



# FGA20N120FTD

## 1200V, 20A Trench IGBT

### Features

- Field stop trench technology
- High speed switching
- Low saturation voltage:  $V_{CE(sat)} = 1.6V @ I_C = 20A$
- High input impedance
- RoHS compliant

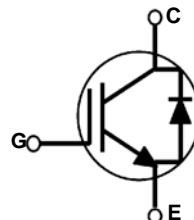
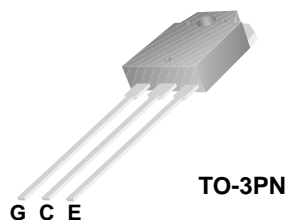
### Applications

- Induction heating and Microwave oven
- Soft switching applications



### General Description

Using advanced field stop trench technology, Fairchild's 1200V trench IGBTs offer superior conduction and switching performances, and easy parallel operation with exceptional avalanche ruggedness. This device is designed for soft switching applications.



### Absolute Maximum Ratings

Symbol	Description	Ratings	Units
$V_{CES}$	Collector to Emitter Voltage	1200	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 25$	V
$I_C$	Continuous Collector Current @ $T_C = 25^\circ C$	40	A
	Continuous Collector Current @ $T_C = 100^\circ C$	20	A
$I_{CM} (1)$	Pulsed Collector Current	60	A
$I_F$	Diode Continuous Forward Current @ $T_C = 25^\circ C$	20	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ C$	298	W
	Maximum Power Dissipation @ $T_C = 100^\circ C$	119	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	$^\circ C$

Notes:  
1: Repetitive rating, Pulse width limited by max. junction temperature

### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction to Case	-	0.42	$^\circ C/W$
$R_{\theta JC}(\text{Diode})$	Thermal Resistance, Junction to Case	-	2.0	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	$^\circ C/W$

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGA20N120FTD	FGA20N120FTDTU	TO-3PN	-	-	30

## 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> = 1mA	1200	-	-	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	-	-	±250	nA
<b>On Characteristics</b>						
V <sub>GE(th)</sub>	G-E Threshold Voltage	I <sub>C</sub> = 20mA, V <sub>CE</sub> = V <sub>GE</sub>	3.5	5.9	7.5	V
V <sub>CE(sat)</sub>	Collector to Emitter Saturation Voltage	I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V T <sub>C</sub> = 25°C	-	1.60	2.00	V
		I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V, T <sub>C</sub> = 125°C	-	1.85	-	V
<b>Dynamic Characteristics</b>						
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 30V, V <sub>GE</sub> = 0V, f = 1MHz	-	3080	-	pF
C <sub>oes</sub>	Output Capacitance		-	95	-	pF
C <sub>res</sub>	Reverse Transfer Capacitance		-	60	-	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>CC</sub> = 600V, I <sub>C</sub> = 20A, R <sub>G</sub> = 10Ω, V <sub>GE</sub> = 15V, Resistive Load, T <sub>C</sub> = 25°C	-	30	-	ns
t <sub>r</sub>	Rise Time		-	79	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	143	-	ns
t <sub>f</sub>	Fall Time		-	217	320	ns
E <sub>on</sub>	Turn-On Switching Loss		-	0.42	-	mJ
E <sub>off</sub>	Turn-Off Switching Loss		-	0.71	1.05	mJ
E <sub>ts</sub>	Total Switching Loss		-	1.13	-	mJ
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>CC</sub> = 600V, I <sub>C</sub> = 20A, R <sub>G</sub> = 10Ω, V <sub>GE</sub> = 15V, Resistive Load, T <sub>C</sub> = 125°C	-	29	-	ns
t <sub>r</sub>	Rise Time		-	93	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	147	-	ns
t <sub>f</sub>	Fall Time		-	259	-	ns
E <sub>on</sub>	Turn-On Switching Loss		-	0.47	-	mJ
E <sub>off</sub>	Turn-Off Switching Loss		-	0.86	-	mJ
E <sub>ts</sub>	Total Switching Loss		-	1.33	-	mJ
Q <sub>g</sub>	Total Gate Charge	V <sub>CE</sub> = 600V, I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V	-	137	-	nC
Q <sub>ge</sub>	Gate to Emitter Charge		-	23	-	nC
Q <sub>gc</sub>	Gate to Collector Charge		-	65	-	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	$I_F = 20\text{A}$	$T_C = 25^\circ\text{C}$	-	1.3	1.7	V
			$T_C = 125^\circ\text{C}$	-	1.3	-	
$t_{rr}$	Diode Reverse Recovery Time	$I_{ES} = 20\text{A},$ $di/dt = 200\text{A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	-	447	-	ns
			$T_C = 125^\circ\text{C}$	-	485	-	
$I_{rr}$	Diode Peak Reverse Recovery Current		$T_C = 25^\circ\text{C}$	-	48	-	A
			$T_C = 125^\circ\text{C}$	-	50	-	
$Q_{rr}$	Diode Reverse Recovery Charge		$T_C = 25^\circ\text{C}$	-	10.8	-	$\mu\text{C}$
			$T_C = 125^\circ\text{C}$	-	12	-	

## Typical Performance Characteristics

Figure 1. Typical Output Characteristics

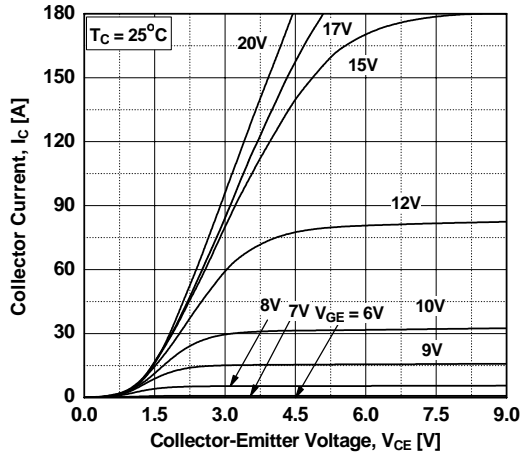


Figure 2. Typical Output Characteristics

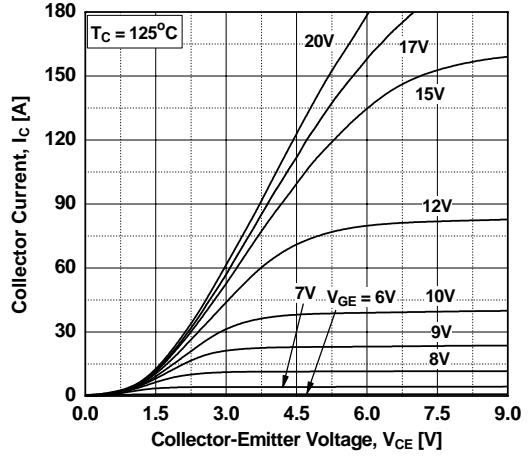


Figure 3. Typical Saturation Voltage Characteristics

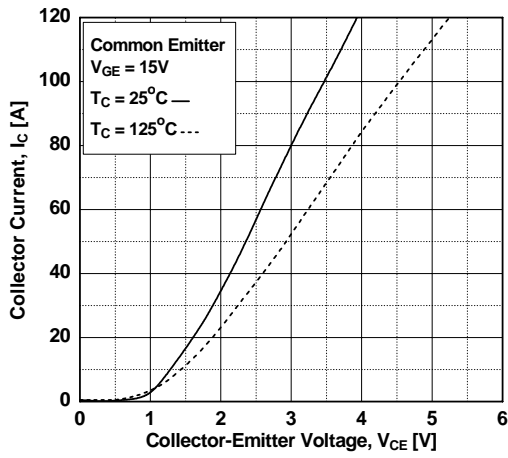


Figure 4. Transfer Characteristics

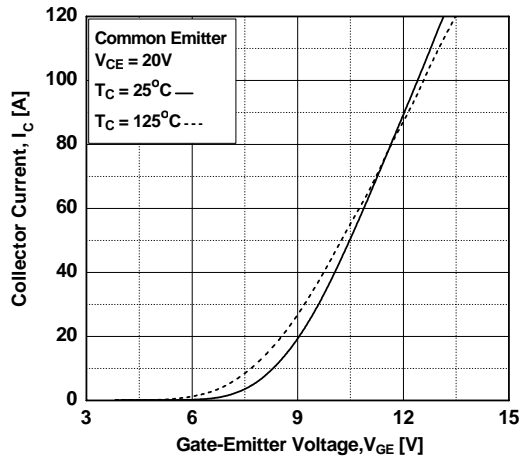


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

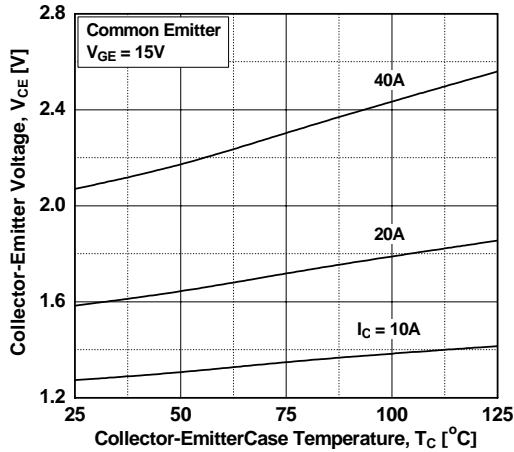
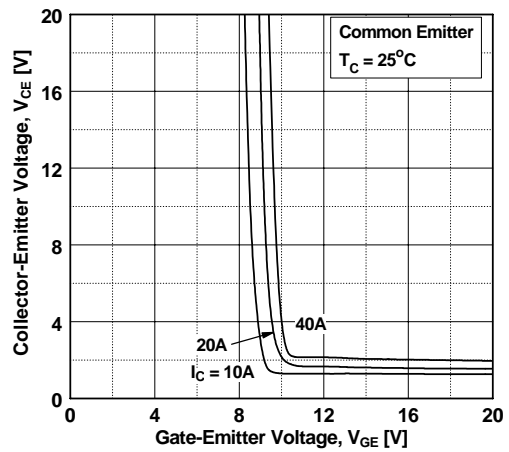


Figure 6. Saturation Voltage vs. Vge



## Typical Performance Characteristics

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

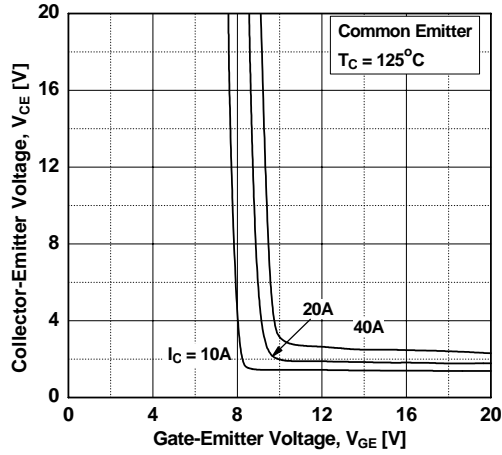


Figure 8. Capacitance Characteristics

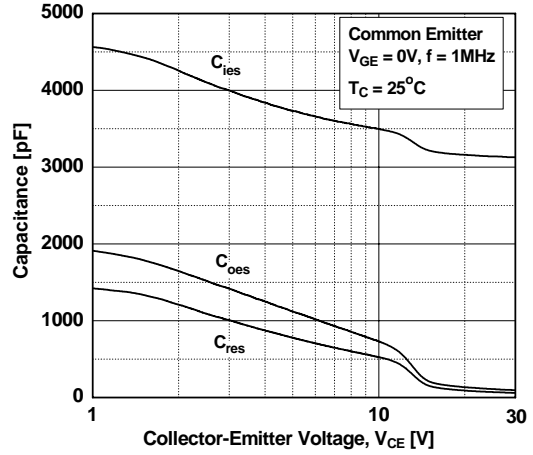


Figure 9. Gate charge Characteristics

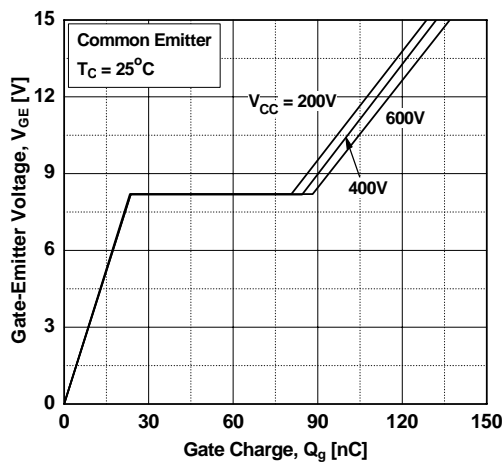


Figure 10. SOA Characteristics

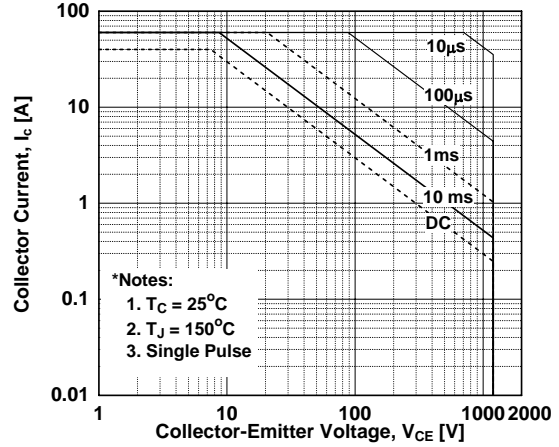


Figure 11. Turn-on Characteristics vs. Gate Resistance

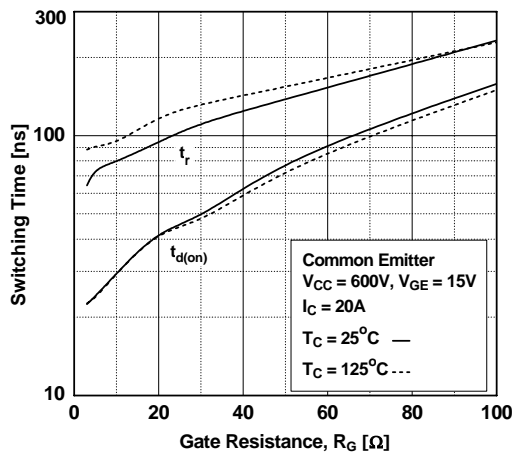
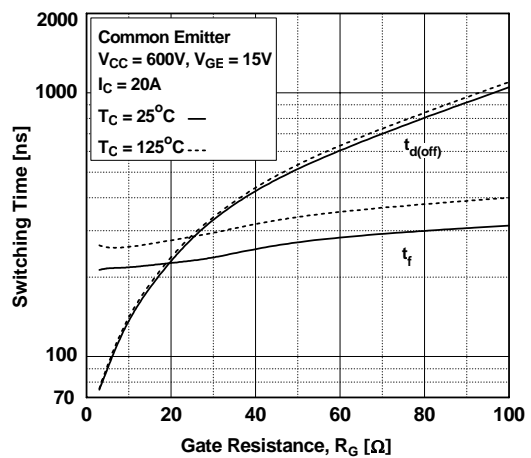
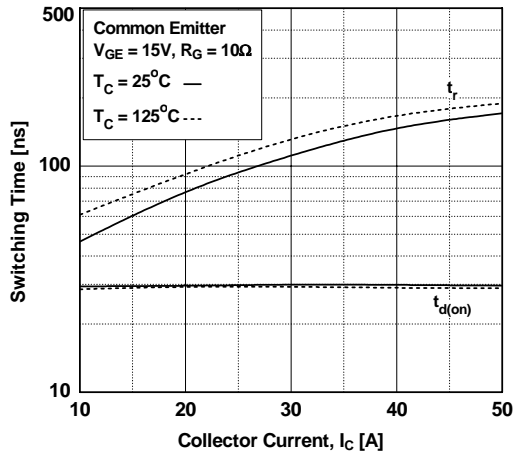


Figure 12. Turn-off Characteristics vs. Gate Resistance

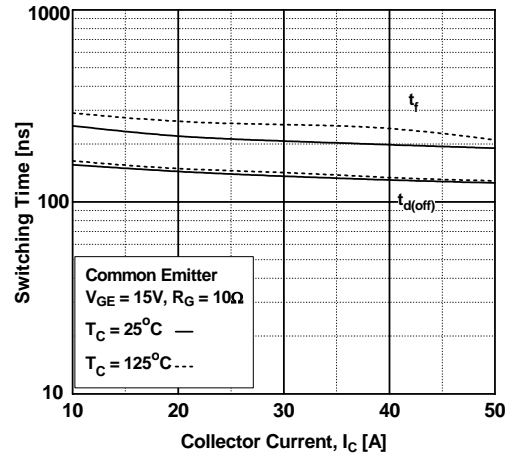


## Typical Performance Characteristics

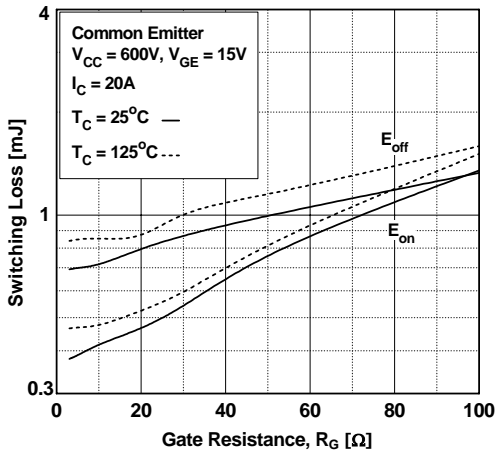
**Figure 13. Turn-on Characteristics vs. Collector Current**



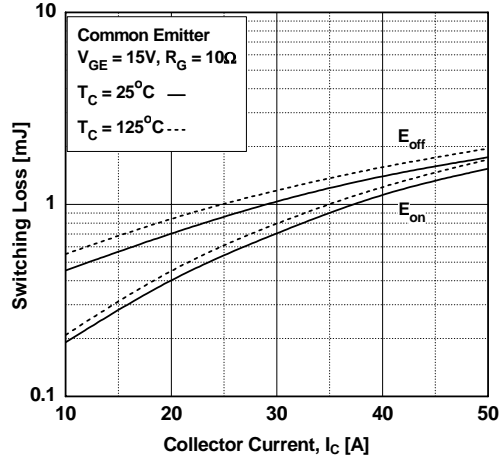
**Figure 14. Turn-off Characteristics vs. Collector Current**



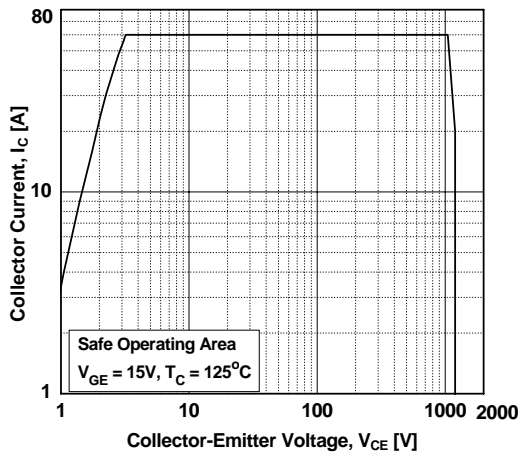
**Figure 15. Switching Loss vs. Gate Resistance**



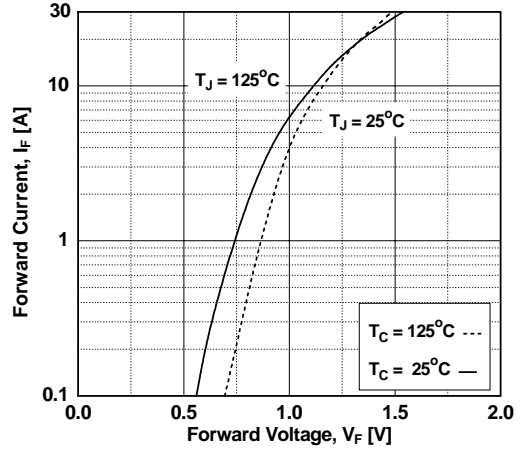
**Figure 16. Switching Loss vs. Collector Current**



**Figure 17. Turn off Switching SOA Characteristics**



**Figure 18. Forward Characteristics**



## Typical Performance Characteristics

Figure 19. Reverse Recovery Current

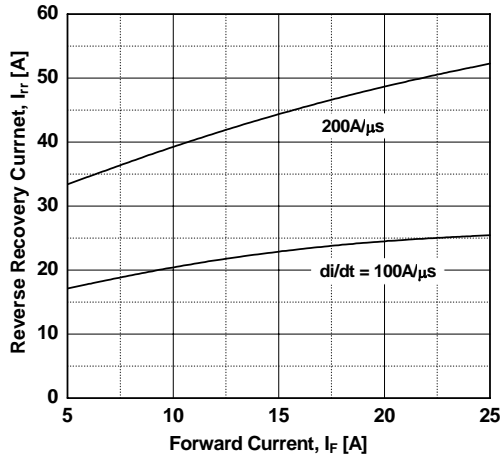


Figure 20. Stored Charge

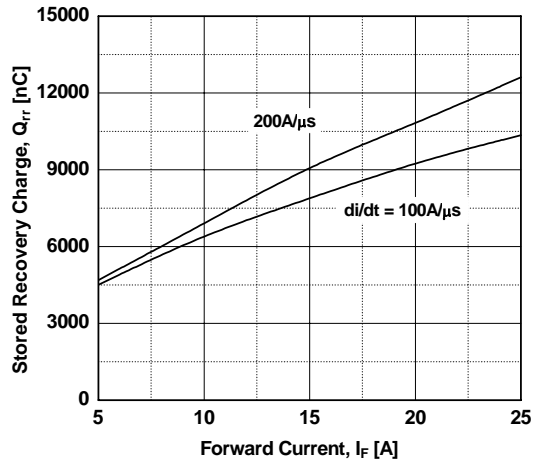


Figure 21. Reverse Recovery Time

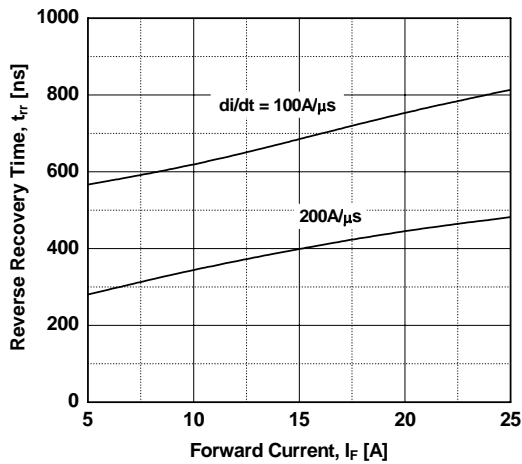
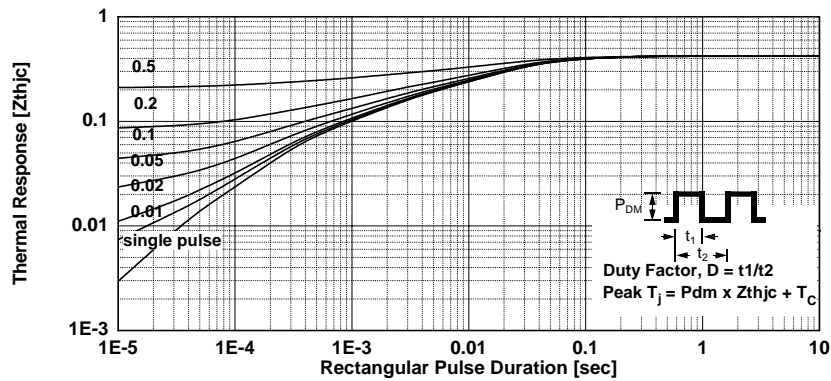
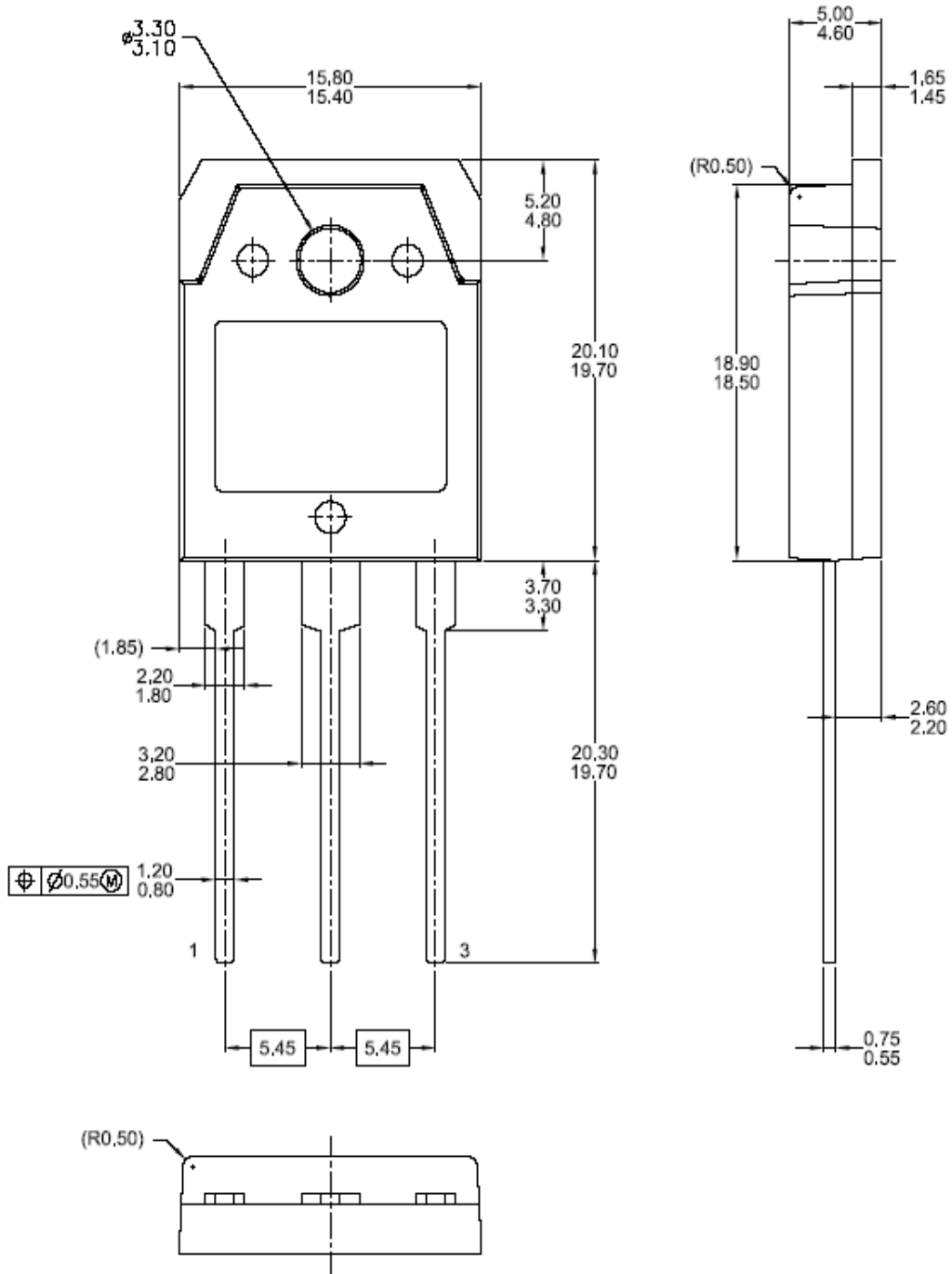


Figure 22. Transient Thermal Impedance of IGBT



Mechanical Dimensions

TO-3PN








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