

## MSH40N01

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

#### Description

The device is using trench DMOS technology. This advanced technology has been especially tailored to minimize  $R_{DS(ON)}$ , provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.

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

#### Features

- $R_{DS(ON)} = 1.7m\Omega @ V_{GS} = 10V$
- Super Low Gate Charge
- 100% EAS Guaranteed
- Green Device Available
- AEC-Q101 Qualification Available

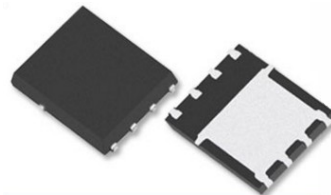
#### Typical Applications

- Power Management in Desktop Computer
- High Frequency Switching
- Synchronous rectifier applications

**Package type :** PDFN 5X6

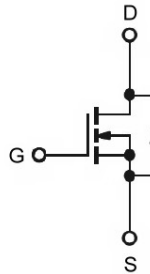
#### Packing & Order Information

3,000/Reel

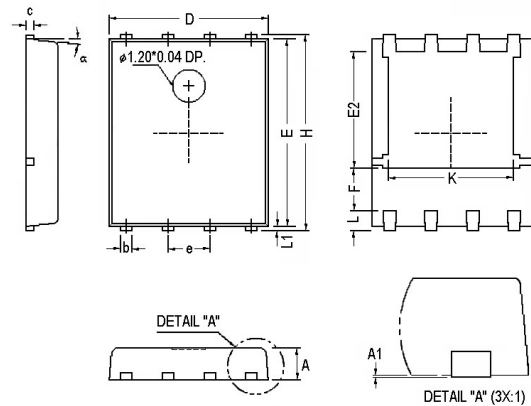


RoHS Compliant

#### Graphic Symbol

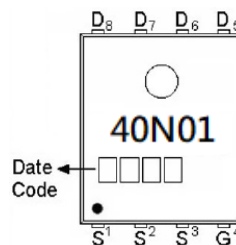


#### Package Dimension



| REF. | Millimeter |      |      | REF.     | Millimeter |      |      |
|------|------------|------|------|----------|------------|------|------|
|      | Min.       | Nom. | Max. |          | Min.       | Nom. | Max. |
| A    | 0.85       | 1.00 | 1.15 | E        | 5.70       | -    | 5.90 |
| A1   | 0.00       | -    | 0.10 | e        | -          | 1.27 | -    |
| b    | 0.30       | -    | 0.51 | H        | 5.90       | -    | 6.20 |
| c    | 0.20       | -    | 0.30 | L        | -          | 0.60 | -    |
| D    | 4.80       | -    | 5.00 | L1       | 0.06       | -    | 0.20 |
| F    | 1.10 Ref.  |      |      | $\alpha$ | 0°         | -    | 12°  |
| E2   | 3.50 Ref.  |      |      | K        | 3.70       | 3.90 | 4.10 |

#### Marking



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#### 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> ( $T_C = 25^\circ\text{C}$ )  | 180        | A                |
|               | Continuous Drain Current <sup>1</sup> ( $T_C = 100^\circ\text{C}$ ) | 125        | A                |
| $I_{DM}$      | Pulsed Drain Current <sup>1,2</sup>                                 | 700        | A                |
| $I_{AS}$      | Single Pulse Avalanche Current, $L = 0.1\text{mH}^3$                | 80         | A                |
| $E_{AS}$      | Single Pulse Avalanche Energy, $L = 0.1\text{mH}^3$                 | 320        | mJ               |
| $P_D$         | Power Dissipation <sup>4</sup> ( $T_C = 25^\circ\text{C}$ )         | 98         | 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> | 45      | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Maximum Junction-to-Case <sup>1</sup>    | 1.4     | $^\circ\text{C/W}$ |

##### 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                         | $V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$                              | 1.2  | 1.6  | 2.2       | V             |
| $BV_{DSS}$   | Drain-Source Breakdown Voltage                 | $V_{GS} = 0\text{V}$ , $I_D = 250\mu\text{A}$                           | 40   | -    | -         | V             |
| $I_{GSS}$    | 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         |               |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance <sup>2</sup> | $V_{GS} = 10\text{V}$ , $I_D = 50\text{A}$                              | -    | 1.4  | 1.7       | m $\Omega$    |
|              |  | $V_{GS} = 4.5\text{V}$ , $I_D = 50\text{A}$                             | -    | 2.1  | 2.6       |               |
| $E_{AS}$     | Single Pulse Avalanche Energy <sup>5</sup>     | $V_{DD} = 25\text{V}$ , $L = 0.1\text{mH}$ , $I_{AS} = 60\text{A}$      | 180  | -    | -         | mJ            |
| $V_{SD}$     | Diode Forward Voltage <sup>2</sup>             | $I_S = 1\text{A}$ , $V_{GS} = 0\text{V}$ , $T_J = 25^\circ\text{C}$     | -    | -    | 1.2       | V             |
| $I_S$        | Continuous Source Current <sup>1,6</sup>       | $V_G = V_D = 0\text{V}$ , Force Current                                 | -    | -    | 180       | A             |
| $I_{SM}$     | Pulsed Source Current <sup>2,6</sup>           |   | -    | -    | 400       |               |

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| Dynamic      |                                 |  |      |      |      |          |
|--------------|---------------------------------|--|------|------|------|----------|
| Symbol       | Parameter                       | Test Conditions  | Min. | Typ. | Max. | Units    |
| $Q_g$        | Total Gate Charge <sup>2</sup>  | $V_{DS}=15V$<br>$I_D=20A$<br>$V_{GS}=10V$                    | --   | 45   | --   | nC       |
| $Q_{gs}$     | Gate-Source Charge              |  | --   | 12   | --   |          |
| $Q_{gd}$     | Gate-Drain Charge               |  | --   | 18.5 | --   |          |
| $t_{d(on)}$  | Turn-On Delay Time <sup>2</sup> | $V_{DS}=15V$<br>$I_D=20A$<br>$V_{GS}=10V$<br>$R_G=3.3\Omega$ | --   | 18.5 | --   | ns       |
| $t_r$        | Rise Time                       |  | --   | 9    | --   |          |
| $t_{d(off)}$ | Turn-Off Delay Time             |  | --   | 58.5 | --   |          |
| $t_f$        | Fall Time                       |  | --   | 32   | --   |          |
| $C_{iss}$    | Input Capacitance               | $V_{DS}=20V$<br>$V_{GS}=0V$<br>$f=1.0MHz$                    | --   | 3972 | --   | pF       |
| $C_{oss}$    | Output Capacitance              |  | --   | 1119 | --   |          |
| $C_{rss}$    | Reverse Transfer Capacitance    |  | --   | 82   | --   |          |
| $R_g$        | Gate Resistance                 | $V_{DS}=0V, V_{GS}=0V, f=1.0MHz$                             | --   | 1.0  | --   | $\Omega$ |

#### Notes

1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
2. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
3. The EAS data shows maximum rating. The test condition is  $V_{DD}=25V$ ,  $V_{GS}=10V$ ,  $L=0.1mH$ ,  $I_{AS}=80A$ .
4. The power dissipation is limited by 150°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.

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

- Typical Electrical Characteristics

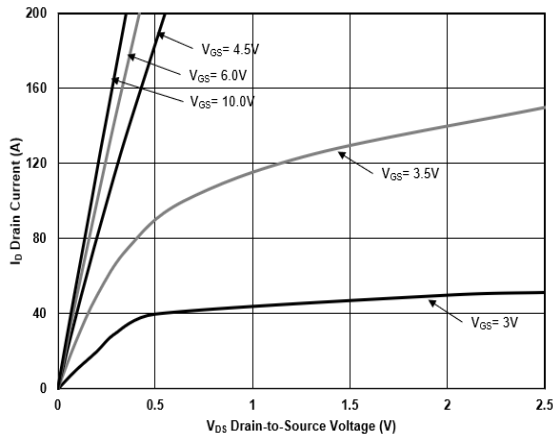


FIG.1-Typical Output Characteristics

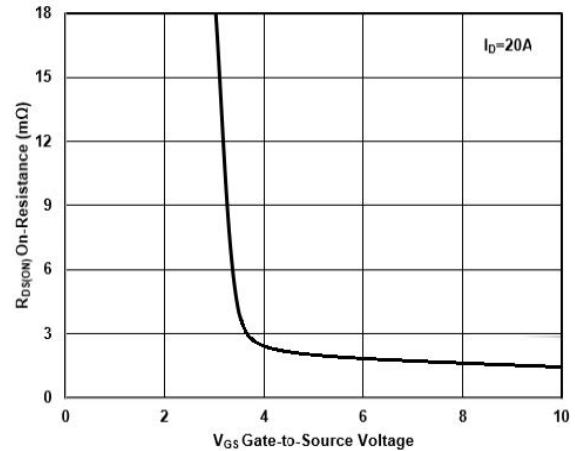


FIG.2-On-Resistance vs. G-S Voltage

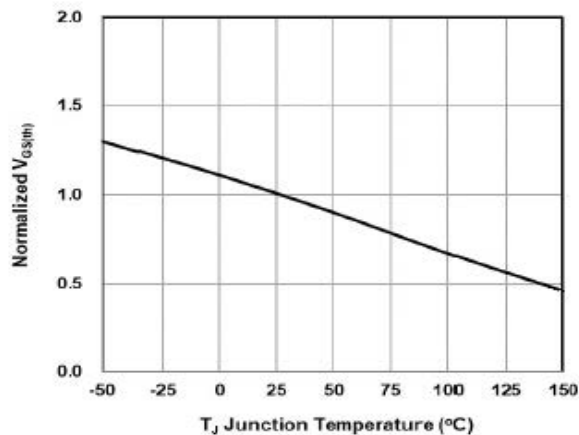


FIG.3-Normalized  $V_{GS(th)}$  vs.  $T_J$

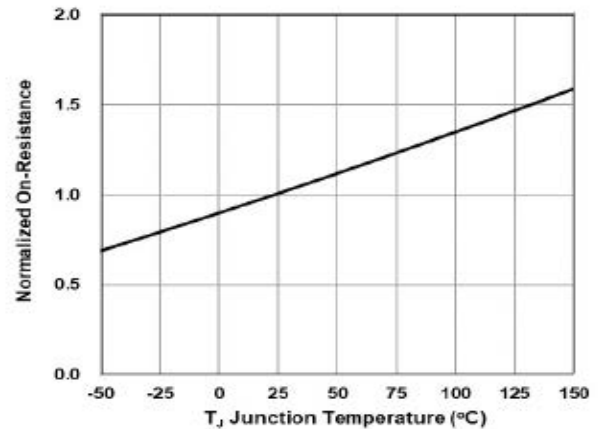


FIG.4-Normalized  $R_{DS(on)}$  vs.  $T_J$

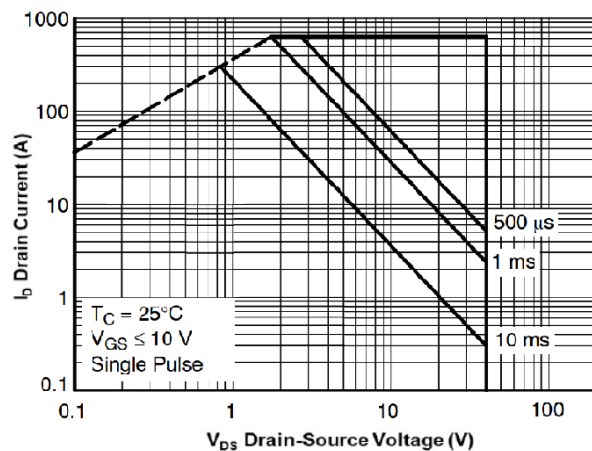


FIG.5-Safe Operating Area

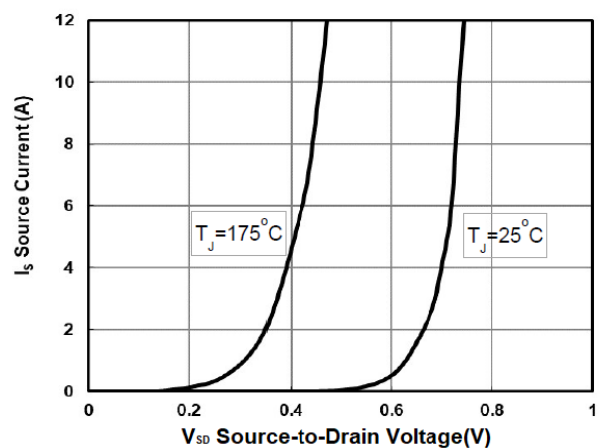


FIG.6-Source Drain Forward Characteristics

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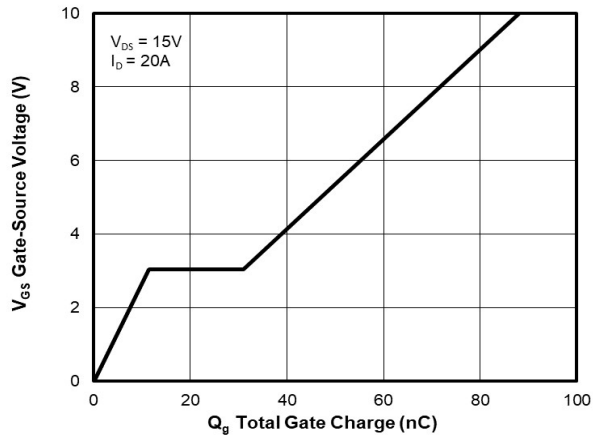


FIG.7-Gate Charge Characteristics

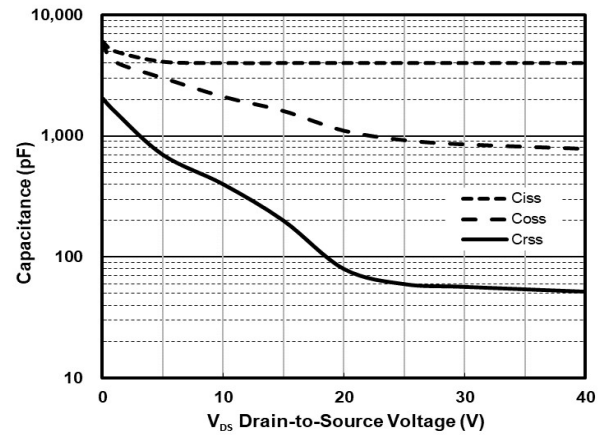


FIG.8-Capacitance Characteristics

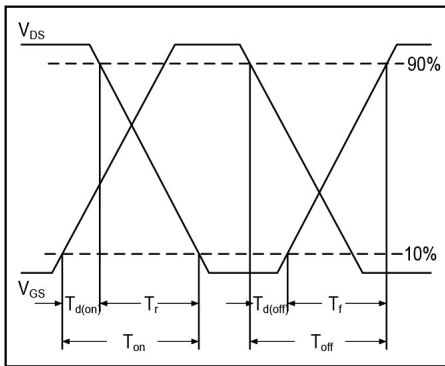


FIG.9-Switching Time Waveform

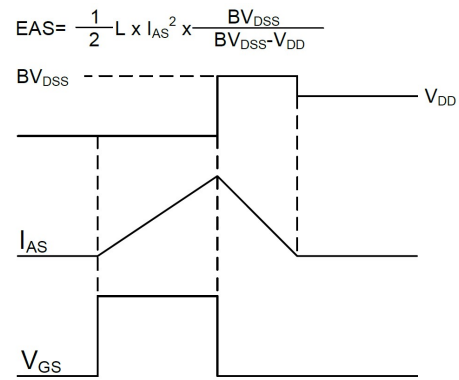


FIG.10-Unclamped Inductive Switching Waveform

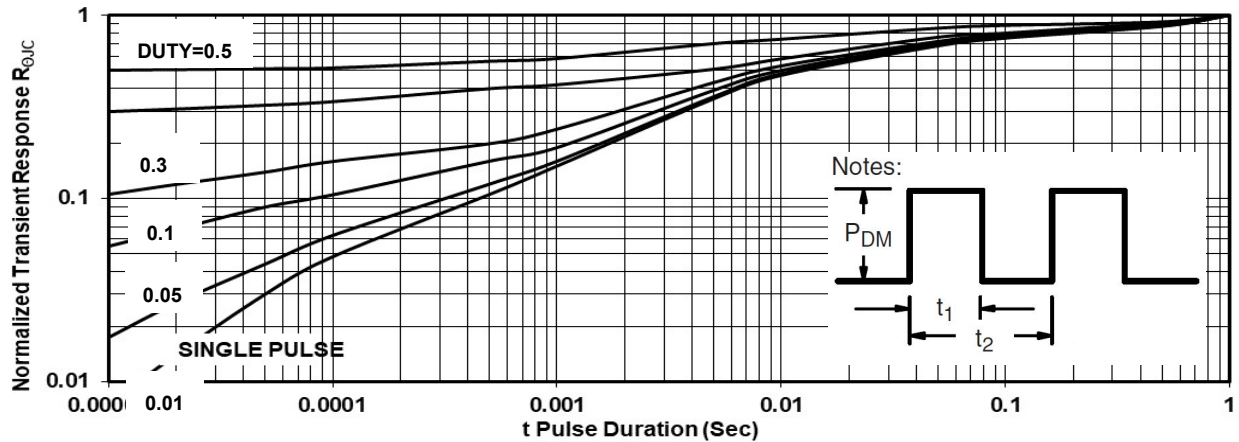


FIG.11-Normalized Maximum Transient Thermal Impedance

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