

# ASC800N1700HPD

1700V, 800A, 3.25mΩ, Six-pack (Three-phase), Silicon Carbide MOSFET Module

Product Data Sheet

ASTC-3T03-25A A/0



## General Description

The AST-HPD module incorporates AST's 1700V Gen3 N-channel SiC MOSFET. NTC temperature sensor inside.

## Features

- High Temperature, Humidity, and Bias Operation
- Ultra Low Loss <10nH
- High-frequency Operation
- Zero Turn-off Tail Current from MOSFET
- Normally-off, Fail-safe Device Operation
- Copper Baseplate and Silicon Nitride Insulator

## Benefits

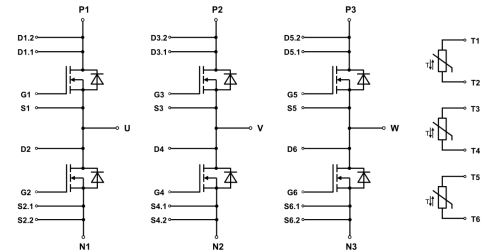
- Enables Compact, Lightweight, Efficient Systems
- Harsh Outdoor Environment Installation
- Mitigates Over-voltage Protection
- Reduced Thermal Requirements and System Cost

## Applications

- New Energy Vehicle Main Drive Inverter
- Aviation Controller
- Industrial Controller

## Key Parameters

| Symbol                  | Parameter                         | Values |      |      | Unit | Test Conditions                                                                              |
|-------------------------|-----------------------------------|--------|------|------|------|----------------------------------------------------------------------------------------------|
| Absolute maximum rating |                                   |        |      |      |      |                                                                                              |
| V <sub>DS</sub>         | Drain-source Voltage              | 1700   |      |      | V    | T <sub>C</sub> =25°C                                                                         |
| I <sub>D</sub>          | Drain Current (continuous)        | 800    |      |      | A    | T <sub>C</sub> =25°C                                                                         |
| T <sub>J</sub>          | Junction Temperature              | 175    |      |      | °C   |                                                                                              |
| Symbol                  | Parameter                         | Min.   | Typ. | Max. | Unit | Test Conditions                                                                              |
| Static characteristics  |                                   |        |      |      |      |                                                                                              |
| R <sub>DS(on)</sub>     | Static Drain-source on Resistance | -      | 3.25 | 3.75 | mΩ   | V <sub>GS</sub> =18V; I <sub>D</sub> =400A; T <sub>C</sub> =25°C                             |
| Dynamic characteristics |                                   |        |      |      |      |                                                                                              |
| Q <sub>G</sub>          | Total Gate Charge                 | -      | 1344 | -    | nC   | V <sub>DD</sub> =1200V; V <sub>GS</sub> =-5/+18V; I <sub>D</sub> =400A; T <sub>C</sub> =25°C |
| Q <sub>GD</sub>         | Gate-drain Charge                 | -      | 400  | -    |      |                                                                                              |
| Source-drain diode      |                                   |        |      |      |      |                                                                                              |
| Q <sub>RR</sub>         | Reverse Recovery Charge           | -      | 3418 | -    | nC   | V <sub>GS</sub> =-5/+18V; I <sub>F</sub> =400A; V <sub>R</sub> =1200V; T <sub>J</sub> =25°C  |



## Ordering Informations

|                        |                |
|------------------------|----------------|
| Order Number / Marking | ASC800N1700HPD |
| Package Type           | HPD            |



## Absolute Maximum Ratings (at $T_c=25^\circ\text{C}$ unless otherwise specified)

| Symbol            | Parameter                                                            | Value       | Unit               |
|-------------------|----------------------------------------------------------------------|-------------|--------------------|
| $V_{DS}$          | Drain-source Voltage                                                 | 1700        | V                  |
| $V_{GS}$          | Gate-source Voltage (dynamic)                                        | -10/+22     | V                  |
| $I_D$             | Drain Current (continuous)                                           | 800         | A                  |
| $I_{DM}$          | Drain Current (pulsed)                                               | 1600        | A                  |
| $T_{op}; T_{stg}$ | Operating and Storage Temperature Range                              | -40 to +175 | $^\circ\text{C}$   |
| $T_J$             | Junction Temperature                                                 | 175         | $^\circ\text{C}$   |
| $L_{Stray}$       | Stray Inductance                                                     | 8.5         | nH                 |
| $V_{isol}$        | Isolation Test Voltage (AC; 2mA; t=10s)                              | 3.4         | kV                 |
| $R_{th JC}$       | Thermal Resistance, Junction to Cooling Fluid                        | 0.085       | $^\circ\text{C/W}$ |
| M                 | Mounting Torque for Module Mounting (Screw M4 baseplate to heatsink) | 2.0         | Nm                 |

## MOSFET Characteristics

| Symbol                                                                                           | Parameter                         | Min. | Typ.  | Max. | Unit          | Test Conditions                                                                   |
|--------------------------------------------------------------------------------------------------|-----------------------------------|------|-------|------|---------------|-----------------------------------------------------------------------------------|
| <b>Static characteristics (at <math>T_c=25^\circ\text{C}</math> unless otherwise specified)</b>  |                                   |      |       |      |               |                                                                                   |
| $BV_{DS}$                                                                                        | Drain-source Breakdown Voltage    | 1700 | -     | -    | V             | $V_{GS}=0V$                                                                       |
| $I_{DSS}$                                                                                        | Zero Gate Voltage Drain Current   | -    | 40    | 400  | $\mu\text{A}$ | $V_{DS}=1700V; V_{GS}=0V$                                                         |
| $I_{GSS}$                                                                                        | Gate-body Leakage Current         | -    | -     | 4    | $\mu\text{A}$ | $V_{GS}=20V; V_{DS}=0V$                                                           |
| $V_{GS(th)}$                                                                                     | Gate Threshold Voltage            | 2.0  | -     | 4.0  | V             | $V_{DS}=V_{GS}; I_D=80mA$                                                         |
| $R_{DS(on)}$                                                                                     | Static Drain-source on Resistance | -    | 3.25  | 3.75 | $m\Omega$     | $V_{GS}=18V; I_D=400A$                                                            |
| $V_{GS(on)}$                                                                                     | Recommended Turn-on Voltage       | -    | 18    | -    | V             | Static                                                                            |
| $V_{GS(off)}$                                                                                    | Recommended Turn-off Voltage      | -    | -5    | -    | V             |                                                                                   |
| $R_G$                                                                                            | Gate Resistance                   | -    | 0.32  | -    | $\Omega$      | $V_{AC}=25mV; f=1MHz$                                                             |
| <b>Dynamic characteristics (at <math>T_c=25^\circ\text{C}</math> unless otherwise specified)</b> |                                   |      |       |      |               |                                                                                   |
| $C_{iss}$                                                                                        | Input Capacitance                 | -    | 51.7  | -    | nF            | $V_{DS}=1200V; f=100kHz; V_{AC}=25mV$                                             |
| $C_{oss}$                                                                                        | Output Capacitance                | -    | 1.6   | -    |               |                                                                                   |
| $C_{rss}$                                                                                        | Reverse Transfer Capacitance      | -    | 128   | -    | pF            |                                                                                   |
| $E_{on}$                                                                                         | Turn-on Switching Energy          | -    | 52.2  | -    | mJ            | $V_{DD}=1200V; V_{GS}=-5/+18V; I_D=400A; \text{Load}=100\mu H$                    |
| $E_{off}$                                                                                        | Turn-off Switching Energy         | -    | 47.6  | -    |               |                                                                                   |
| $Q_{GS}$                                                                                         | Gate-source Charge                | -    | 416   | -    | nC            | $V_{DD}=1200V; V_{GS}=-5/+18V; I_D=400A$                                          |
| $Q_{GD}$                                                                                         | Gate-drain Charge                 | -    | 400   | -    |               |                                                                                   |
| $Q_G$                                                                                            | Total Gate Charge                 | -    | 1344  | -    |               |                                                                                   |
| $t_{d(on)}$                                                                                      | Turn-on Delay Time                | -    | 77.5  | -    | ns            | $V_{DD}=1200V; V_{GS}=-5/+18V; I_D=400A; R_{G(ext)}=5\Omega; \text{Load}=50\mu H$ |
| $t_r$                                                                                            | Rise Time                         | -    | 94.8  | -    |               |                                                                                   |
| $t_{d(off)}$                                                                                     | Turn-off Delay Time               | -    | 429.7 | -    |               |                                                                                   |
| $t_f$                                                                                            | Fall Time                         | -    | 85.8  | -    |               |                                                                                   |

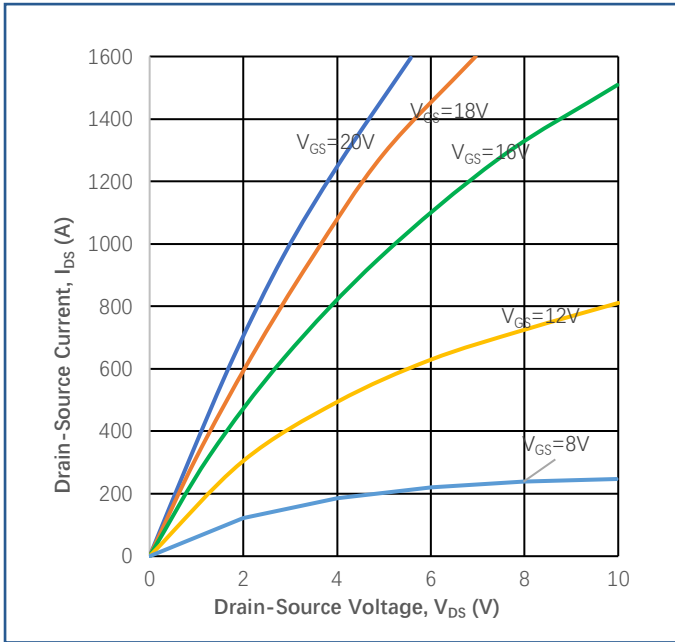
## Body Diode Characteristics (at $T_J=25^{\circ}\text{C}$ unless otherwise specified)

| Symbol    | Parameter                        | Min. | Typ.  | Max. | Unit | Test Conditions                                            |
|-----------|----------------------------------|------|-------|------|------|------------------------------------------------------------|
| $V_{FSD}$ | Forward Voltage                  | -    | -     | 6    | V    | $V_{GS}=0\text{V}; I_F=400\text{A}$                        |
| $I_S$     | Continuous Diode Forward Current | -    | 400   | -    | A    | $V_{GS}=0\text{V}; T_C=25^{\circ}\text{C}$                 |
| $t_{RR}$  | Reverse Recovery Time            | -    | 66.3  | -    | ns   | $V_{GS}=-5/+18\text{V}; I_F=400\text{A}; V_R=1200\text{V}$ |
| $Q_{RR}$  | Reverse Recovery Charge          | -    | 3418  | -    | nC   |                                                            |
| $I_{RRM}$ | Peak Reverse Recovery Current    | -    | 111.4 | -    | A    |                                                            |

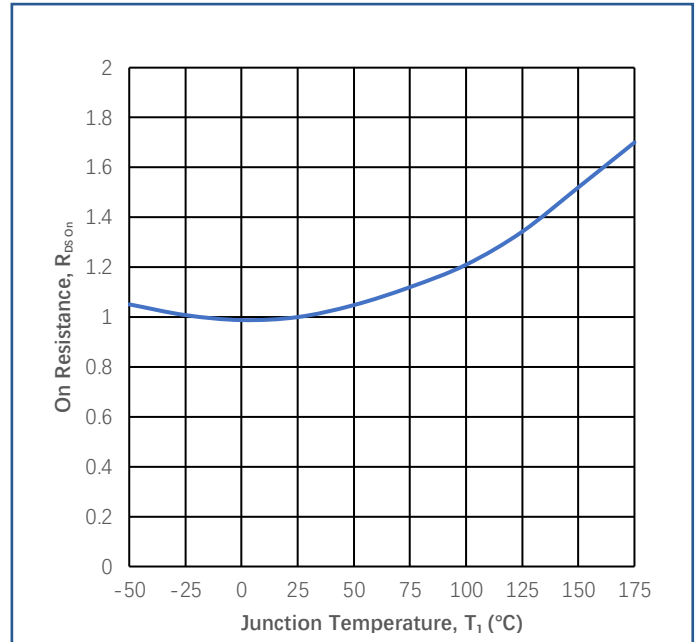
## NTC Thermistor Characteristics

| Symbol       | Parameter                                                    | Min. | Typ. | Max. | Unit       | Test Conditions                                         |
|--------------|--------------------------------------------------------------|------|------|------|------------|---------------------------------------------------------|
| $R_{25}$     | Rated Resistance                                             | -    | 5.00 | -    | k $\Omega$ | $T_{NTC}=25^{\circ}\text{C}$                            |
| $\Delta R/R$ | Deviation of $R_{100}$                                       | -5   | -    | 5    | %          | $T_{NTC}=100^{\circ}\text{C}; R_{100}=493.3\Omega$      |
| $B_{25/50}$  | Beta Value for $25^{\circ}\text{C}$ to $50^{\circ}\text{C}$  | -    | 3375 | -    | K          | $R_2=R_{25}\exp [B_{25/50}(1/T_2-1/(298.15\text{K}))]$  |
| $B_{25/80}$  | Beta Value for $25^{\circ}\text{C}$ to $80^{\circ}\text{C}$  | -    | 3414 | -    | K          | $R_2=R_{25}\exp [B_{25/80}(1/T_2-1/(298.15\text{K}))]$  |
| $B_{25/100}$ | Beta Value for $25^{\circ}\text{C}$ to $100^{\circ}\text{C}$ | -    | 3436 | -    | K          | $R_2=R_{25}\exp [B_{25/100}(1/T_2-1/(298.15\text{K}))]$ |

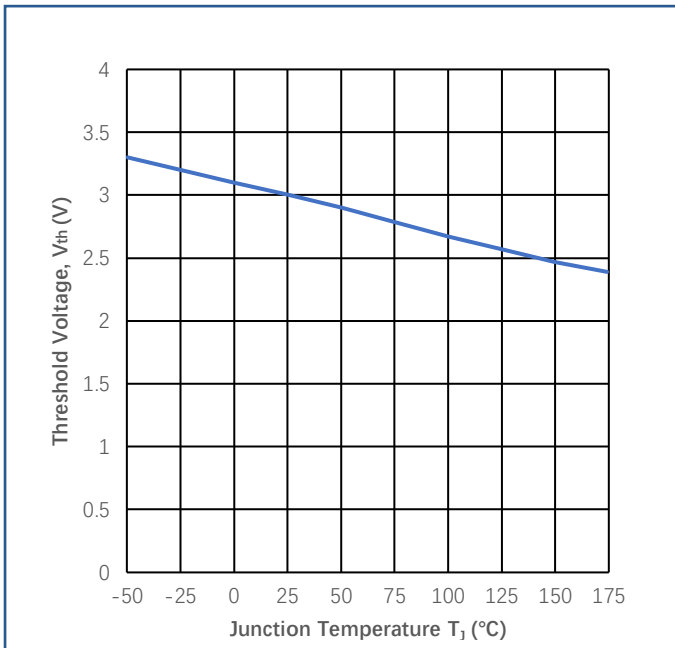
## Typical Performance



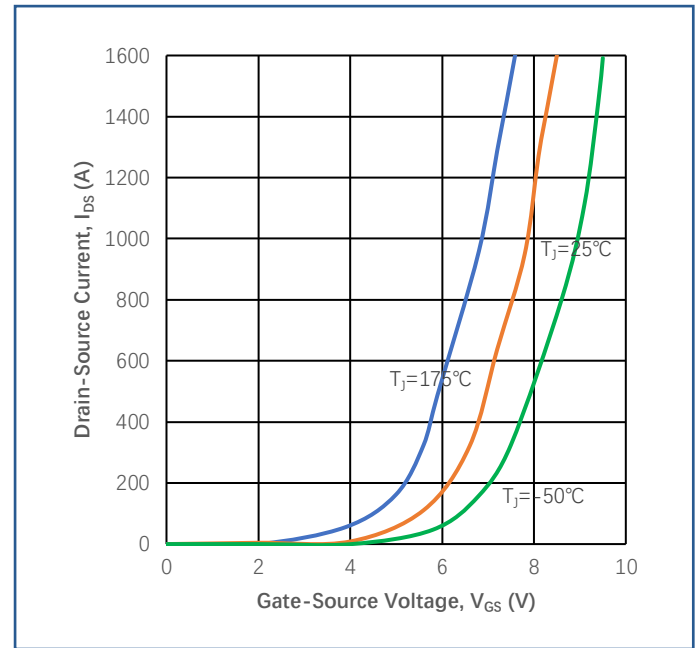
**Figure 1**  
Output Characteristics ( $T_J = 25^\circ\text{C}$ )



**Figure 2**  
Normalized on-resistance vs. Temperature

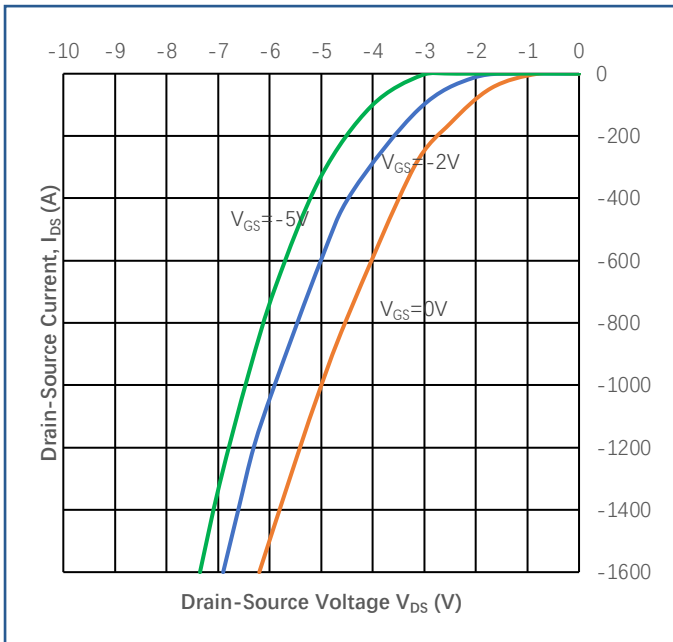


**Figure 3**  
Threshold Voltage vs. Temperature

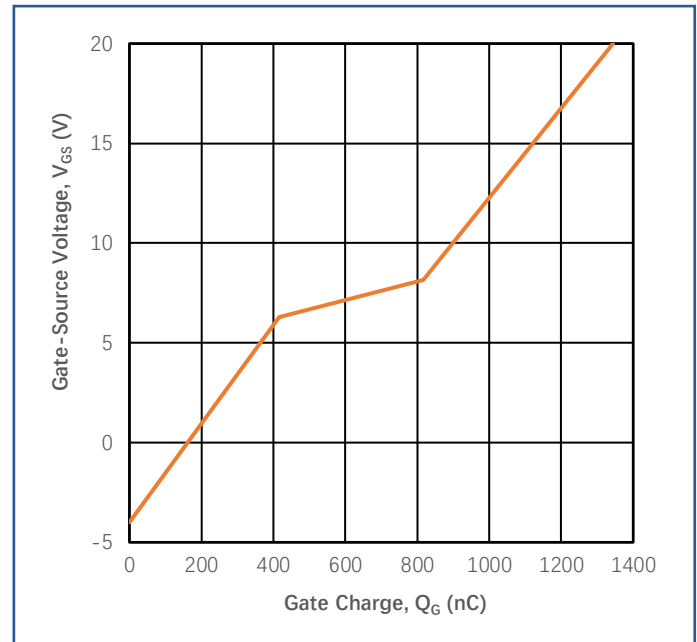


**Figure 4**  
Transfer Characteristic for Various  $T_J$

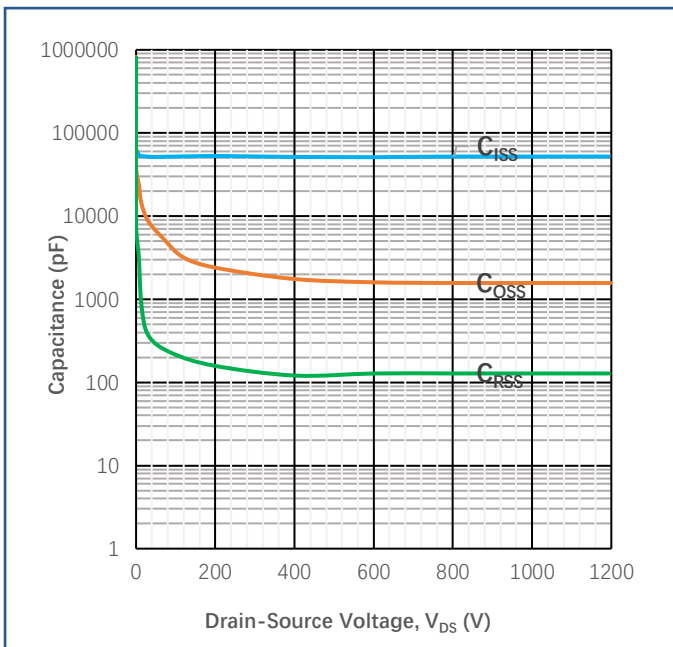
## Typical Performance



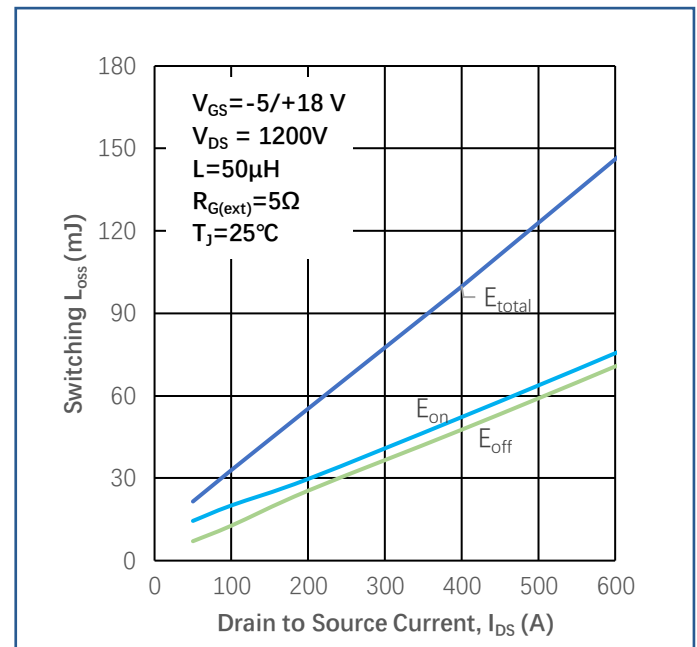
**Figure 5**  
Diode Characteristic at 25 °C



**Figure 6**  
Typical Gate Charge Characteristics

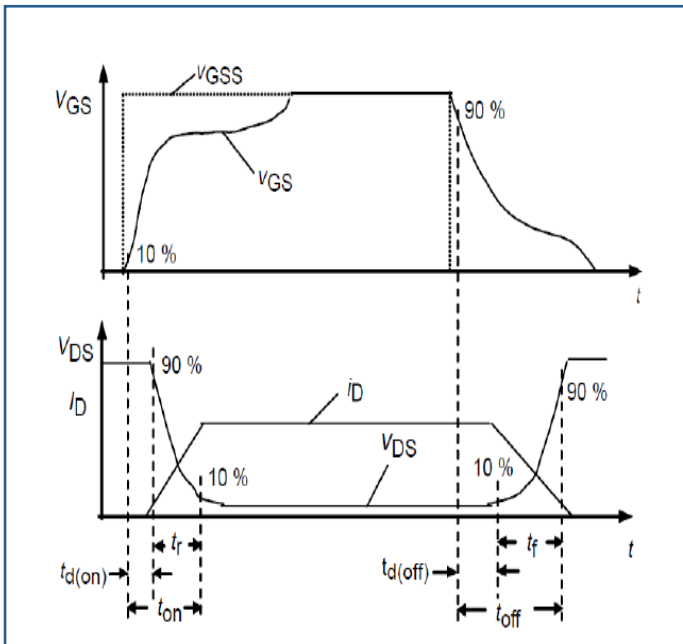


**Figure 7**  
Typical Capacitances vs. Drain-source Voltage



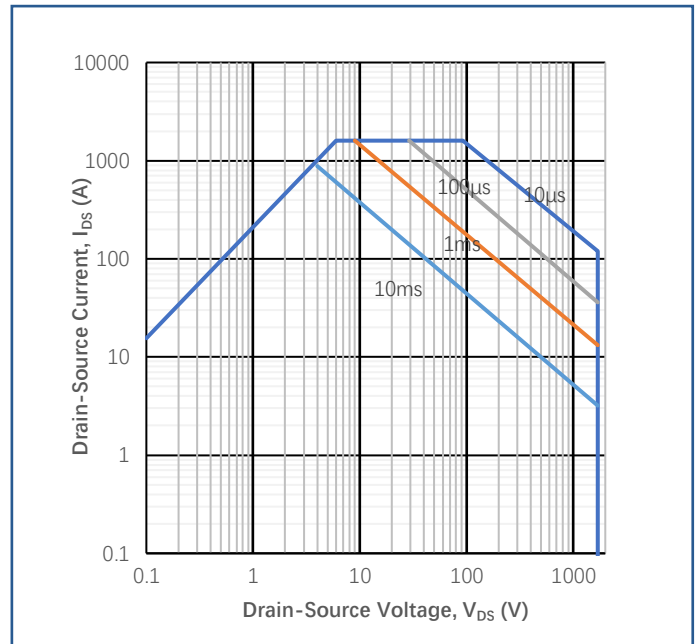
**Figure 8**  
Inductive Switching Energy vs. Drain Current

## Typical Performance



**Figure 9**

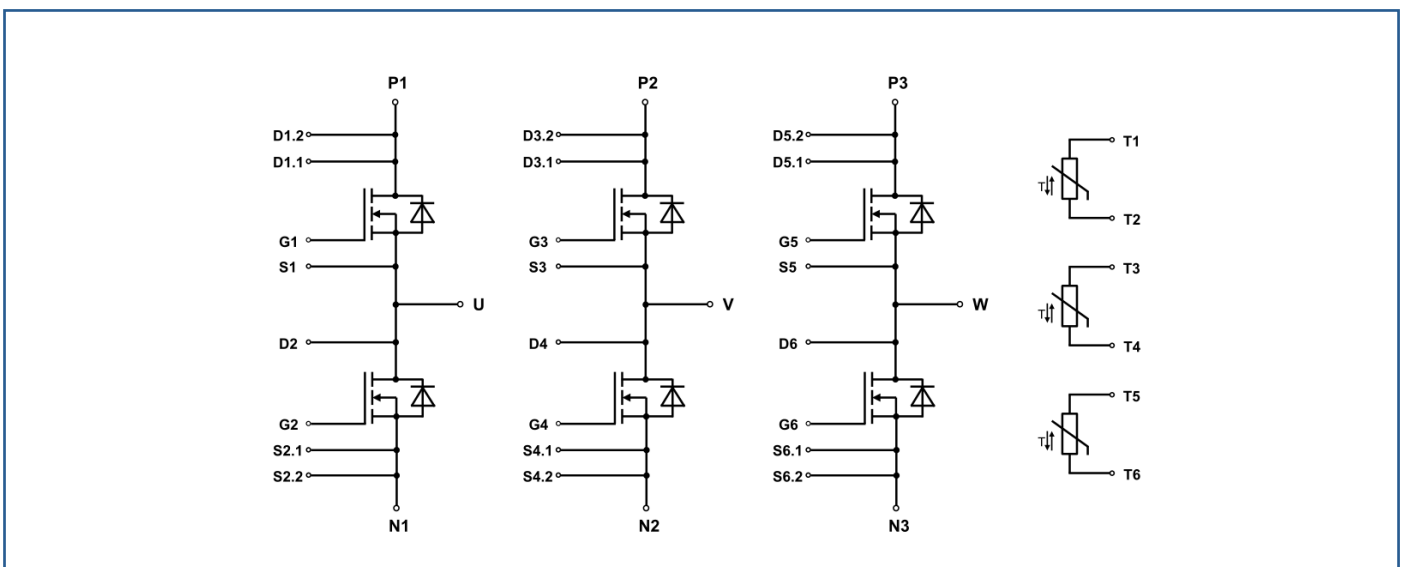
Switching Time Description



**Figure 10**

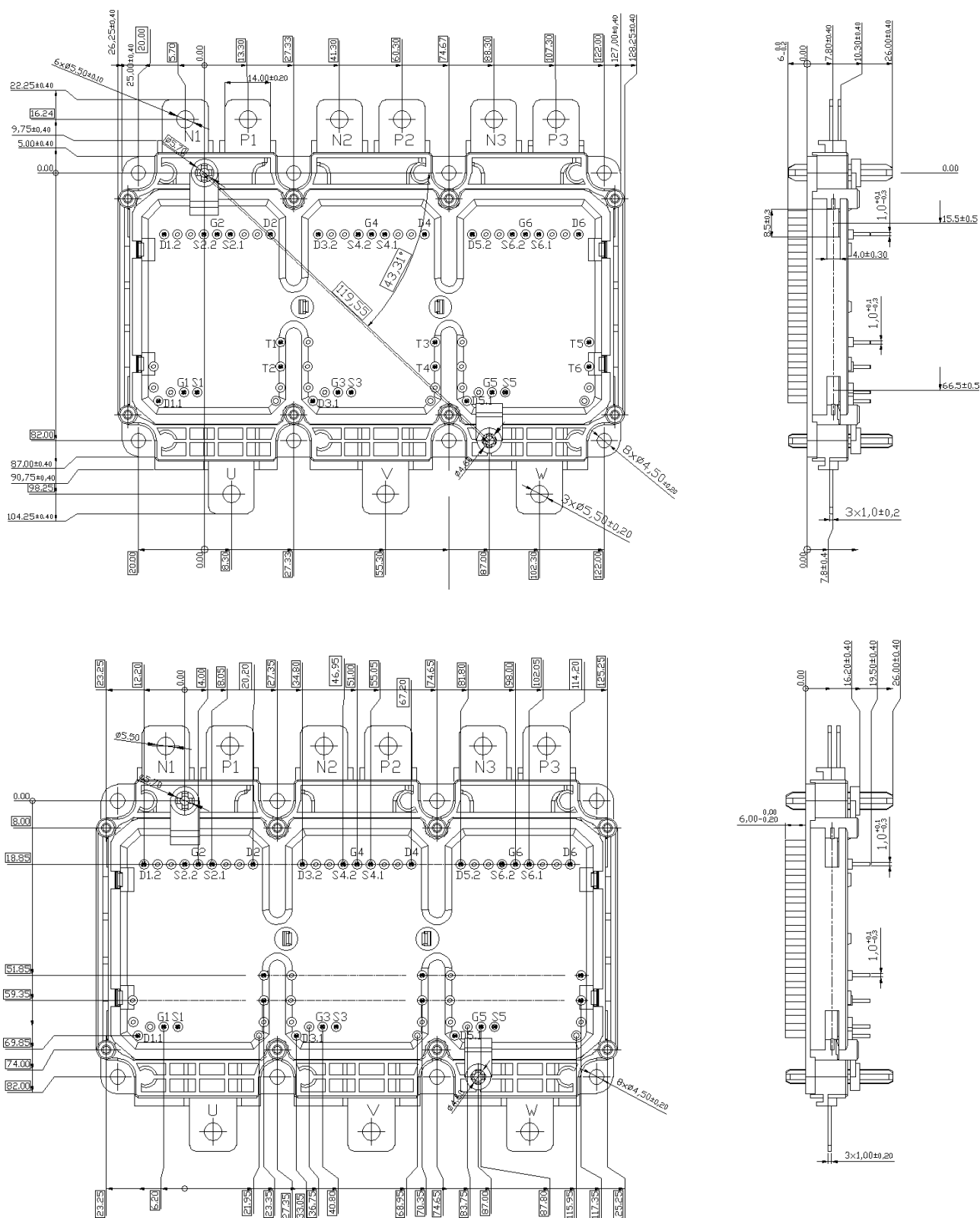
Safe Operating Area

## Circuit Diagram Headline



## Package Dimensions (mm)

### Package Type: HPD



| 未标注线性公差按<br>GB/1804-2000c 级执行 | 公差分段 | 0.5-3 | 3-6  | 6-30 | 30-120 | 120-400 |
|-------------------------------|------|-------|------|------|--------|---------|
|                               | c 级  | ±0.2  | ±0.3 | ±0.5 | ±0.8   | ±1.2    |

## Notes & Disclaimer

---

This document and the information contained herein are subject to change without notice. Any such change shall be evidenced by the publication of an updated version of this document by AST Technology. No communication from any employee or agent of AST Technology or any third party shall effect an amendment or modification of this document.

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, AST Technology hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

Any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of AST Technology in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Except as otherwise explicitly approved by AST Technology in a written document signed by authorized representatives, the products of AST Technology may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.

## Contact Info

---

Tel: +86 755-89300160

Web: <http://www.astsic.com/>

Add: No.1 Rongtian Rd., Pingshan, Shenzhen, China

@2024 Shenzhen AST Technology Company. All Rights Reserved.