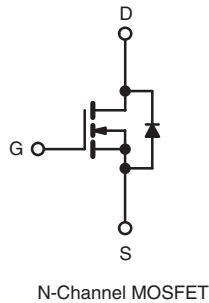


Power MOSFET

PRODUCT SUMMARY

| | | |
|---------------------------|-----------------|------|
| V_{DS} (V) | 200 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 10$ V | 0.18 |
| Q_g (Max.) (nC) | 70 | |
| Q_{gs} (nC) | 13 | |
| Q_{gd} (nC) | 39 | |
| Configuration | Single | |

TO-220 FULLPAK


FEATURES

- Isolated Package
- High Voltage Isolation = 2.5 kV_{RMS} (t = 60 s; f = 60 Hz)
- Sink to Lead Creepage Distance = 4.8 mm
- Dynamic dV/dt Rating
- Low Thermal Resistance
- Lead (Pb)-free Available


RoHS*
COMPLIANT

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 TO-220 FULLPAK eliminates the need for additional insulating hardware in commercial-industrial applications. The molding compound used provides a high isolation capability and a low thermal resistance between the tab and external heatsink. The isolation is equivalent to using a 100 micron mica barrier with standard TO-220 product. The FULLPAK is mounted to a heatsink using a single clip or by a single screw fixing.

ORDERING INFORMATION

| | |
|----------------|----------------|
| Package | TO-220 FULLPAK |
| Lead (Pb)-free | IRFI640GPbF |
| | SiHFI640G-E3 |
| SnPb | IRFI640G |
| | SiHFI640G |

ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted

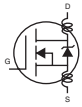

| PARAMETER | SYMBOL | LIMIT | UNIT |
|--|------------------|-----------------------------------|----------|
| Drain-Source Voltage | V_{DS} | 200 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | |
| Continuous Drain Current | I_D | V_{GS} at 10 V $T_C = 25$ °C | 9.8 |
| | | $T_C = 100$ °C | 6.2 |
| Pulsed Drain Current ^a | I_{DM} | 39 | A |
| Linear Derating Factor | | 0.32 | W/°C |
| Single Pulse Avalanche Energy ^b | E_{AS} | 430 | mJ |
| Repetitive Avalanche Current ^a | I_{AR} | 9.8 | A |
| Repetitive Avalanche Energy ^a | E_{AR} | 4.0 | mJ |
| Maximum Power Dissipation | P_D | 40 | W |
| Peak Diode Recovery dV/dt ^c | dV/dt | 5.0 | V/ns |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | - 55 to + 150 | °C |
| Soldering Recommendations (Peak Temperature) | for 10 s | 300 ^d | |
| Mounting Torque | 6-32 or M3 screw | 10 | lbf · in |
| | | 1.1 | N · m |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, L = 6.7 mH, $R_G = 25$ Ω , $I_{AS} = 9.8$ A (see fig. 12).
- $I_{SD} \leq 18$ A, $dI/dt \leq 150$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °C.
- 1.6 mm from case.

* Pb containing terminations are not RoHS compliant, exemptions may apply

| THERMAL RESISTANCE RATINGS | | | | |
|----------------------------------|------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | R_{thJA} | - | 65 | °C/W |
| Maximum Junction-to-Case (Drain) | R_{thJC} | - | 3.1 | |

| SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted | | | | | | | |
|--|---------------------|--|---|------|------|-----------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | | 200 | - | - | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$ | | - | 0.29 | - | V/°C |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | | 2.0 | - | 4.0 | V |
| Gate-Source Leakage | I_{GSS} | $V_{GS} = \pm 20\text{ V}$ | | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$ | | - | - | 25 | μA |
| | | $V_{DS} = 160\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | | - | - | 250 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}$ | $I_D = 5.9\text{ A}^b$ | - | - | 0.18 | Ω |
| Forward Transconductance | g_{fs} | $V_{DS} = 50\text{ V}, I_D = 5.9\text{ A}^b$ | | 5.2 | - | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5 | | - | 1300 | - | pF |
| Output Capacitance | C_{oss} | | | - | 400 | - | |
| Reverse Transfer Capacitance | C_{rss} | | | - | 130 | - | |
| Drain to Sink Capacitance | C | $f = 1.0\text{ MHz}$ | | - | 12 | - | |
| Total Gate Charge | Q_g | $V_{GS} = 10\text{ V}$ | $I_D = 18\text{ A}, V_{DS} = 160\text{ V}$, see fig. 6 and 13 ^b | - | - | 70 | nC |
| Gate-Source Charge | Q_{GS} | | | - | - | 13 | |
| Gate-Drain Charge | Q_{GD} | | | - | - | 39 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 100\text{ V}, I_D = 18\text{ A}, R_G = 9.1\text{ }\Omega, R_D = 5.4\text{ }\Omega$, see fig. 10 ^b | | - | 14 | - | ns |
| Rise Time | t_r | | | - | 51 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 45 | - | |
| Fall Time | t_f | | | - | 36 | - | |
| 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  | | - | - | 9.8 | A |
| Pulsed Diode Forward Current ^a | I_{SM} | | | - | - | 39 | |
| Body Diode Voltage | V_{SD} | $T_J = 25\text{ }^\circ\text{C}, I_S = 9.8\text{ A}, V_{GS} = 0\text{ V}^b$ | | - | - | 2.0 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}, I_F = 18\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$ | | - | 300 | 610 | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | | - | 3.4 | 7.1 | 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 ≤ 2

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

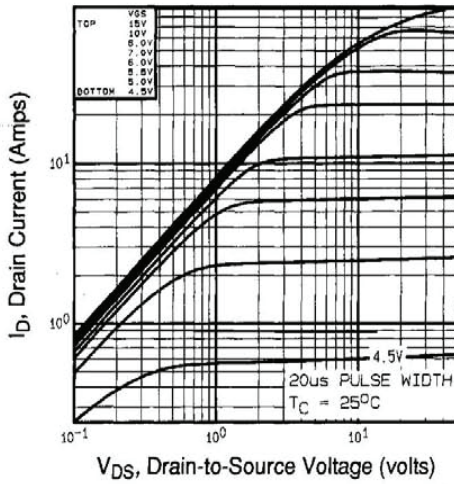


Fig. 1 - Typical Output Characteristics, $T_C = 25^\circ\text{C}$

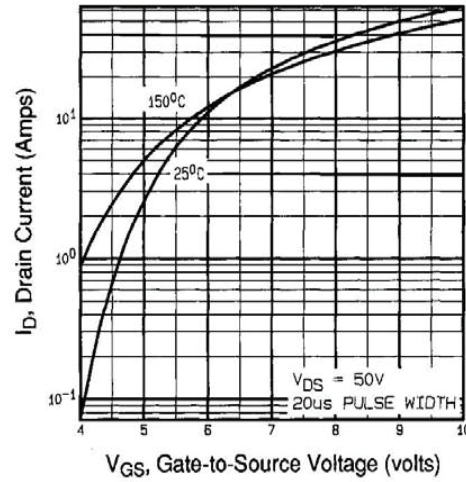


Fig. 3 - Typical Transfer Characteristics

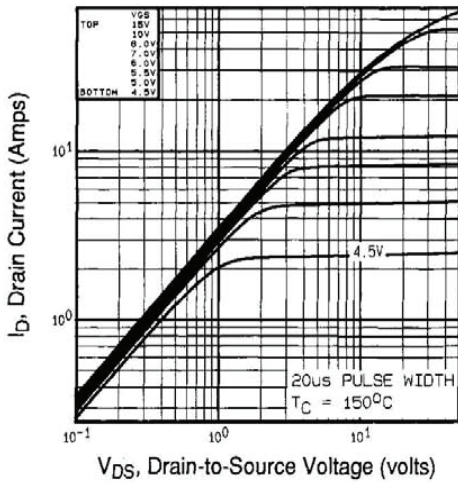


Fig. 2 - Typical Output Characteristics, $T_C = 150^\circ\text{C}$

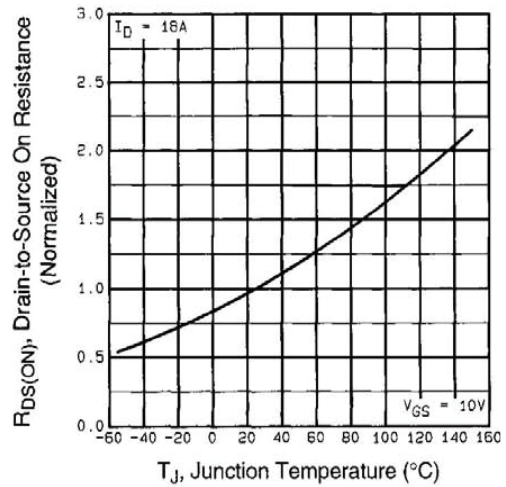


Fig. 4 - Normalized On-Resistance vs. Temperature

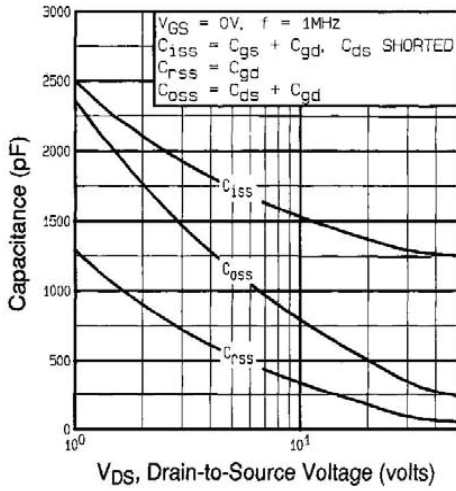


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

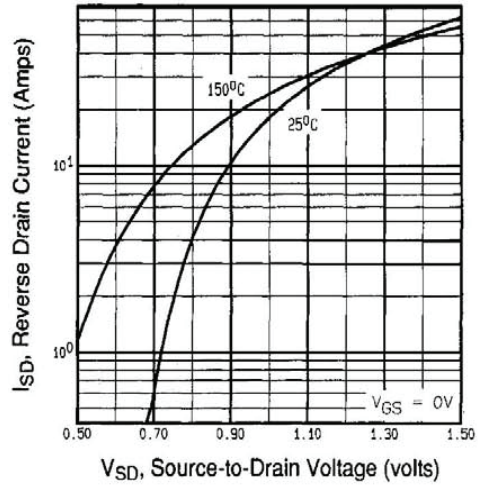


Fig. 7 - Typical Source-Drain Diode Forward Voltage

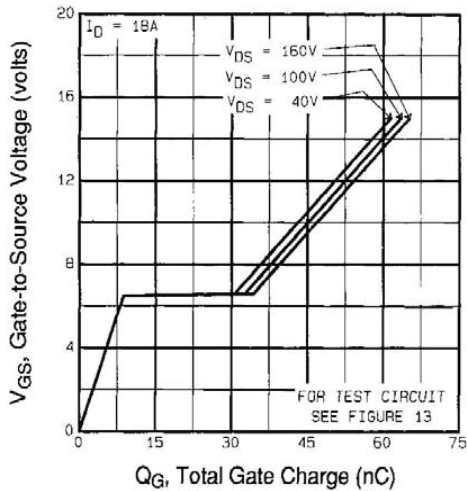


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

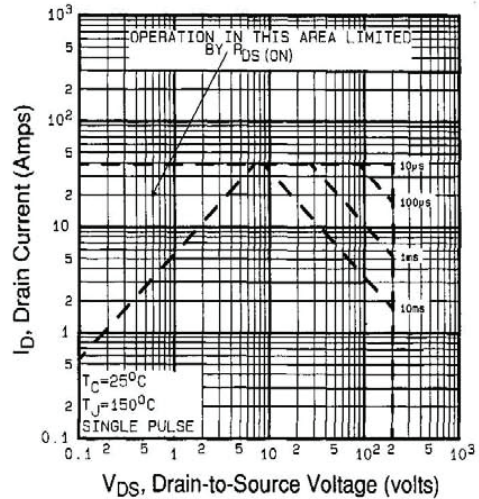


Fig. 8 - Maximum Safe Operating Area

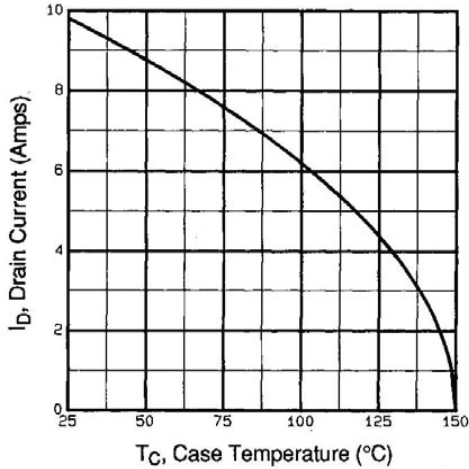


Fig. 9 - Maximum Drain Current vs. Case Temperature



Fig. 10a - Switching Time Test Circuit

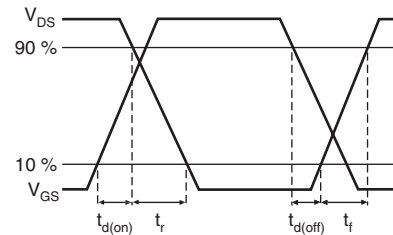


Fig. 10b - Switching Time Waveforms

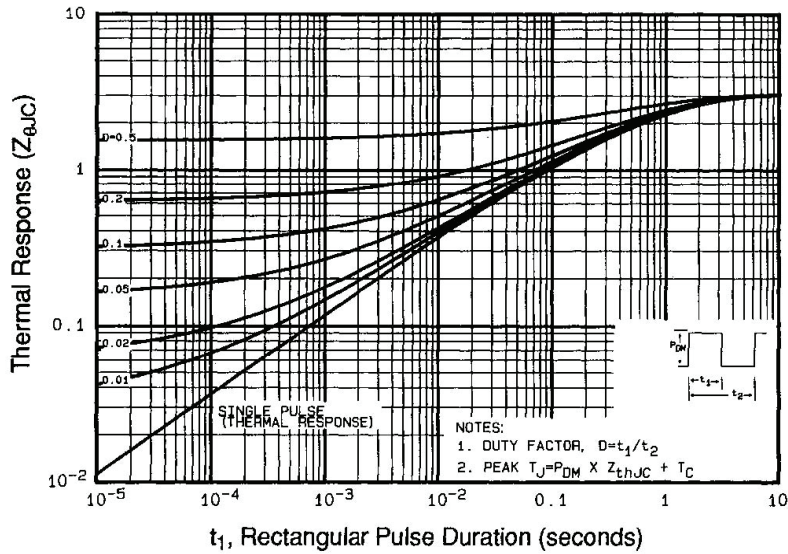


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

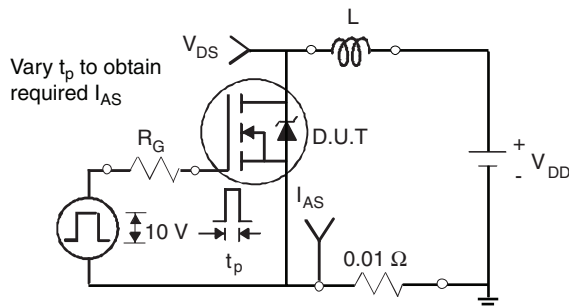


Fig. 12a - Unclamped Inductive Test Circuit

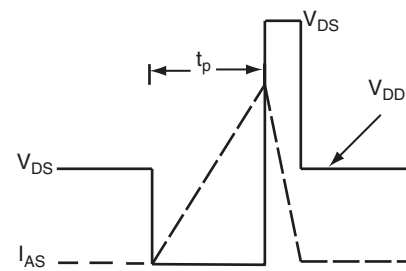


Fig. 12b - Unclamped Inductive Waveforms

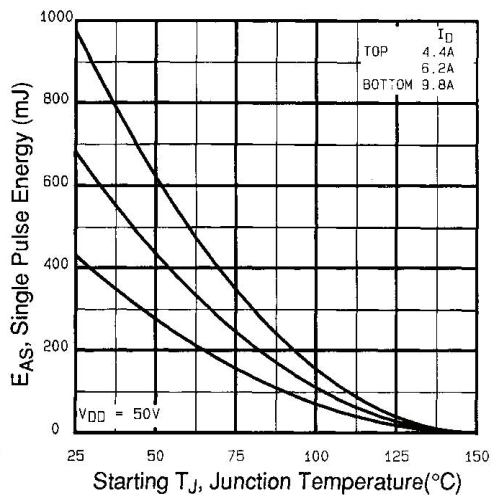


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

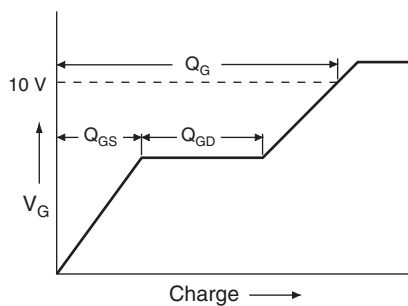


Fig. 13a - Basic Gate Charge Waveform



Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit

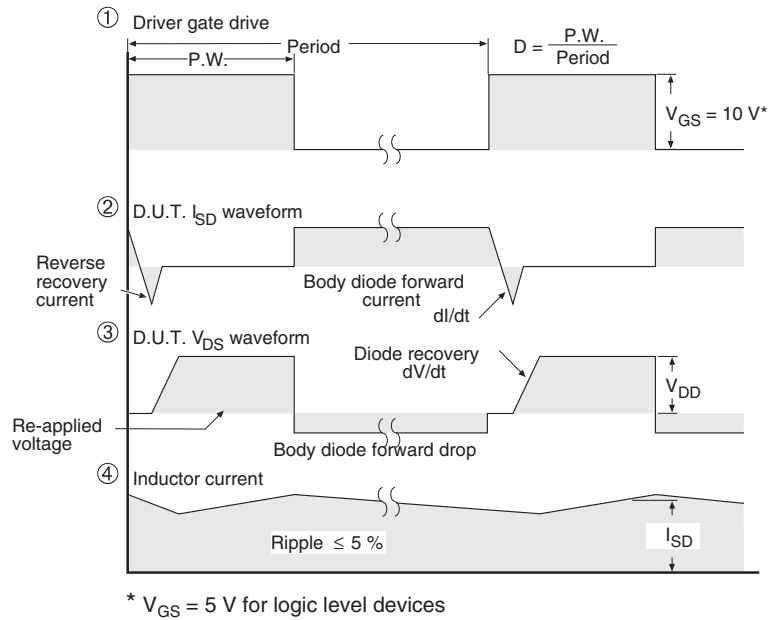
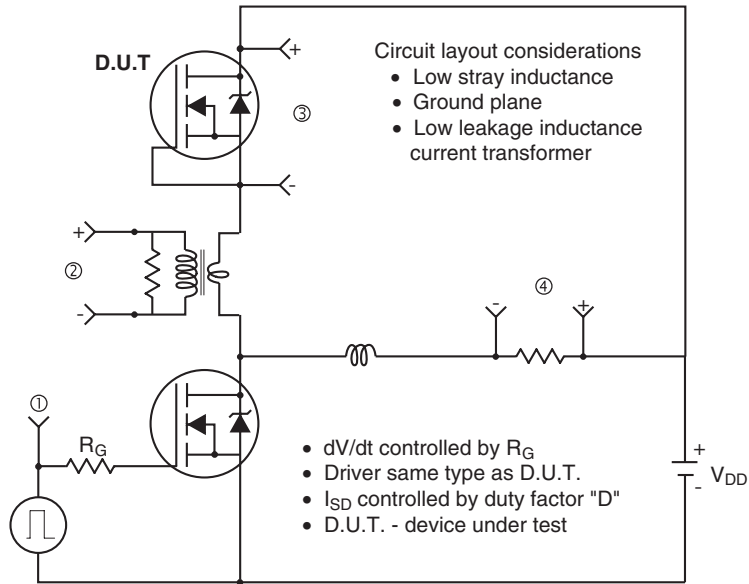


Fig. 14 - For N-Channel

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