

### General Description

- 100% UIS Tested
- Advanced Trench Technology
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant
- 100% EAS Guaranteed

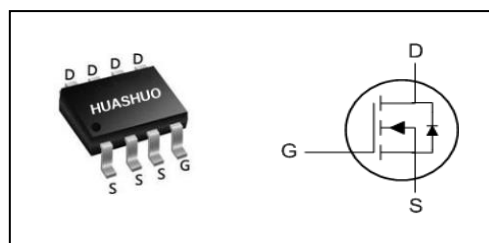
### Applications

- SMPS Synchronous Rectification
- DC/DC Converters
- Or-ing

### Product Summary

|                  |     |            |
|------------------|-----|------------|
| $V_{DS}$         | 40  | V          |
| $R_{DS(ON),typ}$ | 2.5 | m $\Omega$ |
| $I_D$            | 24  | A          |

### SOP-8 Pin Configuration



### Absolute Maximum Ratings

| Symbol                 | Parameter                                      | Rating     | Units       |
|------------------------|------------------------------------------------|------------|-------------|
| $V_{DS}$               | Drain-Source Voltage                           | 40         | V           |
| $V_{GS}$               | Gate-Source Voltage                            | $\pm 20$   | V           |
| $I_D@T_C=25^{\circ}C$  | Continuous Drain Current, $V_{GS} @ 10V_{1,6}$ | 24         | A           |
| $I_D@T_C=100^{\circ}C$ | Continuous Drain Current, $V_{GS} @ 10V_{1,6}$ | 19         | A           |
| $I_{DM}$               | Pulsed Drain Current <sup>2</sup>              | 70         | A           |
| EAS                    | Single Pulse Avalanche Energy <sup>3</sup>     | 80         | mJ          |
| $P_D@T_A=25^{\circ}C$  | Total Power Dissipation <sup>4</sup>           | 3          | W           |
| $T_{STG}$              | Storage Temperature Range                      | -55 to 150 | $^{\circ}C$ |
| $T_J$                  | Operating Junction Temperature Range           | -55 to 150 | $^{\circ}C$ |

### Thermal Data

| Symbol          | Parameter                                        | Typ. | Max. | Unit          |
|-----------------|--------------------------------------------------|------|------|---------------|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient <sup>1</sup> | ---  | 75   | $^{\circ}C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case <sup>1</sup>    | ---  | 40   | $^{\circ}C/W$ |

**N-Ch 40V Fast Switching MOSFETs**
**Electrical Characteristics ( $T_J=25\text{ }^{\circ}\text{C}$ , unless otherwise noted)**

| Symbol       | Parameter                                      | Conditions                                                 | Min. | Typ. | Max.      | Unit      |
|--------------|------------------------------------------------|------------------------------------------------------------|------|------|-----------|-----------|
| $BV_{DS}$    | Drain-Source Breakdown Voltage                 | $V_{GS}=0V$ , $I_D=250\mu A$                               | 40   | ---  | ---       | V         |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance <sup>2</sup> | $V_{GS}=10V$ , $I_D=20A$                                   | ---  | 2.5  | 3.2       | $m\Omega$ |
|              |                                                | $V_{GS}=4.5V$ , $I_D=15A$                                  | ---  | 3.8  | 5.3       |           |
| $V_{GS(th)}$ | Gate Threshold Voltage                         | $V_{GS}=V_{DS}$ , $I_D=250\mu A$                           | 1.2  | 1.7  | 2.2       | V         |
| $I_{DSS}$    | Drain-Source Leakage Current                   | $V_{DS}=32V$ , $V_{GS}=0V$ , $T_J=25^{\circ}\text{C}$      | ---  | ---  | 1         | $\mu A$   |
|              |                                                | $V_{DS}=32V$ , $V_{GS}=0V$ , $T_J=55^{\circ}\text{C}$      | ---  | ---  | 5         |           |
| $I_{GSS}$    | Gate-Source Leakage Current                    | $V_{GS}=\pm 20V$ , $V_{DS}=0V$                             | ---  | ---  | $\pm 100$ | nA        |
| $g_{fs}$     | Forward Transconductance                       | $V_{DS}=5V$ , $I_D=20A$                                    | ---  | 75   | ---       | S         |
| $R_g$        | Gate Resistance                                | $V_{DS}=0V$ , $V_{GS}=0V$ , $f=1\text{MHz}$                | ---  | 1.5  | ---       | $\Omega$  |
| $Q_g$        | Total Gate Charge (4.5V)                       | $V_{DS}=20V$ , $V_{GS}=4.5V$ , $I_D=20A$                   | ---  | 22.7 | ---       | nC        |
| $Q_{gs}$     | Gate-Source Charge                             |                                                            | ---  | 7.5  | ---       |           |
| $Q_{gd}$     | Gate-Drain Charge                              |                                                            | ---  | 5.5  | ---       |           |
| $T_{d(on)}$  | Turn-On Delay Time                             | $V_{DD}=20V$ , $V_{GS}=10V$ , $R_G=3\Omega$ ,<br>$I_D=20A$ | ---  | 10   | ---       | ns        |
| $T_r$        | Rise Time                                      |                                                            | ---  | 5    | ---       |           |
| $T_{d(off)}$ | Turn-Off Delay Time                            |                                                            | ---  | 33   | ---       |           |
| $T_f$        | Fall Time                                      |                                                            | ---  | 6.5  | ---       |           |
| $C_{iss}$    | Input Capacitance                              | $V_{DS}=20V$ , $V_{GS}=0V$ , $f=1\text{MHz}$               | ---  | 2650 | ---       | pF        |
| $C_{oss}$    | Output Capacitance                             |                                                            | ---  | 899  | ---       |           |
| $C_{rss}$    | Reverse Transfer Capacitance                   |                                                            | ---  | 71   | ---       |           |

**Diode Characteristics**

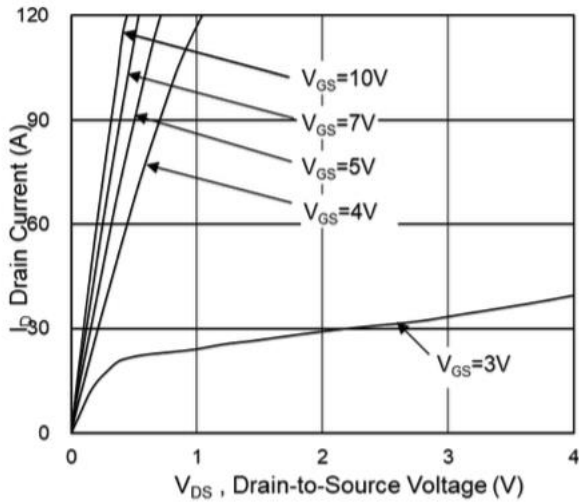
| Symbol   | Parameter                                | Conditions                                        | Min. | Typ. | Max. | Unit |
|----------|------------------------------------------|---------------------------------------------------|------|------|------|------|
| $I_S$    | Continuous Source Current <sup>1,6</sup> | $V_G=V_D=0V$ , Force Current                      | ---  | ---  | 24   | A    |
| $V_{SD}$ | Diode Forward Voltage <sup>2</sup>       | $V_{GS}=0V$ , $I_S=1A$ , $T_J=25^{\circ}\text{C}$ | ---  | ---  | 1    | V    |

Note :

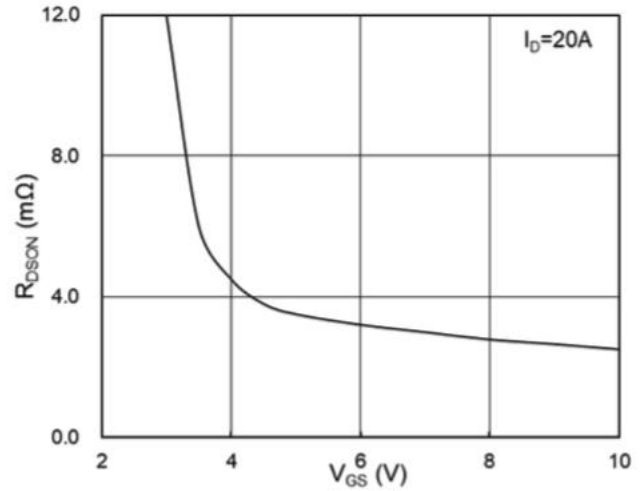
- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
- 2.The data tested by pulsed , pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
- 3.The power dissipation is limited by 150 $^{\circ}\text{C}$  junction temperature
- 4.The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications , should be limited by total power dissipation.



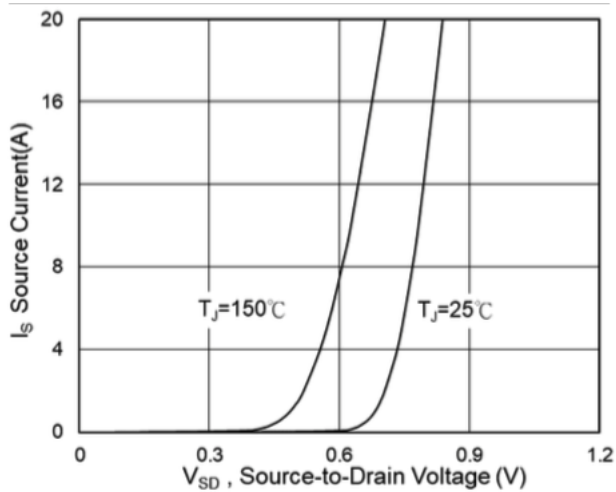
**Typical Characteristics**



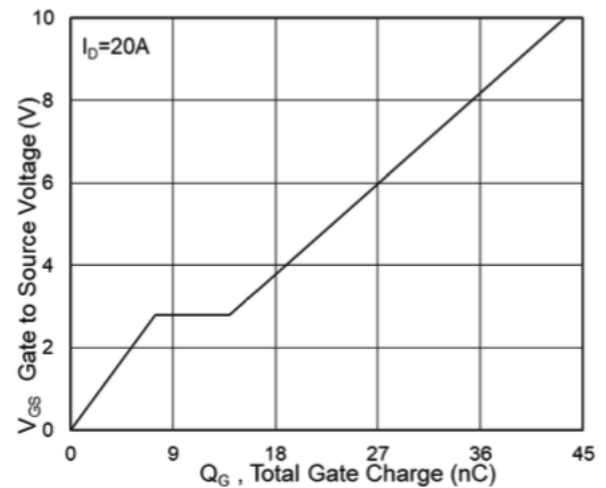
**Fig.1 Typical Output Characteristics**



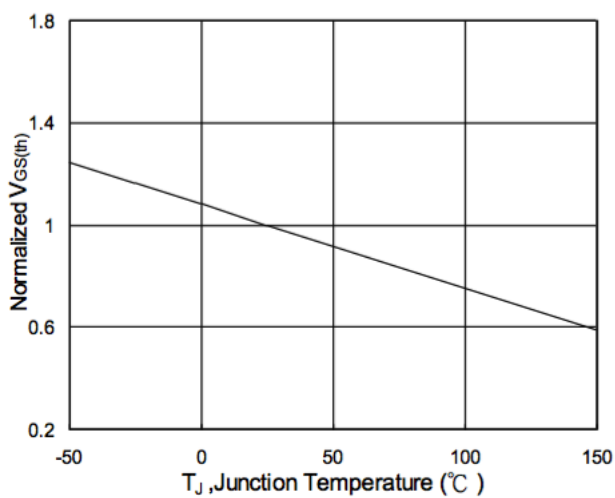
**Fig.2 On-Resistance vs G-S Voltage**



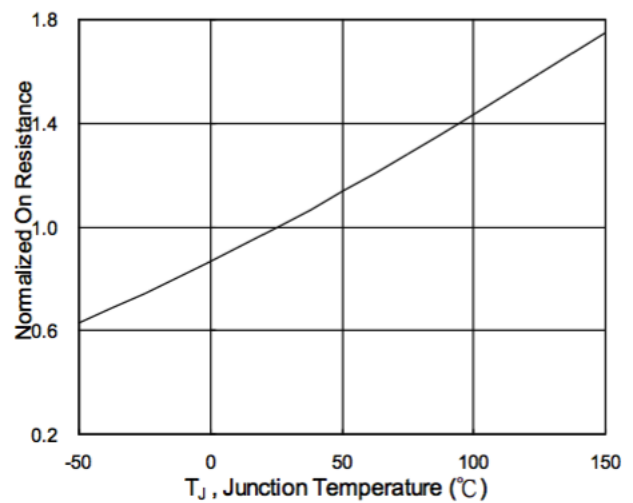
**Fig.3 Source Drain Forward Characteristics**



**Fig.4 Gate-Charge Characteristics**



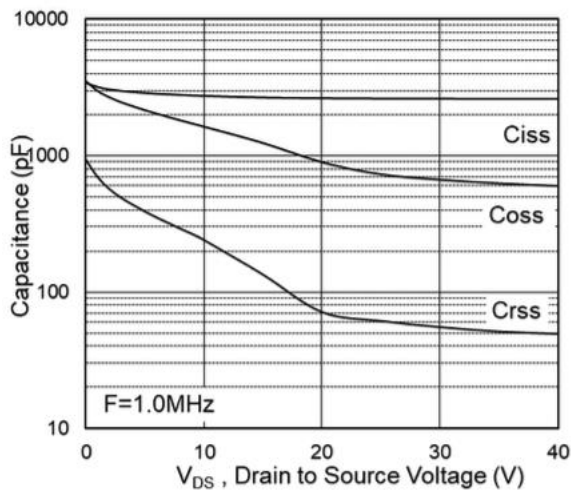
**Fig.5 Normalized  $V_{GS(th)}$  vs  $T_J$**



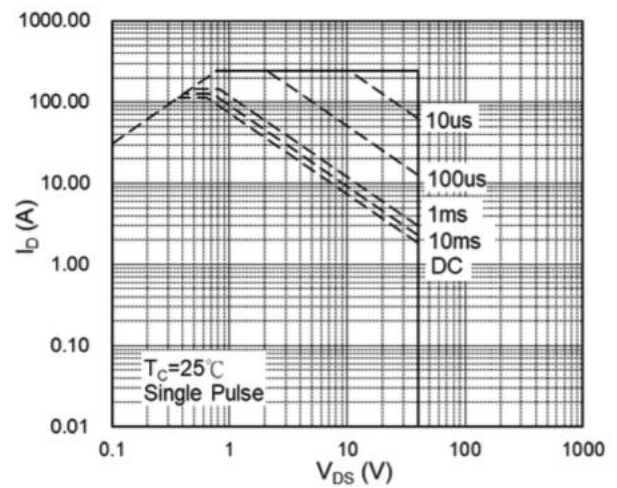
**Fig.6 Normalized  $R_{DS(on)}$  vs  $T_J$**



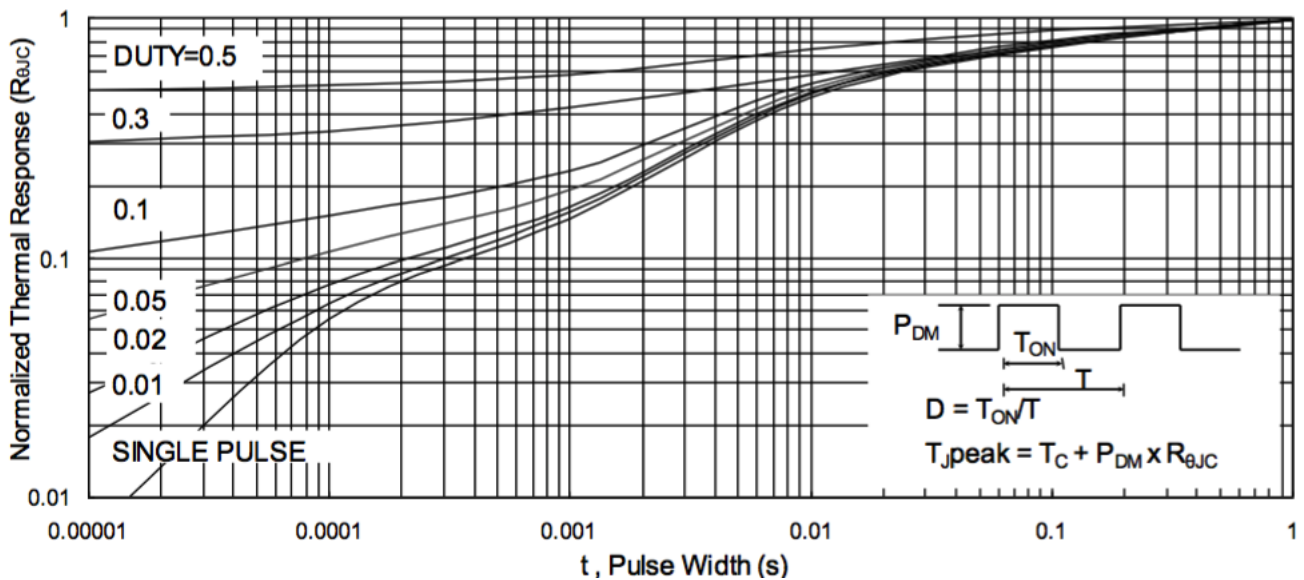
**N-Ch 40V Fast Switching MOSFETs**



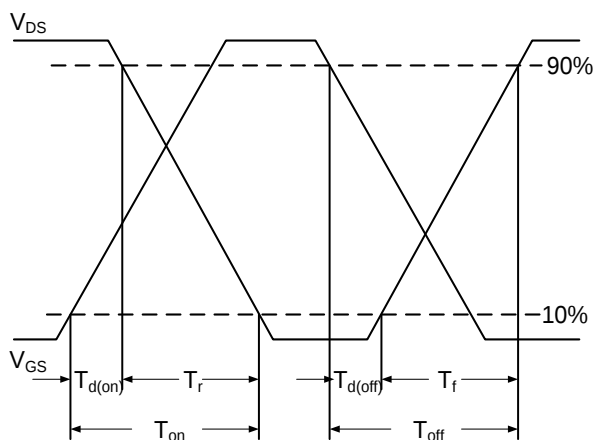
**Fig.7 Capacitance**



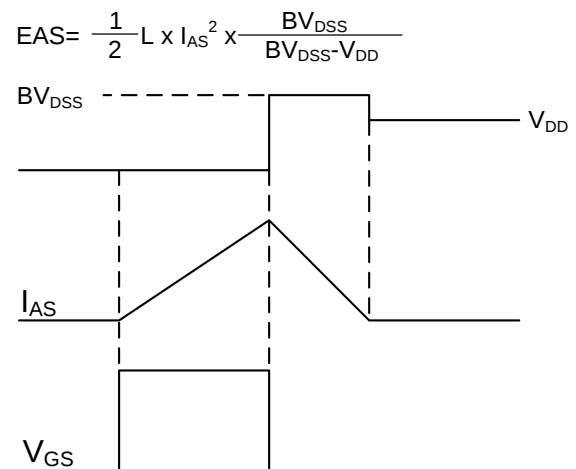
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**



**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Switching**

## Ordering Information

| Part Number | Package code | Packaging      |
|-------------|--------------|----------------|
| HSM4094     | SOP-8        | 4000/Tape&Reel |

