

# PCGA300T65DF8M1

## 650 V, 300 A Field Stop Trench IGBT with Solderable Top Metal



ON Semiconductor®

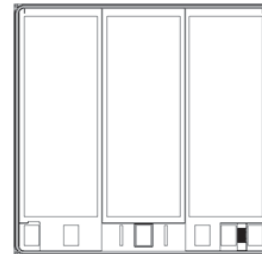
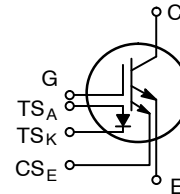
[www.onsemi.com](http://www.onsemi.com)

### Features

- AEC-Q101 Qualified
- Maximum Junction Temperature 175°C
- Positive Temperature Coefficient
- Easy Paralleling
- Short Circuit Rated
- Very Low Saturation Voltage:  $V_{CE(SAT)} = 1.5\text{ V}$  (Typ.) @  $I_C = 300\text{ A}$
- Optimized For Motor Control Applications
- Integrated Temp Sensor And Current Sensor
- Emitter Pad Covered With Solderable Metal Layer

### Applications

- Automotive Traction modules
- General Power Modules



### ORDERING INFORMATION

Part Number	PCGA300T65DF8M1	
Packing	Water (sawn on foil)	
	mils	$\mu\text{m}$
Die Size	472 × 472	12,000 × 12,000
Emitter Attach Area	3 × (141 × 383)	3 × (3,580 × 9,720)
Gate / Sensor Pad Attach Area	6 × (27 × 39)	6 × (680 × 980)
Die Thickness	3	78
Top Metal	5 $\mu\text{m}$ AlSiCu + 1.15 $\mu\text{m}$ Ti/NiV/Ag (STM)	
Back Metal	0.65 $\mu\text{m}$ NiV/Ag	
Topside Passivation	Silicon Nitride plus Polyimide	
Wafer Diameter	200 mm	
Max Possible Die Per Wafer	136	

# PCGA300T65DF8M1

## ABSOLUTE MAXIMUM RATINGS (T<sub>VJ</sub> = 25 °C unless otherwise noted)

Parameter	Symbol	Ratings	Units
Collector–Emitter Voltage	V <sub>CES</sub>	650	V
Gate–Emitter Voltage	V <sub>GES</sub>	±20	V
DC Collector Current, limited by T <sub>VJ</sub> max	I <sub>C</sub>	(Note 1)	A
Pulsed Collector Current, V <sub>GE</sub> =15 V, tp limited by T <sub>VJ</sub> max (Note 2)	I <sub>CM</sub>	900	A
Short Circuit Withstand Time, V <sub>GE</sub> = 15 V, V <sub>CE</sub> ≤ 400 V, T <sub>VJ</sub> ≤ 150 °C	t <sub>sc</sub>	5	μs
Operating Junction Temperature	T <sub>VJ</sub>	–40 to +175	°C
Storage Temperature Range	T <sub>stg</sub>	+17 to +25	°C

1. Depends on the thermal properties of assembly
2. Not subject to production test – verified by design/characterization

## ELECTRICAL CHARACTERISTICS OF THE IGBT (T<sub>VJ</sub> = 25 °C unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Units
-----------	--------	----------------	------	------	------	-------

### Static Characteristics (Tested on wafers)

Collector–Emitter Breakdown Voltage	BV <sub>CES</sub>	V <sub>GE</sub> = 0 V, I <sub>C</sub> = 1 mA	650	–	–	V
Collector–Emitter Saturation Voltage	V <sub>CE(SAT)</sub>	I <sub>C</sub> = 100 A, V <sub>GE</sub> = 15 V	–	1.25	1.55	V
Gate–Emitter Threshold Voltage	V <sub>GE(th)</sub>	V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 300 mA	4.5	5.5	6.5	V
Collector Cut–Off Current	I <sub>CES</sub>	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0 V	–	–	40	μA
Gate Leakage Current	I <sub>GES</sub>	V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0 V	–	–	±400	nA
On–chip temperature – sense diode voltage	V <sub>F</sub>	I <sub>F</sub> = 0.5 mA	2.0	2.4	2.8	V

### Integrated Temp and Current Sensor Characteristics

(not subjected to production test – verified by design / characterization)

On–chip temperature–sense diode voltage	V <sub>F</sub>	I <sub>F</sub> = 0.5 mA, T <sub>VJ</sub> = 100 °C	–	1.9	–	V
Emitter Sense Area Ratio	β <sub>AREA</sub>	Sense Area/Total Area	–	1/10K	–	–
Emitter Current Sense Ratio	β <sub>10Ω</sub>	I <sub>CE</sub> = 300 A, V <sub>GE</sub> = 15 V R <sub>SENSE</sub> = 10 Ω	–	18K	–	–

### Electrical Characteristics (Not subjected to production test – verified by design/characterization)

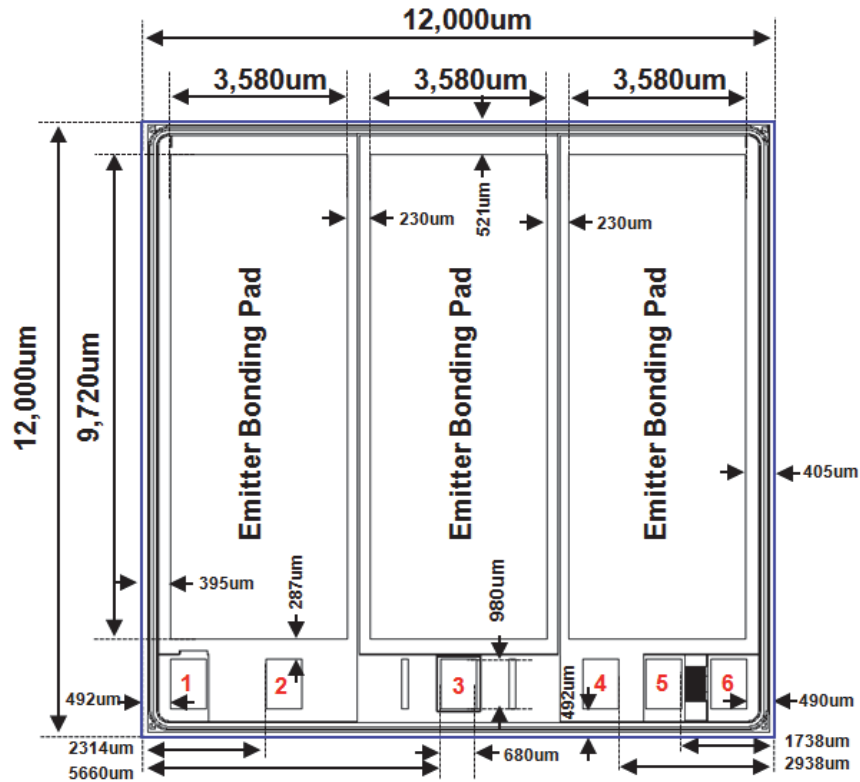
Collector to Emitter Saturation Voltage	V <sub>CE(SAT)</sub>	I <sub>C</sub> = 300 A, V <sub>GE</sub> = 15 V	T <sub>VJ</sub> = 25 °C	–	1.5	1.9	V
			T <sub>VJ</sub> = 175 °C	–	1.8	–	V
Input Capacitance	C <sub>IES</sub>	V <sub>CE</sub> = 30 V, V <sub>GE</sub> = 0 V f = 1 MHz	–	14.0	–	nF	
Output Capacitance	C <sub>OES</sub>		–	690	–	pF	
Reverse Transfer Capacitance	C <sub>RES</sub>		–	106	–	pF	
Internal Gate Resistance	R <sub>G</sub>	f = 1 MHz	–	1.7	–	Ω	
Total Gate Charge	Q <sub>G(Total)</sub>	V <sub>CE</sub> = 400 V, I <sub>C</sub> = 300 A V <sub>GE</sub> = 15 V	–	307	–	nC	
Gate–to–Emitter Charge	Q <sub>GE</sub>		–	97	–	nC	
Gate–to–Collector Charge	Q <sub>GC</sub>		–	64	–	nC	
Turn–On Delay Time	t <sub>d(on)</sub>	V <sub>CE</sub> = 300 V, I <sub>C</sub> = 300 A R <sub>G</sub> = 15 Ω V <sub>GE</sub> = 15 V Inductive Load T <sub>VJ</sub> = 25 °C	–	167	–	ns	
Rise Time	t <sub>r</sub>		–	107	–	ns	
Turn–Off Delay Time	t <sub>d(off)</sub>		–	298	–	ns	
Fall Time	t <sub>f</sub>		–	38	–	ns	

# PCGA300T65DF8M1

## ELECTRICAL CHARACTERISTICS OF THE IGBT ( $T_{VJ} = 25^{\circ}\text{C}$ unless otherwise noted)

Turn-On Delay Time	$t_{d(on)}$	$V_{CE} = 300\text{ V}$ , $I_C = 300\text{ A}$ $R_G = 15\ \Omega$ $V_{GE} = 15\text{ V}$ Inductive Load $T_{VJ} = 150\ ^{\circ}\text{C}$	-	130	-	ns
Rise Time	$t_r$		-	93	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	395	-	ns
Fall Time	$t_f$		-	78	-	ns


3. For ordering, technique and other information on Onsemi automotive bare die products, please contact [automotivebareddie@onsemi.com](mailto:automotivebareddie@onsemi.com)



1. Current Sense Bonding Pad
2. Emitter Sense Bonding Pad
3. Gate Bonding Pad
4. Emitter Sense Bonding Pad
5. Temp Sense Anode Bonding Pad
6. Temp Sense Cathode Bonding Pad

Figure 1. Dimensional Outline and Pad Layout

# PCGA300T65DF8M1

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor 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 in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative