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FAIRCHILD SEMICONDUCTOR®

November 2013

FGA20N120FTD

1200 V, 20 A Field Stop Trench IGBT

Features

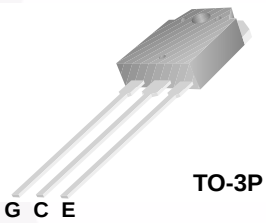
- Field Stop Trench Technology
- High Speed Switching
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.6 V @ I_C = 20 A
- High Input Impedance
- RoHS Compliant

Applications

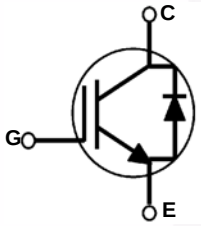
- Induction Heating, Microvewave Oven

General Description

Using advanced field stop trench technology, Fairchild's 1200V trench IGBTs offer superior conduction and switching performances for soft switching applications. The device can operate in parallel configuration with exceptional avalanche ruggedness. This device is designed for induction heating and microwave oven.



TO-3P



Absolute Maximum Ratings

Symbol	Description		Ratings	Unit
V_{CES}	Collector to Emitter Voltage		1200	V
V_{GES}	Gate to Emitter Voltage		± 25	V
I_C	Continuous Collector Current	@ T_C = 25°C	40	A
	Continuous Collector Current	@ T_C = 100°C	20	A
$I_{CM\ (1)}$	Pulsed Collector Current		60	A
I_F	Diode Continuous Forward Current	@ T_C = 25°C	20	A
	Diode Continuous Forward Current	@ T_C = 100°C	10	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 rating, Pulse width limited by max. junction temperature

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$(IGBT)	Thermal Resistance, Junction to Case	-	0.42	°C/W
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case	-	2.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	°C/W

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Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGA20N120FTDTU	FGA20N120FTD	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 = 1 mA	1200	-	-	V
I_{CES}	Collector Cut-Off Current	V_{CE} = V_{CES}, V_{GE} = 0 V	-	-	1	mA
I_{GES}	G-E Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0 V	-	-	±250	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	I_C = 20 mA, V_{CE} = V_{GE}	3.5	5.9	7.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 20 A, V_{GE} = 15 V, T_C = 25°C	-	1.59	2	V
		I_C = 20 A, V_{GE} = 15 V, T_C = 125°C	-	1.85	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	-	3080	-	pF
C_{oes}	Output Capacitance		-	95	-	pF
C_{res}	Reverse Transfer Capacitance		-	60	-	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 600 V, I_C = 20 A, R_G = 10 Ω, V_{GE} = 15 V, Resistive Load, T_C = 25°C	-	30	-	ns
t_r	Rise Time		-	79	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	143	-	ns
t_f	Fall Time		-	217	320	ns
E_{on}	Turn-On Switching Loss		-	0.42	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.71	1.05	mJ
E_{ts}	Total Switching Loss		-	1.13	-	mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 600 V, I_C = 20 A, R_G = 10 Ω, V_{GE} = 15 V, Resistive Load, T_C = 125°C	-	29	-	ns
t_r	Rise Time		-	93	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	147	-	ns
t_f	Fall Time		-	259	-	ns
E_{on}	Turn-On Switching Loss		-	0.47	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.86	-	mJ
E_{ts}	Total Switching Loss		-	1.33	-	mJ
Q_g	Total Gate Charge	V_{CE} = 600 V, I_C = 20 A, V_{GE} = 15 V	-	137	-	nC
Q_{ge}	Gate to Emitter Charge		-	23	-	nC
Q_{gc}	Gate to Collector Charge		-	65	-	nC

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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 = 20 A	T_C = 25°C	-	1.3	1.7	V
			T_C = 125°C	-	1.3	-	
t_{rr}	Diode Reverse Recovery Time	I_F =20 A, di_F/dt = 200 A/μs	T_C = 25°C	-	447	-	ns
			T_C = 125°C	-	485	-	
I_{rr}	Diode Peak Reverse Recovery Current		T_C = 25°C	-	48	-	A
			T_C = 125°C	-	50	-	
Q_{rr}	Diode Reverse Recovery Charge		T_C = 25°C	-	10.8	-	μC
			T_C = 125°C	-	12	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

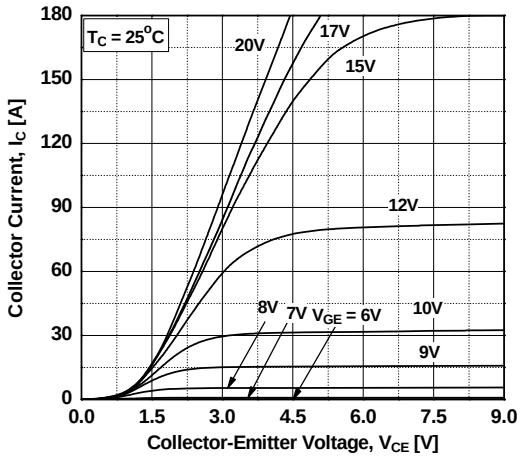


Figure 2. Typical Output Characteristics

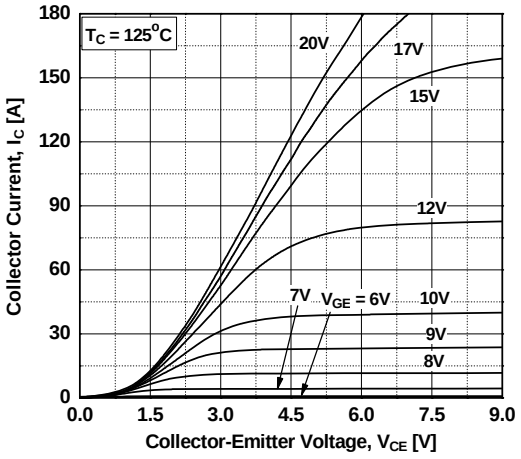


Figure 3. Typical Saturation Voltage Characteristics

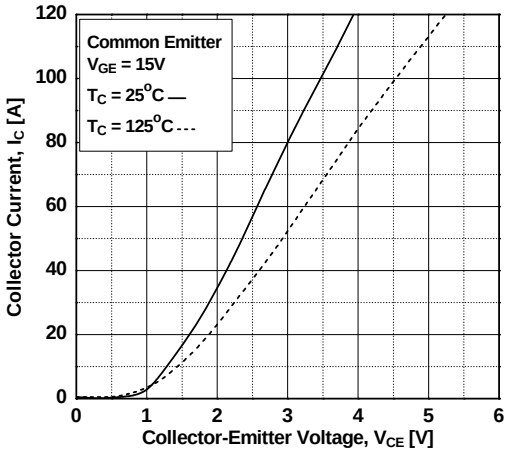


Figure 4. Transfer Characteristics

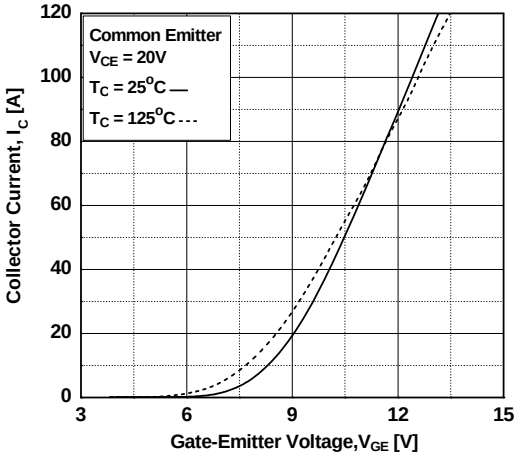


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

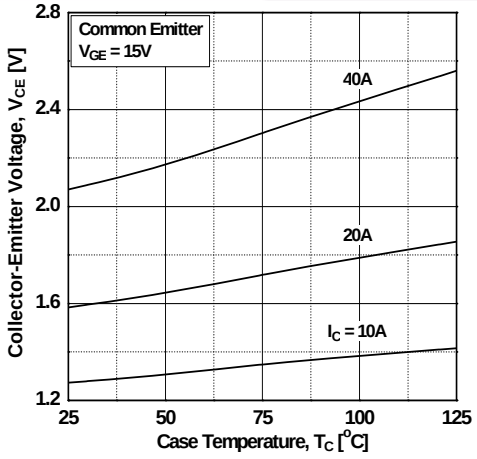
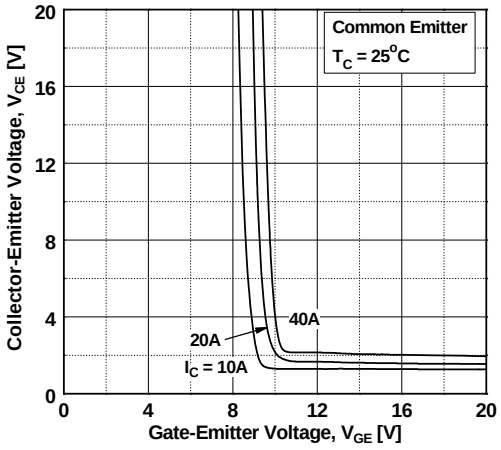


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

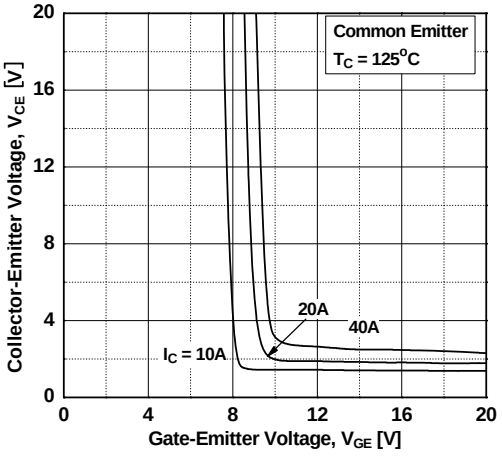


Figure 8. Capacitance Characteristics

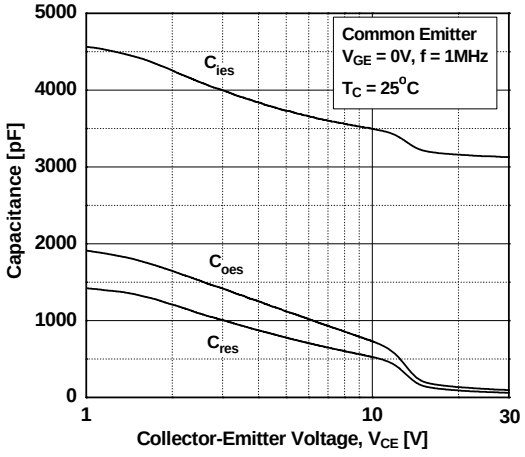


Figure 9. Gate charge Characteristics

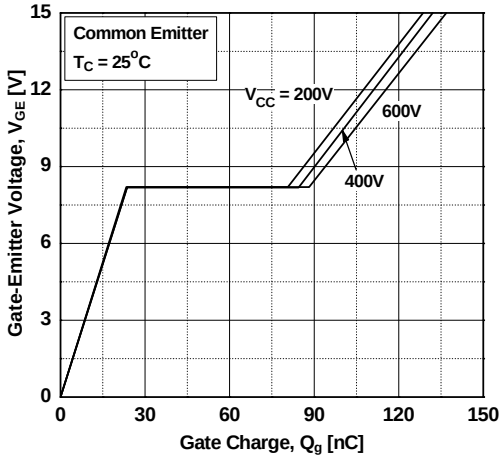


Figure 10. SOA Characteristics

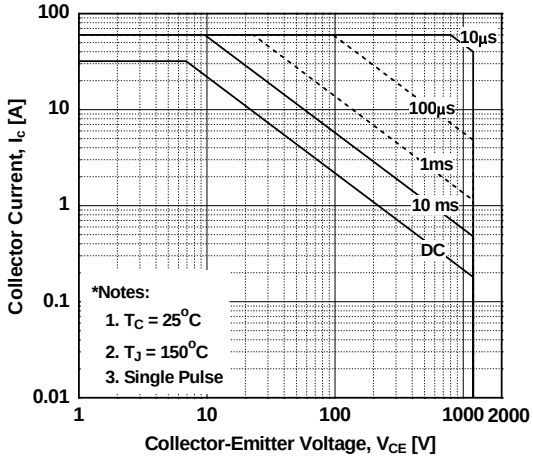


Figure 11. Turn-on Characteristics vs. Gate Resistance

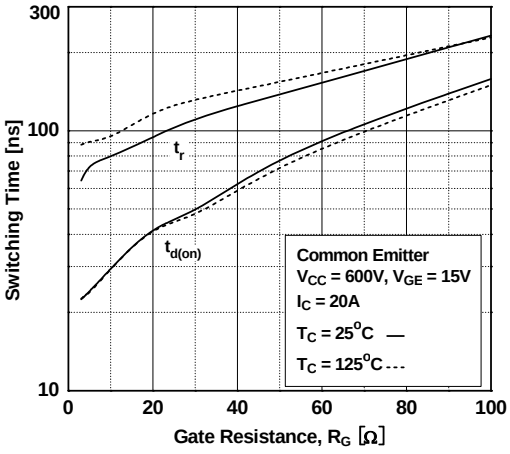
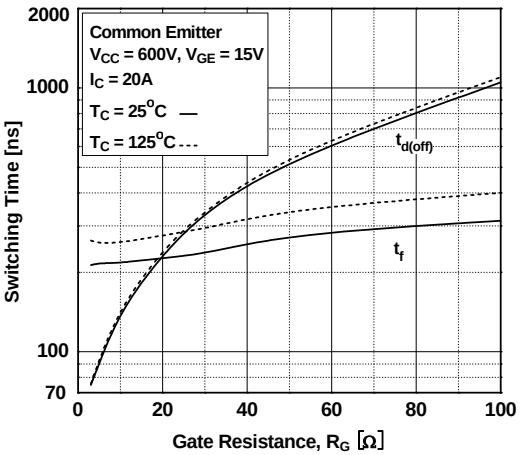


Figure 12. Turn-off Characteristics vs. Gate Resistance



Typical Performance Characteristics

Figure 13. Turn-on Characteristics vs. Collector Current

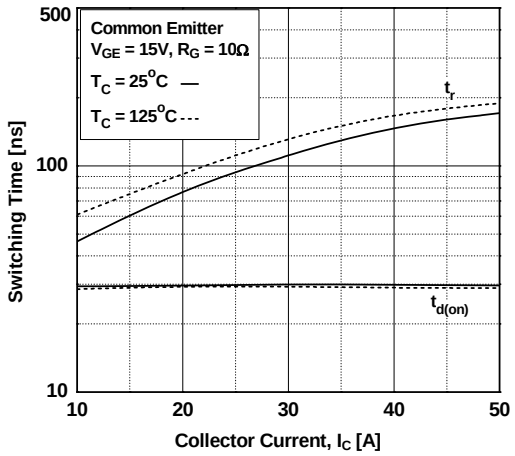


Figure 14. Turn-off Characteristics vs. Collector Current

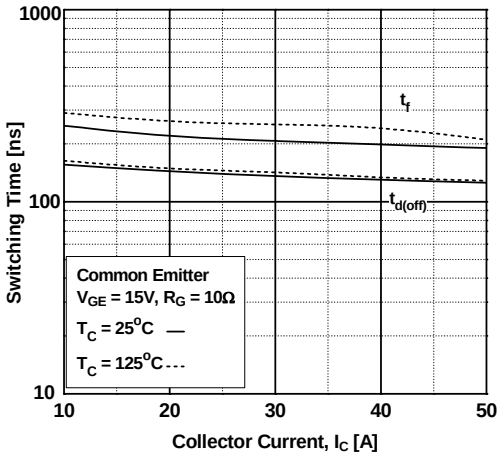


Figure 15. Switching Loss vs. Gate Resistance

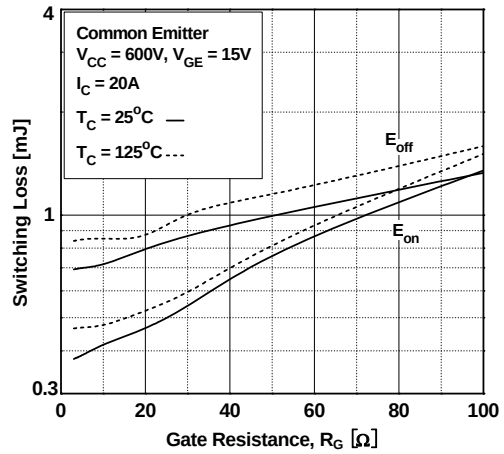


Figure 16. Switching Loss vs. Collector Current

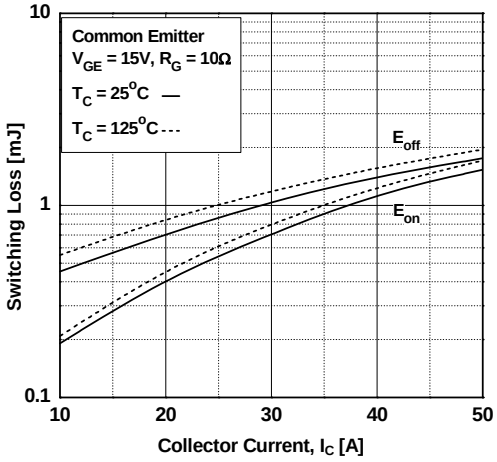


Figure 17. Turn off Switching SOA Characteristics

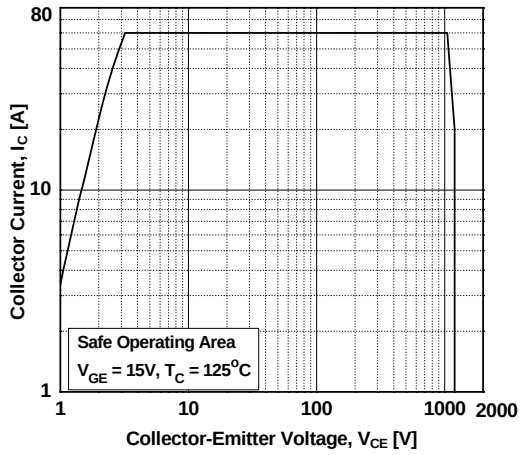
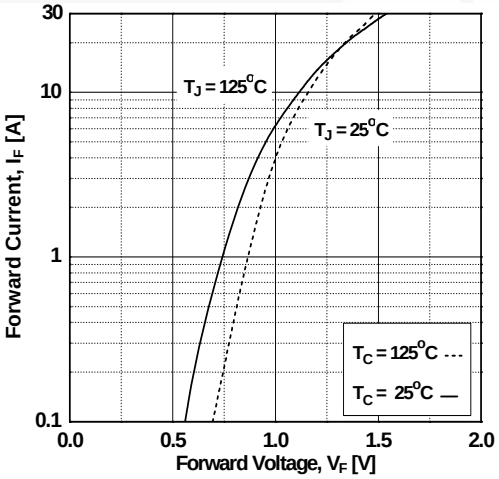


Figure 18. Forward Characteristics



Typical Performance Characteristics

Figure 19. Reverse Recovery Current

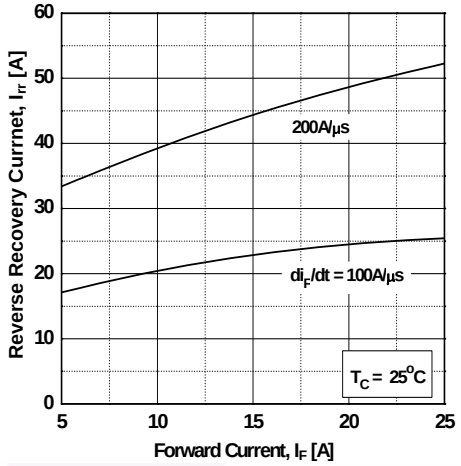


Figure 20. Stored Charge

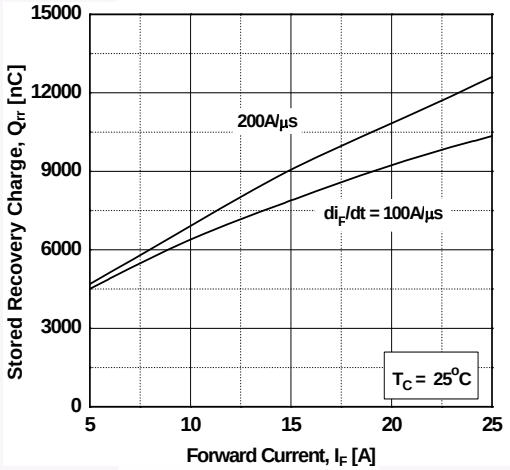


Figure 21.Reverse Recovery Time

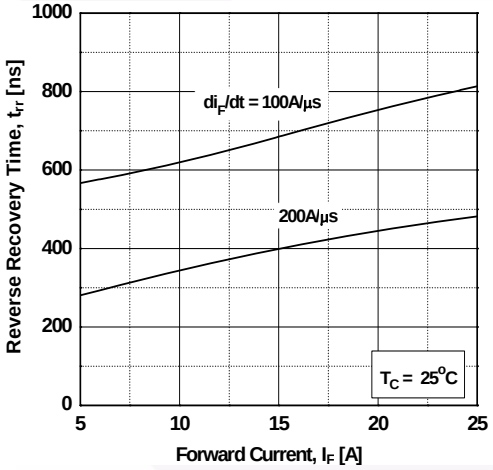
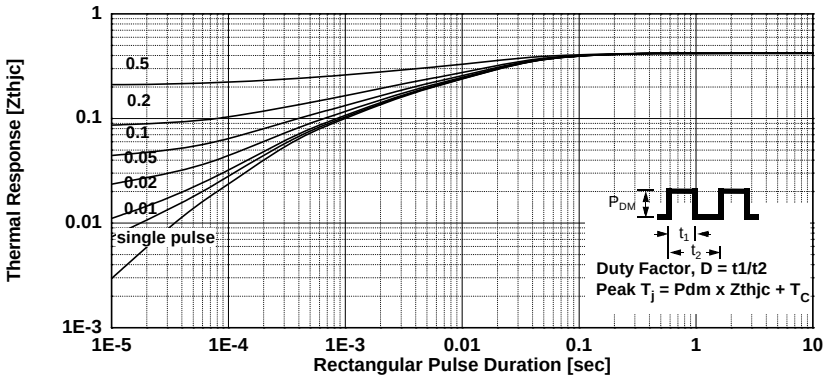


Figure 22.Transient Thermal Impedance of IGBT



Mechanical Dimensions

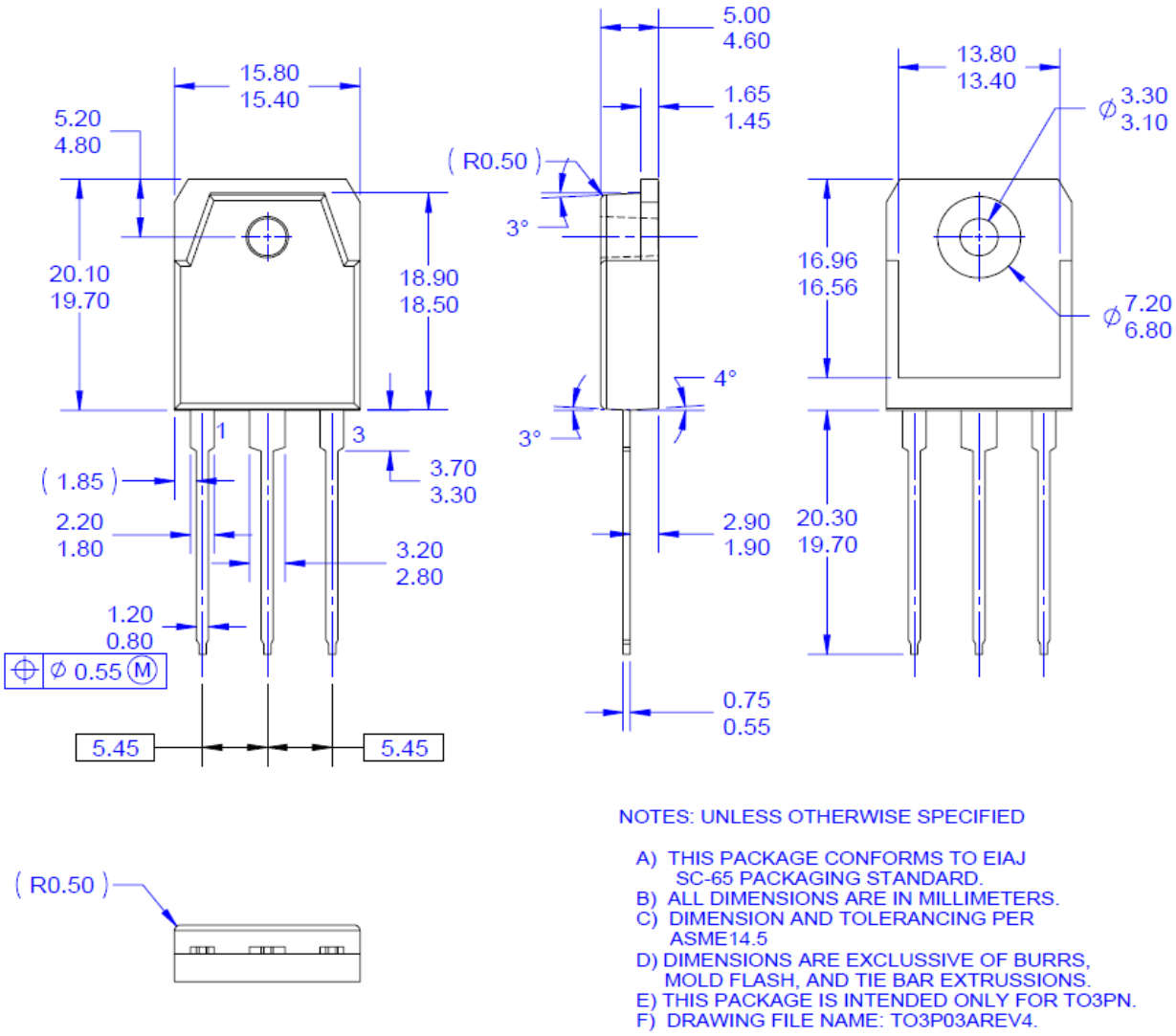


Figure 23. TO-3P 3L - 3LD, T03, PLASTIC, EIAJ SC-65

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