

## N-Ch 250V Fast Switching MOSFETs Product Summary

|                  |     |          |
|------------------|-----|----------|
| $V_{DS}$         | 250 | V        |
| $R_{DS(ON),max}$ | 1.2 | $\Omega$ |
| $I_D$            | 5   | A        |

## General Description

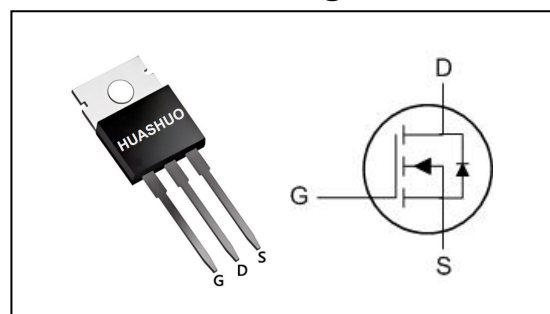
The HSP5N25 is the highest performance trench N-ch MOSFETs with extreme high cell density, which provide excellent  $R_{DS(on)}$  and gate charge for most of the synchronous buck converter applications.

The HSP5N25 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

## Features

- Super Low Gate Charge
- Green Device Available
- Excellent  $C_{dv}/dt$  effect decline
- Advanced high cell density Trench Technology

## TO-220 Pin Configuration



## Absolute Maximum Ratings

| Symbol                | Parameter                                  | Rating     | Units      |
|-----------------------|--------------------------------------------|------------|------------|
| $V_{DS}$              | Drain-Source Voltage                       | 250        | V          |
| $V_{GS}$              | Gate-Source Voltage                        | $\pm 20$   | V          |
| $I_D@T_C=25^\circ C$  | Continuous Drain Current, $V_{GS} @ 10V^1$ | 5          | A          |
| $I_D@T_C=100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 3          | A          |
| $I_{DM}$              | Pulsed Drain Current <sup>2</sup>          | 16         | A          |
| EAS                   | Single Pulse Avalanche Energy <sup>3</sup> | 16         | mJ         |
| $P_D@T_C=25^\circ C$  | Total Power Dissipation <sup>3</sup>       | 38         | 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> | ---  | 70   | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case <sup>1</sup>    | ---  | 4    | $^\circ C/W$ |

**N-Ch 250V Fast Switching MOSFETs**
**Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)**

| Symbol       | Parameter                                      | Conditions                                               | Min. | Typ. | Max.      | Unit       |
|--------------|------------------------------------------------|----------------------------------------------------------|------|------|-----------|------------|
| $BV_{DSS}$   | Drain-Source Breakdown Voltage                 | $V_{GS}=0V$ , $I_D=250\mu A$                             | 250  | ---  | ---       | V          |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance <sup>2</sup> | $V_{GS}=10V$ , $I_D=1A$                                  | ---  | 970  | 1200      | m $\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage                         | $V_{GS}=V_{DS}$ , $I_D=250\mu A$                         | 1    | 1.8  | 3         | V          |
| $I_{DSS}$    | Drain-Source Leakage Current                   | $V_{DS}=250V$ , $V_{GS}=0V$ , $T_J=25^\circ\text{C}$     | ---  | ---  | 1         | $\mu A$    |
|              |                                                | $V_{DS}=250V$ , $V_{GS}=0V$ , $T_J=125^\circ\text{C}$    | ---  | ---  | 100       |            |
| $I_{GSS}$    | Gate-Source Leakage Current                    | $V_{GS}=\pm 20V$ , $V_{DS}=0V$                           | ---  | ---  | $\pm 100$ | nA         |
| $g_{fs}$     | Forward Transconductance                       | $V_{DS}=10V$ , $I_D=1A$                                  | ---  | 7.9  | ---       | S          |
| $R_g$        | Gate Resistance                                | $V_{DS}=0V$ , $V_{GS}=0V$ , $f=1\text{MHz}$              | ---  | 1.8  | ---       | $\Omega$   |
| $Q_g$        | Total Gate Charge (10V)                        | $V_{DS}=100V$ , $V_{GS}=10V$ , $I_D=1A$                  | ---  | 12.5 | ---       | nC         |
| $Q_{gs}$     | Gate-Source Charge                             |                                                          | ---  | 2    | ---       |            |
| $Q_{gd}$     | Gate-Drain Charge                              |                                                          | ---  | 2.5  | ---       |            |
| $T_{d(on)}$  | Turn-On Delay Time                             | $V_{DD}=100V$ , $V_{GS}=10V$ , $R_G=6\Omega$<br>$I_D=1A$ | ---  | 13   | ---       | ns         |
| $T_r$        | Rise Time                                      |                                                          | ---  | 9    | ---       |            |
| $T_{d(off)}$ | Turn-Off Delay Time                            |                                                          | ---  | 38   | ---       |            |
| $T_f$        | Fall Time                                      |                                                          | ---  | 8    | ---       |            |
| $C_{iss}$    | Input Capacitance                              | $V_{DS}=100V$ , $V_{GS}=0V$ , $f=1\text{MHz}$            | ---  | 670  | ---       | pF         |
| $C_{oss}$    | Output Capacitance                             |                                                          | ---  | 14   | ---       |            |
| $C_{rss}$    | Reverse Transfer Capacitance                   |                                                          | ---  | 8    | ---       |            |

**Diode Characteristics**

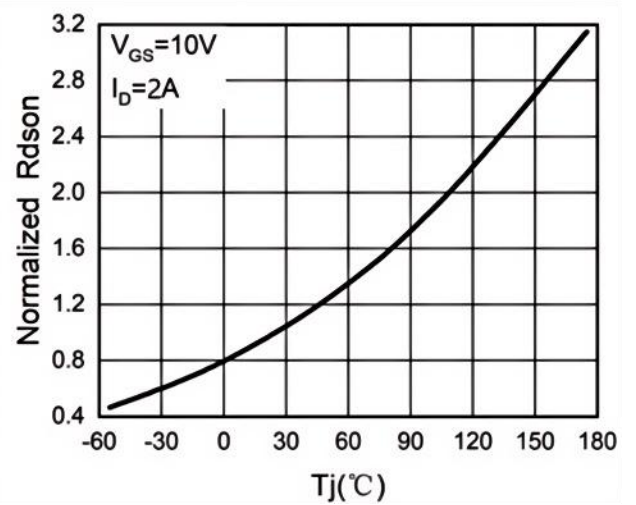
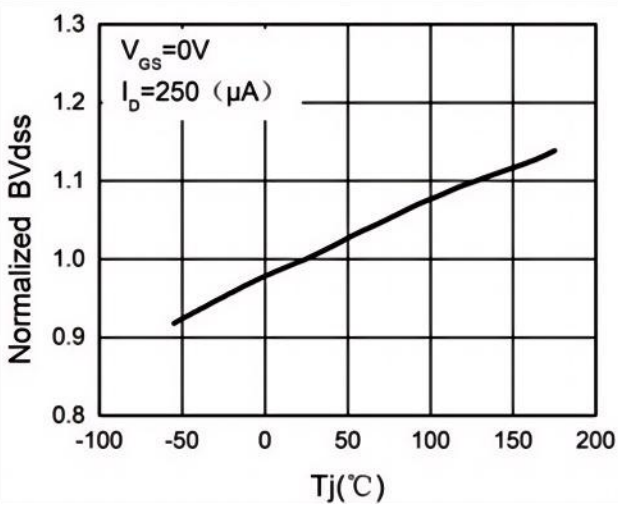
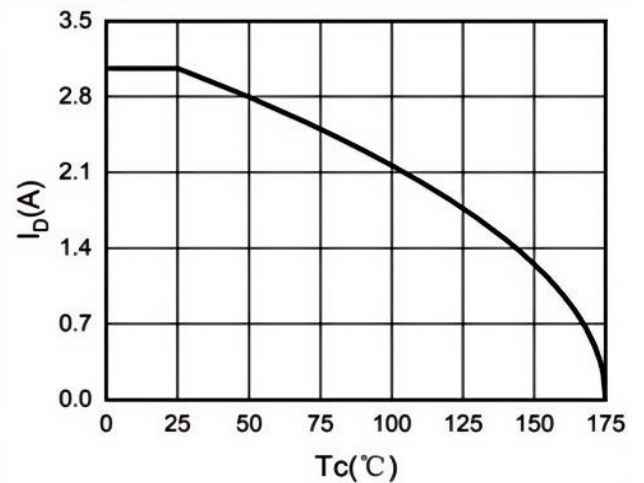
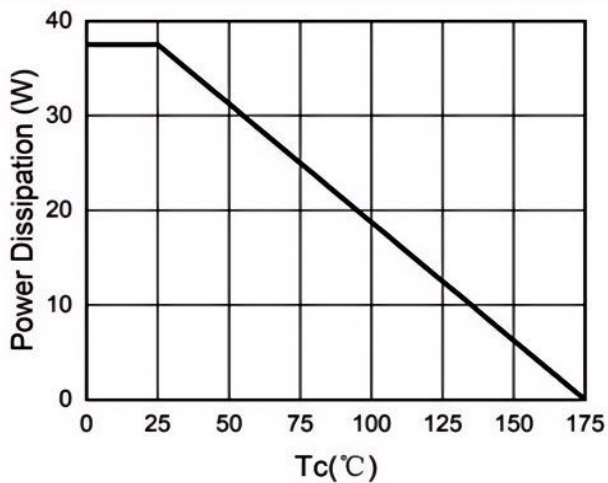
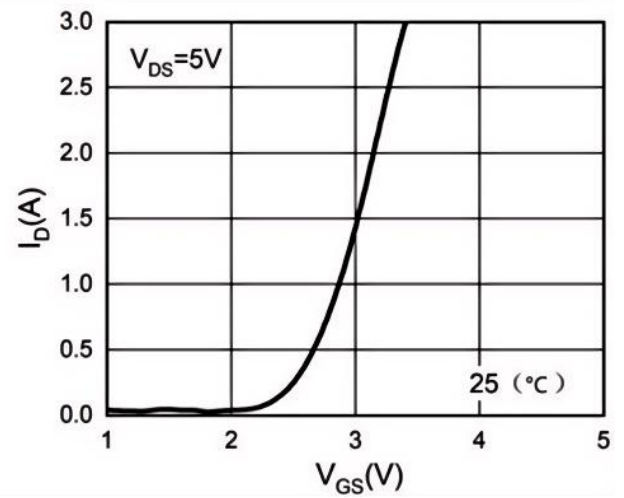
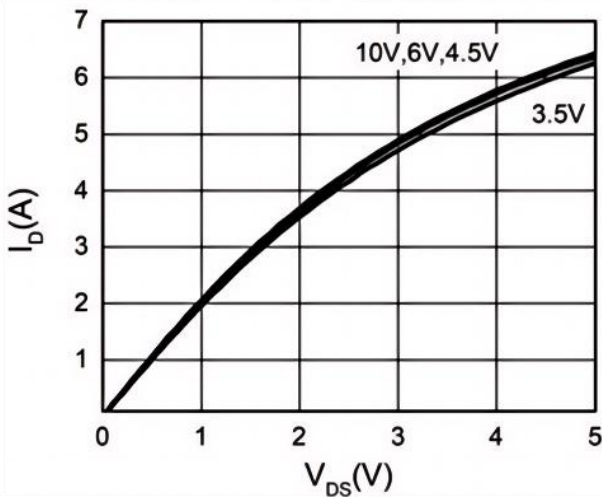
| Symbol   | Parameter                                | Conditions                                                | Min. | Typ. | Max. | Unit |
|----------|------------------------------------------|-----------------------------------------------------------|------|------|------|------|
| $I_S$    | Continuous Source Current <sup>1,5</sup> | $V_G=V_D=0V$ , Force Current                              | ---  | ---  | 5    | A    |
| $I_{SM}$ | Pulsed Source Current <sup>2,5</sup>     |                                                           | ---  | ---  | 16   | A    |
| $V_{SD}$ | Diode Forward Voltage <sup>2</sup>       | $V_{GS}=0V$ , $I_S=1A$ , $T_J=25^\circ\text{C}$           | ---  | ---  | 1.2  | V    |
| $t_{rr}$ | Reverse Recovery Time                    | $I_F=1A$ , $dI/dt=100A/\mu s$ ,<br>$T_J=25^\circ\text{C}$ | ---  | 75   | ---  | nS   |
| $Q_{rr}$ | Reverse Recovery Charge                  | $T_J=25^\circ\text{C}$                                    | ---  | 270  | ---  | nC   |

Note :

- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.
- 2.The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$
- 3.The power dissipation is limited by  $150^\circ\text{C}$  junction temperature
- 4.The data is theoretically the same as  $I_D$  and  $I_{DM}$  , in real applications , should be limited by total power dissipation.



### Typical Characteristics





## N-Ch 250V Fast Switching MOSFETs

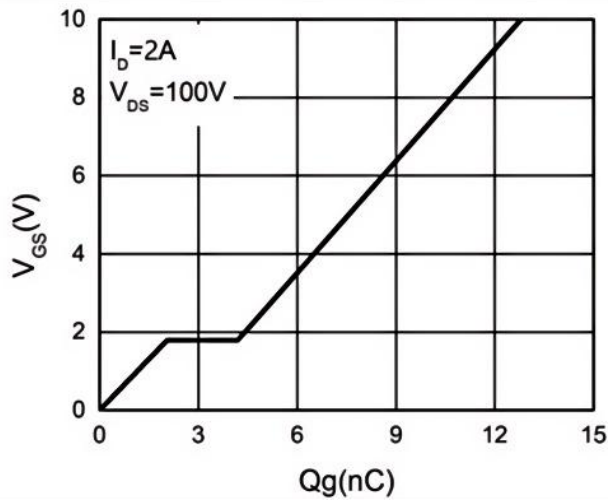


Fig.7 Gate Charge Waveforms

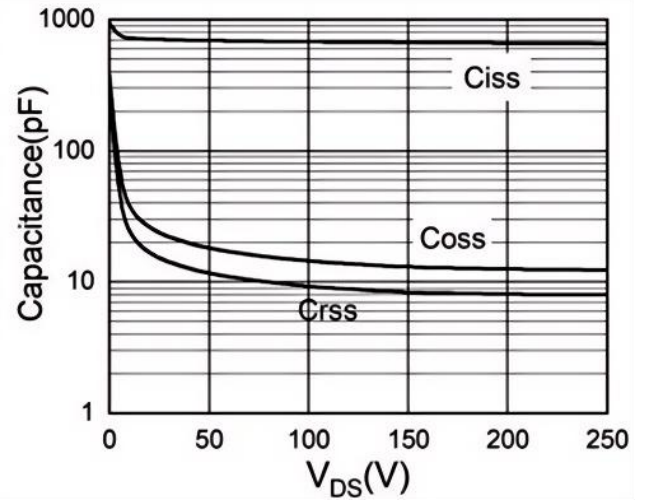


Fig.8 Capacitance

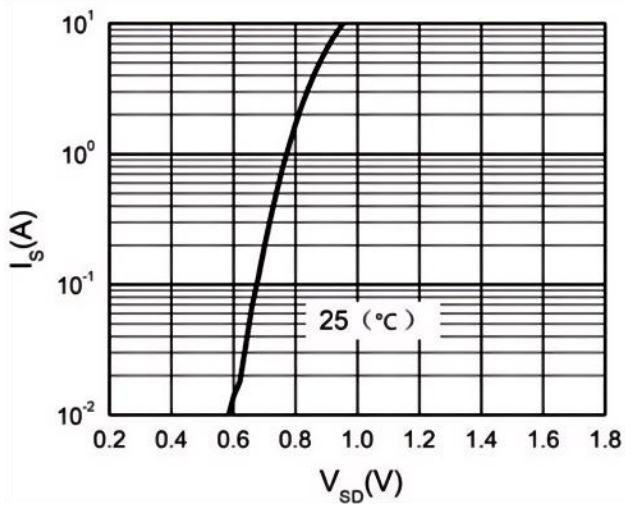


Fig.9 Body Diode Characteristics

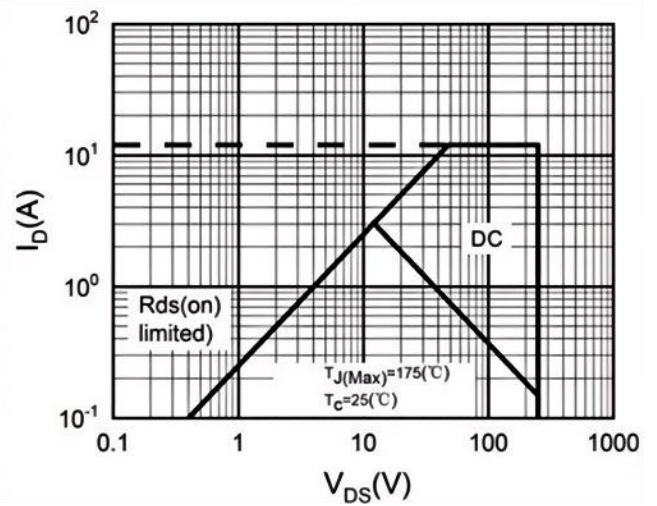
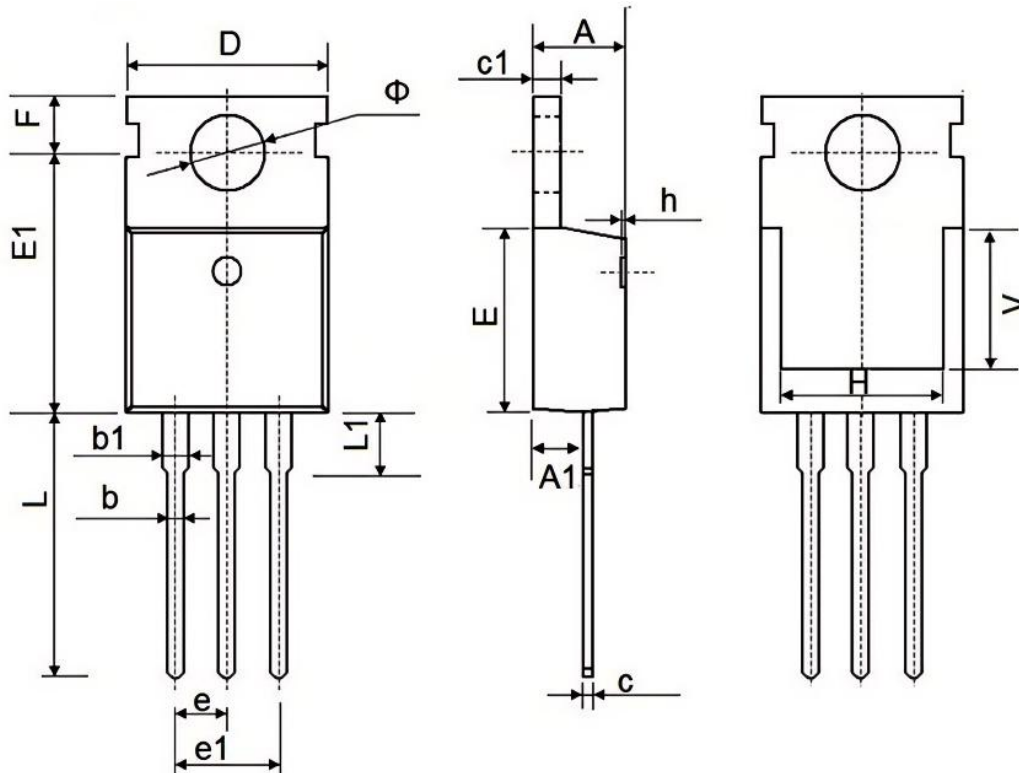


Fig.10 Maximum Safe Operating Area

## Ordering Information

| Part Number    | Package code  | Packaging       |
|----------------|---------------|-----------------|
| <b>HSP5N25</b> | <b>TO-220</b> | <b>1000/Box</b> |

### TO-220 Package Outline



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 4.300                     | 4.700  | 0.169                | 0.185 |
| A1     | 2.200                     | 2.600  | 0.087                | 0.102 |
| b      | 0.700                     | 0.950  | 0.028                | 0.037 |
| b1     | 1.170                     | 1.410  | 0.046                | 0.056 |
| C      | 0.450                     | 0.650  | 0.018                | 0.026 |
| c1     | 1.200                     | 1.400  | 0.047                | 0.055 |
| D      | 9.600                     | 10.400 | 0.378                | 0.409 |
| E      | 8.8500                    | 9.750  | 0.348                | 0.384 |
| E1     | 12.650                    | 12.950 | 0.498                | 0.510 |
| e      | 2.540 TYP.                |        | 0.100TYP.            |       |
| e1     | 4.980                     | 5.180  | 0.196                | 0.204 |
| F      | 2.650                     | 2.950  | 0.104                | 0.116 |
| H      | 7.900                     | 8.100  | 0.311                | 0.319 |
| h      | 0.000                     | 0.300  | 0.000                | 0.012 |
| L      | 12.750                    | 14.300 | 0.502                | 0.563 |
| L1     | 2.850                     | 3.950  | 0.112                | 0.156 |
| V      | 7.500 REF.                |        | 0.295 REF.           |       |
| Φ      | 3.400                     | 4.000  | 0.134                | 0.157 |



## HSP5N25 Marking:

