



# AN2001 Application note

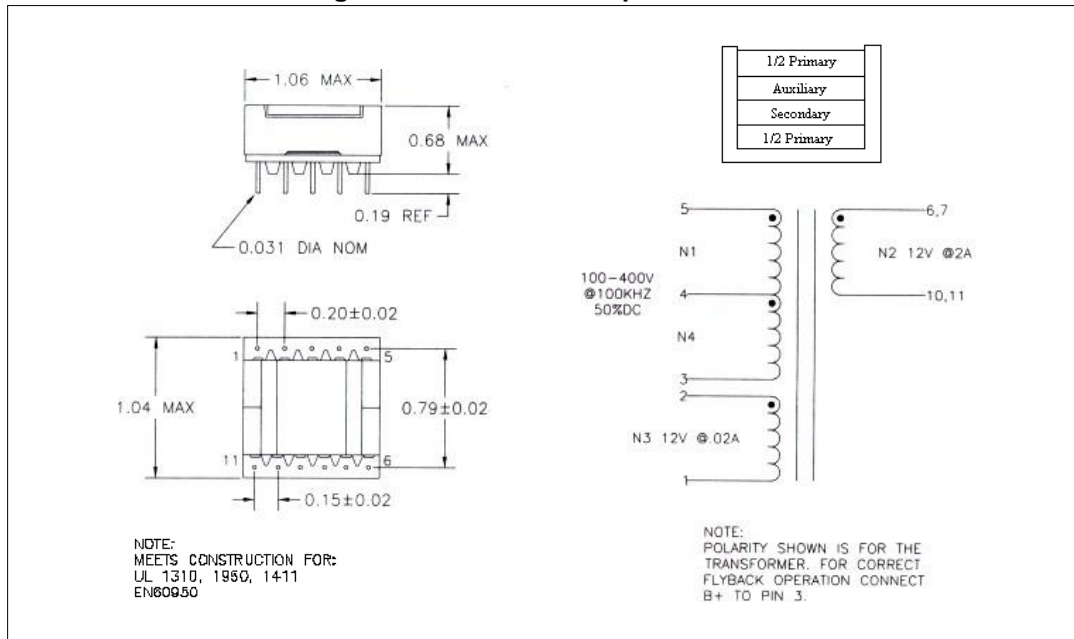
## VIPower™: the VIPer53-E single output reference board with 90 to 264 Vac input, 24 W output

Table 1. Operating conditions

Parameter	Limits
Input voltage range	From 90 to 264 Vac
Input frequency	100 kHz
Output voltage	V = 12 V
Output power	24 W
Efficiency	75% typical
Line regulation	+/- 0
Load regulation	+/- 0.2%
Output ripple voltage	15 mVpp
EMI	EN55022 Class B

Transformer specifications

Figure 11. Transformer specifications



The transformer is designed and manufactured by Cramer Coil and Transformer Co., Inc. Below the electrical specifications of the transformer:

- Primary inductance 1.10 mH±10%

- Primary leakage inductance 6.4  $\mu$ H typical
- HIPOT (N1, N3, N4 to N2) 4000 Vac, 1 second
- DCR (N1/N4) 0.905  $\Omega$  typical
- DCR (N2) 0.020  $\Omega$  typical
- DCR (N3) 0.112  $\Omega$  typical
- Turn ratio (N1/N4:N2) 1:0.121 $\pm$ 3%
- Turn ratio (N1/N4:N3) 1:0.121 $\pm$ 3%

When the VIPer53-E is on, the energy is stored in the primary winding of the transformer (pins from 3 to 5). This energy is transferred to the auxiliary winding (pins 1 and 2), and to the output (6, from 7 to 10, 11) when the VIPer53-E is off. The auxiliary winding provides the bias voltage for the VIPer53-E on pin 7 ( $V_{DD}$ ).

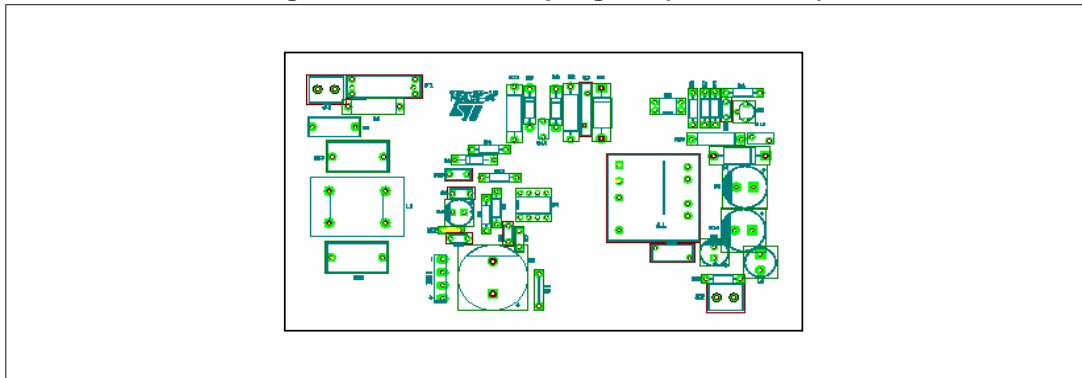
## Different output current and voltage capability

The standard voltage and current values for the reference board can be changed to deliver a different voltage and current value, as shown in [Table 1](#).

**Table 2. Secondary component value to obtain different output voltage and current**

$V_{OUT}$ and $I_{OUT}$	T1	R6	R9	C8, C16	D4
5.0 V 4.8 A	CVP53-003	2.49 k $\Omega$ 1%	2.49 k $\Omega$ 1%	3300 $\mu$ F 10 V	STPS1045
12 V 2.0 A	CVP53-001	3.48 k $\Omega$ 1%	13.3 k $\Omega$ 1%	1000 $\mu$ F 25 V	BYW98-200
15 V 1.6 A	CVP53-004	2.94 k $\Omega$ 1%	14.7 k $\Omega$ 1%	1000 $\mu$ F 35 V	BYW98-200
24 V 1.0 A	CVP53-005	1.50 k $\Omega$ 1%	13.0 k $\Omega$ 1%	470 $\mu$ F 50 V	BYW98-200

**Figure 12. PC board top legend (not in scale)**



**Figure 13. PC board bottom copper (not in scale)**

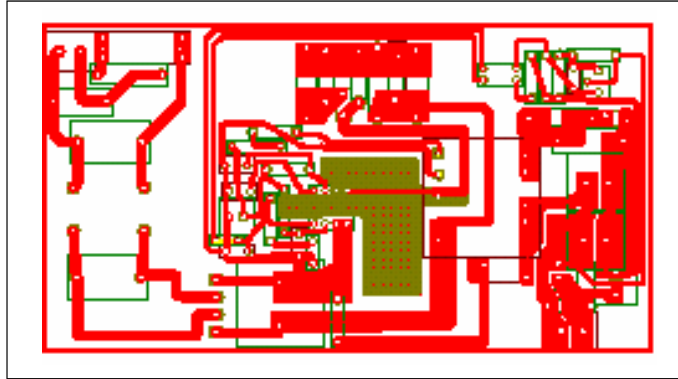


Table 3. Component list

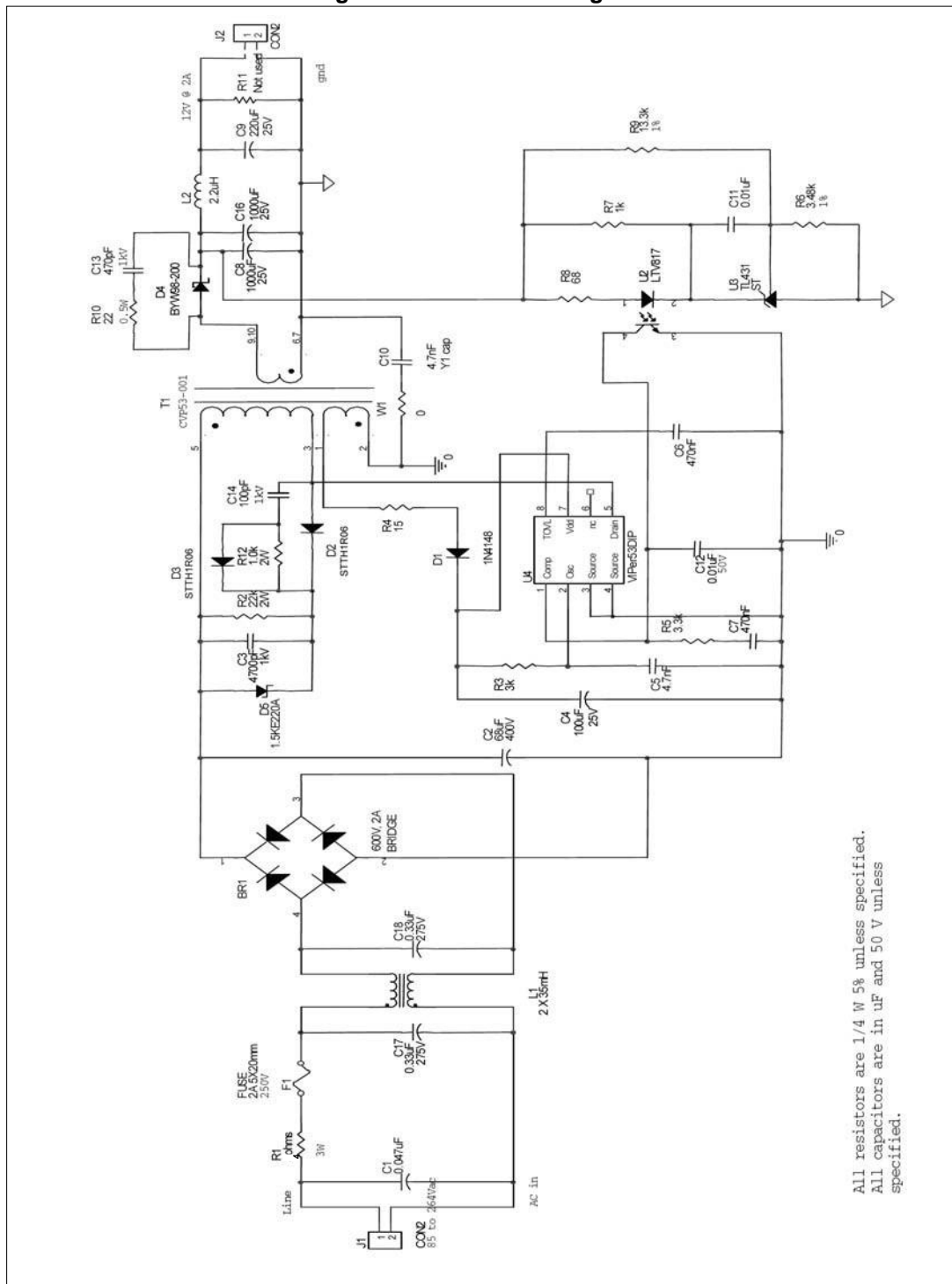
Quantity	Reference	Description
1	BR1	KBP210GDI bridge rectifier
1	C1	0.047 $\mu$ F 250 V
1	C2	68 $\mu$ F/400 V electrolytic
1	C3	4700 pF 1 k V ceramic
1	C4	100 $\mu$ F/25 V electrolytic
1	C5	4.7 nF 50 V polyester
2	C6, C7	470 nF 50 V ceramic
2	C8, C16	1000 $\mu$ F/25 V electrolytic
1	C9	220 $\mu$ F/25 V electrolytic
1	C10	4.7 nF/250 V Y1 cap
2	C11, C12	0.01 $\mu$ F 50 V ceramic
1	C13	470 pF/1 k V ceramic
1	C14	100 pF/1 k V ceramic
1	C15	Not used
2	C17, C18	0.33 $\mu$ F/250 V
1	L1	Panasonic 35 mH common-mode line choke
1	L2	Coilcraft 2.2 $\mu$ H inductor
1	T1	Cramer Coil CVP53-001
1	R1	4 $\Omega$ 5% 3 W wire wound
1	R2	22 k $\Omega$ 5% 2 W resistor
1	R3	3 k $\Omega$ 5% 0.5 W resistor
1	R4	15 $\Omega$ 5% 0.25 W resistor
1	R5	3.3 k $\Omega$ 5% 0.25 W resistor
1	R6	3.48 k $\Omega$ 1% 0.25 W resistor
1	R7	1 k $\Omega$ 5% 0.25 W resistor
1	R8	68 $\Omega$ 5% 0.25 W resistor
1	R9	13.3 k $\Omega$ 1% 0.25 W resistor
1	R10	22 $\Omega$ 5% 0.5 W resistor

1	R12	1 k $\wedge$ 5% 2 W resistor
1	R13	Not used
1	D1	1N4148
2	D2, D3	STTH1R06
1	D4	BYW98-200
1	D5	1.5KE220A transil

Table 3. Component list (continued)

Quantity	Reference	Description
1	U2	H11A817A or LTV817A optocoupler
1	U3	TL431
1	U4	VIPer53DIP-E
2	W1, W2	Jumper wire
2	J1, J2	Connectors

Figure 14. Schematic diagram



All resistors are 1/4 W 5% unless specified.  
All capacitors are in uF and 50 V unless specified.



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## 2 Revision history

**Table 4. Revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
16-Jul-2004	1	First issue
12-Sep-2006	2	- New template - Component list value modified - Schematic diagram modified
12-Nov-2014	3	Updated title in cover page. Content reworked to improve readability, no technical changes.

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