



# Power MOSFETS

## DATASHEET


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**LM60380PAO2A**

P-Channel  
Enhancement Mode MOSFET

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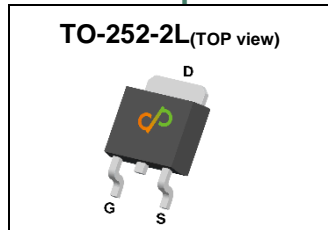


Quality Management Systems

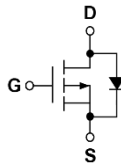
ISO 9001:2015 Certificate

## P-Channel Enhancement Mode MOSFET

### Pin Description



### Symbol



### Product Summary

| Symbol           | P-Channel | Unit       |
|------------------|-----------|------------|
| $V_{DSS}$        | -60       | V          |
| $R_{DS(ON)-Max}$ | 38        | m $\Omega$ |
| ID               | -38       | A          |

### Feature

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

### Applications

- Power Management in DC/DC Converters
- USB Power Delivery (USB PD)

### Ordering Information

| Orderable Part Number | Package Type | Form        | Shipping           | Marking         |
|-----------------------|--------------|-------------|--------------------|-----------------|
| LM60380PAO2A          | TO-252-2L    | Tape & Reel | 3000 / Tape & Reel | 60380<br>□□□□□□ |

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                          |      |
| $T_J$        | 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<br>-49  | A    |
| $I_{DM}^{①}$ | Pulse Drain Current Tested       | T <sub>C</sub> =25°C<br>-95  | A    |
| $I_D$        | Continuous Drain Current         | T <sub>C</sub> =25°C<br>-38  | A    |
|              |                                  | T <sub>C</sub> =100°C<br>-23 |      |
| $P_D$        | Maximum Power Dissipation        | T <sub>C</sub> =25°C<br>54   | W    |
|              |                                  | T <sub>C</sub> =100°C<br>22  |      |
| $I_D$        | Continuous Drain Current         | T <sub>A</sub> =25°C<br>-7.3 | A    |
|              |                                  | T <sub>A</sub> =70°C<br>-5.8 |      |
| $P_D$        | Maximum Power Dissipation        | T <sub>A</sub> =25°C<br>2    | W    |
|              |                                  | T <sub>A</sub> =70°C<br>1.3  |      |
| $I_{AS}^{②}$ | Avalanche Current, Single pulse  | L=0.1mH<br>-25               | A    |
|              |                                  | L=0.5mH<br>-14               |      |
| $E_{AS}^{②}$ | Avalanche Energy, Single pulse   | L=0.1mH<br>31                | mJ   |
|              |                                  | L=0.5mH<br>49                |      |

### Thermal Characteristics

| Symbol              | Parameter                              | Rating              | Unit |
|---------------------|--|---------------------|------|
| $R_{\theta JC}$     | Thermal Resistance-Junction to Case    | Steady State<br>2.3 | °C/W |
| $R_{\theta JA}^{③}$ | Thermal Resistance-Junction to Ambient | Steady State<br>62  | °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> =-10A  | -    | 31    | 38   | mΩ   |
|   |                                  | V <sub>GS</sub> =-4.5V, I <sub>DS</sub> =-5A  | -    | 35    | 45   |      |
| <b>g<sub>fs</sub></b>                       | Forward Transconductance         | V <sub>DS</sub> =-5V, I <sub>DS</sub> =-10A   | -    | 15.4  | -    | S    |
| <b>Dynamic Characteristics</b> <sup>®</sup> |                                  |   |      |       |      |      |
| <b>R<sub>G</sub></b>                        | Gate Resistance                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, Freq.=1MHz                                    | -    | 5     | -    | Ω    |
| <b>C<sub>iss</sub></b>                      | Input Capacitance                | V <sub>GS</sub> =0V, V <sub>DS</sub> =-30V, Freq.=1MHz                                  | -    | 2606  | -    | pF   |
| <b>C<sub>oss</sub></b>                      | Output Capacitance               |   |      |       |      |      |
| <b>C<sub>rss</sub></b>                      | Reverse Transfer Capacitance     |   |      |       |      |      |
| <b>t<sub>d(ON)</sub></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> =-6A                      | -    | 25.2  | -    | nC   |
| <b>Q<sub>g</sub></b>                        | Total Gate Charge                | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-30V, I <sub>D</sub> =-6A                       | -    | 56.1  | -    |      |
| <b>Q<sub>gs</sub></b>                       | Gate-Source Charge               |   | -    | 7     | -    |      |
| <b>Q<sub>gd</sub></b>                       | Gate-Drain Charge                |   | -    | 8.8   | -    |      |
| <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   | -    | -0.75 | -1.1 | V    |
| <b>t<sub>rr</sub></b>                       | Reverse Recovery Time            | I <sub>F</sub> =-1A, V <sub>R</sub> =0V   | -    | 32    | -    | nS   |
| <b>Q<sub>rr</sub></b>                       | Reverse Recovery Charge          | dI <sub>F</sub> /dt=100A/μs   | -    | 7     | -    | 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

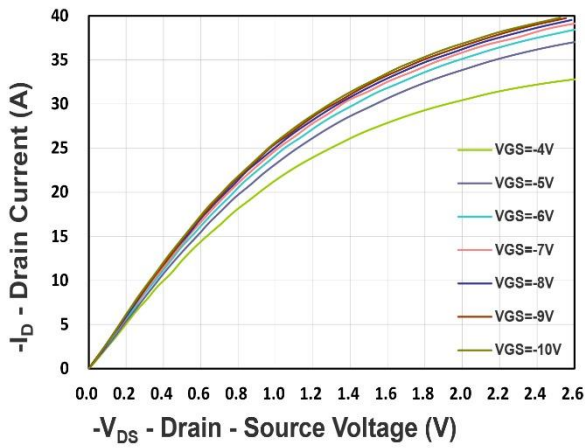


Figure 1. Output Characteristics

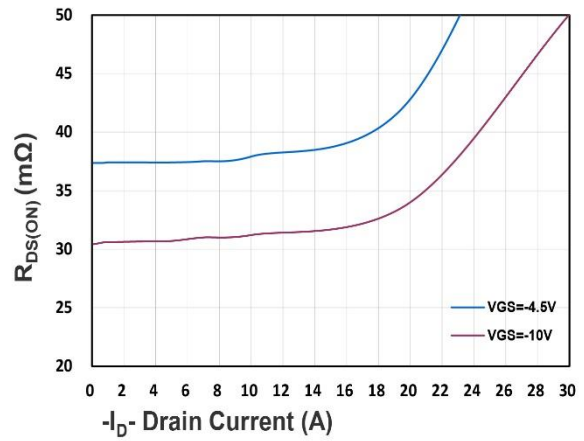


Figure 2. On-Resistance vs. ID

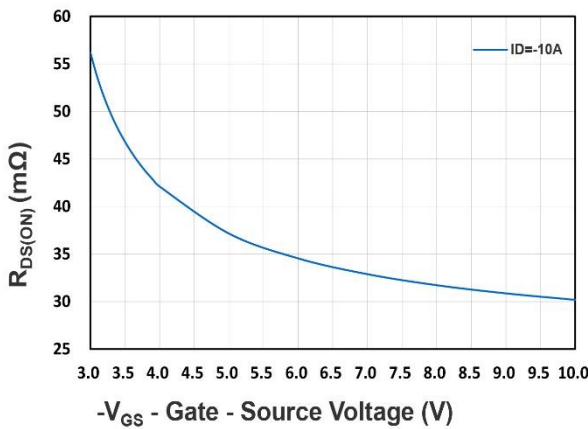


Figure 3. On-Resistance vs. VGS

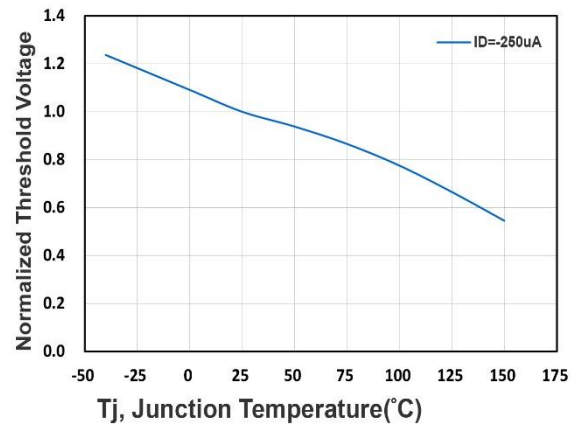


Figure 4. Gate Threshold Voltage

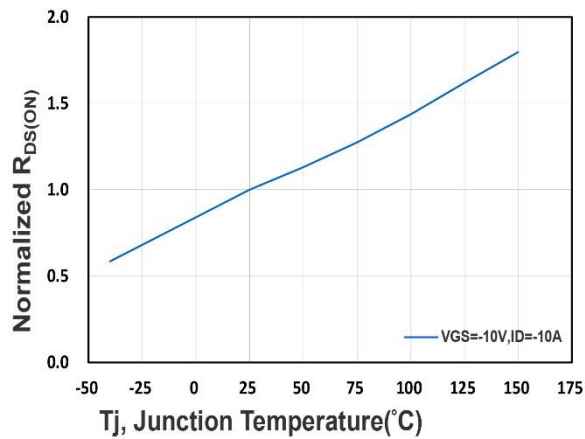


Figure 5. Drain-Source On Resistance

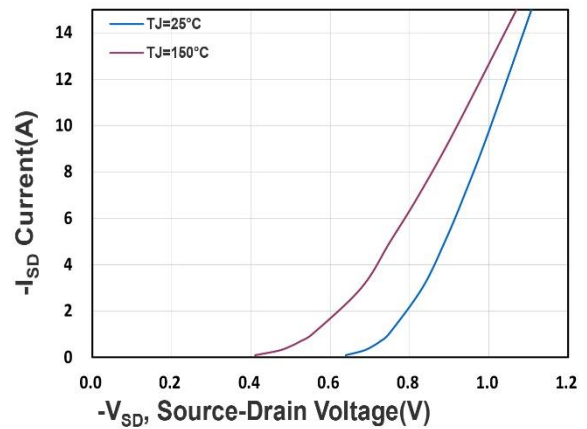


Figure 6. Source-Drain Diode Forward

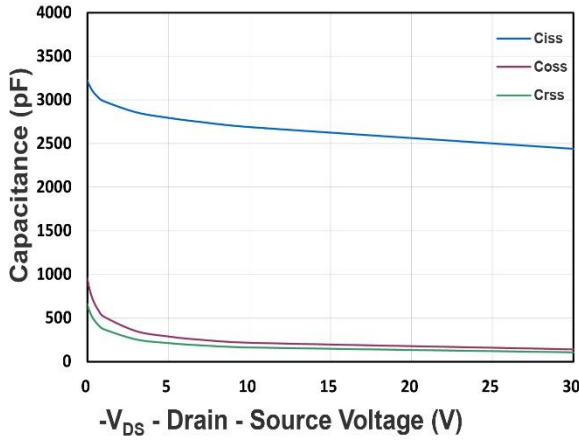


Figure 7. Capacitance

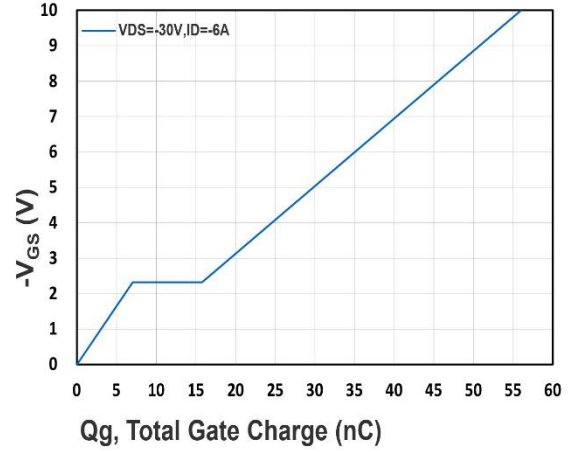


Figure 8. Gate Charge Characteristics

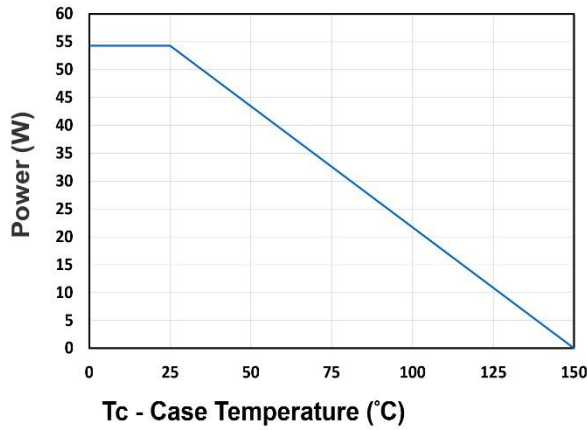


Figure 9. Power Dissipation

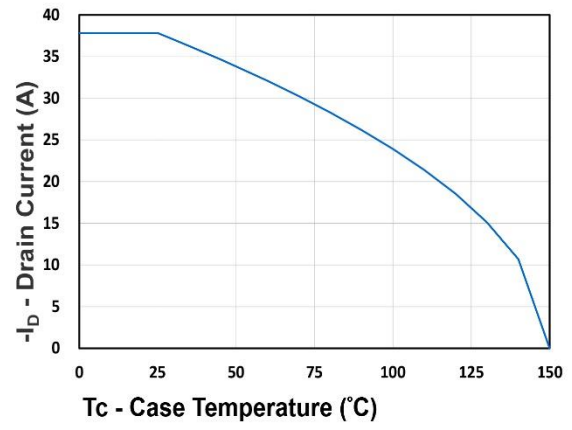


Figure 10. Drain Current

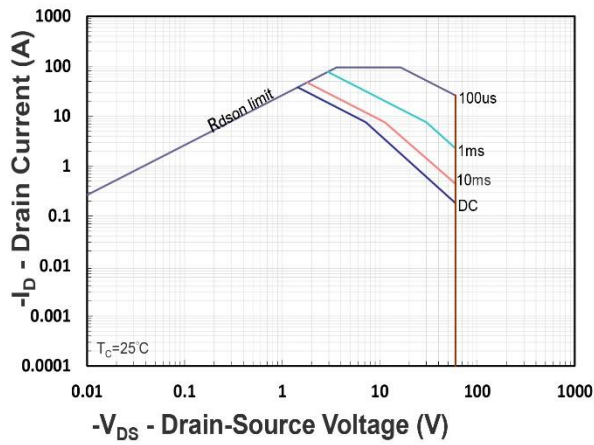


Figure 11. Safe Operating Area

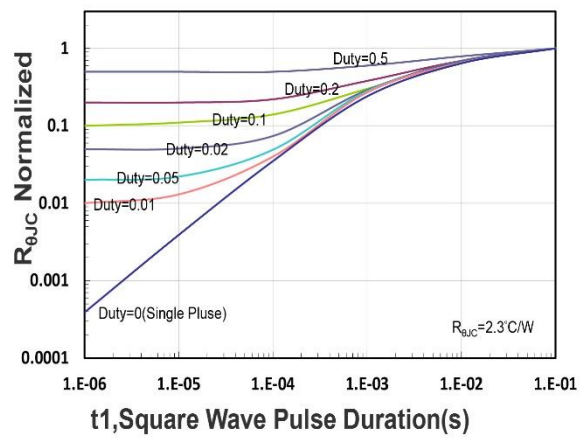


Figure 12.  $R_{\theta JC}$  Transient Thermal Impedance