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May 2014

# FGH40T100SMD

## 1000 V, 40 A Field Stop Trench IGBT

### Features

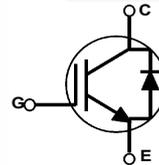
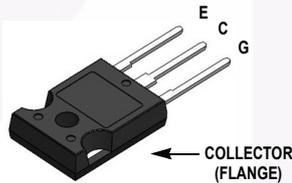
- High Current Capability
- Low Saturation Voltage:  $V_{CE(sat)} = 1.9\text{ V(Typ.)} @ I_C = 40\text{ A}$
- High Input Impedance
- Fast Switching
- RoHS Compliant

### General Description

Using innovative field stop trench IGBT technology, Fairchild's new series of field stop trench IGBTs offer the optimum performance for hard switching application such as UPS, welder and PFC applications.

### Applications

- UPS, welder, PFC



### Absolute Maximum Ratings

Symbol	Description	Ratings	Unit
$V_{CES}$	Collector to Emitter Voltage	1000	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 25$	V
	Transient Gate to Emitter Voltage	$\pm 30$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	80	A
	Collector Current @ $T_C = 100^\circ\text{C}$	40	A
$I_{CM(1)}$	Pulsed Collector Current @ $T_C = 25^\circ\text{C}$	120	A
$I_F$	Diode Forward Current @ $T_C = 25^\circ\text{C}$	80	A
	Diode Forward Current @ $T_C = 100^\circ\text{C}$	40	A
$I_{FM(1)}$	Pulsed Diode Forward Current @ $T_C = 25^\circ\text{C}$	120	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	333	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	166	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: Repetitive rating: Pulse width limited by max. junction temperature

### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC(IGBT)}$	Thermal Resistance, Junction to Case	-	0.45	$^\circ\text{C/W}$
$R_{\theta JC(Diode)}$	Thermal Resistance, Junction to Case	-	0.8	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	$^\circ\text{C/W}$

FGH40T100SMD — 1000 V, 40 A Field Stop Trench IGBT

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGH40T100SMD	FGH40T100SMD	TO-247 A03	-	-	30ea
FGH40T100SMD	FGH40T100SMD_F155	TO-247 G03	-	-	30ea

## Electrical Characteristics of the IGBT T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$BV_{CES}$	Collector to Emitter Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	1000	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	-	0.6	-	V/°C
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$	-	-	1000	$\mu\text{A}$
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0\text{ V}$	-	-	$\pm 500$	nA
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 250\text{ }\mu\text{A}, V_{CE} = V_{GE}$	4.2	5.3	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 40\text{ A}, V_{GE} = 15\text{ V}$	-	1.9	2.3	V
		$I_C = 40\text{ A}, V_{GE} = 15\text{ V}, T_C = 175^\circ\text{C}$	-	2.4	-	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	-	3980	5295	pF
$C_{oes}$	Output Capacitance		-	124	165	pF
$C_{res}$	Reverse Transfer Capacitance		-	76	115	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600\text{ V}, I_C = 40\text{ A}, R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V}, \text{Inductive Load}, T_C = 25^\circ\text{C}$	-	29	38	ns
$t_r$	Rise Time		-	42	55	ns
$t_{d(off)}$	Turn-Off Delay Time		-	285	371	ns
$t_f$	Fall Time		-	23	30	ns
$E_{on}$	Turn-On Switching Loss		-	2.35	3.1	mJ
$E_{off}$	Turn-Off Switching Loss		-	1.15	1.5	mJ
$E_{ts}$	Total Switching Loss		-	3.5	4.6	mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600\text{ V}, I_C = 40\text{ A}, R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V}, \text{Inductive Load}, T_C = 175^\circ\text{C}$	-	27	36	ns
$t_r$	Rise Time		-	49	64	ns
$t_{d(off)}$	Turn-Off Delay Time		-	285	371	ns
$t_f$	Fall Time		-	20	26	ns
$E_{on}$	Turn-On Switching Loss		-	4.4	5.7	mJ
$E_{off}$	Turn-Off Switching Loss		-	1.9	2.5	mJ
$E_{ts}$	Total Switching Loss		-	6.3	8.2	mJ
$Q_g$	Total Gate Charge	$V_{CE} = 600\text{ V}, I_C = 40\text{ A}, V_{GE} = 15\text{ V}$	-	265	398	nC
$Q_{ge}$	Gate to Emitter Charge		-	32	48	nC
$Q_{gc}$	Gate to Collector Charge		-	135	203	nC

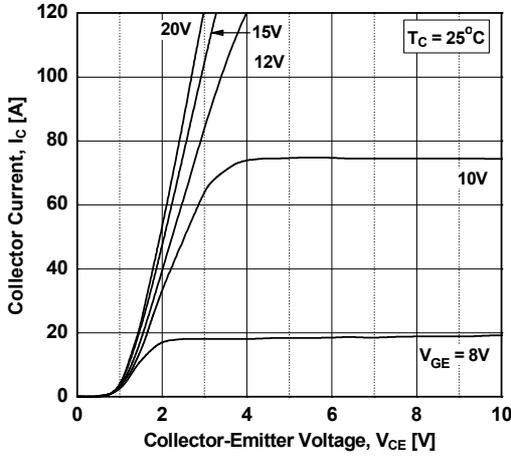
**Electrical Characteristics of Diode** T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit	
V <sub>FM</sub>	Diode Forward Voltage	I <sub>F</sub> = 40 A	T <sub>C</sub> = 25°C	-	3.4	4.4	V
			T <sub>C</sub> = 175°C	-	2.6	-	
t <sub>rr</sub>	Diode Reverse Recovery Time	I <sub>F</sub> = 40 A, di <sub>F</sub> /dt = 200 A/μs	T <sub>C</sub> = 25°C	-	60	78	ns
			T <sub>C</sub> = 175°C	-	256	-	
Q <sub>rr</sub>	Diode Reverse Recovery Charge	I <sub>F</sub> = 40 A, di <sub>F</sub> /dt = 200 A/μs	T <sub>C</sub> = 25°C	-	185	260	nC
			T <sub>C</sub> = 175°C	-	1512	-	

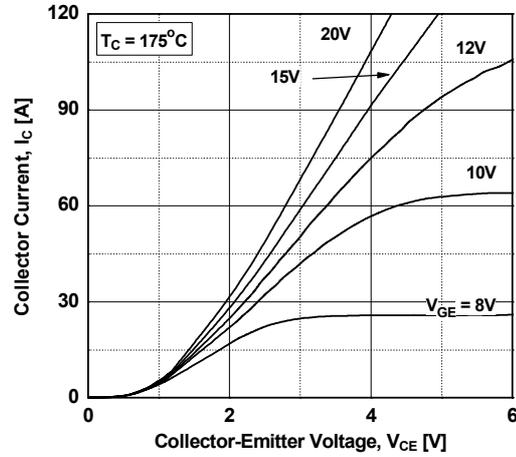


## Typical Performance Characteristics

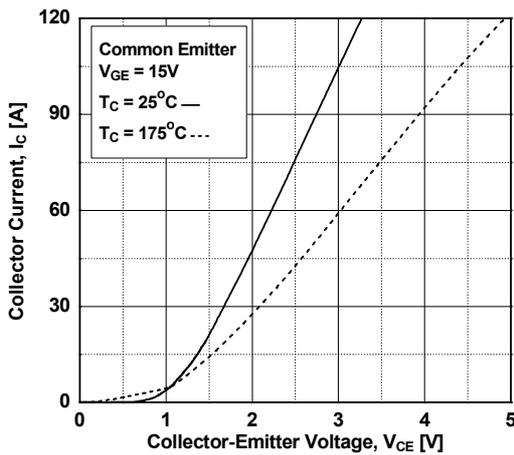
**Figure 1. Typical Output Characteristics**



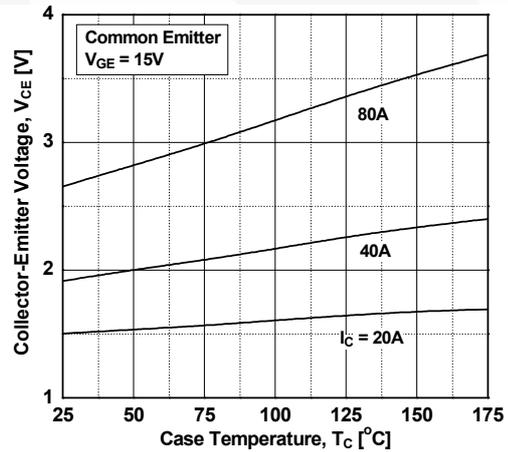
**Figure 2. Typical Output Characteristics**



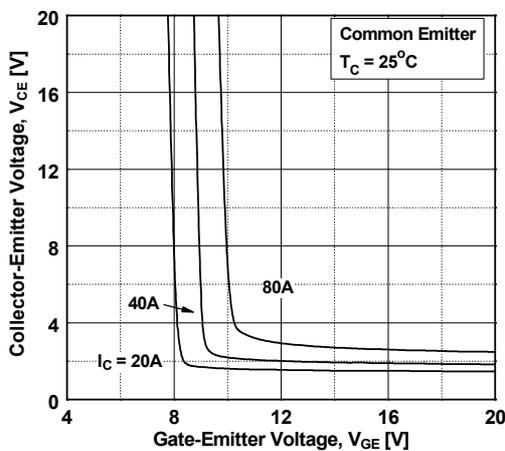
**Figure 3. Typical Saturation Voltage Characteristics**



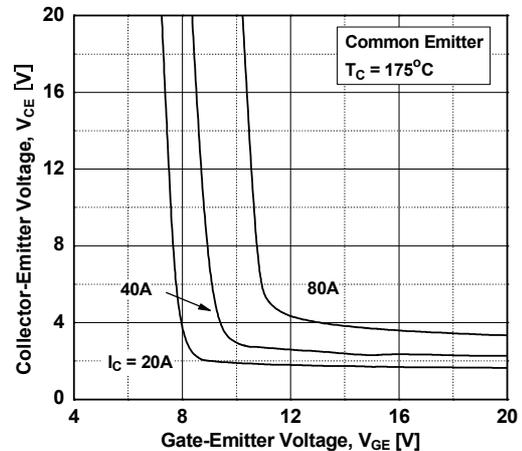
**Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level**



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



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



## Typical Performance Characteristics

Figure 7. Capacitance Characteristics

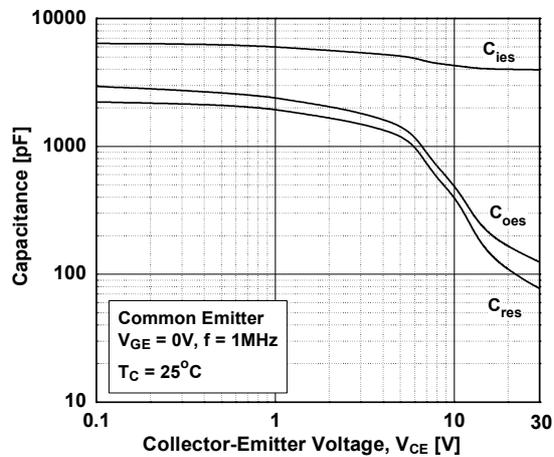


Figure 8. Gate charge Characteristics

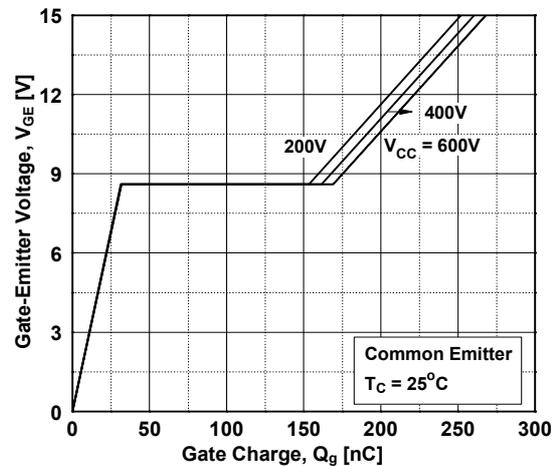


Figure 9. Turn-on Characteristics vs. Gate Resistance

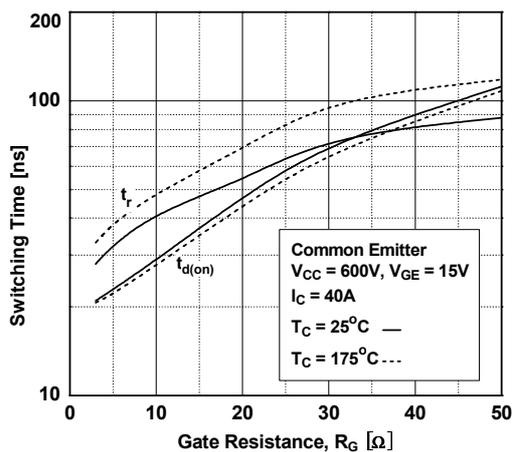


Figure 10. Turn-off Characteristics vs. Gate Resistance

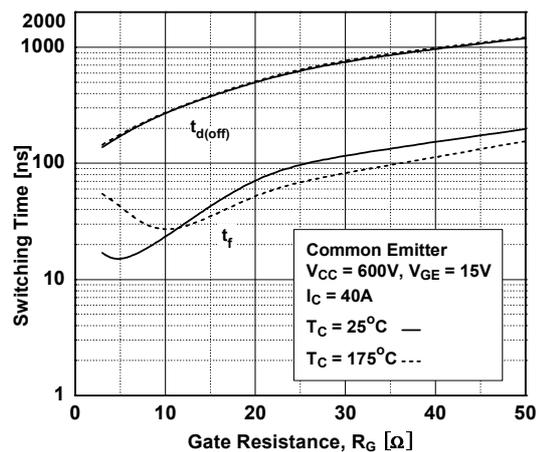


Figure 11. Switching Loss vs. Gate Resistance

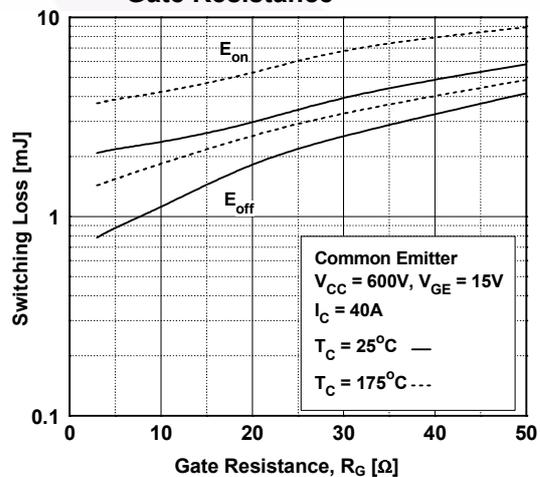
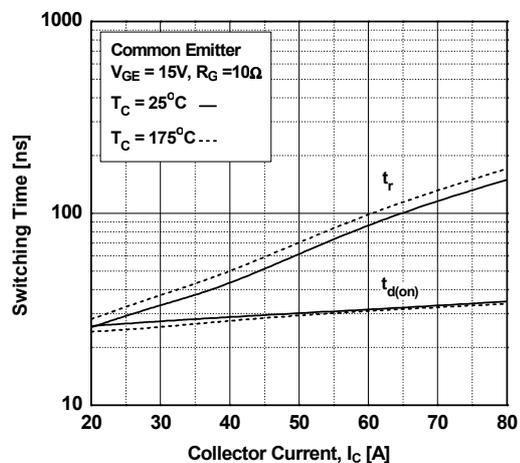
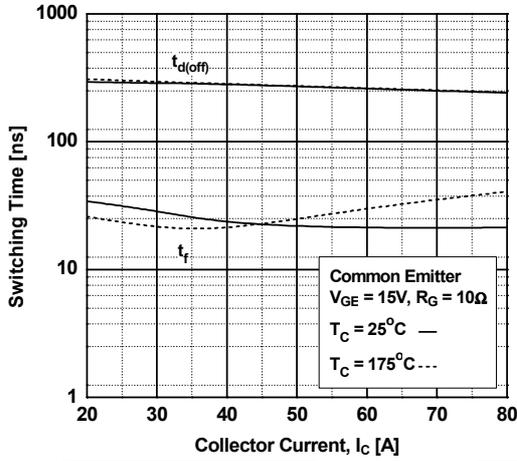


Figure 12. Turn-on Characteristics vs. Collector Current

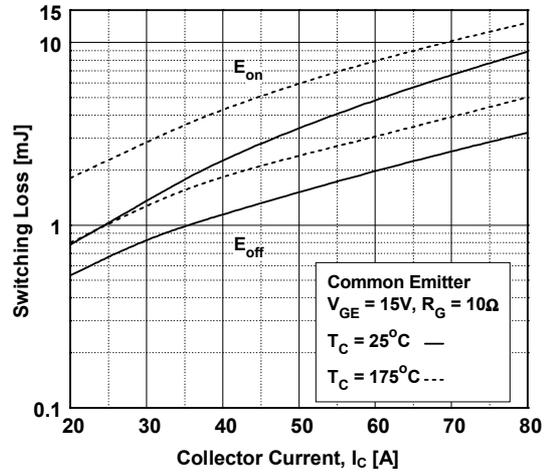


### Typical Performance Characteristics

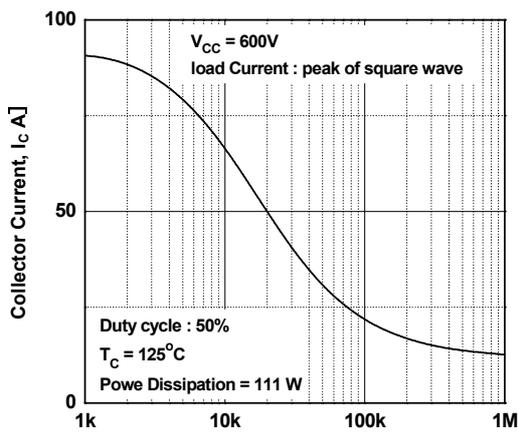
**Figure 13. Turn-off Characteristics vs. Collector Current**



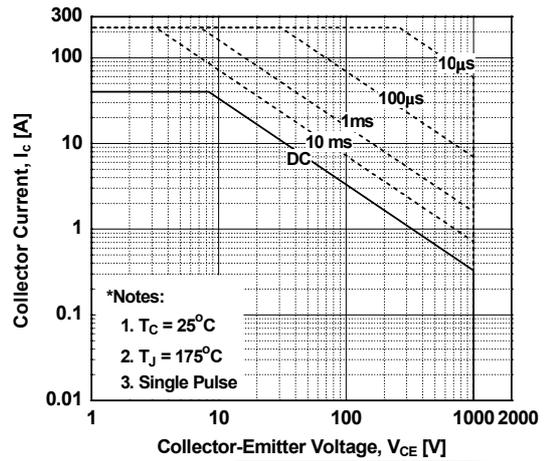
**Figure 14. Switching Loss vs. Collector Current**



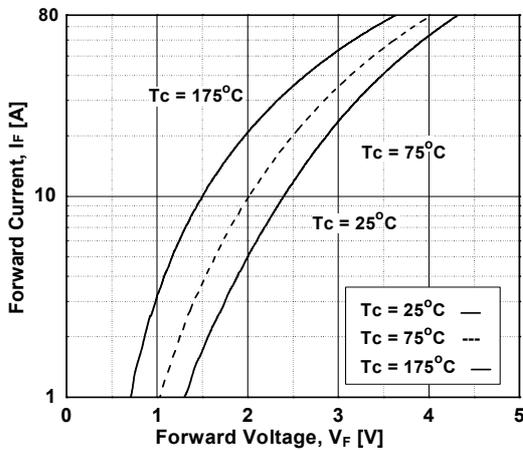
**Figure 15. Load Current Vs. Frequency**



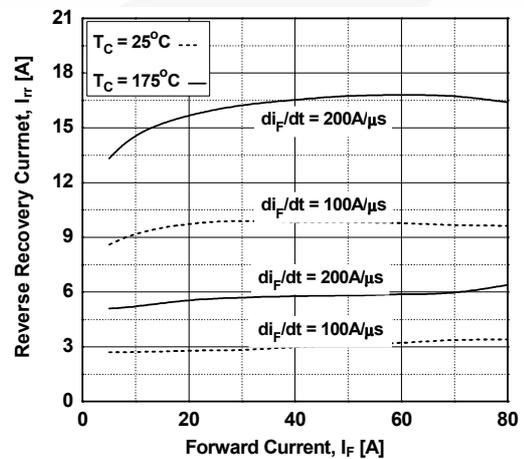
**Figure 16. SOA Characteristics**



**Figure 17. Forward Characteristics**

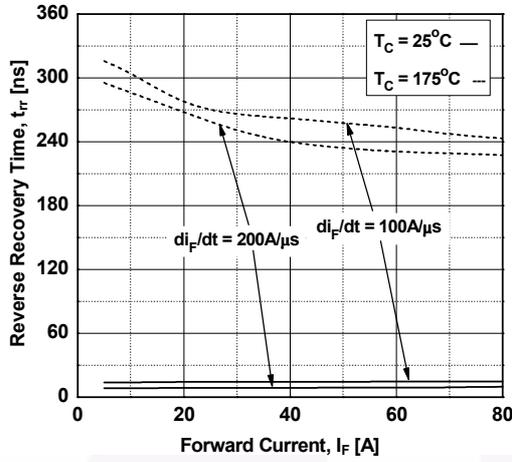


**Figure 18. Reverse Recovery Current**

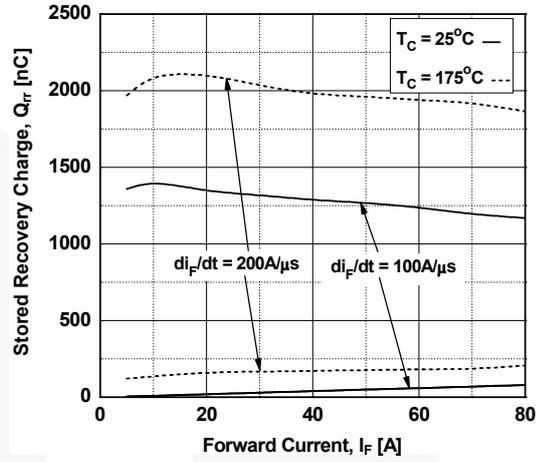


## Typical Performance Characteristics

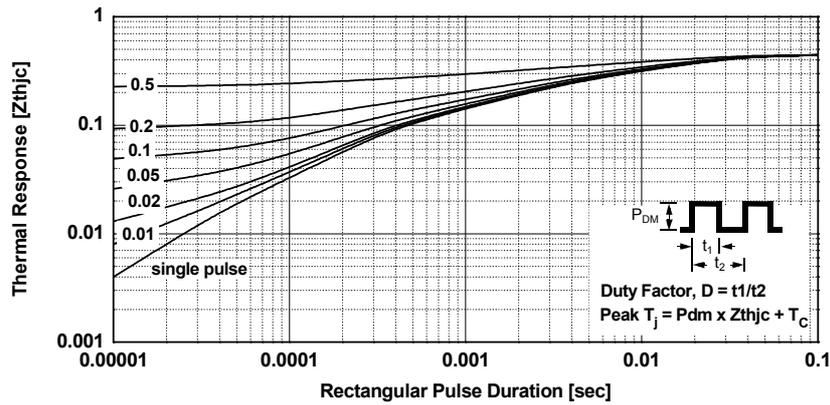
**Figure 19. Reverse Recovery Time**



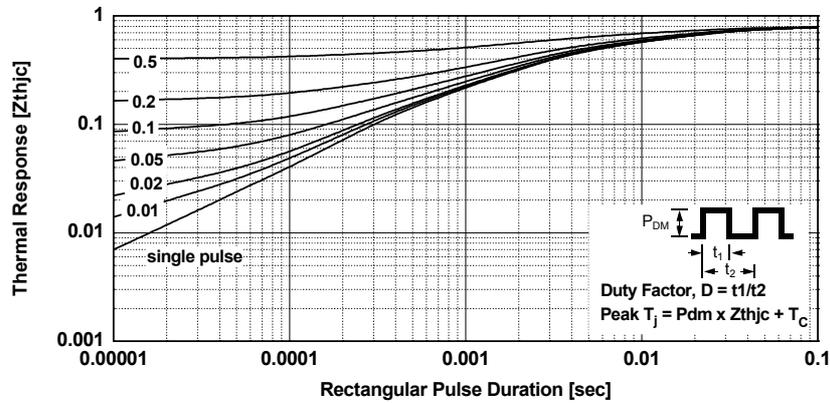
**Figure 20. Stored Charge**



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

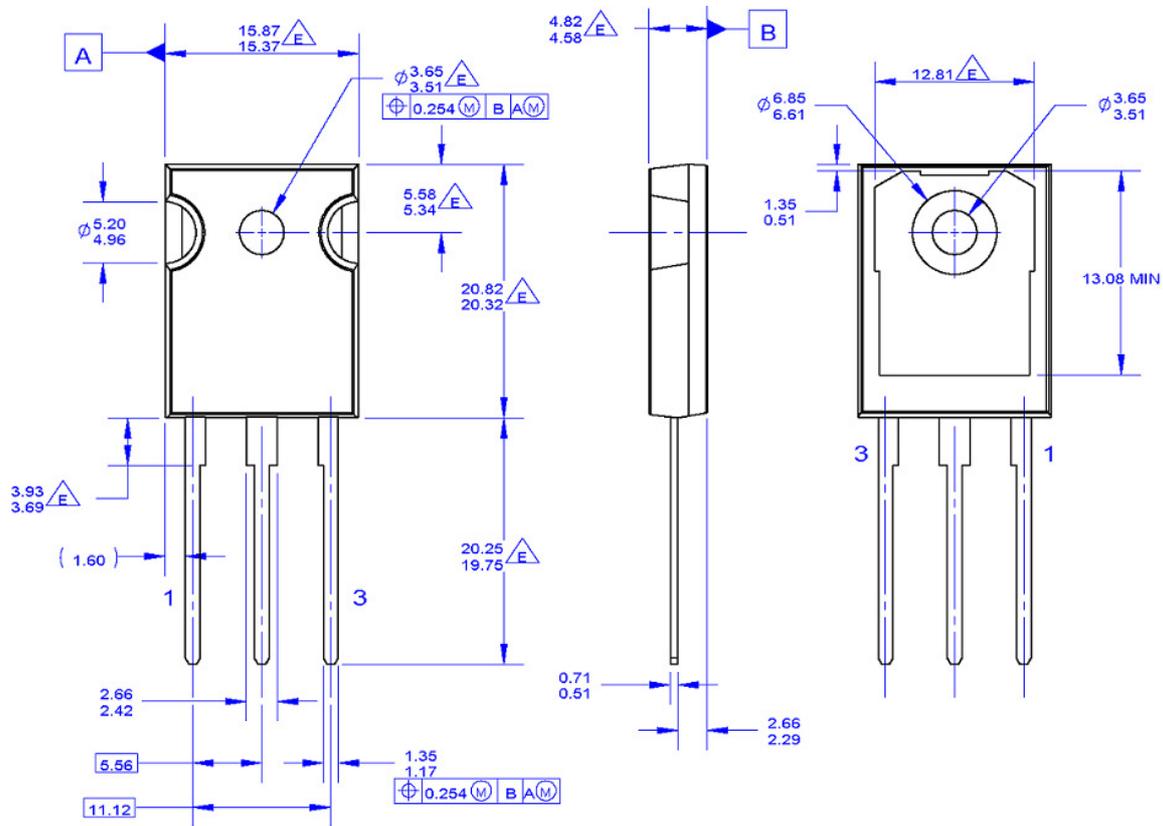


**Figure 22. Transient Thermal Impedance of Diode**





## Mechanical Dimensions



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- 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.
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- D. DRAWING CONFORMS TO ASME Y14.5 - 1994

- $\Delta E$  DOES NOT COMPLY JEDEC STANDARD VALUE
- F. DRAWING FILENAME: MKT-TO247G03\_REV01

**Figure 23. TO-247 3L - TO-247, MOLDED, 3 LEADS, JEDEC AB LONG LEADS**

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| Build it Now™   | GreenBridge™                                    | QFET®                                 | TinyCalc™        |
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