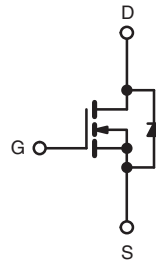
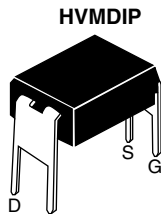


## Power MOSFET

| PRODUCT SUMMARY           |                 |      |
|---------------------------|-----------------|------|
| $V_{DS}$ (V)              | 100             |      |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10$ V | 0.54 |
| $Q_g$ (Max.) (nC)         | 8.3             |      |
| $Q_{gs}$ (nC)             | 2.3             |      |
| $Q_{gd}$ (nC)             | 3.8             |      |
| Configuration             | Single          |      |



N-Channel MOSFET

### FEATURES

- Dynamic  $dV/dt$  Rating
- Repetitive Avalanche Rated
- For Automatic Insertion
- End Stackable
- 175 °C Operating Temperature
- Fast Switching and Ease of Paralleling
- Compliant to RoHS Directive 2002/95/EC


 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 4 pin DIP package is a low cost machine-insertable case style which can be stacked in multiple combinations on standard 0.1" pin centers. The dual drain serves as a thermal link to the mounting surface for power dissipation levels up to 1 W.

| ORDERING INFORMATION |             |
|----------------------|-------------|
| Package              | HVMDIP      |
| Lead (Pb)-free       | IRFD110PbF  |
|                      | SiHFD110-E3 |
| SnPb                 | IRFD110     |
|                      | SiHFD110    |

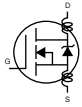
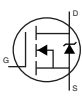
| ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted) |                  |                |                  |      |   |
|---|------------------|----------------|------------------|------|---|
| PARAMETER   |                  | SYMBOL         | LIMIT            | UNIT |   |
| Drain-Source Voltage  |                  | $V_{DS}$       | 100              | V    |   |
| Gate-Source Voltage   |                  | $V_{GS}$       | $\pm 20$         |      |   |
| Continuous Drain Current  | $V_{GS}$ at 10 V | $I_D$          | $T_A = 25$ °C    | 1.0  | A |
|   |                  |                | $T_A = 100$ °C   | 0.71 |   |
| Pulsed Drain Current <sup>a</sup>                                 |                  | $I_{DM}$       | 8.0              |      |   |
| Linear Derating Factor  |                  |                | 0.0083           | W/°C |   |
| Single Pulse Avalanche Energy <sup>b</sup>                        |                  | $E_{AS}$       | 140              | mJ   |   |
| Repetitive Avalanche Current <sup>a</sup>                         |                  | $I_{AR}$       | 1.0              | A    |   |
| Repetitive Avalanche Energy <sup>a</sup>                          |                  | $E_{AR}$       | 0.13             | mJ   |   |
| Maximum Power Dissipation   | $T_A = 25$ °C    | $P_D$          | 1.3              | W    |   |
| Peak Diode Recovery $dV/dt^c$                                     |                  | $dV/dt$        | 5.5              | V/ns |   |
| Operating Junction and Storage Temperature Range                  |                  | $T_J, T_{stg}$ | - 55 to + 175    | °C   |   |
| Soldering Recommendations (Peak Temperature)                      | for 10 s         |                | 300 <sup>d</sup> |      |   |

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 25$  V, starting  $T_J = 25$  °C,  $L = 52$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 2.0$  A (see fig. 12).
- $I_{SD} \leq 5.6$  A,  $dI/dt \leq 75$  A/ $\mu$ s,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 175$  °C.
- 1.6 mm from case.

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

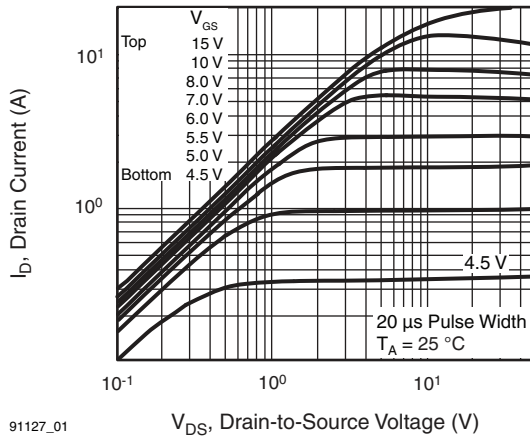
| THERMAL RESISTANCE RATINGS  |            |      |      |      |
|-----------------------------|------------|------|------|------|
| PARAMETER                   | SYMBOL     | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | $R_{thJA}$ | -    | 120  | °C/W |

| SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |                     |   |   |      |      |           |               |
|---|---------------------|---|---|------|------|-----------|---------------|
| PARAMETER   | SYMBOL              | TEST CONDITIONS   |   | MIN. | TYP. | MAX.      | UNIT          |
| <b>Static</b>   |                     |   |   |      |      |           |               |
| Drain-Source Breakdown Voltage  | $V_{DS}$            | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$   |   | 100  | -    | -         | V             |
| $V_{DS}$ Temperature Coefficient  | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$   |   | -    | 0.12 | -         | 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   | $I_{GSS}$           | $V_{GS} = \pm 20\text{ V}$  |   | -    | -    | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current   | $I_{DSS}$           | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$  |   | -    | -    | 25        | $\mu\text{A}$ |
|   |                     | $V_{DS} = 80\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$  |   | -    | -    | 250       |               |
| Drain-Source On-State Resistance  | $R_{DS(on)}$        | $V_{GS} = 10\text{ V}$  | $I_D = 0.60\text{ A}^b$   | -    | -    | 0.54      | $\Omega$      |
| Forward Transconductance  | $g_{fs}$            | $V_{DS} = 50\text{ V}, I_D = 0.60\text{ A}^b$   |   | 0.80 | -    | -         | S             |
| <b>Dynamic</b>  |                     |   |   |      |      |           |               |
| Input Capacitance   | $C_{iss}$           | $V_{GS} = 0\text{ V},$<br>$V_{DS} = 25\text{ V},$<br>$f = 1.0\text{ MHz}$ , see fig. 5  |   | -    | 180  | -         | pF            |
| Output Capacitance  | $C_{oss}$           |   |   | -    | 81   | -         |               |
| Reverse Transfer Capacitance  | $C_{rss}$           |   |   | -    | 15   | -         |               |
| Total Gate Charge   | $Q_g$               | $V_{GS} = 10\text{ V}$  | $I_D = 5.6\text{ A}, V_{DS} = 80\text{ V},$<br>see fig. 6 and 13 <sup>b</sup> | -    | -    | 8.3       | nC            |
| Gate-Source Charge  | $Q_{gs}$            |   |   | -    | -    | 2.3       |               |
| Gate-Drain Charge   | $Q_{gd}$            |   |   | -    | -    | 3.8       |               |
| Turn-On Delay Time  | $t_{d(on)}$         | $V_{DD} = 50\text{ V}, I_D = 5.6\text{ A},$<br>$R_g = 24\text{ }\Omega, R_D = 8.4\text{ }\Omega$ , see fig. 10 <sup>b</sup>                                     |   | -    | 6.9  | -         | ns            |
| Rise Time   | $t_r$               |   |   | -    | 16   | -         |               |
| Turn-Off Delay Time   | $t_{d(off)}$        |   |   | -    | 15   | -         |               |
| Fall Time   | $t_f$               |   |   | -    | 9.4  | -         |               |
| Internal Drain Inductance   | $L_D$               | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact  |   | -    | 4.0  | -         | nH            |
| Internal Source Inductance  | $L_S$               |   |   | -    | 6.0  | -         |               |
| <b>Drain-Source Body Diode Characteristics</b>                              |                     |   |   |      |      |           |               |
| Continuous Source-Drain Diode Current                                       | $I_S$               | MOSFET symbol<br>showing the<br>integral reverse<br>p - n junction diode    |   | -    | -    | 1.0       | A             |
| Pulsed Diode Forward Current <sup>a</sup>                                   | $I_{SM}$            |   |   | -    | -    | 8.0       |               |
| Body Diode Voltage  | $V_{SD}$            | $T_J = 25\text{ }^\circ\text{C}, I_S = 1.0\text{ A}, V_{GS} = 0\text{ V}^b$   |   | -    | -    | 2.5       | V             |
| Body Diode Reverse Recovery Time  | $t_{rr}$            | $T_J = 25\text{ }^\circ\text{C}, I_F = 5.6\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$  |   | -    | 100  | 200       | ns            |
| Body Diode Reverse Recovery Charge  | $Q_{rr}$            |   |   | -    | 0.44 | 0.88      | $\mu\text{C}$ |
| 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)



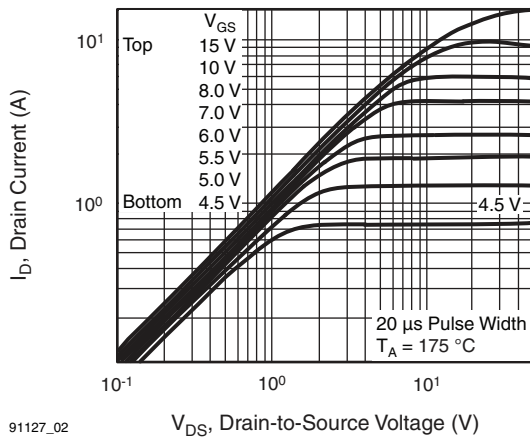
91127\_01

**Fig. 1 - Typical Output Characteristics,  $T_A = 25\text{ °C}$**



91127\_03

**Fig. 3 - Typical Transfer Characteristics**



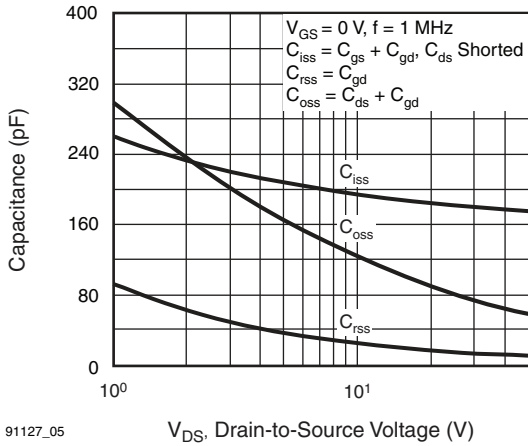
91127\_02

**Fig. 2 - Typical Output Characteristics,  $T_A = 175\text{ °C}$**



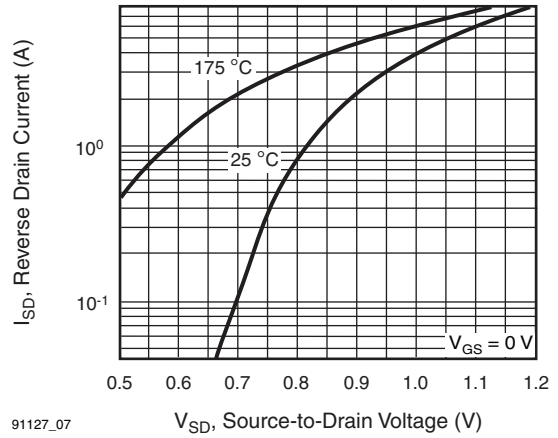
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**Fig. 4 - Normalized On-Resistance vs. Temperature**



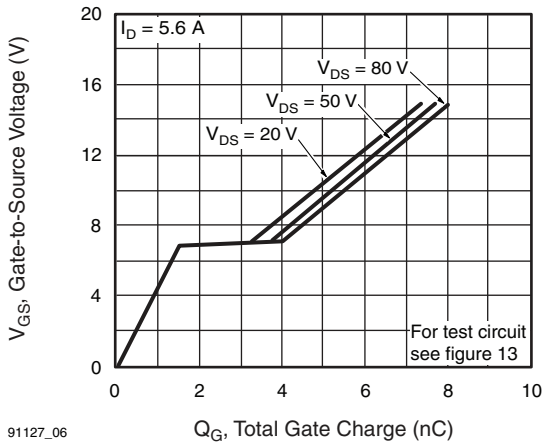
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Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage



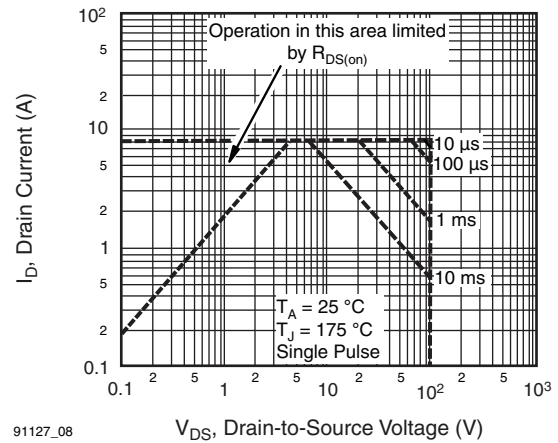
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Fig. 7 - Typical Source-Drain Diode Forward Voltage



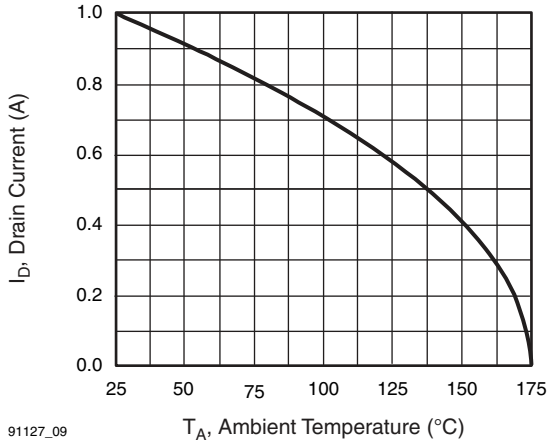
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Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage



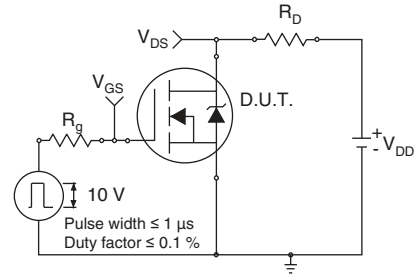
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Fig. 8 - Maximum Safe Operating Area



91127\_09

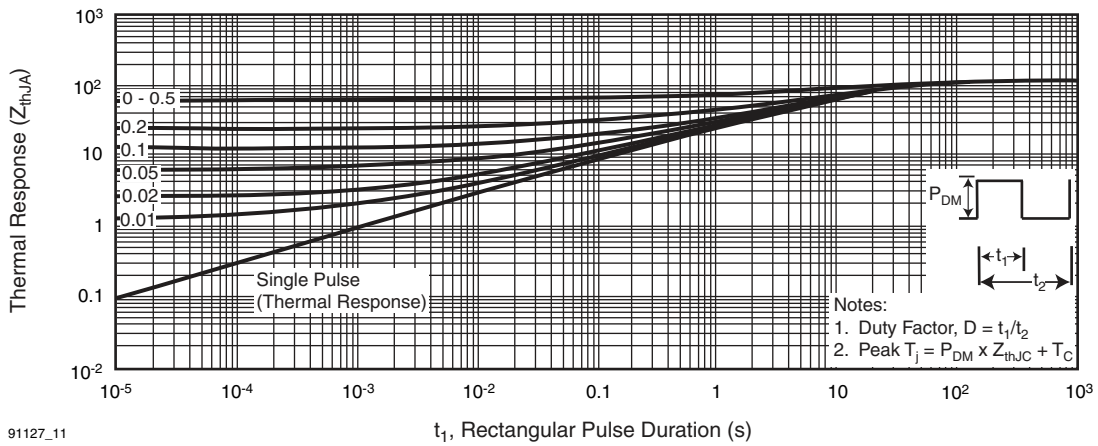
**Fig. 9 - Maximum Drain Current vs. Ambient Temperature**



**Fig. 10a - Switching Time Test Circuit**



**Fig. 10b - Switching Time Waveforms**



91127\_11

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

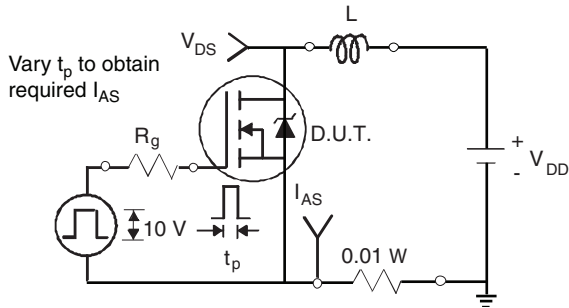


Fig. 12a - Unclamped Inductive Test Circuit



Fig. 12b - Unclamped Inductive Waveforms



91127\_12c

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

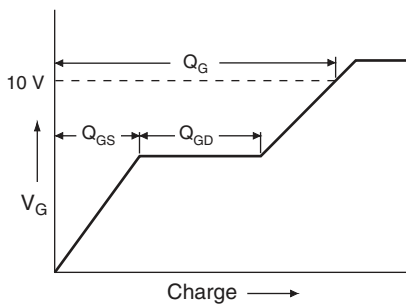


Fig. 13a - Basic Gate Charge Waveform

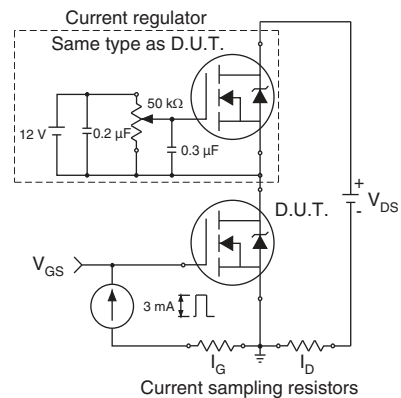


Fig. 13b - Gate Charge Test Circuit

### Peak Diode Recovery dV/dt Test Circuit



**Note**

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

**Fig. 14 - For N-Channel**

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## HVM DIP (High voltage)



| DIM. | INCHES |       | MILLIMETERS |       |
|------|--------|-------|-------------|-------|
|      | MIN.   | MAX.  | MIN.        | MAX.  |
| A    | 0.310  | 0.330 | 7.87        | 8.38  |
| E    | 0.300  | 0.425 | 7.62        | 10.79 |
| L    | 0.270  | 0.290 | 6.86        | 7.36  |

ECN: X10-0386-Rev. B, 06-Sep-10  
DWG: 5974

### Note

- Package length does not include mold flash, protrusions or gate burrs. Package width does not include interlead flash or protrusions.





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