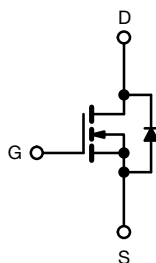
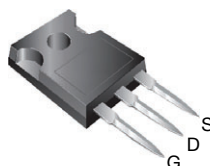


Power MOSFET

TO-247AC

N-Channel MOSFET

FEATURES

- Dynamic dV/dt rating
- Repetitive avalanche rated
- Isolated central mounting hole
- Fast switching
- Simple drive requirements
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS*
Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

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.

PRODUCT SUMMARY

| | | |
|---------------------------|------------------------|------|
| V_{DS} (V) | 250 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 10\text{ V}$ | 0.28 |
| Q_g (max.) (nC) | 63 | |
| Q_{gs} (nC) | 12 | |
| Q_{gd} (nC) | 39 | |
| Configuration | Single | |

ORDERING INFORMATION

| | |
|----------------|------------|
| Package | TO-247AC |
| Lead (Pb)-free | IRFP244PbF |

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

| PARAMETER | | | SYMBOL | LIMIT | UNIT |
|---|------------------------------------|-------------------------------------|----------------|-------------|-----------------------|
| Drain-source voltage | | | V_{DS} | 250 | V |
| Gate-source voltage | | | V_{GS} | ± 20 | |
| Continuous drain current | V_{GS} at 10 V | $T_C = 25\text{ }^{\circ}\text{C}$ | I_D | 15 | A |
| | | $T_C = 100\text{ }^{\circ}\text{C}$ | | 9.7 | |
| Pulsed drain current ^a | | | I_{DM} | 60 | |
| Linear derating factor | | | | 1.2 | W/ $^{\circ}\text{C}$ |
| Single pulse avalanche energy ^b | | | E_{AS} | 550 | mJ |
| Repetitive avalanche current ^a | | | I_{AR} | 15 | A |
| Repetitive avalanche energy ^a | | | E_{AR} | 15 | mJ |
| Maximum power dissipation | $T_C = 25\text{ }^{\circ}\text{C}$ | | P_D | 150 | W |
| Peak diode recovery dV/dt ^c | | | dV/dt | 4.8 | V/ns |
| Operating junction and storage temperature range | | | T_J, T_{stg} | -55 to +150 | $^{\circ}\text{C}$ |
| Soldering recommendations (peak temperature) ^d | | for 10 s | | 300 | |
| Mounting torque | 6-32 or M3 screw | | | 10 | lbf · in |
| | | | | 1.1 | N · m |

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)

b. $V_{DD} = 50\text{ V}$, starting $T_J = 25\text{ }^\circ\text{C}$, $L = 3.9\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 15\text{ A}$ (see fig. 12)

c. $I_{SD} \leq 15\text{ A}$, $dI/dt \leq 150\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$

d. 1.6 mm from case

THERMAL RESISTANCE RATINGS

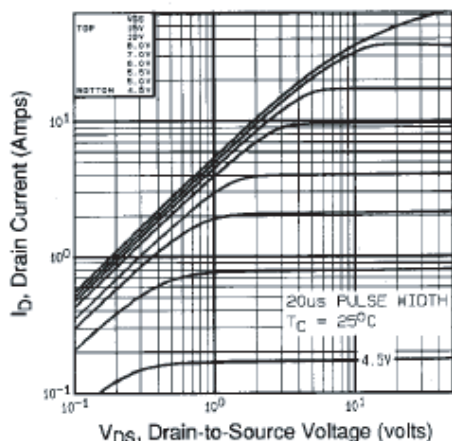
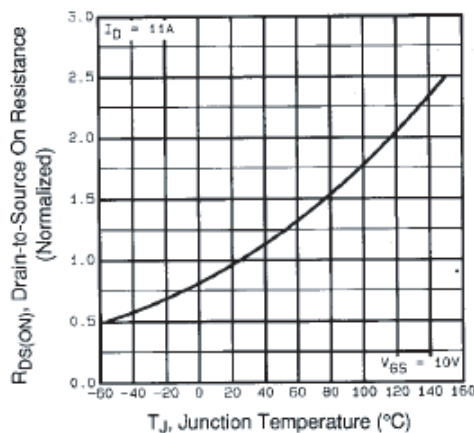
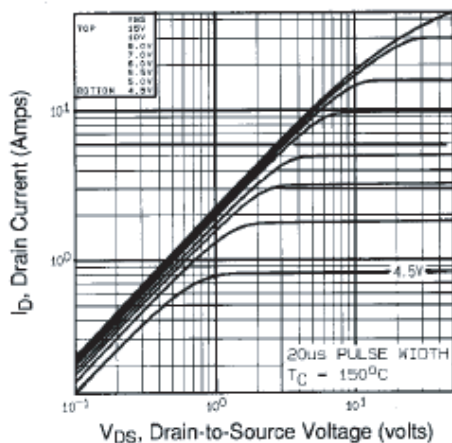
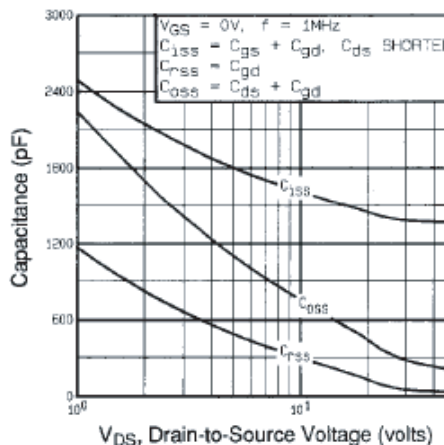
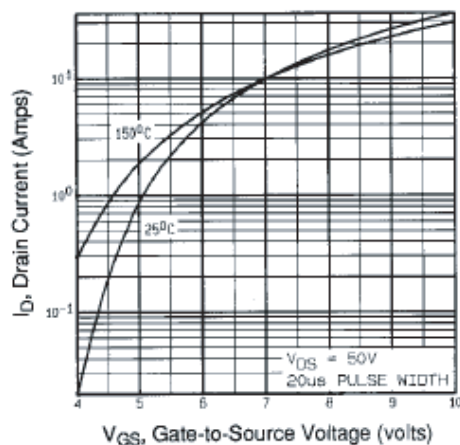
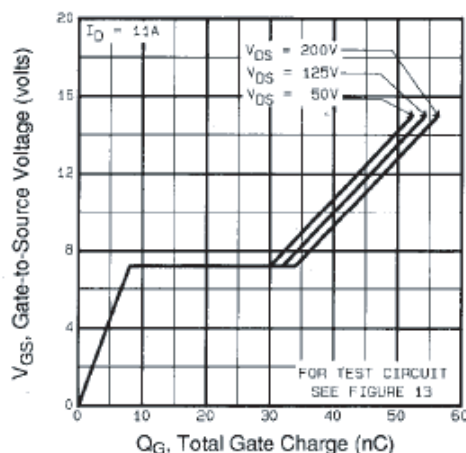
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
|-------------------------------------|------------|------|------|------|
| Maximum junction-to-ambient | R_{thJA} | - | 40 | °C/W |
| Case-to-sink, flat, greased surface | R_{thCS} | 0.24 | - | |
| Maximum junction-to-case (drain) | R_{thJC} | - | 0.83 | |

SPECIFICATIONS ($T_J = 25\text{ °C}$, 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 | | 250 | - | - | V |
| V _{DS} temperature coefficient | ΔV _{DS} /T _J | Reference to 25 °C, I _D = 1 mA | | - | 0.37 | - | 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} = ± 20 V | | - | - | ± 100 | nA |
| Zero gate voltage drain current | I _{DSS} | V _{DS} = 250 V, V _{GS} = 0 V | | - | - | 25 | μA |
| | | V _{DS} = 200 V, V _{GS} = 0 V, T _J = 125 °C | | - | - | 250 | |
| Drain-source on-state resistance | R _{DS(on)} | V _{GS} = 10 V | I _D = 9.0 A ^b | - | - | 0.28 | Ω |
| Forward transconductance | g _{fs} | V _{DS} = 50 V, I _D = 9.0 A ^b | | 6.7 | - | - | S |
| Dynamic | | | | | | | |
| Input capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5 | | - | 1400 | - | pF |
| Output capacitance | C _{oss} | | | - | 320 | - | |
| Reverse transfer capacitance | C _{rss} | | | - | 73 | - | |
| Total gate charge | Q _g | V _{GS} = 10 V | I _D = 11 A, V _{DS} = 200 V, see fig. 6 and 13 ^b | - | - | 63 | nC |
| Gate-source charge | Q _{gs} | | | - | - | 12 | |
| Gate-drain charge | Q _{gd} | | | - | - | 39 | |
| Turn-on delay time | t _{d(on)} | V _{DD} = 125 V, I _D = 11 A , R _g = 9.1 Ω, R _D = 11 Ω, see fig. 10 ^b | | - | 14 | - | ns |
| Rise time | t _r | | | - | 49 | - | |
| Turn-off delay time | t _{d(off)} | | | - | 42 | - | |
| Fall time | t _f | | | - | 24 | - | |
| Internal drain inductance | L _D | Between lead, 6 mm (0.25") from package and center of die contact | | - | 5.0 | - | nH |
| Internal source inductance | L _S | | | - | 13 | - | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous source-drain diode current | I _S | MOSFET symbol showing the integral reverse p - n junction diode | | - | - | 15 | A |
| Pulsed diode forward current ^a | I _{SM} | | | - | - | 60 | |
| Body diode voltage | V _{SD} | T _J = 25 °C, I _S = 15 A, V _{GS} = 0 V ^b | | - | - | 1.8 | V |
| Body diode reverse recovery time | t _{rr} | T _J = 25 °C, I _F = 11 A, dI/dt = 100 A/μs ^b | | - | 290 | 570 | ns |
| Body diode reverse recovery charge | Q _{rr} | | | - | 3.1 | 6.3 | 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 $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

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

Fig. 4 - Normalized On-Resistance vs. Temperature

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

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

Fig. 3 - Typical Transfer Characteristics

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

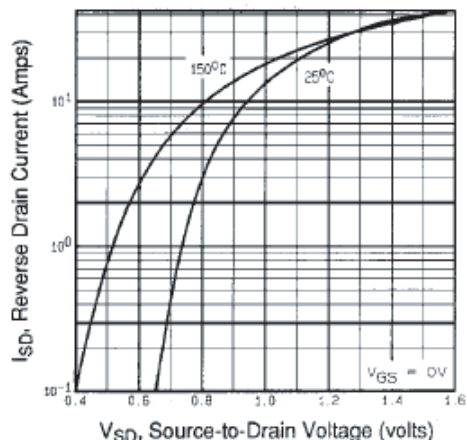
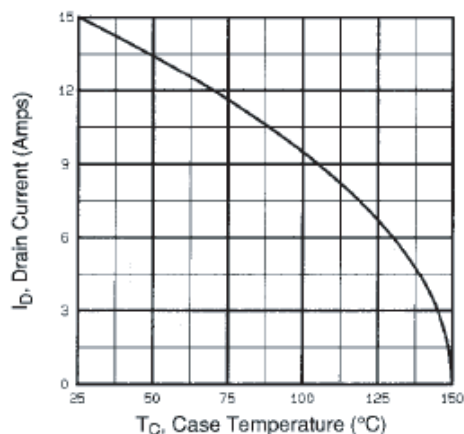
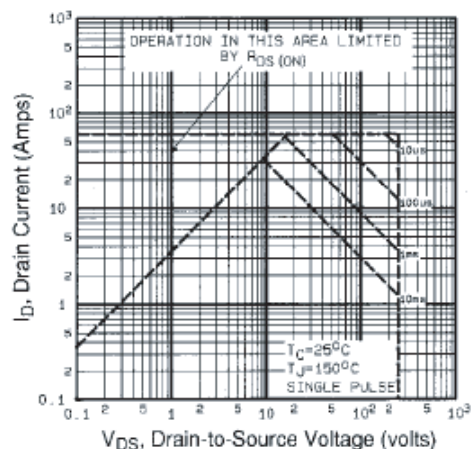
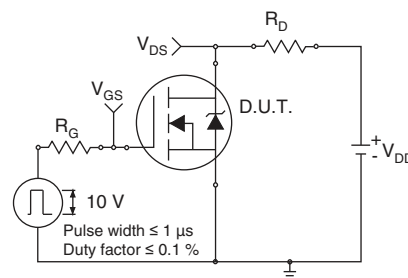
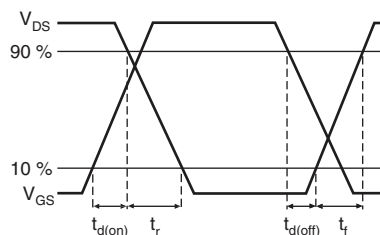
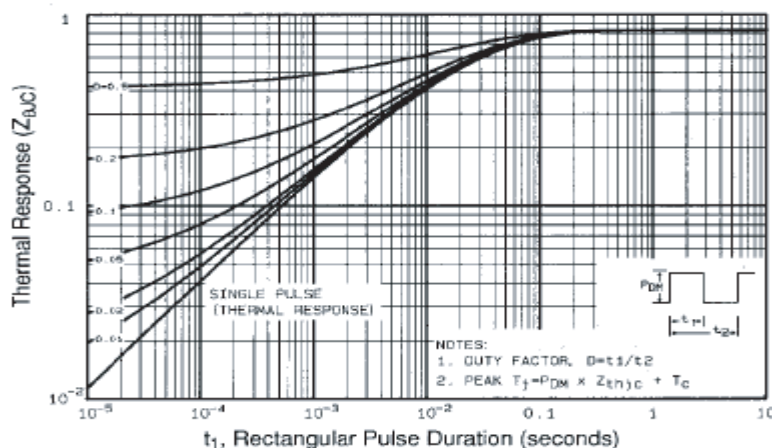
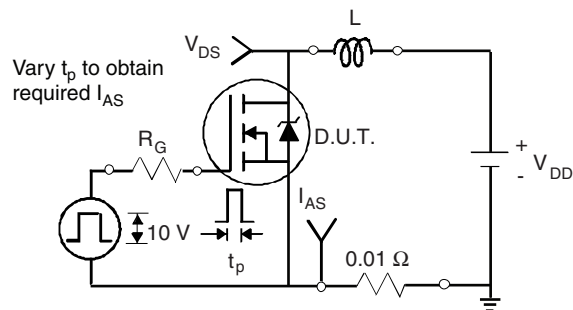
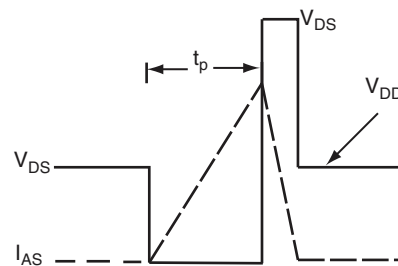
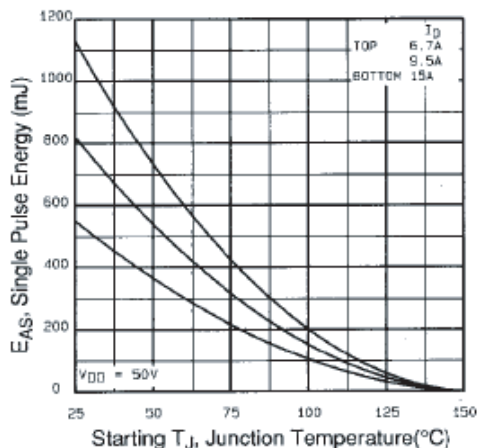
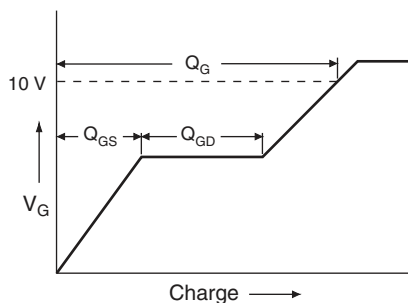
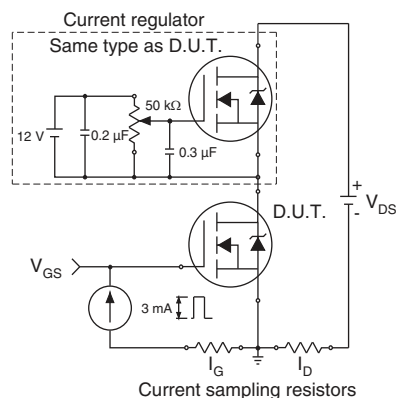
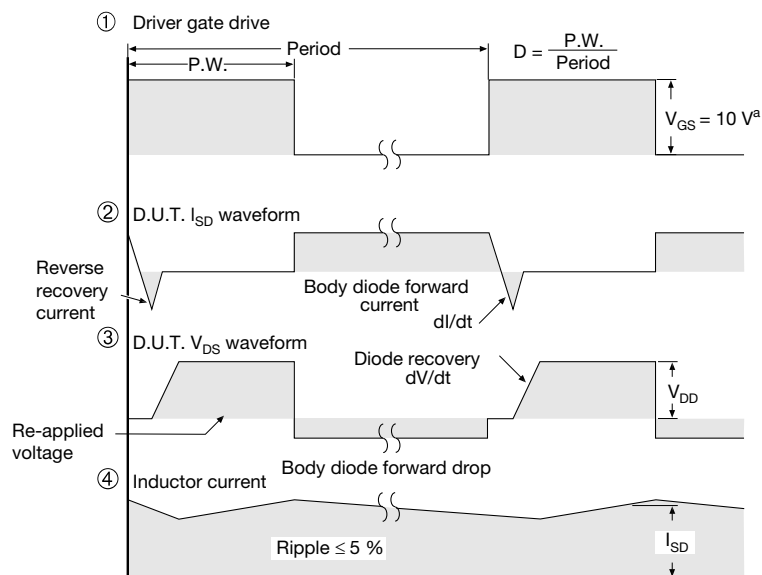
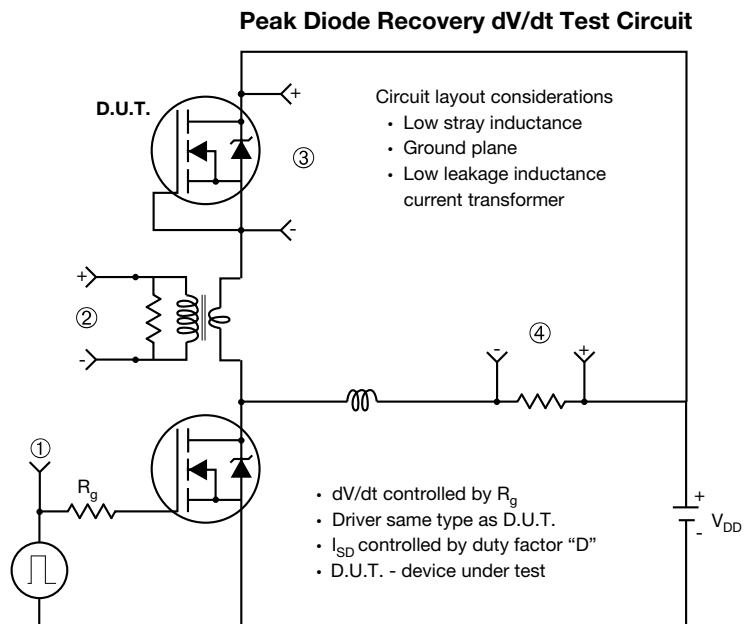

Fig. 7 - Typical Source-Drain Diode Forward Voltage

Fig. 9 - Maximum Drain Current vs. Case Temperature

Fig. 8 - Maximum Safe Operating Area

Fig. 10a - Switching Time Test Circuit

Fig. 10a - 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

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?91211.



TO-247AC (High Voltage)

VERSION 1: FACILITY CODE = 9



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

| MILLIMETERS | | | | |
|-------------|-------|-------|-------|-------|
| DIM. | MIN. | NOM. | MAX. | NOTES |
| A | 4.83 | 5.02 | 5.21 | |
| A1 | 2.29 | 2.41 | 2.55 | |
| A2 | 1.17 | 1.27 | 1.37 | |
| b | 1.12 | 1.20 | 1.33 | |
| b1 | 1.12 | 1.20 | 1.28 | |
| b2 | 1.91 | 2.00 | 2.39 | 6 |
| b3 | 1.91 | 2.00 | 2.34 | |
| b4 | 2.87 | 3.00 | 3.22 | 6, 8 |
| b5 | 2.87 | 3.00 | 3.18 | |
| c | 0.40 | 0.50 | 0.60 | 6 |
| c1 | 0.40 | 0.50 | 0.56 | |
| D | 20.40 | 20.55 | 20.70 | 4 |

| MILLIMETERS | | | | |
|-------------|-----------|-------|-------|-------|
| DIM. | MIN. | NOM. | MAX. | NOTES |
| D1 | 16.46 | 16.76 | 17.06 | 5 |
| D2 | 0.56 | 0.66 | 0.76 | |
| E | 15.50 | 15.70 | 15.87 | 4 |
| E1 | 13.46 | 14.02 | 14.16 | 5 |
| E2 | 4.52 | 4.91 | 5.49 | 3 |
| e | 5.46 BSC | | | |
| L | 14.90 | 15.15 | 15.40 | |
| L1 | 3.96 | 4.06 | 4.16 | 6 |
| Ø P | 3.56 | 3.61 | 3.65 | 7 |
| Ø P1 | 7.19 ref. | | | |
| Q | 5.31 | 5.50 | 5.69 | |
| S | 5.51 BSC | | | |

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: E22-0452-Rev. G, 31-Oct-2022
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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