BSTFL28D12F

DC/DC Converter Detailed Specification

I. Product Overview

This specification specifies the detailed requirements for the hybrid integrated circuit BSTFL28D12F 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 thin film integrated circuits and hybrid integrated circuits
- GJB 360B-2009 Test methods for electronic and electrical components
- GJB 548B-2005 Test methods and procedures for microelectronic devices
- GJB 2438B-2017 General Specification for Hybrid Integrated Circuits

III. Require

3.1. General Principles

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, and the shell lead is all 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.

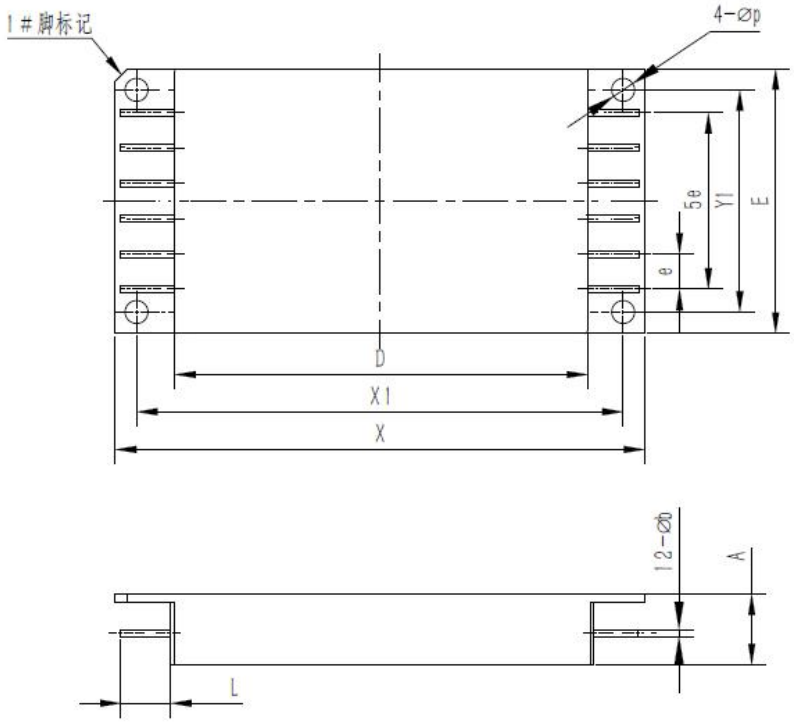


Figure 1. Dimensions

Table 1

Unit is millimeter

DIMENSION SYMBOLS	NUMERICAL		
	MINIMUM	NOMINAL	MAXIMUM
A	-	-	10.16
ϕb	0.90	-	1.10
ϕp	-	3.30	-
D	-	-	63.63
E	-	-	38.23
e	-	5.08	-
X_1	-	70.10	-
Y_1	-	32.00	-
X	-	-	76.33
L	5.60	-	6.10

Note:
1. For tolerances not specified, the tolerances shall be in accordance with the m level in GB/T 1804-2000.
2. The interchangeability dimension e is guaranteed by the shell manufacturing and is not a test requirement.

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_{O1}	+12 Output
2	GND_I	Input	8	GND_O	Output
3	NC	Empty feet	9	V_{O2}	-12 Output
4	INH_1	Prohibited terminal 1	10	TRIM	Output voltage adjustment terminal
5	SYNC OUT	Synchronous output	11	NC	Empty feet
6	SYNC IN	Synchronous input	12	INH_2	Prohibited terminal 2

3.3. Electrical characteristics

The electrical characteristics shall be as specified in Table 1.

Table 3. Electrical characteristics

CHARACTERISTIC	SYMBOL	CONDITION (UNLESS OTHERWISE SPECIFIED, -55℃≤ T_C ≤125℃, V_I =28V±0.5V, INHIBIT 1 AND INHIBIT 2 OPEN, SYNC INPUT FLOATING)	GROUP A	LIMIT VALUE		UNIT
				MINIMUM	MAXIMUM	
Output voltage	V_{O1}	V_I=16V～40V, I_{O1}= I_{O2}=4.5A	1	11.88	12.12	V
			2,3	11.88	12.18	
	V_{O2}		1	-12.20	-11.80	
			2,3	-12.48	-11.52	
Output current	I_{O1}	V_I=16V～40V	1,2,3	-	4.5	A
	I_{O2}			-	4.5	
Output ripple voltage (peak-to-peak)	V_{RIP1}	BW=20Hz→10MHz, I_{O1}= I_{O2}=4.5A	1,2,3	-	150	mV
	V_{RIP2}			-	150	
Voltage regulation	S_{V1}	V_I=16V～40V, I_{O1}= I_{O2}=4.5A	1,2,3	-	200	mV
	S_{V2}			-	200	
Load regulation	S_{I1}	I_{O1}= I_{O2}=0A→4.5A	1,2,3	-	200	mV
	S_{I2}			-	200	
Cross adjustment	S_C	One line has a 30% load, and the other line has a load varying from 30% to 70%	1,2,3	-	750	mV
Output voltage adjustment range [a]	V_{TRIM1}	I_{O1}≤4.5A, I_{O2}≤4.5A, P_O≤110W	1,2,3	12.0	16.5	V
	V_{TRIM2}			-16.5	-12.0	
Input current	I_I	Disable terminal 1 is connected to input ground	1,2,3	-	50	mA
		Disable terminal 2 is connected to -12V output terminal		-	120	
		No load		-	200	

CHARACTERISTIC	SYMBOL	CONDITION (UNLESS OTHERWISE SPECIFIED, -55℃≤ T_C ≤125℃, V_I =28V±0.5V, INHIBIT 1 AND INHIBIT 2 OPEN, SYNC INPUT FLOATING)	GROUP A	LIMIT VALUE		UNIT
				MINIMUM	MAXIMUM	
Input ripple current (peak-to-peak)	I_{RIP}	BW=20Hz→10MHz, I_O =4.5A, Add 10μH inductor and 220μF capacitor to input	1,2,3	-	300	mA
Start threshold	V_{ION}	Full load, input voltage from 0V→28V	1,2,3	14	16	V
Shutdown threshold [a]	V_{IOFF}	Full load, input voltage from 28V to 0V	1,2,3	11.0	14.5	V
Efficiency	η	I_{O1}= I_{O2}=4.5A	1,2,3	80	-	%
Insulation resistance	R_I	Apply 500V_{DC} between the input and output, and between any terminal and the housing, T_A = 25°C	1	100	-	MΩ
Short-circuit power consumption	P_D	Output short circuit	1,2,3	-	100	W
Capacitive load [ab]	C_{LOAD1}	I_{O1}= I_{O2}=4.5A, T_A =25°C	4	-	500	μF
	C_{LOAD2}			-	500	
Input surge voltage [c]	V_{IM}	t=1s, I_O =4.5A, 1 time, T_A = 25℃	4	-	50	V
Switching frequency	f_{SC}	I_{O1}= I_{O2}=4.5A	4,5,6	425	600	kHz
External synchronization frequency range [a]	f_{SYNC}	I_O =4.5A, pin 6 is connected to TTL level, V_{IH} - V_{IL} = 5V, duty cycle 20% to 80%	4,5,6	500	600	kHz
Output voltage change during load transients (peak value) [ad]	V_{LOR}	50% load → full load or full load → 50% load	4,5,6	-	500	mV
Output voltage recovery time during load transients [ade]	t_{LOR}	50% load → full load or full load → 50% load	4,5,6	-	500	μs
Output voltage change (peak value) when input voltage changes transiently [af]	V_{VOR}	Input voltage V_I: 16 V → 40 V, I_O = 4.5A or input voltage V_I: 40 V → 16 V, I_O = 4.5A	4,5,6	-2200	1200	mV
Output voltage recovery time during input voltage transients [aef]	t_{VOR}	Input voltage V_I: 16 V → 40 V, I_O = 4.5A or input voltage V_I: 40 V → 16 V, I_O = 4.5A	4,5,6	-	500	μs
Start-up overshoot (peak)	V_{TO}	Input voltage V_I: 0V→28V, I_O = 4.5A	4,5,6	-	120	mV
Startup delay [g]	t_{TR}	Input voltage V_I: 0V→28V, I_O = 4.5A	4,5,6	-	40	ms

[a] This parameter is guaranteed by design and is tested only during qualification and design or process changes.
[b] Capacitive loads do not affect DC parameters.
[c] After the surge test, test the output voltage at room temperature.
[d] The load transition time should be greater than 10μs.
[e] Recovery time is the time from the start of the transition until the output voltage returns to within ±1% of the corresponding stable value.
[f] The input voltage transition time should be greater than 10μs.
[g] Startup delay can be calculated from the start of the power transition or from the disconnection of the ground inhibit terminal.

3.4. Electrical test requirements

The electrical test requirements shall be grouped as specified in Table 4.

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
Group 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 BSTFL28D12F, which complies with the relevant provisions of Article 3.4.6 of GJB 2438B-2017. The product logo is shown in Figure 3.

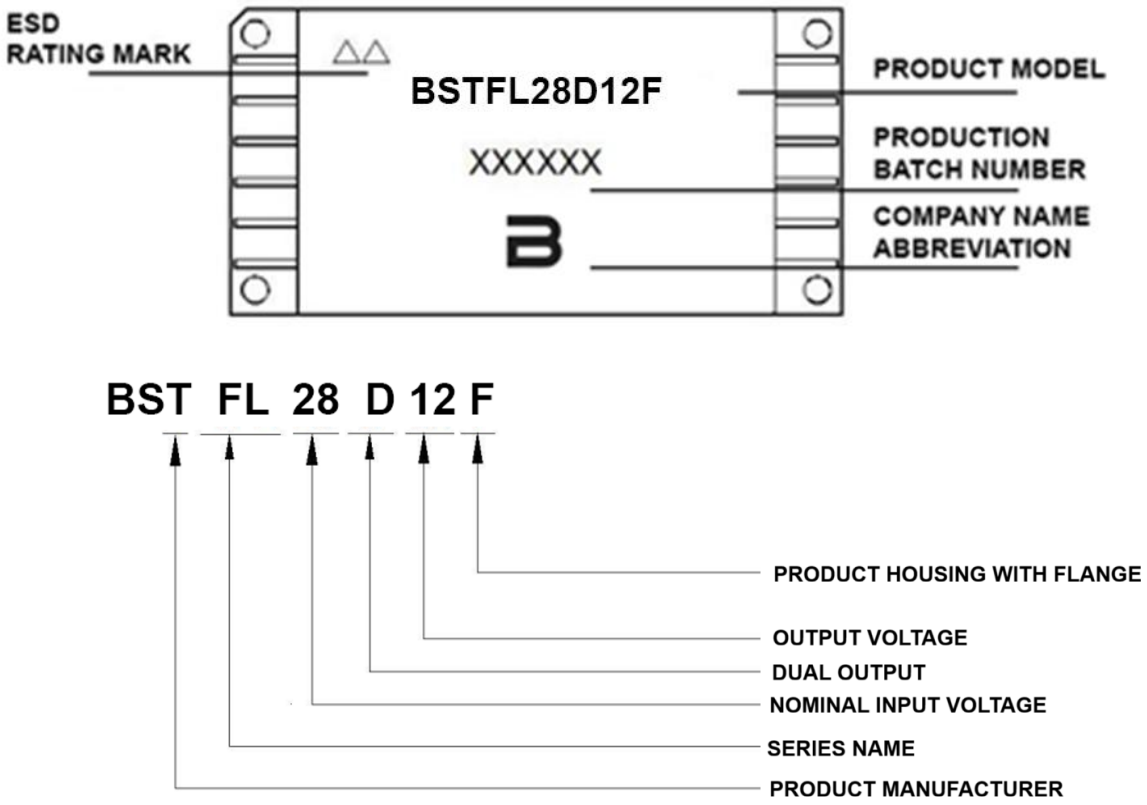


Figure 3. Product logo

IV. Quality Assurance Regulations

4.1. Sampling and inspection

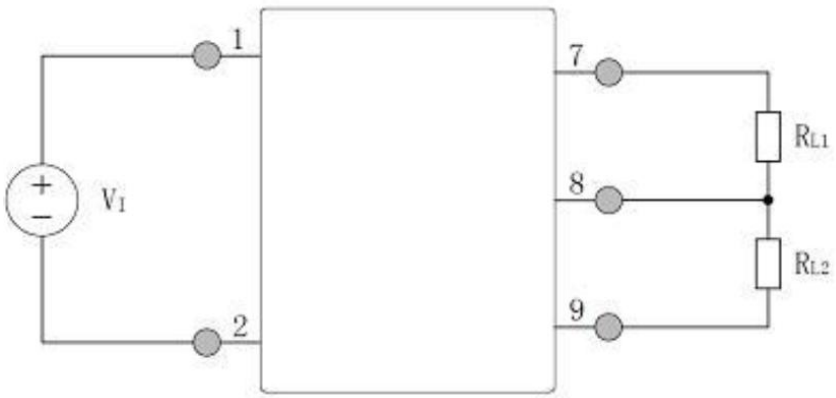
Unless otherwise specified, sampling and inspection procedures shall be in accordance with GJB 2438B-2017 and this specification.

4.2. Filter

Before identification and quality consistency inspection, all circuits should be screened in accordance with C.4 of GJB 2438B-2017 and Table 3 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/ $s^{2,}$ 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 requirements of Table 2	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_{L1} = R_{L2} = 2.62Ω ± 0.12Ω (resistance power not less than 300W)

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

4.3. Identification and Inspection

Identification tests shall be carried out in accordance with the provisions of this specification and the tests carried out shall comply with the requirements of Groups A, B, C and D of this specification. The minimum number of samples required for Group A tests shall not be less than the sum of the number of samples specified for 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 4 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 5 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)

GROUPING	TEST	GJB 548B-2005		SAMPLE SIZE (NUMBER OF SAMPLES RECEIVED)
		METHOD	CONDITION	
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	
	constant acceleration	2001	Same as table 3	
	Random vibration	2026	Test condition Ⅰ (F), no power is applied during the test	
	seal	1014	Same as table 3	
	PIND	2020	Same as table 3	
	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	

GROUPING	TEST	GJB 548B-2005		SAMPLE SIZE (NUMBER OF RECEIVED SAMPLES)
		METHOD	CONDITION	
3	Internal water vapor content	1018	—	3 (0) or 5 (1)
5	ESD Electrical Parameters ESDS Electrical parameters	3015	A1 group 2000V A1 Group	3 (0)
a) This test is only performed for identification inspection or design changes.				

4.4.5. D group test

The Group D test shall be conducted in accordance with the provisions of Table C.15 of GJB 2438B-2017 and the following provisions. The Group D test may be conducted on products with unqualified electrical properties or sealed empty shells that have been screened out from the same inspection batch, and shall be repeated for subsequent inspection batches at intervals not exceeding 26 weeks. If the product shell passes the shell evaluation test upon entering the factory and the test items can cover the tests specified in the identification inspection Group D, the Group D test 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	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. Order document contents

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

6.3. Quality control level

Product quality control is carried out in accordance with the H-level requirements in GJB 2438B-2017.