

Field Stop Trench IGBT

650 V, 40 A

Product Preview

AFGB40T65SPD-BW

General Description

Using the novel field stop 3rd generation IGBT technology, FGH40T65SPD-F085 offers the optimum performance with both low conduction loss and switching loss for a high efficiency operation in various applications, while provides 50 V higher blocking voltage and rugged high current switching reliability. Meanwhile, this part also offers an advantage of outstanding performance in parallel operation.

Features

- AEC-Q101 Qualified
- Low Saturation Voltage: $V_{CE(sat)} = 2.0$ V (Typ.) @ $I_C = 40$ A
- 100% of the Parts are Dynamically Tested (Note 1)
- Short Circuit Ruggedness > 5 μ s @ 25°C
- Maximum Junction Temperature: $T_J = 175^\circ\text{C}$
- Fast Switching
- Tight Parameter Distribution
- Positive Temperature Coefficient for Easy Parallel Operation
- Copacked with Soft, Fast Recovery Diode
- These Devices are Pb-Free and are RoHS Compliant

ABSOLUTE 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}	± 20	V
Transient Gate-to-Emitter Voltage		± 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 (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	267	W
Maximum Power Dissipation ($T_C = 100^\circ\text{C}$)		134	W
Short Circuit Withstand Time ($T_C = 25^\circ\text{C}$)	SCWT	5	μ s
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 to +175	$^\circ\text{C}$
Maximum Lead Temp. For Soldering Purposes, 1/8" from case for 5 seconds	T_L	300	$^\circ\text{C}$

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. $V_{CC} = 400$ V, $V_{GE} = 15$ V, $I_C = 120$ A, $R_G = 20$ Ω , Inductive Load
2. Repetitive rating: pulse width limited by max. junction temperature

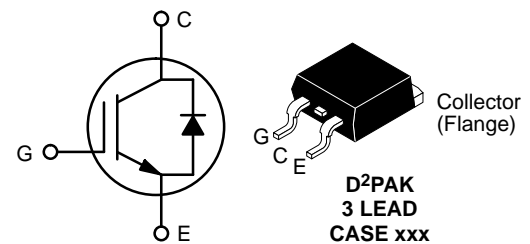
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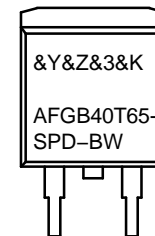
BV_{CES}	$V_{CE(sat)}$ TYP	I_C MAX
650 V	2.0 V	120 A



Typical Applications

- Onboard Charger
- AirCon Compressor
- PTC Heater
- Motor Drivers
- Other Automotive Power-train and Auxiliary Applications

MARKING DIAGRAM



&Y = ON Semiconductor Logo
&Z = Assembly Plant Code
&3 = 3-Digit Date Code
&K = 2-Digit Lot Traceability Code
AFGB40T65SPD-BW = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping†
AFGB40T65SPD-BW	D2PAK (TO-263AB)	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.

AFGB40T65SPD–BW

Table 1. THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Thermal Resistance Junction–to–Case, for IGBT	$R_{\theta JC}$	0.56	°C/W
Thermal Resistance Junction–to–Case, for Diode	$R_{\theta JC}$	1.71	
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
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OFF CHARACTERISTICS

Collector–to–Emitter Breakdown Voltage	BV_{CES}	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	650	–	–	V
Temperature Coefficient of Breakdown Voltage	$\Delta BV_{CES} / \Delta T_J$	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	–	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

ON CHARACTERISTICS

G–E Threshold Voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 400\text{ mA}$	4.0	5.8	7.5	V
Collector–to–Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 40\text{ A}, V_{GE} = 15\text{ V}, T_C = 25^\circ\text{C}$	–	2.0	2.4	V
		$I_C = 40\text{ A}, V_{GE} = 15\text{ V}, T_C = 125^\circ\text{C}$	–	2.9	–	V

DYNAMIC CHARACTERISTICS

Input Capacitance	C_{ies}	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	–	1520	–	pF
Output Capacitance	C_{oes}		–	92	–	
Reverse Transfer Capacitance	C_{res}		–	15	–	

SWITCHING CHARACTERISTICS

Turn–On Delay Time	$t_{d(on)}$	$V_{CC} = 400\text{ V}, I_C = 40\text{ A}, R_G = 6\ \Omega,$ $V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 25^\circ\text{C}$	–	18	–	ns
Rise Time	t_r		–	26	–	ns
Turn–Off Delay Time	$t_{d(off)}$		–	35	–	ns
Fall Time	t_f		–	10	–	ns
Turn–On Switching Loss	E_{on}		–	0.97	–	mJ
Turn–Off Switching Loss	E_{off}		–	0.28	–	mJ
Total Switching Loss	E_{ts}		–	1.25	–	mJ
Turn–On Delay Time	$t_{d(on)}$	$V_{CC} = 400\text{ V}, I_C = 40\text{ A}, R_G = 6\ \Omega,$ $V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 175^\circ\text{C}$	–	14	–	ns
Rise Time	t_r		–	35	–	ns
Turn–Off Delay Time	$t_{d(off)}$		–	38	–	ns
Fall Time	t_f		–	13	–	ns
Turn–On Switching Loss	E_{on}		–	1.61	–	mJ
Turn–Off Switching Loss	E_{off}		–	0.47	–	mJ
Total Switching Loss	E_{ts}		–	2.08	–	mJ
Short Circuit Withstand Time	$t_{d(on)}$	$V_{CC} = 400\text{ V}, R_G = 10\ \Omega, V_{GE} = 15\text{ V}$	5	–	–	μs
Total Gate Charge	Q_g	$V_{CE} = 400\text{ V}, I_C = 40\text{ A}, V_{GE} = 15\text{ V}$	–	36	–	nC
Gate–to–Emitter Charge	Q_{ge}		–	12	–	nC
Gate–to–Collector Charge	Q_{gc}		–	11	–	nC

AFGB40T65SPD–BW

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
DIODE CHARACTERISTICS						
Diode Forward Voltage	V_{FM}	$I_F = 10\text{ A}, T_C = 25^\circ\text{C}$	–	2.0	2.7	V
		$I_F = 10\text{ A}, T_C = 175^\circ\text{C}$	–	1.8	–	
Reverse Recovery Energy	E_{rec}	$I_F = 20\text{ A}$ $dI_F/dt = 200\text{ A}/\mu\text{s}, T_C = 175^\circ\text{C}$	–	51	–	μJ
Diode Reverse Recovery Time	t_{rr}	$I_F = 20\text{ A}$ $dI_F/dt = 200\text{ A}/\mu\text{s}, T_C = 25^\circ\text{C}$	–	34	–	ns
Diode Reverse Recovery Charge	Q_{rr}		–	56	–	nC
Diode Reverse Recovery Time	t_{rr}	$I_F = 20\text{ A}$ $dI_F/dt = 200\text{ A}/\mu\text{s}, T_C = 175^\circ\text{C}$	–	206	–	ns
Diode Reverse Recovery Charge	Q_{rr}		–	731	–	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 PERFORMANCE CHARACTERISTICS

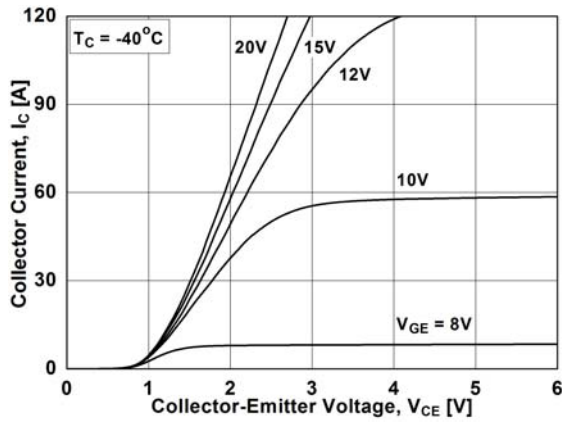


Figure 1. Typical Output Characteristics

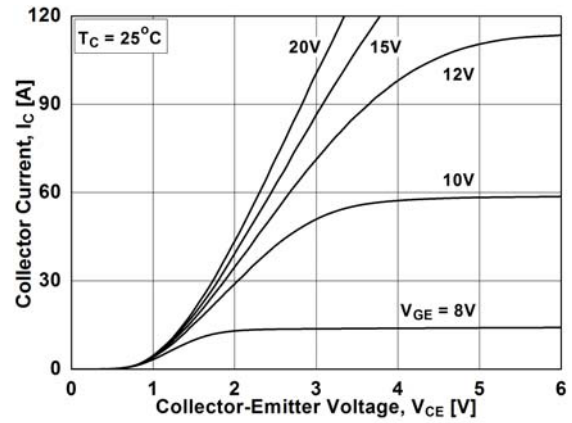


Figure 2. Typical Output Characteristics

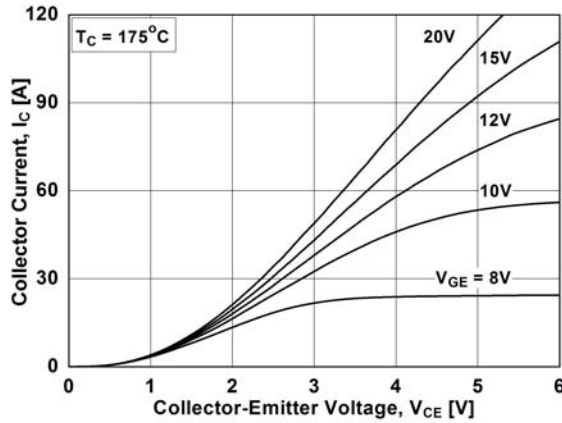


Figure 3. Typical Output Characteristics

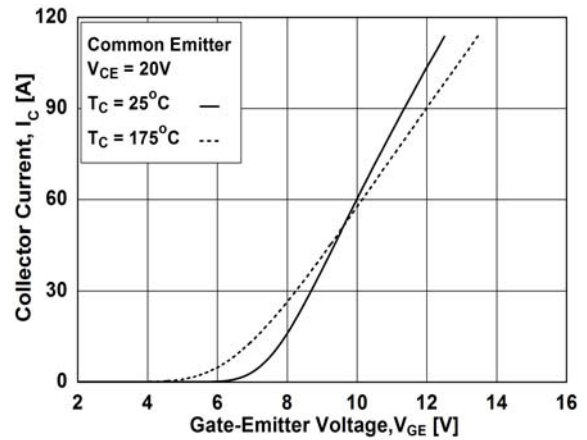


Figure 4. Transfer Characteristics

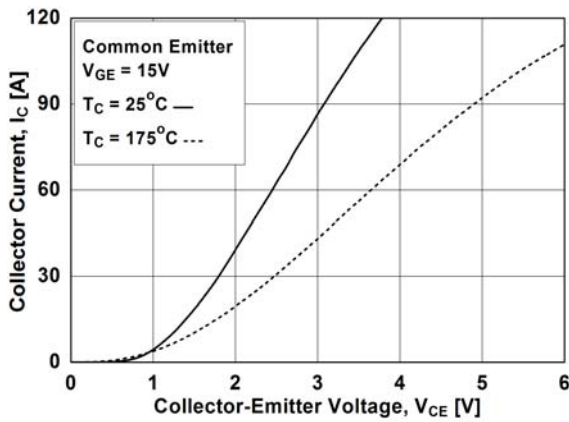


Figure 5. Typical Saturation Voltage

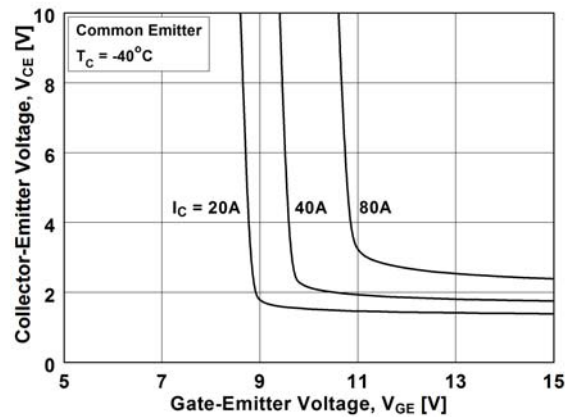


Figure 6. Saturation Voltage vs. V_{GE} Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS

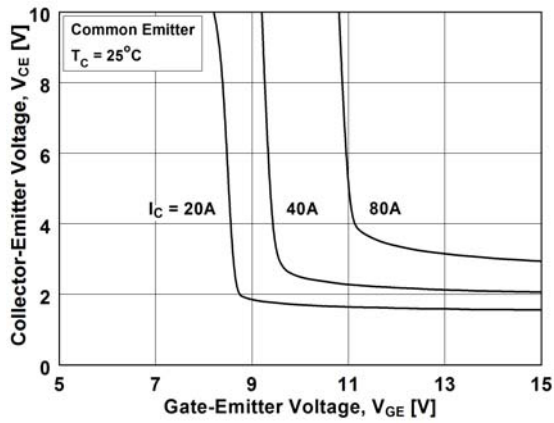


Figure 7. Saturation Voltage vs. V_{GE}

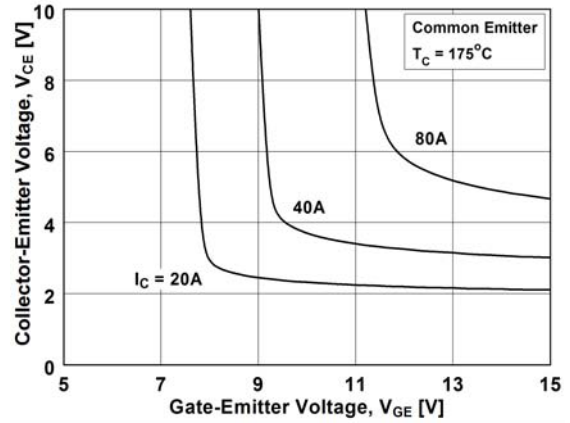


Figure 8. Saturation Voltage vs. V_{GE}

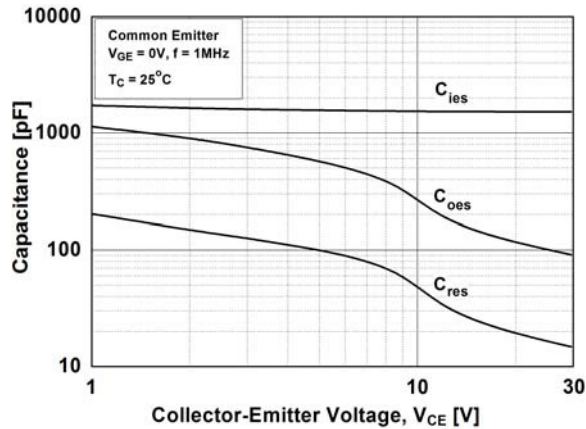


Figure 9. Capacitance Characteristics

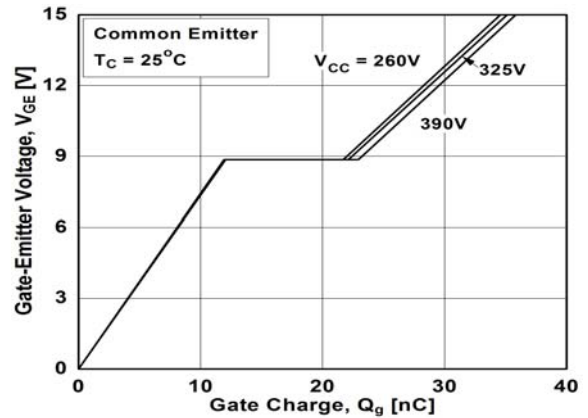


Figure 10. Gate Charge Characteristics

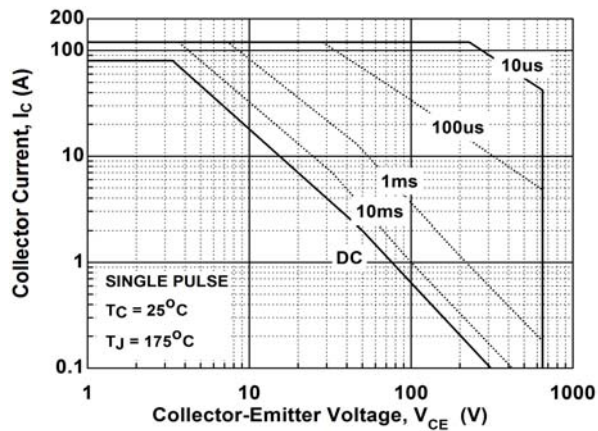


Figure 11. SOA Characteristics

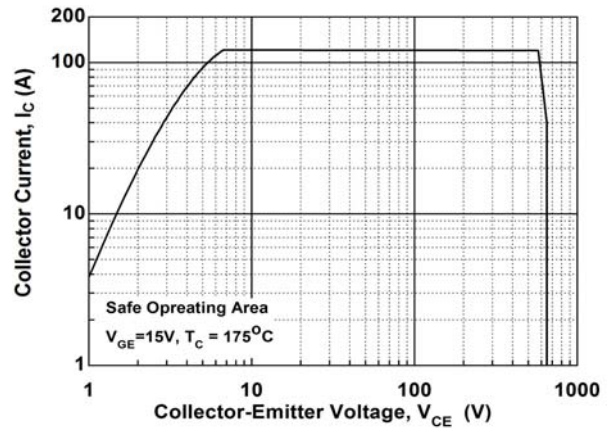


Figure 12. Turn-off Switching SOA Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS

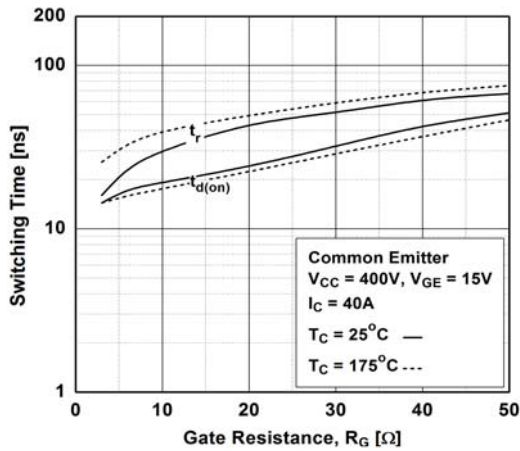


Figure 13. Turn-on Characteristics vs. Gate Resistance

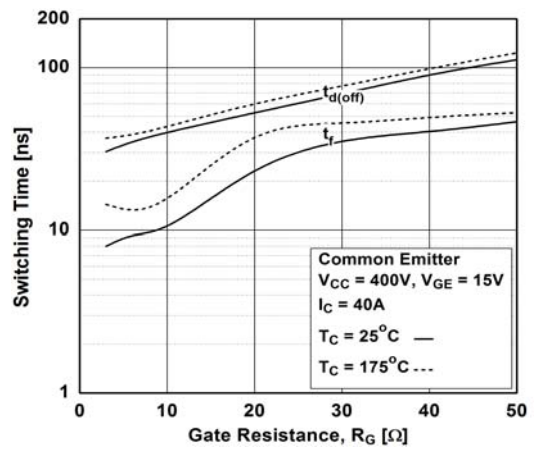


Figure 14. Turn-off Characteristics vs. Gate Resistance

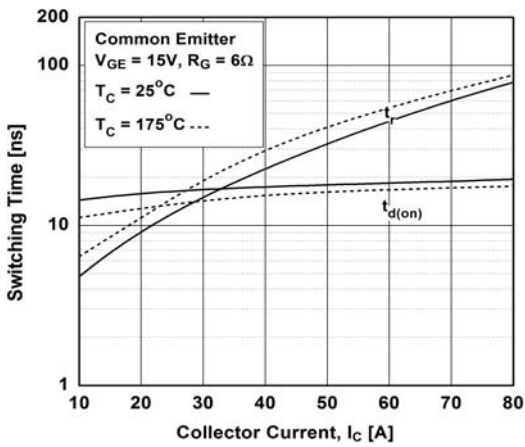


Figure 15. Turn-on Characteristics vs. Collector Current

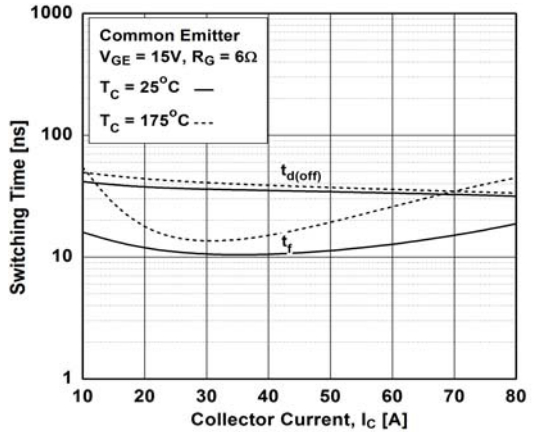


Figure 16. Turn-off Characteristics vs. Collector Current

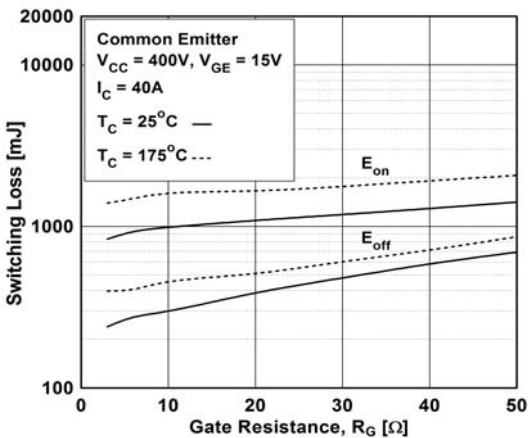


Figure 17. Switching Loss vs. Gate Resistance

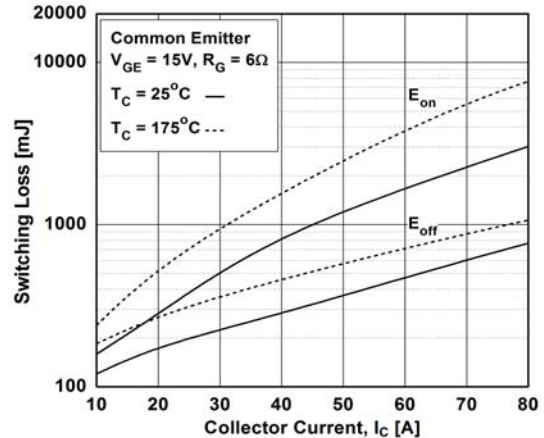


Figure 18. Switching Loss vs. Collector Current

TYPICAL PERFORMANCE CHARACTERISTICS

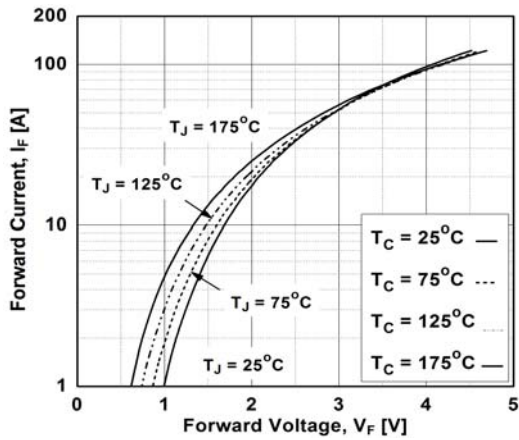


Figure 19. Forward Characteristics

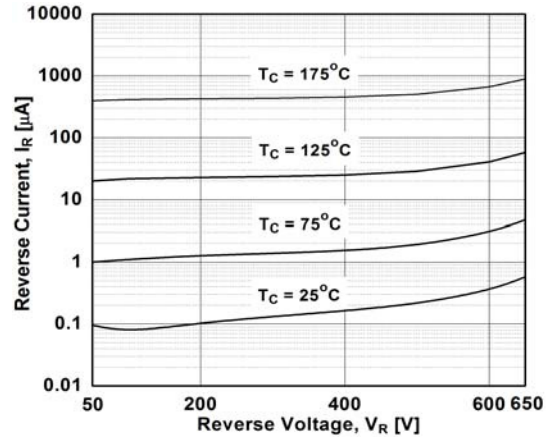


Figure 20. Reverse Current

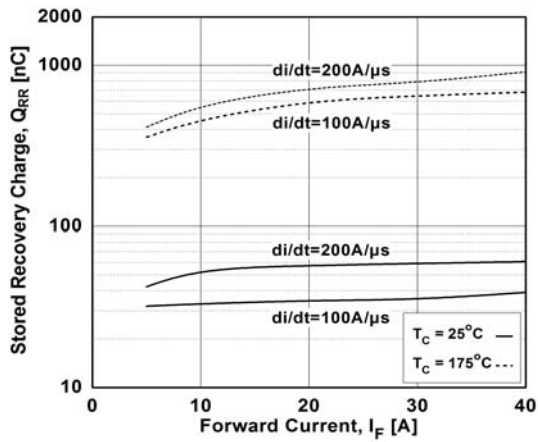


Figure 21. Stored Charge

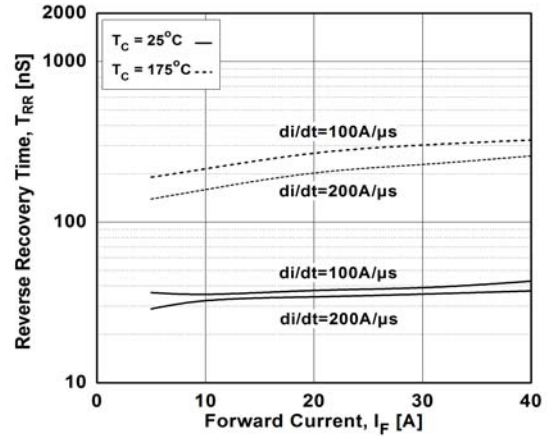


Figure 22. Reverse Recovery Time

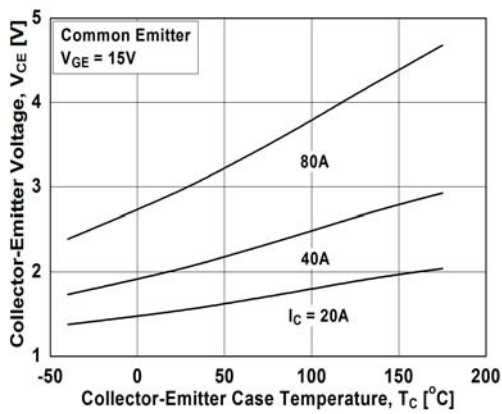


Figure 23. Saturation Voltage vs. Case Temperature at Variant Current Level

TYPICAL PERFORMANCE CHARACTERISTICS

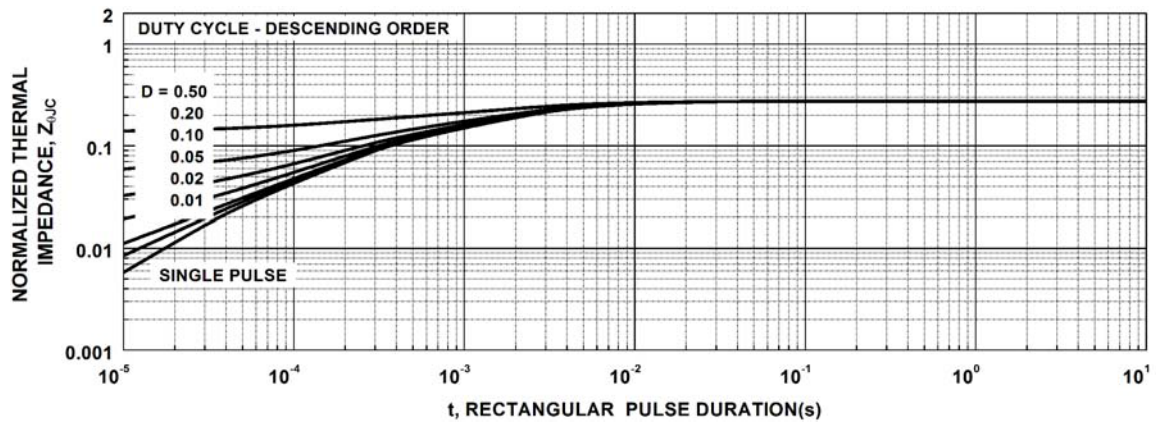


Figure 24. Transient Thermal Impedance of IGBT

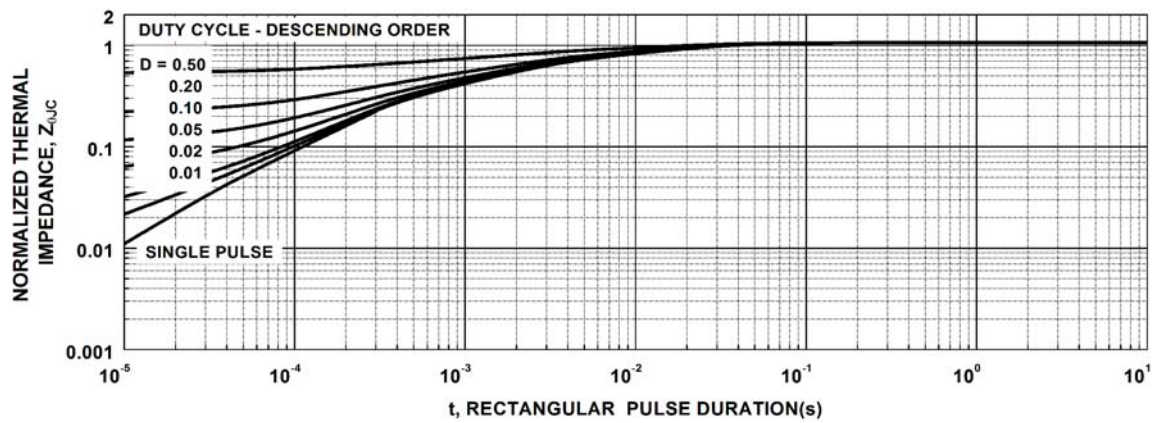
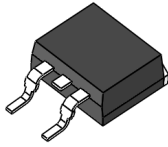


Figure 25. Transient Thermal Impedance of Diode

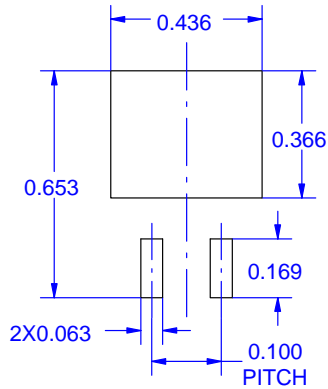
AFGB40T65SPD-BW

PACKAGE DIMENSIONS



D²PAK-3 (TO-263, 3-LEAD)

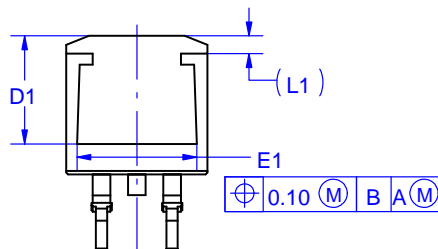
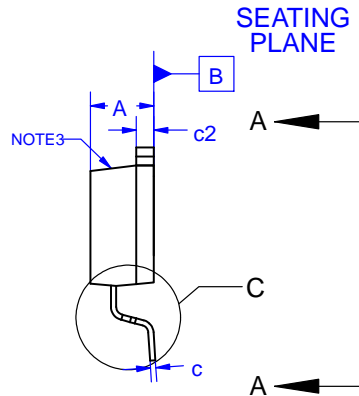
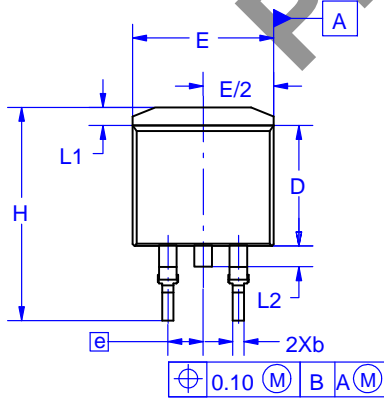
CASE xxx
ISSUE ?



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: INCHES
3. 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 EXTREMS OF THE PLASTIC BODY AT DATUM H.
4. THERMAL PAD CONTOUR IS OPTIONAL WITH DIMENSIONS E, L1, D1 AND E1.

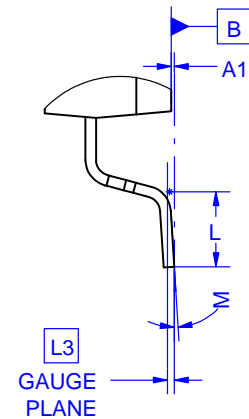
RECOMMENDED MOUNTING FOOTPRINT

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




VIEW A-A

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	0.048	0.054	1.220	1.380
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	0.100 BSC		2.540 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



DETAIL C
SCALE 4 : 1

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