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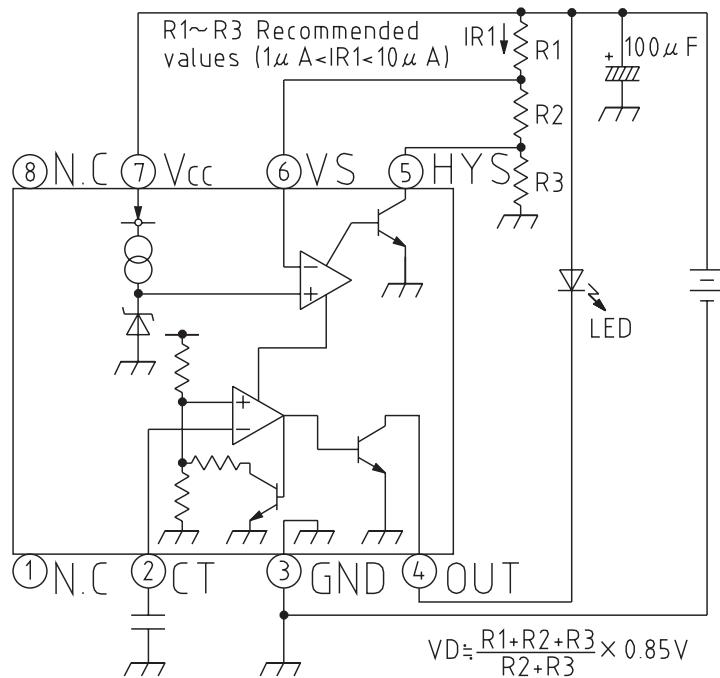
| Item	Rating	Unit
Storage temperature	−40~+125	°C
Operating temperature	−20~+70	°C
Input voltage	−0.3~+3	V
Output Terminal Applied Voltage	−0.3~+7	V
Allowable loss	300	mW

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.)
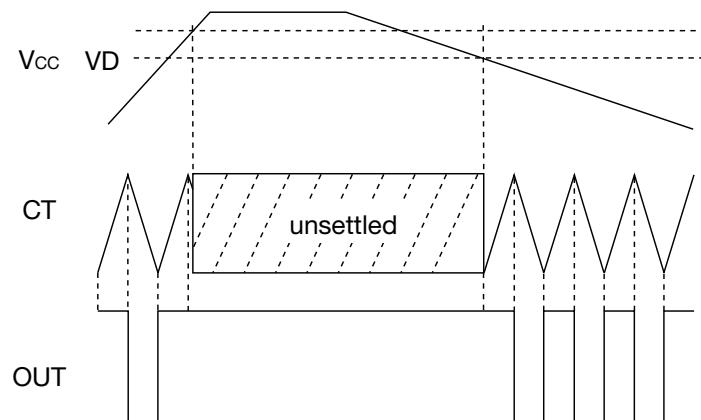
Item	Symbol	Measurement Conditions		Min.	Typ.	Max.	Unit
Current consumption 1	I_{CC1}	V_S=1.0V	MM1251 / MM1253A		25	40	µA
		V_{CT}=0.4V	MM1252A		0.15	0.25	mA
			MM1252B		0.75	0.1	mA
Current consumption 2	I_{CC2}	V_S=0.8V, V_{CT}=0.4V	MM1251A / MM1253A		0.15	0.25	mA
			MM1251B		25	40	µA
Detection voltage	V_D	V_S=1V→0.5V V_{HYS}≦0.1V	MM1251 / MM1252	0.82	0.85	0.88	V
			MM1253	0.841	0.85	0.859	V
Detection voltage temperature factor		$\triangle V/\triangle T$			±200		PPM/°C
HYS pin saturation voltage 1	V_{HYS1}	I_{HYS}=5µA			25	50	mV
HYS pin saturation voltage 2	V_{HYS2}	I_{HYS}=25µA			50	100	mV
C_T pin charge current	I_{CTS}	V_{CT}=0.1V		−60	−40	−20	nA
C_T pin discharge current	I_{CTO}	V_{CT}=0.4V		20	40	60	nA
C_T pin threshold value H	V_{CTH}	V_{CT}=0.1→0.4, V_O≦0.1V		0.2	0.3	0.4	V
C_T pin threshold value L	V_{CTL}	V_{CT}=0.4→0.1, V_O≧0.1V		0.1	0.2	0.3	V
Output sink current	I_{OUT}	V_{CR}=0.4V		5	10		mA
Output saturation voltage	$I_{OUT}L$	V_{CT}=0.4, I_{OUT}=1mA			100	150	mA
Output leak current	I_{LE}	V_S=1V, V_{OUT}=5V				1	µA
Operating limit voltage	V_{OPR}	V_S=0.8×V_{CC} V_{OUT}>0.4V	Rank A		0.65	0.75	V
Step-up operation limit voltage	V_{OPL}	V_S=0.8×V_{CC} V_{CC}=0.1V→0.5V Voltage limit for maintaining LED flashing	Rank B		0.85	0.95	V
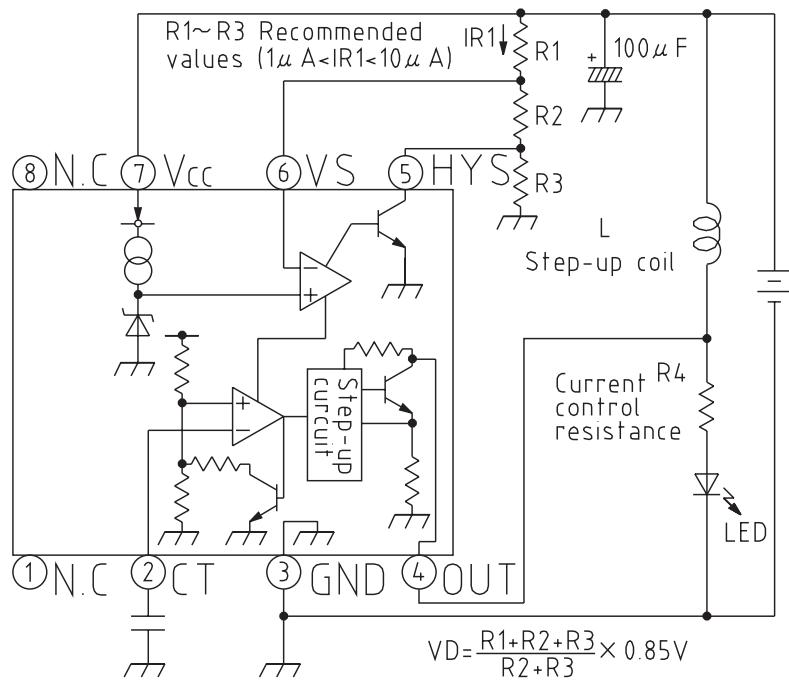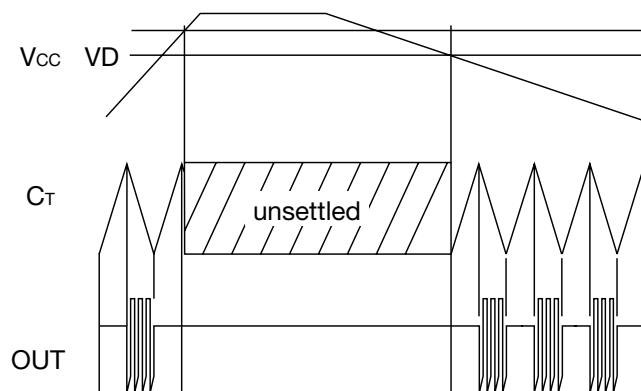
MM1251A/MM1253A

Application Circuit

R1~R3 Recommended values (1μA<IR1<10μA)

IR1

R1
R2
R3

100μF

⑧N.C ⑦Vcc ⑥VS ⑤HYS

LED

①N.C ②CT ③GND ④OUT

$$VD \fallingdotseq \frac{R1+R2+R3}{R2+R3} \times 0.85V$$

Timing Chart

Vcc VD

CT   unsettled
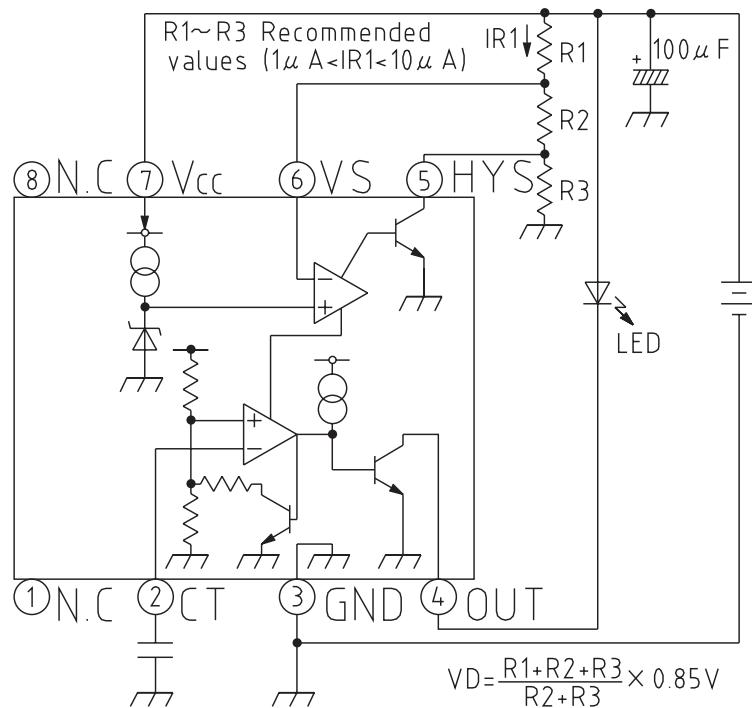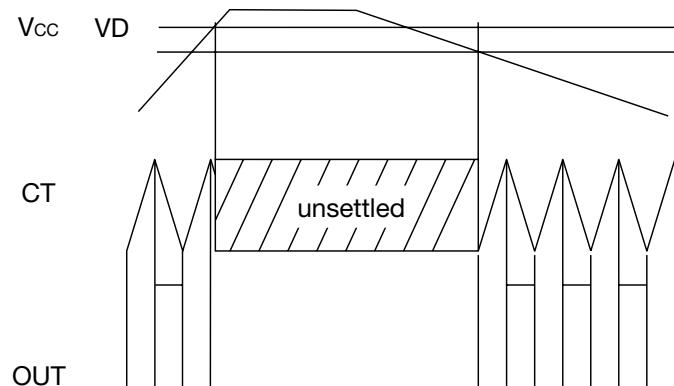
OUT
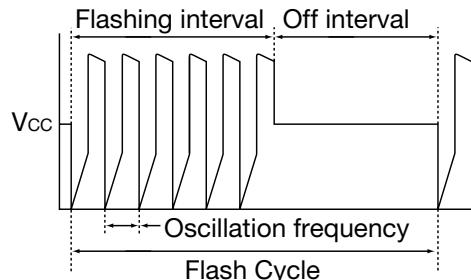
MM1251B

Application Circuit

R1~R3 Recommended values ($1\mu A < IR1 < 10\mu A$)

$$VD = \frac{R1+R2+R3}{R2+R3} \times 0.85V$$

Timing Chart

MM1252A

R1~R3 Recommended values (1μA<IR1<10μA)

IR1
R1
R2
R3

+ 100μF

⑧ N.C ⑦ Vcc ⑥ VS ⑤ HYS

LED

① N.C ② CT ③ GND ④ OUT

$$VD = \frac{R1+R2+R3}{R2+R3} \times 0.85V$$

Timing Chart

Vcc   VD

CT

unsettled
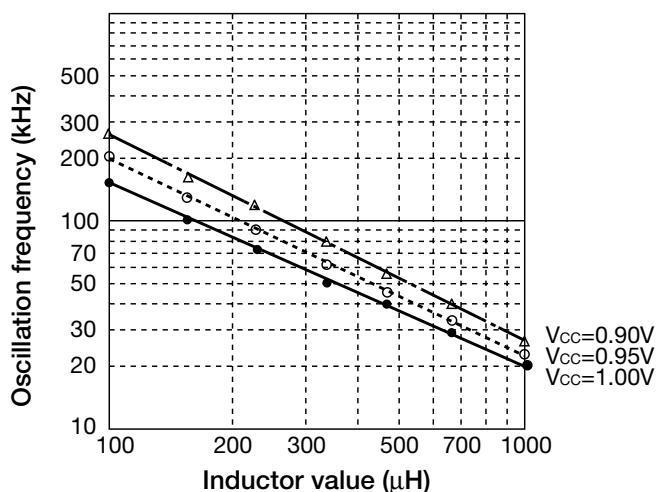
OUT

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 ±50% variance.