

I. Product features

High reliability

- Low voltage input: 4.5V ~ 5.5V, nominal input DC voltage 5V
- And that conversion efficiency is high
- Output power PO: 9.9 W to 66 W
- Operating temperature range Tc: -55 °C ~ + 125 °C
- The starting current is small
- No output overshoot
- It has the function of prohibition
- Output overcurrent and output short circuit protection
- Maximum power density: 80W/in³
- Metal hermetic package

II. Product category

- BSTPL0503S
- BSTPL0505S
- BSTPL0510S
- BSTPL0520S

III. Scope of application

Ground, vehicle, radar, aviation, aerospace and other highly reliable electronic systems.

IV. Product overview

This product is a non-isolated DC/DC converter with high reliability and adjustable output voltage. The product adopts buck circuit topology and pulse width modulation principle, and the output voltage is directly sampled to feed back the pulse width of the modulation controller, so as to realize closed-loop control and meet the requirements of stable voltage output. The output voltage can be adjusted from 0.8V to 3.3 V by changing the external

resistor. This series of products are manufactured by thick film hybrid integration process and packaged in a fully sealed metal shell. The design and manufacture of the product shall meet the requirements of GJB2438A-2002 General Specification for Hybrid Integrated Circuits and the detailed product specifications.

4.1. Technical performance

ABSOLUTE MAXIMUM RATING	
Input voltage (continuous): 5.5V	Mechanical impact: 1500g
Input voltage (transient, 1s): 6V	Soldering temperature resistance of lead: 300 °C (15 s)
Output power: 9.9 W to 66 W	Weight
Storage temperature: -65 °C ~ 150 °C	6.5g BSTPL0503S
	13.5g BSTPL0505S
	17.5g BSTPL0510S
	17.5g BSTPL0520S

4.2. BSTPL0503S electrical characteristics

			MINIMAL	MAX	
Input voltage	VIN	High, low, normal temperature	4.0	5.5	V
Output voltage	Vo	VI=4.0V~5.5V, IO=3A	0.780	3.383	V
Output current	Io	VI=4.0V 5.5V	-	3	A
Output ripple voltage (Peak-to-peak)	VR	Vo=3.3V, IO=3A, BW=6MHz	-	90	mV
Current adjustment degree	SI	Vo=3.3V, IO=0~3A	-	40	mV
Input current	II	No load, connection of inhibit terminal to input ground terminal	-	3	mA
		No load, no terminal open circuit	-	45	
Efficiency	η	Vo=3.3V, Io=3A	86	-	%
Prohibit voltage	VINH	The output is disabled when the disable voltage is applied	0	0.2	V
Insulation resistance	RI	TA = 25 ° C at any outlet (except pin 3) Apply a DC voltage of 500 V to the enclosure	100	-	MΩ

Short-circuit power consumption	PD	The output is shorted	-	4	W
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Capacitive load	CL	TA=25C, Vo=3.3V, Io=3A	-	5000	μF
Switching frequency	fs	Vo=3.3V, Io=3A	240	350	kHz
Output voltage change (peak) during load transient	VLT	Vo = 3.3 V, IO = 1.5a → 3A or IO = 3A → 1.5a	-	350	mV
Recovery time of output voltage during load transient	tLT	O = 3.3 V, IO = 1.5A → 3A or IO = 3A → 1.5A	-	400	μs
Start overshoot (peak)	VTO	Input voltage VI: 0 → 5V, Vo = 3.3 V, IO = 3A	-	70	mV
Startup delay	tTR	Input voltage VI: 0 → 5V, Vo = 3.3 V, IO = 3A	-	10	ms

4.3. Electrical characteristics of BSTPL0505S

Characteristic	Symbol	Conditions (Unless otherwise specified, VI=5V, -55C<TC<125C)	BSTPL0505S		Unit
			Minimal	Max	
Input voltage	VIN	High, low, normal temperature	3.0	5.5	V
Output voltage	Vo	VI=3V 5.5V, IO=5A	0.8	2.5	V
		VI=4.0V 5.5V, IO=5A	2.6	3.3	V
Output current	Io	VI=3V 5.5V	-	5	A
Output ripple voltage (Peak-to-peak)	VR	TA=25C, Vo=3.3V, IO=5A, BW =10kHz 6MHz	-	35	mV
Current adjustment degree	SI	Vo=3.3V, IO=0~5A	-	40	mV
Efficiency	η	Vo=3.3V, Io=5A	93	-	%
Prohibit voltage	VINH	TA=25C, Vo=3.3V, Io=5A	0	0.8	V
Insulation resistance	RI	TA = 25 ° C at any outlet (except pin 3) Apply a DC voltage of 500 V to the enclosure	100	-	MΩ

Start overshoot (peak)	VTO	Input voltage VI: 0 → 5V, Vo = 3.3 V, no load	-	200	mV
Startup delay	tTR	Input voltage VI: 0 → 5V, Vo = 3.3 V, no load	-	10	ms

4.4. Electrical characteristics of BSTPL0510S

CHARACTERISTIC	SYMBOL	CONDITIONS (UNLESS OTHERWISE SPECIFIED, VI=5V, -55C<TC<125C)	BTPL0510S		UNIT
			MINIMAL	MAX	
Input voltage	VIN	High, low, normal temperature	4.5	5.5	V
Output voltage	Vo	IO=10A	0.770	0.830	V
		IO=10A	2.437	2.563	V
		VI=4.5V 5.5V, IO=10A	3.217	3.383	V
Output current	Io	VI=5.0V,V01=0.8V VI=5.0V,V02=2.5V VI=4.5 5.5V,V03=3.3V	-	10	A

Output ripple voltage (Peak-to-peak)	VR	Vo=3.3V, IO=10A, BW=20MHz	-	80	mV
Current adjustment degree	SI	Vo=3.3V, IO=0~10A	-	60	mV
Input current	II	No load, V03 = 3.3 V, inhibit connected to input ground	-	3	mA
		No load, V03 = 3.3 V, disable open circuit	-	80	
Efficiency	η	Vo=3.3V, Io=10A	91	-	%
Insulation resistance	RI	TA = 25 ° C at any outlet (except pin 3) Apply a DC voltage of 500 V to the enclosure	100	-	MΩ
Short-circuit power consumption	PD	The output is shorted	-	3	W
Capacitive load	CL	TA=25C, Vo=3.3V, Io=10A	-	5000	μF
Switching frequency	fs	Vo=3.3V, Io=10A	240	350	kHz
Output voltage change (peak) during load transient	VLT	Vo = 3.3 V, Io = 5A → 10 A or Io = 10 A → 5 A	-	300	mV

Recovery time of output voltage during load transient	tLT	Vo = 3.3 V, Io = 5A → 10 A or Io = 10 A → 5 A	-	350	μs
Start overshoot (peak)	VTO	Input voltage VI: 0 → 10V, Vo = 3.3 V, no load	-	40	mV
Startup delay	tTR	Input voltage VI: 0 → 10V, Vo = 3.3 V, no load	-	8	ms

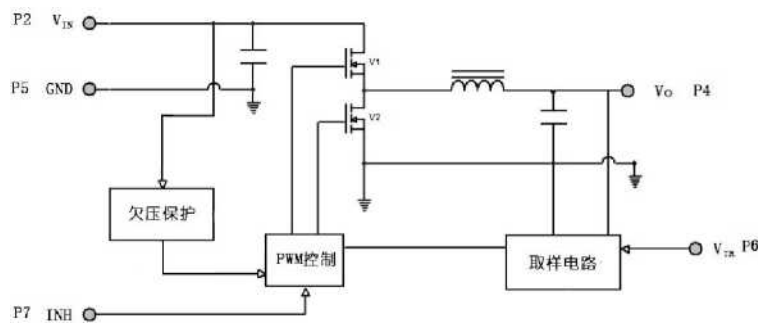
4.5. BSTPL0520S electrical characteristics

Characteristic	Symbol	Conditions (Unless otherwise specified, VI=5V±0.25V, -55C<TC<125C)	BSTPL0520S		Unit
			Minimal	Max	
Input voltage	VIN	High, low, normal temperature	4.5	5.5	V
Output voltage	Vo1	IO=20A	0.770	0.830	
	Vo2	IO=20A	2.437	2.563	
	Vo3	VI=4.5V 5.5V, IO=20A	3.217	3.383	
Output current	Io	Vo1=0.8V, VI=5.0V Vo2=2.5V, VI=5.0V Vo3=3.3V, VI=4.5V 5.5V	-	20	A
Output ripple voltage (Peak-to-peak)	VR	Vo3 = 3.3 V, IO = 20A, oscilloscope BW = 20 MHz	-	150	mV
Current adjustment degree	SI	Vo3=3.3V, IO=0~20A	-	70	mV
Input current	II	No load, Vo3 = 3.3 V, disable connected to input ground	-	3	mA
		No load, Vo3 = 3.3 V, disable open circuit	-	160	
Efficiency	η	Vo3=3.3V, Io=20A	88	-	%

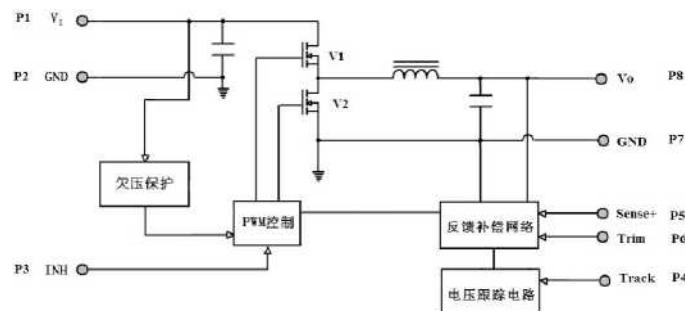
Insulation resistance	RI	TA =25 °C, at any terminal (except pin 9) Apply a DC voltage of 500 V to the enclosure	100	-	MΩ
Short-circuit power consumption	PD	The output is shorted	-	5	W
Capacitive load	CL	TA=25C, Vo3=3.3V, Io=20A	-	5000	μF

Switching frequency	fs	Vo3=3.3V, Io=20A	240	350	kHz
Output voltage change (peak) during load transient	VLT	Vo3 = 3.3 V, IO = 10 A → 20 A or IO = 20 A → 10 A	-	300	mV
Recovery time of output voltage during load transient BCD	tLT	Vo3 = 3.3 V, IO = 10 A → 20 A or IO = 20 A → 10 A	-	350	μs
Start overshoot (peak)	VTO	Input voltage VI: 0 → 5V, Vo3 = 3.3 V, IO = 20 A	-	40	mV
Startup delay	tTR	Input voltage VI: 0 → 5V, Vo3 = 3.3 V, IO = 20 A	-	8	ms

V. Block diagram of circuit principle



BSTPL0505S circuit block diagram



BSTPL0510S circuit block diagram

VI. Typical characteristic curves

(the following curves are measured at $T_c = 25^\circ\text{C}$, $V_{IN} = 5\text{V} \pm 0.15\text{V}$, $V_O = 3.3\text{V}$ full load, unless otherwise specified)

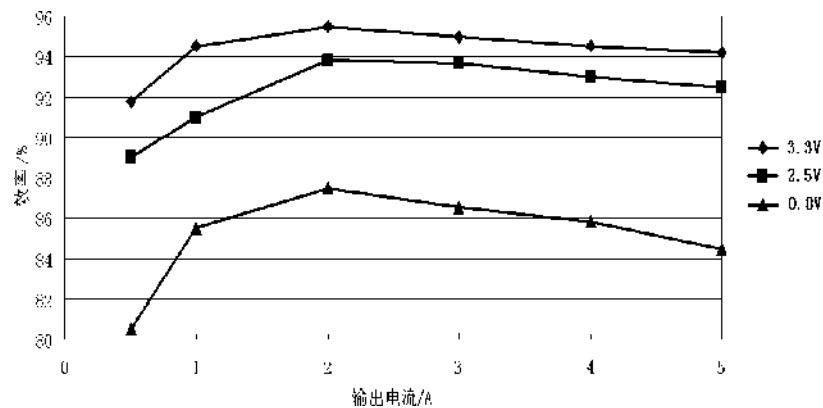


Figure 2. Efficiency Curve of BSTPL0505S

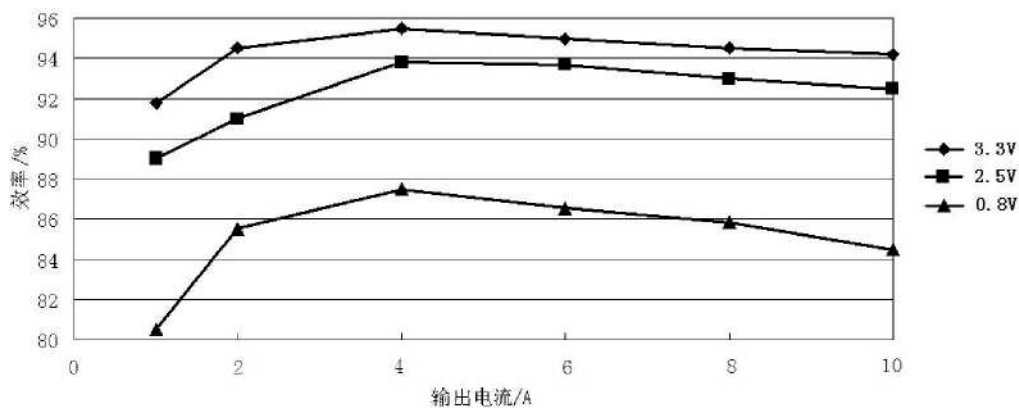


Figure 3. Efficiency curve of BSTPL0510S

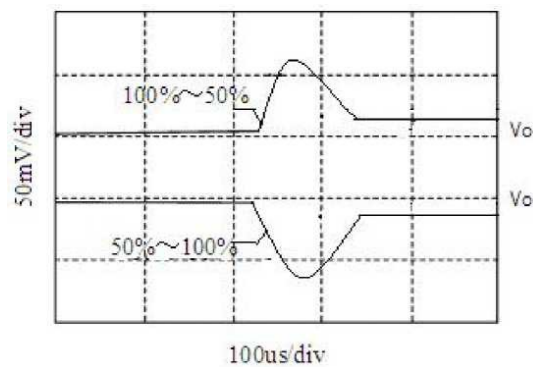


Fig. 3. Load step curve of BSTPL0505S

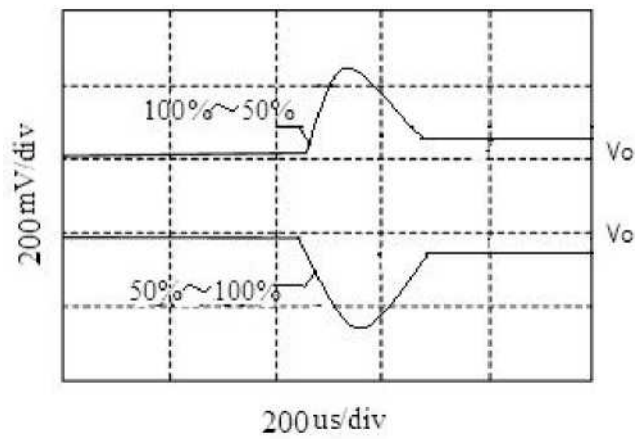


Figure 4. BSTPL0510S Load Step Curve

$I^{\wedge}$:st A4E Ko : &tH £JGE A: : & A 41

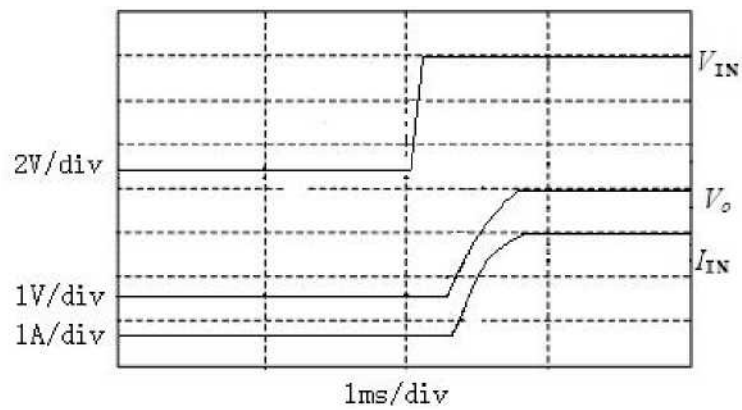


Figure 4. BSTPL0505S Startup Overshoot/Delay and Startup Current

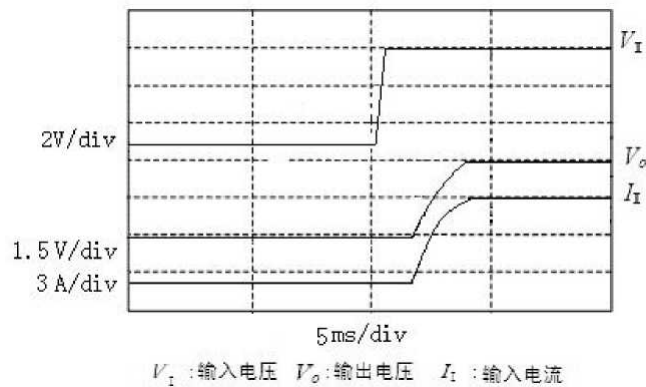


Figure 5. BSTPL0510S Startup Overshoot/Delay and Startup Current

VII. MTBF curve

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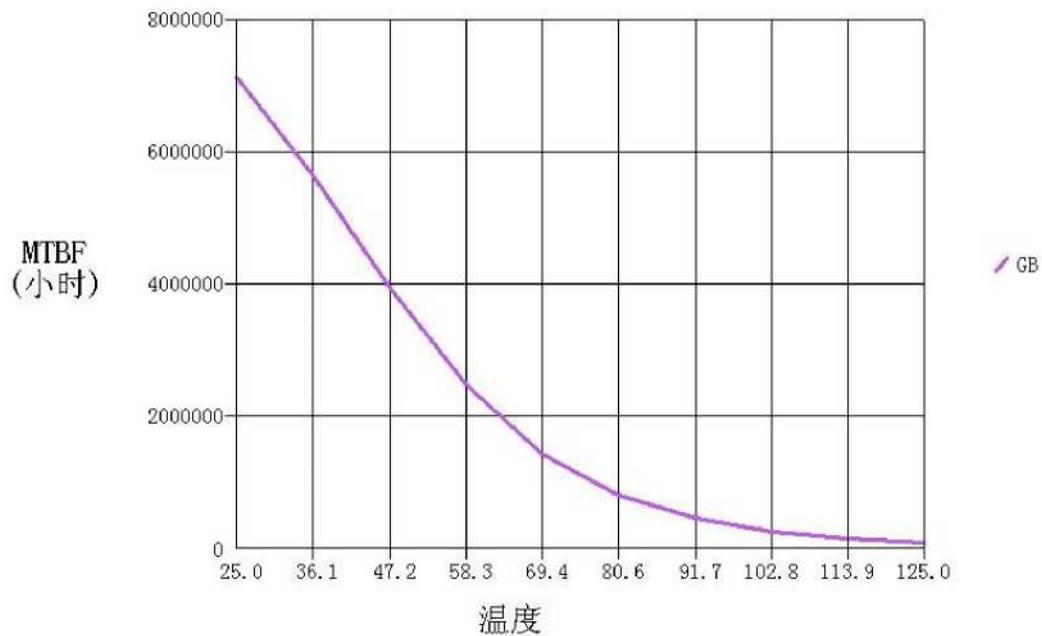


Figure 5. MTBF Temperature Curve (BSTPL0505S)

(According to GJB/Z 299C-2006, the ground is expected to be in good condition)

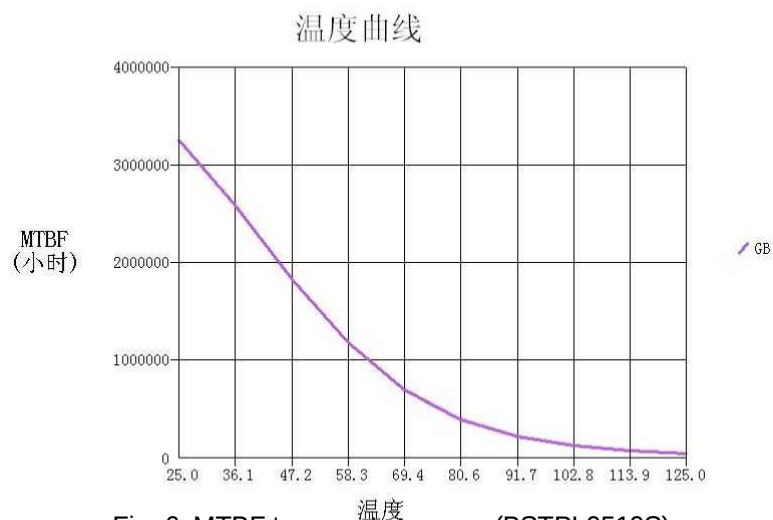
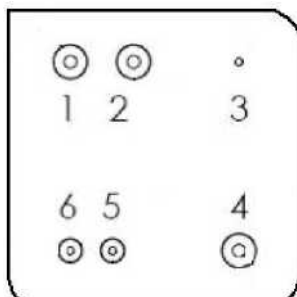


Fig. 6. MTBF temperature curve (BSTPL0510S)

(According to GJB/Z 299C-2006, the ground is expected to be in good condition)

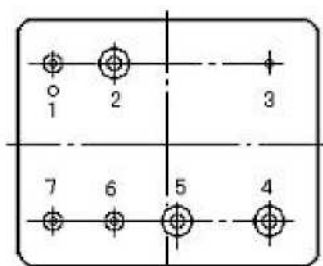
7.1. Functional description of the lead-out terminal



BSTPL0503S Enclosure Bottom View

7.2. BSTPL0503S pin function description

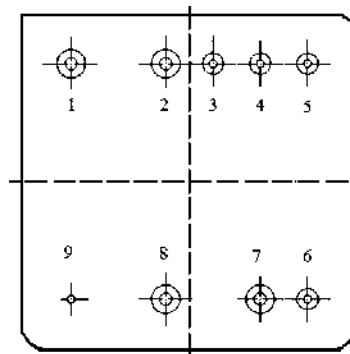
PIN-OUT SERIAL	SYMBOL	FUNCTION
1	V_o	Output positive terminal
2	GND	Input/output common ground
3	GNDc	Shell ground
4	V_i	Enter the positive terminal
5	INH	Forbidden end
6	Trim	Output adjustment terminal



Bottom view of BSTP00505S housing

7.3. BSTPL0505S pin function description

PIN-OUT SERIAL NUMBER	SYMBOL	FUNCTION
1	Track	Output tracking
	VIN	Input end
3	GNDC	Shell ground
4	VO	Output terminal
5	GND	Common ground
6	VTR	Output adjustment terminal
7	INH	Forbidden end



Bottom view of BSTPL0510S housing

7.3. BSTPL0510S pin function description

Pin-out serial number	Symbol	Function	Pin-out serial number	Symbol	Function
1	VI	Enter the positive terminal	6	Trim	Output adjustment terminal
2	GND	Input/output common ground	7	GND	Input/output common ground
3	INH	Forbidden end	8	Vo	Output positive terminal
4	Track	Tracking	9	GNDc	Shell ground
5	Sense+	Output positive sensing terminal			

8. Typical application connection

POL series power supply can realize different output voltages by adjusting the external resistor R_{tr} . The corresponding relationship between R_{tr} and V_O is as follows:

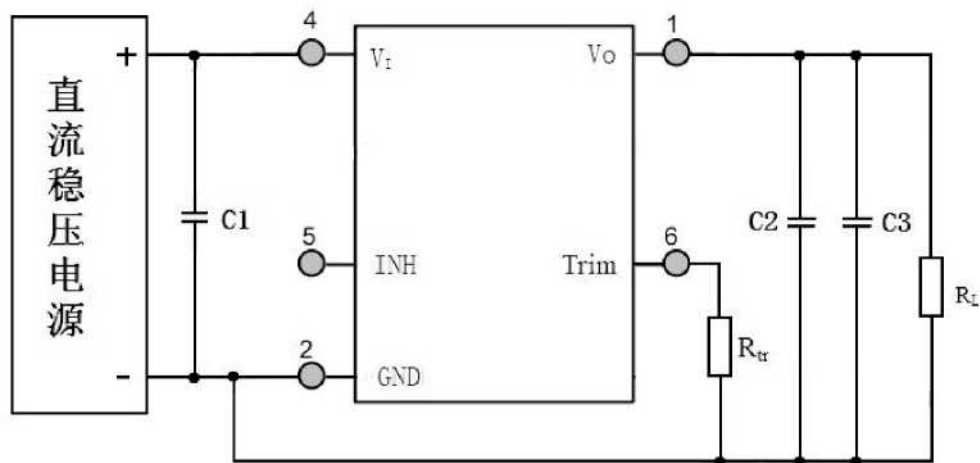
$$168 R_{tr} + 5.267 \times 10^6$$

$$210 R_{tr} + 1.071 \times 10^6$$

$$5.267 \times 10^6 - 1.071 \times 10^6 \times V_O$$

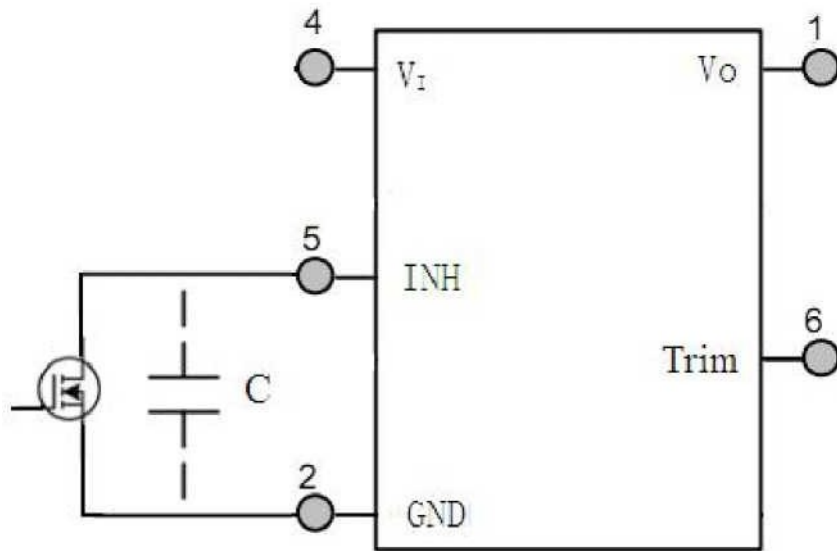
$$210 \times V_O - 168$$

V_O (V)	R_{tr} (k Ω) reference value
3.3	3.3
2.6	6.55
2.5	7.25
0.8	No answer



$C1 = 100 \mu F$; $C2 = 10 \mu F$; $C3 = 0.1 \mu F$ $C1, C2, C3$ are chip capacitors

BSTPL0503S Product connection diagram

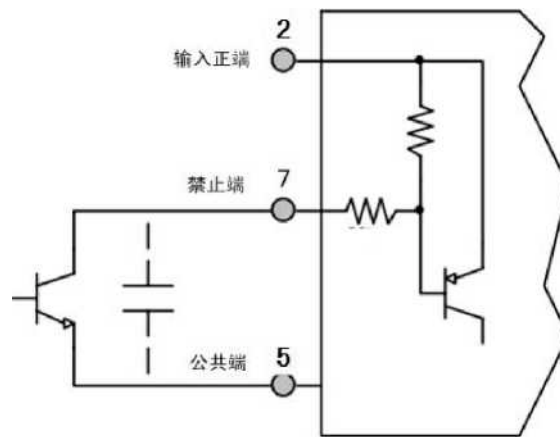


BSTPL0503S Disable Drive Circuit

The start-up delay time of the circuit can be prolonged by adjusting the external capacitor (C = 0.01 μ F, delay time extended by about 5 ms, depending on output)

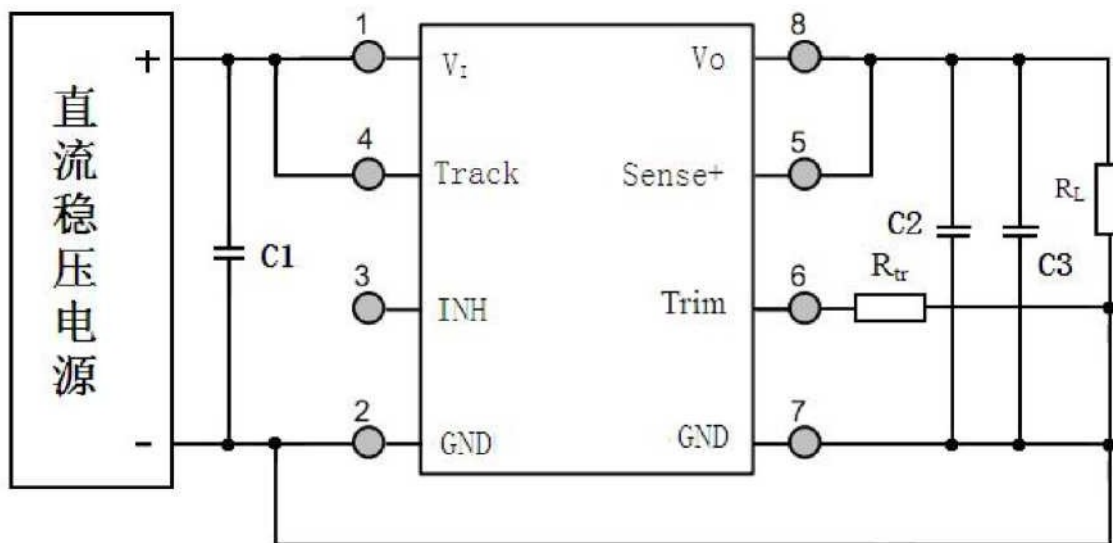


Connection diagram of BSTPL0505S product



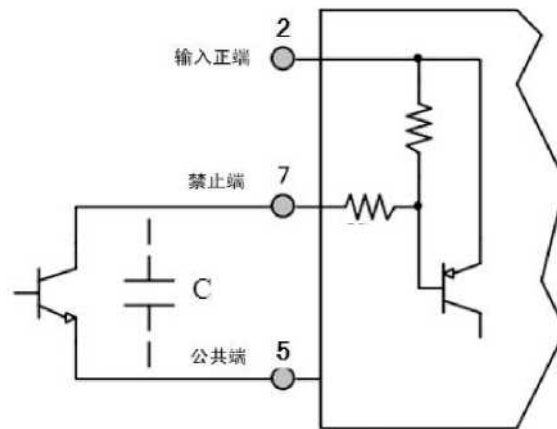
BSTPL0505S Disable Drive Circuit

The start-up delay time of the circuit can be prolonged by adjusting the external capacitor (C = 0.1 μ F, delay time extended by ~ 3ms depending on output)



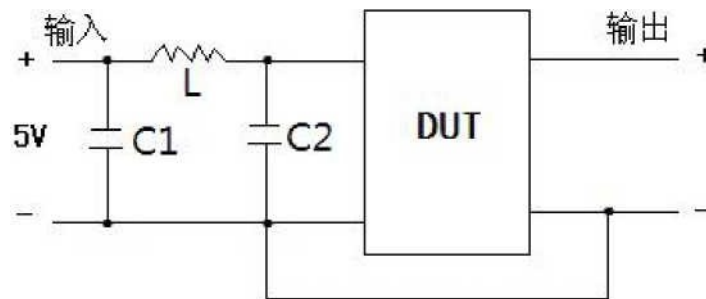
C1 = 100 μ F; C2 = 10 μ F; C3 = 0.1 μ F C1, C2, C3 are chip capacitors

Connection diagram of BSTPL0510S and BSTPL0520S products



BSTPL0510S, BSTPL0520S disable drive circuit

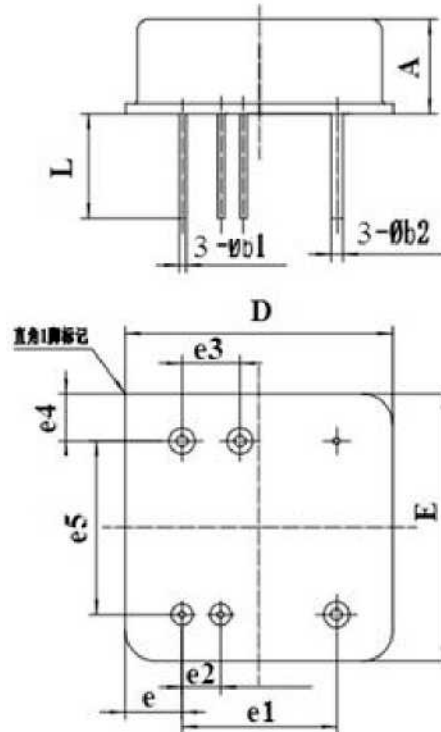
The start-up delay time of the circuit can be prolonged by adjusting the external capacitor (C = 0.01 μ F, delay time is extended by about 10 ms, depending on the output)



Recommended connection of POL power input terminal

The parameters of the inductance and the capacitance are adjusted to reduce the input ripple voltage, (L = 4.7 μ H, C1 = 100 μ F, C2 = 47 μ F, input ripple voltage is 100mV, depending on output)

8.1. Dimensions and description of package outline drawings



9. BSTPL0503S Bottom and Side View

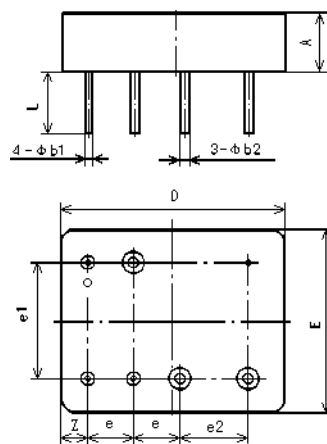
BSTPL0503S Package Size Parameter Table

	VALUE (MM)		
	MINIMAL	NOMINAL	MAX
A	-	-	7.20
$\phi b1$	0.35	-	0.55
$\phi b2$	0.63	-	0.89
D	-	-	18.08
E	-	-	18.08
e	3.43	3.73	4.03
e1 a	-	10.16	-
e2 a	-	2.54	-

e3 a	-	3.81	-
e4	2.80	3.10	3.40
e5 a	-	11.43	-
L	5.90	-	-

9.1. Description of the package housing

Enclosure Model	Base Material	Base Plating	Cover plate (Cap) material	Cover plate Coating	Lead wire Material	Lead wire Plating	Sealing Way	Remark
			(cap)					
PP1818-06	High quality carbon Plain structural steel	Ni	Steel (SPCC-SD)	Ni	Copper core Compound	Au	Energy storage welding	



BSTPL0505 S bottom and side view

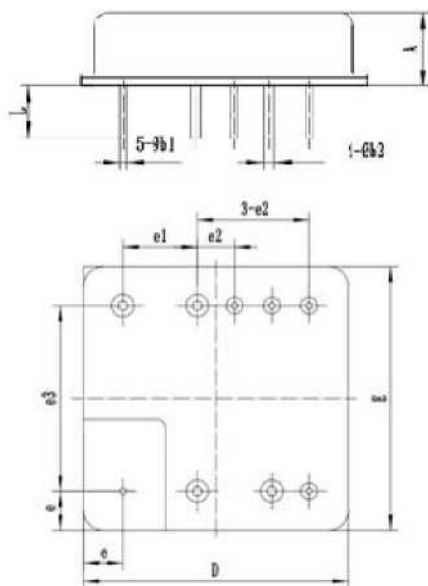
BSTPL0505S Package Size Parameter Table

Symbol	Value (mm)		
	Minimal	Nominal	Max
A	-	-	7.36
Φb1	0.32	-	0.58
Φb2	0.87	-	1.13
D	-	-	25.14
E	-	-	20.66
ea	-	5.08	-
e1 a	-	12.70	-
e2 a	-	7.62	-
Z	2.62	-	3.22
L	5.40	-	-

a e, e1, e2 interchangeability dimensions are guaranteed by the shell manufacturing and inspection, and no assessment requirements are made in this document.

9.2. Description of BSTPL0505S package housing

Enclosure Model	Base Material	Base Plating	Cover plate (Cap) material	Cover plate Coating (cap)	Lead wire Material	Lead wire Plating	Sealing Way	Remark
UPP2520-07	Cold rolled steel (10#)	Ni	Iron-nickel alloy Gold (4J42)	Ni	Copper core Compound	Au	Parallel Seam welding	



BSTPL0510S bottom and side view

BSTPL0510S Package Size Parameter Table

,8	VALUE (MM)		
	MINIMAL	NOMINAL	MAX
A	-	-	7.20
Φb1	0.51	-	0.77
Φb2	0.87	-	1.13
D	-	-	27.57
E	-	-	27.57
ea	3.71	4.01	4.31
e1 a	7.32	7.62	7.92
e2 a	3.51	3.81	4.11
e3 a	18.55	19.05	19.55
L	4.05	-	-
a e, e1, e2, e3 Interchangeability dimensions are guaranteed by shell manufacturing and inspection, and no assessment requirements are made in this document.			

9.3. Description of BSTPL0510S package housing

ENCLOSUREMODEL	BASE MATERIAL	BASE PLATING	COVER PLATE (CAP) MATERIAL	COVER PLATE COATING (CAP)	LEAD WIRE MATERIAL	LEAD WIRE PLATING	SEALING WAY	REMARK
PP2727-09B	High quality carbon Plain structural steel	Au	Steel (SPCC-SD)	Ni	Copper core Compound	Au	Energy storage welding	