



## P-Channel 60-V (D-S) MOSFET

**TrenchFET**®  
MOSFETs**ESD Protected**  
2000 V

| PRODUCT SUMMARY        |                           |                  |            |
|------------------------|---------------------------|------------------|------------|
| $V_{(BR)DSS(min)}$ (V) | $r_{DS(on)}$ ( $\Omega$ ) | $V_{GS(th)}$ (V) | $I_D$ (mA) |
| -60                    | 6 @ $V_{GS} = -10$ V      | -1 to -3.0       | -185       |

**FEATURES**

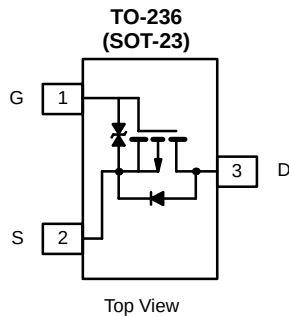
- High-Side Switching
- Low On-Resistance: 6  $\Omega$
- Low Threshold: -2 V (typ)
- Fast Switching Speed: 20 ns (typ)
- Low Input Capacitance: 20 pF (typ)
- Gate-Source ESD Protection

**BENEFITS**

- Ease in Driving Switches
- Low Offset (Error) Voltage
- Low-Voltage Operation
- High-Speed Circuits
- Easily Driven Without Buffer

**APPLICATIONS**

- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc.
- Battery Operated Systems
- Power Supply Converter Circuits
- Solid State Relays



Marking Code: 6Kw//

6K = Part Number Code for TP0610K

w = Week Code

// = Lot Traceability

**ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED)**

| Parameter                                        | Symbol         | Limit                     | Unit               |
|--------------------------------------------------|----------------|---------------------------|--------------------|
| Drain-Source Voltage                             | $V_{DS}$       | -60                       | V                  |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$                  |                    |
| Continuous Drain Current <sup>a</sup>            | $I_D$          | $T_A = 25^\circ\text{C}$  | mA                 |
|                                                  |                | $T_A = 100^\circ\text{C}$ |                    |
| Pulse Drain Current <sup>b</sup>                 | $I_{DM}$       | -800                      |                    |
| Power Dissipation <sup>a</sup>                   | $P_D$          | $T_A = 25^\circ\text{C}$  | mW                 |
|                                                  |                | $T_A = 100^\circ\text{C}$ |                    |
| Maximum Junction-to-Ambient <sup>a</sup>         | $R_{thJA}$     | 350                       | $^\circ\text{C/W}$ |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | -55 to 150                | $^\circ\text{C}$   |

## Notes

a. Surface mounted on FR4 board.

b. Pulse width limited by maximum junction temperature.

**SPECIFICATIONS ( $T_A = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED)**

| Parameter                               | Symbol               | Test Condition                                                                                                                 | Min  | Typ  | Max  | Unit |
|-----------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Static                                  |                      |                                                                                                                                |      |      |      |      |
| Drain-Source Breakdown Voltage          | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0 V, I <sub>D</sub> = −10 μA                                                                                 | −60  |      |      | V    |
| Gate-Threshold Voltage                  | V <sub>GS(th)</sub>  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = −250 μA                                                                   | −1   |      | −3.0 |      |
| Gate-Body Leakage                       | I <sub>GSS</sub>     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V                                                                                 |      |      | ±10  | μA   |
|                                         |                      | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±10 V                                                                                 |      |      | ±200 |      |
|                                         |                      | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±10 V, T <sub>J</sub> = 85°C                                                          |      |      | ±500 |      |
|                                         |                      | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±5 V                                                                                  |      |      | ±100 |      |
| Zero Gate Voltage Drain Current         | I <sub>DSS</sub>     | V <sub>DS</sub> = −50 V, V <sub>GS</sub> = 0 V                                                                                 |      |      | −25  | nA   |
|                                         |                      | V <sub>DS</sub> = −50 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 85°C                                                          |      |      | −250 |      |
| On-State Drain Current <sup>a</sup>     | I <sub>D(on)</sub>   | V <sub>DS</sub> = −10 V, V <sub>GS</sub> = −4.5 V                                                                              | −50  |      |      | mA   |
|                                         |                      | V <sub>DS</sub> = −10 V, V <sub>GS</sub> = −10 V                                                                               | −600 |      |      |      |
| Drain-Source On-Resistance <sup>a</sup> | r <sub>DS(on)</sub>  | V <sub>GS</sub> = −4.5 V, I <sub>D</sub> = −25 mA                                                                              |      |      | 10   | Ω    |
|                                         |                      | V <sub>GS</sub> = −10 V, I <sub>D</sub> = −500 mA                                                                              |      |      | 6    |      |
|                                         |                      | V <sub>GS</sub> = −10 V, I <sub>D</sub> = −500 mA, T <sub>J</sub> = 125°C                                                      |      |      | 9    |      |
| Forward Transconductance <sup>a</sup>   | g <sub>fs</sub>      | V <sub>DS</sub> = −10 V, I <sub>D</sub> = −100 mA                                                                              | 80   |      |      | mS   |
| Diode Forward Voltage <sup>a</sup>      | V <sub>SD</sub>      | I <sub>S</sub> = −200 mA, V <sub>GS</sub> = 0 V                                                                                |      |      | −1.4 | V    |
| Dynamic                                 |                      |                                                                                                                                |      |      |      |      |
| Total Gate Charge                       | Q <sub>g</sub>       | V <sub>DS</sub> = −30 V, V <sub>GS</sub> = −15 V, I <sub>D</sub> ≅ −500 mA                                                     |      | 1.7  |      | nC   |
| Gate-Source Charge                      | Q <sub>gs</sub>      |                                                                                                                                |      | 0.26 |      |      |
| Gate-Drain Charge                       | Q <sub>gd</sub>      |                                                                                                                                |      | 0.46 |      |      |
| Input Capacitance                       | C <sub>iss</sub>     | V <sub>DS</sub> = −25 V, V <sub>GS</sub> = 0 V, f = 1 MHz                                                                      |      | 23   |      | pF   |
| Output Capacitance                      | C <sub>oss</sub>     |                                                                                                                                |      | 10   |      |      |
| Reverse Transfer Capacitance            | C <sub>rss</sub>     |                                                                                                                                |      | 5    |      |      |
| Switching <sup>b</sup>                  |                      |                                                                                                                                |      |      |      |      |
| Turn-On Time                            | t <sub>ON</sub>      | V <sub>DD</sub> = −25 V, R <sub>L</sub> = 150 Ω<br>I <sub>D</sub> ≅ −200 mA, V <sub>GEN</sub> = −10 V<br>R <sub>G</sub> = 10 Ω |      | 20   |      | ns   |
| Turn-Off Time                           | t <sub>OFF</sub>     |                                                                                                                                |      | 35   |      |      |

## Notes

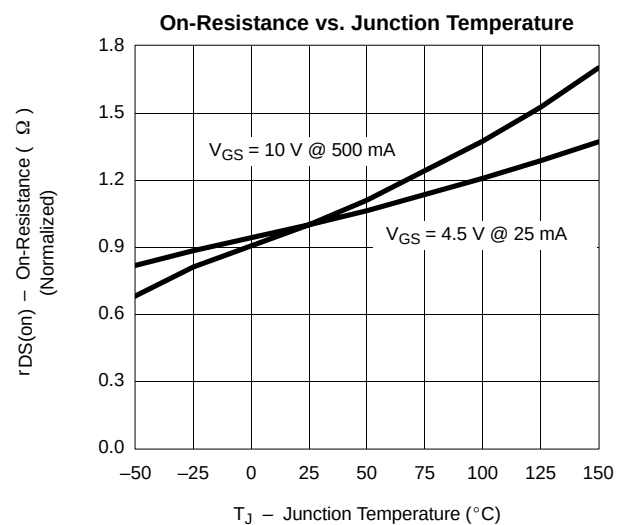
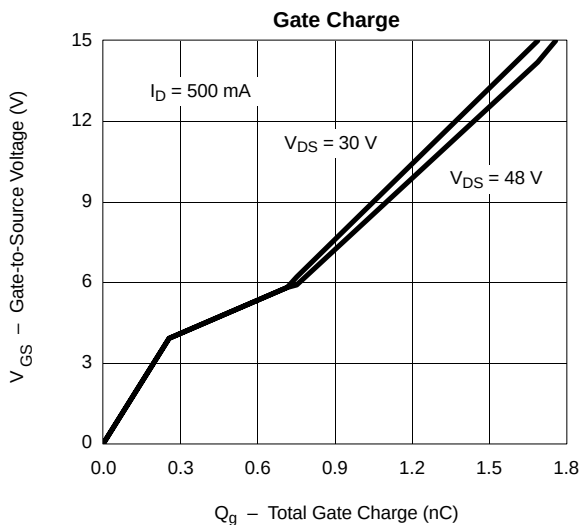
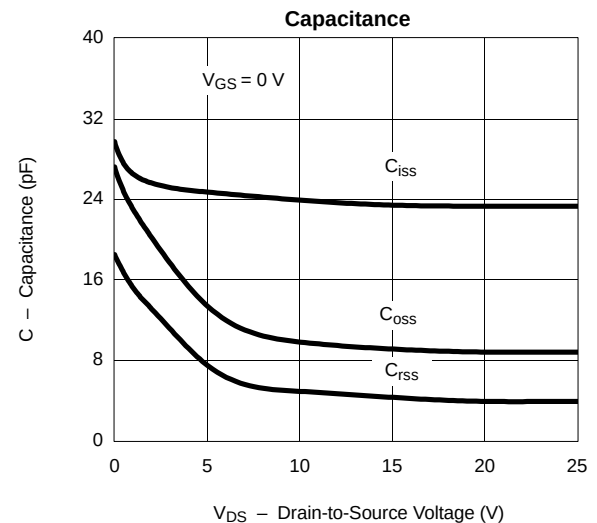
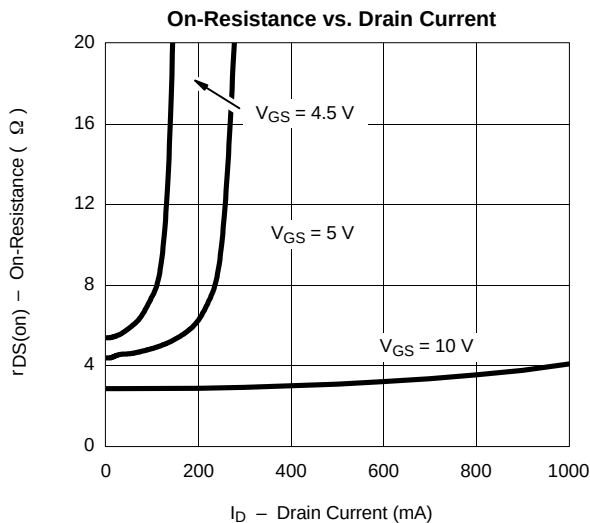
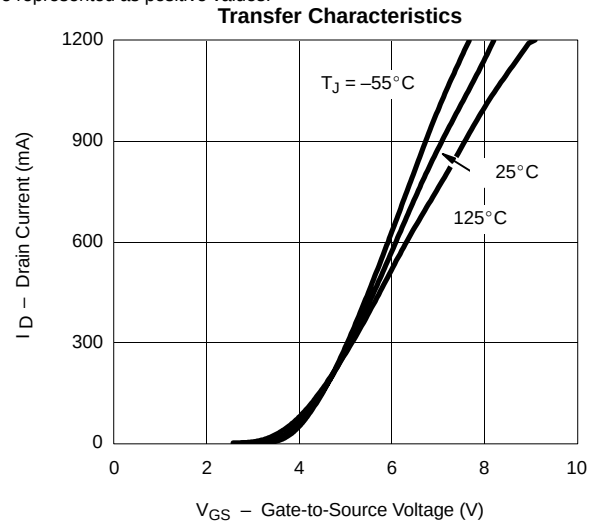
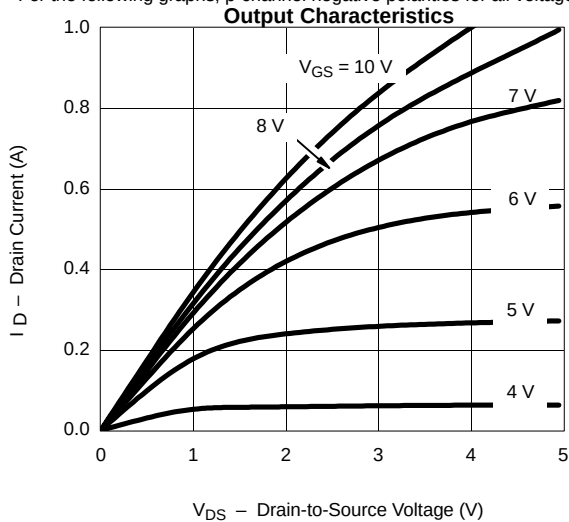
a. Pulse test:  $PW \leq 300\text{ ms}$  duty cycle  $\leq 2\%$ .

b. Switching time is essentially independent of operating temperature.

TPJO60

**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**

For the following graphs, p-channel negative polarities for all voltage and current values are represented as positive values.



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