

# AFGB30T65SQDN

## IGBT for Automotive Applications

650 V, 30 A, D<sup>2</sup>PAK

### Features

- Maximum Junction Temperature:  $T_J = 175^\circ\text{C}$
- High Speed Switching Series
- $V_{CE(sat)} = 1.6\text{ V (typ.) @ } I_C = 30\text{ A}$
- Low VF Soft Recovery Co-packaged Diode
- AEC-Q101 Qualified
- 100% of the Parts are Dynamically Tested (Note 1)

### Typical Applications

- Automotive On Board Charger
- Automotive DC/DC Converter for HEV

### MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise stated)

Parameter	Symbol	Value	Unit
Collector-to-Emitter Voltage	$V_{CES}$	650	V
Gate-to-Emitter Voltage	$V_{GES}$	$\pm 20$	V
Transient Gate-to-Emitter Voltage	$V_{GES}$	$\pm 30$	V
Collector Current ( $T_C = 25^\circ\text{C}$ )	$I_C$	60	A
Collector Current ( $T_C = 100^\circ\text{C}$ )		30	A
Pulsed Collector Current (Note 2)	$I_{CM}$	120	A
Diode Forward Current ( $T_C = 25^\circ\text{C}$ )	$I_F$	40	A
Diode Forward Current ( $T_C = 100^\circ\text{C}$ )		20	A
Pulsed Diode Maximum Forward Current (Note 2)	$I_{FM}$	120	A
Maximum Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_D$	220	W
Maximum Power Dissipation ( $T_C = 100^\circ\text{C}$ )		110	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-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.

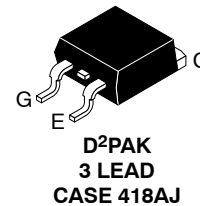
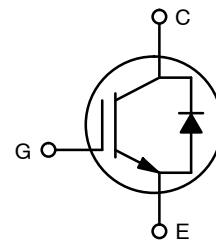
1.  $V_{CC} = 400\text{ V}, V_{GE} = 15\text{ V}, I_C = 90\text{ A}, R_G = 100\ \Omega$ , Inductive Load
2. Repetitive rating: pulse width limited by max. Junction temperature
3. Surface-mounted on FR4 board using  $1\text{ in}^2$  pad size, 1 oz Cu pad.
4. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.



ON Semiconductor®

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

$BV_{CES}$	$V_{CE(sat)}$ TYP	$I_C$ MAX
650 V	1.6 V	120 A



### MARKING DIAGRAM



- &Y = ON Semiconductor Logo
- &Z = Assembly Plant Code
- &3 = 3-Digit Date Code
- &K = 2-Digit Lot Traceability Code
- AFGB30T65SQDN = Specific Device Code

### ORDERING INFORMATION

Device	Package	Shipping†
AFGB30T65SQDN	D2PAK (TO-263)	800 Units / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

# AFGB30T65SQDN

**Table 1. THERMAL RESISTANCE RATINGS**

Parameter	Symbol	Max	Unit
Thermal Resistance Junction-to-Case, for IGBT	$R_{\theta JC}$	0.68	°C/W
Thermal Resistance Junction-to-Case, for Diode	$R_{\theta JC}$	1.55	
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	40	

**Table 2. ELECTRICAL CHARACTERISTICS** ( $T_C = 25^\circ\text{C}$  unless otherwise stated)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Collector-to-Emitter Breakdown Voltage	$BV_{CES}$	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	650	-	-	V
Temperature Coefficient of Breakdown Voltage	$\Delta V_{CES} / \Delta T_J$	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	-	0.6	-	V/°C
Collector Cut-Off Current	$I_{CES}$	$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$	-	-	250	μA
G-E Leakage Current	$I_{GES}$	$V_{GE} = V_{GES}, V_{CE} = 0\text{ V}$	-	-	±400	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 30\text{ mA}$	3.0	4.5	6.0	V
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 30\text{ A}, V_{GE} = 15\text{ V}, T_C = 25^\circ\text{C}$	-	1.6	2.1	V
		$I_C = 30\text{ A}, V_{GE} = 15\text{ V}, T_C = 175^\circ\text{C}$	-	1.92	-	V
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ies}$	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	-	1871	-	pF
Output Capacitance	$C_{oes}$		-	44	-	
Reverse Transfer Capacitance	$C_{res}$		-	7	-	
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 400\text{ V}, I_C = 30\text{ A}, R_G = 6\ \Omega,$ $V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 25^\circ\text{C}$	-	14.5	-	ns
Rise Time	$t_r$		-	16	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	63.2	-	ns
Fall Time	$t_f$		-	8.3	-	ns
Turn-On Switching Loss	$E_{on}$		-	0.783	-	mJ
Turn-Off Switching Loss	$E_{off}$		-	0.160	-	mJ
Total Switching Loss	$E_{ts}$	-	0.943	-	mJ	
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 400\text{ V}, I_C = 30\text{ A}, R_G = 6\ \Omega,$ $V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 175^\circ\text{C}$	-	12.8	-	ns
Rise Time	$t_r$		-	20.8	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	67.2	-	ns
Fall Time	$t_f$		-	11.5	-	ns
Turn-On Switching Loss	$E_{on}$		-	1.01	-	mJ
Turn-Off Switching Loss	$E_{off}$		-	0.369	-	mJ
Total Switching Loss	$E_{ts}$	-	1.379	-	mJ	
Total Gate Charge	$Q_g$	$V_{CE} = 400\text{ V}, I_C = 30\text{ A},$ $V_{GE} = 15\text{ V}$	-	56	-	nC
Gate-to-Emitter Charge	$Q_{ge}$		-	11	-	nC
Gate-to-Collector Charge	$Q_{gc}$		-	14	-	nC

# AFGB30T65SQDN

**Table 2. ELECTRICAL CHARACTERISTICS** ( $T_C = 25^\circ\text{C}$  unless otherwise stated)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>DIODE CHARACTERISTICS</b>						
Diode Forward Voltage	$V_{FM}$	$I_F = 20\text{ A}$	–	1.5	2.1	V
Reverse Recovery Energy	$E_{rec}$	$I_F = 20\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ , $T_C = 25^\circ\text{C}$	–	22	–	$\mu\text{J}$
Diode Reverse Recovery Time	$t_{rr}$		–	131	–	ns
Diode Reverse Recovery Charge	$Q_{rr}$		–	348	–	nC
Reverse Recovery Energy	$E_{rec}$	$I_F = 20\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ , $T_C = 175^\circ\text{C}$	–	100	–	$\mu\text{J}$
Diode Reverse Recovery Time	$t_{rr}$		–	245	–	ns
Diode Reverse Recovery Charge	$Q_{rr}$		–	961	–	nC

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.

# AFGB30T65SQDN

## TYPICAL CHARACTERISTICS

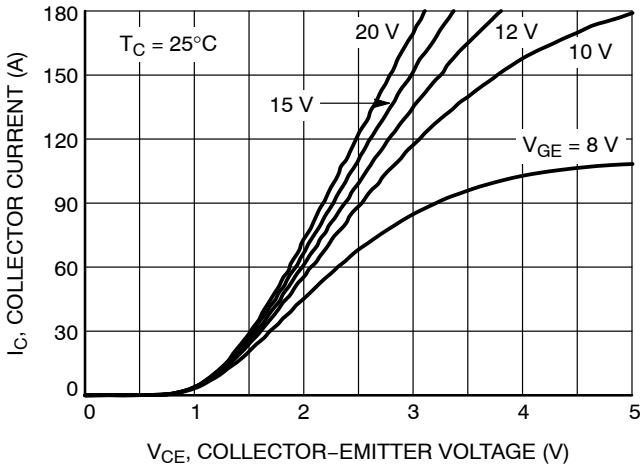


Figure 1. Typical Output Characteristics (25°C)

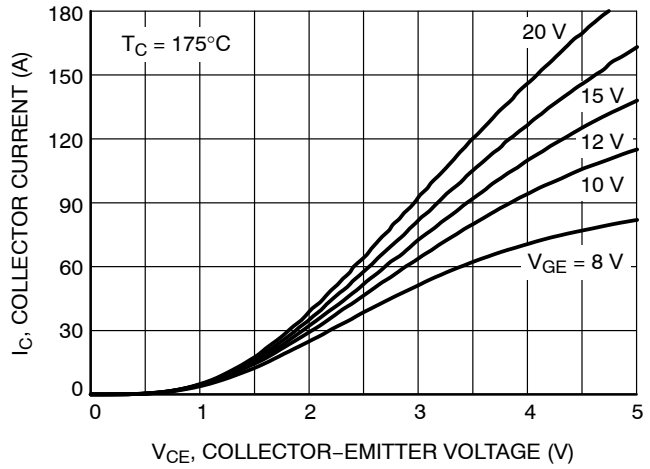


Figure 2. Typical Output Characteristics (175°C)

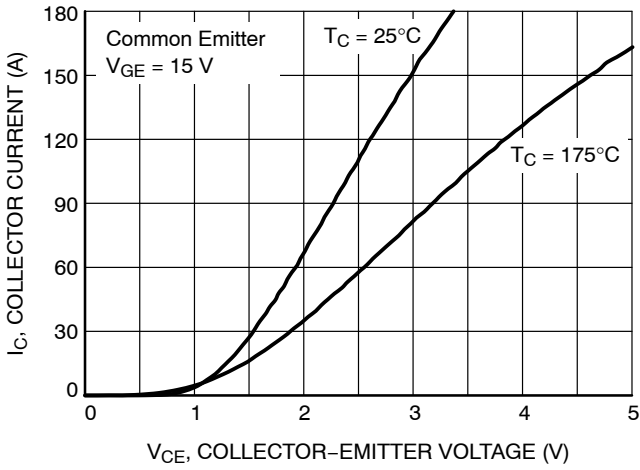


Figure 3. Typical Saturation Voltage Characteristics

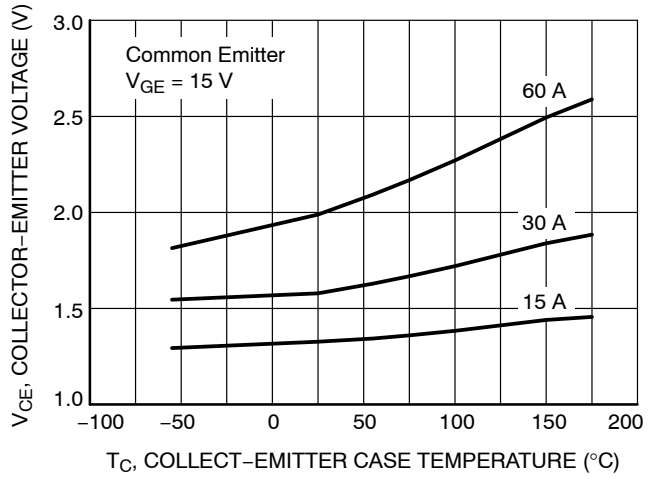


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

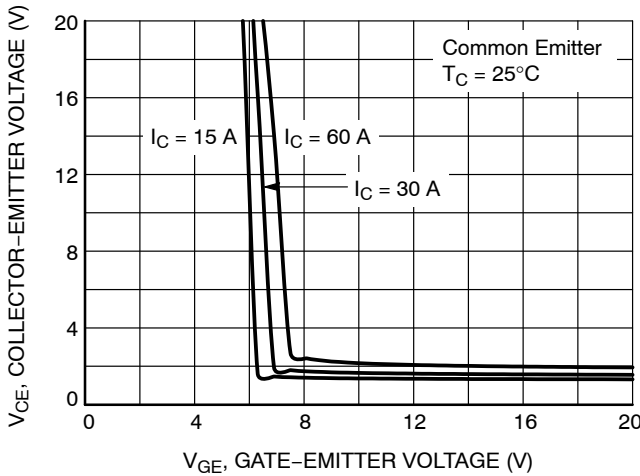


Figure 5. Saturation Voltage vs.  $V_{GE}$  (25°C)

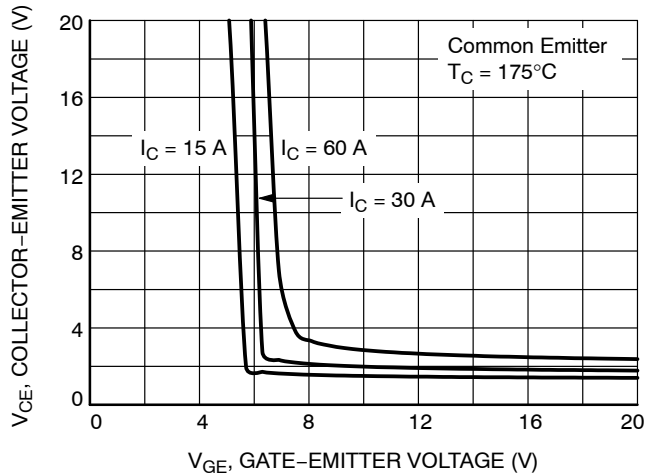


Figure 6. Saturation Voltage vs.  $V_{GE}$  (175°C)

# AFGB30T65SQDN

## TYPICAL CHARACTERISTICS

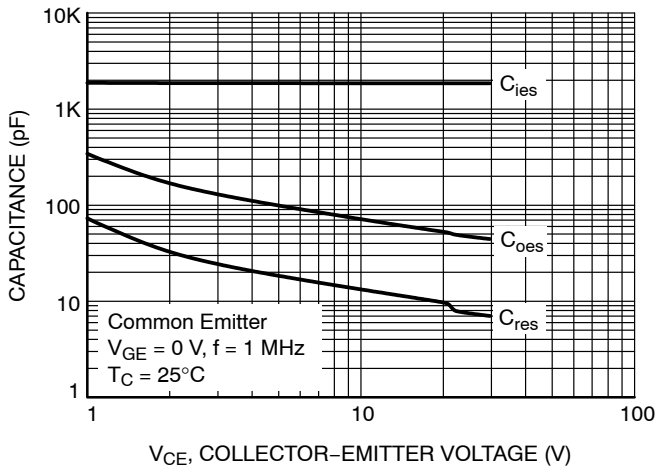


Figure 7. Capacitance Characteristics

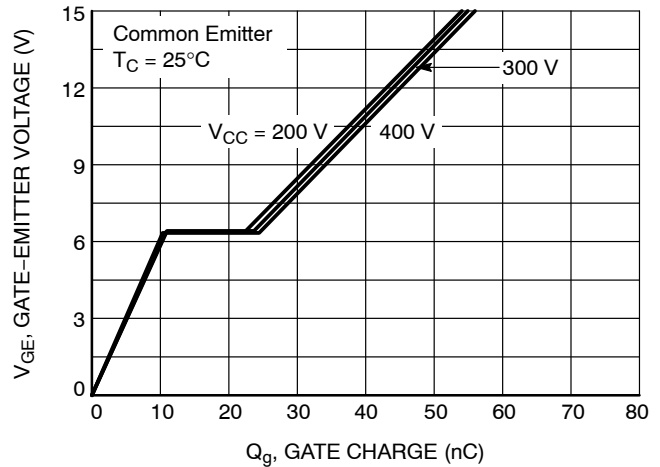


Figure 8. Gate Charge Characteristics

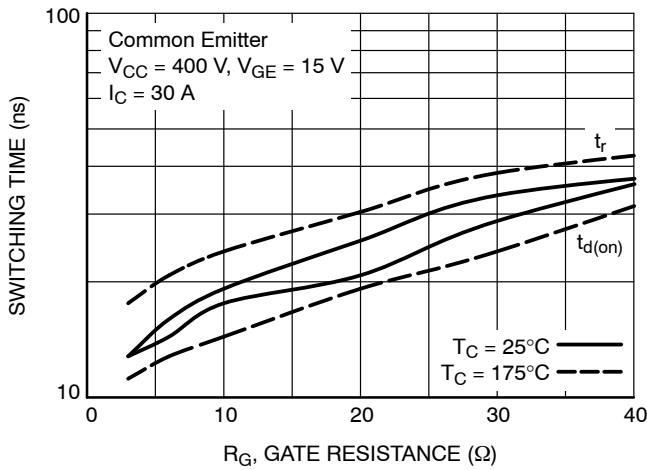


Figure 9. Turn-on Characteristics vs. Gate Resistance

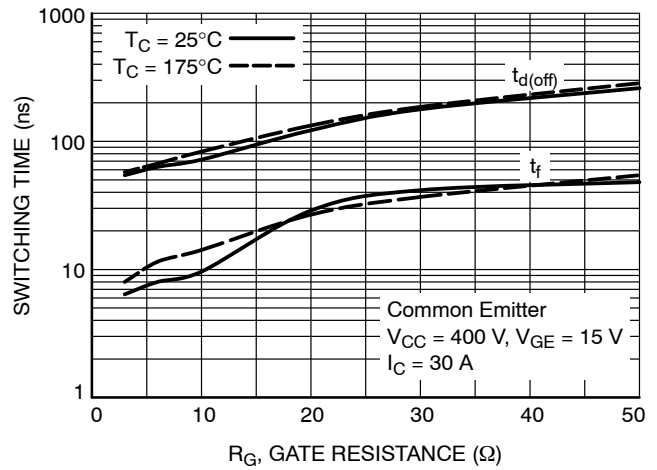


Figure 10. Turn-off Characteristics vs. Gate Resistance

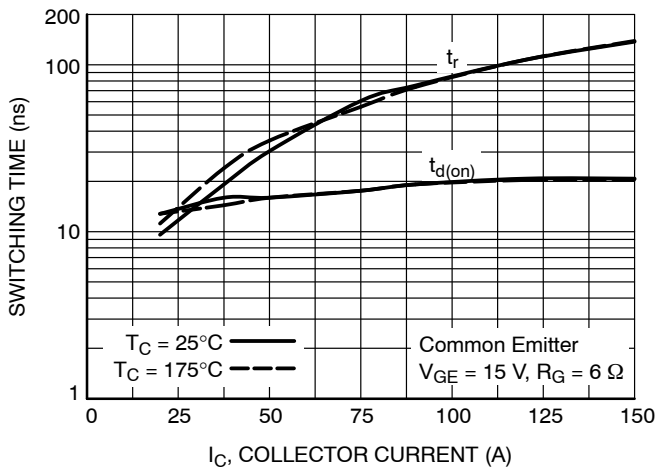


Figure 11. Turn-on Characteristics vs. Collector Current

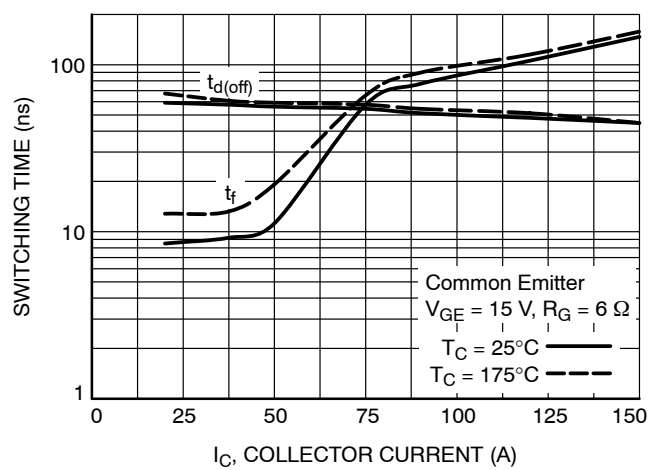


Figure 12. Turn-off Characteristics vs. Collector Current

# AFGB30T65SQDN

## TYPICAL CHARACTERISTICS

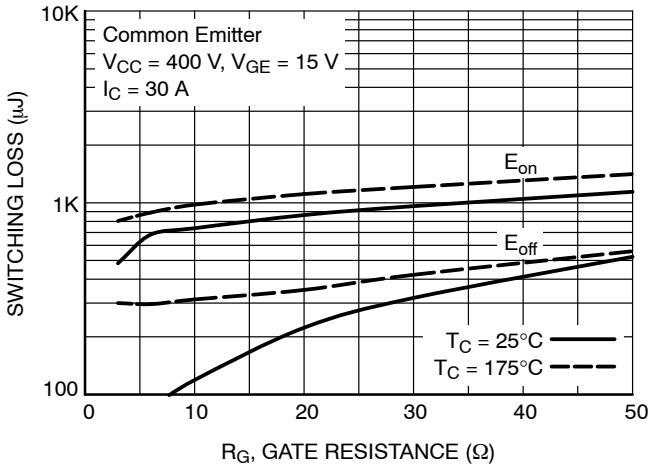


Figure 13. Switching Loss vs. Gate Resistance

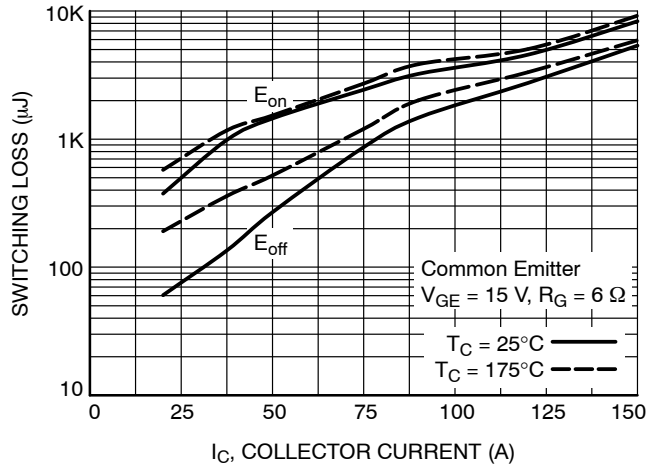


Figure 14. Switching Loss vs. Collector Current

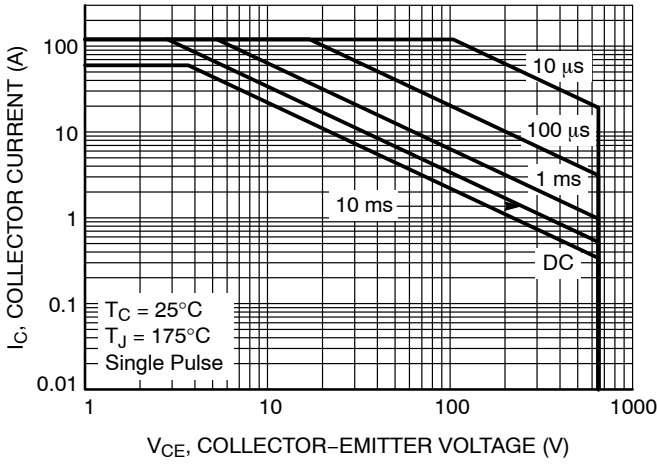


Figure 15. SOA Characteristics

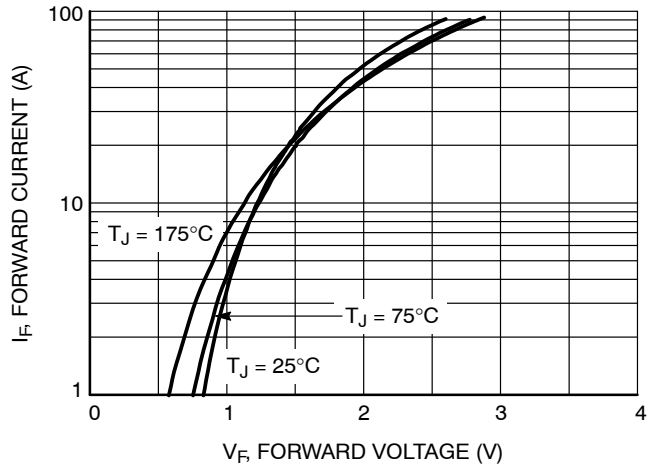


Figure 16. Forward Characteristics

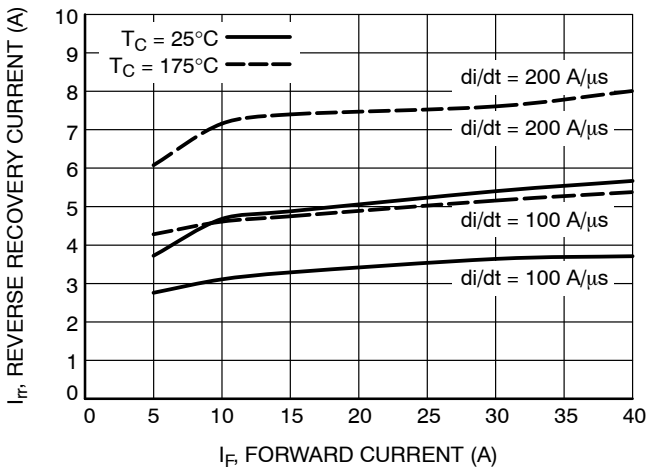


Figure 17. Reverse Recovery Current

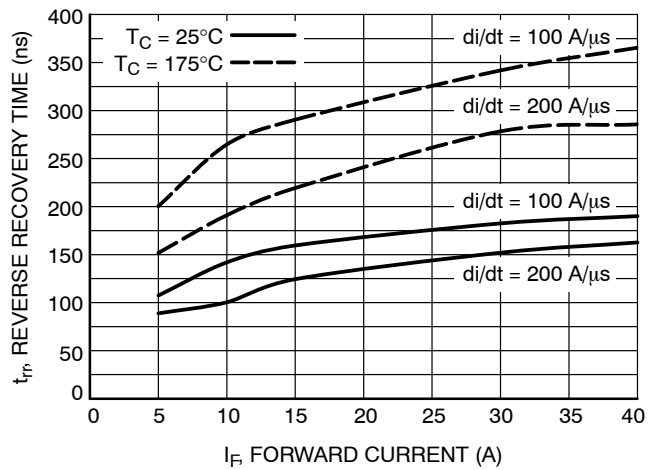


Figure 18. Reverse Recovery Time

# AFGB30T65SQDN

## TYPICAL CHARACTERISTICS

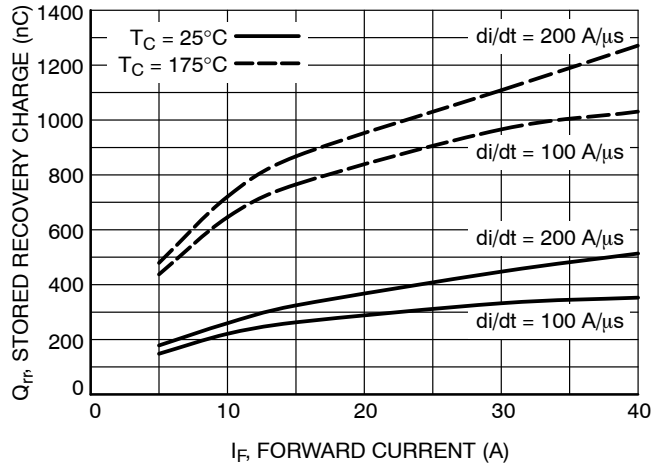


Figure 19. Stored Charge

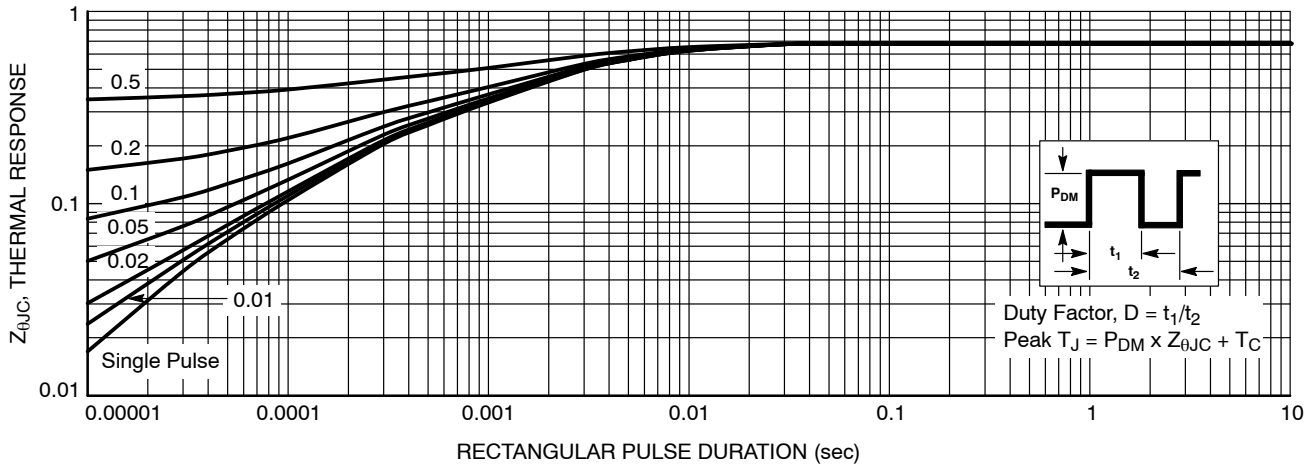


Figure 20. Transient Thermal Impedance of IGBT

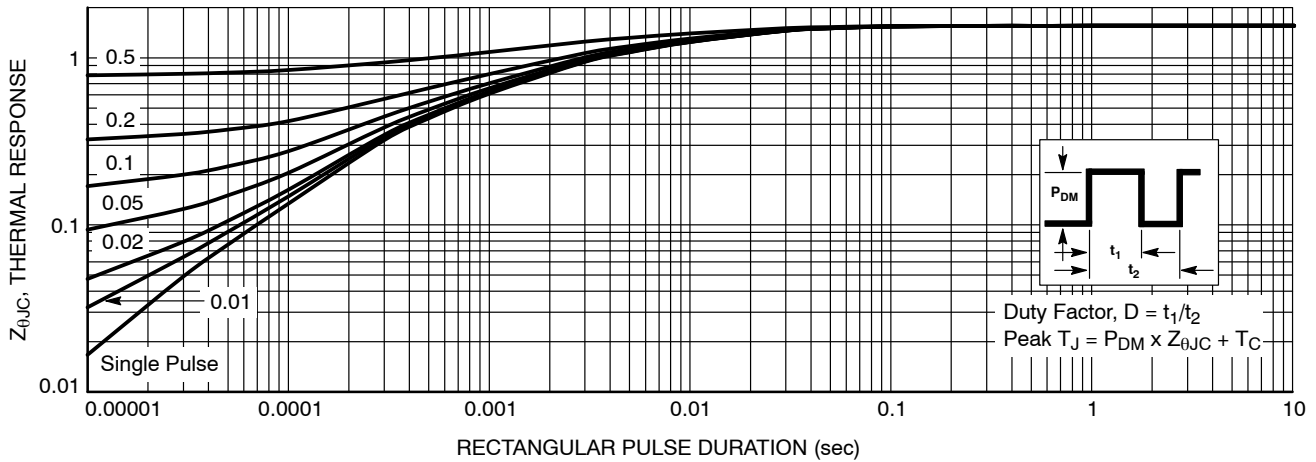
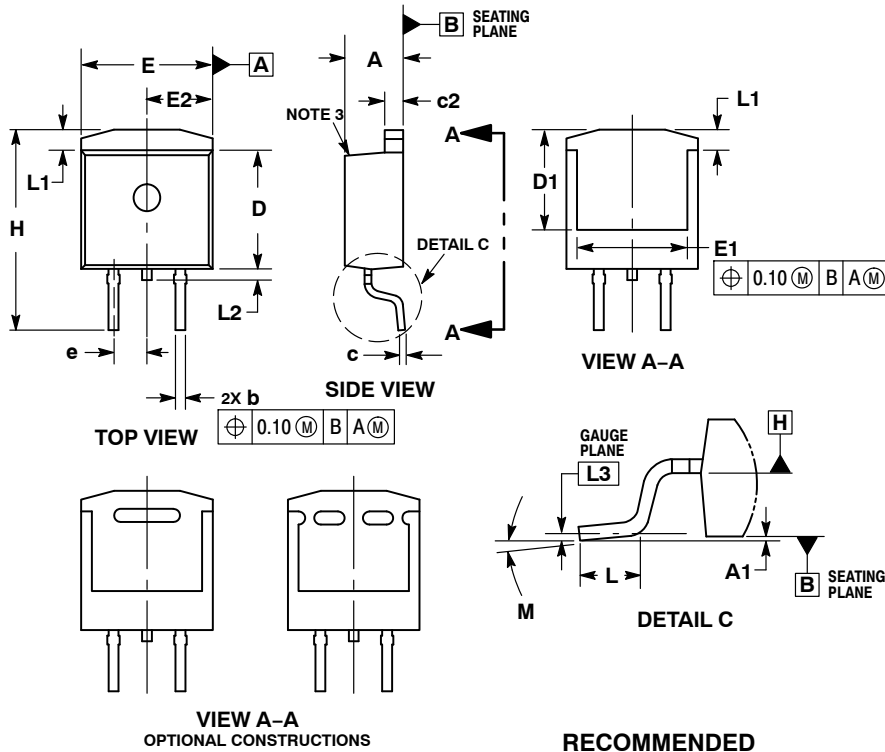


Figure 21. Transient Thermal Impedance of Diode

# AFGB30T65SQDN

## PACKAGE DIMENSIONS

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

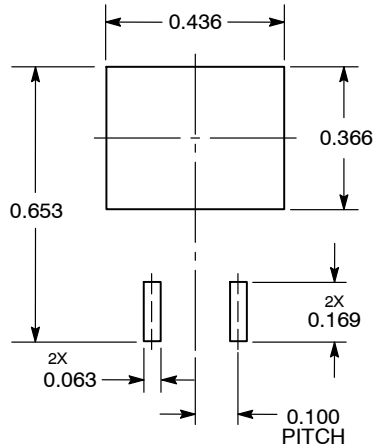


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. CHAMFER OPTIONAL
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
5. THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1 AND E1.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.160	0.190	4.06	4.83
A1	0.000	0.010	0.00	0.25
b	0.020	0.039	0.51	0.99
c	0.012	0.029	0.30	0.74
c2	0.045	0.065	1.14	1.65
D	0.330	0.380	8.38	9.65
D1	0.260	----	6.60	----
E	0.380	0.420	9.65	10.67
E1	0.245	----	6.22	----
e	0.100 BSC	----	2.54 BSC	----
H	0.575	0.625	14.60	15.88
L	0.070	0.110	1.78	2.79
L1	----	0.066	----	1.68
L2	----	0.070	----	1.78
L3	0.010 BSC	----	0.25 BSC	----
M	-8°	8°	-8°	8°

**RECOMMENDED SOLDERING FOOTPRINT\***




DIMENSIONS: INCHES

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



# AFGB30T65SQDN

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

**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



## Стандарт Электрон Связь

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

### Наши контакты:

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331