MM3220series

OUTLINE

 The MM3220 series are protection IC using high voltage CMOS process for overcharge, overdischarge and overcurrent protection of the rechargeable Lithium-ion or Lithium-polymer battery. The overcharge, overdischarge, discharging overcurrent, short, charging , and overcurrent(optional) of the rechargeable one-cell Lithium-ion or Lithium-polymer battery can be detected. Each of these IC composed of four voltage detectors, short detection circuit, reference voltage sources, oscillator, counter circuit and logical circuits.

FEATURES

(Unless otherwise specified, Topr=+25℃)

1) Range and accuracy of detection/release voltage
   - Overcharge detection voltage   4.0V to 4.5V, 5mV steps   Accuracy±20mV
                                                   Accuracy±25mV（Topr=-5 to +60℃）
   - Overcharge release voltage   3.9V to 4.5V, 50mV steps   Accuracy±30mV
   - Overdischarge detection voltage   2.0V to 3.0V, 50mV steps   Accuracy±35mV
   - Overdischarge release voltage   2.0V to 3.5V, 50mV steps   Accuracy±100mV
   - Discharging overcurrent detection voltage 1   +50mV to +300mV, 5mV steps   Accuracy±10mV
   - Discharging overcurrent detection voltage 2 ※ +50mV to +700mV, 50mV steps   Accuracy TYP±20%
   - Charging overcurrent detection voltage ※1   −50mV to −300mV, 5mV steps   Accuracy±20mV
   - Short detection voltage   0.9V fixed   Accuracy±100mV
                                                   Accuracy±300mV ※2

2) Range of detection delay time
   - Overcharge detection delay time   Selection from 0.25s, 1.0s, 1.2s, 4.5s
   - Overdischarge detection delay time   Selection from 20ms, 24ms, 96ms, 125ms, 144ms
   - Discharging overcurrent detection delay time 1 Selection from 8ms, 12ms, 16ms, 20ms, 48ms
   - Discharging overcurrent detection delay time 2 Selection from 0.5ms, 1ms , 1.5ms , 2ms , 4ms
   - Charging overcurrent detection delay time   Selection from 4ms, 6ms, 8ms, 16ms
   - Short detection delay time   400us fixed

3) Low current consumption
   - Normal mode   Typ. 4.0uA, Max. 8.0uA
   - Stand-by mode   Max. 0.1uA

4) Absolute maximum ratings
   - VDD pin   VSS−0.3V to 12V
   - COUT pin and V− pin   VDD−28V to VDD+0.3V
   - DOUT pin   VSS−0.3V to VDD+0.3V
   - Storage temperature   −55 to +125℃
   - Operation temperature   −40 to +85℃

5) Package type   • SOT−26A   2.90 × 2.80 × 1.15 [mm]

   ※1 Optional function
   ※2 When the discharging overcurrent detection voltage 2 function having

ELECTRICAL CHARACTERISTICS
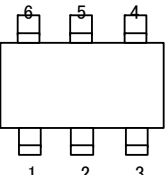
Unless otherwise specified, Topr=+25℃

Parameter	Symbol	Conditions	Min.	Typ.	Max.	unit
INPUT/OUTPUT VOLTAGE						
Operating input voltage	VDD1	VDD-VSS	1.5	–	12.0	V
Minimum operating voltage for 0V charging	Vst	VDD-V-	–	–	1.2	V
COUT pin Nch ON voltage	Vol1	Iol=30uA, VDD=9.0V	–	0.4	0.5	V
COUT pin Pch ON voltage	Voh1	Ioh=-30uA, VDD=7.0V	6.5	6.8	–	V
DOUT pin Nch ON voltage	Vol2	Iol=30uA, VDD=3.8V	–	0.2	0.5	V
DOUT pin Pch ON voltage	Voh2	Ioh=-30uA, VDD=7.0V	6.5	6.8	–	V
CURRENT CONSUMPTION						
Current consumption	IDD	Vcell=3.5V, V-=0V	–	4.0	8.0	uA
Current consumption at stand-by	IS	Vcell=1.9V, V-=3.8V	–	–	0.1	uA
DOUT pin Pch ON voltage	IBL	Vcell=3.5V, V-=0V	-300	–	300	nA
DETECTION/RELEASE VOLTAGE						
Overcharge detection voltage	Vdet1	Ta=+25℃	Typ-0.020	Vdet1	Typ+0.020	V
		Ta=-5～+60℃	Typ-0.025		Typ+0.025	
Overcharge release voltage	Vrel1	Vdet1≠Vrel1	Typ-0.030	Vrel1	Typ+0.030	V
Overdischarge detection voltage	Vdet2		Typ-0.035	Vdet2	Typ+0.035	V
Overdischarge release voltage	Vrel2	Vdet2≠Vrel2	Typ-0.10	Vrel2	Typ+0.100	V
Discharging overcurrent detection voltage 1	Vdet3-1		Typ-0.010	Vdet3-1	Typ+0.010	V
Discharging overcurrent detection voltage 2 ※	Vdet3-2		Typ-20%	Vdet3-2	Typ+20%	V
Charging overcurrent detection voltage ※1	Vdet4		Typ-0.020	Vdet4	Typ+0.020	V
Short detection voltage	Vshort		0.8	0.9	1.0	V
DETECTION DELAY TIME						
Overcharge detection delay time	tVdet1			tVdet1		s
Overdischarge detection delay time	tVdet2			tVdet2		ms
Discharging overcurrent detection delay time 1	tVdet3-1		Typ*0.8	tVdet3-1	Typ*1.2	ms
Discharging overcurrent detection delay time 2 ※1	tVdet3-2			tVdet3-2		ms
Charging overcurrent detection delay time ※1	tVdet4			tVdet4		ms
Short detection delay time	tshort		280	400	560	us

※1 Optional function

PIN EXPLANATIONS

Top view SOT-26A	Pin No.	Symbol	Function
	1	DOUT	Output of overdischarge detection.
	2	COUT	Output of overcharge detection.
	3	V-	Input terminal connected to charger negative voltage.
	4	VBL	Input terminal of the low side cell.
	5	VDD	Input terminal of the high side cell. Supply terminal.
	6	VSS	VSS terminal. Connected to ground.

PACKAGE DIMENSIONS

SOT-26A
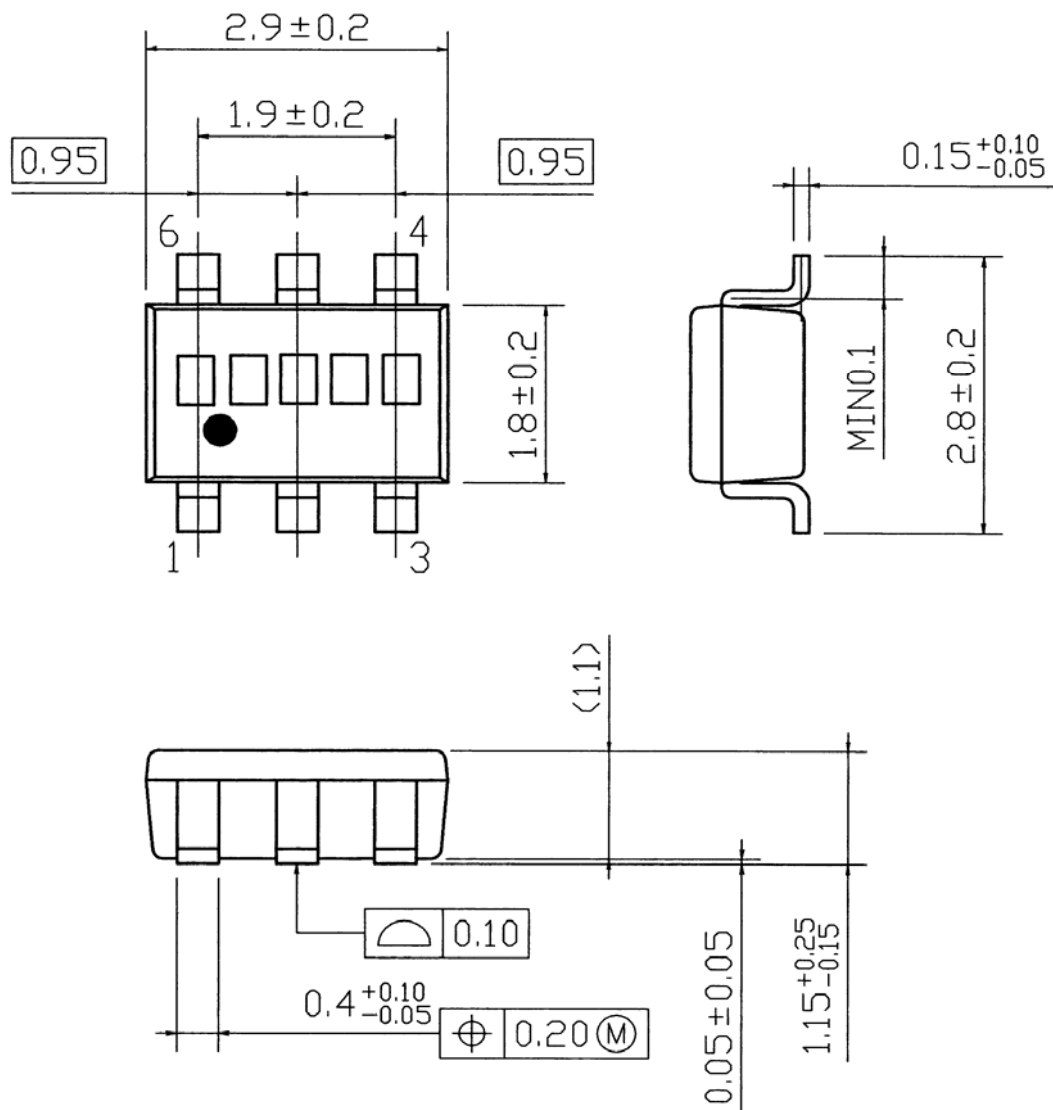
TYPICAL APPLICATION CIRCUIT
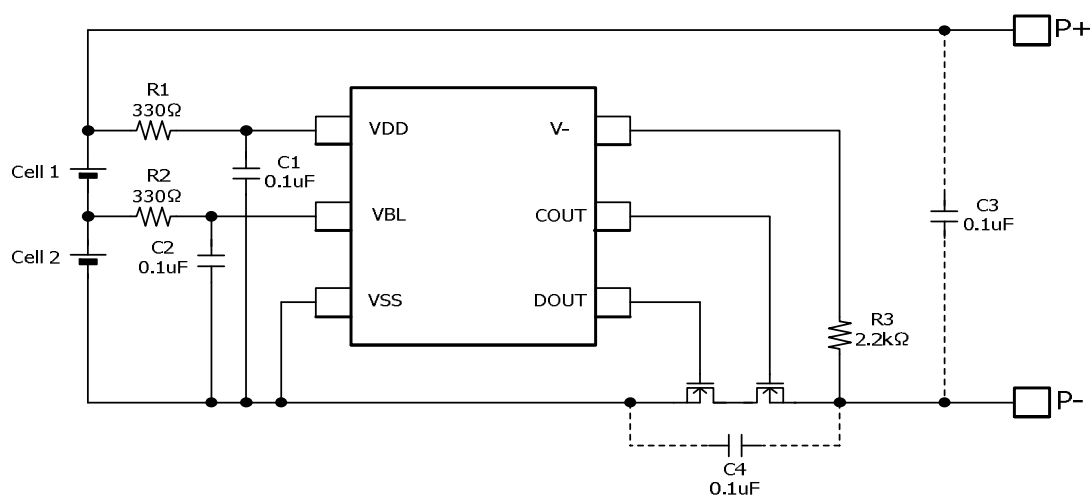
R1 , C1 , R2 , C2 stabilize a supply voltage ripple. However, R1 is enlarged, the detection voltage shifts by voltage when current consumption flows into R1. Please decide it after confirming the characteristic. Moreover, adjust the value of C1 , C2 to 0.01uF or more to do the stability operation, please.

R1 and R3 resistors are current limit resistance if a charger is connected reversibly or a high-voltage charger that exceeds the absolute maximum rating is connected. R1 and R3 may cause a power consumption will be over rating of power dissipation, therefore the `R1+R3` should be more than 1kohm. Moreover, if R3 is too enlarged, the charger connection release cannot be occasionally done after the overdischarge is detected, so adjust the value of R3 to 10kohm or less, please.

In the state of overdischarge, The current flows through overdischarge pull-up resistance built into between VDD terminal and V- terminal when the charger is connected. As a result, current that flows into VDD terminal increases. When current increases, the voltage is generated in R1. And hysteresis might be caused. Please use it after confirming the characteristic.

C3 and C4 capacitors have effect that the system stability about voltage ripple or imported noise. After check characteristics, decide that these capacitors should be inserted or not, where should be inserted, and capacitance value, please.

PRODUCT LINEUP

Status of current IC	Product name (MM3220)	Package	Two stage overcurrent detecting function	Charging overcurrent detection	Overcharge detection voltage	Overcharge release voltage	Overdischarge detection voltage	Overdischarge release voltage	Discharging overcurrent detection voltage 1	Discharging overcurrent detection voltage 2	Charging overcurrent detection voltage	Overcharge detection delay time	Overdischarge detection delay time	Discharging overcurrent detection delay time 1	Discharging overcurrent detection delay time 2	Charging overcurrent detection delay time
			※1		Vdet1	Vrel1	Vdet2	Vrel2	Vdet3-1	Vdet3-2	Vdet4	tVdet1	tVdet2	tVdet3-1	tVdet3-2	tVdet4
ES	B01NRH	SOT26A	×	×	4.300V	4.100V	2.000V	2.000V	0.220V	–	–	1.00s	12.0ms	12.0ms	–	–
ES	C01NRH	SOT26A	○	×	4.300V	4.100V	2.000V	2.000V	0.085V	0.450V	–	1.15s	10.8ms	10.8ms	0.5ms	–
MP	C02NRH	SOT26A	○	×	4.300V	4.100V	2.000V	2.000V	0.100V	0.200V	–	1.00s	12.0ms	48.0ms	4.0ms	–
ES	C03NRH	SOT26A	○	×	4.300V	4.100V	2.000V	2.000V	0.100V	0.200V	–	1.00s	12.0ms	256.0ms	2.5ms	–
MP	D01NRH	SOT26A	×	×	4.250V	4.100V	3.000V	3.000V	0.200V	–	–	1.15s	144.0ms	9.0ms	–	–
MP	D05NRH	SOT26A	×	×	4.250V	4.100V	2.500V	2.500V	0.150V	–	–	1.15s	144.0ms	9.0ms	–	–
MP	F01NRH	SOT26A	×	×	4.225V	4.075V	2.550V	2.550V	0.200V	–	–	1.15s	144.0ms	9.0ms	–	–
ES	G01NRH	SOT26A	×	○	4.290V	4.050V	3.000V	3.200V	0.200V	–	−0.200V	1.00s	128.0ms	12.0ms	–	8.0ms
ES	G06NRH	SOT26A	×	○	4.250V	4.100V	2.500V	3.000V	0.150V	–	−0.100V	1.00s	12.0ms	256.0ms	–	8.0ms
ES	G07NRH	SOT26A	×	○	4.400V	4.250V	2.500V	3.000V	0.150V	–	−0.100V	1.00s	12.0ms	256.0ms	–	8.0ms
ES	H01NRH	SOT26A	×	○	4.225V	4.075V	3.000V	3.000V	0.200V	–	−0.200V	1.15s	144.0ms	9.0ms	–	8.0ms
MP	H02NRH※2	SOT26A	×	○	4.300V	4.150V	2.400V	2.400V	0.200V	–	−0.200V	1.15s	144.0ms	9.0ms	–	8.0ms
ES	H03NRH	SOT26A	×	○	4.250V	4.100V	3.200V	3.200V	0.200V	–	−0.200V	1.15s	144.0ms	9.0ms	–	8.0ms
MP	H04NRH※2	SOT26A	×	○	4.230V	4.080V	2.400V	2.400V	0.200V	–	−0.200V	1.15s	144.0ms	9.0ms	–	8.0ms
MP	H06NRH※2	SOT26A	×	○	4.230V	4.080V	2.865V	2.865V	0.200V	–	−0.200V	1.15s	144.0ms	9.0ms	–	8.0ms
MP	H09NRH※2	SOT26A	×	○	4.225V	4.150V	2.600V	2.600V	0.250V	–	−0.200V	1.15s	1.15s	9.0ms	–	8.0ms
ES	H10NRH※2	SOT26A	×	○	4.250V	4.175V	2.600V	2.600V	0.250V	–	−0.200V	1.15s	1.15s	9.0ms	–	8.0ms
MP	H11NRH	SOT26A	×	○	4.300V	4.150V	2.300V	2.300V	0.150V	–	−0.150V	1.00s	96.0ms	20.0ms	–	8.0ms
ES	H13NRH	SOT26A	×	○	4.250V	4.050V	2.400V	2.400V	0.200V	–	−0.200V	1.00s	128.0ms	12.0ms	–	8.0ms
ES	H15NRH※2	SOT26A	×	○	4.280V	4.130V	2.800V	2.800V	0.150V	–	−0.150V	1.00s	128.0ms	9.0ms	–	8.0ms
MP	J01NRH※2	SOT26A	×	○	4.275V	4.275V	2.500V	2.500V	0.085V	–	−0.060V	0.25s	20.0ms	6.0ms	–	16.0ms
MP	K01NRH	SOT26A	○	○	4.300V	4.100V	2.000V	2.000V	0.125V	0.300V	−0.090V	1.15s	144.0ms	12.0ms	0.5ms	8.0ms
ES	M01NRH※2	SOT26A	×	○	4.280V	4.080V	2.000V	2.000V	0.200V	–	−0.100V	1.00s	128.0ms	12.0ms	–	8.0ms
MP	M04NRH※2	SOT26A	×	○	4.280V	4.080V	2.600V	2.600V	0.135V	–	−0.085V	1.00s	128.0ms	12.0ms	–	8.0ms
MP	N01NRH	SOT26A	×	×	4.250V	4.100V	2.500V	3.000V	0.150V	–	–	1.15s	144.0ms	9.0ms	–	–
MP	Z01NRH※3	SOT26A	○	×	4.300V	4.100V	2.000V	2.000V	0.100V	0.180V	–	1.00s	12.0ms	256.0ms	2.5ms	–

※1 Optional functions   ○ : Provided.
                                       × : Not provided.

※2 0V Charge Disabled

※3 The charging overcurrent function cannot be added to the Z01 rank.

Please inquire to us, if you request a rank other than the above.
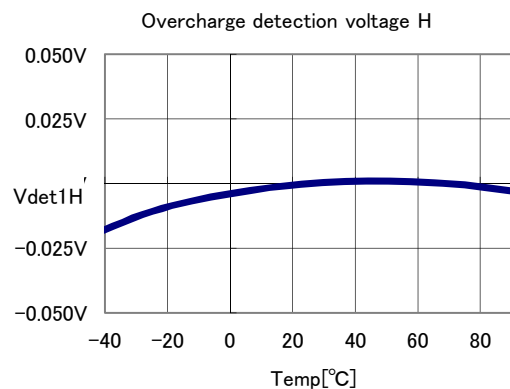
The main item temperature characteristic
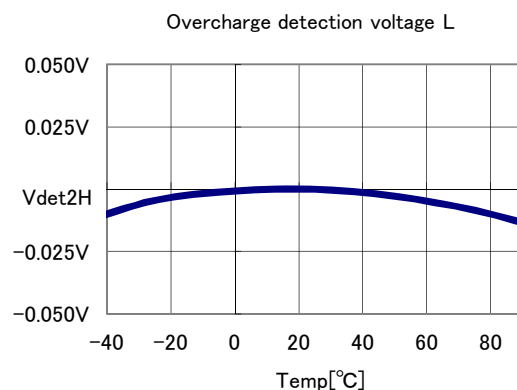
Overcharge detection voltage H

Fig.1 Overcharge detection voltage H
temperature characteristic

Overcharge detection voltage L

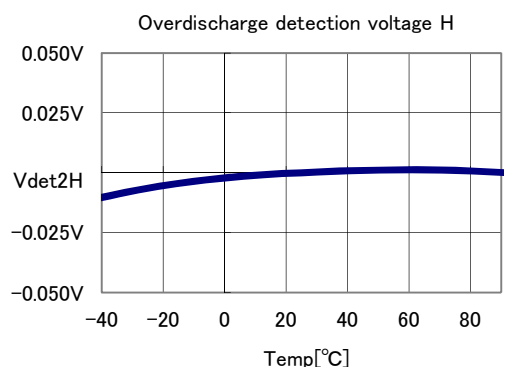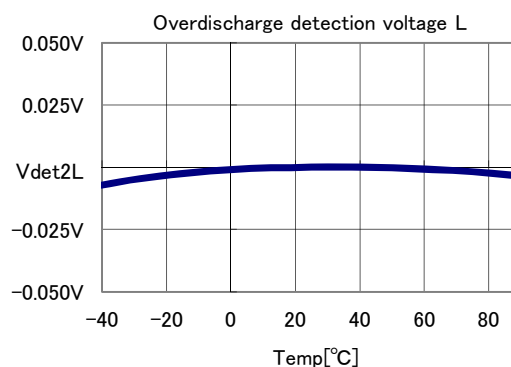Fig.2 Overcharge detection voltage L
temperature characteristic

Overdischarge detection voltage H

Fig.3 Overdischarge detection voltage H
temperature characteristic

Overdischarge detection voltage L

Fig.4 Overdischarge detection voltage H
temperature characteristic

Dischargimg overcurrent detection voltage
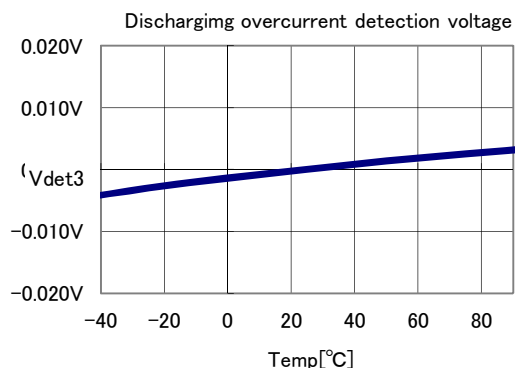
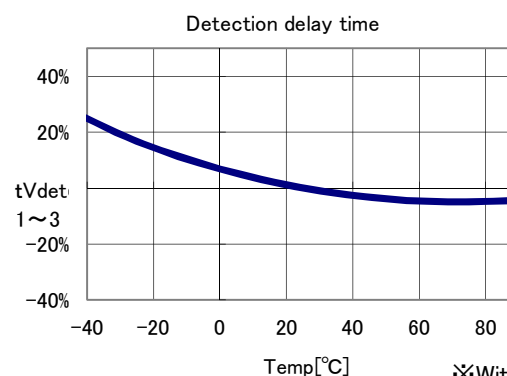Fig.5 Dischargingovercurrent detection
voltage H temperature characteristic

Detection delay time

Fig.6 Detection delay time
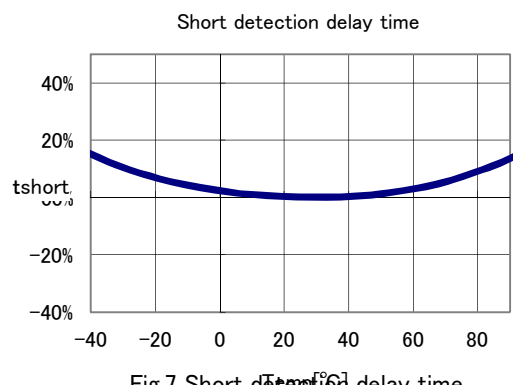temperature characteristic

※Without short
detection delay
time

Short detection delay time

Fig.7 Short detection delay time
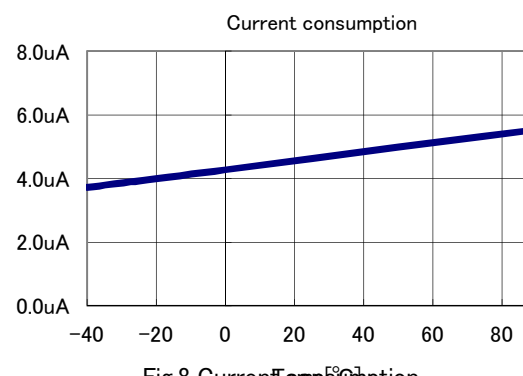temperature characteristic

Current consumption

Fig.8 Current consumption
temperature characteristic