

# Voltage and Current Control (dual op-amp and shunt regulator) (quad op-amp and shunt regulator) Monolithic IC MM1377, 1378

## Outline

The MM1377 incorporates an op-amp with a dual low-input offset voltage and a shunt regulator; the MM1378 combines a quad low-input offset voltage op-amp and shunt regulator. They are appropriate for use in battery chargers, switching power supplies and other voltage and current control applications. Op-amps with low input offset voltage are particularly well-suited for handling current detection signals and other low-amplitude signals.

## Features

### Op-amp unit

- |                                    |                       |
|------------------------------------|-----------------------|
| 1. Input offset voltage            | 0.2mV typ.            |
| 2. Input offset current            | 5nA typ.              |
| 3. Input bias current              | 30nA typ.             |
| 4. Common-mode input voltage range | 0~V <sub>CC</sub> -1V |
| 5. Power supply current            | 0.6mA typ.            |

### Shunt regulator unit

- |  |            |
|--|------------|
| 1. Reference voltage                         | 2.5V typ.  |
| 2. Reference voltage fluctuation (-20~+80°C) | 5mV typ.   |
| 3. Minimum cathode current                   | 0.4mA typ. |

## Package

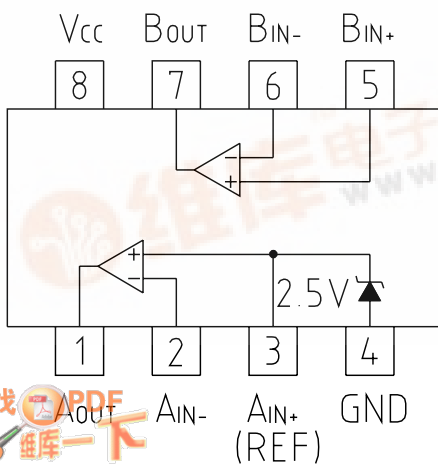
- SOP-8C, SOP-8E (MM1377)
- SOP-14B (MM1378)

## Applications

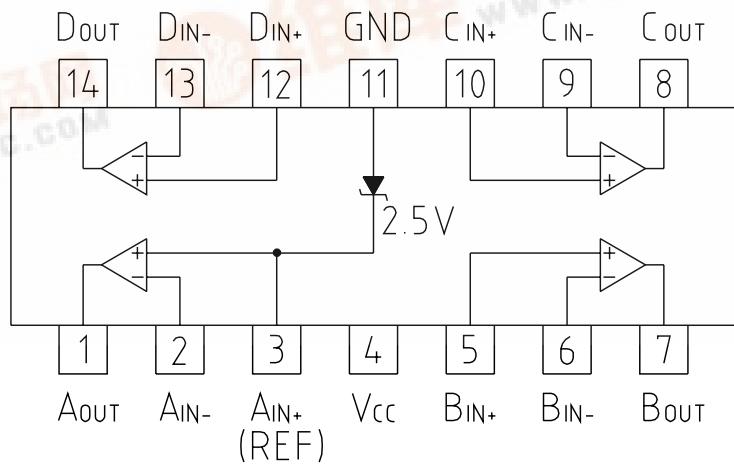
- Charger
- Switching power supply
- AC adapter

## Block Diagram

MM1377

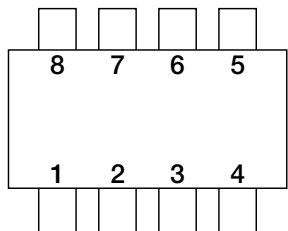


MM1378



### Pin Assignment

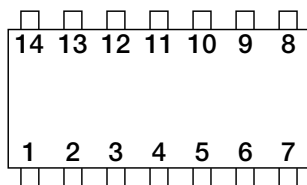
■ MM1377



SOP-8C, SOP-8E

1	A <sub>OUT</sub>
2	A <sub>IN-</sub>
3	A <sub>IN+</sub> (REF)
4	GND
5	B <sub>IN+</sub>
6	B <sub>IN-</sub>
7	B <sub>OUT</sub>
8	V <sub>CC</sub>

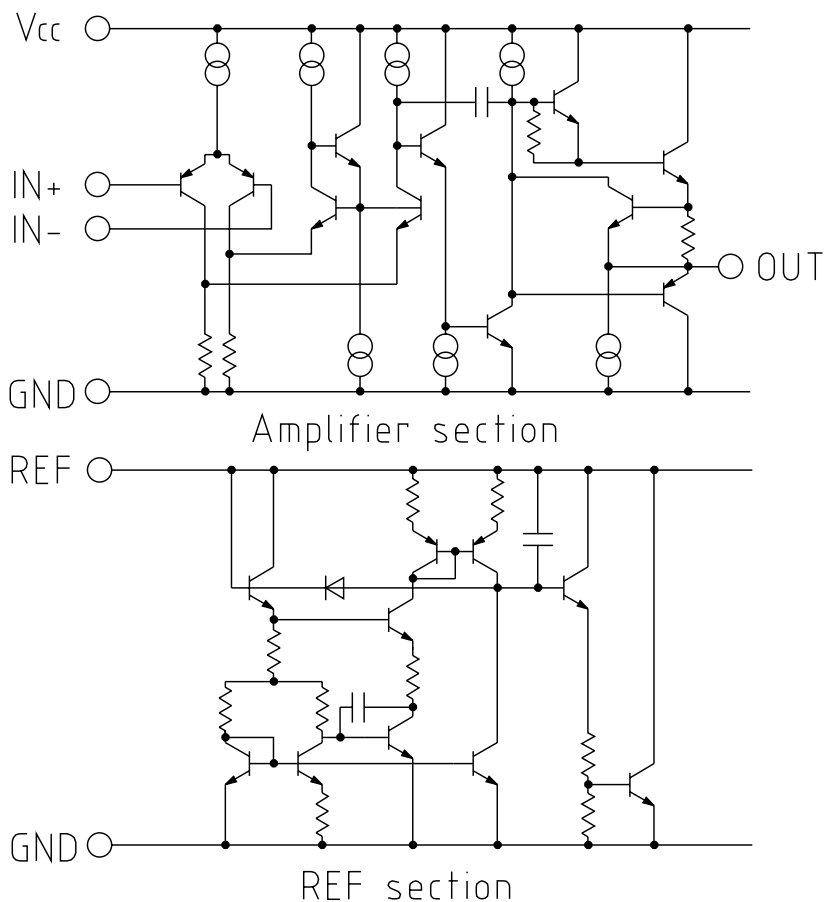
■ MM1378



SOP-14B

1	A <sub>OUT</sub>	8	C <sub>OUT</sub>
2	A <sub>IN-</sub>	9	C <sub>IN-</sub>
3	A <sub>IN+</sub> (REF)	10	C <sub>IN+</sub>
4	V <sub>CC</sub>	11	GND
5	B <sub>IN+</sub>	12	D <sub>IN+</sub>
6	B <sub>IN-</sub>	13	D <sub>IN-</sub>
7	B <sub>OUT</sub>	14	D <sub>OUT</sub>

### Equivalent Circuit Diagram



### Absolute Maximum Ratings

Item	Symbol	Ratings	Units
Storage temperature	T <sub>STG</sub>	-40~+125	°C
Operating temperature	T <sub>OPR</sub>	-20~+85	°C
Power supply voltage	V <sub>CC max.</sub>	-0.3~+24	V
Allowable loss	P <sub>D</sub>	300 (MM1377) 350 (MM1378)	mW

### Recommended Operating Conditions

Item	Symbol	Ratings	Units
Operating temperature	T <sub>OPR</sub>	-15~+80	°C
Operating voltage	V <sub>OPR</sub>	+2~+20 *	V

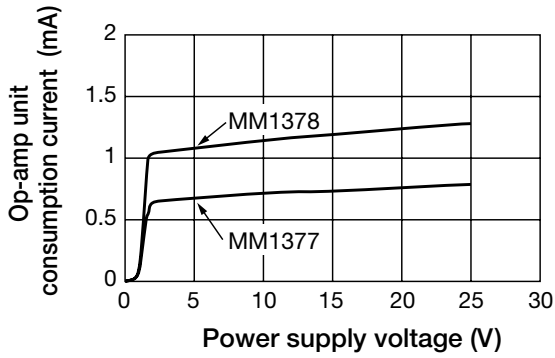
\*Minimum value of operating voltage is for amp unit only

### Electrical Characteristics (Except where noted otherwise, V<sub>CC</sub>=5V, T<sub>a</sub>=25°C)

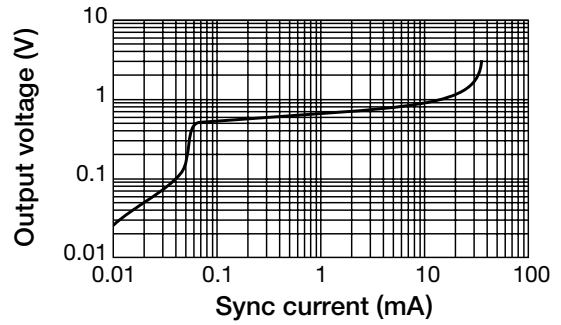
Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
<b>Op-amp unit</b>						
Input offset voltage	V <sub>IO</sub>			0.2	0.9	mV
Input offset current	I <sub>IO</sub>	Excluding amp A		5	50	nA
Input bias current	I <sub>B</sub>			30	150	nA
Common-mode input voltage range	V <sub>I</sub>	Excluding amp A	0		V <sub>CC</sub> -1	V
Power supply current	I <sub>CC</sub>	R <sub>L</sub> =∞, for two circuits	MM1377	0.6	1.0	mA
		R <sub>L</sub> =∞, for four circuits	MM1378	1.2	2.0	
Voltage gain	A <sub>V</sub>			100		dB
Output voltage L	V <sub>OL</sub>	R <sub>L</sub> =∞		10	100	mV
Output voltage H	V <sub>OH</sub>	R <sub>L</sub> =∞	V <sub>CC</sub> -1.1	V <sub>CC</sub> -0.8		V
Common-mode signal rejection ratio	CMRR		65	85		dB
Power supply voltage rejection ratio	PSRR		65	100		dB
Output outflow current	I <sub>SO</sub>		20	35		mA
Output inflow current	I <sub>SI</sub>		10	20		mA
<b>Shunt regulator</b>						
Reference voltage	V <sub>REF</sub>		2.450	2.500	2.550	V
Reference voltage fluctuation within operating temperature range	ΔV <sub>REF</sub>			5	17	mV
Minimum cathode current	I min.			0.4	1.0	mA
Dynamic impedance	Z <sub>KA</sub>			0.4	0.7	Ω

**Characteristics**

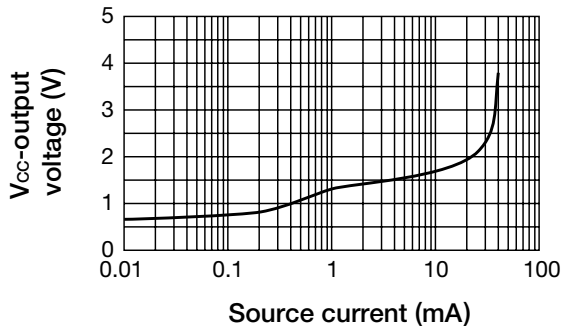
■ Consumption current vs power supply voltage (Ta=25°C)



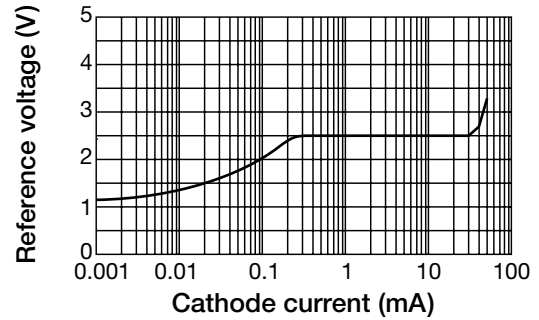
■ Output voltage vs sync current (Ta=25°C)



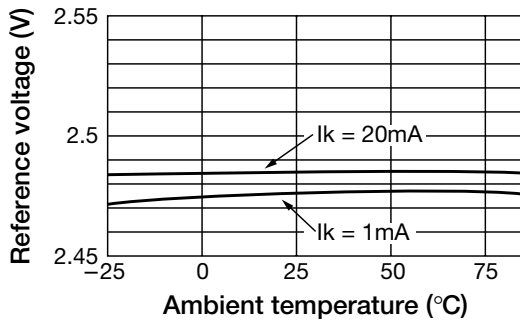
■ (V<sub>CC</sub>-output voltage) vs source current (Ta=25°C)



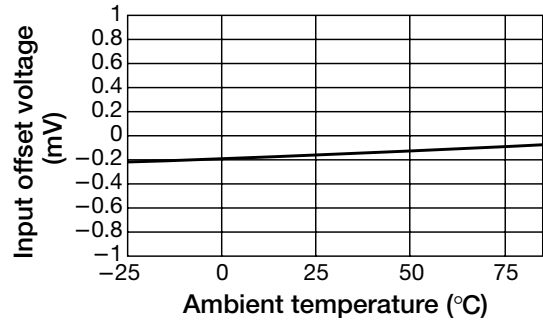
■ Reference voltage vs cathode current (Ta=25°C)



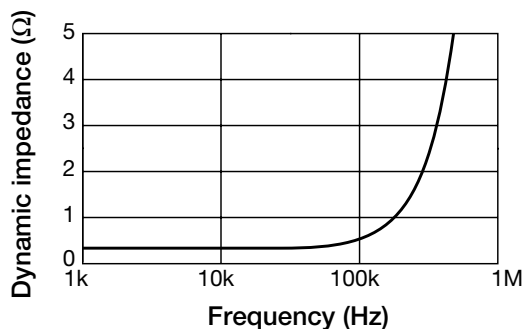
■ Reference voltage vs Ambient temperature



■ Input offset voltage vs Ambient temperature



■ Dynamic impedance vs frequency (Ta=25°C)



■ Voltage gain vs frequency (Ta=25°C)

