

Description

The DGTD65T50S1PT is produced using advanced Field Stop Trench IGBT Technology, which provides excellent quality and high-switching performance.

Features

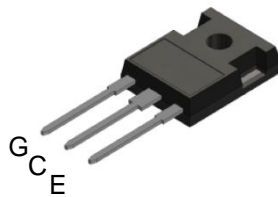
- High-Speed Switching & Low Power Loss
- $V_{CE(sat)} = 1.85V @ I_C = 50A$
- High Input Impedance
- $t_{rr} = 80ns$ (typ) @ $di_f/dt = 1000A/\mu s$
- $E_{off} = 0.55mJ @ T_C = 25^\circ C$
- Maximum Junction Temperature $175^\circ C$
- **Lead-Free Finish & RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

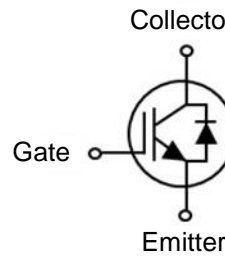
- UPS
- Welder
- Solar Inverter
- IH Cooker

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 ^(E3)
- Weight: 5.6 grams (Approximate)



TO-247



Device Symbol

Ordering Information (Note 4)

| Product | Marking | Quantity |
|---------------|-------------|-------------------------------|
| DGTD65T50S1PT | DGTD65T50S1 | 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



$\text{D} \parallel \parallel$ = Manufacturer's Marking
 DGTD65T50S1 = 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} | 650 | V |
| DC Collector Current, limited by T _{vjmax} | I _C | T _C = 25°C | 100 |
| | | T _C = 100°C | 50 |
| Pulsed Collector Current, t _p limited by T _{vjmax} | I _{Cpuls} | 200 | A |
| Turn Off Safe Operating Area V _{CE} ≤ 650V, T _{vj} = 175°C | - | 200 | A |
| Diode Forward Current limited by T _{vjmax} | I _F | T _C = 25°C | 60 |
| | | T _C = 100°C | 30 |
| Diode Pulsed Current, t _p limited by T _{vjmax} | I _{Fpuls} | 200 | A |
| Gate-Emitter Voltage | V _{GE} | ±20 | V |
| Short Circuit Withstand Time V _{CC} ≤ 400V, V _{GE} = 15V, T _{vj} = 150°C Allowed Number of Short Circuits < 1000 Time Between Short Circuits ≥ 1.0s | tsc | 5 | 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 | 375 |
| | | T _C = 100°C | 188 |
| Thermal Resistance, Junction to Ambient (Note 6) | R _{θJA} | 40 | °C/W |
| Thermal Resistance, Junction to Case for IGBT (Note 6) | R _{θJC} | 0.40 | |
| Thermal Resistance, Junction to Case for Diode (Note 6) | R _{θJC} | 1.20 | |
| Operating Temperature | T _{vj} | -40 to +175 | °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} | 650 | – | – | V | $I_C = 2\text{mA}, V_{GE} = 0\text{V}$ | |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $T_{vj} = 25^{\circ}\text{C}$ | – | 1.85 | 2.40 | V | $I_C = 50\text{A}, V_{GE} = 15\text{V}$ |
| | | $T_{vj} = 175^{\circ}\text{C}$ | – | 2.20 | – | | |
| Diode Forward Voltage | V_F | $T_{vj} = 25^{\circ}\text{C}$ | – | 1.65 | 2.05 | V | $V_{GE} = 0\text{V}, I_F = 30\text{A}$ |
| | | $T_{vj} = 175^{\circ}\text{C}$ | – | 1.55 | – | | |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | 3.8 | 5.0 | 6.2 | V | $V_{CE} = V_{GE}, I_C = 0.5\text{mA}$ | |
| Zero Gate Voltage Collector Current | I_{CES} | – | – | 40 | μA | $V_{CE} = 650\text{V}, V_{GE} = 0\text{V}$ | |
| Gate-Emitter Leakage Current | I_{GES} | – | – | ± 100 | nA | $V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$ | |
| DYNAMIC CHARACTERISTICS | | | | | | | |
| Total Gate Charge | Q_g | – | 287 | – | nC | $V_{CE} = 520\text{V}, I_C = 50\text{A}, V_{GE} = 15\text{V}$ | |
| Gate-Emitter Charge | Q_{ge} | – | 42 | – | | | |
| Gate-Collector Charge | Q_{gc} | – | 181 | – | | | |
| Input Capacitance | C_{ies} | – | 4,453 | – | pF | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$ | |
| Reverse Transfer Capacitance | C_{res} | – | 161 | – | | | |
| Output Capacitance | C_{oes} | – | 238 | – | | | |
| Internal Emitter Inductance Measured 5mm (0.197") From Case | L_E | – | 13 | – | nH | – | |
| Short Circuit Collector Current Max. 1000 Short Circuits. Time Between Short Circuits $\geq 1.0\text{s}$ | $I_{C(SC)}$ | – | 140 | – | A | $V_{GE} = 15\text{V}, V_{CC} = 400\text{V}, t_{SC} \leq 5\mu\text{s}, T_{vj} = 150^{\circ}\text{C}$ | |
| SWITCHING CHARACTERISTICS | | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | – | 58 | – | ns | $V_{GE} = 15\text{V}, V_{CC} = 400\text{V}, I_C = 50\text{A}, R_G = 7.9\Omega, \text{Inductive Load}, T_{vj} = 25^{\circ}\text{C}$ | |
| Rise time | t_r | – | 60 | – | | | |
| Turn-off Delay Time | $t_{d(off)}$ | – | 328 | – | | | |
| Fall Time | t_f | – | 44 | – | mJ | | |
| Turn-on Switching Energy | E_{on} | – | 0.77 | – | | | |
| Turn-off Switching Energy | E_{off} | – | 0.55 | – | | | |
| Total Switching Energy | E_{ts} | – | 1.32 | – | ns | $I_F = 30\text{A}, di_F/dt = 1000\text{A}/\mu\text{s}, T_{vj} = 25^{\circ}\text{C}$ | |
| Reverse Recovery Time | t_{rr} | – | 80 | – | | | |
| Reverse Recovery Current | I_{rr} | – | 24 | – | A | | |
| Reverse Recovery Charge | Q_{rr} | – | 0.95 | – | μC | $V_{GE} = 15\text{V}, V_{CC} = 400\text{V}, I_C = 50\text{A}, R_G = 7.9\Omega, \text{Inductive Load}, T_{vj} = 175^{\circ}\text{C}$ | |
| Turn-on Delay Time | $t_{d(on)}$ | – | 51 | – | ns | | |
| Rise time | t_r | – | 66 | – | | | |
| Turn-off Delay Time | $t_{d(off)}$ | – | 350 | – | | mJ | |
| Fall Time | t_f | – | 49 | – | | | |
| Turn-on Switching Energy | E_{on} | – | 1.05 | – | | | |
| Turn-off Switching Energy | E_{off} | – | 0.55 | – | ns | $I_F = 30\text{A}, di_F/dt = 1000\text{A}/\mu\text{s}, T_{vj} = 175^{\circ}\text{C}$ | |
| Total Switching Energy | E_{ts} | – | 1.6 | – | | | |
| Reverse Recovery Time | t_{rr} | – | 116 | – | A | | |
| Reverse Recovery Current | I_{rr} | – | 34 | – | μC | | |
| Reverse Recovery Charge | Q_{rr} | – | 1.97 | – | | | |

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

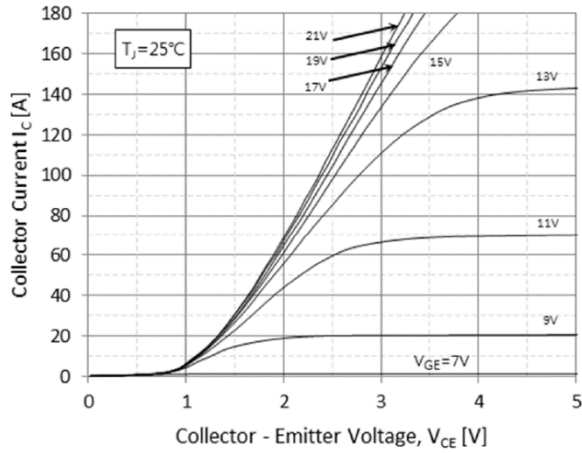


Fig.1 Typical Output Characteristics ($T_J = 25^\circ\text{C}$)

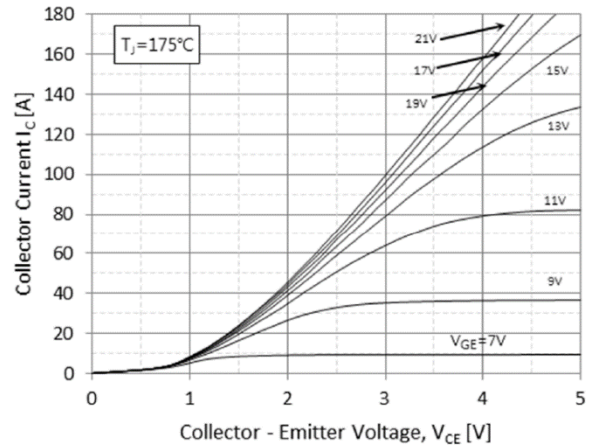


Fig.2 Typical Output Characteristics ($T_J = 175^\circ\text{C}$)

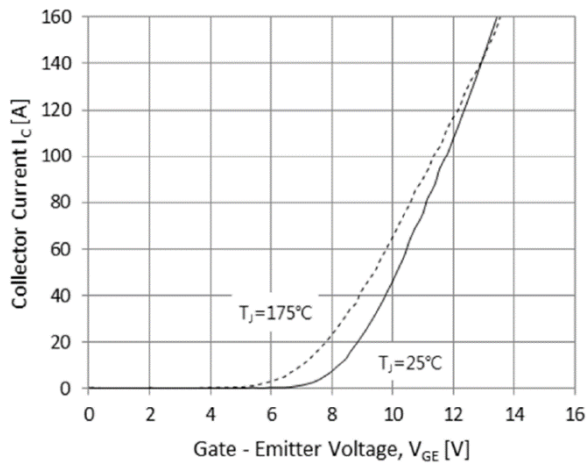


Fig.3 Typical Transfer Characteristics

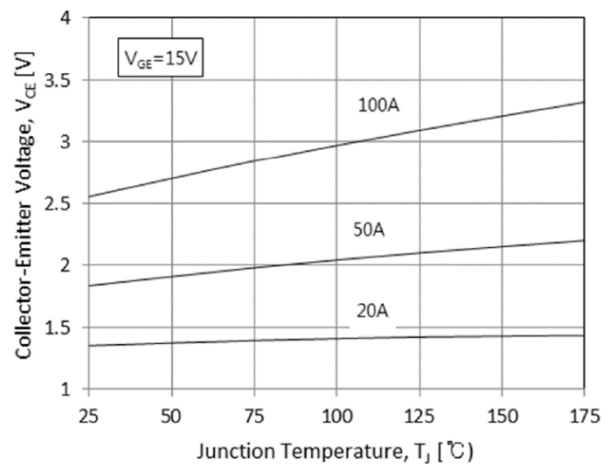


Fig.4 Typical Collector-Emitter Saturation Voltage - Junction Temperature

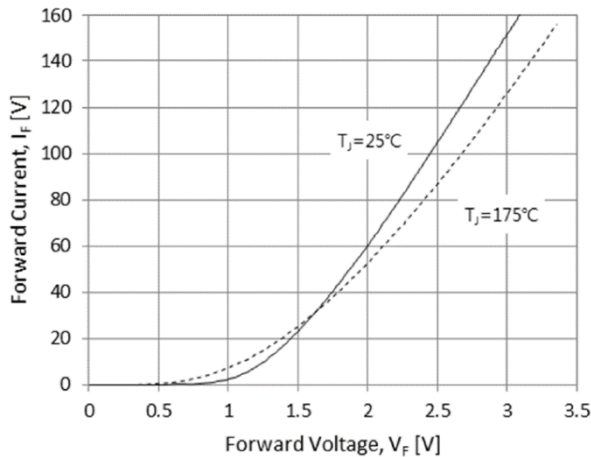


Fig.5 Diode Forward Characteristics

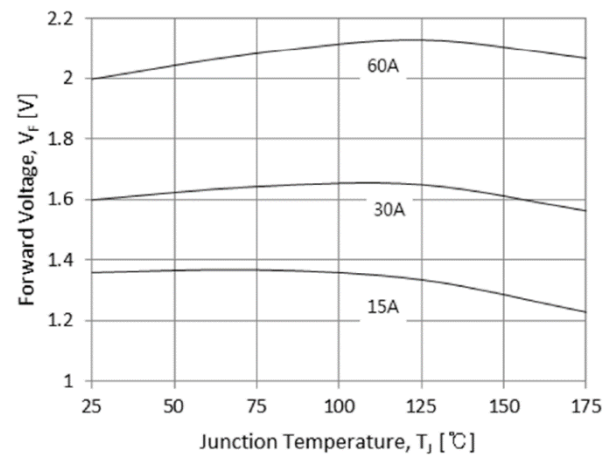


Fig.6 Diode Forward-Junction Temperature

Typical Performance Characteristics (continued)

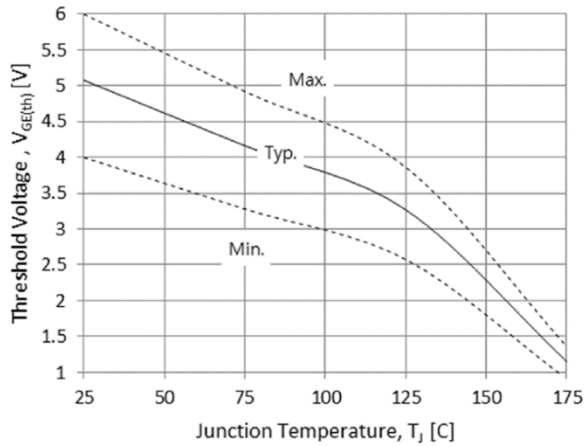


Fig.7 Threshold Voltage-Junction Temperature

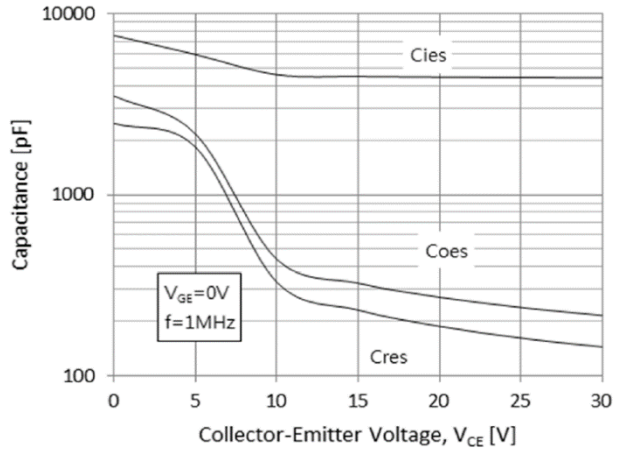


Fig.8 Typical Capacitance

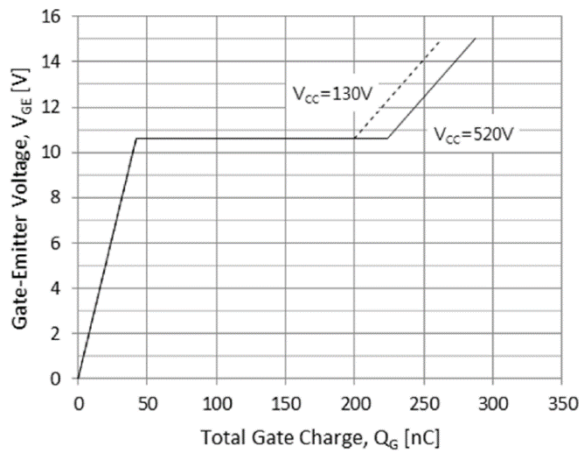


Fig.9 Typical Gate Charge

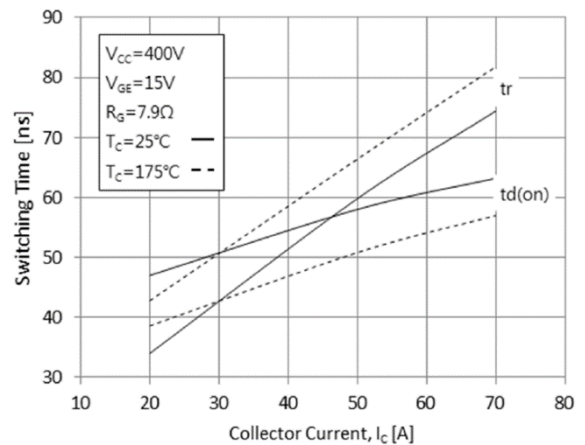


Fig.10 Typical Turn on-Collector Current

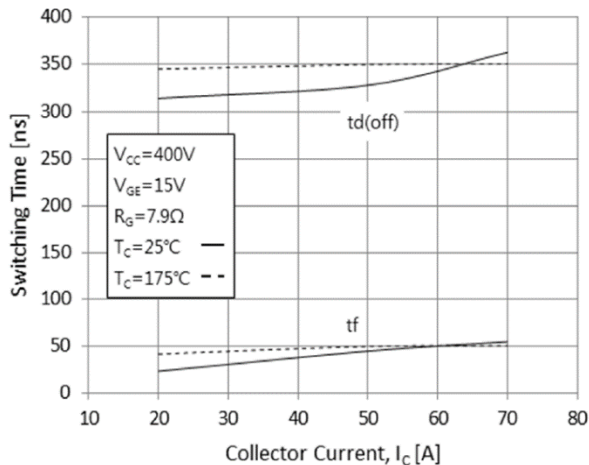


Fig.11 Typical Turn off-Collector Current

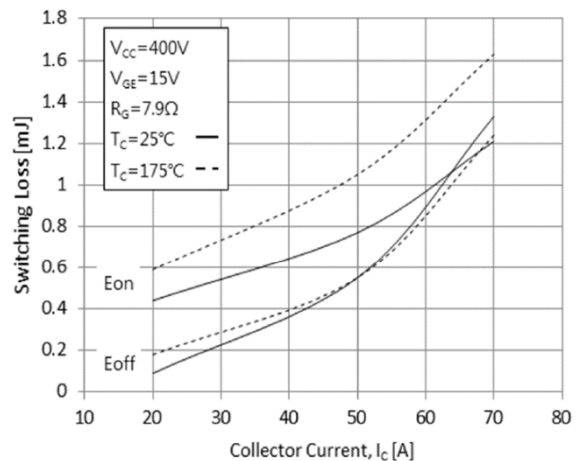


Fig.12 Switching Loss-Collector Current

Typical Performance Characteristics (cont.)

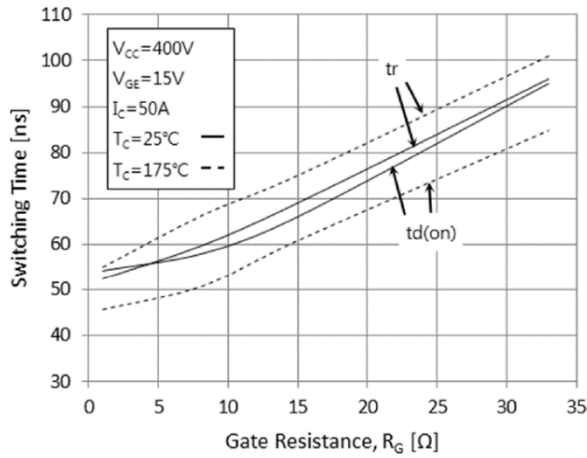


Fig.13 Turn on Characteristics-Gate Resistance

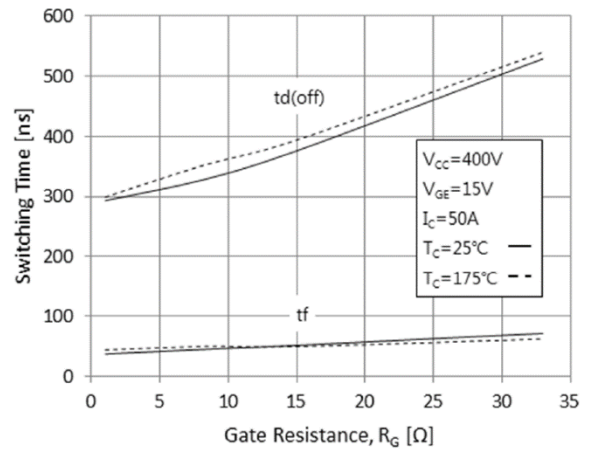


Fig.14 Turn off Characteristics-Gate Resistance

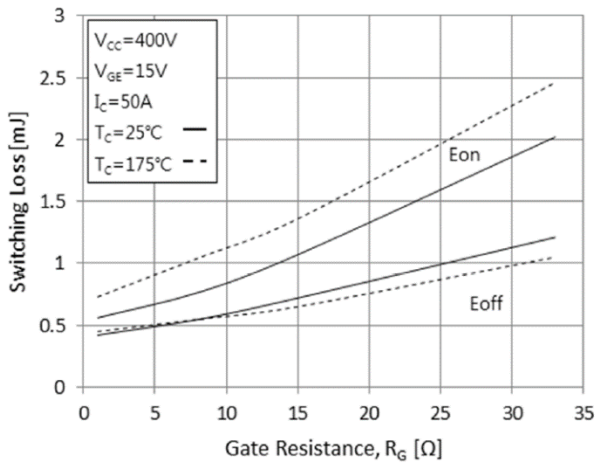


Fig.15 Switching Loss-Gate Resistance

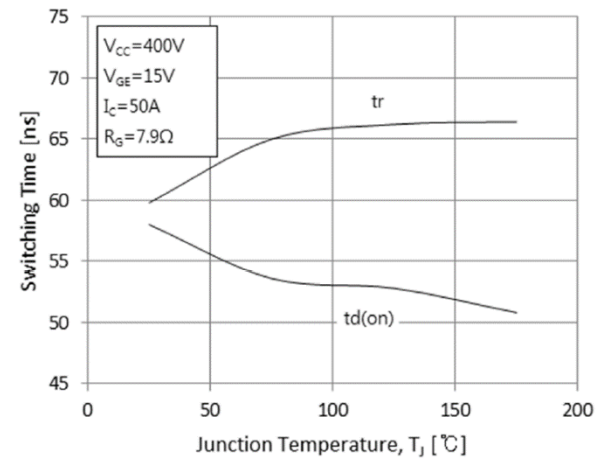


Fig.16 Turn on Characteristics-Junction Temperature

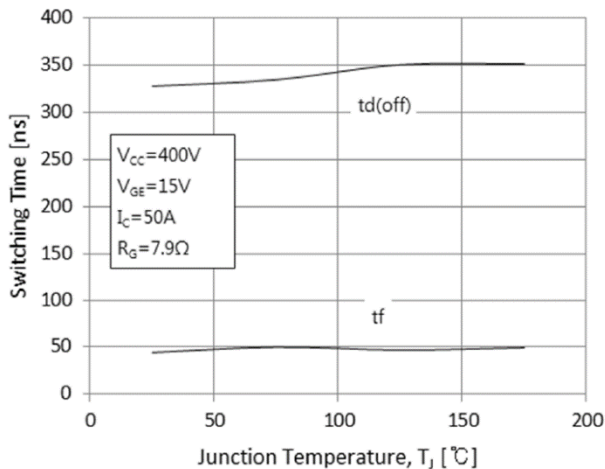


Fig.17 Turn off Characteristics-Junction Temperature

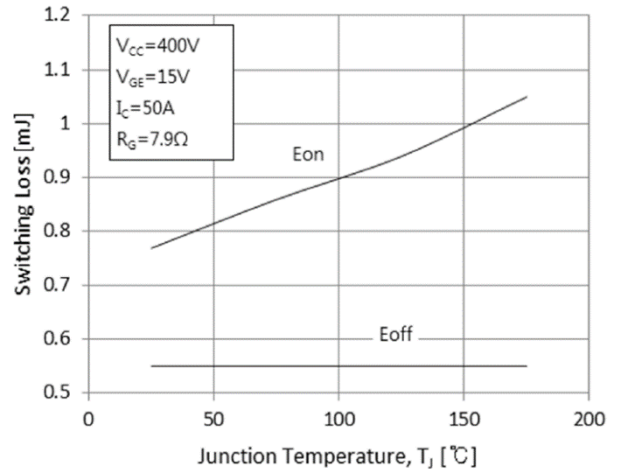


Fig.18 Switching Loss-Junction Temperature

Typical Performance Characteristics (cont.)

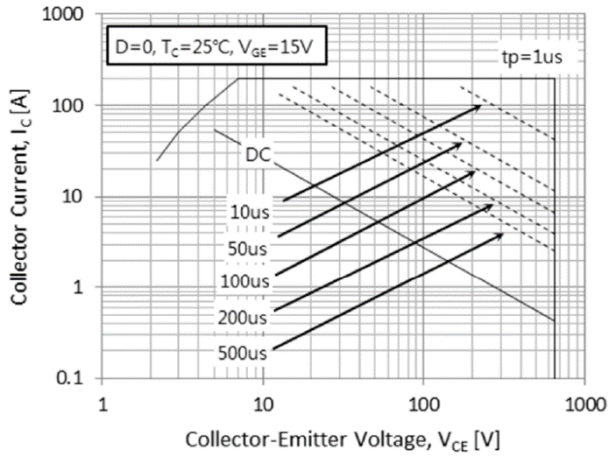


Fig.19 Forward Bias Safe Operating Area

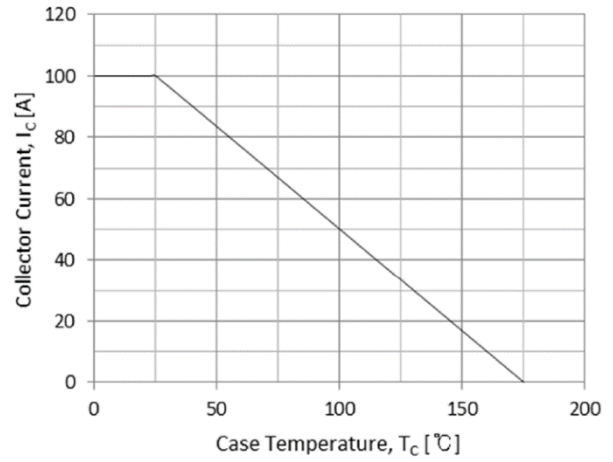


Fig.20 Case Temperature-Collector Current

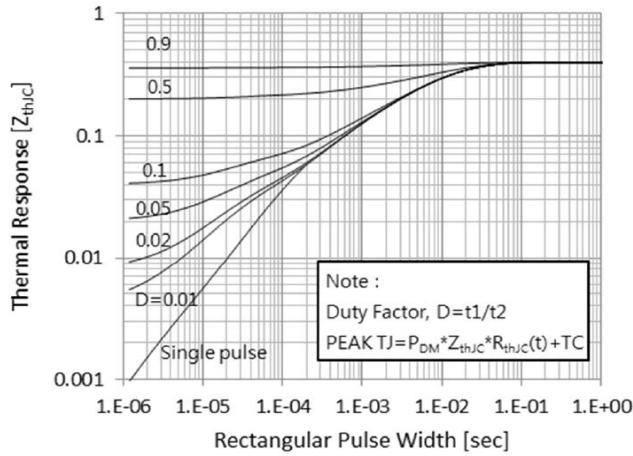


Fig.21 IGBT Transient Thermal Impedance

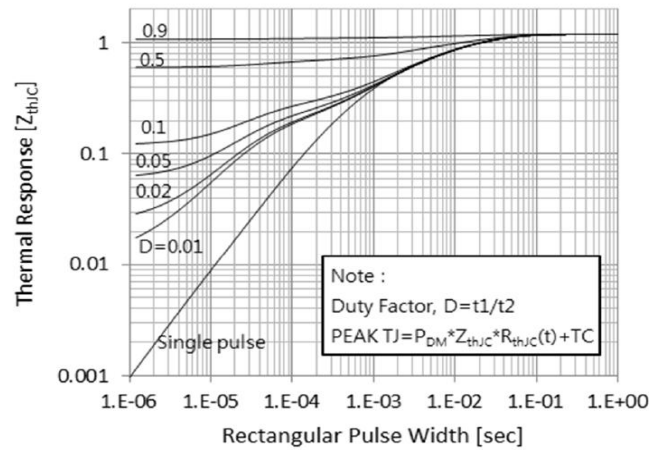
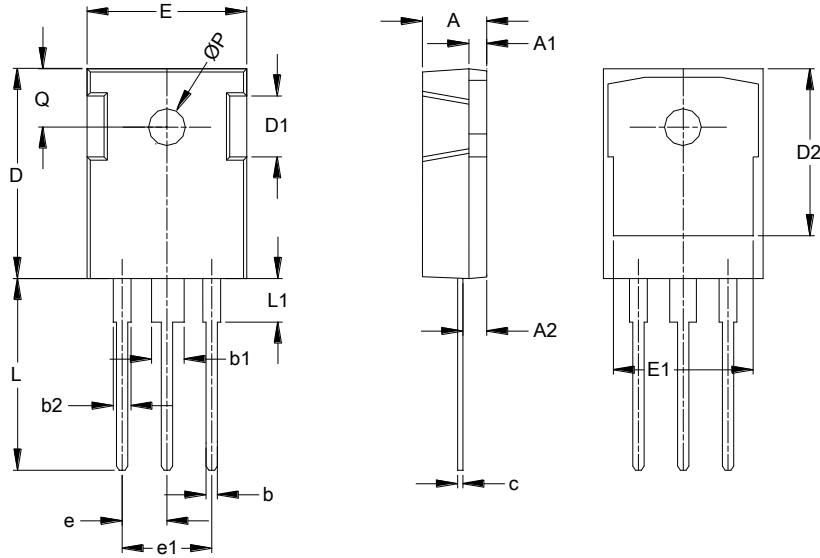


Fig.22 FRD Transient Thermal Impedance

Package Outline Dimensions

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

TO-247 (Type MC)



| TO-247 (Type MC) | | | |
|----------------------|-------|-------|-----|
| 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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