



## 4 Technical Specifications of surge protection DC-DC converter

Table 2 Rated conditions and recommended operating conditions

Absolute Max. Rating	
Input voltage: 15V~50V Input voltage(Transient,1s): 80V Output Power: 22W Storage temperature: -65°C~150°C	Mechanical Shock: 1500g Lead resistance welding temperature: 300°C (15s) Weight(without flange/ with flange): 31g/34g Antistatic intensity: 2000V

Table 3 Electrical characteristics

No.	Items	Conditions (Testing condition as per $T_c=25^\circ\text{C}$ , $V_{IN}=28\text{V}\pm 5\%$ , unless otherwise specified)	HSDF28D5 HSDF28D5F		HSDF28D12 HSDF28D12F		HSDF28D12 HSDF28D12F		
			Min	Max	Min	Max	Min	Max	
1	Input Voltage/V	Low、High、Ambient Temperature	15	50	15	50	15	50	
2	Output Voltage/V	Positive	Ambient	4.95	5.05	11.88	12.12	14.85	15.15
		Negative		4.80	5.20	11.80	12.20	14.80	15.20
		Positive	Low/high	4.925	5.075	11.82	12.18	14.80	15.20
		Negative		4.75	5.25	11.52	12.48	14.40	15.60
3	Output current/A	$V_{IN}=15\text{V}\sim 50\text{V}$	—	1.5	—	0.833	—	0.666	
4	Output Power/W		0	15	0	20	0	20	
5	Output Ripple Voltage/mV	$BW\leq 6\text{MHz}$ , $I_o=\text{Full load}$	—	60	—	50	—	60	
6	Line Regulation/mV	Positive	$V_{IN}=16\text{V}\sim 40\text{V}$ , $I_o=\text{Full}$	—	50	—	50	—	50
		Negative		—	50	—	50	—	50
7	Load Regulation/mV	Positive	No load to full	—	50	—	50	—	50
		Negative		—	50	—	50	—	50
8	Input current/mA	Inhibited	—	6	—	6	—	6	
		$I_o=\text{no load}$	—	60	—	60	—	60	
9	Input Ripple current/mA	$BW\leq 20\text{MHz}$ , $I_o=\text{Full load}$	—	60	—	60	—	60	
10	Efficiency/%	$I_o=\text{Full load}$	73	—	78	—	79	—	
11	Isolation/MΩ	Input to output or any pin to case(except pin 7、8)at 500V, $T_c=25^\circ\text{C}$	100	—	100	—	100	—	
12	Inhibit Function		0	0.7	0	0.7	0	0.7	
13	Under-voltage open voltage/V	$I_o=\text{Full Load}$	12.0	14.8	12.0	14.8	12	14.8	
14	Under-voltage cut-off voltage/V	$I_o=\text{Full Load}$	11.0	14.5	11.0	14.5	11	14.5	
15	Short Circuit								

Protection								
16	Capacitive load / $\mu$ F	$T_c=25^\circ\text{C}$	—	500	—	500	—	500
17	Switching frequency/kHz	$I_o=\text{Full Load}$	350	500	350	500	350	500
18	Cross Regulation	One is 30% load, another one is from 30% to 70% load	—	500	—	500	—	500
19	Step Load Response Transient(mV pK)	50%load $\rightarrow$ full load $\rightarrow$ 50%load	—	400	—	400	—	400
20	Step Load Response Recovery( $\mu$ s)	50%load $\rightarrow$ full load $\rightarrow$ 50%load	—	500	—	500	—	500
21	Step Line Response Transient(mV pK)	$V_{IN}: 16\text{V}\rightarrow 40\text{V},$ $V_{IN}: 40\text{V}\rightarrow 16\text{V},$ $I_o=\text{Full load}$	—	800	—	900	—	900
22	Step Line Response Recovery( $\mu$ s)	$V_{IN}: 16\text{V}\rightarrow 40\text{V}$ $V_{IN}: 40\text{V}\rightarrow 16\text{V}$ $I_o=\text{Full load}$	—	700	—	500	—	500
23	Start-up Overshoot(mV pK)	$V_{IN}: 0\rightarrow 28\text{V},$ $I_o=\text{Full load}$	—	25	—	50	—	50
24	Start-up Delay (ms)	$V_{IN}: 0\rightarrow 28\text{V},$ $I_o=\text{Full load}$	—	20	—	20	—	20

### 5 Circuit block diagram of surge protection DC-DC converter

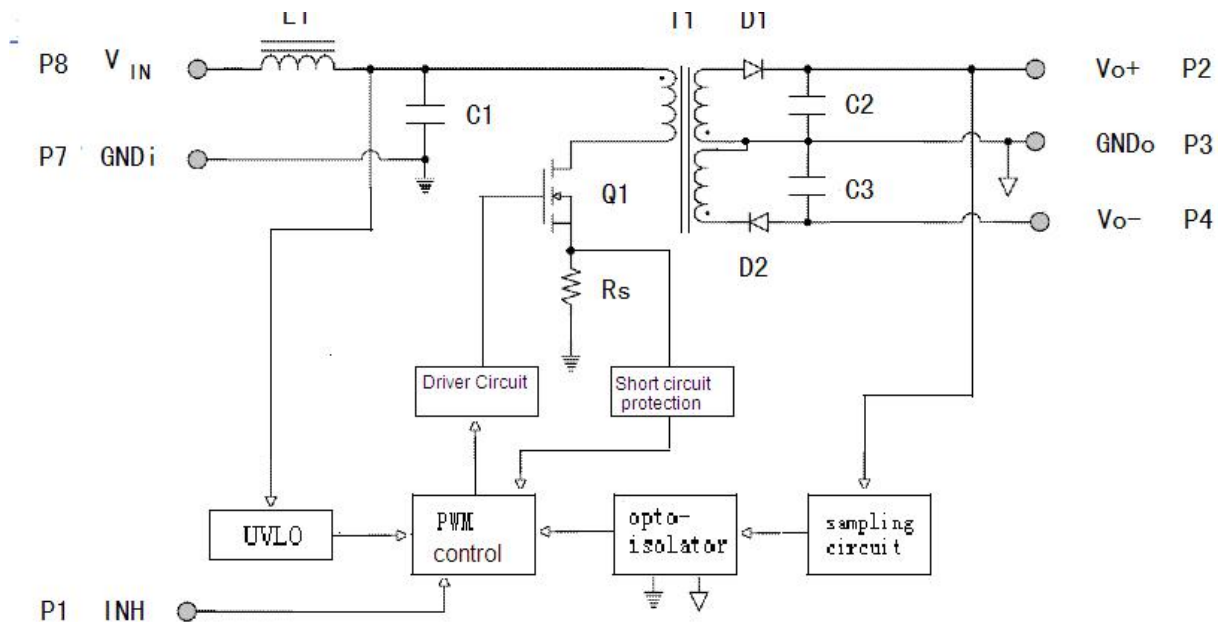


Fig. 1 HSDF28D Series circuit block diagram

## 6. Typical Characteristic Curve of surge protection DC-DC converter

(Testing condition as per  $T_c=25^\circ\text{C}$ ,  $V_{IN}=28\text{V}\pm 5\%$ , unless otherwise specified)

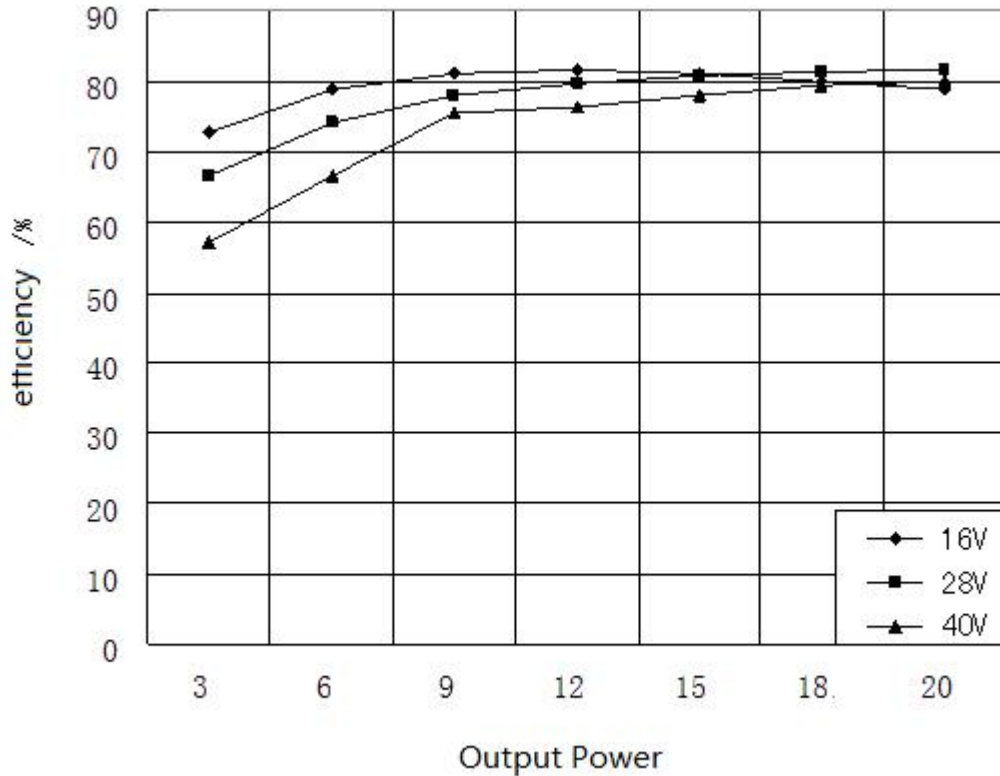


Fig. 2 HSDF28D Efficiency

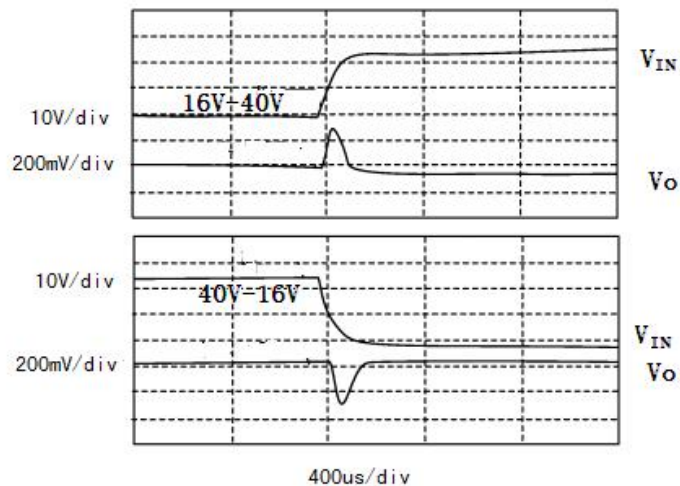


Fig. 3 HSDF28D15 Step Line Response

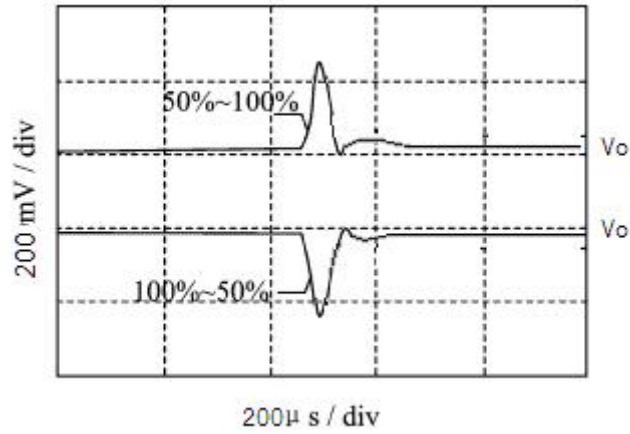


Fig. 4 HSDF28D15 Step Load Response

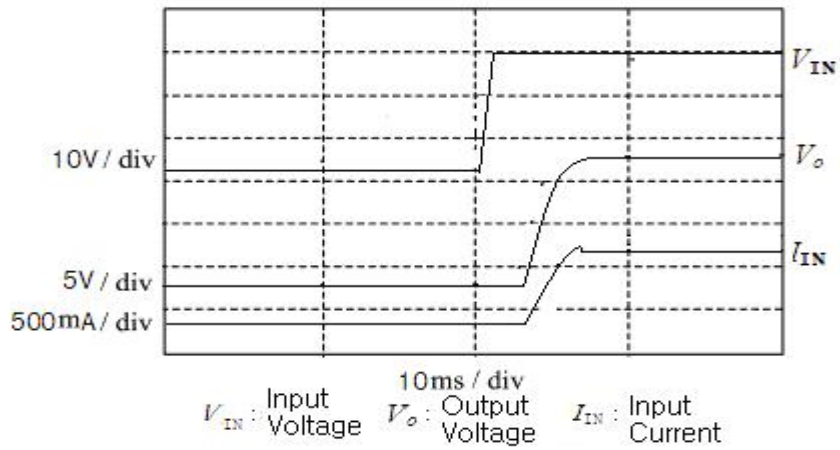


Fig. 5 HSDF28D15 Start-up Overshoot/Start-up Delay

## 7.MTBF Curve of surge protection DC-DC converter

Temperature Curve

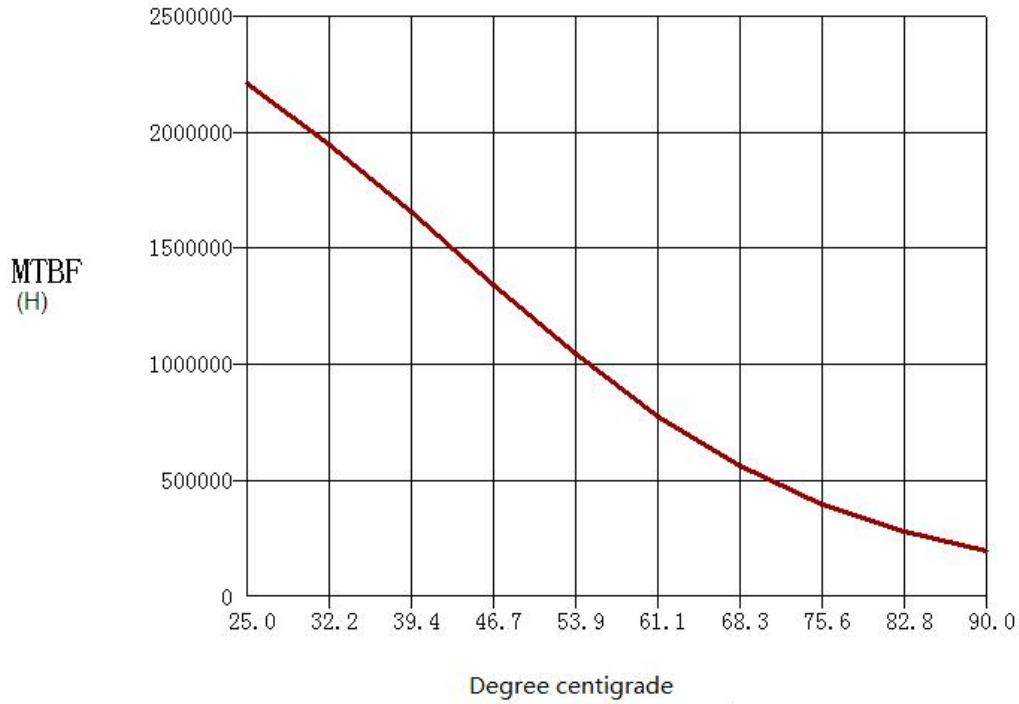


Fig. 6 MTBF Temperature Curve (HSDF28D15)

### 8 Pin Designation of surge protection DC-DC converter

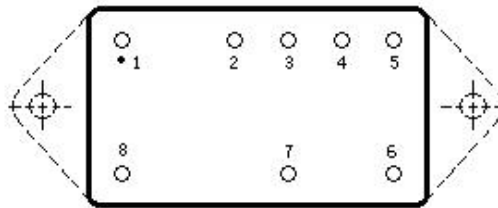


Fig 7 Pin Out Bottom View

Table 4 Pin Designation

Pin	Symbol	Designation
1	INH	Inhibit
2	$V_{o+}$	Positive Output
3	$GND_0$	Output Common
4	$V_{o-}$	Negative Output
5	NC	No connection

6	$GND_C$	Case Ground
7	$GND_I$	Input Common
8	$V_{IN}$	Positive Input

### 9 Typical Connection Diagram of surge protection DC-DC converter

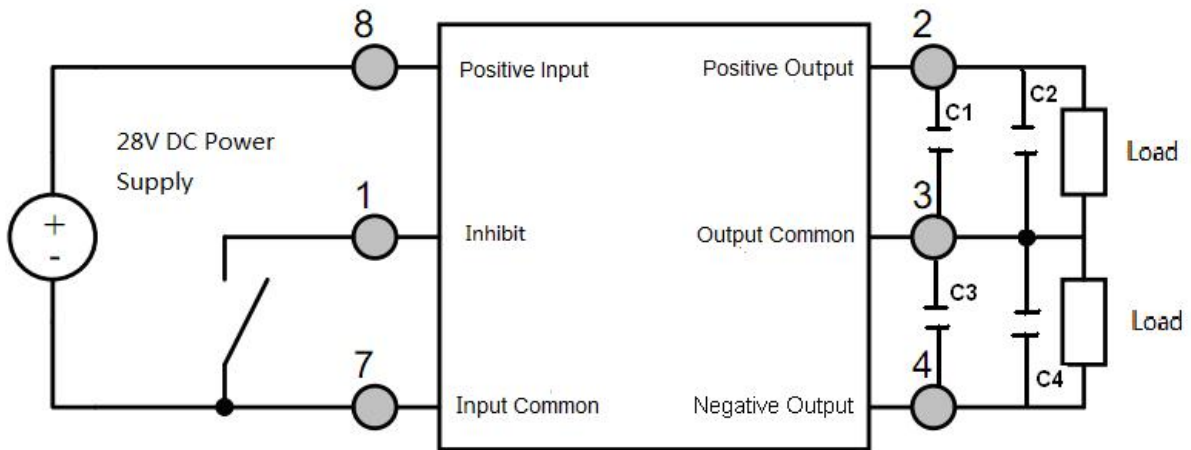
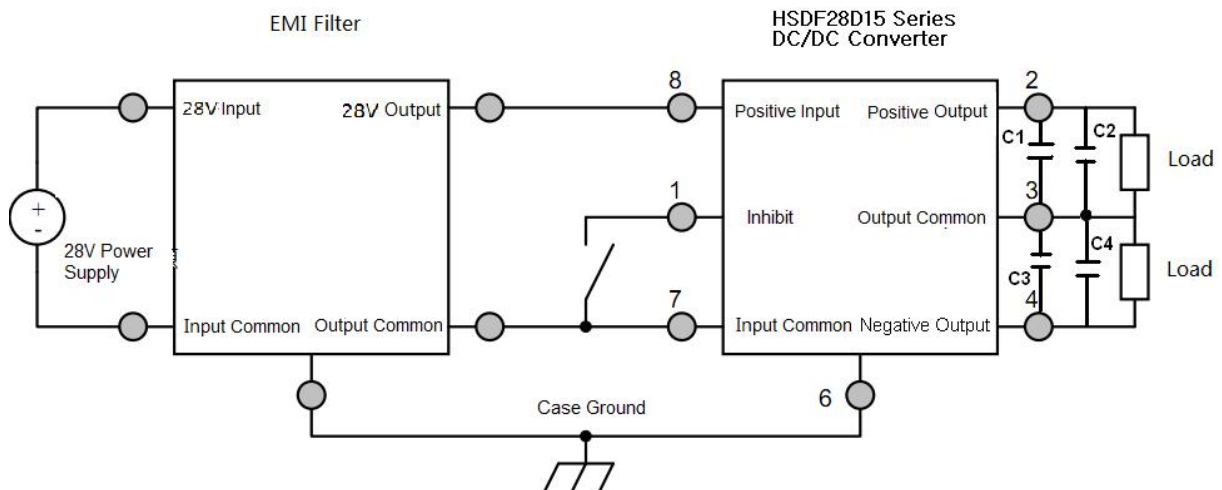


Fig. 8 Connection Diagram



$C1=C3=10\mu F$ ;  $C2=C4=0.1\mu F$ ,  $C1-C4$  are all multilayer capacitors

Fig. 9 EMI Filter Connection Diagram(此图与中文有出入)

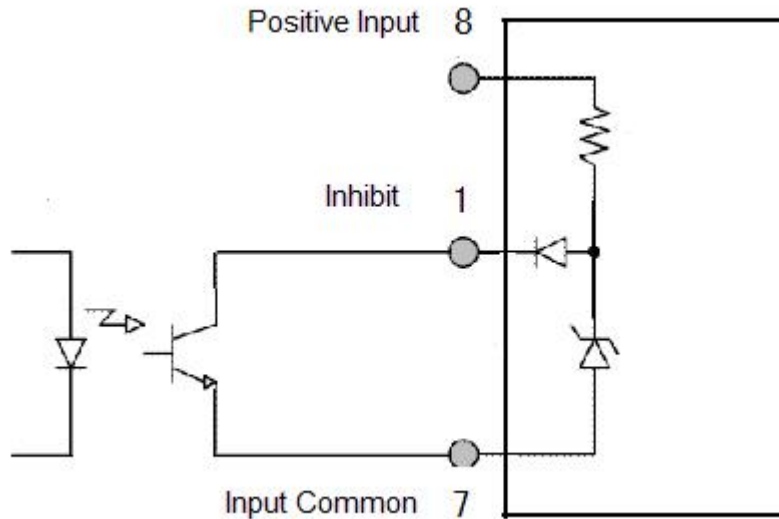


Fig 10 Inhibit Driver Circuit Diagram

## 10. Package Specifications of surge protection DC-DC converter (Unit: mm)

### ① Package without flange

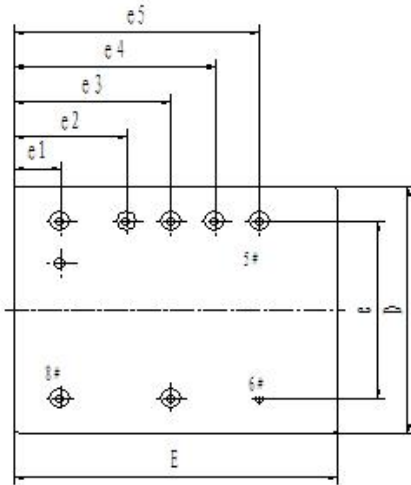


Fig. 11 Bottom View

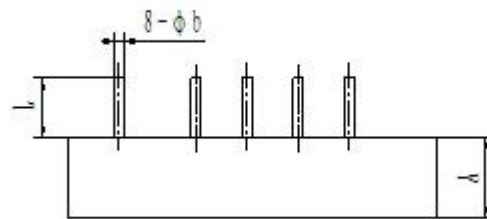


Fig. 12 Side View

### ② Package with Flange



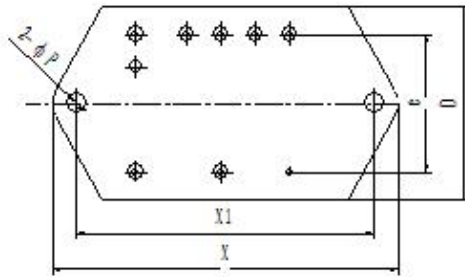


Fig. 13 Bottom View

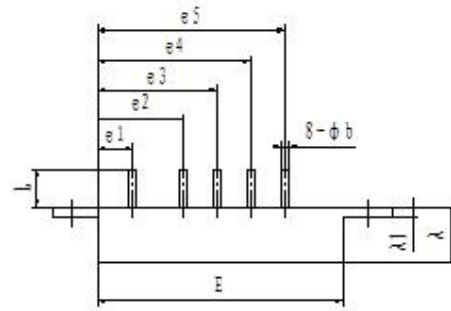


Fig. 14 Side View

Table 5 Package Outline

Symbol	Unit/mm		
	Min	Typical	Max
<i>A</i>	–	8.4	8.90
<i>A1</i>	1.20	1.50	1.80
$\phi b$	0.63	0.76	0.89
<i>D</i>	–	28.44	28.94
<i>E</i>	–	36.83	37.33
<i>e</i>	–	20.32	–
<i>e1</i>	–	5.21	–
<i>e2</i>	–	12.83	–
<i>e3</i>	–	17.91	–
<i>e4</i>	–	22.99	–
<i>e5</i>	–	28.07	–
<i>X</i>	–	50.80	51.30
<i>X1</i>	43.45	43.95	44.45
<i>P</i>	3.00	3.30	3.60
<i>L</i>	5.35	6.35	–

Table 6 Case Materials

Case Model	Header	Header Plating	Cover	Cover Plating	Pin	Pin Plating	Seal	Notes
UPP3728-08t (without flange)	Cold Rolled Steel (10#)	Ni	Kovar (4J42)	Ni	Cu-core Compound	Ni/Au	Parallel seam	Ni Plating is for case ground pin
UPP3728-08j (with flange)	Cold Rolled Steel (10#)	Ni	Kovar (4J42)	Ni	Cu-core Compound	Ni/Au	Parallel seam	Ni Plating is for case ground pin

## 11 Ordering Information of surge protection DC-DC converter

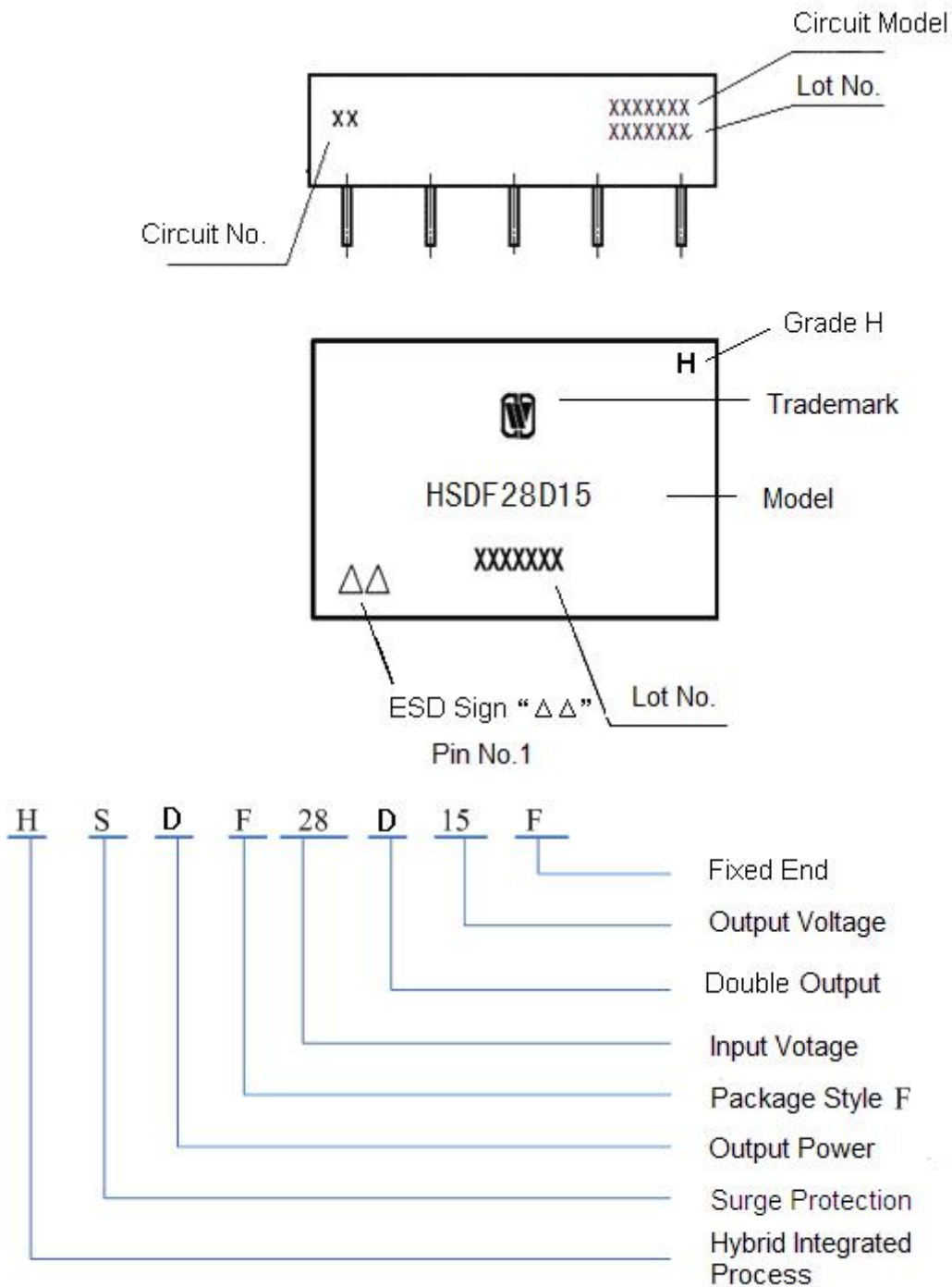


Fig. 15 Part Numbering Key

### 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.
- ☆ Testing position shall be the 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 case is 125℃, the thickness of heat sink (copper) should be 3mm and the area should be more than 70mm×50mm.

☆ When ordering this device , the detail electrical specification shall be based on relevant standards. Data offered in this document shall be for reference only.