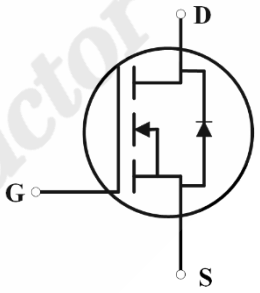
SiC MOS P3M12080K3

N-Channel Enhancement Mode

Features

- Qualified to AEC-Q101
- High Blocking Voltage with Low On-Resistance
- High-Frequency Operation
- Ultra-Small Q_{gd}
- 100% UIS tested



Benefits

- Improve System Efficiency
- Increase Power Density
- Reduce Heat Sink Requirements
- Reduction of System Cost

TO-247-3

Gate	1
Drain	2
Source	3

Applications

- Solar Inverters
- EV Battery Chargers
- High Voltage DC/DC Converters
- Switch Mode Power Supplies

RoHS

Halogen

Order Information

Part Number	Package	Marking
P3M12080K3	TO-247-3	P3M12080K3

Contents

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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	38	A	V_{GS} = 15V T_C = 25℃
		27		V_{GS} = 15V T_C = 100℃
Pulsed Drain Current	$I_{D(pulse)}$	80	A	
Power Dissipation	P_D	221	W	
Operating Junction	T_J	-55 To +175	˚C	
Storage Temperature	T_{stg}	-55 To +175	˚C	
Solder Temperature	T_L	260	˚C	
Mounting Torque	M_d	1 8.8	Nm lbf-in	M3 or 6-32 screw

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 I_D= 100μA
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.4	/	V	(tested after 30ms pulse at V_{GS}=15V) V_{DS}= V_{GS} I_D= 5mA T_J = 25℃
		/	1.6	/	V	V_{DS}= V_{GS} I_D= 5mA T_J = 175℃
Zero Gate Voltage Drain Current	I_{DSS}	/	1.8	100	μA	V_{GS}=0V V_{DS}=1200V
Gate-Source Leakage Current	I_{GSS}	/	20	250	nA	V_{GS}= 15V V_{DS}= 0V
Drain-Source On-State Resistance	$R_{DS(on)}$	/	80	104	mΩ	V_{GS}= 15V I_D= 20A T_J = 25℃
		/	104	/		V_{GS}= 15V I_D= 20A T_J = 175℃
		/	66	/		V_{GS}= 18V I_D= 20A T_J = 25℃

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Transconductance	g_{fs}	/	10	/	S	V_{DS}= 20V I_{DS}= 20A T_J = 25℃
		/	9.6	/		V_{DS}= 20V I_{DS}= 20A T_J= 175℃
Input Capacitance	C_{iss}	/	2032	/	pF	V_{GS}= 0V V_{DS}= 800V f= 1MHz V_{AC}= 25mV
Output Capacitance	C_{oss}	/	73.6	/		
Reverse Transfer Capacitance	C_{rss}	/	6	/		
Coss Stored Energy	E_{oss}	/	52.9	/	μJ	
Turn-on Energy	E_{on}	/	507	/	μJ	V_{DS}= 800V V_{GS}= -3/15V I_D= 20A R_G= 1Ω
Turn-off Energy	E_{off}	/	27	/		
Turn-on Energy	E_{on}	/	405	/	μJ	V_{DS}= 800V V_{GS}= -3/18V I_D= 20A R_G= 1Ω
Turn-off Energy	E_{off}	/	33	/		
Turn-On Delay Time	$t_{d(on)}$	/	17	/	ns	V_{DS}= 800V V_{GS}= -3/15V I_D= 20A R_G= 1Ω
Rise Time	t_r	/	32	/		
Turn-Off Delay Time	$t_{d(off)}$	/	23	/		
Fall Time	t_f	/	18	/		
Internal Gate Resistance	$R_{G(int)}$	/	3.5	/	Ω	f= 1MHz V_{AC}= 25mV

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Gate to Source Charge	Q_{gs}	/	22.2	/	nC	V_{DS}= 800V I_{DS}= 20A V_{GS}= -3 to 15V I_G= 20mA
Gate to Drain Charge	Q_{gd}	/	12.3	/		
Total Gate Charge	Q_g	/	54.6	/		

3. Reverse Diode Characteristics

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Diode Forward Voltage	V_{SD}	5.2	/	V	V_{GS}= -3V I_{SD}= 10A T_J= 25℃
		4.8	/	V	V_{GS}= -3V I_{SD}= 10A T_J= 175℃
Continuous Diode Forward Current	I_S	31	/	A	V_{GS}= -3V
Reverse Recover Time	t_{rr}	33	/	ns	V_{GS}= -3V I_{SD}= 20A V_R= 800V d_{if}/d_t= 3800A/μs T_J= 25℃
Reverse Recovery Charge	Q_{rr}	348	/	nC	
Peak Reverse Recovery Current	I_{rrm}	17	/	A	

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Reverse Recover Time	t_{rr}	28	/	ns	V_{GS}= -3V I_{SD}= 20A V_R= 800V d_{if}/d_t= 4000A/μs T_J= 25℃
Reverse Recovery Charge	Q_{rr}	393	/	nC	
Peak Reverse Recovery Current	I_{rrm}	23	/	A	

4. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	0.68	℃/W

5. Typical Performance

At T_J= 25℃, unless specified otherwise

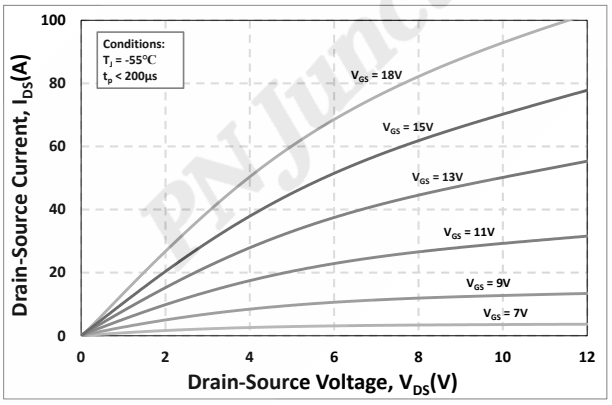


Figure 1. Output Characteristics T_J = -55℃

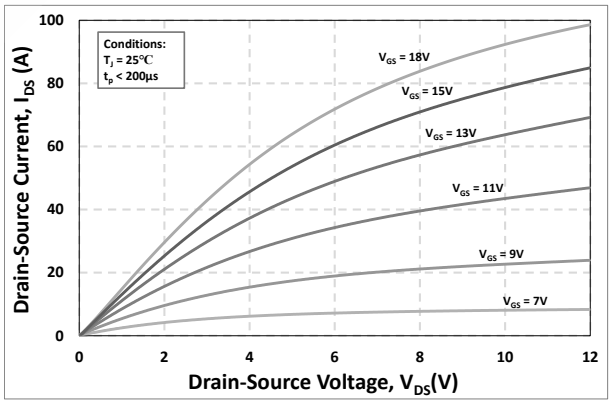


Figure 2. Output Characteristics T_J = 25℃

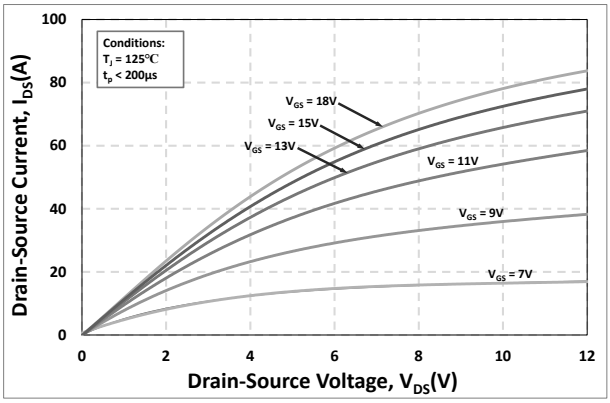


Figure 3. Output Characteristics T_J = 125°C

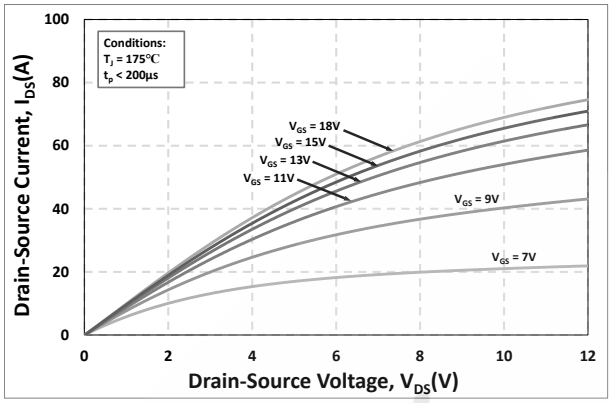


Figure 4. Output Characteristics T_J = 175°C

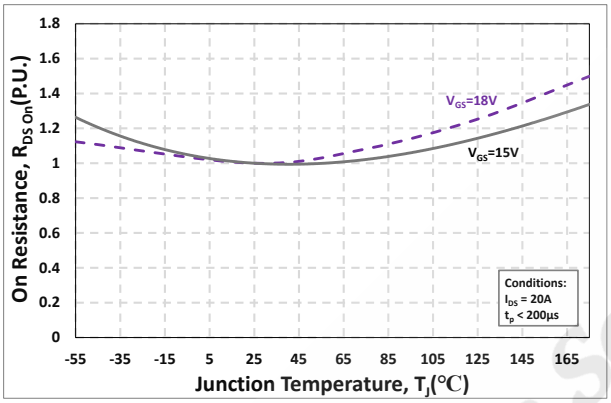


Figure 5. Normalized On-Resistance vs. Temperature

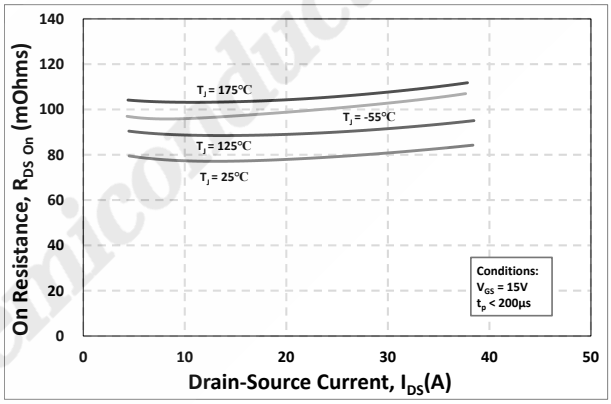


Figure 6. On-Resistance vs. Drain Current Various Temperatures

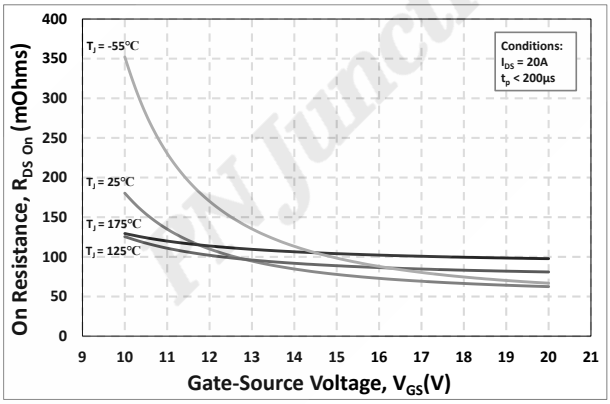


Figure 7. On-Resistance vs. Gate-Source Voltage

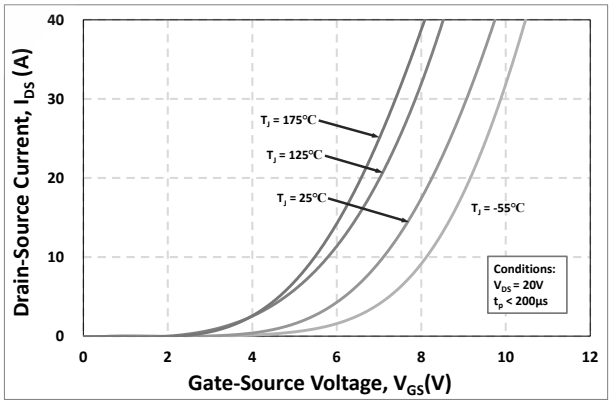


Figure 8. Transfer Characteristic for Various Junction Temperatures

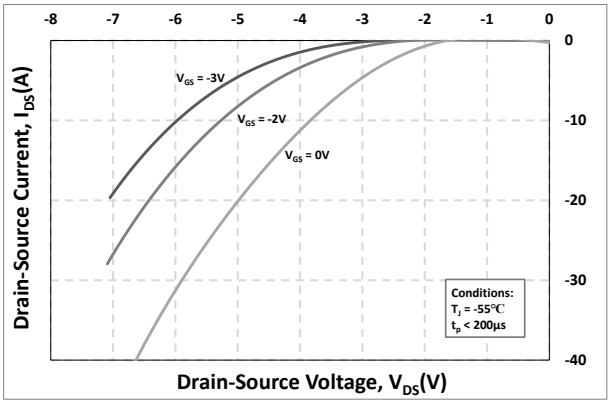


Figure 9. Body Diode Characteristic at -55°C

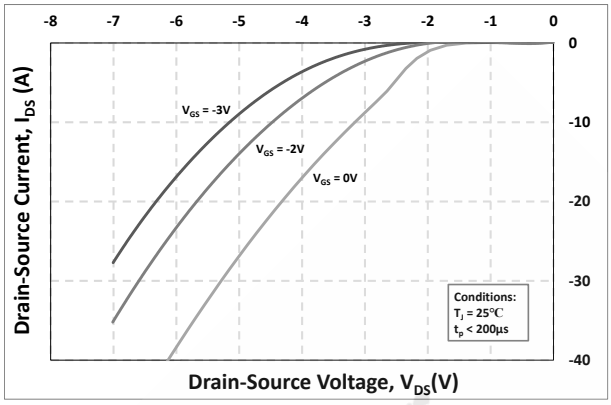


Figure 10. Body Diode Characteristic at 25°C

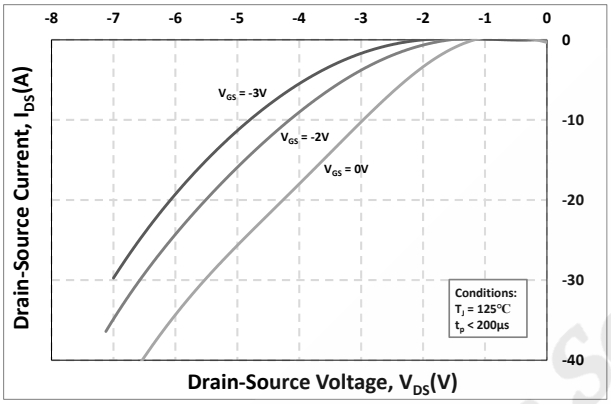


Figure 11. Body Diode Characteristic at 125°C

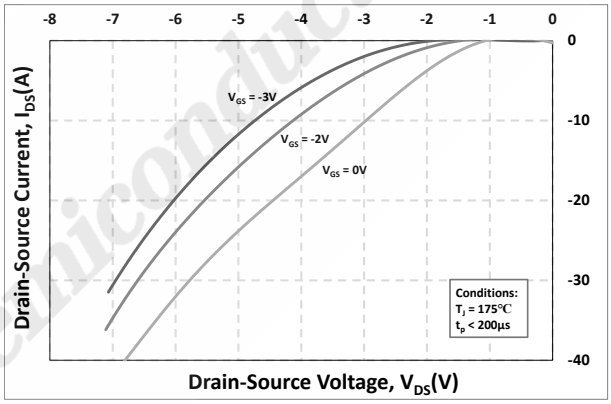


Figure 12. Body Diode Characteristic at 175°C

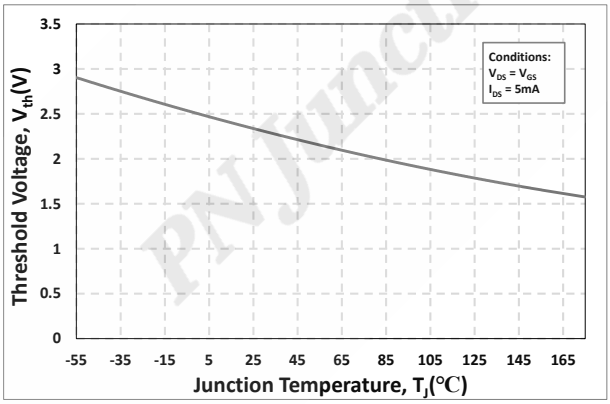


Figure 13. Threshold Voltage vs. Temperature

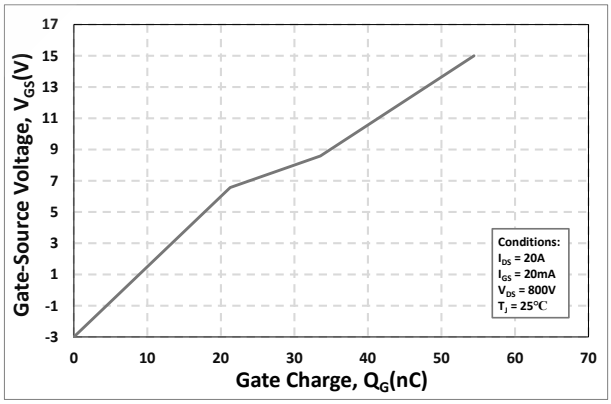


Figure 14. Gate Charge Characteristics

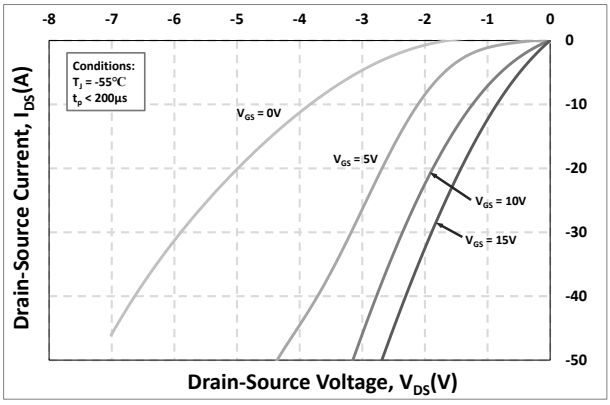


Figure 15. 3rd Quadrant Characteristic at -55°C

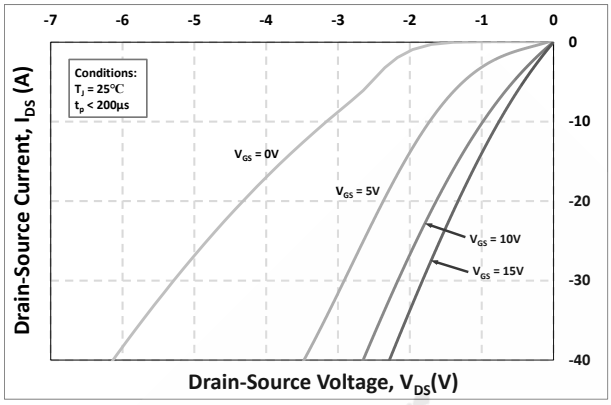


Figure 16. 3rd Quadrant Characteristic at 25°C

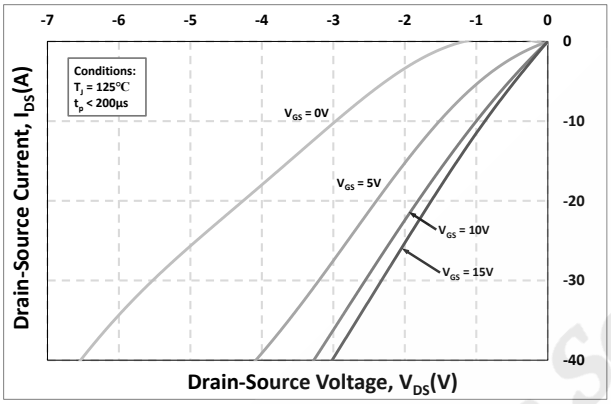


Figure 17. 3rd Quadrant Characteristic at 125°C

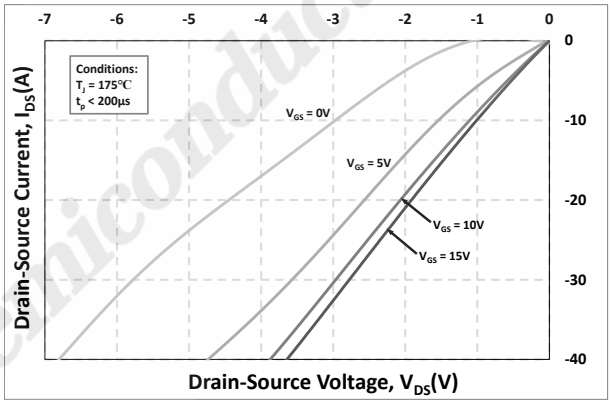


Figure 18. 3rd Quadrant Characteristic at 175°C

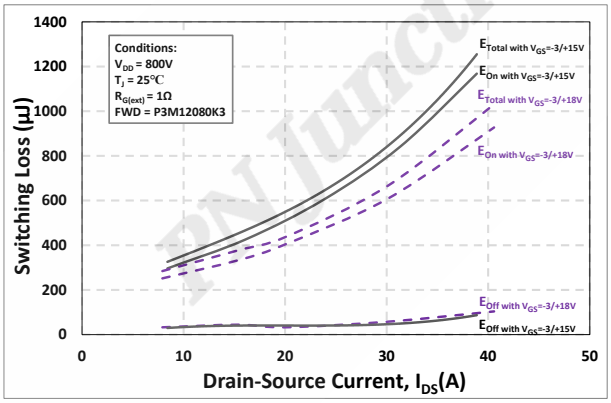


Figure 19. Clamped Inductive Switching Energy vs. Drain Current (V_{DD}= 800V)

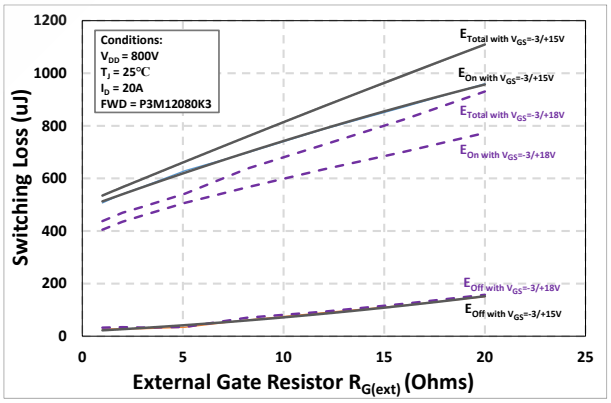


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

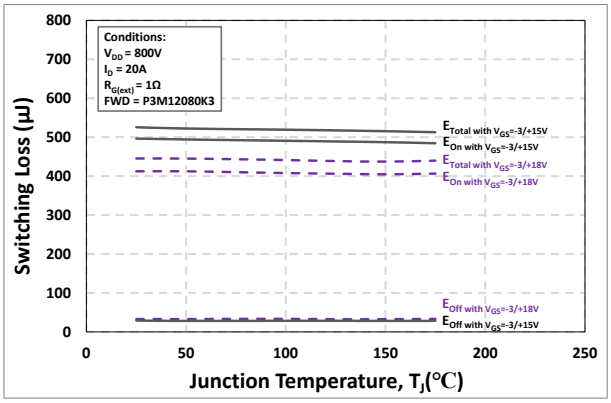


Figure 21. Clamped Inductive Switching Energy vs. Temperature

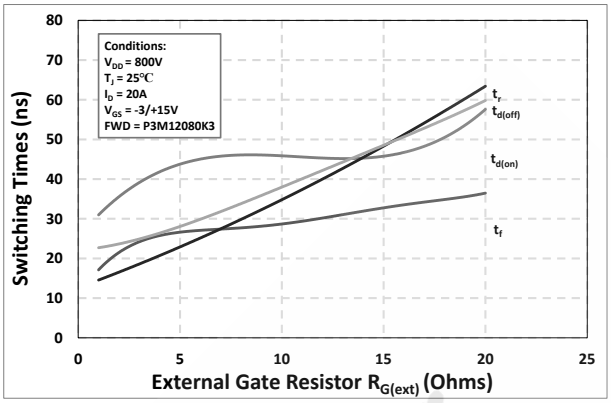


Figure 22. Switching Times vs. $R_{G(ext)}$

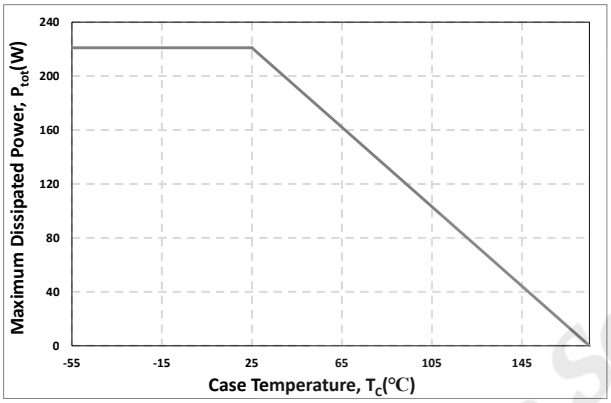


Figure 23. Maximum Power Dissipation Derating vs. Case Temperature

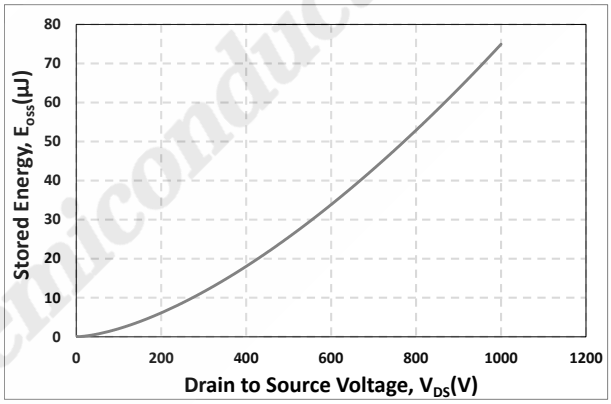


Figure 24. Output Capacitor Stored Energy

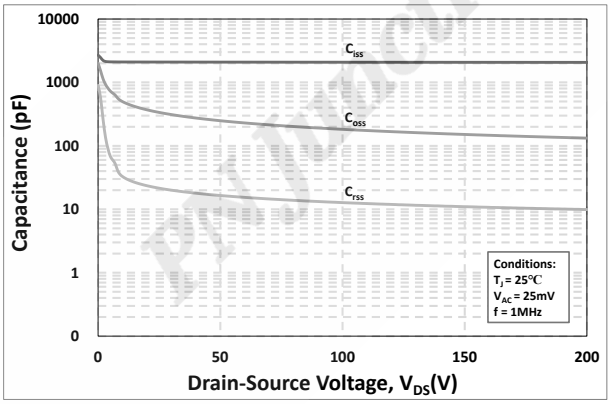


Figure 25. Capacitances vs. Drain-Source Voltage (0 - 200V)

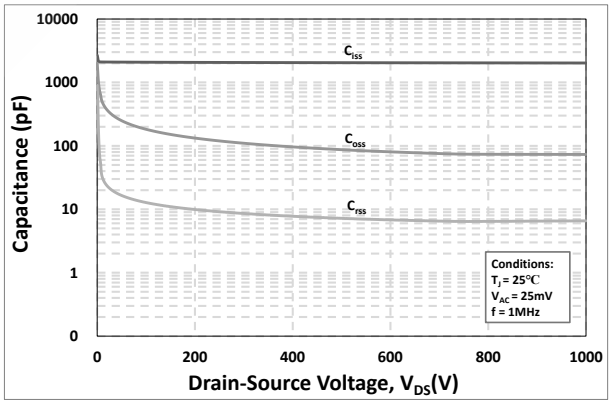


Figure 26. Capacitances vs. Drain-Source Voltage (0 - 1000V)

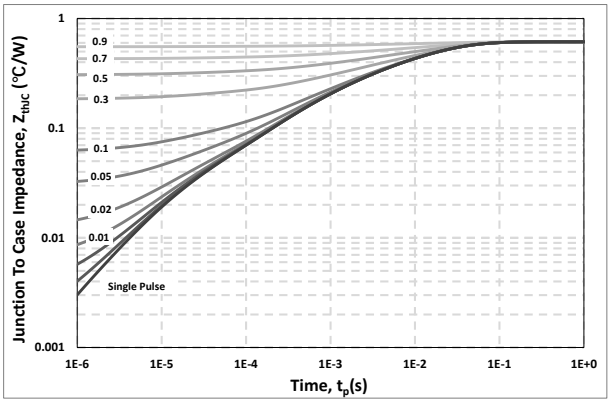


Figure 27. Transient Thermal Impedance (Junction - Case)

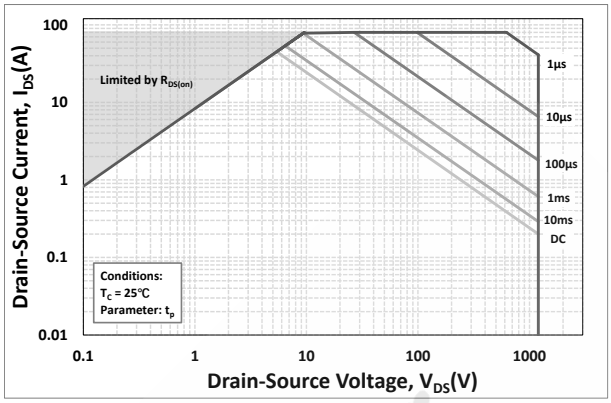


Figure 28. Safe Operating Area

6. Definitions

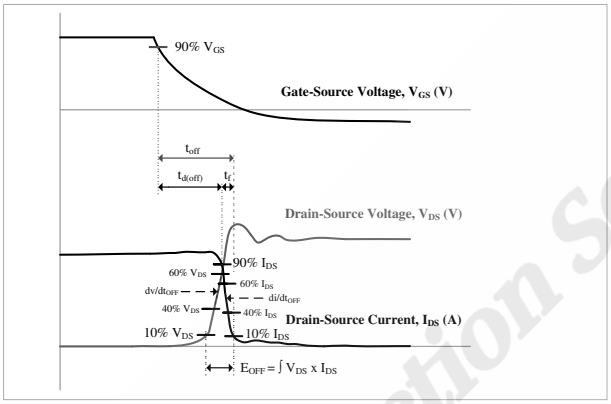


Figure 29. Turn-off Transient Definitions

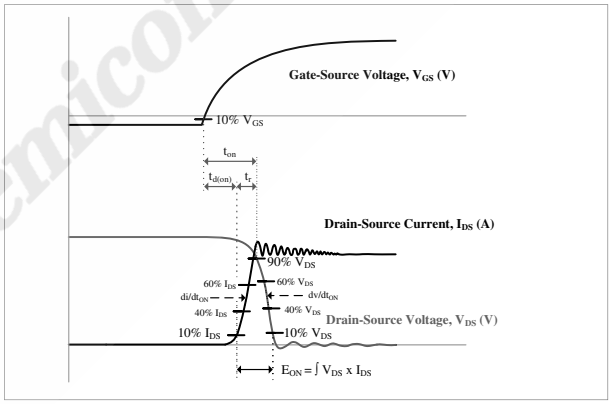


Figure 30. Turn-on Transient Definitions

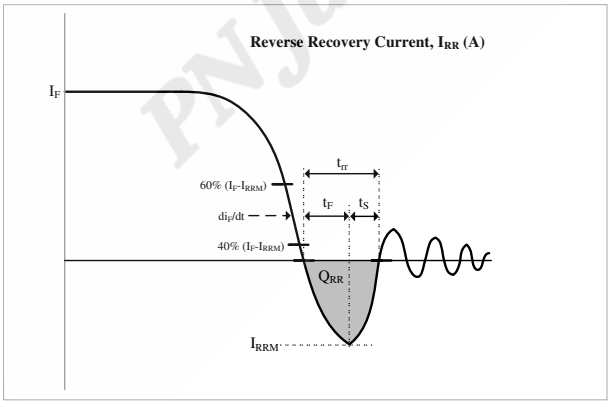


Figure 31. Reverse Recovery Definitions

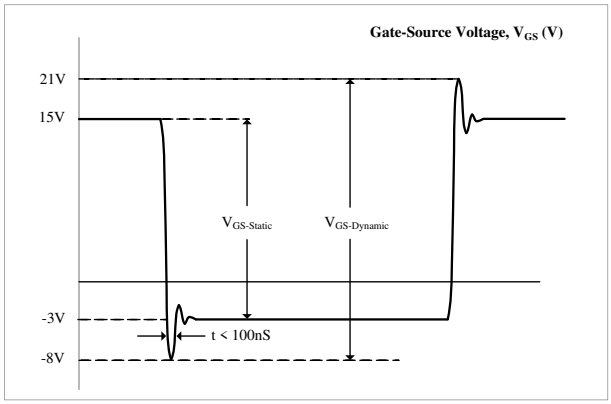
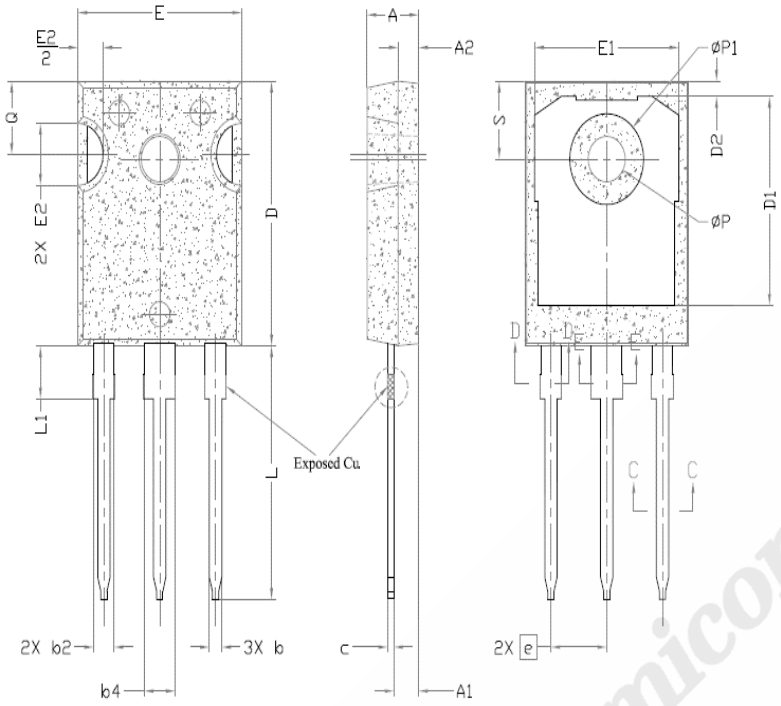


Figure 32. vgs Transient Definitions

7. Package Outlines



SYMBOL	DIMENSIONS			NOTES
	MIN.	NOM.	MAX.	
A	4.83	5.02	5.21	
A1	2.29	2.41	2.55	
A2	1.50	2.00	2.49	
b	1.12	1.20	1.33	
b1	1.12	1.20	1.28	
b2	1.91	2.00	2.39	6
b3	1.91	2.00	2.34	
b4	2.87	3.00	3.22	6, 8
b5	2.87	3.00	3.18	
c	0.55	0.60	0.69	6
c1	0.55	0.60	0.65	
D	20.80	20.95	21.10	4
D1	16.25	16.55	17.65	5
D2	0.51	1.19	1.35	
E	15.75	15.94	16.13	4
E1	13.46	14.02	14.16	5
E2	4.32	4.91	5.49	3
e	5.44BSC			
L	19.81	20.07	20.32	
L1	4.10	4.19	4.40	6
ØP	3.56	3.61	3.65	7
ØP1	7.19REF.			
Q	5.39	5.79	6.20	
S	6.04	6.17	6.30	

Drawing and Dimensions

Important Notice

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

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

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