MC1566L
MC1466L

MULTI-PURPOSE REGULATORS

MONOLITHIC VOLTAGE AND CURRENT REGULATOR

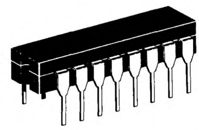
This unique "floating" regulator can deliver hundreds of volts — limited only by the breakdown voltage of the external series pass transistor. Output voltage and output current are adjustable. The MC1466/MC1566 integrated circuit voltage and current regulator is designed to give "laboratory" power-supply performance.

- Voltage/Current Regulation with Automatic Crossover
- Excellent Line Voltage Regulation, 0.01% +1.0 mV
- Excellent Load Voltage Regulation, 0.01% +1.0 mV
- Excellent Current Regulation, 0.1% +1.0 mA
- Short-Circuit Protection
- Output Voltage Adjustable to Zero Volts
- Internal Reference Voltage
- Adjustable Internal Current Source

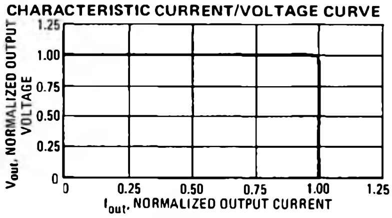
PRECISION WIDE-RANGE VOLTAGE and CURRENT REGULATOR

EPITAXIAL PASSIVATED

CERAMIC PACKAGE
CASE 632
TO-116

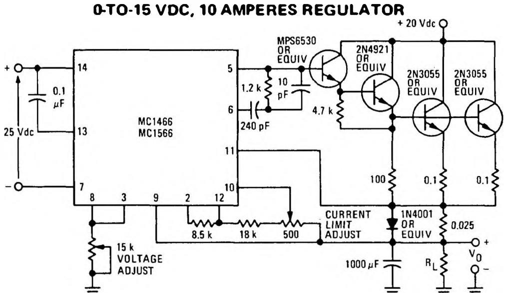


CHARACTERISTIC CURRENT/VOLTAGE CURVE

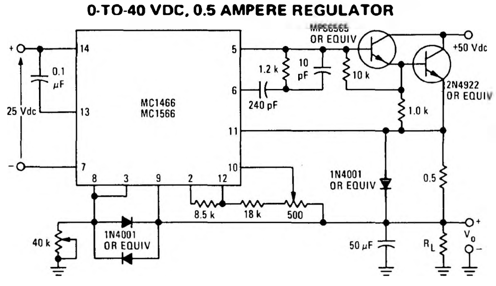


TYPICAL APPLICATIONS

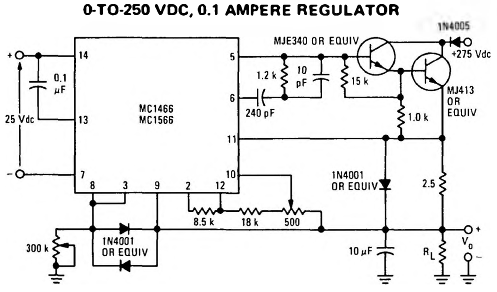
0-TO-15 VDC, 10 AMPERES REGULATOR



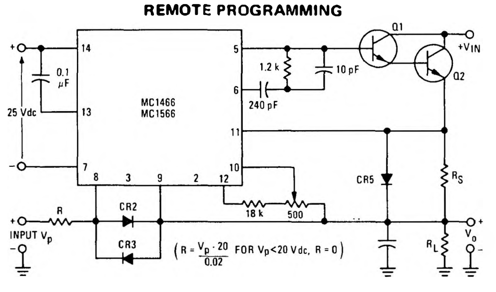
0-TO-40 VDC, 0.5 AMPERE REGULATOR



0-TO-250 VDC, 0.1 AMPERE REGULATOR



REMOTE PROGRAMMING

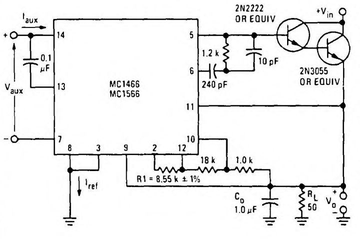
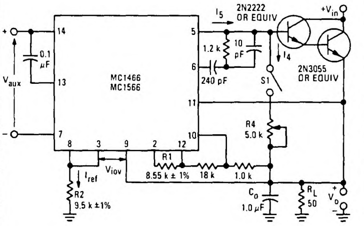
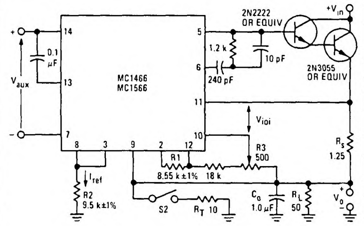


See Packaging Information Section for outline dimensions.

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

Rating		Symbol	Value	Unit
Auxiliary Voltage		V_{aux}		Vdc
	MC1466		30	
	MC1566		35	
Power Dissipation (Package Limitation)		P_D	750	mW
Derate above T_A = +50°C		$1/\theta_{JA}$	6.0	mW/°C
Operating Temperature Range		T_A		°C
	MC1466		0 to +75	
	MC1566		−55 to +125	
Storage Temperature Range		T_{stg}	−65 to +150	°C

ELECTRICAL CHARACTERISTICS (T_A = +25°C, V_{aux} = +25 Vdc unless otherwise noted)

Characteristic Definition	Characteristic		Symbol	Min	Typ	Max	Units
	Auxiliary Voltage (See Notes 1 & 2)		V_{aux}				Vdc
	(Voltage from pin 14 to pin 7)	MC1466		21	–	30	
		MC1566		20	–	35	
	Auxiliary Current		I_{aux}				mAdc
		MC1466		–	9.0	12	
		MC1566		–	7.0	8.5	
	Internal Reference Voltage		V_{IR}				Vdc
	(Voltage from pin 12 to pin 7)	MC1466		17.3	18.5	19.7	
		MC1566		18	18.5	19	
	Reference Current (See Note 3)		I_{ref}				mAdc
		MC1466		0.8	1.0	1.2	
		MC1566		0.9	1.0	1.1	
	Input Current-Pin 8		I_8				μAdc
		MC1466		–	6.0	12	
		MC1566		–	3.0	6.0	
	Power Dissipation		P_D				mW
		MC1466		–	–	360	
		MC1566		–	–	300	
	Input Offset Voltage, Voltage Control		V_{iov}				mVdc
	Amplifier (See Note 4)	MC1466		0	15	40	
		MC1566		3.0	15	25	
	Load Voltage Regulation		ΔV_{iov}				mV
	(See Note 5)	MC1466		–	1.0	3.0	
		MC1566		–	0.7	1.0	
		MC1466	$\Delta V_{ref}/V_{ref}$	–	0.015	0.03	%
		MC1566		–	0.004	0.01	
	Line Voltage Regulation		ΔV_{iov}				mV
	(See Note 6)	MC1466		–	1.0	3.0	
		MC1566		–	0.7	1.0	
		MC1466	$\Delta V_{ref}/V_{ref}$	–	0.015	0.03	%
		MC1566		–	0.004	0.01	
	Temperature Coefficient of Output Voltage		TCV_o				%/°C
	(T_A = 0 to +75°C)	MC1466		–	0.01	–	
	(T_A = −55 to +25°C)	MC1566		–	0.006	–	
	(T_A = +25 to +125°C)	MC1566		–	0.004	–	
	Input Offset Voltage, Current Control		V_{ioi}				mVdc
	Amplifier (See Note 4)	MC1466		0	15	40	
	(Voltage from pin 10 to pin 11)	MC1566		3.0	15	25	
	Load Current Regulation		$\Delta I_L/I_L$				%
	(See Note 7)	MC1466		–	–	0.2	
		MC1566		–	–	0.1	
		MC1466	ΔI_{ref}	–	–	1.0	mAdc
		MC1566		–	–	1.0	

NOTE 1:
The instantaneous input voltage, V_{aux}, must not exceed the maximum value of 30 Volts for the MC1466 or 35 Volts for the MC1566. The instantaneous value of V_{aux} must be greater than 20 Volts for the MC1566 or 21 Volts for the MC1466 for proper internal regulation.

NOTE 2:
The auxiliary supply voltage V_{aux}, must "float" and be electrically isolated from the unregulated high voltage supply, V_{IN}

NOTE 3:
Reference current may be set to any value of current less than 1.2 mAdc by applying the relationship:

$$I_{ref}\,(mA) = \frac{8.55}{R_1\,(k\Omega)}$$

NOTE 4:
A built-in offset voltage (15 mVdc nominal) is provided so that the power supply output voltage or current may be adjusted to zero.

NOTE 5:
Load Voltage Regulation is a function of two additive components, ΔV_{iov} and ΔV_{ref}, where ΔV_{iov} is the change in input offset voltage (measured between pins 8 and 9) and ΔV_{ref} is the change in voltage across R2 (measured between pin 8 and ground). Each component may be measured separately or the sum may be measured across the load. The measurement procedure for the test circuit shown is:

a. With S1 open ($I_4 = 0$) measure the value of $V_{iov\,(1)}$ and $V_{ref\,(1)}$

b. Close S1, adjust R4 so that $I_4 = 500\ \mu A$ and note $V_{iov\,(2)}$ and $V_{ref\,(2)}$.

Then $\Delta V_{iov} = V_{iov\,(1)} - V_{iov\,(2)}$

% Reference Regulation =

$$\frac{[V_{ref\,(1)} - V_{ref\,(2)}]}{V_{ref\,(1)}}\,(100\%) = \frac{\Delta V_{ref}}{V_{ref}}\,(100\%)$$

Load Voltage Regulation =

$$\frac{\Delta V_{ref}}{V_{ref}}\,(100\%) + \Delta V_{iov}$$

NOTE 6:
Line Voltage Regulation is a function of the same two additive components as Load Voltage Regulation, ΔV_{iov} and ΔV_{ref} (see note 5). The measurement procedure is:

a. Set the auxiliary voltage, V_{aux}, to the minimum specified value of 20 Volts for the MC1566 and 21 Volts for the MC1466. Read the value of $V_{iov\,(1)}$ and $V_{ref\,(1)}$.

b. Change the V_{aux} to 35 Volts for the MC1566 or 30 Volts for the MC1466 and note the value of $V_{iov\,(2)}$ and $V_{ref\,(2)}$. Then compute Line Voltage Regulation:

$\Delta V_{iov} = \Delta V_{iov\,(1)} - V_{iov\,(2)}$

% Reference Regulation =

$$\frac{[V_{ref\,(1)} - V_{ref\,(2)}]}{V_{ref\,(1)}}\,(100\%) = \frac{\Delta V_{ref}}{V_{ref}}\,(100\%)$$

Line Voltage Regulation =

$$\frac{\Delta V_{ref}}{V_{ref}}\,(100\%) + \Delta V_{iov}$$

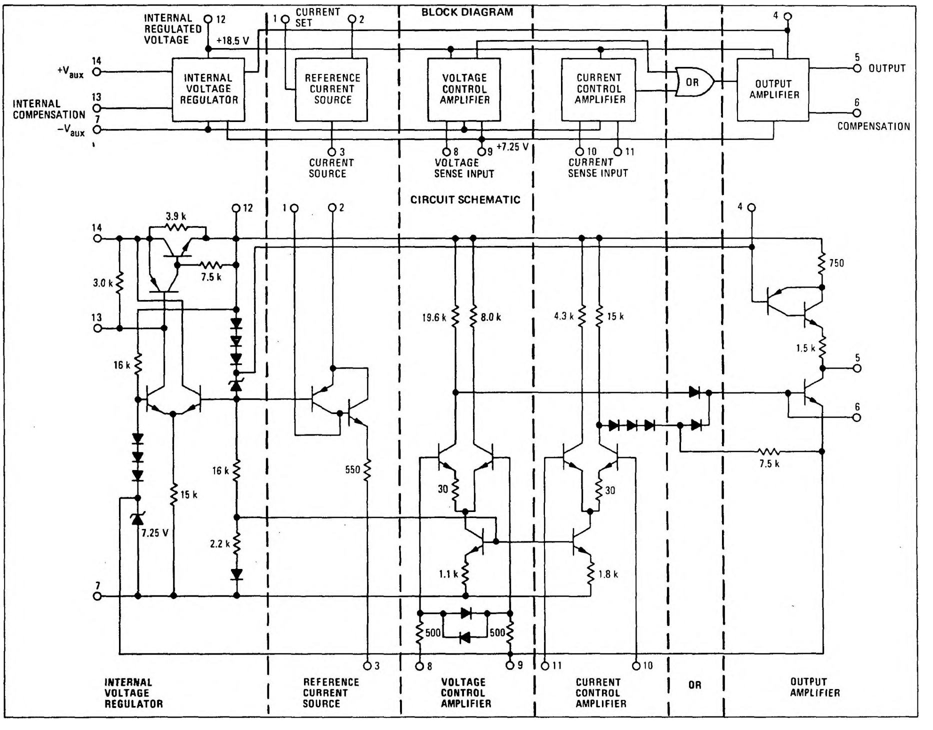
NOTE 7:
Load Current Regulation is measured by the following procedure:

a. With S2 open, adjust R3 for an initial load current, $I_{L(1)}$, such that V_o is 8.0 Vdc.

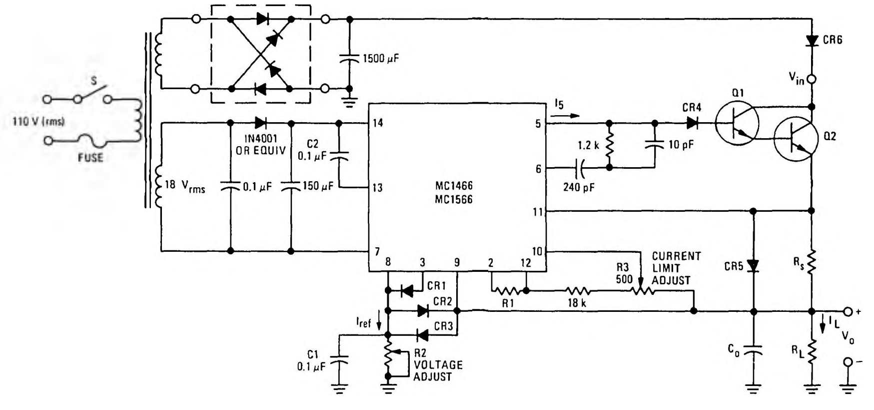
b. With S2 closed, adjust R_T for $V_o = 1.0$ Vdc and read $I_{L(2)}$. Then Load Current Regulation =

$$\frac{[I_{L(2)} - I_{L(1)}]}{I_{L(1)}}\,(100\%) + I_{ref}$$

where I_{ref} is 1.0 mAdc, Load Current Regulation is specified in this manner because I_{ref} passes through the load in a direction opposite that of load current and does not pass through the current sense resistor, R_s.



TYPICAL CIRCUIT CONNECTION



NORMAL DESIGN PROCEDURE AND DESIGN CONSIDERATIONS

1. Constant Voltage:

   For constant voltage operation, output voltage V_o is given by:

   $V_o = (I_{ref})\ (R_2)$

   where R2 is the resistance from pin 8 to ground and I_{ref} is the output current of pin 3.

   The recommended value of I_{ref} is 1.0 mAdc. Resistor R1 sets the value of I_{ref}:

   $I_{ref} = \frac{8.5}{R_1}$

   where R1 is the resistance between pins 2 and 12.

2. Constant Current:

   For constant current operation:

   (a) Select R_s for a 250 mV drop at the maximum desired regulated output current, I_{max}.

   (b) Adjust potentiometer R3 to set constant current output at desired value between zero and I_{max}.

3. If V_{in} is greater than 20 Vdc, CR2, CR3, and CR4 are necessary to protect the MC1466/MC1566 during short-circuit or transient conditions.

4. In applications where very low output noise is desired, R2 may be bypassed with C1 (0.1 µF to 2.0 µF). When R2 is bypassed, CR1 is necessary for protection during short-circuit conditions.

5. CR5 is recommended to protect the MC1466/MC1566 from simultaneous pass transistor failure and output short-circuit.

6. The RC network (10 pF, 240 pF, 1.2 k ohms) is used for compensation. The values shown are valid for all applications. However, the 10 pF capacitor may be omitted if f_T of Q1 and Q2 is greater than 0.5 MHz.

7. For remote sense applications, the positive voltage sense terminal (pin 9) is connected to the positive load terminal through a separate sense lead; and the negative sense terminal (the ground side of R2) is connected to the negative load terminal through a separate sense lead.

8. C_o may be selected by using the relationship:

   $C_o = (100\ \mu F)\ I_{L(max)}$, where $I_{L(max)}$ is the maximum load current in amperes.

9. C2 is necessary for the internal compensation of the MC1466/MC1566.

10. For optimum regulation, current out of pin 5, I_5, should not exceed 0.5 mAdc. Therefore select Q1 and Q2 such that:

    $\frac{I_{max}}{\beta 1 \beta 2} \leqslant 0.5$ mAdc

    where: I_{max} = maximum short-circuit load current (mAdc)

    $\beta 1$ = minimum beta of Q1

    $\beta 2$ = minimum beta of Q2

    Although Pin 5 will source up to 1.5 mAdc, $I_5 > 0.5$ mAdc will result in a degradation in regulation.

11. CR6 is recommended when $V_o > 150$ Vdc and should be rated such that Peak Inverse Voltage $> V_o$.