FAIRCHILD SEMICONDUCTOR®

April 2013

FGH40T100SMD

1000 V, 40 A Field Stop Trench IGBT

Features

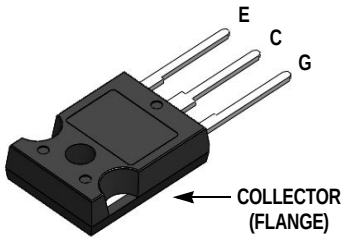
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.9 V(Typ.) @ I_C = 40 A
- High Input Impedance
- Fast Switching
- RoHS Compliant

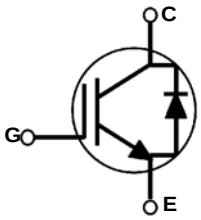
Applications

- UPS, Welder, PFC

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.





Absolute Maximum Ratings

Symbol	Description		Ratings	Unit
V_{CES}	Collector to Emitter Voltage		1000	V
V_{GES}	Gate to Emitter Voltage		± 20	V
I_C	Collector Current	@ T_C = 25°C	80	A
	Collector Current	@ T_C = 125°C	40	A
$I_{CM\ (1)}$	Pulsed Collector Current	@ T_C = 25°C	120	A
I_F	Diode Forward Current	@ T_C = 25°C	80	A
	Diode Forward Current	@ T_C = 125°C	40	A
$I_{FM\ (1)}$	Pulsed Diode Forward Current	@ T_C = 25°C	120	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	333	W
	Maximum Power Dissipation	@ T_C = 125°C	111	W
T_J	Operating Junction Temperature		-55 to +175	°C
T_{stg}	Storage Temperature Range		-55 to +175	°C
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds		300	°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	°C/W
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case	-	0.8	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	°C/W

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Package Marking and Ordering Information

Device Marking	Device	Package	Eco Status	Packaging Type	Qty per Tube
FGH40T100SMD	FGH40T100SMD	TO-247	RoHS	Tube	30ea

Electrical Characteristics of the IGBT T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{CES}	Collector to Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 1mA	1000	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	V_{GE} = 0V, I_C = 250 uA	-	0.6	-	V/°C
I_{CES}	Collector Cut-Off Current	V_{CE} = V_{CES}, V_{GE} = 0V	-	-	1000	μA
I_{GES}	G-E Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0V	-	-	±500	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	I_C = 250uA, V_{CE} = V_{GE}	4.2	5.3	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 40A, V_{GE} = 15V	-	1.9	2.3	V
		I_C = 40A, V_{GE} = 15V, T_C = 125°C	-	2.3	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	-	3980	5295	pF
C_{oes}	Output Capacitance		-	124	165	pF
C_{res}	Reverse Transfer Capacitance		-	76	115	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 600V, I_C = 40A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 25°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} = 600V, I_C = 40A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 175°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} = 600V, I_C = 40A, V_{GE} = 15V	-	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_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max	Unit
V_{FM}	Diode Forward Voltage	I_F = 40A	T_C = 25°C	-	3.4	4.4	V
			T_C = 175°C	-	2.6	-	
t_{rr}	Diode Reverse Recovery Time	I_F =40A, dI_F/dt = 200A/μs	T_C = 25°C	-	60	78	ns
			T_C = 175°C	-	256	-	
Q_{rr}	Diode Reverse Recovery Charge		T_C = 25°C	-	185	260	nC
			T_C = 175°C	-	1512	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

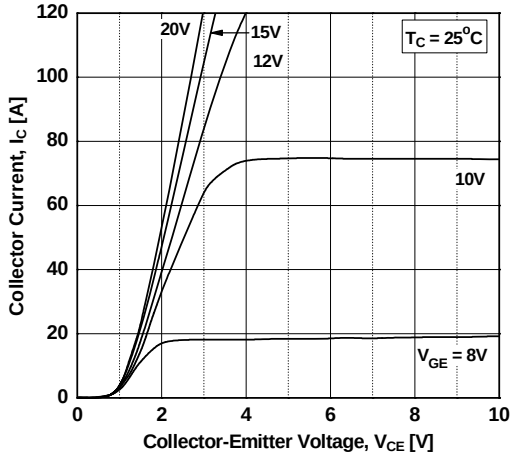


Figure 2. Typical Output Characteristics

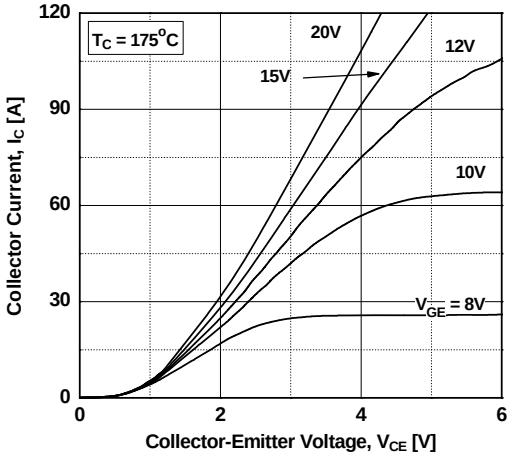


Figure 3. Typical Saturation Voltage Characteristics

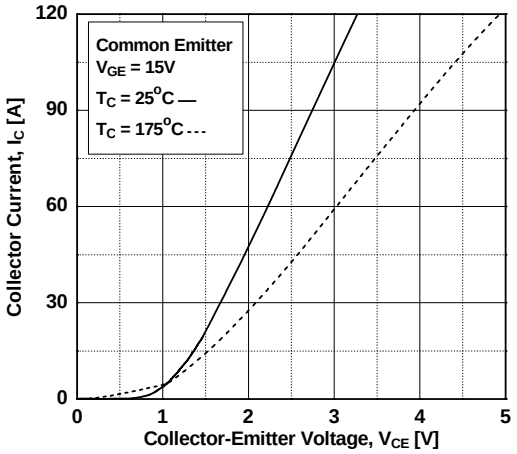


Figure 4. Transfer Characteristics

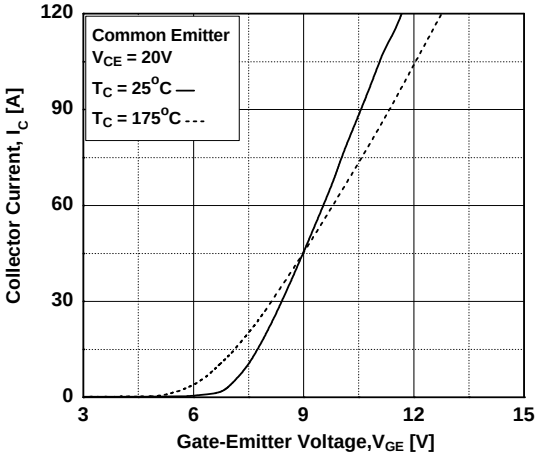


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

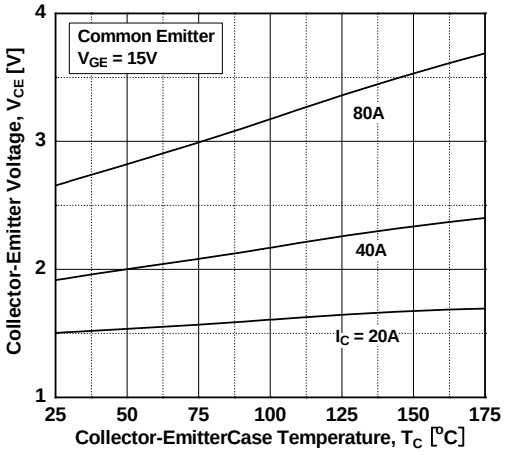
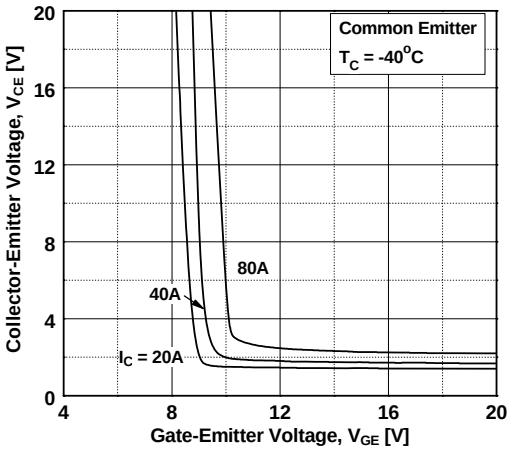


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

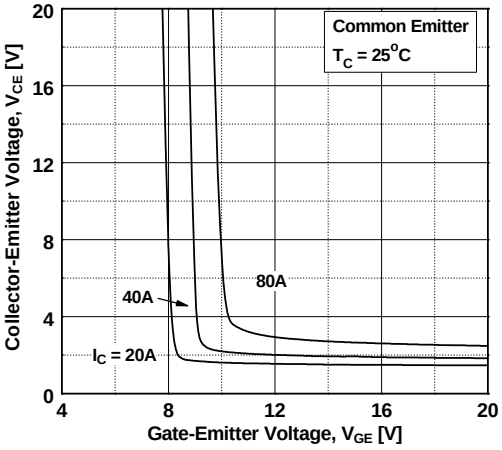


Figure 8. Saturation Voltage vs. V_{GE}

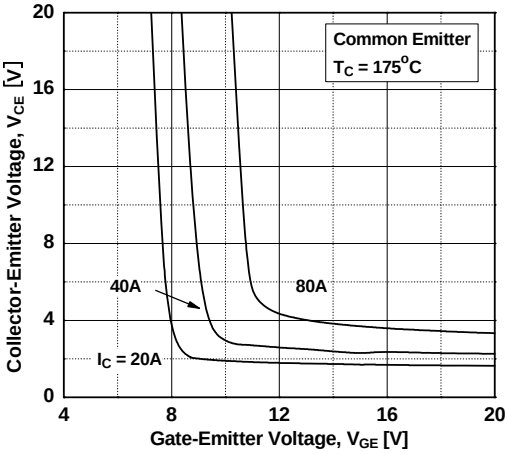


Figure 9. Capacitance Characteristics

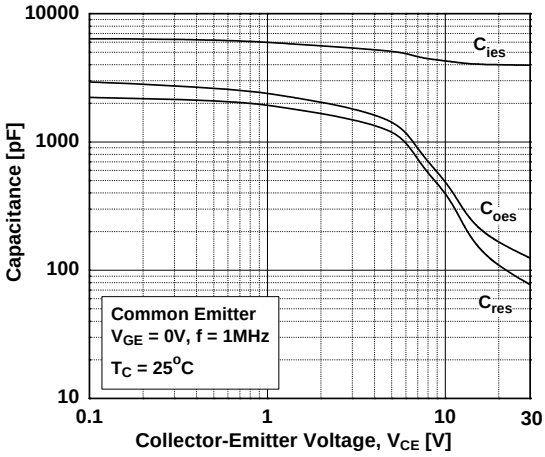


Figure 10. Gate charge Characteristics

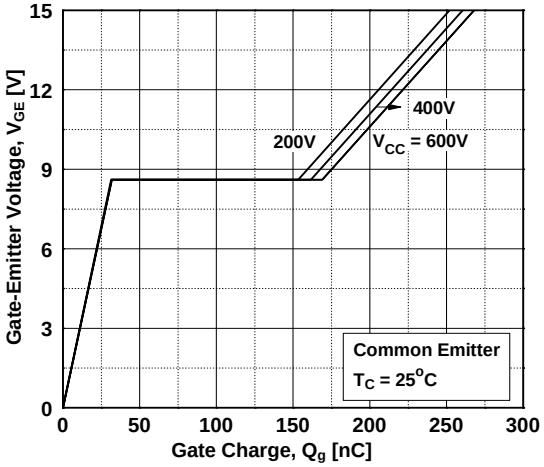


Figure 11. SOA Characteristics

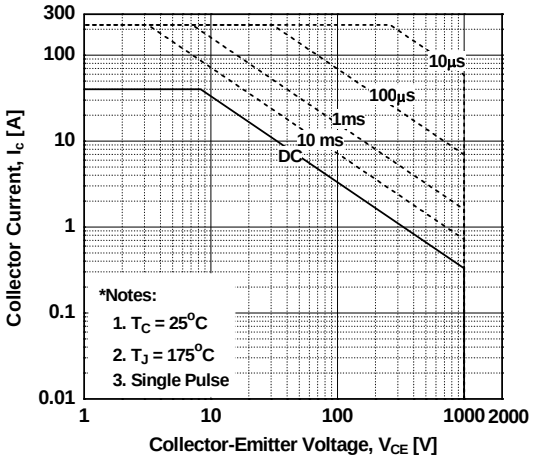
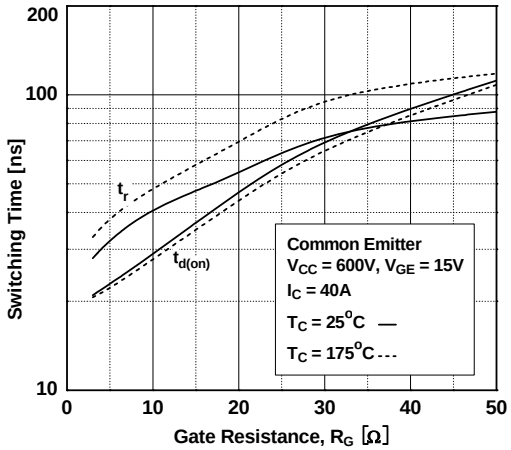


Figure 12. Turn-on Characteristics vs. Gate Resistance



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Gate Resistance

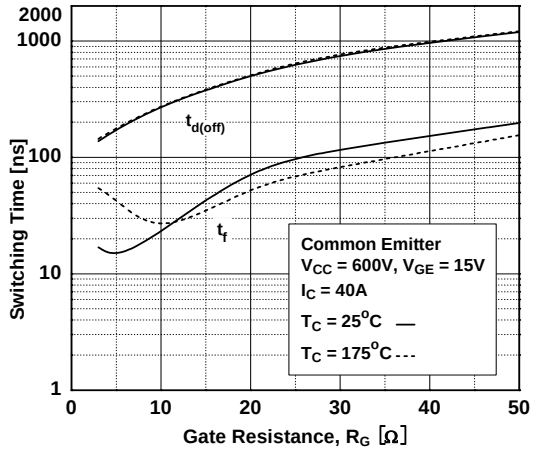


Figure 14. Turn-on Characteristics vs. Collector Current

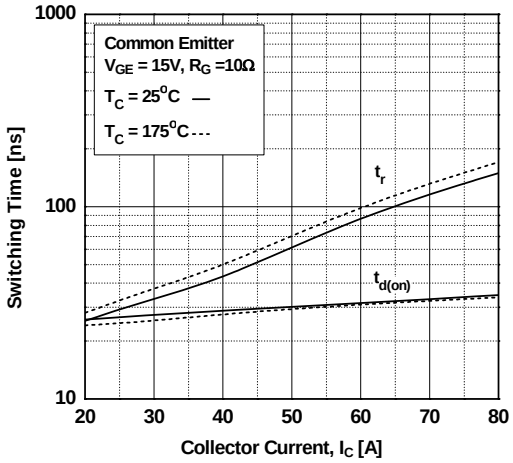


Figure 15. Turn-off Characteristics vs. Collector Current

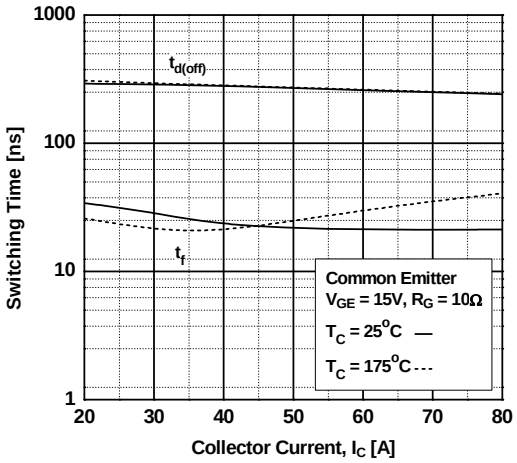


Figure 16. Switching Loss vs. Gate Resistance

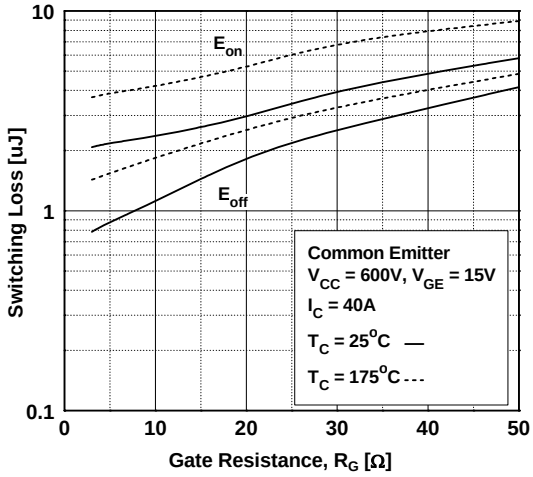


Figure 17. Switching Loss vs. Collector Current

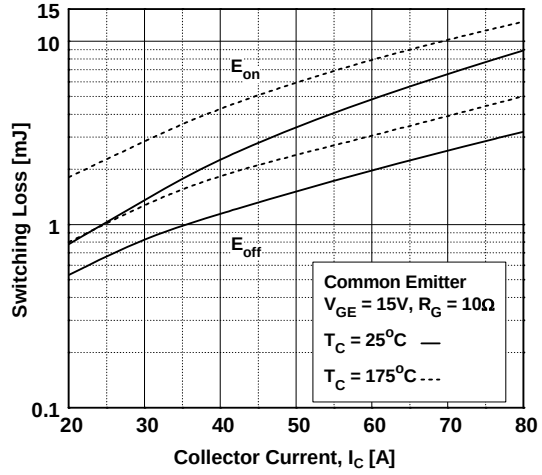
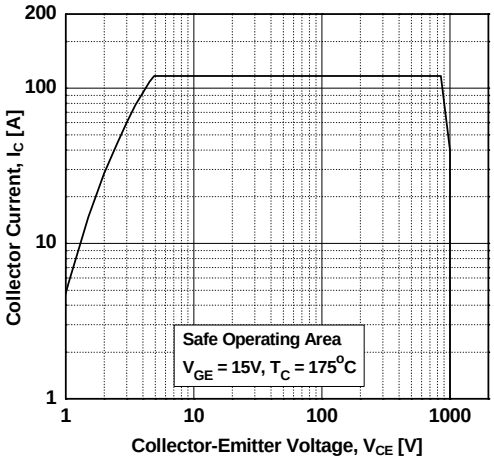


Figure 18. Turn off Switching SOA Characteristics



Typical Performance Characteristics

Figure 19. Current Derating

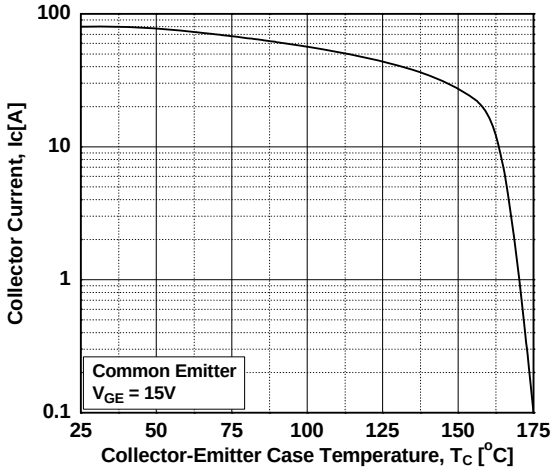


Figure 20. Load Current Vs. Frequence

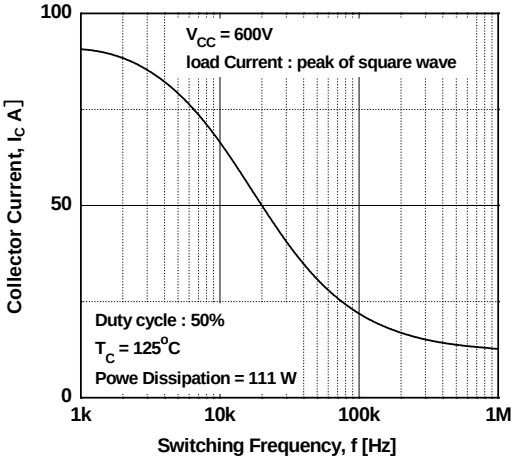


Figure 21. Diode Forward Characteristics

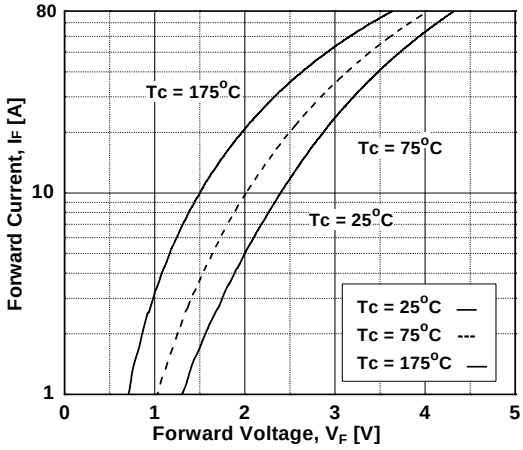


Figure 22. Reverse Current

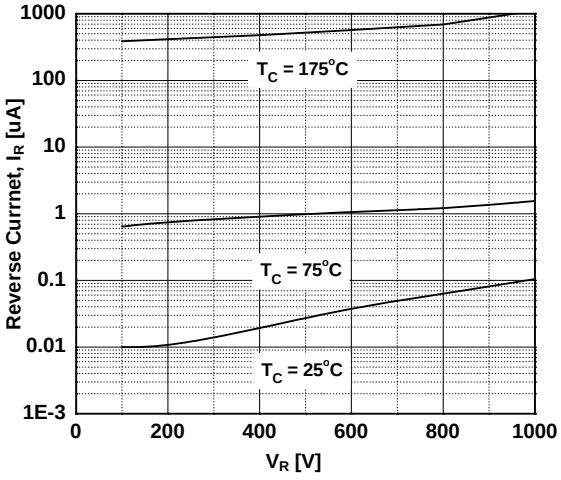


Figure 23. Stored Charge

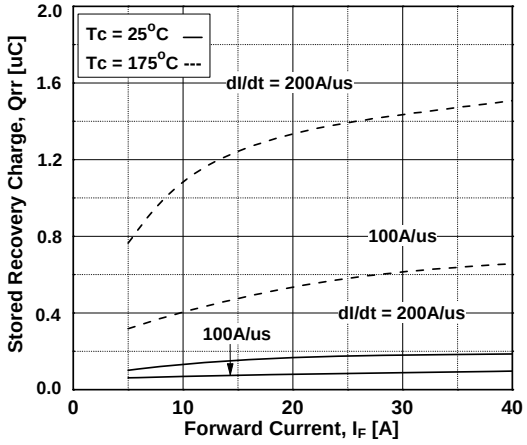
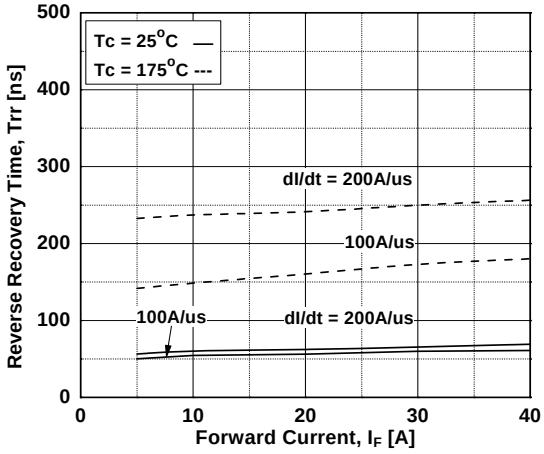


Figure 24. Reverse Recovery Time



Typical Performance Characteristics

Figure 25. Transient Thermal Impedance of IGBT

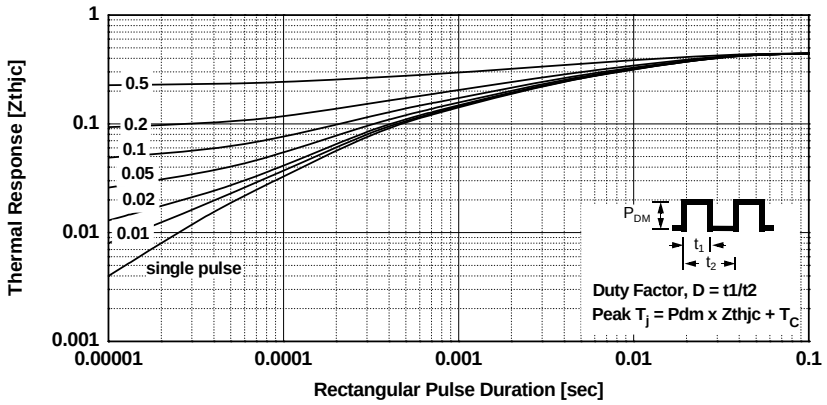
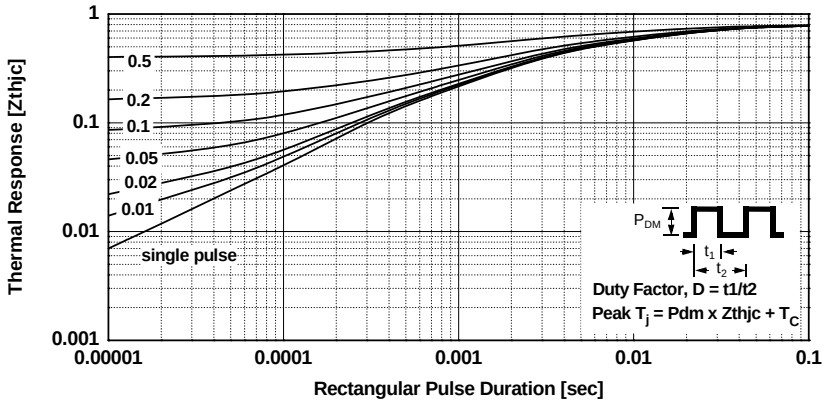
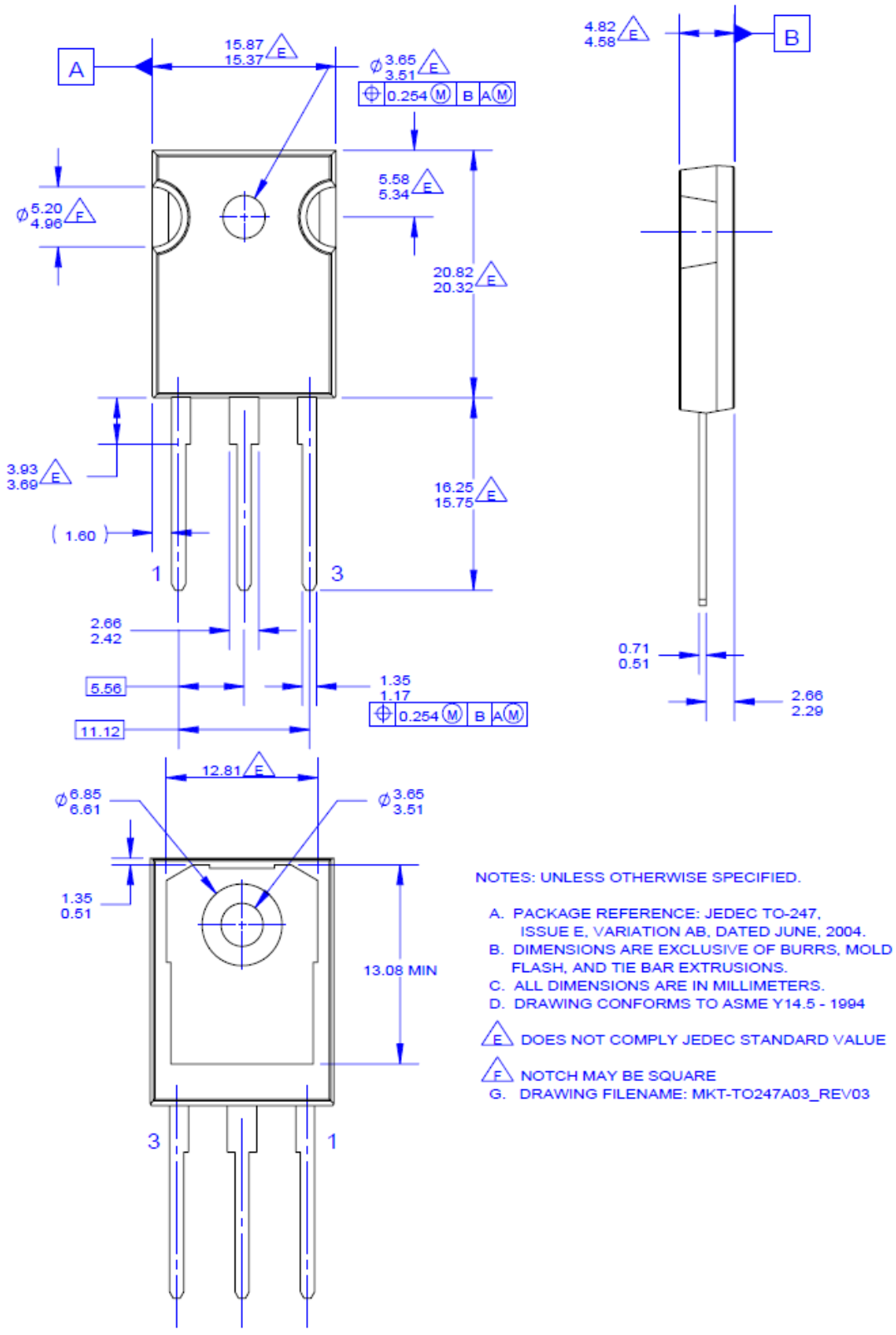


Figure 26.Transient Thermal Impedance of Diode



Mechanical Dimensions

TO-247A03



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Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
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Rev. I64