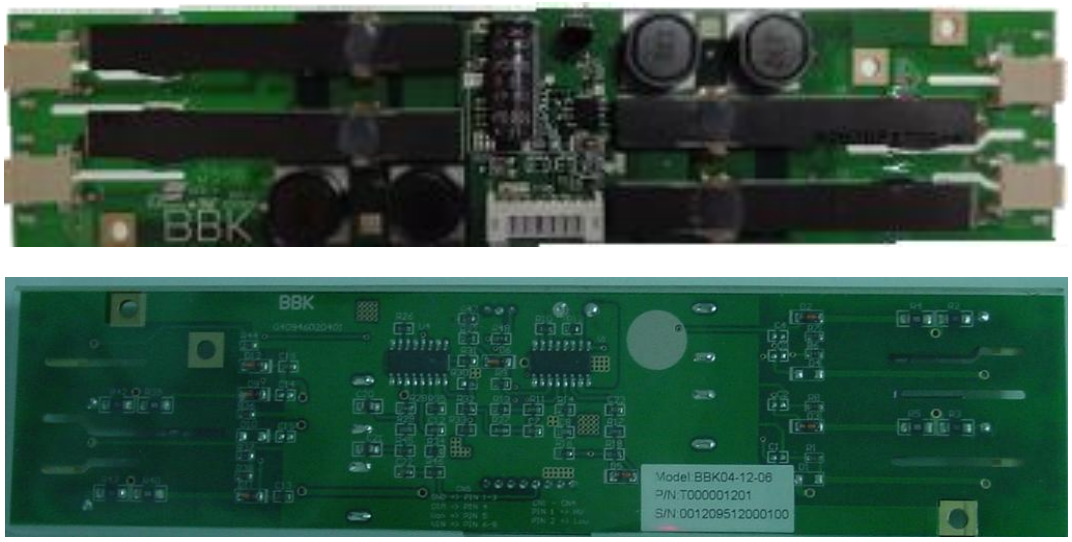
BBK Technology Corp.

Piezo Ceramics DC-AC Inverter

Specification



Note: Actual product image may be different.

Model	BBK04-12-06
Part No.	T0-475A0
Description	4 lamps with wide range dimming control
Customer	
Hardware Rev	1.0
Document Rev	1.0

Approved by	Verified by	Prepared by
Bart	Bart	Catherine

Revision Record

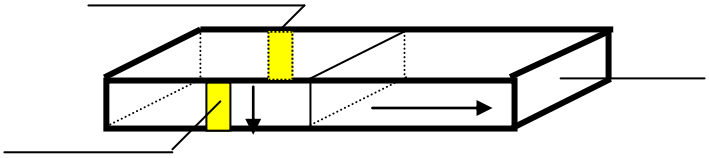
Request Document No.	Date	Page	Item	Description	Revision
TCTT12092201	22/12/2009				1.0

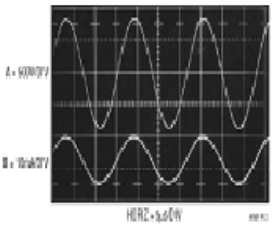
1. General:

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
- 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	Iin	D_{PWM}=20% & V_{IPWM}5V	-	0.1	-	A	
		Max		D_{PWM}=100% & V_{IPWM}=0V	-	2.65	-		
3	Input Inrush Current		-	D_{PWM}=100% & V_{IPWM}=0V	-	-	5	Apeak	Initial power on only.
4	Output Inrush Current		-	D_{PWM}=50%	-	-	10	mApeak	
5	Total Output Current		Iout	D_{PWM}=100% & V_{IPWM}=0V	20	24	28	mA	
6	Individual Output Current	Min	I_L	D_{PWM}=20% & V_{IPWM}=5V	≧2.1	≦2.6	≦3.1	mA	Low volt side of LOAD
		Max		D_{PWM}=100% & V_{IPWM}=0V	70.	7.5	8.0		
7	Oscillating Frequency		Fw	-	50	53	60	KHz	
8	Minimum Duty Ratio		Dmin	D_{PWM}=D_{min}	-	-	-	%	
9	On/Off Control Voltage	On	V_{BLON}	-	2.6	-	5	V	
		Off		-	0	-	2.5	V	
10	On/Off Control Current		I_{BLON}	-	5	-	10	mA	
11	Internal DC Control Voltage	Min	V_{IPWM}	-	-	5	-	V	Duty Ratio ≤ 1%
		Max		-	-	0	-	V	Duty Ratio=100%
12	Internal DC Control Current		I_{IPWM}	-	-	5	-	mA	
13	Open Lamp Voltage		Vs	Ta=-20℃	TBD	-	3500	Vrms	Under B/L condition
				Ta=0℃	2820	-	3500		
				Ta=25℃	2090	-	3500		
14	Lamp Voltage		Vw	-	650	750	800	Vrms	*120KΩ load
15	DC Bias Level		I_{DC}	-	-	-	10	%	$\lvert I_{peak} - I_{-peak}\rvert / I_L$

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: -20℃～+85℃
Storage Humidity : 90% Max. Operating Humidity : 90% Max
(Non-condensation)

2.3 Protection Mechanism:

Condition	Test Method	Protection	NOTE
Over Voltage	All Open Lamp	Shutdown	$0.1S<T_{fault}<2S$
Over Current	Input Shutter	Shutdown	
Output Short	Output Shutter: 2K	LowVoltage (30V~50v)	
Arcing	Transformer Open	Shutdown	

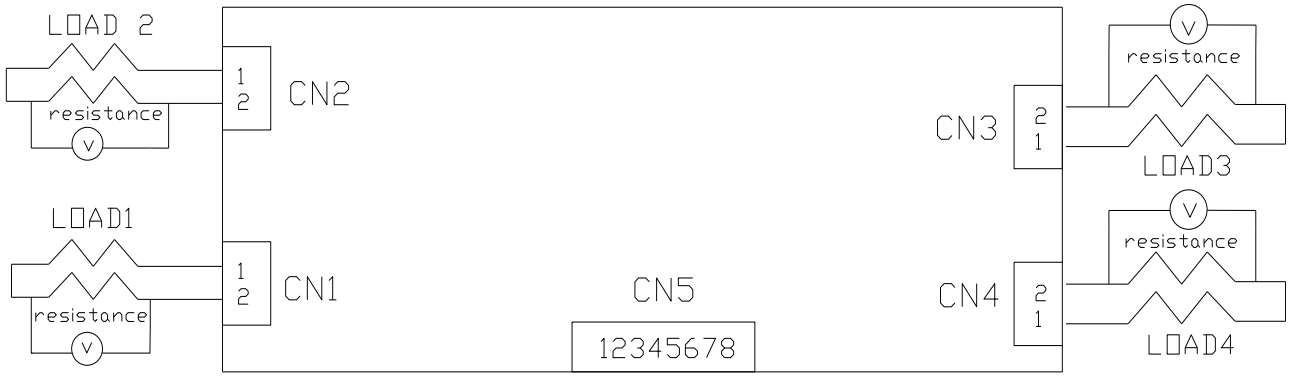
3. Application Notes:

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: CN5 [JST S8B-PH-KL]

Pin	Signal name	Function
1,2,3	GND	GND
4	VADJ	0 to +5V voltage level
5	ON/OFF	+5V/0V
6,7,8	VIN	+12V

Voltage level dimming: 0V Brightest, +5.0V Dark

4.2 Output connector pin assignment:

Output: CN1,CN2,CN3,CN4 [YEONHO35001HS021L]

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=-20℃ 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.	
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	50G 11mSec. Half-sinusoidal waveform X, Y, Z, 6 directions	No noticeable changes allowed
9	Vibration	10-55Hz, 10 min. 1.0G X, Y, Z 3 directions, 1 time	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 60950-1:2001

6.2 Abnormal tests

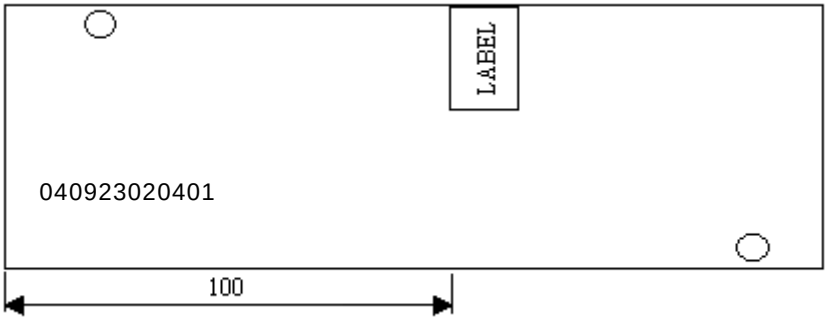
There must be no smell, smoke and fire cause by any failure on the inverter circuit. All components open/short test must be performed and reported. Especially, should not rely on a fuse or an over load protection function of the power supply.

6.3 Limited current circuit

The inverter conforms to IEC60950 limited current circuit spec and is UL

7. Additional notes:

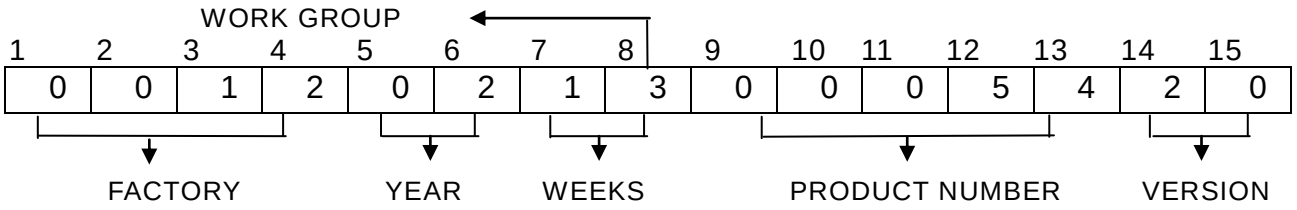
7.1 Label position (Reverse side of PCB)



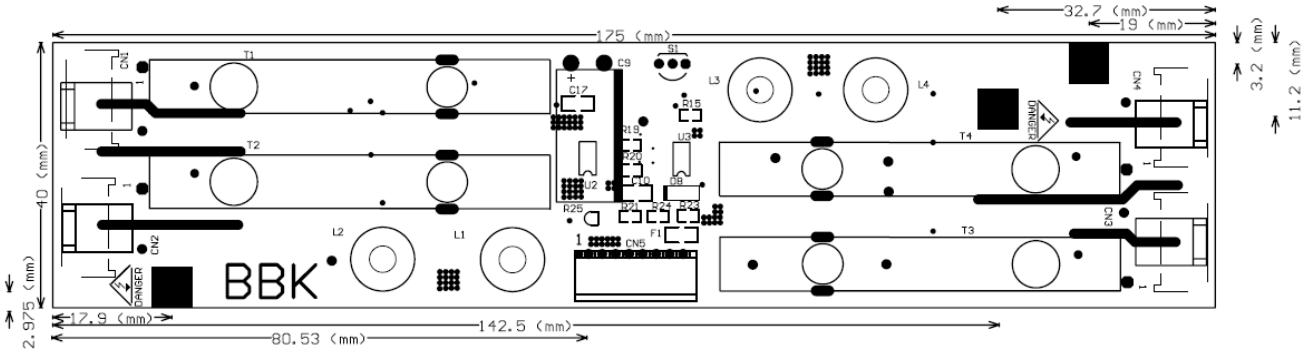
Label: Includes model, part number and data code.

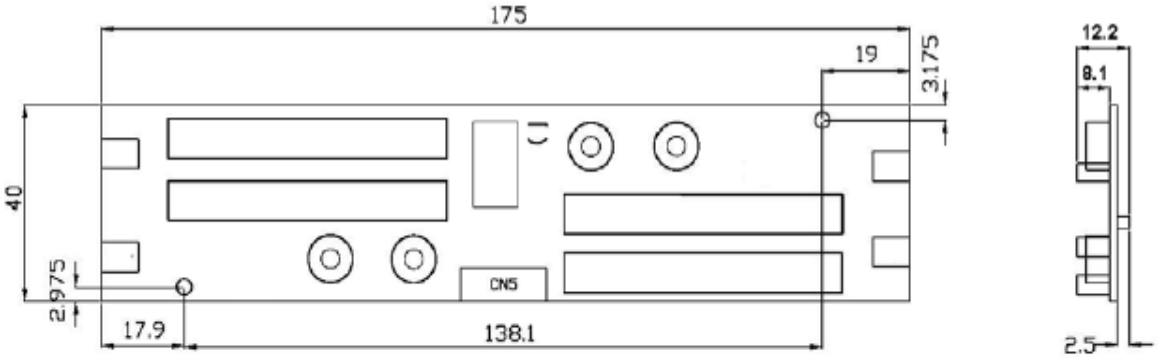
Model Part No Data code

7.2 Data code (example):



8. PCB layout:





NOTES:

1. PCB Board general tolerance: ± 0.1mm
2. Hole tolerance: ± 0.1mm
3. Base board thickness: 1.6mm
4. Material: FR-4
5. Thru hole: 3.2mm

9. BOM

項次	料號	零件位置	品名規格
1	D200000001	U4	IC TL494BDR2G SO16
2	D200000005	U3	IC IR2302SPBF SOCI-8
3	D200010006	U2	MOS AP4228G SO-8
4	D200000001	U1	IC TL494BDR2G SO16
5	4213200911	T4	PZT 53.6K707120L
6	4213200911	T3	PZT 53.6K707120L
7	4213200911	T2	PZT 53.6K707120L
8	4213200911	T1	PZT 53.6K707120L
9	D200070001	S1	SCR LT S08M02-600A
10	D200113034	R9	C/R SMD 0603 4.7K 5%
11	D200113030	R8	C/R SMD 0603 3.3K5%
12	D200113030	R7	C/R SMD 0603 3.3K5%
13	D200113018	R6	C/R SMD 0603 180Ω 5%
14	D200111012	R5	C/R SMD 1206 1M 1%
15	D200113018	R48	C/R SMD 0603 180Ω 5%
16	D200113033	R47	C/R SMD 0603 3.3K 1%
17	D200113034	R46	C/R SMD 0603 4.7K 5%
18	D200113034	R45	C/R SMD 0603 4.7K 5%
19	D200113020	R44	C/R SMD 0603 220Ω 1%
20	D200111013	R43	C/R SMD 1206 5.6M 5%
21	D200111013	R42	C/R SMD 1206 5.6M 5%
22	D200111012	R40	C/R SMD 1206 1M 1%
23	D200111012	R4	C/R SMD 1206 1M 1%
24	D200111012	R39	C/R SMD 1206 1M 1%
25	D200113030	R38	C/R SMD 0603 3.3K 5%
26	D200113020	R37	C/R SMD 0603 220Ω 1%
27	D200113030	R36	C/R SMD 0603 3.3K 5%
28	D200113051	R35	C/R SMD 0603 100K 1%
29	D200113072	R34	C/R SMD 0603 1M 5%
30	D200113034	R33	C/R SMD 0603 4.7K 5%

31	D200113001	R32	C/R SMD 0603 0Ω 5%
32	D200113001	R31	C/R SMD 0603 0Ω 5%
33	D200113001	R30	C/R SMD 0603 0Ω 5%
34	D200111013	R3	C/R SMD 1206 5.6M 5%
35	D200113096	R29	C/R SMD 0603 27K 1%
36	D200113302	R28	C/R SMD 0603 30Ω K 5%
37	D200113103	R27	C/R SMD 0603 10K 5%
38	D200113049	R26	C/R SMD 0603 51K 1%
39	D200140001	R25	VR SMD 3mm 2K BOURNS
40	D200113103	R24	C/R SMD 0603 10K 5%
41		R23	C/R SMD 0603 10K 5%(no mont)
42	D200113033	R22	C/R SMD 0603 3.3K 1%
43	D200113065	R21	C/R SMD 0603 470K 5%
44	D200113004	R20	C/R SMD 0603 18Ω 1%
45	D200111013	R2	C/R SMD 1206 5.6M 5%
46	D200113004	R19	C/R SMD 0603 18Ω 1%
47	D200113033	R18	C/R SMD 0603 3.3K 1%
48	D200113082	R17	C/R SMD 0603 15K 1%
49	D200113065	R16	C/R SMD 0603 470K 5%
50	D200113034	R15	C/R SMD 0603 4.7K 5%
51	D200113072	R14	C/R SMD 0603 1M 5%
52	D200113003	R13	C/R SMD 0603 16.2Ω 1%
53	D200113034	R12	C/R SMD 0603 4.7K 5%
54	D200113098	R11	C/R SMD 0603 4.22K 1%
55	D200113049	R10	C/R SMD 0603 51K 1%
56	D200113020	R1	C/R SMD 0603 220Ω 1%
57	D200400002	L4	13uH,125
58	D200400002	L3	13uH,125
59	D200400002	L2	13uH,125
60	D200400002	L1	13uH,125
61	D210100001	F1	CHIP FUSE 1206 SMD 3.15A/32V
62	D200020001	D9	Diode LL4148 SMD
63	D200020001	D8	Diode LL4148 SMD
64	D200020001	D6	Diode LL4148 SMD
65	D200020001	D5	Diode LL4148 SMD
66	D200020001	D4	1N4148(no mont)
67	D200020001	D3	Diode LL4148 SMD
68	D200020001	D2	Diode LL4148 SMD
69	D200020001	D12	Diode LL4148 SMD

70	D200020001	D11	Diode LL4148 SMD
71	D200020001	D10	1N4148(no mont)
72	D200020001	D1	1N4148(no mont)
73	D200341501	CN5	CON.DIP 2.0mm-8P 90°
74	D200341301	CN4	CON.SMD 3.5mm-2P
75	D200341301	CN3	CON.SMD 3.5mm-2P
76	D200341301	CN2	CON.SMD 3.5mm-2P
77	D200341301	CN1	CON.SMD 3.5mm-2P
78	D200233002	C9	E/C 680UF/16V (8 § x16)
79	D200203003	C8	S/C SMD 0603 NPO 561/50V 2%
80	D200203001	C7	S/C SMD 0603 Y5V 104/50V
81		C4	390pf,2%(no mont)
82		C3	104/50V(no mont)
83	D200203001	C23	S/C SMD 0603 Y5V 104/50V
84	D200203001	C22	S/C SMD 0603 Y5V 104/50V
85	D200202001	C21	S/C SMD 0805 Y5V 106/10V
86	D200202001	C20	S/C SMD 0805 Y5V 106/10V
87		C2	104/50V(no mont)
88	D200203001	C19	S/C SMD 0603 Y5V 104/50V
89	D200203001	C17	S/C SMD 0603 Y5V 104/50V
90		C15	104/50V(no mont)
91		C14	2.2nF(no mont)
92	D200203005	C13	S/C SMD 0603 Y5V 390/50V
93	D200203001	C12	S/C SMD 0603 Y5V 104/50V
94	D200203001	C10	S/C SMD 0805 Y5V 106/10V
95		C1	104/50V(no mont)
103	D700060302		雙面背膠 圓 8mm×0.75mm
102	D700060301		雙面背膠 圓 5mm×厚度 0.75mm
101	D700060208		蜂巢隔板(中) 9 刀
100	D700060207		蜂巢隔板(中) 14 刀
98	D700020002		序號貼紙
99	D700060102		外箱(高)
104	D700060501		天地板 356×336mm 3 層板
96	D210090002		PCB INVERTER 1 TO 4
97	D300000001		103-MB 鍍金>3um A 模

10. **CIRCUIT SCHEMATIC**