

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

1200 V, 1.33 V, 40 A

AFGBP40T120SWD

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.

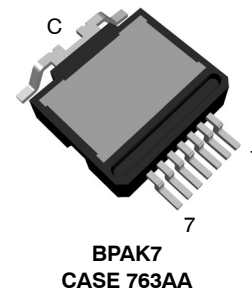
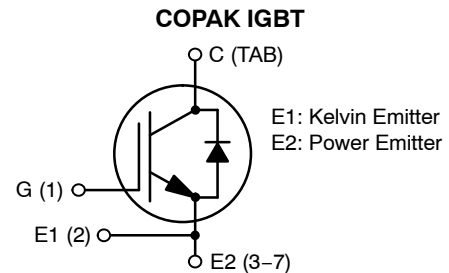
Features

- 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 $T_J = 175\text{ }^{\circ}\text{C}$
- AEC-Q101 Qualified, PPAP Available Upon Request
- This Device is Lead Pb-Free, Halogen Free and RoHS Compliant

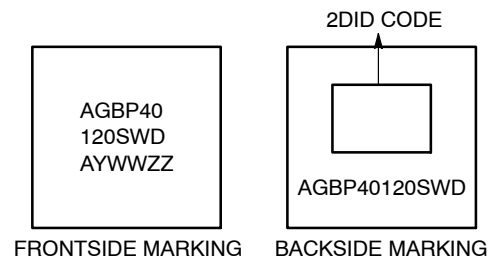
Applications

- OBC

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



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](#).

AFGBP40T120SWD

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 _{θJC}	0.22	°C/W
Thermal Resistance, Junction-to-Case for Diode		0.44	
Thermal Resistance, Junction-to-Ambient	R _{θJA}	40	

AFGBP40T120SWD

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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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	ΔBV _{CES} /ΔT _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}	V _{GE} = 0/15 V, V _{CE} = 800 V, I _C = 20 A, R _G = 10 Ω, T _J = 25 °C		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}	V _{GE} = 0/15 V, V _{CE} = 800 V, I _C = 40 A, R _G = 10 Ω, T _J = 175 °C		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}	V _{GE} = 0/15 V, V _{CE} = 800 V, I _C = 20 A, R _G = 10 Ω, T _J = 175 °C		2.80		mJ
Turn-Off Switching Loss	E _{OFF}			2.95		
Total Switching Loss	E _{TOT}			5.75		

AFGBP40T120SWD

ELECTRICAL CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise stated) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GE} = 0/15\text{ V}, V_{CE} = 800\text{ V},$ $I_C = 40\text{ A}, R_G = 10\text{ }\Omega,$ $T_J = 175\text{ }^{\circ}\text{C}$		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	$I_F = 40\text{ A}, T_J = 25\text{ }^{\circ}\text{C}$	1.00	1.40	1.80	V
		$I_F = 40\text{ A}, T_J = 175\text{ }^{\circ}\text{C}$		1.43		

DIODE SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

Reverse Recovery Time	t_{RR}	$V_R = 800\text{ V}, I_F = 20\text{ A},$ $di_F/dt = 500\text{ A}/\mu\text{s}, T_J = 25\text{ }^{\circ}\text{C}$		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}	$V_R = 800\text{ V}, I_F = 40\text{ A},$ $di_F/dt = 500\text{ A}/\mu\text{s}, T_J = 25\text{ }^{\circ}\text{C}$		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}	$V_R = 800\text{ V}, I_F = 20\text{ A},$ $di_F/dt = 500\text{ A}/\mu\text{s}, T_J = 175\text{ }^{\circ}\text{C}$		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}	$V_R = 800\text{ V}, I_F = 40\text{ A},$ $di_F/dt = 500\text{ A}/\mu\text{s}, T_J = 175\text{ }^{\circ}\text{C}$		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.

AFGBP40T120SWD

TYPICAL CHARACTERISTICS

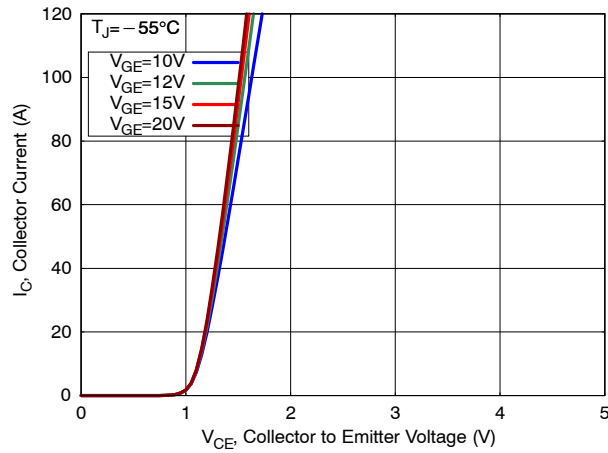


Figure 1. Output Characteristics

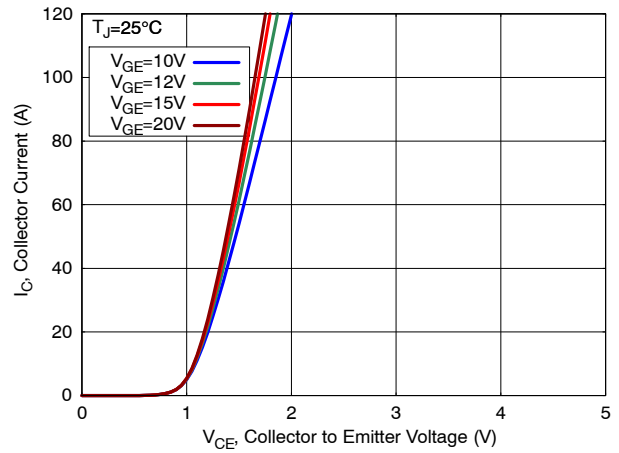


Figure 2. Output Characteristics

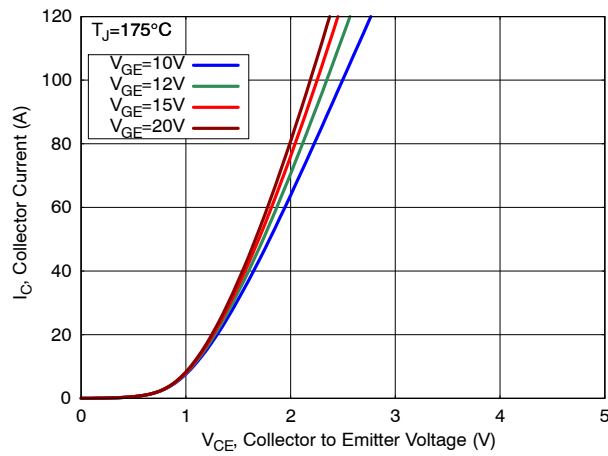


Figure 3. Output Characteristics

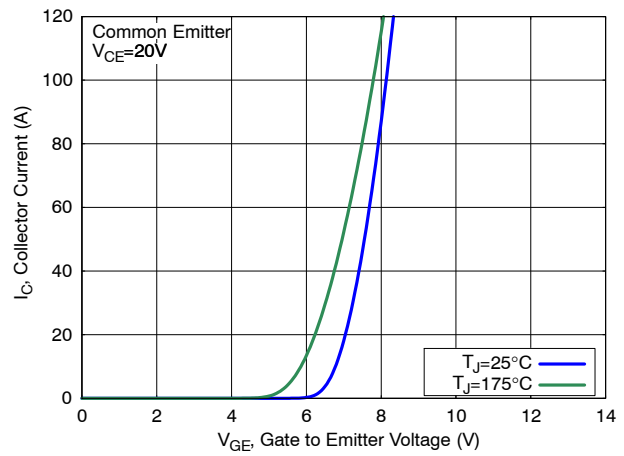


Figure 4. Transfer Characteristics

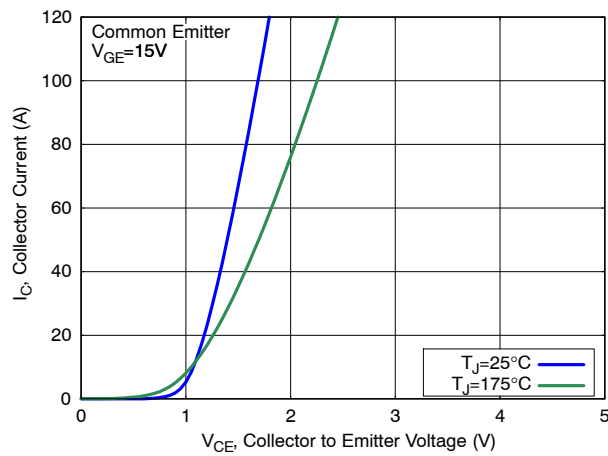


Figure 5. Saturation Characteristics

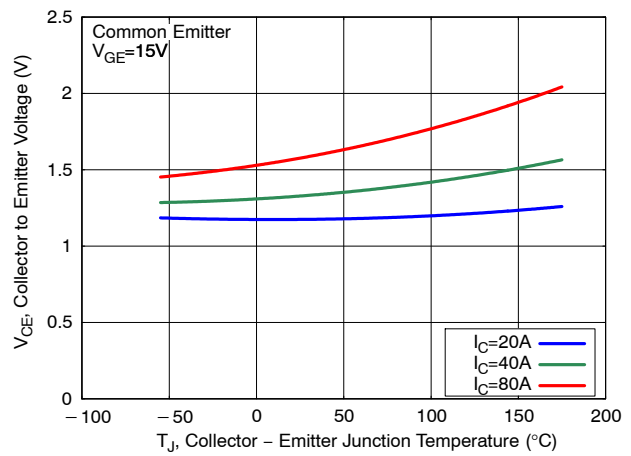


Figure 6. Saturation Voltage vs. Junction Temperature

AFGBP40T120SWD

TYPICAL CHARACTERISTICS

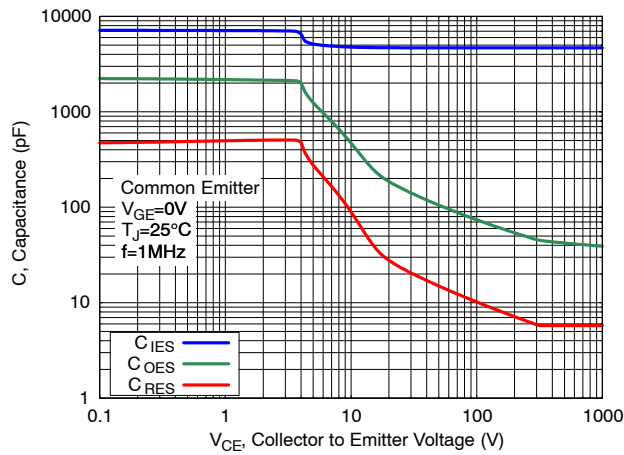


Figure 7. Capacitance Characteristics

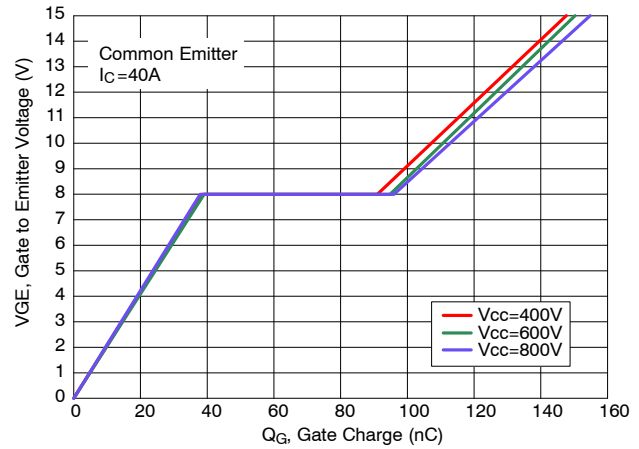


Figure 8. Gate Charge Characteristics

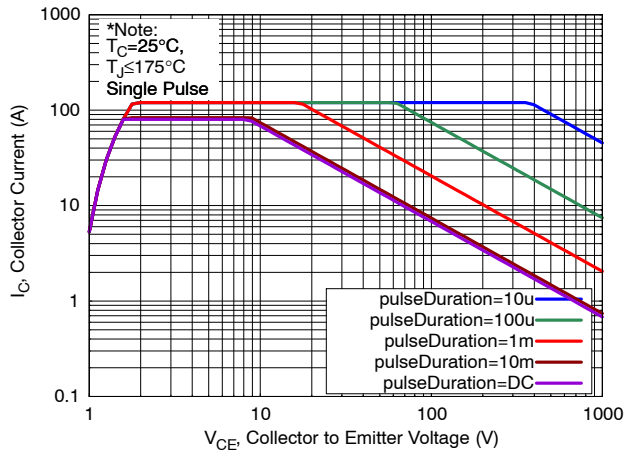


Figure 9. Max SOA Characteristics

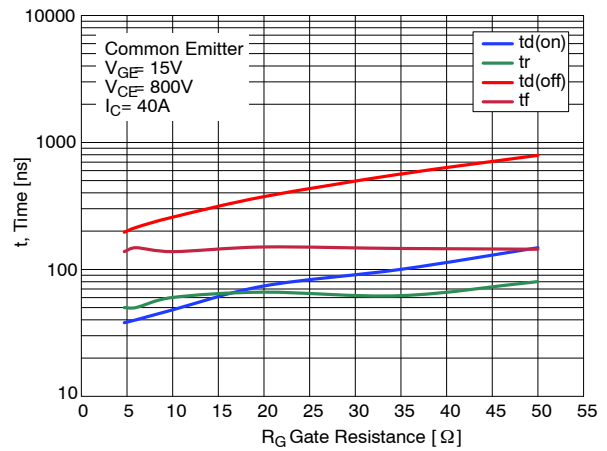


Figure 10. Switching Time vs. Gate Resistance

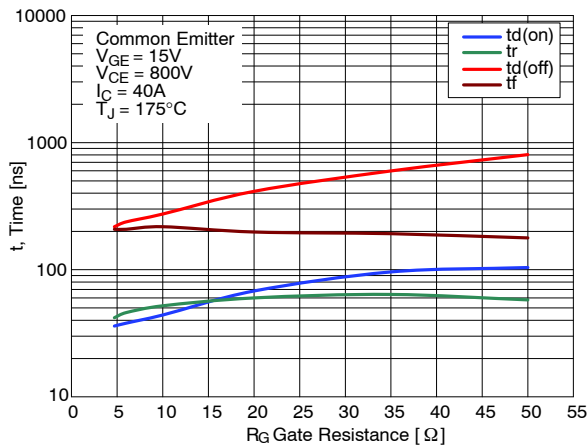


Figure 11. Switching Time vs. Gate Resistance

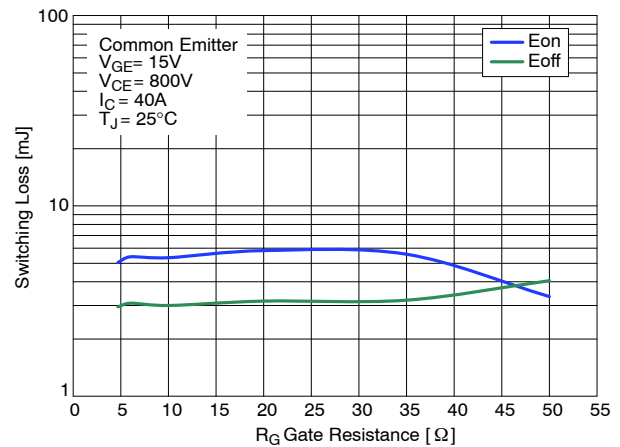


Figure 12. Switching Loss vs. Gate Resistance

AFGBP40T120SWD

TYPICAL CHARACTERISTICS

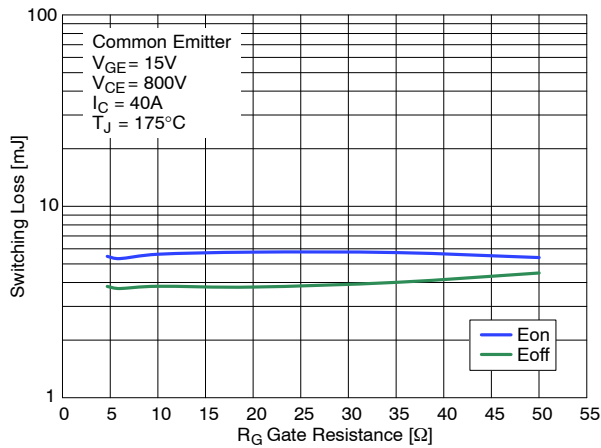


Figure 13. Switching Loss vs. Gate Resistance

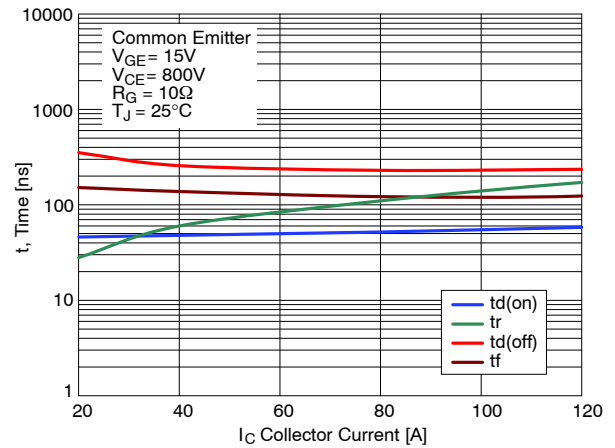


Figure 14. Switching Time vs. Collector Current

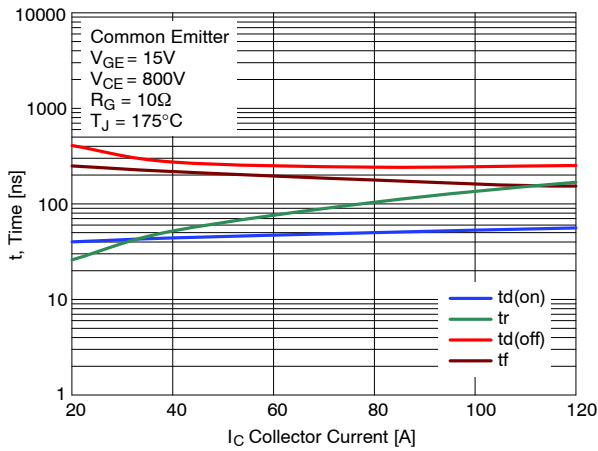


Figure 15. Switching Time vs. Collector Current

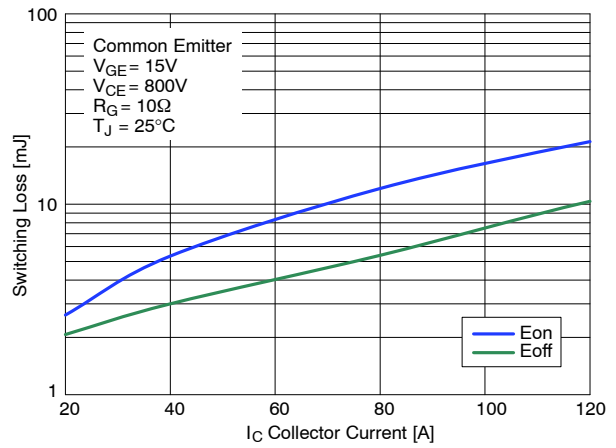


Figure 16. Switching Loss vs. Collector Current

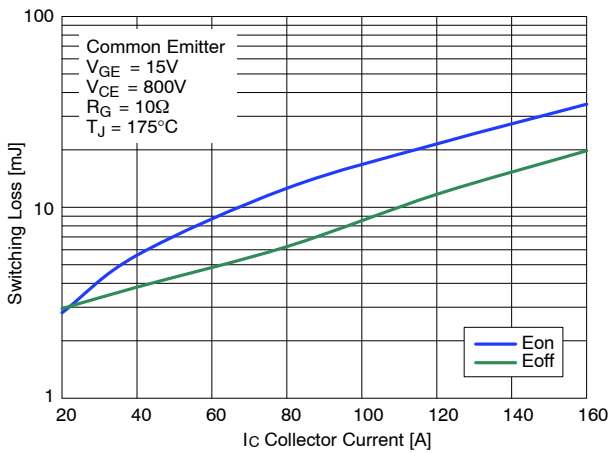


Figure 17. Switching Loss vs. Collector Current

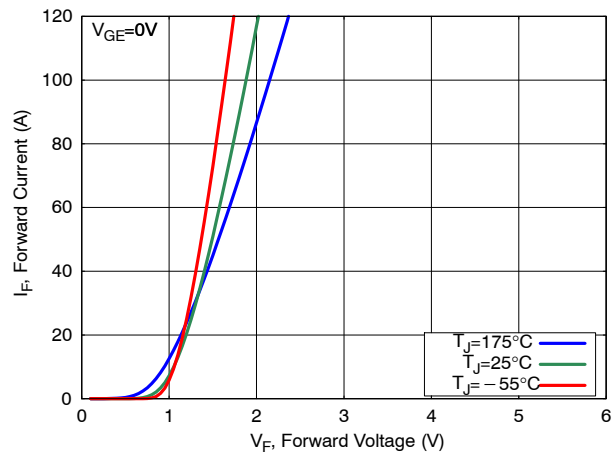


Figure 18. Diode Forward Characteristics

AFGBP40T120SWD

TYPICAL CHARACTERISTICS

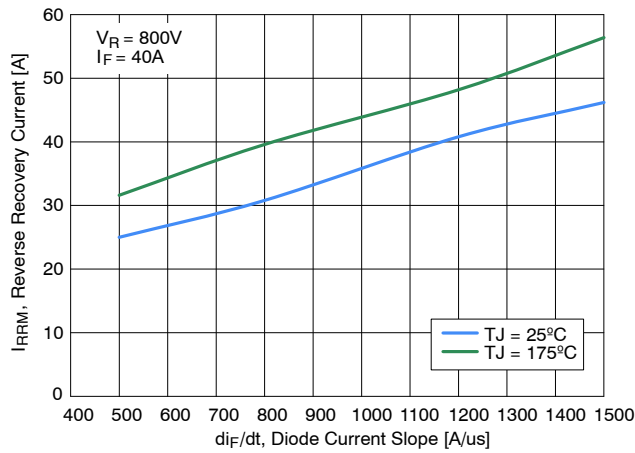


Figure 19. Diode Reverse Recovery Current

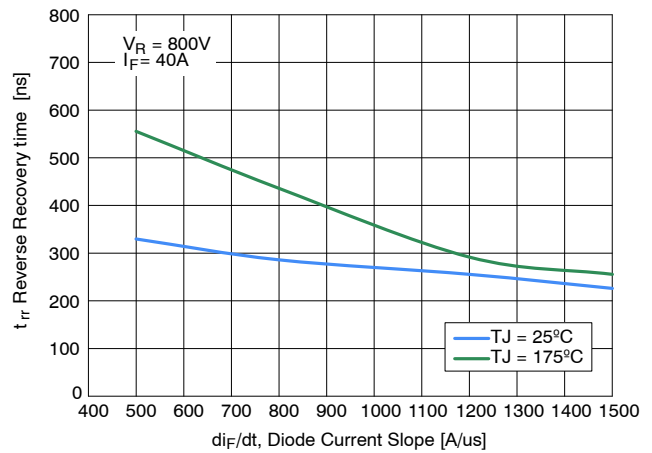


Figure 20. Diode Reverse Recovery Time

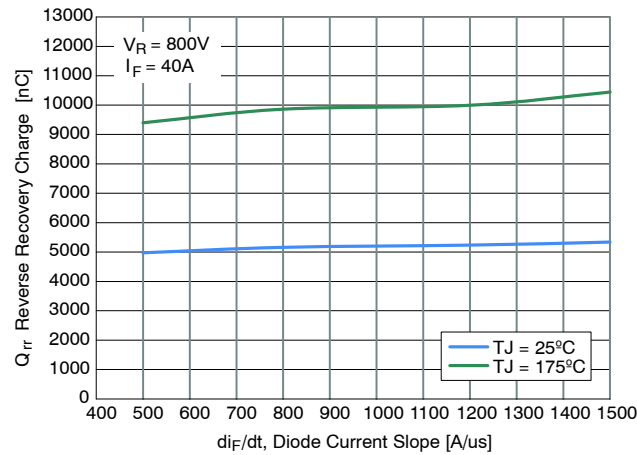


Figure 21. Diode Stored Charge Characteristics

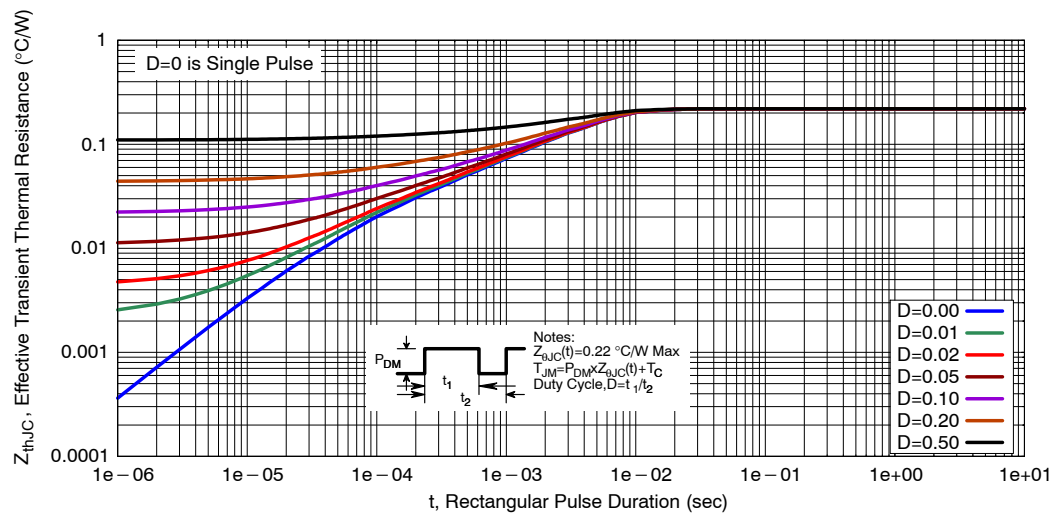


Figure 22. Max Transient Thermal Impedance of IGBT

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TYPICAL CHARACTERISTICS

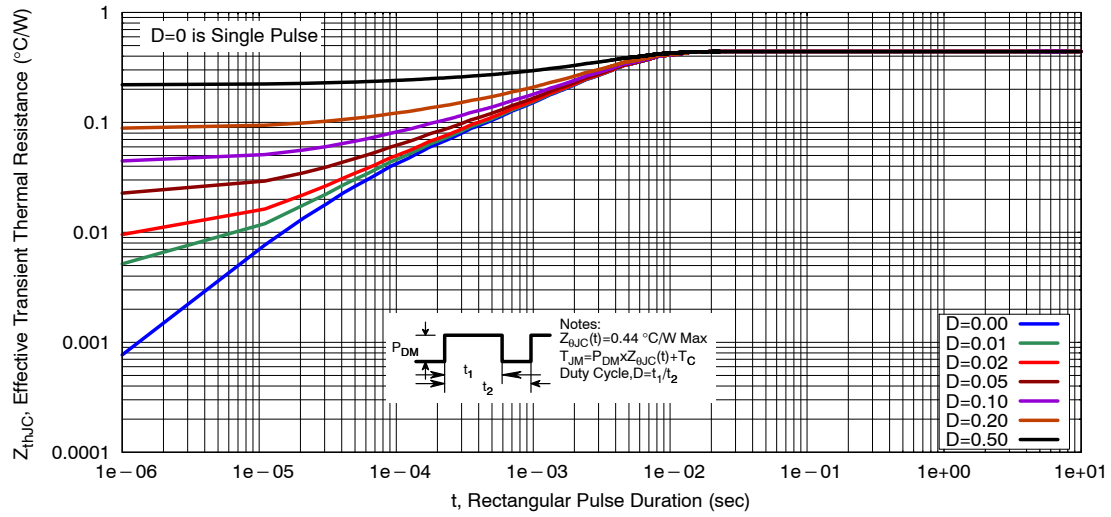


Figure 23. Max Transient Thermal Impedance of Diode

REVISION HISTORY

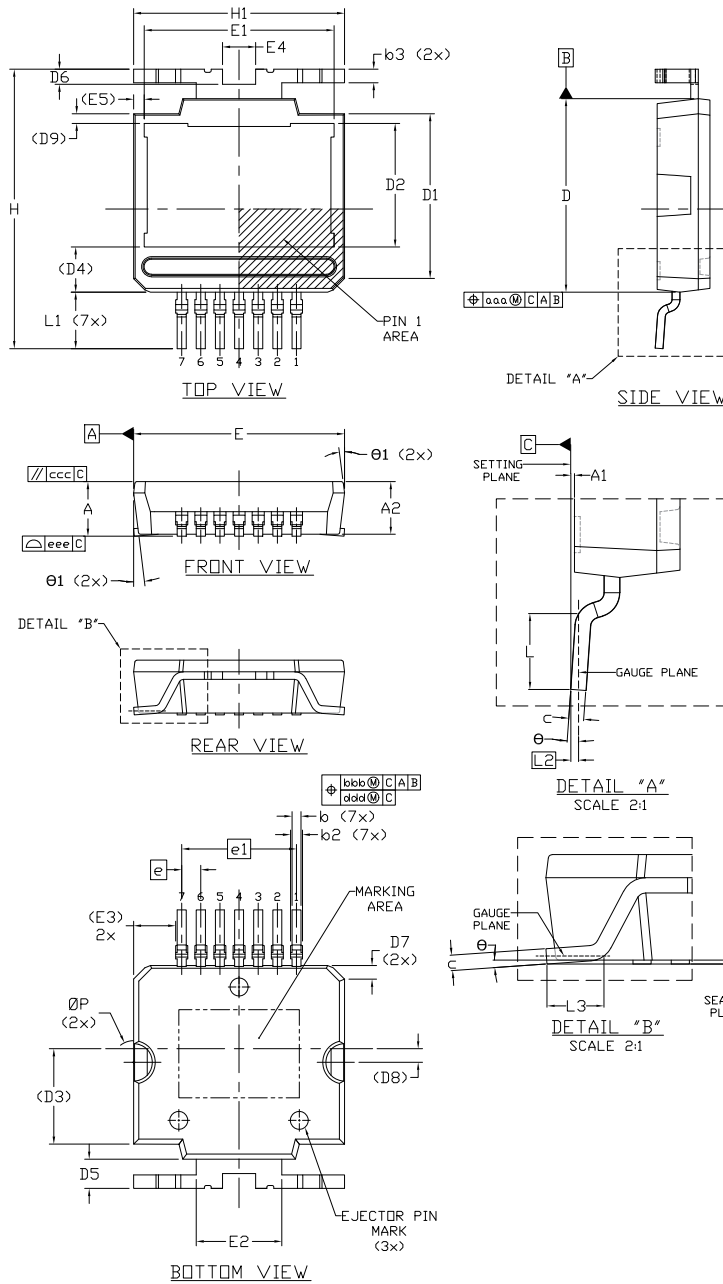
Revision	Description of Changes	Date
0	Initial public release	7/21/2025

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.

AFGBP40T120SWD

PACKAGE DIMENSIONS

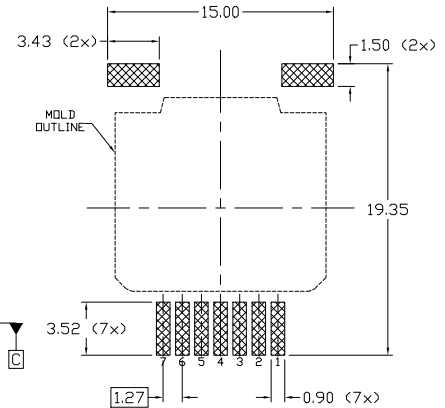
BPAK7 14.00x12.85x3.50, 1.27P
CASE 763AA
ISSUE A



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			DIM	MILLIMETERS		
	MIN.	NOM.	MAX.		MIN.	NOM.	MAX.
A	3.53	3.63	3.73	E3		2.79 REF.	
A1	0.05	0.15	0.25	E4	2.10	2.20	2.30
A2	3.40	3.50	3.60	E5		0.70 REF.	
b	0.50	0.60	0.70	e		1.27 BSC	
b2	0.60	0.80	1.00	e1		7.62 BSC	
b3	0.80	0.90	1.00	H	18.05	18.55	19.05
c	0.45	0.55	0.65	H1	13.80	14.00	14.20
D	12.75	12.85	12.95	L	2.32	2.47	2.62
D1	10.84	10.94	11.04	L1	3.65	3.75	3.85
D2	7.85	8.10	8.35	L2		0.26 BSC	
D3		6.32 REF.		L3	1.79	1.89	1.99
D4		3.00 REF.		P	2.40	2.50	2.60
D5	1.85	1.95	2.05	θ	0°	---	8°
D6	0.90	1.00	1.10	$\theta 1$	0°	---	7°
D7	0.85	0.91	1.05	aaa		0.20	
D8		0.90 REF.		bbb		0.25	
D9		0.82 REF.		ccc		0.20	
E	13.90	14.00	14.10	ddd		0.20	
E1	12.50	12.60	12.70	eee		0.20	
E2	5.58	5.68	5.78				



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