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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.

FAIRCHILD™

FGH40N65UFD
650 V, 40 A Field Stop IGBT

Features

- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.8 V @ I_C = 40 A
- High Input Impedance
- Fast Switching
- RoHS Compliant

Applications

- Solar Inverter, UPS, Welder, PFC

General Description

Using novel field stop IGBT technology, Fairchild's field stop IGBTs offer the optimum performance for solar inverter, UPS, welder and PFC applications where low conduction and switching losses are essential.

COLLECTOR (FLANGE)
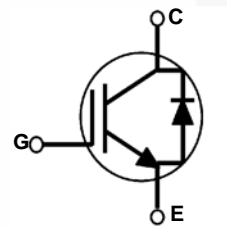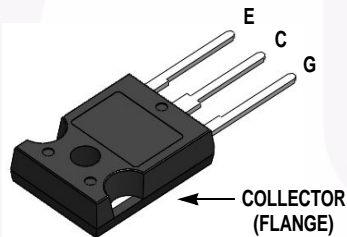
Absolute Maximum Ratings

Symbol	Description		Ratings	Unit
V_{CES}	Collector to Emitter Voltage		650	V
V_{GES}	Gate to Emitter Voltage		±20	V
	Transient Gate-to-Emitter Voltage		±30	
I_C	Collector Current	@ T_C = 25°C	80	A
	Collector Current	@ T_C = 100°C	40	A
$I_{CM (1)}$	Pulsed Collector Current	@ T_C = 25°C	120	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	290	W
	Maximum Power Dissipation	@ T_C = 100°C	116	W
T_J	Operating Junction Temperature		-55 to +150	^{o}C
T_{stg}	Storage Temperature Range		-55 to +150	^{o}C
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds		300	^{o}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
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case	-	1.45	^{o}C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	^{o}C/W

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGH40N65UFDTU	FGH40N65UFD	TO-247	Tube	N/A	N/A	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, $I_C = 250$ µA	650	-	-	V
$\Delta BV_{CES} / \Delta T_J$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0$ V, $I_C = 250$ µA	-	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	$I_C = 250$ µA, $V_{CE} = V_{GE}$	4.0	5.0	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 40$ A, $V_{GE} = 15$ V	-	1.8	2.4	V
		$I_C = 40$ A, $V_{GE} = 15$ V, $T_C = 125°C$	-	2.0	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE} = 30$ V, $V_{GE} = 0$ V, f = 1 MHz	-	2110	-	pF
C_{oes}	Output Capacitance		-	200	-	pF
C_{res}	Reverse Transfer Capacitance		-	60	-	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400$ V, $I_C = 40$ A, $R_G = 10$ Ω, $V_{GE} = 15$ V, Inductive Load, $T_C = 25°C$	-	24	-	ns
t_r	Rise Time		-	44	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	112	-	ns
t_f	Fall Time		-	30	60	ns
E_{on}	Turn-On Switching Loss		-	1.19	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.46	-	mJ
E_{ts}	Total Switching Loss		-	1.65	-	mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400$ V, $I_C = 40$ A, $R_G = 10$ Ω, $V_{GE} = 15$ V, Inductive Load, $T_C = 125°C$	-	24	-	ns
t_r	Rise Time		-	45	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	120	-	ns
t_f	Fall Time		-	40	-	ns
E_{on}	Turn-On Switching Loss		-	1.2	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.69	-	mJ
E_{ts}	Total Switching Loss		-	1.89	-	mJ
Q_g	Total Gate Charge	$V_{CE} = 400$ V, $I_C = 40$ A, $V_{GE} = 15$ V	-	120	-	nC
Q_{ge}	Gate to Emitter Charge		-	14	-	nC
Q_{gc}	Gate to Collector Charge		-	58	-	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	$I_F = 20$ A	$T_C = 25°C$	-	1.95	2.6	V
			$T_C = 125°C$	-	1.85	-	
t_{rr}	Diode Reverse Recovery Time	$I_F = 20$ A, $di_F/dt = 200$ A/μs	$T_C = 25°C$	-	45	-	ns
			$T_C = 125°C$	-	140	-	
Q_{rr}	Diode Reverse Recovery Charge		$T_C = 25°C$	-	75	-	nC
			$T_C = 125°C$	-	375	-	

FGH40N65UFD — 650 V, 40 A Field Stop IGBT

Typical Performance Characteristics

Figure 1. Typical Output Characteristics
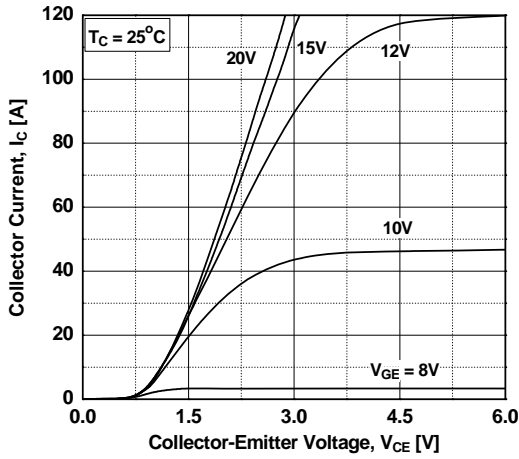
Figure 2. Typical Output Characteristics
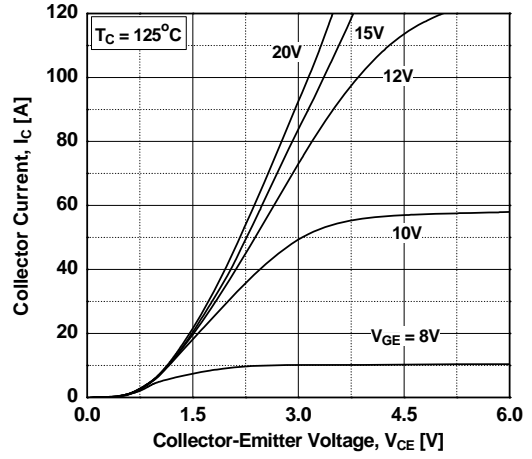
Figure 3. Typical Saturation Voltage Characteristics
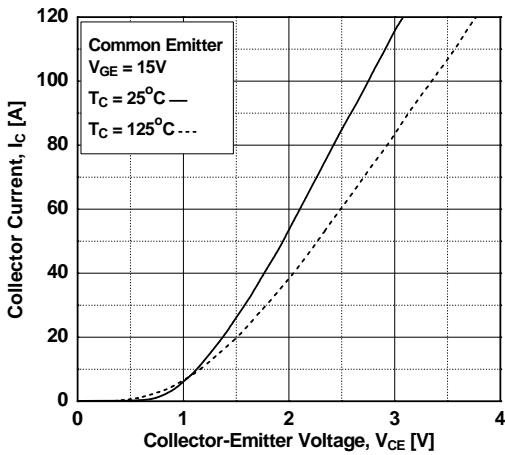
Figure 4. Transfer Characteristics
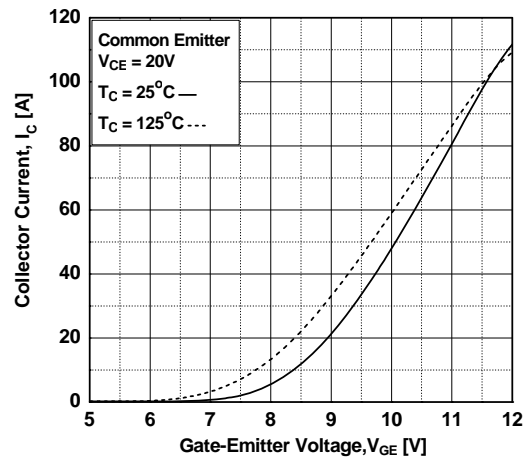
Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level
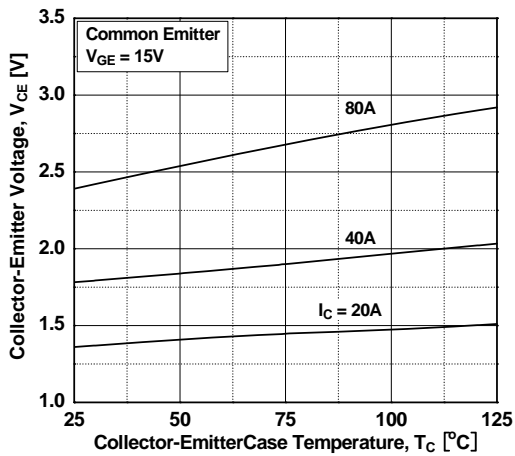
Figure 6. Saturation Voltage vs. V_{GE}
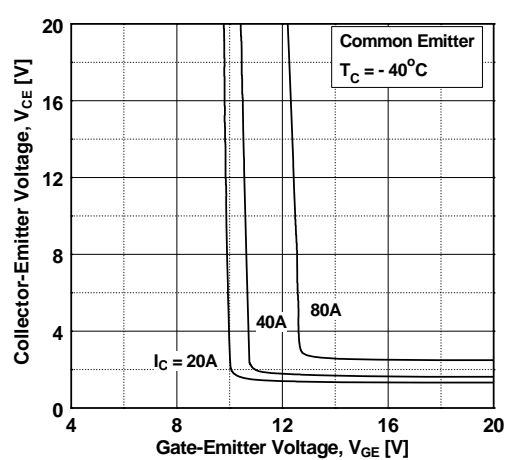
Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}
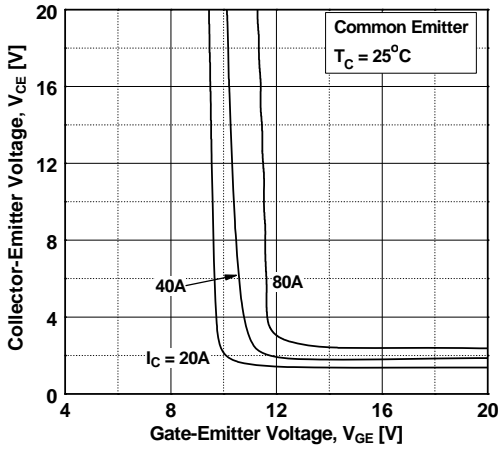
Figure 8. Saturation Voltage vs. V_{GE}
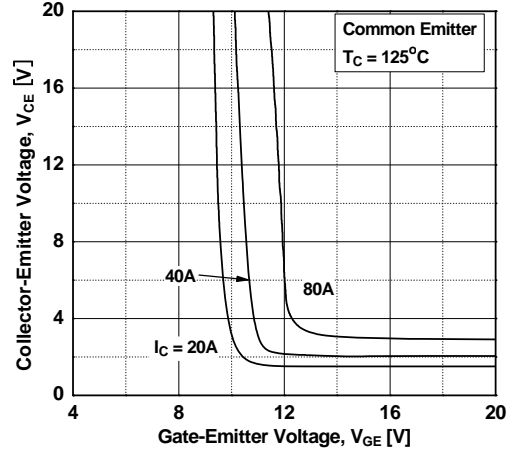
Figure 9. Capacitance Characteristics
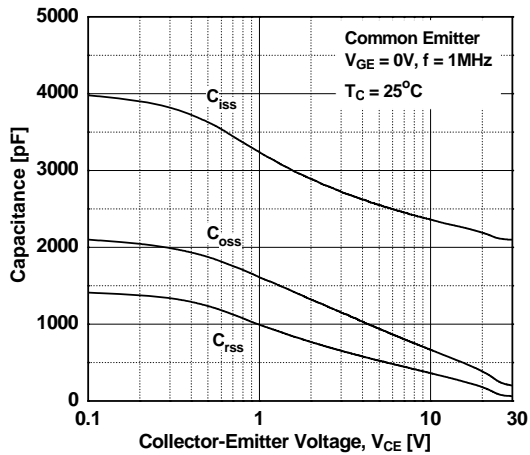
Figure 10. Gate charge Characteristics
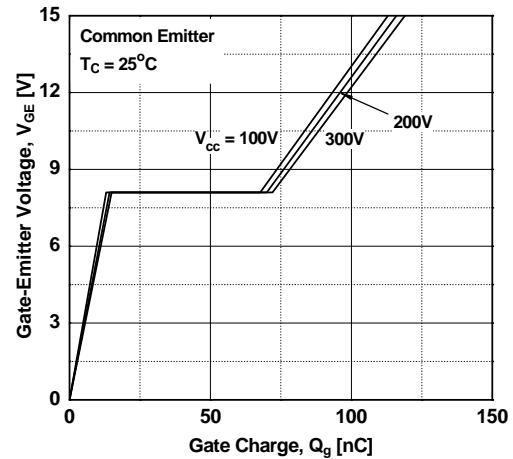
Figure 11. SOA Characteristics
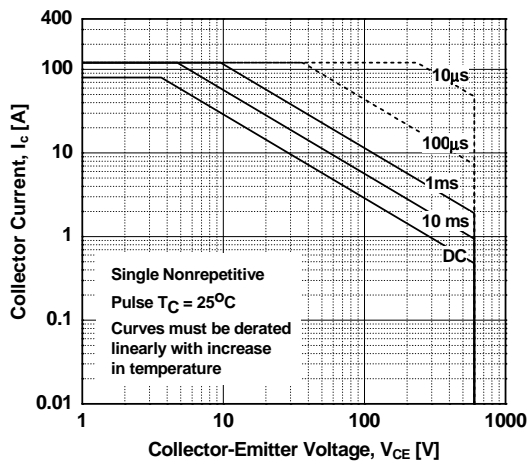
Figure 12. Turn-on Characteristics vs. Gate Resistance
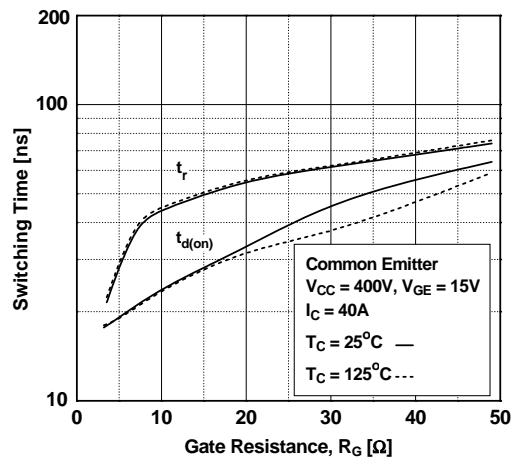
Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Gate Resistance
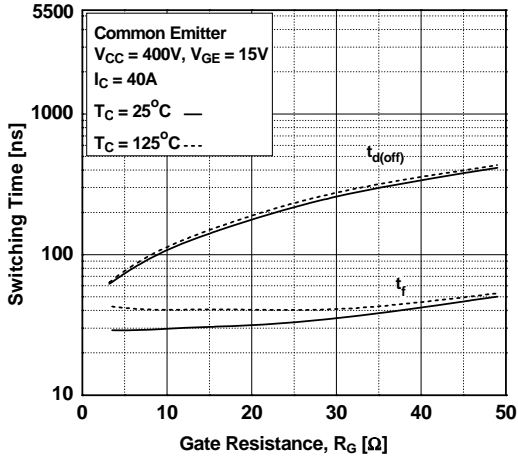
Figure 14. Turn-on Characteristics vs. Collector Current
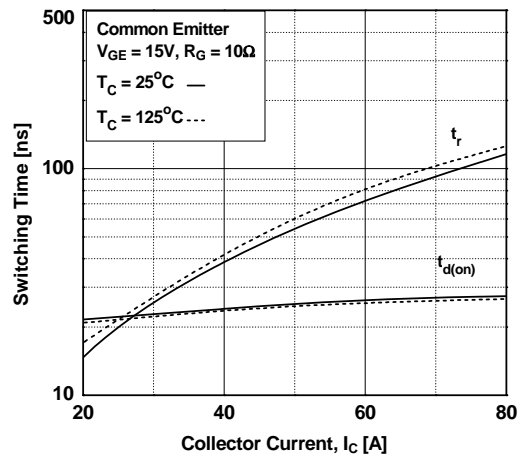
Figure 15. Turn-off Characteristics vs. Collector Current
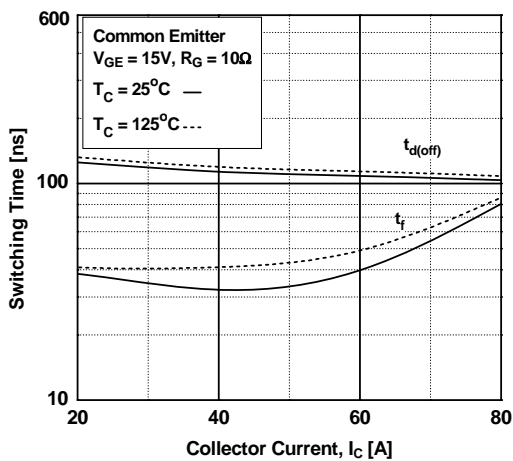
Figure 16. Switching Loss vs. Gate Resistance
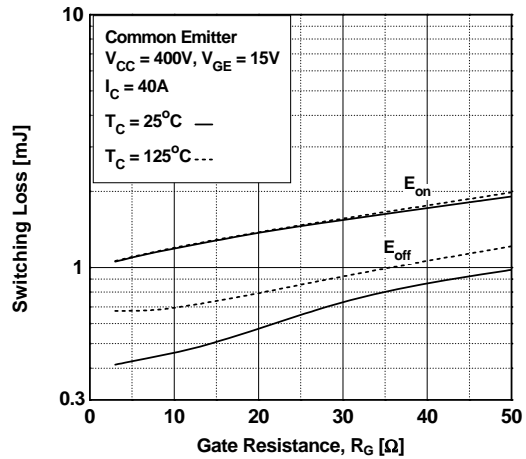
Figure 17. Switching Loss vs. Collector Current
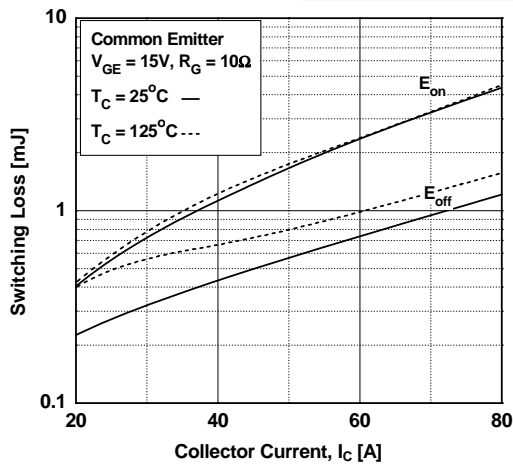
Figure 18. Turn off Switching SOA Characteristics
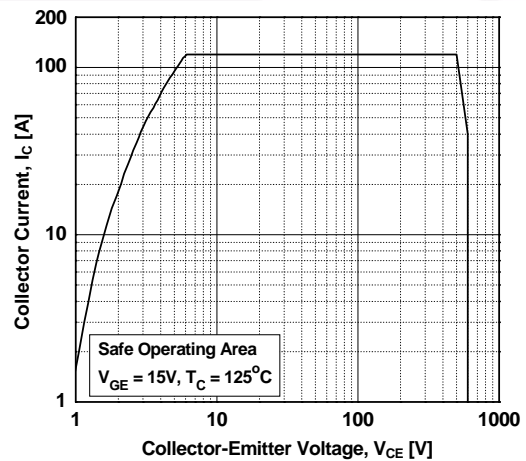
Typical Performance Characteristics

Figure 19. Forward Characteristics
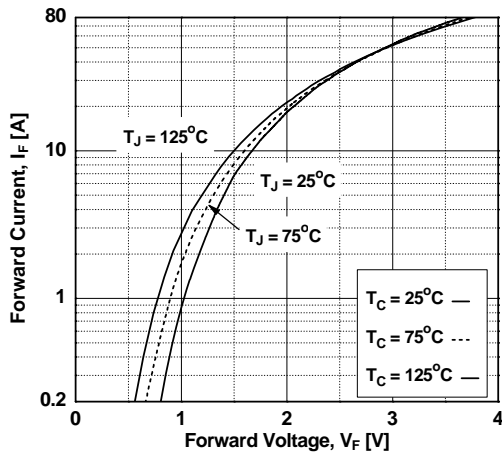
Figure 20. Reverse Current
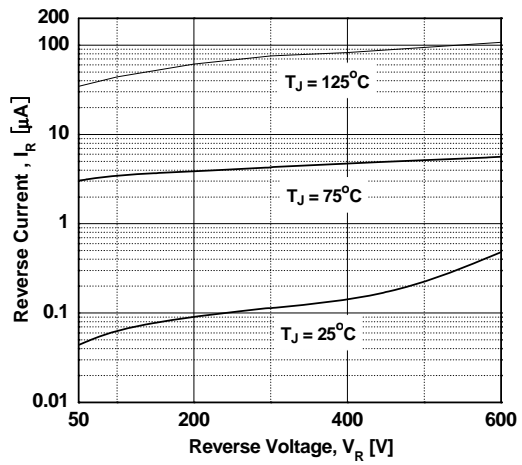
Figure 21. Stored Charge
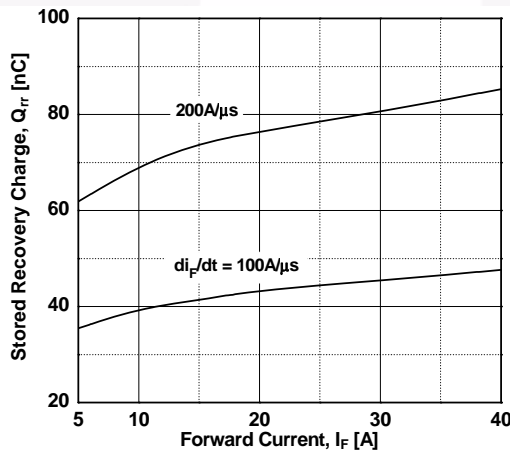
Figure 22. Reverse Recovery Time
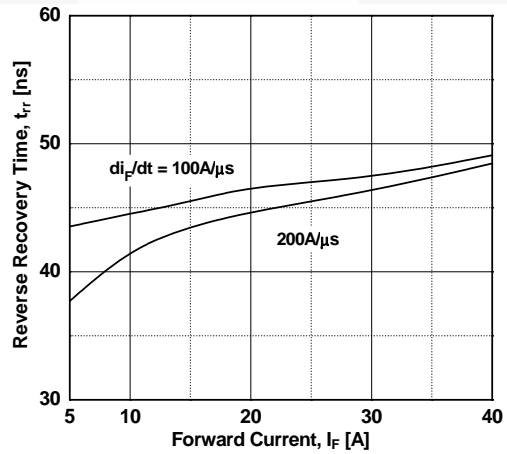
Figure 23.Transient Thermal Impedance of IGBT

Duty Factor, D = t1/t2
Peak T_J = Pdm x Zthjc + T_C

A

15.87 / 15.37 E

Ø 4.13 / 3.53

5.58 / 5.34 E

Ø 5.20 / 4.96

20.82 / 20.32 E

1 2 3

3.93 / 3.69 E

(1.60)

1.87 / 1.53 (2X)

16.25 / 15.75 E

2.77 / 2.43

5.56

1.35 / 1.17

⊕ 0.254 Ⓜ B AⓂ

11.12

4.82 / 4.58 E

B

0.71 / 0.51

2.66 / 2.29

12.81 E

Ø 6.85 / 6.61

Ø 3.65 / 3.51 E

⊕ 0.254 Ⓜ B AⓂ

1.35 / 0.51

13.08 MIN

3 1

FAIRCHILD ™
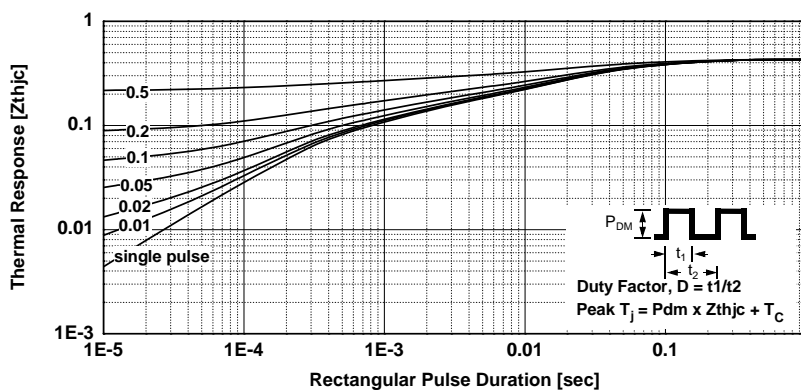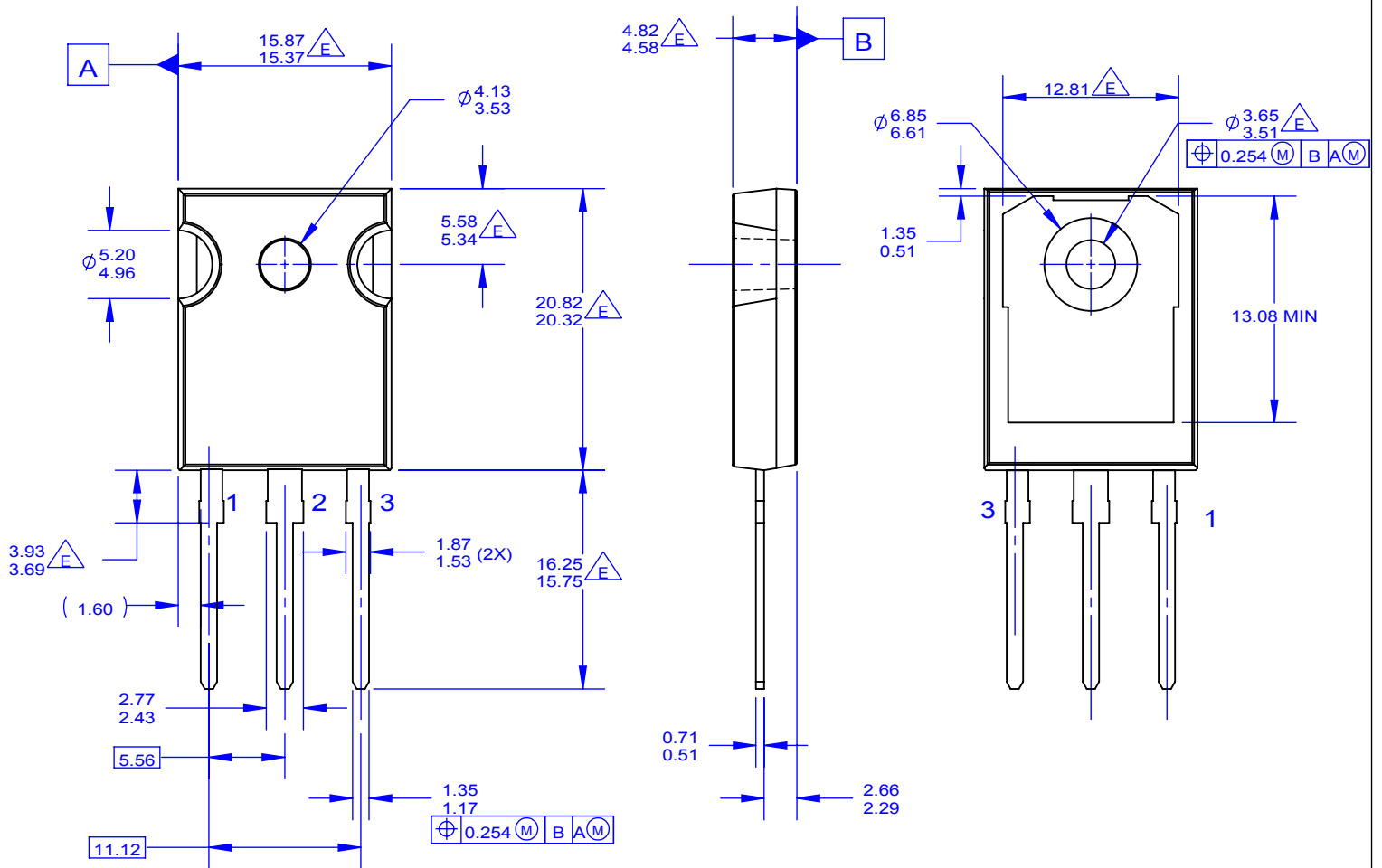
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