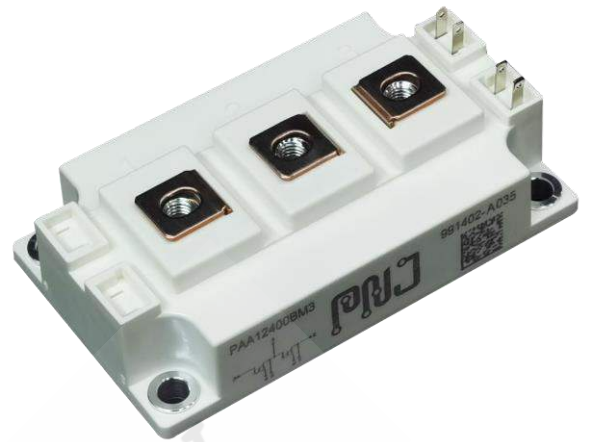


SiC Half-Bridge Module PAA12400BM3

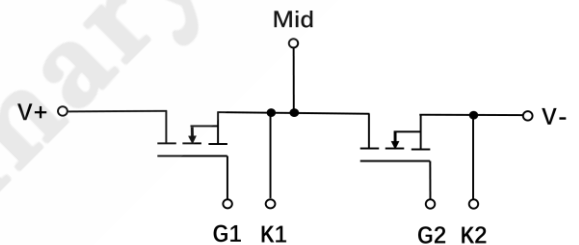
Features

- Industry Standard 62 mm Footprint
- High Junction Temperature(175°C) Operation
- 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
PAA12400BM3	62mm	PAA12400BM3



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PNJ Preliminary

1. Maximum Ratings

At $T_J = 25^\circ\text{C}$, unless specified otherwise

Parameter	Symbol	Value	Unit	Test Conditions
Drain - Source Voltage	V_{DSmax}	1200	V	$V_{GS} = -3\text{V}$ $I_D = 100\mu\text{A}$
Gate - Source Voltage (Dynamic)	V_{GSmax}	-10 / +25	V	AC ($f > 1\text{Hz}$)
Gate - Source Voltage (Static)	V_{GSop}	-5 / +20	V	Static
Continuous Drain Current	I_D	350	A	$V_{GS} = 20\text{V}$ $T_C = 25^\circ\text{C}$
		248		$V_{GS} = 20\text{V}$ $T_C = 100^\circ\text{C}$
Operating Junction Temperature	T_J	-40 To +175	$^\circ\text{C}$	

2. Electrical Characteristics

At $T_J = 25^\circ\text{C}$, unless specified otherwise (Per Position)

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ	Max.		
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	1200	/	/	V	$V_{GS} = -3\text{V}$
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.0	5	V	$V_{DS} = V_{GS}$ $I_D = 100\text{mA}$ $T_J = 25^\circ\text{C}$
		/	1.3	/	V	$V_{DS} = V_{GS}$ $I_D = 100\text{mA}$ $T_J = 175^\circ\text{C}$

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ	Max.		
Reverse Bias Drain Current	I_{DSS}	/	5	50	μA	$V_{GS} = -3V$ $V_{DS} = 1200V$
Gate-Source Leakage Current	I_{GSS}	/	20	250	nA	$V_{GS} = 20V$ $V_{DS} = 0V$
Drain-Source On-State Resistance	$R_{DS(on)}$	/	5.6	7.3	m Ω	$V_{GS} = 20V$ $I_D = 300A$
Transconductance	g_{fs}	/	123	/	S	$V_{DS} = 20V$ $I_{DS} = 300A$ $T_J = 25^\circ C$
		/	130	/	S	$V_{DS} = 20V$ $I_{DS} = 300A$ $T_J = 175^\circ C$
Turn-on Energy	E_{on}	/	11.3	/	mJ	
Turn-off Energy	E_{off}	/	6.0	/		
Turn-On Delay Time	$T_{d(on)}$	/	69.0	/	nS	$V_{DS} = 600V$ $I_{DS} = 400A$ $V_{GS} = -5V/20V$ $R_G = 3.0\Omega$ $L = 10\mu H$
Rise Time	T_r	/	77.3	/		
Turn-Off Delay Time	$T_{d(off)}$	/	153.6	/		
Fall Time	T_f	/	41.8	/		
Internal Gate Resistance	$R_{G(int)}$	/	0.84	/	Ω	$f = 100kHz$ $V_{AC} = 25mV$

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ	Max.		
Input Capacitance	C_{iss}	/	29.5	/	nF	$V_{GS} = -3V$ $V_{DS} = 1000V$ $f = 100kHz$ $V_{AC} = 25mV$
Output Capacitance	C_{oss}	/	1.16	/	nF	
Reverse Transfer Capacitance	C_{rss}	/	85.3	/	pF	
Thermal Resistance from Junction to Case	$R_{\theta JC}$	/	0.145	/	$^{\circ}C/W$	

3. Reverse Diode Characteristics

At $T_J = 25^{\circ}C$, unless specified otherwise (Per Position)

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Diode Forward Voltage	V_{SD}	6.3	/	V	$V_{GS} = -5V$ $I_{SD} = 150A$ $T_J = 25^{\circ}C$
		5.8	/	V	$V_{GS} = -5V$ $I_{SD} = 150A$ $T_J = 175^{\circ}C$
Reverse Recover Time	t_{rr}	32.5	/	ns	$V_{GS} = -5V$ $I_{SD} = 400A$ $V_R = 600V$ $d_{if}/d_t = 6700A/\mu s$ $T_J = 25^{\circ}C$
Reverse Recovery Charge	Q_{rr}	3.3	/	μC	
Peak Reverse Recovery Current	I_{rrm}	168.8	/	A	

Reverse Recovery Energy	E_{RR}	0.34	/	mJ	$V_{DS} = 600V$ $I_{DS} = 400A$ $V_{GS} = -5V/20V$ $R_G = 3.0\Omega$ $L = 10\mu H$
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4. Module Physical Characteristics

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ	Max.		
Package Resistance, M1	R_{3-1}	/	1	/	m Ω	$T_J = 125^\circ C$
Package Resistance, M2	R_{1-2}	/	1	/	m Ω	$T_J = 125^\circ C$
Case Temperature	T_C	-40	/	125	$^\circ C$	
Weight	W	/	300	/	g	
Mounting Torque	M_S	4.5	5	5.5	N-m	Baseplate, M6 bolts
		4.5	5	5.5		Power Terminals, M6 bolts
Case Isolation Voltage	V_{isol}	/	/	5.5	kV	AC, 50Hz, 1min
Comparative Tracking Index	CTI	/	600	/		

5. Typical Performance

At $T_J = 25^\circ\text{C}$, unless specified otherwise (Per Position)

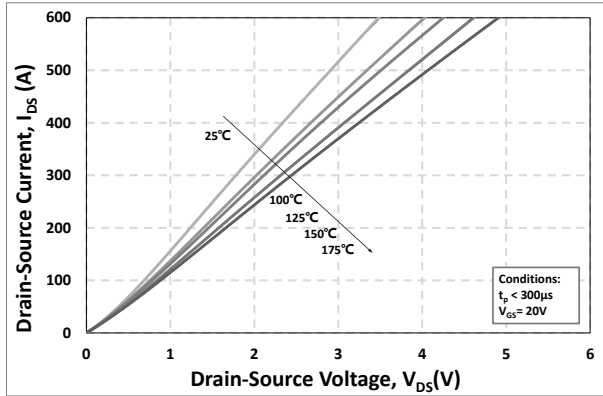


Figure 1. Output Characteristics for Various Junction Temperatures

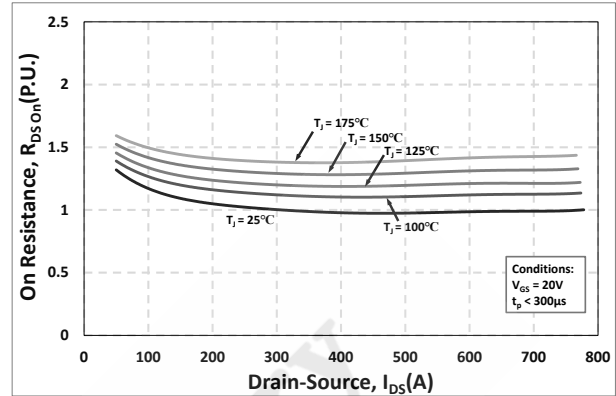


Figure 2. Normalized On-State Resistance vs. Drain Current for Various Junction Temperatures

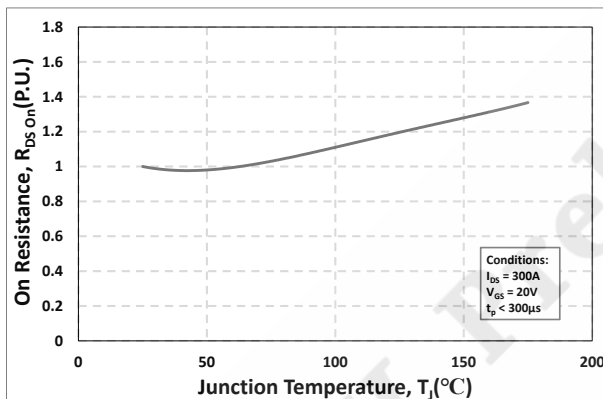


Figure 3. Normalized On-State Resistance vs. Junction Temperature

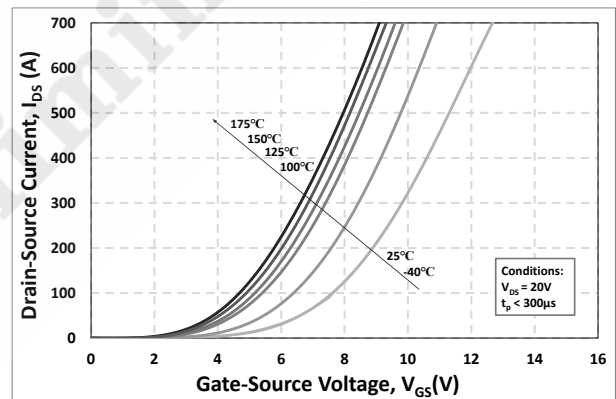


Figure 4. Transfer Characteristic for Various Junction Temperatures

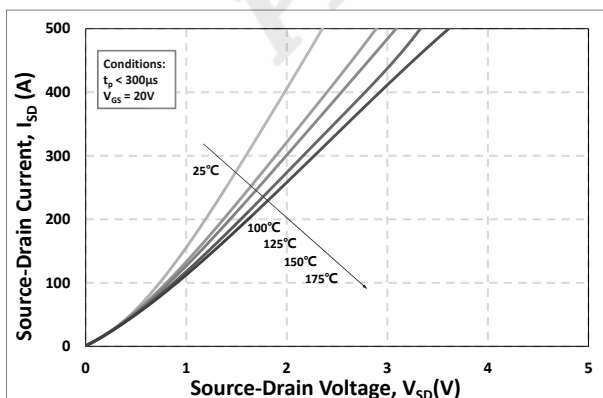


Figure 5. 3rd Quadrant Characteristic vs. Junction Temperatures at $V_{GS} = 20\text{V}$

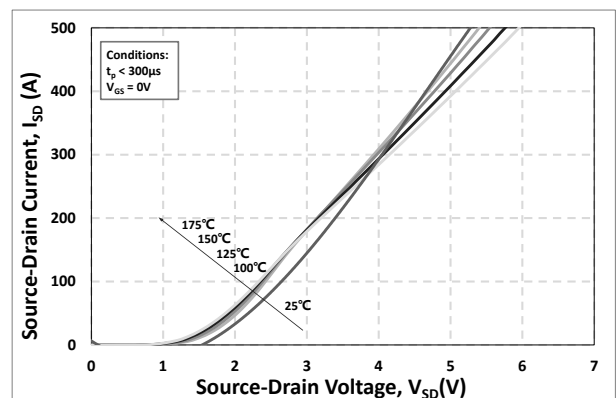


Figure 6. 3rd Quadrant Characteristic vs. Junction Temperatures at $V_{GS} = 0\text{V}$ (Body Diode)

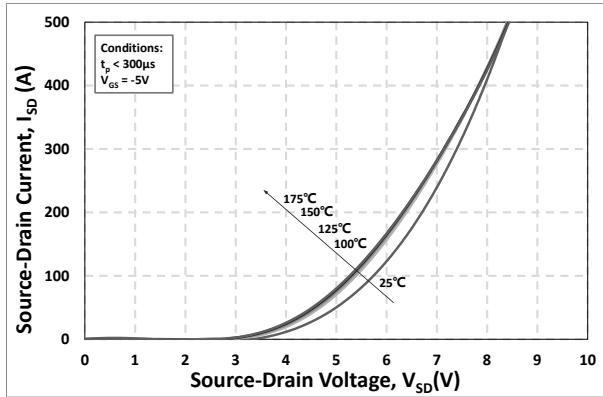


Figure 7. 3rd Quadrant Characteristic vs. Junction Temperatures at $V_{GS} = -5V$ (Body Diode)

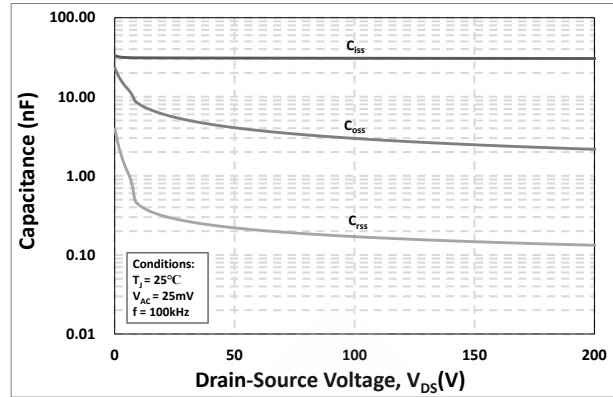


Figure 8. Capacitances vs. Drain-Source Voltage (0 - 200V)

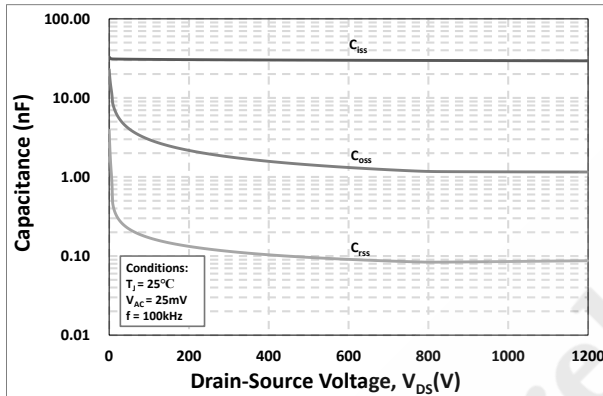


Figure 9. Capacitances vs. Drain-Source Voltage (0 - 1200V)

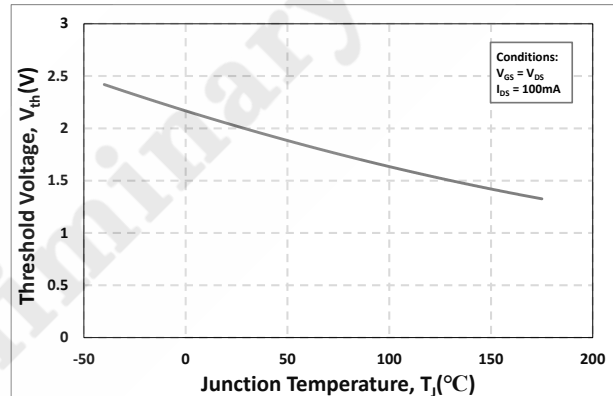


Figure 10. Threshold Voltage vs. Junction Temperature

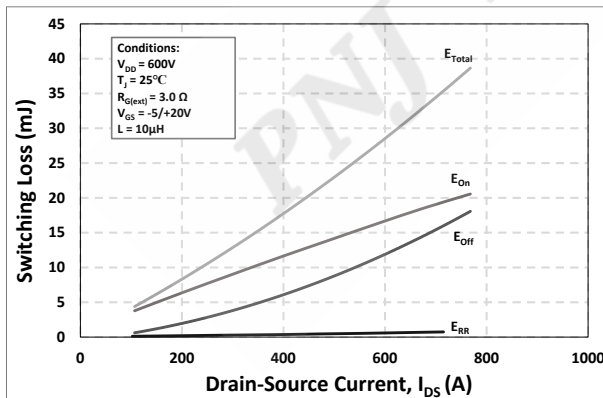


Figure 11. Switching Loss vs. Drain-Source Current ($V_{DS} = 600V$)

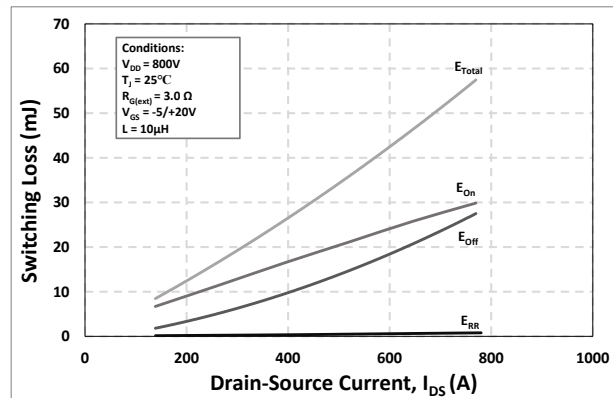


Figure 12. Switching Loss vs. Drain-Source Current ($V_{DS} = 800V$)

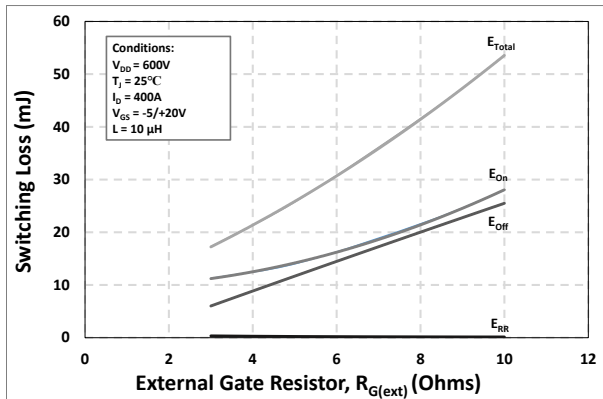


Figure 13. Switching Loss vs. External Gate Resistance

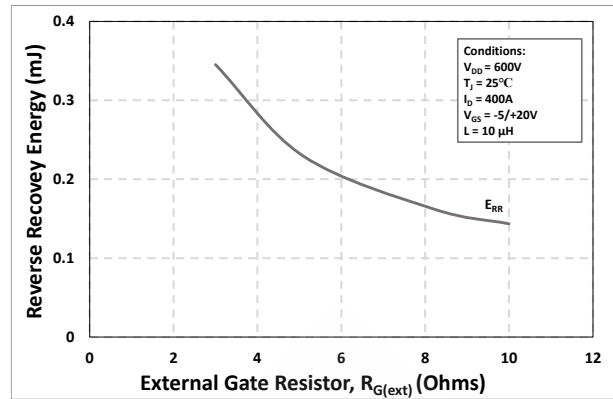


Figure 14. Reverse Recovery Energy vs. External Gate Resistance

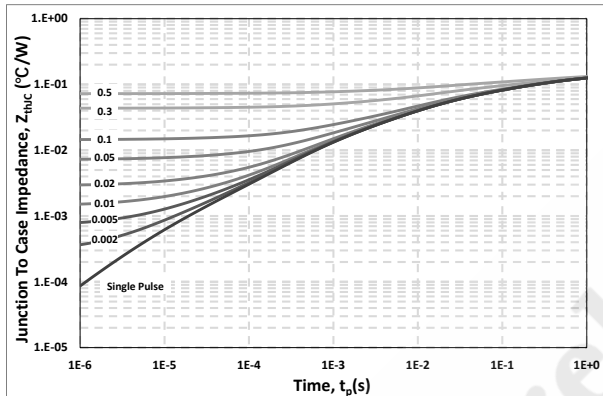


Figure 15. MOSFET Junction to Case Transient Thermal Impedance, Z_{thJC} ($^{\circ}C/W$)

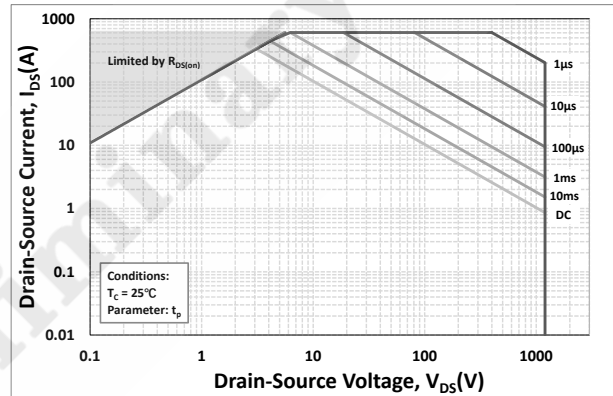


Figure 16. Forward Bias Safe Operating Area (FBSOA)

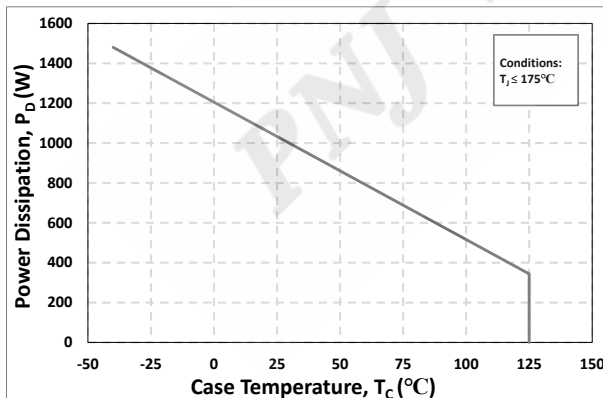


Figure 17. Maximum Power Dissipation Derating vs. Case Temperature

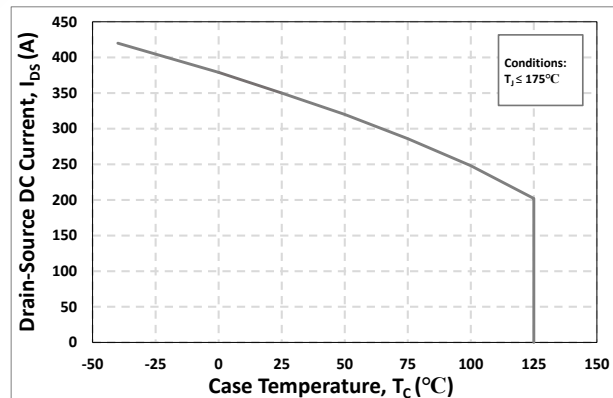


Figure 18. Continuous Drain Current Derating vs. Case Temperature

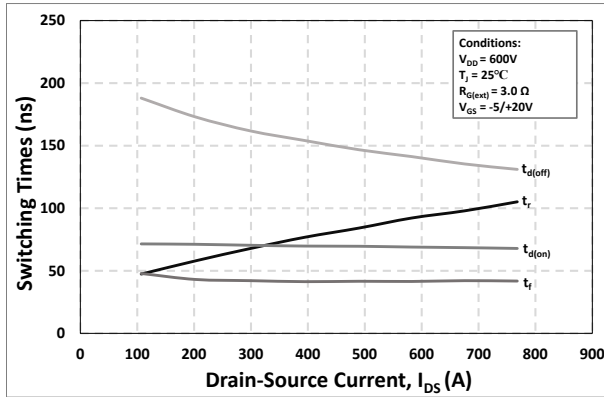


Figure 19. Switching Times vs. Drain-Source Current

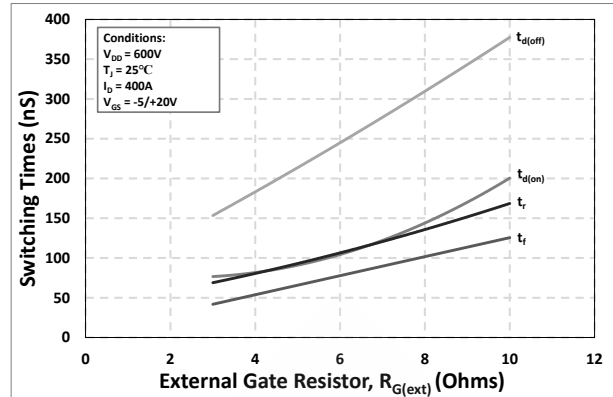


Figure 20. Switching Times vs. External Gate Resistance

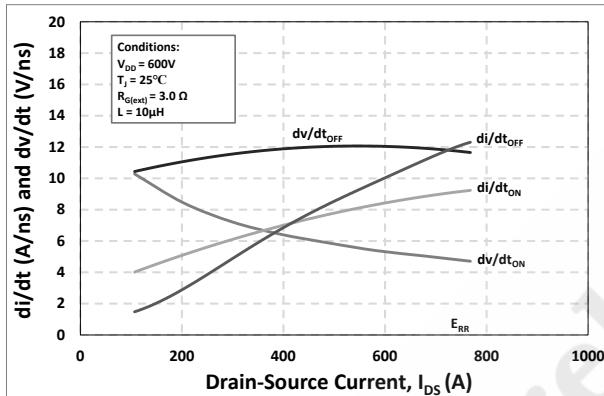


Figure 21. dv/dt and di/dt vs. Source Current

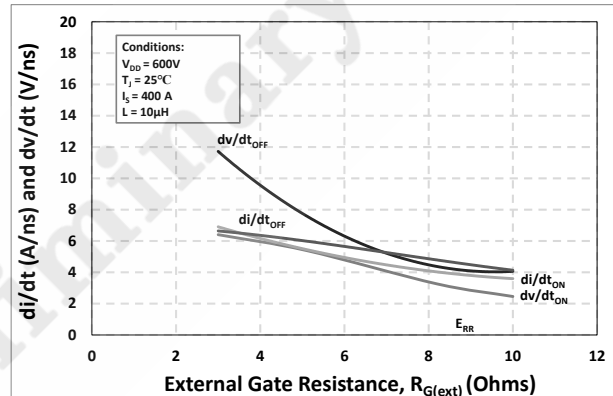
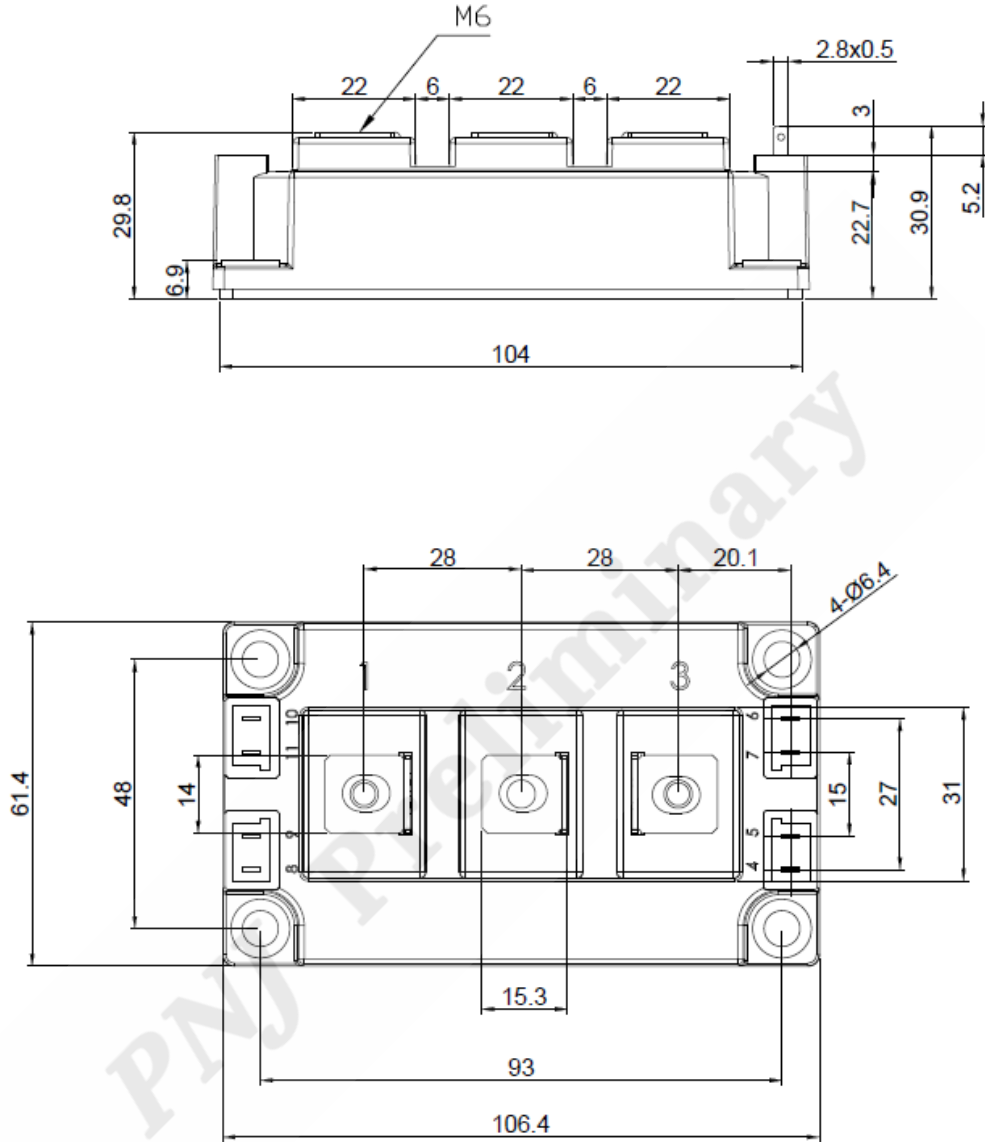


Figure 22. dv/dt and di/dt vs. External Gate Resistance

PNJ PRELIMINARY

6. Package Dimensions



Drawing and Dimensions