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

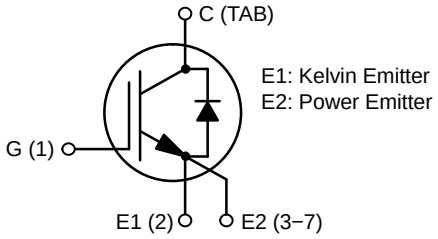
1200 V, 1.4 V, 40 A

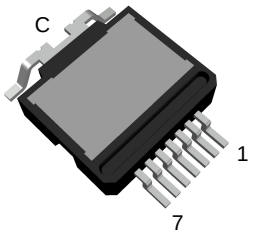
Product Preview

AFGBP40T120SWD

BV_{CES}	$V_{CE(sat)}$ TYP	I_C MAX
1200 V	1.4 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.

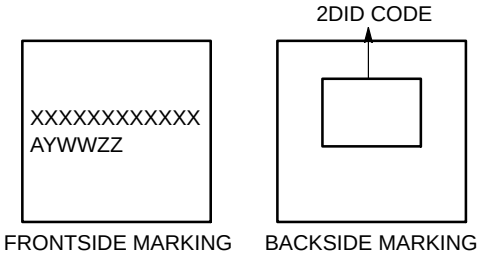
Features

- 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 Pb-Free, Halogen Free and are RoHS Compliant

Applications

- OBC

MARKING DIAGRAM



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

ORDERING INFORMATION

Device	Package	Shipping†
AFGBP40T120SWD	BPAK	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.

This document contains information on a product under development. **onsemi** reserves the right to change or discontinue this product without notice.

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	1000	W
	T_C = 100°C		500	
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. Repetitive rating: Pulse width limited by max. junction temperature.

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case for IGBT	$R_{\theta JC}$	0.15	°C/W
Thermal Resistance, Junction-to-Case for Diode		0.3	
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	TBD	

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 = 5 mA	1200	–	–	V
Collector-to-Emitter Breakdown Voltage Temperature Coefficient	$\Delta BV_{CES}/\Delta T_J$		–	1224	–	mV/°C
Zero Gate Voltage Collector Current	I_{CES}	V_{GE} = 0 V, V_{CE} = V_{CES}	–	–	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	–	6.49	–	V
Collector-to-Emitter Saturation Voltage	$V_{CE(SAT)}$	V_{GE} = 15 V, I_C = 40 A, T_J = 25 °C	–	1.36	–	
		V_{GE} = 15 V, I_C = 40 A, T_J = 175 °C	–	1.73	–	
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{IES}	V_{GE} = 0 V, V_{CE} = 30 V, f = 1 MHz	–	4228	–	pF
Output Capacitance	C_{OES}		–	168	–	
Reverse Transfer Capacitance	C_{RES}		–	20.5	–	
Total Gate Charge	Q_G	V_{GE} = 15 V, V_{CE} = 800 V, I_C = 40 A	–	150	–	nC
Gate-to-Emitter Charge	Q_{GE}		–	35	–	
Gate-to-Collector Charge	Q_{GC}		–	58.6	–	
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	–	35.7	–	ns
Turn-Off Delay Time	$t_{d(OFF)}$		–	304	–	
Rise Time	t_r		–	6.44	–	
Fall Time	t_f		–	374	–	
Turn-On Switching Loss	E_{ON}		–	0.43	–	mJ
Turn-Off Switching Loss	E_{OFF}		–	3.11	–	
Total Switching Loss	E_{TOT}		–	3.53	–	
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	–	37.1	–	ns
Turn-Off Delay Time	$t_{d(OFF)}$		–	210	–	
Rise Time	t_r		–	8.88	–	
Fall Time	t_f		–	257	–	
Turn-On Switching Loss	E_{ON}		–	0.93	–	mJ
Turn-Off Switching Loss	E_{OFF}		–	3.95	–	
Total Switching Loss	E_{TOT}		–	4.89	–	
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	–	31.2	–	ns
Turn-Off Delay Time	$t_{d(OFF)}$		–	346	–	
Rise Time	t_r		–	8.1	–	
Fall Time	t_f		–	737	–	
Turn-On Switching Loss	E_{ON}		–	0.66	–	mJ
Turn-Off Switching Loss	E_{OFF}		–	5.51	–	
Total Switching Loss	E_{TOT}		–	6.17	–	

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	−	32.9	−	ns
Turn-Off Delay Time	$t_{d(OFF)}$		−	231	−	
Rise Time	t_r		−	10.8	−	
Fall Time	t_f		−	452	−	
Turn-On Switching Loss	E_{ON}		−	1.55	−	mJ
Turn-Off Switching Loss	E_{OFF}		−	6.59	−	
Total Switching Loss	E_{TOT}		−	8.14	−	
DIODE CHARACTERISTICS						
Forward Voltage	V_F	I_F = 40 A, T_J = 25 °C	−	1.64	−	V
		I_F = 40 A, T_J = 175 °C	−	1.65	−	
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	−	161	−	ns
Reverse Recovery Charge	Q_{RR}		−	2005	−	nC
Reverse Recovery Energy	E_{REC}		−	0.49	−	mJ
Peak Reverse Recovery Current	I_{RRM}		−	27.6	−	A
Reverse Recovery Time	t_{RR}	V_R = 800 V, I_F = 40 A, dI_F/dt = 500 A/μs, T_J = 25 °C	−	188	−	ns
Reverse Recovery Charge	Q_{RR}		−	3437	−	nC
Reverse Recovery Energy	E_{REC}		−	0.62	−	mJ
Peak Reverse Recovery Current	I_{RRM}		−	39.7	−	A
Reverse Recovery Time	t_{RR}	V_R = 800 V, I_F = 20 A, dI_F/dt = 500 A/μs, T_J = 175 °C	−	223	−	ns
Reverse Recovery Charge	Q_{RR}		−	3617	−	nC
Reverse Recovery Energy	E_{REC}		−	1.25	−	mJ
Peak Reverse Recovery Current	I_{RRM}		−	36.2	−	A
Reverse Recovery Time	t_{RR}	V_R = 800 V, I_F = 40 A, dI_F/dt = 500 A/μs, T_J = 175 °C	−	260	−	ns
Reverse Recovery Charge	Q_{RR}		−	6475	−	nC
Reverse Recovery Energy	E_{REC}		−	1.76	−	mJ
Peak Reverse Recovery Current	I_{RRM}		−	54	−	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.

TYPICAL CHARACTERISTICS

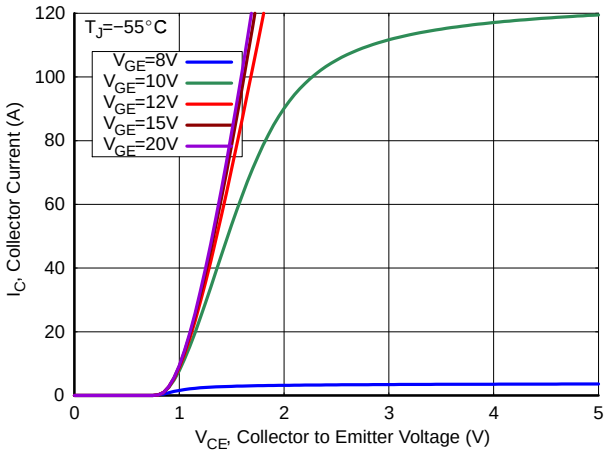


Figure 1. Output Characteristics

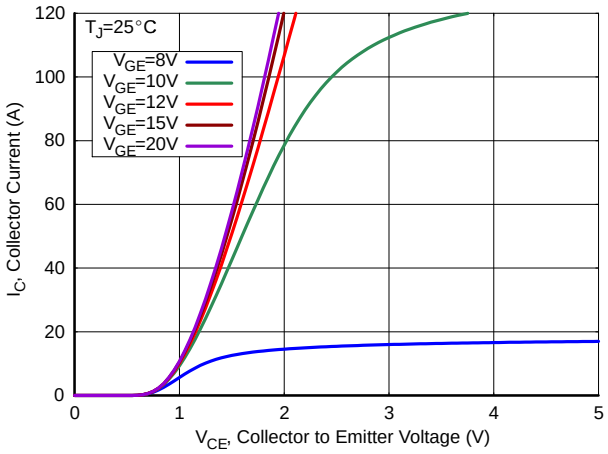


Figure 2. Output Characteristics

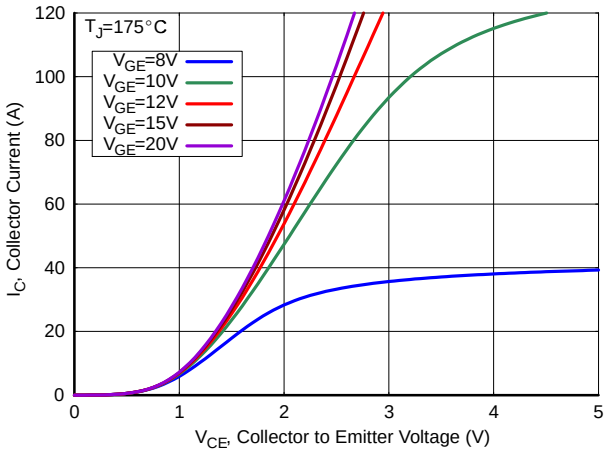


Figure 3. Output Characteristics

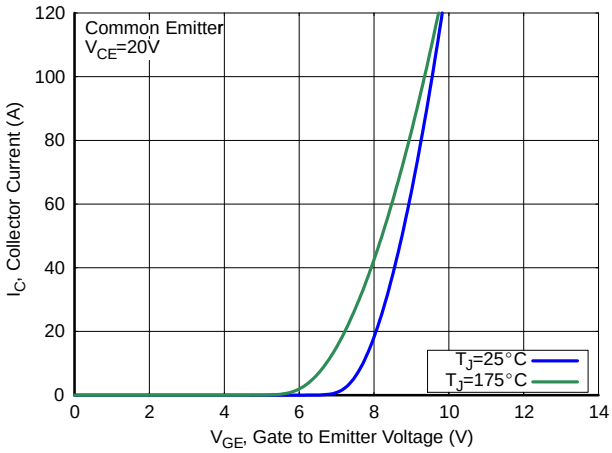


Figure 4. Transfer Characteristics

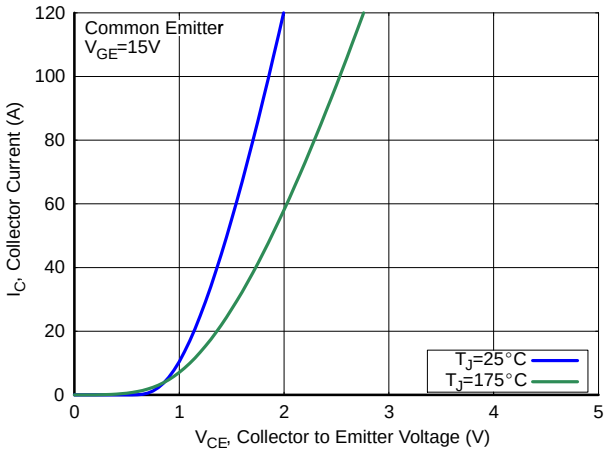


Figure 5. Saturation Characteristics

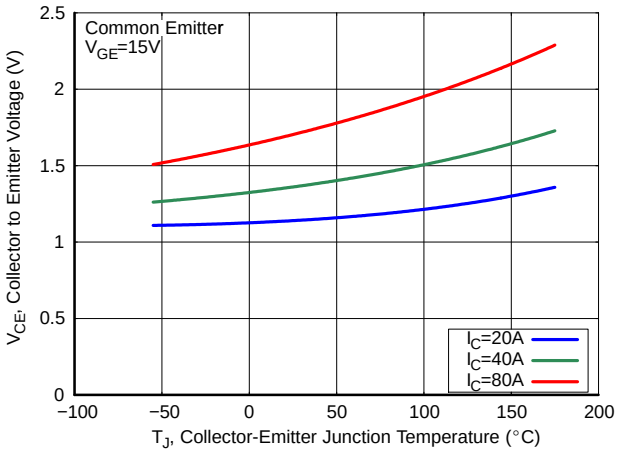


Figure 6. Saturation Voltage vs. Junction Temperature

TYPICAL CHARACTERISTICS

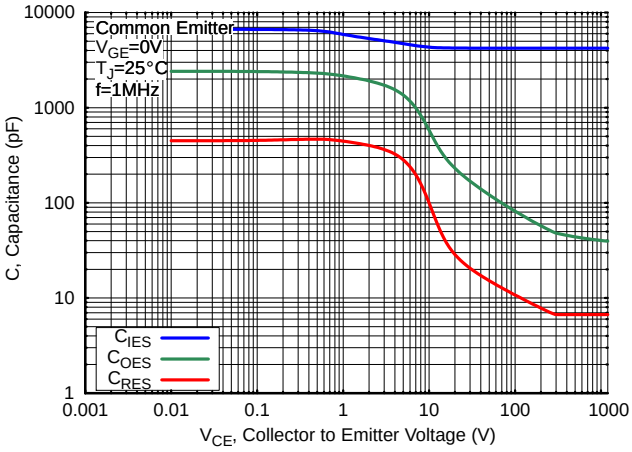


Figure 7. Capacitance Characteristics

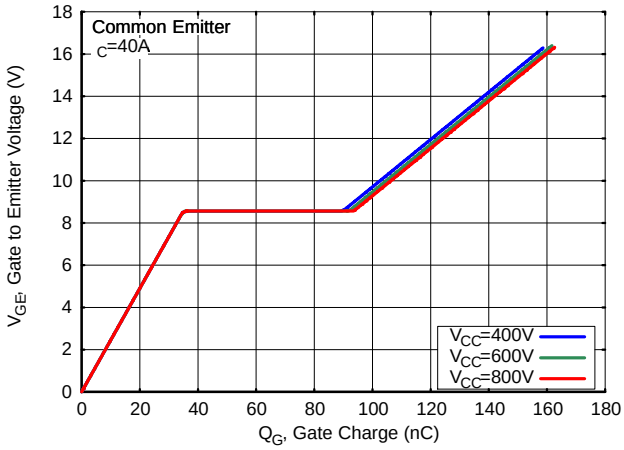


Figure 8. Gate Charge Characteristics

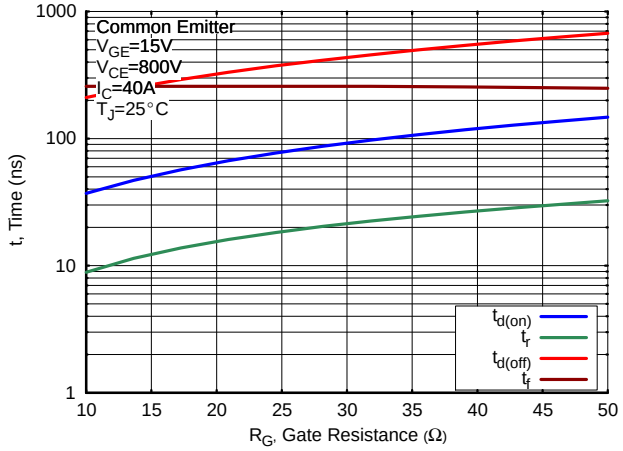


Figure 9. Switching Time vs. Gate Resistance

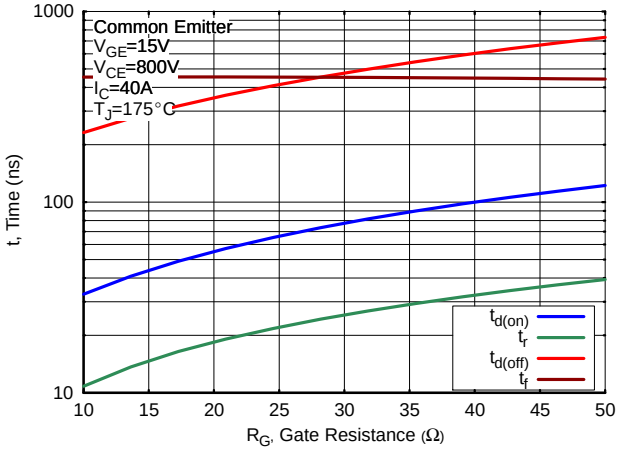


Figure 10. Switching Time vs. Gate Resistance

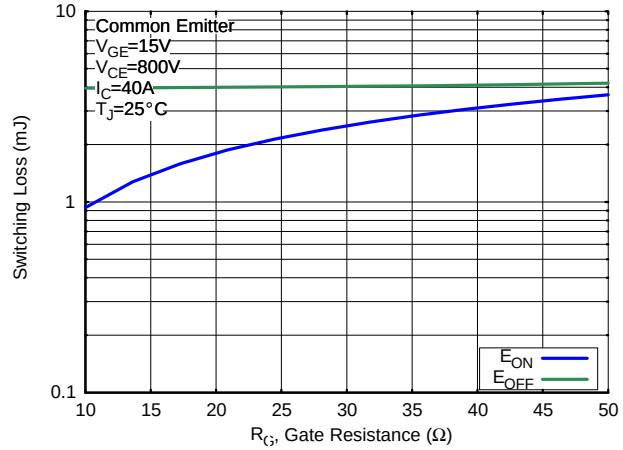


Figure 11. Switching Loss vs. Gate Resistance

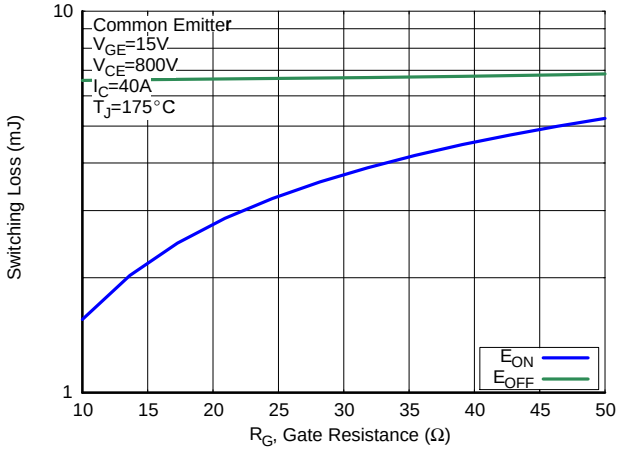


Figure 12. Switching Loss vs. Gate Resistance

TYPICAL CHARACTERISTICS

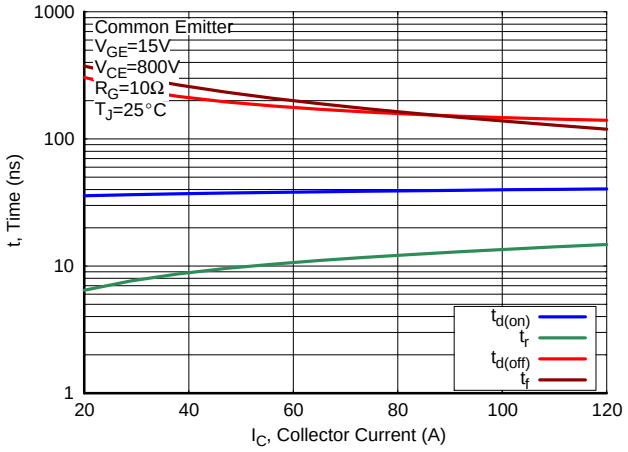


Figure 13. Switching Time vs. Collector Current

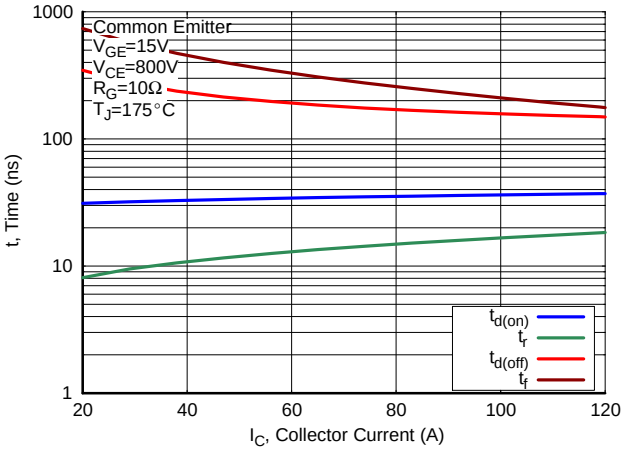


Figure 14. Switching Time vs. Collector Current

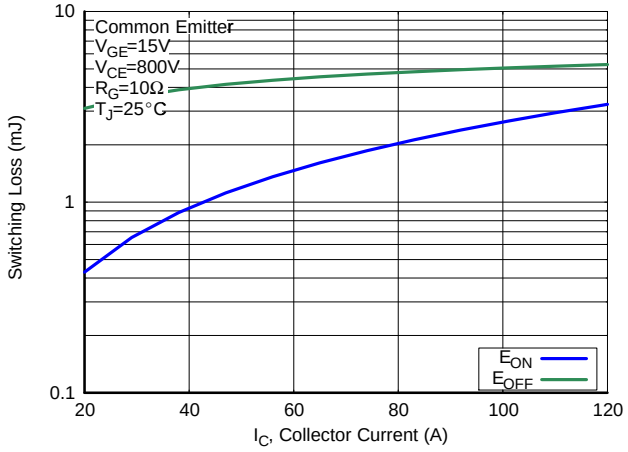


Figure 15. Switching Loss vs. Collector Current

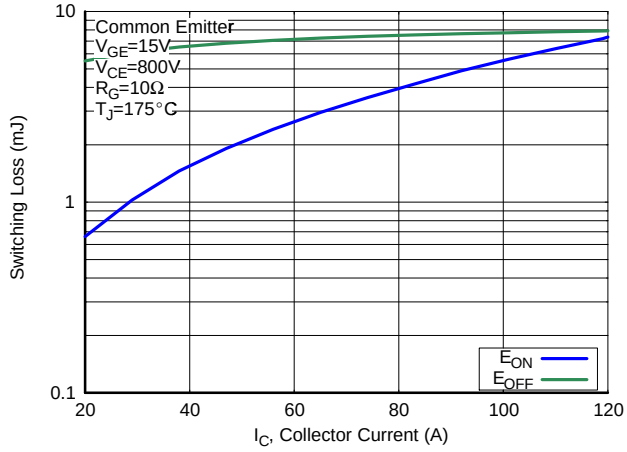


Figure 16. Switching Loss vs. Collector Current

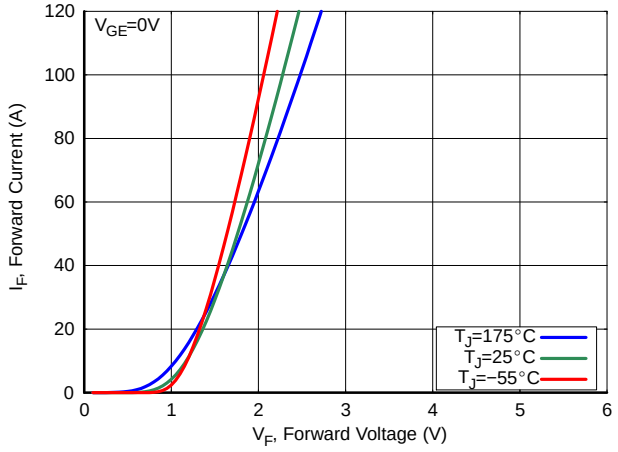


Figure 17. Diode Forward Characteristics

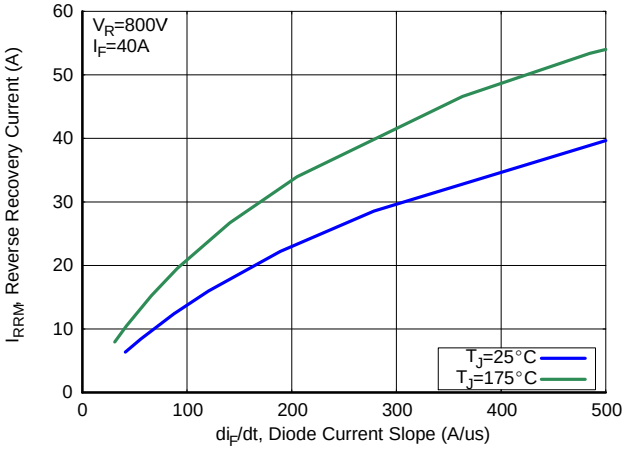


Figure 18. Diode Reverse Recovery Current

TYPICAL CHARACTERISTICS

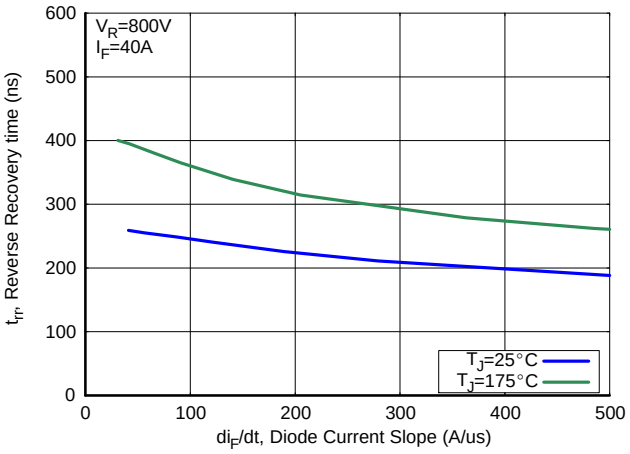


Figure 19. Diode Reverse Recovery Time

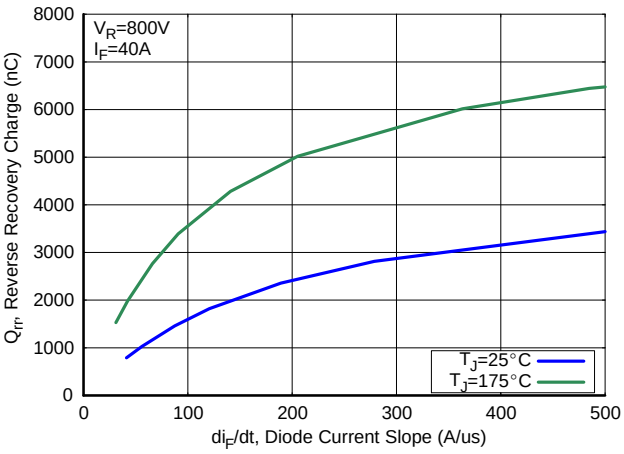


Figure 20. Transient Thermal Impedance of IGBT

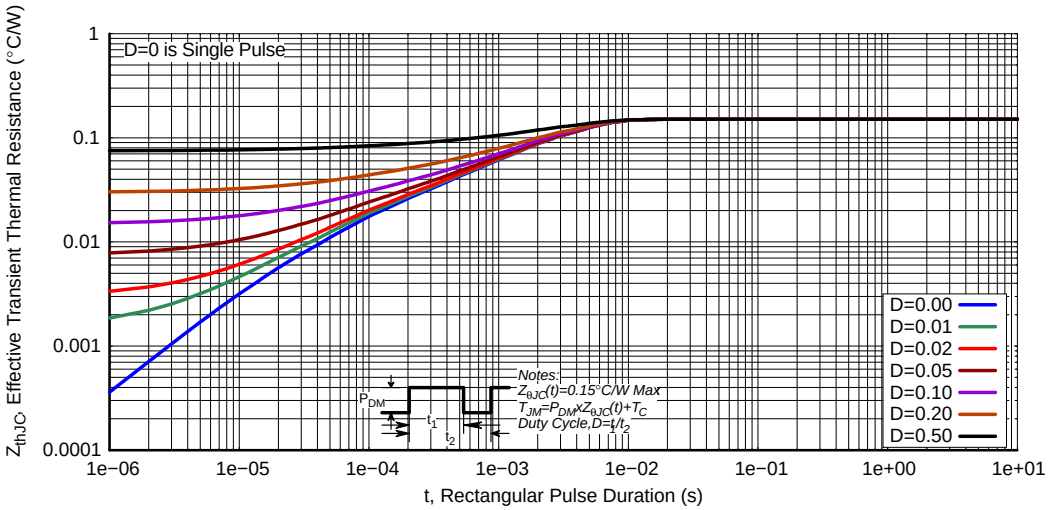


Figure 21. Saturation Characteristics

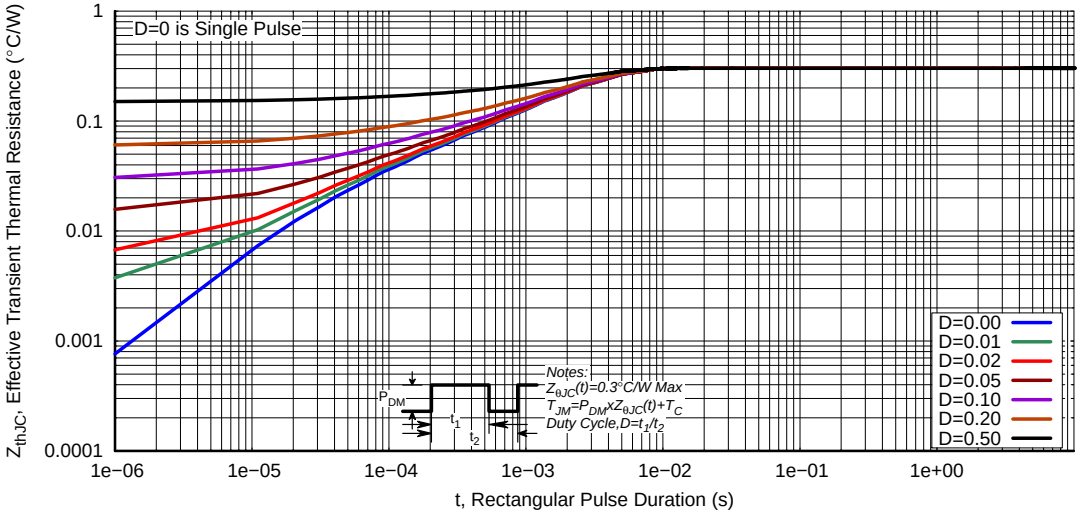


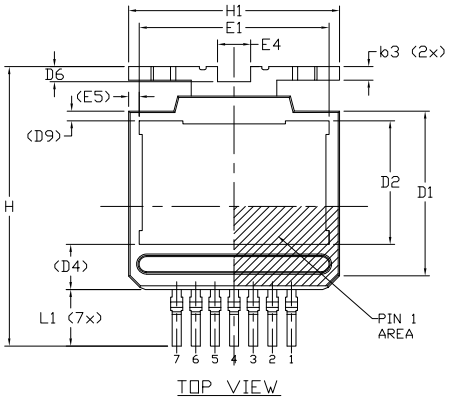
Figure 22. Transient Thermal Impedance of Diode

REVISION HISTORY

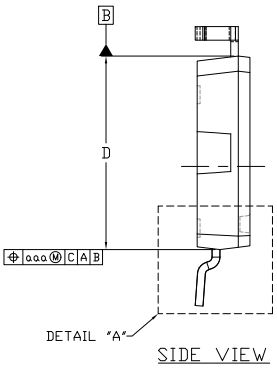
Revision	Description of Changes	Date
P1	Product review for advanced datasheet release. Update Description; Maximum Rating table; Electrical Characteristics such as VCESAT, Capacitance and gate charge; Remove AC SW to TBD; Update figure 18; Add in Package Dimension info.	5/29/2025
P2	Product review for Advance datasheet release: Remove fast switching in description; Update IGES max limit with +/− 400 nA and remove typ limit; Update VF limit; Update Switching characteristics limit	6/4/2025
P3	Removing figure 9 as per recommended.	6/11/2025

PACKAGE DIMENSIONS

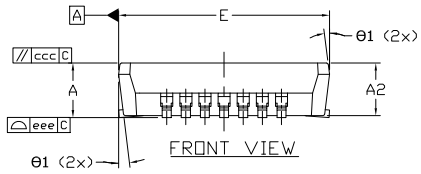
BPAK7 14.00x12.85x3.50, 1.27P
CASE 763AA
ISSUE A



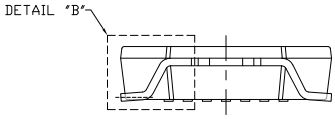
TOP VIEW



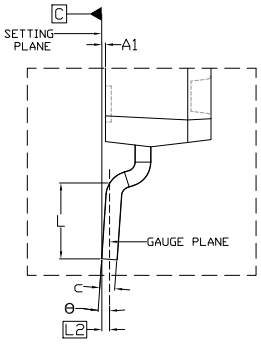
SIDE VIEW



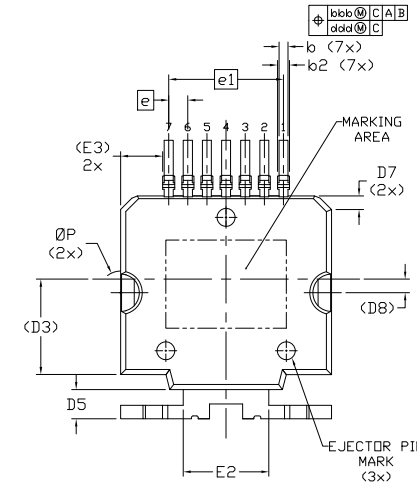
FRONT VIEW



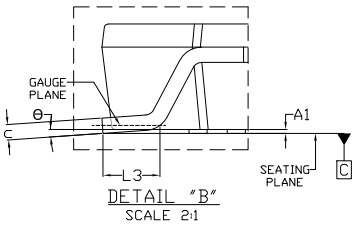
REAR VIEW



DETAIL "A"
SCALE 2:1



BOTTOM VIEW



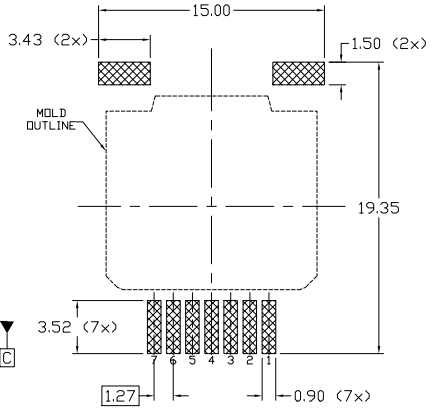
DETAIL "B"
SCALE 2:1

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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