

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 μA 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

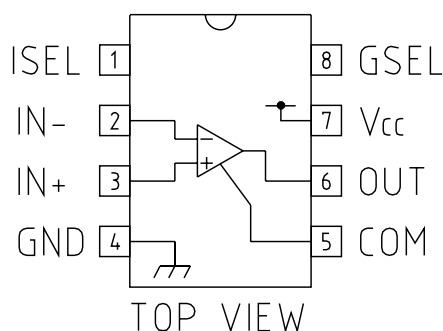
	Channel	Package	CMRR (f=1kHz)	Increased current sensing		Input conversion offset voltage (mV)
				1 (V)	2 (V)	
MM1380AW	1	VSOP-8A	80dB typ.	1.8~24*	-0.3~V _{CC} -2.4	± 0.5

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

Applications

- (1) Notebook PCs
- (2) PDA

Pin Assignment

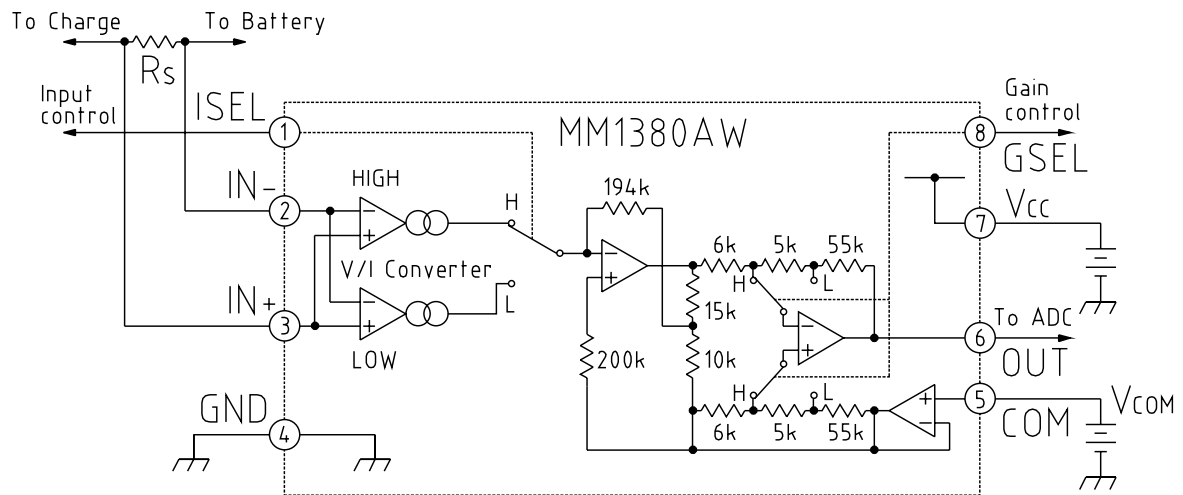


1	ISEL
2	IN-
3	IN+
4	GND
5	COM
6	OUT
7	V _{CC}
8	GSEL

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	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

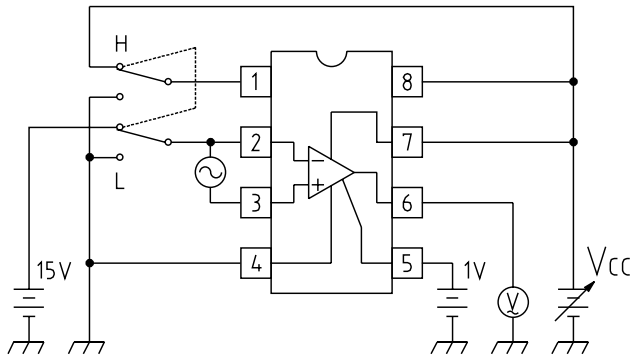
Item	Symbol	Ratings	Units
Operating temperature	T_{OPR}	-20~+85	°C
Operating voltage	V_{CC}	+3~+24	V

Electrical Characteristics (Except where otherwise indicated, Ta=25°C, Vcc=5V, Vicm=15V, Vcom=2.5V, Visel=5V, Vgsel=5V, RL=10kΩ)

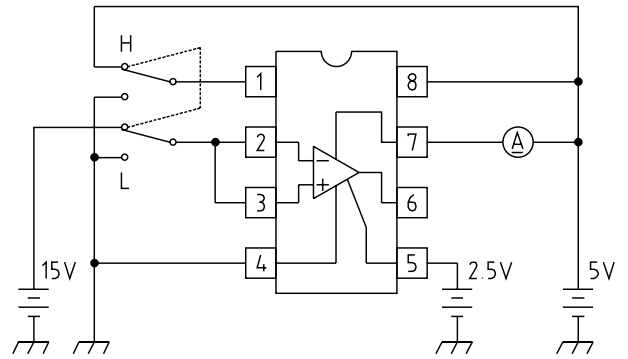
Item	Signal	Measurement conditions	Min.	Typ.	Max.	Unit
Supply voltage range	Vcc	Vcom=Vcc/2	3		24	V
Supply current	Icc	∠VIN=0V, RL: OPEN		150	200	μA
Voltage gain 1 (×100)	Gv1	Vgsel=5V	97	100	103	mV/mV
Voltage gain 2 (×50)	Gv2	Vgsel=0V	48.5	50	51.5	mV/mV
Input offset voltage 1 (High side)	V _{OFF1}	∠VIN=0V, Visel=5V	-0.5		0.5	mV
Input offset voltage 2 (Low side)	V _{OFF2}	∠VIN=0V, Visel=0V	-0.5		0.5	mV
Temperature coefficient of Voff 1	∠V _{OFF1}	Visel=5V	-4		4	μV/°C
Temperature coefficient of Voff 2	∠V _{OFF2}	Visel=0V	-6		6	μV/°C
Input common mode voltage range 1 (High side)	Vicm1	Visel=5V	1.8		24	V
Input common mode voltage range 2 (Low side)	Vicm2	Visel=0V	-0.3		Vcc-2.4	V
Input differential voltage	Vidf		-200		200	mV
Input bias current 1 (High side)	Ib1	Visel=5V, ∠VIN=0V	0.8	1.2	1.6	μA
Input bias current 2 (Low side)	Ib2	Visel=0V, ∠VIN=0V	-0.8	-1.2	-1.6	μA
Input impedance	Zi		100			kΩ
COM terminal voltage range	Vcom	RL: OPEN	1.2		Vcc-1.2	V
ISEL terminal current	Iisel	Visel=5V		1.0		μA
ISEL terminal voltage range 1 (High side)	Visel1		1.7		24	V
ISEL terminal voltage range 2 (Low side)	Visel2		0		0.5	V
GSEL terminal sink current	Igsel	Vgsel=5V		1.0		μA
GSEL terminal voltage range 1 (×100)	Vgsel1		1.7		24	V
GSEL terminal voltage range 2 (×50)	Vgsel2		0		0.5	V
Output voltage range	V _{OUT}	RL: OPEN	0.3		Vcc-0.3	V
Output source current	Isrc	V _{OUT} =Vcc-0.3V	0.5	1.0		mA
Output sink current	Isnk	V _{OUT} =0.3V	-0.5	-1.0		mA
Cut off frequency 1 (Gv1=100)	Fc1	Vgsel=5V, V _{OUT} =-3dB		100		kHz
Cut off frequency 2 (Gv2=50)	Fc2	Vgsel=0V, V _{OUT} =-3dB		140		kHz
Supply voltage rejection ratio 1 (High side)	PSRR1	f=1kHz, Visel=5V	70	80		dB
Supply voltage rejection ratio 2 (Low side)	PSRR2	f=1kHz, Visel=0V	70	80		dB
Common mode rejection ratio 1 (High side)	CMRR1	f=1kHz, Visel=5V	70	80		dB
Common mode rejection ratio 2 (Low side)	CMRR2	f=1kHz, Visel=0V	70	80		dB

Measuring Circuit

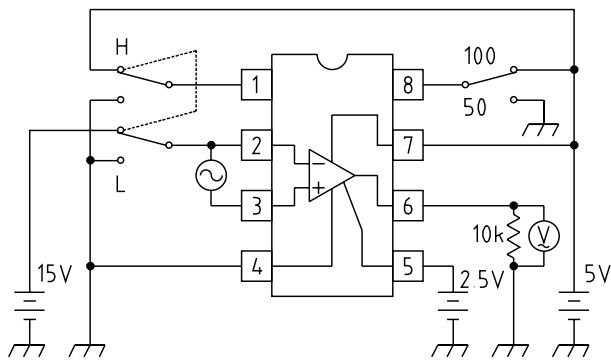
■ Supply voltage range



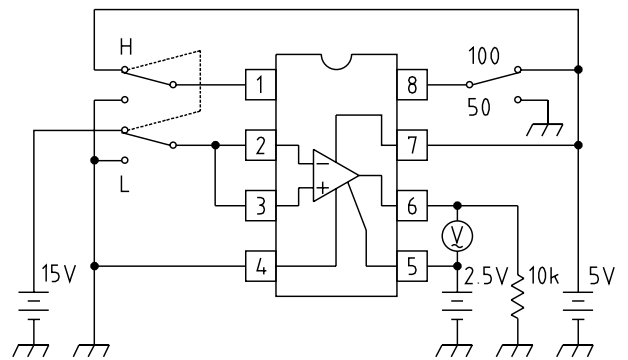
■ Supply current



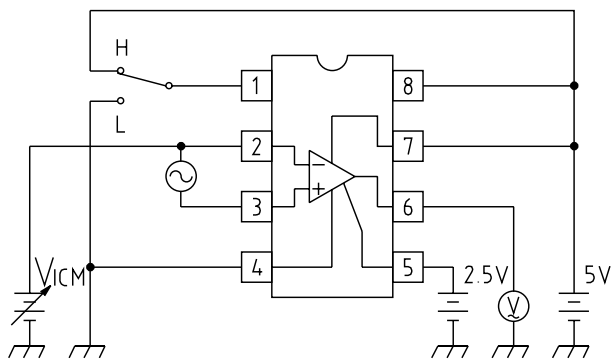
■ Voltage gain



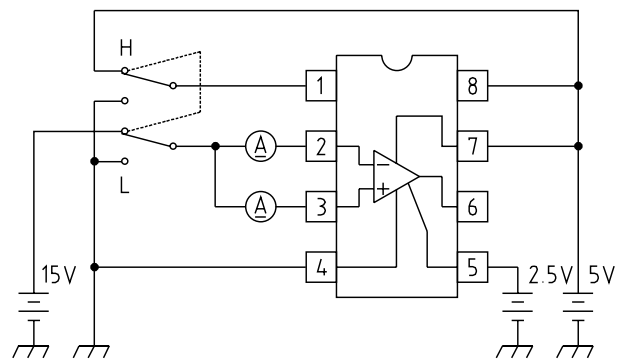
■ Offset voltage



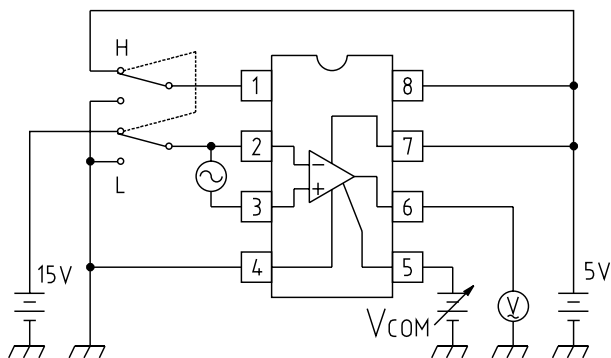
■ Input common mode voltage range



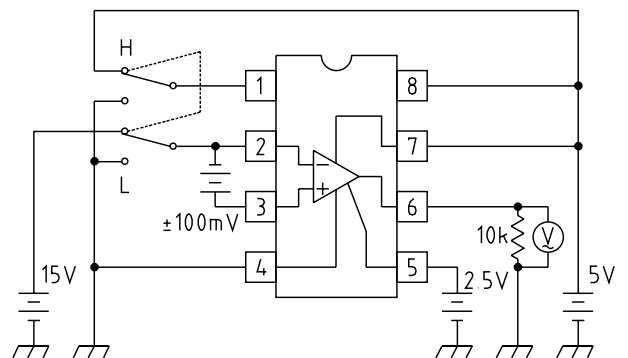
■ Input bias current



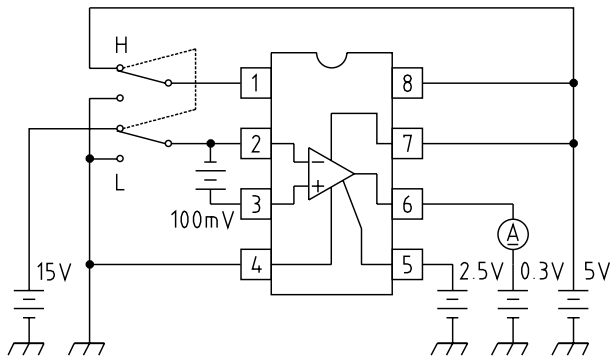
■ COM terminal voltage range



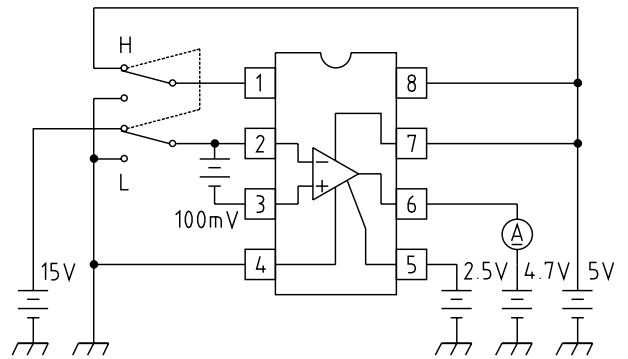
■ Output voltage range



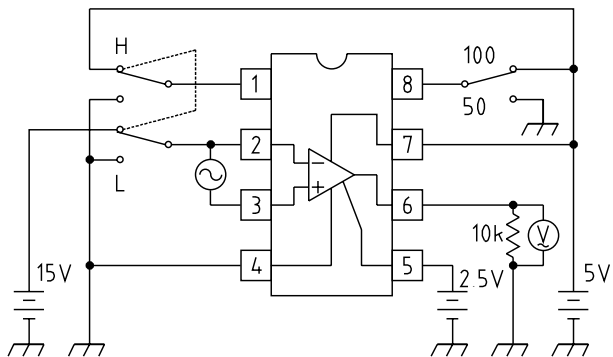
■ Output source current



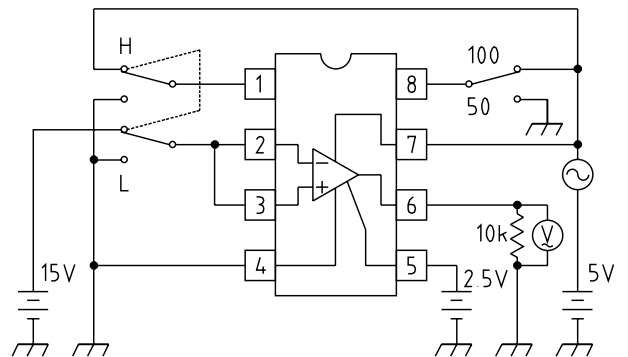
■ Output sink current



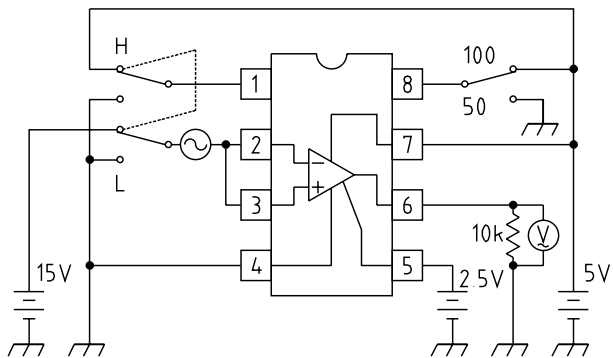
■ Cut off frequency



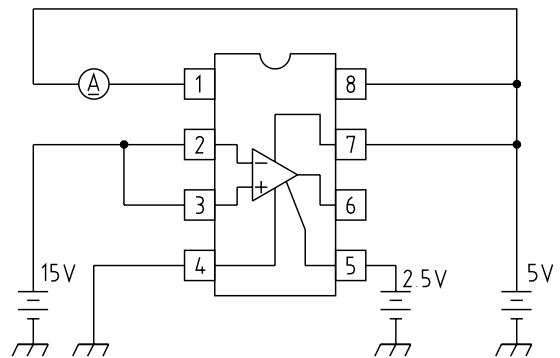
■ Supply voltage rejection ratio



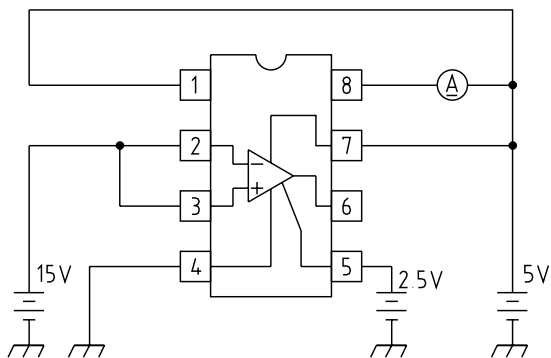
■ Common mode rejection ratio



■ ISEL terminal sink current

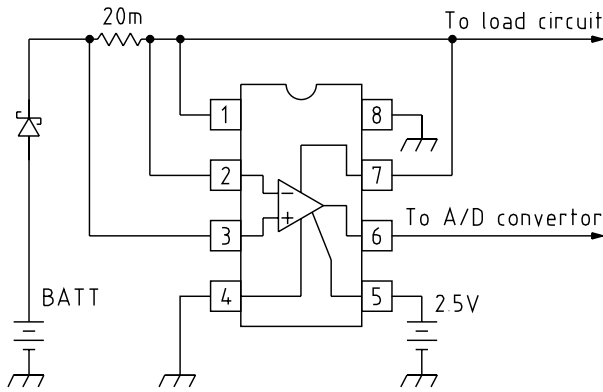


■ GSEL terminal sink current



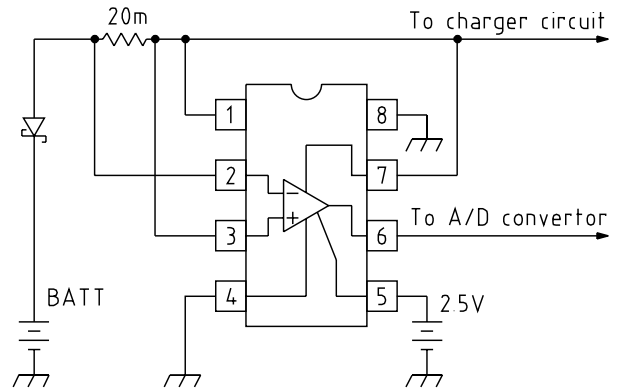
Application Circuit

Battery current sensing circuit



$R_s=20m\Omega$ 、 $G_v=50:1V/A$

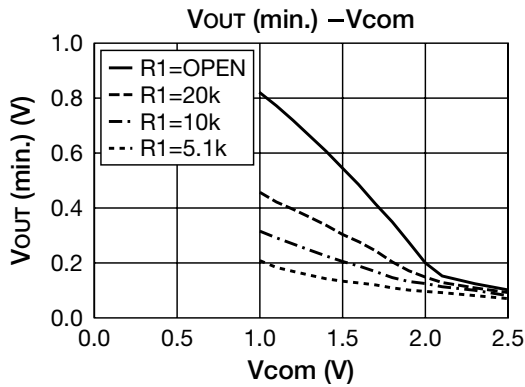
Charger current sensing circuit



$R_s=20m\Omega$ 、 $G_v=50:1V/A$

Characteristics

Minimum output voltage vs COM terminal voltage



Input bias current vs differential input voltage

