# DGTD120T40S1PT

## 1200V FIELD STOP IGBT IN TO247



## Description

The DIODES™ 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/μs
- Ultra Soft, Fast Recovery Anti-Parallel Diode
- Ultra Narrowed $V_F$ Distribution Control
- **Lead-Free Finish & RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

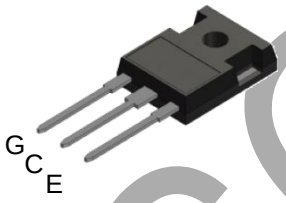
## Applications

- Motor drives
- UPS
- Solar inverters
- IH cookers

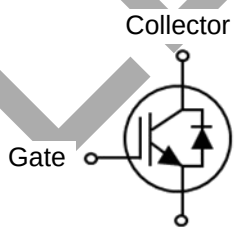
## Mechanical Data

- Package: TO247
- Package 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)

TO247 (Type MC)




Top View




Device Symbol

## Ordering Information (Note 4)

| Part Number | Package | Marking | Packing | |
|---|---|---|---|---|
| | | | Qty. | Carrier |
| DGTD120T40S1PT | TO247 (Type MC) | 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 https://www.diodes.com/quality/lead-free/ 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: 22 = 2022)
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 | $T_C$ = +25°C | $I_C$ | 80 | A |
| | $T_C$ = +100°C | | 40 | A |
| Pulsed Collector Current, $t_p$ Limited by $T_{vjmax}$ | | $I_{CM}$ | 160 | A |
| Diode Forward Current | $T_C$ = +25°C | $I_F$ | 80 | A |
| | $T_C$ = +100°C | | 40 | A |
| Diode Pulsed Current, $t_p$ Limited by $T_{vjmax}$ | | $I_{FM}$ | 160 | A |
| Gate-Emitter Voltage | | $V_{GES}$ | ±20 | V |
| Short Circuit Withstand Time<br>$V_{CC} \leq$ 600V, $V_{GE}$ = 15V, $T_{vj}$ = +150°C<br>Allowed Number of Short Circuits < 1000<br>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) | $T_C$ = +25°C | $P_D$ | 357 | W |
| | $T_C$ = +100°C | | 142 | |
| Thermal Resistance, Junction to Ambient (Note 6) | | $R_{\theta JA}$ | 40 | °C/W |
| Thermal Resistance, Junction to Case for IBGT (Note 6) | | $R_{\theta JC}$ | 0.35 | |
| Thermal Resistance, Junction to Case for Diode (Note 6) | | $R_{\theta JC}$ | 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°C, unless otherwise specified.)

| Parameter | | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|---|
| **STATIC CHARACTERISTICS** | | | | | | | |
| Collector-Emitter Breakdown Voltage | | $BV_{CES}$ | 1,200 | — | — | V | $I_C$ = 1mA, $V_{GE}$ = 0V |
| Collector-Emitter Saturation Voltage | $T_{vj}$ = +25°C | $V_{CE(sat)}$ | — | 2.00 | 2.40 | V | $I_C$ = 40A, $V_{GE}$ = 15V |
| | $T_{vj}$ = +150°C | | — | 2.45 | — | | |
| Diode Forward Voltage | $T_{vj}$ = +25°C | $V_F$ | — | 2.40 | 3.00 | V | $I_F$ = 40A |
| | $T_{vj}$ = +150°C | | — | 2.45 | — | | |
| Gate-Emitter Threshold Voltage | | $V_{GE(th)}$ | 4.5 | 5.5 | 6.5 | V | $V_{CE}$ = $V_{GE}$, $I_C$ = 1mA |
| Zero Gate Voltage Collector Current | | $I_{CES}$ | — | — | 1.0 | mA | $V_{CE}$ = 1200V, $V_{GE}$ = 0V |
| Gate-Emitter Leakage Current | | $I_{GES}$ | — | — | ±250 | nA | $V_{GE}$ = 20V, $V_{CE}$ = 0V |
| **DYNAMIC CHARACTERISTICS** | | | | | | | |
| Total Gate Charge | | $Q_g$ | — | 341 | — | nC | $V_{CE}$ = 600V, $I_C$ = 40A<br>$V_{GE}$ = 15V |
| Gate-Emitter Charge | | $Q_{ge}$ | — | 52 | — | | |
| Gate-Collector Charge | | $Q_{gc}$ | — | 126 | — | | |
| Input Capacitance | | $C_{ies}$ | — | 6,030 | — | pF | $V_{CE}$ = 30V, $V_{GE}$ = 0V<br>f = 1MHz |
| Reverse Transfer Capacitance | | $C_{res}$ | — | 107 | — | | |
| Output Capacitance | | $C_{oes}$ | — | 206 | — | | |
| **SWITCHING CHARACTERISTICS** | | | | | | | |
| Turn-on Delay Time | | $t_{d(on)}$ | — | 65 | — | ns | $V_{GE}$ = 15V, $V_{CC}$ = 600V<br>$I_C$ = 40A, $R_G$ = 10Ω<br>Inductive Load<br>$T_{vj}$ = +25°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 | $I_F$ = 40A<br>$dI_F/dt$ = 200A/µs<br>$T_{vj}$ = +25°C |
| Reverse Recovery Current | | $I_{rr}$ | — | 7 | — | A | |
| Reverse Recovery Charge | | $Q_{rr}$ | — | 350 | — | nC | |
| Turn-on Delay Time | | $t_{d(on)}$ | — | 70 | — | ns | $V_{GE}$ = 15V, $V_{CC}$ = 600V<br>$I_C$ = 40A, $R_G$ = 10Ω<br>Inductive Load<br>$T_{vj}$ = +150°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 | $I_F$ = 40A<br>$dI_F/dt$ = 200A/µs<br>$T_{vj}$ = +150°C |
| Reverse Recovery Current | | $I_{rr}$ | — | 10 | — | A | |
| Reverse Recovery Charge | | $Q_{rr}$ | — | 900 | — | nC | |

## Typical Performance Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

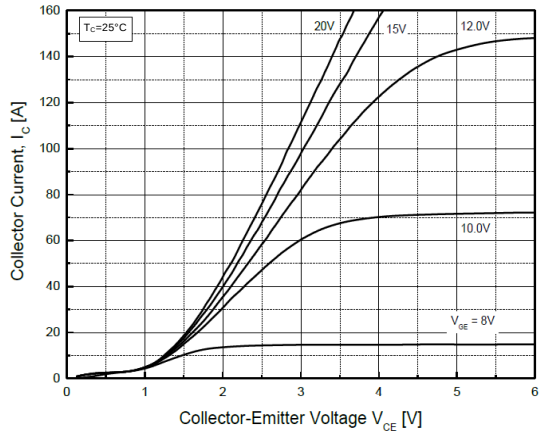



Fig.1 Typical Output Characteristics

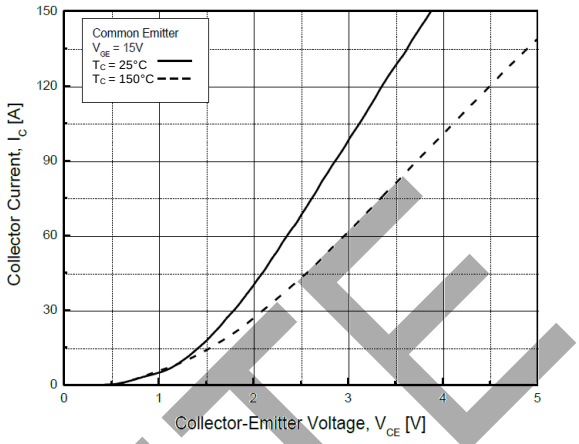



Fig.2 Typical Collector-Emitter Saturation Voltage

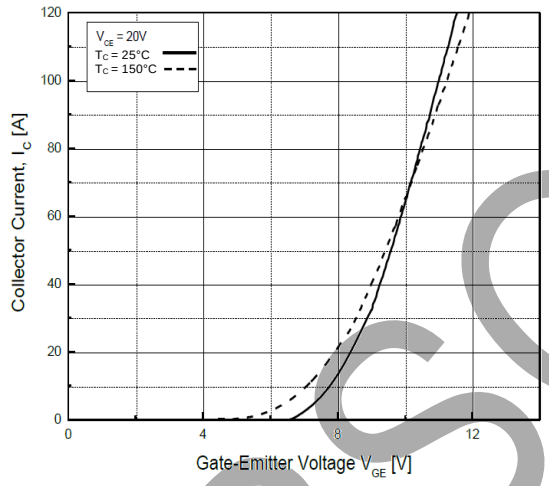



Fig.3 Typical Transfer Characteristics

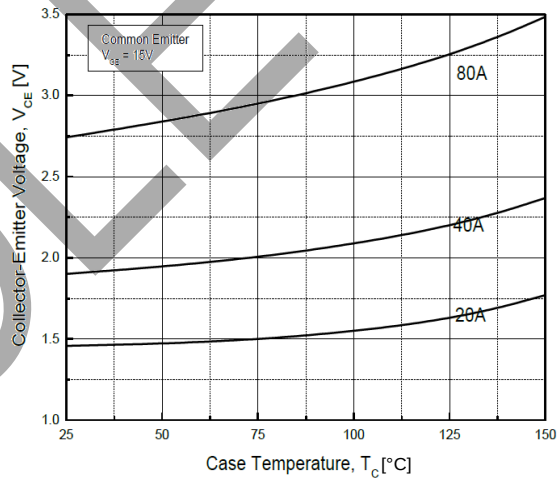



Fig.4 Typical Collector-Emitter Saturation Voltage at Case Temperature

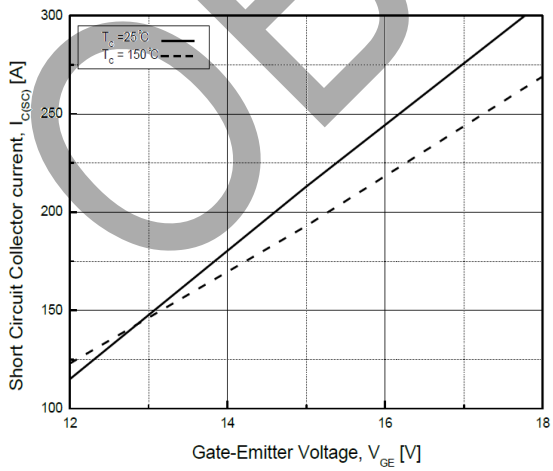



Fig.5 Typical Short Circuit Collector Current

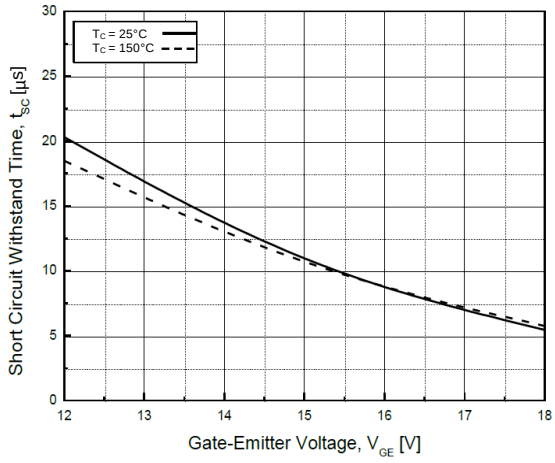



Fig.6 Typical Short Circuit Withstand Time

## Typical Performance Characteristics (continued)

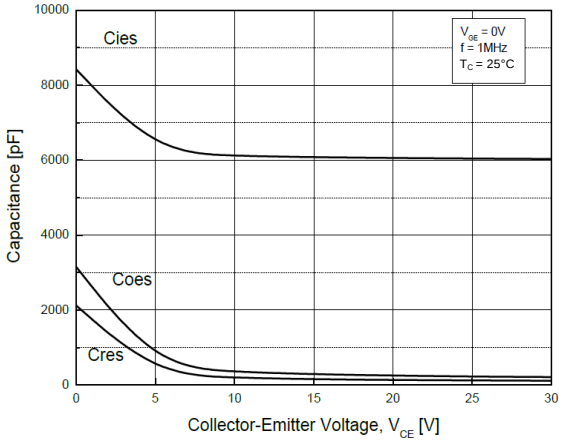



Fig.7 Typical Capacitance

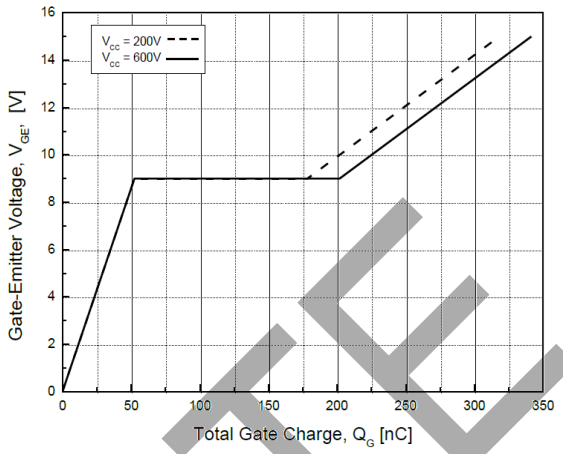



Fig.8 Typical Gate Charge

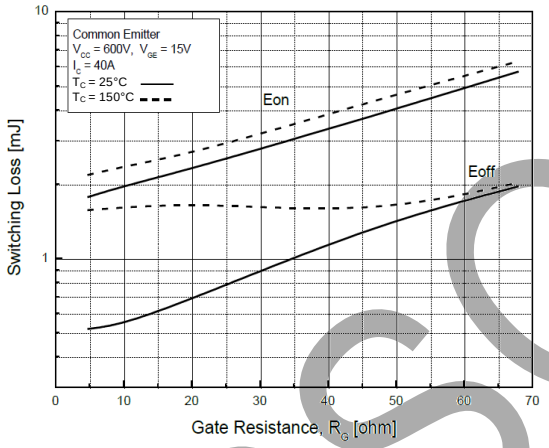



Fig.9 Switching Loss-Gate Resistance

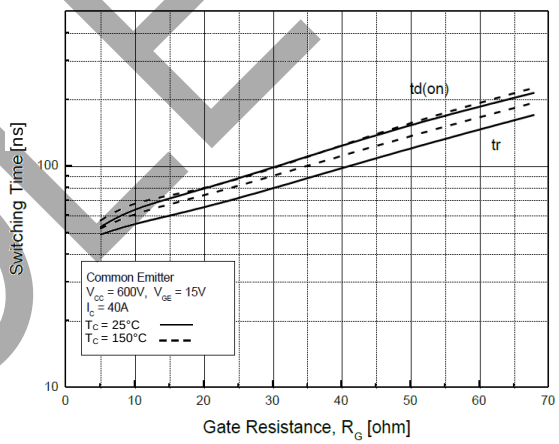



Fig.10 Turn on Characteristics-Gate Resistance

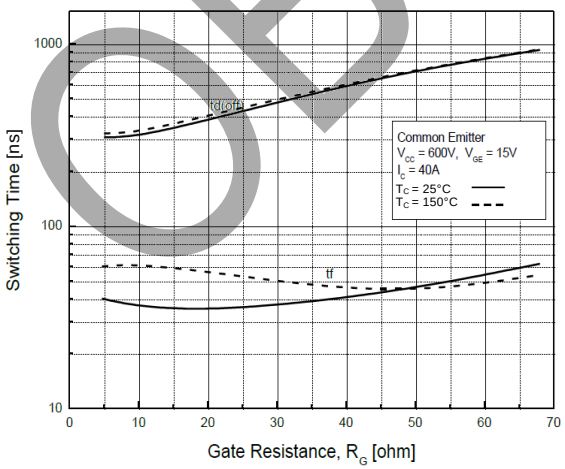



Fig.11 Turn off Characteristics-Gate Resistance

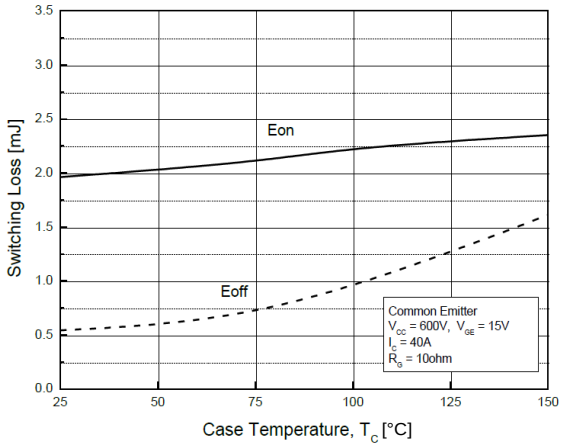



Fig.12 Switching Loss-Case Temperature

## Typical Performance Characteristics (continued)

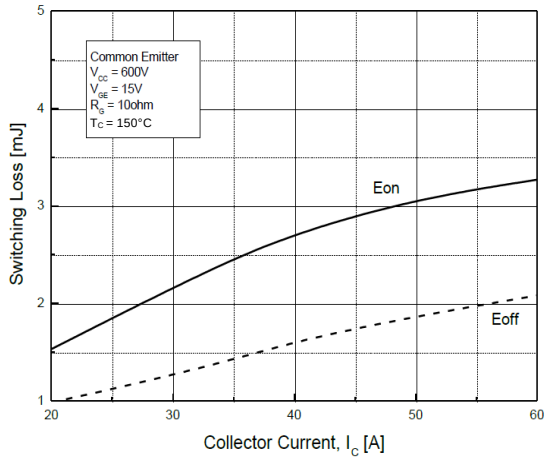



Fig.13 Switching Loss-Collector Current

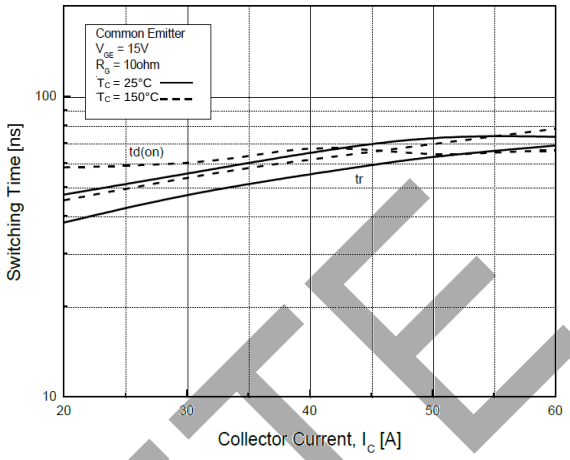



Fig.14 Typical Turn on-Collector Current

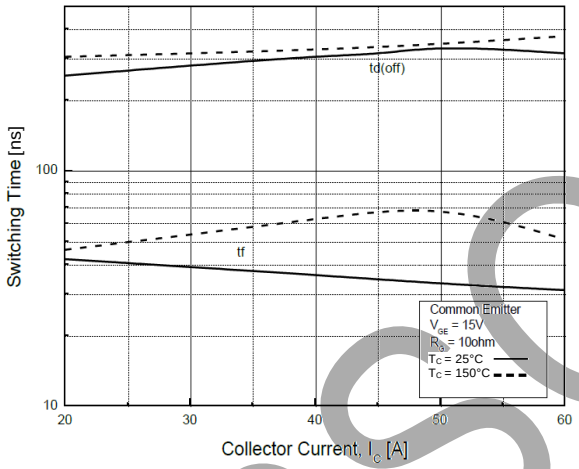



Fig.15 Typical Turn off-Collector Current

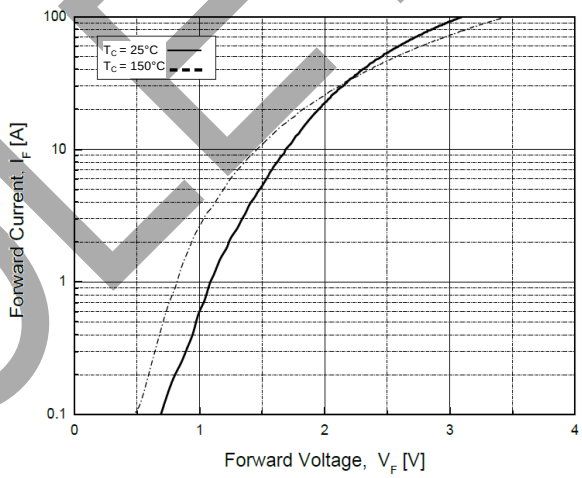



Fig.16 Diode Forward Characteristics

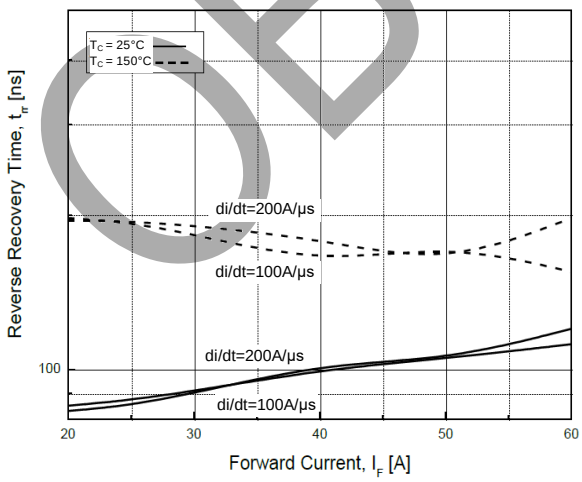



Fig.17 Typical Turn off-Collector Current

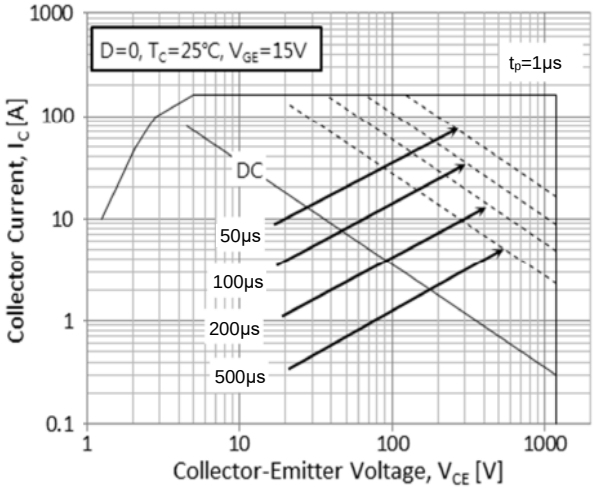



Fig.18 Forward Bias Safe Operating Area

## Typical Performance Characteristics (continued)

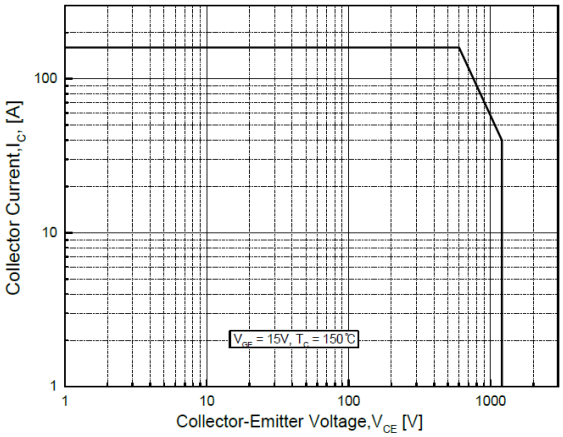



Fig.19 Reverse Bias Safe Operating Area

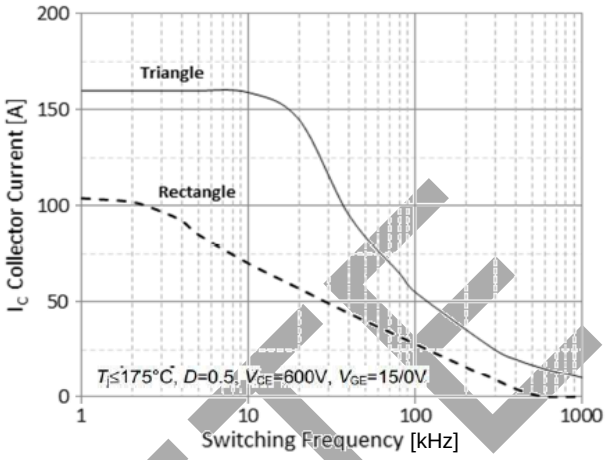



Fig.20 Switching frequency – Collector current

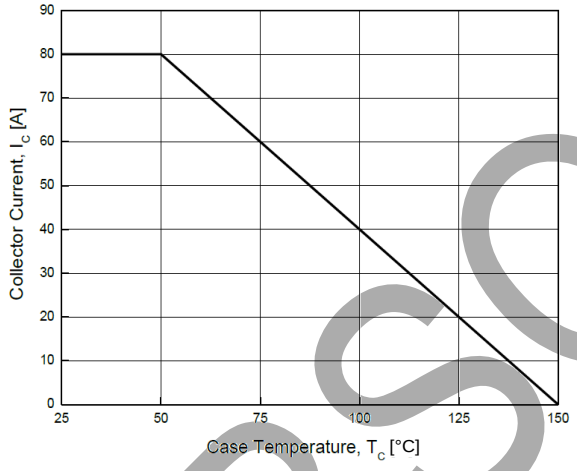



Fig.21 Case Temperature – Collector Current

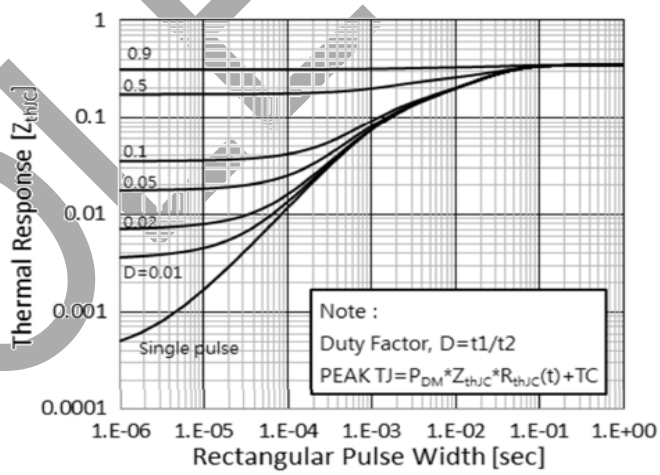
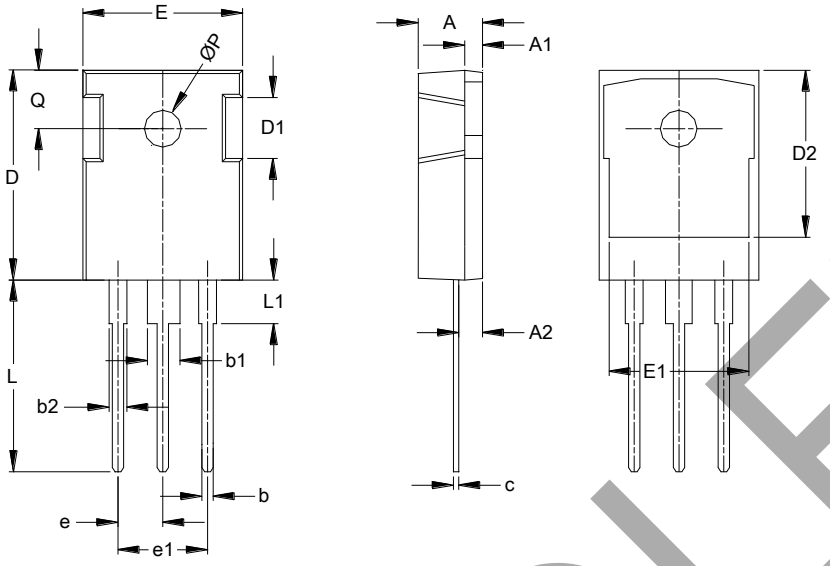



Fig.22 IGBT Transient Thermal Impedance

## Package Outline Dimensions

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

**TO247 (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: 7. 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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