

## Features

- Advance SGT MOS Technology
- Low Gate Charge
- 100% UIS Tested
- Low Gate Charge

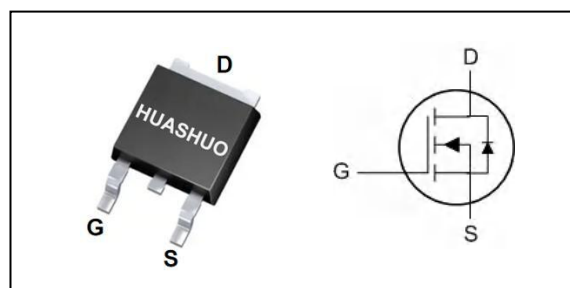
## Product Summary

|                  |     |            |
|------------------|-----|------------|
| $V_{DS}$         | 40  | V          |
| $R_{DS(ON),typ}$ | 4.7 | m $\Omega$ |
| $I_D$            | 50  | A          |

## Applications

- SMPS Synchronous Rectification
- DC/DC Converters
- ORING

## TO-252 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 <sup>1</sup>      | 50         | A           |
| $I_D@T_C=100^{\circ}C$ | Continuous Drain Current <sup>1</sup>      | 31         | A           |
| $I_{DM}$               | Pulsed Drain Current <sup>2</sup>          | 90         | A           |
| EAS                    | Single Pulse Avalanche Energy <sup>3</sup> | 68         | mJ          |
| $I_{AS}$               | Avalanche Current                          | 37         | A           |
| $P_D@T_C=25^{\circ}C$  | Total Power Dissipation <sup>4</sup>       | 70         | 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 (Steady State) <sup>1</sup> | ---  | 55   | $^{\circ}C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case <sup>1</sup>                   | ---  | 1.7  | $^{\circ}C/W$ |

**Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)**

| Symbol              | Parameter                                      | Conditions                                                                            | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------------------------|---------------------------------------------------------------------------------------|------|------|------|------|
| BV <sub>DSS</sub>   | Drain-Source Breakdown Voltage                 | V <sub>GS</sub> =0V, I <sub>D</sub> =250uA                                            | 40   | ---  | ---  | V    |
| R <sub>DS(ON)</sub> | Static Drain-Source On-Resistance <sup>2</sup> | V <sub>GS</sub> =10V, I <sub>D</sub> =15A                                             | ---  | 4.7  | 6.5  | mΩ   |
|                     |                                                | V <sub>GS</sub> =4.5V, I <sub>D</sub> =15A                                            | ---  | 7.5  | 10.5 |      |
| V <sub>GS(th)</sub> | Gate Threshold Voltage                         | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA                              | 1.2  | 1.9  | 2.2  | V    |
| I <sub>DSS</sub>    | Drain-Source Leakage Current                   | V <sub>DS</sub> =32V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C                       | ---  | ---  | 1    | uA   |
|                     |                                                | V <sub>DS</sub> =32V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C                       | ---  | ---  | 5    |      |
| I <sub>GSS</sub>    | Gate-Source Leakage Current                    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                            | ---  | ---  | ±100 | nA   |
| R <sub>g</sub>      | Gate Resistance                                | V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz                                      | ---  | 1.9  | ---  | Ω    |
| Q <sub>g</sub>      | Total Gate Charge                              | V <sub>DS</sub> =20V, V <sub>GS</sub> =10V, I <sub>D</sub> =15A                       | ---  | 20   | ---  | nC   |
| Q <sub>gs</sub>     | Gate-Source Charge                             |                                                                                       | ---  | 3.5  | ---  |      |
| Q <sub>gd</sub>     | Gate-Drain Charge                              |                                                                                       | ---  | 4.2  | ---  |      |
| T <sub>d(on)</sub>  | Turn-On Delay Time                             | V <sub>DD</sub> =20V, V <sub>GS</sub> =10V, R <sub>G</sub> =3Ω<br>I <sub>D</sub> =15A | ---  | 12   | ---  | ns   |
| T <sub>r</sub>      | Rise Time                                      |                                                                                       | ---  | 9.6  | ---  |      |
| T <sub>d(off)</sub> | Turn-Off Delay Time                            |                                                                                       | ---  | 21   | ---  |      |
| T <sub>f</sub>      | Fall Time                                      |                                                                                       | ---  | 16   | ---  |      |
| C <sub>iss</sub>    | Input Capacitance                              | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, f=1MHz                                     | ---  | 950  | ---  | pF   |
| C <sub>oss</sub>    | Output Capacitance                             |                                                                                       | ---  | 493  | ---  |      |
| C <sub>rss</sub>    | Reverse Transfer Capacitance                   |                                                                                       | ---  | 48   | ---  |      |

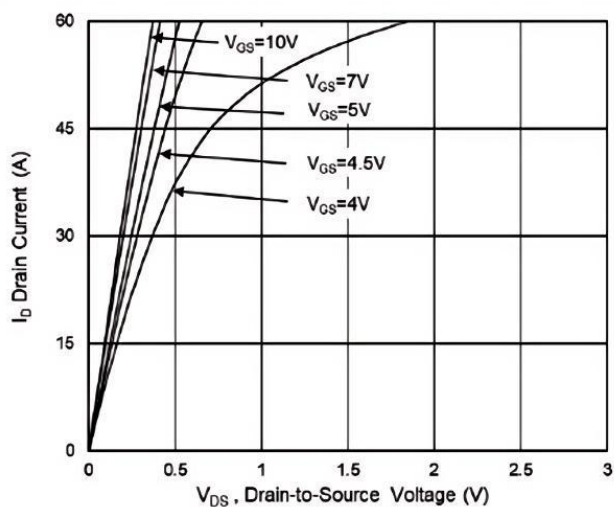
**Diode Characteristics**

| Symbol          | Parameter                                | Conditions                                                    | Min. | Typ. | Max. | Unit |
|-----------------|------------------------------------------|---------------------------------------------------------------|------|------|------|------|
| I <sub>S</sub>  | Continuous Source Current <sup>1,5</sup> | V <sub>G</sub> =V <sub>D</sub> =0V, Force Current             | ---  | ---  | 50   | A    |
| V <sub>SD</sub> | Diode Forward Voltage <sup>2</sup>       | V <sub>GS</sub> =0V, I <sub>S</sub> =1A, T <sub>J</sub> =25°C | ---  | ---  | 1.2  | V    |

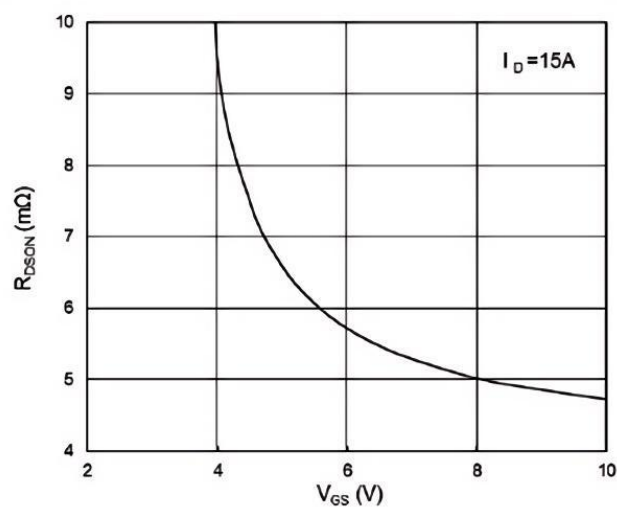
Note :

- 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 ≤ 300us , duty cycle ≤ 2%
- 3.The EAS data shows Max. rating . The test condition is V<sub>DD</sub>=25V, V<sub>GS</sub>=10V, L=0.1mH, I<sub>AS</sub>=37A
- 4.The power dissipation is limited by 150°C junction temperature
- 5.The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub> , in real applications , should be limited by total power dissipation.

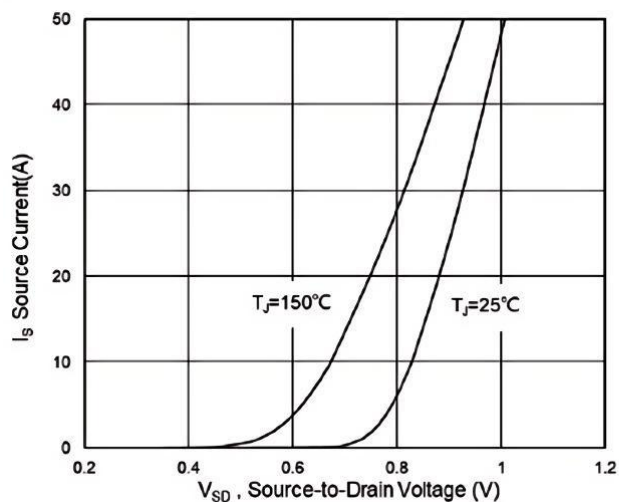
## Typical Characteristics



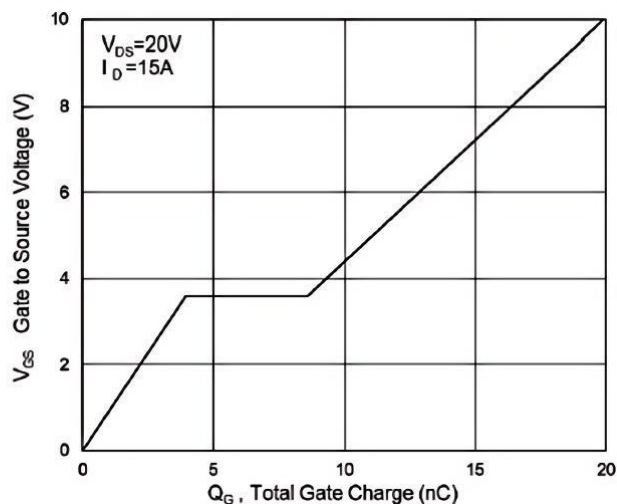
**Fig.1 Typical Output Characteristics**



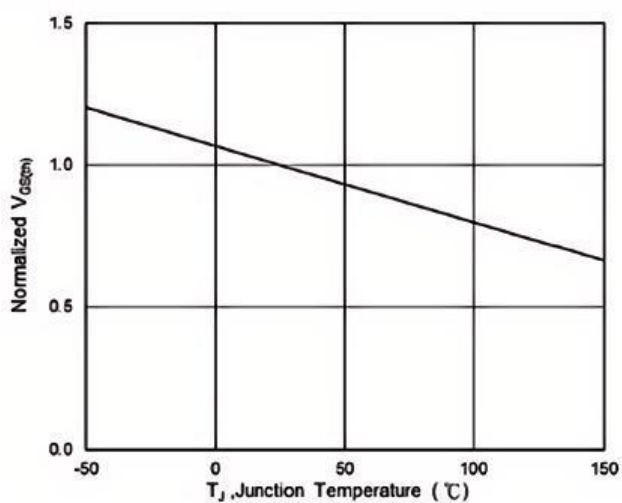
**Fig.2 On-Resistance vs. G-S Voltage**



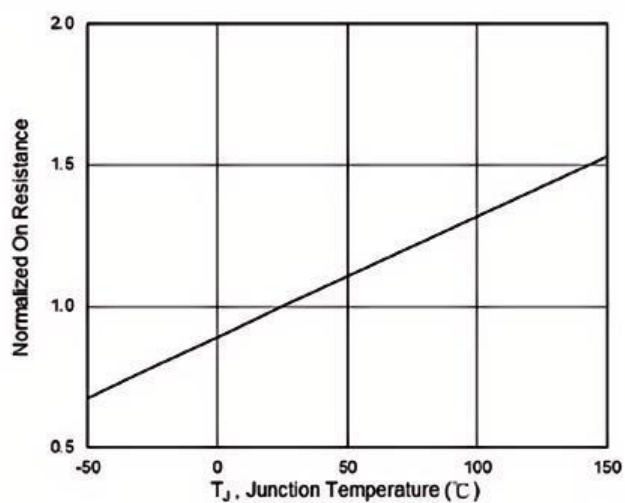
**Fig.3 Source Drain Forward Characteristics**



**Fig.4 Gate-Charge Characteristics**



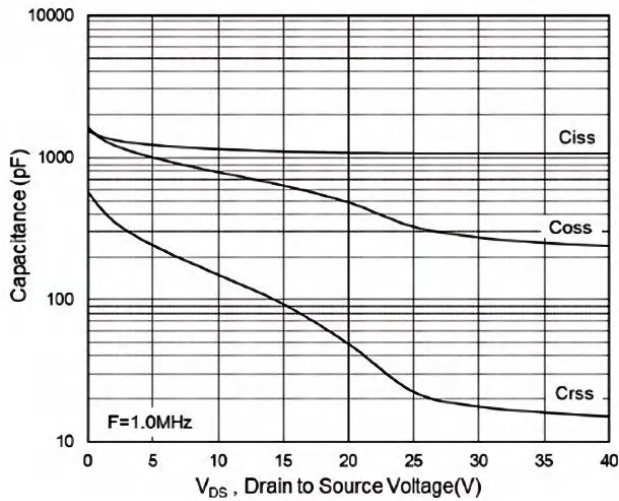
**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**



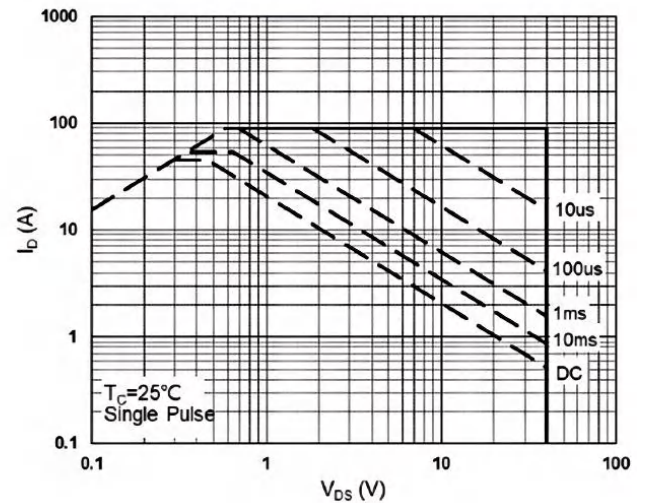
**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**



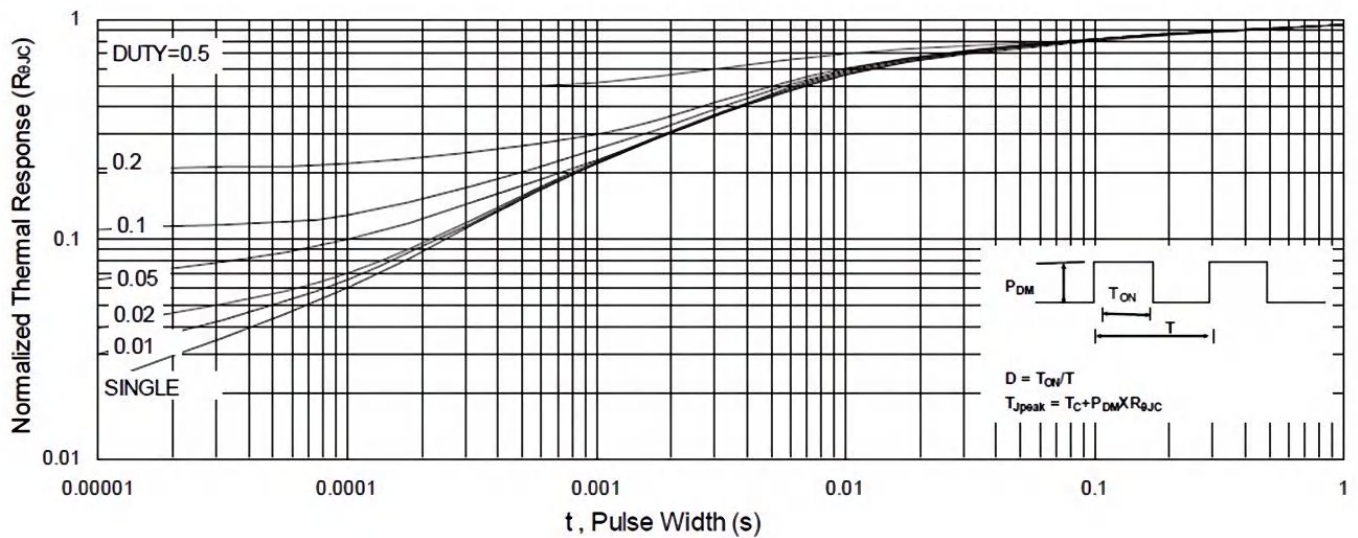
**N-Ch 40V Fast Switching MOSFETs**



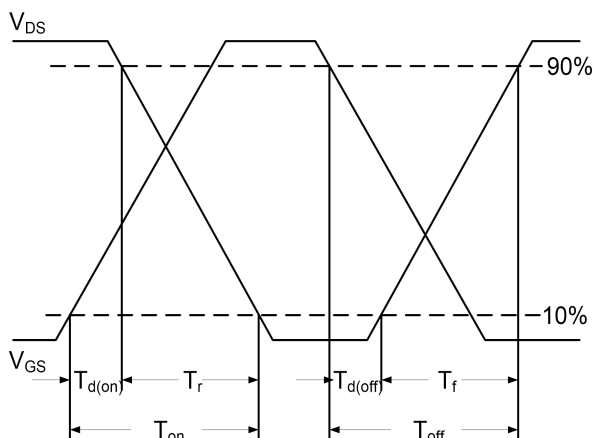
**Fig.7 Capacitance**



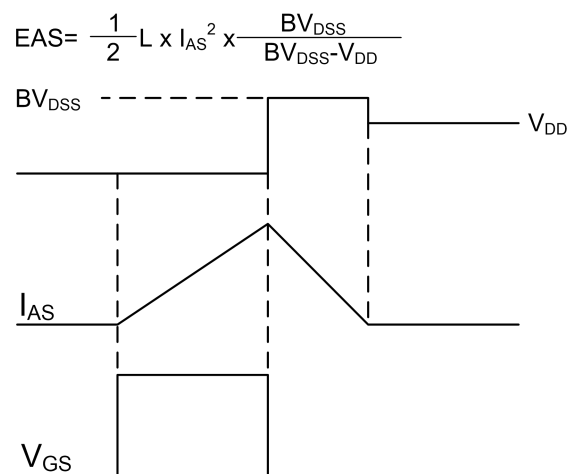
**Fig.8 Safe Operating Area**



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



**Fig.10 Switching Time Waveform**

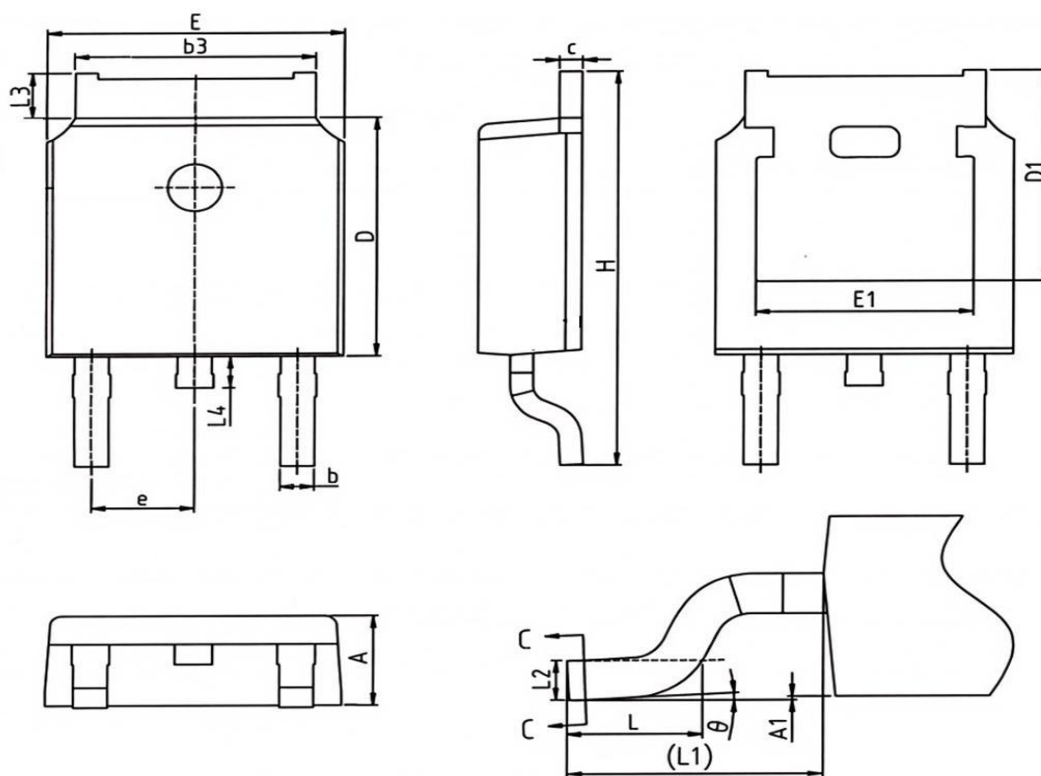


**Fig.11 Unclamped Inductive Waveform**

## Ordering Information

| Part Number | Package code | Packaging      |
|-------------|--------------|----------------|
| HSU4054     | TO252        | 2500/Tape&Reel |

### TO252 Package Outline



| SYMBOLS | MILLIMETERS |      | INCHES   |       |
|---------|-------------|------|----------|-------|
|         | MIN         | MAX  | MIN      | MAX   |
| A       | 2.18        | 2.40 | 0.086    | 0.095 |
| A1      | -           | 0.2  | -        | 0.008 |
| b       | 0.68        | 0.9  | 0.026    | 0.036 |
| b3      | 4.95        | 5.46 | 0.194    | 0.215 |
| C       | 0.43        | 0.89 | 0.017    | 0.035 |
| D       | 5.97        | 6.22 | 0.235    | 0.245 |
| D1      | 5.300REF    |      | 0.209REF |       |
| E       | 6.35        | 6.73 | 0.250    | 0.265 |
| E1      | 4.32        | ---  | 0.170    | -     |
| e       | 2.286BSC    |      | 0.09BSC  |       |
| H       | 9.4         | 10.5 | 0.370    | 0.413 |
| L       | 1.38        | 1.78 | 0.054    | 0.070 |
| L1      | 2.90REF     |      | 0.114REF |       |
| L2      | 0.51BSC     |      | 0.020BSC |       |
| L3      | 0.88        | 1.28 | 0.034    | 0.050 |
| L4      | 0.5         | 1    | 0.019    | 0.039 |
| θ       | 0°          | 8°   | 0°       | 8°    |

## HSU4054 Marking:

