



## 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

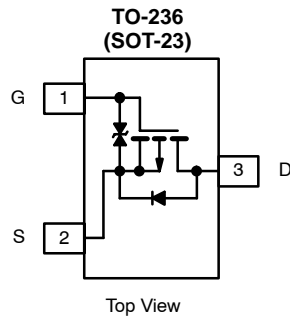
- High-Side Switching
- Low On-Resistance: 6  $\Omega$
- Low Threshold: -2 V (typ)
- Fast Switching Speed: 20 ns (typ)
- Low Input Capacitance: 20 pF (typ)
- Gate-Source ESD Protection

### 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

Ordering Information: TP0610K-T1  
TP0610K-T1—E3 (Lead (Pb)-Free)

### 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>            | $I_D$          | $T_A = 25^\circ\text{C}$  | -185                      |
|  |                | $T_A = 100^\circ\text{C}$ | -115                      |
| Pulse Drain Current <sup>b</sup>                 | $I_{DM}$       | -800                      | mA                        |
| Power Dissipation <sup>a</sup>                   | $P_D$          | $T_A = 25^\circ\text{C}$  | 350                       |
|  |                | $T_A = 100^\circ\text{C}$ | 140                       |
| Maximum Junction-to-Ambient <sup>a</sup>         | $R_{thJA}$     | 350                       | $^\circ\text{C}/\text{W}$ |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | -55 to 150                | $^\circ\text{C}$          |

#### Notes

- Surface mounted on FR4 board.
- Pulse width limited by maximum junction temperature.



| SPECIFICATIONS (T <sub>A</sub> = 25 °C UNLESS OTHERWISE NOTED) |                      |  |      |      |      |      |
|--|----------------------|--|------|------|------|------|
| Parameter  | Symbol               | Test Condition   | Min  | Typ  | Max  | Unit |
| <b>Static</b>  |                      |  |      |      |      |      |
| 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 | nA   |
|  |                      | 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> = -60 V, V <sub>GS</sub> = 0 V   |      |      | -25  | nA   |
|  |                      | V <sub>DS</sub> = -60 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    |
| <b>Dynamic</b>   |                      |  |      |      |      |      |
| 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    |      |      |
| <b>Switching<sup>b</sup></b>                                   |                      |  |      |      |      |      |
| 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 ≤ 300 ms duty cycle ≤ 2%.

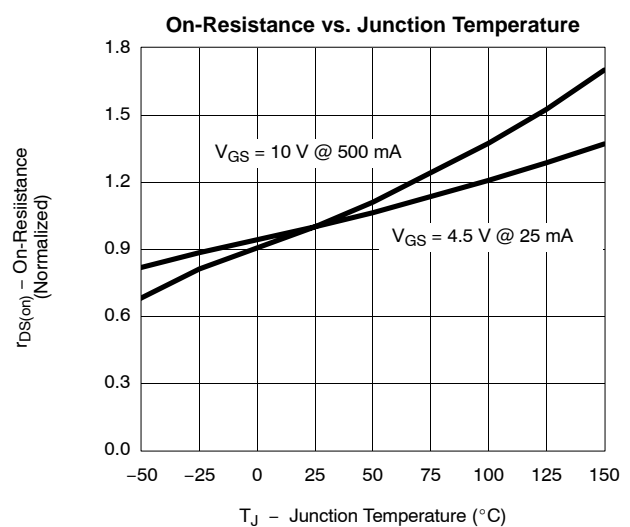
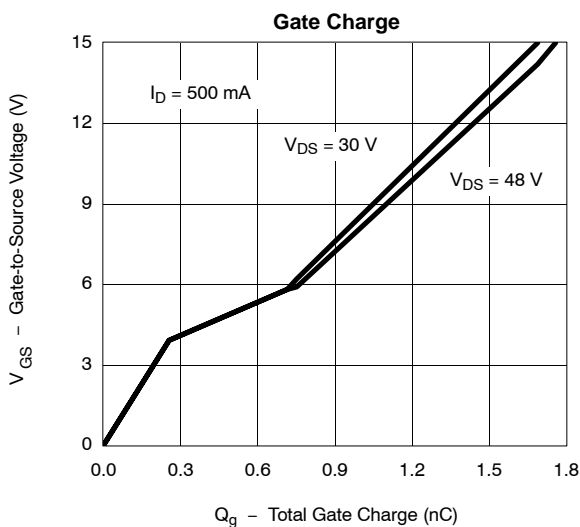
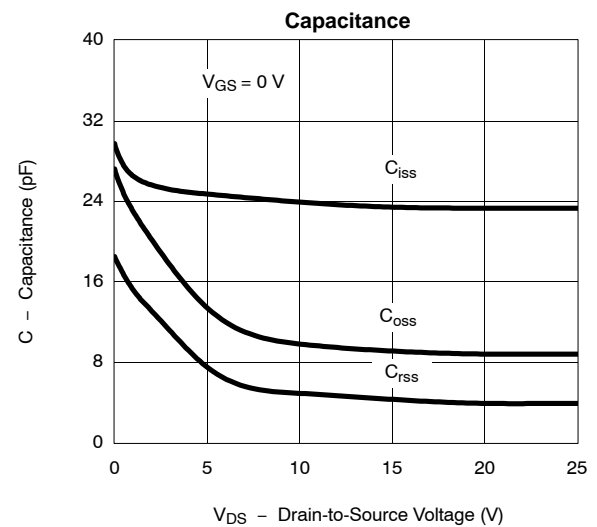
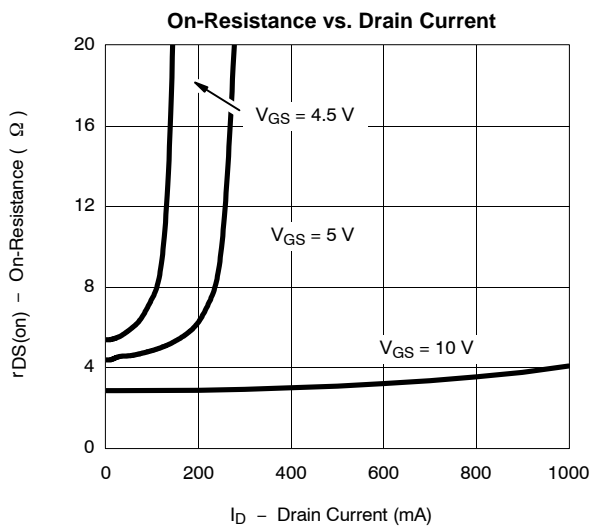
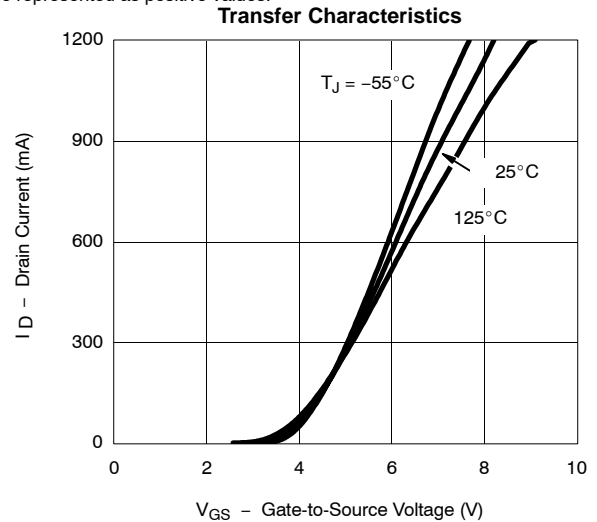
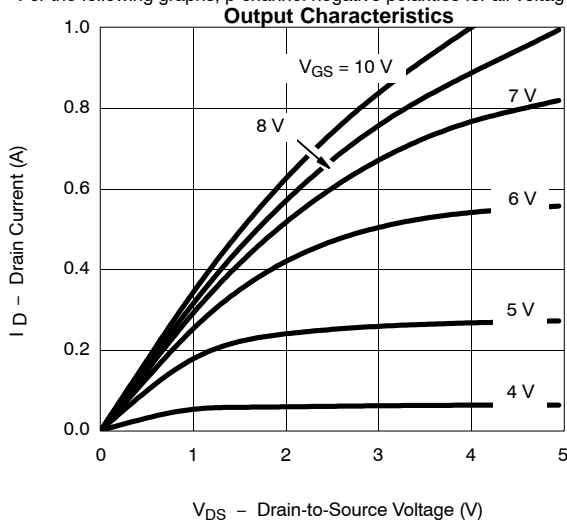
b. Switching time is essentially independent of operating temperature.

TPJO60

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

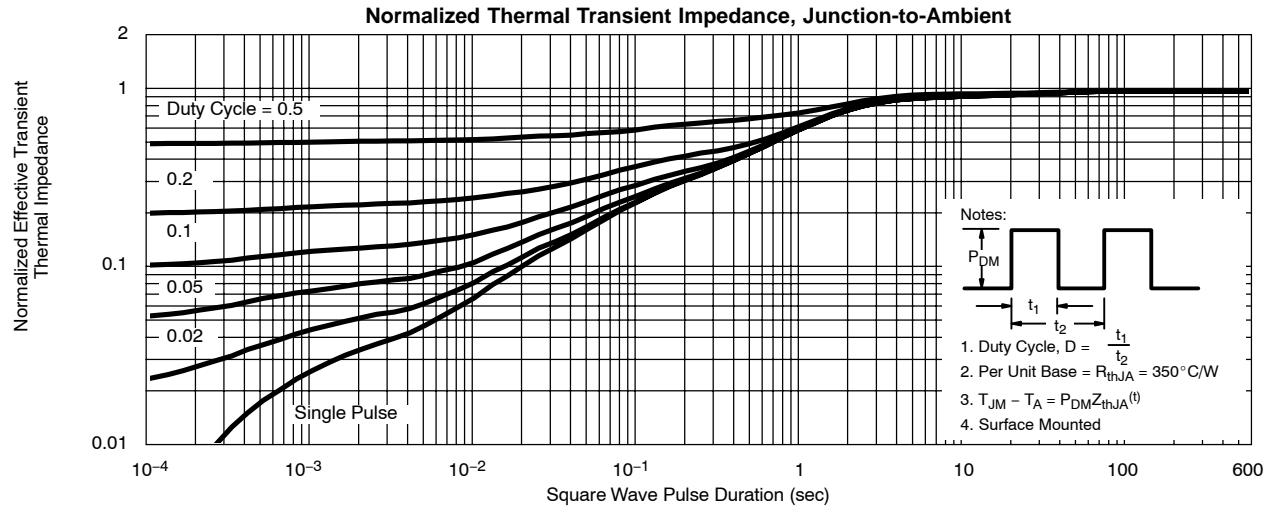
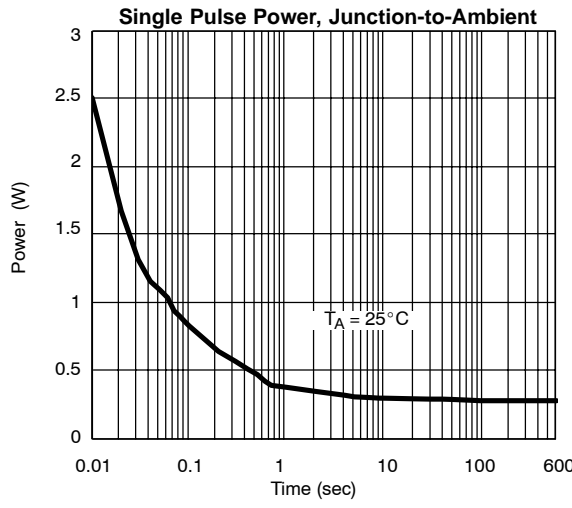
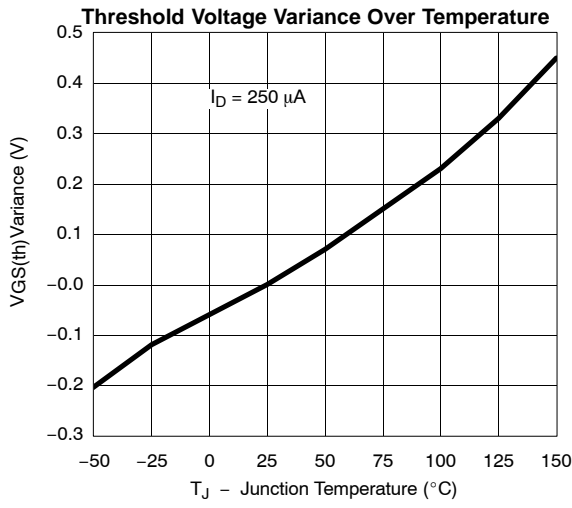
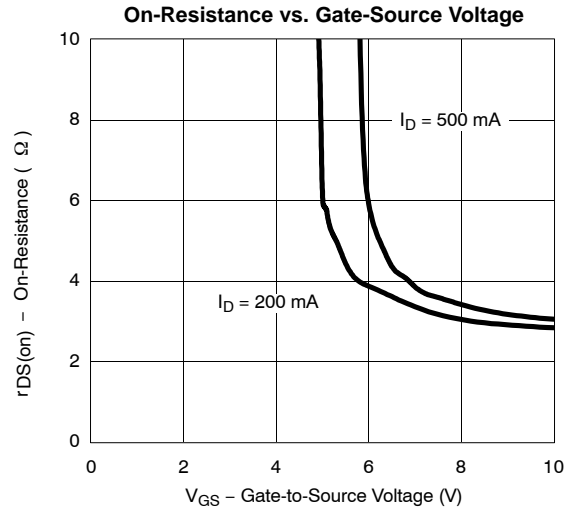
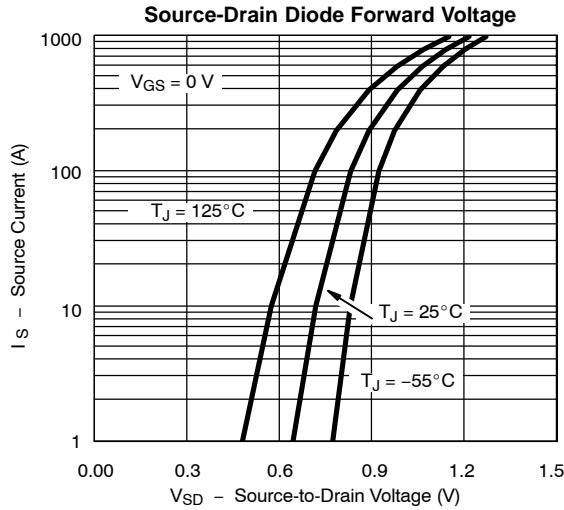
**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**

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



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