

# Hybrid Surge Protection Transient Suppression DC/DC Converter (HSSO28S Series)

## 1 Features

- High reliability
- Wide input voltage range: 12V~50V, typical  
DC input voltage: 28V
- Maximum input transient voltage: 80V, 1s
- Output Power  $P_o$ : 1.5W
- Operating temperature range  $T_c$ : -55°C~+125°C
- Low Startup current
- No output overshoot
- Inhibit function
- Under-voltage input lock and output short circuit protection
- Hermetically sealed metal case



Size: 25.14×20.66×7.38  
Weight: 11g

HSSO28S3R3
HSSO28S5
HSSO28S12
HSSO28S15

## 2 Scope of application

High-reliability electronic system for aviation , aerospace and some applications of high input transient suppression requirements.

## 3 Descriptions

This series products are high reliable DC/DC converters featured with transient protection (80 v, 1 s) . Single ended flyback, pulse width modulated and transformer magnetic feedback topology design are used in these products., The operating principle is that the sampling signal of output voltage, coupled by the transformer, 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. Thick film hybrid techniques provide the HSSO28S Series converters with high reliability and optimum miniaturization. The design and manufacturing process of HSSO28S Series converters are in compliance with MIL-PRF-38534.

## 4 Technical Specifications

Table 2 Rated conditions and recommended operating conditions

Absolute Max. Rating	
Input voltage: 12V~50V Input voltage (Transient,1s) : 80V Output Power: 1.62W Storage temperature: -65°C~150°C	Mechanical Shock: 1500g Lead resistance to welding temperature: 300°C (15s) Weight: 11g Antistatic intensity: 2000V

Table 3 Electrical characteristics

No.	Items	Condition (Unless other wise, -55°C≤T <sub>c</sub> ≤125°C, V <sub>IN</sub> =28V±5%)	HSS028S3R3		HSS028S5		HSS028S12	
			Min	Max	Min	Max	Min	Max
1	Input Voltage/V	Low, High, Ambient Temperature	12	50	12	50	15	50
2	Output Voltage/V	Full Load	3.267	3.333	4.95	5.05	11.88	12.12
		Ambient Low/high	3.17	3.43	4.8	5.2	11.52	12.48
3	Output current/A	V <sub>IN</sub> =12V~50V	—	0.3	—	0.3	—	0.125
4	Output Power/W		0	1	0	1.5	0	1.5
5	Output Ripple Voltage/mV	BW≤20MHz, Full load	—	50	—	50	—	50
6	Line Regulation/mV	V <sub>IN</sub> =12V~50V, Full load	—	150	—	150	—	60
7	Load Regulation/mV	10% load →full	—	400	—	400	—	700
		50% load→full	—	250	—	250	—	250
8	Input current/mA	Inhibited	—	3.5	—	3.5	—	3.5
		I <sub>o</sub> =no load	—	10	—	10	—	10
9	Input Ripple current/mA	BW≤20MHz, Full load	—	30	—	30	—	30
10	Efficiency/%	Full load	69	—	72	—	75	—
11	Isolation/MΩ	Input to output or any pin to case at 500V, T <sub>c</sub> =25°C	100	—	100	—	100	—
12	Inhibit voltage		0	0.7	0	0.7	0	0.7
13	Under voltage turn-on voltage/V	Full load	6.5	11.5	6.5	11.5	6.5	11.5
14	Short Circuit Protection		With		With		With	
15	Capacitive load /μF	T <sub>c</sub> =25°C	—	500	—	500	—	200
16	Switching frequency/kHz	Full Load	325	475	325	475	325	475
17	Step Load Response Transient(mV pK)	50%load→full load or full load→50%load	-300	300	-300	300	-300	300
18	Step Load Response Recovery(μs)	50%load→full load or full load→50%load	—	500	—	600	—	400
19	Step Line Response Transient(mV pK)	V <sub>IN</sub> : 12V→50V, V <sub>IN</sub> : 50V→12V, I <sub>o</sub> =Full load	-300	300	-400	400	-400	400
20	Step Line Response Recovery(μs)	V <sub>IN</sub> : 12V→50V V <sub>IN</sub> : 50V→12V I <sub>o</sub> =Full load	—	500	—	600	—	400

21	Start-up Overshoot(mV pK)	V <sub>IN</sub> : 0→28V, I <sub>o</sub> =Full load	—	15	—	25	—	50
22	Start-up Delay (ms)	V <sub>IN</sub> : 0→28V, I <sub>o</sub> =Full load	—	20	—	20	—	20

Form 3 (Continued) Electrical characteristics

No.	Items	Conditions (Unless other wise, $-55^{\circ}\text{C} \leq T_c \leq 125^{\circ}\text{C}$ , $V_{IN}=28\text{V} \pm 5\%$ )	HSS028S15		
			Min	Max	
1	Input Voltage/V	Low, High, Ambient Temperature	12	50	
2	Output Voltage/V	I <sub>o</sub> =Full Load	Ambient	14.85	15.15
			Low/high	14.40	15.60
3	Output current/A	V <sub>IN</sub> =12V~50V	—	0.05	
4	Output Power/W		0	1.5	
5	Output Ripple Voltage/mV	BW≤20MHz, Full load	—	50	
6	Line Regulation/mV	V <sub>IN</sub> =12V~50V, Full load	—	60	
7	Load Regulation/mV	10% load →full	—	700	
		50% load→full	—	250	
8	Input current/mA	Inhibited	—	3.5	
		I <sub>o</sub> =no load	—	10	
9	Input Ripple current/mA	BW≤20MHz, I <sub>o</sub> =Full load	—	50	
10	Efficiency/%	Full load	76	—	
11	Isolation/MΩ	Input to output or any pin to case at 500V, T <sub>c</sub> =25°C	100	—	
12	Inhibit voltage		0	0.7	
13	Under voltage open voltage/V	Full load	6.5	11.5	
14	Short Circuit Protection		With		
15	Capacitive load /μF	T <sub>c</sub> =25°C	—	200	
16	Switching frequency/kHz	I <sub>o</sub> =Full Load	325	475	
17	Step Load Response Transient(mV pK)	50%load→full load or full load→50%load	-300	300	
18	Step Load Response Recovery(μs)	50%load→full load or full load→50%load	—	400	
19	Step Line Response Transient(mV pK)	V <sub>IN</sub> : 12V→50V, V <sub>IN</sub> : 50V→12V, I <sub>o</sub> =Full load	-400	400	
20	Step Line Response Recovery(μs)	V <sub>IN</sub> : 12V→50V V <sub>IN</sub> : 50V→12V I <sub>o</sub> =Full load	—	400	
21	Start-up Overshoot(mV pK)	V <sub>IN</sub> : 0→28V, I <sub>o</sub> =Full load	—	50	
22	Start-up Delay (ms)	V <sub>IN</sub> : 0→28V, I <sub>o</sub> =Full load	—	20	

a. The output load should not be less than 10% of the rated load.

## 5 Circuit block diagram

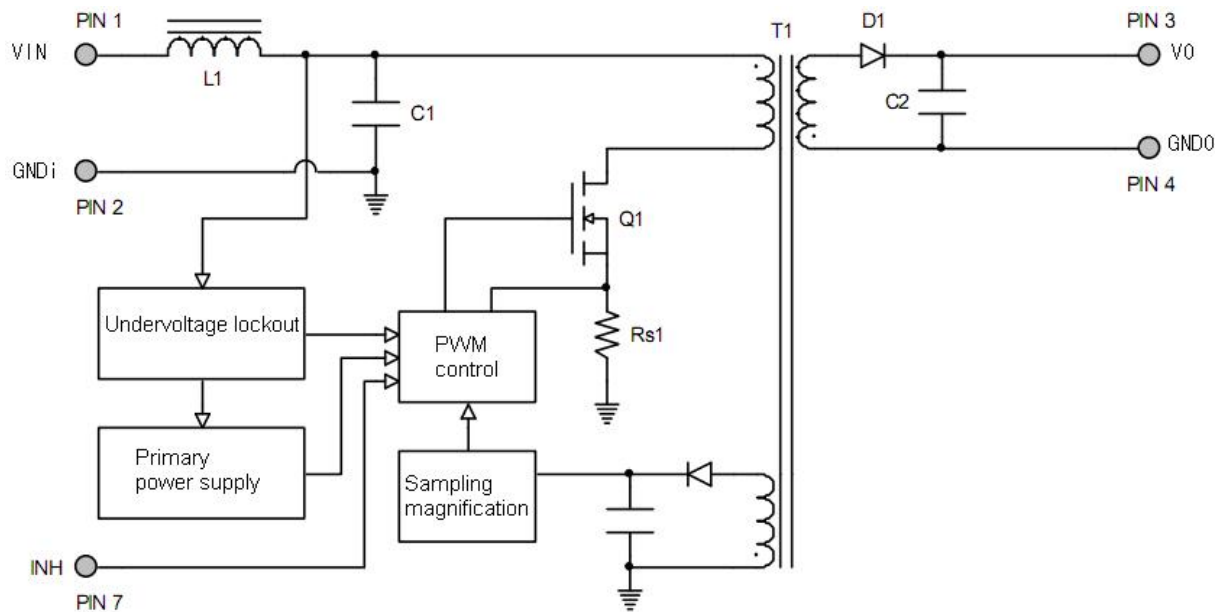


Fig 1 HSSO28S Series circuit block diagram

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

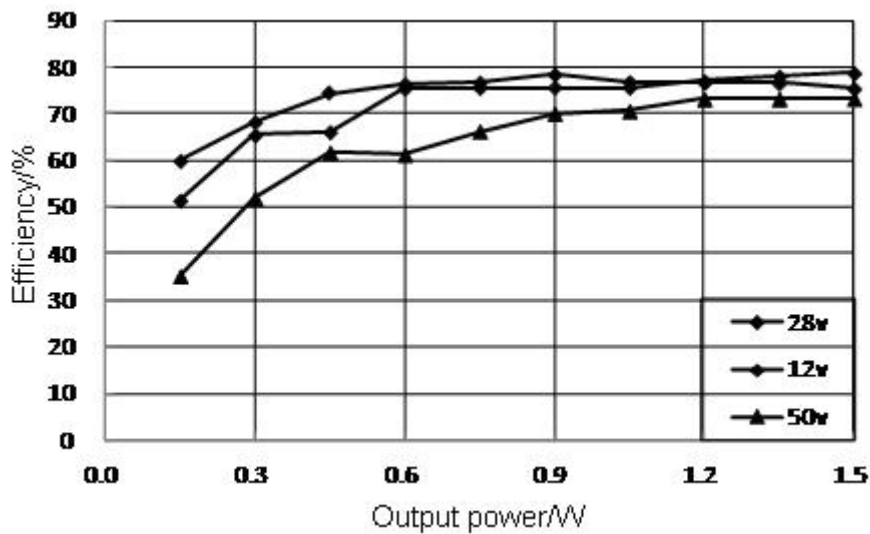


Fig 2 HSSO28S15 Efficiency Curve

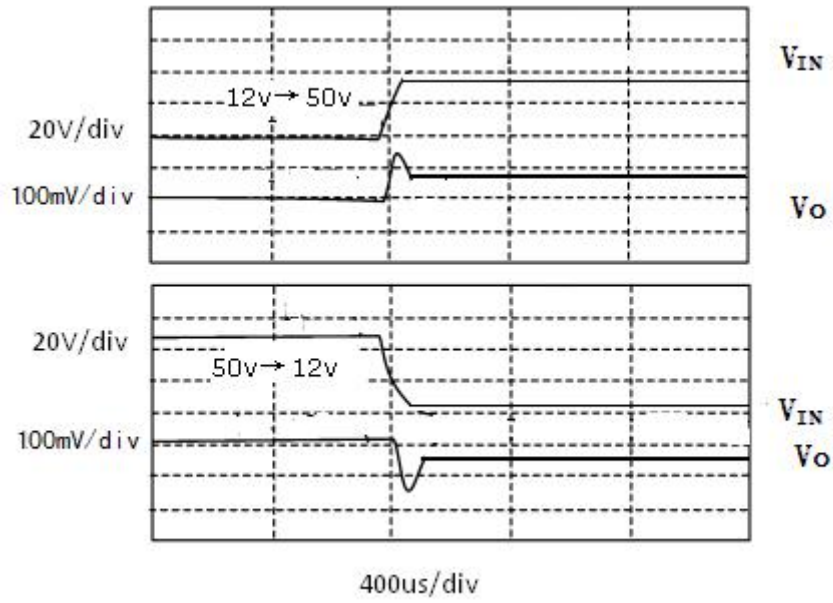


Fig 3 HSS028S15 Step Line Response

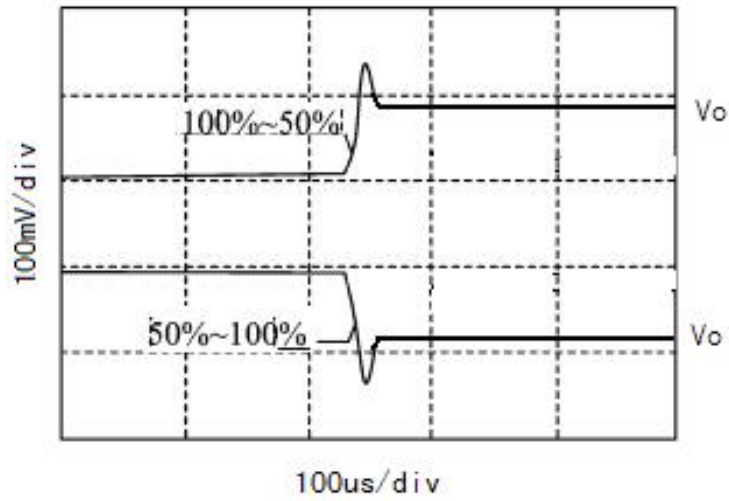


Fig 4 HSS028S15 Step Load Response

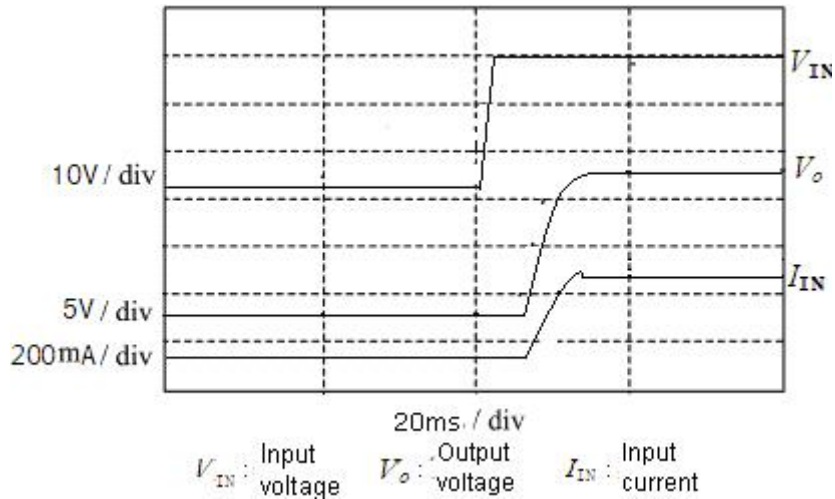


Fig 5 HSS028S15 Start-up Overshoot/Start-up Delay

## 7. MTBF Curve

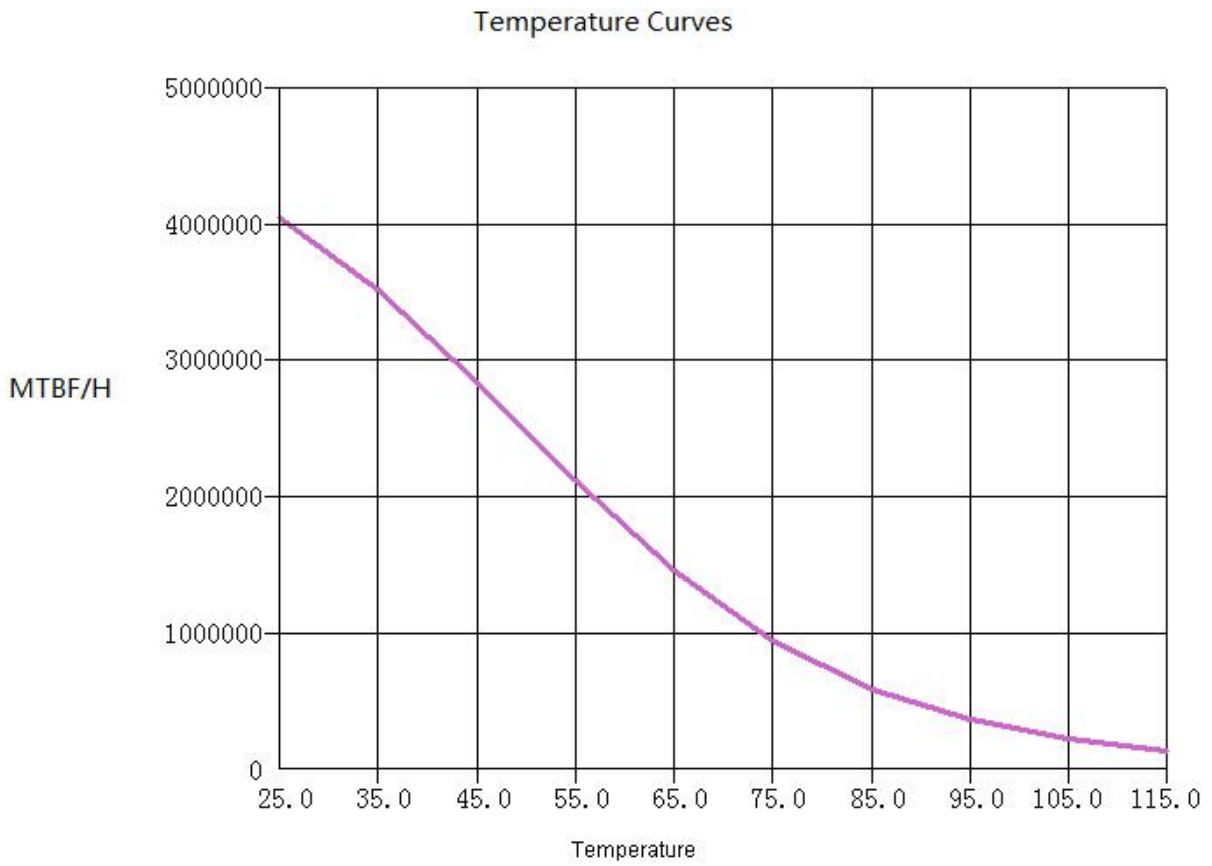


Fig 6 MTBF Temperature Curve (HSS028S15)  
(Well ground condition)

## 8 Pin Designations

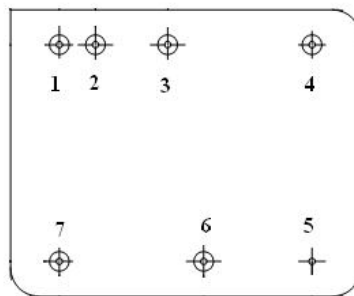


Fig 7 Bottom View

Table 4 Pin Designations

Pin	Symbol	Designation
1	$V_{IN}$	Positive input
2	$GND_I$	Input ground
3	$V_o$	Positive output
4	$GND_o$	Output ground
5	$GND_c$	Case ground
6	NC	NC
7	INH	Inhibit

## 9 Typical Connection Diagram

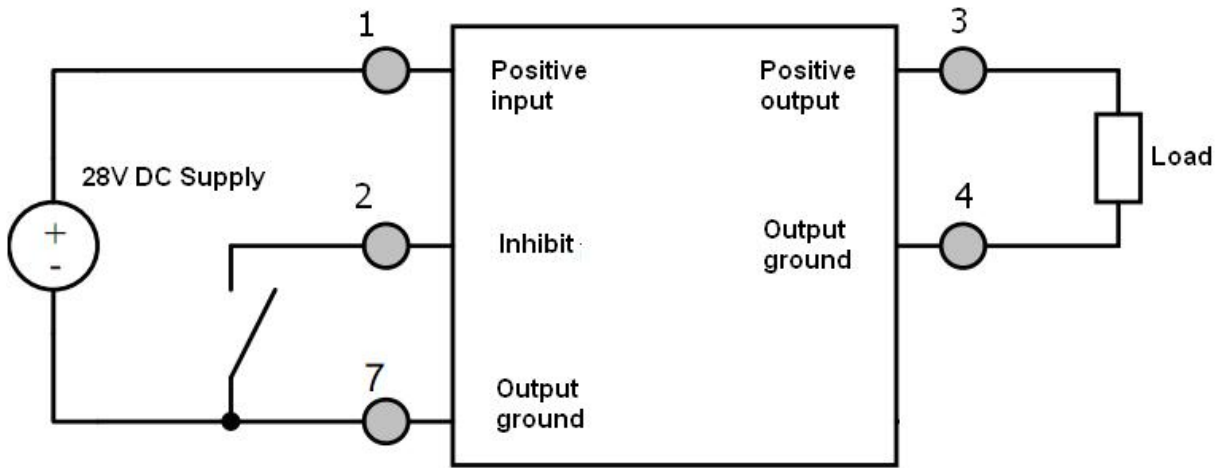


Fig 8 Connection Diagram

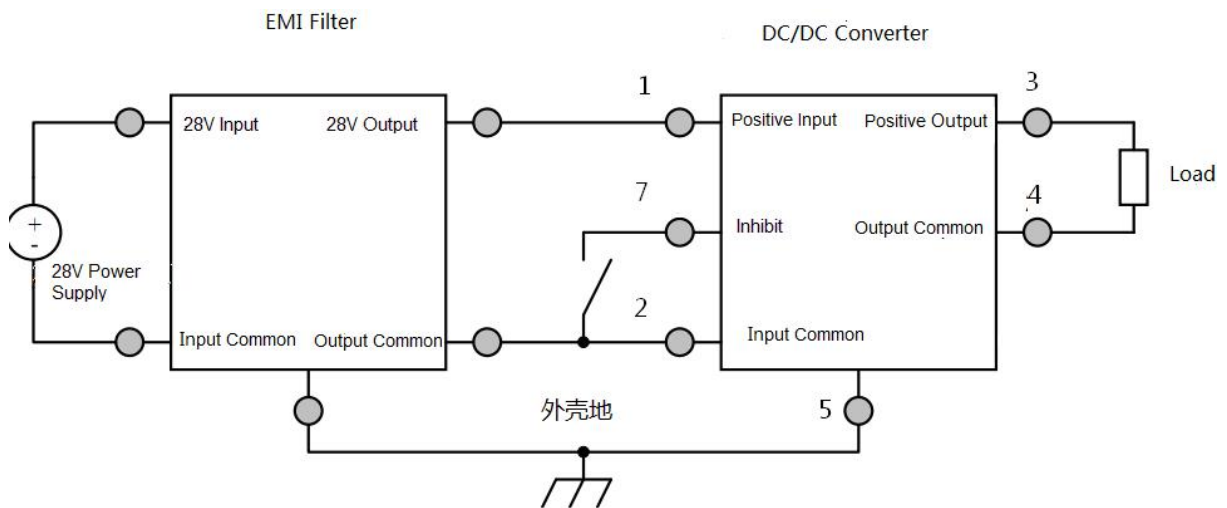


Fig 9 EMI Filter Connection Diagram

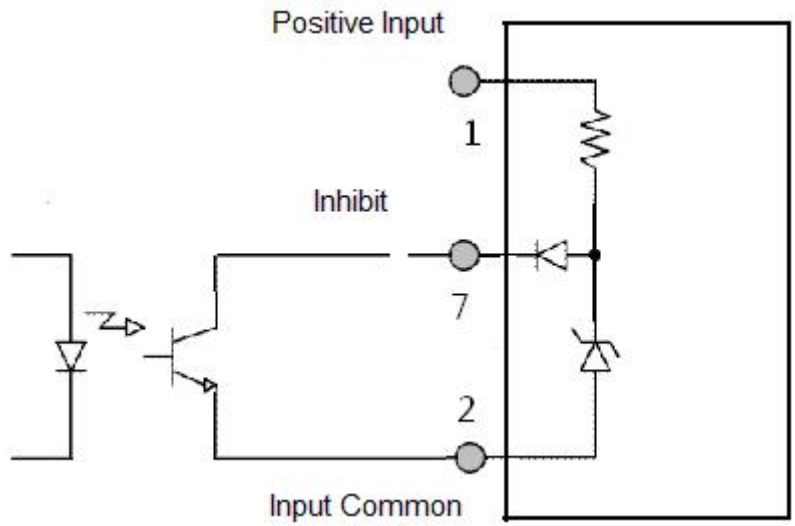


Fig 10 Inhibit Driver Circuit Diagram

### 10. Package Specifications (Unit: mm)

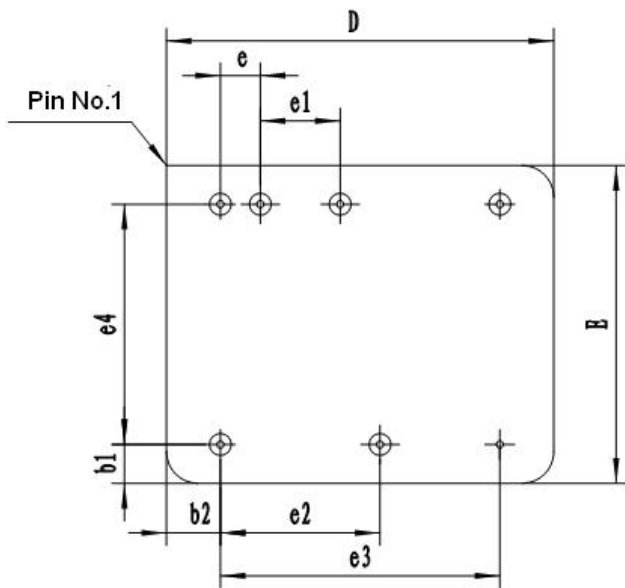


Fig 11 Bottom View

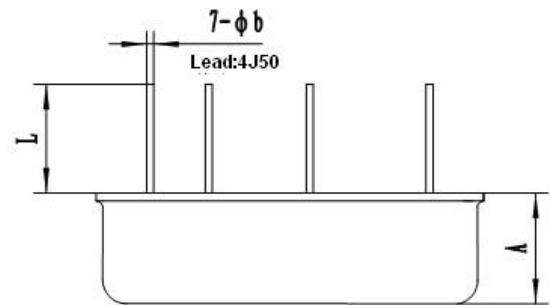


Fig 12 Side View

Table 5 Package Outline

Symbols	Unit/mm		
	Minimum	Nominal	Maximum



<i>A</i>	-	-	7.38
$\phi b$	0.32	-	0.58
<i>b1</i>	2.16	-	2.76
<i>b2</i>	3.13	-	3.73
<i>D</i>	-	-	25.14
<i>E</i>	-	-	20.66
<i>e</i>	2.24	2.54	2.84
<i>e1</i>	4.78	5.08	5.38
<i>e2</i>	9.86	10.16	10.46
<i>e3</i>	17.28	17.78	18.28
<i>e4</i>	14.74	15.24	15.74
<i>L</i>	5.86	-	-

注：*e*、*e1*、*e2*、*e3*、*e4* are interchangeable size, made by the shell manufacturing and inspection, this specification does not do the assessment requirements.

Table 6 Case Materials

Case Model	Header	Header Plating	Cover	Cover Plating	Pin	Pin Plating	Sealing	Notes
UPP2520-07	High quality carbon structural steel (08AL)	Au	SPCC-SD	Ni	4J50	Au	Energy storage welding	

## 11 Ordering Information

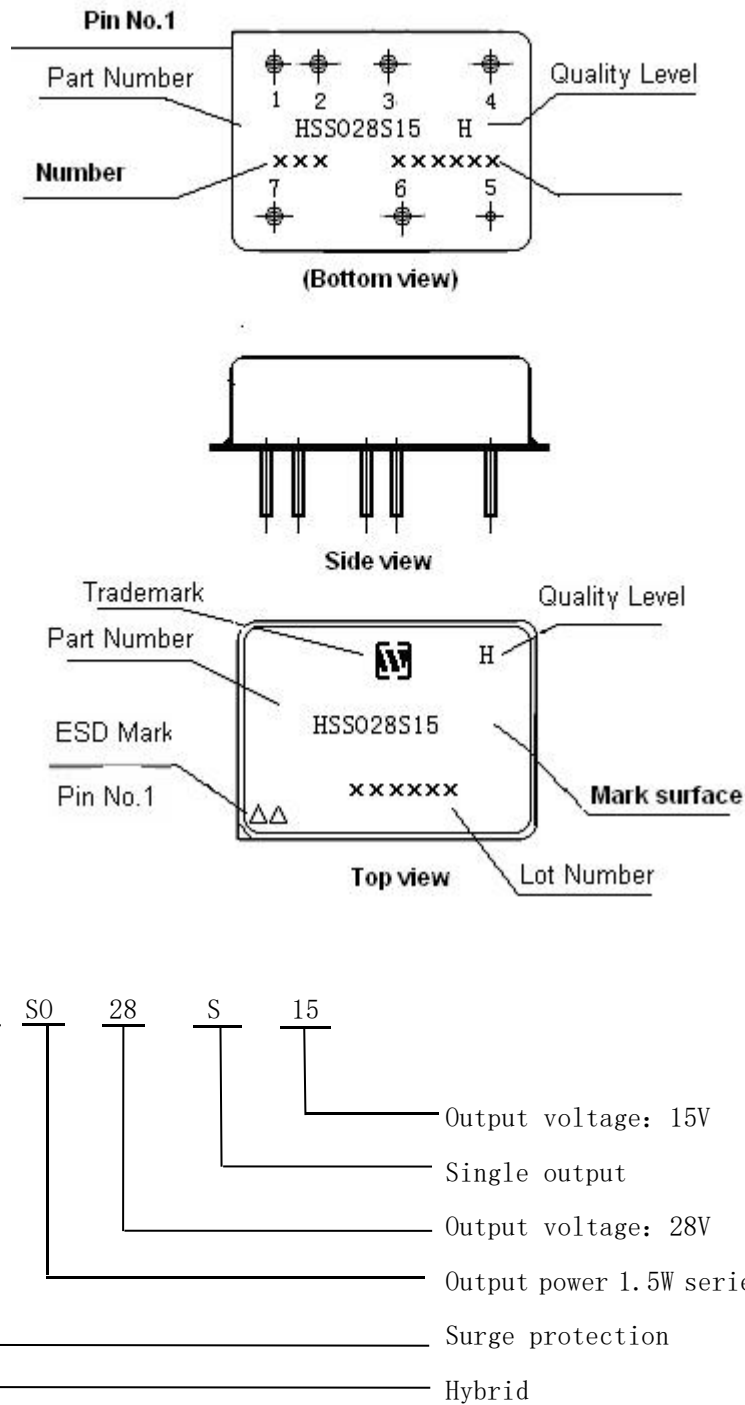


Fig 15 Part Numbering Key

### 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 root of the pin 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 using ,the output load should not be less than 10% of the rated load
- ☆ When ordering this device , the detail electrical specification shall be based on relevant standards. While data offered in this document shall be for reference only.