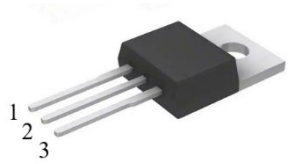
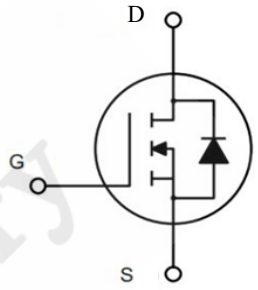
SiC MOS P3M06060T3
N-Channel Enhancement Mode



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-220-3

Gate	1
Drain	2
Source	3

Applications

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

Order Information

Part Number	Package	Marking
P3M06060T3	TO-220-3	P3M06060T3

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	46	A	V_{GS}= 15V T_C= 25℃
		33		V_{GS}= 15V T_C= 100℃
Power Dissipation	P_D	170	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= 5mA T_J= 25℃
		/	1.65	/	V	V_{DS}= V_{GS} I_D= 5mA T_J = 175℃
Reverse Bias Drain Current	I_{DSS}	/	0.5	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	$R_{DS(on)}$	/	60	78	mΩ	V_{GS}= 15V I_D= 20A
		/	52	/	mΩ	V_{GS}= 18V I_D= 20A
Trans conductance	g_{fs}	/	12	/	S	V_{DS}= 20V I_{DS}= 20A T_J= 25℃
		/	11	/	S	V_{DS}= 20V I_{DS}= 20A T_J= 175℃

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Input Capacitance	C_{iss}	/	1911	/	pF	V_{GS}= 0V V_{DS}= 400V f= 1MHz V_{AC}= 25mV
Output Capacitance	C_{oss}	/	162	/	pF	
Reverse Transfer Capacitance	C_{rss}	/	15.3	/	pF	
Coss Stored Energy	E_{oss}	/	15	/	μJ	
Turn-on Energy	E_{on}	/	172.8	/	μJ	V_{DS}= 400V V_{GS}= -3/15V I_D= 20A R_G= 1Ω
Turn-off Energy	E_{off}	/	29.2	/		
Turn-On Delay Time	$t_{d(on)}$	/	15.5	/	nS	V_{DS}= 400V V_{GS}= -3/15V I_D= 20A R_G= 1Ω
Rise Time	t_r	/	27.2	/		
Turn-Off Delay Time	$t_{d(off)}$	/	24.3	/		
Fall Time	t_f	/	15.5	/		
Internal Gate Resistance	$R_{G(int)}$	/	1.06	/	Ω	f= 1MHz V_{AC}= 25mV
Gate to Source Charge	Q_{gs}	/	17.5	/	nC	V_{DS}= 400V I_{DS}= 20A V_{GS}= -3 to 15V I_G= 50mA
Gate to Drain Charge	Q_{gd}	/	15.3	/		
Total Gate Charge	Q_g	/	53.1	/		

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}= 10A T_J= 25℃
		4.3	/	V	V_{GS}= -3V I_{SD}= 10A T_J= 175℃
Continuous Diode Forward Current	I_S	27	/	A	V_{GS}= -3V
Reverse Recover Time	t_{rr}	29.6	/	nS	V_{GS}= -3V I_{SD}= 20A V_R= 400V d_{if}/d_t= 3100A/μs T_J= 25℃
Reverse Recovery Charge	Q_{rr}	273	/	nC	
Peak Reverse Recovery Current	I_{rrm}	15.6	/	A	

4. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	0.88	℃/W

5. Typical Performance

At T_J= 25°C, unless specified otherwise

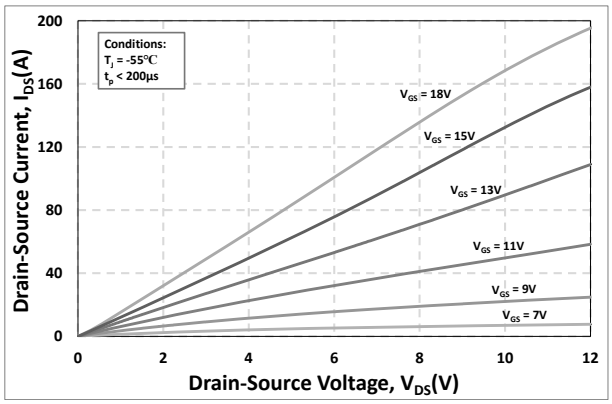


Figure 1. Output Characteristics T_J = -55°C

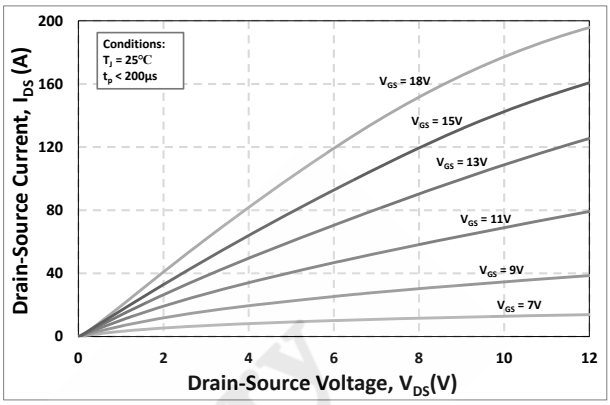


Figure 2. Output Characteristics T_J = 25°C

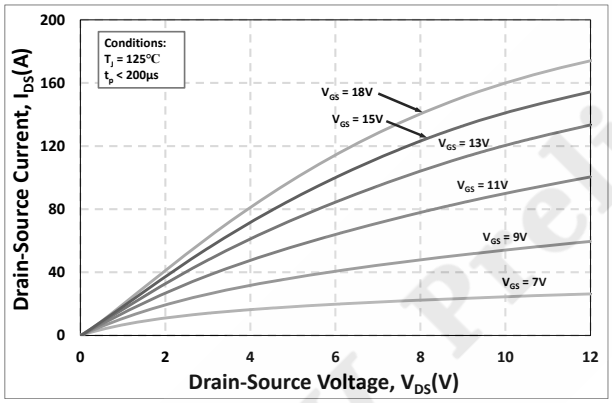


Figure 3. Output Characteristics T_J = 125°C

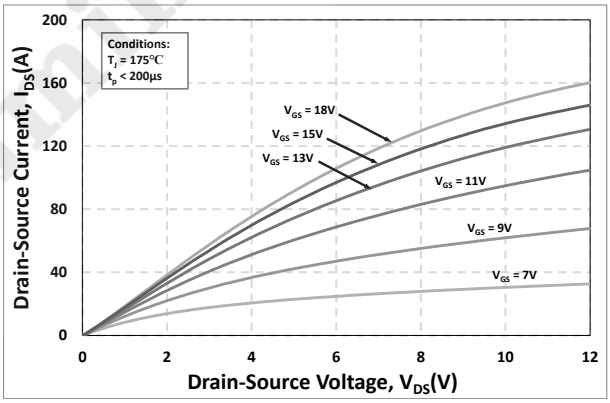


Figure 4. Output Characteristics T_J = 175°C

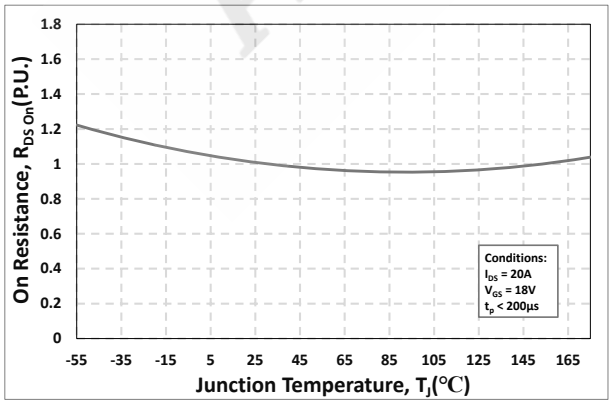


Figure 5. Normalized On-Resistance vs. Temperature

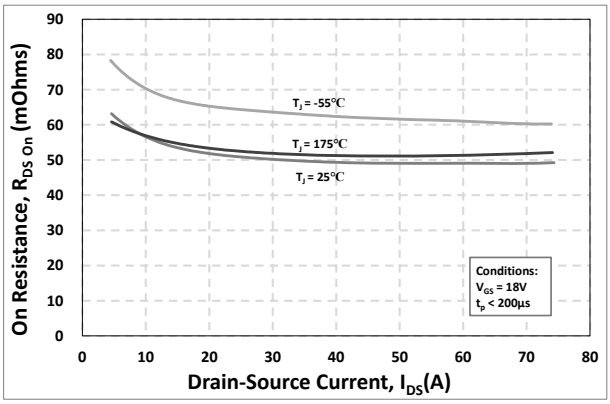


Figure 6. On-Resistance vs. Drain Current Various Temperatures

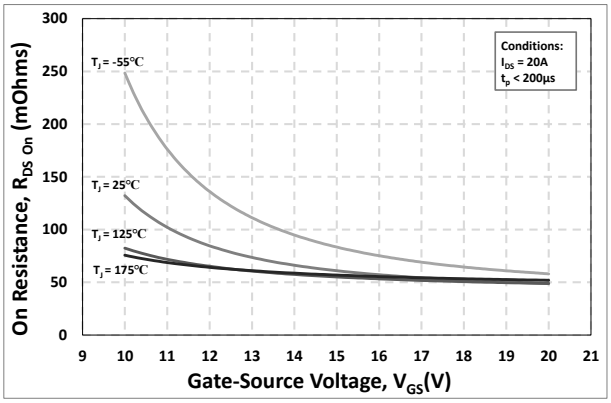


Figure 7. On-Resistance vs. Gate-Source Voltage

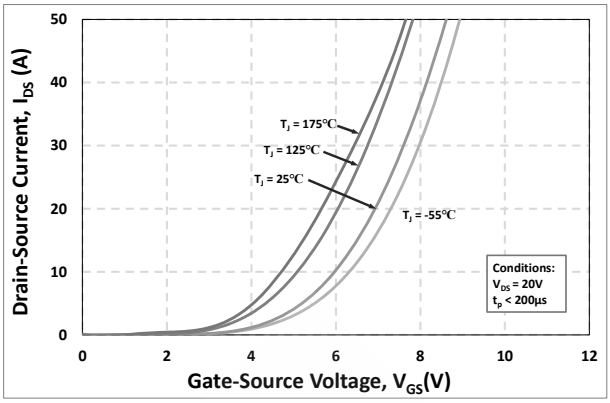


Figure 8. Transfer Characteristic for Various Junction Temperatures

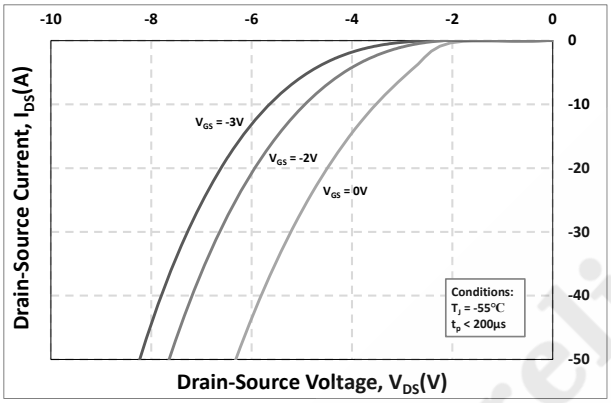


Figure 9. Body Diode Characteristic at -55°C

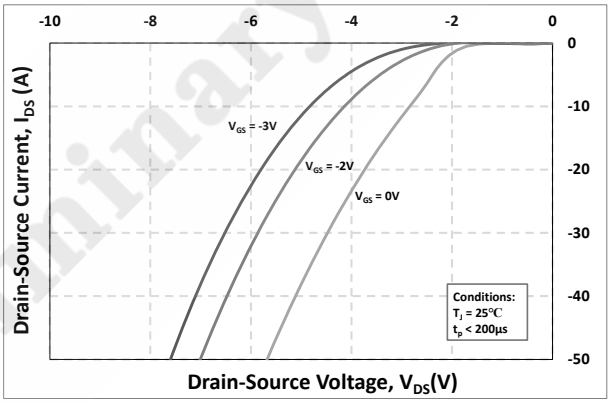


Figure 10. Body Diode Characteristic at 25°C

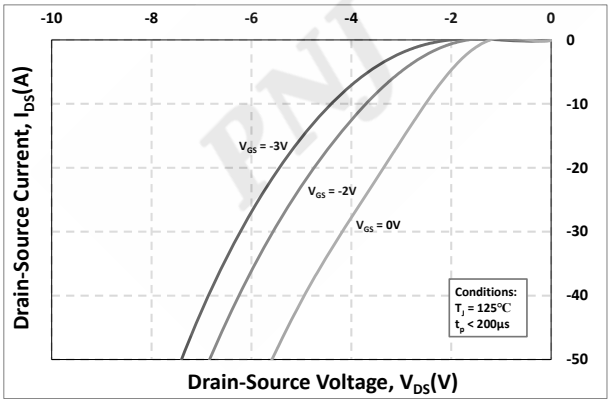


Figure 11. Body Diode Characteristic at 125°C

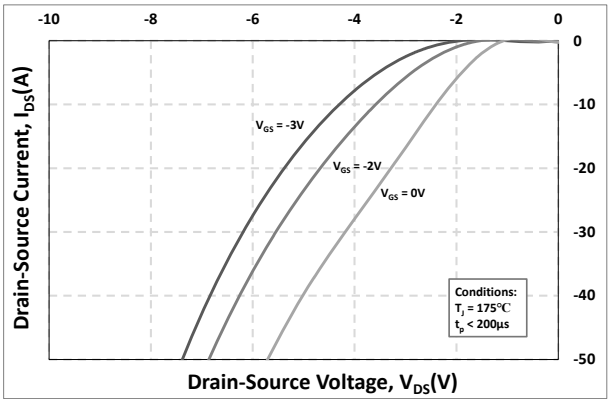


Figure 12. Body Diode Characteristic at 175°C

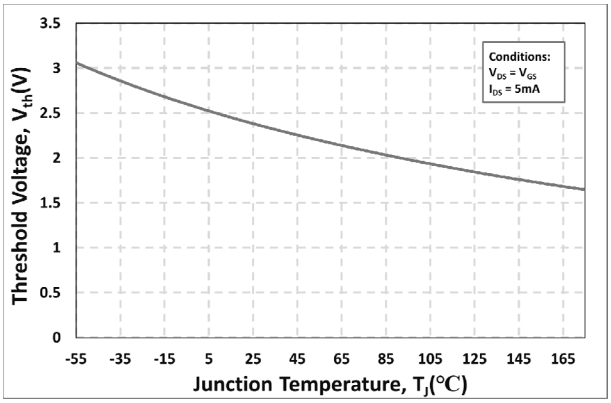


Figure 13. Threshold Voltage vs. Temperature

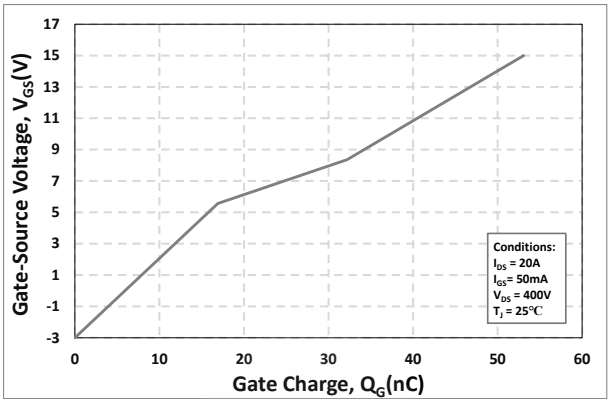


Figure 14. Gate Charge Characteristics

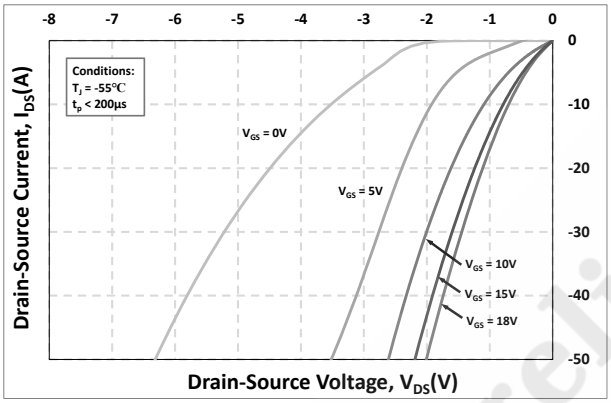


Figure 15. 3rd Quadrant Characteristic at -55°C

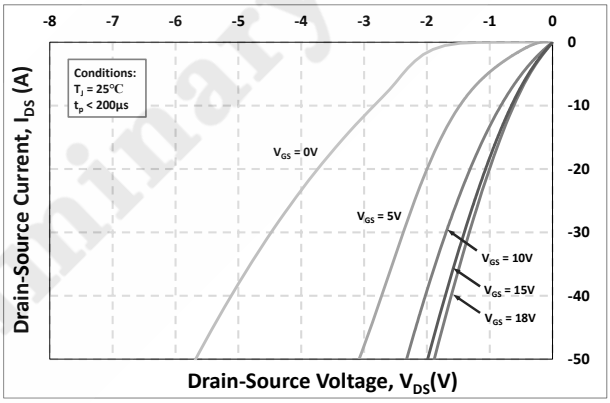


Figure 16. 3rd Quadrant Characteristic at 25°C

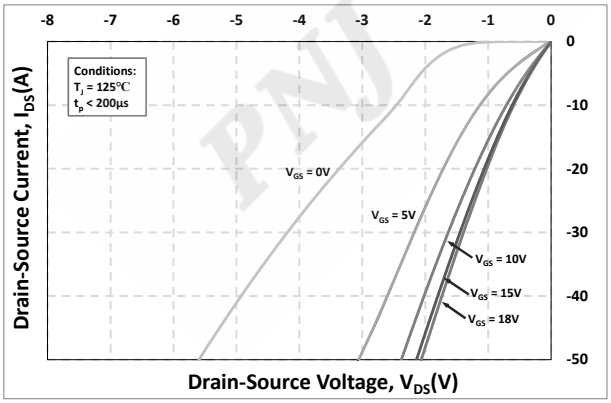


Figure 17. 3rd Quadrant Characteristic at 125°C

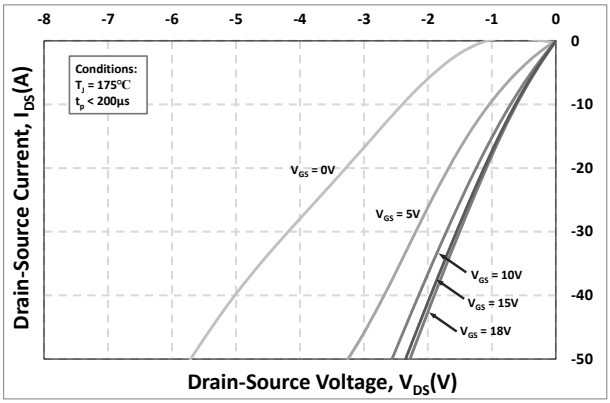


Figure 18. 3rd Quadrant Characteristic at 175°C

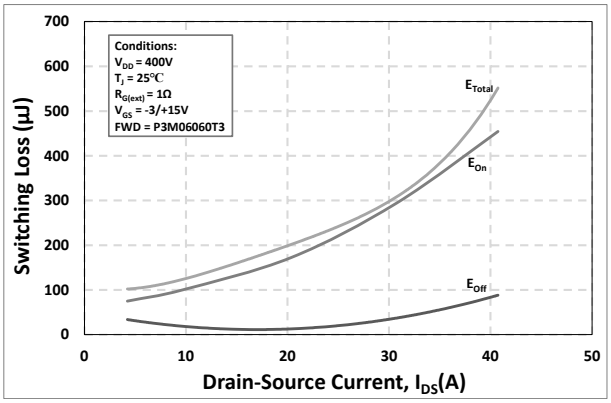


Figure 19. Clamped Inductive Switching Energy vs. Drain Current (V_{DD}= 400V)

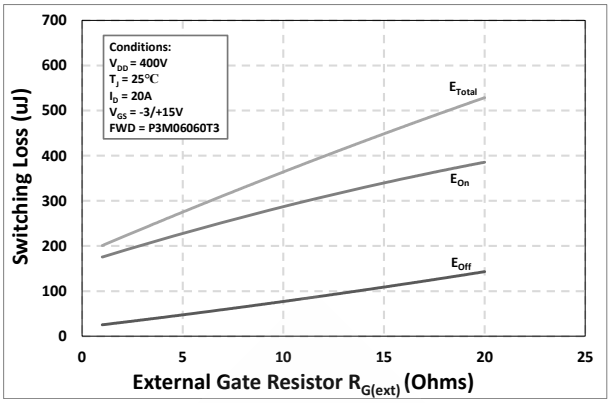


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

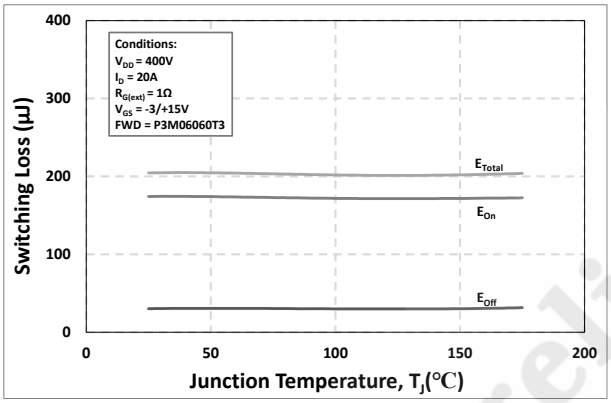


Figure 21. Clamped Inductive Switching Energy vs. Temperature

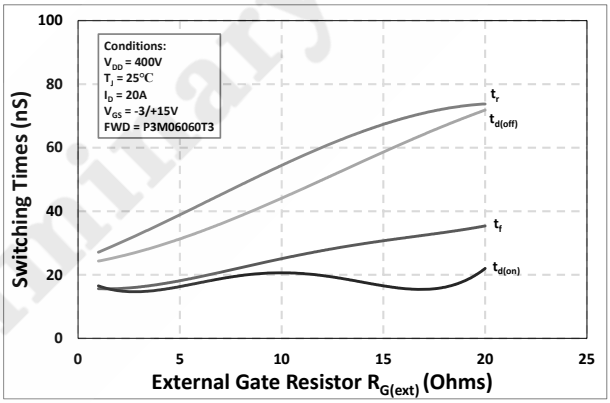


Figure 22. Switching Times vs. $R_{G(ext)}$

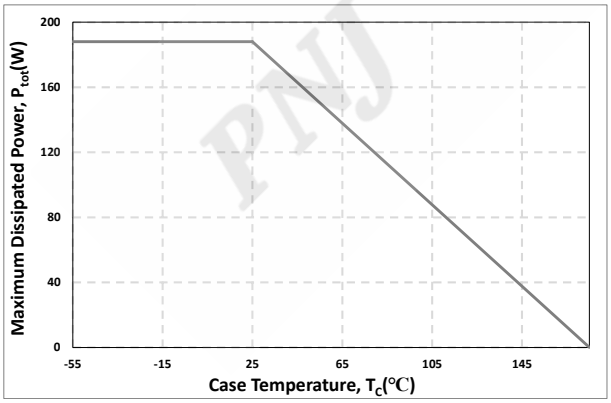


Figure 23. Maximum Power Dissipation Derating vs. Case Temperature

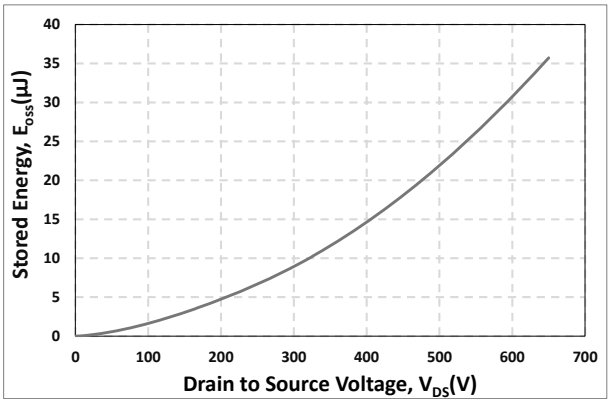


Figure 24. Output Capacitor Stored Energy

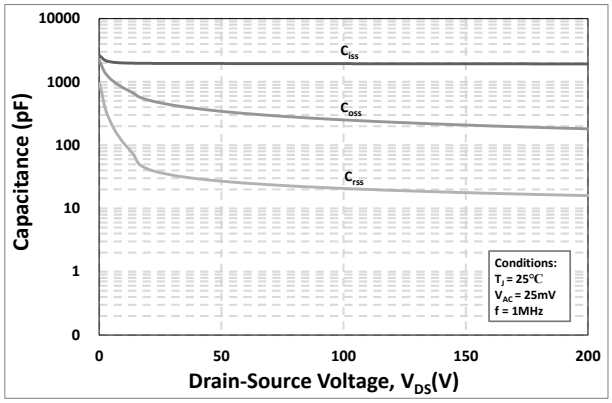


Figure 25. Capacitances vs. Drain-Source Voltage (0 - 200V)

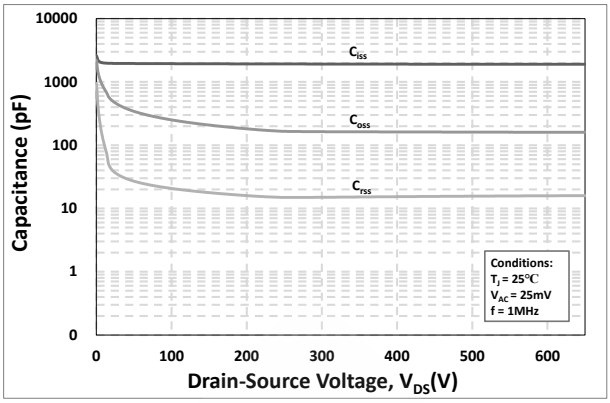


Figure 26. Capacitances vs. Drain-Source Voltage (0 - 650V)

6. Definitions

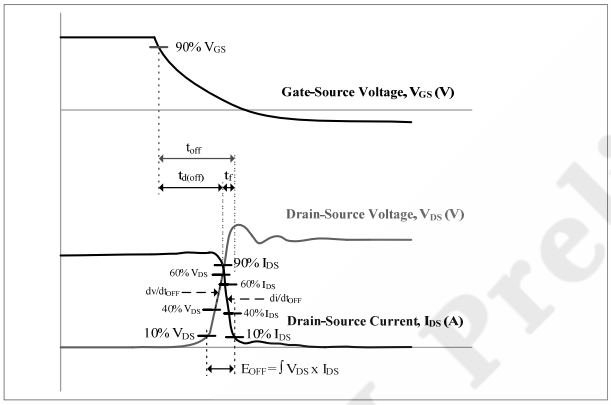


Figure 27. Turn-off Transient Definitions

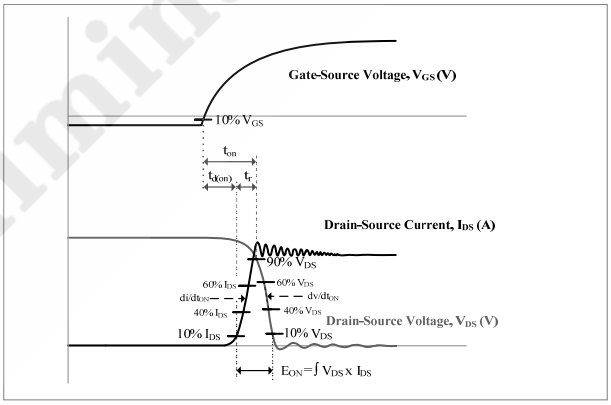


Figure 28. Turn-on Transient Definitions

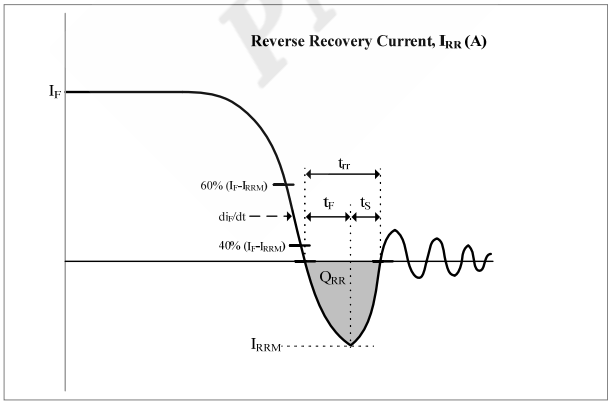


Figure 29. Reverse Recovery Definitions

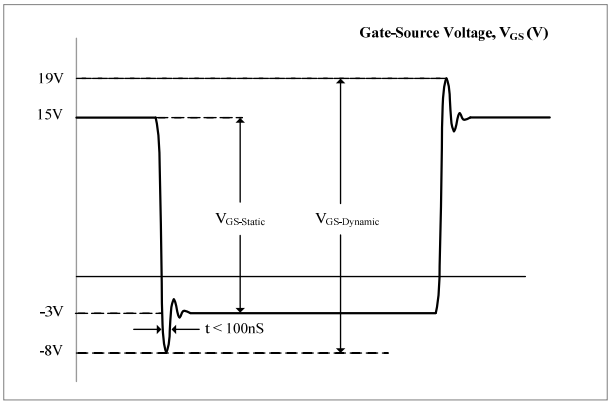
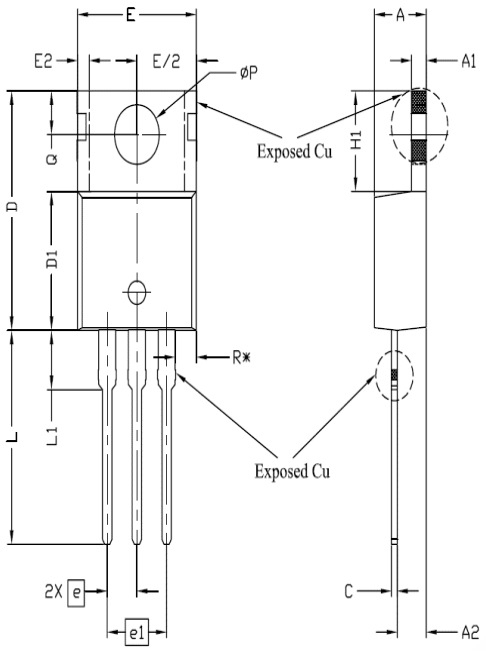


Figure 30. Vgs Transient Definitions

7. Package Outlines



SYMBOL	DIMENSIONS			NOTES
	MIN.	NOM.	MAX.	
A	4.24	4.44	4.64	
A1	1.15	1.27	1.40	
A2	2.30	2.48	2.70	
b	0.70	0.80	0.90	
b1	1.20	1.55	1.75	
b2	1.20	1.45	1.70	
c	0.40	0.50	0.60	
D	14.70	15.37	16.00	4
D1	8.82	8.92	9.02	
D2	12.43	12.73	12.83	5
E	9.96	10.16	10.36	4,5
E1	6.86	7.77	8.89	5
E2	-	-	0.76	6
E3*	8.70REF.			
e	2.54BSC			
e1	5.08BSC			
H1	6.30	6.45	6.60	5,6
L	13.47	13.72	13.97	
L1	3.60	3.80	4.00	
øP	3.75	3.84	3.93	
Q	2.60	2.80	3.00	
Q1*	1.73REF.			
R*	1.82REF.			

Drawing and Dimensions

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