BSTFL28S12F
DC/DC Converter Detailed Specification

I. Product Overview

This specification specifies the detailed requirements for the hybrid integrated circuit BSTFL28S12F DC/DC converter (hereinafter referred to as the circuit).

II. References

The relevant clauses in the following documents become clauses of this specification through reference. For referenced documents with a date or edition, any subsequent amendments (excluding errata) or revisions are not applicable to this specification. However, parties using this specification are encouraged to explore the possibility of using the latest version. For referenced documents without a date or edition, the latest version applies to this specification.

- GB/T 1804-2000 General tolerances for linear and angular dimensions without tolerance indication
- GB/T 15138-1994 Dimensions of film integrated circuits and hybrid integrated circuits
- GJB 360B-2009 Test methods for electronic and electrical components
- GJB 548B-2005 Microelectronic device test methods and procedures
- GJB 2438B-2017 General Specifications for Hybrid Integrated Circuits

III. Requirements

3.1. General

The circuit shall comply with all requirements specified in this specification and GJB 2438B-2017. When the requirements of this specification are inconsistent with the general specifications, this specification shall prevail.

3.2. Design, structure and dimensions

3.2.1 Process structure

This circuit adopts thick film hybrid integrated circuit technology, fully sealed metal shell packaging, 4J50 copper core composite lead as rigid lead, all leads of the shell are gold-plated.

3.2.2 Absolute Maximum Ratings

- Input voltage range (V_I) 16V～42V
- Lead soldering temperature (T_h) 300℃ (10s)
- Storage temperature range (T_{stg}) -65℃～150℃

3.2.3. Recommended operating conditions

- Input voltage range (V_I) 16V ~ 40V
- Operating temperature range (T_C) -55℃～125℃

3.2.4 Dimensions

The overall dimensions shall comply with GB/T 15138 and Figure 1.

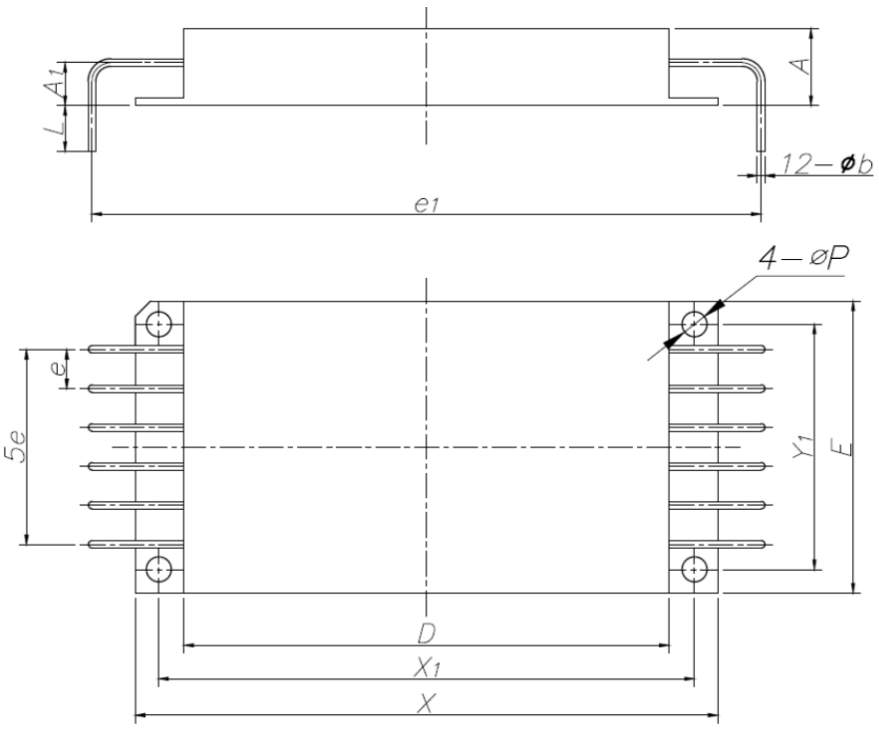


Figure 1. Dimensions

Unit is millimeter

Table 1

DIMENSION SYMBOLS	NUMERICAL		
	MINIMUM	NOMINAL	MAXIMUM
A	-	-	10.40
A_1	5.29	-	5.89
фb	0.90	-	1.10
ΦP	-	3.30	-

DIMENSION SYMBOLS	NUMERICAL		
	MINIMUM	NOMINAL	MAXIMUM
D	-	-	63.70
E	-	-	38.30
e	-	5.08	-
e_1	-	87.60	-
L	5.50	-	6.50
X	-	-	76.40
X_1	-	70.10	-
Y_1	-	32.00	-

Notes: 1. Tolerances not specified are based on Class M in GB/T 1804-2000.
2. Interchangeability of dimensions e and e1 is guaranteed by the housing manufacturer and is not a requirement for assessment.

3.2.5 Terminal Arrangement

The terminal arrangement should be as shown in Figure 2.

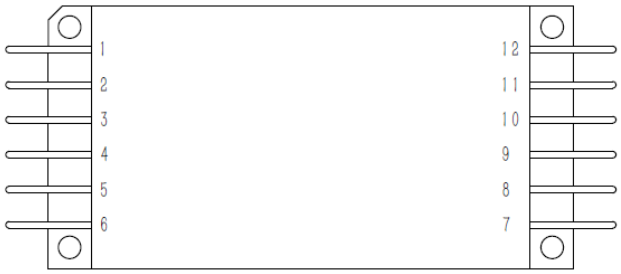


Figure 2. Terminal arrangement (top view)

Table 2

PIN NUMBER	SYMBOL	FUNCTION	PIN NUMBER	SYMBOL	FUNCTION
1	V_I	Positive input	7	V_O	Output terminal
2	GND_I	Input ground	8	GND_O	Output ground
3	TRIM	Output voltage adjustment	9	SEN-	Negative sensing terminal
4	INH_1	Prohibited terminal 1	10	SEN+	Positive sensing terminal
5	SYNC OUT	Sync output	11	SHARE	Current sharing terminal
6	SYNC IN	Sync input	12	INH_2	Prohibited terminal 2

3.3. Electrical characteristics

The electrical characteristics shall be as specified in Table 3.

Table 3. Electrical characteristics

CHARACTERISTIC	SYMBOL	CONDITION (UNLESS OTHERWISE SPECIFIED, -55℃≤ T_C ≤125℃, V_I =28V±0.5V, THE INHIBIT TERMINAL, YNCHRONIZATION INPUT TERMINAL, SYNCHRONIZATION OUTPUT TERMINAL, OUTPUT VOLTAGE ADJUSTMENT TERMINAL, AND CURRENT SHARING TERMINAL ARE LEFT FLOATING, THE POSITIVE SENSING TERMINAL IS CONNECTED TO THE OUTPUT TERMINAL, AND THE NEGATIVE SENSING TERMINAL IS CONNECTED TO THE OUTPUT GROUND)	GROUP A	LIMIT VALUE		UNIT
				MINIMUM	MAXIMUM	
Output voltage	V_O	V_I=16V～40V, I_O=9.2A	1,2,3	11.88	12.12	V
Output current	I_O	V_I=16V～40V	1,2,3	-	9.2	A
Output ripple voltage (peak-to-peak)	V_{RIP}	BW=20Hz→10MHz, I_O=9.2A	1,2,3	-	120	mV
Voltage regulation	S_V	V_I=16V～40V, I_O=9.2A	1,2,3	-	60	mV
Load regulation	S_I	I_O=0A→9.2A	1,2,3	-	120	mV
Output voltage adjustment range a	V_{TRIM}	I_O≤9.2A, P_O≤110W	1,2,3	9.6	13.2	V
Input current	I_I	Prohibit terminal 1 from connecting to input ground	1,2,3	-	6	mA
		Prohibit terminal 2 from connecting to output ground		-	120	
		No load, terminals 1 and 2 are prohibited from being open		-	160	
Input ripple current (peak-to-peak)	I_{RIP}	BW=20Hz→10MHz, I_O =9.2A, Add 10μH inductor and 220μF capacitor to input	1,2,3	-	200	mA
Start threshold	V_{ION}	Full load, input voltage from 0V→28V	1,2,3	14.5	16.0	V
Shutdown threshold a	V_{IOFF}	Full load, input voltage from 28V→0V	1,2,3	14.0	15.5	V
efficiency	η	I_O =9.2A	1,2,3	80	-	%
Insulation resistance	R_I	Apply 500V_{DC} between the input and output, or between any terminal and the housing, at T_A = 25°C.	1	100	-	MΩ
Short-circuit power consumption	P_D	Output short circuit	1,2,3	-	80	W
Power distribution accuracy a	P_E	Full load, number of products connected in parallel ≤ 3, T_A = 25℃	1	-	12	%
Capacitive load ab	C_{LOAD}	I_O =9.2A, T_A =25°C	4	-	1000	μF
Switching frequency	f_{SC}	I_O =9.2A	4,5,6	425	600	kHz

CHARACTERISTIC	SYMBOL	CONDITION (UNLESS OTHERWISE SPECIFIED, -55℃≤ T_C ≤125℃, V_I =28V±0.5V, THE INHIBIT TERMINAL, YNCHRONIZATION INPUT TERMINAL, SYNCHRONIZATION OUTPUT TERMINAL, OUTPUT VOLTAGE ADJUSTMENT TERMINAL, AND CURRENT SHARING TERMINAL ARE LEFT FLOATING, THE POSITIVE SENSING TERMINAL IS CONNECTED TO THE OUTPUT TERMINAL, AND THE NEGATIVE SENSING TERMINAL IS CONNECTED TO THE OUTPUT GROUND)	GROUP A	LIMIT VALUE		UNIT
				MINIMUM	MAXIMUM	
External synchronization frequency rangea	f_{SYNC}	I_O =9.2A, pin 6 is connected to TTL level, V_{IH} - V_{IL} = 5V, duty cycle 20% to 80%	4,5,6	500	600	kHz
ac during load transient (peak value)	V_{LOR}	50% load → full load or full load → 50% load	4,5,6	-800	800	mV
Output voltage recovery time during load transients acd	t_{LOR}	50% load → full load or full load → 50% load	4,5,6	-	900	μs
Output voltage change (peak value) ae when input voltage changes transiently	V_{VOR}	Input voltage V_I: 16V→40V, I_O = 9.2 A or input voltage V_I: 40V→16V, I_O = 9.2 A	4,5,6	-1200	1200	mV
Output voltage recovery time ade when input voltage transient	t_{VOR}	Input voltage V_I: 16V→40V, I_O = 9.2 A or input voltage V_I: 40V→16V, I_O = 9.2 A	4,5,6	-	900	μs
Start-up overshoot (peak)	V_{TO}	Input voltage V_I: 0V→28V, I_O =9.2A	4,5,6	-	50	mV
Startup delay f	t_{TR}	Input voltage V_I: 0V→28V, I_O =9.2A	4,5,6	-	40	ms
Input surge voltage g	V_{IM}	t=1s, I_O =9.2A, 1 time, T_A = 25℃	4	-	50	V

a) This parameter is guaranteed by design and is tested only during qualification inspection and when the design or process is changed;
b) Capacitive load does not affect DC parameters;
c) The load transition time should be greater than 10μs;
d) Recovery time refers to the time from the start of the jump until the output voltage returns to the corresponding stable value within ±1%;
e) The jump time of the input voltage should be greater than 10μs;
f) The start-up delay time can be calculated from the jump of the power supply or from the disconnection of the grounded inhibit terminal;
g) Test the output voltage at room temperature after the surge test.

3.4. Electrical test requirements

The electrical test requirements shall be grouped as specified in Table 2.

Table 4. Electrical test requirements

TEST CONDITIONS	GROUPING (ACCORDING TO TABLE C11 OF GJB 2438B-2017)
Final electrical test (after aging)	A1[a], A2, A3, A4, A5, A6
A test requirements	A1, A2, A3, A4, A5, A6
Endpoint electrical test in group C	A1
a) PDA is suitable for A1 group	

3.5 Device Marking

The device model is ZVFL28D12F/110W, which complies with the relevant provisions of Article 3.4.6 of GJB 2438B-2017. The product logo is shown in Figure 3.

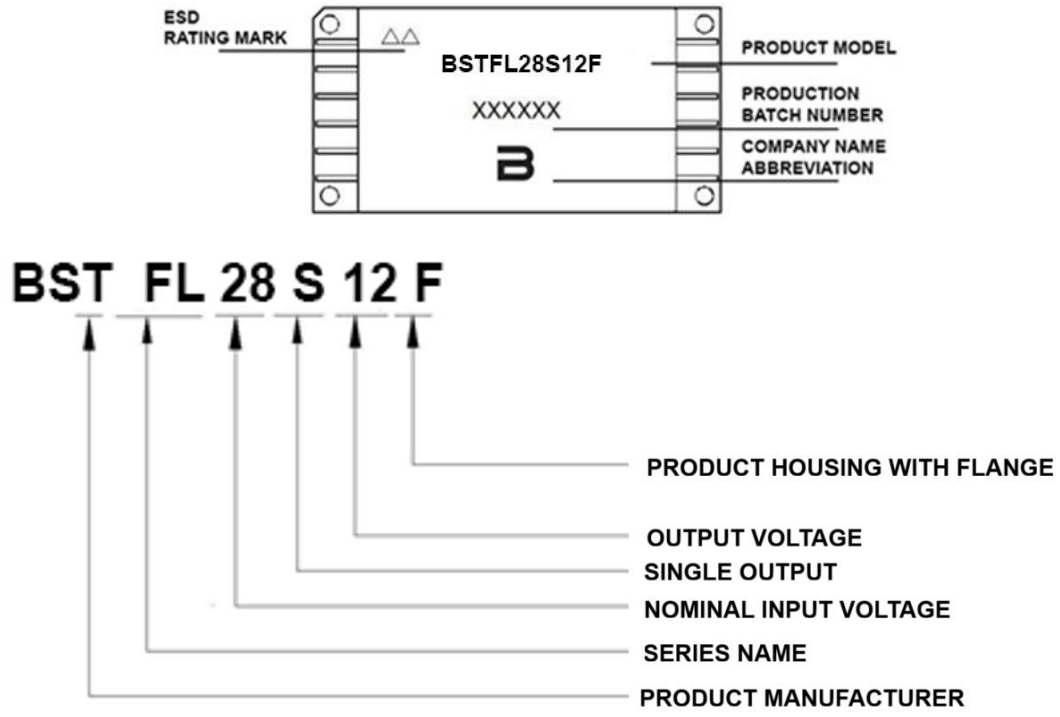


Figure 3. Product logo

IV. Quality Assurance Regulations

4.1 Sampling and Inspection

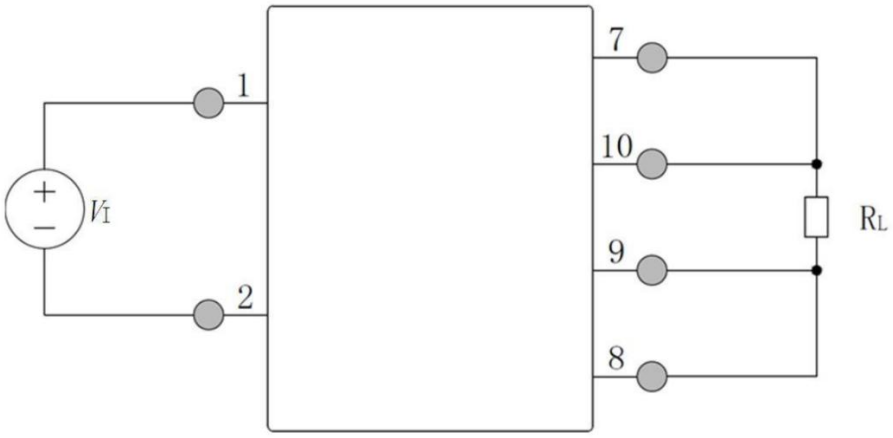
Unless otherwise specified, sampling and inspection procedures shall be in accordance with GJB 2438B-2017 and this specification.

4.2 Screening

Before identification and quality consistency inspection, all circuits should be screened in accordance with C.4 of GJB 2438B-2017 and Table 5 of this specification.

Table 5. Screening

TEST	GJB 548B-2005		REQUIRE
	METHOD	CONDITION	
Internal visual inspection	2017		100%
Temperature Cycle	1010	Condition C, , -65^{0}_{-10}℃～-150^{+15}_{0}10 times, t1 = 30min±1min, t2 ≤1min	100%
constant acceleration	2001	Acceleration 29400m/ ^{s2,} Y1 direction, 1min	100%
PIND	2020	Condition A	100%
Aging	1015	T_C = 125°C, 160h (Aging diagram see Figure 4)	100%
Final electrical test	-	Should comply with the provisions of Table 2 of this specification	100%
seal a. Detailed leak inspection b. Rough leak detection	1014	Detailed inspection test conditions A1, pressure: 310kPa, time: 10h, R_1 ≤5×10^{-3} (Pa·$cm^{3)}$/s (He) Rough test conditions C1, pressure: 310kPa, time: 8h	100%
External visual inspection	2009		100%



V_I = 28V ± 0.5V, R_L=1.6Ω ± 0.2Ω (resistance power not less than 250W)

Figure 4. Aging and steady-state life test block diagram

4.3. Identification and testing

The identification inspection shall be carried out in accordance with the provisions of this specification, and the inspections carried out shall comply with the requirements of the inspection groups A, B, C and D of this specification.

The number of sample populations shall not be less than the sum of the number of samples in groups B, C, and D.

4.4. Quality consistency inspection

4.4.1. Overview

Quality consistency inspection shall be carried out in accordance with the provisions of C.5 of GJB 2438B-2017 and this specification, and the inspections carried out shall comply with the A, B, C and D group inspections specified in this specification.

4.4.2. Group A Test

Group A inspection shall be carried out in accordance with Table C.11 of GJB 2438B-2017 and Table 6 of this specification; when the required sample size exceeds the batch size, 100% inspection shall be carried out.

Table 6. Tests of Group A

GROUPING	PARAMETER	NUMBER OF SAMPLES (NUMBER OF RECEPTIONS)
1	Static test at 25℃	116(0)
2	Static test at 125℃	76(0)
3	Static test at -55℃	45(0)
4	Dynamic test at 25℃	116(0)
5	Dynamic test at 125℃	76(0)
6	Dynamic test at -55℃	45(0)

4.4.3. Group B test

Group B inspection shall be in accordance with C.5.3.3 of GJB 2438B-2017 and Table 7 of this specification.

Table 7. Group B test

GROUPING	TEST	GJB 548B-2005		SAMPLE SIZE (NUMBER OF SAMPLES RECEIVED)
		METHOD	CONDITION	
1	Dimensions	2016	Comply with Article 3.2.4 of this specification	2 (0)
2	Solvent resistance	2015	—	3 (0)
3	Internal visual and structural inspection	2014	—	1 (0)
4	Bonding strength a) Hot pressing welding b) Ultrasonic welding	2011	D	2 (0)
5	Die shear strength	2019	—	2 (0)
6	Solderability	2003	Solder temperature 245℃±5℃, water vapor aging 8h	1 (0)
a) This test item is not applicable to laser marking products.				

4.4.4 Group C Test

Group C inspection shall be carried out in accordance with Table C.14 and the following provisions in GJB 2438B-2017.

Table 8. Group C test

GROUPING	TEST	GJB 548B-2005		SAMPLE SIZE (NUMBER OF RECEIVED SAMPLES)
		METHOD	CONDITION	
1	Resistance to welding heat	GJB360B Method 210	Condition A	5 (0)
	External visual inspection	2009	—	
	Temperature Cycle	1010	Same as Table 3 of this specification	
	constant acceleration	2001	Same as Table 3 of this specification	
	Random vibration	2026	Test condition Ⅰ (F), no power is applied during the test	
	Seal	1014	Same as Table 3 of this specification	
	PIND	2020	Same as Table 3 of this specification	
	Visual inspection	1010	—	

	Endpoint electrical testing	—	Should comply with the requirements of Table 2 of this specification	
2	Steady-state life	1005	T_C = 125°C, 1000h (see Figure 4 for the test block diagram)	5 (0)
	Endpoint electrical testing	—	Should comply with the requirements of Table 2 of this specification	
3	Internal water vapor content b	1018	—	3 (0) or 5 (1)
5	ESD[a] Electrical parameters ESDS Electrical parameters	3015	A1 Group 2000V A1 Group	3 (0)
This test is only performed during identification inspection or design changes.				

4.4.5. Group D Test

Group D testing should be conducted in accordance with Table C.15 of GJB 2438B-2017 and the following provisions. Group D testing may be performed on screened products with unqualified electrical properties or sealed empty housings from the same inspection batch, and repeated for subsequent inspection batches at intervals not exceeding 26 weeks. If the product housing passes the enclosure evaluation test upon receipt, and the test items cover the Group D qualification test, Group D testing does not need to be repeated.

Table 9. D group test

GROUPING	TEST	GJB 548B-2005		SAMPLE SIZE (NUMBER OF RECEIVED)
		METHOD	CONDITION	
1	thermal shock	1011	C, 15 cycles	5 (0)
	Stability baking	1008	150℃, 1h	
	Lead firmness	2004	Condition B_1, 6.3.5 in 2004	1 (0)
	seal	1014	Same as Table 3 of this specification	5 (0)
2	salt spray	1009	Condition A	5 (0)
3	Insulation resistance	1003	500V, 80nA maximum	3 (0)

V. Delivery Preparation

Packaging requirements should comply with the provisions of Article 5.1 of GJB 2438B-2017.

VI. Notes

6.1. Intended Use

Circuits conforming to the requirements of this specification are intended for use in the design of new equipment and for the maintenance of existing equipment.

6.2. Contents of order documents

The contents of the contract and order form shall comply with the provisions of Article 6.2 of GJB 2438B-2017.

6.3. Control requirements

The product is controlled in accordance with the H-level requirements specified in GJB2438B-2017.