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March 2015

FGA60N60UFD

600 V, 60 A Field Stop IGBT

Features

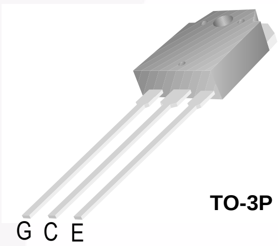
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.9 V @ I_C = 60 A
- High Input Impedance
- Fast Switching
- RoHS Compliant

Applications

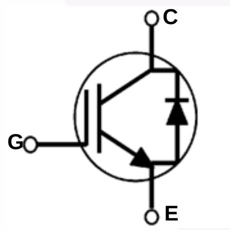
- Solar Inverter, UPS, Welder, PFC

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.



TO-3P



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.	Max.	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

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGA60N60UFDTU	FGA60N60UFD	TO-3P	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
ΔBV_{CES} / ΔT_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	-	1.9	2.4	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	-	2855	-	pF
C_{oes}	Output Capacitance		-	325	-	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	-	23	-	ns
t_r	Rise Time		-	58	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	130	-	ns
t_f	Fall Time		-	40	80	ns
E_{on}	Turn-On Switching Loss		-	1.81	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.81	-	mJ
E_{ts}	Total Switching Loss		-	2.62	-	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	-	22	-	ns
t_r	Rise Time		-	61	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	141	-	ns
t_f	Fall Time		-	63	-	ns
E_{on}	Turn-On Switching Loss		-	1.92	-	mJ
E_{off}	Turn-Off Switching Loss		-	1.23	-	mJ
E_{ts}	Total Switching Loss		-	3.15	-	mJ
Q_g	Total Gate Charge	V_{CE} = 400 V, I_C = 60 A, V_{GE} = 15 V	-	188	-	nC
Q_{ge}	Gate to Emitter Charge		-	21	-	nC
Q_{gc}	Gate to Collector Charge		-	97	-	nC

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max	Unit
V_{FM}	Diode Forward Voltage	I_F = 30 A	T_C = 25°C	-	2.0	2.6	V
			T_C = 125°C	-	1.8	-	
t_{rr}	Diode Reverse Recovery Time	I_F = 30 A, di_F/dt = 200 A/μs	T_C = 25°C	-	47	-	ns
			T_C = 125°C	-	179	-	
Q_{rr}	Diode Reverse Recovery Charge		T_C = 25°C	-	83	-	nC
			T_C = 125°C	-	567	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

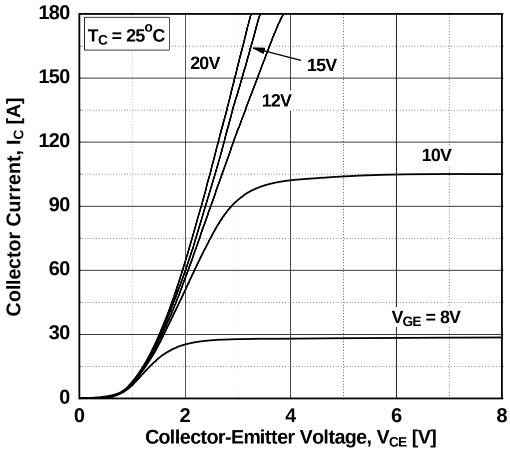


Figure 2. Typical Output Characteristics

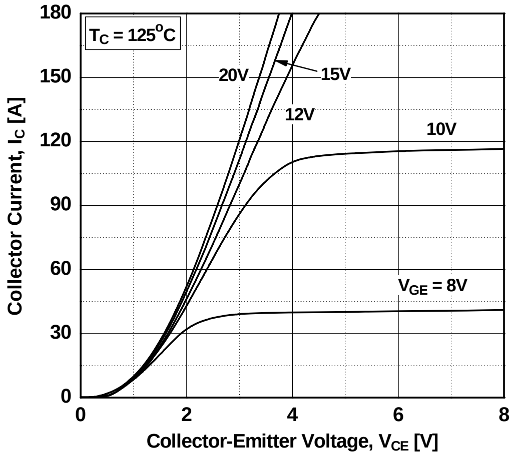


Figure 3. Typical Saturation Voltage Characteristics

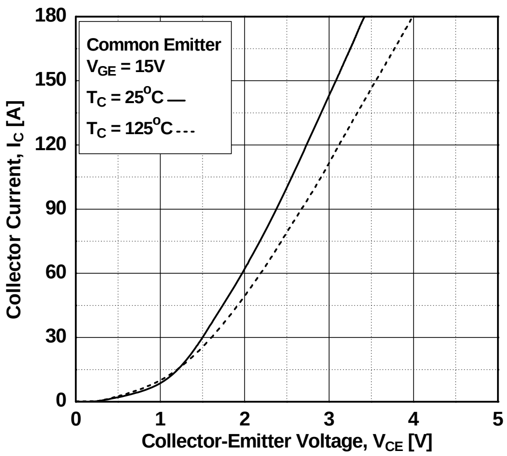


Figure 4. Transfer Characteristics

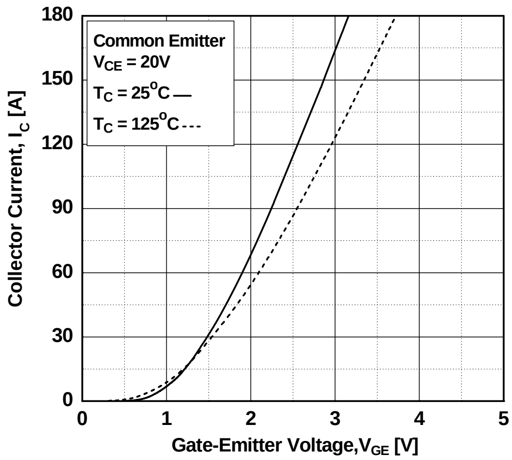


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

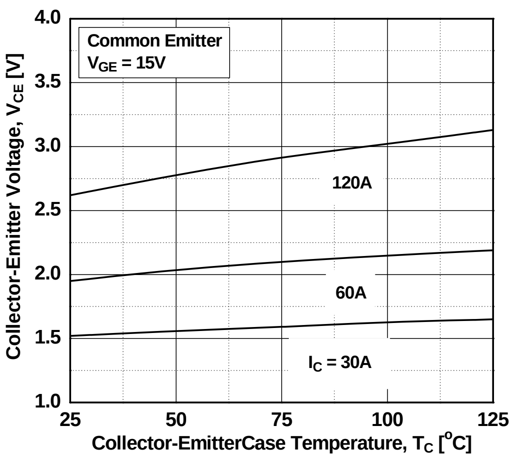
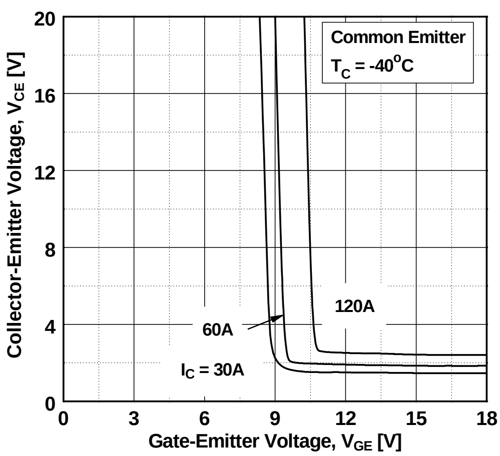


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

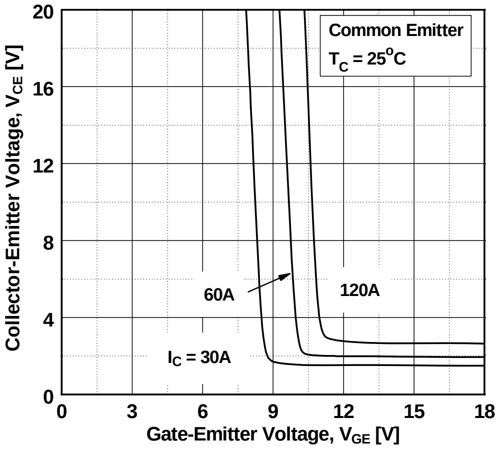


Figure 8. Saturation Voltage vs. V_{GE}

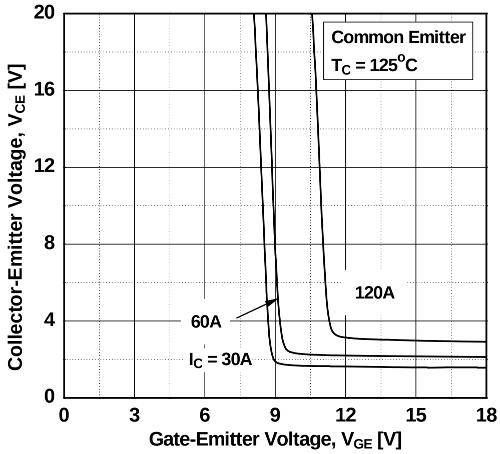


Figure 9. Capacitance Characteristics

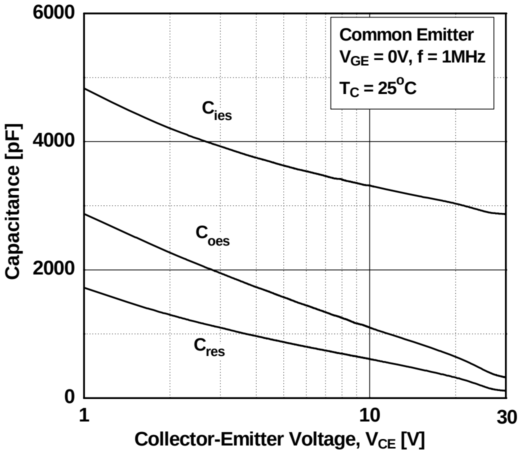


Figure 10. Gate charge Characteristics

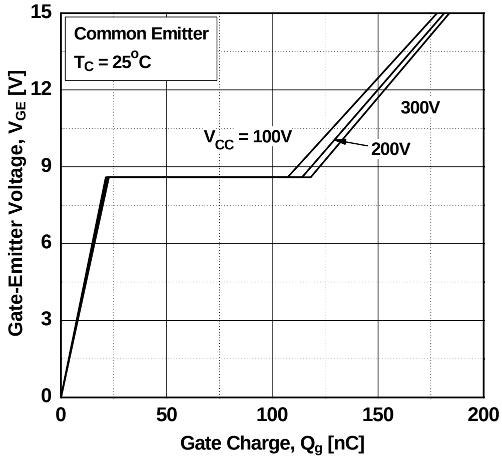


Figure 11. SOA Characteristics

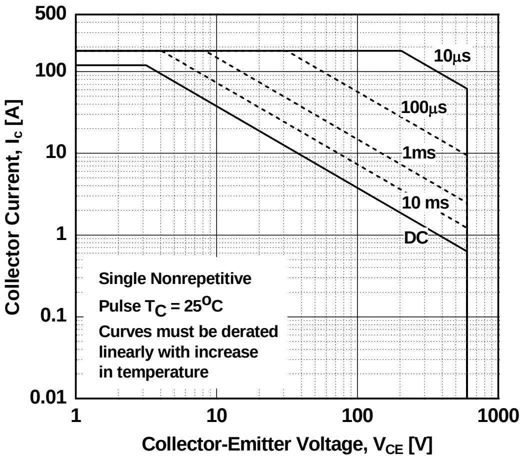
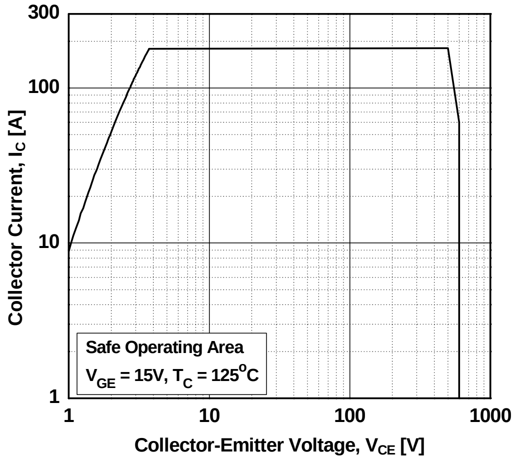


Figure 12. Turn off Switching SOA Characteristics



Typical Performance Characteristics

Figure 13. Turn-on Characteristics vs. Gate Resistance

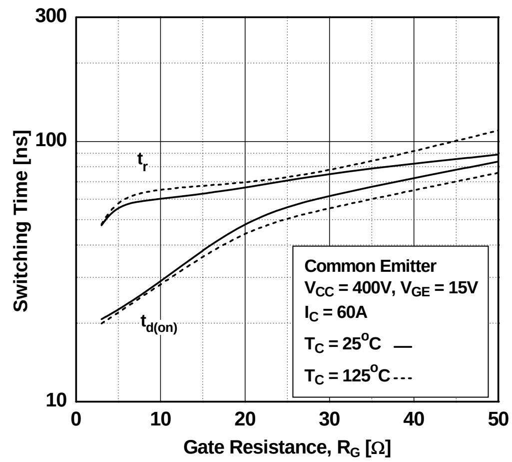


Figure 14. Turn-off Characteristics vs. Gate Resistance

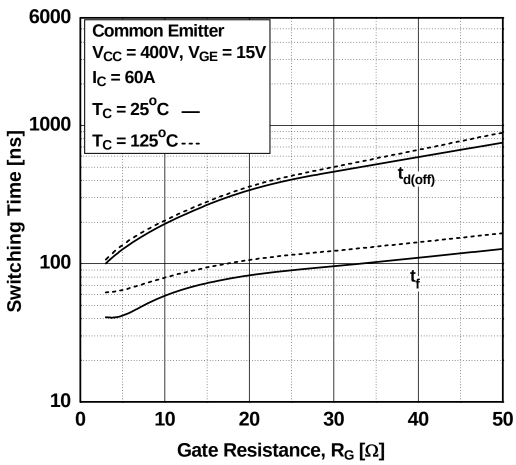


Figure 15. Turn-on Characteristics vs. Collector Current

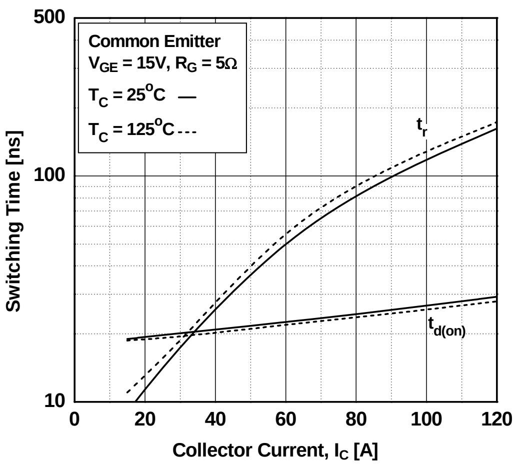


Figure 16. Turn-off Characteristics vs. Collector Current

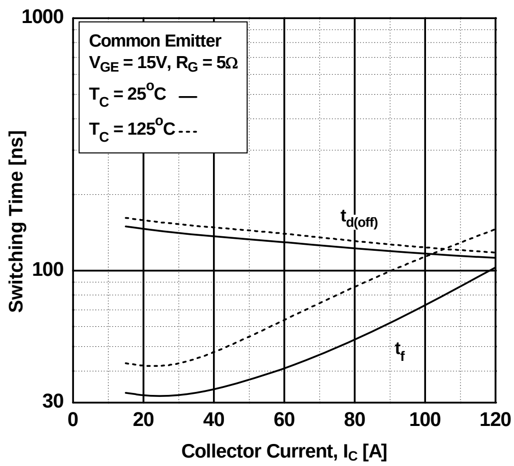


Figure 17. Switching Loss vs. Gate Resistance

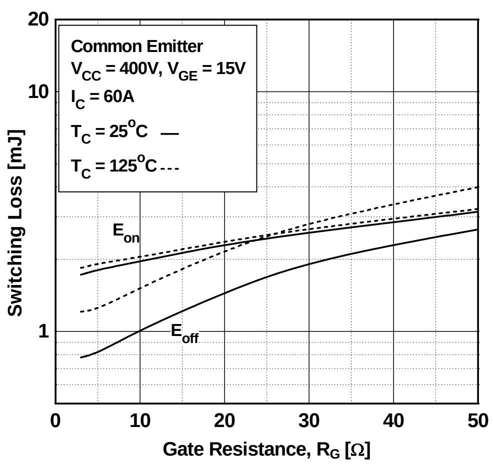
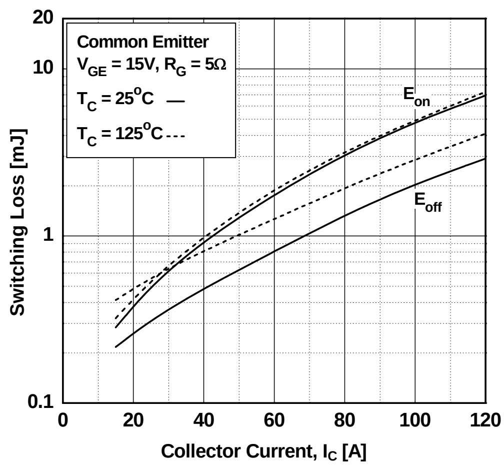


Figure 18. Switching Loss vs. Collector Current



Typical Performance Characteristics

Figure 19. Forward Characteristics

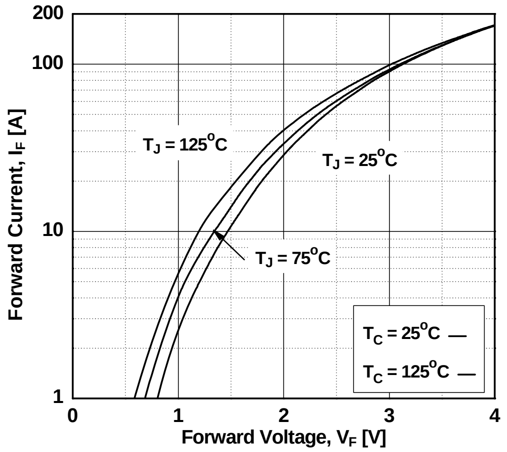


Figure 20. Reverse Current

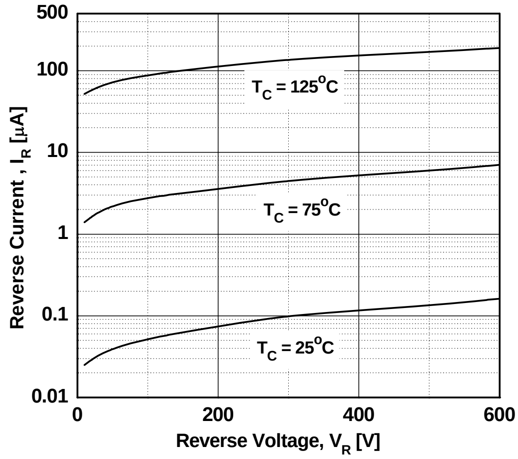


Figure 21. Stored Charge

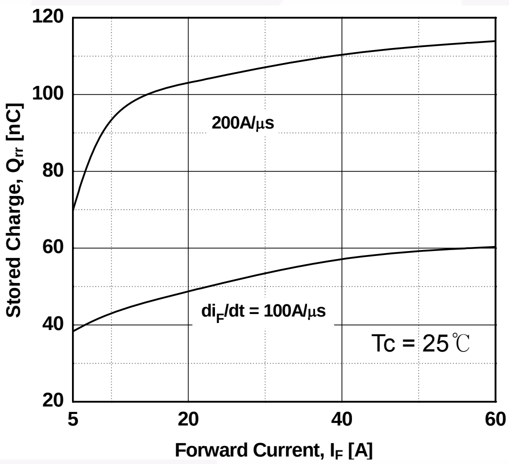


Figure 22. Reverse Recovery Time

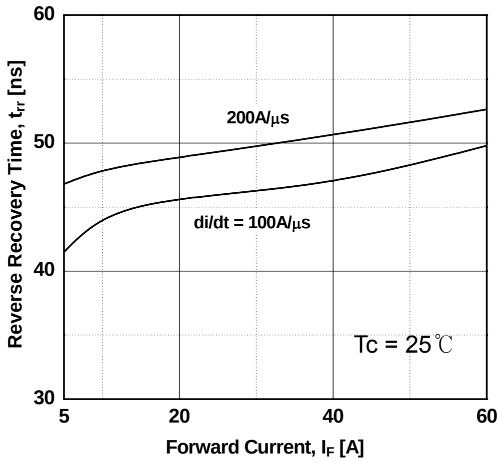
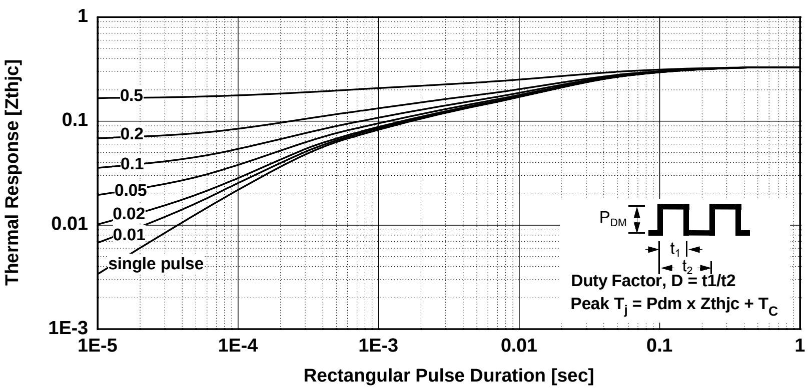
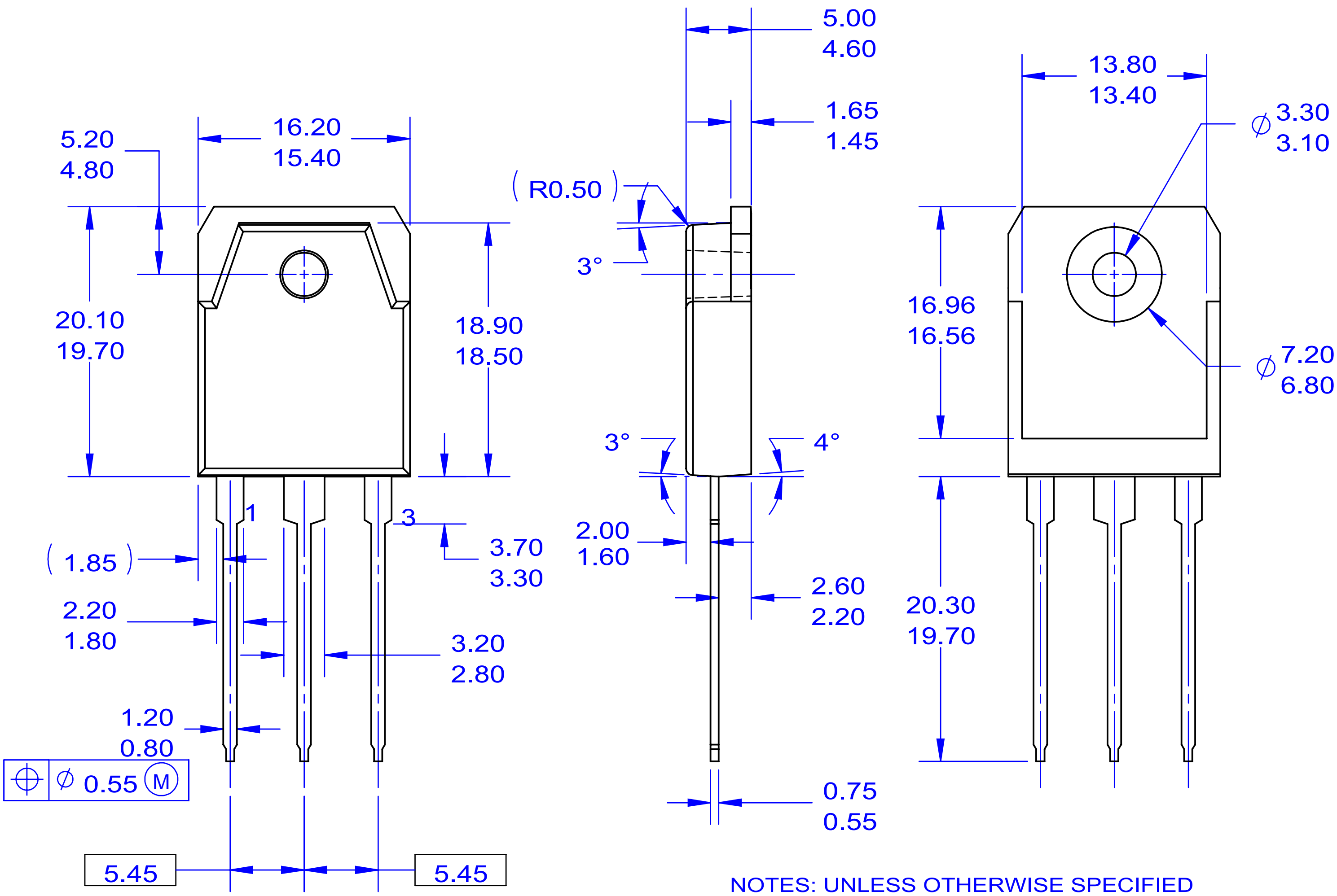
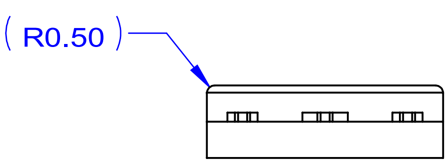


Figure 23. Transient Thermal Impedance of IGBT







NOTES: UNLESS OTHERWISE SPECIFIED

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