

# FGA50S110P

## 1100 V, 50 A Shorted-anode IGBT

### Features

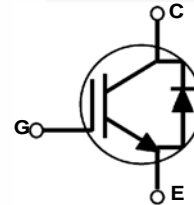
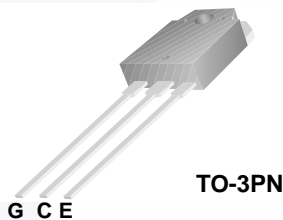
- Intrinsic Anti-parallel Diode for Soft-switching Applications
- High Switching Frequency Range 10 kHz to 50kHz
- High Temperature Stable Behavior ( $T_{jmax} = 175^{\circ}\text{C}$ )
- Low Saturation Voltage Drop :  $V_{CE(sat)} = 2.06 \text{ V @ } I_c = 50 \text{ A}$
- Robust Pot Detection Noise Immunity
- RoHS Compliant (Pb-free lead plating)

### Applications

- Induction Cooker, Rice-jar, and Microwave Oven
- Soft-switching Applications

### General Description

Using advanced field stop trench and shorted-anode technology, Fairchild's shorted-anode trench IGBTs offer superior conduction and switching performances for switching applications. This device is tailored to induction cooker and microwave oven.



### Absolute Maximum Ratings

Symbol	Description	Ratings	Unit
$V_{CES}$	Collector to Emitter Voltage	1100	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 25$	V
$I_C$	Collector Current @ $T_C = 25^{\circ}\text{C}$	50	A
	Collector Current @ $T_C = 100^{\circ}\text{C}$	30	A
$I_{CM(1)}$	Pulsed Collector Current	120	A
$I_F$	Diode Continuous Forward Current @ $T_C = 25^{\circ}\text{C}$	50	A
	Diode Continuous Forward Current @ $T_C = 100^{\circ}\text{C}$	30	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^{\circ}\text{C}$	300	W
	Maximum Power Dissipation @ $T_C = 100^{\circ}\text{C}$	150	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, Max	-	0.6	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max	-	40	$^{\circ}\text{C}/\text{W}$

**Notes:**

1: Limited by  $T_{jmax}$

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGA50S110P	FGA50S110P	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>						
I <sub>CES</sub>	Collector Cut-Off Current	V <sub>CE</sub> = 1100 V, V <sub>GE</sub> = 0 V	-	-	1	mA
I <sub>GES</sub>	G-E Leakage Current	V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0 V	-	-	±500	nA
<b>On Characteristics</b>						
V <sub>GE(th)</sub>	G-E Threshold Voltage	I <sub>C</sub> = 50 mA, V <sub>CE</sub> = V <sub>GE</sub>	4.5	5.6	7.5	V
V <sub>CE(sat)</sub>	Collector to Emitter Saturation Voltage	I <sub>C</sub> = 50 A, V <sub>GE</sub> = 15 V T <sub>C</sub> = 25°C	-	2.06	2.6	V
		I <sub>C</sub> = 50 A, V <sub>GE</sub> = 15 V T <sub>C</sub> = 125°C	-	2.54	-	V
		I <sub>C</sub> = 50 A, V <sub>GE</sub> = 15 V, T <sub>C</sub> = 175°C	-	2.7	-	V
V <sub>FM</sub>	Diode Forward Voltage	I <sub>F</sub> = 50 A, T <sub>C</sub> = 25°C	-	1.96	2.6	V
		I <sub>F</sub> = 50 A, T <sub>C</sub> = 175°C	-	2.67	-	V
<b>Dynamic Characteristics</b>						
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 30 V, V <sub>GE</sub> = 0 V, f = 1 MHz	-	2056	-	pF
C <sub>oes</sub>	Output Capacitance		-	47.8	-	pF
C <sub>res</sub>	Reverse Transfer Capacitance		-	35.8	-	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>CC</sub> = 600 V, I <sub>C</sub> = 50 A, R <sub>G</sub> = 10 Ω, V <sub>GE</sub> = 15 V, Resistive Load, T <sub>C</sub> = 25°C	-	24	-	ns
t <sub>r</sub>	Rise Time		-	294	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	280	-	ns
t <sub>f</sub>	Fall Time		-	95	-	ns
E <sub>on</sub>	Turn-On Switching Loss		-	2240	-	μJ
E <sub>off</sub>	Turn-Off Switching Loss		-	990	-	μJ
E <sub>ts</sub>	Total Switching Loss	-	3230	-	μJ	
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>CC</sub> = 600 V, I <sub>C</sub> = 50 A, R <sub>G</sub> = 10 Ω, V <sub>GE</sub> = 15 V, Resistive Load, T <sub>C</sub> = 175°C	-	24	-	ns
t <sub>r</sub>	Rise Time		-	346	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	308	-	ns
t <sub>f</sub>	Fall Time		-	184	-	ns
E <sub>on</sub>	Turn-On Switching Loss		-	2640	-	μJ
E <sub>off</sub>	Turn-Off Switching Loss		-	1820	-	μJ
E <sub>ts</sub>	Total Switching Loss	-	4460	-	μJ	
Q <sub>g</sub>	Total Gate Charge	V <sub>CE</sub> = 600 V, I <sub>C</sub> = 50 A, V <sub>GE</sub> = 15 V	-	195	-	nC
Q <sub>ge</sub>	Gate to Emitter Charge		-	15.4	-	nC
Q <sub>gc</sub>	Gate to Collector Charge		-	99.9	-	nC

## Typical Performance Characteristics

Figure 1. Typical Output Characteristics

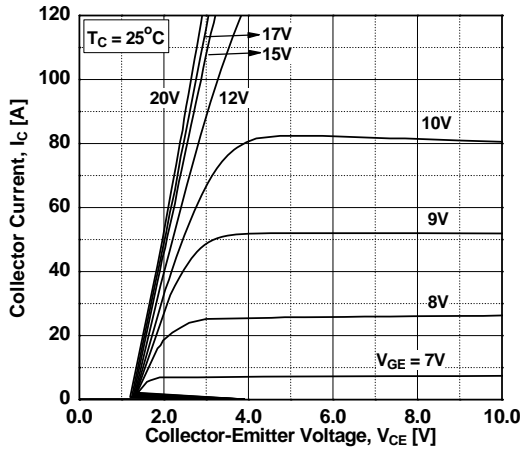


Figure 2. Typical Output Characteristics

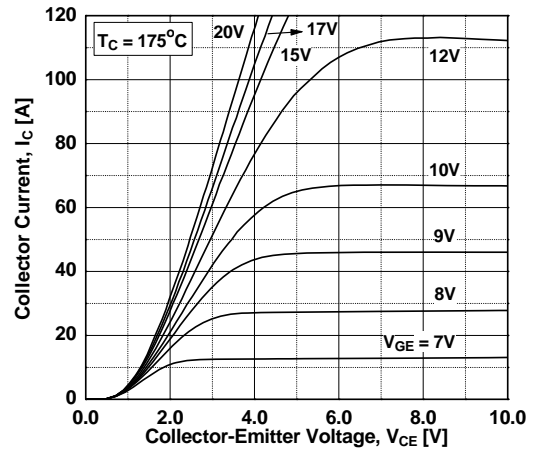


Figure 3. Typical Saturation Voltage Characteristics

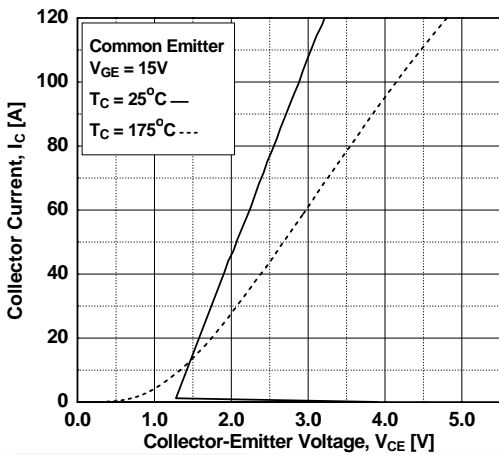


Figure 4. Transfer Characteristics

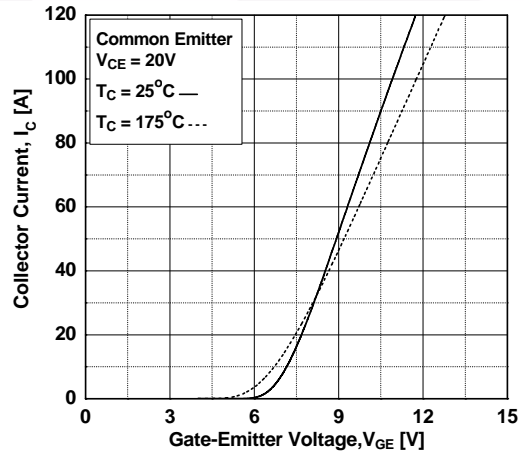


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

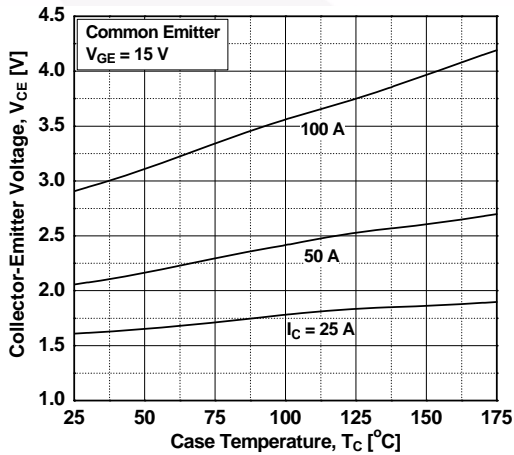
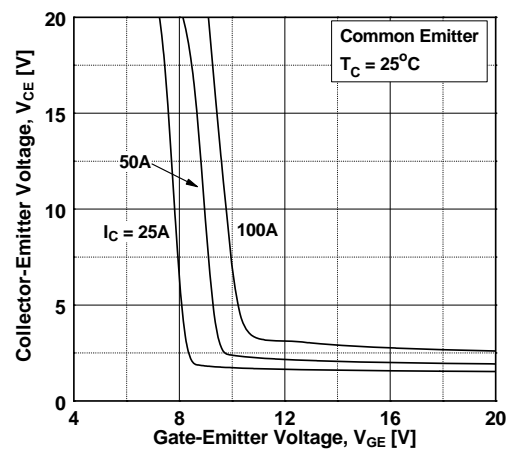


Figure 6. Saturation Voltage vs. Vge



## Typical Performance Characteristics

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

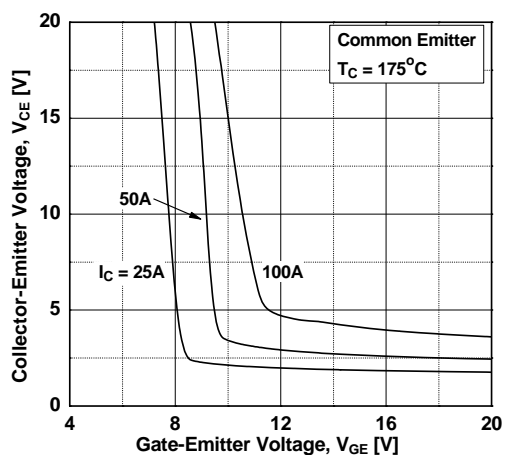


Figure 8. Capacitance Characteristics

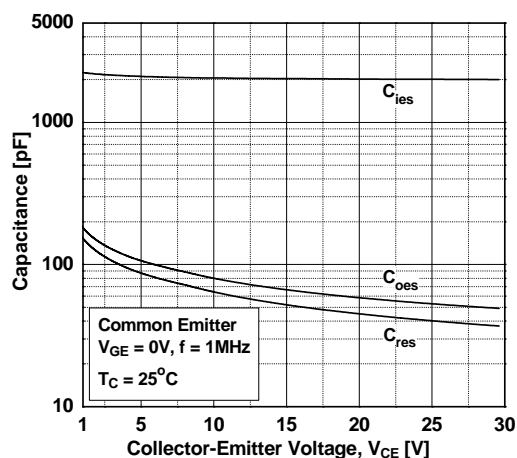


Figure 9. Gate charge Characteristics

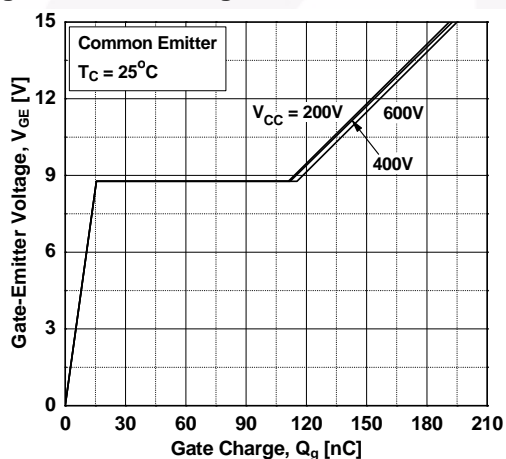


Figure 10. SOA Characteristics

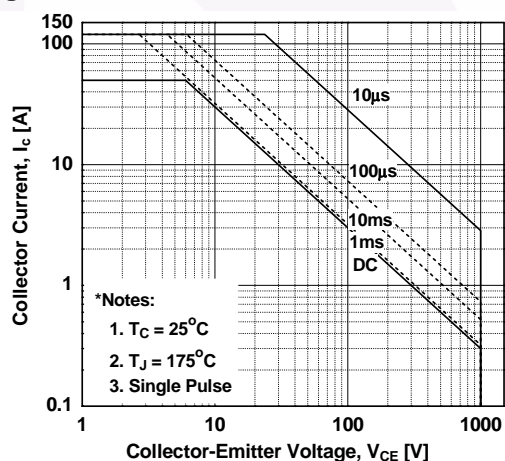


Figure 11. Turn-on Characteristics vs. Gate Resistance

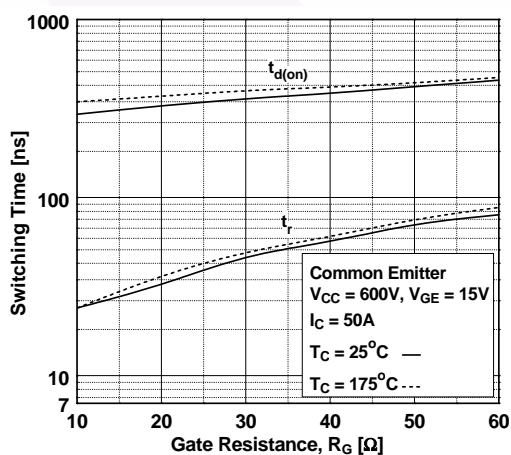
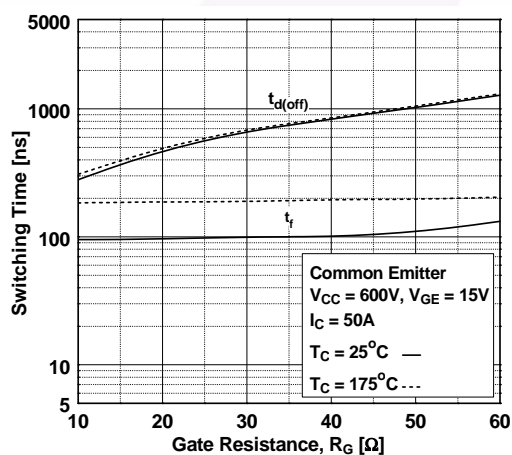
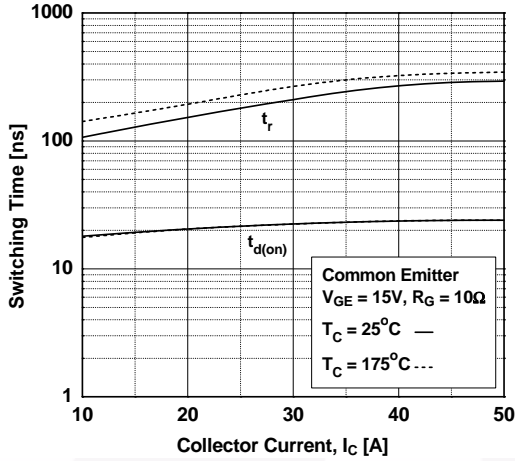


Figure 12. Turn-off Characteristics vs. Gate Resistance

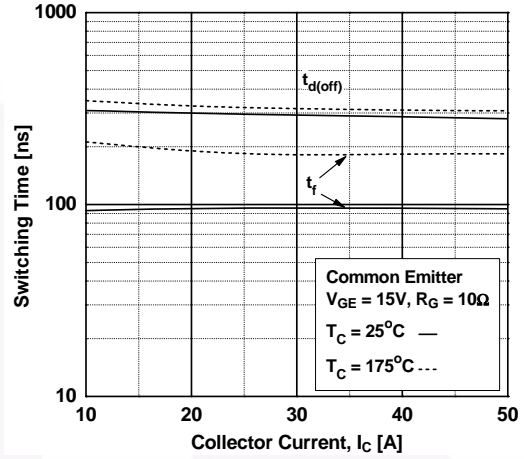


## Typical Performance Characteristics

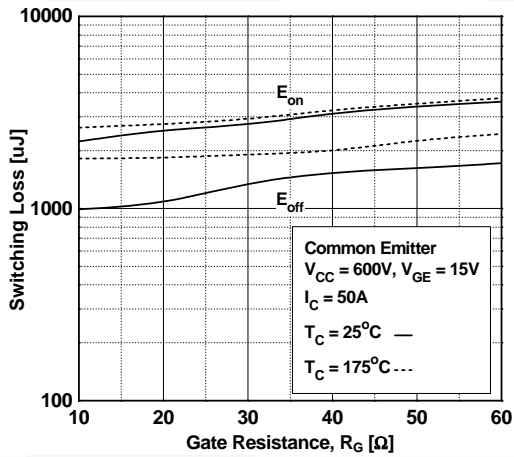
**Figure 13. Turn-on Characteristics vs. Collector Current**



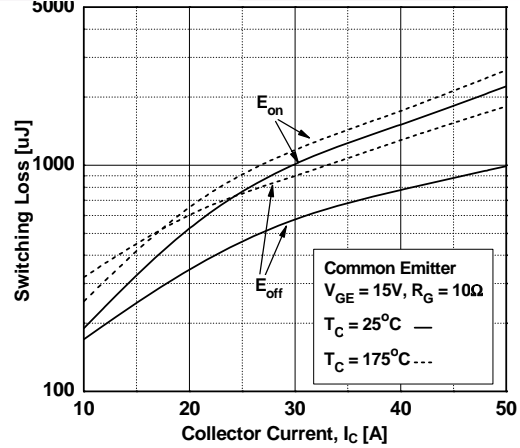
**Figure 14. Turn-off Characteristics vs. Collector Current**



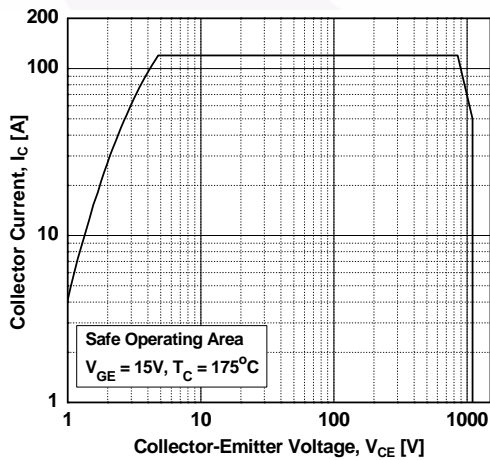
**Figure 15. Switching Loss vs. Gate Resistance**



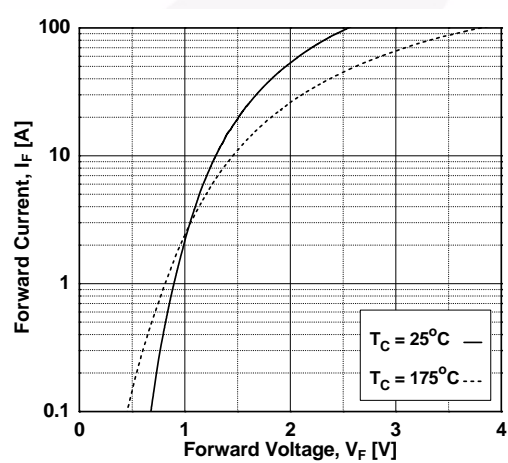
**Figure 16. Switching Loss vs. Collector Current**



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

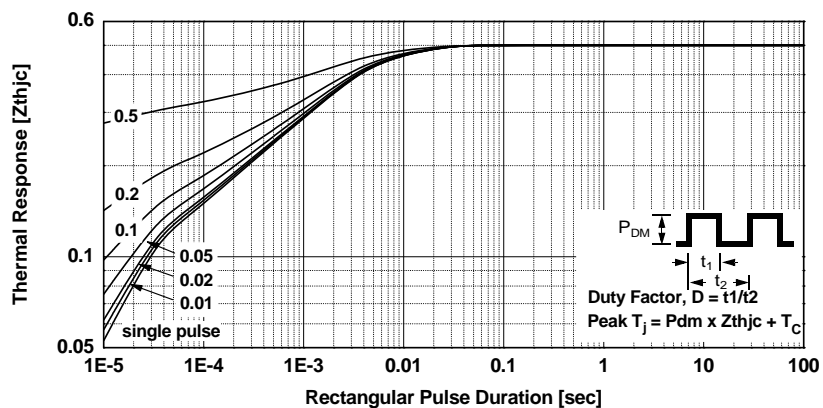


**Figure 18. Forward Characteristics**



Typical Performance Characteristics

Figure 19. Transient Thermal Impedance of IGBT









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