



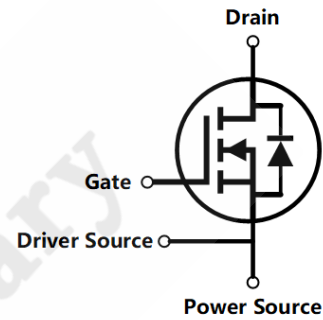
P3M06060K4 SiC MOS N-Channel Enhancement Mode

V_{RRM}	=	650	V
I_D	=	48	A
$I_D(100^\circ\text{C})$	=	34	A
$R_{DS(on)}$	=	60	m Ω

SiC MOS P3M06060K4 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



Standards Benefits

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

TO-247-4

Drain	1
Power Source	2
Driver Source	3
Gate	4

Applications

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



Order Information

Part Number	Package	Marking
P3M06060K4	TO-247-4	P3M06060K4



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PNJ Preliminary



1. Maximum Ratings

At $T_J = 25^\circ\text{C}$, unless specified otherwise

Parameter	Symbol	Value	Unit	Test Conditions
Drain - Source Voltage	V_{DSmax}	650	V	$V_{GS} = -3\text{V}$ $I_D = 100\mu\text{A}$
Gate - Source Voltage (dynamic)	V_{GSmax}	-8 / +20	V	AC ($f > 1\text{ Hz}$)
Gate - Source Voltage (static)	V_{GSop}	-3 / +15	V	Static
Continuous Drain Current	I_D	48	A	$V_{GS} = 15\text{V}$ $T_C = 25^\circ\text{C}$
		34		$V_{GS} = 15\text{V}$ $T_C = 100^\circ\text{C}$
Power Dissipation	P_D	188	W	
Operating Junction	T_J	-55 To +175	$^\circ\text{C}$	
Storage Temperature	T_{stg}	-55 To +175	$^\circ\text{C}$	
Solder Temperature	T_L	260	$^\circ\text{C}$	
Mounting Torque	M_d	1 8.8	Nm lbf-in	M3 or 6-32 screw



2. Electrical Characteristics

At $T_J = 25^\circ\text{C}$, unless specified otherwise

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	650	/	/	V	$V_{GS} = -3V$ $I_D = 100\mu A$
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.2	/	V	$V_{DS} = V_{GS}$ $I_D = 20mA$ $T_J = 25^\circ\text{C}$
		/	1.65	/	V	$V_{DS} = V_{GS}$ $I_D = 20mA$ $T_J = 175^\circ\text{C}$
Reverse Bias Drain Current	I_{DSS}	/	0.5	10	μA	$V_{GS} = -3V$ $V_{DS} = 650V$
Gate-Source Leakage Current	I_{GSS}	/	20	250	nA	$V_{GS} = 15V$ $V_{DS} = 0V$
Drain-Source On-State Resistance	$R_{DS(on)}$	/	60	79	m Ω	$V_{GS} = 15V$ $I_D = 20A$
		/	52	/	m Ω	$V_{GS} = 18V$ $I_D = 20A$
Trans conductance	g_{fs}	/	12	/	S	$V_{DS} = 20V$ $I_{DS} = 20A$ $T_J = 25^\circ\text{C}$
		/	11	/	S	$V_{DS} = 20V$ $I_{DS} = 20A$ $T_J = 175^\circ\text{C}$
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	



P3M06060K4 SiC MOS N-Channel Enhancement Mode

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Turn-on Energy	E_{on}	/	51	/	μ	$V_{DS} = 400V$ $V_{GS} = -3/15V$ $I_D = 20A$ $R_G = 1\Omega$
Turn-off Energy	E_{off}	/	32	/		
Turn-On Delay Time	$T_{d(on)}$	/	14	/	ns	
Rise Time	T_r	/	13	/		
Turn-Off Delay Time	$T_{d(off)}$	/	22	/		
Fall Time	T_f	/	17	/		
Internal Gate Resistance	$R_{G(int)}$	/	1.06	/	Ω	$f = 1MHz$ $V_{AC} = 25mV$
Gate to Source Charge	Q_{gs}	/	17.5	/	nC	$V_{DS} = 400V$ $I_{DS} = 20A$ $V_{GS} = -3 \text{ to } 15V$ $I_G = 50mA$
Gate to Drain Charge	Q_{gd}	/	15.3	/		
Total Gate Charge	Q_g	/	53.1	/		

3. Reverse Diode Characteristics

At $T_J = 25^\circ C$, unless specified otherwise

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Diode Forward Voltage	V_{SD}	4.8	/	V	$V_{GS} = -3V$ $I_{SD} = 10A$ $T_J = 25^\circ C$
		4.3	/	V	$V_{GS} = -3V$ $I_{SD} = 10A$ $T_J = 175^\circ C$
Continuous Diode Forward Current	I_S	29	/	A	$V_{GS} = -3V$

Reverse Recover Time	t_{rr}	18	/	ns	$V_{GS} = -3/15V$ $I_{SD} = 20A$ $V_R = 400V$ $di_f/dt = 3700A/\mu s$ $T_J = 25^\circ C$
Reverse Recovery Charge	Q_{rr}	473	/	nC	
Peak Reverse Recovery Current	I_{rrm}	44	/	A	

4. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	0.8	$^\circ C/W$

5. Typical Performance

At $T_J = 25^\circ C$, unless specified otherwise

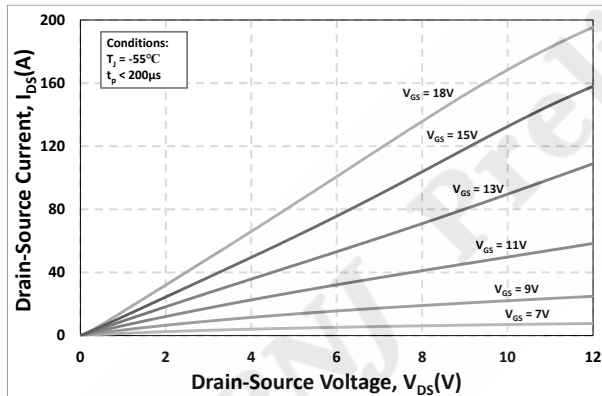


Figure 1. Output Characteristics $T_J = -55^\circ C$

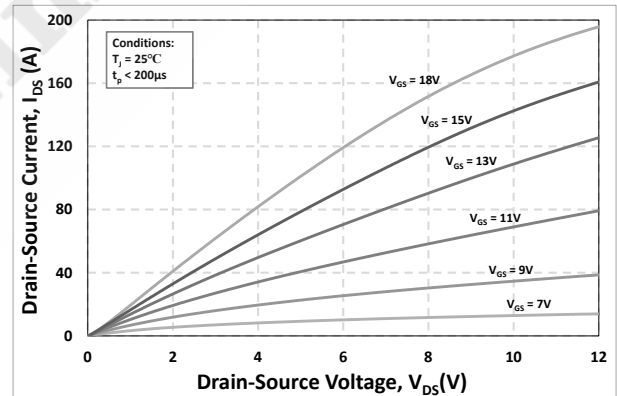


Figure 2. Output Characteristics $T_J = 25^\circ C$

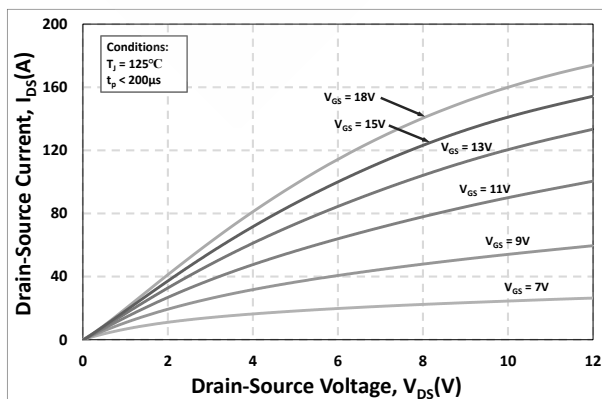


Figure 3. Output Characteristics $T_J = 125^\circ C$

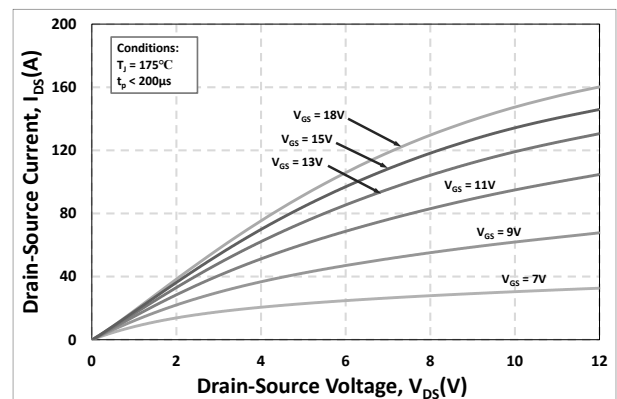


Figure 4. Output Characteristics $T_J = 175^\circ C$

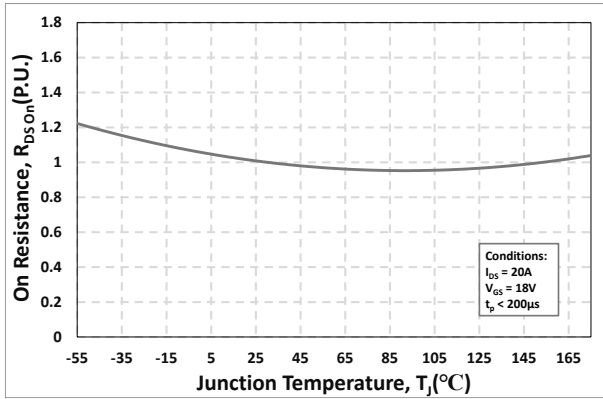


Figure 5. Normalized On-Resistance vs. Temperature

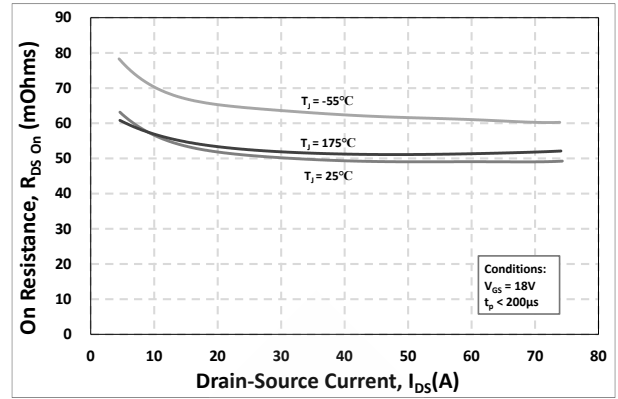


Figure 6. On-Resistance vs. Drain Current Various Temperatures

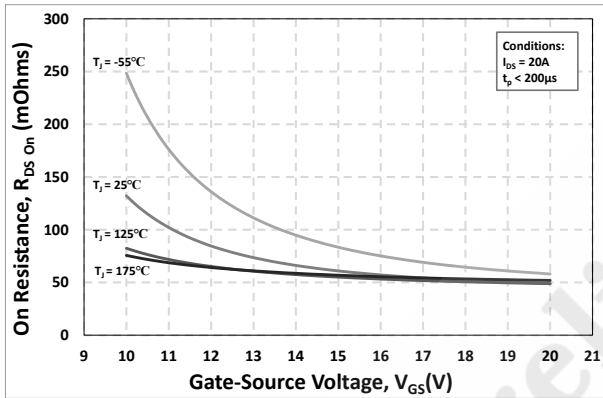


Figure 7. On-Resistance vs. Gate-Source Voltage

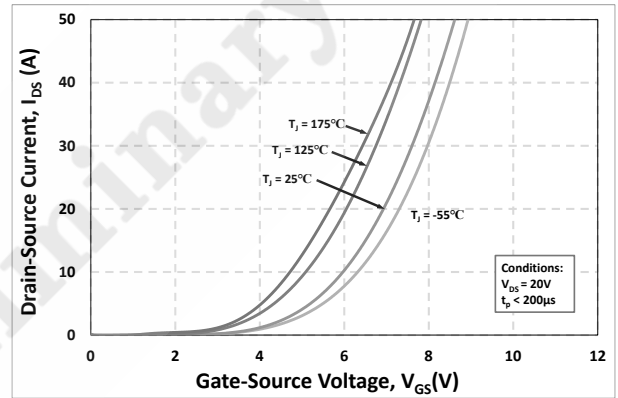


Figure 8. Transfer Characteristic for Various Junction Temperatures

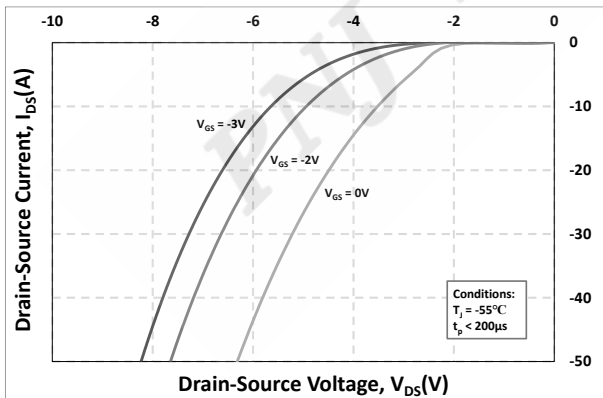


Figure 9. Body Diode Characteristic at -55°C

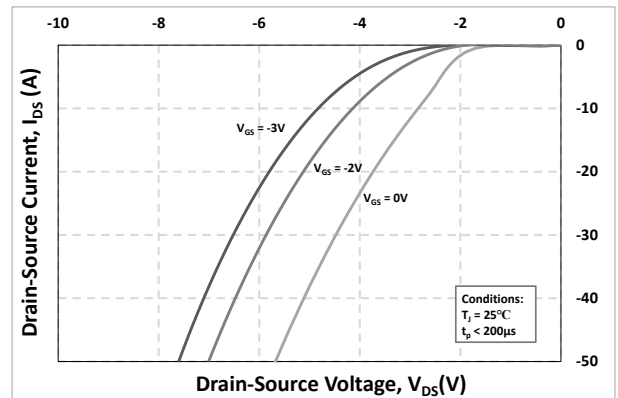


Figure 10. Body Diode Characteristic at 25°C

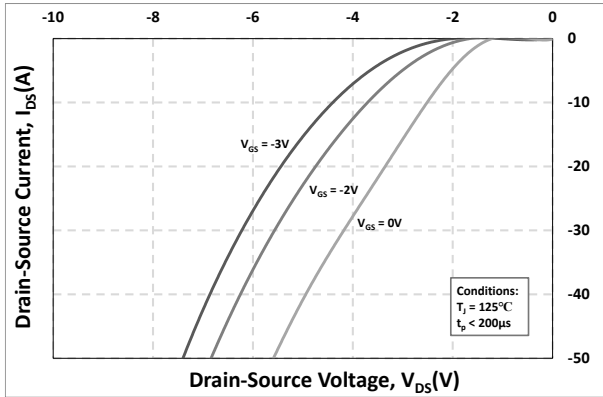


Figure 11. Body Diode Characteristic at 125°C

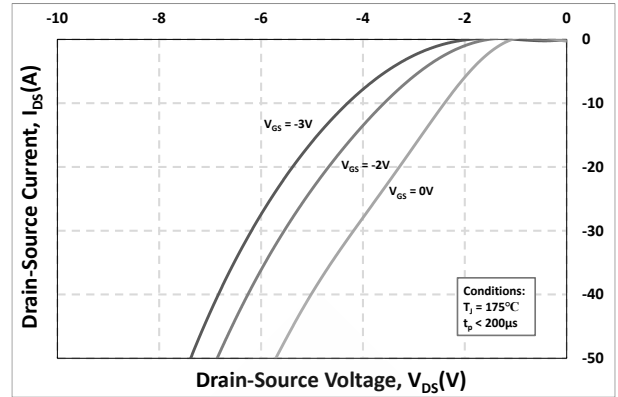


Figure 12. Body Diode Characteristic at 175°C

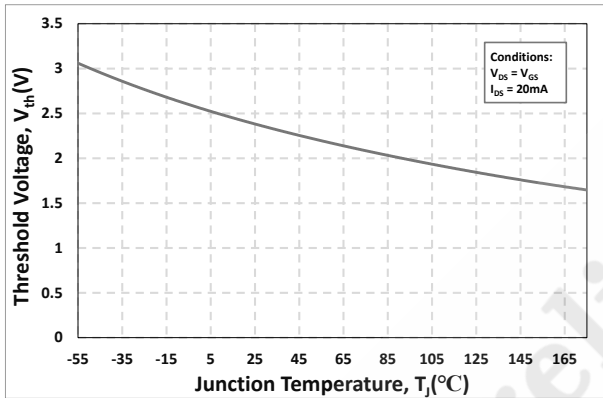


Figure 13. Threshold Voltage vs. Temperature

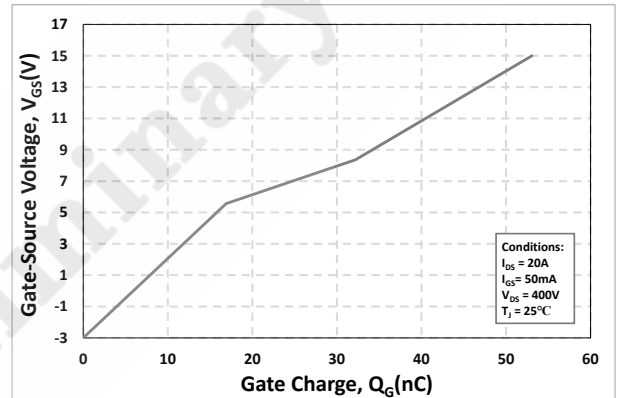


Figure 14. Gat Charge Characteristics

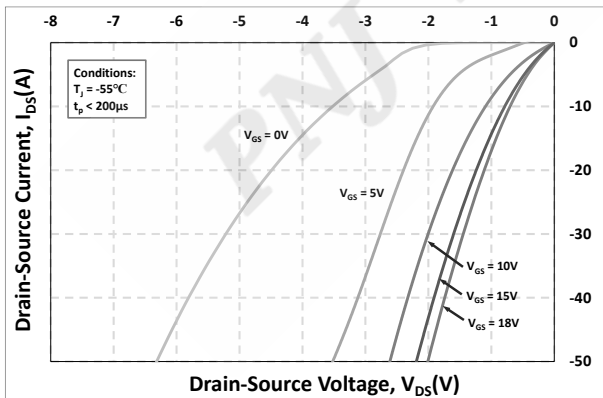


Figure 15. 3rd Quadrant Characteristic at -55°C

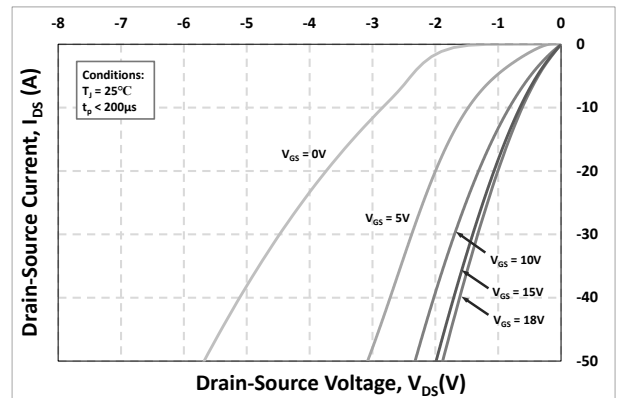


Figure 16. 3rd Quadrant Characteristic at 25°C

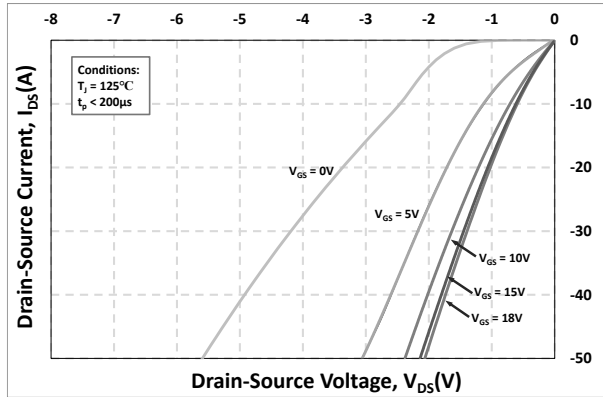


Figure 17. 3rd Quadrant Characteristic at 125°C

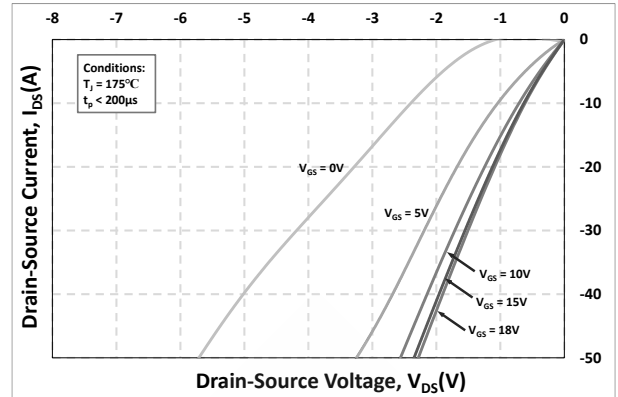


Figure 18. 3rd Quadrant Characteristic at 175°C

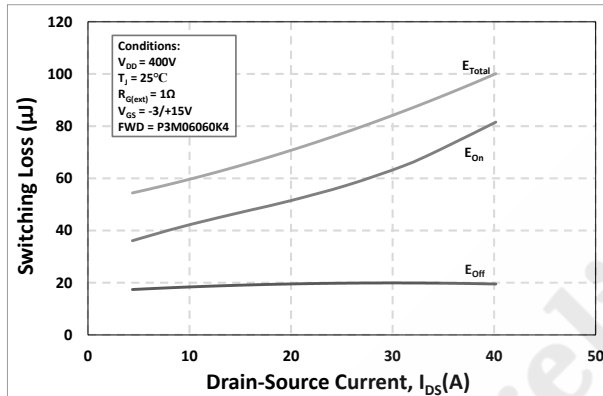


Figure 19. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 400V$)

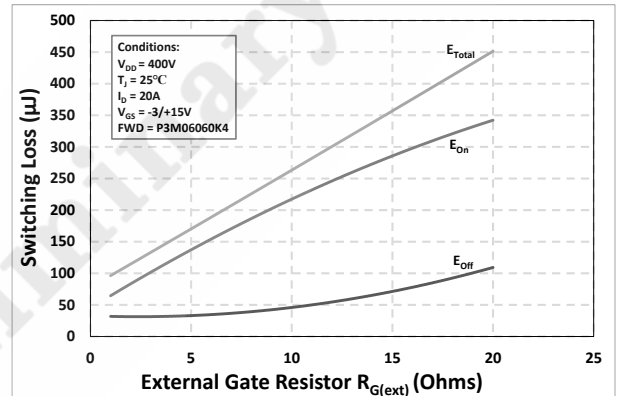


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

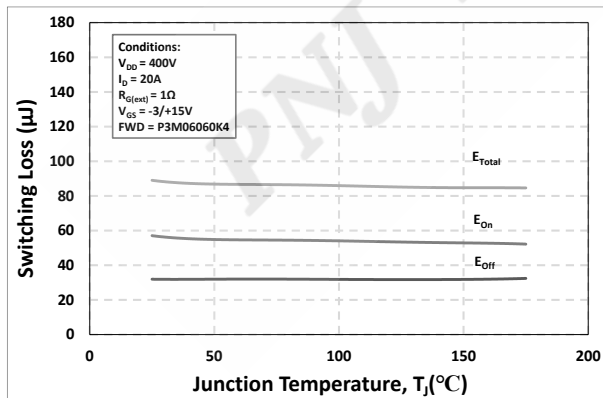


Figure 21. Clamped Inductive Switching Energy vs. Temperature

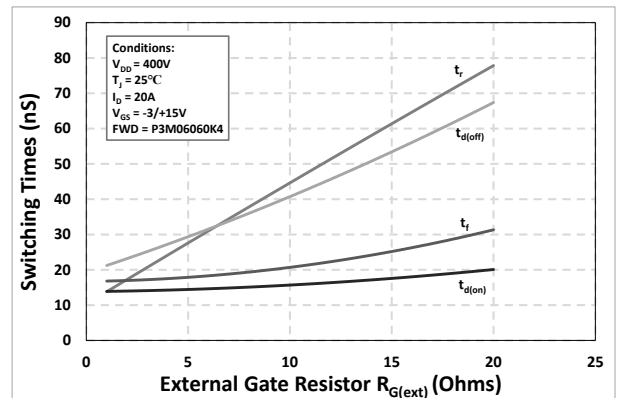


Figure 22. Switching Times vs. $R_{G(ext)}$

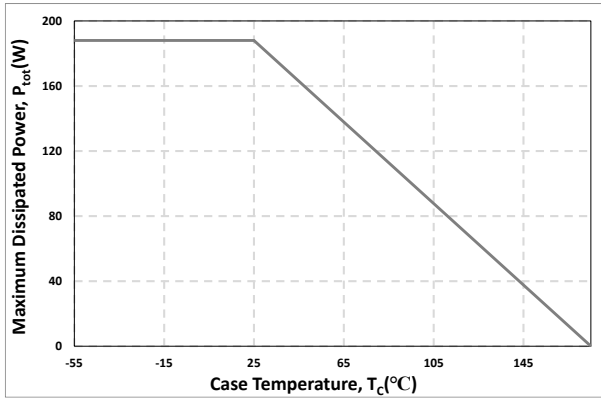


Figure 23. Maximum Power Dissipation Derating vs. Case Temperature

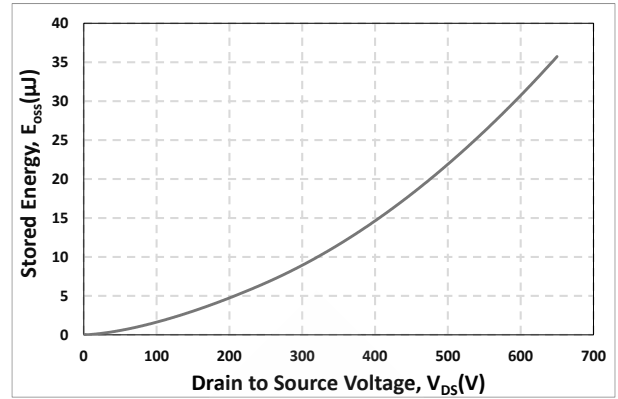


Figure 24. Output Capacitor Stored Energy

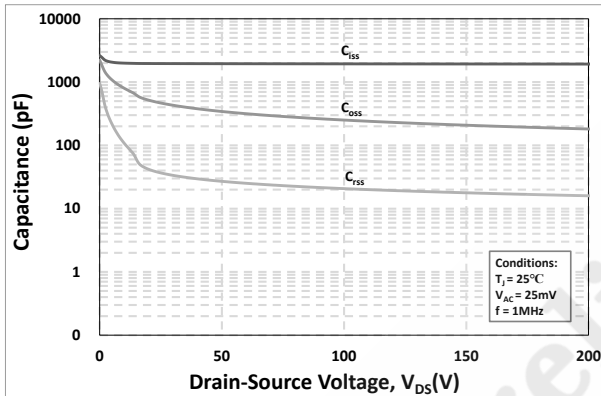


Figure 25. Capacitances vs. Drain-Source Voltage (0 - 200V)

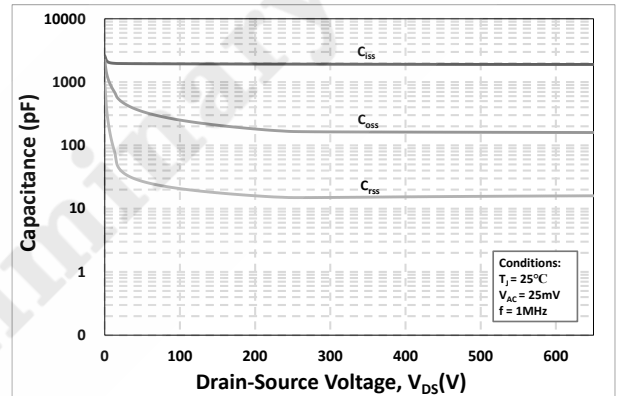


Figure 26. Capacitances vs. Drain-Source Voltage (0 - 650V)

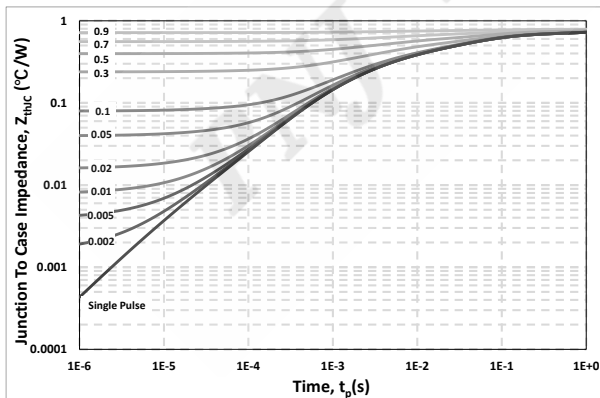


Figure 27. Transient Thermal Impedance (Junction - Case)

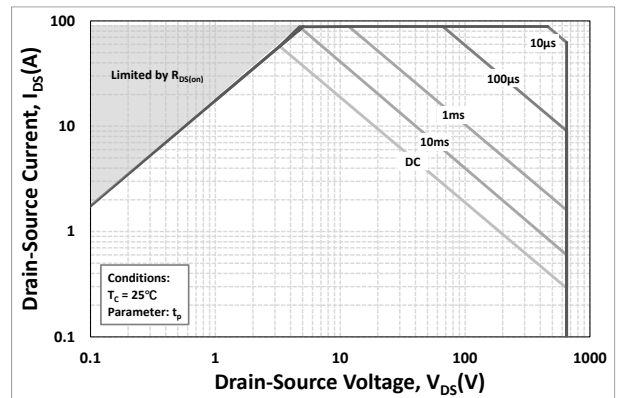
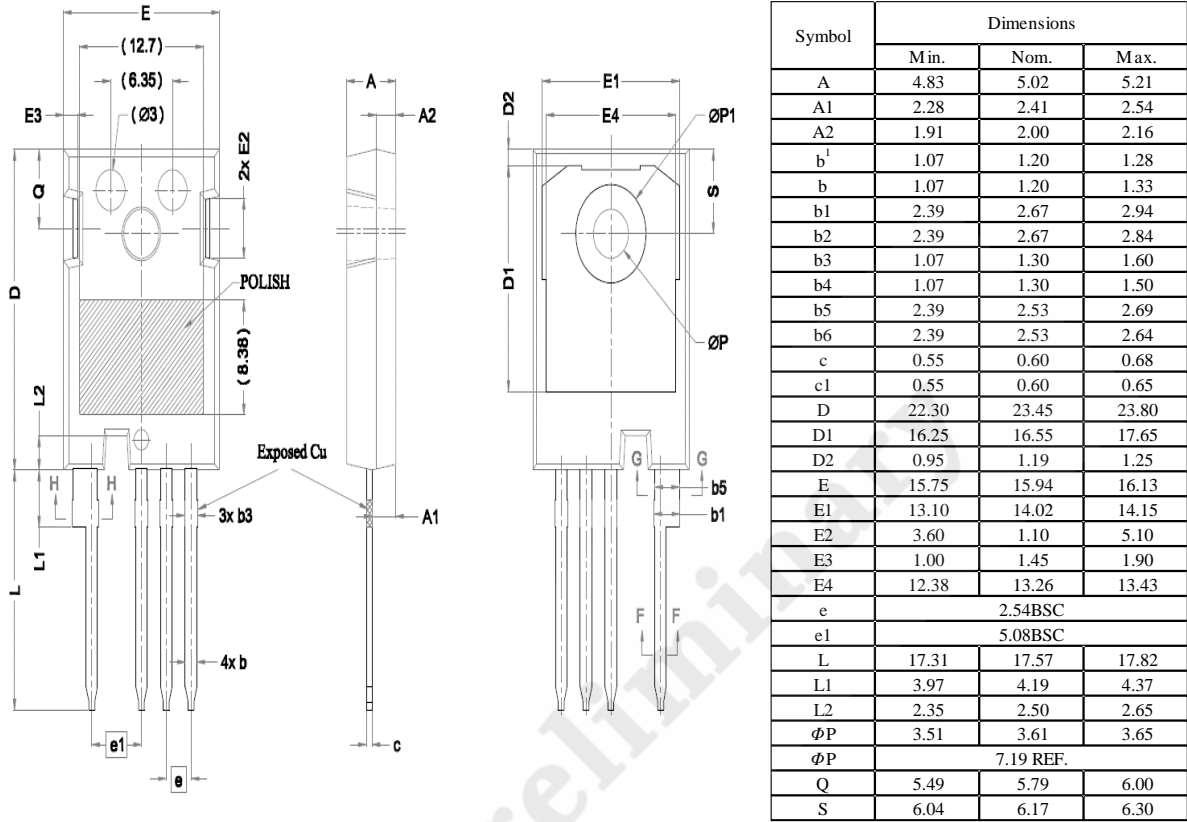


Figure 28. Safe Operating Area

6. Package Outlines



Drawing and Dimensions