FAIRCHILD
SEMICONDUCTOR®

September 2013

FGB5N60UNDF
600 V, 5 A
Short Circuit Rated IGBT

Features

- Short Circuit Rated 10 us
- High Current Capability
- High Input Impedance
- Fast Switching
- RoHS Compliant

Applications

- Sewing Machine, CNC, Home Appliances, Motor Control

General Description

Using advanced NPT IGBT technology, Fairchild's the NPT IGBTs offer the optimum performance for low-power inverter-driven applications where low-losses and short-circuit rugged-ness features are essential, such as sewing machine, CNC, motor control and home appliances.

COLLECTOR
(FLANGE)

G C E   TO-263AB/D²-PAK

C

G

E
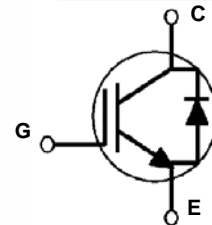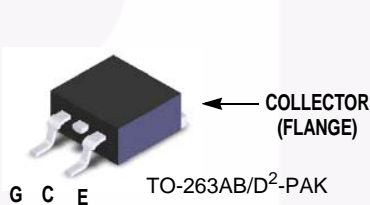
Absolute Maximum Ratings

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	10	A
	Collector Current	@ T_C = 100°C	5	A
$I_{CM\,(1)}$	Pulsed Collector Current	@ T_C = 25°C	15	A
I_F	Diode Forward Current	@ T_C = 25°C	5	A
	Diode Forward Current	@ T_C = 100°C	2.5	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	73.5	W
	Maximum Power Dissipation	@ T_C = 100°C	29.4	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	Typ.	Max.	Unit
$R_{\theta JC}$(IGBT)	Thermal Resistance, Junction to Case		1.7	°C/W
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case		4.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (PCB Mount)(2)		40	°C/W

Notes:
2: Mounted on 1" square PCB (FR4 or G-10 material)

Package Marking and Ordering Information

Device Marking	Device	Package	Rel Size	Tape Width	Quantity
FGB5N60UNDF	FGB5N60UNDF	TO-263AB(D^2-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
I_{CES}	Collector Cut-Off Current	V_{CE} = V_{CES}, V_{GE} = 0V	-	-	1	mA
I_{GES}	G-E Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0V	-	-	±10	uA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	I_C = 5mA, V_{CE} = V_{GE}	5.5	6.8	8.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 5A, V_{GE} = 15V	-	1.9	2.4	V
		I_C = 5A, V_{GE} = 15V, T_C = 125°C	-	2.3	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	-	181		pF
C_{oes}	Output Capacitance		-	28		pF
C_{res}	Reverse Transfer Capacitance		-	7		pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 400V, I_C = 5A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 25°C	-	5.4		ns
t_r	Rise Time		-	1.9		ns
$t_{d(off)}$	Turn-Off Delay Time		-	25.4		ns
t_f	Fall Time		-	101	202	ns
E_{on}	Turn-On Switching Loss		-	0.08		mJ
E_{off}	Turn-Off Switching Loss		-	0.07		mJ
E_{ts}	Total Switching Loss		-	0.15		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 400V, I_C = 5A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 125°C	-	5.2		ns
t_r	Rise Time		-	2.3		ns
$t_{d(off)}$	Turn-Off Delay Time		-	26.6		ns
t_f	Fall Time		-	125		ns
E_{on}	Turn-On Switching Loss		-	0.15		mJ
E_{off}	Turn-Off Switching Loss		-	0.09		mJ
E_{ts}	Total Switching Loss		-	0.24		mJ
T_{sc}	Short Circuit Withstand Time	V_{CC} = 350V, R_G = 100Ω, V_{GE} = 15V, T_C = 150°C	10	-	-	μs

Electrical Characteristics of the IGBT $T_C = 25°C$ unless otherwise noted

Q_g	Total Gate Charge	$V_{CE} = 400V$, $I_C = 5A$, $V_{GE} = 15V$	-	12.1		nC
Q_{ge}	Gate to Emitter Charge		-	1.7		nC
Q_{gc}	Gate to Collector Charge		-	7.2		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	$I_F = 5A$	$T_C = 25°C$	-	1.7	2.2	V
			$T_C = 125°C$	-	1.6	-	
t_{rr}	Diode Reverse Recovery Time	$I_F = 5A$, $dI_F/dt = 200A/\mu s$	$T_C = 25°C$	-	35		ns
			$T_C = 125°C$	-	87		
Q_{rr}	Diode Reverse Recovery Charge		$T_C = 25°C$	-	71		nC
			$T_C = 125°C$	-	240	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

$T_C = 25^oC$, $V_{GE} = 12V$, 15V, 17V, 20V

Collector Current, I_C [A] vs. Collector-Emitter Voltage, V_{CE} [V]
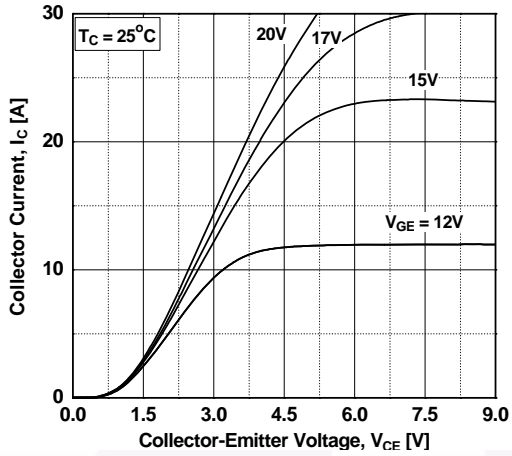
Figure 2. Typical Output Characteristics

$T_C = 125^oC$, $V_{GE} = 12V$, 15V, 17V, 20V

Collector Current, I_C [A] vs. Collector-Emitter Voltage, V_{CE} [V]
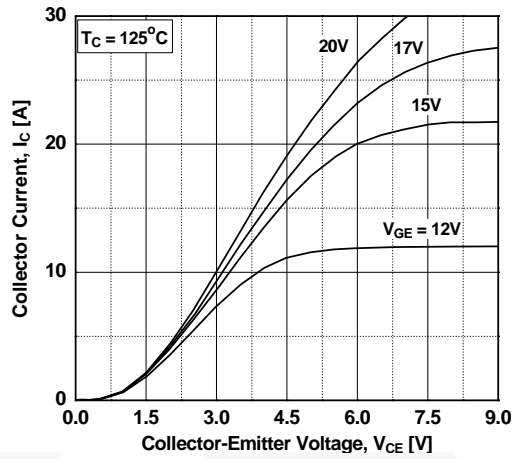
Figure 3. Typical Saturation Voltage Characteristics

Common Emitter
$V_{GE} = 15V$
$T_C = 25^oC$ —
$T_C = 125^oC$ ---

Collector Current, I_C [A] vs. Collector-Emitter Voltage, V_{CE} [V]
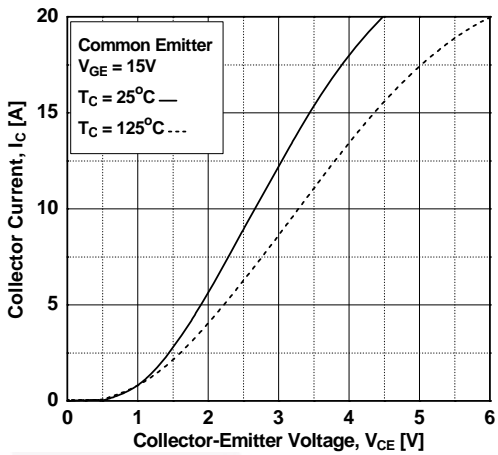
Figure 4. Transfer Characteristics

Common Emitter
$V_{CE} = 20V$
$T_C = 25^oC$ —
$T_C = 125^oC$ ---

Collector Current, I_C [A] vs. Gate-Emitter Voltage, V_{GE} [V]
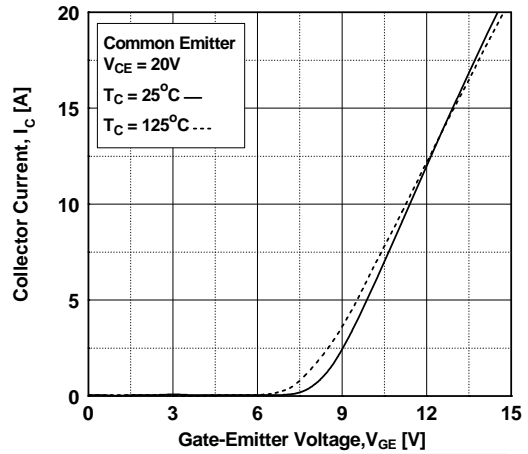
Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

Common Emitter
$V_{GE} = 15V$
10A, 5A, $I_C = 2.5A$

Collector-Emitter Voltage, V_{CE} [V] vs. Case Temperature, T_C [^oC]
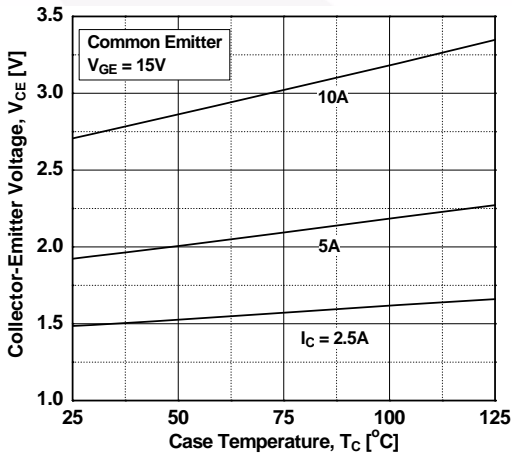
Figure 6. Saturation Voltage vs. V_{GE}

Common Emitter
$T_C = 25^oC$
10A, 5A, $I_C = 2.5A$

Collector-Emitter Voltage, V_{CE} [V] vs. Gate-Emitter Voltage, V_{GE} [V]
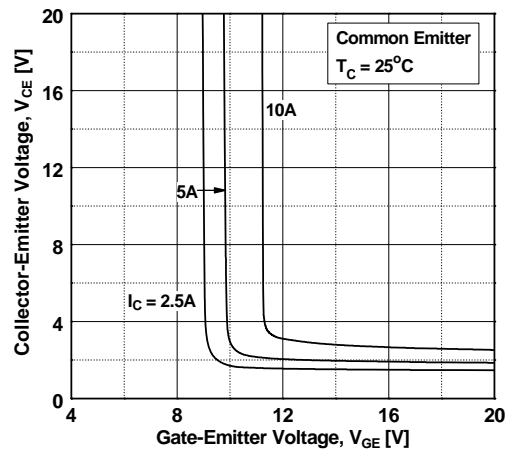
Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}
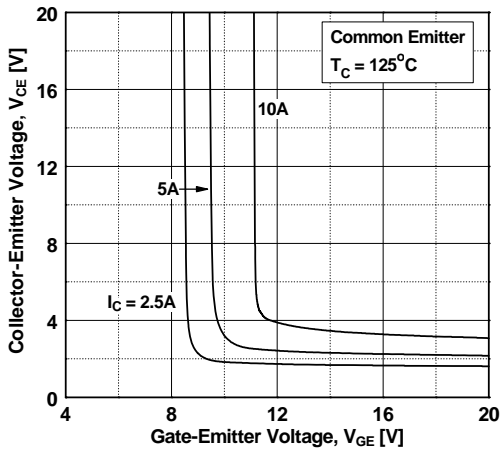
Figure 8. Capacitance Characteristics
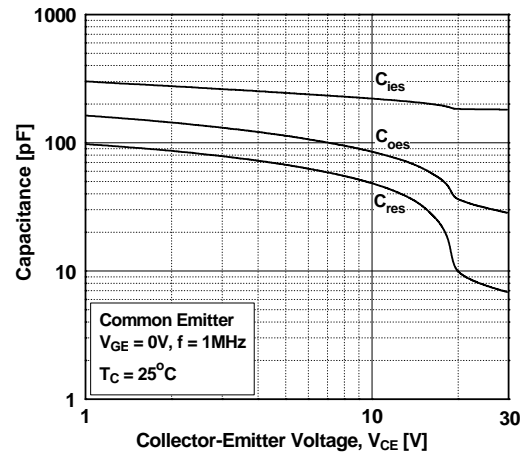
Figure 9. Gate charge Characteristics
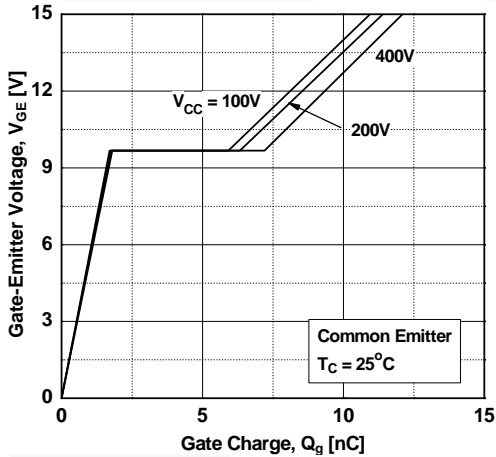
Figure 10. SOA Characteristics
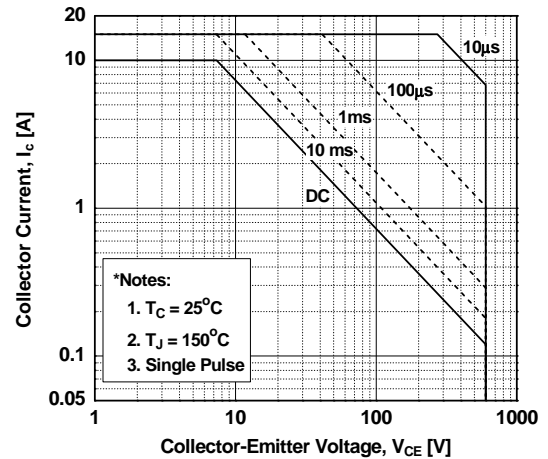
Figure 11. Turn-on Characteristics vs. Gate Resistance
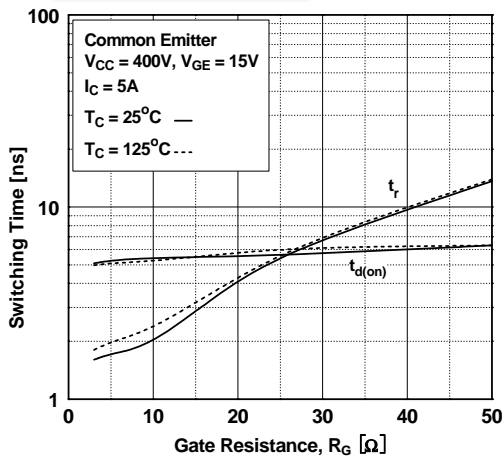
Figure 12. Turn-off Characteristics vs. Gate Resistance
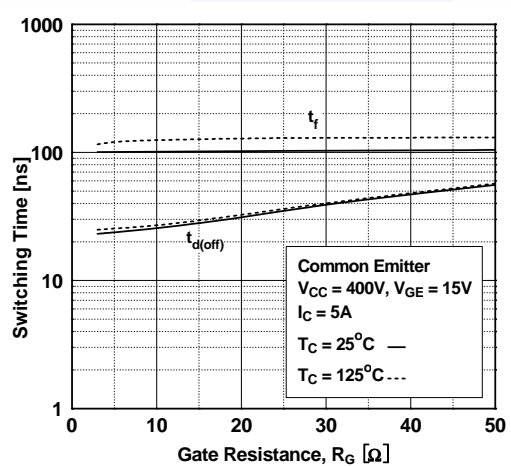
Typical Performance Characteristics
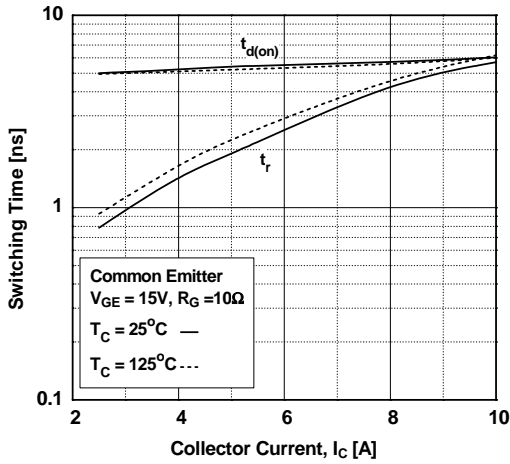
Figure 13. Turn-on Characteristics vs. Collector Current

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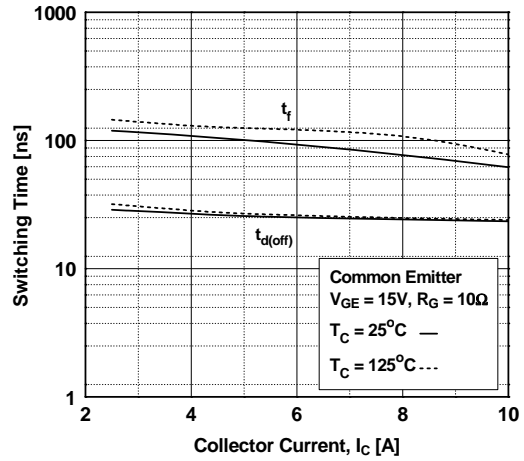
Figure 15. Switching Loss vs. Gate Resistance
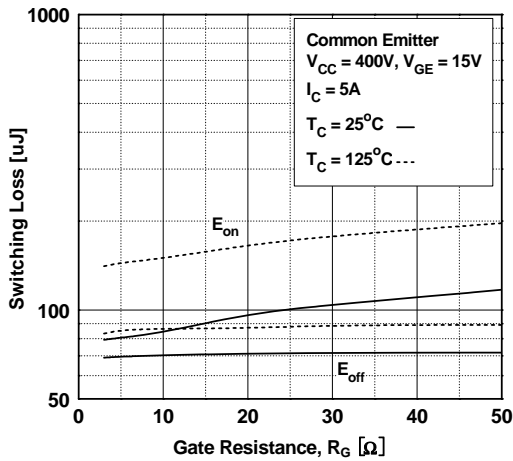
Figure 16. Switching Loss vs Collector Current
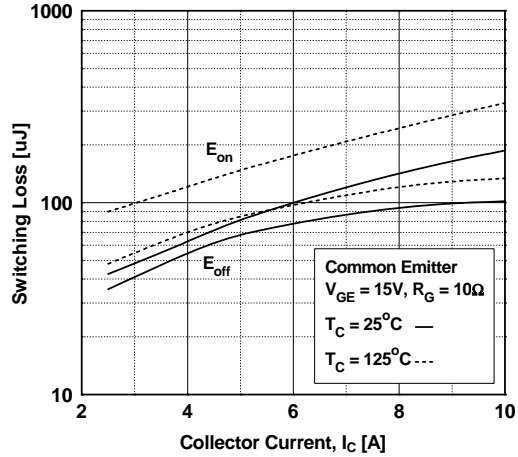
Figure 17. Turn off Switching SOA Characteristics
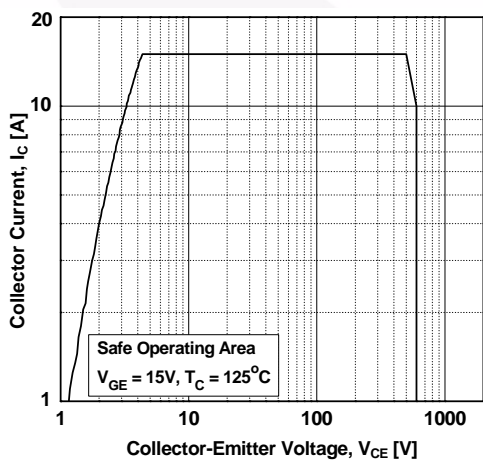
Figure 18. Forward Characteristics
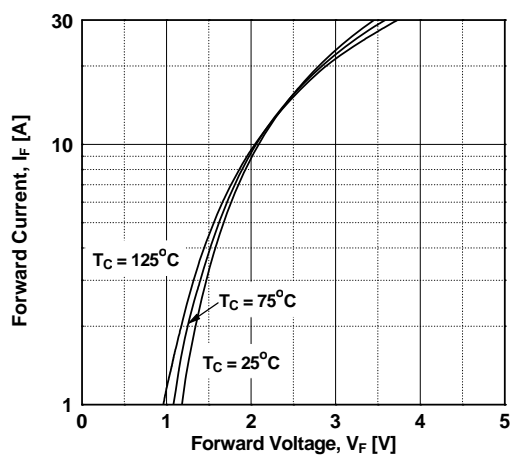
Typical Performance Characteristics

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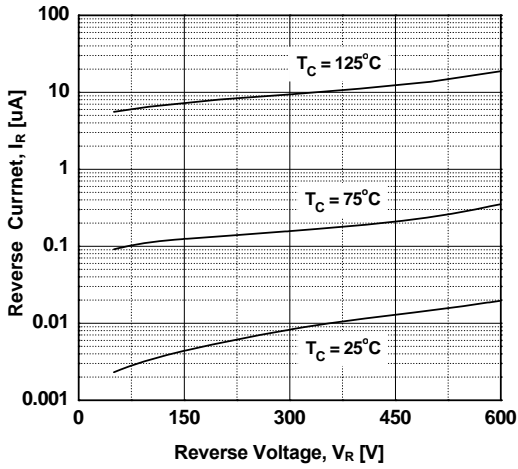
Figure 20. Stored Charge
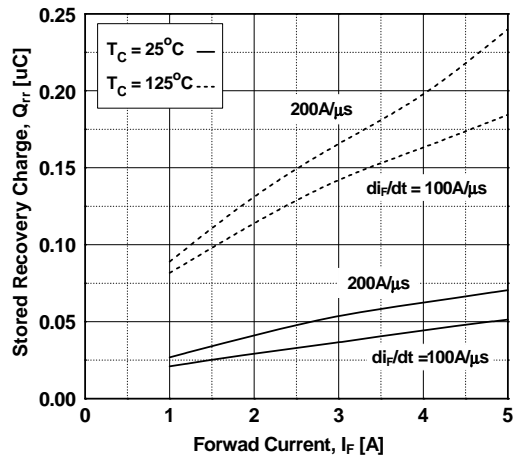
Figure 21. Reverse Recovery Time
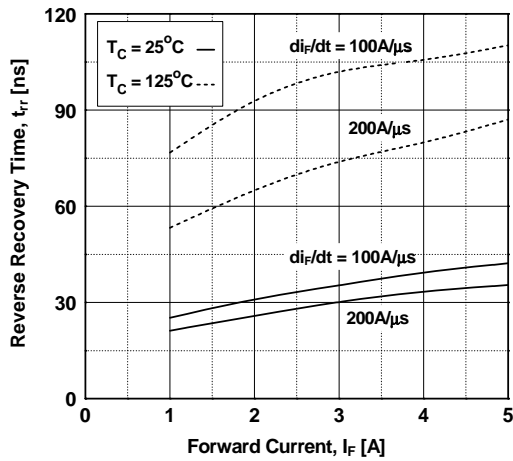
Figure 22. Transient Thermal Impedance of IGBT

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

Mechanical Dimensions

NOTES: UNLESS OTHERWISE SPECIFIED
A) ALL DIMENSIONS ARE IN MILLIMETERS.
B) REFERENCE JEDEC, TO-263, VARIATION AB.
C) DIMENSIONING AND TOLERANCING PER
   ANSI Y14.5M - 1994.
D) LOCATION OF THE PIN HOLE MAY VARY
   (LOWER LEFT CORNER, LOWER CENTER
   AND CENTER OF THE PACKAGE).
E) LANDPATTERN RECOMMENDATION PER IPC
   TO254P1524X482-3N
F) FILENAME: TO263A02REV6

LAND PATTERN RECOMMENDATION
UNLESS NOTED, ALL DIMS TYPICAL

SEE DETAIL A

GAGE PLANE

SEATING PLANE

DETAIL A, ROTATED 90°
SCALE: 2X

Figure 23.   TO-263 2L (D2PAK) - 2LD,TO263, SURFACE MOUNT

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.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TT263-002

Dimensions in Millimeters

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BitSiC™
Build it Now™
CorePLUS™
CorePOWER™
CROSSVOLT™
CTL™
Current Transfer Logic™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficentMax™
ESBC™

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Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
FPS™

F-PFS™
FRFET®
Global Power Resource℠
GreenBridge™
Green FPS™
Green FPS™ e-Series™
G*max*™
GTO™
IntelliMAX™
ISOPLANAR™
Marking Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
mWSaver®
OptoHiT™
OPTOLOGIC®
OPTOPLANAR®

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PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™

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SignalWise™
SmartMax™
SMART START™
Solutions for Your Success™
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STEALTH™
SuperFET®
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS®
SyncFET™

Sync-Lock™
SYSTEM GENERAL ®*
TinyBoost®
TinyBuck®
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TranSiC™
TriFault Detect™
TRUECURRENT®*
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PRODUCT STATUS DEFINITIONS
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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