

Description

The DGTD120T40S1PT is produced using advanced Field Stop Trench IGBT Technology, which provides low $V_{CE(sat)}$, excellent quality and high switching performance.

Features

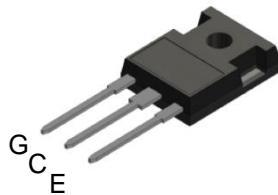
- High-Speed Switching & Low Power Loss
- $V_{CE(sat)} = 2.0V @ I_C = 40A$
- High Input Impedance
- $t_{rr} = 100ns$ (typ) @ $di_f/dt = 200A/us$
- Ultra Soft, Fast Recovery Anti-parallel Diode
- Ultra Narrowed VF Distribution Control
- **Lead-Free Finish & RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

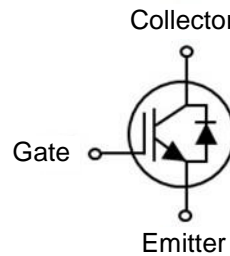
- Motor Drive
- UPS
- Solar Inverter
- IH Cooker

Mechanical Data

- Case: TO-247 (Type MC)
- Case Material: Molded Plastic. "Green" Molding Compound.
- UL Flammability Classification Rating 94V-0
- Terminals: Finish – Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208
- Weight: 5.6 grams (Approximate)



TO-247



Device Symbol

Ordering Information (Note 4)

| Product | Marking | Quantity |
|----------------|--------------|-------------------------------|
| DGTD120T40S1PT | DGTD120T40S1 | 450 per Box in Tubes (Note 5) |

- Notes:
1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
 2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
 4. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.
 5. 30 Devices per Tube

Marking Information



= Manufacturer's Marking
 DGTD120T40S1 = Product Type Marking Code
 YY = Year (ex: 18 = 2018)
 LLLLL = Lot Code
 WW = Week (01 to 53)

Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|------------------|------------------------|------|
| Collector-Emitter Voltage | V _{CE} | 1200 | V |
| DC Collector Current | I _C | T _C = 25°C | 80 |
| | | T _C = 100°C | 40 |
| Pulsed Collector Current, t _p limited by T _{vjmax} | I _{CM} | 160 | A |
| Diode Forward Current | I _F | T _C = 25°C | 80 |
| | | T _C = 100°C | 40 |
| Diode Pulsed Current, t _p limited by T _{vjmax} | I _{FM} | 160 | A |
| Gate-Emitter Voltage | V _{GES} | ±20 | V |
| Short Circuit Withstand Time V _{CC} ≤ 600V, V _{GE} = 15V, T _{vj} = 150°C Allowed Number of Short Circuits < 1000 Time Between Short Circuits ≥ 1.0s | t _{sc} | 10 | μs |

Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|------------------|------------------------|------|
| Power Dissipation Linear Derating Factor (Note 6) | P _D | T _C = 25°C | 357 |
| | | T _C = 100°C | 142 |
| Thermal Resistance, Junction to Ambient (Note 6) | R _{θJA} | 40 | °C/W |
| Thermal Resistance, Junction to Case for IBGT (Note 6) | R _{θJC} | 0.35 | |
| Thermal Resistance, Junction to Case for Diode (Note 6) | R _{θJC} | 0.80 | |
| Operating Temperature | T _{vj} | -55 to +150 | °C |
| Storage Temperature Range | T _{STG} | -55 to +150 | |

Note: 6. When mounted on a standard JEDEC 2-layer FR-4 board.

Electrical Characteristics (@ $T_{vj} = +25^{\circ}\text{C}$, unless otherwise specified.)

| Parameter | Symbol | Min | Typ | Max | Unit | Condition | |
|--------------------------------------|---------------|--------------------------------|-------|-----------|------|--|---|
| STATIC CHARACTERISTICS | | | | | | | |
| Collector-Emitter Breakdown Voltage | BV_{CES} | 1,200 | – | – | V | $I_C = 1\text{mA}, V_{GE} = 0\text{V}$ | |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $T_{vj} = 25^{\circ}\text{C}$ | – | 2.00 | 2.40 | V | $I_C = 40\text{A}, V_{GE} = 15\text{V}$ |
| | | $T_{vj} = 150^{\circ}\text{C}$ | – | 2.45 | – | | |
| Diode Forward Voltage | V_F | $T_{vj} = 25^{\circ}\text{C}$ | – | 2.40 | 3.00 | V | $I_F = 40\text{A}$ |
| | | $T_{vj} = 150^{\circ}\text{C}$ | – | 2.45 | – | | |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | 4.5 | 5.5 | 6.5 | V | $V_{CE} = V_{GE}, I_C = 1\text{mA}$ | |
| Zero Gate Voltage Collector Current | I_{CES} | – | – | 1.0 | mA | $V_{CE} = 1200\text{V}, V_{GE} = 0\text{V}$ | |
| Gate-Emitter Leakage Current | I_{GES} | – | – | ± 250 | nA | $V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$ | |
| DYNAMIC CHARACTERISTICS | | | | | | | |
| Total Gate Charge | Q_g | – | 341 | – | nC | $V_{CE} = 600\text{V}, I_C = 40\text{A}, V_{GE} = 15\text{V}$ | |
| Gate-Emitter Charge | Q_{ge} | – | 52 | – | | | |
| Gate-Collector Charge | Q_{gc} | – | 126 | – | | | |
| Input Capacitance | C_{ies} | – | 6,030 | – | pF | $V_{CE} = 30\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$ | |
| Reverse Transfer Capacitance | C_{res} | – | 107 | – | | | |
| Output Capacitance | C_{oes} | – | 206 | – | | | |
| SWITCHING CHARACTERISTICS | | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | – | 65 | – | ns | $V_{GE} = 15\text{V}, V_{CC} = 600\text{V}, I_C = 40\text{A}, R_G = 10\Omega, \text{Inductive Load}, T_{vj} = 25^{\circ}\text{C}$ | |
| Rise time | t_r | – | 55 | – | | | |
| Turn-off Delay Time | $t_{d(off)}$ | – | 308 | – | | | |
| Fall Time | t_f | – | 40 | – | | | |
| Turn-on Switching Energy | E_{on} | – | 1.96 | – | mJ | | |
| Turn-off Switching Energy | E_{off} | – | 0.54 | – | | | |
| Total Switching Energy | E_{ts} | – | 2.50 | – | | | |
| Reverse Recovery Time | t_{rr} | – | 100 | – | ns | | $I_F = 40\text{A}, di_F/dt = 200\text{A}/\mu\text{s}, T_{vj} = 25^{\circ}\text{C}$ |
| Reverse Recovery Current | I_{rr} | – | 7 | – | A | | |
| Reverse Recovery Charge | Q_{rr} | – | 350 | – | nC | | |
| Turn-on Delay Time | $t_{d(on)}$ | – | 70 | – | ns | $V_{GE} = 15\text{V}, V_{CC} = 600\text{V}, I_C = 40\text{A}, R_G = 10\Omega, \text{Inductive Load}, T_{vj} = 150^{\circ}\text{C}$ | |
| Rise time | t_r | – | 62 | – | | | |
| Turn-off Delay Time | $t_{d(off)}$ | – | 325 | – | | | |
| Fall Time | t_f | – | 62 | – | | | |
| Turn-on Switching Energy | E_{on} | – | 2.35 | – | mJ | | |
| Turn-off Switching Energy | E_{off} | – | 1.61 | – | | | |
| Total Switching Energy | E_{ts} | – | 3.96 | – | | | |
| Reverse Recovery Time | t_{rr} | – | 180 | – | ns | | $I_F = 40\text{A}, di_F/dt = 200\text{A}/\mu\text{s}, T_{vj} = 150^{\circ}\text{C}$ |
| Reverse Recovery Current | I_{rr} | – | 10 | – | A | | |
| Reverse Recovery Charge | Q_{rr} | – | 900 | – | nC | | |

Typical Performance Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

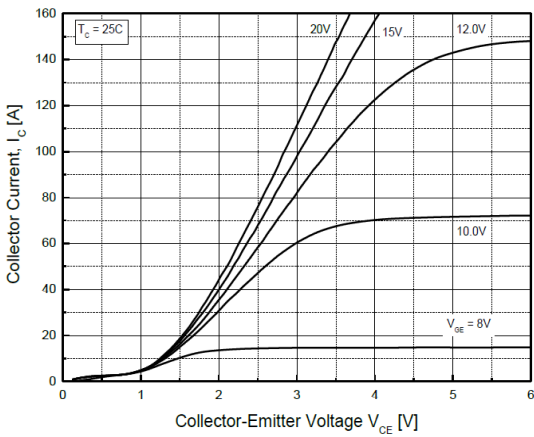


Fig.1 Typical Output Characteristics

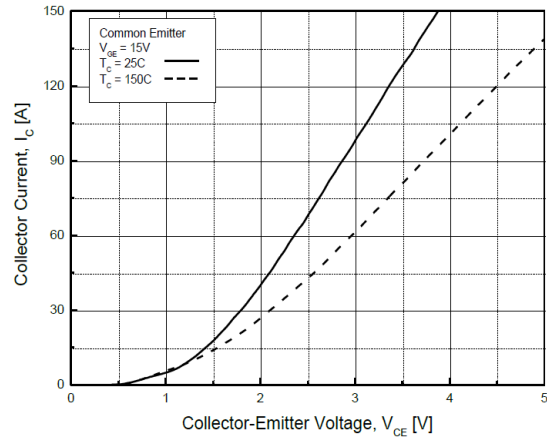


Fig.2 Typical Collector-Emitter Saturation Voltage

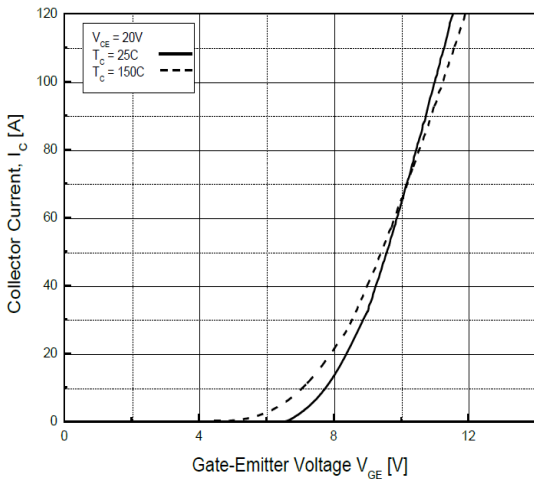


Fig.3 Typical Transfer Characteristics

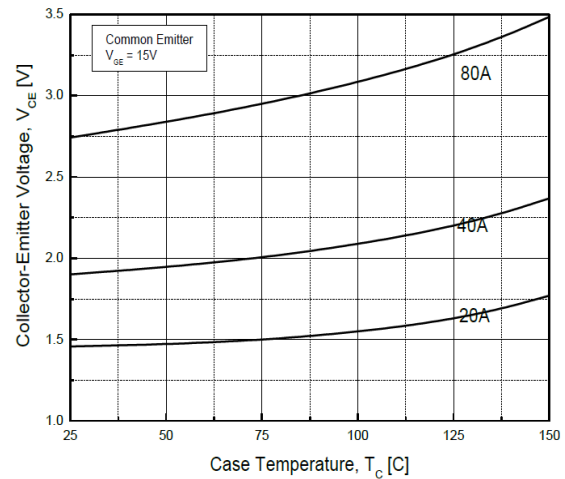


Fig.4 Typical Collector-Emitter Saturation Voltage at Case Temperature

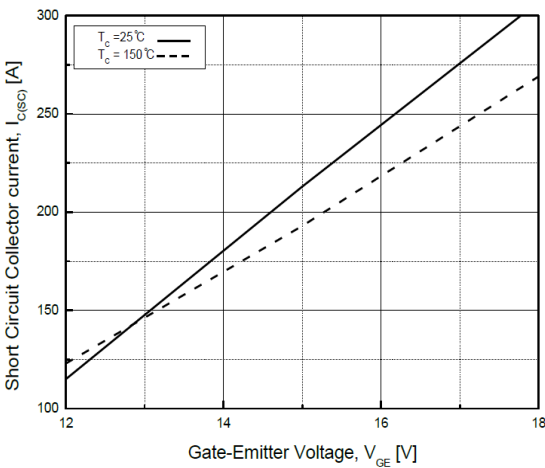


Fig.5 Typical Short Circuit Collector Current

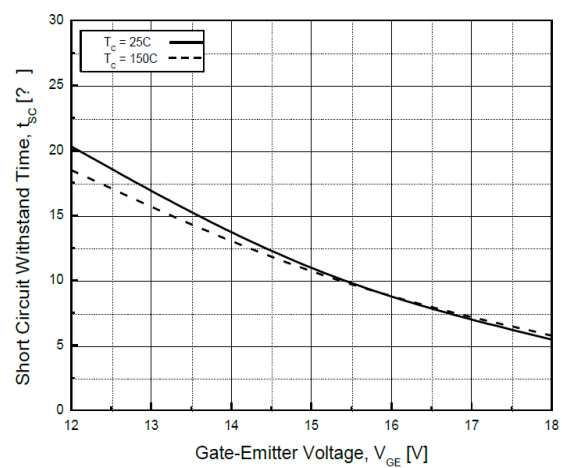


Fig.6 Typical Short Circuit Withstand Time

Typical Performance Characteristics (continued)

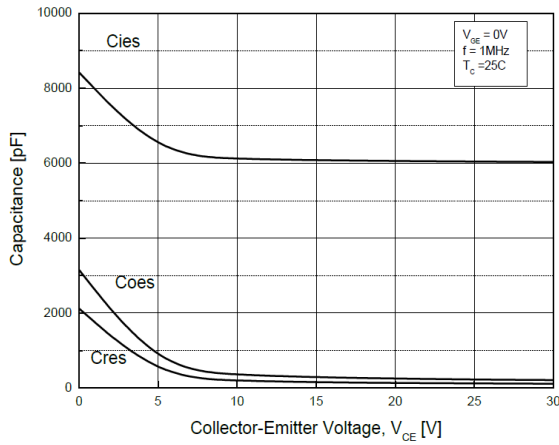


Fig.7 Typical Capacitance

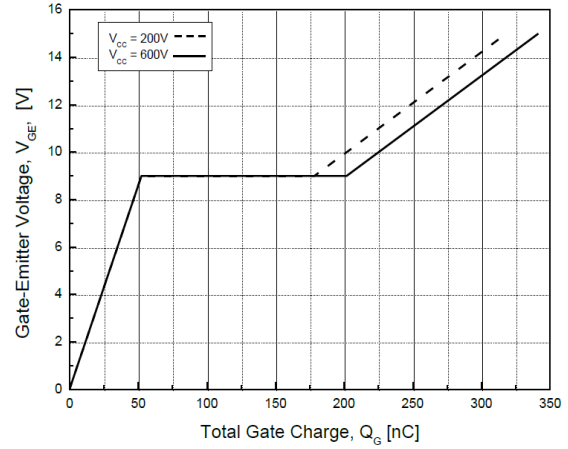


Fig.8 Typical Gate Charge

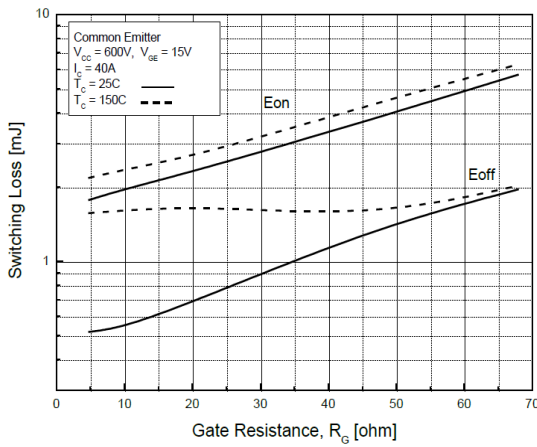


Fig.9 Switching Loss-Gate Resistance

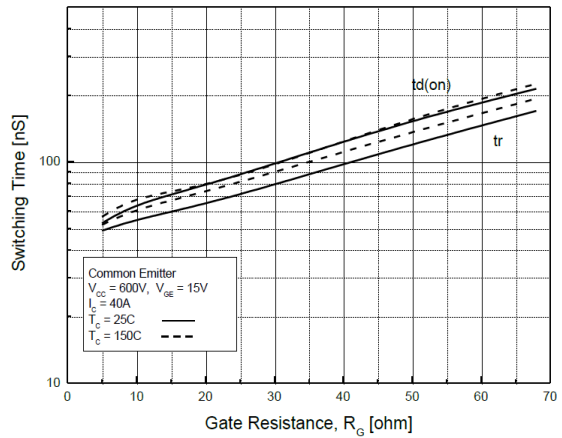


Fig.10 Turn on Characteristics-Gate Resistance

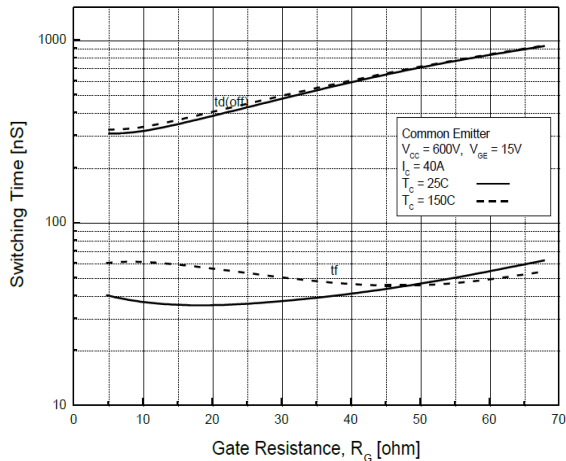


Fig.11 Turn off Characteristics-Gate Resistance

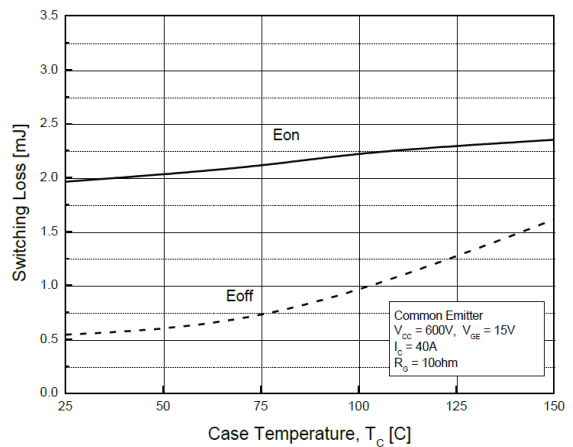


Fig.12 Switching Loss-Case Temperature

Typical Performance Characteristics (cont.)

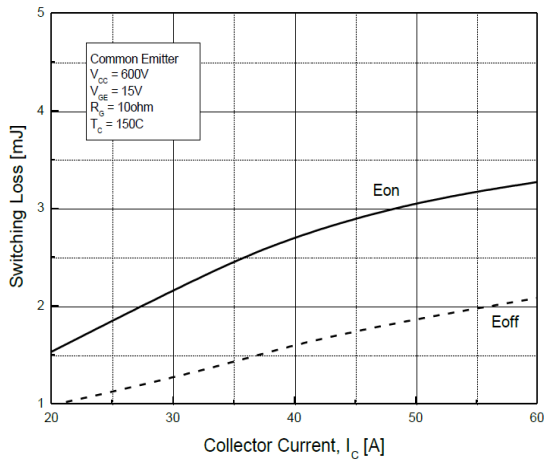


Fig.13 Switching Loss-Collector Current

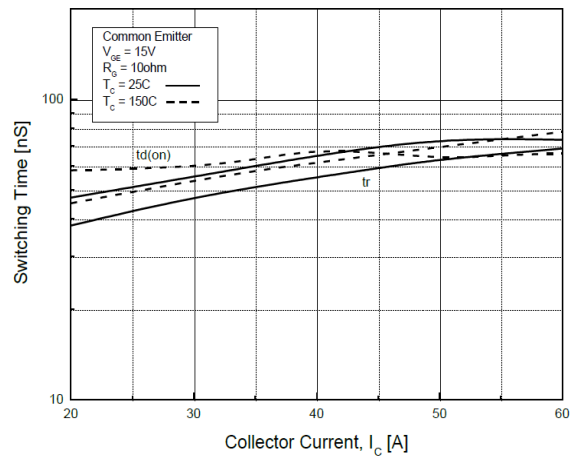


Fig.14 Typical Turn on-Collector Current

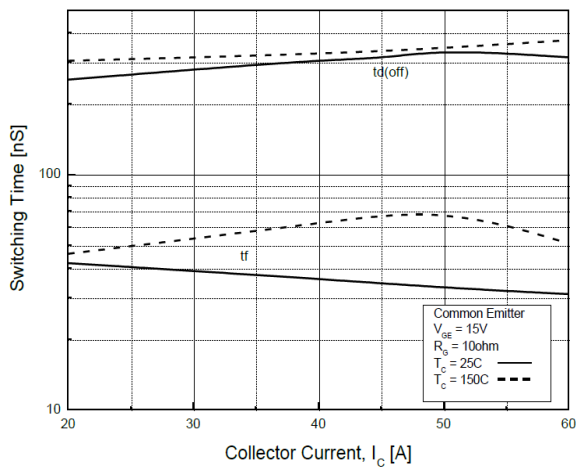


Fig.15 Typical Turn off-Collector Current

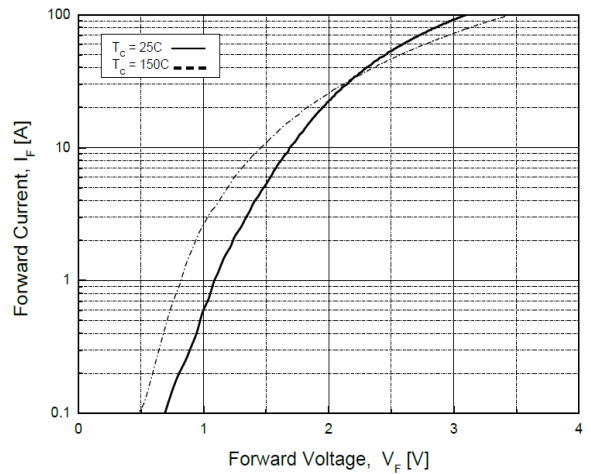


Fig.16 Diode Forward Characteristics

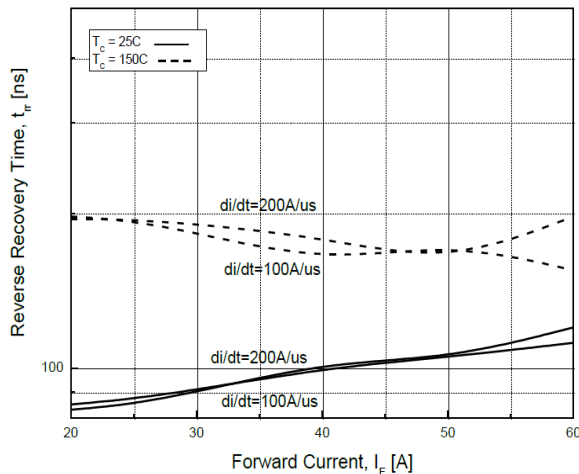


Fig.17 Typical Turn off-Collector Current

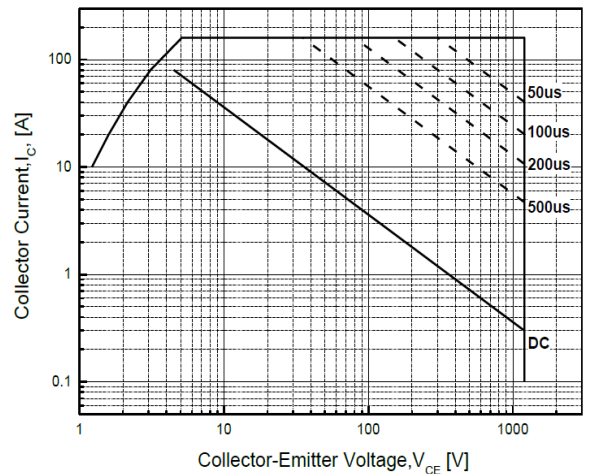


Fig.18 Forward Bias Safe Operating Area

Typical Performance Characteristics (cont.)

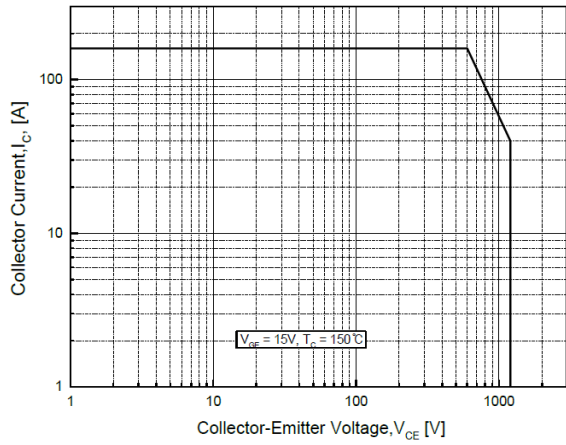


Fig.19 Reverse Bias Safe Operating Area

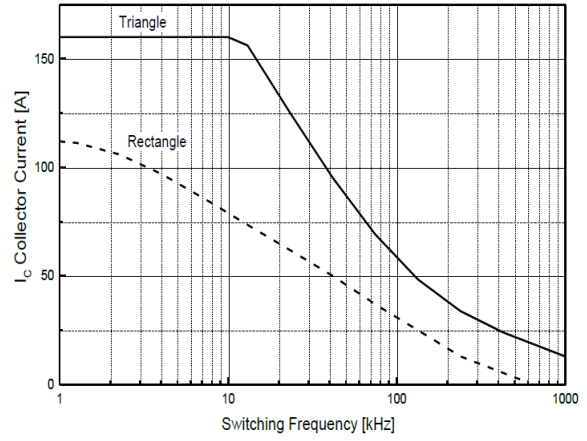


Fig.20 Switching frequency – Collector current

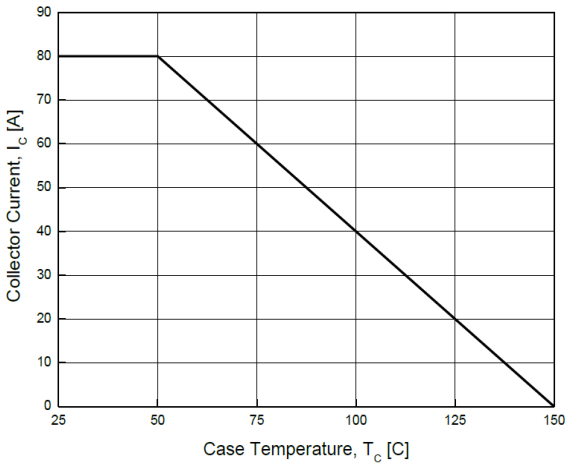


Fig.21 Case Temperature – Collector Current

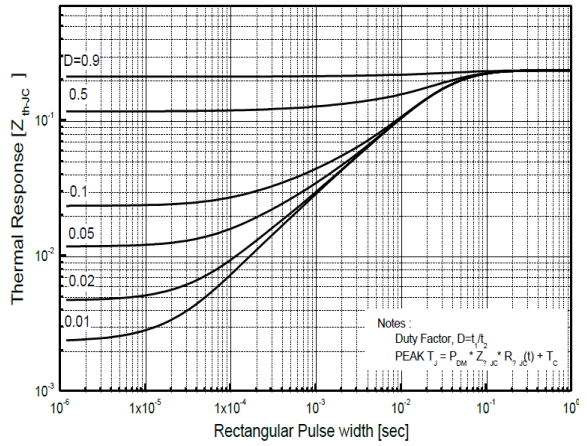
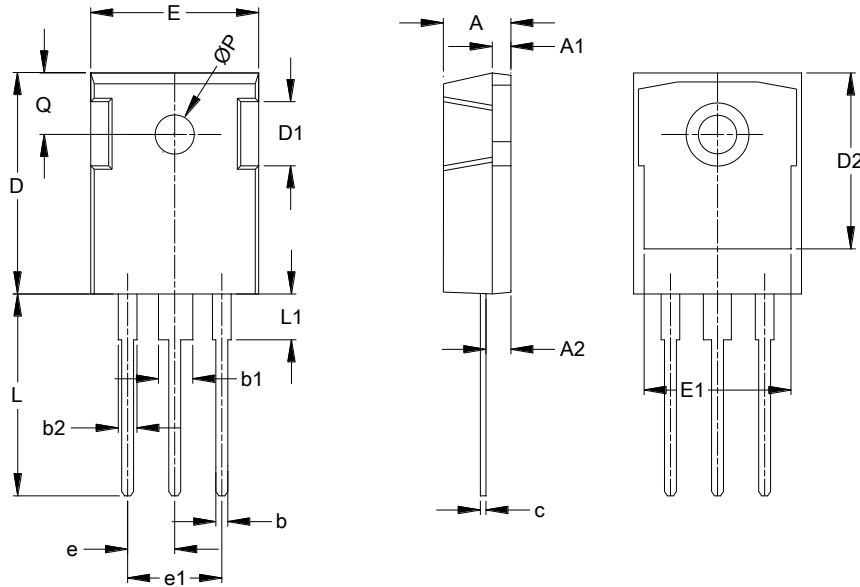


Fig.22 IGBT Transient Thermal Impedance

Package Outline Dimensions

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

TO-247 (Type MC)



| TO-247 | | | |
|----------------------|-------|-------|-----|
| Dim | Min | Max | Typ |
| A | 4.700 | 5.310 | - |
| A1 | 1.500 | 2.490 | - |
| A2 | 2.200 | 2.600 | - |
| b | 0.990 | 1.400 | - |
| b1 | 2.590 | 3.430 | - |
| b2 | 1.650 | 2.390 | - |
| c | 0.380 | 0.890 | - |
| D | 20.30 | 21.46 | - |
| D1 | 4.320 | 5.490 | - |
| D2 | 13.08 | - | - |
| E | 15.45 | 16.26 | - |
| E1 | 13.06 | 14.02 | - |
| e | 5.450 | | |
| e1 | 10.90 | | |
| L | 19.81 | 20.57 | - |
| L1 | - | 4.500 | - |
| Q | 5.380 | 6.200 | - |
| øP | 3.500 | 3.700 | - |
| All Dimensions in mm | | | |

Note : For high voltage applications, the appropriate industry sector guidelines should be considered with regards to creepage and clearance distances between device Terminals and PCB tracking.

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