

Sense Current Amplifier

Monolithic IC MM1380

Outline

This IC improves on the previous sensor amp MM1089 (Dual). It is a single amp that allows current sensing regardless of the IC power supply (V_{CC}). Further, the common mode signal rejection ratio and power supply fluctuation rejection ratio have been improved, and gain is switched between 50 and 100 times.

Features

- | | |
|---|------------------------|
| (1) Common mode signal rejection ratio (CMRR1.1kHz) | 100dB typ. |
| (2) Power supply fluctuation rejection ratio (PSRR1.1kHz) | 80dB typ. |
| (3) Operating power supply voltage range | +3 ~ +24V |
| (4) Consumption current | 150 μ A typ. |
| (5) Voltage gain | 50/100 times switching |
| (6) Input equivalent offset voltage | \pm 0.5mV |
| (7) Current detection | High/Low switching |
| (8) Single type | |

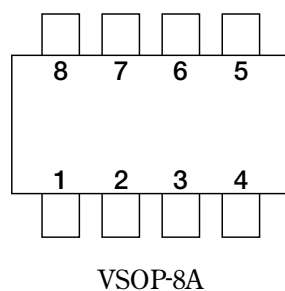
Package

VSOP-8A

Applications

- (1) Notebook PCs
- (2) PDA

Pin Assignment

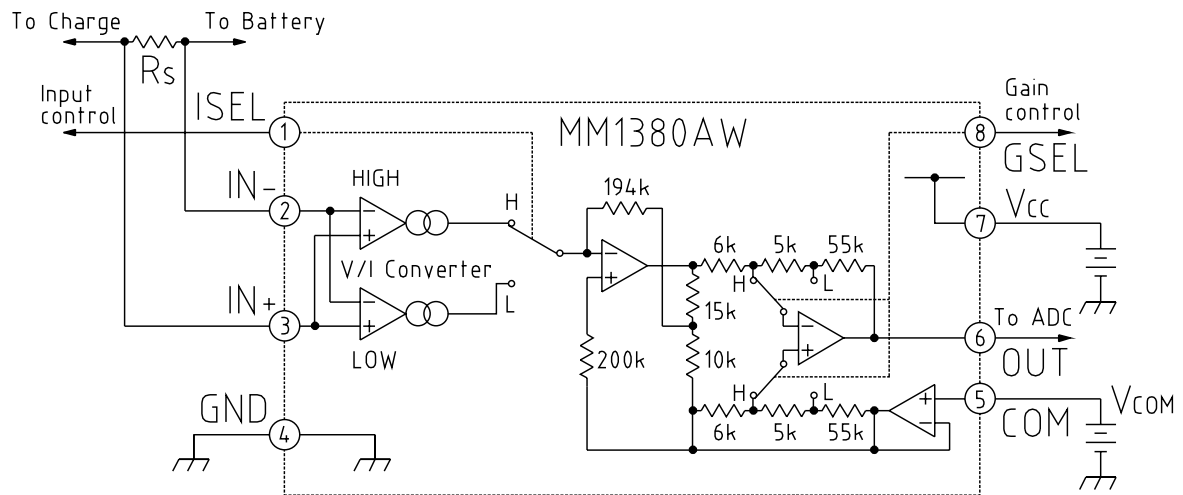


1	ISEL
2	IN-
3	IN+
4	GND
5	COM
6	OUT
7	V_{CC}
8	GSEL

Pin Description

Pin No.	Pin name	Functions	Internal equivalent circuit
1	ISEL	Input selection switch terminal Input common mode voltage range ISEL="H" : from 1.8V to 24V ISEL="L" : from -0.3V to V _{CC} -2.4V	
4	GND	Ground terminal	
2	IN-	Inverted input terminal	
3	IN+	Non-Inverted input terminal	
5	COM	Reference voltage input terminal	
6	OUT	Output terminal	
7	V _{CC}	Supply voltage terminal	
8	GSEL	Gain selection switch terminal Voltage gain GSEL="H" : G _V =100 GSEL="L" : G _V =50	

Block Diagram



Absolute Maximum Ratings

Item	Symbol	Ratings	Units
Storage temperature	T _{STG}	-40~+125	°C
Supply voltage	V _{CCmax.}	-0.3~+25	V
Input terminal voltage	V _{imax.}	-0.3~+25	V
Allowable loss	P _d	300	mW

Recommended Operating Conditions

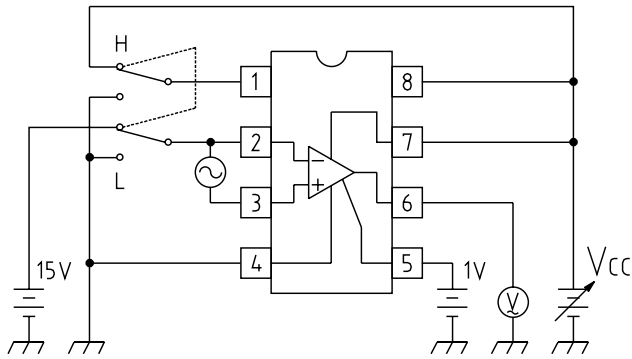
Item	Symbol	Ratings	Units
Operating temperature	T _{OPR}	-20~+85	°C
Operating voltage	V _{CC}	+3~+24	V

Electrical Characteristics (Except where otherwise indicated, $T_a=25^{\circ}\text{C}$, $V_{CC}=5\text{V}$, $V_{ICM}=15\text{V}$, $V_{COM}=25\text{V}$, $V_{ISEL}=5\text{V}$, $V_{GSEL}=5\text{V}$, $R_L=10\text{k}\Omega$)

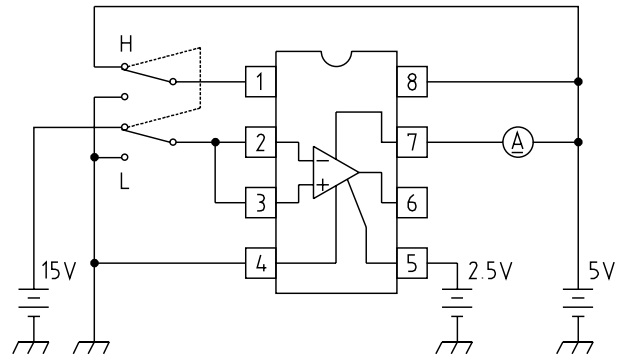
Item	Signal	Measurement conditions	Min.	Typ.	Max.	Unit
Supply voltage range	V_{CC}	$V_{COM}=V_{CC}/2$	3		24	V
Supply current	I_{CC}	$\Delta V_{IN}=0\text{V}$, R_L : OPEN		150	200	μA
Voltage gain 1 ($\times 100$)	G_{V1}	$V_{GSEL}=5\text{V}$	97	100	103	mV/mV
Voltage gain 2 ($\times 50$)	G_{V2}	$V_{GSEL}=0\text{V}$	48.5	50	51.5	mV/mV
Input offset voltage 1 (High side)	V_{OFF1}	$\Delta V_{IN}=0\text{V}$, $V_{ISEL}=5\text{V}$	-0.5		0.5	mV
Input offset voltage 2 (Low side)	V_{OFF2}	$\Delta V_{IN}=0\text{V}$, $V_{ISEL}=0\text{V}$	-0.5		0.5	mV
Temperature coefficient of Voff 1	ΔV_{OFF1}	$V_{ISEL}=5\text{V}$	-4		4	$\mu\text{V}/^{\circ}\text{C}$
Temperature coefficient of Voff 2	ΔV_{OFF2}	$V_{ISEL}=0\text{V}$	-6		6	$\mu\text{V}/^{\circ}\text{C}$
Input common mode voltage range 1 (High side)	V_{ICM1}	$V_{ISEL}=5\text{V}$	1.8		24	V
Input common mode voltage range 2 (Low side)	V_{ICM2}	$V_{ISEL}=0\text{V}$	-0.3		$V_{CC}-2.4$	V
Input differential voltage	V_{IDF}		-200		200	mV
Input bias current 1 (High side)	I_{B1}	$V_{ISEL}=5\text{V}$, $\Delta V_{IN}=0\text{V}$	0.8	1.2	1.6	μA
Input bias current 2 (Low side)	I_{B2}	$V_{ISEL}=0\text{V}$, $\Delta V_{IN}=0\text{V}$	-0.8	-1.2	-1.6	μA
Input impedance	Z_i		100			$\text{k}\Omega$
COM terminal voltage range	V_{COM}	R_L : OPEN	1.2		$V_{CC}-1.2$	V
ISEL terminal current	I_{ISEL}	$V_{ISEL}=5\text{V}$		1.0		μA
ISEL terminal voltage range 1 (High side)	V_{ISEL1}		1.7		24	V
ISEL terminal voltage range 2 (Low side)	V_{ISEL2}		0		0.5	V
GSEL terminal sink current	I_{GSEL}	$V_{GSEL}=5\text{V}$		1.0		μA
GSEL terminal voltage range 1 ($\times 100$)	V_{GSEL1}		1.7		24	V
GSEL terminal voltage range 2 ($\times 50$)	V_{GSEL2}		0		0.5	V
Output voltage range	V_{OUT}	R_L : OPEN	0.3		$V_{CC}-0.3$	V
Output source current	I_{SRC}	$V_{OUT}=V_{CC}-0.3\text{V}$	0.5	1.0		mA
Output sink current	I_{SNK}	$V_{OUT}=0.3\text{V}$	-0.5	-1.0		mA
Cut off frequency 1 ($G_{V1}=100$)	F_{C1}	$V_{GSEL}=5\text{V}$, $V_{OUT}=-3\text{dB}$		100		kHz
Cut off frequency 2 ($G_{V2}=50$)	F_{C2}	$V_{GSEL}=0\text{V}$, $V_{OUT}=-3\text{dB}$		140		kHz
Supply voltage rejection ratio 1 (High side)	PSRR1	$f=1\text{kHz}$, $V_{ISEL}=5\text{V}$	70	80		dB
Supply voltage rejection ratio 2 (Low side)	PSRR2	$f=1\text{kHz}$, $V_{ISEL}=0\text{V}$	70	80		dB
Common mode rejection ratio 1 (High side)	CMRR1	$f=1\text{kHz}$, $V_{ISEL}=5\text{V}$	70	80		dB
Common mode rejection ratio 2 (Low side)	CMRR2	$f=1\text{kHz}$, $V_{ISEL}=0\text{V}$	70	80		dB

Measuring Circuit

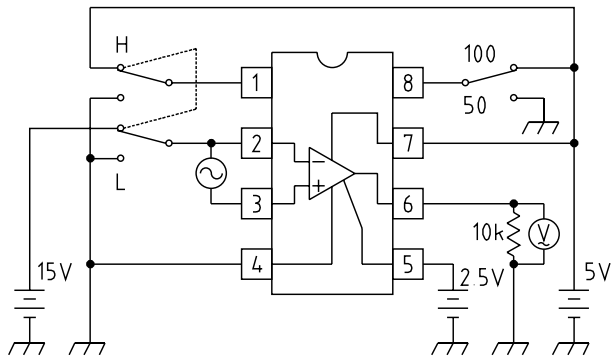
Supply voltage range



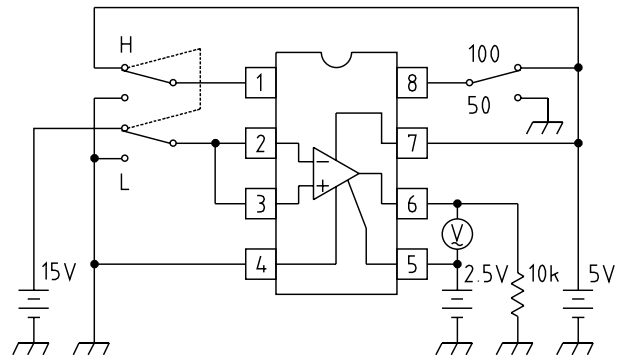
Supply current



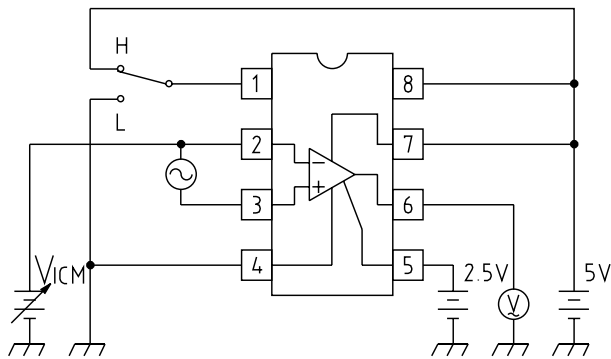
Voltage gain



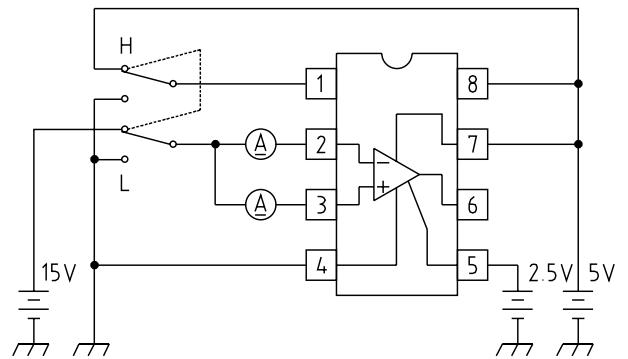
Offset voltage



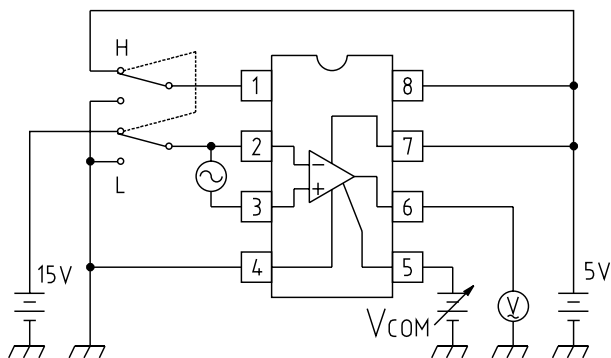
Input common mode voltage range



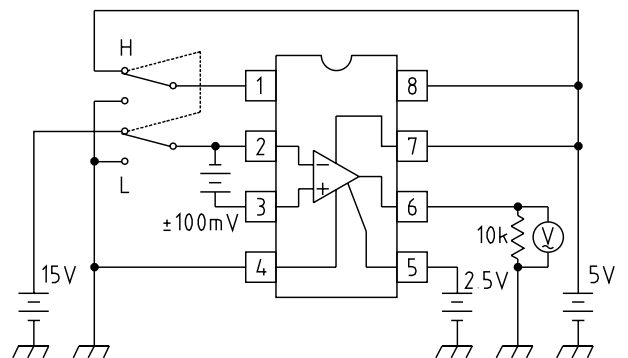
Input bias current



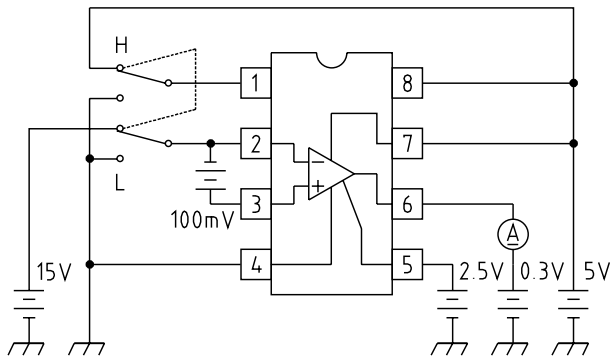
COM terminal voltage range



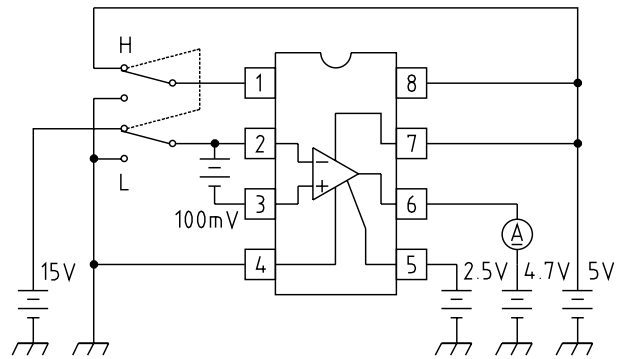
Output voltage range



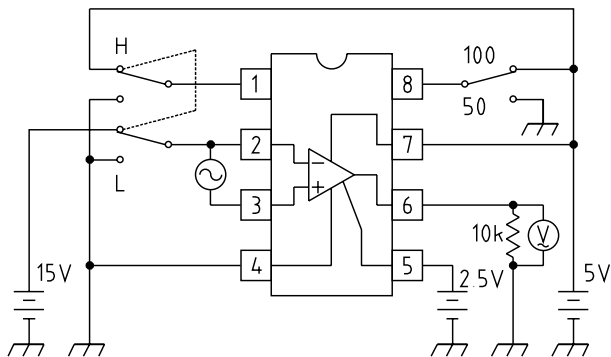
■ Output source current



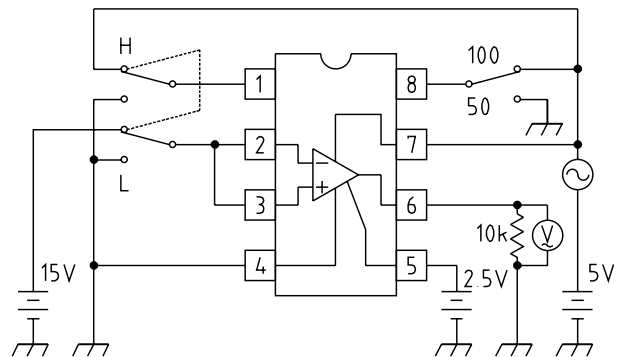
■ Output sink current



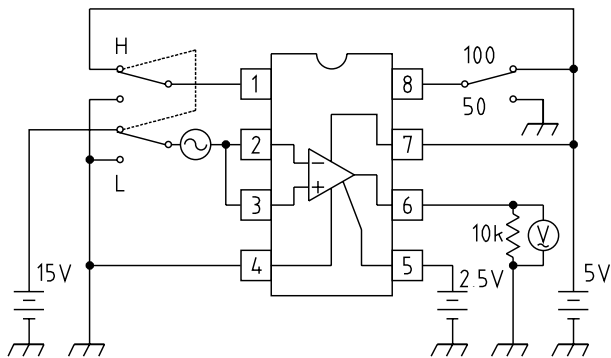
■ Cut off frequency



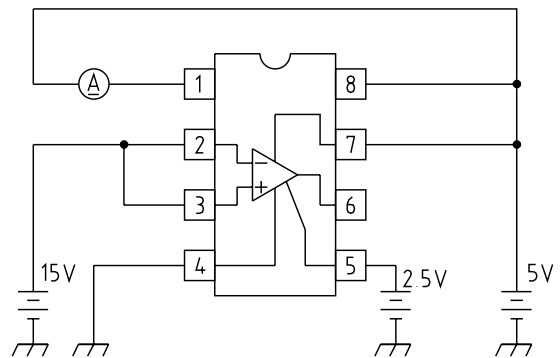
■ Supply voltage rejection ratio



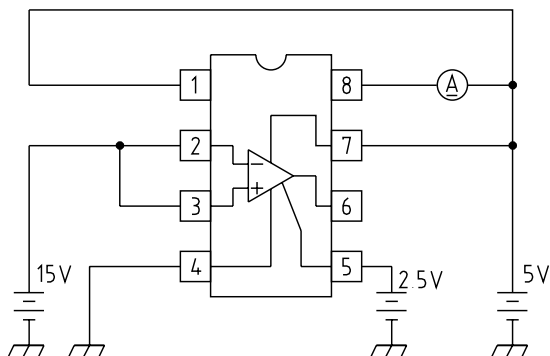
■ Common mode rejection ratio



■ ISEL terminal sink current

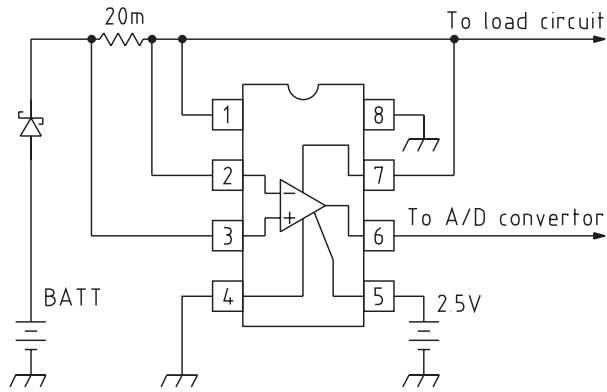


■ GSEL terminal sink current



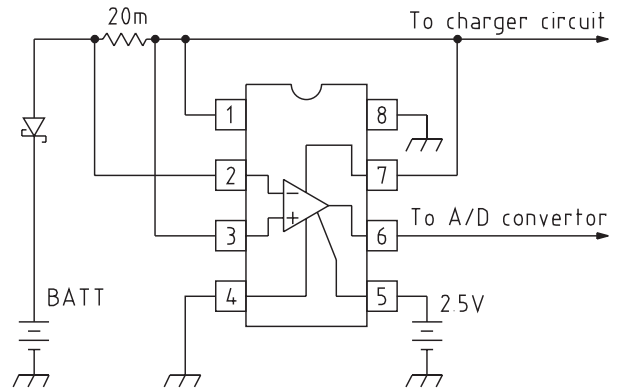
Application Circuit

Battery current sensing circuit



$R_s=20m\Omega$ 、 $G_v=50:1V/A$

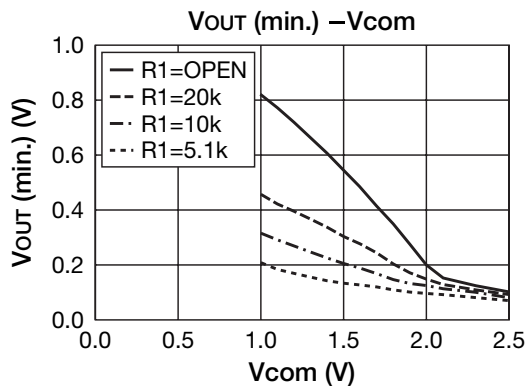
Charger current sensing circuit



$R_s=20m\Omega$ 、 $G_v=50:1V/A$

Characteristics

Minimum output voltage-COM terminal voltage



Input bias current-differential input voltage

