

FGH40T65SPD

650 V, 40 A Field Stop Trench IGBT

Features

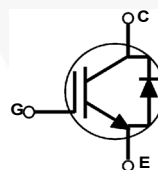
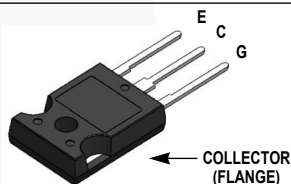
- Maximum Junction Temperature : $T_J = 175^{\circ}\text{C}$
- Positive Temperature Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)} = 1.85\text{ V (Typ.) @ } I_C = 40\text{ A}$
- High Input Impedance
- Fast Switching
- Tighten Parameter Distribution
- RoHS Compliant
- Short Circuit Ruggedness > 5 us @ 25°C

General Description

Using novel field stop IGBT technology, Fairchild's new series of field stop 3rd generation IGBTs offer the optimum performance for solar inverter, UPS, welder, telecom, ESS and PFC applications where low conduction and switching losses are essential.

Applications

- Solar Inverter UPS, Welder, PFC, Telecom, ESS



Absolute Maximum Ratings

Symbol	Description	FGH40T65SPD_F155	Unit
V_{CES}	Collector to Emitter Voltage	650	V
V_{GES}	Gate to Emitter Voltage	± 20	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}	Pulsed Collector Current	120	A
I_F	Diode Forward Current @ $T_C = 25^{\circ}\text{C}$	40	A
	Diode Forward Current @ $T_C = 100^{\circ}\text{C}$	20	A
I_{FM}	Pulsed Diode Maximum Forward Current	120	A
P_D	Maximum Power Dissipation @ $T_C = 25^{\circ}\text{C}$	267	W
	Maximum Power Dissipation @ $T_C = 100^{\circ}\text{C}$	134	W
SCWT	Short Circuit Withstand Time @ $T_C = 25^{\circ}\text{C}$	5	μs
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
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction to Case	-	0.56	$^{\circ}\text{C/W}$
$R_{\theta JC}(\text{Diode})$	Thermal Resistance, Junction to Case	-	1.71	$^{\circ}\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	$^{\circ}\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Qty per Tube
FGH40T65SPD	FGH40T65SPD_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 V, I _C = 1 mA	650	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	V _{GE} = 0 V, I _C = 1 mA	-	0.6	-	V/°C
I _{CES}	Collector Cut-Off Current	V _{CE} = V _{CES} , V _{GE} = 0 V	-	-	250	μA
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	5.5	7.5	V
V _{CE(sat)}	Collector to Emitter Saturation Voltage	I _C = 40 A, V _{GE} = 15 V	-	1.85	2.4	V
		I _C = 40 A, V _{GE} = 15 V, T _C = 175°C	-	2.51	-	V
Dynamic Characteristics						
C _{ies}	Input Capacitance	V _{CE} = 30 V, V _{GE} = 0 V, f = 1 MHz	-	1370	-	pF
C _{oes}	Output Capacitance		-	94	-	pF
C _{res}	Reverse Transfer Capacitance		-	16	-	pF
Switching Characteristics						
T _{d(on)}	Turn-On Delay Time	V _{CC} = 400 V, I _C = 40 A, R _G = 6 Ω, V _{GE} = 15 V, Inductive Load, T _C = 25°C	-	16	-	ns
T _r	Rise Time		-	42	-	ns
T _{d(off)}	Turn-Off Delay Time		-	37	-	ns
T _f	Fall Time		-	11	-	ns
E _{on}	Turn-On Switching Loss		-	1.16	-	mJ
E _{off}	Turn-Off Switching Loss		-	0.28	-	mJ
E _{ts}	Total Switching Loss		-	1.44	-	mJ
T _{d(on)}	Turn-On Delay Time	V _{CC} = 400 V, I _C = 40 A, R _G = 6 Ω, V _{GE} = 15 V, Inductive Load, T _C = 175°C	-	14	-	ns
T _r	Rise Time		-	49	-	ns
T _{d(off)}	Turn-Off Delay Time		-	38	-	ns
T _f	Fall Time		-	18	-	ns
E _{on}	Turn-On Switching Loss		-	1.54	-	mJ
E _{off}	Turn-Off Switching Loss		-	0.52	-	mJ
E _{ts}	Total Switching Loss		-	2.06	-	mJ
T _{SC}	Short Circuit Withstand Time	V _{CC} = 400 V, V _{GE} = 15 V, R _G = 10 Ω	5	-	-	μs

Electrical Characteristics of the IGBT (Continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Q_g	Total Gate Charge	$V_{CE} = 400\text{ V}$, $I_C = 40\text{ A}$, $V_{GE} = 15\text{ V}$	-	35	-	nC
Q_{ge}	Gate to Emitter Charge		-	11	-	nC
Q_{gc}	Gate to Collector Charge		-	12	-	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 = 20 A	T _C = 25°C	-	2.2	2.7	V
			T _C = 175°C	-	1.9	-	
E _{rec}	Reverse Recovery Energy	I _F = 20 A, dI _F /dt = 200 A/μs	T _C = 175°C	-	76	-	μJ
T _{rr}	Diode Reverse Recovery Time		T _C = 25°C	-	34	-	ns
			T _C = 175°C	-	196	-	
Q _{rr}	Diode Reverse Recovery Charge		T _C = 25°C	-	52	-	nC
			T _C = 175°C	-	638	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

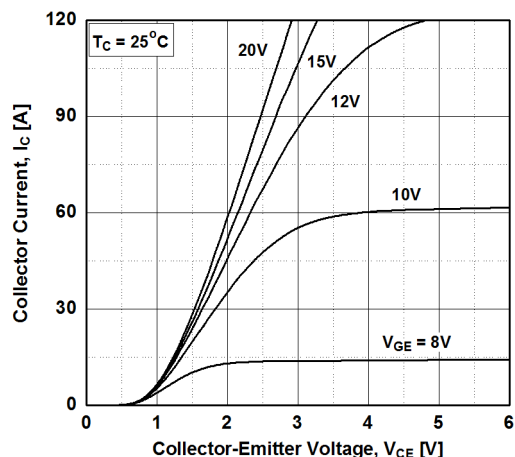


Figure 2. Typical Output Characteristics

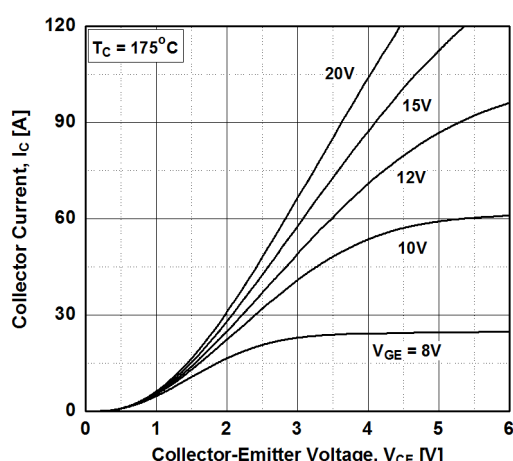


Figure 3. Typical Saturation Voltage Characteristics

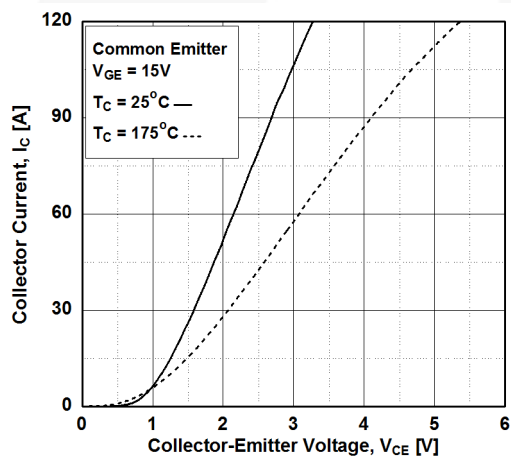


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

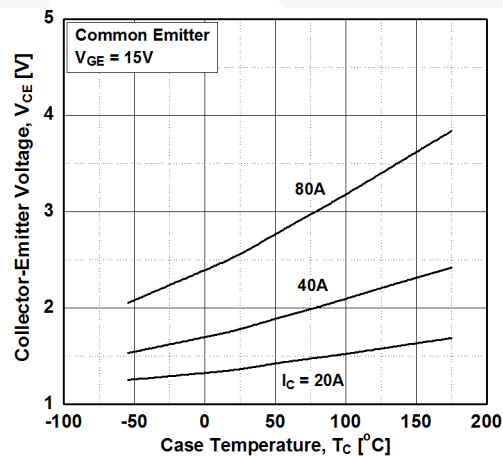


Figure 5. Saturation Voltage vs. V_{GE}

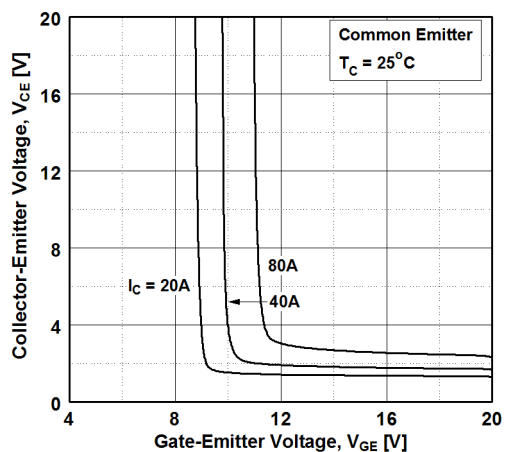
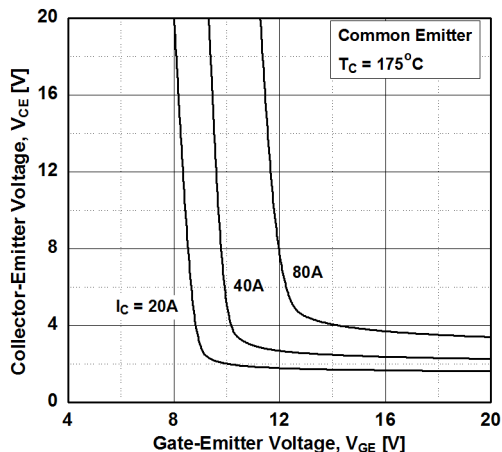


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Capacitance Characteristics

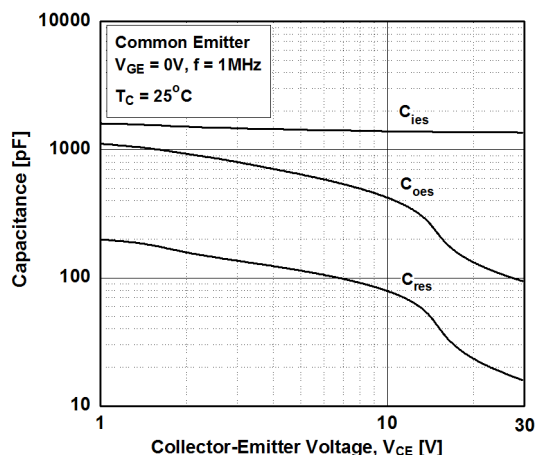


Figure 8. Gate charge Characteristics

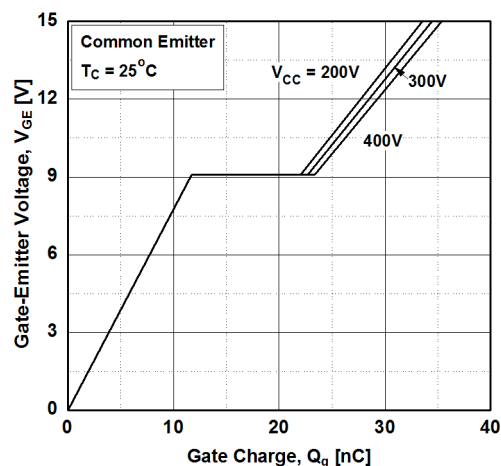


Figure 9. Turn-on Characteristics vs. Gate Resistance

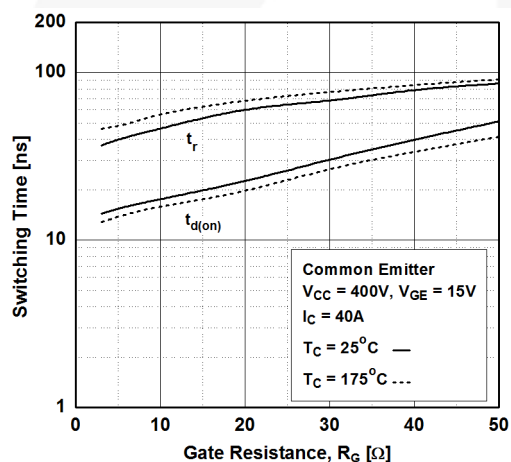


Figure 10. Turn-off Characteristics vs. Gate Resistance

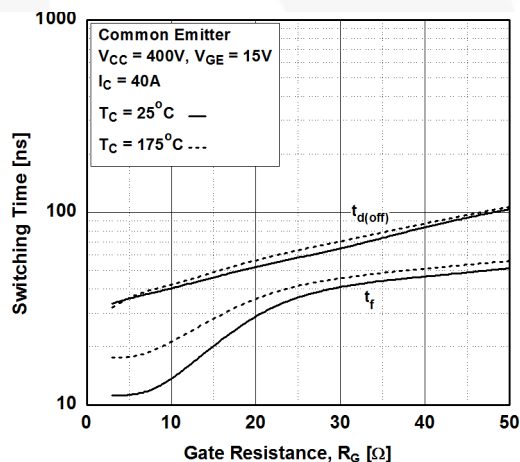


Figure 11. Switching Loss vs. Gate Resistance

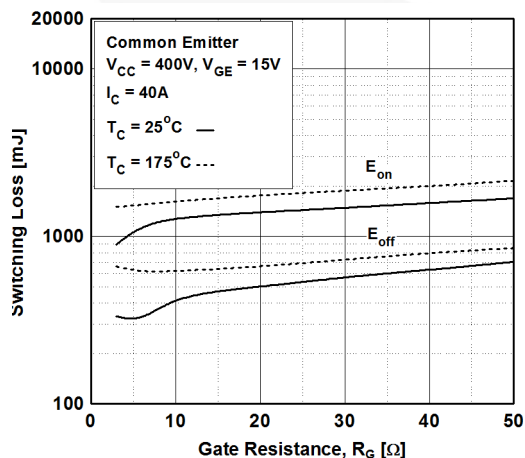
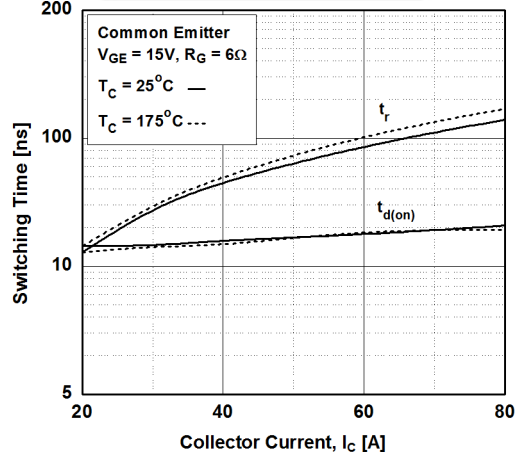


Figure 12. Turn-on Characteristics vs. Collector Current



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Collector Current

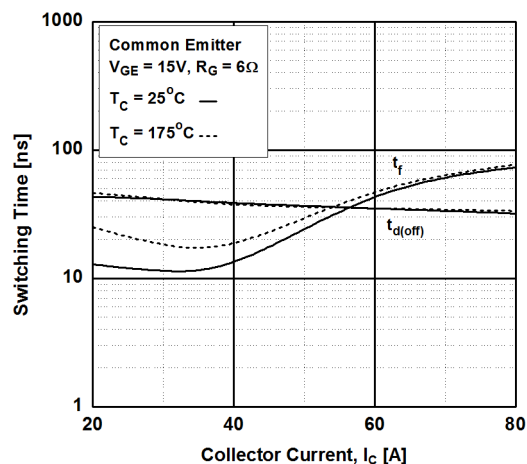


Figure 14. Switching Loss vs. Collector Current

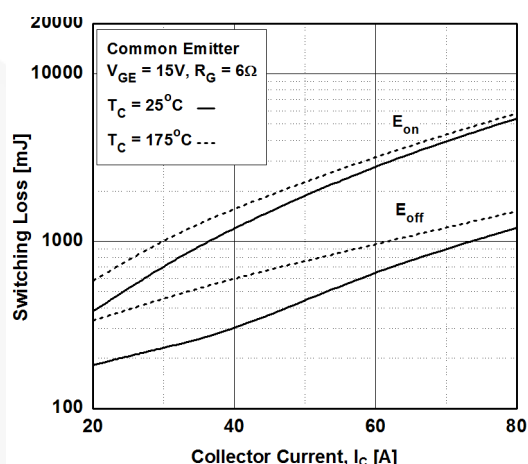


Figure 15. Load Current Vs. Frequency

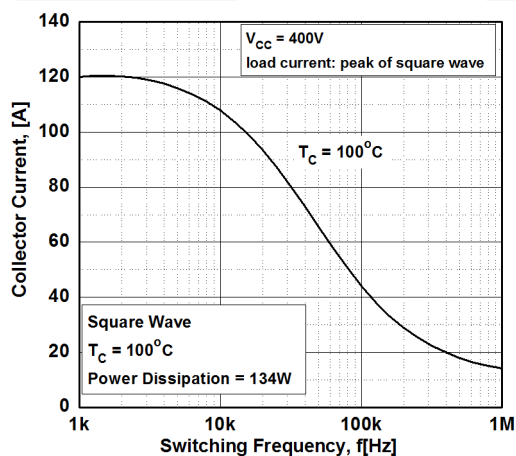


Figure 16. SOA Characteristics

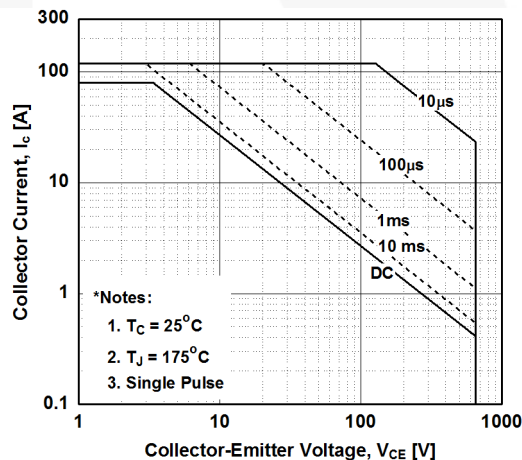


Figure 17. Forward Characteristics

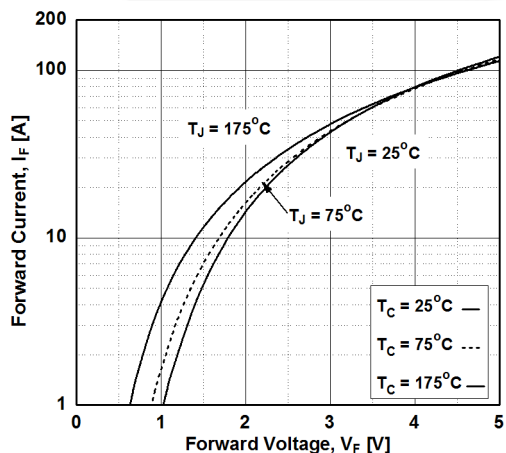
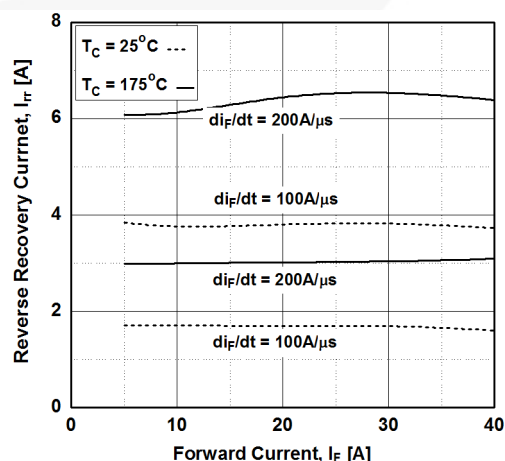


Figure 18. Reverse Recovery Current



Typical Performance Characteristics

Figure 19. Reverse Recovery Time

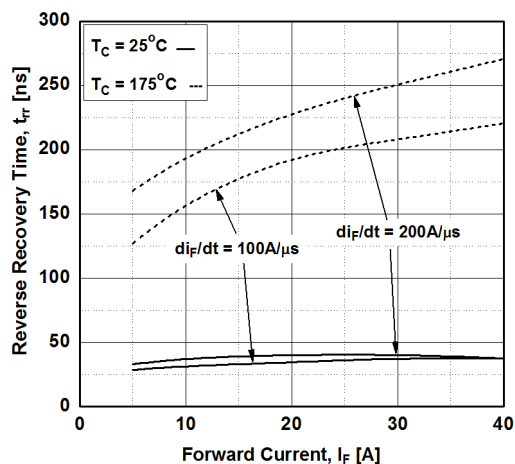


Figure 20. Stored Charge

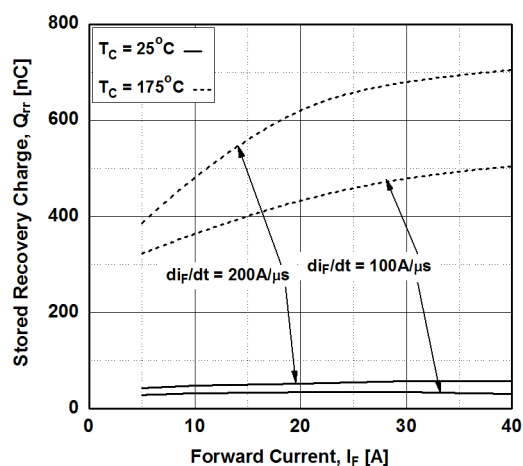


Figure 21. Transient Thermal Impedance of IGBT

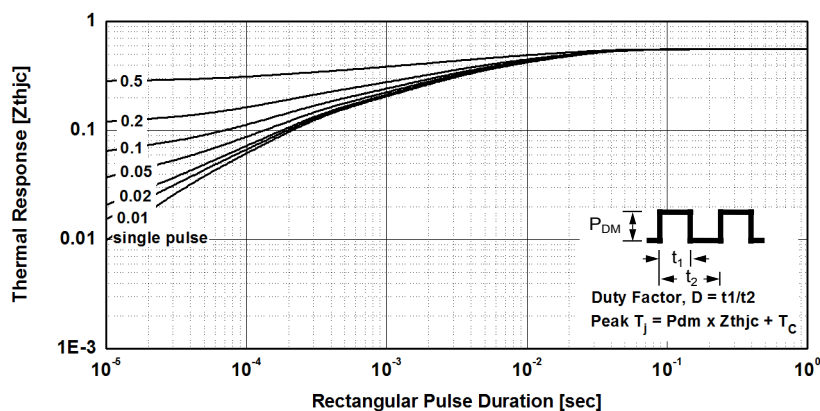
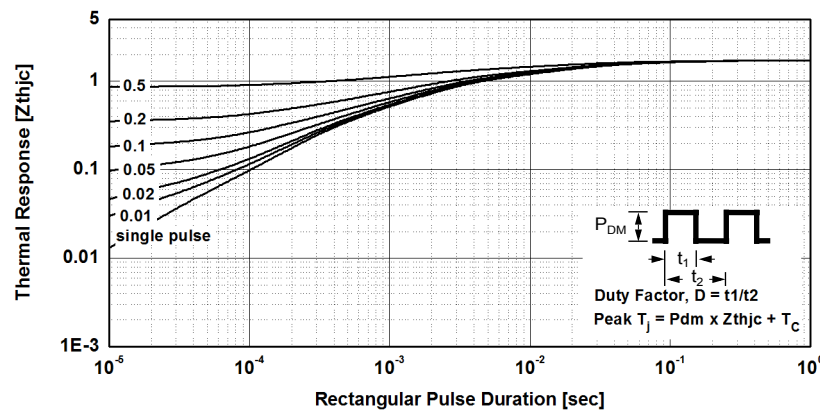
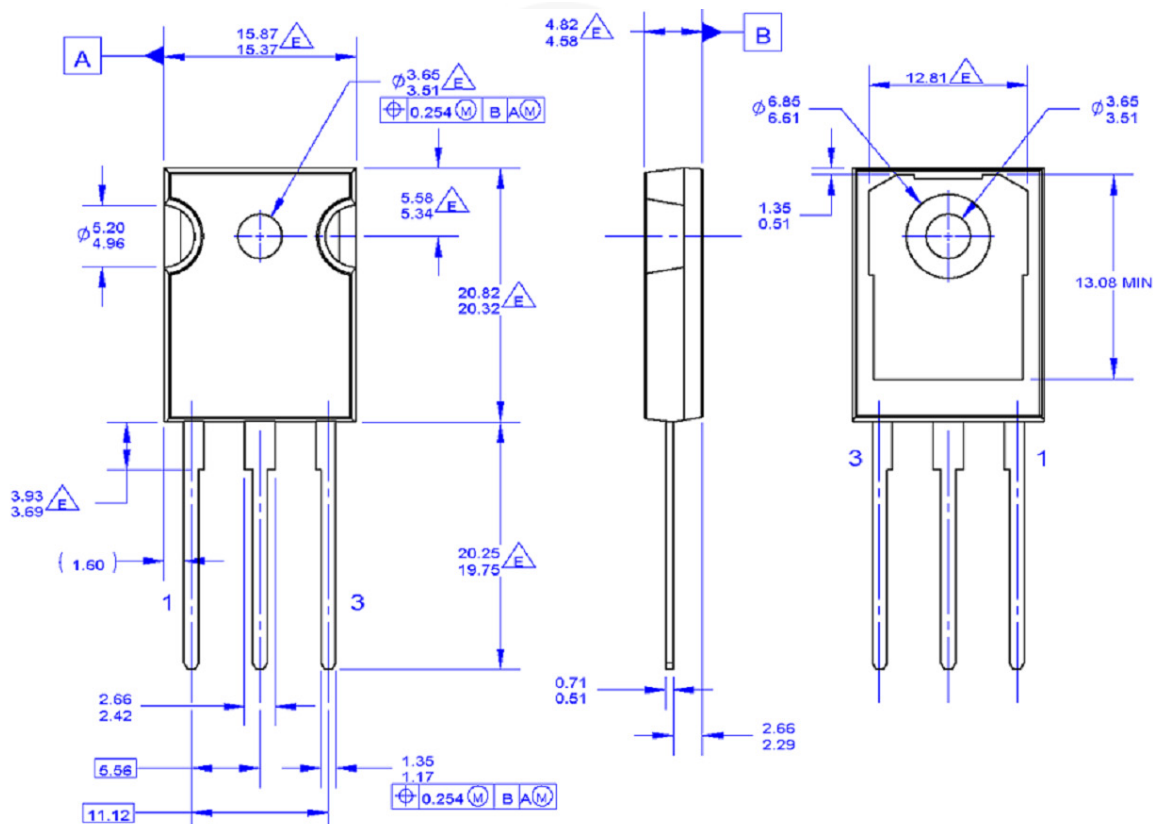


Figure 22. Transient Thermal Impedance of Diode



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

E. DOES NOT COMPLY JEDEC STANDARD VALUE
F. DRAWING FILENAME: MKT-TO247G03_REV01

Figure 23. TO-247 3L - TO-247, MOLDED, 3 LEADS, JEDEC AB LONG LEADS

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Datasheet Identification	Product Status	Definition
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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
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