Thermal protection and control terminal for charge and discharge off mode

MM3855 Series

Description

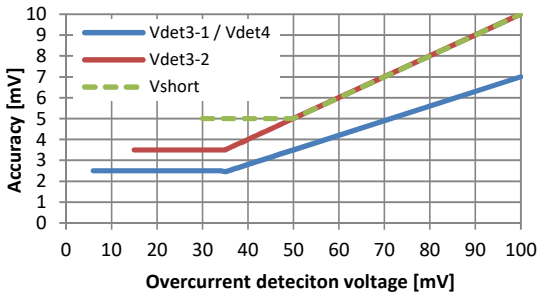
MM3855 series are protection ICs with thermal protection and control teminal for charge and discharge off mode for rechargeable Lithium-ion or Lithium-polymer battery.
By using external thermistor, this protects the battery pack and system over temperature. In addition , it reduces the current consumption of system by using charge and dischrge off mode , when the system is shutdown.

Features

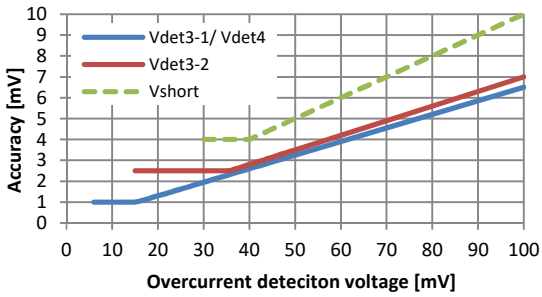
・Accuracy and selectable range of detection/release voltage

			Accuracy		
	symbol	Range	Standard	Bxx/Lxx Series	
Overcharge detection voltage	Vdet1	4.1V to 5.0V	+/-20mV	+/-20mV	Ta=-20to60degC
Overdischarge detection voltage	Vdet2	2.1V to 3.0V	+/-35mV	+/-35mV	Ta= 25degC
Discharging overcurrent detection voltage1	Vdet3-1	6mV to+100mV	+/-2.5mV	+/-1.0mV	Ta= 25degC
Discharging overcurrent detection voltage2	Vdet3-2	15mV to+100mV	+/-3.5mV	+/-2.5mV	Ta= 25degC
Charging overcurrent detection voltage	Vdet4	-6mV to-100mV	+/-2.5mV	+/-1.0mV	Ta= 25degC
Short detection voltage1	Vshort1	30mV to 200mV	+/-5.0mV	+/-4.0mV	Ta= 25degC
0V battery charge inhibition battery voltage		0.9V fixed	+/-0.3V	+/-0.3V	Ta= 25degC

Standard Accuracy (Ta=25 degC)



Bxx/Lxx Series Accuracy (Ta=25 degC)



・Selectable overcurrent accuracy — Selectable "Standard" or "Bxx series"

・Temperature detection function — Selectable "enable" or "disable" ("Bxx series"can not select "enable".)

・0V battery charge function — Selectable "Permission" or "inhibition"

・CNT terminal for charge and discharge off mode — CNT terminal set High level, turns to off mode.

・Current consumption (Not include NTC bias current)

Normal mode

Temperature detection function "enable" / "Bxx series"	3.0uA typ. 5.0uA max. (Ta=-20 to +85 degC)
Temperature detection function "disable"	2.5uA typ. 4.5uA max. (Ta=-20 to +85 degC)

Standby mode

Overdischarge latch function "enable".	0.1uA max. (Ta=-20 to +60 degC)
Overdischarge latch function "disable".	0.8uA max. (Ta=-20 to +85 degC)

Applications

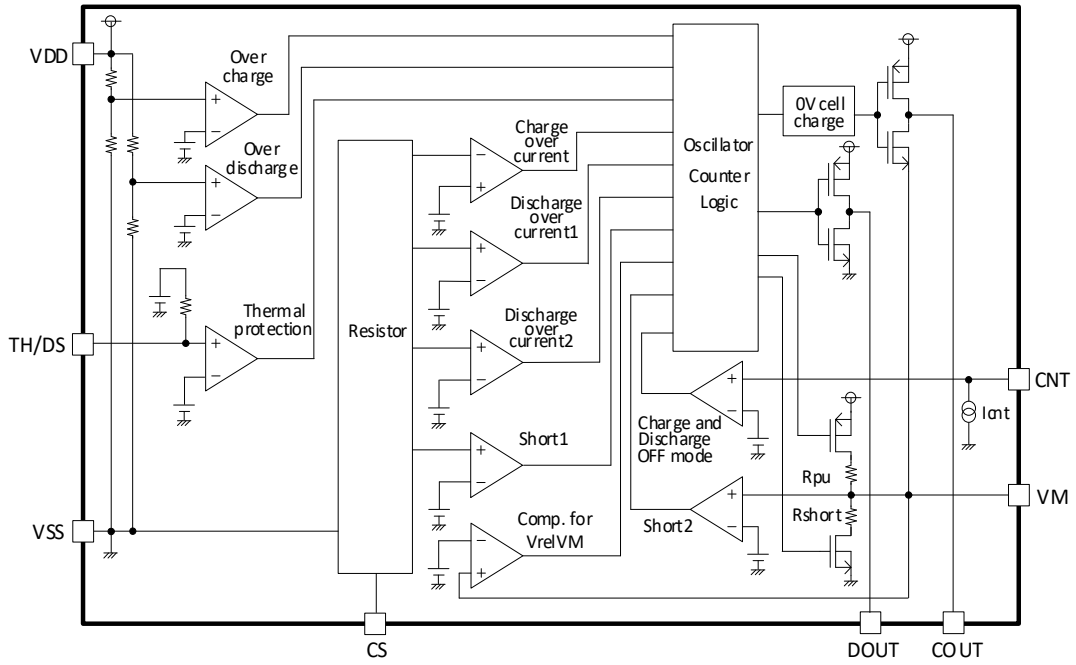
・Lithium-ion rechargeable battery pack

・Lithium polymer rechargeable battery pack

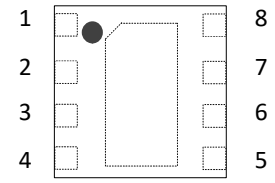
Package type

・SSON-8F,G — 1.60 × 1.60 × 0.55 [mm]

Block diagram



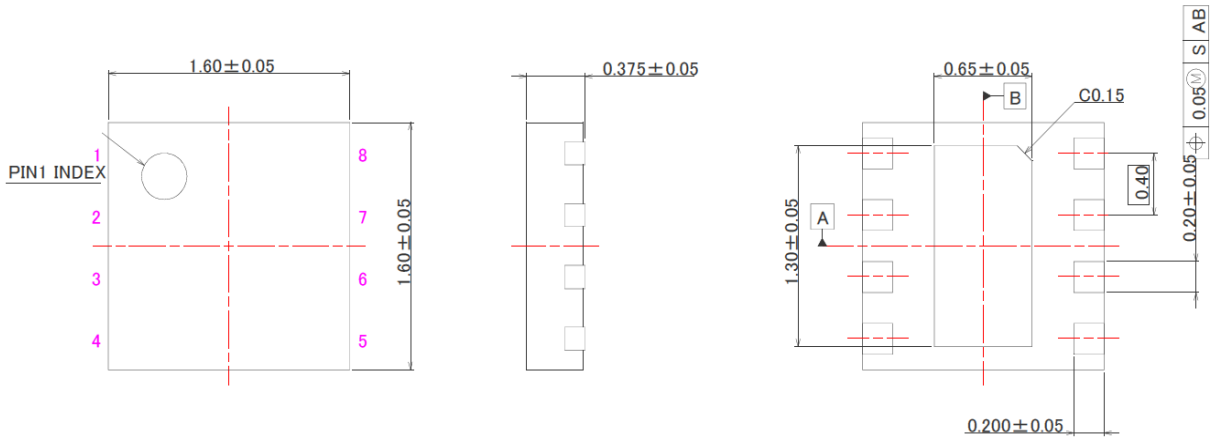
Package and pin configuration



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/DS	Input terminal for temperature detection / delay short

Package dimensions

Unit:mm



Absolute maximum ratings

Parameter	Symbol	Rating	Unit
Supply voltage	VDD	-0.3 to 12	V
CNT terminal	VCNT	-0.3 to VDD+0.3	V
VM terminal	VM	VDD-28 to VDD+0.3	V
COUT terminal	VCO	VDD-28 to VDD+0.3	V
DOUT terminal	VDO	-0.3 to VDD+0.3	V
CS terminal	VCS	-0.3 to VDD+0.3	V
TH/DS terminal	VTH/VDS	-0.3 to VDD+0.3	V
Storage temperature	Tstg	-55 to +125	degC

Recommend operating conditions

Parameter	Symbol	Rating	Unit
Operating ambient temperature	Topr	-40 to +85	degC
Operating voltage	Vop	1.5 to 5.5	V

Electrical characteristics

(Unless otherwise specified, Ta=25 degC)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Discharge overcurrent release current	Irelease	※1 VM=VrelVM2 VDD=3.2V,VCS=0V	150	-	-	uA
Discharge overcurrent release	Rshort	※1 VM=3.7V VDD=3.7V,VCS=0V	5.0	10.0	15.0	kohm
VM terminal pull-up resistances	Rpu		150	300	600	kohm
COUT L level output voltage	VcoL	VDD=4.5V, Icout=30uA	-	0.1	0.5	V
COUT H level output voltage	VcoH	VDD=4.0V, Icout=-30uA	VDD-0.5	VDD-0.1	-	V
DOUT L level output voltage	VdoL	VDD=2.0V, Idout=30uA	-	0.1	0.5	V
DOUT H level output voltage	VdoH	VDD=4.0V, Idout=-30uA	VDD-0.5	VDD-0.1	-	V
Current consumption (Temp detect "Enable")/("Bxx series")	Idd	※2 VDD=4.0V VM=Vcs=0V	-	3.0	5.0	uA
Current consumption (Temp detect "disable")		※2 VDD=4.0V VM=Vcs=0V	-	2.5	4.5	uA
Standby current (Overdischarge latch function"enable")	Is	※1 VDD=2.0V Vcs=0V,VM=VDD	-	-	0.1	uA
Standby current (Overdischarge latch function"disable")		※2 VDD=2.0V Vcs=0V,VM=VDD	-	-	0.8	uA
CNT terminal pull-down current	Icnt	VDD=VCNT=3.6V,Vcs=VM=0V	-	1.0	2.0	uA
Current consumption of TH terminal	Ith	RNTC=470kohm	-	-	1.5	uA
		RNTC=175kohm	-	-	3.5	
		RNTC=88kohm	-	-	6.0	

※1 Ta=-20 to +60 degC

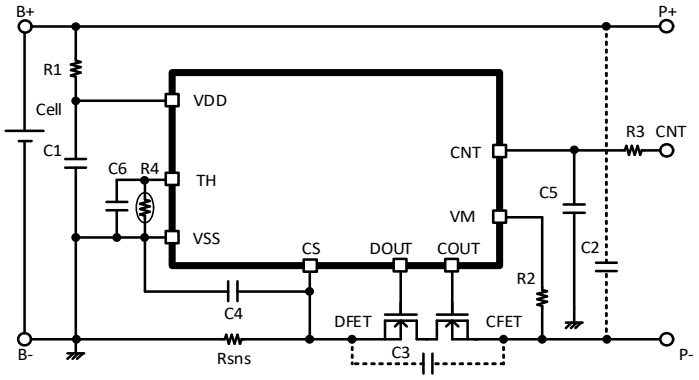
※2 Ta=-20 to +85 degC

Electrical characteristics

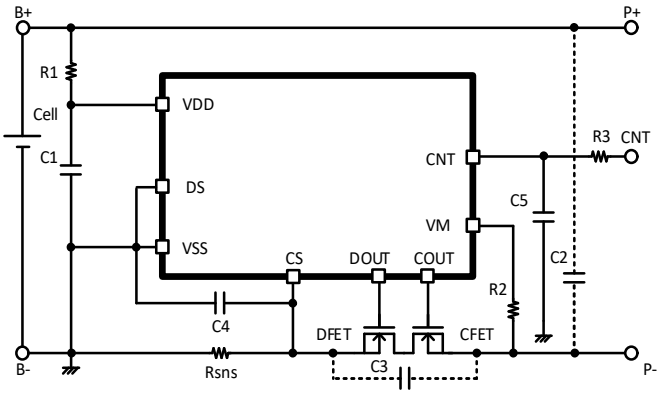
(Unless otherwise specified, Ta=25 degC)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Temperature detection function detection resistance	RdetTH	Ta=+25 to +85 degC	-10%	RdetTH	+10%	kΩ
Temperature detection function release resistance	RretTH	Ta=+25 to +85 degC	-12%	RretTH	+12%	kΩ
Overcharge detection voltage	Vdet1	Ta=+25degC	-0.020	Vdet1	+0.020	V
		Ta=-20 to +60 degC				
Overcharge release voltage	Vrel1		-0.030	Vrel1	+0.030	V
Overdischarge detection voltage	Vdet2		-0.035	Vdet2	+0.035	V
Overdischarge release voltage	Vrel2		-0.065	Vrel2	+0.090	V
Discharging overcurrent detection voltage 1	Vdet3-1 (Standard)	Vdet3-1=6mV to 35mV	-2.5	Vdet3-1	+2.5	mV
		Vdet3-1=35mV to 100mV	-7%		+7%	
	Vdet3-1 (Bxx)	Vdet3-1=6mV to 35mV	-1.0		+1.0	
		Vdet3-1=35mV to 100mV	-6.5%		+6.5%	
Discharging overcurrent detection voltage 2	Vdet3-2 (Standard)	Vdet3-2=15mV to 35mV	-3.5	Vdet3-2	+3.5	mV
		Vdet3-2=35mV to 100mV	-10%		+10%	
	Vdet3-2 (Bxx)	Vdet3-2=15mV to 35mV	-2.5		+2.5	
		Vdet3-2=35mV to 100mV	-7%		-7%	
Charging overcurrent detection voltage	Vdet4 (Standard)	Vdet4=6mV to 35mV	-2.5	Vdet4	+2.5	mV
		Vdet4=35mV to 100mV	-7%		+7%	
	Vdet4 (Bxx)	Vdet4=6mV to 35mV	-1.0		+1.0	
		Vdet4=35mV to 100mV	-6.5%		+6.5%	
Short detection voltage 1	VShort1 (Standard)	Vdet4=30mV to 50mV	-5.0	VShort1	+5.0	mV
		Vdet4=50mV to 100mV	-10%		+10%	
	VShort1 (Bxx)	Vdet4=30mV to 50mV	-4.0		+4.0	
		Vdet4=50mV to 100mV	-10%		+10%	
Short detection voltage 2	Vshort 2		-0.200	VDD-0.9	+0.200	V
Minimum operating voltage for 0V charging	Vst		-	-	1.2	V
0V battery charge inhibition battery voltage	Vst		-0.300	0.900	+0.300	V
Charge and discharge off mode detection and release voltage	Vcnt		0.9	1.2	1.5	V
Monitor voltage for the charger connection	VrelVM		0.150	0.250	0.350	V
Release voltage from discharging overcurrent mode	VrelVM2	VDD=3.7V VCS=0V	VDD-1.4	VDD-1.1	VDD-0.08	V
Overcharge detection delay time	tVdet1		-20%	tVdet1	+20%	s
Overdischarge detection delay time	tVdet2		-20%	tVdet2	+20%	ms
Discharging overcurrent detection1 delay time	tVdet3-1		-20%	tVdet3-1	+20%	ms
Discharging overcurrent detection2 delay time	tVdet3-2		-20%	tVdet3-2	+20%	ms
Charging overcurrent detection delay time	tVdet4		-20%	tVdet4	+20%	ms
Short detection delay time	tshort		-40%	tshort	+40%	us
Charge and discharge off mode detection time	tCDGdet		-20%	tCDGdet	+20%	ms
Temperature detection function release delay time	tRdetTH		-20%	512	+20%	ms

Typical application circuit



Temperature detection function "enable"



Temperature detection function "disable"

Unit:ohm ,F

Symbol	Part	Min.	Typ.	Max.	Purpose
R1	Resistor	-	100	1k	For voltage fluctuation and ESD
R2	Resistor	-	1k	-	For current limit of charger reverse connection
R3	Resistor	-	1k	-	For exogenous noise
R4	Thermistor	-	470k (B=4700K)	-	For thermal protection
Rsns	Resistor	-	-	-	Charge and discharge curent sensing
C1	Capacitor	0.01u	0.1u	1.0u	For voltage fluctuation
C2	Capacitor	-	0.1u	-	For exogenous noise
C3	Capacitor	-	0.1u	-	For exogenous noise
C4	Capacitor	-	0.1u	-	For exogenous noise
C5	Capacitor	-	0.1u	-	For exogenous noise
C6	Capacitor	0.01u	0.1u	1.0u	For exogenous noise
DFET	Nch MOS FET	-	-	-	Charge and discharge control
CFET					

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

Lineup

Table1 Detection

Rank name	Overcharge detection	Overdischarge detection	Discharging overcurrent detection 1	Discharging overcurrent detection 2	Charging overcurrent detection	Short detection1	Temperature detection resistance
	Vdet1	Vdet2	Vdet3-1	Vdet3-2	Vdet4	Vshort1	RdetTH
AC1	4.520V	2.100V	21.0mV	No function	-24.0mV	100.0mV	No function
AJ1	4.475V	2.400V	35.0mV	50.0mV	-35.0mV	100.0mV	90.0kΩ
AL1	4.475V	2.500V	20.5mV	29.5mV	-26.5mV	70.0mV	No function
AL2	4.475V	2.500V	22.5mV	No function	-21.0mV	100.0mV	No function
BC1	4.475V	2.500V	15.0mV	No function	-15.0mV	40.0mV	No function
BC2	4.520V	2.300V	15.0mV	No function	-15.0mV	46.0mV	No function
BC3	4.540V	2.300V	14.0mV	No function	-15.0mV	50.0mV	No function
BL1	4.430V	2.500V	21.0mV	No function	-21.0mV	40.0mV	No function
BL2	4.480V	2.300V	23.0mV	No function	-23.0mV	50.0mV	No function
CN1	4.250V	2.600V	21.0mV	No function	-19.0mV	100mV	90.0kΩ
EN5	4.470V	2.465V	13.0mV	No function	-15.0mV	50.0mV	90.0kΩ
EN7	4.450V	2.600V	36.0mV	No function	-21.0mV	90.0mV	48.0kΩ
LC1	4.475V	2.500V	15.0mV	No function	-15.0mV	40.0mV	18.78kΩ
LE1	4.500V	2.400V	10.0mV	No function	-10.0mV	25.0mV	42.9kΩ

Table2 Function list

Rank name	Overcharge detection latch function	Overdischarge detection latch function	Discharging overcurrent latch function	Charging overcurrent latch function	0V battery charge function	Temperature detection function	Delay time combination
AC1	Disable	Disable	Disable	Enable	inhibition	disable	(I)
AJ1	Disable	Disable	Disable	Enable	Permission	Enable	(A)
AL1	Disable	Disable	Disable	Enable	Permission	disable	(B)
AL2	Disable	Disable	Disable	Enable	Permission	disable	(C)
BC1	Disable	Disable	Disable	Enable	inhibition	disable	(J)
BC2	Disable	Disable	Disable	Enable	inhibition	disable	(K)
BC3	Disable	Disable	Disable	Enable	inhibition	disable	(L)
BL1	Disable	Disable	Disable	Enable	Permission	Enable	(G)
BL2	Disable	Disable	Disable	Enable	Permission	Enable	(H)
CN1	Disable	Enable	Disable	Enable	Permission	Enable	(F)
EN5	Enable	Enable	Disable	Enable	Permission	Enable	(D)
EN7	Enable	Enable	Disable	Enable	Permission	Enable	(E)
LC1	Disable	Disable	Disable	Enable	inhibition	Enable	(M)
LE1	Enable	Enable	Disable	Enable	inhibition	Enable	(N)

Lineup

Table3 Detection delay time

Combination	tVdet1	tVdet2	tVdet3-1	tVdet3-2	tVdet4	tshort1	tCDGdet	tRdetTH
(A)	1024ms	64ms	4096ms	16.0ms	16.0ms	280us	48.0ms	512ms
(B)	1024ms	64ms	4096ms	16.0ms	16.0ms	280us	48.0ms	No function
(C)	1024ms	20ms	16ms	No function	16.0ms	300us	48.0ms	No function
(D)	1024ms	128ms	8.0ms	No function	8.0ms	250us	48.0ms	512ms
(E)	1024ms	2048ms	2048.0ms	No function	8.0ms	280us	48.0ms	64ms
(F)	1024ms	96ms	16ms	No function	32.0ms	280us	48.0ms	1024ms
(G)	512ms	64ms	16ms	No function	8.0ms	280us	48.0ms	No function
(H)	512ms	64ms	16ms	No function	16.0ms	530us	48.0ms	No function
(I)	1024ms	64ms	32ms	No function	16.0ms	280us	48.0ms	No function
(J)	1024ms	64ms	32ms	No function	16.0ms	250us	48.0ms	No function
(K)	1024ms	64ms	64ms	No function	64.0ms	280us	48.0ms	No function
(L)	1024ms	64ms	128ms	No function	64.0ms	280us	48.0ms	No function
(M)	1024ms	64ms	32ms	No function	16.0ms	280us	48.0ms	1024ms
(N)	1024ms	64ms	32ms	No function	16.0ms	250us	48.0ms	1024ms

Table4 Parameter options

Parameter	Symbol	Range
Temperature detection function detection resistance	RdetTH	30kohm to 200kohm
Overcharge detection voltage	Vdet1	4.1V to 5.0V, 5mV steps
Overdischarge detection voltage	Vdet2	2.1V to 3.0V, 50mV steps
Discharging overcurrent detection voltage 1	Vdet3-1	6mV to +100mV, 1mV steps
Discharging overcurrent detection voltage 2	Vdet3-2	15mV to +100mV, 1mV steps
Charging overcurrent detection voltage	Vdet4	-6mV to -100mV, 1mV steps
Short detection voltage	Vshort1	30mV to 200mV, 50mV steps
Overcharge detection delay time	tVdet1	256ms to 4.6s
Overdischarge detection delay time	tVdet2	8ms to 256ms
Discharging overcurrent 1 detection delay time	tVdet3-1	8ms to 8192ms
Discharging overcurrent 2 detection delay time	tVdet3-2	6ms to 64ms
Charging overcurrent detection delay time	tVdet4	6ms to 64ms

NOTES

【Safety Precautions】

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- This product is intended for applying to computers, OA units, communication units, instrumentation units, machine tools, industrial robots, AV units, household electrical appliances, and other general electronic units.

【Precautions for Product Liability Act】

- No responsibility is assumed by us for any consequence resulting from any wrong or improper use or operation, etc. of this product.

【ATTENTION】

- This product is designed and manufactured with the intention of normal use in general electronics. No special circumstance as described below is considered for the use of it when it is designed. With this reason, any use and storage under the circumstances below may affect the performance of this product. Prior confirmation of performance and reliability is requested to customers.
  Environment with strong static electricity or electromagnetic wave
  Environment with high temperature or high humidity where dew condensation may occur

- This product is not designed to withstand radioactivity, and must avoid using in a radioactive environment.

- This specification is written in Japanese and English. The English text is faithfully translated into the Japanese. However, if any question arises, Japanese text shall prevail.

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