IGBT for Automotive Applications

650 V, 30 A, D2PAK

AFGB30T65SQDN-BW

ON Semiconductor®

www.onsemi.com

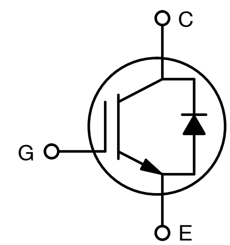
Features

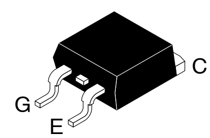
- Maximum Junction Temperature: T_J = 175°C
- High Speed Switching Series
- $V_{CE(sat)}$ = 1.6 V (typ.) @ I_C = 30 A
- Low VF Soft Recovery Co−packaged Diode
- AEC−Q101 Qualified
- 100% of the Parts are Dynamically Tested (Note 1)

Typical Applications

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

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





D2PAK
3 LEAD
CASE 221BQ

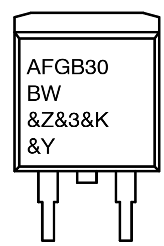
MAXIMUM RATINGS (T_C = 25°C unless otherwise stated)

Parameter	Symbol	Value	Unit
Collector−to−Emitter Voltage	V_{CES}	650	V
Gate−to−Emitter Voltage	V_{GES}	±20	V
Transient Gate−to−Emitter Voltage	V_{GES}	±30	V
Collector Current (T_C = 25°C)	I_C	60	A
Collector Current (T_C = 100°C)		30	A
Pulsed Collector Current (Note 2)	I_{CM}	120	A
Diode Forward Current (T_C = 25°C)	I_F	40	A
Diode Forward Current (T_C = 100°C)		20	A
Pulsed Diode Maximum Forward Current (Note 2)	I_{FM}	120	A
Maximum Power Dissipation (T_C = 25°C)	P_D	220	W
Maximum Power Dissipation (T_C = 100°C)		110	W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	−55 to +175	°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 V, V_{GE} = 15 V, I_C = 90 A, R_G = 100 Ω, Inductive Load
2. Repetitive rating: pulse width limited by max. Junction temperature
3. Surface−mounted on FR4 board using 1 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.

MARKING DIAGRAM



AFGB30BW	=	Specific Device Code
&Z	=	Assembly Plant Code
&3	=	3−Digit Date Code
&K	=	2−Dig Lot Traceability Code
&Y	=	ON Semiconductor Logo

ORDERING INFORMATION

Device	Package	Shipping†
AFGB30T65SQDN−BW	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.

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°C unless otherwise stated)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector−to−Emitter Breakdown Voltage	BV_{CES}	V_{GE} = 0 V, I_C = 1 mA	650	–	–	V
Temperature Coefficient of Breakdown Voltage	$\Delta V_{CES}/\Delta T_J$	V_{GE} = 0 V, I_C = 1 mA	–	0.6	–	V/°C
Collector Cut−Off Current	I_{CES}	$V_{CE} = V_{CES}$, V_{GE} = 0 V	–	–	250	μA
G−E Leakage Current	I_{GES}	$V_{GE} = V_{GES}$, V_{CE} = 0 V	–	–	±400	nA
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$, I_C = 30 mA	3.0	4.5	6.0	V
Collector−to−Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 30 A, V_{GE} = 15 V, T_C = 25°C	–	1.6	2.1	V
		I_C = 30 A, V_{GE} = 15 V, T_C = 175°C	–	1.92	–	V
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ies}	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	–	1871	–	pF
Output Capacitance	C_{oes}		–	44	–	
Reverse Transfer Capacitance	C_{res}		–	7	–	
SWITCHING CHARACTERISTICS						
Turn−On Delay Time	$t_{d(on)}$	V_{CC} = 400 V, I_C = 30 A, R_G = 6 Ω, V_{GE} = 15 V, Inductive Load, T_C = 25°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 V, I_C = 30 A, R_G = 6 Ω, V_{GE} = 15 V, Inductive Load, T_C = 175°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 V, I_C = 30 A, V_{GE} = 15 V	–	56	–	nC
Gate−to−Emitter Charge	Q_{ge}		–	11	–	nC
Gate−to−Collector Charge	Q_{gc}		–	14	–	nC

Table 2. ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise stated)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
DIODE CHARACTERISTICS						
Diode Forward Voltage	V_{FM}	I_F = 20 A	–	1.5	2.1	V
Reverse Recovery Energy	E_{rec}	I_F = 20 A dI_F/dt = 200 A/μs, T_C = 25°C	–	22	–	μJ
Diode Reverse Recovery Time	t_{rr}		–	131	–	ns
Diode Reverse Recovery Charge	Q_{rr}		–	348	–	nC
Reverse Recovery Energy	E_{rec}	I_F = 20 A dI_F/dt = 200 A/μs, T_C = 175°C	–	100	–	μJ
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.

TYPICAL CHARACTERISTICS

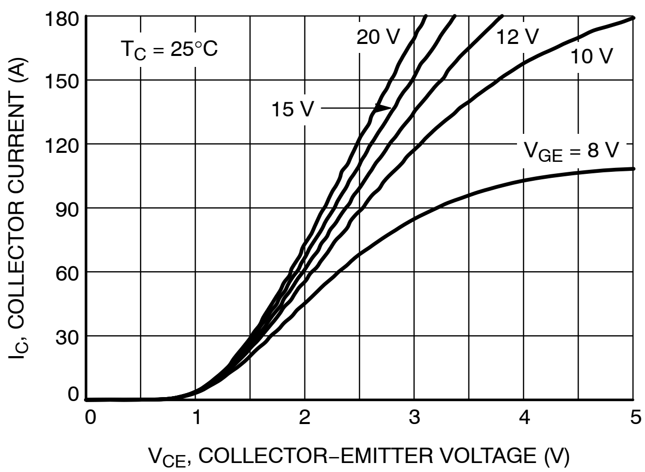


Figure 1. Typical Output Characteristics (25°C)

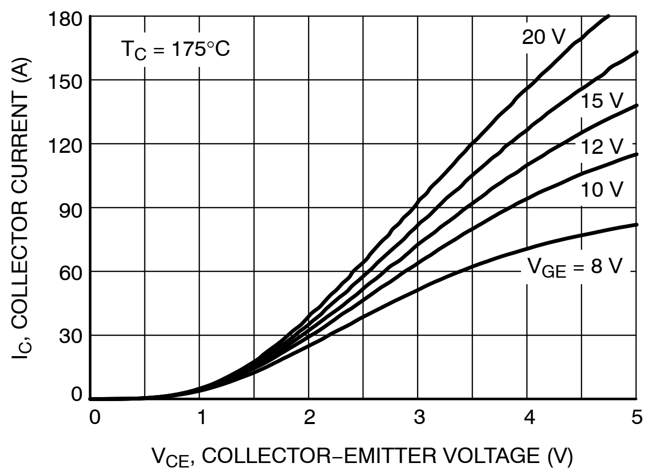


Figure 2. Typical Output Characteristics (175°C)

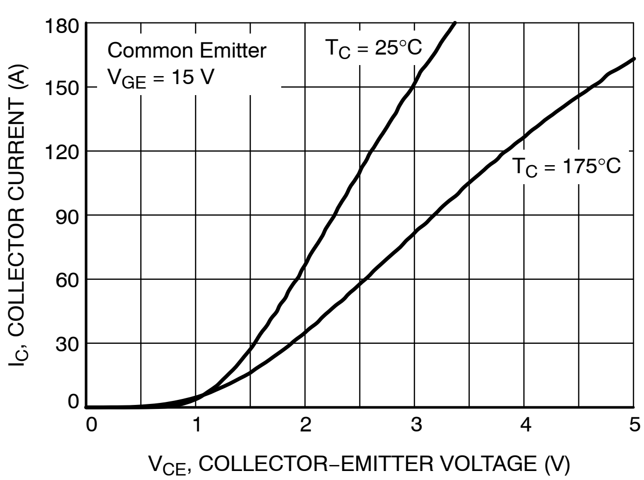


Figure 3. Typical Saturation Voltage Characteristics

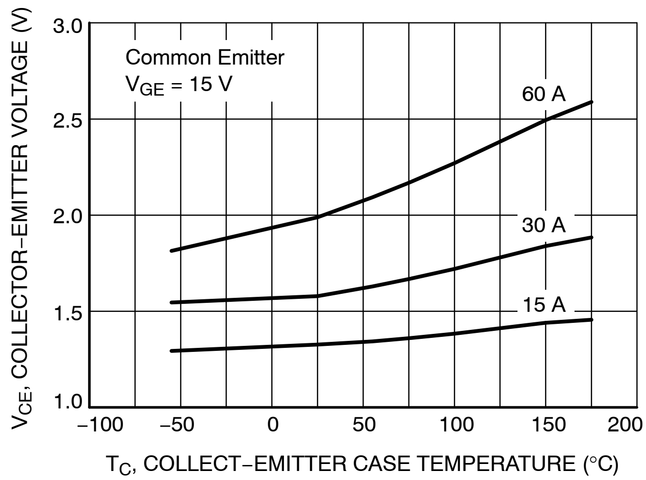


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

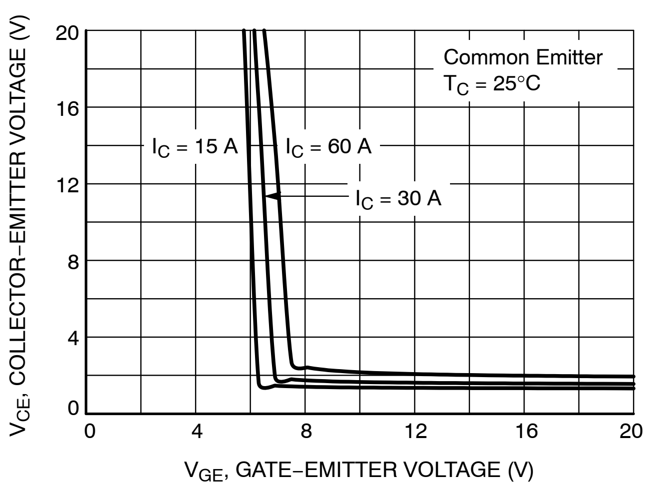


Figure 5. Saturation Voltage vs. V_{GE} (25°C)

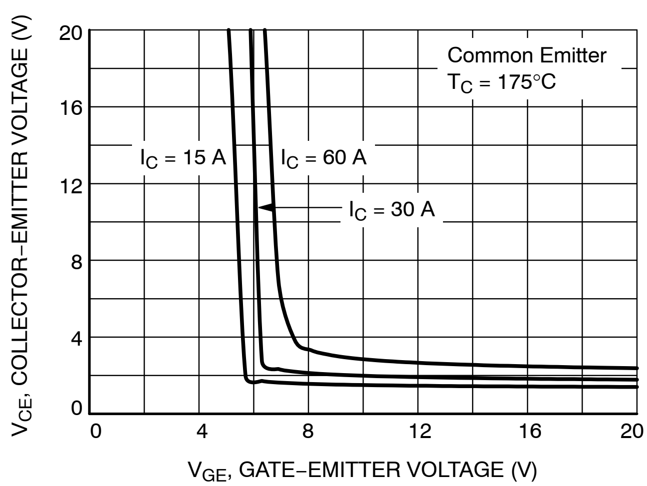


Figure 6. Saturation Voltage vs. V_{GE} (175°C)

TYPICAL CHARACTERISTICS

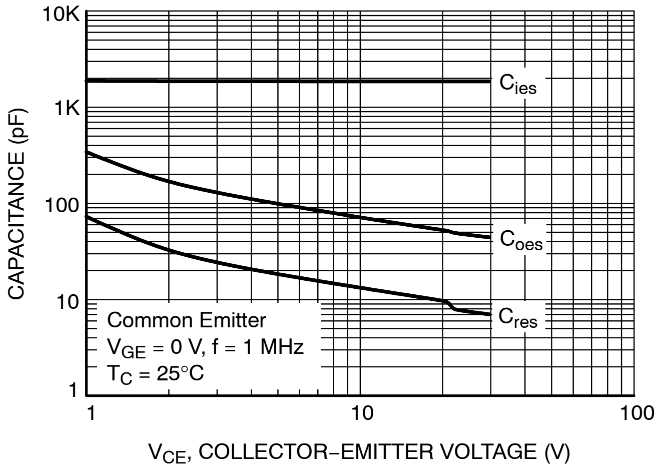


Figure 7. Capacitance Characteristics

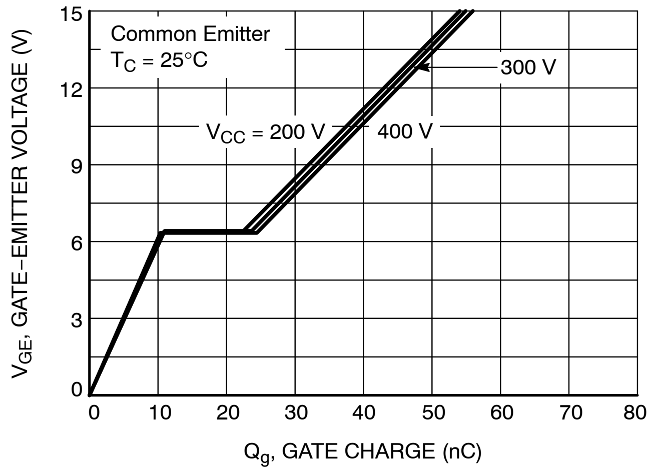


Figure 8. Gate Charge Characteristics

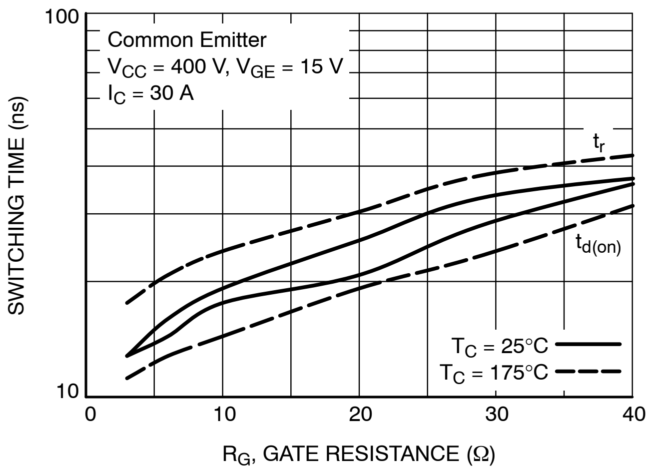


Figure 9. Turn−on Characteristics vs. Gate Resistance

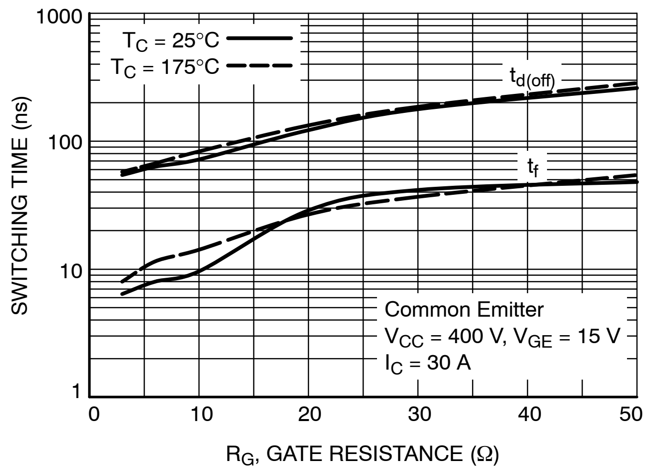


Figure 10. Turn−off Characteristics vs. Gate Resistance

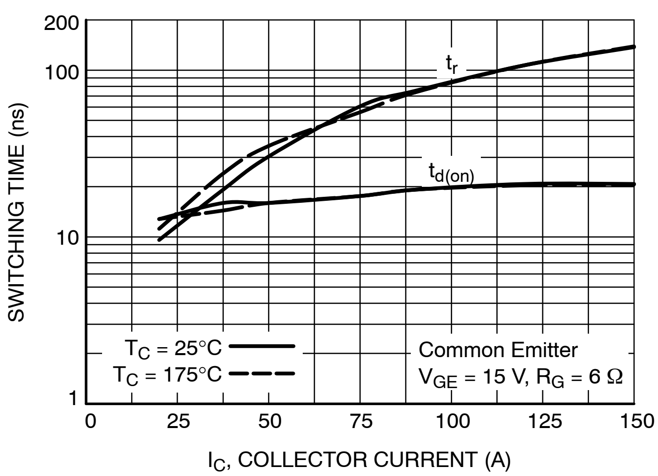


Figure 11. Turn−on Characteristics vs. Collector Current

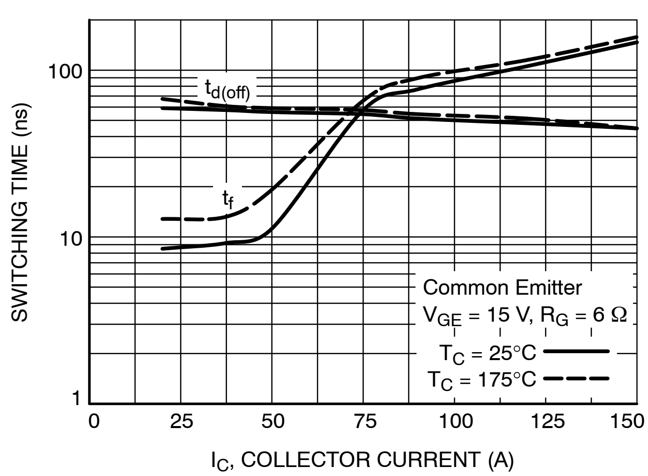


Figure 12. Turn−off Characteristics vs. Collector Current

TYPICAL CHARACTERISTICS

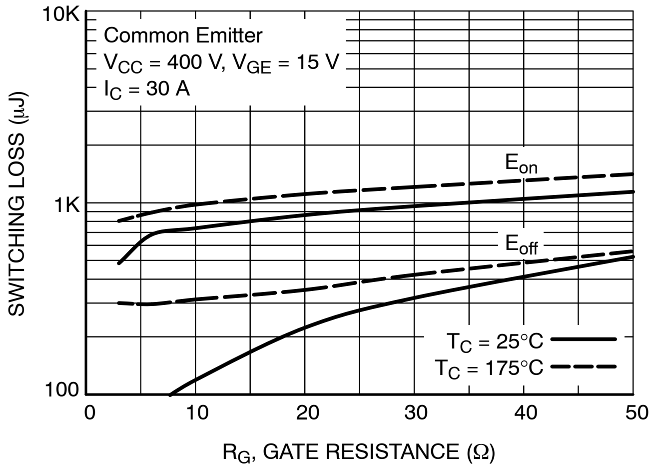


Figure 13. Switching Loss vs. Gate Resistance

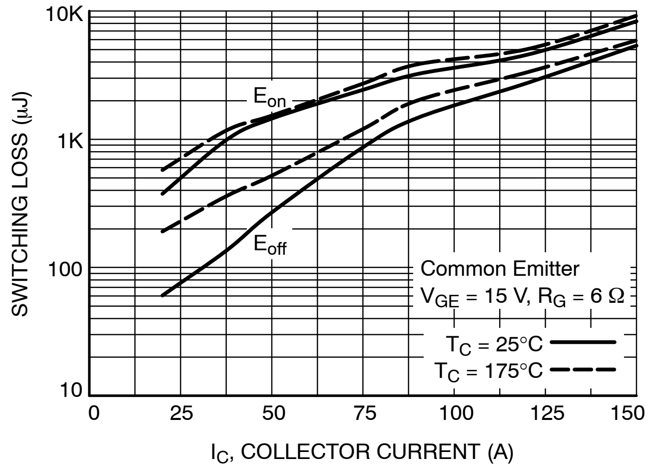


Figure 14. Switching Loss vs. Collector Current

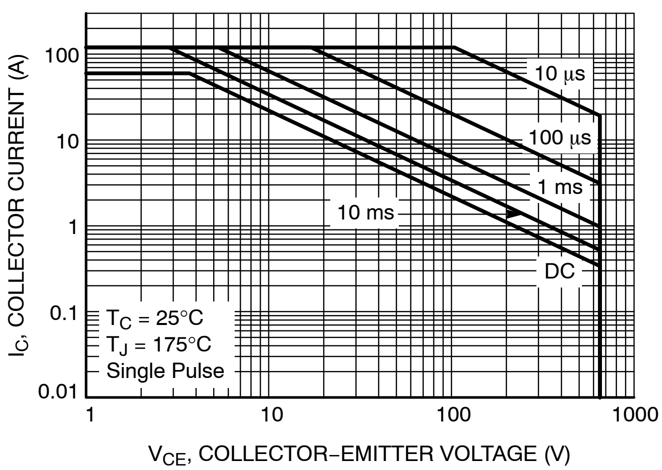


Figure 15. SOA Characteristics

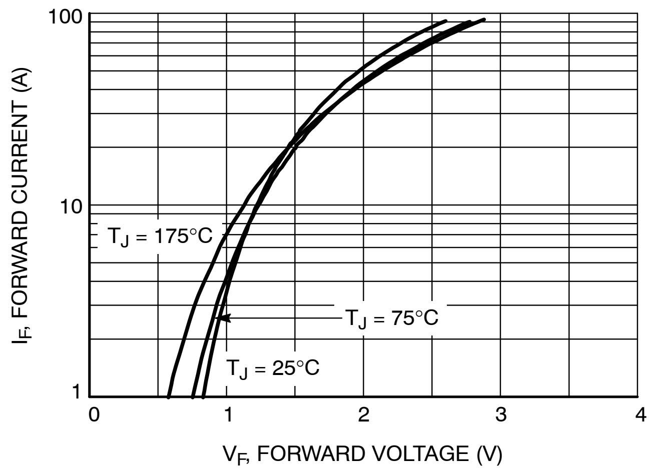


Figure 16. Forward Characteristics

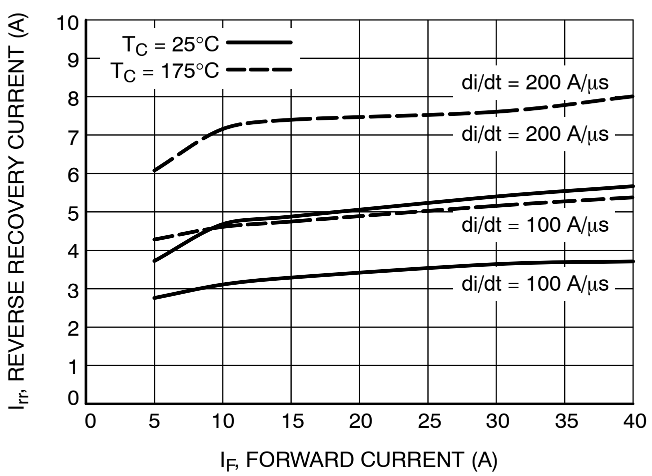


Figure 17. Reverse Recovery Current

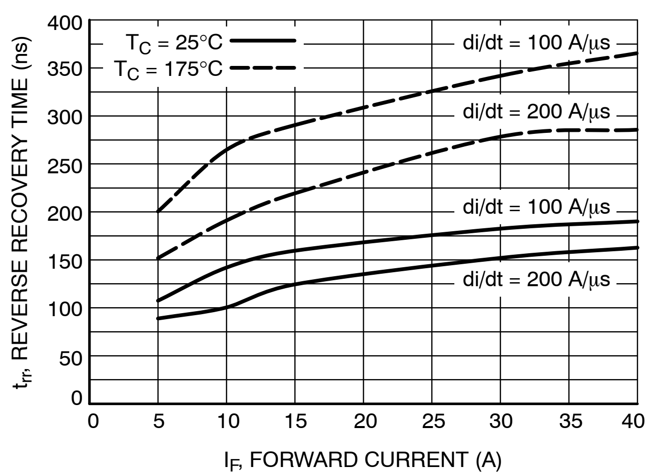


Figure 18. Reverse Recovery Time

TYPICAL CHARACTERISTICS

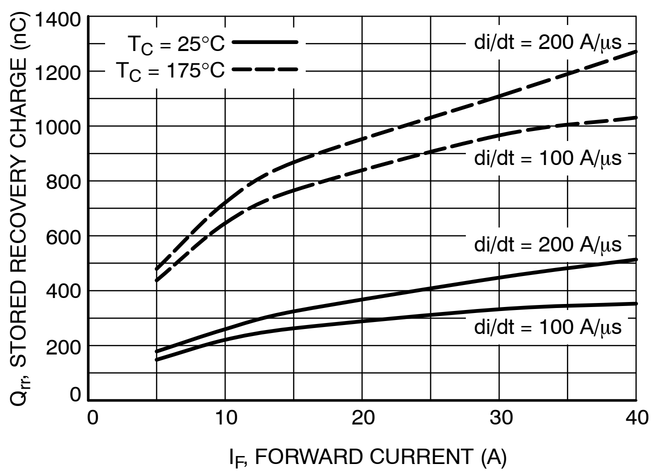


Figure 19. Stored Charge

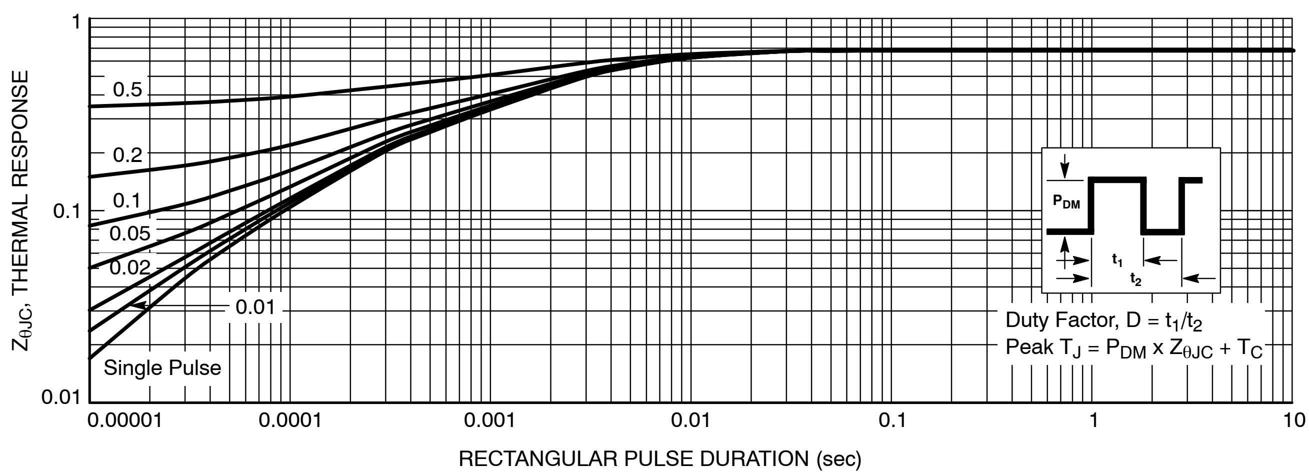


Figure 20. Transient Thermal Impedance of IGBT

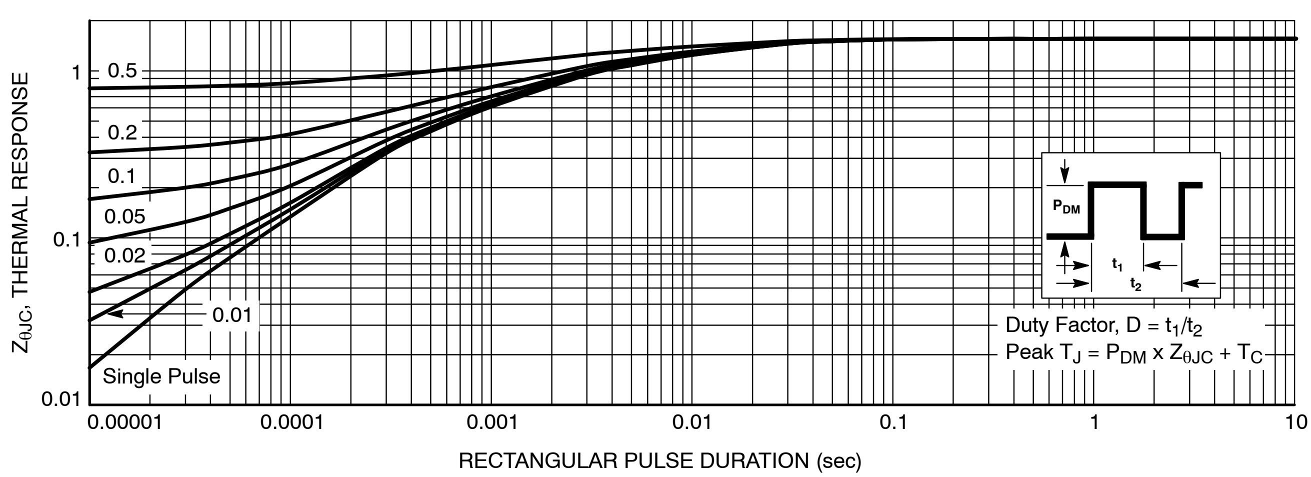
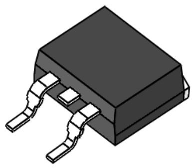


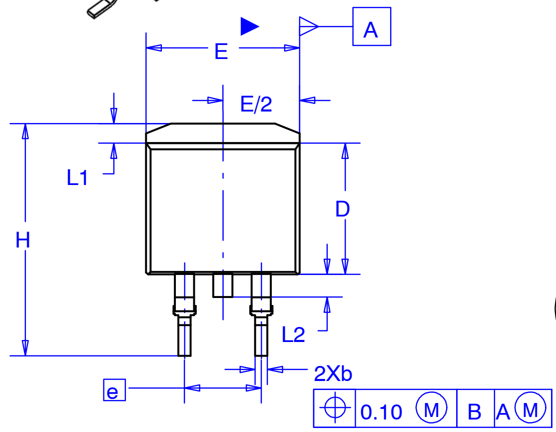
Figure 21. Transient Thermal Impedance of Diode

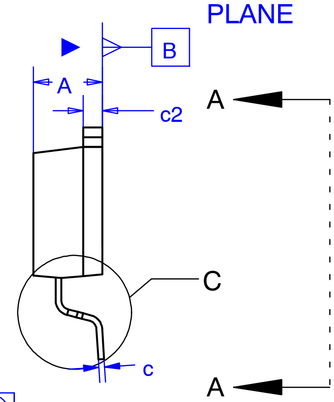


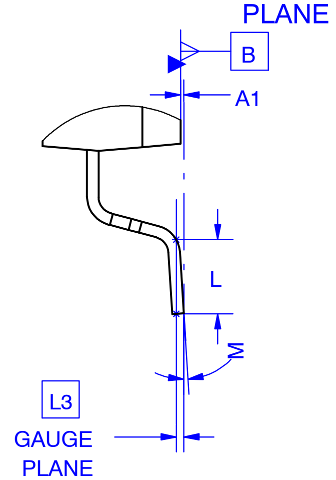
SCALE 1:1

D2PAK3 (TO−263−3LD)
CASE 221BQ
ISSUE O

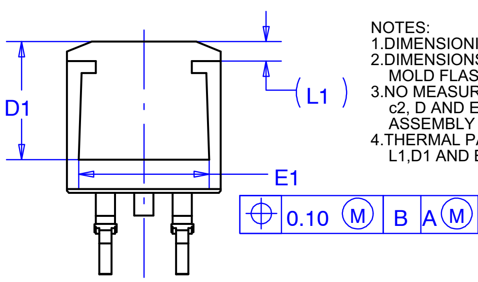
DATE 09 SEP 2020





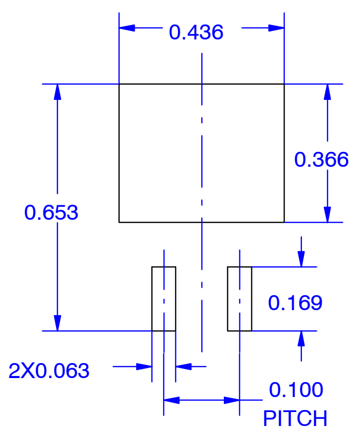


DETAIL C
SCALE 4 : 1



VIEW A−A

NOTES:
1.DIMENSIONING AND TOLERANCING PER ASME Y14.5M,2009.
2.DIMENSIONS c, c2 AND D, E DO NOT INCLUDE BURR AND MOLD FLASH.
3.NO MEASUREMENT AND OUTGOING VISION CAPABILITY ON c, c2, D AND E, FLASH AND BURR ARE UNAVOIDABLE IN ASSEMBLY PROCESS.
4.THERMAL PAD CONTOUR IS OPTIONAL WITH DIMENSIONS E, L1,D1 AND E1.



RECOMMENDED
MOUNTING FOOTPRINT

FOR additional information on our Pb−Free strategy and soldering,please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

GENERIC
MARKING DIAGRAM*

XXXXXX
XXXXXX
AYWWZZ

XXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Assembly Lot Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.160	0.190	4.060	4.830
A1	0.000	0.010	0.000	0.250
b	0.020	0.039	0.510	0.990
c	0.013	0.019	0.327	0.487
c2	0.047	0.054	1.200	1.360
D	0.334	0.350	8.490	8.890
D1	0.260	−−−	6.600	−−−
E	0.380	0.420	9.650	10.670
E1	0.245	−−−	6.220	−−−
e	0.200 BSC		5.080 BSC	
H	0.575	0.625	14.600	15.880
L	0.070	0.110	1.780	2.790
L1	−−−	0.066	−−−	1.680
L2	−−−	0.070	−−−	1.780
L3	0.010 BSC		0.250 BSC	
M	−8	8°	−8	8°

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