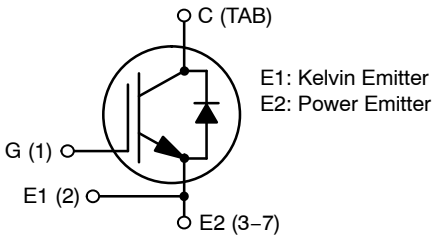
IGBT – Power, Co-PAK N-Channel, Field Stop VII (FS7), BPAK

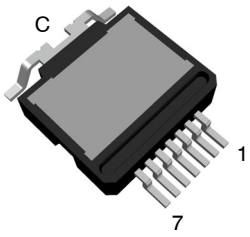
1200 V, 1.33 V, 40 A

AFGBP40T120SWD

BV_{CES}	$V_{CE(sat)}$ TYP	I_C MAX
1200 V	1.33 V	40 A

COPAK IGBT





BPAK7
CASE 763AA

Description

Using the novel field stop 7th generation IGBT technology and the Gen7 Diode in top-side cooled package (BPAK). The design choice ensures direct thermal contact with the heatsink, resulting in an improvement of the thermal performance. Overall, this device offers the optimum performance with low on state voltage, better thermal performance and minimal switching losses for both hard and soft switching topologies in automotive applications.

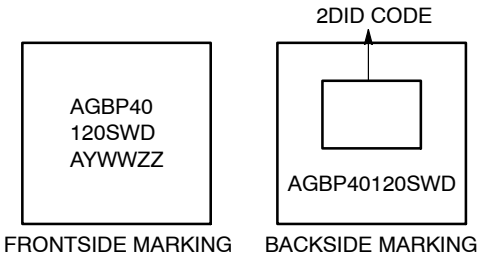
Features

- Extremely Efficient Trench with Field Stop Technology
- BPAK, a New Top-side Cooled Package Designed to Meet High Voltage and Improve Thermal Performance
- The Creepage Distance Exceeding 5.6 mm to Align with the IEC60664-1 for Voltages Up to 800 V
- Maximum Junction Temperature T_J = 175 °C
- AEC-Q101 Qualified, PPAP Available Upon Request
- This Device is Lead Pb-Free, Halogen Free and RoHS Compliant

Applications

- OBC

MARKING DIAGRAM



AGBP40120SWD = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Assembly Lot Code

ORDERING INFORMATION

Device	Package	Shipping†
AFGBP40T120SWD	BPAK	800 / 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.

MAXIMUM RATINGS (T_J = 25 °C unless otherwise noted)

Parameter		Symbol	Value	Unit
Collector-to-Emitter Voltage		V_{CE}	1200	V
Gate-to-Emitter Voltage		V_{GE}	±20	V
Transient Gate-to-Emitter Voltage			±30	V
Collector Current	T_C = 25 °C	I_C	80	A
	T_C = 100 °C		40	
Power Dissipation	T_C = 25 °C	P_D	681	W
	T_C = 100 °C		340	
Pulsed Collector Current	T_C = 25 °C, t_p = 10 μs (Note 1)	I_{CM}	120	A
Diode Forward Current	T_C = 25 °C	I_F	80	A
	T_C = 100 °C		40	
Pulsed Diode Maximum Forward Current	T_C = 25 °C, t_p = 10 μs (Note 1)	I_{FM}	120	A
Operating Junction and Storage Temperature Range		T_J, T_{STG}	−55 to +175	°C
Lead Temperature for Soldering Purposes		T_L	260	°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. Single pulse, limited by junction temperature

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case for IGBT	$R_{\theta JC}$	0.22	°C/W
Thermal Resistance, Junction-to-Case for Diode		0.44	
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	40	

ELECTRICAL CHARACTERISTICS (T_J = 25 °C unless otherwise stated)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-to-Emitter Breakdown Voltage	BV_{CES}	V_{GE} = 0 V, I_C = 1 mA	1200			V
Collector-to-Emitter Breakdown Voltage Temperature Coefficient	$\Delta BV_{CES}/\Delta T_J$	V_{GE} = 0 V, I_C = 9.99 mA		1234		mV/°C
Zero Gate Voltage Collector Current	I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V			40	μA
Gate-to-Emitter Leakage Current	I_{GES}	V_{GE} = ±20 V, V_{CE} = 0 V			±400	nA
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GE(TH)}$	V_{GE} = V_{CE}, I_C = 40 mA	4.45	5.73	6.53	V
Collector-to-Emitter Saturation Voltage	$V_{CE(SAT)}$	V_{GE} = 15 V, I_C = 40 A, T_J = 25 °C	0.96	1.33	1.7	
		V_{GE} = 15 V, I_C = 40 A, T_J = 175 °C		1.57		
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{IES}	V_{GE} = 0 V, V_{CE} = 30 V, f = 1 MHz		4687		pF
Output Capacitance	C_{OES}			141		
Reverse Transfer Capacitance	C_{RES}			20.5		
Total Gate Charge	Q_G	V_{GE} = 15 V, V_{CE} = 800 V, I_C = 40 A		155		nC
Gate-to-Emitter Charge	Q_{GE}			37.9		
Gate-to-Collector Charge	Q_{GC}			58.9		
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(ON)}$	V_{GE} = 0/15 V, V_{CE} = 800 V, I_C = 20 A, R_G = 10 Ω, T_J = 25 °C		46		ns
Turn-Off Delay Time	$t_{d(OFF)}$			352		
Rise Time	t_r			26		
Fall Time	t_f			152		
Turn-On Switching Loss	E_{ON}			2.60		mJ
Turn-Off Switching Loss	E_{OFF}			2.07		
Total Switching Loss	E_{TOT}			4.67		
Turn-On Delay Time	$t_{d(ON)}$	V_{GE} = 0/15 V, V_{CE} = 800 V, I_C = 40 A, R_G = 10 Ω, T_J = 25 °C		48		ns
Turn-Off Delay Time	$t_{d(OFF)}$			258		
Rise Time	t_r			60		
Fall Time	t_f			138		
Turn-On Switching Loss	E_{ON}			5.34		mJ
Turn-Off Switching Loss	E_{OFF}			3.00		
Total Switching Loss	E_{TOT}			8.34		
Turn-On Delay Time	$t_{d(ON)}$	V_{GE} = 0/15 V, V_{CE} = 800 V, I_C = 20 A, R_G = 10 Ω, T_J = 175 °C		40		ns
Turn-Off Delay Time	$t_{d(OFF)}$			408		
Rise Time	t_r			26		
Fall Time	t_f			250		
Turn-On Switching Loss	E_{ON}			2.80		mJ
Turn-Off Switching Loss	E_{OFF}			2.95		
Total Switching Loss	E_{TOT}			5.75		

ELECTRICAL CHARACTERISTICS (T_J = 25 °C unless otherwise stated) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(ON)}$	V_{GE} = 0/15 V, V_{CE} = 800 V, I_C = 40 A, R_G = 10 Ω, T_J = 175 °C		44		ns
Turn-Off Delay Time	$t_{d(OFF)}$			274		
Rise Time	t_r			52		
Fall Time	t_f			218		
Turn-On Switching Loss	E_{ON}			5.61		mJ
Turn-Off Switching Loss	E_{OFF}			3.82		
Total Switching Loss	E_{TOT}			9.44		
DIODE CHARACTERISTICS						
Forward Voltage	V_F	I_F = 40 A, T_J = 25 °C	1.00	1.40	1.80	V
		I_F = 40 A, T_J = 175 °C		1.43		
DIODE SWITCHING CHARACTERISTICS, INDUCTIVE LOAD						
Reverse Recovery Time	t_{RR}	V_R = 800 V, I_F = 20 A, dI_F/dt = 500 A/μs, T_J = 25 °C		275		ns
Reverse Recovery Charge	Q_{RR}			3193		nC
Reverse Recovery Energy	E_{REC}			1.4		mJ
Peak Reverse Recovery Current	I_{RRM}			19.4		A
Reverse Recovery Time	t_{RR}	V_R = 800 V, I_F = 40 A, dI_F/dt = 500 A/μs, T_J = 25 °C		330		ns
Reverse Recovery Charge	Q_{RR}			4971		nC
Reverse Recovery Energy	E_{REC}			2.4		mJ
Peak Reverse Recovery Current	I_{RRM}			25.0		A
Reverse Recovery Time	t_{RR}	V_R = 800 V, I_F = 20 A, dI_F/dt = 500 A/μs, T_J = 175 °C		415		ns
Reverse Recovery Charge	Q_{RR}			6905		nC
Reverse Recovery Energy	E_{REC}			3.6		mJ
Peak Reverse Recovery Current	I_{RRM}			28.0		A
Reverse Recovery Time	t_{RR}	V_R = 800 V, I_F = 40 A, dI_F/dt = 500 A/μs, T_J = 175 °C		555		ns
Reverse Recovery Charge	Q_{RR}			9401		nC
Reverse Recovery Energy	E_{REC}			4.9		mJ
Peak Reverse Recovery Current	I_{RRM}			31.6		A

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.

NOTE: For optimal lifetime and reliability, **onsemi** recommends operating conditions not exceeding 80% of the maximum ratings specified in this datasheet.

TYPICAL CHARACTERISTICS

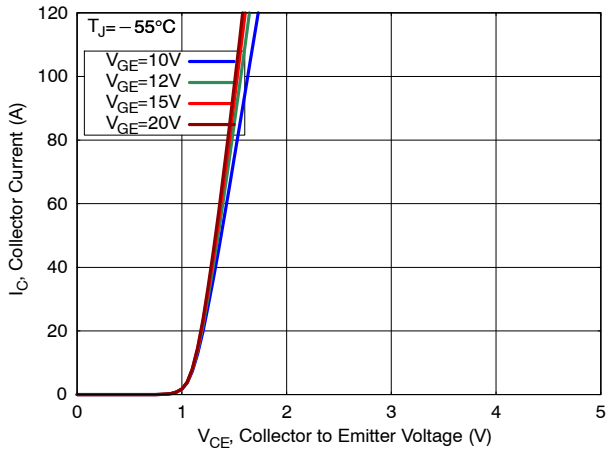


Figure 1. Output Characteristics

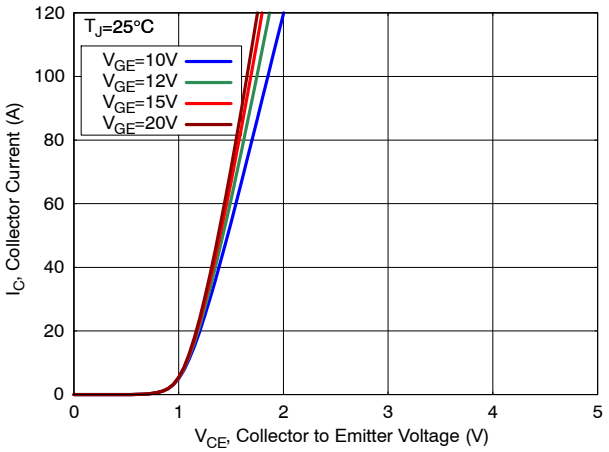


Figure 2. Output Characteristics

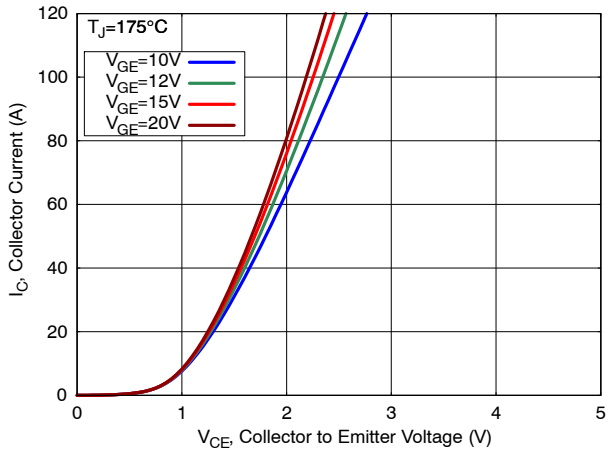


Figure 3. Output Characteristics

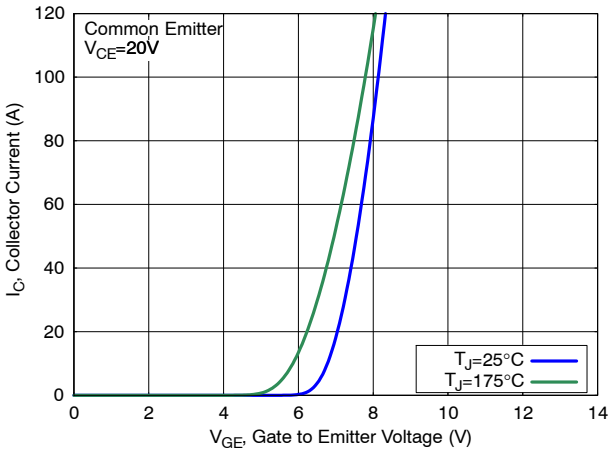


Figure 4. Transfer Characteristics

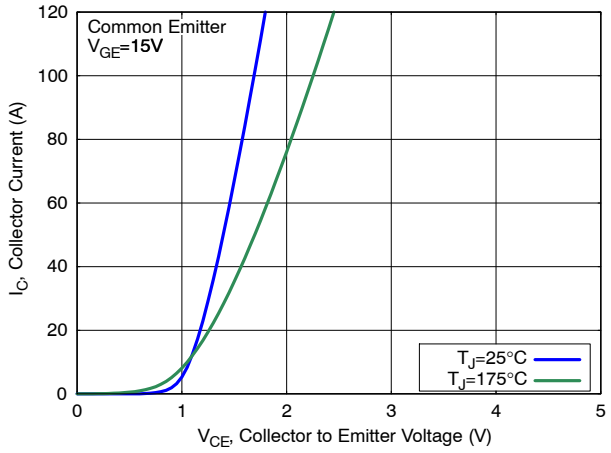


Figure 5. Saturation Characteristics

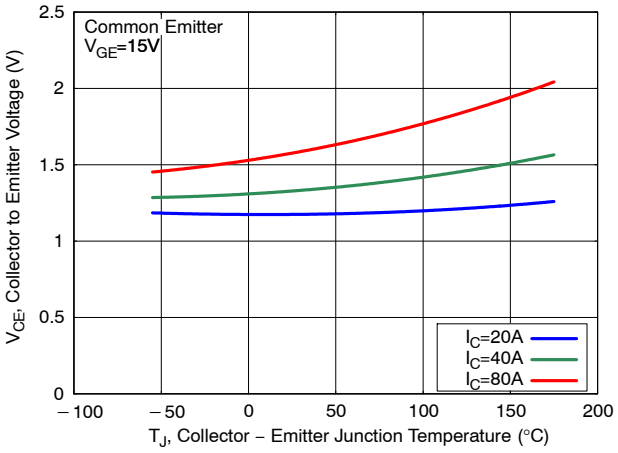


Figure 6. Saturation Voltage vs. Junction Temperature

TYPICAL CHARACTERISTICS

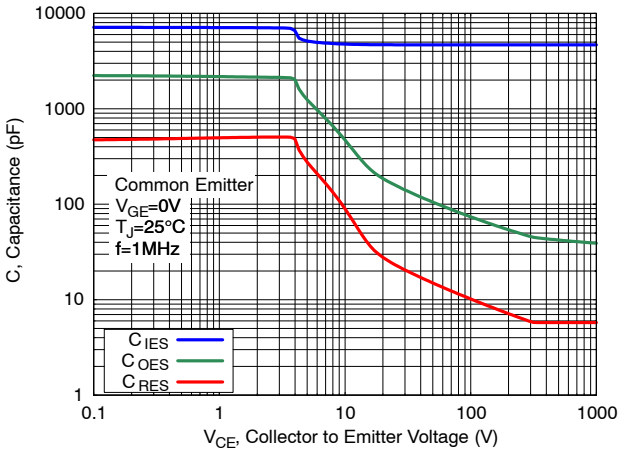


Figure 7. Capacitance Characteristics

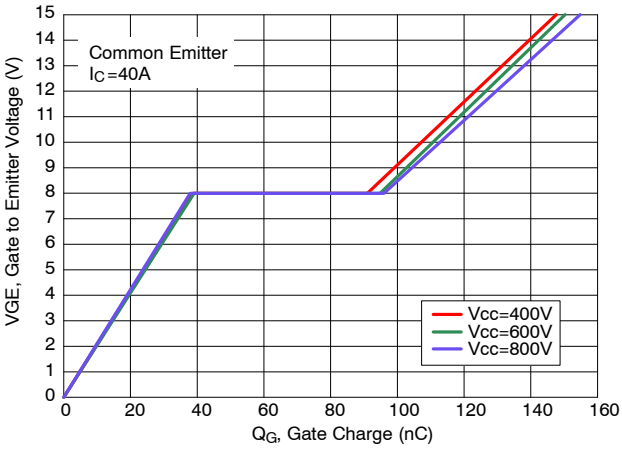


Figure 8. Gate Charge Characteristics

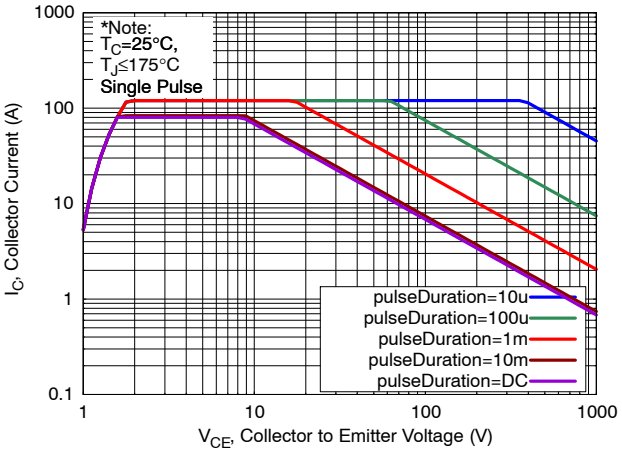


Figure 9. Max SOA Characteristics

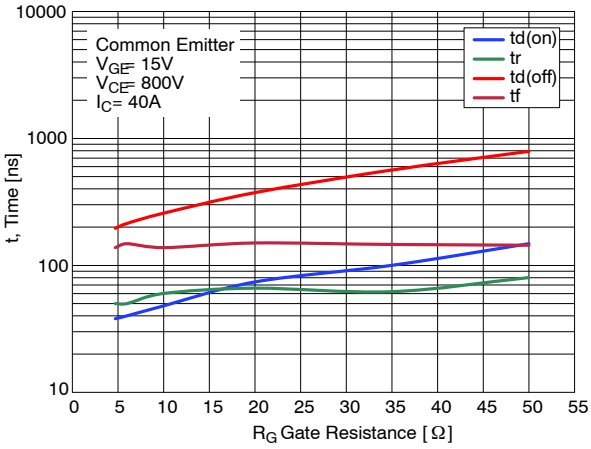


Figure 10. Switching Time vs. Gate Resistance

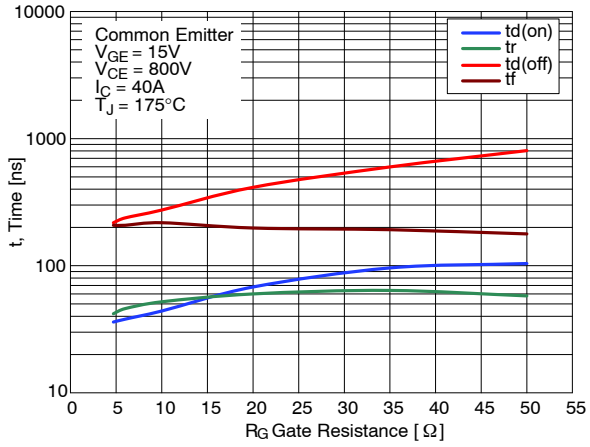


Figure 11. Switching Time vs. Gate Resistance

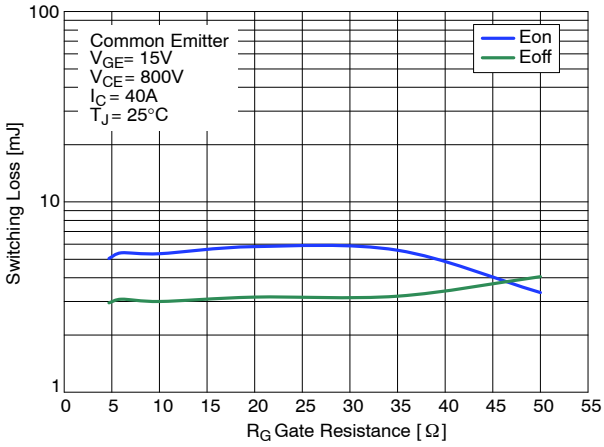


Figure 12. Switching Loss vs. Gate Resistance

TYPICAL CHARACTERISTICS

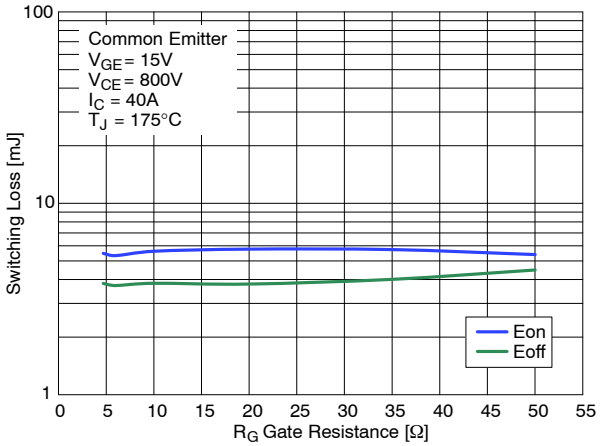


Figure 13. Switching Loss vs. Gate Resistance

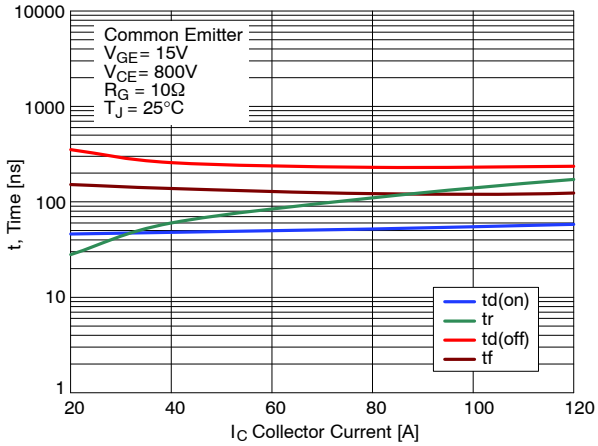


Figure 14. Switching Time vs. Collector Current

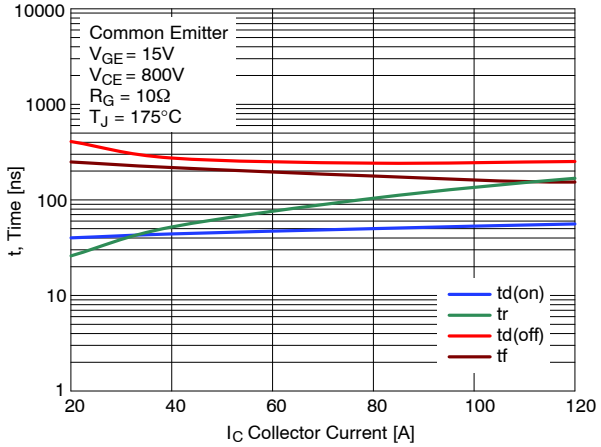


Figure 15. Switching Time vs. Collector Current

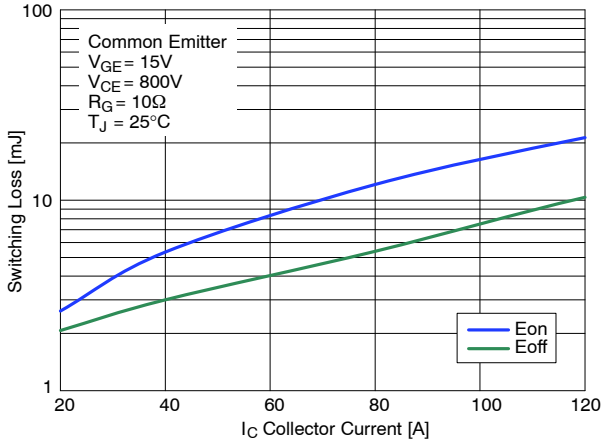


Figure 16. Switching Loss vs. Collector Current

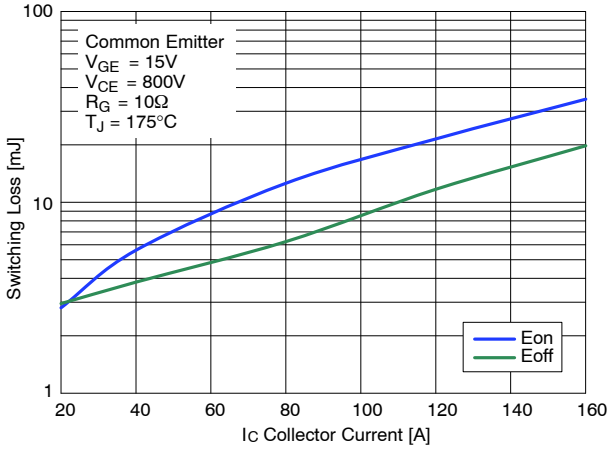


Figure 17. Switching Loss vs. Collector Current

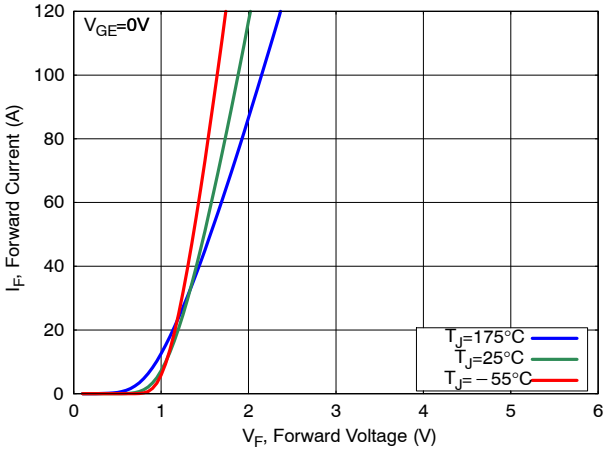


Figure 18. Diode Forward Characteristics

TYPICAL CHARACTERISTICS

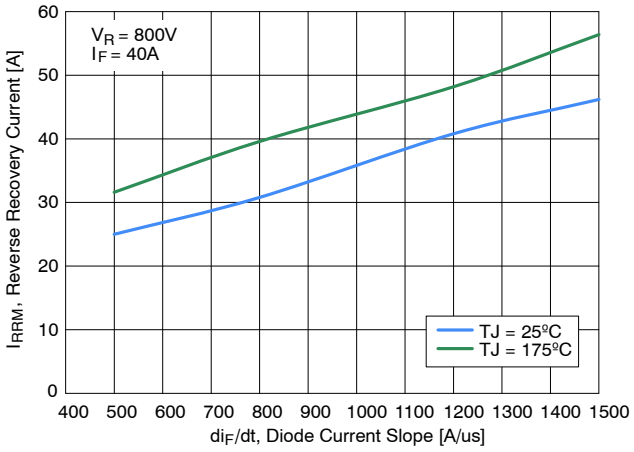


Figure 19. Diode Reverse Recovery Current

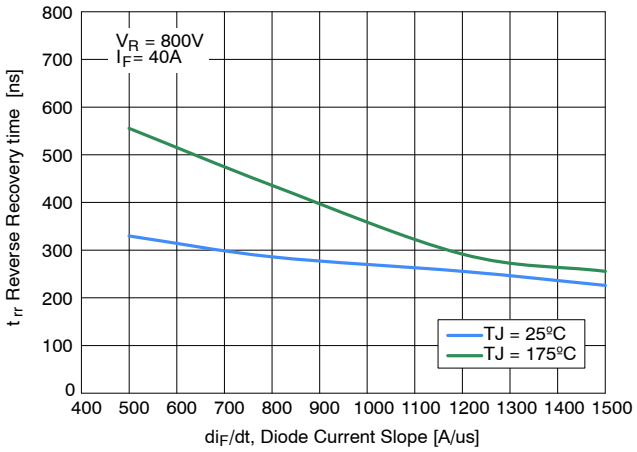


Figure 20. Diode Reverse Recovery Time

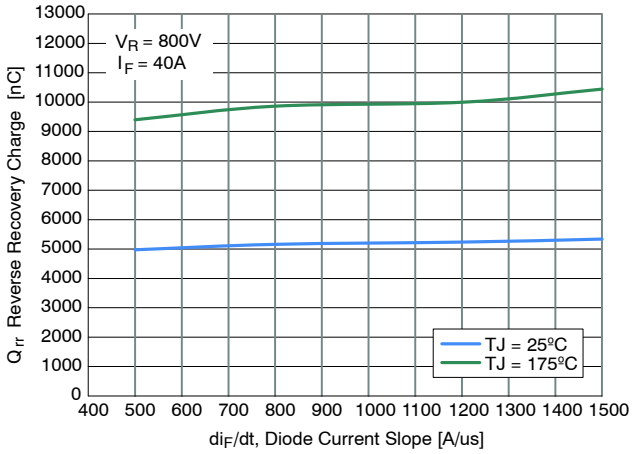


Figure 21. Diode Stored Charge Characteristics

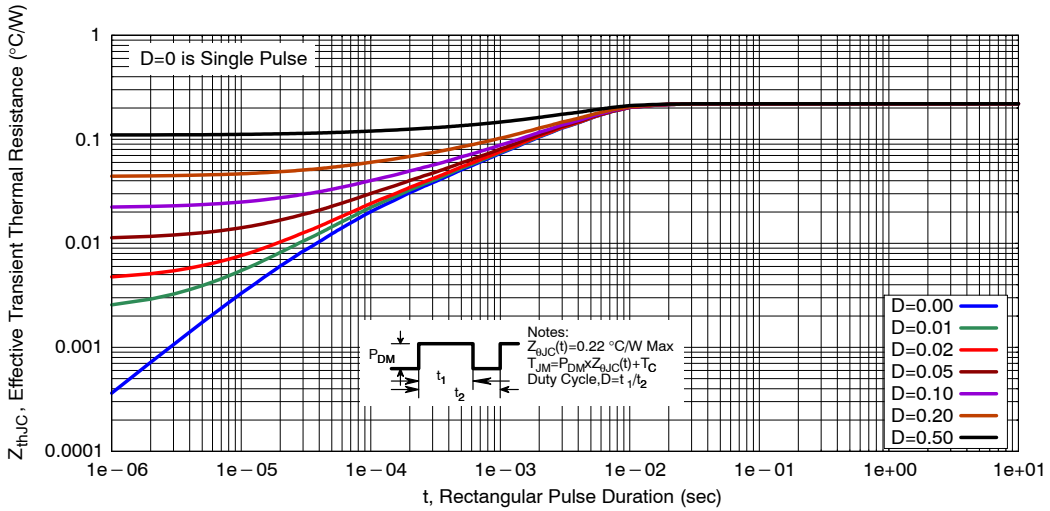


Figure 22. Max Transient Thermal Impedance of IGBT

TYPICAL CHARACTERISTICS

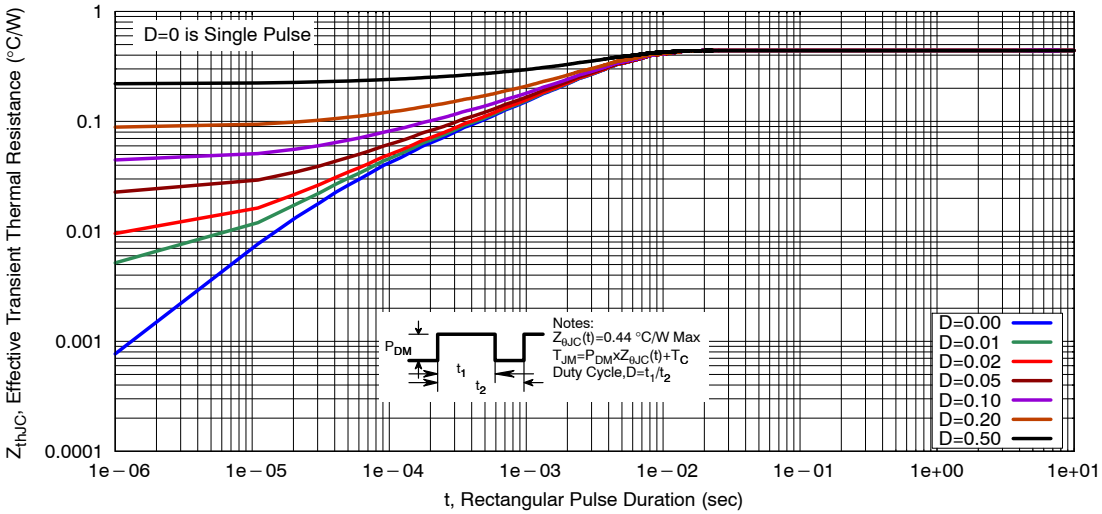


Figure 23. Max Transient Thermal Impedance of Diode

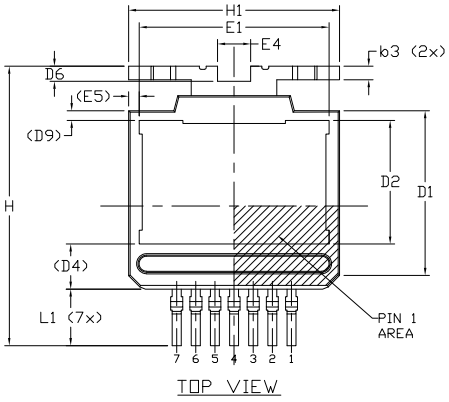
REVISION HISTORY

Revision	Description of Changes	Date
0	Initial public release	7/21/2025

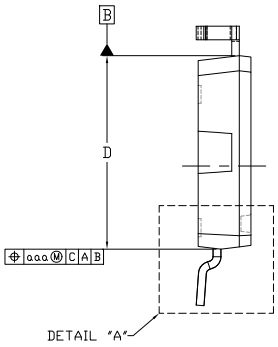
This document has undergone updates prior to the inclusion of this revision history table. The changes tracked here only reflect updates made on the noted approval dates.

PACKAGE DIMENSIONS

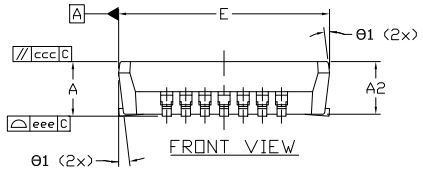
BPAK7 14.00x12.85x3.50, 1.27P
CASE 763AA
ISSUE A



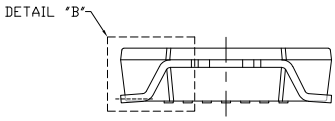
TOP VIEW



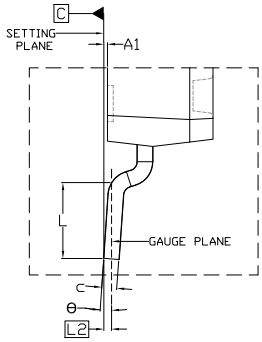
SIDE VIEW



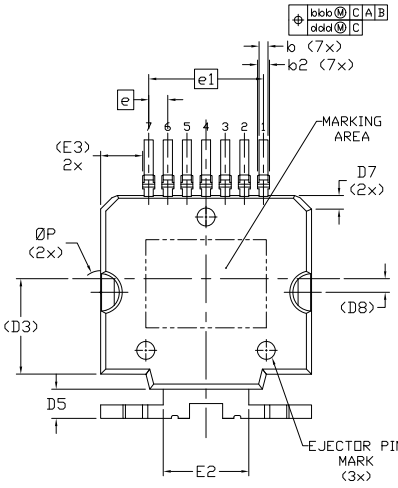
FRONT VIEW



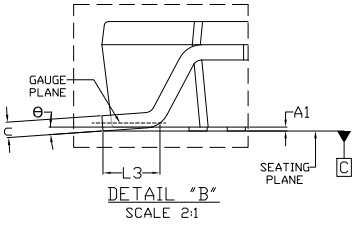
REAR VIEW



DETAIL "A"
SCALE 2:1



BOTTOM VIEW



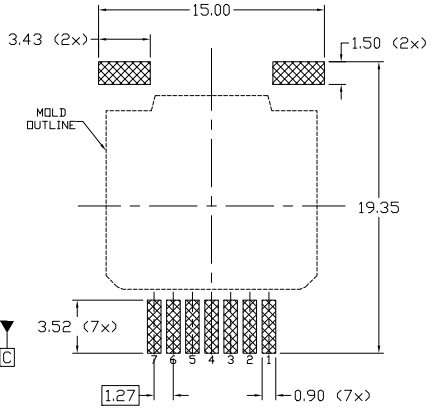
DETAIL "B"
SCALE 2:1

NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15mm PER SIDE.
4. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5. DIMENSIONS A1 IS THE LEAD STAND-OFF FROM THE BOTTOM SURFACE OF THE PACKAGE BODY.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	3.53	3.63	3.73
A1	0.05	0.15	0.25
A2	3.40	3.50	3.60
b	0.50	0.60	0.70
b2	0.60	0.80	1.00
b3	0.80	0.90	1.00
c	0.45	0.55	0.65
D	12.75	12.85	12.95
D1	10.84	10.94	11.04
D2	7.85	8.10	8.35
D3	6.32 REF.		
D4	3.00 REF.		
D5	1.85	1.95	2.05
D6	0.90	1.00	1.10
D7	0.85	0.91	1.05
D8	0.90 REF.		
D9	0.82 REF.		
E	13.90	14.00	14.10
E1	12.50	12.60	12.70
E2	5.58	5.68	5.78

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
E3	2.79 REF.		
E4	2.10	2.20	2.30
E5	0.70 REF.		
e	1.27 BSC		
e1	7.62 BSC		
H	18.05	18.55	19.05
H1	13.80	14.00	14.20
L	2.32	2.47	2.62
L1	3.65	3.75	3.85
L2	0.26 BSC		
L3	1.79	1.89	1.99
P	2.40	2.50	2.60
θ	0°	---	8°
θ1	0°	--	7°
aaa	0.20		
bbb	0.25		
ccc	0.20		
ddd	0.20		
eee	0.20		



RECOMMENDATION MOUNTING FOOTPRINT*

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

ADDITIONAL INFORMATION

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