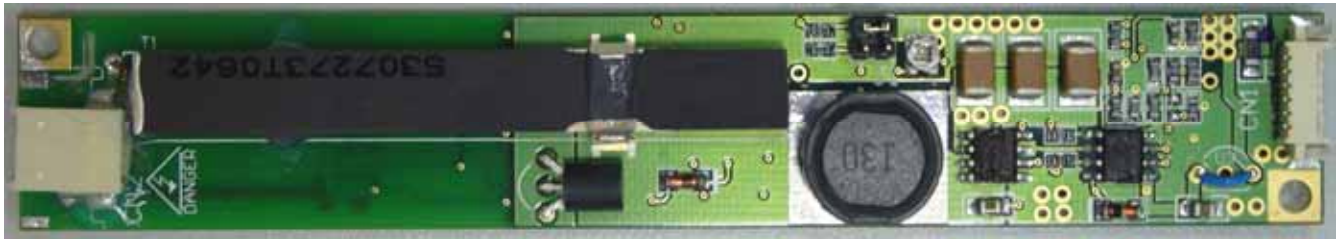


Piezo Ceramics DC-AC Inverter Specification

[RoHS Compliant]



Note: Actual product image may be different.

| | |
|--------------|---|
| Model | FC01-12-06 |
| Part No. | D008888010 |
| Description | 1 lamps with wide range dimming control Independent open lamp protection |
| Customer | |
| Hardware Rev | 1.0 |
| Document Rev | 1.2 |

| Approved by | Verified by | Prepared by |
|-------------|-------------|-------------|
| Eddie | Bart | Queenie |

ZIPPY inverters are distributed by:

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Your flatpanel partner

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 **US E304655**

Revision Record

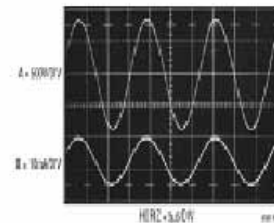
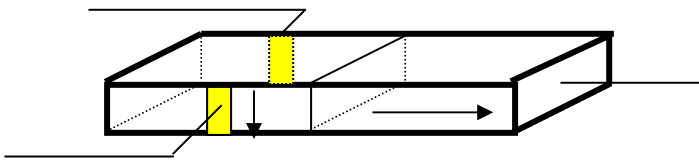
| Request Document No. | Date | Page | Item | Description | Revision |
|----------------------|------------|------|------|--|----------|
| FC09172006 | 9/17/2006 | 1 | | Change Document Rev to 1.1 Consolidate pin 1 definition on page 6 & 8 | 1.1 |
| FC12272006 | 12/27/2006 | 5 | 2.2 | Change Document Rev to 1.2 Correction Environmental Characteristic | 1.2 |
| | | 6 | 5.1 | Correction Production tests | |
| | | 7 | 5.2 | Deletion Typical duty cycle | |
| | | 7 | 6.1 | Correction Applicable safety standards | |
| | | 7 | 7.1 | Correction Label Set | |
| | | | | | |
| | | | | | |
| | | | | | |

1. General:

Piezoelectric ceramics are used to convert electric energy to mechanical energy and vice versa. Piezoelectric transformer can generate a high voltage output by a low voltage input through the utilization of mechanical resonance and magnification phenomenon of the piezoelectric transducer.

1.1 Principle:

The piezoelectric transformer has primary and secondary electrodes on the piezoelectric ceramics. The primary side is polarized in the thickness direction and secondary side is polarized in the length direction. When a voltage with the resonance frequency is applied on the primary side, a strong mechanical vibration is generated by “inverse piezoelectric effect” of the ceramics, and a high voltage is output from the secondary side, matching its vibration frequency by “direct piezoelectric effect”.



1.2 Advantages & special features:

- No EMI (Piezo ceramics)
 - > 85% High efficiency
 - Inflammability (no liability)
 - Wide range no flicker dimming
 - One size fits all
 - Constant current mode
 - Wide operating temperature -40 to +85
 - Independent open lamp protection
 - Independent short circuit protection
 - Balanced sine wave output, no harmonic current noise
 - Balanced sine wave output, ultra low harmonic current noise
 - Short start up time, extended CCFL lifespan
 - Open lamp and short circuit protection
 - Built-in Arc Protection
 - 100% full load test
 - Compact Size, high reliability
 - Low heat generation
 - UL approval E304655
 - RoHS compliant with Piezo ceramic exemption
- *Spec subject to models

2. Detailed specification:

2.1 Electrical characteristics (Ta=25±5)

| | ITEM | | TEST | Min. | Typ. | Max. | Unit | Notes |
|----|-----------------------------|------------------------------|--|------|-------|------|--------------------|---|
| 1 | Input voltage | Vin | - | 10.8 | 12 | 13.2 | v | |
| 2 | Input current | Min | D _{PWM} =0% & V _{IPWM} =5V | - | 0.1 | - | A | |
| | | Max | D _{PWM} =100% & V _{IPWM} =0V | - | 0.44 | - | | |
| 3 | Input Inrush Current | - | D _{PWM} =100% & V _{IPWM} =0V | - | - | 2 | A _{peak} | Initial power on only. |
| 4 | Output Inrush Current | - | D _{PWM} =50% | - | - | 11 | mA _{peak} | |
| 5 | Total Output Current | I _{out} | D _{PWM} =100% & V _{IPWM} =0V | 5.5 | 6.0 | 6.5 | mA | |
| 6 | Individual Output Current | Min | D _{PWM} =0% & V _{IPWM} =5V | ≥ 0 | ≤ 0.5 | ≤ 1 | mA | Low volt side of LOAD |
| | | Max | D _{PWM} =100% & V _{IPWM} =0V | 5.5 | 6.0 | 6.5 | | |
| 7 | Oscillating Frequency | F _w | - | 50 | 53 | 60 | KHz | |
| 8 | Minimum Duty Ratio | D _{min} | D _{PWM} =D _{min} | - | - | - | % | |
| 9 | On/Off Control Voltage | On | - | 1.8 | - | 5 | v | |
| | | Off | - | 0 | - | 1.7 | v | |
| 10 | On/Off Control Current | I _{B_{LON}} | - | 5 | - | 10 | mA | |
| 11 | Internal DC Control Voltage | Min | - | - | 5 | - | v | Duty Ratio ≤ 1% |
| | | Max | - | - | 0 | - | v | Duty Ratio=100% |
| 12 | Internal DC Control Current | I _{IPWM} | - | - | 5 | - | mA | |
| 13 | Open Lamp Voltage | V _s | Ta=-20 | TBD | - | 3500 | V _{rms} | Under B/L condition |
| | | | Ta=0 | 2820 | - | 3500 | | |
| | | | Ta=25 | 2090 | - | 4000 | | |
| 14 | Lamp Voltage | V _w | - | 700 | 750 | 800 | V _{rms} | *120KΩ load |
| 15 | DC Bias Level | I _{DC} | - | - | - | 10 | % | I _{peak} - I _{-peak} /I _L |

Note: Lamp voltages are measured with a simulated resistive load. Piezo inverter will automatically adjust output voltage to compensate for load changes caused by lamp manufacturing tolerance, ambient temperature, lamp aging and etc.

2.2 Environmental Characteristic:

| | | | |
|-----------------------|------------|------------------------|-----------|
| Storage Temperature | : -40 ~+85 | Operating Temperature: | -40 ~+85 |
| Storage Humidity | : 90% Max | Operating Humidity | : 90% Max |
| (RH Non-condensation) | | | |

2.3 Protection Mechanism:

| Condition | Test Method | Protection | NOTE |
|--------------|--------------------|------------|-----------------------------|
| Over Voltage | Open Lamp | Shutdown | 0.1S<T _{fault} <2S |
| Over Current | Input Shutter | Shutdown | |
| Output Short | Output Shutter: 2K | Shutdown | |
| Arcing | Transformer Open | Shutdown | |

3.Application Notes:

- 3.1 Always connect output loading before turning on the unit to avoid damages.
- 3.2 Avoid over stressing the high voltage output connector by using short wire.
- 3.3 Avoid bending, twisting or applying any pressure to the PCB and Piezo transformer.

4. Typical Application:

LCD-TV, LCD-Monitor CCFL backlight

4.1 Input connector pin assignment:



Input: CN1 [MOLEX 53261-0690]

| Pin | Signal name | Function |
|------|-------------|---|
| 1, 2 | VIN | +12V |
| 3 | VADJ | 0 to +5V voltage level or 100-1000Hz 0 to +5V PWM |
| 4 | ON/OFF | +5V / 0V |
| 5, 6 | GND | Ground |

Voltage level dimming: 0V Brightest, +5V Dark

4.2 Output connector pin assignment:

Output: CN2 [JST SM02B-BHSS-1-TB]

| Pin | Signal name | Function |
|-----|-------------|------------------|
| 1 | CFL HOT | CFL High voltage |
| 2 | CFL COLD | CFL Low Voltage |

*Wrong connections will cause electric shock and also break down of the product.

5. Reliability

5.1 Production tests

| | Test item | Test condition | Criteria |
|---|----------------------|--|---|
| 1 | Low temp. Operation | Ta=-40 500 hr. | Measurement must be performed 1 hr. after taken out from the chamber. Must meet initial performance except CCFL deterioration. |
| 2 | High temp. Operation | Ta=+85 500 hr. | |
| 3 | High temp & Humidity | Ta=50 , 80%RH, 1000 hr. | |
| 4 | Low temp. Storage | Ta=-40 , 240hr. Non operation | Measurement must be performed 4 hr. after taking out from the chamber. Must meet initial performance except CCFL deterioration. |
| 5 | High temp. Storage | Ta=+85 , 240hr. Non operation | |
| 6 | Thermal shock | Ta=-20 , 30min.<->+60 , 30min. 200 cycles, non operation, Transition duration less than 3 min. | Measurement must be performed 4 hr. after taking out from the chamber. Must meet initial performance except CCFL deterioration. |
| 7 | On-Off Cycle | Ta=25 ± 3 500 hr., 10[s] ON, 10[s] OFF 100,000 cycles | Must meet Initial performance except CCFL deterioration. |
| 8 | Shock | 100G 11mSec. Half-sine pulse 1time each axis X, Y, Z, | No noticeable changes allowed |
| 9 | Vibration | 10-57Hz, Amplitude 0.75mm, 57~500Hz 2G Sweep: 11 min.,60 min. each axis X, Y, Z, | No noticeable changes allowed |

6. Safety requirements

6.1 Applicable safety standards

- UL 60950-1:2003
- CSA C22.2 NO.60950-1-03
- IEC60950-1:2001
- EN 60950-11:2001

6.2 Abnormal tests

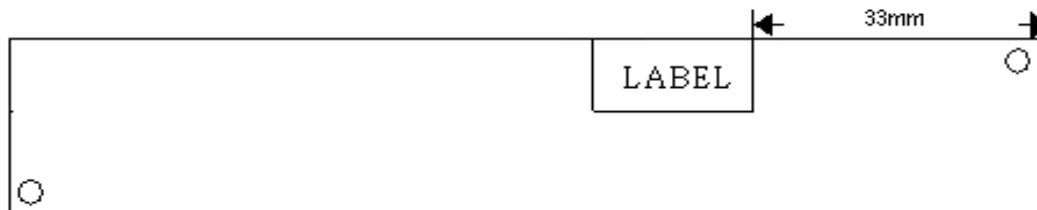
There must be no smell, smoke and fire cause by any failure on the inverter circuit. All components open/short test must be performed and reported. Especially, should not rely on a fuse or an over load protection function of the power supply.

6.3 Limited current circuit

The inverter conforms to IEC60950 limited current circuit spec and is UL approved with file number: E304655.

7. Additional notes:

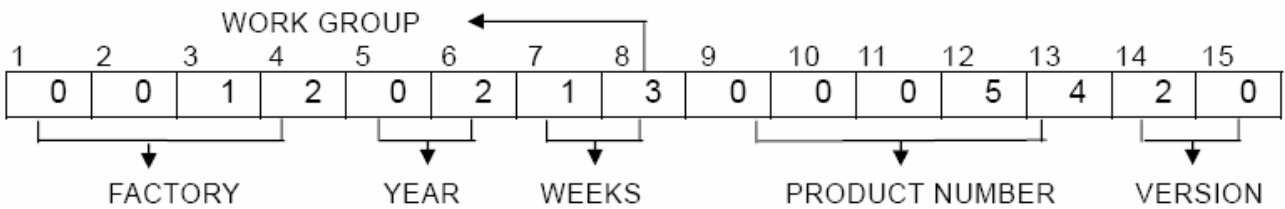
7.1 Label position (Reverse side of PCB)



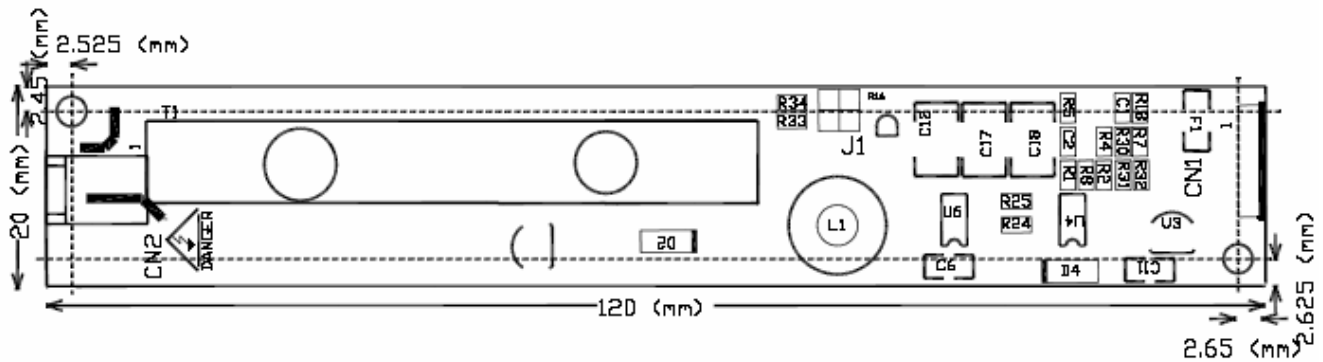
Label: Includes model, part number and data code.

| |
|-----------|
| Model |
| Part No |
| Data code |

7.2 Data code (example):



8. PCB layout:



NOTES:

1. PCB Board general tolerance: $\pm 0.1\text{mm}$
2. Hole tolerance: $\pm 0.1\text{mm}$
3. Base board thickness: 1.0mm
4. Material: FR-4
5. Thru hole: 3.0mm

Appendix

Zippy Piezo Inverter lamp current jumper

