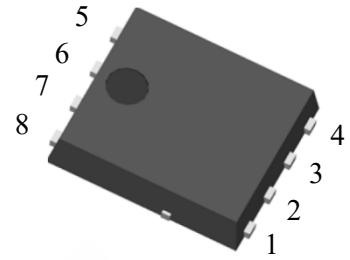




# P3M06300D5 SiC MOS N-Channel Enhancement Mode

$V_{RRM}$  = 650 V  
 $I_D$  = 9 A  
 $I_D(100^\circ\text{C})$  = 7 A  
 $R_{DS(on)}$  = 300 m $\Omega$

## SiC MOS P3M06300D5 N-Channel Enhancement Mode



### Features

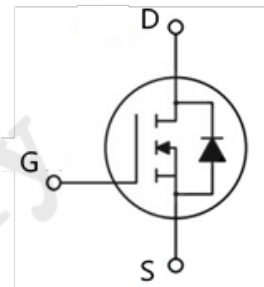
- High Blocking Voltage with Low On-Resistance
- High-Frequency Operation
- Ultra-Small  $Q_{gd}$
- 100% UIS tested

### Benefits

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

### Applications

- Solar Inverters
- Active Clamp Flyback, LLC resonant, Class D
- Mobile fast-chargers, adapters
- Notebook adaptors
- High Voltage DC/DC Converters
- Switch Mode Power Supplies



DFN5\*6

Drain	5~8
Source	1~3
Gate	4



### Order Information

Part Number	Package	Marking
P3M06300D5	DFN5*6	P3M06300D5



## Contents

Features.....	1
Benefits.....	1
Applications.....	1
Order Information .....	1
<b>Contents.....</b>	<b>2</b>
1. Maximum Ratings.....	3
2. Electrical Characteristics .....	4
3. Reverse Diode Characteristics.....	5
4. Thermal Characteristics.....	6
5. Typical Performance .....	6
6. Definitions .....	11
7. Package Outlines.....	12

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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	$V_{GS} = -3\text{V}$ $I_D = 100\mu\text{A}$
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	$I_D$	9	A	$V_{GS} = 15\text{V}$ $T_C = 25^\circ\text{C}$
		7		$V_{GS} = 15\text{V}$ $T_C = 100^\circ\text{C}$
Power Dissipation	$P_D$	26	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	$^\circ\text{C}$	



## 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	$V_{GS} = -3\text{V}$ $I_D = 100\mu\text{A}$
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.2	/	V	$V_{DS} = V_{GS}$ $I_D = 5\text{mA}$ $T_J = 25^\circ\text{C}$
		/	1.45	/	V	$V_{DS} = V_{GS}$ $I_D = 5\text{mA}$ $T_J = 175^\circ\text{C}$
Reverse Bias Drain Current	$I_{DSS}$	/	0.5	10	$\mu\text{A}$	$V_{GS} = -3\text{V}$ $V_{DS} = 650\text{V}$
Gate-Source Leakage Current	$I_{GSS}$	/	2	125	nA	$V_{GS} = 15\text{V}$ $V_{DS} = 0\text{V}$
Drain-Source On-State Resistance	$R_{DS(on)}$	/	300	500	m $\Omega$	$V_{GS} = 15\text{V}$ $I_D = 4.5\text{A}$
Trans conductance	$g_{fs}$	/	2.7	/	S	$V_{DS} = 20\text{V}$ $I_{DS} = 4.5\text{A}$ $T_J = 25^\circ\text{C}$
		/	2.3	/		$V_{DS} = 20\text{V}$ $I_{DS} = 4.5\text{A}$ $T_J = 175^\circ\text{C}$
Input Capacitance	$C_{iss}$	/	338	/	pF	$V_{GS} = 0\text{V}$ $V_{DS} = 400\text{V}$ $f = 1\text{MHz}$ $V_{AC} = 25\text{mV}$
Output Capacitance	$C_{oss}$	/	39.4	/		
Reverse Transfer Capacitance	$C_{rss}$	/	3.35	/		
Coss Stored Energy	$E_{oss}$	/	5.6	/		



# P3M06300D5 SiC MOS N-Channel Enhancement Mode

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Turn-on Energy	$E_{on}$	/	30.7	/	$\mu$ J	$V_{DS} = 400V$ $V_{GS} = -3/15V$ $I_D = 5A$ $R_G = 1\Omega$
Turn-off Energy	$E_{off}$	/	5.6	/		
Turn-On Delay Time	$T_{d(on)}$	/	10.2	/	nS	$V_{DS} = 400V$ $V_{GS} = -3/15V$ $I_D = 5A$ $R_G = 1\Omega$
Rise Time	$T_r$	/	11.4	/		
Turn-Off Delay Time	$T_{d(off)}$	/	14.1	/		
Fall Time	$T_f$	/	32.3	/		
Internal Gate Resistance	$R_{G(int)}$	/	23.2	/	$\Omega$	$f = 1MHz$ $V_{AC} = 25mV$
Gate to Source Charge	$Q_{gs}$	/	2.45	/	nC	$V_{DS} = 400V$ $I_{DS} = 4.5A$ $V_{GS} = -3 \text{ to } 15V$ $I_G = 4mA$
Gate to Drain Charge	$Q_{gd}$	/	2.75	/		
Total Gate Charge	$Q_g$	/	9.04	/		

## 3. Reverse Diode Characteristics

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

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Diode Forward Voltage	$V_{SD}$	4.5	/	V	$V_{GS} = -3V$ $I_{SD} = 2.75A$ $T_J = 25^\circ C$
		4	/	V	$V_{GS} = -3V$ $I_{SD} = 2.75A$ $T_J = 175^\circ C$

Continuous Diode Forward Current	$I_S$	5.3	/	A	$V_{GS} = -3V$
Reverse Recover Time	$t_{rr}$	14.6	/	ns	$V_{GS} = -3V$ $I_{SD} = 5A$ $V_R = 400V$ $d_{if}/d_t = 1500A/\mu s$ $T_J = 25^\circ C$
Reverse Recovery Charge	$Q_{rr}$	192.4	/	nC	
Peak Reverse Recovery Current	$I_{rrm}$	21.2	/	A	

#### 4. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	5.86	$^\circ C/W$

#### 5. Typical Performance

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

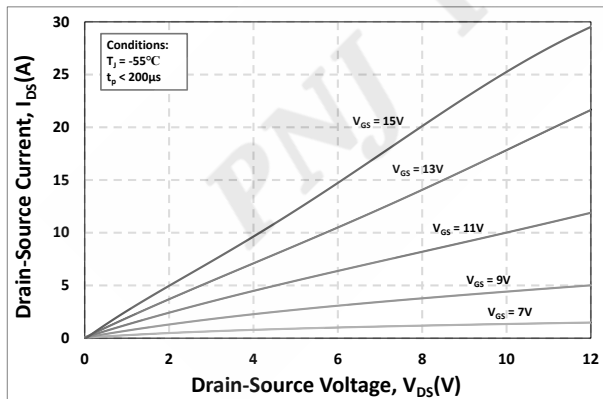


Figure 1. Output Characteristics  $T_J = -55^\circ C$

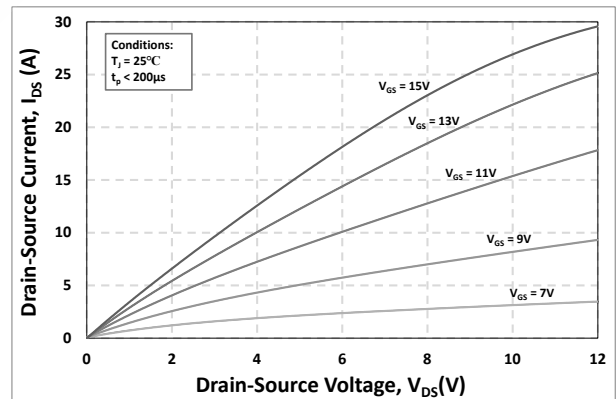


Figure 2. Output Characteristics  $T_J = 25^\circ C$

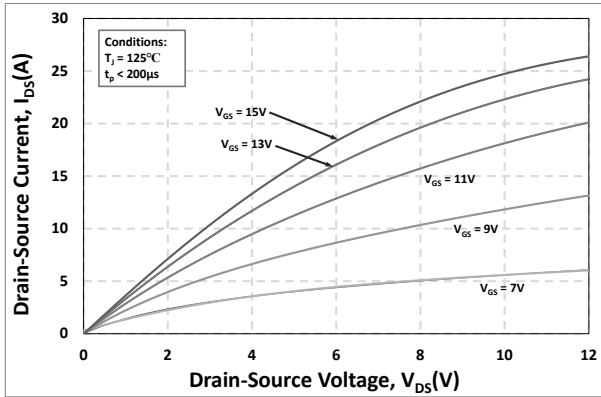


Figure 3. Output Characteristics  $T_J = 125^\circ\text{C}$

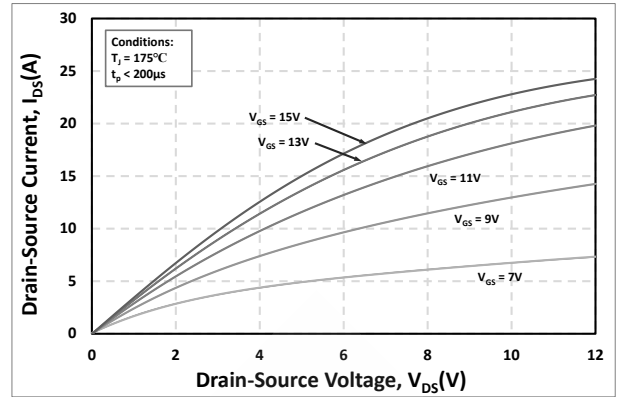


Figure 4. Output Characteristics  $T_J = 175^\circ\text{C}$

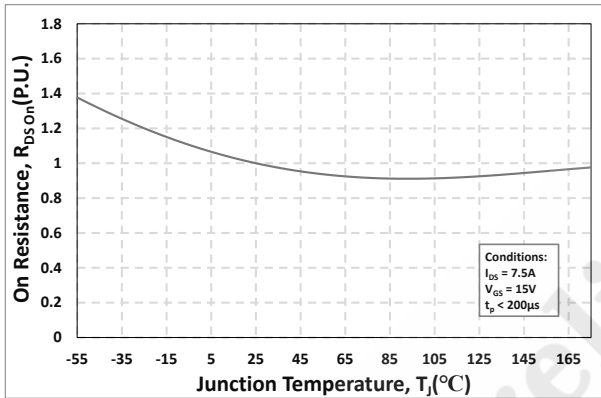


Figure 5. Normalized On-Resistance vs. Temperature

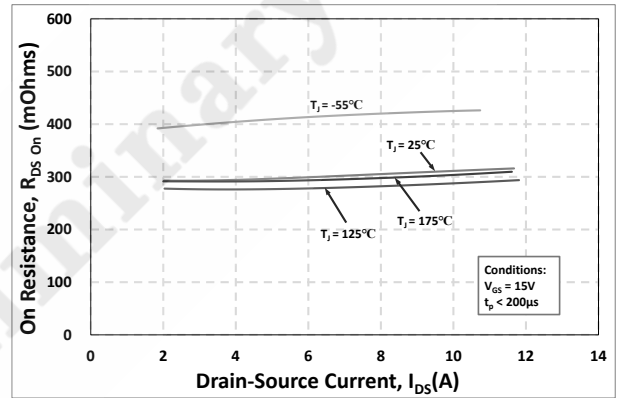


Figure 6. On-Resistance vs. Drain Current Various Temperatures

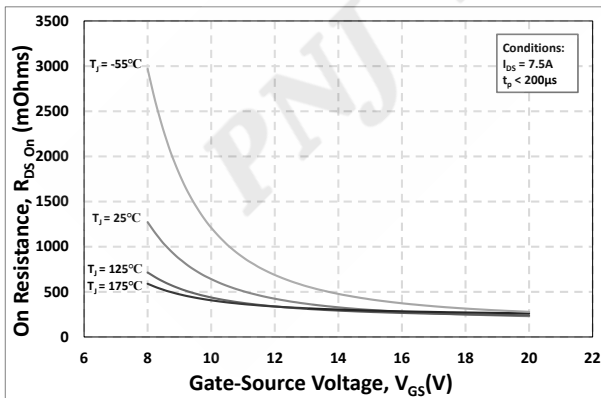


Figure 7. On-Resistance vs. Gate-Source Voltage

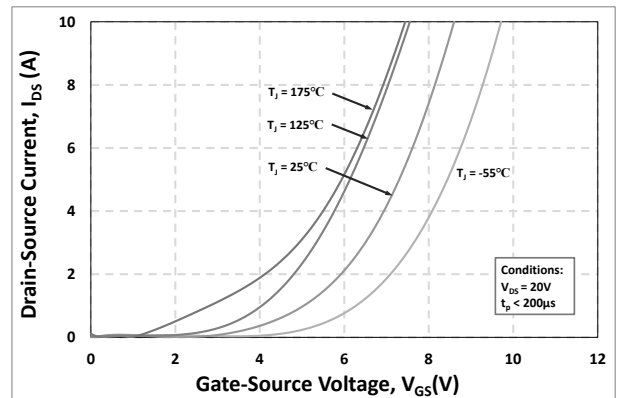


Figure 8. Transfer Characteristic for Various Junction Temperatures

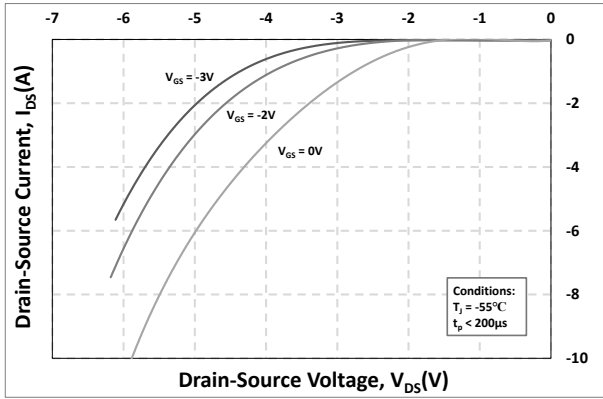


Figure 9. Body Diode Characteristic at -55°C

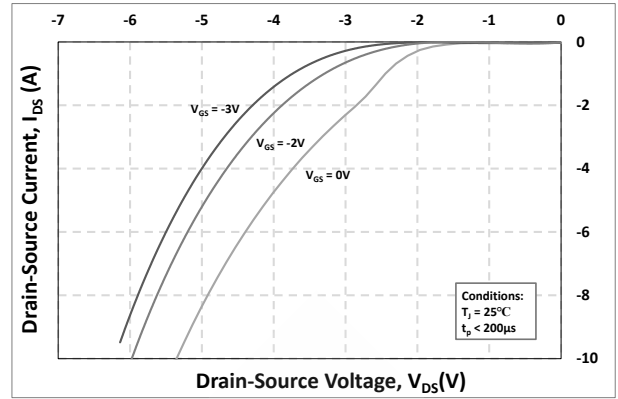


Figure 10. Body Diode Characteristic at 25°C

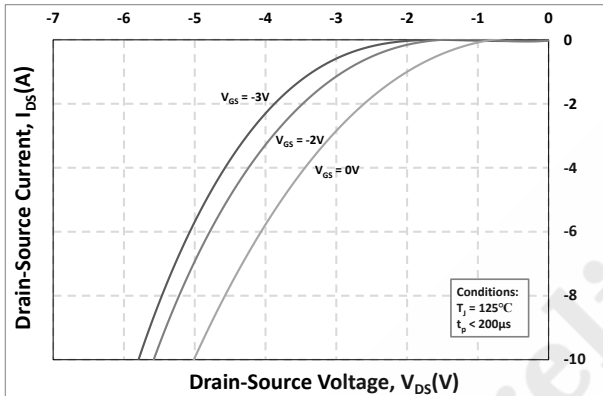


Figure 11. Body Diode Characteristic at 125°C

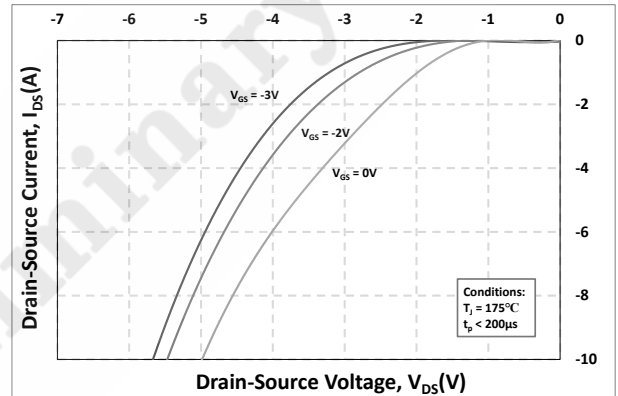


Figure 12. Body Diode Characteristic at 175°C

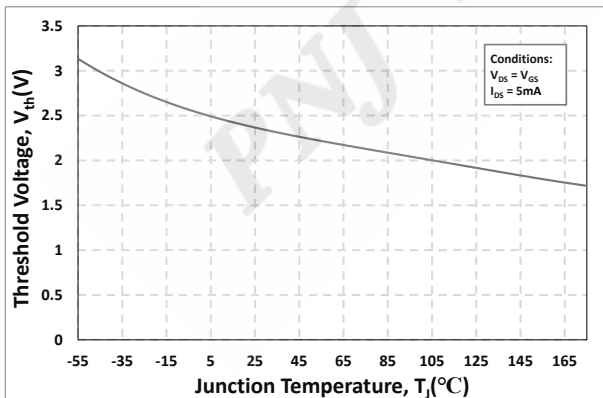


Figure 13. Threshold Voltage vs. Temperature

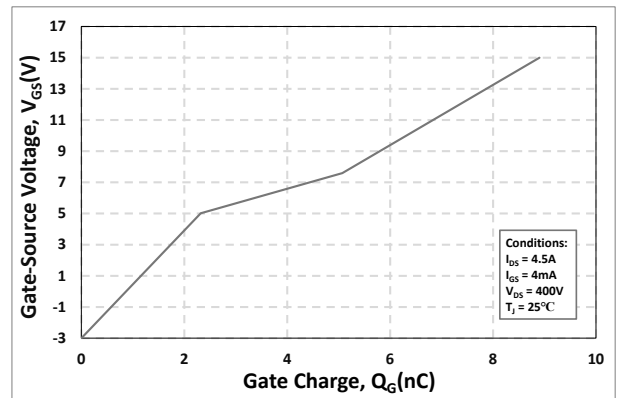


Figure 14. Gate Charge Characteristics



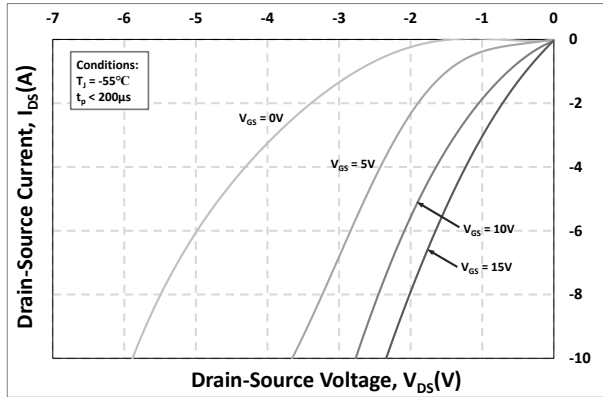


Figure 15. 3rd Quadrant Characteristic at -55°C

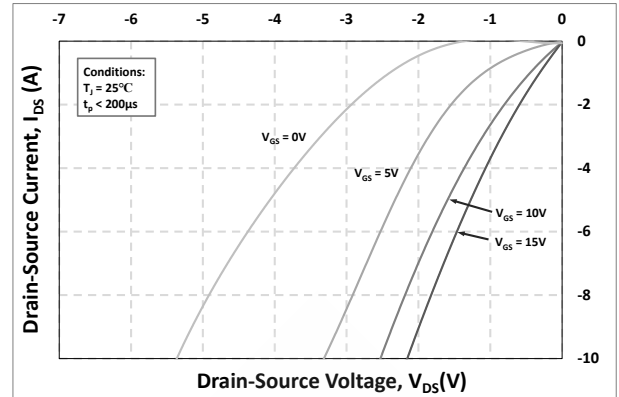


Figure 16. 3rd Quadrant Characteristic at 25°C

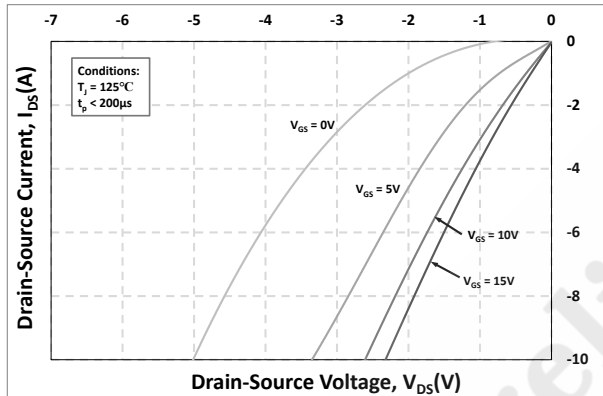


Figure 17. 3rd Quadrant Characteristic at 125°C

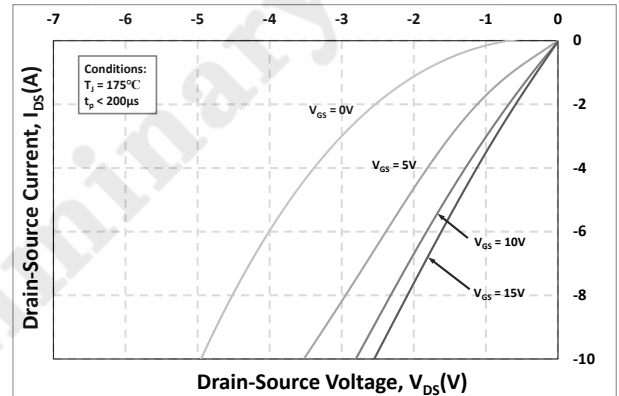


Figure 18. 3rd Quadrant Characteristic at 175°C

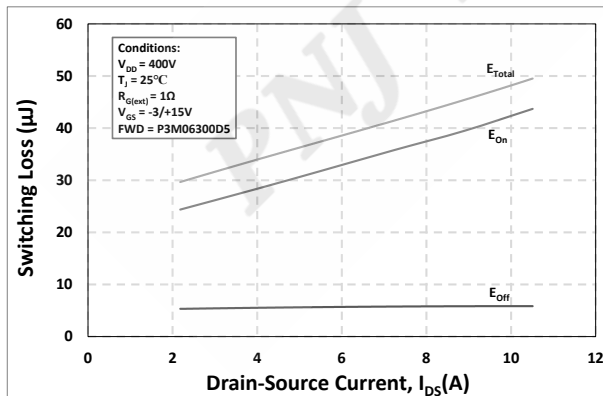


Figure 19. Clamped Inductive Switching Energy vs. Drain Current (VDD= 400V)

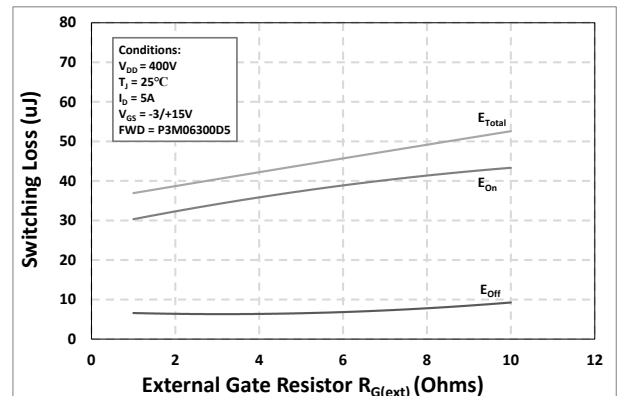


Figure 20. Clamped Inductive Switching Energy vs. Temperature

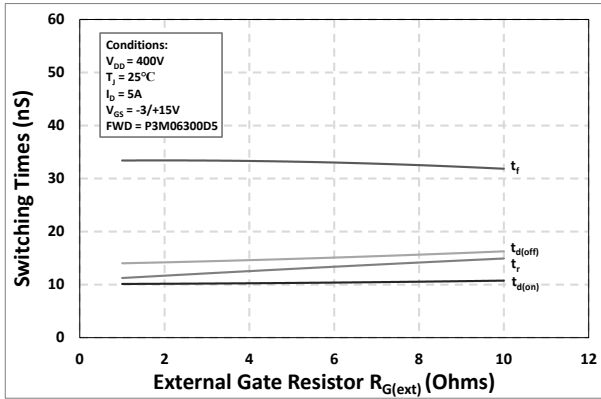


Figure 21. Switching Times vs.  $R_{G(ext)}$

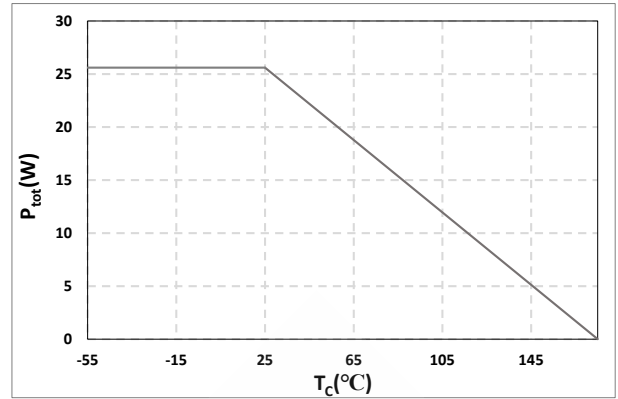


Figure 22. Maximum Power Dissipation Derating vs. Case Temperature

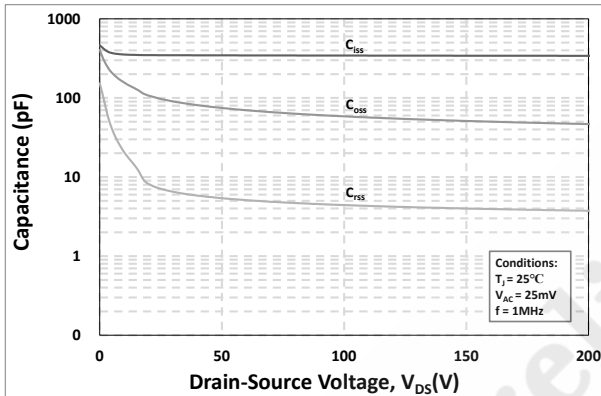


Figure 23. Capacitances vs. Drain-Source Voltage (0 - 200V)

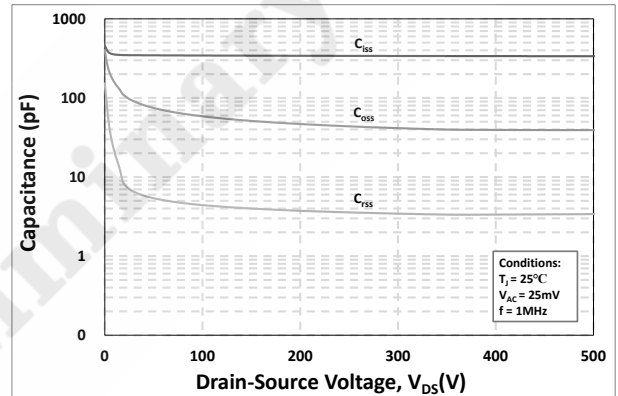


Figure 24. Capacitances vs. Drain-Source Voltage (0 - 500V)

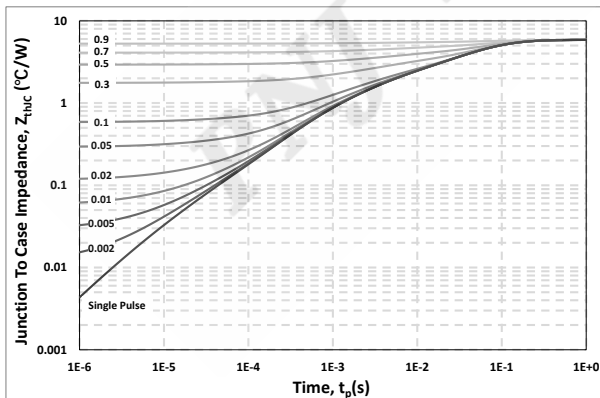


Figure 25. Transient Thermal Impedance (Junction - Case)

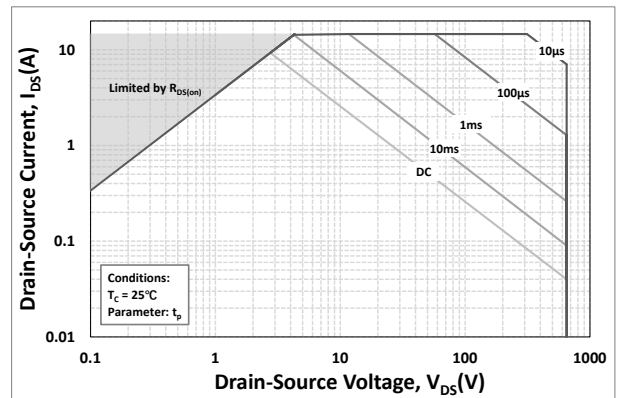


Figure 26. Safe Operating Area

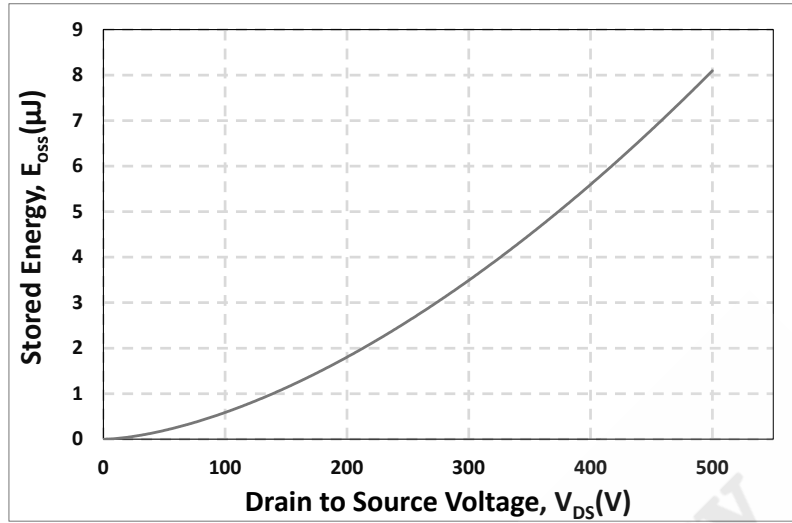


Figure 27. Output Capacitor Stored Energy

## 6. Definitions

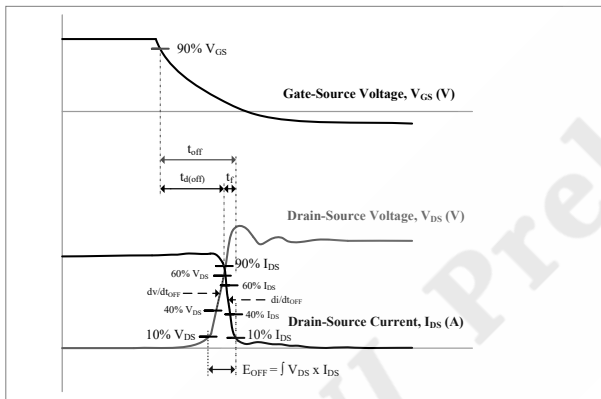


Figure 28. Turn-off Transient Definitions

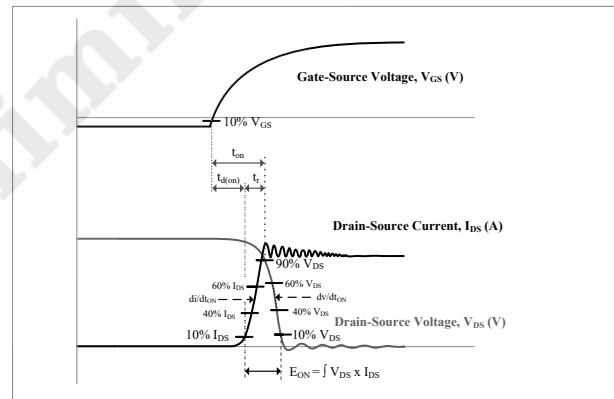


Figure 29. Turn-on Transient Definitions

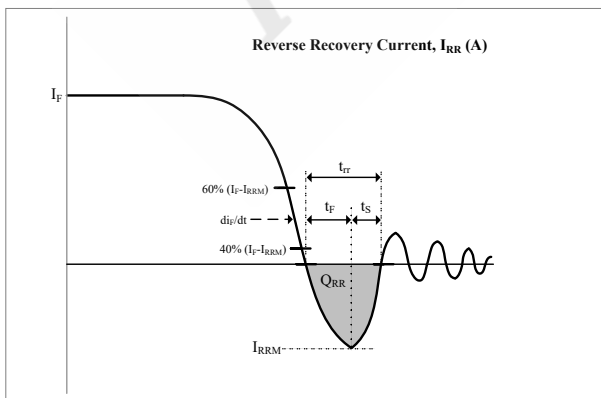


Figure 30. Reverse Recovery Definitions

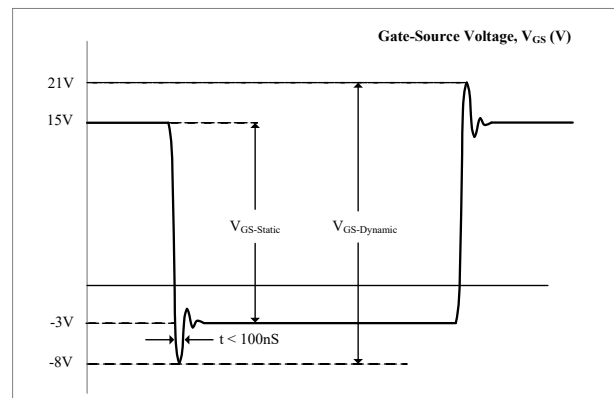
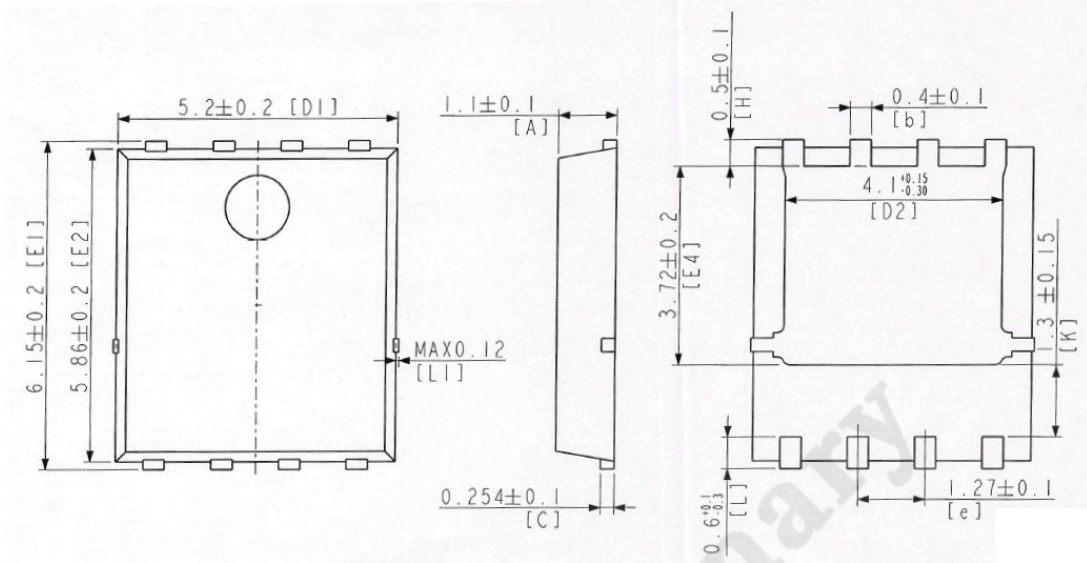


Figure 31. V<sub>GS</sub> Transient Definitions

## 7. Package Outlines



Drawing and Dimensions

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