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# FGA90N33ATD

## 330V, 90A PDP Trench IGBT

### Features

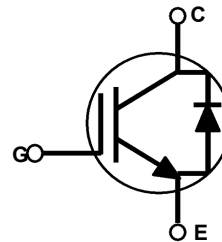
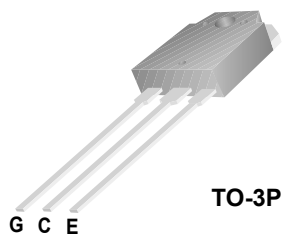
- High current capability
- Low saturation voltage:  $V_{CE(sat)} = 1.1V @ I_C = 20A$
- High input impedance
- Fast switching
- RoHS compliant

### 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

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 @ $T_C = 25^\circ C$	90	A
$I_{C \text{ pulse}(1)}$	Pulsed Collector Current @ $T_C = 25^\circ C$	220	A
$I_{C \text{ pulse}(2)}$	Pulsed Collector Current @ $T_C = 25^\circ C$	330	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ C$	223	W
	Maximum Power Dissipation @ $T_C = 100^\circ C$	89	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
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction to Case	-	0.56	$^\circ C/W$
$R_{\theta JC}(\text{Diode})$	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, Pulse width<5usec  
 \* $I_C$  pluse limited by max  $T_J$

## Package Marking and Ordering Information

Device Marking	Device	Package	Packaging Type	Qty per Tube	Max Qty per Box
FGA90N33ATD	FGA90N33ATDTU	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>						
$BV_{CES}$	Collector to Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 400\mu A$	330	-	-	V
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	-	-	400	$\mu A$
$I_{GES}$	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	$I_C = 250\mu A, V_{CE} = V_{GE}$	2.5	4.0	5.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 20A, V_{GE} = 15V$	-	1.1	1.4	V
		$I_C = 45A, V_{GE} = 15V,$	-	1.3	-	V
		$I_C = 90A, V_{GE} = 15V,$	-	1.6	-	V
		$I_C = 90A, V_{GE} = 15V,$ $T_C = 125^\circ C$	-	1.7	-	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V,$ $f = 1MHz$	-	2200	-	pF
$C_{oes}$	Output Capacitance		-	135	-	pF
$C_{res}$	Reverse Transfer Capacitance		-	100	-	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, $T_C = 25^\circ C$	-	23	-	ns
$t_r$	Rise Time		-	40	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	100	-	ns
$t_f$	Fall Time		-	180	240	ns
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 200V, I_C = 20A,$ $R_G = 5\Omega, V_{GE} = 15V,$ Resistive Load, $T_C = 125^\circ C$	-	20	-	ns
$t_r$	Rise Time		-	40	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	110	-	ns
$t_f$	Fall Time		-	250	300	ns
$Q_g$	Total Gate Charge	$V_{CE} = 200V, I_C = 20A,$ $V_{GE} = 15V$	-	95	-	nC
$Q_{ge}$	Gate to Emitter Charge		-	12	-	nC
$Q_{gc}$	Gate to Collector Charge		-	40	-	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	$I_F = 10\text{A}$	$T_C = 25^\circ\text{C}$	-	1.1	1.5	V
			$T_C = 125^\circ\text{C}$	-	0.96	-	
$t_{rr}$	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	$I_F = 10\text{A}, dI/dt = 200\text{A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	-	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

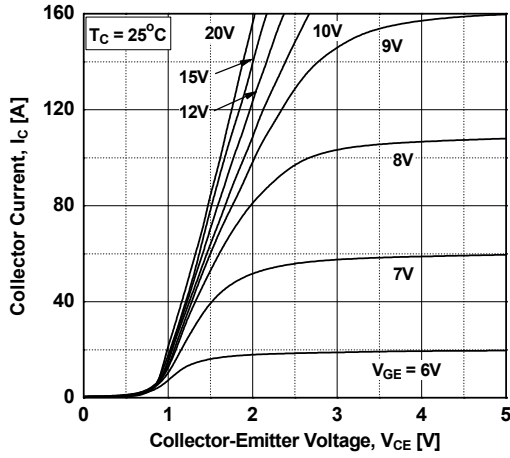


Figure 2. Typical Output Characteristics

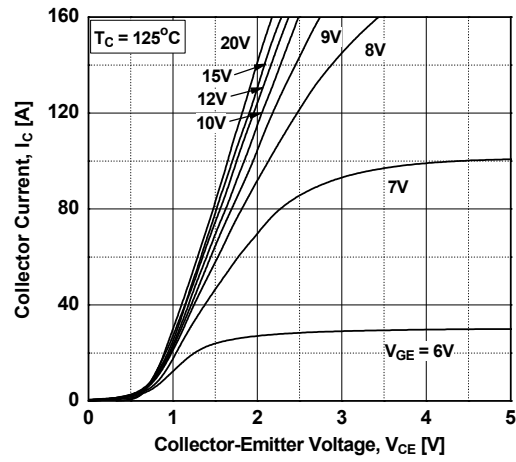


Figure 3. Typical Saturation Voltage Characteristics

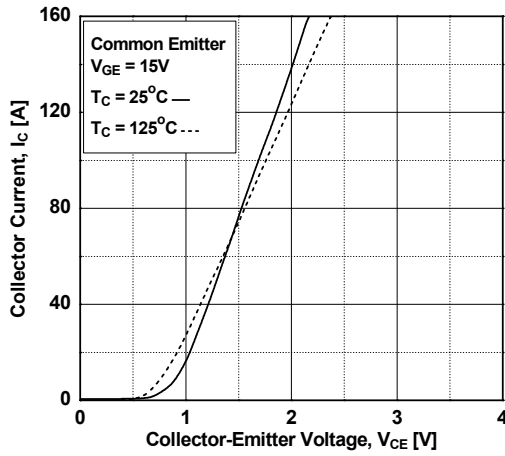


Figure 4. Transfer Characteristics

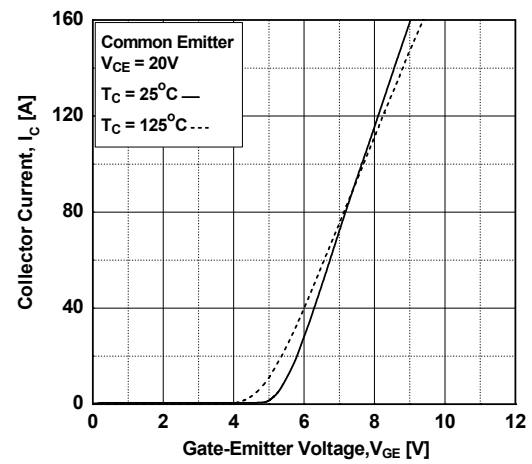


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

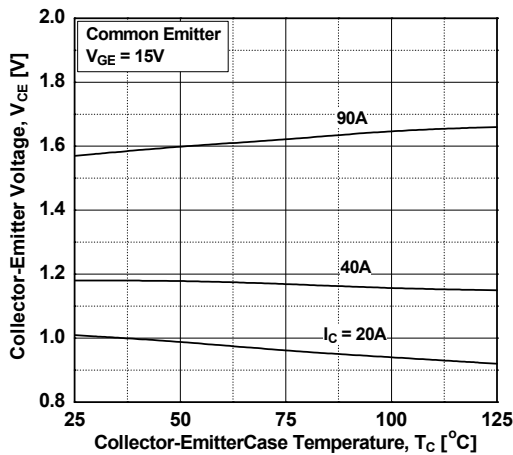
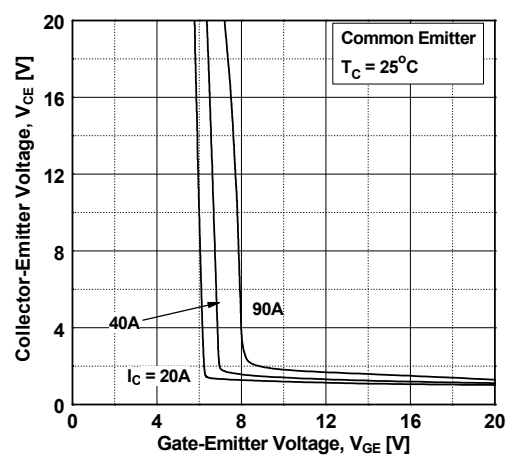


Figure 6. Saturation Voltage vs. Vge



## Typical Performance Characteristics

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

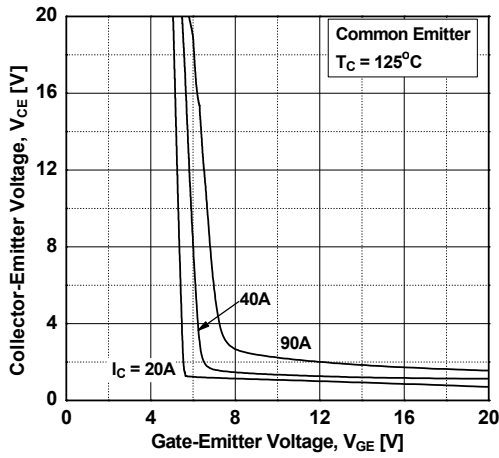


Figure 8. Capacitance Characteristics

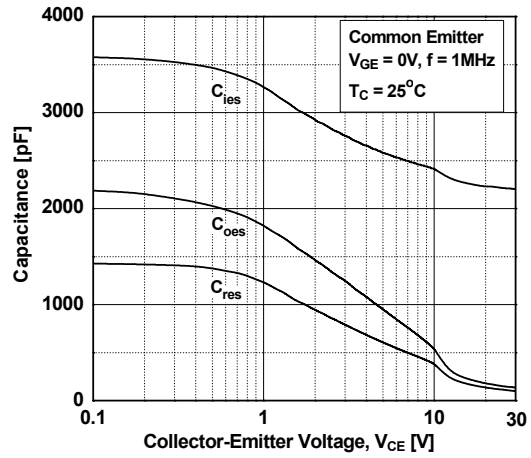


Figure 9. Gate charge Characteristics

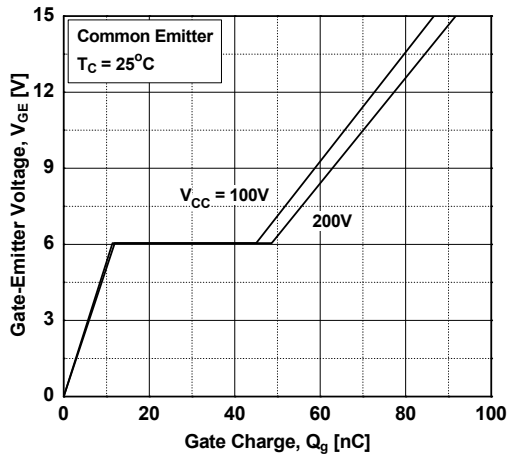


Figure 10. SOA Characteristics

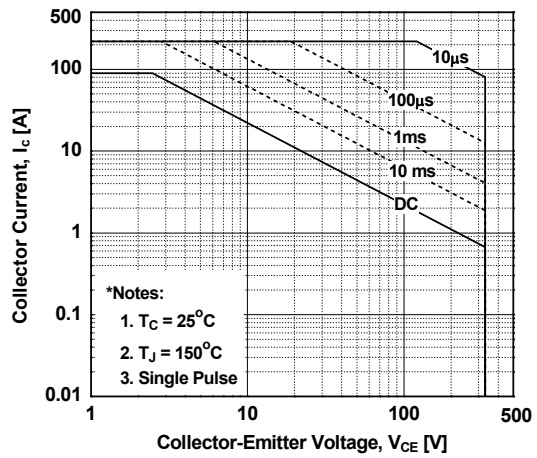


Figure 11. Turn-on Characteristics vs. Gate Resistance

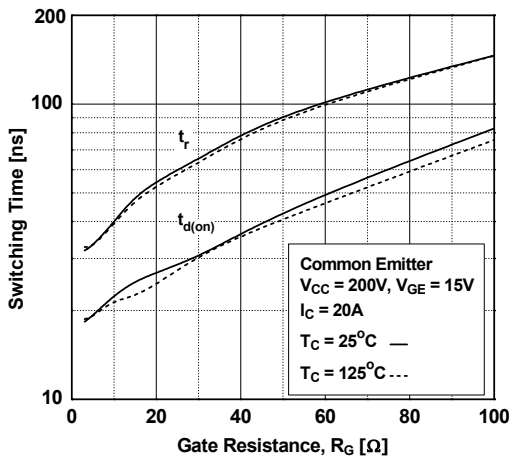
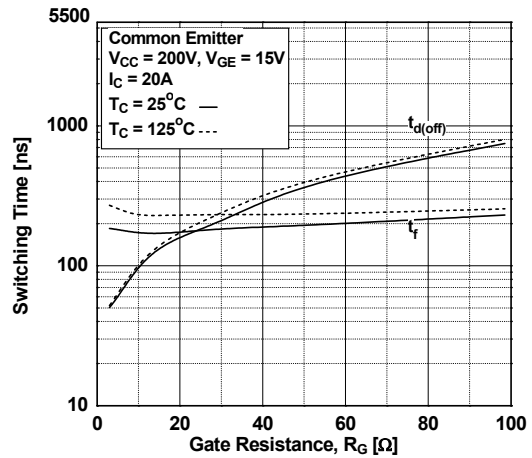
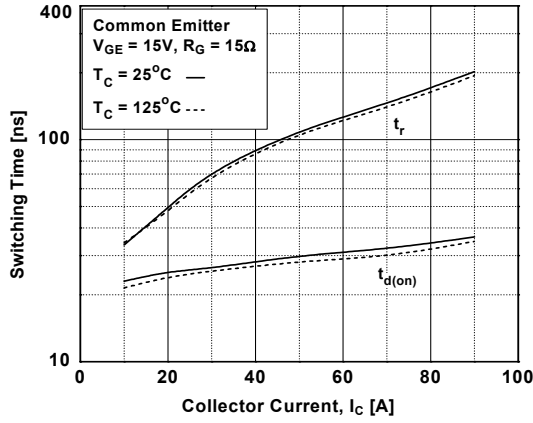


Figure 12. Turn-off Characteristics vs. Gate Resistance

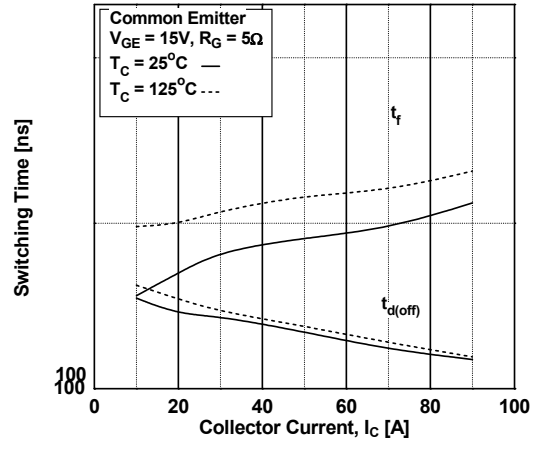


## Typical Performance Characteristics

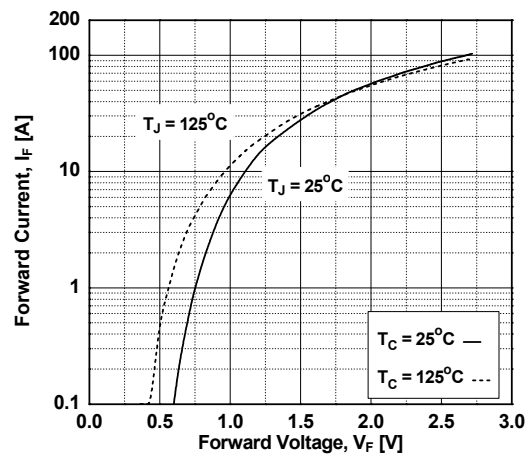
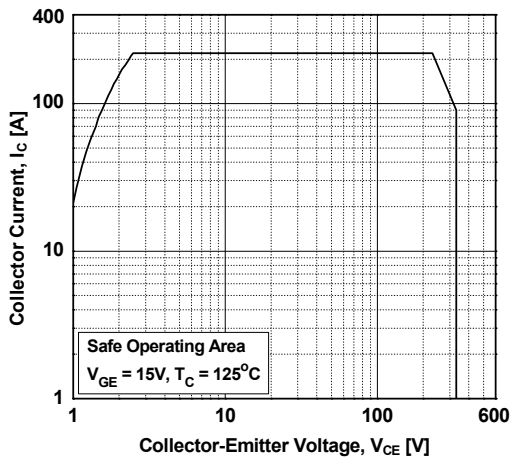
**Figure 13. Turn-on Characteristics vs. Collector Current**



**Figure 14. Turn-off Characteristics vs. Collector Current**



**Figure 15. Turn off Switching SOA Characteristics** **Figure 16. Forward Characteristics**



## Typical Performance Characteristics

Figure 17. Reverse Recovery Current

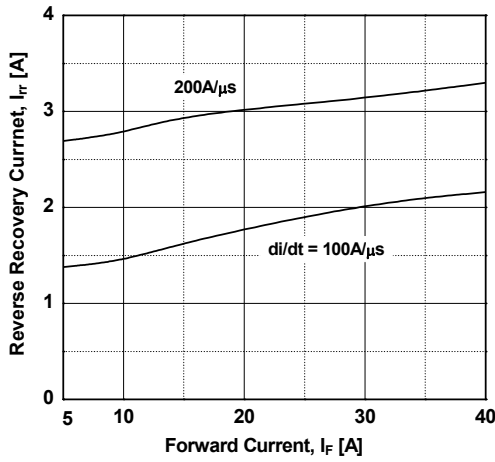


Figure 18. Stored Charge

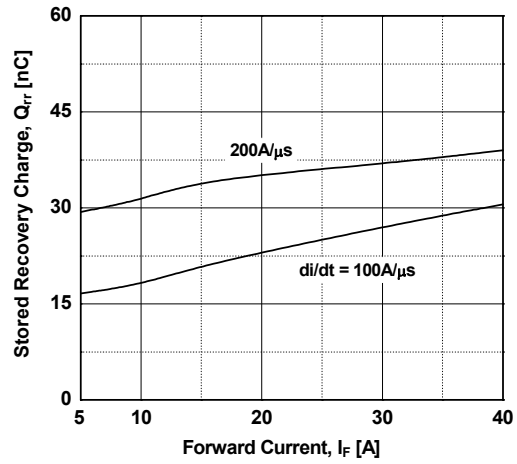


Figure 19. Reverse Recovery Current

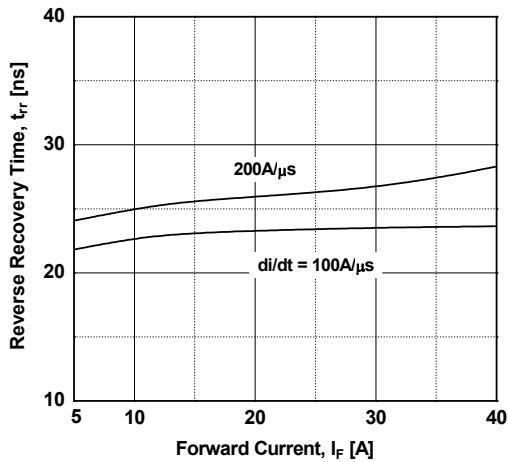
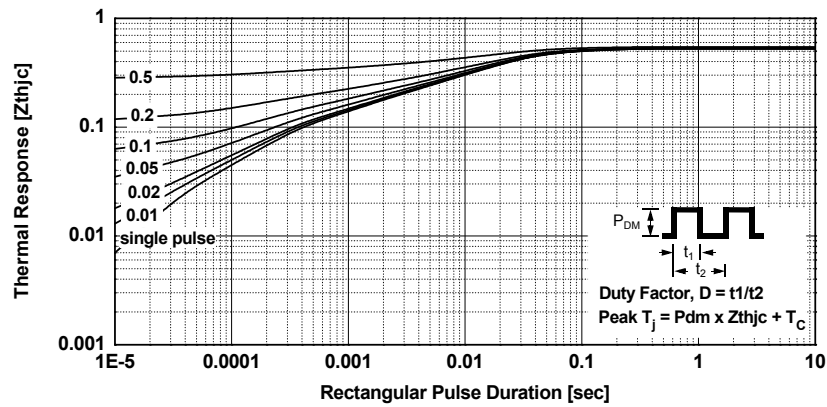


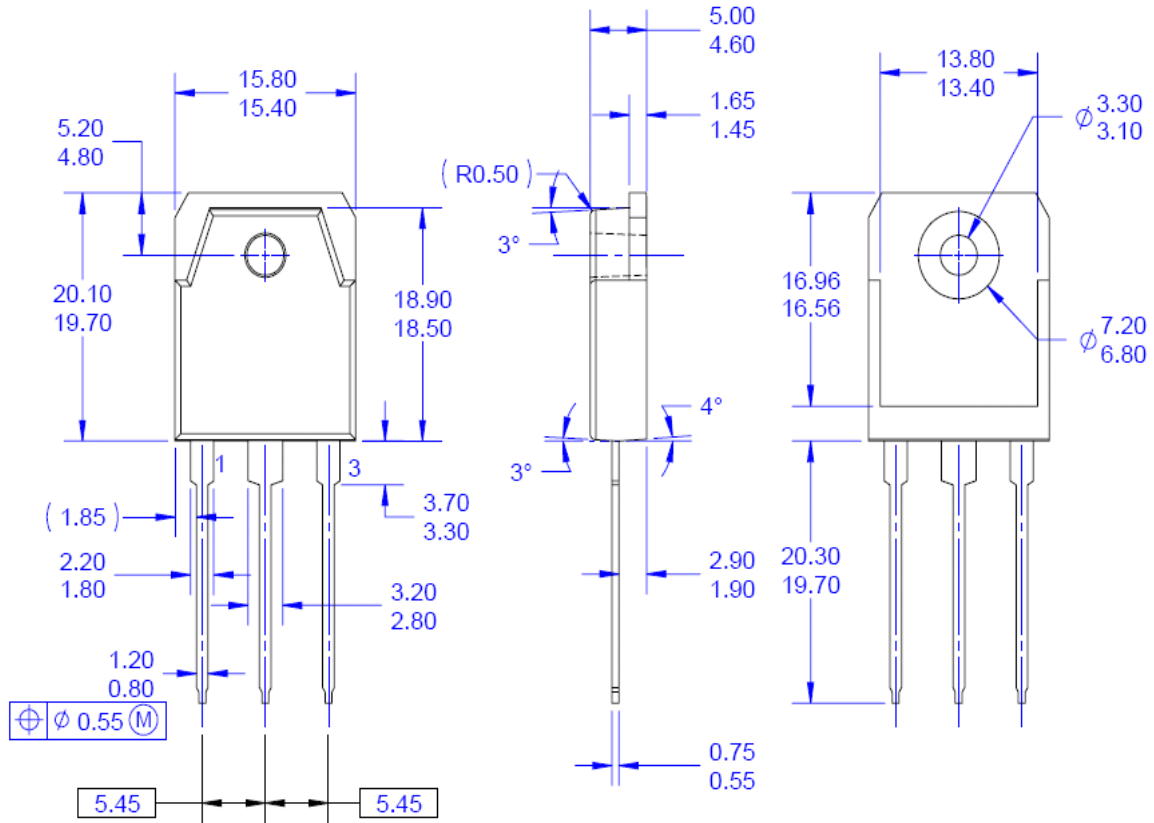
Figure 20. Transient Thermal Impedance of IGBT





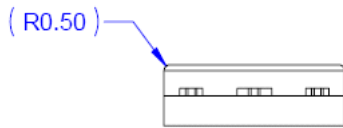
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TO-3PN



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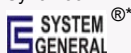


Dimensions in Millimeters



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