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February 2012

# FGB5N60UNDF

## 600V, 5A

### Short Circuit Rated IGBT

#### Features

- Short circuit rated 10us
- High current capability
- High input impedance
- Fast switching
- RoHS compliant

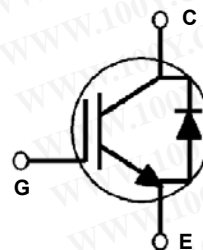


#### Applications

- Home appliance inverter-driven application
  - Fan Motor Driver, Circulation Pump, Refrigerator, Dish Washer

#### 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 ruggedness feature are essential.



#### Absolute Maximum Ratings

Symbol	Description	Ratings	Units
$V_{CES}$	Collector to Emitter Voltage	600	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	10	A
	Collector Current @ $T_C = 100^\circ\text{C}$	5	A
$I_{CM(1)}$	Pulsed Collector Current @ $T_C = 25^\circ\text{C}$	15	A
$I_F$	Diode Forward Current @ $T_C = 25^\circ\text{C}$	5	A
	Diode Forward Current @ $T_C = 100^\circ\text{C}$	5	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	73.5	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	29.4	W
$T_J$	Operating Junction Temperature	-55 to +150	$^\circ\text{C}$
$T_{stg}$	Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	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.	Units
$R_{\theta JC}$ (IGBT)	Thermal Resistance, Junction to Case		1.7	$^{\circ}\text{C/W}$
$R_{\theta JC}$ (Diode)	Thermal Resistance, Junction to Case		4.5	$^{\circ}\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (PCB Mount)(2)		40	$^{\circ}\text{C/W}$

### 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/D2-PAK		-	50

## Electrical Characteristics of the IGBT $T_C = 25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV <sub>CES</sub>	Collector to Emitter Breakdown Voltage	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA	600	-	-	V
I <sub>CES</sub>	Collector Cut-Off Current	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0V	-	-	1	mA
I <sub>GES</sub>	G-E Leakage Current	V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0V	-	-	±10	uA
On Characteristics						
V <sub>GE(th)</sub>	G-E Threshold Voltage	I <sub>C</sub> = 5mA, V <sub>CE</sub> = V <sub>GE</sub>	5.5	6.8	8.5	V
V <sub>CE(sat)</sub>	Collector to Emitter Saturation Voltage	I <sub>C</sub> = 5A, V <sub>GE</sub> = 15V	-	1.9	2.4	V
		I <sub>C</sub> = 5A, V <sub>GE</sub> = 15V, T <sub>C</sub> = 125°C	-	2.3	-	V
Dynamic Characteristics						
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 30V, V <sub>GE</sub> = 0V, f = 1MHz	-	181		pF
C <sub>oes</sub>	Output Capacitance		-	28		pF
C <sub>res</sub>	Reverse Transfer Capacitance		-	7		pF
Switching Characteristics						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>CC</sub> = 400V, I <sub>C</sub> = 5A, R <sub>G</sub> = 10Ω, V <sub>GE</sub> = 15V, Inductive Load, T <sub>C</sub> = 25°C	-	5.4		ns
t <sub>r</sub>	Rise Time		-	1.9		ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	25.4		ns
t <sub>f</sub>	Fall Time		-	101	202	ns
E <sub>on</sub>	Turn-On Switching Loss		-	0.08		mJ
E <sub>off</sub>	Turn-Off Switching Loss		-	0.07		mJ
E <sub>ts</sub>	Total Switching Loss		-	0.15		mJ
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>CC</sub> = 400V, I <sub>C</sub> = 5A, R <sub>G</sub> = 10Ω, V <sub>GE</sub> = 15V, Inductive Load, T <sub>C</sub> = 125°C	-	5.2		ns
t <sub>r</sub>	Rise Time		-	2.3		ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	26.6		ns
t <sub>f</sub>	Fall Time		-	125		ns
E <sub>on</sub>	Turn-On Switching Loss		-	0.15		mJ
E <sub>off</sub>	Turn-Off Switching Loss		-	0.09		mJ
E <sub>ts</sub>	Total Switching Loss		-	0.24		mJ
T <sub>sc</sub>	Short Circuit Withstand Time	V <sub>CC</sub> = 350V, R <sub>G</sub> = 100Ω, V <sub>GE</sub> = 15V, T <sub>C</sub> = 150°C	10	-	-	μs

**Electrical Characteristics of the IGBT**  $T_C = 25^\circ\text{C}$  unless otherwise noted

$Q_g$	Total Gate Charge	$V_{CE} = 400\text{V}, I_C = 5\text{A},$ $V_{GE} = 15\text{V}$	-	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**  $T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max	Units
$V_{FM}$	Diode Forward Voltage	$I_F = 5\text{A}$	$T_C = 25^\circ\text{C}$	-	1.7	2.2	V
			$T_C = 125^\circ\text{C}$	-	1.6	-	
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 5\text{A}, di_F/dt = 200\text{A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	-	35		ns
			$T_C = 125^\circ\text{C}$	-	87		
$Q_{rr}$	Diode Reverse Recovery Charge		$T_C = 25^\circ\text{C}$	-	71		nC
			$T_C = 125^\circ\text{C}$	-	240	-	

## Typical Performance Characteristics

Figure 1. Typical Output Characteristics

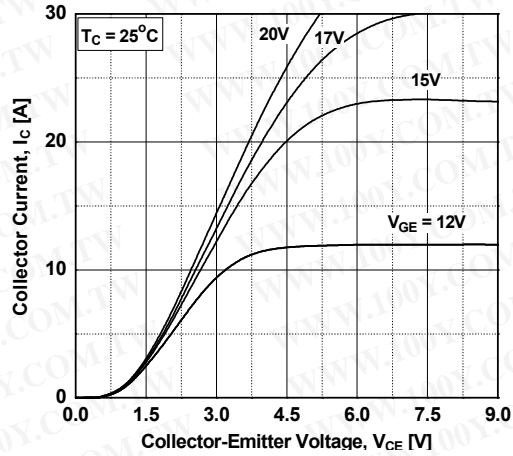


Figure 2. Typical Output Characteristics

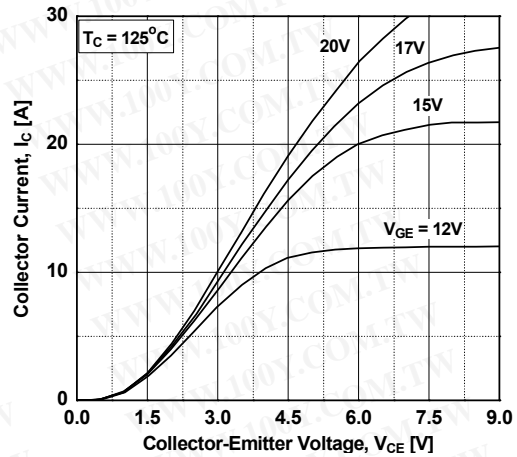


Figure 3. Typical Saturation Voltage Characteristics

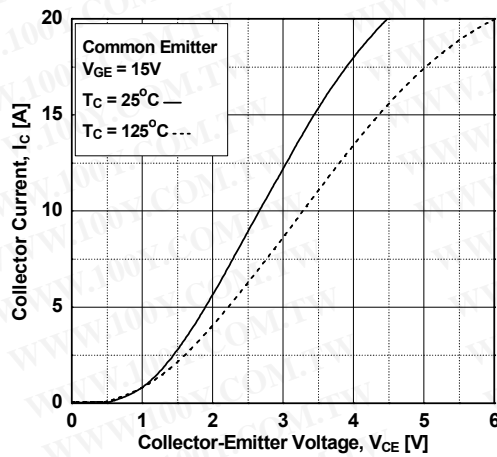


Figure 4. Transfer Characteristics

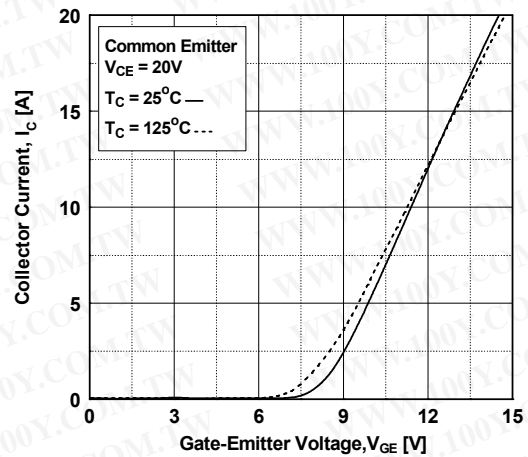


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

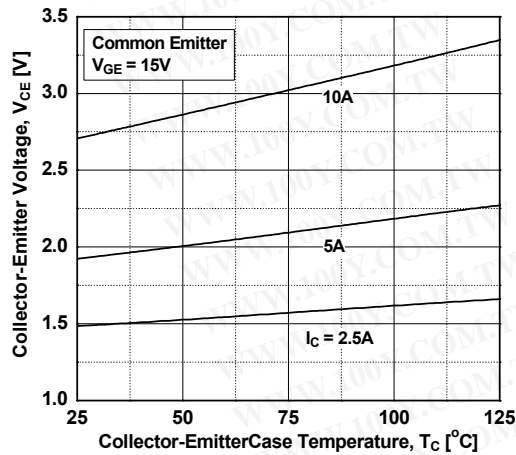
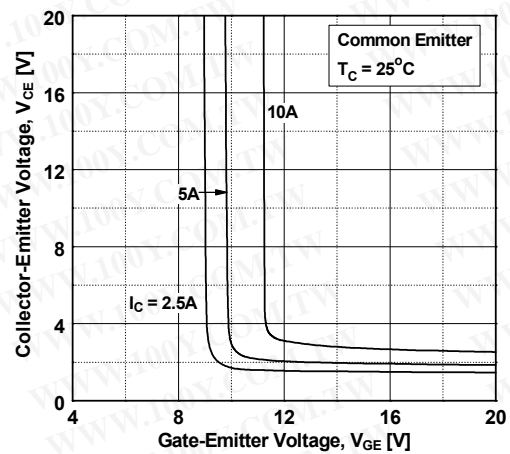


Figure 6. Saturation Voltage vs. Vge



## Typical Performance Characteristics

Figure 7. Saturation Voltage vs.  $V_{GE}$

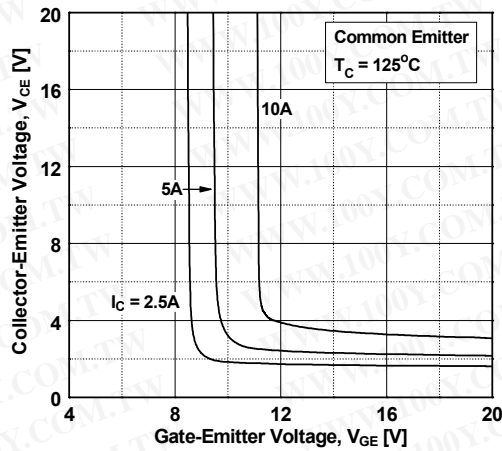


Figure 8. Capacitance Characteristics

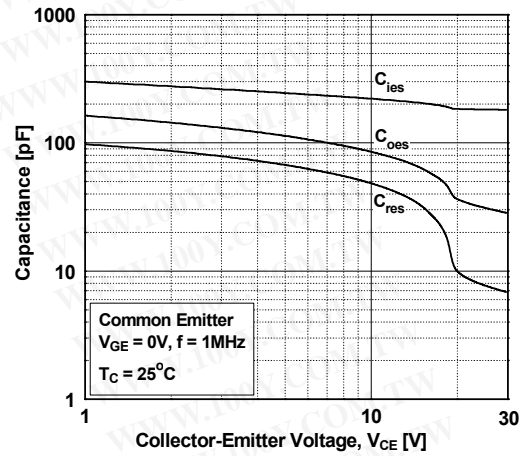


Figure 9. Gate charge Characteristics

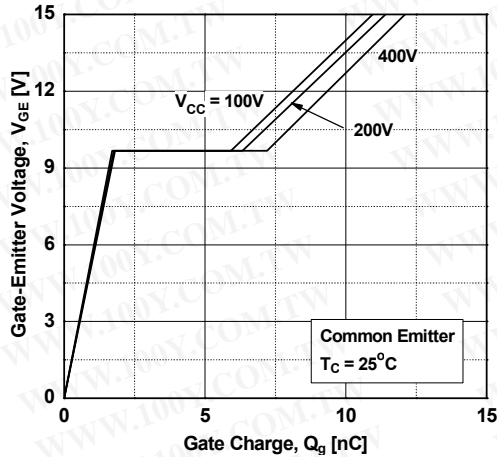


Figure 10. SOA Characteristics

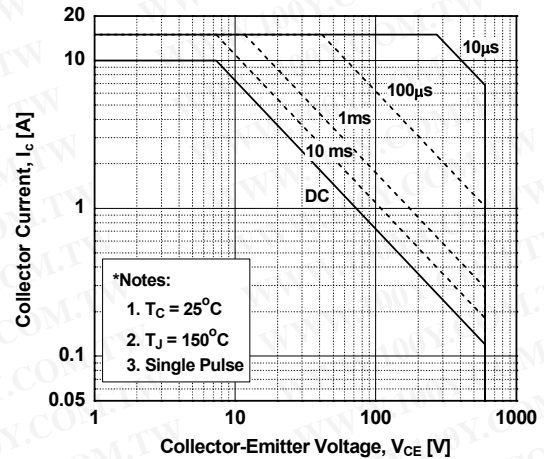


Figure 11. Turn-on Characteristics vs. Gate Resistance

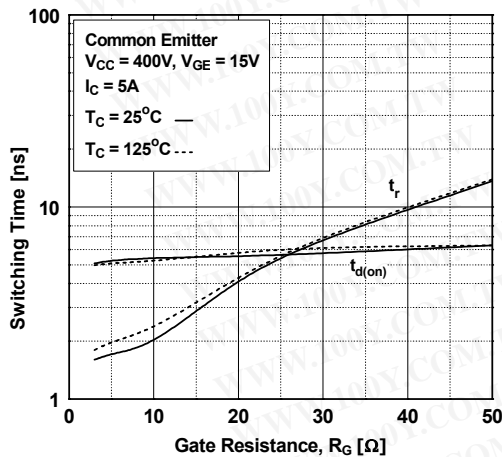
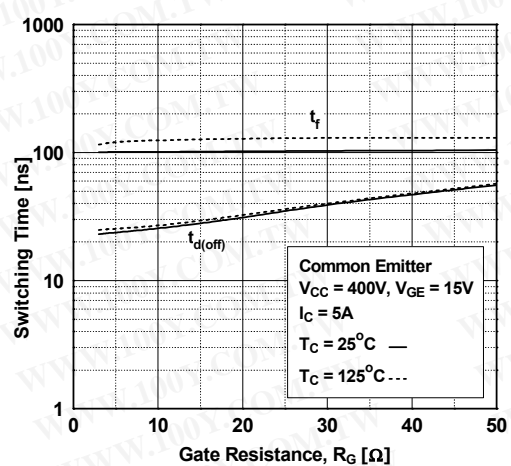


Figure 12. Turn-off Characteristics vs. Gate Resistance



## Typical Performance Characteristics

Figure 13. Turn-on Characteristics vs. Collector Current

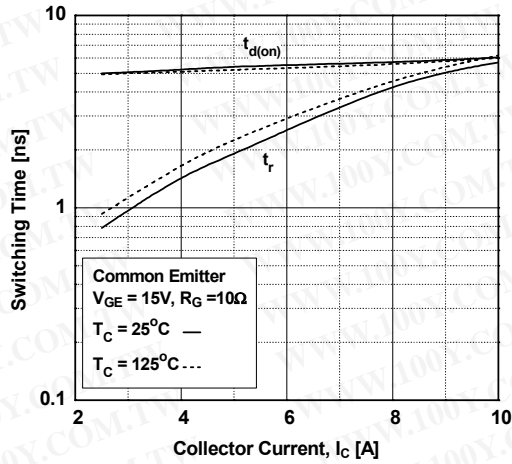


Figure 14. Turn-off Characteristics vs. Collector Current

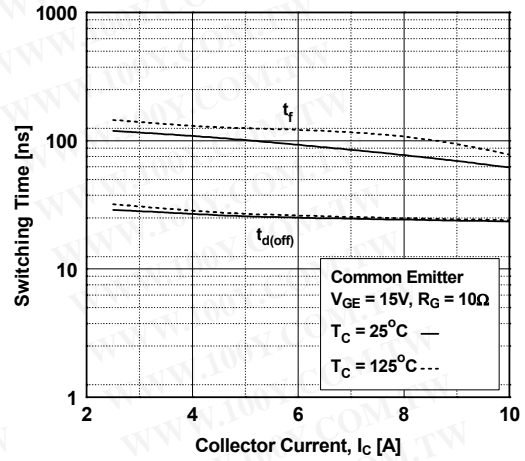


Figure 15. Switching Loss vs. Gate Resistance

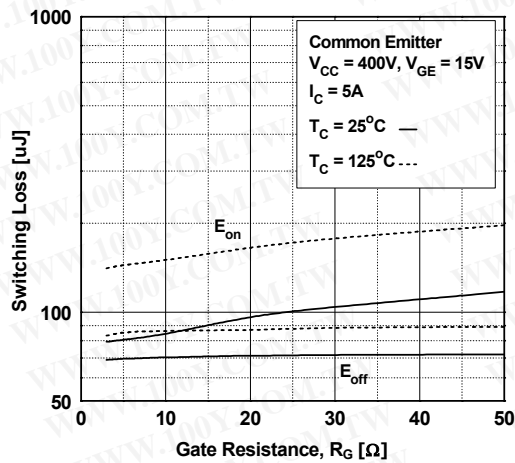


Figure 16. Switching Loss vs. Collector Current

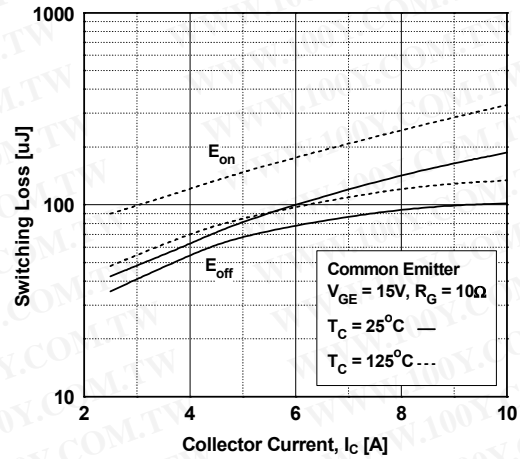


Figure 17. Turn off Switching SOA Characteristics

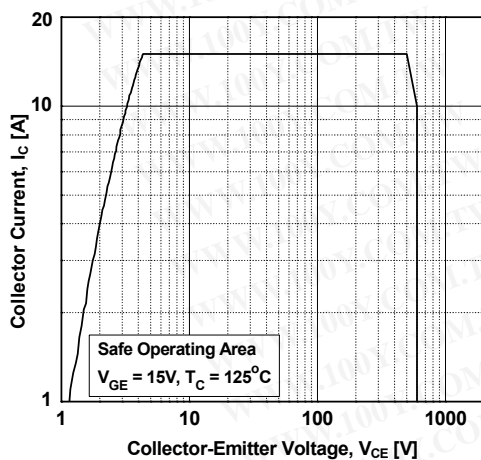
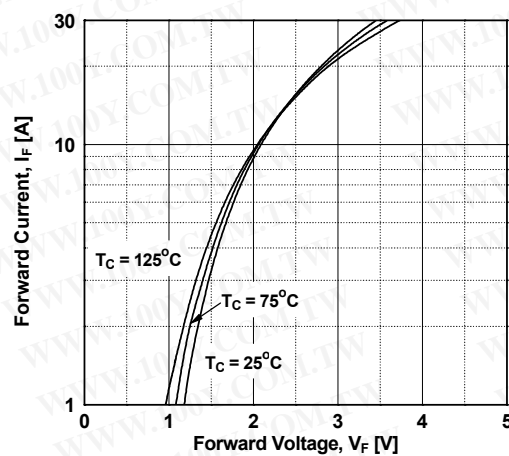


Figure 18. Forward Characteristics



## Typical Performance Characteristics

Figure 19. Reverse Recovery Current

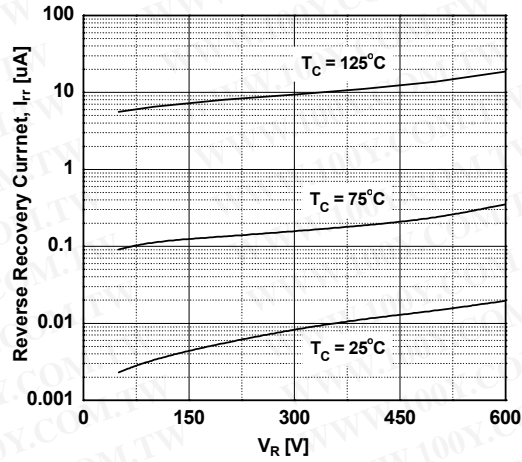


Figure 20. Stored Charge

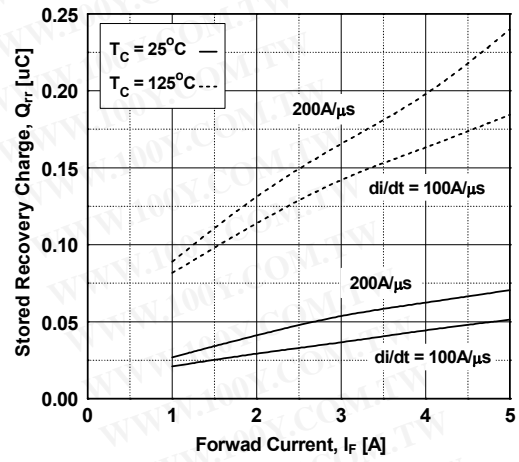


Figure 21. Reverse Recovery Time

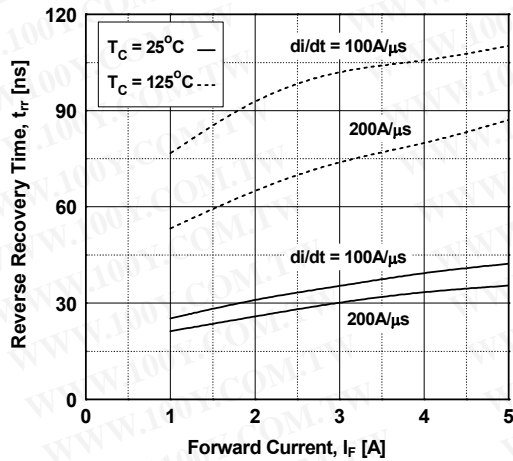
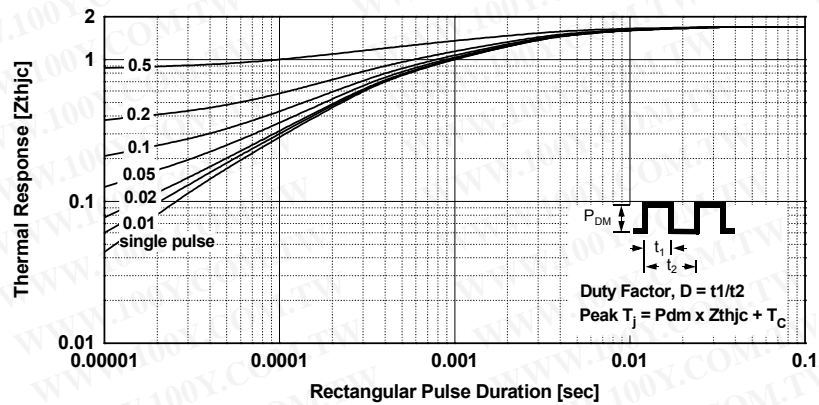


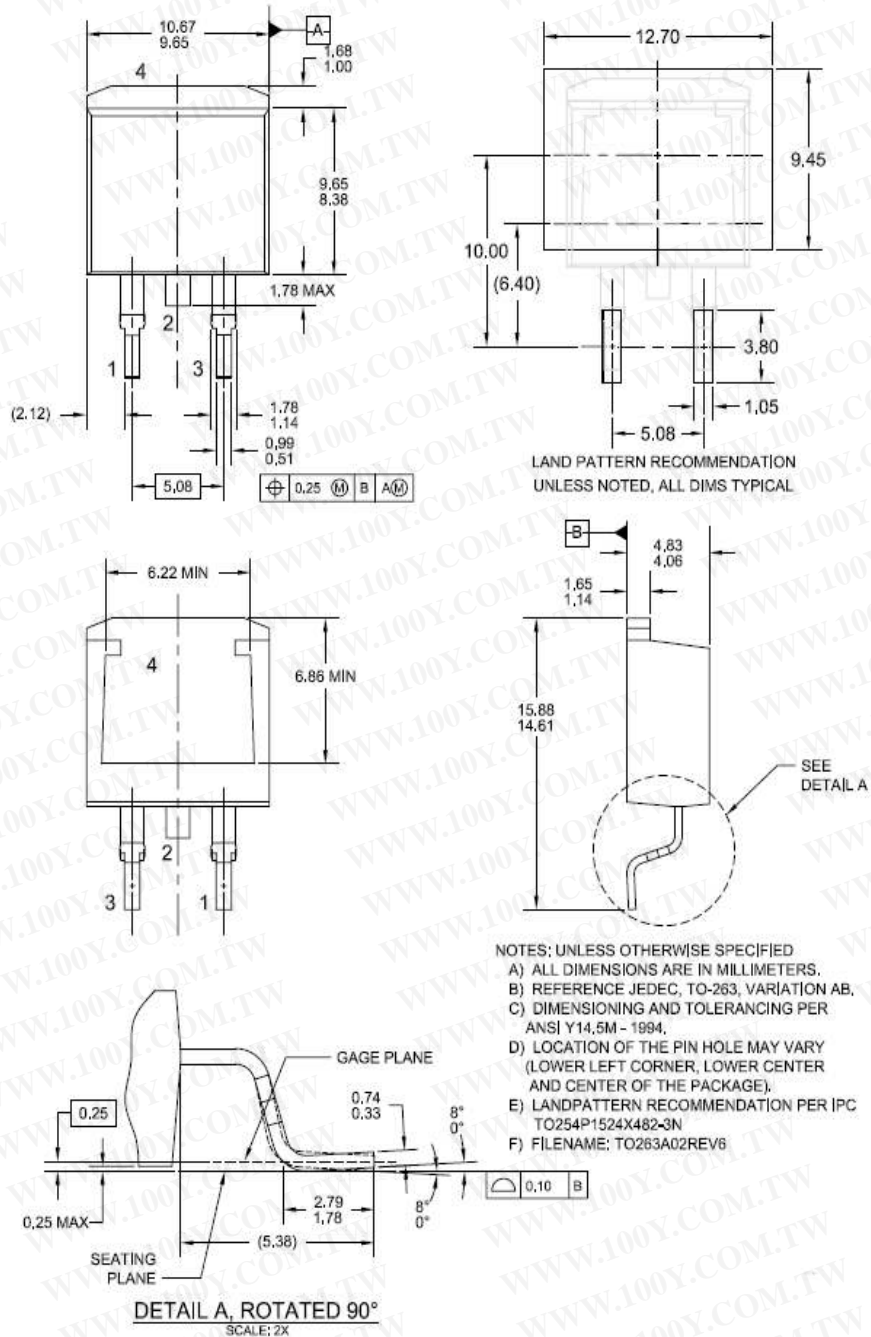
Figure 23. Transient Thermal Impedance of IGBT





# Mechanical Dimensions

## TO-263AB/D<sup>2</sup>-PAK





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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.
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Rev. 158