



September 2013

# FGB7N60UNDF

## 600 V, 7 A

### Short Circuit Rated IGBT

#### Features

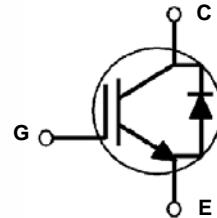
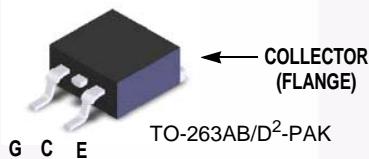
- Short Circuit Rated 10 us
- High Current Capability
- High Input Impedance
- Fast Switching
- RoHS Compliant

#### 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 ruggedness features are essential, such as sewing machine, CNC, motor control and home appliances.



#### Absolute Maximum Ratings

Symbol	Description	Ratings	Unit
$V_{CES}$	Collector to Emitter Voltage	600	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	14	A
	Collector Current @ $T_C = 100^\circ\text{C}$	7	A
$I_{CM(1)}$	Pulsed Collector Current @ $T_C = 25^\circ\text{C}$	21	A
$I_F$	Diode Forward Current @ $T_C = 25^\circ\text{C}$	7	A
	Diode Forward Current @ $T_C = 100^\circ\text{C}$	3.5	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	83	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	33	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.	Unit
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction to Case		1.5	$^\circ\text{C}/\text{W}$
$R_{\theta JC}(\text{Diode})$	Thermal Resistance, Junction to Case		3.5	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (PCB Mount)(2)		40	$^\circ\text{C}/\text{W}$

#### 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
FGB7N60UNDF	FGB7N60UNDF	TO-263AB(D <sup>2</sup> -PAK)		-	50

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$\text{BV}_{\text{CES}}$	Collector to Emitter Breakdown Voltage	$\text{V}_{\text{GE}} = 0\text{V}$ , $\text{I}_C = 250\mu\text{A}$	600	-	-	V
$\text{I}_{\text{CES}}$	Collector Cut-Off Current	$\text{V}_{\text{CE}} = \text{V}_{\text{CES}}$ , $\text{V}_{\text{GE}} = 0\text{V}$	-	-	1	mA
$\text{I}_{\text{GES}}$	G-E Leakage Current	$\text{V}_{\text{GE}} = \text{V}_{\text{GES}}$ , $\text{V}_{\text{CE}} = 0\text{V}$	-	-	$\pm 10$	$\mu\text{A}$
<b>On Characteristics</b>						
$\text{V}_{\text{GE}(\text{th})}$	G-E Threshold Voltage	$\text{I}_C = 7\text{mA}$ , $\text{V}_{\text{CE}} = \text{V}_{\text{GE}}$	5.5	6.8	8.5	V
$\text{V}_{\text{CE}(\text{sat})}$	Collector to Emitter Saturation Voltage	$\text{I}_C = 7\text{A}$ , $\text{V}_{\text{GE}} = 15\text{V}$	-	1.9	2.3	V
		$\text{I}_C = 7\text{A}$ , $\text{V}_{\text{GE}} = 15\text{V}$ , $T_C = 125^\circ\text{C}$	-	2.1	-	V
<b>Dynamic Characteristics</b>						
$\text{C}_{\text{ies}}$	Input Capacitance	$\text{V}_{\text{CE}} = 30\text{V}$ , $\text{V}_{\text{GE}} = 0\text{V}$ , $f = 1\text{MHz}$	-	275		pF
$\text{C}_{\text{oes}}$	Output Capacitance		-	41		pF
$\text{C}_{\text{res}}$	Reverse Transfer Capacitance		-	10		pF
<b>Switching Characteristics</b>						
$t_{\text{d}(\text{on})}$	Turn-On Delay Time	$\text{V}_{\text{CC}} = 400\text{V}$ , $\text{I}_C = 7\text{A}$ , $\text{R}_G = 10\Omega$ , $\text{V}_{\text{GE}} = 15\text{V}$ , Inductive Load, $T_C = 25^\circ\text{C}$	-	5.9		ns
$t_r$	Rise Time		-	4.2		ns
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time		-	32.3		ns
$t_f$	Fall Time		-	68	89	ns
$E_{\text{on}}$	Turn-On Switching Loss		-	99		uJ
$E_{\text{off}}$	Turn-Off Switching Loss		-	104		uJ
$E_{\text{ts}}$	Total Switching Loss		-	203		uJ
$t_{\text{d}(\text{on})}$	Turn-On Delay Time		-	6		ns
$t_r$	Rise Time		-	4.3		ns
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time		-	33.8		ns
$t_f$	Fall Time		-	113		ns
$E_{\text{on}}$	Turn-On Switching Loss		-	181		uJ
$E_{\text{off}}$	Turn-Off Switching Loss		-	144		uJ
$E_{\text{ts}}$	Total Switching Loss		-	325		uJ
$T_{\text{sc}}$	Short Circuit Withstand Time	$\text{V}_{\text{CC}} = 350\text{V}$ , $\text{R}_G = 100\Omega$ , $\text{V}_{\text{GE}} = 15\text{V}$ , $T_C = 150^\circ\text{C}$	10			us

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

$Q_g$	Total Gate Charge	$V_{CE} = 400\text{V}$ , $I_C = 7\text{A}$ , $V_{GE} = 15\text{V}$	-	18	-	nC
$Q_{ge}$	Gate to Emitter Charge		-	3	-	nC
$Q_{gc}$	Gate to Collector Charge		-	13	-	nC

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit
$V_{FM}$	Diode Forward Voltage	$I_F = 7\text{A}$	$T_C = 25^\circ\text{C}$	-	1.7	2.2
			$T_C = 125^\circ\text{C}$	-	1.6	
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 7\text{A}$ , $dI_F/dt = 200\text{A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	-	32.3	
			$T_C = 125^\circ\text{C}$	-	70	ns
$Q_{rr}$	Diode Reverse Recovery Charge		$T_C = 25^\circ\text{C}$	-	59	
			$T_C = 125^\circ\text{C}$	-	172	nC

## Typical Performance Characteristics

Figure 1. Typical Output Characteristics

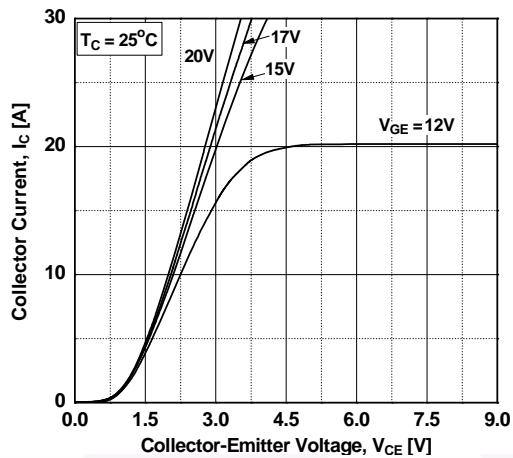


Figure 3. Typical Saturation Voltage Characteristics

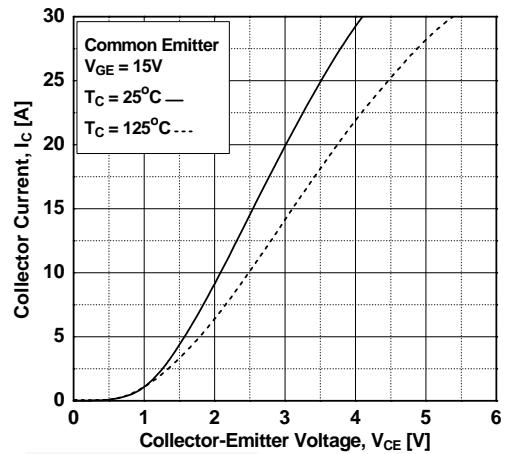


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

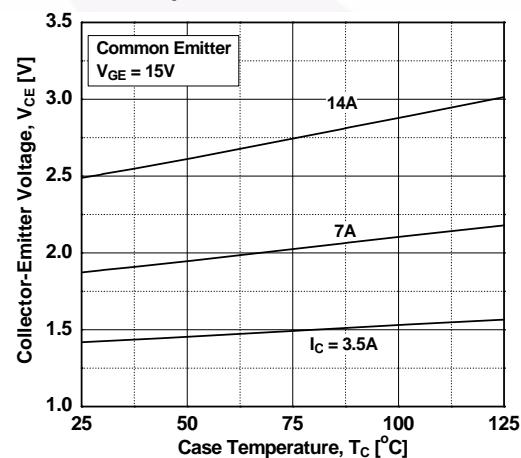


Figure 2. Typical Output Characteristics

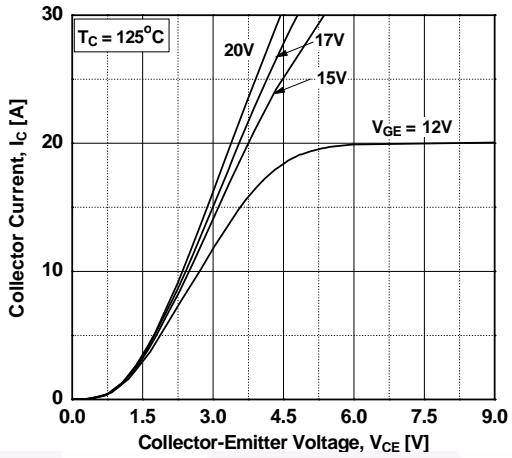


Figure 4. Transfer Characteristics

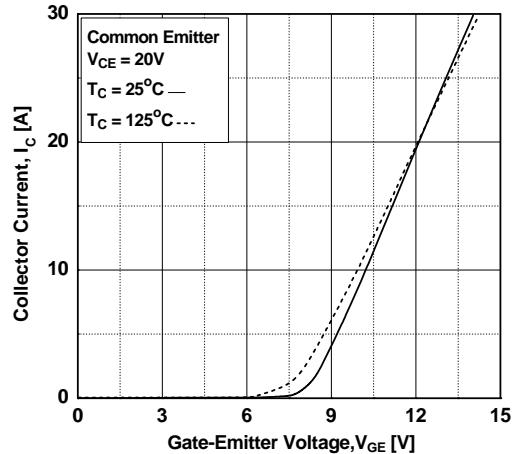
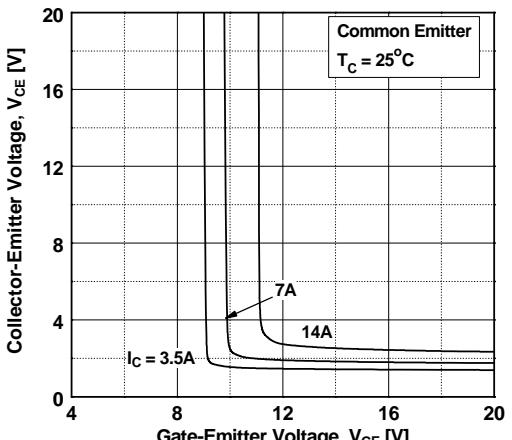


Figure 6. Saturation Voltage vs. Vge



## Typical Performance Characteristics

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

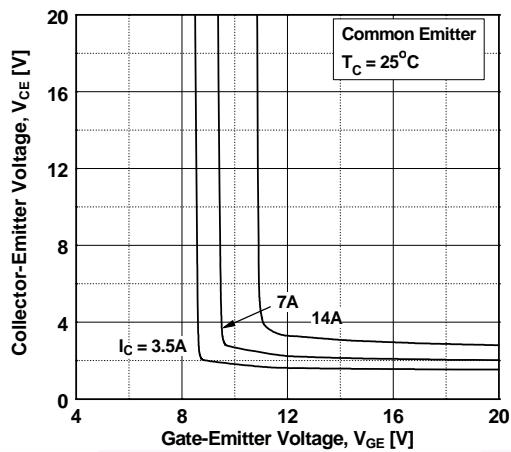


Figure 9. Gate charge Characteristics

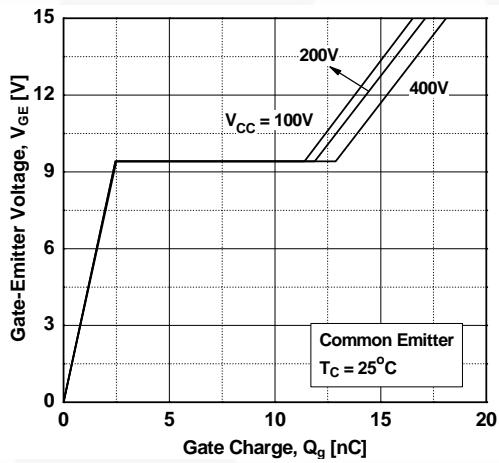


Figure 11. Turn-on Characteristics vs. Gate Resistance

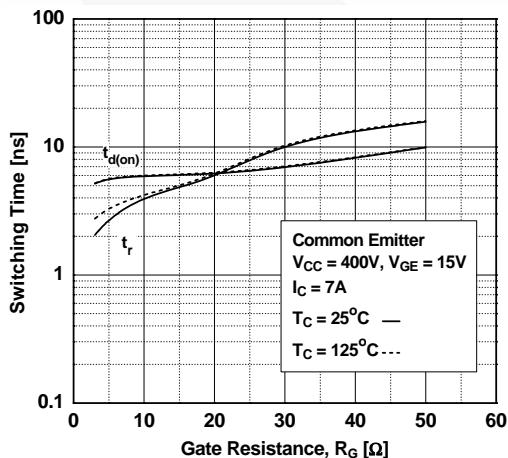


Figure 8. Capacitance Characteristics

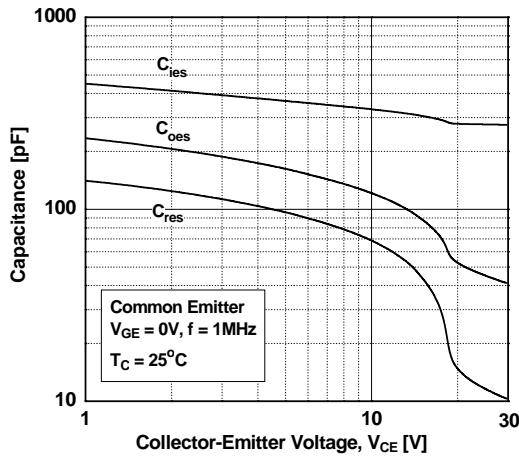


Figure 10. SOA Characteristics

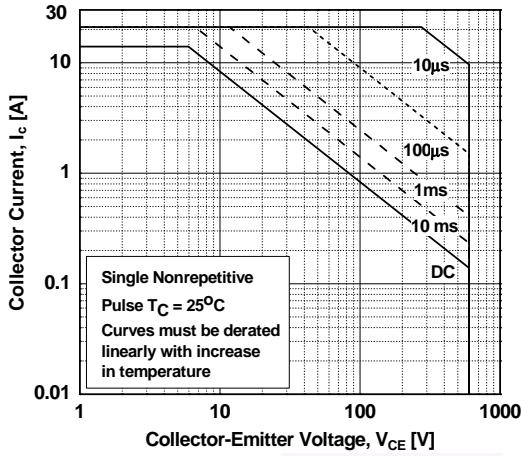
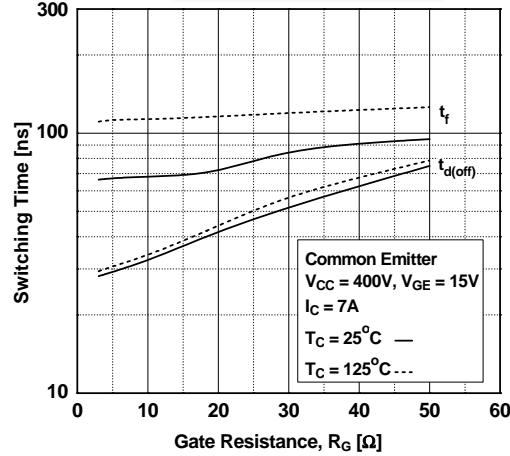


Figure 12. Turn-off Characteristics vs. Gate Resistance



## Typical Performance Characteristics

Figure 13. Turn-on Characteristics vs. Collector Current

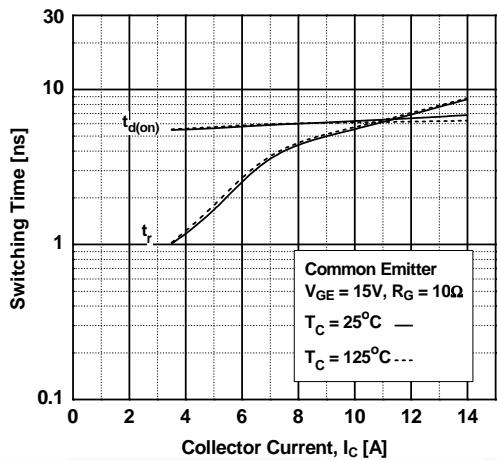


Figure 14. Turn-off Characteristics vs. Collector Current

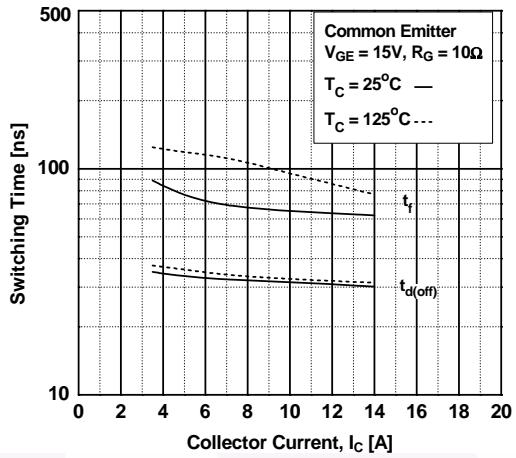


Figure 15. Switching Loss vs. Gate Resistance

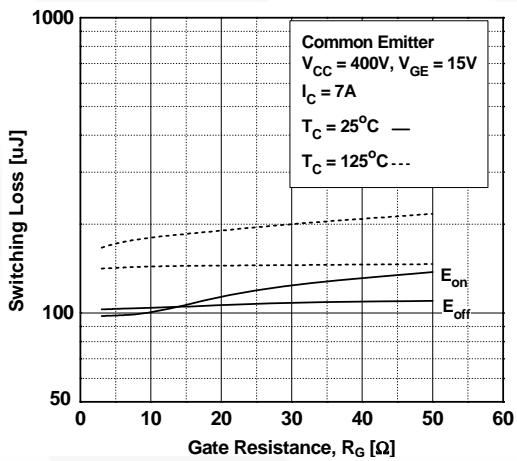


Figure 16. Switching Loss vs. Collector Current

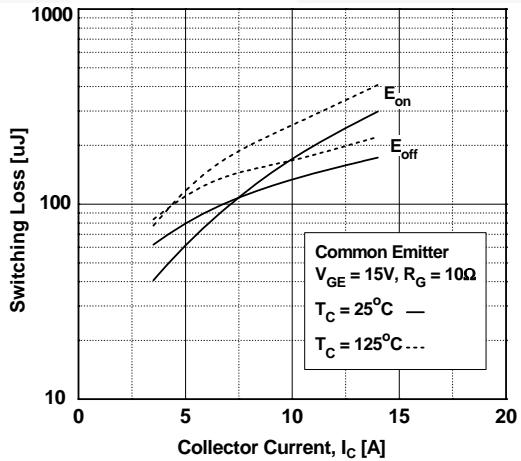


Figure 17. Turn off Switching SOA Characteristics

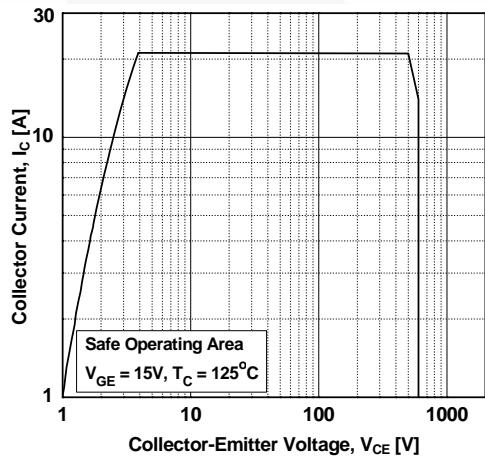
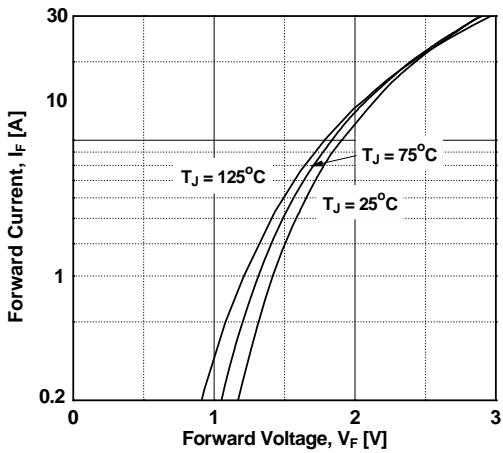


Figure 18. Forward Characteristics



## Typical Performance Characteristics

Figure 19. Reverse Current

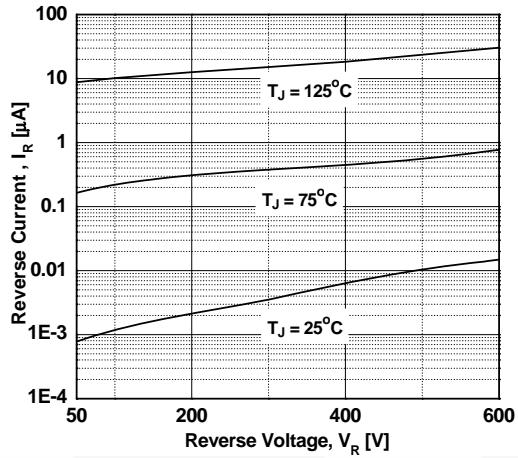


Figure 20. Stored Charge

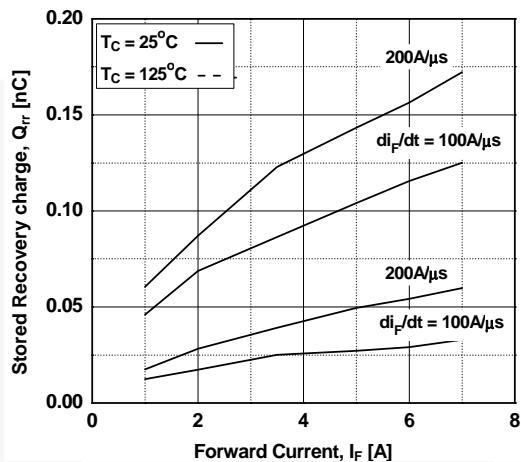


Figure 21. Reverse Recovery Time

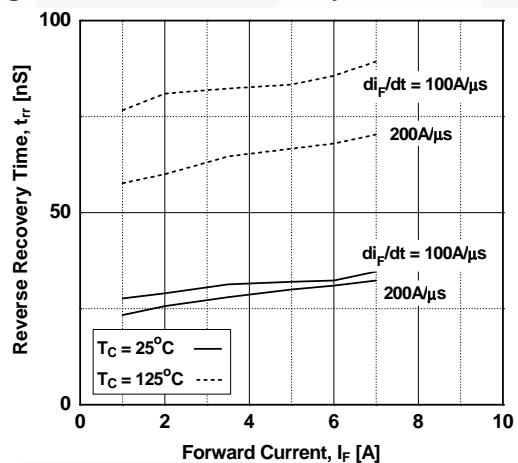
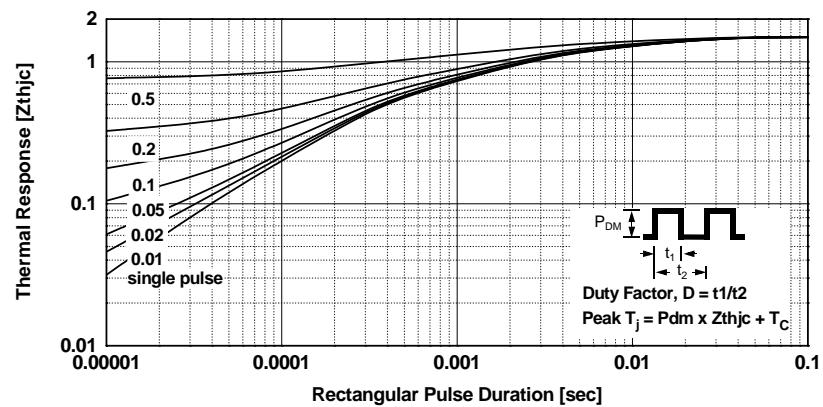


Figure 22. Transient Thermal Impedance of IGBT



## Mechanical Dimensions

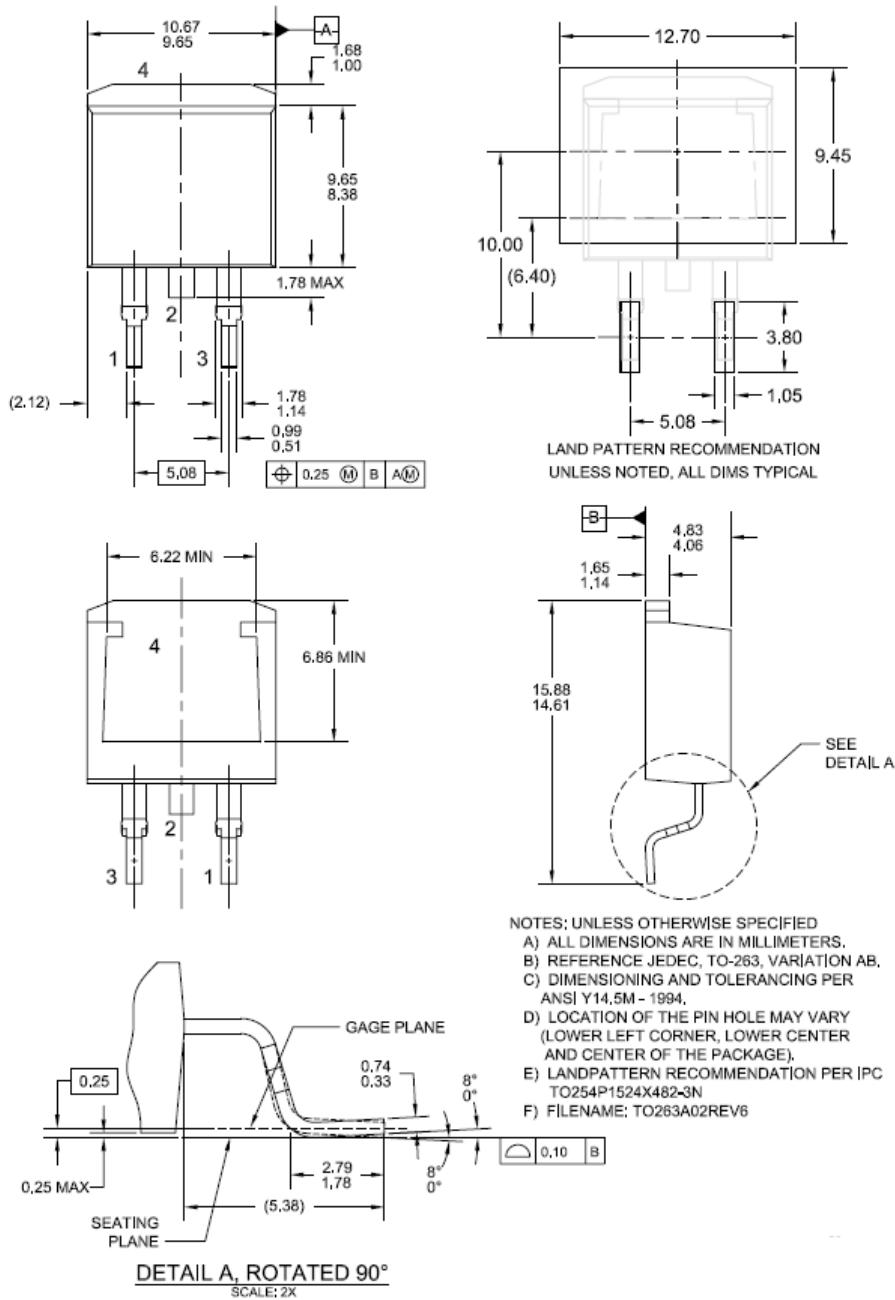


Figure 23. TO-263 2L (D2PAK) - 2LD, TO263, SURFACE MOUNT

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Dimensions in Millimeters



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