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March 2013

FGA20S120M 1200 V, 20 A Shorted-anode IGBT

Features

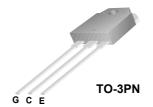
- · High Speed Switching
- Low Saturation Voltage: V_{CE(sat)} = 1.55 V @ I_C = 20 A
- · High Input Impedance
- RoHS Compliant

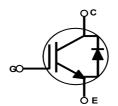
Applications

• 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.





Absolute Maximum Ratings $T_C = 25$ °C unless otherwise noted

Symbol	Description		Ratings	Unit	
V _{CES}	Collector to Emitter Voltage		1200	V	
V_{GES}	Gate to Emitter Voltage		±25	V	
I _C	Collector Current	@ T _C = 25°C	40	А	
.0	Collector Current	$@ T_C = 100^{\circ}C$	20	А	
I _{CM (1)}	Pulsed Collector Current		60	Α	
I _F	Diode Continuous Forward Current	@ T _C = 25°C	40	Α	
I _F	Diode Continuous Forward Current	@ T _C = 100°C	20	Α	
P _D	Maximum Power Dissipation	@ T _C = 25°C	348	W	
' ט	Maximum Power Dissipation	$@T_C = 100^{\circ}C$	174	W	
T _J	Operating Junction Temperature		-55 to +175	°C	
T _{stg}	Storage Temperature Range		-55 to +175	°C	
T _L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds		300	°C	

Thermal Characteristics

Symbol	Parameter	Тур.	Max.	Unit
$R_{\theta JC}(IGBT)$	Thermal Resistance, Junction to Case		0.43	°C/W
$R_{\theta JC}(Diode)$	Diode) Thermal Resistance, Junction to Case		0.43	°C/W
R _{θJA} Thermal Resistance, Junction to Ambient			40	°C/W

Notes:

1: Limited by Tjmax

Package Marking and Ordering Information

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

Electrical Characteristics of the IGBT $T_C = 25$ °C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Charac	teristics					
BV _{CES}	Collector to Emitter Breakdown Voltage	V _{GE} = 0V, I _C = 2mA	1200	-	-	V
I _{CES}	Collector Cut-Off Current	V _{CE} = V _{CES} , V _{GE} = 0V	-	-	1	mA
I _{GES}	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	-	-	±250	nA
On Charac	taristics				ı	
V _{GE(th)}	G-E Threshold Voltage	I _C = 20mA, V _{CE} = V _{GE}	4.5	6.0	7.5	V
	Collector to Emitter Saturation Voltage	I _C = 20A, V _{GE} = 15V T _C = 25°C	-	1.55	1.85	V
V _{CE(sat)}		I _C = 20A, V _{GE} = 15V, T _C = 125°C	-	1.75	-	V
		I _C = 20A, V _{GE} = 15V, T _C = 175°C	-	1.85	=	V
V _{FM}	Diode Forward Voltage	I _F = 20A, T _C = 25°C		1.7	2.2	٧
FIVI	Blode Forward Vollage	I _F = 20A, T _C = 175°C		2.1	-	V
Dynamic C	haracteristics				,	
C _{ies}	Input Capacitance	- 1/ - 201/1/ - 01/		2680		pF
C _{oes}	Output Capacitance	V _{CE} = 30V _, V _{GE} = 0V, f = 1MHz		53		pF
C _{res}	Reverse Transfer Capacitance			43		pF
Switching	Characcteristics					
t _{d(on)}	Turn-On Delay Time		-	43	-	ns
t _r	Rise Time	-	-	176	-	ns
t _{d(off)}	Turn-Off Delay Time	V _{CC} = 600V, I _C = 20A,	-	310	-	ns
t _f	Fall Time	$R_G = 10\Omega$, $V_{GE} = 15V$,	-	320	480	ns
E _{on}	Turn-On Switching Loss	Resistive Load, T _C = 25°C	-	0.52	-	mJ
E _{off}	Turn-Off Switching Loss	-	-	1.43	2.15	mJ
E _{ts}	Total Switching Loss		-	1.95	-	mJ
t _{d(on)}	Turn-On Delay Time		-	41	-	ns
t _r	Rise Time	-	-	260	-	ns
t _{d(off)}	Turn-Off Delay Time	V _{CC} = 600V, I _C = 20A,	-	345	-	ns
t _f	Fall Time	$R_G = 10\Omega$, $V_{GE} = 15V$,	-	520	-	ns
E _{on}	Turn-On Switching Loss	Resistive Load, $T_C = 175^{\circ}C$	-	0.78	-	mJ
E _{off}	Turn-Off Switching Loss	-	-	1.97	-	mJ
E _{ts}	Total Switching Loss	-	-	2.75	-	mJ
Q _g	Total Gate Charge		-	208	-	nC
	Gate to Emitter Charge	$V_{CE} = 600V, I_{C} = 20A,$	_	18		nC
Q_{ge}	Gale to Emitter Charge	V _{GE} = 15V	_	10	-	IIC

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

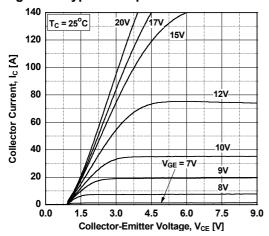


Figure 3. Typical Saturation Voltage Characteristics

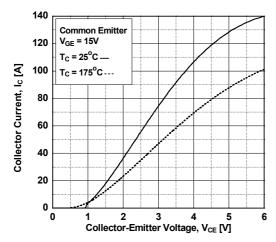


Figure 5. Saturation Voltage vs. Case
Temperature at Variant Current Level

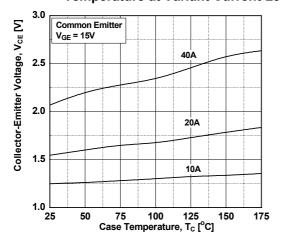


Figure 2. Typical Output Characteristics

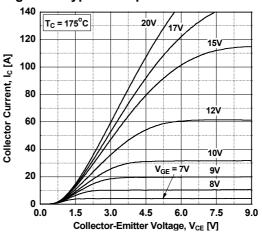


Figure 4. Transfer Characteristics

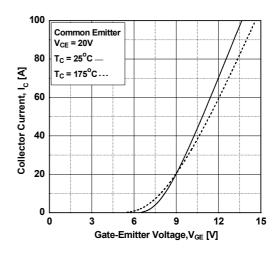
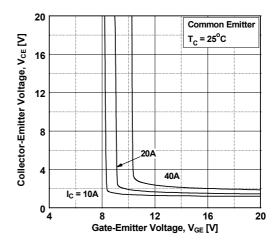


Figure 6. Saturation Voltage vs. Vge



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

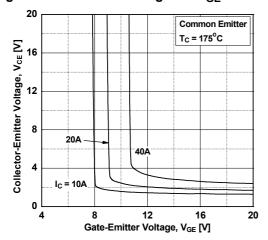


Figure 9. Gate Charge Characteristics

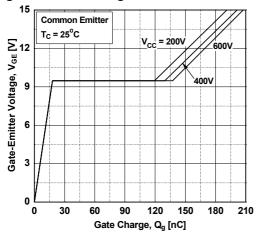


Figure 11. Turn-On Characteristics vs.
Gate Resistance

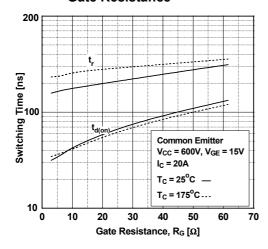


Figure 8. Capacitance Characteristics

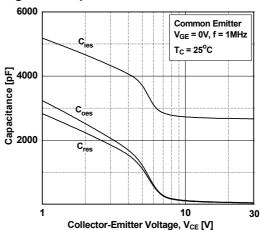


Figure 10. SOA Characteristics

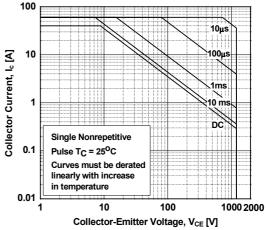
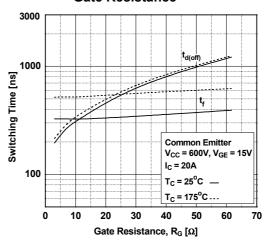


Figure 12. Turn-Off Characteristics vs.
Gate Resistance



Typical Performance Characteristics

Figure 13. Turn-On Characteristics vs. Collector Current

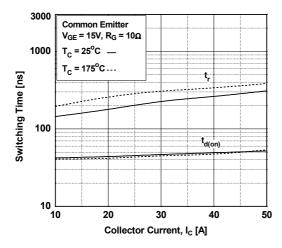


Figure 14. Turn-off Characteristics vs. Collector Current

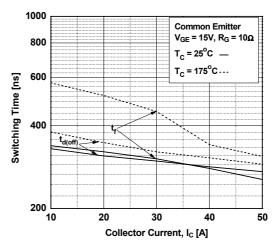


Figure 15. Switching Loss vs.

Gate resistance

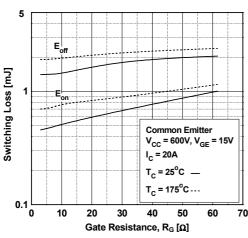


Figure 16. Switching Loss vs.
Collector Current

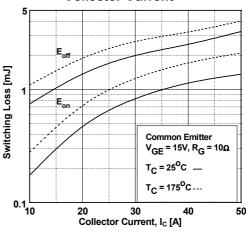


Figure 17. Turn-Off Switching SOA Characteristics Collector Currrent

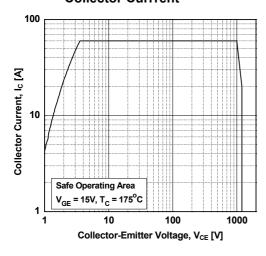
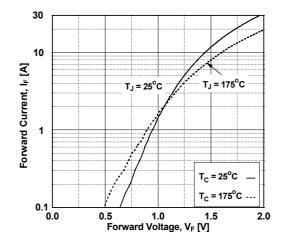
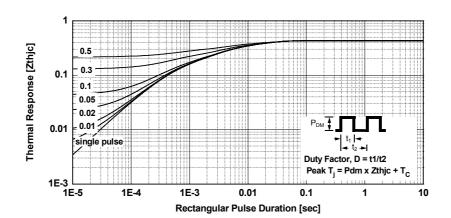


Figure 18. Diode Forward Characteristics







Mechanical Dimensions TO-3PN 5.00 4.60 ¢3.30 3.10 15,80 15,40 1.65 1.45 (R0.50) 20.10 19,70 18.90 18.50 (1.85)2.20 1.80 3 20 2 80 20.30 19.70 **⊕** Ø0.55**⋈** 1.20 0.80 1 5.45 5.45 (R0.50) Dimensions in Millimeters





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