

Remaining Battery Power Display Monolithic IC MM1210 Series

Outline

This IC detects battery voltage and displays the remaining power in the battery using an LCD. Long life and light weight are emphasized in the most recent portable equipment, which increasingly use nickel cadmium and nickel hydrogen batteries. For these batteries, the discharge characteristics mean that extremely precise detection of the remaining battery power is required.

This IC enables detection of this type through high precision voltage detection.

Features

1. Two built-in detection voltages 1.18V / 1.06V typ.
2. High precision detection voltages $\pm 1\%$ typ.
3. Low current consumption During detection ; 15 μ A typ.
During waiting ; 15 μ A typ.
4. Setting possible during non-induction
It is possible to set a time period for which detection is ignored, as for example when voltage drops due to temporary heavy loads.
5. Ripple absorption pins
It is possible to check fluctuations in detection through continuous rippling.
6. Built-in hysteresis voltage

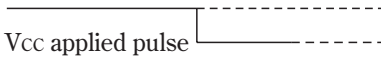
Package

SOP-8D (MM1210XF)

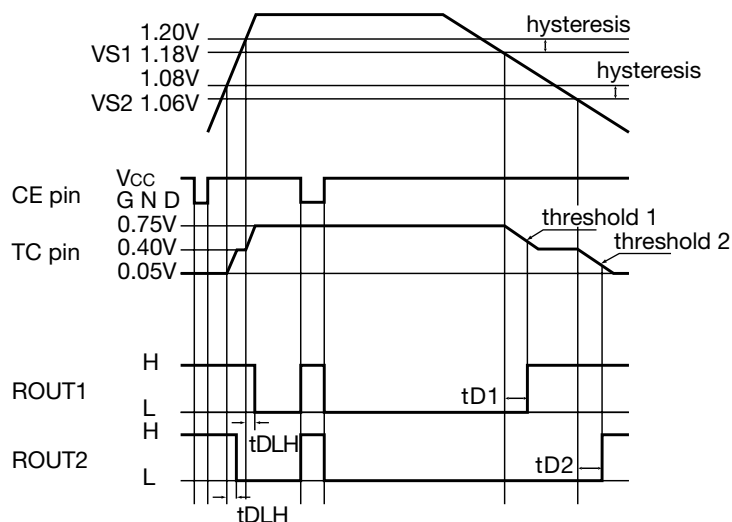
Absolute Maximum Ratings

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

Electrical Characteristics (Unless otherwise specified Ta=25°C, V_{CC}=1.5V, V_{CE}=V_{CC})

Item		Symbol	Measurement Conditions	Min.	Typ.	Max.	Unit
Current consumption		I _{CC1}	V _{CC} =1.5V		15	25	μA
Current consumption during waiting		I _{CC2}	V _{CC} =1.3V, V _{CE} =0.3V		1.5	2.5	μA
Detection voltage I		V _{TH1}	V _{CC} =H→L	1.169	1.180	1.191	V
Detection voltage II		V _{TH2}	V _{CC} =H→L	1.050	1.060	1.070	V
Detection voltage Difference		ΔV _T	ΔV _T =V _{TH1} -V _{TH2}	100	120	140	mV
Detection voltage temperature factor					±200		PPM/°C
Hysteresis voltage		V _{HYS}		10	20	35	mV
Output sink current I		I _{S1}	V _{CC} =1.3V, V _{O1} =0.3V	40			μA
Output sink current II		I _{S2}	V _{CC} =1.3V, V _{O2} =0.3V	40			μA
Output saturation voltage I		V _{O1}	I _{SINK} =30UA		150	250	mV
Output saturation voltage II		V _{O2}	I _{SINK} =30UA		150	250	mV
Output leak voltage I		I _{LE1}	V _{CC} =1.0V, V _{O1} =0.5V			1	μA
Output leak voltage II		I _{LE2}	V _{CC} =1.0V, V _{O2} =1.5V			1	μA
Power supply voltage operating limit		V _{OPL}	V _{CC} =variable, V _O < 0.4V		0.70	0.75	V
CE pin	Input H voltage	V _{CEH}		-0.3	V _{CC}	0.3	V
	Input L current	I _{CEH}	V _{CC} =1.5V, V _{CE} =0V	100	300	500	nA
	Input L voltage	V _{CEL}		-0.3	0	0.3	V
TC pin	Threshold value I	V _{TH1}	V _{CC} =1.0V, V _{TC} =variable	0.34	0.42	0.50	V
	Threshold value II	V _{TH2}	V _{CC} =1.0V, V _{TC} =variable	0.04	0.12	0.20	V
	Discharge current	I _{DIS}	V _{CC} =1.0V, V _{TC} =0.5V	30	60	90	nA
	Charge current	I _{CHA}	V _{CC} =1.5V, V _{TC} =0.5V	0.40	0.80	1.20	μA
Non-induction time		t _d	V _{CC} =1.5V, C=0.033UF	120	180	240	mS
L transmission delay time		t _{dLH}	V _{CC} =L→H, C=0.033UF	1.0	2.0	4.0	mS
Ripple absorption resistance		RRIP	measure resistance between pins 8-6	70	100	130	kΩ
Note : V _{CC} applied pulse conditions							
					td1 1.25V 1.10V	td2 1.15V 1.00V	

Timing Chart



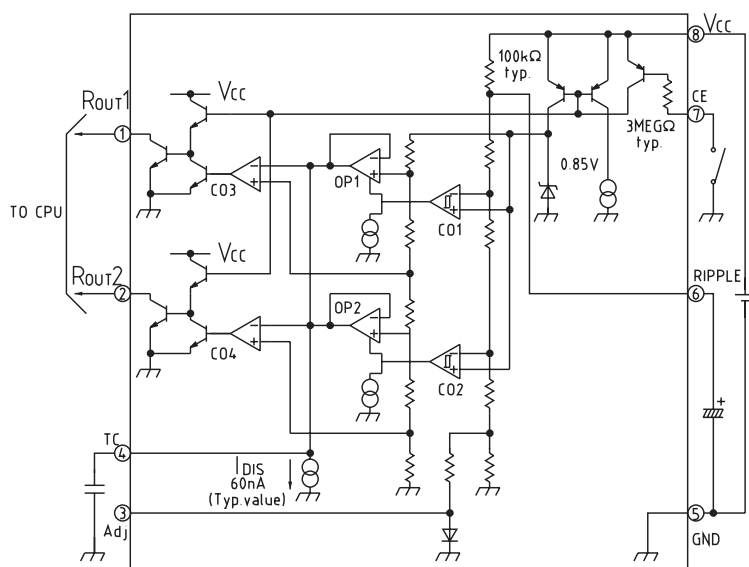
★ Delay time is calculated by the following formula :

$$tD1=tD2 \text{ (S)}=C_T \text{ (F)} \times (5.4 \times 10^6)$$

$$tDLH \text{ (S)}=C_T \text{ (F)} \times (6.3 \times 10^4)$$

C_T , TC pin connection capacitance

Block Diagram, Example of Application Circuit



Output

Vcc	1.18	1.06
ROUT 1	L	H
LED 2	L	H

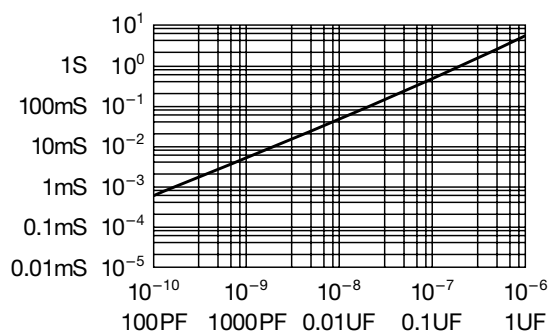
CE pin

H	Operation
L	Waiting

Note 1 : Please connect the CE pin to Vcc when not using.

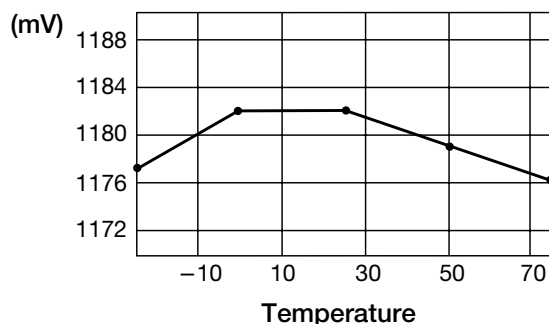
Note 2 : The Adj terminal is used in the product inspection process, so please do not connect it to other wiring.

Capacitance of external capacitor for non-induction time

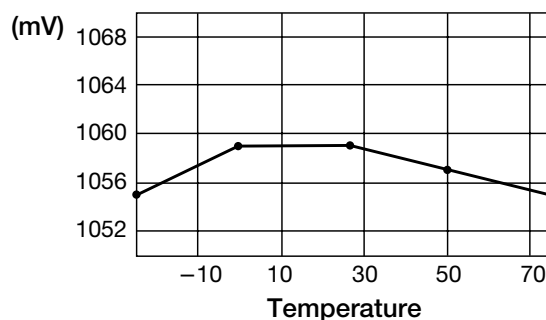


Characteristics

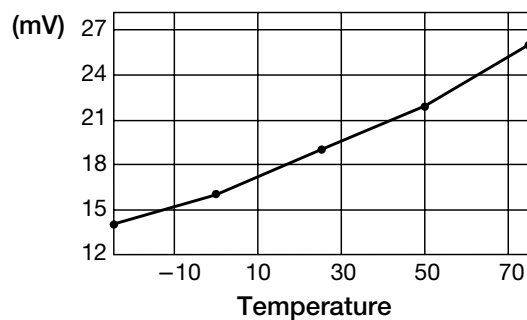
■ Detection voltage 1
Temperature characteristics



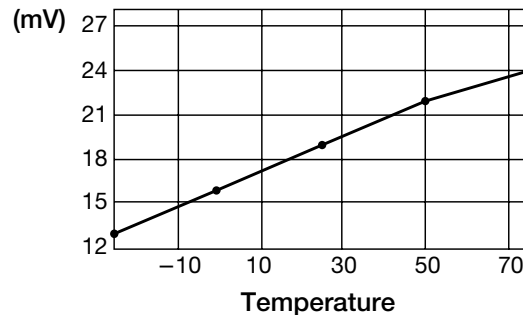
■ Detection voltage 2
Temperature characteristics



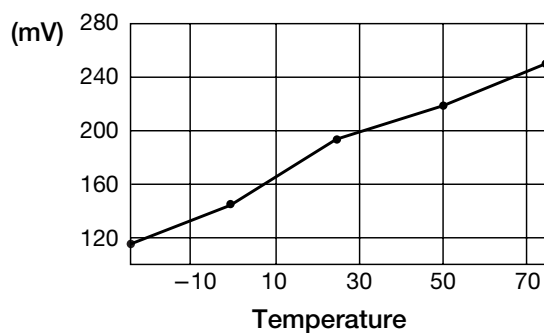
■ Hysteresis voltage 1
Temperature characteristics



■ Hysteresis voltage 2
Temperature characteristics



■ Output sink current 1
Temperature characteristics



■ Output saturation voltage 1
Temperature characteristics

