

# PCFG40T65SQF

## Product Preview IGBT Die

Using novel field stop IGBT technology, ON Semiconductor's new series of field stop 4<sup>th</sup> generation IGBTs offer the optimum performance for solar inverter and UPS applications where low conduction and switching losses are essential.

### Features

- Maximum Junction Temperature:  $T_J = 175^{\circ}\text{C}$
- Positive Temperature Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage:  $V_{CE(sat)} = 1.6\text{ V (Typ.) @ } I_C = 40\text{ A}$
- High Input Impedance
- Fast Switching
- Tighten Parameter Distribution

### Typical Applications

- Solar Inverters
- UPS Systems

### MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Collector to Emitter Voltage, $T_J = 25^{\circ}\text{C}$	$V_{CES}$	650	V
Gate to Emitter Voltage	$V_{GES}$	$\pm 20$	V
Transient Gate to Emitter Voltage		$\pm 30$	V
Collector Current @ $T_C = 25^{\circ}\text{C}$	$I_C$	80	A
Collector Current @ $T_C = 100^{\circ}\text{C}$		40	A
Pulsed Collector Current	$I_{CM}$	160	A
Operating Junction Temperature	$T_J$	-55 to +175	$^{\circ}\text{C}$
Storage Temperature Range	$T_{STG}$	-55 to +175	$^{\circ}\text{C}$

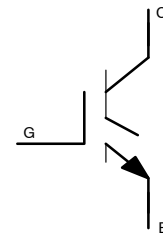
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



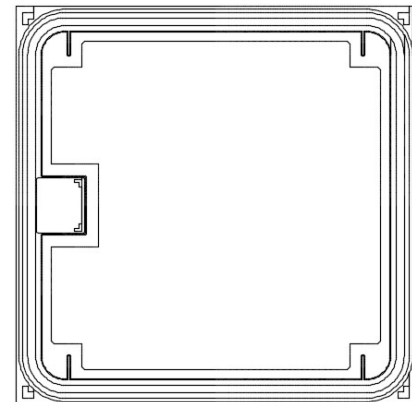
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$V_{RCE} = 650\text{ V}$   
 $I_C = \text{Limited by } T_{J(max)}$



IGBT Die



DIE Outline

### ORDERING INFORMATION

Device	Inking?	Shipping Method
PCFG40T65SQF	No	Sawn Wafer on Tape

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

# PCFG40T65SQF

## MECHANICAL DATA

Parameter	Symbol	Unit
Die Size	3492 × 3498	μm <sup>2</sup>
Gate Pad Size	419.5 × 487.6	μm <sup>2</sup>
Emitter Pad Size	2874 × 2880	μm <sup>2</sup>
Die Thickness	2.48	mils
Wafer Diameter	200	mm
Back Metal thickness	1.05	μm
Front Metal thickness	5.35	μm
Top Pad metal	Ti / TiN + W plug + AlSiCu	
Back metal	Al + Vni + Ag 1 KA + 5 KA + 4.5 KA	
Passivation	HRNit 15 KA	
Storage Temperature Range	-55 to +175	°C

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage	V <sub>GE</sub> = 0 V, I <sub>C</sub> = 1 mA	BV <sub>CES</sub>	650	-	-	V
Temperature Coefficient of Breakdown Voltage	I <sub>C</sub> = 1 mA, reference to 25°C	ΔBV <sub>CES</sub> /ΔT <sub>J</sub>	-	0.6	-	V/°C
Collector-Emitter Cutoff Current	V <sub>GE</sub> = 0 V, V <sub>CE</sub> = V <sub>CES</sub>	I <sub>DSS</sub>	-	-	250	μA
Gate Leakage Current	V <sub>CE</sub> = 0 V, V <sub>GE</sub> = V <sub>GES</sub>	I <sub>GSS</sub>	-	-	±400	nA

### ON CHARACTERISTICS

G-E Threshold Voltage	V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 40 mA	V <sub>GE(th)</sub>	2.6	4.5	6.4	V
Collector-Emitter Saturation Voltage	I <sub>C</sub> = 40 A, V <sub>GE</sub> = 15 V	V <sub>CE(sat)</sub>	-	1.6	2.1	V
	I <sub>C</sub> = 40 A, V <sub>GE</sub> = 15 V, T <sub>C</sub> = 175°C		-	1.92	-	V

### DYNAMIC CHARACTERISTICS

Input Capacitance	V <sub>GE</sub> = 0 V, V <sub>CE</sub> = 30 V, f = 1 MHz	C <sub>ies</sub>	-	2620	-	pF
Output Capacitance		C <sub>oes</sub>	-	60	-	
Reverse Transfer Capacitance		C <sub>res</sub>	-	9	-	

### GATE CHARGE CHARACTERISTICS

Total Gate Charge	V <sub>CE</sub> = 400 V, I <sub>C</sub> = 40 A, V <sub>GE</sub> = 15 V	Q <sub>g</sub>	-	80	-	nC
Gate to Emitter Charge		Q <sub>ge</sub>	-	15	-	
Gate to Collector Charge		Q <sub>gc</sub>	-	20	-	

### SWITCHING CHARACTERISTICS

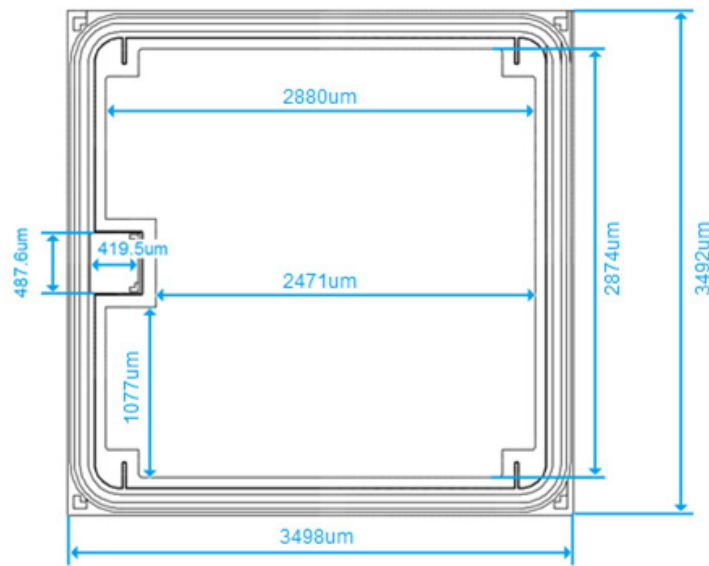
Turn-On Delay Time	V <sub>CC</sub> = 400 V, I <sub>C</sub> = 10 A, R <sub>G</sub> = 6 Ω, V <sub>GE</sub> = 15 V, Inductive Load, T <sub>C</sub> = 25°C	T <sub>d(on)</sub>	-	16.4	-	ns
Rise Time		T <sub>r</sub>	-	4.8	-	
Turn-Off Delay Time		T <sub>d(off)</sub>	-	86.4	-	
Fall Time		T <sub>f</sub>	-	8.8	-	
Turn-On Switching Loss		E <sub>on</sub>	-	138	-	μJ
Turn-Off Switching Loss		E <sub>off</sub>	-	52	-	
Total Switching Loss		E <sub>ts</sub>	-	190	-	

# PCFG40T65SQF

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified) (continued)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
<b>SWITCHING CHARACTERISTICS</b> (continued)						
Turn-On Delay Time	$V_{CC} = 400\text{ V}$ , $I_C = 20\text{ A}$ , $R_G = 6\ \Omega$ , $V_{GE} = 15\text{ V}$ , Inductive Load, $T_C = 25^\circ\text{C}$	$T_{d(on)}$	-	17.6	-	ns
Rise Time		$T_r$	-	9.6	-	
Turn-Off Delay Time		$T_{d(off)}$	-	80	-	
Fall Time		$T_f$	-	8.8	-	
Turn-On Switching Loss		$E_{on}$	-	329	-	$\mu\text{J}$
Turn-Off Switching Loss		$E_{off}$	-	84	-	
Total Switching Loss		$E_{ts}$	-	413	-	
Turn-On Delay Time	$V_{CC} = 400\text{ V}$ , $I_C = 10\text{ A}$ , $R_G = 6\ \Omega$ , $V_{GE} = 15\text{ V}$ , Inductive Load, $T_C = 175^\circ\text{C}$	$T_{d(on)}$	-	14.4	-	ns
Rise Time		$T_r$	-	6.4	-	
Turn-Off Delay Time		$T_{d(off)}$	-	99.2	-	
Fall Time		$T_f$	-	8	-	
Turn-On Switching Loss		$E_{on}$	-	269	-	$\mu\text{J}$
Turn-Off Switching Loss		$E_{off}$	-	132	-	
Total Switching Loss		$E_{ts}$	-	401	-	
Turn-On Delay Time	$V_{CC} = 400\text{ V}$ , $I_C = 20\text{ A}$ , $R_G = 6\ \Omega$ , $V_{GE} = 15\text{ V}$ , Inductive Load, $T_C = 175^\circ\text{C}$	$T_{d(on)}$	-	16	-	ns
Rise Time		$T_r$	-	11.2	-	
Turn-Off Delay Time		$T_{d(off)}$	-	91.2	-	
Fall Time		$T_f$	-	8	-	
Turn-On Switching Loss		$E_{on}$	-	581	-	$\mu\text{J}$
Turn-Off Switching Loss		$E_{off}$	-	237	-	
Total Switching Loss		$E_{ts}$	-	818	-	


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.



(all dimensions in  $\mu\text{m}$ )

**Figure 1. Die Layout**

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