

# Hybrid Transient Suppression DC to DC converter (HSTR28D Series)

## 1 Features of transient suppression DC to 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

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

- Operating temperature range  $T_c$ : -55°C~+125°C

Weight: 47g(without flange)

- Low Startup current

55g (with flange)

- No output overshoot

Table1 Device models

- Inhibit function

- Input under-voltage locked function  
and output short circuit protection

HSTR28D5、HSTR28D5F
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HSTR28D12、HSTR28D12F
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HSTR28D15、HSTR28D15F
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- Maximum power density: 41W/in<sup>3</sup>

- Hermetically sealed metal case

## 2 Scope of application transient suppression DC to DC converter

High reliability electronic system for aviation and aerospace, etc

## 3 Descriptions transient suppression DC to DC converter

This series device is highly reliable and is featured with surge protection (80v, 1s) for transient suppression DC to 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.

Thick film hybrid techniques provide the HTR 28 Series of converters with high reliability and optimum miniaturization. The design and manufacturing process of HTR 28 Series of converters are in compliance with MIL-PRF-38534 and detailed specifications.

## 4 Technical Specifications transient suppression DC to DC converter

Table 2 Rated conditions and recommended operating conditions

Absolute Max. Rating
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Input voltage: 15V~50V	Mechanical Shock: 1500g
Input voltage (Transient,1s) : 80V	Lead resistance welding temperature: 300°C (15s)
Output Power: 44W	Weight (without flange/ with flange) : 47g/55g
Storage temperature: -65°C~150°C	Antistatic intensity: 2000V

Table 3 Electrical characteristics

No	Items	Conditions	HSTR28D5 HSTR28D5F		HSTR28D12 HSTR28D12F		HSTR28D15 HSTR28D15F		
			Min	Max	Min	Max	Min	Max	
1	Input Voltage/V	Low, High, Ambient Temperature	15	50	15	50	15	50	
2	Output Voltage/V Output current/A	P	Ambient, full load	4.95	5.05	11.88	12.12	14.85	15.15
		N		4.95	5.05	11.88	12.12	14.85	15.15
		P	Low/high, full load	4.93	5.07	11.82	12.18	14.70	15.30
		N		4.93	5.07	11.82	12.18	14.70	15.30
3	Input Voltage/V	$V_{IN}=15V\sim 50V$	—	3	—	1.67	—	1.33	
4	Output Voltage/V		0	30	0	40	0	40	
5	Output Ripple Voltage/mV	$BW\leq 20MHz$ , full load	—	60	—	50	—	50	
6	Voltage Regulation/mV	P	$V_{IN}=16V\sim 40V$ , full load	—	50	—	50	—	50
		N		—	50	—	50	—	50
7	Load Regulation/mV	P	IO=0→full load	—	50	—	50	—	50
		N		—	50	—	50	—	50
8	Input Current/mA	Inhibit		—	6	—	6	—	6
		IO=0		—	60	—	60	—	60
9	Input Ripple current /mA	$BW\leq 20MHz$ , full load	—	50	—	50	—	50	
10	Efficiency/%	full load	73	—	78	—	79	—	
11	Isolation /MΩ	Input to output or any pin to case(except pin 7, 8)at 500V, $T_A=25^\circ C$	100	—	100	—	100	—	
12	Inhibit Voltage		0	0.7	0	0.7	0	0.7	
13	Inhibit open-circuit Voltage/V	full load	10	14	10	14	10	14	
14	Under voltage open voltage/V	full load	12.0	14.8	12.0	14.8	12	14.8	
15	Under voltage cut-off voltage/V	full load	11.0	14.5	11.0	14.5	11	14.5	
16	Short Circuit Protection		Reduced flow pattern		Reduced flow pattern		Reduced flow pattern		
17	Capacitive load /μF	$T_c=25^\circ C$	—	500	—	500	—	500	
18	Switching frequency/kHz	full load	400	500	400	500	400	500	
19	External Synchro Frequency Range/kHz	$T_c=25^\circ C$ , full load, TTL electrical level ( $V_{IH}\geq 4.5V$ , $V_{IL}\leq 0.8V$ ), Load Ratio 40%~60%	400	500	400	500	400	500	
20	Cross Regulation/mV	One is 30% load, another one is from 30% to 70% load	—	650	—	650	—	650	
21	Step Load Response Transient(mV pK)	50% load→full load or full load→50% load	—	400	—	450	—	500	
22	Step Load, Output	50% load→full load or	—	350	—	400	—	300	

	Voltage Recovery/ $\mu$ s	full load $\rightarrow$ 50% load						
23	Input Voltage Transient, Output Voltage (Peak) /mV	Input Voltage $V_{IN}$ ; 16V $\rightarrow$ 40V, full load or Input Voltage $V_{IN}$ ; 40V $\rightarrow$ 16V, full load	—	600	—	900	—	900
24	Input Voltage Transient, Output Voltage Recovery/ $\mu$ s	Input Voltage $V_{IN}$ ; 16V $\rightarrow$ 40V, full load or Input Voltage $V_{IN}$ ; 40V $\rightarrow$ 16V, full load	—	500	—	500	—	500
25	Start-up Overshoot(mV pK)	Input Voltage $V_{IN}$ ; 0 $\rightarrow$ 28V, full load	—	50	—	50	—	50
26	Start-up Delay (ms)	Input Voltage $V_{IN}$ ; 0 $\rightarrow$ 28V, full load	—	20	—	20	—	20

### 5 Circuit block diagram transient suppression DC to DC converter

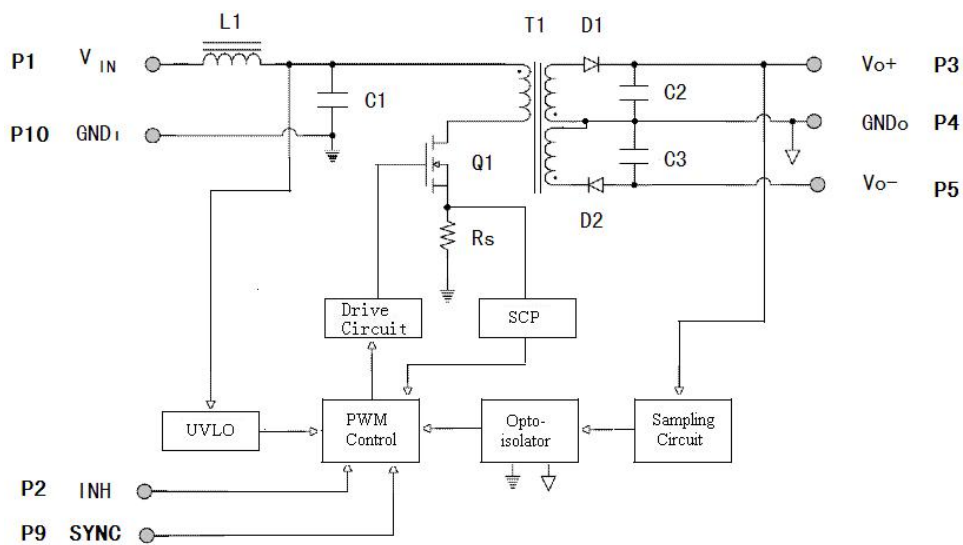


Fig. 1 HSTR28D Series circuit block diagram

### 6. Typical Characteristic Curve transient suppression DC to DC converter ( $T_c=25^\circ\text{C}$ , $V_{IN}=28\text{V}\pm 5\%$ , Full load)

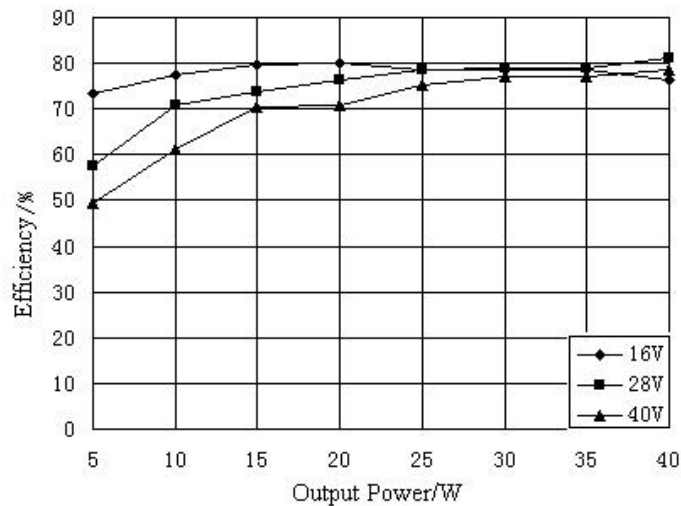


Fig. 2 HSTR28D15 Efficiency

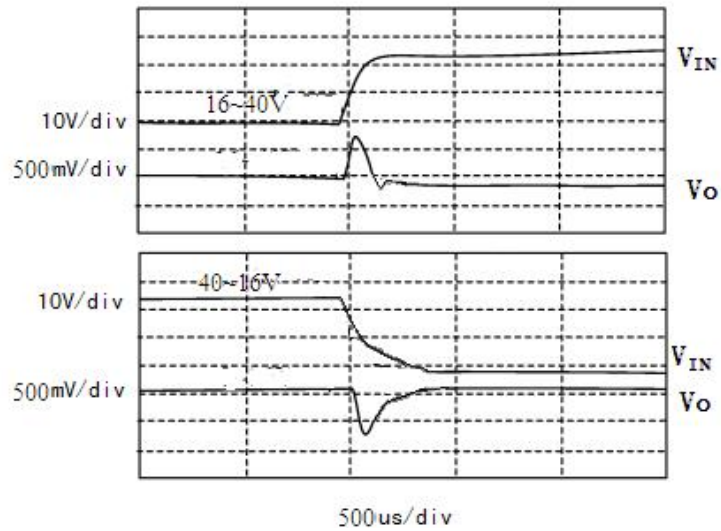


Fig. 3 HSTR28D15 Step Line Response

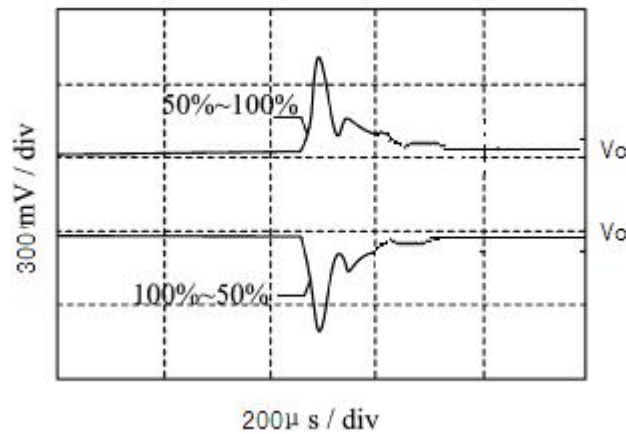


Fig. 4 HSTR28D15 Step Load Response

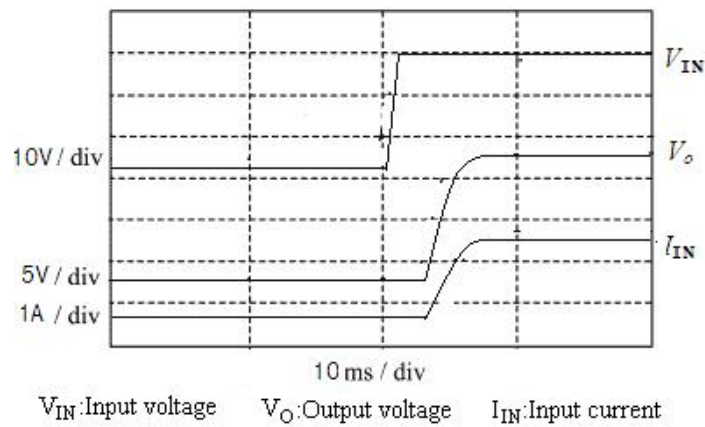


Fig. 5 HSTR28D15 Start-up Overshoot/Start-up Delay

## 7.MTBF Curve transient suppression DC to DC converter

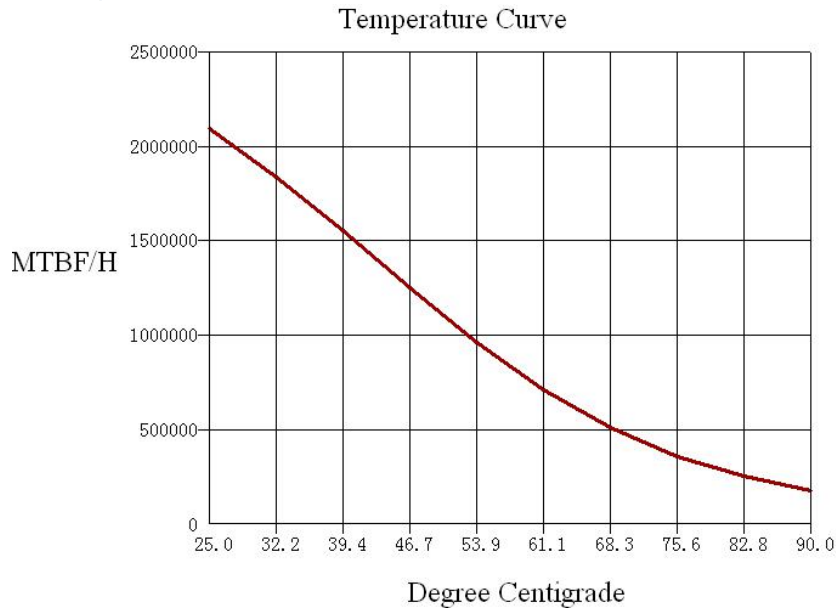


Fig. 6 MTBF Temperature Curve (HSTR28D15)

### 8 Pin Designation transient suppression DC to DC converter

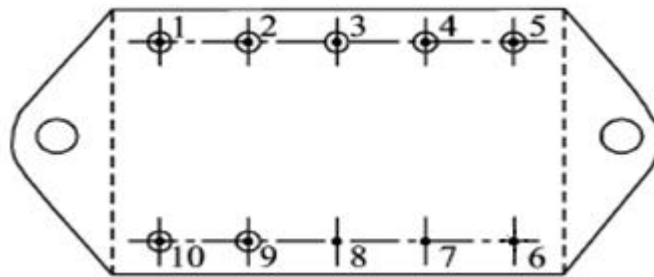


Fig. 7 Pin Out Bottom View

Table 4 Pin Designation

Pin	Symbol	Designation
1	$V_{IN}$	Positive Input
2	INH	Inhibit
3	$V_{O+}$	Positive Output
4	$GND_O$	Output Common
5	$V_{O-}$	Negative Output
6	$GND_C$	Case
7	$GND_C$	Case
8	$GND_C$	Case
9	SYNC	External Synchro Input
10	$GND_I$	Input Common

### 9 Typical Connection Diagram transient suppression DC to DC converter

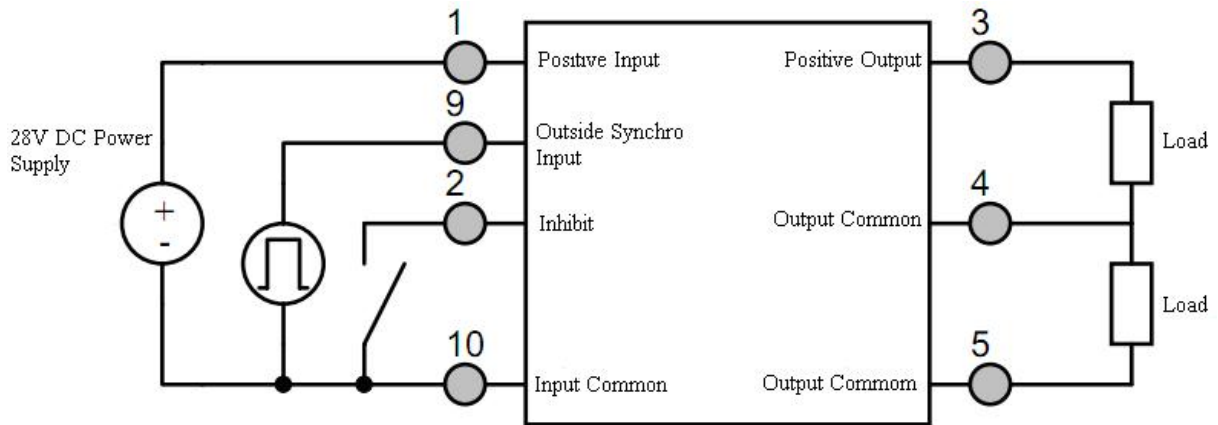


Fig. 8 Connection Diagram

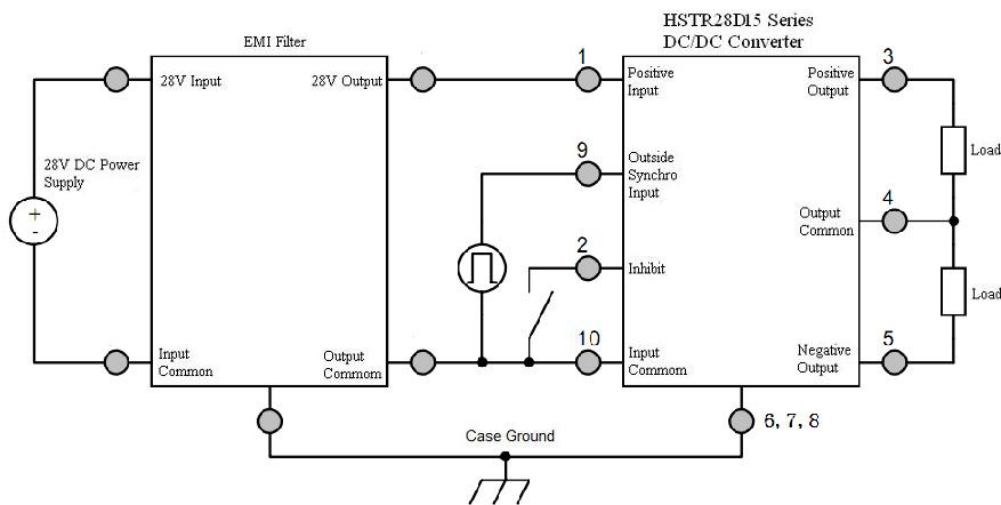


Fig. 9 EMI Filter Connection Diagram

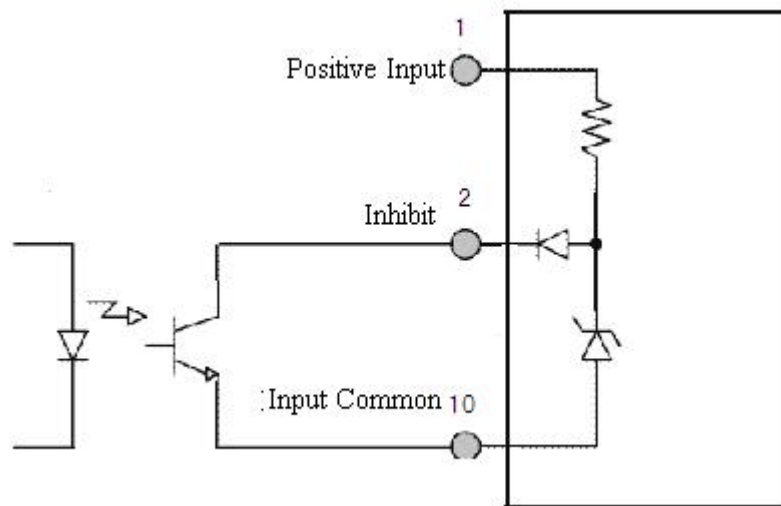


Fig. 10 Inhibit Driver Circuit Diagram

## 10. Package Specifications transient suppression DC to DC converter (Unit: mm)

① Package without flange

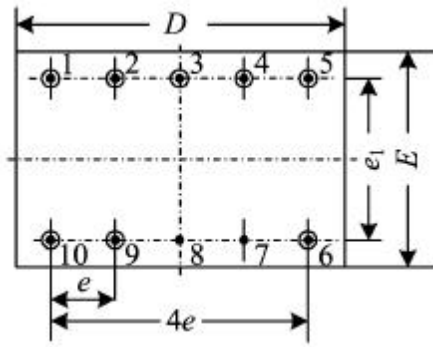


Fig. 11 Bottom View

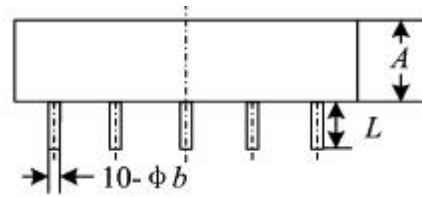


Fig. 12 Side View

② Package with Flange

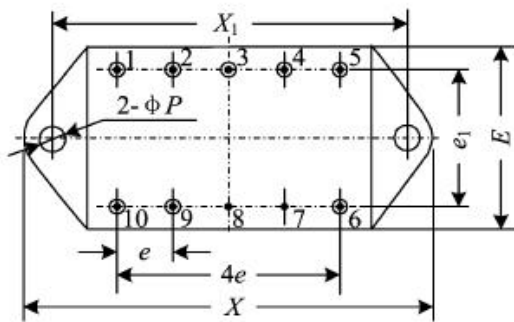


Fig. 13 Bottom View

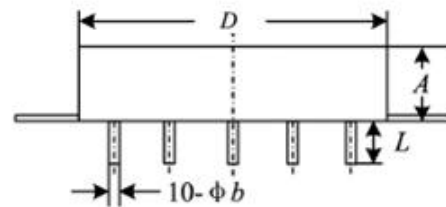


Fig. 14 Side View

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	—	—	29.00
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
UPP5429-10g (without flange)	Cold Rolled Steel (10#)	Ni	Kovar (4J42)	Ni	Cu-core Compound	Ni/Au	Parallel seam	Ni Plating is for case ground pin
UPP5429-10f	Cold Rolled	Ni	Kovar	Ni	Cu	Ni/Au	Parallel seam	Ni Plating is

(with flange)	Steel (10#)		(4J42)		Compound			for case ground pin
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### 11 Ordering Information transient suppression DC to DC converter

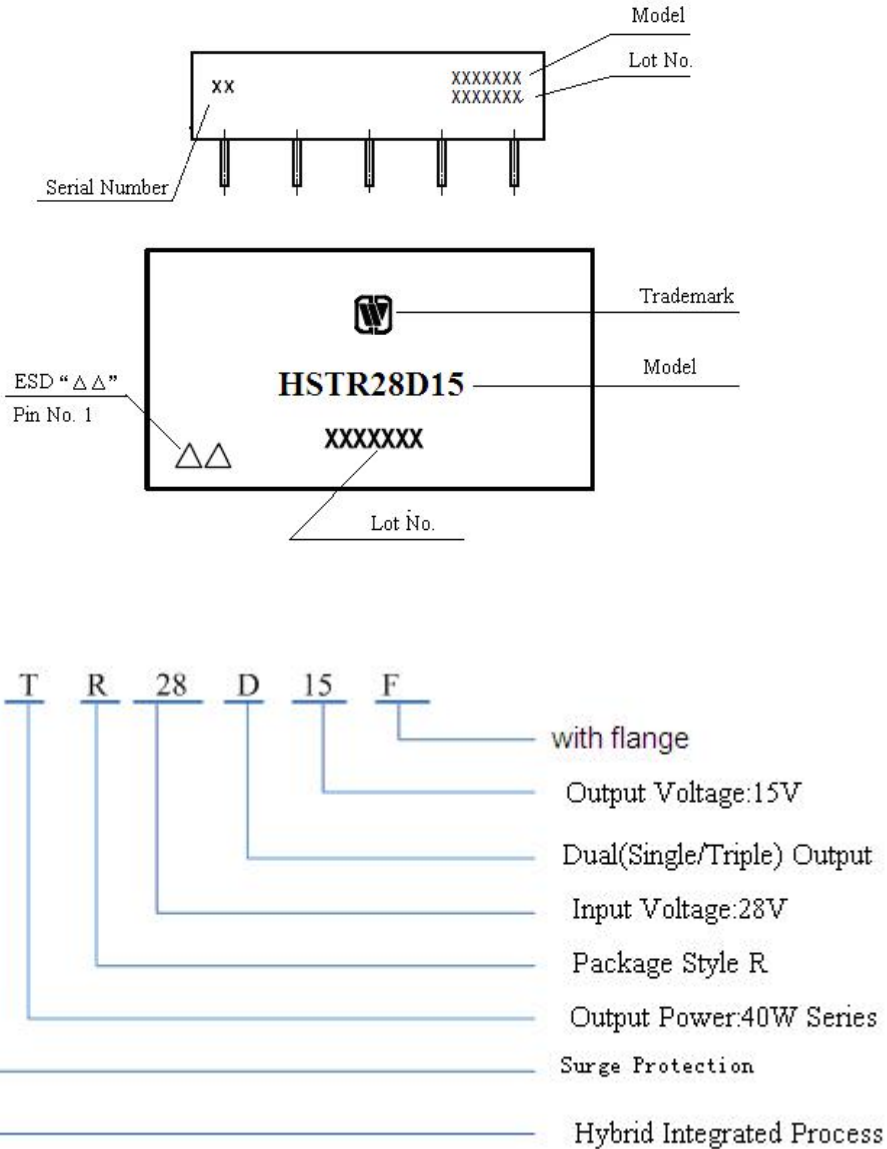


Fig. 15 Part Numbering Key

#### 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 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 lager 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.