

SiC MOSFET P3M171K0G7

N-Channel Enhancement Mode



Features

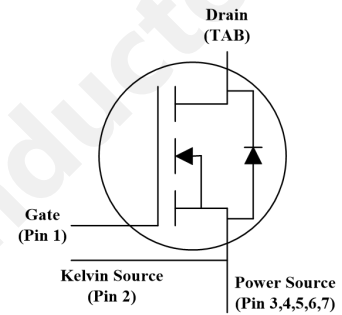
- Qualified to AEC-Q101
- High Blocking Voltage with Low On-Resistance
- High-Frequency Operation
- Ultra-Small Q_{gd}
- 100% UIS tested

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
P3M171K0G7	TO-263-7	P3M171K0G7

Contents

Features.....	1
Benefits.....	1
Applications.....	1
Order Information	1
Contents.....	2
1. Maximum Ratings.....	3
2. Electrical Characteristics	4
3. Reverse Diode Characteristics.....	6
4. Thermal Characteristics.....	6
5. Typical Performance	7
6. Definitions	12
7. Package Outlines.....	13

PN Junction Semiconductor

1. Maximum Ratings

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

Parameter	Symbol	Value	Unit	Test Conditions
Drain - Source Voltage	V_{DSmax}	1700	V	$V_{GS} = 0V$ $I_D = 200\mu A$
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	6.3	A	$V_{GS} = 15V$ $T_C = 25^\circ\text{C}$
		4.5		$V_{GS} = 15V$ $T_C = 100^\circ\text{C}$
		6.7		$V_{GS} = 18V$ $T_C = 25^\circ\text{C}$
		4.7		$V_{GS} = 18V$ $T_C = 100^\circ\text{C}$
Pulsed Drain Current	$I_{D(pulse)}$	12	A	$PW \leq 10\mu s$, Duty cycle $\leq 1\%$
Power Dissipation	P_D	68	W	
Operating Junction Temperature	T_J	-55 To +175	$^\circ\text{C}$	
Storage Temperature	T_{stg}	-55 To +150	$^\circ\text{C}$	
Solder Temperature	T_L	245	$^\circ\text{C}$	

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	$V_{(BR)DSS}$	1700	/	/	V	$V_{GS} = 0V$ $I_D = 200\mu A$
Gate Threshold Voltage	$V_{GS(th)}$	2.0	2.8	/	V	$V_{DS} = V_{GS}$ $I_D = 2mA$ $T_J = 25^\circ\text{C}$
		/	2.0	/	V	$V_{DS} = V_{GS}$ $I_D = 2mA$ $T_J = 175^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	/	2	200	μA	$V_{GS} = 0V$ $V_{DS} = 1700V$
Gate-Source Leakage Current	I_{GSS}	/	2	125	nA	$V_{GS} = -5 \text{ to } 18V$ $V_{DS} = 0V$
Drain-Source On-State Resistance	$R_{DS(on)}$	/	1	1.4	Ω	$V_{GS} = 15V$ $I_D = 2A$ $T_J = 25^\circ\text{C}$
		/	1.15	/		$V_{GS} = 15V$ $I_D = 2A$ $T_J = 175^\circ\text{C}$
		/	0.8	/		$V_{GS} = 18V$ $I_D = 2A$ $T_J = 25^\circ\text{C}$
		/	1.1	/		$V_{GS} = 18V$ $I_D = 2A$ $T_J = 175^\circ\text{C}$
Transconductance	g_{fs}	/	1.1	/	S	$V_{DS} = 20V$ $I_{DS} = 2A$ $T_J = 25^\circ\text{C}$
		/	1.2	/		$V_{DS} = 20V$ $I_{DS} = 2A$ $T_J = 175^\circ\text{C}$

Parameter	Symbol	Value			Unit	Test Conditions	
		Min.	Typ.	Max.			
Input Capacitance	C_{iss}	/	200	/	pF	$V_{GS} = 0V$ $V_{DS} = 1000V$ $f = 1MHz$ $V_{AC} = 25mV$	
Output Capacitance	C_{oss}	/	22	/	pF		
Reverse Transfer Capacitance	C_{rss}	/	8	/	pF		
Coss Stored Energy	E_{oss}	/	17	/	μJ		
Turn-on Energy	E_{on}	/	328.3	/	μJ	$V_{DS} = 1200V$ $V_{GS} = -3/15V$ $I_D = 2A$ $R_G = 20\Omega$	
Turn-off Energy	E_{off}	/	73.3	/			
Rise Time	T_r	/	36	/	ns		
Turn-On Delay Time	T_{don}	/	46	/			
Turn-Off Delay Time	T_{doff}	/	49	/			
Fall Time	T_f	/	43	/			
Turn-on Energy	E_{on}	/	282.3	/	μJ		$V_{DS} = 1200V$ $V_{GS} = -3/18V$ $I_D = 2A$ $R_G = 20\Omega$
Turn-off Energy	E_{off}	/	61.3	/			
Rise Time	T_r	/	27	/	ns		
Turn-On Delay Time	T_{don}	/	34	/			
Turn-Off Delay Time	T_{doff}	/	49	/			
Fall Time	T_f	/	43	/			
Internal Gate Resistance	$R_{G(int)}$	/	42	/	Ω	$f = 1MHz$ $V_{AC} = 25mV$	

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Gate to Source Charge	Q_{gs}	/	2.2	/	nC	$V_{DS} = 1200V$ $I_{DS} = 2A$ $V_{GS} = -3 \text{ to } 15V$ $I_G = 2mA$
Gate to Drain Charge	Q_{gd}	/	2.5	/		
Total Gate Charge	Q_g	/	7.4	/		

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}	5.4	/	V	$V_{GS} = -3V$ $I_{SD} = 1A$ $T_J = 25^\circ C$
		5.2	/	V	$V_{GS} = -3V$ $I_{SD} = 1A$ $T_J = 175^\circ C$
Continuous Diode Forward Current	I_S	/	5	A	$V_{GS} = -3V$

4. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	2.2	$^\circ C/W$

5. Typical Performance

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

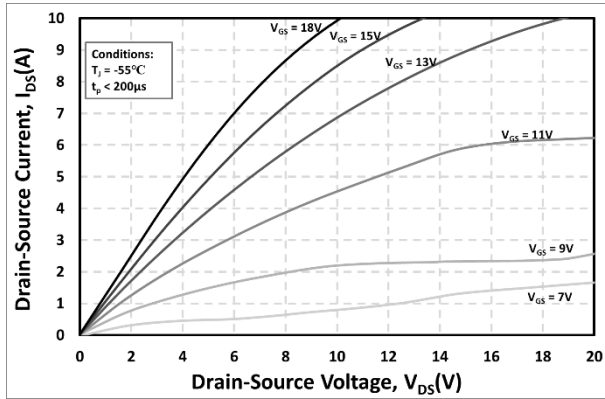


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

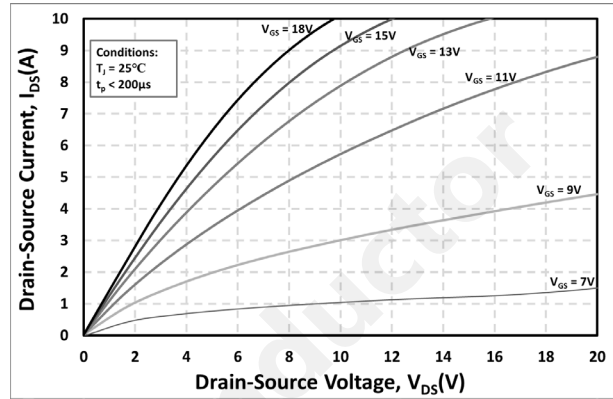


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

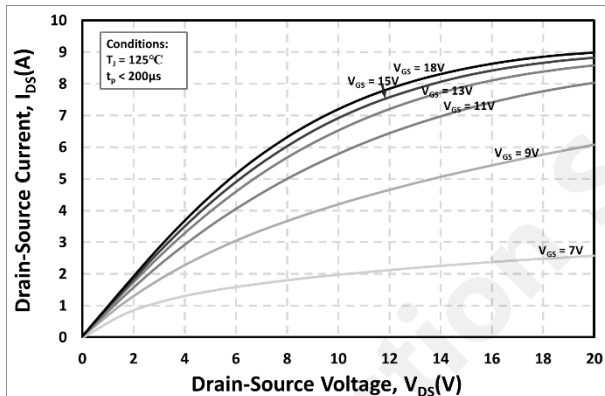


Figure 3. Output Characteristics $T_J = 125^\circ\text{C}$

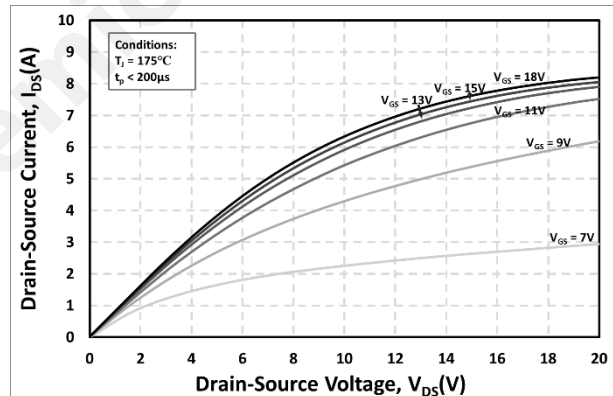


Figure 4. Output Characteristics $T_J = 175^\circ\text{C}$

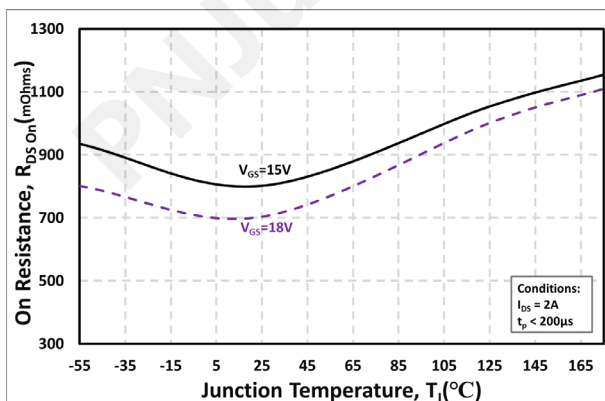


Figure 5. Normalized On-Resistance vs. Temperature

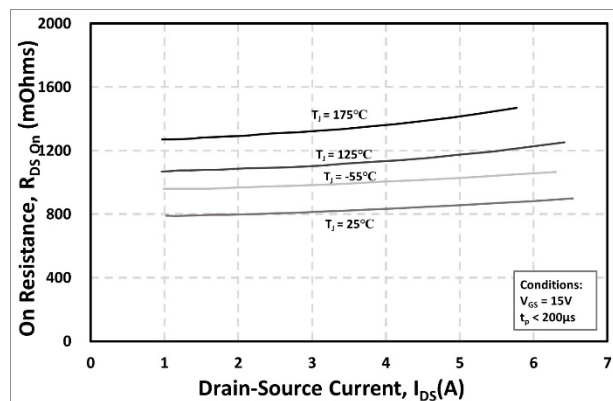


Figure 6. On-Resistance vs. Drain Current Various Temperatures

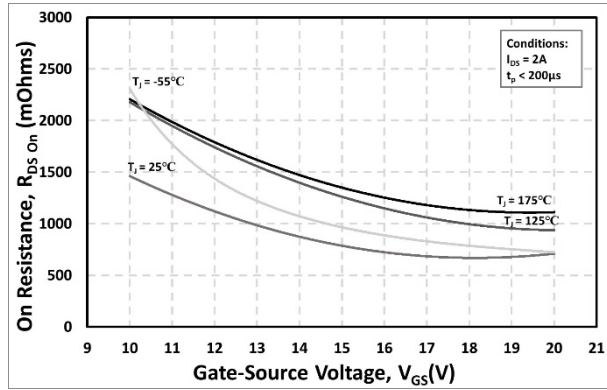


Figure 7. On-Resistance vs. Gate-Source Voltage

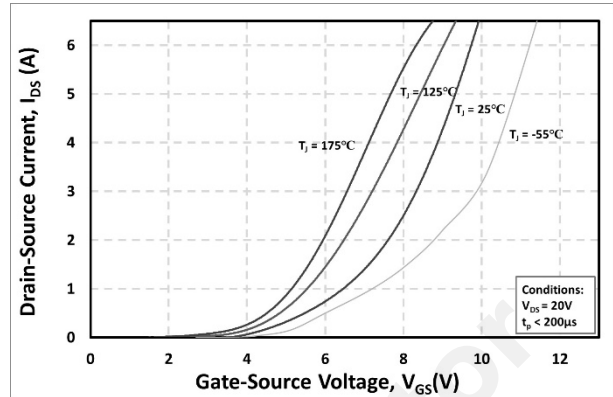


Figure 8. Transfer Characteristic for Various Junction Temperatures

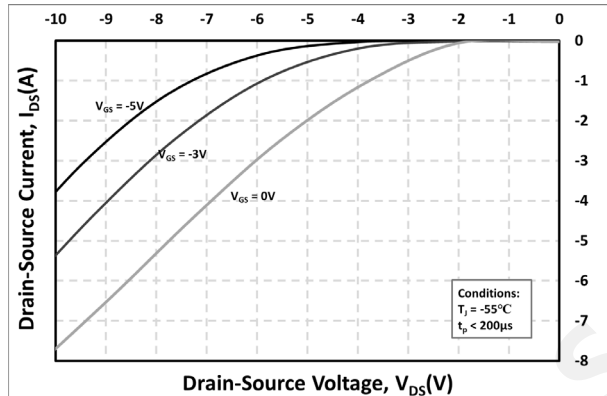


Figure 9. Body Diode Characteristic at -55°C

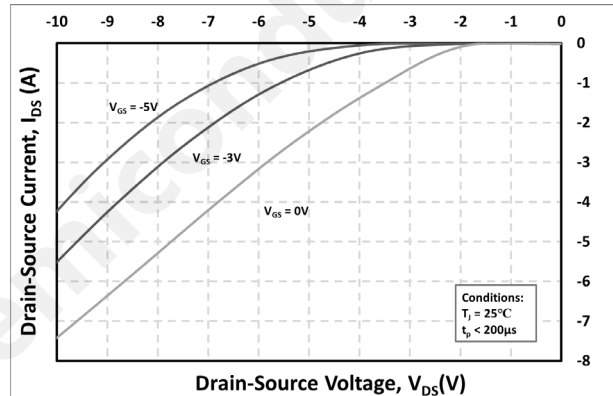


Figure 10. Body Diode Characteristic at 25°C

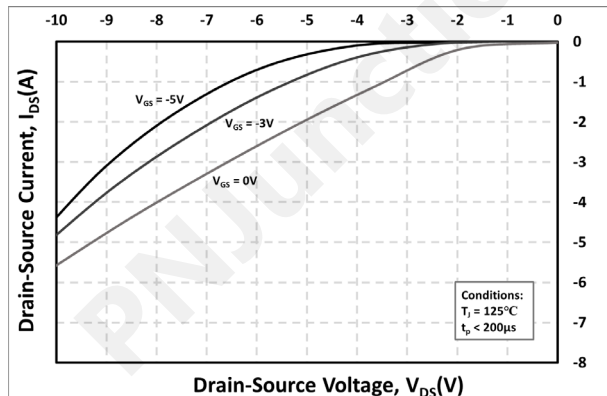


Figure 11. Body Diode Characteristic at 125°C

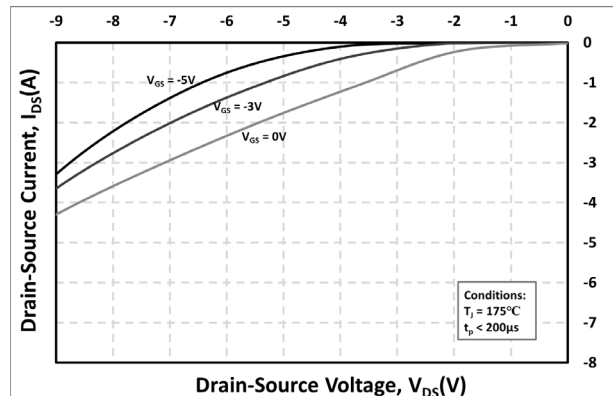


Figure 12. Body Diode Characteristic at 175°C

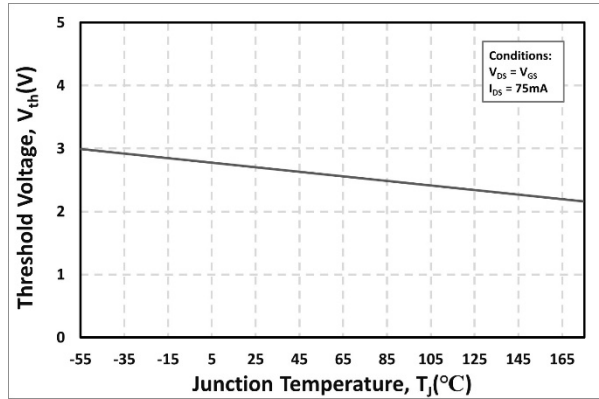


Figure 13. Threshold Voltage vs. Temperatures

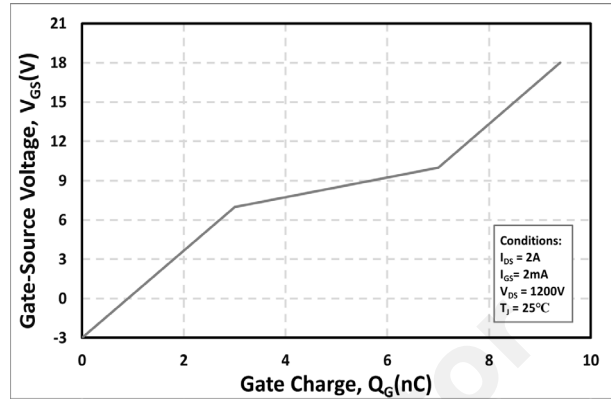


Figure 14. Gate Charge Characteristics

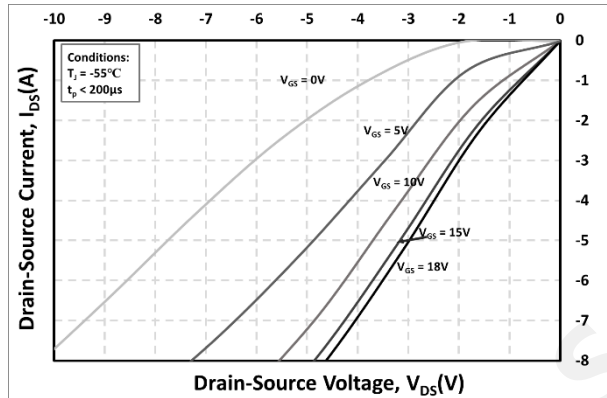


Figure 15. 3rd Quadrant Characteristic at -55°C

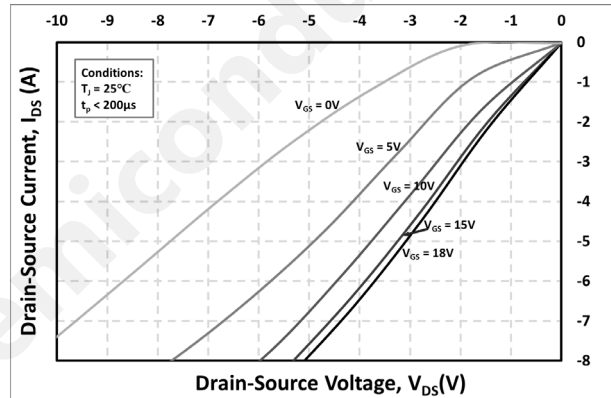


Figure 16. 3rd Quadrant Characteristic at 25°C

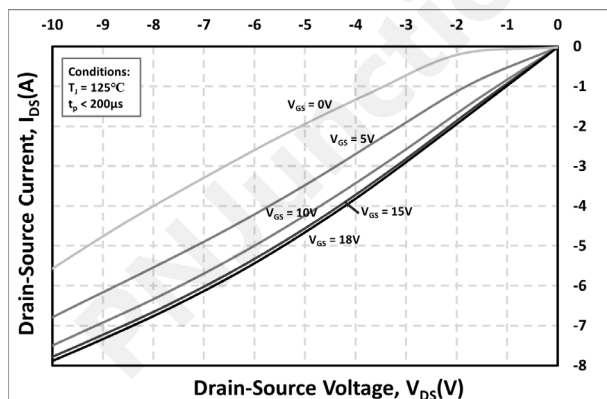


Figure 17. 3rd Quadrant Characteristic at 125 °C

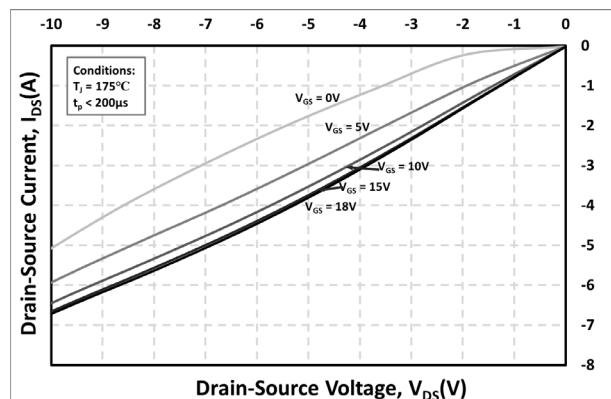


Figure 18. 3rd Quadrant Characteristic at 175 °C

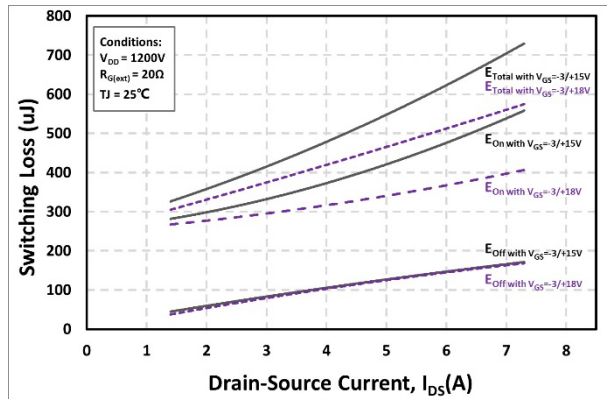


Figure 19. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 1200V$)

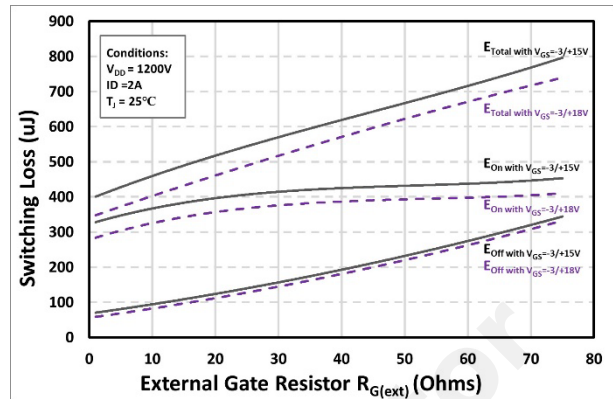


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

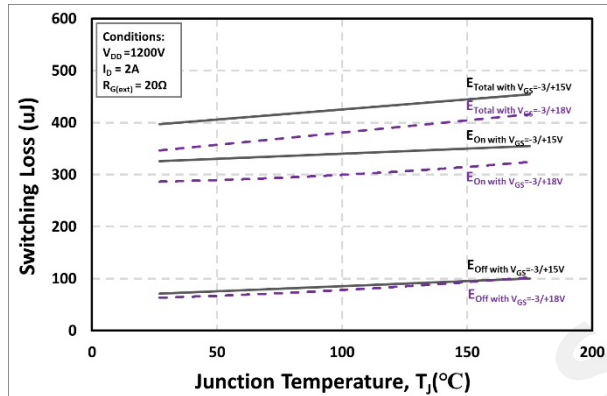


Figure 21. Clamped Inductive Switching Energy vs. Temperature

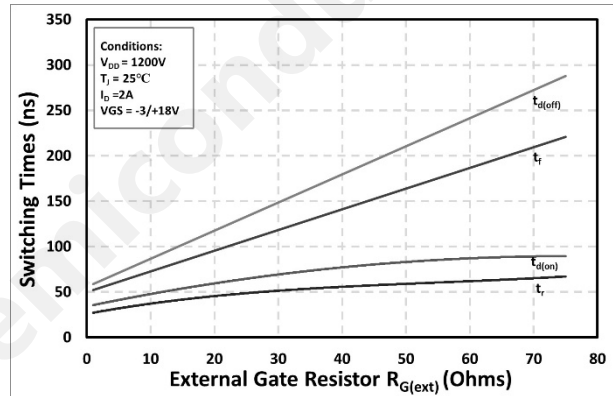


Figure 22. Switching Times vs. $R_{G(ext)}$

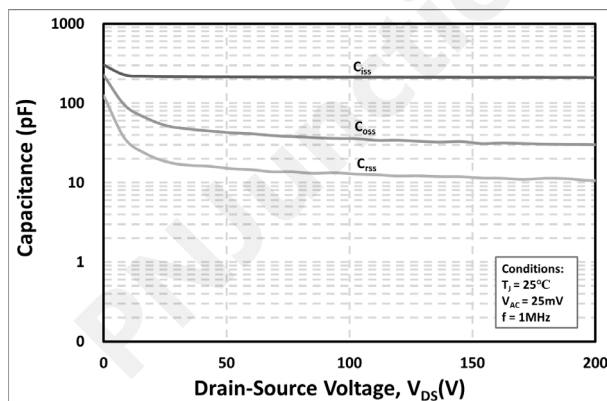


Figure 23. Capacitances vs. Drain-Source Voltage (0-200V)

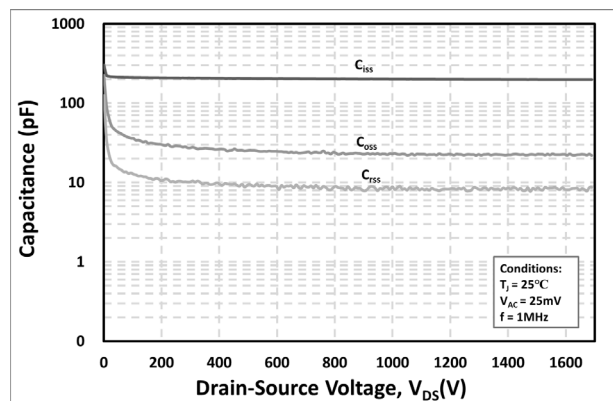


Figure 24. Capacitances vs. Drain-Source Voltage (0-1700V)

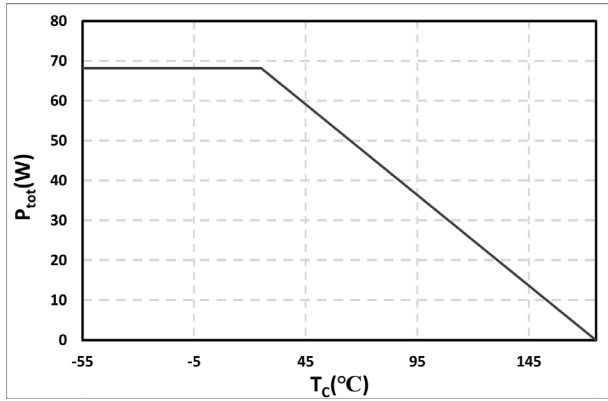


Figure 25. Maximum Power Dissipation Derating vs. Case Temperature

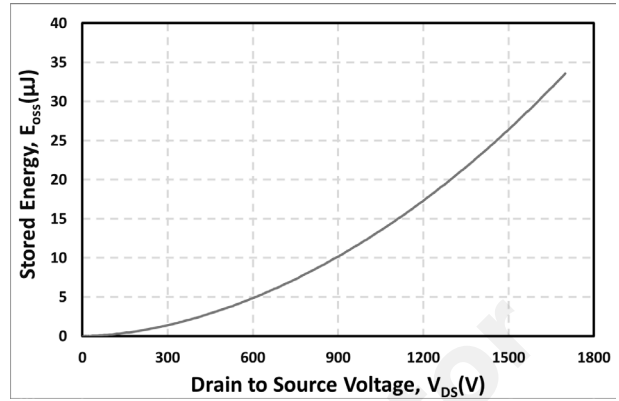


Figure 26. Output Capacitor Stored Energy

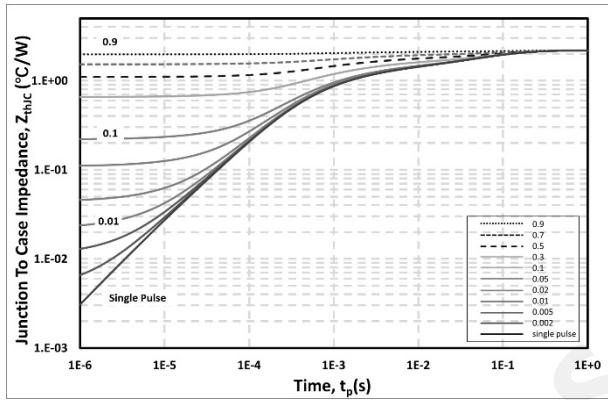


Figure 27. Transient Thermal Impedance (Junction - Case)

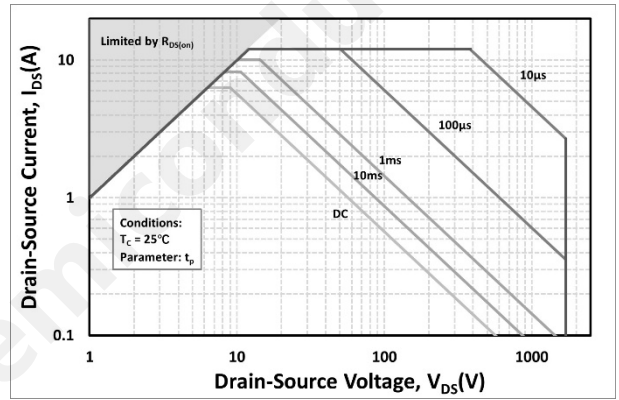


Figure 28. Safe Operating Area

6. Definitions

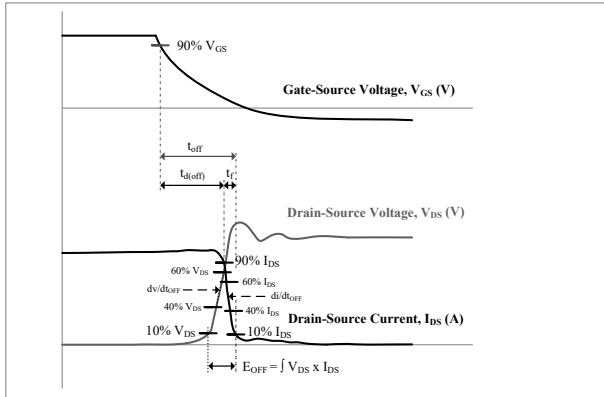


Figure 29. Turn-off Transient Definitions

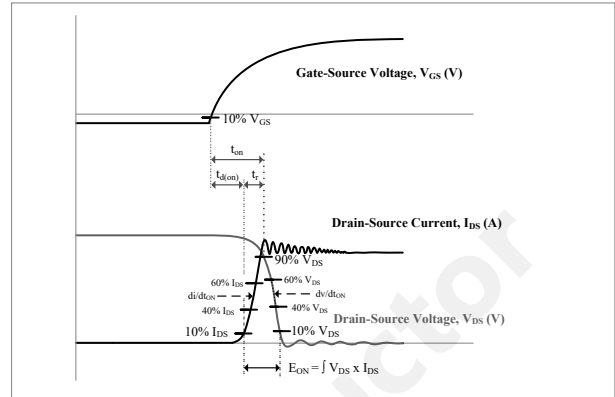


Figure 30. Turn-on Transient Definitions

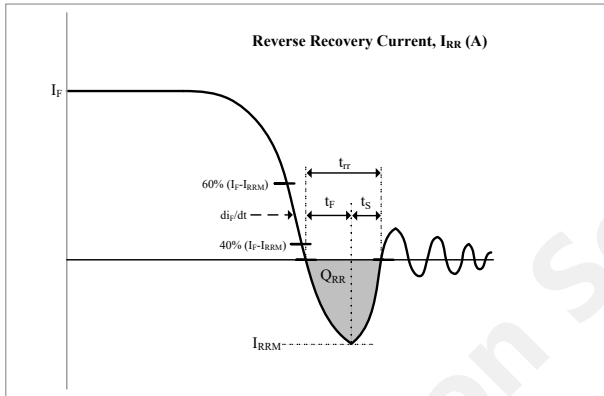


Figure 31. Reverse Recovery Definitions

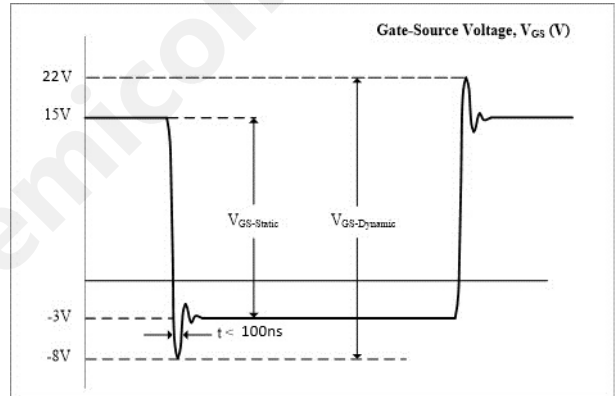
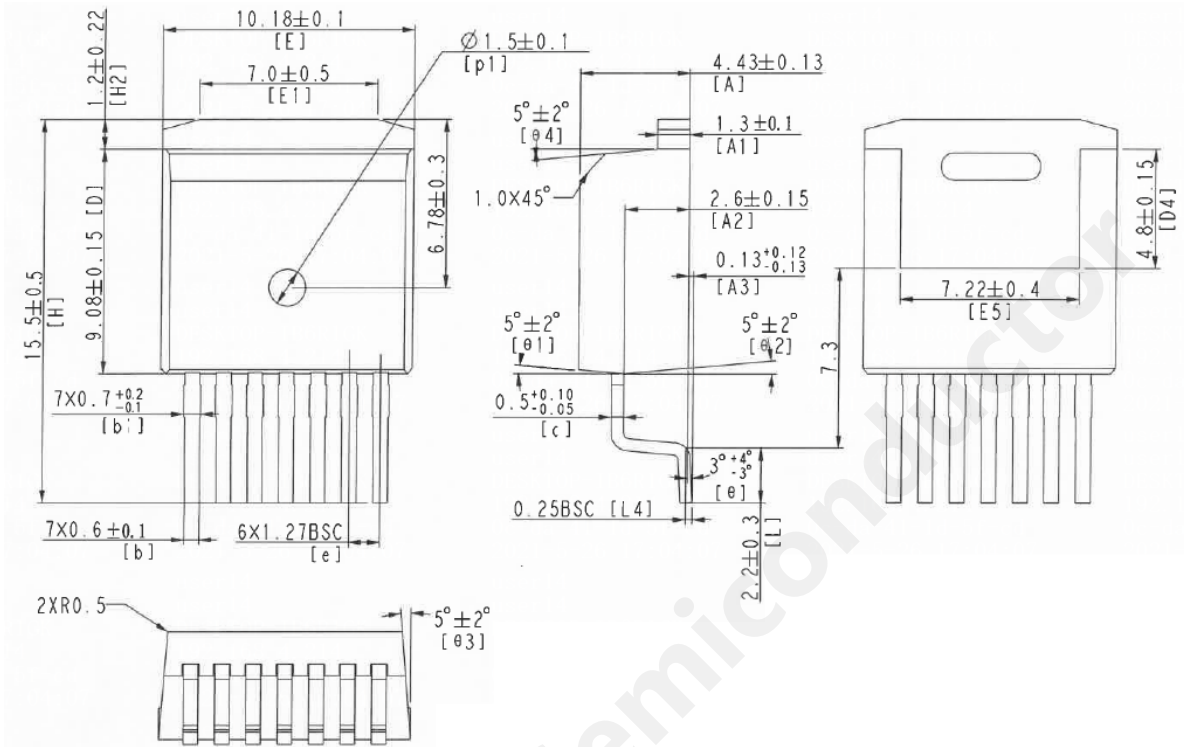


Figure 32. V_{GS} Transient Definitions

7. Package Outlines



Drawing and Dimensions

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