# 650V 4A SiC Schottky MPS™ Diode

| | | |
|---|---|---|
| $V_{RRM}$ | = | 650 V |
| $I_F$ | = | 4 A |
| $Q_C$ | = | 10 nC |

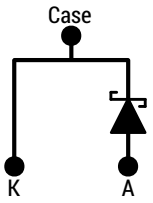
## Features

- Gen5 SiC MPS™Technology for Low $V_F$ of 1.22V
- Benchmark Low Built-In Voltage ($V_{BI}$)
- Superior Figure of Merit $Q_C$ * $V_F$
- Enhanced Surge Current & UIS Robustness
- Low Thermal Resistance
- Zero Reverse Recovery and Zero Forward Recovery
- Excellent dV/dt Ruggedness

## Package




TO-220-2




RoHS

REACH

## Advantages

- Lowest Conduction Losses Across All Load Conditions
- Increased System Power Density
- Optimal Price Performance
- High System Reliability
- Reduced Cooling Requirements
- Temperature Independent Fast Switching
- Easy to Parallel without Thermal Runaway

## Applications

- Switched Mode Power Supply (SMPS)
- Server and Telecom Power Supply
- Solar Microinveter
- Power Factor Correction (PFC)
- Uninterruptible Power Supply (UPS)

## Absolute Maximum Ratings

| Parameter | Symbol | Conditions | Values | Unit | Note |
|---|---|---|---|---|---|
| Repetitive Peak Reverse Voltage | $V_{RRM}$ | | 650 | V | |
| Continuous Forward Current | $I_F$ | $T_C$ = 25°C, D = 1 | 14 | A | Fig. 4 |
| | | $T_C$ = 110°C, D = 1 | 9 | | |
| | | $T_C$ = 158°C, D = 1 | 4 | | |
| Non-Repetitive Peak Forward Surge Current, Half Sine Wave | $I_{F,SM}$ | $T_C$ = 25°C, $t_P$ = 10 ms | 24 | A | |
| | | $T_C$ = 150°C, $t_P$ = 10 ms | 20 | | |
| Repetitive Peak Forward Surge Current, Half Sine Wave | $I_{F,RM}$ | $T_C$ = 25°C, $t_P$ = 10 ms | 15 | A | |
| | | $T_C$ = 150°C, $t_P$ = 10 ms | 10 | | |
| $i^2t$ Value | $\int i^2dt$ | $T_C$ = 25°C, $t_P$ = 10 ms | 2.88 | $A^2s$ | |
| Non-Repetitive Avalanche Energy | $E_{AS}$ | L = 3.3 mH, $I_{AS}$ = 4 A | 27 | mJ | |
| Diode Ruggedness | dV/dt | $V_R$ = 0 ~ 520 V | 200 | V/ns | |
| Power Dissipation | $P_{TOT}$ | $T_C$ = 25°C | 53 | W | Fig. 3 |
| Operating and Storage Temperature | $T_j$ , $T_{stg}$ | | -55 to 175 | °C | |

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## Electrical Characteristics

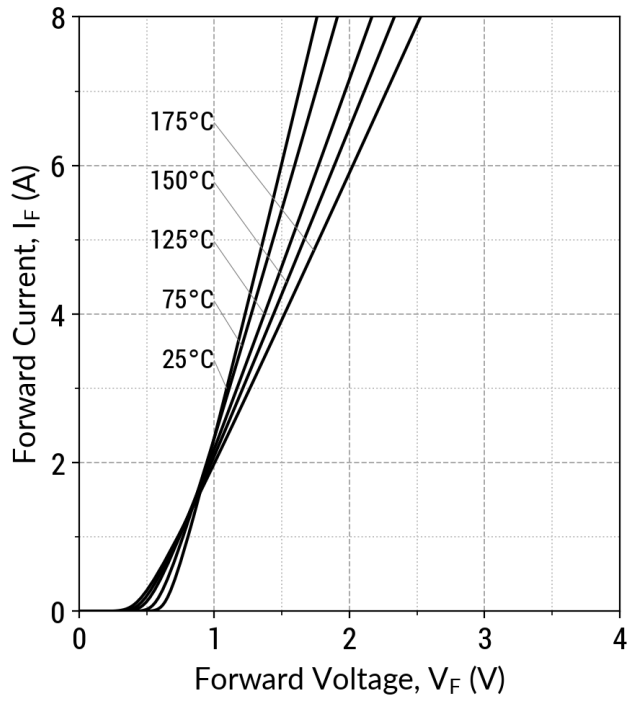
| Parameter | Symbol | Conditions | | Values Min. | Values Typ. | Values Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Diode Forward Voltage | $V_F$ | $I_F$ = 4 A, $T_j$ = 25°C | | | 1.22 | 1.45 | V | Fig. 1 |
| | | $I_F$ = 4 A, $T_j$ = 125°C | | | 1.4 | | | |
| Reverse Current | $I_R$ | $V_R$ = 650 V, $T_j$ = 25°C | | | 2 | 100 | µA | Fig. 2 |
| | | $V_R$ = 650 V, $T_j$ = 125°C | | | 27 | | | |
| Total Capacitive Charge | $Q_C$ | $I_F \le I_{F,MAX}$ $dI_F/dt$ = 200 A/µs | $V_R$ = 300 V | | 8 | | nC | Fig. 7 |
| | | | $V_R$ = 400 V | | 10 | | | |
| Switching Time | $t_S$ | | $V_R$ = 300 V | | < 10 | | ns | |
| | | | $V_R$ = 400 V | | | | | |
| Total Capacitance | C | $V_R$ = 1 V, f = 1MHz | | | 185 | | pF | Fig. 6 |
| | | $V_R$ = 400 V, f = 1MHz | | | 13 | | | |

## Thermal/Package Characteristics

| Parameter | Symbol | Conditions | Values Min. | Values Typ. | Values Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Thermal Resistance, Junction - Case | $R_{thJC}$ | | | 2.83 | | °C/W | Fig. 9 |
| Weight | $W_T$ | | | 2 | | g | |
| Mounting Torque | $T_M$ | Screws to Heatsink | | | 1.0 | Nm | |

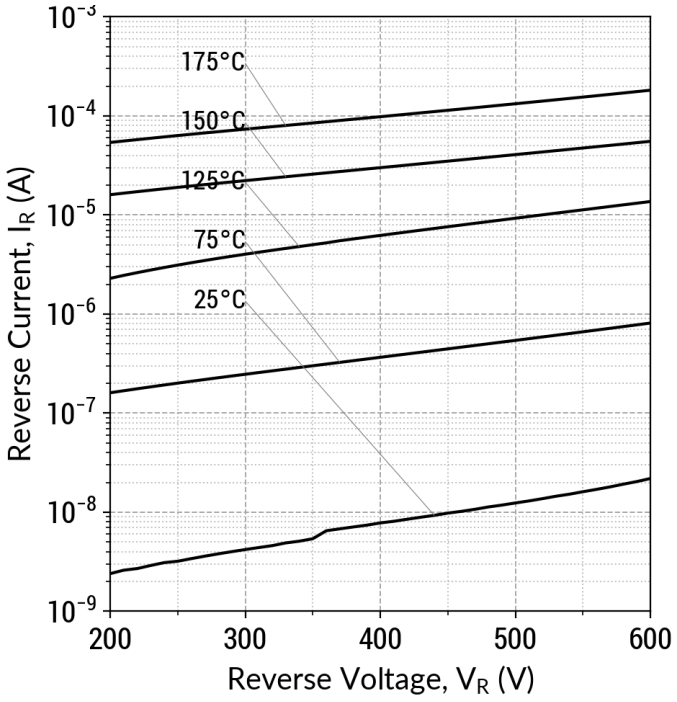
NOTE: This datasheet provides preliminary specifications. Parameters, conditions and values are subject to change.

## Figure 1: Typical Forward Characteristics



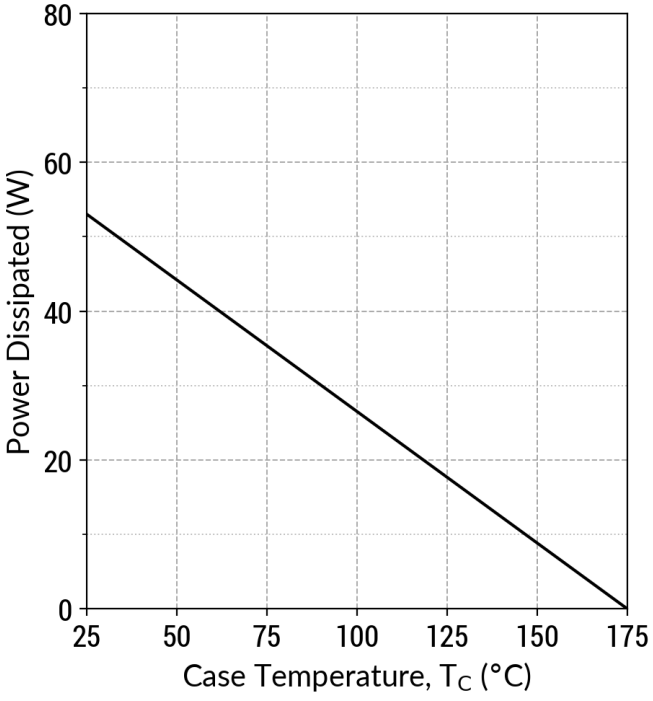

$I_F = f(V_F,T_j)$; $t_P = 250\ \mu s$

## Figure 2: Typical Reverse Characteristics



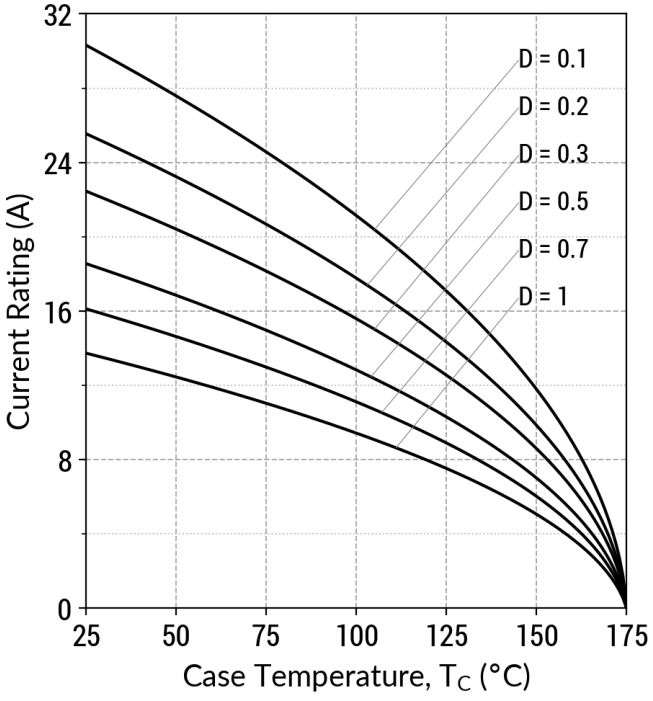

$I_R = f(V_R,T_j)$

## Figure 3: Power Derating Curves



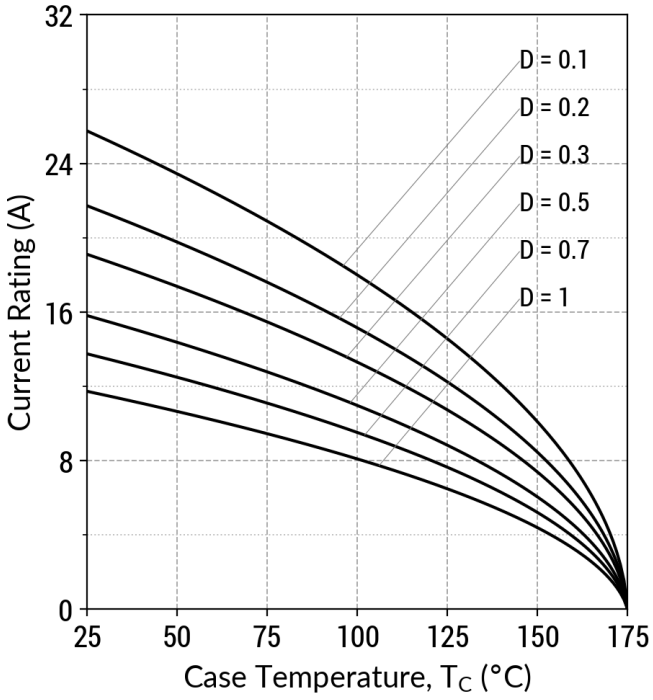

$P_{TOT} = f(T_C)$; $T_j = 175°C$

## Figure 4: Current Derating Curves (Typical $V_F$)



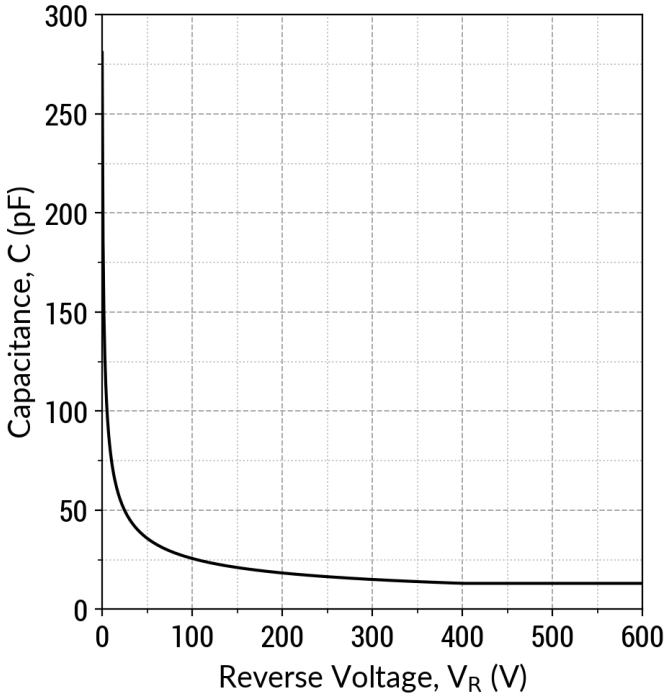

$I_F = f(T_C)$; $D = t_P/T$; $T_j \leq 175°C$; $f_{SW} > 10kHz$

## Figure 5: Current Derating Curves (Maximum $V_F$)



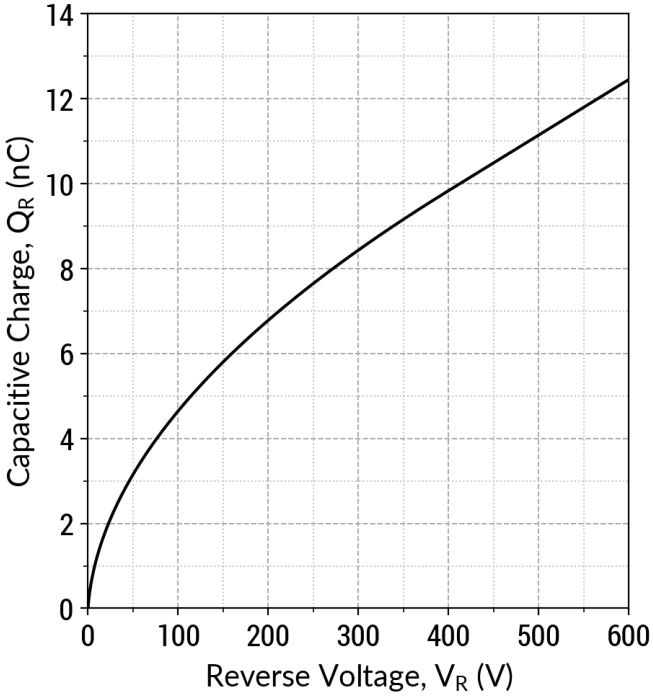

$I_F = f(T_C)$; $D = t_P/T$; $T_j \leq 175°C$; $f_{SW} > 10kHz$

## Figure 6: Typical Junction Capacitance vs Reverse Voltage Characteristics



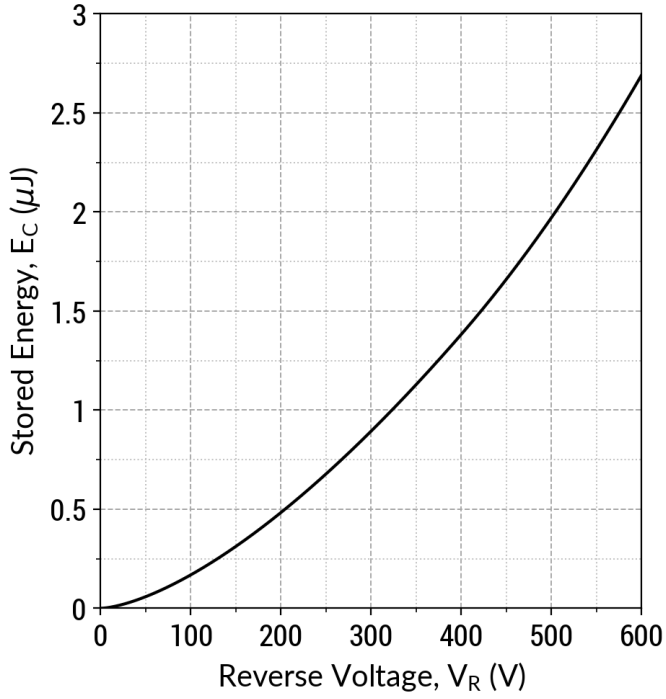

$C = f(V_R)$; $f = 1MHz$

## Figure 7: Typical Capacitive Charge vs Reverse Voltage Characteristics



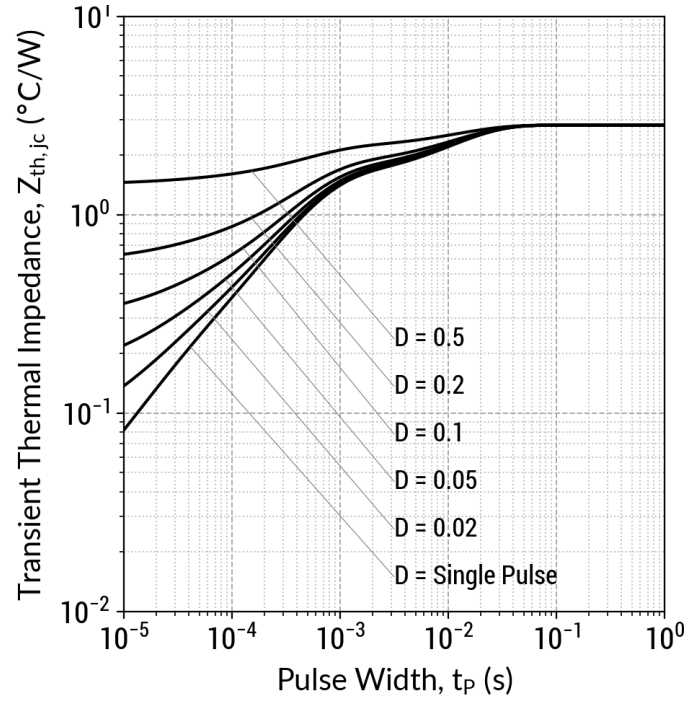

$Q_C = f(V_R)$; $f = 1MHz$

## Figure 8: Typical Capacitive Energy vs Reverse Voltage Characteristics



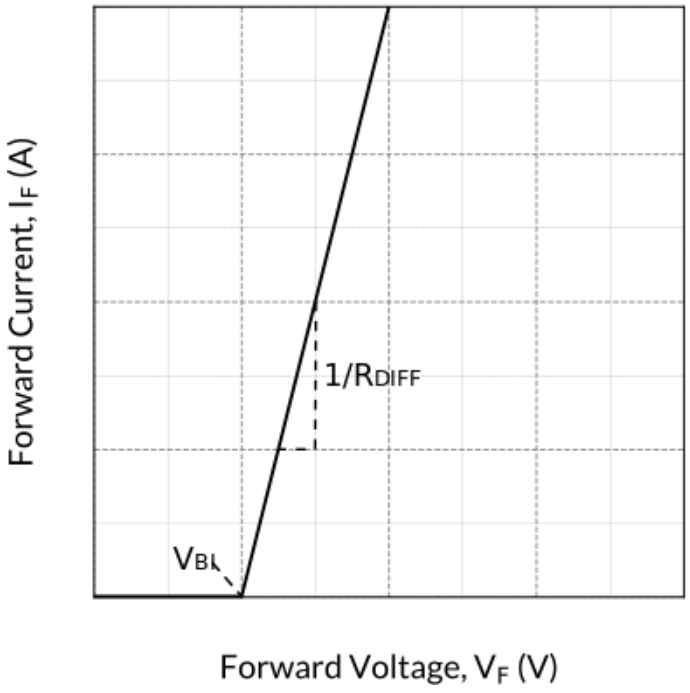

$E_C = f(V_R)$; $f = 1MHz$

## Figure 9: Transient Thermal Impedance




$Z_{th,jc} = f(t_P,D)$; $D = t_P/T$

## Figure 10: Forward Curve Model




$I_F = f(V_F,T_j)$

## Forward Curve Model Equation:

$I_F = (V_F - V_{BI})/R_{DIFF}$ (A)

### Built-In Voltage ($V_{BI}$):

$V_{BI}(T_j) = m \times T_j + n$ (V)

m = -0.00122 (V/°C)

n = 0.725 (V)

### Differential Resistance ($R_{DIFF}$):

$R_{DIFF}(T_j) = a \times T_j^2 + b \times T_j + c$ (Ω)

a = 2.64e-06 (Ω/°C$^2$)

b = 0.000263 (Ω/°C)

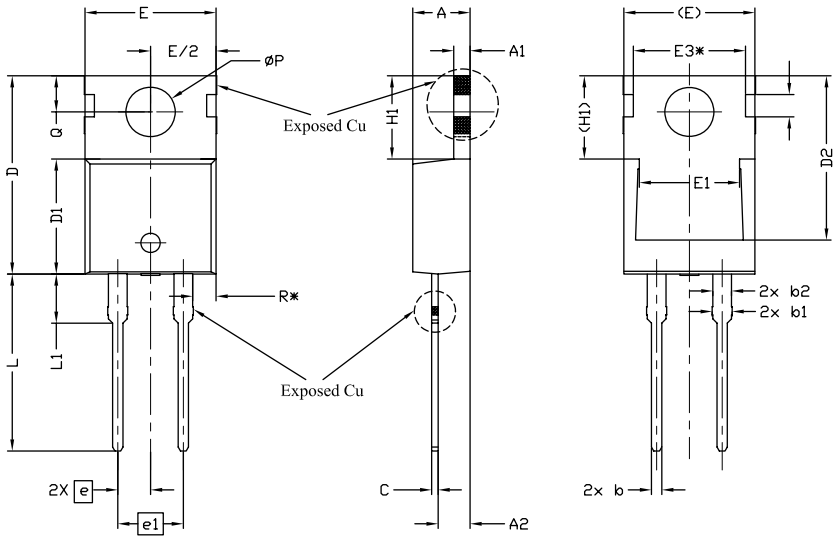
c = 0.125 (Ω)

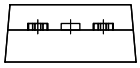
## Forward Power Loss Equation:

$P_{LOSS} = V_{BI}(T_j) \times I_{AVG} + R_{DIFF}(T_j) \times I_{RMS}^2$

# Package Dimensions

## TO-220-2 Package Outline

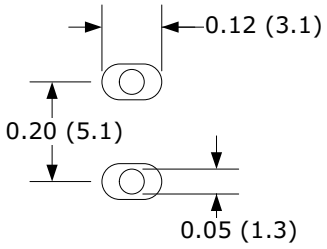


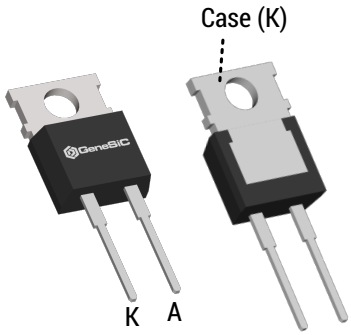
| SYMBOL | DIMENSIONS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 4.24 | 4.44 | 4.64 |
| A1 | 1.15 | 1.27 | 1.40 |
| A2 | 2.30 | 2.48 | 2.70 |
| b | 0.70 | 0.80 | 0.90 |
| b1 | 1.20 | 1.55 | 1.75 |
| b2 | 1.20 | 1.45 | 1.70 |
| c | 0.40 | 0.50 | 0.60 |
| D | 14.70 | 15.37 | 16.00 |
| D1 | 8.82 | 8.92 | 9.02 |
| D2 | 12.43 | 12.73 | 12.83 |
| E | 9.96 | 10.16 | 10.36 |
| E1 | 6.86 | 7.77 | 8.89 |
| E3* | | 8.70REF. | |
| e | | 2.54BSC | |
| e1 | | 5.08BSC | |
| H1 | 6.30 | 6.45 | 6.60 |
| L | 13.47 | 13.72 | 13.97 |
| L1 | 3.60 | 3.80 | 4.00 |
| ØP | 3.75 | 3.84 | 3.93 |
| Q | 2.60 | 2.80 | 3.00 |
| Q1* | | 1.73REF. | |
| R* | | 1.82REF. | |

Note:
1. Package Reference: JEDEC TO220, Variation AB.
2. All Dimensions Are In mm.
3. Slot Required, Notch May Be Rounded
4. Dimension D & E Do Not Include Mold Flash. Mold Flash Shall Not Exceed 0.127mm Pre Side. These Dimensions Are Measured At The Outermost Extreme Of The Plastic Body.
5. Thermal Pad Contour Optional Within Dimensions E, H1, D2 & E1.
6. Dimension E2 & H1 Define A Zone Where Stamping And Singulation Irregularities Are Allowed.
7. "*" is reference .

## Recommended Solder Pad Layout




## Package View




**NOTE**

1. CONTROLLED DIMENSION IS MILLIMETER.
2. DIMENSIONS DO NOT INCLUDE END FLASH, MOLD FLASH, MATERIAL PROTRUSIONS.

## Compliance

### RoHS Compliance

The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS 2), as adopted by EU member states on January 2, 2013 and amended on March 31, 2015 by EU Directive 2015/863. RoHS Declarations for this product can be obtained from your Navitas representative.

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## Related Links

- Reliability: https://navitassemi.com/contact-navitas/
- Quality: https://navitassemi.com/quality/

## Revision History

- Rev 24/May: Updated with most recent data

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