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November 2013

# FGH80N60FD 600 V Field Stop IGBT

### **Features**

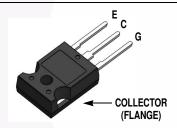
- · High Current Capability
- Low Saturation Voltage: V<sub>CE(sat)</sub> = 1.8 V @ I<sub>C</sub> = 40 A
- · High Input Impedance
- Fast Switching
- RoHS Complaint

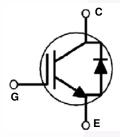
## **Applications**

• Induction Heating, PFC, Telecom, ESS

## **General Description**

Using novel field stop IGBT technology, Fairchild's field stop IGBTs offer the optimum performance for induction heating, telecom, ESS and PFC applications where low conduction and switching losses are essential.





## **Absolute Maximum Ratings**

Symbol	Description		Ratings	Unit
V <sub>CES</sub>	Collector-Emitter Voltage		600	V
V <sub>GES</sub>	Gate-Emitter Voltage		± 20	V
l <sub>o</sub>	Collector Current	@ T <sub>C</sub> = 25°C	80	А
I <sub>C</sub>	Collector Current	@ T <sub>C</sub> = 100°C	40	Α
I <sub>CM (1)</sub>	Pulsed Collector Current	@ T <sub>C</sub> = 25°C	160	Α
P <sub>D</sub>	Maximum Power Dissipation	@ T <sub>C</sub> = 25°C	290	W
ט י	Maximum Power Dissipation	@ T <sub>C</sub> = 100°C	116	W
T <sub>J</sub>	Operating Junction Temperature		-55 to +150	°C
T <sub>stg</sub>	Storage Temperature Range		-55 to +150	°C
T <sub>L</sub>	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		0.43	°C/W
$R_{\theta JC}(Diode)$	Thermal Resistance, Junction-to-Case		1.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient		40	°C/W

# **Package Marking and Ordering Information**

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGH80N60FDTU	FGH80N60FD	TO-247	Tube	N/A	N/A	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 <sub>CES</sub>	Collector-Emitter Breakdown Voltage	$V_{GE} = 0 \text{ V}, I_{C} = 250 \text{ uA}$	600			V
$\Delta BV_{CES}$ / $\Delta T_J$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0 \text{ V}, I_{C} = 250 \text{ uA}$		0.6		V/°C
I <sub>CES</sub>	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0 V$			250	uA
I <sub>GES</sub>	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0 V$			±400	nA
On Charac	teristics					
V <sub>GE(th)</sub>	G-E Threshold Voltage	I <sub>C</sub> = 250 uA, V <sub>CE</sub> = V <sub>GE</sub>	4.5	5.5	7.0	V
5.=()		I <sub>C</sub> = 40 A, V <sub>GE</sub> = 15 V		1.8	2.4	V
V <sub>CE(sat)</sub>	Collector to Emitter Saturation Voltage	I <sub>C</sub> = 40 A, V <sub>GE</sub> = 15 V, T <sub>C</sub> = 125°C		2.05		V
Dynamic C	haracteristics					
C <sub>ies</sub>	Input Capacitance			2110		pF
C <sub>oes</sub>	Output Capacitance	$V_{CE} = 30 \text{ V}, V_{GE} = 0 \text{ V},$ f = 1  MHz		200		pF
C <sub>res</sub>	Reverse Transfer Capacitance	- 1 = 1 IVII IZ		60		pF
Switching	Characteristics					
t <sub>d(on)</sub>	Turn-On Delay Time			21		ns
t <sub>r</sub>	Rise Time			56		ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{CC} = 400 \text{ V}, I_{C} = 40 \text{ A},$		126		ns
t <sub>f</sub>	Fall Time	$R_G = 10 \Omega, V_{GE} = 15 V,$		50	100	ns
E <sub>on</sub>	Turn-On Switching Loss	Inductive Load, T <sub>C</sub> = 25°C		1	1.5	mJ
E <sub>off</sub>	Turn-Off Switching Loss			0.52	0.78	mJ
E <sub>ts</sub>	Total Switching Loss			1.52	2.28	mJ
t <sub>d(on)</sub>	Turn-On Delay Time			20		ns
t <sub>r</sub>	Rise Time			54	\	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{CC} = 400 \text{ V}, I_{C} = 40 \text{ A},$		131		ns
t <sub>f</sub>	Fall Time	$R_G = 10 \Omega, V_{GE} = 15 V,$		70		ns
E <sub>on</sub>	Turn-On Switching Loss	Inductive Load, T <sub>C</sub> = 125°C		1.1		mJ
E <sub>off</sub>	Turn-Off Switching Loss			0.78		mJ
E <sub>ts</sub>	Total Switching Loss			1.88		mJ
Qg	Total Gate Charge			120		nC
Q <sub>ge</sub>	Gate-Emitter Charge	$V_{CE} = 400 \text{ V}, I_{C} = 40 \text{ A},$ $V_{GE} = 15 \text{ V}$		14		nC
Q <sub>gc</sub>	Gate-Collector Charge	7 *GE - 10 *		58		nC

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

Symbol	Parameter	Test Condition	ns	Min.	Тур.	Max	Unit
V <sub>FM</sub>	Diode Forward Voltage	I <sub>F</sub> = 20 A	T <sub>C</sub> = 25°C	-	2.3	2.8	V
			T <sub>C</sub> = 125°C	-	1.7	-	
t	t <sub>rr</sub> Diode Reverse Recovery Time	I <sub>F</sub> =20 A,	T <sub>C</sub> = 25°C	-	36	-	ns
٩r			T <sub>C</sub> = 125°C	-	105	-	
I	Diode Reverse Recovery Current		$T_C = 25^{\circ}C$	-	2.6	-	Α
<sup>1</sup> rr	Block Hereice Heesvery Carrent		T <sub>C</sub> = 125°C	-	7.8	-	'`
Q <sub>rr</sub>	Diode Reverse Recovery Charge		$T_C = 25^{\circ}C$	-	46.8	-	nC
∽rr			T <sub>C</sub> = 125°C	-	409	-	

## **Typical Performance Characteristics**

Figure 1. Typical Output Characteristics

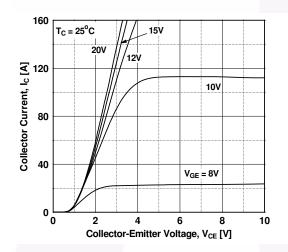


Figure 3. Typical Saturation Voltage Characteritics

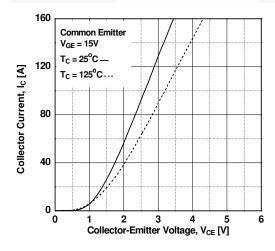


Figure 5. Saturation Voltage vs. Case

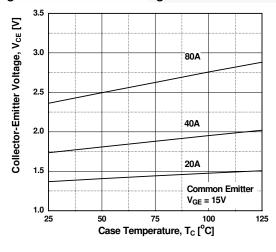


Figure 2. Typical Saturation Voltage Characteristics

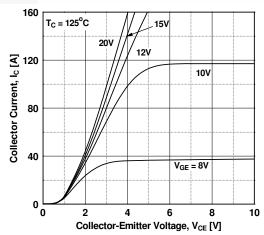


Figure 4. Transfer Characteristics

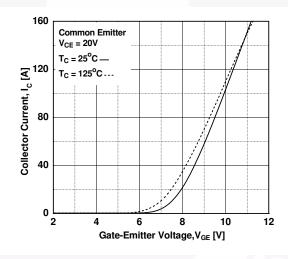
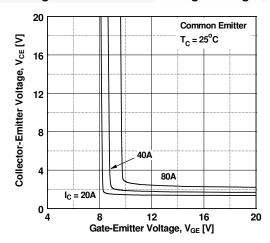


Figure 6. Saturation Voltage vs. Vge



## Typical Performance Characteristics (Continued)

Figure 7. Saturation Voltage vs. Vge

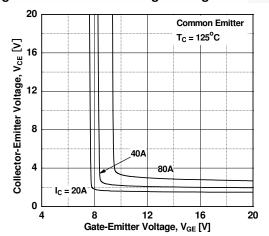


Figure 8. Capacitance Characteristics

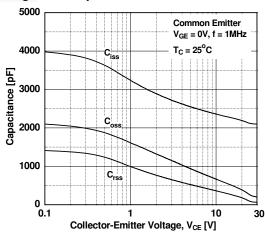


Figure 9. Gate Charge Characteristics

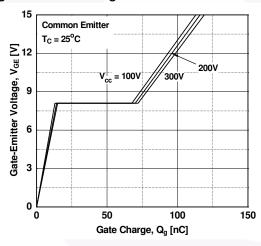


Figure 10. SOA Characteeristics

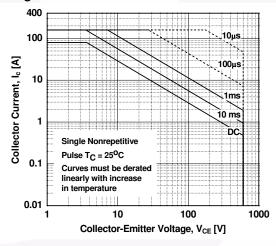


Figure 11. Turn-Off Switching SOA Characteristics

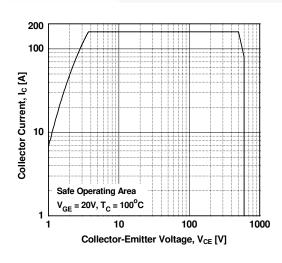
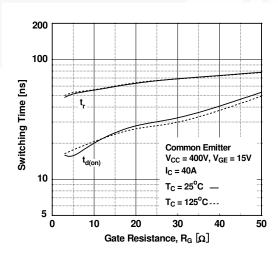


Figure 12. Turn-On Characteristics vs.
Gate Resistance



## Typical Performance Characteristics (Continued)

Figure 13. Turn-Off Characteristics vs.
Gate Resistance

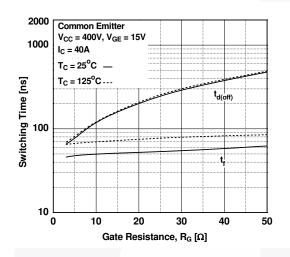


Figure 15. Turn-Off Characteristics vs. Collector Current

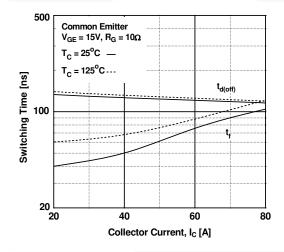


Figure 17. Switching Loss vs Collector Current

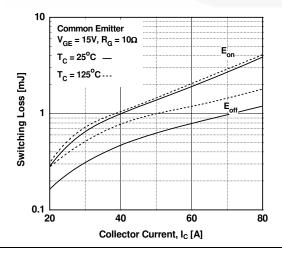


Figure 14. Turn-On Characteristics vs. Collector Current

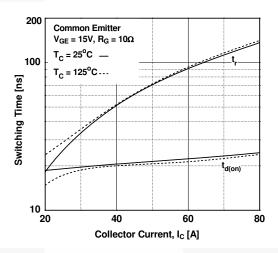
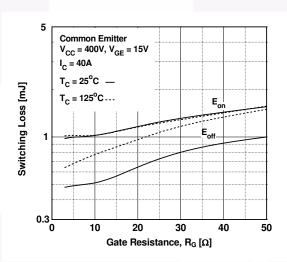


Figure 16. Switching Loss vs Gate Resistance



## Typical Performance Characteristics (Continued)

Figure 18. Transient Thermal Impedance of IGBT

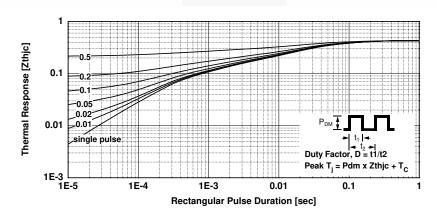


Figure 19. Forward Characteristics

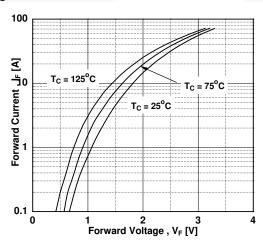


Figure 20. Stored Charge

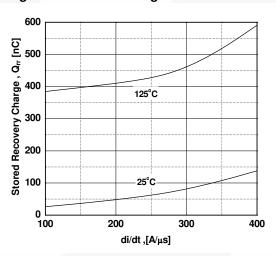


Figure 21. Reverse Recovery Time

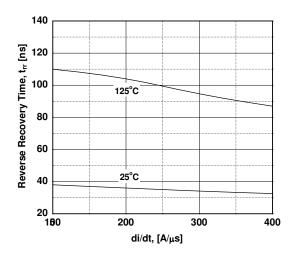
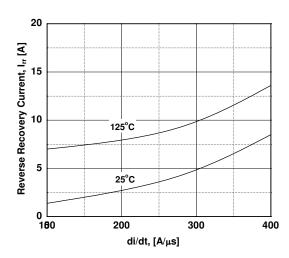


Figure 22. Reverse Recovery Current



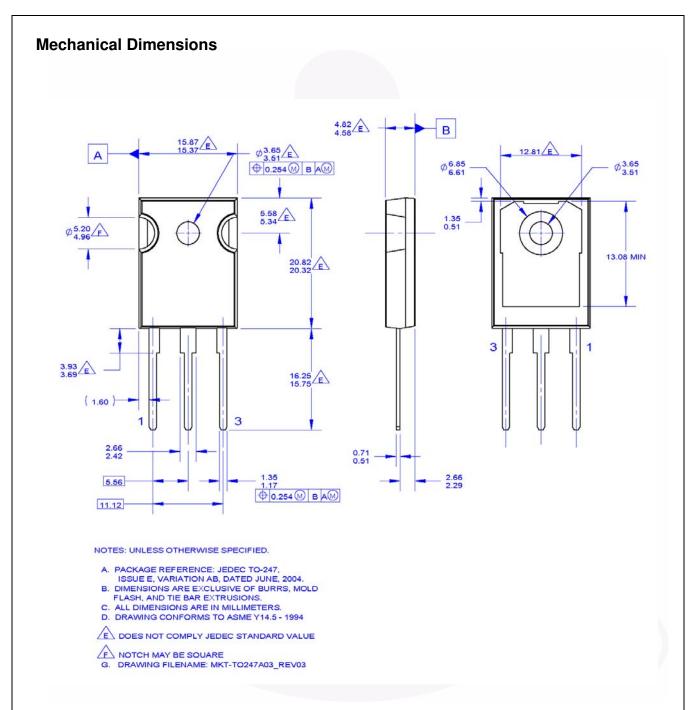


Figure 23. TO-247 3L - TO-247, MOLDED, 3 LEAD, JEDEC VARIATION AB

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