

## MS39P93

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

#### Description

These miniature surface mount MOSFETs utilize a high cell density trench process to provide low  $r_{DS(on)}$  and to ensure minimal power loss and heat dissipation. Typical applications are DC-DC converters and power management in portable and battery-powered products such as computers, printers, PCMCIA cards, cellular and cordless telephones.

#### Features

- Low  $r_{DS(on)}$  provides higher efficiency and extends battery life
- Low thermal impedance copper lead frame TSOP-6 saves board space
- RoHS compliant package

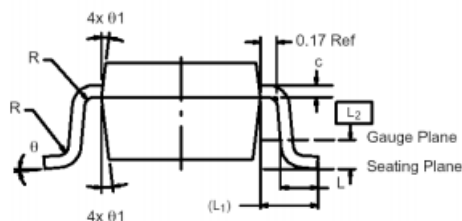
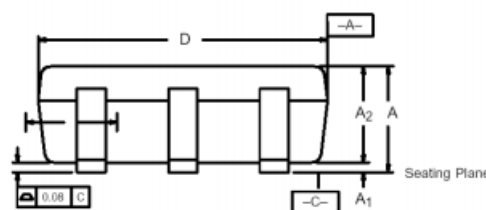
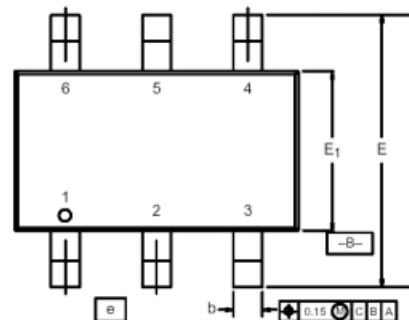
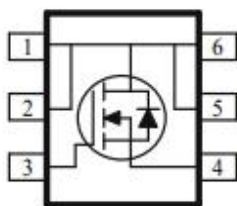
#### Packing & Order Information

3,000/Reel



**RoHS**  
COMPLIANT

#### Graphic symbol



| Dim            | MILLIMETERS |      |      | INCHES     |       |       |
|----------------|-------------|------|------|------------|-------|-------|
|                | Min         | Nom  | Max  | Min        | Nom   | Max   |
| A              | 0.91        | —    | 1.10 | 0.036      | —     | 0.043 |
| A <sub>1</sub> | 0.01        | —    | 0.10 | 0.0004     | —     | 0.004 |
| A <sub>2</sub> | 0.84        | —    | 1.00 | 0.033      | 0.038 | 0.039 |
| b              | 0.30        | 0.32 | 0.45 | 0.012      | 0.013 | 0.018 |
| c              | 0.10        | 0.15 | 0.20 | 0.004      | 0.006 | 0.008 |
| D              | 2.95        | 3.05 | 3.10 | 0.116      | 0.120 | 0.122 |
| E              | 2.70        | 2.85 | 2.98 | 0.106      | 0.112 | 0.117 |
| E <sub>1</sub> | 1.55        | 1.65 | 1.70 | 0.061      | 0.065 | 0.067 |
| e              | 1.00 BSC    |      |      | 0.0394 BSC |       |       |
| L              | 0.35        | —    | 0.50 | 0.014      | —     | 0.020 |
| L <sub>1</sub> | 0.60 Ref    |      |      | 0.024 Ref  |       |       |
| L <sub>2</sub> | 0.25 BSC    |      |      | 0.010 BSC  |       |       |
| R              | 0.10        | —    | —    | 0.004      | —     | —     |
| θ              | 0°          | 4°   | 8°   | 0°         | 4°    | 8°    |
| θ <sub>1</sub> | 7° Nom      |      |      | 7° Nom     |       |       |

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

#### Absolute Maximum Ratings (Tc=25°C unless otherwise specified)

| Symbol        | Parameter                                                        | Value       | Unit |
|---------------|------------------------------------------------------------------|-------------|------|
| $V_{DS}$      | Drain-Source Voltage                                             | 30          | V    |
| $V_{GS}$      | Gate-Source Voltage                                              | $\pm 20$    | V    |
| $I_D$         | Continuous Drain Current <sup>a</sup> ( $T_A=25^\circ\text{C}$ ) | -2.5        | A    |
|               | Continuous Drain Current <sup>a</sup> ( $T_A=70^\circ\text{C}$ ) | -1.9        | A    |
| $I_{DM}$      | Pulsed Drain Current <sup>b</sup>                                | -10         | A    |
| $I_S$         | Continuous Source Current (Diode Conduction) <sup>a</sup>        | $\pm 1.6$   | A    |
| $P_D$         | Power Dissipation <sup>a</sup> ( $T_A=25^\circ\text{C}$ )        | 1.15        | W    |
|               | Power Dissipation <sup>a</sup> ( $T_A=70^\circ\text{C}$ )        | 0.7         | W    |
| $T_J/T_{STG}$ | Operating Junction and Storage Temperature                       | -55 to +150 | °C   |

#### Thermal Resistance Ratings

| Symbol     | Parameter                                                   | Typ | Max | Units |
|------------|-------------------------------------------------------------|-----|-----|-------|
| $R_{THJA}$ | Maximum Junction-to-Ambient <sup>a</sup> ( $t \leq 10$ sec) | 93  | 110 | °C/W  |
|            | Maximum Junction-to-Ambient <sup>a</sup> (Steady-State)     | 130 | 150 |       |

#### Notes:

- Surface Mounted on 1" x 1" FR4 Board.
- Pulse width limited by maximum junction temperature

#### Static

| Symbol       | Parameter                               | Test Conditions                                                                                | Min | Typ.  | Max.         | Units         |
|--------------|-----------------------------------------|------------------------------------------------------------------------------------------------|-----|-------|--------------|---------------|
| $V_{GS(th)}$ | Gate-Threshold Voltage                  | $V_{DS} = V_{GS}$ , $I_D = -250\mu\text{A}$                                                    | -1  |       |              |               |
| $I_{GSS}$    | Gate-Body Leakage                       | $V_{DS} = 0$ V, $V_{GS} = \pm 20$ V                                                            |     |       | $\pm 100$    | nA            |
| $I_{DSS}$    | Zero Gate Voltage Drain Current         | $V_{DS} = -24$ V, $V_{GS} = 0$ V<br>$V_{DS} = -24$ V, $V_{GS} = 0$ V, $T_J = 55^\circ\text{C}$ |     |       | -1<br>-10    | $\mu\text{A}$ |
| $I_{D(on)}$  | On-State Drain Current <sup>A</sup>     | $V_{DS} = -5$ V, $V_{GS} = -10$ V                                                              | -3  |       |              | A             |
| $I_{DS(on)}$ | Drain-Source On-Resistance <sup>A</sup> | $V_{GS} = -10$ V, $I_D = -2.5$ A<br>$V_{GS} = -4.5$ V, $I_D = -1.9$ A                          |     |       | 0.13<br>0.19 | $\Omega$      |
| $g_{fs}$     | Forward Transconductance <sup>A</sup>   | $V_{DS} = -5$ V, $I_D = -2.5$ A                                                                |     | 3     |              | S             |
| $V_{SD}$     | Diode Forward Voltage                   | $I_S = -1.6$ A, $V_{GS} = 0$ V                                                                 |     | -0.70 |              | V             |

#### Dynamic<sup>b</sup>

| Symbol   | Parameter          | Test Conditions                                       | Min | Typ. | Max. | Units |
|----------|--------------------|-------------------------------------------------------|-----|------|------|-------|
| $Q_g$    | Total Gate Charge  | $V_{DS} = -5$ V, $I_D = -2.5$ A,<br>$V_{GS} = -4.5$ V | --  | 6.0  | --   | nC    |
| $Q_{gs}$ | Gate-Source Charge |                                                       | --  | 0.8  | --   | nC    |
| $Q_{gd}$ | Gate-Drain Charge  |                                                       | --  | 1.3  | --   | nC    |

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| Dynamic <sup>b</sup> |                              |                                                                                                       |     |      |      |       |
|----------------------|------------------------------|-------------------------------------------------------------------------------------------------------|-----|------|------|-------|
| Symbol               | Parameter                    | Test Conditions                                                                                       | Min | Typ. | Max. | Units |
| $t_{d(on)}$          | Turn-On Delay Time           | $V_{DD} = -5\text{ V}$ , $R_L = 5\text{ OHM}$ ,<br>$V_{GEN} = -4.5\text{ V}$ , $R_G = 5\text{ OHM}$ , | --  | 6.5  | --   | ns    |
| $t_r$                | Rise Time                    |                                                                                                       | --  | 20   | --   | ns    |
| $t_{d(off)}$         | Turn-Off Delay Time          |                                                                                                       | --  | 31   | --   | ns    |
| $t_f$                | Fall Time                    |                                                                                                       | --  | 21   | --   | ns    |
| $C_{ISS}$            | Input Capacitance            | P-Channel<br>$V_{DS} = -15\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$f = 1.0\text{ MHz}$                | --  | 451  | --   | pF    |
| $C_{OSS}$            | Output Capacitance           |                                                                                                       | --  | 130  | --   | pF    |
| $C_{RSS}$            | Reverse Transfer Capacitance |                                                                                                       | --  | 33   | --   | pF    |

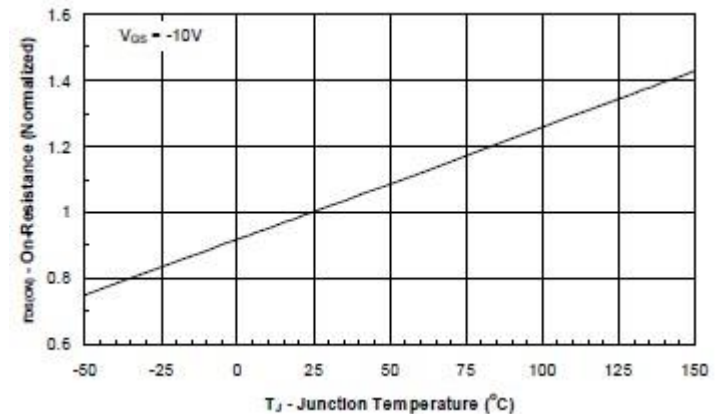
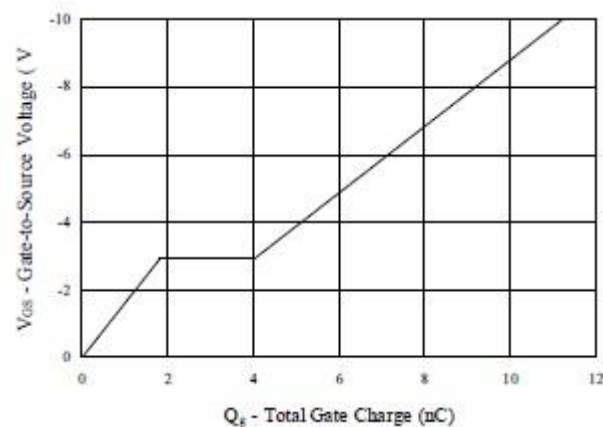
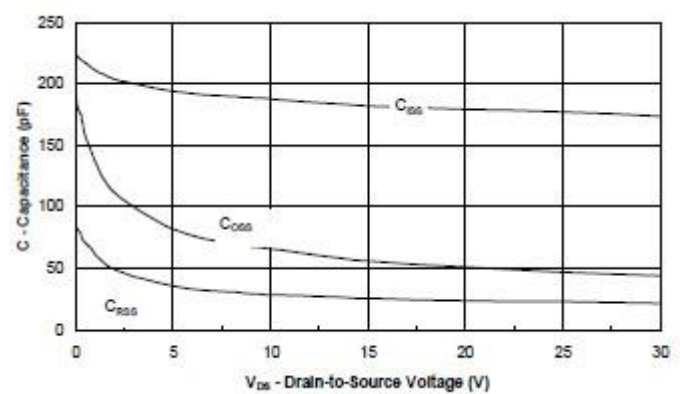
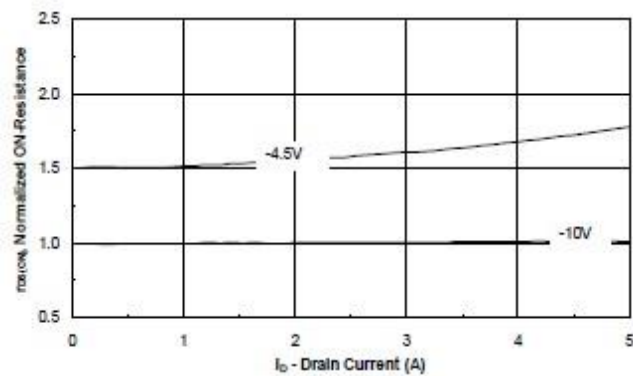
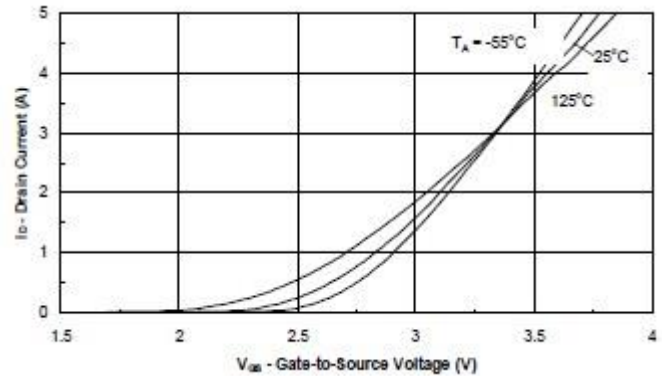
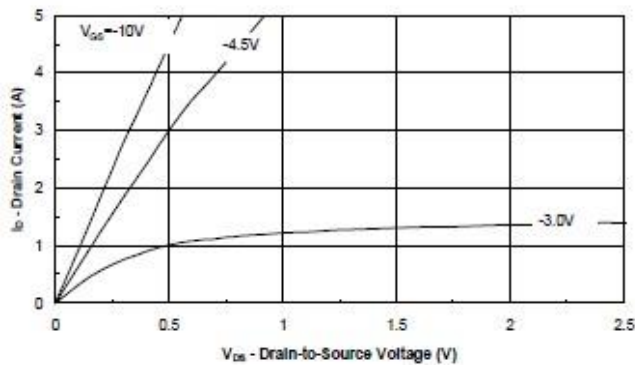
**Notes:**

- Pulse test:  $PW \leq 300\mu s$  duty cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production testing.

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

#### ■ Typical Electrical Characteristics (P-Channel)



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#### Typical Electrical Characteristics (P-Channel)

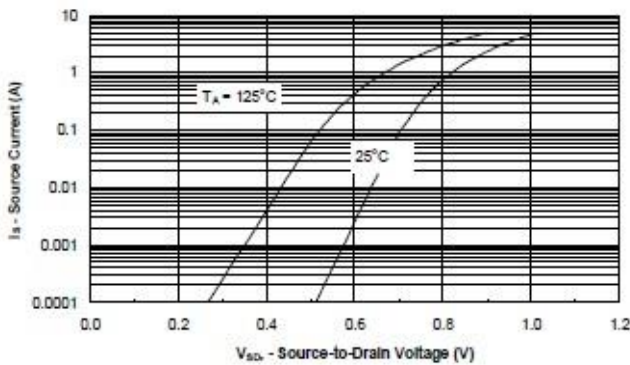


FIG.7- SOURCE-DRAIN DIODE FORWARD VOLTAGE

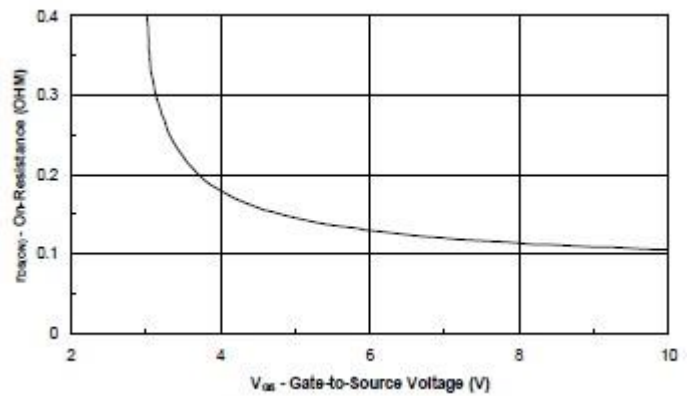


FIG.8- ON-RESISTANCE VS GATO-TO SOURCE VOLTAGE

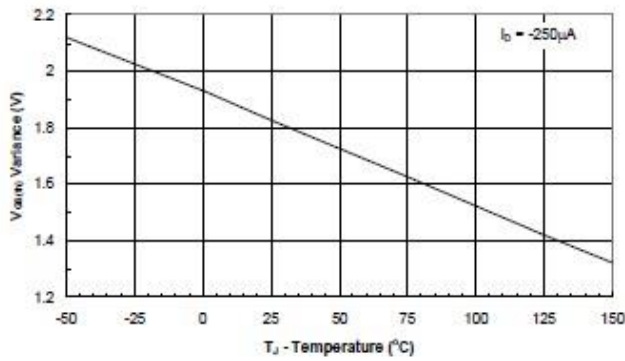


FIG.9-THRESHOLD VOLTAGE

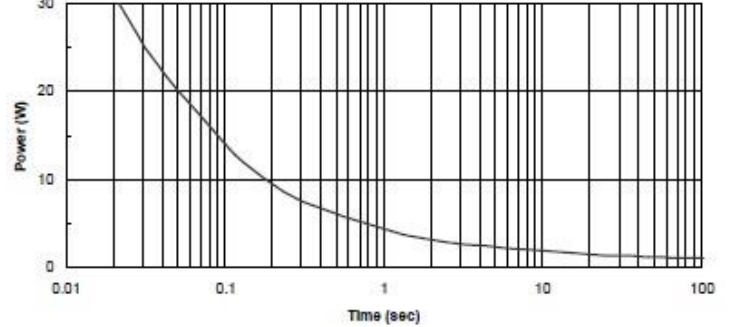


FIG.10-SINGLE PULSE POWER

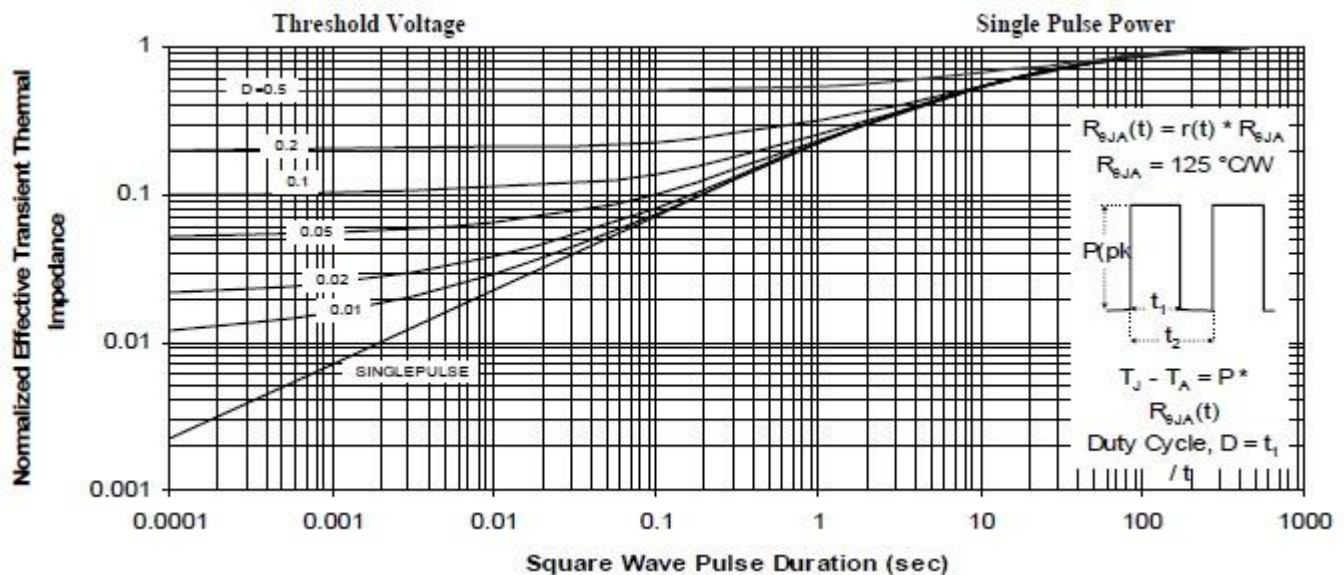


FIG.11-NORMALIZED THERMAL TRANSIENT JUNCTION TO AMBIENT

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