

Sense Current Amplifier Monolithic IC MM1380

Outline

This IC was developed for charge/discharge current - voltage conversion for secondary batteries (MiMH, Li-ion) in notebook PCs, PDA, etc.

The IC can operate from a 3V power supply, and detection power supply can detect current up to 24V. It monitors charge and discharge current on notebook PC batteries, inputs the data to the CPU and manages remaining battery power, etc.

Features

- | | |
|---|---|
| 1. CMRR $f = 1\text{kHz}$ | 80dB typ. |
| 2. PSRR $f = 1\text{kHz}$ | 80dB typ. |
| 3. Power supply voltage | 3 ~ 24V |
| 4. Consumption current | 150 μ A typ. |
| 5. Voltage gain | switchable between 50 $\times$ and 100 $\times$ |
| 6. Input equivalent offset voltage | $\pm 0.5\text{mV}$ |
| 7. Current detection high/low switching | |

Package

VSOP-8A

Sense Current Amplifier

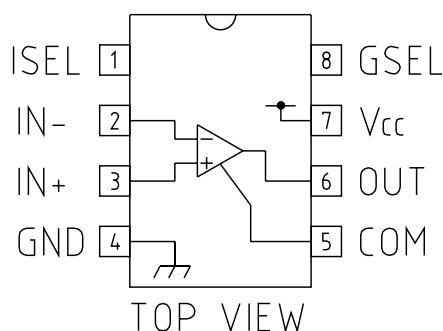
	Channel	Package	CMRR ($f=1\text{kHz}$)	Increased current sensing		Input conversion offset voltage (mV)
				1 (V)	2 (V)	
MM1380AW	1	VSOP-8A	80dB typ.	1.8~24*	$-0.3\sim V_{CC}-2.4$	± 0.5

*The current can be detected up to 24V regardless of the power voltage.

Applications

- (1) Notebook PCs
- (2) PDA

Pin Assignment

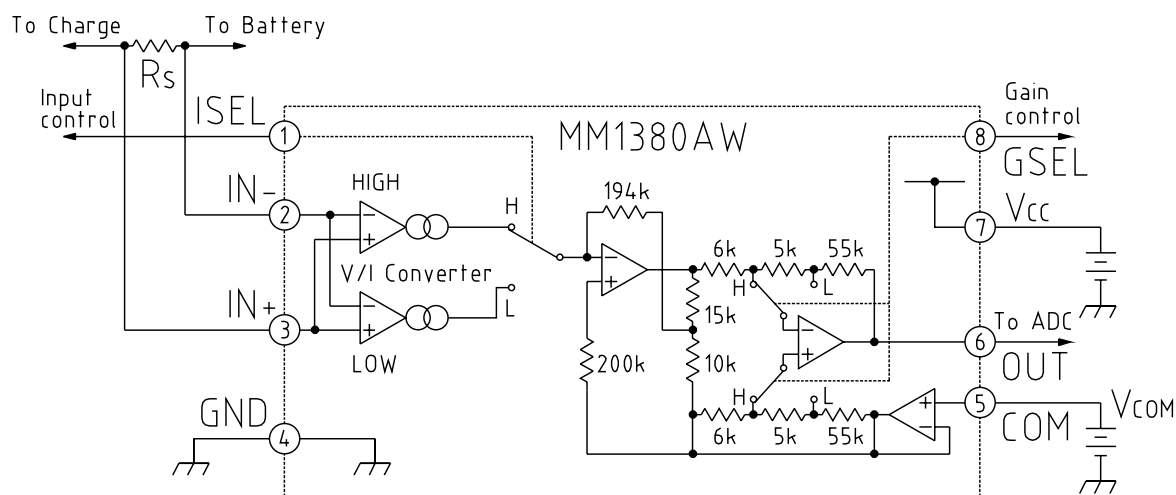


1	ISEL
2	IN-
3	IN+
4	GND
5	COM
6	OUT
7	V _{CC}
8	GSEL

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	Vcc	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

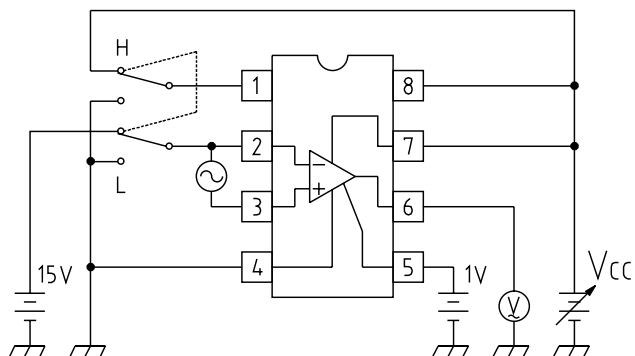
Item	Symbol	Ratings	Units
Operating temperature	T_{OPR}	-20~+85	°C
Operating voltage	V_{CC}	+3~+24	V

Electrical Characteristics (Except where otherwise indicated, $T_a=25^{\circ}\text{C}$, $V_{CC}=5\text{V}$, $V_{ICM}=15\text{V}$, $V_{COM}=2.5\text{V}$, $V_{ISEL}=5\text{V}$, $V_{GSEL}=5\text{V}$, $R_L=10\text{k}\Omega$)

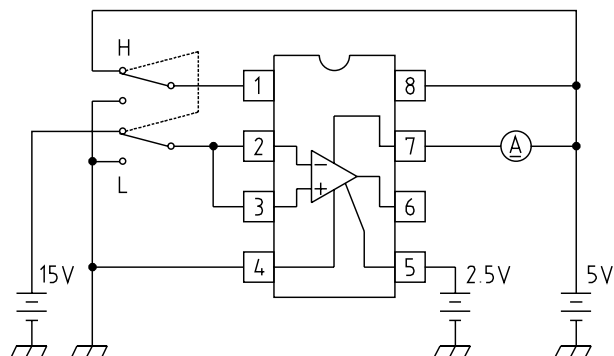
Item	Signal	Measurement conditions	Min.	Typ.	Max.	Unit
Supply voltage range	V_{CC}	$V_{COM}=V_{CC}/2$	3		24	V
Supply current	I_{CC}	$\angle V_{IN}=0\text{V}$, R_L : OPEN		150	200	μA
Voltage gain 1 ($\times 100$)	G_{V1}	$V_{GSEL}=5\text{V}$	97	100	103	mV/mV
Voltage gain 2 ($\times 50$)	G_{V2}	$V_{GSEL}=0\text{V}$	48.5	50	51.5	mV/mV
Input offset voltage 1 (High side)	V_{OFF1}	$\angle V_{IN}=0\text{V}$, $V_{ISEL}=5\text{V}$	-0.5		0.5	mV
Input offset voltage 2 (Low side)	V_{OFF2}	$\angle V_{IN}=0\text{V}$, $V_{ISEL}=0\text{V}$	-0.5		0.5	mV
Temperature coefficient of Voff 1	$\angle V_{OFF1}$	$V_{ISEL}=5\text{V}$	-4		4	$\mu\text{V}/^{\circ}\text{C}$
Temperature coefficient of Voff 2	$\angle V_{OFF2}$	$V_{ISEL}=0\text{V}$	-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}	$V_{ISEL}=5\text{V}$, $\angle V_{IN}=0\text{V}$	0.8	1.2	1.6	μA
Input bias current 2 (Low side)	I_{b2}	$V_{ISEL}=0\text{V}$, $\angle V_{IN}=0\text{V}$	-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

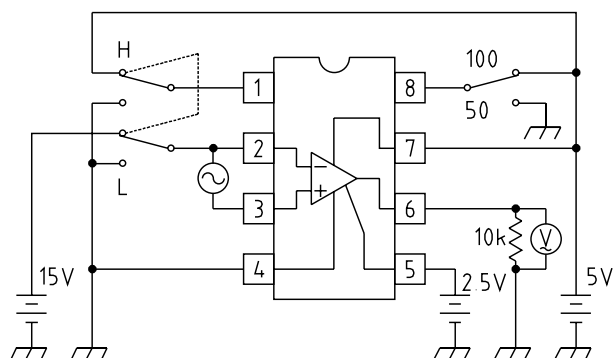
Supply voltage range



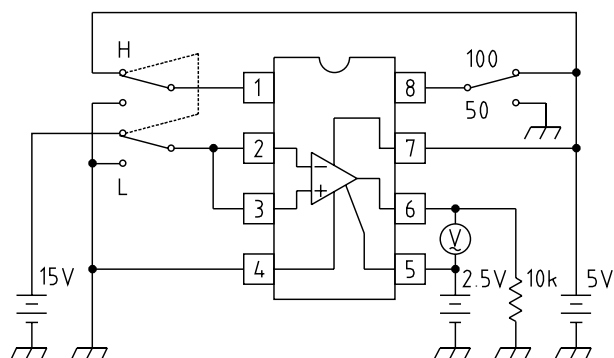
Supply current



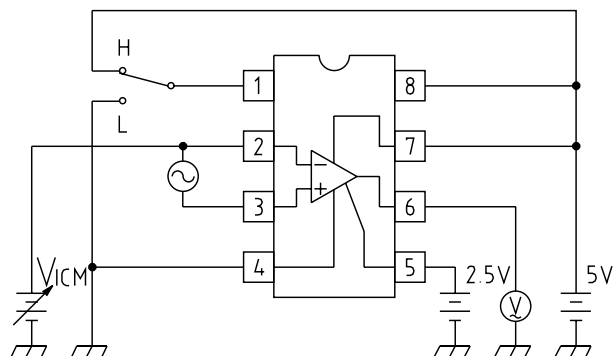
Voltage gain



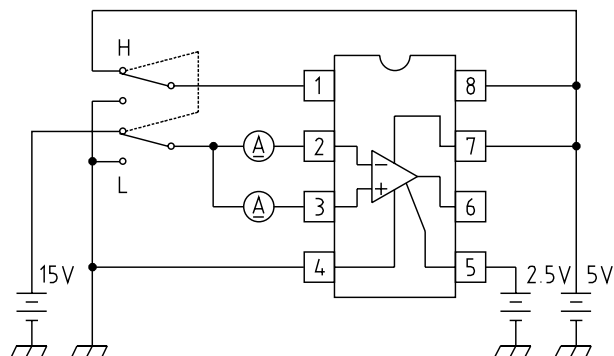
Offset voltage



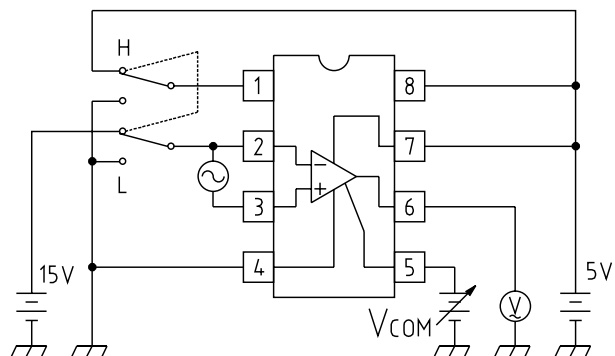
Input common mode voltage range



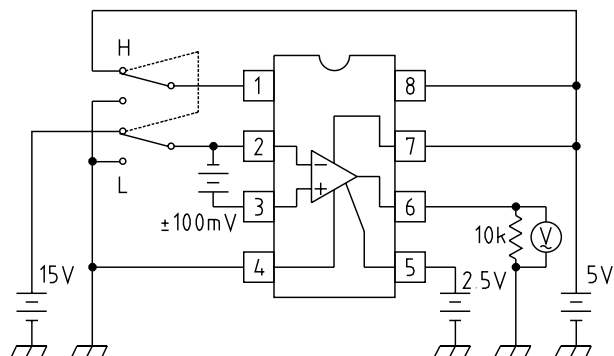
Input bias current



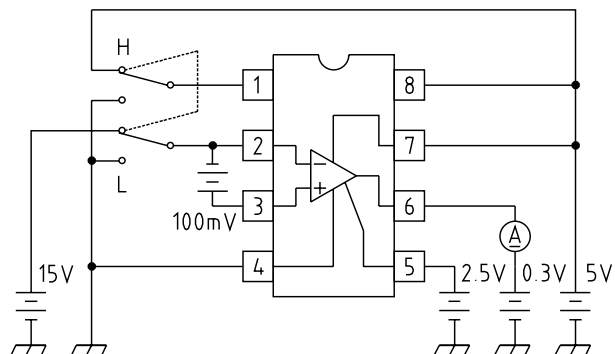
COM terminal voltage range



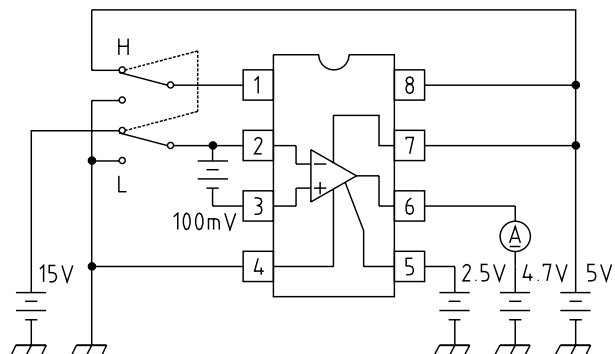
Output voltage range



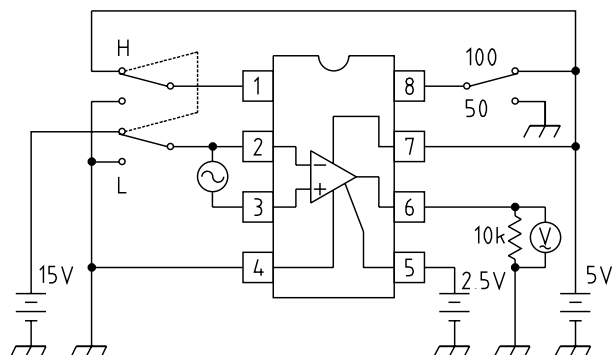
■ Output source current



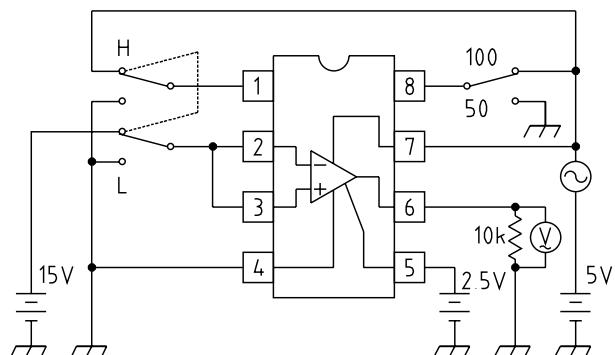
■ Output sink current



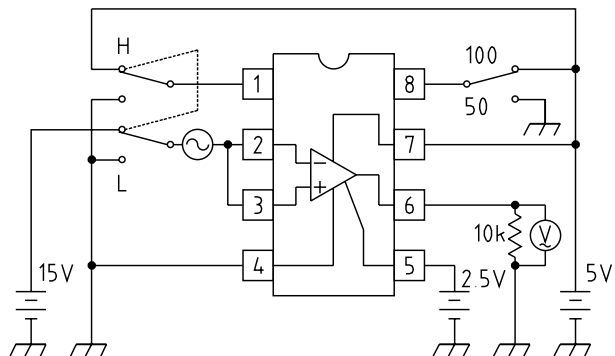
■ Cut off frequency



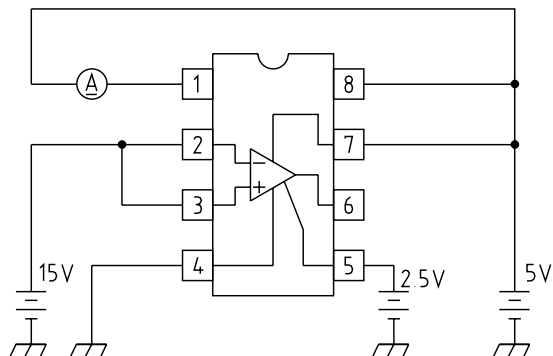
■ Supply voltage rejection ratio



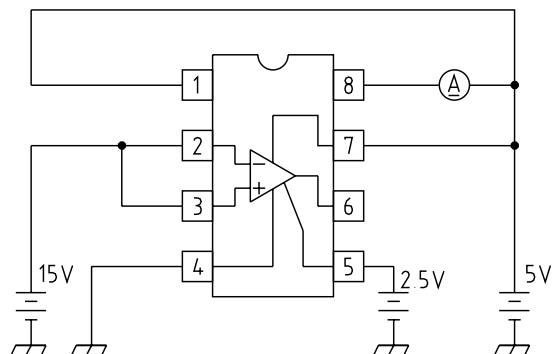
■ Common mode rejection ratio



■ ISEL terminal sink current

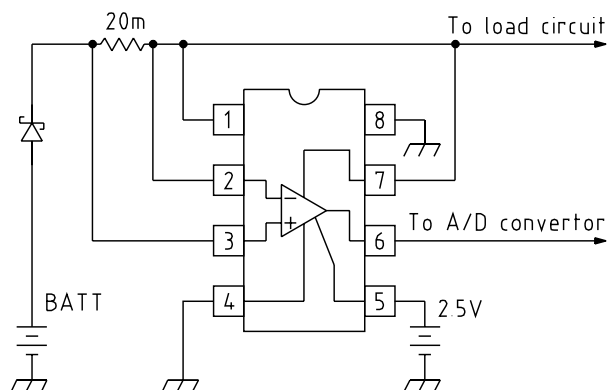


■ GSEL terminal sink current



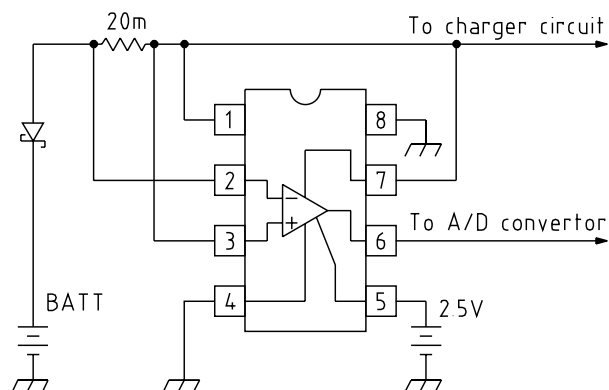
Application Circuit

Battery current sensing circuit



$$R_s = 20\text{m}\Omega, \quad G_V = 50:1\text{V/A}$$

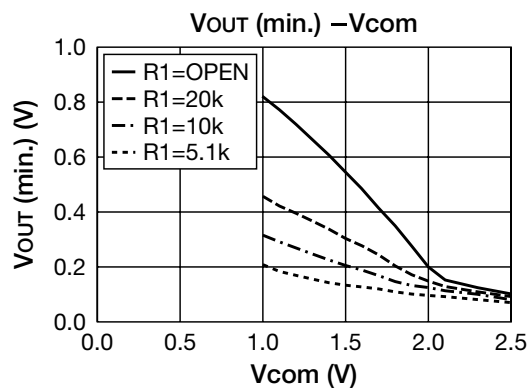
Charger current sensing circuit



$$R_s = 20\text{m}\Omega, \quad G_V = 50:1\text{V/A}$$

Characteristics

Minimum output voltage vs COM terminal voltage



Input bias current vs differential input voltage

