

August 2014

FGA40N65SMD 650 V, 40 A 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: $V_{CE(sat)} = 1.9 \text{ V(Typ.)} @ I_C = 40 \text{ A}$
- Fast Switching : E_{OFF} = 6.5 uJ/A
- · Tighten Parameter Distribution
- RoHS Compliant

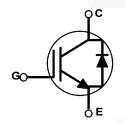
Applications

- · Solar Inverter, UPS, Welder, PFC, Induction Heating
- · Telecom, ESS

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, induction heating, telecom, ESS and PFC applications where low conduction and switching losses are essential.





Absolute Maximum Ratings

Symbol	Description		Ratings	Unit
V _{CES}	Collector to Emitter Voltage	650	V	
V_{GES}	Gate to Emitter Voltage		± 20	V
▼GES	Transient Gate to Emitter Voltage		± 30	V
I _C	Collector Current	@ T _C = 25°C	80	А
.0	Collector Current	@ T _C = 100°C	40	А
I _{CM (1)}	Pulsed Collector Current		120	А
l _F	Diode Forward Current	@ T _C = 25°C	40	А
'F	Diode Forward Current	@ T _C = 100°C	20	Α
I _{FM (1)}	Pulsed Diode Maximum Forward Currer	120	А	
P _D	Maximum Power Dissipation	@ T _C = 25°C	349	W
' ט	Maximum Power Dissipation	@ T _C = 100°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

Notes

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

Thermal Characteristics

Symbol	Parameter	Тур.	Max.	Unit
$R_{\theta JC}(IGBT)$	(IGBT) Thermal Resistance, Junction to Case		0.43	°C/W
$R_{\theta JC}(Diode)$	le) Thermal Resistance, Junction to Case		1.5	°C/W
$R_{\theta JA}$	R _{0JA} Thermal Resistance, Junction to Ambient		40	°C/W

Package Marking and Ordering Information

Part Number	Part Number Top Mark		Package Packing Method		Reel Size Tape Width	
FGA40N65SMD	FGA40N65SMD	TO-3PN	Tube	N/A	N/A	30

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

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Charac	teristics					
BV _{CES}	Collector to Emitter Breakdown Voltage	$V_{GE} = 0 \text{ V}, I_{C} = 250 \mu\text{A}$	650	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_{J}}$	Temperature Coefficient of Breakdown Voltage	V_{GE} = 0 V, I_{C} = 250 μ A	-	0.6	-	V/°C
I _{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0 V$	-	-	250	μΑ
I _{GES}	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0 V$	-	_	±400	nA
On Charac	teristics					
V _{GE(th)}	G-E Threshold Voltage	$I_C = 250 \mu A, V_{CE} = V_{GE}$	3.5	4.5	6.0	V
()		I _C = 40 A, V _{GE} = 15 V	-	1.9	2.5	V
V _{CE(sat)}	Collector to Emitter Saturation Voltage	I _C = 40 A, V _{GE} = 15 V, T _C = 175°C	-	2.1	-	V
Dynamic C	Characteristics					
C _{ies}	Input Capacitance		-	1880	-	pF
C _{oes}	Output Capacitance	$V_{CE} = 30 \text{ V}, V_{GE} = 0 \text{ V},$ f = 1 MHz	-	180	-	pF
C _{res}	Reverse Transfer Capacitance	1 - 1 1011 12	-	50	-	pF
Switching	Characteristics		7			
t _{d(on)}	Turn-On Delay Time		-	12	16	ns
t _r	Rise Time		-	20	28	ns
t _{d(off)}	Turn-Off Delay Time	$V_{CC} = 400 \text{ V}, I_{C} = 40 \text{ A},$	-	92	120	ns
t _f	Fall Time	$R_G = 6 \Omega$, $V_{GE} = 15 V$,	-	13	17	ns
E _{on}	Turn-On Switching Loss	Inductive Load, T _C = 25°C	-	0.82	1.23	mJ
E _{off}	Turn-Off Switching Loss		-	0.26	0.34	mJ
E _{ts}	Total Switching Loss		-	1.08	1.57	mJ
t _{d(on)}	Turn-On Delay Time		-	15	- \	ns
t _r	Rise Time		_	22	-	ns
t _{d(off)}	Turn-Off Delay Time	V _{CC} = 400 V, I _C = 40 A,	-	116	-	ns
t _f	Fall Time	$R_G = 6 \Omega$, $V_{GE} = 15 V$,	-	16	-	ns
E _{on}	Turn-On Switching Loss	Inductive Load, T _C = 175°C	-	1.08	-	mJ
E _{off}	Turn-Off Switching Loss		-	0.60	-	mJ
E _{ts}	Total Switching Loss]	-	1.68	-	mJ

Electrical Characteristics of the IGBT (Continued)

Symbol	Parameter	Test Conditions	Min.	Тур.	Max	Unit
Qg	Total Gate Charge		-	119	180	nC
Q _{ge}	Gate to Emitter Charge	V _{CE} = 400 V, I _C = 40 A, V _{GE} = 15 V	-	13	20	nC
Q _{gc}	Gate to Collector Charge	VGE - 13 V	-	58	90	nC

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

Symbol	Parameter	Test Conditions		Min.	Тур.	Max	Unit
V	Diode Forward Voltage	I _F = 20 A	T _C = 25°C	-	2.1	2.6	V
V_{FM}	Blode Forward Vollage	1,5 20 //	T _C = 175°C	-	1.7	-	
E _{rec}	Reverse Recovery Energy		T _C = 175°C	-	96	-	uJ
t _{rr}	Diode Reverse Recovery Time	I -20 A	T _C = 25°C	-	42	-	ns
blode Neverse Necessery Time	I _F =20 A, di _F /dt = 200 A/μs	T _C = 175°C	-	200	-		
Irr	Diode Peak Reverse Recovery Current		T _C = 25°C	-	3.6	-	Α
·rr			T _C = 175°C	-	8.0	-	, ,
Q _{rr} Diode	Diode Reverse Recovery Charge		T _C = 25°C	-	76	-	nC
≪II.	2.533 November 1. 1550 Very Charge		T _C = 175°C	-	800	-	0

Figure 1. Typical Output Characteristics

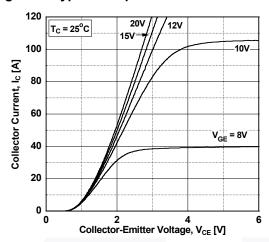


Figure 3. Typical Saturation Voltage Characteristics

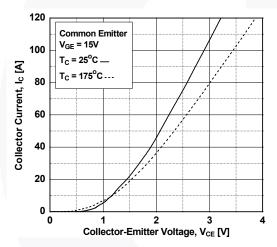


Figure 5. Saturation Voltage vs. V_{GE}

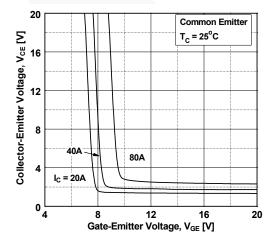


Figure 2. Typical Output Characteristics

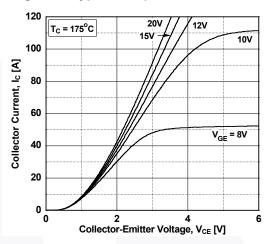


Figure 4. Saturation Voltage vs. Case
Temperature at Variant Current Level

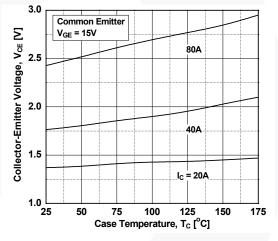


Figure 6. Saturation Voltage vs. V_{GE}

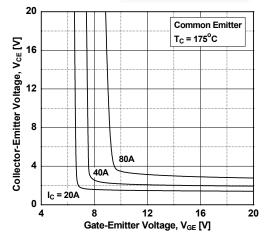


Figure 7. Capacitance Characteristics

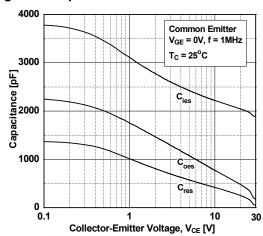


Figure 9. Turn-on Characteristics vs.
Gate Resistance

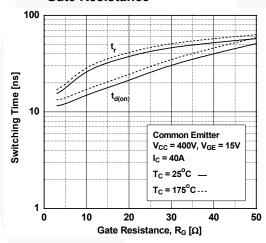


Figure 11. Switching Loss vs.
Gate Resistance

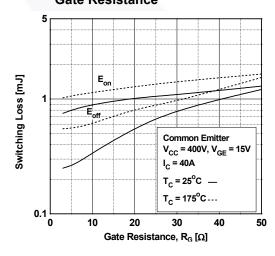


Figure 8. Gate charge Characteristics

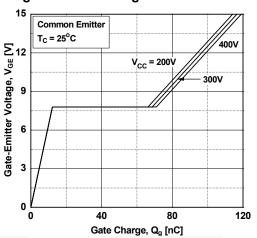


Figure 10. Turn-off Characteristics vs.
Gate Resistance

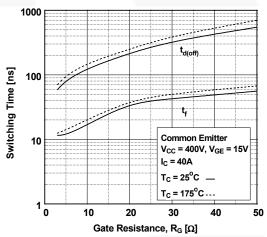


Figure 12. Turn-on Characteristics vs.
Collector Current

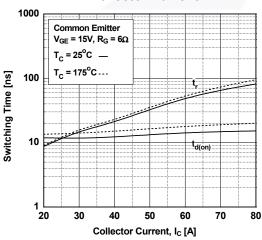


Figure 13. Turn-off Characteristics vs. Collector Current

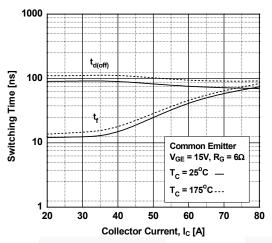


Figure 14. Switching Loss vs. Collector Current

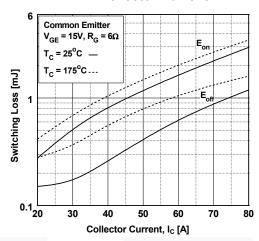


Figure 15. Load Current vs. Frequency

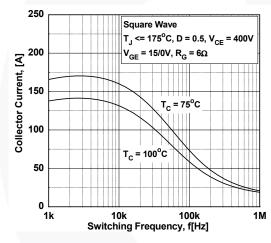


Figure 16. SOA Characteristics

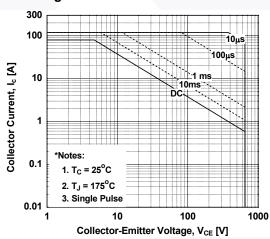


Figure 17. Forward Characteristics

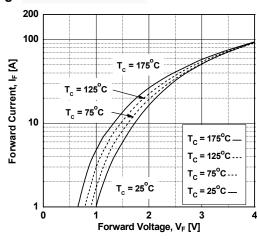


Figure 18. Reverse Recovery Current

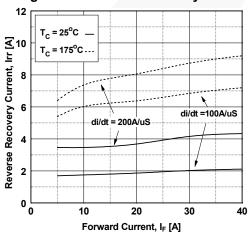


Figure 19. Reverse Recovery Time

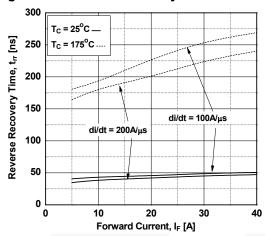


Figure 20. Stored Charge

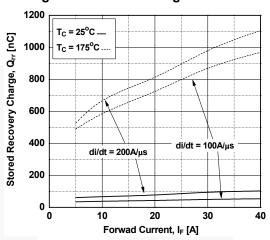


Figure 21. Transient Thermal Impedance of IGBT

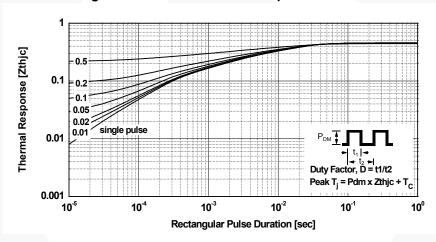
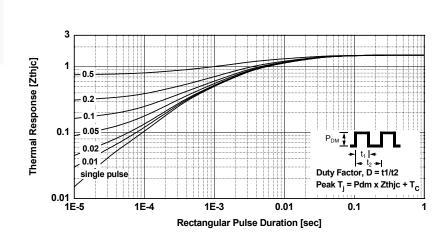
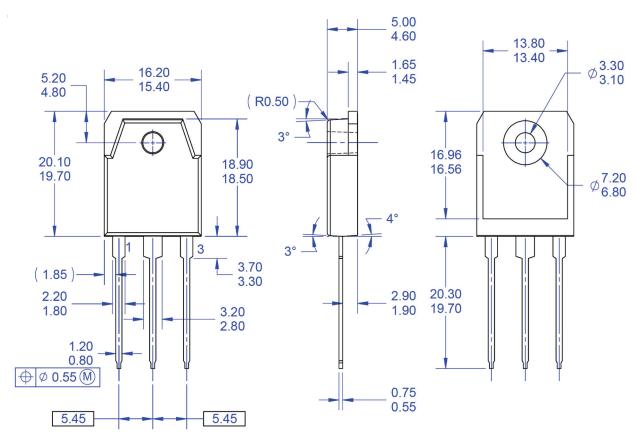


Figure 22. Transient Thermal Impedance of Diode



Mechanical Dimensions



(R0.50)

- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE CONFORMS TO EIAJ SC-65 PACKAGING STANDARD.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSION AND TOLERANCING PER ASME14.5-2009.
- D) DIMENSIONS ARE EXCLUSSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSSIONS. DRAWING FILE NAME: TO3PN03AREV1.
- FAIRCHILD SEMICONDUCTOR.

Figure 23. TO-3P 3L - 3LD, T03, PLASTIC, EIAJ SC-65

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Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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.

Rev. 171

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