



ON Semiconductor®

FGH40T120SMD / FGH40T120SMD-F155

1200 V, 40 A FS Trench IGBT

Features

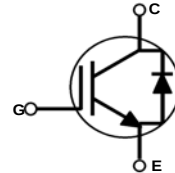
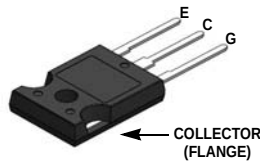
- FS Trench Technology, Positive Temperature Coefficient
- High Speed Switching
- Low Saturation Voltage: $V_{CE(sat)} = 1.8 \text{ V}$ @ $I_C = 40 \text{ A}$
- 100% of the Parts tested for $I_{LM}(1)$
- High Input Impedance
- RoHS Compliant

Applications

- Solar Inverter, Welder, UPS & PFC applications.

General Description

Using innovative field stop trench IGBT technology, ON Semiconductor'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.



Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Description	Ratings	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 @ $T_C = 25^\circ\text{C}$	80	A
	Collector Current @ $T_C = 100^\circ\text{C}$	40	A
$I_{LM}(1)$	Clamped Inductive Load Current @ $T_C = 25^\circ\text{C}$	160	A
$I_{CM}(2)$	Pulsed Collector Current	160	A
I_F	Diode Continuous Forward Current @ $T_C = 25^\circ\text{C}$	80	A
	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	40	A
I_{FM}	Diode Maximum Forward Current	240	A
P_D	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	555	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	277	W
T_J	Operating Junction Temperature	-55 to +175	$^\circ\text{C}$
T_{stg}	Storage Temperature Range	-55 to +175	$^\circ\text{C}$
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction to Case	--	0.27	$^\circ\text{C/W}$
$R_{\theta JC}(\text{Diode})$	Thermal Resistance, Junction to Case	--	0.89	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	--	40	$^\circ\text{C/W}$

Notes:

1. $V_{CC} = 600 \text{ V}$, $V_{GE} = 15 \text{ V}$, $I_C = 160 \text{ A}$, $R_G = 10 \Omega$, Inductive Load
2. Limited by T_{Jmax}

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGH40T120SMD	FGH40T120SMD	TO-247 A03	-	-	30
FGH40T120SMD	FGH40T120SMD-F155	TO-247G03	-	-	30

Electrical Characteristics of the IGBT $T_C = 25^\circ\text{C}$ 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 $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{FM}	Diode Forward Voltage	$I_F = 40\text{ A}, T_C = 25^\circ\text{C}$	-	3.8	4.8	V
		$I_F = 40\text{ A}, T_C = 175^\circ\text{C}$	-	2.7	-	V
t_{rr}	Diode Reverse Recovery Time	$V_R = 600\text{ V}, I_F = 40\text{ A},$ $di_F/dt = 200\text{ A/us}, T_C = 25^\circ\text{C}$	-	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	$V_R = 600\text{ V}, I_F = 40\text{ A},$ $di_F/dt = 200\text{ A/us}, T_C = 175^\circ\text{C}$	-	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

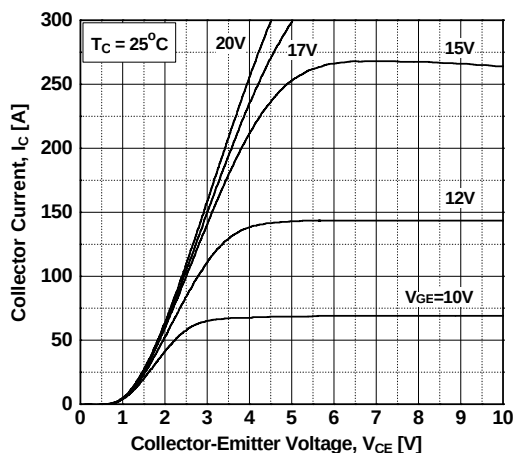


Figure 2. Typical Output Characteristics

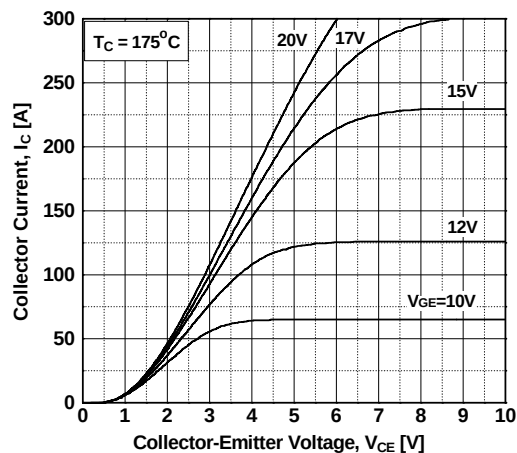


Figure 3. Typical Saturation Voltage Characteristics

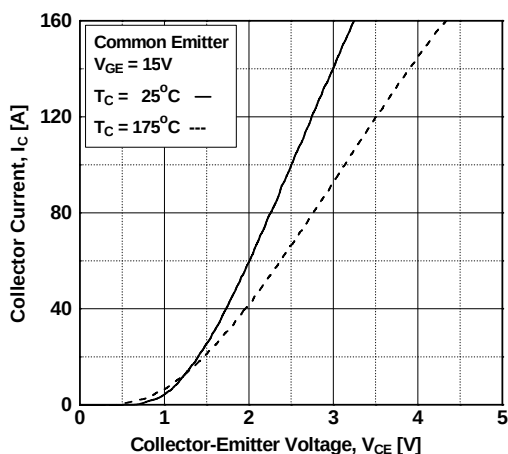


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

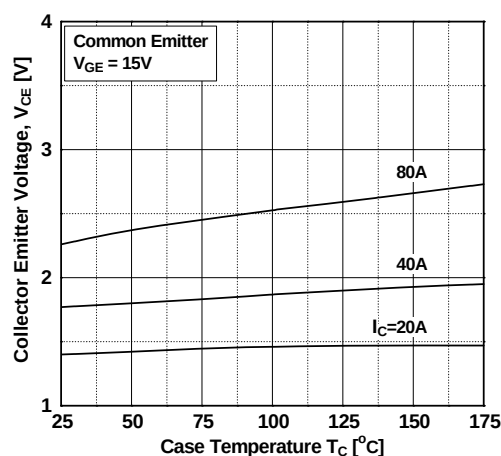


Figure 5. Saturation Voltage vs. V_{GE}

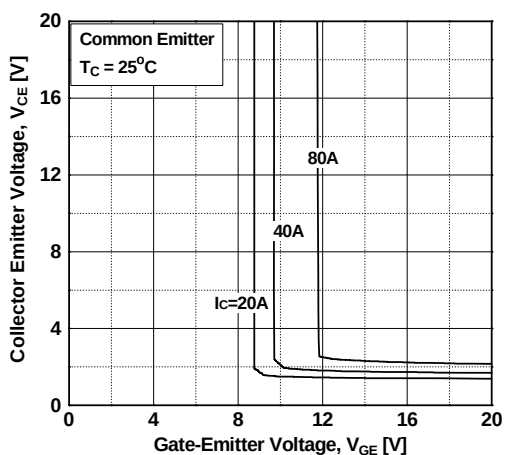
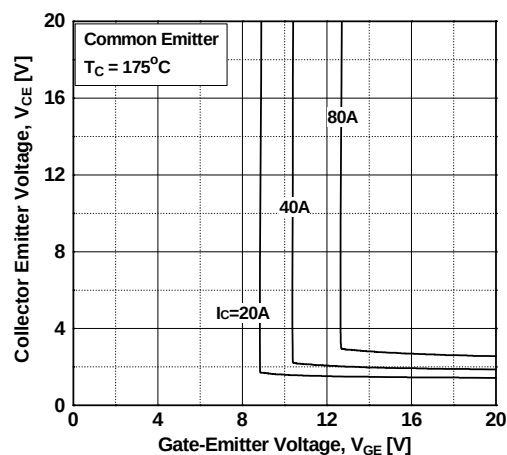


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Capacitance Characteristics

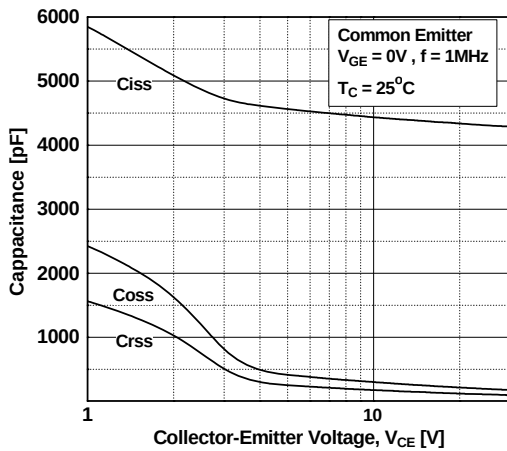


Figure 8. Load Current vs. Frequency

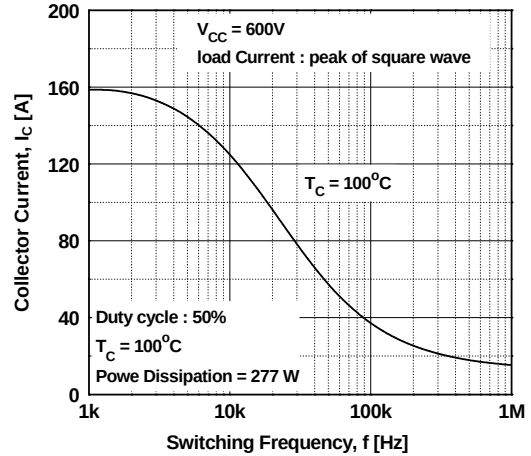


Figure 9. Turn-on Characteristics vs. Gate Resistance

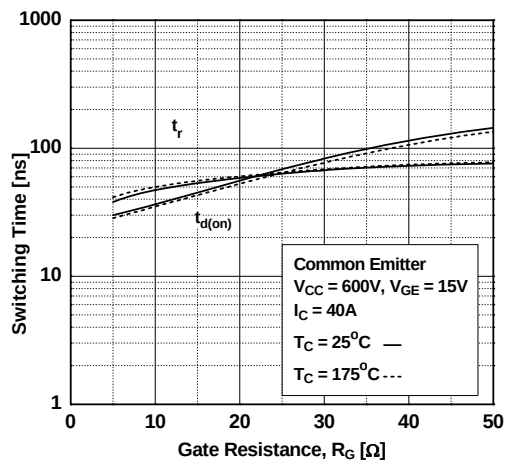


Figure 10. Turn-off Characteristics vs. Gate Resistance

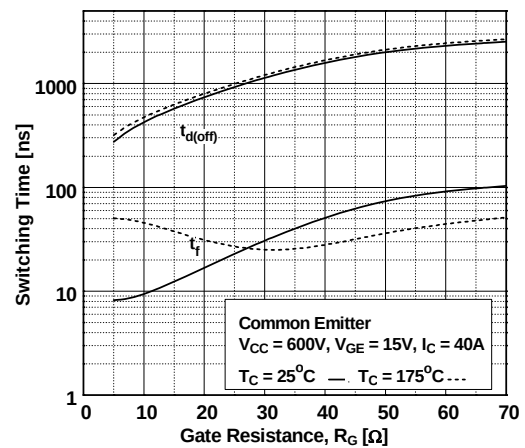


Figure 11. Switching Loss vs. Gate Resistance

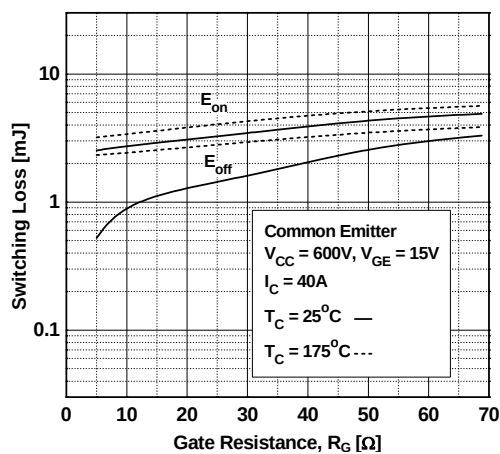
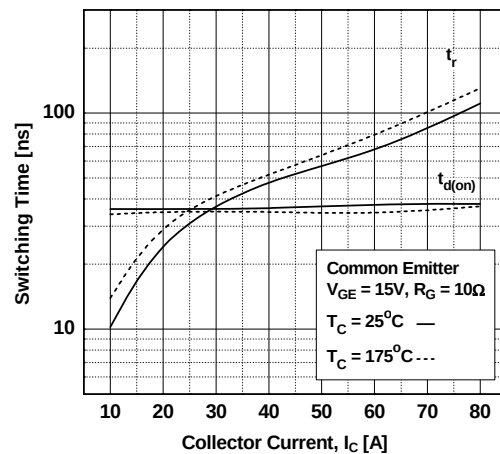


Figure 12. Turn-on Characteristics vs. Collector Current



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Collector Current

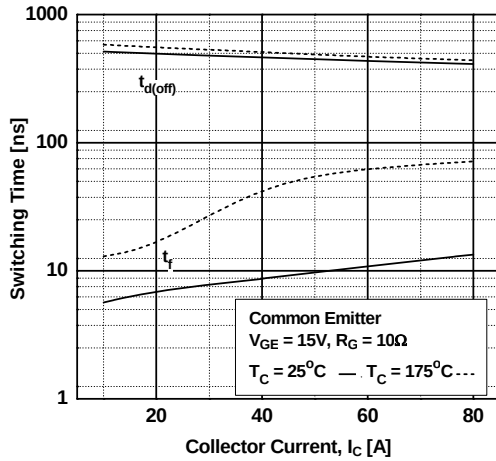


Figure 14. Switching Loss vs. Collector Current

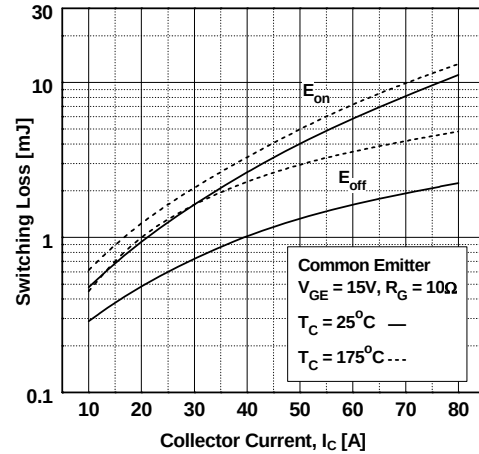


Figure 15. Gate Charge Characteristics

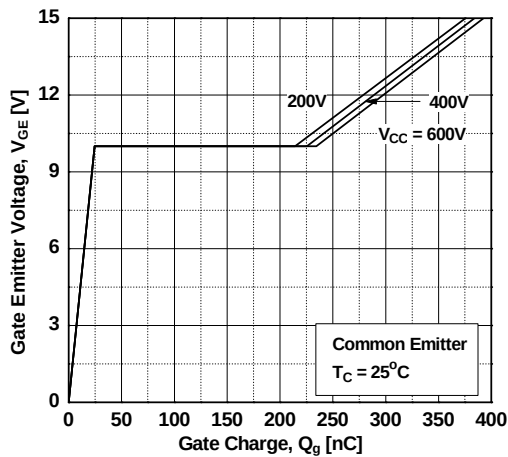


Figure 16. SOA Characteristics

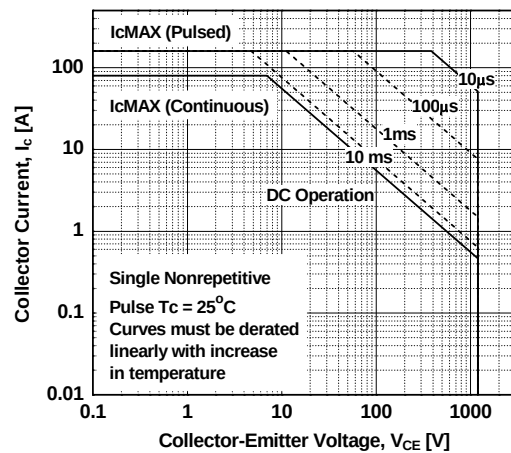


Figure 17. Forward Characteristics

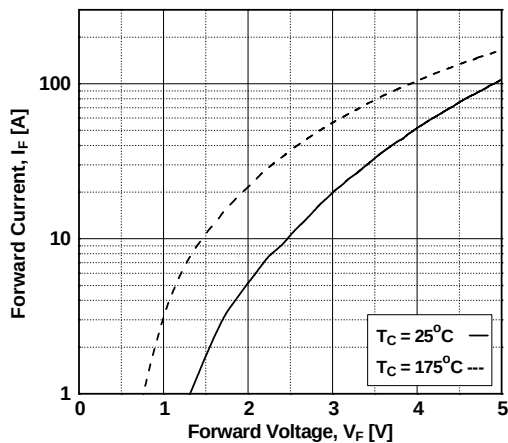
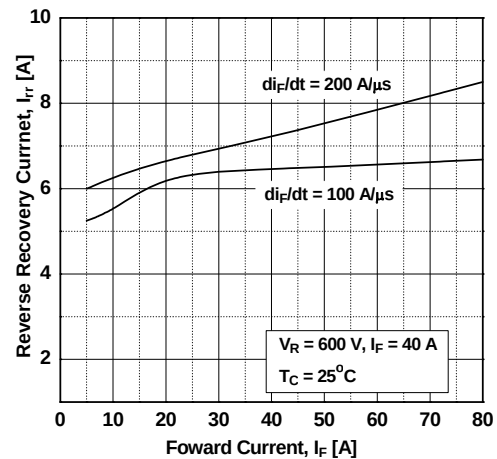


Figure 18. Reverse Recovery Current



Typical Performance Characteristics

Figure 19. Reverse Recovery Time

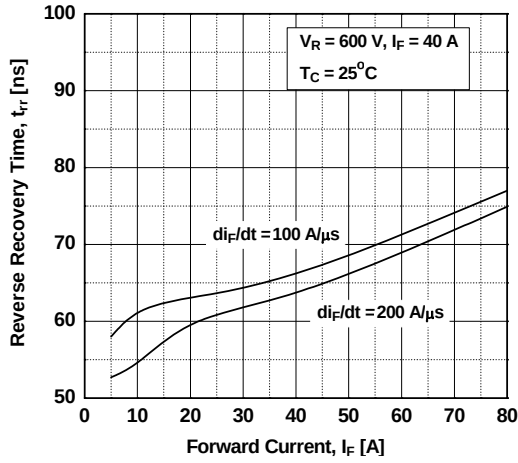


Figure 20. Stored Charge

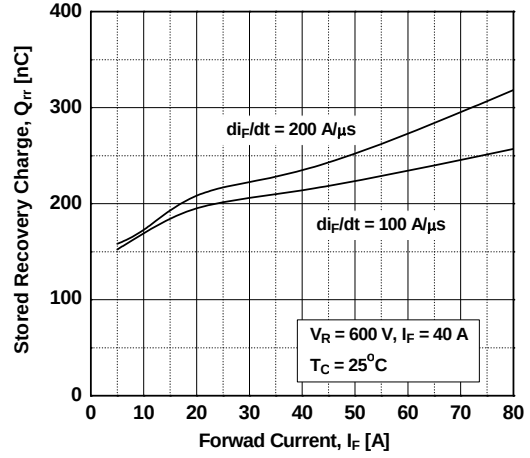
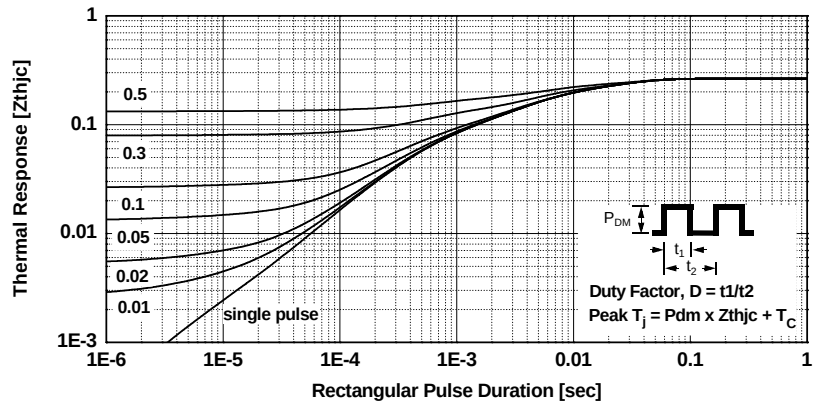
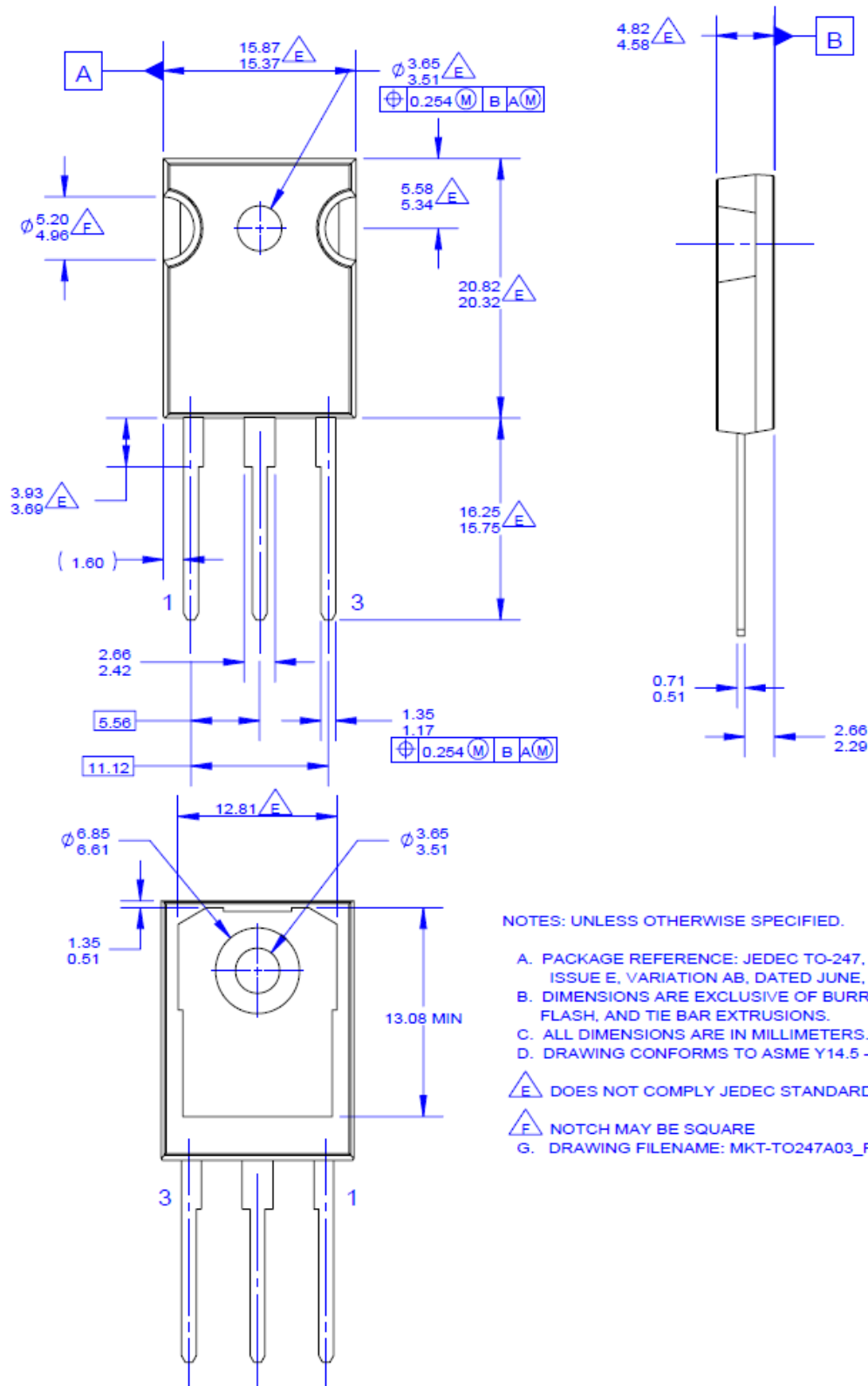


Figure 21. Transient Thermal Impedance of IGBT



Mechanical Dimensions

TO - 247A03

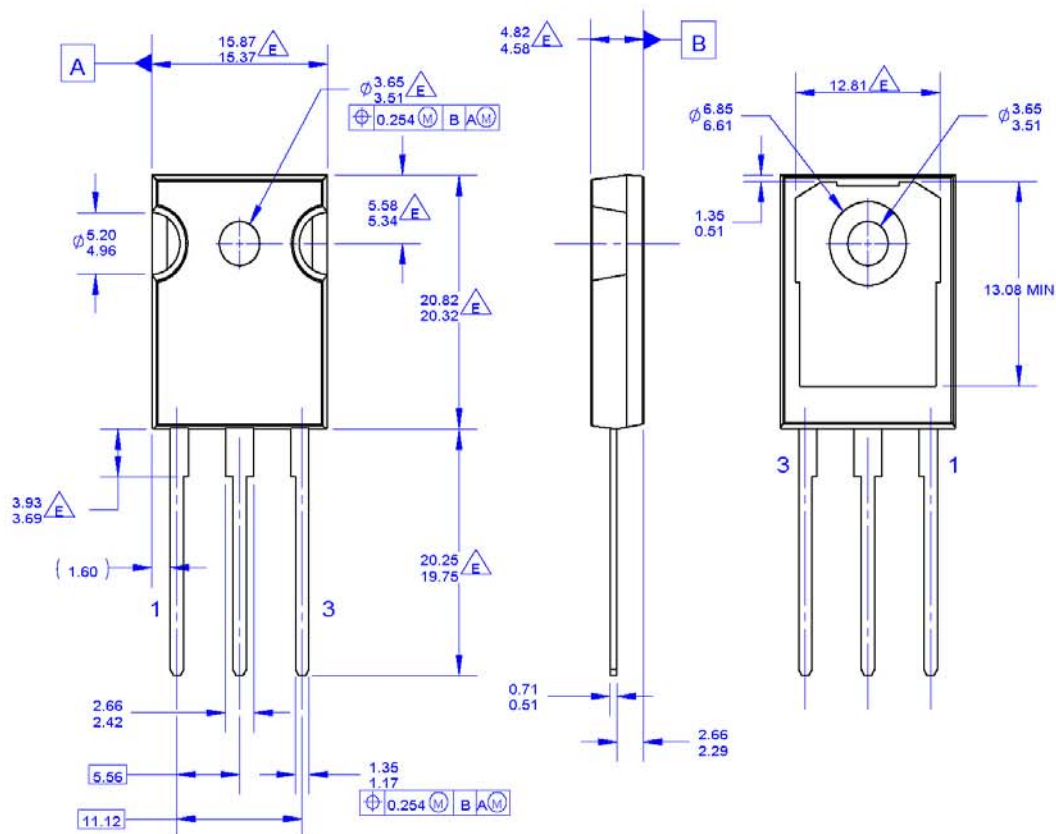


NOTES: UNLESS OTHERWISE SPECIFIED.

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- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
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- (E) DOES NOT COMPLY JEDEC STANDARD VALUE
- (F) NOTCH MAY BE SQUARE
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Mechanical Dimensions

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