HUASHUO SEMICONDUCTOR

# HSBA4006

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

## General Description

The HSBA4006 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 HSBA4006 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

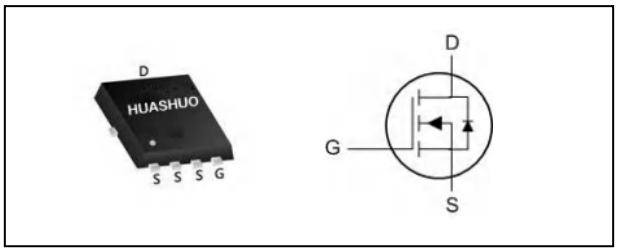
## Product Summary

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

## Features

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

## PRPAK5X6 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℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 60 | A |
| $I_D$@$T_C$=100℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 45 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 120 | A |
| EAS | Single Pulse Avalanche Energy[3] | 76 | mJ |
| $I_{AS}$ | Avalanche Current | 39 | A |
| $P_D$@$T_C$=25℃ | Total Power Dissipation[4] | 46 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | ℃ |

### Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction-ambient (Steady State)[1] | --- | 62 | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case[1] | --- | 2.7 | ℃/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 | 1.5 | 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 | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±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 ≦ 300us , duty cycle ≦ 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.

## Typical Characteristics

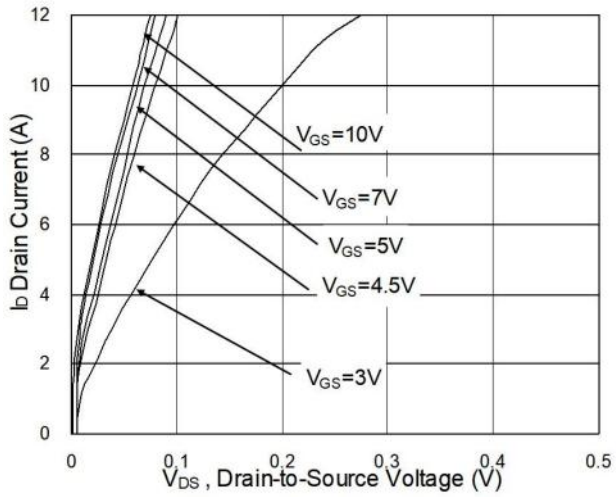



Fig.1 Typical Output Characteristics

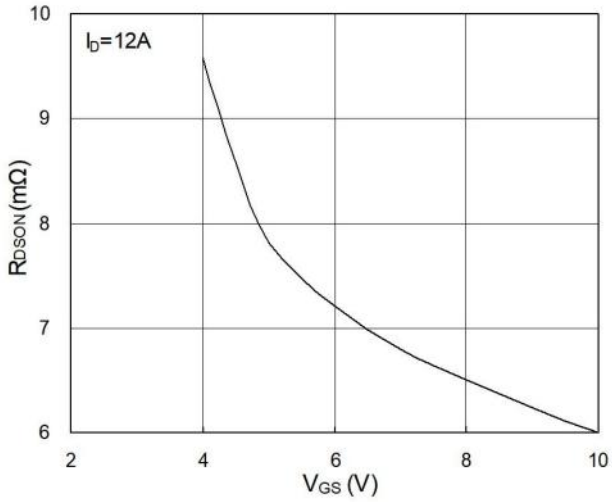



Fig.2 On-Resistance vs. G-S Voltage

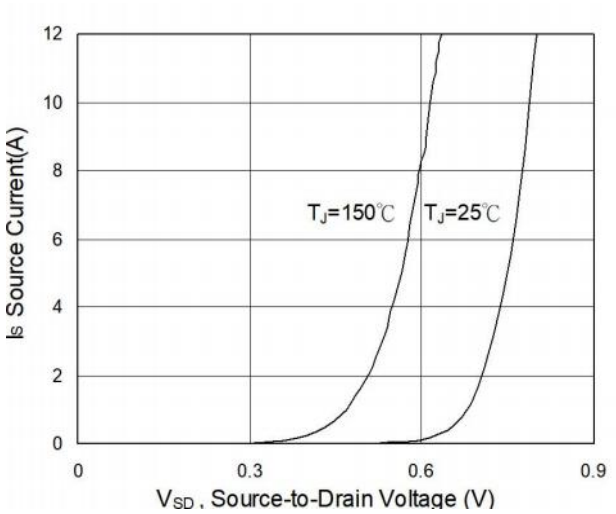



Fig.3 Forward Characteristics of Reverse

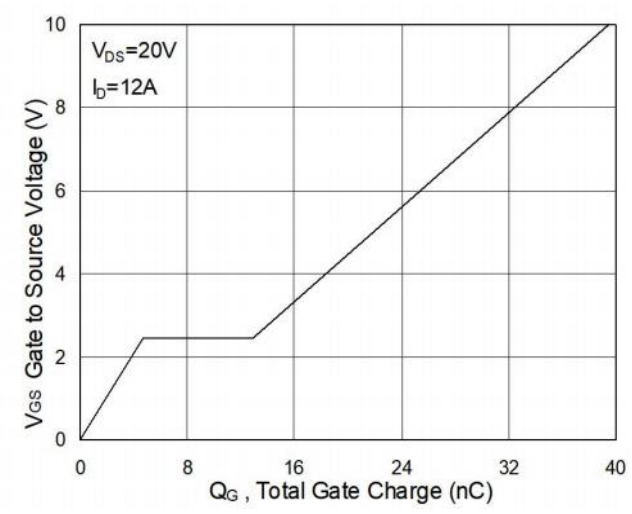



Fig.4 Gate-Charge Characteristics

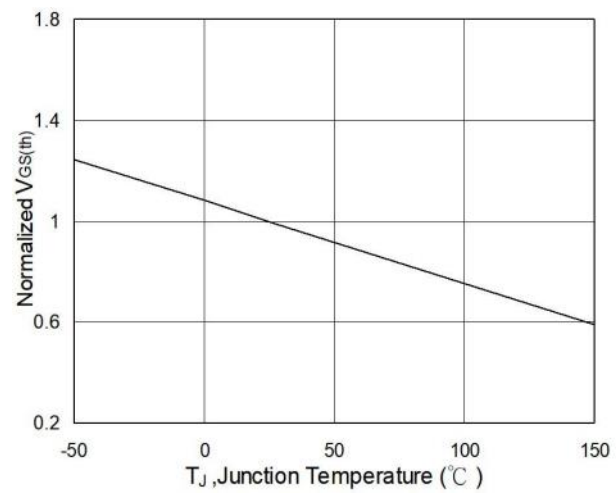



Fig.5 Normalized $V_{GS(th)}$ vs. $T_J$

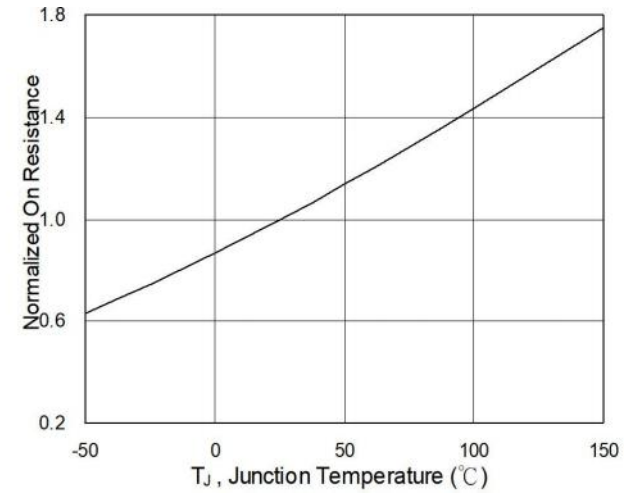



Fig.6 Normalized $R_{DSON}$ vs. $T_J$

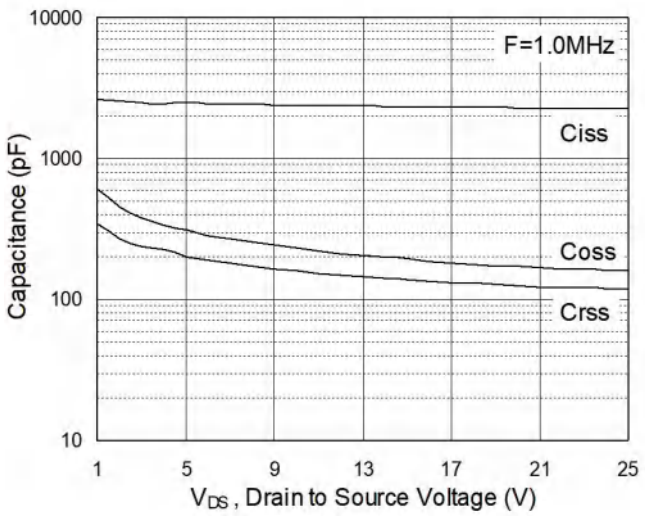



Fig.7 Capacitance

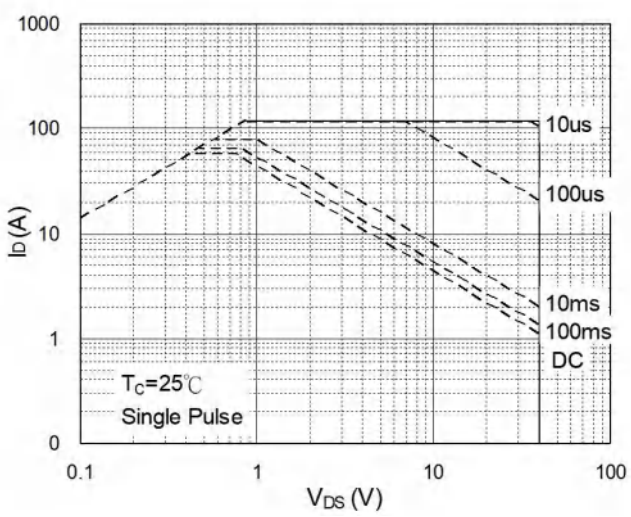



Fig.8 Safe Operating Area

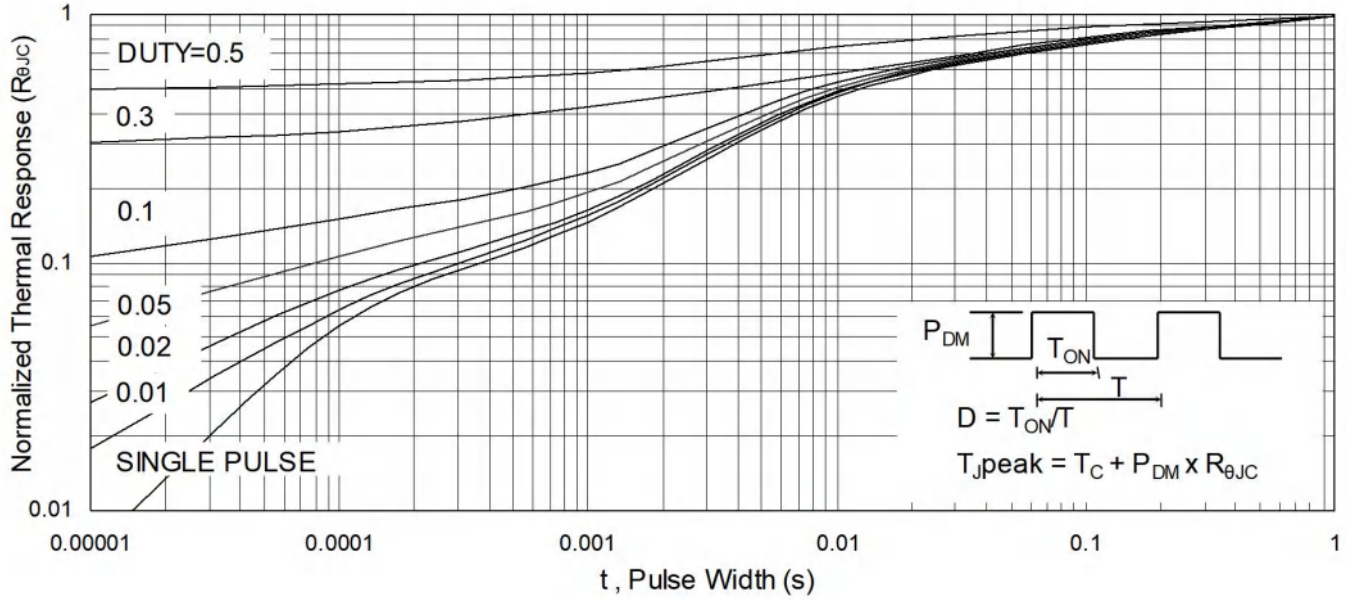



Fig.9 Normalized Maximum Transient Thermal Impedance

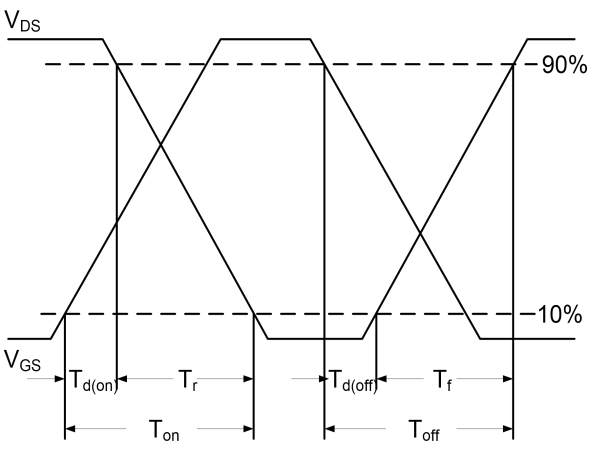



Fig.10 Switching Time Waveform

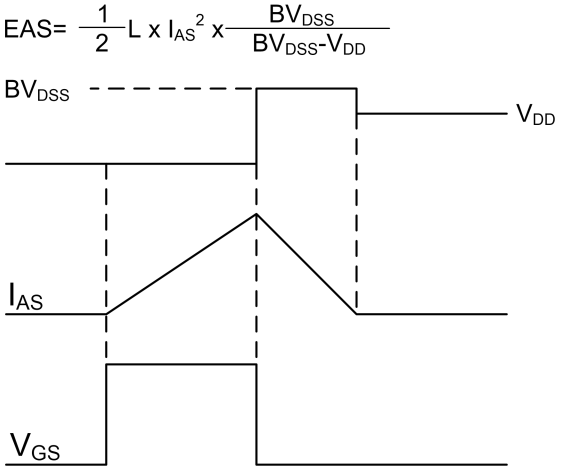
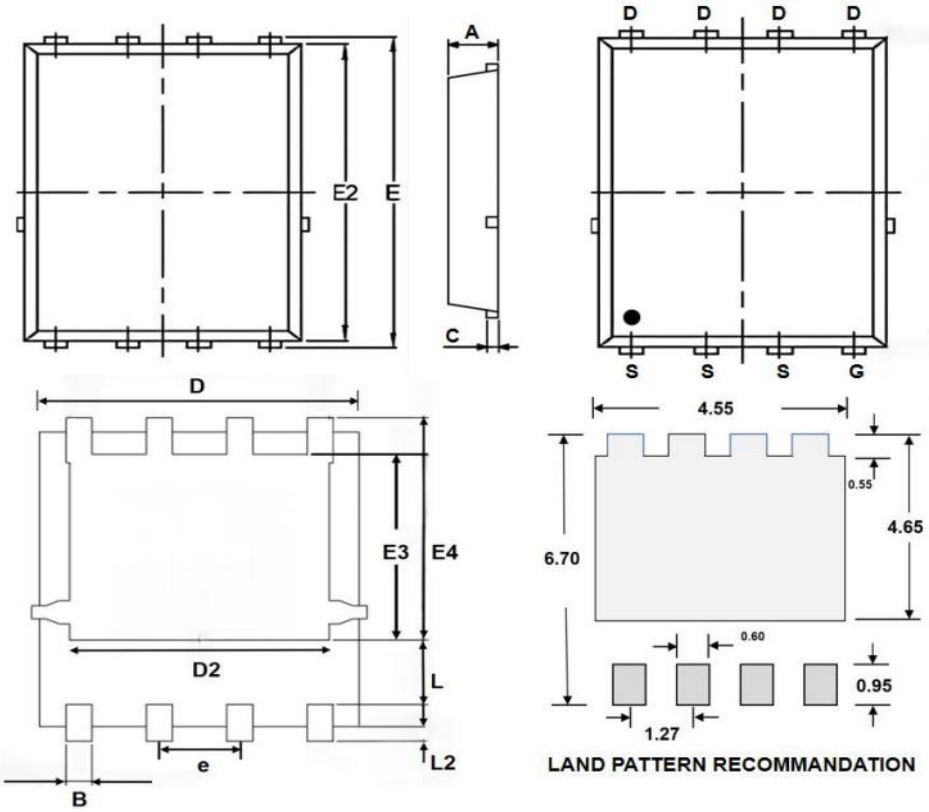



Fig.11 Unclamped Inductive Waveform

# Ordering Information

| Part Number | Package code | Packaging |
|---|---|---|
| HSBA4006 | PRPAK5*6 | 3000/Tape&Reel |

## PRPAK5*6 Package Outline




| SYMBOLS | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.80 | -- | 1.20 | 0.031 | -- | 0.047 |
| B | 0.25 | -- | 0.51 | 0.012 | -- | 0.020 |
| C | 0.15 | -- | 0.35 | 0.006 | -- | 0.014 |
| D | 4.80 | -- | 5.45 | 0.189 | -- | 0.209 |
| D2 | 3.61 | -- | 4.35 | 0.142 | -- | 0.171 |
| E | 5.90 | -- | 6.35 | 0.232 | -- | 0.250 |
| E2 | 5.42 | -- | 6.06 | 0.213 | -- | 0.232 |
| E3 | 3.23 | -- | 3.90 | 0.127 | -- | 0.154 |
| E4 | 3.69 | -- | 4.55 | 0.145 | -- | 0.179 |
| L | 0.61 | -- | 1.80 | 0.024 | -- | 0.071 |
| L2 | 0.05 | -- | 0.36 | 0.002 | -- | 0.014 |
| e | -- | 1.27 | -- | -- | 0.050 | -- |

# HSBA4006 Marking: