



ON Semiconductor®

FGH40T100SMD

1000 V, 40 A Field Stop Trench IGBT

Features

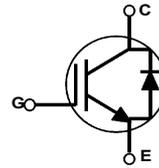
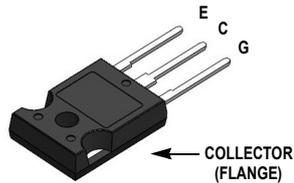
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)} = 1.9 \text{ V(Typ.) @ } I_C = 40 \text{ A}$
- High Input Impedance
- Fast Switching
- RoHS Compliant

Applications

- UPS, welder, PFC

General Description

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



Absolute Maximum Ratings

Symbol	Description	Ratings	Unit
V_{CES}	Collector to Emitter Voltage	1000	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
$I_{CM(1)}$	Pulsed Collector Current @ $T_C = 25^\circ\text{C}$	120	A
I_F	Diode Forward Current @ $T_C = 25^\circ\text{C}$	80	A
	Diode Forward Current @ $T_C = 100^\circ\text{C}$	40	A
$I_{FM(1)}$	Pulsed Diode Forward Current @ $T_C = 25^\circ\text{C}$	120	A
P_D	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	333	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	166	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	$^\circ\text{C}$

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	-	0.45	$^\circ\text{C/W}$
$R_{\theta JC(Diode)}$	Thermal Resistance, Junction to Case	-	0.8	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGH40T100SMD	FGH40T100SMD	TO-247 A03	-	-	30ea
FGH40T100SMD	FGH40T100SMD-F155	TO-247 G03	-	-	30ea

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	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	1000	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	-	0.6	-	V/°C
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$	-	-	1000	μA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0\text{ V}$	-	-	± 500	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 250\text{ }\mu\text{A}, V_{CE} = V_{GE}$	4.2	5.3	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 40\text{ A}, V_{GE} = 15\text{ V}$	-	1.9	2.3	V
		$I_C = 40\text{ A}, V_{GE} = 15\text{ V}, T_C = 175^\circ\text{C}$	-	2.4	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	-	3980	5295	pF
C_{oes}	Output Capacitance		-	124	165	pF
C_{res}	Reverse Transfer Capacitance		-	76	115	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600\text{ V}, I_C = 40\text{ A}, R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V}, \text{Inductive Load}, T_C = 25^\circ\text{C}$	-	29	38	ns
t_r	Rise Time		-	42	55	ns
$t_{d(off)}$	Turn-Off Delay Time		-	285	371	ns
t_f	Fall Time		-	23	30	ns
E_{on}	Turn-On Switching Loss		-	2.35	3.1	mJ
E_{off}	Turn-Off Switching Loss		-	1.15	1.5	mJ
E_{ts}	Total Switching Loss		-	3.5	4.6	mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600\text{ V}, I_C = 40\text{ A}, R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V}, \text{Inductive Load}, T_C = 175^\circ\text{C}$	-	27	36	ns
t_r	Rise Time		-	49	64	ns
$t_{d(off)}$	Turn-Off Delay Time		-	285	371	ns
t_f	Fall Time		-	20	26	ns
E_{on}	Turn-On Switching Loss		-	4.4	5.7	mJ
E_{off}	Turn-Off Switching Loss		-	1.9	2.5	mJ
E_{ts}	Total Switching Loss		-	6.3	8.2	mJ
Q_g	Total Gate Charge	$V_{CE} = 600\text{ V}, I_C = 40\text{ A}, V_{GE} = 15\text{ V}$	-	265	398	nC
Q_{ge}	Gate to Emitter Charge		-	32	48	nC
Q_{gc}	Gate to Collector Charge		-	135	203	nC

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit	
V_{FM}	Diode Forward Voltage	$I_F = 40\text{ A}$	$T_C = 25^\circ\text{C}$	-	3.4	4.4	V
			$T_C = 175^\circ\text{C}$	-	2.6	-	
t_{rr}	Diode Reverse Recovery Time	$I_F = 40\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	-	60	78	ns
			$T_C = 175^\circ\text{C}$	-	256	-	
Q_{rr}	Diode Reverse Recovery Charge	$I_F = 40\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	-	185	260	nC
			$T_C = 175^\circ\text{C}$	-	1512	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

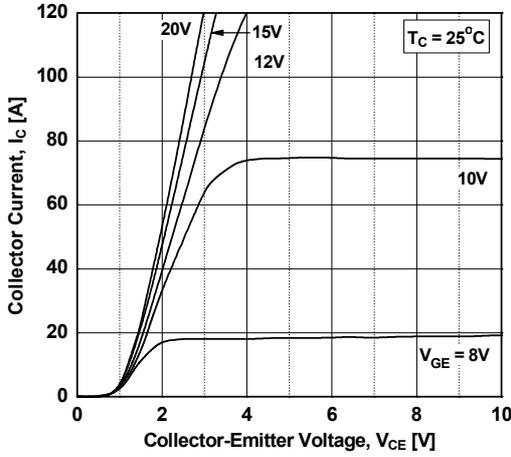


Figure 2. Typical Output Characteristics

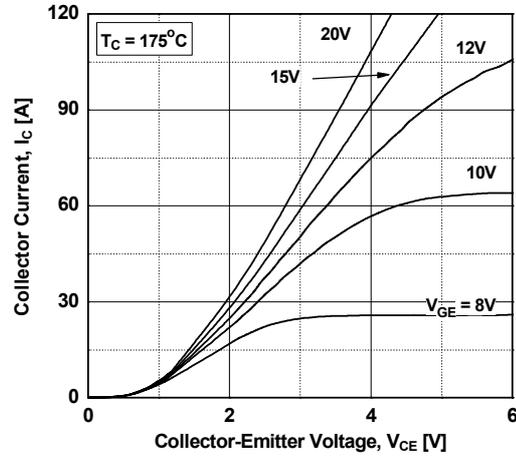


Figure 3. Typical Saturation Voltage Characteristics

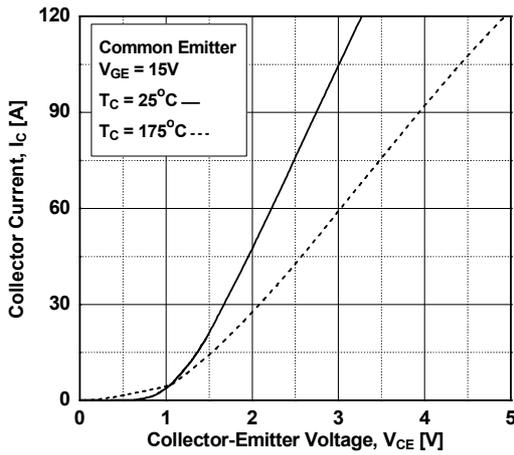


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

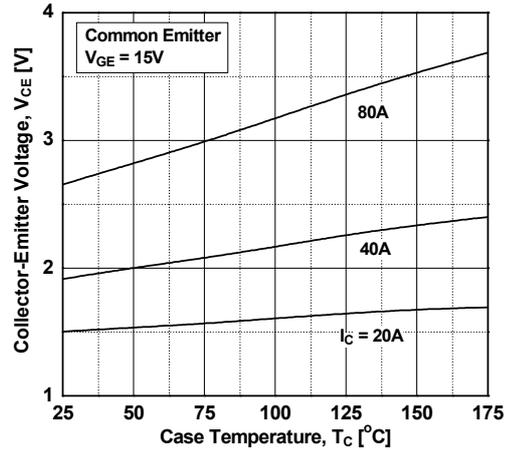


Figure 5. Saturation Voltage vs. Vge

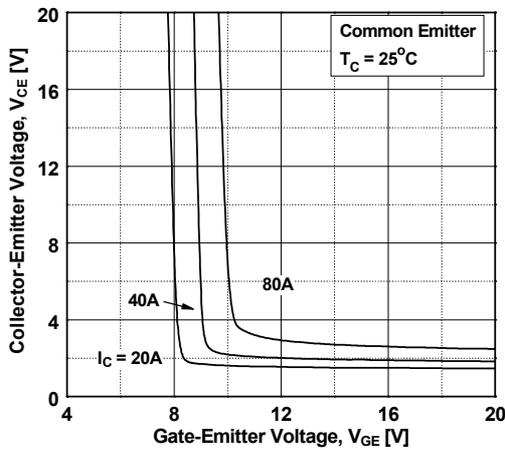
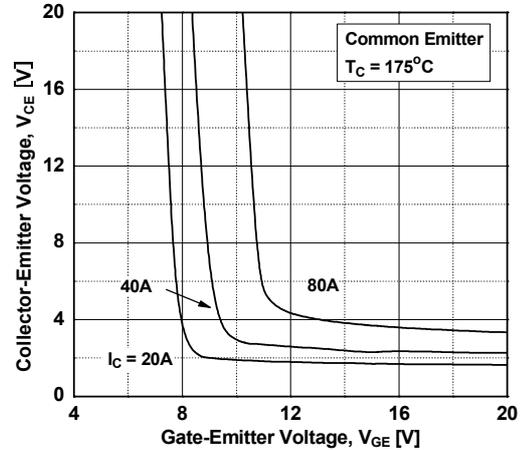


Figure 6. Saturation Voltage vs. Vge



Typical Performance Characteristics

Figure 7. Capacitance Characteristics

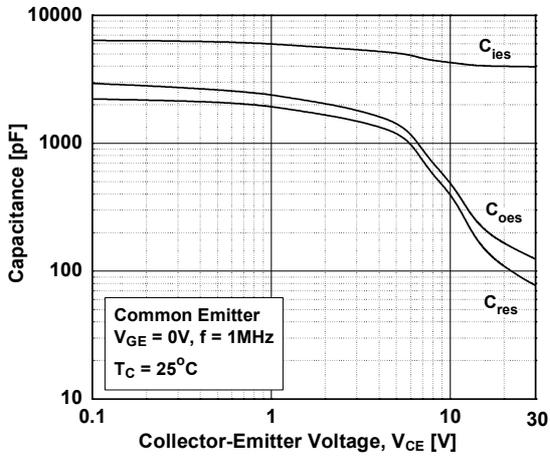


Figure 8. Gate charge Characteristics

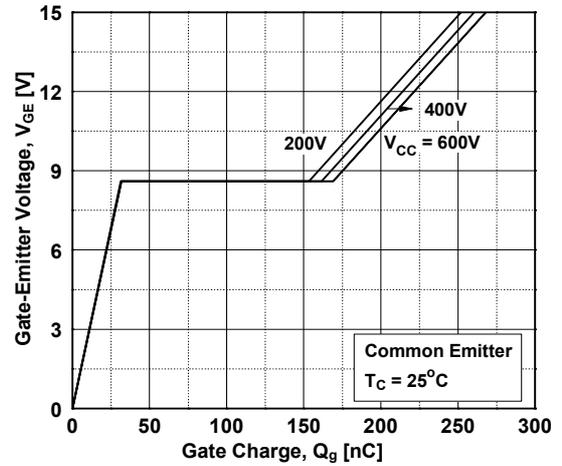


Figure 9. Turn-on Characteristics vs. Gate Resistance

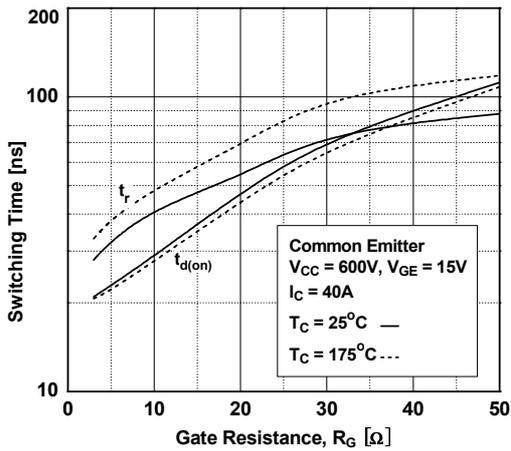


Figure 10. Turn-off Characteristics vs. Gate Resistance

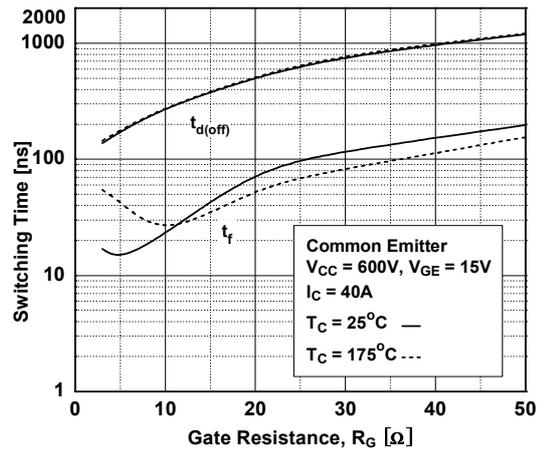


Figure 11. Switching Loss vs. Gate Resistance

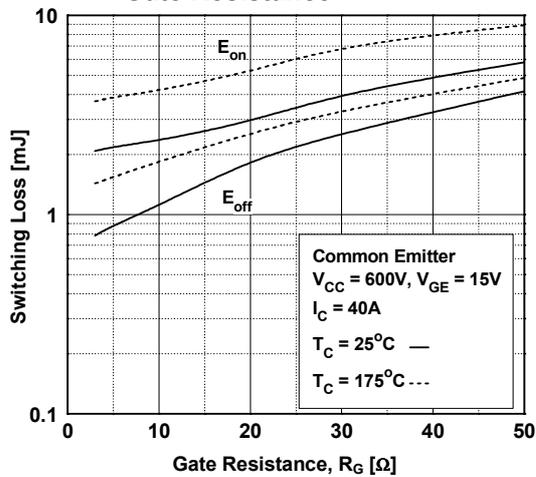
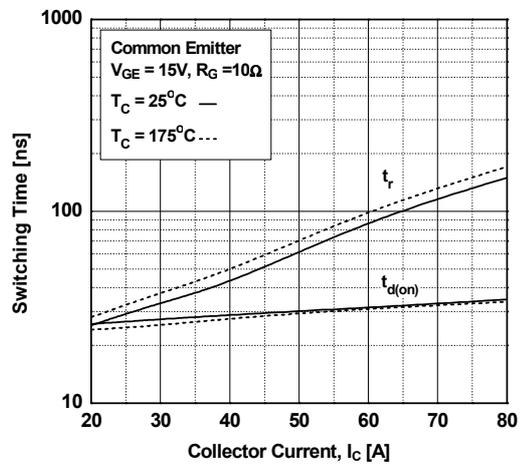


Figure 12. Turn-on Characteristics vs. Collector Current



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Collector Current

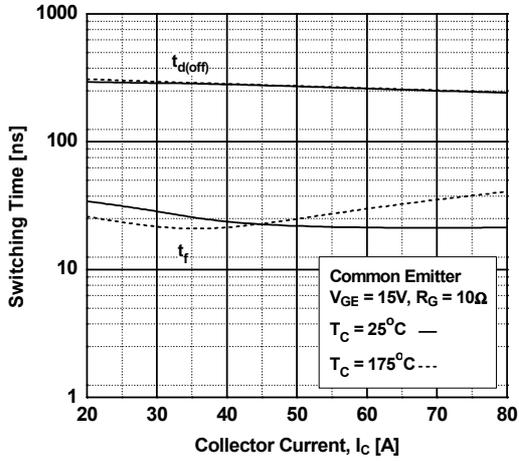


Figure 14. Switching Loss vs. Collector Current

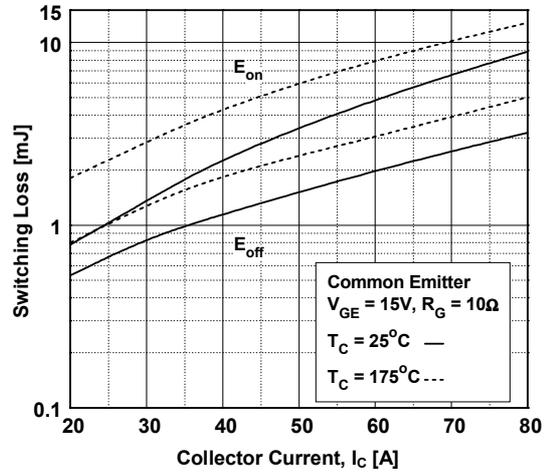


Figure 15. Load Current Vs. Frequency

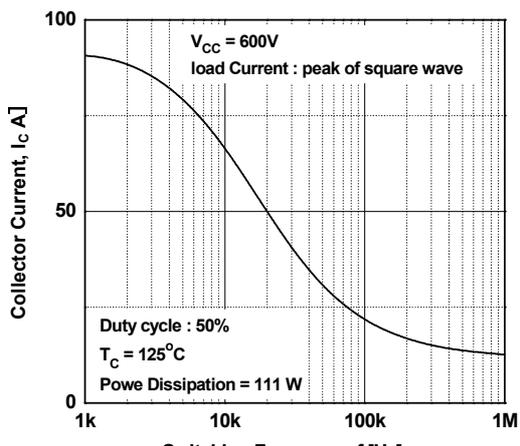


Figure 16. SOA Characteristics

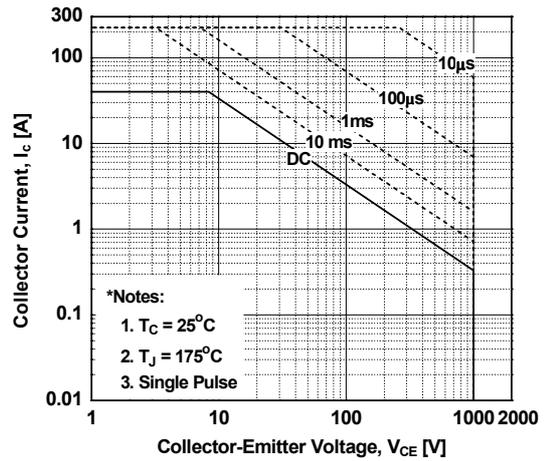


Figure 17. Forward Characteristics

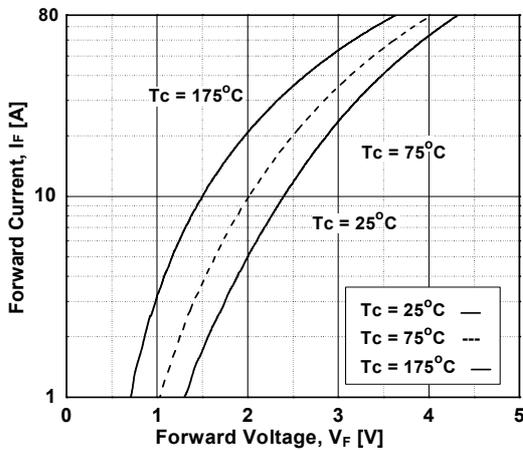
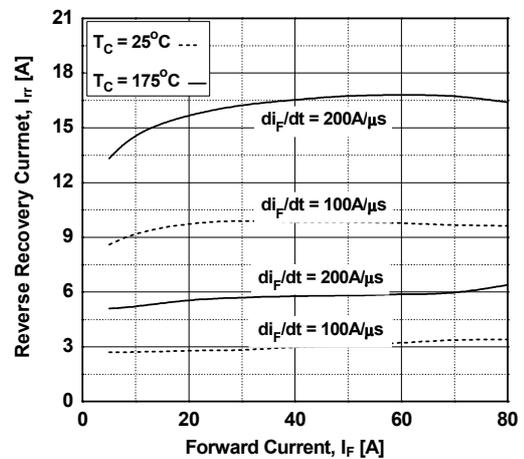


Figure 18. Reverse Recovery Current



Typical Performance Characteristics

Figure 19. Reverse Recovery Time

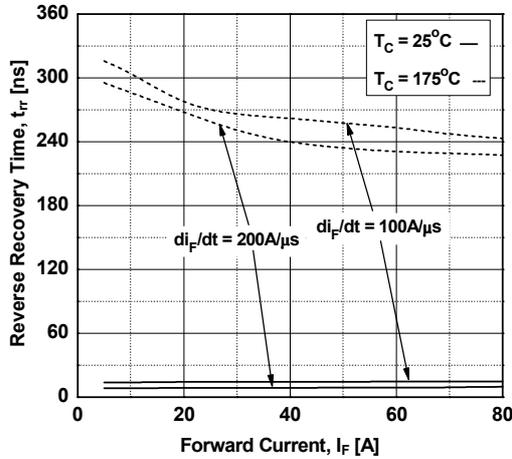


Figure 20. Stored Charge

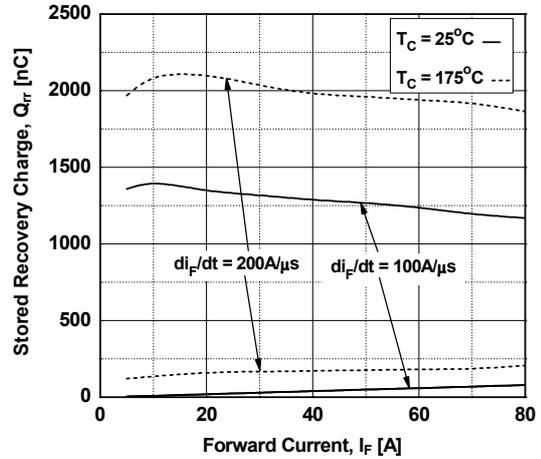


Figure 21. Transient Thermal Impedance of IGBT

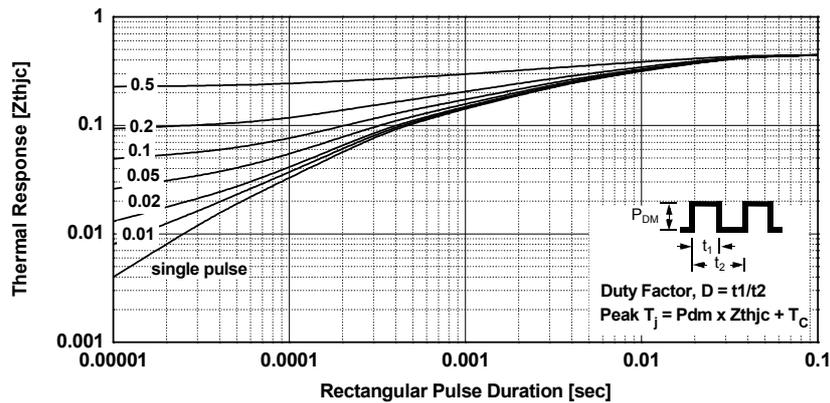
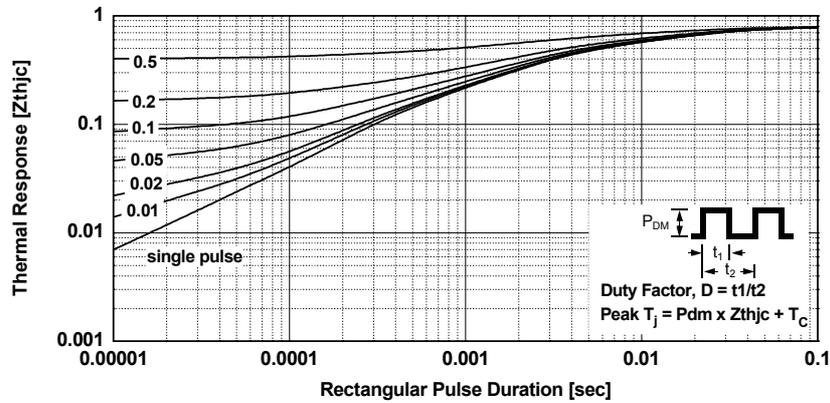
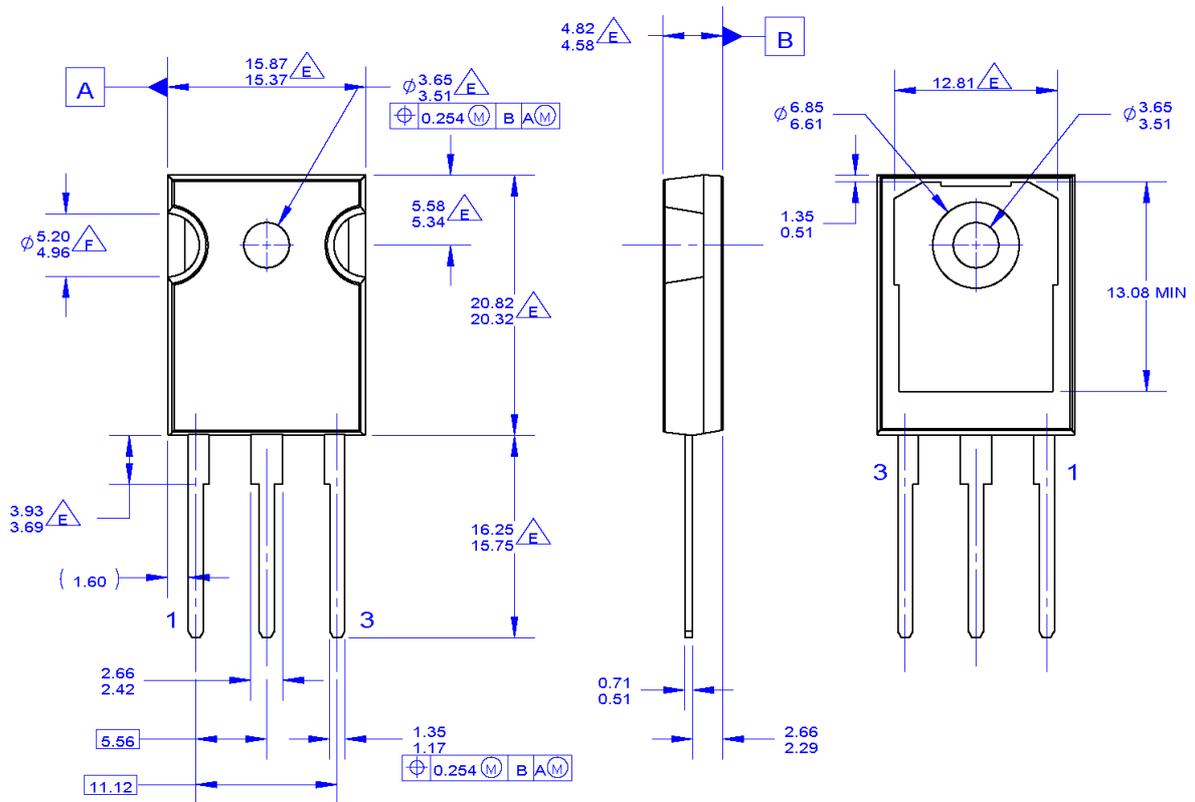


Figure 22. Transient Thermal Impedance of Diode



Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DRAWING CONFORMS TO ASME Y14.5 - 1994
- $\triangle E$ DOES NOT COMPLY JEDEC STANDARD VALUE
- $\triangle F$ NOTCH MAY BE SQUARE
- G. DRAWING FILENAME: MKT-TO247A03_REV03

Figure 23. TO-247, MOLDED, 3 LEAD, JEDEC VARIATION AB (Active)

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Dimensions in Millimeters

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