

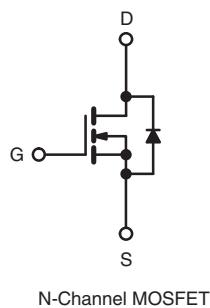
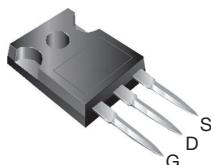
## Power MOSFET

| PRODUCT SUMMARY           |                 |     |
|---------------------------|-----------------|-----|
| $V_{DS}$ (V)              | 900             |     |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10$ V | 3.7 |
| $Q_g$ (Max.) (nC)         | 78              |     |
| $Q_{gs}$ (nC)             | 10              |     |
| $Q_{gd}$ (nC)             | 42              |     |
| Configuration             | Single          |     |

### FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Isolated Central Mounting Hole
- Fast Switching
- Ease of Parallelizing
- Simple Drive Requirements
- Compliant to RoHS Directive 2002/95/EC


**RoHS\***  
COMPLIANT

**TO-247AC**


### 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-247AC package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220AB devices. The TO-247AC is similar but superior to the earlier TO-218 package because its isolated mounting hole. It also provides greater creepage distances between pins to meet the requirements of most safety specifications.

### ORDERING INFORMATION

|                |                           |
|----------------|---------------------------|
| Package        | TO-247AC                  |
| Lead (Pb)-free | IRFPF30PbF<br>SiHFPF30-E3 |
| SnPb           | IRFPF30<br>SiHFPF30       |

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

| PARAMETER                                        | SYMBOL           | LIMIT            | UNIT     |
|--------------------------------------------------|------------------|------------------|----------|
| Drain-Source Voltage                             | $V_{DS}$         | 900              |          |
| Gate-Source Voltage                              | $V_{GS}$         | $\pm 20$         | V        |
| Continuous Drain Current                         | $I_D$            | 3.6              | A        |
|                                                  |                  | 2.3              |          |
| Pulsed Drain Current <sup>a</sup>                | $I_{DM}$         | 14               |          |
| Linear Derating Factor                           |                  | 1.0              | W/°C     |
| Single Pulse Avalanche Energy <sup>b</sup>       | $E_{AS}$         | 170              | mJ       |
| Repetitive Avalanche Current <sup>a</sup>        | $I_{AR}$         | 3.6              | A        |
| Repetitive Avalanche Energy <sup>a</sup>         | $E_{AR}$         | 13               | mJ       |
| Maximum Power Dissipation                        | $P_D$            | 125              | W        |
| Peak Diode Recovery dV/dt <sup>c</sup>           | dV/dt            | 1.5              | V/ns     |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$   | - 55 to + 150    | °C       |
| Soldering Recommendations (Peak Temperature)     | for 10 s         | 300 <sup>d</sup> |          |
| Mounting Torque                                  | 6-32 or M3 screw | 10               | Ibf · 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,  $L = 24$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 3.6$  A (see fig. 12).
- $I_{SD} \leq 3.6$  A,  $dI/dt \leq 70$  A/ $\mu$ s,  $V_{DD} \leq 600$ ,  $T_J \leq 150$  °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         | $R_{thJA}$ | -    | 40   | °C/W |
| Case-to-Sink, Flat, Greased Surface | $R_{thCS}$ | 0.24 | -    |      |
| Maximum Junction-to-Case (Drain)    | $R_{thJC}$ | -    | 1.0  |      |

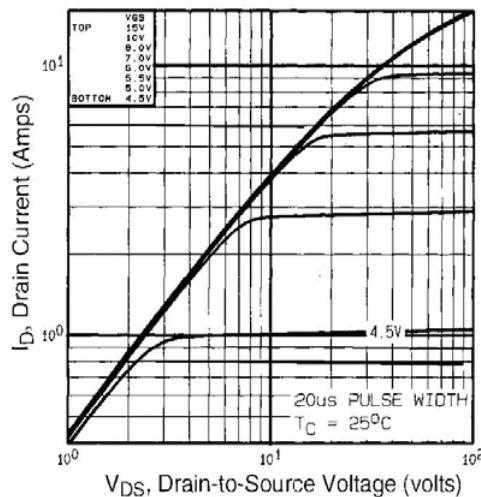
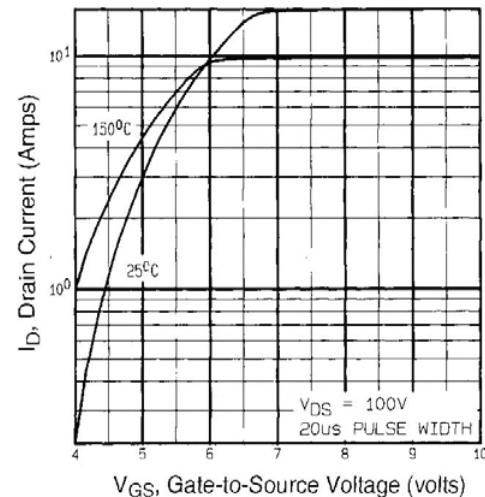
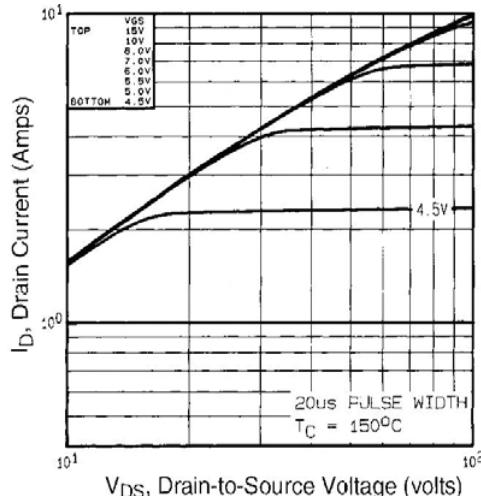
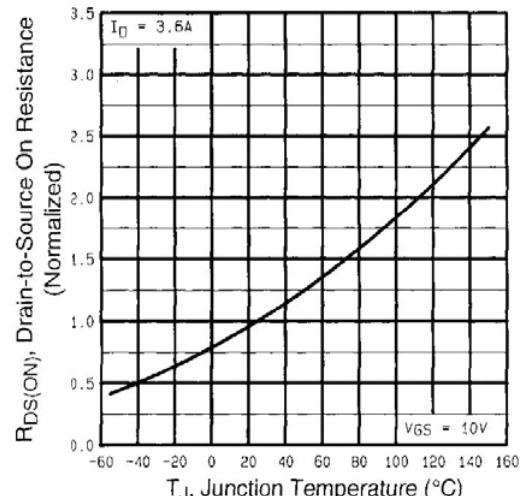
SPECIFICATIONS ( $T_J = 25$  °C, unless otherwise noted)

| PARAMETER                                      | SYMBOL              | TEST CONDITIONS                                                                           |                                                                                      | MIN. | TYP. | MAX.  | UNIT |  |
|------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------|------|-------|------|--|
| <b>Static</b>                                  |                     |                                                                                           |                                                                                      |      |      |       |      |  |
| Drain-Source Breakdown Voltage                 | $V_{DS}$            | $V_{GS} = 0$ V, $I_D = 250$ µA                                                            |                                                                                      | 900  | -    | -     | V    |  |
| $V_{DS}$ Temperature Coefficient               | $\Delta V_{DS}/T_J$ | Reference to 25 °C, $I_D = 1$ mA                                                          |                                                                                      | -    | 1.1  | -     | 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                            | $I_{GSS}$           | $V_{GS} = \pm 20$ V                                                                       |                                                                                      | -    | -    | ± 100 | nA   |  |
| Zero Gate Voltage Drain Current                | $I_{DSS}$           | $V_{DS} = 900$ V, $V_{GS} = 0$ V                                                          |                                                                                      | -    | -    | 100   | µA   |  |
|                                                |                     | $V_{DS} = 720$ V, $V_{GS} = 0$ V, $T_J = 125$ °C                                          |                                                                                      | -    | -    | 500   |      |  |
| Drain-Source On-State Resistance               | $R_{DS(on)}$        | $V_{GS} = 10$ V                                                                           | $I_D = 2.2$ A <sup>b</sup>                                                           | -    | -    | 3.7   | Ω    |  |
| Forward Transconductance                       | $g_{fs}$            | $V_{DS} = 100$ V, $I_D = 2.2$ A <sup>b</sup>                                              |                                                                                      | 2.3  | -    | -     | S    |  |
| <b>Dynamic</b>                                 |                     |                                                                                           |                                                                                      |      |      |       |      |  |
| Input Capacitance                              | $C_{iss}$           | $V_{GS} = 0$ V,<br>$V_{DS} = 25$ V,<br>$f = 1.0$ MHz, see fig. 5                          |                                                                                      | -    | 1200 | -     | pF   |  |
| Output Capacitance                             | $C_{oss}$           |                                                                                           |                                                                                      | -    | 320  | -     |      |  |
| Reverse Transfer Capacitance                   | $C_{rss}$           |                                                                                           |                                                                                      | -    | 200  | -     |      |  |
| Total Gate Charge                              | $Q_g$               | $V_{GS} = 10$ V                                                                           | $I_D = 3.6$ A, $V_{DS} = 360$ V<br>see fig. 6 and 13 <sup>b</sup>                    | -    | -    | 78    | nC   |  |
| Gate-Source Charge                             | $Q_{gs}$            |                                                                                           |                                                                                      | -    | -    | 10    |      |  |
| Gate-Drain Charge                              | $Q_{gd}$            |                                                                                           |                                                                                      | -    | -    | 42    |      |  |
| Turn-On Delay Time                             | $t_{d(on)}$         |                                                                                           |                                                                                      | -    | 14   | -     |      |  |
| Rise Time                                      | $t_r$               | $V_{DD} = 450$ V, $I_D = 3.6$ A,<br>$R_g = 12$ Ω, $R_D = 120$ Ω, see fig. 10 <sup>b</sup> |                                                                                      | -    | 25   | -     | ns   |  |
| Turn-Off Delay Time                            | $t_{d(off)}$        |                                                                                           |                                                                                      | -    | 90   | -     |      |  |
| Fall Time                                      | $t_f$               |                                                                                           |                                                                                      | -    | 30   | -     |      |  |
| Internal Drain Inductance                      | $L_D$               |                                                                                           |                                                                                      | -    | 5.0  | -     |      |  |
| Internal Source Inductance                     | $L_S$               | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact                |                                                                                      | 0    | 13   | -     | nH   |  |
| <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                  |  | -    | -    | 3.6   | A    |  |
| Pulsed Diode Forward Current <sup>a</sup>      | $I_{SM}$            |                                                                                           |                                                                                      | -    | -    | 14    |      |  |
| Body Diode Voltage                             | $V_{SD}$            | $T_J = 25$ °C, $I_S = 3.6$ A, $V_{GS} = 0$ V <sup>b</sup>                                 |                                                                                      | -    | -    | 1.8   | V    |  |
| Body Diode Reverse Recovery Time               | $t_{rr}$            | $T_J = 25$ °C, $I_F = 3.6$ A, $dI/dt = 100$ A/µs <sup>b</sup>                             |                                                                                      | -    | 430  | 650   | ns   |  |
| Body Diode Reverse Recovery Charge             | $Q_{rr}$            |                                                                                           |                                                                                      | -    | 1.4  | 2.1   | 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 ≤ 300 µs; duty cycle ≤ 2 %.

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

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

**Fig. 3 - Typical Transfer Characteristics**

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

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

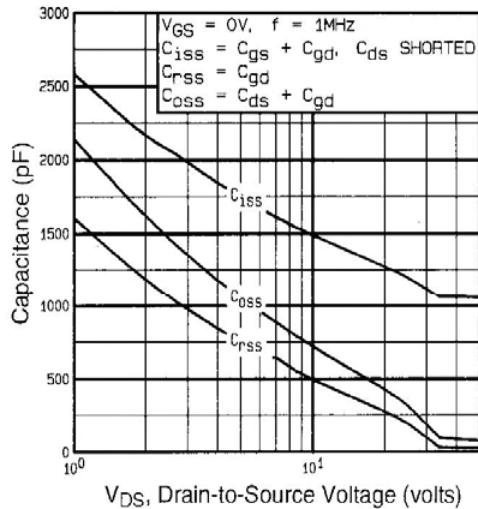


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

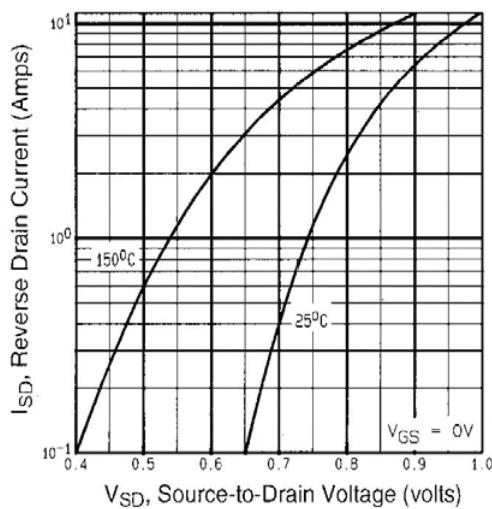


Fig. 7 - Typical Source-Drain Diode Forward Voltage

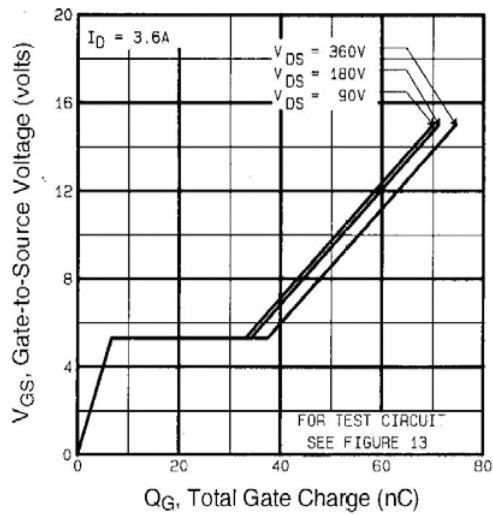


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

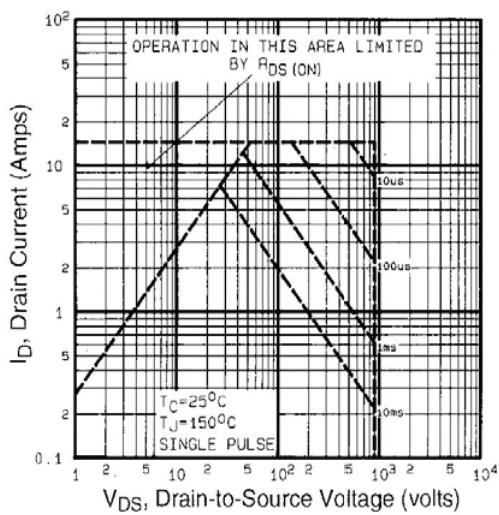
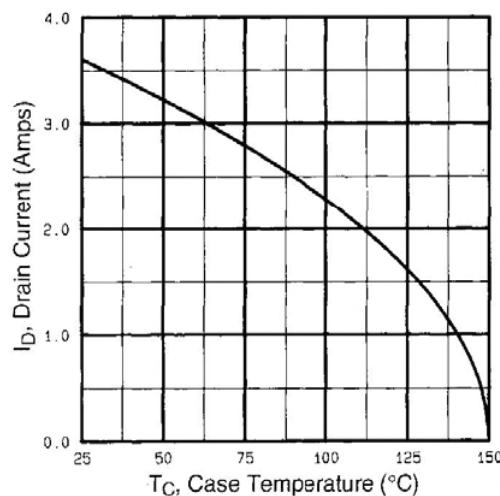
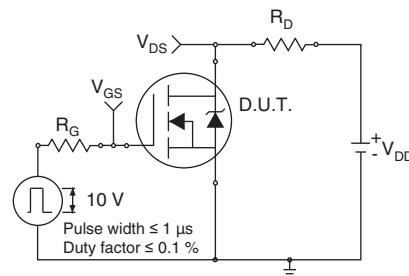
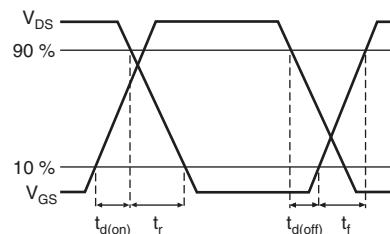
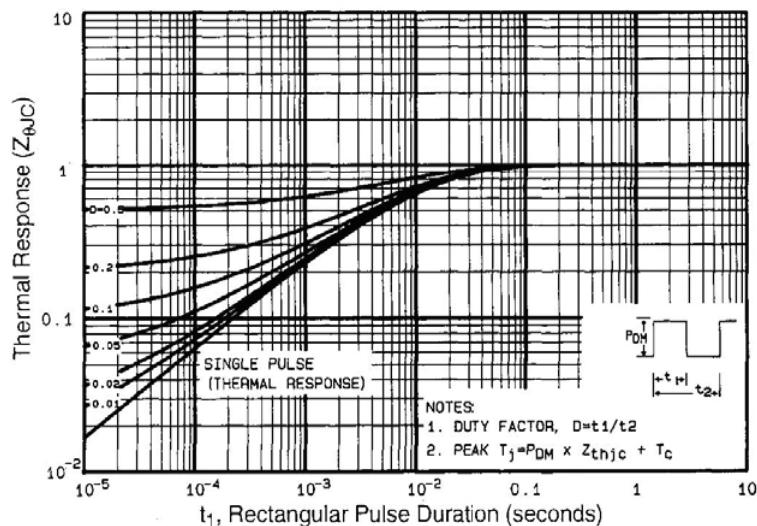


Fig. 8 - Maximum Safe Operating Area


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

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

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

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

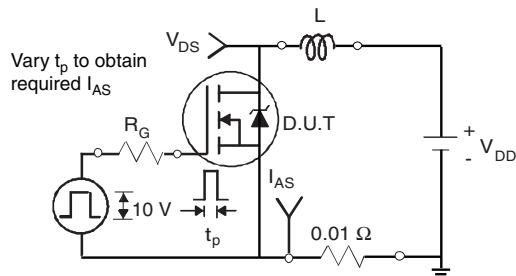


Fig. 12a - Unclamped Inductive Test Circuit

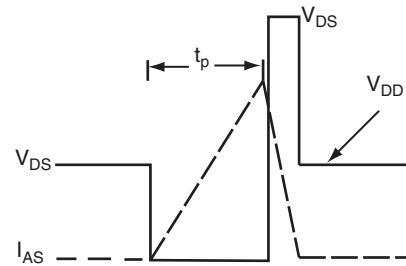


Fig. 12b - Unclamped Inductive Waveforms

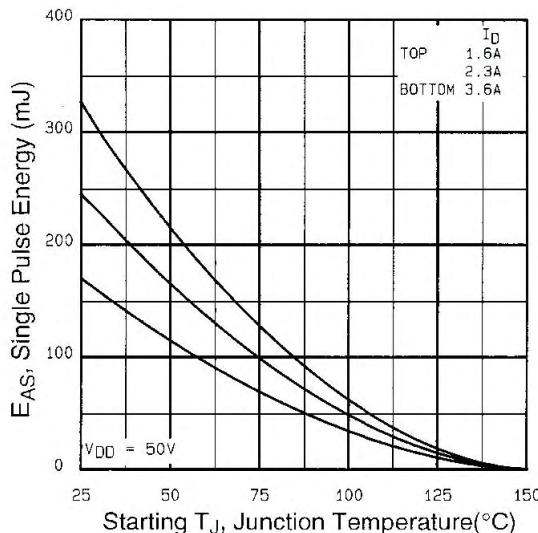


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

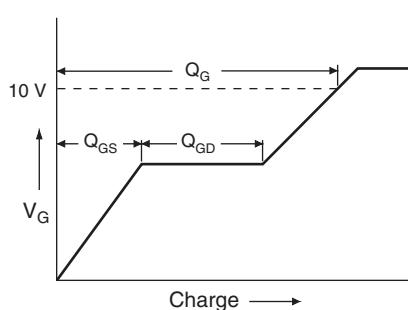


Fig. 13a - Basic Gate Charge Waveform

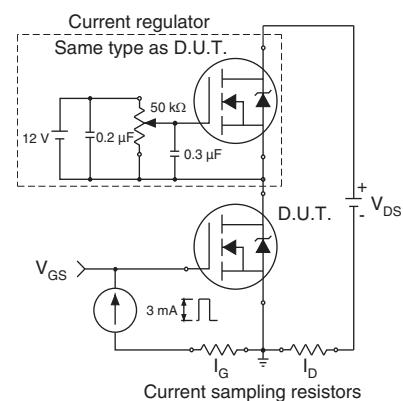
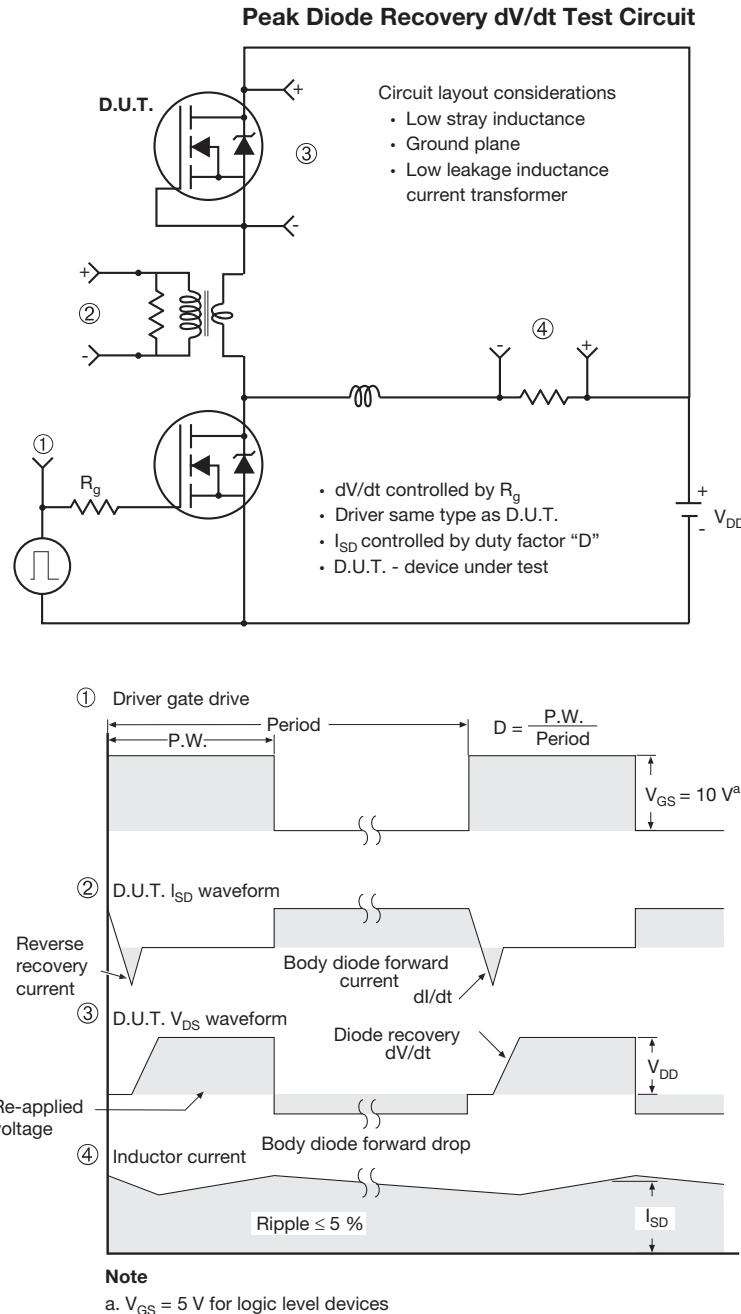


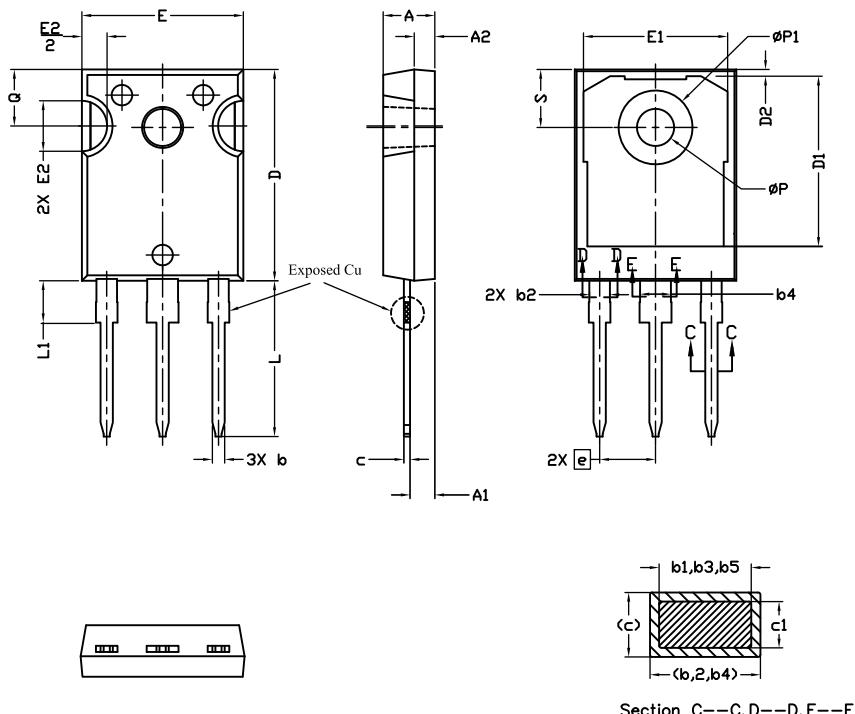
Fig. 13b - Gate Charge Test Circuit


**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?91249](http://www.vishay.com/ppg?91249).

### TO-247AC (High Voltage)

#### VERSION 1: FACILITY CODE = 9



Section C—C, D—D, E—E

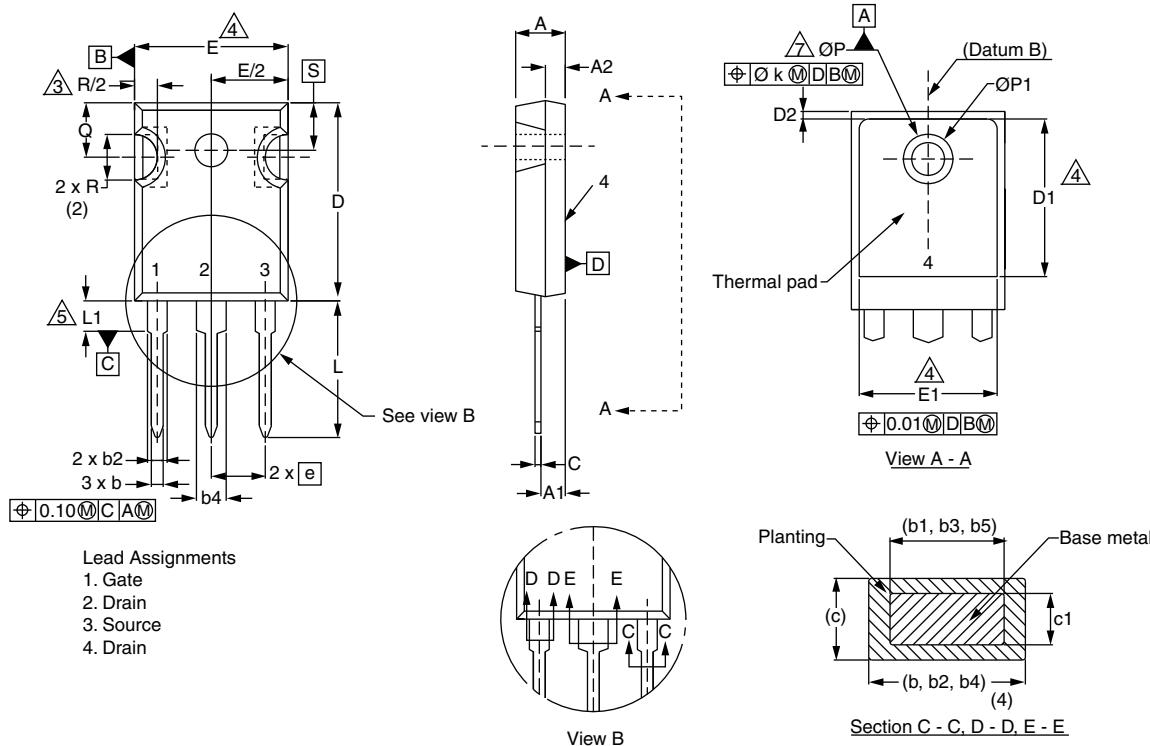
| MILLIMETERS |       |       |       |
|-------------|-------|-------|-------|
| DIM.        | MIN.  | MAX.  | NOTES |
| A           | 4.83  | 5.21  |       |
| A1          | 2.29  | 2.55  |       |
| A2          | 1.50  | 2.49  |       |
| b           | 1.12  | 1.33  |       |
| b1          | 1.12  | 1.28  |       |
| b2          | 1.91  | 2.39  | 6     |
| b3          | 1.91  | 2.34  |       |
| b4          | 2.87  | 3.22  | 6, 8  |
| b5          | 2.87  | 3.18  |       |
| c           | 0.55  | 0.69  | 6     |
| c1          | 0.55  | 0.65  |       |
| D           | 20.40 | 20.70 | 4     |

#### Notes

- (1) Package reference: JEDEC® TO247, variation AC
- (2) All dimensions are in mm
- (3) Slot required, notch may be rounded
- (4) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These dimensions are measured at the outermost extremes of the plastic body
- (5) Thermal pad contour optional with dimensions D1 and E1
- (6) Lead finish uncontrolled in L1
- (7) Ø 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
- (8) Dimension b2 and b4 does not include dambar protrusion. Allowable dambar protrusion shall be 0.1 mm total in excess of b2 and b4 dimension at maximum material condition

| MILLIMETERS |           |       |       |
|-------------|-----------|-------|-------|
| DIM.        | MIN.      | MAX.  | NOTES |
| D1          | 16.25     | 16.85 | 5     |
| D2          | 0.56      | 0.76  |       |
| E           | 15.50     | 15.87 | 4     |
| E1          | 13.46     | 14.16 | 5     |
| E2          | 4.52      | 5.49  | 3     |
| e           | 5.44 BSC  |       |       |
| L           | 14.90     | 15.40 |       |
| L1          | 3.96      | 4.16  | 6     |
| Ø P         | 3.56      | 3.65  | 7     |
| Ø P1        | 7.19 ref. |       |       |
| Q           | 5.31      | 5.69  |       |
| S           | 5.54      | 5.74  |       |

### VERSION 2: FACILITY CODE = Y



| MILLIMETERS |       |       |       |
|-------------|-------|-------|-------|
| DIM.        | MIN.  | MAX.  | NOTES |
| A           | 4.58  | 5.31  |       |
| A1          | 2.21  | 2.59  |       |
| A2          | 1.17  | 2.49  |       |
| b           | 0.99  | 1.40  |       |
| b1          | 0.99  | 1.35  |       |
| b2          | 1.53  | 2.39  |       |
| b3          | 1.65  | 2.37  |       |
| b4          | 2.42  | 3.43  |       |
| b5          | 2.59  | 3.38  |       |
| c           | 0.38  | 0.86  |       |
| c1          | 0.38  | 0.76  |       |
| D           | 19.71 | 20.82 |       |
| D1          | 13.08 | -     |       |

ECN: E19-0614-Rev. E, 08-Jan-2020

DWG: 5971

| MILLIMETERS |          |       |       |
|-------------|----------|-------|-------|
| DIM.        | MIN.     | MAX.  | NOTES |
| D2          | 0.51     | 1.30  |       |
| E           | 15.29    | 15.87 |       |
| E1          | 13.72    | -     |       |
| e           | 5.46 BSC |       |       |
| Ø k         | 0.254    |       |       |
| L           | 14.20    | 16.25 |       |
| L1          | 3.71     | 4.29  |       |
| Ø P         | 3.51     | 3.66  |       |
| Ø P1        | -        | 7.39  |       |
| Q           | 5.31     | 5.69  |       |
| R           | 4.52     | 5.49  |       |
| S           | 5.51 BSC |       |       |

#### 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) Ø 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

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