

## Features

- High Breakdown Voltage to 1200V for Improved Reliability
- Maximum Junction Temperature 175°C
- Positive Temperature Coefficient
- Including SiC FWD
- 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

- PV Inverter
- Switch Mode Power Supplies
- Welding Machine

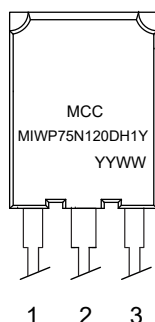
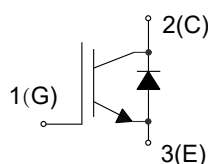
## Maximum Ratings

| Parameter                                                                              | Symbol        | Rating                        | Unit |
|----------------------------------------------------------------------------------------|---------------|-------------------------------|------|
| Collector-Emitter Voltage                                                              | $V_{CE}$      | 1200                          | V    |
| DC Collector Current <sup>(3)</sup>                                                    | $I_C$         | $T_C=25^\circ\text{C}$<br>150 | A    |
|                                                                                        |               | $T_C=100^\circ\text{C}$<br>75 |      |
| Pulsed Collector Current <sup>(4)</sup> , $V_{GE}=15\text{V}$                          | $I_{C,pluse}$ | 300                           | A    |
| Diode Forward Current <sup>(3)</sup>                                                   | $I_F$         | $T_C=25^\circ\text{C}$<br>90  | A    |
|                                                                                        |               | $T_C=150^\circ\text{C}$<br>30 |      |
| Diode Pulsed Current <sup>(4)</sup>                                                    | $I_{F,pluse}$ | 225                           | A    |
| Continuous Gate-Emitter Voltage                                                        | $V_{GE}$      | $\pm 20$                      | V    |
| Transient Gate-Emitter Voltage <sup>(5)</sup>                                          |               | $\pm 30$                      |      |
| Turn off Safe Operation Area<br>$V_{CE} \leq 1200\text{V}$ , $T_J = 175^\circ\text{C}$ |               | 300                           | A    |
| Power Dissipation                                                                      | $P_D$         | $T_C=25^\circ\text{C}$<br>600 | W    |
|                                                                                        |               | $T_J=175^\circ\text{C}$       |      |

Note:

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.  $t_p \leq 10\mu\text{s}$ , Duty Cycle < 1%

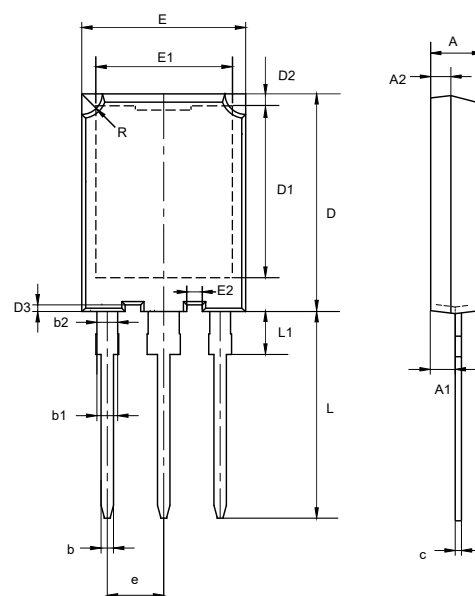
## Internal Structure



Device Code: MIWP75N120DH1Y  
Date Code: YYWW (Year & Week)

# Trench and Field Stop IGBT 1200V 75A

## TO-247Plus



| DIMENSIONS |            |       |           |       |      |
|------------|------------|-------|-----------|-------|------|
| DIM        | INCHES     |       | MM        |       | NOTE |
|            | MIN        | MAX   | MIN       | MAX   |      |
| A          | 0.192      | 0.201 | 4.90      | 5.10  |      |
| A1         | 0.090      | 0.099 | 2.31      | 2.51  |      |
| A2         | 0.074      | 0.083 | 1.90      | 2.10  |      |
| b          | 0.044      | 0.050 | 1.14      | 1.26  |      |
| b1         | 0.073      | 0.085 | 1.86      | 2.16  |      |
| b2         | 0.077      | 0.081 | 1.96      | 2.06  |      |
| c          | 0.022      | 0.026 | 0.58      | 0.64  |      |
| D          | 0.822      | 0.831 | 20.90     | 21.10 |      |
| D1         | 0.639      | 0.664 | 16.25     | 16.85 |      |
| D2         | 0.041      | 0.054 | 1.05      | 1.35  |      |
| D3         | 0.022      | 0.031 | 0.58      | 0.78  |      |
| E          | 0.618      | 0.626 | 15.70     | 15.90 |      |
| E1         | 0.515      | 0.532 | 13.10     | 13.50 |      |
| E2         | 0.053      | 0.061 | 1.35      | 1.55  |      |
| e          | 0.214(BSC) |       | 5.44(BSC) |       |      |
| L          | 0.778      | 0.791 | 19.78     | 20.08 |      |
| L1         | 0.158      | 0.167 | 4.03      | 4.23  |      |
| R          | 0.074      | 0.083 | 1.90      | 2.10  |      |

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

| Parameter                             | Symbol        | Test Conditions                                                                     | Min  | Typ  | Max       | Unit    |
|---------------------------------------|---------------|-------------------------------------------------------------------------------------|------|------|-----------|---------|
| <b>IGBT Static Characteristics</b>    |               |                                                                                     |      |      |           |         |
| Collector-Emitter Breakdown Voltage   | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=250\mu A$                                                           | 1200 |      |           | V       |
| Collector-Emitter Saturation Voltage  | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=75A, T_J=25^\circ C$                                               | 1.8  | 2.1  | 2.5       | V       |
|                                       |               | $V_{GE}=15V, I_C=75A, T_J=125^\circ C$                                              |      | 2.5  |           |         |
|                                       |               | $V_{GE}=15V, I_C=75A, T_J=150^\circ C$                                              |      | 2.6  |           |         |
| G-E Threshold Voltage                 | $V_{GE(th)}$  | $I_C=2.6mA, V_{CE}=V_{GE}$                                                          | 5.2  | 5.8  | 6.5       | V       |
| C-E Leakage Current                   | $I_{CES}$     | $V_{CE}=1200V, V_{GE}=0V, T_J=25^\circ C$                                           |      |      | 0.25      | mA      |
|                                       |               | $V_{CE}=1200V, V_{GE}=0V, T_J=150^\circ C$                                          |      |      | 5         |         |
| G-E Leakage Current                   | $I_{GES}$     | $V_{CE}=0V, V_{GE}=\pm 20V$                                                         |      |      | $\pm 100$ | nA      |
| <b>Dynamic Characteristics</b>        |               |                                                                                     |      |      |           |         |
| Input Capacitance                     | $C_{ies}$     | $V_{CE}=25V, V_{GE}=0V, f=1MHz$                                                     |      | 8.43 |           | nF      |
| Reverse Transfer Capacitance          | $C_{res}$     |                                                                                     |      | 0.19 |           |         |
| Gate Charge                           | $Q_G$         | $V_{CC}=960V, I_C=75A, V_{GE}=15V$                                                  |      | 0.65 |           | $\mu C$ |
| <b>IGBT Switching Characteristics</b> |               |                                                                                     |      |      |           |         |
| Turn-On Delay Time                    | $t_{d(on)}$   | $V_{CC}=600V, I_C=75A,$<br>$V_{GE}=-5V\sim 15V,$<br>$R_G=10\Omega, T_J=25^\circ C$  |      | 23   |           | ns      |
| Rise Time                             | $t_r$         |                                                                                     |      | 108  |           |         |
| Turn-Off Delay Time                   | $t_{d(off)}$  |                                                                                     |      | 227  |           |         |
| Fall Time                             | $t_f$         |                                                                                     |      | 91   |           |         |
| Turn-On Energy                        | $E_{on}$      | $V_{CC}=600V, I_C=75A,$<br>$V_{GE}=-5V\sim 15V,$<br>$R_G=10\Omega, T_J=25^\circ C$  |      | 7.3  |           | mJ      |
| Turn-Off Energy                       | $E_{off}$     |                                                                                     |      | 2.2  |           |         |
| Turn-On Delay Time                    | $t_{d(on)}$   | $V_{CC}=600V, I_C=75A,$<br>$V_{GE}=-5V\sim 15V,$<br>$R_G=10\Omega, T_J=125^\circ C$ |      | 26   |           | ns      |
| Rise Time                             | $t_r$         |                                                                                     |      | 101  |           |         |
| Turn-Off Delay Time                   | $t_{d(off)}$  |                                                                                     |      | 243  |           |         |
| Fall Time                             | $t_f$         |                                                                                     |      | 108  |           |         |
| Turn-On Energy                        | $E_{on}$      | $V_{CC}=600V, I_C=75A,$<br>$V_{GE}=-5V\sim 15V,$<br>$R_G=10\Omega, T_J=125^\circ C$ |      | 7.5  |           | mJ      |
| Turn-Off Energy                       | $E_{off}$     |                                                                                     |      | 3.0  |           |         |
| Turn-On Delay Time                    | $t_{d(on)}$   | $V_{CC}=600V, I_C=75A,$<br>$V_{GE}=-5V\sim 15V,$<br>$R_G=10\Omega, T_J=150^\circ C$ |      | 27   |           | ns      |
| Rise Time                             | $t_r$         |                                                                                     |      | 95   |           |         |
| Turn-Off Delay Time                   | $t_{d(off)}$  |                                                                                     |      | 252  |           |         |
| Fall Time                             | $t_f$         |                                                                                     |      | 116  |           |         |
| Turn-On Energy                        | $E_{on}$      | $V_{CC}=600V, I_C=75A,$<br>$V_{GE}=-5V\sim 15V,$<br>$R_G=10\Omega, T_J=150^\circ C$ |      | 7.6  |           | mJ      |
| Turn-Off Energy                       | $E_{off}$     |                                                                                     |      | 3.5  |           |         |

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

| Parameter                    | Symbol | Test Conditions                        | Min | Typ  | Max | Unit |
|------------------------------|--------|----------------------------------------|-----|------|-----|------|
| <b>Diode Characteristics</b> |        |                                        |     |      |     |      |
| Diode Forward Voltage        | $V_F$  | $V_{GE}=0V, I_F=30A, T_j=25^{\circ}C$  |     | 1.4  | 1.6 | V    |
|                              |        | $V_{GE}=0V, I_F=30A, T_j=175^{\circ}C$ |     | 2.0  |     |      |
| Diode Capacitive Charge      | $Q_c$  | $V_R=800V$                             |     | 162  |     | nC   |
| Diode Capacitance            | C      | $V_R=0V, f=1MHz$                       |     | 2179 |     | pF   |
|                              |        | $V_R=400V, f=1MHz$                     |     | 152  |     |      |
|                              |        | $V_R=800V, f=1MHz$                     |     | 118  |     |      |

# Thermal characteristics

| Parameter                                        | Symbol         | Min | Typ  | Max | Units         |
|--------------------------------------------------|----------------|-----|------|-----|---------------|
| Operating Junction Temperature Range             | $T_J$          | -40 |      | 175 | $^{\circ}C$   |
| Storage Temperature Range                        | $T_{stg}$      | -55 |      | 175 | $^{\circ}C$   |
| Thermal Resistance from Junction to Case (IGBT)  | $R_{th_{J-C}}$ |     | 0.25 |     | $^{\circ}C/W$ |
| Thermal Resistance from Junction to Case (Diode) | $R_{th_{J-C}}$ |     | 0.53 |     | $^{\circ}C/W$ |
| Thermal Resistance from Junction to Ambient      | $R_{th_{J-A}}$ |     |      | 40  | $^{\circ}C/W$ |

## Curve Characteristics

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

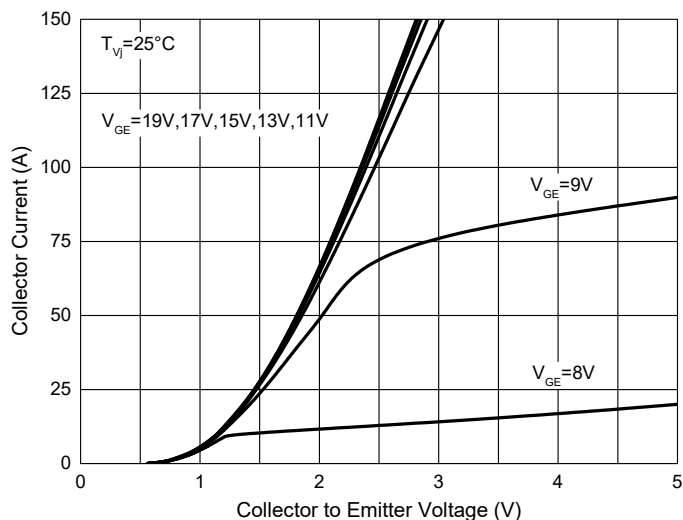


Fig. 2 - Typical Output Characteristic ( $T_J=150^\circ\text{C}$ )

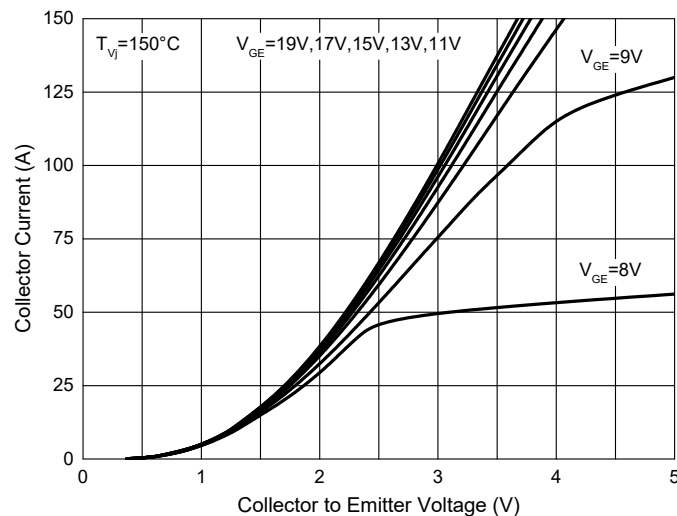


Fig. 3 - Typical Transfer Characteristic

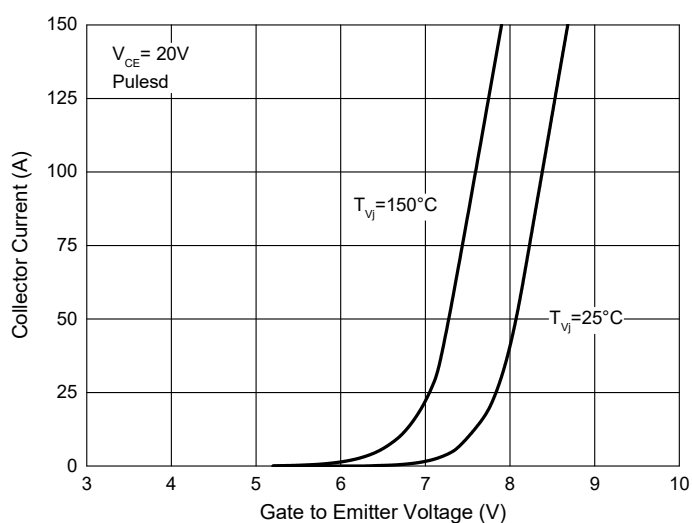


Fig. 4 - Typical Instantaneous Forward Characteristics

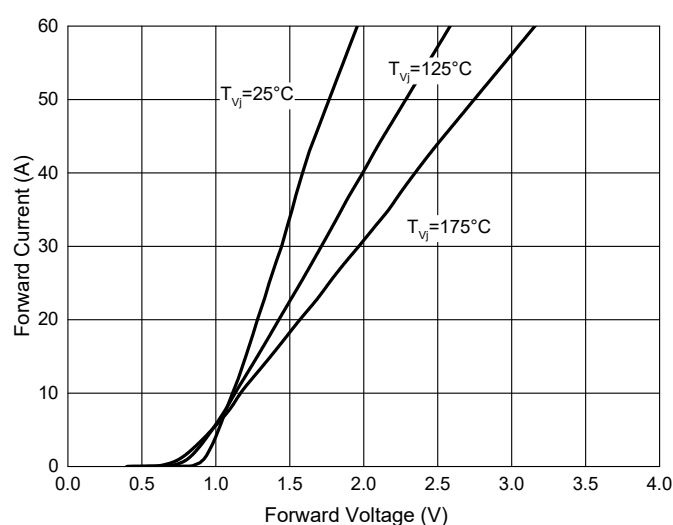


Fig. 5 -  $V_{GE(th)}$  vs Junction Temperature

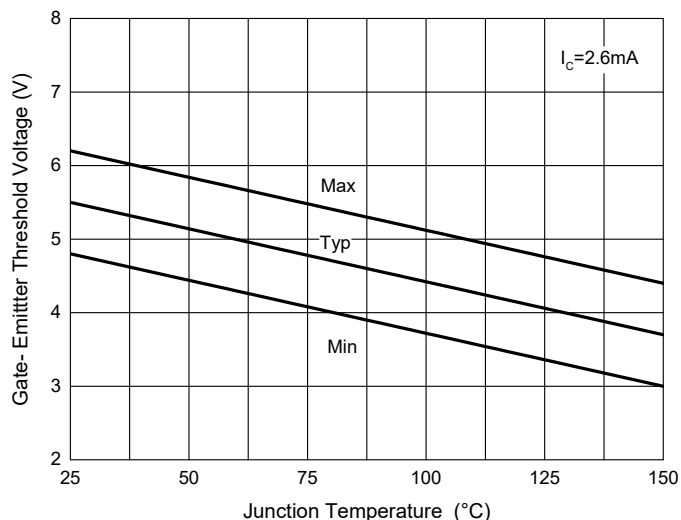
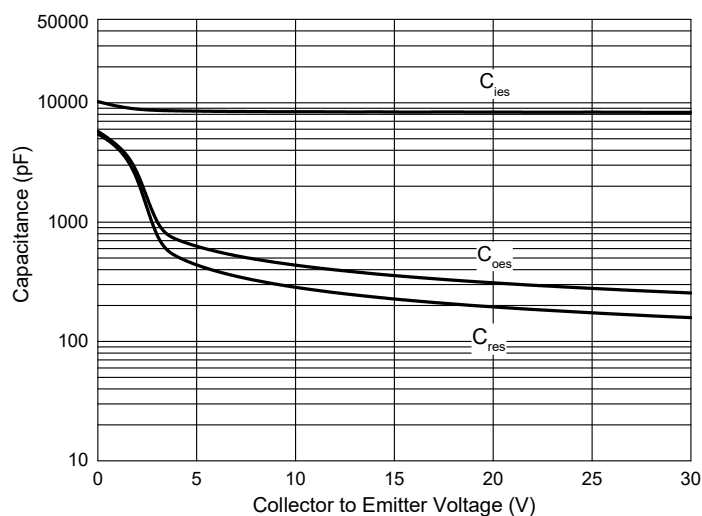


Fig. 6 - Capacitance Characteristics



## Curve Characteristics

Fig. 7 - IGBT Switching Loss vs  $I_C$

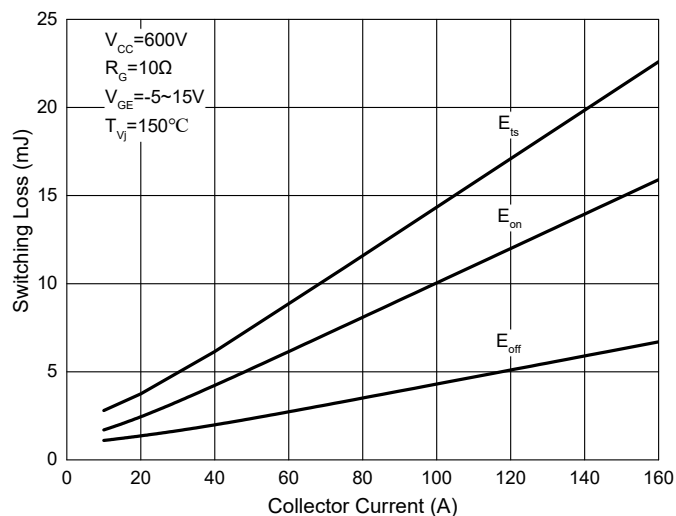


Fig. 8- IGBT Switching Loss vs  $R_g$

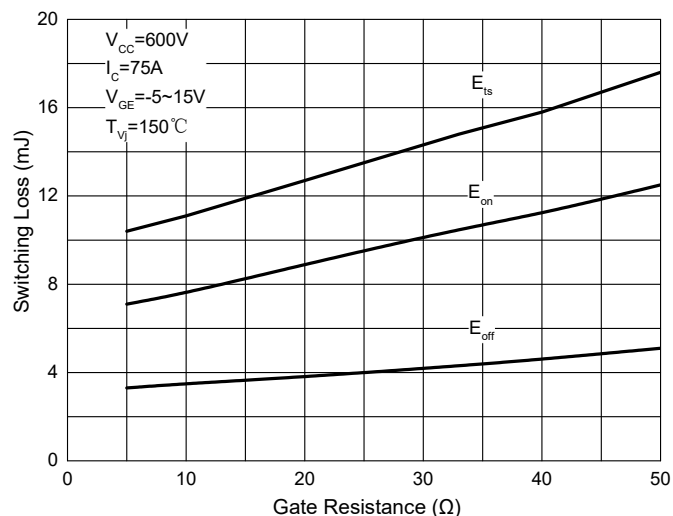


Fig. 9 - Switching Loss vs Junction Temperature

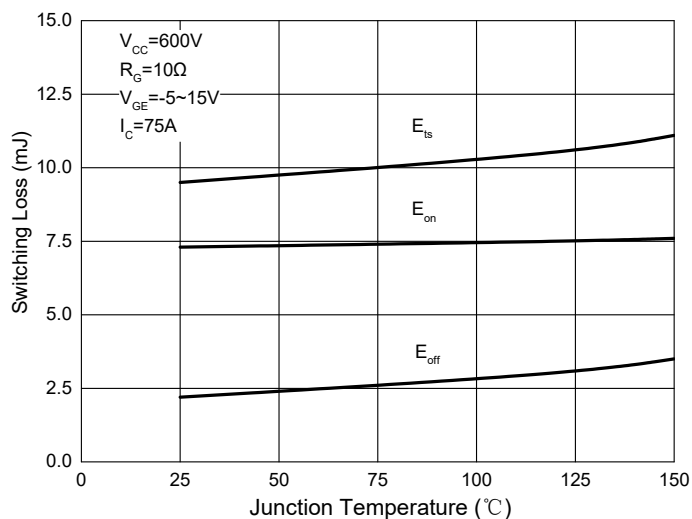


Fig. 10 - Switching Time vs Collect Current

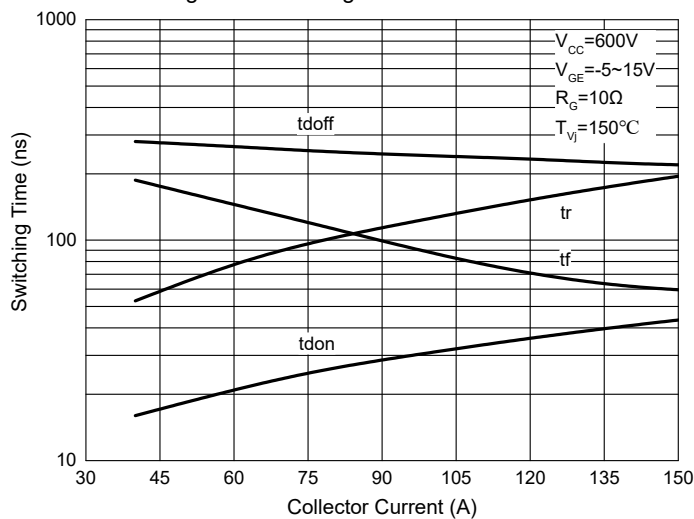


Fig. 11 - Switching Time vs Gate Resistance

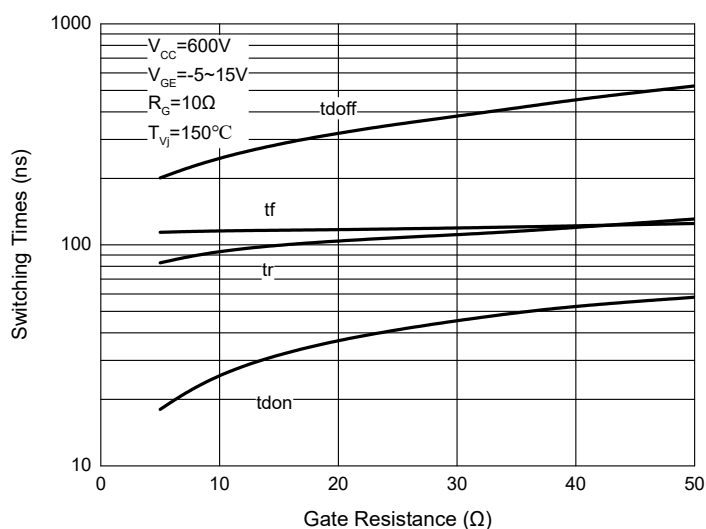
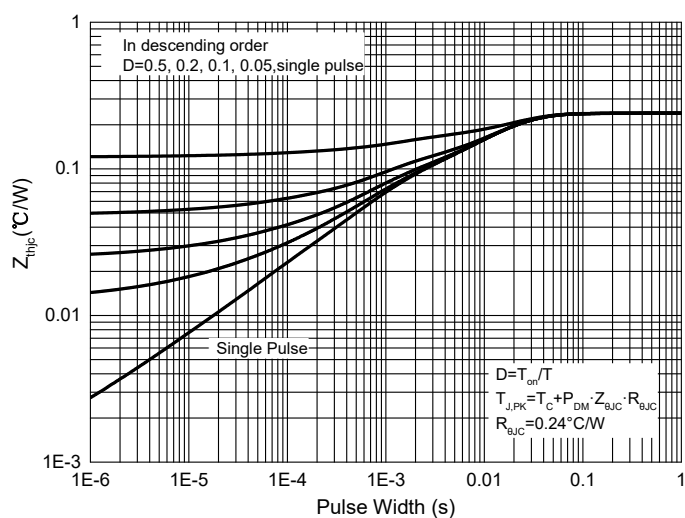


Fig. 12 - IGBT Transient Thermal Impedance



## Curve Characteristics

Fig. 13 - Diode Transient Thermal Impedance

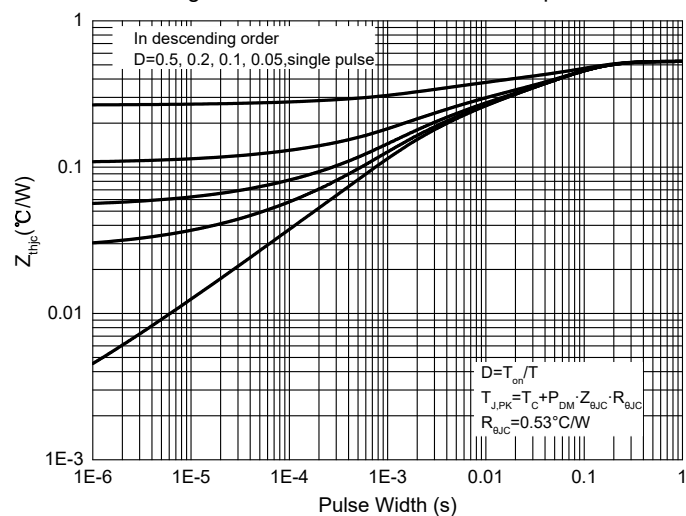


Fig. 14 - Collector Current vs Case Temperature

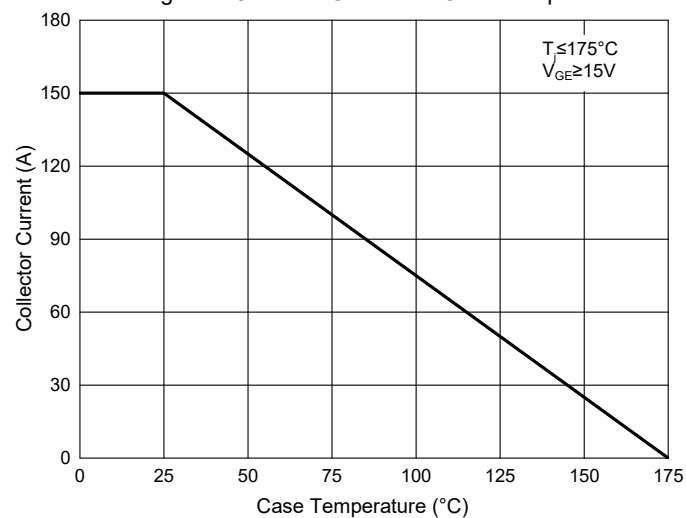
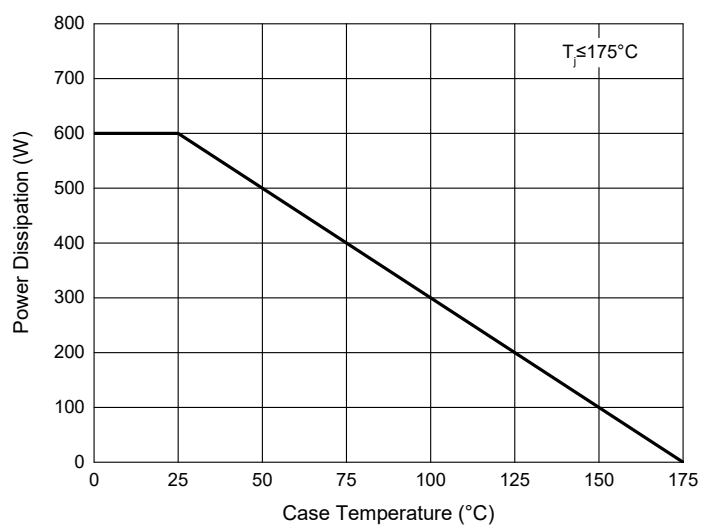


Fig. 15 - Power Derating



## Ordering Information

| Device         | Packing                       |
|----------------|-------------------------------|
| Part Number-BP | Tube: 30pcs/Tube, 1800pcs/Ctn |

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