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# FGA20S120M

## 1200 V, 20 A Shorted-anode IGBT

### Features

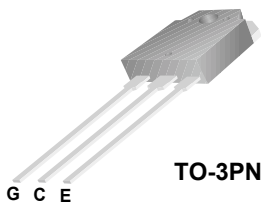
- High Speed Switching
- Low Saturation Voltage:  $V_{CE(sat)} = 1.55 \text{ V @ } I_C = 20 \text{ A}$
- High Input Impedance
- RoHS Compliant

### Applications

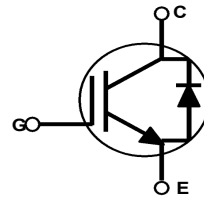
- Induction Heating, Microwave Oven

### General Description

Using advanced field stop trench and shorted-anode technology, Fairchild®'s shorted-anode trench IGBTs offer superior conduction and switching performances for soft switching applications. The device can operate in parallel configuration with exceptional avalanche capability. This device is designed for induction heating and microwave oven.



TO-3PN



### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Description	Ratings	Unit
$V_{CES}$	Collector to Emitter Voltage	1200	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 25$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	40	A
	Collector Current @ $T_C = 100^\circ\text{C}$	20	A
$I_{CM(1)}$	Pulsed Collector Current	60	A
$I_F$	Diode Continuous Forward Current @ $T_C = 25^\circ\text{C}$	40	A
$I_F$	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	20	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	348	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	174	W
$T_J$	Operating Junction Temperature	-55 to +175	$^\circ\text{C}$
$T_{stg}$	Storage Temperature Range	-55 to +175	$^\circ\text{C}$
$T_L$	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction to Case	--	0.43	$^\circ\text{C/W}$
$R_{\theta JC}(\text{Diode})$	Thermal Resistance, Junction to Case	--	0.43	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	--	40	$^\circ\text{C/W}$

Notes:  
1: Limited by  $T_{jmax}$

### Package Marking and Ordering Information

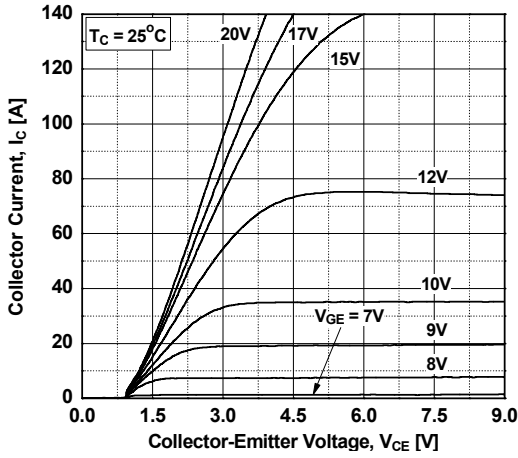
Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGA20S120M	FGA20S120M	TO-3PN	-	-	30

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

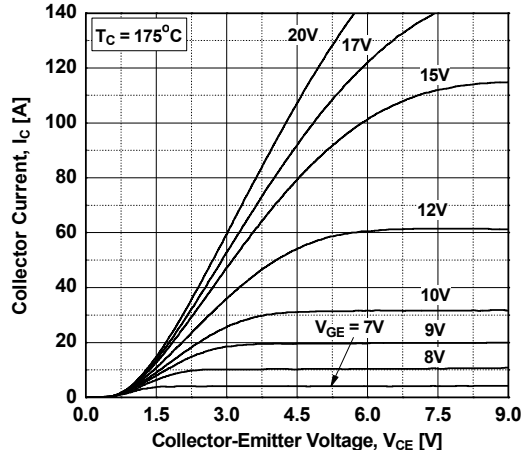
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
BV <sub>CES</sub>	Collector to Emitter Breakdown Voltage	V <sub>GE</sub> = 0V, I <sub>C</sub> = 2mA	1200	-	-	V
I <sub>CES</sub>	Collector Cut-Off Current	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0V	-	-	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>	4.5	6.0	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	-	1.55	1.85	V
		I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V, T <sub>C</sub> = 125°C	-	1.75	-	V
		I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V, T <sub>C</sub> = 175°C	-	1.85	-	V
V <sub>FM</sub>	Diode Forward Voltage	I <sub>F</sub> = 20A, T <sub>C</sub> = 25°C	--	1.7	2.2	V
		I <sub>F</sub> = 20A, T <sub>C</sub> = 175°C	--	2.1	-	V
<b>Dynamic Characteristics</b>						
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 30V, V <sub>GE</sub> = 0V, f = 1MHz	--	2680	--	pF
C <sub>oes</sub>	Output Capacitance		--	53	--	pF
C <sub>res</sub>	Reverse Transfer Capacitance		--	43	--	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	-	43	-	ns
t <sub>r</sub>	Rise Time		-	176	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	310	-	ns
t <sub>f</sub>	Fall Time		-	320	480	ns
E <sub>on</sub>	Turn-On Switching Loss		-	0.52	-	mJ
E <sub>off</sub>	Turn-Off Switching Loss		-	1.43	2.15	mJ
E <sub>ts</sub>	Total Switching Loss	-	1.95	-	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> = 175°C	-	41	-	ns
t <sub>r</sub>	Rise Time		-	260	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	345	-	ns
t <sub>f</sub>	Fall Time		-	520	-	ns
E <sub>on</sub>	Turn-On Switching Loss		-	0.78	-	mJ
E <sub>off</sub>	Turn-Off Switching Loss		-	1.97	-	mJ
E <sub>ts</sub>	Total Switching Loss	-	2.75	-	mJ	
Q <sub>g</sub>	Total Gate Charge	V <sub>CE</sub> = 600V, I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V	-	208	-	nC
Q <sub>ge</sub>	Gate to Emitter Charge		-	18	-	nC
Q <sub>gc</sub>	Gate to Collector Charge		-	119	-	nC

## Typical Performance Characteristics

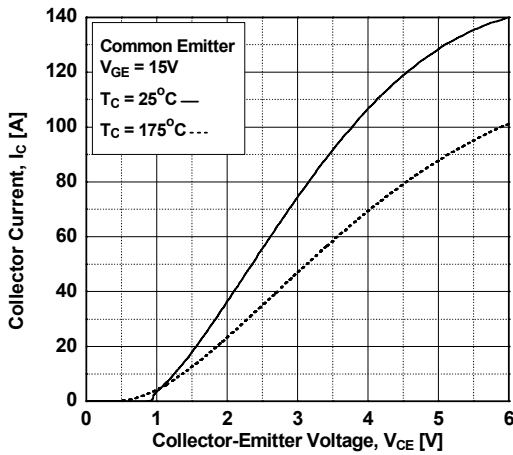
**Figure 1. Typical Output Characteristics**



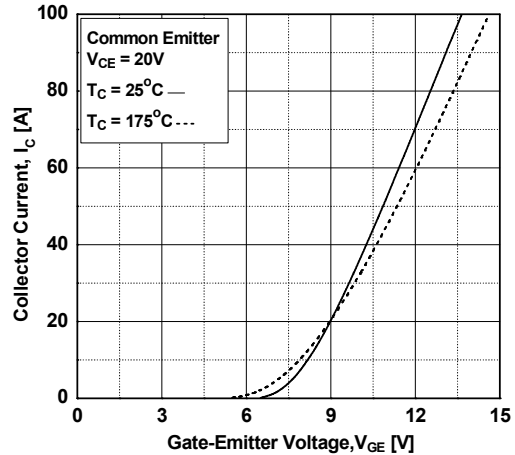
**Figure 2. Typical Output Characteristics**



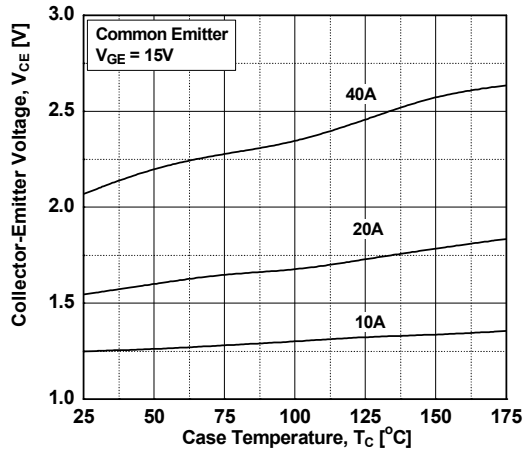
**Figure 3. Typical Saturation Voltage Characteristics**



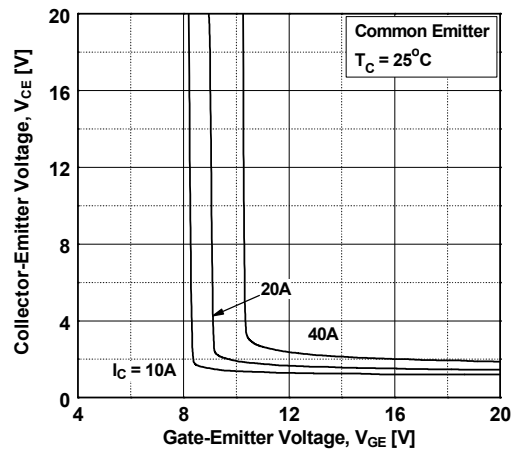
**Figure 4. Transfer Characteristics**



**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.  $V_{GE}$

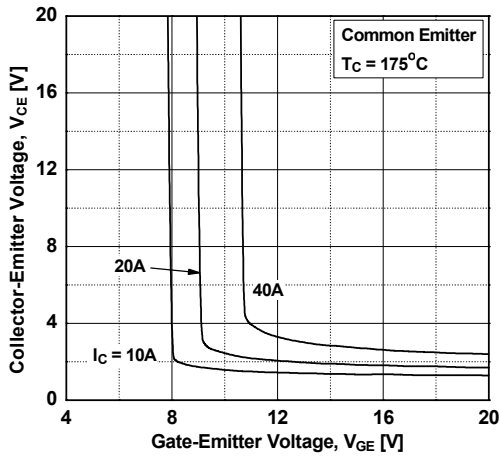


Figure 8. Capacitance Characteristics

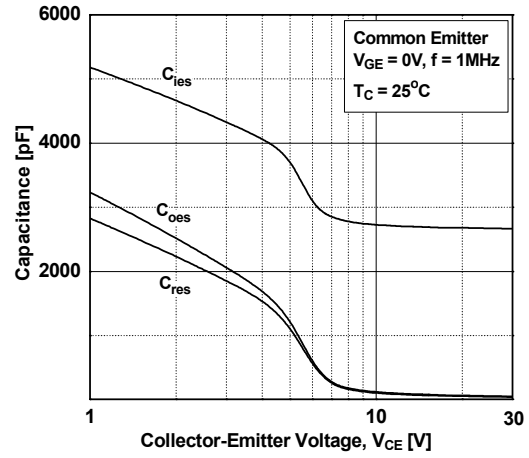


Figure 9. Gate Charge Characteristics

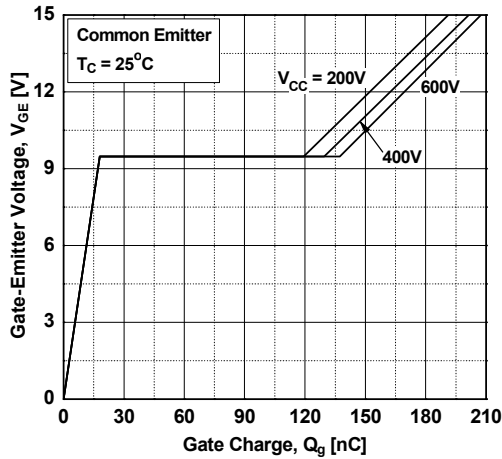


Figure 10. SOA Characteristics

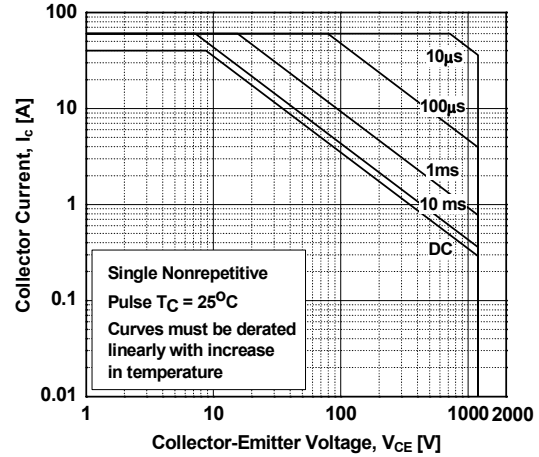


Figure 11. Turn-On Characteristics vs. Gate Resistance

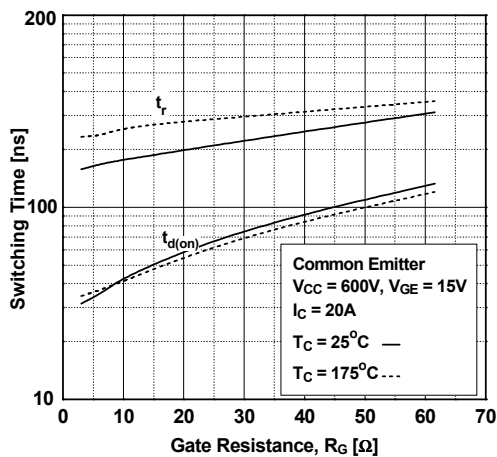
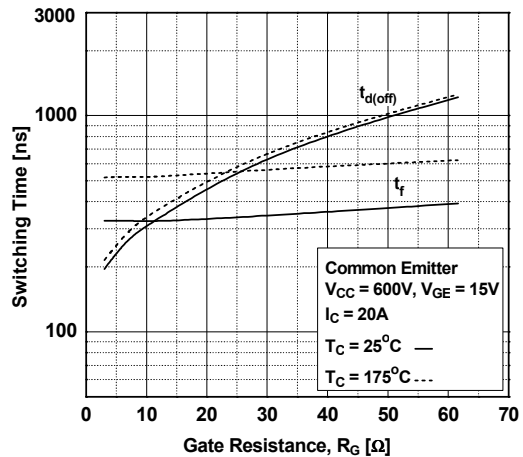


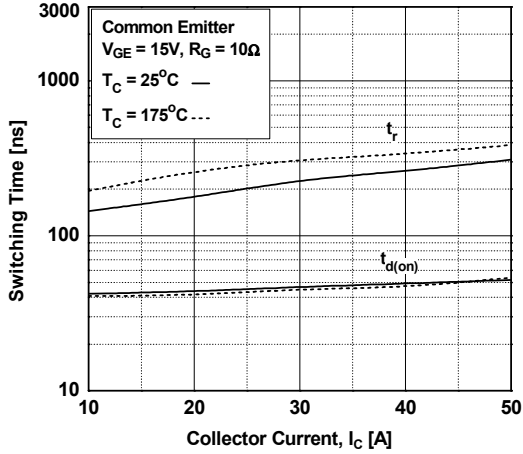
Figure 12. Turn-Off Characteristics vs. Gate Resistance



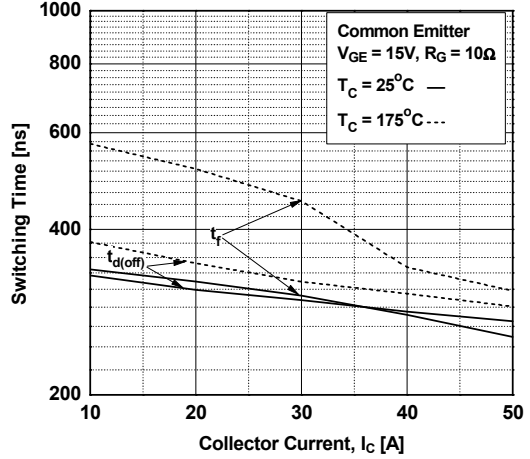


## Typical Performance Characteristics

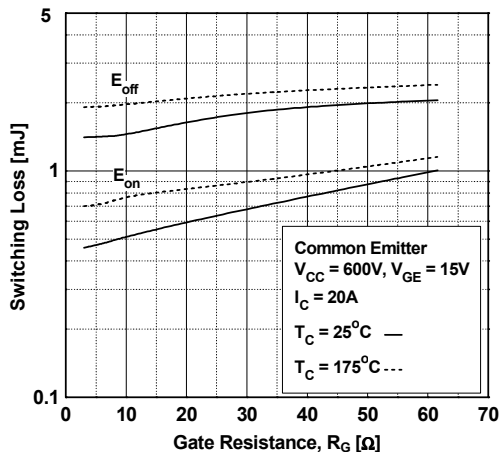
**Figure 13. Turn-On Characteristics vs. Collector Current**



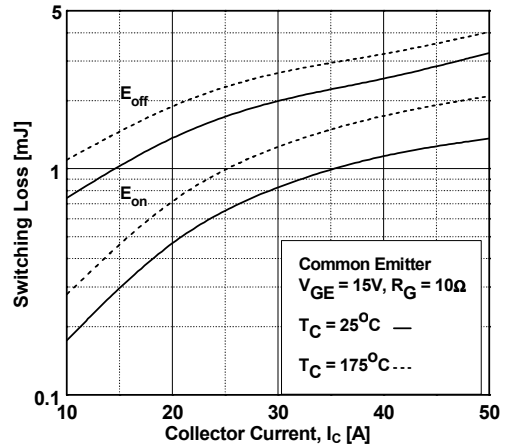
**Figure 14. Turn-off Characteristics vs. Collector Current**



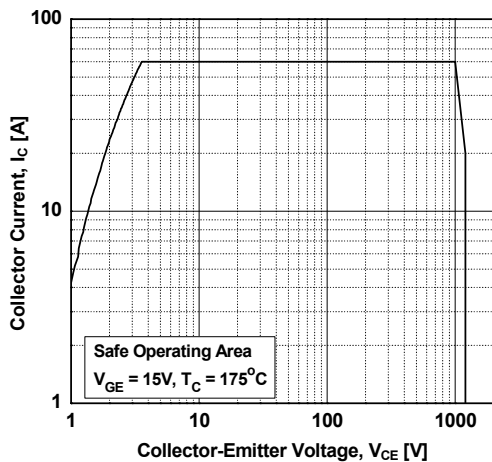
**Figure 15. Switching Loss vs. Gate resistance**



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



**Figure 17. Turn-Off Switching SOA Characteristics Collector Current**



**Figure 18. Diode Forward Characteristics**

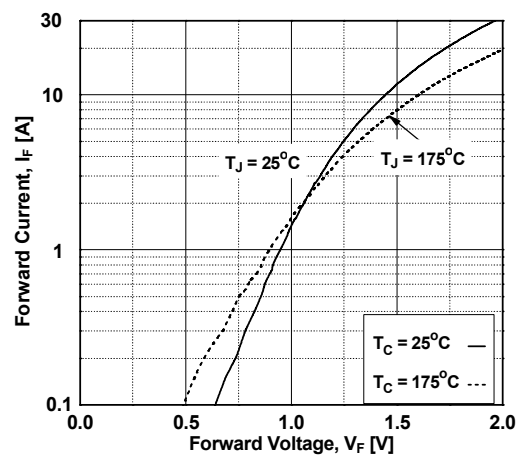
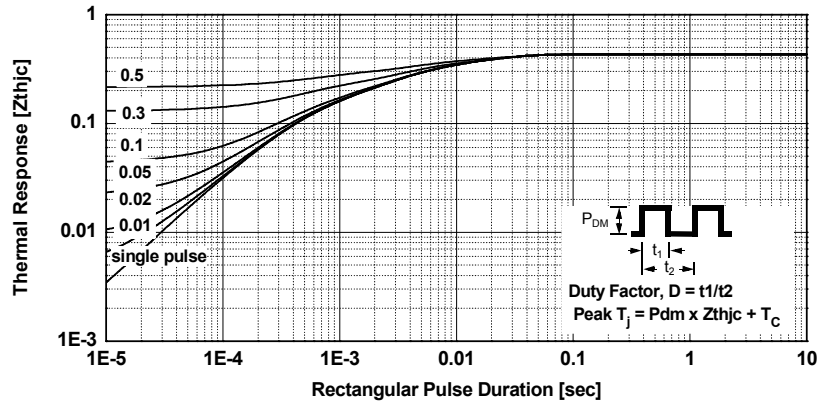
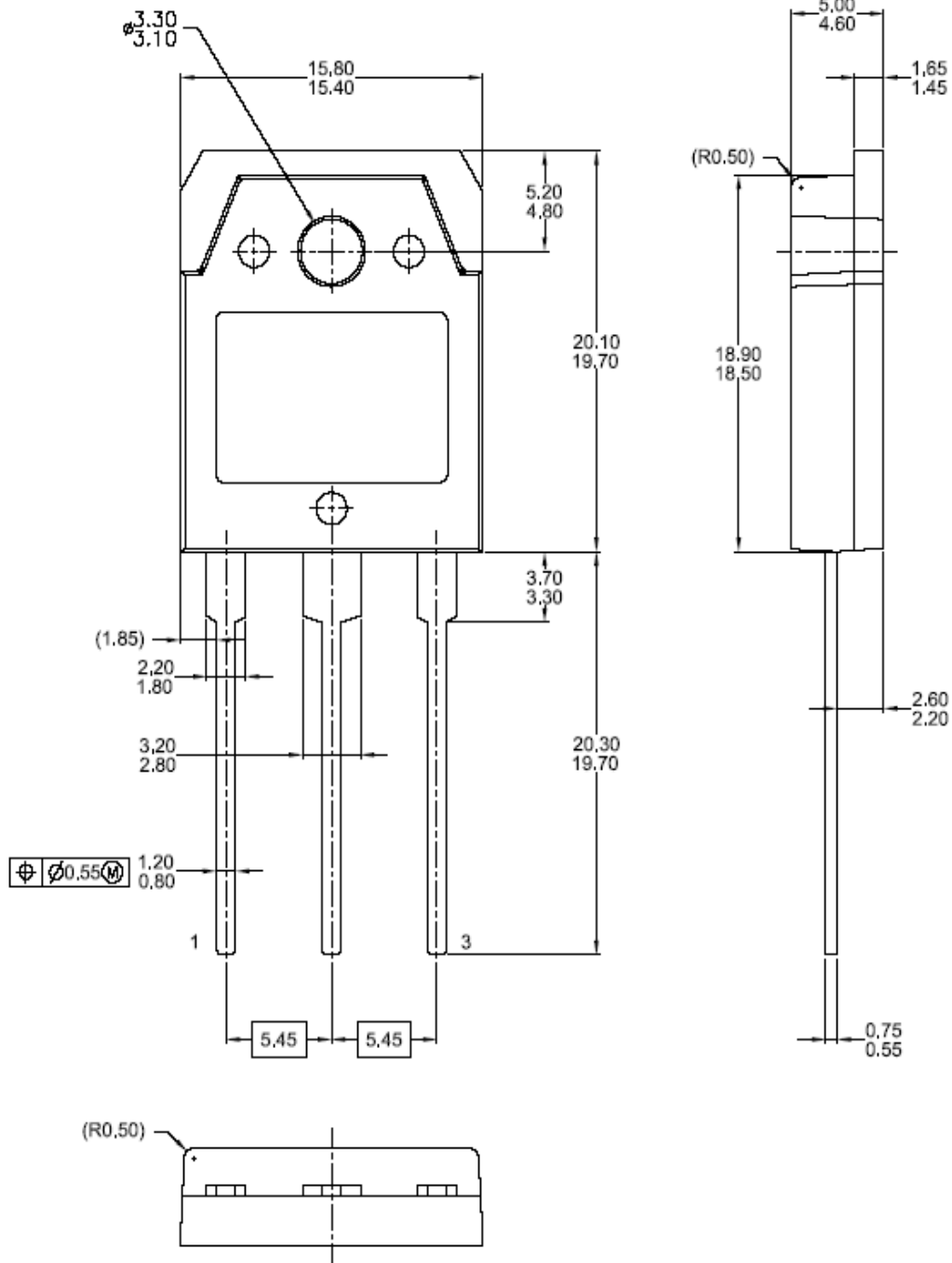


Figure 19. Transient Thermal Impedance of IGBT



Mechanical Dimensions

TO-3PN



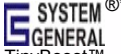



Dimensions in Millimeters





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Rev. I64