

## MSQ40P07D

### P-Channel 40-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

- $R_{DS(ON)} = 40m\Omega @ V_{GS} = -10V$
- Super Low Gate Charge
- Excellent  $CdV/dt$  effect decline
- 100% EAS Guaranteed
- Green Device Available

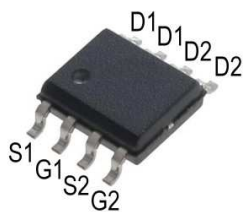
#### Typical Applications

- Motor Drive
- Power Tools
- LED Lighting

Package type : SOP-8

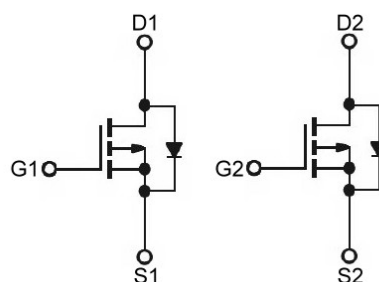
#### Packing & Order Information

3,000/Reel

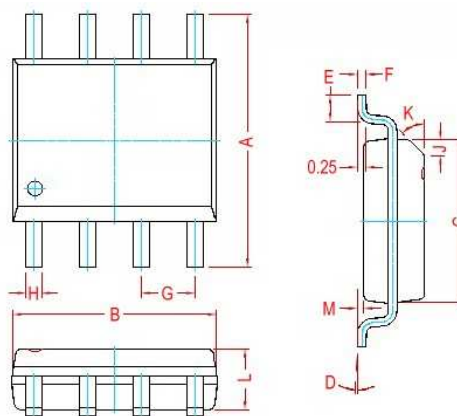


RoHS Compliant

#### Graphic Symbol

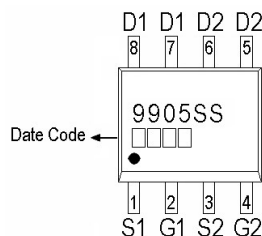


#### Package Dimension



| 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



# MSQ40P07D

## P-Channel 40-V (D-S) MOSFET

### MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

#### Absolute Maximum Ratings

| Symbol        | Parameter                                                          | Value       | Units            |
|---------------|--------------------------------------------------------------------|-------------|------------------|
| $V_{DS}$      | Drain-Source Voltage                                               | -40         | V                |
| $V_{GS}$      | Gate-Source Voltage                                                | $\pm 20$    | V                |
| $I_D$         | Continuous Drain Current <sup>1</sup> ( $T_A = 25^\circ\text{C}$ ) | -6.5        | A                |
|               | Continuous Drain Current <sup>1</sup> ( $T_A = 70^\circ\text{C}$ ) | -5.1        | A                |
| $I_{DM}$      | Pulsed Drain Current <sup>1,2</sup>                                | -13         | A                |
| $I_{AS}$      | Single Pulse Avalanche Current, $L = 0.1\text{mH}^3$               | -27.2       | A                |
| $E_{AS}$      | Single Pulse Avalanche Energy, $L = 0.1\text{mH}^3$                | 37          | mJ               |
| $P_D$         | Power Dissipation <sup>4</sup> ( $T_C = 25^\circ\text{C}$ )        | 2.5         | W                |
| $T_J/T_{STG}$ | Operating Junction and Storage Temperature                         | -55 to +150 | $^\circ\text{C}$ |

#### Thermal Resistance Ratings

| Symbol          | Parameter                                | Maximum | Units              |
|-----------------|------------------------------------------|---------|--------------------|
| $R_{\theta JA}$ | Maximum Junction-to-Ambient <sup>1</sup> | 85      | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Maximum Junction-to-Case <sup>1</sup>    | 50      | $^\circ\text{C/W}$ |

#### Electrical Characteristics ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

| Symbol       | Parameter                                      | Test Conditions                                                          | Min. | Typ. | Max.      | Units         |
|--------------|------------------------------------------------|--------------------------------------------------------------------------|------|------|-----------|---------------|
| $V_{GS(th)}$ | Gate Threshold Voltage                         | $V_{DS} = V_{GS}$ , $I_D = -250\mu\text{A}$                              | -1.0 | -    | -2.5      | V             |
| $BV_{DSS}$   | Drain-Source Breakdown Voltage                 | $V_{GS} = 0\text{V}$ , $I_D = -250\mu\text{A}$                           | -40  | -    | -         | V             |
| $g_{fs}$     | Forward Transconductance                       | $V_{DS} = -5\text{V}$ , $I_D = -6\text{A}$                               | -    | 12   | -         | S             |
| $I_{GSS}$    | Gate-Source Leakage Current                    | $V_{DS} = 0\text{V}$ , $V_{GS} = \pm 20\text{V}$                         | -    | -    | $\pm 100$ | nA            |
| $I_{DSS}$    | Drain-Source Leakage Current                   | $V_{DS} = -32\text{V}$ , $V_{GS} = 0\text{V}$ , $T_J = 25^\circ\text{C}$ | -    | -    | -1        | $\mu\text{A}$ |
|              |                                                | $V_{DS} = -32\text{V}$ , $V_{GS} = 0\text{V}$ , $T_J = 55^\circ\text{C}$ | -    | -    | -5        | $\mu\text{A}$ |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance <sup>2</sup> | $V_{GS} = -10\text{V}$ , $I_D = -6\text{A}$                              | -    | -    | 40        | m $\Omega$    |
|              |                                                | $V_{GS} = -4.5\text{V}$ , $I_D = -4\text{A}$                             | -    | -    | 65        | m $\Omega$    |
| EAS          | Single Pulse Avalanche Energy <sup>5</sup>     | $V_{DD} = -25\text{V}$ , $L = 0.1\text{mH}$ , $I_{AS} = -15\text{A}$     | 11.2 | -    | -         | mJ            |
| $V_{SD}$     | Diode Forward Voltage <sup>2</sup>             | $I_S = -6\text{A}$ , $V_{GS} = 0\text{V}$ , $T_J = 25^\circ\text{C}$     | -    | -    | -1.2      | V             |
| $I_S$        | Continuous Source Current <sup>1,6</sup>       | $V_G = V_D = 0\text{V}$ , Force Current                                  | -    | -    | -6.5      | A             |
| $I_{SM}$     | Pulsed Source Current <sup>2,6</sup>           |                                                                          | -    | -    | -13       |               |

#### Notes

1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.
2. The data tested by pulsed, pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .
3. The EAS data shows maximum rating. The test condition is  $V_{DD} = -25\text{V}$ ,  $V_{GS} = -10\text{V}$ ,  $L = 0.1\text{mH}$ ,  $I_{AS} = -27.2\text{A}$ .
4. The power dissipation is limited by  $150^\circ\text{C}$  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.

## MSQ40P07D

P-Channel 40-V (D-S) MOSFET

| Dynamic      |                                 |                                    |      |      |      |          |
|--------------|---------------------------------|------------------------------------|------|------|------|----------|
| Symbol       | Parameter                       | Test Conditions                    | Min. | Typ. | Max. | Units    |
| $Q_g$        | Total Gate Charge <sup>2</sup>  | $V_{DS} = -20V$                    | --   | 9    | --   | nC       |
| $Q_{gs}$     | Gate-Source Charge              | $I_D = -6A$                        | --   | 2.5  | --   |          |
| $Q_{gd}$     | Gate-Drain Charge               | $V_{GS} = -4.5V$                   | --   | 3.1  | --   |          |
| $t_{d(on)}$  | Turn-On Delay Time <sup>2</sup> | $V_{DS} = -15V$                    | --   | 19.2 | --   | ns       |
| $t_r$        | Rise Time                       | $I_D = -1A$                        | --   | 12.8 | --   |          |
| $t_{d(off)}$ | Turn-Off Delay Time             | $V_{GS} = -10V$                    | --   | 48.6 | --   |          |
| $t_f$        | Fall Time                       | $R_G = 3.3\Omega$                  | --   | 4.6  | --   |          |
| $C_{ISS}$    | Input Capacitance               | $V_{DS} = -15V$                    | --   | 1004 | --   | pF       |
| $C_{OSS}$    | Output Capacitance              | $V_{GS} = 0V$                      | --   | 108  | --   |          |
| $C_{RSS}$    | Reverse Transfer Capacitance    | $f = 1.0MHz$                       | --   | 80   | --   |          |
| $R_g$        | Gate Resistance                 | $V_{GS} = V_{DS} = 0V, f = 1.0MHz$ | --   | 16   | --   | $\Omega$ |

#### • Typical Electrical Characteristics

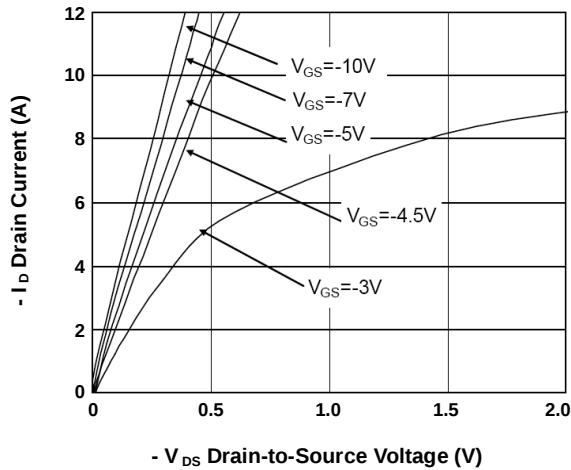


FIG.1-Typical Output Characteristics

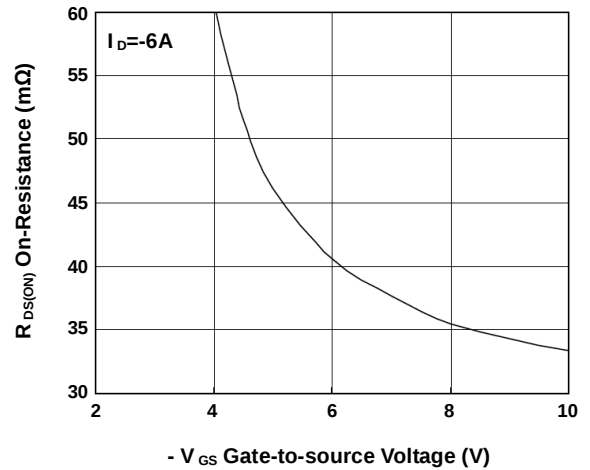


FIG.2-On-Resistance vs. G-S Voltage

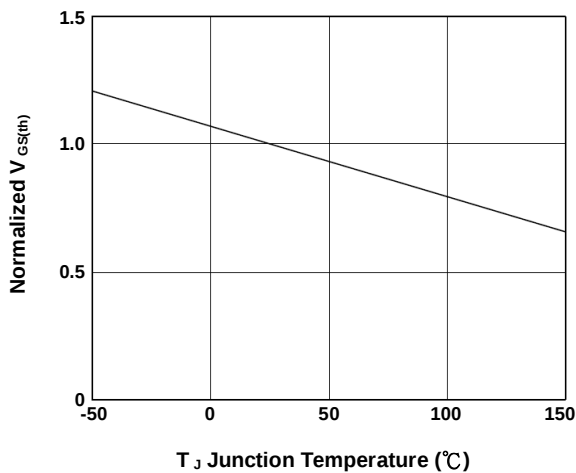


FIG.3-Normalized  $V_{GS(th)}$  vs.  $T_J$

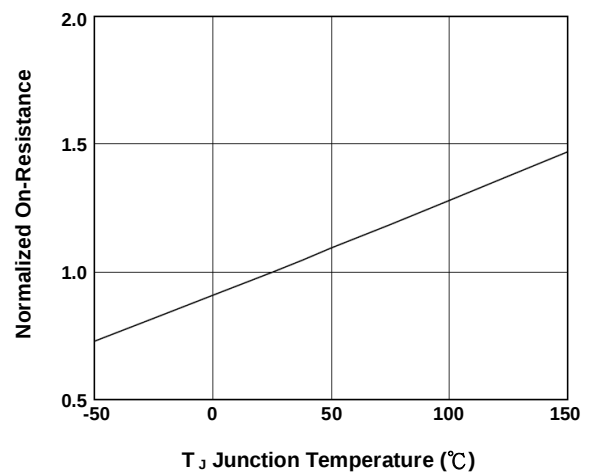


FIG.4-Normalized  $R_{DS(on)}$  vs.  $T_J$

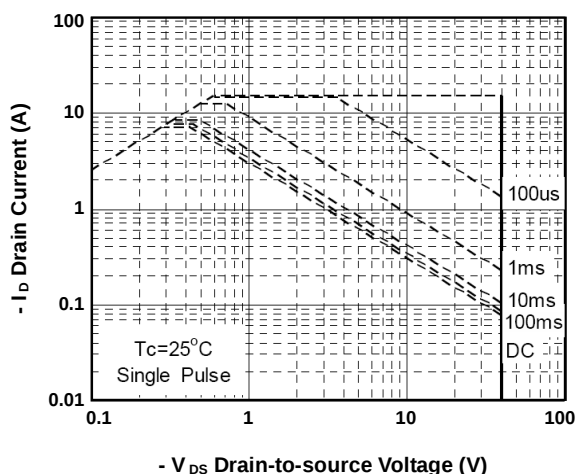


FIG.5-Safe Operating Area

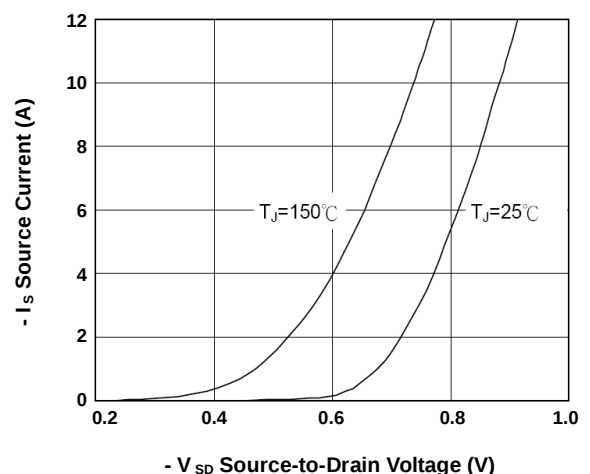


FIG.6-Forward Characteristics of Reverse

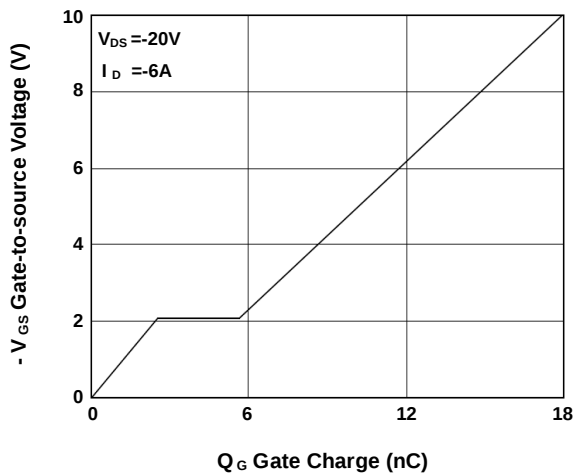


FIG.7-Gate Charge Characteristics

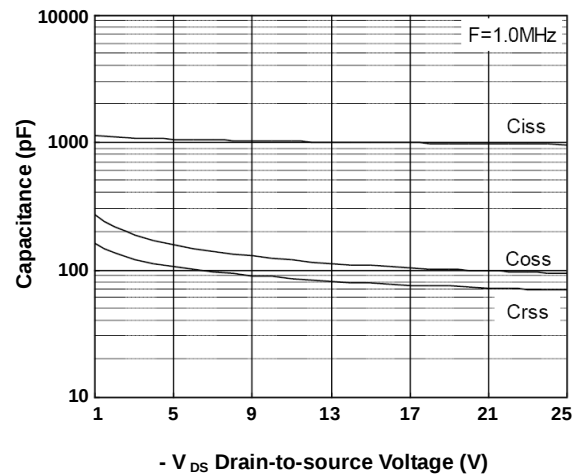


FIG.8-Capacitance Characteristics

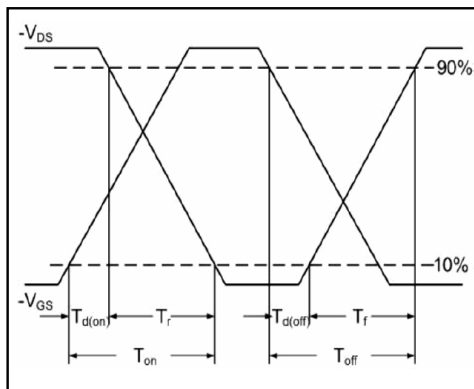


FIG.9-Switching Time Waveform

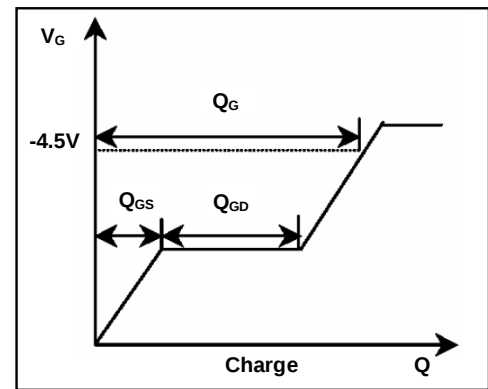


FIG.10-Gate Charge Waveform

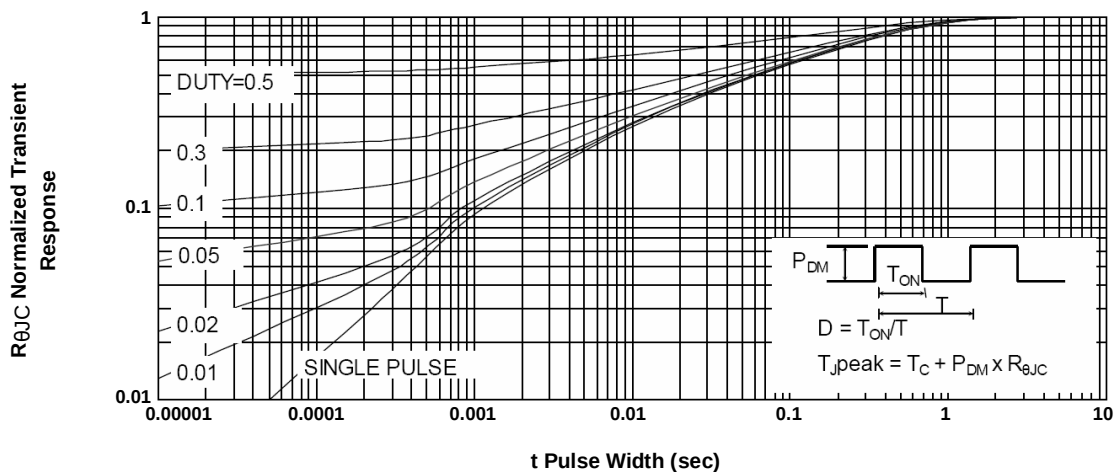


FIG.11-Normalized Maximum Transient Thermal Impedance

**Disclaimer**

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Bruckewell Technology Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Bruckewell"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product. Bruckewell makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Bruckewell disclaims

- (i) Any and all liability arising out of the application or use of any product.
- (ii) Any and all liability, including without limitation special, consequential or incidental damages.
- (iii) Any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Bruckewell's knowledge of typical requirements that are often placed on Bruckewell products in generic applications.

Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time.

Product specifications do not expand or otherwise modify Bruckewell's terms and conditions of purchase, including but not limited to the warranty expressed therein.