



ON Semiconductor®

# FGH75T65SQDT

## 650 V, 75 A Field Stop Trench IGBT

### Features

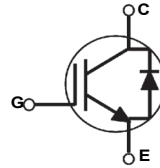
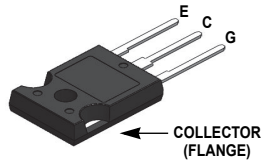
- Maximum Junction Temperature:  $T_J = 175^{\circ}\text{C}$
- Positive Temperature Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage:  $V_{CE(sat)} = 1.6\text{ V (Typ.) @ } I_C = 75\text{ A}$
- 100% of the Parts tested for  $I_{LM}(1)$
- High Input Impedance
- Fast Switching
- Tighten Parameter Distribution
- RoHS Compliant

### General Description

Using novel field stop IGBT technology, ON semiconductor's new series of field stop 4<sup>th</sup> generation IGBTs offer the optimum performance for solar inverter, UPS, welder, telecom, ESS and PFC applications where low conduction and switching losses are essential.

### Applications

- Solar Inverter, UPS, Welder, Telecom, ESS, PFC



### Absolute Maximum Ratings

Symbol	Description	FGH75T65SQDT-F155 (1)	Unit
$V_{CES}$	Collector to Emitter Voltage	650	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 20$	V
	Transient Gate to Emitter Voltage	$\pm 30$	V
$I_C$	Collector Current @ $T_C = 25^{\circ}\text{C}$	150	A
	Collector Current @ $T_C = 100^{\circ}\text{C}$	75	A
$I_{LM}(2)$	Pulsed Collector Current @ $T_C = 25^{\circ}\text{C}$	300	A
$I_{CM}(3)$	Pulsed Collector Current	300	A
$I_F$	Diode Forward Current @ $T_C = 25^{\circ}\text{C}$	150	A
	Diode Forward Current @ $T_C = 100^{\circ}\text{C}$	75	A
$I_{FM}(3)$	Pulsed Diode Maximum Forward Current	300	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^{\circ}\text{C}$	375	W
	Maximum Power Dissipation @ $T_C = 100^{\circ}\text{C}$	188	W
$T_J$	Operating Junction Temperature	-55 to +175	$^{\circ}\text{C}$
$T_{stg}$	Storage Temperature Range	-55 to +175	$^{\circ}\text{C}$
$T_L$	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	$^{\circ}\text{C}$

**Notes:**

1. Due to system integration constraints between Fairchild and ON semiconductor, as of November 1, 2017 any product part number with an underscore will be replaced with a dash. This is a notification.
2.  $V_{CC} = 400\text{ V}$ ,  $V_{GE} = 15\text{ V}$ ,  $I_C = 300\text{ A}$ ,  $R_G = 21\ \Omega$ , Inductive Load
3. Repetitive rating: Pulse width limited by max. junction temperature

FGH75T65SQDT — 650 V, 75 A Field Stop Trench IGBT

## Thermal Characteristics

Symbol	Parameter	FGH75T65SQDT-F155	Unit
$R_{\theta JC}$ (IGBT)	Thermal Resistance, Junction to Case, Max.	0.4	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$ (Diode)	Thermal Resistance, Junction to Case, Max.	0.65	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	$^{\circ}\text{C}/\text{W}$

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGH75T65SQDT_F155	FGH75T65SQDT	TO-247 G03	Tube	-	-	30

## Electrical Characteristics of the IGBT $T_C = 25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$BV_{CES}$	Collector to Emitter Breakdown Voltage	$V_{GE} = 0\text{V}, I_C = 1\text{mA}$	650	-	-	V
$\Delta BV_{CES} / \Delta T_J$	Temperature Coefficient of Breakdown Voltage	$I_C = 1\text{mA}$ , Reference to $25^{\circ}\text{C}$	-	0.6	-	$\text{V}/^{\circ}\text{C}$
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0\text{V}$	-	-	250	$\mu\text{A}$
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0\text{V}$	-	-	$\pm 400$	nA
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 75\text{mA}, V_{CE} = V_{GE}$	2.6	4.5	6.4	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 75\text{A}, V_{GE} = 15\text{V}$	-	1.6	2.1	V
		$I_C = 75\text{A}, V_{GE} = 15\text{V}, T_C = 175^{\circ}\text{C}$	-	1.92	-	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$	-	4845	-	pF
$C_{oes}$	Output Capacitance		-	155	-	pF
$C_{res}$	Reverse Transfer Capacitance		-	14	-	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400\text{V}, I_C = 18.8\text{A}, R_G = 4.7\ \Omega, V_{GE} = 15\text{V},$ Inductive Load, $T_C = 25^{\circ}\text{C}$	-	23	-	ns
$t_r$	Rise Time		-	10	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	120	-	ns
$t_f$	Fall Time		-	7	-	ns
$E_{on}$	Turn-On Switching Loss		-	300	-	$\mu\text{J}$
$E_{off}$	Turn-Off Switching Loss		-	70	-	$\mu\text{J}$
$E_{ts}$	Total Switching Loss		-	370	-	$\mu\text{J}$
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400\text{V}, I_C = 37.5\text{A}, R_G = 4.7\ \Omega, V_{GE} = 15\text{V},$ Inductive Load, $T_C = 25^{\circ}\text{C}$	-	26	-	ns
$t_r$	Rise Time		-	19	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	114	-	ns
$t_f$	Fall Time		-	11	-	ns
$E_{on}$	Turn-On Switching Loss		-	746	-	$\mu\text{J}$
$E_{off}$	Turn-Off Switching Loss		-	181	-	$\mu\text{J}$
$E_{ts}$	Total Switching Loss		-	927	-	$\mu\text{J}$

### Electrical Characteristics of the IGBT (Continued)

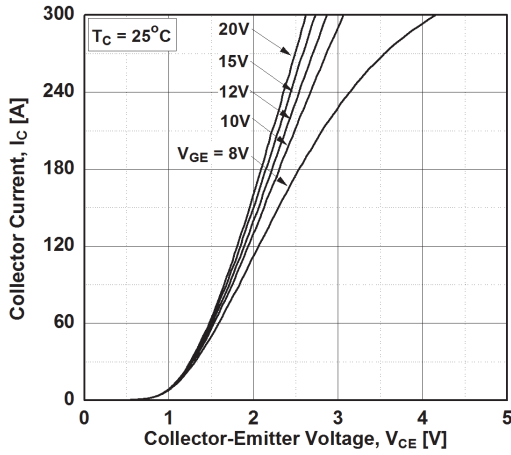
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$T_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400\text{ V}$ , $I_C = 18.8\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GE} = 15\text{ V}$ , Inductive Load, $T_C = 175^\circ\text{C}$	-	22	-	ns
$T_r$	Rise Time		-	12	-	ns
$T_{d(off)}$	Turn-Off Delay Time		-	135	-	ns
$T_f$	Fall Time		-	14	-	ns
$E_{on}$	Turn-On Switching Loss		-	760	-	$\mu\text{J}$
$E_{off}$	Turn-Off Switching Loss		-	180	-	$\mu\text{J}$
$E_{ts}$	Total Switching Loss		-	940	-	$\mu\text{J}$
$T_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400\text{ V}$ , $I_C = 37.5\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GE} = 15\text{ V}$ , Inductive Load, $T_C = 175^\circ\text{C}$	-	24	-	ns
$T_r$	Rise Time		-	24	-	ns
$T_{d(off)}$	Turn-Off Delay Time		-	125	-	ns
$T_f$	Fall Time		-	10	-	ns
$E_{on}$	Turn-On Switching Loss		-	1520	-	$\mu\text{J}$
$E_{off}$	Turn-Off Switching Loss		-	401	-	$\mu\text{J}$
$E_{ts}$	Total Switching Loss		-	1921	-	$\mu\text{J}$
$Q_g$	Total Gate Charge	$V_{CE} = 400\text{ V}$ , $I_C = 75\text{ A}$ , $V_{GE} = 15\text{ V}$	-	128	-	nC
$Q_{ge}$	Gate to Emitter Charge		-	23	-	nC
$Q_{gc}$	Gate to Collector Charge		-	29	-	nC

### Electrical Characteristics of the Diode $T_C = 25^\circ\text{C}$ unless otherwise noted

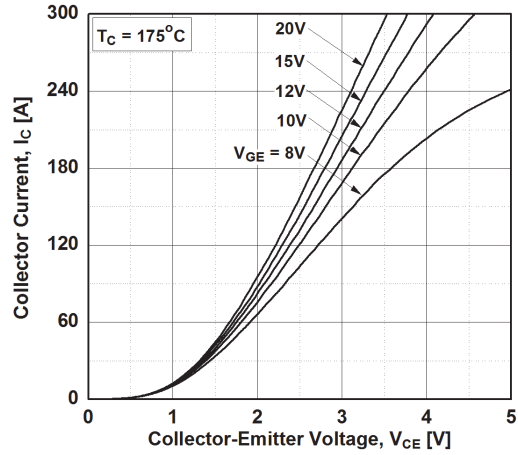
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_{FM}$	Diode Forward Voltage	$I_F = 75\text{ A}$	$T_C = 25^\circ\text{C}$	-	1.8	2.1	V
			$T_C = 175^\circ\text{C}$	-	1.7	-	
$E_{rec}$	Reverse Recovery Energy	$I_F = 75\text{ A}$ , $di_F/dt = 200\text{ A}/\mu\text{s}$	$T_C = 175^\circ\text{C}$	-	160	-	$\mu\text{J}$
$T_{rr}$	Diode Reverse Recovery Time		$T_C = 25^\circ\text{C}$	-	76	-	ns
			$T_C = 175^\circ\text{C}$	-	270	-	
$Q_{rr}$	Diode Reverse Recovery Charge		$T_C = 25^\circ\text{C}$	-	206	-	nC
		$T_C = 175^\circ\text{C}$	-	2199	-		

## Typical Performance Characteristics

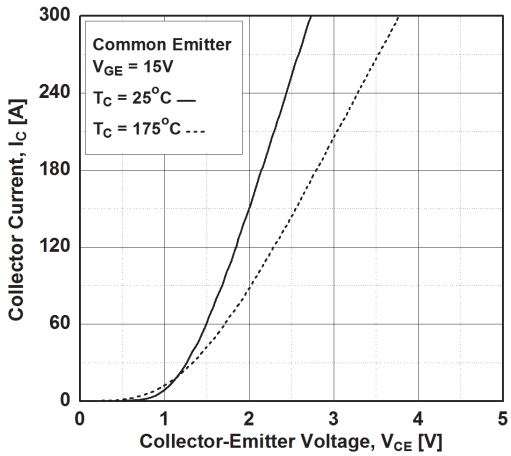
**Figure 1. Typical Output Characteristics**



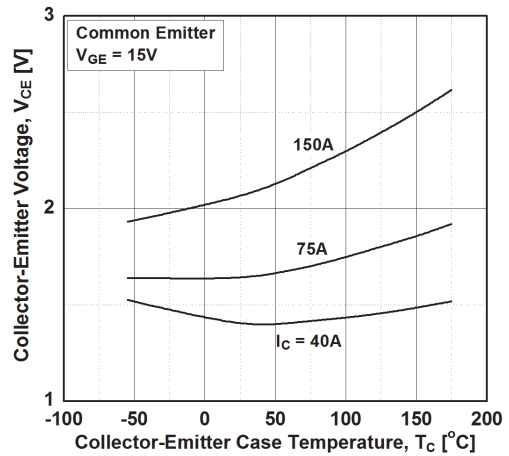
**Figure 2. Typical Output Characteristics**



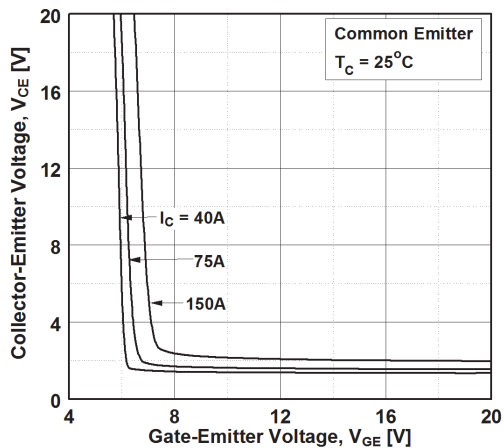
**Figure 3. Typical Saturation Voltage Characteristics**



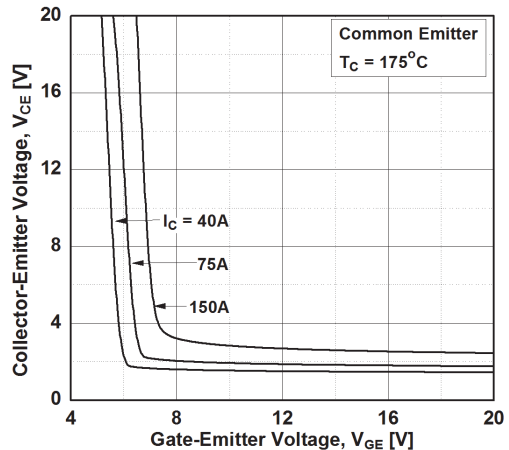
**Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level**



**Figure 5. Saturation Voltage vs. Vge**

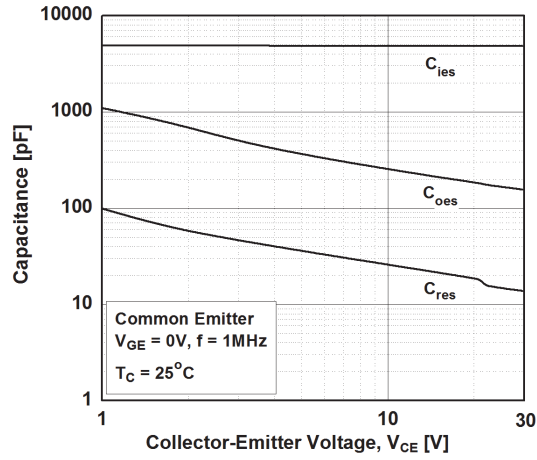


**Figure 6. Saturation Voltage vs. Vge**

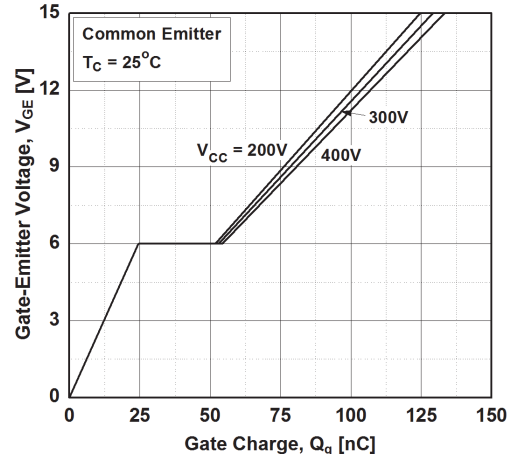


## Typical Performance Characteristics

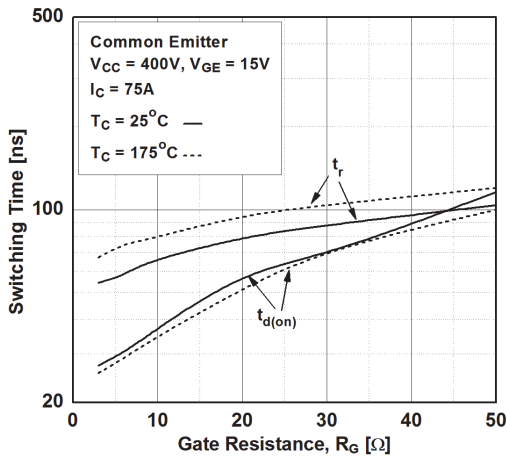
**Figure 7. Capacitance Characteristics**



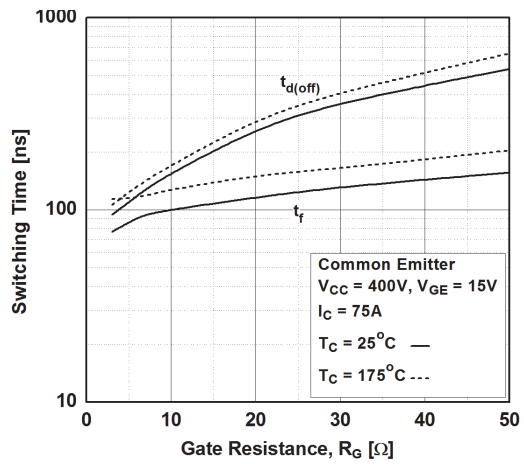
**Figure 8. Gate charge Characteristics**



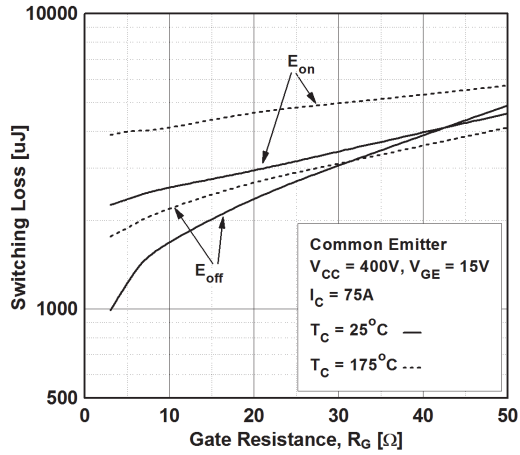
**Figure 9. Turn-on Characteristics vs. Gate Resistance**



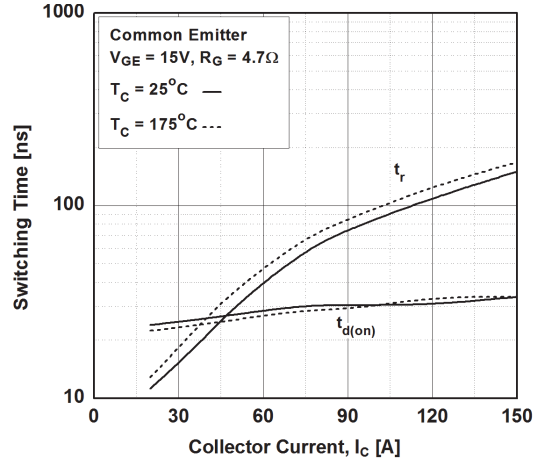
**Figure 10. Turn-off Characteristics vs. Gate Resistance**



**Figure 11. Switching Loss vs. Gate Resistance**

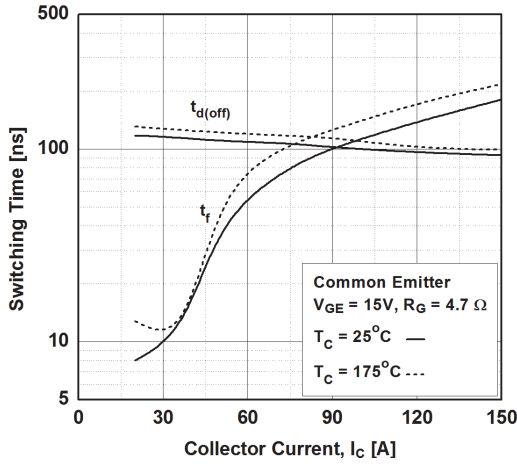


**Figure 12. Turn-on Characteristics vs. Collector Current**

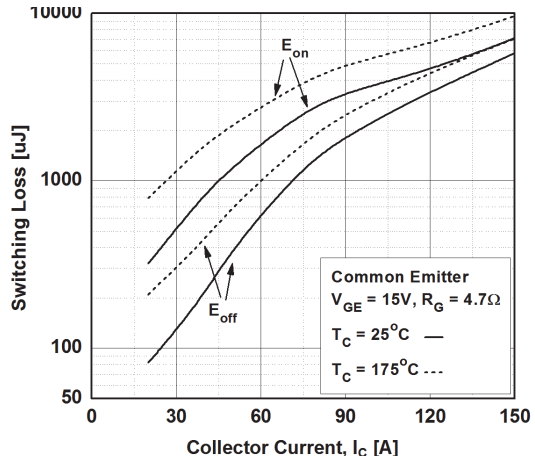


## Typical Performance Characteristics

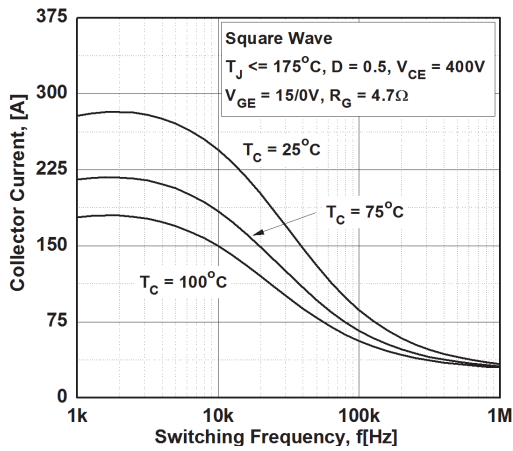
**Figure 13. Turn-off Characteristics vs. Collector Current**



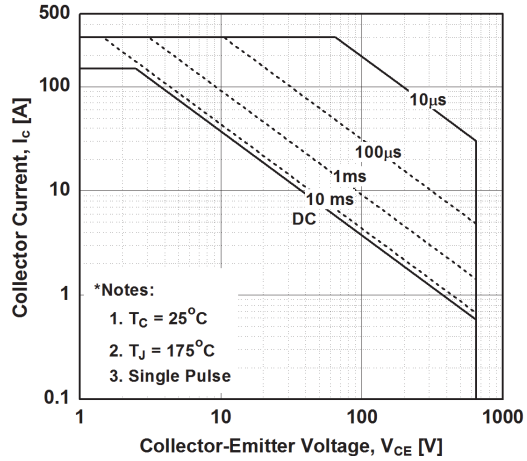
**Figure 14. Switching Loss vs. Collector Current**



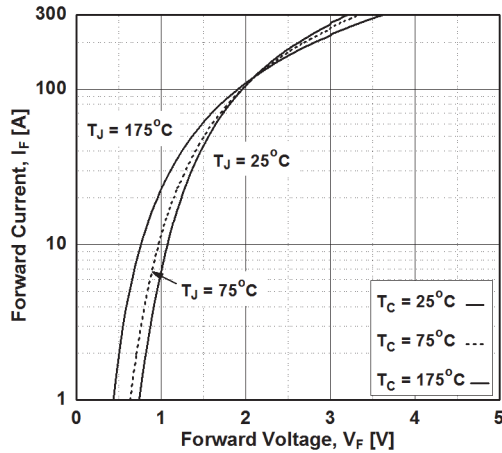
**Figure 15. Load Current Vs. Frequency**



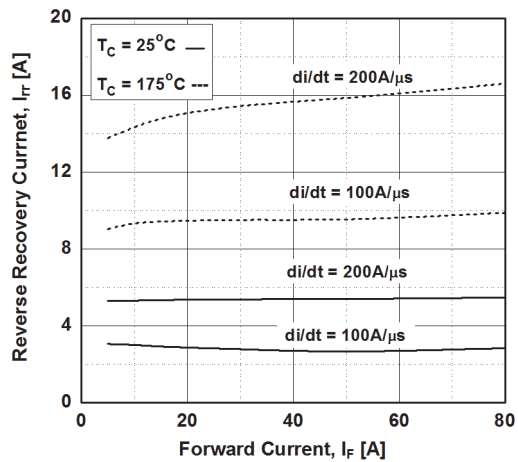
**Figure 16. SOA Characteristics**



**Figure 17. Forward Characteristics**

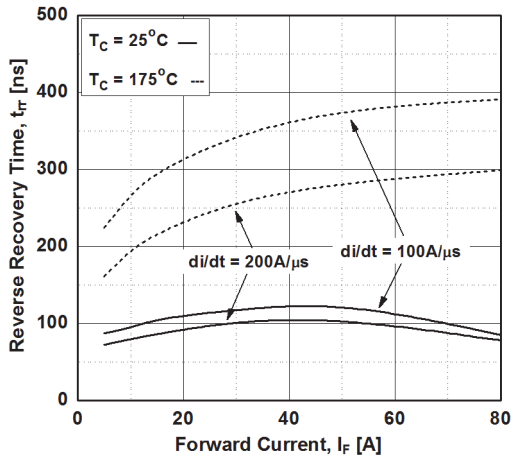


**Figure 18. Reverse Recovery Current**

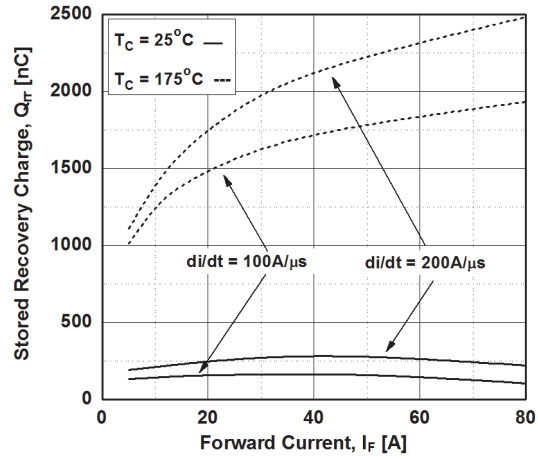


## Typical Performance Characteristics

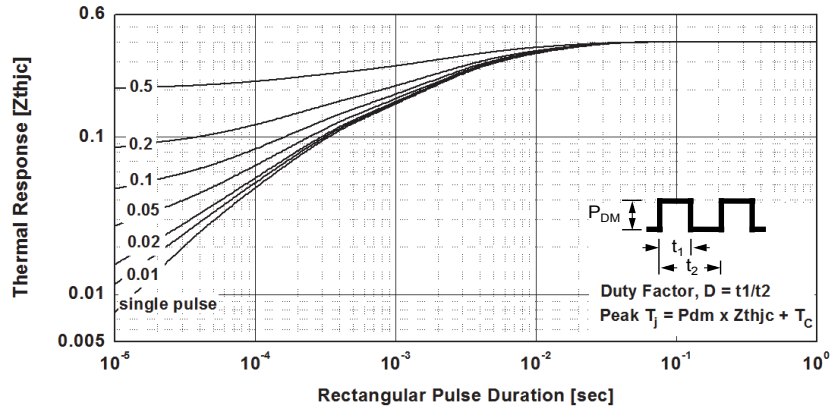
**Figure 19. Reverse Recovery Time**



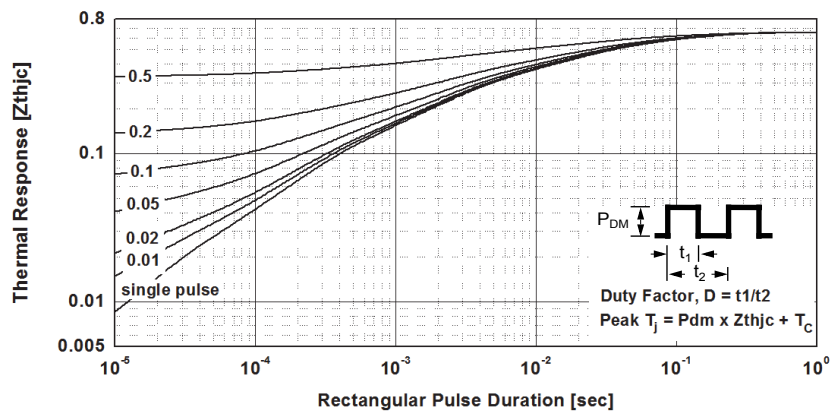
**Figure 20. Stored Charge**



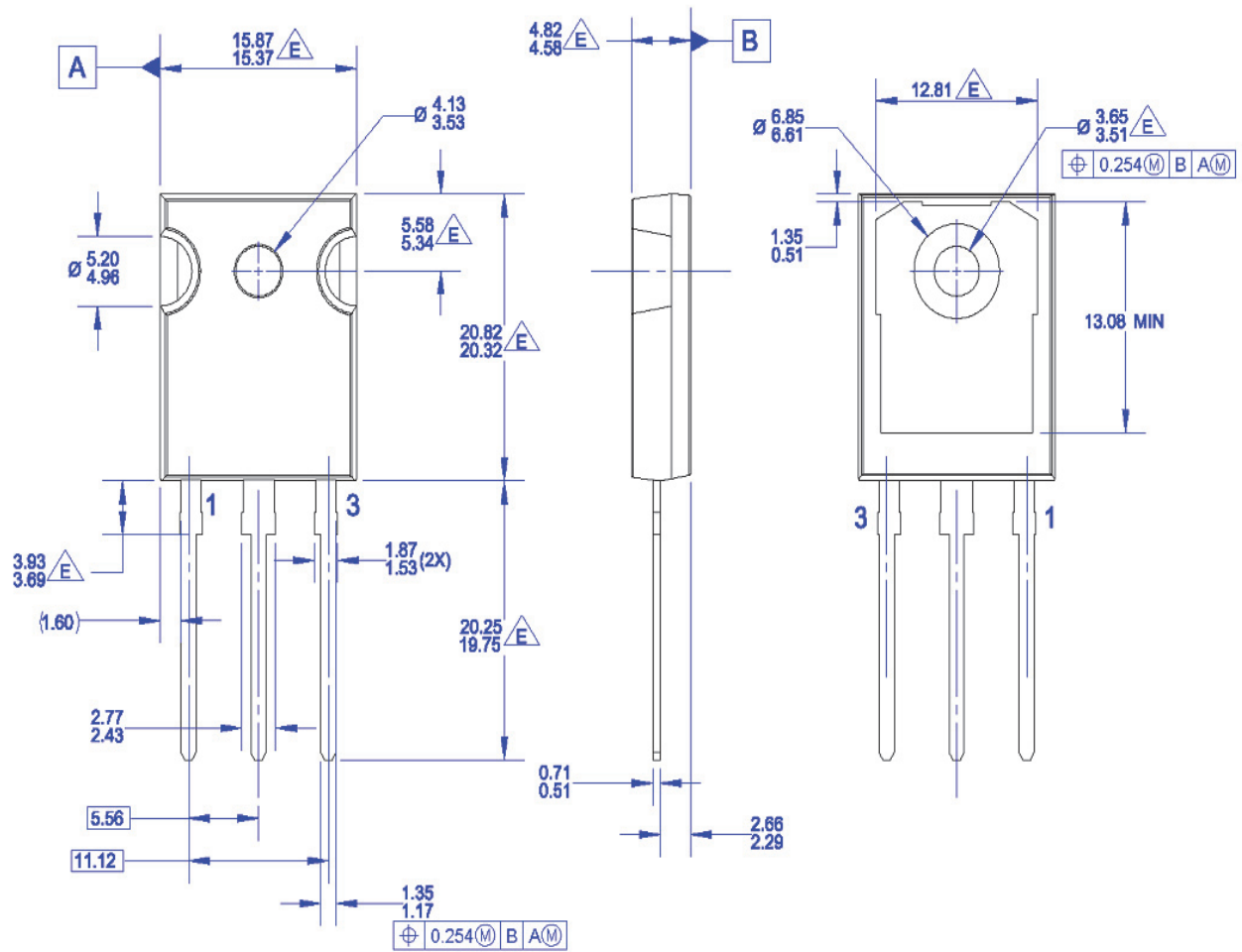
**Figure 21. Transient Thermal Impedance of IGBT**



**Figure 22. Transient Thermal Impedance of Diode**



**Mechanical Dimensions**



- NOTES: UNLESS OTHERWISE SPECIFIED.
- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
  - B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
  - C. ALL DIMENSIONS ARE IN MILLIMETERS.
  - D. DRAWING CONFORMS TO ASME Y14.5 - 1994
  - E. DOES NOT COMPLY JEDEC STANDARD VALUE
  - F. DRAWING FILENAME: MKT-T0247G03\_REV02



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