

Hybrid Surge Protection DC DC converter (HSTR28S Series)

1 Features of surge protection DC DC converter

- High reliability
- Wide input voltage range: 15V~50V, Nominal
DC input voltage: 28V
- Surge protection voltage: 80V, 1s



Dimensions: 54.40×29.00×10.66mm

(without flange)

- Output Power P_O : 40W
- Operating temperature range T_c : -55°C~+125°C

Dimensions: 74.00×29.00×10.66mm (with flange)

Weight: 47g (without flange)

- Low Startup current
- No output overshoot

55g (with flange)

- Inhibit function
- Input under-voltage locked function
and output short circuit protection
- Maximum power density: 41W/in³
- Hermetically sealed metal case

Table 1 Device models

HSTR28S3R3 H	HSTR28S8
STR28S3R3F	HSTR28S8F
HSTR28S5	HSTR28S12
HSTR28S5F	HSTR28S12F
HSTR28S5R2	HSTR28S15
HSTR28S5R2F	HSTR28S15F

2 Scope of application of surge protection DC DC converter

C DC converter

High-reliability electronic system for aviation and aerospace, etc

3 Description of surge protection DC DC converter

This series device is highly reliable and is featured with surge protection (80v, 1s) for surge protection DC DC converter. Single ended, pulse width modulated and transformer magnetic feedback topology design is used in this device. The operating principle is that the sampling signal of output voltage, coupled by the opto-coupler, works together with the sampling signal of input loop current to regulate the pulse width of the controller. The double loop control creates constant voltage output and short circuit protection.

Devices are produced by using thick film hybrid integration process, and metal package sealing. The design and manufacturing process of HTR 28 Series of converters are in compliance with General Standards of Hybrid Integrated Circuits and detailed specification of manufacturing. Input terminal connected to the accessory power supply filter can improve the electro-magnetic compatibility of devices.

4 Technical Specifications of surge protection DC DC converter

Table 2 Rated conditions and recommended operating conditions

Absolute Max. Rating

Input voltage: 15V~50V	Mechanical Shock: 1500g
Input voltage (Transient,1s) : 80V	Lead resistance welding temperature: 300°C (15s)
Output Power: 41.5W	Weight (without flange/ with flange) : 47g/55g
Storage temperature: -65°C~150°C	Antistatic intensity: 2000V

Table 3 (a) Electrical characteristics

No.	Items	Conditions	HSTR28S3R3 HSTR28S3R3F		HSTR28S5R2 HSTR28S5R2F		HSTR28S8 HSTR28S8F	
			Min	Max	Min	Max	Min	Max
1	Input Voltage/V	Low、High、 Ambient Temperature	15	50	15	50	15	50
2	Output Voltage/V	Io=Full Load	3.25	3.35	5.14	5.26	7.92	8.08
		Ambient Low/high	3.20	3.40	5.07	5.33	7.88	8.12
3	Output current/A	V _{IN} =15V~50V	—	6.06	—	6	—	4.4
4	Output Power/W		0	20	0	31	0	35
5	Output Ripple Voltage/mV	BW=6MHz, Io=Full load	—	50	—	50	—	50
6	Line Regulation/mV	V _{IN} =15V~50V, Io=Full	—	20	—	20	—	20
7	Load Regulation/mV	Io=No load to load	—	50	—	50	—	50
8	Input current/mA	Inhibit	—	6	—	6	—	6
		Io=no load	—	60	—	60	—	60
9	Input Ripple current/mA	BW=20MHz, Io=Full load	—	50	—	50	—	50
10	Efficiency/%	Io=Full load	65	—	72	—	74	—
11	Isolation/MΩ	Input to output or any pin to case(except pin 7、8)at 500V, T _A =25°C	100	—	100	—	100	—
12	Inhibit Function		0	0.7	0	0.7	0	0.7
13	Inhibit open-circuit Voltage/V	Io=Full Load	9	13	10	14	10	14
14	Under voltage open voltage/V	Io=Full Load	12	14.8	12	14.8	12	14.8
15	Under voltage cut-off voltage/V	Io=Full Load	11	14.5	11	14.5	11	14.5
16	Short Circuit Protection		<u>Reduced flow pattern</u>		<u>Reduced flow pattern</u>		<u>Reduced flow pattern</u>	
17	Capacitive load /μF	T _c =25°C	—	1000	—	1000	—	500
18	Switching frequency/kHz	Io=Full Load	400	550	400	550	400	550
19	External Synchro Frequency Range/kHz	T _c =25°C, full load, TTL electrical level (V _{IH} ≥4.5V, V _{IL} ≤0.8V), Duty Ratio 40%~60%	400	550	400	550	400	550
20	Step Load Response Transient(mV pK)	50%load→full load →50%load	-500	500	-500	500	-500	500
21	Step Load Response	50%load→full load →50%load	—	500	—	500	—	500

	Recovery(μ s)							
22	Step Line Response Transient(mV pK)	$V_{IN}: 16V \rightarrow 40V,$ $V_{IN}: 40V \rightarrow 16V,$ $I_o = \text{Full load}$	-600	600	-600	600	-600	600
23	Step Line Response Recovery(μ s)	$V_{IN}: 16V \rightarrow 40V$ $V_{IN}: 40V \rightarrow 16V$ $I_o = \text{Full load}$	—	500	—	500	—	500
24	Start-up Overshoot(mV pK)	$V_{IN}: 0 \rightarrow 28V,$ $I_o = \text{Full load}$	—	15	—	50	—	50
25	Start-up Delay (ms)	$V_{IN}: 0 \rightarrow 28V,$ $I_o = \text{Full load}$	—	20	—	20	—	20

Table3 (b) Electrical characteristics

No.	Parameter	Conditions	HSTR28S5 HSTR28S5F		HSTR28S12 HSTR28S12F		HSTR28S15 HSTR28S15F	
			Min	Max	Min	Max	Min	Max
1	Input Voltage/V	Low、High、 Ambient Temperature	15	50	15	50	15	50
2	Output Voltage/V	$I_o = \text{Full Load}$	4.95	5.05	11.88	12.12	14.85	15.15
		Ambient Low/high	4.88	5.12	11.70	12.30	14.62	15.38
3	Output current/A	$V_{IN} = 15V \sim 50V$	—	6	—	3.33	—	2.67
4	Output Power/W		0	30	0	40	0	40
5	Output Ripple Voltage/mV	BW=6MHz, $I_o = \text{Full load}$	—	50	—	50	—	50
6	Line Regulation/mV	$V_{IN} = 15V \sim 50V,$ $I_o = \text{Full}$	—	20	—	20	—	20
7	Load Regulation/mV	$I_o = \text{No load to load}$	—	50	—	50	—	50
8	Input current/mA	Inhibit	—	6	—	6	—	6
		$I_o = \text{no load}$	—	60	—	60	—	60
9	Input Ripple current/mA	BW=20MHz, $I_o = \text{Full load}$	—	50	—	50	—	50
10	Efficiency/%	$I_o = \text{Full load}$	72	—	76	—	77	—
11	Isolation/M Ω	Input to output or any pin to case(except pin 7、8) at 500V, $T_A = 25^\circ\text{C}$	100	—	100	—	100	—
12	Inhibit Function		0	0.7	0	0.7	0	0.7
13	Inhibit open-circuit Voltage/V	$I_o = \text{Full Load}$	10	14	10	14	10	14
14	Under-voltage open voltage/V	$I_o = \text{Full Load}$	12	14.8	12	14.8	12	14.8
15	Under-voltage cut-off voltage/V	$I_o = \text{Full Load}$	11	14.5	11	14.5	11	14.5
16	Short Circuit Protection		Reduced flow pattern		Reduced flow pattern		Reduced flow pattern	
17	Capacitive load / μ F	$T_A = 25^\circ\text{C}$	—	1000	—	500	—	500
18	Step Load Response Transient(mV pK)	50%load \rightarrow full load \rightarrow 50%load	400	550	400	550	400	550

19	External Synchro frequency range/kHz	$T_c=25^\circ\text{C}$, full load, TTL electrical level ($V_{IH}\geq 4.5\text{V}$, $V_{IL}\leq 0.8\text{V}$), Duty Ratio 40%~60%	400	550	400	550	400	500
20	Step Load Response Recovery(μs)	50%load \rightarrow full load \rightarrow 50%load	-500	500	-700	700	-700	700
21	Step Line Response Transient(mV pK)	V_{IN} : 16V \rightarrow 40V, V_{IN} : 40V \rightarrow 16V, I_o =Full load	—	500	—	500	—	500
22	Step Line Response Recovery(μs)	V_{IN} : 16V \rightarrow 40V V_{IN} : 40V \rightarrow 16V I_o =Full load	-600	600	-900	900	-900	900
23	Start-up Overshoot (mV pK)	V_{IN} : 0 \rightarrow 28V, I_o =Full load	—	500	—	500	—	500
24	Start-up Delay (ms)	V_{IN} : 0 \rightarrow 28V, I_o =Full load	—	50	—	50	—	50
25	Step Load Response Transient(mV pK)	50%load \rightarrow full load \rightarrow 50%load	—	20	—	20	—	20

5 Circuit block diagram of surge protection DC DC converter

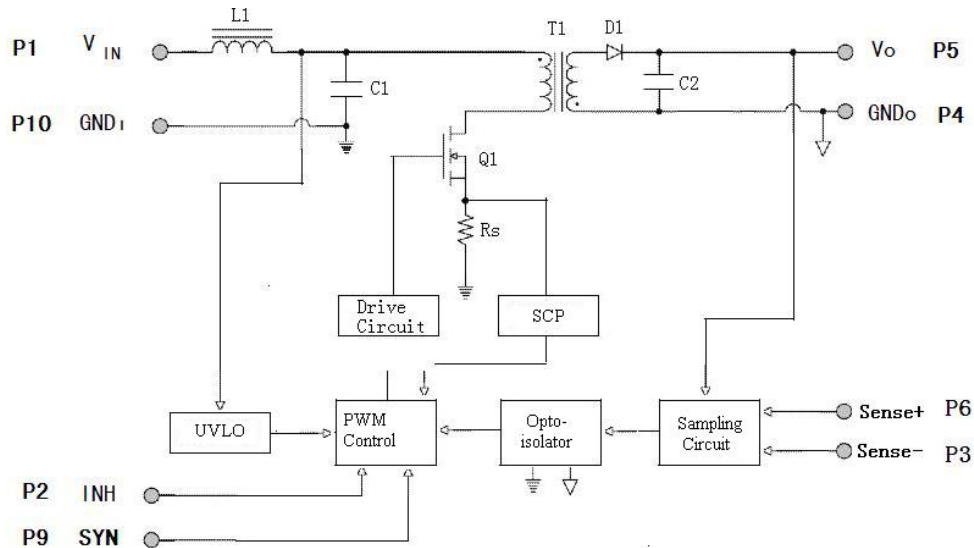


Fig. 1 HSTR28S Series circuit block diagram

6. Typical Characteristic Curve of surge protection DC DC converter

(Unless otherwise specified, test conditions for the following curves in Fig2- Fig.5 are $T_c=25^\circ\text{C}$, $V_{IN}=28\text{V}\pm 5\%$.)

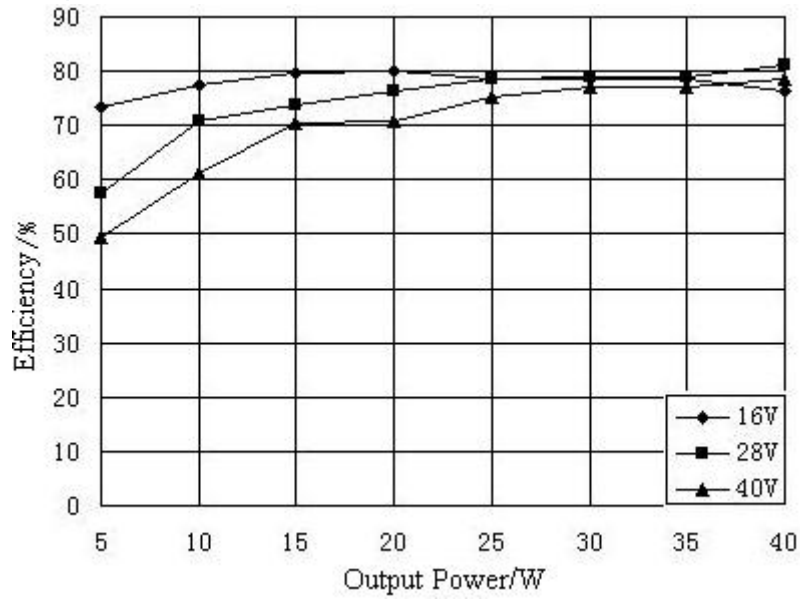


Fig. 2 HSTR28S15 Efficiency

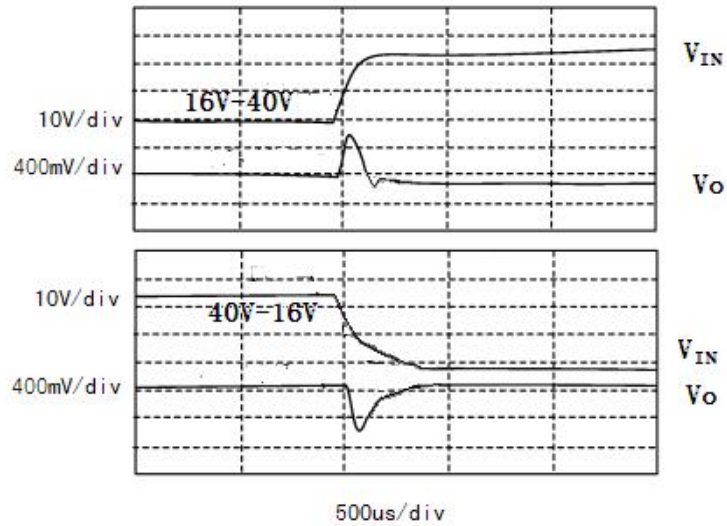


Fig. 3 HSTR28S15 Input Step Line Response

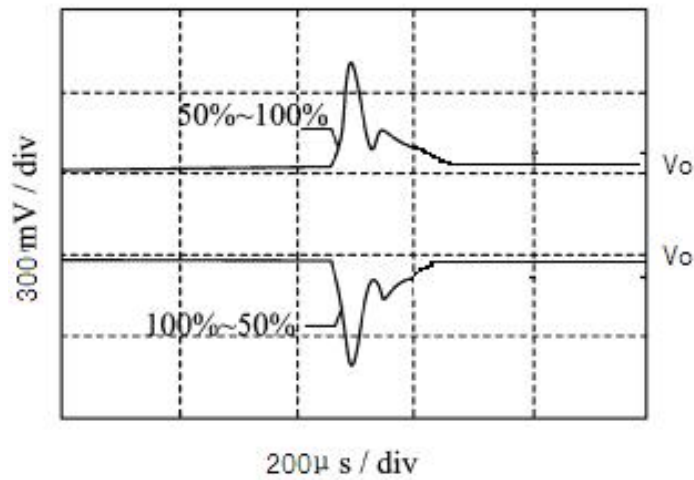


Fig. 4 HSTR28S15 Step Load Response

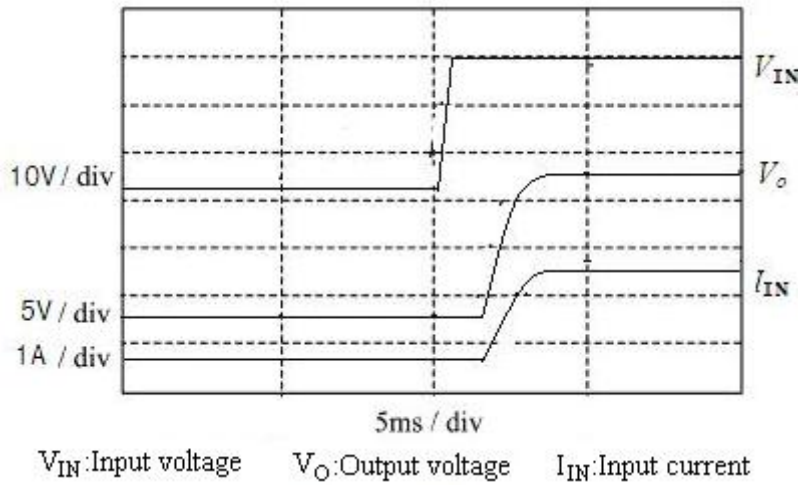


Fig. 5 HSTR28S15 Start-up Overshoot/Start-up Delay

7.MTBF Curve of surge protection DC DC converter

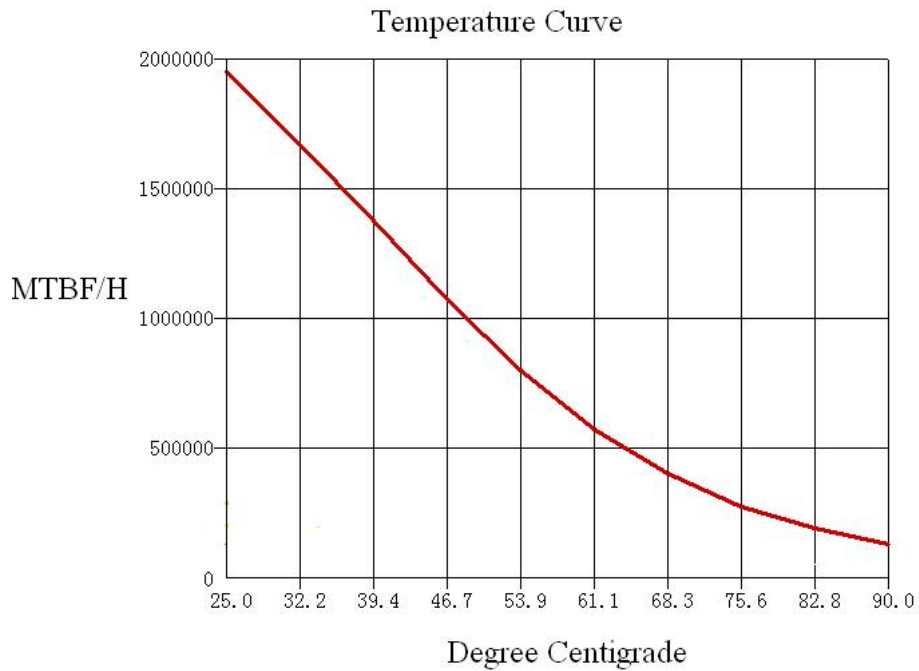


Fig. 6 MTBF Temperature Curve (HSTR28S15)

8 Pin Designation of surge protection DC DC converter

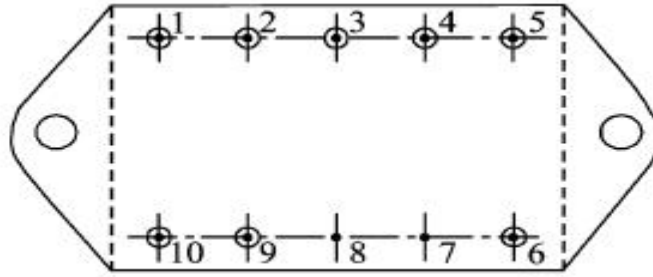


Fig. 7 Pin Out Bottom View

Table 4 Pin Designation

Pin	Symbol	Designation
1	V_I	Positive Input
2	INH	Inhibit
3	Sense.	Sensitive Negative Output
4	GND_O	Output Ground
5	V_O	Positive Output
6	Sense+	Sensitive Positive Output
7	GND_C	Case Ground
8	GND_C	Case Ground
9	SYN	External Synchro Input
10	GND_I	Input Ground

9 Typical Connection Diagram of surge protection DC DC converter

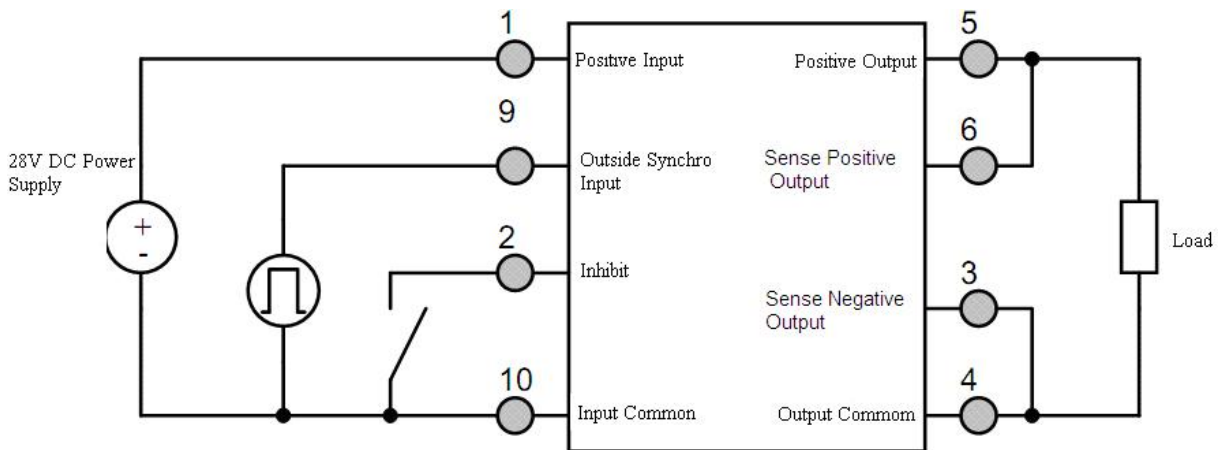


Fig. 8 Connection Diagram

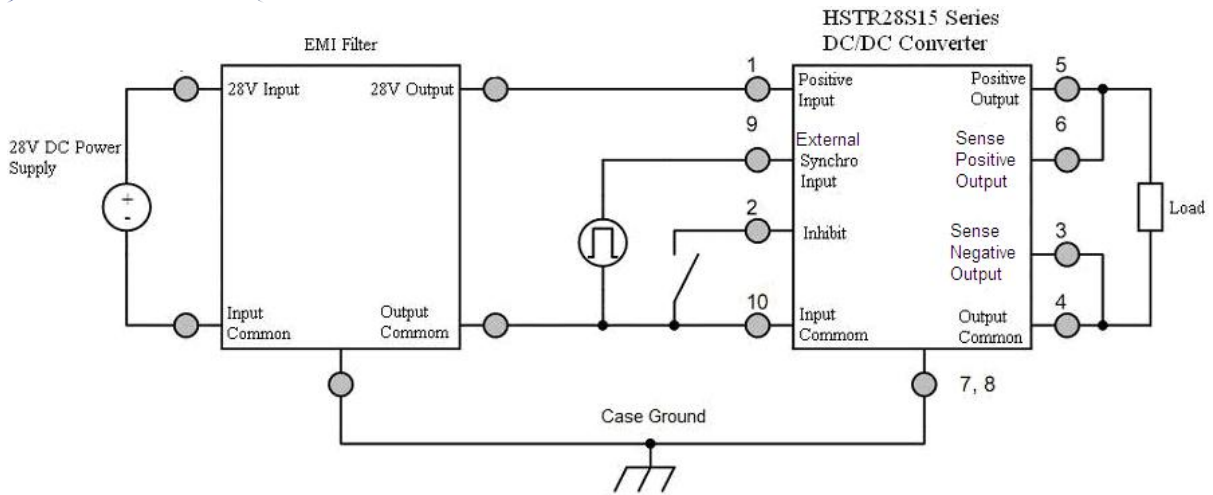


Fig. 9 EMI Filter Connection Diagram

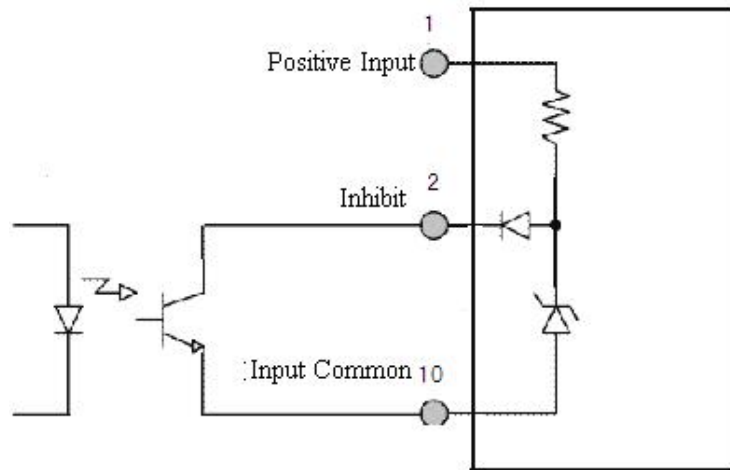


Fig. 10 Inhibit Driver Circuit Diagram

10. Package Outline Dimensions of surge protection DC DC converter (Unit: mm)

① Package without flange

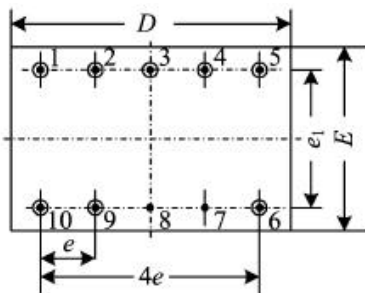


Fig. 11 Bottom View

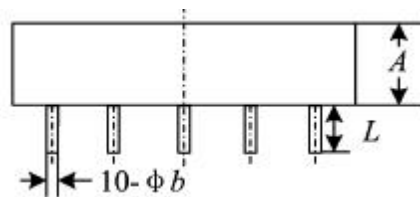


Fig. 12 Side View

② Package with Flange

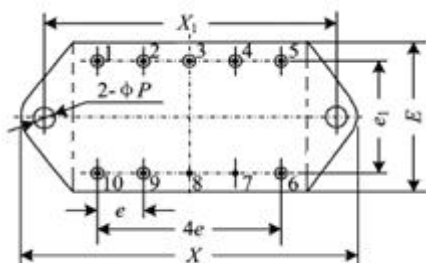


Fig. 13 Bottom View

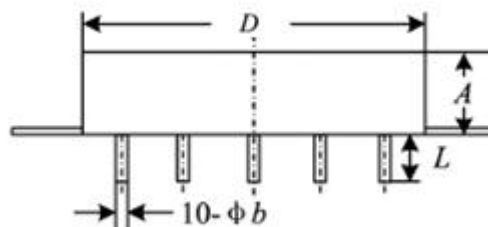


Fig. 14 Side View

Table 5 Package Outline

Symbol	Unit/mm		
	Min	Typical	Max
A	—	—	10.66
Φb	0.87	1.00	1.13
D	—	—	54.40
e	—	10.16	—
e1	—	20.32	—
E	—	—	29.0
L	5.40	—	—
ΦP	3.80	4.10	4.40
X	—	—	74.00
X1	64.27	64.77	65.27

Table 6 Case Materials

Case Model	Header	Header Plating	Cover	Cover Plating	Pin	Pin Plating	Seal	Notes
UPP5429-10j (without flange)	Cold Rolled Steel (10#)	Ni	Kovar (4J42)	Ni	Cu-core Compound	Ni/Au	Parallel seam	Ni Plating is for case ground pin
UPP5429-10n (with flange)	Cold Rolled Steel (10#)	Ni	Kovar (4J42)	Ni	Cu Compound	Ni/Au	Parallel seam	Ni Plating is for case ground pin

11 Ordering Information of surge protection DC DC converter

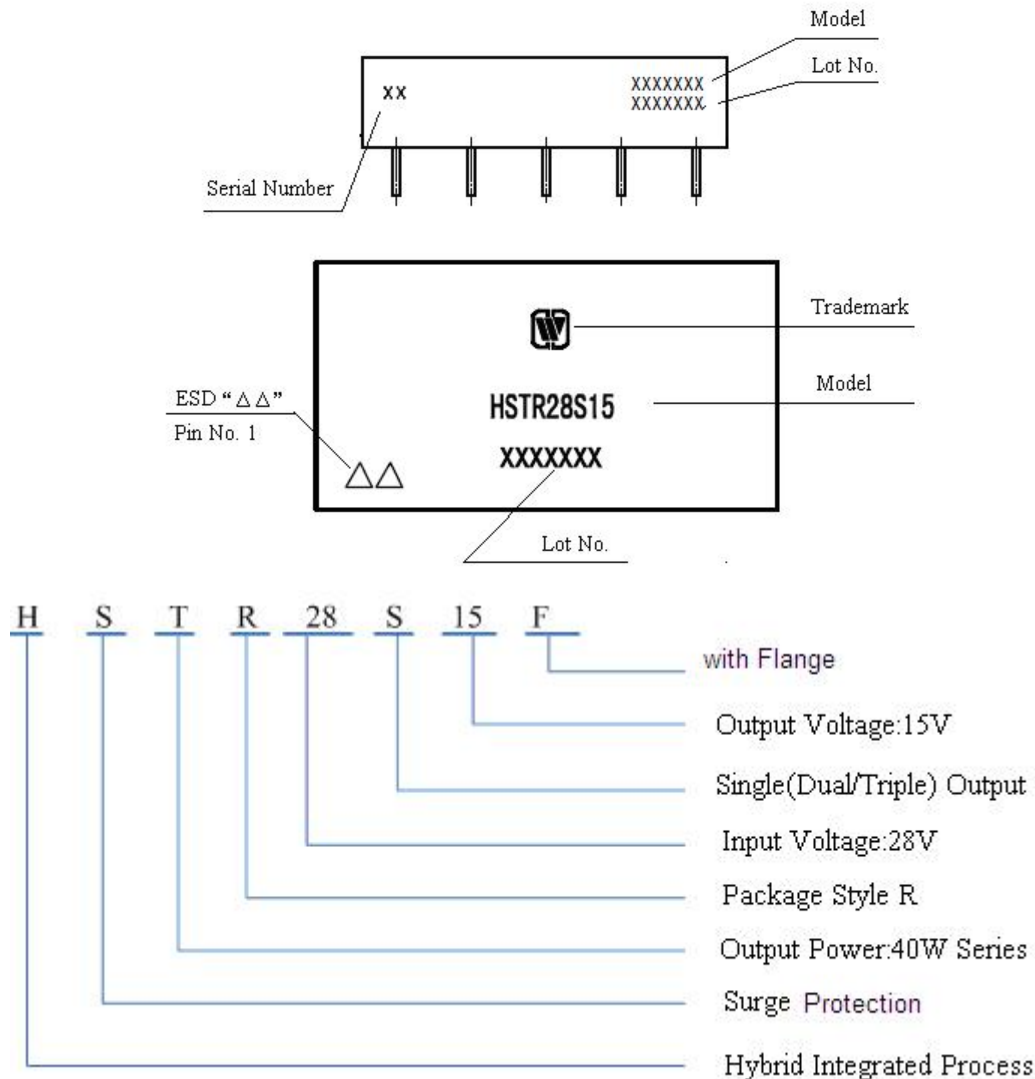


Figure 15 Part Numbering Key

Application Notes:

- ☆ Both positive and negative terminals for power supply shall be correctly connected when power is applied so as to avoid permanent damage to the device.
- ☆ This device has the sensitive terminal. Devices in use shall be correctly connected in accordance with specified drawings, in order to avoid damage to the device and ensure a good sensitive terminal contact.
- ☆ Testing position shall be pin bottom of the device when the electrical characteristic is measured.
- ☆ The baseplate of the device shall be closely attached to the circuit board during device mounting so as to avoid the damage on pins. The shockproof actions shall be adopted when necessary.
- ☆ Pins shall not be bended to avoid the glass insulator cracking and case leaking.
- ☆ Pins at inhibit terminal shall be hung in the air during no operation.
- ☆ When the temperature of package is 125°C, please use the Copper as the radiator, whose thickness should be 3mm, and area should larger than 100mm×65mm.
- ☆ When ordering this device, the detail electrical specification shall be based on relevant standards.



Data offered in this document shall be for reference only.