

ASC600N650HPD

650V, 2m Ω , Six-pack (Three-phase), Silicon Carbide MOSFET Module

Product Data Sheet

ASTC-3T03-223A A/0



爱仕特半导体
AST Semiconductor

General Description

The AST-HPD module incorporates AST's 650V 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

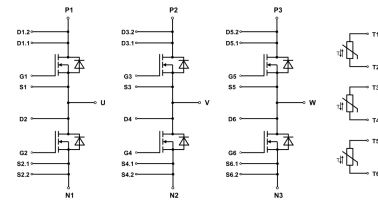
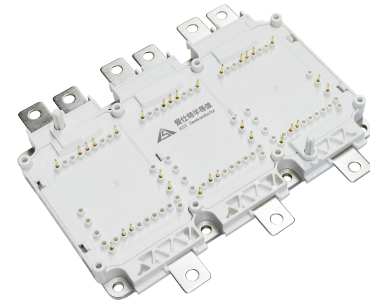
Benefits

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

Applications

- Traction Inverter for New Energy Vehicles
- Aviation Controller
- Industrial Controller

Key Parameters



Ordering Information

Order Number	ASC600N650HPD
Marking	ASC600N650HPD
Package Type	HPD

Symbol	Parameter	Values			Unit	Test Conditions
Absolute maximum rating						
V _{DS}	Drain-Source Voltage	650			V	T _c =25°C
I _D	Drain Current (continuous)	600			A	T _c =25°C; V _{GS} =18V
		510				T _c =65°C; V _{GS} =18V
T _{J; Max}	Junction Temperature	175			°C	
Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
Static characteristics						
R _{DS(on)}	Static Drain-Source on Resistance	-	2.0	2.5	mΩ	V _{GS} =18V; I _D =300A; T _c =25°C
Dynamic characteristics						
Q _G	Total Gate Charge	-	1416	-	nC	V _{DD} =400V; V _{GS} =-5/+18V; I _D =300A; T _c =25°C
Q _{GD}	Gate-Drain Charge	-	384	-		
Source-drain diode						
Q _{RR}	Reverse Recovery Charge	-	4.1	-	μC	V _{GS} =-5/+18V; I _F =600A; V _R =400V; I _{load} =50μH; R _{G(off)} =5Ω; T _i =25°C

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

Symbol	Parameter	Value	Unit
V_{DS}	Drain-Source Voltage	650	V
V_{GS}	Gate-Source Voltage (dynamic)	-10/+22	V
I_D	Drain Current (continuous; $T_c=25^{\circ}\text{C}$)	600	A
	Drain Current (continuous; $T_c=65^{\circ}\text{C}$)	510	
I_{DM}	Drain Current (pulsed)	1020	A
$T_{op}; T_{stg}$	Operating and Storage Temperature Range	-40 to +175	$^{\circ}\text{C}$
$T_{J; Max}$	Junction Temperature	175	$^{\circ}\text{C}$
L_{Stray}	Stray Inductance	8.5	nH
V_{isol}	Isolation Test Voltage (AC; 2mA; t=10s)	3.0	kV
$R_{th JC}$	Thermal Resistance, Junction to Case	0.085	$^{\circ}\text{C/W}$
M	Mounting Torque for Module Mounting (Screw M4 Baseplate to Heatsink)	2.0	Nm
p	Maximum Pressure in Cooling Circuit ($T_{baseplate} < 40^{\circ}\text{C}$ (relative pressure))	2.5	Bar
	Maximum Pressure in Cooling Circuit ($T_{baseplate} \geq 40^{\circ}\text{C}$ (relative pressure))	2.0	

MOSFET Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
Static characteristics (at $T_c=25^{\circ}\text{C}$ unless otherwise specified)						
BV_{DS}	Drain-Source Breakdown Voltage	650	-	-	V	$V_{GS}=0\text{V}; I_D=2.0\text{mA}$
I_{DSS}	Zero Gate Voltage Drain Current	-	-	60	μA	$V_{DS}=650\text{V}; V_{GS}=0\text{V}$
I_{GSS}	Gate-Body Leakage Current	-	-	3.0	μA	$V_{GS}=-10/+20\text{V}; V_{DS}=0\text{V}$
$V_{GS(th)}$	Gate Threshold Voltage	2.0	-	4.0	V	$V_{DS}=V_{GS}; I_D=60\text{mA}$
$R_{DS(on)}$	Static Drain-Source on Resistance	-	2.0	2.5	$\text{m}\Omega$	$V_{GS}=18\text{V}; I_D=300\text{A}$
$V_{GS(on)}$	Recommended Turn-on Voltage	-	18	-	V	Static
$V_{GS(off)}$	Recommended Turn-off Voltage	-	-5	-		
R_G	Gate Resistance	-	0.4	-	Ω	$V_{AC}=25\text{mV}; f=1\text{MHz}$
Dynamic characteristics (at $T_c=25^{\circ}\text{C}$ unless otherwise specified)						
C_{iss}	Input Capacitance	-	43	-	nF	$V_{DS}=400\text{V}; f=100\text{KHz}; V_{AC}=25\text{mV}$
C_{oss}	Output Capacitance	-	1.95	-		
C_{rss}	Reverse Transfer Capacitance	-	186	-	pF	
E_{on}	Turn-on Switching Energy	-	8.3	-	mJ	$V_{DS}=400\text{V}; V_{GS}=-5/+18\text{V}; I_D=600\text{A}; R_{G(ext)}=5.0\Omega; \text{Load}=50\mu\text{H}$
E_{off}	Turn-off Switching Energy	-	34.8	-		
Q_{GS}	Gate-Source Charge	-	336	-	nC	$V_{DD}=400\text{V}; V_{GS}=-5/+18\text{V}; I_D=300\text{A}$
Q_{GD}	Gate-Drain Charge	-	384	-		
Q_G	Total Gate Charge	-	1416	-		
$t_{d(on)}$	Turn-on Delay Time	-	169	-	ns	$V_{DD}=400\text{V}; V_{GS}=-5/+18\text{V}; I_D=600\text{A}; R_{G(ext)}=5.0\Omega; \text{Load}=50\mu\text{H}$
t_r	Rise Time	-	124	-		
$t_{d(off)}$	Turn-off Delay Time	-	403	-		
t_f	Fall Time	-	93	-		



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	-	3.5	6	V	$V_{GS}=0V$; $I_F=300A$
I_S	Continuous Diode Forward Current	-	300	-	A	$V_{GS}=0V$; $T_C=25^\circ\text{C}$
t_{RR}	Reverse Recovery Time	-	114	-	ns	$V_{GS}=-5/+18V$; $I_F=600A$; $V_R=400V$; $R_{G(off)}=5\Omega$; Load=50 μH
Q_{RR}	Reverse Recovery Charge	-	4.1	-	μC	
I_{RRM}	Peak Reverse Recovery Current	-	204	-	A	

NTC Thermistor Characteristics

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

Typical Performance

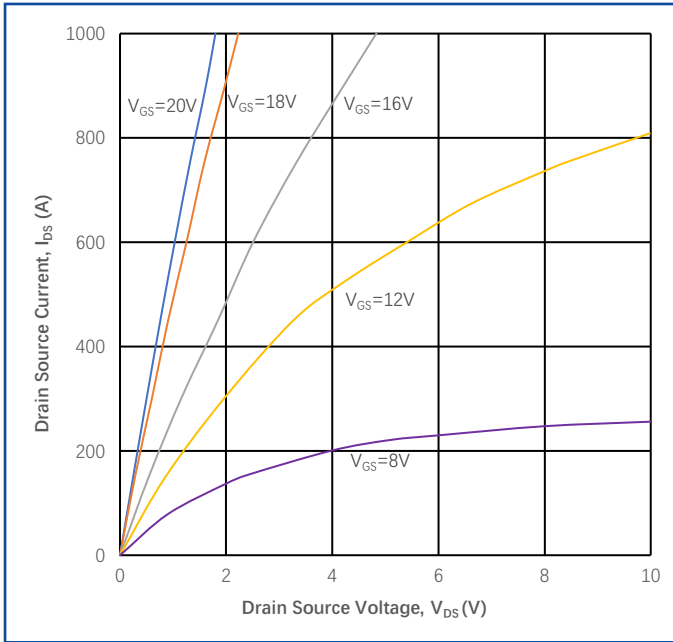


Figure 1
Output Characteristics ($T_J = 25^\circ\text{C}$)

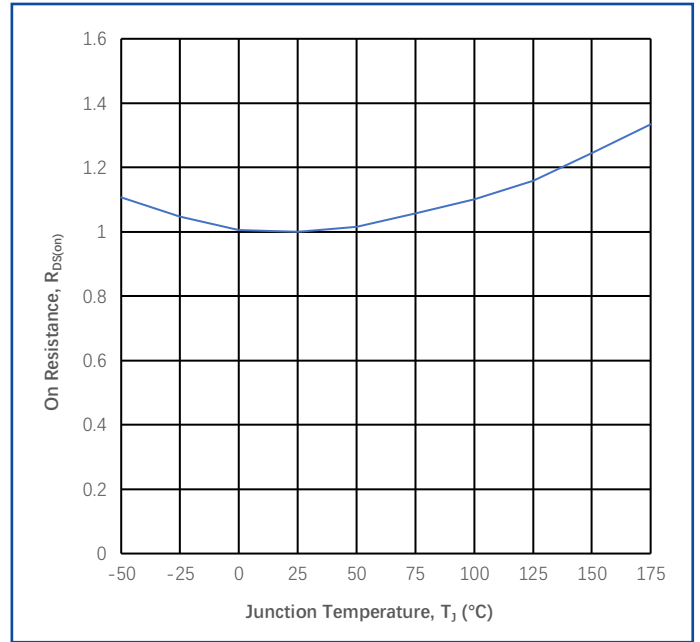


Figure 2
Normalized On-Resistance vs. Temperature

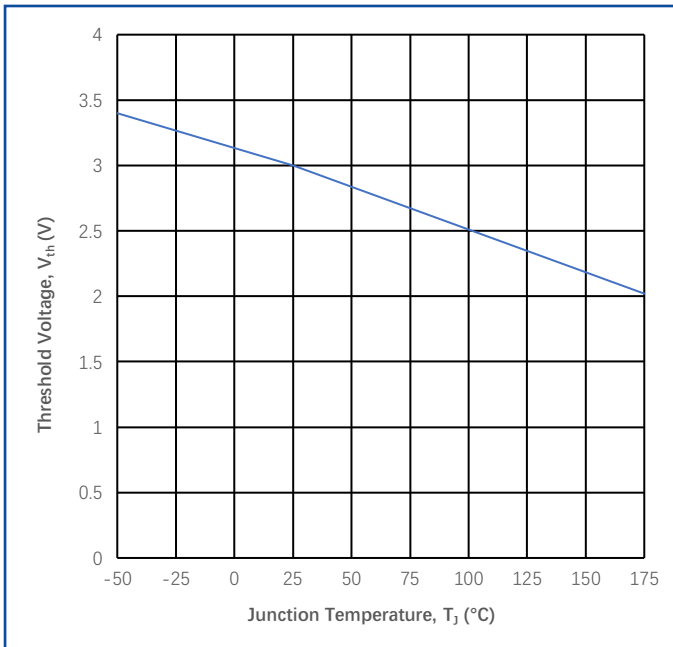


Figure 3
Threshold Voltage vs. Temperature

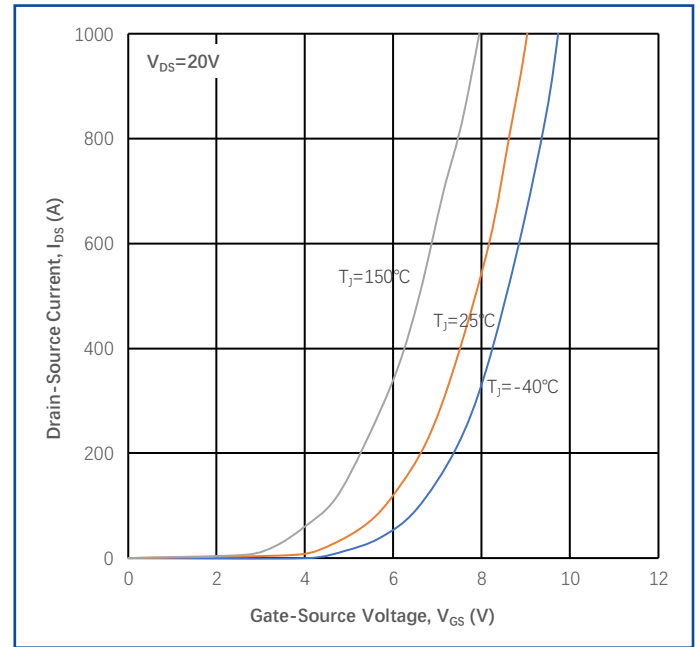


Figure 4
Transfer Characteristic for Various T_J

Typical Performance

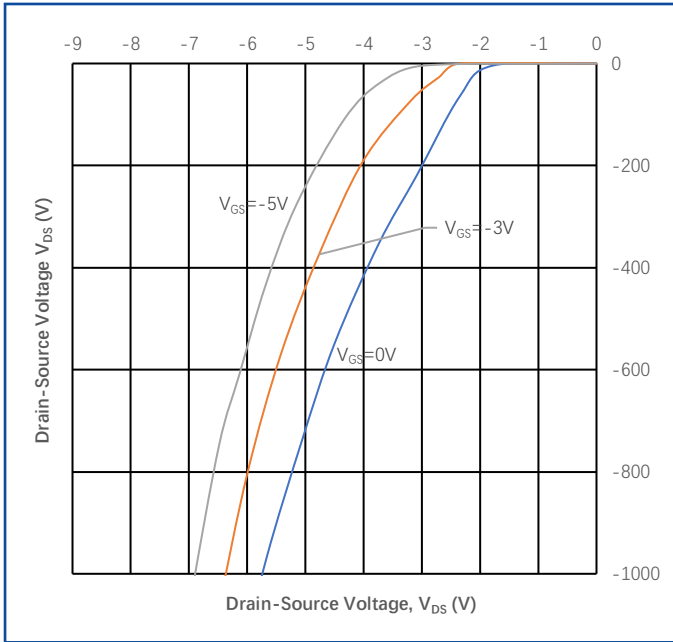


Figure 5

Diode Characteristic at 25°C

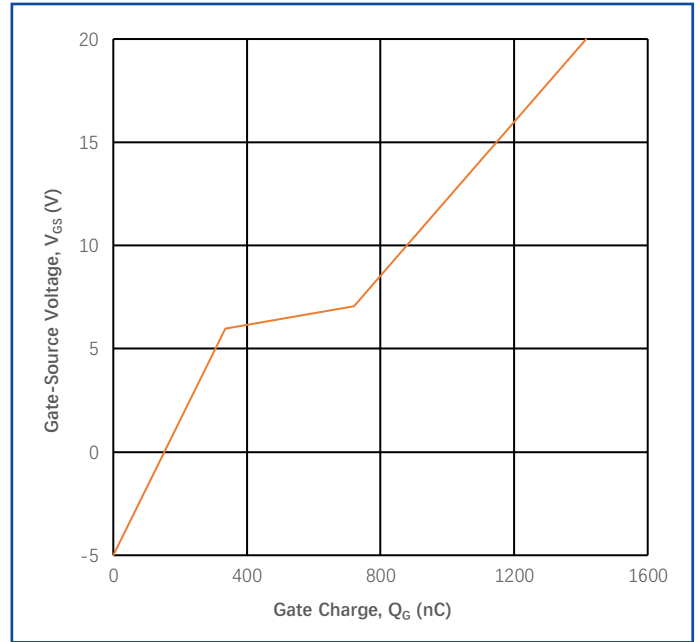


Figure 6

Typical Gate Charge Characteristics

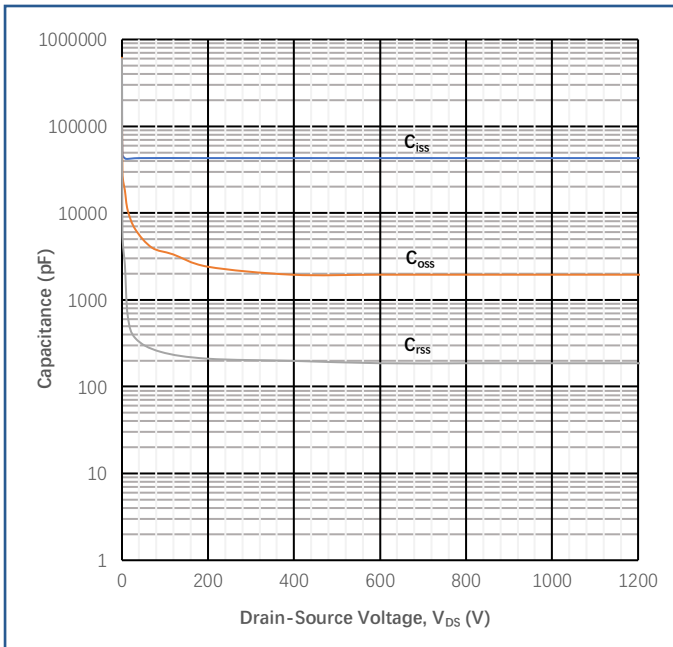


Figure 7

Typical Capacitances vs. Drain-Source Voltage

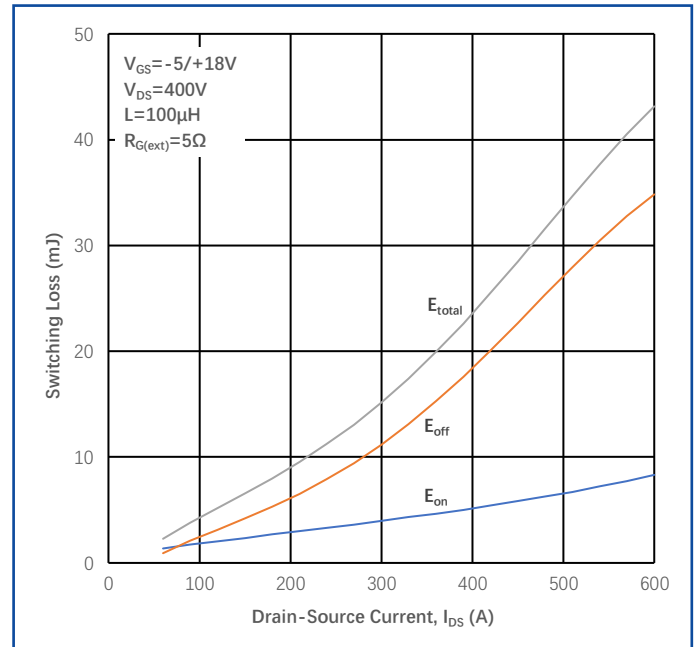


Figure 8

Inductive Switching Energy vs. Drain Current

Typical Performance

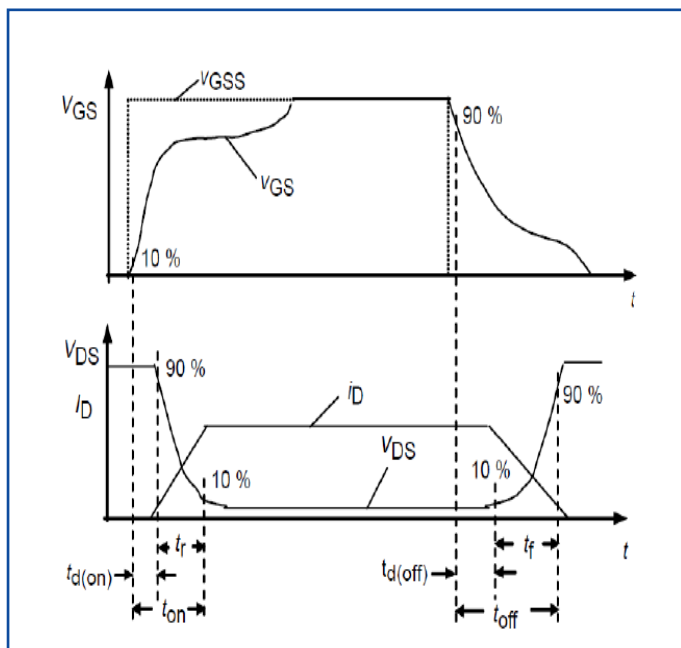


Figure 9

Switching Time Description

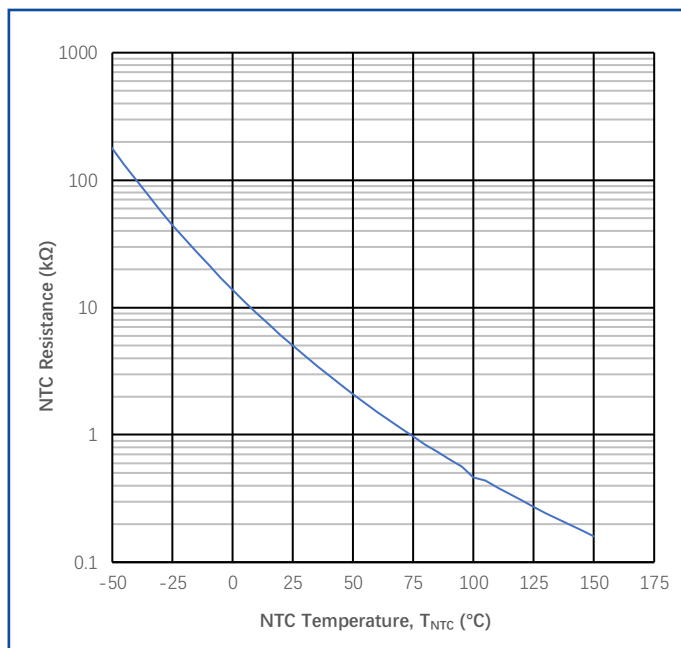
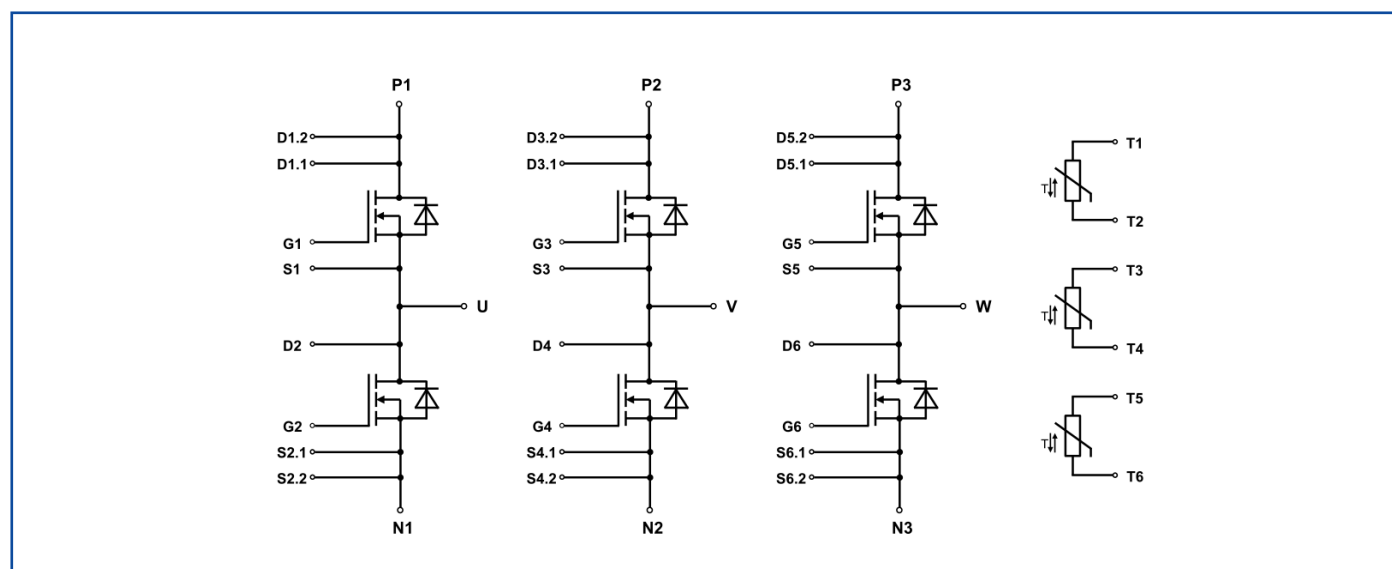


Figure 10

NTC-Temperature characteristic (typical)

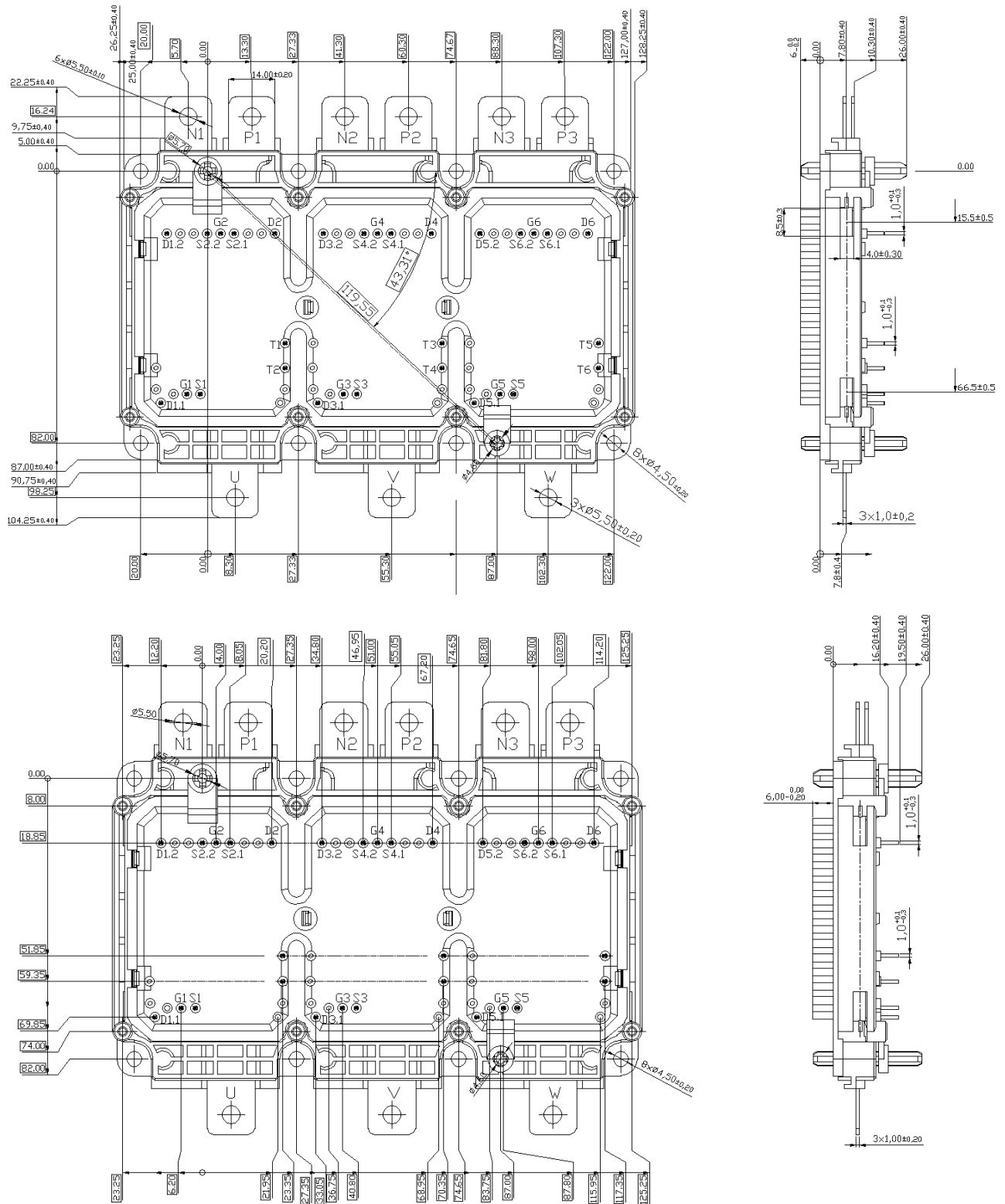
Circuit Diagram Headline





Package Dimensions (mm)

Package Type: HPD



未标注线性公差按 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

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