

PCGA300T65DF8M1

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



ON Semiconductor®

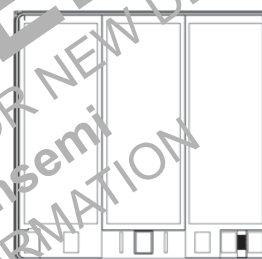
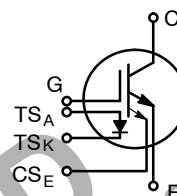
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Features

- 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 | μm |
| Die Size | 472×472 | $12,000 \times 12,000$ |
| Emitter Attach Area | $3 \times (141 \times 383)$ | $3 \times (3,580 \times 9,720)$ |
| Gate / Sensor Pad Attach Area | $6 \times (27 \times 39)$ | $6 \times (680 \times 980)$ |
| Die Thickness | 3 | 78 |
| Top Metal | 5 μm AlSiCu + 1.15 μm Ti/NiV/Ag (STM) | |
| Back Metal | 0.65 μm NiV/Ag | |
| Topside Passivation | Silicon Nitride plus Polyimide | |
| Wafer Diameter | 200 mm | |
| Max Possible Die Per Wafer | 136 | |

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ABSOLUTE MAXIMUM RATINGS (T_{VJ} = 25 °C unless otherwise noted)

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

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

Static Characteristics (Tested on wafers)

| | | | | | | |
|---|----------------------|---|-----|------|------|----|
| Collector-Emitter Breakdown Voltage | BV _{CES} | V _{GE} = 0 V, I _C = 1 mA | 650 | – | – | V |
| Collector-Emitter Saturation Voltage | V _{CE(SAT)} | I _C = 100 A, V _{GE} = 15 V | – | 1.25 | 1.55 | V |
| Gate-Emitter Threshold Voltage | V _{GE(th)} | V _{GE} = V _{CE} , I _C = 300 mA | 4.5 | 5.5 | 6.5 | V |
| Collector Cut-Off Current | I _{CES} | V _{CE} = V _{CES} , V _{GE} = 0 V | – | – | 40 | μA |
| Gate Leakage Current | I _{GES} | V _{GE} = V _{GES} , V _{CE} = 0 V | – | – | ±400 | nA |
| On-chip temperature – sense diode voltage | V _F | I _F = 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 _F | I _F = 0.5 mA, T _{VJ} = 100 °C | – | 1.9 | – | V |
| Emitter Sense Area Ratio | β _{AREA} | Sense Area/Total Area | – | 1/10K | – | – |
| Emitter Current Sense Ratio | β _{10Ω} | I _{CE} = 300 A, V _{GE} = 15 V R _{SENSE} = 10 Ω | – | 18K | – | – |

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

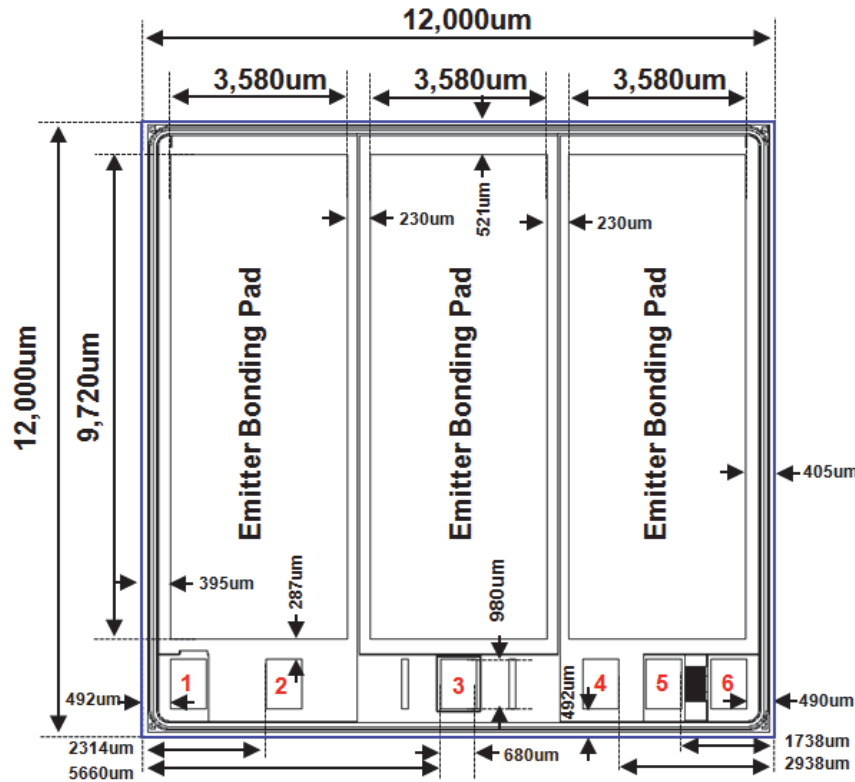
| | | | | | | | |
|---|-----------------------|---|--------------------------|------|-----|-----|---|
| Collector to Emitter Saturation Voltage | V _{CE(SAT)} | I _C = 300 A, V _{GE} = 15 V | T _{VJ} = 25 °C | – | 1.5 | 1.9 | V |
| | | | T _{VJ} = 175 °C | – | 1.8 | – | V |
| Input Capacitance | C _{IES}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

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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



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

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