

Thick Film Hybrid Large Power military DC/DC Converters

(HOL28S Series)

1 Features of military DC/DC Converters HOL28S Series

- High reliability
- Input voltage range : 16V ~ 40V , Typical
DC input voltage: 28V
- Output power PO : 66W ~ 120W
- Operating temperature range T_c : -55°C ~ +125°C
- Low Start-up current
- No output overshoot
- Inhibit function
- under-voltage and short circuit protection
- Output short circuit and over-current protection
- Output voltage fine tunable
- Output sensing function
- Maximum power density : 100W/in³
- Efficiency 92%
- Hermetically sealed metal cases



Size :
76.70*38.60*10.66mm³

Table1 Product models

HOL28S5
HOL28S9R5
HOL28S24

2 Scope of of military DC/DC Converters HOL28S Series application

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

3 Description of military DC/DC Converters HOL28S Series

This series products are high reliable hybrid thick film large power DC/DC converters. By using half-bridge circuit topology and pulse width modulation principle, the output sampling voltage isolated by opto coupler to modulate the pulse width and form the closed-loop control to make the product a stable voltage output. This series products are made by thick film hybrid integrated process, hermetically sealed metal cases. Product Web : www.ecrimpower.com E-mail: sales@ecrim.cn Phone: +86 551-63667943 Fax: +86 551-65743191 - 1 -

design and manufacturing meets MIL-PRF-38534 requirements. Customers can connect the matching power EMI filters in the input port to improve the product's electromagnetic compatibility.

4 Electrical performance of military DC/DC Converters HOL28S Series

Tabel2 Rated conditions and recommended operating conditions

Absolute Max. Rated value	
Output voltage : 15.5V ~ 41V	Mechanical Shock : 1500g
Output power : 120W	Lead resistance to welding temperature : 300°C (15s)
Storage temperature : -65°C ~ 150°C	Weight : 100g
	ESD : 2000V

Table 3 Electric characteristics

No.	Parameter	Conditions (Unless other wise , - 55°C≤T _c ≤125°C , V _{IN} =28V±5%)	HOL28S5		HOL28S6R3		HOL28S9R5		
			Min	Max	Min	Max	Min	Max	
1	Input voltage/V	Low、 High、 Ambient Temperature	16	40	16	40	16	40	
2	Output voltage/V	Full load	Ambient	4.9	5.1	6.25	6.35	9.405	9.595
			Low/high	4.8	5.2	6.2	6.4	9.405	9.595
3	Output current/A	V _{IN} =16V ~ 40V	-	24	-	16.8	-	12.6	
4	Output Power/W		-	120	-	105	-	120	
5	Output Ripple Voltage/mV	BW≤20MHz , Full load	-	100	-	100	-	100	
6	Line Regulation/mV	V _{IN} =16V ~ 40V , Full	-	50	-	20	-	95	

		load							
7	Load Regulation/mV	No load to full		-	50	-	63	-	95
8	Input current/mA	Inhibited		-	10	-	10	-	10
		Io=no load		-	150	-	120	-	160
9	Input Ripple current/mA	BW≤20MHz , Full load		-	200	-	200	-	200
10	Efficiency/%	Full load	Ambient	90	-	90	-	90	-
			Low/high	86	-	86	-	88	-
11	Isolation/MΩ	Input to output or any pin to case at 500V , T _c =25°C		100	-	100	-	100	-
12	Inhibit voltage			-	0.3	-	0.3	-	0.3
13	Inhibit open circuit voltage/V	Full load		1.25	4	1.25	4	1.25	4
14	Under voltage turn-on voltage/V	Full load		14.5	15.5	14.5	15.5	14.5	15.5
15	Under voltage cut-off voltage/V	Full load		14	15	14	15	14	15
16	Short Circuit Protection power consumption	-		-	20	-	20	-	20
17	Capacitive load/μF	T _c =25°C		-	1000	-	1000	-	1000
18	switching frequency/kHz	Full load		250	350	250	350	250	350
19	Step Load Response Transient(mV pK)	50%load→full load or Full load →50% load		-	800	-	500	-	800
20	Step Load Response Recovery(μs)	50%load→full load or Full load →50% load		-	600	-	500	-	800
21	Step Line Response Transient(mV pK)	V _{IN} : 16V→40V , V _{IN} : 40V→16V , Io=Full load		-	600	-	500	-	600
22	Step Line Response	V _{IN} : 16V→40V ,		-	1500	-	1500	-	2000

	Recovery(μ s)	$V_{IN} : 40V \rightarrow 16V$, $I_o = \text{Full load}$						
23	Start-up Overshoot(mV pK)	$V_{IN} : 0 \rightarrow 28V$, $I_o = \text{Full load}$	-	50	-	63	-	95
24	Start-up Delay (ms)	$V_{IN} : 0 \rightarrow 28V$, $I_o = \text{Full load}$	-	20	-	20	-	10

Table 3-2 Electric characteristics

No.	Parameter	Conditions (Unless other wise , - $55^{\circ}C \leq T_c \leq 125^{\circ}C$, $V_{IN} = 28V \pm 5\%$)		HOL28S24		HOL28S28		HOL28SXX	
				Min	Max	Min	Max	Min	Max
1	Input voltage/V	Low、 High、 Ambient Temperature		16	40	16	40		
2	Output voltage/V	Full load	Ambient	23.7	24.3	27.7	28.3		
			Low/high	23.7	24.3	27.7	28.6		
3	Output current/A	$V_{IN} = 16V \sim 40V$		-	5	-	4.2		
4	Output Power/W			0	120	-	120		
5	Output Ripple Voltage/mV	BW \leq 20MHz, Full load		-	200	-	200		
6	Line Regulation/mV	$V_{IN} = 16V \sim 40V$, Full load		-	240	-	280		
7	Lode Regulation/mV	No load to full		-	240	-	280		
8	Input current/mA	Inhibited		-	15	-	15		
		$I_o = \text{no load}$		-	80	-	80		
9	Input Ripple current/mA	BW \leq 20MHz, Full load		-	200	-	200		
10	Efficiency/%	Full load	Ambient	87	-	88	-		
			Low/high	85	-	87	-		
11	Isolation/M Ω	Input to output or any pin to case at $500V$, $T_c = 25^{\circ}C$		100	-	100	-		

12	Inhibit voltage		-	0.3	-	0.3		
13	Inhibit open circuit voltage/V	Full load	1.25	4	1.25	4		
14	Under voltage open voltage/V	Full load	14.5	15.5	14.5	15.5		
15	Under voltage cut-off voltage/V	Full load	14	15	14	15		
16	Short Circuit Protection	-	-	15	-	15		
17	Capacitive load/ μ F	$T_c=25^\circ\text{C}$	-	200	-	200		
18	switching frequency/kHz	Full load	250	350	250	350		
19	Step Load Response Transient(mV pK)	50%load \rightarrow full load or Full load \rightarrow 50% load	-	2000	-	1400		
20	Step Load Response Recovery(μ s)	50%load \rightarrow full load or Full load \rightarrow 50% load	-	800	-	800		
21	Step Line Response Transient(mV pK)	$V_{IN} : 16\text{V}\rightarrow 40\text{V}$, $V_{IN} : 40\text{V}\rightarrow 16\text{V}$, $I_o=\text{Full load}$	-	-	-	-		
22	Step Line Response Recovery(μ s)	$V_{IN} : 16\text{V}\rightarrow 40\text{V}$, $V_{IN} : 40\text{V}\rightarrow 16\text{V}$, $I_o=\text{Full load}$	-	-	-	-		
23	Start-up Overshoot(mV pK)	$V_{IN} : 0\rightarrow 28\text{V}$, $I_o=\text{Full load}$	-	150	-	150		
24	Start-up Delay (ms)	$V_{IN} : 0\rightarrow 28\text{V}$, $I_o=\text{Full load}$	-	50	-	20		

5 Circuit block diagram of military DC/DC Converters HOL28S Series

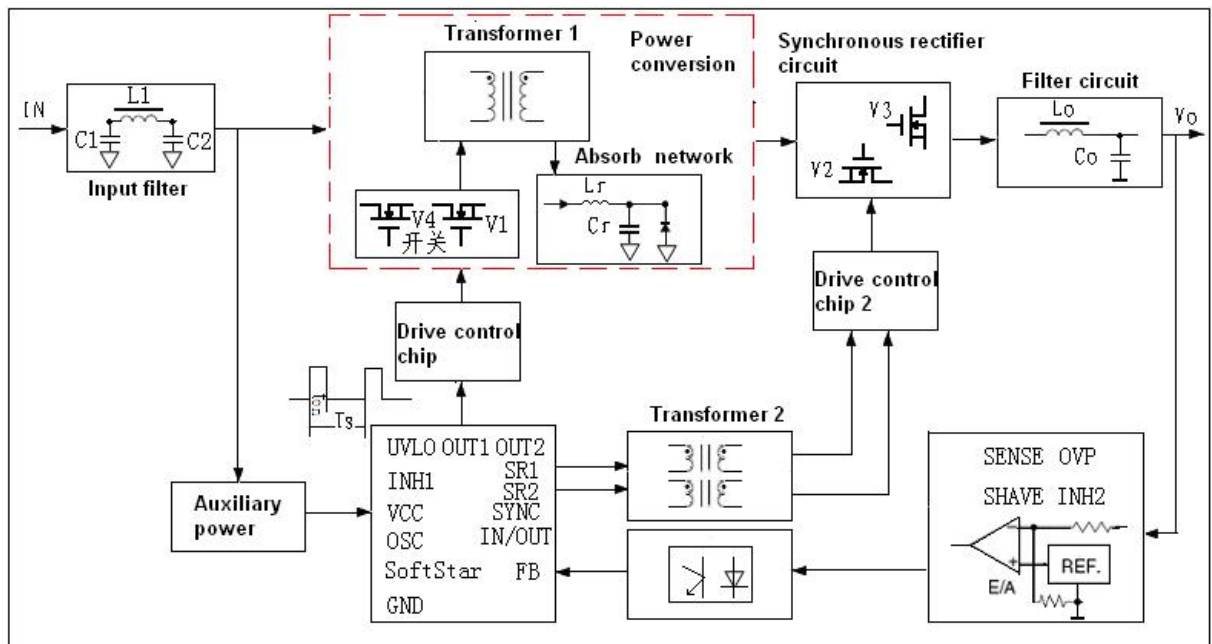


Fig 1 HOL28S Series circuit block diagram

6 Typical Performance Curves of military DC/DC Converters HOL28S Series

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

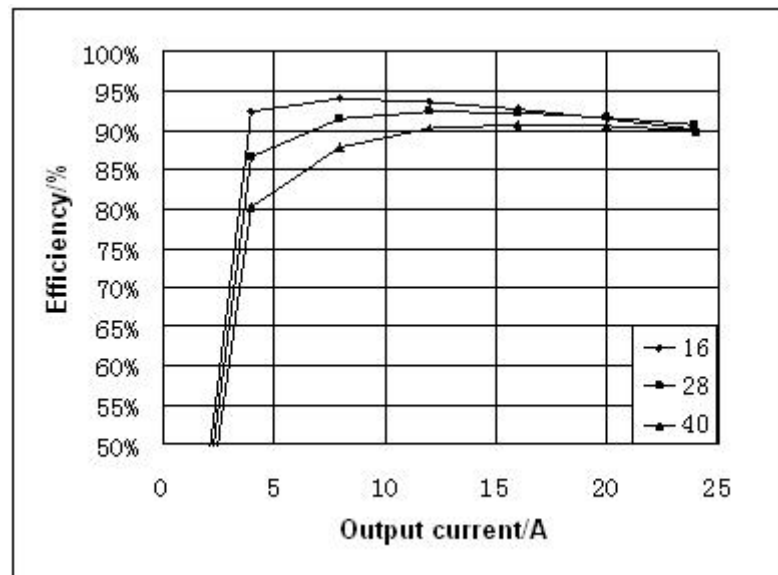


Fig 2 HOL28S5 Efficiency curves



Fig 3 HOL28S5 Input Step Curve

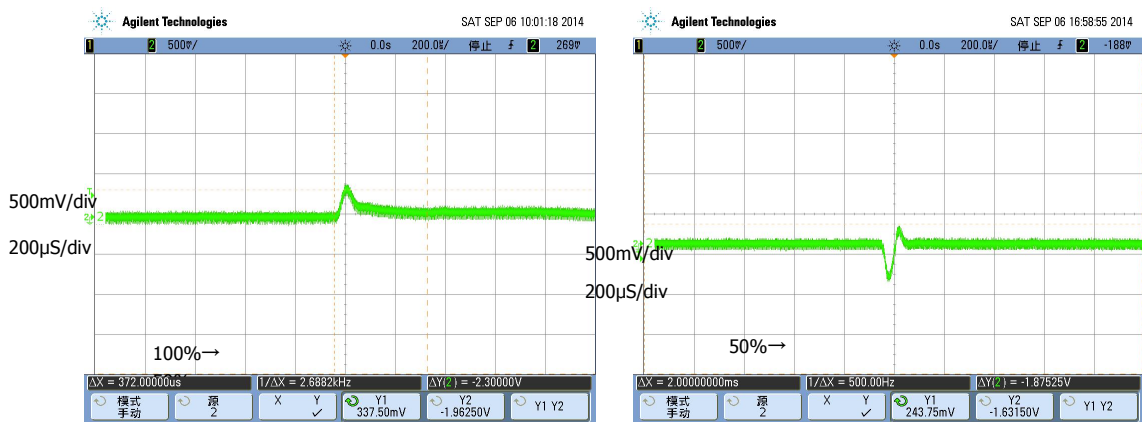


Fig 4 HOL28S5 Step Load Response

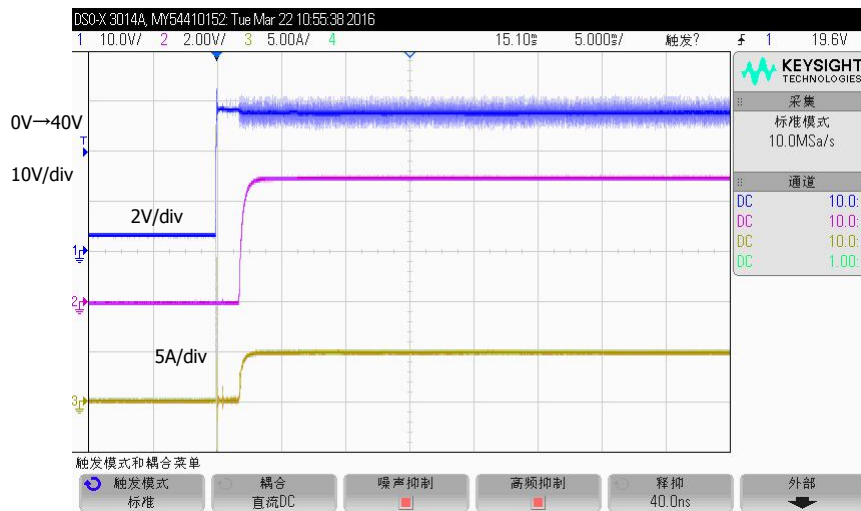


Fig 5 HOL28S5 Start-up Overshoot/Start-up Delay

7 MTBF Curves of military DC/DC Converters HOL28S Series

Temperature Curves

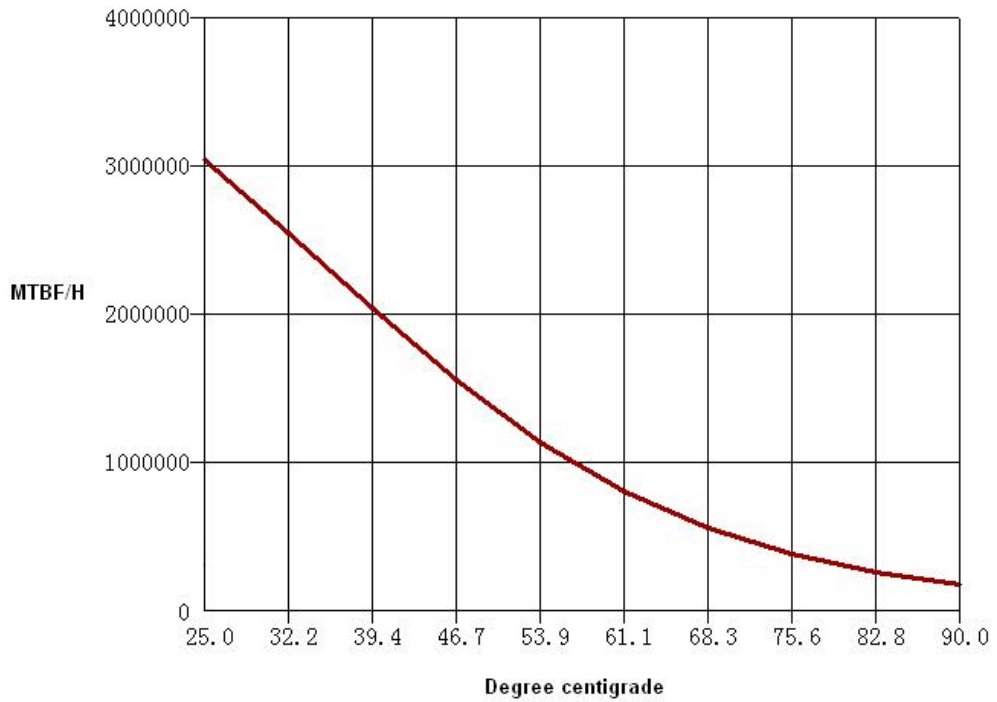


Fig 6 MTBF Temperature Curves (HOL28S5)

(Well ground condition)

8 Pin Designations of military DC/DC Converters HOL28S Series



Figure 7 Pin Out Bottom View

Pin Designation

Pin	Symbol	Designation	Pin	Symbol	Designation
1	⊕	1	14	⊕	14
2		2	13		13
3		3	12		12
4		4	11		11
5		5	10		10
6		6	9		9
7	⊕	7	8	⊕	8

1	V_i	Positive input	8	V_o	Output
2	GND_i	Input ground	9	GND_o	Output ground
3	TRIM	Trimming	10	SEN-	Negative output sensing
4	INH1	Primary Inhibit	11	SEN+	Positive output sensing
5	NC	NC	12	SHARE	Current flow control terminal
6	SYN_i	Synchronous input	13	NC	NC
7	NC	NC	14	NC	NC

Notes : HOL28S5、HOL28S24、HOL28S28 (This three models using this package type)

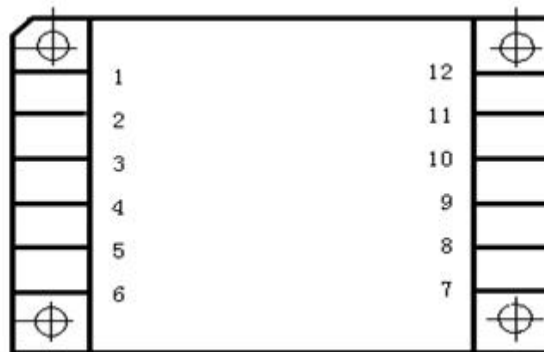


Figure 8 Pin out Bottom View

Pin Designation

Pin	Symbol	Designation	Pin	Symbol	Designation
1	V_i	Positive input	7	V_o	Output
2	GND_i	Input ground	8	GND_o	Output ground
3	TRIM	Trimming	9	SEN-	Negative output sensing
4	INH1	Primary Inhibit	10	SEN+	Positive output sensing
5	NC	NC	11	SHARE	Current flow control terminal
6	SYN_i	Synchronous	12	NC	NC

		input			
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Notes: Subsequent series of products designed in the form of the package

9 Typical Connection Diagram of military DC/DC Converters HOL28S Series

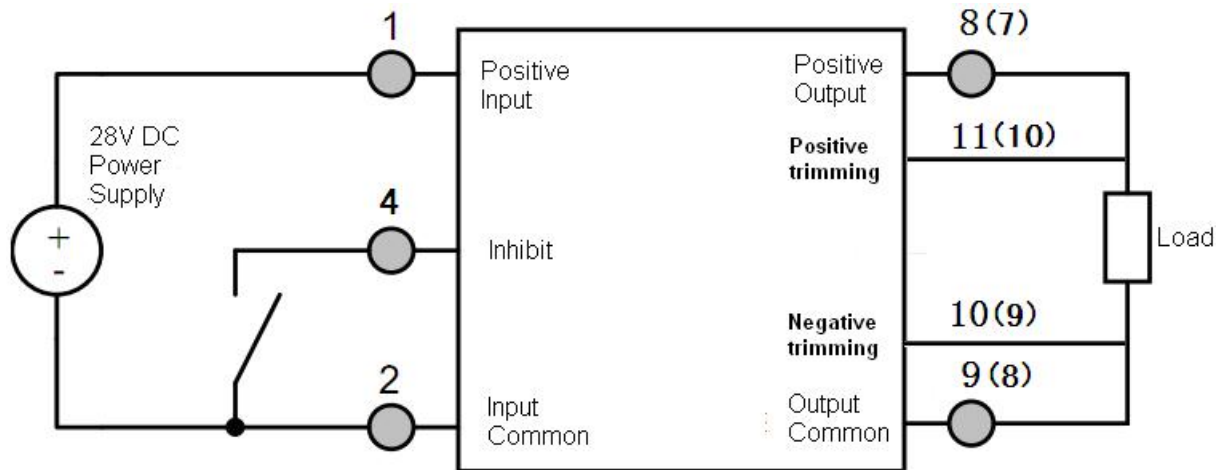


Fig 9 Products Using Connection Diagram

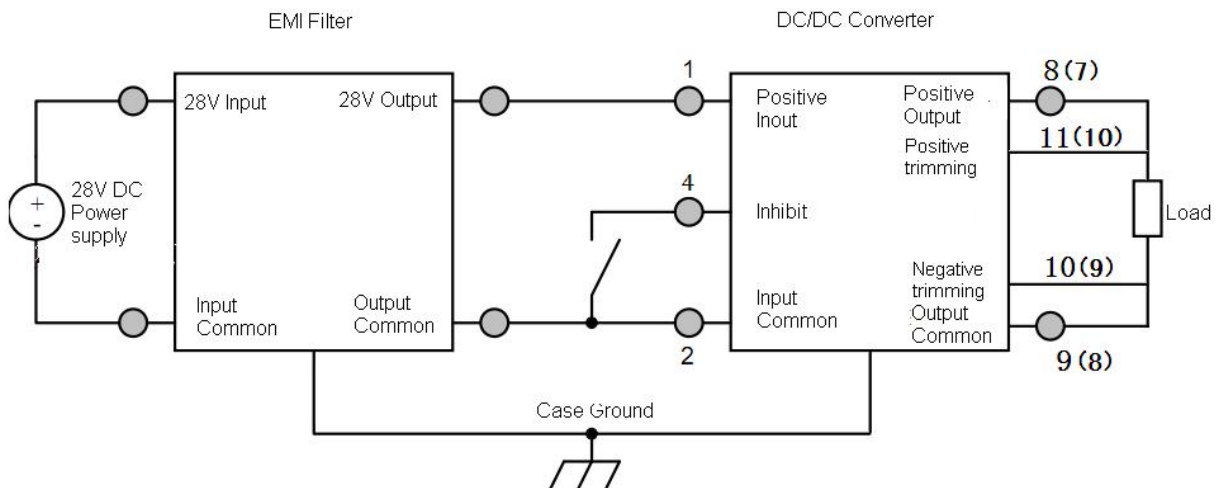


Fig 10 EMI Filter Connection Diagram

10 Package Specifications of military DC/DC Converters HOL28S Series

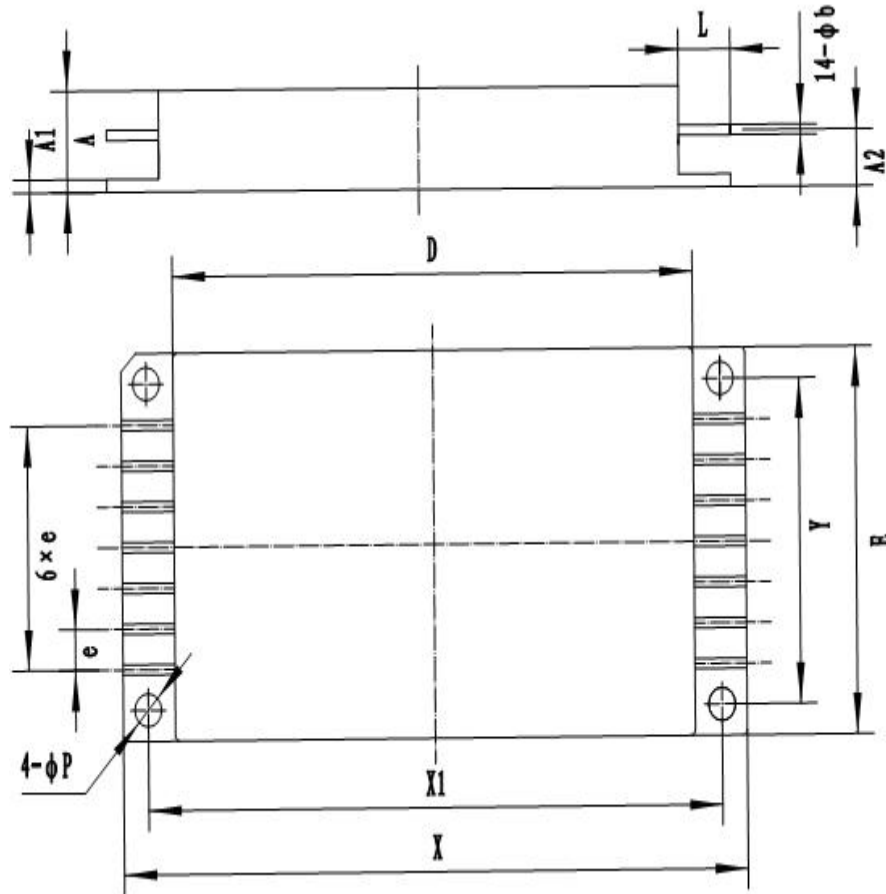


Fig 11 Bottom View

Table 4 Package Outline

Dimension Symbols	Unit/mm		
	Minimum	Nominal	Maximum
A	-	-	10.66
A ₁	0.97	-	1.57
A ₂	5.29	-	5.89
φb	0.87	-	1.13
D	-	-	64.00
E	-	-	38.60
e	3.7	-	4.3
L	5.35	-	-
φP	3.00	-	3.60
Y	31.50	-	32.50
X ₁	69.60	-	70.60
X	-	-	76.70

Notes: e is interchangeable size, made by the shell manufacturing and inspection, this specification does not do the assessment requirements.

Table 5 Case Materials

Case Model	Header	Header Plating	Cover	Cover Plating	Pin	Pin Plating	Sealing Style	Notes
fpp6438-14d	Cold Rolled Steel (10#)	Dau-2/Ni4Au1.0	Kovar (4J42)	Ni	Oxygen-free copper		Parallel seam welding	

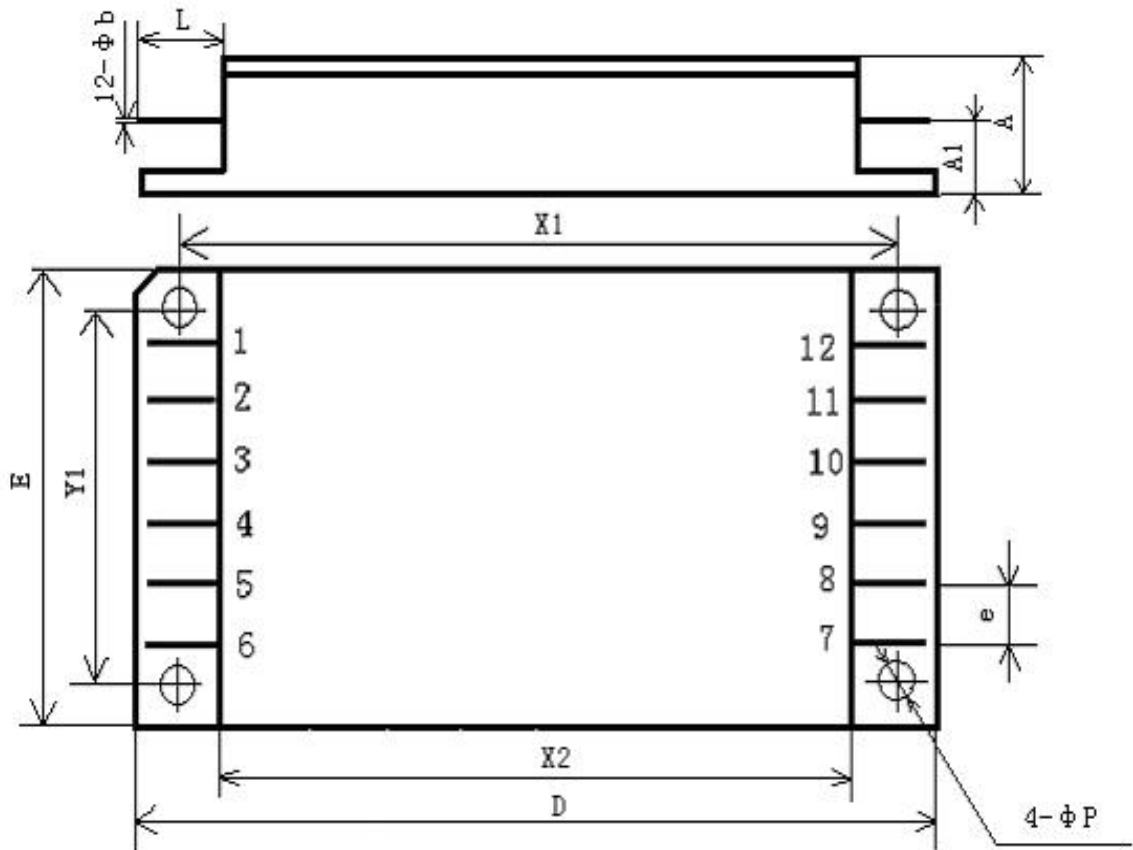


Fig 12 Bottom View

Table 6 Package Outline

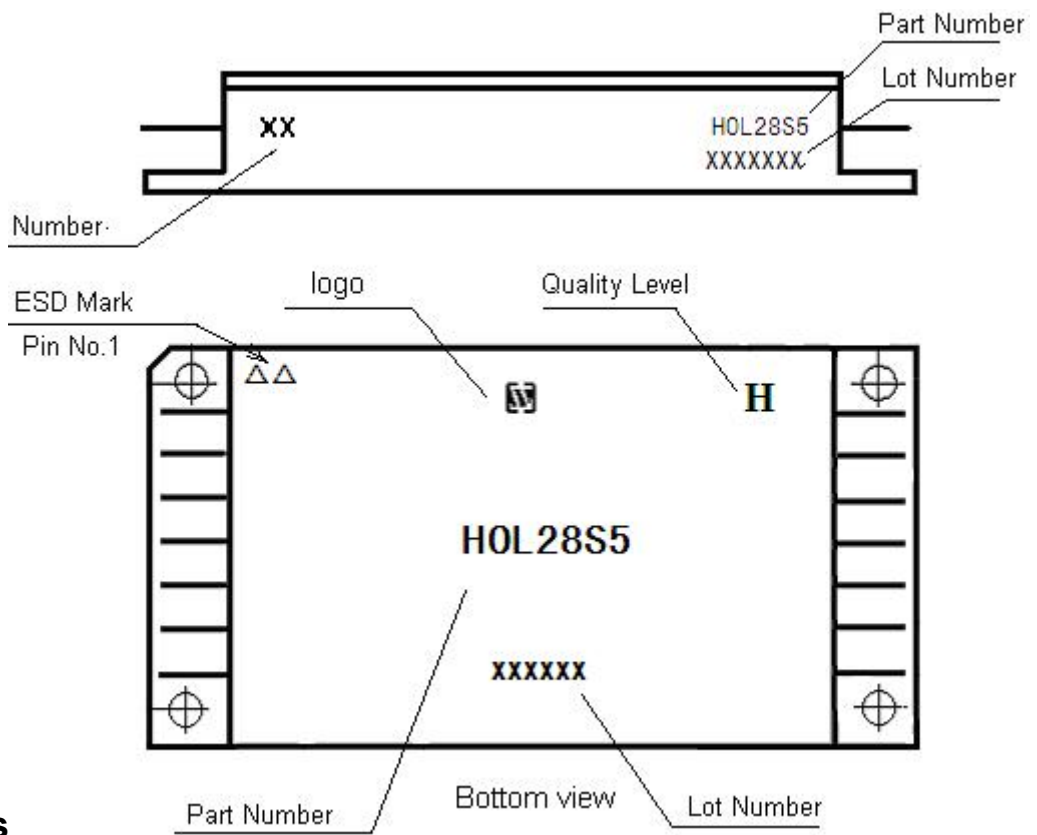
Dimension Symbols	Unit/mm		
	Minimum	Nominal	Maximum
A	-	-	10.66
A ₁	5.29	-	5.89
φ _b	0.87	-	1.13
D	-	-	76.70
E	-	-	38.60
e	-	5.08	-
L	5.35	-	-
φ _P	3.00	-	3.60
X ₁	69.90	70.1	70.3
X ₂	-	-	64.00

Y ₁	31.80	32	32.20
Notes: e is interchangeable size, made by the shell manufacturing and inspection, this specification does not do the assessment requirements.			

Table 7 Package Outline

Case Model	Header	Header Plating	Cover	Cover Plating	Pin	Pin Plating	Sealing Style	Notes
fpp6438-12d	Cold Rolled Steel (10#)	Dau-2/Ni4Au1.0	Kovar 金(4J42)	Ni	Oxygen-free copper		Parallel seam welding	

11 Ordering Information of military DC/DC Converters



HOL28SSeries

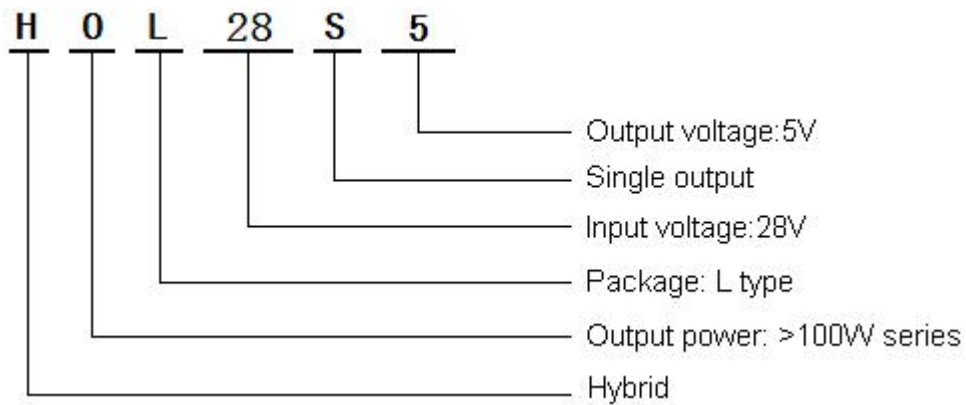


Fig 13 Part Numbering Key

Part Numbering Key

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

