

# IGBT for Automotive Applications

650 V, 30 A

## AFGB30T65RQDN

Using novel field stop IGBT technology, **onsemi**'s new series of FS4 IGBTs offer the optimum performance for automotive applications. This technology is Short circuit rated and offers high figure of merit with low conduction and switching losses.

### Features

- Maximum Junction Temperature:  $T_J = 175^{\circ}\text{C}$
- Positive Temperature Coefficient for Easy Parallel Operation
- High Current Capability
- Low Saturation Voltage:  $V_{CE(Sat)} = 1.58\text{ V (Typ.) @ } I_C = 30\text{ A}$
- 100% of the Parts Tested for ILM (Note 2)
- High Input Impedance
- Fast Switching
- Tightened Parameter Distribution
- This Device is Pb-Free and RoHS Compliant
- AEC-Q101 Qualified

### Typical Applications

- E-compressor for HEV/EV
- PTC Heater for HEV/EV

$BV_{CES}$	$V_{CE(sat)}$ TYP	$I_C$
650 V		30 A

### ORDERING INFORMATION

Device	Package	Shipping†
AFGB30T65RQDN	D2PAK (TO-263)	800 Units /

# AFGB30T65RQDN

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

Parameter	Symbol	Value	Unit
Collector to Emitter Voltage	V <sub>CES</sub>	650	V
Gate to Emitter Voltage Transient Gate to Emitter Voltage T <sub>pulse</sub> = 5 μs, D < 0.10	V <sub>GES</sub>	±20 ±30	V
Collector Current (Note 1) @T <sub>C</sub> = 25°C @T <sub>C</sub> = 100°C	I <sub>C</sub>	68 30	A
Pulsed Collector Current (Note 2)	I <sub>LM</sub>	120	A
Pulsed Collector Current (Note 3)	I <sub>CM</sub>	120	A
Diode Forward Current (Note 1) @T <sub>C</sub> = 25°C @T <sub>C</sub> = 100°C	I <sub>F</sub>	68 30	A
Pulsed Diode Maximum Forward Current	I <sub>FM</sub>	120	A
Non-Repetitive Forward Surge Current (Half-Sine Pulse, tp = 8.3 ms, T <sub>C</sub> = 25°C) (Half-Sine Pulse, tp = 8.3 ms, T <sub>C</sub> = 150°C)	I <sub>F, SM</sub>	140 100	A
Short Circuit Withstand Time V <sub>GE</sub> = 15 V, V <sub>CC</sub> = 400 V, T <sub>C</sub> = 150°C	T <sub>SC</sub>	5	μs
Maximum Power Dissipation @T <sub>C</sub> = 25°C @T <sub>C</sub> = 100°C	P <sub>D</sub>	235.48 117.74	W
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +175	°C
Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5 seconds	T <sub>L</sub>	265	°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.

1. Value limited by bond wire.
2. V<sub>CC</sub> = 400 V, V<sub>GE</sub> = 15 V, I<sub>C</sub> = 90 A, R<sub>G</sub> = 100 Ω, Inductive Load, 100% Tested.
3. Repetitive rating: pulse width limited by max. Junction temperature.

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Min	Typ	Max	Unit
Thermal Resistance Junction-to-Case, for IGBT	R <sub>θJC</sub>	-	0.49	0.64	°C/W
Thermal Resistance Junction-to-Case, for Diode	R <sub>θJC</sub>	-	0.97	1.26	
Thermal Resistance Junction-to-Ambient	R <sub>θJA</sub>	-	-	40	

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

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

Collector-to-Emitter Breakdown Voltage, Gate-Emitter Short-Circuited	BV <sub>CES</sub>	V <sub>GE</sub> = 0 V, I <sub>C</sub> = 1 mA	650	-	-	V
Temperature Coefficient of Breakdown Voltage	ΔBV <sub>CES</sub> /ΔT <sub>J</sub>	V <sub>GE</sub> = 0 V, I <sub>C</sub> = 1 mA	-	0.61	-	V/°C
Collector-Emitter Cut-Off Current, Gate-Emitter Short-Circuited	I <sub>CES</sub>	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0 V	-	-	30	μA
Gate Leakage Current, Collector-Emitter Short-Circuited	I <sub>GES</sub>	V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0 V	-	-	±400	nA

### ON CHARACTERISTICS

Gate-Emitter Threshold Voltage	V <sub>GE(th)</sub>	V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 30 mA	4.30	5.30	6.30	V
Collector-Emitter Saturation Voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> = 30 A, V <sub>GE</sub> = 15 V, T <sub>J</sub> = 25°C	-	1.58	1.82	V
		I <sub>C</sub> = 30 A, V <sub>GE</sub> = 15 V, T <sub>J</sub> = 175°C	-	1.94	-	V

### DYNAMIC CHARACTERISTICS

Input Capacitance	C <sub>ies</sub>	V <sub>CE</sub> = 30 V, V <sub>GE</sub> = 0 V, f = 1 MHz	-	1580	-	pF
Output Capacitance	C <sub>oes</sub>		-	54	-	
Reverse Transfer Capacitance	C <sub>res</sub>		-	7	-	
Gate Resistance	R <sub>g</sub>	FREQ = 1 MHz	-	15	-	Ω
Gate Charge Total	Q <sub>g</sub>	V <sub>CE</sub> = 400 V, I <sub>C</sub> = 30 A, V <sub>GE</sub> = 15 V	-	38	-	nC
Gate-Emitter Charge	Q <sub>ge</sub>		-	13	-	
Gate-Collector Charge	Q <sub>gc</sub>		-	11	-	

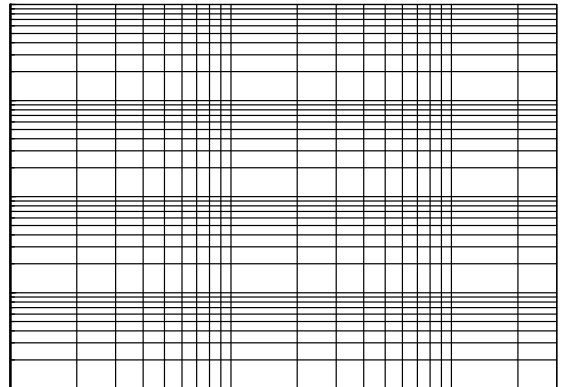
### SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

Turn-On Delay Time	t <sub>d(on)</sub>	T <sub>J</sub> = 25°C, V <sub>CC</sub> = 400 V, I <sub>C</sub> = 15 A, R <sub>g</sub> = 2.5 Ω, V <sub>GE</sub> = 15 V, Inductive Load	-	20	-	ns
Rise Time	t <sub>r</sub>		-	18	-	
Turn-Off Delay Time	t <sub>d(off)</sub>		-	60	-	
Fall Time	t <sub>f</sub>		-	92	-	
Turn-On Switching Loss	E <sub>on</sub>	T <sub>J</sub> = 25°C, V <sub>CC</sub> = 400 V, I <sub>C</sub> = 30 A, R <sub>g</sub> = 2.5 Ω, V <sub>GE</sub> = 15 V, Inductive Load	-	0.34	-	mJ
Turn-Off Switching Loss	E <sub>off</sub>		-	0.32	-	
Total Switching Loss	E <sub>ts</sub>		-	0.66	-	
Turn-On Delay Time	t <sub>d(on)</sub>		-	18	-	
Rise Time	t <sub>r</sub>	-	37	-		
Turn-Off Delay Time	t <sub>d(off)</sub>	-	48	-		
Fall Time	t <sub>f</sub>	-	75	-		
Turn-On Switching Loss	E <sub>on</sub>	T <sub>J</sub> = 25°C, V <sub>CC</sub> = 400 V, I <sub>C</sub> = 30 A, R <sub>g</sub> = 2.5 Ω, V <sub>GE</sub> = 15 V, Inductive Load	-	0.78	-	mJ
Turn-Off Switching Loss	E <sub>off</sub>		-	0.56	-	
Total Switching Loss	E <sub>ts</sub>		-	1.34	-	
Turn-On Delay Time	t <sub>d(on)</sub>		-	20	-	
Rise Time	t <sub>r</sub>	-	24	-		
Turn-Off Delay Time	t <sub>d(off)</sub>	-	-	-		



# AFGB30T65RQDN

## TYPICAL CHARACTERISTICS



**AFGB30T65RQDN**

**AFGB30T65RQDN**

# AFGB30T65RQDN

## TYPICAL CHARACTERISTICS (Continued)

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SCALE 1:1

**D<sup>2</sup>PAK-3 (TO-263, 3-LEAD)**  
CASE 418AJ  
ISSUE F

DATE 11 MAR 2021

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