# MSQ30P05

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

### Description

The device is the highest performance trench P-ch MOSFETs with extreme high cell density, which provide excellent $R_{DS(ON)}$ and gate charge for most of the synchronous buck converter applications.

The device meets the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

### Features

- $R_{DS(ON)}$ =45mΩ@ $V_{GS}$ =-10V
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- 100% EAS Guaranteed
- Green Device Available

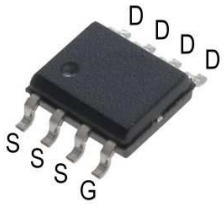
### Typical Applications

- Notebook
- Load Switch
- Battery Protection
- Hand-held Instruments

**Package type**：SOP-8

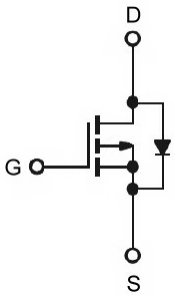
### Packing & Order Information

3,000/Reel

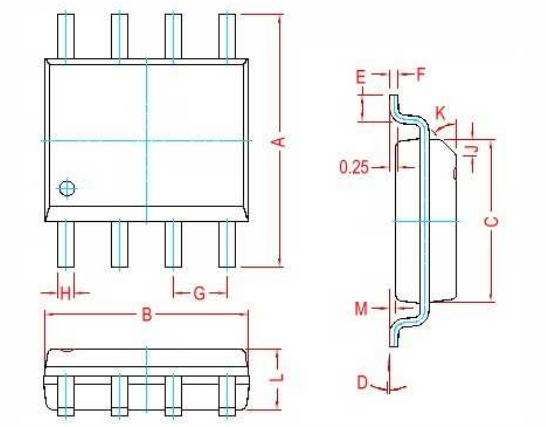



RoHS Compliant

### Graphic Symbol

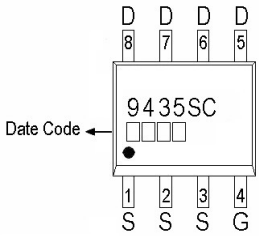



### Package Dimension




| REF. | Millimeter | | REF. | Millimeter | |
|---|---|---|---|---|---|
| | Min. | Max. | | Min. | Max. |
| A | 5.80 | 6.20 | M | 0.10 | 0.25 |
| B | 4.80 | 5.00 | H | 0.35 | 0.51 |
| C | 3.80 | 4.00 | L | 1.35 | 1.75 |
| D | 0° | 8° | J | 0.40 Ref. | |
| E | 0.40 | 0.90 | K | 45° Ref. | |
| F | 0.19 | 0.26 | G | 1.27 Typ. | |

### Marking



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## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | -30 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$ | Continuous Drain Current[1] ($T_A$=25°C) | -5.1 | A |
| | Continuous Drain Current[1] ($T_A$=70°C) | -4.1 | A |
| $I_{DM}$ | Pulsed Drain Current[1,2] | -25 | A |
| $I_{AS}$ | Single Pulse Avalanche Current, L =0.1mH[3] | -19 | A |
| $E_{AS}$ | Single Pulse Avalanche Energy, L =0.1mH[3] | 18 | mJ |
| $P_D$ | Power Dissipation[4] ($T_A$=25°C) | 1.67 | W |
| $T_J/T_{STG}$ | Operating Junction and Storage Temperature | -55 to +150 | °C |

### Thermal Resistance Ratings

| Symbol | Parameter | Maximum | Units |
|---|---|---|---|
| $R_{\theta JA}$ | Maximum Junction-to-Ambient[1] | 75 | °C/W |
| $R_{\theta JC}$ | Maximum Junction-to-Case[1] | 60 | °C/W |

### Electrical Characteristics ($T_J$=25°C unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{GS\ (th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=-250μA | -1.0 | - | -2.5 | V |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_D$=-250μA | -30 | - | - | V |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=-5V, $I_D$=-4A | - | 11 | - | S |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{DS}$=0V, $V_{GS}$=±20V | - | - | ±100 | nA |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=-24V, $V_{GS}$=0V, $T_J$=25°C<br>$V_{DS}$=-24V, $V_{GS}$=0V, $T_J$=55°C | - | - | -1<br>-5 | μA |
| $R_{DS\ (on)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=-10V, $I_D$=-5A<br>$V_{GS}$=-4.5V, $I_D$=-4A | -<br>- | -<br>- | 45<br>82 | mΩ |
| EAS | Single Pulse Avalanche Energy[5] | $V_{DD}$=-25V, L =0.1mH, $I_{AS}$=-10A | 5 | - | - | mJ |
| $V_{SD}$ | Diode Forward Voltage[2] | $I_S$=-2.6A, $V_{GS}$=0V, $T_J$=25°C | - | -0.84 | -1.2 | V |
| $I_S$ | Continuous Source Current[1,6] | $V_G$=$V_D$=0V, Force Current | - | - | -5.1 | A |
| $I_{SM}$ | Pulsed Source Current[2,6] | | - | - | -25 | |

**Notes**

1. The data tested by surface mounted on a 1 inch$^2$ FR-4 board with 2OZ copper.
2. The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%.
3. The EAS data shows maximum rating. The test condition is $V_{DD}$=-25V, $V_{GS}$=-10V, L=0.1mH, $I_{AS}$=-19A.
4. The power dissipation is limited by 150℃ junction temperature.
5. The Min. value is 100% EAS tested guarantee.
6. The data is theoretically the same as $I_D$ and $I_{DM}$, in real applications, should be limited by total power dissipation.

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## Dynamic

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge[2] | $V_{DS}$ =-20V<br>$I_D$ =-4A<br>$V_{GS}$ =-4.5V | -- | 6.4 | -- | nC |
| $Q_{gs}$ | Gate-Source Charge | | -- | 2.3 | -- | |
| $Q_{gd}$ | Gate-Drain Charge | | -- | 2 | -- | |
| $t_{d(on)}$ | Turn-On Delay Time[2] | $V_{DS}$ =-15V<br>$I_D$ =-4A<br>$V_{GS}$ =-10V<br>$R_G$ =3.3Ω | -- | 2.8 | -- | ns |
| $t_r$ | Rise Time | | -- | 8.4 | -- | |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 39 | -- | |
| $t_f$ | Fall Time | | -- | 6 | -- | |
| $C_{ISS}$ | Input Capacitance | $V_{DS}$ =-15V<br>$V_{GS}$ =0V<br>f =1.0MHz | -- | 585 | -- | pF |
| $C_{OSS}$ | Output Capacitance | | -- | 100 | -- | |
| $C_{RSS}$ | Reverse Transfer Capacitance | | -- | 85 | -- | |

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- **Typical Electrical Characteristics**

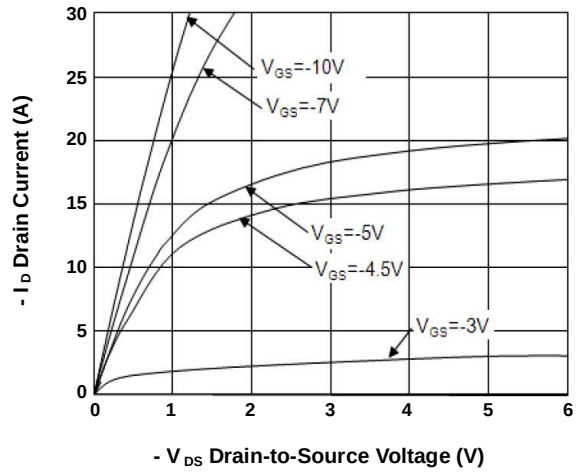


FIG.1-Typical Output Characteristics

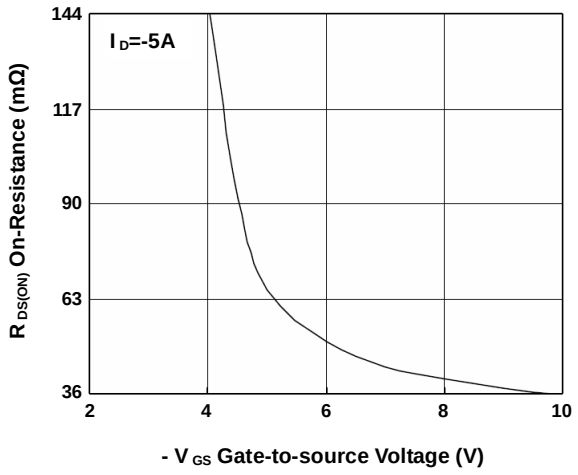


FIG.2-On-Resistance vs. G-S Voltage

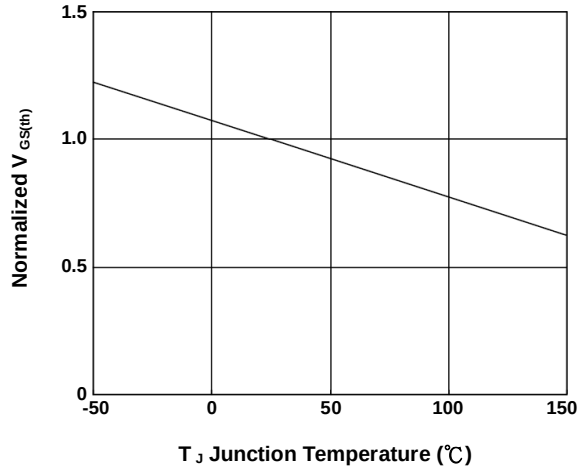


FIG.3-Normalized $V_{GS(th)}$ vs. $T_J$

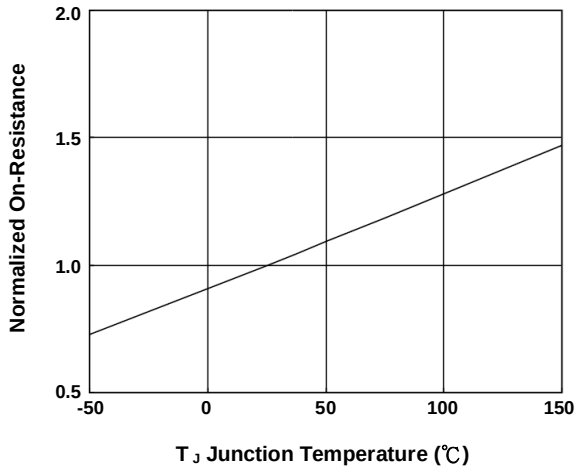


FIG.4-Normalized $R_{DSON}$ vs. $T_J$

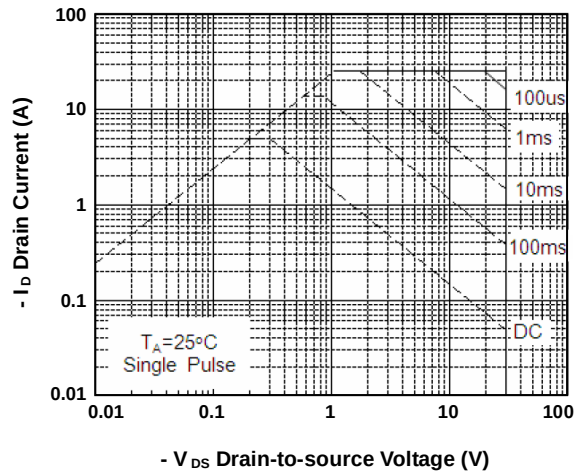


FIG.5-Safe Operating Area

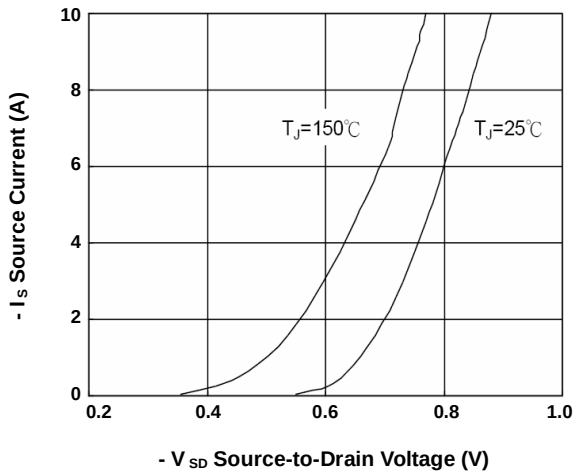


FIG.6-Forward Characteristics of Reverse

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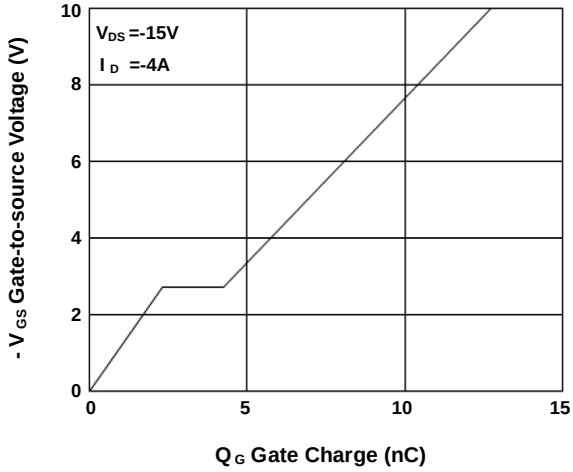


FIG.7-Gate Charge Characteristics

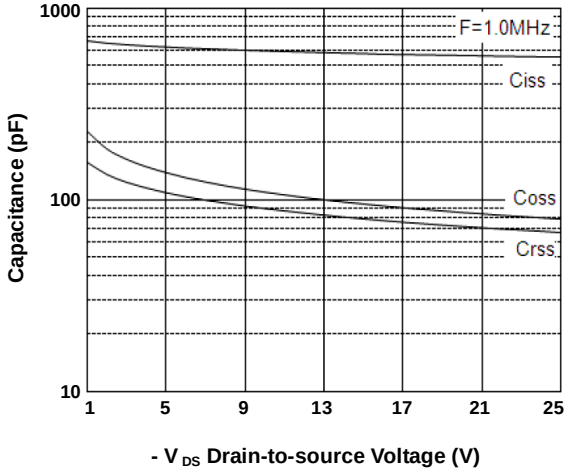


FIG.8-Capacitance Characteristics

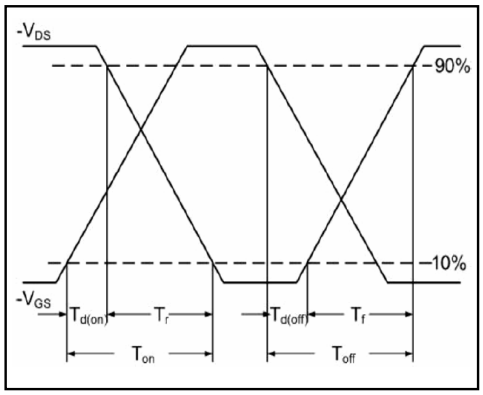


FIG.9-Switching Time Waveform

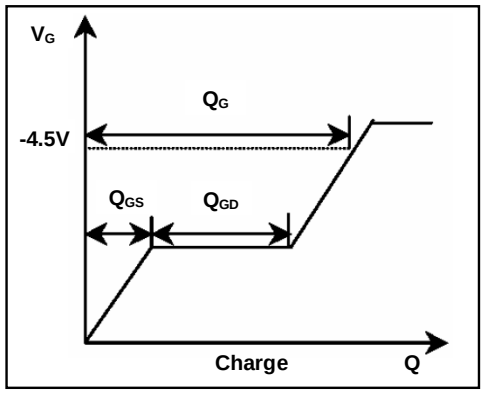


FIG.10-Gate Charge Waveform

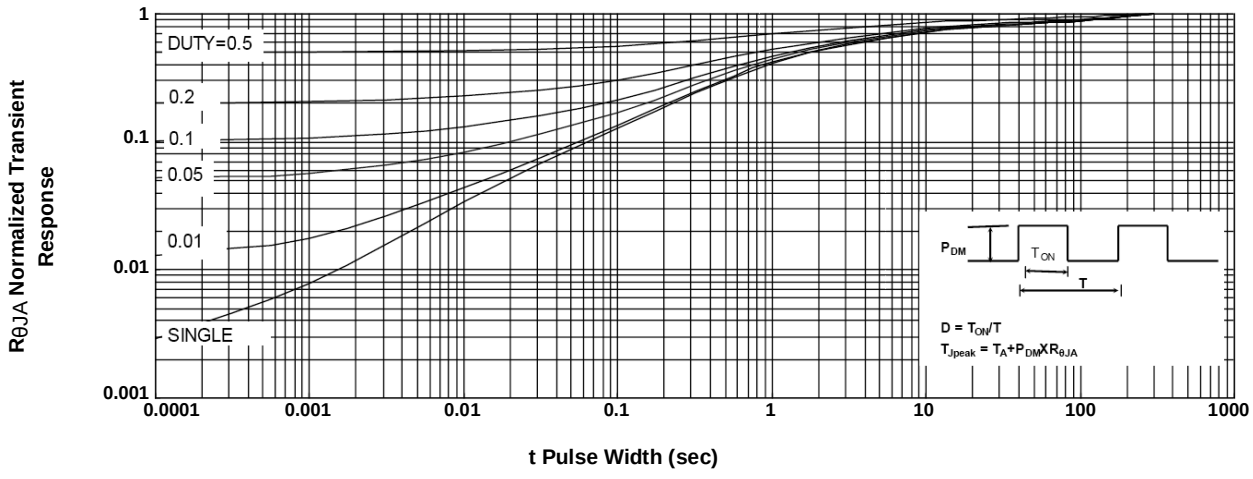


FIG.11-Normalized Maximum Transient Thermal Impedance

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