ON Semiconductor

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ON Semiconductor®

FGH60N60UFDTU-F085
600V, 60A Field Stop IGBT

Features

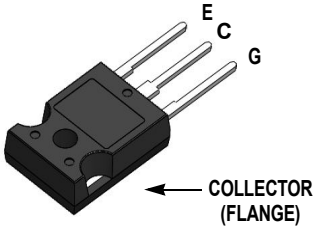
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.8 V @ I_C = 60 A
- High Input Impedance
- Fast Switching
- RoHS Compliant
- Qualified to Automotive Requirements of AEC-Q101

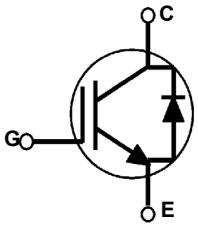
General Description

Using Novel Field Stop IGBT Technology, ON Semiconductor's new series of Field Stop IGBTs offer the optimum performance for Automo-tive Chargers, Inverter, and other applications where low con-duction and switching losses are essential.

Applications

- Automotive chargers, Converters, High Voltage Auxiliaries
- Inverters, PFC, UPS





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°C	120	A
	Collector Current	@ T_C = 100°C	60	A
$I_{CM\ (1)}$	Pulsed Collector Current	@ T_C = 25°C	180	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	298	W
	Maximum Power Dissipation	@ T_C = 100°C	119	W
T_J	Operating Junction Temperature		-55 to +150	°C
T_{stg}	Storage Temperature Range		-55 to +150	°C
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds		300	°C

Notes:
1: Repetitive test , Pulse width limited by max. junction temperature

Thermal Characteristics

Symbol	Parameter	Typ.	Unit
$R_{\theta JC}$(IGBT)	Thermal Resistance, Junction to Case	0.33	°C/W
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case	1.1	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	°C/W

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Publication Order Number:
FGH60N60UFDTU-F085/D

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGH60N60UFDTU-F085	FGH60N60UFD	TO-247	Tube	N/A	N/A	30

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} = 0 V, I_C = 250 μA	600	-	-	V
$\Delta BV_{CES} / \Delta T_J$	Temperature Coefficient of Breakdown Voltage	V_{GE} = 0 V, I_C = 250 μA	-	0.67	-	V/°C
I_{CES}	Collector Cut-Off Current	V_{CE} = V_{CES}, V_{GE} = 0 V	-	-	250	μA
I_{GES}	G-E Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0 V	-	-	±400	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	I_C = 250 μA, V_{CE} = V_{GE}	4.0	5.0	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 60 A, V_{GE} = 15 V	-	1.8	2.9	V
		I_C = 60 A, V_{GE} = 15 V, T_C = 125°C	-	2.1	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	-	2540	-	pF
C_{oes}	Output Capacitance		-	330	-	pF
C_{res}	Reverse Transfer Capacitance		-	110	-	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 400 V, I_C = 60 A, R_G = 5 Ω, V_{GE} = 15 V, Inductive Load, T_C = 25°C	-	29	-	ns
t_r	Rise Time		-	60	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	138	-	ns
t_f	Fall Time		-	28	80	ns
E_{on}	Turn-On Switching Loss		-	2.47	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.81	-	mJ
E_{ts}	Total Switching Loss		-	3.28	-	mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 400 V, I_C = 60 A, R_G = 5 Ω, V_{GE} = 15 V, Inductive Load, T_C = 125°C	-	28	-	ns
t_r	Rise Time		-	55	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	147	-	ns
t_f	Fall Time		-	71	-	ns
E_{on}	Turn-On Switching Loss		-	3.01	-	mJ
E_{off}	Turn-Off Switching Loss		-	1.21	-	mJ
E_{ts}	Total Switching Loss		-	4.22	-	mJ
Q_g	Total Gate Charge	V_{CE} = 400 V, I_C = 60 A, V_{GE} = 15 V	-	192	-	nC
Q_{ge}	Gate to Emitter Charge		-	24	-	nC
Q_{gc}	Gate to Collector Charge		-	102	-	nC

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max	Units
V_{FM}	Diode Forward Voltage	I_F = 30 A	T_C = 25°C	-	1.70	2.6	V
			T_C = 125°C	-	1.54	-	
t_{rr}	Diode Reverse Recovery Time	I_F = 30 A, di_F/dt = 200 A/μs	T_C = 25°C	-	76	-	ns
			T_C = 125°C	-	242	-	
Q_{rr}	Diode Reverse Recovery Charge		T_C = 25°C	-	208	-	nC
			T_C = 125°C	-	1162	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

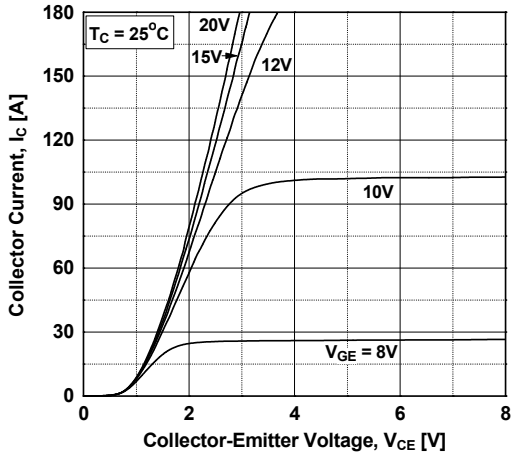


Figure 2. Typical Output Characteristics

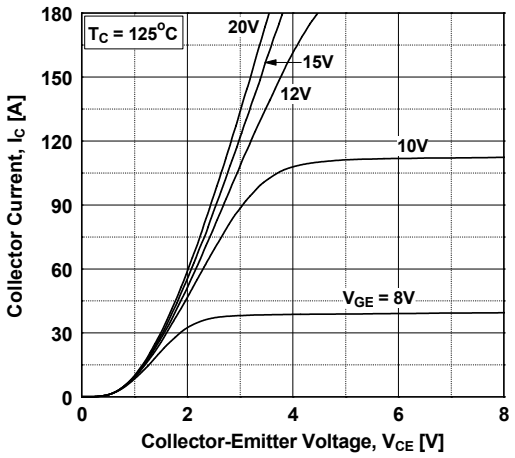


Figure 3. Typical Saturation Voltage Characteristics

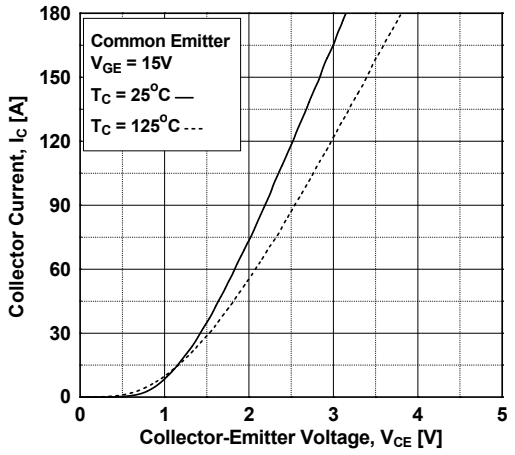


Figure 4. Transfer Characteristics

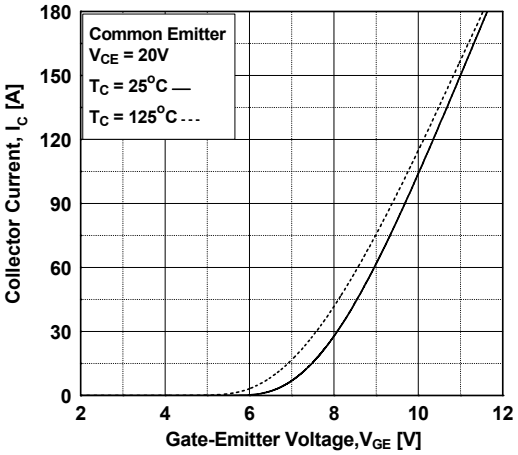


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

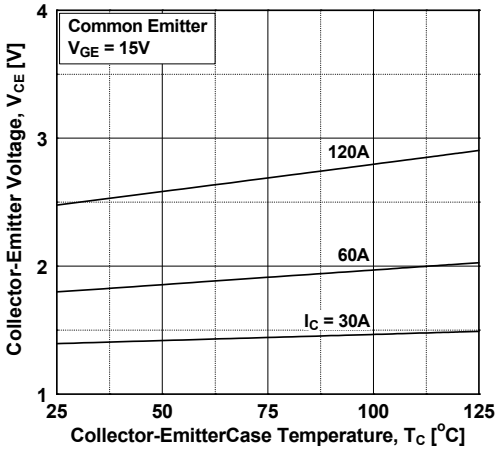
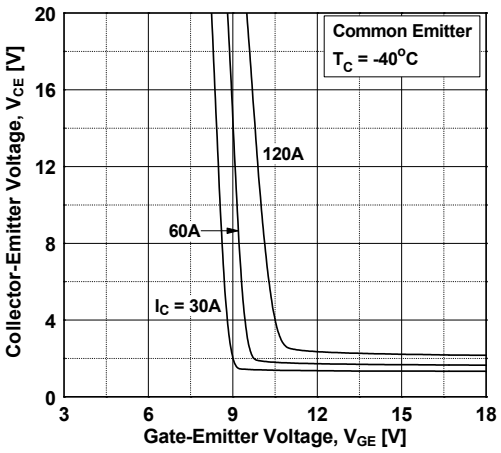


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

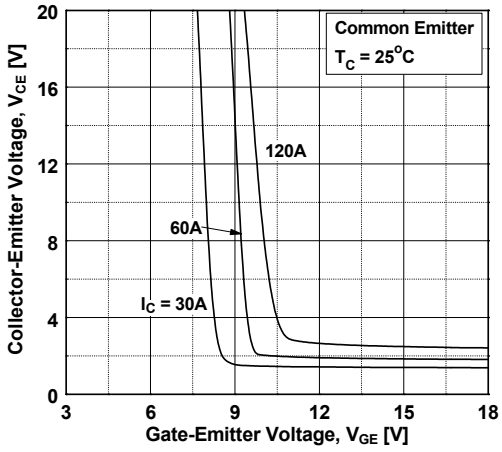


Figure 8. Saturation Voltage vs. V_{GE}

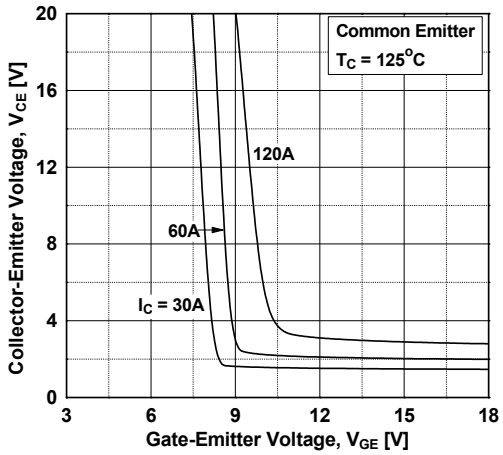


Figure 9. Capacitance Characteristics

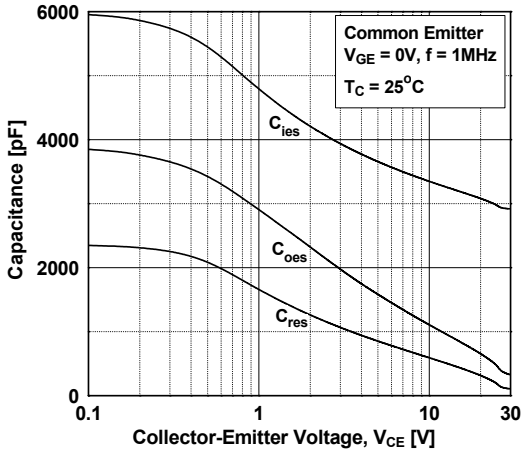


Figure 10. Gate charge Characteristics

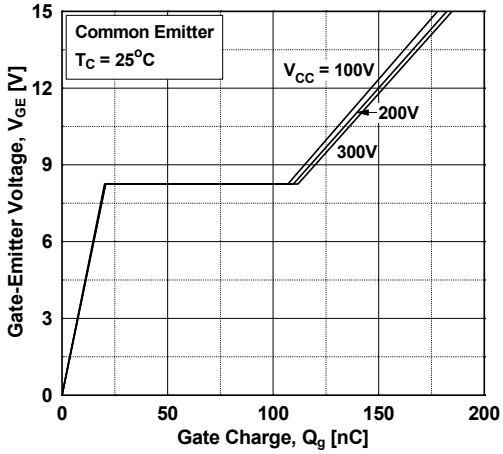


Figure 11. SOA Characteristics Characteristics

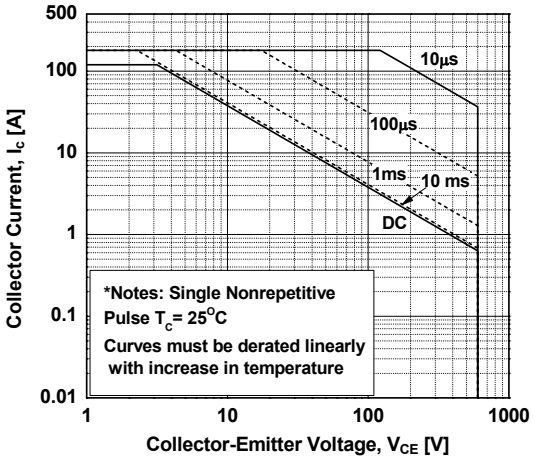
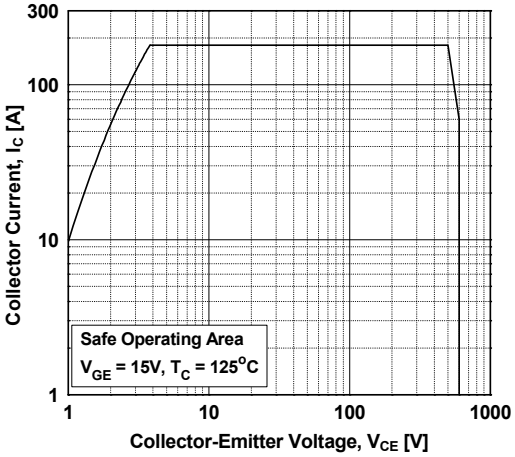


Figure 12. Turn off Switching SOA



Typical Performance Characteristics

Figure 13. Turn-on Characteristics vs. Gate Resistance

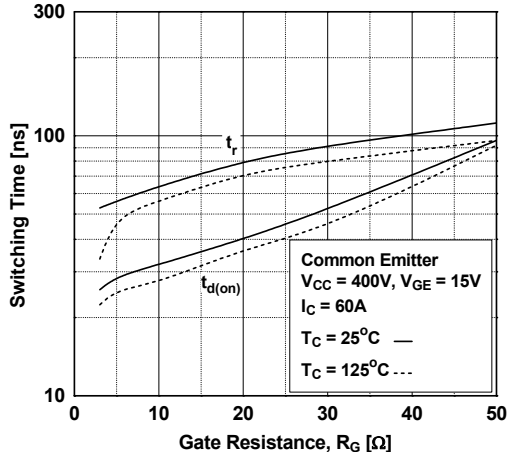


Figure 14. Turn-off Characteristics vs. Gate Resistance

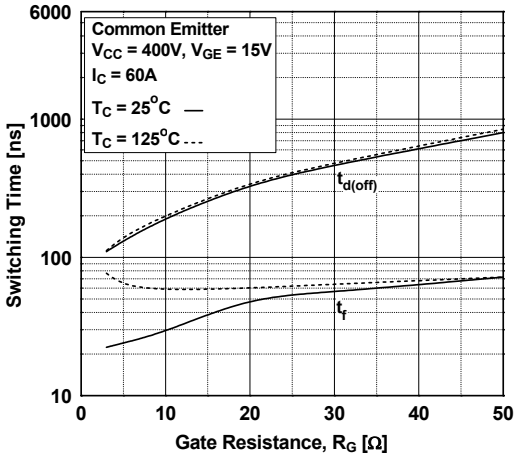


Figure 15. Turn-on Characteristics vs. Collector Current

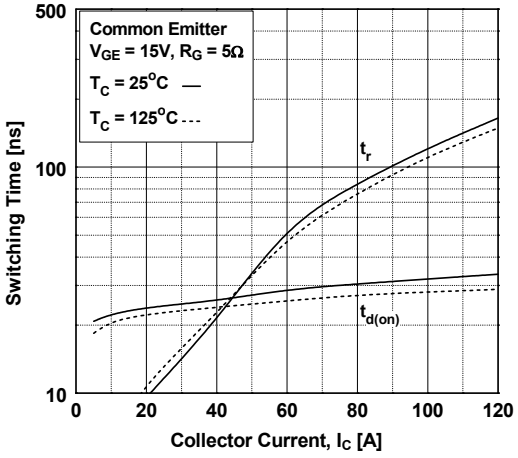


Figure 16. Turn-off Characteristics vs. Collector Current

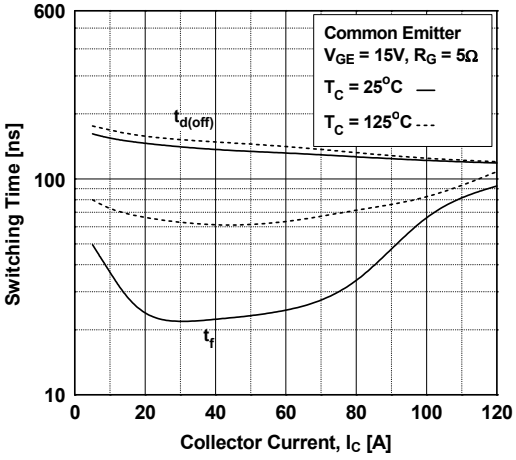


Figure 17. Switching Loss vs. Gate Resistance

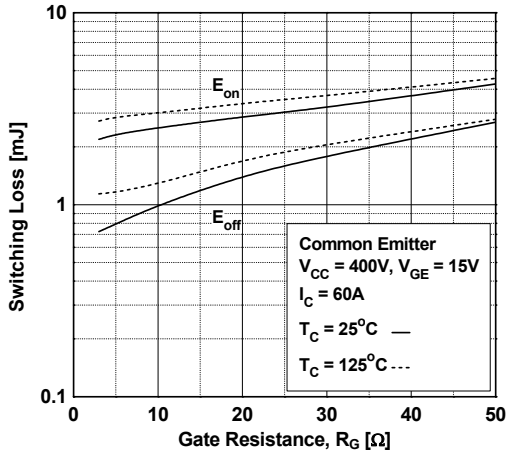
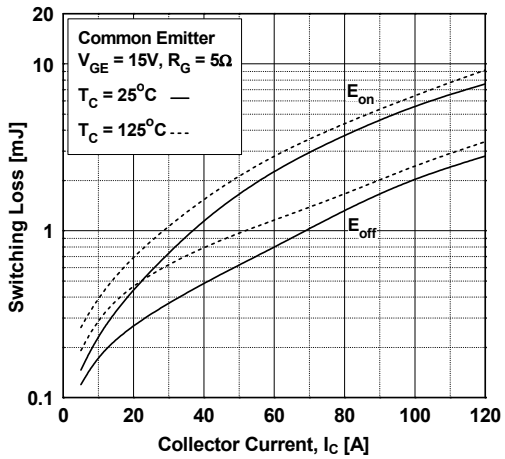


Figure 18. Switching Loss vs. Collector Current



Typical Performance Characteristics

Figure 19. Forward Characteristics

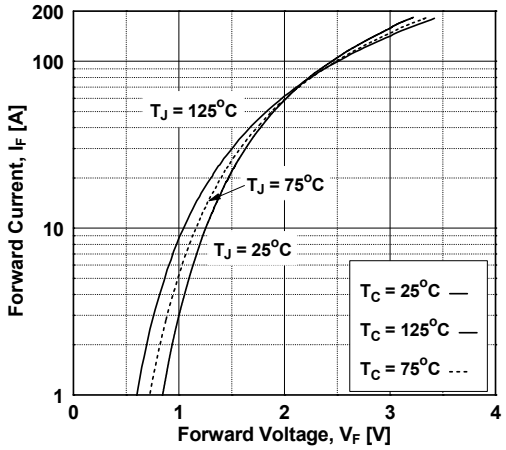


Figure 20. Reverse Current

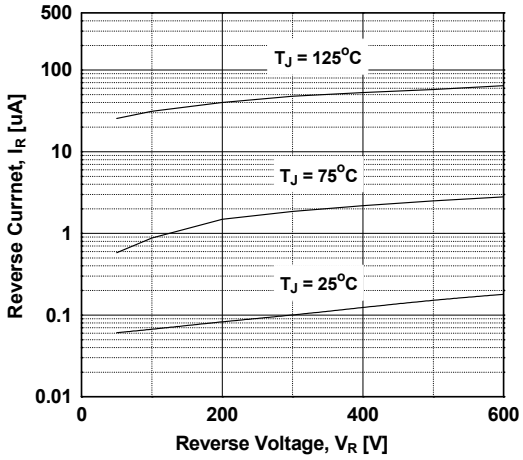


Figure 21. Stored Charge

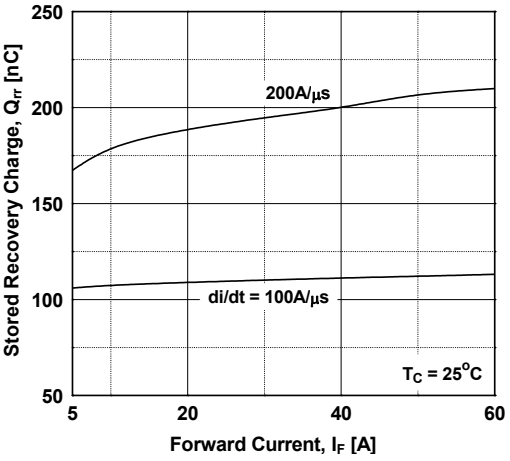


Figure 22. Reverse Recovery Time

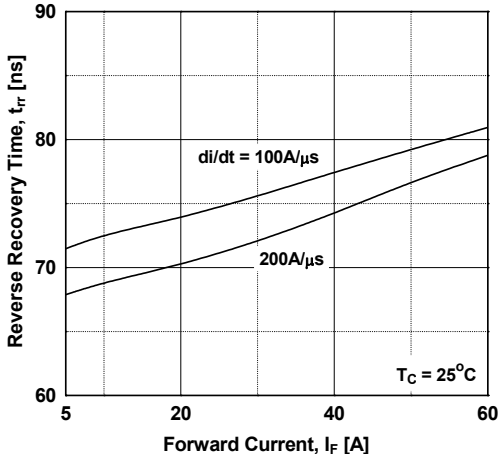
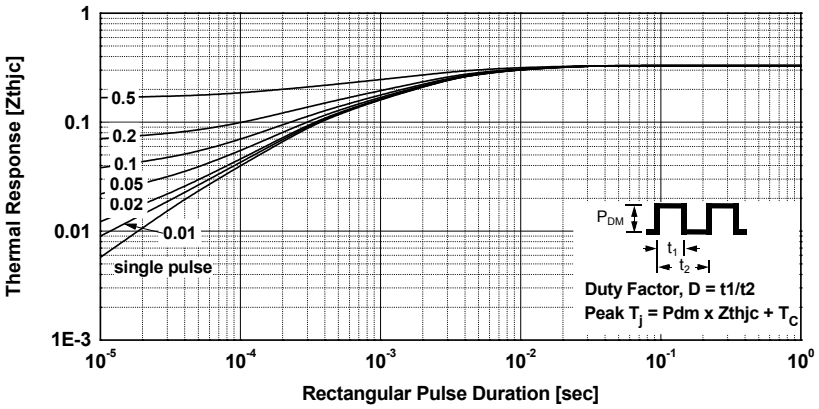
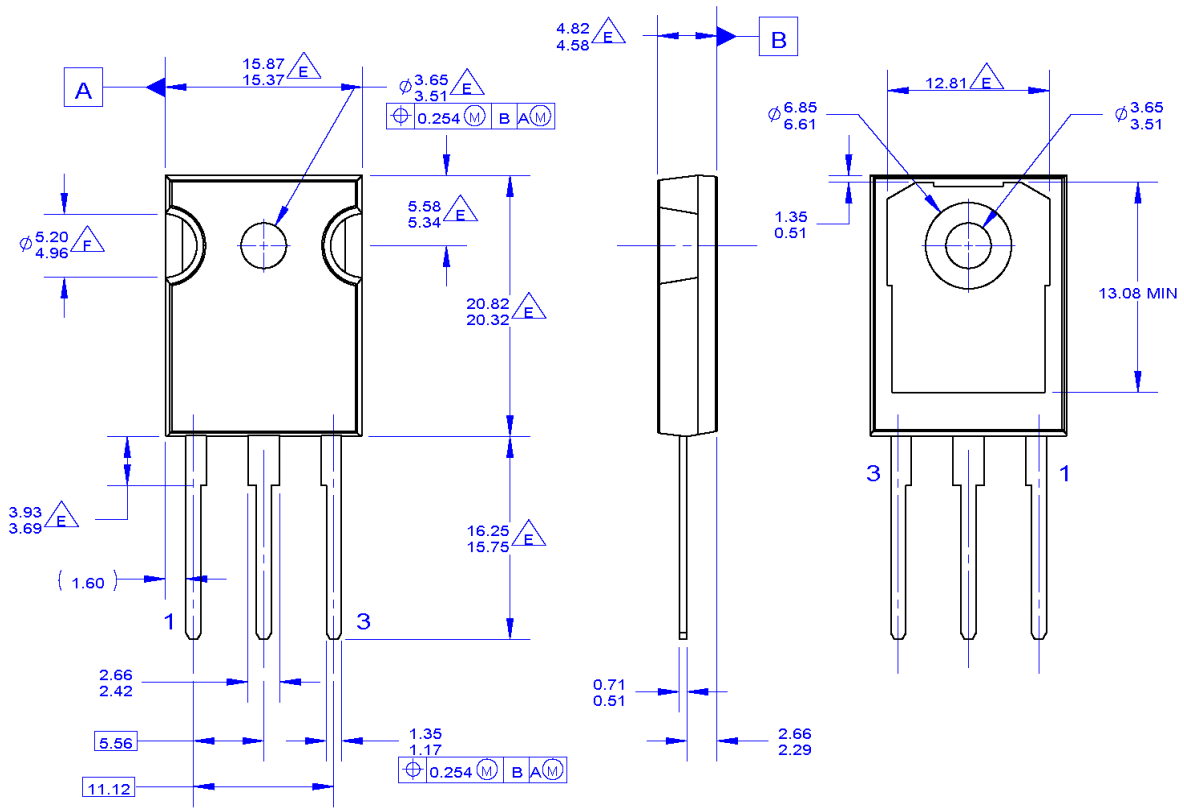


Figure 23. Transient Thermal Impedance of IGBT



Mechanical Dimensions



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Figure 24. TO-247 3L - TO-247,MOLDED,3 LEAD,JEDEC VARIATION AB

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