




# Power MOSFETS

## DATASHEET

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**LM60400PAI8A**

P-Channel  
Enhancement Mode MOSFET

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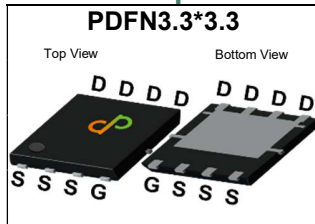


Quality Management Systems

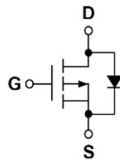
ISO 9001:2015 Certificate

## P-Channel Enhancement Mode MOSFET

### Pin Description



### Symbol



### Product Summary

Symbol	P-Channel	Unit
$V_{DSS}$	-60	V
$R_{DS(ON)-Max}$	40	m $\Omega$
$I_D$	-24	A

### Feature

- Reliable and Rugged
- ROHS Compliant & Halogen-Free
- 100% UIS and Rg Tested

### Applications

- Power Management in DC/DC Converters
- Load Switch

### Ordering Information

Orderable Part Number	Package Type	Form	Shipping	Marking
LM60400PAI8A	PDFN3.3*3.3	Tape & Reel	5000 / Tape & Reel	60400 □□□□□□

Note : □□□□□□ = Lot Code

### Absolute Maximum Ratings (T<sub>J</sub>=25°C Unless Otherwise Noted)

Symbol	Parameter	P-Channel	Unit
$V_{DSS}$	Drain-Source Voltage	-60	V
$V_{GSS}$	Gate-Source Voltage	±20	V
$T_J$	Maximum Junction Temperature	150	°C
$T_{STG}$	Storage Temperature Range	-55 to 150	°C
$I_S$	Diode Continuous Forward Current	T <sub>C</sub> =25°C -38	A
$I_{DM}^{①}$	Pulse Drain Current Tested	T <sub>C</sub> =25°C -59	A
$I_D$	Continuous Drain Current	T <sub>C</sub> =25°C -24	A
		T <sub>C</sub> =100°C -15	
$P_D$	Maximum Power Dissipation	T <sub>C</sub> =25°C 42	W
		T <sub>C</sub> =100°C 17	
$I_D$	Continuous Drain Current	T <sub>A</sub> =25°C -4.7	A
		T <sub>A</sub> =70°C -3.7	
$P_D$	Maximum Power Dissipation	T <sub>A</sub> =25°C 1.6	W
		T <sub>A</sub> =70°C 1	
$I_{AS}^{②}$	Avalanche Current, Single pulse	L=0.1mH -25	A
		L=0.5mH -14	
$E_{AS}^{③}$	Avalanche Energy, Single pulse	L=0.1mH 31	mJ
		L=0.5mH 49	

### Thermal Characteristics

Symbol	Parameter	Rating	Unit
$R_{\theta JC}$	Thermal Resistance-Junction to Case	Steady State	3 °C/W
$R_{\theta JA}^{③}$	Thermal Resistance-Junction to Ambient	Steady State	80 °C/W

Note ① : Max. current is limited by junction temperature

Note ② : UIS tested and pulse width are limited by maximum junction temperature 150°C

Note ③ : Surface Mounted on 1in<sup>2</sup> FR-4 board with 1oz

## P-Channel Electrical Characteristics (T<sub>J</sub>=25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static Electrical Characteristics</b>						
<b>BV<sub>DSS</sub></b>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>DS</sub> =-250uA	-60	-	-	V
<b>I<sub>DSS</sub></b>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =-48V, V <sub>GS</sub> =0V	-	-	-1	uA
<b>V<sub>GS(th)</sub></b>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250uA	-1.1	-1.8	-2.5	V
<b>I<sub>GSS</sub></b>	Gate Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
<b>R<sub>DS(ON)</sub></b> <sup>④</sup>	Drain-Source On-state Resistance	V <sub>GS</sub> =-10V, I <sub>DS</sub> =-8A	-	34	40	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>DS</sub> =-5A	-	38	50	
<b>gfs</b>	Forward Transconductance	V <sub>DS</sub> =-10V, I <sub>DS</sub> =-4A	-	12	-	S
<b>Dynamic Characteristics</b> <sup>⑤</sup>						
<b>R<sub>G</sub></b>	Gate Resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, Freq.=1MHz	-	3.35	-	Ω
<b>C<sub>iss</sub></b>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =-30V, Freq.=1MHz	-	2460	-	pF
<b>C<sub>oss</sub></b>	Output Capacitance					
<b>C<sub>rss</sub></b>	Reverse Transfer Capacitance					
<b>td(ON)</b>	Turn-on Delay Time	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-30V, I <sub>D</sub> =-1A, R <sub>GEN</sub> =6Ω	-	9.2	-	nS
<b>t<sub>r</sub></b>	Turn-on Rise Time					
<b>t<sub>d(OFF)</sub></b>	Turn-off Delay Time					
<b>t<sub>f</sub></b>	Turn-off Fall Time					
<b>Q<sub>g</sub></b>	Total Gate Charge	V <sub>GS</sub> =-4.5V, V <sub>DS</sub> =-30V, I <sub>D</sub> =-8A	-	24.6	-	nC
<b>Q<sub>g</sub></b>	Total Gate Charge	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-30V, I <sub>D</sub> =-8A	-	52.6	-	
<b>Q<sub>gs</sub></b>	Gate-Source Charge		-	9	-	
<b>Q<sub>gd</sub></b>	Gate-Drain Charge		-	7	-	
<b>Source-Drain Characteristics</b>						
<b>V<sub>SD</sub></b> <sup>④</sup>	Diode Forward Voltage	I <sub>SD</sub> =-1A, V <sub>GS</sub> =0V	-	-0.7	-1.1	V
<b>t<sub>rr</sub></b>	Reverse Recovery Time	I <sub>F</sub> =-1A, V <sub>R</sub> =0V	-	35	-	nS
<b>Q<sub>rr</sub></b>	Reverse Recovery Charge	dI <sub>F</sub> /dt=100A/μs	-	7.3	-	nC

Note ④ : Pulse test (pulse width≤300us, duty cycle≤2%).

Note ⑤ : Guaranteed by design, not subject to production testing.

## P-Channel Typical Characteristics

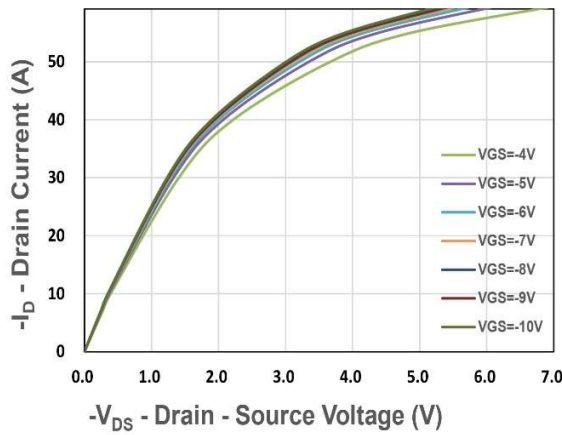


Figure 1. Output Characteristics

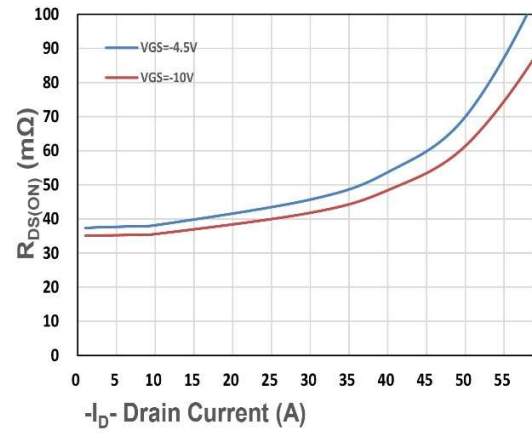


Figure 2. On-Resistance vs. ID

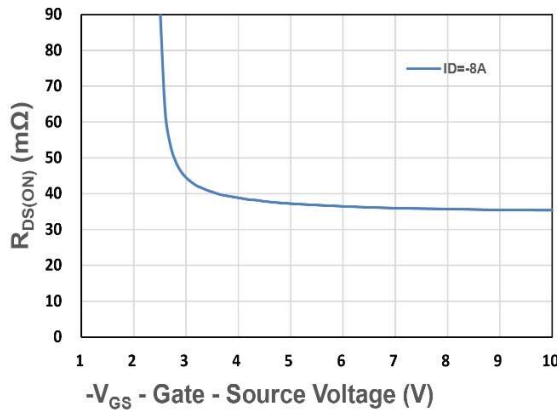


Figure 3. On-Resistance vs. VGS

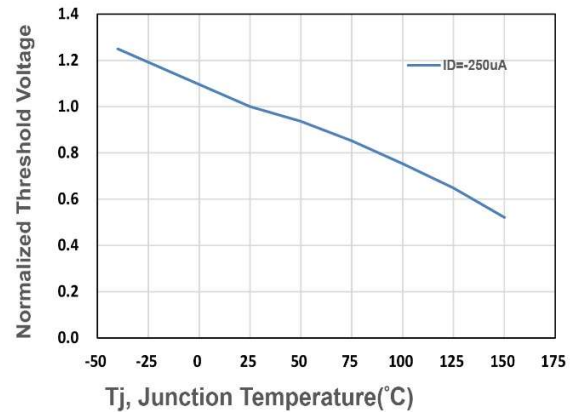


Figure 4. Gate Threshold Voltage

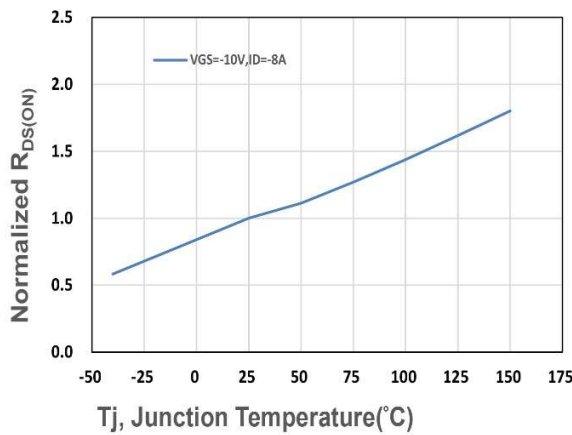


Figure 5. Drain-Source On Resistance

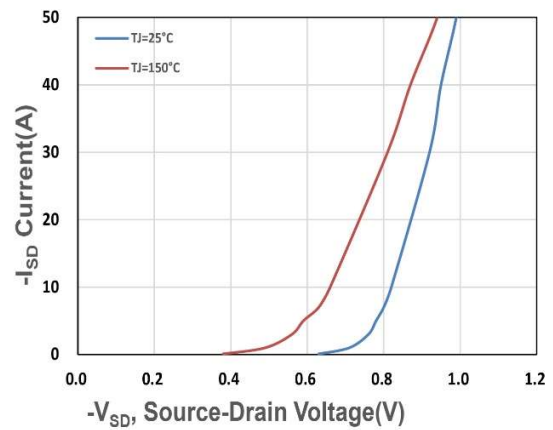


Figure 6. Source-Drain Diode Forward

# LM60400PAI8A

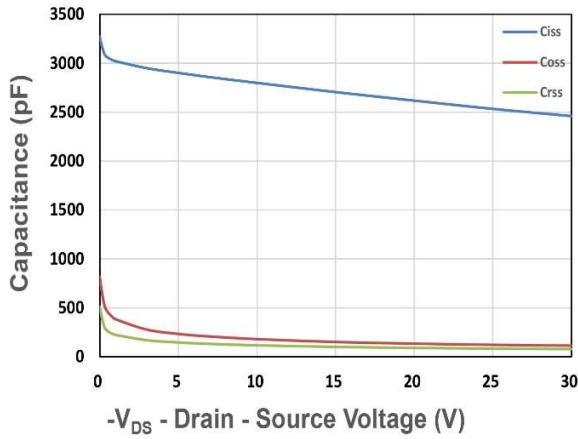


Figure 7. Capacitance

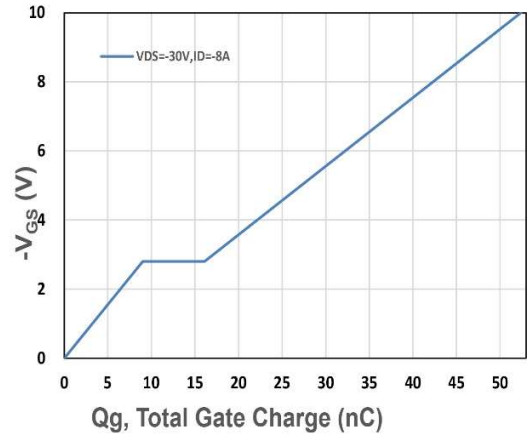


Figure 8. Gate Charge Characteristics

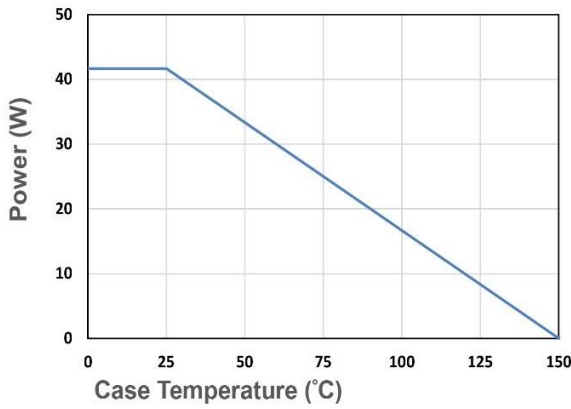


Figure 9. Power Dissipation

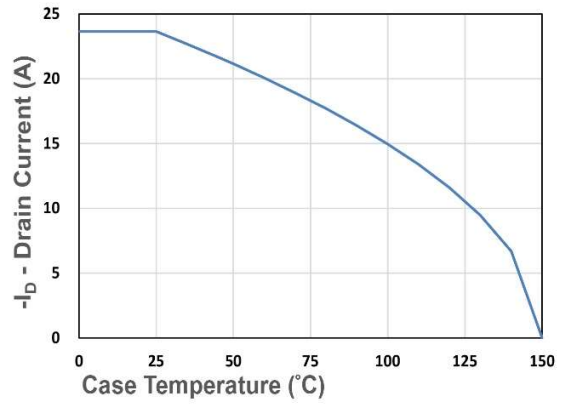


Figure 10. Drain Current

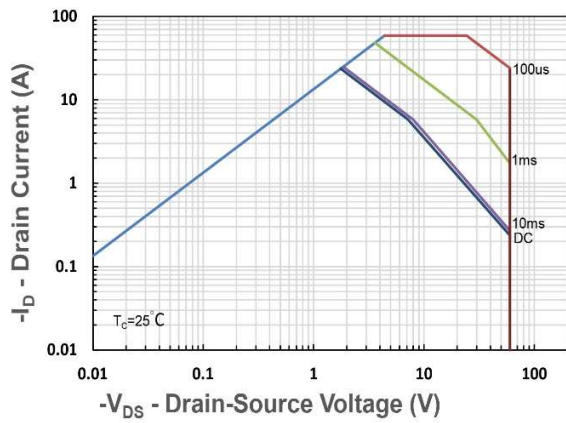


Figure 11. Safe Operating Area

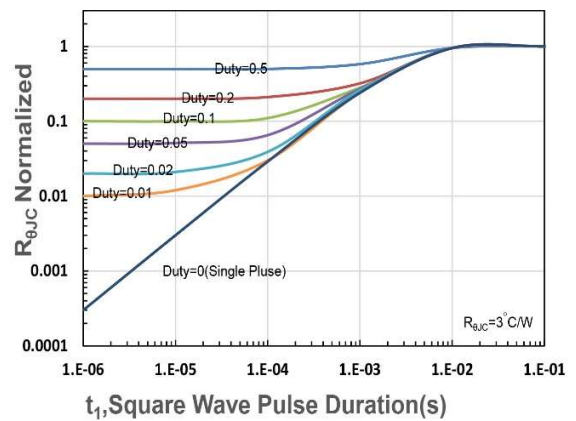


Figure 12.  $R_{thJC}$  Transient Thermal Impedance