



4 - 7 cells Li-ion/polymer battery protection IC

MM3877 series

Outline

The MM3877 series are protection IC using high voltage CMOS process for overcharge, overdischarge, overcurrent, temperature protection, and cell balance control of the rechargeable Lithium-ion or Lithium-polymer battery. The overcharge, overdischarge, discharging overcurrent, charging overcurrent, and short of the rechargeable 4-7cells lithium-ion or lithium-polymer battery can be detected. In addition, the temperature detection by external NTC thermistor and cell balance control are also possible. The internal circuit of IC is composed by the voltage detector, the reference voltage source, oscillator, counter circuit and the logical circuit, etc. A stacking configuration using multiple ICs is also possible, so a low-cost, space-saving protection circuit can be configured for applications with more than 7 cells.

Features

(Unless otherwise specified, Ta=25°C)

1) Range and accuracy of detection/release voltage

• Overcharge detection voltage	3.6V to 4.5V, 5mV steps	Accuracy±20mV
• Overcharge release voltage	3.4V to 4.5V, 50mV steps	Accuracy±30mV
• Overdischarge detection voltage	2.0V to 3.0V, 50mV steps	Accuracy±50mV
• Overdischarge release voltage	2.0V to 3.5V, 50mV steps	Accuracy±100mV
• Cell balance detection voltage	3.6V to 4.5V, 50mV steps	Accuracy±25mV
• Discharging overcurrent detection voltage1	30mV to 300mV, 5mV steps	Accuracy±10%
• Discharging overcurrent detection voltage2	60mV to 600mV, 5mV steps	Accuracy±15%
• Short detection voltage	0.2V to 1.0V, 0.05V steps	Accuracy±20%
• Charging overcurrent detection voltage	-300mV to -20mV, 5mV step	Accuracy±10%
• Temperature protection detection temperature	-40°C to 75°C, 5°C step	Accuracy±5°C

2) Range of detection delay time

• Overcharge detection delay time	100ms to 2.048s
• Overdischarge detection delay time	100ms to 2.048s
• Cell balance detection delay time	100ms to 4.096s
• Discharging overcurrent detection delay time1	100ms to 2560ms, COC=0.01uF
• Discharging overcurrent detection delay time2	10ms to 640ms, COC=0.01uF
• Short detection delay time	200us to 500us, 50us step
• Charging overcurrent detection delay time	4ms to 2.048s
• Temperature protection detection delay time	4ms to 2.048s

※ Voltage monitoring of overcharge protection, overdischarge protection and cell balance control measures the voltage of each cell in turn at [Cell voltage monitoring period(=Typ.71.75ms)]. For that reason, each detection time and release time fluctuates within the range of Spec depending on the difference between the timing at which the voltage changes and the timing at which the voltage is monitored.

3) 0V battery charge function

Selection from "Prohibition" or "Permission"





4) SEL pin can be set from 4cell protection to 7 cell protection.

5) Power save function

6) Cascade connection

7) Low current consumption

- Ave. current consumption (Normal mode) Typ. 20.0uA Max. 30.0uA (VCELL=3.5V)
- Current consumption (power save mode) Typ. 1.0uA Max. 1.5uA (VCELL=1.8V)

8) Package type

- VSOP-20A 8.66 × 6.00 × 1.63 [mm]

Pin explanations

VSOP-20A	Pin No.	Symbol	Function
<p style="text-align: center;">TOP VIEW</p>	1	VDD	The input pin of the power supply of IC.
	2	V7	The input pin of the positive voltage of V7 cell and the output pin of cell balance control of V7 cell.
	3	V6	The input pin of the positive voltage of V6, and the negative voltage of V7 cell. And the output pin of cell balance control of V6 cell.
	4	V5	The input pin of the positive voltage of V5, and the negative voltage of V6 cell. And the output pin of cell balance control of V5 cell.
	5	V4	The input pin of the positive voltage of V4, and the negative voltage of V5 cell. And the output pin of cell balance control of V4 cell.
	6	V3	The input pin of the positive voltage of V3, and the negative voltage of V4 cell. And the output pin of cell balance control of V3 cell.
	7	V2	The input pin of the positive voltage of V2, and the negative voltage of V3 cell. And the output pin of cell balance control of V2 cell.
	8	V1	The input pin of the positive voltage of V1, and the negative voltage of V2 cell. And the output pin of cell balance control of V1 cell.
	9	SEL	This input pin is changing function for 4cell, 5cell, 6cell, and 7cell in series.
	10	PD	The output pin for controlling pull-down of load negative voltage.
	11	COC	This input pin sets delay time of discharging overcurrent detection, and selects mode.
	12	VSS	The input pin of the negative voltage of V1 cell. The input pin the ground of IC.
	13	TH	Temperature detection pin.
	14	CS	Temperature detection pin..
	15	DCHG	When charge/discharge control FET drive mode, DCHG pin is discharge control output pin. When cascade mode, DCHG pin is discharge control output pin and load connect signal input pin.
	16	VLM	The input pin connected to load negative voltage.
	17	OV	When charge/discharge control FET drive mode, OV pin is charge control output pin. When cascade mode, OV pin is charge control output pin and charger connect signal input pin.
	18	VCM	The input pin connected to charger negative voltage.
	19	SOC	The input pin for charge control. And, charger connect signal output pin.
	20	SDC	The input pin for discharge control. And, load connect signal output pin.



Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
VDD pin supply voltage	V _{VDDMAX}	-0.3	42	V
Voltage between the input terminals of voltage of battery	V _{cellMAX}	-0.3	6	V
VCM pin supply voltage	V _{VCMMAX}	VDD-42	VDD+0.3	V
VLM pin supply voltage	V _{VLMMAX}	VDD-42	VDD+0.3	V
OV pin supply voltage	V _{OVMAX}	VDD-42	VDD+0.3	V
DCHG pin supply voltage	V _{DCHGMAX}	VDD-42	VDD+0.3	V
CS pin supply voltage	V _{CSMAX}	VSS-0.3	VDD+0.3	V
Storage temperature	T _{STG}	-55	125	°C

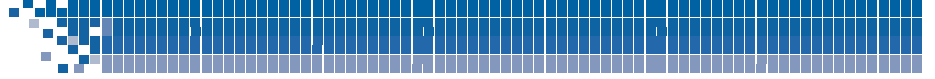
Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Operating ambient temperature	T _{OPR}	-40	85	°C
Operating voltage	V _{OPR}	3.5	31.5	V

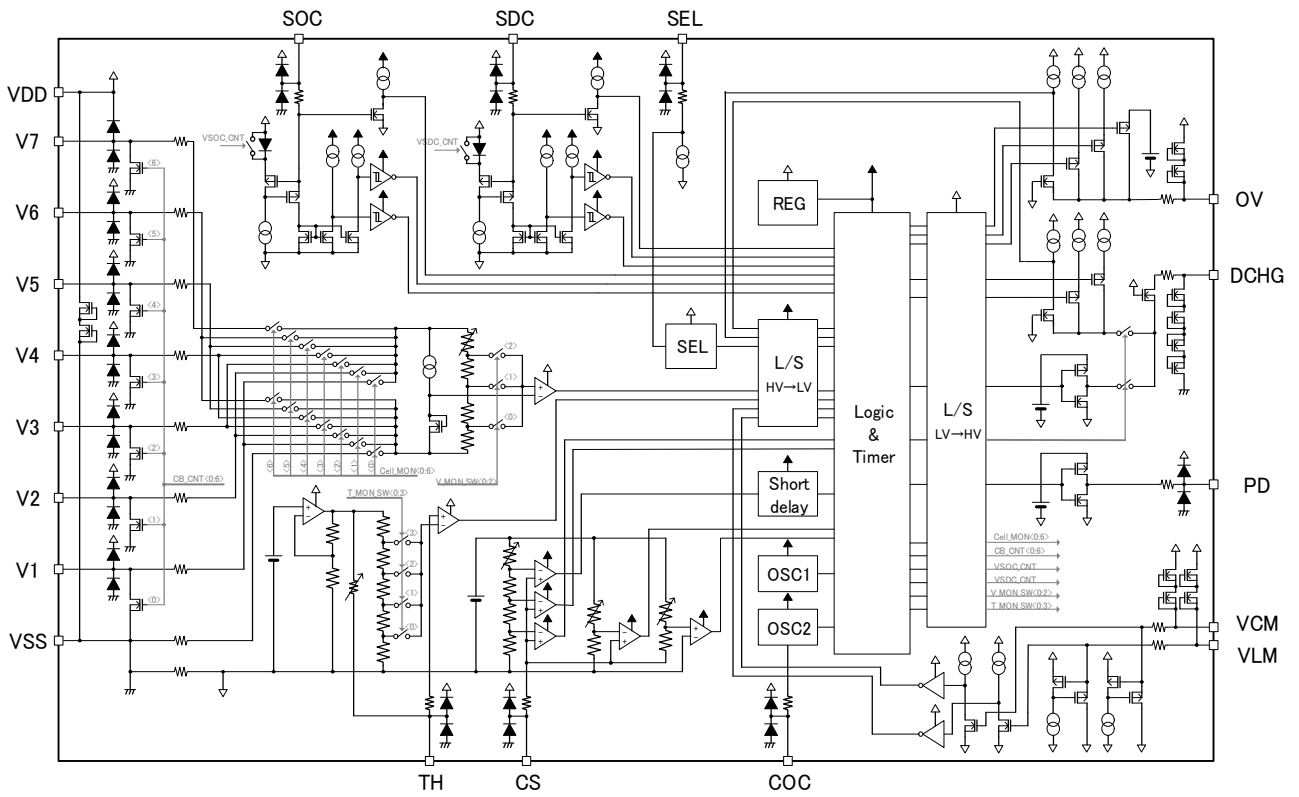
Electrical characteristics

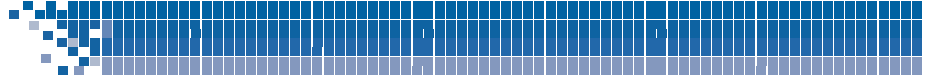
(特記なき場合、Ta=25°C)

Parameter	Symbol	Note	Min	Typ	Max	Unit
Current consumption						
Current consumption1 (VDD)	I _{dd}	V _{cell} =3.5V	-	20.0	30.0	uA
Current consumption2 (VDD)	I _{dd_ps}	V _{cell} =1.8V	-	1.0	1.5	uA
Detection / Release voltage						
Overcharge detection voltage	V _{ovp}		Typ-0.020	V _{ovp}	Typ+0.020	V
Overcharge release voltage	V _{ovr}		Typ-0.030	V _{ovr}	Typ+0.030	V
Overdischarge detection voltage	V _{ovvp}		Typ-0.050	V _{ovvp}	Typ+0.050	V
Overdischarge release voltage	V _{ovvr}		Typ-0.100	V _{ovvr}	Typ+0.100	V
Cell balance detection voltage	V _{cbd}		Typ-0.025	V _{cbd}	Typ+0.025	V
Discharging overcurrent detection voltage 1	V _{docp1}		Typ-10%	V _{docp1}	Typ+10%	V
Discharging overcurrent detection voltage 2	V _{docp2}		Typ-15%	V _{docp2}	Typ+15%	V
Short detection voltage	V _{scp}		Typ-20%	V _{scp}	Typ+20%	V
Charging overcurrent detection voltage	V _{cocp}		Typ-10%	V _{cocp}	Typ+10%	V
High temp protection detection temp for discharge control	T _{thp1}		Typ-5	T _{thp1}	Typ+5	°C
High temp protection detection temp for charge control	T _{thp2}		Typ-5	T _{thp2}	Typ+5	°C
Low temp protection detection temp for charge control	T _{thp3}		Typ-5	T _{thp3}	Typ+5	°C
Low temp protection detection temp for discharge control	T _{thp4}		Typ-5	T _{thp4}	Typ+5	°C
Detection voltage delay time						
Overcharge detection delay time	t _{ovp}		Typ-25%	t _{ovp}	Typ+25%	s
Overdischarge detection delay time	t _{ovvp}		Typ-25%	t _{ovvp}	Typ+25%	s
Cell balance detection delay time	t _{cbd}		Typ-25%	t _{cbd}	Typ+25%	s
Discharging overcurrent detection delay time 1	t _{docp1}	COC=0.01uF	Typ-30%	t _{docp1}	Typ+30%	ms
Discharging overcurrent detection delay time 2	t _{docp2}	COC=0.01uF	Typ-30%	t _{docp2}	Typ+30%	ms
Short detection delay time	t _{scp}		Typ-50%	t _{scp}	Typ+50%	us
Charging overcurrent detection delay time	t _{cocp}		Typ-30%	t _{cocp}	Typ+30%	ms
Temp protection detection delay time	t _{thp}		Typ-25%	t _{thp}	Typ+25%	ms



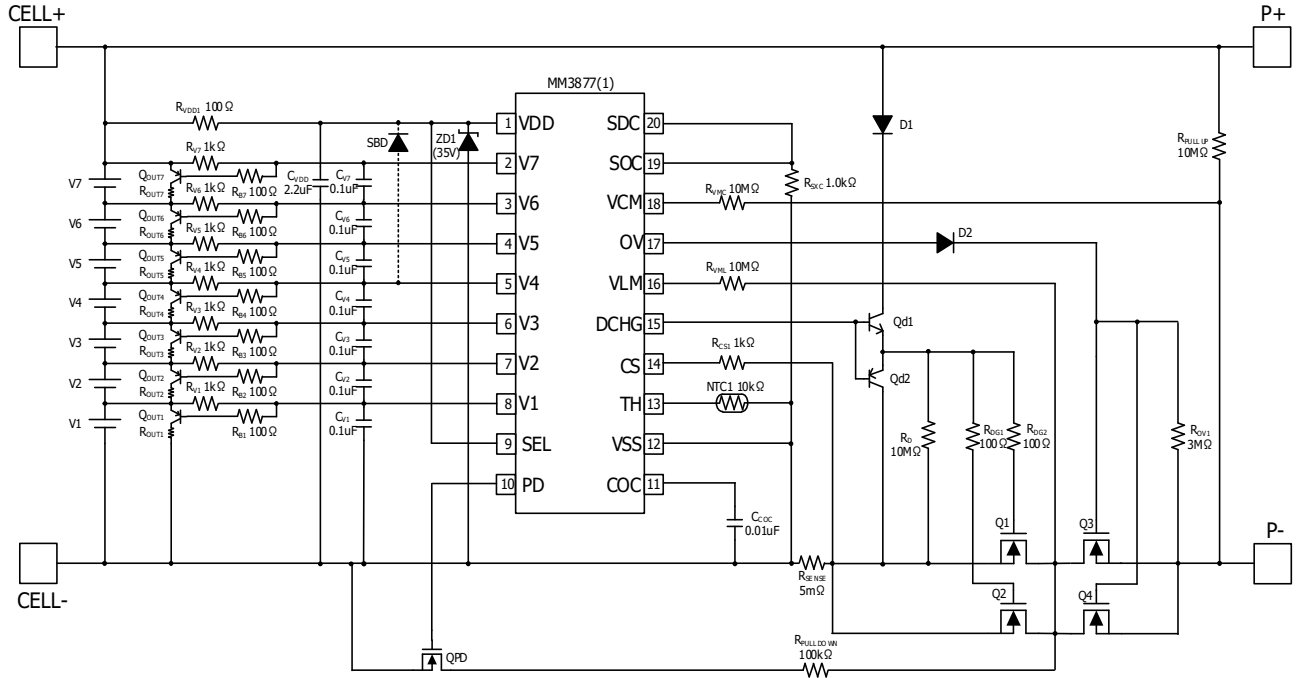
Block diagram





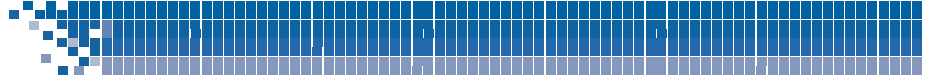
Typical application circuit

• 7 cells protection circuit



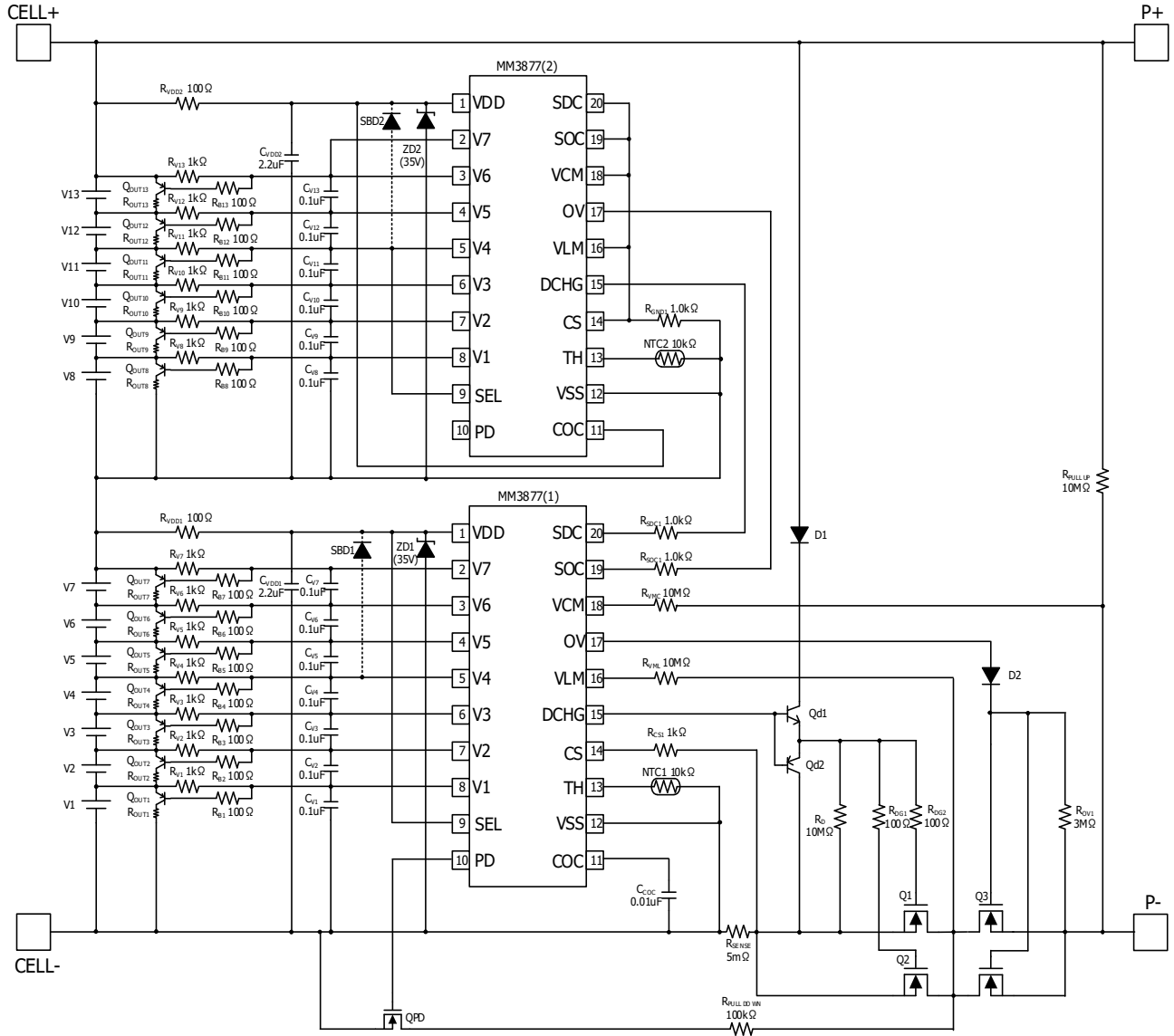
※ This circuits are typical examples provided for reference purposes, so in actual applications, the circuit constants, conditions and operations should be thoroughly studied. Mitsumi Electric Co., Ltd. assumes no responsibility for any trouble or damage as a result of the use of this circuits.





Typical application circuit

- 13 cells protection circuit



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