

# Remaining Battery Power Display Monolithic IC MM1251, MM1252, MM1253

## Outline

This IC detects battery voltage and displays the power remaining in the battery. Display of the battery's remaining power is an indispensable function for portable equipment. The use of this IC makes this display easily achievable.

The usual method of display of remaining battery power, as in the MM1206, is three marks lighting up in sequence on an LED or other display. This IC, however, uses only one light to display the remaining battery power, resulting in lower cost.

## Features

1. Adjustable flashing speed
2. Adjustable detection voltage supports all settings
3. Adjustable hysteresis voltage enables response to large ripple settings
4. High precision voltage detection (MM1253) enables support of sets using nickel cadmium and other batteries
5. The LED can be lit up by the voltage from one battery (type of special built-in step-up circuit : rank B)

## Package

SOP-8D (MM1251AF, MM1251BF, MM1252AF, MM1252BF, MM1253AF)

## Series Description

	Display Pattern		Detection Precision
	Normal	Low Power	
MM1251	Light Off	Flashing	±30mV
MM1252	Light On	Flashing	±30mV
MM1253	Light Off	Flashing	±9mV

## Absolute Maximum Ratings (Ta=25°C)

Item	Rating	Unit
Storage temperature	-40~+125	°C
Operating temperature	-20~+70	°C
Input voltage	-0.3~+3	V
Output Terminal Applied Voltage	-0.3~+7	V
Allowable loss	300	mW

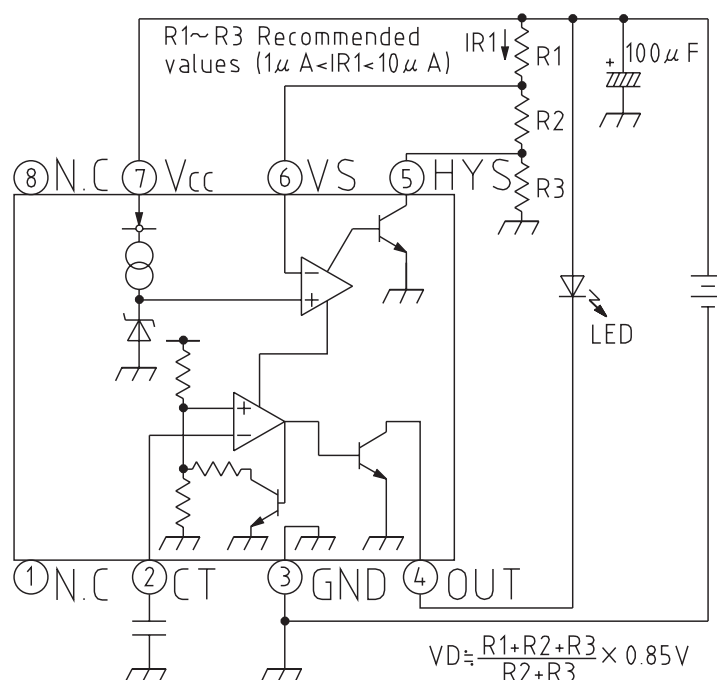
# Electrical Characteristics

(Unless otherwise specified Ta=25°C, Vc=1.5V, Vs=0.8V)  
 (Applicable to all models when the model name is left blank.)

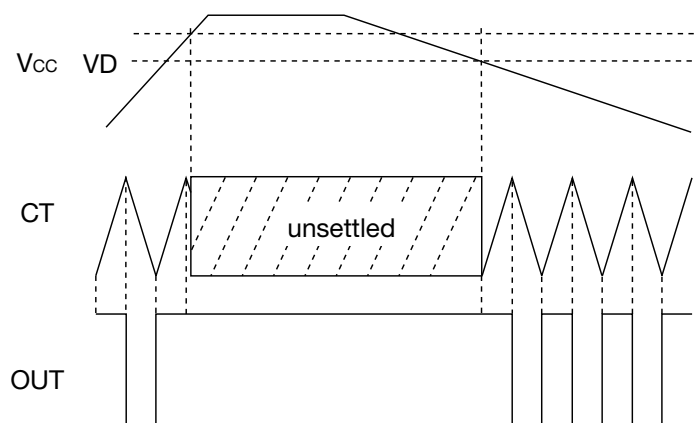
Item	Symbol	Measurement Conditions	Min.	Typ.	Max.	Unit
Current consumption 1	Icc1	Vs=1.0V		25	40	μA
		VCT=0.4V		0.15	0.25	mA
Current consumption 2	Icc2	Vs=0.8V, VCT=0.4V		0.15	0.25	mA
Detection voltage	VD	Vs=1V→0.5V VHYS ≤ 0.1V	0.82	0.85	0.88	V
Detection voltage temperature factor		ΔV/ΔT		±200		PPM/°C
HYS pin saturation voltage 1	VHYS1	IHYS=5μA		25	50	mV
HYS pin saturation voltage 2	VHYS2	IHYS=25μA		50	100	mV
CT pin charge current	ICTS	VCT=0.1V	-60	-40	-20	nA
CT pin discharge current	ICTO	VCT=0.4V	20	40	60	nA
CT pin threshold value H	VCTH	VCT=0.1→0.4, VO ≤ 0.1V	0.2	0.3	0.4	V
CT pin threshold value L	VCTL	VCT=0.4→0.1, VO ≥ 0.1V	0.1	0.2	0.3	V
Output sink current	IOUT	VCR=0.4V	5	10		mA
Output saturation voltage	IOUTL	VCT=0.4, IOUT=1mA		100	150	mA
Output leak current	ILE	Vs=1V, VOUT=5V			1	μA
Operating limit voltage	VOPR	Vs=0.8×VCC VOUT > 0.4V	Rank A	0.65	0.75	V
Step-up operation limit voltage	VOPL	Vs=0.8×VCC VCC=0.1V→0.5V Voltage limit for maintaining LED flashing	Rank B	0.85	0.95	V

## MM1251A/MM1253A

### Application Circuit

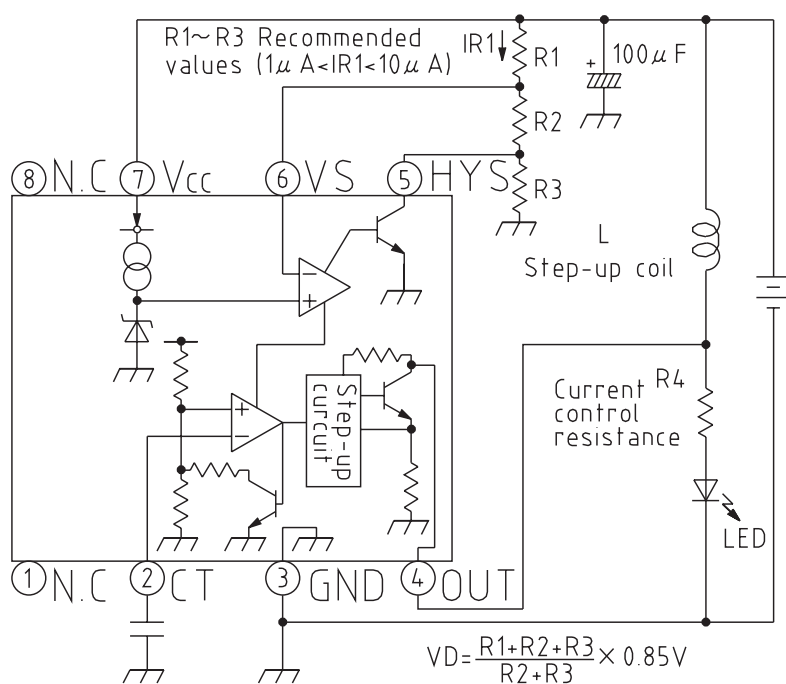


### Timing Chart

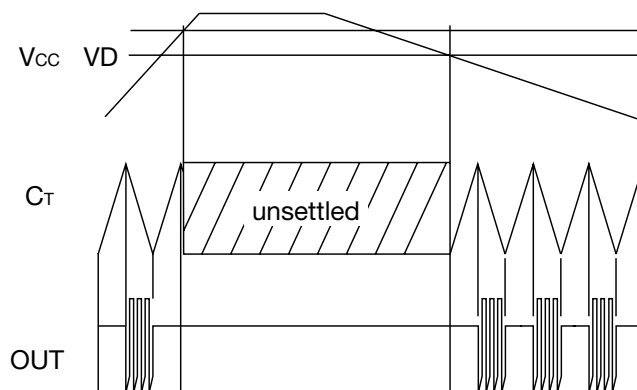


# MM1251B

## Application Circuit

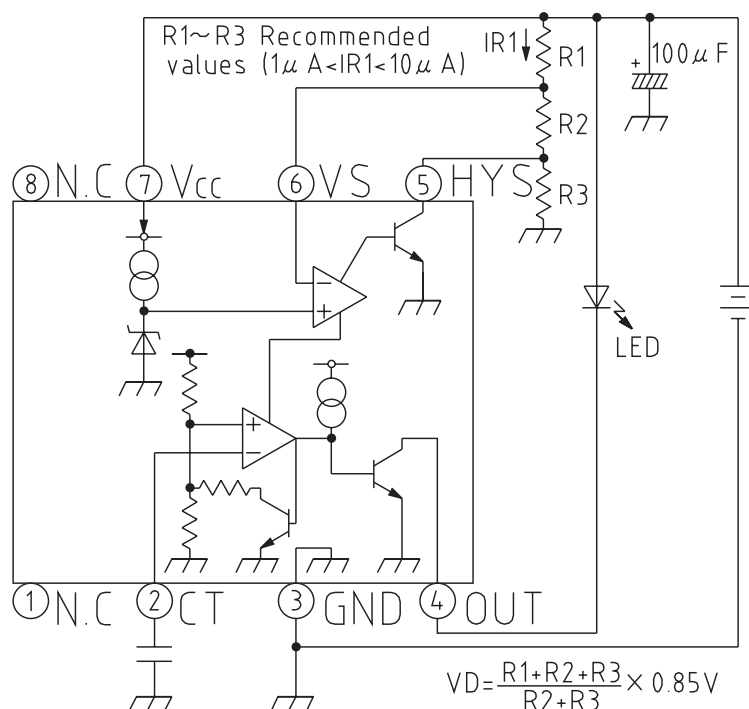


## Timing Chart

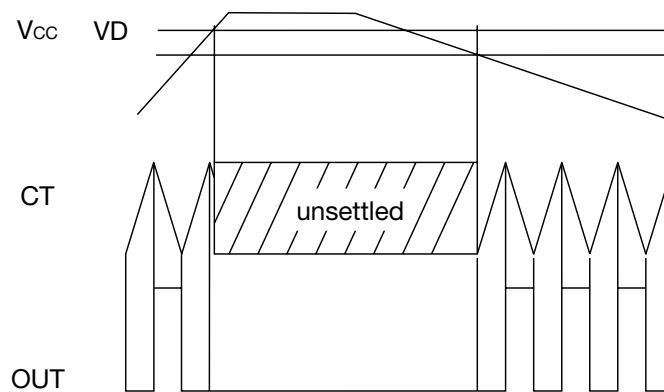


## MM1252A

### Application Circuit

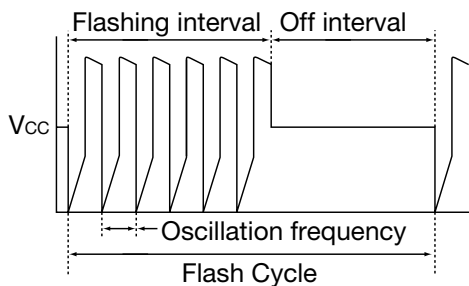


### Timing Chart

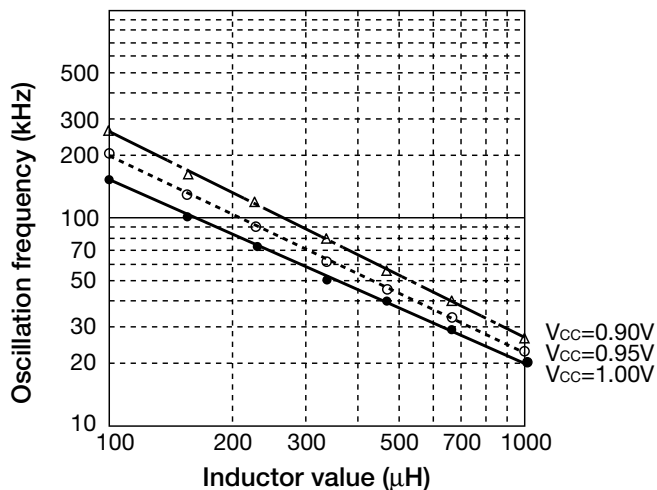


## Step-up (Rank B) Type Inductor Values

This circuit allows step-up for LED lighting even when low only. The LED repeats On/Off at high frequency, but to the human eye it appears as if the LED is lit. Therefore, we do not recommend the use of this step-up circuit in other circuits.



Inductor Value-Oscillation Frequency Characteristics (reference data)



Note : The above data are reference values. Please set constants using a  $\pm 50\%$  variance.