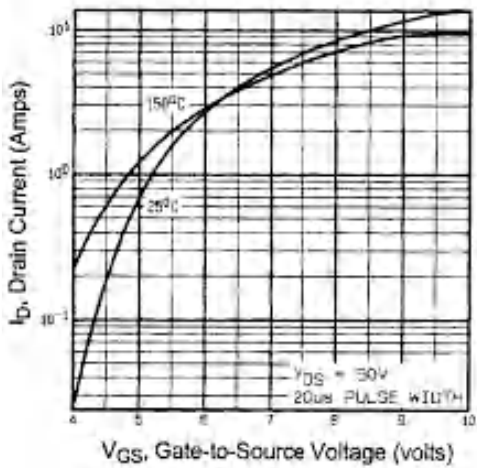


Fig. 3 - Typical Transfer Characteristics

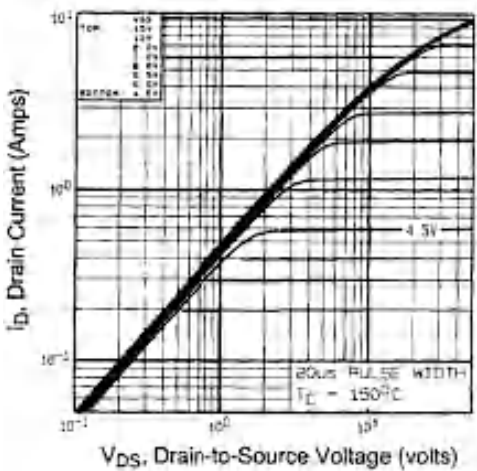


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^{\circ}\text{C}$

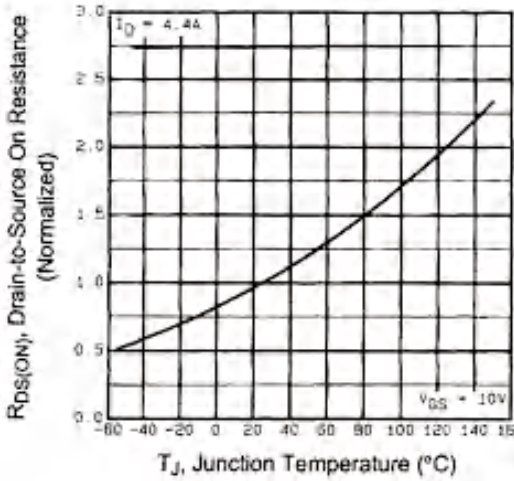


Fig. 4 - Normalized On-Resistance vs. Temperature

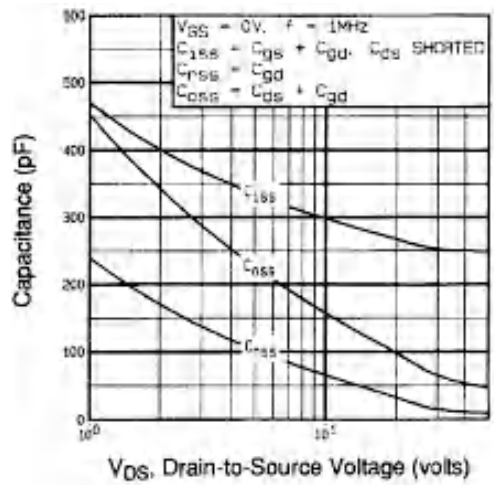


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage



Fig. 7 - Typical Source-Drain Diode Forward Voltage



Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage



Fig. 8 - Maximum Safe Operating Area

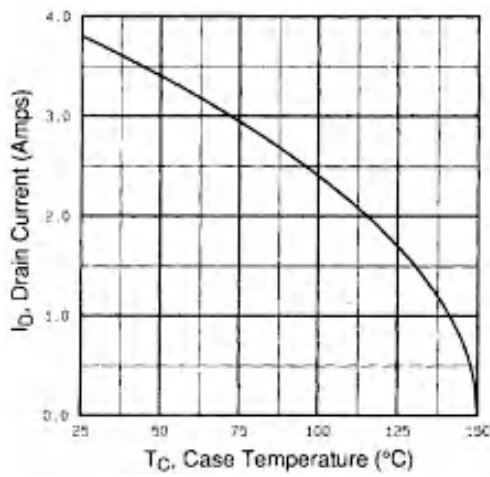


Fig. 9 - Maximum Drain Current vs. Case Temperature

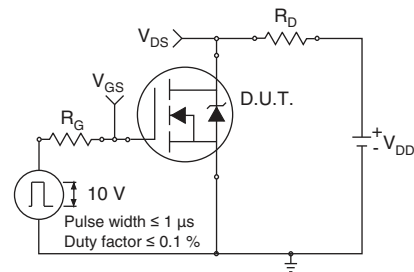


Fig. 10a - Switching Time Test Circuit

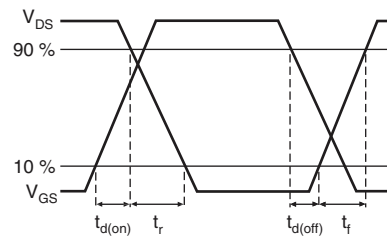


Fig. 10b - Switching Time Waveforms

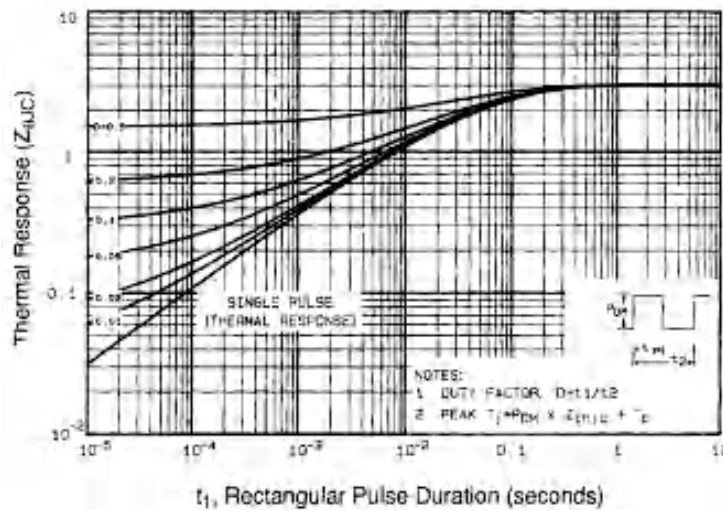


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case



Fig. 12a - Unclamped Inductive Test Circuit



Fig. 12b - Unclamped Inductive Waveforms

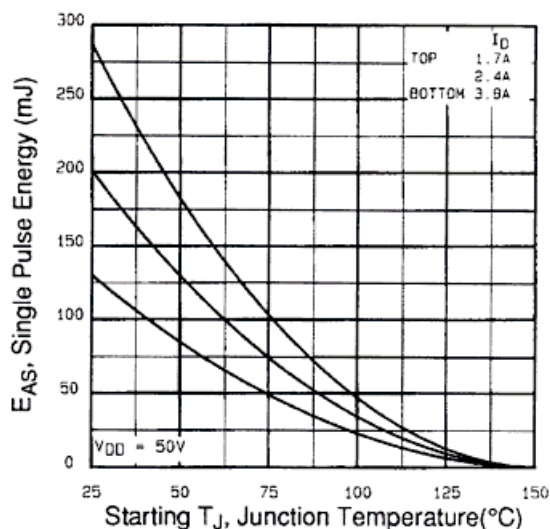


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

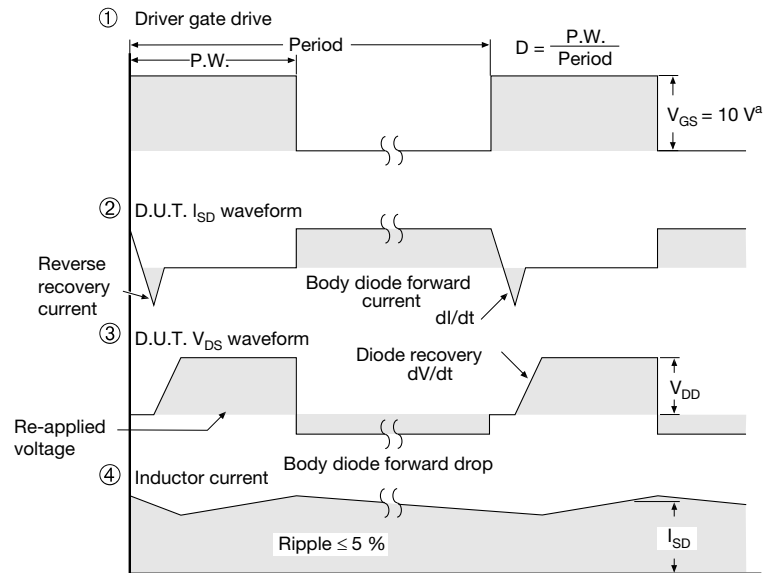
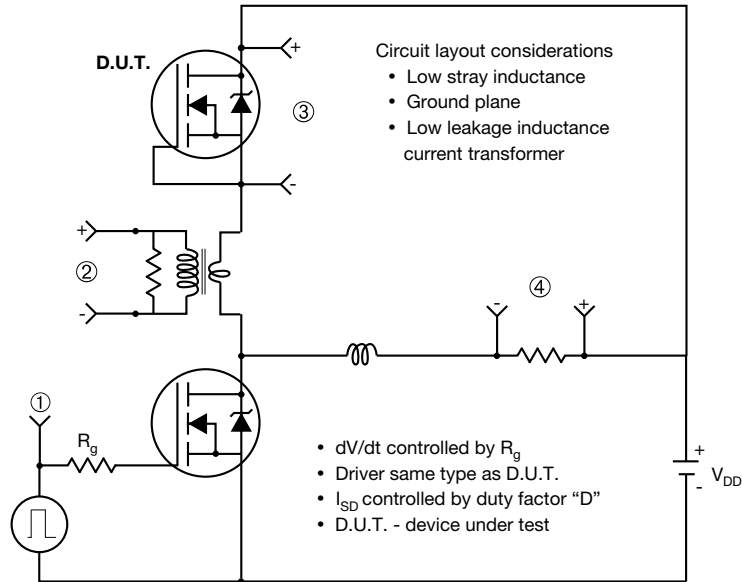


Fig. 13a - Basic Gate Charge Waveform



Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note

a. $V_{GS} = 5 V$ for logic level devices

Fig. 14 - For N-Channel

TO-252AA Case Outline

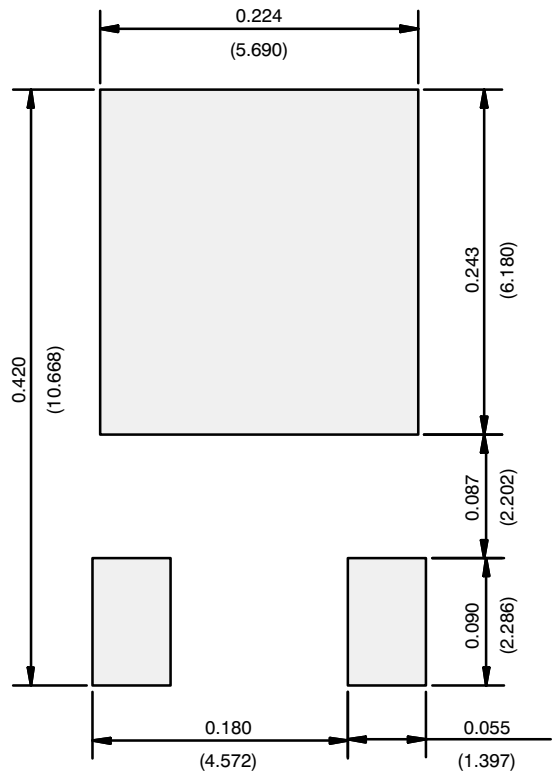


| DIM. | MILLIMETERS | | INCHES | |
|--|-------------|-------|-----------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 2.18 | 2.38 | 0.086 | 0.094 |
| A1 | - | 0.127 | - | 0.005 |
| b | 0.64 | 0.88 | 0.025 | 0.035 |
| b2 | 0.76 | 1.14 | 0.030 | 0.045 |
| b3 | 4.95 | 5.46 | 0.195 | 0.215 |
| C | 0.46 | 0.61 | 0.018 | 0.024 |
| C2 | 0.46 | 0.89 | 0.018 | 0.035 |
| D | 5.97 | 6.22 | 0.235 | 0.245 |
| D1 | 4.10 | - | 0.161 | - |
| E | 6.35 | 6.73 | 0.250 | 0.265 |
| E1 | 4.32 | - | 0.170 | - |
| H | 9.40 | 10.41 | 0.370 | 0.410 |
| e | 2.28 BSC | | 0.090 BSC | |
| e1 | 4.56 BSC | | 0.180 BSC | |
| L | 1.40 | 1.78 | 0.055 | 0.070 |
| L3 | 0.89 | 1.27 | 0.035 | 0.050 |
| L4 | - | 1.02 | - | 0.040 |
| L5 | 1.01 | 1.52 | 0.040 | 0.060 |
| ECN: T16-0236-Rev. P, 16-May-16 DWG: 5347 | | | | |

Notes

- Dimension L3 is for reference only.

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads
Dimensions in Inches/(mm)

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