Alimentatore stabilizzato con tensione di uscita variabile

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IT C. ZUCCANTE MESTRE

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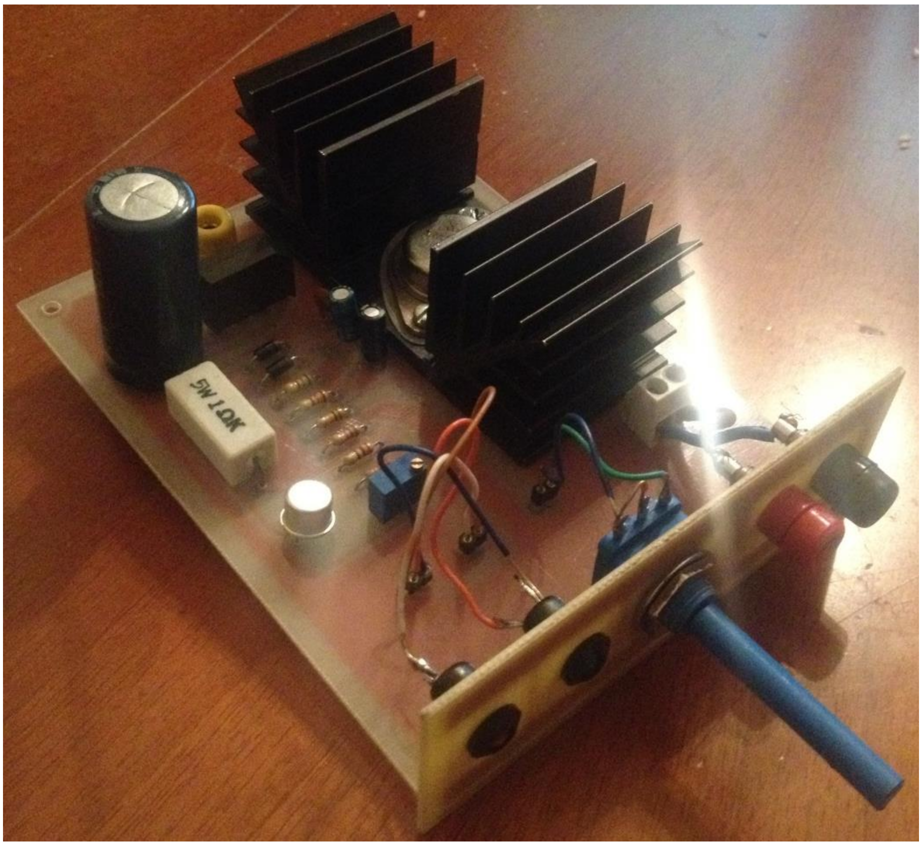
Sommario

Di seguito si illustra il progetto di un alimentatore stabilizzato.
che serve a trasformare una tensione alternata di 18V in una tensione continua variabile da 3V a 12V con 1A di corrente massima.
La tensione è regolata tramite un potenziometro ed un regolatore LM317K.
Il circuito contiene due led uno verde ed uno rosso, che segnalano rispettivamente la presenza di tensione e il raggiungimento della corrente massima fornibile.



Indice

Tavole

Introduzione

Lo scopo del progetto è di realizzare un circuito in grado di acquisire una tensione di 18V alternati e di fornire in uscita una tensione continua e aventi le seguenti specifiche:
Tensione continua variabile da 3V a 12V.
Corrente massima 1A

- Fattore di ripple massimo 5%
- Un led rosso che segnala che si è raggiunta la corrente massima
- Un led verde che segnala la presenza di tensione

Viene utilizzato un trasformatore esterno al circuito che trasforma la tensione di rete di 230V AC in 18V AC che verranno utilizzati dal circuito.
Un ponte di diodi KBL05 utilizzato come raddrizzatore trasforma le semionde negative in positive per ottenere la tensione continua.
Un condensatore da 4.7uF viene utilizzato come filtro che stabilizza il segnale.
Il led rosso segnala che si sta richiedendo la corrente massima.
Il Regolatore LM317K regola e stabilizza meglio la tensione da 3V a 12V al variare del valore del potenziometro.
Il led verde segnala la presenza di tensione.

1. Schema elettrico

Di seguito si mostra lo schema a blocchi del circuito:

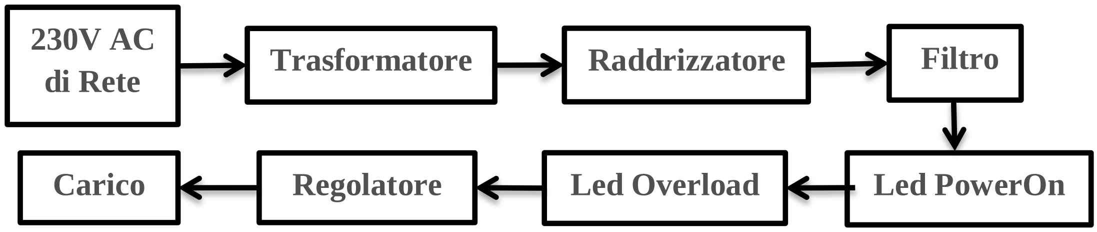
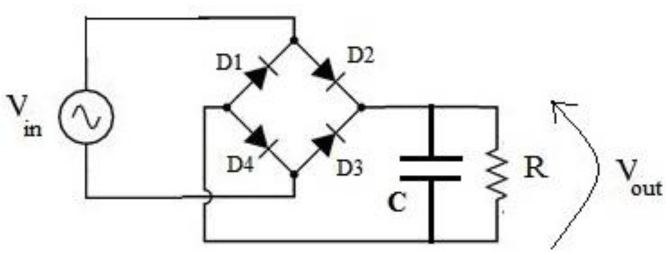


Figura 1

Nel circuito vero e proprio non sarà presente il trasformatore.

2. Raddrizzatore e filtro



Il ponte di diodi non fa altro che prendere in ingresso un segnale sinusoidale alternato e dare in uscita un segnale con le semionde negative trasformate in positive.
Infatti sia nella fase della semionda positiva che in quella negativa la corrente sul carico scorre nello stesso verso.
Grazie al condensatore si ottiene una forma d'onda simile al dente di sega semplificando i calcoli.

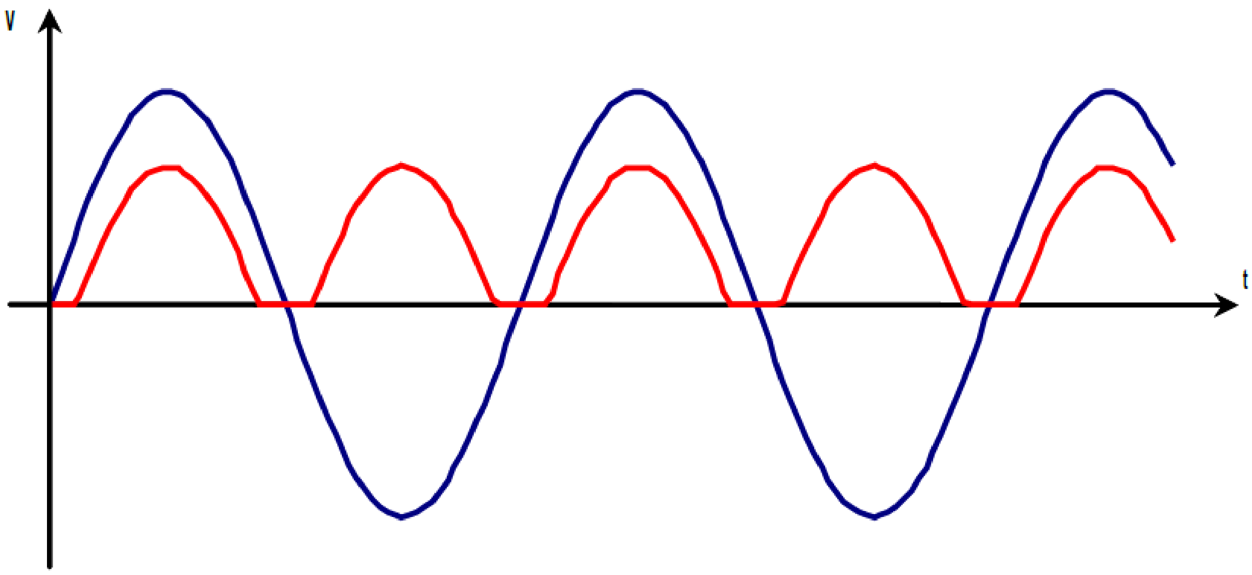


Figure 2

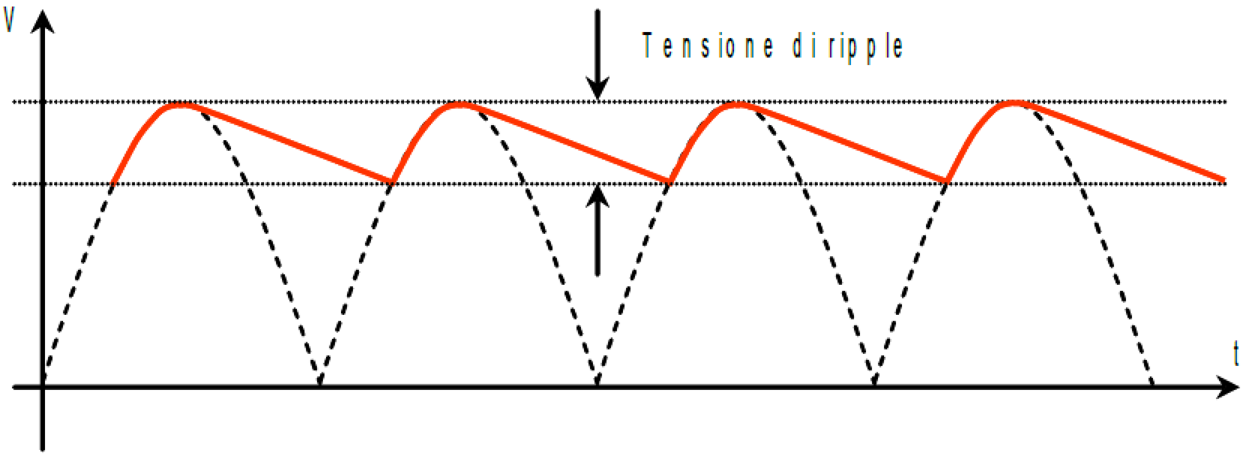


Figura 3

3. Segnalazione presenza di tensione (PowerOn)

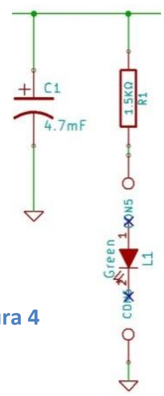


Figura 4

Per segnalare la presenza di tensione è stato posto un led, con opportuna resistenza, ai capi del condensatore. La caduta di tensione sul led verde è di 2.1V quindi il led si accenderà a circa questa tensione.

4. Segnalazione corrente max (Overload)

Se la corrente in entrata raggiunge il valore di quella massima il transistor entra in conduzione facendo accendere il led rosso. Quindi per alte correnti come quella richiesta(1 A) si dovrà utilizzare una resistenza (R2) da 5W.

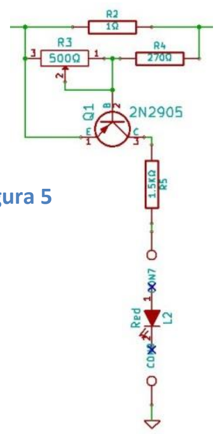


Figura 5

5. Regolatore di tensione e dissipatore

Il regolatore fornisce in uscita una tensione di forma d'onda idealmente lineare, regolabile tramite la variazione della resistenza del potenziometro. E stata usata la configurazione proposta dal datasheet, al posto di una resistenza normale tra ADJ e GND è stato usato un potenziometro, appunto per far regolare all'utilizzatore la tensione di uscita.

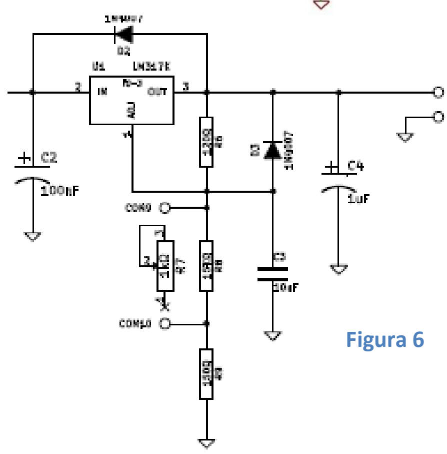


Figura 6

6. Dimensionamento dei componenti

6.1. Componenti elettrici

Condensatore:

$$C \geq \frac{I_O*T}{4*\sqrt{3}*r_{MAX}*V_O} \geq \frac{1*0.02}{4*\sqrt{3}*0.05*16.7} = 3.46uF \quad (6.1.1)$$

Pero si deve tenere conto dell'errore del 20% presente nella serie E6:

$$C_N \geq \frac{C}{1-e} \geq \frac{C3.46}{1-0.2} = 4.32uF \quad (6.1.2)$$

E' stato scelto un condensatore da 4.7uF.

Ponte di diodi:

La corrente media sui diodi:

$$I_{DM} = \frac{I_O}{2} = \frac{1}{2} = 0.5A \quad (6.1.3)$$

La tensione inversa:

$$V_{RRM} > V_O + V_F + \frac{I_O*T}{4*C} > 16.7 + 0.7 + \frac{1*0.02}{4*4.7uF} = 18.86V \quad (6.1.4)$$

E' stato scelto un ponte KBL005.

Segnalazione presenza di tensione:

$$R_{LEDV} = \frac{V_O - V_{LEDV}}{10mA} = \frac{16.7 - 2.1}{10mA} = 1460\Omega$$

E stata scelta una resistenza da 1.5kΩ.

Segnalazione Overload:

Led Rosso:

$$R_{LEDR} = \frac{V_O - V_{EC} - V_{LEDR}}{10mA} = \frac{16.7-0.2-1.7}{10mA} = 1480\Omega \quad (6.1.5)$$

E stata scelta una resistenza da 1.5kΩ.

Resistenze Overload

$$I_{RBOUT} = \frac{I_{IN}}{1+\alpha} = \frac{1}{1+500} = 1.99mA \quad (6.1.6)$$

$$R_{BOUT} = \frac{V_{RPOTMAX} - V_{EB}}{I_{RBOUT}} = \frac{1-0.6}{1.99mA} = 200.4\Omega \quad (6.1.7)$$

E' stata scelta 270Ω.

$$I_B > \frac{10mA}{H_{FE}} > \frac{10mA}{100} = 0.1mA \quad (6.1.8)$$

E' stata scelta 0.2mA.

$$I_{REB} = I_{RBOUT} + I_B = 1.99mA + 0.2mA = 2.19mA \quad (6.1.9)$$

$$R_{EB} = \frac{V_{EB}}{I_{REB}} = \frac{0.6}{2.19mA} = 273.22\Omega \quad (6.1.10)$$

E' stata scelta 500Ω.

Trasformatore:

$$V_{SO} > \frac{V_{OM}+2V_F}{\sqrt{2}} > \frac{16.7+1.4}{\sqrt{2}} = 14.11V \quad (6.1.11)$$

$$S = V_{SO} * 1.8I_O = 18 * 1.8 = 32.4VA \quad (6.1.12)$$

E' stata scelto un trasformatore da 18V 50VA.

Stabilizzatore:

Partendo dalla formula fornita dal datasheet:

$$V_O = V_{REF} * \left(1 + \frac{R_2}{R_1}\right) + (R_2 * I_{ADJ}) \quad (6.1.13)$$

$$R_1 = \frac{V_{REF}}{I_{OUTMIN}} = \frac{1.25}{10mA} = 125\Omega \quad (6.1.14)$$

E' stata scelta una resistenza da 120Ω.

$$R_2 = \frac{V_O - V_{REF}}{\frac{V_{REF}}{R_1} + I_{ADJ}} = \frac{12-1.25}{\frac{1.25}{120} + 100uA} = 1022\Omega \quad (6.1.15)$$

Però non è possibile trovare un potenziometro da 1022Ω.

Quindi è stata messa una resistenza in serie ed una in parallelo al potenziometro:

$$R_S \leq R_{MIN} = 150\Omega \quad (6.1.16)$$

$$R > R_2 - R_S = 872\Omega \quad (6.1.17)$$

$$R_P \geq \frac{(R_2 - R_S) * R}{R - (R_2 - R_S)} \text{ con } R_P > R = 6823\Omega \quad (6.1.18)$$

E' stata scelta una resistenza in parallelo di 15kΩ.

6.2. Analisi termica

Dissipatore:

$$P_{LM317} = (V_I - V_O) * I_O = (18.6 - 2.8) * 1 = 15.8W \quad (6.2.1)$$

$$\varphi_{SA} < \frac{T_{JMAX} - T_A}{P_{LM317}} - \varphi_{JC} - \varphi_{CS} < \frac{125-40}{15.8} - 2.3 - 0.6 = 2.4C°/W \quad (6.2.2)$$

7. Lista componenti

Lista dei componenti utilizzati per realizzare il progetto:

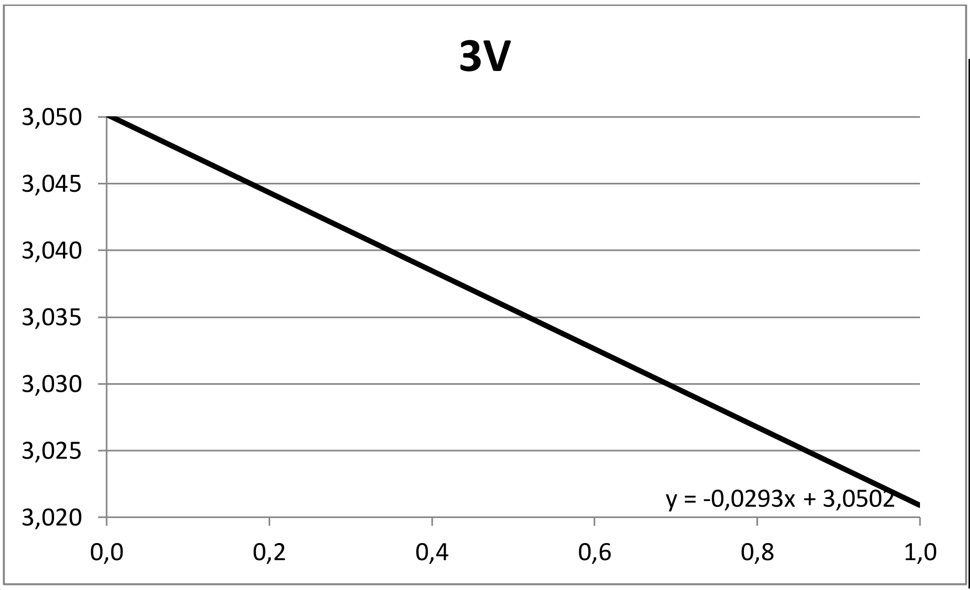
Materiale	sigla	Q/tà
Condensatore ceramico	100nF	1
Condensatore elettrolitico	1uF 25V	1
Condensatore elettrolitico	10uF 25v	1
Condensatore elettrolitico	4700uF 50V	1
Ponte a diodi	KL004	1
Diodo	1N4007	2
Led rosso	5mm	1
Led verde	5mm	1
Boccola gialla		2
Dissipatore TO-3	$\theta_{sa} \leq 2{,}4\ C°/W$	1
Regolatore di tensione	LM317K	1
Resistenza	1Ω 5W	1
Trimmer cermet multigiri	500Ω	1
Transistor pnp	2N2905	1
Morsettiera a due vie		1
Tulipano da 2		3
Porta led		2
Boccola rossa		1
Boccola nera		1
Potenziometro	1KΩ	1
Kit di isolamento		1

8. Caratteristica di uscita

Finito il progetto sono state effettuare delle misure di tensione al variare della richiesta di corrente per ricavare le caratteristiche di uscita e la resistenza del circuito.

8.1. Vmin

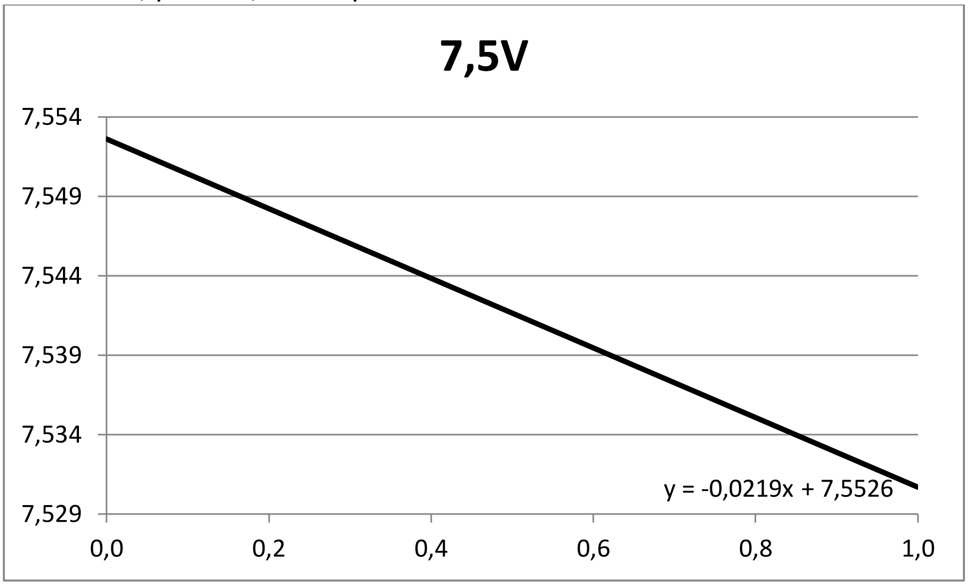
La prima serie di misure è stata effettuata impostando come tensione di uscita quella minima, ovvero 3V. Come si può vedere dalla tabella e dal grafico la tensione in uscita è abbastanza stabile, infatti si ha una caduta di soli 29mV chiedendo 1A.



I(A)	3(V)
0,0	3,049
0,1	3,047
0,2	3,045
0,3	3,042
0,4	3,039
0,5	3,036
0,6	3,032
0,7	3,030
0,8	3,027
0,9	3,024
1,0	3,020

8.2. Vm

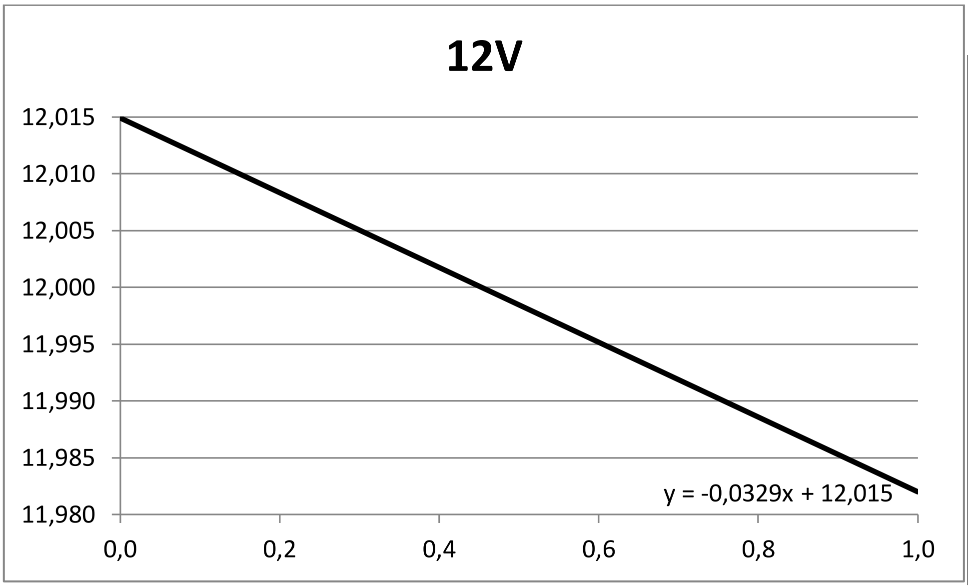
La seconda serie di misure è stata effettuata impostando come tensione di uscita una tensione intermedia, pari a 7,5V. In questo caso la caduta di tensione è di 22mV.



I(A)	7,5(V)
0,0	7,551
0,1	7,550
0,2	7,548
0,3	7,547
0,4	7,545
0,5	7,542
0,6	7,540
0,7	7,538
0,8	7,536
0,9	7,532
1,0	7,529

8.3. Vmax

L'ultima serie di misure è stata effettuata impostando la tensione di uscita alla tensione massima, pari a 12V. La caduta di tensione in questo caso è di 33mV.



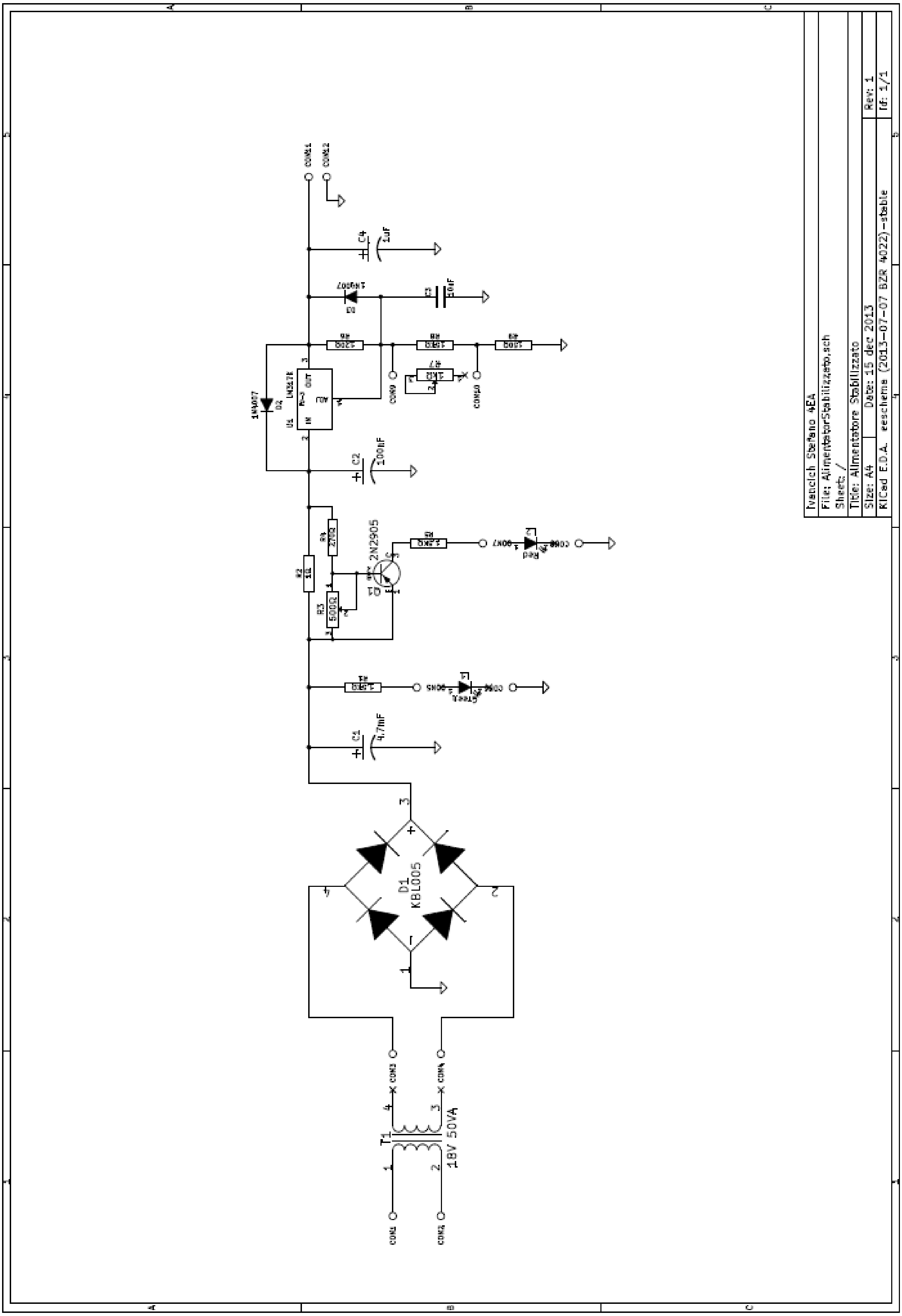
I(A)	12(V)
0,0	12,013
0,1	12,011
0,2	12,009
0,3	12,005
0,4	12,002
0,5	12,000
0,6	11,997
0,7	11,993
0,8	11,989
0,9	11,984
1,0	11,980

9. Conclusioni

Come si vede dai grafici il coefficiente angolare indica la resistenza del circuito, che è molto bassa, il valore oscilla tra i 21.9mΩ e 32.9mΩ.

Quindi nonostante molte scelte siano state condizionate dai componenti in possesso dal magazzino scolastico, l'alimentatore rispetta le specifiche di progetto.

Disegni tecnici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Date: 15 dec 2013
Rev: 1
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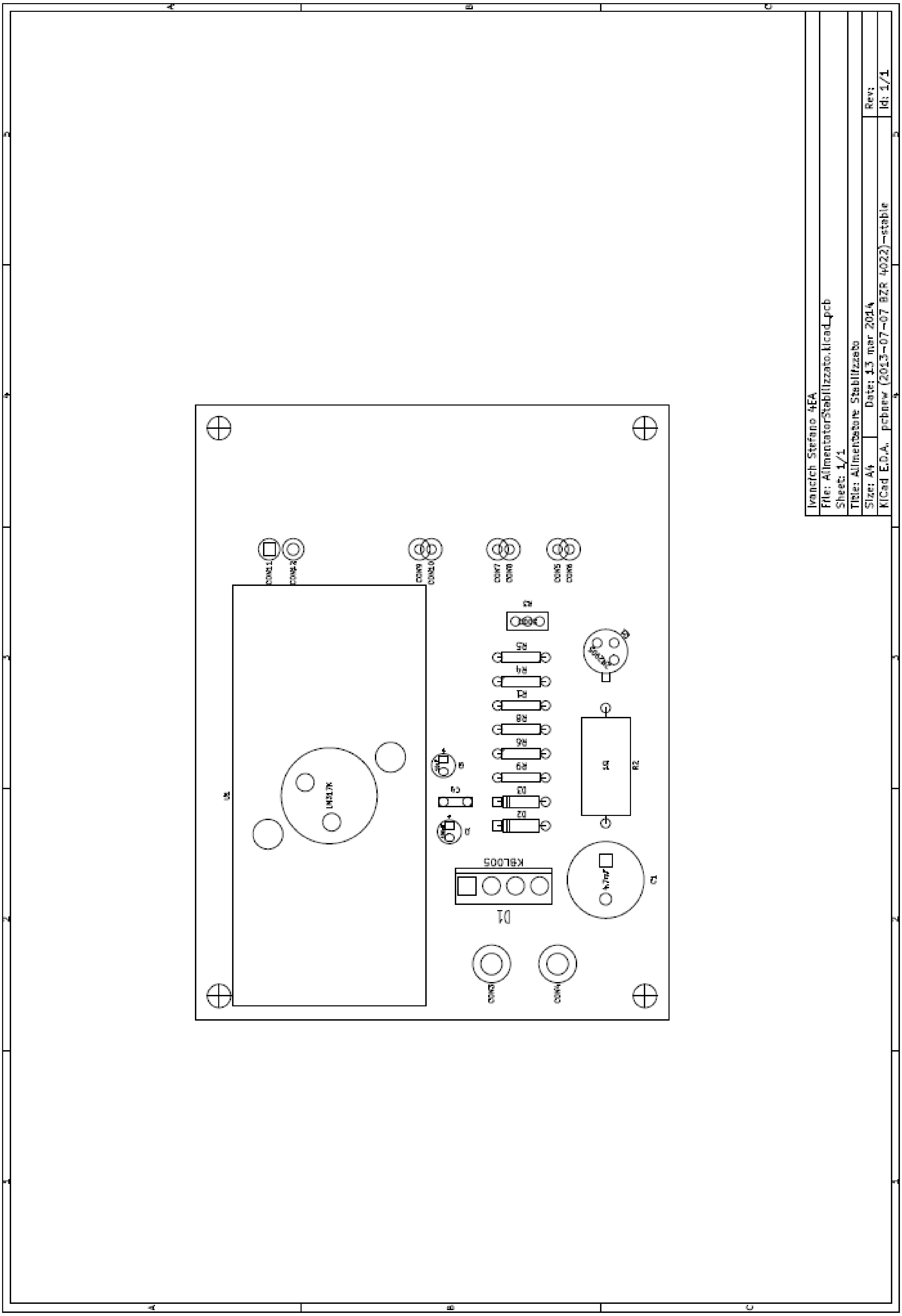
KBL005
T1
18V 50VA
2N2905
C1
4.7mF
C2
100nF
C4
1uF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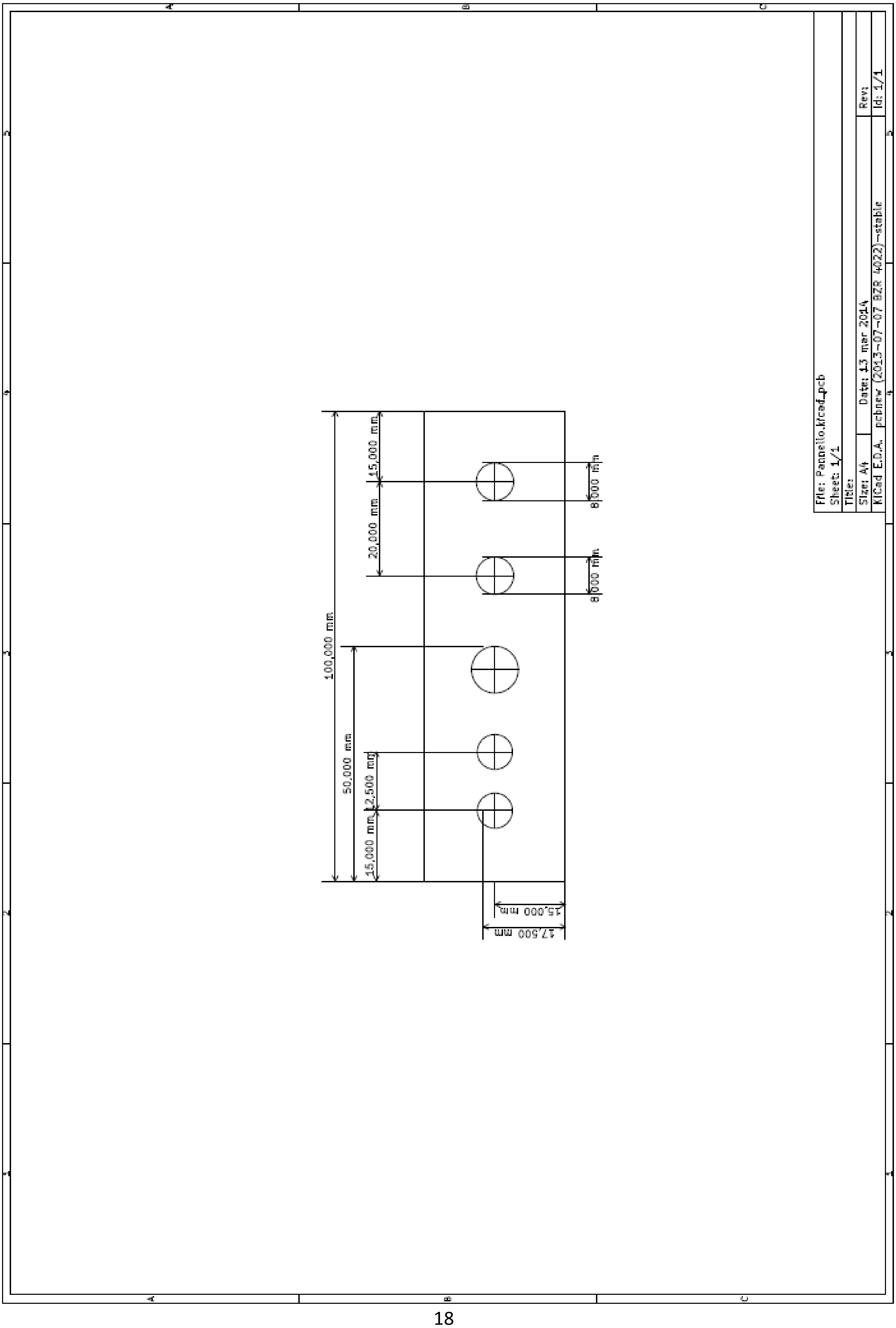
D1
LM317K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15,000 mm
12,500 mm
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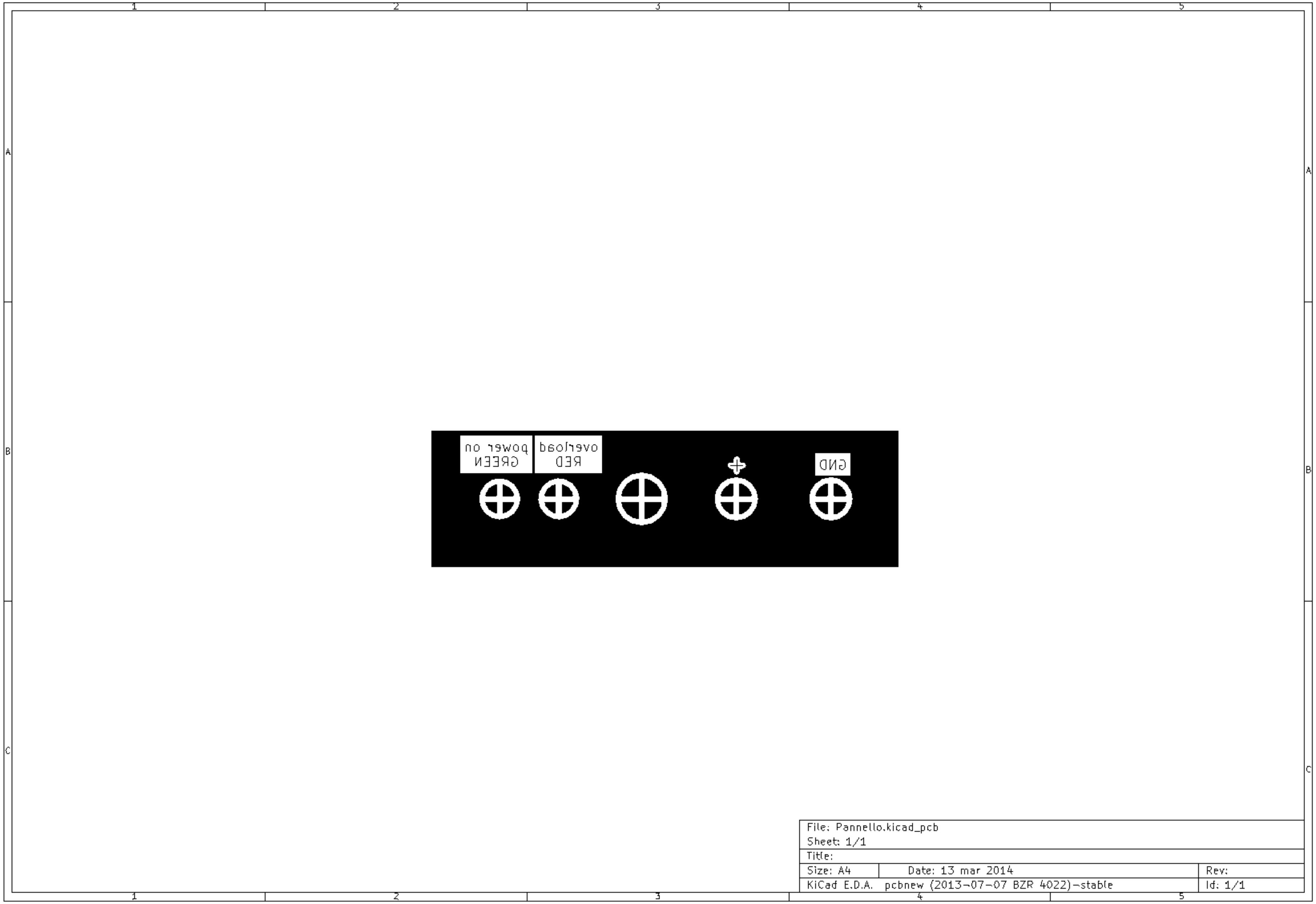
15,000 mm
8,000 mm
8,000 mm
15,000 mm
17,500 mm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overload
RED
+
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Rev:
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Id: 1/1

Bibliografia

E.Cuniberti, L. De Lucchi, E&E Elettronica e Elettrotecnica, volume 2B, Novara: De Agostini Scuola Spa – Petrini, 2012, unita 5, 5.4 Circuiti raddrizzatori pagina 164.

E.Cuniberti, L. De Lucchi, E&E Elettronica e Elettrotecnica, volume 1B, Novara: De Agostini Scuola Spa – Petrini, 2012, unita 1, 1.4 Diodo pagina 15.

E.Cuniberti, L. De Lucchi, E&E Elettronica e Elettrotecnica, volume 2A, Novara: De Agostini Scuola Spa – Petrini, 2012, unita 6, 6.3 Trasformatore pagina 138.

E.Cuniberti, L. De Lucchi, E&E Elettronica e Elettrotecnica, volume 1B, Novara: De Agostini Scuola Spa – Petrini, 2012, unita 5, 5.1 Condensatore pagina 160.

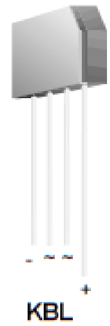
E.Cuniberti, L. De Lucchi, E&E Elettronica e Elettrotecnica, volume 1B, Novara: De Agostini Scuola Spa – Petrini, 2012, unita 1, 1.5 BJT pagina 18.

Datasheets

KBL005 - KBL10

FAIRCHILD SEMICONDUCTOR®

KBL005 - KBL10



Features

- Ideal for printed circuit board .
- Reliable low cost construction.
- High surge current capability.
- UL certified, UL #E96005.

Bridge Rectifiers

Absolute Maximum Ratings*

T_A = 25°C unless otherwise noted

Symbol	Parameter	Value							Units
		005	01	02	04	06	08	10	
V_{RRM}	Maximum Repetitive Reverse Voltage	50	100	200	400	600	800	1000	V
V_{RMS}	Maximum RMS Bridge Input Voltage	35	70	140	280	420	560	700	V
V_R	DC Reverse Voltage (Rated V_R)	50	100	200	400	600	800	1000	V
$I_{F(AV)}$	Average Rectified Forward Current, @ T_A = 50°C	4.0							A
I_{FSM}	Non-repetitive Peak Forward Surge Current 8.3 ms Single Half-Sine-Wave	200							A
T_{stg}	Storage Temperature Range	-55 to +150							°C
T_J	Operating Junction Temperature	-55 to +150							°C

*These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

Thermal Characteristics

Symbol	Parameter	Value	Units
P_D	Power Dissipation	6.58	W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient,* per leg	19	°C/W
$R_{\theta JL}$	Thermal Resistance, Junction to Lead,* per leg	2.4	°C/W

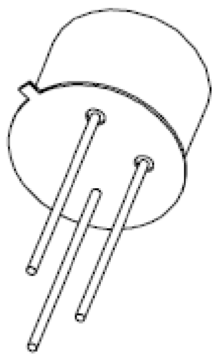
*Device mounted on PCB with 0.375 " (9.5 mm) lead length and 0.5 x 0.5" (13 x 13 mm) copper pads.

Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Device	Units
V_F	Forward Voltage, per bridge @ 4.0 A	1.1	V
I_R	Reverse Current, total bridge @ rated V_R T_A = 25°C T_A = 100°C	5.0 500	µA µA

DATA SHEET



2N2905; 2N2905A
PNP switching transistors

Product specification
Supersedes data of September 1994
File under Discrete Semiconductors, SC04

1997 May 28

Philips
Semiconductors

PHILIPS

PNP switching transistors | 2N2905; 2N2905A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 60 V).

APPLICATIONS

- High-speed switching
- Driver applications for industrial service.

DESCRIPTION

PNP switching transistor in a TO-39 metal package.
NPN complements: 2N2219 and 2N2219A.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector, connected to case

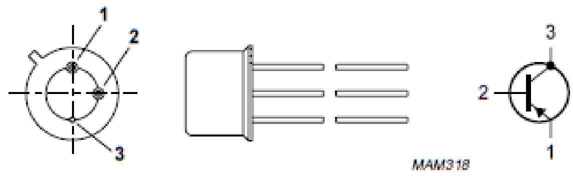


Fig.1 Simplified outline (TO-39) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base			
	2N2905		–	–40	V
	2N2905A		–	–60	V
I_C	collector current (DC)		–	–600	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	600	mW
h_{FE}	DC current gain	I_C = –150 mA; V_{CE} = –10 V	100	300	
f_T	transition frequency	I_C = –50 mA; V_{CE} = –20 V; f = 100 MHz	200	–	MHz
t_{off}	turn-off time	I_{Con} = –150 mA; I_{Bon} = –15 mA; I_{Boff} = 15 mA	–	300	ns

PNP switching transistors 2N2905; 2N2905A

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base			
	2N2905		–	–40	V
	2N2905A		–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–600	mA
I_{CM}	peak collector current		–	–800	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	600	mW
		$T_{case} \leq 25$ °C	–	3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	292	K/W
$R_{th\ j\text{-}c}$	thermal resistance from junction to case		58	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current 2N2905	I_E = 0; V_{CB} = –50 V	–	–20	nA
		I_E = 0; V_{CB} = –50 V; T_{amb} = 150 °C	–	–20	μA
I_{CBO}	collector cut-off current 2N2905A	I_E = 0; V_{CB} = –50 V	–	–10	nA
		I_E = 0; V_{CB} = –50 V; T_{amb} = 150 °C	–	–10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	50	nA
h_{FE}	DC current gain 2N2905	V_{CE} = –10 V I_C = –0.1 mA	35	–	
		I_C = –1 mA	50	–	
		I_C = –10 mA	75	–	
		I_C = –150 mA; note 1	100	300	
		I_C = –500 mA; note 1	30	–	
h_{FE}	DC current gain 2N2905A	V_{CE} = –10 V I_C = –0.1 mA	75	–	
		I_C = –1 mA	100	–	
		I_C = –10 mA	100	–	
		I_C = –150 mA; note 1	100	300	
		I_C = –500 mA; note 1	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –150 mA; I_B = –15 mA; note 1	–	–400	mV
		I_C = –500 mA; I_B = –50 mA; note 1	–	–1.6	V
V_{BEsat}	base-emitter saturation voltage	I_C = –150 mA; I_B = –15 mA; note 1	–	–1.3	V
		I_C = –500 mA; I_B = –50 mA; note 1	–	–2.6	V
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = –10 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	I_C = i_c = 0; V_{EB} = –2 V; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = –50 mA; V_{CE} = –20 V; f = 100 MHz; note 1	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.2					
t_{on}	turn-on time	I_{Con} = –150 mA; I_{Bon} = –15 mA; I_{Boff} = 15 mA	–	45	ns
t_d	delay time		–	15	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	300	ns
t_s	storage time		–	250	ns
t_f	fall time		–	50	ns

Note

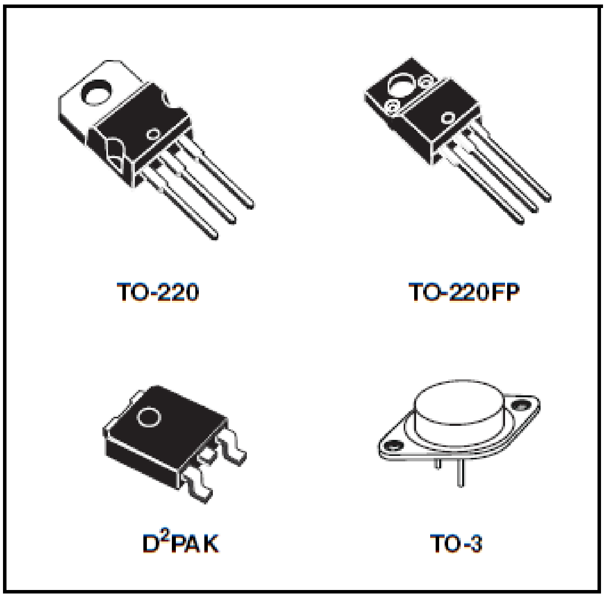
1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.

LM117/LM217/LM317

1.2 V to 37 V adjustable voltage regulators

Features

- Output voltage range: 1.2 to 37 V
- Output current in excess of 1.5 A
- 0.1% Line and load regulation
- Floating operation for high voltages
- Complete series of protections: current limiting, thermal shutdown and SOA control



Description

The LM117/LM217/LM317 are monolithic integrated circuit in TO-220, TO-220FP, TO-3 and D^2PAK packages intended for use as positive adjustable voltage regulators.

They are designed to supply more than 1.5 A of load current with an output voltage adjustable over a 1.2 to 37 V range.

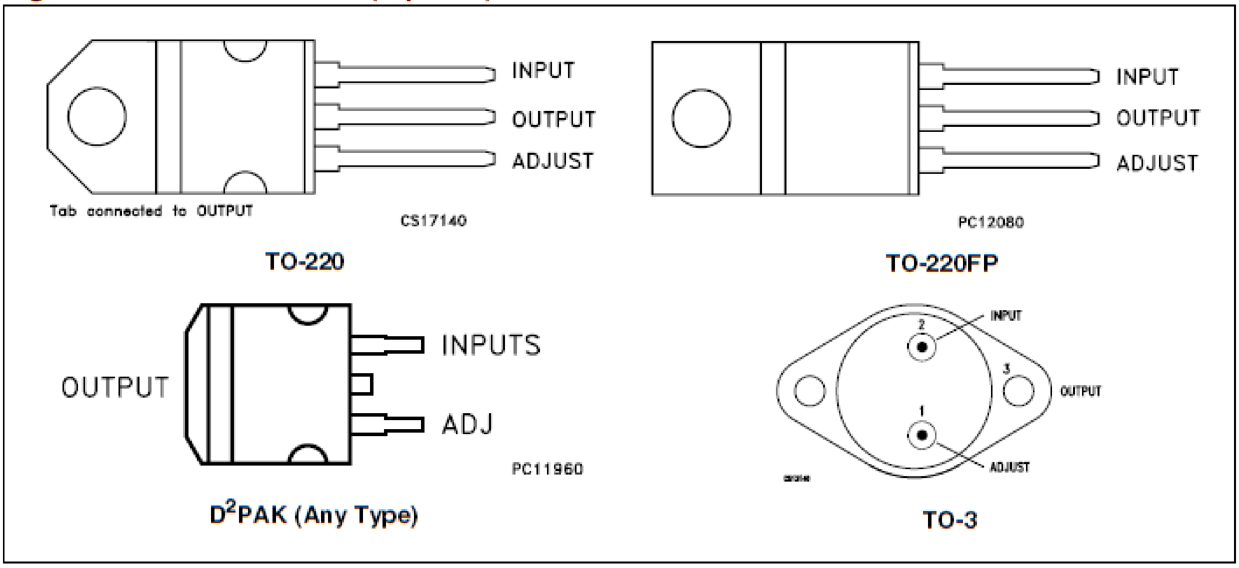
The nominal output voltage is selected by means of only a resistive divider, making the device exceptionally easy to use and eliminating the stocking of many fixed regulators.

Table 1. Device summary

Order codes			
TO-220	**D^2PAK (tape and reel)**	**TO-220FP**	**TO-3**
			LM117K
LM217T	LM217D2T-TR		LM217K
LM317T	LM317D2T-TR	LM317P	LM317K

1 Pin configuration

Figure 1. Pin connections (top view)



2 Maximum ratings

Table 2. **Absolute maximum ratings**

Symbol	Parameter		Value	Unit
$V_I - V_O$	Input-reference differential voltage		40	V
I_O	Output current		Internally limited	
T_{OP}	Operating junction temperature for:	LM117	-55 to 150	°C
		LM217	-25 to 150	
		LM317	0 to 125	
P_D	Power dissipation		Internally limited	
T_{STG}	Storage temperature		-65 to 150	°C

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

Table 3. **Thermal data**

Symbol	Parameter	D^2PAK	TO-220	TO-220FP	TO-3	Unit
R_{thJC}	Thermal resistance junction-case	3	3	5	4	°C/W
R_{thJA}	Thermal resistance junction-ambient	62.5	50	60	35	°C/W

4 Electrical characteristics

Table 4. Electrical characteristics for LM117/LM217 (V_I - V_O = 5 V, I_O = 500 mA, I_{MAX} = 1.5 A and P_{MAX} = 20 W, T_J = -55 to 150°C for LM117, T_J = -25 to 150 °C for LM217, unless otherwise specified)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
ΔV_O	Line regulation	V_I - V_O = 3 to 40 V	T_J = 25°C		0.01	0.02	%/V
					0.02	0.05	
ΔV_O	Load regulation	$V_O \le 5$ V I_O = 10 mA to I_{MAX}	T_J = 25°C		5	15	mV
					20	50	
		$V_O \ge 5$ V, I_O = 10 mA to I_{MAX}	T_J = 25°C		0.1	0.3	%
					0.3	1	
I_{ADJ}	Adjustment pin current				50	100	µA
ΔI_{ADJ}	Adjustment pin current	V_I - V_O = 2.5 to 40V I_O = 10 mA to I_{MAX}			0.2	5	µA
V_{REF}	Reference voltage (between pin 3 and pin 1)	V_I - V_O = 2.5 to 40V I_O= 10 mA to I_{MAX} $P_D \le P_{MAX}$		1.2	1.25	1.3	V
$\Delta V_O/V_O$	Output voltage temperature stability				1		%
$I_{O(min)}$	Minimum load current	V_I - V_O = 40 V			3.5	5	mA
$I_{O(max)}$	Maximum load current	V_I - $V_O \le 15$ V, $P_D < P_{MAX}$		1.5	2.2		A
		V_I - V_O = 40 V, $P_D < P_{MAX}$, T_J = 25°C			0.4		
eN	Output noise voltage (percentage of V_O)	B = 10Hz to 100kHz, T_J = 25°C			0.003		%
SVR	Supply voltage rejection [1]	T_J = 25°C, f = 120Hz	C_{ADJ}=0		65		dB
			C_{ADJ}=10µF	66	80		

1. C_{ADJ} is connected between pin 1 and ground.

Table 5. Electrical characteristics for LM317 (V_I - V_O = 5 V, I_O = 500 mA, I_{MAX} = 1.5 A and P_{MAX} = 20 W, T_J = 0 to 125°C, unless otherwise specified)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
ΔV_O	Line regulation	V_I - V_O = 3 to 40 V	T_J = 25°C		0.01	0.04	%/V
					0.02	0.07	
ΔV_O	Load regulation	$V_O \leq 5$ V I_O = 10 mA to I_{MAX}	T_J = 25°C		5	25	mV
					20	70	
		$V_O \geq 5$ V, I_O = 10 mA to I_{MAX}	T_J = 25°C		0.1	0.5	%
					0.3	1.5	
I_{ADJ}	Adjustment pin current				50	100	µA
ΔI_{ADJ}	Adjustment pin current	V_I - V_O = 2.5 to 40V, I_O = 10 mA to 500mA			0.2	5	µA
V_{REF}	Reference voltage (between pin 3 and pin 1)	V_I - V_O = 2.5 to 40V I_O = 10 mA to 500mA $P_D \leq P_{MAX}$		1.2	1.25	1.3	V
$\Delta V_O/V_O$	Output voltage temperature stability				1		%
$I_{O(min)}$	Minimum load current	V_I - V_O = 40 V			3.5	10	mA
$I_{O(max)}$	Maximum load current	V_I - $V_O \leq 15$ V, $P_D < P_{MAX}$		1.5	2.2		A
		V_I - V_O = 40 V, $P_D < P_{MAX}$, T_J = 25°C			0.4		
eN	Output noise voltage (percentage of V_O)	B = 10Hz to 100kHz, T_J = 25°C			0.003		%
SVR	Supply voltage rejection (1)	T_J = 25°C, f = 120Hz	C_{ADJ}=0		65		dB
			C_{ADJ}=10µF	66	80		

1. C_{ADJ} is connected between pin 1 and ground.

6 Application information

The LM117/217/317 provides an internal reference voltage of 1.25 V between the output and adjustments terminals. This is used to set a constant current flow across an external resistor divider (see *Figure 3*), giving an output voltage V_O of:

$V_O = V_{REF} (1 + R_2/R_1) + I_{ADJ} R_2$

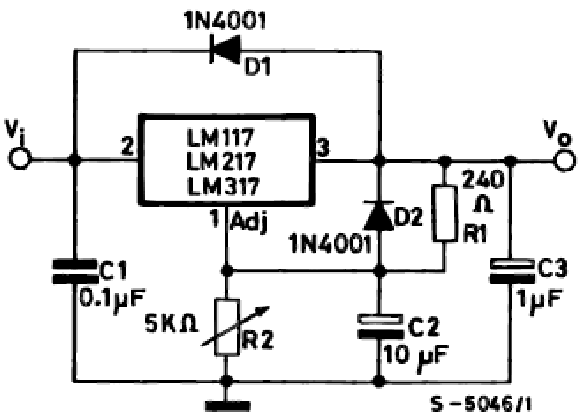
The device was designed to minimize the term I_{ADJ} (100 µA max) and to maintain it very constant with line and load changes. Usually, the error term $I_{ADJ} \times R_2$ can be neglected. To obtain the previous requirement, all the regulator quiescent current is returned to the output terminal, imposing a minimum load current condition. If the load is insufficient, the output voltage will rise. Since the LM117/217317 is a floating regulator and "sees" only the input-to-output differential voltage, supplies of very high voltage with respect to ground can be regulated as long as the maximum input-to-output differential is not exceeded. Furthermore, programmable regulator are easily obtainable and, by connecting a fixed resistor between the adjustment and output, the device can be used as a precision current regulator. In order to optimize the load regulation, the current set resistor R_1 (see *Figure 3*) should be tied as close as possible to the regulator, while the ground terminal of R_2 should be near the ground of the load to provide remote ground sensing. Performance may be improved with added capacitance as follow:

An input bypass capacitor of 0.1 µF

An adjustment terminal to ground 10 µF capacitor to improve the ripple rejection of about 15 dB (CADJ).

An 1 µF tantalum (or 25 µF Aluminium electrolytic) capacitor on the output to improve transient response. In additional to external capacitors, it is good practice to add protection diodes, as shown in *Figure 4* D1 protect the device against input short circuit, while D2 protect against output short circuit for capacitance discharging.

Figure 7. Voltage regulator with protection diodes



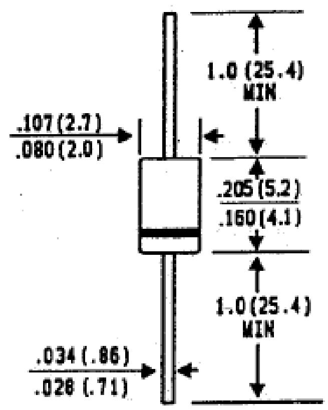
Note: D1 protect the device against input short circuit, while D2 protects against output short circuit for capacitors discharging.

1N4001 THRU 1N4007

1.0 AMP SILICON RECTIFIERS

VOLTAGE RANGE
50 to 1000 Volts
CURRENT
1.0 Ampere

DO-41



Dimensions in inches and (millimeters)

FEATURES

* The plastic package carries Underwriters Laboratory Flammability Classification 94V-0
* Low cost construction utilizing void-free molded plastic technique
* Diffused junction
* Low reverse leakage
* High current capability
* Easily cleaned with Freon, Alcohol, Chlorothen, and similar solvents
* High temperature soldering guaranteed : 265°C/10 seconds/.375"(9.5mm)lead lengths at 5 lbs(2.3kg) tension

MECHANICAL DATA

* Case: Molded plastic
* Polarity: Color band denotes cathode end
* Lead: Plated axial lead, solderable per MIL-STD-202E method 208C
* Mounting position: Any
* Weight: 0.012 ounce, 0.3 gram

MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified.
Single phase, half wave, 60 Hz, resistive or inductive load.
For capacitive load derate current by 20%.

		SYMBOLS	1N4001	1N4002	1N4003	1N4004	1N4005	1N4006	1N4007	UNITS
Maximum Recurrent Peak Reverse Voltage		Vrrm	50	100	200	400	600	800	1000	V
Maximum RMS Voltage		Vrms	35	70	140	280	420	560	700	V
Maximum DC Blocking Voltage		Vdc	50	100	200	400	600	800	1000	V
Maximum Average Forward Rectified Current .375" (9.5mm)lead length at TA=75°C		I(AV)	1.0							A
Peak Forward Surge Current 8.3 ms single half sine wave superimposed on rated load (JEDEC method)		Ifsm	30							A
Maximum Instantaneous Forward Voltage at 1.0A DC		VF	1.1							V
Maximun Reverse Current at Rated DC Blocking Voltage per element	@TA=25°C	IR	5.0							uA
	@TA=100°C	HTIR	50							uA
Maximum DC Reverse Current Average, Full cycle .375"(9.5mm) lead length at TL=75°C		HTIR	30							uA
Typical Junction Capacitance (Note1)		CJ	30							pf
Typical Thermal Resistance (Note2)		RTHja	50							°C/W
Operating and Storage Temperature Range		Tj,Tstg	-65 TO +175							°C

NOTES :
1. Measured at 1.0 MHz and applied reverse voltage of 4.0 Volts.
2. Thermal Resistance from Junction to Ambient at .375"(9.5mm)lead length, P.C.board mounted.

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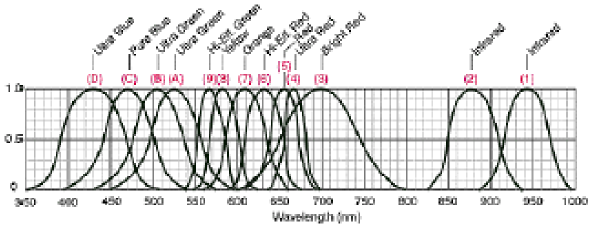
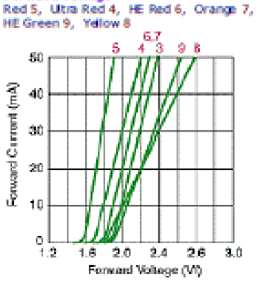
-Security and Surveillance
-Solar Trees
-Oil and Gas
-Telecommunications
-Traffic Management
-Hospital Signals

Wavelength (nm)	Color Name	Fwd Voltage (Vf @ 20ma)	Intensity 5mm LEDs	Viewing Angle	LED Dye Material
940	Infrared	1.5	16mW @50mA	15°	GaAlAs/GaAs -- Gallium Aluminum Arsenide/Gallium Arsenide
880	Infrared	1.7	18mW @50mA	15°	GaAlAs/GaAs -- Gallium Aluminum Arsenide/Gallium Arsenide
850	Infrared	1.7	26mW @50mA	15°	GaAlAs/GaAs -- Gallium Aluminum Arsenide/Gallium Aluminum Arsenide
660	Ultra Red	1.8	2000mcd @50mA	15°	GaAlAs/GaAs -- Gallium Aluminum Arsenide/Gallium Aluminum Arsenide
635	High Eff. Red	2.0	200mcd @20mA	15°	GaAsP/GaP - Gallium Arsenic Phosphide / Gallium Phosphide
633	Super Red	2.2	3500mcd @20mA	15°	InGaAlP - Indium Gallium Aluminum Phosphide
620	Super Orange	2.2	4500mcd @20mA	15°	InGaAlP - Indium Gallium Aluminum Phosphide
612	Super Orange	2.2	6500mcd @20mA	15°	InGaAlP - Indium Gallium Aluminum Phosphide
605	Orange	2.1	160mcd @20mA	15°	GaAsP/GaP - Gallium Arsenic Phosphide / Gallium Phosphide
595	Super Yellow	2.2	5500mcd @20mA	15°	InGaAlP - Indium Gallium Aluminum Phosphide
592	Super Pure Yellow	2.1	7000mcd @20mA	15°	InGaAlP - Indium Gallium Aluminum Phosphide
585	Yellow	2.1	100mcd @20mA	15°	GaAsP/GaP - Gallium Arsenic Phosphide / Gallium Phosphide
4500K	"Incan-descent" White	3.6	2000mcd @20mA	20°	SiC/GaN -- Silicon Carbide/Gallium Nitride
6500K	Pale White	3.6	4000mcd @20mA	20°	SiC/GaN -- Silicon Carbide/Gallium Nitride
8000K	Cool White	3.6	6000mcd @20mA	20°	SiC/GaN - Silicon Carbide / Gallium Nitride
574	Super Lime Yellow	2.4	1000mcd @20mA	15°	InGaAlP - Indium Gallium Aluminum Phosphide
570	Super Lime Green	2.0	1000mcd @20mA	15°	InGaAlP - Indium Gallium Aluminum Phosphide
565	High Efficiency Green	2.1	200mcd @20mA	15°	GaP/GaP - Gallium Phosphide/Gallium Phosphide
560	Super Pure Green	2.1	350mcd @20mA	15°	InGaAlP - Indium Gallium Aluminum Phosphide
555	Pure Green	2.1	80mcd @20mA	15°	GaP/GaP - Gallium Phosphide/ Gallium Phosphide
525	Aqua Green	3.5	10,000mcd @20mA	15°	SiC/GaN - Silicon Carbide / Gallium Nitride
505	Blue Green	3.5	2000mcd @20mA	45°	SiC/GaN - Silicon Carbide / Gallium Nitride
470	Super Blue	3.6	3000mcd @20mA	15°	SiC/GaN - Silicon Carbide / Gallium Nitride
430	Ultra Blue	3.8	100mcd @20mA	15°	SiC/GaN - Silicon Carbide / Gallium Nitride

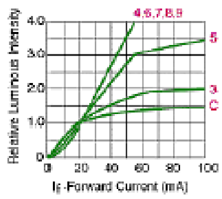
Relative Intensity vs Wavelength (P)



Forward Current vs Forward Voltage
Red 5, Ultra Red 4, HE Red 6, Orange 7, Bright Red 3, HE Green 9, Yellow 8



Relative Luminous Intensity vs Forward Current
Ultra Red 4, HE Red 6, Orange 7, Yellow 8, HE Green 9
Red 5, Bright Red 3, Pure Blue C



Forward Current vs Ambient Air Temperature
Red 5, Ultra Red 4, HE Red 6, Orange 7,
HE Green 9, Ultra Blue D, Yellow 8, Bright Red 3

Relative Luminous Intensity vs Ambient Temperature