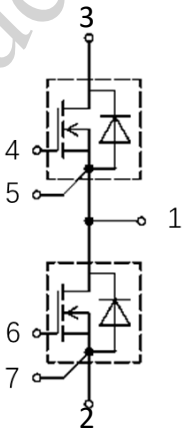
SiC Half-Bridge Module

PAAA12350BM

Features

- Industry Standard 62 mm Footprint
- High Junction Temperature(175℃) Operation
- Low Inductance(10.2nH) Design
- Copper Baseplate



Applications

- Railway & Traction
- Solar
- EV Chargers
- Industrial Automation & Testing

Standards Benefits

- Fast Time-to-Market with Minimal Development Required for Transition from 62mm Si IGBT Packages
- Increased System Efficiency, due to Low Switching & Conduction Losses of SiC

Order Information

Part Number	Package	Marking
PAAA12350BM	62mm	PAAA12350BM

Contents

1. Maximum Ratings

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value	Unit	Test Conditions
Drain - Source Voltage	V_{DSmax}	1200	V	
Gate - Source Voltage (Dynamic)	V_{GSmax}	-8 / +21	V	AC (f >1Hz)
Gate - Source Voltage(static) turn-on gate voltage turn-off gate voltage	$V_{GS,on}$ $V_{GS,off}$	+15/+18 -3	V	Static
Continuous Drain Current	I_D	350	A	V_{GS} =18V T_F = 25℃ T_J = 175℃
		290		V_{GS} =18V T_F = 65℃ T_J = 175℃
Power Dissipation	P_D	800	W	T_F =65℃
Operating Junction Temperature	T_J	-40 To +175	℃	
Storage Temperature	T_{stg}	-40 To +125	℃	

2. Electrical Characteristics

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	1200	/	/	V	V_{GS}=0V
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.5	/	V	V_{DS}= V_{GS} I_D= 140mA
Reverse Bias Drain Current	I_{DSS}	/	1	100	μA	V_{GS}= -3V V_{DS}= 1200V
Gate-Source Leakage Current	I_{GSS}	/	1	100	nA	V_{GS}= 18V V_{DS}= 0V
Drain-Source On-State Resistance	$R_{DS(on)}$	/	4.5	/	mΩ	V_{GS}= 18V I_D= 350A T_J= 25℃
		/	5.5	/		V_{GS}= 18V I_D= 350A T_J= 125℃
		/	6.5	/		V_{GS}= 18V I_D= 350A T_J= 175℃
Transconductance	g_{fs}	/	140	/	S	V_{DS}= 20V I_{DS}= 350A T_J= 25℃
Internal Gate Resistance	$R_{G(int)}$	/	1.1	/	Ω	f= 1MHz V_{AC}= 25mV
Coss Stored Energy	E_{oss}	/	390	/	μJ	V_{DS}= 800V f= 250kHz
Input Capacitance	C_{iss}	/	25	/	nF	V_{GS}= 0V V_{DS}= 800V f= 250kHz V_{AC}= 25mV
Output Capacitance	C_{oss}	/	1	/	nF	
Reverse Transfer Capacitance	C_{rss}	/	90	/	pF	

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Gate to Source Charge	Q_{gs}	/	254	/	nC	V_{DS}= 800V I_{DS}= 350A V_{GS}= -3 to 18V
Gate to Drain Charge	Q_{gd}	/	118	/		
Total Gate Charge	Q_g	/	806	/		
Turn-on Energy	E_{on}	/	11.2	/	mJ	V_{DS}= 600V I_{DS}= 350A Rg=3Ω V_{GS}= -3V/18V L= 10μH
Turn-off Energy	E_{off}	/	5.3	/		
Turn-On Delay Time	$T_{d(on)}$	/	75.7	/	ns	
Rise Time	T_r	/	82.2	/		
Turn-Off Delay Time	$T_{d(off)}$	/	161	/		
Fall Time	T_f	/	41.3	/		

3. Reverse Diode Characteristics

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Diode Forward Voltage	V_{SD}	5.7	/	V	V_{GS}= -3V I_{SD}= 160A T_J= 25℃
		4.9	/	V	V_{GS}= -3V I_{SD}= 160A T_J= 175℃
Reverse Recover Time	t_{rr}	37.8	/	ns	V_{DS}= 600V I_{SD}= 350A d_{if}/d_t= 6400A/μs Vgs = -3/18V T_J= 25℃
Reverse Recovery Charge	Q_{rr}	2.8	/	uC	
Peak Reverse Recovery Current	I_{rrm}	122	/	A	
Reverse Recovery Energy	E_{RR}	812.6	/	uJ	

4. Thermal Characteristics

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Thermal Resistance from Junction to Case	$R_{\theta JC}$	/	0.132	/	℃/W

5. NTC Thermistor Characteristics

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Rated Resistance	R_{NTC}	/	5	/	kΩ	T_{NTC}= 25℃
Resistance Tolerance	△R/R	-5	/	5	%	T_{NTC}= 25℃
B-value	$B_{25/50}$	/	3380	/	K	T_2= 50℃
B-value	$B_{25/85}$	/	3435	/	K	T_2= 80℃
B-value	$B_{25/100}$	/	3485	/	K	T_2= 100℃
Power Dissipation	P_{NTC}	/	/	10	mW	T_{NTC}= 25℃

6. Typical Performance

At T_J= 25℃, unless specified otherwise

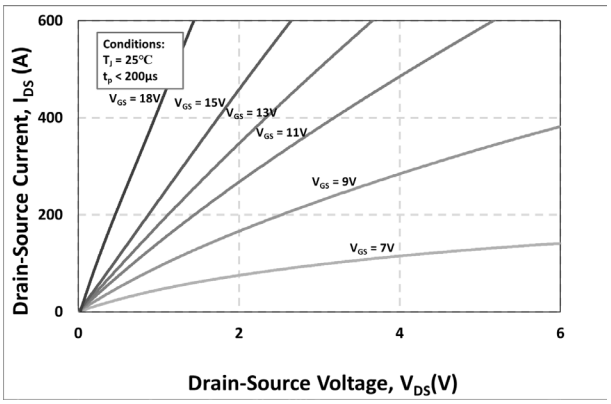


Figure 1. Output Characteristics T_J = 25℃

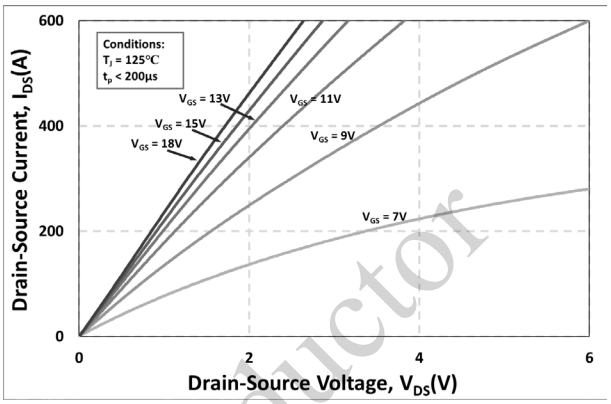


Figure 2. Output Characteristics T_J = 125℃

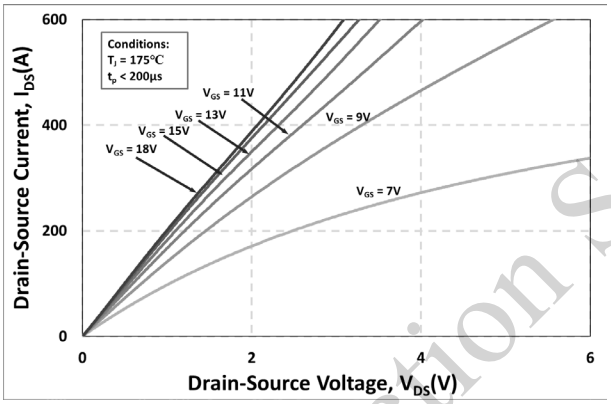


Figure 3. Output Characteristics T_J = 175℃

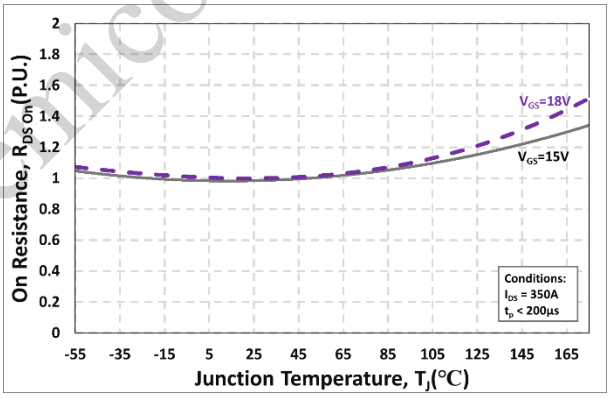


Figure 4. Normalized On-Resistance vs. Temperature

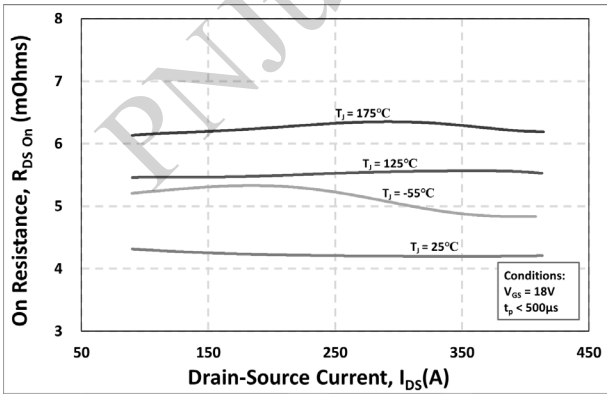


Figure 5. On-Resistance vs. Drain Current Various Temperatures

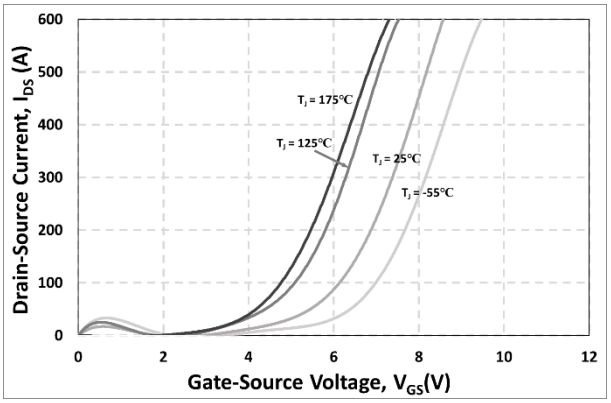


Figure 6. Transfer Characteristic for Various Junction Temperatures

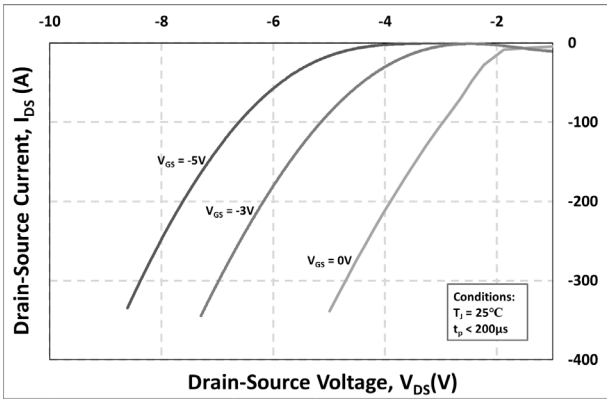


Figure 7. Body Diode Characteristic at 25°C

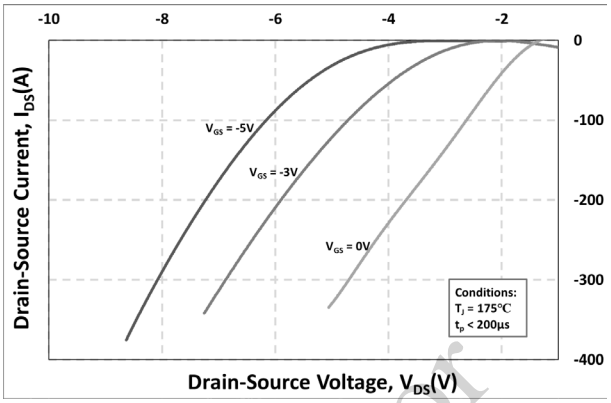


Figure 8. Body Diode Characteristic at 175°C

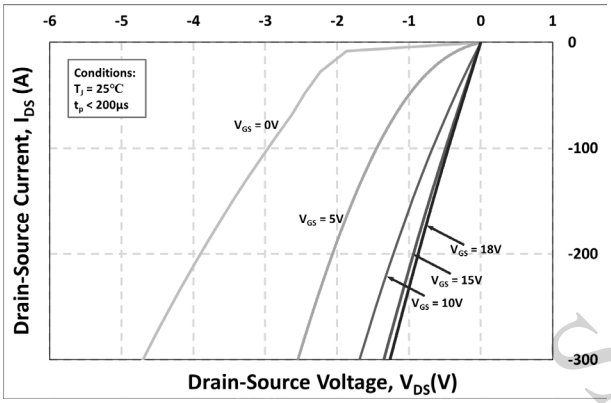


Figure 9. 3rd Quadrant Characteristic at 25°C

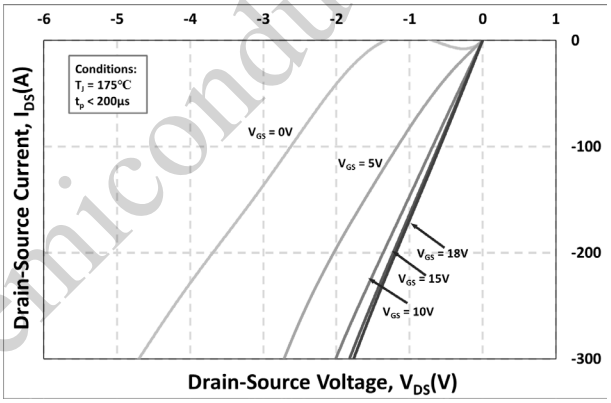


Figure 10. 3rd Quadrant Characteristic at 175°C

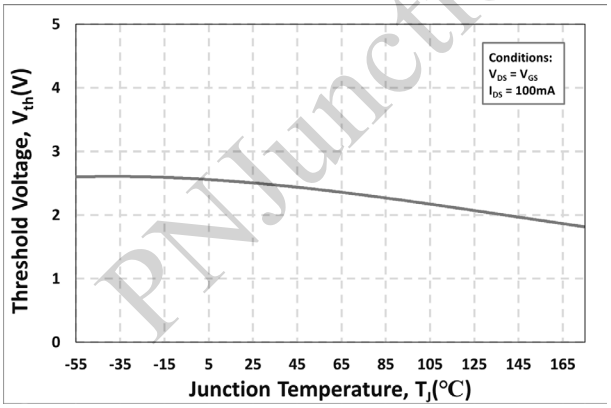


Figure 11. Threshold Voltage vs. Temperature

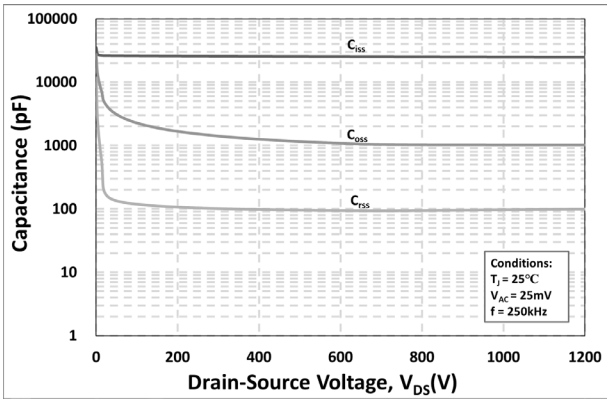


Figure 12. Capacitances vs. Drain-Source Voltage (0 - 1200V)

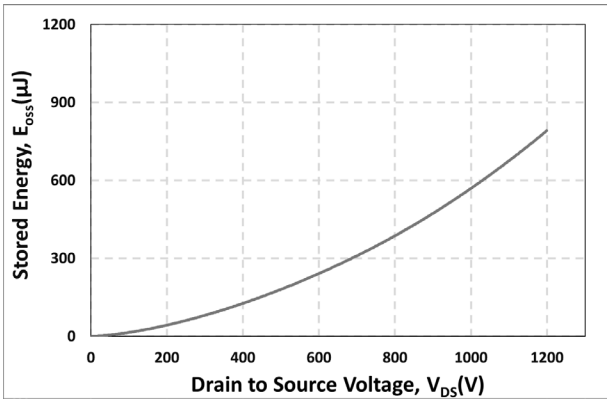


Figure 13. Output Capacitor Stored Energy

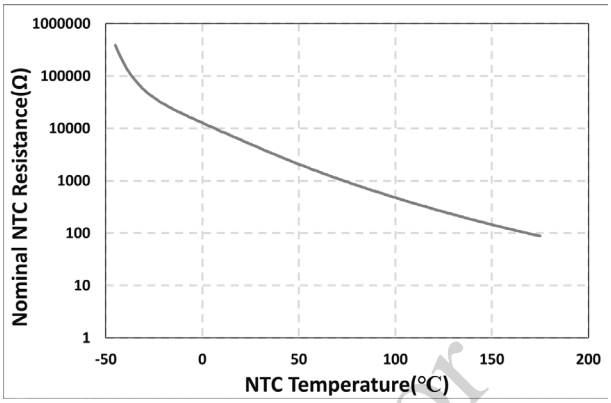


Figure 14. Nominal NTC Resistance vs. NTC Temperature

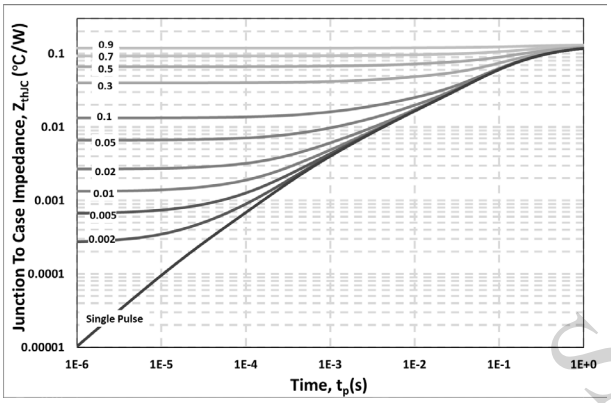


Figure 15. Transient Thermal Impedance (Junction - Case)

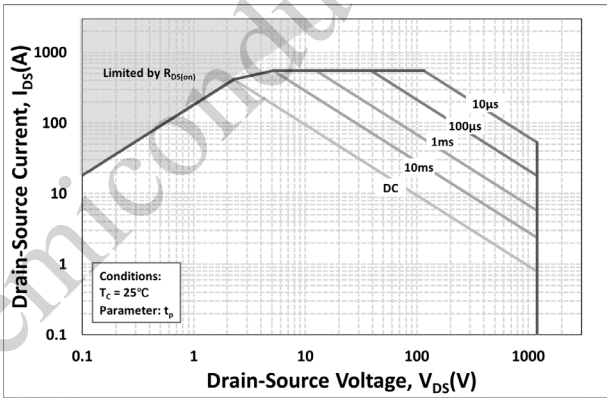


Figure 16. Forward Bias Safe Operating Area (FBSOA)

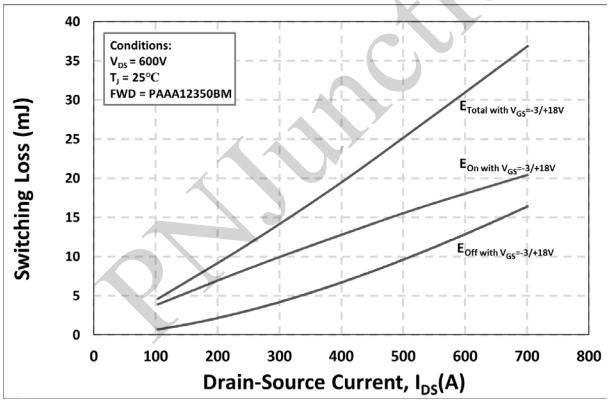


Figure 17. Switching Loss vs. Drain-Source Current (VDS = 600 V)

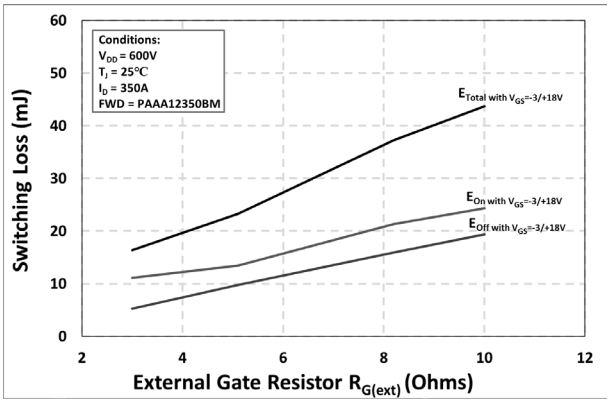


Figure 18. Switching Loss vs. External Gate Resistance

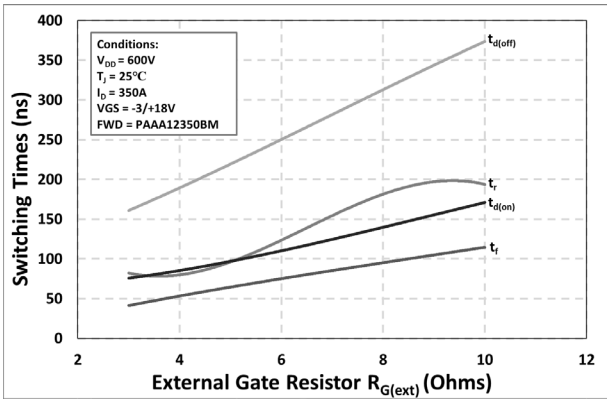


Figure 19. Switching Times vs. External Gate Resistance

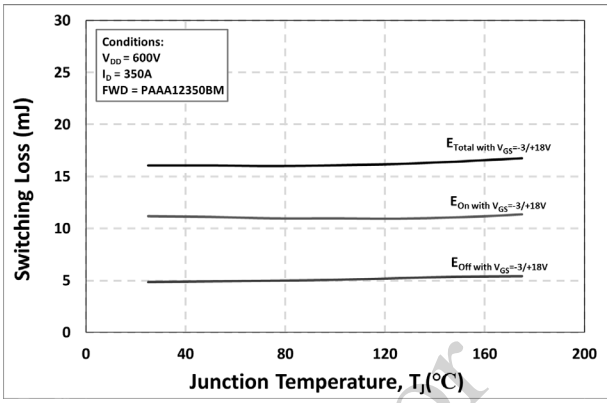


Figure 20. Clamped Inductive Switching Energy vs. Temperature

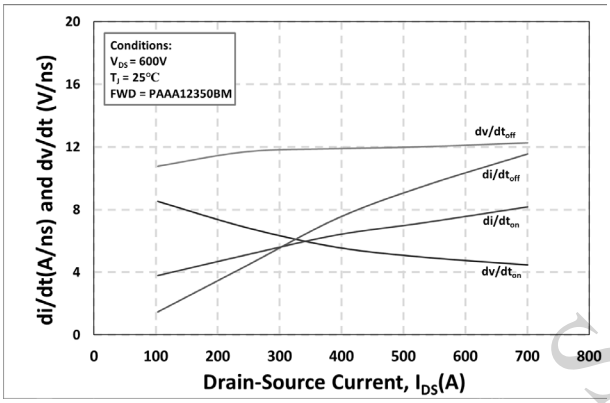


Figure 21. di/dt(A/ns) and dv/dt (V/ns) vs. Drain-Source Current

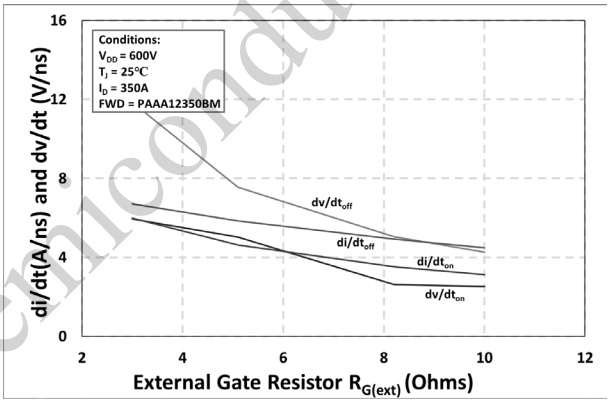
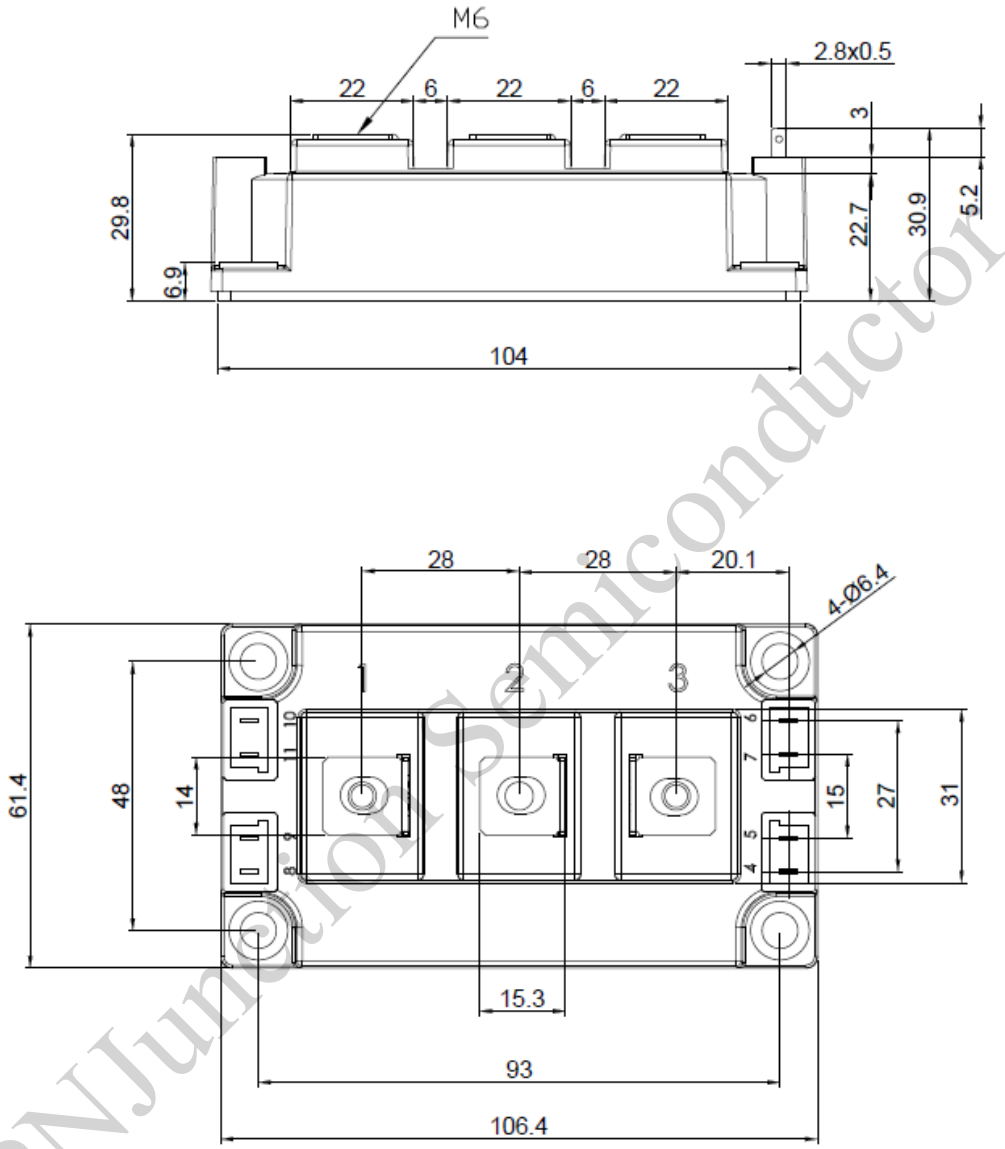


Figure 22. di/dt(A/ns) and dv/dt (V/ns) vs. External Gate Resistance

7. Package Outlines



Important Notice

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, PN Junction hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

PN Junction reserves the right to make changes at any time to any products or information herein, without notice. “Typical” parameters which may be provided in PN Junction data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including “Typical” must be validated for each customer application by customer’s technical experts.

In addition, any information given in this document is subject to customer’s compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer’s products and any use of the product of PN Junction in customer’s applications. The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer’s technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest PN Junction office (www.pnjsemi.com).

Warnings

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest PN Junction office.

Except as otherwise explicitly approved by PN Junction in a written document signed by authorized representatives of PN Junction, PN Junction’s products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.