ORDERING INFORMATION

Device	Temperature Range	Package
MC1438R	0°C to +70°C	Metal Power
MC1538R	−55°C to +125°C	Metal Power

MC1438R
MC1538R

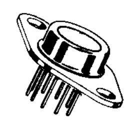
POWER BOOSTER

The MC1538/MC1438 is designed as a high current gain amplifier (70 dB), with unity voltage gain that can deliver load currents up to ±300 mAdc. This device is ideally suited to follow an operational amplifier (such as MC1556/MC1456) for driving low impedance loads and improving the overall circuit performance.

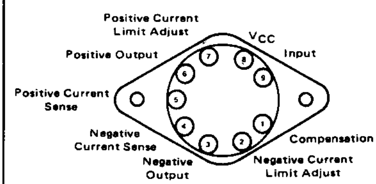
- High Input Impedance – 0.4 Meg-Ohm typ – when driving the MC1538/MC1438, the gain of an operational amplifier will approach the unloaded open-loop gain. Internal power dissipation of the operational amplifier will be independent of output voltage and therefore thermal drift will be reduced.
- Large Power Bandwidth – 1.5 MHz typ – considerably better than present operational amplifiers. Bandwidth and slew rate will be limited by the operational amplifier, not the MC1538/MC1438.
- Low Output Impedance – 10 Ohms typ – allows the MC1538/MC1438 to drive a capacitive load with greatly reduced phase shift compared with an operational amplifier. Output voltage swing capability is much increased when driving small load impedances.
- Adjustable Current Limit – ±5.0 mAdc to ±300 mAdc
- Excellent Power-Supply Rejection – 1.0 mV/V typ
- Current Gain – 3000 typ

OPERATIONAL AMPLIFIERS POWER BOOSTER

SILICON MONOLITHIC INTEGRATED CIRCUIT

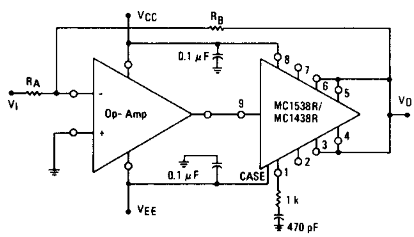


R SUFFIX
CASE 614

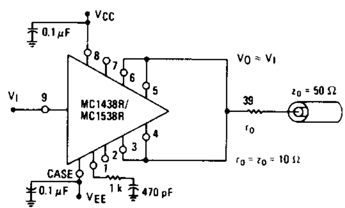


TYPICAL APPLICATIONS

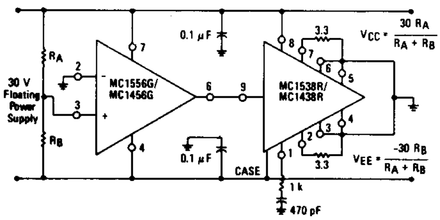
OPERATIONAL AMPLIFIER BOOST CIRCUIT



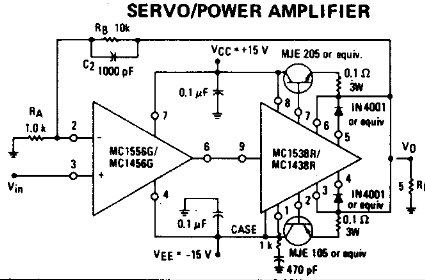
DIGITAL OR ANALOG LINE DRIVER



POWER SUPPLY SPLITTER



SERVO/POWER AMPLIFIER



Under some conditions of circuit layout and loading, the MC1538R/MC1438R will oscillate when driven into current limiting. Oscillation during positive current limiting can usually be suppressed by placing a 0.02 µF capacitor between Pins 7 and 5. Oscillations during negative current limit can usually be suppressed by placing a 0.02 µF capacitor between Pins 1 and 2. 100 Ohms in series with this capacitor will reduce any cross-over distortion occurring when driving extremely low impedance loads.

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

Rating	Symbol	MC1538R	MC1438R	Unit
Power Supply Voltage	V_{CC} V_{EE}	+22 -22	+18 -18	Vdc
Input Voltage Swing	$\|V_{in}\|$	V_{CC} or V_{EE}		Vdc
Load Current	I_L	350		mAdc
Power Dissipation @ T_A = +25°C Derate above T_A = +25°C	P_D $1/R_{\theta JA}$	3.0 24		Watts mW/°C
Power Dissipation @ T_C = +25°C Derate above T_C = +25°C	P_D $1/R_{\theta JC}$	17.5 140		Watts mW/°C
Operating Ambient Temperature Range MC1438R MC1538R	T_A	0 to + 70 -55 to +125		°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +150		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	41.6	°C/W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	7.15	°C/W

ELECTRICAL CHARACTERISTICS

(R_L = 300 ohms, T_C = +25°C unless otherwise noted.)

				MC1538R			MC1438R			
				5.0 V < V_{CC} = $\|V_{EE}\|$ < 20 V			V_{CC} = +15 V, V_{EE} = -15 V			
Characteristic (Linear Operation)	**Fig**	**Note**	**Symbol**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
Voltage Gain (f = 1.0 kHz)	1	–	A_V	0.9	0.95	1.0	0.85	0.95	1.0	V/V
Current Gain ($A_I = \Delta I_O/\Delta I_I$)	1	–	A_I	–	3000	–	–	3000	–	A/A
Output Impedance (f = 1.0 kHz)	1	–	z_o	–	10	–	–	10	–	Ohms
Input Impedance (f = 1.0 kHz)	1	–	z_i	–	400	–	–	400	–	k ohms
Output Voltage Swing (See Note 3)	1	3	V_O	±12	±13	–	±11	±12	–	Vdc
Input Bias Current	2	–	I_{IB}	–	60	200	–	60	300	μAdc
Output Offset Voltage	2	1	V_{OO}	–	25	150	–	25	200	mVdc
Small Signal Bandwidth (R_L = 300 ohms) (V_I = 0 Vdc, V_I = 100 mV[rms])	1	–	BW	–	8.0	–	–	8.0	–	MHz
Power Bandwidth (See Note 3) (V_O = 20 V_{p-p}, THD = 5%)	1	–	BW_P	–	1.5	–	–	1.5	–	MHz
Total Harmonic Distortion (Note 3) (f = 1.0 kHz, V_O = 20 V_{p-p})	1	–	THD	–	0.5	–	–	0.5	–	%
Output Short-Circuit Current			I_{OS}							mAdc
(R1 = R2 = ∞)	3	2		75	95	125	65	95	140	
(R1 = R2 = 3.3 ohms)	3			–	300	–	–	300	–	
Adjustable Range	4,5			–	5.0 to 300	–	–	5.0 to 300	–	
Power Supply Sensitivity	2	–	PSRR							mV/V
(V_{EE} constant)				–	1.0	–	–	1.0	–	
(V_{CC} constant)				–	1.0	–	–	1.0	–	
Power Supply Current (R_L ∞, V_I = 0)	2	–	I_{CC} I_{EE}	4.5	6.0	10	2.5	6.0	15	mAdc
Power Dissipation (See Note 3) (R_L ∞, V_I = 0)	2	3	P_C	150	180	300	75	180	450	mW

Note 1. Output offset Voltage is the quiescent dc output voltage with the input grounded.

Note 2. Short-Circuit Current, I_{SC}, is adjustable by varying R1, R2, R3 and R4. The positive current limit is set by R1 or R3, and the negative current limit is set by R2 or R4. See Figures 4 and 5 for curves of short-circuit current versus R1, R2, R3 and R4.

Note 3. V_{CC} = +15 V, V_{EE} = -15 V.

TEST CIRCUITS

FIGURE 1

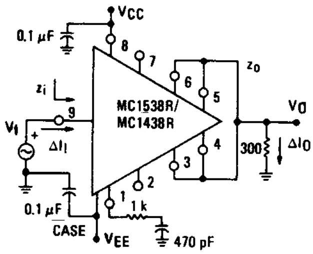


FIGURE 2

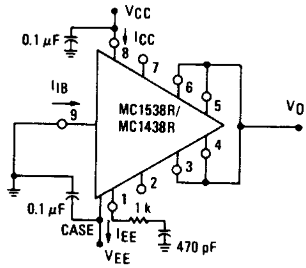
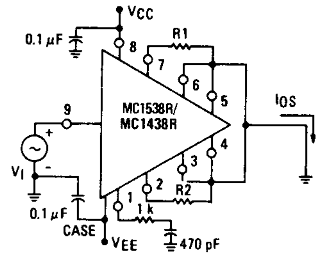
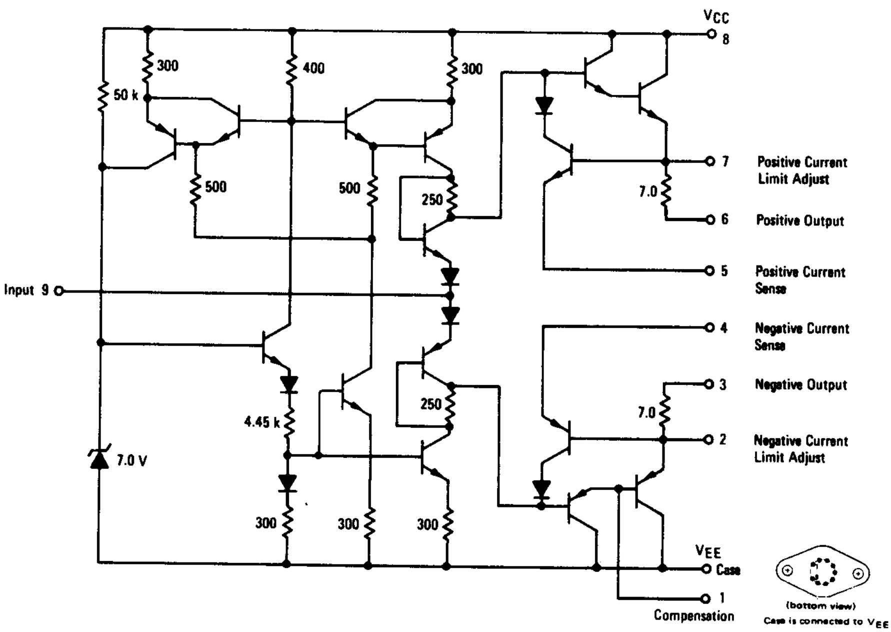


FIGURE 3



CIRCUIT SCHEMATIC



TYPICAL CHARACTERISTICS

(V_{CC} = +15 Vdc, V_{EE} = -15 Vdc, T_A = +25°C unless otherwise noted.)

FIGURE 4 – SHORT-CIRCUIT CURRENT versus R1 OR R2 (100 mA to 300 mA)

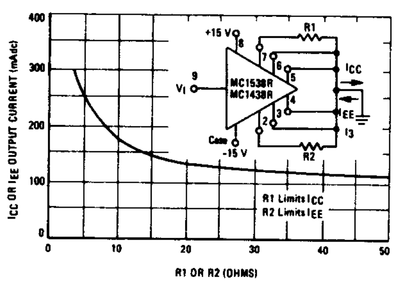
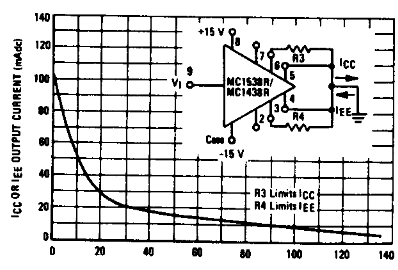


FIGURE 5 – SHORT-CIRCUIT CURRENT versus R3 OR R4 (5.0 mA to 100 mA)



TYPICAL CHARACTERISTICS (continued)

FIGURE 6 – POWER SUPPLY CURRENT versus SHUNT RESISTANCE

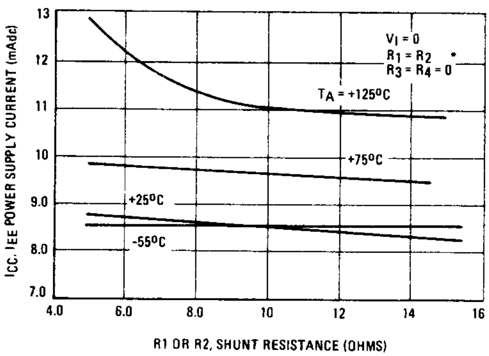


FIGURE 7 – SMALL SIGNAL GAIN AND PHASE RESPONSE

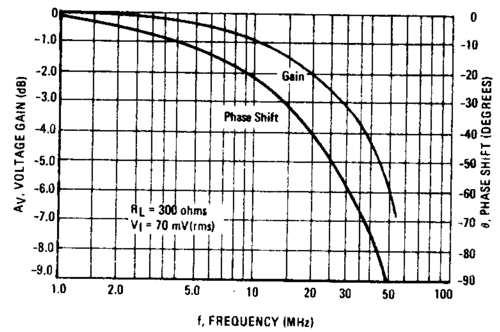


FIGURE 8 – POSITIVE OUTPUT VOLTAGE SWING versus LOAD CURRENT

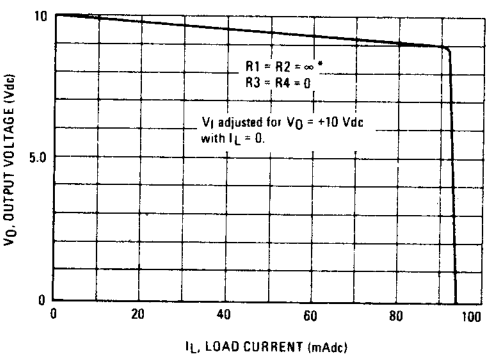


FIGURE 9 – NEGATIVE OUTPUT VOLTAGE SWING versus LOAD CURRENT

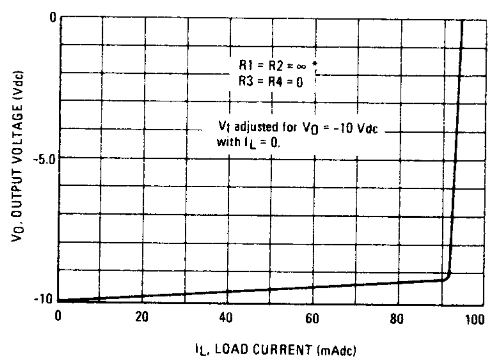


FIGURE 10 – OUTPUT OFFSET VOLTAGE versus TEMPERATURE

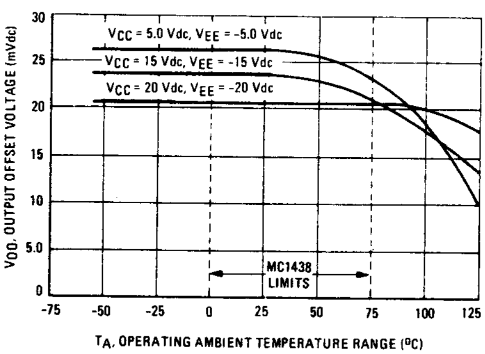
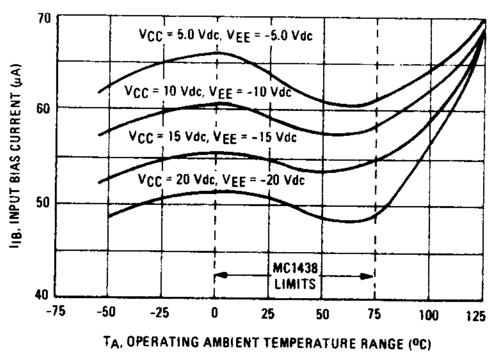


FIGURE 11 – INPUT BIAS CURRENT versus TEMPERATURE



*See figures 4 and 5 for definition of R1, R2, R3, and R4.

TYPICAL CHARACTERISTICS (continued)

(V_{CC} = +15 Vdc, V_{EE} = –15 Vdc, T_A = +25°C unless otherwise noted.)

FIGURE 12 – PULSE RESPONSE CHARACTERISTICS

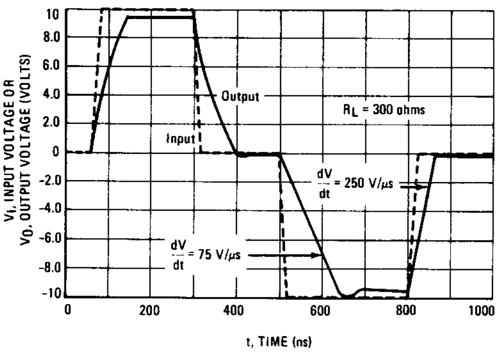
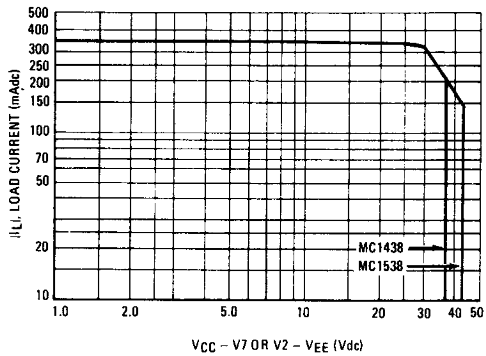


FIGURE 13 – DC SAFE OPERATING AREA



TYPICAL APPLICATIONS

FIGURE 14 – NON-INVERTING AC POWER AMPLIFIER

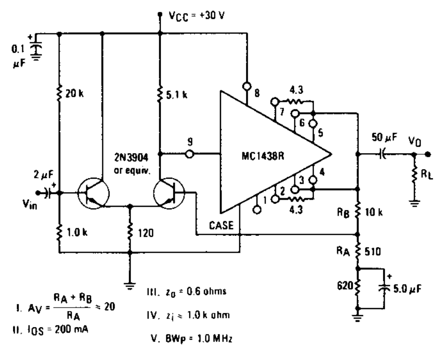


FIGURE 15 – NON-INVERTING POWER AMPLIFIER

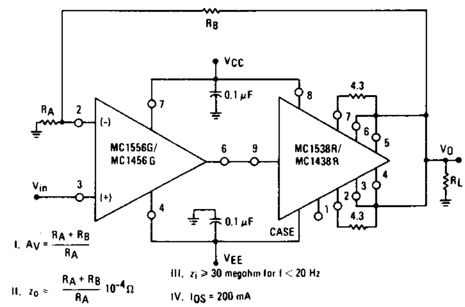


FIGURE 16 – NON-INVERTING VOLTAGE FOLLOWER

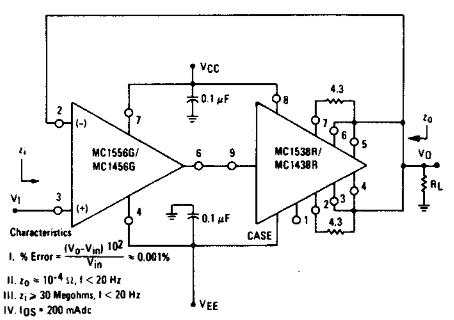
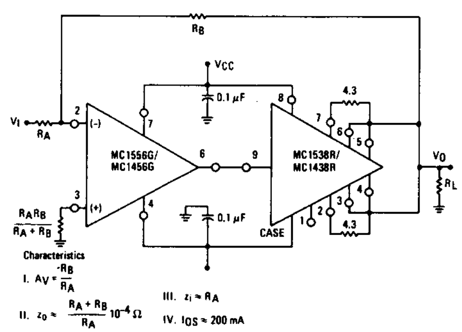


FIGURE 17 – INVERTING POWER AMPLIFIER



6

TYPICAL APPLICATIONS (continued)

FIGURE 18 – PROGRAMMABLE VOLTAGE SOURCE

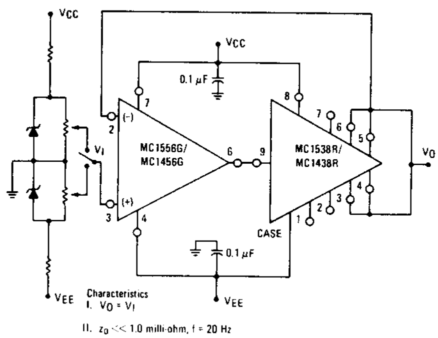


FIGURE 19 – CONSTANT CURRENT SOURCE OR TRANSCONDUCTANCE AMPLIFIER

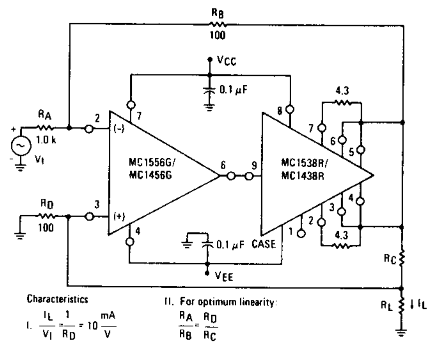


FIGURE 20 – SIGNAL DISTRIBUTION

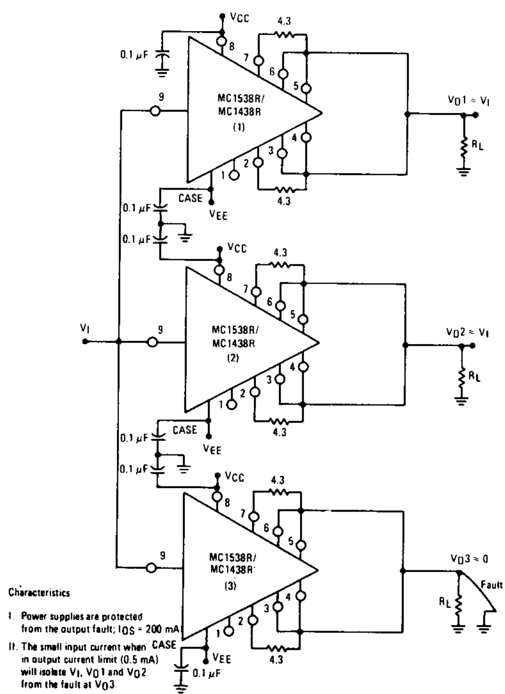


FIGURE 21 – ASTABLE MULTIVIBRATOR

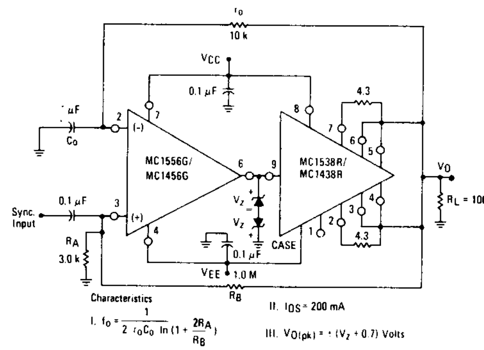


FIGURE 22 – WIEN BRIDGE OSCILLATOR