

Description

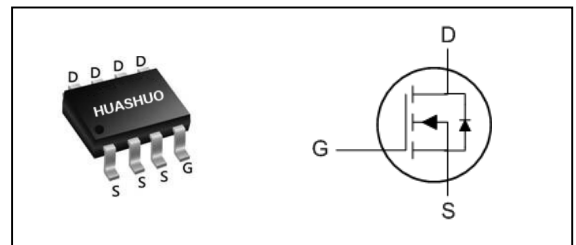
The HSM4004 is the high cell density trench N-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The HSM4004 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 |
| $R_{DS(ON),max}$ | 12 | mΩ |
| I_D | 10 | A |

SOP8 Pin Configuration

Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|-----------------------|--|------------|-------|
| V_{DS} | Drain-Source Voltage | 40 | V |
| V_{GS} | Gate-Source Voltage | ±20 | V |
| $I_D@T_A=25^{\circ}C$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 10 | A |
| $I_D@T_A=70^{\circ}C$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 8 | A |
| I_{DM} | Pulsed Drain Current ² | 34 | A |
| EAS | Single Pulse Avalanche Energy ³ | 31 | mJ |
| I_{AS} | Avalanche Current | 25 | A |
| $P_D@T_A=25^{\circ}C$ | Total Power Dissipation ⁴ | 1.5 | 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 |
|-----------------|---|------|------|------|
| $R_{\theta JA}$ | Thermal Resistance Junction-ambient (Steady State) ¹ | --- | 65 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case ¹ | --- | 30 | °C/W |

Electrical Characteristics ($T_J=25\text{ }^\circ\text{C}$, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|------------------------------|--|---|------|-------|-----------|----------------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=250\mu A$ | 40 | --- | --- | V |
| $\Delta BV_{DSS}/\Delta T_J$ | BVDSS Temperature Coefficient | Reference to 25°C , $I_D=1\text{mA}$ | --- | 0.034 | --- | $V/^\circ\text{C}$ |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance ² | $V_{GS}=10V, I_D=8A$ | --- | --- | 12 | m Ω |
| | | $V_{GS}=4.5V, I_D=6A$ | --- | --- | 17 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}=V_{DS}, I_D=250\mu A$ | 1.0 | --- | 2.5 | V |
| $\Delta V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -5.64 | --- | $\text{mV}/^\circ\text{C}$ |
| I_{DSS} | Drain-Source Leakage Current | $V_{DS}=32V, V_{GS}=0V, T_J=25^\circ\text{C}$ | --- | --- | 1 | μA |
| | | $V_{DS}=32V, V_{GS}=0V, T_J=55^\circ\text{C}$ | --- | --- | 5 | |
| I_{GSS} | Gate-Source Leakage Current | $V_{GS}=\pm 20V, V_{DS}=0V$ | --- | --- | ± 100 | nA |
| gfs | Forward Transconductance | $V_{DS}=5V, I_D=8A$ | --- | 36 | --- | S |
| R_g | Gate Resistance | $V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$ | --- | 2.1 | --- | Ω |
| Q_g | Total Gate Charge (4.5V) | $V_{DS}=20V, V_{GS}=4.5V, I_D=8A$ | --- | 10.7 | --- | nC |
| Q_{gs} | Gate-Source Charge | | --- | 3.3 | --- | |
| Q_{gd} | Gate-Drain Charge | | --- | 4.2 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DD}=12V, V_{GS}=10V, R_G=3.3\Omega$ $I_D=6A$ | --- | 8.6 | --- | ns |
| T_r | Rise Time | | --- | 3.4 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 24.8 | --- | |
| T_f | Fall Time | | --- | 2.2 | --- | |
| C_{iss} | Input Capacitance | $V_{DS}=15V, V_{GS}=0V, f=1\text{MHz}$ | --- | 1314 | --- | pF |
| C_{oss} | Output Capacitance | | --- | 120 | --- | |
| C_{rss} | Reverse Transfer Capacitance | | --- | 88 | --- | |

Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|----------|--|---|------|------|------|------|
| I_S | Continuous Source Current ^{1,5} | $V_G=V_D=0V$, Force Current | --- | --- | 8.5 | A |
| I_{SM} | Pulsed Source Current ^{2,5} | | --- | --- | 34 | A |
| V_{SD} | Diode Forward Voltage ² | $V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$ | --- | --- | 1.2 | V |

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper.
- 2.The data tested by pulsed , pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is $V_{DD}=25V, V_{GS}=10V, L=0.1\text{mH}, I_{AS}=25A$
- 4.The power dissipation is limited by 150°C 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

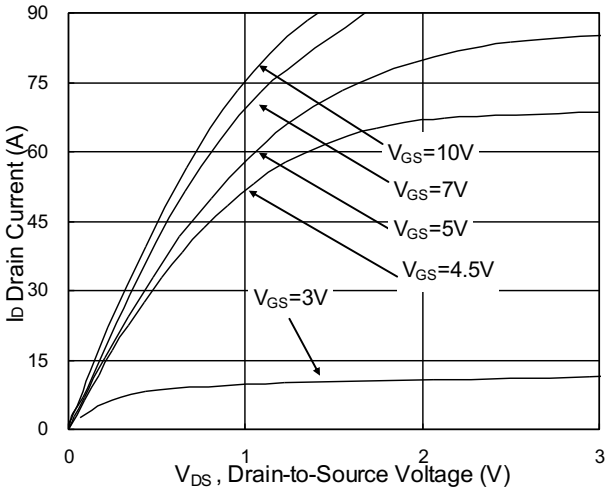


Fig.1 Typical Output Characteristics

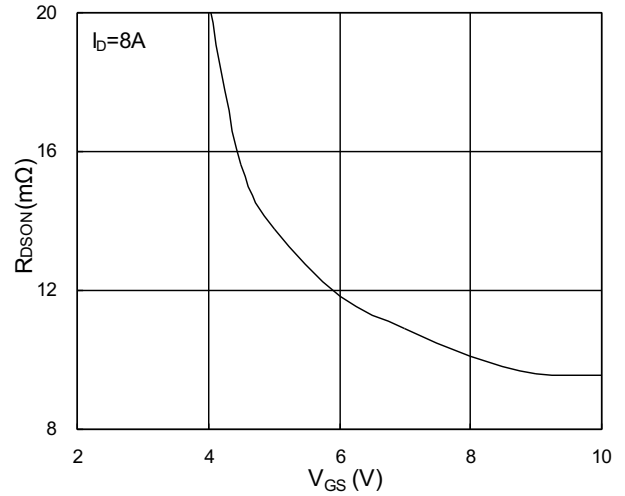


Fig.2 On-Resistance vs. G-S Voltage

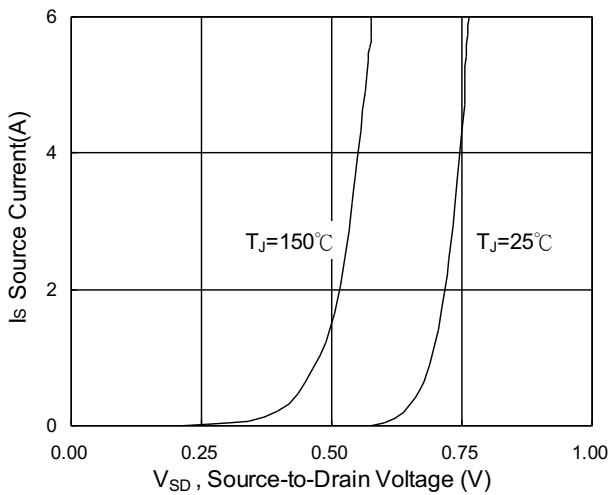


Fig.3 Forward Characteristics of Reverse

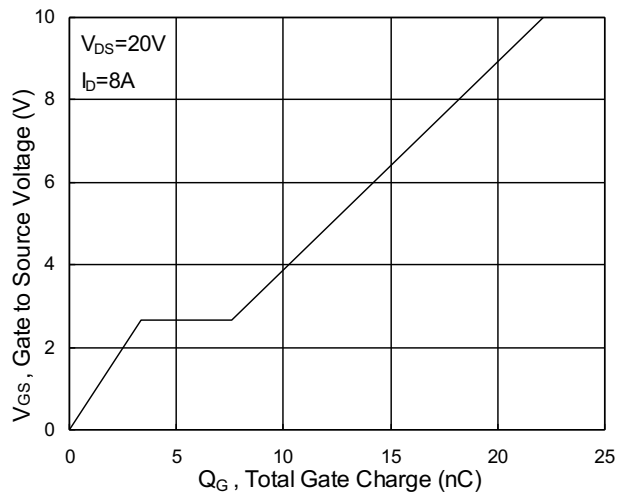


Fig.4 Gate-Charge Characteristics

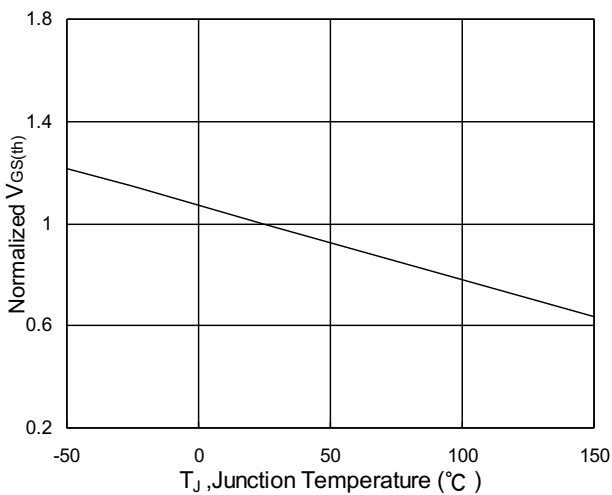


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

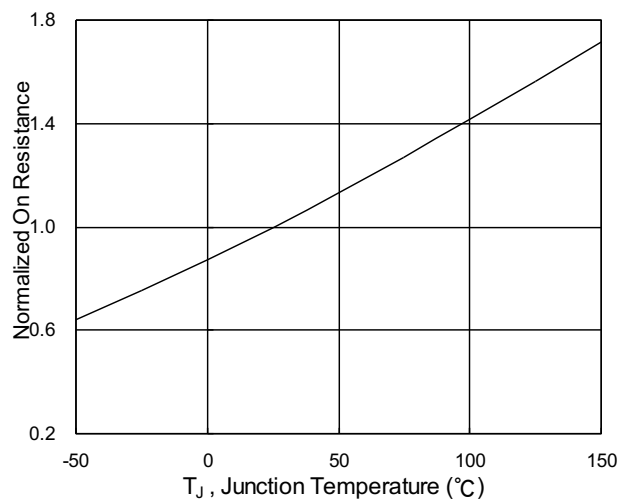


Fig.6 Normalized $R_{DS(on)}$ vs. T_J



N-Ch 40V Fast Switching MOSFETs

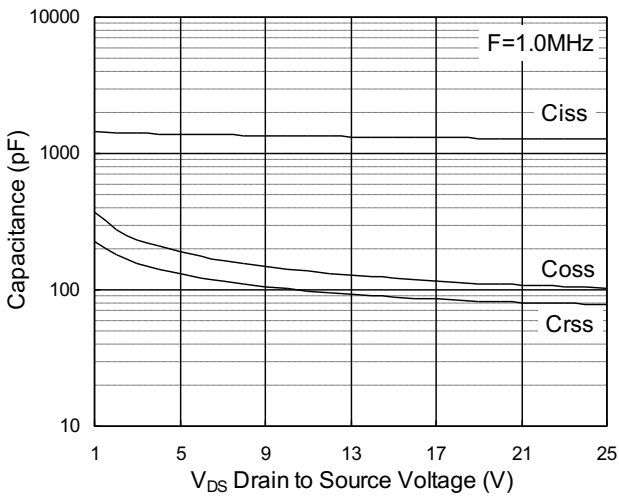


Fig.7 Capacitance

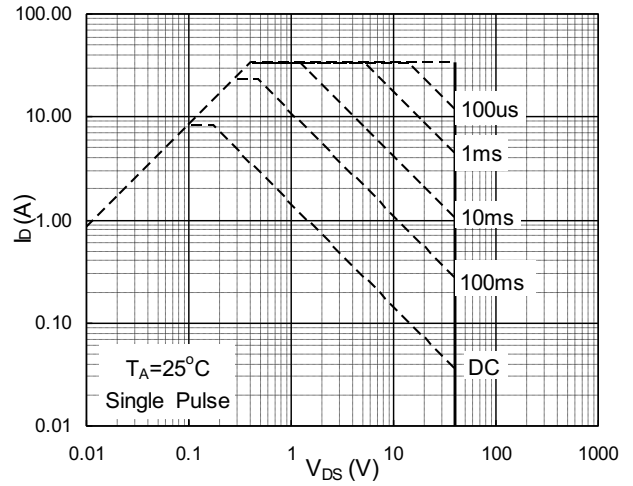


Fig.8 Safe Operating Area

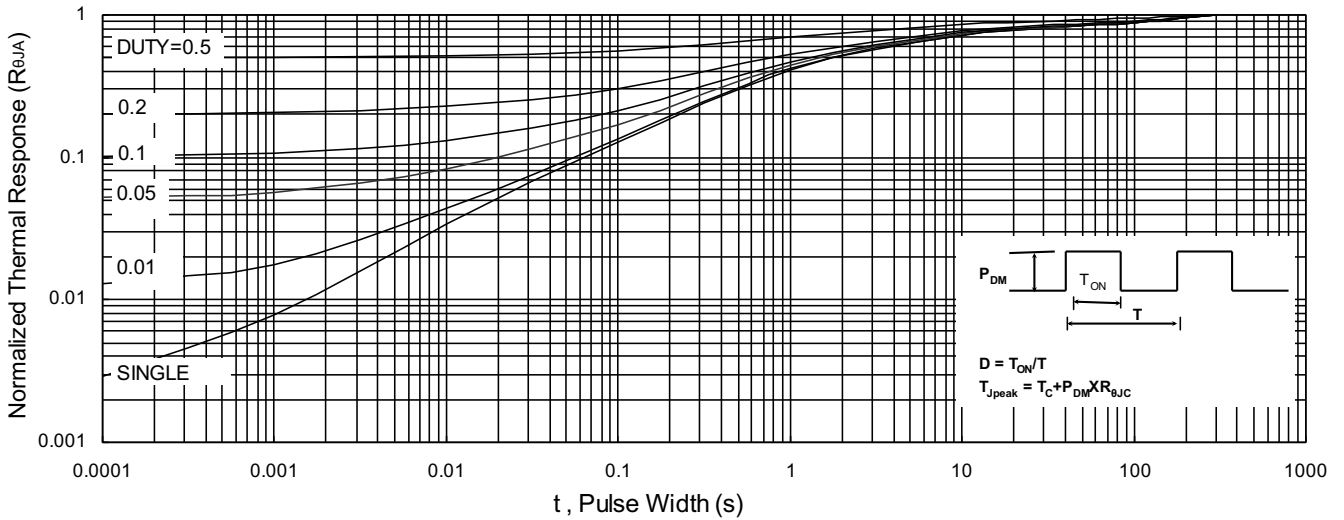


Fig.9 Normalized Maximum Transient Thermal Impedance

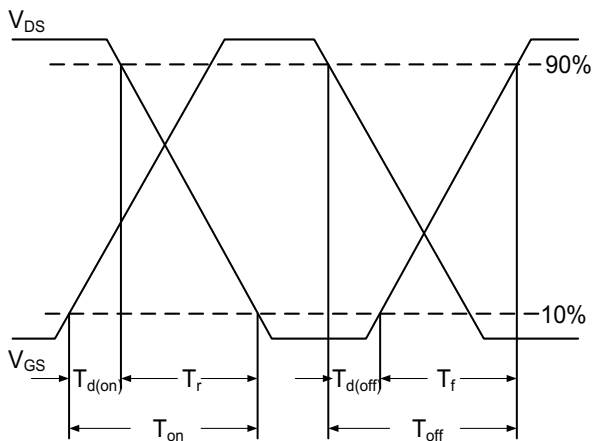


Fig.10 Switching Time Waveform

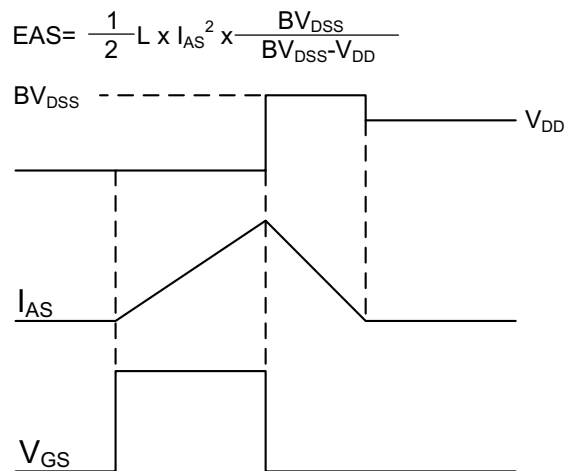
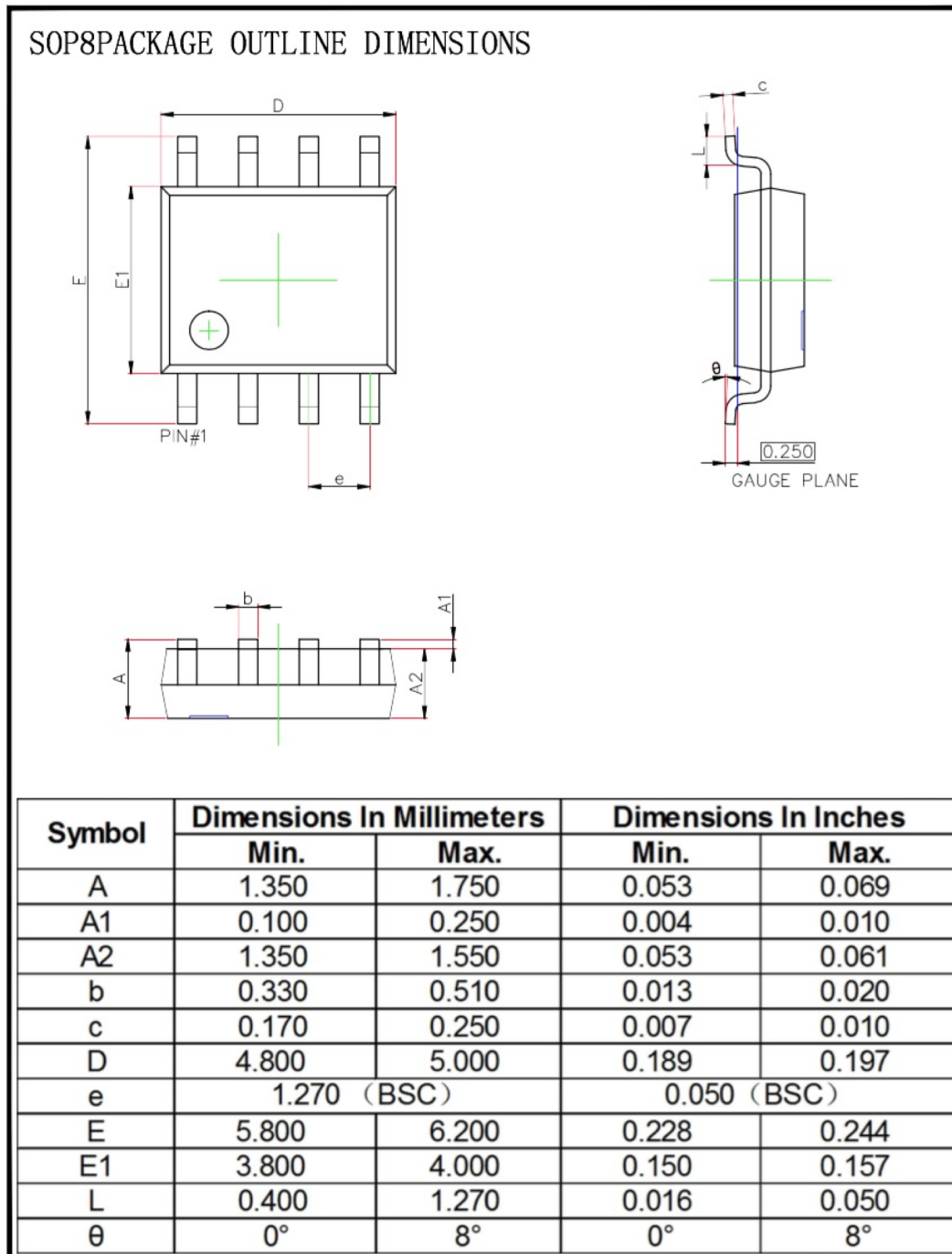


Fig.11 Unclamped Inductive Switching

Ordering Information

| Part Number | Package code | Packaging |
|-------------|--------------|----------------|
| HSM4004 | SOP-8 | 2500/Tape&Reel |



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