

2 cells lithium-ion/lithium-polymer battery protection IC

MM3766 series

Outline

The MM3766 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 rechargeable two cells 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.

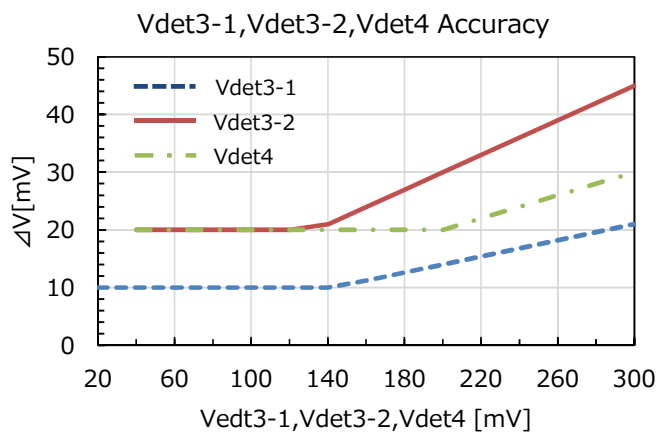
Features

(Unless otherwise specified, $T_a=25^\circ\text{C}$)

1) Range and accuracy of detection/release voltage

• Overcharge detection voltage	3.6V to 4.5V, 5mV steps	Accuracy $\pm 15\text{mV}$
• Overcharge release voltage	3.4V to 4.5V, 50mV steps	Accuracy $\pm 30\text{mV}$
• Overdischarge detection voltage	2.0V to 3.0V, 50mV steps	Accuracy $\pm 35\text{mV}$
• Overdischarge release voltage	2.0V to 3.5V, 50mV steps	Accuracy $\pm 50\text{mV}$
• Discharging overcurrent detection voltage1	+20mV to +300mV, 5mV steps	Accuracy $\pm \Delta V$ ※1
• Discharging overcurrent detection voltage2	+40mV to +600mV, 10mV steps	Accuracy $\pm \Delta V$ ※1
• Charging overcurrent detection voltage	-300mV to -40mV, 5mV steps	Accuracy $\pm \Delta V$ ※1
• Short detection voltage	Selection from 0.7V, 0.8V, 0.9V	Accuracy $\pm 300\text{mV}$

※1 Current detection voltage accuracy



When there is not Vdet3-2, detection accuracy of Vshort is equivalent to Vdet3-2.

These range and accuracy are the one of the standard setting. It may be different in each IC rank. Please refer to an individual specifications about detail parameters.

2) Range of detection delay time

• Overcharge detection delay time	Selection from 256ms to 4.6s
• Overdischarge detection delay time	Selection from 8ms to 2s
• Discharging overcurrent detection delay time1	Selection from 8ms to 512ms
• Discharging overcurrent detection delay time2	Selection from 0.5ms to 6ms
• Charging overcurrent detection delay time	Selection from 4ms to 64ms
• Short detection delay time	300us fixed





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

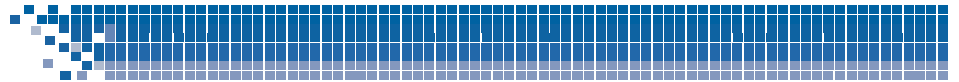
- 4) Low current consumption
 - Normal mode Typ. 4.0uA, Max. 8.0uA
 - Stand-by mode Max. 0.1uA (In case Overdischarge latch function Enable.)
 - Max. 2.5uA (In case Overdischarge latch function Disable.)

- 5) Package type 2.90 × 2.80 × 1.15 [mm]
 - SOT-26B

Pin explanations

SOT-26B	Pin No.	Symbol	Function
	1	DOUT	Discharge FET control terminal
	2	COU	Charge FET control terminal
	3	V-	Charger negative voltage input terminal
	4	VBL	Input terminal of the low side cell
	5	VDD	Positive power supply voltage input terminal
	6	VSS	Negative power supply voltage input terminal





Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
VDD pin supply voltage	V _{VDDMAX}	VSS-0.3	VDD+12	V
VBL pin supply voltage	V _{VBLMAX}	VSS-0.3	VDD+0.3	V
V- terminal voltage	V _{V-MAX}	VDD-28	VDD+0.3	V
COUt terminal voltage	V _{COUtMAX}	VDD-28	VDD+0.3	V
DOUt terminal voltage	V _{DOUtMAX}	VSS-0.3	VDD+0.3	V
Voltage between cell input pins	V _{VBCELLMAX}	-0.3	10	V
Storage temperature	T _{stg}	-55	125	°C

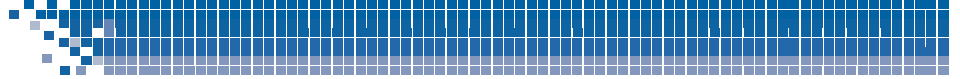
Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Operating ambient temperature	T _{opr}	-40	85	°C
Operating voltage	V _{op}	1.5	10.0	V

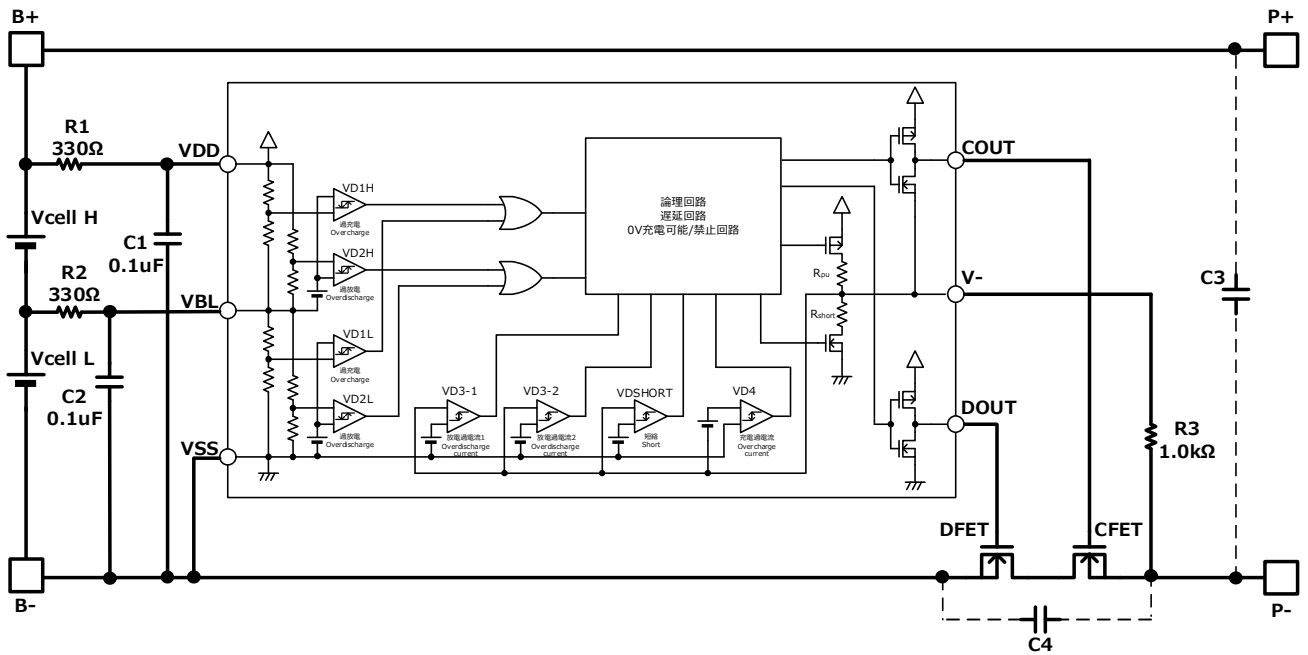
Electrical characteristics

(Unless otherwise specified, T_a=25°C)

Parameter	Symbol	Note	Min	Typ	Max	Unit
Input/Output voltage						
Maximum forbidden voltage for 0V charging	V _{st}	"Prohibition" function	0.6	0.9	1.2	V
Minimum operating voltage for 0V charging		"Permission" function	-	-	1.2	V
COUt pin Nch ON voltage	V _{ol1}	I _{ol} =30uA, V _{cell} =4.6V	-	0.2	0.5	V
COUt pin Pch ON voltage	V _{oh1}	I _{oh} =-30uA, V _{cell} =3.5V	VDD-0.5	VDD-0.2	-	V
DOUt pin Nch ON voltage	V _{ol2}	I _{ol} =30uA, V _{cell} =1.9V	-	0.2	0.5	V
DOUt pin Pch ON voltage	V _{oh2}	I _{oh} =-30uA, V _{cell} =3.5V	VDD-0.5	VDD-0.2	-	V
Current consumption						
Current consumption	I _{dd}	V _{cell} =3.5V, V ₋ =0V	-	4.0	8.0	uA
Current consumption at stand-by	I _s	In case Overdischarge latch function Enable	-	-	0.1	uA
		In case Overdischarge latch function Disable	-	1.2	2.5	uA
Detection/Release voltage						
Overcharge detection voltage	V _{det1}	T _a =+25°C	Typ-0.015	V _{det1}	Typ+0.015	V
		T _a =-5~+60°C	Typ-0.020		Typ+0.020	
Overcharge release voltage	V _{rel1}		Typ-0.030	V _{rel1}	Typ+0.030	V
Overdischarge detection voltage	V _{det2}		Typ-0.035	V _{det2}	Typ+0.035	V
Overdischarge release voltage	V _{rel2}		Typ-0.050	V _{rel2}	Typ+0.050	V
Discharging overcurrent detection voltage1	V _{det3-1}		Typ-ΔV	V _{det3}	Typ+ΔV	V
Discharging overcurrent detection voltage2	V _{det3-2}		Typ-ΔV	V _{det3}	Typ+ΔV	V
Charging overcurrent detection voltage	V _{det4}		Typ-ΔV	V _{det4}	Typ+ΔV	V
Short detection voltage	V _{short}		Typ-0.300	V _{short}	Typ+0.300	V
Detection delay time						
Overcharge detection delay time	t _{Vdet1}		Typ*0.8	t _{Vdet1}	Typ*1.2	s
Overdischarge detection delay time	t _{Vdet2}		Typ*0.8	t _{Vdet2}	Typ*1.2	ms
Discharging overcurrent detection delay time1	t _{Vdet3-1}		Typ*0.8	t _{Vdet3-1}	Typ*1.2	ms
Discharging overcurrent detection delay time2	t _{Vdet3-2}		Typ*0.8	t _{Vdet3-2}	Typ*1.2	ms
Charging overcurrent detection delay time	t _{Vdet4}		Typ*0.8	t _{Vdet4}	Typ*1.2	ms
Short detection delay time	t _{Vshort}		150	300	600	us



Block diagram / Typical application circuit



Symbol	Part	Min.	Typ.	Max.	Unit
R1/R2	Resistor	-	330	1k	Ω
C1/C2	Capacitor	0.033	0.1	1.0	uF
R2	Resistor	-	1.0k	2.2k	Ω
C3/C4	Capacitor		0.1		uF

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

