IGBT - Field Stop 600 V, 20 A

FGH20N60SFDTU, FGH20N60SFDTU-F085

Description

Using Novel Field Stop IGBT Technology, ON Semiconductor's new series of Field Stop IGBTs offer the optimum performance for Automotive Chargers, Inverter, and other applications where low conduction and switching losses are essential.

Features

- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)} = 2.2 \text{ V}$ @ $I_C = 20 \text{ A}$
- High Input Impedance
- Fast Switching
- Qualified to Automotive Requirements of AEC-Q101 (FGH20N60SFDTU-F085)
- These Devices are Pb-Free and are RoHS Compliant

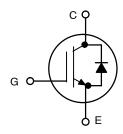
Applications

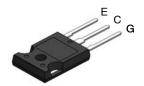
- Automotive Chargers, Converters, High Voltage Auxiliaries
- Inverters, PFC, UPS



ON Semiconductor®

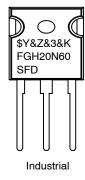
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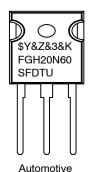




TO-247-3LD CASE 340CK

MARKING DIAGRAM





\$Y = ON Semiconductor Logo &Z = Assembly Plant Code &3 = Numeric Date Code &K = Lot Code

FGH20N60SFD,

FGH20N60SFDTU = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

ABSOLUTE MAXIMUM RATINGS

Description	Symbol	Ratings	Unit	
Collector to Emitter Voltage	V _{CES}	600	V	
Gate to Emitter Voltage		V _{GES}	±20	V
Transient Gate-to-Emitter Voltage		1	±30	V
Collector Current	Tc = 25°C	I _C	40	Α
	Tc = 100°C	1	20	Α
Pulsed Collector Current	Tc = 25°C	I _{CM} (Note 1)	60	Α
Maximum Power Dissipation	Tc = 25°C	P_{D}	165	W
	Tc = 100°C	1	66	W
Operating Junction Temperature		TJ	-55 to +150	°C
Storage Temperature Range	T _{stg}	-55 to +150	°C	
Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Sec	conds	T _L	300	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance Junction-to-Case	R _{θJC} (IGBT)	0.76	°C/W
Thermal Resistance Junction-to-Case	$R_{\theta JC}$ (Diode)	2.51	°C/W
Thermal Resistance Junction-to-Ambient	$R_{ hetaJA}$	40	°C/W

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Package Method	Reel Size	Tape Width	Quantity
FGH20N60SFDTU	FGH20N60SFD	TO-247	Tube	-	-	30
FGH20N60SFDTU-F085*	FGH20N60SFDTU	TO-247	Tube	-	-	30

^{*}Qualified to Automotive Requirements of AEC-Q101

ELECTRICAL CHARACTERISTICS OF THE IGBT (T_C = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Тур	Max	Unit
OFF CHARACTERISTICS				-		
Collector to Emitter Breakdown Voltage	BV _{CES}	V _{GE} = 0 V, I _C = 250 μA	600	-	-	V
Temperature Coefficient of Breakdown Voltage	$\Delta BV_{CES}/\Delta T_{J}$	V_{GE} = 0 V, I_{C} = 250 μA	-	0.6	-	V/°C
Collector Cut-Off Current	I _{CES}	V _{CE} = V _{CES} , V _{GE} = 0 V	-	-	250	μА
G-E Leakage Current	I _{GES}	V _{GE} = V _{GES} , V _{CE} = 0 V	-	_	±400	nA
ON CHARACTERISTICs						
G-E Threshold Voltage	V _{GE(th)}	$I_C = 250 \mu A, V_{CE} = V_{GE}$	4.0	4.6	6.5	V
Collector to Emitter Saturation Voltage	V _{CE(sat)}	I _C = 20 A, V _{GE} = 15 V	_	2.2	2.8	V
		I _C = 20 A, V _{GE} = 15 V, T _C = 125°C	-	2.4	-	V
DYNAMIC CHARACTERISTICS						
Input Capacitance	C _{ies}	V _{CE} = 30 V, V _{GE} = 0 V, f = 1 MHz	_	985	-	pF
Output Capacitance	C _{oes}	1	_	110	-	pF
Reverse Transfer Capacitance	C _{res}	1	_	40	-	pF

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

ELECTRICAL CHARACTERISTICS OF THE IGBT ($T_C = 25^{\circ}C$ unless otherwise noted) (continued)

Parameter	Symbol	Test Conditions	Min	Тур	Max	Unit
SWITCHING CHARACTERISTICS				•	•	
Turn-On Delay Time	t _{d(on)}	V _{CC} = 400 V, I _C = 20 A,	-	13	_	ns
Rise Time	t _r	$R_G = 10 \Omega$, $V_{GE} = 15 V$, Inductive Load, $T_C = 25^{\circ}C$	-	18	_	ns
Turn-Off Delay Time	t _{d(off)}		-	90	_	ns
Fall Time	t _f	1	-	20	48	ns
Turn-On Switching Loss	E _{on}	1	-	0.43	_	mJ
Turn-Off Switching Loss	E _{off}	1	-	0.13	_	mJ
Total Switching Loss	E _{ts}	1	-	0.56	_	mJ
Turn-On Delay Time	t _{d(on)}	V _{CC} = 400 V, I _C = 20 A,	-	13	_	ns
Rise Time	t _r	$R_G = 10 \Omega$, $V_{GE} = 15 V$, Inductive Load, $T_C = 125^{\circ}C$	-	16	_	ns
Turn-Off Delay Time	t _{d(off)}	1	-	95	_	ns
Fall Time	t _f	1	-	50	_	ns
Turn-On Switching Loss	E _{on}	1	-	0.53	-	mJ
Turn-Off Switching Loss	E _{off}	1	-	0.24	-	mJ
Total Switching Loss	E _{ts}	1	-	0.77	-	mJ
Total Gate Charge	Qg	V _{CE} = 400 V, I _C = 20 A, V _{GE} = 15 V	-	66	-	nC
Gate to Emitter Charge	Q _{ge}	1	-	7	_	nC
Gate to Collector Charge	Q _{gc}	1	-	33	-	nC

$\textbf{ELECTRICAL CHARACTERISTICS OF THE DIODE} \ (T_J = 25^{\circ}\text{C unless otherwise noted})$

Parametr	Symbol	Test Conditions		Min	Тур	Max	Unit
Diode Forward Voltage	V_{FM}	I _F = 10 A	T _C = 25°C	-	1.9	2.5	V
			T _C = 125°C	-	1.7	-	
Diode Reverse Recovery Time	t _{rr}	$I_F = 10 \text{ A}, di_F/dt = 200 \text{ A}/\mu\text{s}$	T _C = 25°C	-	40	-	ns
			T _C = 125°C	-	180	-	
Diode Reverse Recovery Charge	Q _{rr}		T _C = 25°C	-	70	-	nC
			T _C = 125°C	-	495	-	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL PERFORMANCE CHARACTERISTICS

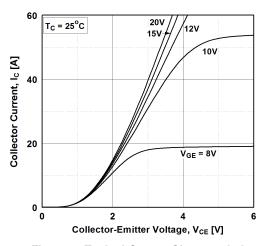


Figure 1. Typical Output Characteristics

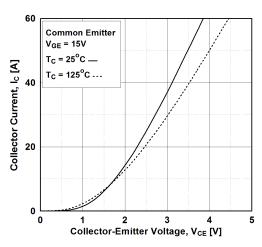


Figure 3. Typical Saturation Voltage Characteristics

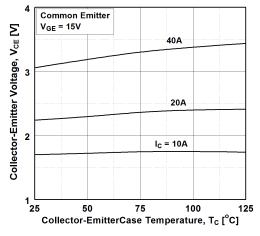


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

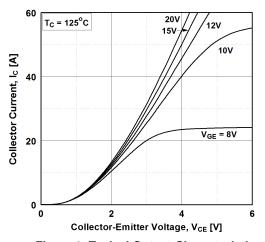


Figure 2. Typical Output Characteristics

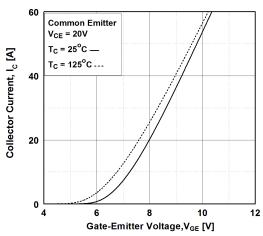


Figure 4. Transfer Characteristics

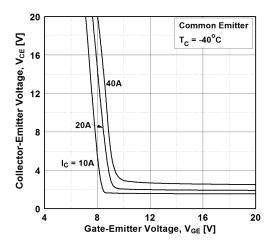


Figure 6. Saturation Voltage vs. V_{GE}

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

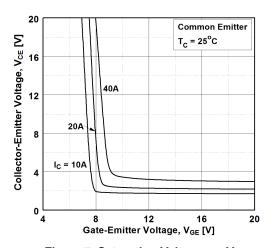


Figure 7. Saturation Voltage vs. V_{GE}

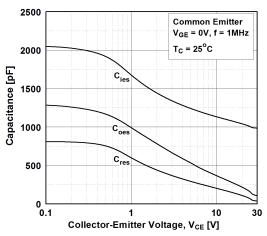


Figure 9. Capacitance Characteristics

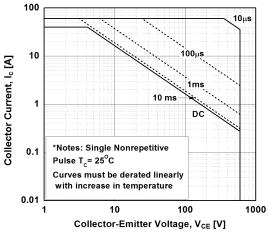


Figure 11. SOA Characteristics

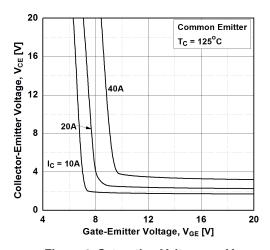


Figure 8. Saturation Voltage vs. V_{GE}

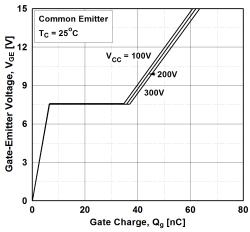


Figure 10. Gate Charge Characteristics

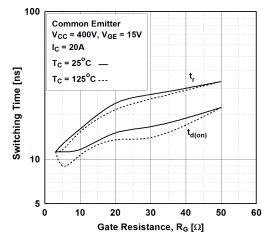


Figure 12. Turn-on Characteristics vs. Gate Resistance

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

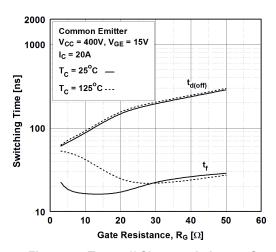


Figure 13. Turn-off Characteristics vs. Gate Resistance

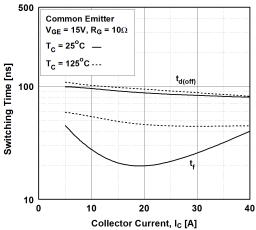


Figure 15. Turn-off Characteristics vs. Collector Current

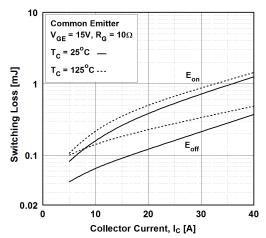


Figure 17. Switching Loss vs. Collector Current

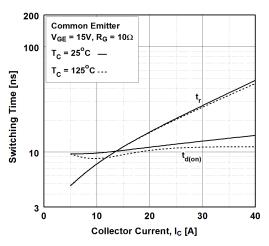


Figure 14. Turn-on Characteristics vs.
Collector Current

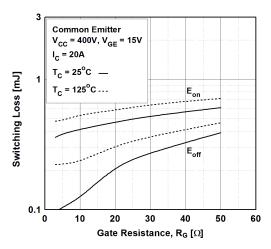


Figure 16. Switching Loss vs. Gate Resistance

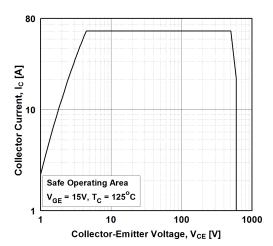


Figure 18. Turn-off Switching SOA
Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

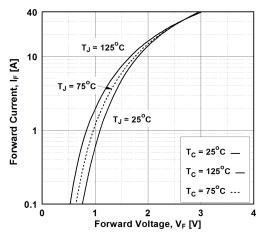


Figure 19. Forward Characteristics

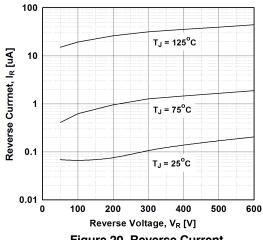


Figure 20. Reverse Current

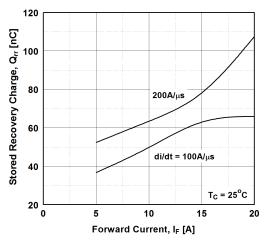


Figure 21. Stored Charge

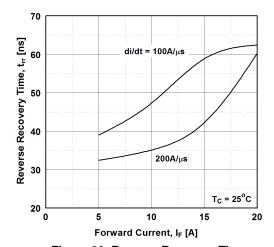


Figure 22. Reverse Recovery Time

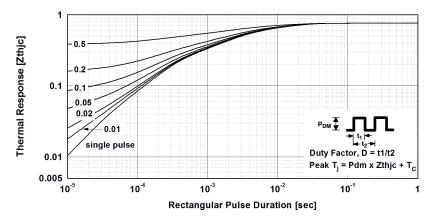
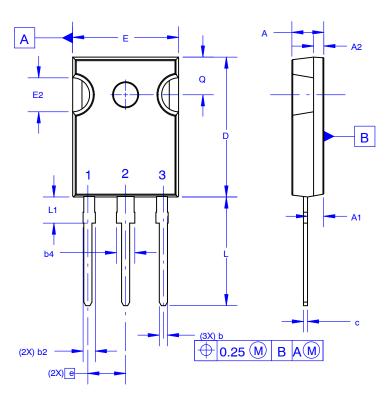


Figure 23. Transient Thermal Impedance of IGBT

TO-247-3LD SHORT LEAD

CASE 340CK ISSUE A





- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

GENERIC MARKING DIAGRAM*



XXXX = Specific Device Code

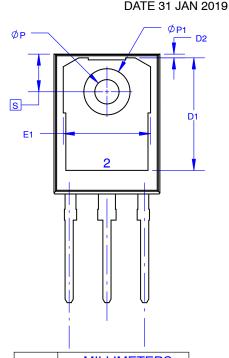
A = Assembly Location

Y = Year

WW = Work Week

ZZ = Assembly Lot Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.



DIM	MIL	LIMET	ERS
DIIVI	MIN	NOM	MAX
Α	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
С	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
е	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93
ØΡ	3.51	3.58	3.65
Ø P1	6.60	6.80	7.00
Q	5.34	5.46	5.58
S	5.34	5.46	5.58

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DESCRIPTION:	TO-247-3LD SHORT LEAD		PAGE 1 OF 1	

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