



FGH40N60UFD

600 V, 40 A Field Stop IGBT

Features

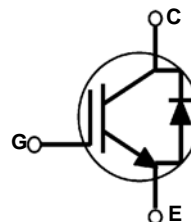
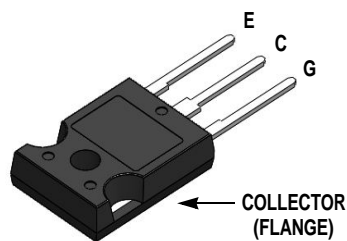
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)} = 1.8\text{ V @ } I_C = 40\text{ A}$
- High Input Impedance
- Fast Switching
- RoHS Compliant

Applications

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

General Description

Using novel field stop IGBT technology, Fairchild®'s field stop IGBTs offer the optimum performance for solar inverter, UPS, welder, microwave oven, telecom, ESS and PFC applications where low conduction and switching losses are essential.



Absolute Maximum Ratings

Symbol	Description	Ratings	Unit
V_{CES}	Collector to Emitter Voltage	600	V
V_{GES}	Gate to Emitter Voltage	± 20	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
P_D	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	290	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	116	W
T_J	Operating Junction Temperature	-55 to +150	$^\circ\text{C}$
T_{stg}	Storage Temperature Range	-55 to +150	$^\circ\text{C}$
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
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction to Case	-	0.43	$^\circ\text{C/W}$
$R_{\theta JC}(\text{Diode})$	Thermal Resistance, Junction to Case	-	1.45	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Packaging Type	Qty per Tube	Max Qty per Box
FGH40N60UFD	FGH40N60UFDTU	TO-247	Tube	30ea	-

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
V_{CES}	Collector to Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	600	-	-	V
$\Delta BV_{CES} / \Delta T_J$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	-	0.6	-	V/°C
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	-	-	250	μA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	-	-	±400	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 250\mu A, V_{CE} = V_{GE}$	4.0	5.0	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 40A, V_{GE} = 15V$	-	1.8	2.4	V
		$I_C = 40A, V_{GE} = 15V, T_C = 125^\circ C$	-	2.0	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V, f = 1MHz$	-	2110	-	pF
C_{oes}	Output Capacitance		-	200	-	pF
C_{res}	Reverse Transfer Capacitance		-	60	-	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400V, I_C = 40A, R_G = 10\Omega, V_{GE} = 15V, \text{Inductive Load}, T_C = 25^\circ C$	-	24	-	ns
t_r	Rise Time		-	44	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	112	-	ns
t_f	Fall Time		-	30	60	ns
E_{on}	Turn-On Switching Loss		-	1.19	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.46	-	mJ
E_{ts}	Total Switching Loss	-	1.65	-	mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400V, I_C = 40A, R_G = 10\Omega, V_{GE} = 15V, \text{Inductive Load}, T_C = 125^\circ C$	-	24	-	ns
t_r	Rise Time		-	45	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	120	-	ns
t_f	Fall Time		-	40	-	ns
E_{on}	Turn-On Switching Loss		-	1.2	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.69	-	mJ
E_{ts}	Total Switching Loss	-	1.89	-	mJ	
Q_g	Total Gate Charge	$V_{CE} = 400V, I_C = 40A, V_{GE} = 15V$	-	120	-	nC
Q_{ge}	Gate to Emitter Charge		-	14	-	nC
Q_{gc}	Gate to Collector Charge		-	58	-	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	$I_F = 20\text{A}$	$T_C = 25^\circ\text{C}$	-	1.95	2.6	V
			$T_C = 125^\circ\text{C}$	-	1.85	-	
t_{rr}	Diode Reverse Recovery Time	$I_F = 20\text{A}, dI_{ES}/dt = 200\text{A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	-	45	-	ns
			$T_C = 125^\circ\text{C}$	-	140	-	
Q_{rr}	Diode Reverse Recovery Charge	$I_F = 20\text{A}, dI_{ES}/dt = 200\text{A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	-	75	-	nC
			$T_C = 125^\circ\text{C}$	-	375	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

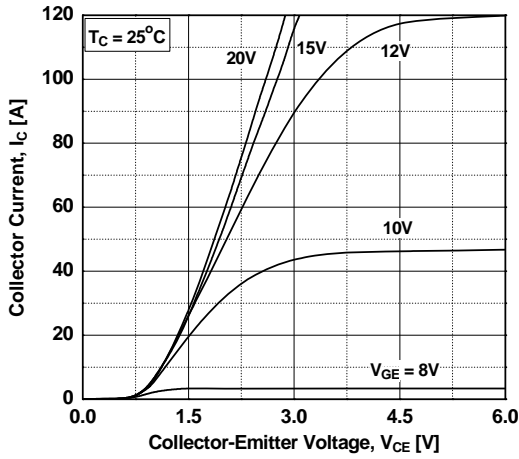


Figure 2. Typical Output Characteristics

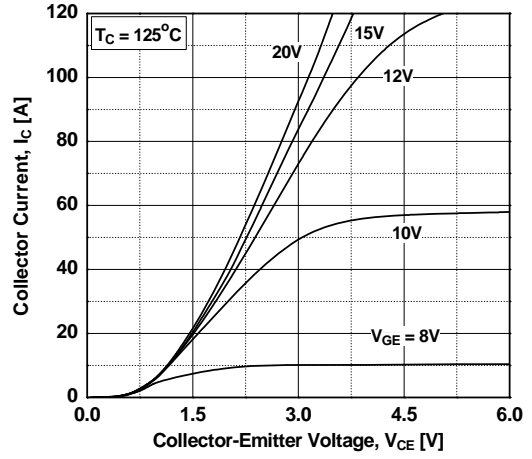


Figure 3. Typical Saturation Voltage Characteristics

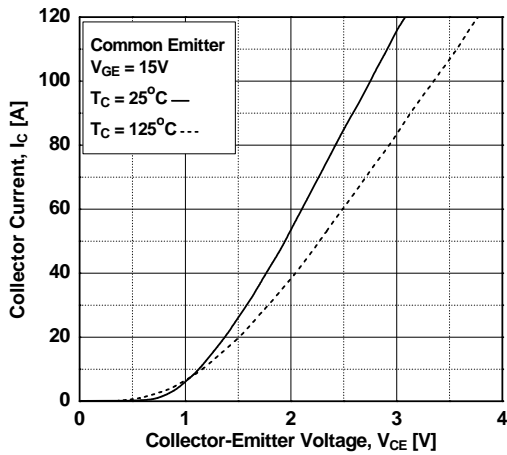


Figure 4. Transfer Characteristics

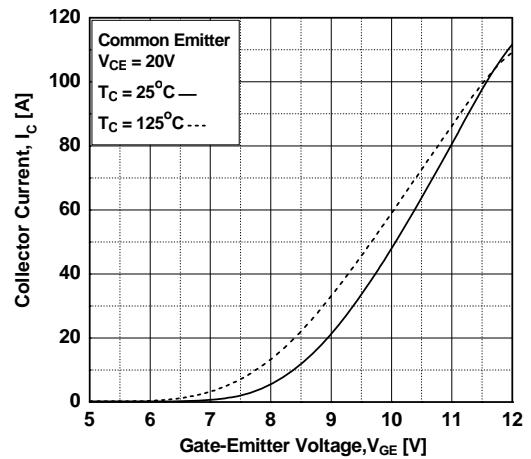


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

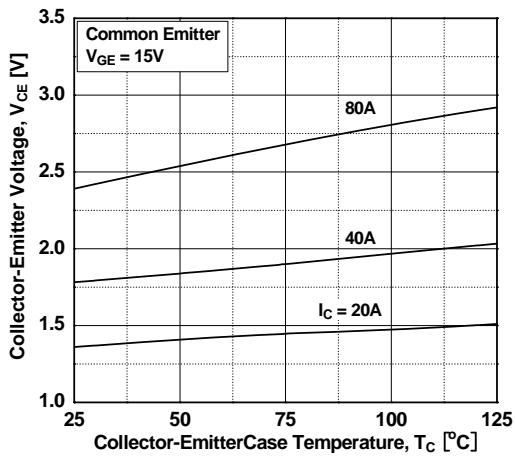
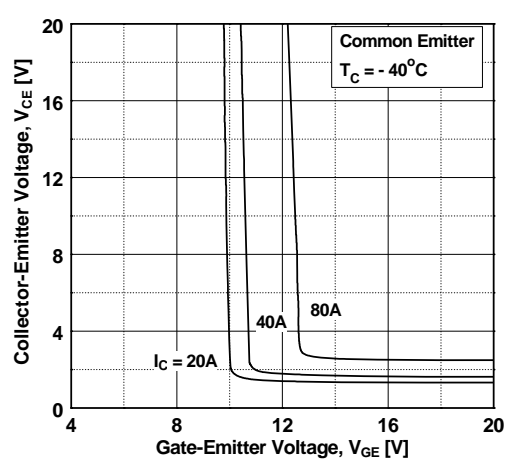


Figure 6. Saturation Voltage vs. Vge



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

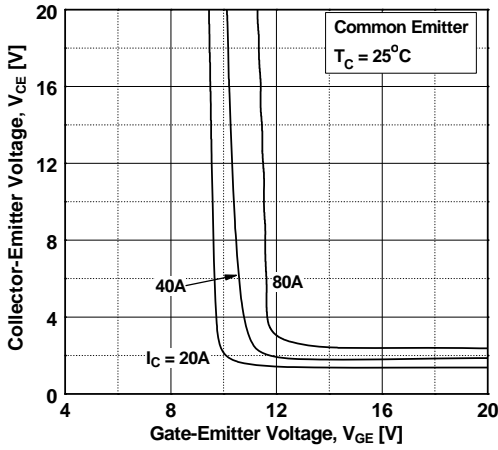


Figure 8. Saturation Voltage vs. V_{GE}

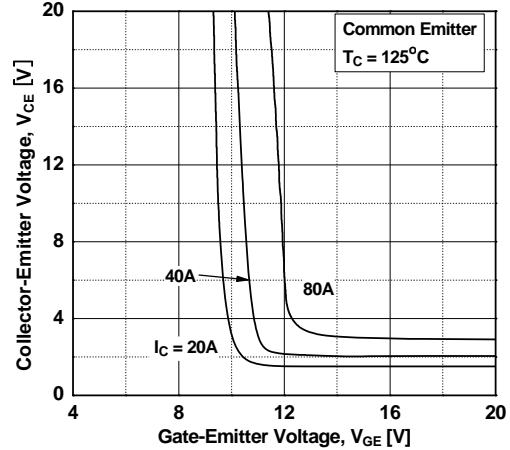


Figure 9. Capacitance Characteristics

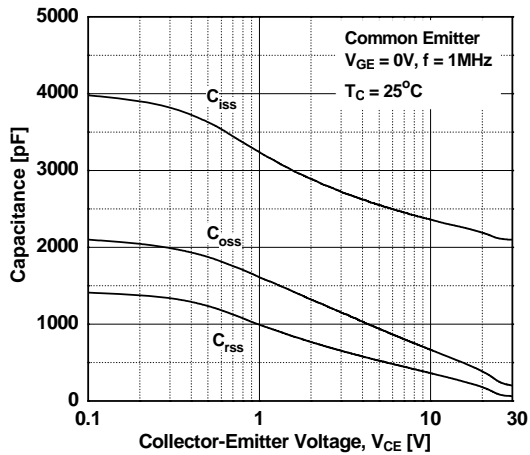


Figure 10. Gate charge Characteristics

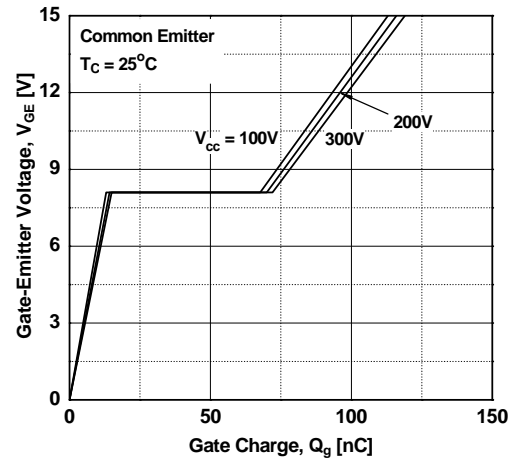


Figure 11. SOA Characteristics

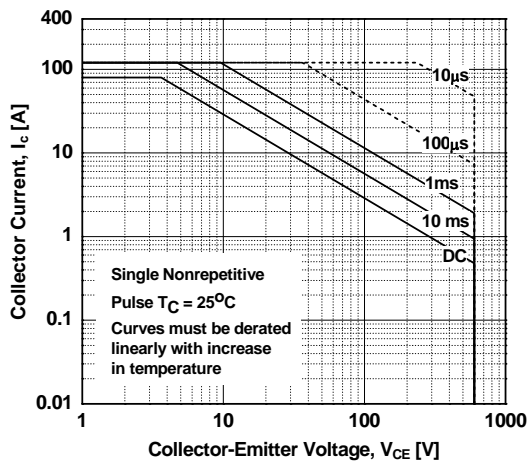
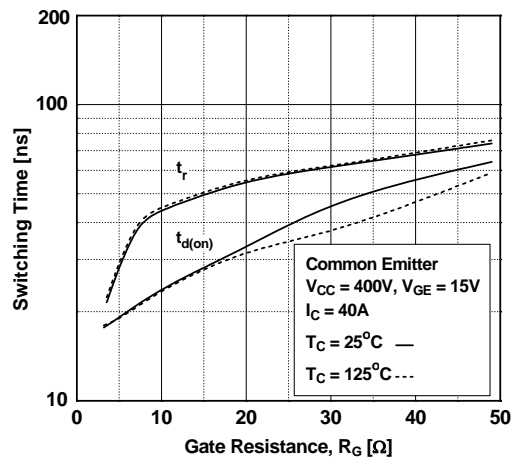


Figure 12. Turn-on Characteristics vs. Gate Resistance



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Gate Resistance

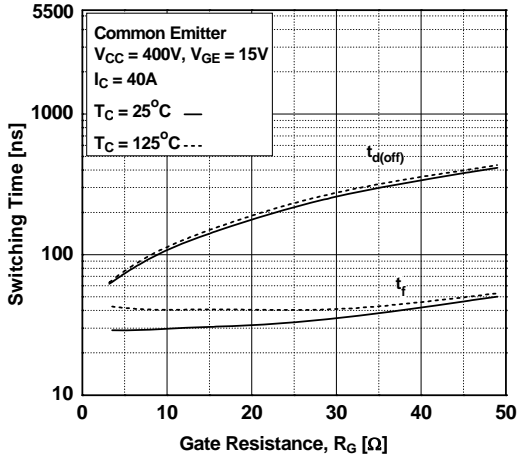


Figure 14. Turn-on Characteristics vs. Collector Current

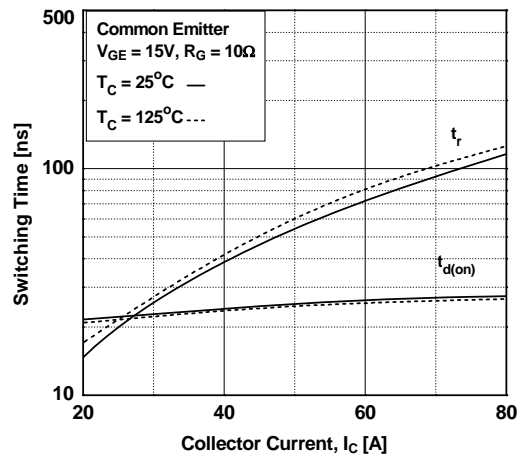


Figure 15. Turn-off Characteristics vs. Collector Current

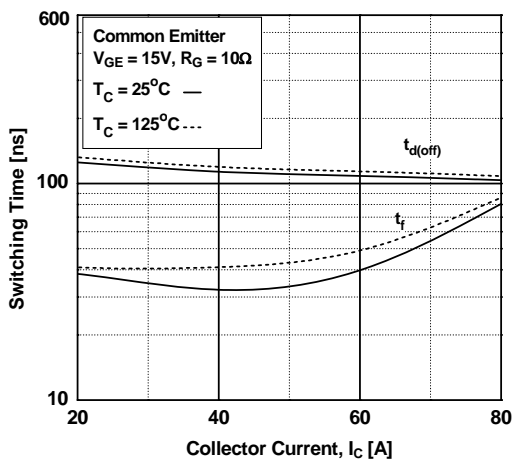


Figure 16. Switching Loss vs. Gate Resistance

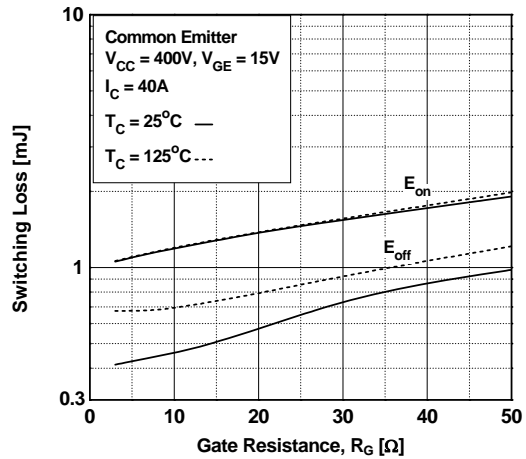


Figure 17. Switching Loss vs. Collector Current

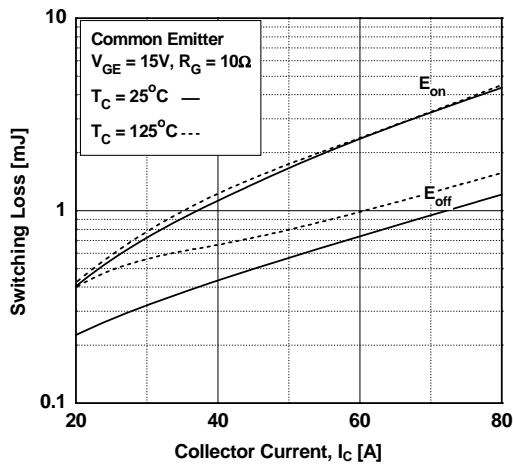
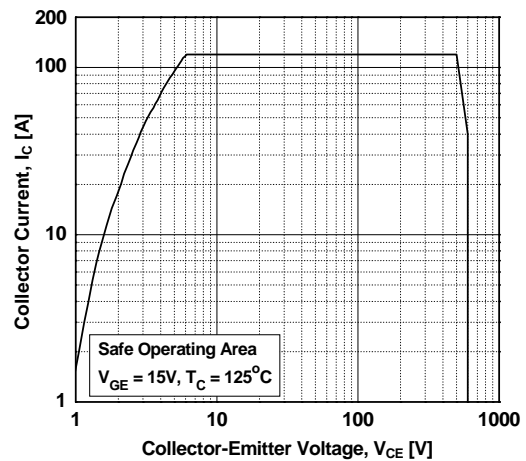


Figure 18. Turn off Switching SOA Characteristics



Typical Performance Characteristics

Figure 19. Forward Characteristics

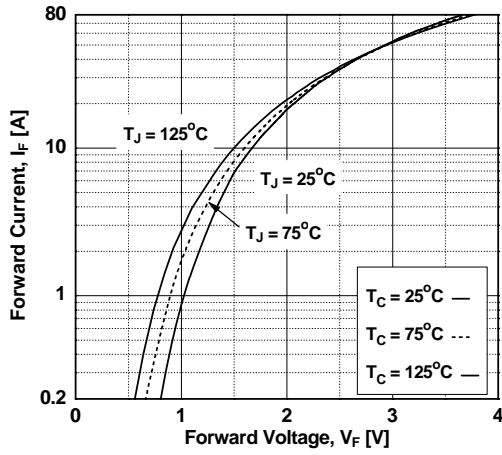


Figure 20. Typical Reverse Current vs. Reverse Voltage

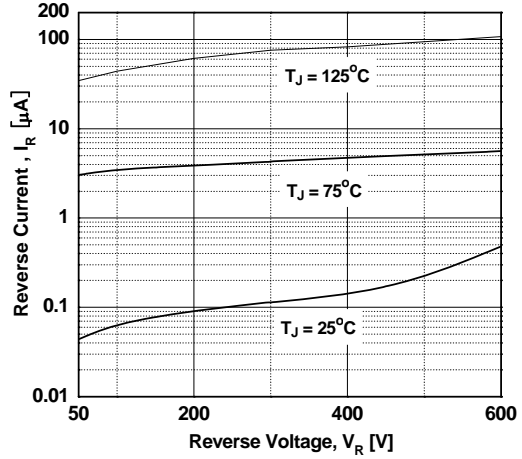


Figure 21. Stored Charge

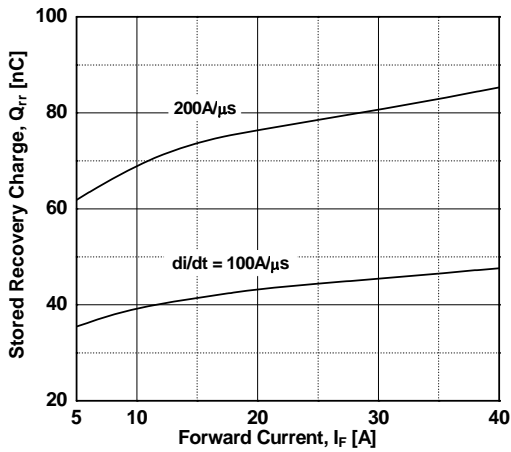


Figure 22. Reverse Recovery Time

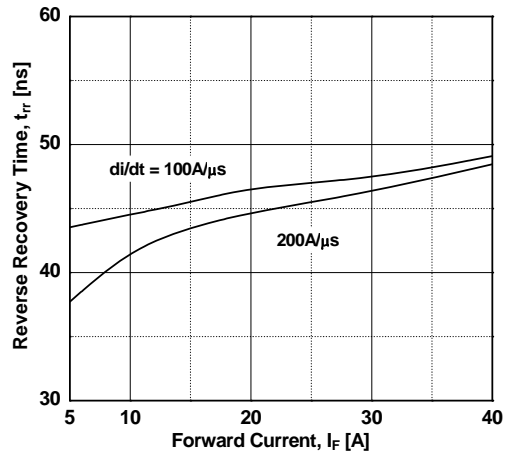
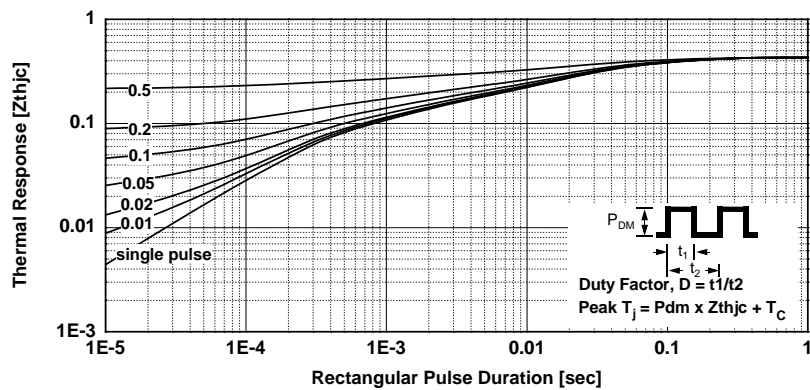
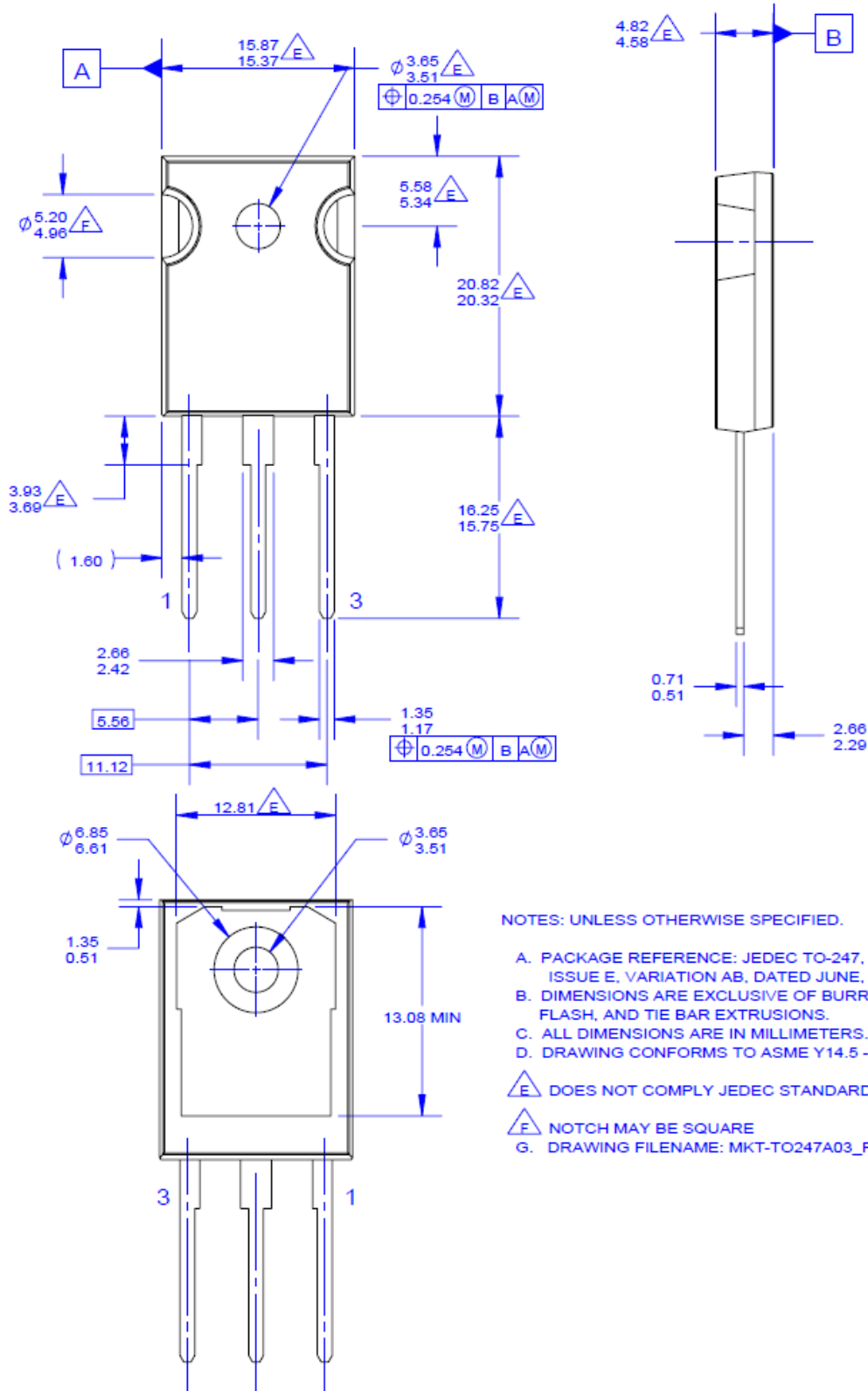


Figure 23. Transient Thermal Impedance of IGBT



Mechanical Dimensions

TO-247A03




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. NOTCH MAY BE SQUARE
- G. DRAWING FILENAME: MKT-TO247A03_REV03



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Definition of Terms

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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