IGBT - Field Stop, Trench

650 V, 50 A

FGH50T65UPD

Description

Using innovative field stop trench IGBT technology, ON Semiconductor's new series of field-stop trench IGBTs offer optimum performance for solar inverter, UPS, welder, and digital power generator where low conduction and switching losses are essential.

Features

- Maximum Junction Temperature: $T_J = 175^{\circ}C$
- Positive Temperature Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)} = 1.65 V(Typ.) @ I_C = 50 A$
- 100% of Parts Tested I_{LM} (Note 2)
- High Input Impedance
- Tightened Parameter Distribution
- Short Circuit Ruggedness > 5 µs @ 25°C
- This Device is Pb-Free and is RoHS Compliant

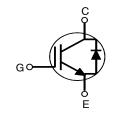
Applications

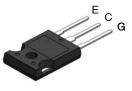
- Solar Inverter, UPS, Welder, Digital Power Generator
- Telecom, ESS



ON Semiconductor®

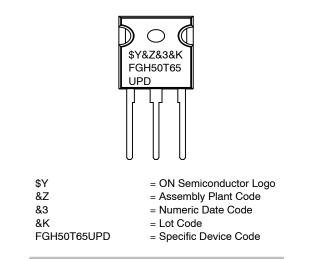
www.onsemi.com





TO-247-3LD CASE 340CK

MARKING DIAGRAMS



ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

ABSOLUTE MAXIMUM RATINGS

Descriptio	Symbol	Ratings	Unit	
Collector to Emitter Voltage		V _{CES}	650	V
Gate to Emitter Voltage		V _{GES}	±20	V
Transient Gate to Emitter Voltage		1 1	±25	V
Collector Current	$T_{C} = 25^{\circ}C$	Ι _C	100	А
Collector Current	$T_{\rm C} = 100^{\circ}{\rm C}$	1 1	50	А
Pulsed Collector Current (Note 1)		I _{CM}	150	А
Clamped Inductive Load Current (Note 2)	$T_{\rm C} = 25^{\circ}{\rm C}$	I _{LM}	150	А
Diode Forward Current	$T_{\rm C} = 25^{\circ}{\rm C}$	١ _F	60	А
Diode Forward Current	$T_{\rm C} = 100^{\circ}{\rm C}$	1 1	30	А
Pulsed Diode Maximum Forward Current (No	I _{FM}	150	А	
Maximum Power Dissipation $T_{\rm C} = 25^{\circ}{\rm C}$		PD	340	W
Maximum Power Dissipation	aximum Power Dissipation T _C = 100°C		170	W
Short Circuit Withstand Time	$T_{\rm C} = 25^{\circ}{\rm C}$	SCWT	5	μs
Operating Junction Temperature	TJ	-55 to +175	°C	
Storage Temperature Range	T _{stg}	-55 to +175	°C	
Maximum Lead Temp. for Soldering Purpose	ΤL	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.
Repetitive rating: Pulse width limited by max. junction temperature.
Ic = 150 A, Vce = 400 V, Rg = 10 Ω

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction to Case (IGBT)	$R_{\theta JC}$	0.44	°C/W
Thermal Resistance, Junction to Case (Diode)	$R_{\theta JC}$	1.2	°C/W
Thermal Resistance, Junction to Ambient	R_{\thetaJA}	40	°C/W

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGH50T65UPD	FGH50T65UPD	TO-247-3LD	Tube	N/A	N/A	30

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

Parameter	Symbol	bol Test Conditions		Тур	Max	Unit
OFF CHARACTERISTICS						
Collector to Emitter Breakdown Voltage	BV _{CES}	V _{GE} = 0 V, I _C = 1 mA	650	-	-	V
Temperature Coefficient of Breakdown Voltage	$\Delta BV_{CES} / \Delta T_J$	V_{GE} = 0 V, I _C = 250 µA		0.65		V/°C
Collector Cut-Off Current	I _{CES}	$V_{CE} = V_{CES}, V_{GE} = 0 V$		-	250	μA
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} = 50 mA, V_{CE} = V_{GE}	4.0	6.0	7.5	V
Collector to Emitter Saturation Voltage	V _{CE(sat)}	I _C = 50 A, V _{GE} = 15 V	-	1.65	2.3	V
		I_{C} = 50 A, V_{GE} = 15 V, T_{C} = 175°C	-	2.1	-	V

ELECTRICAL CHARACTERISTICS OF THE IGBT	Γ (T _C = 25°C unless otherwise noted) (continued)
--	---

Parameter	Symbol	Test Conditions	Min	Тур	Max	Unit
DYNAMIC CHARACTERISTICS		·				
Input Capacitance	C _{ies}	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	-	3450	4710	pF
Output Capacitance	C _{oes}	1	-	110	146	pF
Reverse Transfer Capacitance	C _{res}	1	-	60	90	pF
SWITCHING CHARACTERISTICS		-				-
Turn-On Delay Time	t _{d(on)}	$V_{CC} = 400 \text{ V}, I_C = 50 \text{ A},$	-	32	41	ns
Rise Time	t _r	$R_G = 6.0 \Omega$, $V_{GE} = 15 V$, Inductive Load, $T_C = 25^{\circ}C$	-	59	77	ns
Turn-Off Delay Time	t _{d(off)}	1	-	160	208	ns
Fall Time	t _f	1	-	22	29	ns
Turn-On Switching Loss	E _{on}	1	-	2.7	3.5	mJ
Turn-Off Switching Loss	E _{off}	1	-	0.74	0.96	mJ
Total Switching Loss	E _{ts}		-	3.44	4.46	mJ
Turn-On Delay Time	t _{d(on)}	$V_{\rm CC} = 400 \text{ V}, I_{\rm C} = 50 \text{ A},$	-	29	-	ns
Rise Time	t _r	$R_G = 6.0 \Omega, V_{GE} = 15 V,$ Inductive Load, $T_C = 175^{\circ}C$	-	72	-	ns
Turn-Off Delay Time	t _{d(off)}	1	-	166	-	ns
Fall Time	t _f	1	-	19	-	ns
Turn-On Switching Loss	E _{on}	1	-	3.5	-	mJ
Turn-Off Switching Loss	E _{off}	1	-	1.2	-	mJ
Total Switching Loss	E _{ts}	1	-	4.7	-	mJ
Short Circuit Withstand Time	Tsc	V_{GE} = 15 V, V_{CC} = $$ 400 V, Rg = 10 Ω	5	-	-	μs
Total Gate Charge	Qg	V_{CE} = 400 V, I_{C} = 50 A, V_{GE} = 15 V	-	230	345	nC
Gate to Emitter Charge	Q _{ge}	1	-	31	47	nC
Gate to Collector Charge	Q _{gc}	1	_	130	195	nC

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

Parameter	Symbol	Test Conditions		Min	Тур	Max	Unit
Diode Forward Voltage	V _{FM}	I _F = 30 A	$T_{C} = 25^{\circ}C$	-	2.1	2.7	V
			T _C = 175°C	-	1.78	-	
Reverse Recovery Energy	E _{rec}	I _F = 30 A, di _F /dt = 200 A/μs	T _C = 175°C	-	46	-	μJ
Diode Reverse Recovery Time	t _{rr}		$T_{C} = 25^{\circ}C$	-	41	53	ns
			T _C = 175°C	-	144	-	
Diode Reverse Recovery Charge	Q _{rr}		$T_{C} = 25^{\circ}C$	-	76	106	nC
			T _C = 175°C	-	486	-	

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

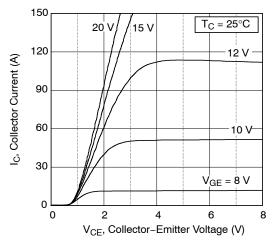


Figure 1. Typical Output Characteristics

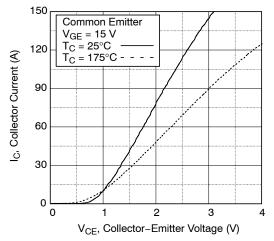


Figure 3. Typical Saturation Voltage Characteristics

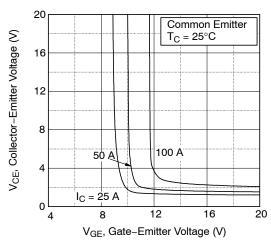


Figure 5. Saturation Voltage vs. V_{GE}

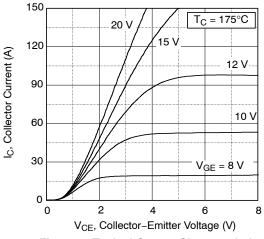


Figure 2. Typical Output Characteristics

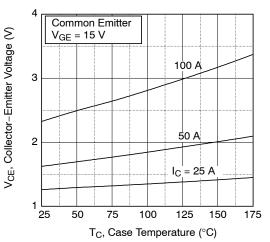
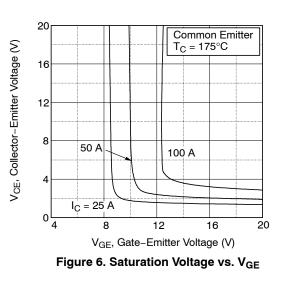


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

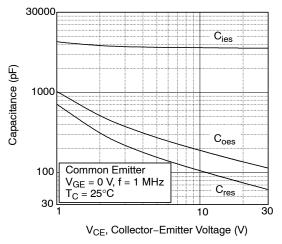


Figure 7. Capacitance Characteristics

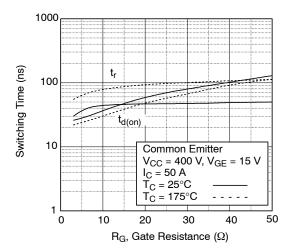


Figure 9. Turn-On Characteristics vs. Gate Resistance

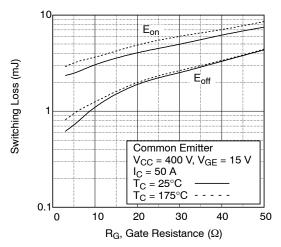


Figure 11. Switching Loss vs. Gate Resistance

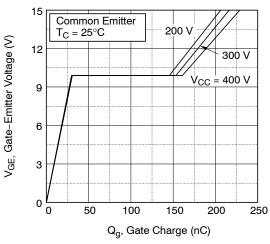


Figure 8. Gate Charge Characteristics

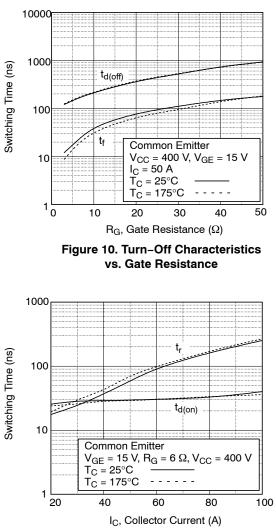
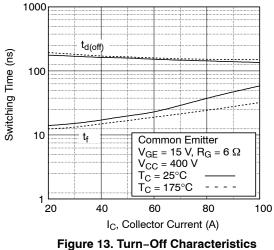
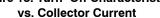


Figure 12. Turn–On Characteristics vs. Collector Current

TYPICAL PERFORMANCE CHARACTERISTICS (continued)





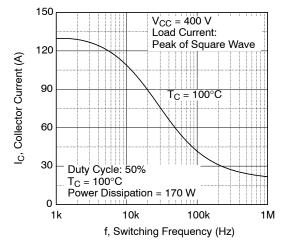


Figure 15. Load Current vs. Frequency

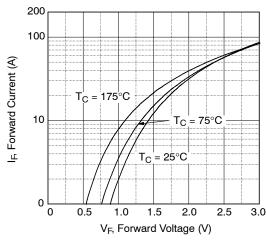


Figure 17. Forward Characteristics

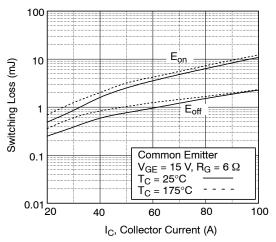


Figure 14. Switching Loss vs. Collector Current

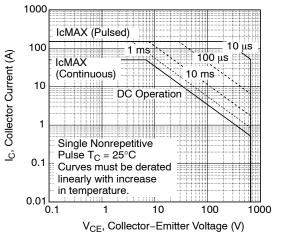
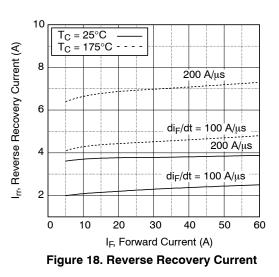


Figure 16. SOA Characteristics



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

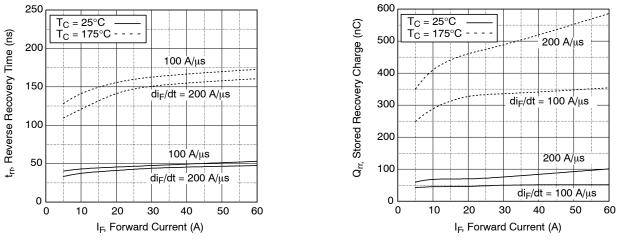


Figure 19. Reverse Recovery Time



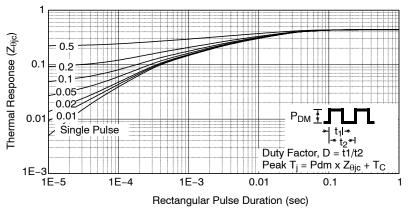


Figure 21. Transient Thermal Impedance of IGBT

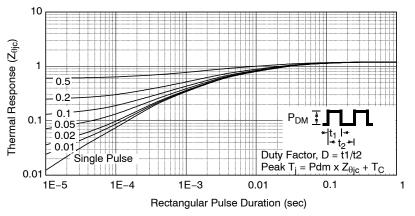
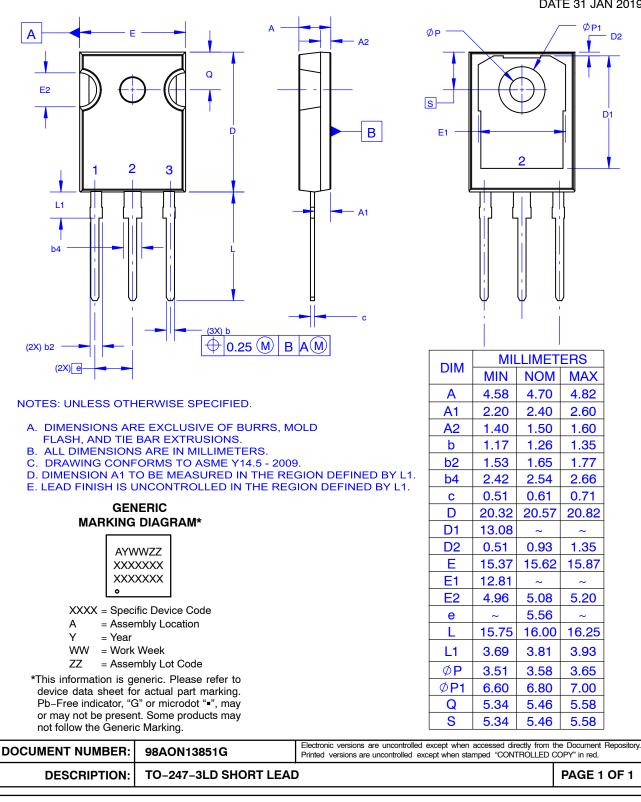


Figure 22. Transient Thermal Impedance of Diode



TO-247-3LD SHORT LEAD CASE 340CK **ISSUE A**

DATE 31 JAN 2019



onsemi and ONSEMI are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

onsemi, ONSEMI, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries. onsemi owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of onsemi's product/patent coverage may be accessed at <u>www.onsemi.com/site/pdf/Patent_Marking.pdf</u>. onsemi reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and onsemi makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or indental damages. Buyer is responsible for its products and applications using onsemi products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by onsemi. "Typical" parameters which may be provided in onsemi data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. onsemi does not convey any license under any of its intellectual property rights nor the rights of others. onsemi products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification. Buyer shall indemnify and hold onsemi and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs,

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation onsemi Website: www.onsemi.com

ONLINE SUPPORT: <u>www.onsemi.com/support</u> For additional information, please contact your local Sales Representative at <u>www.onsemi.com/support/sales</u>