One Cell Li-ion/Li-Polymer Battery Protection IC

MM415x Series

Outline

MM415x series are protection ICs with thermal protection and control teminal for charge and discharge off mode for rechargeable Lithium-ion or Lithium-polymer battery.
By using external thermistor, this protects the battery pack and system over temperature. In addition , it reduces the current consumption of system by using charge and dischrge off mode , when the system is shutdown.

Applications

Lithium-ion rechargeable battery pack
Lithium-polymer rechargeable battery pack

Specification

Item	Specification	Unit
Operation temperature	-40～85	℃
Operating voltage	1.5～6.0	V

Features

Detection Voltage Setting Ranges and Accuracy

	Range	Ta=25℃
Overcharge Detection Voltage	3.8V～4.8V, 5mV Step	±15mV
Overdischarge Detection Voltage	2.0V～3.0V, 50mV Step	±35mV
Discharging Overcurrent Detection Voltage 1	3mV ～50mV, 0.1mV Step	±1.00mV (MM4140 Series)
		±0.75mV (MM4141 Series)
		±0.50mV (MM4142 Series)
Discharging Overcurrent Detection Voltage 2	6mV～100mV, 0.5mV Step	±2.00mV (MM4140/MM4141 Series)
		±1.50mV (MM4142 Series)
Charging Overcurrent Detection Voltage	-3mV～-50mV, 0.1mV Step	±1.00mV (MM4140 Series)
		±0.75mV (MM4141 Series)
		±0.50mV (MM4142 Series)
Short Detection Voltage1	10mV～150mV, 1mV Step	±2.5mV
0V Battery Charging Inhibition Voltage	1.2V～2.0V, 0.1V Step	±0.2V (1.2V)
		±0.1V (1.3V~2.0V)
High temperature detection	50℃～85℃	±3℃

Package

SSON-8K/SSON-8L
SSON-8TA/SSON-8TB/ SSON-8TC *1

*1 There is no the tab on the back of the package.

Mitsumi Electric CO.,LTD.
Semiconductor Business Division
Strategy Engineering Department
tel:+81-46-230-3470

Pin explanations

Pin No	Symbol	Function
1	CNT	Control terminal for charge and discharge FET
2	VM	Input terminal for charger negative voltage
3	COUT	Control terminal for charge FET
4	DOUT	Control terminal for discharge FET
5	VSS	Input terminal for negative power supply voltage
6	VDD	Input terminal for positive power supply voltage
7	CS	Input terminal for overcurrent detection
8	TH	Input terminal for temperature detection

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply Voltage	VDD	VSS-0.3	VSS+6.0	V
VM Terminal voltage	VM	VDD-28	VDD+0.3	V
COUT Terminal voltage	VCOUT	VDD-28	VDD+0.3	V
DOUT Terminal voltage	VDOUT	VSS-0.3	VDD+0.3	V
CS Terminal voltage	VCS	VSS-0.3	VDD+0.3	V
TH Terminal voltage	VTH	VSS-0.3	VDD+0.3	V
CNT Terminal voltage	VCNT	VSS-0.3	VDD+0.3	V
Storage temperature	Tstg	-55	125	℃

Electrical characteristics

(Unless otherwise specified,Ta=25℃)

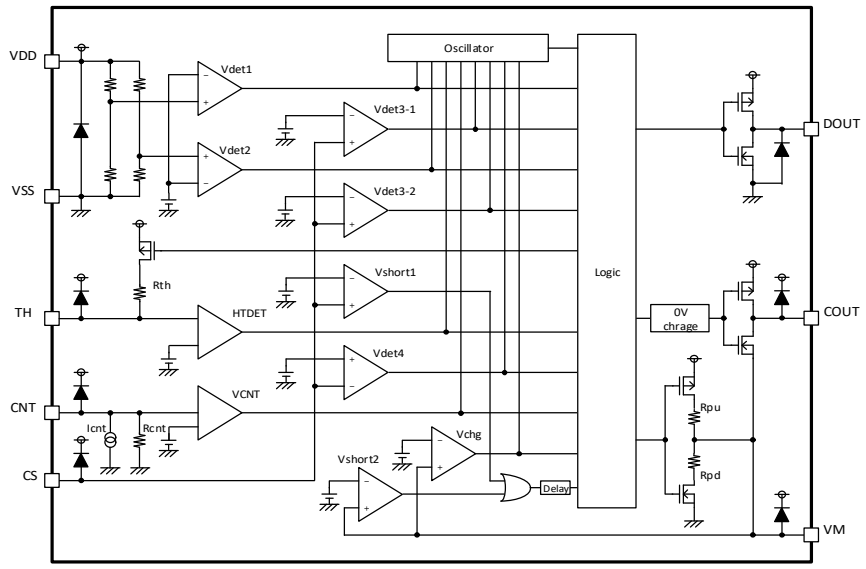
Parameter	Symbol	Note	Min	Typ	Max	Unit
Input current						
TH terminal current	Ith	VDD=4.0V, Rntc=100kΩ	-	0.5	1.0	uA
Current consumption	Idd	VDD=4.0V, VCS=VM=0V	-	2.5	4.0	uA
Current consumption2	Idd2	Idd2＝Idd＋Ith	-	3.0	5.0	uA
Stand-by Current Overdischarge Latch "ENABLE"	Is	VDD=1.5V VCS=0V,VM=open	-	-	0.1	uA
Stand-by Current Overdischarge Latch "DISABLE"		VDD=1.5V VCS=0V,VM=open	-	-	0.5	uA
		VDD=2.0V VCS=0V,VM=open	-	-	0.6	uA
Internal resistance						
VM pull up resistance	Rpu	VDD=1.8V, VCS=VM=0V	500	1000	2000	kΩ
VM pull down resistance	Rpd	VDD=3.6V VCS=0V,VM=2.0V	5	10	15	kΩ
TH pull up resistance	Rth	VDD=3.6V,VTH=1.5V VCS=VM=0V	75	150	300	kΩ
CNT pull down resistance	Rcnt	VDD=3.6V,VCNT=0.4V VCS=VN=0V	-	30	-	kΩ
COUT output resistance L	RcoL	VDD=5.0V COUT=0.1V,VCS=VM=0V	-	3.0	6.0	kΩ
COUT output resistance H	RcoH	VDD=4.0V COUT=3.9V,VCS=VM=0V	-	10.0	20.0	kΩ

Electrical characteristics

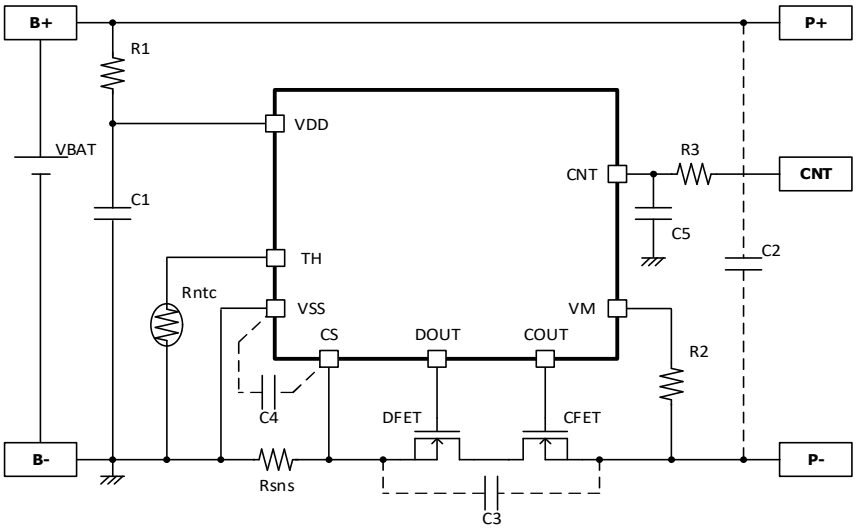
(Unless otherwise specified,Ta=25℃)

Parameter	Symbol	Note	Min	Typ	Max	Unit
DOUT output resistance L	RdoL	VDD=1.8V DOUT=0.1V,VCS=VM=0V	-	2.0	4.0	kΩ
DOUT output resistance H	RdoH	VDD=4.0V DOUT=3.9V,VCS=VM=0V	-	10.0	20.0	kΩ
detection/release voltage,delay time						
Overcharge detection voltage	Vdet1	Ta=25℃	-0.015	Vdet1	+0.015	V
		Ta=-20 to 60℃	-0.020		+0.020	
Overcharge release voltage	Vrel1	Latch function is Disable.	-0.030	Vrel1	+0.030	V
Overdischarge detection voltage	Vdet2		-0.035	Vdet2	+0.035	V
Overdischarge release voltage	Vrel2	Latch function is Disable.	-0.065	Vrel2	+0.065	V
Charger detect voltage	Vchg	Overcharge mode Overdischarge mode	-0.100	Vchg	+0.100	V
Discharging overcurrent detection Voltage 1	Vdet3-1	Ta=25℃ (MM4150)	-1.00	Vdet3-1	+1.00	mV
		Ta=25℃ (MM4151)	-0.75		+0.75	
		Ta=25℃ (MM4152)	-0.50		+0.50	
		Ta=-20 to 60℃ (MM4150)	-1.50		+1.50	
		Ta=-20 to 60℃ (MM4151)	-1.25		+1.25	
		Ta=-20 to 60℃ (MM4152)	-1.00		+1.00	
Discharging overcurrent detection voltage 2	Vdet3-2	Ta=25℃ (MM4150)	-2.00	Vdet3-2	+2.00	mV
		Ta=25℃ (MM4151)				
		Ta=25℃ (MM4152)	-1.50		+1.50	
		Ta=-20 to 60℃ (MM4150)	-2.50		+2.50	
		Ta=-20 to 60℃ (MM4151)				
		Ta=-20 to 60℃ (MM4152)	-2.00		+2.00	
Discharging overcurrent release voltage	Vrel3		-0.400	VDD-1.0	+0.400	V
Charging overcurrent detection voltage	Vdet4	Ta=25℃ (MM4150)	-1.00	Vdet4	+1.00	mV
		Ta=25℃ (MM4151)	-0.75		+0.75	
		Ta=25℃ (MM4152)	-0.50		+0.50	
		Ta=-20 to 60℃ (MM4150)	-1.50		+1.50	
		Ta=-20 to 60℃ (MM4151)	-1.25		+1.25	
		Ta=-20 to 60℃ (MM4152)	-1.00		+1.00	
Charging overcurrent release voltage	Vrel4		-0.100	Vrel4	+0.100	V
Short detection voltage 1	Vshort1	Ta=25℃	-2.5	Vshort1	+2.5	mV
		Ta=-20 to 60℃	-3.0		+3.0	
Short detection voltage 2	Vshort2		-0.400	VDD-0.9	+0.300	V
Minimum Operating Voltage for 0V Charging	Vst		-	-	1.2	V
0V battery charge inhibition battery voltage	Vst	Vst=1.2V rank	-0.200	Vst	+0.200	V
		Vst=1.3V~2.0V rank	-0.100		+0.100	
Overcharge detection delay time	tVdet1		-20%	tVdet1	+20%	ms
Overdischarge detection delay time	tVdet2		-20%	tVdet2	+20%	ms
Discharging overcurrent detection delay time 1	tVdet3-1		-20%	tVdet3-1	+20%	ms
Discharging overcurrent detection delay time 2	tVdet3-2		-20%	tVdet3-2	+20%	ms
Charging overcurrent detection delay time	tVdet4		-20%	tVdet4	+20%	ms
Short detection delay time	tVshort		-30%	tVshort	+30%	us
High temperature detection	HTDET		-3	HTDET	+3	℃
Charge and discharge off voltage	Vcnt		-0.3	Vcnt	0.3	V

Block diagram



Typical application circuit



Unit:Ω ,F

Symbol	Part	Min.	Typ.	Max.	Purpose
R1	Resistor	-	100	1k	For voltage fluctuation and ESD immunity
R2	Resistor	-	1k	-	For current limit of charger reverse connection
R3 *3	Resistor	-	1k	-	For exogenous noise
Rsns	Resistor	-	-	-	Charging and discharging curent sensing
Rntc *2	NTC Themistor	-	100k *1	-	For temperature protection
C1	Capacitor	0.047u	0.1u	2.2u	For voltage fluctuation
C2,C3,C4,C5	Capacitor	-	0.1u	-	For exogenous noise
DFET,CFET	Nch MOS FET	-	-	-	Charge and discharge control

*1. NTC Thermistor R=100kΩ±1% at 25°C, B-Constant=4250K±1% at 25/50°C

*2. When not using the abnormal temperature protection function, no connect the TH terminal anywhere.

*3. When not using the Forcible charge and discharge OFF mode Function, CNT terminal should be connected to Vss or Open. R3 and C3 are unnecessary.

* The above application circuit and constant value do not guarantee proper operation.
Please evaluate thoroughly by actual application to set up constants.