



March 2015



FGH40N60UF 600 V, 40 A Field Stop IGBT

Features

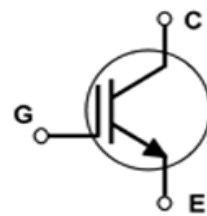
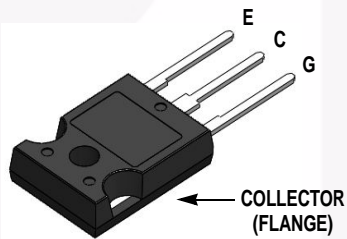
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)} = 1.8\text{ V @ } I_C = 40\text{ A}$
- High Input Impedance
- Fast Switching
- RoHS Compliant

Applications

- Solar Inverter, UPS, Welder, PFC

General Description

Using novel field stop IGBT technology, Fairchild's field stop IGBTs offer the optimum performance for solar inverter, UPS, welder 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
	Transient Gate-to-Emitter Voltage	± 30	
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
$R_{\theta JC(IGBT)}$	Thermal Resistance, Junction to Case	-	0.43	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	$^\circ\text{C/W}$

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGH40N60UFTU	FGH40N60UF	TO-247	Tube	N/A	N/A	30

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
Off Characteristics							
BV_{CES}	Collector to Emitter Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 250\ \mu\text{A}$	600	-	-	V	
$\Delta BV_{CES} / \Delta T_J$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 250\ \mu\text{A}$	-	0.6	-	V/ $^\circ\text{C}$	
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$	-	-	250	μA	
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0\text{ V}$	-	-	± 400	nA	
On Characteristics							
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 250\ \mu\text{A}, V_{CE} = V_{GE}$	4.0	5.0	6.5	V	
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 40\text{ A}, V_{GE} = 15\text{ V}$	-	1.8	2.4	V	
		$I_C = 40\text{ A}, V_{GE} = 15\text{ V}, T_C = 125^\circ\text{C}$	-	2.0	-	V	
Dynamic Characteristics							
C_{ies}	Input Capacitance	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	-	2110	-	pF	
C_{oes}	Output Capacitance		-	200	-	pF	
C_{res}	Reverse Transfer Capacitance		-	60	-	pF	
Switching Characteristics							
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400\text{ V}, I_C = 40\text{ A}, R_G = 10\ \Omega, V_{GE} = 15\text{ V}, \text{Inductive Load}, T_C = 25^\circ\text{C}$	-	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		$V_{CC} = 400\text{ V}, I_C = 40\text{ A}, R_G = 10\ \Omega, V_{GE} = 15\text{ V}, \text{Inductive Load}, T_C = 125^\circ\text{C}$	-	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	$V_{CE} = 400\text{ V}, I_C = 40\text{ A}, V_{GE} = 15\text{ V}$		-	120	-	nC
Q_{ge}	Gate to Emitter Charge			-	14	-	nC
Q_{gc}	Gate to Collector Charge		-	58	-	nC	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

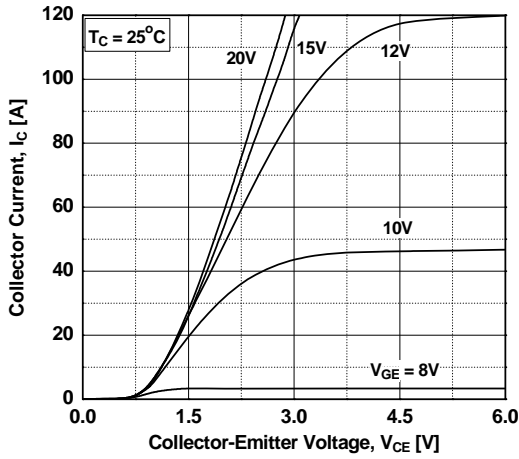


Figure 2. Typical Output Characteristics

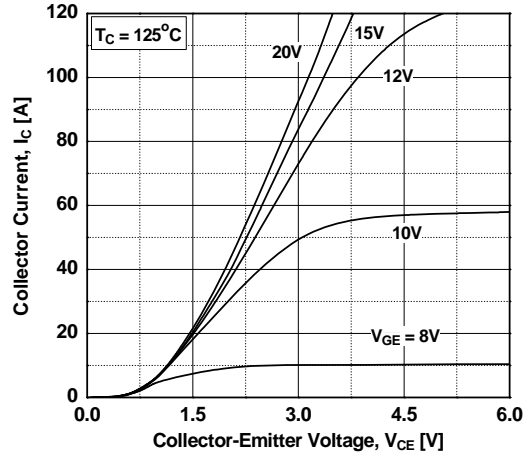


Figure 3. Typical Saturation Voltage Characteristics

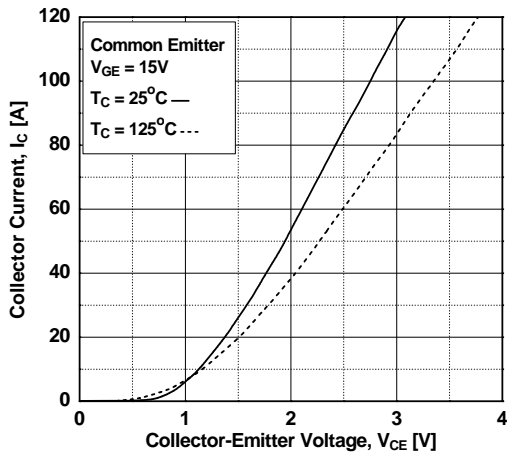


Figure 4. Transfer Characteristics

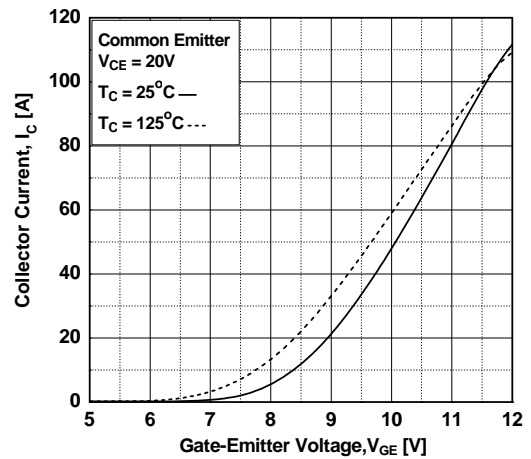


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

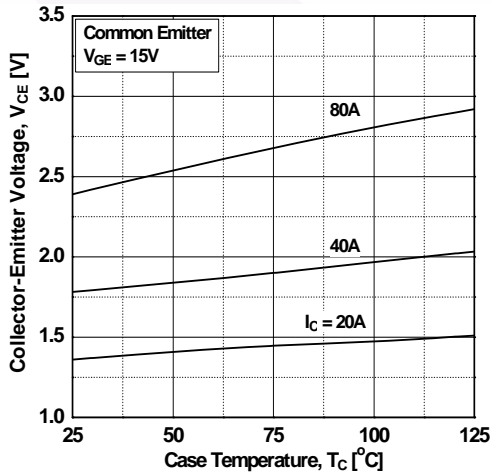
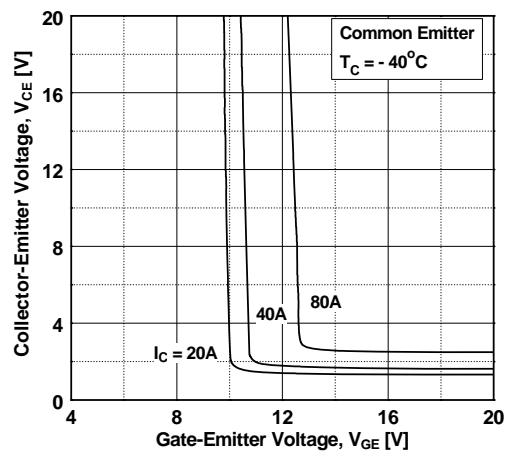


Figure 6. Saturation Voltage vs. Vge



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

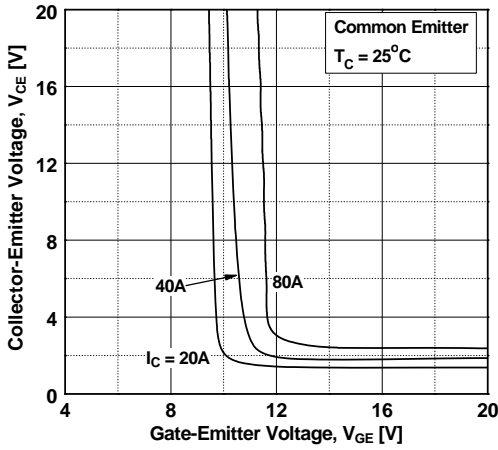


Figure 8. Saturation Voltage vs. V_{GE}

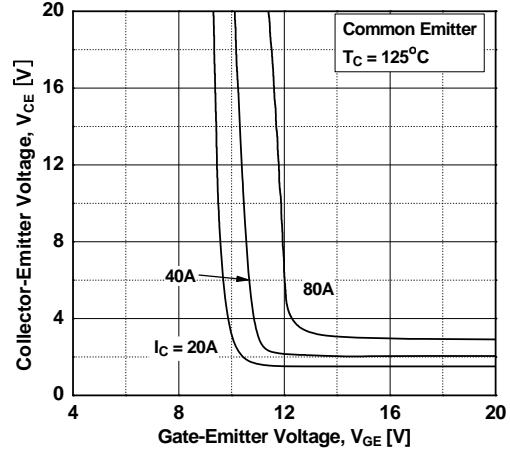


Figure 9. Capacitance Characteristics

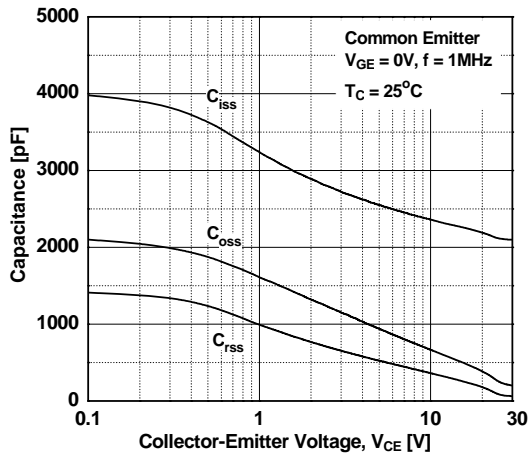


Figure 10. Gate charge Characteristics

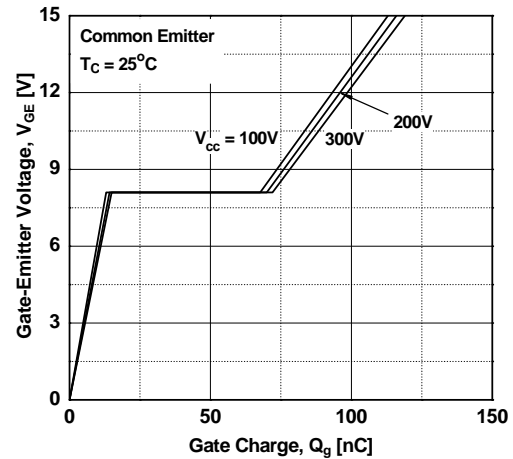


Figure 11. SOA Characteristics

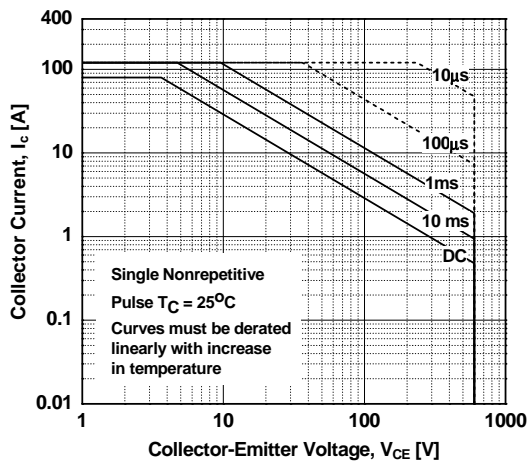
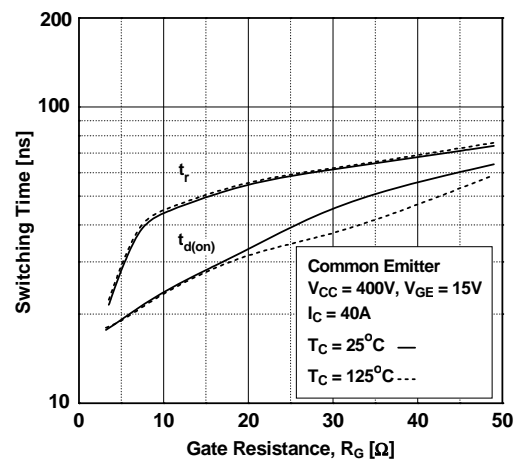


Figure 12. Turn-on Characteristics vs. Gate Resistance



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Gate Resistance

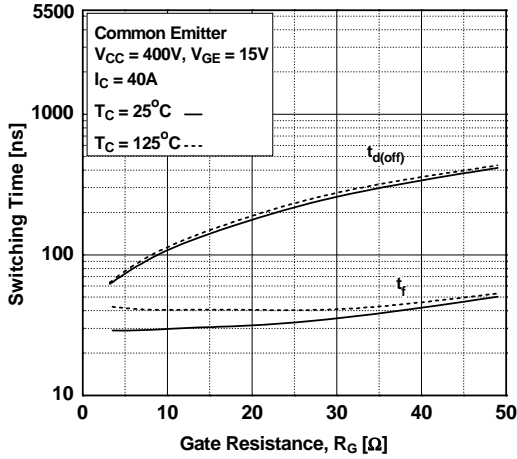


Figure 14. Turn-on Characteristics vs. Collector Current

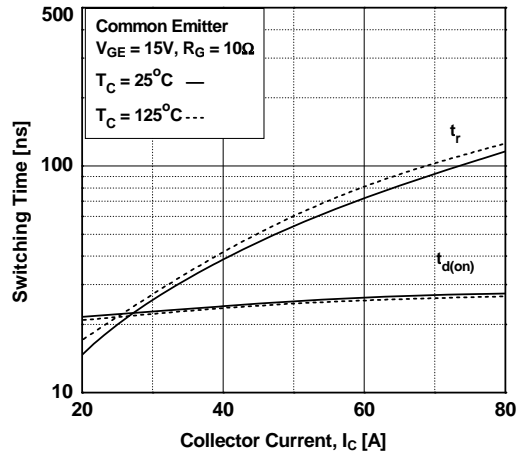


Figure 15. Turn-off Characteristics vs. Collector Current

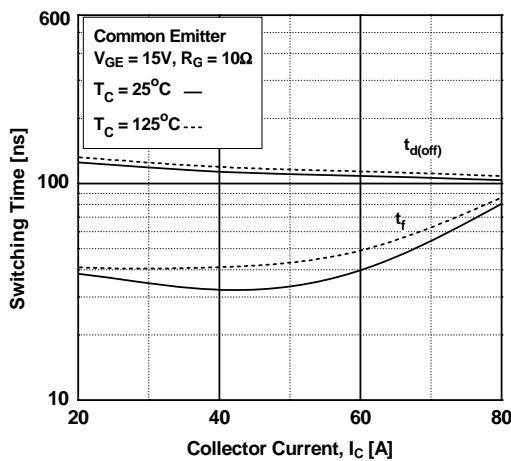


Figure 16. Switching Loss vs. Gate Resistance

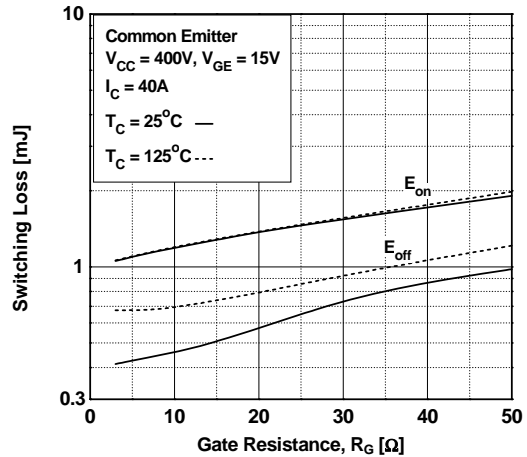


Figure 17. Switching Loss vs. Collector Current

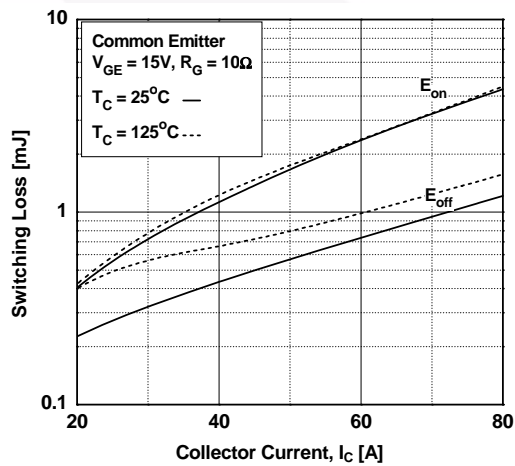
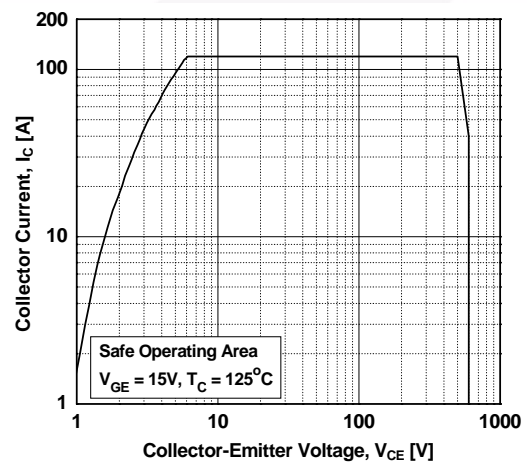
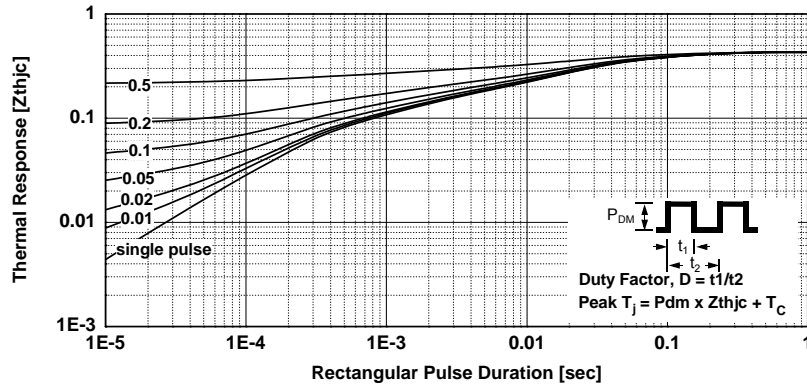


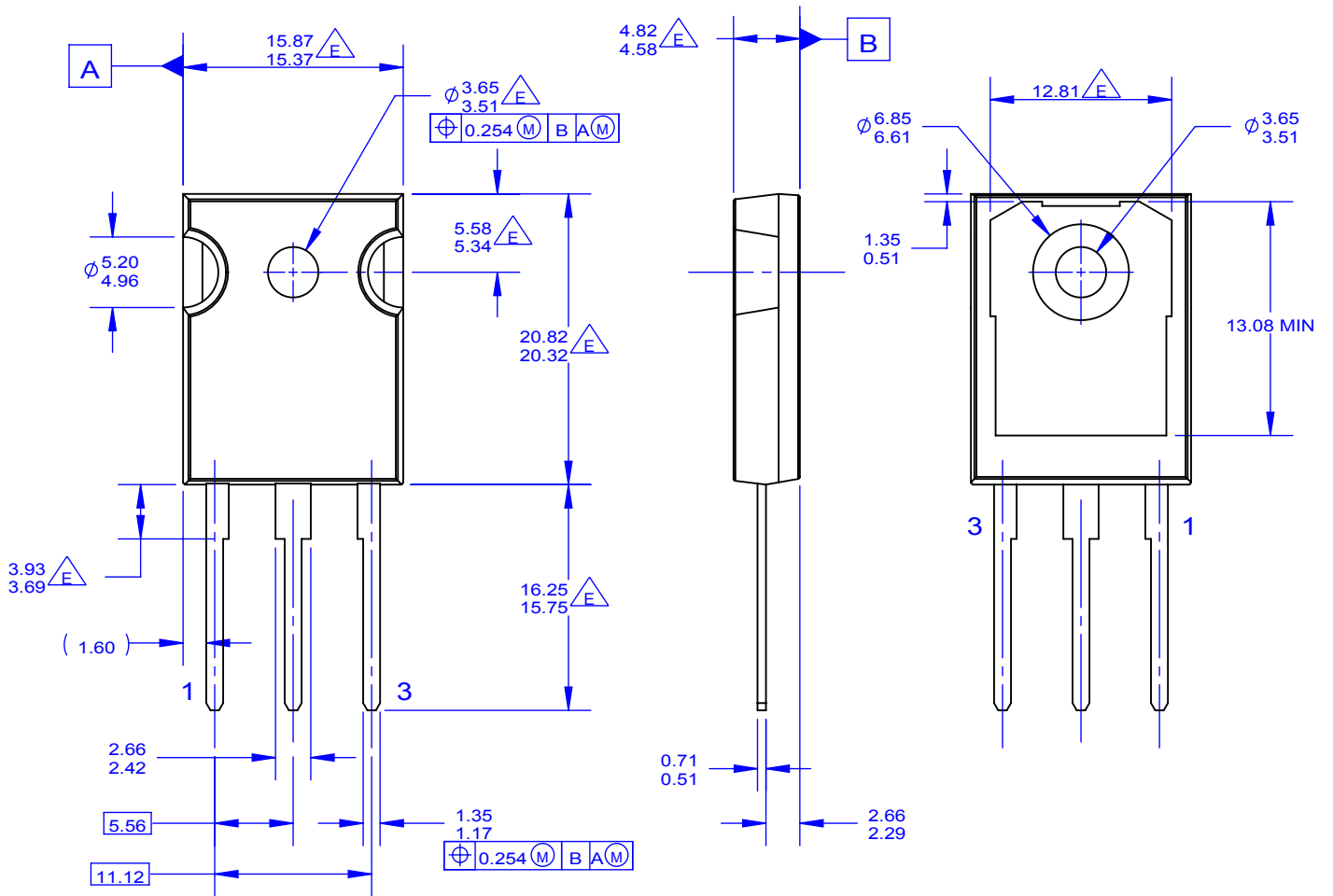
Figure 18. Turn off Switching SOA Characteristics



Typical Performance Characteristics

Figure 19. Transient Thermal Impedance of IGBT





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