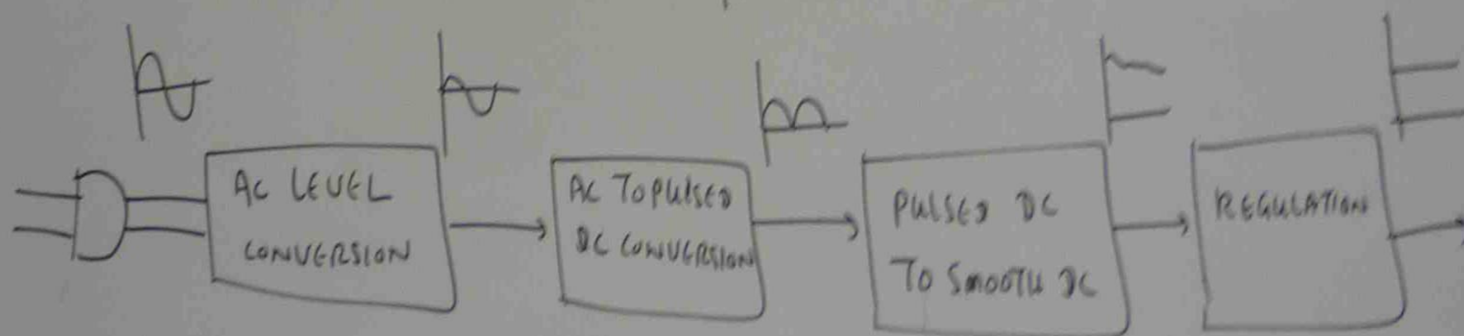
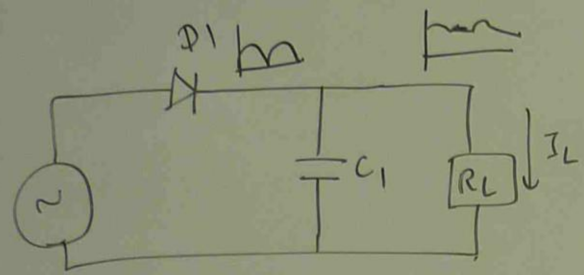
POWER SUPPLIES

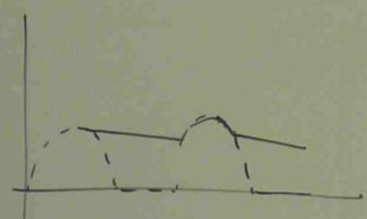
MOST ELECTRONIC EQUIPMENTS REQUIRES SOME FORM OF DC POWER TO OPERATE. IF THIS EQUIPMENT IS TO BE OPERATED FROM A STANDARD AC OUTLET, THEN A DC POWER SUPPLY IS NEEDED. A POWER SUPPLY TAKES ELECTRICAL POWER FROM A DISTRIBUTION SYSTEM AND CONVERTS IT TO THE DESIRED FORM OF POWER.



BLOCK DIAGRAM OF A REGULATED POWER SUPPLY

SINGLE PHASE HALF WAVE RECTIFIER



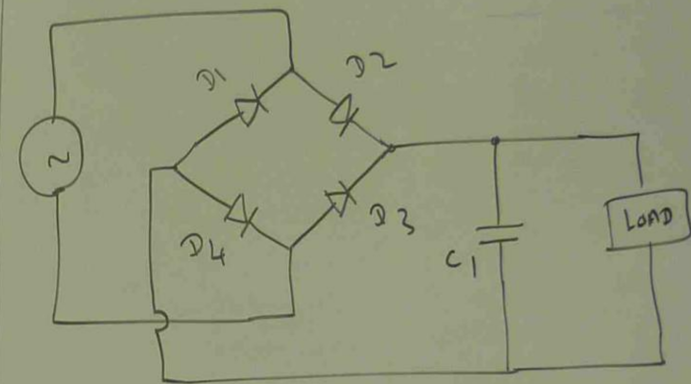


C_1 - FILTER CAPACITOR

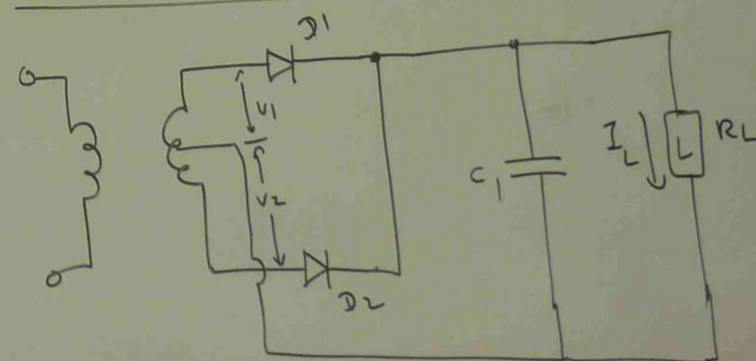
HALF WAVE RECTIFIER WITH FILTER CAPACITOR.

FULL WAVE RECTIFIER

THE BRIDGE RECTIFIER



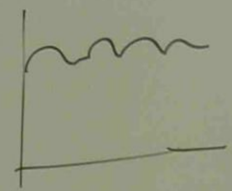
THE CENTRE-TAPPED FULL WAVE RECTIFIER



CENTRE TAPPED TRANSFORMER, FULL WAVE RECTIFIER

CALCULATING THE SIZE OF FILTER CAPACITOR

$$V_{dc} = V_r f_r R_L C$$



V_{dc} = DC OUTPUT VOLTAGE

V_r – P-P RIPPLE VOLTAGE

f_r – RIPPLE FREQUENCY

C – CAPACITANCE

R_L – LOAD SEEN BY CAPACITOR.

Pb CALCULATE THE LOAD RESISTANCE AND CAPACITOR SIZE OF A FULL WAVE RECTIFIER THAT SUPPLIES 40V DC WITH 2% RIPPLE VOLTAGE AT 250mA TO A RESISTIVE LOAD. ASSUME THE RECTIFIER CIRCUIT IS SUPPLIED WITH 50HZ AC.

(RIPPLE FREQ = 100HZ)

$$R_L = \frac{V_L}{I} = \frac{40}{250 \times 10^{-3}} = 160\Omega$$

$$V_r = 40 \times \frac{2}{100} = 0.8V$$

$$V_{dc} = V_r f_r R_L C$$

$$40 = 0.8 \times 100 \times 160 \times C$$

$$C = \frac{40}{0.8 \times 100 \times 160}$$

$$C = 3125 \mu F$$

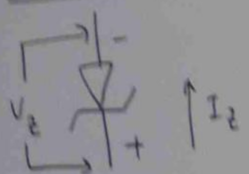
POWER SUPPLIES - PART (2)

VOLTAGE REGULATION

THE PURPOSE OF VOLTAGE REGULATION IS TO MAINTAIN A CONSTANT VOLTAGE ACROSS A LOAD REGARDLESS OF ANY CHANGE IN LOAD CONDITION (OR) SUPPLY VOLTAGE.

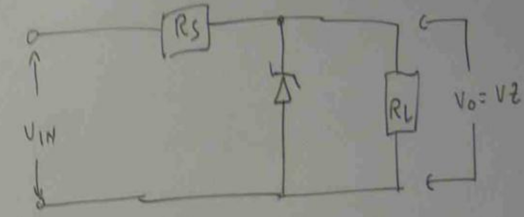
THE MAIN TYPES OF REGULATION ARE SERIES, SHUNT AND SWITCHING.

ZENER DIODE - VOLTAGE REFERENCE DIODE.



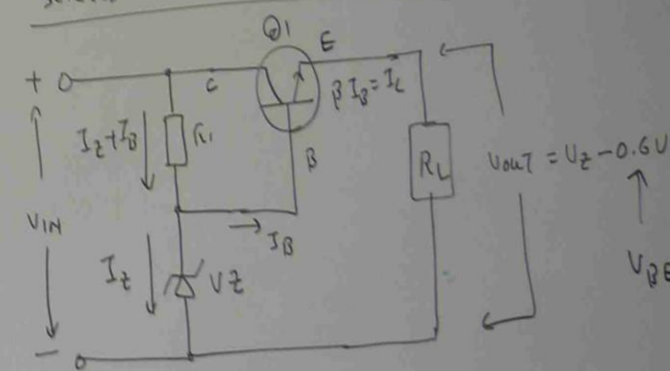
THE OUTPUT VOLTAGE ACROSS THE LOAD R_L EQUALS THE ZENER VOLTAGE V_Z.

THE OUTPUT VOLTAGE IS KEPT CONSTANT DESPITE CHANGES IN V_{IN} AND I_L.



BASIC SERIES ZENER REGULATOR

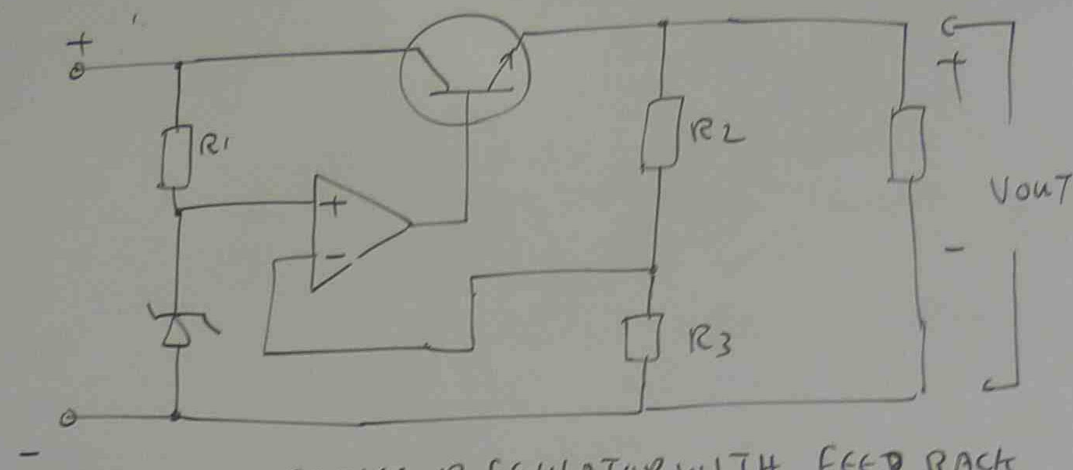
SERIES TRANSISTOR REGULATOR



$V_{BE} = 0.6V$ SILICON TRANSISTOR

$V_{BE} = 0.2V$ - GERMANIUM TRANSISTOR

REGULATORS WITH FEEDBACK



SERIES REGULATOR WITH FEEDBACK

$$V_{OUT} = \left(\frac{R_2}{R_3} + 1 \right) \times V_{REF}$$

WHERE $V_{REF} = V_Z$

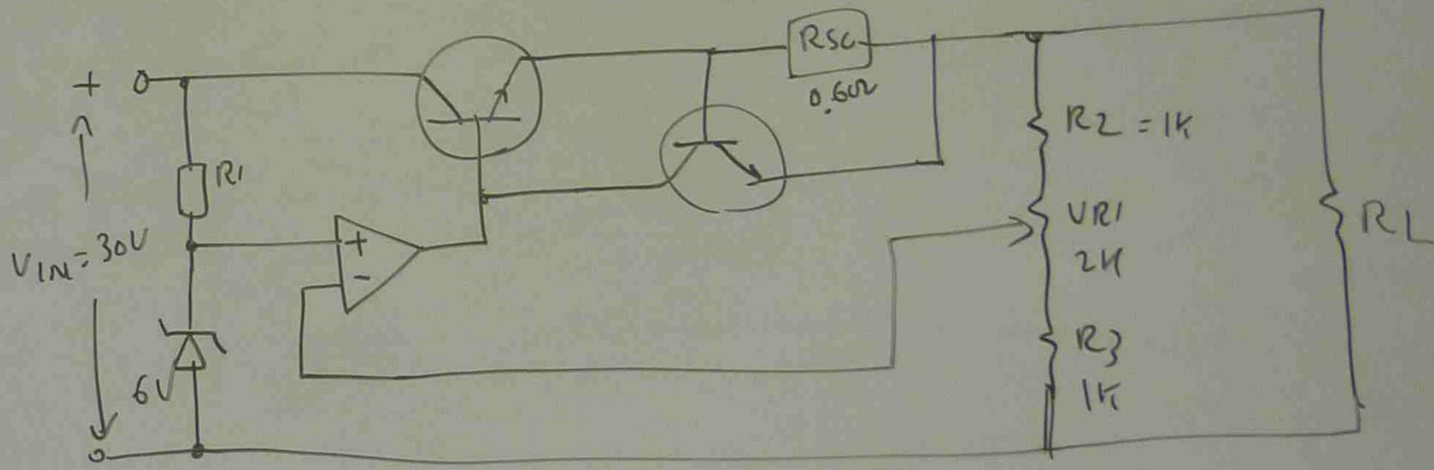
$$P_d = \text{DISSIPATED POWER} = \left(V_{IN} - V_{OUT} \right) \times I_L$$

pb/ FOR THE CIRCUIT IN FIGURE, CALCULATE

(a) THE MAXIMUM AND MINIMUM OUTPUT VOLTAGES

(b) THE CURRENT THAT WILL FLOW IF OUTPUT IS SHORT CIRCUITED.

(c) THE POWER DISSIPATED BY Q1 IF THE OUTPUT IS SHORT CIRCUITED



Pb/ FOR THE CIRCUIT IN FIGURE, CALCULATE

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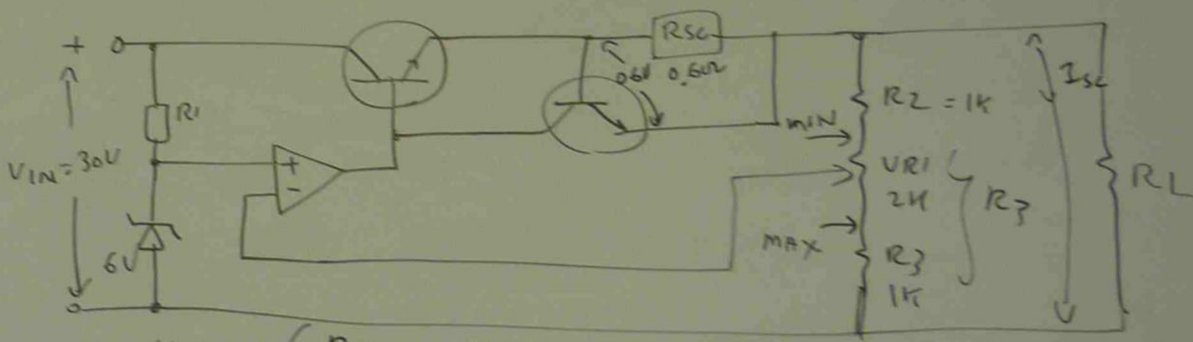


(a) $V_{OUT} = \left(\frac{R_2}{R_3} + 1\right) V_{REF}$

$V_{OUT} = \left(\frac{1}{3} + 1\right) \times 6 = (1.33) \times 6 = 8V$

$V_{OUT} = \left(\frac{3}{1} + 1\right) \times 6 = 4 \times 6 = 24V$

(b) $I_{SC} = \frac{0.6}{R_{SC}} = \frac{0.6}{0.6\Omega} = 1A$

(c) $P_d = (V_{IN} - V_{OUT}) \times I_L$

$= (30 - 0) \times 1 = 30W$

TRANSISTOR CONNECTIONS

The TO-92 dilemma

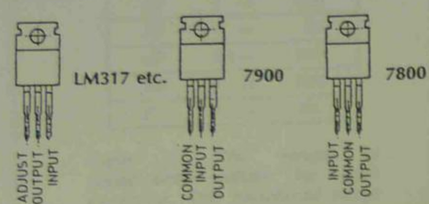
The TO-92 package is very common, but has at least six variations on the lead connections and has numerous lead forms. Transistor data books vary in their method of referring to the particular variation of the package, and some data books even leave out the variation altogether, and just state that the transistor is in a TO-92 package. A little like giving your address as 'Australia'.

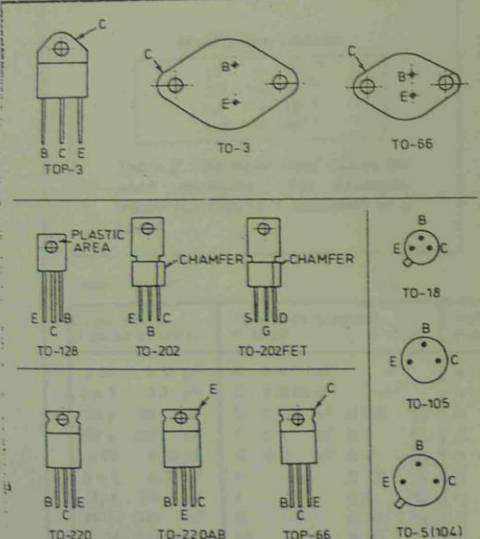
The package is used for transistors, FETs, SCRs and other devices including regulator ICs, PUTs, UJTs etc. Each pinout variation is usually shown with the terminals marked for both transistors and FETs, although not all variations have pinouts for both devices.

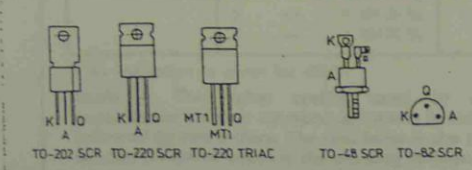
One variation is known as the standard, but it is not the most common variation. Some transistors come in two variations – for example, the BC182B has a totally different lead configuration to the BC182L, even though both are in a TO-92 package. We have even found variations referred to in data manuals that don't exist, that is, no drawing showing the lead connections could be found in the manual.

Obviously there is a slight(?) possibility of confusion – perhaps our summary below will help. Each variation that we could find is shown in two ways; as viewed from the bottom and as seen when mounted on a PCB. Next to each drawing is a listing of some transistor types that apply to that variation. We have not included FET example types, although the FET pinouts are included where applicable.

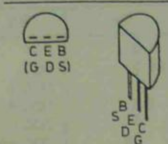
Voltage regulators



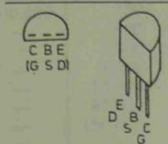




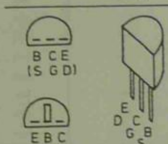
TO-92



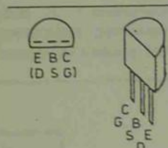
Variation 1
Also called variation 71, 96 etc.
Includes the following transistor types:
MPS6542, '6543, '6546, '6547.
MPSH10, '11, '19, '20, '24, '30.
PE3100, BF233.



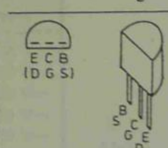
Variation 2
Also called variation 72, 92 etc.
Known as the 'standard'.
2N3641, '3642, '3643, '3903, '3904.
2N3905, '3906, '4400, '4403, '5401.
BC170, '171, '172, '173, '174, '317.



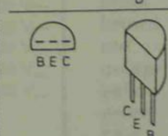
Variation 3
Also called variation 74, 94 etc.
TIPP31, '32, '110, 117.
BC182L, '183L, '213L, '214L, '257.
BC258, '259, '635, '636, '639, '640.
2N3702, '2926.



Variation 4
Also called variation 77, 97 etc.
The most common type.
BC237B, '307B, '327, '328, '337.
BC338, '415, '485, '546, '547.
BC548, '549, '556, '557, '558.
BC559, '560. BF936, '324.

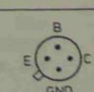


Variation 5
Also called variation 76.
2SC710. Mainly used for FETs.

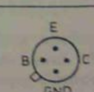


Variation 6
Also called variation 98.
BF194, '195, '196, '197, '198, '199.
BF237, '238, '240, '241, '254, '255.
BF450, '451.

TO-72



BF180
BF200



BF115
BF167
BF173
BF184
BF185

CAPACITOR CODES

This reference sheet is intended to help readers who have problems converting between multipliers for capacitors. It includes the standard we use in the magazine, (conforms to metric standard, by the way), and shows when to use the nanofarad or the millifarad instead of the venerable microfarad.

Although a very difficult area to summarise, due to the number of standards being used, the data sheet also includes information on how to interpret manufacturer's capacitor value codes. The standard used by Philips is reproduced below.

The multiplier

Table 1 shows the range of capacitance values that apply to each multiplier. For example, the value of 1nF is OK, but 100nF is outside the range – instead use the next multiplier and express the value as 0.1uF. Table 2 simply shows the actual value the multiplier represents. For example, the millifarad (mF) is one thousandth of a farad (F).

Table 3 is a conversion table between all the multipliers. For example, a 2.2nF capacitor could also be a 2200pF capacitor or a 0.0022uF capacitor.

Value codes

Capacitor value coding varies, and we include that used by Philips as a guide. Note the use of the multiplier in place of the decimal point. For example, 8.2pF would be written as 8p2.

Another way of expressing a value of a capacitor is to print the first two digits followed by a multiplier digit. This way, 47nF would be expressed as 473, perhaps followed with a letter representing tolerance. To convert the number to a value, write the first two digits, followed by the number of zeros expressed by the third digit. The value obtained is in pF, which can then be converted to nF or uF using Table 3.

Multiplier ranges

pF	1 →	820
nF	1 →	82
uF	0.1→	820
mF	1 →	820
F	1 →	inf.

Table 1. The range of capacitance values for each multiplier. The nanofarad range has the least number of values.

Multiplier values

pF	= 10^{-12}
nF	= 10^{-9}
uF	= 10^{-6}
mF	= 10^{-3}

Table 2. The numerical values for each multiplier. For example, micro (u) means 1 millionth of a farad.

Conversions

pF	nF	uF	mF	F
100	0.1	0.0001	—	—
820	0.82	0.00082	—	—
1,000	1	0.001	—	—
8,200	8.2	0.0082	—	—
10,000	10	0.01	—	—
82,000	82	0.082	—	—
100,000	100	0.1	0.0001	—
—	820	0.82	0.00082	—
—	1,000	1	0.001	—
—	8,200	8.2	0.0082	—
—	10,000	10	0.01	—
—	82,000	82	0.082	—
—	100,000	100	0.1	0.0001
—	—	820	0.82	0.00082
—	—	1,000	1	0.001
—	—	8,200	8.2	0.0082
—	—	10,000	10	0.01
—	—	82,000	82	0.082
—	—	100,000	100	0.01
—	—	—	820	0.82
—	—	—	1000	1

Table 3. Conversion reference table. This table should allow conversion between multipliers for most given capacitor values. Numerical values for each decade are from 1 to 8.2.

757,1N960				
758,1N961	1N4740	10	14	25

DC Power Dissipation: 400milliwatts @ $50^{\circ}C$ Ambient (Derate 3.2mW/°C above $50^{\circ}C$)

1N973

▼DC Power Dissipation: 1Watt @ $50^{\circ}C$ Ambient) (Derate 6.67mW/°C above $50^{\circ}C$)

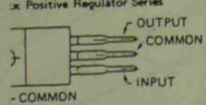
This range will dissipate up to 3W @ $75^{\circ}C$ with 10mm lead length as heatsink.

V_Z, ZENER VOLTAGE @ I_{ZT} (VOLTS)

ree Terminal Regulators

	Polarity	Case	V_{OUT} min	V_{OUT} typ	V_{OUT} max	I_{OUT} (nom)	Dropout Voltage
05	positive	TO-92	4.8	5	5.2	100mA	1.7
62	positive	TO-92	5.95	6.2	6.45	100mA	1.7
09	positive	TO-92	8.64	9	9.36	100mA	1.7
12	positive	TO-92	11.5	12	12.5	100mA	1.7
15	positive	TO-92	14.4	15	15.6	100mA	1.7
5	positive	TO-220	4.8	5	5.2	1A	2
5	positive	TO-220	5.75	6.0	6.25	1A	2
9	positive	TO-220	8.64	9	9.36	1A	2
2	positive	TO-220	11.5	12	12.5	1A	2
5	positive	TO-220	14.4	15	15.6	1A	2
4	positive	TO-220	23	25	25	1A	2
5	negative	TO-220	-4.8	-5	-5.2	1A	1.1
2	negative	TO-220	-11.5	-12	-12.5	1A	1.1
5	negative	TO-220	-14.4	-15	-15.6	1A	1.1
17K	positive	TO-3	adj. 1.2 to 37			1.5Amin	
17T	positive	TO-220	adj. 1.2 to 37			1.5Amin	
50K	positive	TO-3	adj. 1.2 to 33			3A	
50T	positive	TO-220	adj. 1.2 to 33			3A	
05	positive	TO-3	4.85	5	5.25	5A	2.5

nections TO-220 Package
x Positive Regulator Series

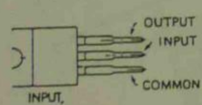


Top View

Connections TO-3 Package
78H05 Positive Regulator

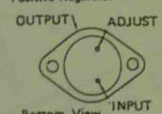
Bottom View

nections TO-220 Package
x Negative Regulator Series



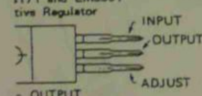
Top View

Connection TO-3 Package
LM317K and LM350K
Positive Regulator



Bottom View

nections TO-220 Package
1171 and LM350T
tive Regulator



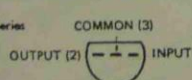
Top View

Note:
Maximum power dissipation for:

TO-220 pack
LM317T 15W
LM350T 25W

TO-3 pack
LM317K 20W
LM350K 30W

nection TO-92 Package
xx Positive Regulator Series



Bottom View

imum Power
apation for
92 Pack 0.75W

336 Reference Diodes

	LM336-2.5	LM336-5.0
Fwd Current (mA)	10	10
mmed Ref Voltage	2.44-2.54	4.9-5.1
amic Impedance		

Voltage Regulators

These voltage regulators almost make power supply building unnecessary since they require only a filtered DC voltage input, they are essentially indestructible (if used within manufacturer's specs.) because of internal current limiting and thermal shutdown should a short occur. They are ideally suited to local, on board regulation simplifying power supply distribution systems. Excellent for TTL and project supplies. With the advent of microprocessors and microcomputers, these regulators have been used extensively in power supplies for such systems. This type of use typifies their versatility and reliability. Another area of supply regulation use is with analogue operational amplifiers. These circuits usually call for both + and - complementary rail voltages. These three terminal devices ideally suit such requirements.

The addition of protection diodes, as shown in the 317/350 application circuit, is recommended if there is any possibility of the regulator input or output being shorted to ground. These may also be necessary if significant (>1uF) capacitance is connected between ground and either the common or output terminals of the regulator.

Increase the Output Voltage of a 3 Terminal Voltage Regulator

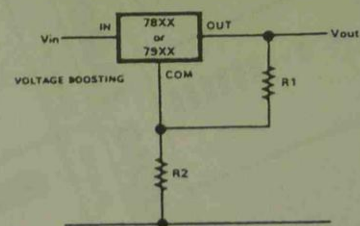
Regulators like the 7805 and the 7905 can give higher output if two additional resistors are configured into the circuit as shown below.

$R1 = V_R/0.02$ $R2 = V_B/0.025$

Where V_R is the normal regulated voltage from the IC and V_B is the amount by which the regulator has to be boosted above V_R.
Some examples are given below:

V_{out}	Regulator	R1	R2
6	5V	220	39
9	5V	220	150
13.8	12V	560	68
18	15V	680	120

To make a variable regulator, use a potentiometer as R2.

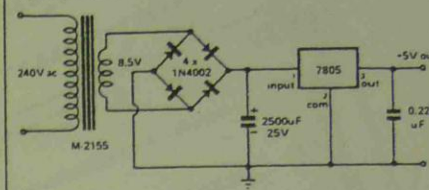


Increasing the Output Current of the Regulator

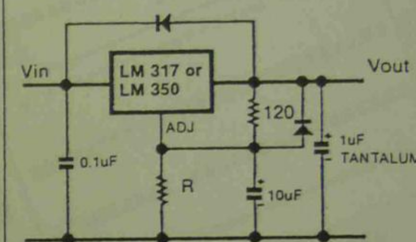
By adding a PNP power transistor to a positive regulator, the output current can be increased above the normal rating of the regulator itself. The circuit shown below can be expected to deliver in excess of 4A with the pass transistor mounted on a heatsink. The same conditions can also be implemented with a negative regulator, the difference being the polarities of components, the pass transistor in this case would be an NPN type such as a 2N3055.

Typical Power Supply Using a 3 Terminal Regulator

Output: 5V @ 1A
The same basic circuit can be used with other regulators of different voltages, only the input ac voltage has to be changed to accommodate the the requirement of that regulator. eg. If an output of 12V was the requirement, a 7812 IC could be used with an ac input voltage of 15V.



LM317 or LM350 Series



1. Choose Resistor R as follows:
   R=(96xVout)-120
   Where R is in ohms and Vout is in volts
2. Vin should be at least 2.5 volts greater than Vout.
3. Capacitor voltage ratings must be chosen appropriately.
4. The protection diodes shown will be necessary if the input or output of the regulator is shorted to ground. 1 amp types should be adequate.

LM334 Adjustable Current Source

Operating Voltage	1-30
Max Power Dissipation	200mW
Voltage Sensitivity	0.1%/V
Temperature Sensitivity	+0.33%/°C

I=68mV/Rset

FETS

FETS	Case	BVGSS V @	IG(uA)	VGS(OFF) Min	Max	@ VDS	ID(nA)	IDss(mA) Min	Max	@ VDS	VGS	Yfs(umhos) Min	Max	@ VDS	Ptot mW	Use/Comments
BF245B	TO-92 Var 1	60	1	0.5	8	15	10	6	15	15	0	3000	6500	15	300	N/CH Junction Audio to H.F.
BF981	SOT-103	>6		2.5		10	20uA	4	25	10	0	14000	typ		225	N/CH Dual Gate MOS. VHF Amp
BFW10	TO-72(25)	30						8	20	15	0		6500		300	N/CH Junction Audio to H.F.
BFW11	TO-72(25)	30						4	10	15	0		6500		300	N/CH Junction Audio to H.F.
BFW61	TO-72(25)	25						2	20	15	0		6500		300	N/CH Junction Audio to H.F.
MEM631	W-25	± 6	± 10		4	15	200uA	5	30	15	0	1600	typ	15	500	N/CH Dual Gate MOS. VHF Amp
MFE131	TO-72(2)	± 6	± 10		4	15	200uA		30	15	0	8000	20000	15	300	N/CH Dual Gate MOS. VHF Amp
MPF102	TO-92(72)	25	10	0.5	8	15	2	2	20	15	0	2000	7500	15	310	N/CH Junction — VHF
MPF103	TO-92(72)	25	1		6	15	1	1	5	15	0	1000	5000	15	310	N/CH Junction — Audio Sw.
MPF104	TO-92(72)	25	1		7	15	1	2	9	15	0	1500	5500	15	310	N/CH Junction — Audio Sw.
MPF105	TO-92(72)	25	1		8	15	10	4	16	15	0	2000	6000	15	310	N/CH Junction — Audio Sw.
MPF106	TO-92(72)	25	1	0.5	4	15	10	4	10	15	0	2500	7000	15	310	N/CH Junction — RF
MPF121	206(B)	± 6	± 10		4	15	200uA	5	30	15	0	10000	20000	15	500	N/CH Dual Gate MOS. VHF Amp
MPF131	262	± 6	± 10		4	15	200uA	3	30	15	0	8000	20000	15	350	N/CH Dual Gate MOS. VHF Amp
2N4342	TO-92(72)	25	10		5	10		12	30	10	0		6000	10	180	P/CH Junction — Audio Sw.
2N4360	TO-92(72)	40	10	0.5	6	15	100	1	5	15	0	1000	5000	15	310	P/CH Junction — Audio Sw.
2N5245	TO-92/77	30	1	1.5	6	10		1	18		0		5800	typ 10	360	N/CH VHF/UHF Mixer
2N5457	TO-92(72)	25	1	0.5	6	15	10	1	5	15	0	1000	5000	15	310	N/CH Junction — Audio Sw.
2N5458	TO-92(72)	25	1	1	7	15	10	2	6	15	0	1500	5500	15	310	N/CH Junction — Audio Sw.
2N5459	TO-92(72)	25	1	2	8	15	10	4	9	15	0	2000	6000	15	310	N/CH Junction — Audio Sw.
2N5484	TO-92(72)	25	1	0.3	3	15	10	1	5	15	0	3000	6000	15	310	N/CH Junction — VHF
2N5485	TO-92(72)	25	1	0.5	4	15	10	4	10	15	0	3500	7000	15	310	N/CH Junction — VHF
2N5486	TO-92(72)	25	1	2	6	15	10	8	20	15	0	4000	8000	15	310	N/CH Junction — VHF
3SK40	TO-72(2)	± 6	± 10		4	15	200uA		25	15	0	8000		15	250	N/CH Dual Gate MOS. VHF Amp
3SK121	2-6F1A	-5		-2.5	4	5	100uA	20	45	5	0	17000	typ	typ 10	200	N/CH UHF GaAs Dual Gate
40673	TO-72(2)	± 6	± 10	-2	typ	15	200uA		35	15	0	12000		15	330	N/CH Dual Gate MOS. VHF Amp

POWER FETS

TYPE	CASE	Ptot (W)	Vds(max) (V)	Id(max) (A)	Vgs(off) min	max	Gfs umhos	Ciss (pF)	Rds (ohms)	Comment
BUZ71	TO220	40	50	14	-	-	-	-	0.1	Nch Power MOSFET
VN10K	TO92	1	60	1	.3	1.5	100K	48	5	Nch DMOS FET
VN46AF	TO202F	12.5	40	2	.8	2			-	Nch VMOS FET
VN66AF	TO202F	12.5	60	2	.8	2	150K	50	-	Nch VMOS FET
VN86AF	TO202F	12.5	80	2	.8	2	-	-	-	Nch VMOS FET
VN88AF	TO202F	12.5	80	2	.8	2	-	-	-	Nch VMOS FET
2SJ48	TO3	100	120	7	.15	1.45	1M	900	-	Pch Power MOSFET
2SJ49	TO3	100	140	7	.15	1.45	1M	900	-	Pch Power MOSFET
2SJ50	TO3	100	160	7	.15	1.45	1M	900	-	Pch Power MOSFET
2SK133	TO3	100	120	7	.15	1.45	1M	600	-	Nch Power MOSFET
2SK134	TO3	100	140	7	.15	1.45	1M	600	-	Nch Power MOSFET
2SK135	TO3	100	160	7	.15	1.45	1M	600	-	Nch Power MOSFET

SMALL SIGNAL DIODES

TYPE	CASE	VR	IF (mA)	Cd (pF)	VF @	IF (mA)	IR (uA)	@ VR	Trr (nS)	Use/Comparable Types
Germanium										
AA119	DO-7	30	100	1.2	2.2	10	150	30		AM/FM Detection Point Contact
OA47	DO-7	25	110	3.5	0.45	10	100	25	70	Gold Bonded G.P. Switching
OA90	DO-7	20	45		1.5	10	450	20		G.P. Point Contact OA70, OA80
OA91	DO-7	90	50		1.9	10	180	75		G.P. Point Contact OA71, 79, 81
DSOA91	DO-7	50	30	1	1	5	200	10		G.P. OA91, 1N60
OA95	DO-7	90	50		1.5	10	110	0.75		G.P. Point Contact
Silicon										
BA100	DO-7	60	90	25	0.96	10	10	60		G.P. — Alloyed
BA102	DO-7	20		20-45	Cd Ratio 1.4 @	4/10 V/VV				Variable Capacitance
BA114	DO-7		20		0.7	1				Bias Stabilizer
BA234/4	DO-35	20	100	<2	1	100	0.1	15		UHF Sw.
BAW62	SOD-27	75	200	2	0.75	5	5	75	4	High Speed Silicon Sw.
BB119	DO-35	15		20-25 @ 4V	Cd Ratio >>1.3					Varicap — replaces BA102
BB122	DO-35	30		12 @ 3V	Cd Ratio 5.2		0.05	28		Varicap VHF UHF
BB212	TO-92	12		500-620 @ 0.5V	Cd Ratio > 22.5		0.05	10		AM Dual Varicap
OA200	DO-7	50	160	25	0.96	10	0.1	50		Small Signal — Alloyed
OA202	DO-7	150	160	25	0.96	10	0.1	150		Small Signal — Alloyed
1N914A	DO-35	75	75	4	1	10	5	75	4	Small Signal Sw. 1N4148
1N4148	DO-35	75	200	4	1	10	0.025	20	4	Small Signal Sw. 1N914A
1N4448	DO-35	75	300	4	1	100	0.025	6	4	G.P. Silicon Sw. 1N4148
5082-2800	DO-7	70	15	2	0.41	1	0.2	50	0.1	Schottky (Hot Carrier) UHF Detector, Mixer Switch

RECTIFIERS

TYPE	MAT	VR	IF(A)	VF @	IF(A)	IR(uA)	@ VR	USE
BYX21/200/R	S	75	25	1.2	25	1.1mA	75	Automobile H. Duty Press fit.
BYX98/300	S	300	10	1.4	10	200	300	Power Rectifier Stud Mount
DS5404	S	200	3	1.1	3	5	200	G.P. Rectifier
EM4005	S	50	1	1.1	1	5	50	G.P. Rectifier
EM401	S	100	1	1.1	1	5	100	G.P. Rectifier
EM404	S	400	1	1.1	1	5	400	G.P. Rectifier
EM410	S	1000	1	1.1	1	5	1000	G.P. Rectifier
MR110	S	100	10					G.P. Stud Mount
MR410	S	400	10					G.P. Stud Mount
MR5108	S	1000	3	1.1	3	5	1000	G.P. Rectifier
IN3492/R	S	100	25	1.7	18	1mA	100	Heavy Duty Automobile Press fit.
IN3493/R	S	200	25	1.7	18	1mA	200	Heavy Duty Automobile Press fit.
IN4001	S	50	1	1.1	1	5	50	G.P. Rectifier.
IN4002	S	100	1	1.1	1	5	100	G.P. Rectifier.
IN4004	S	400	1	1.1	1	5	400	G.P. Rectifier.
IN4007	S	1000	1	1.1	1	0.2	1000	G.P. Rectifier.
BY229-400	S	400	7	1.85	20			SMPS trr=450nS
1N4936	S	400	1	1	1	5	400	SMPS trr=200nS
IN5059(A14B)	S	200	2.5	1.25	2.5	0.2	200	Transient Protected (Controlled Avalanche).
IN5060(A14D)	S	400	2.5	1.25	2.5	0.2	400	Transient Protected (Controlled Avalanche).
IN5061(A14M)	S	600	2.5	1.25	2.5	0.2	600	Transient Protected (Controlled Avalanche).
IN5062(A14N)	S	800	2.5	1.25	2.5	0.5	800	Transient Protected (Controlled Avalanche).
IN5404	S	400	3	1.1	3	5	400	G.P. Rectifier.
IN5408	S	1000	3	1.1	3	5	1000	G.P. Rectifier.
IN5624	S	200	5	1.1	5	5	200	Transient Protected (Controlled Avalanche).