RoHS Compliant

Magnachip

# MBQ75T65PEH

## 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.

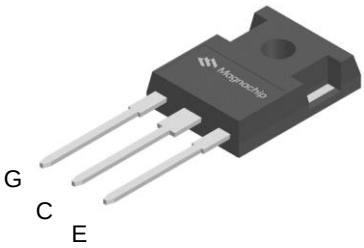
### Features

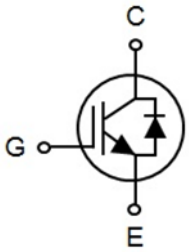
- High ruggedness for motor control
- $V_{CE(sat)}$ positive temperature coefficient
- Very soft, fast recovery anti-parallel diode
- Low EMI
- Maximum junction temperature 175°C

### Applications

- PV Inverter
- UPS Power
- Welder

TO-247




G : Gate
C : Collector
E : Emitter

### Maximum Ratings

| Parameter | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Collector-emitter voltage | | $V_{CE}$ | 650 | V |
| DC collector current, limited by $T_{vjmax}$ | $T_C$=25°C | $I_C$ | 100 | A |
| | $T_C$=100°C | | 75 | A |
| Pulsed collector current, $t_p$ limited by $T_{vjmax}$ | | $I_{Cpuls}$ | 225 | A |
| Diode forward current, limited by $T_{vjmax}$ | $T_C$=25°C | $I_F$ | 80 | A |
| | $T_C$=100°C | | 50 | |
| Diode pulsed current, $t_p$ limited by $T_{vjmax}$ | | $I_{Fpuls}$ | 225 | A |
| Gate-emitter voltage | | $V_{GE}$ | ±20 | V |
| Power dissipation | $T_C$=25°C | $P_D$ | 428 | W |
| | $T_C$=100°C | | 214 | W |
| Short circuit withstand time<br>$V_{CC} \leq$ 360V, $V_{GE}$ = 15V, $T_{vj}$ = 150°C | | $t_{sc}$ | 5 | μs |
| Operating Junction temperature range | | $T_{vj}$ | -40~175 | °C |
| Storage temperature range | | $T_{stg}$ | -55~150 | °C |

### Thermal Characteristics

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Thermal resistance junction-to-ambient | $R_{th(j-a)}$ | 40 | °C/W |
| Thermal resistance junction-to-case for IGBT | $R_{th(j-c)}$ | 0.35 | |
| Thermal resistance junction-to-case for Diode | $R_{th(j-c)}$ | 0.70 | |

## Ordering Information

| Part Number | Marking | Temp. Range | Package | Packing | RoHS Status |
|---|---|---|---|---|---|
| MBQ75T65PEHTH | 75T65PEH | -55~175°C | TO-247 | Tube | Halogen Free |

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

| Parameter | Symbol | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static Characteristics** | | | | | | | |
| Collector-emitter breakdown voltage | $BV_{CES}$ | $I_C$ = 2mA, $V_{GE}$ = 0V | | 650 | - | - | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C$ = 75A, $V_{GE}$= 15V | $T_{vj}$ = 25°C | - | 1.7 | 2 | V |
| | | | $T_{vj}$ = 175°C | - | 2.2 | - | |
| Diode forward voltage | $V_F$ | $V_{GE}$ = 0V, $I_F$ = 50A | $T_{vj}$ = 25°C | - | 1.55 | 1.8 | V |
| | | | $T_{vj}$ = 175°C | - | 1.6 | - | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $V_{CE}$ = $V_{GE}$, $I_C$ = 1.2mA | | 4.5 | 5.5 | 6.5 | 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 Characteristics** | | | | | | | |
| Total gate charge | $Q_G$ | $V_{CE}$ = 520V, $I_C$ = 75A, $V_{GE}$ = 15V | | - | 280 | - | nC |
| Gate-emitter charge | $Q_{GE}$ | | | - | 42 | - | |
| Gate-collector charge | $Q_{GC}$ | | | - | 114 | - | |
| Input capacitance | $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | - | 6900 | - | pF |
| Output capacitance | $C_{oes}$ | | | - | 230 | - | |
| Reverse transfer capacitance | $C_{res}$ | | | - | 158 | - | |
| **Switching Characteristics** | | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{GE}$ = -5/15V, $V_{CC}$ = 400V, $I_C$ = 75A, $R_G$ = 10Ω, Inductive Load, $T_{vj}$ = 25°C | | - | 38 | - | ns |
| Rise time | $t_r$ | | | - | 192 | - | |
| Turn-off delay time | $t_{d(off)}$ | | | - | 156 | - | |
| Fall time | $t_f$ | | | - | 103 | - | |
| Turn-on switching energy | $E_{on}$ | | | - | 4.69 | - | mJ |
| Turn-off switching energy | $E_{off}$ | | | - | 1.75 | - | |
| Total switching energy | $E_{ts}$ | | | - | 6.44 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{GE}$ = -5/15V, $V_{CC}$ = 400V, $I_C$ = 75A, $R_G$ = 10Ω, Inductive Load, $T_{vj}$ = 175°C | | - | 37 | - | ns |
| Rise time | $t_r$ | | | - | 194 | - | |
| Turn-off delay time | $t_{d(off)}$ | | | - | 168 | - | |
| Fall time | $t_f$ | | | - | 106 | - | |
| Turn-on switching energy | $E_{on}$ | | | - | 5.62 | - | mJ |
| Turn-off switching energy | $E_{off}$ | | | - | 2.04 | - | |
| Total switching energy | $E_{ts}$ | | | - | 7.66 | - | |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 50A, $di_F/dt$ = 200A/ μs, $T_{vj}$ = 25°C | | - | 181 | - | ns |
| Reverse recovery current | $I_{rr}$ | | | - | 10.4 | - | A |
| Reverse recovery charge | $Q_{rr}$ | | | - | 1.12 | - | μC |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 50A, $di_F/dt$ = 200A/ μs, $T_{vj}$ = 175°C | | - | 384 | - | ns |
| Reverse recovery current | $I_{rr}$ | | | - | 13.3 | - | A |
| Reverse recovery charge | $Q_{rr}$ | | | - | 3.07 | - | μC |

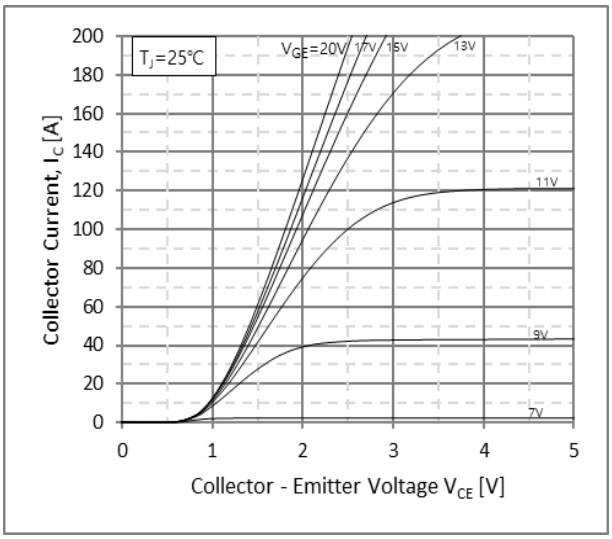



**Fig.1 Typical Output Characteristics($T_J$=25℃)**

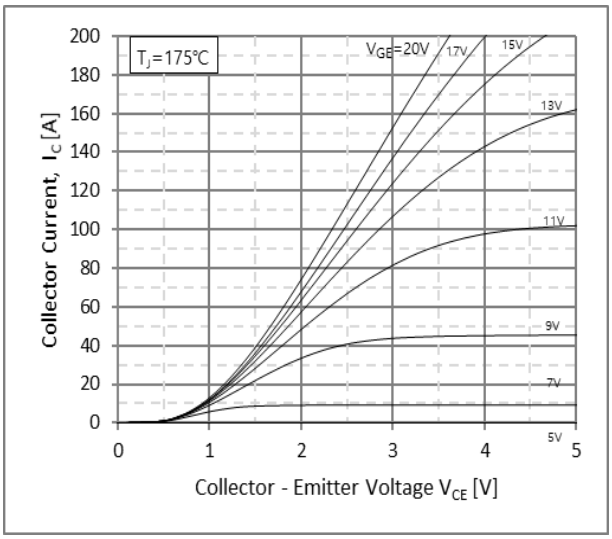



**Fig.2 Typical Output Characteristics($T_J$=175℃)**

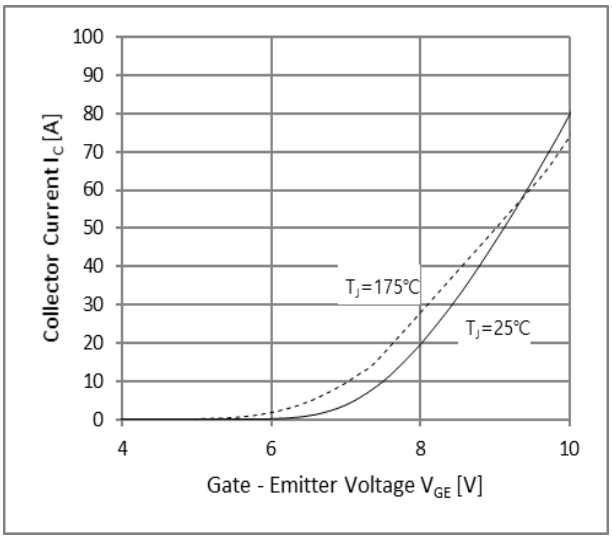



**Fig.3 Typical Transfer Characteristics**

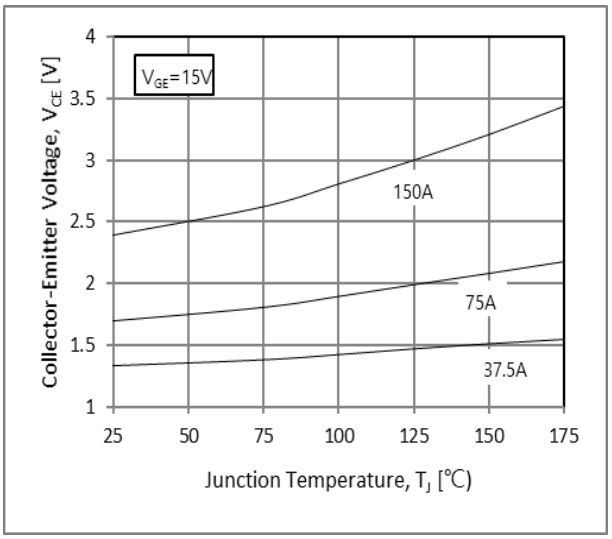



**Fig.4 Typical Collector-Emitter Saturation Voltage -Junction Temperature**

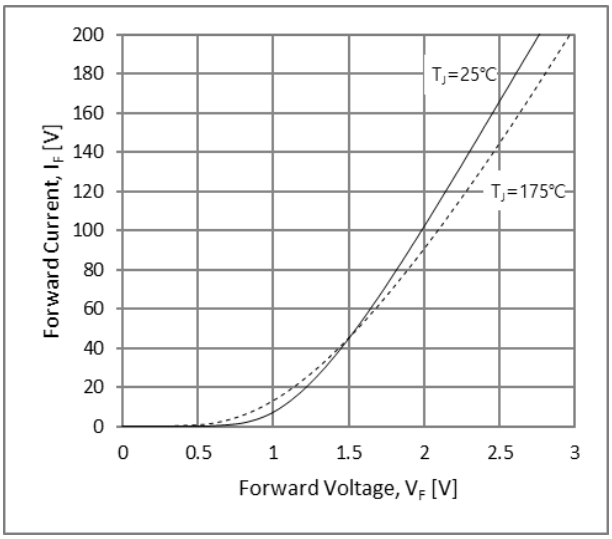



**Fig.5 Diode Forward Characteristics**

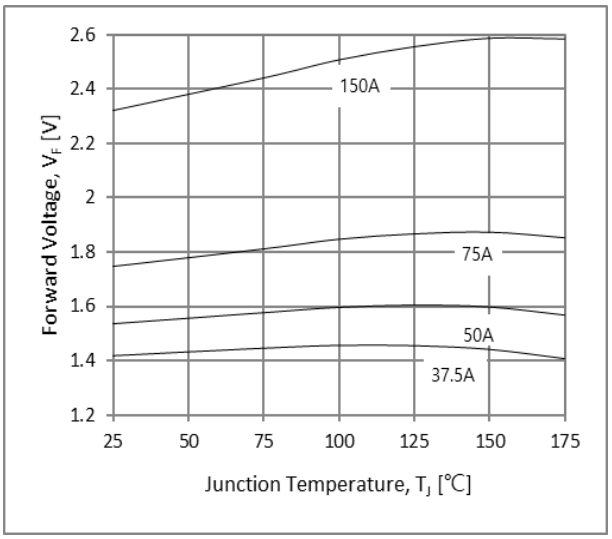



**Fig.6 Diode Forward-Junction Temperature**

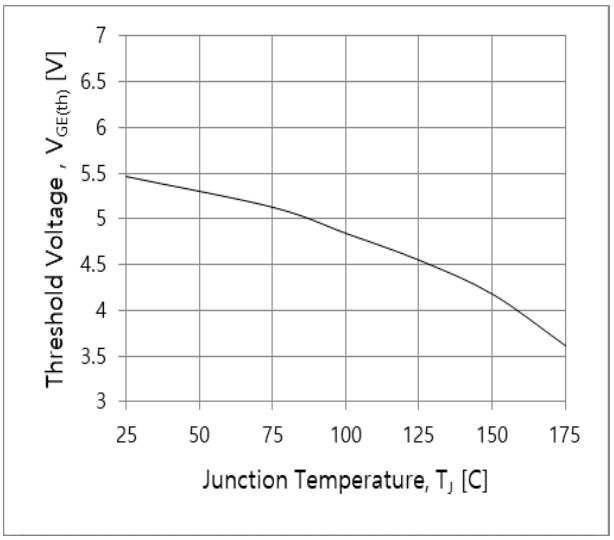



**Fig.7 Threshold Voltage-Junction Temperature**

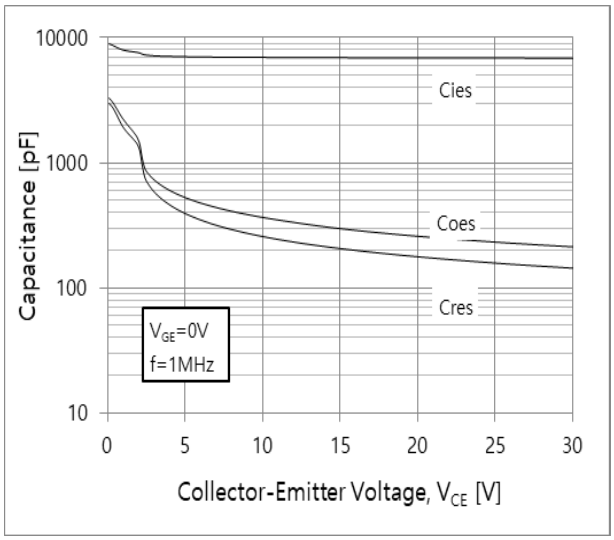



**Fig.8 Typical Capacitance**

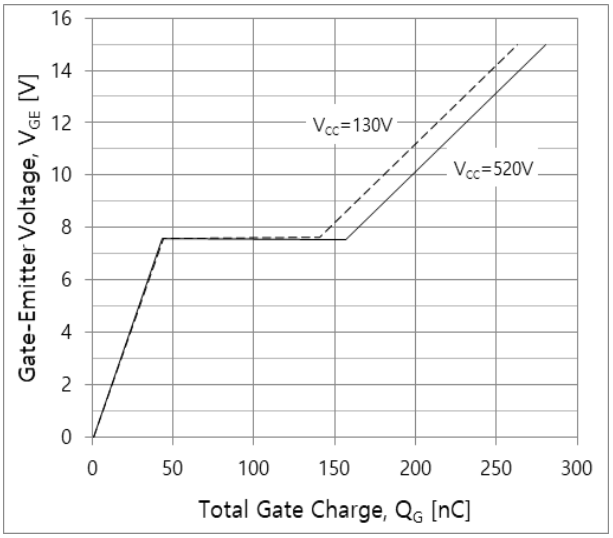



**Fig.9 Typical Gate Charge**

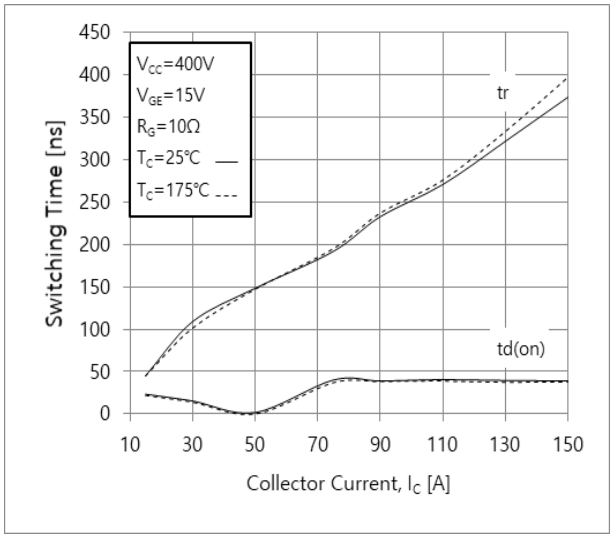



**Fig.10 Typical Turn on-Collector Current**

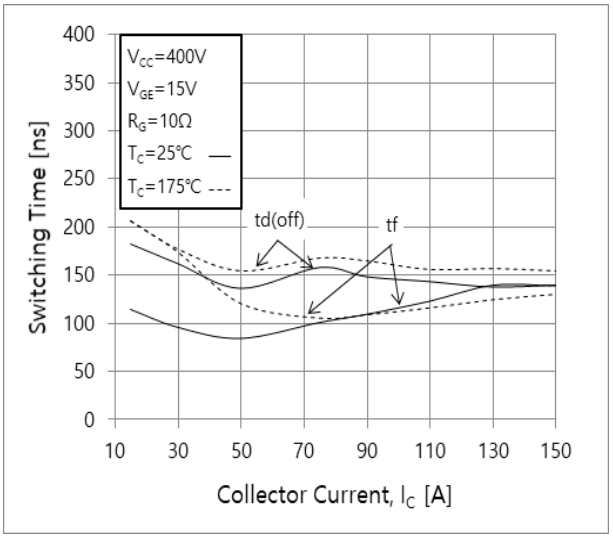



**Fig.11 Typical Turn off-Collector Current**

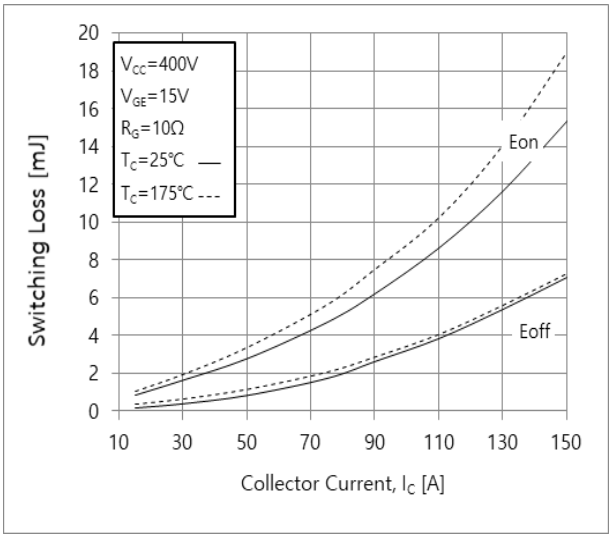



**Fig.12 Switching Loss-Collector Current**

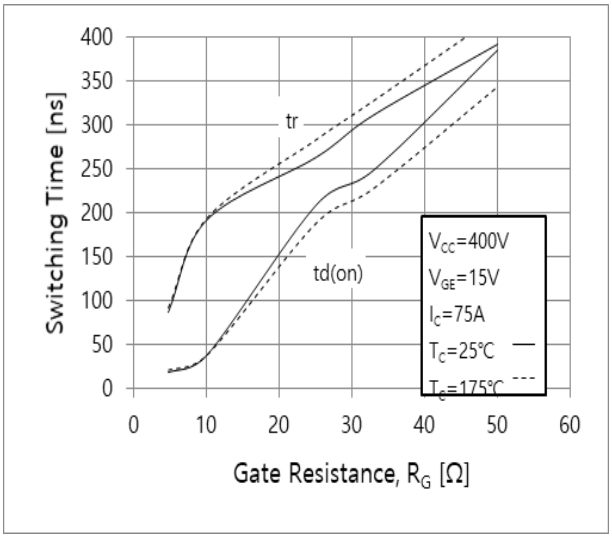



**Fig.13 Turn on Characteristics-Gate Resistance**

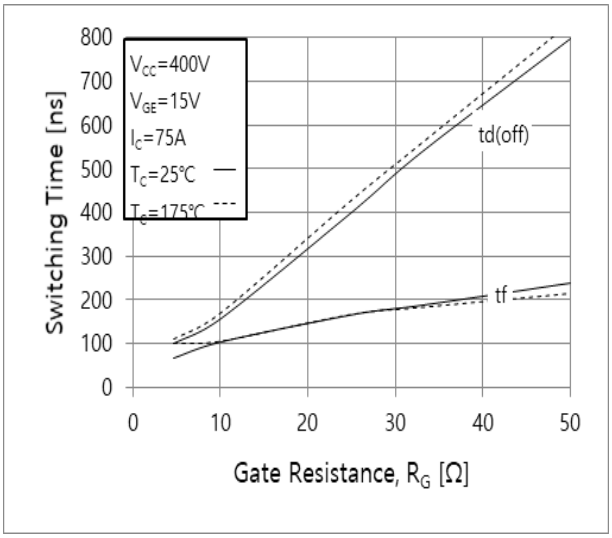



**Fig.14 Turn off Characteristics-Gate Resistance**

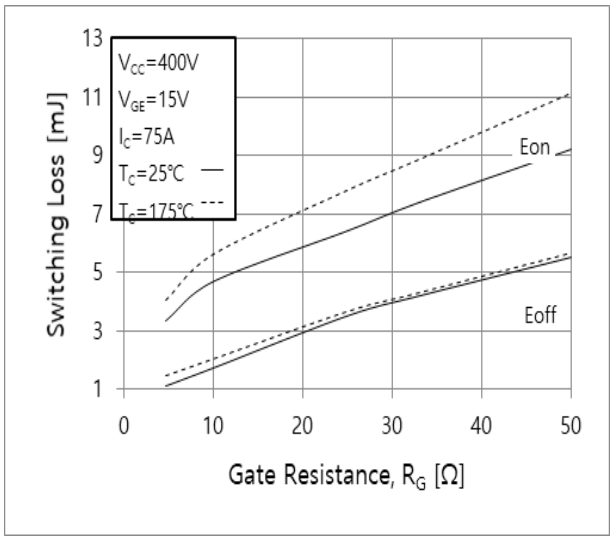



**Fig.15 Switching Loss-Gate Resistance**

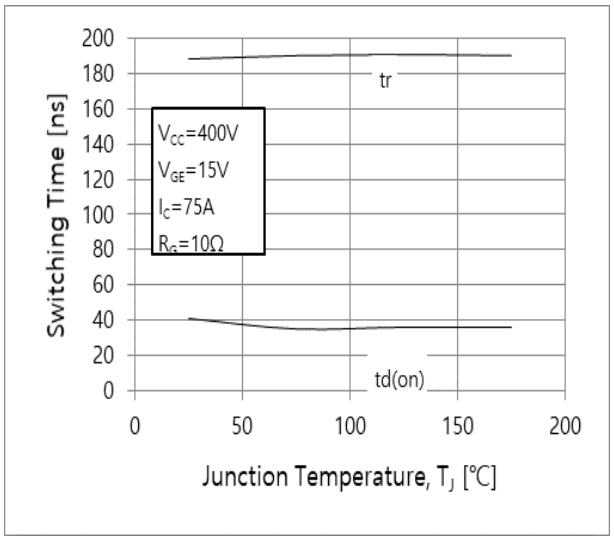



**Fig.16 Turn on Characteristics-Junction Temperature**

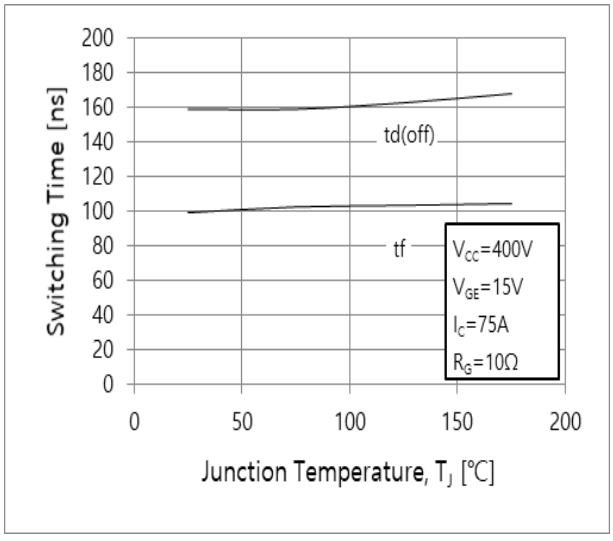



**Fig.17 Turn off Characteristics**

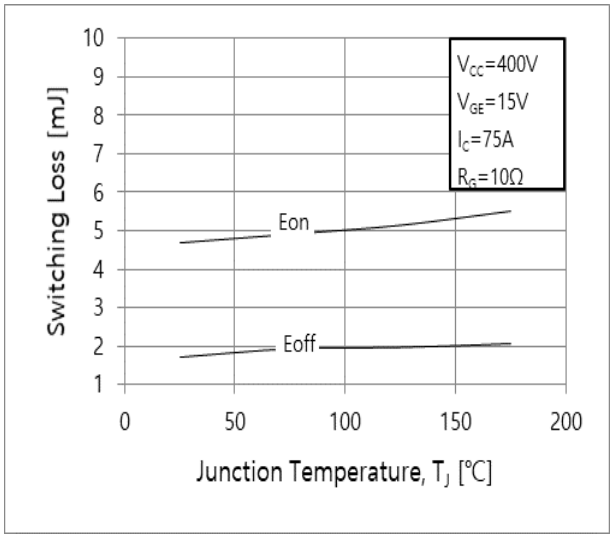



**Fig.18 Switching Loss-Junction Temperature**

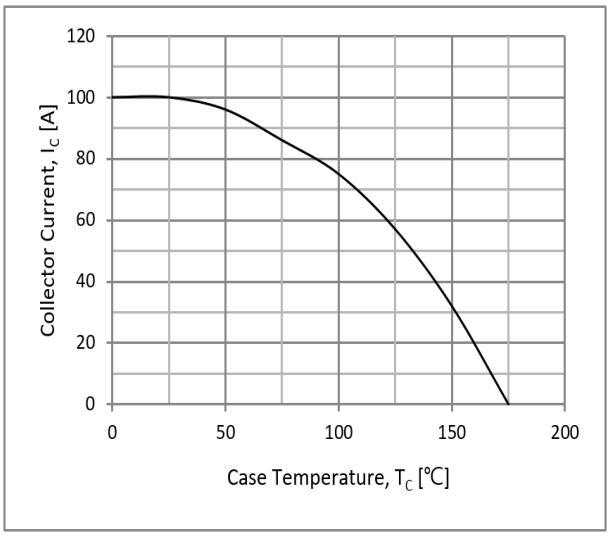



**Fig.19 Case Temperature-Collector Current**

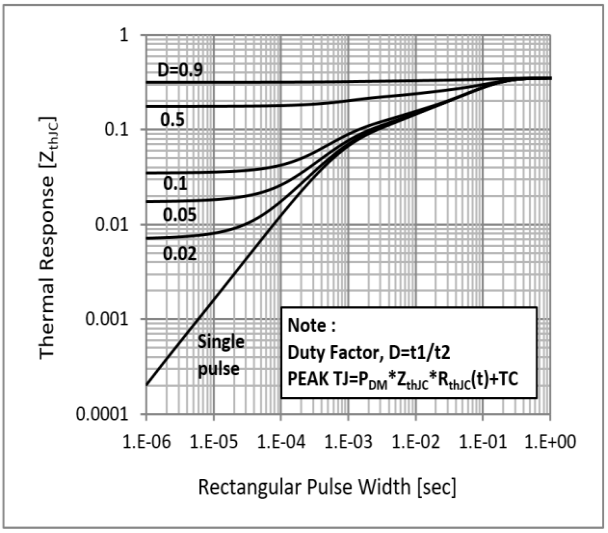



**Fig.20 IGBT Transient Thermal Impedance**

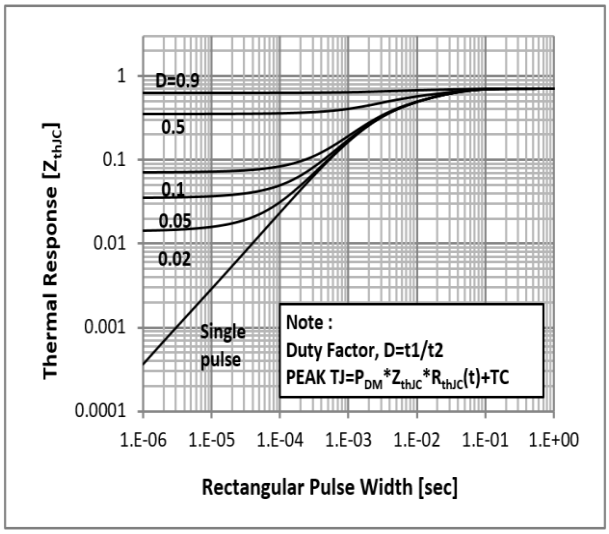



**Fig.21 FRD Transient Thermal Impedance**

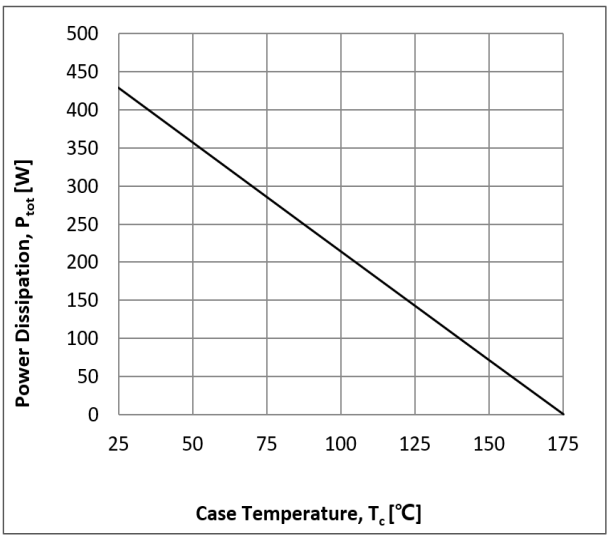
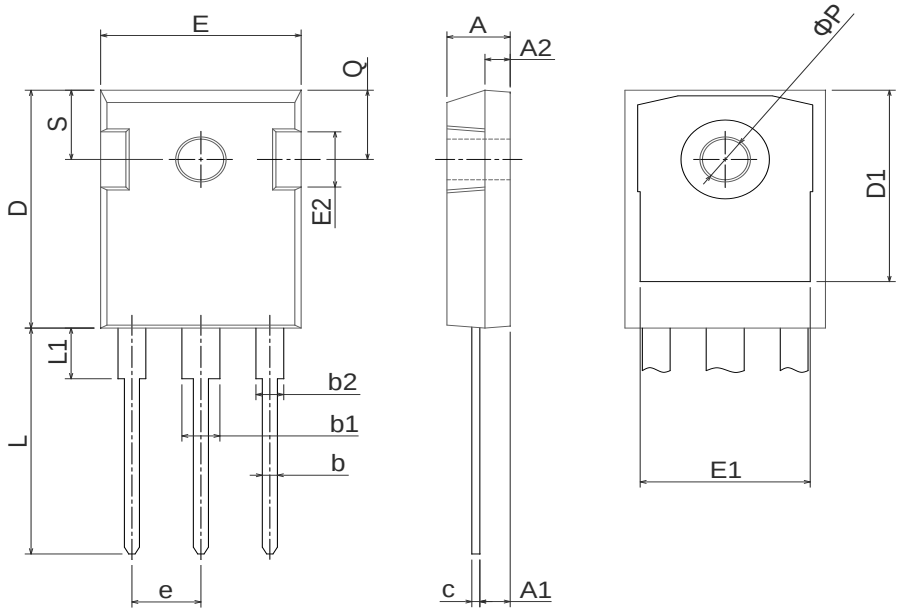



**Fig.22 Power Dissipation-Case Temperature**

## Physical Dimension

### TO-247

**Dimensions are in millimeters, unless otherwise specified**




| Dimension | Min(mm) | Max(mm) |
|---|---|---|
| A | 4.70 | 5.31 |
| A1 | 2.20 | 2.60 |
| A2 | 1.50 | 2.49 |
| b | 0.99 | 1.40 |
| b1 | 2.59 | 3.43 |
| b2 | 1.65 | 2.39 |
| c | 0.38 | 0.89 |
| D | 20.30 | 21.46 |
| D1 | 13.08 | - |
| E | 15.45 | 16.26 |
| E1 | 13.06 | 14.02 |
| E2 | 4.32 | 5.49 |
| e | 5.45BSC | |
| L | 19.81 | 20.57 |
| L1 | - | 4.50 |
| ΦP | 3.50 | 3.70 |
| Q | 5.38 | 6.20 |
| S | 6.15BSC | |

**Note : Package body size, length and width do not include mold flash, protrusions and gate burrs.**

**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.