HUASHUO SEMICONDUCTOR

# HSU6048

## N-Ch 60V Fast Switching MOSFETs

### Description

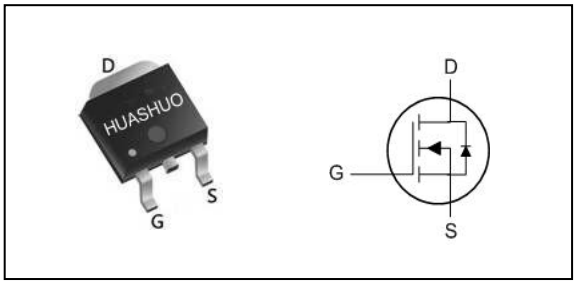
The HSU6048 is the high cell density trenched N-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The HSU6048 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

### Product Summary

| | | |
|---|---|---|
| $V_{DS}$ | 60 | V |
| $R_{DS(ON),TYP}$ | 3.5 | mΩ |
| $I_D$ | 90 | A |

### TO-252 Pin Configuration




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

### Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 60 | V |
| $V_{GS}$ | Gate-Source Voltage | ± 20 | V |
| $I_D$@$T_C$=25℃ | Continuous Drain Current[1,6] | 90 | A |
| $I_D$@$T_C$=100℃ | Continuous Drain Current[1,6] | 67 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 240 | A |
| EAS | Single Pulse Avalanche Energy[3] | 101 | mJ |
| $I_{AS}$ | Avalanche Current | 54 | A |
| $P_D$@$T_C$=25℃ | Total Power Dissipation[4] | 60 | 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 [1] | --- | 60 | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case[1] | --- | 1.8 | ℃/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 | 60 | --- | --- | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V , $I_D$=20A | --- | 3.5 | 3.6 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=15A | --- | 4.7 | 5.4 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.2 | --- | 2.3 | V |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=48V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=48V , $V_{GS}$=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 , $I_D$=20A | --- | 65 | --- | S |
| $R_g$ | Gate Resistance | $V_{DS}$=0V , $V_{GS}$=0V , f=1MHz | --- | 0.7 | --- | Ω |
| $Q_g$ | Total Gate Charge (10V) | $V_{DS}$=30V , $V_{GS}$=10V , $I_D$=20A | --- | 58 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 16 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 4 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DD}$=30V , $V_{GS}$=10V , $R_G$=3Ω, $I_D$=20A | --- | 18 | --- | ns |
| $T_r$ | Rise Time | | --- | 8 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 50 | --- | |
| $T_f$ | Fall Time | | --- | 10.5 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=30V , $V_{GS}$=0V , f=1MHz | --- | 3458 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 1522 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 22 | --- | |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current[1,5] | $V_G$=$V_D$=0V , Force Current | --- | --- | 90 | A |
| $V_{SD}$ | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=1A , $T_J$=25℃ | --- | --- | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$=20A , dI/dt=100A/μs , $T_J$=25℃ | --- | 24 | --- | nS |
| $Q_{rr}$ | Reverse Recovery Charge | | --- | 85 | --- | nC |

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 $V_{DD}$=50V,$V_{GS}$=10V,L=0.1mH,$I_{AS}$=54A
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.
6.The maximum current rating is package limited.

## Typical Characteristics

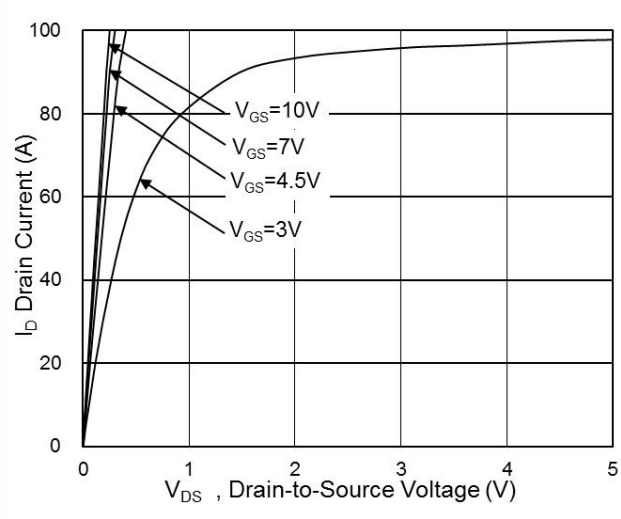



**Fig.1 Typical Output Characteristics**

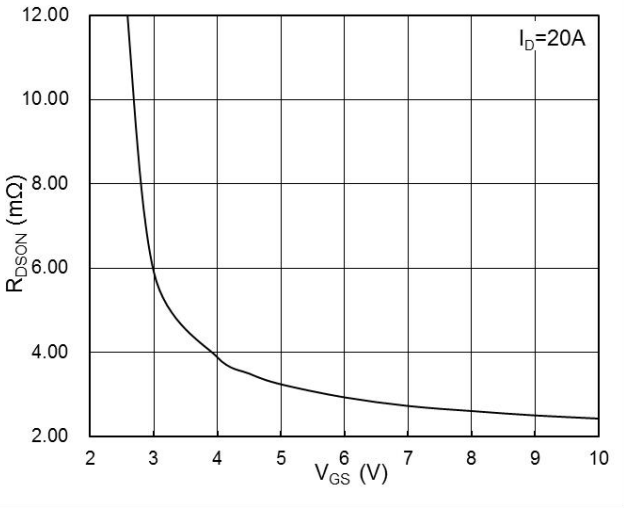



**Fig.2 On-Resistance vs G-S Voltage**

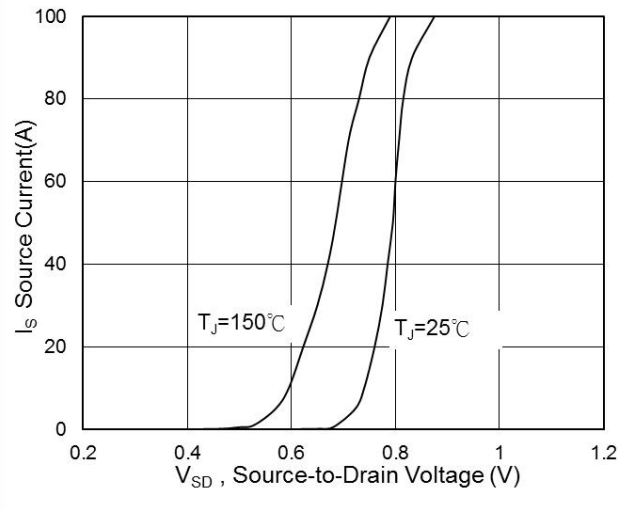



**Fig.3 Diode Forward Voltage vs. Current**

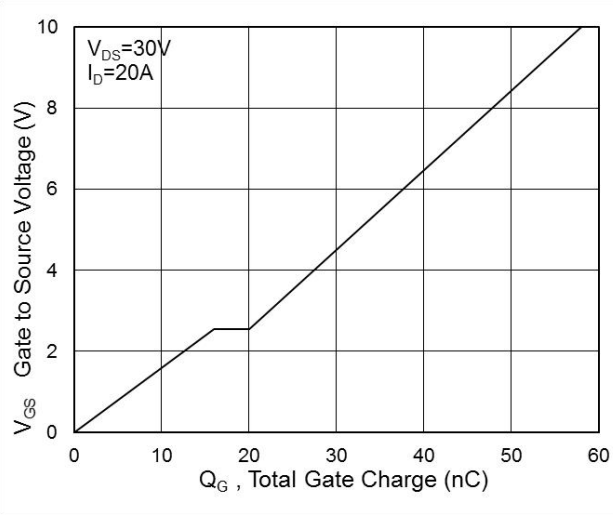



**Fig.4 Gate-Charge Characteristics**

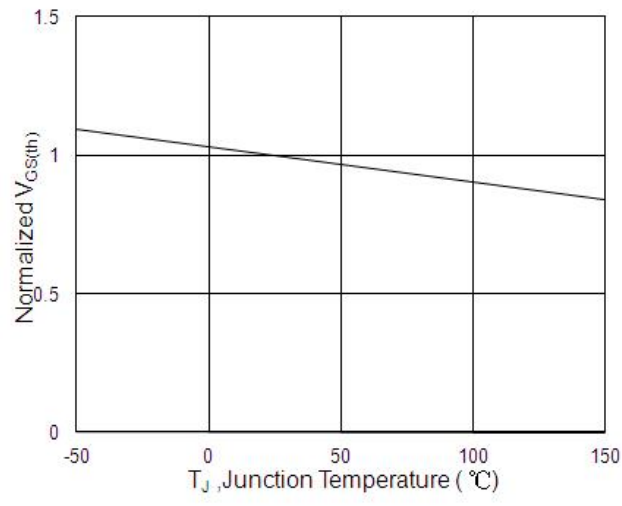



**Fig.5 Normalized $V_{GS(th)}$ vs $T_J$**

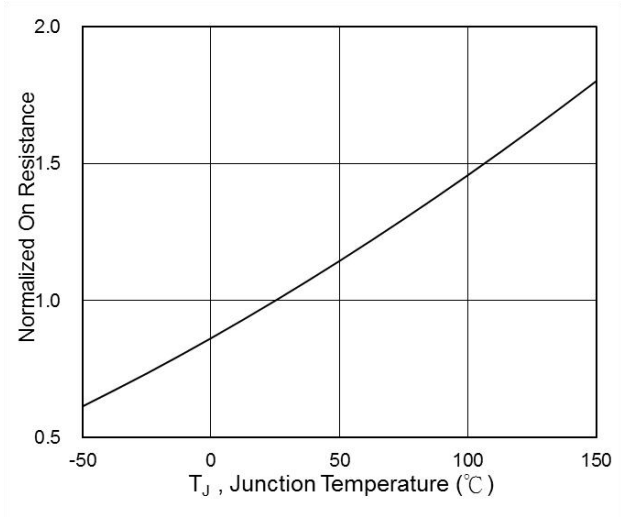



**Fig.6 Normalized $R_{DSON}$ vs $T_J$**

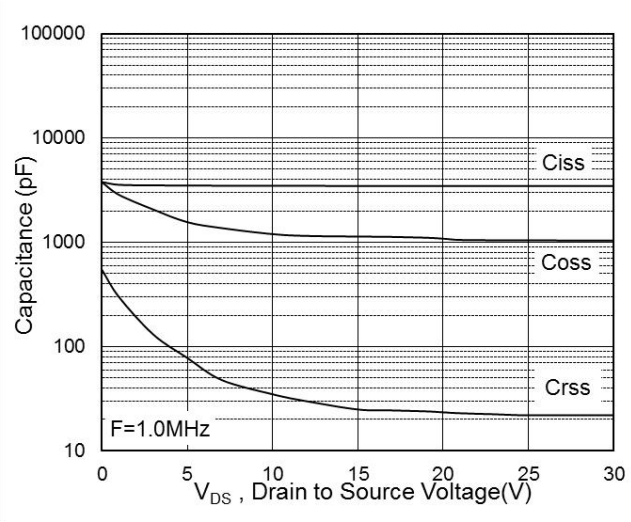



Fig.7 Capacitance

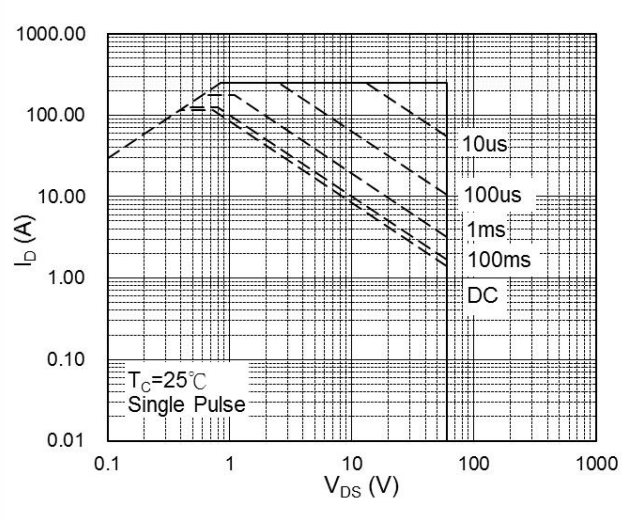



Fig.8 Safe Operating Area

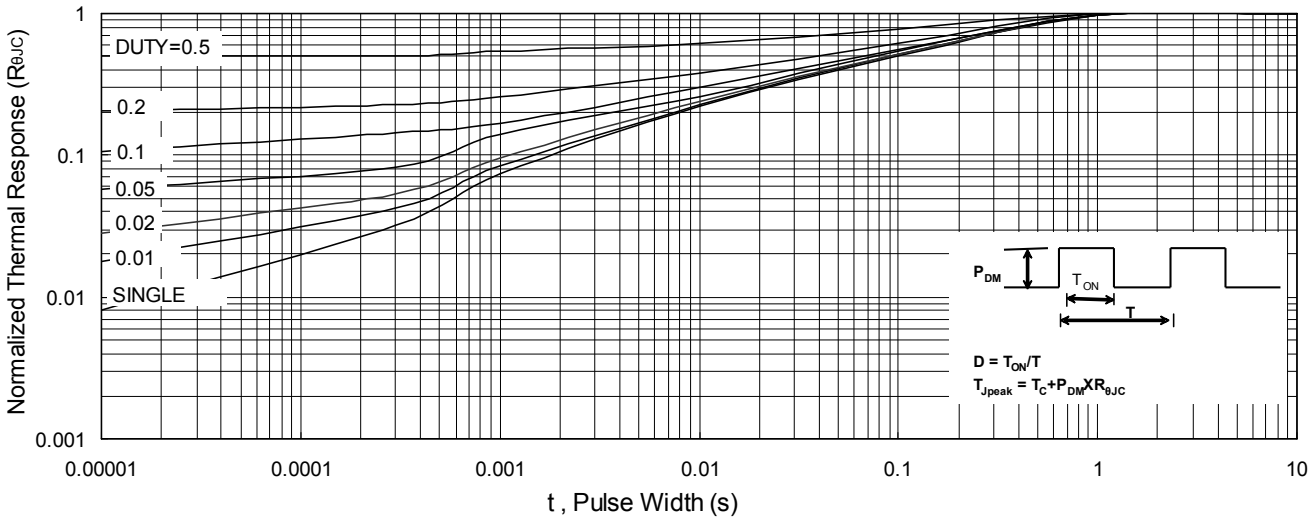



Fig.9 Normalized Maximum Transient Thermal Impedance

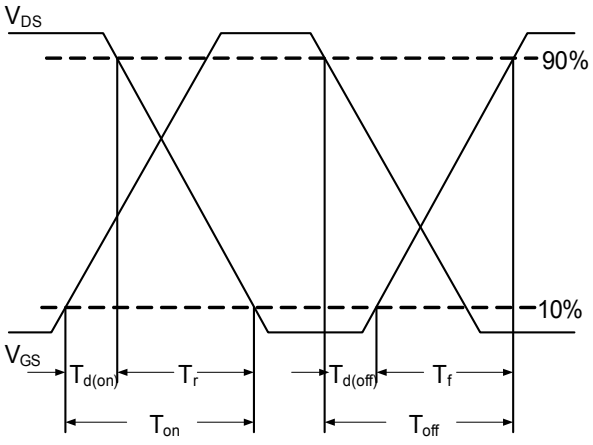



Fig.10 Switching Time Waveform

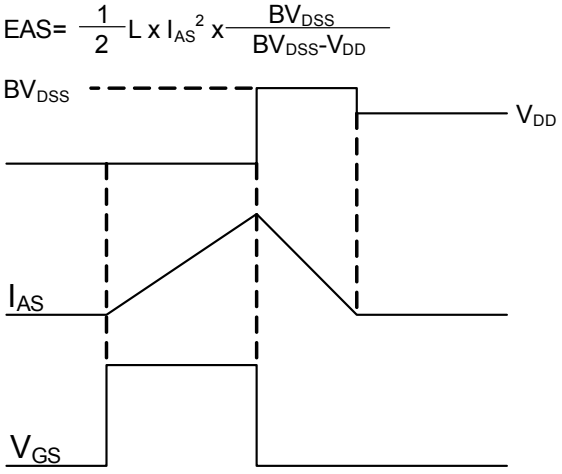
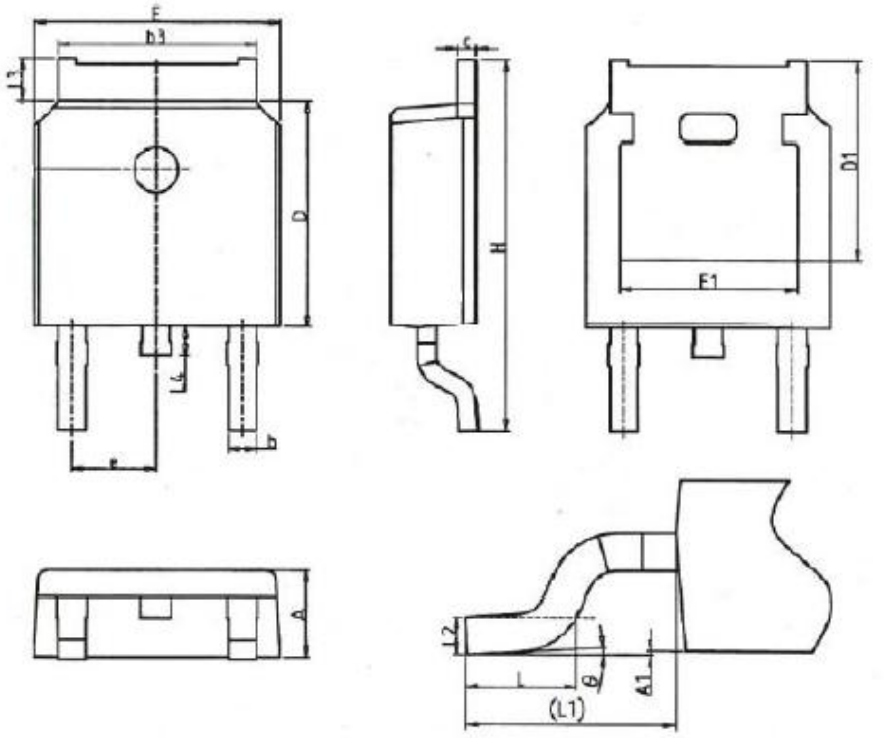



Fig.11 Unclamped Inductive Switching

# TO252-2L 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° |