# MS35C31

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

**Description**

These miniature surface mount MOSFETs utilize a high cell density trench process to provide low rDS(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 rDS(on) provides higher efficiency and extends battery life
- Low thermal impedance copper lead frame TSOP-6 saves board space
- Fast switching speed
- High performance trench technology
- RoHS compliant package

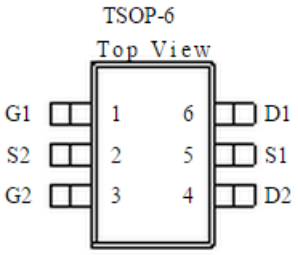
**Packing & Order Information**

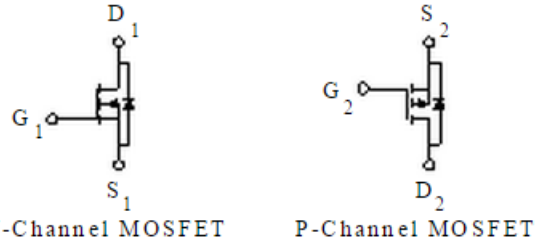
3,000/Reel

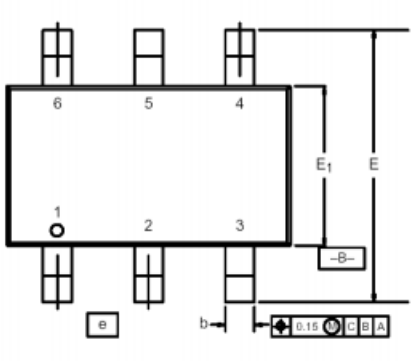


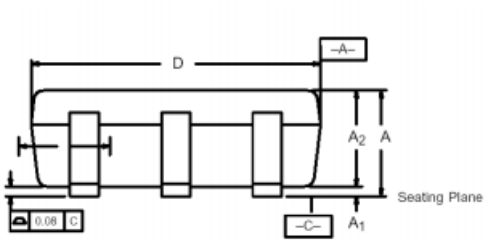
**RoHS**
COMPLIANT

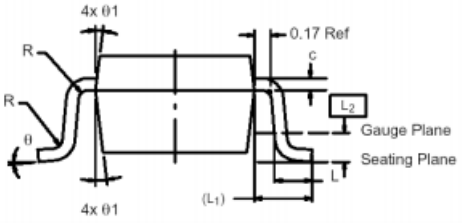
**Graphic symbol**




| Dim | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| | Min | Nom | Max | Min | Nom | Max |
| A | 0.91 | – | 1.10 | 0.036 | – | 0.043 |
| $A_1$ | 0.01 | – | 0.10 | 0.0004 | – | 0.004 |
| $A_2$ | 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 |
| $E_1$ | 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 |
| $L_1$ | 0.60 Ref | | | 0.024 Ref | | |
| $L_2$ | 0.25 BSC | | | 0.010 BSC | | |
| R | 0.10 | – | – | 0.004 | – | – |
| θ | 0° | 4° | 8° | 0° | 4° | 8° |
| $\theta_1$ | 7° Nom | | | 7° Nom | | |


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

| Symbol | Parameter | N-Channel | P-Channel | Unit |
|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 30 | -26.5 | V |
| $V_{GS}$ | Gate-Source Voltage | ±12 | ±12 | V |
| $I_D$ | Continuous Drain Current[a] ($T_A$=25°C) | 3.7 | -2.7 | A |
| | Continuous Drain Current[a] ($T_A$=70°C) | 2.9 | -2.1 | A |
| $I_{DM}$ | Pulsed Drain Current[b] | 8 | -8 | A |
| $I_S$ | Continuous Source Current (Diode Conduction)[a] | 1.05 | -1.05 | A |
| $P_D$ | Power Dissipation[a] ($T_A$ =25°C) | 1.15 | | W |
| | Power Dissipation[a] ($T_A$ =70°C) | 0.7 | | W |
| $T_J/T_{STG}$ | Operating Junction and Storage Temperature Range | -55 to +150 | | °C |

**Thermal Resistance Ratings**

| Symbol | Parameter | N-Channel | | P-Channel | | Units |
|---|---|---|---|---|---|---|
| | | Typ | Max | Typ | Max | |
| $R_{THJA}$ | Maximum Junction-to-Ambient[a] (t <= 10 sec) | 93 | 110 | 93 | 110 | °C/W |
| | Maximum Junction-to-Ambient[a] (Steady-State) | 130 | 150 | 130 | 150 | |

**Notes:**

a. Surface Mounted on 1” x 1” FR4 Board.

b. Pulse width limited by maximum junction temperature

**SPECIFICATIONS (TA = 25°C UNLESS OTHERWISE NOTED)**

| Symbol | Parameter | Test Conditions | Ch | Min | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate-Threshold Voltage | $V_{DS}$ = $V_{GS}$ , $I_D$ = 250μA<br>$V_{DS}$ = $V_{GS}$ , $I_D$ = -250μA | N<br>P | 0.6<br>-0.6 | | | V |
| $I_{GSS}$ | Gate-Body Leakage | $V_{DS}$ = 0 V , $V_{GS}$ = 12 V<br>$V_{DS}$ = 0 V , $V_{GS}$ = -12 V | N<br>P | | | 100<br>-100 | uA |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 21 V , $V_{GS}$ = 0 V<br>$V_{DS}$ = -21 V , $V_{GS}$ = 0 V<br>$V_{DS}$ = 21 V , $V_{GS}$ = 0 V , $T_J$= 55°C<br>$V_{DS}$ = -21 V , $V_{GS}$ = 0 V , $T_J$= 55°C | N<br>P<br>N<br>P | | | 1<br>-1<br>10<br>-10 | uA |
| $I_{D(on)}$ | On-State Drain Current[A] | $V_{DS}$ = 5 V , $V_{GS}$ = 4.5 V<br>$V_{DS}$ = -5 V , $V_{GS}$ = -4.5 V | N<br>P | 5<br>-5 | | | A |
| $r_{DS(on)}$ | Drain-Source On-Resistance[A] | $V_{GS}$ = 4.5 V , $I_D$ = 3.7 A<br>$V_{GS}$ = -4.5 V , $I_D$ = 3.1 A<br>$V_{GS}$ = 2.5 V , $I_D$ = 2.7 A<br>$V_{GS}$ = -2.5 V , $I_D$ = -2.2 A | N<br>P<br>N<br>P | | | 0.058<br>0.112<br>0.08<br>0.17 | Ω |
| $g_{fs}$ | Forward Tranconductance[A] | $V_{DS}$ = 5 V , $I_D$ = 3.7 A<br>$V_{DS}$ = -5 V , $I_D$ = 3.1 A | N<br>P | | 10<br>5 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$ = 1.05 A , $V_{GS}$ = 0 V<br>$I_S$ = -1.05 A , $V_{GS}$ = 0 V | N<br>P | | 0.80<br>-0.83 | | S |


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| Dynamic[b] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Symbol** | **Parameter** | **Test Conditions** | **Ch** | **Min** | **Typ.** | **Max.** | **Units** |
| $Q_g$ | Total Gate Charge | N-Channel<br>$V_{DS}$ = 15 V , $I_D$= 2.7 A , $V_{GS}$ = 4.5 V<br>P-Channel<br>$V_{DS}$ = -15 V , $I_D$= -3.1 A , $V_{GS}$ = -4.5 V | N<br>P | | 6.3<br>3.8 | | nC |
| $Q_{gs}$ | Gate-Source Charge | | N<br>P | | 0.9<br>0.6 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | | N<br>P | | 1.9<br>1.5 | | nC |
| $t_{d(on)}$ | Turn-On Delay Time | N-Channel<br>$V_{DD}$ = 15 V , $V_{GS}$ = 4.5 V ,<br>$R_{GEN}$ = 15 Ω , $I_D$ = 1 A<br>P-Channel<br>$V_{DD}$ = -15 V , $V_{GS}$ = -4.5 V ,<br>$R_{GEN}$ = 15 Ω , $I_D$ = -1 A | N<br>P | | 5<br>5 | | ns |
| $t_r$ | Rise Time | | N<br>P | | 12<br>15 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | N<br>P | | 13<br>20 | | ns |
| $t_f$ | Fall Time | | N<br>P | | 7<br>20 | | ns |

**Notes:**

a. Pulse test: PW <= 300us duty cycle <= 2%.

b. Guaranteed by design, not subject to production testing.


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