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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
SEMICONDUCTOR®

November 2013

FGL35N120FTD
1200 V, 35 A Field Stop Trench IGBT

Features

- Field Stop Trench Technology
- High Speed Switching
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.68 V @ I_C = 35 A
- High Input Impedance

Applications

- Solar Inverter, UPS, Welder, PFC

General Description

Using advanced field stop trench IGBT technology, Fairchild's 1200V trench IGBTs offer the optimum performance for hard switching application such as solar inverter, UPS, welder applications.

G C E   **TO-264 3L**

C

G

E
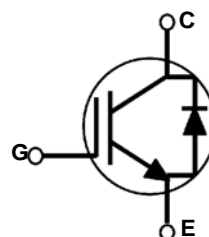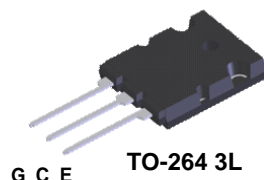
Absolute Maximum Ratings

Symbol	Description		Ratings	Unit
V_{CES}	Collector to Emitter Voltage		1200	V
V_{GES}	Gate to Emitter Voltage		± 25	V
I_C	Collector Current	@ T_C = 25°C	70	A
	Collector Current	@ T_C = 100°C	35	A
$I_{CM\ (1)}$	Pulsed Collector Current	@ T_C = 25°C	105	A
I_F	Diode Continuous Forward Current	@ T_C = 25°C	80	A
	Diode Continuous Forward Current	@ T_C = 100°C	40	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	368	W
	Maximum Power Dissipation	@ T_C = 100°C	147	W
T_J	Operating Junction Temperature		-55 to +150	°C
T_{stg}	Storage Temperature Range		-55 to +150	°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	Max.	Unit
$R_{\theta JC}$(IGBT)	Thermal Resistance, Junction to Case	0.34	°C/W
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case	0.9	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	25	°C/W

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGL35N120FTDTU	FGL35N120FTD	TO-264	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	1200	-	-	V
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}$, $V_{GE} = 0$ V	-	-	1	mA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}$, $V_{CE} = 0$ V	-	-	±250	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 35$ mA, $V_{CE} = V_{GE}$	3.5	6.2	7.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 35$ A, $V_{GE} = 15$ V	-	1.68	2.2	V
		$I_C = 35$ 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	-	5090	-	pF
C_{oes}	Output Capacitance		-	180	-	pF
C_{res}	Reverse Transfer Capacitance		-	95	-	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600$ V, $I_C = 35$ A, $R_G = 10$ Ω, $V_{GE} = 15$ V, Inductive Load, $T_C = 25°C$	-	34	-	ns
t_r	Rise Time		-	63	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	172	-	ns
t_f	Fall Time		-	107	-	ns
E_{on}	Turn-On Switching Loss		-	2.5	-	mJ
E_{off}	Turn-Off Switching Loss		-	1.7	-	mJ
E_{ts}	Total Switching Loss		-	4.2	-	mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600$ V, $I_C = 35$ A, $R_G = 10$ Ω, $V_{GE} = 15$ V, Inductive Load, $T_C = 125°C$	-	33	-	ns
t_r	Rise Time		-	66	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	180	-	ns
t_f	Fall Time		-	146	-	ns
E_{on}	Turn-On Switching Loss		-	3.1	-	mJ
E_{off}	Turn-Off Switching Loss		-	2.1	-	mJ
E_{ts}	Total Switching Loss		-	5.2	-	mJ
Q_g	Total Gate Charge	$V_{CE} = 600$ V, $I_C = 35$ A, $V_{GE} = 15$ V	-	210	-	nC
Q_{ge}	Gate to Emitter Charge		-	42	-	nC
Q_{gc}	Gate to Collector Charge		-	101	-	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	$I_F = 35$ A	$T_C = 25^oC$	-	2.7	3.4	V
			$T_C = 125^oC$	-	2.5	-	
t_{rr}	Diode Reverse Recovery Time		$T_C = 25^oC$	-	337	-	ns
			$T_C = 125^oC$	-	520	-	
I_{rr}	Diode Peak Reverse Recovery Current	$I_F = 35$ A, $di_F/dt = 200$ A/μs	$T_C = 25^oC$	-	7.6	-	A
			$T_C = 125^oC$	-	12.9	-	
Q_{rr}	Diode Reverse Recovery Charge		$T_C = 25^oC$	-	1292	-	nC
			$T_C = 125^oC$	-	3377	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics
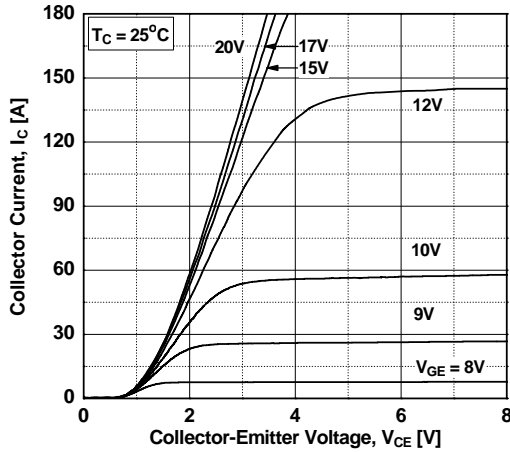

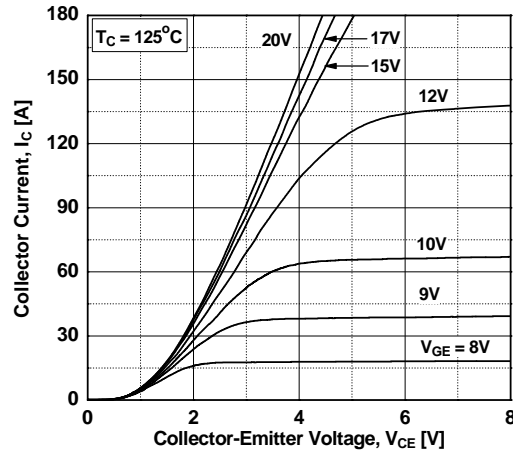### Figure 2. Typical Output Characteristics

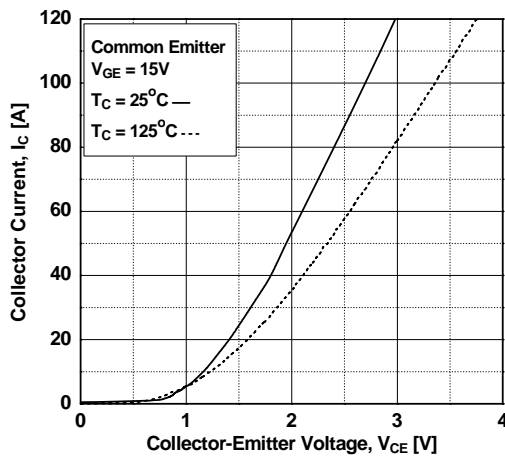### Figure 3. Typical Saturation Voltage Characteristics

Figure 4. Transfer Characteristics
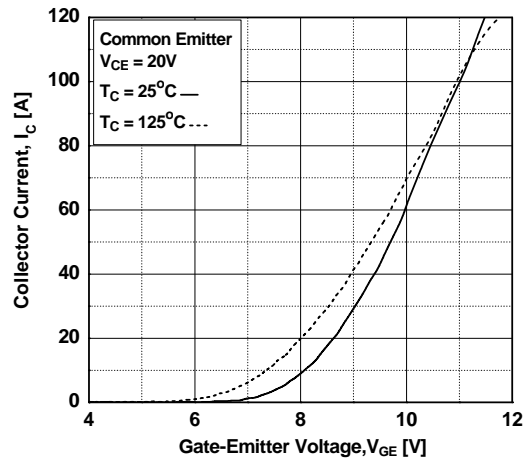

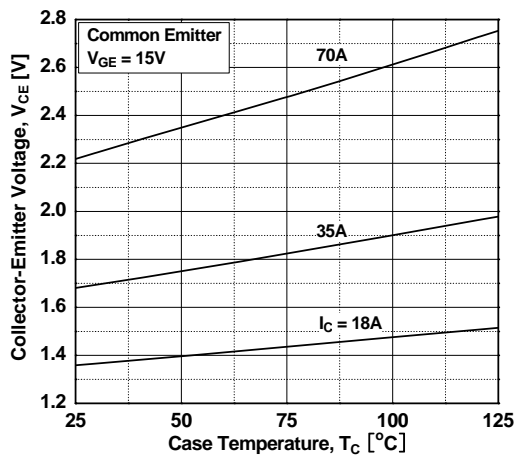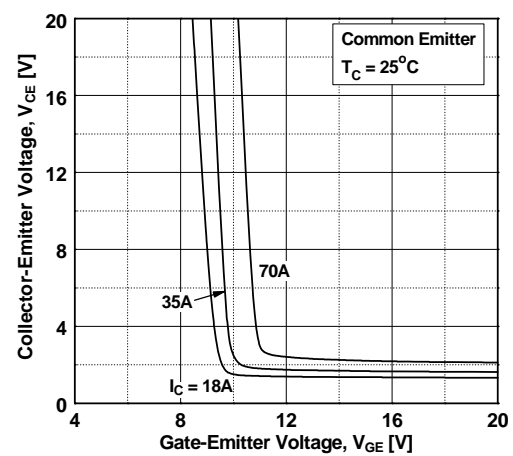### Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

Figure 6. Saturation Voltage vs. V_{GE}

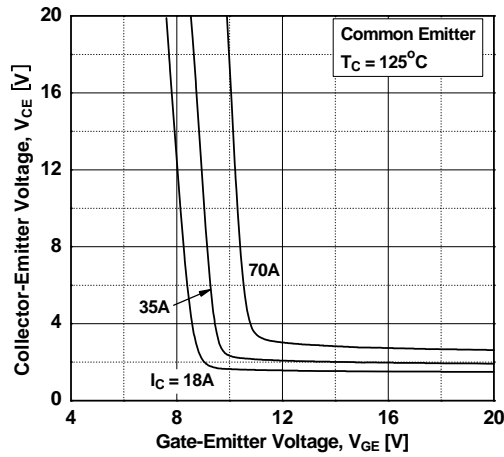## Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

Common Emitter
$T_C = 125°C$

70A

35A

$I_C = 18A$

Collector-Emitter Voltage, V_{CE} [V]

Gate-Emitter Voltage, V_{GE} [V]

Figure 8. Load Current vs. Frequency

$V_{CC} = 600V$
load Current : peak of square wave

Duty cycle : 50%
$T_C = 100°C$
Power Dissipation = 147W

Collector Current, I_C [A]

Frequency, f [kHz]
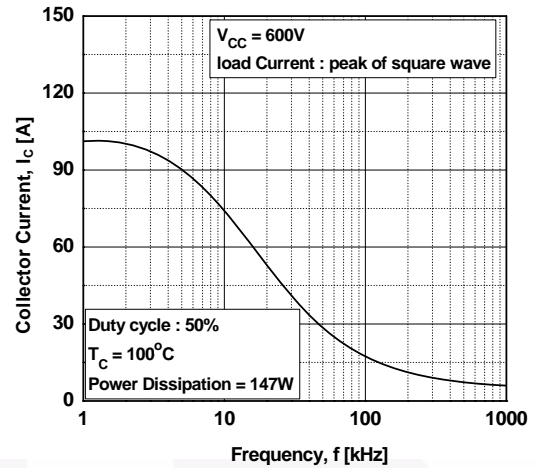
Figure 9. Capacitance Characteristics

Common Emitter
$V_{GE} = 0V$, f = 1MHz
$T_C = 25°C$

C_{ies}

C_{oes}

C_{res}

Capacitance [pF]

Collector-Emitter Voltage, V_{CE} [V]
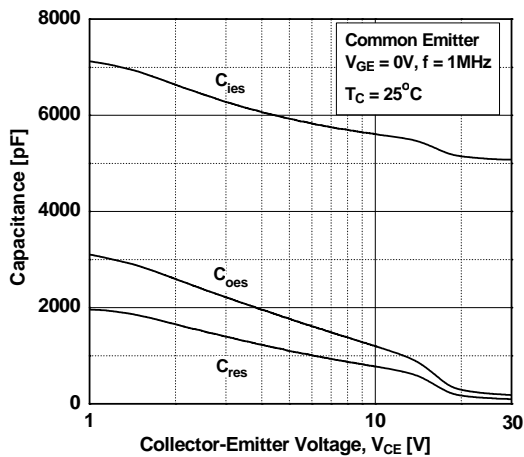
Figure 10. Gate Charge Characteristics

Common Emitter
$T_C = 25°C$

600V
$V_{CC} = 200V$
400V

Gate-Emitter Voltage, V_{GE} [V]

Gate Charge, Q_g [nC]
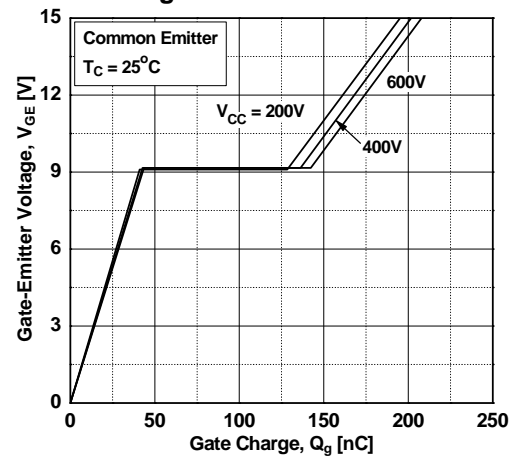
Figure 11. SOA Characteristics

10μs
100μs
1ms
10 ms
DC

*Notes:
1. $T_C = 25°C$
2. $T_J = 150°C$
3. Single Pulse

Collector Current, I_C [A]

Collector-Emitter Voltage, V_{CE} [V]
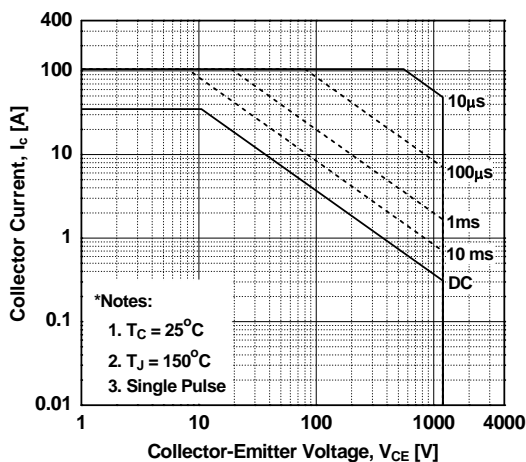
Figure 12. Turn-on Characteristics vs. Gate Resistance

t_r

$t_{d(on)}$

Common Emitter
$V_{CC} = 600V$, $V_{GE} = 15V$
$I_C = 35A$
$T_C = 25°C$ ——
$T_C = 125°C$ - - -

Switching Time [ns]

Gate Resistance, R_G [Ω]
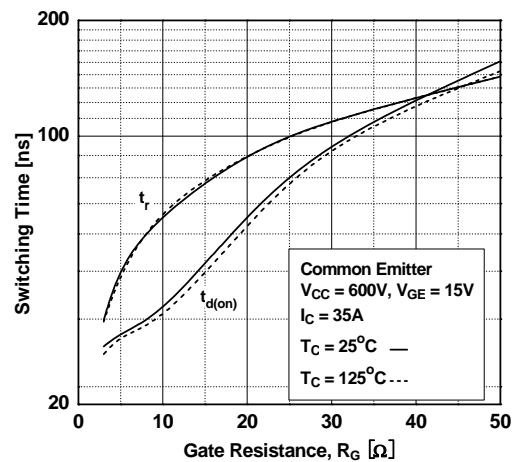
Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Gate Resistance
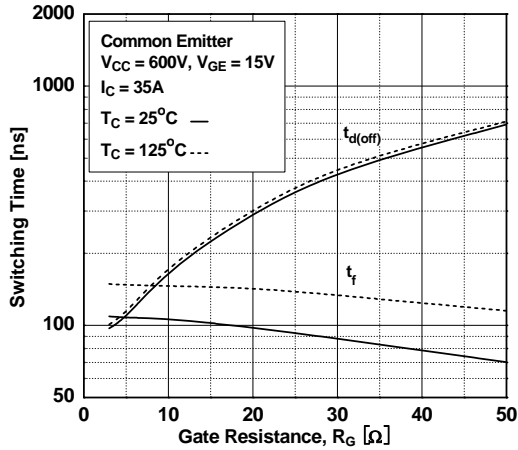

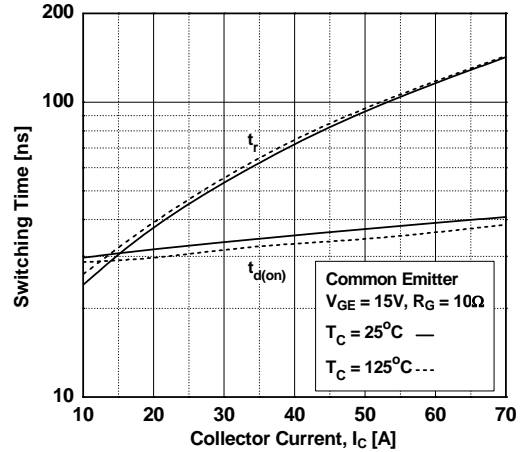### Figure 14. Turn-on Characteristics vs. Collector Current

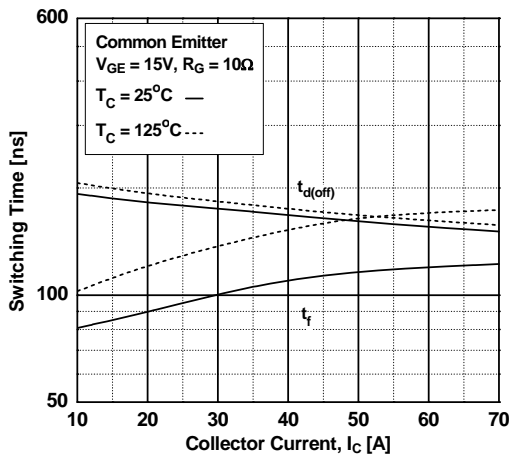### Figure 15. Turn-off Characteristics vs. Collector Current
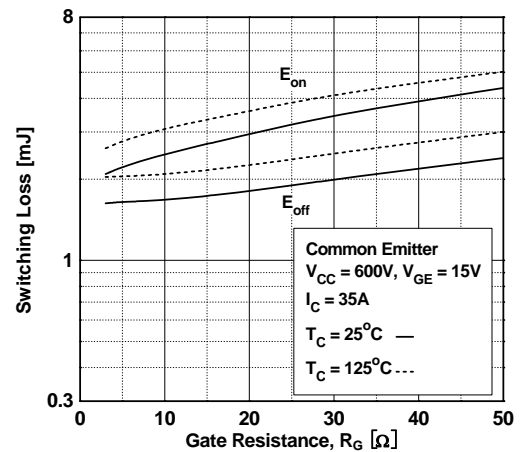

Figure 16. Switching Loss vs. Gate Resistance

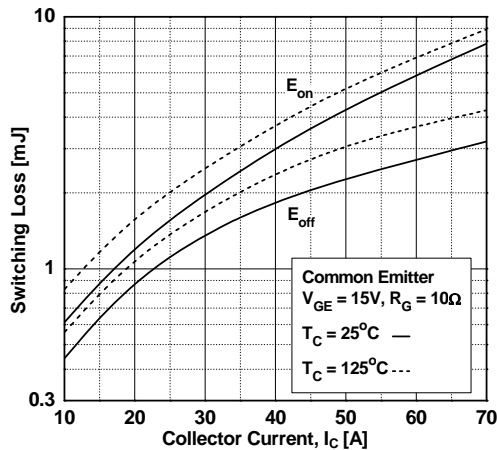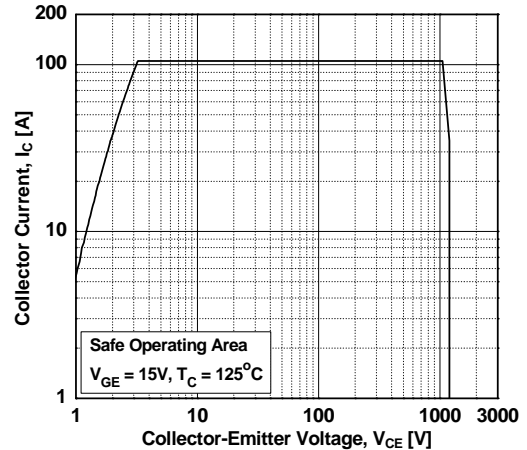### Figure 17. Switching Loss vs. Collector Current

Figure 18. Turn off Switching SOA Characteristics

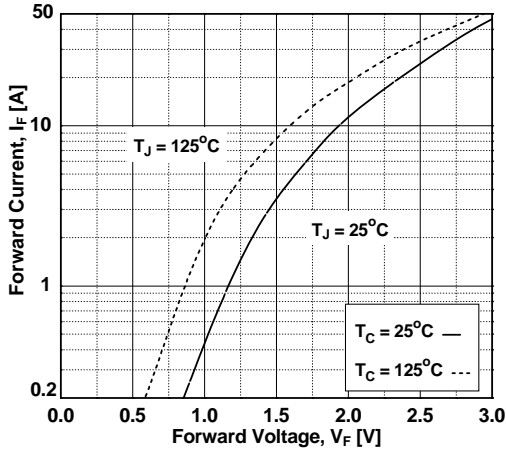## Typical Performance Characteristics

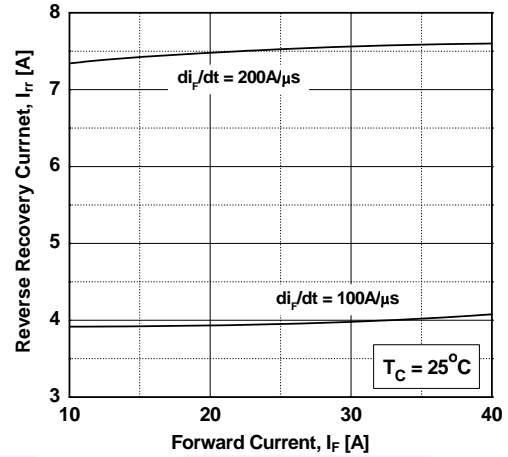### Figure 19. Forward Characteristics

Figure 20. Reverse Recovery Current
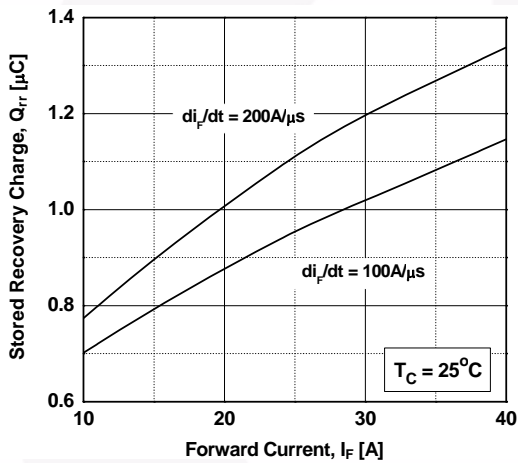

Figure 21. Stored Charge

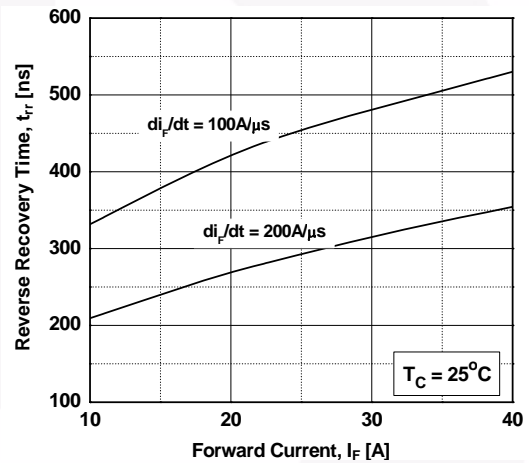
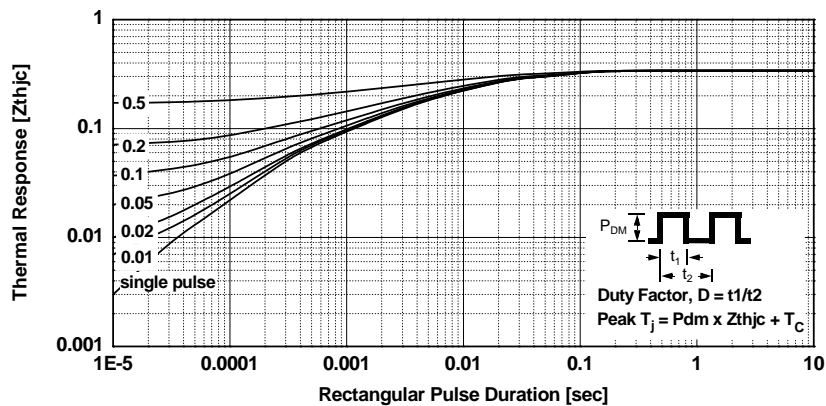### Figure 22. Reverse Recovery Time

Figure 23.Transient Thermal Impedance of IGBT

Mechanical Dimensions

FRONT VIEW   SIDE VIEW   BACK VIEW

BOTTOM VIEW

NOTES:

A. PACKAGE REFERENCE: JEDEC TO264 VARIATION AA.
B. ALL DIMENSIONS ARE IN MILLIMETERS.
C. OUT OF JEDEC STANDARD VALUE.
D. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
E. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
F. THIS PACKAGE IS INTENDED ONLY FOR "FS PKG CODE AR"
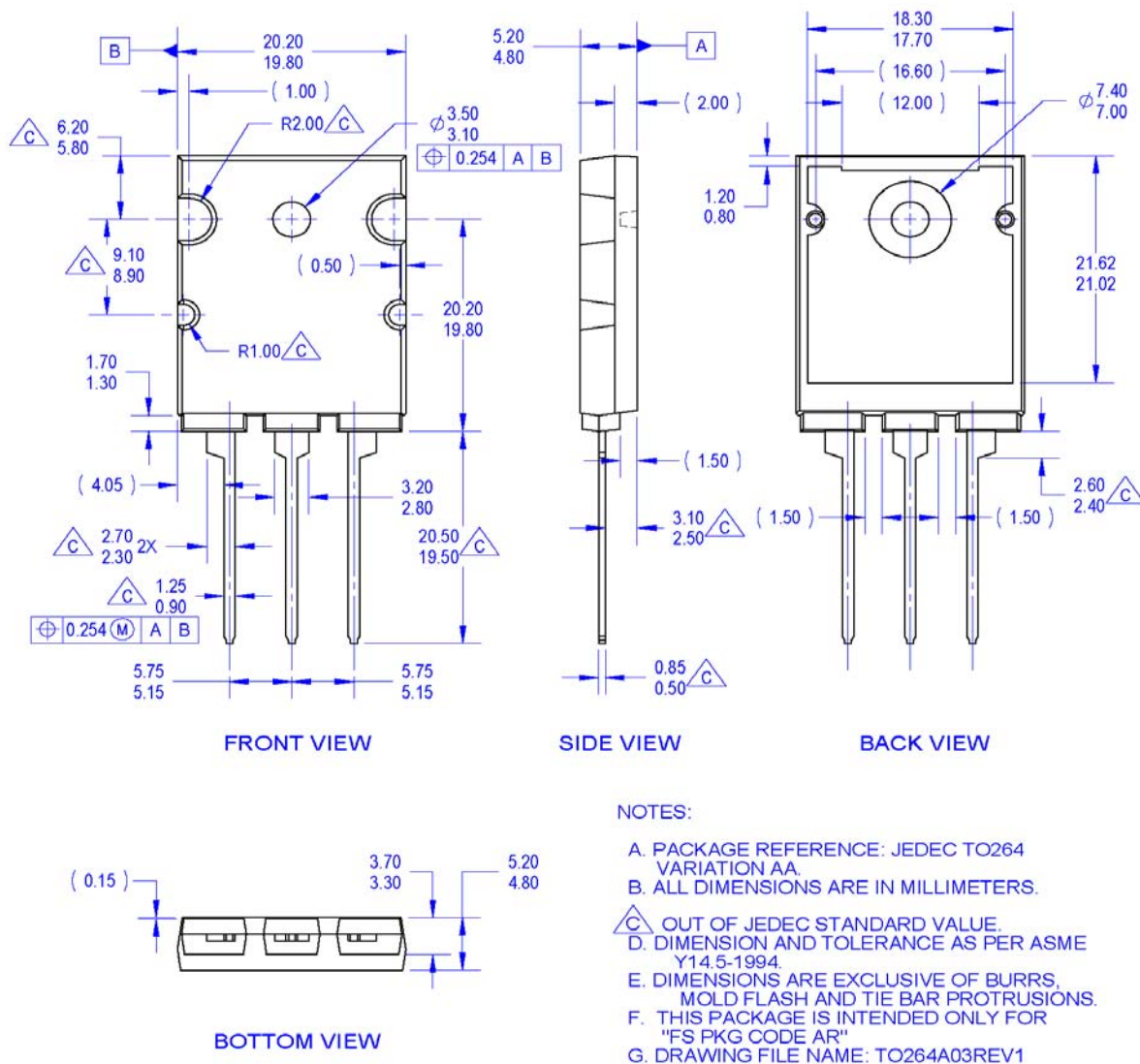G. DRAWING FILE NAME: TO264A03REV1

Figure 24. TO-264 3L - 3LD; TO264; MOLDED; JEDEC VARIATION AA

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

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http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TO264-003

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Dual Cool™	Marking Small Speakers Sound Louder		TinyWire™
EcoSPARK®	and Better™	Saving our world, 1mW/W/kW at a time™	TranSiC™
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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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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.

Rev. I66

PUBLICATION ORDERING INFORMATION