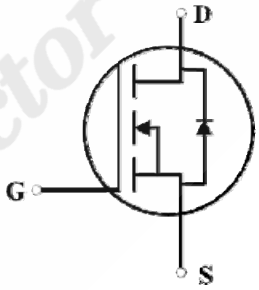
V_{RRM}	=	650	V
I_D	=	68	A
I_D(100℃)	=	48	A
$R_{DS(on)}$	=	40	mΩ

SiC MOS P3M06040K3
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
P3M06040K3	TO-247-3	P3M06040K3

Contents

1. Maximum Ratings

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value	Unit	Test Conditions
Drain - Source Voltage	V_{DSmax}	650	V	V_{GS}= 0V I_D= 100μA
Gate - Source Voltage (dynamic)	V_{GSmax}	-8 / +20	V	AC (f>1 Hz)
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	68	A	V_{GS}= 15V T_C= 25℃
		48		V_{GS}= 15V T_C= 100℃
Pulsed Drain Current	$I_{D(pulse)}$	123	A	
Power Dissipation	P_D	254	W	
Operating Junction	T_J	-55 To +175	℃	
Storage Temperature	T_{stg}	-55 To +175	℃	
Solder Temperature	T_L	260	℃	
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	$V_{(BR)DSS}$	650	/	/	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= 7.5mA T_J = 25℃
		/	1.6	/	V	V_{DS}= V_{GS} I_D= 7.5mA T_J = 175℃
Zero Gate Voltage Drain Current	I_{DSS}	/	1	100	μA	V_{GS}= 0V V_{DS}= 650V
Gate-Source Leakage Current	I_{GSS}	/	20	250	nA	V_{GS}= 15V V_{DS}= 0V
Drain-Source On-State Resistance	$R_{DS(on)}$	/	40	52	mΩ	V_{GS}= 15V I_D= 40A T_J= 25℃
		/	36	/		V_{GS}= 18V I_D= 40A T_J= 25℃
Trans conductance	g_{fs}	/	16	/	S	V_{DS}= 20V I_{DS}= 40A T_J= 25℃
		/	15	/		V_{DS}= 20V I_{DS}= 40A T_J= 175℃

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Input Capacitance	C_{iss}	/	3398	/	pF	V_{GS}= 0V V_{DS}= 400V f= 1MHz V_{AC}= 25mV
Output Capacitance	C_{oss}	/	243	/		
Reverse Transfer Capacitance	C_{rss}	/	9.7	/		
Coss Stored Energy	E_{oss}	/	46.4	/	μJ	
Turn-on Energy	E_{on}	/	568	/	μJ	V_{DS}= 400V V_{GS}= -3/15V I_D= 40A R_G= 1Ω
Turn-off Energy	E_{off}	/	31	/		
Turn-on Energy	E_{on}	/	387	/	μJ	V_{DS}= 400V V_{GS}= -3/18V I_D= 40A R_G= 1Ω
Turn-off Energy	E_{off}	/	29	/		
Turn-On Delay Time	$t_{d(on)}$	/	21	/	ns	V_{DS}= 400V V_{GS}= -3/15V I_D= 40A R_G= 1Ω
Rise Time	t_r	/	57	/		
Turn-Off Delay Time	$t_{d(off)}$	/	27	/		
Fall Time	t_f	/	7	/		
Internal Gate Resistance	$R_{G(int)}$	/	0.9	/	Ω	f= 1MHz V_{AC}= 25mV
Gate to Source Charge	Q_{gs}	/	41.2	/	nC	V_{DS}= 400V I_{DS}= 40A V_{GS}= -3 to 15V I_G= 20mA
Gate to Drain Charge	Q_{gd}	/	20.5	/		
Total Gate Charge	Q_g	/	87.3	/		

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}= 20A T_J= 25℃
		5.0	/	V	V_{GS}= -3V I_{SD}= 20A T_J= 175℃
Continuous Diode Forward Current	I_S	40.6	/	A	V_{GS}= -3V
Reverse Recover Time	t_{rr}	39	/	ns	V_{GS}= -3V I_{SD}= 40A V_R= 400V d_{if}/d_t= 2300A/μs T_J= 25℃
Reverse Recovery Charge	Q_{rr}	179	/	nC	
Peak Reverse Recovery Current	I_{rrm}	10	/	A	
Reverse Recover Time	t_{rr}	32	/	ns	V_{GS}= -3V I_{SD}= 40A V_R= 400V d_{if}/d_t= 3200A/μs T_J= 25℃
Reverse Recovery Charge	Q_{rr}	221	/	nC	
Peak Reverse Recovery Current	I_{rrm}	12	/	A	

4. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	0.59	℃/W

5. Typical Performance

At T_J= 25℃, unless specified otherwise

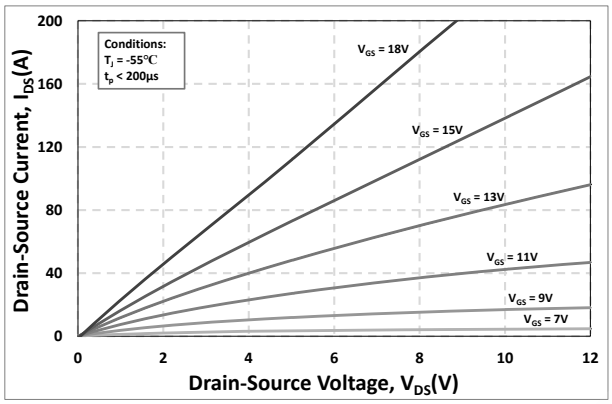


Figure 1. Output Characteristics T_J = -55℃

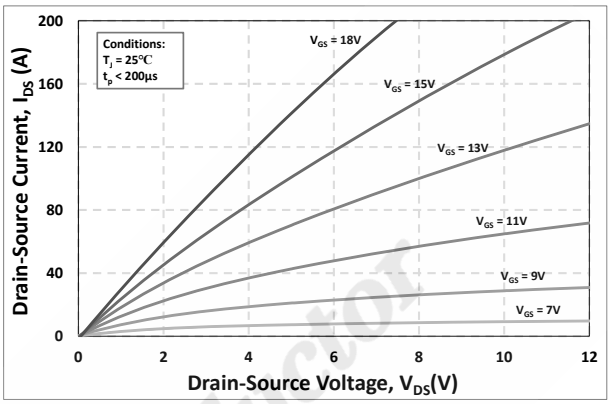


Figure 2. Output Characteristics T_J = 25℃

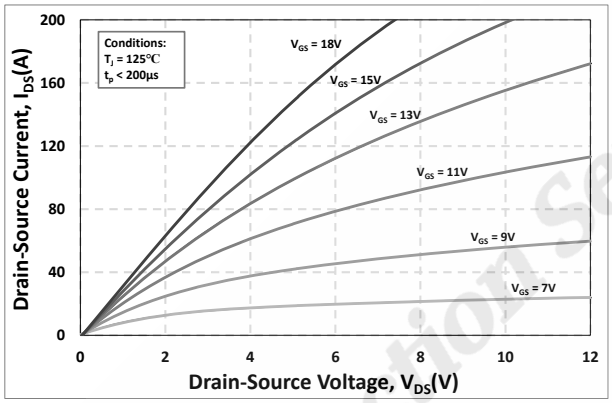


Figure 3. Output Characteristics T_J = 125℃

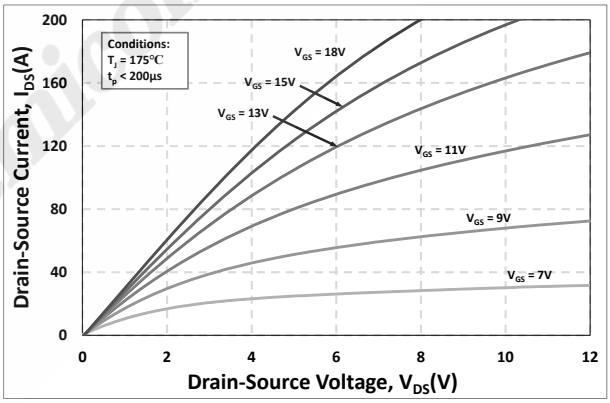


Figure 4. Output Characteristics T_J = 175℃

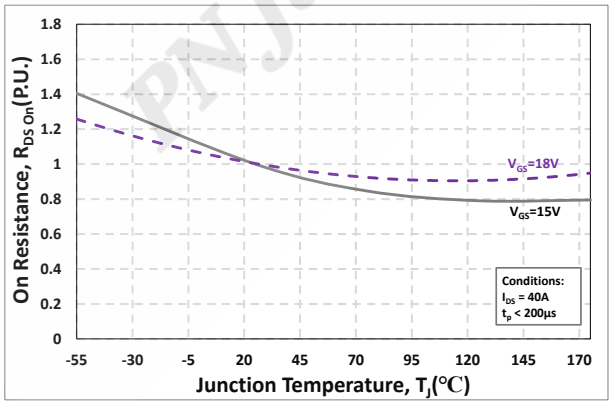


Figure 5. Normalized On-Resistance vs. Temperature

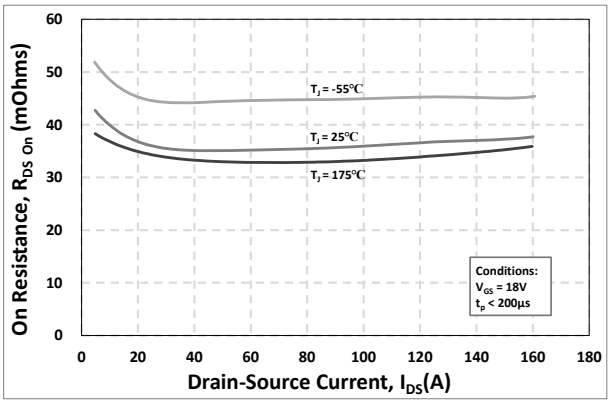


Figure 6. On-Resistance vs. Drain Current Various Temperatures

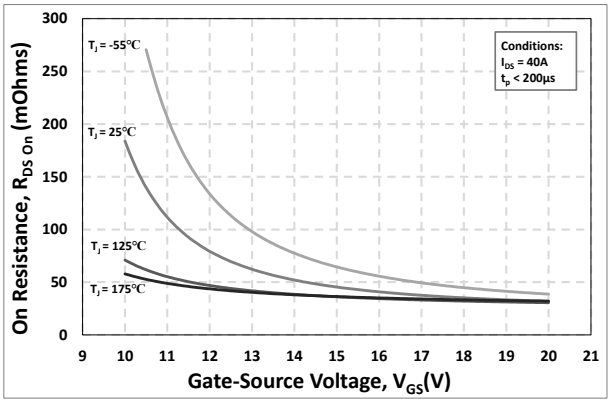


Figure 7. On-Resistance vs. Gate-Source Voltage

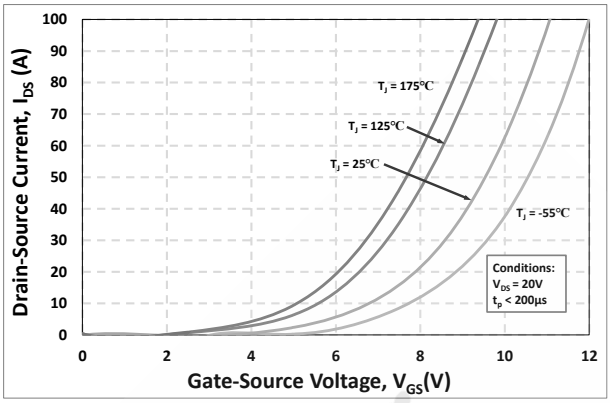


Figure 8. Transfer Characteristic for Various Junction Temperatures

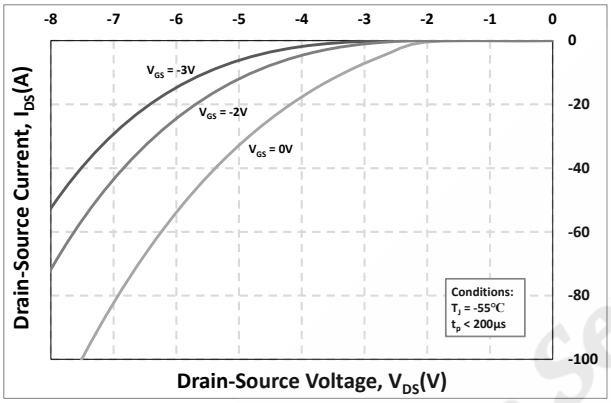


Figure 9. Body Diode Characteristic at -55°C

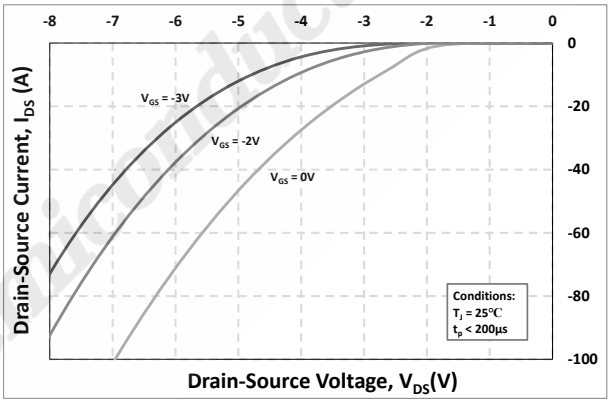


Figure 10. Body Diode Characteristic at 25°C

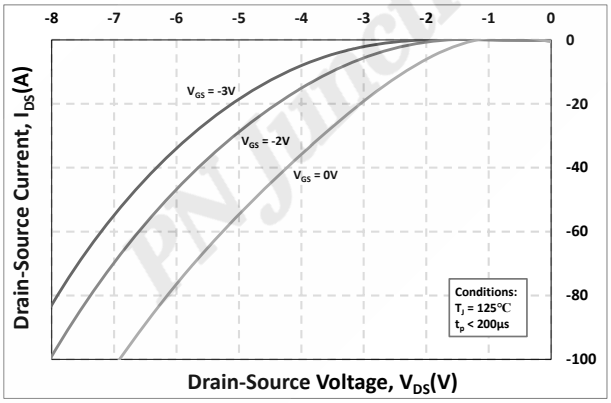


Figure 11. Body Diode Characteristic at 125°C

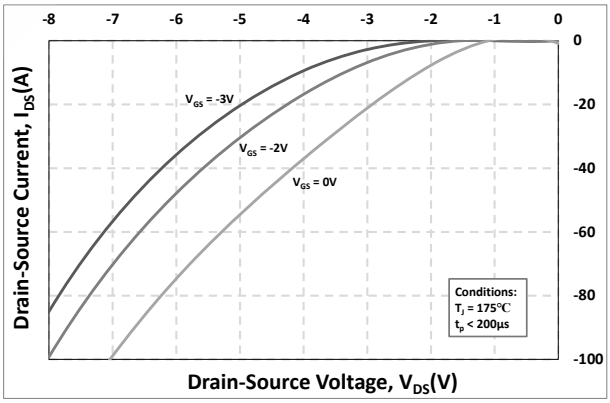


Figure 12. Body Diode Characteristic at 175°C

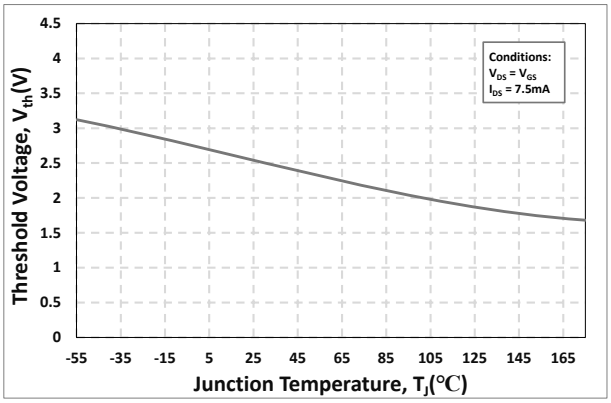


Figure 13. Threshold Voltage vs. Temperature

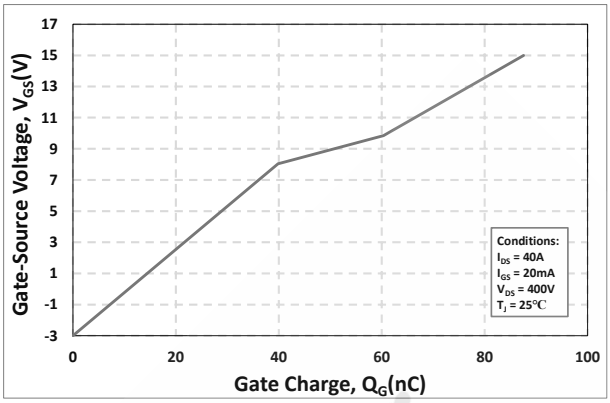


Figure 14. Gate Charge Characteristics

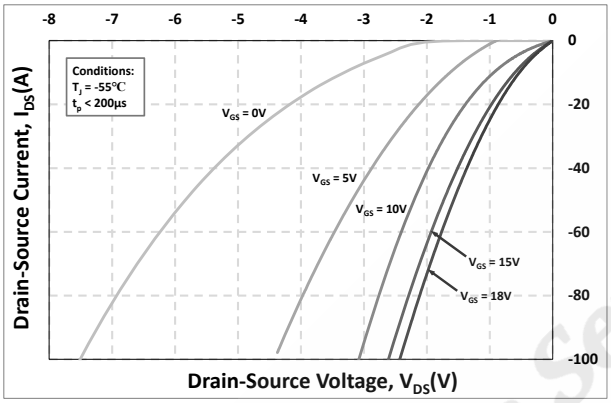


Figure 15. 3rd Quadrant Characteristic at -55℃

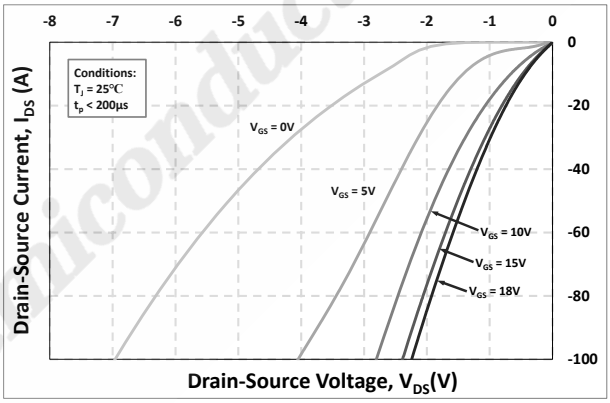


Figure 16. 3rd Quadrant Characteristic at 25℃

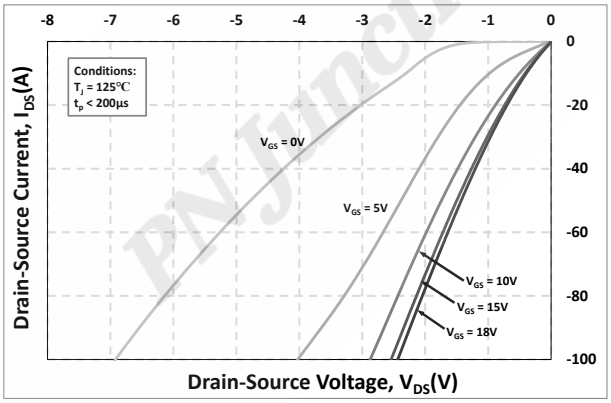


Figure 17. 3rd Quadrant Characteristic at 125℃

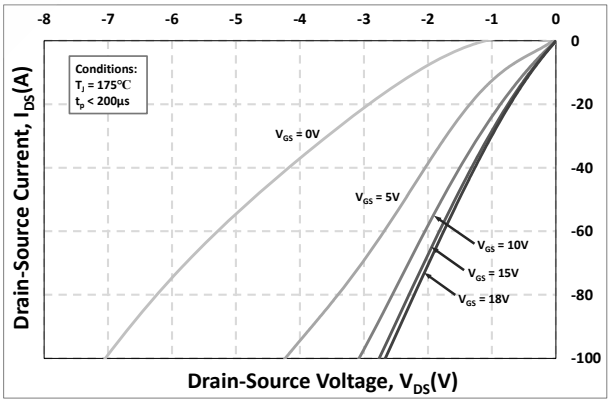


Figure 18. 3rd Quadrant Characteristic at 175℃

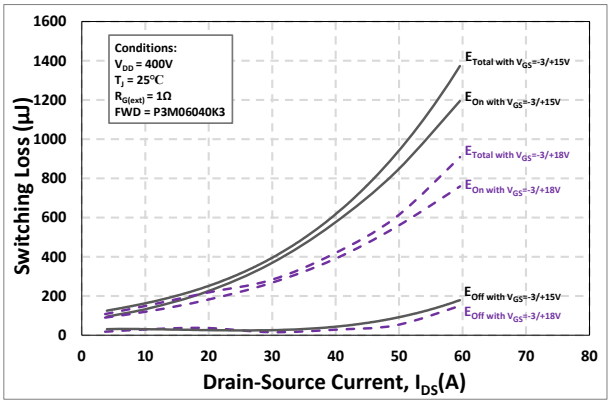


Figure 19. Clamped Inductive Switching Energy vs. Drain Current (V_{DD}= 400V)

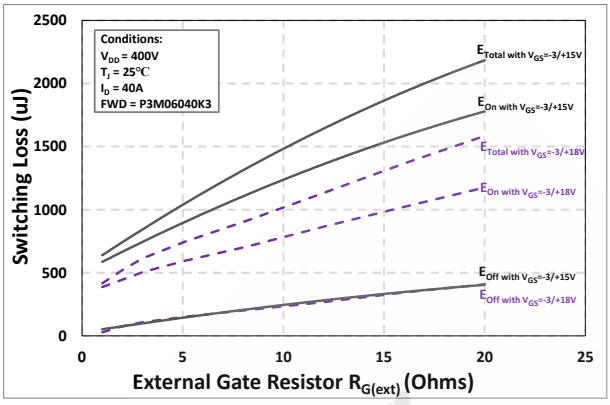


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

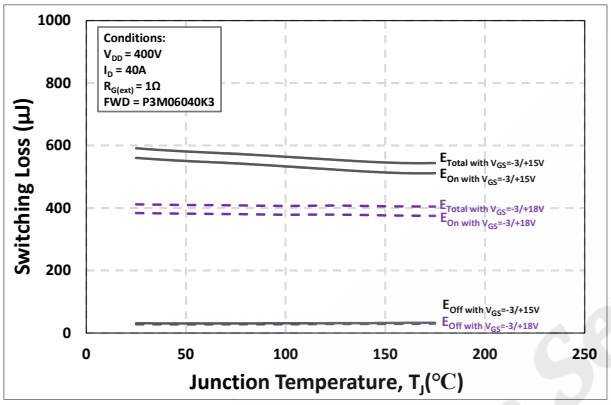


Figure 21. Clamped Inductive Switching Energy vs. Temperature

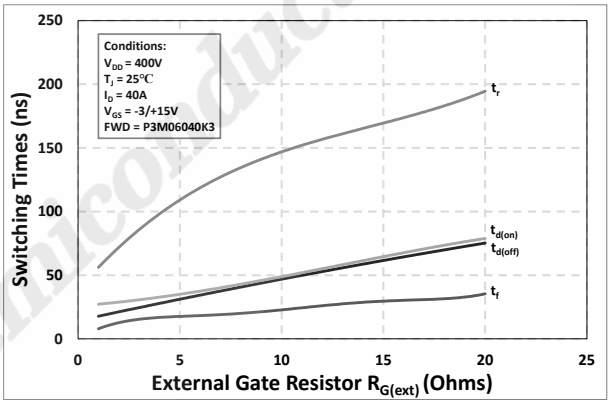


Figure 22. Switching Times vs. $R_{G(ext)}$

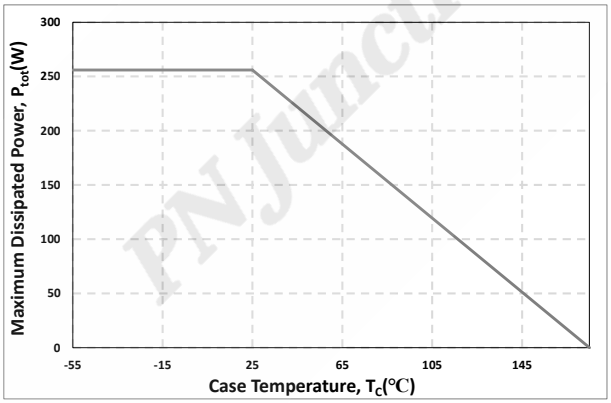


Figure 23. Maximum Power Dissipation Derating vs. Case Temperature

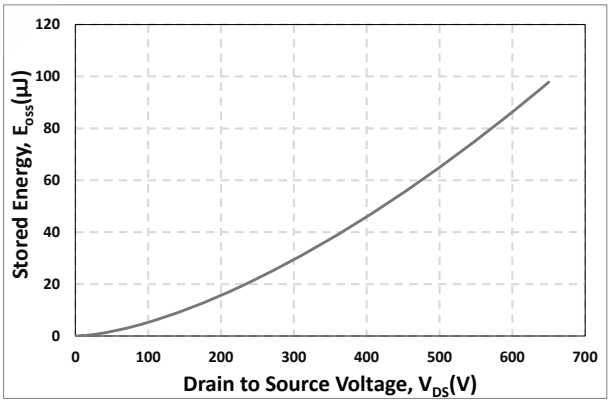


Figure 24. Output Capacitor Stored Energy

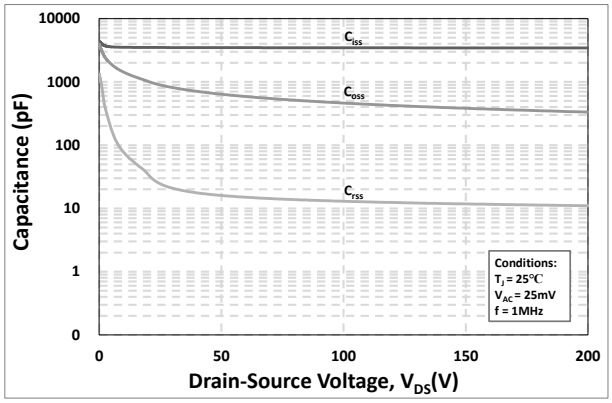


Figure 25. Capacitances vs. Drain-Source Voltage (0 - 200V)

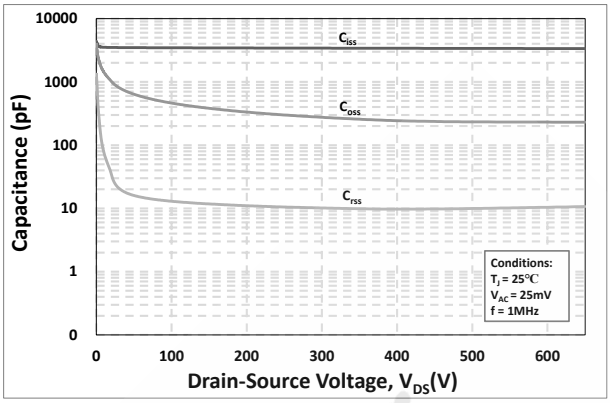


Figure 26. Capacitances vs. Drain-Source Voltage (0 - 650V)

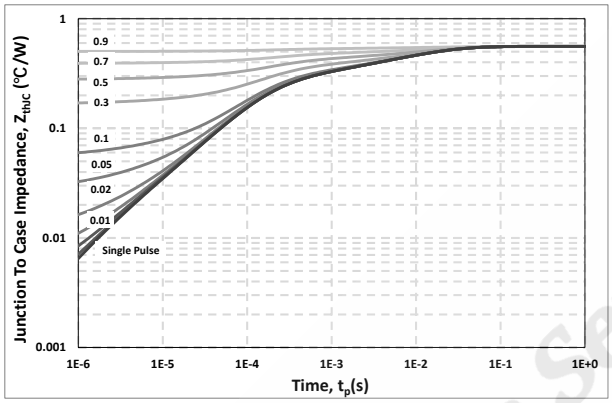


Figure 27. Transient Thermal Impedance (Junction - Case)

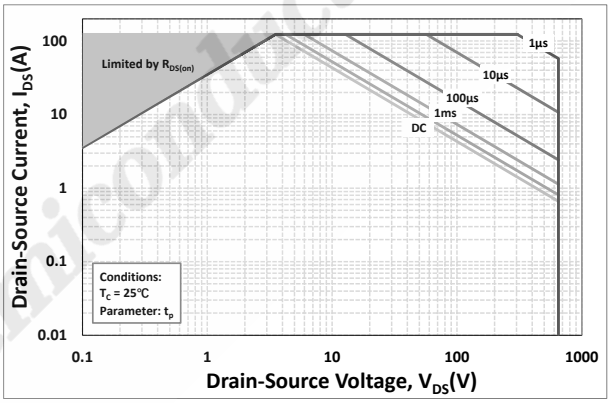


Figure 28. Safe Operating Area

6. Definitions

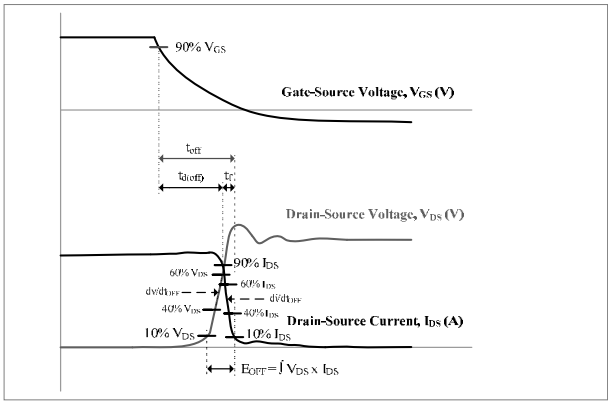


Figure 29. Turn-off Transient Definitions

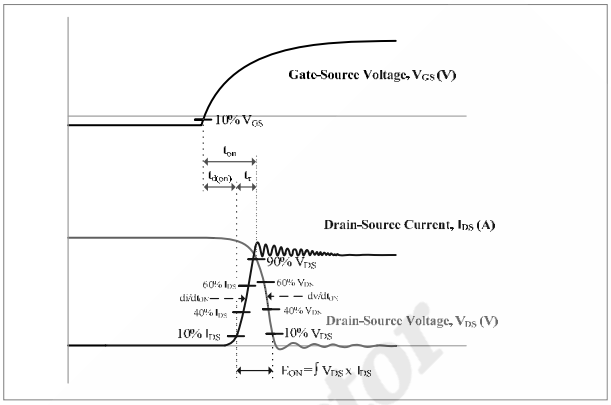


Figure 30. Turn-on Transient Definitions

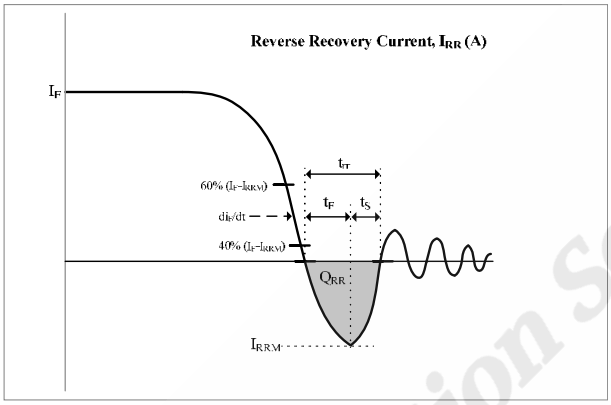


Figure 31. Reverse Recovery Definitions

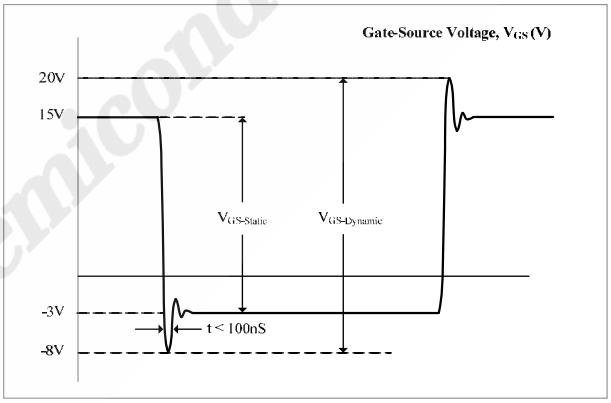
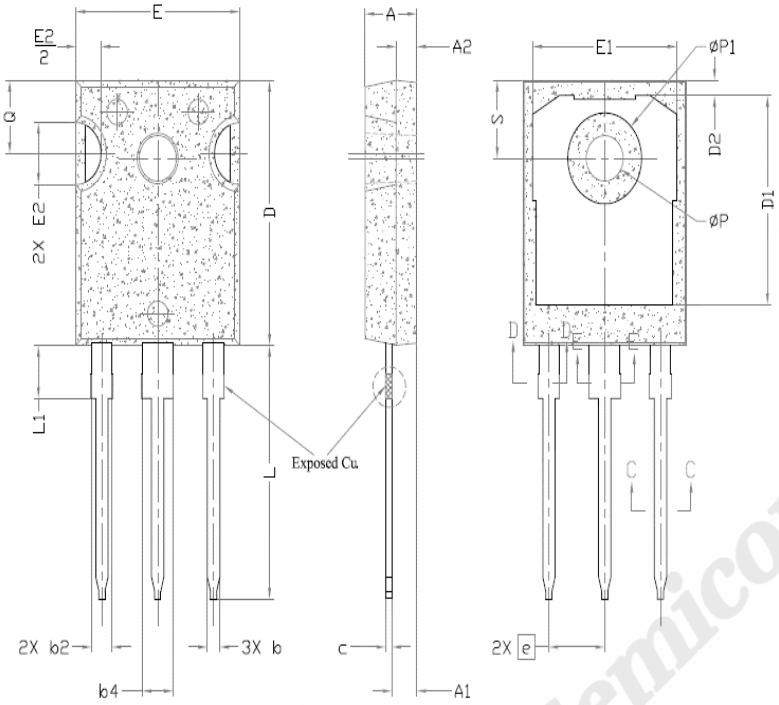


Figure 32. vgs Transient Definitions

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

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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).

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