RoHS Compliant

MagnaChip

# MBF15T65PEH

## 650V Field Stop IGBT



### General Description

This IGBT is produced using advanced MagnaChip's Field Stop Trench IGBT Technology, which provides high performance, excellent quality and high ruggedness.

This device is for motor control.

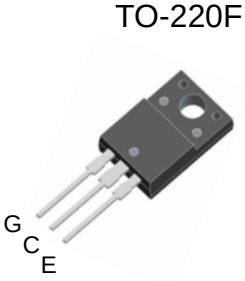
### Features

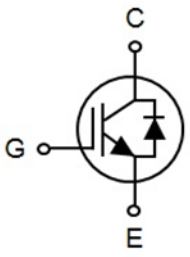
- High ruggedness for motor control
- $V_{CE(sat)}$ positive temperature coefficient
- Very soft, fast recovery anti-parallel diode
- Low EMI
- Maximum junction temperature 175°C

### Applications

- Inverter for motor control

TO-220F




G : Gate
C : Collector
E : Emitter

**Package outline and symbol**

### Maximum Rating

| Parameter | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Collector-emitter voltage | | $V_{CE}$ | 650 | V |
| DC collector current, limited by $T_{vjmax}$ | $T_C$=25°C | $I_C$ | 19 | A |
| | $T_C$=100°C | | 12 | A |
| Pulsed collector current, $t_p$ limited by $T_{jvjmax}$ | | $I_{Cpuls}$ | 38 | A |
| Diode forward current limited by $T_{vjmax}$ | $T_C$=25°C | $I_F$ | 19 | A |
| | $T_C$=100°C | | 12 | |
| Diode pulsed current, $t_p$ limited by $T_{vjmax}$ | | $I_{Fpuls}$ | 38 | A |
| Gate-emitter voltage | | $V_{GE}$ | ±20 | V |
| Power dissipation | $T_C$=25°C | $P_D$ | 48 | W |
| | $T_C$=100°C | | 24 | W |
| Short circuit withstand time<br>$V_{CC} \leq$ 360V, $V_{GE}$ = 15V, $T_{vj}$ = 150°C | | tsc | 5 | μs |
| Operating Junction temperature range | | $T_{vj}$ | -55~175 | °C |
| Storage temperature range | | $T_{stg}$ | -55~175 | °C |

### Thermal Characteristic

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Thermal resistance junction-to-ambient | $R_{\theta JA}$ | 62 | °C/W |
| Thermal resistance junction-to-case for IGBT | $R_{\theta JC}$ | 3.1 | |
| Thermal resistance junction-to-case for Diode | $R_{\theta JC}$ | 5.2 | |

## Ordering Information

| Part Number | Marking | Temp. Range | Package | Packing | RoHS Status |
|---|---|---|---|---|---|
| MBF15T65PEHTH | 15T65PEH | -55~175°C | TO-220F | Tube | Halogen Free |

## Electrical Characteristic ($T_{vj}$ = 25°C unless otherwise specified)

| Parameter | Symbol | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static Characteristic** | | | | | | | |
| Collector-emitter breakdown voltage | $BV_{CES}$ | $I_C$ = 2mA, $V_{GE}$ = 0V | | 650 | - | - | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C$ = 15A, $V_{GE}$= 15V | $T_{vj}$ = 25°C | | 1.80 | 2.20 | V |
| | | | $T_{vj}$ = 175°C | | 2.10 | | |
| Diode forward voltage | $V_F$ | $V_{GE}$ = 0V, $I_F$ = 15A | $T_{vj}$ = 25°C | | 1.85 | 2.30 | V |
| | | | $T_{vj}$ = 175°C | | 1.95 | | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $V_{CE}$ = $V_{GE}$, $I_C$ = 0.5mA | | 5.0 | 6.0 | 7.0 | V |
| Zero gate voltage collector current | $I_{CES}$ | $V_{CE}$ = 650V, $V_{GE}$ = 0V, $T_{vj}$ = 25°C | | - | - | 20 | μA |
| Gate-emitter leakage current | $I_{GES}$ | $V_{GE}$ = 20V, $V_{CE}$ = 0V | | - | - | ±100 | nA |
| **Dynamic Characteristic** | | | | | | | |
| Total gate charge | $Q_g$ | $V_{CE}$ = 520V, $I_C$ = 15A, $V_{GE}$ = 15V | | - | 61 | | nC |
| Gate-emitter charge | $Q_{ge}$ | | | - | 11 | | |
| Gate-collector charge | $Q_{gc}$ | | | - | 35 | | |
| Input capacitance | $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | - | 1129 | - | pF |
| Reverse transfer capacitance | $C_{oes}$ | | | - | 57 | - | |
| Output capacitance | $C_{res}$ | | | - | 31 | - | |
| **Switching Characteristic** | | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{GE}$ = 15V, $V_{CC}$ = 400V, $I_C$ = 15A, $R_G$ = 10Ω, Inductive Load, $T_{vj}$ = 25°C | | - | 19 | - | ns |
| Rise time | $t_r$ | | | - | 27 | - | |
| Turn-off delay time | $t_{d(off)}$ | | | - | 128 | - | |
| Fall time | $t_f$ | | | - | 32 | - | |
| Turn-on switching energy | $E_{on}$ | | | - | 270 | - | μJ |
| Turn-off switching energy | $E_{off}$ | | | - | 86 | - | |
| Total switching energy | $E_{ts}$ | | | - | 356 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{GE}$ = 15V, $V_{CC}$ = 400V, $I_C$ = 15A, $R_G$ = 10Ω, Inductive Load, $T_{vj}$ = 175°C | | - | 17 | - | ns |
| Rise time | $t_r$ | | | - | 29 | - | |
| Turn-off delay time | $t_{d(off)}$ | | | - | 150 | - | |
| Fall time | $t_f$ | | | - | 130 | - | |
| Turn-on switching energy | $E_{on}$ | | | - | 342 | - | μJ |
| Turn-off switching energy | $E_{off}$ | | | - | 288 | - | |
| Total switching energy | $E_{ts}$ | | | - | 630 | - | |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 15A, $di_F/dt$ = 200A/ μs, $T_{vj}$ = 25°C | | - | 150 | - | ns |
| Reverse recovery current | $I_{rr}$ | | | - | 5.2 | - | A |
| Reverse recovery charge | $Q_{rr}$ | | | - | 460 | - | nC |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 15A, $di_F/dt$ = 200A/ μs, $T_{vj}$ = 175°C | | - | 207 | - | ns |
| Reverse recovery current | $I_{rr}$ | | | - | 6.1 | - | A |
| Reverse recovery charge | $Q_{rr}$ | | | - | 790 | - | nC |

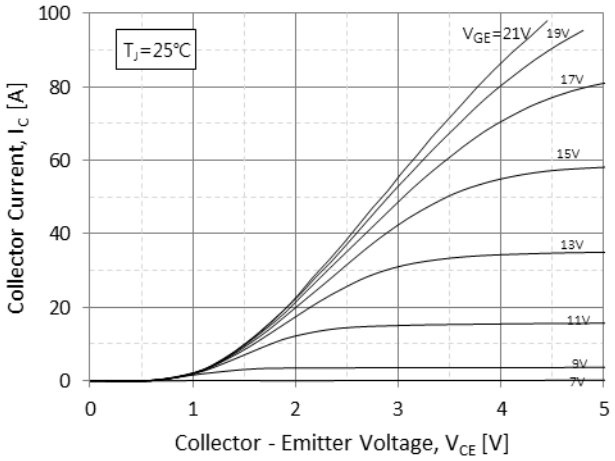



**Fig.1 Typical Output Characteristics($T_J$=25℃)**

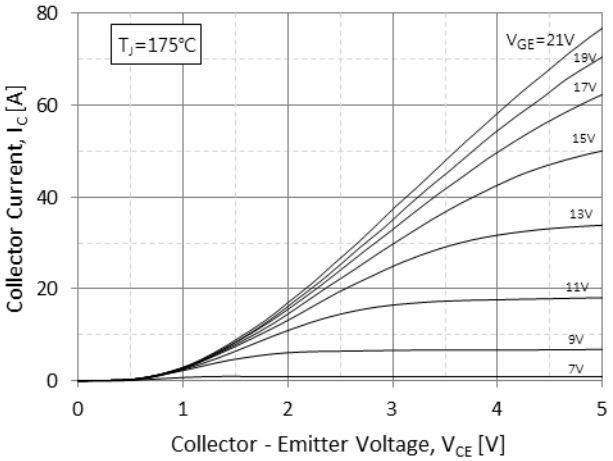



**Fig.2 Typical Output Characteristics($T_J$=175℃)**

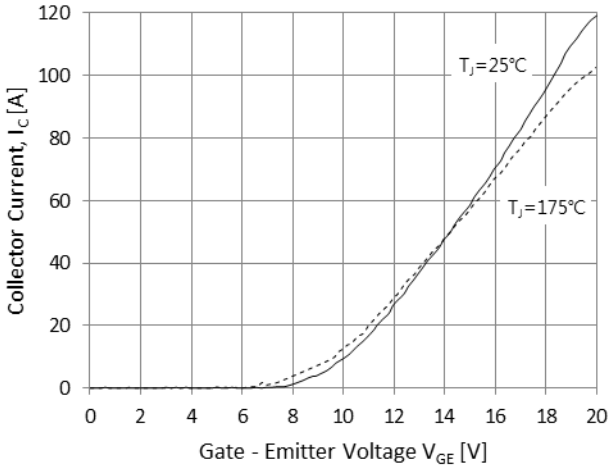



**Fig.3 Typical Transfer Characteristics**

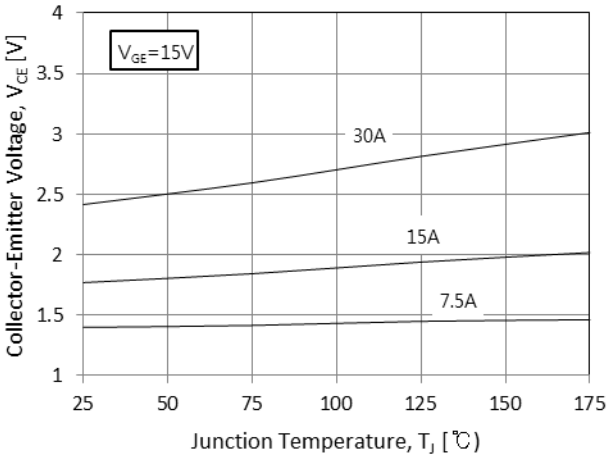



**Fig.4 Typical Collector-Emitter Saturation Voltage -Junction Temperature**

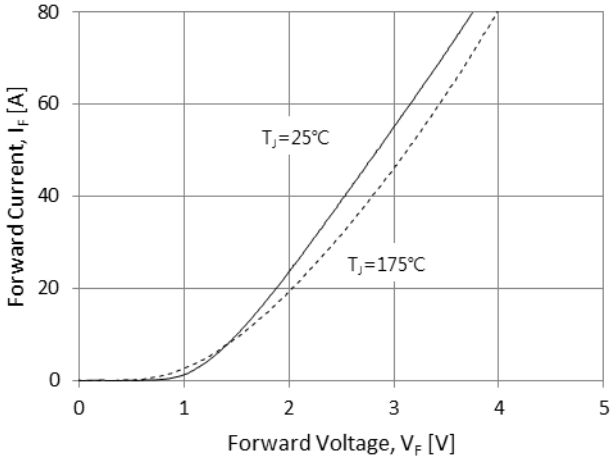



**Fig.5 Diode Forward Characteristics**

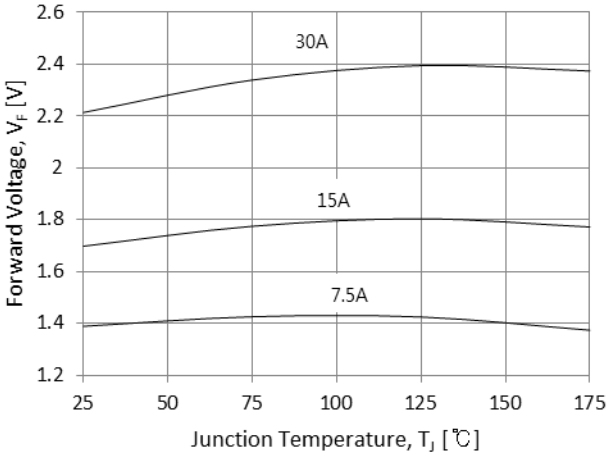



**Fig.6 Diode Forward-Junction Temperature**

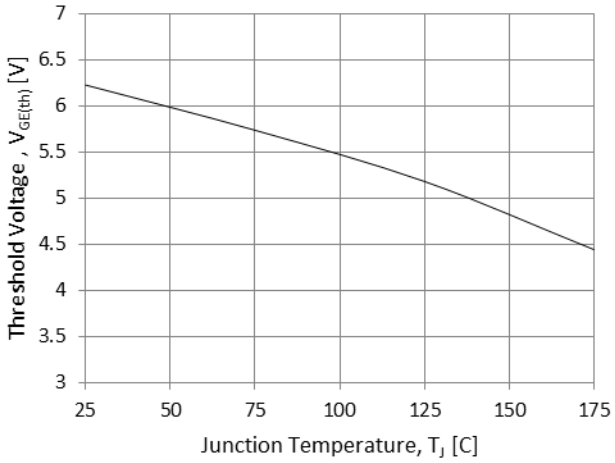



**Fig.7 Threshold Voltage-Junction Temperatur e**

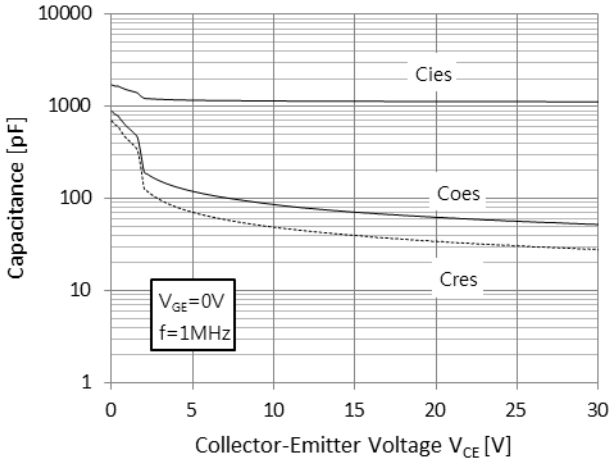



**Fig.8 Typical Capacitance**

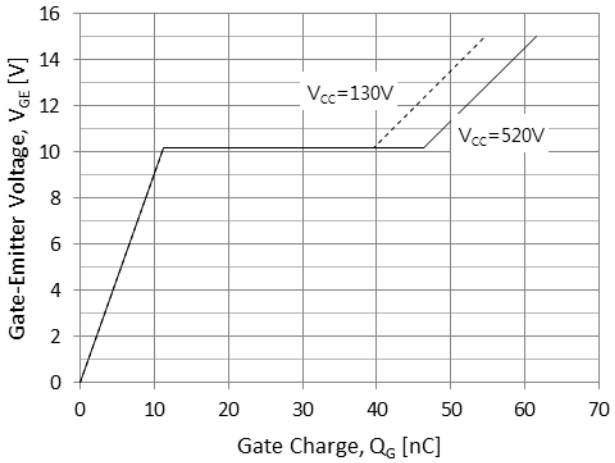



**Fig.9 Typical Gate Charge**

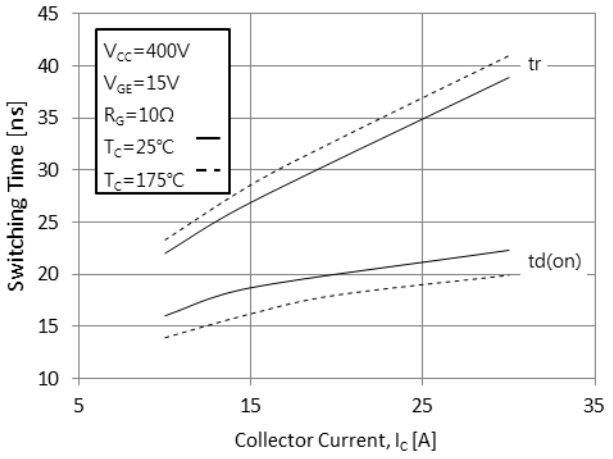



**Fig.10 Typical Turn on-Collector Current**

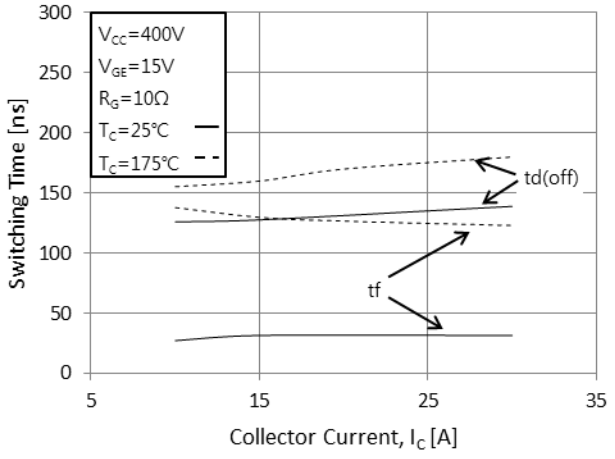



**Fig.11 Typical Turn off-Collector Current**

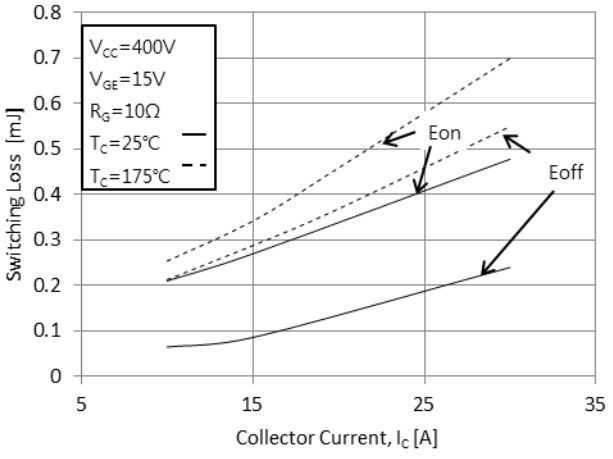



**Fig.12 Switching Loss-Collector Current**

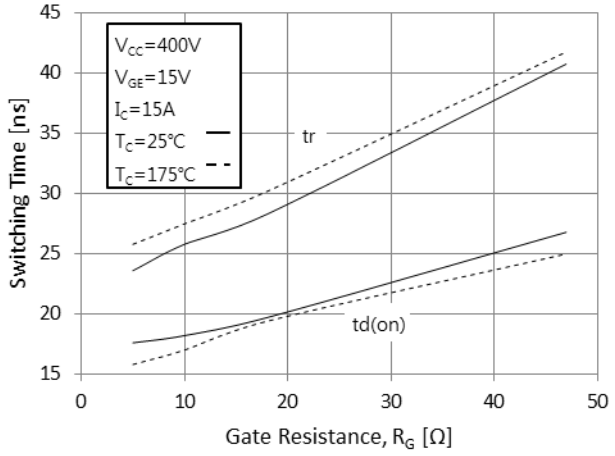



**Fig.13 Turn on Characteristics-Gate Resistance**

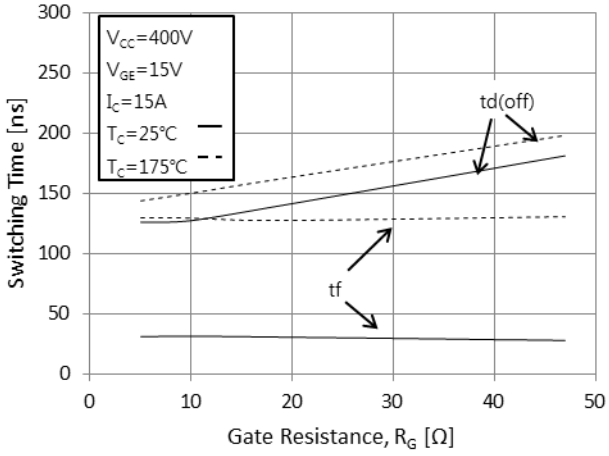



**Fig.14 Turn off Characteristics-Gate Resistance**

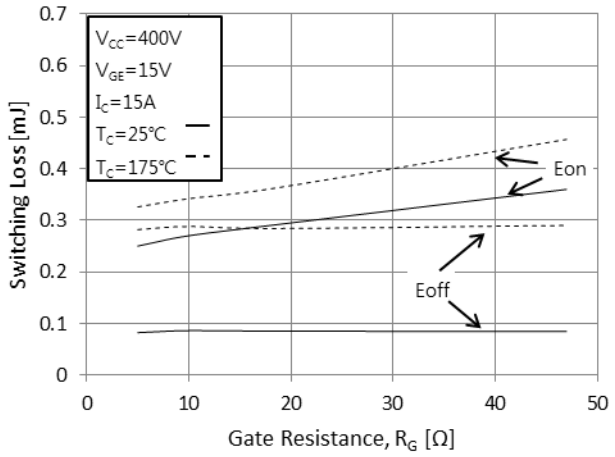



**Fig.15 Switching Loss-Gate Resistance**

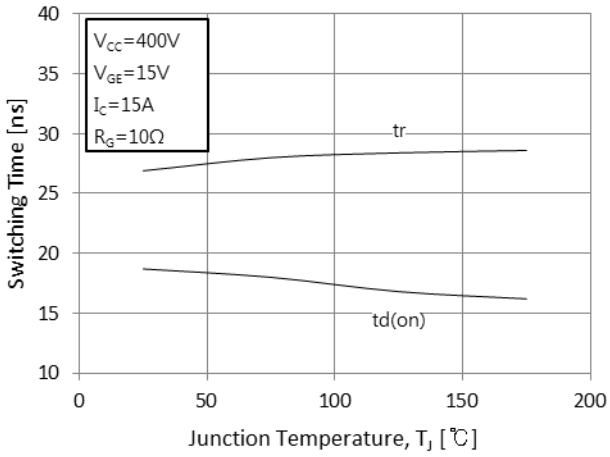



**Fig.16 Turn on Characteristics-Junction Temperature**

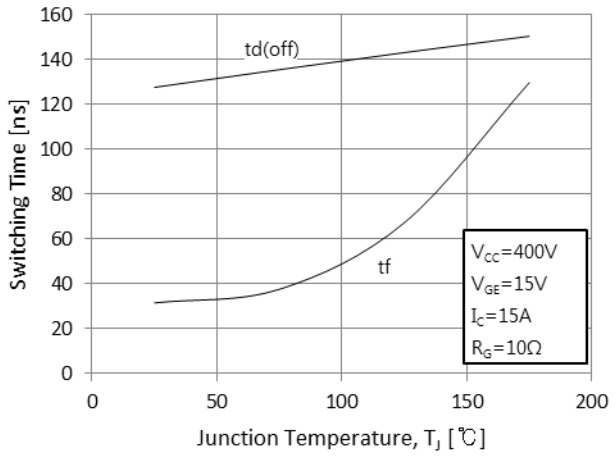



**Fig.17 Turn off Characteristics-Junction Temperature**

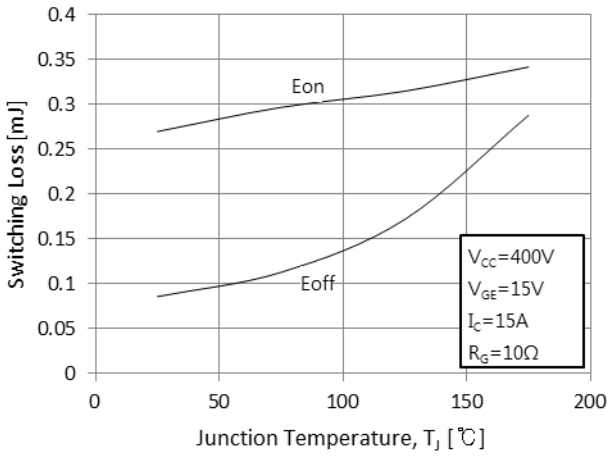



**Fig.18 Switching Loss-Junction Temperature**

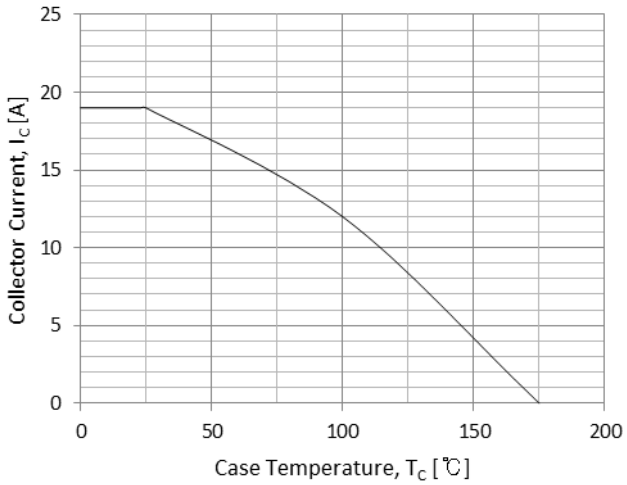
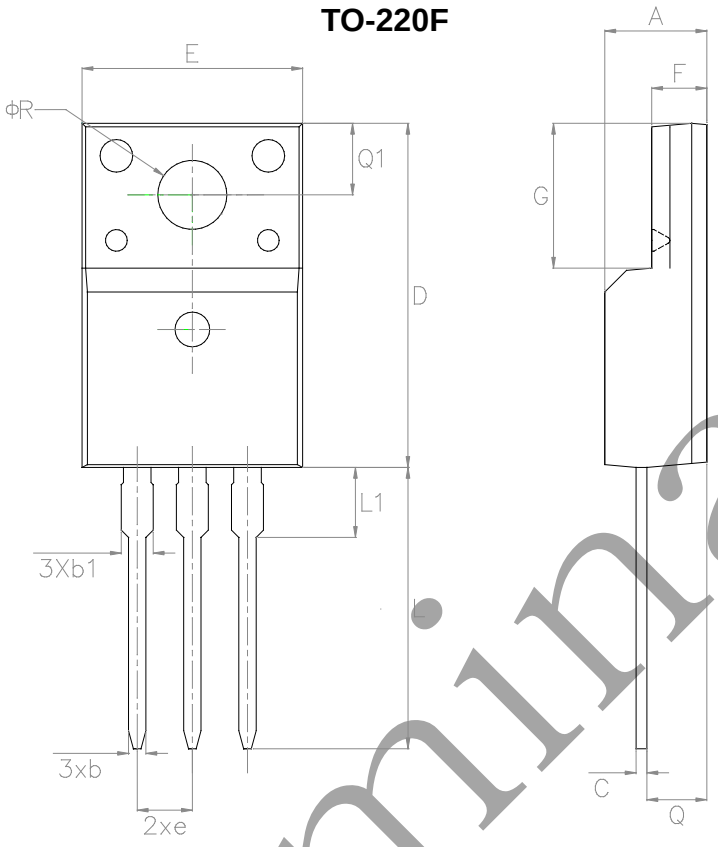



**Fig.19 Case Temperature-Collector Current**

## Package outline dimension

**TO-220F**




| Symbol | Min | Nom | Max |
|---|---|---|---|
| A | 4.50 | - | 4.93 |
| b | 0.63 | - | 0.91 |
| b1 | 1.15 | - | 1.47 |
| C | 0.33 | - | 0.63 |
| D | 15.47 | - | 16.13 |
| E | 9.60 | - | 10.71 |
| e | 2.54 BSC | | |
| F | 2.34 | - | 2.84 |
| G | 6.48 | - | 6.90 |
| L | 12.24 | - | 13.72 |
| L1 | 2.79 | - | 3.67 |
| Q | 2.52 | - | 2.96 |
| Q1 | 3.10 | - | 3.50 |
| ØR | 3.00 | - | 3.55 |

**DISCLAIMER:**

The Products are not designed for use in hostile environments, including, without limitation, aircraft, nuclear power generation, medical appliances, and devices or systems in which malfunction of any Product can reasonably be expected to result in a personal injury. Seller's customers using or selling Seller's products for use in such applications do so at their own risk and agree to fully defend and indemnify Seller.