

# Remaining Battery Power Display Monolithic IC MM1206

## Outline

This IC detects battery voltage and displays the remaining power on an LED or LCD display. The appeal of battery-driven equipment lies in its portability, but when the battery runs down and the equipment does not function, customer complaints and breakdowns may result.

This IC prevents such trouble before it starts.

## Features

1. There are three displays for remaining battery power :  
FULL / MIDDLE / EMPTY.
2. Nine patterns built in for detection voltage, linked to two manganese batteries.  
Standard setting : 2.5V, 2.25V
3. External parts held to a minimum

## Package

SOP-8D (MM1206XF)  
VSOP-8A (MM1206AF)

## Detection Voltage Matrix Chart

| SW1             | SW2             | Detection Voltage 1 | Detection Voltage 2 |
|-----------------|-----------------|---------------------|---------------------|
| GND             | GND             | 2.64V               | 2.35V               |
| GND             | OPEN            | 2.62V               | 2.27V               |
| GND             | V <sub>CC</sub> | 2.60V               | 2.18V               |
| OPEN            | GND             | 2.52V               | 2.35V               |
| OPEN            | OPEN            | 2.50V               | 2.25V               |
| OPEN            | V <sub>CC</sub> | 2.48V               | 2.17V               |
| V <sub>CC</sub> | GND             | 2.42V               | 2.30V               |
| V <sub>CC</sub> | OPEN            | 2.40V               | 2.24V               |
| V <sub>CC</sub> | V <sub>CC</sub> | 2.38V               | 2.15V               |

\*Voltage Accuracy  
Detection Voltage 1 :  $\pm 100\text{mV}$  typ.  
Detection Voltage 2 :  $\pm 90\text{mV}$  typ.

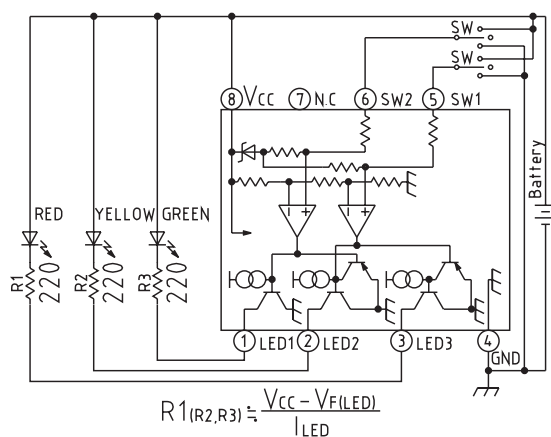
## Absolute Maximum Ratings (Ta=25°C)

| Item                  | Rating     |
|-----------------------|------------|
| Storage temperature   | -40~+125°C |
| Operating temperature | -20~+70°C  |
| Input voltage         | 5V         |
| Allowable loss        | 300mW      |

## Electrical Characteristics (Unless otherwise specified Ta=25°C, SW1=SW2=open)

| Item                                 | Symbol              | Measurement Conditions                              | Min. | Typ. | Max. | Unit.  |
|--------------------------------------|---------------------|-----------------------------------------------------|------|------|------|--------|
| Current consumption I                | I <sub>CC</sub>     | V <sub>CC</sub> =3.0V                               |      | 0.75 | 1.1  | mA     |
| Detection voltage I                  | V <sub>TH1</sub>    | V <sub>CC</sub> =H→L                                | 2.4  | 2.5  | 2.6  | V      |
| Detection voltage II                 | V <sub>TH2</sub>    | V <sub>CC</sub> =H→L                                | 2.16 | 2.25 | 2.34 | V      |
| Detection voltage difference         | ΔV <sub>T</sub>     | ΔV <sub>T</sub> =V <sub>TH1</sub> -V <sub>TH2</sub> | 210  | 250  | 290  | mV     |
| Detection voltage temperature factor | V <sub>TH</sub> /ΔT |                                                     |      | ±200 |      | ppm/°C |
| Detection voltage I, Adjustment 1    | +ΔV <sub>T1</sub>   | SW1=GND                                             | 70   | 100  | 130  | mV     |
| Detection voltage I, Adjustment 2    | -ΔV <sub>T1</sub>   | SW1=V <sub>CC</sub>                                 | -70  | -100 | -130 | mV     |
| Detection voltage II, Adjustment 1   | +ΔV <sub>T2</sub>   | SW2=GND                                             | 70   | 100  | 130  | mV     |
| Detection voltage II, Adjustment 2   | -ΔV <sub>T2</sub>   | SW2=V <sub>CC</sub>                                 | -70  | -100 | -130 | mV     |
| Output sink current I                | I <sub>S1</sub>     | V <sub>CC</sub> =2.7V, V <sub>CE</sub> =0.5V        | 5    | 10   |      | mA     |
| Output sink current II               | I <sub>S2</sub>     | V <sub>CC</sub> =2.38V, V <sub>CE</sub> =0.5V       | 5    | 10   |      | mA     |
| Output sink current III              | I <sub>S3</sub>     | V <sub>CC</sub> =2.0V, V <sub>CE</sub> =0.5V        | 5    | 10   |      | mA     |
| Output saturation voltage I          | V <sub>CE1</sub>    | V <sub>CC</sub> =2.7V, I <sub>SINK</sub> =1mA       |      | 100  | 150  | mV     |
| Output saturation voltage II         | V <sub>CE2</sub>    | V <sub>CC</sub> =2.38V, I <sub>SINK</sub> =1mA      |      | 100  | 150  | mV     |
| Output saturation voltage III        | V <sub>CE3</sub>    | V <sub>CC</sub> =2.0V, I <sub>SINK</sub> =1mA       |      | 50   | 80   | mV     |
| Output leak voltage I                | I <sub>LE1</sub>    | V <sub>CC</sub> =2.3V, V <sub>CE</sub> =1.5V        |      |      | 1    | μA     |
| Output leak voltage II               | I <sub>LE2</sub>    | V <sub>CC</sub> =2.7V, V <sub>CE</sub> =1.5V        |      |      | 1    | μA     |
| Output leak voltage II               | I <sub>LE2'</sub>   | V <sub>CC</sub> =2.0V, V <sub>CE</sub> =1.5V        |      |      | 1    | μA     |
| Output leak voltage III              | I <sub>LE3</sub>    | V <sub>CC</sub> =2.5V, V <sub>CE</sub> =1.5V        |      |      | 1    | μA     |

## Block Diagram, Example of Application Circuit



|      | 2.50V |     | 2.25V |
|------|-------|-----|-------|
| LED1 | ON    | OFF | OFF   |
| LED2 | OFF   | ON  | OFF   |
| LED3 | OFF   | OFF | ON    |

## Timing Chart

