

March 2014

FGAF20N60SMD 600 V, 20 A Field Stop IGBT

Features

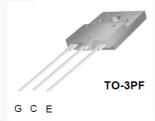
- Maximum Junction Temperature : T_J = 175°C
- · Positive Temperaure Co-efficient for easy Parallel Operating
- · High Current Capability
- Low Saturation Voltage: $V_{CE(sat)} = 1.7 \text{ V(Typ.)} \otimes I_C = 20 \text{ A}$
- · High Input Impedance
- Fast Swiching: E_{OFF} = 7 uJ/A
- · Tightened Parameter Distribution
- · RoHS Compliant

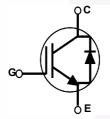
Applications

- · Sewing Machine, CNC
- · Home Appliances, Motor-Control

General Description

Using novel field stop IGBT technology, Fairchild's new series of field stop 2nd generation IGBTs offer the optimum performance for solar inverter, UPS, welder and PFC applications where low conduction and switching losses are essential.





Absolute Maximum Ratings

Symbol	Description		Ratings	Unit
V _{CES}	Collector to Emitter Voltage		600	V
V _{GES}	Gate to Emitter Voltage		± 20	V
I _C	Collector Current	@ T _C = 25°C	40	Α
'C	Collector Current	@ T _C = 100°C	20	А
I _{CM (1)}	Pulsed Collector Current		60	Α
le \	Diode Forward Current	@ T _C = 25°C	20	Α
¹F	Diode Forward Current	@ T _C = 100°C	10	Α
I _{FM (1)}	Pulsed Diode Maximum Forward Curren	t	60	Α
P _D	Maximum Power Dissipation	@ T _C = 25°C	75	W
י ט	Maximum Power Dissipation	@ T _C = 100°C	37.5	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

Notes:

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

Thermal Characteristics

Symbol	Parameter	Тур.	Max.	Unit
$R_{\theta JC}(IGBT)$	Thermal Resistance, Junction to Case	-	2.0	°C/W
$R_{\theta JC}(Diode)$	Thermal Resistance, Junction to Case	-	4.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient		40	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGAF20N60SMD	FGAF20N60SMD	TO-3PF	-	-	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	$V_{GE} = 0V, I_{C} = 250\mu A$	600	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_{J}}$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0V, I_{C} = 250\mu A$	-	0.62	-	V/°C
I _{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	-	-	250	μΑ
I _{GES}	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	-	-	±400	nA
On Charac	teristics					
V _{GE(th)}	G-E Threshold Voltage	I _C = 250μA, V _{CE} = V _{GE}	3.5	4.7	6.0	V
- (- /		I _C = 20A, V _{GE} = 15V	-	1.7	2.5	V
V _{CE(sat)}	Collector to Emitter Saturation Voltage	I _C = 20A, V _{GE} = 15V, T _C = 175°C	-	1.9	-	V
Dynamic C	haracteristics					
C _{ies}	Input Capacitance		-	925	-	pF
C _{oes}	Output Capacitance	V _{CE} = 30V _, V _{GE} = 0V, f = 1MHz	-	89	-	pF
C _{res}	Reverse Transfer Capacitance	1 = 1WITZ	-	30	-	pF
Switching	Characteristics					
t _{d(on)}	Turn-On Delay Time		-	12	-	ns
t _r	Rise Time		-	22	- /	ns
t _{d(off)}	Turn-Off Delay Time	V _{CC} = 400V, I _C = 20A,	-	91	- 1	ns
t _f	Fall Time	$R_G = 10\Omega, V_{GE} = 15V,$	-	21	27	ns
E _{on}	Turn-On Switching Loss	Inductive Load, T _C = 25°C	-	452	_	uJ
E _{off}	Turn-Off Switching Loss		-	141	187	uJ
E _{ts}	Total Switching Loss		-	593	-	uJ
t _{d(on)}	Turn-On Delay Time		-	12	- /	ns
t _r	Rise Time		-	19	-	ns
t _{d(off)}	Turn-Off Delay Time	$V_{CC} = 400V, I_C = 20A,$	-	93	-	ns
t _f	Fall Time	$R_G = 10\Omega, V_{GE} = 15V,$	-	16	-	ns
E _{on}	Turn-On Switching Loss	Inductive Load, T _C = 175°C	-	667	-	uJ
E _{off}	Turn-Off Switching Loss		-	317	-	uJ
E _{ts}	Total Switching Loss			984		uJ

Electrical Characteristics of the IGBT (Continued)

Symbol	Parameter	Test Conditions	Min.	Тур.	Max	Unit
Qg	Total Gate Charge		-	64	-	nC
Q _{ge}	Gate to Emitter Charge	V _{CE} = 400V, I _C = 20A, V _{GE} = 15V	-	6.2	-	nC
Q_{gc}	Gate to Collector Charge	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	-	32	-	nC

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

Symbol	Parameter		Test Conditions		Min.	Тур.	Max	Unit	
V _{FM} Diode Forward	Diode Forward Voltage	I_ =	I _F = 10A		$T_C = 25^{\circ}C$	-	2.3	-	V
	2.040 : 0.114.4 : 0.1490	'F			T _C = 175°C	-	1.67	-	,
E _{rec}	Reverse Recovery Energy				T _C = 175°C	-	13.8	-	uJ
t _{rr}	Diode Reverse Recovery Time	$I_F = 10A$, $dI_F/dt = 200A/\mu s$		T _C = 25°C	-	26.7	-	ns	
ना				T _C = 175°C	-	88.2	-		
Q _{rr}	Diode Reverse Recovery Charge				T _C = 25°C	-	42	-	nC
~ I	2.000 November 1.000 November 1				T _C = 175°C	-	245	-	::0

Figure 1. Typical Output Characteristics

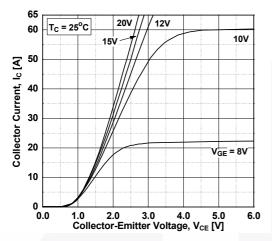


Figure 3. Typical Saturation Voltage Characteristics

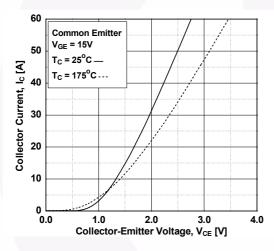


Figure 5. Saturation Voltage vs. Case
Temperature at Variant Current Level

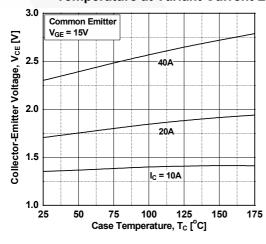


Figure 2. Typical Output Characteristics

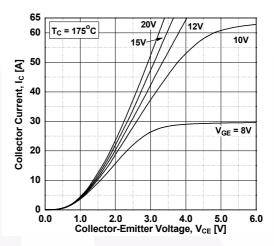


Figure 4. Transfer Characteristics

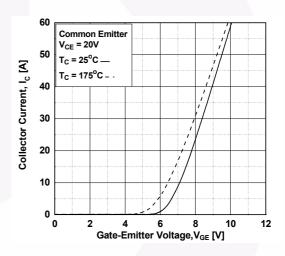


Figure 6. Saturation Voltage vs. V_{GE}

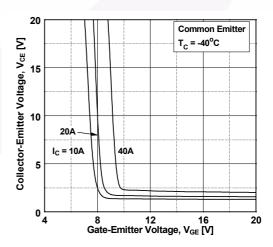


Figure 7. Saturation Voltage vs. V_{GE}

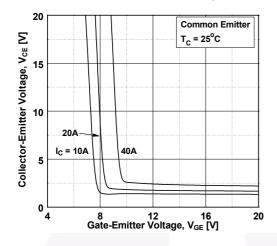


Figure 9. Capacitance Characteristics

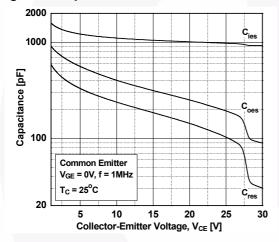


Figure 11. SOA Characteristics

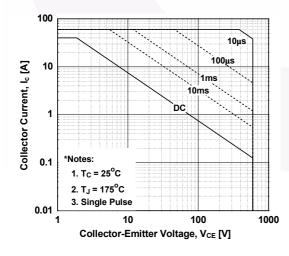


Figure 8. Saturation Voltage vs. V_{GE}

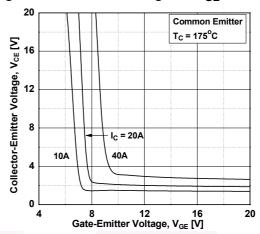


Figure 10. Gate charge Characteristics

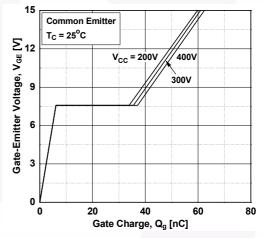


Figure 12. Turn-on Characteristics vs.
Gate Resistance

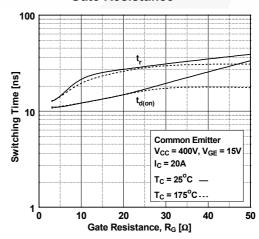


Figure 13. Turn-off Characteristics vs.
Gate Resistance

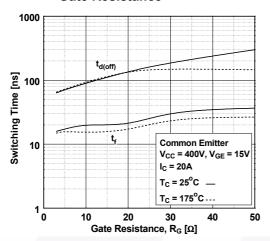


Figure 15. Turn-off Characteristics vs. Collector Current

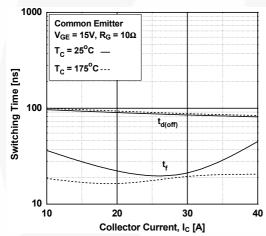


Figure 17. Switching Loss vs. Collector Current

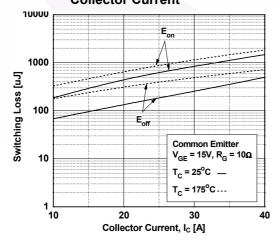


Figure 14. Turn-on Characteristics vs.
Collector Current

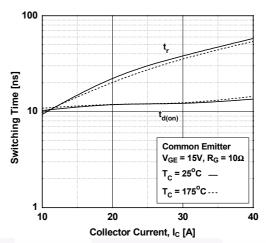


Figure 16. Switching Loss vs.
Gate Resistance

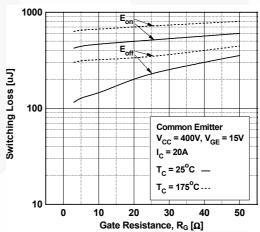


Figure 18. Turn off Switching SOA Characteristics

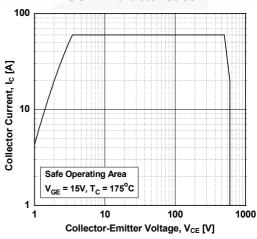


Figure 19. Current Derating

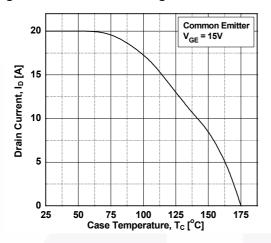


Figure 21. Load Current Vs. Frequency

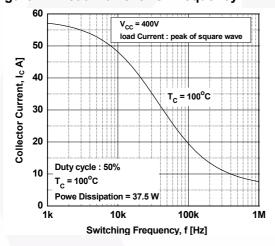


Figure 23. Reverse Current

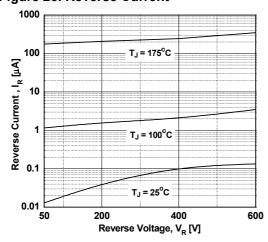


Figure 20. Power Dissipation

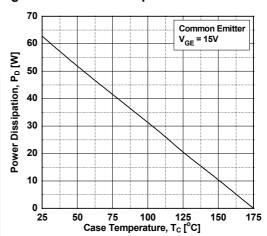


Figure 22. Forward Characteristics

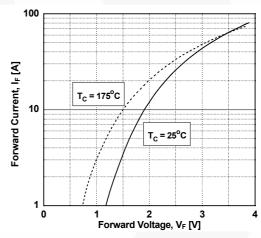


Figure 24. Stored Charge

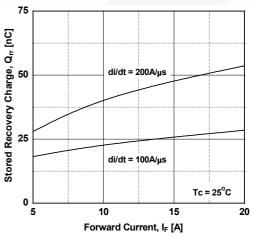


Figure 25. Reverse Recovery Time

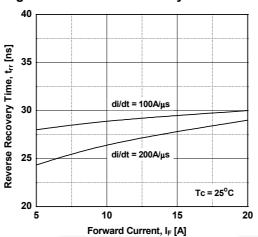


Figure 26.Transient Thermal Impedance of IGBT

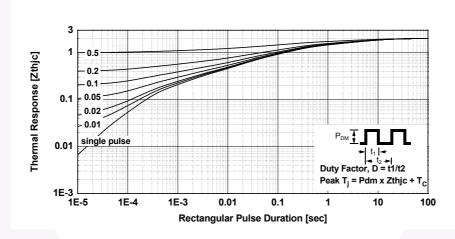
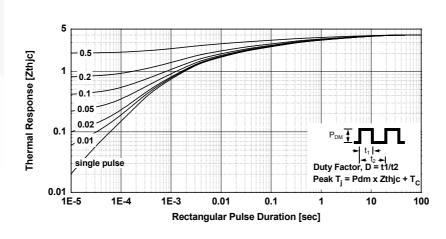


Figure 27.Transient Thermal Impedance of Diode



Mechanical Dimensions

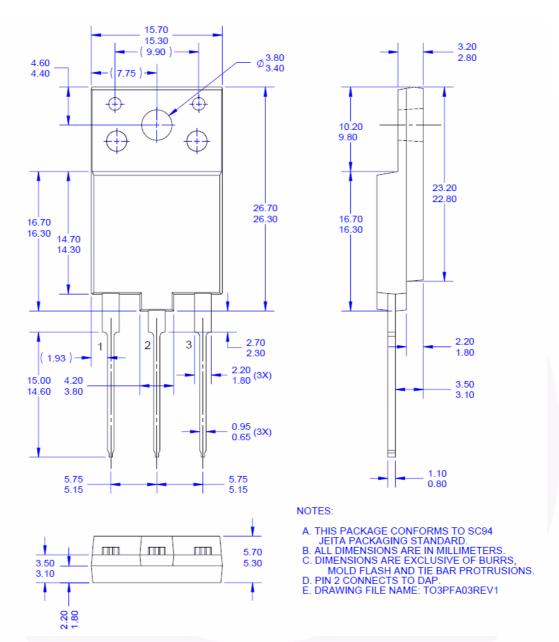


Figure 28. TO3PF,MOLDED,3LD,FULLPACK (AG)

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Dimensions in Millimeters





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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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