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

## Description

The HSU4006 is the high cell density trenched N-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The HSU4006 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

- 100% EAS Guaranteed
- Green Device Available
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- Advanced high cell density Trench technology

## Product Summary

| | | |
|---|---|---|
| $V_{DS}$ | 40 | V |
| $R_{DS(ON),max}$ | 7.5 | mΩ |
| $I_D$ | 60 | A |

## TO252 Pin Configuration
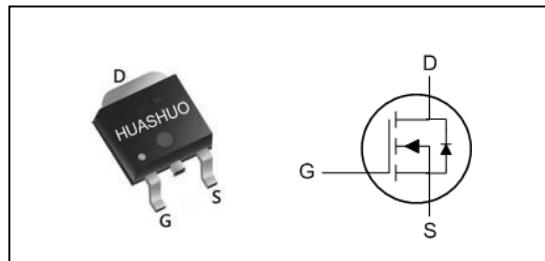


## Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 40 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$@$T_C$=25°C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 60 | A |
| $I_D$@$T_C$=100°C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 45 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 120 | A |
| EAS | Single Pulse Avalanche Energy[3] | 76.1 | mJ |
| $I_{AS}$ | Avalanche Current | 39 | A |
| $P_D$@$T_C$=25°C | Total Power Dissipation[4] | 44.6 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | °C |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | °C |

## Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{θJA}$ | Thermal Resistance Junction-ambient (Steady State)[1] | --- | 62 | °C/W |
| $R_{θJC}$ | Thermal Resistance Junction-Case[1] | --- | 2.8 | °C/W |

## Electrical Characteristics (T$_J$=25 ℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| BV$_{DSS}$ | Drain-Source Breakdown Voltage | V$_{GS}$=0V , I$_D$=250uA | 40 | --- | --- | V |
| $\triangle$BV$_{DSS}$/$\triangle$T$_J$ | BVDSS Temperature Coefficient | Reference to 25℃ , I$_D$=1mA | --- | 0.034 | --- | V/℃ |
| R$_{DS(ON)}$ | Static Drain-Source On-Resistance$^2$ | V$_{GS}$=10V , I$_D$=12A | --- | --- | 7.5 | mΩ |
| | | V$_{GS}$=4.5V , I$_D$=10A | | --- | 10 | |
| V$_{GS(th)}$ | Gate Threshold Voltage | V$_{GS}$=V$_{DS}$ , I$_D$ =250uA | 1.0 | --- | 2.5 | V |
| $\triangle$V$_{GS(th)}$ | V$_{GS(th)}$ Temperature Coefficient | | --- | -4.96 | --- | mV/℃ |
| I$_{DSS}$ | Drain-Source Leakage Current | V$_{DS}$=32V , V$_{GS}$=0V , T$_J$=25℃ | --- | --- | 1 | uA |
| | | V$_{DS}$=32V , V$_{GS}$=0V , T$_J$=55℃ | | --- | 5 | |
| I$_{GSS}$ | Gate-Source Leakage Current | V$_{GS}$=$\pm$20V , V$_{DS}$=0V | --- | --- | $\pm$100 | nA |
| gfs | Forward Transconductance | V$_{DS}$=5V , I$_D$=12A | --- | 39 | --- | S |
| R$_g$ | Gate Resistance | V$_{DS}$=0V , V$_{GS}$=0V , f=1MHz | --- | 1.6 | --- | Ω |
| Q$_g$ | Total Gate Charge (4.5V) | V$_{DS}$=20V , V$_{GS}$=4.5V , I$_D$=12A | --- | 18.8 | | nC |
| Q$_{gs}$ | Gate-Source Charge | | --- | 4.7 | | |
| Q$_{gd}$ | Gate-Drain Charge | | --- | 8.2 | | |
| T$_{d(on)}$ | Turn-On Delay Time | V$_{DD}$=15V , V$_{GS}$=10V , R$_G$=3.3Ω I$_D$=1A | --- | 14.3 | | ns |
| T$_r$ | Rise Time | | --- | 2.6 | | |
| T$_{d(off)}$ | Turn-Off Delay Time | | --- | 77 | | |
| T$_f$ | Fall Time | | --- | 4.8 | | |
| C$_{iss}$ | Input Capacitance | V$_{DS}$=15V , V$_{GS}$=0V , f=1MHz | --- | 2332 | | pF |
| C$_{oss}$ | Output Capacitance | | --- | 193 | | |
| C$_{rss}$ | Reverse Transfer Capacitance | | --- | 138 | | |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| I$_S$ | Continuous Source Current$^{1,5}$ | V$_G$=V$_D$=0V , Force Current | --- | --- | 60 | A |
| I$_{SM}$ | Pulsed Source Current$^{2,5}$ | | --- | --- | 120 | A |
| V$_{SD}$ | Diode Forward Voltage$^2$ | V$_{GS}$=0V , I$_S$=1A , T$_J$=25℃ | --- | --- | 1 | V |

Note :
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 $\leqq$ 300us , duty cycle $\leqq$ 2%
3.The EAS data shows Max. rating . The test condition is V$_{DD}$=25V,V$_{GS}$=10V,L=0.1mH,I$_{AS}$=39A
4.The power dissipation is limited by 150℃ junction temperature
5.The data is theoretically the same as I$_D$ and I$_{DM}$ , in real applications , should be limited by total power dissipation.

**HUASHUO SEMICONDUCTOR**

## Typical Characteristics
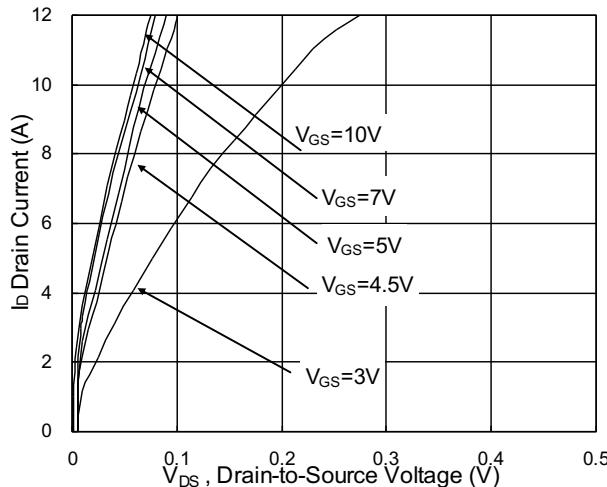
**Fig.1 Typical Output Characteristics**

$V_{GS}=10V$

$V_{GS}=7V$

$V_{GS}=5V$

$V_{GS}=4.5V$

$V_{GS}=3V$

$I_D$ Drain Current (A)

$V_{DS}$ , Drain-to-Source Voltage (V)
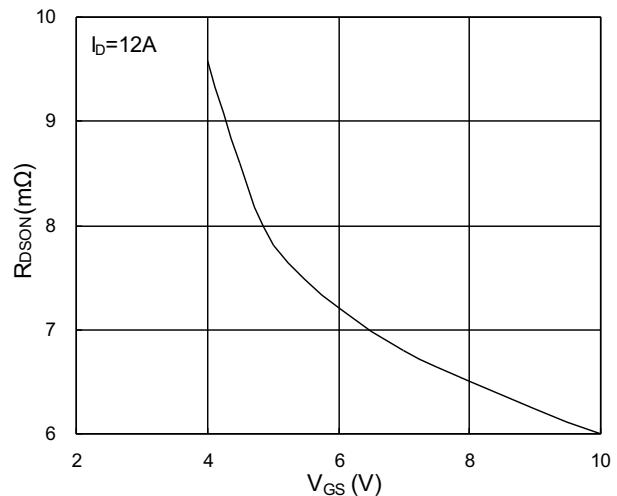
**Fig.2 On-Resistance vs. G-S Voltage**

$I_D=12A$

$R_{DSON}(m\Omega)$

$V_{GS}$ (V)
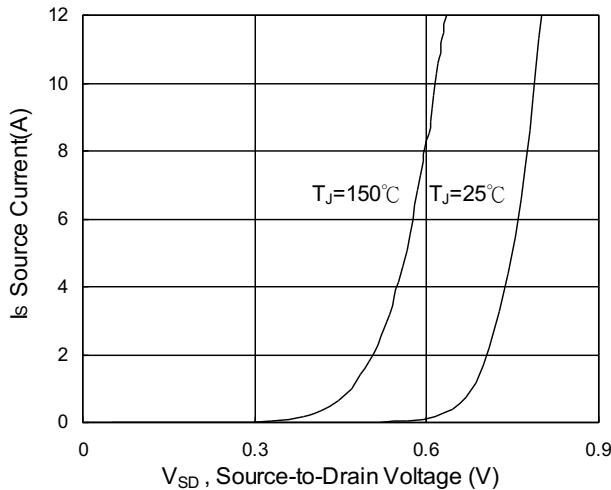
**Fig.3 Forward Characteristics of Reverse**

$I_S$ Source Current(A)

$T_J=150℃$   $T_J=25℃$

$V_{SD}$ , Source-to-Drain Voltage (V)
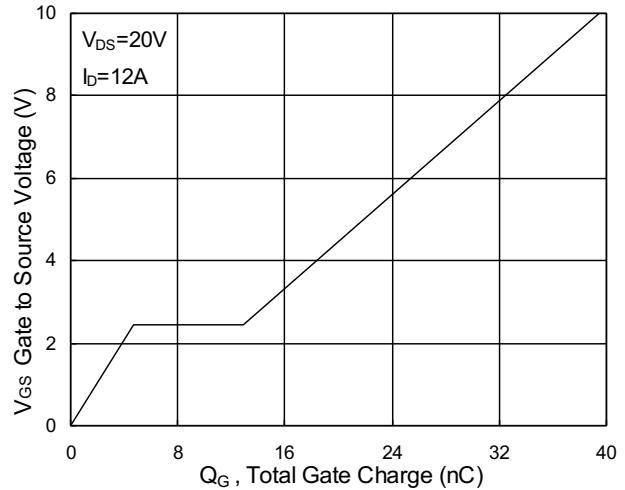
**Fig.4 Gate-Charge Characteristics**

$V_{DS}=20V$

$I_D=12A$

$V_{GS}$ Gate to Source Voltage (V)

$Q_G$ , Total Gate Charge (nC)
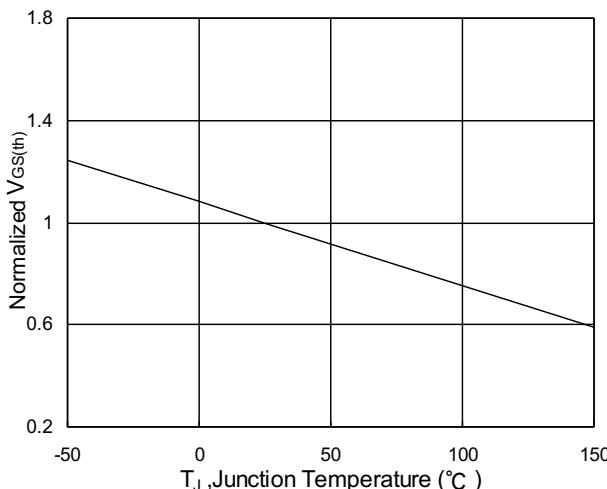
**Fig.5 Normalized $V_{GS(th)}$ vs. $T_J$**

Normalized $V_{GS(th)}$

$T_J$ ,Junction Temperature (℃ )
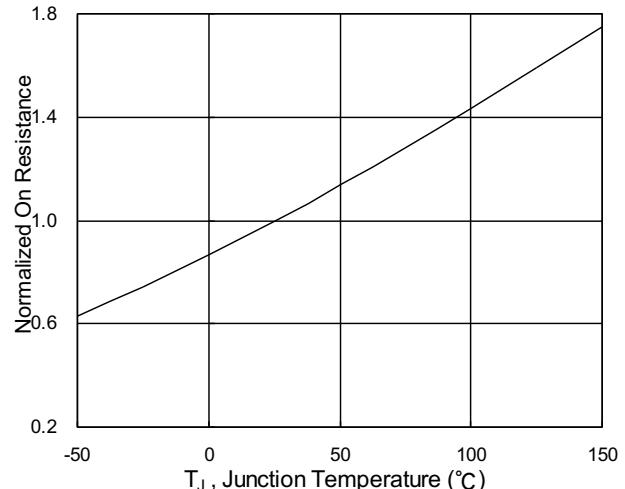
**Fig.6 Normalized $R_{DSON}$ vs. $T_J$**

Normalized On Resistance

$T_J$ , Junction Temperature (℃)
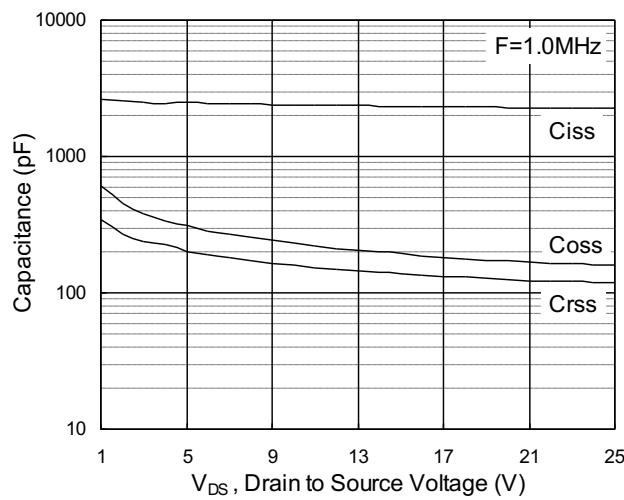
**Fig.7 Capacitance**
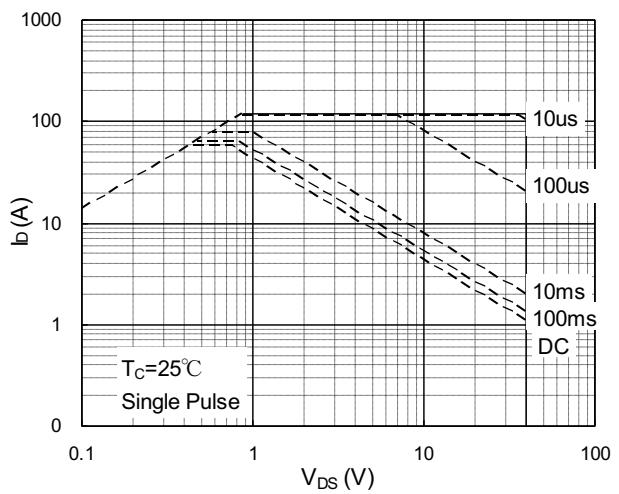
**Fig.8 Safe Operating Area**

$$D = T_{ON}/T$$

$$T_{J}peak = T_C + P_{DM} \times R_{\theta JC}$$
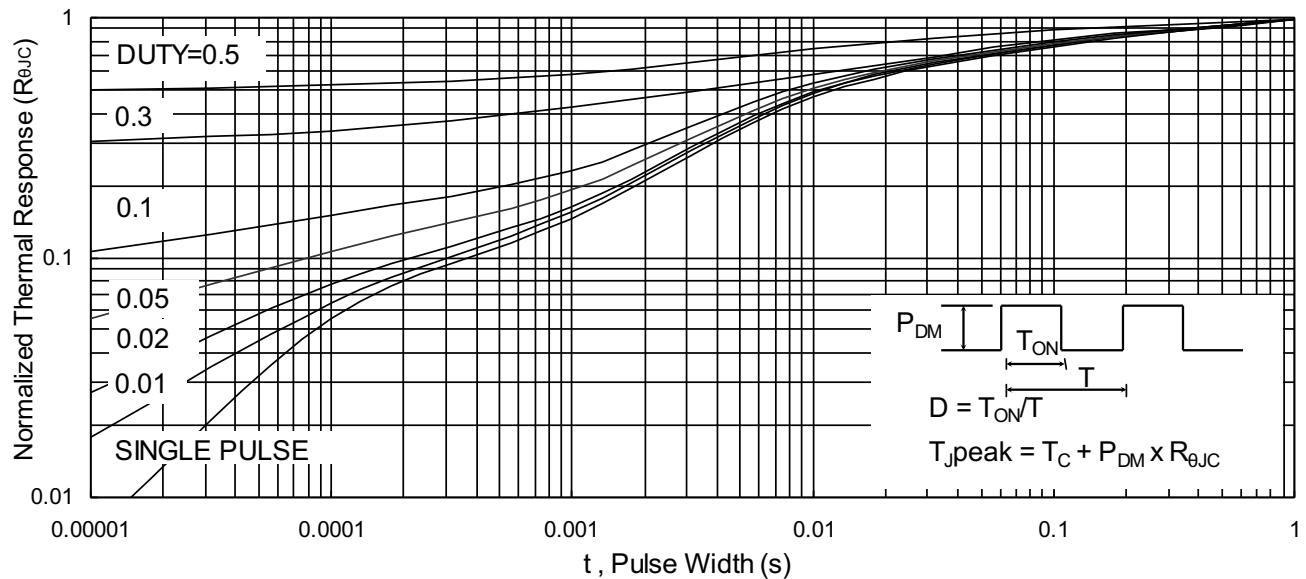
**Fig.9 Normalized Maximum Transient Thermal Impedance**
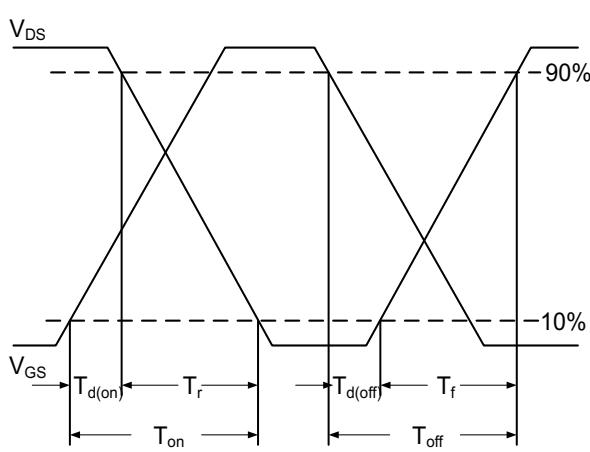
**Fig.10 Switching Time Waveform**

$$EAS = \frac{1}{2}L \times I_{AS}^2 \times \frac{BV_{DSS}}{BV_{DSS}-V_{DD}}$$
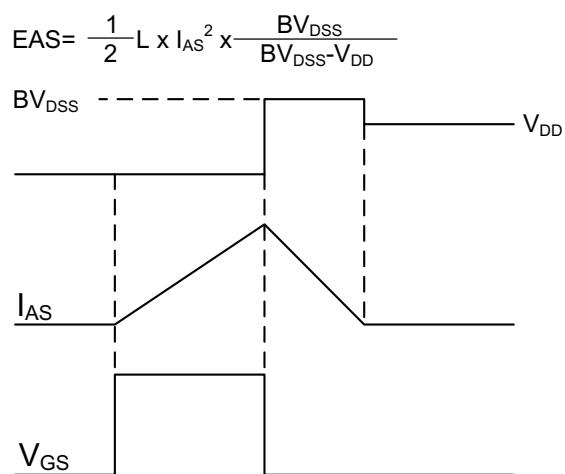
**Fig.11 Unclamped Inductive Waveform**

# Ordering Information

| Part Number | Package code | Packaging |
|---|---|---|
| HSU4006 | TO252-2 | 2500/Tape&Reel |



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 2.200 | 2.400 | 0.087 | 0.094 |
| A1 | 0.000 | 0.127 | 0.000 | 0.005 |
| B | 1.350 | 1.650 | 0.053 | 0.065 |
| b | 0.500 | 0.700 | 0.020 | 0.028 |
| b1 | 0.700 | 0.900 | 0.028 | 0.035 |
| c | 0.430 | 0.580 | 0.017 | 0.023 |
| c1 | 0.430 | 0.580 | 0.017 | 0.023 |
| D | 6.350 | 6.650 | 0.250 | 0.262 |
| D1 | 5.200 | 5.400 | 0.205 | 0.213 |
| E | 5.400 | 5.700 | 0.213 | 0.224 |
| e | 2.300 TYP. | | 0.091 TYP. | |
| e1 | 4.500 | 4.700 | 0.177 | 0.185 |
| L | 9.500 | 9.900 | 0.374 | 0.390 |
| L1 | 2.550 | 2.900 | 0.100 | 0.114 |
| L2 | 1.400 | 1.780 | 0.055 | 0.070 |
| L3 | 0.600 | 0.900 | 0.024 | 0.035 |
| V | 3.800 REF. | | 0.150 REF. | |
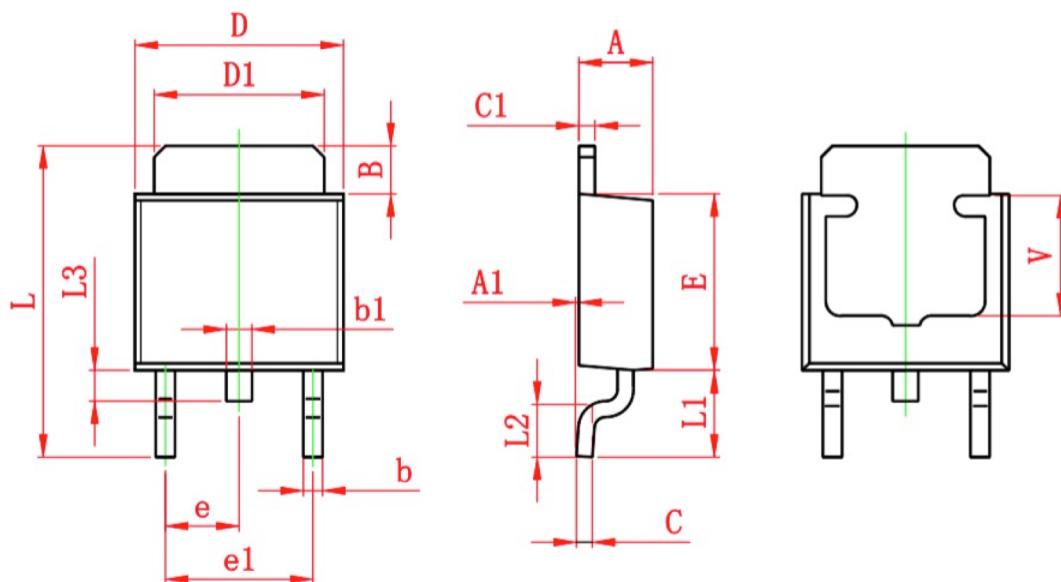
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