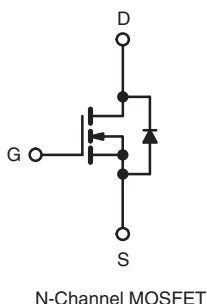
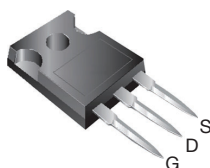


## Power MOSFET

### PRODUCT SUMMARY

|                           |                 |       |
|---------------------------|-----------------|-------|
| $V_{DS}$ (V)              | 60              |       |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10$ V | 0.009 |
| $Q_g$ (Max.) (nC)         | 190             |       |
| $Q_{gs}$ (nC)             | 55              |       |
| $Q_{gd}$ (nC)             | 90              |       |
| Configuration             | Single          |       |

**TO-247AC**


### FEATURES

- Dynamic  $dV/dt$  Rating
- Repetitive Avalanche Rated
- Ultra Low On- Resistance
- Very Low Thermal Resistance
- Isolated Central Mounting Hole
- 175 °C Operating Temperature
- Fast Switching
- 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 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 | IRFP064PbF<br>SiHFP064-E3 |
| SnPb           | IRFP064<br>SiHFP064       |

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

| PARAMETER                                                 | SYMBOL           | LIMIT          | UNIT     |
|-----------------------------------------------------------|------------------|----------------|----------|
| Drain-Source Voltage                                      | $V_{DS}$         | 60             | V        |
| Gate-Source Voltage                                       | $V_{GS}$         | $\pm 20$       |          |
| Continuous Drain Current <sup>a</sup>                     | $V_{GS}$ at 10 V | $T_C = 25$ °C  | A        |
|                                                           |                  | $T_C = 100$ °C |          |
| Pulsed Drain Current <sup>a</sup>                         | $I_{DM}$         | 520            |          |
| Linear Derating Factor                                    |                  | 2.0            | W/°C     |
| Single Pulse Avalanche Energy <sup>b</sup>                | $E_{AS}$         | 1000           | mJ       |
| Repetitive Avalanche Current <sup>a</sup>                 | $I_{AR}$         | 70             | A        |
| Repetitive Avalanche Energy <sup>a</sup>                  | $E_{AR}$         | 30             | mJ       |
| Maximum Power Dissipation                                 | $P_D$            | 300            | W        |
| Peak Diode Recovery $dV/dt$ <sup>c</sup>                  | $dV/dt$          | 4.5            | V/ns     |
| Operating Junction and Storage Temperature Range          | $T_J, T_{stg}$   | - 55 to + 175  | °C       |
| Soldering Recommendations (Peak Temperature) <sup>d</sup> | for 10 s         | 300            |          |
| Mounting Torque                                           | 6-32 or M3 screw | 10             | lbf · in |
|                                                           |                  | 1.1            | N · m    |

#### Notes

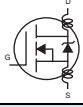
- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 25$  V, starting  $T_J = 25$  °C,  $L = 69$   $\mu$ H,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 130$  A (see fig. 12).
- $I_{SD} \leq 130$  A,  $dI/dt \leq 300$  A/ $\mu$ s,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 175$  °C.
- 1.6 mm from case.
- Current limited by the package (die current = 130 A).

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

**THERMAL RESISTANCE RATINGS**

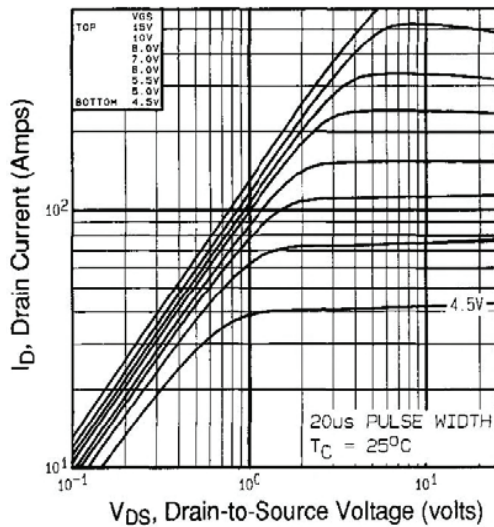
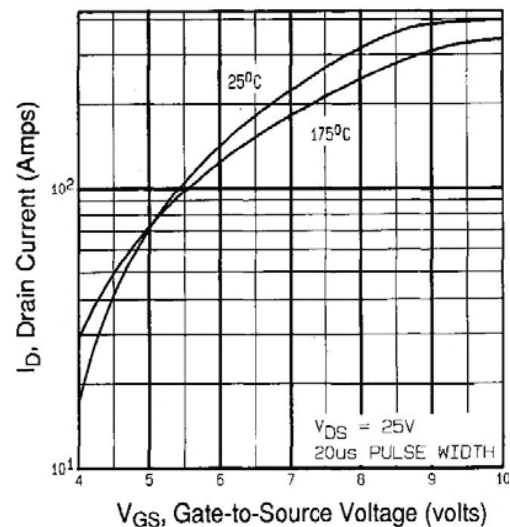
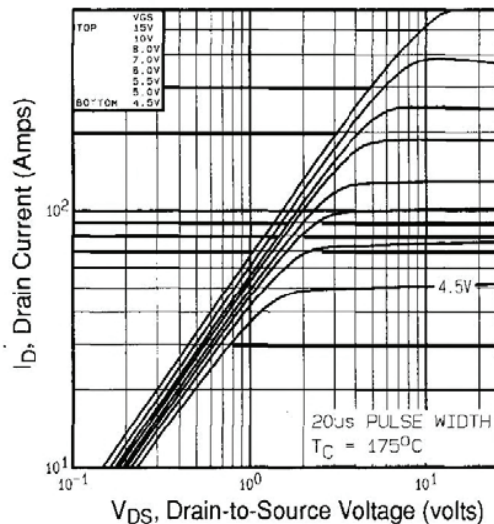
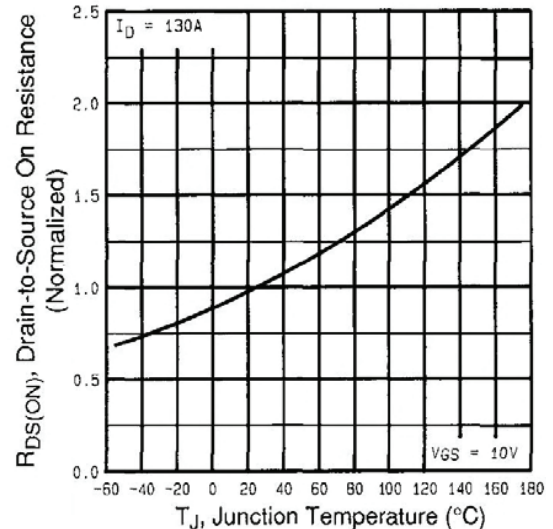
| PARAMETER                           | SYMBOL     | TYP. | MAX. | UNIT |
|-------------------------------------|------------|------|------|------|
| Maximum Junction-to-Ambient         | $R_{thJA}$ | -    | 40   | °C/W |
| Case-to-Sink, Flat, Greased Surface | $R_{thCS}$ | 0.24 | -    |      |
| Maximum Junction-to-Case (Drain)    | $R_{thJC}$ | -    | 0.50 |      |

**SPECIFICATIONS** ( $T_J = 25\text{ °C}$ , unless otherwise noted)

| PARAMETER                                 | SYMBOL                           | TEST CONDITIONS                                                                                                                                                 |                                                                                   | MIN. | TYP.  | MAX.            | UNIT |
|-------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|-------|-----------------|------|
| Static                                    |                                  |                                                                                                                                                                 |                                                                                   |      |       |                 |      |
| Drain-Source Breakdown Voltage            | V <sub>DS</sub>                  | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                                                                                                  |                                                                                   | 60   | -     | -               | V    |
| V <sub>DS</sub> Temperature Coefficient   | ΔV <sub>DS</sub> /T <sub>J</sub> | Reference to 25 °C, I <sub>D</sub> = 1 mA                                                                                                                       |                                                                                   | -    | 0.048 | -               | V/°C |
| Gate-Source Threshold Voltage             | V <sub>GS(th)</sub>              | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                                                                     |                                                                                   | 2.0  | -     | 4.0             | V    |
| Gate-Source Leakage                       | I <sub>GSS</sub>                 | V <sub>GS</sub> = ± 20 V                                                                                                                                        |                                                                                   | -    | -     | ± 100           | nA   |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>                 | V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V                                                                                                                   |                                                                                   | -    | -     | 25              | μA   |
|                                           |                                  | V <sub>DS</sub> = 48 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150 °C                                                                                          |                                                                                   | -    | -     | 250             |      |
| Drain-Source On-State Resistance          | R <sub>DS(on)</sub>              | V <sub>GS</sub> = 10 V                                                                                                                                          | I <sub>D</sub> = 78 A <sup>b</sup>                                                | -    | -     | 0.009           | Ω    |
| Forward Transconductance                  | g <sub>fs</sub>                  | V <sub>DS</sub> = 25 V, I <sub>D</sub> = 78 A <sup>b</sup>                                                                                                      |                                                                                   | 38   | -     | -               | S    |
| Dynamic                                   |                                  |                                                                                                                                                                 |                                                                                   |      |       |                 |      |
| Input Capacitance                         | C <sub>iss</sub>                 | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 25 V,<br>f = 1.0 MHz, see fig. 5                                                                                    |                                                                                   | -    | 7400  | -               | pF   |
| Output Capacitance                        | C <sub>oss</sub>                 |                                                                                                                                                                 |                                                                                   | -    | 3200  | -               |      |
| Reverse Transfer Capacitance              | C <sub>rss</sub>                 |                                                                                                                                                                 |                                                                                   | -    | 540   | -               |      |
| Total Gate Charge                         | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V                                                                                                                                          | I <sub>D</sub> = 130 A, V <sub>DS</sub> = 48 V,<br>see fig. 6 and 13 <sup>b</sup> | -    | -     | 190             | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>                  |                                                                                                                                                                 |                                                                                   | -    | -     | 55              |      |
| Gate-Drain Charge                         | Q <sub>gd</sub>                  |                                                                                                                                                                 |                                                                                   | -    | -     | 90              |      |
| Turn-On Delay Time                        | t <sub>d(on)</sub>               | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 130 A,<br>R <sub>g</sub> = 4.3 Ω, R <sub>D</sub> = 0.22 Ω, see fig. 10 <sup>b</sup>                                    |                                                                                   | -    | 21    | -               | ns   |
| Rise Time                                 | t <sub>r</sub>                   |                                                                                                                                                                 |                                                                                   | -    | 190   | -               |      |
| Turn-Off Delay Time                       | t <sub>d(off)</sub>              |                                                                                                                                                                 |                                                                                   | -    | 110   | -               |      |
| Fall Time                                 | t <sub>f</sub>                   |                                                                                                                                                                 |                                                                                   | -    | 190   | -               |      |
| Internal Drain Inductance                 | L <sub>D</sub>                   | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact  |                                                                                   | -    | 5.0   | -               | nH   |
| Internal Source Inductance                | L <sub>S</sub>                   |                                                                                                                                                                 |                                                                                   | -    | 13    | -               |      |
| Drain-Source Body Diode Characteristics   |                                  |                                                                                                                                                                 |                                                                                   |      |       |                 |      |
| Continuous Source-Drain Diode Current     | I <sub>S</sub>                   | MOSFET symbol<br>showing the<br>integral reverse<br>p - n junction diode    |                                                                                   | -    | -     | 70 <sup>c</sup> | A    |
| Pulsed Diode Forward Current <sup>a</sup> | I <sub>SM</sub>                  |                                                                                                                                                                 |                                                                                   | -    | -     | 520             |      |
| Body Diode Voltage                        | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 130 A, V <sub>GS</sub> = 0 V <sup>b</sup>                                                                              |                                                                                   | -    | -     | 3.0             | V    |
| Body Diode Reverse Recovery Time          | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 130 A, dI/dt = 100 A/μs <sup>b</sup>                                                                                   |                                                                                   | -    | 160   | 250             | ns   |
| Body Diode Reverse Recovery Charge        | Q <sub>rr</sub>                  |                                                                                                                                                                 |                                                                                   | -    | 0.9   | 1.7             | μC   |
| Forward Turn-On Time                      | t <sub>on</sub>                  | Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )                                                               |                                                                                   |      |       |                 |      |

**Notes**

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- Current limited by the package (die current = 130 A).

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

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

**Fig. 3 - Typical Transfer Characteristics**

**Fig. 2 - Typical Output Characteristics,  $T_C = 175^\circ\text{C}$** 

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

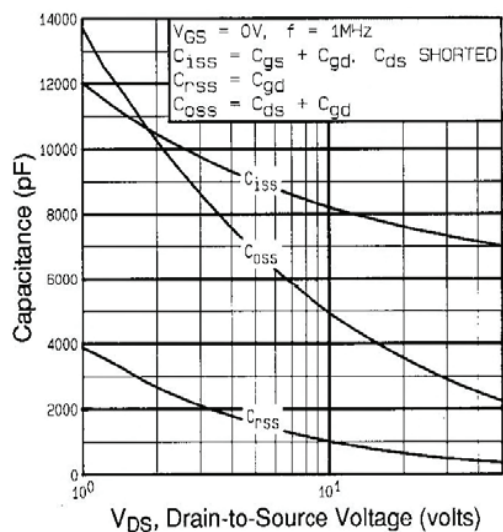


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

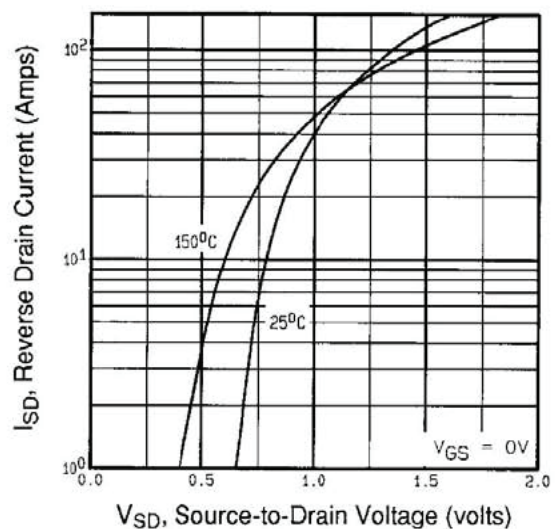


Fig. 7 - Typical Source-Drain Diode Forward Voltage

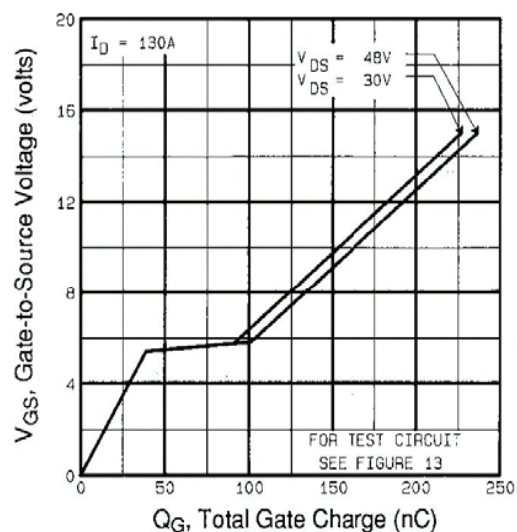


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

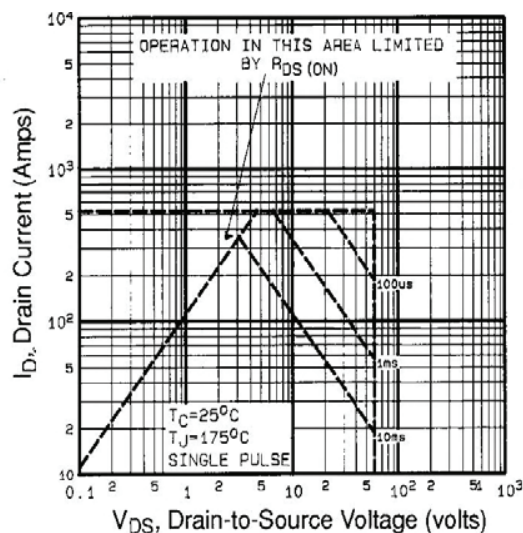


Fig. 8 - Maximum Safe Operating Area

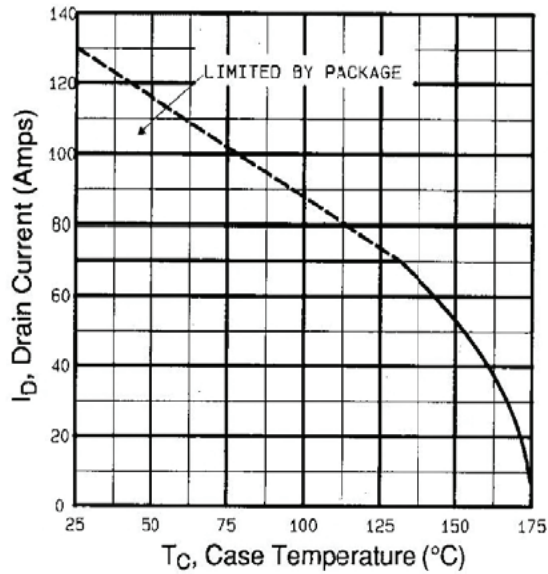


Fig. 9 - Maximum Drain Current vs. Case Temperature

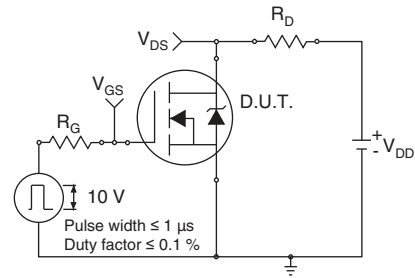


Fig. 10a - Switching Time Test Circuit

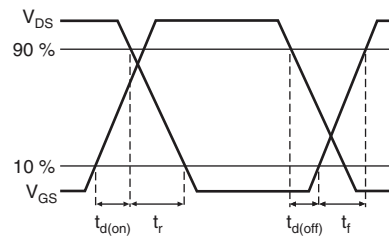


Fig. 10b - Switching Time Waveforms

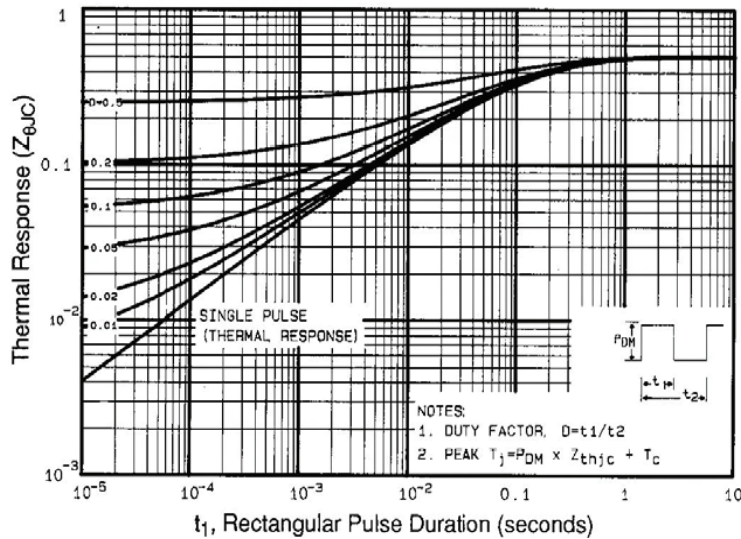


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

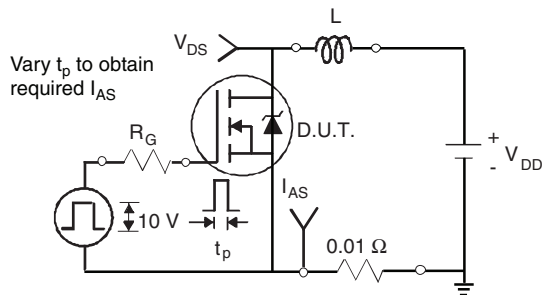


Fig. 12a - Unclamped Inductive Test Circuit

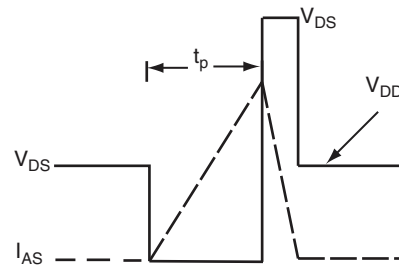


Fig. 12b - Unclamped Inductive Waveforms

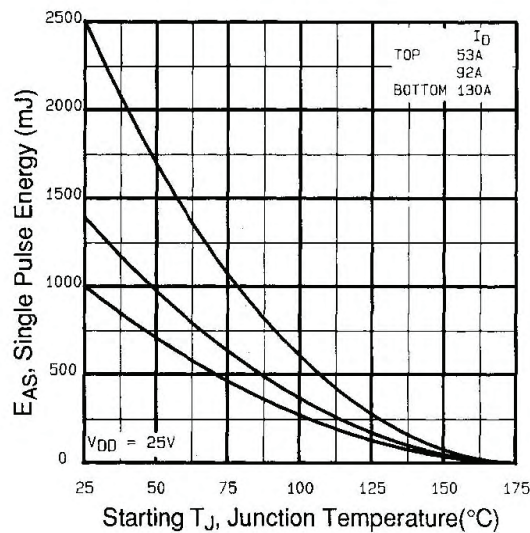


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

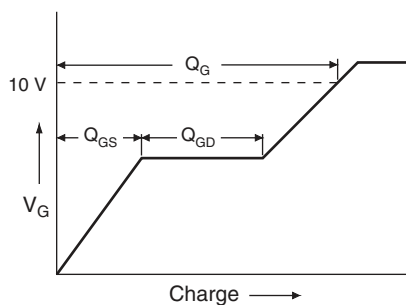


Fig. 13a - Basic Gate Charge Waveform

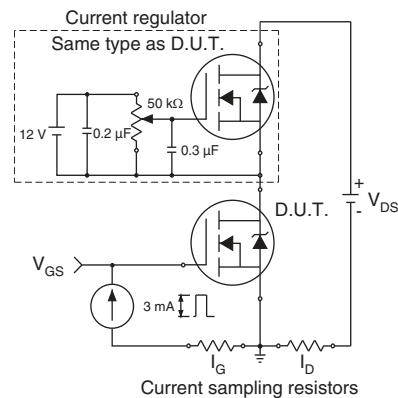
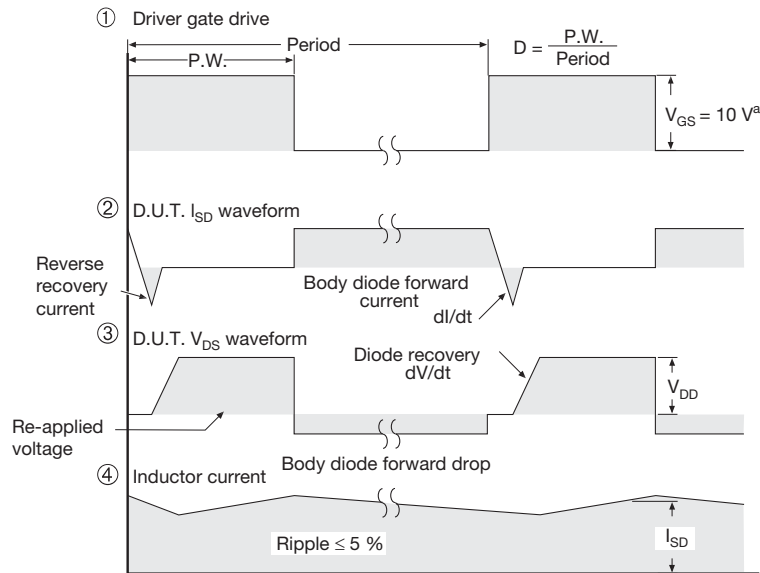
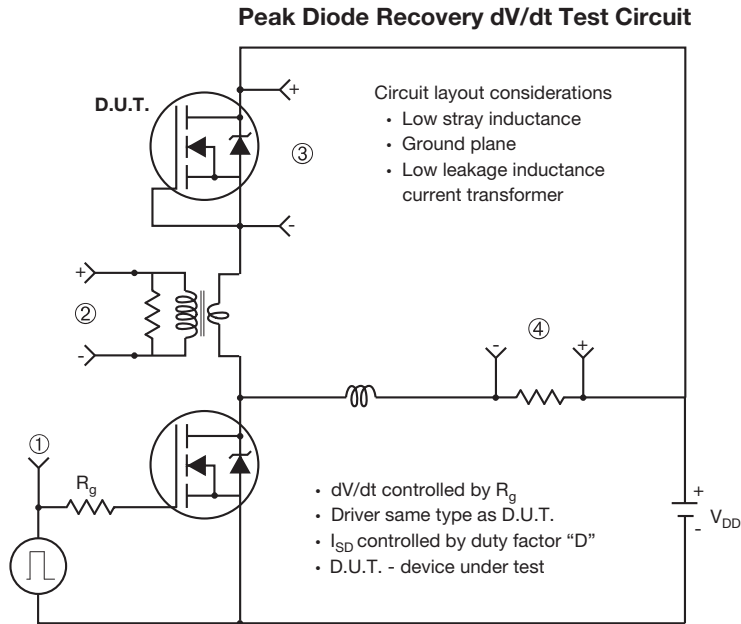


Fig. 13b - Gate Charge Test Circuit





**Note**

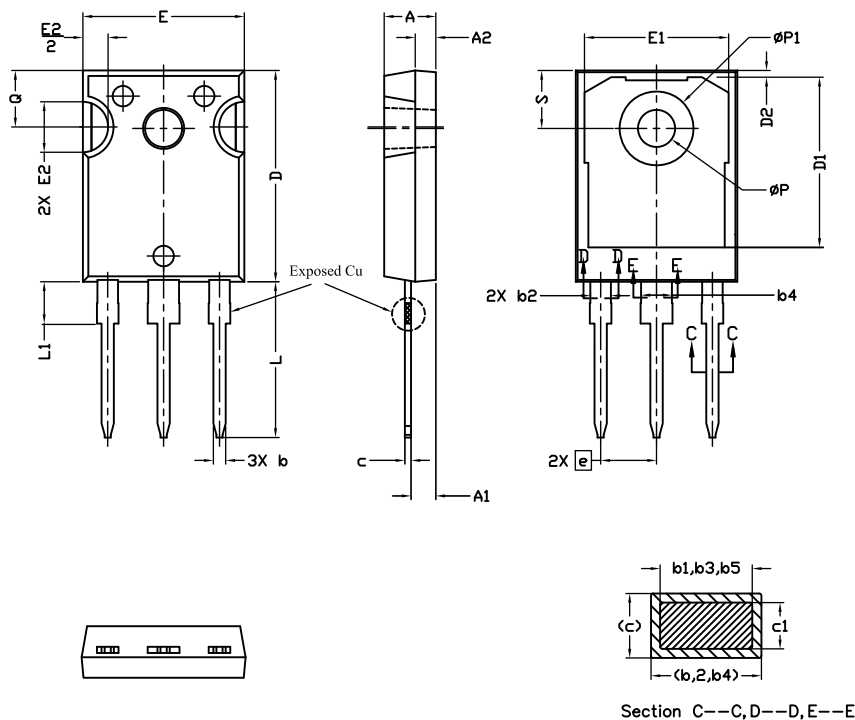
a.  $V_{GS} = 5\text{ V}$  for logic level devices

**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

| 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     |

| 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  |       |

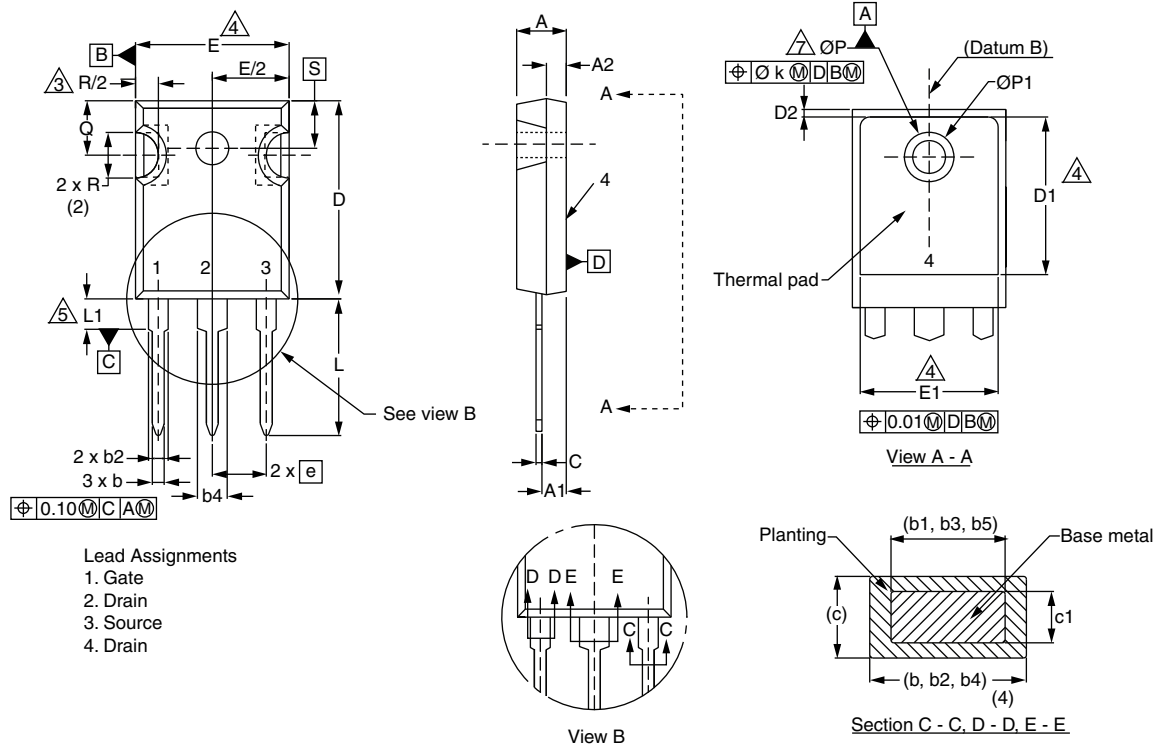
**Notes**

- (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    |       |       |

ECN: E19-0614-Rev. E, 08-Jan-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")
- (7) Outline conforms to JEDEC outline TO-247 with exception of dimension c



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