

Hybrid Surge Protection DC/DC Converter (HSFL28D Series)

1 Features

- High reliability
- Wide input voltage range: 15V~50V, Nominal DC input voltage 28V
- surge protection voltage: 80V, 1s
- Output Power P_O: 65W
- Operating temperature range T_c: -55°C~+125°C
- Low Startup current
- No output overshoot
- Inhibit function
- Input under voltage locked function and output short circuit protection
- Maximum power density: 43W/in³
- Hermetically sealed metal case



Size 76.70×38.60×10.66mm³
Weight 82g

Table1 Product models

| |
|-------------|
| ➤ HSFL28D5 |
| ➤ HSFL28D12 |
| ➤ HSFL28D15 |

2 Scope of application

High-reliability electronic system for aviation and aerospace, etc

3 Descriptions

This series product is highly reliable and is featured with surge protection (80 v, 1 s) for DC/DC converter. Single ended, pulse width modulated and transformer magnetic feedback topology design are used in this product. The operating principle is that the sampling signal of output voltage, coupled by the opto-coupler, works together with the sampling signal of input loop current to regulate the pulse width of the controller. The double loop control creates constant voltage output and short circuit protection. Thick film hybrid techniques provide the converters with high reliability and optimum miniaturization. The design and manufacturing process of GJB2438A-2002 of converters are in compliance with General Standards of Hybrid Integrated Circuits and detailed standards of manufacturing.

4 Technical Specifications

Table 2 Rated conditions and recommended operating conditions

| Absolute Max. Rating | |
|---|--|
| Input voltage: 15V~50V Input voltage (Transient,1s) : 80V Output Power: 71W Storage temperature: -65°C~150°C | Mechanical Shock: 1500g Lead temperature: 300°C (15s) Weight: 82g Antistatic intensity: 2000V |

Table 3 Electrical characteristics

| No | characteristic | Conditions (Except provided by, $-55^{\circ}\text{C} \leq T_c \leq 125^{\circ}\text{C}$, $V_{IN} = 28\text{V} \pm 5\%$) | HSFL28D5 | | HSFL28D12 | | HSFL28D15 | |
|----|-----------------------|--|----------|-------|-----------|-------|-----------|-------|
| | | | Min | Max | Min | Max | Min | Max |
| 1 | Input Voltage/V | Low, High, Ambient Temperature | 15 | 50 | 15 | 50 | 15 | 50 |
| 2 | Output Voltage/V | Positive Io=Full Load | Ambient | 5.05 | 11.88 | 12.12 | 14.85 | 15.15 |
| | | | 4.95 | 5.05 | 11.88 | 12.12 | 14.85 | 15.15 |
| | | Negative | Ambient | 5.075 | 11.82 | 12.18 | 14.70 | 15.30 |
| | | | Low/high | 5.075 | 11.82 | 12.18 | 14.70 | 15.30 |
| 3 | Output current/A | $V_{IN} = 15\text{V} \sim 50\text{V}$ | — | 5 | — | 2.5 | — | 2.17 |
| 4 | Output Power/W | | 0 | 50 | 0 | 60 | 0 | 65 |
| 5 | Output Ripple Voltage | $BW \leq 20\text{MHz}$, $I_o = \text{Full}$ | — | 50 | — | 80 | — | 100 |

| | /mV | ➤ load | | | | | | | |
|----|--|--|--------------------------------|----------------------------|------------|--------------------------|------|--------------------------|------|
| 6 | Line Regulation/ mV | Positive | ➤ VIN =16 V~ 40 V | ➤ - | ➤ 50 | - | 50 | - | 50 |
| | | negative | | ➤ - | ➤ 50 | - | 50 | - | 50 |
| 7 | ➤ Load Regul ation/mV | Positive | ➤ Io=No load to l oad | ➤ - | ➤ 50 | - | 50 | - | 50 |
| | | negative | | ➤ - | ➤ 50 | - | 50 | - | 50 |
| 8 | ➤ Input curre nt/mA | ➤ Inhibit | | ➤ - | ➤ 6 | - | 6 | - | 6 |
| | | ➤ Io=no load | | ➤ - | ➤ 60 | - | 60 | - | 60 |
| 9 | ➤ Input Rippl e current/m A | ➤ BW≤20MHz, Io =Full load | | ➤ - | ➤ 80 | - | 80 | - | 80 |
| 10 | ➤ Efficiency /% | ➤ Io=Full load | | ➤ 74 | ➤ - | 80 | - | 81 | - |
| 11 | ➤ Isolation/M Ω | ➤ Input to output or any pin to c ase(except pin 7、8)at 500V, T c=25°C | | ➤ 10 0 | ➤ - | 100 | - | 100 | - |
| 12 | ➤ Inhibit Fun ction | ➤ | | ➤ 0 | ➤ 0.7 | 0 | 0.7 | 0 | 0.7 |
| 13 | ➤ Inhibit ope n-circuit Vo ltage/V | ➤ Io=Full Load | | ➤ 10 | ➤ 14 | 10 | 14 | 10 | 14 |
| 14 | ➤ Under volta ge open v oltage/V | ➤ Io=Full Load | | ➤ 1 2. 0 | ➤ 14. 8 | 12.0 | 14.8 | 12 | 14.8 |
| 15 | ➤ Under volta ge cut-off voltage/V | ➤ Io=Full Load | | ➤ 1 1. 0 | ➤ 14. 5 | 11.0 | 14.5 | 11 | 14.5 |
| 16 | ➤ Short Circu it Protectio n | ➤ | | ➤ Reduced flow patterns | | Reduced flow patterns | | Reduced flow patterns | |
| 17 | ➤ Capacitive load | ➤ Tc=25°C | | ➤ - | ➤ 50 0 | - | 500 | - | 500 |
| | ➤ / μ F | | | | | | | | |
| 18 | ➤ switching fr equency/kH | ➤ Io=Full Load | | ➤ 18 0 | ➤ 26 0 | 180 | 260 | 180 | 260 |

| | Z | | | | | | | |
|----|-----------------------------------|---|-----|-----|-----|-----|-----|-----|
| 19 | External sync frequency range/kHz | Tc=25°C, Io=Full load, TTL level (VIH≥4.5V, VIL≤0.8V), Duty cycle 40%~60% | 200 | 300 | 200 | 300 | 200 | 300 |
| 20 | Step Line Response Transient(mV) | One 30% load Another 30%→70% load | — | 650 | — | 650 | — | 650 |
| 21 | Step Line Response Recovery(μs) | 50%load→full load →50%load | — | 400 | — | 450 | — | 500 |
| 22 | Step Line Response Transient(mV) | 50%load→full load →50%load | — | 500 | — | 500 | — | 500 |
| 23 | Step Line Response Transient(mV) | VIN: 16V→40V, VIN: 40V→16V, Io=Full load | — | 600 | — | 900 | — | 900 |
| 24 | Step Line Response Recovery(μs) | VIN: 16V→40V, VIN: 40V→16V, Io=Full load | — | 500 | — | 500 | — | 500 |
| 25 | Start-up Overshoot(mV) | VIN: 0→28V, Io=Full load | — | 50 | — | 50 | — | 50 |
| 26 | Start-up Delay (ms) | VIN: 0→28V, Io=Full load | — | 20 | — | 20 | — | 20 |

5 Circuit block diagram

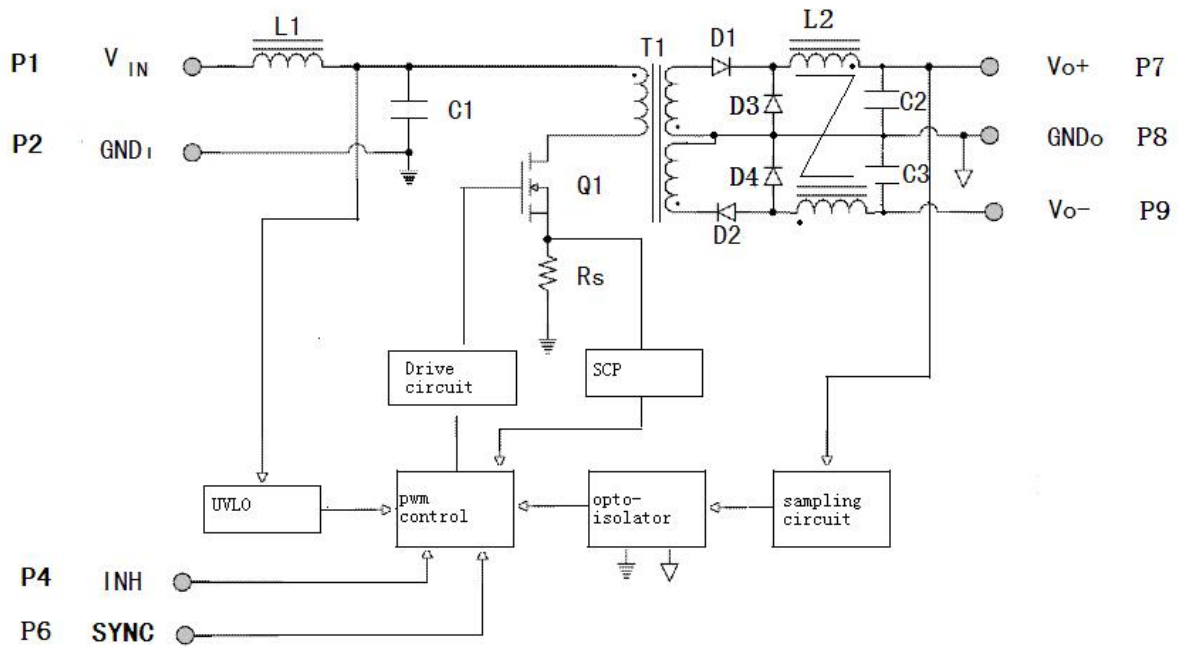


Figure1 HSFL28D seriesCircuit block diagram

6. Typical Characteristic Curve (Tc=25°C, VIN=28V±5%)

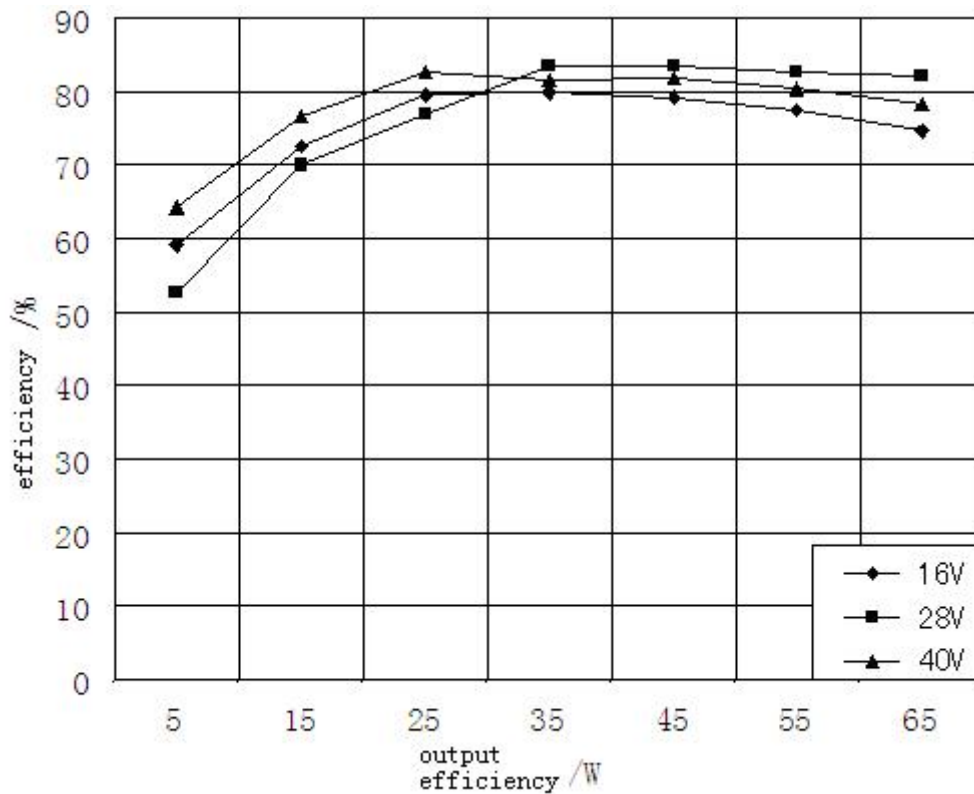


Figure 2 HSFL28D15 Efficiency

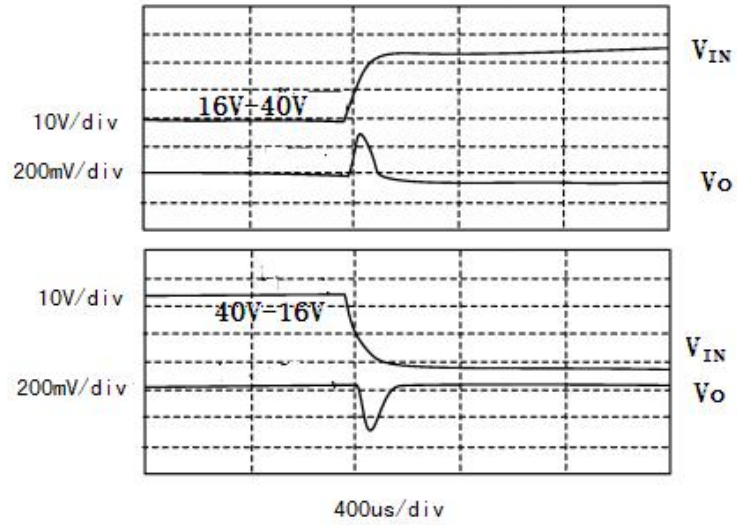


Figure 3 HSFL28D15 Step Line Response

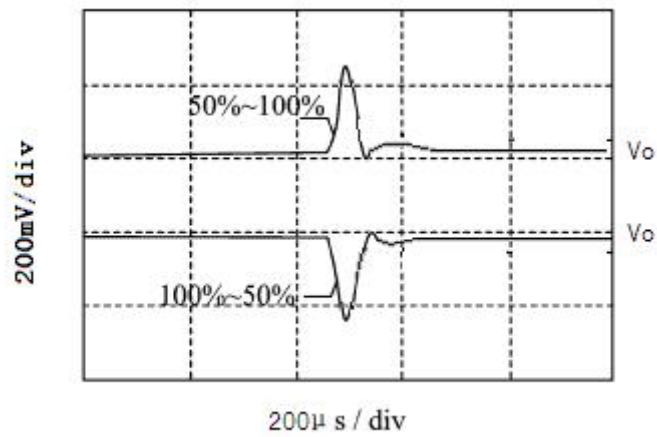


Figure 4 HSFL28D15 Step Load Response

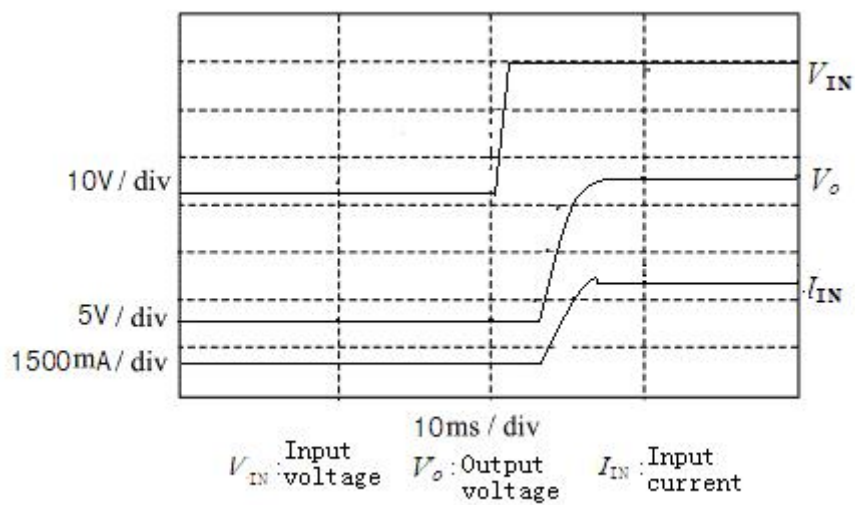


Figure 5 HSFL28D15Start-up Overshoot/Start-up Delay

7.MTBF Curve

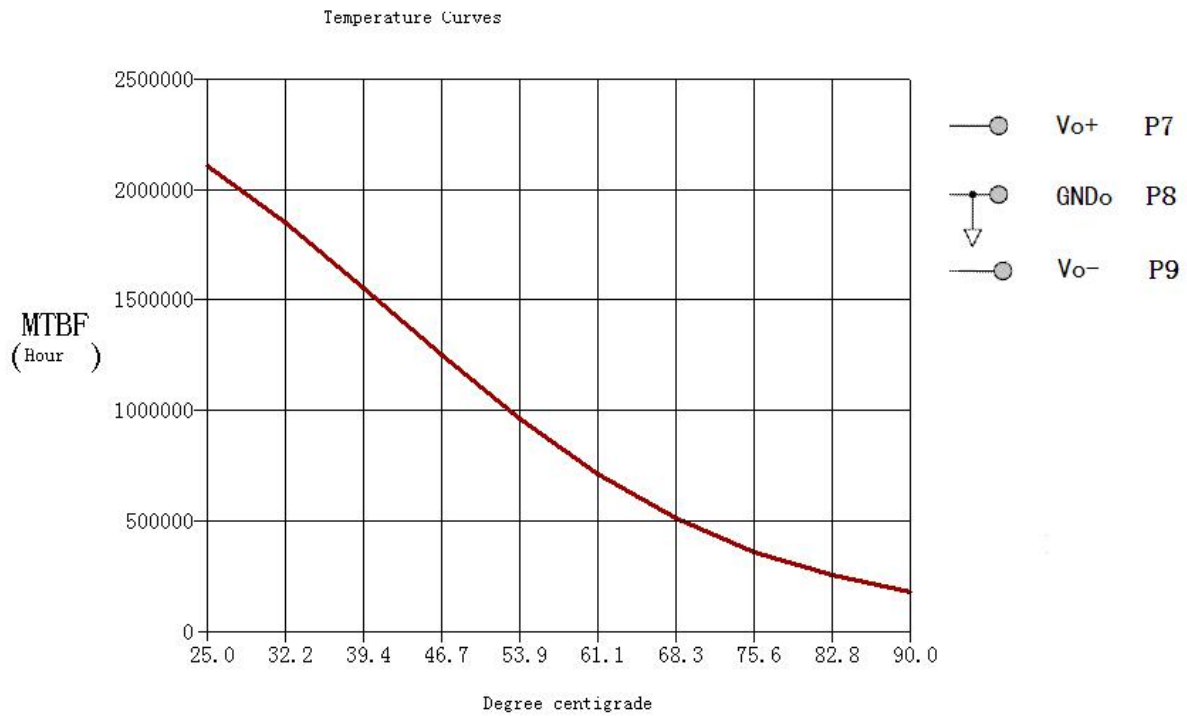


Figure 6 MTBF Temperature Curve (HSFL28D15)
(According to GJB/Z 2990-2006)

8 Pin Designation

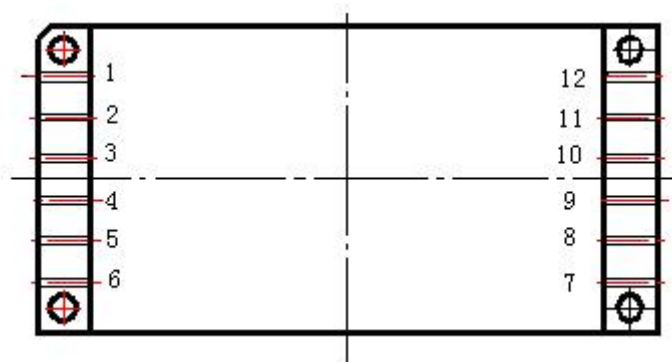


Figure 7 Pin Out Bottom View

Table4 Pin Designation

| ➤ No. | ➤ Symbol | ➤ Designation | ➤ No | ➤ Sym bol | ➤ Designation |
|-------|----------|-------------------|------|-----------|------------------|
| ➤ 1 | ➤ VIN | ➤ Positive Output | ➤ 7 | ➤ VO+ | ➤ Positive Input |
| ➤ 2 | ➤ GNDI | ➤ Input Common | ➤ 8 | ➤ GND | ➤ Output Common |

| | | | | | |
|-----|--------|--------------------------|------|-------|-------------------|
| | | n | | O | |
| ➤ 3 | ➤ NC | ➤ No connectio n | ➤ 9 | ➤ VO- | ➤ Negative Output |
| ➤ 4 | ➤ INH | ➤ Inhibit | ➤ 10 | ➤ NC | ➤ No connection |
| ➤ 5 | ➤ NC | ➤ No connectio n | ➤ 11 | ➤ NC | ➤ No connection |
| ➤ 6 | ➤ SYNC | ➤ External sync input | ➤ 12 | ➤ NC | ➤ No connection |

9 Typical Connection Diagram

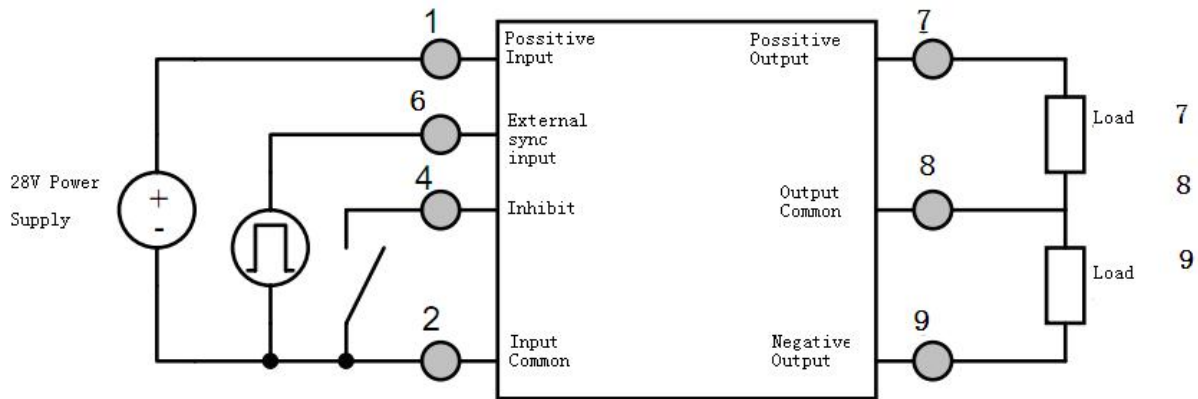


Figure 8 Connection Diagram

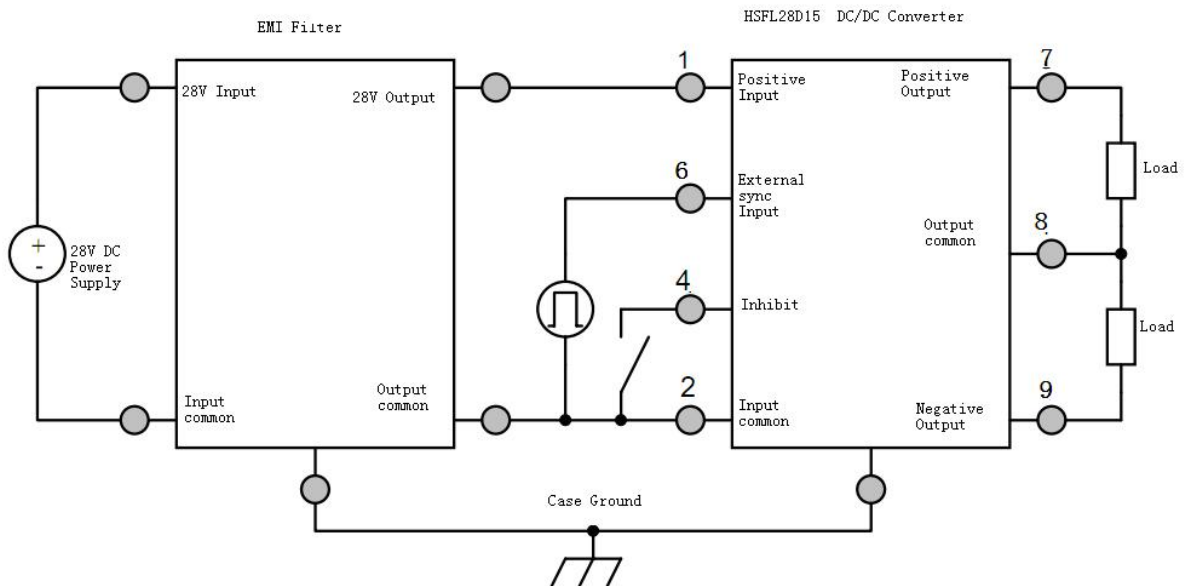


Figure 9 EMI Filter Connection Diagram

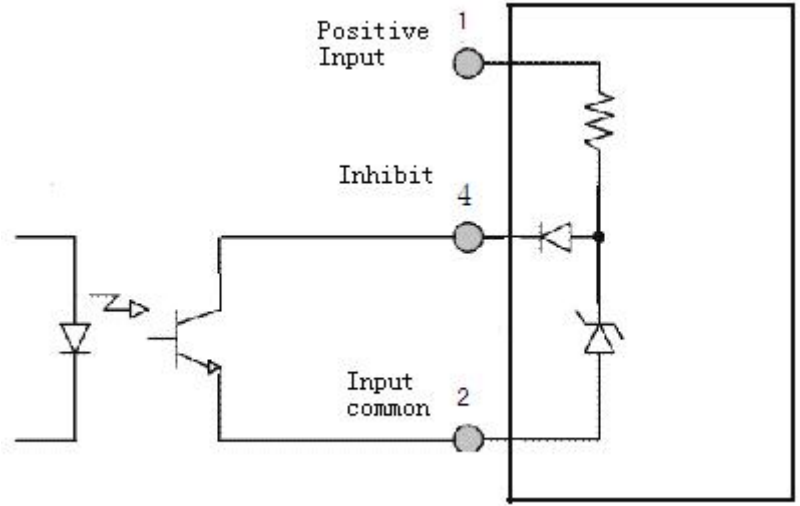


Figure 10 Inhibit Driver Circuit Diagram

10. Package Specifications

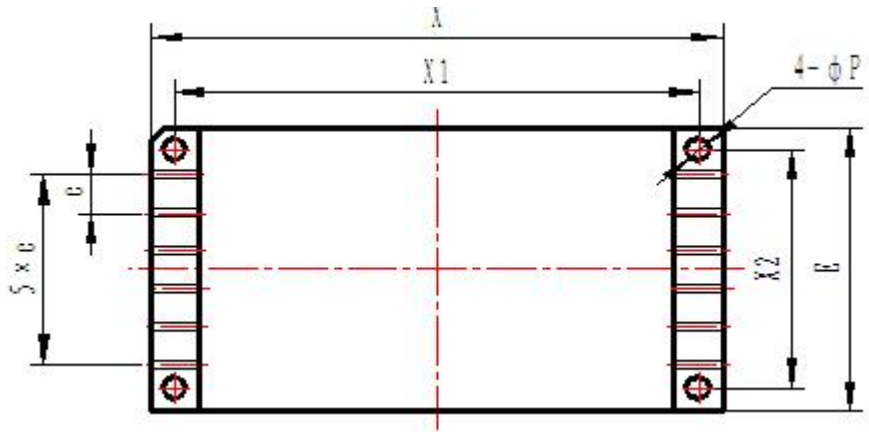


Figure 11 Bottom View

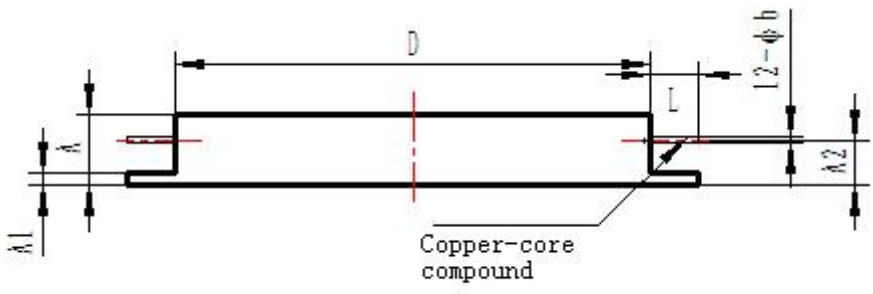


Figure 12 Side View

Table 5 Package Outline

| Symbols | Unit/mm | | |
|---------|---------|---|---------|
| | Minimum | | Minimum |
| A | - | - | 10.66 |
| A1 | 0.97 | - | 1.57 |

| | | | |
|----------|-------|------|-------|
| A2 | 5.09 | - | 6.09 |
| ϕ b | 0.87 | - | 1.13 |
| D | - | - | 64.00 |
| E | - | - | 38.60 |
| e | - | 5.08 | - |
| L | 5.35 | - | - |
| ϕ P | 3.00 | - | 3.60 |
| X2 | 31.50 | - | 32.50 |
| X1 | 69.60 | - | 70.60 |
| X | 75.70 | - | 76.70 |

Table 6 Case Materials

| Case Model | Header | Header Plating | Cover | Cover Plating | Pin | Pin Plating | Sealing | Notes |
|------------|-------------------------|----------------|--------------|---------------|-----------------------|-------------|-------------|-------|
| FPP6438-12 | Cold Rolled Steel (10#) | Ni | Kovar (4J42) | Ni | Copper -core Compound | Ni/Au | Compression | |

11 Ordering Information

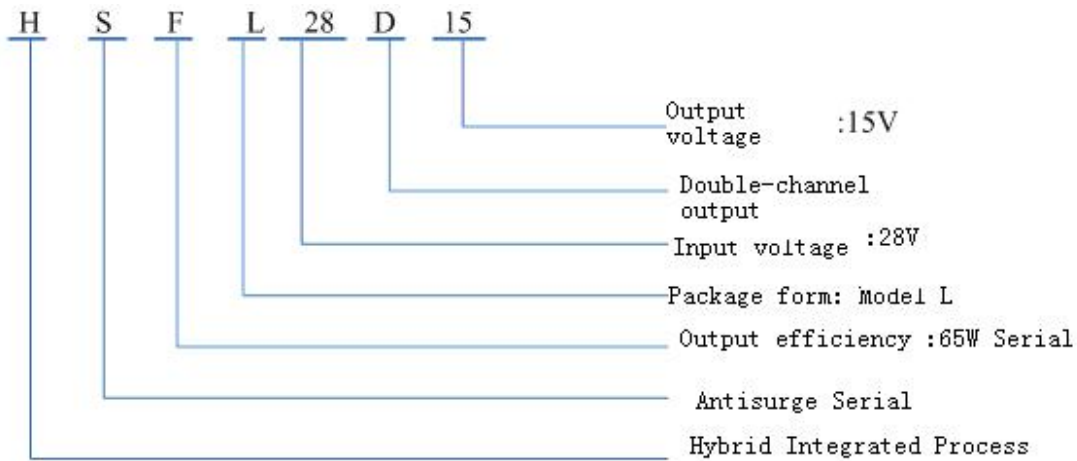
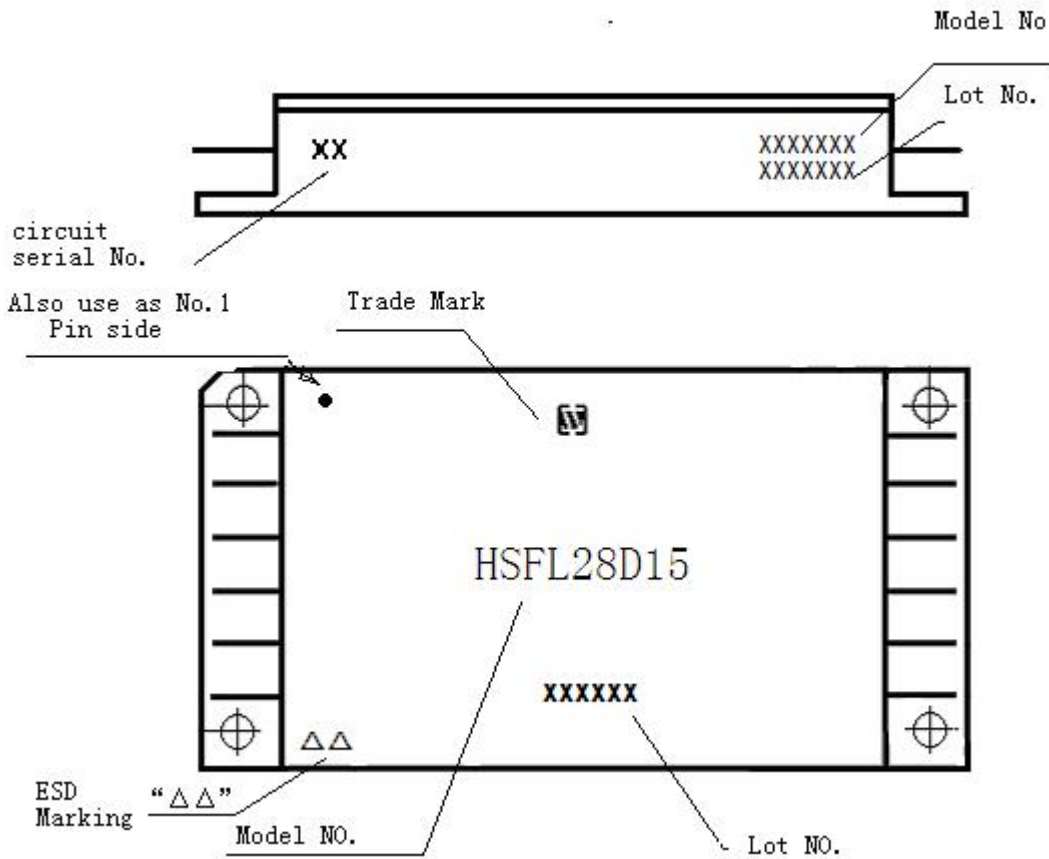


Table13 Part Numbering Key

Application Notes

- ☆ 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 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 the case temperture is 125°C, the thickness of the heatsink is recommended 3mm and the area of plate should be greater than 120mm×80mm。
- ☆ 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.