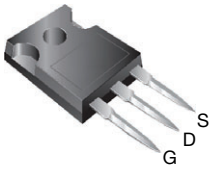
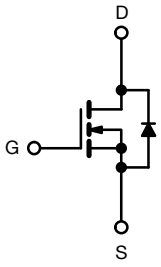
# Power MOSFET

TO-247AC




N-Channel MOSFET

## FEATURES

- Low figure-of-merit $R_{on}$ x $Q_g$
- 100 % avalanche tested
- High peak current capability
- dv/dt ruggedness
- Improved $T_{rr}/Q_{rr}$
- Improved gate charge
- High power dissipations capability
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

HALOGEN FREE Available

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) at $T_J$ max. | 560 | |
| $R_{DS(on)}$ (Ω) | $V_{GS}$ = 10 V | 0.270 |
| $Q_g$ max. (nC) | 76 | |
| $Q_{gs}$ (nC) | 21 | |
| $Q_{gd}$ (nC) | 34 | |
| Configuration | Single | |

| ORDERING INFORMATION | |
|---|---|
| Package | TO-247AC |
| Lead (Pb)-free | SiHG20N50C-E3 |
| Lead (Pb)-free and halogen-free | SiHG20N50C-GE3 |

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

| PARAMETER | | | SYMBOL | LIMIT | UNIT |
|---|---|---|---|---|---|
| Drain-source voltage | | | $V_{DS}$ | 500 | V |
| Gate-source voltage | | | $V_{GS}$ | ± 30 | |
| Continuous drain current ($T_J$ = 150 °C) [a] | $V_{GS}$ at 10 V | $T_C$ = 25 °C | $I_D$ | 20 | A |
| | | $T_C$ = 100 °C | | 11 | |
| Pulsed drain current [b] | | | $I_{DM}$ | 80 | |
| Linear derating factor | | | | 1.8 | W/°C |
| Single pulse avalanche energy [c] | | | $E_{AS}$ | 361 | mJ |
| Maximum power dissipation | | | $P_D$ | 250 | W |
| Reverse diode dv/dt [d] | | | dv/dt | 5 | V/ns |
| Operating junction and storage temperature range | | | $T_J$, $T_{stg}$ | -55 to +150 | °C |
| Soldering recommendations (peak temperature) [d] | For 10 s | | | 300 | |

**Notes**

a. Limited by maximum junction temperature
b. Repetitive rating; pulse width limited by maximum junction temperature
c. $V_{DD}$ = 50 V, starting $T_J$ = 25 °C, L = 2.5 mH, $R_g$ = 25 Ω, $I_{AS}$ = 17 A
d. $I_{SD} \leq$ 18 A, di/dt ≤ 380 A/µs, $V_{DD} \leq V_{DS}$, $T_J \leq$ 150 °C
e. 1.6 mm from case

| THERMAL RESISTANCE RATINGS | | | | |
|---|---|---|---|---|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum junction-to-ambient | $R_{thJA}$ | - | 40 | °C/W |
| Maximum junction-to-case (drain) | $R_{thJC}$ | - | 0.5 | |

| **SPECIFICATIONS** ($T_J$ = 25 °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 | $\Delta V_{DS}/T_J$ | Reference to 25 °C, $I_D$ = 1 mA | - | 0.7 | - | V/°C |
| Gate-source threshold voltage (N) | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 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 | - | - | 25 | µA |
| | | $V_{DS}$ = 400 V, $V_{GS}$ = 0 V, $T_J$ = 125 °C | - | - | 250 | |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 10 A | - | 0.225 | 0.270 | Ω |
| Forward transconductance | $g_{fs}$ | $V_{DS}$ = 50 V, $I_D$ = 10 A | - | 6.4 | - | S |
| **Dynamic** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 25 V, f = 1 MHz | - | 2451 | 2942 | pF |
| Output capacitance | $C_{oss}$ | | - | 300 | 360 | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 26 | 32 | |
| Total gate charge | $Q_g$ | $V_{GS}$ = 10 V, $I_D$ = 18 A, $V_{DS}$ = 400 V | - | 65 | 76 | nC |
| Gate-source charge | $Q_{gs}$ | | - | 21 | - | |
| Gate-drain charge | $Q_{gd}$ | | - | 29 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$ = 250 V, $I_D$ = 18 A, $R_g$ = 9.1 Ω | - | 80 | - | ns |
| Rise time | $t_r$ | | - | 27 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 32 | - | |
| Fall time | $t_f$ | | - | 44 | - | |
| Gate input resistance | $R_g$ | f = 1 MHz, open drain | - | 1.1 | - | Ω |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous source-drain diode current | $I_S$ | MOSFET symbol showing the integral reverse p - n junction diode  | - | - | 20 | A |
| Pulsed diode forward current | $I_{SM}$ | | - | - | 80 | |
| Diode forward voltage | $V_{SD}$ | $T_J$ = 25 °C, $I_S$ = 18 A, $V_{GS}$ = 0 V | - | - | 1.5 | V |
| Reverse recovery time | $t_{rr}$ | $T_J$ = 25 °C, $I_F$ = $I_S$, di/dt = 100 A/µs, $V_R$ = 35 V | - | 503 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 6.7 | - | µC |
| Reverse recovery current | $I_{RRM}$ | | - | 30 | - | A |

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

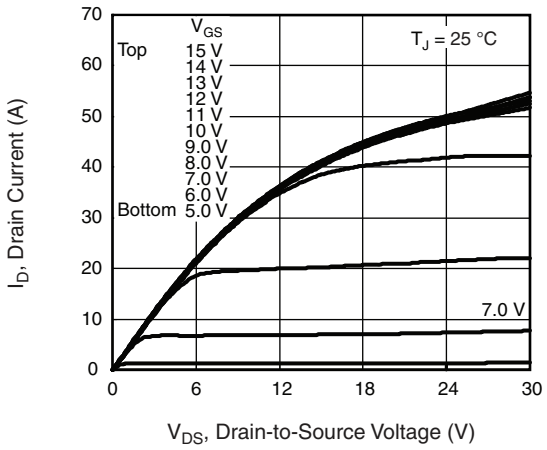



**Fig. 1 - Fig. 1 - Typical Output Characteristics, $T_C$ = 25 °C**

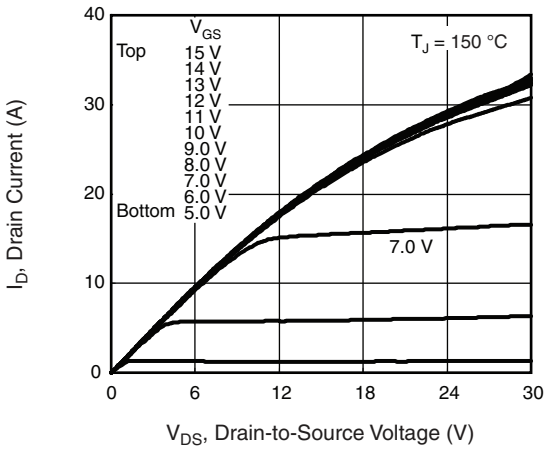



**Fig. 2 - Typical Output Characteristics, $T_C$ = 150 °C**

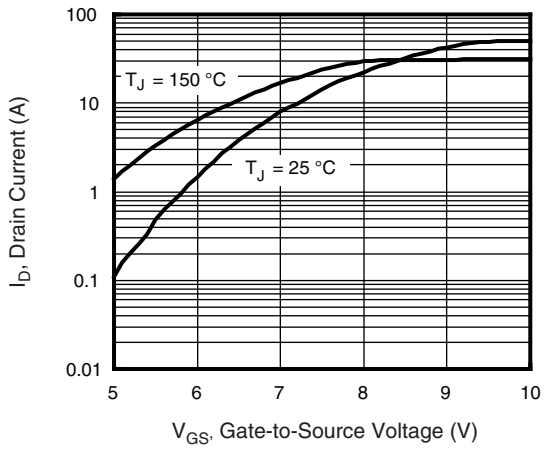



**Fig. 3 - Typical Transfer Characteristics**

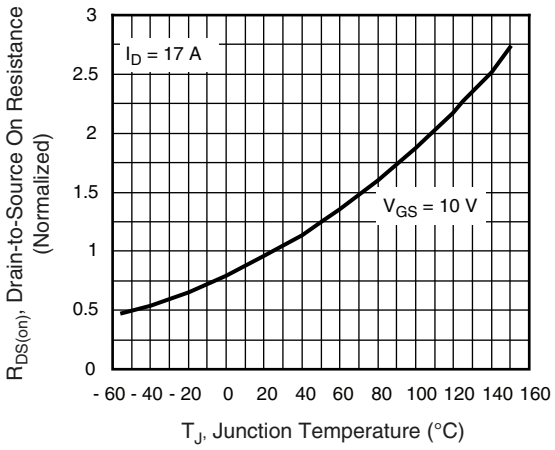



**Fig. 4 - Normalized On-Resistance vs. Temperature**

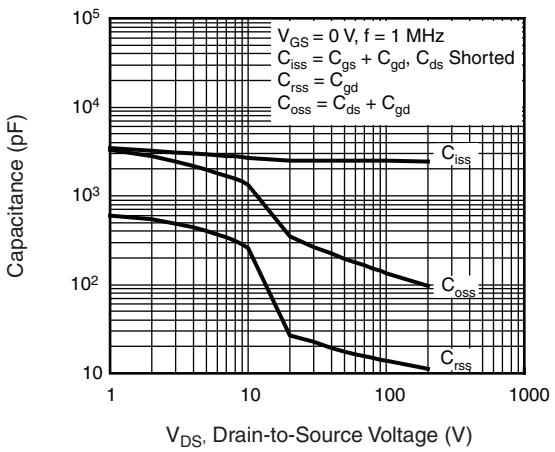



**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**

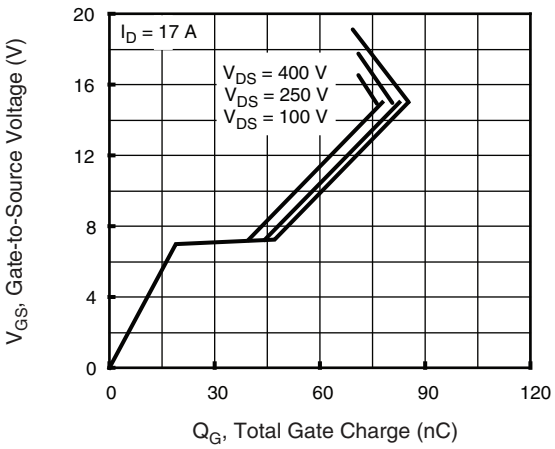



**Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage**

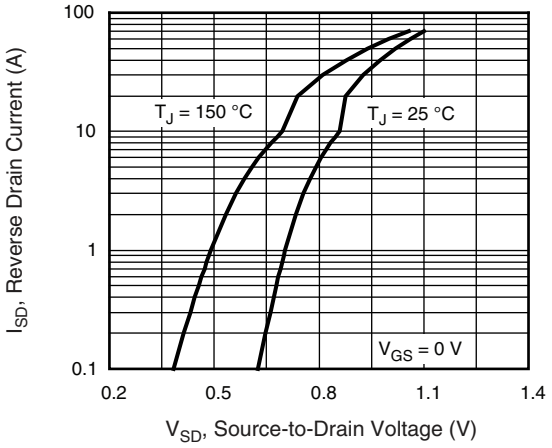



**Fig. 7 - Typical Source-Drain Diode Forward Voltage**

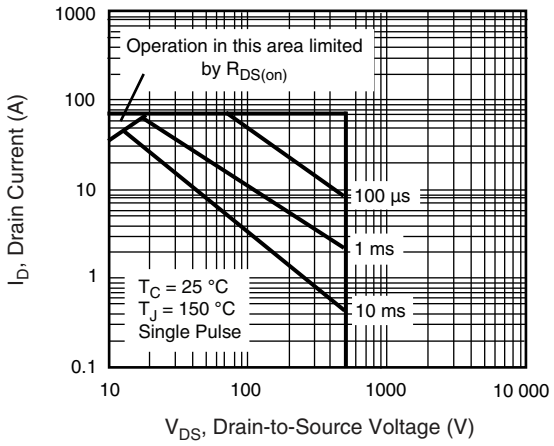



**Fig. 8 - Maximum Safe Operating Area**

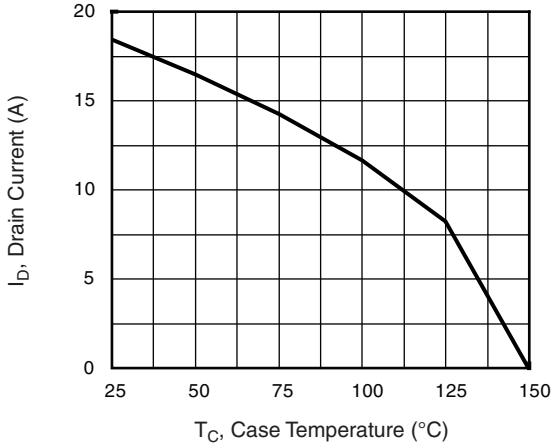



**Fig. 9 - Maximum Drain Current vs. Case Temperature**

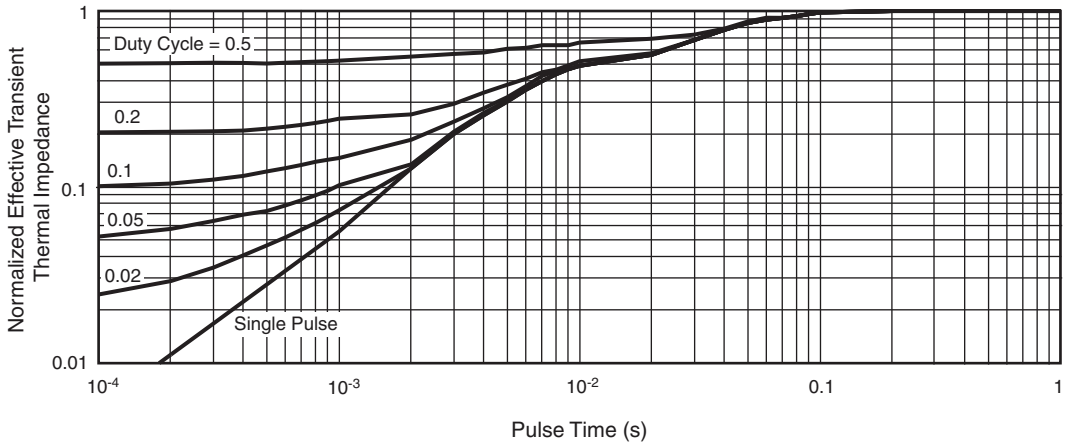



**Fig. 10 - Normalized Thermal Transient Impedance, Junction-to-Case (TO-247)**

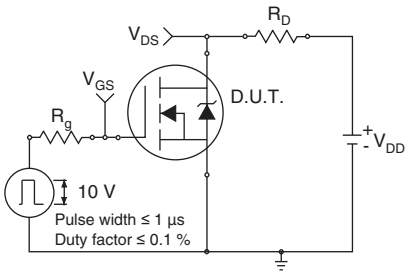



**Fig. 11 - Switching Time Test Circuit**

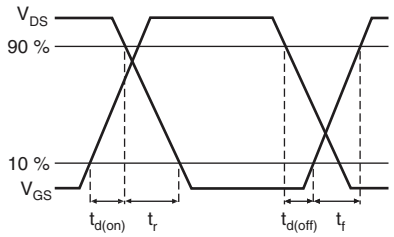



**Fig. 12 - Switching Time Waveforms**

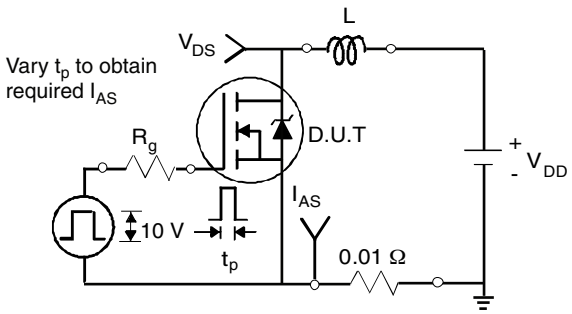



**Fig. 13 - Unclamped Inductive Test Circuit**

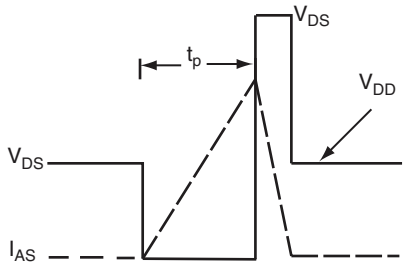



**Fig. 14 - Unclamped Inductive Waveforms**

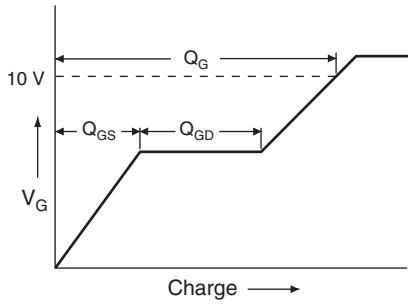



**Fig. 15 - Basic Gate Charge Waveform**

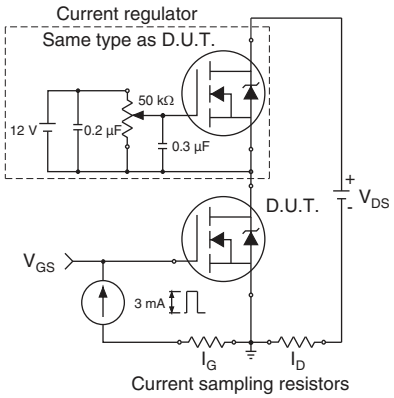
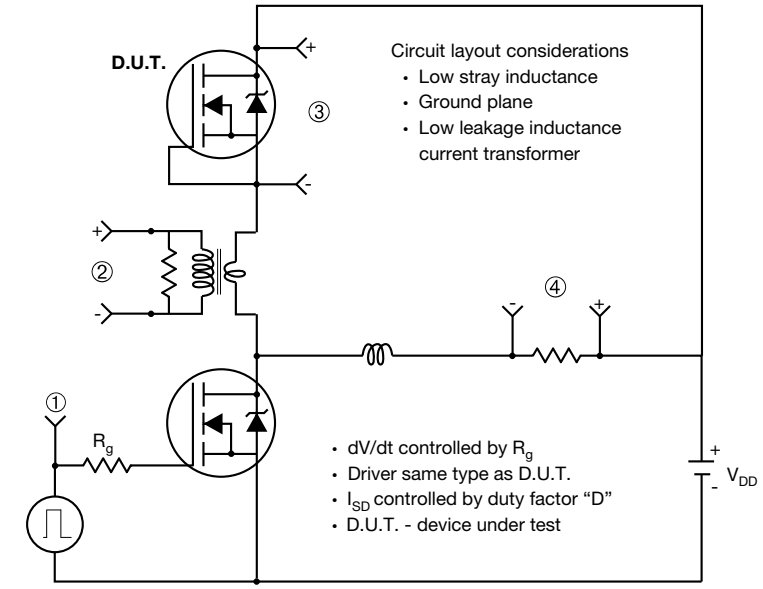
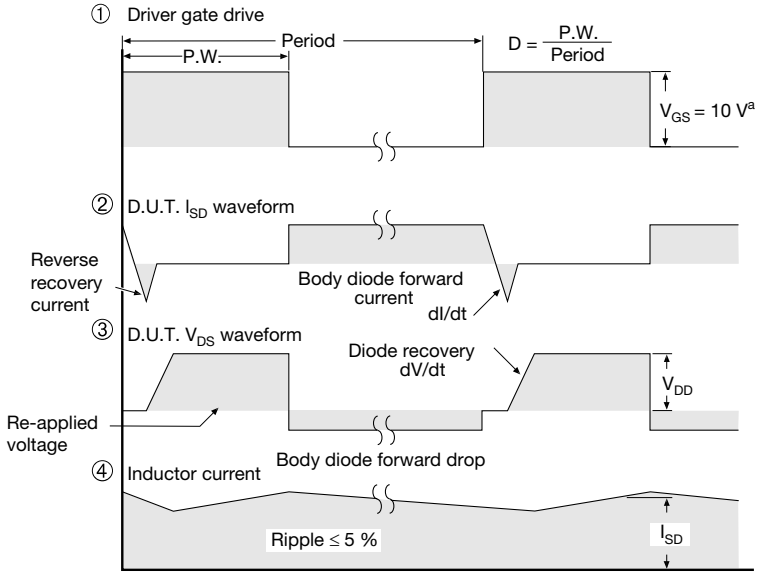



**Fig. 16 - Gate Charge Test Circuit**

**Peak Diode Recovery dV/dt Test Circuit**




**Note**

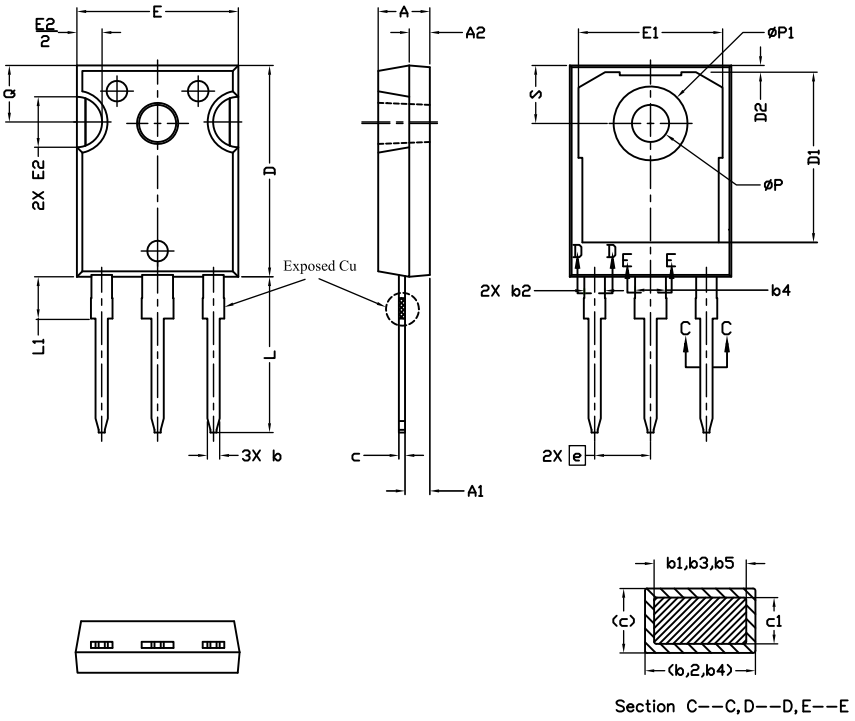
a. $V_{GS}$ = 5 V for logic level devices

**Fig. 17 - 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?91382.*

# TO-247AC (High Voltage)

## VERSION 1: FACILITY CODE = 9









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

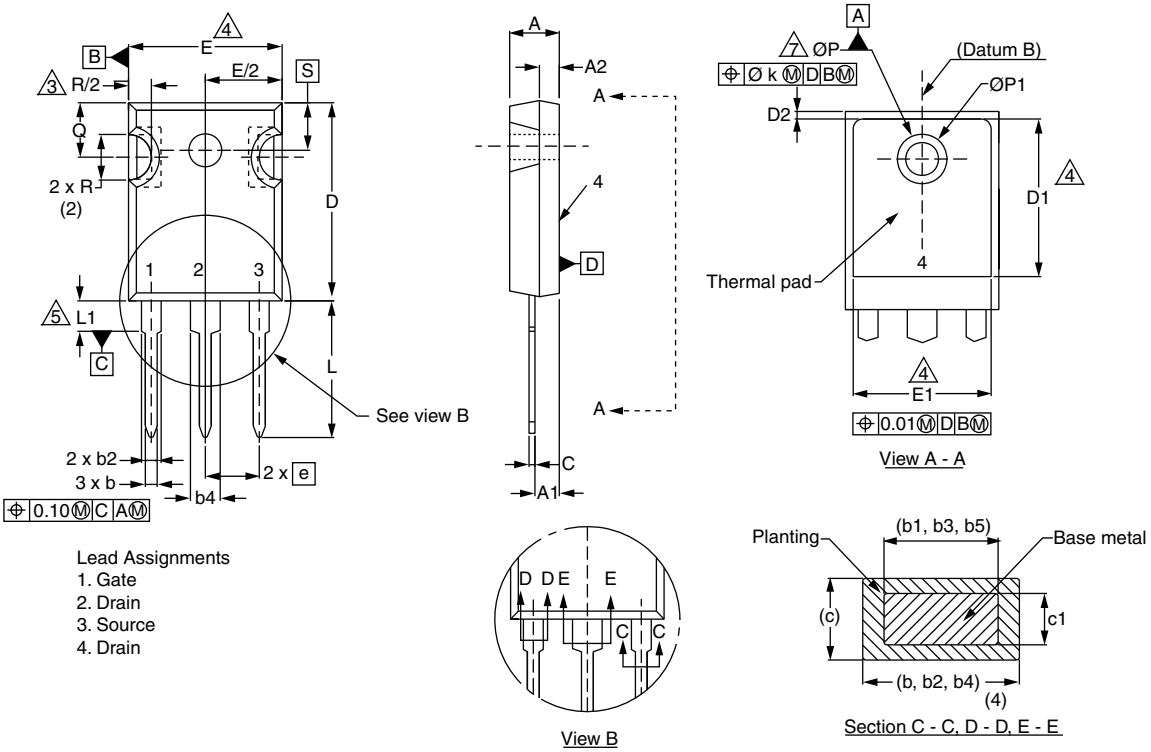
| | MILLIMETERS | | |
|---|---|---|---|
| DIM. | MIN. | MAX. | NOTES |
| A | 4.83 | 5.21 | |
| A1 | 2.29 | 2.55 | |
| A2 | 1.50 | 2.49 | |
| b | 1.12 | 1.33 | |
| b1 | 1.12 | 1.28 | |
| b2 | 1.91 | 2.39 | 6 |
| b3 | 1.91 | 2.34 | |
| b4 | 2.87 | 3.22 | 6, 8 |
| b5 | 2.87 | 3.18 | |
| c | 0.55 | 0.69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




Lead Assignments
1. Gate
2. Drain
3. Source
4. Drain

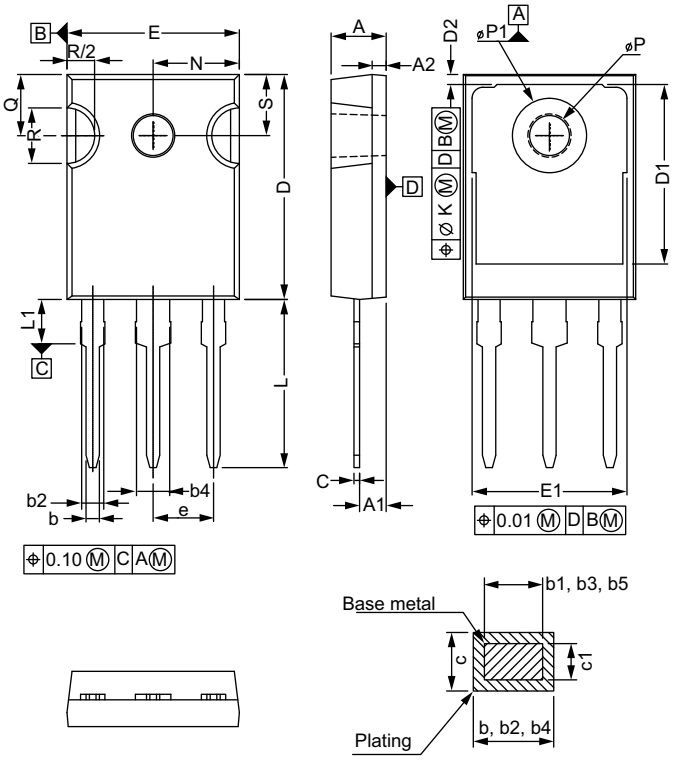
| | MILLIMETERS | | |
|---|---|---|---|
| DIM. | MIN. | MAX. | NOTES |
| A | 4.58 | 5.31 | |
| A1 | 2.21 | 2.59 | |
| A2 | 1.17 | 2.49 | |
| b | 0.99 | 1.40 | |
| b1 | 0.99 | 1.35 | |
| b2 | 1.53 | 2.39 | |
| b3 | 1.65 | 2.37 | |
| b4 | 2.42 | 3.43 | |
| b5 | 2.59 | 3.38 | |
| c | 0.38 | 0.86 | |
| c1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

| | 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

## 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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