

HNHX0503S High reliability point of load DC to DC converter

1 Features of high reliability point of load DC-DC converter

- High reliability
- Low voltage input: 4.0V~5.5V, Typical 5V
- High conversion efficiency
- Output Power P_O : 10W
- Operating temperature T_c : $-55^{\circ}\text{C} \sim +125^{\circ}\text{C}$
- Low start-up current
- No output overshoot
- Inhibit function
- Output over current and short circuit protection
- Maximum power density: $78\text{W}/\text{in}^3$
- Hermetically sealed metal case



尺寸: $18.00 \times 18.00 \times 6.86\text{mm}^3$

重量: 6.5g

HNHX0503S

2 Scope of application of high reliability point of load DC-DC converter

High-reliability electronic system for ground ,vehicle ,radar , aviation and aerospace, etc

3 Description of high reliability point of load DC-DC converter

HNHX0503S is a high reliable, output voltage adjustable non-isolated High reliability point of load DC to DC converter with BUCK circuit topology and pulse width modulation principle. The output sampling voltage is directly feedbacked to modulate the pulse width to achieve closed-loop control to meet the stability of the voltage output requirements. By changing the external resistance method to achieve the output voltage 0.8V-3.3V adjustable.. The series of products are made by thick-film hybrid integrated production process, metal sealed package. The design and manufacturing process of HNHX0503S Series converters are in compliance with MIL-PRF-38534.

4 Technical Specifications of high reliability point of load D C-DC converter

Table 2 Rated conditions and recommended operating conditions

Absolute Max. Rating	
Input voltage: 4.0V~5.5V Input voltage (Transient, 1s) : 5.8V Output Power: 10 W Storage temperature: -65°C~150°C	Mechanical Shock: 1500g Lead solderalbe temperature: 300°C (10s) Weight: 8 g

Table 3 Electrical characteristics

Items	Sym	Conditions (Unless other wise , $V_i=5V\pm 0.25V, -55^\circ C\leq T_c\leq 125^\circ C$)	A Group	Limited		Unit
				Min	Max	
Output voltage	V_{o1}	$I_o=3A$	1,2,3	0.770	0.830	V
	V_{o2}	$I_o=3A$		2.435	2.565	
	V_{o3}	$V_i=4.0V\sim 5.5V, I_o=3A$		3.215	3.385	
Output current	I_o	$V_{o1}=0.8V, V_i=5.0V$ $V_{o2}=2.5V, V_i=5.0V$ $V_{o3}=3.3V, V_i=4.0V\sim 5.5V$	1,2,3	-	3	A
Output ripple voltage (Peak-peak)	V_R	$V_{o3}=3.3V, I_o=3A, \text{Oscilloscope } BW=20MHz$	1,2,3	-	90	mV
Current regulation	S_i	$V_{o3}=3.3V, I_o=0\rightarrow 3A$	1,2,3	-	40	mV
Input current	I_i	No load, $V_{o3}=3.3V$, Inhibit connect Input Ground	1,2,3	-	3	mA
		No load, $V_{o3}=3.3V$, Inhibit open	1,2,3	-	45	
Efficiency	η	$V_{o3}=3.3V, I_o=3A$	1,2,3	86	-	%
Inhibit voltage	V_{INH}	With inhibit voltage, output voltage is inhibition	1,2,3	0	0.2	V
Insulation resistance	R_i	$T_A=25^\circ C$, impose 500V DC voltage between case and any pin (Expect pin 3)	1	100	-	MΩ
Short circuit power consumption	P_D	Output short	1,2,3	-	4	W
Capacitive load ^{ab}	C_L	$T_A=25^\circ C, V_{o3}=3.3V, I_o=3A$	4	-	5000	μF
switching frequency ^b	f_s	$V_{o3}=3.3V, I_o=3A$	4,5,6	240	350	kHz
Step Load Response Transient (Peak)	V_{LT}	$V_{o3}=3.3V, I_o=1.5A\rightarrow 3A$ 或 $I_o=3A\rightarrow 1.5A$	4,5,6	-	350	mV
Step Load Response Recovery ^{bcd}	t_{LT}	$V_{o3}=3.3V, I_o=1.5A\rightarrow 3A$ 或 $I_o=3A\rightarrow 1.5A$	4,5,6	-	400	μs
Start-up Overshoot (peak)	V_{TO}	Output voltage $V_i: 0\rightarrow 5V, V_{o3}=3.3V, I_o=3A$	4,5,6	-	70	mV
Start-up Delay	t_{TR}	Output voltage $V_i: 0\rightarrow 5V, V_{o3}=3.3V, I_o=3A$	4,5,6	-	10	ms

- a Capacitive load may be any value from 0 to the maximum limit without compromising DC performance
- b This parameter shall be guaranteed by design and tested only when there is qualification test and design or process change.
- c Load step transition time shall be large than $15\mu\text{s}$;
- d Recovery time means that step starts until output voltage comes back to the corresponding $\pm 1\%$;
- e Start up delay time measurement is for a step application of power at the input while power is applied to the input

5 Circuit block diagram of high reliability point of load DC-DC converter

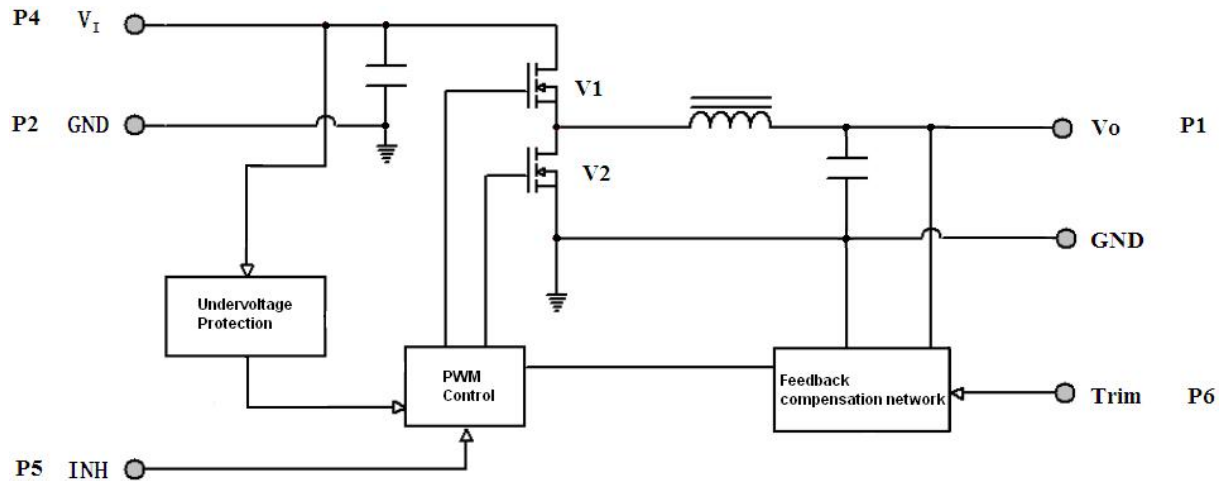


Fig 2 HNHX0503S circuit block diagram

6 Typical Characteristic Curve of high reliability point of load DC-DC converter (Testing condition as per $T_c=25^\circ\text{C}$, $V_{IN}=5V\pm 0.15V$, $V_o=3.3V$, full load. unless otherwise specified)

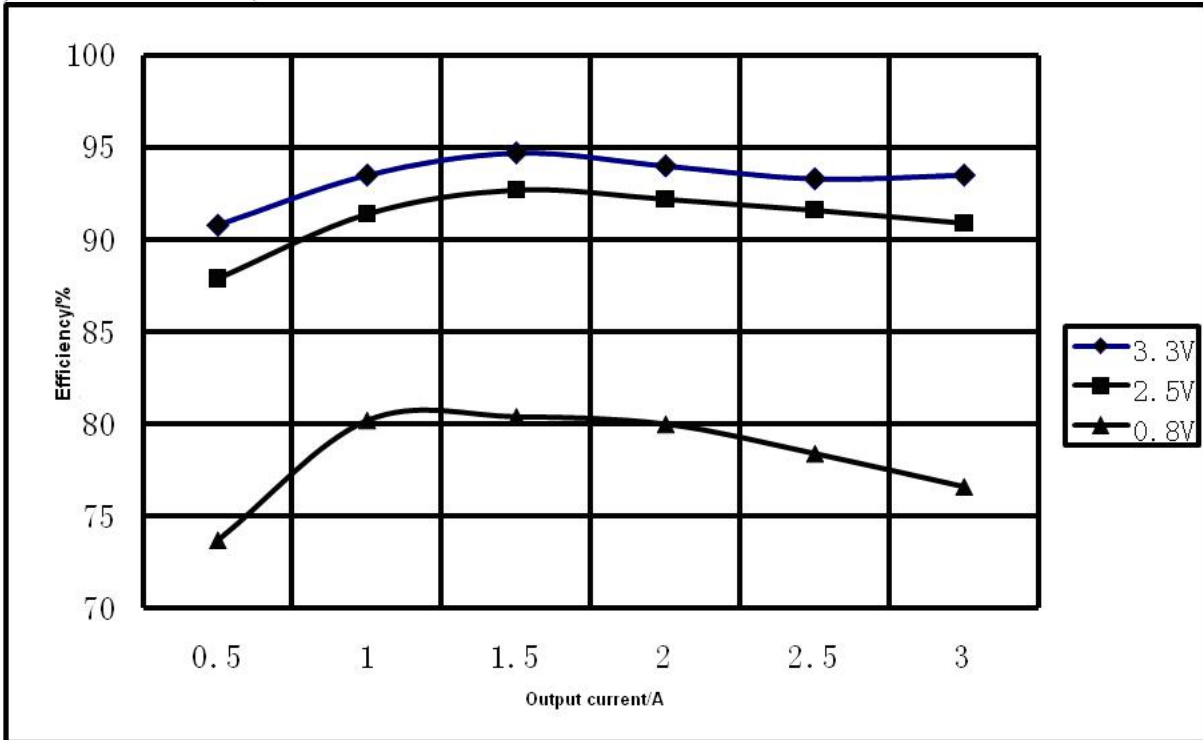


Fig 3 HNHX0503S Efficiency

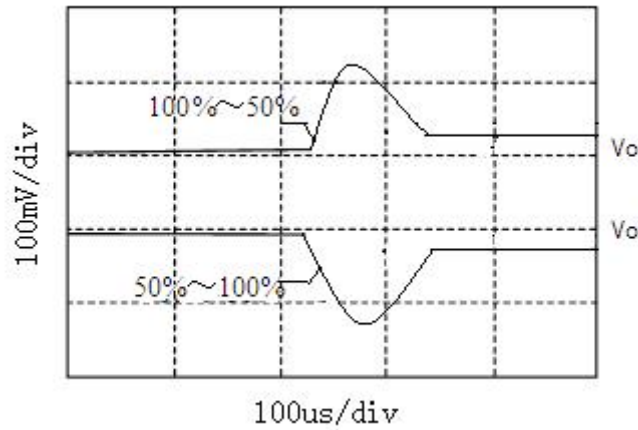
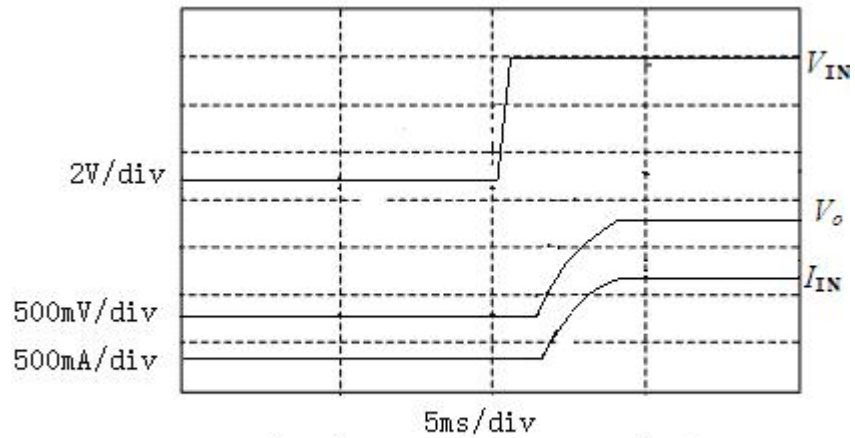


Fig 4 HNHX0503S Load



V_{IN} : Input voltage V_o : Output voltage I_{IN} : Input current

Fig 5 HNHX0503S Overshoot/Start-up Delay

7 MTBF Curve of high reliability point of load DC-DC converter

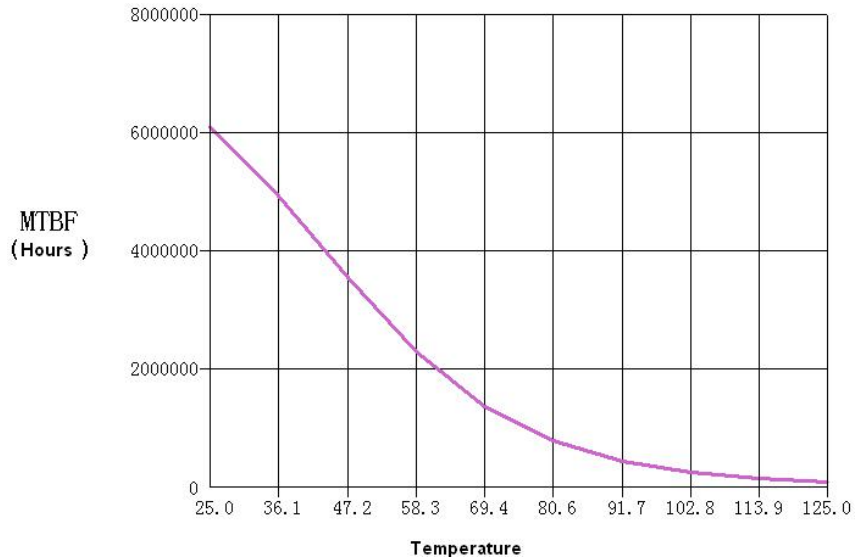


Fig 6 MTBF Temperature Curve (HNHX0503S)

(Ground good condition is expected)

8 Pin Designations of high reliability point of load DC-DC converter

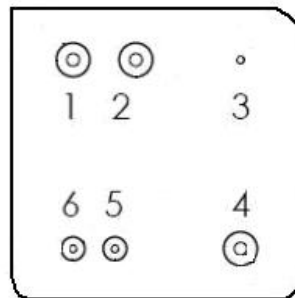
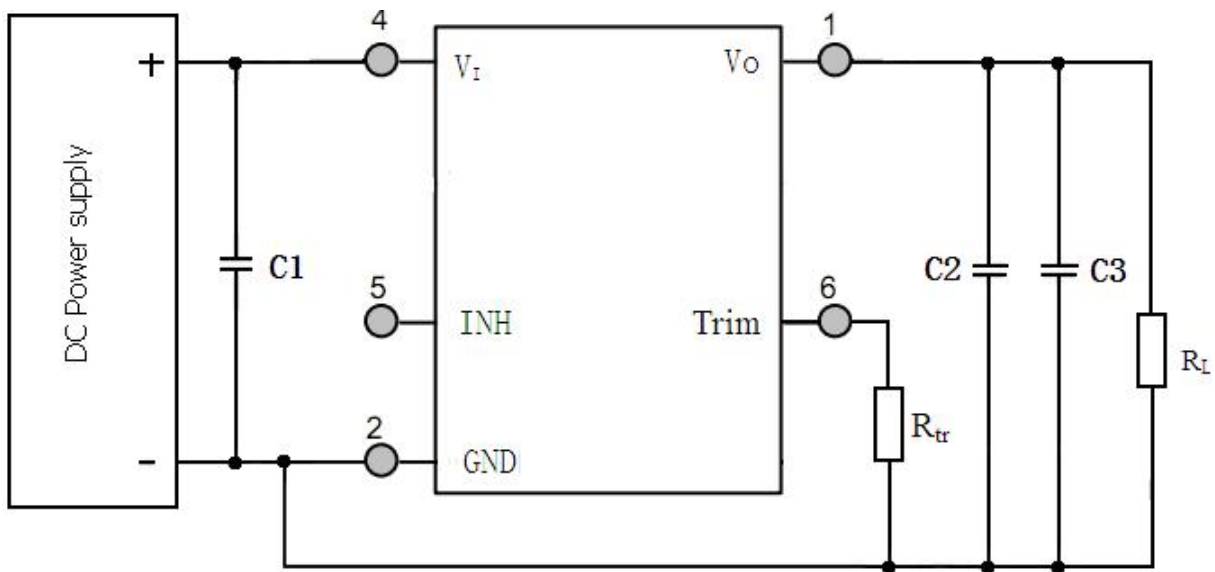


Figure 7 Bottom View

Table 4 Pin Designation

Pin	Symbol	Designation	Pin	Symbol	Designation
1	V _o	Positive output	4	V _i	Positive input
2	GND	Common GND	5	INH	Inhibit
3	GND _C	Case ground	6	Trim	Output Trimming

9 Typical Connection Diagram of high reliability point of load DC-DC converter



$C1=100\mu\text{F}$; $C2=10\mu\text{F}$; $C3=0.1\mu\text{F}$ $C1$ 、 $C2$ 、 $C3$ are chip capacitors

Fig 8 Connection Diagram

In fig 8, By adjusting the external resistor R_{tr} , can achieve different output voltage, R_{tr} and V_o relationship is shown as follow:

$$V_o = \frac{168R_{tr} + 5.267 \times 10^6}{210R_{tr} + 1.071 \times 10^6}$$

$$R_{tr} = \frac{5.267 \times 10^6 - 1.071 \times 10^6 \times V_o}{210 \times V_o - 168}$$

V_o (V)	$R_{tr}(k\Omega)$ Reference
3.3	3.3
2.6	6.55
2.5	7.25
0.8	None

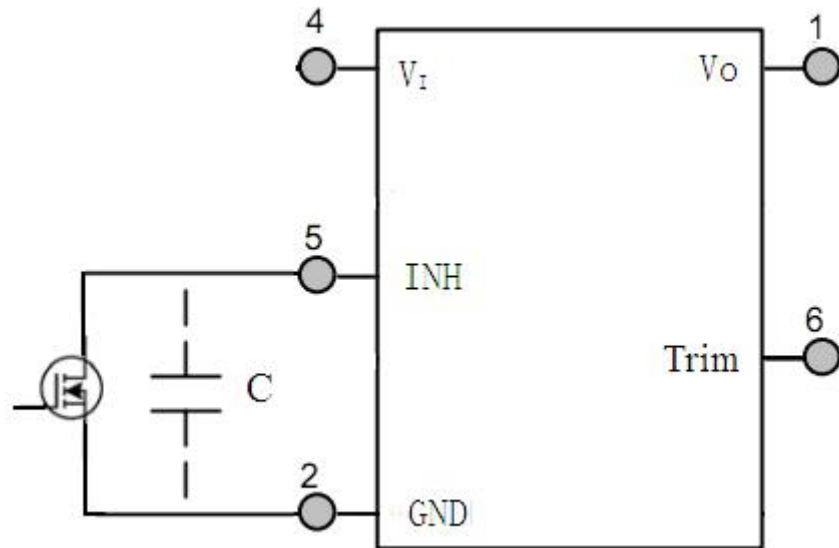


Fig 9 Inhibit Driver Circuit Diagram

The start-up delay (roughly 5ms when $C=0.01\mu\text{F}$) can be elonged by adjusting the external capacitor.

10 Package Specifications of high reliability point of load DC-DC converter

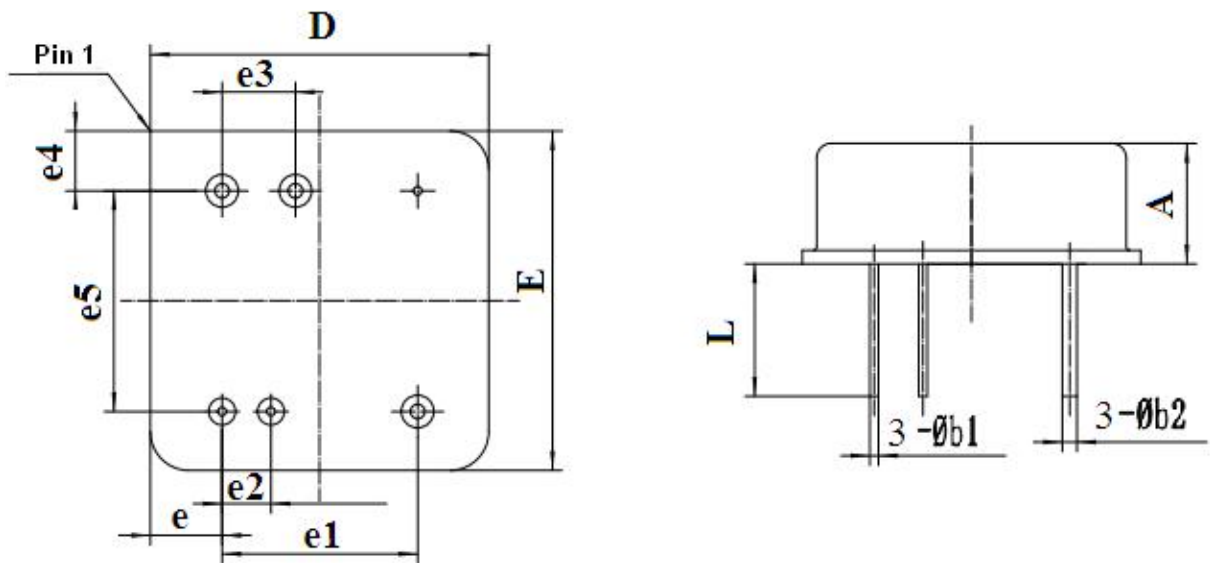


Fig 10 Bottom View and Side View

Table 5 Package Outline

Symbols	Unit/mm		
	Minimum	Nominal	Maximum
A	-	-	7.20
$\phi b1$	0.35	-	0.55
$\phi b2$	0.63	-	0.89

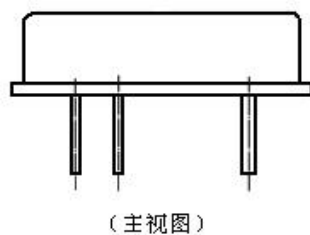
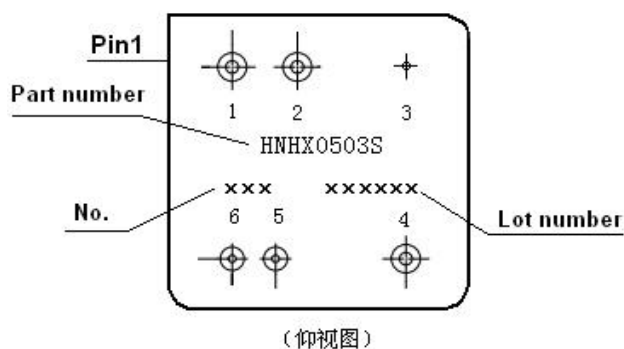
<i>D</i>	-	-	18.08
<i>E</i>	-	-	18.08
<i>e</i>	3.43	3.73	4.03
<i>e1^a</i>	-	10.16	-
<i>e2^a</i>	-	2.54	-
<i>e3^a</i>	-	3.81	-
<i>e4</i>	2.80	3.10	3.40
<i>e5^a</i>	-	11.43	-
<i>L</i>	5.90	-	-

^a *e*、*e1*、*e2* interchangeability dimensions are guaranteed by the manufacture and inspection of the enclosure, this specification is not required as an assessment.

Table 6 Case Materials

Case Model	Header	Header Plating	Cover	Cover Plating	Pin	Pin Plating	Sealing	Notes
PP1818-06	Cold Rolled Steel	Ni	Steel (SPCC-SD)	Ni	Copper -core Compound	Au	Compression	

11 Ordering Information of high reliability point of load DC-DC converter



H N H X 05 03 S

Single output
Output current: 3A
Input voltage:5V
Package type: Non-standard
Output power 15W series (10W)
Non-isolated
Hybrid

Fig 11 Part Numbering Key

Application Notes of high reliability point of load DC-DC converter:

- ☆ 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.