

## Features

- High Speed Smooth Switching Device for Hard and Soft Switching
- Positive Temperature Coefficient
- High Ruggedness, Good Thermal Stability
- Moisture Sensitivity Level 1
- Halogen Free. "Green" Device (Note 1)
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant (Note 2) ("P" Suffix Designates RoHS Compliant. See Ordering Information)

## Applications

- Soft Switching Applications
- Air Conditioning
- Motor Drive Inverter

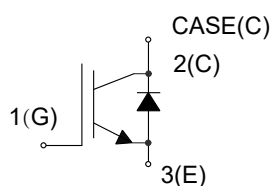
## Maximum Ratings

| Parameter                                                  | Symbol        | Rating                   | Unit    |
|------------------------------------------------------------|---------------|--------------------------|---------|
| Collector-Emitter Voltage                                  | $V_{CE}$      | 650                      | V       |
| DC Collector Current <sup>(Note 3)</sup>                   | $I_C$         | $T_C=25^{\circ}C$<br>20  | A       |
|                                                            |               | $T_C=100^{\circ}C$<br>10 |         |
| Pulsed Collector Current, $V_{GE}=15V$ <sup>(Note 4)</sup> | $I_{C,pluse}$ | 40                       | A       |
| Diode Forward Current <sup>(Note 3)</sup>                  | $I_F$         | $T_C=25^{\circ}C$<br>20  | A       |
|                                                            |               | $T_C=100^{\circ}C$<br>10 |         |
| Diode Pulsed Current <sup>(Note 4)</sup>                   | $I_{F,pluse}$ | 40                       | A       |
| Gate-Emitter Voltage                                       | $V_{GE}$      | $\pm 20$                 | V       |
| Transient Gate-Emitter Voltage <sup>(Note 5)</sup>         |               | $\pm 30$                 |         |
| Short Circuit Withstand Time <sup>(Note 6)</sup>           | $t_{SC}$      | 5                        | $\mu s$ |
| Power Dissipation, $T_C=25^{\circ}C$ $T_J=175^{\circ}C$    | $P_D$         | 100                      | W       |

Notes:

1. Halogen free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
2. High Temperature Solder Exemptions Applied, see EU Directive Annex 7a.
3. Limited by  $T_{Jmax}$ .
4.  $T_p$  limited by  $T_{Jmax}$ .
5.  $T_p \leq 10\mu s$ , Duty Cycle < 1%
6.  $V_{GE}=15V$ ,  $V_{CE} \leq 400V$

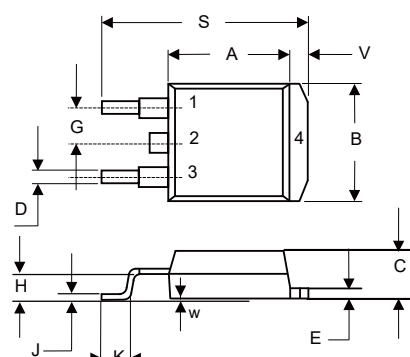
## Internal Structure



Device Code: MIB10N65AT0Y  
Date Code: YYWW: (Year & Week)

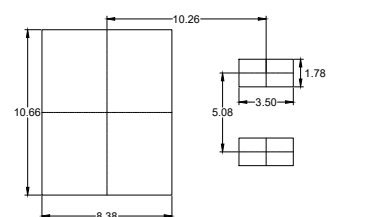
# Trench and Field Stop IGBT 650V 10A

## D<sup>2</sup>-PAK



| DIMENSIONS |        |       |       |       |      |
|------------|--------|-------|-------|-------|------|
| DIM        | INCHES |       | MM    |       | NOTE |
|            | MIN    | MAX   | MIN   | MAX   |      |
| A          | 0.331  | 0.370 | 8.40  | 9.40  |      |
| B          | 0.378  | 0.417 | 9.60  | 10.60 |      |
| C          | 0.165  | 0.189 | 4.20  | 4.80  |      |
| D          | 0.027  | 0.037 | 0.68  | 0.94  |      |
| E          | 0.045  | 0.055 | 1.14  | 1.40  |      |
| G          | 0.10   |       | 2.54  |       | TYP. |
| H          | 0.096  | 0.134 | 2.43  | 3.40  |      |
| J          | 0.011  | 0.025 | 0.28  | 0.64  |      |
| K          | 0.071  | 0.131 | 1.80  | 3.32  |      |
| S          | 0.575  | 0.625 | 14.60 | 15.87 |      |
| V          | 0.042  | 0.058 | 1.07  | 1.47  |      |
| W          | 0.000  | 0.010 | 0.00  | 0.25  |      |

## Suggested Solder Pad Layout



**Electrical Characteristics @ 25°C (Unless Otherwise Specified)**

| Parameter                             | Symbol        | Test Conditions                                                          | Min | Typ   | Max       | Unit    |
|---------------------------------------|---------------|--------------------------------------------------------------------------|-----|-------|-----------|---------|
| <b>IGBT Static Characteristics</b>    |               |                                                                          |     |       |           |         |
| Collector-Emitter Breakdown Voltage   | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=250\mu A$                                                | 650 |       |           | V       |
| Collector-Emitter Saturation Voltage  | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=10A, T_J=25^\circ C$                                    |     | 1.40  | 1.70      | V       |
|                                       |               | $V_{GE}=15V, I_C=10A, T_J=125^\circ C$                                   |     | 1.55  |           |         |
|                                       |               | $V_{GE}=15V, I_C=10A, T_J=150^\circ C$                                   |     | 1.60  |           |         |
| G-E Threshold Voltage                 | $V_{GE(th)}$  | $I_C=1mA, V_{CE}=V_{GE}$                                                 | 4.4 | 5.2   | 6.0       | V       |
| C-E Leakage Current                   | $I_{CES}$     | $V_{CE}=650V, V_{GE}=0V, T_J=25^\circ C$                                 |     |       | 0.25      | mA      |
|                                       |               | $V_{CE}=650V, V_{GE}=0V, T_J=150^\circ C$                                |     |       | 1         |         |
| G-E Leakage Current                   | $I_{GES}$     | $V_{CE}=0V, V_{GE}=\pm 20V$                                              |     |       | $\pm 200$ | nA      |
| <b>Dynamic Characteristics</b>        |               |                                                                          |     |       |           |         |
| Input Capacitance                     | $C_{ies}$     | $V_{CE}=25V, V_{GE}=0V, f=1MHz$                                          |     | 0.89  |           | nF      |
| Reverse Transfer Capacitance          | $C_{oes}$     |                                                                          |     | 0.04  |           |         |
| Reverse Transfer Capacitance          | $C_{res}$     |                                                                          |     | 0.01  |           |         |
| Gate Charge                           | $Q_g$         | $V_{CC}=300V, I_C=10A, V_{GE}=15V$                                       |     | 0.059 |           | $\mu C$ |
| <b>IGBT Switching Characteristics</b> |               |                                                                          |     |       |           |         |
| Turn-On Delay Time                    | $t_{d(on)}$   | $V_{CC}=300V, I_C=10A, V_{GE}=-5\sim 15V, R_G=51\Omega, T_J=25^\circ C$  |     | 10    |           | ns      |
| Rise Time                             | $t_r$         |                                                                          |     | 26    |           |         |
| Turn-Off Delay Time                   | $t_{d(off)}$  |                                                                          |     | 68    |           |         |
| Fall Time                             | $t_f$         |                                                                          |     | 135   |           |         |
| Turn-On Energy                        | $E_{on}$      | $V_{CC}=300V, I_C=10A, V_{GE}=-5\sim 15V, R_G=51\Omega, T_J=25^\circ C$  |     | 0.36  |           | mJ      |
| Turn-Off Energy                       | $E_{off}$     |                                                                          |     | 0.17  |           |         |
| Turn-On Delay Time                    | $t_{d(on)}$   |                                                                          |     | 14    |           | ns      |
| Rise Time                             | $t_r$         |                                                                          |     | 35    |           |         |
| Turn-Off Delay Time                   | $t_{d(off)}$  |                                                                          |     | 68    |           |         |
| Fall Time                             | $t_f$         |                                                                          |     | 162   |           |         |
| Turn-On Energy                        | $E_{on}$      | $V_{CC}=300V, I_C=10A, V_{GE}=-5\sim 15V, R_G=51\Omega, T_J=125^\circ C$ |     | 0.42  |           | mJ      |
| Turn-Off Energy                       | $E_{off}$     |                                                                          |     | 0.29  |           |         |
| Turn-On Delay Time                    | $t_{d(on)}$   |                                                                          |     | 16    |           | ns      |
| Rise Time                             | $t_r$         |                                                                          |     | 41    |           |         |
| Turn-Off Delay Time                   | $t_{d(off)}$  |                                                                          |     | 69    |           |         |
| Fall Time                             | $t_f$         |                                                                          |     | 181   |           |         |
| Turn-On Energy                        | $E_{on}$      | $V_{CC}=300V, I_C=10A, V_{GE}=-5\sim 15V, R_G=51\Omega, T_J=150^\circ C$ |     | 0.46  |           | mJ      |
| Turn-Off Energy                       | $E_{off}$     |                                                                          |     | 0.33  |           |         |
| Short Circuit Collector Current       | $I_{C(SC)}$   | $V_{CC}=400V, V_{GE}=15V, T_{sc}\leq 5\mu s, T_{j,start}=25^\circ C$     |     | 110   |           | A       |

# Electrical Characteristics @ 25°C (Unless Otherwise Specified)

| Parameter                    | Symbol    | Test Conditions                                                 | Min | Typ  | Max  | Unit    |
|------------------------------|-----------|-----------------------------------------------------------------|-----|------|------|---------|
| <b>Diode Characteristics</b> |           |                                                                 |     |      |      |         |
| Diode Forward Voltage        | $V_F$     | $V_{GE}=0V, I_F=10A, T_J=25^{\circ}C$                           |     | 1.70 | 2.20 | V       |
|                              |           | $V_{GE}=0V, I_F=10A, T_J=125^{\circ}C$                          |     | 1.50 |      |         |
|                              |           | $V_{GE}=0V, I_F=10A, T_J=150^{\circ}C$                          |     | 1.40 |      |         |
| Reverse Recovery Current     | $I_{rr}$  | $V_R=300V, I_F=10A,$<br>$di_F/dt=-365A/\mu s, T_J=25^{\circ}C$  |     | 6    |      | A       |
| Reverse Recovery time        | $t_{rr}$  |                                                                 |     | 176  |      | ns      |
| Reverse Recovery Charge      | $Q_{rr}$  |                                                                 |     | 0.12 |      | $\mu C$ |
| Reverse Recovery Energy      | $E_{rec}$ |                                                                 |     | 0.05 |      | mJ      |
| Reverse Recovery Current     | $I_{rr}$  | $V_R=300V, I_F=10A,$<br>$di_F/dt=-365A/\mu s, T_J=125^{\circ}C$ |     | 7    |      | A       |
| Reverse Recovery time        | $t_{rr}$  |                                                                 |     | 189  |      | ns      |
| Reverse Recovery Charge      | $Q_{rr}$  |                                                                 |     | 0.48 |      | $\mu C$ |
| Reverse Recovery Energy      | $E_{rec}$ |                                                                 |     | 0.09 |      | mJ      |
| Reverse Recovery Current     | $I_{rr}$  | $V_R=300V, I_F=10A,$<br>$di_F/dt=-365A/\mu s, T_J=150^{\circ}C$ |     | 8    |      | A       |
| Reverse Recovery time        | $t_{rr}$  |                                                                 |     | 195  |      | ns      |
| Reverse Recovery Charge      | $Q_{rr}$  |                                                                 |     | 0.62 |      | $\mu C$ |
| Reverse Recovery Energy      | $E_{rec}$ |                                                                 |     | 0.11 |      | mJ      |

## Thermal characteristics

| Parameter                                        | Symbol         | Min | Typ | Max | Units         |
|--------------------------------------------------|----------------|-----|-----|-----|---------------|
| Operating Junction Temperature Range             | $T_J$          | -40 |     | 175 | $^{\circ}C$   |
| Storage Temperature Range                        | $T_{stg}$      | -55 |     | 150 | $^{\circ}C$   |
| Thermal Resistance from Junction to Case (IGBT)  | $R_{th_{J-C}}$ |     |     | 1.5 | $^{\circ}C/W$ |
| Thermal Resistance from Junction to Case (Diode) | $R_{th_{J-C}}$ |     |     | 2.0 | $^{\circ}C/W$ |
| Thermal Resistance from Junction to Ambient      | $R_{th_{J-A}}$ |     |     | 60  | $^{\circ}C/W$ |

## Curve Characteristics

Fig. 1 - Typical Output Characteristic( $T_J=25^\circ\text{C}$ )

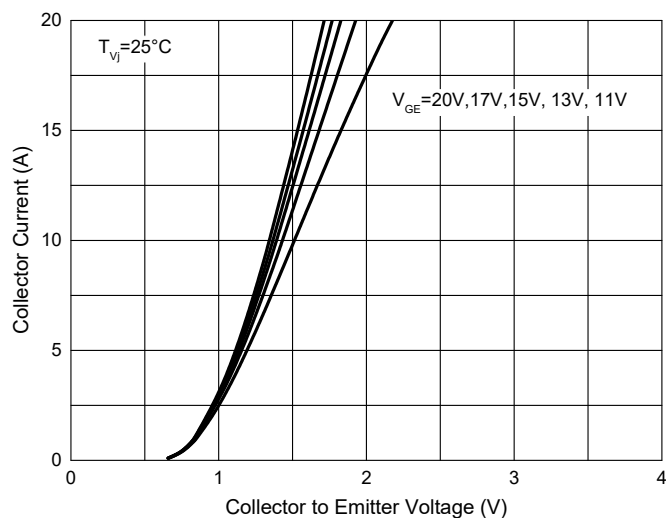


Fig. 2 - Typical Output Characteristic ( $T_J=150^\circ\text{C}$ )

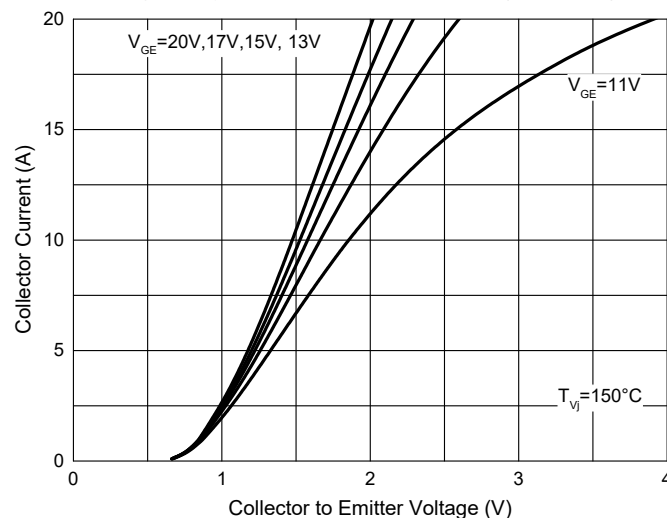


Fig. 3 - Typical Transfer Characteristic

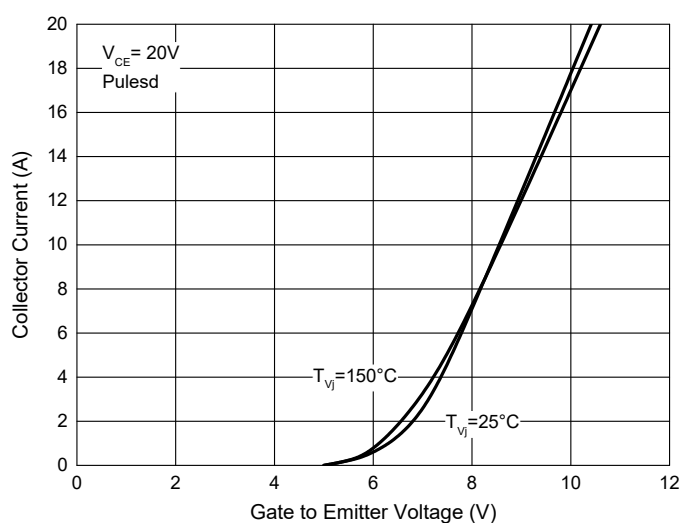


Fig. 4 - Diode Forward Current Characteristics

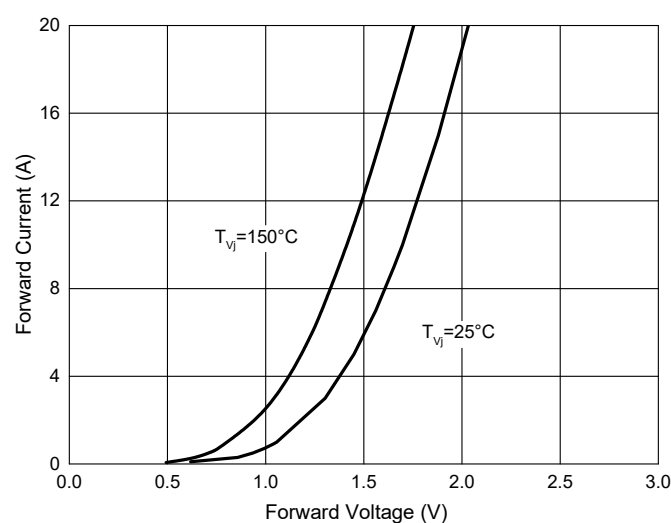


Fig. 5 - IGBT Switching Loss vs  $I_C$

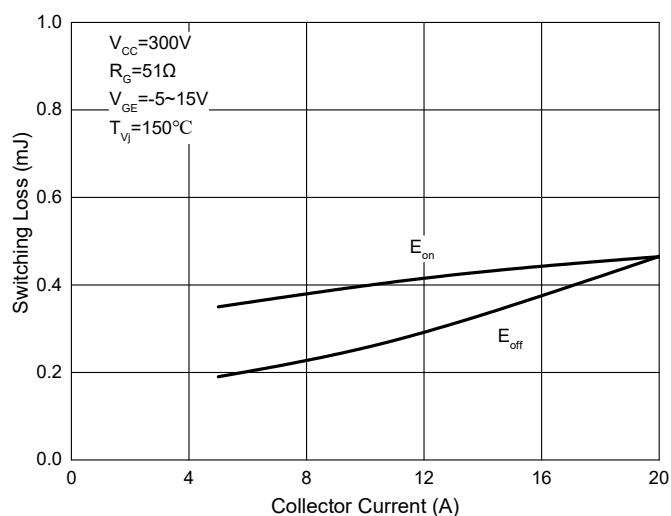
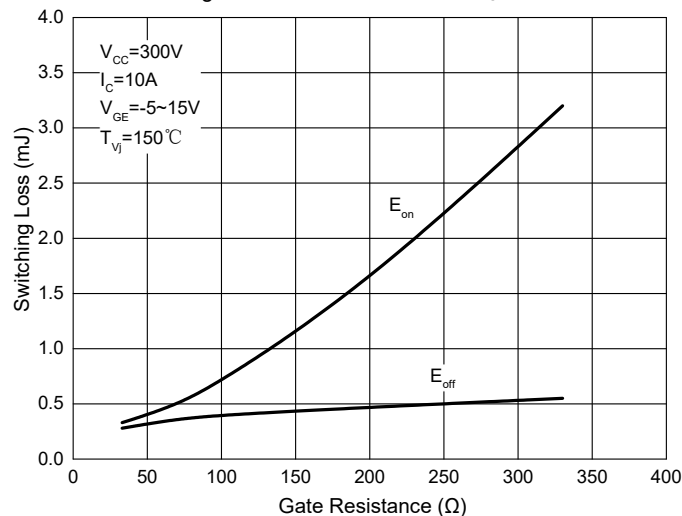


Fig. 6 - IGBT Switch Loss vs  $R_G$



## Curve Characteristics

Fig. 7 - Diode Switching Loss vs  $I_F$

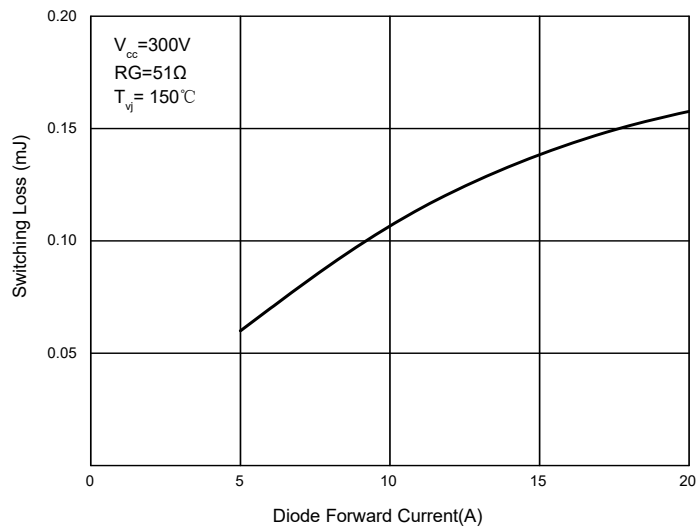


Fig. 8- Capacitance Characteristics

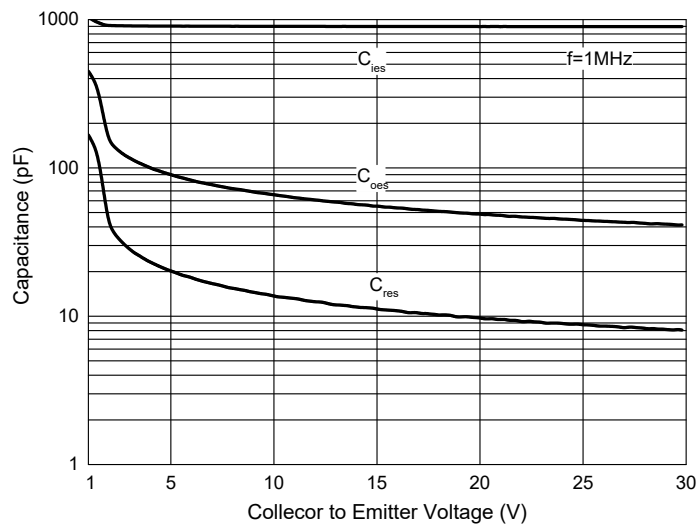


Fig. 9 - IGBT Transient Thermal Impedance

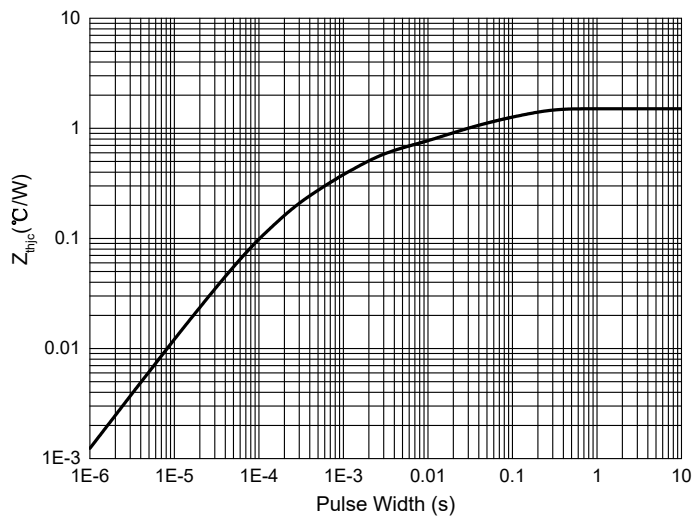
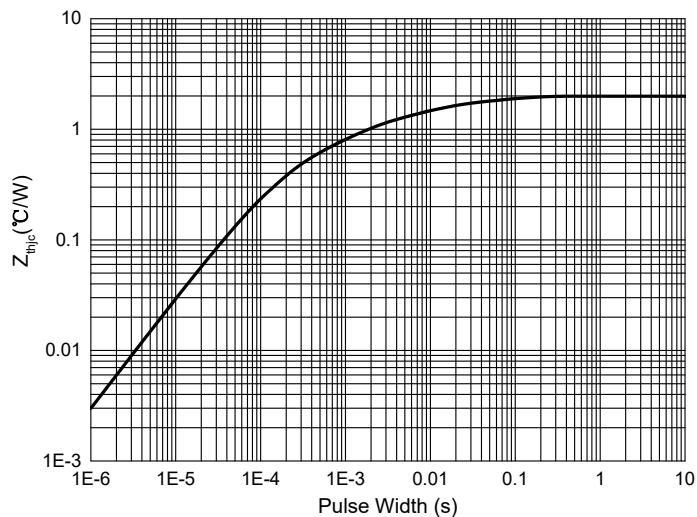


Fig. 10 - Diode Transient Thermal Impedance



## Ordering Information

| Device         | Packing                |
|----------------|------------------------|
| Part Number-TP | Tape&Reel: 800pcs/Reel |

### \*\*\*IMPORTANT NOTICE\*\*\*

**Micro Commercial Components Corp.** reserves the right to make changes without further notice to any product herein to make corrections, modifications , enhancements , improvements , or other changes . **Micro Commercial Components Corp** . does not assume any liability arising out of the application or use of any product described herein; neither does it convey any license under its patent rights ,nor the rights of others . The user of products in such applications shall assume all risks of such use and will agree to hold **Micro Commercial Components Corp** . and all the companies whose products are represented on our website, harmless against all damages. **Micro Commercial Components Corp.** products are sold subject to the general terms and conditions of commercial sale, as published at <https://www.mccsemi.com/Home/TermsAndConditions>.

### \*\*\*LIFE SUPPORT\*\*\*

MCC's products are not authorized for use as critical components in life support devices or systems without the express written approval of Micro Commercial Components Corporation.

### \*\*\*CUSTOMER AWARENESS\*\*\*

Counterfeiting of semiconductor parts is a growing problem in the industry. Micro Commercial Components (MCC) is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. MCC strongly encourages customers to purchase MCC parts either directly from MCC or from Authorized MCC Distributors who are listed by country on our web page cited below. Products customers buy either from MCC directly or from Authorized MCC Distributors are genuine parts, have full traceability, meet MCC's quality standards for handling and storage. **MCC will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources.** MCC is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.