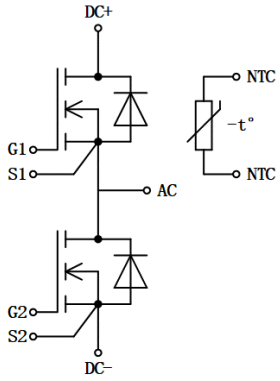
SiC Half-Bridge Module

PAIA12050AM

Features

- High blocking voltage
- Low on-state resistance
- Low stray inductance
- Low switching loss
- Low thermal resistance



Applications

- High-frequency switching application
- DC/DC converter
- Motor drives
- Solar inverter
- Electric vehicle
- UPS systems

Standards Benefits

- Improve system efficiency
- Improve power density
- Reduce cooling requirement
- Reduce system cost

Order Information

Part Number	Package	Marking
PAIA1250AM	EASY 1B	PAIA1250AM

Contents

1. Maximum Ratings

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value	Unit	Test Conditions
Drain - Source Voltage	V_{DSmax}	1200	V	V_{GS}=0V I_D= 100μA
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	80	A	V_{GS} =15V T_C = 25℃ T_J = 150℃
		50		V_{GS} =15V T_C = 100℃ T_J = 150℃
Operating Junction Temperature	T_J	-40 To +150	℃	

2. Electrical Characteristics

At T_J= 25℃, 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}=0V
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.7	/	V	V_{DS}= V_{GS} I_D= 17.7mA T_J= 25℃
Reverse Bias Drain Current	I_{DSS}	/	1	100	μA	V_{GS}= 0V V_{DS}= 1200V

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Gate-Source Leakage Current	I_{GSS}	/	20	250	nA	V_{GS}= 15V V_{DS}= 0V
Drain-Source On-State Resistance	$R_{DS(on)}$	/	25	35	mΩ	V_{GS}= 15V I_D= 50A
Transconductance	g_{fs}	/	28	/	S	V_{DS}= 20V I_{DS}= 50A T_J= 25℃
Turn-on Energy	E_{on}	/	0.31	/	mJ	V_{DS}= 600V I_{DS}= 50A V_{GS}= -3V/15V R_G= 1.0Ω L= 100μH
Turn-off Energy	E_{off}	/	0.18	/		
Turn-On Delay Time	$T_{d(on)}$	/	18.2	/	nS	
Rise Time	T_r	/	26.7	/		
Turn-Off Delay Time	$T_{d(off)}$	/	40.0	/		
Fall Time	T_f	/	12.8	/		
Internal Gate Resistance	$R_{G(int)}$	/	3.0	/	Ω	f= 100kHz V_{AC}= 25mV
Input Capacitance	C_{iss}	/	2.0	/	nF	V_{GS}= 0V V_{DS}= 800V f= 100kHz V_{AC}= 25mV
Output Capacitance	C_{oss}	/	0.07	/	nF	
Reverse Transfer Capacitance	C_{rss}	/	6.4	/	pF	
Thermal Resistance from Junction to Case	$R_{\theta JC}$	/	0.40	/	℃/W	

3. Reverse Diode Characteristics

At T_J= 25℃, unless specified otherwise (Per Position)

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Diode Forward Voltage	V_{SD}	5.2	/	V	V_{GS}= -3V I_{SD}= 25A T_J= 25℃
		4.6	/	V	V_{GS}= -3V I_{SD}= 25A T_J= 150℃
Continuous Diode Forward Current	I_S	50	/	A	V_{GS}= -3V
Reverse Recover Time	t_{rr}	13.4	/	ns	V_{GS}= -3/15V I_{SD}= 50A V_R= 600V d_{if}/d_t= 5300A/μs R_G =1.0Ω T_J= 25℃
Reverse Recovery Charge	Q_{rr}	0.55	/	μC	
Peak Reverse Recovery Current	I_{rrm}	74.6	/	A	
Reverse Recovery Energy	E_{RR}	0.27	/	mJ	V_R= 600V I_{SD}= 50A V_{GS}= -3V/15V R_G= 1.0Ω L= 100μH

4. Module Physical Characteristics

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Case Temperature	T_C	-40	/	125	℃	

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Weight	W	/	23	/	g	
Mounting Force Per Clamp	F	20	/	50	N	
Case Isolation Voltage	V_{isol}	/	3	/	kV	AC, 50Hz, 1min
Comparative Tracking Index	CTI	200	/	/		

5. NTC Thermistor Characteristics

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Rated Resistance	R_{NTC}	/	5	/	kΩ	T_{NTC}= 25℃
Resistance Tolerance	$\triangle R/R$	-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 (Per Position)

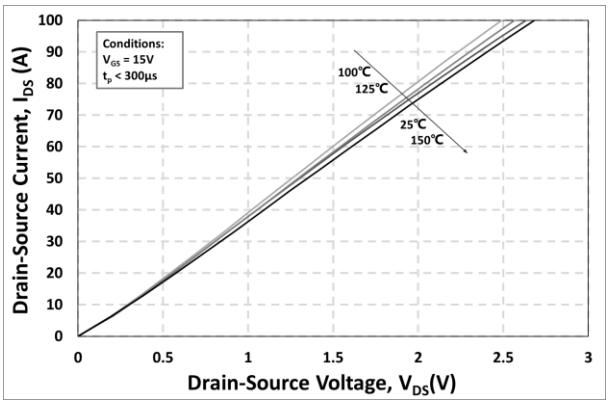


Figure 1. Output Characteristics for Various Junction Temperatures

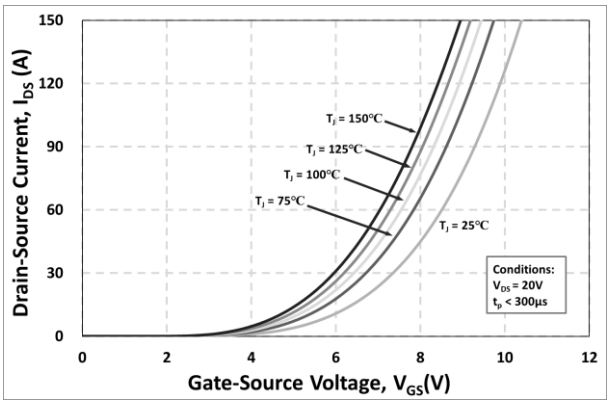


Figure 2. Transfer Characteristic for Various Junction Temperatures -State Resistance vs. Junction Temperature

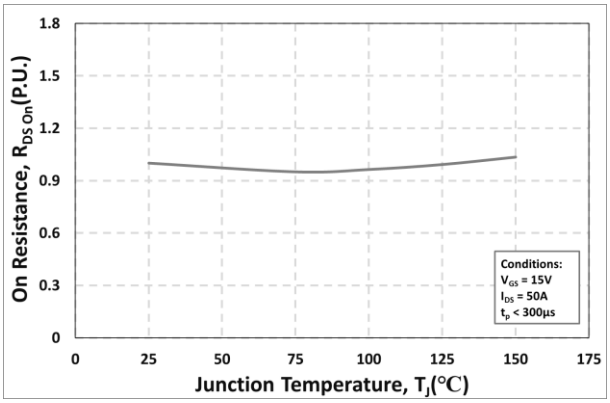


Figure 3. Normalized On-State Resistance vs. Junction Temperature

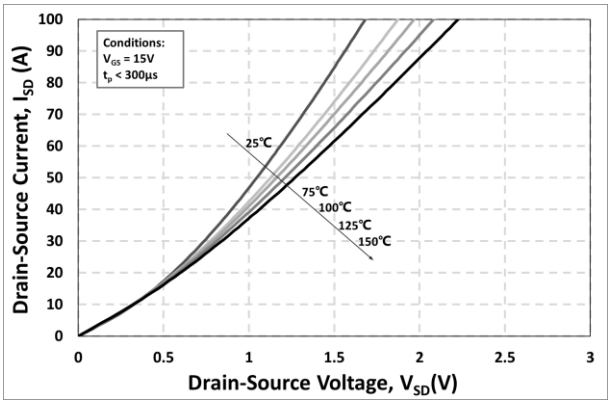


Figure 4. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS} =15V

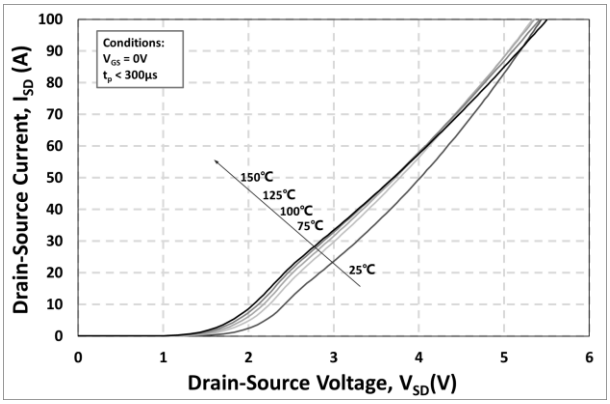


Figure 5. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS} = 0V (Body Diode)

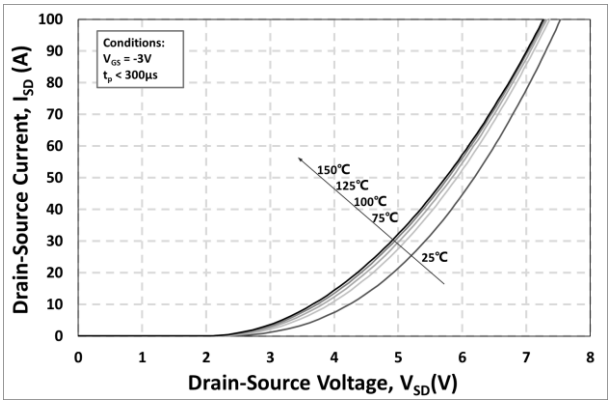


Figure 6. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS} = -3V (Body Diode)

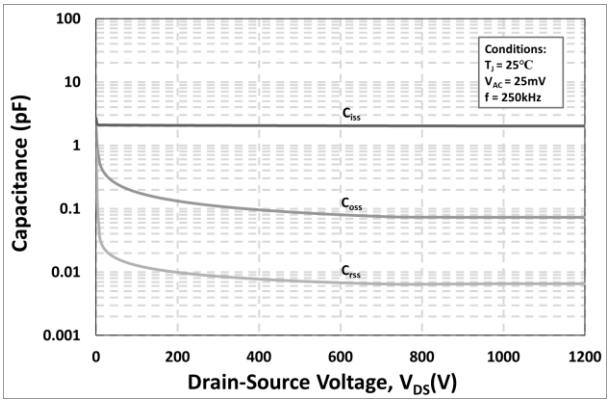


Figure 7. Capacitances vs. Drain-Source Voltage (0 - 1200V)

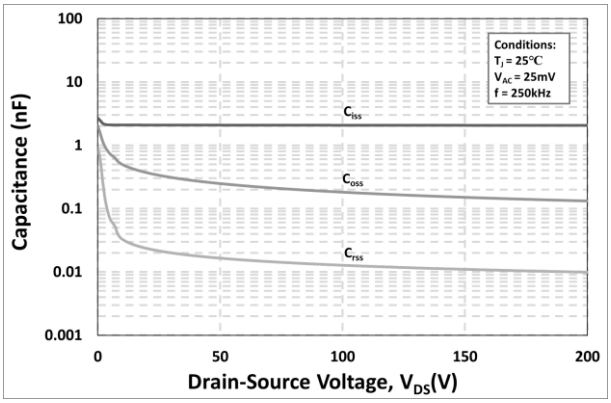


Figure 8. Capacitances vs. Drain-Source Voltage (0 - 200V)

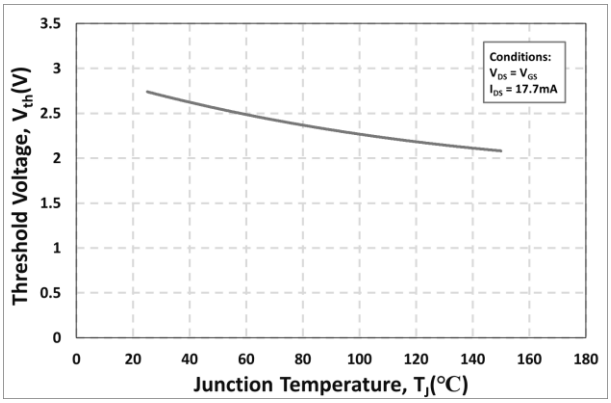


Figure 9. Threshold Voltage vs. Junction Temperature

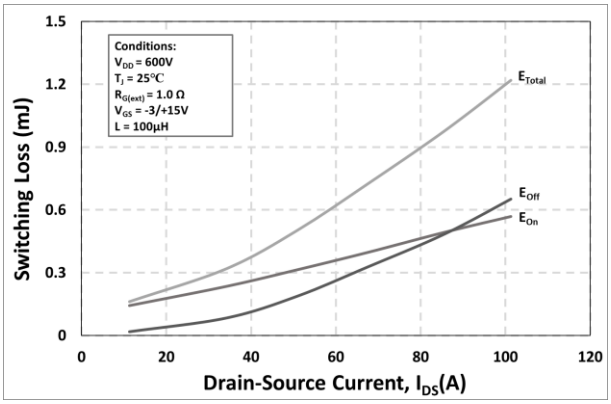


Figure 10. Switching Loss vs. Drain-Source Current (V_{DS} = 600 V)

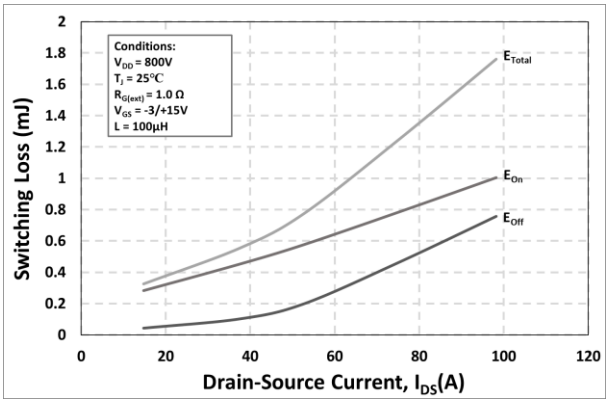


Figure 11. Switching Loss vs. Drain-Source Current (V_{DS} = 800 V)

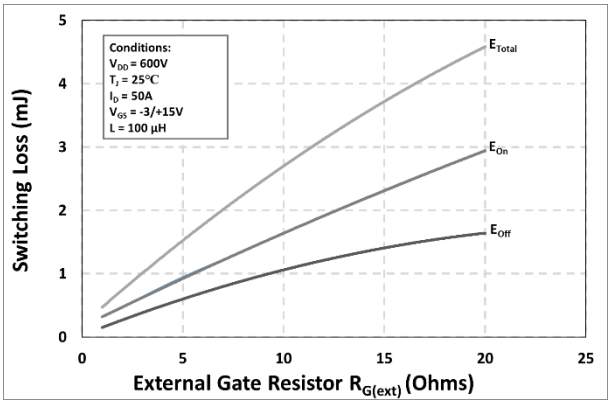


Figure 12. Switching Loss vs. External Gate Resistance

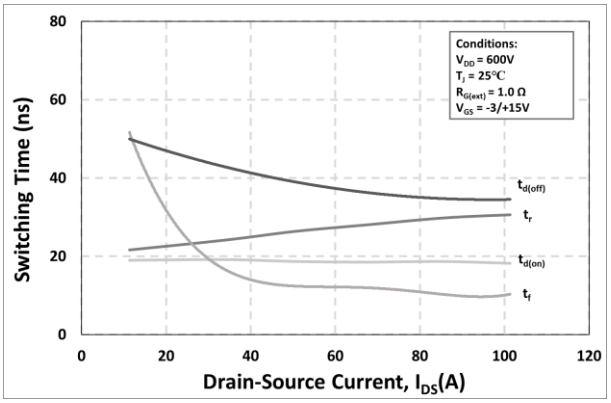


Figure 13. Switching Times vs. Drain-Source Current

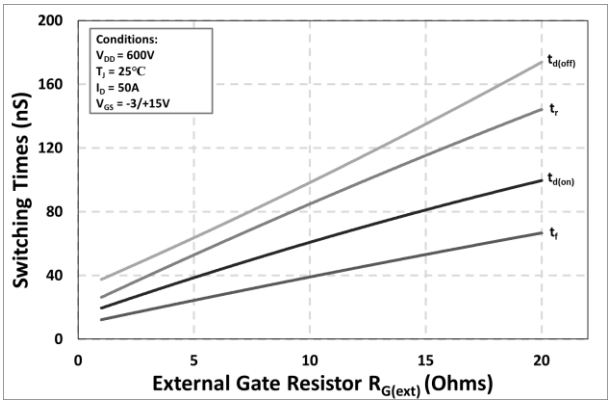


Figure 14. Switching Times vs. External Gate Resistance

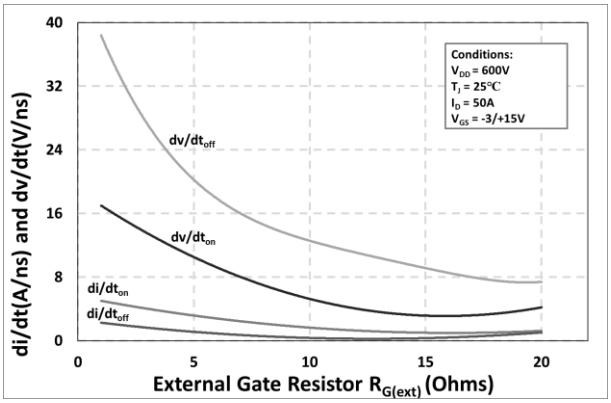


Figure 15. dv/dt and di/dt vs. External Gate Resistance

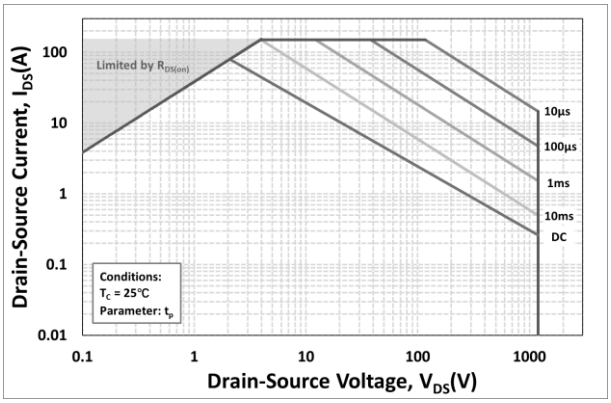


Figure 16. Forward Bias Safe Operating Area (FBSOA)

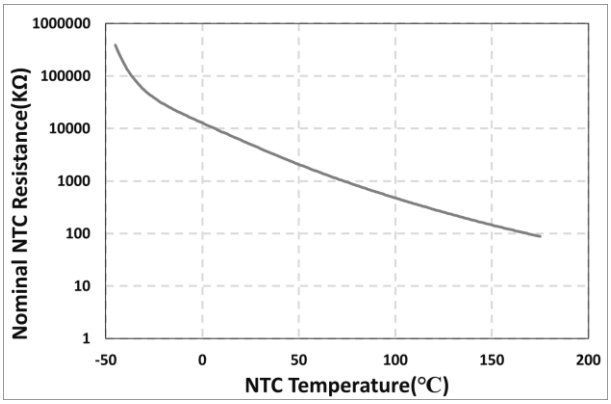


Figure 17. Nominal NTC Resistance vs. NTC Temperature

7. Definitions

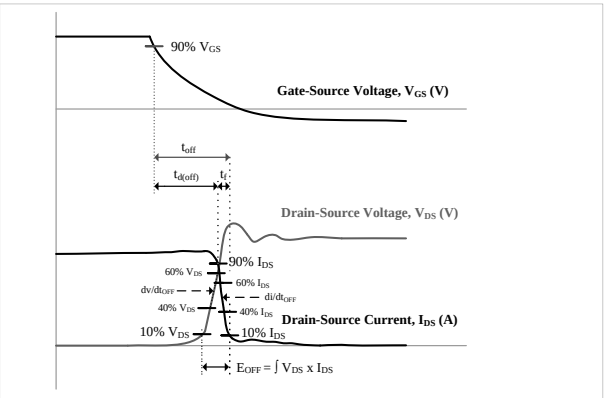


Figure 18. Turn-off Transient Definitions

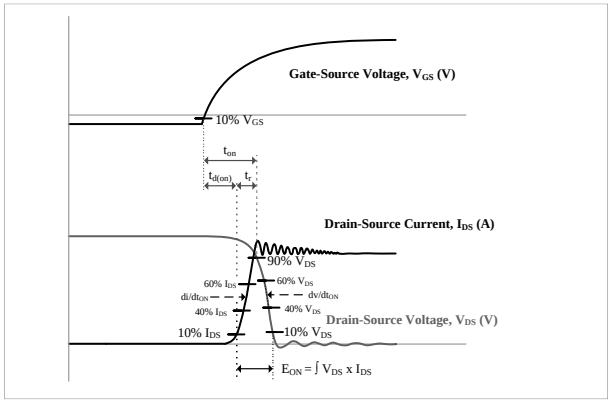


Figure 19. Turn-on Transient Definitions

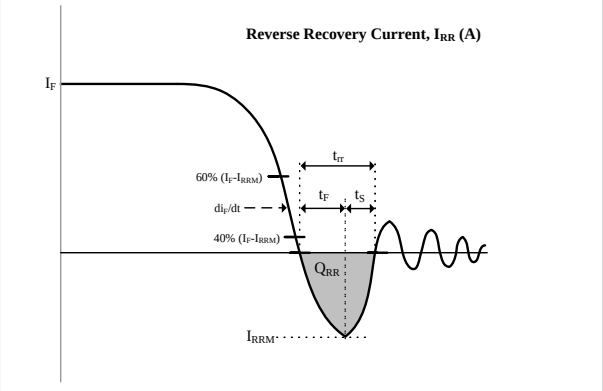


Figure 20. Reverse Recovery Definitions

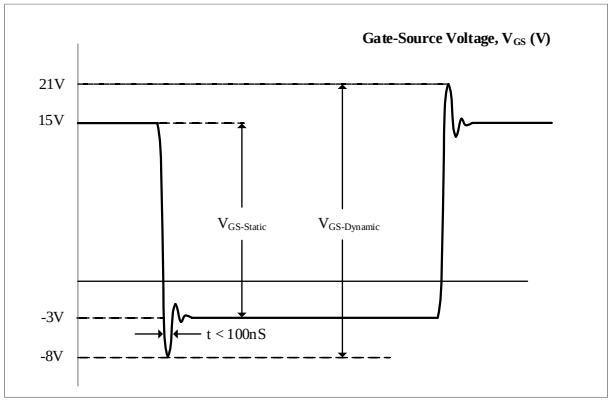
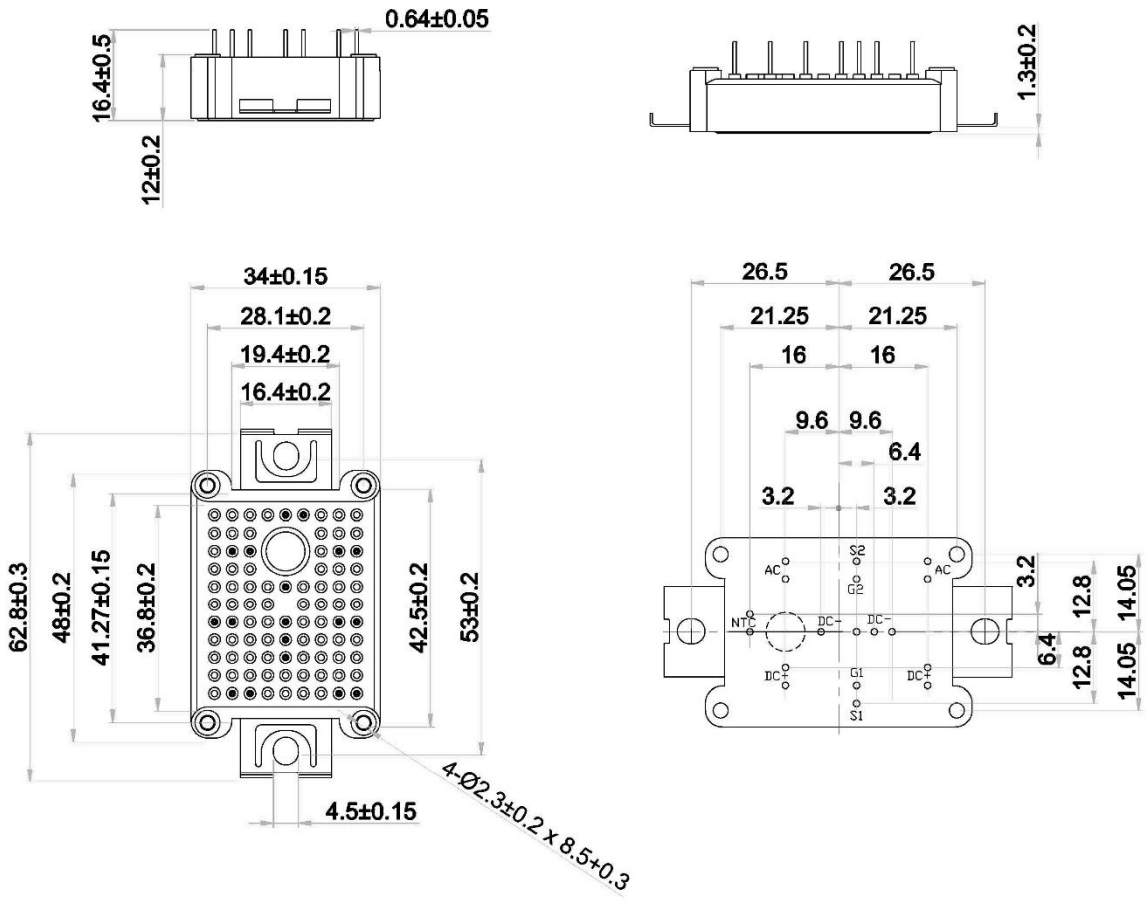


Figure 21. vgs Transient Definitions

8. Package Outlines



Drawing and Dimensions

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.