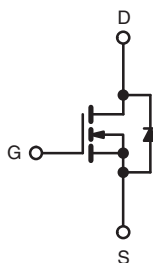
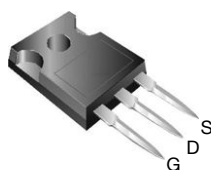


Power MOSFET

PRODUCT SUMMARY

| | | |
|---------------------------|------------------------|-------|
| V_{DS} (V) | 500 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 10\text{ V}$ | 0.135 |
| Q_g (Max.) (nC) | 190 | |
| Q_{gs} (nC) | 59 | |
| Q_{gd} (nC) | 84 | |
| 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
- Low $R_{DS(on)}$
- Compliant to RoHS Directive 2002/95/EC



RoHS*
COMPLIANT

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switching and High Frequency Circuits

ORDERING INFORMATION

| | |
|----------------|----------------|
| Package | TO-247AC |
| Lead (Pb)-free | IRFP32N50KPbF |
| | SiHFP32N50K-E3 |
| SnPb | IRFP32N50K |
| | SiHFP32N50K |

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted)

| PARAMETER | SYMBOL | LIMIT | UNIT |
|--|----------------------------------|-----------------------------------|---------------------|
| Drain-Source Voltage | V_{DS} | 500 | V |
| Gate-Source Voltage | V_{GS} | ± 30 | |
| Continuous Drain Current | V_{GS} at 10 V | $T_C = 25\text{ }^\circ\text{C}$ | A |
| | | $T_C = 100\text{ }^\circ\text{C}$ | |
| Pulsed Drain Current ^a | I_{DM} | 130 | |
| Linear Derating Factor | | 3.7 | W/ $^\circ\text{C}$ |
| Single Pulse Avalanche Energy ^b | E_{AS} | 450 | mJ |
| Repetitive Avalanche Current ^a | I_{AR} | 32 | A |
| Repetitive Avalanche Energy ^a | E_{AR} | 46 | mJ |
| Maximum Power Dissipation | $T_C = 25\text{ }^\circ\text{C}$ | | W |
| Peak Diode Recovery dV/dt ^c | dV/dt | 13 | 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 | |
| Mounting Torque | 6-32 or M3 screw | 10 | lbf · in |
| | | 1.1 | N · m |

Notes


- Repetitive rating; pulse width limited by maximum junction temperature.
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 0.87\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 32\text{ A}$.
- $I_{SD} \leq 32\text{ A}$, $dI/dt \leq 197\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$.
- 1.6 mm from case.

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

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} | - | 0.26 | |

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 V, I _D = 250 μA | | 500 | - | - | V |
| V _{DS} Temperature Coefficient | ΔV _{DS} /T _J | Reference to 25 °C, I _D = 1 mA | | - | 0.54 | - | V/°C |
| Gate-Source Threshold Voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 250 μA | | 3.0 | - | 5.0 | V |
| Gate-Source Leakage | I _{GSS} | V _{GS} = ± 30 V | | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} = 500 V, V _{GS} = 0 V | | - | - | 50 | μA |
| | | V _{DS} = 400 V, V _{GS} = 0 V, T _J = 150 °C | | - | - | 250 | |
| Drain-Source On-State Resistance | R _{DS(on)} | V _{GS} = 10 V | I _D = 32 A ^b | - | 0.135 | 0.16 | Ω |
| Forward Transconductance | g _{fs} | V _{DS} = 50 V, I _D = 32 A | | 14 | - | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5 | | - | 5280 | - | pF |
| Output Capacitance | C _{oss} | | | - | 550 | - | |
| Reverse Transfer Capacitance | C _{rss} | | | - | 45 | - | |
| Output Capacitance | C _{oss} | V _{GS} = 0 V | V _{DS} = 1.0 V, f = 1.0 MHz | - | 5630 | - | |
| | | | V _{DS} = 400 V, f = 1.0 MHz | - | 155 | - | |
| Effective Output Capacitance | C _{oss eff.} | V _{DS} = 0 V to 400 V ^c | | - | 265 | - | |
| Total Gate Charge | Q _g | V _{GS} = 10 V | I _D = 32 A, V _{DS} = 400 V ^b | - | - | 190 | nC |
| Gate-Source Charge | Q _{gs} | | | - | - | 59 | |
| Gate-Drain Charge | Q _{gd} | | | - | - | 84 | |
| Turn-On Delay Time | t _{d(on)} | V _{DD} = 250 V, I _D = 32 A, R _g = 4.3 Ω, V _{GS} = 10 V ^b | | - | 28 | - | ns |
| Rise Time | t _r | | | - | 120 | - | |
| Turn-Off Delay Time | t _{d(off)} | | | - | 48 | - | |
| Fall Time | t _f | | | - | 54 | - | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous Source-Drain Diode Current | I _S | MOSFET symbol showing the integral reverse p - n junction diode  | | - | - | 32 | A |
| Pulsed Diode Forward Current ^a | I _{SM} | | | - | - | 130 | |
| Body Diode Voltage | V _{SD} | T _J = 25 °C, I _S = 32 A, V _{GS} = 0 V ^b | | - | - | 1.5 | V |
| Body Diode Reverse Recovery Time | t _{rr} | T _J = 25 °C, I _F = 32 A, dI/dt = 100 A/μs ^b | | - | 530 | 800 | ns |
| Body Diode Reverse Recovery Charge | Q _{rr} | | | - | 9.0 | 13.5 | μC |
| Body Diode Reverse Recovery Current | I _{RRM} | | | - | 30 | - | A |
| 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.
- Pulse width $\leq 400\text{ }\mu\text{s}$; 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} .

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

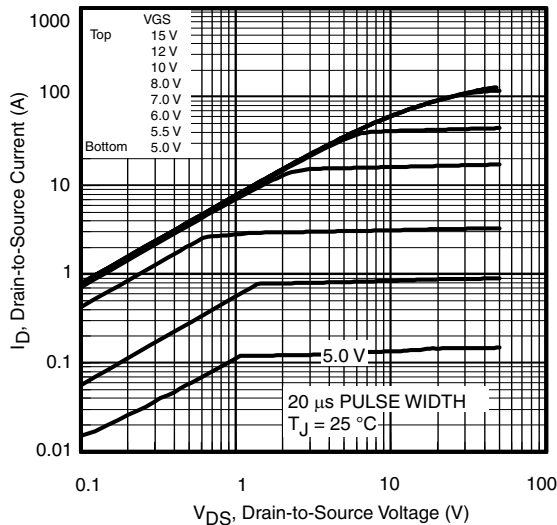


Fig. 1 - Typical Output Characteristics

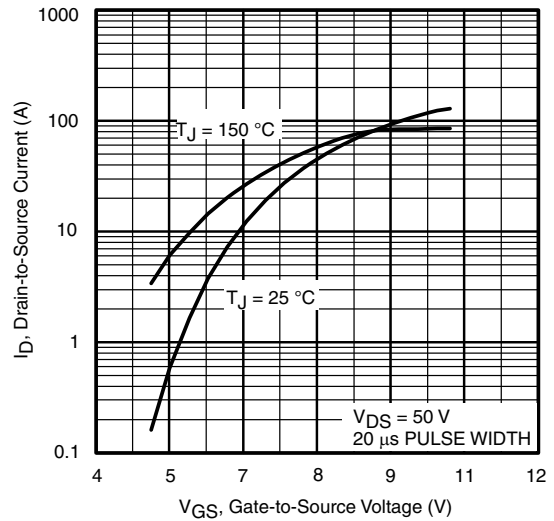


Fig. 3 - Typical Transfer Characteristics

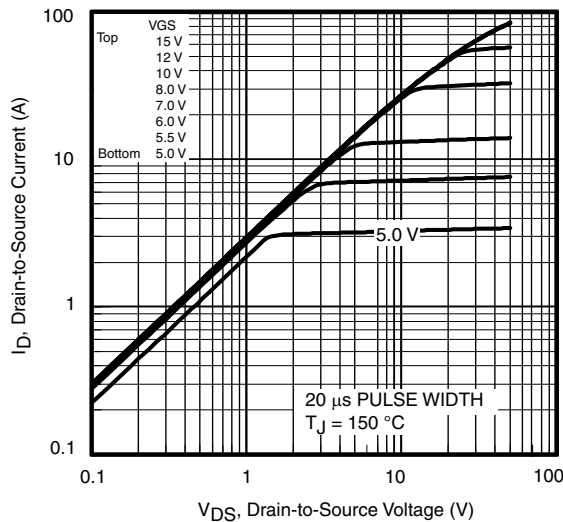


Fig. 2 - Typical Output Characteristics

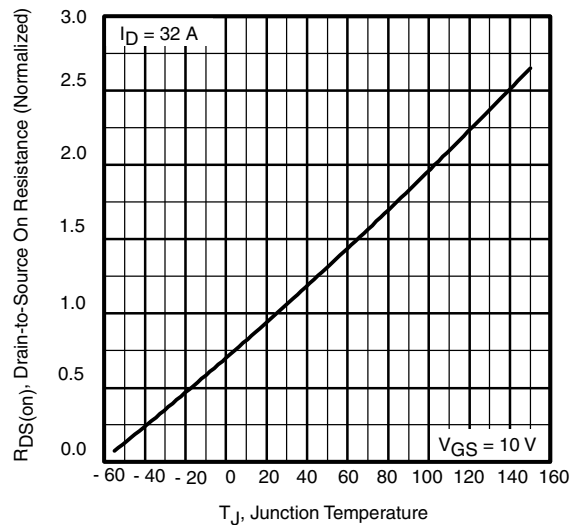


Fig. 4 - Normalized On-Resistance vs. Temperature

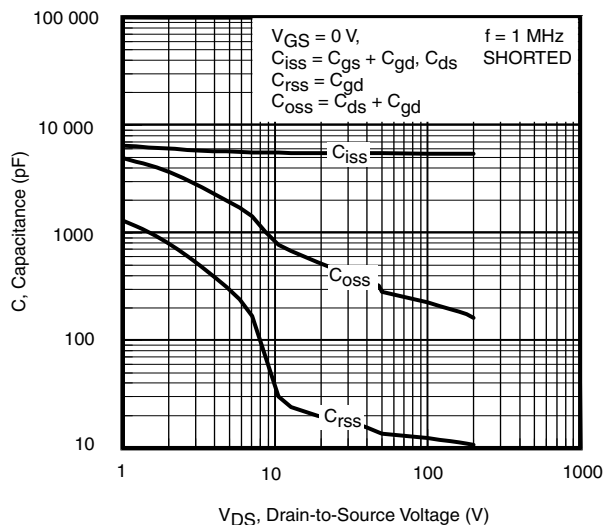


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

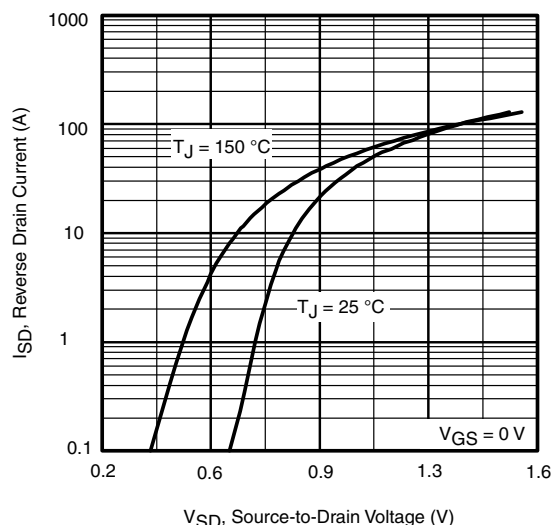


Fig. 7 - Typical Source-Drain Diode Forward Voltage

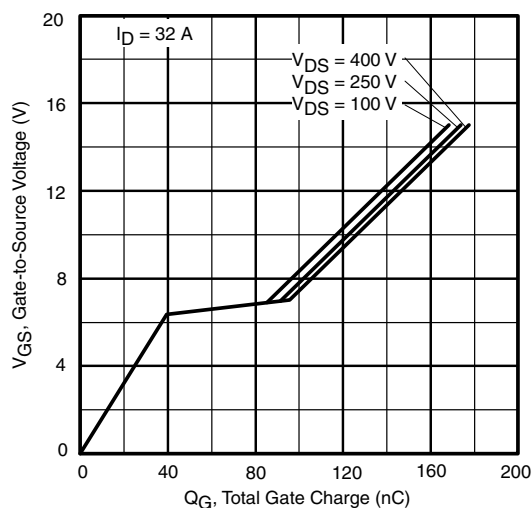


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

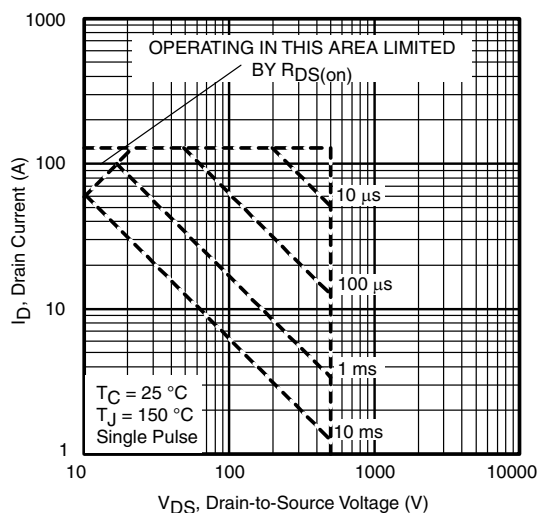


Fig. 8 - Maximum Safe Operating Area

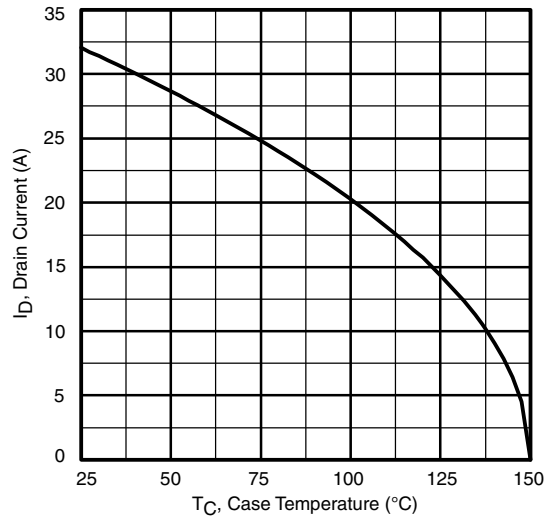


Fig. 9 - Maximum Drain Current vs. Case Temperature

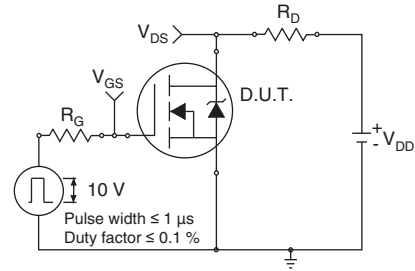


Fig. 10a - Switching Time Test Circuit



Fig. 10b - Switching Time Waveforms

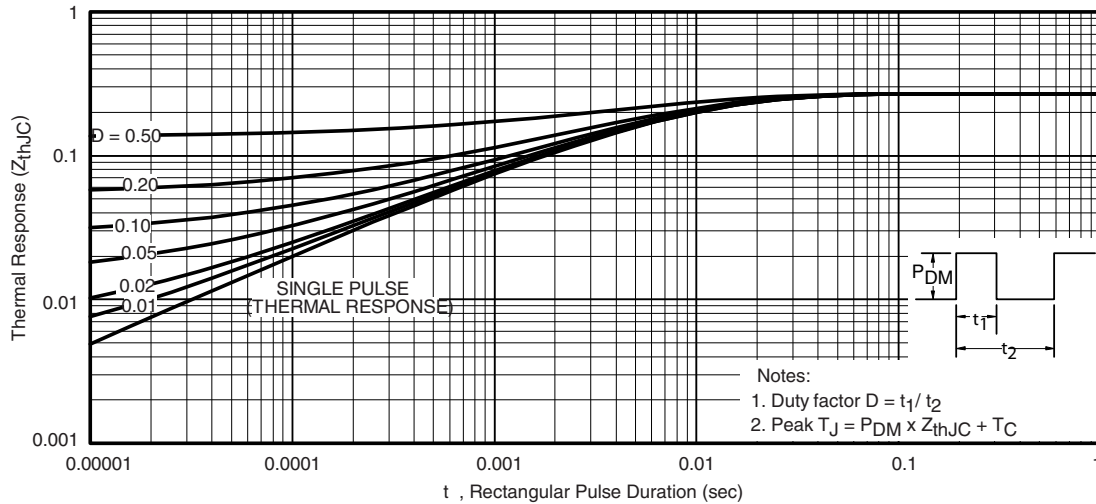


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

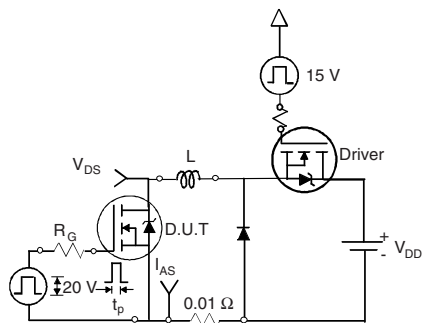


Fig. 12a - Unclamped Inductive Test Circuit

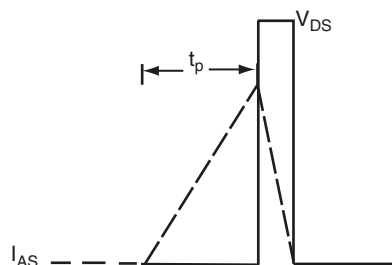


Fig. 12b - Unclamped Inductive Waveforms

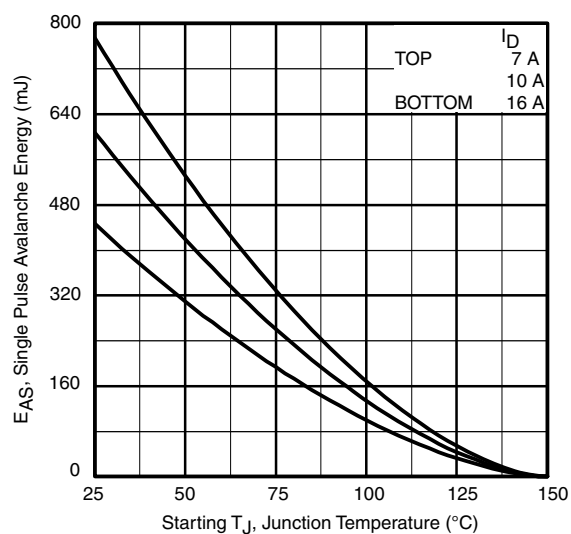


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

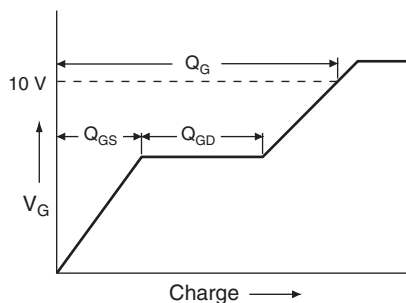


Fig. 13a - Basic Gate Charge Waveform

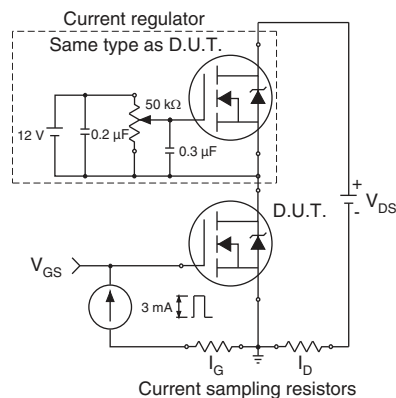
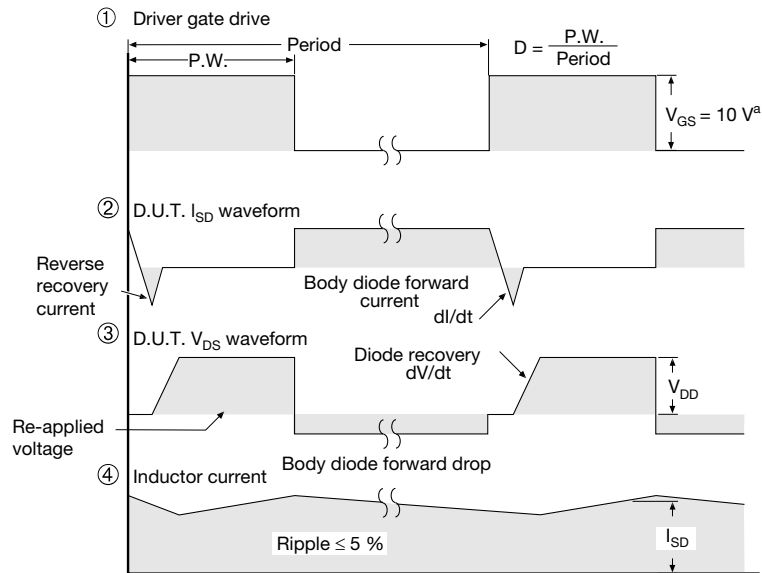
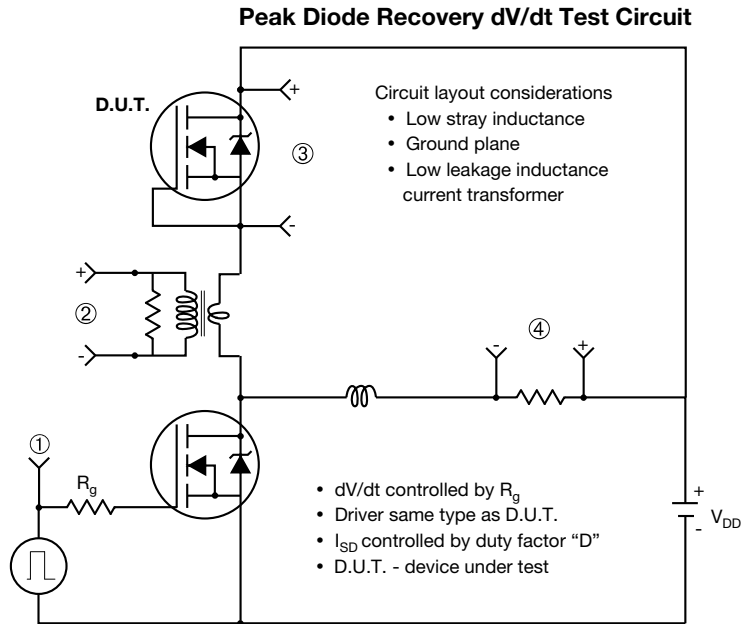


Fig. 13b - Gate Charge Test Circuit



Note

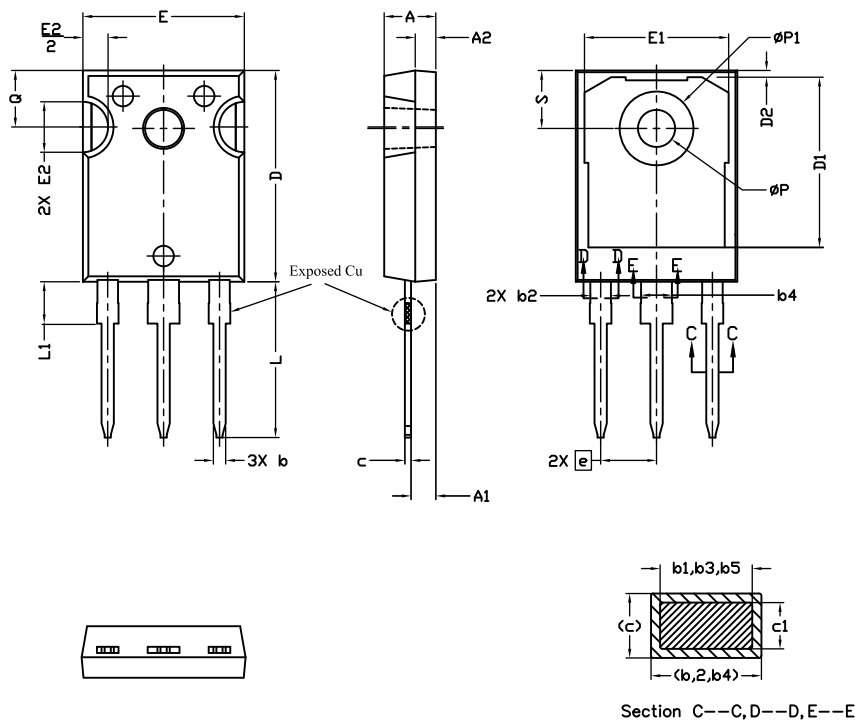
a. $V_{GS} = 5 V$ for logic level devices

Fig. 14 - For N-Channel

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TO-247AC (High Voltage)

VERSION 1: FACILITY CODE = 9


| 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 |

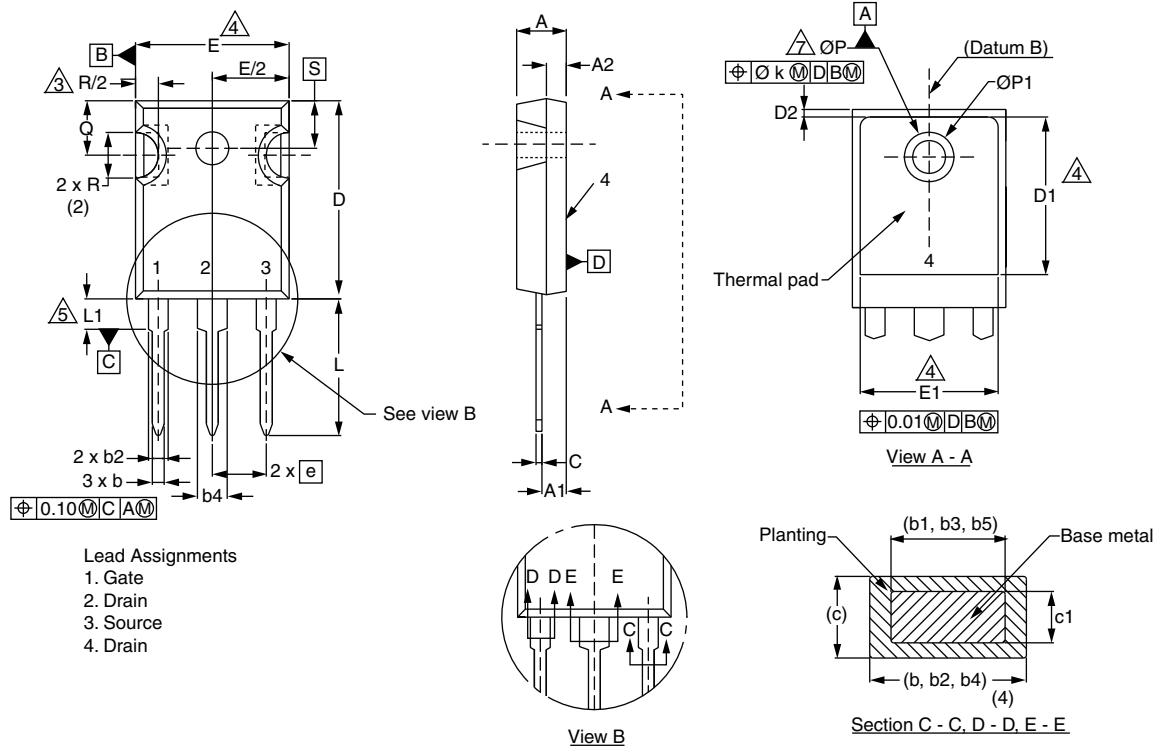
| MILLIMETERS | | | |
|-------------|-----------|-------|-------|
| DIM. | MIN. | MAX. | NOTES |
| D1 | 16.25 | 16.85 | 5 |
| D2 | 0.56 | 0.76 | |
| E | 15.50 | 15.87 | 4 |
| E1 | 13.46 | 14.16 | 5 |
| E2 | 4.52 | 5.49 | 3 |
| e | 5.44 BSC | | |
| L | 14.90 | 15.40 | |
| L1 | 3.96 | 4.16 | 6 |
| Ø P | 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

- Dimensioning and tolerancing per ASME Y14.5M-1994
- Contour of slot optional
- 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
- Thermal pad contour optional with dimensions D1 and E1
- Lead finish uncontrolled in L1
- 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")
- Outline conforms to JEDEC outline TO-247 with exception of dimension c



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