

## Features

- AEC-Q101 Qualified
- High speed smooth switching device for hard & soft switching
- Positive Temperature Coefficient
- Maximum junction temperature 150 °C
- High ruggedness, temperature stable
- 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

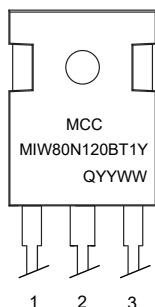
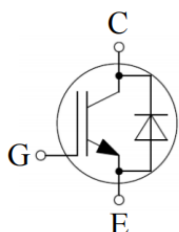
- PTC

| Parameter                                                                                | Symbol                    | Rating   | Unit |
|------------------------------------------------------------------------------------------|---------------------------|----------|------|
| Collector-Emitter Voltage                                                                | $V_{CE}$                  | 1200     | V    |
| DC Collector Current <sup>(3)</sup>                                                      | $T_C=25^{\circ}\text{C}$  | 160      | A    |
|                                                                                          | $T_C=100^{\circ}\text{C}$ | 80       |      |
| Pulsed Collector Current <sup>(4)</sup> , $V_{GE}=15\text{V}$                            | $I_{C,pluse}$             | 240      | A    |
| Diode Forward Current <sup>(3)</sup>                                                     | $T_C=25^{\circ}\text{C}$  | 80       | A    |
|                                                                                          | $T_C=100^{\circ}\text{C}$ | 40       |      |
| Diode Pulsed Current <sup>(4)</sup>                                                      | $I_{F,pluse}$             | 160      | 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>$V_{CE} \leq 1200\text{V}$ , $T_J = 150^{\circ}\text{C}$ |                           | 240      | A    |
| Power Dissipation                                                                        | $T_C=25^{\circ}\text{C}$  | $P_D$    | W    |
|                                                                                          | $T_J=150^{\circ}\text{C}$ |          |      |

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%

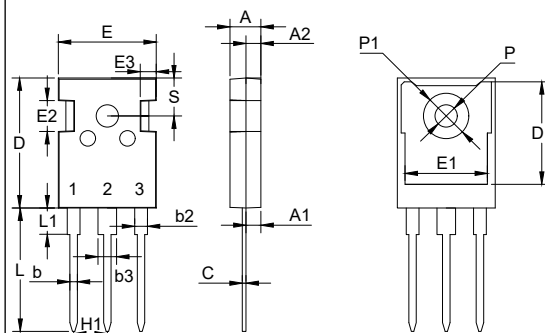
## Internal Structure



Device Code: MIW80N120BT1Y  
Date Code: QYYWW (Year & Week)

# Trench and Field Stop IGBT 1200V 80A

## TO-247AB



| DIM | INCHES |       | MM    |       | NOTE |
|-----|--------|-------|-------|-------|------|
|     | MIN    | MAX   | MIN   | MAX   |      |
| A   | 0.189  | 0.205 | 4.80  | 5.20  |      |
| A1  | 0.087  | 0.103 | 2.21  | 2.61  |      |
| A2  | 0.073  | 0.085 | 1.85  | 2.15  |      |
| b   | 0.039  | 0.055 | 1.00  | 1.40  |      |
| b2  | 0.075  | 0.087 | 1.91  | 2.21  |      |
| C   | 0.020  | 0.028 | 0.50  | 0.70  |      |
| D   | 0.815  | 0.839 | 20.70 | 21.30 |      |
| D1  | 0.640  | 0.663 | 16.25 | 16.85 |      |
| E   | 0.610  | 0.634 | 15.50 | 16.10 |      |
| E1  | 0.512  | 0.535 | 13.00 | 13.60 |      |
| E2  | 0.189  | 0.205 | 4.80  | 5.20  |      |
| E3  | 0.091  | 0.106 | 2.30  | 2.70  |      |
| L   | 0.772  | 0.796 | 19.62 | 20.22 |      |
| L1  | -      | 0.169 | -     | 4.30  |      |
| P   | 0.134  | 0.150 | 3.40  | 3.80  | Φ    |
| P1  |        | 0.287 | -     | 7.30  | Φ    |
| S   | 0.242  |       | 6.15  |       | TYP  |
| H1  | 0.214  |       | 5.44  |       | TYP  |
| b3  | 0.110  | 0.126 | 2.80  | 3.20  |      |

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

| Parameter                             | Symbol        | Test Conditions                                                                      | Min  | Typ  | Max       | Unit    |
|---------------------------------------|---------------|--------------------------------------------------------------------------------------|------|------|-----------|---------|
| <b>IGBT Static Characteristics</b>    |               |                                                                                      |      |      |           |         |
| Collector-Emitter Breakdown Voltage   | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=1mA$                                                                 | 1200 |      |           | V       |
| Collector-Emitter Saturation Voltage  | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=80A, T_J=25^{\circ}C$                                               | 1.45 | 1.75 | 2.30      | V       |
|                                       |               | $V_{GE}=15V, I_C=80A, T_J=125^{\circ}C$                                              |      | 2.15 |           |         |
|                                       |               | $V_{GE}=15V, I_C=80A, T_J=150^{\circ}C$                                              |      | 2.25 |           |         |
| G-E Threshold Voltage                 | $V_{GE(th)}$  | $I_C=2.6mA, V_{CE}=V_{GE}$                                                           | 5.35 | 6.0  | 6.7       | V       |
| C-E Leakage Current                   | $I_{CES}$     | $V_{CE}=1200V, V_{GE}=0V, T_J=25^{\circ}C$                                           |      |      | 0.25      | mA      |
|                                       |               | $V_{CE}=1200V, V_{GE}=0V, T_J=150^{\circ}C$                                          |      |      | 1.00      |         |
| G-E Leakage Current                   | $I_{GES}$     | $V_{CE}=0V, V_{GE}=\pm 20V$                                                          |      |      | $\pm 100$ | nA      |
| <b>Dynamic Characteristics</b>        |               |                                                                                      |      |      |           |         |
| Input Capacitance                     | $C_{ies}$     | $V_{CE}=25V, V_{GE}=0V, f=1MHz$                                                      |      | 7.95 |           | nF      |
| Reverse Transfer Capacitance          | $C_{res}$     |                                                                                      |      | 0.19 |           |         |
| Gate Charge                           | $Q_g$         | $V_{CC}=960V, I_C=80A, V_{GE}=15V$                                                   |      | 0.65 |           | $\mu C$ |
| <b>IGBT Switching Characteristics</b> |               |                                                                                      |      |      |           |         |
| Turn-On Delay Time                    | $td_{(on)}$   | $V_{CC}=600V, I_C=80A,$<br>$V_{GE}=-5V\sim 15V,$<br>$R_G=10\Omega, T_J=25^{\circ}C$  |      | 33   |           | ns      |
| Rise Time                             | $t_r$         |                                                                                      |      | 85   |           |         |
| Turn-Off Delay Time                   | $td_{(off)}$  |                                                                                      |      | 231  |           |         |
| Fall Time                             | $t_f$         |                                                                                      |      | 174  |           |         |
| Turn-On Energy                        | $E_{on}$      | $V_{CC}=600V, I_C=80A,$<br>$V_{GE}=-5V\sim 15V,$<br>$R_G=10\Omega, T_J=25^{\circ}C$  |      | 7.5  |           | mJ      |
| Turn-Off Energy                       | $E_{off}$     |                                                                                      |      | 4.6  |           |         |
| Turn-On Delay Time                    | $td_{(on)}$   |                                                                                      |      | 30   |           | ns      |
| Rise Time                             | $t_r$         |                                                                                      |      | 79   |           |         |
| Turn-Off Delay Time                   | $td_{(off)}$  |                                                                                      |      | 243  |           |         |
| Fall Time                             | $t_f$         |                                                                                      |      | 263  |           |         |
| Turn-On Energy                        | $E_{on}$      | $V_{CC}=600V, I_C=80A,$<br>$V_{GE}=-5V\sim 15V,$<br>$R_G=10\Omega, T_J=125^{\circ}C$ |      | 7.8  |           | mJ      |
| Turn-Off Energy                       | $E_{off}$     |                                                                                      |      | 5.5  |           |         |
| Turn-On Delay Time                    | $td_{(on)}$   |                                                                                      |      | 28   |           | ns      |
| Rise Time                             | $t_r$         |                                                                                      |      | 74   |           |         |
| Turn-Off Delay Time                   | $td_{(off)}$  |                                                                                      |      | 252  |           |         |
| Fall Time                             | $t_f$         |                                                                                      |      | 325  |           |         |
| Turn-On Energy                        | $E_{on}$      | $V_{CC}=600V, I_C=80A,$<br>$V_{GE}=-5V\sim 15V,$<br>$R_G=10\Omega, T_J=150^{\circ}C$ |      | 8.0  |           | mJ      |
| Turn-Off Energy                       | $E_{off}$     |                                                                                      |      | 6.2  |           |         |

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

| Parameter                    | Symbol    | Test Conditions                                            | Min | Typ  | Max | Unit    |
|------------------------------|-----------|------------------------------------------------------------|-----|------|-----|---------|
| <b>Diode Characteristics</b> |           |                                                            |     |      |     |         |
| Diode Forward Voltage        | $V_F$     | $V_{GE}=0V, I_F=40A, T_J=25^{\circ}C$                      | 1.6 | 2.0  | 2.6 | V       |
|                              |           | $V_{GE}=0V, I_F=40A, T_J=125^{\circ}C$                     |     | 1.80 |     |         |
|                              |           | $V_{GE}=0V, I_F=40A, T_J=150^{\circ}C$                     |     | 1.70 |     |         |
| Reverse Recovery Current     | $I_{rr}$  | $V_R=600V, I_F=40A, di_F/dt=-520A/\mu s, T_J=25^{\circ}C$  |     | 14   |     | A       |
| Diode Reverse Recovery Time  | $t_{rr}$  |                                                            |     | 439  |     | ns      |
| Reverse Recovery Charge      | $Q_{rr}$  |                                                            |     | 2.55 |     | $\mu C$ |
| Reverse Recovery Energy      | $E_{rec}$ |                                                            |     | 0.92 |     | mJ      |
| Reverse Recovery Current     | $I_{rr}$  | $V_R=600V, I_F=40A, di_F/dt=-520A/\mu s, T_J=125^{\circ}C$ |     | 18   |     | A       |
| Diode Reverse Recovery Time  | $t_{rr}$  |                                                            |     | 628  |     | ns      |
| Reverse Recovery Charge      | $Q_{rr}$  |                                                            |     | 6.33 |     | $\mu C$ |
| Reverse Recovery Energy      | $E_{rec}$ |                                                            |     | 2.05 |     | mJ      |
| Reverse Recovery Current     | $I_{rr}$  | $V_R=600V, I_F=40A, di_F/dt=-520A/\mu s, T_J=150^{\circ}C$ |     | 20   |     | A       |
| Diode Reverse Recovery Time  | $t_{rr}$  |                                                            |     | 773  |     | ns      |
| Reverse Recovery Charge      | $Q_{rr}$  |                                                            |     | 7.05 |     | $\mu C$ |
| Reverse Recovery Energy      | $E_{rec}$ |                                                            |     | 2.25 |     | mJ      |

**Thermal characteristics**

| Parameter                                        | Symbol         | Min | Typ | Max  | Units         |
|--------------------------------------------------|----------------|-----|-----|------|---------------|
| Operating Junction Temperature Range             | $T_J$          | -40 |     | 150  | $^{\circ}C$   |
| Storage Temperature Range                        | $T_{stg}$      | -55 |     | 150  | $^{\circ}C$   |
| Thermal Resistance from Junction to Case (IGBT)  | $R_{th_{J-C}}$ |     |     | 0.24 | $^{\circ}C/W$ |
| Thermal Resistance from Junction to Case (Diode) | $R_{th_{J-C}}$ |     |     | 0.65 | $^{\circ}C/W$ |
| Thermal Resistance from Junction to Ambient      | $R_{th_{J-A}}$ |     |     | 40   | $^{\circ}C/W$ |

## Curve Characteristics

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

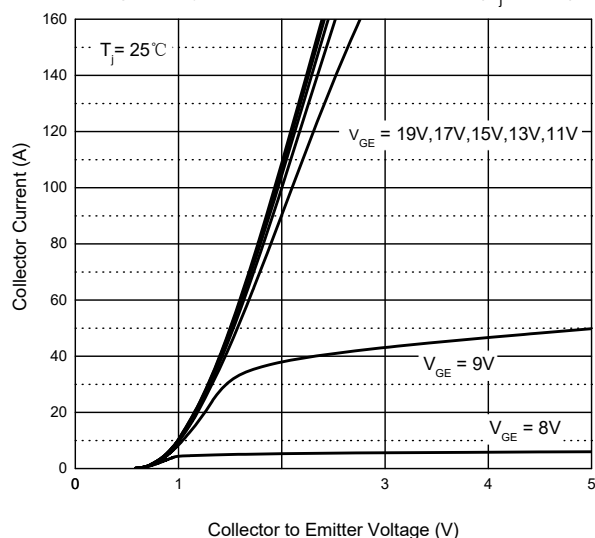


Fig. 2 - Typical Output Characteristic ( $T_J = 150^\circ\text{C}$ )

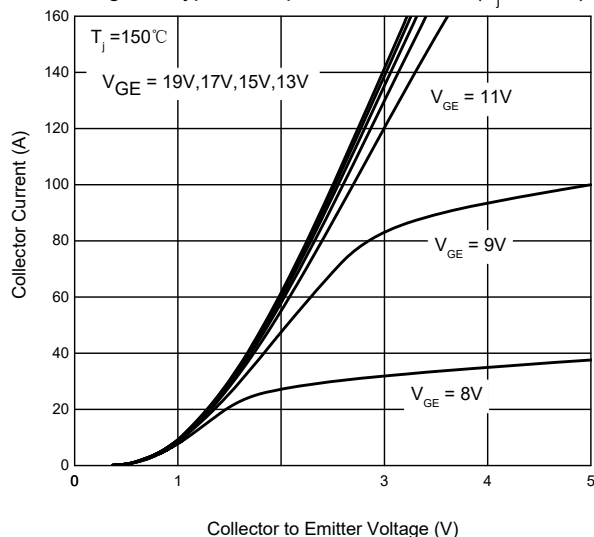


Fig. 3 - Typical Transfer Characteristic

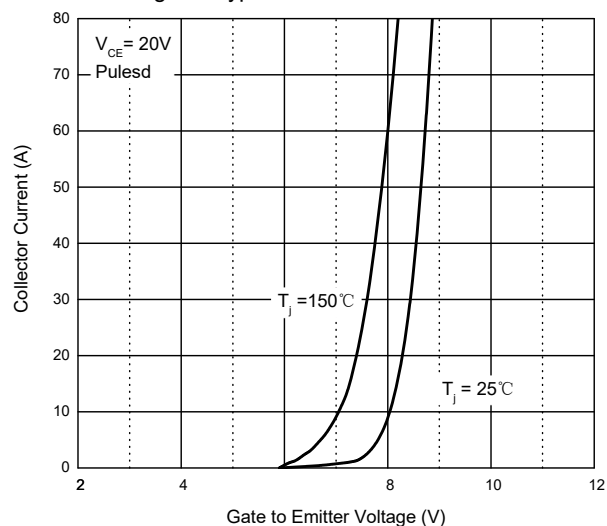


Fig. 4 - Diode Forward Current vs. Forward Voltage

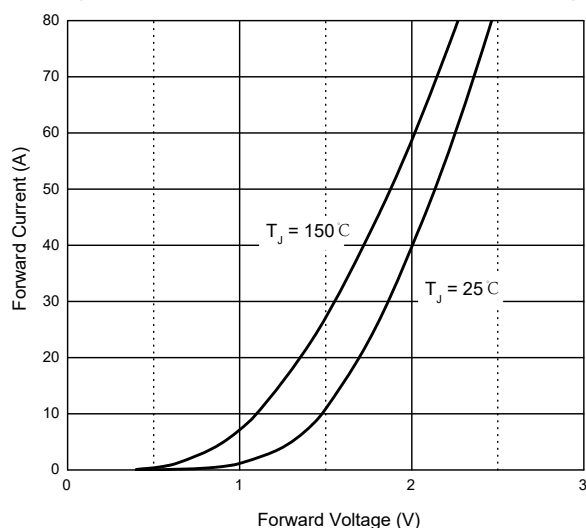


Fig. 5 - Capacitance Characteristics

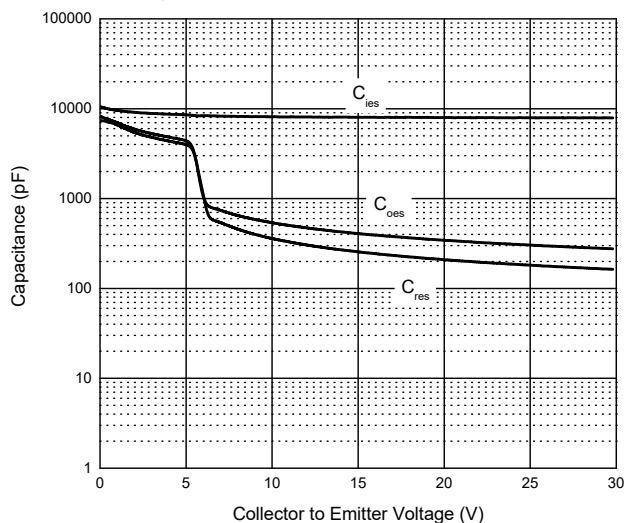
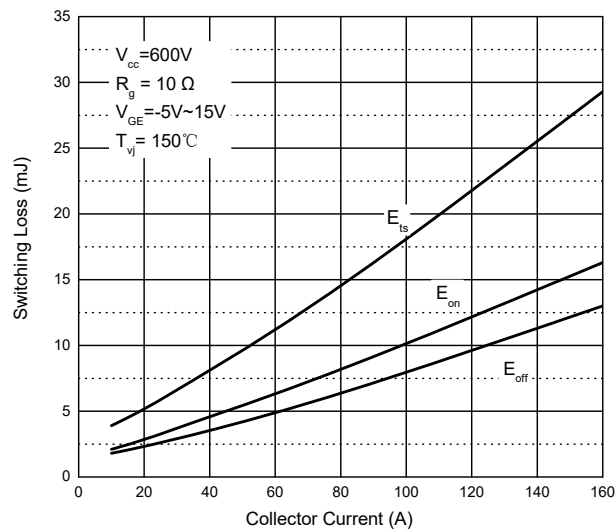


Fig. 6 - IGBT Switching Loss vs.  $I_C$



## Curve Characteristics

Fig. 7- IGBT Switching Loss vs.  $R_g$

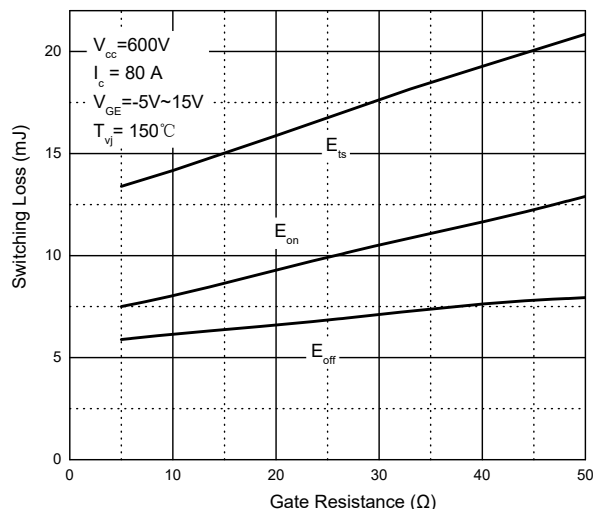


Fig. 8 -IGBT Switching Loss vs. Junction Temperature

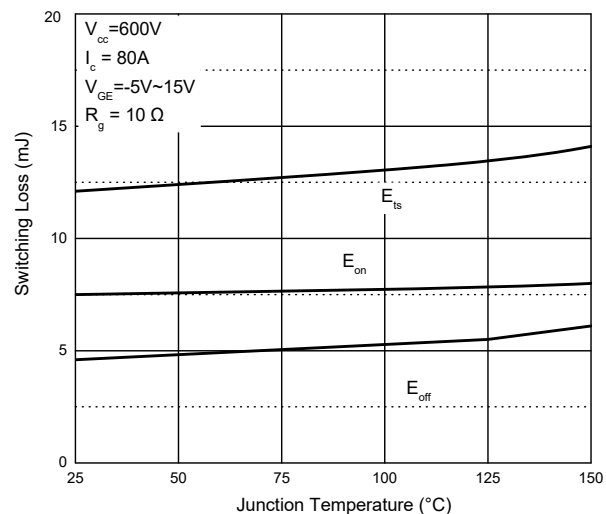


Fig. 9  $V_{GE(th)}$  vs. Junction Temperature

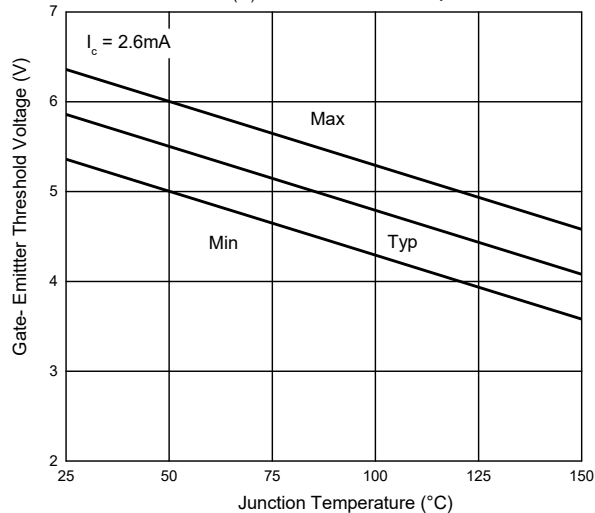


Fig. 10 - Switching Time vs. Collect Current

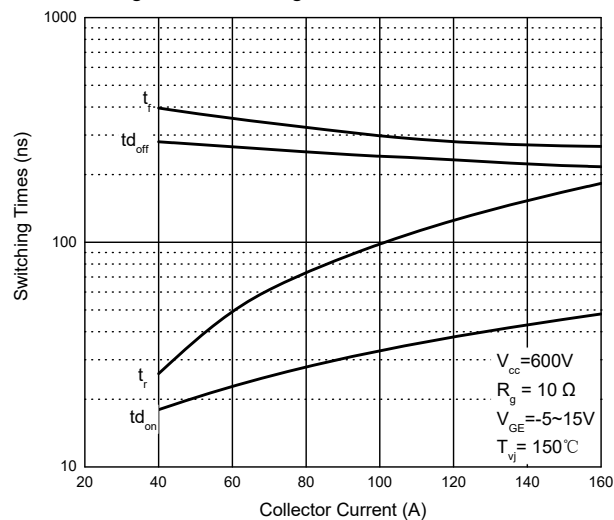


Fig. 11 - Switching Time vs. Gate Resistance

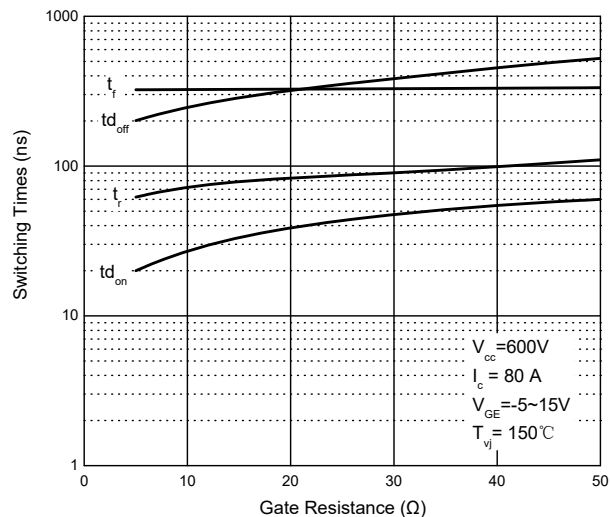
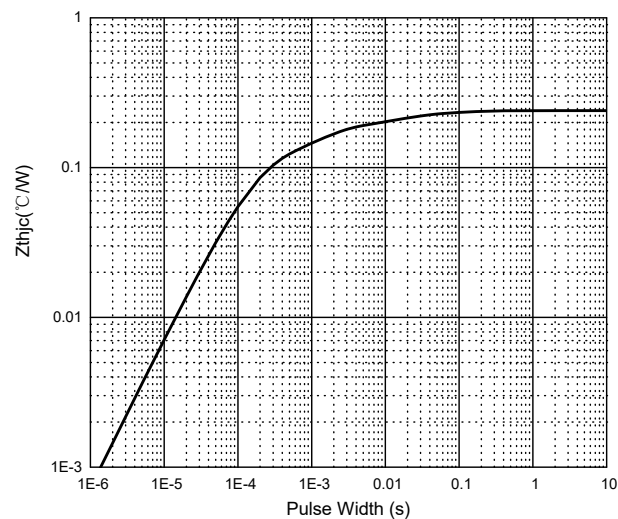


Fig. 12 - IGBT Transient Thermal Impedance



## Curve Characteristics

Fig. 13 - Diode Transient Thermal Impedance

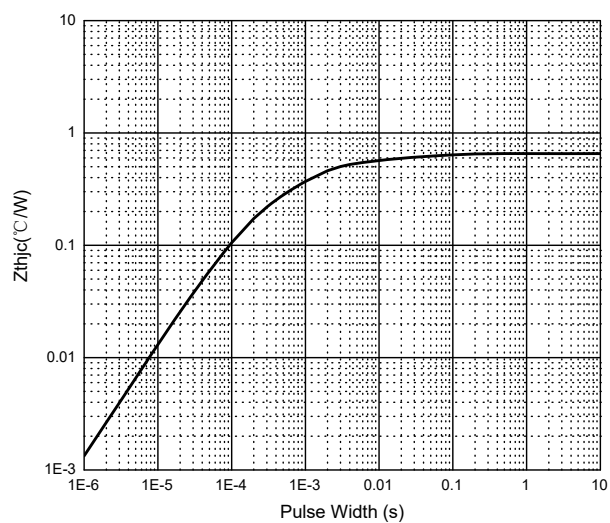


Fig. 14 - Collector Current vs. Case Temperature

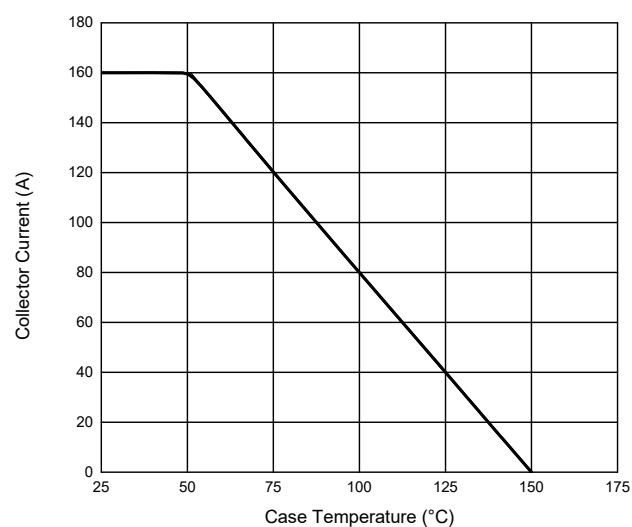
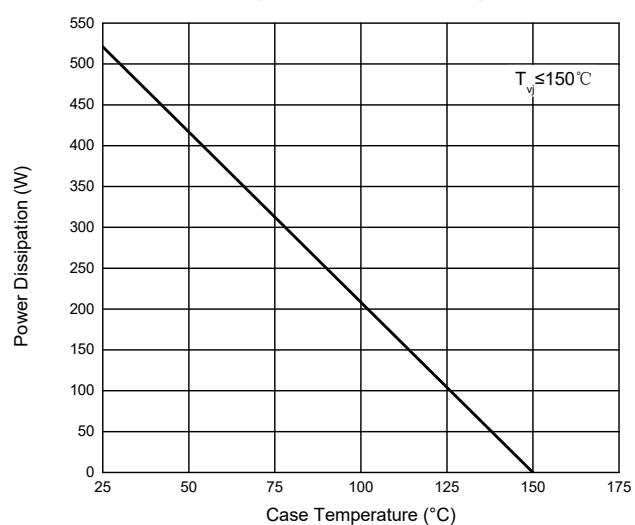


Fig. 15 - Power Derating



## Ordering Information

| Device          | Packing                                   |
|-----------------|-------------------------------------------|
| Part Number -BP | Tube: 30pcs/Tube, 360pcs/Box, 1800pcs/Ctn |

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