

### Description

The DGTD120T25S1PT is produced using advanced Field Stop Trench IGBT Technology, which provides low  $V_{CE(sat)}$ , excellent quality and high-switching performance.

### Features

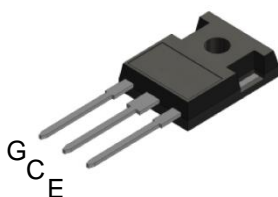
- High Speed Switching & Low  $V_{CE(sat)}$  Loss
- $V_{CE(sat)} = 2.0V @ I_C = 25A$
- High Input Impedance
- $t_{rr} = 100ns$  (typ) @  $di_f/dt = 500A/\mu s$
- Ultra-Soft, Fast Recovery Anti-parallel Diode
- Ultra Narrowed VF Distribution Control
- Positive Temperature Coefficient For Easy Paralleling
- Maximum Junction Temperature  $175^\circ C$
- **Lead-Free Finish & RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

### Applications

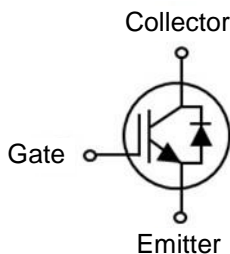
- Motor Drive
- UPS
- Welder
- Solar Inverter
- IH Cooker

### 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
- Weight: 5.6 grams (Approximate)



TO-247



Device Symbol

### Ordering Information (Note 4)

Product	Marking	Quantity
DGTD120T25S1PT	DGTD120T25S1	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](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  
 DGTD120T25S1 = Product Type Marking Code  
 YY = Year (ex: 18 = 2018)  
 LLLLL = Lot Code  
 WW = Week (01 to 53)

**Absolute Maximum Ratings** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CE}$	1,200	V
DC Collector Current, limited by $T_{vjmax}$	$I_C$	$T_C = 25^\circ\text{C}$	50
		$T_C = 100^\circ\text{C}$	25
Pulsed Collector Current, $t_p$ limited by $T_{vjmax}$	$I_{Cpuls}$	100	A
Turn Off Safe Operating Area $V_{CE} \leq 1200\text{V}$ , $T_{vj} = 175^\circ\text{C}$	-	100	A
Diode Forward Current limited by $T_{vjmax}$	$I_F$	$T_C = 25^\circ\text{C}$	25
		$T_C = 100^\circ\text{C}$	12.5
Diode Pulsed Current, $t_p$ limited by $T_{vjmax}$	$I_{Fpuls}$	100	A
Gate-Emitter Voltage	$V_{GE}$	$\pm 20$	V
Short Circuit Withstand Time $V_{CC} \leq 600\text{V}$ , $V_{GE} = 15\text{V}$ , $T_{vj} = 175^\circ\text{C}$ Allowed Number of Short Circuits < 1000 Time Between Short Circuits $\geq 1.0\text{s}$	tsc	10	$\mu\text{s}$

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

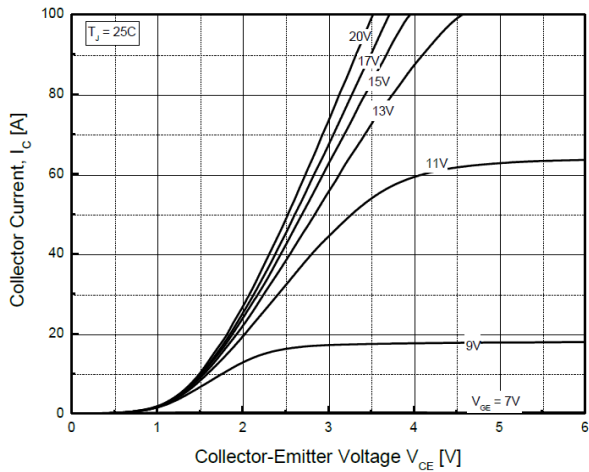
Characteristic	Symbol	Value	Unit
Power Dissipation Linear Derating Factor (Note 6)	$P_D$	$T_C = 25^\circ\text{C}$	348
		$T_C = 100^\circ\text{C}$	174
Thermal Resistance, Junction to Ambient (Note 6)	$R_{\theta JA}$	40	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case for IGBT (Note 6)	$R_{\theta JC}$	0.43	
Thermal Resistance, Junction to Case for Diode (Note 6)	$R_{\theta JC}$	1.55	
Operating Temperature	$T_{vj}$	-40 to +175	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-55 to +150	

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

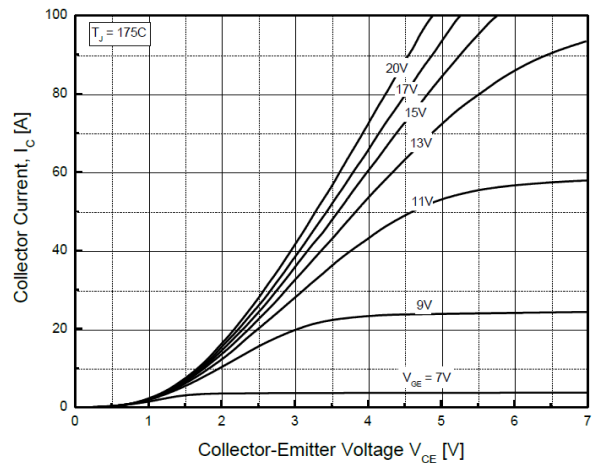
**Electrical Characteristics** (@ $T_{vj} = +25^{\circ}\text{C}$ , unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Condition	
<b>STATIC CHARACTERISTICS</b>							
Collector-Emitter Breakdown Voltage	$BV_{CES}$	1200	–	–	V	$I_C = 500\mu\text{A}$ , $V_{GE} = 0\text{V}$	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$T_{vj} = 25^{\circ}\text{C}$	–	2.00	2.40	V	$I_C = 25\text{A}$ , $V_{GE} = 15\text{V}$
		$T_{vj} = 150^{\circ}\text{C}$	–	2.40	–		
		$T_{vj} = 175^{\circ}\text{C}$	–	2.50	–		
Diode Forward Voltage	$V_F$	$T_{vj} = 25^{\circ}\text{C}$	–	2.10	2.60	V	$V_{GE} = 0\text{V}$ , $I_F = 12.5\text{A}$
		$T_{vj} = 175^{\circ}\text{C}$	–	1.90	–		
Diode Forward Voltage	$V_F$	$T_{vj} = 25^{\circ}\text{C}$	–	2.50	3.00	V	$V_{GE} = 0\text{V}$ , $I_F = 25\text{A}$
		$T_{vj} = 150^{\circ}\text{C}$	–	2.55	–		
		$T_{vj} = 175^{\circ}\text{C}$	–	2.45	–		
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	5.0	6.0	7.0	V	$V_{CE} = V_{GE}$ , $I_C = 0.85\text{mA}$	
Zero Gate Voltage Collector Current	$I_{CES}$	$T_{vj} = 25^{\circ}\text{C}$	–	–	250	$\mu\text{A}$	$V_{CE} = 1200\text{V}$ , $V_{GE} = 0\text{V}$
		$T_{vj} = 175^{\circ}\text{C}$	–	–	2500		
Gate-Emitter Leakage Current	$I_{GES}$	–	–	$\pm 250$	nA	$V_{GE} = 20\text{V}$ , $V_{CE} = 0\text{V}$	
Transconductance	$g_{fs}$	–	16	–	S	$V_{CE} = 20\text{V}$ , $I_C = 25\text{A}$	
<b>DYNAMIC CHARACTERISTICS</b>							
Total Gate Charge	$Q_g$	–	204	–	nC	$V_{CE} = 960\text{V}$ , $I_C = 25\text{A}$ , $V_{GE} = 15\text{V}$	
Gate-Emitter Charge	$Q_{ge}$	–	34	–			
Gate-Collector Charge	$Q_{gc}$	–	94	–			
Input Capacitance	$C_{ies}$	–	3942	–	pF	$V_{CE} = 25\text{V}$ , $V_{GE} = 0\text{V}$ , $f = 1\text{MHz}$	
Reverse Transfer Capacitance	$C_{res}$	–	72	–			
Output Capacitance	$C_{oes}$	–	142	–			
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 $\geq 1.0\text{s}$	$I_{C(SC)}$	–	121	–	A	$V_{GE} = 15\text{V}$ , $V_{CC} = 600\text{V}$ , $t_{SC} \leq 10\mu\text{s}$ , $T_{vj} = 175^{\circ}\text{C}$	
<b>SWITCHING CHARACTERISTICS</b>							
Turn-on Delay Time	$t_{d(on)}$	–	73	–	ns	$V_{GE} = 15\text{V}$ , $V_{CC} = 600\text{V}$ , $I_C = 25\text{A}$ , $R_G = 23\Omega$ , Inductive Load, $T_{vj} = 25^{\circ}\text{C}$	
Rise time	$t_r$	–	41	–			
Turn-off Delay Time	$t_{d(off)}$	–	269	–			
Fall Time	$t_f$	–	39	–			
Turn-on Switching Energy	$E_{on}$	–	1.44	–	mJ	$I_F = 25\text{A}$ , $di_F/dt = 500\text{A}/\mu\text{s}$ , $V_R = 600\text{V}$ , $T_{vj} = 25^{\circ}\text{C}$	
Turn-off Switching Energy	$E_{off}$	–	0.55	–			
Total Switching Energy	$E_{ts}$	–	1.99	–			
Reverse Recovery Time	$t_{rr}$	–	100	–	ns	$I_F = 25\text{A}$ , $di_F/dt = 500\text{A}/\mu\text{s}$ , $V_R = 600\text{V}$ , $T_{vj} = 25^{\circ}\text{C}$	
Reverse Recovery Current	$I_{rr}$	–	17	–	A		
Reverse Recovery Charge	$Q_{rr}$	–	0.85	–	$\mu\text{C}$		
Rate Of Fall Of Reverse Current During $t_b$	$di_{rr}/dt$	–	-376	–	$\text{A}/\mu\text{s}$		
Turn-on Delay Time	$t_{d(on)}$	–	65	–	ns	$V_{GE} = 15\text{V}$ , $V_{CC} = 600\text{V}$ , $I_C = 25\text{A}$ , $R_G = 23\Omega$ , Inductive Load, $T_{vj} = 175^{\circ}\text{C}$	
Rise time	$t_r$	–	45	–			
Turn-off Delay Time	$t_{d(off)}$	–	292	–			
Fall Time	$t_f$	–	75	–			
Turn-on Switching Energy	$E_{on}$	–	2.43	–	mJ	$I_F = 25\text{A}$ , $di_F/dt = 500\text{A}/\mu\text{s}$ , $V_R = 600\text{V}$ , $T_{vj} = 175^{\circ}\text{C}$	
Turn-off Switching Energy	$E_{off}$	–	1.09	–			
Total Switching Energy	$E_{ts}$	–	3.52	–			
Reverse Recovery Time	$t_{rr}$	–	150	–	ns	$I_F = 25\text{A}$ , $di_F/dt = 500\text{A}/\mu\text{s}$ , $V_R = 600\text{V}$ , $T_{vj} = 175^{\circ}\text{C}$	
Reverse Recovery Current	$I_{rr}$	–	25	–	A		
Reverse Recovery Charge	$Q_{rr}$	–	1.85	–	$\mu\text{C}$		
Rate Of Fall Of Reverse Current During $t_b$	$di_{rr}/dt$	–	-374	–	$\text{A}/\mu\text{s}$		

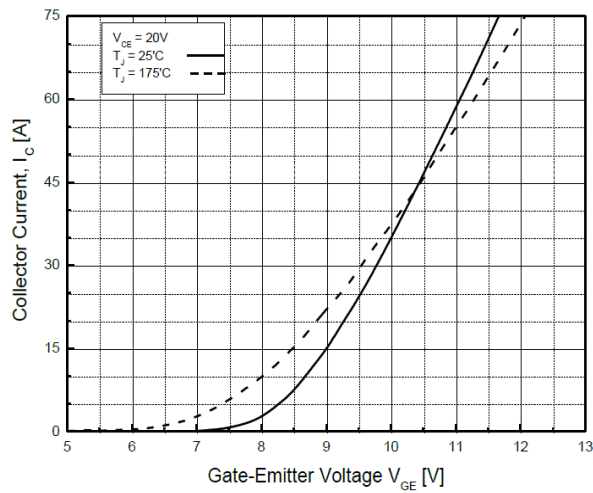
**Typical Performance Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



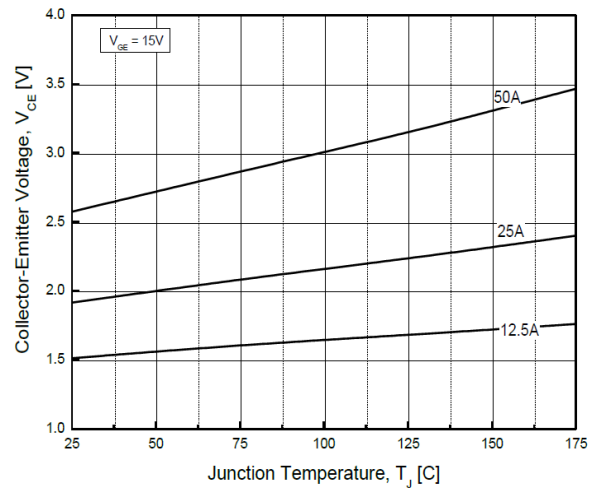
**Fig.1 Typical Output Characteristic**( $T_j=25^\circ\text{C}$ )



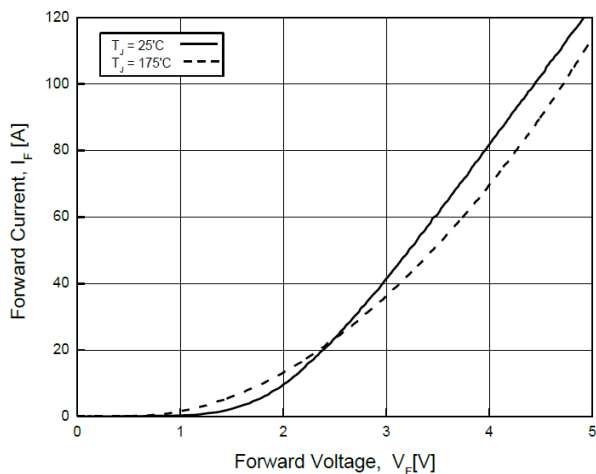
**Fig.2 Typical Output Characteristic**( $T_j=175^\circ\text{C}$ )



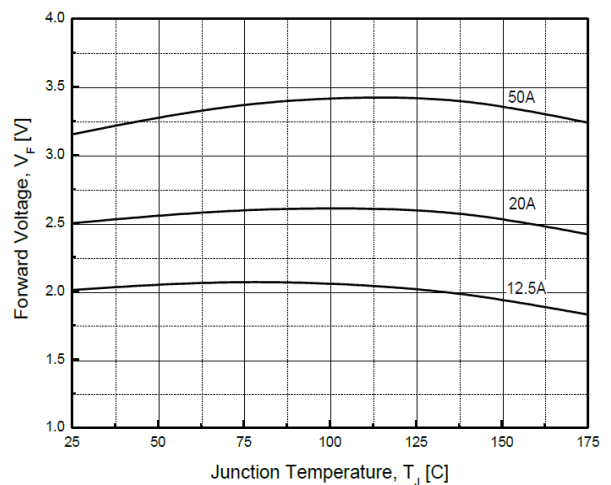
**Fig.3 Typical Transfer Characteristic**



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

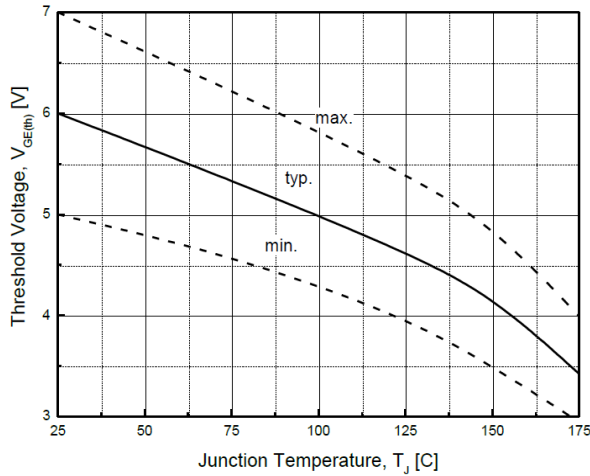


**Fig.5 Diode Forward Characteristic**

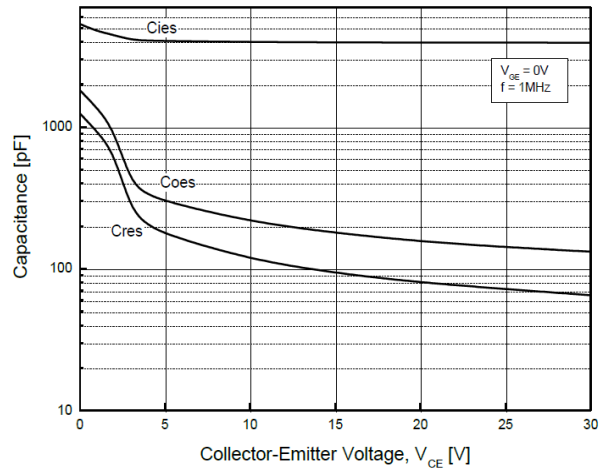


**Fig.6 Diode Forward-Junction Temperature**

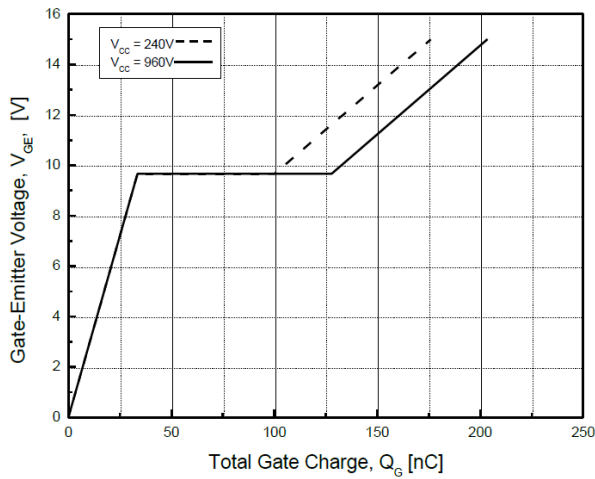
**Typical Performance Characteristics** (continued)



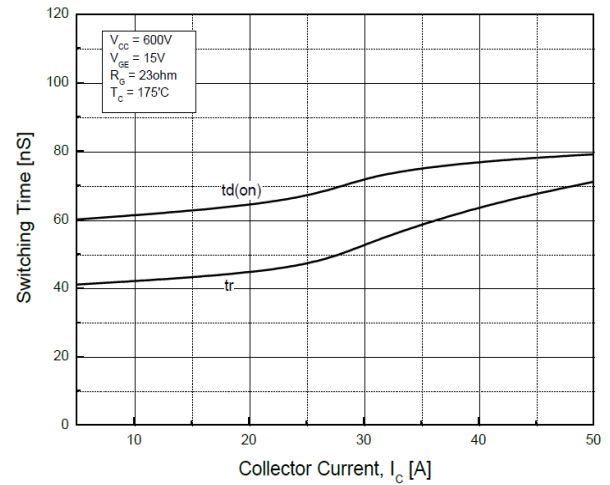
**Fig.7 Threshold Voltage-Junction Temperature**



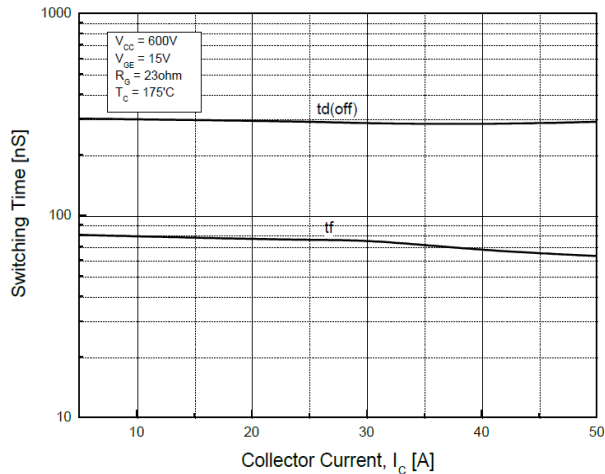
**Fig.8 Typical Capacitance**



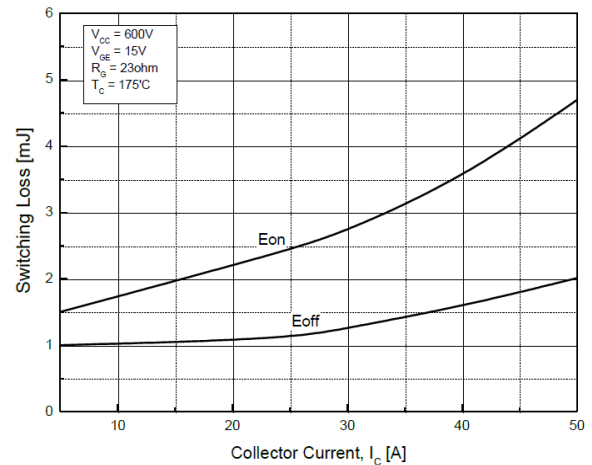
**Fig.9 Typical Gate Charge**



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



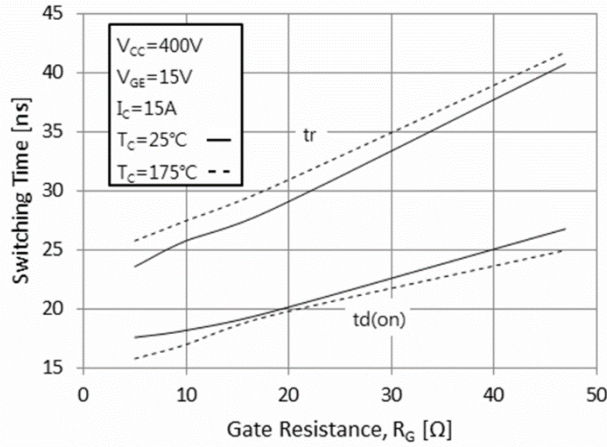
**Fig.11 Typical Turn off-Collector Current**



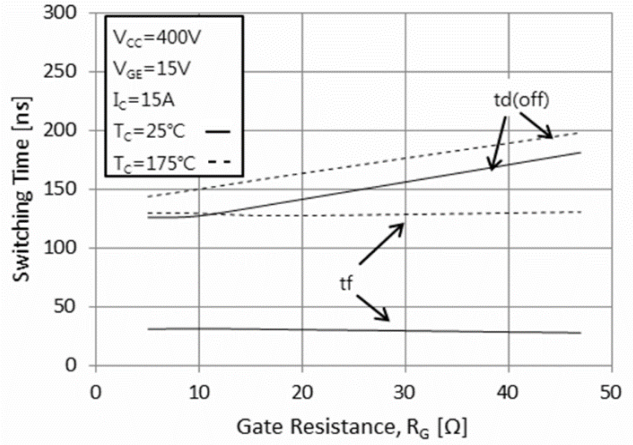
**Fig.12 Switching Loss-Collector Current**



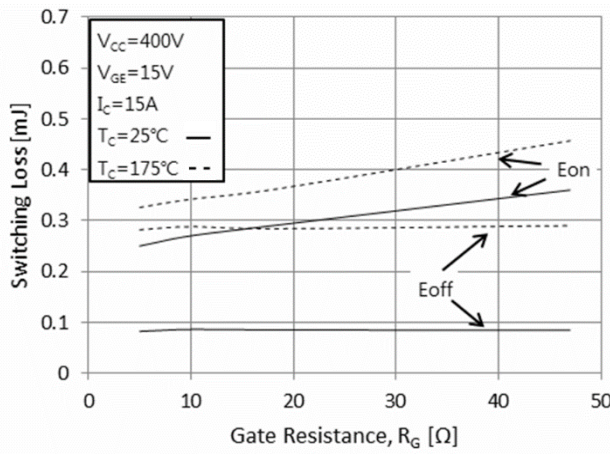
**Typical Performance Characteristics** (cont.)



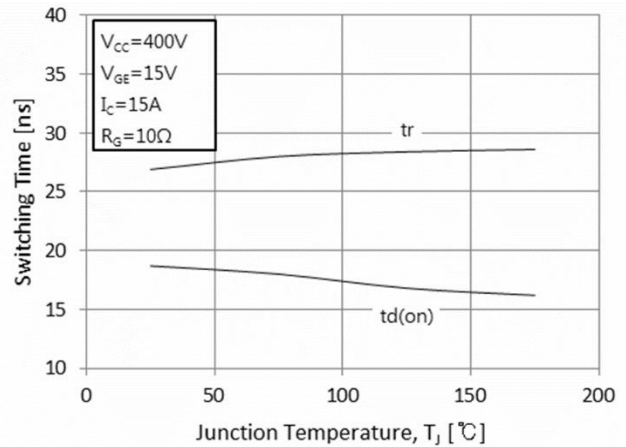
**Fig.13 Turn on Characteristics-Gate Resistance**



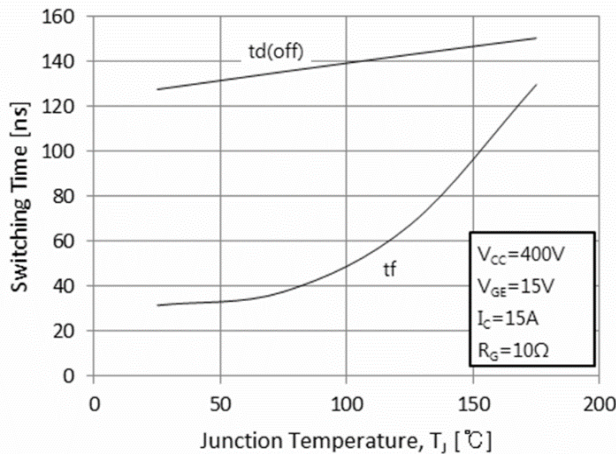
**Fig.14 Turn off Characteristics-Gate Resistance**



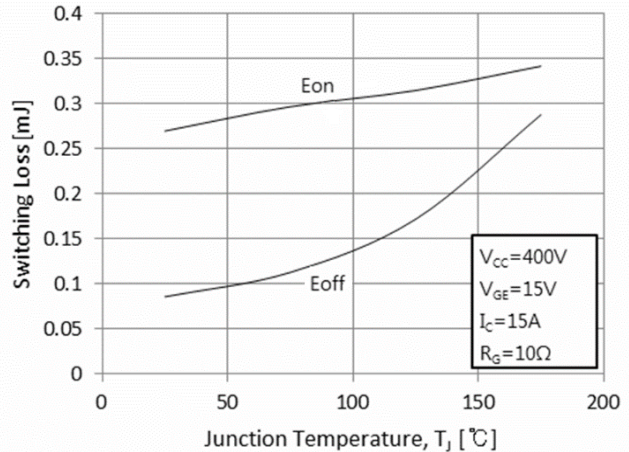
**Fig.15 Switching Loss-Gate Resistance**



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

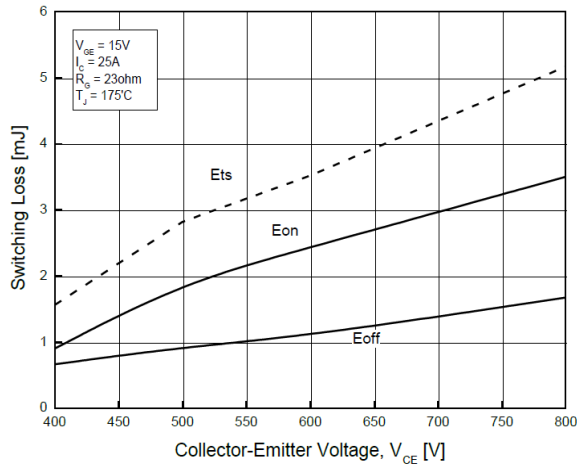


**Fig.17 Turn off Characteristics-Junction Temperature**

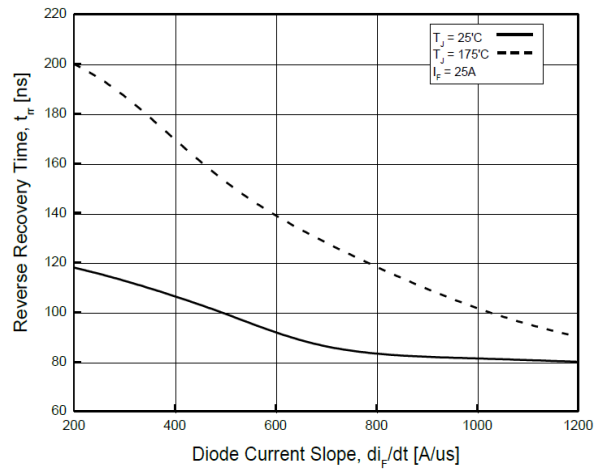


**Fig.18 Switching Loss-Junction Temperature**

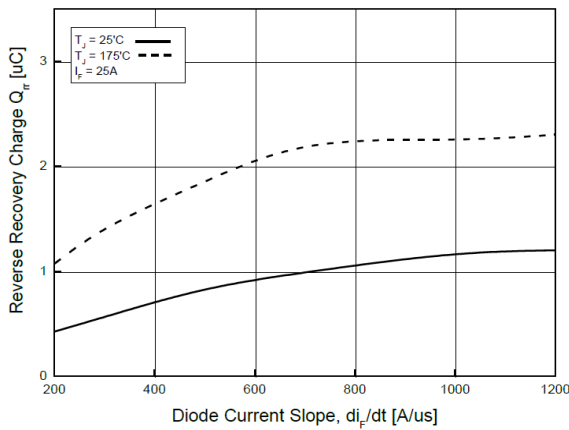
**Typical Performance Characteristics (cont.)**



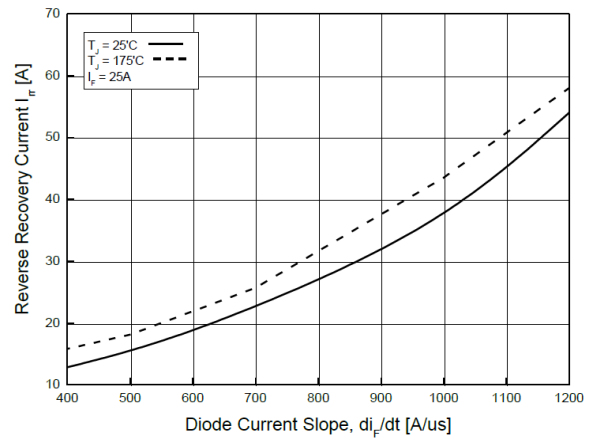
**Fig.19 Switching Loss-Collector Emitter Voltage**



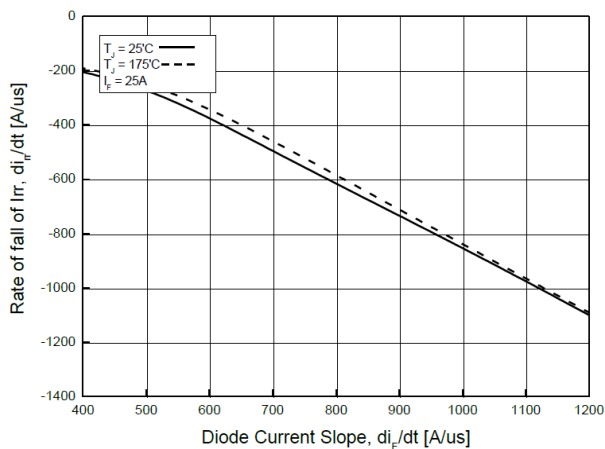
**Fig.20 Reverse Recovery Time -Diode current slope**



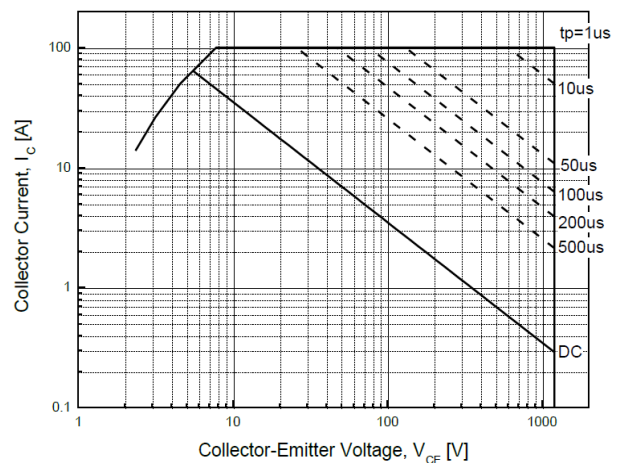
**Fig.21 Reverse Recovery Charge -Diode Current Slope**



**Fig.22 Reverse Recovery Current -Diode current slope**

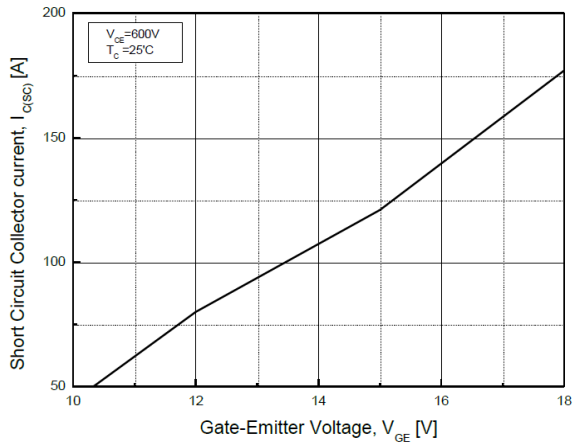


**Fig.23 Rate of fall of reverse recovery current -Diode Current Slope**

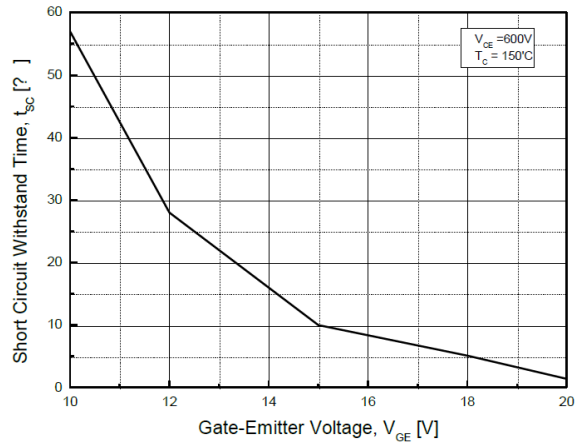


**Fig.24 Forward Bias Safe Operating Area**

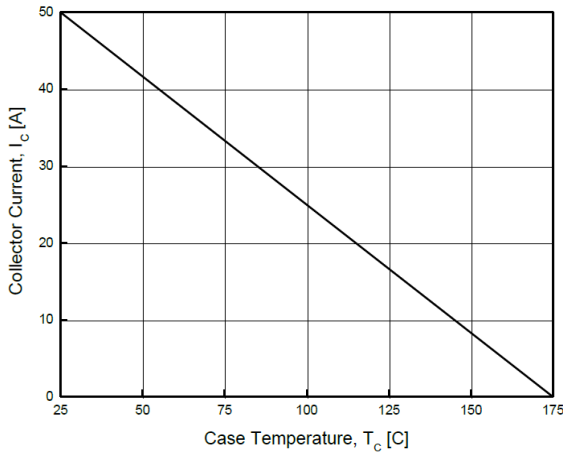
**Typical Performance Characteristics (cont.)**



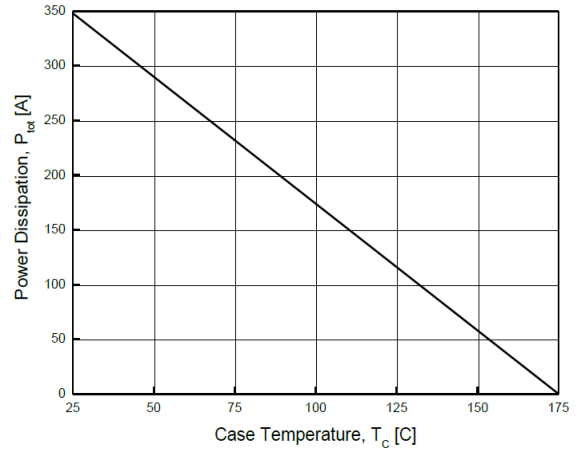
**Fig.25 Typical Short Circuit Collector Current**



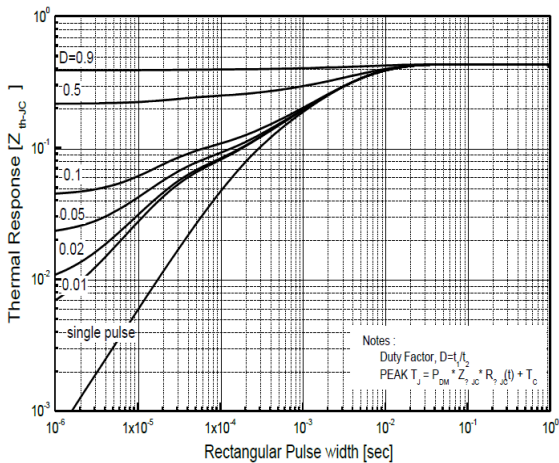
**Fig.26 Typical Short Circuit Withstand Time**



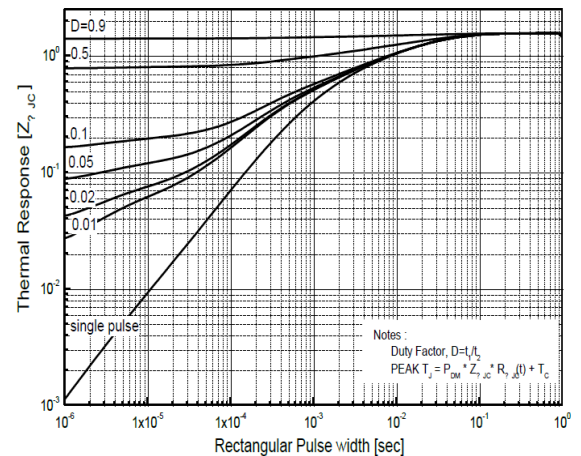
**Fig.27 Case Temperature-Collector Current**



**Fig.28 Power Dissipation-Case Temperature**



**Fig.29 IGBT Transient Thermal Impedance**



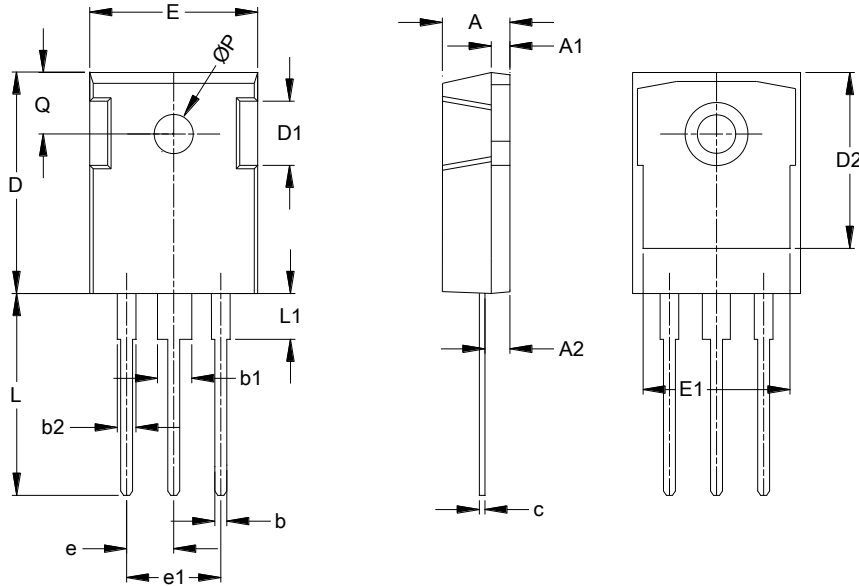
**Fig.30 FRD Transient Thermal Impedance**



**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	-
<b>All Dimensions in mm</b>			

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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2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

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