April 2013

FGB40N60SM

600 V, 40 A Field Stop IGBT

Features

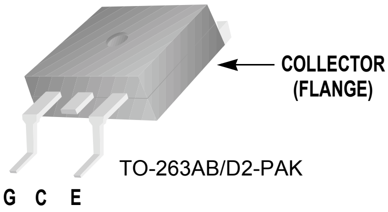
- Maximum Junction Temperature : T_J = 175°C
- Positive Temperaure Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: VCE(sat) = 1.9 V(Typ.) @ IC = 40 A
- High Input Impedance
- Fast Switching: E_{OFF} = 6.5 uJ/A
- Tighten Parameter Distribution
- RoHS Compliant
- IR Reflow Only

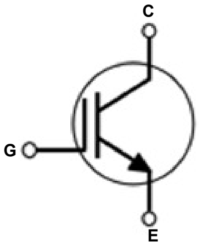
Applications

- Welder, PFC

General Description

Using novel field stop IGBT technology, Fairchild®'s new series of Field Stop 2_{nd} generation IGBTs offer the optimum performance for welder and PFC applications where low conduction and switching losses are essential. ®





Absolute Maximum Ratings

Symbol	Description	Ratings	Unit
V_{CES}	Collector to Emitter Voltage	600	V
V_{GES}	Gate to Emitter Voltage	± 20	V
I_C	Collector Current @ T_C = 25°C	80	A
	Collector Current @ T_C = 100°C	40	A
$I_{CM\ (1)}$	Pulsed Collector Current	120	A
P_D	Maximum Power Dissipation @ T_C = 25°C	349	W
	Maximum Power Dissipation @ T_C = 100°C	174	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

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	-	0.43	^{o}C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	62.5	^{o}C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGB40N60SM	FGB40N60SM	TO-263AB/D2-PAK	-	-	50

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} = 0V, I_C = 250μA	600	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	V_{GE} = 0V, I_C = 250μA	-	0.6	-	V/^{o}C
I_{CES}	Collector Cut-Off Current	V_{CE} = V_{CES}, V_{GE} = 0V	-	-	250	μA
I_{GES}	G-E Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0V	-	-	±400	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	I_C = 250μA, V_{CE} = V_{GE}	3.5	4.5	6.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 40A, V_{GE} = 15V	-	1.9	2.3	V
		I_C = 40A, V_{GE} = 15V, T_C = 175^{o}C	-	2.1	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	-	1880	-	pF
C_{oes}	Output Capacitance		-	180	-	pF
C_{res}	Reverse Transfer Capacitance		-	50	-	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 400V, I_C = 40A, R_G = 6Ω, V_{GE} = 15V, Inductive Load, T_C = 25^{o}C	-	12	16	ns
t_r	Rise Time		-	20	28	ns
$t_{d(off)}$	Turn-Off Delay Time		-	92	120	ns
t_f	Fall Time		-	13	17	ns
E_{on}	Turn-On Switching Loss		-	0.87	1.30	mJ
E_{off}	Turn-Off Switching Loss		-	0.26	0.34	mJ
E_{ts}	Total Switching Loss		-	1.13	1.64	mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 400V, I_C = 40A, R_G = 6Ω, V_{GE} = 15V, Inductive Load, T_C = 175^{o}C	-	15	-	ns
t_r	Rise Time		-	22	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	116	-	ns
t_f	Fall Time		-	16	-	ns
E_{on}	Turn-On Switching Loss		-	0.97	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.60	-	mJ
E_{ts}	Total Switching Loss		-	1.57	-	mJ

Electrical Characteristics of the IGBT (Continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit
Q_g	Total Gate Charge	V_{CE} = 400V, I_C = 40A, V_{GE} = 15V	-	119	180	nC
Q_{ge}	Gate to Emitter Charge		-	13	20	nC
Q_{gc}	Gate to Collector Charge		-	58	90	nC

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

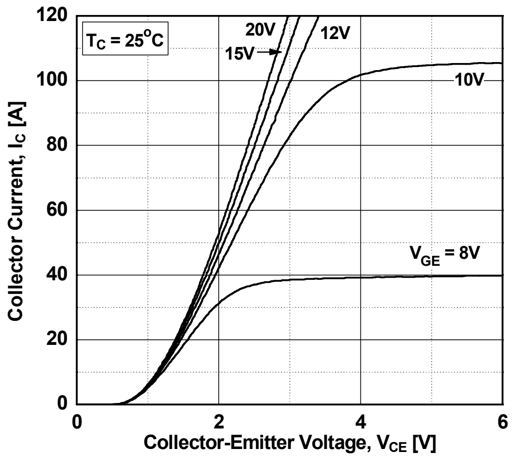


Figure 2. Typical Output Characteristics

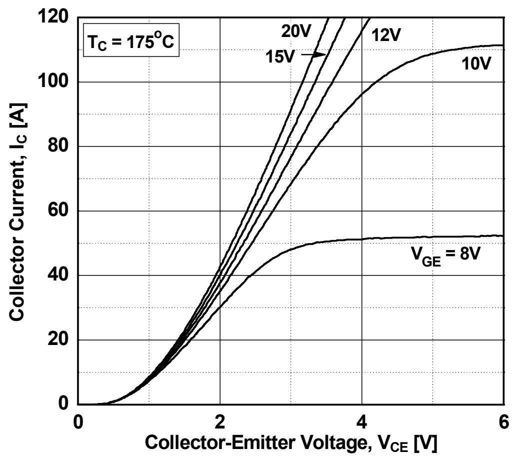


Figure 3. Typical Saturation Voltage Characteristics

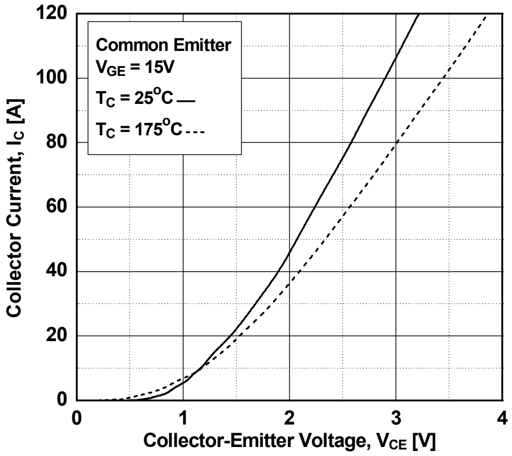


Figure 4. Transfer Characteristics

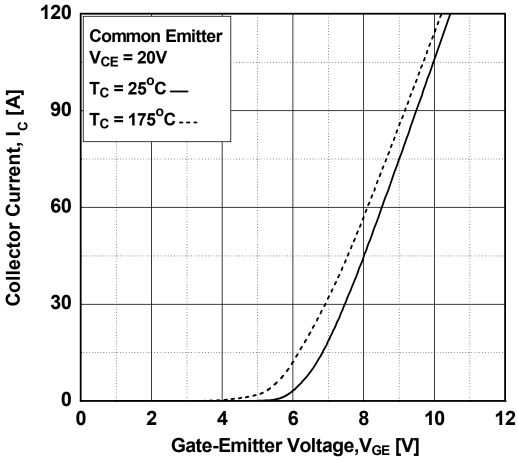


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

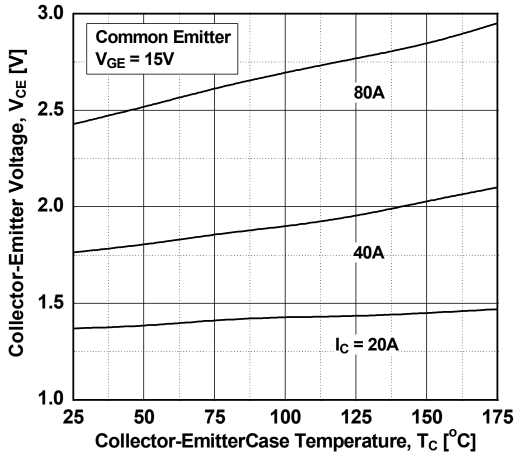
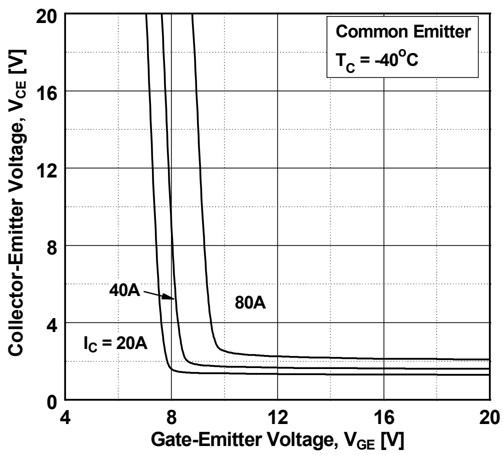


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

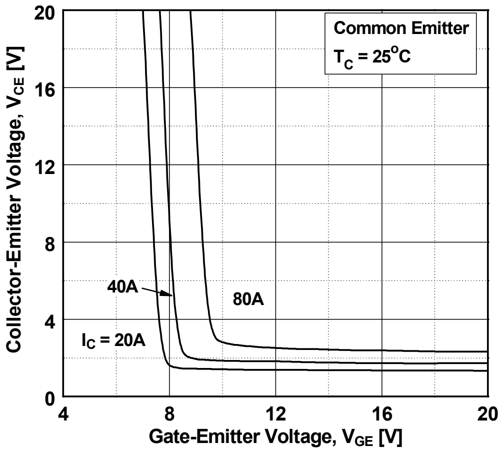


Figure 8. Saturation Voltage vs. V_{GE}

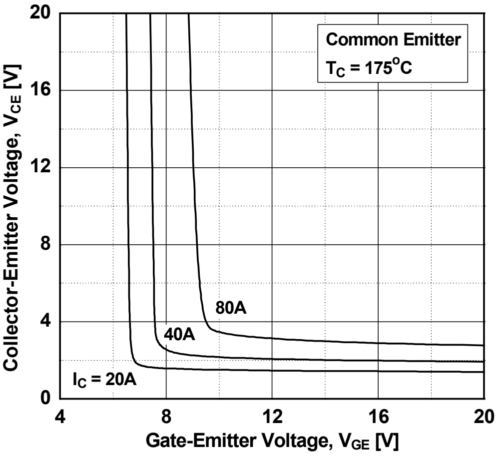


Figure 9. Capacitance Characteristics

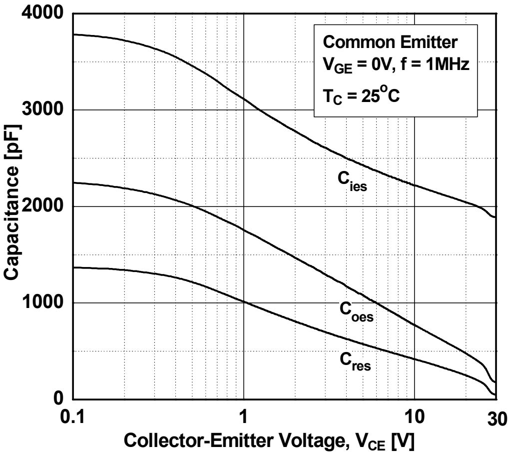


Figure 10. Gate charge Characteristics

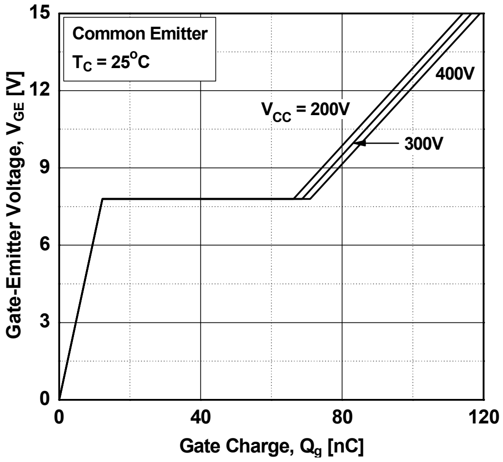


Figure 11. SOA Characteristics

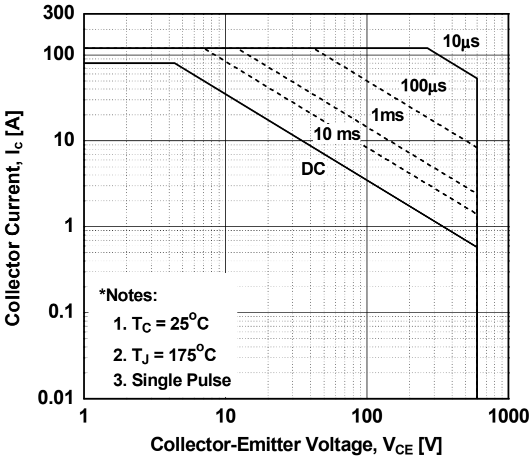
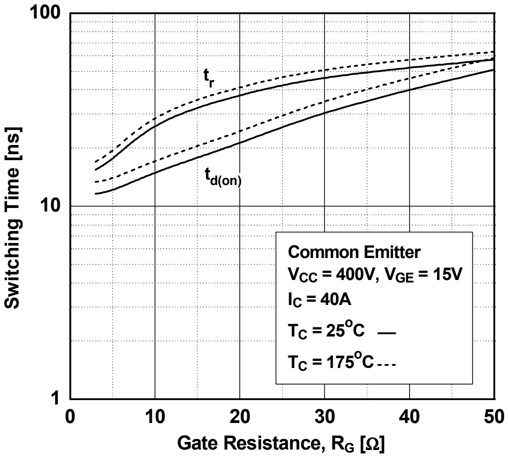


Figure 12. Turn-on Characteristics vs. Gate Resistance



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Gate Resistance

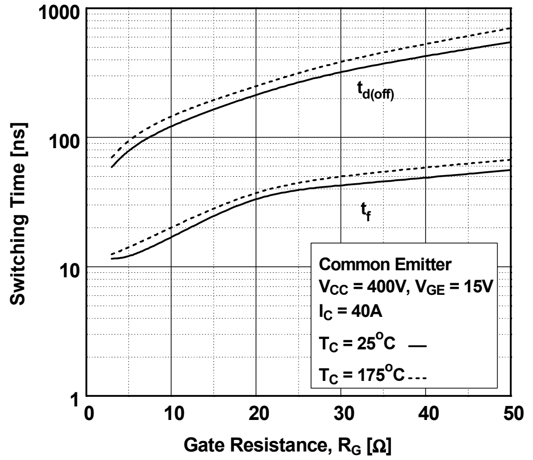


Figure 14. Turn-on Characteristics vs. Collector Current

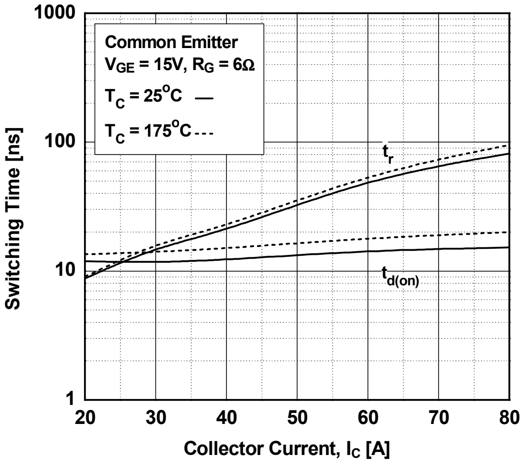


Figure 15. Turn-off Characteristics vs. Collector Current

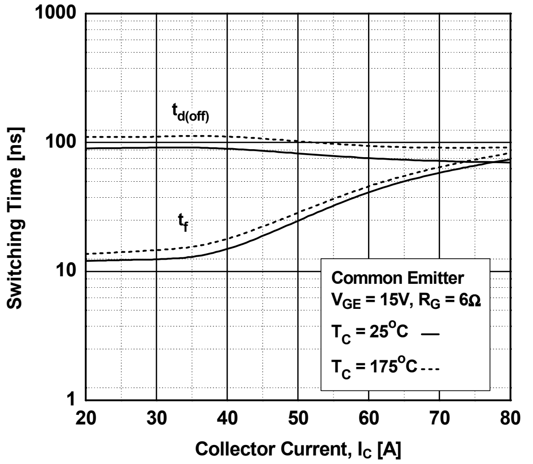


Figure 16. Switching Loss vs. Gate Resistance

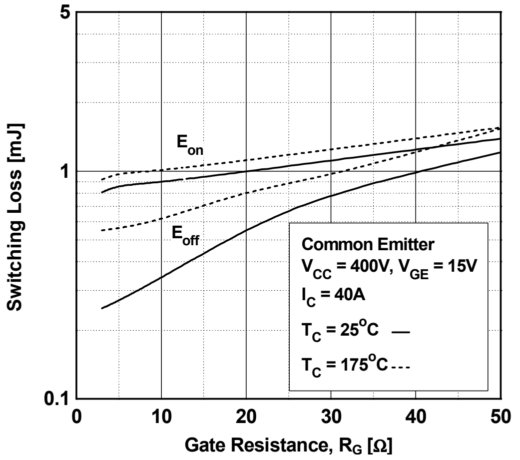


Figure 17. Switching Loss vs. Collector Current

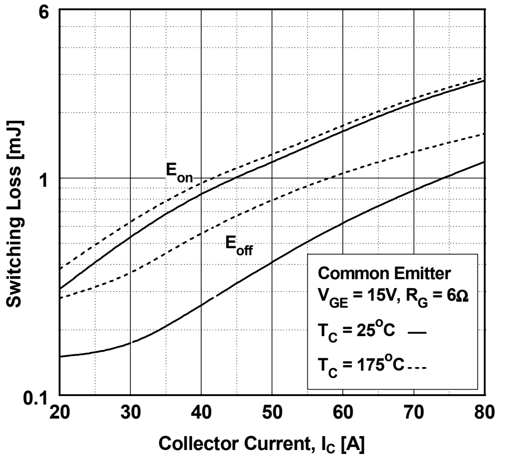
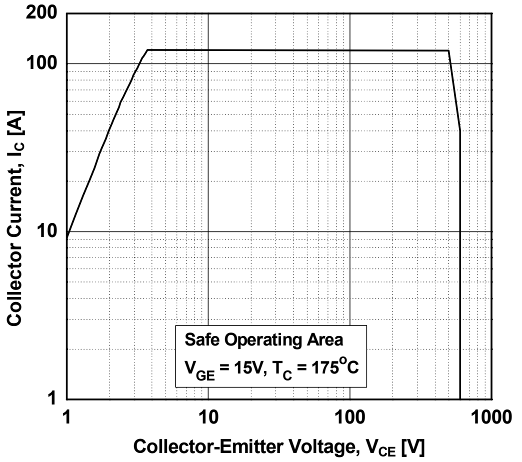


Figure 18. Turn off Switching SOA Characteristics



Typical Performance Characteristics

Figure 19. Current Derating

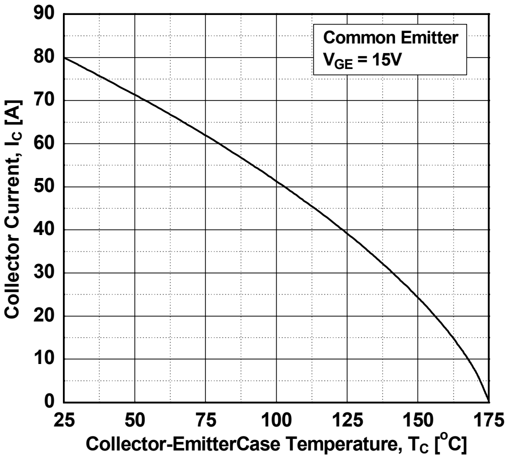


Figure 20. Load Current Vs. Frequency

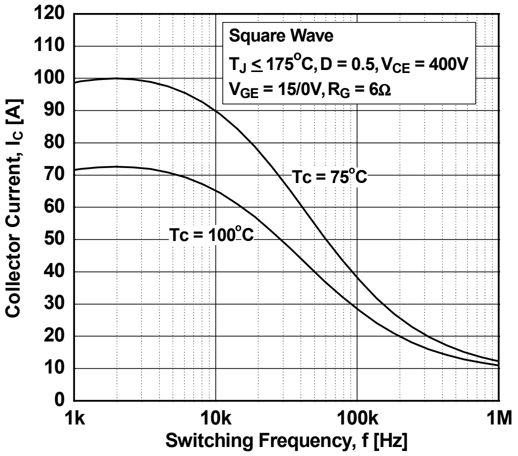
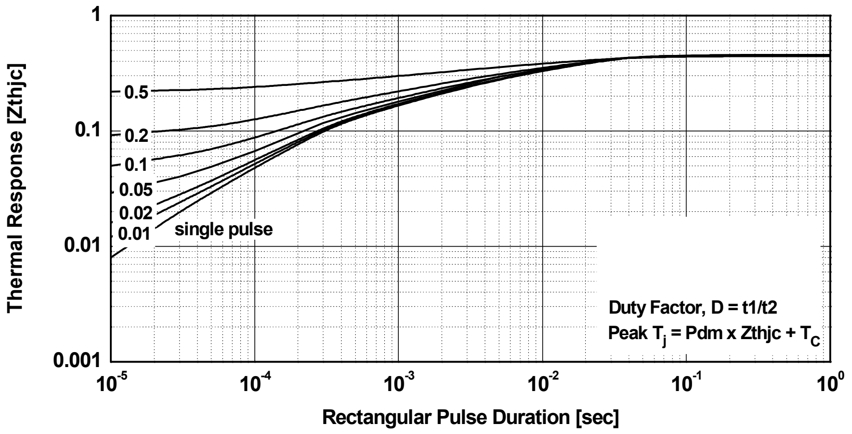
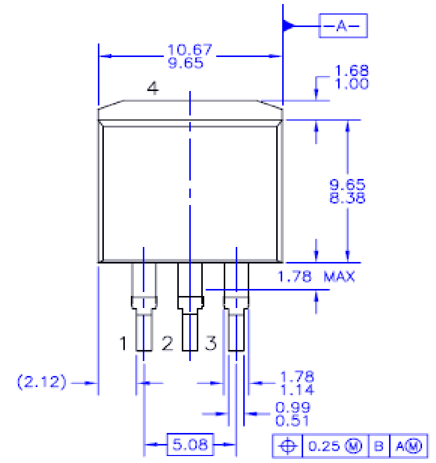


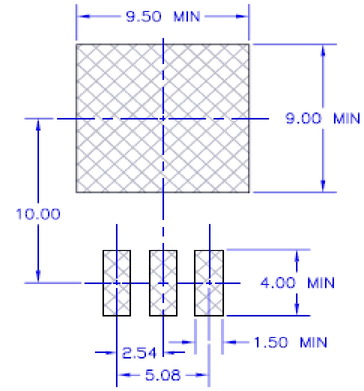
Figure 21.Transient Thermal Impedance of IGBT



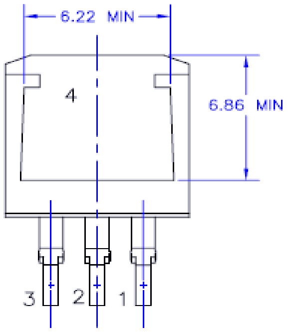
Mechanical Dimensions

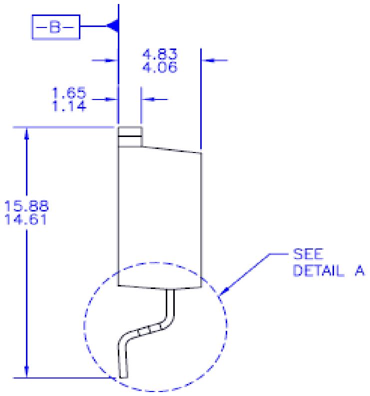
D^2PAK





LAND PATTERN RECOMMENDATION





NOTES: UNLESS OTHERWISE SPECIFIED

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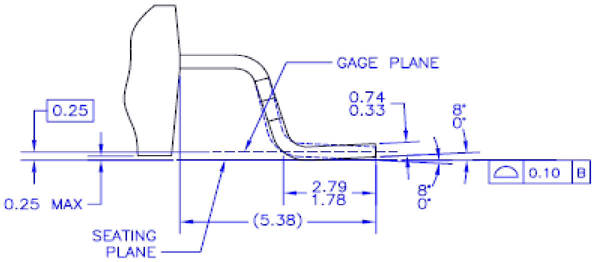
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMNSIONS ARE EXLCUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D) DIMENSIONS AND TOLERANCES PER ASME Y14.5M – 1994.
- E) LOCATION OF THE PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE).
- F) DRAWING FILENAME: TO263B03REV2



DETAIL A, ROTATED 90°
SCALE: 10X

Dimensions in Millimeters

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Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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