

### Description

The HSM4410 is the high cell density trenched N-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

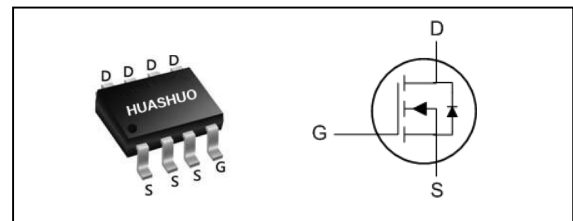
The HSM4410 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

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

### Product Summary

|                  |     |            |
|------------------|-----|------------|
| $V_{DS}$         | 30  | V          |
| $R_{DS(ON),max}$ | 9.5 | m $\Omega$ |
| $I_D$            | 12  | A          |

### SOP8 Pin Configuration



### Absolute Maximum Ratings

| Symbol               | Parameter                                  | Rating     | Units      |
|----------------------|--|------------|------------|
| $V_{DS}$             | Drain-Source Voltage                       | 30         | V          |
| $V_{GS}$             | Gate-Source Voltage                        | $\pm 20$   | V          |
| $I_D@T_A=25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 12         | A          |
| $I_D@T_A=70^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 8          | A          |
| $I_{DM}$             | Pulsed Drain Current <sup>2</sup>          | 50         | A          |
| EAS                  | Single Pulse Avalanche Energy <sup>3</sup> | 51         | mJ         |
| $I_{AS}$             | Avalanche Current                          | 32         | A          |
| $P_D@T_A=25^\circ C$ | Total Power Dissipation <sup>4</sup>       | 2.5        | 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 <sup>1</sup> | ---  | 50   | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case <sup>1</sup>    | ---  | 25   | $^\circ C/W$ |



**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  | 30   | ---   | ---  | V     |
| ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | BVDSS Temperature Coefficient                  | Reference to 25°C, I <sub>D</sub> =1mA  | ---  | 0.027 | ---  | V/°C  |
| R <sub>DS(ON)</sub>                 | Static Drain-Source On-Resistance <sup>2</sup> | V <sub>GS</sub> =10V, I <sub>D</sub> =12A   | ---  | 7.5   | 9.5  | mΩ    |
|                                     |  | V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A  | ---  | 12.5  | 14.5 |       |
| V <sub>GS(th)</sub>                 | Gate Threshold Voltage                         | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA                              | 1    | 1.5   | 2.5  | V     |
| ΔV <sub>GS(th)</sub>                | V <sub>GS(th)</sub> Temperature Coefficient    |   | ---  | -5.8  | ---  | mV/°C |
| I <sub>DSS</sub>                    | Drain-Source Leakage Current                   | V <sub>DS</sub> =24V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C                       | ---  | ---   | 1    | uA    |
|                                     |  | V <sub>DS</sub> =24V, 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    |
| g <sub>fs</sub>                     | Forward Transconductance                       | V <sub>DS</sub> =5V, I <sub>D</sub> =10A  | ---  | 5.8   | ---  | S     |
| R <sub>g</sub>                      | Gate Resistance                                | V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz                                      | ---  | 1.56  | ---  | Ω     |
| Q <sub>g</sub>                      | Total Gate Charge (4.5V)                       | V <sub>DS</sub> =15V, V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A                      | ---  | 11    | ---  | nC    |
| Q <sub>gs</sub>                     | Gate-Source Charge                             |   | ---  | 4.5   | ---  |       |
| Q <sub>gd</sub>                     | Gate-Drain Charge                              |   | ---  | 5     | ---  |       |
| T <sub>d(on)</sub>                  | Turn-On Delay Time                             | V <sub>DD</sub> =15V, V <sub>GS</sub> =10V, R <sub>G</sub> =6Ω<br>I <sub>D</sub> =10A | ---  | 10    | ---  | ns    |
| T <sub>r</sub>                      | Rise Time                                      |   | ---  | 6     | ---  |       |
| T <sub>d(off)</sub>                 | Turn-Off Delay Time                            |   | ---  | 32    | ---  |       |
| T <sub>f</sub>                      | Fall Time                                      |   | ---  | 7     | ---  |       |
| C <sub>iss</sub>                    | Input Capacitance                              | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f=1MHz                                     | ---  | 950   | ---  | pF    |
| C <sub>oss</sub>                    | Output Capacitance                             |   | ---  | 200   | ---  |       |
| C <sub>rss</sub>                    | Reverse Transfer Capacitance                   |   | ---  | 170   | ---  |       |

**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             | ---  | ---  | 12   | A    |
| I <sub>SM</sub> | Pulsed Source Current <sup>2,5</sup>     |   | ---  | ---  | 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    |
| t <sub>rr</sub> | Reverse Recovery Time                    | I <sub>F</sub> =10A, dI/dt=100A/μs,                           | ---  | 15   | ---  | nS   |
| Q <sub>rr</sub> | Reverse Recovery Charge                  | T <sub>J</sub> =25°C  | ---  | 32   | ---  | nC   |

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>=35A
- 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

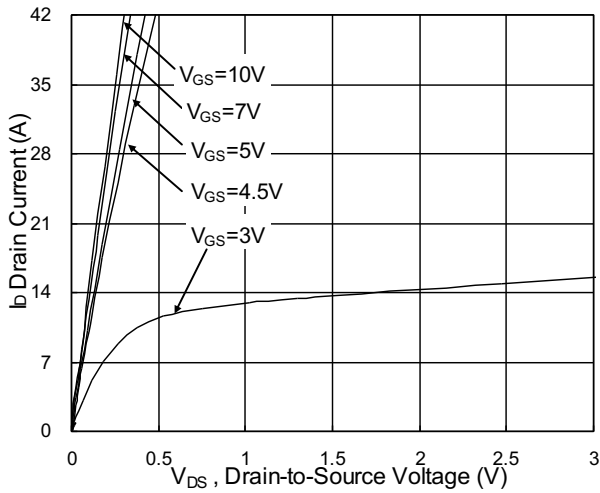


Fig.1 Typical Output Characteristics

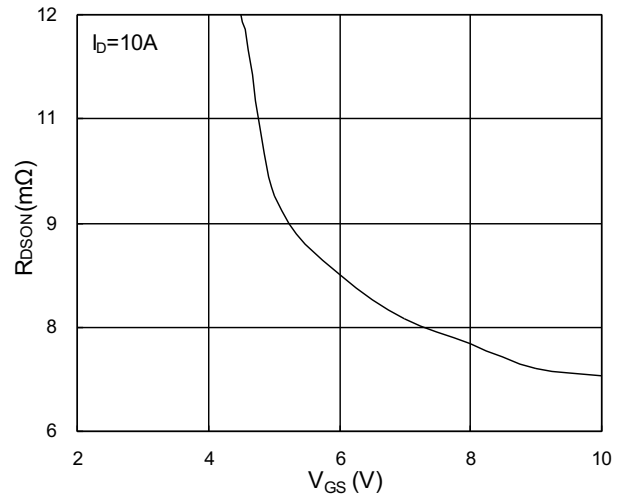


Fig.2 On-Resistance vs. Gate-Source

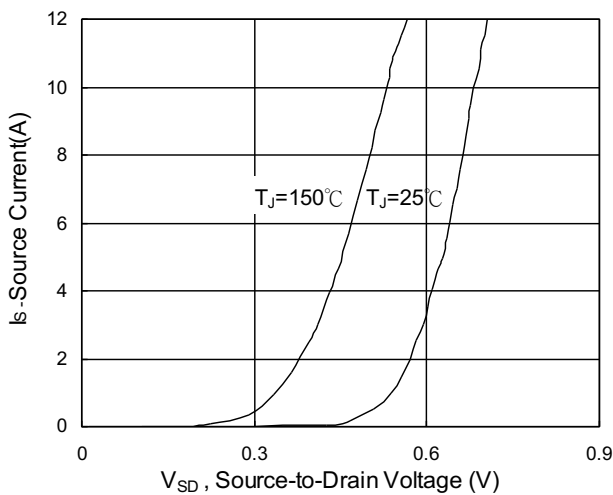


Fig.3 Forward Characteristics of reverse

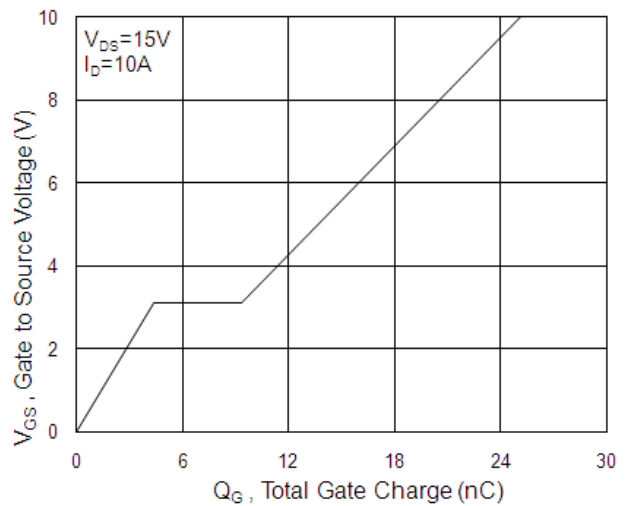


Fig.4 Gate-Charge Characteristics

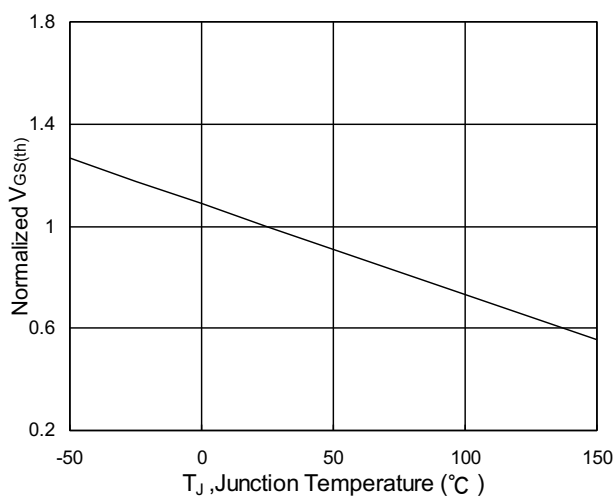


Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$

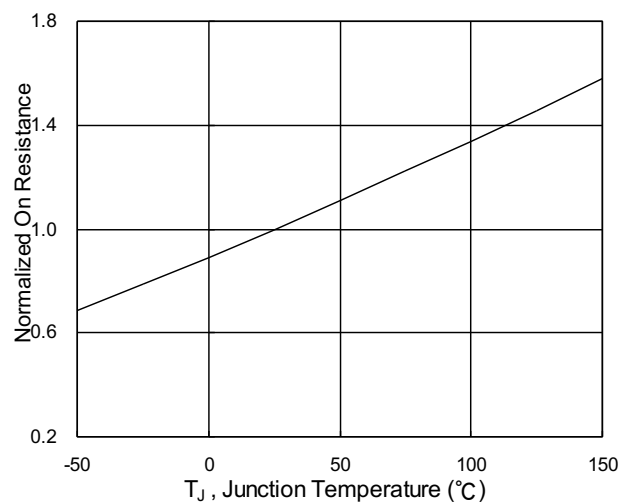
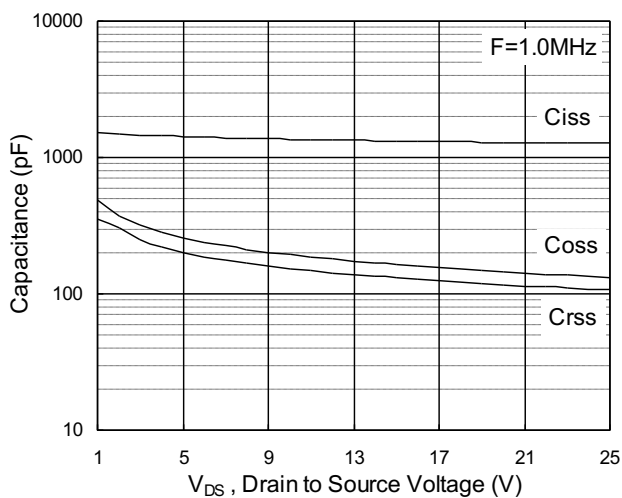
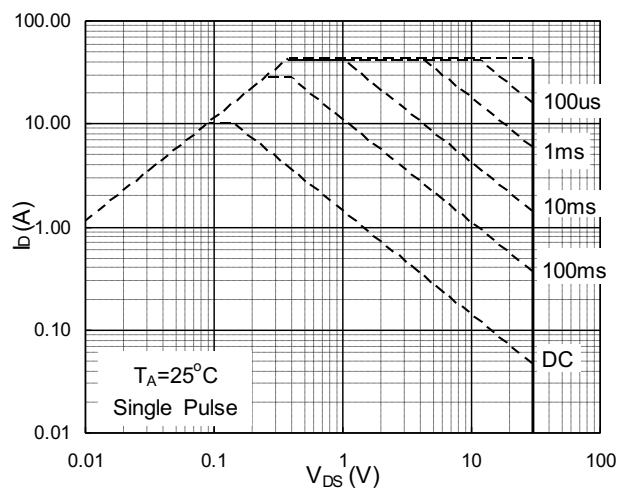


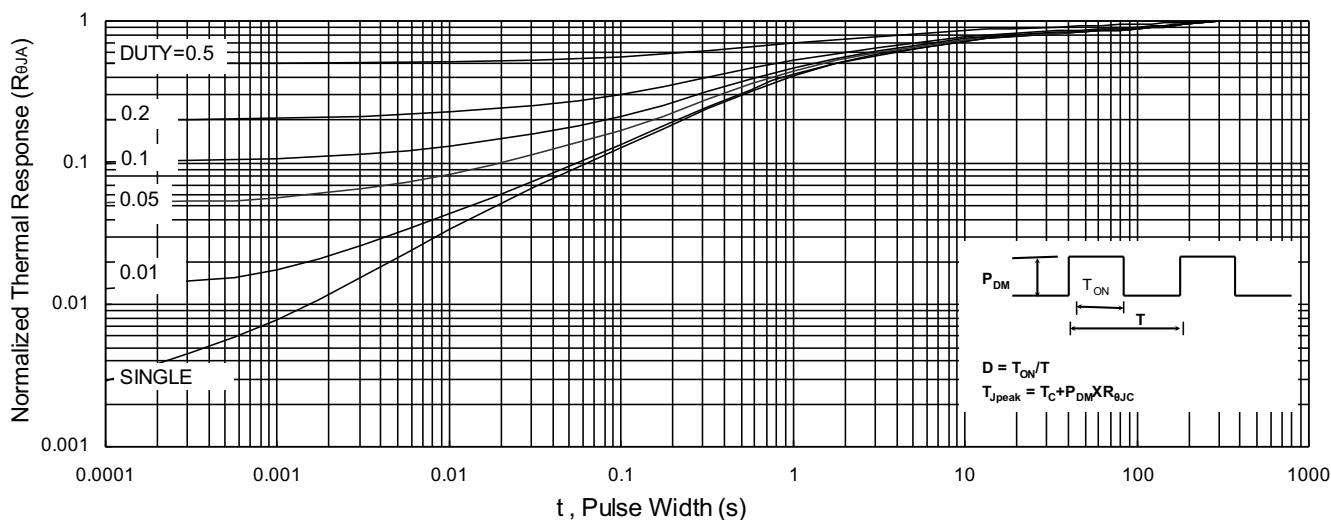
Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$



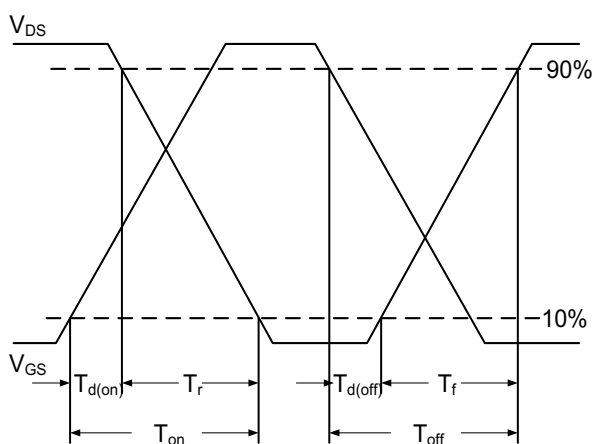
**Fig.7 Capacitance**



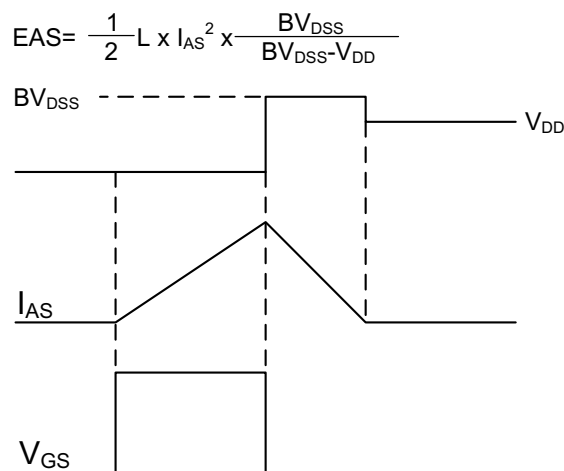
**Fig.8 Safe Operating Area**



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



**Fig.10 Switching Time Waveform**

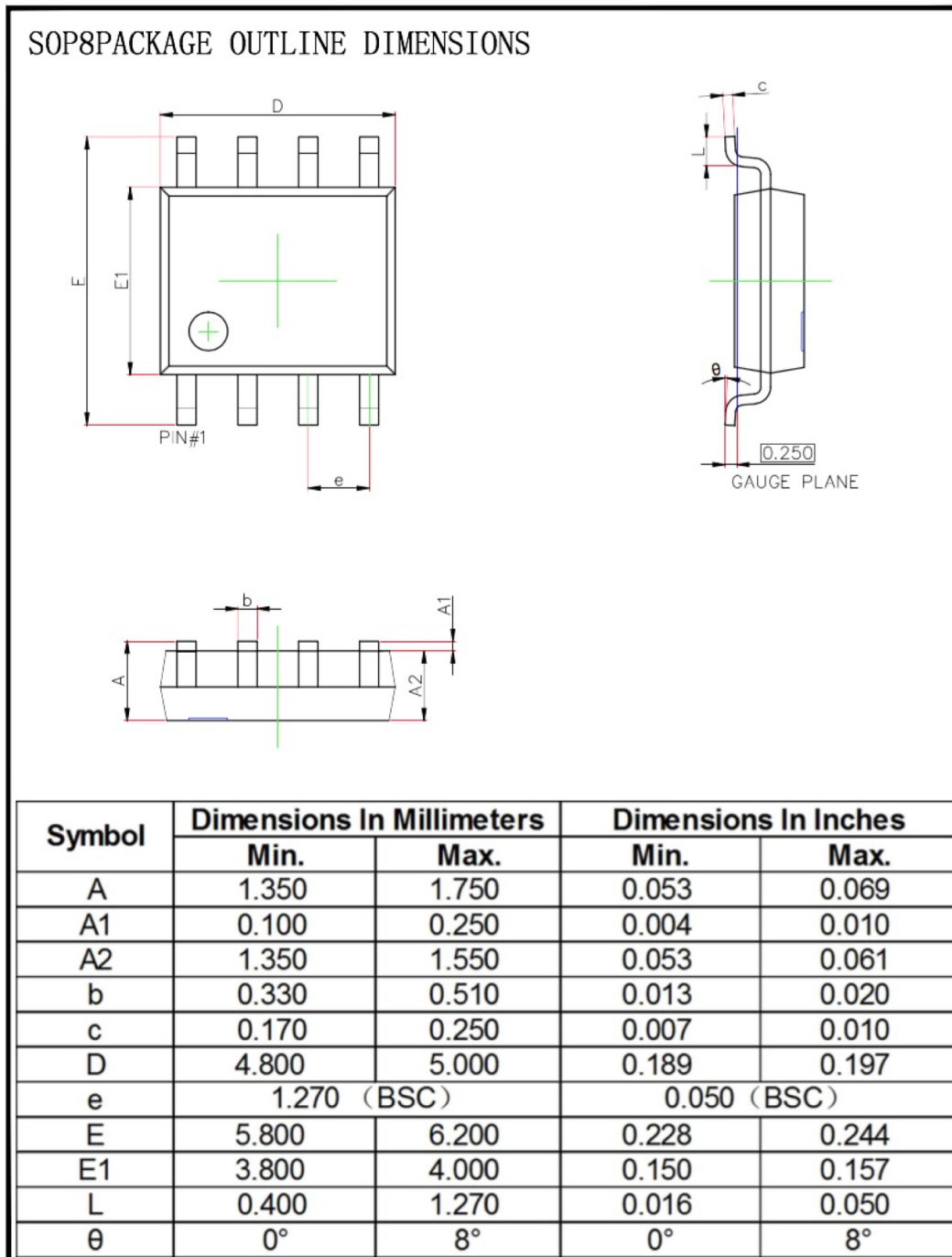


**Fig.11 Unclamped Inductive Switching**



## Ordering Information

| Part Number | Package code | Packaging      |
|-------------|--------------|----------------|
| HSM4410     | SOP-8        | 4000/Tape&Reel |



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