

General Description

This IGBT is produced using advanced Magnachip's Field Stop Trench IGBT Technology, which provides low $V_{CE(SAT)}$, high switching performance and excellent quality.

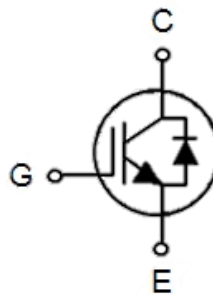
This device is for PFC, UPS & Inverter applications.

Applications

- Welder

Features

- High Speed Switching & Low Power Loss
- $V_{CE(sat)} = 2.1V @ I_C = 40A$
- High Input Impedance
- $t_{rr} = 285ns$ (typ.)
- Ultra-Soft, fast recovery anti-parallel diode
- Ultra-narrowed V_F distribution control
- Positive Temperature coefficient for easy paralleling



- G : Gate
- C : Collector
- E : Emitter

Package outline and symbol

Absolute Maximum Ratings

| Characteristics | | Symbol | Rating | Unit |
|----------------------------------------------------------------------------------|---------------------|-------------|----------|------------|
| Collector-emitter voltage | | V_{CES} | 1200 | V |
| Gate-emitter voltage | | V_{GE} | ± 20 | V |
| DC collector current, limited by T_{vjmax} | $T_C = 25^\circ C$ | I_C | 80 | A |
| | $T_C = 100^\circ C$ | | 40 | A |
| Pulsed collector current, t_p limited by T_{vjmax} | | I_{Cpuls} | 160 | A |
| Diode forward current, limited by T_{vjmax} | $T_C = 25^\circ C$ | I_F | 80 | A |
| | $T_C = 100^\circ C$ | | 40 | A |
| Diode pulsed current, Pulse time limited by T_{jmax} | | I_{Fpuls} | 160 | A |
| Power dissipation | $T_C = 25^\circ C$ | P_D | 428 | W |
| | $T_C = 100^\circ C$ | | 214 | W |
| Short circuit withstand time $V_{CE} = 500V, V_{GE} = 15V, T_C = 150^\circ C$ | | t_{sc} | 3 | μs |
| Operating Junction temperature range | | T_{vj} | -40~175 | $^\circ C$ |
| Storage temperature range | | T_{stg} | -55~150 | $^\circ C$ |

Thermal Characteristics

| Characteristics | Symbol | Rating | Unit |
|-----------------------------------------------|---------------|--------|--------------|
| Thermal resistance junction-to-ambient | $R_{th(j-a)}$ | 40 | $^\circ C/W$ |
| Thermal resistance junction-to-case for IGBT | $R_{th(j-c)}$ | 0.35 | |
| Thermal resistance junction-to-case for Diode | $R_{th(j-c)}$ | 0.8 | |

Ordering Information

| Part Number | Marking | Temp. Range | Package | Packing | RoHS Status |
|----------------|-----------|-------------|---------|---------|--------------|
| MBQ40T120QESTH | 40T120QES | -55~150°C | TO-247 | Tube | Halogen Free |

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

| Characteristics | Symbol | Conditions | Min | Typ | Max | Unit | |
|--------------------------------------|----------------------|----------------------------------------------------------|-------------------------|-----|------|------|---|
| Static Characteristics | | | | | | | |
| Collector-emitter breakdown voltage | BV _{CES} | I _C = 1mA, V _{GE} = 0V | 1200 | - | - | V | |
| Collector-emitter saturation voltage | V _{CE(sat)} | I _C = 40A, V _{GE} = 15V | T _{vj} = 25°C | - | 2.1 | 2.7 | V |
| | | | T _{vj} = 175°C | - | 2.75 | - | |
| Diode forward voltage | V _F | V _{GE} = 0V, I _F = 40A | T _{vj} = 25°C | - | 1.95 | 2.50 | V |
| | | | T _{vj} = 175°C | - | 2.05 | - | |
| Gate-emitter threshold voltage | V _{GE(th)} | V _{CE} = V _{GE} , I _C = 1mA | 4.0 | 5.0 | 6.0 | V | |
| Zero gate voltage collector current | I _{CES} | V _{CE} = 1200V, V _{GE} = 0V | - | - | 1 | mA | |
| Gate-emitter leakage current | I _{GES} | V _{GE} = 20V, V _{CE} = 0V | - | - | ±250 | nA | |

Dynamic Characteristics

| | | | | | | |
|------------------------------|------------------|------------------------------------------------------------------------|---|------|---|----|
| Total gate charge | Q _g | V _{CE} = 960V, I _C = 40A, V _{GE} = 15V | - | 428 | - | nC |
| Gate-emitter charge | Q _{ge} | | - | 56 | - | |
| Gate-collector charge | Q _{gc} | | - | 232 | - | |
| Input capacitance | C _{ies} | V _{CE} = 30V, V _{GE} = 0V, f = 1MHz | - | 6780 | - | pF |
| Output capacitance | C _{oes} | | - | 158 | - | |
| Reverse transfer capacitance | C _{res} | | - | 86 | - | |

Switching Characteristics

| | | | | | | | | |
|---------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------|------|------|----|----|----|---|
| Turn-on delay time | t _{d(on)} | V _{GE} = 15V, V _{CC} = 600V, I _C = 40A, R _G = 10Ω, Inductive Load, T _{vj} = 25°C | - | 74 | - | ns | | |
| Rise time | t _r | | - | 114 | - | | | |
| Turn-off delay time | t _{d(off)} | | - | 178 | - | | | |
| Fall time | t _f | | - | 95 | - | mJ | | |
| Turn-on switching energy | E _{on} | | - | 5.13 | - | | | |
| Turn-off switching energy | E _{off} | | - | 0.77 | - | | | |
| Total switching energy | E _{ts} | - | 5.90 | - | mJ | | | |
| Turn-on delay time | t _{d(on)} | V _{GE} = 15V, V _{CC} = 600V, I _C = 40A, R _G = 10Ω, Inductive Load, T _{vj} = 175°C | - | 67 | | - | ns | |
| Rise time | t _r | | - | 122 | | - | | |
| Turn-off delay time | t _{d(off)} | | - | 193 | | - | | |
| Fall time | t _f | | - | 134 | | - | mJ | |
| Turn-on switching energy | E _{on} | | - | 7.47 | | - | | |
| Turn-off switching energy | E _{off} | | - | 1.44 | - | | | |
| Total switching energy | E _{ts} | - | 8.91 | - | mJ | | | |
| Reverse recovery time | t _{rr} | I _F = 40A, di _F /dt = 300A/μs, T _{vj} = 25°C | - | 285 | | - | ns | |
| Reverse recovery current | I _{rr} | | - | 15 | | - | | A |
| Reverse recovery charge | Q _{rr} | | - | 2.09 | | - | | |
| Reverse recovery time | t _{rr} | I _F = 40A, di _F /dt = 300A/μs, T _{vj} = 175°C | - | 472 | | - | ns | |
| Reverse recovery current | I _{rr} | | - | 20 | | - | | A |
| Reverse recovery charge | Q _{rr} | | - | 4.55 | - | | | |

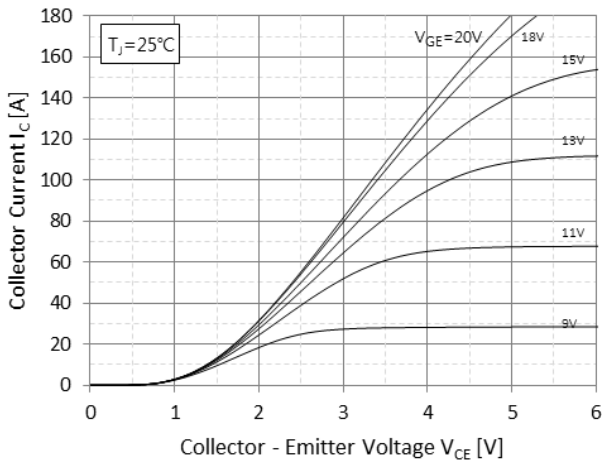


Fig.1 Typical Output Characteristics ($T_j = 25^\circ\text{C}$)

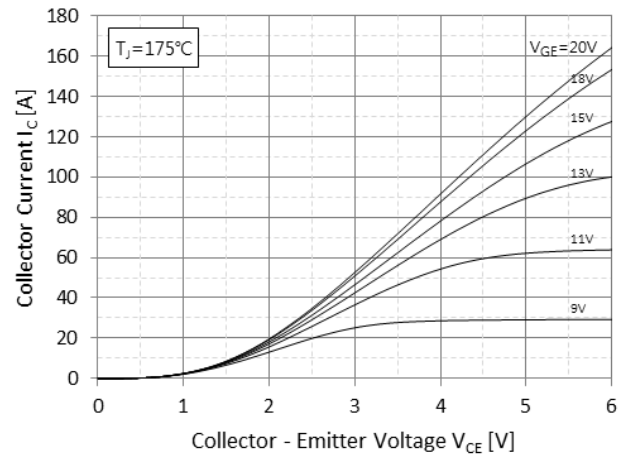


Fig.2 Typical Output Characteristics ($T_j = 175^\circ\text{C}$)

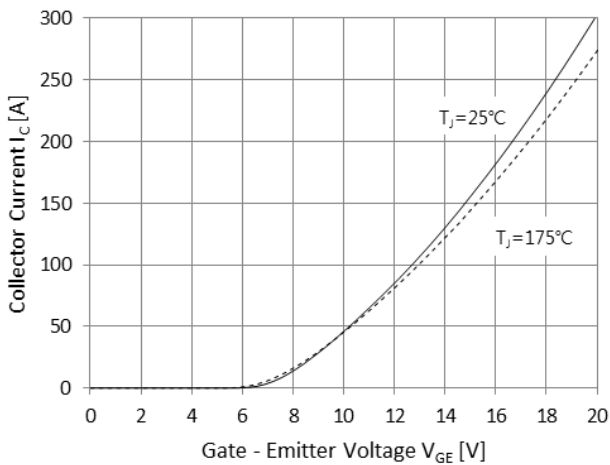


Fig.3 Typical Transfer Characteristics

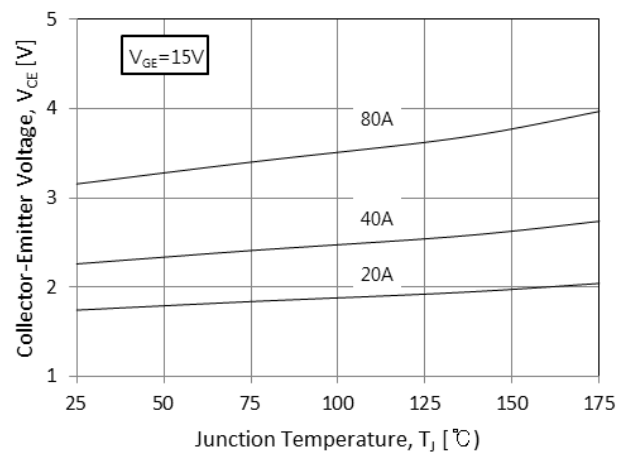


Fig.4 Typical Collector-Emitter Saturation Voltage - Junction Temperature

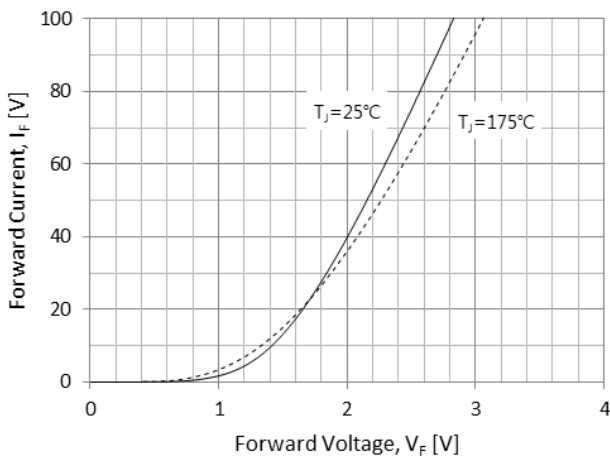


Fig.5 Diode Forward Characteristics

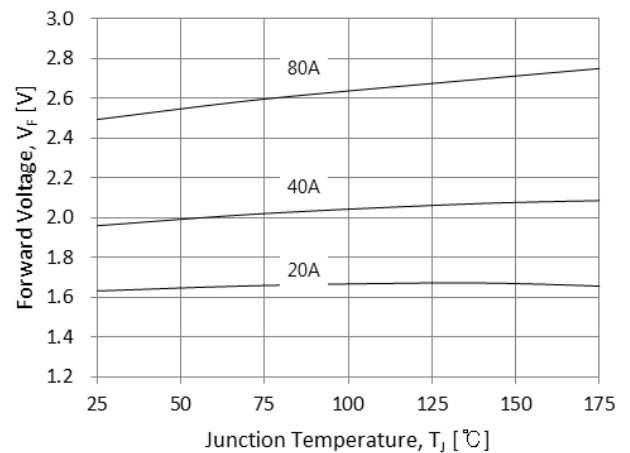


Fig.6 Diode Forward-Junction Temperature

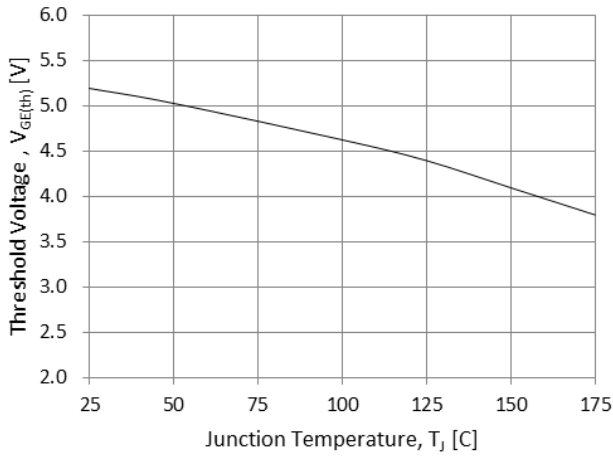


Fig.7 Threshold Voltage-Junction Temperature

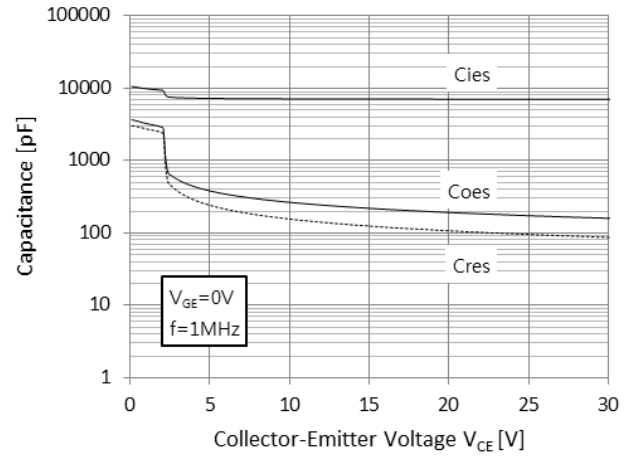


Fig.8 Typical Capacitance

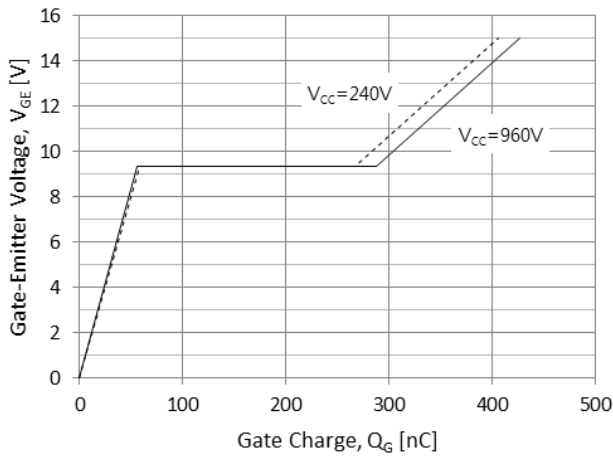


Fig.9 Typical Gate Charge

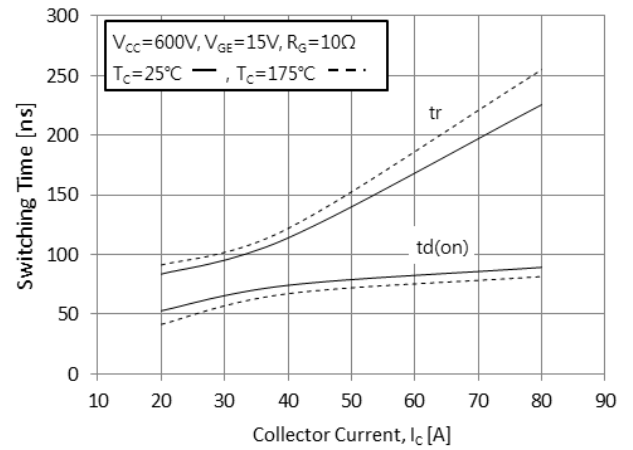


Fig.10 Typical Turn on-Collector Current

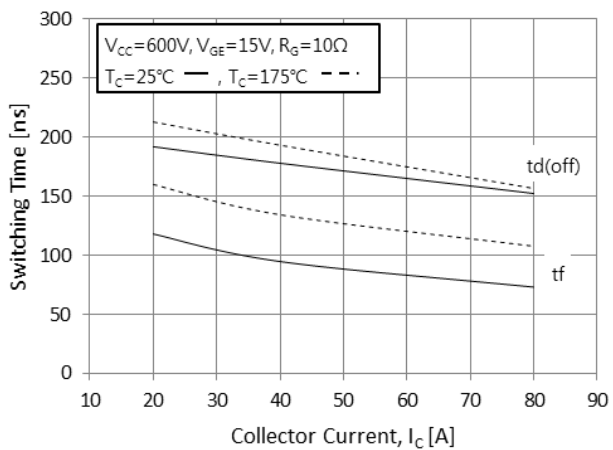


Fig.11 Typical Turn off-Collector Current

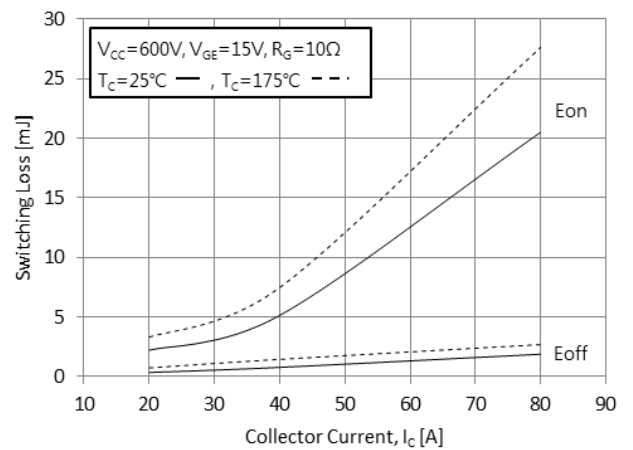


Fig.12 Switching Loss-Collector Current

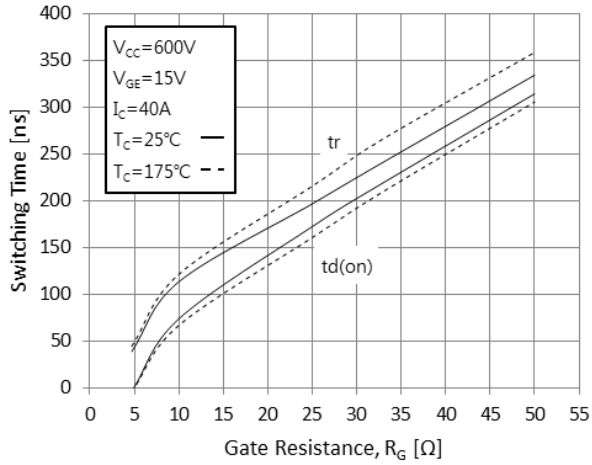


Fig.13 Turn on Characteristics-Gate Resistance

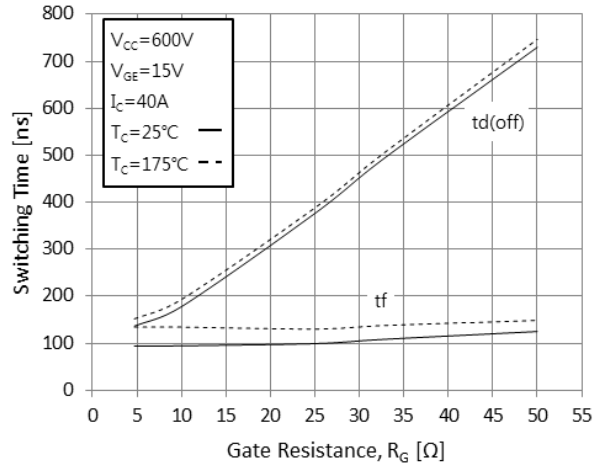


Fig.14 Turn off Characteristics-Gate Resistance

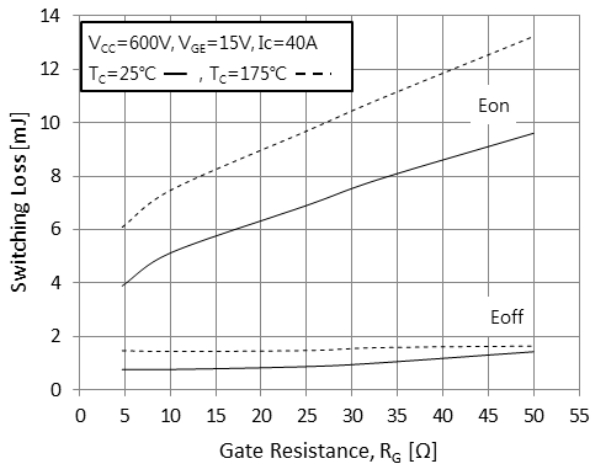


Fig.15 Switching Loss-Gate Resistance

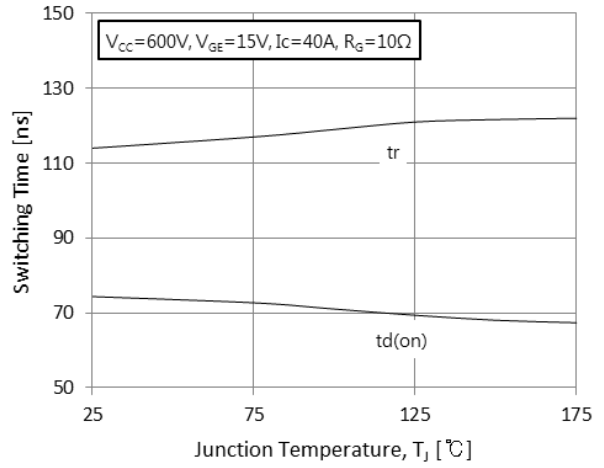


Fig.16 Turn on Characteristics-Junction Temperature

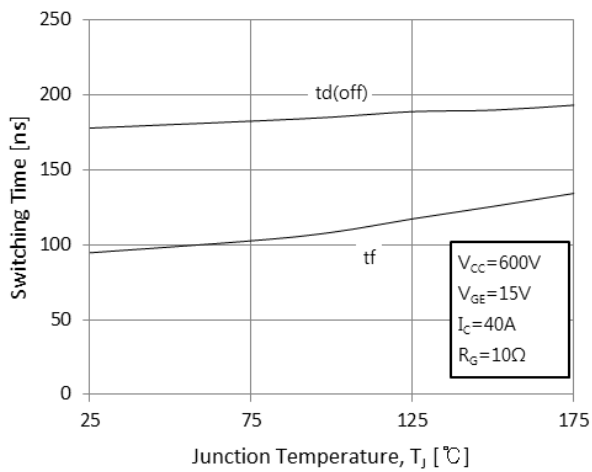


Fig.17 Turn off Characteristics-Junction Temperature

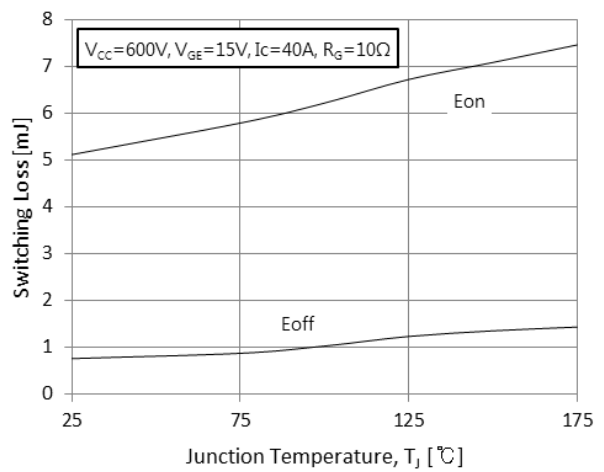


Fig.18 Switching Loss-Junction Temperature

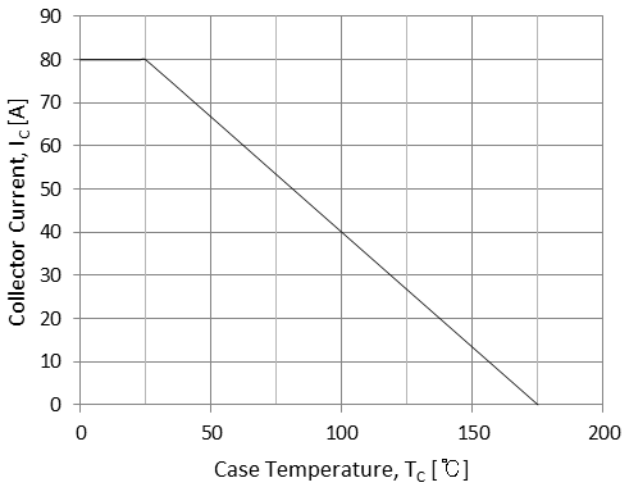


Fig.19 Case Temperature-Collector Current

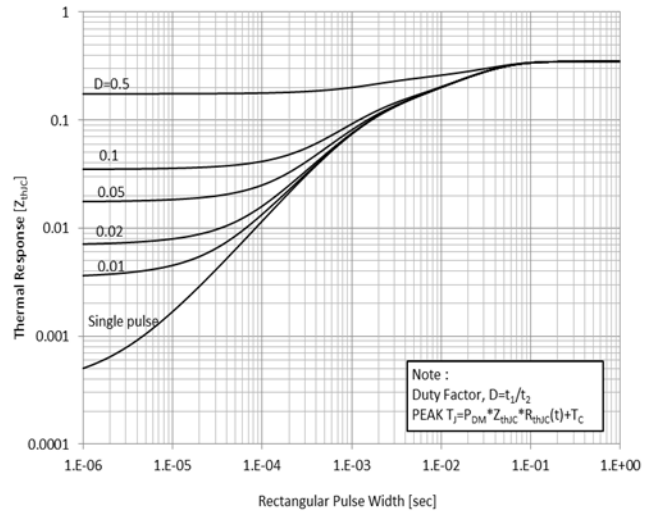


Fig.20 IGBT Transient Thermal Impeadance

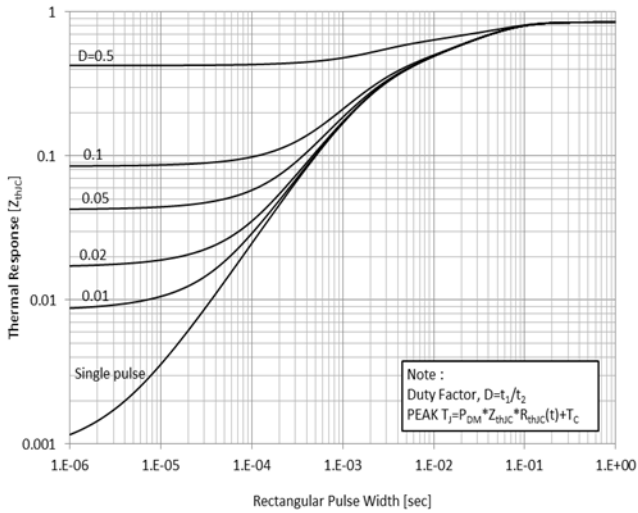
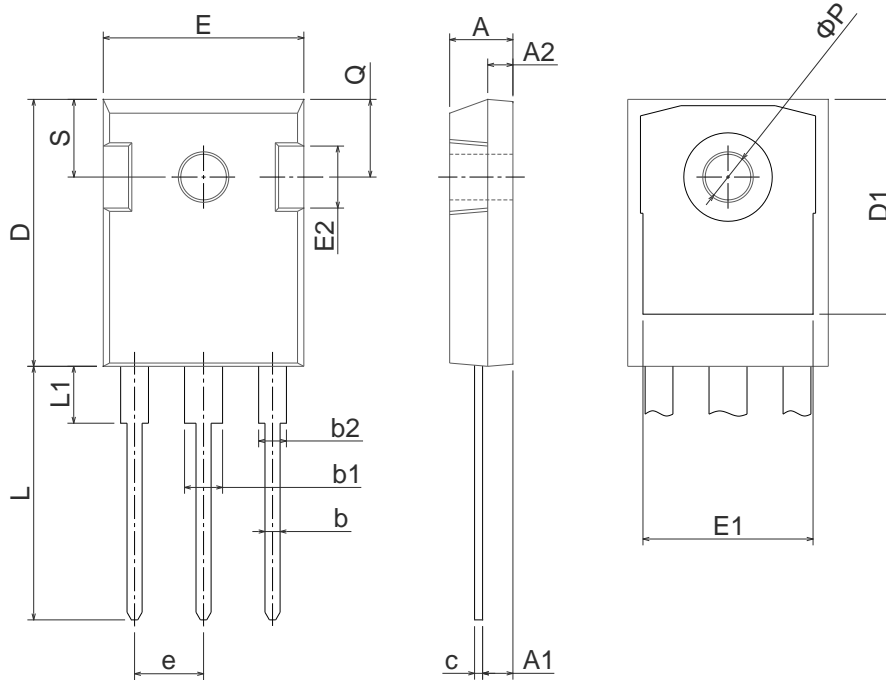


Fig.21 FRD Transient Thermal Impeadance


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:

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