March 2016

FGY40T120SMD

1200 V, 40 A Field Stop Trench IGBT

Features

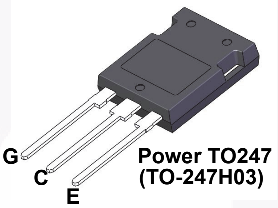
- FS Trench Technology, Positive Temperature Coefficient
- High Speed Switching
- Low Saturation Voltage: $V_{CE(sat)}$ =1.8 V @ I_C = 40 A
- 100% of the Parts tested for I_{LM}(1)
- High Input Impedance
- RoHS Compliant

General Description

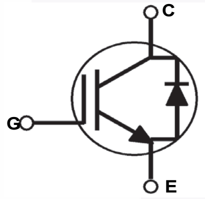
Using innovative field stop trench IGBT technology, Fairchild's new series of field stop trench IGBTs offer the optimum performance for hard switching application such as solar inverter, UPS, welder and PFC applications.

Applications

- Solar Inverter, Welder, UPS & PFC applications.



Power TO247 (TO-247H03)



Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Description	FGY40T120SMD	Unit
V_{CES}	Collector to Emitter Voltage	1200	V
V_{GES}	Gate to Emitter Voltage	±25	V
	Transient Gate to Emitter Voltage	±30	V
I_C	Collector Current @ T_C = 25°C	80	A
	Collector Current @ T_C = 100°C	40	A
I_{LM} (1)	Clamped Inductive Load Current @ T_C = 25°C	160	A
I_{CM} (2)	Pulsed Collector Current	160	A
I_F	Diode Continuous Forward Current @ T_C = 25°C	80	A
	Diode Continuous Forward Current @ T_C = 100°C	40	A
I_{FM}	Diode Maximum Forward Current	240	A
P_D	Maximum Power Dissipation @ T_C = 25°C	882	W
	Maximum Power Dissipation @ T_C = 100°C	441	W
T_J	Operating Junction Temperature	-55 to +175	°C
T_{stg}	Storage Temperature Range	-55 to +175	°C
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	°C

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$(IGBT)	Thermal Resistance, Junction to Case	--	0.17	°C/W
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case	--	0.55	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	--	40	°C/W

Notes:
1. Vcc = 600 V,V_{GE} = 15 V, I_C = 160 A, R_G = 10 Ω, Inductive Load
2. Limited by Tjmax

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGY40T120SMD	FGY40T120SMD	TP-247	-	-	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 uA	1200	-	-	V
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}$, V_{GE} = 0 V	-	-	250	uA
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 = 40 mA, $V_{CE} = V_{GE}$	4.9	6.2	7.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 40 A, V_{GE} = 15 V T_C = 25°C	-	1.8	2.4	V
		I_C = 40 A, V_{GE} = 15 V, T_C = 175°C	-	2.0	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30 V, V_{GE} = 0 V, f = 1MHz	-	4300	-	pF
C_{oes}	Output Capacitance		-	180	-	pF
C_{res}	Reverse Transfer Capacitance		-	100	-	pF
Switching Characcteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 600 V, I_C = 40 A, R_G = 10 Ω, V_{GE} = 15 V, Inductive Load, T_C = 25°C	-	40	-	ns
t_r	Rise Time		-	47	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	475	-	ns
t_f	Fall Time		-	10	-	ns
E_{on}	Turn-On Switching Loss		-	2.7	-	mJ
E_{off}	Turn-Off Switching Loss		-	1.1	-	mJ
E_{ts}	Total Switching Loss		-	3.8	-	mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 600 V, I_C = 40 A, R_G = 10 Ω, V_{GE} = 15 V, Inductive Load, T_C = 175°C	-	40	-	ns
t_r	Rise Time		-	55	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	520	-	ns
t_f	Fall Time		-	50	-	ns
E_{on}	Turn-On Switching Loss		-	3.4	-	mJ
E_{off}	Turn-Off Switching Loss		-	2.5	-	mJ
E_{ts}	Total Switching Loss		-	5.9	-	mJ
Q_g	Total Gate Charge	V_{CE} = 600 V, I_C = 40 A, V_{GE} = 15 V	-	370	-	nC
Q_{ge}	Gate to Emitter Charge		-	23	-	nC
Q_{gc}	Gate to Collector Charge		-	210	-	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 = 40 A, T_C = 25°C	-	3.8	4.8	V
		I_F = 40 A, T_C = 175°C	-	2.7	-	V
t_{rr}	Diode Reverse Recovery Time	V_R = 600 V, I_F = 40 A, di_F/dt = 200 A/us, T_C = 25°C	-	65	-	ns
Q_{rr}	Diode Reverse Recovery Charge		-	234	-	nC
E_{rec}	Reverse Recovery Energy	V_R = 600 V, I_F = 40 A, di_F/dt = 200 A/us, T_C = 175°C	-	97	-	uJ
t_{rr}	Diode Reverse Recovery Time		-	200	-	ns
Q_{rr}	Diode Reverse Recovery Charge		-	1800	-	nC

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

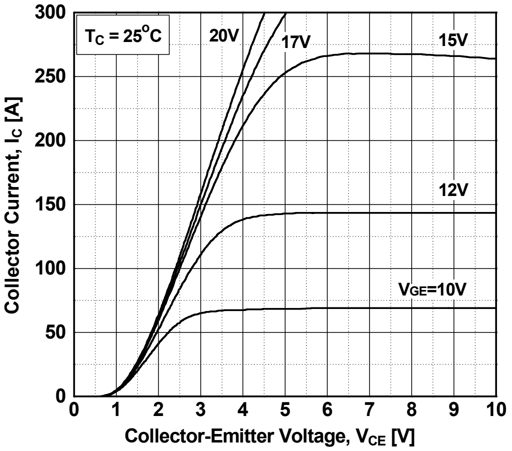


Figure 2. Typical Output Characteristics

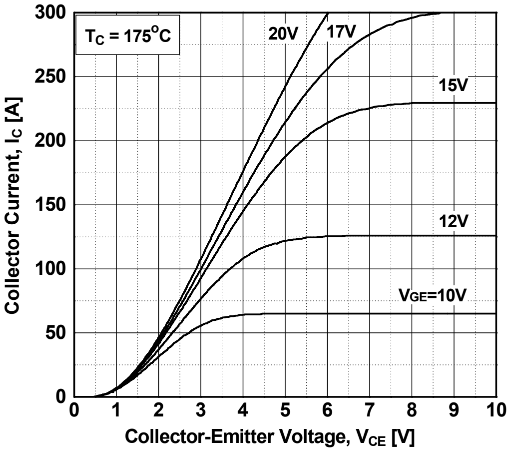


Figure 3. Typical Saturation Voltage Characteristics

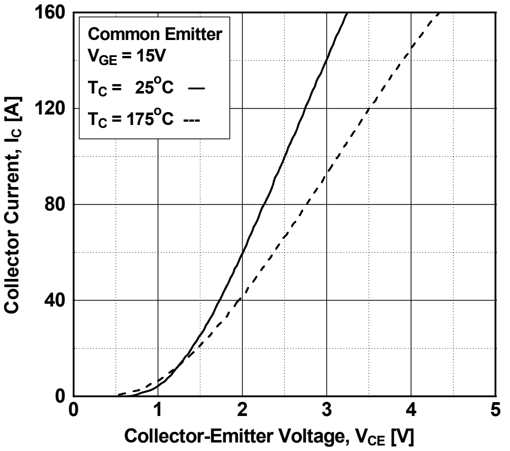


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

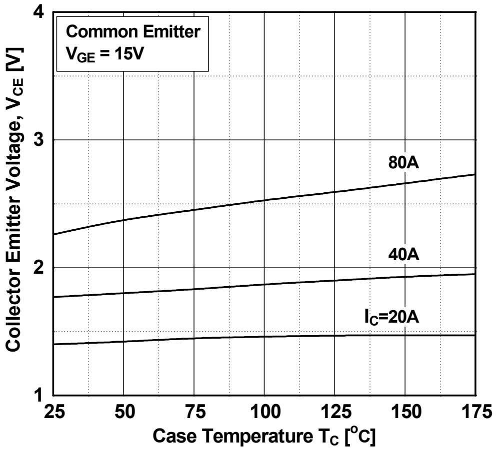


Figure 5. Saturation Voltage vs. V_{GE}

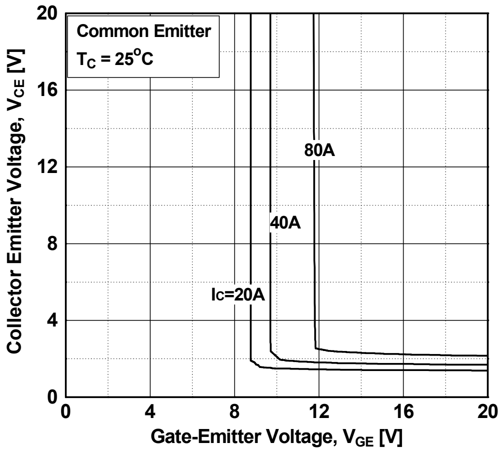
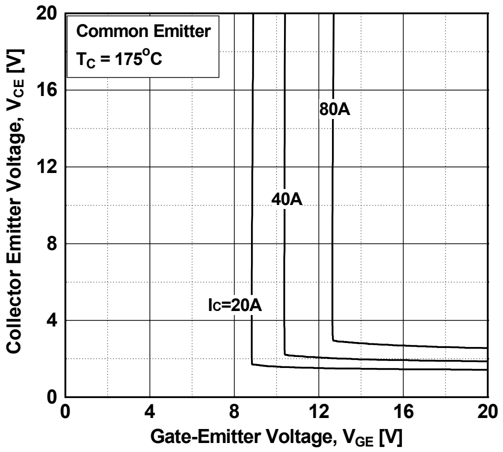


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Capacitance Characteristics

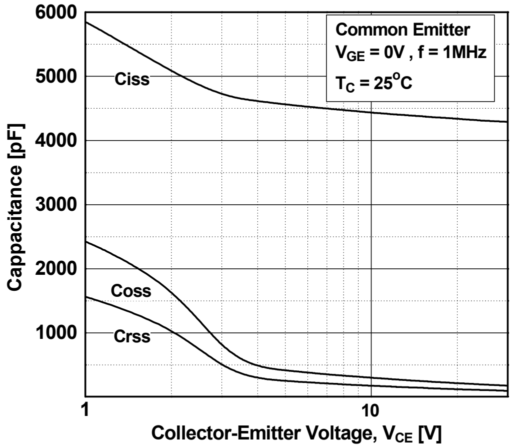


Figure 8. Load Current vs. Frequency

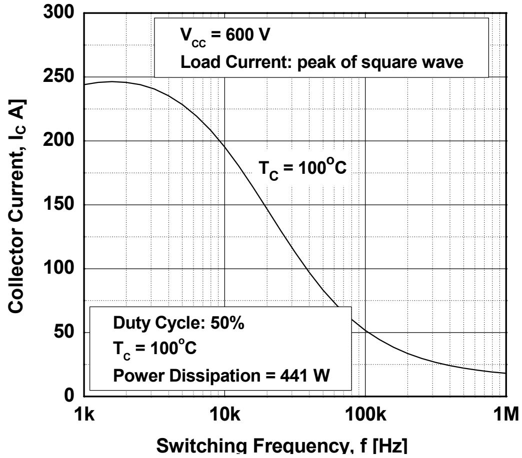


Figure 9. Turn-on Characteristics vs. Gate Resistance

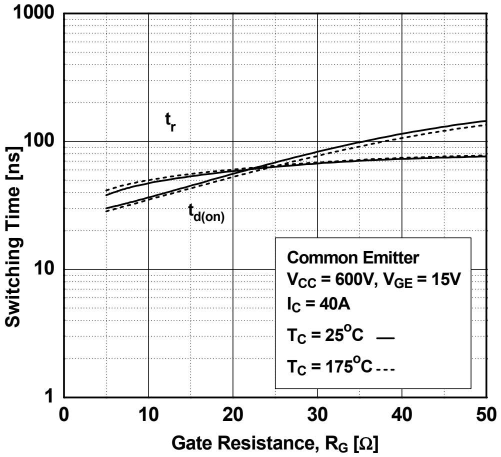


Figure 10. Turn-off Characteristics vs. Gate Resistance

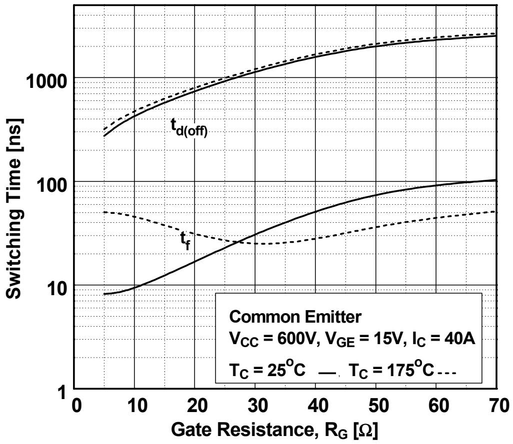


Figure 11. Swithcing Loss vs. Gate Resistance

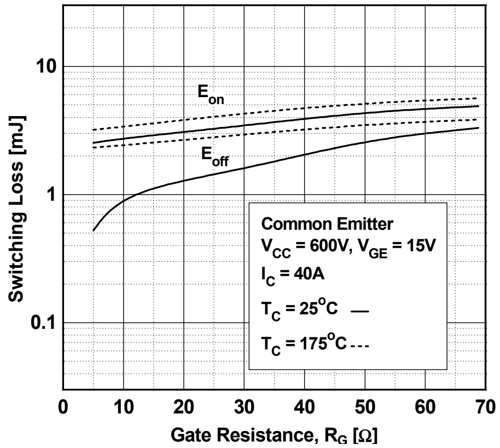
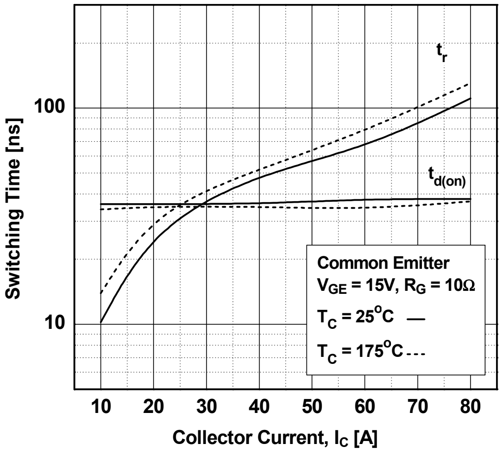


Figure 12. Turn-on Characteristics vs. Collector Current



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Collector Current

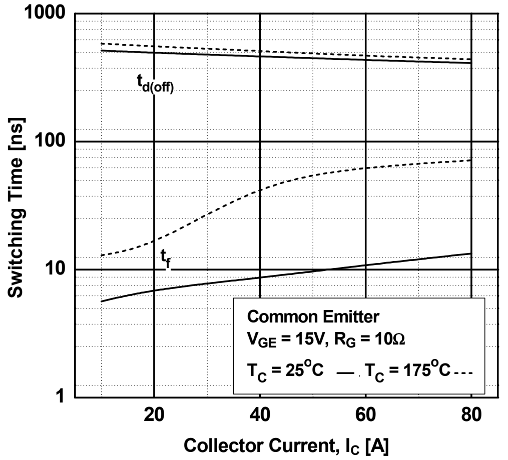


Figure 14. Swithcing Loss vs. Collector Current

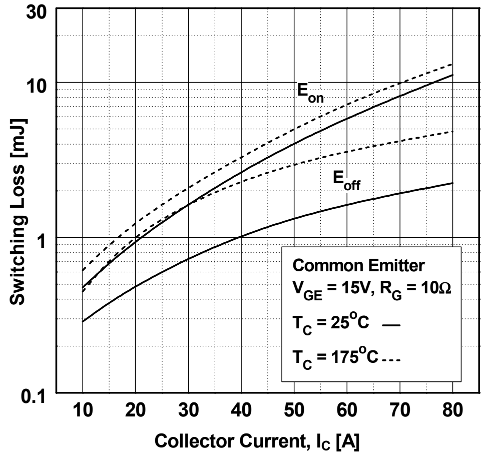


Figure 15. Gate Charge Characteristics

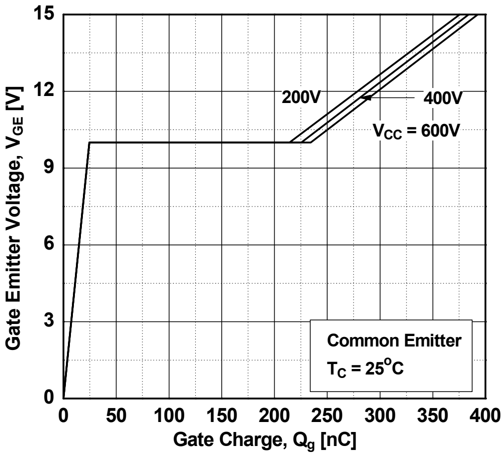


Figure 16. SOA Characteristics

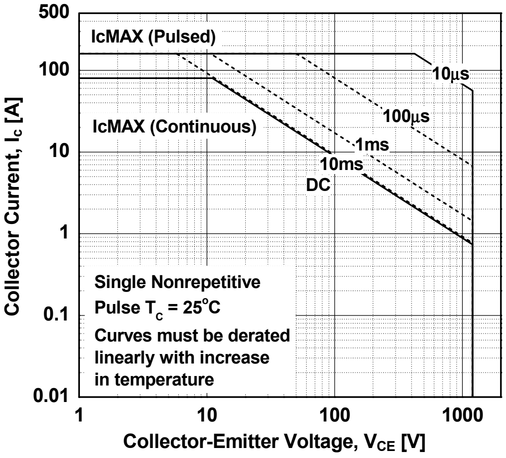


Figure 17. Forward Characteristics

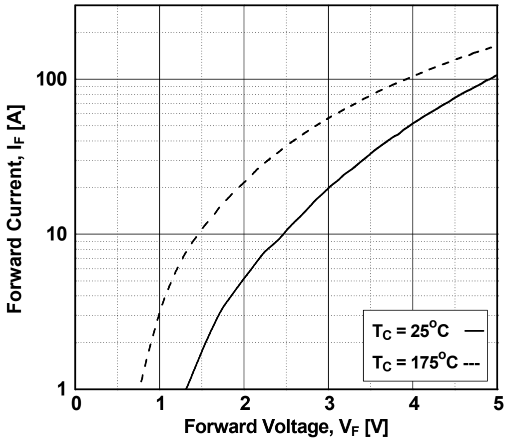
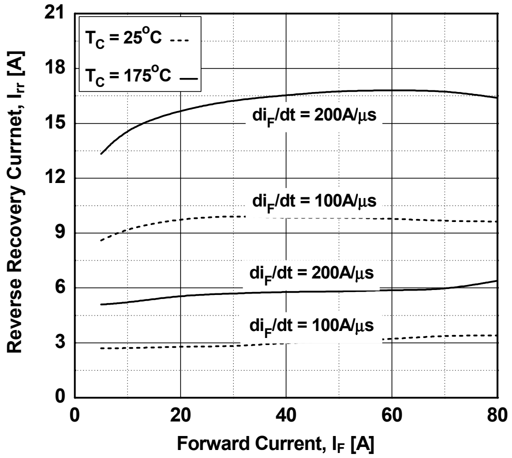


Figure 18. Reverse Recovery Current



Typical Performance Characteristics

Figure 19. Reverse Recovery Time

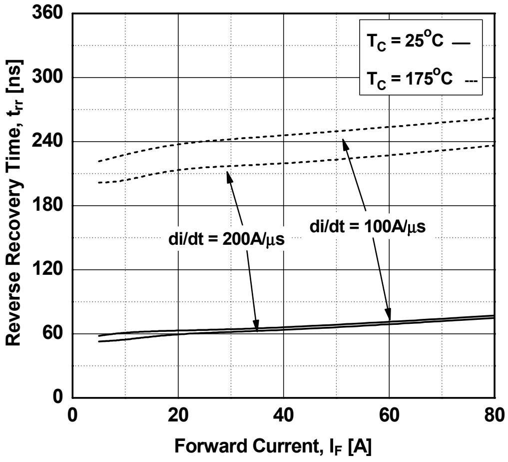


Figure 20. Stored Charge

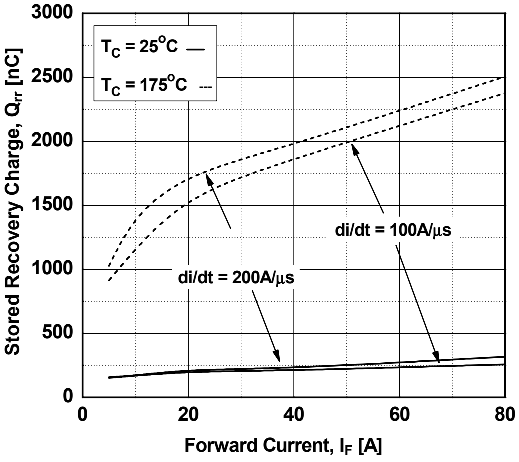


Figure 21. Transient Thermal Impedance of IGBT

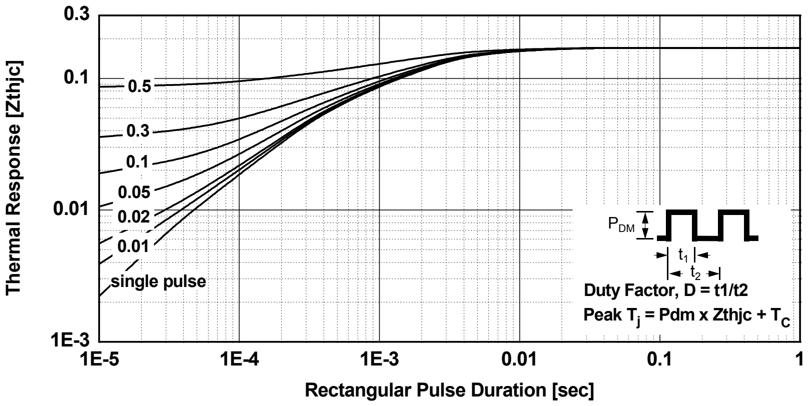
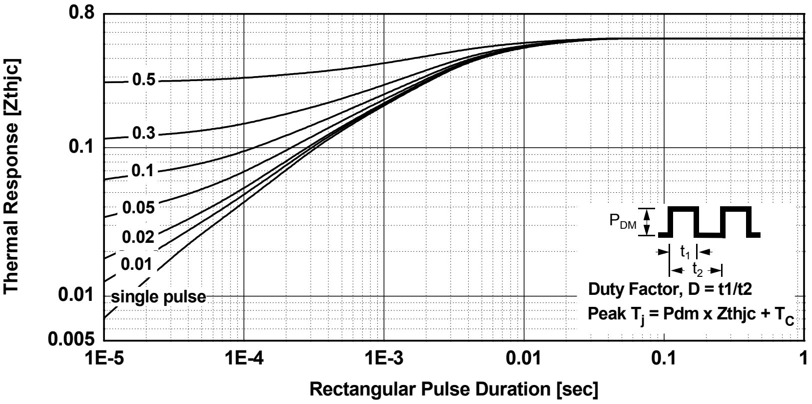
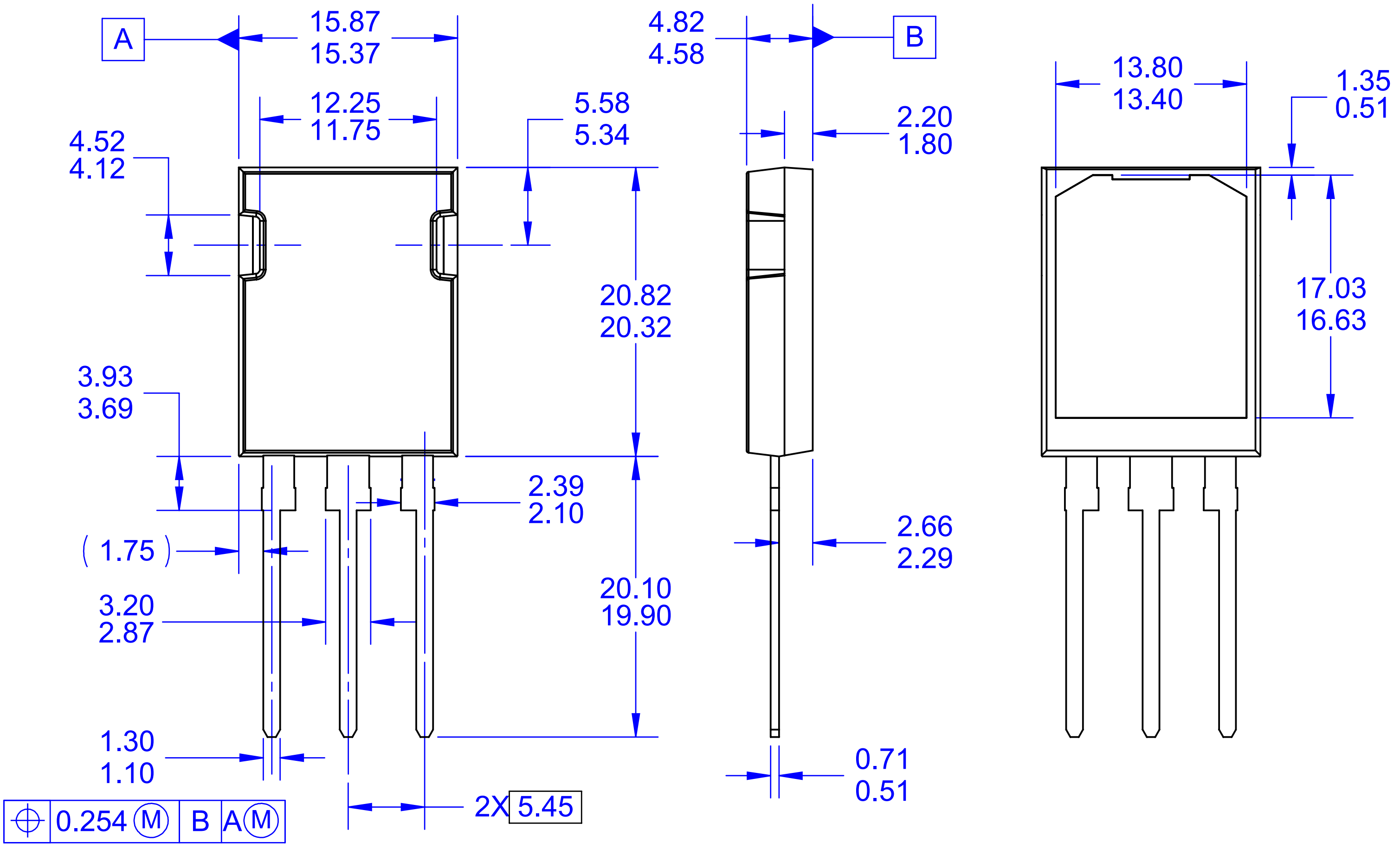


Figure 22. Transient Thermal Impedance of Diode





FRONT VIEW SIDE VIEW BOTTOM VIEW

NOTES:

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