

Features

- Low switching losses, High ruggedness, temperature stable
- Maximum Junction Temperature 175 °C
- Positive Temperature Coefficient
- Moisture Sensitivity Level 1
- High short circuit capability (5us)
- 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

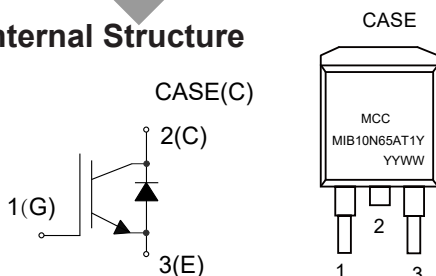
Maximum Ratings

| Parameter | Symbol | Rating | Unit |
|---|---------------|-------------------------|---------------|
| Collector-Emitter Voltage | V_{CE} | 650 | V |
| DC Collector Current ⁽³⁾ | I_C | $T_C=25^\circ\text{C}$ | 20 |
| | | $T_C=100^\circ\text{C}$ | 10 |
| Pulsed Collector Current ⁽⁴⁾ , $V_{GE}=15\text{V}$ | $I_{C,pluse}$ | 30 | A |
| Diode Forward Current ⁽³⁾ | I_F | $T_C=25^\circ\text{C}$ | 20 |
| | | $T_C=100^\circ\text{C}$ | 10 |
| Diode Pulsed Current ⁽⁴⁾ | $I_{F,pluse}$ | 30 | A |
| Continuous Gate-Emitter Voltage | V_{GE} | ± 20 | V |
| Transient Gate-Emitter Voltage ⁽⁵⁾ | | ± 30 | |
| Turn off Safe Operation Area, $T_J \leq 150^\circ\text{C}$ $V_{CE} \leq 650\text{V}$ | | 30 | A |
| Short Circuit Withstand Time ⁽⁶⁾ | T_{SC} | 5 | μs |
| Power Dissipation, $T_C=25^\circ\text{C}$, $T_J=175^\circ\text{C}$ | P_D | 115 | W |

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%
6. $V_{GE}=15\text{V}$, $V_{CEM} \leq 650\text{V}$, $V_{cc}=400\text{V}$

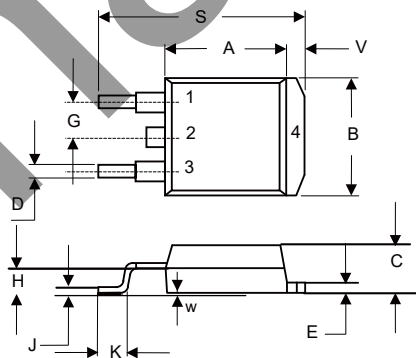
Internal Structure



Device Code: MIB10N65AT1Y
Date Code: YYWW (Year & Week)

Trench and Field Stop IGBT 650V 10A

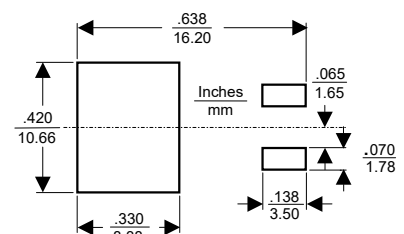
D2-PAK



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 | 0.010 | | 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 |
|---------------------------------------|---------------|---|-----|------|-----------|---------|
| IGBT Static Characteristics | | | | | | |
| Collector-Emitter Breakdown Voltage | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=1mA$ | 650 | | | V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=10A, T_j=25^\circ C$ | | 1.65 | 2.15 | V |
| | | $V_{GE}=15V, I_C=10A, T_j=125^\circ C$ | | 1.80 | | |
| | | $V_{GE}=15V, I_C=10A, T_j=150^\circ C$ | | 1.85 | | |
| G-E Threshold Voltage | $V_{GE(th)}$ | $I_C=250\mu A, V_{CE}=V_{GE}$ | 4.0 | 5.5 | 6.5 | V |
| C-E Leakage Current | I_{CES} | $V_{CE}=650V, V_{GE}=0V, T_j=25^\circ C$ | | | 0.25 | mA |
| | | $V_{CE}=650V, V_{GE}=0V, T_j=150^\circ C$ | | | 5 | |
| G-E Leakage Current | I_{GES} | $V_{CE}=0V, V_{GE}=\pm 20V$ | | | ± 200 | nA |
| Dynamic Characteristics | | | | | | |
| Input Capacitance | C_{ies} | $V_{CE}=25V, V_{GE}=0V, f=1MHz$ | | 0.56 | | nF |
| Reverse Transfer Capacitance | C_{res} | | | | 0.01 | |
| Gate Charge | Q_G | $V_{CC}=400V, I_C=10A, V_{GE}=15V$ | | 0.06 | | μC |
| IGBT Switching Characteristics | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CC}=400V, I_C=10A, V_{GE}=-5V\sim 15V, R_G=10\Omega, T_j=25^\circ C$ | | 7 | | ns |
| Rise Time | t_r | | | 17 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 23 | | |
| Fall Time | t_f | | | 106 | | mJ |
| Turn-On Energy | E_{on} | | | 0.19 | | |
| Turn-Off Energy | E_{off} | | | 0.17 | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CC}=400V, I_C=10A, V_{GE}=-5V\sim 15V, R_G=10\Omega, T_j=125^\circ C$ | | 6 | | ns |
| Rise Time | t_r | | | 18 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 28 | | |
| Fall Time | t_f | | | 161 | | mJ |
| Turn-On Energy | E_{on} | | | 0.21 | | |
| Turn-Off Energy | E_{off} | | | 0.25 | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CC}=400V, I_C=10A, V_{GE}=-5V\sim 15V, R_G=10\Omega, T_j=150^\circ C$ | | 6 | | ns |
| Rise Time | t_r | | | 18 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 31 | | |
| Fall Time | t_f | | | 189 | | mJ |
| Turn-On Energy | E_{on} | | | 0.23 | | |
| Turn-Off Energy | E_{off} | | | 0.3 | | |

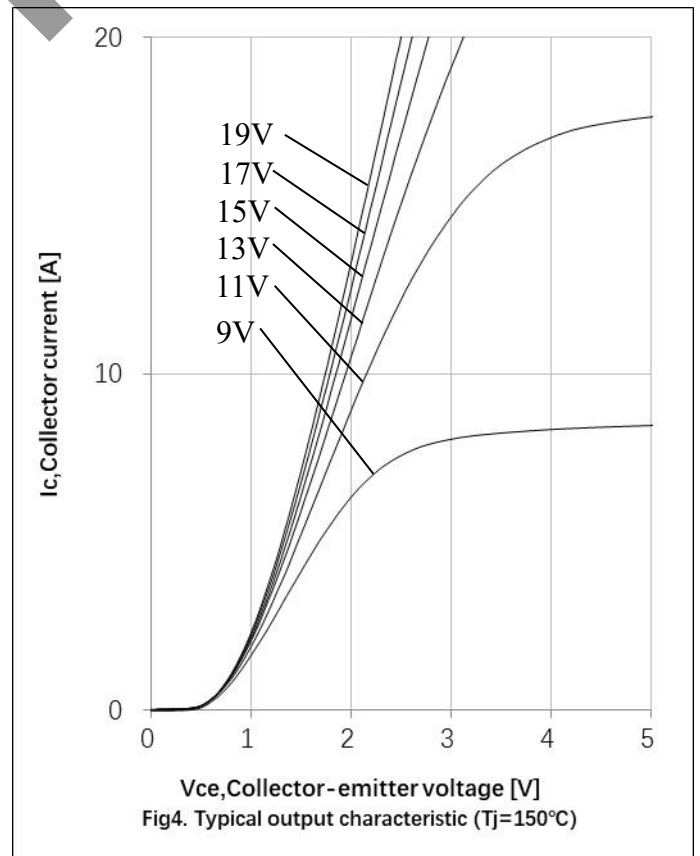
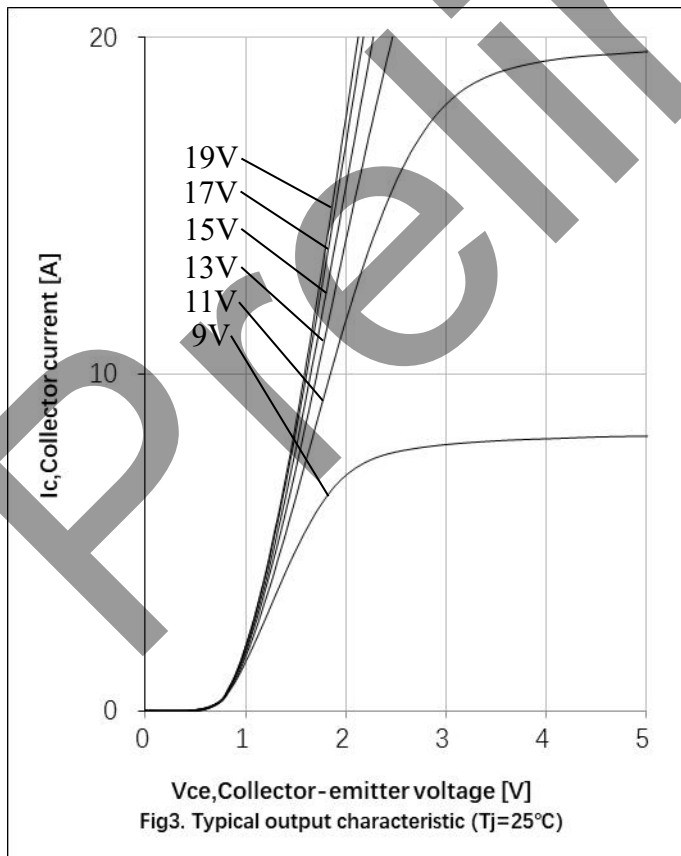
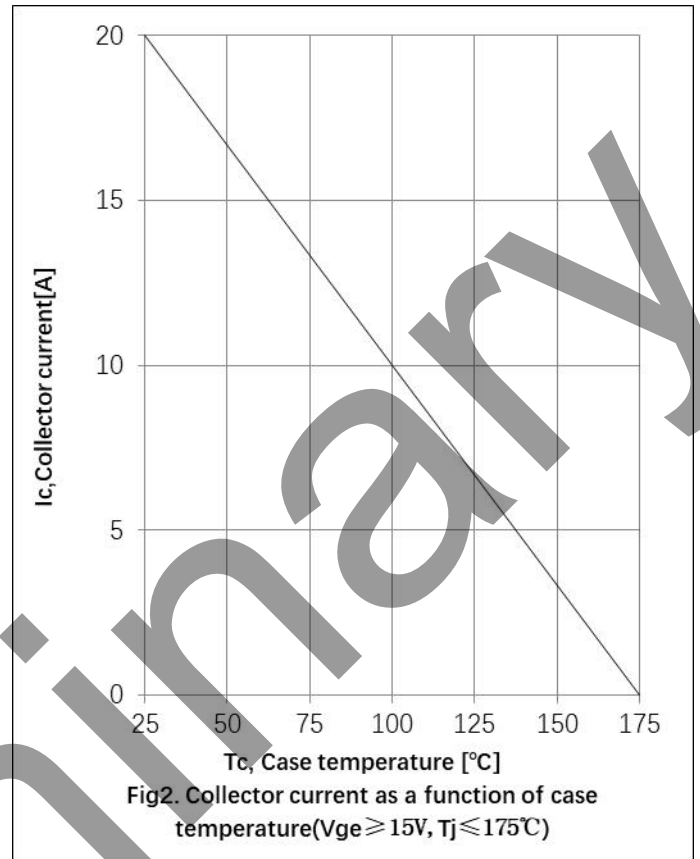
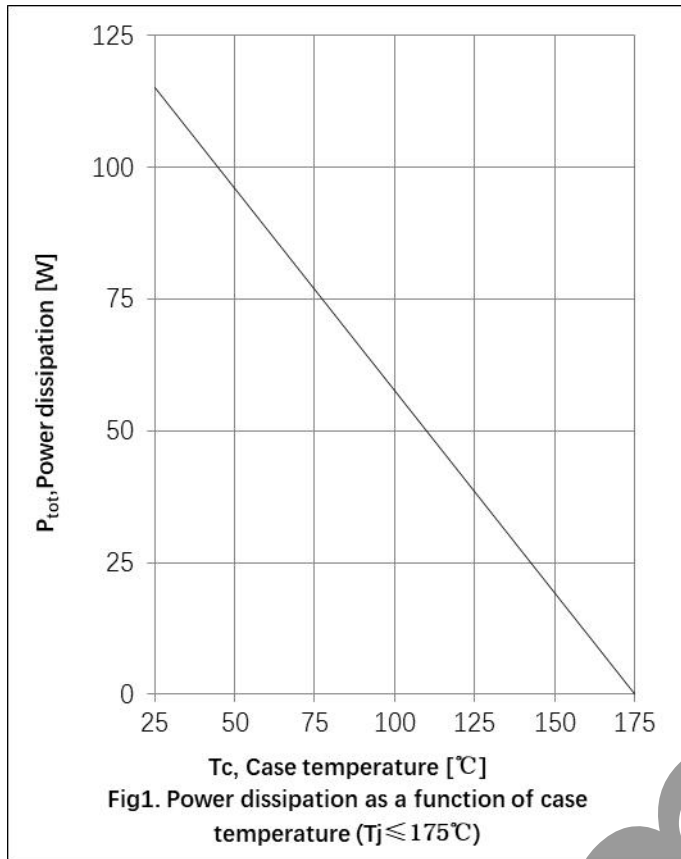
Electrical Characteristics @ 25°C (Unless Otherwise Specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|------------------------------|-----------|--|-----|------|------|---------|
| Diode Characteristics | | | | | | |
| Diode Forward Voltage | V_F | $V_{GE}=0V, I_F=30A, T_j=25^\circ C$ | | 1.50 | 2.00 | V |
| | | $V_{GE}=0V, I_F=30A, T_j=125^\circ C$ | | 1.40 | | |
| | | $V_{GE}=0V, I_F=30A, T_j=150^\circ C$ | | 1.35 | | |
| Reverse Recovery Current | I_{rr} | | | 9 | | A |
| Diode Reverse Recovery Time | t_{rr} | $V_R=400V, I_F=10A,$ $di_F/dt=-320A/\mu s, T_j=25^\circ C$ | | 81 | | ns |
| Reverse Recovery Charge | Q_{rr} | | | 0.33 | | μC |
| Reverse Recovery Energy | E_{rec} | | | 0.06 | | mJ |
| Reverse Recovery Current | I_{rr} | | | 11 | | A |
| Diode Reverse Recovery Time | t_{rr} | $V_R=400V, I_F=10A,$ $di_F/dt=-320A/\mu s, T_j=125^\circ C$ | | 99 | | ns |
| Reverse Recovery Charge | Q_{rr} | | | 0.52 | | μC |
| Reverse Recovery Energy | E_{rec} | | | 0.14 | | mJ |
| Reverse Recovery Current | I_{rr} | | | 12 | | A |
| Diode Reverse Recovery Time | t_{rr} | $V_R=400V, I_F=10A,$ $di_F/dt=-320A/\mu s, T_j=150^\circ C$ | | 106 | | ns |
| Reverse Recovery Charge | Q_{rr} | | | 0.77 | | μC |
| Reverse Recovery Energy | E_{rec} | | | 0.17 | | mJ |

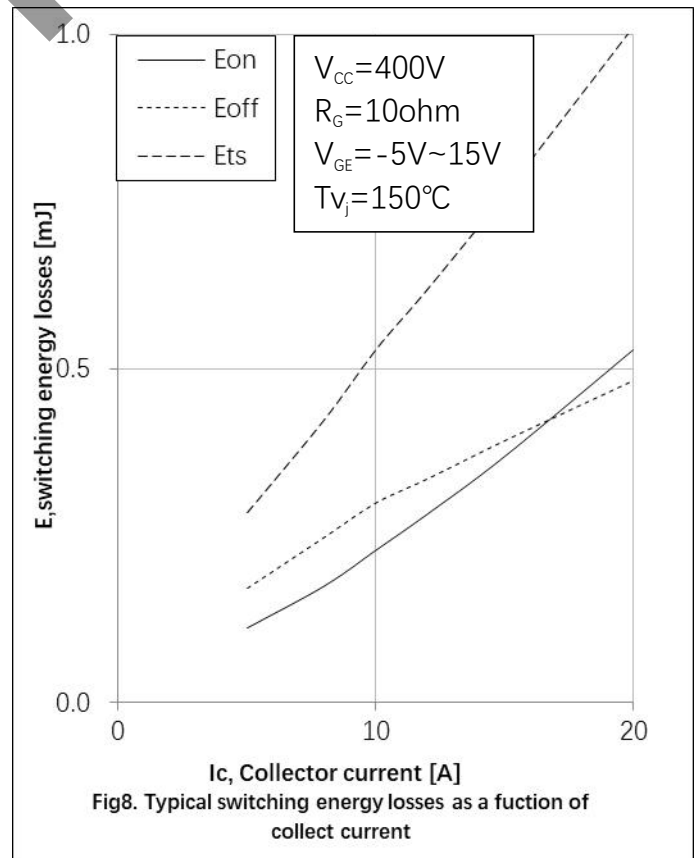
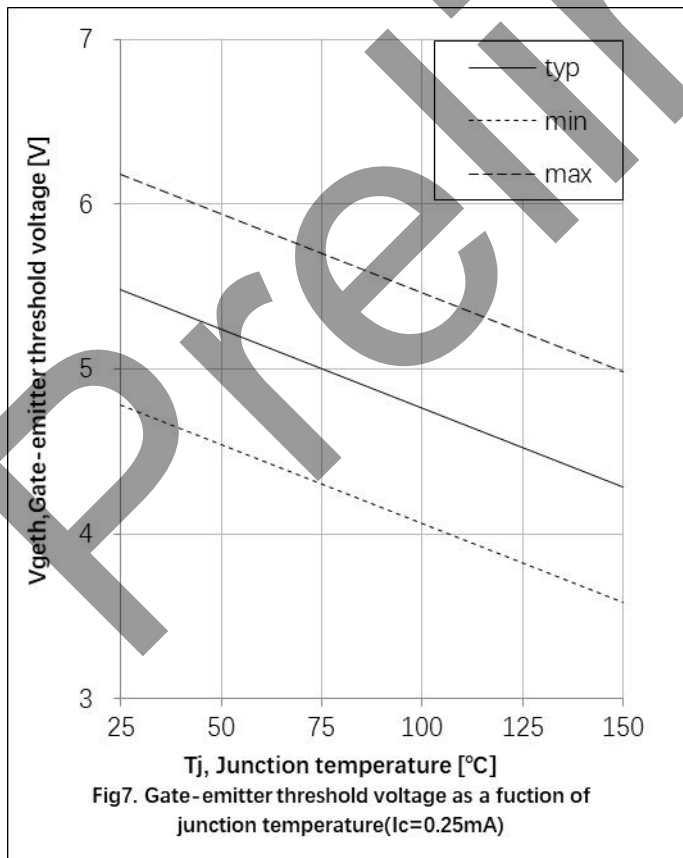
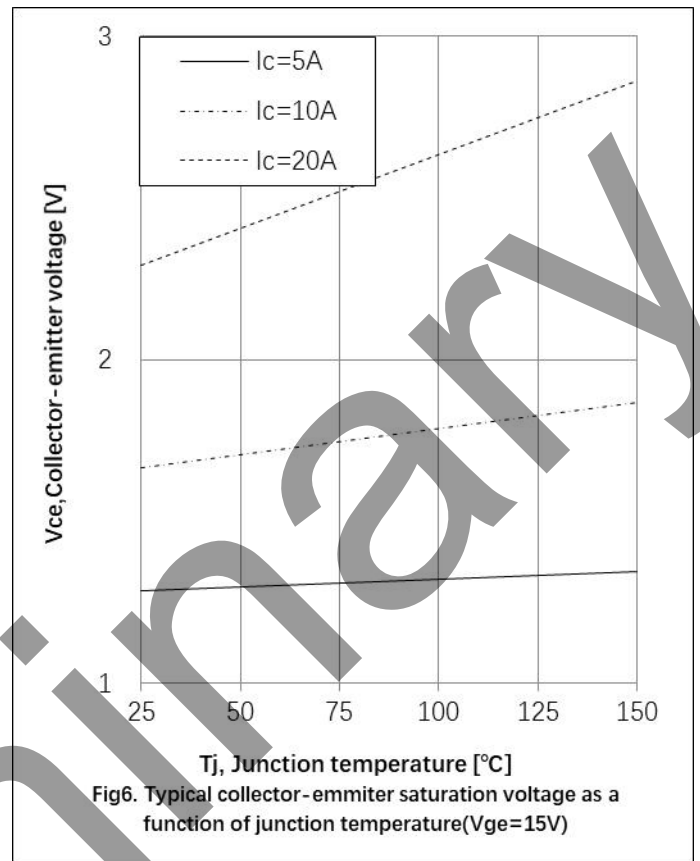
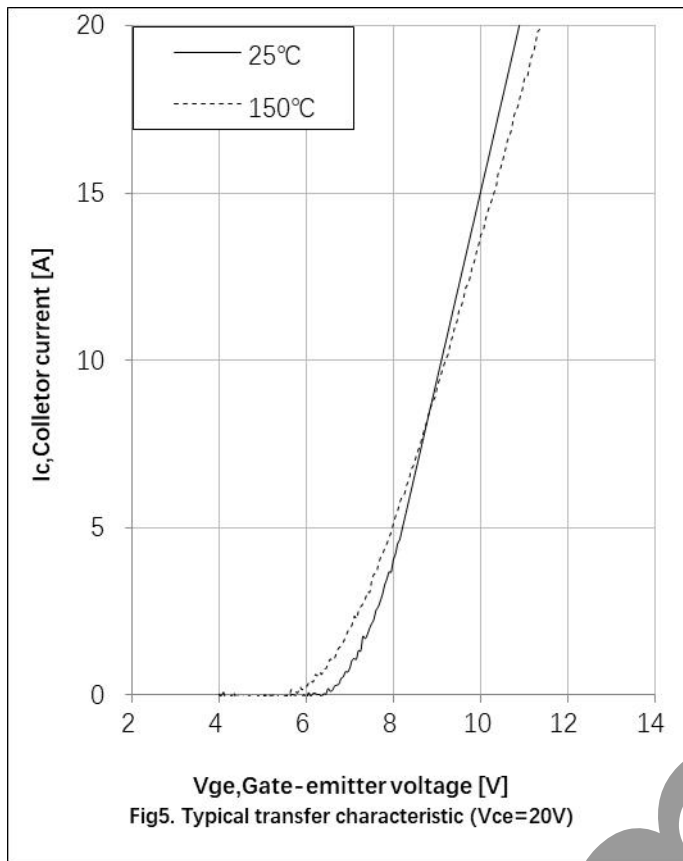
Thermal characteristics

| 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) | $R_{th_{J-C}}$ | | | 1.3 | $^\circ C/W$ |
| Thermal Resistance from Junction to Case (Diode) | $R_{th_{J-C}}$ | | | 1.5 | $^\circ C/W$ |
| Thermal Resistance from Junction to Ambient | $R_{th_{J-A}}$ | | | 40 | $^\circ C/W$ |

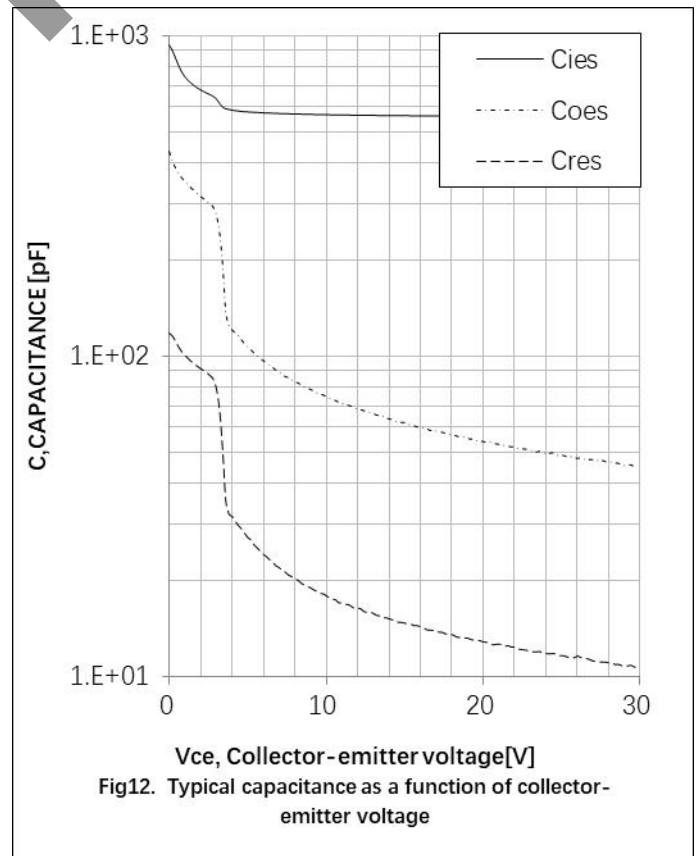
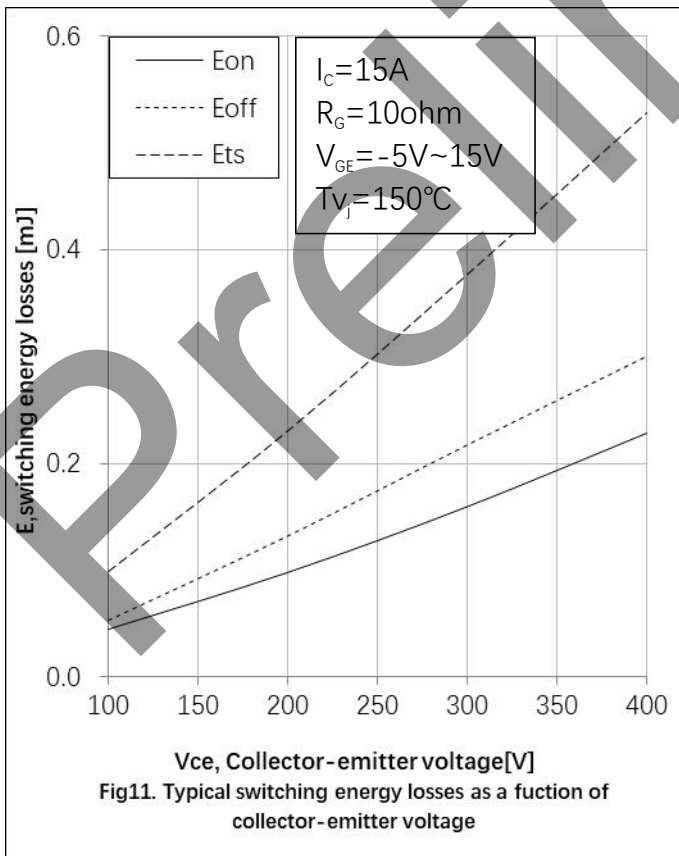
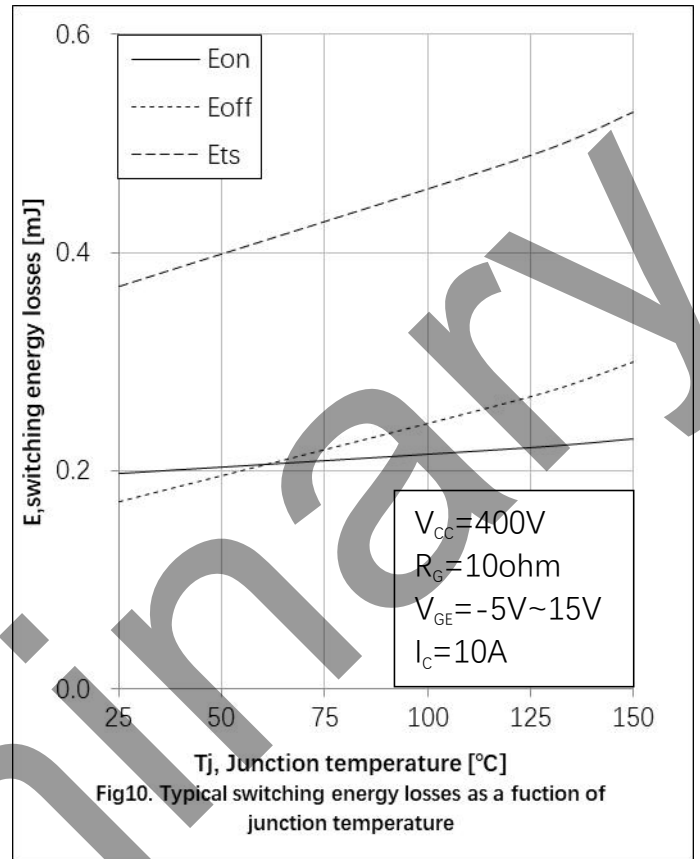
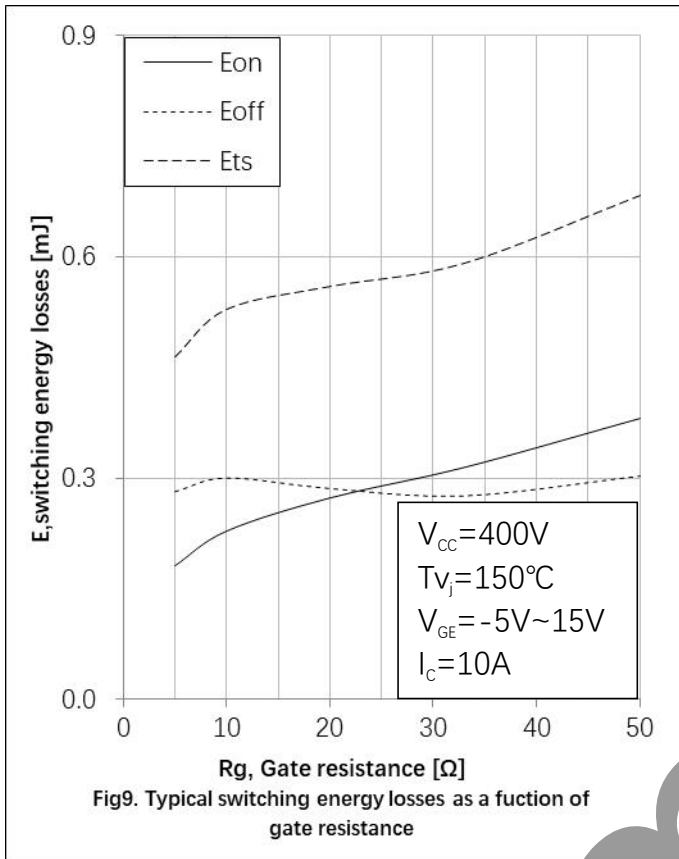
Curve Characteristics



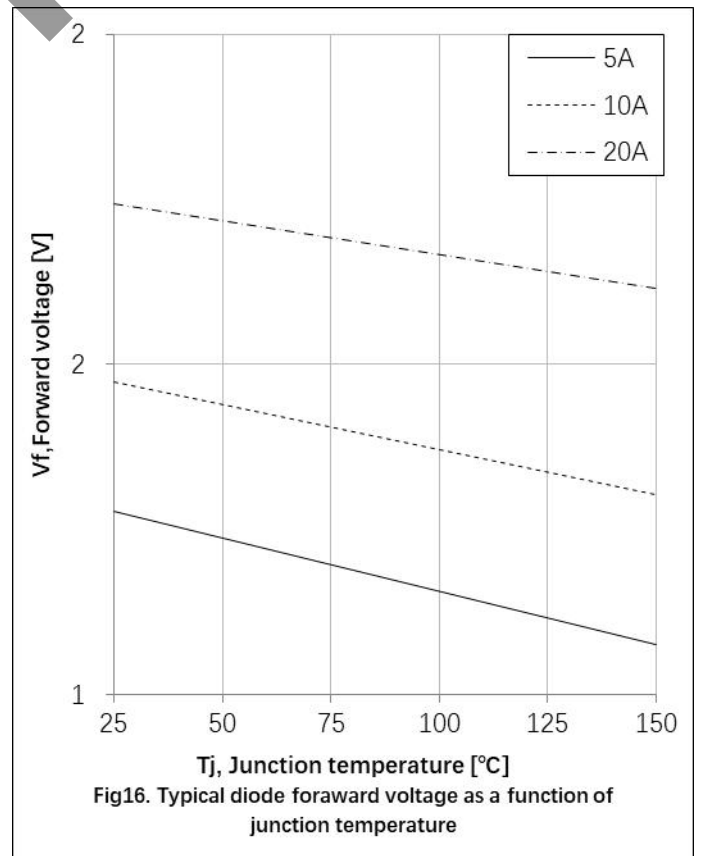
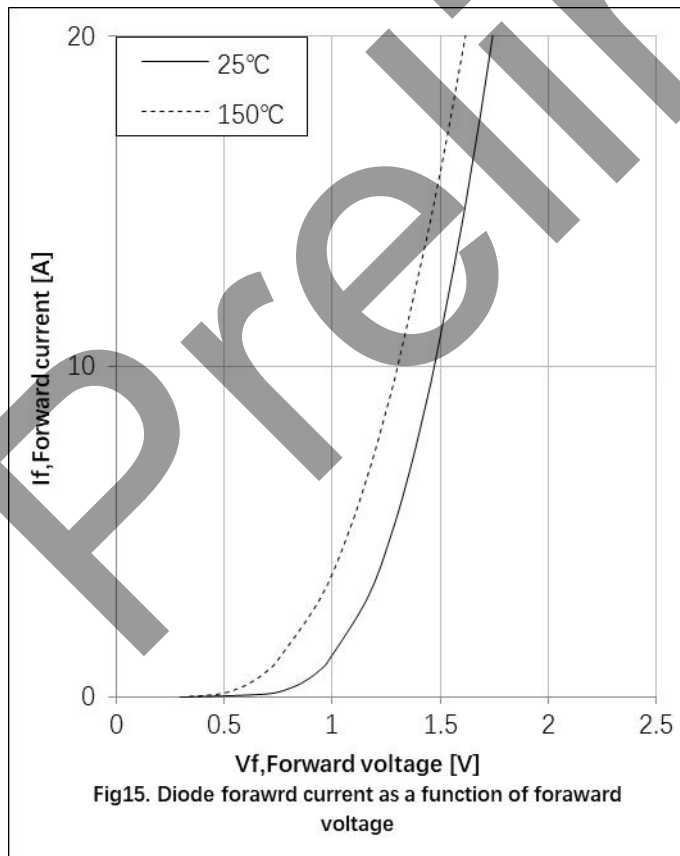
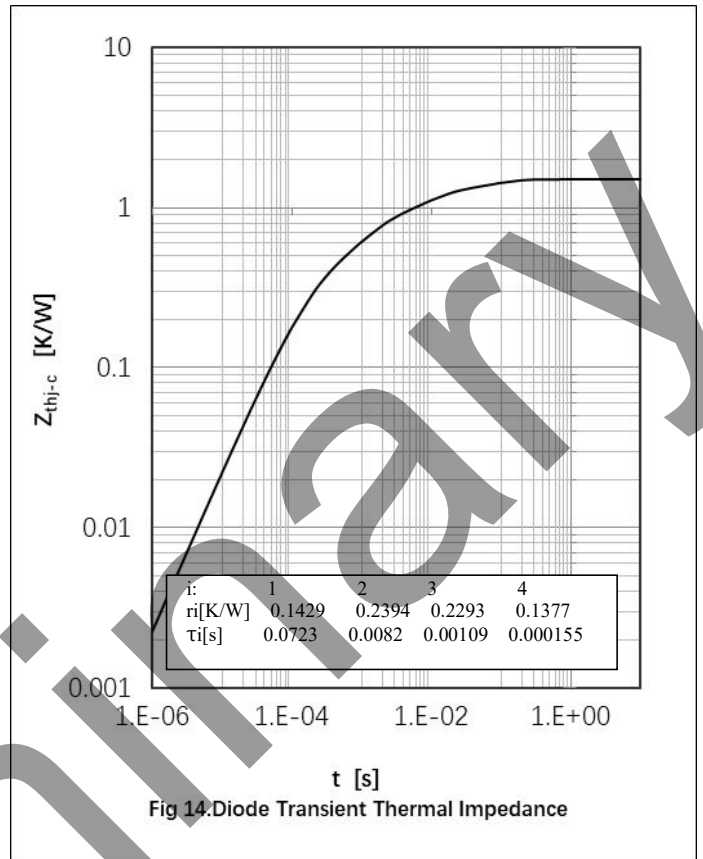
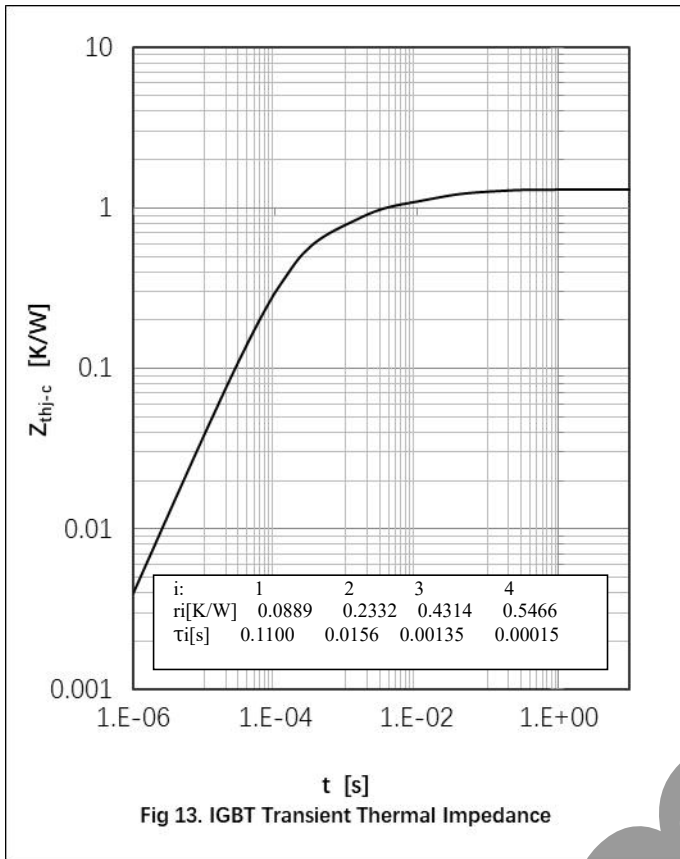
Curve Characteristics



Curve Characteristics



Curve Characteristics



Ordering Information

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

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