

SiC MOSFET P3M12040G7

N-Channel Enhancement Mode



Features

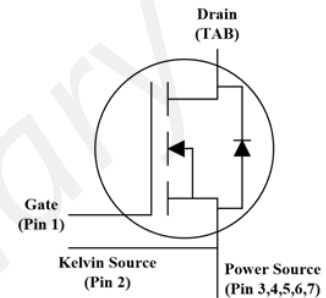
- Qualified to AEC-Q101
- High Blocking Voltage with Low On-Resistance
- High-Frequency Operation
- Ultra-Small Q_{gd}
- 100% UIS tested

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-263-7

Drain	TAB
Gate	1
Kelvin Source	2
Power Source	3~7



Order Information

Part Number	Package	Marking
P3M12040G7	TO-263-7	P3M12040G7

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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}	1200	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	66	A	$V_{GS} = 18V$ $T_C = 25^\circ\text{C}$
		50		$V_{GS} = 18V$ $T_C = 100^\circ\text{C}$
Pulsed Drain Current	$I_{D(pulse)}$	180	A	$PW \leq 10\mu s$, Duty cycle $\leq 1\%$
Power Dissipation	P_D	312	W	
Operating Junction	T_J	-55 To +175	$^\circ\text{C}$	
Storage Temperature	T_{stg}	-55 To +150	$^\circ\text{C}$	
Solder Temperature	T_L	260	$^\circ\text{C}$	

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	$V_{(BR)DSS}$	1200	/	/	V	$V_{GS} = 0V$ $I_D = 1mA$
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.4	/	V	(tested after 30ms pulse at $V_{GS} = 18V$) $V_{DS} = V_{GS}$ $I_D = 10mA$ $T_J = 25^\circ\text{C}$
		/	1.8	/	V	$V_{DS} = V_{GS}$ $I_D = 10mA$ $T_J = 175^\circ\text{C}$
Reverse Bias Drain Current	I_{DSS}	/	1	100	μA	$V_{GS} = 0V$ $V_{DS} = 1200V$
Gate-Source Leakage Current	I_{GSS}	/	2	250	nA	$V_{GS} = 18V$ $V_{DS} = 0V$
Drain-Source On-State Resistance	$R_{DS(on)}$	/	40	52	m Ω	$V_{GS} = 18V$ $I_D = 40A$ $T_J = 25^\circ\text{C}$
		/	53	/		$V_{GS} = 18V$ $I_D = 40A$ $T_J = 175^\circ\text{C}$
		/	49	/		$V_{GS} = 15V$ $I_D = 40A$ $T_J = 25^\circ\text{C}$
Transconductance	g_{fs}	/	21	/	S	$V_{DS} = 20V$ $I_{DS} = 40A$ $T_J = 25^\circ\text{C}$
		/	20	/		$V_{DS} = 20V$ $I_{DS} = 40A$ $T_J = 175^\circ\text{C}$

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Input Capacitance	C_{iss}	/	2654	/	pF	$V_{GS} = 0V$ $V_{DS} = 800V$ $f = 1MHz$ $V_{AC} = 25mV$
Output Capacitance	C_{oss}	/	95.5	/		
Reverse Transfer Capacitance	C_{rss}	/	5.7	/		
Coss Stored Energy	E_{oss}	/	91.1	/	μJ	
Internal Gate Resistance	$R_{G(int)}$	/	1.3	/	Ω	$f = 1MHz$ $V_{AC} = 25mV$
Turn-on Energy	E_{on}	/	320	/	μJ	$V_{DS} = 800V$ $V_{GS} = -3/18V$ $I_{DS} = 40A$ $R_G = 1\Omega$
Turn-off Energy	E_{off}	/	75.9	/		
Turn-On Delay Time	$T_{d(on)}$	/	15.2	/	ns	
Rise Time	T_r	/	15.9	/		
Turn-Off Delay Time	$T_{d(off)}$	/	28.2	/		
Fall Time	T_f	/	16.7	/		
Gate to Source Charge	Q_{gs}	/	28	/	nC	$V_{DS} = 800V$ $I_{DS} = 40A$ $V_{GS} = -3/15V$ $I_G = 5mA$
Gate to Drain Charge	Q_{gd}	/	15.8	/		
Total Gate Charge	Q_g	/	74.4	/		

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}	4.6	/	V	$V_{GS} = -3\text{V}$ $I_{SD} = 20\text{A}$ $T_J = 25^\circ\text{C}$
		4.3	/	V	$V_{GS} = -3\text{V}$ $I_{SD} = 20\text{A}$ $T_J = 175^\circ\text{C}$
Continuous Diode Forward Current	I_S	/	56	A	$V_{GS} = -3\text{V}$
Reverse Recover Time	t_{rr}	18.7	/	ns	$V_{GS} = -3/18\text{V}$ $I_{SD} = 40\text{A}$
Reverse Recovery Charge	Q_{rr}	476	/	nC	$V_R = 800\text{V}$ $di_f/dt = 5400\text{A}/\mu\text{s}$
Peak Reverse Recovery Current	I_{rrm}	43.9	/	A	$T_J = 25^\circ\text{C}$

4. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	0.56	$^\circ\text{C}/\text{W}$

5. Typical Performance

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

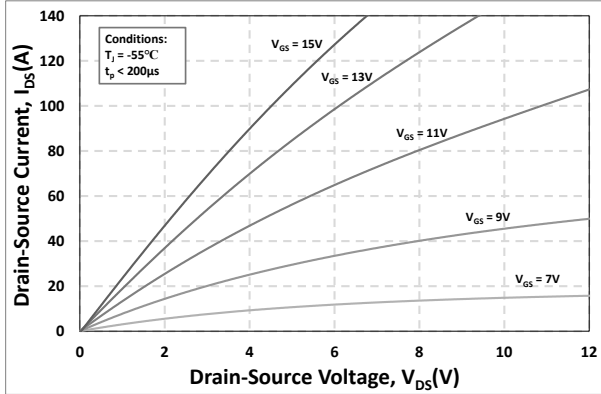


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

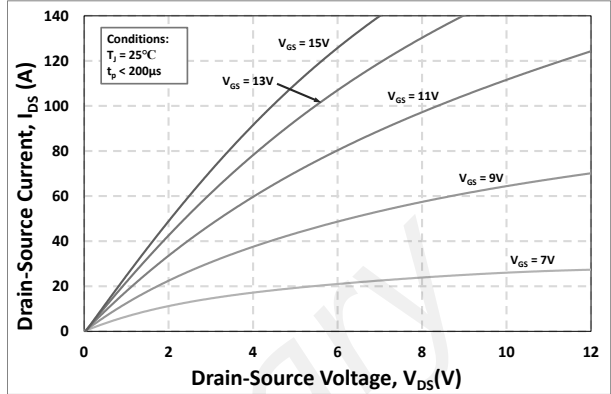


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

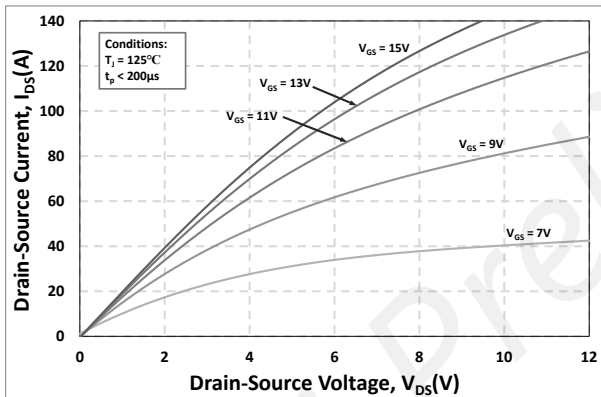


Figure 3. Output Characteristics $T_J = 125^\circ\text{C}$

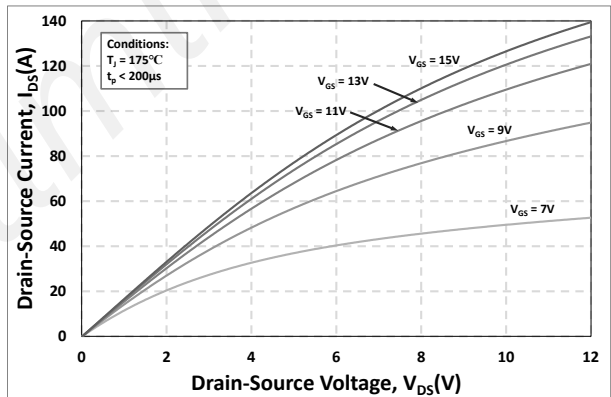


Figure 4. Output Characteristics $T_J = 175^\circ\text{C}$

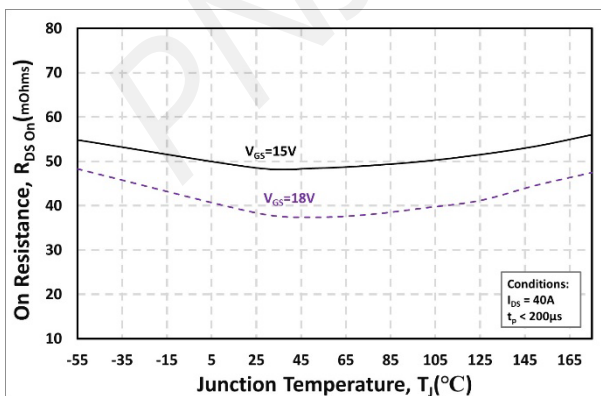


Figure 5. Normalized On-Resistance vs. Temperature

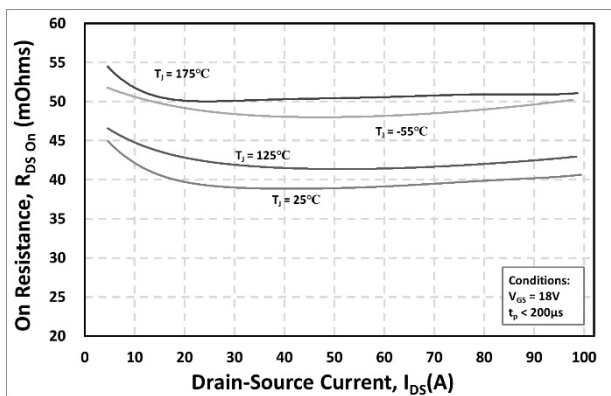


Figure 6. On-Resistance vs. Drain Current Various Temperatures

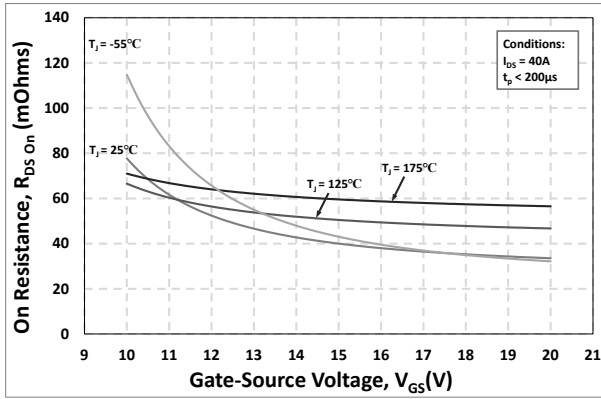


Figure 7. On-Resistance vs. Gate-Source Voltage

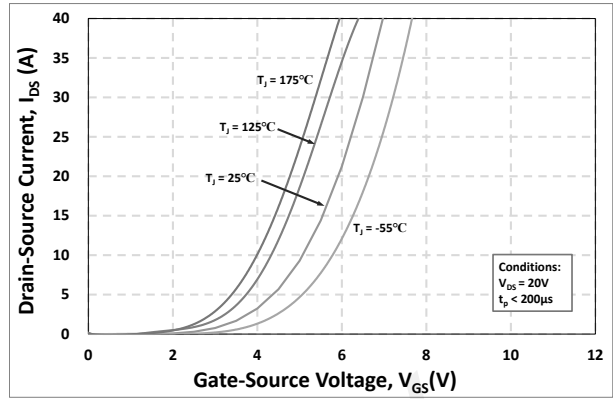


Figure 8. Transfer Characteristic for Various Junction Temperatures

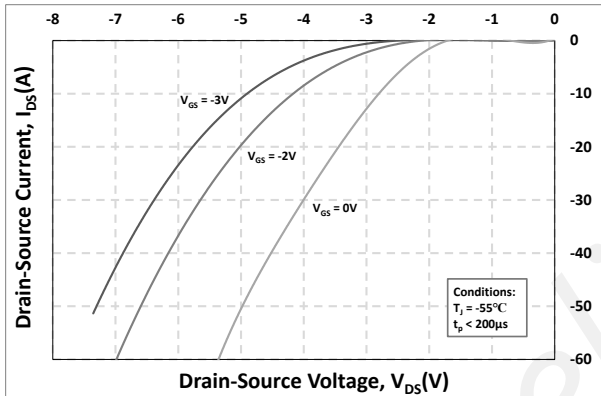


Figure 9. Body Diode Characteristic at -55°C

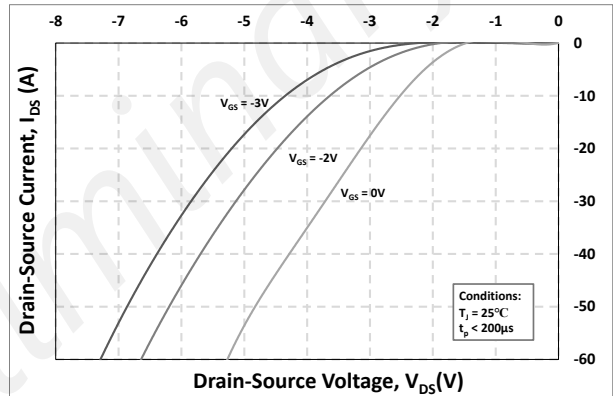


Figure 10. Body Diode Characteristic at 25°C

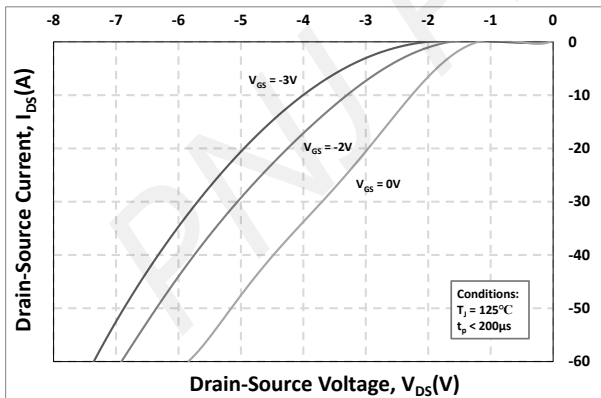


Figure 11. Body Diode Characteristic at 125°C

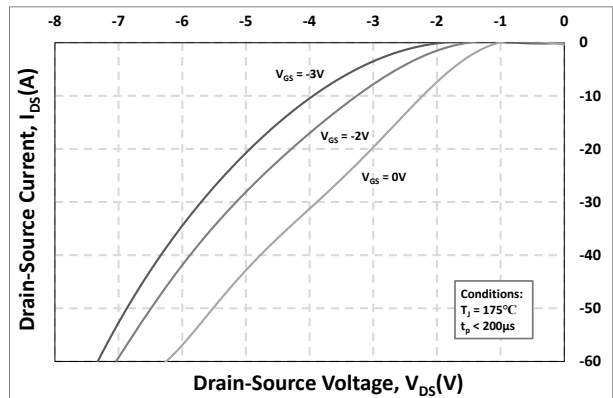


Figure 12. Body Diode Characteristic at 175°C

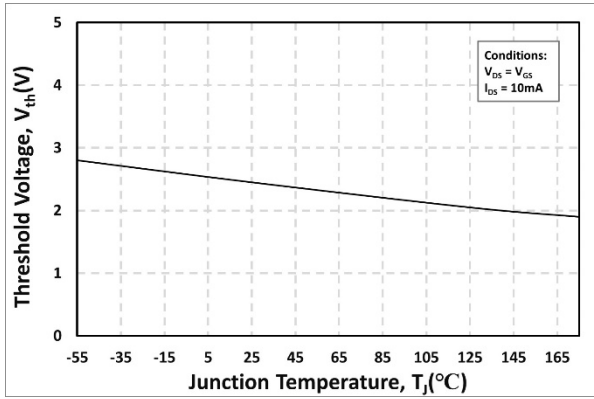


Figure 13. Threshold Voltage vs. Temperature

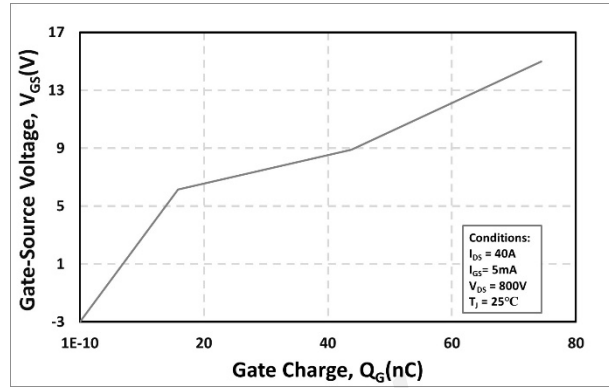


Figure 14. Gate Charge Characteristics(VGS=15V)

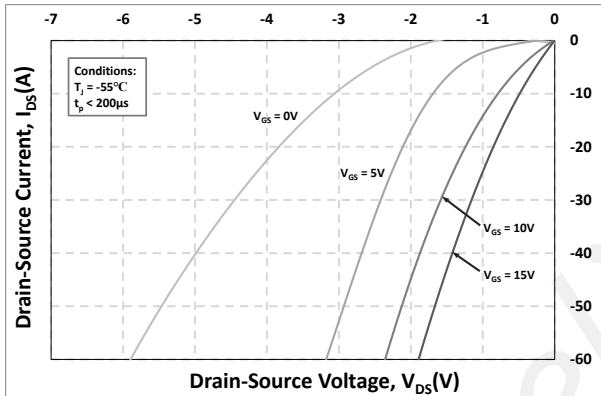


Figure 15. 3rd Quadrant Characteristic at -55°C

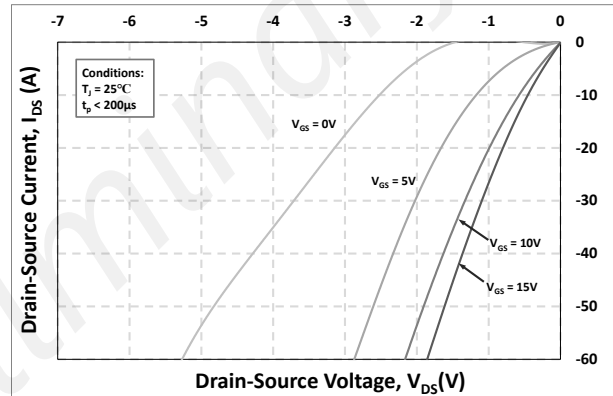


Figure 16. 3rd Quadrant Characteristic at 25°C

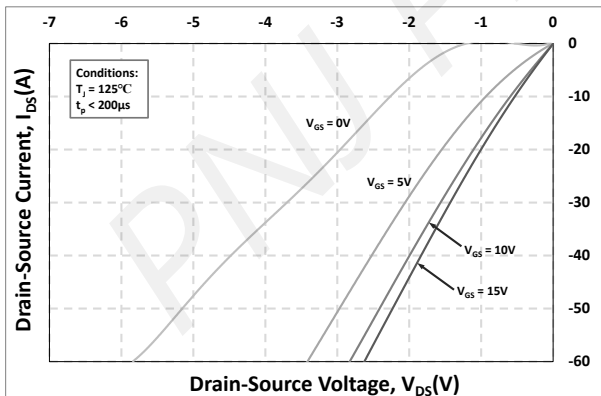


Figure 17. 3rd Quadrant Characteristic at 125°C

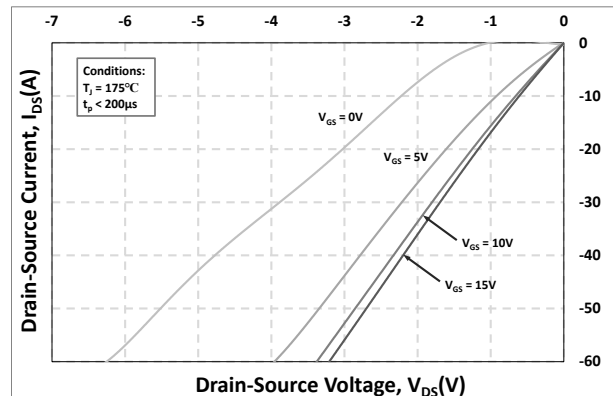


Figure 18. 3rd Quadrant Characteristic at 175°C

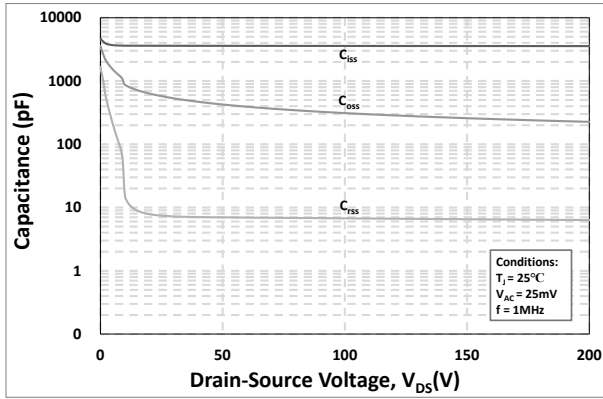


Figure 19. Capacitances vs. Drain-Source Voltage (0 - 200V)

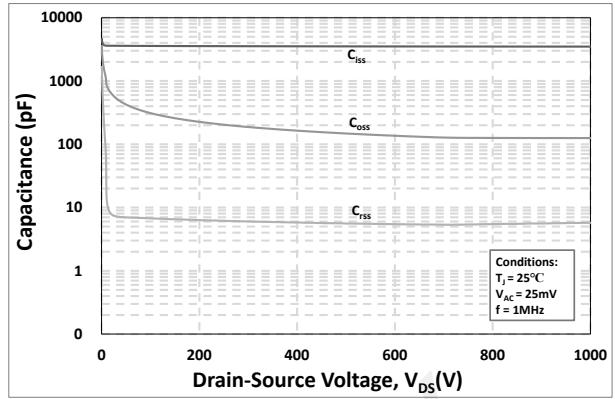


Figure 20. Capacitances vs. Drain-Source Voltage (0 - 1000V)

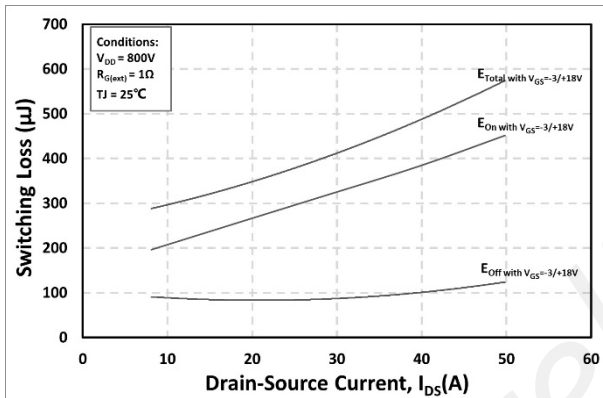


Figure 21. Clamped Inductive Switching Energy vs. Drain Current (VDD= 800V)

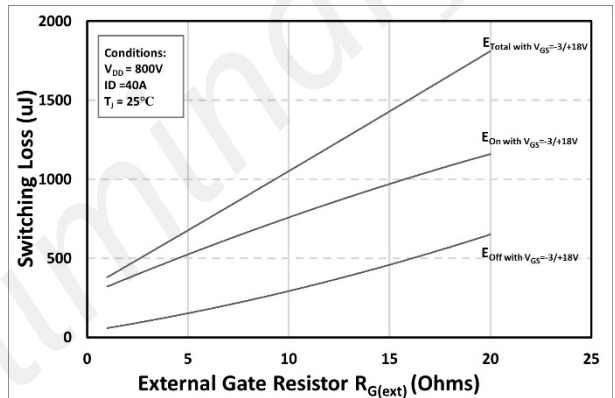


Figure 22. Clamped Inductive Switching Energy vs. Temperature

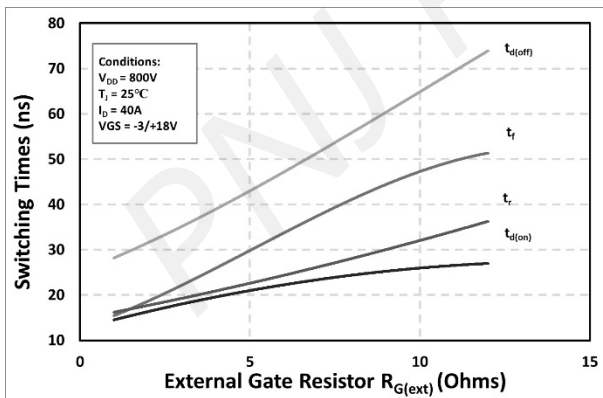


Figure 23. Switching Times vs. RG(ext)

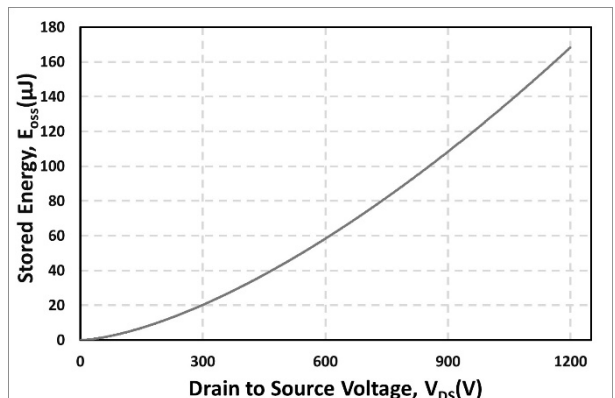


Figure 24. Output Capacitor Stored Energy

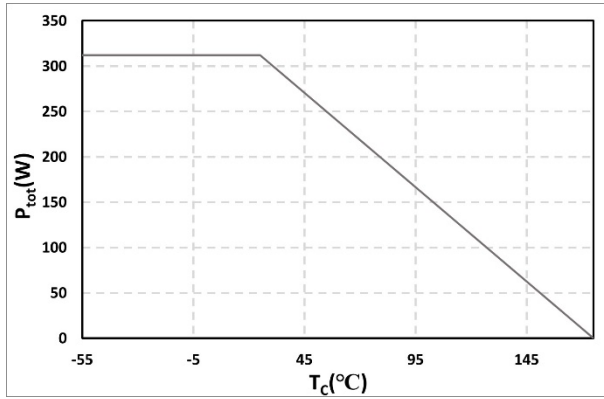


Figure 25. Maximum Power Dissipation Derating vs. Case Temperature

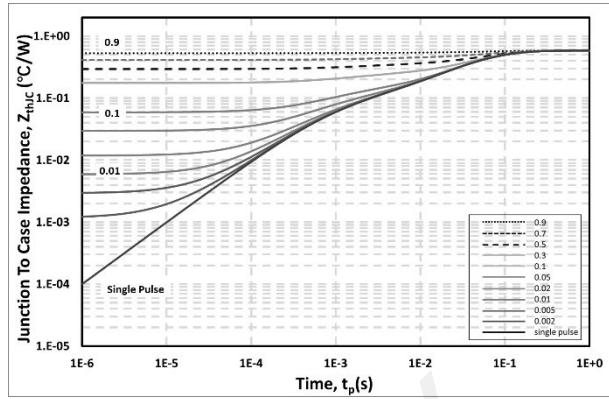


Figure 26. Transient Thermal Impedance (Junction - Case)

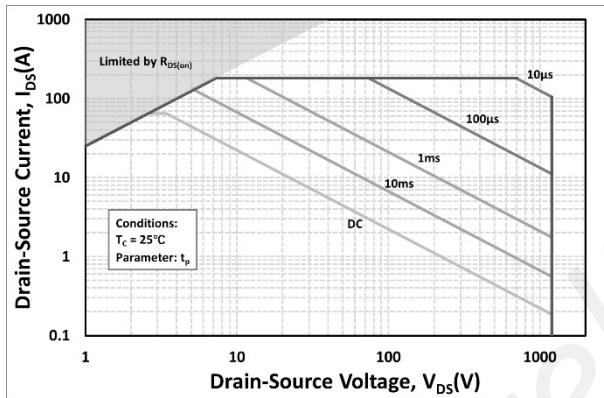


Figure 27. Safe Operating Area

PNJ Preliminary

6. Definitions

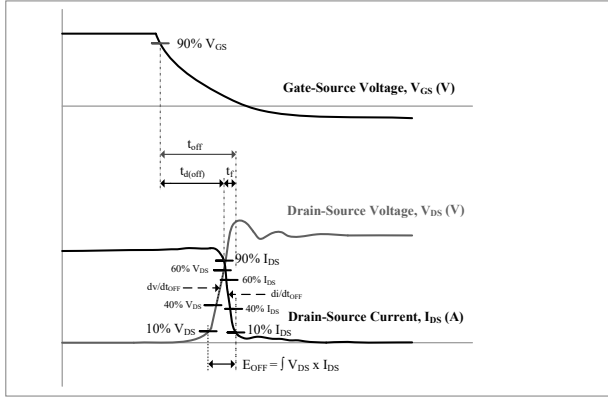


Figure 28. Turn-off Transient Definitions

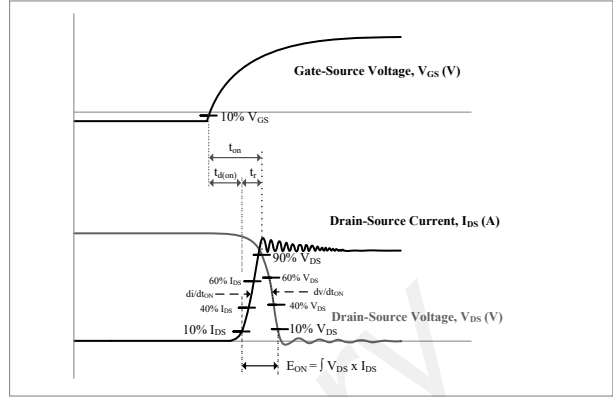


Figure 29. Turn-on Transient Definitions

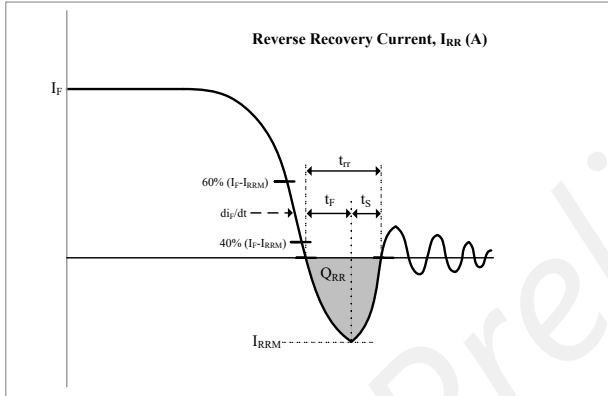


Figure 30. Reverse Recovery Definitions

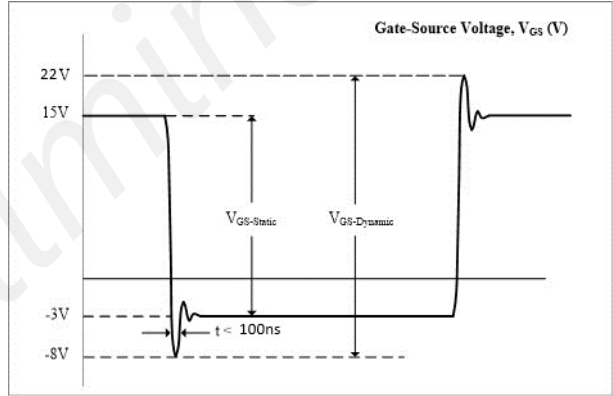


Figure 31. V_{GS} Transient Definitions



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