

SiC MOS P3M06025K4

N-Channel Enhancement Mode

Features

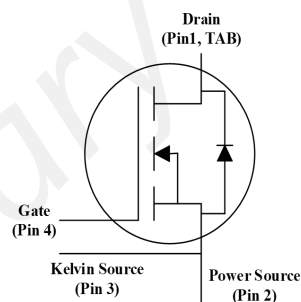
- Qualified to AEC-Q101
- High Blocking Voltage with Low On-Resistance
- High-Frequency Operation
- Ultra-Small Q_{gd}
- 100% UIS tested

Benefits

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

Applications

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



TO-247-4

Drain	1
Power Source	2
Kelvin Source	3
Gate	4



Order Information

Part Number	Package	Marking
P3M06025K4	TO-247-4	P3M06025K4

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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	$V_{GS} = 0V$ $I_D = 100\mu A$
Gate - Source Voltage (dynamic)	V_{GSmax}	-8 / +22	V	Duty cycle $\leq 1\%$
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	82	A	$V_{GS} = 18V$ $T_C = 25^\circ\text{C}$
		58		$V_{GS} = 18V$ $T_C = 100^\circ\text{C}$
		78		$V_{GS} = 15V$ $T_C = 25^\circ\text{C}$
		55		$V_{GS} = 15V$ $T_C = 100^\circ\text{C}$
Pulsed Drain Current	$I_{D(pulse)}$	200	A	$PW \leq 10\mu s$, Duty cycle $\leq 1\%$
Power Dissipation	P_D	349	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	$V_{GS} = 0V$ $I_D = 1.5mA$
Gate Threshold Voltage	$V_{GS(th)}$	2.0	2.5	/	V	$V_{DS} = V_{GS}$ $I_D = 20mA$ $T_J = 25^\circ\text{C}$
		/	2.0	/	V	$V_{DS} = V_{GS}$ $I_D = 20mA$ $T_J = 175^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	/	1	100	μA	$V_{GS} = 0V$ $V_{DS} = 650V$
Gate-Source Leakage Current	I_{GSS}	/	1	250	nA	$V_{GS} = -5 \text{ to } 18V$ $V_{DS} = 0V$
Drain-Source On-State Resistance	$R_{DS(on)}$	/	25	33	m Ω	$V_{GS} = 18V$ $I_D = 40A$ $T_J = 25^\circ\text{C}$
		/	36	/		$V_{GS} = 18V$ $I_D = 40A$ $T_J = 175^\circ\text{C}$
		/	32	/		$V_{GS} = 15V$ $I_D = 40A$ $T_J = 25^\circ\text{C}$
		/	40	/		$V_{GS} = 15V$ $I_D = 40A$ $T_J = 175^\circ\text{C}$
Trans conductance	g_{fs}	/	17	/	S	$V_{DS} = 20V$ $I_{DS} = 40A$ $T_J = 25^\circ\text{C}$
		/	16	/		$V_{DS} = 20V$ $I_{DS} = 40A$ $T_J = 175^\circ\text{C}$

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Input Capacitance	C _{iss}	/	3900	/	pF	V _{GS} = 0V V _{DS} = 400V f= 1MHz V _{AC} = 25mV
Output Capacitance	C _{oss}	/	260	/		
Reverse Transfer Capacitance	C _{rss}	/	6	/		
Coss Stored Energy	E _{oss}	/	24	/	μJ	μJ V _{DS} = 400V V _{GS} = -3/15V I _D = 40A R _G = 1Ω
Turn-on Energy	E _{on}	/	120	/		
Turn-off Energy	E _{off}	/	50	/		
Turn-on Energy	E _{on}	/	91	/	μJ	V _{DS} = 400V V _{GS} = -3/18V I _D = 40A R _G = 1Ω
Turn-off Energy	E _{off}	/	26	/		
Turn-On Delay Time	t _{d(on)}	/	28	/	ns	V _{DS} = 400V V _{GS} = -3/18V I _D = 40A R _G = 1Ω
Rise Time	t _r	/	17	/		
Turn-Off Delay Time	t _{d(off)}	/	33	/		
Fall Time	t _f	/	6	/		
Internal Gate Resistance	R _{G(int)}	/	1.3	/	Ω	f= 1MHz V _{AC} = 25mV
Gate to Source Charge	Q _{gs}	/	46	/	nC	V _{DS} = 400V I _{DS} = 40A V _{GS} = -3 to 18V I _G = 10mA
Gate to Drain Charge	Q _{gd}	/	36	/		
Total Gate Charge	Q _g	/	119	/		

3. Reverse Diode Characteristics

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

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Diode Forward Voltage	V_{SD}	5.3	/	V	$V_{GS} = -3V$ $I_{SD} = 20A$ $T_J = 25^\circ\text{C}$
		4.7	/	V	$V_{GS} = -3V$ $I_{SD} = 20A$ $T_J = 175^\circ\text{C}$
Continuous Diode Forward Current	I_S	/	63	A	$V_{GS} = -3V$
Reverse Recover Time	t_{rr}	12	/	ns	$V_{GS} = -3V/18V$
Reverse Recovery Charge	Q_{rr}	76	/	nC	$I_{SD} = 40A$ $V_R = 400V$
Peak Reverse Recovery Current	I_{rrm}	10	/	A	$dI/dt = 3900A/\mu s$ $T_J = 25^\circ\text{C}$

4. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	0.43	$^\circ\text{C}/W$

5. Typical Performance

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

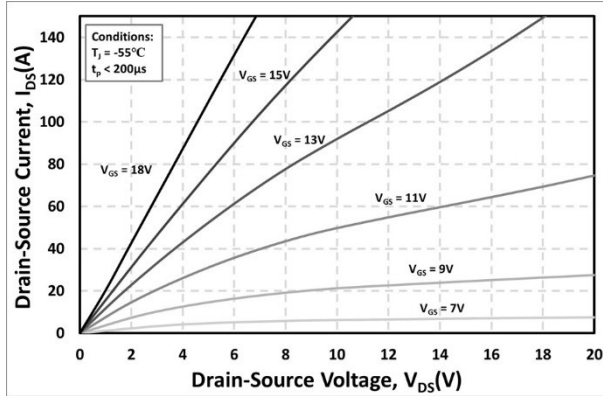


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

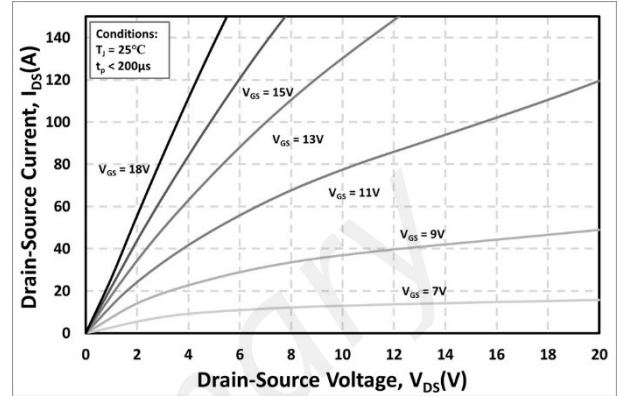


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

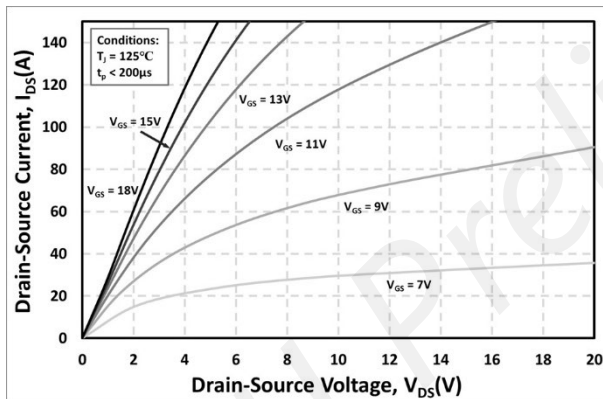


Figure 3. Output Characteristics $T_J = 125^\circ\text{C}$

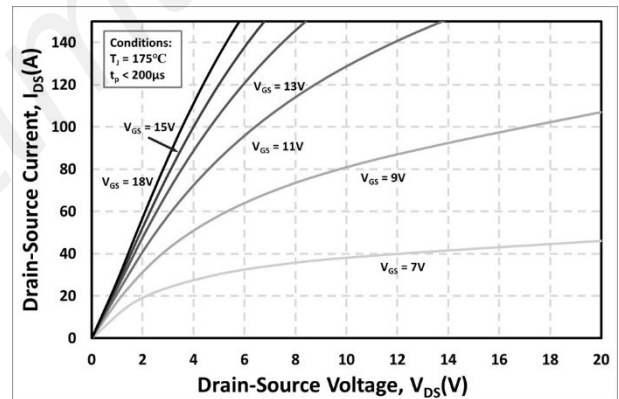


Figure 4. Output Characteristics $T_J = 175^\circ\text{C}$

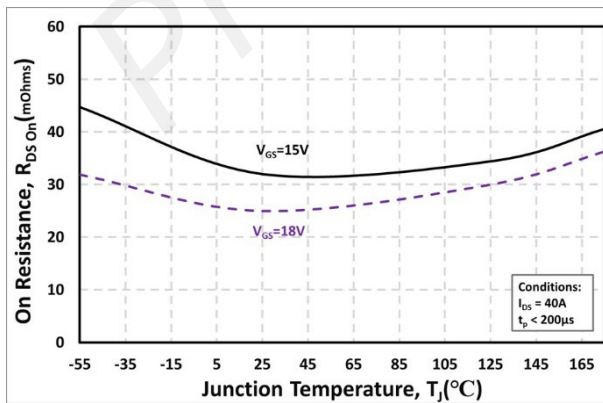


Figure 5. Normalized On-Resistance vs. Temperature

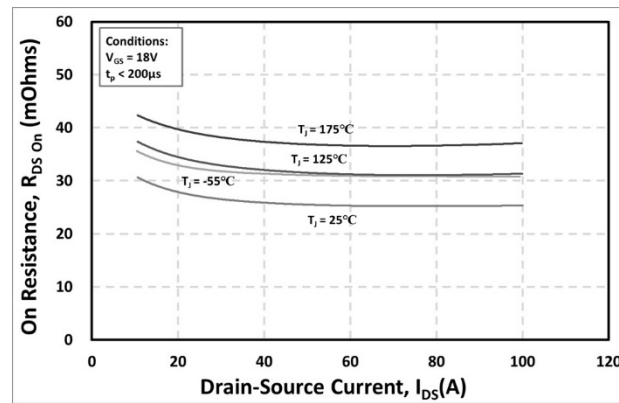


Figure 6. On-Resistance vs. Drain Current Various Temperatures

P3M06025K4 SiC MOSFET

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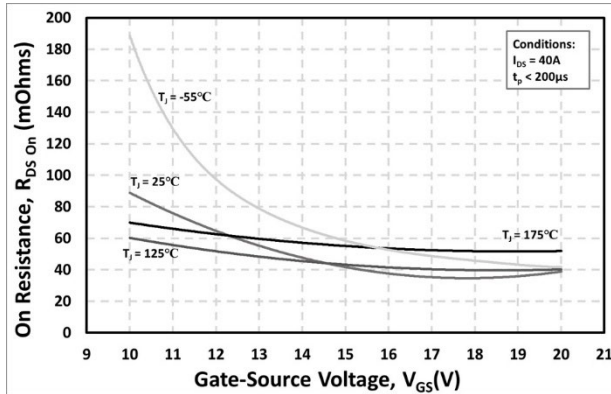


Figure 7. On-Resistance vs. Gate-Source Voltage

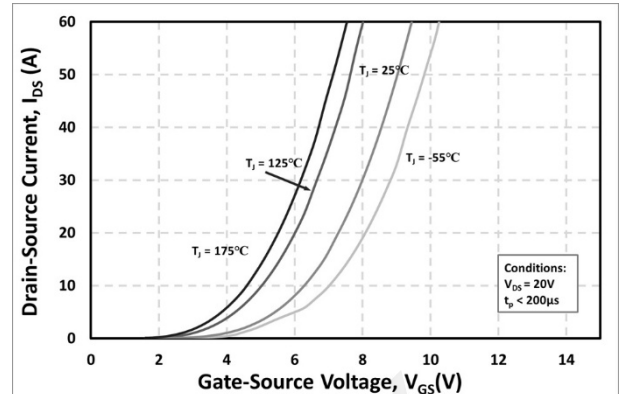


Figure 8. Transfer Characteristic for Various Junction Temperatures

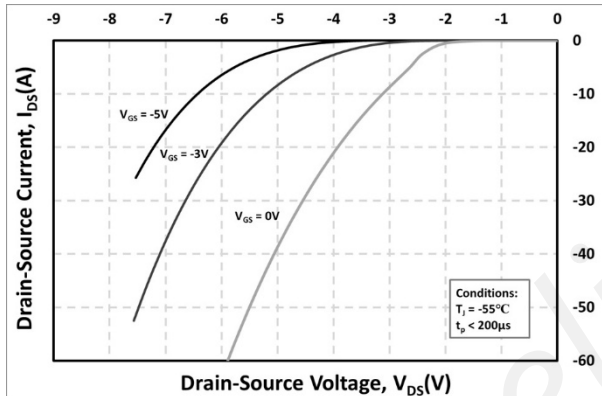


Figure 9. Body Diode Characteristic at -55°C

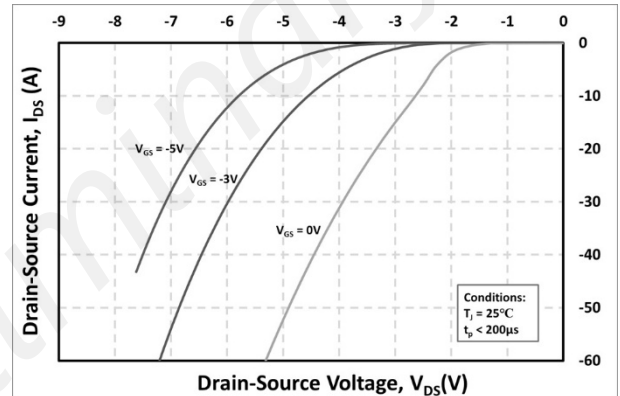


Figure 10. Body Diode Characteristic at 25°C

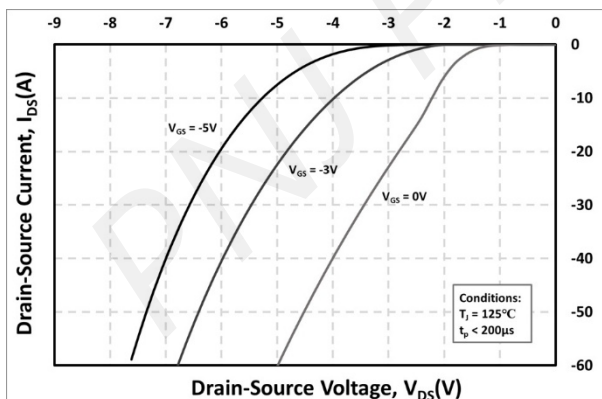


Figure 11. Body Diode Characteristic at 125°C

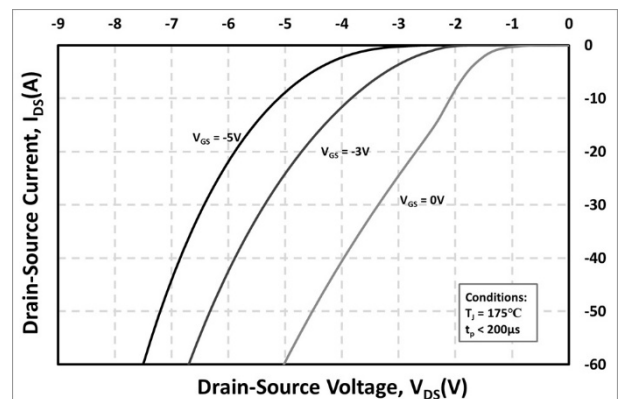


Figure 12. Body Diode Characteristic at 175°C

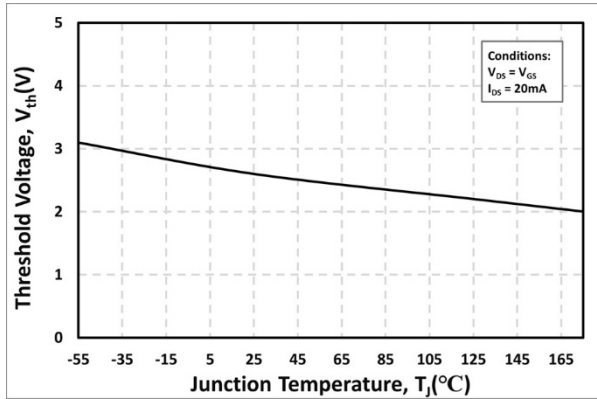


Figure 13. Threshold Voltage vs. Temperature

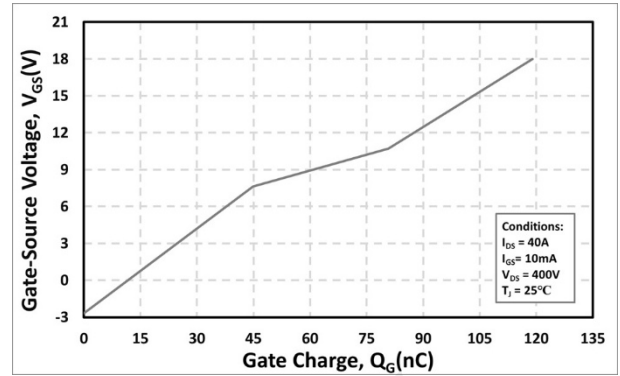


Figure 14. Gate Charge Characteristics

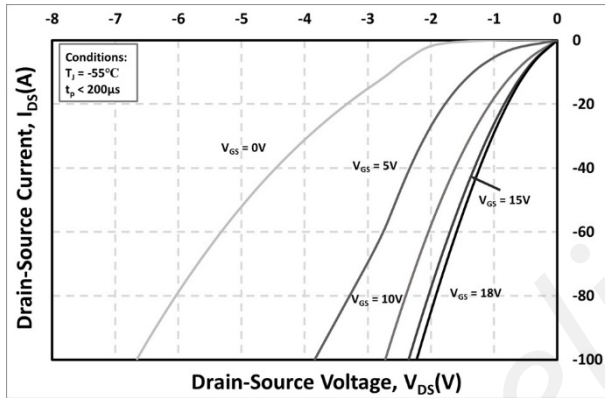


Figure 15. 3rd Quadrant Characteristic at -55°C

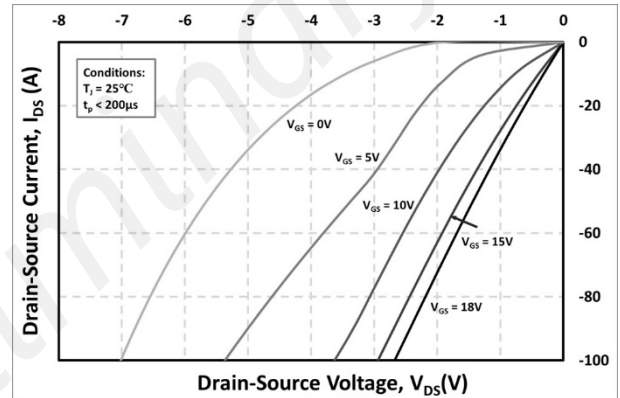


Figure 16. 3rd Quadrant Characteristic at 25°C

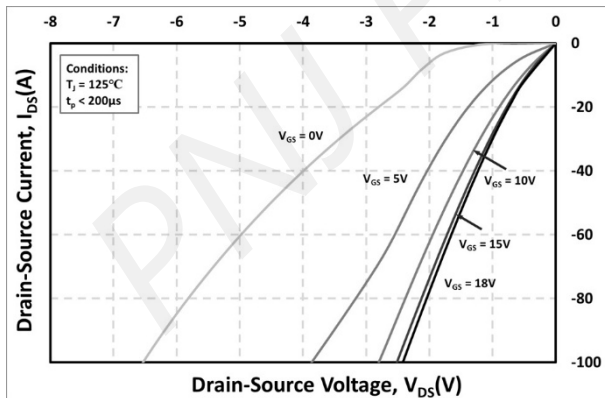


Figure 17. 3rd Quadrant Characteristic at 125°C

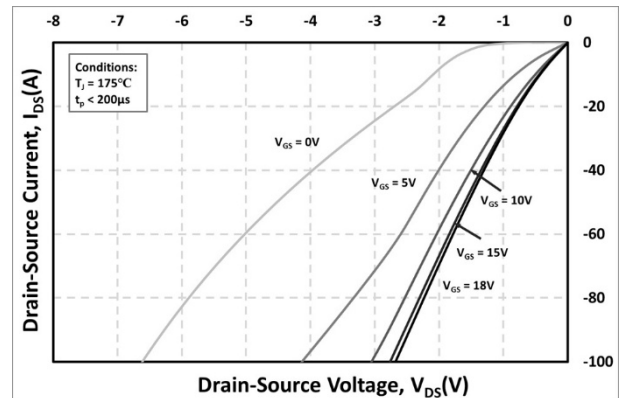


Figure 18. 3rd Quadrant Characteristic at 175°C

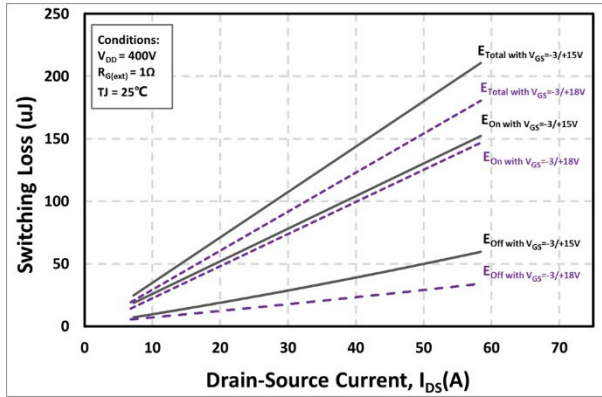


Figure 19. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 400V$)

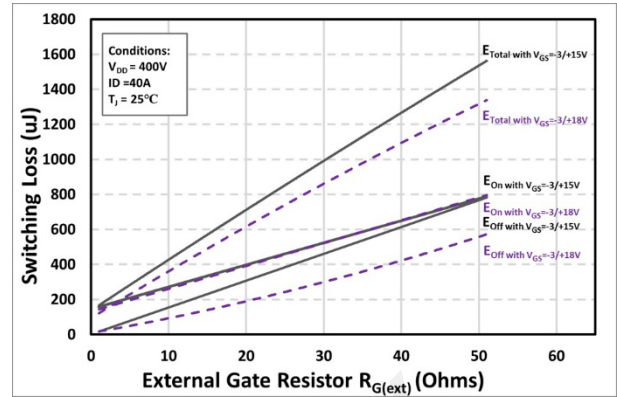


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

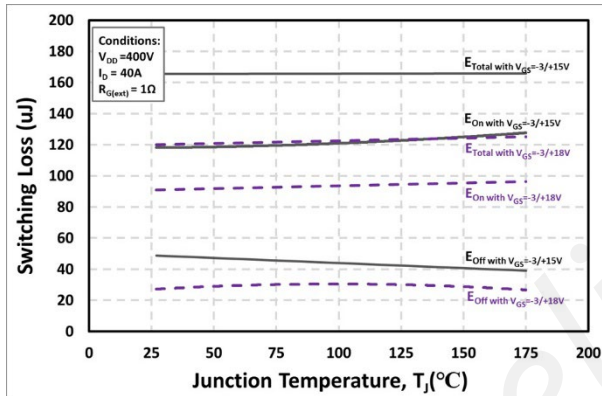


Figure 21. Clamped Inductive Switching Energy vs. Temperature

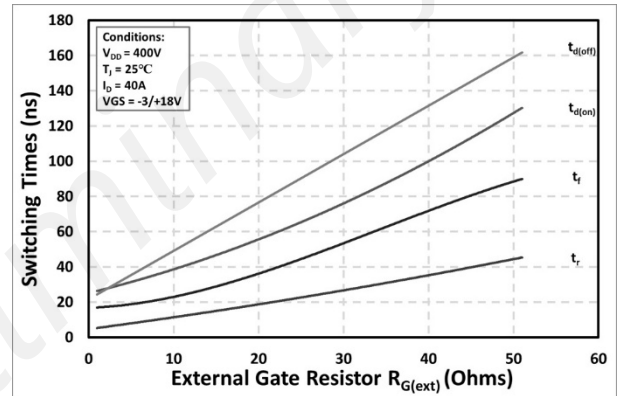


Figure 22. Switching Times vs. $R_{G(ext)}$

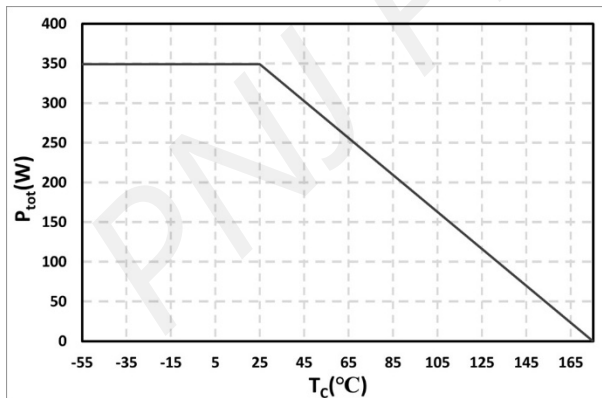


Figure 23. Maximum Power Dissipation Derating vs. Case Temperature

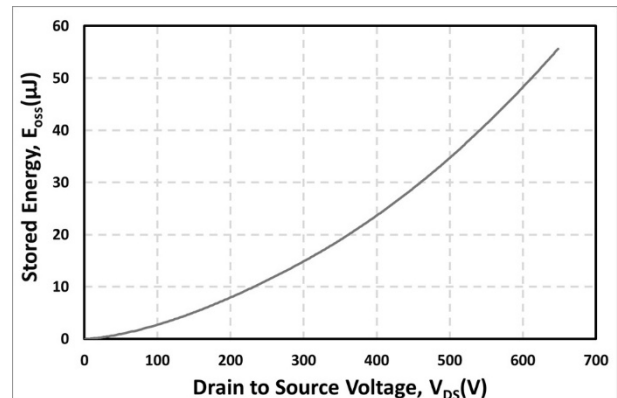


Figure 24. Output Capacitor Stored Energy

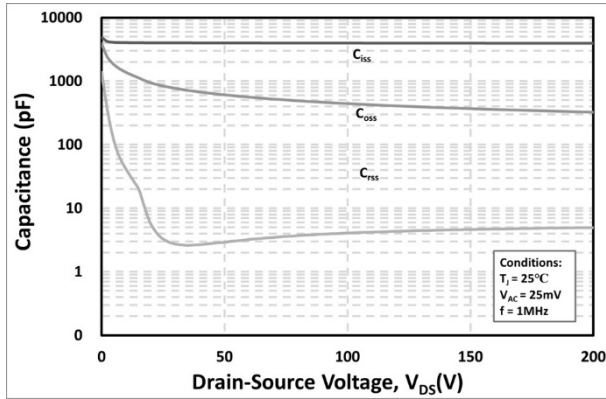


Figure 25. Capacitances vs. Drain-Source Voltage (0 - 200V)

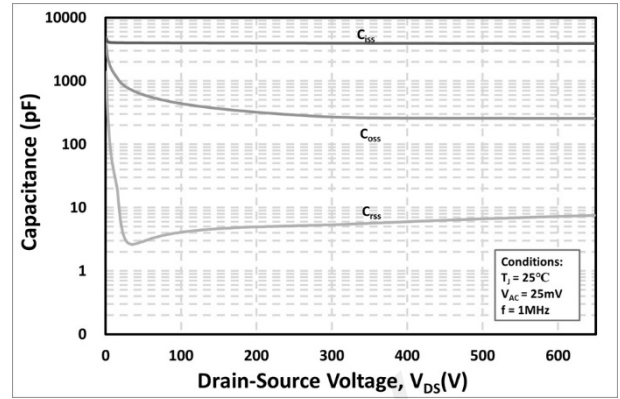


Figure 26. Capacitances vs. Drain-Source Voltage (0 - 650V)

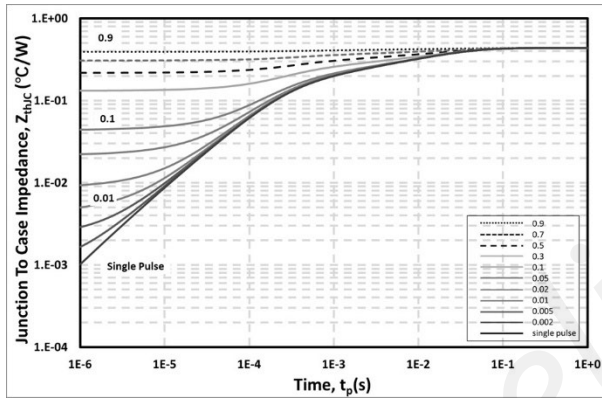


Figure 27. Transient Thermal Impedance (Junction - Case)

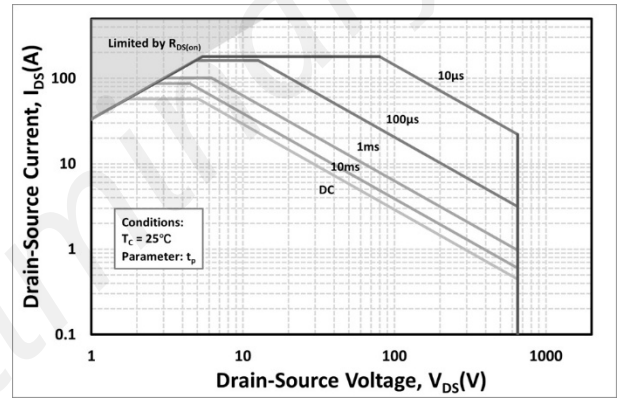


Figure 28. Safe Operating Area

6. Definitions

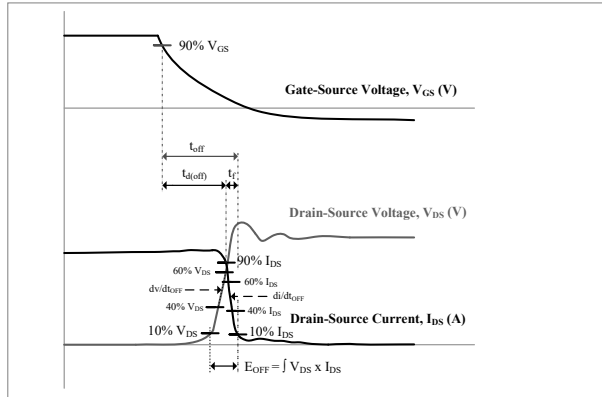


Figure 29. Turn-off Transient Definitions

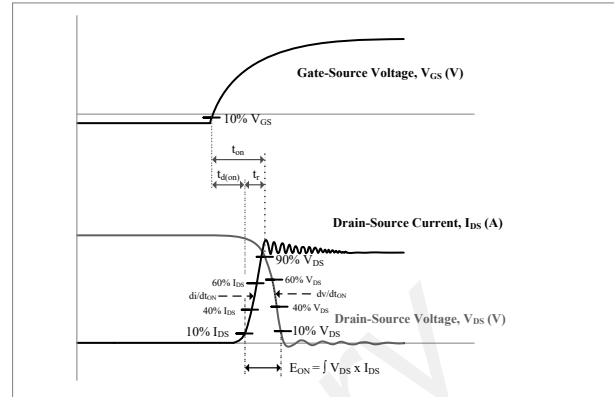


Figure 30. Turn-on Transient Definitions

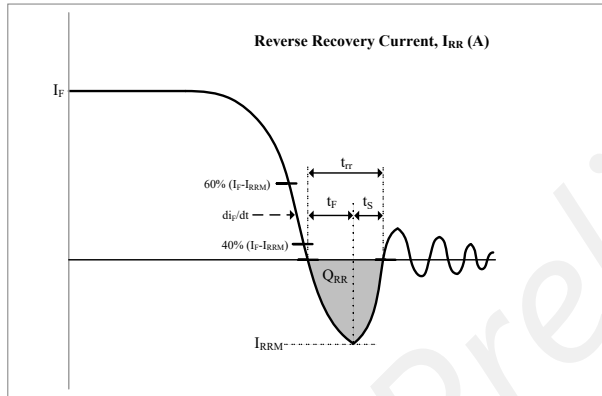


Figure 31. Reverse Recovery Definitions

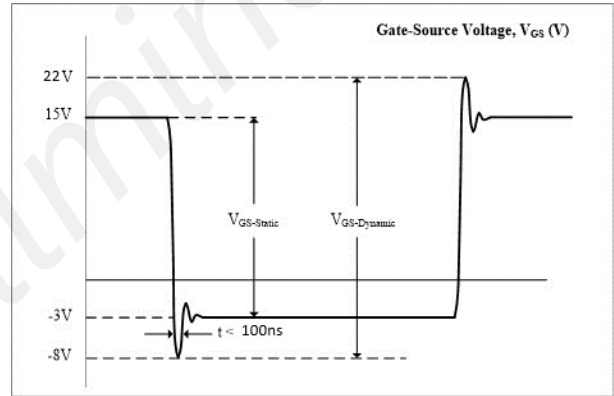
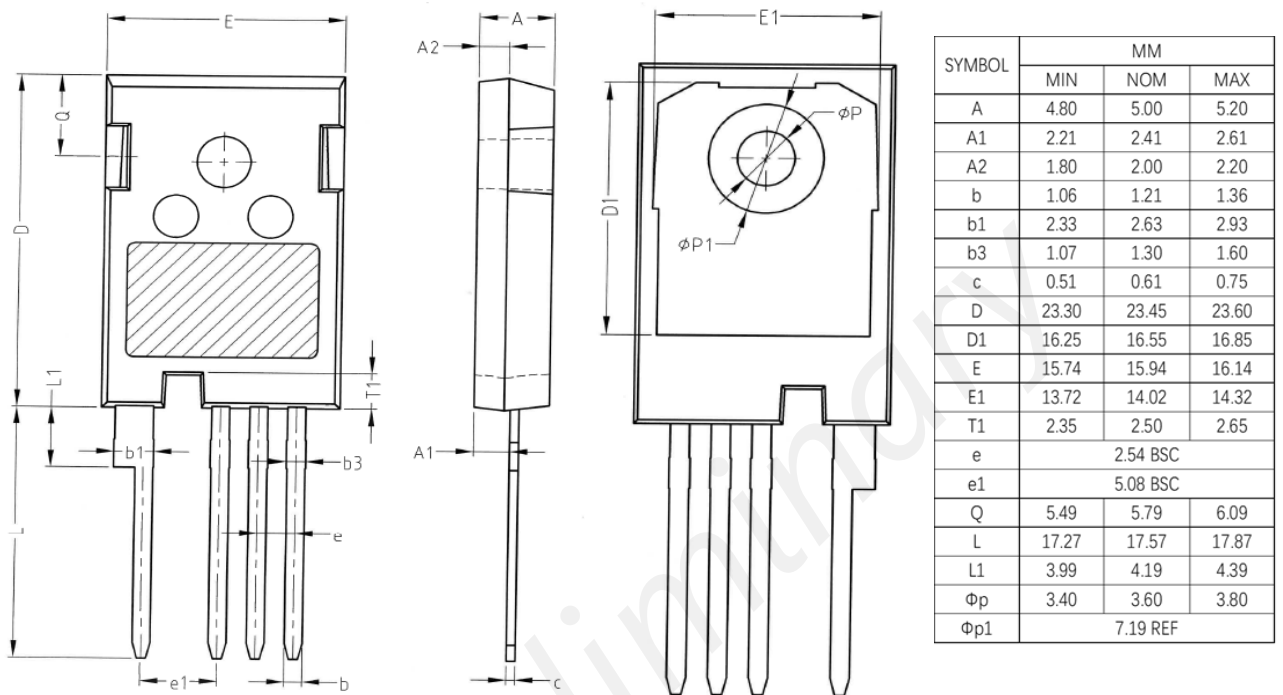


Figure 32. v_{GS} Transient Definitions

7. Package Outlines



Drawing and Dimensions

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