Linear charge control IC (2-channel built-in charge flag)

MM3758

Outline

This IC is a linear charge control IC for 1-cell lithium-ion and lithium polymer batteries. It has a built-in power MOSFET and reverse current protection circuit, eliminating the need for external sense resistors and reverse current protection diodes, thus reducing the number of components and heat generation. The IC also supports temperature profiles to ensure battery safety by limiting charge current and battery voltage at low and high battery temperatures. 2-channel charge flag is built in to enable detailed confirmation of charge status.

Application

Mobile devices, etc.

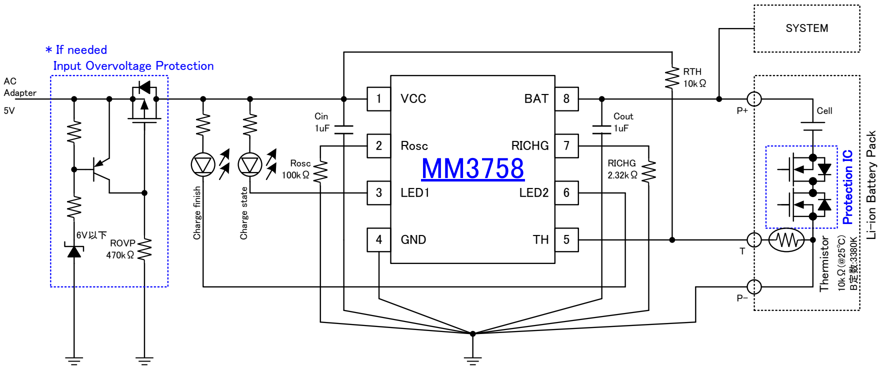
Feature

1. built-in power MOSFET
2. Built-in reverse current prevention circuit
3. compatible with JEITA recommended charging temperature profile
4. Built-in thermal regulation function
5. Built-in 2-channel charge status flag (Nch open drain)
6. Operating temperature range Ta=-40~85°C

Major Specification

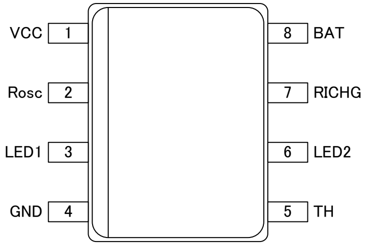
Parameter	Specification	Units
Rating voltage (VCC)	6	V
Operating voltage range (VCC)	4.3～5.8	V
Charge voltage	4.2	V
Fast charge current	~ 1500	mA
Pre-charge current	Fast charge current x0.1	mA
Fast charge starting voltage	2.9	V
Full charge current	Fast charge current x0.1	mA
BAT leakage current (max.)	100	nA
Thermal regulation temperature	122	℃
Charging timer	Pre:1, Fast:5	Hour

Application Circuit


＊If needed
Input Overvoltage Protection
AC Adapter
5V
6V以下
ROVP 470kΩ
Charge finish
Charge state
Rosc 100kΩ
Cin 1uF
1 VCC
2 Rosc
3 LED1
4 GND
MM3758
8 BAT
7 RICHG
6 LED2
5 TH
Cout 1uF
RICHG 2.32kΩ
RTH 10kΩ
SYSTEM
P+
T
P−
Cell
Protection IC
Thermistor
10kΩ(@25℃)
B定数:3380K
Li-ion Battery Pack

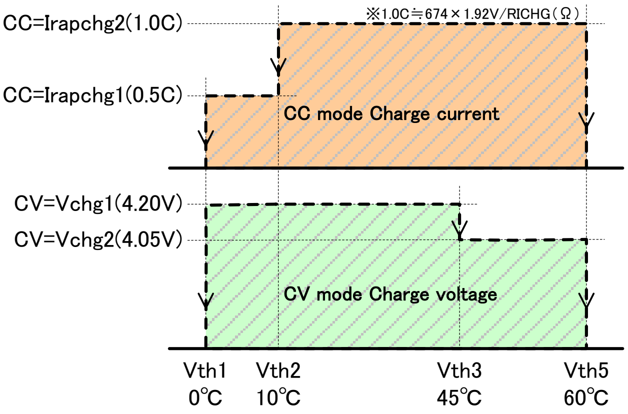
Package

SOP-8J
(5.02mm x 6.0mm x 1.65mm)


VCC 1
Rosc 2
LED1 3
GND 4
8 BAT
7 RICHG
6 LED2
5 TH

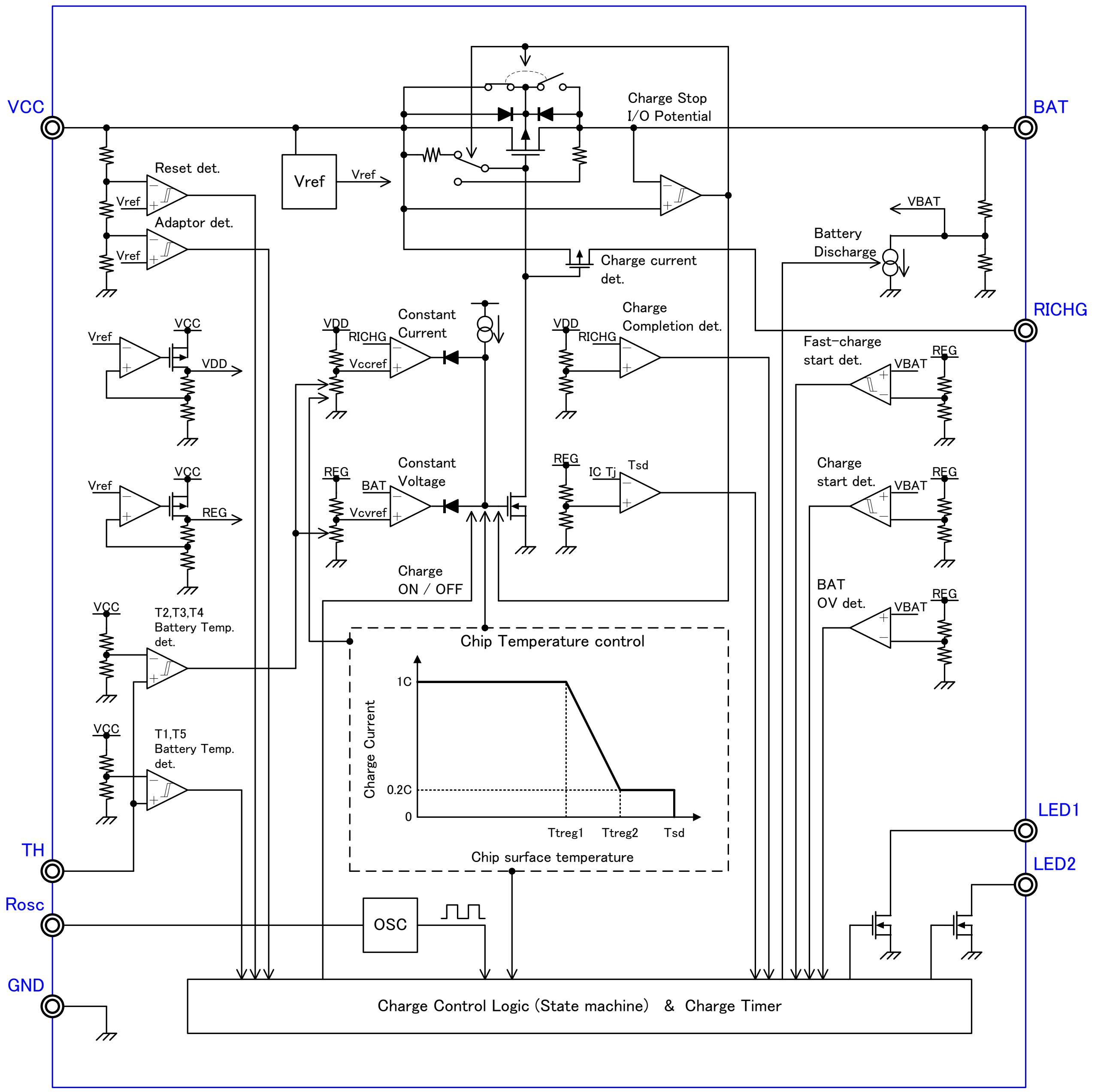
(TOP VIEW)

Battery Temperature Profile

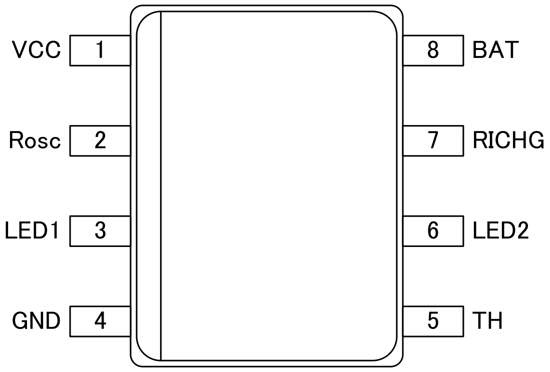


- Any products mentioned this leaflet are subject to any modification in their appearance and others for improvements without prior notification.
- The details listed here are not a guarantee of the individual products at the time of ordering.
- When using the products, you will be asked to check their specifications.

1. BLOCK DIAGRAM


VCC
BAT
Charge Stop
I/O Potential
Reset det.
Vref
Vref
Adaptor det.
Vref
VBAT
Battery
Discharge
Charge current
det.
RICHG
VCC
Vref
VDD
VDD
RICHG
Constant
Current
Vccref
VDD
RICHG
Charge
Completion det.
Fast-charge
start det.
REG
VBAT
VCC
Vref
REG
REG
BAT
Constant
Voltage
Vcvref
REG
IC Tj
Tsd
Charge
start det.
REG
VBAT
Charge
ON / OFF
BAT
OV det.
REG
VBAT
VCC
T2,T3,T4
Battery Temp.
det.
Chip Temperature control
1C
Charge Current
0.2C
0
Ttreg1
Ttreg2
Tsd
Chip surface temperature
VCC
T1,T5
Battery Temp.
det.
TH
LED1
LED2
Rosc
OSC
GND
Charge Control Logic (State machine) & Charge Timer

2. PIN CONFIGURATION



（TOP VIEW）

3. TERMINAL EXPLANATIONS

PIN No.	PIN NAME	TERMINAL EXPLANATIONS
1	VCC	External power supply connection pin, Input pin of the charge control FET
2	Rosc	Oscillation frequency setting resistance connection pin fosc=0.912V/(1.425E-10*Rosc) * Approximate. The fosc value for each Rosc value is specified on Page 14.
3	LED1	Charging status flag pin (Nch open drain output) During charging "L", Abnormal "open", Charging complete "open"
4	GND	Ground Pin
5	TH	Battery temperature detection input pin (connecting a thermistor)
6	LED2	Charge completion flag pin (Nch open drain output) During charging "open", Abnormal "open", Charging complete "L"
7	RICHG	Charge current setting resistance connection pin ICHG=674*1.92V/RICHG * Approximate. The Charge current value for each RICHG value is specified on Page 14.
8	BAT	Charge control FET output pin (Connect to the positive side of a battery pack)

4. ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Storage Temperature	Tstg	-55	150	℃
Operating Temperature	Topr	-40	85	℃
VCC, Rosc, LED1, TH, LED2, RICHG, BAT Pin Voltage	Vin	-0.3	6.0	V
BAT Pin Output Current	IBAT	-	1.5	A
LED1,2 Pin Sink Current	ILED	-	20	mA
Power Dissipation(*1)	Pd	-	1.424	W

*1 ： When mounted on a 76.2×114.3×1.6tmm(epoxy glass ,double-sided, copper layer 60%)　PC bord.

5. RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating Temperature	Topr	0	45	℃
VCC Operating Voltage(*2)	Vop	4.3	5.8	V
BAT pin Voltage	Vbop	0	4.35	V

*2 ： Operation is possible from more than 4.0V, but in order to full charge up to 4.2V is required than 4.3V

6. ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, Ta=0～45°C, VCC=5.0V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply Current	Icc	During fast charge (Irapchg = 558mA setting)	-	3.0	4.5	mA
BAT Leak Current 1	Ileak1	BAT(=VSENSE)=4.2V, AC adaptor is unconnected	-	-	0.1	uA
BAT Leak Current 2	Ileak2	VCC=4.8V, charging is completed			2	uA
Reset Detection Voltage	Vpor	Reset when VCC<Vpor	2.3	2.5	2.7	V
ADP Detection Voltage	Vadp	Charging stops when VCC<Vadp	3.6	3.8	4.0	V
BAT Pin Discharge Current 1	Idischg1	BAT=3.2V, in charge error mode	-	10	20	uA
BAT Pin Discharge Current 2	Idischg2	BAT=3.2V	100	200	300	uA
Charge Start Detection Voltage	Vstart	BAT=L→H	1.0	1.1	1.2	V
Charge Start Detection Voltage Hysteresis	Vstarthys	BAT=H→L	50	100	150	mV
Fast-charge Start Detection Voltage	Vqchgon	BAT=L→H	2.8	2.9	3.0	V
Fast-charge Start Detection Voltage Hysteresis	Vqchgonhys	BAT=H→L	40	80	120	mV
BAT Regulation Voltage	Vchg1	Vth1≦VTH<Vth3	4.17	4.20	4.23	V
	Vchg2	Vth3≦VTH<Vth4	4.00	4.05	4.10	V
Charge Stop I/O Potential Difference 1	Vdef1	Charge stops when VCC－BAT < Vdef1 VCC=H→L	5	30	65	mV
Charge Stop I/O Potential Difference 2	Vdef2	Charge stops when VCC－BAT < Vdef2 VCC=L→H	5	45	65	mV
Battery Overvoltage Detection Voltage	Vov	VCC ≧Vov+100mV	4.27	4.35	4.43	V

(Unless otherwise specified, Ta=0～45°C, VCC=5.0V)

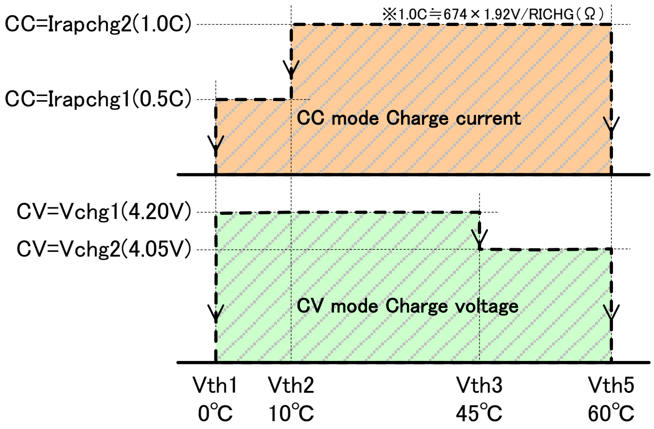
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Forced Charge Current	Istart	RICHG=2.32kΩ, 0.3C (1.0C=Irapchg2)	116	167	219	mA
Trickle-charge Current	Iprechg	RICHG=2.32kΩ, 0.17C (1.0C=Irapchg2) BAT=2.6V	50	95	140	mA
Fast-charge Current	Irapchg1	RICHG=2.32kΩ, BAT=3.6V Vth1≦VTH<Vth2	251	279	307	mA
	Irapchg2	RICHG=2.32kΩ, BAT=3.6V Vth2≦VTH<Vth4	530	558	586	mA
Charge Completion Current	Ifc	RICHG=2.32kΩ, BAT＞Vqchgon	50	95	140	mA
LED1,2 Output pin Low-Level Voltage	VledL	Iled=10mA	-	-	0.4	V
LED1,2 Output pin Leak Current	Iledleak	LED=5V	-1	-	1	uA
Series Pass Tr On Resistance	Ron	Io=200mA	-	0.38	0.6	Ω
Chip Temperature Detection1(*3)	Ttreg1	Applied to Tj (chip temperature)	112	122	132	°C
Chip Temperature Detection2(*3)	Ttreg2	Applied to Tj (chip temperature)	-	132	-	°C
Chip Temperature Detection Difference (*3)	Tdtreg	Applied to Tj (chip temperature) Ttreg2-Ttreg1	5	10	15	°C
Thermal Shutdown Temperature (*3)	Tsd	Applied to Tj (chip temperature)	143	153	163	°C

*3 ： The parameter is guaranteed by design.

(Unless otherwise specified, Ta=0～45°C, VCC=5.0V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Battery Connection Detection T0	Vth0	TH=L→H		VCC* 0.8096		
Cold Temp. Charge Stop Battery Temperature Detection Voltage T1	Vth1	TH=L→H, Charge stop threshold(0°C)	VCC* 0.7142	VCC* 0.7313	VCC* 0.7480	V
Cold Temp. Charge Recovery Battery Temperature Detection Voltage T1R(*4)	Vth1R	TH=H→L, Charge recovery threshold(3°C)	-	VCC* 0.7055	-	V
Battery Temperature Detection Voltage T2	Vth2	TH=L→H, CC=0.5C Charge threshold(10°C)	VCC* 0.6231	VCC* 0.6419	VCC* 0.6604	V
Battery Temperature Detection Voltage T2R	Vth2R	TH=H→L, CC=1C Charge threshold(13°C)	-	VCC* 0.6137	-	V
Battery Temperature Detection Voltage T3	Vth3	TH=H→L, CV=4.05V Charge threshold(45°C)	VCC* 0.3149	VCC* 0.3296	VCC* 0.3448	V
Battery Temperature Detection Voltage T3R	Vth3R	TH=L→H, CV=4.20V Charge threshold(41°C)	-	VCC* 0.3604	-	V
Hot Temp. Charge Stop Battery Temperature Detection Voltage T4	Vth4	TH=H→L, Charge stop threshold(60°C)	VCC* 0.2208	VCC* 0.2316	VCC* 0.2431	V
Hot Temp. Charge Recovery Battery Temperature Detection Voltage T4R(*4)	Vth4R	TH=L→H, Charge recovery threshold(55°C)	-	VCC* 0.2612	-	V

*4 ： When the first charge and recharge, to become T1 = T1R =0 degree, and T5 = T5R = 60 degree, please be careful about the noise and GND wiring.


※1.0C≒674×1.92V/RICHG(Ω)
CC=Irapchg2(1.0C)
CC=Irapchg1(0.5C)
CC mode Charge current
CV=Vchg1(4.20V)
CV=Vchg2(4.05V)
CV mode Charge voltage
Vth1
0℃
Vth2
10℃
Vth3
45℃
Vth5
60℃

*Thermistor ： 10kohm@25°C, B-Constant : 3380K (Recommended ： NCP15XH103F03RC)

MM3758AF JEITA Profile

(Unless otherwise specified, Ta=0～45°C, VCC=5.0V)

PARAMETER	SYMBOL	TEST　CONDITIONS	MIN.	TYP.	MAX.	UNIT
Oscillator Frequency (*3)	fosc	Rosc=100kΩ	57.6	64	70.4	kHz
BAT Pin Discharge Time (*3)	Tdischg	Rosc=100kΩ	58	64	70	ms
AC Adaptor Connection Detection Time (*3,5)	Tadp	Applied when VCC≧Vadp detection	24	-	32	ms
	Tadp2	Applied when VCC≦Vpor detection	32	64	96	us
Forced Charge Time (*3)	Tistart	Rosc=100kΩ	480	512	544	ms
Forced Charge OFF Time (*3)	Toff	Rosc=100kΩ	115	128	141	ms
Battery Voltage Detection Time(*3,6)	Tcon	Rosc=100kΩ	96	-	128	ms
Fast Charge Start Voltage Detection Time(*3,6)	Tqstart	Rosc=100kΩ	96	-	128	ms
Charge Completion Current Detection Time(*3,7)	Tifc	Rosc=100kΩ	192	-	256	ms
Trickle-charge Timer (*3)	Tdchg	Rosc=100kΩ	54	60	66	min
Fast-charge Timer(*3)	Tchg	Rosc=100kΩ	270	300	330	min
Battery Overvoltage Detection Time(*3,6)	Tov	Rosc=100kΩ	96	-	128	ms
Charge Stop Battery Temperature Detection Time(*3,6)	Tpro	Rosc=100kΩ Vth1 or Vth4	96	-	128	ms
Charge Recovery Battery Temperature Detection Time(*3,6)	TproR	Rosc=100kΩ Vth1R or Vth4R	96	-	128	ms

*3 : The parameter is guaranteed by design.

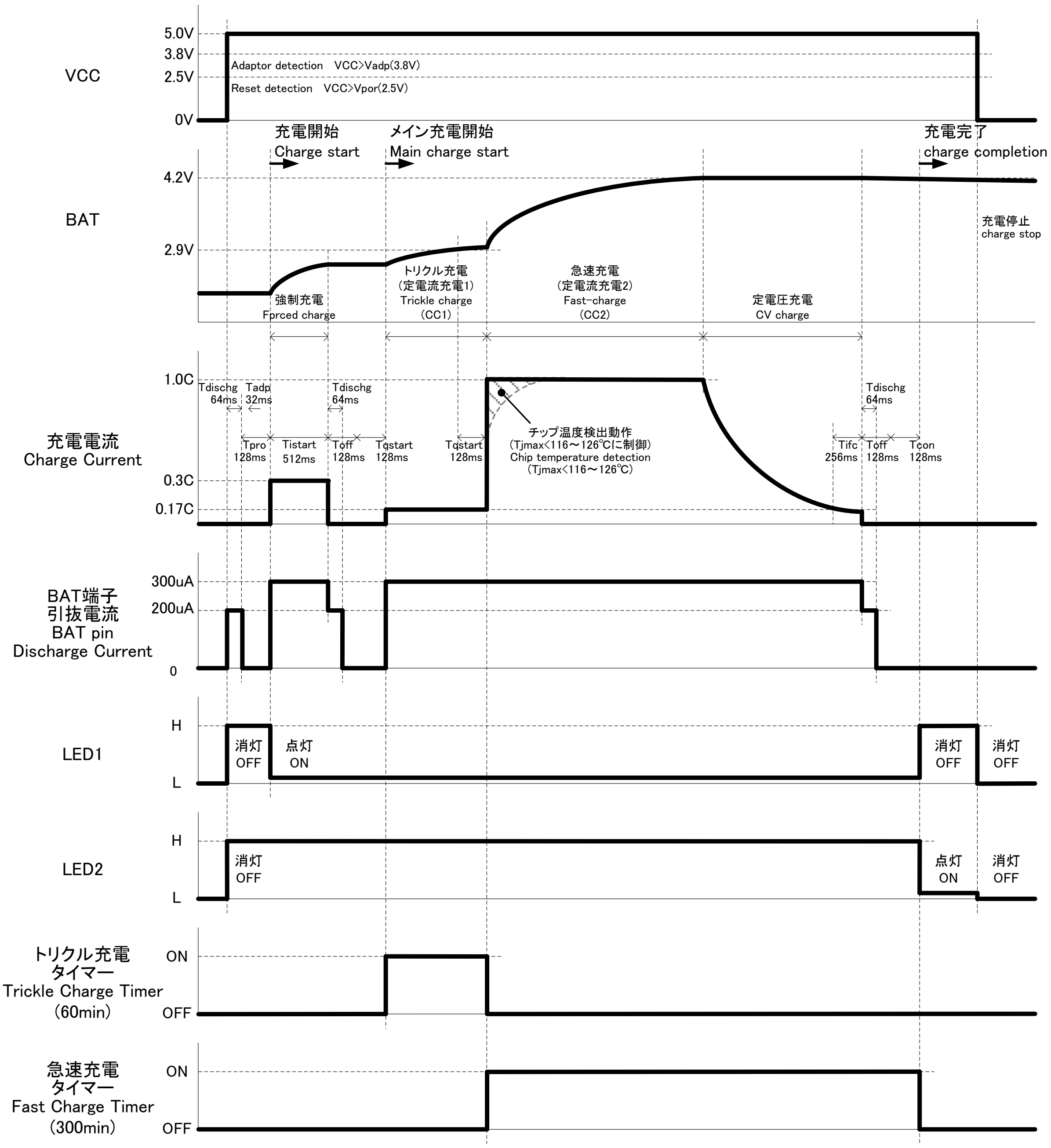
*5 : The detection time varies depending on the timing of detection for approximately one clock(8ms) due to the mode transition system operated when matched 4 times in 8ms.

*6 : The detection time varies depending on the timing of detection for approximately one clock(32ms) due to the mode transition system operated when matched 4 times in 32ms.

*7 : The detection time varies depending on the timing of detection for approximately one clock(64ms) due to the mode transition system operated when matched 4 times in 64ms.

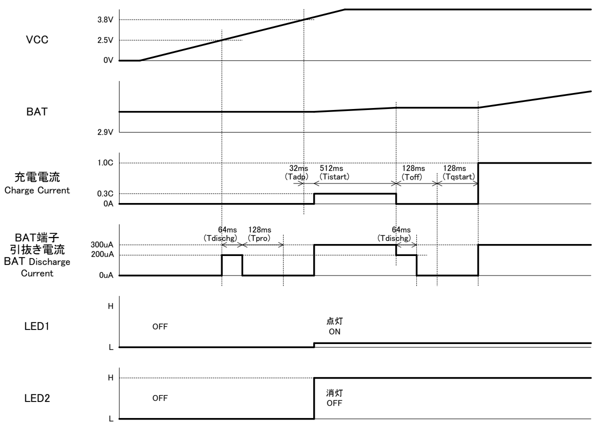
7. TIMING CHART

- Charging Timing chart (Normal charge)

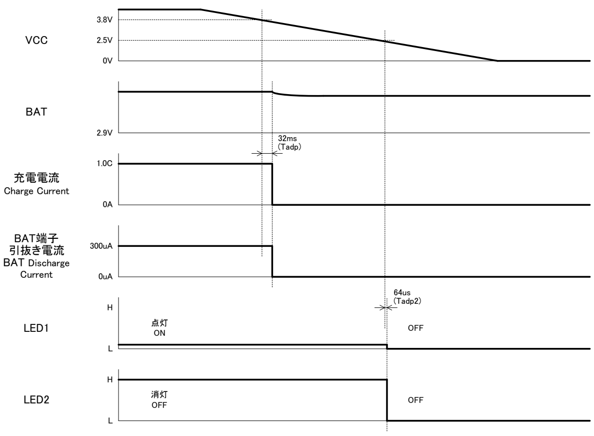


*8 : All typ numeric value.

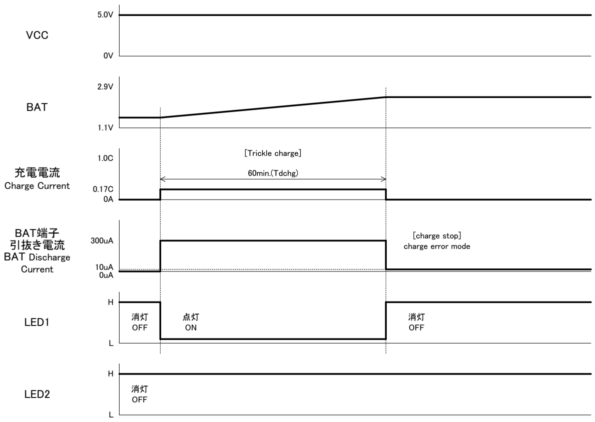
- Input Adaptor


VCC
3.8V
2.5V
0V
BAT
2.9V
充電電流
Charge Current
1.0C
0.3C
0A
32ms (Tadp)
512ms (Tistart)
128ms (Toff)
128ms (Tqstart)
BAT端子
引抜き電流
BAT Discharge Current
300uA
200uA
0uA
64ms (Tdischg)
128ms (Tpro)
64ms (Tdischg)
LED1
H
L
OFF
点灯
ON
LED2
H
L
OFF
消灯
OFF

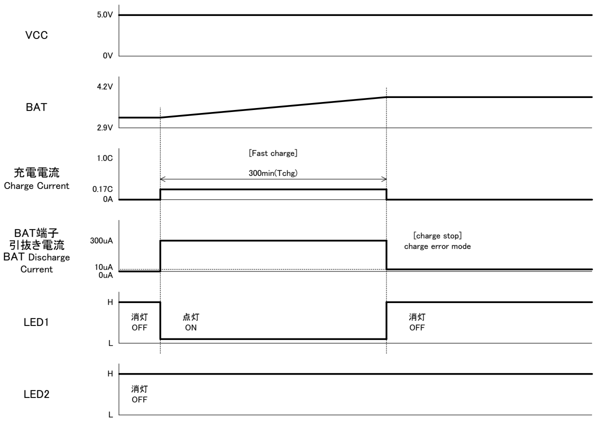
- Release Adaptor


VCC
3.8V
2.5V
0V
BAT
2.9V
32ms (Tadp)
充電電流
Charge Current
1.0C
0A
BAT端子
引抜き電流
BAT Discharge Current
300uA
0uA
64us (Tadp2)
LED1
H
L
点灯
ON
OFF
LED2
H
L
消灯
OFF
OFF

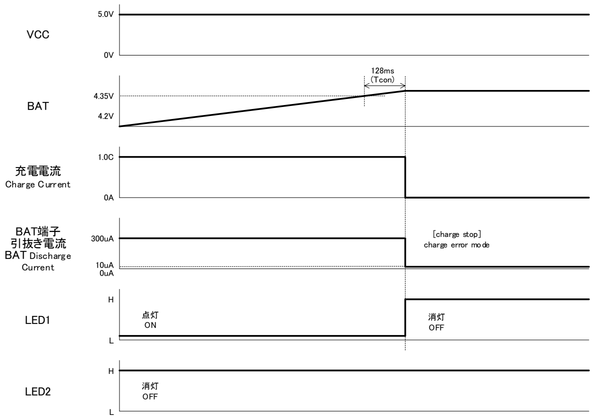
- Trickle charge time-up


VCC
5.0V
0V
BAT
2.9V
1.1V
充電電流
Charge Current
1.0C
0.17C
0A
[Trickle charge]
60min.(Tdchg)
BAT端子
引抜き電流
BAT Discharge Current
300uA
10uA
0uA
[charge stop]
charge error mode
LED1
H
L
消灯
OFF
点灯
ON
消灯
OFF
LED2
H
L
消灯
OFF

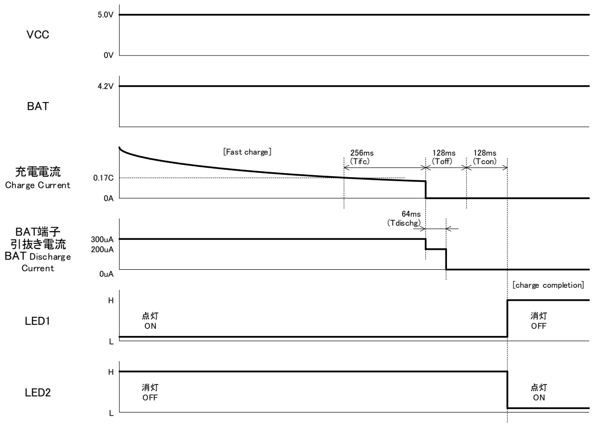
- Fast charge time-up


VCC
5.0V
0V
BAT
4.2V
2.9V
充電電流
Charge Current
1.0C
0.17C
0A
[Fast charge]
300min(Tchg)
BAT端子
引抜き電流
BAT Discharge Current
300uA
10uA
0uA
[charge stop]
charge error mode
LED1
H
L
消灯
OFF
点灯
ON
消灯
OFF
LED2
H
L
消灯
OFF

- Battery overvoltage detection(BAT>4.35V)

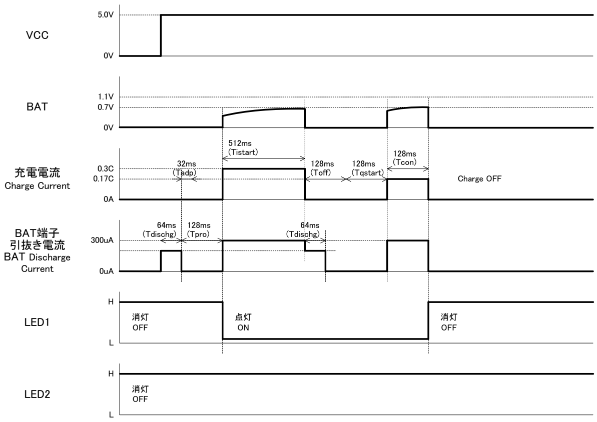

VCC
5.0V
0V
BAT
128ms (Tcon)
4.35V
4.2V
充電電流
Charge Current
1.0C
0A
BAT端子
引抜き電流
BAT Discharge Current
300uA
10uA
0uA
[charge stop]
charge error mode
LED1
H
L
点灯
ON
消灯
OFF
LED2
H
L
消灯
OFF

- Full charge detection

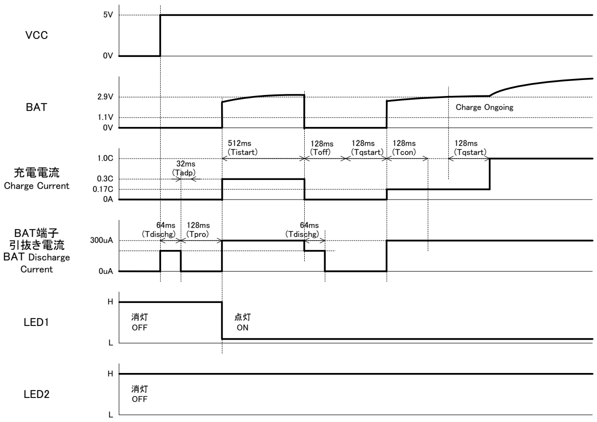

VCC
5.0V
0V
BAT
4.2V
充電電流
Charge Current
[Fast charge]
256ms (Tifc)
128ms (Toff)
128ms (Tcon)
0.17C
0A
64ms (Tdischg)
BAT端子
引抜き電流
BAT Discharge Current
300uA
200uA
0uA
[charge completion]
LED1
H
L
点灯
ON
消灯
OFF
LED2
H
L
消灯
OFF
点灯
ON

*8 ： All typ numeric value.

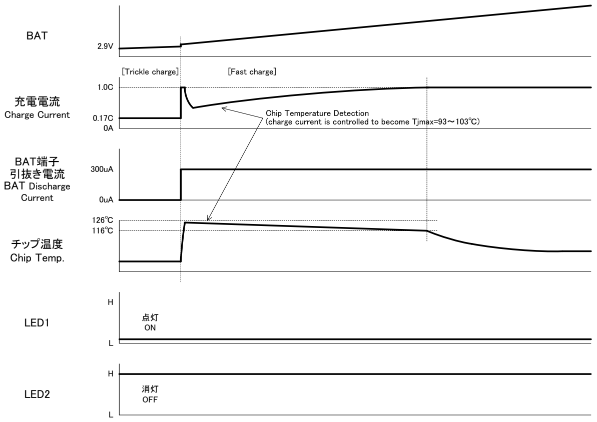
- Deep discharge battery charging start


VCC
5.0V
0V
BAT
1.1V
0.7V
0V
充電電流
Charge Current
0.3C
0.17C
0A
32ms
(Tadp)
512ms
(Tistart)
128ms
(Toff)
128ms
(Tqstart)
128ms
(Tcon)
Charge OFF
BAT端子
引抜き電流
BAT Discharge
Current
300uA
0uA
64ms
(Tdischg)
128ms
(Tpro)
64ms
(Tdischg)
LED1
H
L
消灯
OFF
点灯
ON
消灯
OFF
LED2
H
L
消灯
OFF

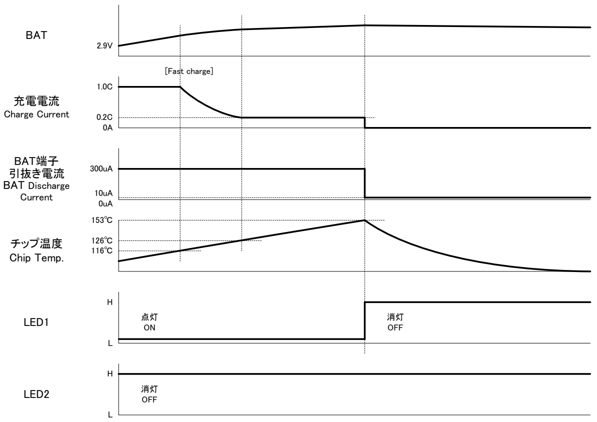
- Over-discharge protection pack charging start


VCC
5V
0V
BAT
2.9V
1.1V
0V
Charge Ongoing
充電電流
Charge Current
1.0C
0.3C
0.17C
0A
32ms
(Tadp)
512ms
(Tistart)
128ms
(Toff)
128ms
(Tqstart)
128ms
(Tcon)
128ms
(Tqstart)
BAT端子
引抜き電流
BAT Discharge
Current
300uA
0uA
64ms
(Tdischg)
128ms
(Tpro)
64ms
(Tdischg)
LED1
H
L
消灯
OFF
点灯
ON
LED2
H
L
消灯
OFF

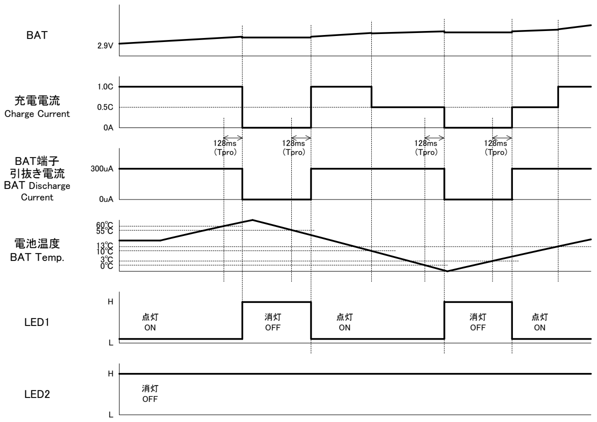
- Chip temperature detection


BAT
2.9V
[Trickle charge]
[Fast charge]
充電電流
Charge Current
1.0C
0.17C
0A
Chip Temperature Detection
(charge current is controlled to become Tjmax=93～103℃)
BAT端子
引抜き電流
BAT Discharge
Current
300uA
0uA
チップ温度
Chip Temp.
126℃
116℃
LED1
H
L
点灯
ON
LED2
H
L
消灯
OFF

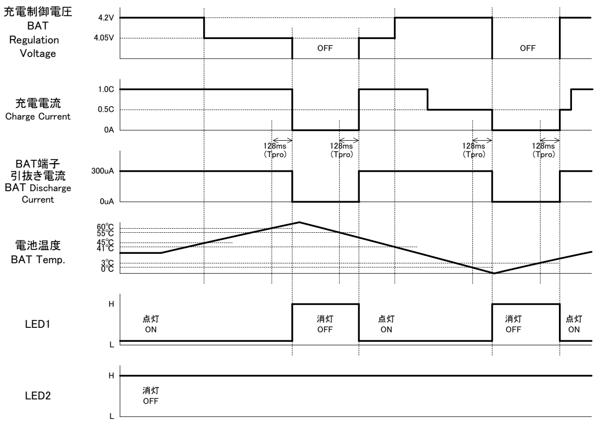
- Thermal shutdown


BAT
2.9V
[Fast charge]
充電電流
Charge Current
1.0C
0.2C
0A
BAT端子
引抜き電流
BAT Discharge
Current
300uA
10uA
0uA
チップ温度
Chip Temp.
153℃
126℃
116℃
LED1
H
L
点灯
ON
消灯
OFF
LED2
H
L
消灯
OFF

- Battery temperature detection (Constant Current Mode)


BAT
2.9V
充電電流
Charge Current
1.0C
0.5C
0A
128ms
(Tpro)
128ms
(Tpro)
128ms
(Tpro)
128ms
(Tpro)
BAT端子
引抜き電流
BAT Discharge
Current
300uA
0uA
電池温度
BAT Temp.
60℃
55℃
13℃
10℃
3℃
0℃
LED1
H
L
点灯
ON
消灯
OFF
点灯
ON
消灯
OFF
点灯
ON
LED2
H
L
消灯
OFF

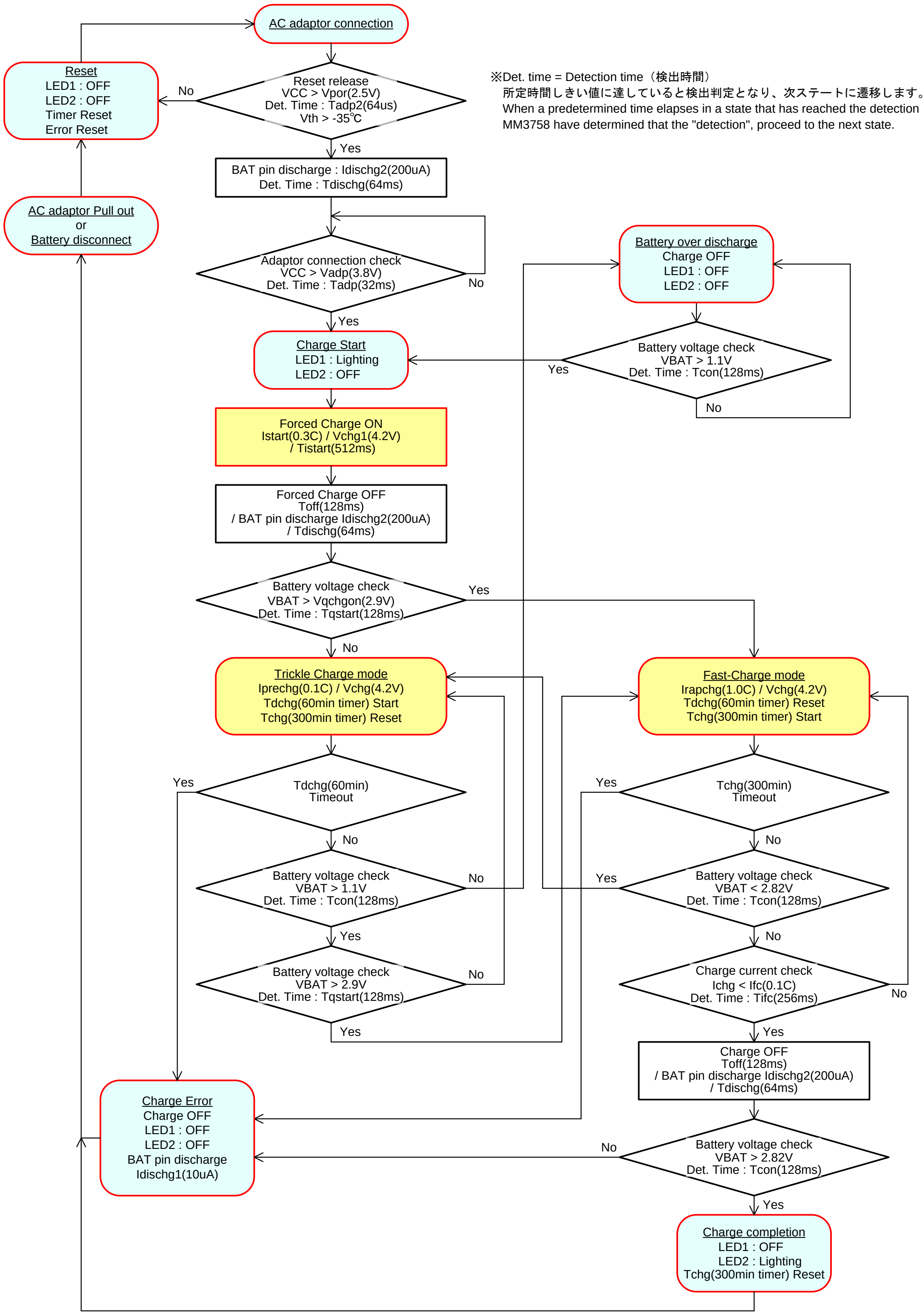
- Battery temperature detection (Constant Voltage Mode)


充電制御電圧
BAT
Regulation
Voltage
4.2V
4.05V
OFF
OFF
充電電流
Charge Current
1.0C
0.5C
0A
128ms
(Tpro)
128ms
(Tpro)
128ms
(Tpro)
128ms
(Tpro)
BAT端子
引抜き電流
BAT Discharge
Current
300uA
0uA
電池温度
BAT Temp.
60℃
55℃
45℃
41℃
3℃
0℃
LED1
H
L
点灯
ON
消灯
OFF
点灯
ON
消灯
OFF
点灯
ON
LED2
H
L
消灯
OFF

*8 : All typ numeric value.

8. FLOW CHART

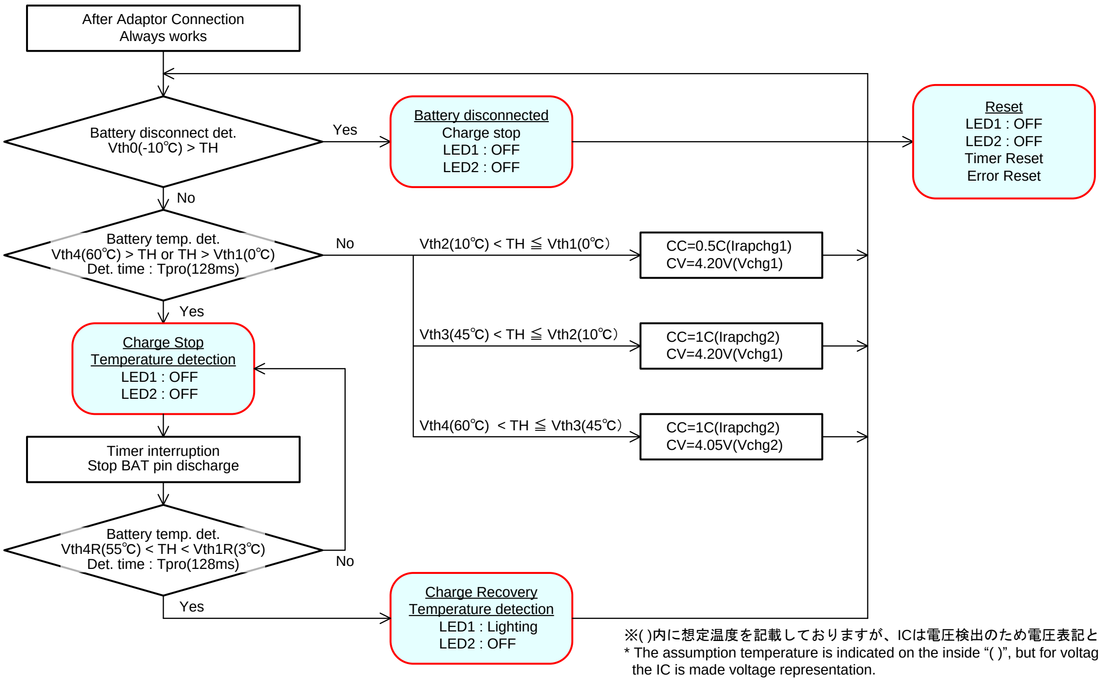
- Main flow chart


AC adaptor connection
Reset release
VCC > Vpor(2.5V)
Det. Time : Tadp2(64us)
Vth > -35℃
No
Reset
LED1 : OFF
LED2 : OFF
Timer Reset
Error Reset
Yes
BAT pin discharge : Idischg2(200uA)
Det. Time : Tdischg(64ms)
AC adaptor Pull out
or
Battery disconnect
Adaptor connection check
VCC > Vadp(3.8V)
Det. Time : Tadp(32ms)
No
Yes
Battery over discharge
Charge OFF
LED1 : OFF
LED2 : OFF
Charge Start
LED1 : Lighting
LED2 : OFF
Yes
Battery voltage check
VBAT > 1.1V
Det. Time : Tcon(128ms)
No
Forced Charge ON
Istart(0.3C) / Vchg1(4.2V)
/ Tistart(512ms)
Forced Charge OFF
Toff(128ms)
/ BAT pin discharge Idischg2(200uA)
/ Tdischg(64ms)
Battery voltage check
VBAT > Vqchgon(2.9V)
Det. Time : Tqstart(128ms)
Yes
No
Trickle Charge mode
Iprechg(0.1C) / Vchg(4.2V)
Tdchg(60min timer) Start
Tchg(300min timer) Reset
Fast-Charge mode
Irapchg(1.0C) / Vchg(4.2V)
Tdchg(60min timer) Reset
Tchg(300min timer) Start
Yes
Tdchg(60min)
Timeout
No
Yes
Tchg(300min)
Timeout
No
Battery voltage check
VBAT > 1.1V
Det. Time : Tcon(128ms)
No
Yes
Battery voltage check
VBAT < 2.82V
Det. Time : Tcon(128ms)
No
Yes
Battery voltage check
VBAT > 2.9V
Det. Time : Tqstart(128ms)
No
Yes
Charge current check
Ichg < Ifc(0.1C)
Det. Time : Tifc(256ms)
No
Yes
Charge OFF
Toff(128ms)
/ BAT pin discharge Idischg2(200uA)
/ Tdischg(64ms)
Charge Error
Charge OFF
LED1 : OFF
LED2 : OFF
BAT pin discharge
Idischg1(10uA)
No
Battery voltage check
VBAT > 2.82V
Det. Time : Tcon(128ms)
Yes
Charge completion
LED1 : OFF
LED2 : Lighting
Tchg(300min timer) Reset

※Det. time = Detection time（検出時間）
所定時間しきい値に達していると検出判定となり、次ステートに遷移します。
When a predetermined time elapses in a state that has reached the detection conditions, MM3758 have determined that the "detection", proceed to the next state.

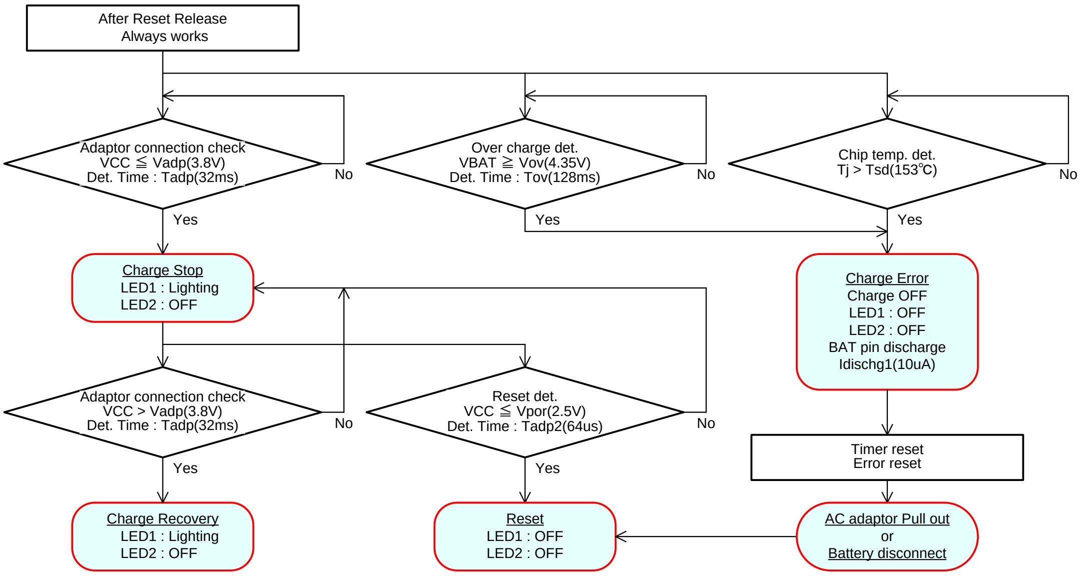
*8 : All typ. numeric value.
*9 : Charge current, charge completion current and each detection time for RICHG=2.32kΩ, Rosc=100kΩ.

- Battery temperature profile


After Adaptor Connection
Always works
Battery disconnect det.
Vth0(-10℃) > TH
Yes
Battery disconnected
Charge stop
LED1 : OFF
LED2 : OFF
Reset
LED1 : OFF
LED2 : OFF
Timer Reset
Error Reset
No
Battery temp. det.
Vth4(60℃) > TH or TH > Vth1(0℃)
Det. time : Tpro(128ms)
No
Vth2(10℃) < TH ≦ Vth1(0℃)
CC=0.5C(Irapchg1)
CV=4.20V(Vchg1)
Vth3(45℃) < TH ≦ Vth2(10℃)
CC=1C(Irapchg2)
CV=4.20V(Vchg1)
Vth4(60℃) < TH ≦ Vth3(45℃)
CC=1C(Irapchg2)
CV=4.05V(Vchg2)
Yes
Charge Stop
Temperature detection
LED1 : OFF
LED2 : OFF
Timer interruption
Stop BAT pin discharge
Battery temp. det.
Vth4R(55℃) < TH < Vth1R(3℃)
Det. time : Tpro(128ms)
No
Yes
Charge Recovery
Temperature detection
LED1 : Lighting
LED2 : OFF

※( )内に想定温度を記載しておりますが、ICは電圧検出のため電圧表記としております。
* The assumption temperature is indicated on the inside “( )”, but for voltage detection, the IC is made voltage representation.

- Protection function (Always detected)

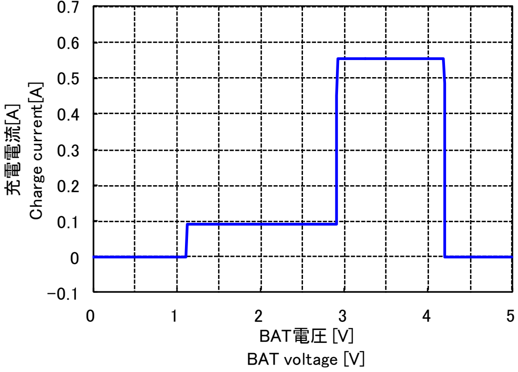

After Reset Release
Always works
Adaptor connection check
VCC ≦ Vadp(3.8V)
Det. Time : Tadp(32ms)
No
Over charge det.
VBAT ≧ Vov(4.35V)
Det. Time : Tov(128ms)
No
Chip temp. det.
Tj > Tsd(153℃)
No
Yes
Yes
Yes
Charge Stop
LED1 : Lighting
LED2 : OFF
Charge Error
Charge OFF
LED1 : OFF
LED2 : OFF
BAT pin discharge
Idischg1(10uA)
Adaptor connection check
VCC > Vadp(3.8V)
Det. Time : Tadp(32ms)
No
Reset det.
VCC ≦ Vpor(2.5V)
Det. Time : Tadp2(64us)
No
Timer reset
Error reset
Yes
Yes
Charge Recovery
LED1 : Lighting
LED2 : OFF
Reset
LED1 : OFF
LED2 : OFF
AC adaptor Pull out
or
Battery disconnect

*8 : All typ. numeric value.
*9 : Charge current, charge completion current and each detection time for RICHG=2.32kΩ, Rosc=100kΩ.

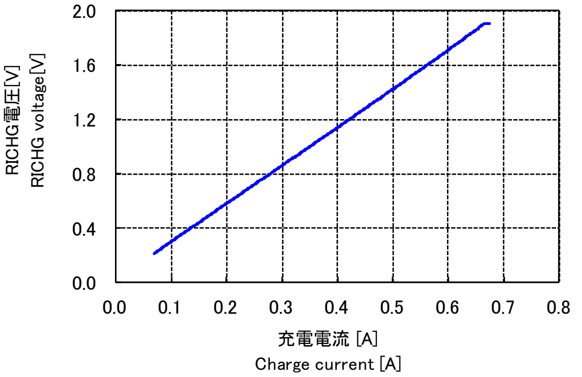
9. TYPICAL PERFORMANCE CHARACTERISTICS

（Unless otherwise specified, VCC=5.0V, RICHG=2.32kΩ, Rosc=100kΩ, Ta=25°C）

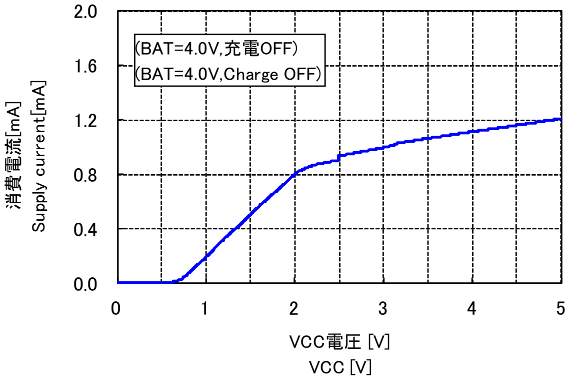
充電電流　対　BAT電圧
Charge current vs. BAT voltage



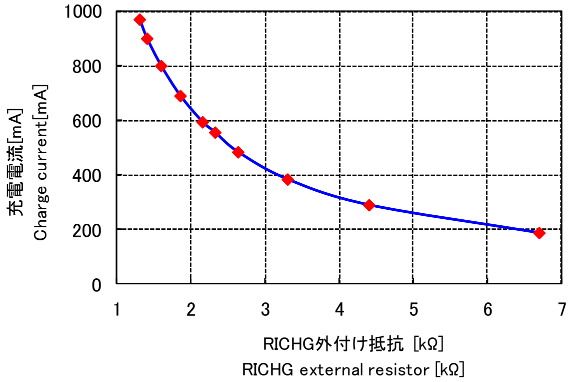
RICHG電圧　対　充電電流
RICHG voltage vs. Charge current



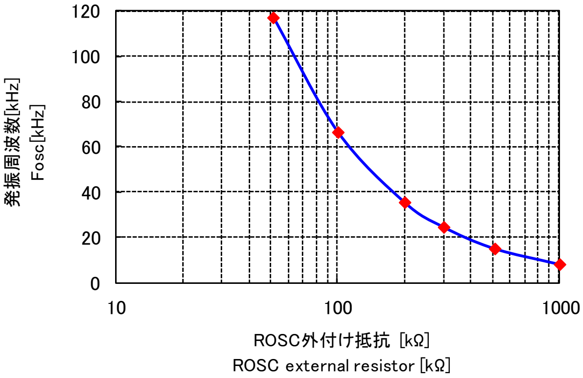
消費電流　対　VCC電圧
Supply current vs. VCC



充電電流　対　RICHG外付け抵抗
Charge current vs. RICHG external resistor

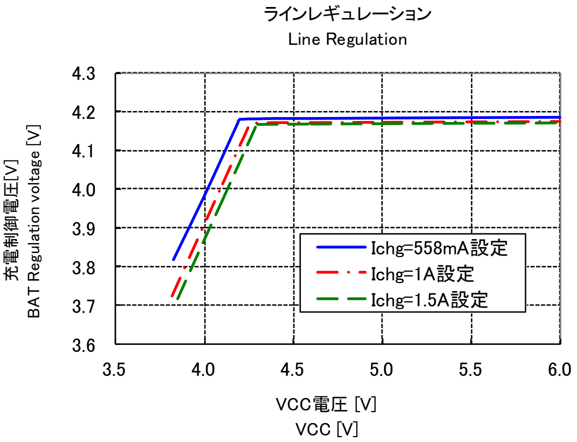


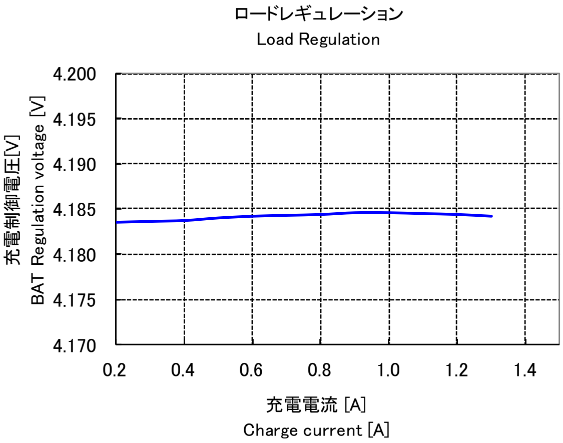
発振周波数　対　ROSC外付け抵抗
Fosc vs. ROSC external resistor

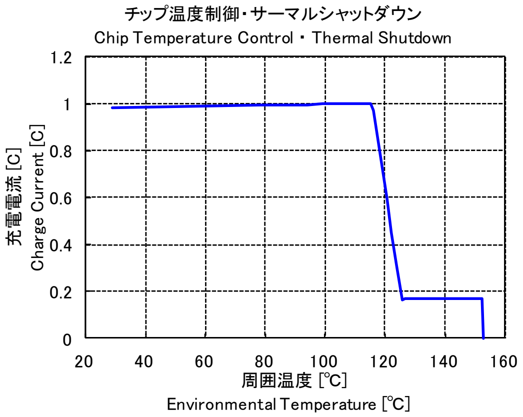


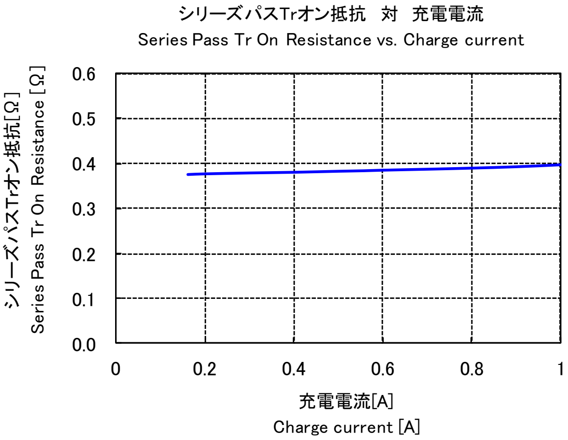
*10 ： These are typical characteristics.

（Unless otherwise specified, VCC=5.0V, RICHG=2.32kΩ, Rosc=100kΩ, Ta=25°C）





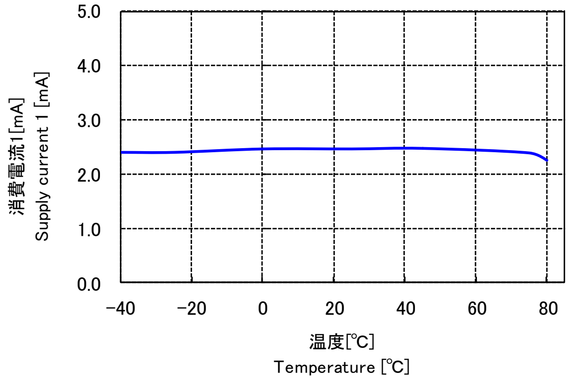




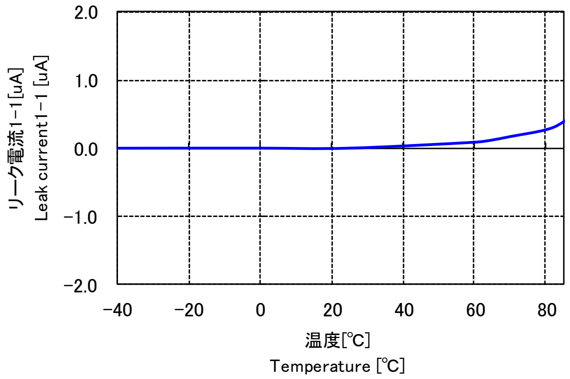
*10 ： These are typical characteristics.

● TEMPERATURE DEPENDENCY

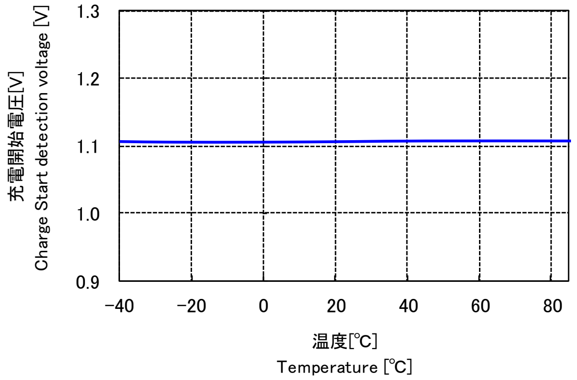
消費電流1
Supply current 1



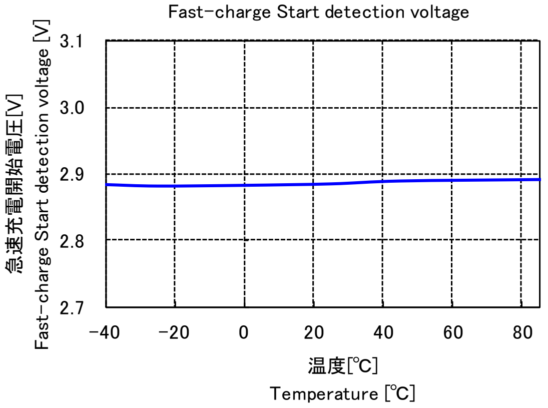
リーク電流1−1
Leak current 1−1



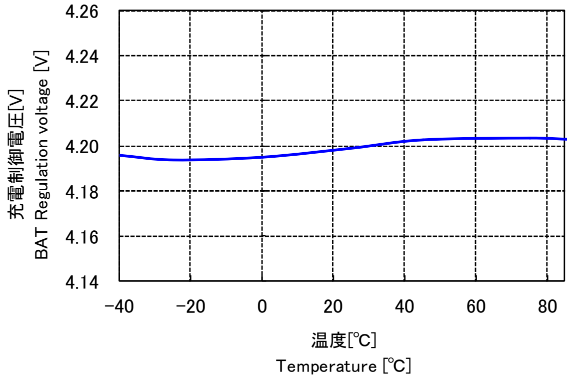
充電開始電圧
Charge Start detection voltage



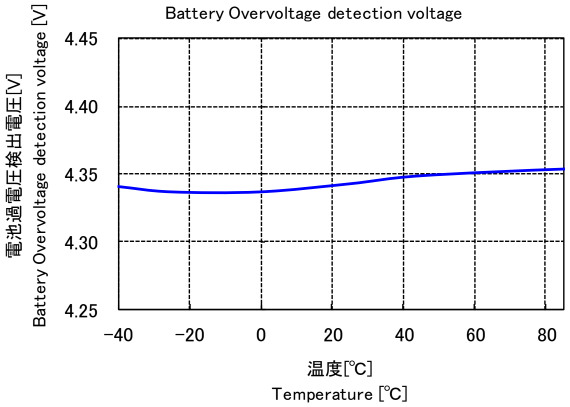
急速充電開始電圧
Fast−charge Start detection voltage



充電制御電圧
BAT Regulation voltage



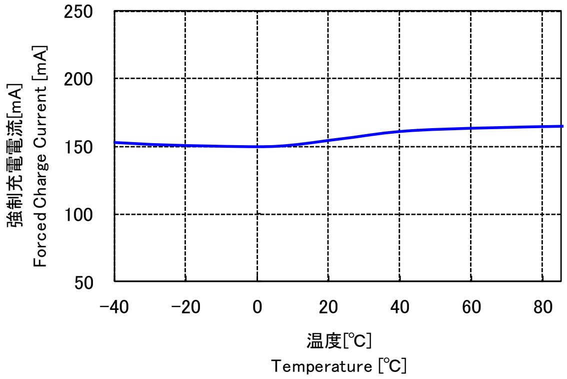
電池過電圧検出電圧
Battery Overvoltage detection voltage



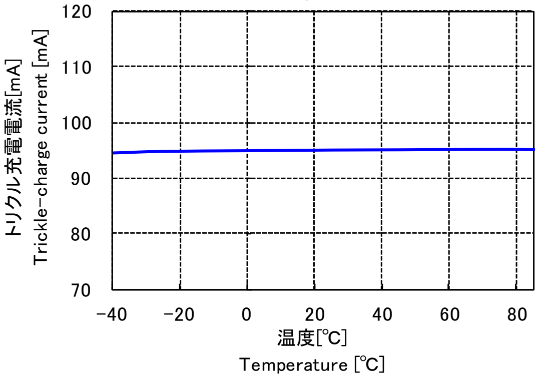
*10 : These are typical characteristics.

- TEMPERATURE DEPENDENCY

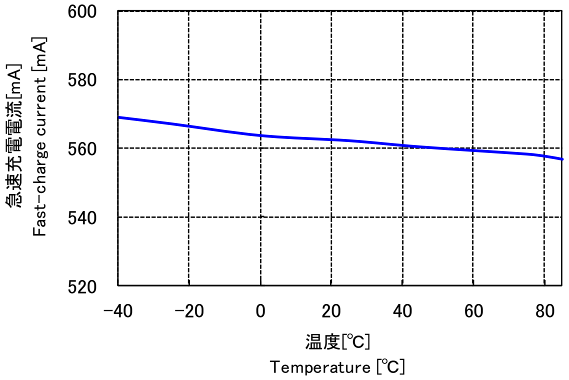
強制充電電流
Forced Charge Current



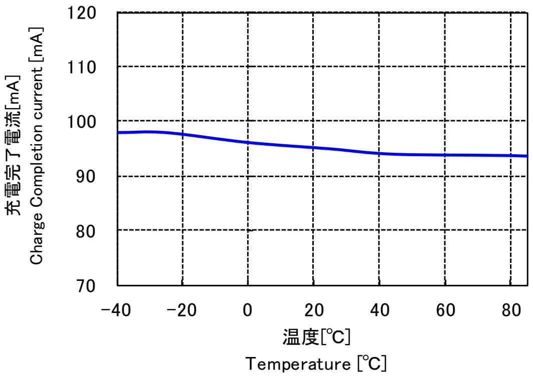
トリクル充電電流
Trickle−charge current



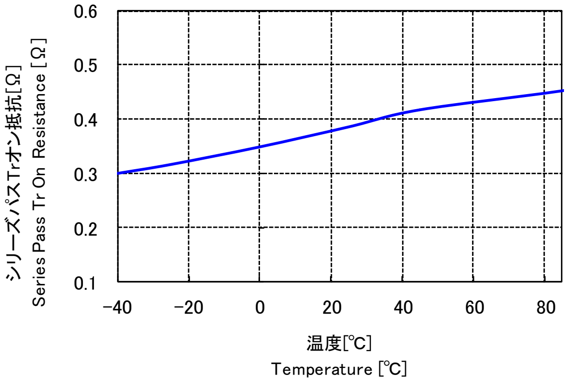
急速充電電流
Fast−charge current



充電完了電流
Charge Completion current

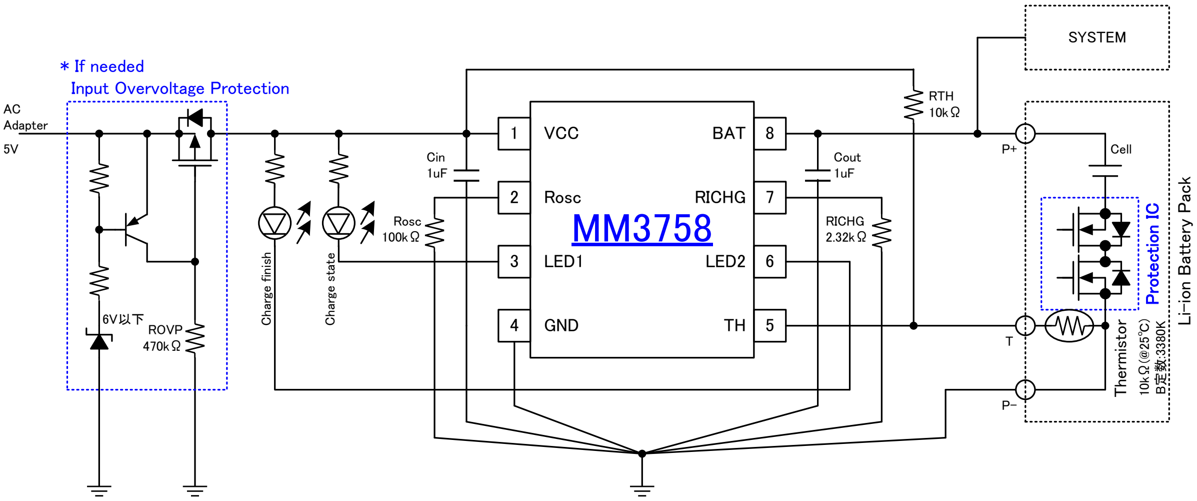


シリーズパスTrオン抵抗
Series Pass Tr On Resistance



*10 : These are typical characteristics.

10. TYPICAL APPLICATION CIRCUIT


＊If needed
Input Overvoltage Protection
AC
Adapter
5V
6V以下
ROVP
470kΩ
Charge finish
Charge state
Cin
1uF
Rosc
100kΩ
1
2
3
4
VCC
Rosc
LED1
GND
MM3758
BAT
RICHG
LED2
TH
8
7
6
5
Cout
1uF
RICHG
2.32kΩ
RTH
10kΩ
SYSTEM
P+
T
P−
Cell
Protection IC
Thermistor
10kΩ(@25℃)
B定数:3380K
Li-ion Battery Pack

・Mitsumi Electric Co., Ltd. shall not be liable for any trouble or damage caused by using this circuit.

・In the event a problem which may affect industrial property or any other rights of us or a third party is encountered during the use of information described in these circuit, Mitsumi Electric Co., Ltd. shall not be liable for any such problem, nor grant.