SiC MOSFET P3M12010TM

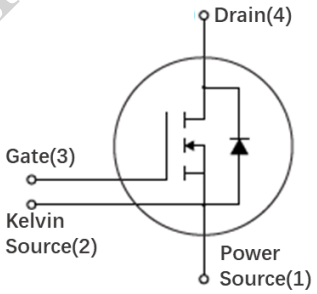
N-Channel Enhancement Mode

Features

- High Blocking Voltage with Low On-Resistance
- High-Frequency Operation
- Ultra-Small Q_{gd}

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

Drain	4
Gate	3
Kelvin Source	2
Power Source	1

Order Information

Part Number	Package	Marking
P3M12010TM	TPAK	P3M12010TM

Contents

1. Maximum Ratings

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value	Unit	Test Conditions
Drain - Source Voltage	V_{DSmax}	1200	V	V_{GS}= -3V I_D= 100μA
Gate - Source Voltage (Dynamic)	V_{GSmax}	-8 / +21	V	AC (f>1 Hz)
Gate - Source Voltage (Static)	V_{GSop}	-3 / +15/+18	V	Static
Continuous Drain Current, assumes $R_{th(j-c)}$<0.19 K/W	I_D	230	A	V_{GS}= 18V T_C= 25℃
		170		V_{GS}= 18V T_C= 100℃
Power Dissipation	P_D	1000	W	Tc =25℃
Operating Junction	T_J	-55 To +175	℃	
Storage Temperature	T_{stg}	-55 To +175	℃	

2. Electrical Characteristics

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	1200	/	/	V	V_{GS}= -3V I_D= 2.5 mA
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.5	/	V	V_{DS}= V_{GS} I_D= 24mA T_J = 25℃
		/	1.8	/	V	V_{DS}= V_{GS} I_D= 24mA T_J = 175℃
Reverse Bias Drain Current	I_{DSS}	/	1	100	μA	V_{GS}= -3V V_{DS}= 1200V
Gate-Source Leakage Current	I_{GSS}	/	10	300	nA	V_{GS}= 18V V_{DS}= 0V
Drain-Source On-State Resistance	$R_{DS(on)}$	/	8	/	mΩ	V_{GS}= 18V I_D= 100A T_J = 25℃
		/	11	/		V_{GS}= 18V I_D= 100A T_J = 125℃
		/	13.5	/		V_{GS}= 18V I_D= 100A T_J = 175℃
		/	10	/		V_{GS}= 15V I_D= 100A T_J = 25℃

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Input Capacitance	C_{iss}	/	12.6	/	nF	V_{GS}= 0V V_{DS}= 800V f= 500kHz V_{AC}= 25mV
Output Capacitance	C_{oss}	/	432	/	pF	
Reverse Transfer Capacitance	C_{rss}	/	30	/	pF	
Coss Stored Energy	E_{oss}	/	170	/	μJ	
Gate to Source Charge	Q_{gs}	/	182	/	nC	V_{DS}= 800V I_{DS}= 100A V_{GS}= -3/18V I_G= 24mA
Gate to Drain Charge	Q_{gd}	/	94	/		
Total Gate Charge	Q_g	/	434	/		
Turn-on Energy	E_{on}	/	2128	/	μJ	V_{DS}= 800V I_{DS}= 100A V_{GS}= -3V/18V R_G= 1.0Ω L= 50μH
Turn-off Energy	E_{off}	/	944	/		
Turn-On Delay Time	$T_{d(on)}$	/	42.7	/	ns	
Rise Time	T_r	/	25.9	/		
Turn-Off Delay Time	$T_{d(off)}$	/	76.2	/		
Fall Time	T_f	/	21.8	/		

3. Reverse Diode Characteristics

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Diode Forward Voltage	V_{SD}	6.2	/	V	V_{GS}= -3V I_{SD}= 100A T_J = 25℃
		5.6	/	V	V_{GS}= -3V I_{SD}= 100A T_J= 175℃
Reverse Recover Time	t_{rr}	31	/	ns	V_{GS}= -3/18V I_{SD}= 100A V_{DS}= 800V d_{if}/d_t= 5000A/μs T_J= 25℃
Reverse Recovery Charge	Q_{rr}	1747	/	μC	
Peak Reverse Recovery Current	I_{rrm}	94	/	A	
Reverse Recovery Energy	E_{RR}	941	/	uJ	

4. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	0.15	℃/W

5. Typical Performance

At T_J= 25℃, unless specified otherwise

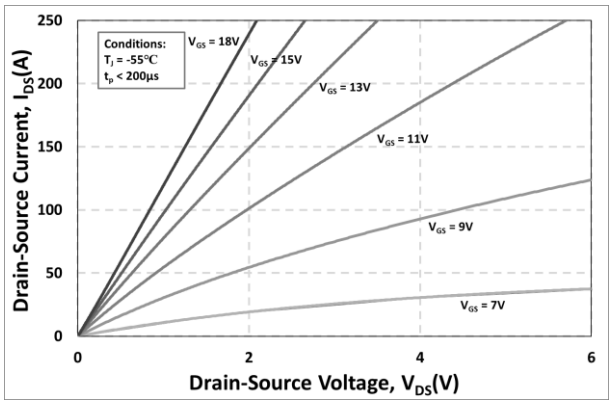


Figure 1. Output Characteristics T_J = -55℃

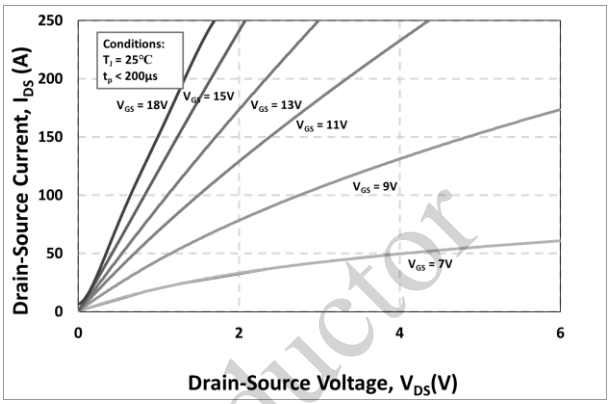


Figure 2. Output Characteristics T_J = 25℃

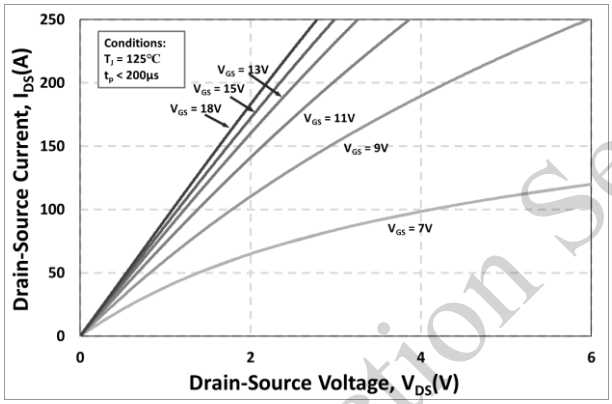


Figure 3. Output Characteristics T_J = 125℃

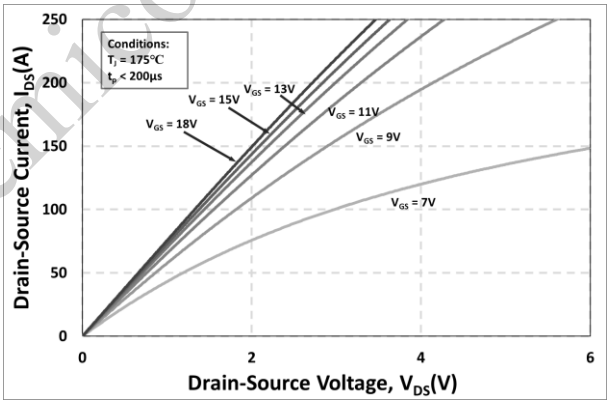


Figure 4. Output Characteristics T_J = 175ºC

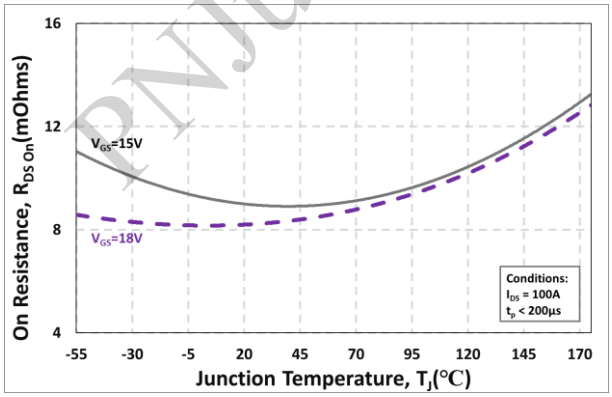


Figure 5. On-Resistance vs. Temperature

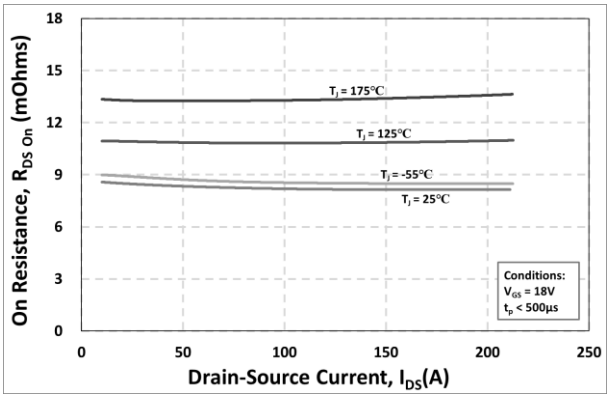


Figure 6. On-Resistance vs. Drain Current Various Temperatures

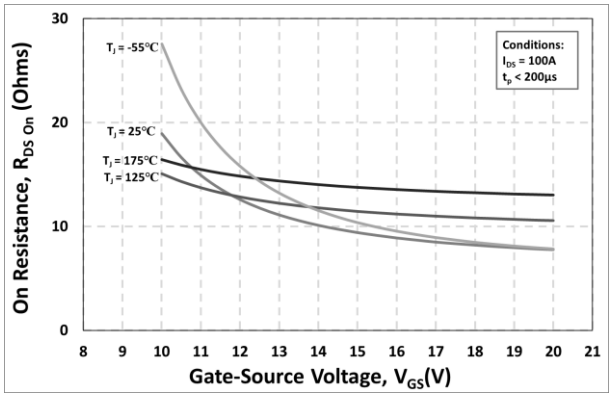


Figure 7. On-Resistance vs. Gate-Source Voltage

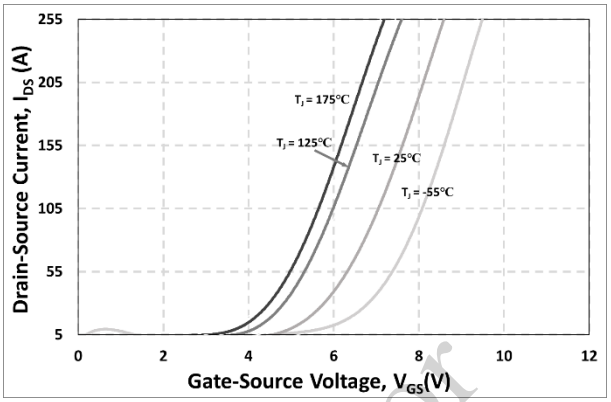


Figure 8. Transfer Characteristic for Various Junction Temperatures

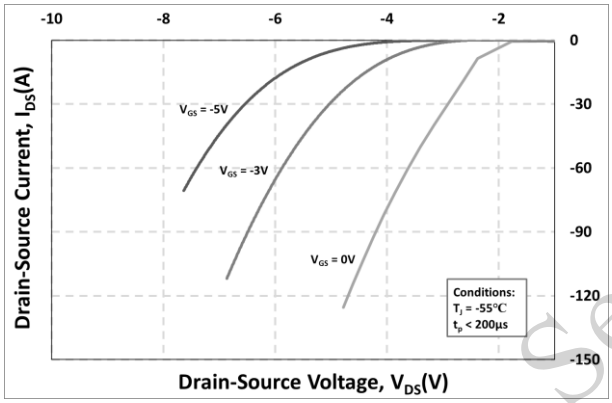


Figure 9. Body Diode Characteristic at -55°C

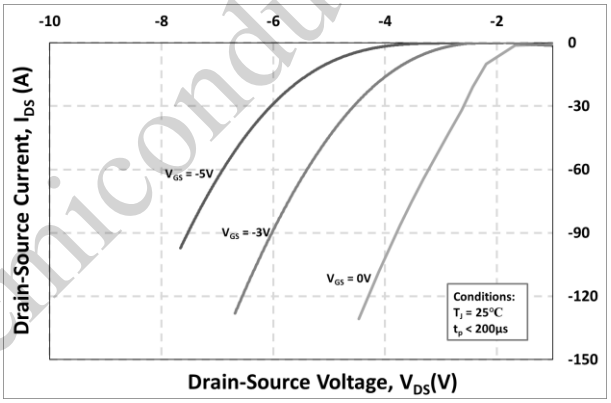


Figure 10. Body Diode Characteristic at 25°C

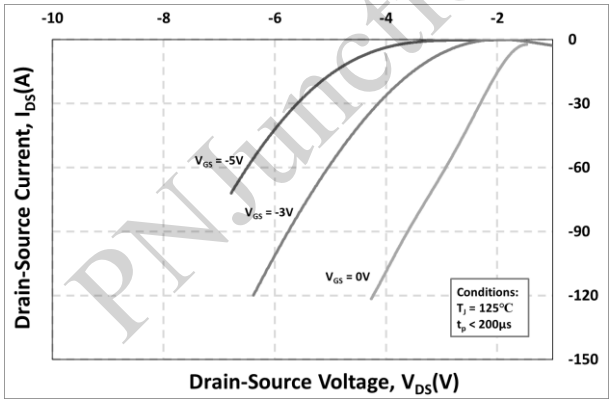


Figure 11. Body Diode Characteristic at 125°C

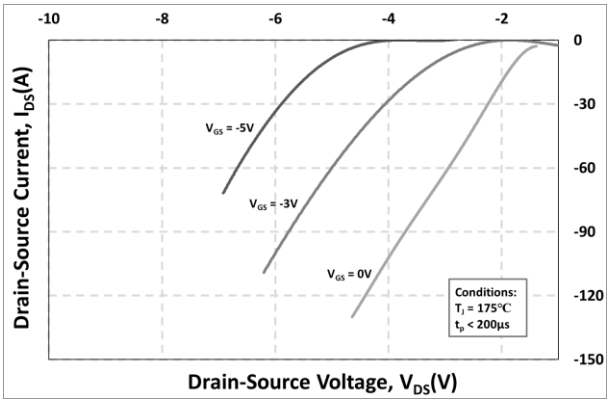


Figure 12. Body Diode Characteristic at 175°C

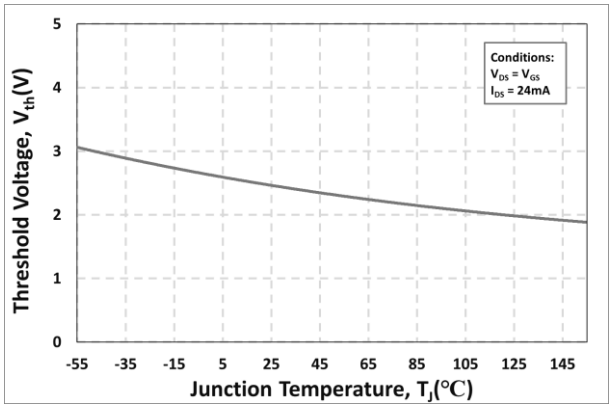


Figure 13. Threshold Voltage vs. Temperature

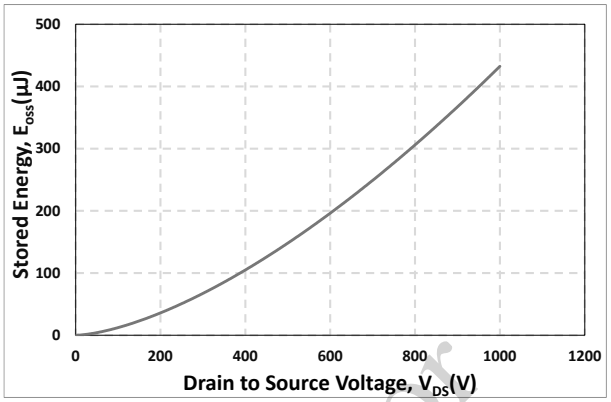


Figure 14. Output Capacitor Stored Energy

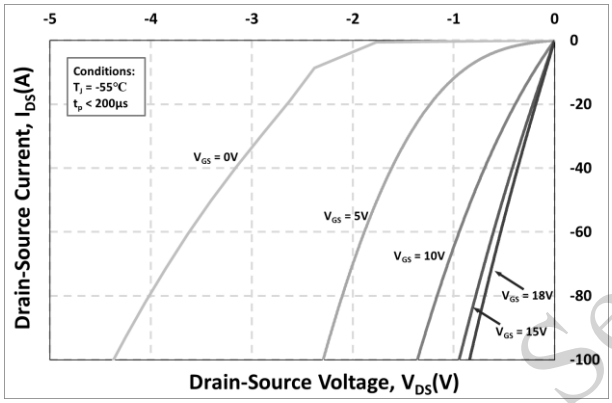


Figure 15. 3rd Quadrant Characteristic at -55°C

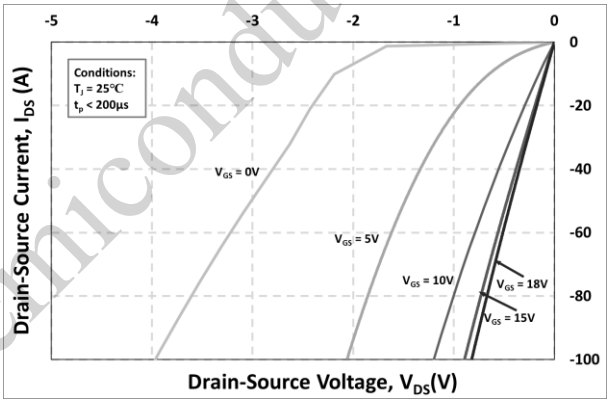


Figure 16. 3rd Quadrant Characteristic at 25°C

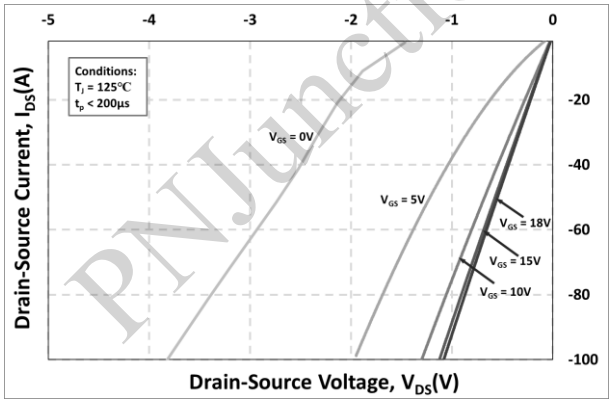


Figure 17. 3rd Quadrant Characteristic at 125°C

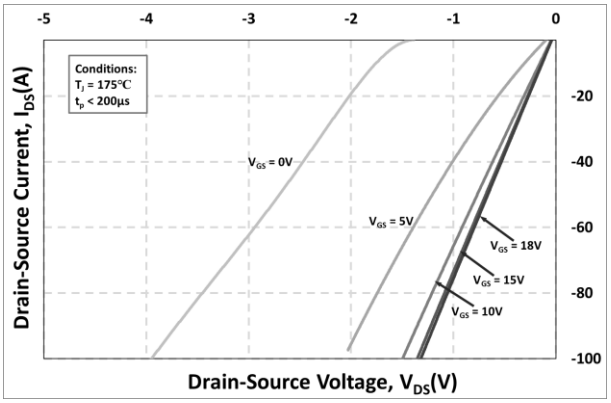


Figure 18. 3rd Quadrant Characteristic at 175°C

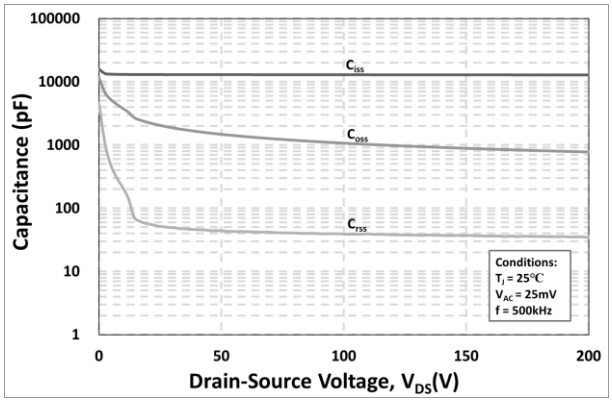


Figure 19. Capacitances vs. Drain-Source Voltage (0 - 200V)

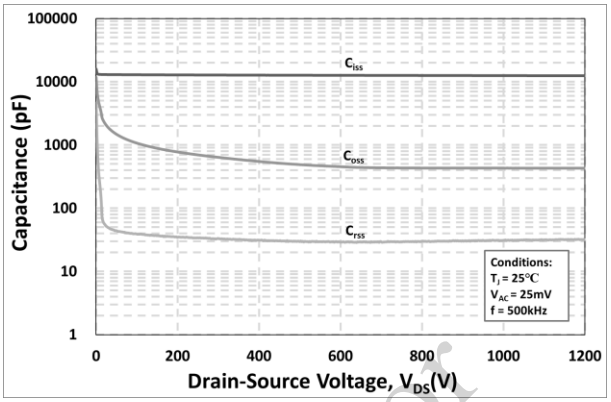


Figure 20. Capacitances vs. Drain-Source Voltage (0 - 1200V)

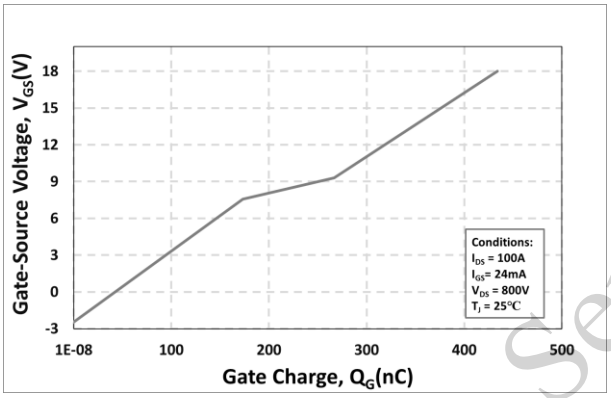


Figure 21. Gate Charge Characteristics

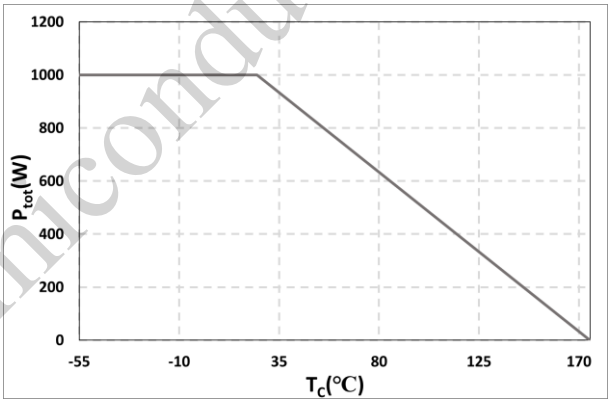


Figure 22. Maximum Power Dissipation Derating vs. Case Temperature

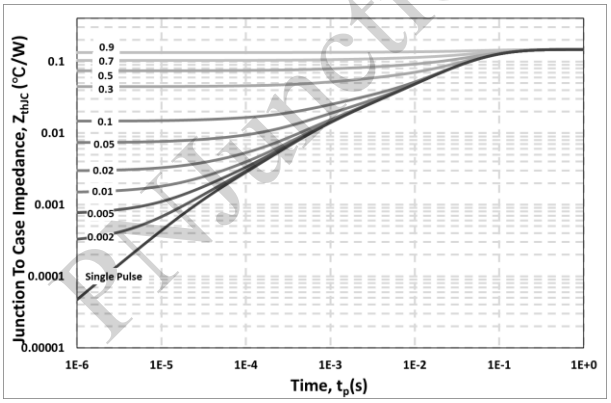


Figure 23. Transient Thermal Impedance (Junction - Case)

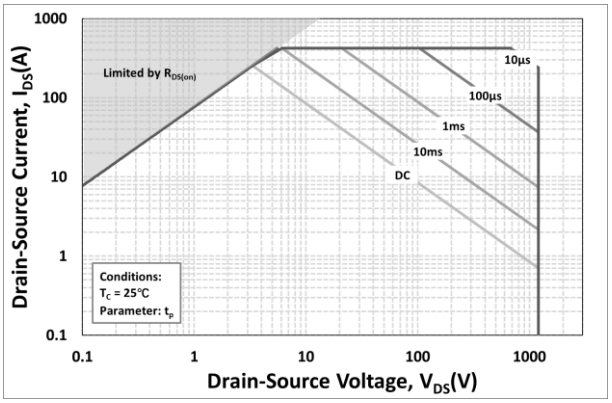


Figure 24. Forward Bias Safe Operating Area (FBSOA)

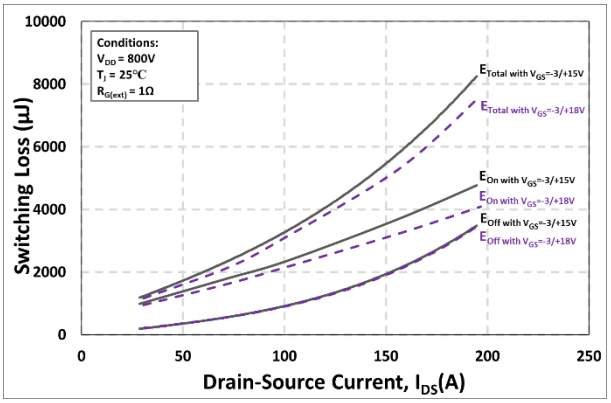


Figure 25. Switching Loss vs. Drain-Source Current (VDS = 800 V)

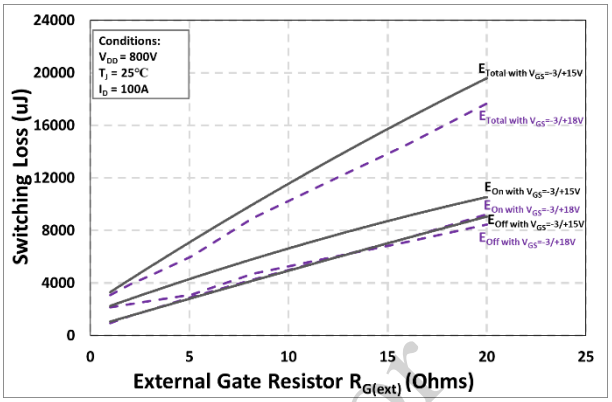


Figure 26. Switching Loss vs. External Gate Resistance

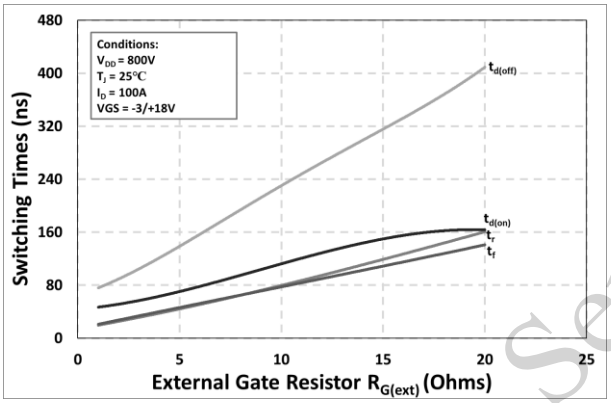


Figure 27. Switching Times vs. External Gate Resistance

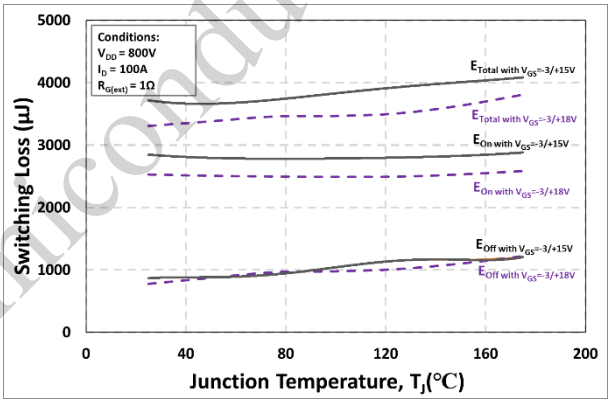
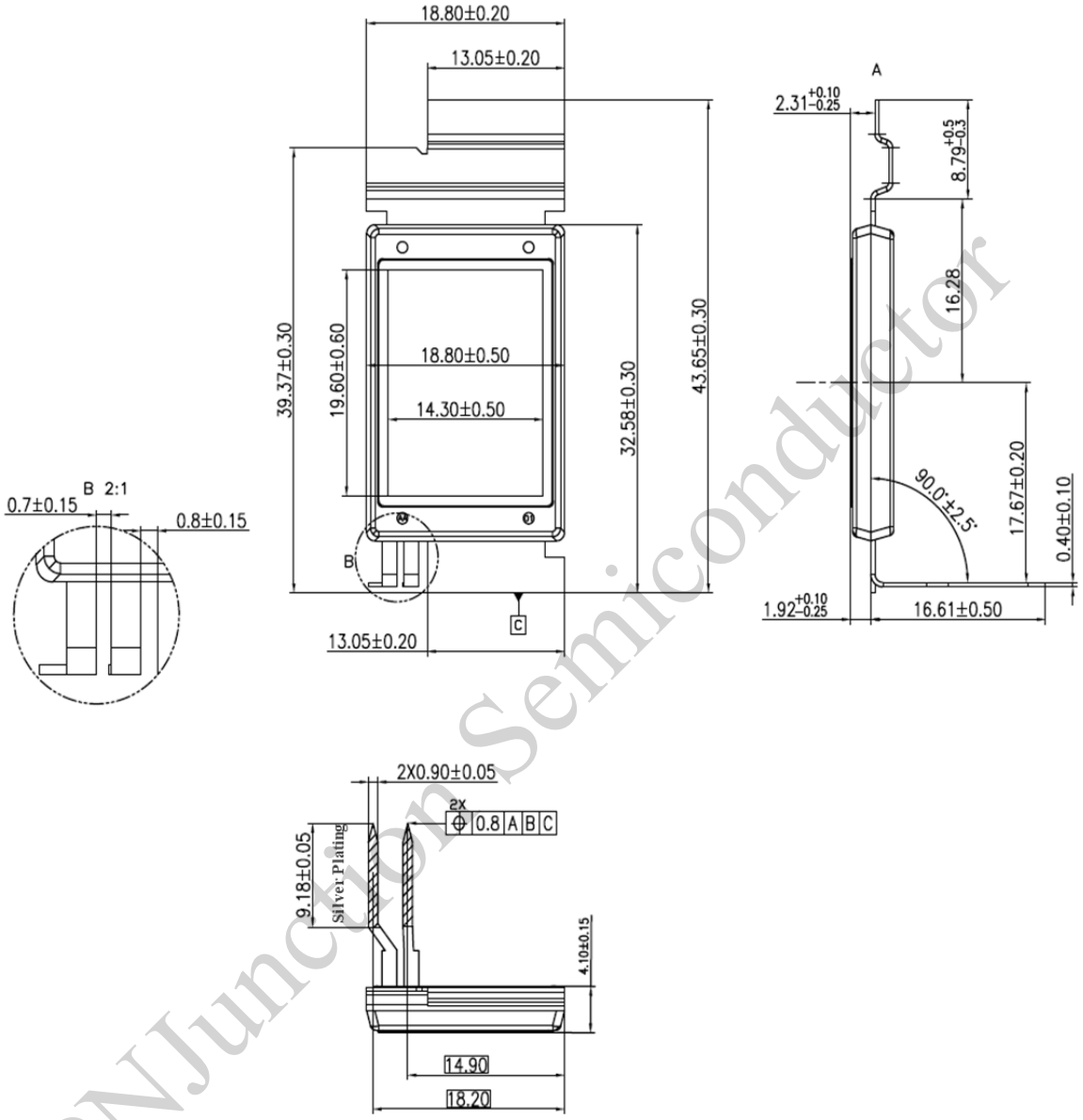


Figure 28. Clamped Inductive Switching Energy vs. Temperature

6. Package Outlines



Drawing and Dimensions

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