

# LINEAR INTEGRATED CIRCUITS

## Magnetic Amplifier Controller

7-58-11-31

UC1838  
UC2838  
UC3838

### FEATURES

- Independent 1% Reference
- Two Uncommitted, Identical Operational Amplifiers
- 100mA Reset Current Source with -100V Capability
- 5V to 40V Analog Operation
- 5W DIL Package

### DESCRIPTION

The UC1838 family of magnetic amplifier controllers contains the circuitry to generate and amplify a low-level analog error signal along with a high voltage-compliant current source. This source will provide the reset current necessary to enable a magnetic amplifier to regulate and control a power supply output in the range of 2A to 20A.

By controlling the reset current to a magnetic amplifier, this device will define the amount of volt-seconds the magnetic amplifier will block before switching to the conducting state. Magnetic amplifiers are ideal for post-regulators for multiple-output power supplies where each output can be independently controlled with efficiencies up to 99%. With a square or pulse-width-modulated input voltage, a magnetic amplifier will block a portion of this input waveform, allowing just enough to pass to provide a regulated output. With the UC1838, only the magnetic amplifier coil, three diodes, and an output L-C filter are necessary to implement a complete closed-loop regulator.

The UC1838 contains a precision 2.5V reference, two uncommitted high-gain op amps and a high-gain PNP-equivalent current source which can deliver up to 100mA of magnetic amplifier reset current.

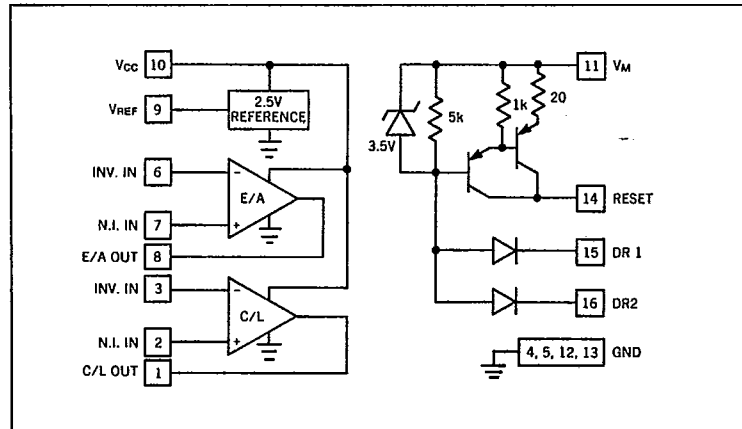
These devices are available in a plastic "bat-wing" DIP for operation over a -20°C to +85°C temperature range and, with reduced power, in a hermetically sealed cerdip for -55°C to +125°C operation.

### ABSOLUTE MAXIMUM RATINGS

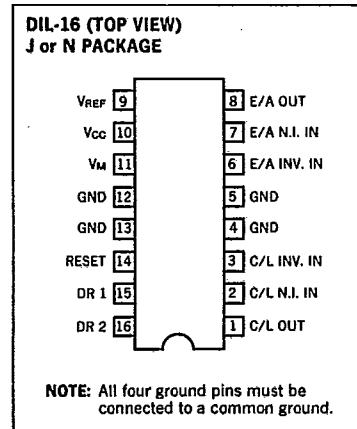
Supply Voltage, V <sub>CC</sub>	40V
Magnetic Amp. Source Voltage, V <sub>M</sub>	40V
Reset Output Voltage, V <sub>R</sub>	-80V
Total Current Source Voltage, V <sub>M</sub> - V <sub>R</sub>	100V
Amplifier Input Range	-3V to V <sub>CC</sub>
Reset Input Current, I <sub>DR</sub>	-10mA
<b>Plastic      Cerdip</b>	
Power Dissipation at T <sub>A</sub> = 25°C	2W      1W
Derate Above 50°C	20mW/°C      10mW/°C
Power Dissipation at T <sub>J</sub> (leads/case) = 25°C	5W      2W
Derate for Ground Lead Temperature Above 70°C	70mW/°C      —
Derate for Case Temperature Above 25°C	—      16mW/°C
Operating Temperature Range	-55°C to +125°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 sec)	300°C

**NOTE:** All voltages are with respect to ground pins.  
All currents are positive into the specified terminal.

### BLOCK DIAGRAM



### CONNECTION DIAGRAM

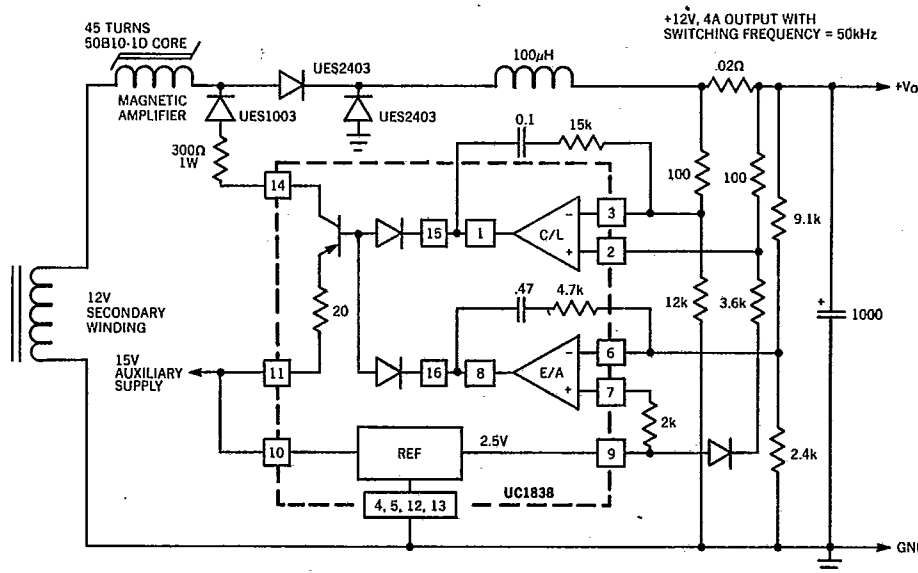


**ELECTRICAL CHARACTERISTICS** (Unless otherwise stated, these specifications apply for  $T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$  for the UC1838,  $-20^\circ\text{C}$  to  $+85^\circ\text{C}$  for the UC2838, and  $0^\circ\text{C}$  to  $+70^\circ\text{C}$  for the UC3838;  $V_{CC} = 20\text{V}$ ,  $V_M = 5\text{V}$ .)

PARAMETER	TEST CONDITIONS	UC1838/UC2838			UC3838			UNITS
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
<b>Reference Section</b>								
Supply Current	$V_{CC} = V_M = 40\text{V}$	—	6	8	—	6	8	mA
Reference Output	$T_A = 25^\circ\text{C}$	2.47	2.5	2.53	2.45	2.5	2.55	V
Line Regulation	$V_{CC} = 5$ to $30\text{V}$	—	1	5	—	1	10	mV
Load Regulation	$I_O = 0$ to $-2\text{mA}$	—	15	25	—	15	25	mV
Short Circuit Current	$V_{REF} = 0\text{V}$	—	-30	-60	—	-30	-60	mA
Temperature Stability*	Over Operating Temp. Range	—	15	25	—	10	25	mV
<b>Amplifier Section (Each Amplifier)</b>								
Offset Voltage	$V_{CM} = 2.5\text{V}$	—	—	5	—	—	10	mV
Input Bias Current	$V_{IN} = 0\text{V}$	—	—	-1	—	—	-1	$\mu\text{A}$
Input Offset Current		—	—	100	—	—	100	nA
Minimum Output Swing		0.4	—	18	0.4	—	18	V
Output Sink Current	$V_O = 5\text{V}$	1	10	30	1	10	30	mA
Output Source Current	$V_O = 0\text{V}$	-1	-10	-20	-1	-10	-20	mA
$A_{VOL}$	$V_O = 1$ to $11\text{V}$	100	120	—	100	120	—	dB
CMRR	$V_{IN} = 1$ to $11\text{V}$	70	80	—	70	80	—	dB
PSRR	$V_{CC} = 10$ to $20\text{V}$	70	100	—	70	100	—	dB
Gain Bandwidth*		0.6	0.8	—	0.6	0.8	—	MHz
<b>Reset Drive Section</b>								
Input Leakage	$V_{DR} = 30\text{V}$	—	—	10	—	—	10	$\mu\text{A}$
Output Leakage	$V_R = -80\text{V}$	—	—	-100	—	—	-100	$\mu\text{A}$
Input Current	$I_R = -50\text{mA}$ , $V_R = 0$	—	-1	-2	—	-1	-2	mA
Maximum Reset Current	$I_{DR} = -3\text{mA}$ , $V_R = 0$	-90	-120	-200	-90	-120	-200	mA
Transconductance	$I_R = -10$ to $-50\text{mA}$	.03	.04	.05	.03	.04	.05	A/V

**NOTE:** These parameters guaranteed by design and not 100% tested in production.

**TYPICAL APPLICATION**



UNITRODE INTEGRATED CIRCUITS  
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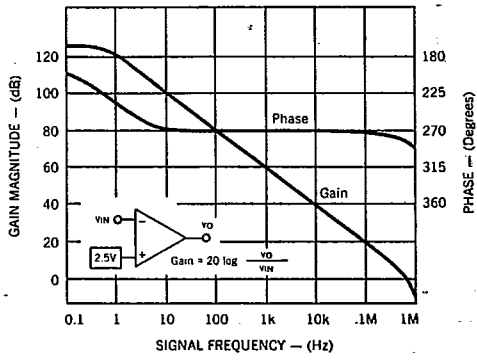
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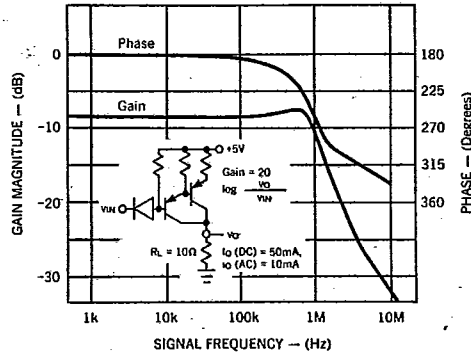
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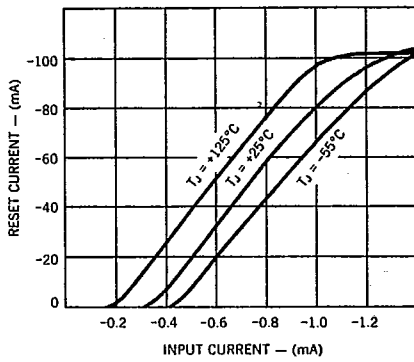
Amplifier Open-Loop Response



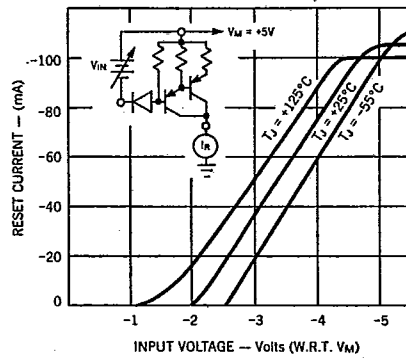
Reset Driver Response



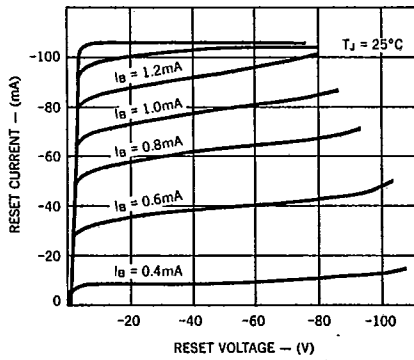
Reset Driver — Input Current



Reset Driver — Input Voltage



Reset Driver — Output Impedance



Reference Temperature Coefficient

