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October 2013

FGB20N60SFD_F085 600V, 20A Field Stop IGBT

Features

- · High current capability
- Low saturation voltage: V_{CE(sat)} = 2.2V @ I_C = 20A
- · High input impedance
- · Fast switching
- · Qualified to Automotive Requirements of AEC-Q101
- · RoHS complaint

Applications

- Inverters, SMPS, PFC, UPS
- · Automotive Chargers, Converters, High Voltage Auxiliaries





General Description

Using novel field-stop IGBT technology, Fairchild's new series of field-stop IGBTs offers the optimum performance for

automotive chargers, inverters, and other applications where

low conduction and switching losses are essential.



Absolute Maximum Ratings

Symbol	Description		Ratings	Units
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
•0	Collector Current	@ T _C = 100°C	20	A
I _{CM (1)}	Pulsed Collector Current @ T _C = 25°C		60	Α
I _F	Diode Forward Current	@ T _C = 25°C	20	Α
	Diode Forward Current	@ T _C = 100°C	10	А
I _{FM(1)}	Pulsed Diode Maximum Forward Current		60	Α
P_{D}	Maximum Power Dissipation	@ T _C = 25°C	208	W
	Maximum Power Dissipation	@ T _C = 100°C	83	W
T _J	Operating Junction Temperature		-55 to +150	°C
T _{stg}	Storage Temperature Range		-55 to +150	°C
T _L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds		300	°C

Thermal Characteristics

Symbol	Parameter	Ratings	Units	
$R_{\theta JC}(IGBT)_{(2)}$	Thermal Resistance, Junction to Case	0.6	°C/W	
$R_{\theta JC}(Diode)$	Thermal Resistance, Junction to Case	2.6	°C/W	

Symbol	Parameter	Тур.	Units	
$R_{ hetaJA}$	Thermal Resistance, Junction to Ambient (PCB Mount)(2)	75	°C/W	

Package Marking and Ordering Information

		Packaging			Max Qty
Device Marking	Device	Package	Type	Qty per Tube	per Box
FGB20N60SFD	FGB20N60SFD_F085	TO-263	Tube	50ea	-

Electrical Characteristics of the IGBT $T_C = 25^{\circ}C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Units
Off Charac	eteristics					
BV _{CES}	Collector to Emitter Breakdown Voltage	$V_{GE} = 0V, I_{C} = 250\mu A$	600	-	-	V
$\Delta BV_{CES} \over \Delta T_J$	Temperature Coefficient of Breakdown Voltage	V _{GE} = 0V, I _C = 250μA	-	0.79	-	V/°C
I _{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	-	-	250	
		ICES at 80%*BVCES, 150°C	-	-	250	μА
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	$I_{C} = 250 \mu A, V_{CE} = V_{GE}$	4.0	4.8	6.5	V
, ,		I _C = 20A, V _{GE} = 15V	-	2.2	2.85	V
V _{CE(sat)}	Collector to Emitter Saturation Voltage	I _C = 20A, V _{GE} = 15V, T _C = 125°C	-	2.4	-	V
Dynamic C	Characteristics	,	- 1			
C _{ies}	Input Capacitance		-	940	1250	pF
C _{oes}	Output Capacitance	$V_{CE} = 30V, V_{GE} = 0V,$	-	110	146	pF
C _{res}	Reverse Transfer Capacitance	f = 1MHz	-	40	53	pF
Switching	Characteristics	,	1		II.	
t _{d(on)}	Turn-On Delay Time		-	10	13	ns
t _r	Rise Time		-	16	21	ns
t _{d(off)}	Turn-Off Delay Time	V _{CC} = 400V, I _C = 20A,	-	90	120	ns
t _f	Fall Time	$R_G = 10\Omega$, $V_{GE} = 15V$,	-	24	36	ns
E _{on}	Turn-On Switching Loss	Inductive Load, T _C = 25°C	-	0.31	0.41	mJ
E _{off}	Turn-Off Switching Loss	_	-	0.13	0.21	mJ
E _{ts}	Total Switching Loss		-	0.44	0.59	mJ
t _{d(on)}	Turn-On Delay Time		-	12	16	ns
t _r	Rise Time		-	16	21	ns
t _{d(off)}	Turn-Off Delay Time	$V_{CC} = 400V, I_{C} = 20A,$	-	95	126	ns
t _f	Fall Time	$R_G = 10\Omega$, $V_{GE} = 15V$, Inductive Load, $T_C = 125^{\circ}C$	-	28	43	ns
E _{on}	Turn-On Switching Loss		-	0.45	0.60	mJ
E _{off}	Turn-Off Switching Loss		-	0.21	0.38	mJ
E _{ts}	Total Switching Loss		-	0.66	0.88	mJ
Q _g	Total Gate Charge		-	63	95	nC
Q _{ge}	Gate to Emitter Charge	$V_{CE} = 400V, I_{C} = 20A,$ $V_{GE} = 15V$	-	7	11	nC

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

Symbol	Parameter	Test Conditions		Min.	Тур.	Max	Units
V _{FM} Diode Forward Voltage	Diode Forward Voltage	I _E = 10A	$T_{\rm C} = 25^{\rm o}{\rm C}$	-	1.9	2.5	V
	1671	T _C = 125°C	-	1.7	-]	
t _{rr} Diode F	Diode Reverse Recovery Time	$I_{ES} = 10A$, $dI_{ES}/dt = 200A/\mu s$	$T_C = 25^{\circ}C$	-	111	-	ns
11	,		T _C = 125°C	-	204	-	
Q _{rr}	Q _{rr} Diode Reverse Recovery Charge		$T_C = 25^{\circ}C$	-	174	244	nC
111	y enange		$T_{\rm C}$ = 125°C	-	463	1	

Notes:

Rthja for D2-PAK: according to JESD51-2, test method environmental condition and JESD51-3, low effective thermal conductivity test board for leaded surface mount package. thermal measurements. JESD51-2: Integrated Circuits Thermal Test Method Environmental Conditions - Natural Convection (Still Air).

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

^{2:}Rthjc for D2-PAK: according to Mil standard 883-1012 test method.

Figure 1. Typical Output Characteristics

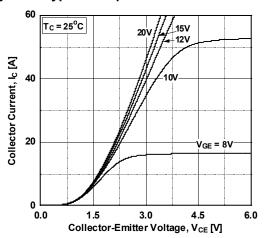


Figure 3. Typical Saturation Voltage Characteristics

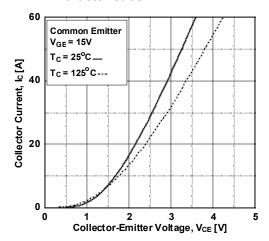


Figure 5. Saturation Voltage vs. Case
Temperature at Variant Current Level

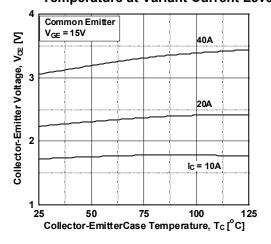


Figure 2. Typical Output Characteristics

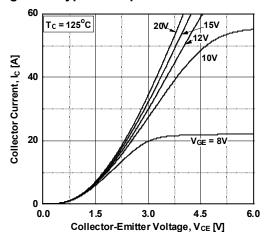


Figure 4. Transfer Characteristics

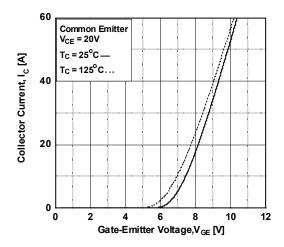


Figure 6. Saturation Voltage vs. V_{GE}

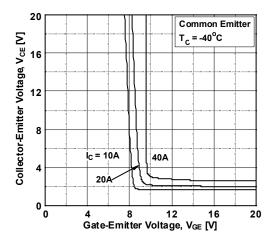


Figure 7. Saturation Voltage vs. V_{GE}

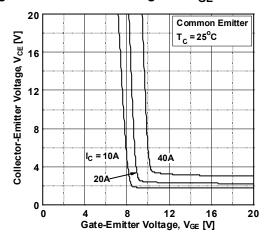


Figure 9. Capacitance Characteristics

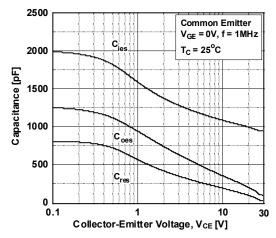


Figure 11. SOA Characteristics

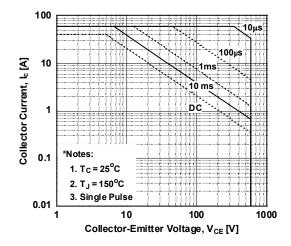


Figure 8. Saturation Voltage vs. V_{GE}

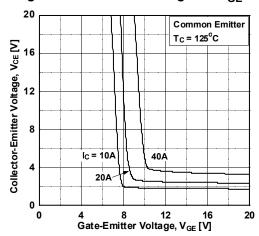


Figure 10. Gate charge Characteristics

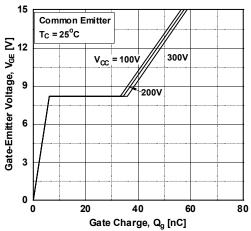


Figure 12. Turn-on Characteristics vs. Gate Resistance

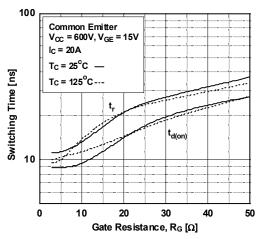


Figure 13. Turn-off Characteristics vs.
Gate Resistance

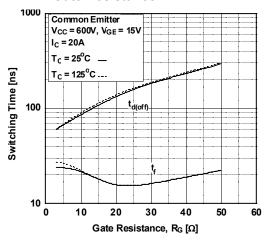


Figure 15. Turn-off Characteristics vs. Collector Current

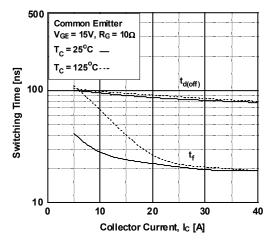


Figure 17. Switching Loss vs. Collector Current

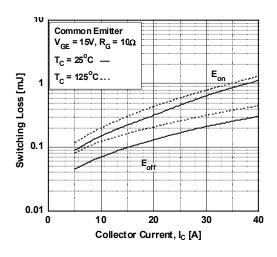


Figure 14. Turn-on Characteristics vs.
Collector Current

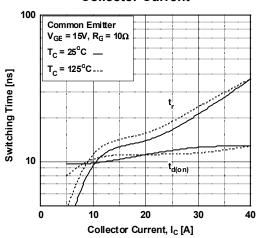


Figure 16. Switching Loss vs. Gate Resistance

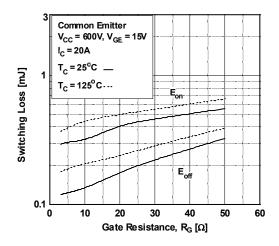


Figure 18. Turn off Switching SOA Characteristics

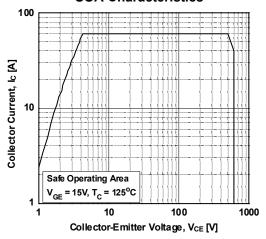


Figure 19. Forward Characteristics

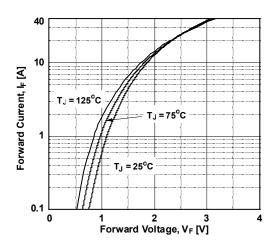


Figure 20. Typical Reverse Current vs. Reverse Voltage

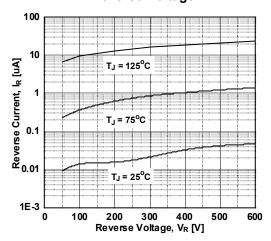


Figure 21. Stored Charge

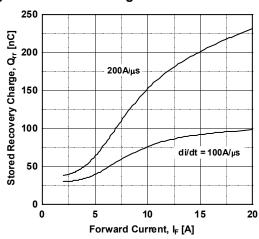


Figure 22. Reverse Recovery Time

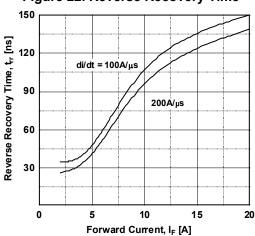
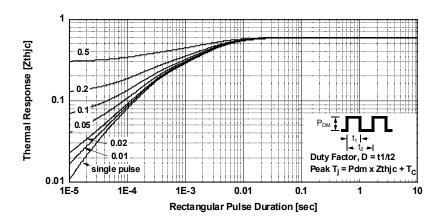
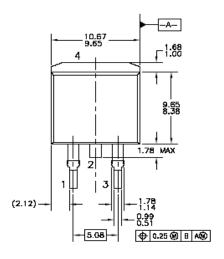


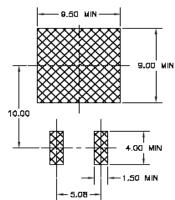
Figure 23.Transient Thermal Impedance of IGBT



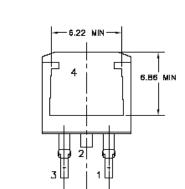
Mechanical Dimensions

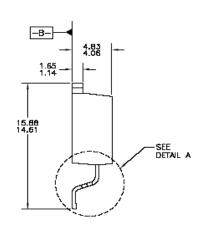
D²PAK

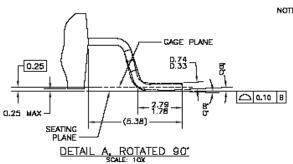




LAND PATTERN RECOMMENDATION







- NOTES: LINLESS OTHERWISE SPECIFIED

 A) ALL DIMENSIONS ARE IN MILLIMETERS.

 B) REFERENCE JEDEC, TO—263, ISSUE D,
 VARIATION AB, DATED JULY 2003.

 C) DIMENSIONING AND TOLERANCING PER
 ANSI Y14.5M 1982.

 D) LOCATION OF THE PIN HOLE MAY VARY
 (LOWER LEFT CORNER, LOWER CENTER
 AND CENTER OF THE PACKAGE).

 B) PRESENCE OF TRIMMED CENTER LEAD
 IS OPTIONAL

Dimensions in Millimeters

TO283AD2REVD





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