

# TPSI4178DY-T1-GE3

## N-Channel 30-V (D-S) MOSFET

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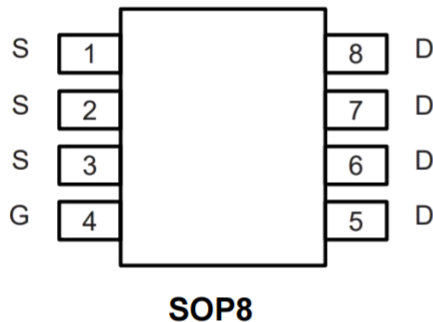
### Product Summary

- $V_{DS}$  30 V
- $I_{DS}$  (@  $V_{GS} = 10V$ ) 9A
- $R_{DS(ON)}$  (@  $V_{GS} = 10V$ ) < 16mΩ(Typ)

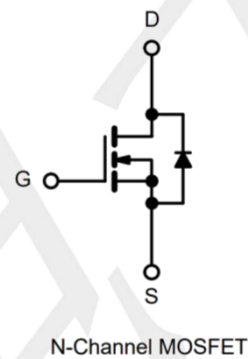
### Application

- Reverse Battery protection
- Load switch
- Power management
- PWM Application

### Package and Pin Configuration



### Circuit diagram



### Absolute Maximum Ratings (T<sub>A</sub>=25°C unless otherwise noted)

| PARAMETER                            | SYMBOL    | LIMIT       | UNIT |
|--------------------------------------|-----------|-------------|------|
| Drain-Source Voltage                 | $V_{DS}$  | 30          | V    |
| Gate-Source Voltage                  | $V_{GS}$  | ±20         | V    |
| Continuous Drain Current             | $I_D$     | 9           | A    |
| Pulsed Drain Current (note1)         | $I_{DM}$  | 30          | A    |
| Maximum Power Dissipation            | $P_D$     | 3           | W    |
| Operating Junction Temperature Range | $T_J$     | -55 to +150 | °C   |
| Storage Temperature Range            | $T_{stg}$ | -55 to +150 | °C   |

### Thermal Characteristic

| PARAMETER                                           | Symbol          | Value | Unit |
|-----------------------------------------------------|-----------------|-------|------|
| Thermal Resistance from Junction to Ambient (t≤10s) | $R_{\theta JA}$ | 62.5  | °C/W |

notes 1. Repetitive Rating: Pulse width limited by maximum junction temperature.

2. When mounted on 1" square PCB (FR4 material).

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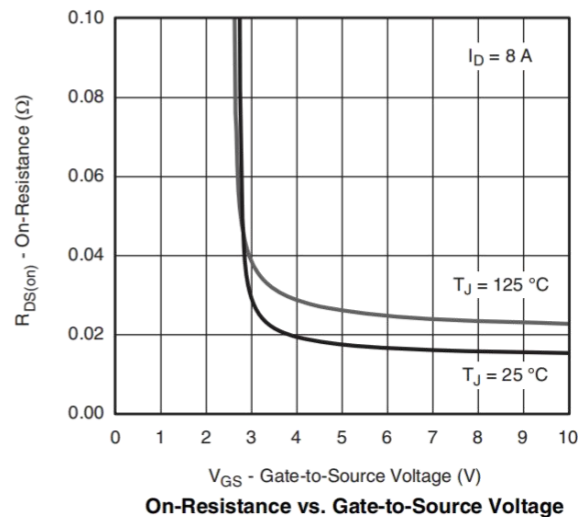
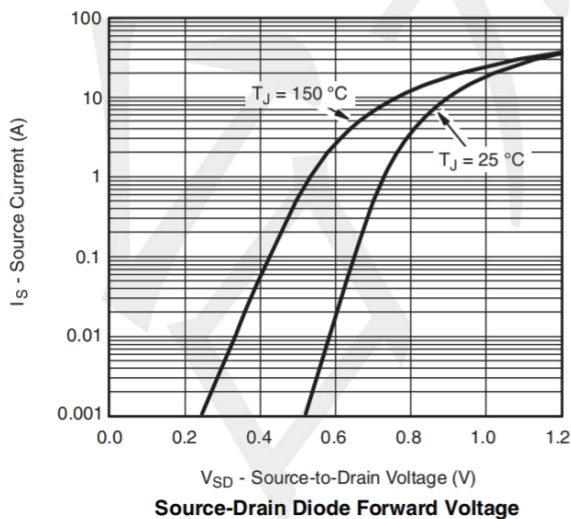
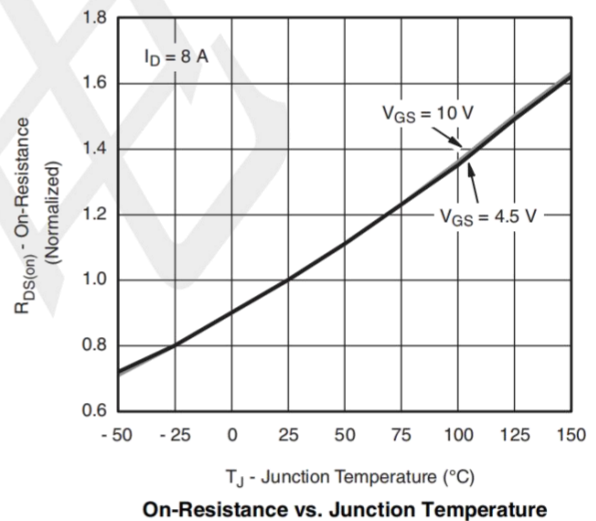
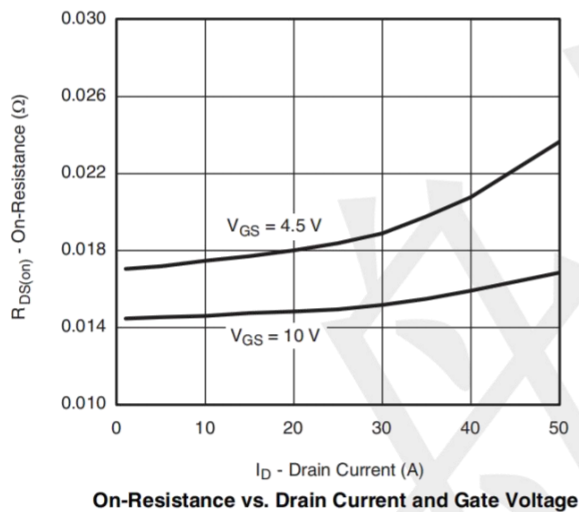
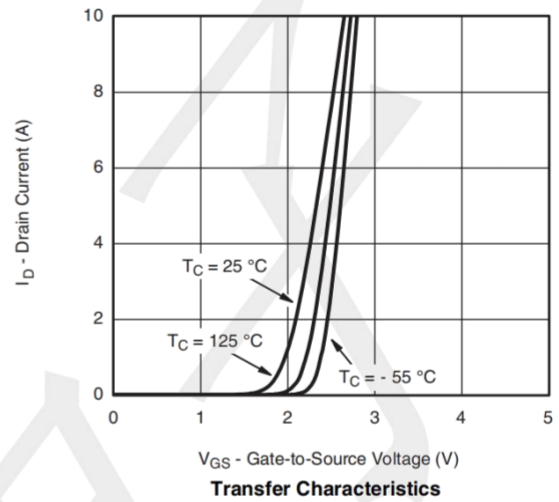
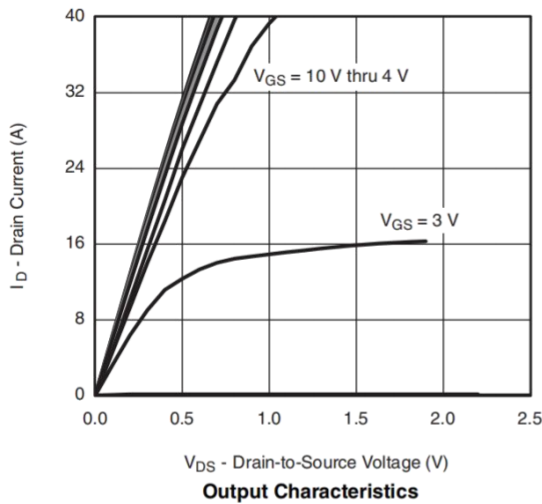
### Electrical Characteristics (T<sub>A</sub>=25 °C unless otherwise noted)

| PARAMETER                                               | CONDITIONS                                                                                      | SYMBOL              | MIN | TYP  | MAX  | UNIT |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------|---------------------|-----|------|------|------|
| Static                                                  |                                                                                                 |                     |     |      |      |      |
| Drain-Source Breakdown Voltage                          | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                                      | BV <sub>DSS</sub>   | 30  | --   | --   | V    |
| Gate-Source Threshold Voltage                           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = 250μA                                       | V <sub>GS(th)</sub> | 1.0 | --   | 2.5  | V    |
| Gate-Source Leakage                                     | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±20V                                                     | I <sub>GSS</sub>    | --  | --   | ±100 | nA   |
| Zero Gate Voltage Drain Current                         | V <sub>DS</sub> = 24V, V <sub>GS</sub> =0V                                                      | I <sub>DSS</sub>    | --  | --   | 1    | μA   |
|                                                         | V <sub>DS</sub> = 24V, T <sub>J</sub> =125°C                                                    |                     | --  | --   | 25   | μA   |
| Drain-Source On-State Resistance (Note 1)               | V <sub>GS</sub> = 10V, I <sub>D</sub> =9A                                                       | R <sub>DS(on)</sub> | --  | 16   | 22   | mΩ   |
|                                                         | V <sub>GS</sub> = 4.5V, I <sub>D</sub> =7A                                                      |                     | --  | 20   | 30   |      |
| Forward Transconductance (Note 2)                       | V <sub>DS</sub> = 10V, I <sub>D</sub> = 1A                                                      | g <sub>fs</sub>     | --  | 3.8  | --   | S    |
| Dynamic (Note 2)                                        |                                                                                                 |                     |     |      |      |      |
| Total Gate Charge (Note 3)                              | V <sub>DS</sub> = 15V,<br>I <sub>D</sub> =9A,<br>V <sub>GS</sub> =10V                           | Q <sub>g</sub>      | --  | 12.6 | --   | nC   |
| Gate-Source Charge (Note 3)                             |                                                                                                 | Q <sub>gs</sub>     | --  | 1.8  | --   |      |
| Gate-Drain Charge (Note 3)                              |                                                                                                 | Q <sub>gd</sub>     | --  | 2.7  | --   |      |
| Input Capacitance                                       | V <sub>DS</sub> =25V,<br>V <sub>GS</sub> = 0V,<br>F= 1.0MHz                                     | C <sub>iss</sub>    | --  | 492  | --   | pF   |
| Output Capacitance                                      |                                                                                                 | C <sub>oss</sub>    | --  | 67   | --   |      |
| Reverse Transfer Capacitance                            |                                                                                                 | C <sub>rss</sub>    | --  | 49   | --   |      |
| Switching                                               |                                                                                                 |                     |     |      |      |      |
| Turn-On Delay Time (Note 3)                             | V <sub>DD</sub> = 15V,<br>I <sub>D</sub> = 1A,<br>V <sub>GS</sub> = 10V,<br>R <sub>G</sub> = 6Ω | t <sub>d(on)</sub>  | --  | 5.8  | --   | nS   |
| Rise Time (Note 3)                                      |                                                                                                 | t <sub>r</sub>      | --  | 16.6 | --   |      |
| Turn-Off Delay Time (Note 3)                            |                                                                                                 | t <sub>d(off)</sub> | --  | 31.2 | --   |      |
| Fall Time (Note 3)                                      |                                                                                                 | t <sub>f</sub>      | --  | 7.6  | --   |      |
| Source-Drain Diode Ratings and Characteristics (Note 2) |                                                                                                 |                     |     |      |      |      |
| Forward Voltage                                         | V <sub>GS</sub> = 0V, I <sub>SD</sub> = 1A                                                      | V <sub>SD</sub>     | --  | 0.8  | 1.2  | V    |
| Continuous Source Current                               | Integral reverse diode in the MOSFET                                                            | I <sub>S</sub>      | --  | --   | 9    | A    |
| Pulsed Current (Note 1)                                 |                                                                                                 | I <sub>SM</sub>     | --  | --   | 30   | A    |

Notes:

1. Pulse test; pulse width ≤ 300 μS, duty cycle ≤ 2%.
2. Guaranteed by design, not subject to production testing.
3. Independent of operating temperature

### TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

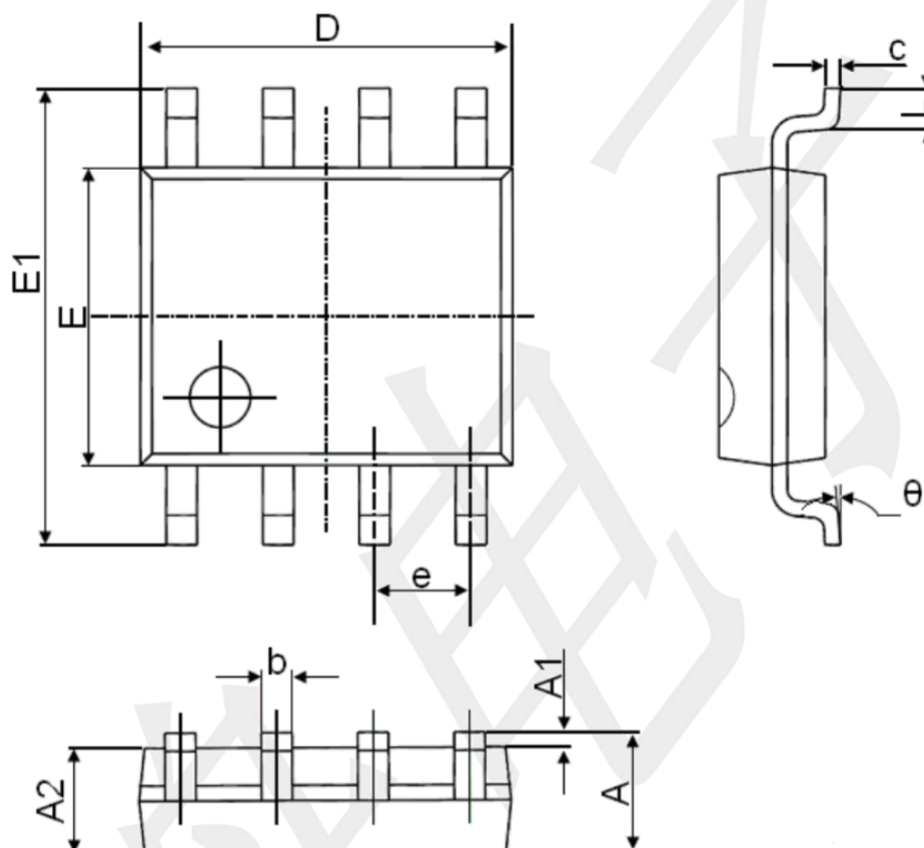


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### Package Information SOP8



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | 1.350                     | 1.750 | 0.053                | 0.069 |
| A1     | 0.100                     | 0.250 | 0.004                | 0.010 |
| A2     | 1.350                     | 1.550 | 0.053                | 0.061 |
| b      | 0.330                     | 0.510 | 0.013                | 0.020 |
| c      | 0.170                     | 0.250 | 0.006                | 0.010 |
| D      | 4.700                     | 5.100 | 0.185                | 0.200 |
| E      | 3.800                     | 4.000 | 0.150                | 0.157 |
| E1     | 5.800                     | 6.200 | 0.228                | 0.244 |
| e      | 1.270(BSC)                |       | 0.050(BSC)           |       |
| L      | 0.400                     | 1.270 | 0.016                | 0.050 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |