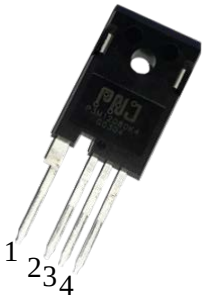
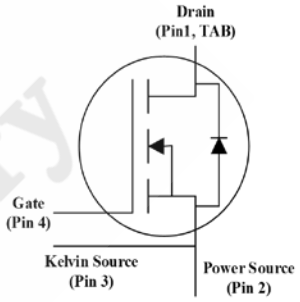
V_{RRM}	=	650 V
I_D	=	27 A
I_D(100℃)	=	19 A
$R_{DS(on)}$	=	120 mΩ

SiC MOS P3M06120K4
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



TO-247-4

Drain	1
Power Source	2
Kelvin Source	3
Gate	4

Benefits

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

Applications

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

RoHS

Halogen

Order Information

Part Number	Package	Marking
P3M06120K4	TO-247-4	P3M06120K4

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	27	A	V_{GS}= 15V T_C= 25℃
		19		V_{GS}= 15V T_C= 100℃
Power Dissipation	P_D	131	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	2.2	/	V	(tested after 30ms pulse at V_{GS}=15V) V_{DS}= V_{GS} I_D= 5mA T_J = 25℃
		/	1.65	/	V	V_{DS}= V_{GS} I_D= 5mA T_J = 175℃
Zero Gate Voltage Drain Current	I_{DSS}	/	1.3	500	μA	V_{GS}= 0V V_{DS}= 650V
Gate-Source Leakage Current	I_{GSS}	/	2	125	nA	V_{GS}= 15V V_{DS}= 0V
Drain-Source On-State Resistance	$R_{DS(on)}$	/	120	158	mΩ	V_{GS}= 15V I_D= 10A T_J = 25℃
		/	100	/		V_{GS}= 18V I_D= 10A T_J = 25℃
Trans conductance	g_{fs}	/	7	/	S	V_{DS}= 20V I_{DS}= 10A T_J = 25℃
		/	6.6	/		V_{DS}= 20V I_{DS}= 10A T_J= 175℃

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Input Capacitance	C_{iss}	/	1200	/	pF	V_{GS}= 0V V_{DS}= 400V f= 1MHz V_{AC}= 25mV
Output Capacitance	C_{oss}	/	85.6	/		
Reverse Transfer Capacitance	C_{rss}	/	8.6	/		
Coss Stored Energy	E_{oss}	/	14.3	/	μJ	
Turn-on Energy	E_{on}	/	38	/	μJ	V_{DS}= 400V V_{GS}= -3/15V I_D= 10A R_G= 1Ω
Turn-off Energy	E_{off}	/	7	/		
Turn-on Energy	E_{on}	/	24	/	μJ	V_{DS}= 400V V_{GS}= -3/18V I_D= 10A R_G= 1Ω
Turn-off Energy	E_{off}	/	8	/		
Turn-On Delay Time	$t_{d(on)}$	/	13	/	ns	V_{DS}= 400V V_{GS}= -3/15V I_D= 10A R_G= 1Ω
Rise Time	t_r	/	11	/		
Turn-Off Delay Time	$t_{d(off)}$	/	19	/		
Fall Time	t_f	/	15	/		
Internal Gate Resistance	$R_{G(int)}$	/	1.3	/	Ω	f= 1MHz V_{AC}= 25mV
Gate to Source Charge	Q_{gs}	/	9.8	/	nC	V_{DS}= 400V I_{DS}= 10A V_{GS}= -3 to 15V I_G= 20mA
Gate to Drain Charge	Q_{gd}	/	8.5	/		
Total Gate Charge	Q_g	/	31.6	/		

3. Reverse Diode Characteristics

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Diode Forward Voltage	V_{SD}	4.8	/	V	V_{GS}= -3V I_{SD}= 5A T_J = 25℃
		4.2	/	V	V_{GS}= -3V I_{SD}= 5A T_J= 175℃
Continuous Diode Forward Current	I_S	20	/	A	V_{GS}= -3V
Reverse Recover Time	t_{rr}	14	/	ns	V_{GS}= -3V I_{SD}= 10A V_R= 400V di_f/dt= 3500A/μs T_J= 25℃
Reverse Recovery Charge	Q_{rr}	277	/	nC	
Peak Reverse Recovery Current	I_{rrm}	34	/	A	
Reverse Recover Time	t_{rr}	13	/	ns	V_{GS}= -3V I_{SD}= 10A V_R= 400V di_f/dt= 4000A/μs T_J= 25℃
Reverse Recovery Charge	Q_{rr}	303	/	nC	
Peak Reverse Recovery Current	I_{rrm}	39	/	A	

4. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	1.14	℃/W

5. Typical Performance

At T_J= 25℃, unless specified otherwise

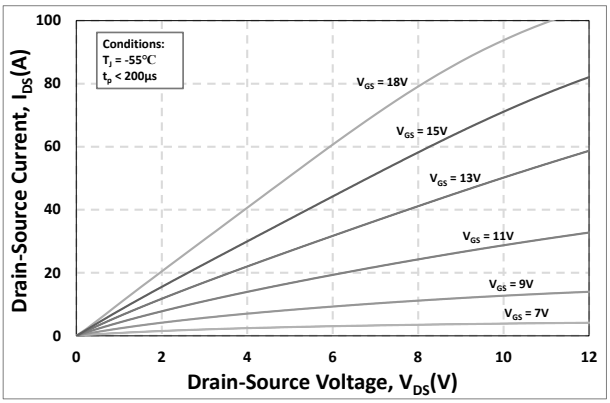


Figure 1. Output Characteristics T_J = -55℃

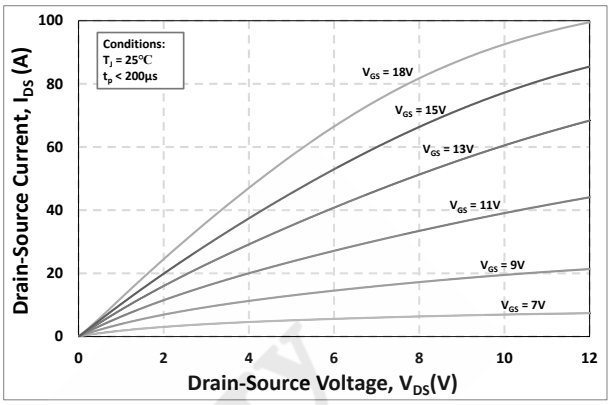


Figure 2. Output Characteristics T_J = 25℃

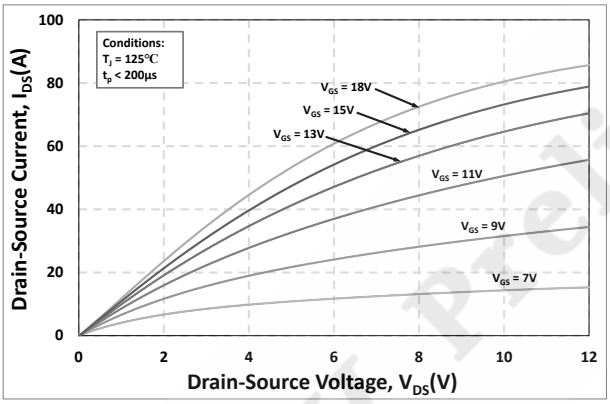


Figure 3. Output Characteristics T_J = 125℃

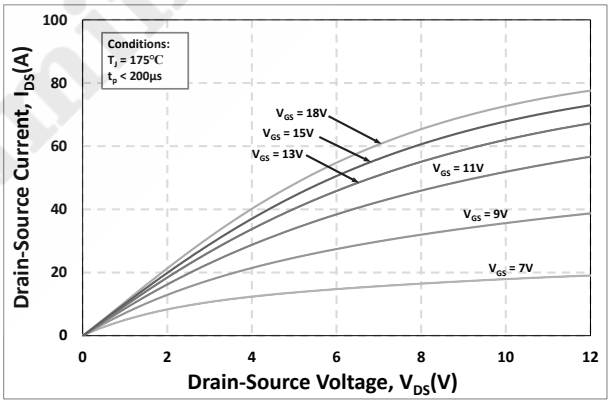


Figure 4. Output Characteristics T_J = 175ºC

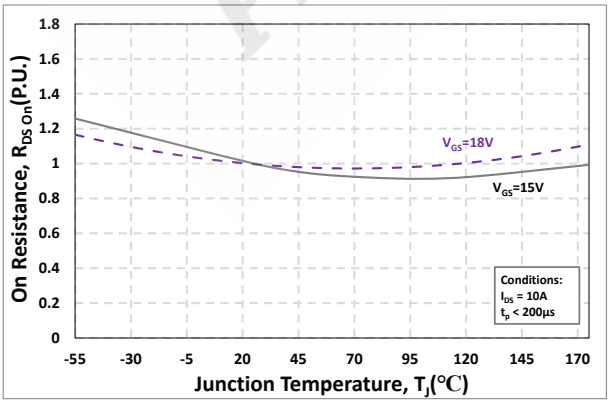


Figure 5. Normalized On-Resistance vs. Temperature

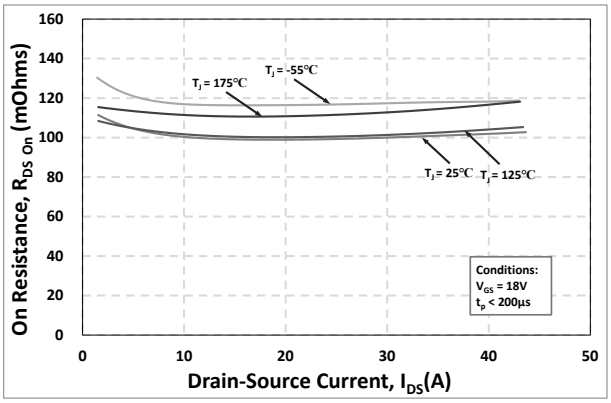


Figure 6. On-Resistance vs. Drain Current Various Temperatures

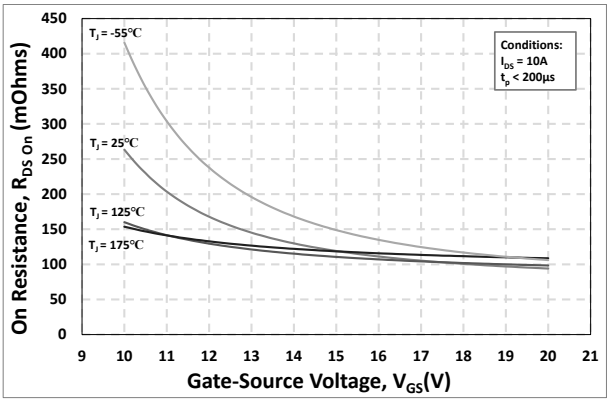


Figure 7. On-Resistance vs. Gate-Source Voltage

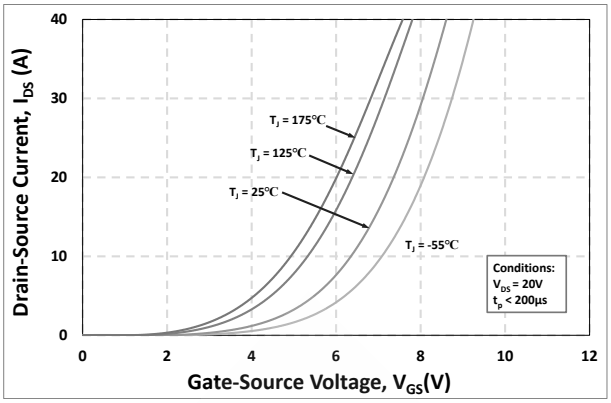


Figure 8. Transfer Characteristic for Various Junction Temperatures

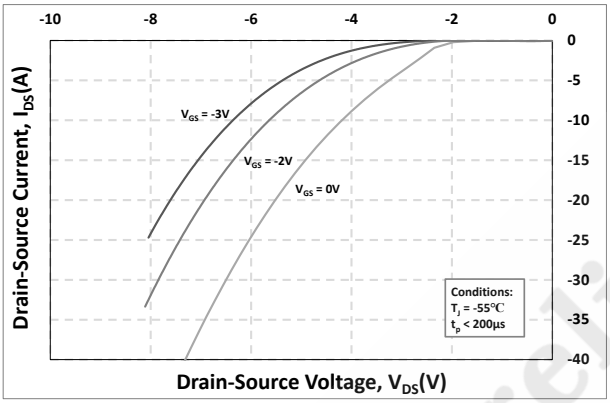


Figure 9. Body Diode Characteristic at -55°C

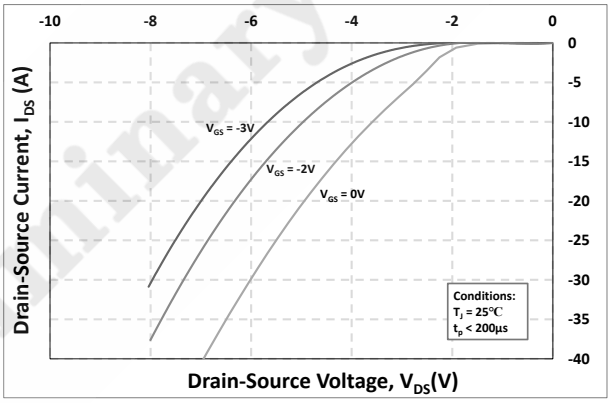


Figure 10. Body Diode Characteristic at 25°C

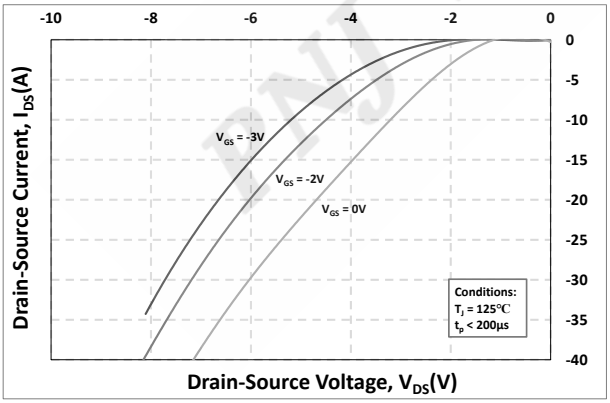


Figure 11. Body Diode Characteristic at 125°C

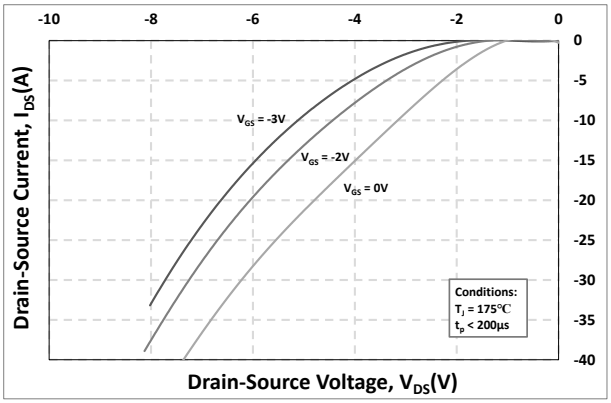


Figure 12. Body Diode Characteristic at 175°C

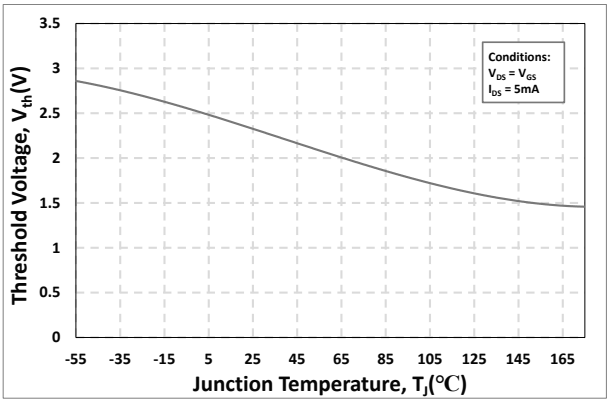


Figure 13. Threshold Voltage vs. Temperature

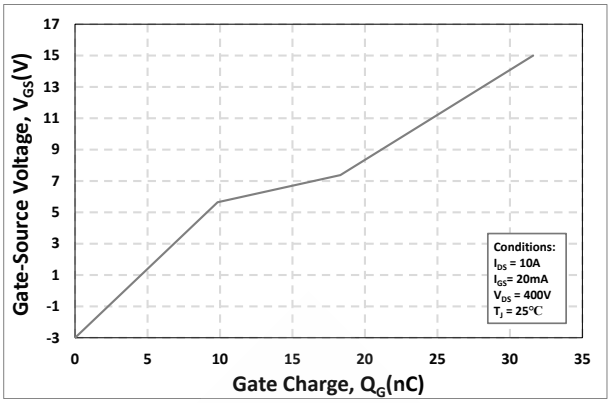


Figure 14. Gat Charge Characteristics

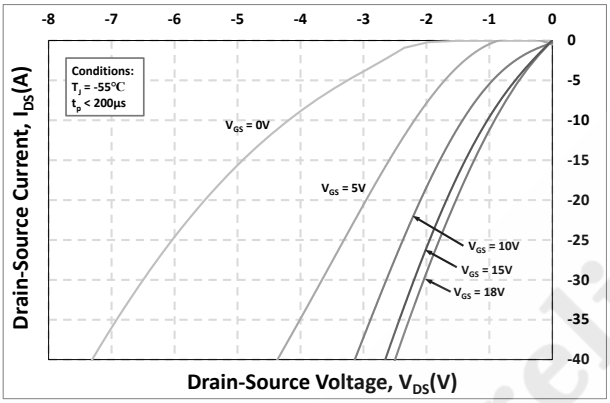


Figure 15. 3rd Quadrant Characteristic at -55°C

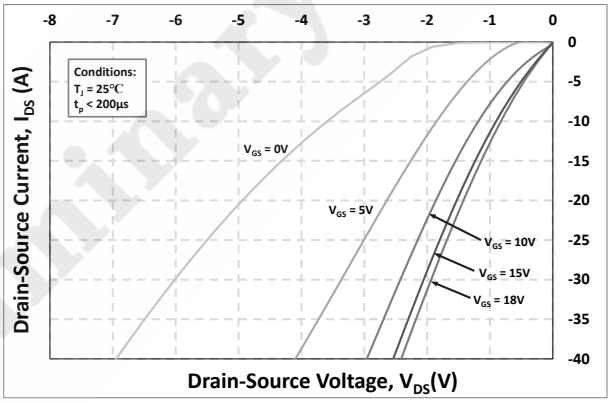


Figure 16. 3rd Quadrant Characteristic at 25°C

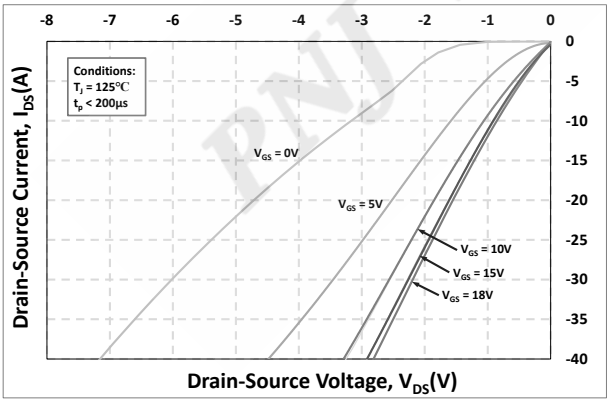


Figure 17. 3rd Quadrant Characteristic at 125°C

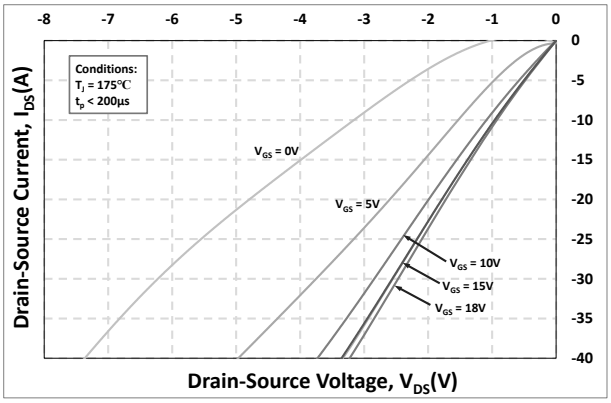


Figure 18. 3rd Quadrant Characteristic at 175ºC

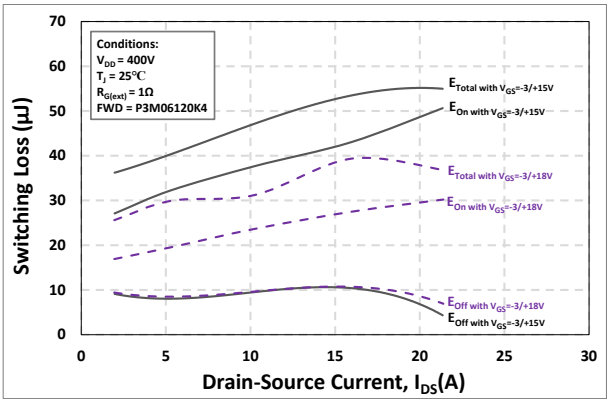


Figure 19. Clamped Inductive Switching Energy vs. Drain Current (V_{DD}= 400V)

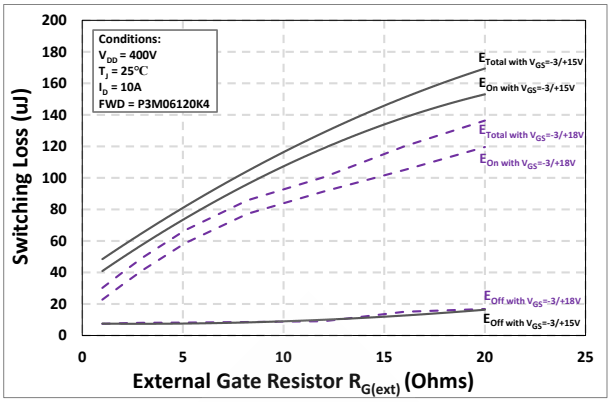


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

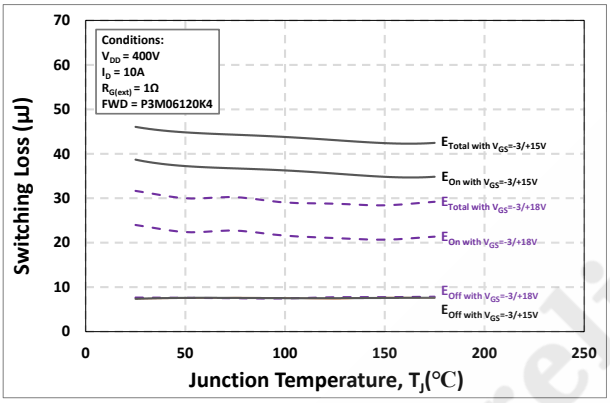


Figure 21. Clamped Inductive Switching Energy vs. Temperature

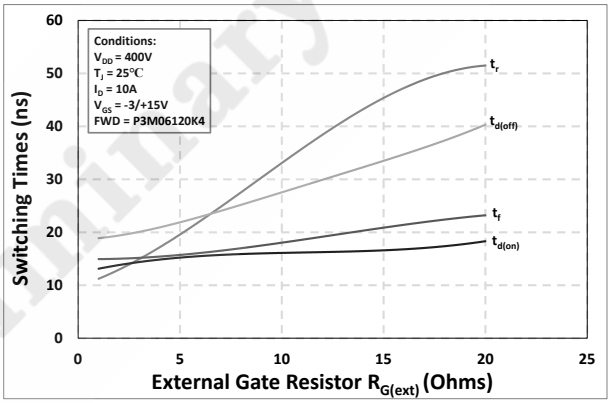


Figure 22. Switching Times vs. $R_{G(ext)}$

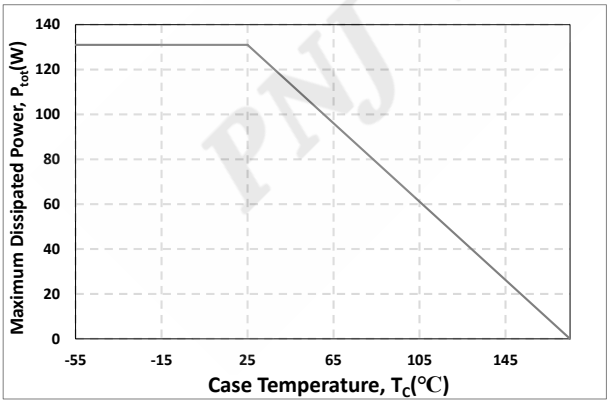


Figure 23. Maximum Power Dissipation Derating vs. Case Temperature

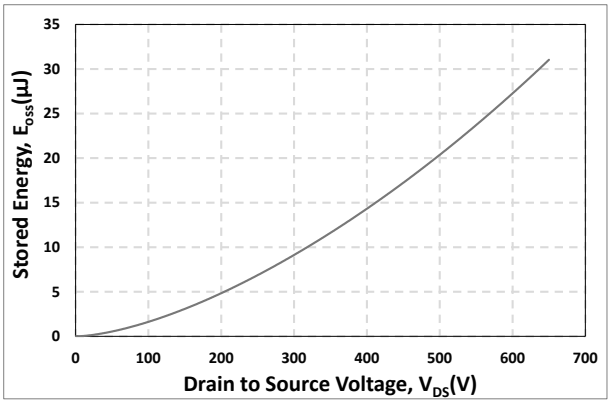


Figure 24. Output Capacitor Stored Energy

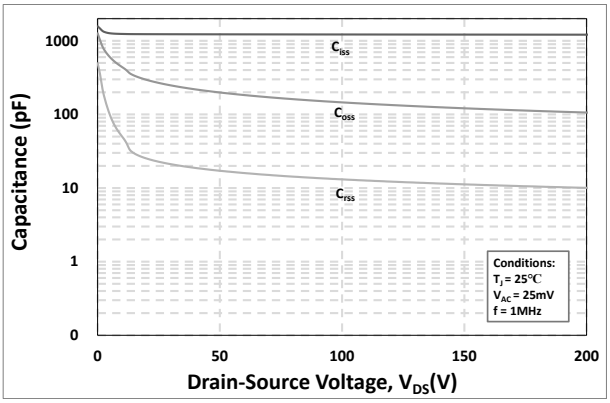


Figure 25. Capacitances vs. Drain-Source Voltage (0 - 200V)

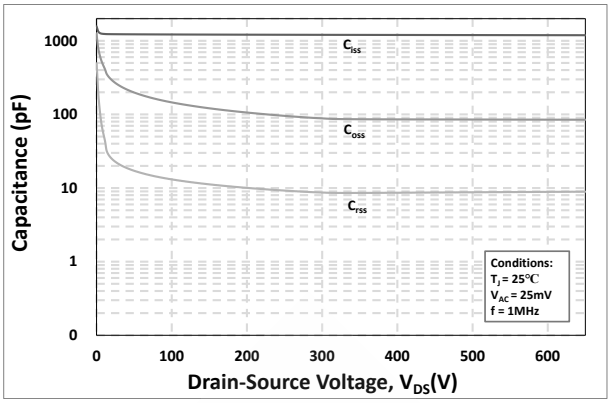


Figure 26. Capacitances vs. Drain-Source Voltage (0 - 650V)

6. Definitions

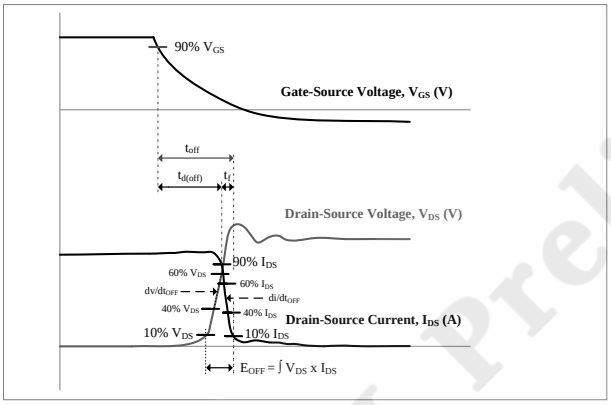


Figure 27. Turn-off Transient Definitions

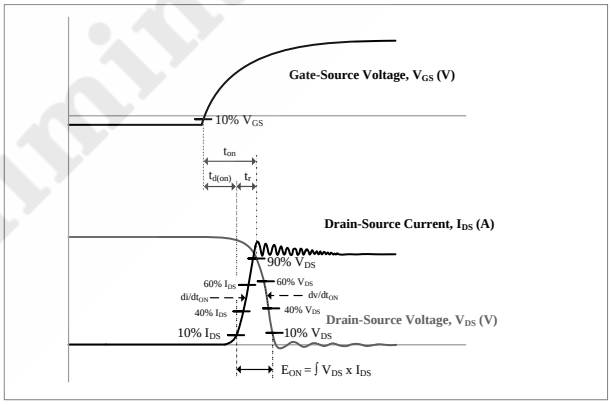


Figure 28. Turn-on Transient Definitions

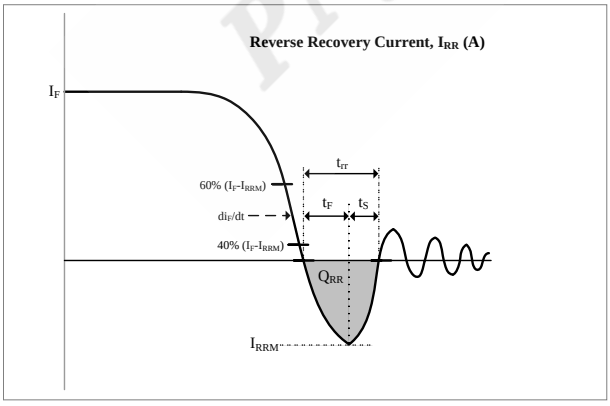


Figure 29. Reverse Recovery Definitions

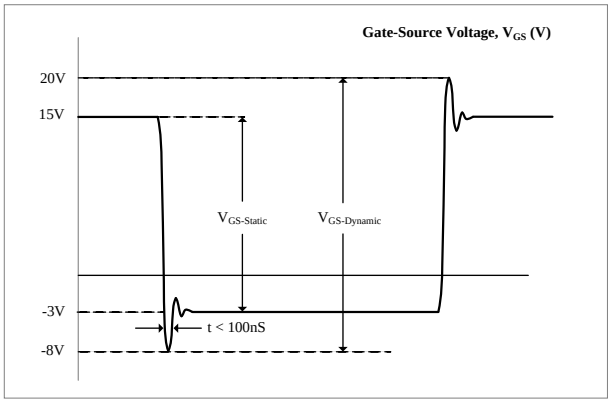
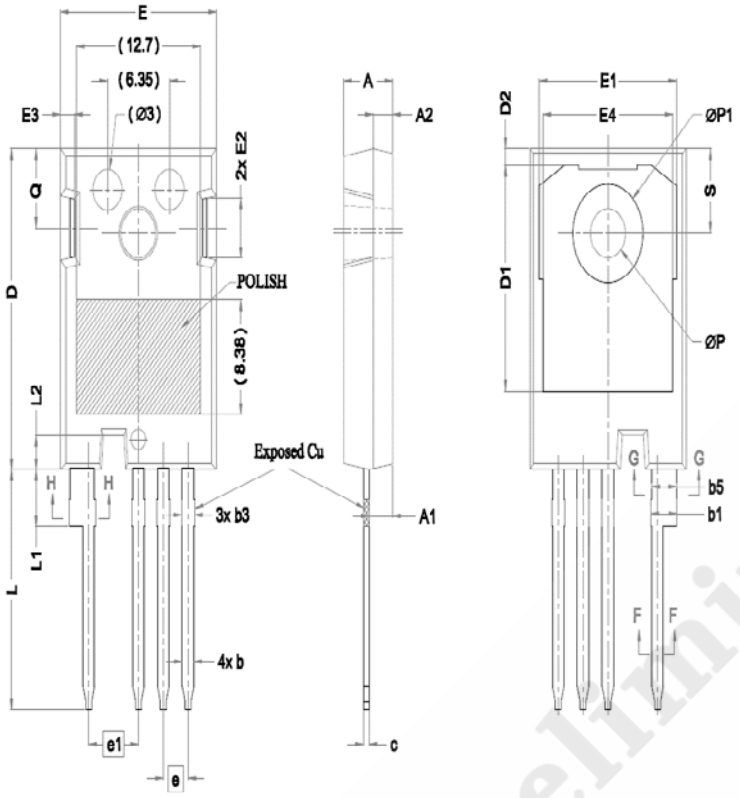


Figure 30. vgs Transient Definitions

7. Package Outlines



Symbol	Dimensions		
	Min.	Nom.	Max.
A	4.83	5.02	5.21
A1	2.28	2.41	2.54
A2	1.91	2.00	2.16
b[1]	1.07	1.20	1.28
b	1.07	1.20	1.33
b1	2.39	2.67	2.94
b2	2.39	2.67	2.84
b3	1.07	1.30	1.60
b4	1.07	1.30	1.50
b5	2.39	2.53	2.69
b6	2.39	2.53	2.64
c	0.55	0.60	0.68
c1	0.55	0.60	0.65
D	22.30	23.45	23.80
D1	16.25	16.55	17.65
D2	0.95	1.19	1.25
E	15.75	15.94	16.13
E1	13.10	14.02	14.15
E2	3.60	1.10	5.10
E3	1.00	1.45	1.90
E4	12.38	13.26	13.43
e	2.54BSC		
e1	5.08BSC		
L	17.31	17.57	17.82
L1	3.97	4.19	4.37
L2	2.35	2.50	2.65
ΦP	3.51	3.61	3.65
ΦP	7.19 REF.		
Q	5.49	5.79	6.00
S	6.04	6.17	6.30

Drawing and Dimensions

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