High-reliability hybrid integrated DC/DC converter (HSG28 series)

1. Features (see Fig. 1 for outside view, and Table 1 for models)

Range of input DC voltage: 18~36V, nominal input DC voltage 28V
Output power: 5W
Operating temperature (T_c): -55~+105℃
Input, output and case are isolated mutually
Insulation resistance: R≥100MΩ (DC 500V)
With the function of inhibit and short-circuit protection
Power density: 28W/in^3
Function of pins: same as that of like products of Interpoint Company
Totally sealed metal case

2. Scope of application

High-reliability electronic system for aviation and aerospace, etc.

Size: Style G: 34×27.34×9.00mm^3
Style R: 53.08×28.19×10.00mm^3(without fixed end)
73.80×28.19×10.00mm^3(with fixed end)
Weight: Style G: 27g; Style R: 43g
HSW28M15: 46g

Fig. 1 Outside view of HSG28 series

Table 1 Product models

single	style	dual	style	triple	style	multi-output	style
HSG28S12	G	HSG28D5N	G	HSG28T12	G	HSW28M15	W
HSG28S3R5	G	HSG28D12	G	HSG28T15	G		
HSG28S5	G	HSG28D15	G				
HSG28S18	G	HSG28D15N	G				
HSG28S20	G						
HSG28S55	G						
HSR28S5F－A	R						

3. Description

HSG28 series high-reliability DC/DC converter can work at 28V input voltage, and the output power is 5W. The case of this series adopts totally sealed metal structure.

HSG28 series products adopt the push-pull topology and the full-wave rectification technology, the constant switching frequency is 200~300kHz.

Both the design and manufacture of HSG28 series products satisfy the requirements of GJB2438A-2002 “General specifications for hybrid integration circuit”. Test method and procedure of electric circuit shall execute GJB548A-96 “Test method and procedure for microelectronic devices”.

4. Electrical performance (Table 2~6)

Table 2 Rated conditions and recommended operating conditions

Absolute max. rated value	Input voltage: 18~36V Power dissipation: 5W Lead soldering temperature: 300℃/(10s) Storage temperature range: -55~125℃ Logical low voltage: ≤0.2V
Recommended operating conditions	Range of input DC voltage: 18~36V Ambient temperature (T_A): －55~＋85℃

Table 3 Electrical characteristics (single-output)

Parameter	Conditions (unless otherwise specified) $V_{in}=28V\pm5\%$, $-55℃\leqslant T_A\leqslant+85℃$	HSG28S5		HSG28S18		HSG28S55		HSG28S12	
		enterprise military standard							
		Q/HW20086-94		Q/HW30275-99		Q/HW30005-97		Q/HW20304-2001	
		min.	max	min.	max	min.	max	min.	max
input voltage/V	—	22	32	22	34	22	34	12	18
output voltage/V	—	4.8	5.2	17.7	18.3	54.0	56.0	11.75	12.25
output power/W	—	—	3.5	—	4	—	1.4	—	5
output current/A	—	0	0.7	0	0.2	0	0.03	0	0.4
output ripple voltage/mV	full load, 100MHz, $T_A=25℃$	—	80	—	80	—	80	—	30
efficiency/%	full load, $T_A=25℃$	65	—	65	—	50	—	75	—
load regulation/%	no-load to full load, $T_A=25℃$	—	1	—	1	—	1	—	0.5
voltage regulation/%	full load, $T_A=25℃$	—	0.1	—	0.5	—	0.5	—	0.5
insulating resistance/MΩ	$T_A=25℃$, apply 500V DC between any two of input, output and case	100	—	100	—	100	—	10	—
inhibit function	—	—	YES	—	YES	—	YES	—	—
protection function	—	—	YES	—	—	—	YES	YES	—

Table 3 (continued)

Parameter	Conditions (unless otherwise specified) $V_{in}=28V\pm5\%$, $-55℃\leqslant T_A\leqslant+85℃$	HSG28S20		HSR28S5F—A		HSG28S3R5	
		enterprise military standard:					
		Q/HW30020-97		Q/HW30326-2000		Q/HW30436-2003	
		min.	max.	min.	max.	min.	max.
input voltage/V	—	22	34	18	40	23	33
output voltage/V	—	19.70	20.30	4.93	5.07	3.35	3.65
output power/W	—	—	2	—	5	—	3.5
output current/A	—	0	0.1	0	1	—	1
output ripple voltage/mV	full load, 100MHz, $T_A=25℃$	—	100	—	60	—	80
efficiency/%	full load, $T_A=25℃$	60	—	76	—	68	—
load regulation/%	no-load to full load, $T_A=25℃$	—	1	—	50mV	—	100mV
voltage regulation/%	full load, $T_A=25℃$	—	0.5	—	50mV	—	50mV
insulating resistance/MΩ	$T_A=25℃$ apply 500V DC between any two of input, output and case	100	—	100	—	—	—
inhibit function	—	YES	—	—	—	—	YES
protection function	—	—	—	—	—	—	YES

Table 4 Electrical Characteristics (dual-output)

Parameter	conditions (unless otherwise specified) $V_{in}=28V\pm5\%$, $-55℃\leqslant T_A\leqslant+85℃$	HSG28D12		HSG28D15		HSG28D15N		HSG28D5N	
		enterprise military standard:							
		Q/HW20089—64		Q/HW30004—97		Q/HW20087—94		Q/HW30266—99	
		min.	max.	min.	max.	min.	max.	min.	max.
input voltage/V	—	22	32	18	40	22	32	20	36
output voltage/V	—	11.7	+12.3	+14.80	+15.20	+14.85	+15.15	+4.75	+5.25
		−12.3	−11.7	−15.20	−14.80	−15.30	−14.70	−5.25	−4.75
output power/W	—	—	4	—	4	—	4	—	4
output current/A	—	—	±0.175	—	±0.133	—	0.20	0	0.70
							−0.08	−0.05	0
output ripple voltage/mV	full load, 100MHz, $T_A=25℃$	—	80	—	80	—	80	—	80
efficiency/%	full load, $T_A=25℃$	65	—	72	—	65	—	70	—
load regulation/%	no-load to full load, $T_A=25℃$	0.1	—	—	0.8	0.01	—	—	1.0
voltage regulation/%	full load, $T_A=25℃$	0.1	—	—	0.2	0.01	—	—	0.5
insulating resistance/MΩ	$T_A=25℃$ apply 500V DC between any two of input, output and case	100	—	100	—	100	—	100	—
inhibit function	—	YES	—	—	YES	—	YES	YES	—
protection function	—	—	YES	—	—	—	—	—	—

Table 5 Electrical characteristics (triple-output)

Parameter	conditions (unless otherwise specified) V_{in}=28V±5%, −55℃≤ T_A ≤ +85℃(HSG28T15) −55℃≤ T_C ≤+125℃(HSG28T12)		HSG28T15 enterprise military standard: Q/HW30576−2004		HSG28T12 enterprise military standard: Q/HW20504−2005	
			min.	max.	min.	max.
input voltage/V	−		22	30	20	32
output voltage/V	−	V_{out1}	14.8	15.2	11.8	12.2
		V_{out2}	14.8	15.2	11.8	12.2
		V_{out3}	14.8	15.2	11.8	12.2
output power/W	−		−	5	−	5
output current/A	−		−	0.08	−	0.1
output ripple voltage/mV	full load, 100MHz, T_A =25℃		−	100	−	100
efficiency/%	full load, T_A =25℃		65	−	65	−
load regulation/mV	no-load to full load, T_A =25℃		−	100	−	50
voltage regulation/mV	full load, T_A =25℃		−	100	−	100
insulating resistance/MΩ	T_A =25℃, apply 500VDC voltage between input and output or between any pin (except pin 2) and case		100	−	100	−
inhibit function/V	T_A =25℃, in the range of inhibit voltage, the circuit output is shut down		−	0.2	−	0.2
protection function	−		−	YES	−	YES

Table 6 Electrical characteristics (multi-output)

Parameter	conditions (unless otherwise specified) V_{in}=28V±5% −55℃≤ T_A ≤ +85℃	HSW28M15 enterprise military standard: Q/HW30413−2004	
		min.	max.
input voltage/V	−	24	32
output voltage/V	−	14.9	15.1
output power/W	−	−	2.7
output current/A	−	−	0.03
output ripple voltage/mV	full load, 20MHz, T_A =25℃	−	50
efficiency/%	full load, T_A =25℃	30	−
load regulation/%	no-load to full load, T_A =25℃	−	0.2
voltage regulation/%	full load, T_A =25℃	−	0.2
insulating resistance/MΩ	T_A =25℃ apply 500VDC voltage between any two of input, output and case	100	−

5 Circuit block diagram (Fig.2)

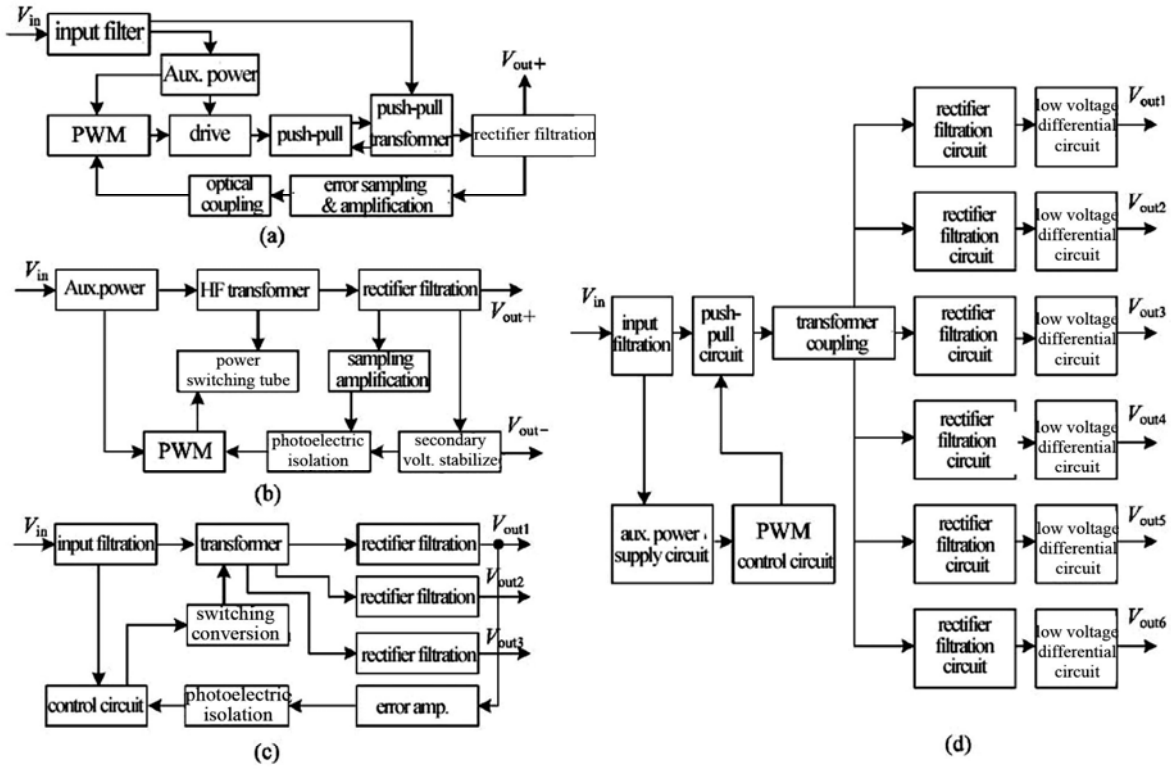

Fig. 2 Circuit block diagram for DC/DC converter (a) single-output (b) dual-output (c) triple-output (d) multi-output

6 MTBF Curve (Fig.3-1~4)

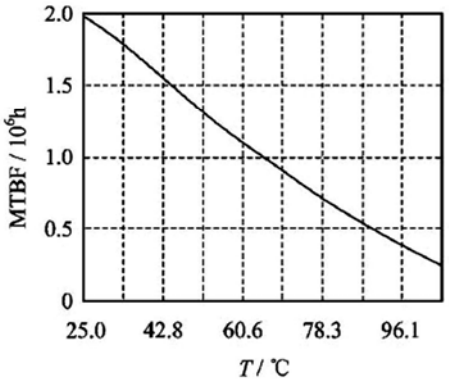

Fig.3-1 MTBF-Temperature curve for model HSG28S5

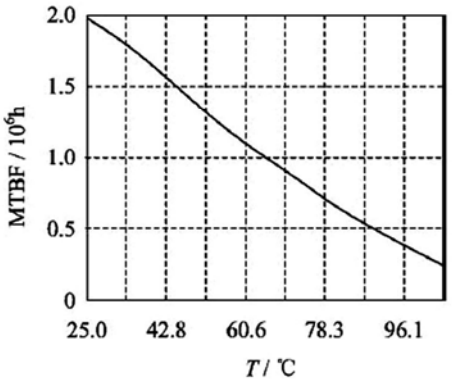

Fig.3-2 MTBF-Temperature curve for model HSG28D15

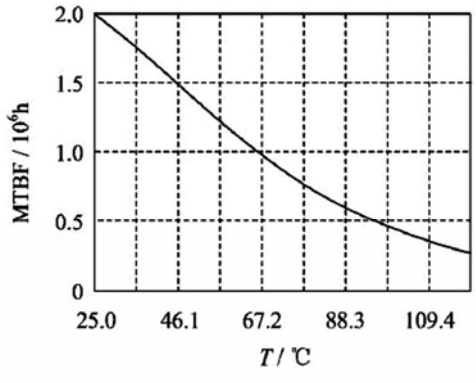

Fig.3-3 MTBF-Temperature curve for model HSG28T12

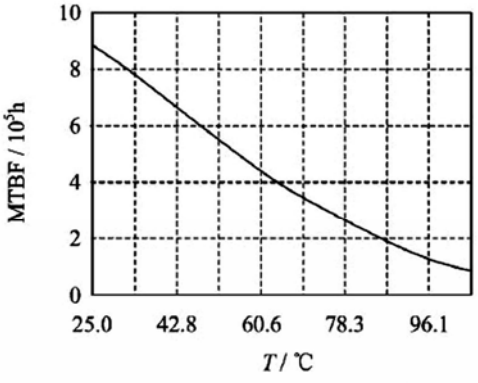

Fig.3-4 MTBF-Temperature curve for model HSW28M15

(as per GJB/Z299B-98, envisaged good ground condition)

7 Pin designation (Fig.4, Table 7~9)

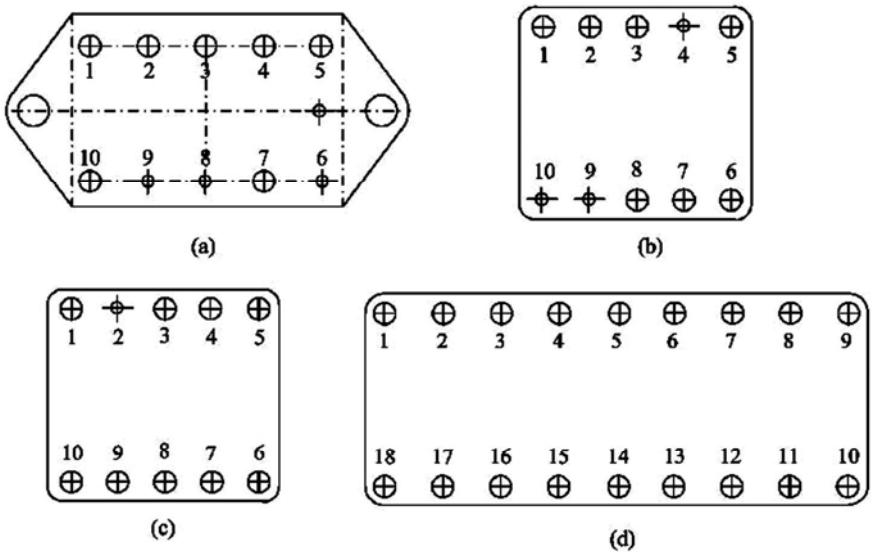

Fig. 4 Pin designation (bottom view)
(a) Style R, (b) Style G, (c) Style G (HSG28T12, HSG28T15), (d) HSW28M15

Table 7 Pin designation

functions	Pinout number						
	HSG28S5	HSG28S18	HSG28S55	HSG15S12	HSG28S20	HSR28S5F-A	HSG28S3R5
positive input	3	3	3	3	3	1	3
positive output	6	6	6	5	6	5	5
input ground	5	5	5	1	5	10	6
output ground	7	7	8	4	8	4	7
adjustment*	—	—	—	—	—	3	—
inhibit	2	2	2	—	2	2	2
case ground	4,9,10	4,9,10	4,9,10	—	4,9,10	6,7,8	4,9,10
no connection	1,8	1,8	1,7	2,6,7,8	1,7	9	1,8

Note: *adjustment pinout adjusts the change of output voltage through external resistance between adjustment pin and output (positive and ground)

Table 8 Pin designation

functions	pinout number		
	HSG28D5N	HSG28D15	HSG28D15N
positive input	3	3	3
input ground	5	5	5
positive output	6	6	6
negative output	8	8	8
output ground	7	7	7
inhibit	2	2	2
case ground	4,9,10	4,9,10	4,9,10
no connection	1	1	1

Table 9 Pin designation

functions	pinout number			
	HSG28D12	HSG28T12	HSG28T15	HSW28M15
positive input	3	3	3	18
input ground	5	1	1	1
positve output	6	5(output 1), 6(output 2), 8(output 3)	5(output 1), 6(output 2), 8(output 3)	4,6,8,10,12,14
negative output	8	—	—	—
output ground	7	4(output 1), 7(output 2), 9(output 3)	4(output 1), 7(output 2), 9(output 3)	5,7,9,11,13,15
inhibit	2	10	10	—
case ground	4,9,10	2	2	—
no connection	1	Note: *adjustment pinout	—	2,3,16,17

Note: *adjustment pinout adjusts the change of output voltage through external resistance between adjustment pin and output (positive and ground)

8 Connecting diagram for typical application (Fig.5~7)

(1) connecting diagram for operation

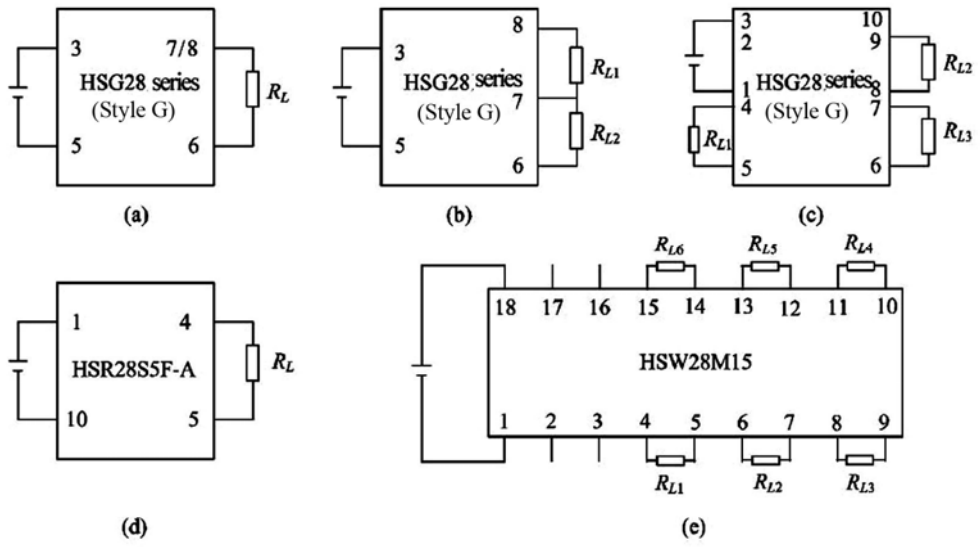

Fig. 5 Connecting diagram for operation
(a) Single-output (b) Dual-output (c) Triple-output (d) Type R (e) HSW28M15

(2) connection diagram for inhibit terminal

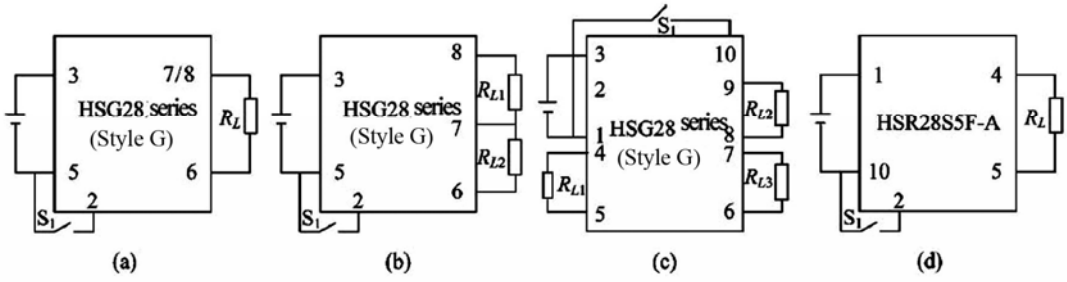

Fig. 6 Connection diagram for inhibit terminal
(a) single-output (b) dual-output (c) triple-output (d) Style R

(3) Connecting diagram for EMI filter

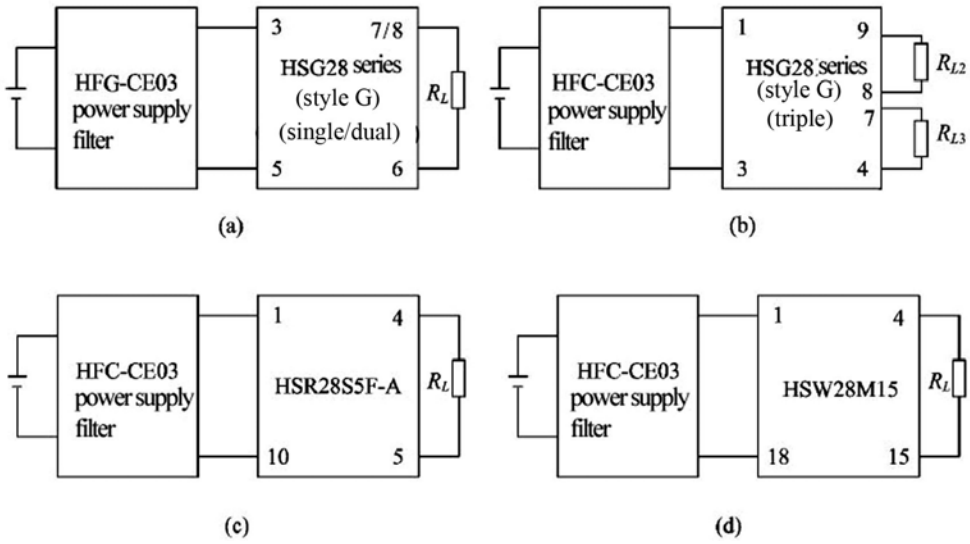

Fig. 7 Connecting diagram for filter

(a) Single and dual output model (b) Triple output model (c) Style R (d) Model HSW28M15

9 Package specifications (unit: mm) (Fig.10~13, Table 10)

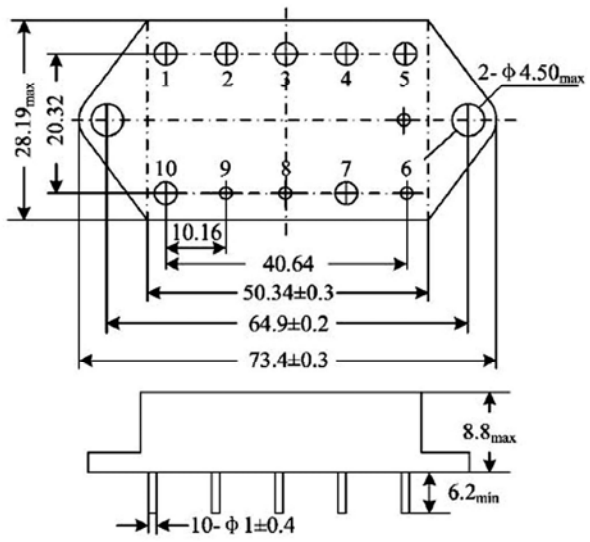

Fig. 10 Style R

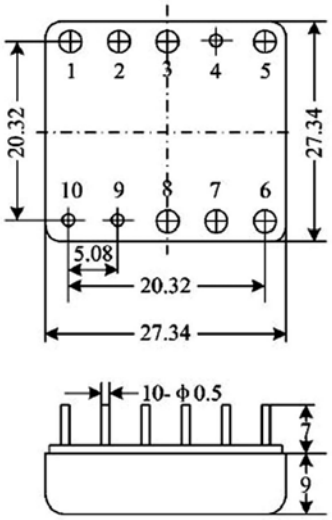

Fig. 11 Style G

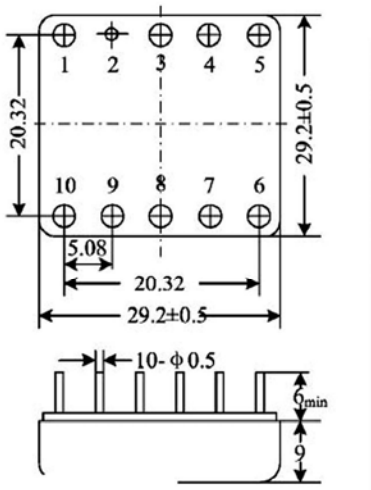

Fig. 12 Style G (HSG28T12/HSG28T15)

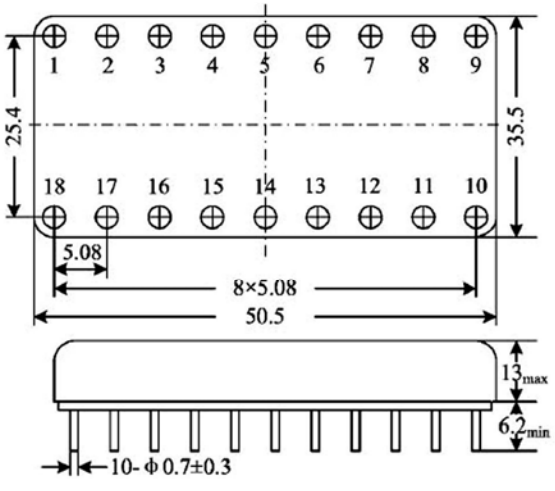

Fig. 13 Model SW28M15

Table 10 Case materials

case model	header	header plating	cover	cover plating	pin material	pin plating	sealing style	notes
UPP2727—10 (style G)	cold rolled steel (10#)	Ni	iron/nickel alloy (4J42)	Ni	iron/nickel alloy (4J50)	Ni/Au	compression seal	
UPP5328—10d (style R)	cold rolled steel (10#)	Ni	iron/nickel alloy (4J42)	Ni	copper compound	Ni/Au	compression seal	ground pin plating is Ni
PP4833—18 (HSW28M15)	cold rolled steel (08AL)	Ni/Au	cold rolled steel (08AL)	Ni/Sn	iron/nickel alloy (4J50)	Ni/Au	compression seal	

Note: the temperature of solder pins within 10s shall not exceed 300℃

10 Part numbering key (Fig.14)

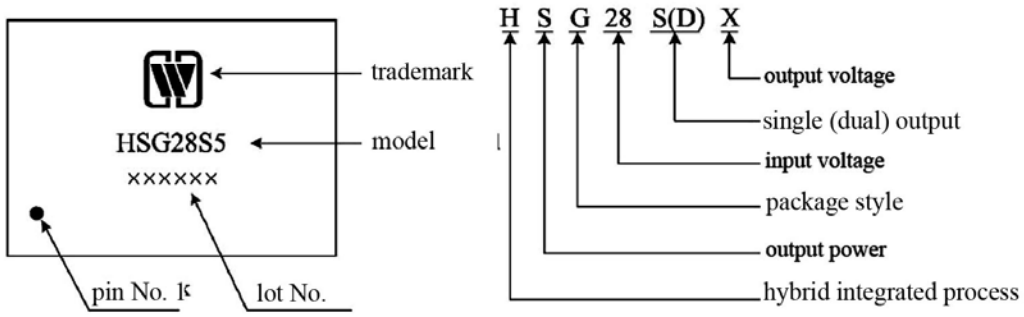

Fig. 14 Part numbering key

Application notes:

★ Upon power-on, be sure to correctly connect the positive and negative pole of the power supply to ensure correct power supply for fear of burning.
★ When carrying out the electrical performance test, the test position shall be the pinouts of the product.
★ Upon assembly, the bottom of the product shall fit to the circuit board closely so as to avoid damage of pins, and shockproof provision shall be added, if necessary.
★ Do not bend the pinouts to prevent the insulator from breaking, which affects the sealing property.
★ When the user places an order for the product, detailed electric performance indexes shall refer to the relevant enterprise standard.