



**THE DATASHEET OF  
FGA70N33BTD**





# FGA70N33BTD

## 330V, 70A PDP IGBT

### Features

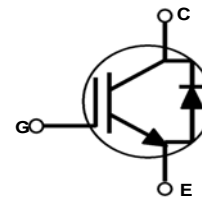
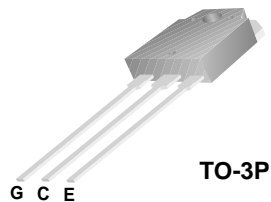
- High current capability
- Low saturation voltage:  $V_{CE(sat)} = 1.7V @ I_C = 70A$
- High input impedance
- Fast switching
- RoHS Compliant

### Applications

- PDP System

### 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.



### Absolute Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Description	Ratings	Units
$V_{CES}$	Collector to Emitter Voltage	330	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 30$	V
$I_{Cpulse(1)*}$	Pulsed Collector Current @ $T_C = 25^\circ C$	160	A
$I_{Cpulse(2)*}$	Pulsed Collector Current @ $T_C = 25^\circ C$	220	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ C$	149	W
	Maximum Power Dissipation @ $T_C = 100^\circ C$	60	W
$V_{RRM}$	Peak Repetitive Reverse Voltage of Diode	330	V
$I_{F(AV)}$	Average Rectified Forward Current of diode @ $T_C = 100^\circ C$	10	A
$I_{FSM}$	Non-repetitive Peak Surge Current of diode 60Hz Single Half-Sine wave	100	A
$T_J, T_{stg}$	Operating Junction Temperature and Storage Temperature	-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	--	0.84	$^\circ C/W$
$R_{\theta JC}(Diode)$	Thermal Resistance, Junction to Case	--	1.16	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	--	40	$^\circ C/W$

**Notes:**

- 1: Repetitive test, Pulse width=100usec, Duty=0.1
  - 2: Half Sine Wave, D< 0.01, pluse width < 5usec
- \* $I_{C\_pulse}$  limited by max  $T_J$

## Package Marking and Ordering Information

Device Marking	Device	Package	Packaging Type	Qty per Tube	Max Qty per Box
FGA70N33BTD	FGA70N33BTDU	TO-3P	Tube	30ea	--

## 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>						
$V_{CES}$	Collector to Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	330	--	--	V
$\frac{\Delta V_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	--	0.3	--	V/°C
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	--	--	250	$\mu A$
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	--	--	$\pm 400$	nA
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 250\mu A, V_{CE} = V_{GE}$	2.3	3.3	4.3	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 20A, V_{GE} = 15V$	--	1.1	--	V
		$I_C = 40A, V_{GE} = 15V,$	--	1.4	--	V
		$I_C = 70A, V_{GE} = 15V, T_C = 25^\circ C$	--	1.7	--	V
		$I_C = 70A, V_{GE} = 15V,$ $T_C = 125^\circ C$	--	1.8	--	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V,$ $f = 1MHz$	--	1380	--	pF
$C_{oes}$	Output Capacitance		--	140	--	pF
$C_{res}$	Reverse Transfer Capacitance		--	60	--	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 200V, I_C = 20A,$ $R_G = 5\Omega, V_{GE} = 15V,$ Resistive Load, $T_C = 25^\circ C$	--	13	--	ns
$t_r$	Rise Time		--	26	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	46	--	ns
$t_f$	Fall Time		--	198	--	ns
$t_{d(on)}$	Turn-On Delay Time		$V_{CC} = 200V, I_C = 20A,$ $R_G = 5\Omega, V_{GE} = 15V,$ Resistive Load, $T_C = 125^\circ C$	--	13	--
$t_r$	Rise Time	--		28	--	ns
$t_{d(off)}$	Turn-Off Delay Time	--		48	--	ns
$t_f$	Fall Time	--		268	--	ns
$Q_g$	Total Gate Charge	$V_{CE} = 200V, I_C = 20A,$ $V_{GE} = 15V$		--	49	--
$Q_{ge}$	Gate to Emitter Charge		--	6.8	--	nC
$Q_{gc}$	Gate to Collector Charge		--	17.5	--	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	$I_F = 10A$	$T_C = 25^\circ\text{C}$	--	1.1	1.5	V
			$T_C = 125^\circ\text{C}$	--	0.95	--	
$t_{rr}$	Diode Reverse Recovery Time		$T_C = 25^\circ\text{C}$	--	23	--	ns
			$T_C = 125^\circ\text{C}$	--	36	--	
$I_{rr}$	Diode Peak Reverse Recovery Current	$I_F = 10A, di/dt = 200A/\mu s$	$T_C = 25^\circ\text{C}$	--	2.8	--	A
			$T_C = 125^\circ\text{C}$	--	5.1	--	
$Q_{rr}$	Diode Reverse Recovery Charge		$T_C = 25^\circ\text{C}$	--	32	--	nC
			$T_C = 125^\circ\text{C}$	--	91	--	

## Typical Performance Characteristics

Figure 1. Typical Output Characteristics

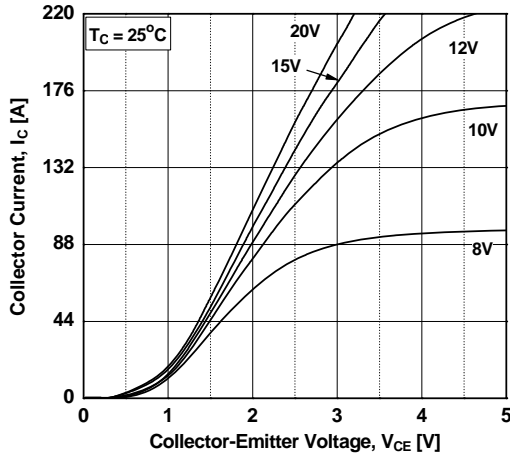


Figure 2. Typical Output Characteristics

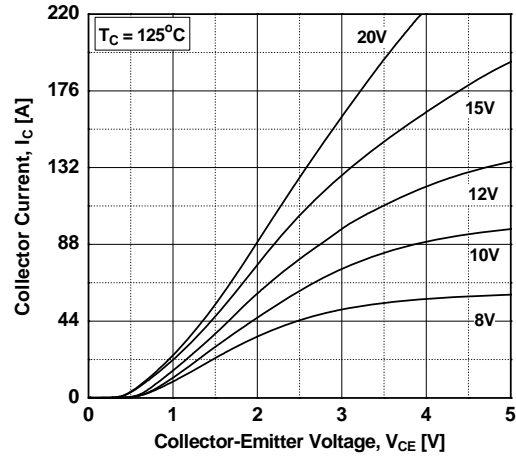


Figure 3. Typical Saturation Voltage Characteristics

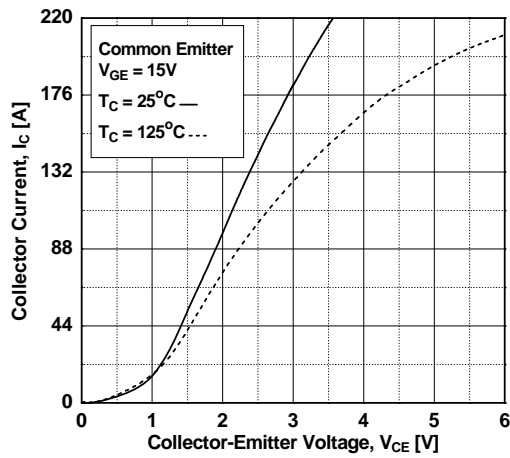


Figure 4. Transfer Characteristics

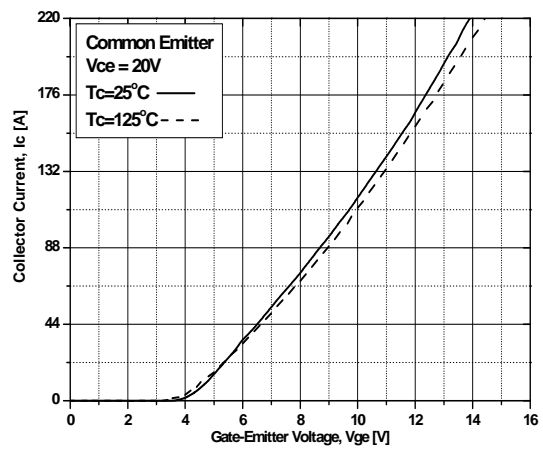


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

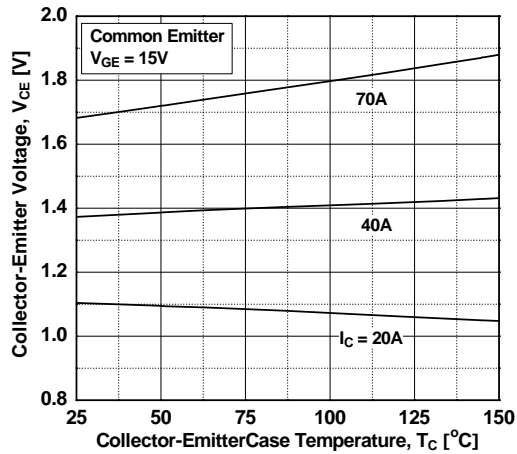
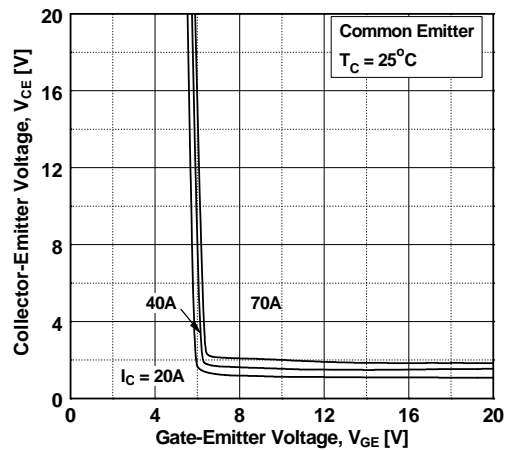


Figure 6. Saturation Voltage vs. Vge



## Typical Performance Characteristics

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

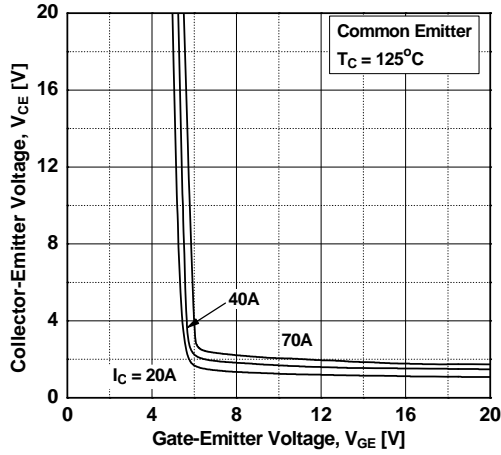


Figure 8. Capacitance Characteristics

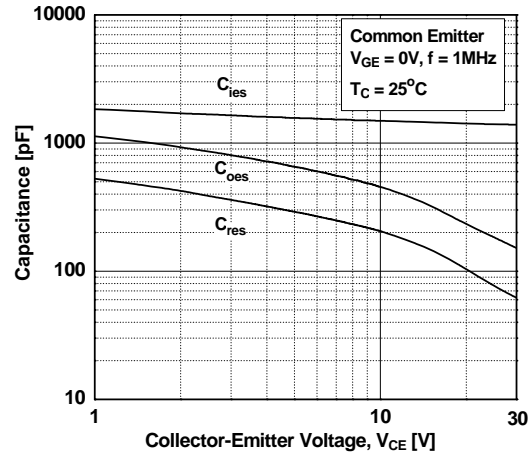


Figure 9. Gate charge Characteristics

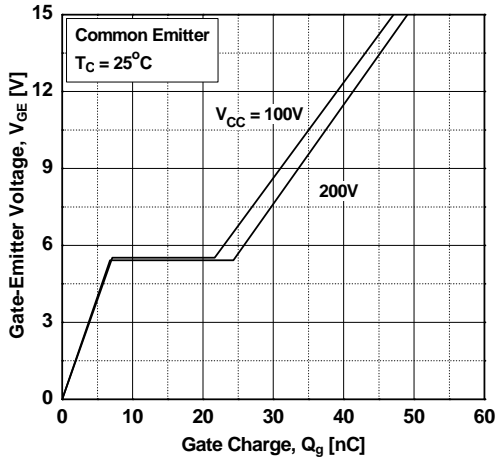


Figure 10. SOA Characteristics

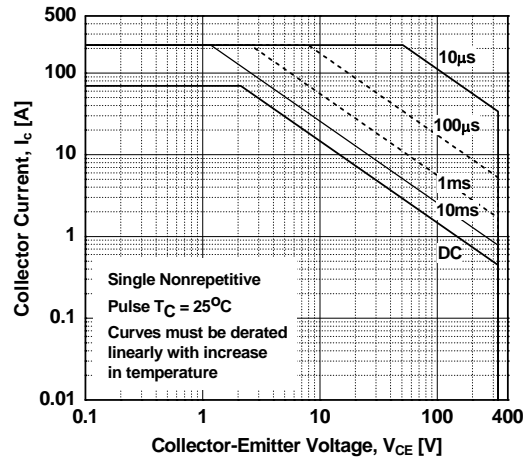


Figure 11. Turn-on Characteristics vs. Gate Resistance

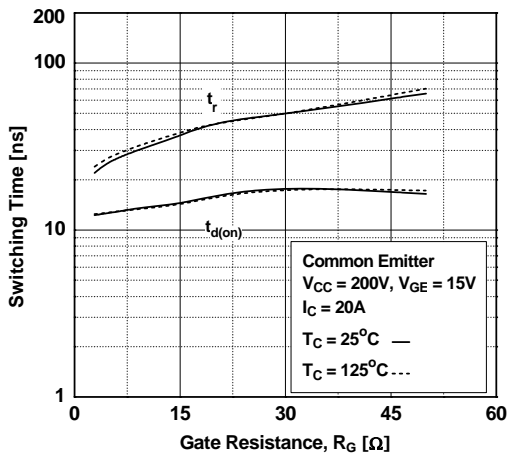
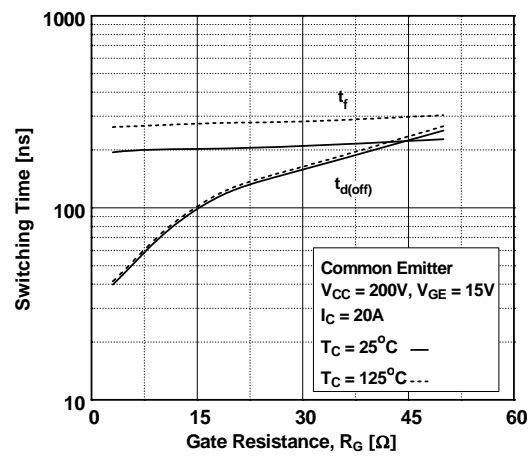


Figure 12. Turn-off Characteristics vs. Gate Resistance



## Typical Performance Characteristics

Figure 13. Turn-on Characteristics vs. Collector Current

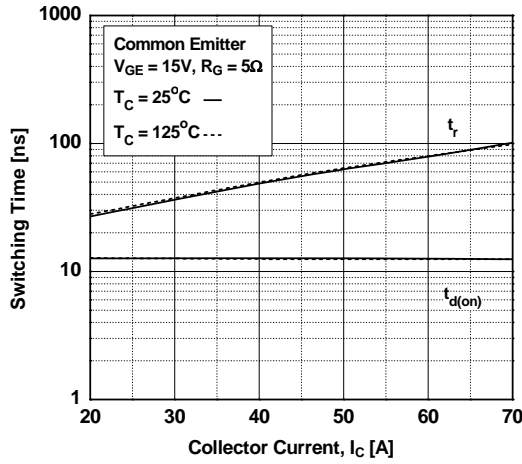


Figure 14. Turn-off Characteristics vs. Collector Current

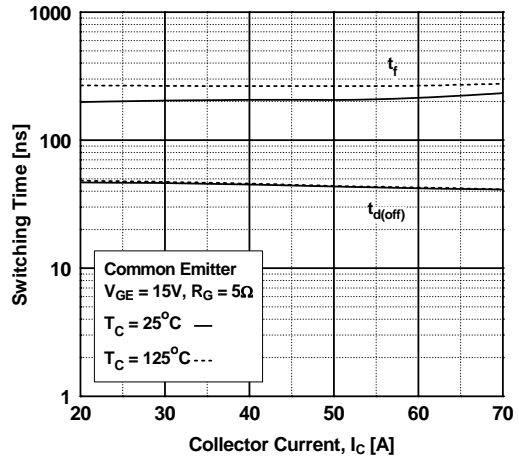


Figure 15. Switching Loss vs. Gate Resistance

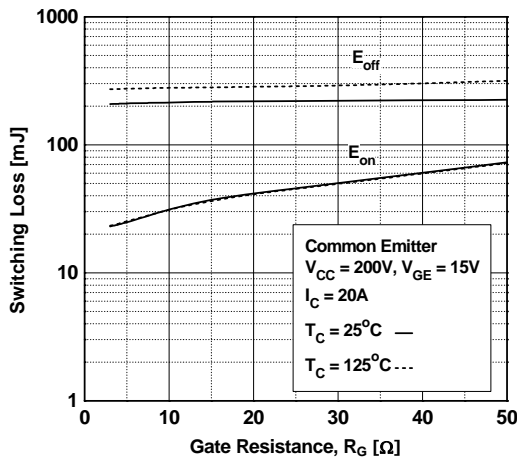


Figure 16. Switching Loss vs. Collector Current

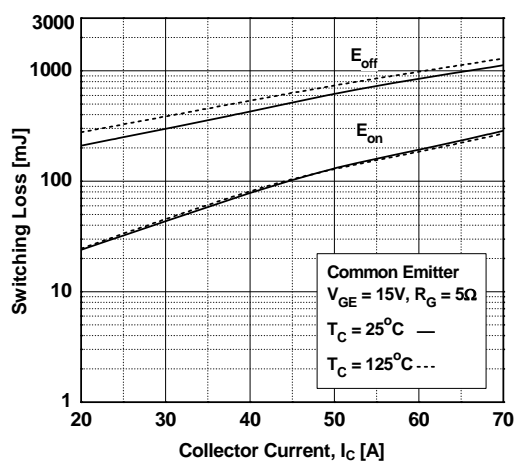
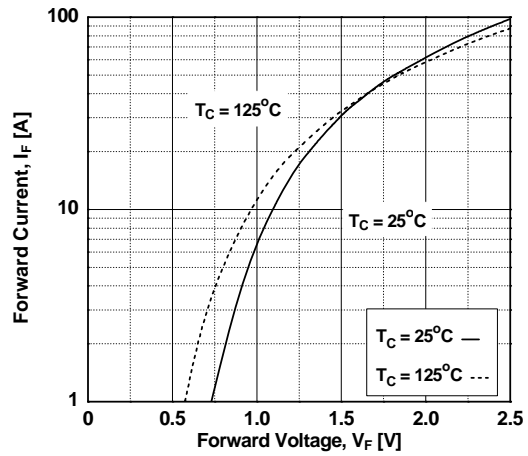
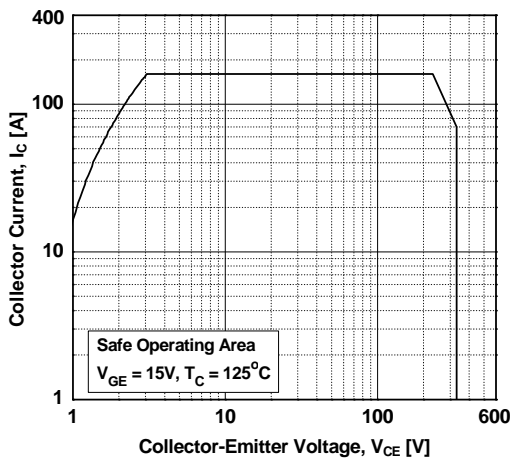


Figure 17. Turn off Switching SOA Characteristics Figure 18. Forward Characteristics



## Typical Performance Characteristics

Figure 19. Reverse Recovery Current

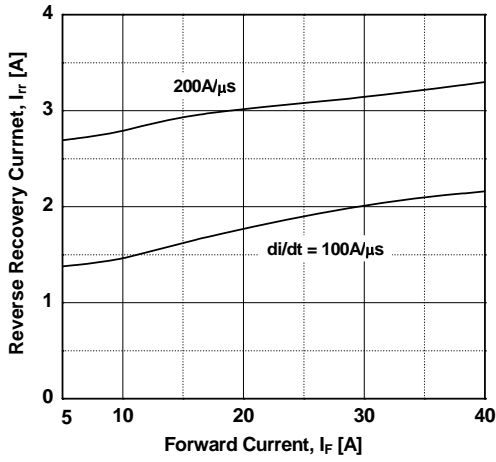


Figure 20. Stored Charge

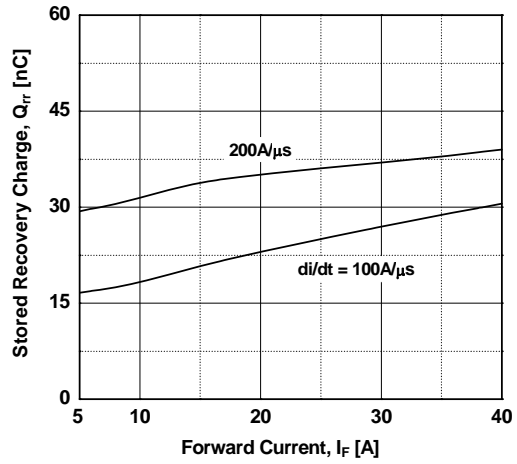


Figure 21. Reverse Recovery Time

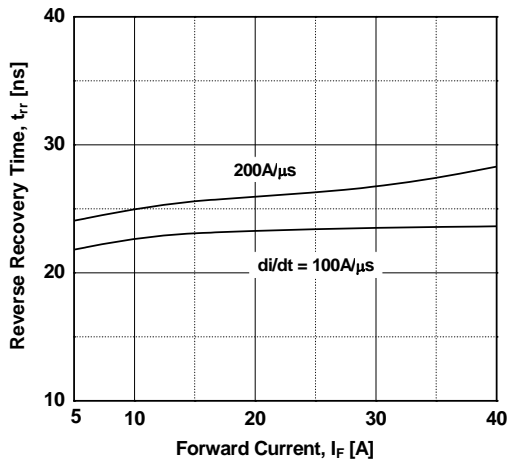
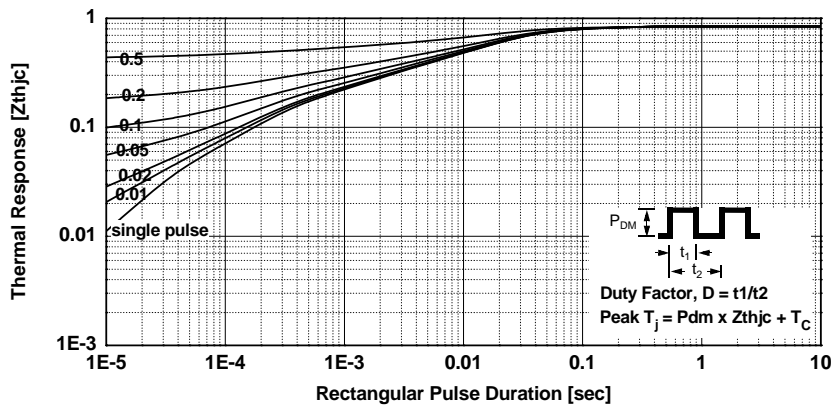
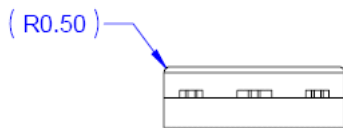
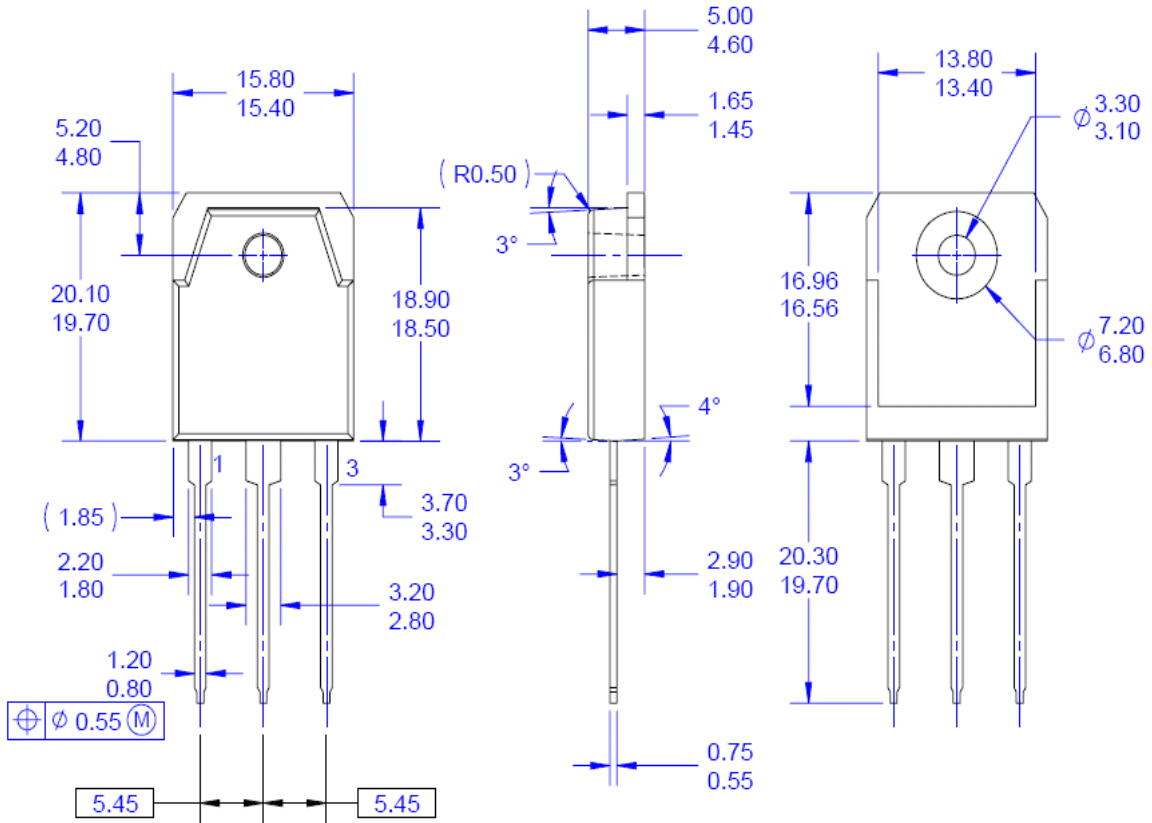


Figure 22. Transient Thermal Impedance of IGBT



Mechanical Dimensions

TO-3PN



NOTES: UNLESS OTHERWISE SPECIFIED


- A) THIS PACKAGE CONFORMS TO EIAJ SC-65 PACKAGING STANDARD.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSION AND TOLERANCING PER ASME14.5
- D) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- E) THIS PACKAGE IS INTENDED ONLY FOR TO3PN.
- F) DRAWING FILE NAME: TO3P03AREV4.

Dimensions in Millimeters



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| AX-CAP™*  | FRFET®  | PowerXS™  | <b>power</b>  |
| BitSiC®   | Global Power Resource <sup>SM</sup>   | Programmable Active Droop™  | franchise   |
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