

October 2011

FGA60N65SMD 650V, 60A Field Stop IGBT

Features

- Maximum Junction Temperature : T_J =175°C
- Positive Temperature Co-efficient for Easy Parallel Operating
- · High Current Capability
- Low Saturation Voltage: $V_{CE(sat)} = 1.9V(Typ.) @ I_C = 60A$
- Fast Switching
- Tighten Parameter Distribution
- · RoHS Compliant

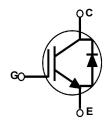
Applications

· Solar Inverter, UPS, SMPS, Welder, PFC

General Description

Using Novel Field Stop IGBT Technology, Fairchild's new series of Field Stop IGBTs offer the optimum performance for Solar Inverter, UPS, SMPS, Welder and PFC applications where low conduction and switching losses are essential.





Absolute Maximum Ratings

Symbol	Description		Ratings	Units	
V _{CES}	Collector to Emitter Voltage		650	V	
V _{GES}	Gate to Emitter Voltage		± 20	V	
I _C	Collector Current	@ T _C = 25°C	120	Α	
·C	Collector Current	@ T _C = 100°C	60	Α	
I _{CM (1)}	Pulsed Collector Current		180	Α	
I _F	Diode Forward Current	@ T _C = 25°C	60	Α	
	Diode Forward Current	@ T _C = 100°C	30	Α	
I _{FM (1)}	Pulsed Diode Maximum Forward Current		180	Α	
P_{D}	Maximum Power Dissipation	@ T _C = 25°C	600	W	
	Maximum Power Dissipation	@ T _C = 100°C	300	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.	Units
$R_{\theta JC}(IGBT)$	T) Thermal Resistance, Junction to Case		0.25	°C/W
$R_{\theta JC}(Diode)$	Thermal Resistance, Junction to Case	-	1.1	°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
FGA60N65SMD FGA60N65SMD TO-3PN		-	-	30	

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

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Units
Off Charac	teristics			•		
BV _{CES}	Collector to Emitter Breakdown Voltage	$V_{GE} = 0V, I_{C} = 250\mu A$	650	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_{J}}$	Temperature Coefficient of Breakdown Voltage	V _{GE} = 0V, I _C = 250μA	-	0.6	-	V/°C
I _{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	-	-	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 = 250μA, V _{CE} = V _{GE}	3.5	4.5	6.0	V
02(0.)		I _C = 60A, V _{GE} = 15V	_	1.9	2.5	V
V _{CE(sat)}	Collector to Emitter Saturation Voltage	I _C = 60A, V _{GE} = 15V, T _C = 175°C	-	2.1	-	V
Dynamic C	haracteristics					
C _{ies}	Input Capacitance		-	2915	-	pF
C _{oes}	Output Capacitance	V _{CE} = 30V _, V _{GE} = 0V, f = 1MHz	-	270	-	pF
C _{res}	Reverse Transfer Capacitance	1 - 11/11/12	-	85	-	pF
Switching	Characteristics					
t _{d(on)}	Turn-On Delay Time		_	18	27	ns
t _r	Rise Time		-	47	70	ns
t _{d(off)}	Turn-Off Delay Time	V _{CC} = 400V, I _C = 60A,	-	104	146	ns
t _f	Fall Time	$R_G = 3\Omega, V_{GF} = 15V,$	-	50	68	ns
E _{on}	Turn-On Switching Loss	Inductive Load, T _C = 25°C	_	1.54	2.31	mJ
E _{off}	Turn-Off Switching Loss		-	0.45	0.60	mJ
E _{ts}	Total Switching Loss		_	1.99	2.91	mJ
t _{d(on)}	Turn-On Delay Time		-	18	-	ns
t _r	Rise Time	$V_{CC} = 400V, I_{C} = 60A,$ $R_{G} = 3\Omega, V_{GE} = 15V,$	-	41	-	ns
t _{d(off)}	Turn-Off Delay Time		-	115	-	ns
t _f	Fall Time		-	48	-	ns
E _{on}	Turn-On Switching Loss	Inductive Load, T _C = 175°C	-	2.08	-	mJ
E _{off}	Turn-Off Switching Loss		-	0.78	-	mJ
E _{ts}	Total Switching Loss	1	-	2.86	-	mJ

Electrical Characteristics of the IGBT (Continued)

Symbol	Parameter	Test Conditions	Min.	Тур.	Max	Units
Q_g	Total Gate Charge		-	189	284	nC
Q _{ge}	Gate to Emitter Charge	V _{CE} = 400V, I _C = 60A, V _{GE} = 15V	-	20	30	nC
Q _{gc}	Gate to Collector Charge	VGE - 10V	-	91	137	nC

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

Symbol	Parameter	Test Conditions		Min.	Тур.	Max	Units
VEM	V _{FM} Diode Forward Voltage	I _F = 30A	T _C = 25°C	-	2.1	2.6	٧
FIVI		,	T _C = 175°C	-	1.7	-	
E _{rec}	Reverse Recovery Energy		T _C = 175°C	-	127	-	uJ
t _{rr}	t _{rr} Diode Reverse Recovery Time	II _F =30A,	T _C = 25°C	-	47	-	ns
*11			T _C = 175°C	-	212	-	
Im	Diode Peak Reverse Recovery Current		T _C = 25°C	-	3.7	-	Α
-11	2.000 . 00		T _C = 175°C	-	8.8	-	, ,
Q _{rr}	Diode Reverse Recovery Charge		T _C = 25°C	-	87	-	nC
-11			T _C = 175°C	-	933	-	_

Figure 1. Typical Output Characteristics

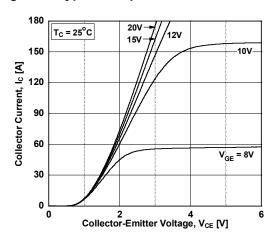


Figure 3. Typical Saturation Voltage Characteristics

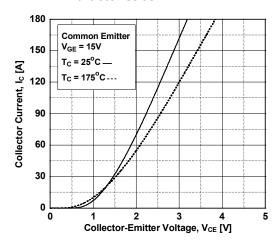


Figure 5. Saturation Voltage vs. Case
Temperature at Variant Current Level

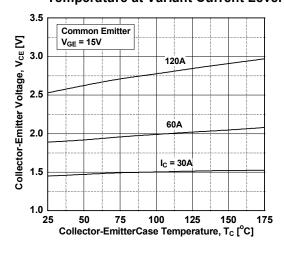


Figure 2. Typical Output Characteristics

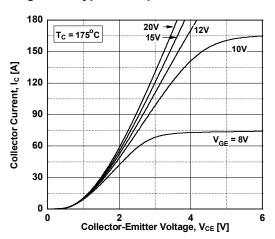


Figure 4. Transfer Characteristics

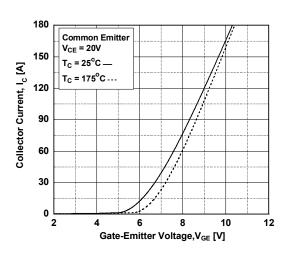


Figure 6. Saturation Voltage vs. V_{GE}

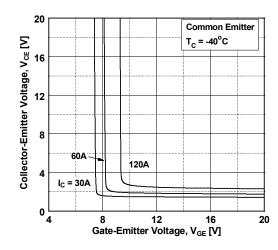


Figure 7. Saturation Voltage vs. V_{GE}

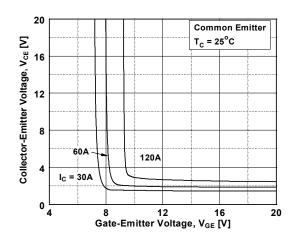


Figure 9. Capacitance Characteristics

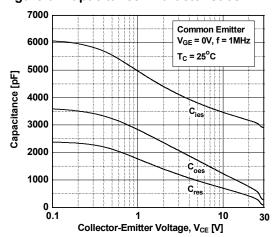


Figure 11. SOA Characteristics

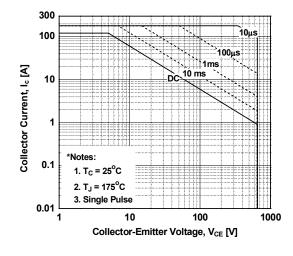


Figure 8. Saturation Voltage vs. V_{GE}

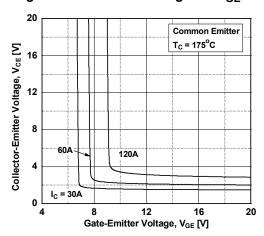


Figure 10. Gate charge Characteristics

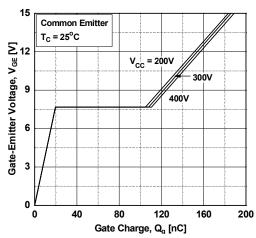


Figure 12. Turn-on Characteristics vs.
Gate Resistance

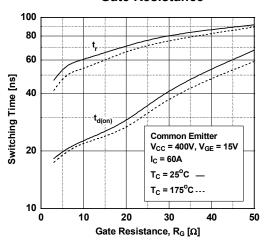


Figure 13. Turn-off Characteristics vs.
Gate Resistance

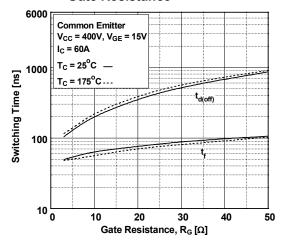


Figure 14. Turn-on Characteristics vs.
Collector Current

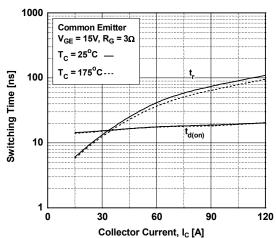


Figure 15. Turn-off Characteristics vs. Collector Current

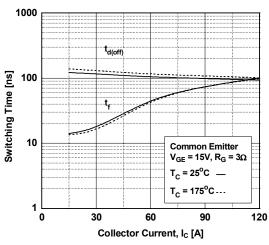


Figure 16. Switching Loss vs. Gate Resistance

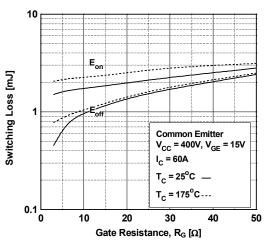


Figure 17. Switching Loss vs. Collector Current

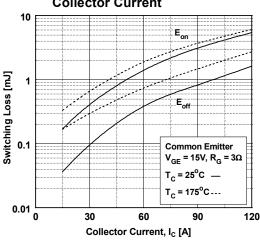


Figure 18. Turn off Switching SOA Characteristics

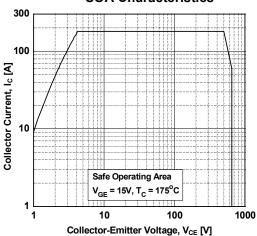


Figure 19. Current Derating

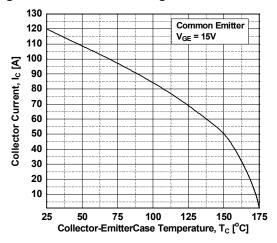


Figure 21. Forward Characteristics

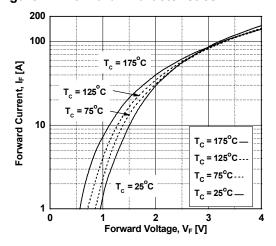


Figure 23. Stored Charge

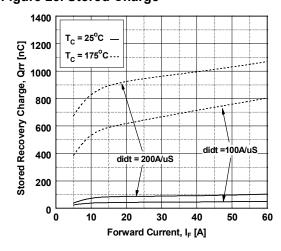


Figure 20. Load Current Vs. Frequency

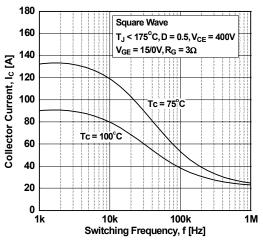


Figure 22. Reverse Recovery Current

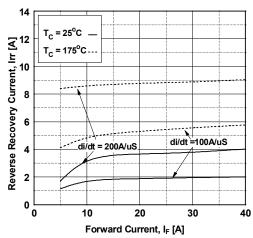


Figure 24. Reverse Recovery Time

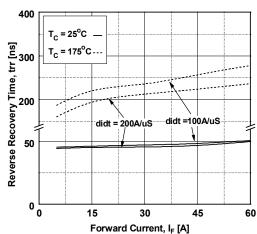


Figure 25.Transient Thermal Impedance of IGBT

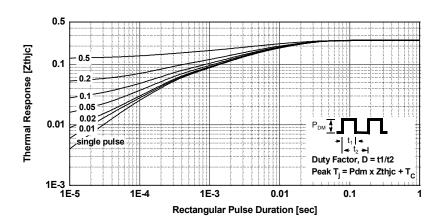
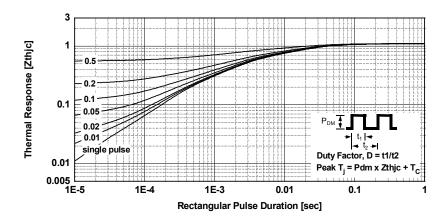
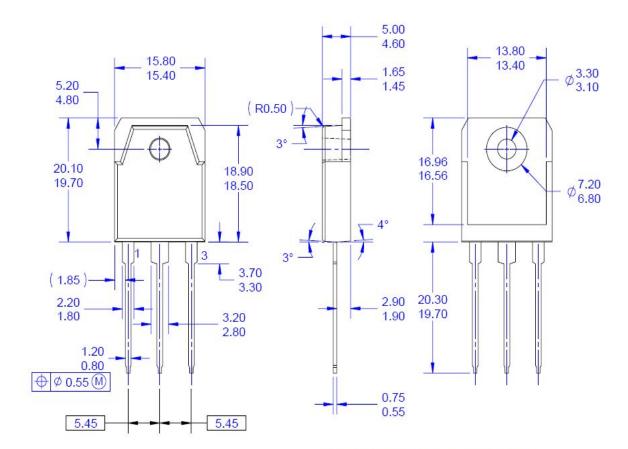


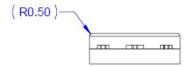
Figure 26.Transient Thermal Impedance of Diode



Mechanical Dimensions

TO-3PN





NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO EIAJ SC-65 PACKAGING STANDARD.
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Datasheet Identification	Product Status	Definition
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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.
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