3- 5 cells Li-ion/polymer battery protection IC

MM3575 series

Outline

The MM3575 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, charging overcurrent, cell balance and from V5 to V3 pin disconnect of the rechargeable from 3 to 5cell Lithium-ion or Lithium-polymer battery can be detected. By using cascade connection, it is also possible to protect 6 or more cells rechargeable Lithium-ion battery. And the regulator can be constructed by using external Nch MOS FET. The internal circuit of IC is composed by the voltage detector, the reference voltage source, delay time control circuit, and the logical circuit, etc.

Features

(Unless otherwise specified,Ta=25℃)

1) Range and accuracy of detection/release voltage

・Overcharge detection voltage	3.6V to 4.5V, 5mV steps	Accuracy±25mV（Ta=0～50℃）
・Overcharge release voltage	3.4V to 4.5V, 50mV steps	Accuracy±50mV
・Overdischarge detection voltage	2.0V to 3.0V, 50mV steps	Accuracy±80mV
・Overdischarge release voltage	2.0V to 3.5V, 50mV steps	Accuracy±100mV
・Discharging overcurrent detection voltage1	+30mV to +300mV, 5mV steps	Accuracy±15mV
・Discharging overcurrent detection voltage2	2 or 4 times of VDET3-1	Accuracy±15%
・Short detection voltage	4 or 8 times of VDET3-1	Accuracy±100mV
・Charging overcurrent detection voltage	-300mV to -20mV, 5mV step	Accuracy±10mV
・Cell balance detection voltage	3.6V to 4.5V, 5mV steps	Accuracy±30mV（Ta=0～50℃）

2) Range of detection delay time

・Overcharge detection delay time	Selection from 0.25s, 1.0s, 1.2s, 4.1s
・Overdischarge detection delay time	Selection from 0.25s, 1.0s, 1.2s, 4.1s
・Discharging overcurrent detection delay time1	Setting by a capacitor of COC pin.
・Discharging overcurrent detection delay time2	Setting by a capacitor of COC pin.
・Short detection delay time	Selection from 100us, 200us, 300us
・Charging overcurrent detection delay time	Setting by a capacitor of COC pin.
・Disconnect detection delay time	Selection from 25ms, 50ms, 100ms
・Cell balance detection delay time	Selection from 0.1s, 0.25s, 0.5s

3) 0V battery charge function — Selection from "Prohibition" or "Permission"

4) Protected operation can be detect of V5 to V1 pin disconnection

5) The setting for three cell , for four cell , and for five cell protection can be set with the SEL pin.

6) The charge and discharge of the battery can be controlled with SDC pin and SOC pin.

7) Power save mode built-in

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8) Regulator function built-in

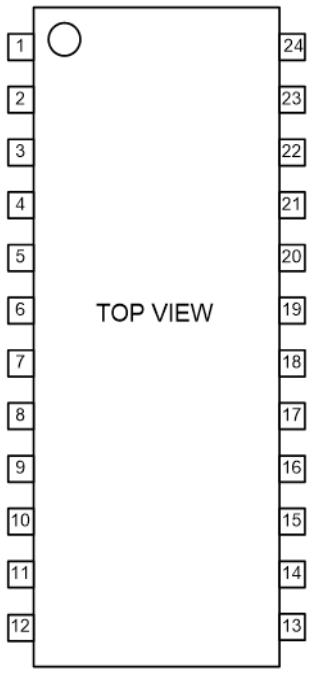
9) Low current consumption

- VDD pin current consumption(Vcell=4.3V) Typ. 25.0uA Max. 35.0uA
- VDD pin current consumption(Vcell=3.5V) Typ. 20.0uA Max. 30.0uA
- VDD pin current consumption(Vcell=2.0V) Typ. 10.0uA Max. 15.0uA
- VDD pin current consumption at power save1(Vcell=3.5V) Typ. 12.0uA Max. 16.0uA
- VDD pin current consumption at power save2(Vcell=3.5V) Typ. 4.0uA Max. 6.0uA

10 Package type

- VSOP-24A 7.90 × 7.60 × 1.25 [mm]

Pin explanations

VSOP-24A	Pin No.	Symbol	Function
	1	VDD	The input terminal of the power supply of IC.
	2	SOC	The control terminal of output over charge detection.
	3	SDC	The control terminal of output over discharge detection.
	4	VM2	Input terminal connected to charger negative voltage.
	5	OV	Charge control output terminal. Output type is Pch open drain.
	6	VM1	Input terminal connected to discharge voltage.
	7	DCHG	Discharge control output terminal. Output type is CMOS.
	8	COC	A terminal which sets delay time of overcurrent.
	9	CS1	Input of overcurrent detection.
	10	CS2	Common terminal of overcurrent detection circuit.
	11	DRIVE	The drive terminal of FET for regulator.
	12	REG_IN	The input terminal of regulator voltage
	13	SEL	This pin is for changing function for 3cell in series or 4cell in series , 5cell in series.
	14	VSS	The input terminal of the negative voltage of V1 cell. The input terminal of the ground of IC.
	15	OUT1	V1 cell balance control output terminal.
	16	V1	The input terminal of the positive voltage of V1 cell, and the negative voltage of V2 cell.
	17	OUT2	V2 cell balance control output terminal.
	18	V2	The input terminal of the positive voltage of V2 cell, and the negative voltage of V3 cell.
	19	OUT3	V3 cell balance control output terminal.
	20	V3	The input terminal of the positive voltage of V3 cell, and the negative voltage of V4 cell.
	21	OUT4	V4 cell balance control output terminal.
	22	V4	The input terminal of the positive voltage of V4 cell, and the negative voltage of V5 cell.
	23	OUT5	V5 cell balance control output terminal.
	24	V5	The input terminal of the positive voltage of V5 cell.

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
VDD pin supply voltage	V_{VDDMAX}	VSS-0.3	VSS+30.0	V
Voltage between the input terminals of voltage of battery	$V_{cellMAX}$	-0.3	10.0	V
VM1 pin supply voltage	V_{VM1MAX}	VDD-30	VDD+0.3	V
VM2 pin supply voltage	V_{VM2MAX}	VDD-30	VDD+0.3	V
OV pin supply voltage	V_{OVMAX}	VDD-30	VDD+0.3	V
DCHG pin supply voltage	$V_{DCHGMAX}$	VSS-0.3	VDD+0.3	V
OUT1~5 pin supply voltage	$V_{OUT1\sim5MAX}$	VSS-0.3	VDD+0.3	V
Storage temperature	T_{STG}	-55	125	℃

Recommended Operating Conditions

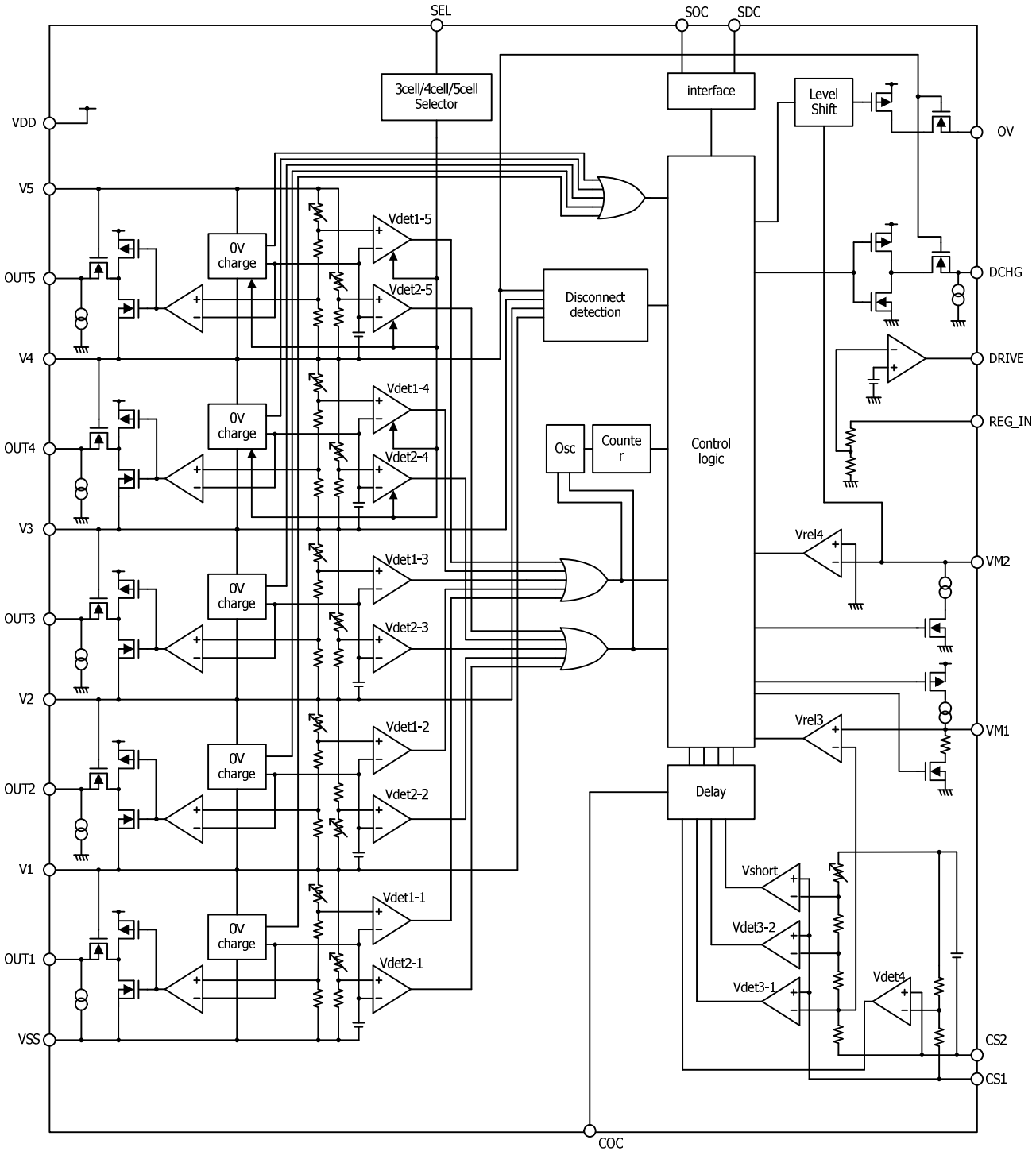
Parameter	Symbol	Min	Max	Unit
Operating ambient temperature	T_{OPR}	-40	85	℃
Operating voltage	V_{OPR}	VSS+3.5	VSS+22.5	V

Electrical characteristics

(特記なき場合、Ta=25℃)

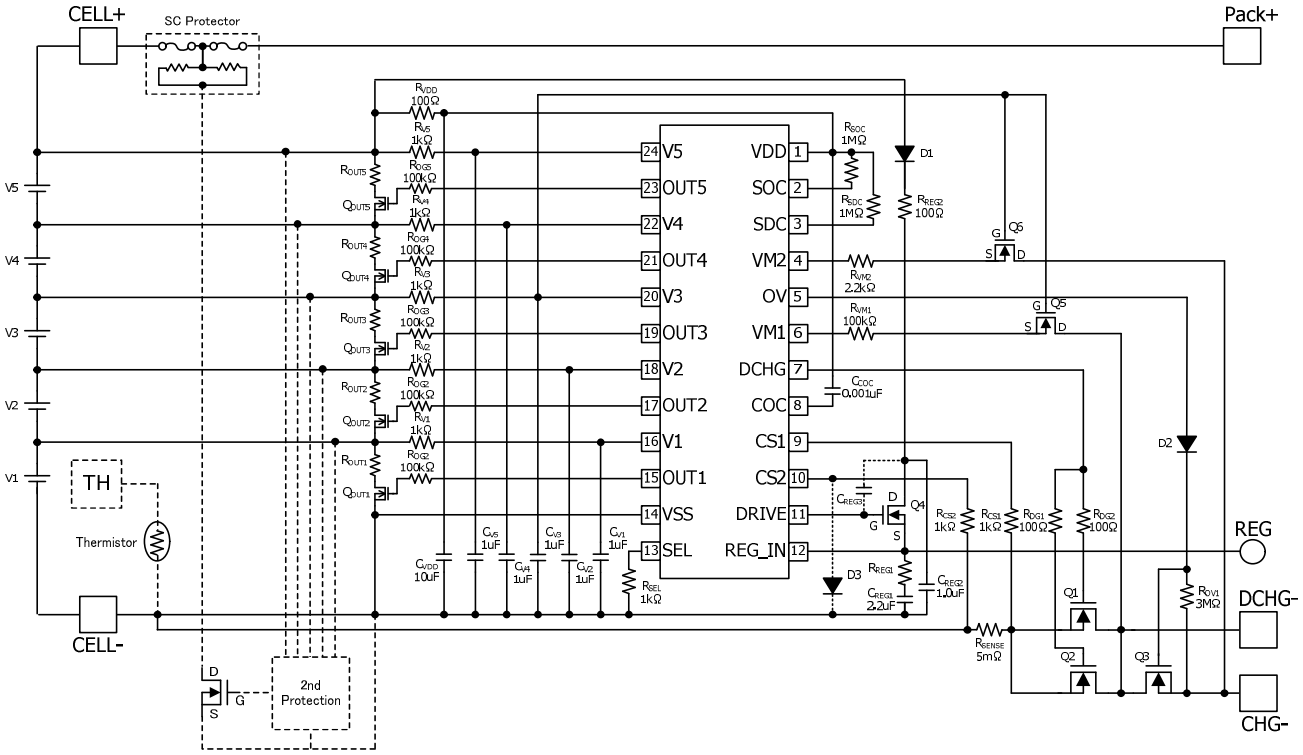
Parameter	Symbol	Note	Min	Typ	Max	Unit
Current consumption						
Current consumption1 (VDD)	I_{DD1}	Vcell=4.3V	-	25.0	35.0	uA
Current consumption2 (VDD)	I_{DD2}	Vcell=3.5V	-	20.0	30.0	uA
Current consumption3 (VDD)	I_{DD3}	Vcell=2.0V, V-=VSS	-	10.0	15.0	uA
Power save 1 Current consumption (VDD)	I_{DD_PS1}	Vcell=3.5V, SDC,SOC=OPEN	-	12.0	16.0	uA
Power save 2 Current consumption (VDD)	I_{DD_PS2}	Vcell=3.5V, SDC,SOC=VSS	-	4.0	6.0	uA
Detection / Release voltage						
Overcharge detection voltage	V_{DET1}	Ta=0～50℃	Typ-0.025	V_{DET1}	Typ+0.025	V
Overcharge release voltage	V_{REL1}		Typ-0.050	V_{REL1}	Typ+0.050	V
Cell balance detection voltage	V_{DET_CB}	Ta=0～50℃	Typ-0.030	V_{DET_CB}	Typ+0.030	V
Overdischarge detection voltage	V_{DET2}		Typ-0.080	V_{DET2}	Typ+0.080	V
Overdischarge release voltage	V_{REL2}		Typ-0.100	V_{REL2}	Typ+0.100	V
Discharging overcurrent detection voltage 1	V_{DET3-1}		Typ-0.015	V_{DET3-1}	Typ+0.015	V
Discharging overcurrent detection voltage 2	V_{DET3-2}		Typ-15%	V_{DET3-2}	Typ+15%	V
Short detection voltage	V_{SHORT}		Typ-0.100	V_{SHORT}	Typ+0.100	V
Charging overcurrent detection voltage	V_{DET4}		Typ-0.010	V_{DET4}	Typ+0.010	V
Detection voltage delay time						
Overcharge detection delay time	t_{VDET1}		Typ-25%	t_{VDET1}	Typ+25%	s
Cell balance detection delay time	t_{VDET_CB}		Typ-25%	t_{VDET_CB}	Typ+25%	s
Overdischarge detection delay time	$t_{VDET\,2}$		Typ-25%	$t_{VDET\,2}$	Typ+25%	s
Discharging overcurrent detection delay time 1	$t_{VDET3-1}$		Typ-30%	$t_{VDET3-1}$	Typ+30%	ms
Discharging overcurrent detection delay time 2	$t_{VDET3-2}$		Typ-30%	$t_{VDET3-2}$	Typ+30%	ms
Short detection delay time	t_{SHORT}		Typ-50%	t_{SHORT}	Typ+50%	us
Charging overcurrent detection delay time	t_{VDET4}		Typ-30%	t_{VDET4}	Typ+30%	ms
Disconnect detection delay time	t_{VDET5}		Typ-25%	t_{VDET5}	Typ+25%	ms

Block diagram



Typical application circuit

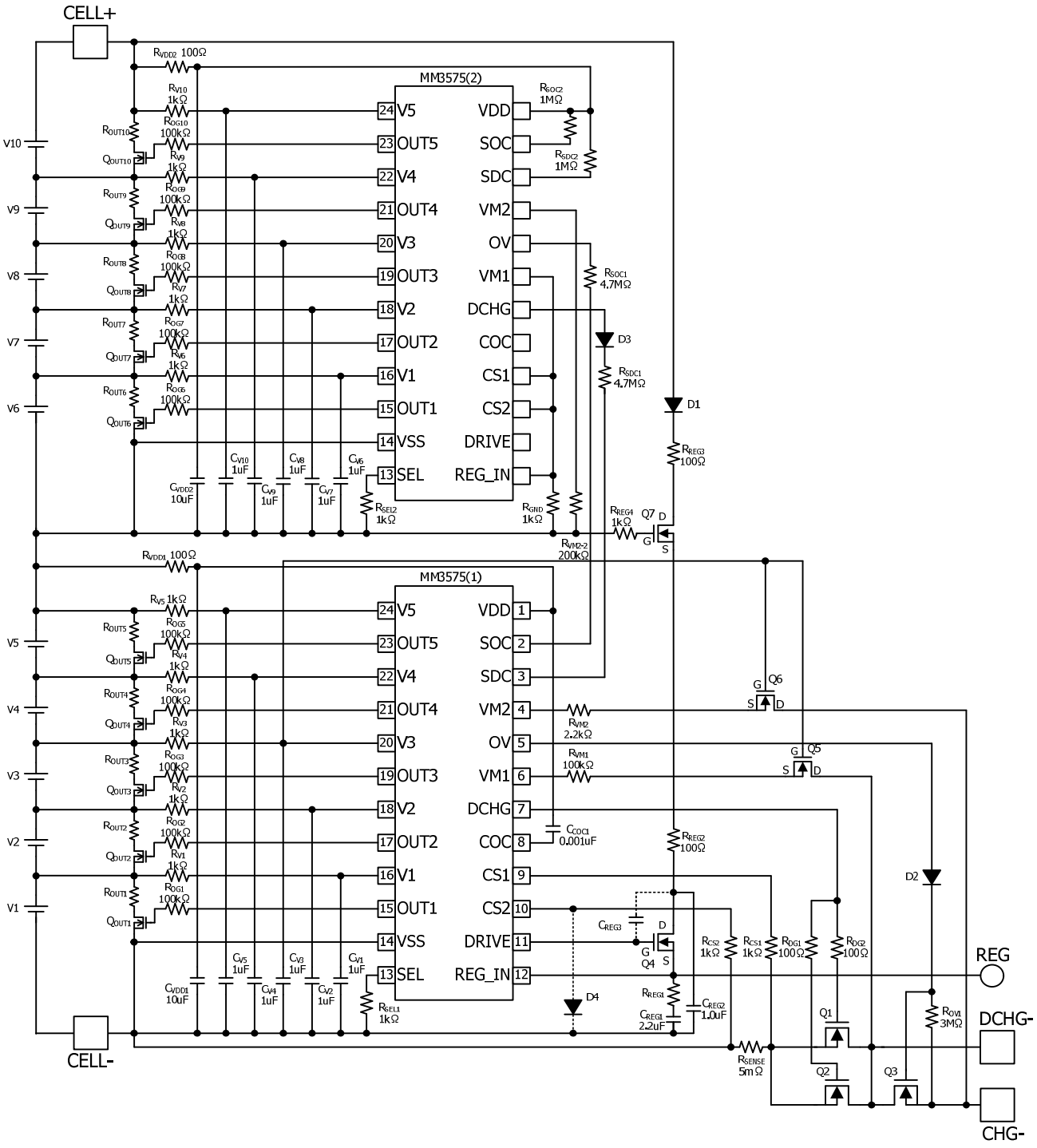
・5 cells protection circuit



※ 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

・10 cells protection circuit



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