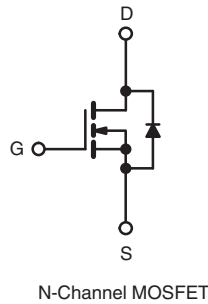
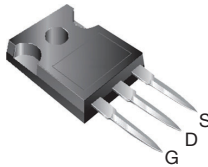


## Power MOSFET

| PRODUCT SUMMARY           |                        |     |
|---------------------------|------------------------|-----|
| $V_{DS}$ (V)              | 800                    |     |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ | 1.2 |
| $Q_g$ (Max.) (nC)         | 200                    |     |
| $Q_{gs}$ (nC)             | 24                     |     |
| $Q_{gd}$ (nC)             | 110                    |     |
| Configuration             | Single                 |     |

**TO-247AC**


### FEATURES

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


**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-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 of its isolated mounting hole. It also provides greater creepage distance between pins to meet the requirements of most safety specifications.

| ORDERING INFORMATION |                           |
|----------------------|---------------------------|
| Package              | TO-247AC                  |
| Lead (Pb)-free       | IRFPE50PbF<br>SiHFPE50-E3 |
| SnPb                 | IRFPE50<br>SiHFPE50       |

| ABSOLUTE MAXIMUM RATINGS ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |                  |                                   |                  |                     |
|---|------------------|-----------------------------------|------------------|---------------------|
| PARAMETER   | SYMBOL           | LIMIT                             | UNIT             |                     |
| Drain-Source Voltage  | $V_{DS}$         | 800                               | V                |                     |
| Gate-Source Voltage   | $V_{GS}$         | $\pm 20$                          |                  |                     |
| Continuous Drain Current  | $V_{GS}$ at 10 V | $T_C = 25\text{ }^\circ\text{C}$  | 7.8              | A                   |
|   |                  | $T_C = 100\text{ }^\circ\text{C}$ | 4.9              |                     |
| Pulsed Drain Current <sup>a</sup>   |                  |                                   | 31               |                     |
| Linear Derating Factor  |                  |                                   | 1.5              | W/ $^\circ\text{C}$ |
| Single Pulse Avalanche Energy <sup>b</sup>  | $E_{AS}$         | 770                               |                  | mJ                  |
| Repetitive Avalanche Current <sup>a</sup>   | $I_{AR}$         | 7.8                               |                  | A                   |
| Repetitive Avalanche Energy <sup>a</sup>  | $E_{AR}$         | 19                                |                  | mJ                  |
| Maximum Power Dissipation   |                  | $T_C = 25\text{ }^\circ\text{C}$  | 190              | W                   |
| Peak Diode Recovery $dV/dt^c$   |                  |                                   | 2.0              | 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 <sup>d</sup> |                     |
| 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).
- $V_{DD} = 50\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 23\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 7.8\text{ A}$  (see fig. 12).
- $I_{SD} \leq 7.8\text{ A}$ ,  $dI/dt \leq 140\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq 600\text{ V}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 1.6 mm from case.

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

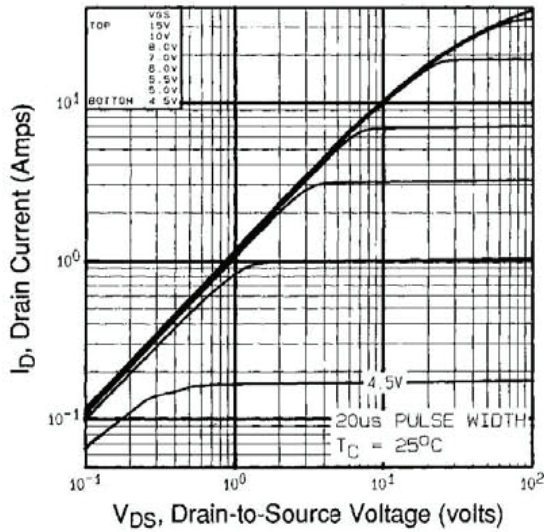
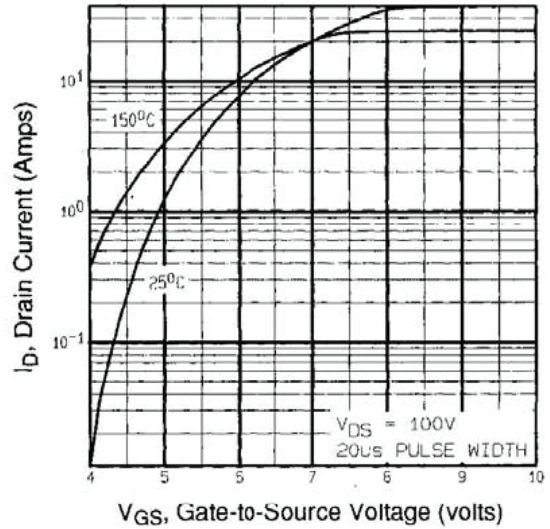
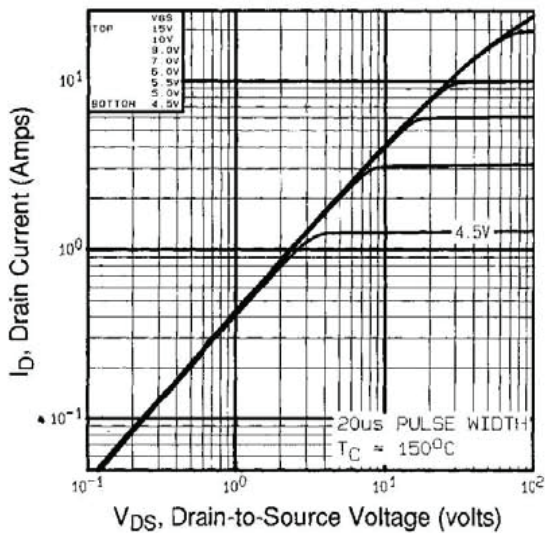
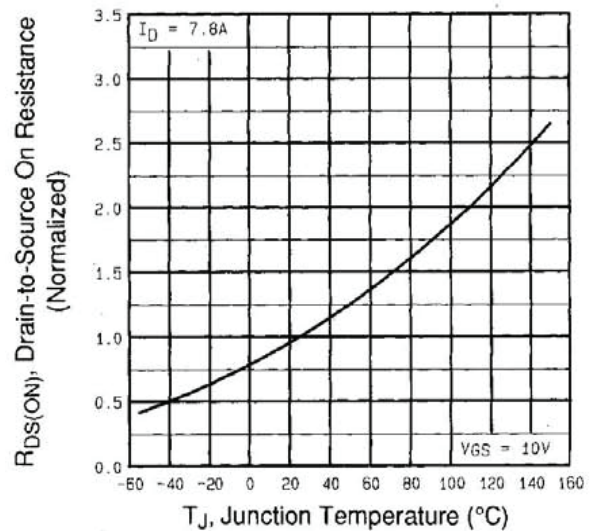
| THERMAL RESISTANCE RATINGS          |            |      |      |      |
|-------------------------------------|------------|------|------|------|
| PARAMETER                           | SYMBOL     | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient         | $R_{thJA}$ | -    | 40   | °C/W |
| Case-to-Sink, Flat, Greased Surface | $R_{thCS}$ | 0.24 | -    |      |
| Maximum Junction-to-Case (Drain)    | $R_{thJC}$ | -    | 0.65 |      |

## 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                 | $V_{DS}$            | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$   | 800  | -    | -         | V             |
| $V_{DS}$ Temperature Coefficient               | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$  | -    | 0.98 | -         | 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                | $I_{DSS}$           | $V_{DS} = 800\text{ V}$ , $V_{GS} = 0\text{ V}$  | -    | -    | 100       | $\mu\text{A}$ |
|  |                     | $V_{DS} = 640\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$  | -    | -    | 500       |               |
| Drain-Source On-State Resistance               | $R_{DS(on)}$        | $V_{GS} = 10\text{ V}$   $I_D = 4.7\text{ A}^b$  | -    | -    | 1.2       | $\Omega$      |
| Forward Transconductance                       | $g_{fs}$            | $V_{DS} = 100\text{ V}$ , $I_D = 4.7\text{ A}^b$   | 5.6  | -    | -         | 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   | -    | 3100 | -         | pF            |
| Output Capacitance                             | $C_{oss}$           |  | -    | 800  | -         |               |
| Reverse Transfer Capacitance                   | $C_{riss}$          |  | -    | 490  | -         |               |
| Total Gate Charge                              | $Q_g$               | $V_{GS} = 10\text{ V}$   $I_D = 7.8\text{ A}$ , $V_{DS} = 400\text{ V}$ ,<br>see fig. 6 and 13 <sup>b</sup>  | -    | -    | 200       | nC            |
| Gate-Source Charge                             | $Q_{gs}$            |  | -    | -    | 24        |               |
| Gate-Drain Charge                              | $Q_{gd}$            |  | -    | -    | 110       |               |
| Turn-On Delay Time                             | $t_{d(on)}$         | $V_{DD} = 400\text{ V}$ , $I_D = 7.8\text{ A}$ ,<br>$R_g = 6.2\text{ }\Omega$ , $R_D = 52\text{ }\Omega$<br>see fig. 10 <sup>b</sup>                             | -    | 19   | -         | ns            |
| Rise Time                                      | $t_r$               |  | -    | 38   | -         |               |
| Turn-Off Delay Time                            | $t_{d(off)}$        |  | -    | 120  | -         |               |
| Fall Time                                      | $t_f$               |  | -    | 39   | -         |               |
| Internal Drain Inductance                      | $L_D$               | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact  | -    | 5.0  | -         | nH            |
| Internal Source Inductance                     | $L_S$               |  | -    | 13   | -         |               |
| <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    | -    | -    | 7.8       | A             |
| Pulsed Diode Forward Current <sup>a</sup>      | $I_{SM}$            |  | -    | -    | 31        |               |
| Body Diode Voltage                             | $V_{SD}$            | $T_J = 25\text{ }^\circ\text{C}$ , $I_S = 7.8\text{ A}$ , $V_{GS} = 0\text{ V}^b$  | -    | -    | 1.8       | V             |
| Body Diode Reverse Recovery Time               | $t_{rr}$            | $T_J = 25\text{ }^\circ\text{C}$ , $I_F = 7.8\text{ A}$ ,<br>$di/dt = 100\text{ A}/\mu\text{s}^b$  | -    | 650  | 980       | ns            |
| Body Diode Reverse Recovery Charge             | $Q_{rr}$            |  | -    | 3.8  | 5.7       | $\mu\text{C}$ |
| Forward Turn-On Time                           | $t_{on}$            | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$ )  |      |      |           |               |

### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

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

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

**Fig. 3 - Typical Transfer Characteristics**

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

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

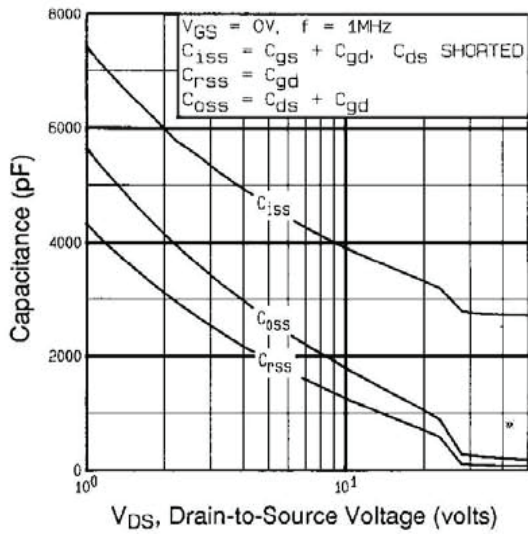


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

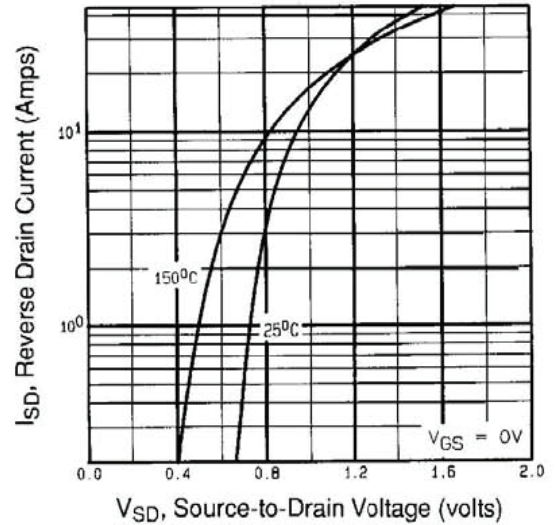


Fig. 7 - Typical Source-Drain Diode Forward Voltage

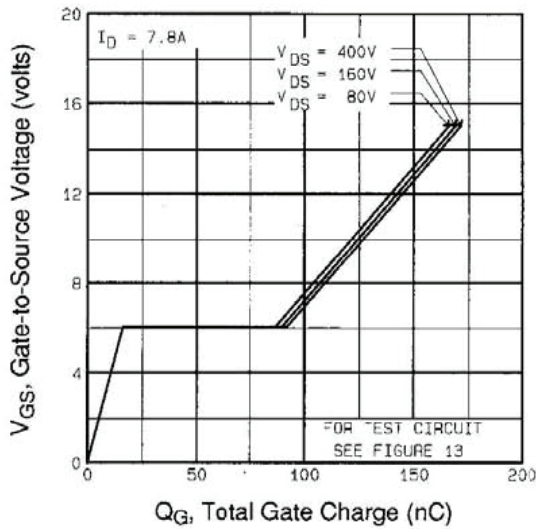


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

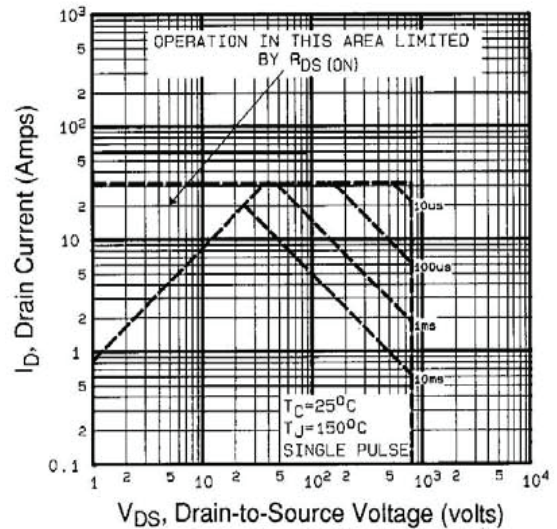


Fig. 8 - Maximum Safe Operating Area



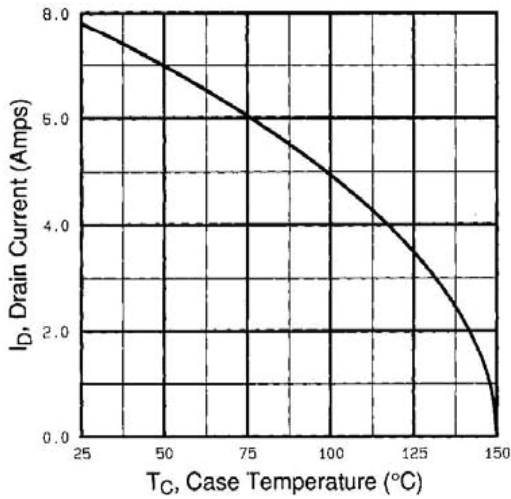


Fig. 9 - Maximum Drain Current vs. Case Temperature

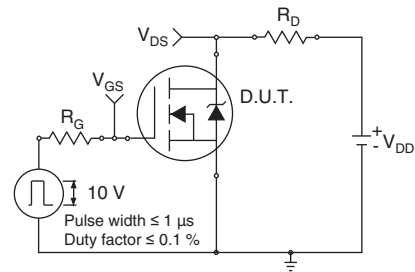


Fig. 10a - Switching Time Test Circuit

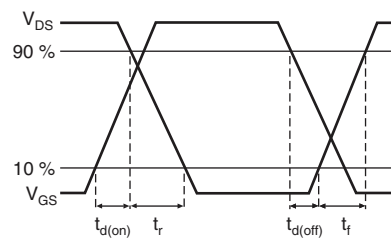


Fig. 10b - Switching Time Waveforms

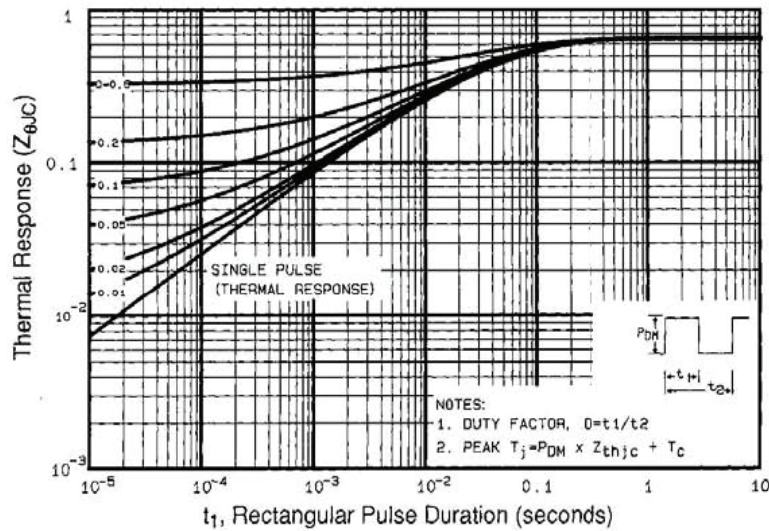


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

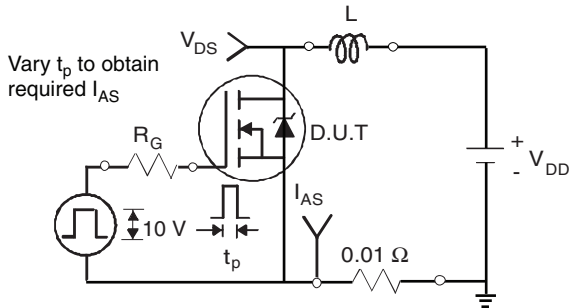


Fig. 12a - Unclamped Inductive Test Circuit

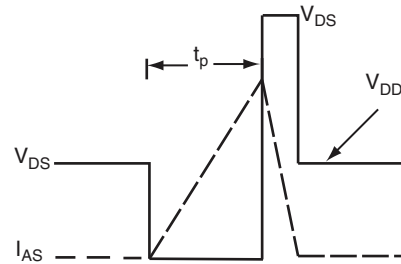


Fig. 12b - Unclamped Inductive Waveforms

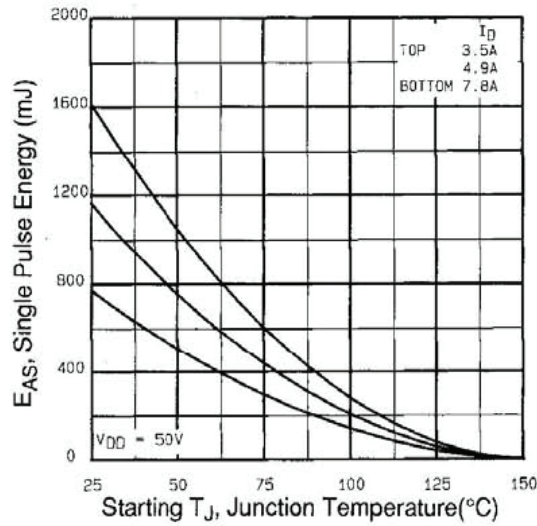


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

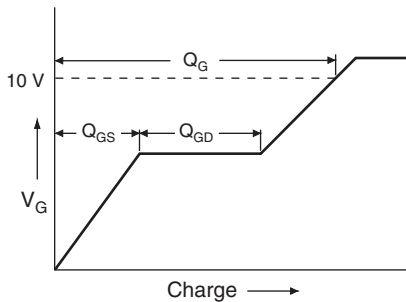


Fig. 13a - Basic Gate Charge Waveform

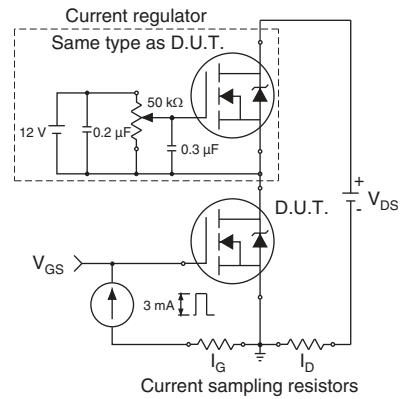
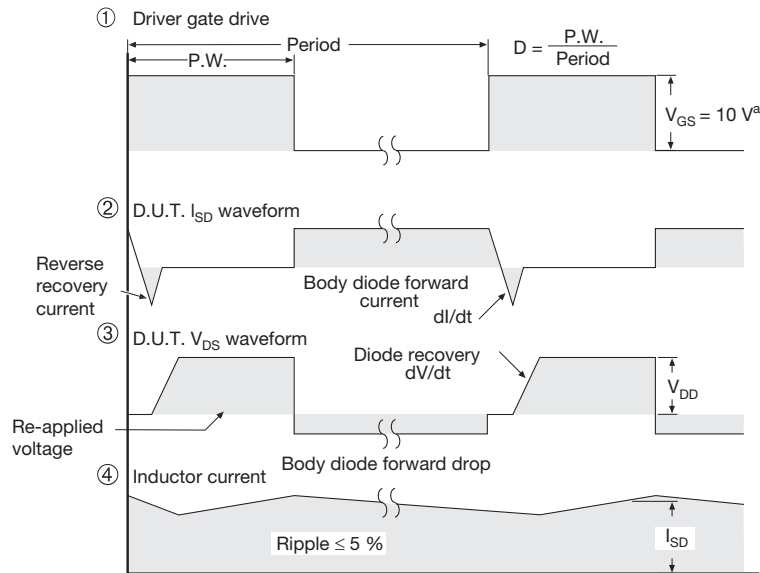
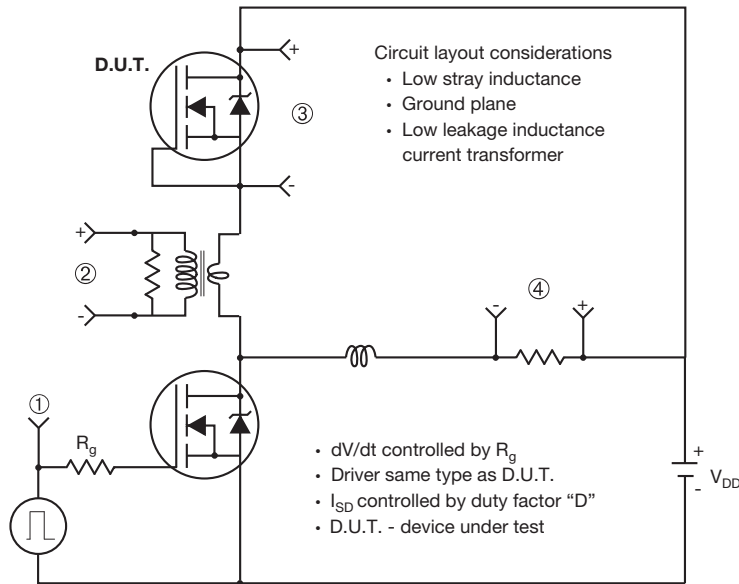


Fig. 13b - Gate Charge Test Circuit

### Peak Diode Recovery dV/dt Test Circuit



**Note**

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

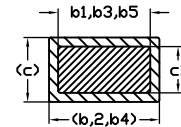
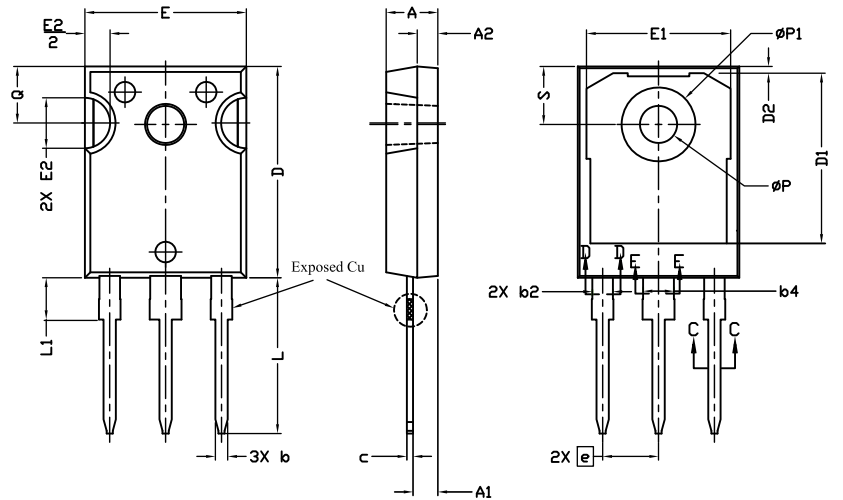
**Fig. 14 - For N-Channel**

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# TO-247AC (High Voltage)

VERSION 1: FACILITY CODE = 9



Section C--C, D--D, E--E

| DIM. | MILLIMETERS |       | NOTES |
|------|-------------|-------|-------|
|      | MIN.        | MAX.  |       |
| 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     |

| DIM. | MILLIMETERS |       | NOTES |
|------|-------------|-------|-------|
|      | MIN.        | MAX.  |       |
| 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  |       |

**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





**VERSION 2: FACILITY CODE = Y**



| DIM. | MILLIMETERS |       | NOTES |
|------|-------------|-------|-------|
|      | MIN.        | MAX.  |       |
| 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       | -     |       |

| DIM. | MILLIMETERS |       | NOTES |
|------|-------------|-------|-------|
|      | MIN.        | MAX.  |       |
| 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



**VERSION 3: FACILITY CODE = N**



| MILLIMETERS |       |       |
|-------------|-------|-------|
| DIM.        | MIN.  | MAX.  |
| A           | 4.65  | 5.31  |
| A1          | 2.21  | 2.59  |
| A2          | 1.17  | 1.37  |
| b           | 0.99  | 1.40  |
| b1          | 0.99  | 1.35  |
| b2          | 1.65  | 2.39  |
| b3          | 1.65  | 2.34  |
| b4          | 2.59  | 3.43  |
| b5          | 2.59  | 3.38  |
| c           | 0.38  | 0.89  |
| c1          | 0.38  | 0.84  |
| D           | 19.71 | 20.70 |
| D1          | 13.08 | -     |

| MILLIMETERS |          |       |
|-------------|----------|-------|
| DIM.        | MIN.     | MAX.  |
| D2          | 0.51     | 1.35  |
| E           | 15.29    | 15.87 |
| E1          | 13.46    | -     |
| e           | 5.46 BSC |       |
| k           | 0.254    |       |
| L           | 14.20    | 16.10 |
| L1          | 3.71     | 4.29  |
| N           | 7.62 BSC |       |
| P           | 3.56     | 3.66  |
| P1          | -        | 7.39  |
| Q           | 5.31     | 5.69  |
| R           | 4.52     | 5.49  |
| S           | 5.51 BSC |       |

ECN: E20-0545-Rev. F, 19-Oct-2020  
 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) 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")



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