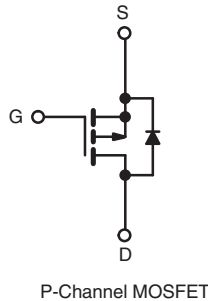
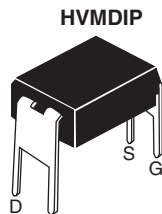


Power MOSFET

| PRODUCT SUMMARY | |
|---------------------------|-------------------------|
| V_{DS} (V) | - 200 |
| $R_{DS(on)}$ (Ω) | $V_{GS} = - 10$ V 1.5 |
| Q_g (Max.) (nC) | 15 |
| Q_{gs} (nC) | 3.2 |
| Q_{gd} (nC) | 8.4 |
| Configuration | Single |



FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- For Automatic Insertion
- End Stackable
- P-Channel
- Fast Switching
- Ease of Paralleling
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912


RoHS*
COMPLIANT

Note

* Lead (Pb)-containing terminations are not RoHS-compliant. Exemptions may apply.

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 | IRFD9220PbF |
| | SiHFD9220-E3 |
| SnPb | IRFD9220 |
| | SiHFD9220 |

| ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted) | | | | |
|---|--------------------|----------------|------------------|------|
| PARAMETER | SYMBOL | LIMIT | UNIT | |
| Drain-Source Voltage | V_{DS} | - 200 | V | |
| Gate-Source Voltage | V_{GS} | ± 20 | | |
| Continuous Drain Current | V_{GS} at - 10 V | $T_A = 25$ °C | - 0.56 | A |
| | | $T_A = 100$ °C | - 0.36 | |
| Pulsed Drain Current ^a | I_{DM} | - 4.5 | | |
| Linear Derating Factor | | 0.0083 | W/°C | |
| Single Pulse Avalanche Energy ^b | E_{AS} | 80 | mJ | |
| Avalanche Current ^a | I_{AR} | - 0.56 | A | |
| Repetitive Avalanche Energy ^a | E_{AR} | 0.10 | mJ | |
| Maximum Power Dissipation | $T_A = 25$ °C | P_D | 1.0 | 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 | |

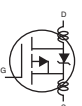

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = - 50$ V, starting $T_J = 25$ °C, $L = 17.8$ mH, $R_g = 25$ Ω , $I_{AS} = - 3$ A (see fig. 12).
- $I_{SD} \leq - 3.9$ A, $dI/dt \leq 95$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °C.



d. 1.6 mm from case.

| 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 |
| 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 $25\text{ }^\circ\text{C}$, $I_D = -1\text{ mA}$ | - | -0.22 | - | 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} | $V_{DS} = -200\text{ V}, V_{GS} = 0\text{ V}$ | - | - | -100 | μA |
| | | $V_{DS} = -160\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | - | - | -500 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = -10\text{ V}, I_D = -0.34\text{ A}^b$ | - | - | 1.5 | Ω |
| Forward Transconductance | g_{fs} | $V_{DS} = -50\text{ V}, I_D = -0.35\text{ A}^b$ | 0.55 | - | - | S |
| Dynamic | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, V_{DS} = -25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5 | - | 340 | - | μF |
| Output Capacitance | C_{oss} | | - | 110 | - | |
| Reverse Transfer Capacitance | C_{rss} | | - | 33 | - | |
| Total Gate Charge | Q_g | $V_{GS} = -10\text{ V}, I_D = -2.1\text{ A}, V_{DS} = -160\text{ V}$, see fig. 6 and 13 ^b | - | - | 15 | nC |
| Gate-Source Charge | Q_{gs} | | - | - | 3.2 | |
| Gate-Drain Charge | Q_{gd} | | - | - | 8.4 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = -100\text{ V}, I_D = -3.9\text{ A}, R_g = 18\text{ }\Omega, R_D = 24\text{ }\Omega$, see fig. 10 ^b | - | 8.8 | - | ns |
| Rise Time | t_r | | - | 27 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 7.3 | - | |
| Fall Time | t_f | | - | 19 | - | |
| 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  | - | - | -0.56 | A |
| Pulsed Diode Forward Current ^a | I_{SM} | | - | - | -4.5 | |
| Body Diode Voltage | V_{SD} | $T_J = 25\text{ }^\circ\text{C}, I_S = -0.56\text{ A}, V_{GS} = 0\text{ V}^b$ | - | - | -6.3 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}, I_F = -3.9\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$ | - | 150 | 300 | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | - | 0.97 | 2.0 | μC |

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)

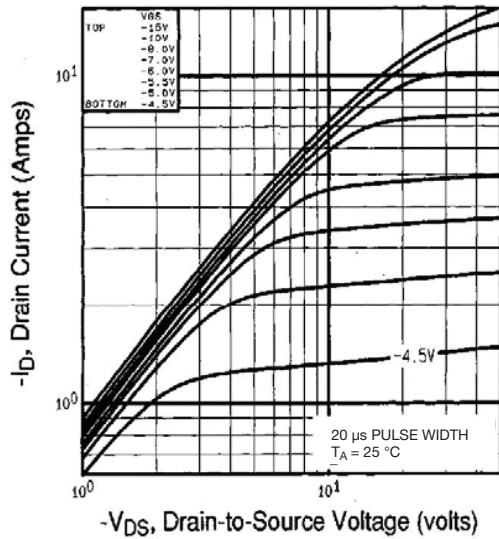


Fig. 1 - Typical Output Characteristics, $T_A = 25\text{ }^\circ\text{C}$

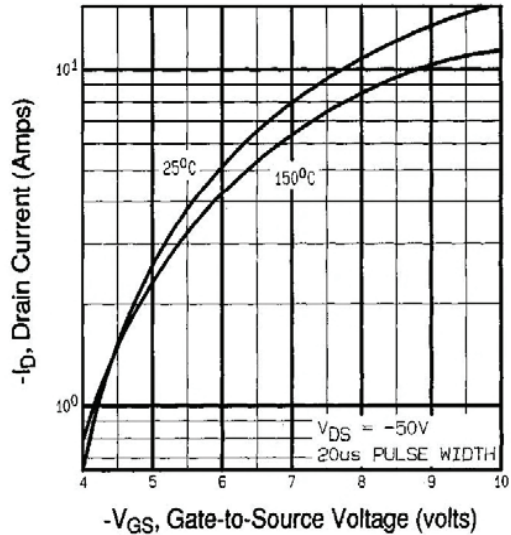


Fig. 3 - Typical Transfer Characteristics

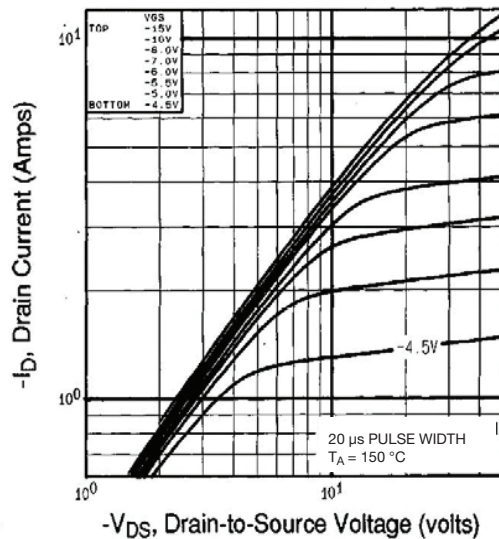


Fig. 2 - Typical Output Characteristics, $T_A = 150\text{ }^\circ\text{C}$

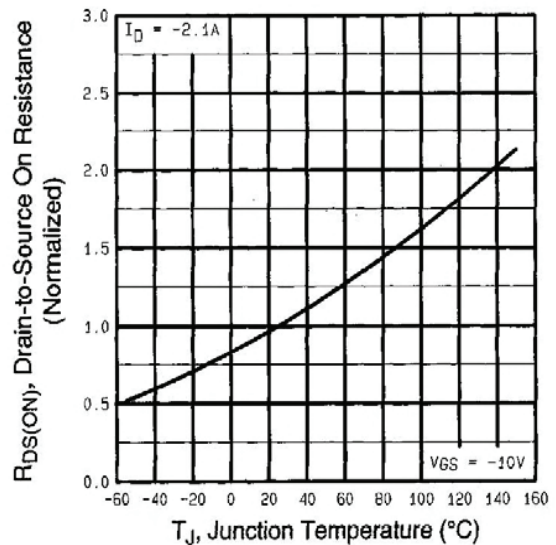


Fig. 4 - Normalized On-Resistance vs. Temperature

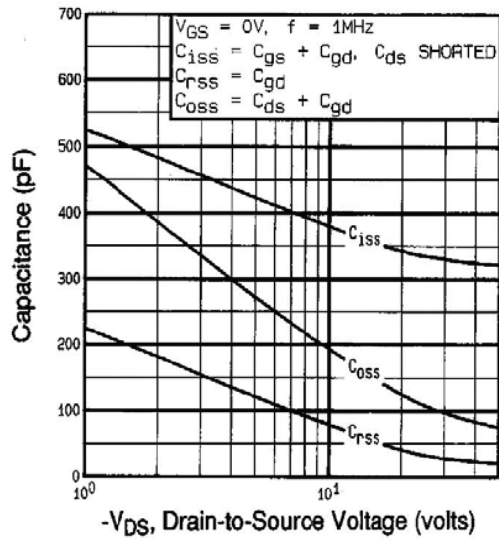


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

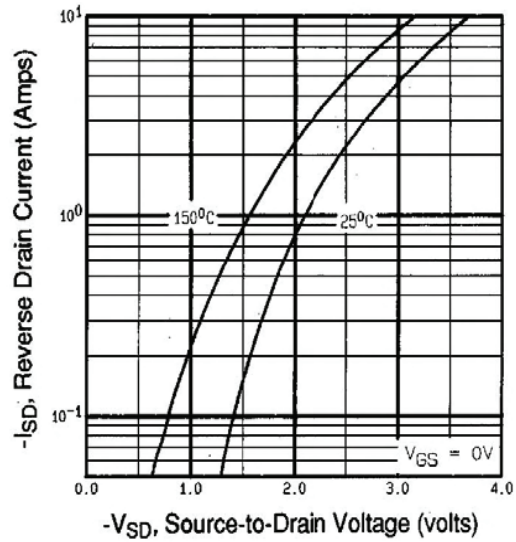


Fig. 7 - Typical Source-Drain Diode Forward Voltage

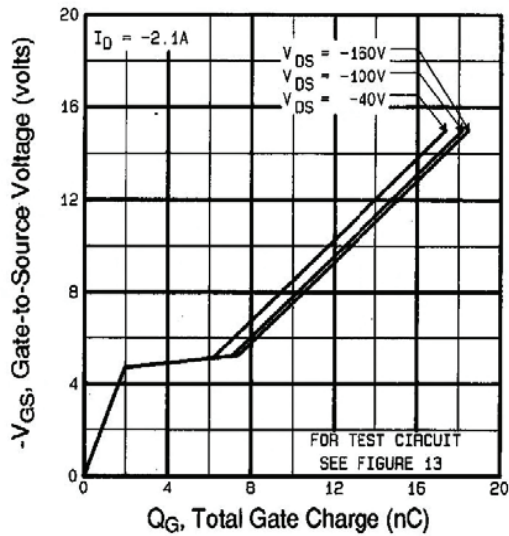


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

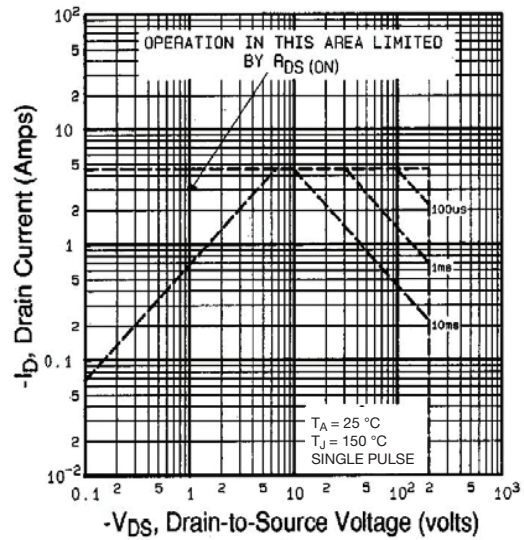


Fig. 8 - Maximum Safe Operating Area

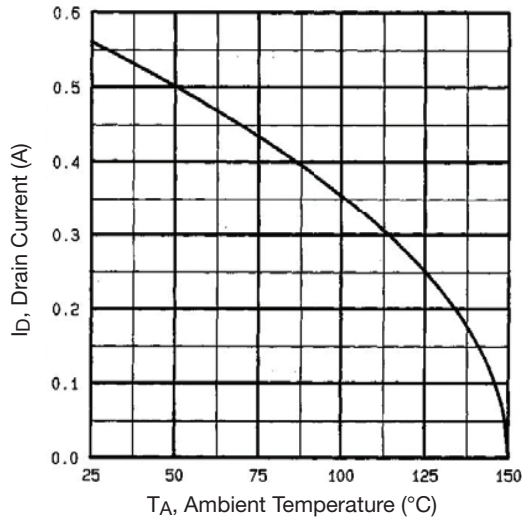


Fig. 9 - Maximum Drain Current vs. Ambient Temperature

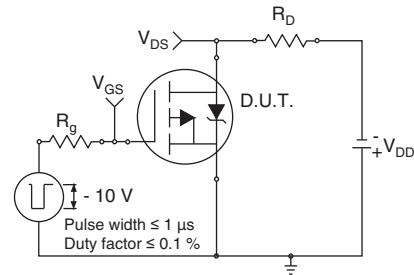


Fig. 10 - Switching Time Test Circuit

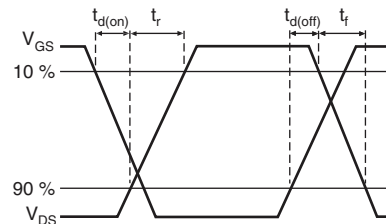


Fig. 11 - Switching Time Waveforms

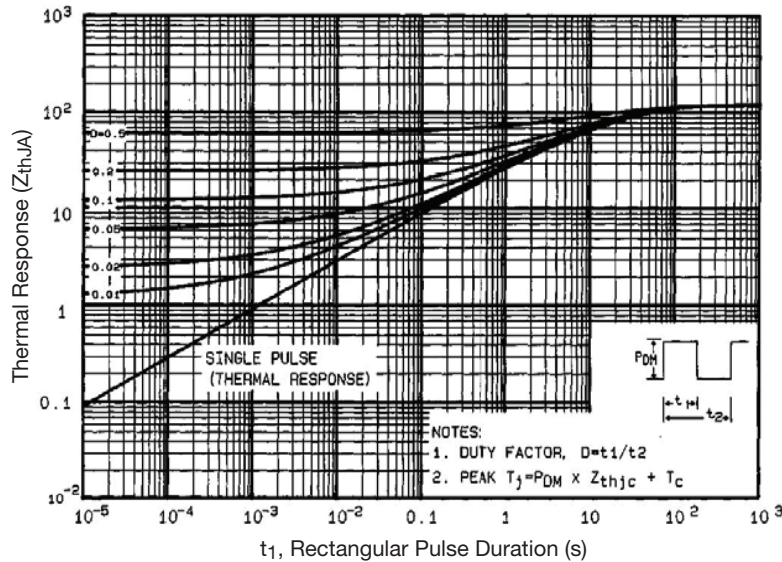


Fig. 12 - Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

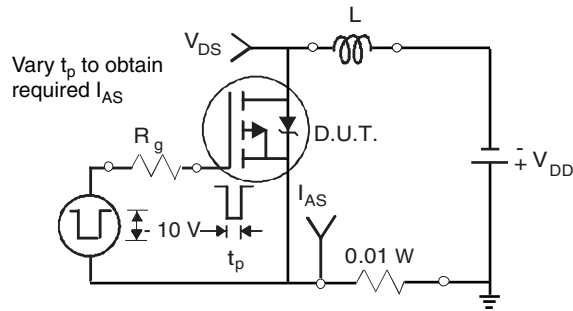


Fig. 13 - Unclamped Inductive Test Circuit

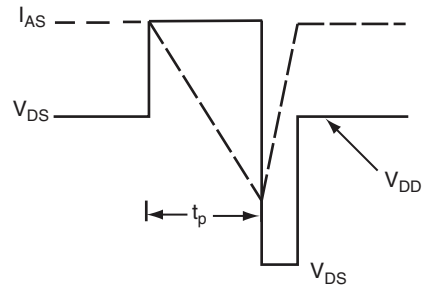


Fig. 14 - Unclamped Inductive Waveforms

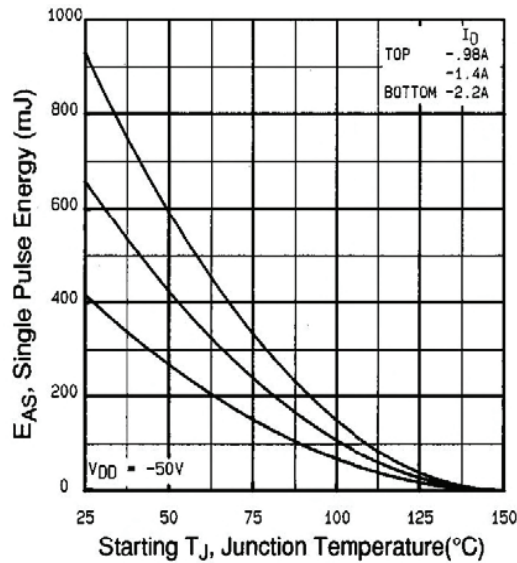


Fig. 15 - Maximum Avalanche Energy vs. Drain Current

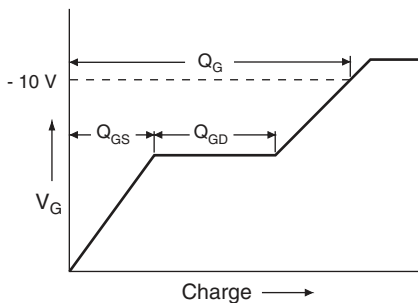


Fig. 16 - Basic Gate Charge Waveform

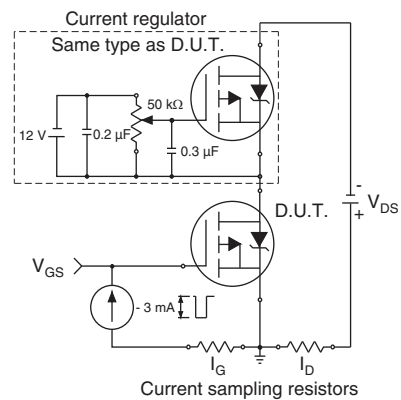
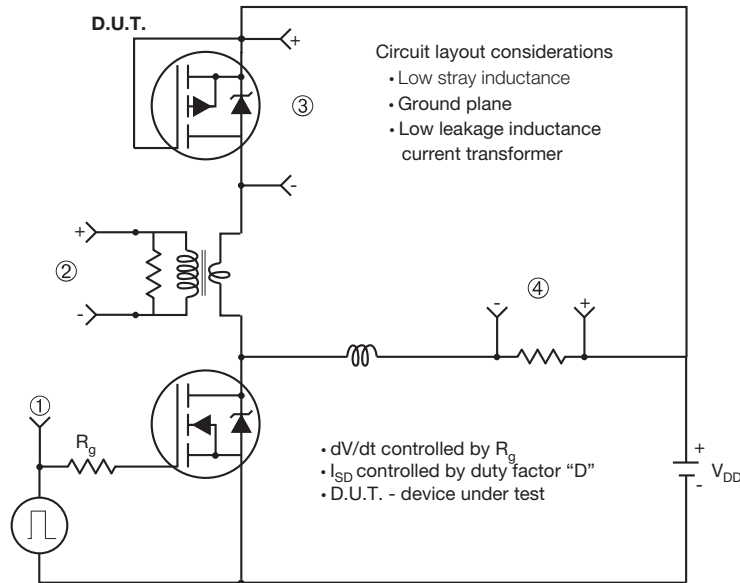


Fig. 17 - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



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

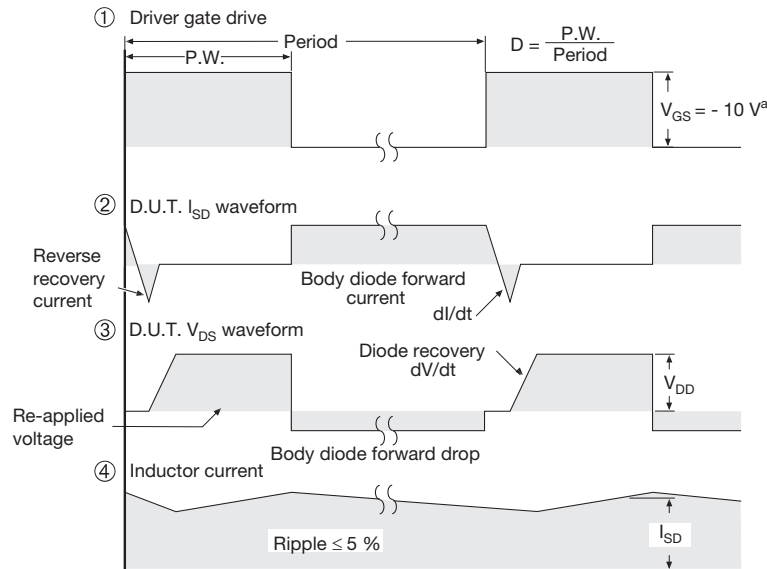


Fig. 18 - For P-Channel

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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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