

## General Description

The HSP120N08 is the high cell density SGT N-ch MOSFETs, which provide excellent RDS(ON) and gate charge for most of the synchronous buck converter applications.

The HSP120N08 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

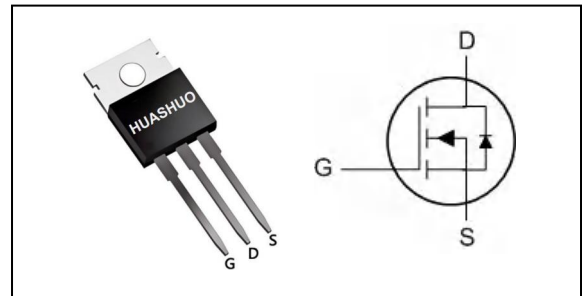
## Features

- 100% EAS Guaranteed
- Motor Drives
- SR(Synchronous rectification)
- DC/DC Converter
- Advanced high cell density SGT MOS Technology

## Product Summary

|                  |     |            |
|------------------|-----|------------|
| $V_{DS}$         | 80  | V          |
| $R_{DS(ON),TYP}$ | 4.7 | m $\Omega$ |
| $I_D$            | 120 | A          |

## TO-220 Pin Configuration



## Absolute Maximum Ratings

| Symbol                      | Parameter                                      | Rating     | Units            |
|-----------------------------|------------------------------------------------|------------|------------------|
| $V_{DS}$                    | Drain-Source Voltage                           | 80         | V                |
| $V_{GS}$                    | Gate-Source Voltage                            | $\pm 20$   | V                |
| $I_D@T_C=25^\circ\text{C}$  | Continuous Drain Current, $V_{GS} @ 10V^{1,6}$ | 120        | A                |
| $I_D@T_C=100^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 10V^{1,6}$ | 100        | A                |
| $I_{DM}$                    | Pulsed Drain Current <sup>2</sup>              | 480        | A                |
| EAS                         | Single Pulse Avalanche Energy <sup>3</sup>     | 560        | mJ               |
| $P_D@T_C=25^\circ\text{C}$  | Total Power Dissipation <sup>4</sup>           | 220        | W                |
| $T_{STG}$                   | Storage Temperature Range                      | -55 to 175 | $^\circ\text{C}$ |
| $T_J$                       | Operating Junction Temperature Range           | -55 to 175 | $^\circ\text{C}$ |

## Thermal Data

| Symbol          | Parameter                                        | Typ. | Max. | Unit               |
|-----------------|--------------------------------------------------|------|------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient <sup>1</sup> | ---  | 60   | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case <sup>1</sup>    | ---  | 0.7  | $^\circ\text{C/W}$ |



**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                                             | 80   | 92   | ---  | V    |
| R <sub>DS(ON)</sub> | Static Drain-Source On-Resistance <sup>2</sup> | V <sub>GS</sub> =10V, I <sub>D</sub> =50A                                              | ---  | 4.7  | 5.7  | mΩ   |
| V <sub>GS(th)</sub> | Gate Threshold Voltage                         | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA                               | 2    | 3    | 4    | V    |
| I <sub>DSS</sub>    | Drain-Source Leakage Current                   | V <sub>DS</sub> =80V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C                        | ---  | ---  | 1    | uA   |
|                     |                                                | V <sub>DS</sub> =64V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C                        | ---  | ---  | 100  |      |
| 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> =30A                                               | ---  | 80   | ---  | S    |
| R <sub>g</sub>      | Gate Resistance                                | V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz                                       | ---  | 1.6  | ---  | Ω    |
| Q <sub>g</sub>      | Total Gate Charge (10V)                        | V <sub>DD</sub> =40V, V <sub>GS</sub> =10V, I <sub>D</sub> =25A                        | ---  | 66   | ---  | nC   |
| Q <sub>gs</sub>     | Gate-Source Charge                             |                                                                                        | ---  | 25   | ---  |      |
| Q <sub>gd</sub>     | Gate-Drain Charge                              |                                                                                        | ---  | 14   | ---  |      |
| T <sub>d(on)</sub>  | Turn-On Delay Time                             | V <sub>DD</sub> =40V, V <sub>GS</sub> =10V, R <sub>G</sub> =3Ω,<br>I <sub>D</sub> =25A | ---  | 20   | ---  | ns   |
| T <sub>r</sub>      | Rise Time                                      |                                                                                        | ---  | 39   | ---  |      |
| T <sub>d(off)</sub> | Turn-Off Delay Time                            |                                                                                        | ---  | 44   | ---  |      |
| T <sub>f</sub>      | Fall Time                                      |                                                                                        | ---  | 22   | ---  |      |
| C <sub>iss</sub>    | Input Capacitance                              | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V, f=1MHz                                      | ---  | 4033 | ---  | pF   |
| C <sub>oss</sub>    | Output Capacitance                             |                                                                                        | ---  | 548  | ---  |      |
| C <sub>rss</sub>    | Reverse Transfer Capacitance                   |                                                                                        | ---  | 35   | ---  |      |

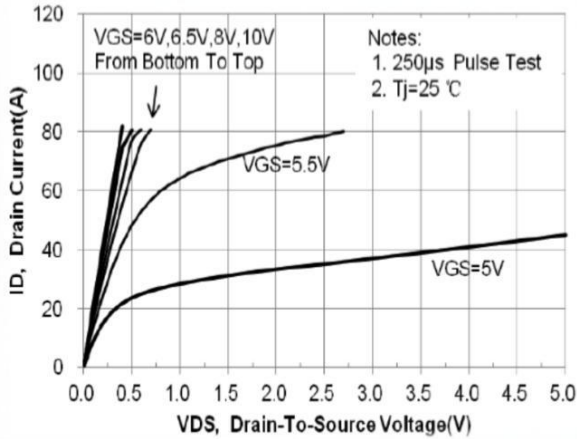
**Diode Characteristics**

| 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              | ---  | ---  | 120  | A    |
| V <sub>SD</sub> | Diode Forward Voltage <sup>2</sup>       | V <sub>GS</sub> =0V, I <sub>S</sub> =50A, T <sub>J</sub> =25°C | ---  | ---  | 1.2  | V    |
| t <sub>rr</sub> | Reverse Recovery Time                    | I <sub>F</sub> =20A, dI/dt=500A/μs,                            | ---  | 60   | ---  | nS   |
| Q <sub>rr</sub> | Reverse Recovery Charge                  | T <sub>J</sub> =25°C                                           | ---  | 340  | ---  | nC   |

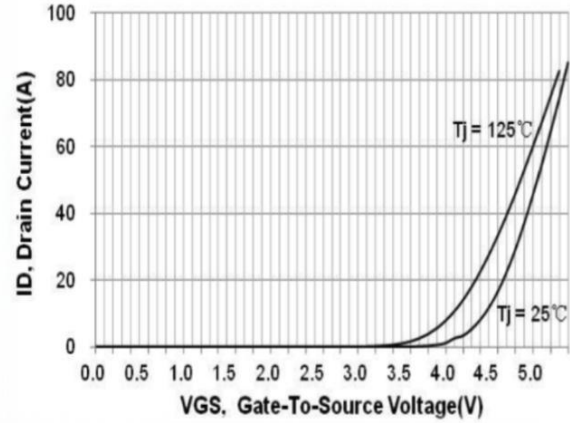


## Typical Characteristics

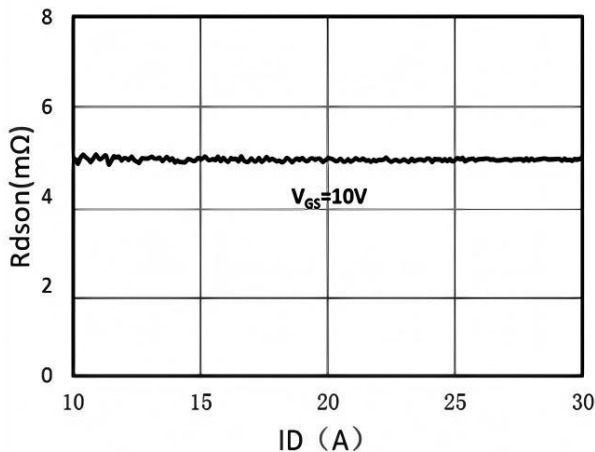
**Figure 1. Typ. Output Characteristics ( $T_J=25^{\circ}\text{C}$ )**



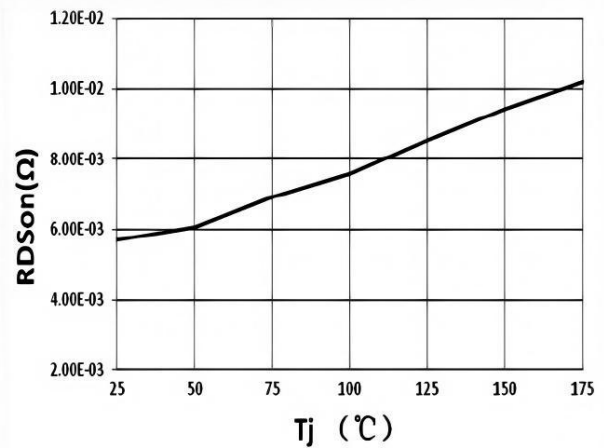
**Figure 2. Transfer Characteristics (Junction Temperature)**



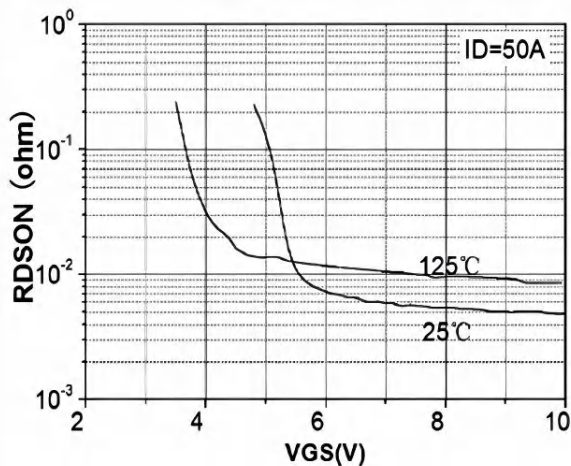
**Figure 3. On-Resistance vs. Drain Current and Gate Voltage Figure**



**Figure 4. On-Resistance vs. Junction Temperature**



**Figure 5. On-Resistance vs. Gate-Source Voltage (Junction Temperature)**



**Figure 6. Body-Diode Characteristics (Junction Temperature)**

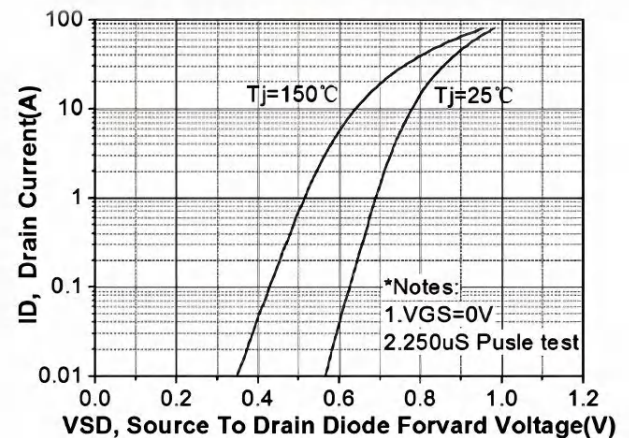




Figure 7. Gate-Charge Characteristics

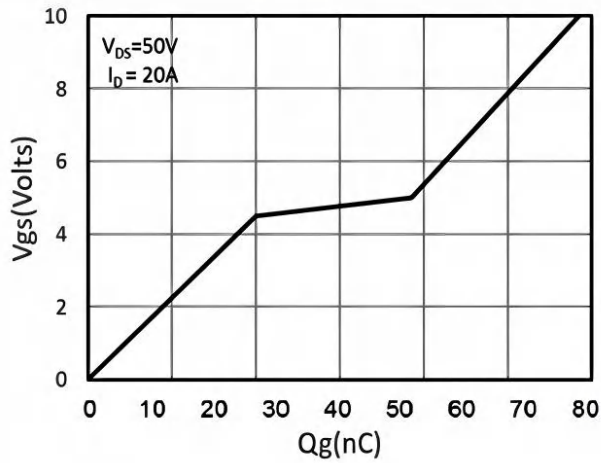


Figure 8. Capacitance Characteristics

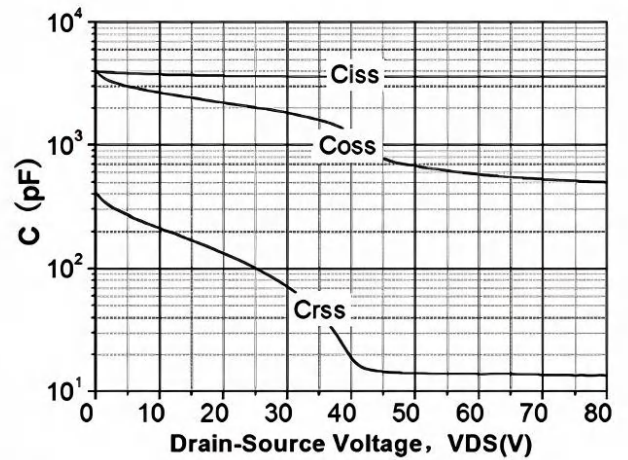


Figure 9: Normalized Maximum Transient Thermal Impedance ( $R_{thJC}$ )

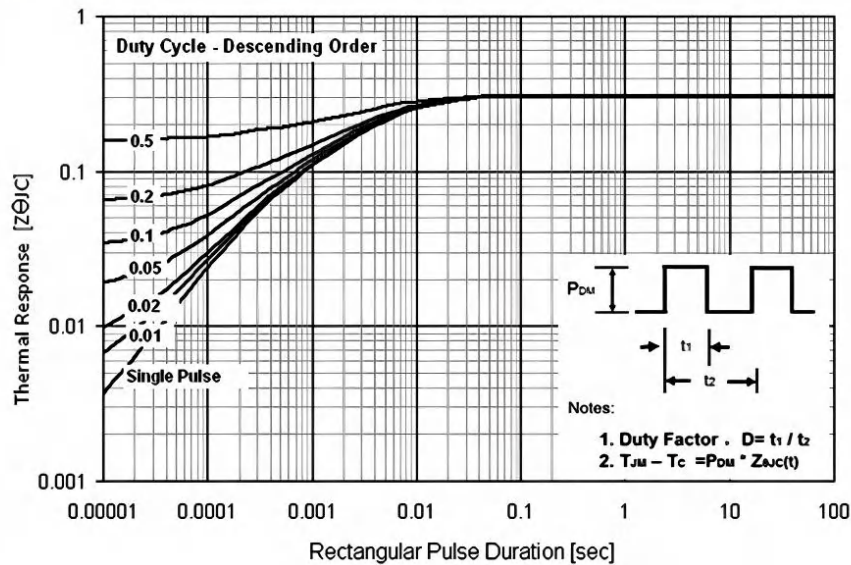
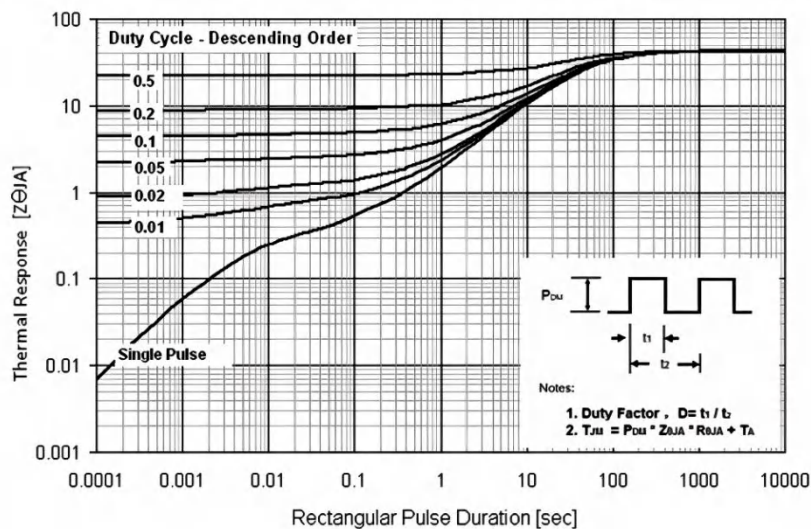


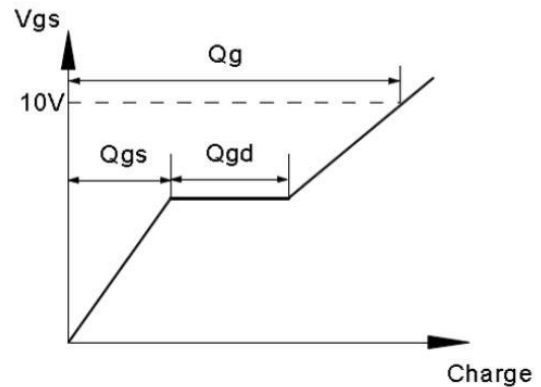
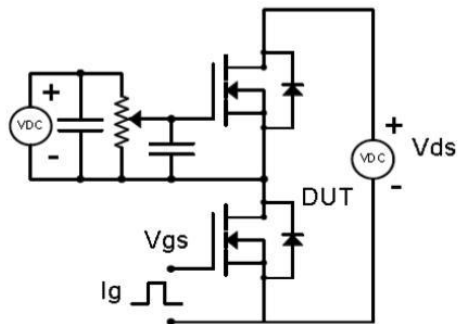
Figure 10: Normalized Maximum Transient Thermal Impedance ( $R_{thJA}$ )



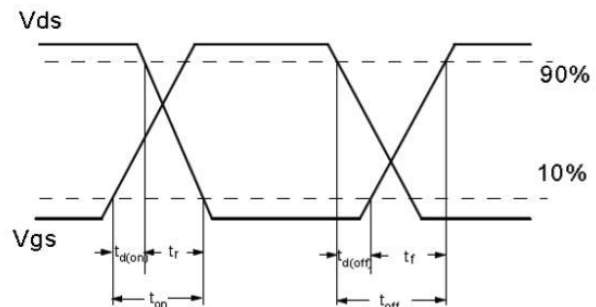
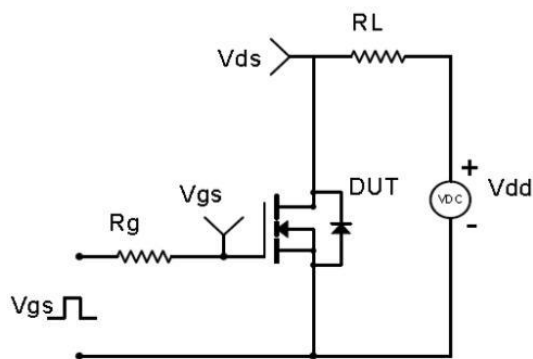


**Test Circuit & Waveform**

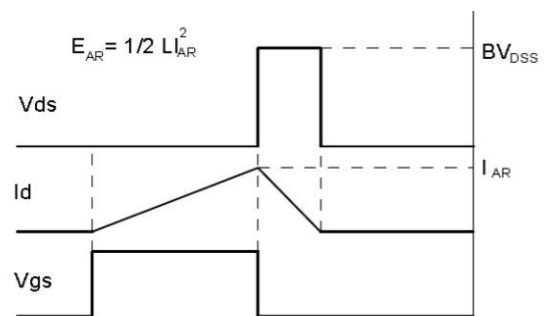
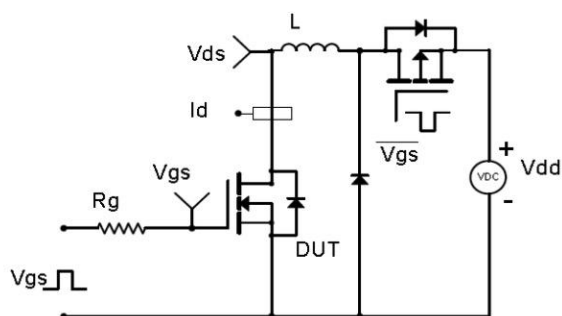
Gate Charge Test Circuit & Waveform



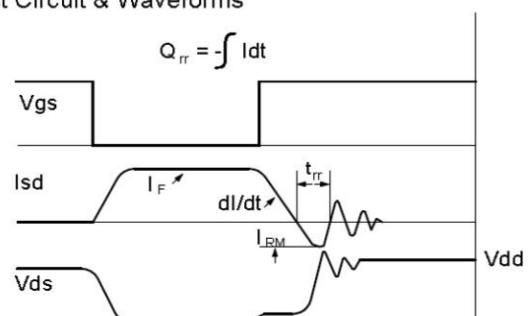
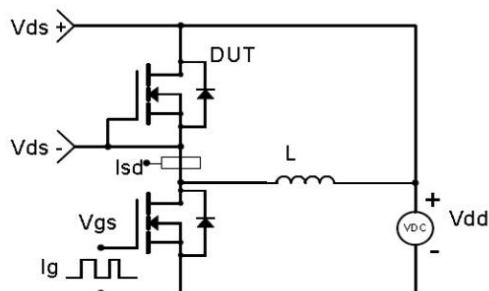
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

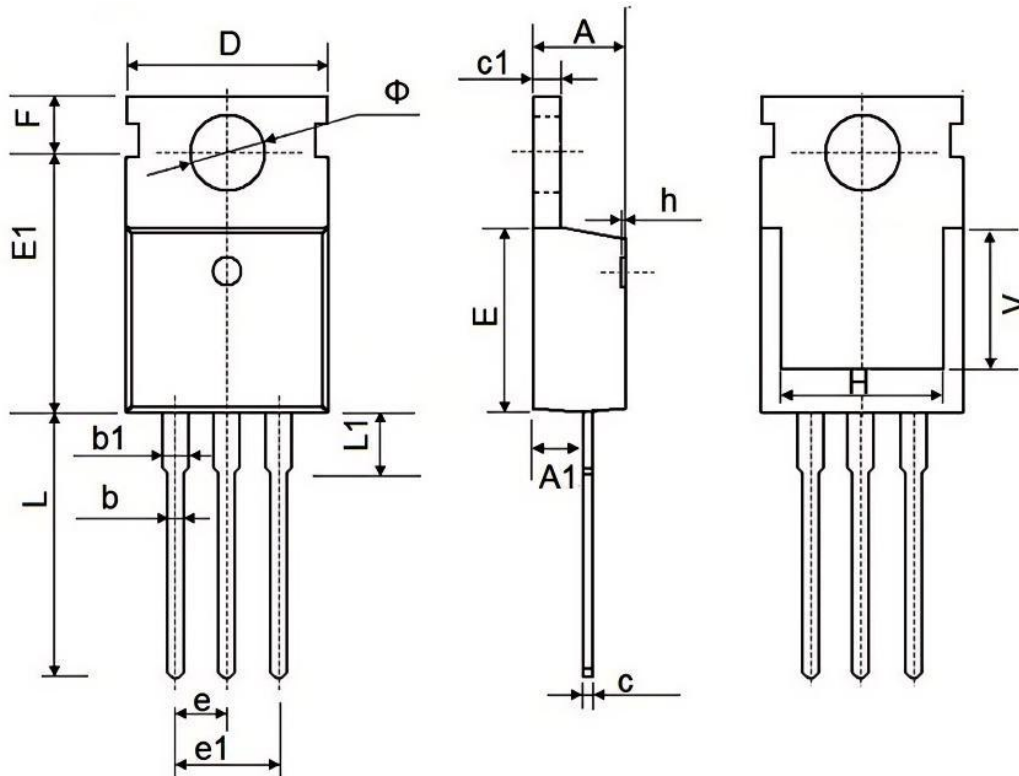




## Ordering Information

| Part Number | Package code | Packaging |
|-------------|--------------|-----------|
| HSP120N08   | TO-220       | 1000/Box  |

**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 |