

Power MOSFET



P-Channel MOSFET

FEATURES

- Surface-mount
- Available in tape and reel
- Dynamic dv/dt rating
- Repetitive avalanche rated
- P-channel
- Fast switching
- Ease of paralleling
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
Available

DESCRIPTION

Third generation power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The SOT-223 package is designed for surface-mount using vapor phase, infrared, or wave soldering techniques. Its unique package design allows for easy automatic pick-and-place as with other SOT or SOIC packages but has the added advantage of improved thermal performance due to an enlarged tab for heatsinking. Power dissipation of greater than 1.25 W is possible in a typical surface mount application.

Marking code: FF

| PRODUCT SUMMARY | | |
|---------------------------|------------------|-----|
| V_{DS} (V) | -100 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = -10$ V | 1.2 |
| Q_g max. (nC) | 8.7 | |
| Q_{gs} (nC) | 2.2 | |
| Q_{gd} (nC) | 4.1 | |
| Configuration | Single | |

| ORDERING INFORMATION | |
|---------------------------------|---|
| Package | SOT-223 |
| Lead (Pb)-free and halogen-free | SiHFL9110TR-GE3 ^a IRFL9110TRPbF-BE3 ^{a, b} |
| Lead (Pb)-free | IRFL9110TRPbF ^a |

Notes

- See device orientation
- “-BE3” denotes alternate manufacturing location

| ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted) | | | | |
|---|-------------------|----------------|-------|---|
| PARAMETER | SYMBOL | LIMIT | UNIT | |
| Drain-source voltage | V_{DS} | -100 | V | |
| Gate-source voltage | V_{GS} | ± 20 | | |
| Continuous drain current | V_{GS} at -10 V | $T_C = 25$ °C | -1.1 | A |
| | | $T_C = 100$ °C | -0.69 | |
| Pulsed drain current ^a | I_{DM} | -8.8 | W/°C | |
| Linear derating factor | | 0.025 | | |
| Linear derating factor (PCB mount) ^e | | 0.017 | | |
| Single pulse avalanche energy ^b | E_{AS} | 100 | mJ | |
| Avalanche current ^a | I_{AR} | -1.1 | A | |
| Repetitive avalanche energy ^a | E_{AR} | 0.31 | mJ | |
| Maximum power dissipation | P_D | $T_C = 25$ °C | 3.1 | W |
| Maximum power dissipation (PCB mount) ^e | | $T_A = 25$ °C | 2.0 | |
| Peak diode recovery dv/dt ^c | dv/dt | -5.5 | V/ns | |
| Operating junction and storage temperature range | T_J, T_{stg} | -55 to +150 | °C | |
| Soldering recommendations (peak temperature) ^d | For 10 s | 300 | | |

Notes



- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- $V_{DD} = -25$ V, starting $T_J = 25$ °C, $L = 7.7$ mH, $R_g = 25$ Ω , $I_{AS} = -4.4$ A (see fig. 12)
- $I_{SD} \leq -4.4$ A, $di/dt \leq -75$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °C
- 1.6 mm from case
- When mounted on 1" square PCB (FR-4 or G-10 material)



| THERMAL RESISTANCE RATINGS | | | | | |
|--|-------------------|------|------|------|------|
| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Maximum junction-to-ambient (PCB mount) ^a | R _{thJA} | - | - | 60 | °C/W |
| Maximum junction-to-case (drain) | R _{thJC} | - | - | 40 | |

Note

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

| SPECIFICATIONS (T _J = 25 °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 | | -100 | - | - | V |
| V _{DS} temperature coefficient | ΔV _{DS} /T _J | Reference to 25 °C, I _D = -1 mA | | - | -0.091 | - | 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} = -100 V, V _{GS} = 0 V | | - | - | -100 | μA |
| | | V _{DS} = -80 V, V _{GS} = 0 V, T _J = 125 °C | | - | - | -500 | |
| Drain-source on-state resistance | R _{DS(on)} | V _{GS} = -10 V | I _D = -0.66 A ^b | - | - | 1.2 | Ω |
| Forward transconductance | g _{fs} | V _{DS} = -50 V, I _D = -0.66 A | | 0.82 | - | - | S |
| Dynamic | | | | | | | |
| Input capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = -25 V, f = 1.0 MHz, see fig. 5 | | - | 200 | - | pF |
| Output capacitance | C _{oss} | | | - | 94 | - | |
| Reverse transfer capacitance | C _{rss} | | | - | 18 | - | |
| Total gate charge | Q _g | V _{GS} = -10 V | I _D = -4.0 A, V _{DS} = -80 V, see fig. 6 and 13 ^b | - | - | 8.7 | nC |
| Gate-source charge | Q _{gs} | | | - | - | 2.2 | |
| Gate-drain charge | Q _{gd} | | | - | - | 4.1 | |
| Turn-on delay time | t _{d(on)} | V _{DD} = -50 V, I _D = -4.0 A, R _g = 24 Ω, R _D = 11 Ω, see fig. 10 ^b | | - | 10 | - | ns |
| Rise time | t _r | | | - | 27 | - | |
| Turn-off delay time | t _{d(off)} | | | - | 15 | - | |
| Fall time | t _f | | | - | 17 | - | |
| Internal drain inductance | L _D | Between lead, 6 mm (0.25") from package and center of die contact  | | - | 4.0 | - | nH |
| Internal source inductance | L _S | | | - | 6.0 | - | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous source-drain diode current | I _S | MOSFET symbol showing the integral reverse p - n junction diode  | | - | - | -1.1 | A |
| Pulsed diode forward current ^a | I _{SM} | | | - | - | -8.8 | |
| Body diode voltage | V _{SD} | T _J = 25 °C, I _S = -1.1 A, V _{GS} = 0 V ^b | | - | - | -5.5 | V |
| Body diode reverse recovery time | t _{rr} | T _J = 25 °C, I _F = -4.0 A, dI/dt = 100 A/μs ^b | | - | 80 | 160 | ns |
| Body diode reverse recovery charge | Q _{rr} | | | - | 0.15 | 0.30 | 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 ≤ 300 μs; duty cycle ≤ 2 %

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

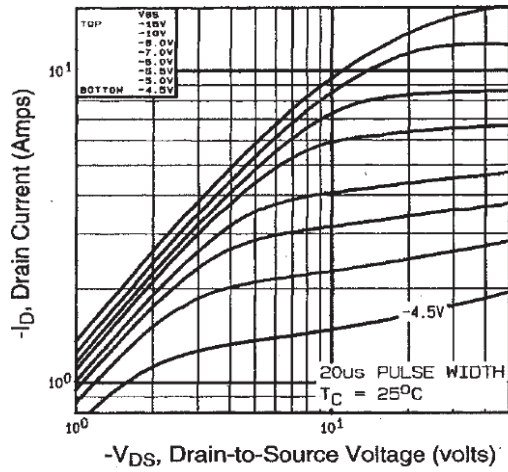


Fig. 1 - Typical Output Characteristics

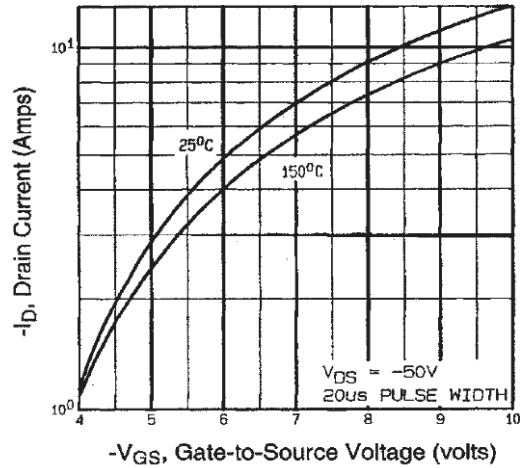


Fig. 3 - Typical Transfer Characteristics

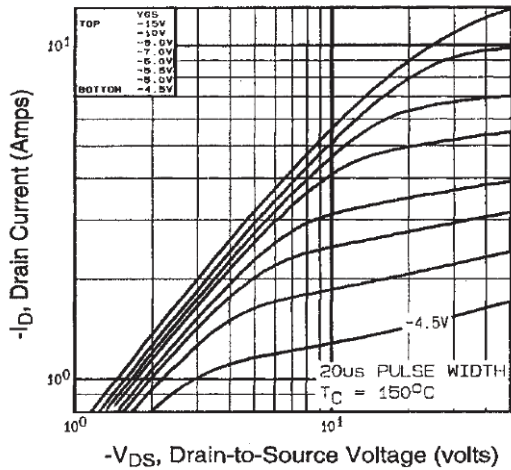


Fig. 2 - Typical Output Characteristics

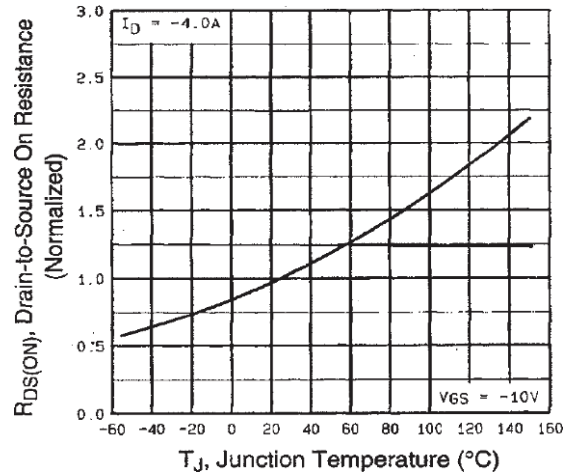


Fig. 4 - Normalized On-Resistance vs. Temperature

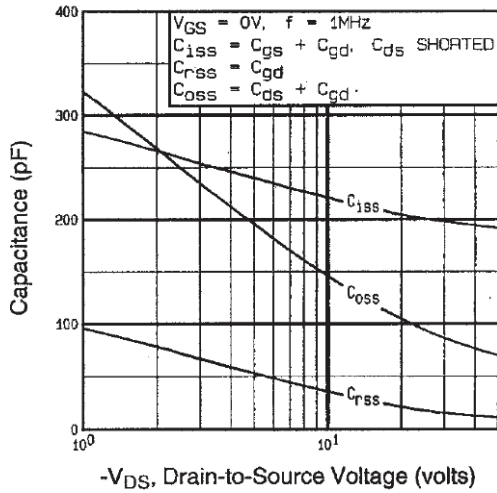


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

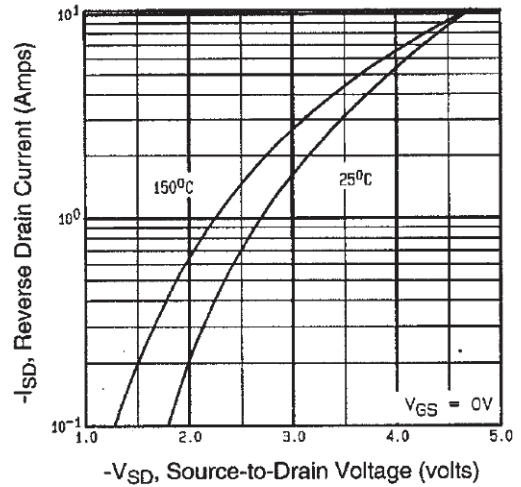


Fig. 7 - Typical Source-Drain Diode Forward Voltage



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

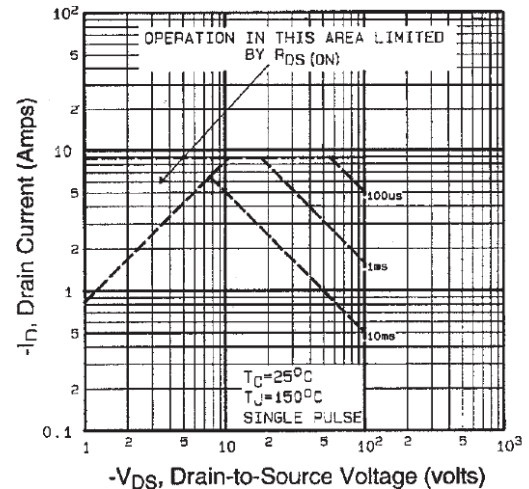


Fig. 8 - Maximum Safe Operating Area

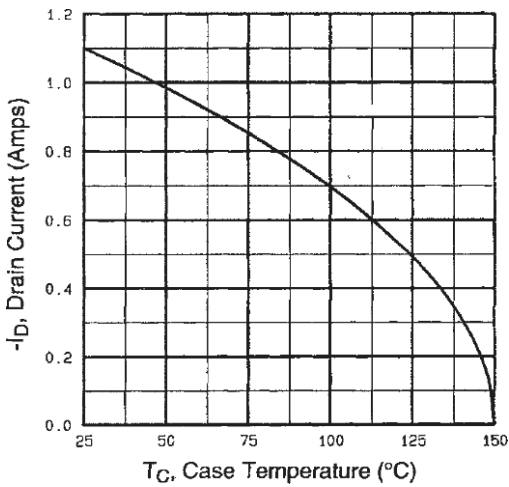


Fig. 9 - Maximum Drain Current vs. Case Temperature



Fig. 10a - Switching Time Test Circuit

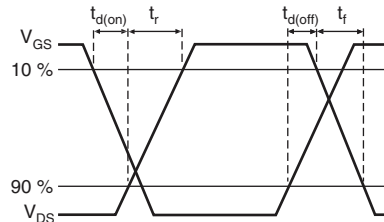


Fig. 10b - Switching Time Waveforms

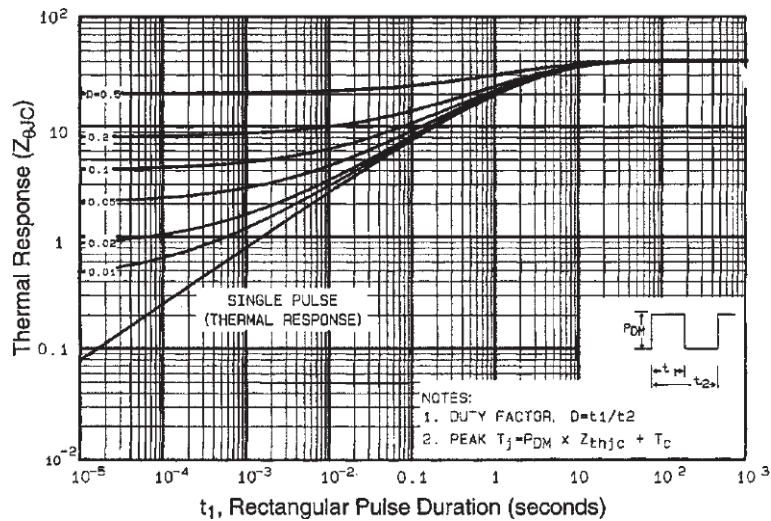


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

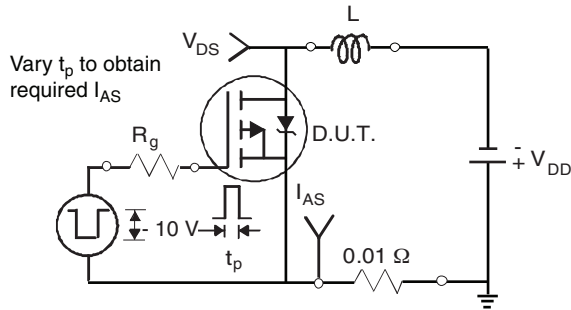


Fig. 12a - Unclamped Inductive Test Circuit

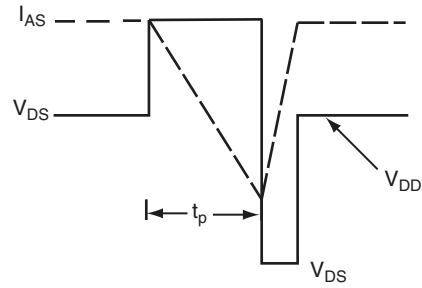


Fig. 12b - Unclamped Inductive Waveforms

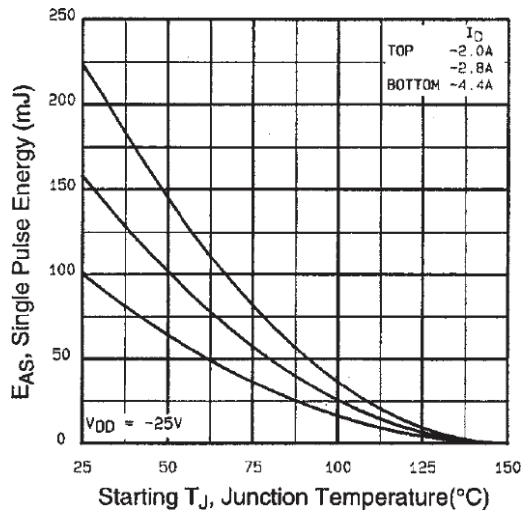


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

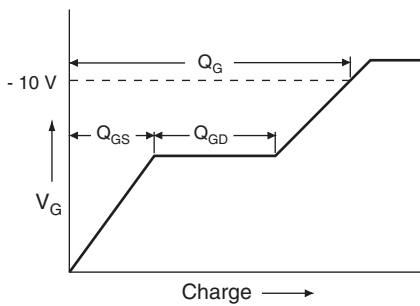


Fig. 13a - Basic Gate Charge Waveform

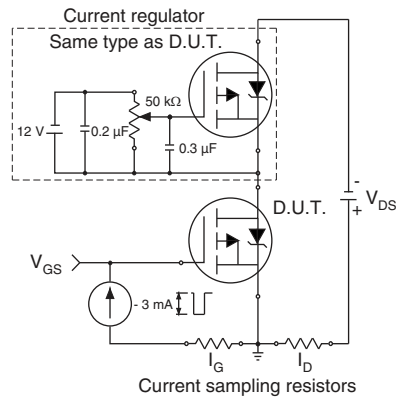
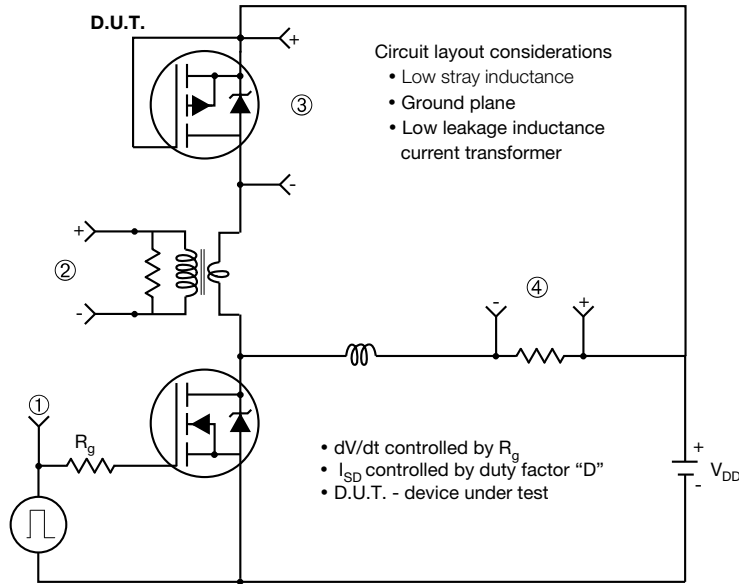


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note
 • Compliment N-Channel of D.U.T. for driver



Fig. 14 - For P-Channel

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SOT-223 (HIGH VOLTAGE)



| DIM. | MILLIMETERS | | INCHES | |
|---|-------------|------|------------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 1.55 | 1.80 | 0.061 | 0.071 |
| B | 0.65 | 0.85 | 0.026 | 0.033 |
| B1 | 2.95 | 3.15 | 0.116 | 0.124 |
| C | 0.25 | 0.35 | 0.010 | 0.014 |
| D | 6.30 | 6.70 | 0.248 | 0.264 |
| E | 3.30 | 3.70 | 0.130 | 0.146 |
| e | 2.30 BSC | | 0.0905 BSC | |
| e1 | 4.60 BSC | | 0.181 BSC | |
| H | 6.71 | 7.29 | 0.264 | 0.287 |
| L | 0.91 | - | 0.036 | - |
| L1 | 0.061 BSC | | 0.0024 BSC | |
| θ | - | 10' | - | 10' |
| ECN: S-82109-Rev. A, 15-Sep-08 DWG: 5969 | | | | |

Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension do not include mold flash.
4. Outline conforms to JEDEC outline TO-261AA.



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