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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

April 2015

FGH40T120SMDL4
1200 V, 40 A FS Trench IGBT

Features

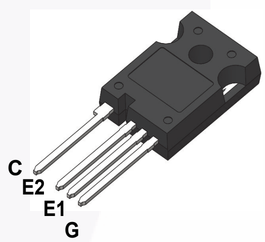
- FS Trench Technology, Positive Temperature Coefficient
- Excellent Switching Performance due to Kelvin Emitter Pin
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.8 V @ I_C = 40 A
- 100% of the Parts tested for I_{LM}(1)
- High Input Impedance
- RoHS Compliant

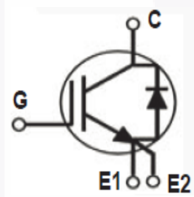
General Description

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 and PFC applications





E1: Kelvin Emitter
E2: Power Emitter

Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Description		FGH40T120SMDL4	Unit
V_{CES}	Collector to Emitter Voltage		1200	V
V_{GES}	Gate to Emitter Voltage		±25	V
	Transient Gate to Emitter Voltage		±30	
I_C	Collector Current	@ T_C = 25°C	80	A
	Collector Current	@ T_C = 100°C	40	
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	
I_{FM}	Diode Maximum Forward Current		240	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	555	W
	Maximum Power Dissipation	@ T_C = 100°C	277	
T_J	Operating Junction Temperature		-55 to +175	°C
T_{stg}	Storage Temperature Range		-55 to +175	°C
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds		300	°C

Thermal Characteristics

Symbol	Parameter	FGH40T120SMDL4	Unit
$R_{\theta JC}$(IGBT)	Thermal Resistance, Junction to Case	0.27	°C/W
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case	0.89	°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 = 20 Ω, inductive load.
2. Limited by Tjmax.

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGH40T120SMDL4	FGH40T120SMDL4	TO-247 A04	-	-	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	-	44	-	ns
t_r	Rise Time		-	42	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	464	-	ns
t_f	Fall Time		-	24	-	ns
E_{on}	Turn-On Switching Loss		-	2.24	-	mJ
E_{off}	Turn-Off Switching Loss		-	1.02	-	mJ
E_{ts}	Total Switching Loss		-	3.26	-	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	-	42	-	ns
t_r	Rise Time		-	48	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	518	-	ns
t_f	Fall Time		-	24	-	ns
E_{on}	Turn-On Switching Loss		-	3.11	-	mJ
E_{off}	Turn-Off Switching Loss		-	2.01	-	mJ
E_{ts}	Total Switching Loss		-	5.12	-	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^{o}C	-	3.8	4.8	V
		I_F = 40 A, T_C = 175^{o}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^{o}C	-	65	-	ns
I_{rr}	Diode Peak Reverse Recovery Current		-	7.2	-	A
Q_{rr}	Diode Reverse Recovery Charge		-	234	-	nC
t_{rr}	Diode Reverse Recovery Time	V_R = 600 V, I_F = 40 A, di_F/dt = 200 A/us, T_C = 175^{o}C	-	200	-	ns
I_{rr}	Diode Peak Reverse Recovery Current		-	18.0	-	A
Q_{rr}	Diode Reverse Recovery Charge		-	1800	-	nC

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

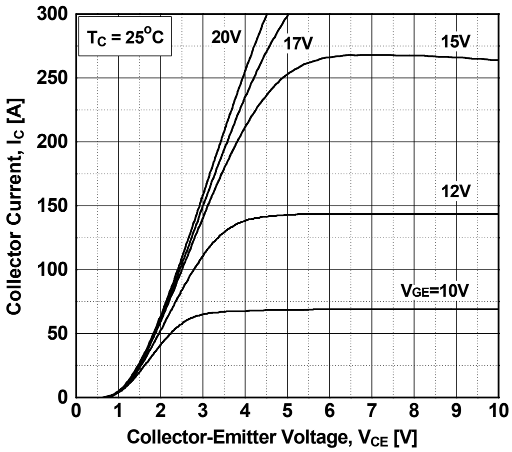


Figure 2. Typical Output Characteristics

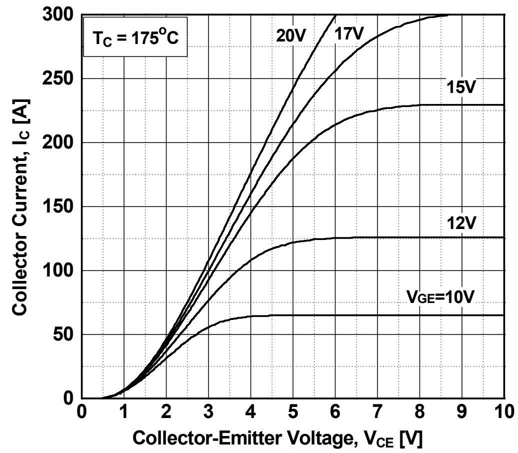


Figure 3. Typical Saturation Voltage Characteristics

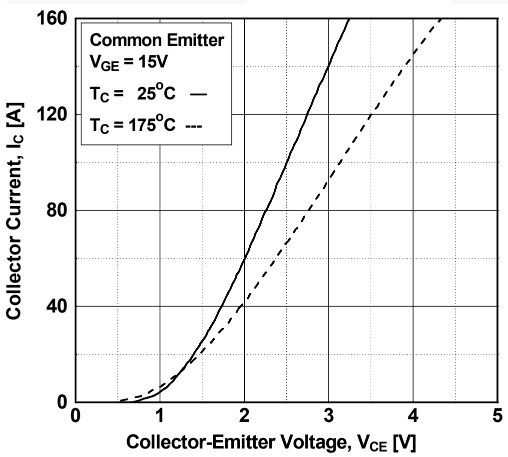


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

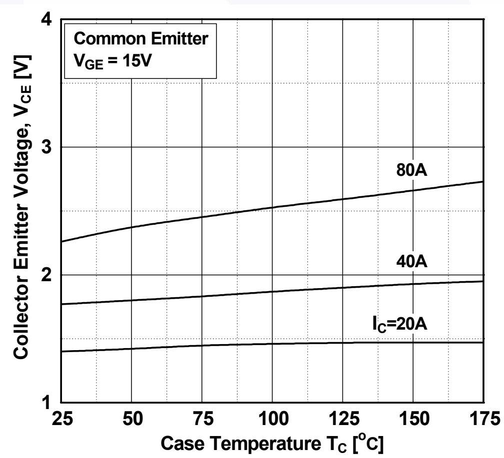


Figure 5. Saturation Voltage vs. V_{GE}

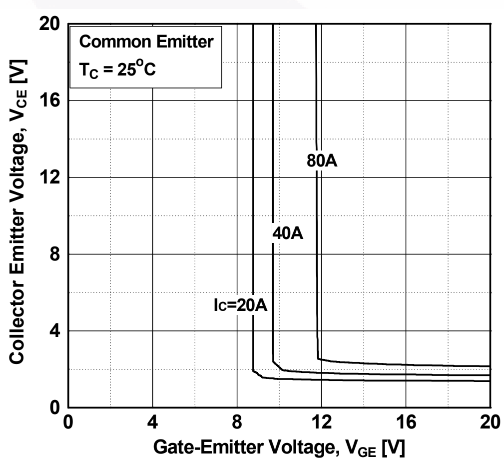
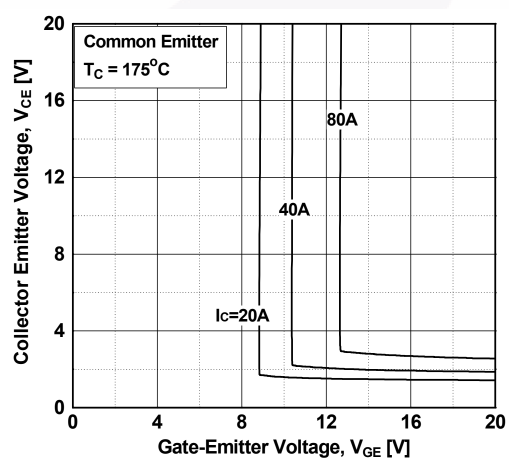


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Capacitance Characteristics

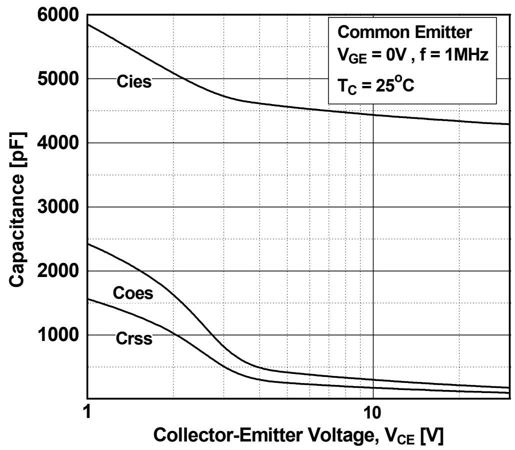


Figure 8. Gate Charge Characteristics

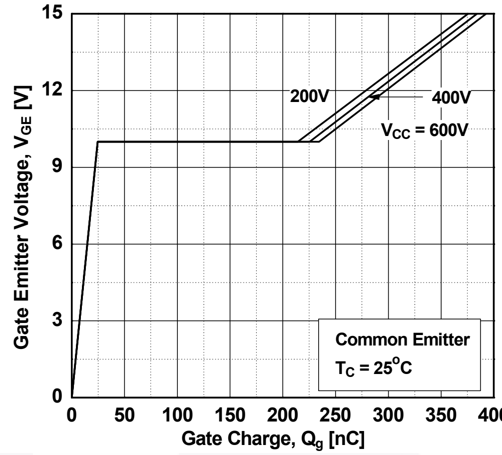


Figure 9. Turn-on Characteristics vs. Gate Resistance

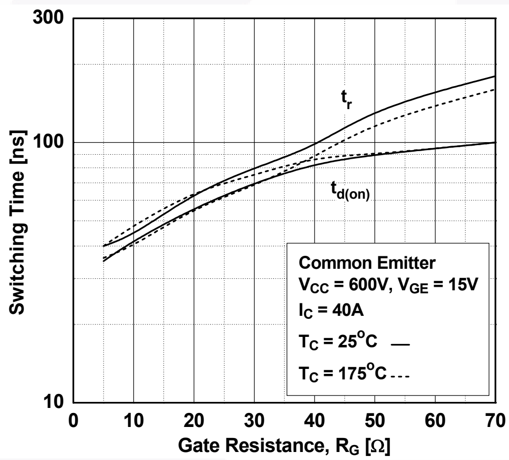


Figure 10. Turn-off Characteristics vs. Gate Resistance

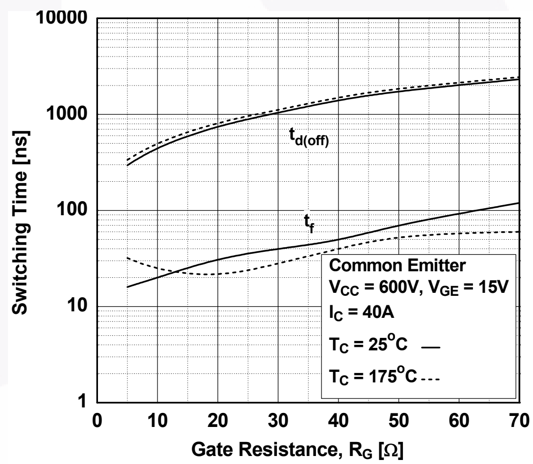


Figure 11. Switching Loss vs. Gate Resistance

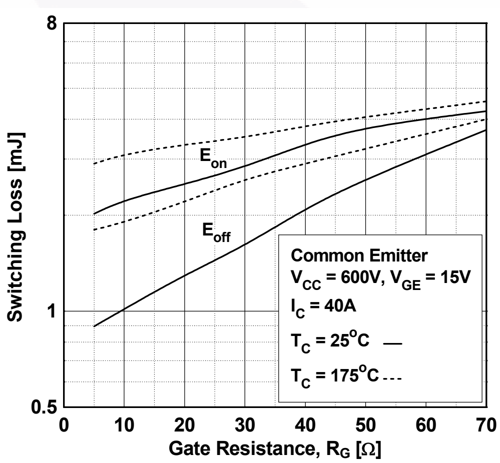
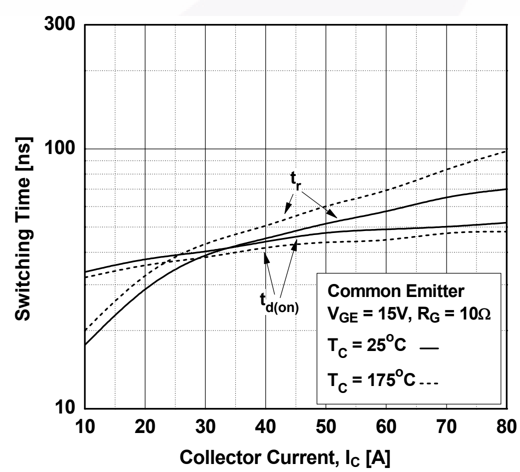


Figure 12. Turn-on Characteristics vs. Collector Current



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Collector Current

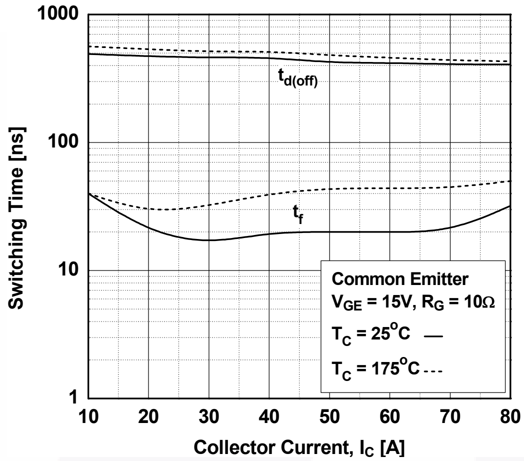


Figure 14. Switching Loss vs. Collector Current

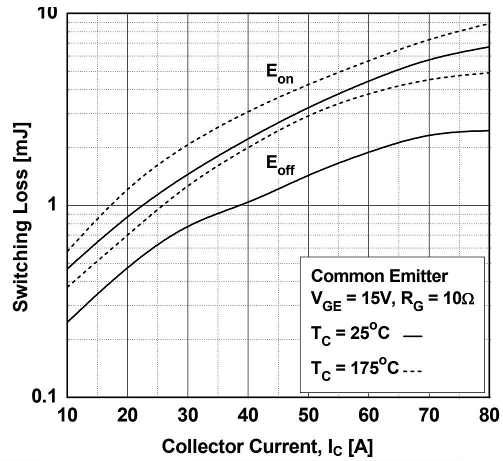


Figure 15. Load Current vs. Frequency

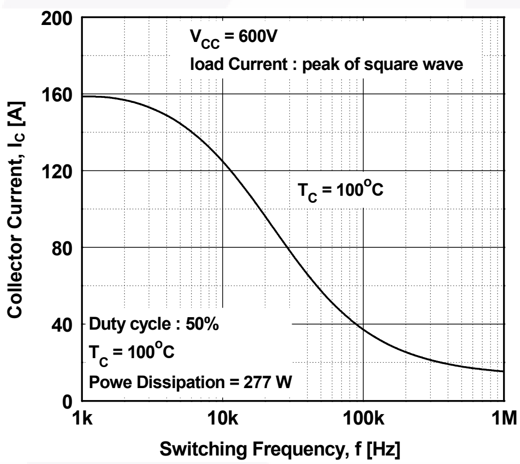


Figure 16. SOA Characteristics

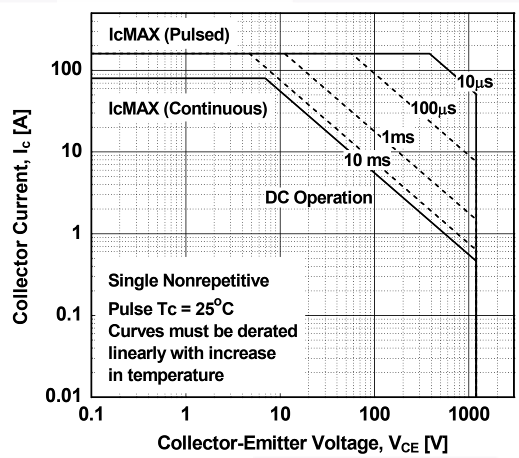


Figure 17. Forward Characteristics

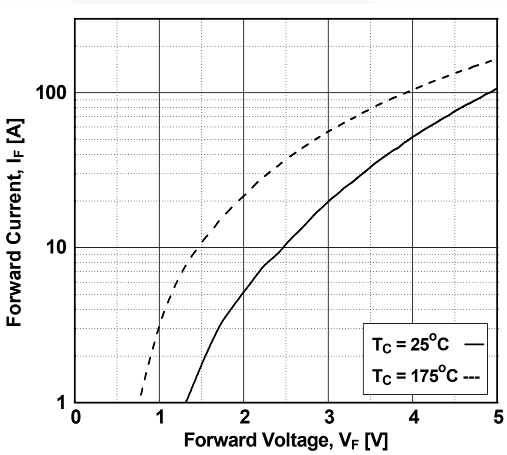
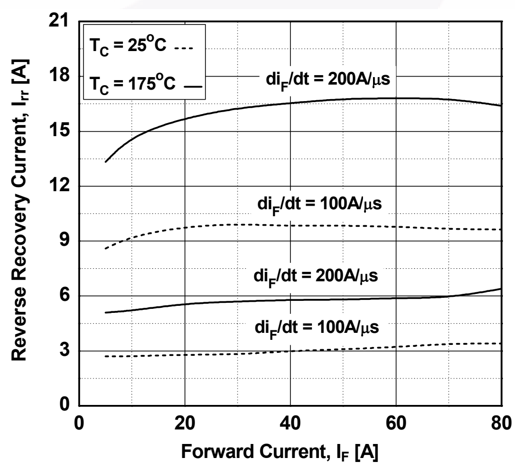


Figure 18. Reverse Recovery Current



Typical Performance Characteristics

Figure 19. Reverse Recovery Time

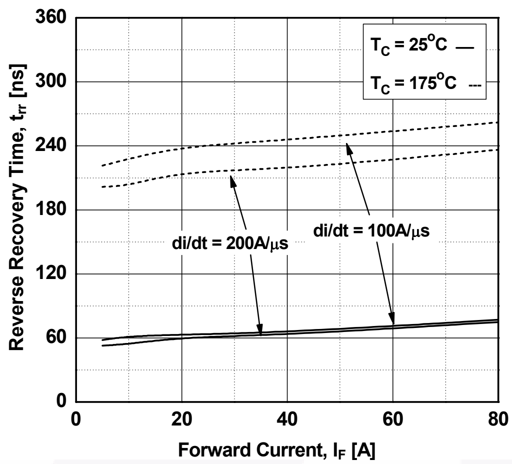


Figure 20. Stored Charge

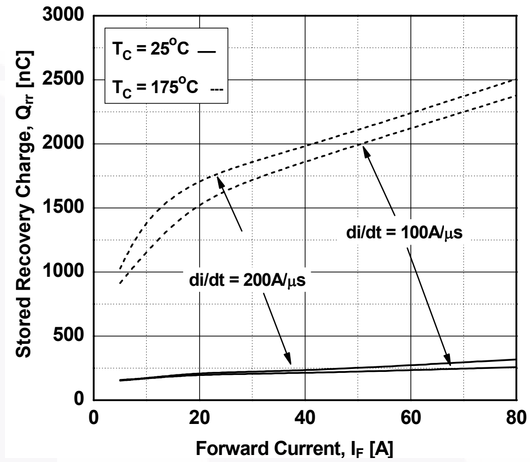


Figure 21. Transient Thermal Impedance of IGBT

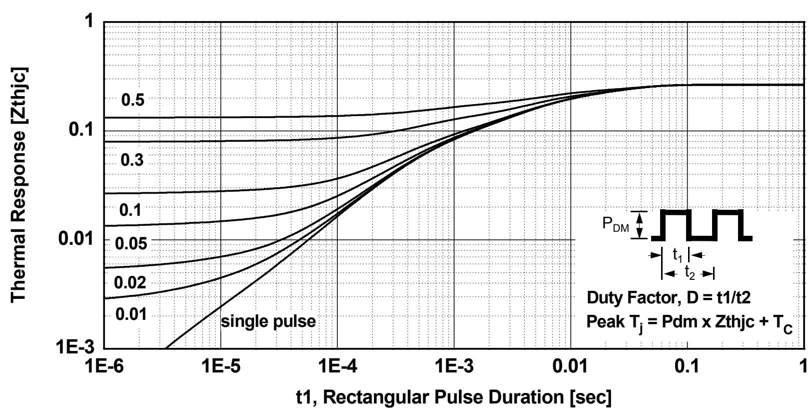
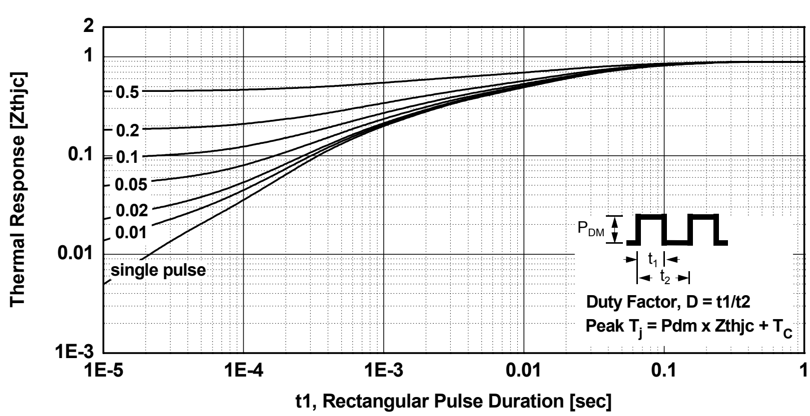
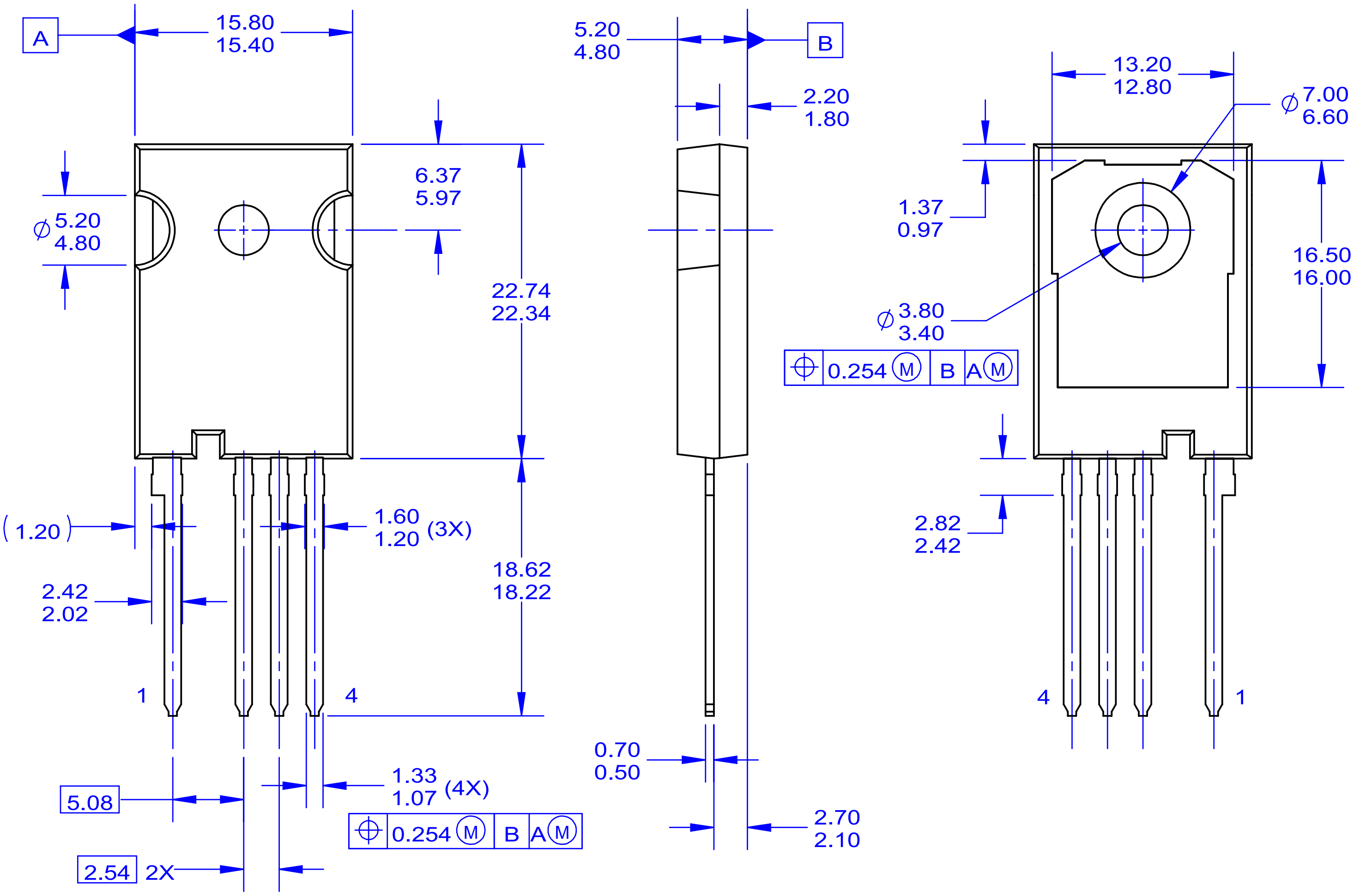


Figure 22. Transient Thermal Impedance of Diode





NOTES:

A. NO INDUSTRY STANDARD APPLIES TO THIS PACKAGE.
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C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DRAWING CONFORMS TO ASME Y14.5-2009.
F. DRAWING FILENAME;MKT-TO247A04_REV02.

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