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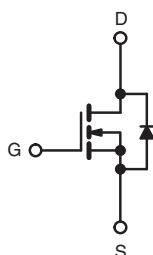
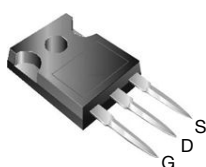
IRFP22N60K, SiHFP22N60K

Vishay Siliconix

Power MOSFET

| PRODUCT SUMMARY | | |
|---------------------------|------------------------|------|
| V_{DS} (V) | 600 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 10\text{ V}$ | 0.24 |
| Q_g (Max.) (nC) | 150 | |
| Q_{gs} (nC) | 45 | |
| Q_{gd} (nC) | 76 | |
| Configuration | Single | |

TO-247AC



N-Channel MOSFET

FEATURES

- Low Gate Charge Q_g Results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dV/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Enhanced Body Diode dV/dt Capability
- Compliant to RoHS Directive 2002/95/EC


RoHS*
COMPLIANT

BENEFITS

- Hard Switching Primary or PFS Switch
- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- Motor Drive

| ORDERING INFORMATION | |
|----------------------|----------------|
| Package | TO-247AC |
| Lead (Pb)-free | IRFP22N60KPbF |
| | SiHFP22N60K-E3 |
| SnPb | IRFP22N60K |
| | SiHFP22N60K |

| ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | | |
|---------------------------------------------------------------------------------------|----------------------------------|-----------------------------------|---------------------|------------------|
| PARAMETER | SYMBOL | LIMIT | UNIT | |
| Drain-Source Voltage | V_{DS} | 600 | V | |
| Gate-Source Voltage | V_{GS} | ± 30 | | |
| Continuous Drain Current | V_{GS} at 10 V | $T_C = 25\text{ }^\circ\text{C}$ | 22 | A |
| | | $T_C = 100\text{ }^\circ\text{C}$ | 14 | |
| Pulsed Drain Current ^a | I_{DM} | 88 | | |
| Linear Derating Factor | | 2.9 | W/ $^\circ\text{C}$ | |
| Single Pulse Avalanche Energy ^b | E_{AS} | 380 | mJ | |
| Repetitive Avalanche Current ^a | I_{AR} | 22 | A | |
| Repetitive Avalanche Energy ^a | E_{AR} | 37 | mJ | |
| Maximum Power Dissipation | $T_C = 25\text{ }^\circ\text{C}$ | P_D | 370 | W |
| Peak Diode Recovery dV/dt ^c | | dV/dt | 15 | V/ns |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | | - 55 to + 150 | $^\circ\text{C}$ |
| Soldering Recommendations (Peak Temperature) | for 10 s | | 300 ^d | |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 1.5\text{ mH}$, $R_g = 25\text{ }^\circ\Omega$, $I_{AS} = 22\text{ A}$ (see fig. 12).
- $I_{SD} \leq 22\text{ A}$, $dI/dt \leq 360\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$.
- 1.6 mm from case.


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

IRFP22N60K, SiHFP22N60K

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| THERMAL RESISTANCE RATINGS | | | | |
|-------------------------------------|------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | R_{thJA} | - | 40 | °C/W |
| Case-to-Sink, Flat, Greased Surface | R_{thCS} | 0.24 | - | |
| Maximum Junction-to-Case (Drain) | R_{thJC} | - | 0.34 | |

| 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} | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 600 | - | - | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}^d$ | - | 0.30 | - | V/°C |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 3.0 | - | 5.0 | V |
| Gate-Source Leakage | I_{GSS} | $V_{GS} = \pm 30\text{ V}$ | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$ | - | - | 50 | μA |
| | | $V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | - | - | 250 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 13\text{ A}^b$ | - | 0.240 | 0.280 | Ω |
| Forward Transconductance | g_{fs} | $V_{DS} = 50\text{ V}, I_D = 13\text{ A}^b$ | 11 | - | - | S |
| Dynamic | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5 | - | 3570 | - | pF |
| Output Capacitance | C_{oss} | | - | 350 | - | |
| Reverse Transfer Capacitance | C_{rss} | | - | 36 | - | |
| Output Capacitance | C_{oss} | $V_{GS} = 0\text{ V}$ | $V_{DS} = 1.0\text{ V}, f = 1.0\text{ MHz}$ | - | 4710 | - |
| Effective Output Capacitance | $C_{oss\text{ eff.}}$ | | $V_{DS} = 480\text{ V}, f = 1.0\text{ MHz}$ | - | 92 | - |
| Total Gate Charge | Q_g | $V_{GS} = 10\text{ V}$ | $I_D = 22\text{ A}, V_{DS} = 480\text{ V}$ see fig. 6 and 13 ^b | - | - | 150 |
| Gate-Source Charge | Q_{gs} | | - | - | 45 | |
| Gate-Drain Charge | Q_{gd} | | - | - | 76 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 300\text{ V}, I_D = 22\text{ A}, R_g = 6.2, V_{GS} = 10\text{ V}$, see fig. 10 ^b | - | 26 | - | ns |
| Rise Time | t_r | | - | 99 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 48 | - | |
| Fall Time | t_f | | - | 37 | - | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous Source-Drain Diode Current | I_S | MOSFET symbol showing the integral reverse p - n junction diode  | - | - | 22 | A |
| Pulsed Diode Forward Current ^a | I_{SM} | | - | - | 88 | |
| Body Diode Voltage | V_{SD} | $T_J = 25\text{ }^\circ\text{C}, I_S = 22\text{ A}, V_{GS} = 0\text{ V}^b$ | - | - | 1.5 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}$ | - | 590 | 890 | ns |
| | | $T_J = 125\text{ }^\circ\text{C}$ | - | 670 | 1010 | |
| Body Diode Reverse Recovery Charge | Q_{rr} | $T_J = 25\text{ }^\circ\text{C}$ | - | 7.2 | 11 | μC |
| | | $T_J = 125\text{ }^\circ\text{C}$ | - | 8.5 | 13 | |
| Reverse Recovery Current | I_{RRM} | $T_J = 25\text{ }^\circ\text{C}$ | - | 26 | 39 | |
| Forward Turn-On Time | t_{on} | Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D) | | | | |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.
- $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0% to 80% V_{DS} .



IRFP22N60K, SiHFP22N60K
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TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

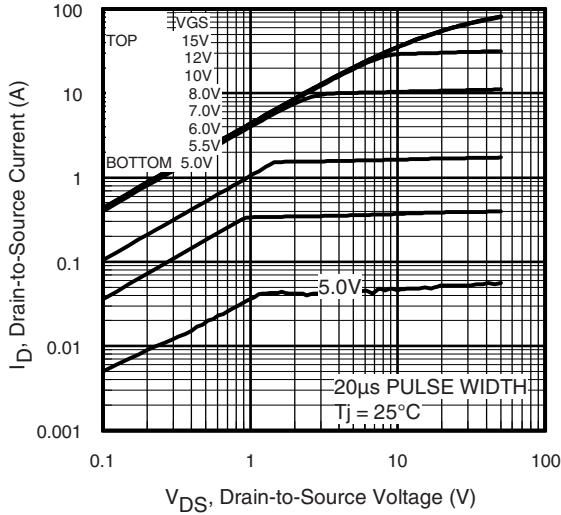


Fig. 1 - Typical Output Characteristics

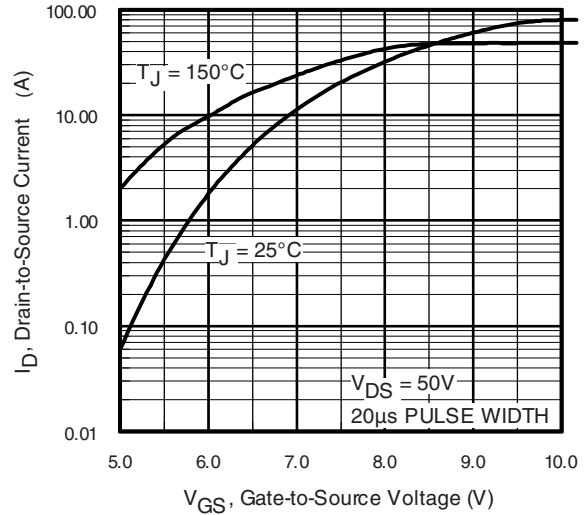


Fig. 3 - Typical Transfer Characteristics

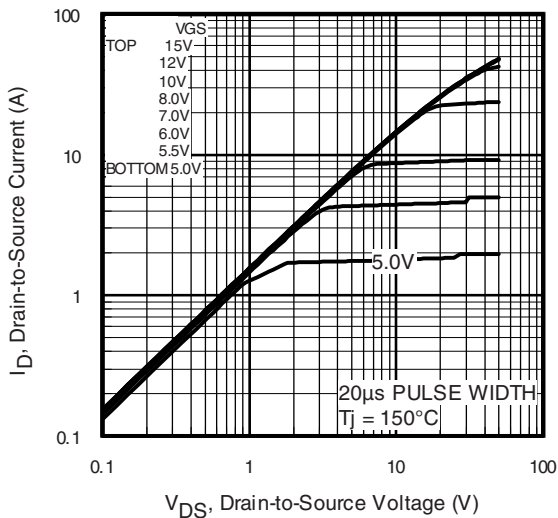


Fig. 2 - Typical Output Characteristics

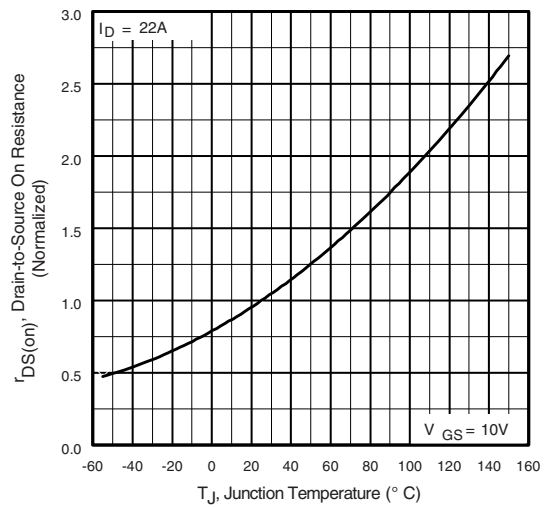


Fig. 4 - Normalized On-Resistance vs. Temperature

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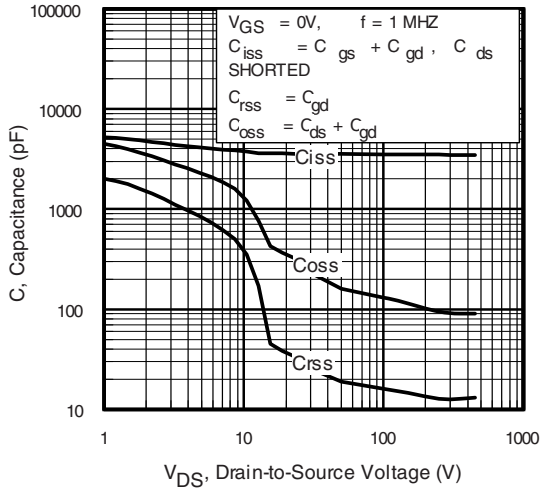


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

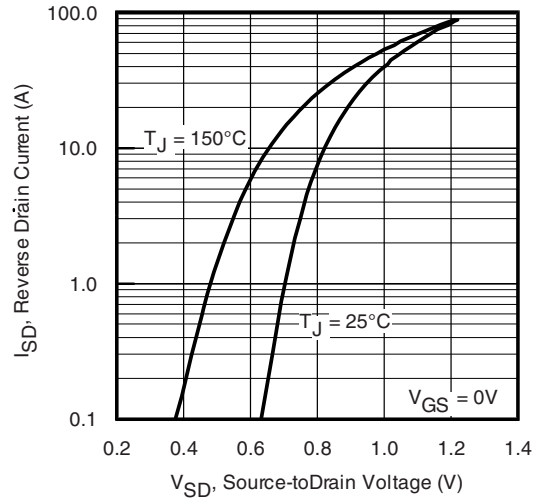


Fig. 7 - Typical Source-Drain Diode Forward Voltage

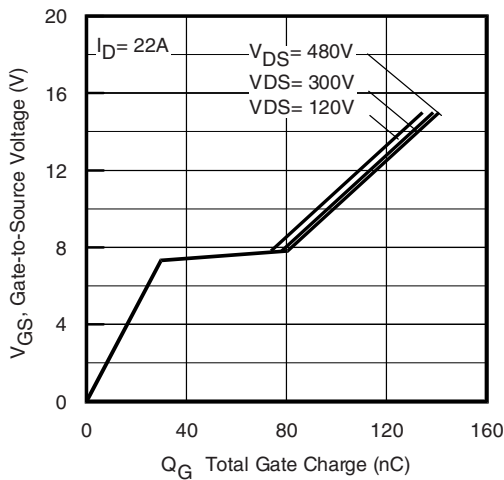


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

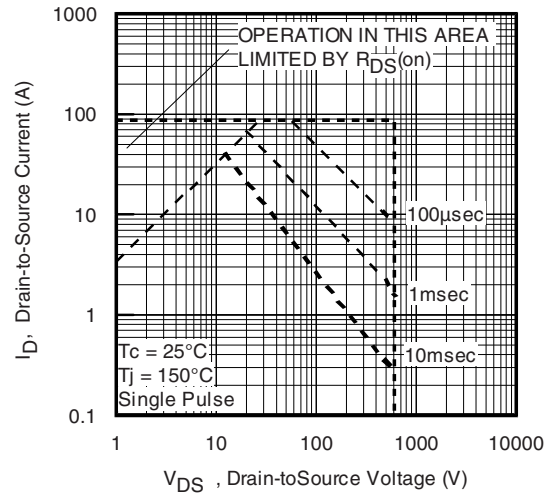


Fig. 8 - Maximum Safe Operating Area



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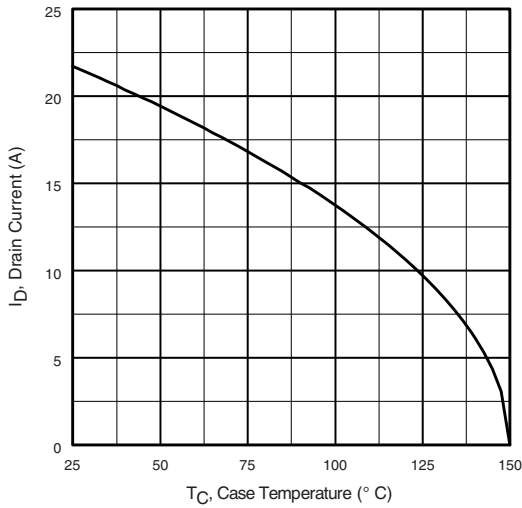


Fig. 9 - Maximum Drain Current vs. Case Temperature

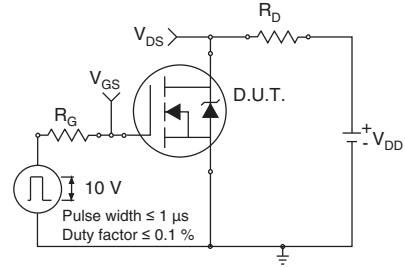


Fig. 10a - Switching Time Test Circuit

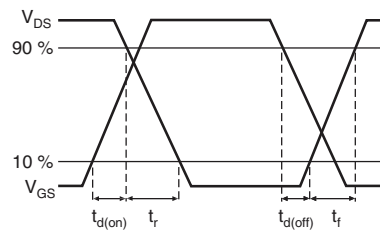


Fig. 10b - Switching Time Waveforms

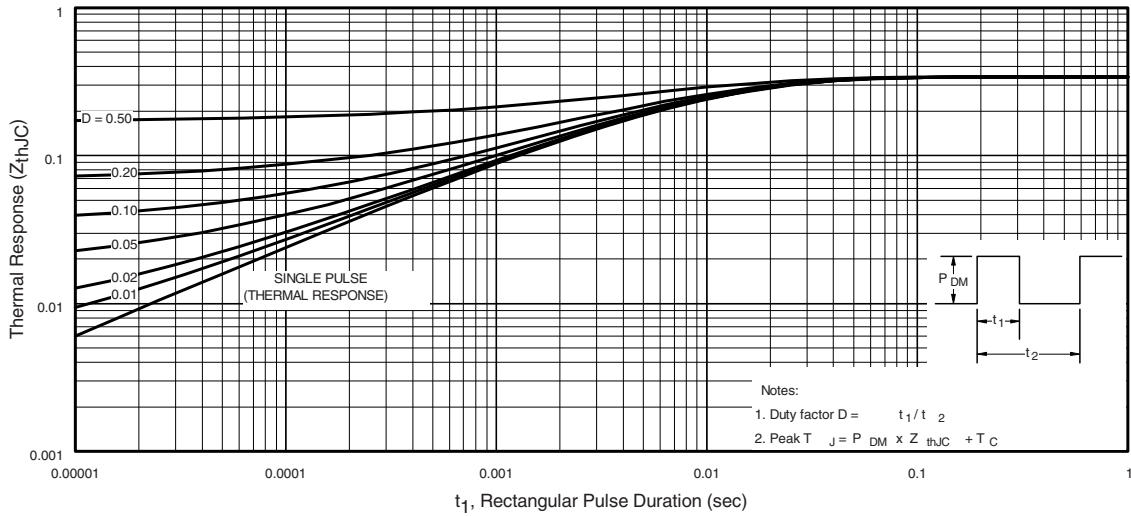


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

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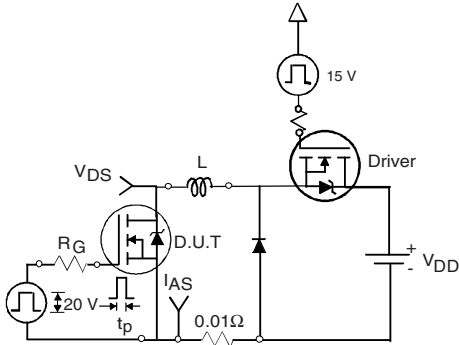


Fig. 12a - Unclamped Inductive Test Circuit

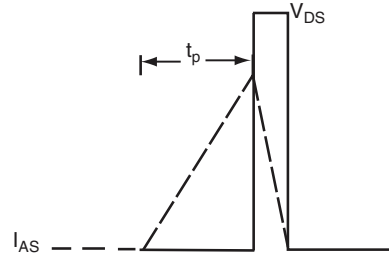


Fig. 12b - Unclamped Inductive Waveforms

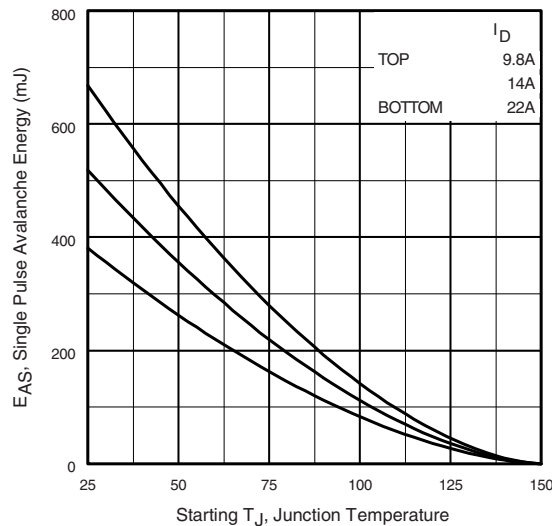


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

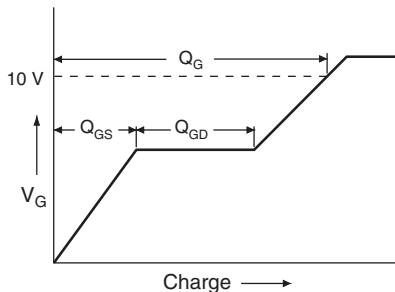


Fig. 13a - Basic Gate Charge Waveform

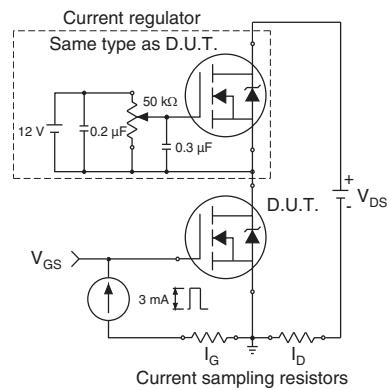
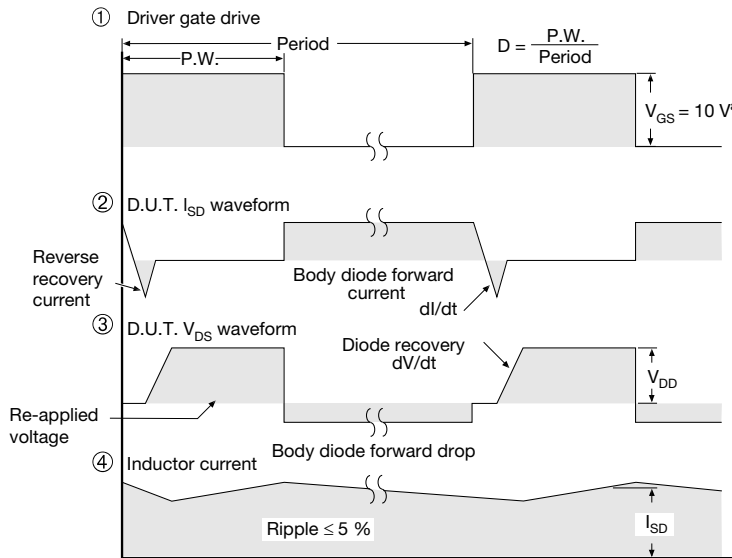
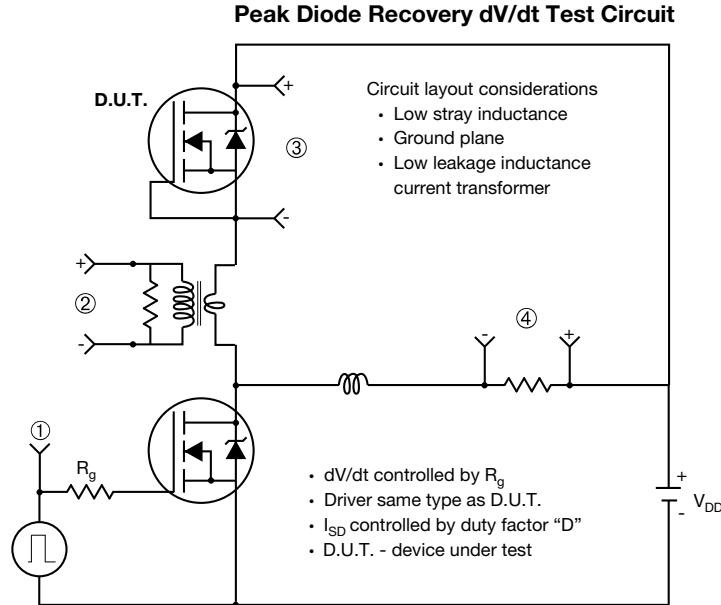


Fig. 13b - Gate Charge Test Circuit



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

Fig. 14 - For N-Channel

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?91208.

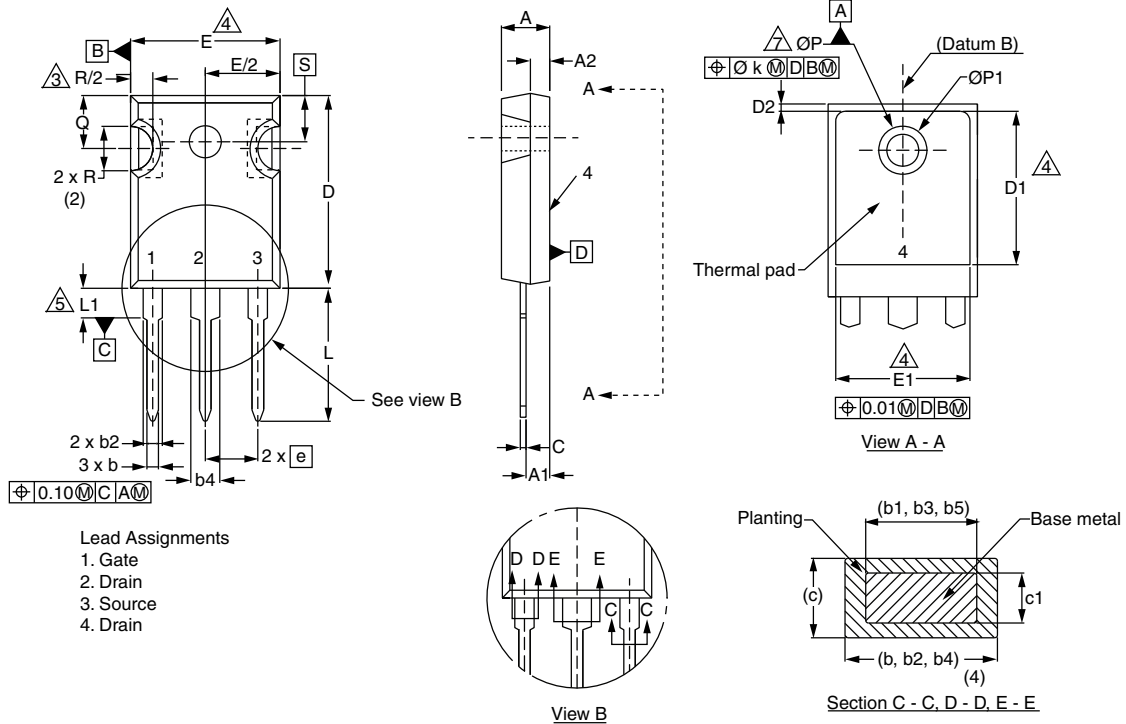


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Package Information

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TO-247AC (High Voltage)



| DIM. | MILLIMETERS | | INCHES | |
|------|-------------|-------|--------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.58 | 5.31 | 0.180 | 0.209 |
| A1 | 2.21 | 2.59 | 0.087 | 0.102 |
| A2 | 1.17 | 2.49 | 0.046 | 0.098 |
| b | 0.99 | 1.40 | 0.039 | 0.055 |
| b1 | 0.99 | 1.35 | 0.039 | 0.053 |
| b2 | 1.53 | 2.39 | 0.060 | 0.094 |
| b3 | 1.65 | 2.37 | 0.065 | 0.093 |
| b4 | 2.42 | 3.43 | 0.095 | 0.135 |
| b5 | 2.59 | 3.38 | 0.102 | 0.133 |
| c | 0.38 | 0.86 | 0.015 | 0.034 |
| c1 | 0.38 | 0.76 | 0.015 | 0.030 |
| D | 19.71 | 20.82 | 0.776 | 0.820 |
| D1 | 13.08 | - | 0.515 | - |

| DIM. | MILLIMETERS | | INCHES | |
|------------------|-------------|-------|-----------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| D2 | 0.51 | 1.30 | 0.020 | 0.051 |
| E | 15.29 | 15.87 | 0.602 | 0.625 |
| E1 | 13.72 | - | 0.540 | - |
| e | 5.46 BSC | | 0.215 BSC | |
| $\varnothing k$ | 0.254 | | 0.010 | |
| L | 14.20 | 16.25 | 0.559 | 0.640 |
| L1 | 3.71 | 4.29 | 0.146 | 0.169 |
| N | 7.62 BSC | | 0.300 BSC | |
| $\varnothing P$ | 3.51 | 3.66 | 0.138 | 0.144 |
| $\varnothing P1$ | - | 7.39 | - | 0.291 |
| Q | 5.31 | 5.69 | 0.209 | 0.224 |
| R | 4.52 | 5.49 | 0.178 | 0.216 |
| S | 5.51 BSC | | 0.217 BSC | |

ECN: X13-0103-Rev. D, 01-Jul-13
 DWG: 5971

Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Contour of slot optional.
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body.
4. Thermal pad contour optional with dimensions D1 and E1.
5. Lead finish uncontrolled in L1.
6. $\varnothing P$ to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154").
7. Outline conforms to JEDEC outline TO-247 with exception of dimension c.
8. Xian and Mingxin actually photo.





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