

**FAIRCHILD**  
SEMICONDUCTOR®

April 2009

# FGPF50N33BT

## 330V, 50A PDP IGBT

### Features

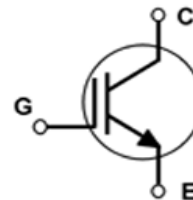
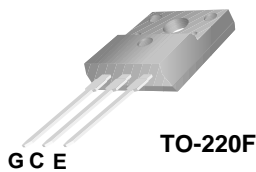
- High current capability
- Low saturation voltage:  $V_{CE(sat)} = 1.6V @ I_C = 50A$
- High input impedance
- Fast switching

### General Description

Using Novel Trench IGBT Technology, Fairchild's new series of trench IGBTs offer the optimum performance for PDP applications where low conduction and switching losses are essential.

### Applications

- PDP System



### Absolute Maximum Ratings

Symbol	Description	Ratings	Units
$V_{CES}$	Collector to Emitter Voltage	330	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 30$	V
$I_C$	Collector Current @ $T_C = 25^\circ C$	50	A
$I_{Cpulse (1)*}$	Pulsed Collector Current @ $T_C = 25^\circ C$	120	A
$I_{Cpulse (2)*}$	Pulsed Collector Current @ $T_C = 25^\circ C$	160	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ C$	43	W
	Maximum Power Dissipation @ $T_C = 100^\circ C$	17.2	W
$T_J$	Operating Junction Temperature	-55 to +150	$^\circ C$
$T_{stg}$	Storage Temperature Range	-55 to +150	$^\circ C$
$T_L$	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	$^\circ C$

### Thermal Characteristics


Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}(IGBT)$	Thermal Resistance, Junction to Case	-	2.9	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	62.5	$^\circ C/W$

#### Notes:

- 1: Repetitive test, Pulse width=100usec, Duty=0.1
- 2: Half Sine Wave,  $D < 0.01$ , pluse width < 10usec

\* $I_{c\_pulse}$  limited by max  $T_J$

## Package Marking and Ordering Information

Device Marking	Device	Package	 Eco Status	Packaging Type	Qty per Tube
FGPF50N33BT	FGPF50N33BTTU	TO-220F	RoHS	Tube	50ea

 For Fairchild's definition of "green" Eco Status, please visit: [http://www.fairchildsemi.com/company/green/rohs\\_green.html](http://www.fairchildsemi.com/company/green/rohs_green.html).

## Electrical Characteristics of the IGBT T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
<b>Off Characteristics</b>						
BV <sub>CES</sub>	Collector to Emitter Breakdown Voltage	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA, T <sub>C</sub> =25°C	330	-	-	V
		V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA, T <sub>C</sub> =125°C	340	-	-	V
ΔBV <sub>CES</sub> ΔT <sub>J</sub>	Temperature Coefficient of Breakdown Voltage	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA	-	0.2	-	V/°C
I <sub>CES</sub>	Collector Cut-Off Current	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0V, T <sub>C</sub> =25°C	-	-	20	μA
		V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0V, T <sub>C</sub> =125°C	-	-	200	μA
I <sub>GES</sub>	G-E Leakage Current	V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0V	-	-	±200	nA
<b>On Characteristics</b>						
V <sub>GE(th)</sub>	G-E Threshold Voltage	I <sub>C</sub> = 250μA, V <sub>CE</sub> = V <sub>GE</sub>	2.3	3.3	4.3	V
V <sub>CE(sat)</sub>	Collector to Emitter Saturation Voltage	I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V,	-	1.2	1.5	V
		I <sub>C</sub> = 30A, V <sub>GE</sub> = 15V,	-	1.3	-	V
		I <sub>C</sub> = 50A, V <sub>GE</sub> = 15V, T <sub>C</sub> = 25°C	-	1.6	-	V
		I <sub>C</sub> = 50A, V <sub>GE</sub> = 15V, T <sub>C</sub> = 125°C	-	1.7	-	V
<b>Dynamic Characteristics</b>						
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 30V, V <sub>GE</sub> = 0V, f = 1MHz	-	980	-	pF
C <sub>oes</sub>	Output Capacitance		-	70	-	pF
C <sub>res</sub>	Reverse Transfer Capacitance		-	40	-	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>CC</sub> = 200V, I <sub>C</sub> = 20A, R <sub>G</sub> = 5Ω, V <sub>GE</sub> = 15V, Resistive Load, T <sub>C</sub> = 25°C	-	9	-	ns
t <sub>r</sub>	Rise Time		-	33	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	32	-	ns
t <sub>f</sub>	Fall Time		-	202	-	ns
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>CC</sub> = 200V, I <sub>C</sub> = 20A, R <sub>G</sub> = 5Ω, V <sub>GE</sub> = 15V, Resistive Load, T <sub>C</sub> = 125°C	-	9	-	ns
t <sub>r</sub>	Rise Time		-	37	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	33	-	ns
t <sub>f</sub>	Fall Time		-	332	-	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>CE</sub> = 200V, I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V	-	35	-	nC
Q <sub>ge</sub>	Gate to Emitter Charge		-	6	-	nC
Q <sub>gc</sub>	Gate to Collector Charge		-	14	-	nC

### Typical Performance Characteristics

Figure 1. Typical Output Characteristics

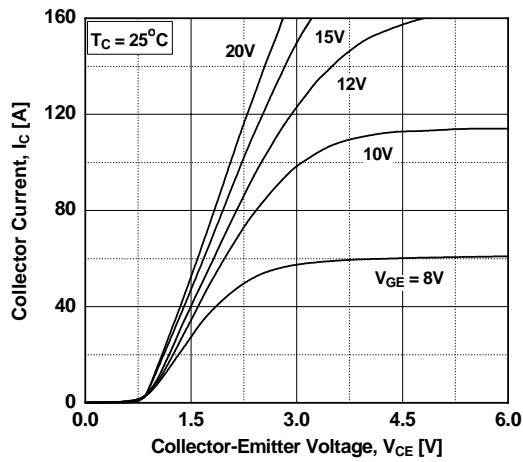


Figure 2. Typical Output Characteristics

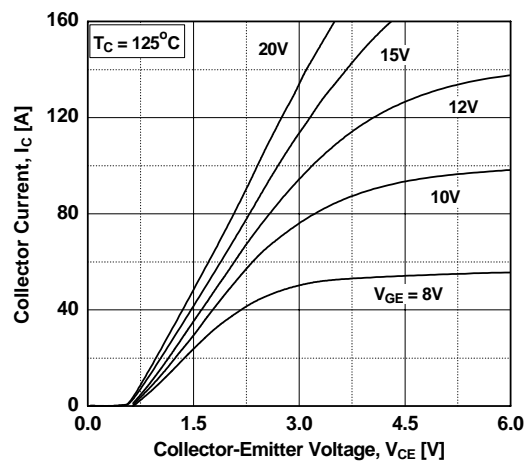


Figure 3. Typical Saturation Voltage Characteristics

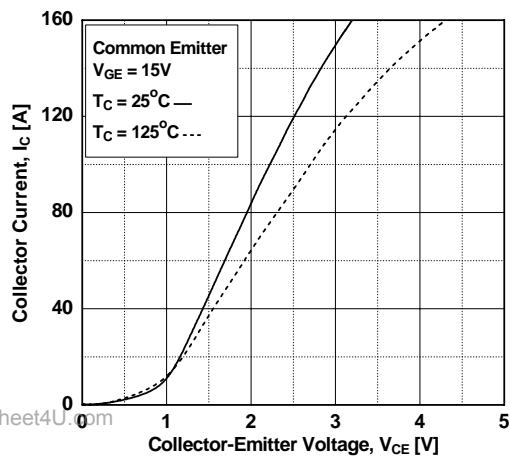


Figure 4. Transfer Characteristics

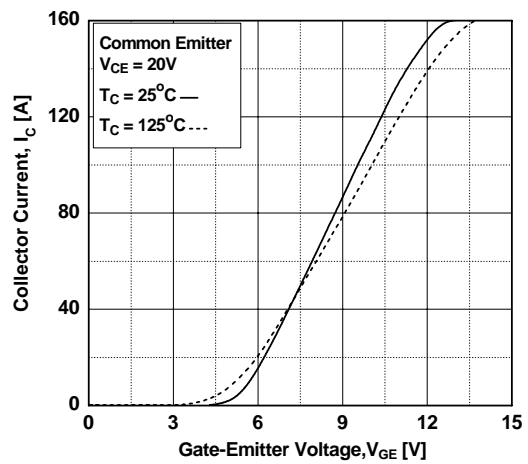


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

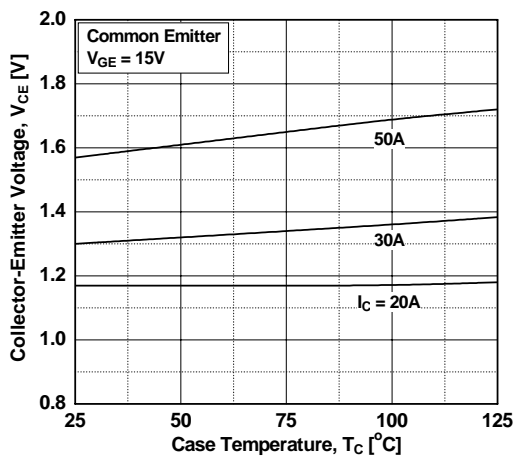
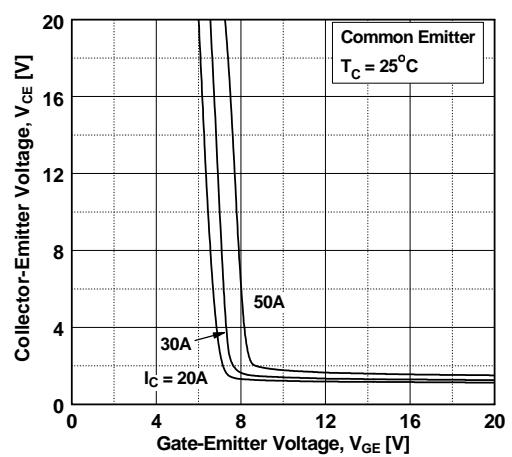


Figure 6. Saturation Voltage vs. Vge



### Typical Performance Characteristics

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

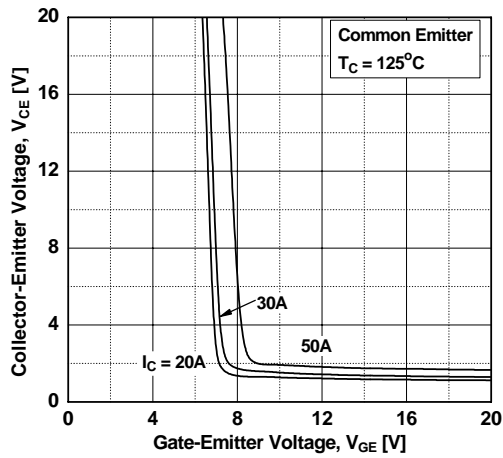


Figure 8. Capacitance Characteristics

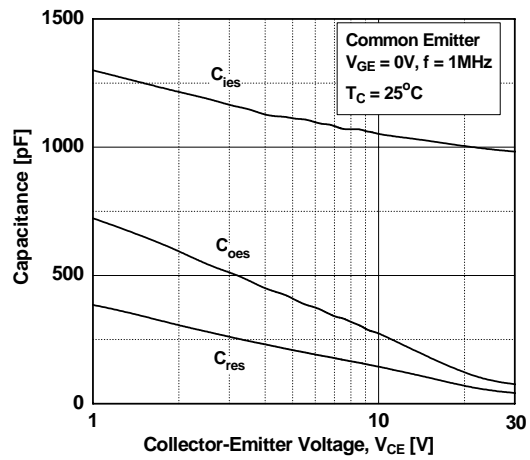


Figure 9. Gate charge Characteristics

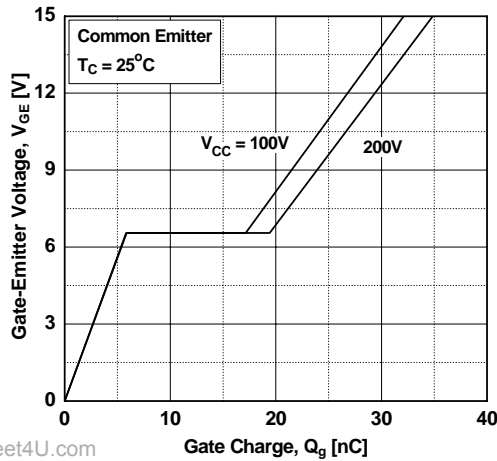


Figure 10. SOA Characteristics

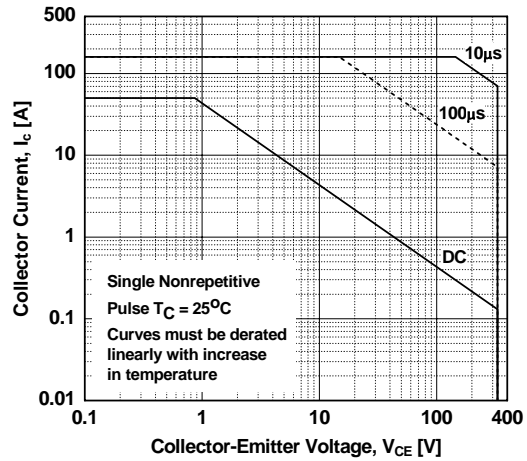


Figure 11. Turn-on Characteristics vs. Gate Resistance

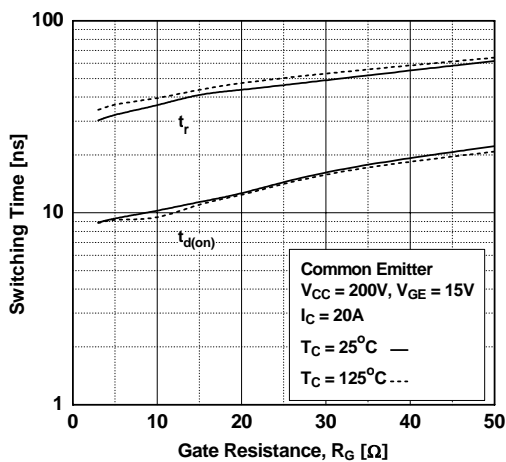
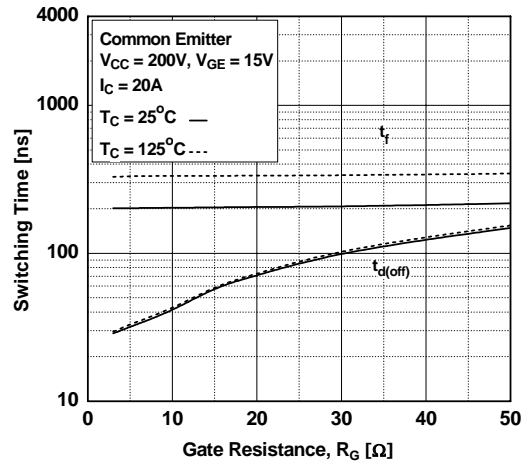


Figure 12. Turn-off Characteristics vs. Gate Resistance



### Typical Performance Characteristics

Figure 13. Turn-on Characteristics vs. Collector Current

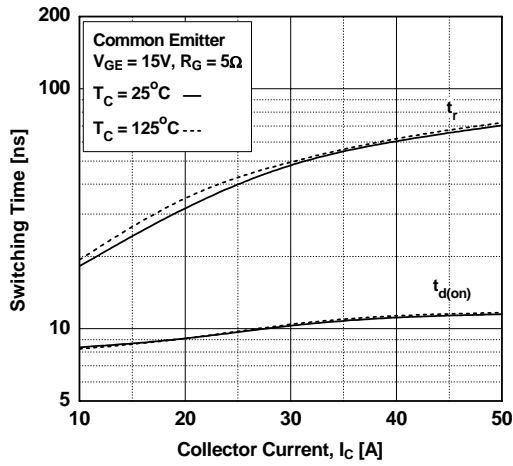


Figure 14. Turn-off Characteristics vs. Collector Current

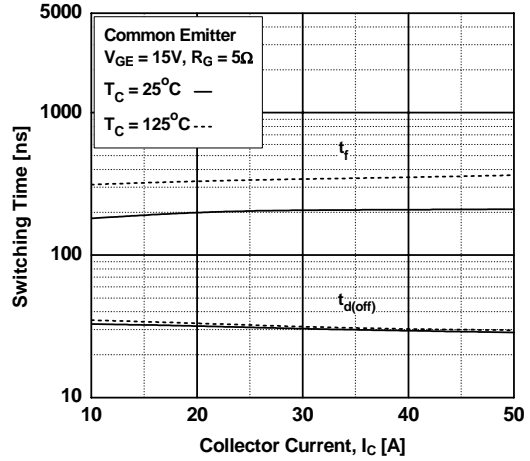


Figure 15. Switching Loss vs. Gate Resistance

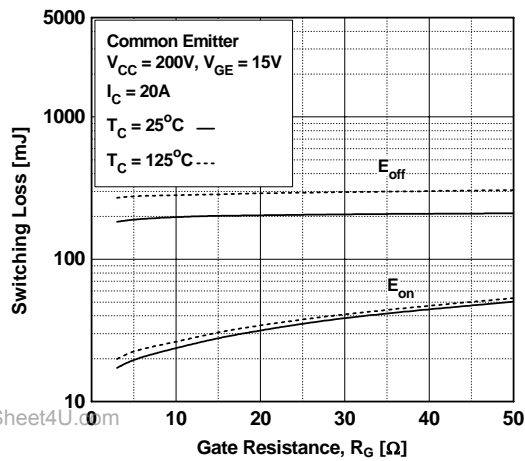


Figure 16. Switching Loss vs. Collector Current

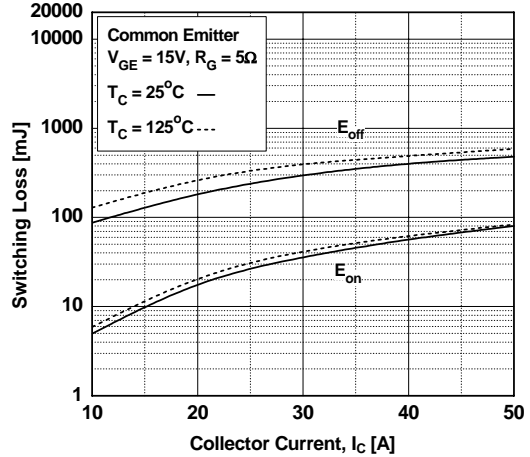
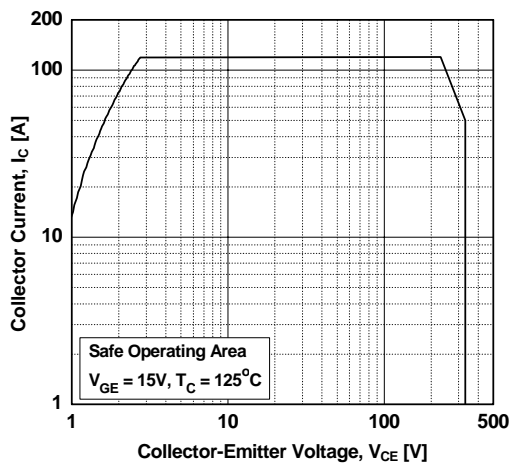


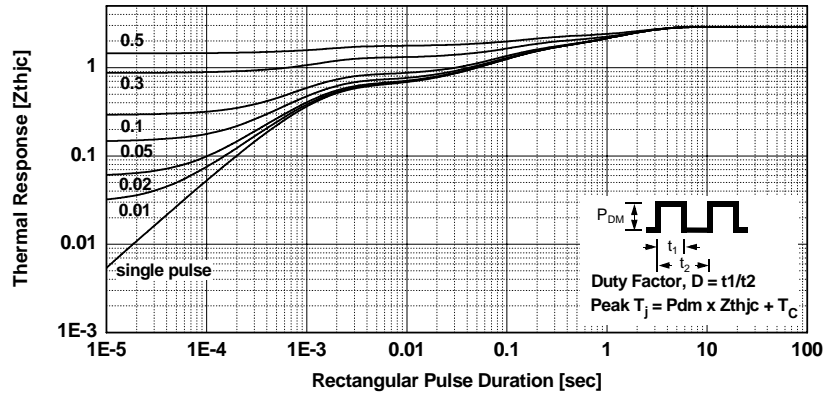
Figure 17. Turn off Switching SOA Characteristics



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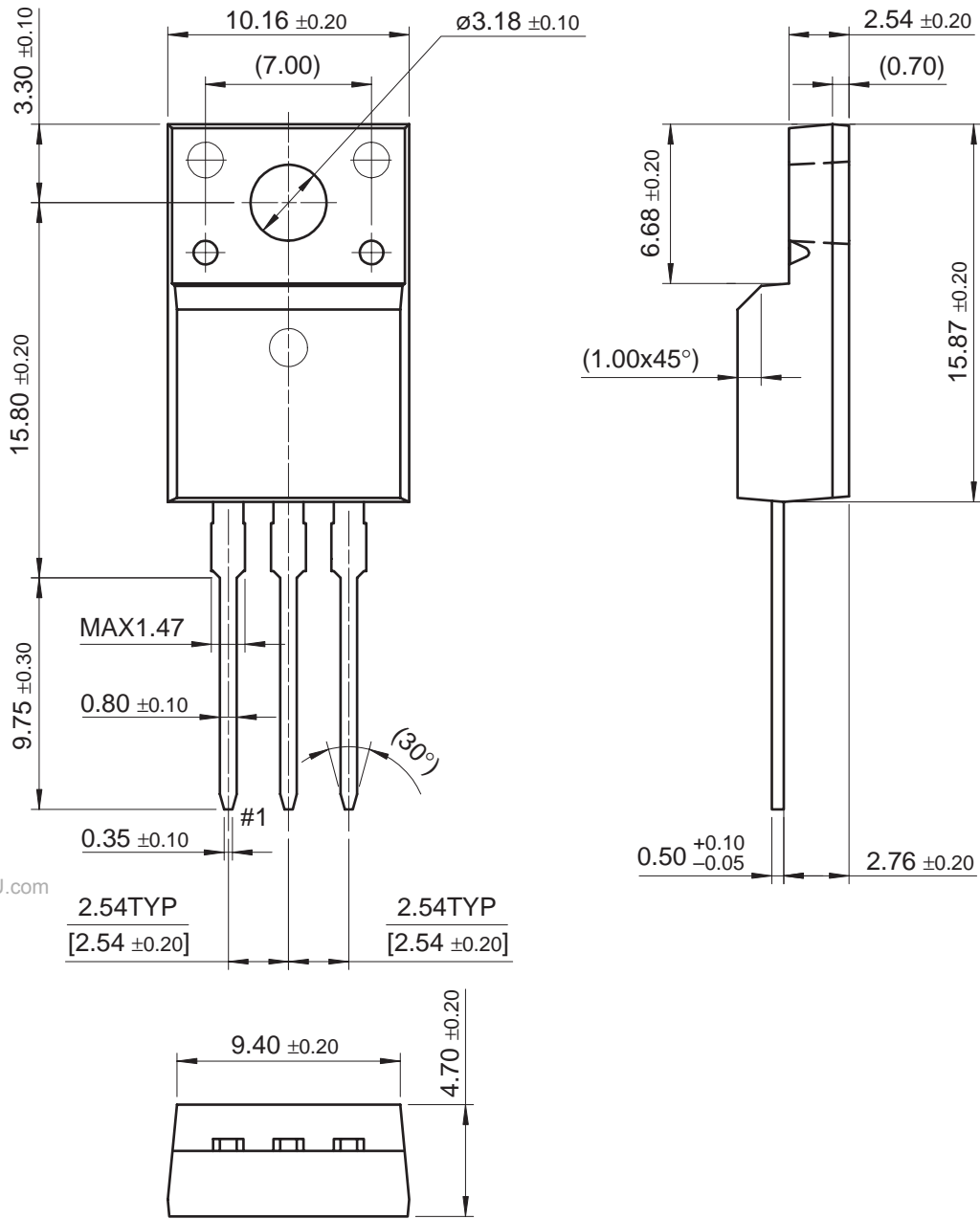
Typical Performance Characteristics

Figure 18. Transient Thermal Impedance of IGBT



### Mechanical Dimensions

## TO-220F









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Dimensions in Millimeters



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