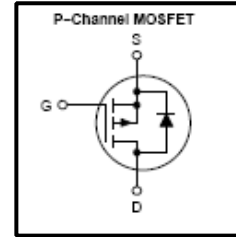


# Trench Power MOSFET

## -20 V, Single P-Channel, SOT-23

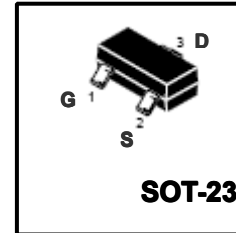
### Features

- -3.2A, -20V,  $R_{DS(on)}$ (Max 85m $\Omega$ )@ $V_{GS}=-4.5V$
- -1.8 V Rated for Low Voltage Gate Drive
- SOT-23 Surface Mount for Small Footprint
- Single Pulse Avalanche Energy Rated



### General Description

This Power MOSFET is produced using Winsemi's advanced MOS technology. This latest technology has been especially designed to minimize on-state resistance, have a high rugged avalanche characteristics. This devices is specially well suited for Load/Power Management for Portables and Computing, Charging Circuits and Battery Protection



### Absolute Maximum Ratings

| Symbol         | Parameter                                       |                             | Value            | Units      |   |
|----------------|---|-----------------------------|------------------|------------|---|
| $V_{DSS}$      | Drain Source Voltage                            |                             | -20              | V          |   |
| $I_D$          | Continuous Drain Current(Note 1)                | Steady State                | $T_c=25^\circ C$ | -2.4       | A |
|                |   |                             | $T_c=85^\circ C$ | -1.7       |   |
|                |   | $t \leq 10s$                | $T_c=25^\circ C$ | -3.2       |   |
| $P_D$          | Total Power Dissipation(Note 1)                 | Steady State                | $T_c=25^\circ C$ | 0.73       | W |
|                |   |                             | $t \leq 10s$     | 1.25       |   |
| $I_D$          | Continuous Drain Current(Note 2)                | Steady State                | $T_c=25^\circ C$ | -1.8       | A |
|                |   |                             | $T_c=85^\circ C$ | -1.3       |   |
|                |   |                             | $T_c=25^\circ C$ | 0.42       |   |
| $P_D$          | Total Power Dissipation(Note 2)                 |                             |                  |            | W |
| $I_{DM}$       | Drain Current Pulsed                            | $t=10s$                     | -7.5             | A          |   |
| $V_{GS}$       | Gate to Source Voltage                          |                             | $\pm 8$          | V          |   |
| ESD            | ESD Capability (Note 3)                         | $C=100pF, R_s = 1500\Omega$ | 225              | V          |   |
| $T_J, T_{stg}$ | Junction and Storage Temperature                |                             | -55~150          | $^\circ C$ |   |
| $T_L$          | Maximum lead Temperature for soldering purposes |                             | 260              | $^\circ C$ |   |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

### Thermal Characteristics

| Symbol    | Parameter                                       | Value |     |     | Units        |
|-----------|---|-------|-----|-----|--------------|
|           |   | Min   | Typ | Max |              |
| $R_{QJA}$ | Thermal Resistance, Junction-to-Ambient(Note 1) | -     | -   | 170 | $^\circ C/W$ |
| $R_{QJA}$ | Thermal Resistance, Junction-to-Ambient(Note 1) |       |     | 110 | $^\circ C/W$ |
| $R_{QJA}$ | Thermal Resistance, Junction-to-Ambient(Note 2) |       |     | 300 | $^\circ C/W$ |

Note 1: Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces)

Note 2: Surface-mounted on FR4 board using the minimum recommended pad size.

Note 3: ESD Rating Information: HBM Class 0

## Electrical Characteristics (Tc = 25°C)

| Characteristics                                 | Symbol        | Test Condition  | Min                       | Type  | Max       | Unit          |    |
|---|---------------|---|---------------------------|-------|-----------|---------------|----|
| Gate leakage current(Note 4)                    | $I_{GSS}$     | $V_{GS} = \pm 8\text{ V}, V_{DS} = 0\text{ V}$        | -                         | -     | $\pm 100$ | nA            |    |
| Drain cut-off current(Note 4)                   | $I_{DSS}$     | $V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$          | -                         | -     | -1        | $\mu\text{A}$ |    |
| Drain-source breakdown voltage                  | $V_{(BR)DSS}$ | $I_D = -250\ \mu\text{A}, V_{GS} = 0\text{ V}$        | -20                       | -     | -         | V             |    |
| Gate threshold voltage                          | $V_{GS(th)}$  | $V_{DS} = V_{DS} I_D = -250\ \mu\text{A}$             | -0.40                     | -0.72 | -1.5      | V             |    |
| Drain-source ON resistance                      | $R_{DS(ON)}$  | $V_{GS} = -4.5\text{ V}, I_D = -1.6\text{ A}$         | -                         | 70    | 85        | m $\Omega$    |    |
|   |               | $V_{GS} = -2.5\text{ V}, I_D = -1.3\text{ A}$         | -                         | 90    | 120       |               |    |
|   |               | $V_{GS} = -1.8\text{ V}, I_D = -0.9\text{ A}$         | -                         | 112   | 200       |               |    |
| Forward Transconductance                        | $g_{fs}$      | $V_{DS} = -5.0\text{ V}, I_D = -2.3\text{ A}$         | -                         | 75    | -         | S             |    |
| Input capacitance                               | $C_{iss}$     | $V_{DS} = -10\text{ V},$                              | -                         | 675   | -         | pF            |    |
| Reverse transfer capacitance                    | $C_{rss}$     | $V_{GS} = 0\text{ V},$                                | -                         | 75    | -         |               |    |
| Output capacitance                              | $C_{oss}$     | $f = 1\text{ MHz}$                                    | -                         | 100   | -         |               |    |
| Switching time<br>(Note 5)                      | Rise time     | $t_r$   | $V_{GS} = -4.5\text{ V},$ | -     | 12.6      | -             | ns |
|   | Turn-on time  | $t_{on}$  | $V_{DS} = -10\text{ V},$  | -     | 7.5       | -             |    |
|   | Fall time     | $t_f$   | $I_D = -1.6\text{ A},$    | -     | 21.0      | -             |    |
|   | Turn-off time | $t_{off}$   | $R_G = 6.0\ \Omega$       | -     | 30.2      | -             |    |
| Total gate charge (gate-source plus gate-drain) | $Q_g$         | $V_{GS} = -4.5\text{ V},$<br>$V_{DS} = -10\text{ V},$ | -                         | 7.5   | 8.5       | nC            |    |
| Gate-source charge                              | $Q_{gs}$      | $I_D = -1.6\text{ A}$                                 | -                         | 1.2   | -         |               |    |
| Gate-drain ("miller") Charge                    | $Q_{gd}$      |   | -                         | 2.2   | -         |               |    |
| Reverse Recovery Charge                         | $R_G$         |   | -                         | 6.5   | -         | $\Omega$      |    |

## Source-Drain Ratings and Characteristics (Ta = 25°C)

| Characteristics                  | Symbol    | Test Condition   | Min | Type  | Max  | Unit          |
|----------------------------------|-----------|--|-----|-------|------|---------------|
| Continuous drain reverse current | $I_{DR}$  | -  | -   | -     | -2.4 | A             |
| Pulse drain reverse current      | $I_{DRP}$ | -  | -   | -     | -7.5 | A             |
| Forward voltage (diode)          | $V_{DSF}$ | $I_{DR} = -2.4\text{ A}, V_{GS} = 0\text{ V}$  | -   | -0.82 | -1.2 | V             |
| Reverse recovery time            | $t_{rr}$  | $I_{DR} = -2.4\text{ A},$<br>$V_{GS} = 0\text{ V},$<br>$dI_{DR} / dt = 100\text{ A} / \mu\text{s}$ | -   | 12.8  | 15   | ns            |
| Charge Time                      | $t_a$     |  | -   | 9.9   |      | ns            |
| Discharge Time                   | $t_b$     |  | -   | 3.0   |      | ns            |
| Reverse recovery charge          | $Q_{rr}$  |  | -   | 1008  | -    | $\mu\text{C}$ |

Note 4: Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle 3 2%.

Note 5: Switching characteristics are independent of operating junction temperature.

This transistor is an electrostatic sensitive device

Please handle with caution

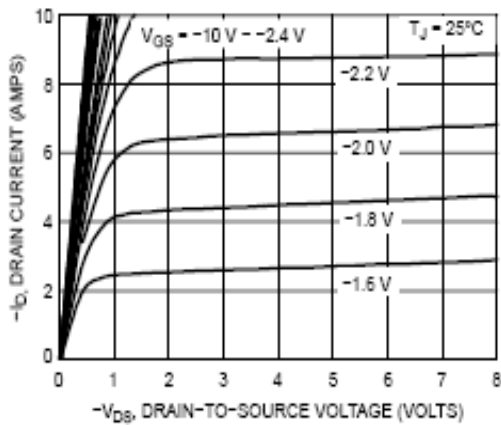


Fig. 1 On-State Characteristics

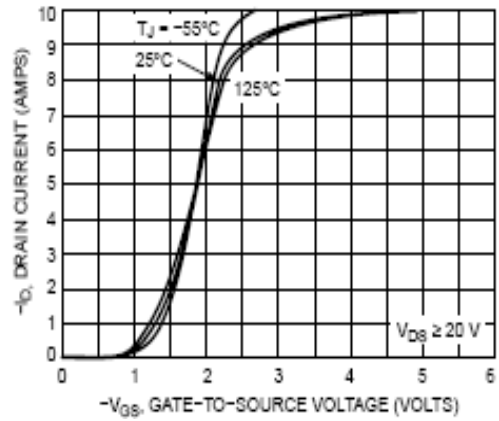


Fig.2 Transfer Current Characteristics

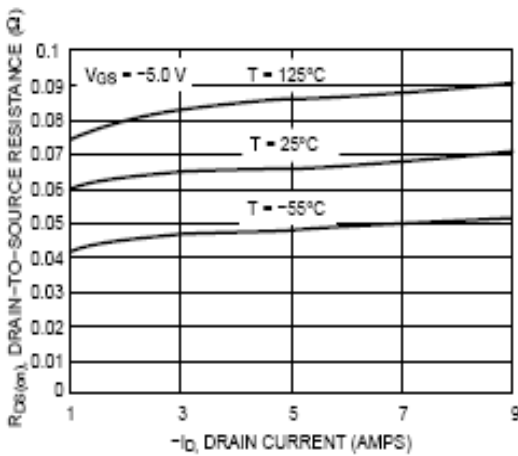


Fig.3 On-Resistance vs. Drain Current and Temperature

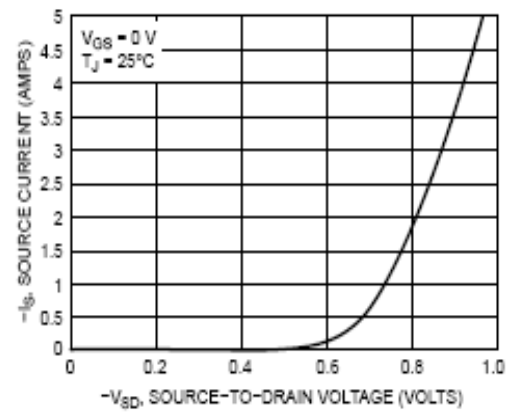


Fig.4 Diode Forward Voltage vs. Current

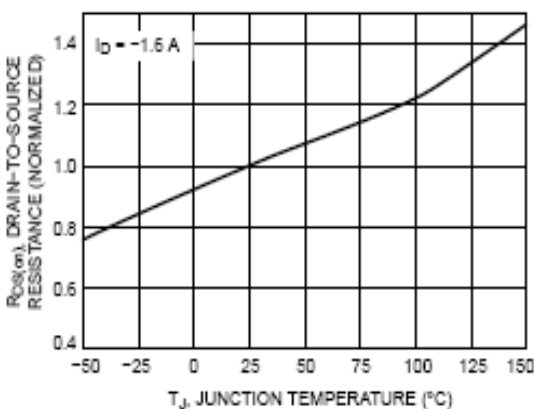


Fig.5 On-Resistance Variation vs Junction Temperature

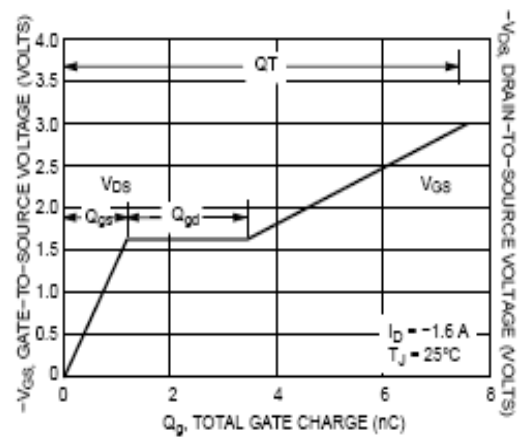
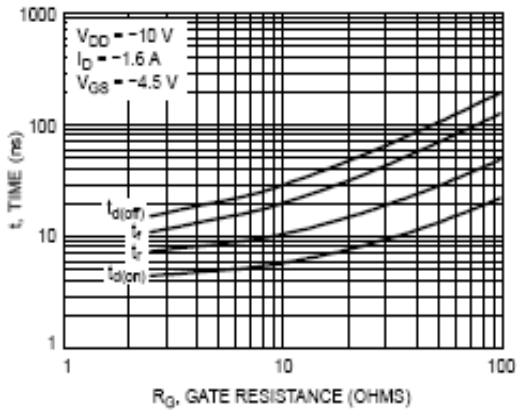
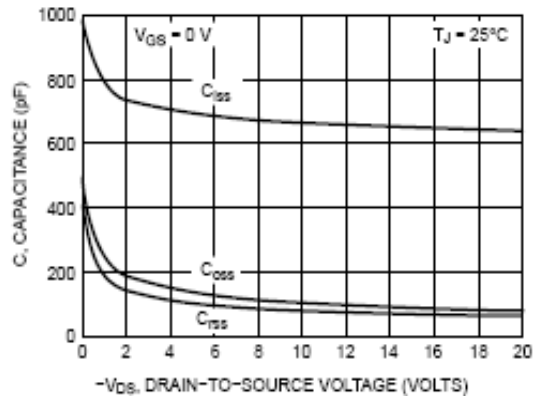


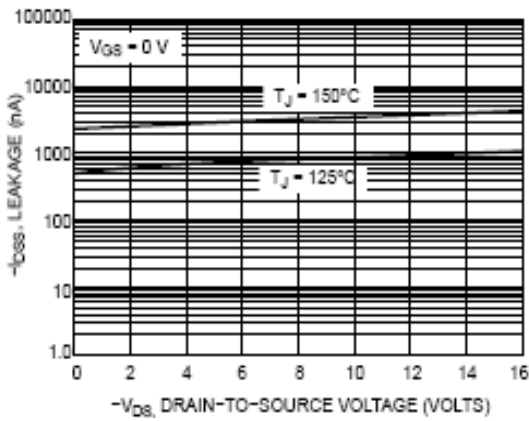
Fig.6 Gate Charge Characteristics



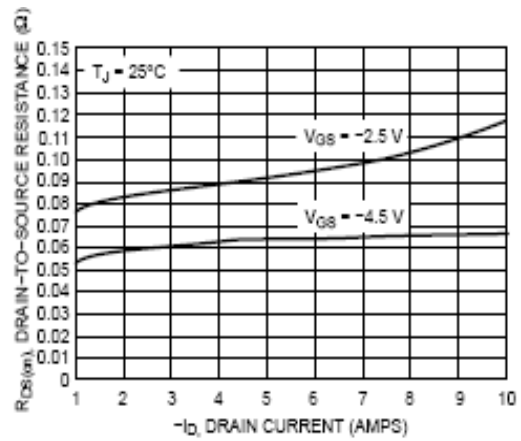
**Fig.7 Resistive Switching Time Variation vs. Gate Resistance**



**Fig.8 Maximum Drain Current vs Case Temperature**



**Fig.9 Drain-to-Source Leakage Current vs. Voltage**



**Fig.10 On-Resistance vs. Drain Current and Temperature**

SOT-23 Package Dimension

