

# Lithium-ion battery charge control IC

## Monolithic IC MM3635

### Outline

This IC is a linear charge control IC for low capacity battery.  
 Charging from 0V of battery voltage is available, so this IC is optimum for product used low-capacity battery.  
 Charge control voltage can be set according to a battery to be used. (4.2 or 4.05V)

### Features

1. BAT Regulation Voltage      4.2V±30mV(0.7%) / 4.05V±50mV (Setting by CVSEL pin)
2. Fast Charge Current          15mA±1.8mA RICHG=74.2kΩ
3. Charging from 0V of battery voltage.
4. Trickle-charge current, Fast-charge current, Charge completion current can be set using external resistors(maximum charging current is 0.7 A).
5. Battery temperature detection function is provided via a thermistor, and so the charging ON/OFF can be controlled according to the battery temperature.
6. Chip temperature detection enables control of IC temperature rises at high-power charging. The battery can therefore be charged with optimal charging regulation.
7. Built-in charging timer. Charging timer time can be freely set using external resistor.
8. Small package                  SSON-10A (2.7×2.5×0.6mm)

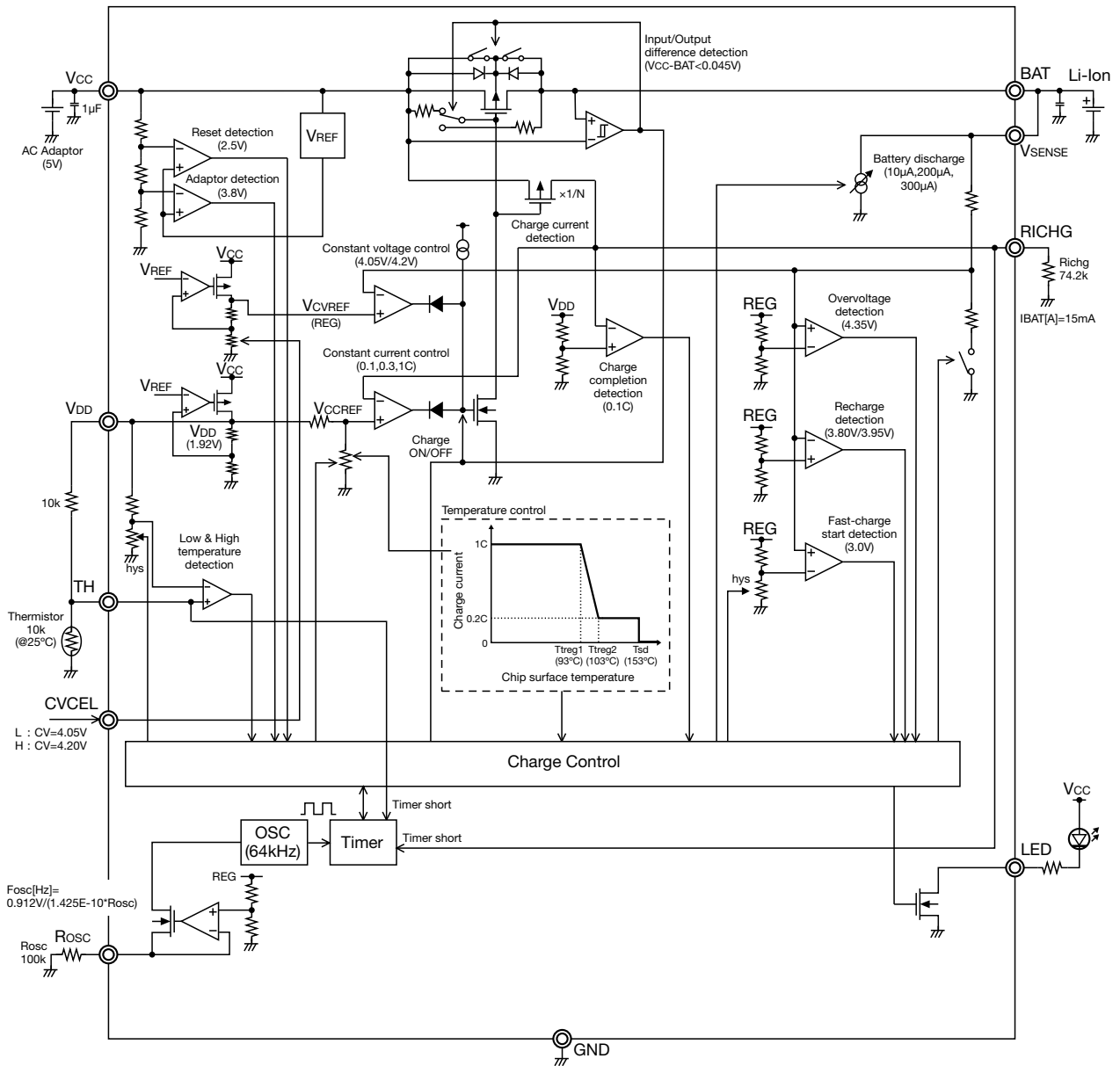
### Package

SSON-10A

### Applications

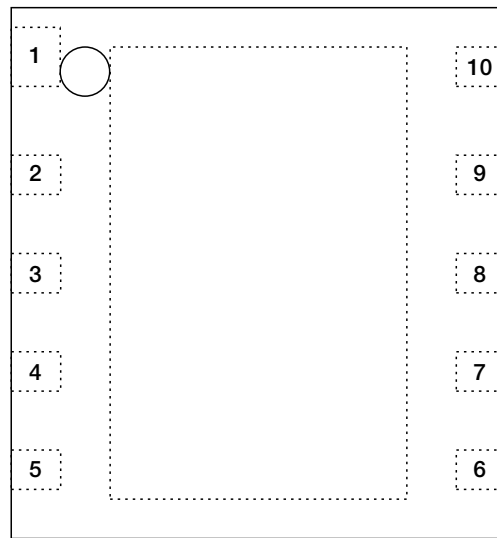
1. Cellular phones
2. Portable music players
3. Digital still cameras
4. Portable game devices

Block Diagram



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• 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.

Pin Assignment



SSON-10A  
(TOP VIEW)

1	V <sub>CC</sub>	6	TH
2	Rosc	7	CVSEL
3	LED	8	RICHG
4	GND	9	V <sub>SENSE</sub>
5	V <sub>DD</sub>	10	BAT

## Pin Description

Pin No.	Symbol	Function
1	V <sub>CC</sub>	Power supply, charge Tr input pin. Connect to an AC adaptor.
2	R <sub>osc</sub>	Oscillation frequency setting resistance connection pin $f_{osc}=0.912V/(1.425E-10 \times R_{osc})$ * Estimation : The fosc value for each R <sub>osc</sub> value is specified on the Characteristics page.
3	LED	LED connect pin (Nch open drain output) Turn on during charging.
4	GND	Ground pin
5	V <sub>DD</sub>	Battery temperature detecting reference voltage pin * It is not recommended to be used other than as battery temperature detecting reference voltage (resistance connection) since it is also used for internal charge current reference voltage.
6	TH	Battery temperature detection input pin. Connect to a thermistor.
7	CVSEL	A change pin of the charge constant voltage. L or Open : CV=4.05V, H : CV=4.20V
8	R <sub>ICHG</sub>	Charge current setting resistance connection pin $I_{CHG}=674 \times V_{DD} \text{ pin voltage} / R_{ICHG}$ * Estimation: The Charge Current value for each R <sub>ICHG</sub> value is specified on the Characteristics page.
9	V <sub>SENSE</sub>	Battery voltage detection, constant voltage charge control pin Connect to the positive side of a battery pack.
10	BAT	Charge Tr output pin Connect to the positive side of a battery pack.

## Absolute Maximum Ratings

Item	Symbol	Ratings	Units
Storage temperature	T <sub>STG</sub>	-55~+150	°C
Operating temperature	T <sub>OPR</sub>	-40~+85	°C
Pin voltage	V <sub>in</sub>	-0.3~+6.0	V
BAT pin output current	I <sub>BAT</sub>	700	mA
LED pin sink current	I <sub>LED</sub>	20	mA
Power dissipation	P <sub>d</sub>	1.94 (*1)	W

note : \*1 When mounted on a 40 × 40 × 1.6tmm (epoxy glass, double-sided, copper layer 90%) PC board.

## Recommended Operating Conditions

Item	Symbol	Ratings	Units
Operating temperature	T <sub>OPR</sub>	0~+45	°C
V <sub>CC</sub> Operating voltage	V <sub>op</sub>	4.5~5.5	V

**Electrical Characteristics** (Except where noted otherwise Ta=0~45°C, V<sub>CC</sub>=5.0V)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Supply current	I <sub>CC</sub>	During fast charge (I <sub>rapchg</sub> = 500mA setting)		3.0	4.5	mA
Leak current	I <sub>leak</sub>	Inflow current of BAT/V <sub>SENSE</sub> pin under the following conditions : 1. BAT (=V <sub>SENSE</sub> )=3.6V AC adaptor is unconnected 2. Charging is completed		1	2	μA
Reset detection voltage	V <sub>por</sub>	Reset mode when V <sub>CC</sub> <V <sub>POR</sub>	2.3	2.5	2.7	V
ADP detection voltage	V <sub>adp</sub>	Charging stops when V <sub>CC</sub> <V <sub>adp</sub>	3.6	3.8	4.0	V
V <sub>SENSE</sub> pin discharge current 1	I <sub>dischg1</sub>	V <sub>SENSE</sub> (=BAT)=3.2V in charge error mode		10.0	20.0	μA
V <sub>SENSE</sub> pin discharge current 2	I <sub>dischg2</sub>	V <sub>SENSE</sub> (=BAT)=3.2V	100	200	300	μA
Fast-charge start detection voltage	V <sub>qchg</sub>	Applied to detection voltage from trickle charge to fast charge	2.9	3.0	3.1	V
Fast-charge start detection voltage hysteresis	V <sub>qchg<h>hys</h></sub>	Applied to detection voltage from fast charge to trickle charge	40	90	120	mV
Recharge detection voltage	V <sub>rechg1</sub>	CVSEL=H	3.85	3.95	4.05	V
	V <sub>rechg2</sub>	CVSEL=L	3.70	3.80	3.90	
BAT regulation voltage	V <sub>chg1</sub>	CVSEL=H	4.17	4.20	4.23	V
	V <sub>chg2</sub>	CVSEL=L	4.00	4.05	4.10	
Charge stop I/O potential difference 1	V <sub>def1</sub>	Charge stops when V <sub>CC</sub> -BAT<V <sub>def1</sub> V <sub>CC</sub> =H→L	5	30	65	mV
Charge stop I/O potential difference 2	V <sub>def2</sub>	Charge stops when V <sub>CC</sub> -BAT<V <sub>def2</sub> V <sub>CC</sub> =L→H	5	45	65	mV
Battery overvoltage detection voltage	V <sub>ov</sub>	V <sub>CC</sub> >V <sub>ov</sub> +100mV	4.27	4.35	4.43	V
Forced charge current	I <sub>start</sub>	RICHG=74.2kΩ 0.3C (1.0C=I <sub>rapchg</sub> )	3.10	3.85	4.60	mA
Trickle-charge current	I <sub>prechg</sub>	RICHG=74.2kΩ 0.1C (1.0C=I <sub>rapchg</sub> )	0.75	1.00	1.25	mA
Fast-charge current	I <sub>rapchg</sub>	RICHG=74.2kΩ 1.0C BAT=3.6V	13.2	15.0	16.8	mA
Charge completion current	I <sub>fc</sub>	RICHG=74.2kΩ BAT=V <sub>qchg</sub>	0.75	1.00	1.25	mA
Chip temperature detection1(*1)	T <sub>treg1</sub>	Applied to T <sub>j</sub> (chip temperature)	83	93	103	°C
Chip temperature detection2(*1)	T <sub>treg2</sub>	Applied to T <sub>j</sub> (chip temperature)		103		°C
Chip temperature detection difference (*1)	T <sub>dtreg</sub>	Applied to T <sub>j</sub> (chip temperature) T <sub>treg2</sub> -T <sub>treg1</sub>	5	10	15	°C
Thermal shutdown temperature (*1)	T <sub>sd</sub>	Applied to T <sub>j</sub> (chip temperature)	143	153	163	°C
Temperature detecting reference voltage	V <sub>DD</sub>	V <sub>DD</sub> pin Output Voltage		1.92		V
Temperature detecting reference terminal current (*1)	I <sub>DD</sub>	V <sub>DD</sub> pin Output Current		3		mA

note : \*1 The parameter is guaranteed by design.

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Charge Stop Battery Temperature Detection Voltage (Low temperature)	VthSL	Charge stop threshold when TH pin rises(-3°C)	$V_{DD} \times 0.7722$	$V_{DD} \times 0.7562$	$V_{DD} \times 0.7397$	V
Charge Recovery Battery Temperature Detection Voltage (Low temperature)	VthRL	Charge recovery threshold when TH pin falls (0°C)	$V_{DD} \times 0.7480$	$V_{DD} \times 0.7313$	$V_{DD} \times 0.7142$	V
Charge Stop Battery Temperature Detection Voltage (High temperature)	VthSH	Charge stop threshold when TH pin falls(45°C)	$V_{DD} \times 0.3448$	$V_{DD} \times 0.3296$	$V_{DD} \times 0.3149$	V
Charge Recovery Battery Temperature Detection Voltage (High temperature)	VthRH	Charge recovery threshold when TH pin rises (42°C)	$V_{DD} \times 0.3684$	$V_{DD} \times 0.3526$	$V_{DD} \times 0.3372$	V
TMRcnt pin Low-Level Input Voltage	VcvselL				0.5	V
TMRcnt pin High-Level Input Voltage	VcvselH		2			V
TMRcnt pin Low-Level Input Current	IcvselL	CVSEL=0V			1	μA
TMRcnt pin High-Level Input Current	IcvselH	CVSEL=5.0V			10	μA
LED Output pin Low-Level Voltage	VledL	Iled=10mA			0.4	V
LED Output pin Leak Current	Iledleak	LED=5V	-1		1	μA
Series Pass Tr On Resistance	Ron	Io=200mA		0.38	0.60	Ω
Oscillator frequency (★1)	Foc	Rosc=100kΩ	57.6	64	70.4	kHz
VSENSE pin discharge time (★1)	Tdischg	Foc=64kHz	58	64	70	ms
AC Adaptor connection detection time (★1, 2)	Tadp	Foc=64kHz Vpor < Vcc < Vadp Applied when Vcc = > Vadp detection	24		32	ms
	Tadp2	Applied when Vcc = < Vpor detection	32	64	96	μs
Forced charge time (★1)	Tistart	Foc=64kHz	480	512	544	ms
Forced charge OFF time (★1)	Toff	Foc=64kHz	115	128	141	ms
Battery voltage detection time (★1, 3)	Tcon	Foc=64kHz	96		128	ms
Fast charge start voltage detection time (★1, 3)	Tqstart	Foc=64kHz	96		128	ms
Charge completion current detection time (★1, 4)	Tifc	Foc=64kHz	192		256	ms
Recharge start voltage detection time (★1, 4)	Trechg	Foc=64kHz	192		256	ms
Trickle-charge timer (★1)	Tdchg	Foc=64kHz	54	60	66	min
Fast-charge timer (★1)	Tchg	Foc=64kHz	270	300	330	min
Battery overvoltage detection time (★1,3)	Tov	Foc=64kHz	96		128	ms
Charge stop battery temperature detection time (★1,3)	Tpro	Foc=64kHz VthSL, VTH=L→H or VthSH, VTH=H→L	96		128	ms
Charge recovery battery temperature detection time (★1,3)	TproR	Foc=64kHz VthRL, VTH=H→L or VthRH, VTH=L→H				

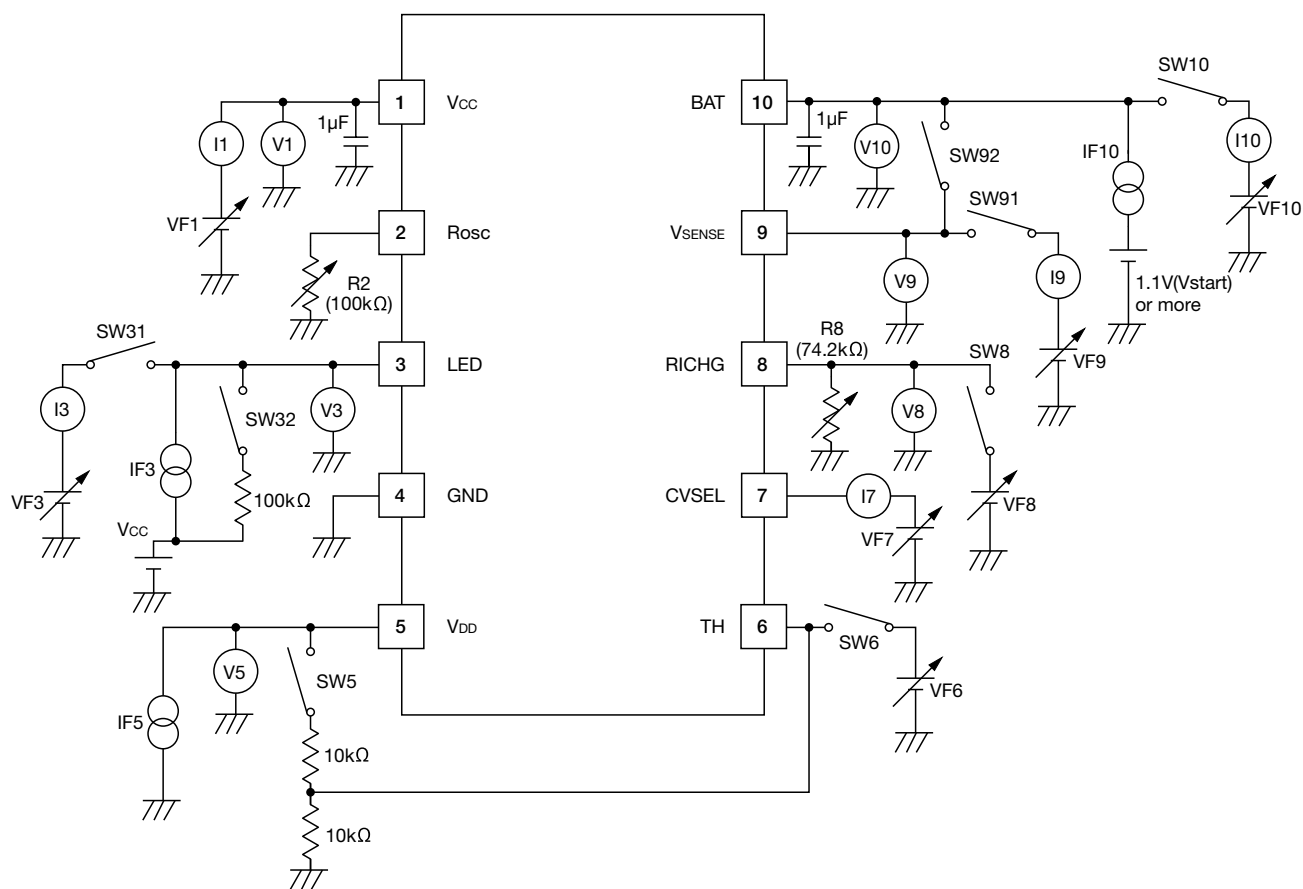
note : ★1 The parameter is guaranteed by design.

note : ★2 The detection time varies depending on the timing of detection for approximately one clock due to the mode transition system operated when matched 4 times in 8ms.

note : ★3 The detection time varies depending on the timing of detection for approximately one clock due to the mode transition system operated when matched 4 times in 32ms.

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

## Measuring Circuit



• SW setting condition

Test Circuit	SW31	SW32	SW5	SW6	SW8	SW91	SW92	SW10
A	×	×	○	×	×	×	○	○
B	×	×	○	×	×	○	×	○
C	×	○	○	×	×	×	○	○
D	×	○	×	○	×	×	○	○
E	○	×	○	×	×	×	○	○
F	×	○	○	×	×	×	○	×
G	×	×	×	○	×	×	○	×

**Test Conditions**

(Except where noted otherwise Ta=0~45°C, Vcc=5.0V, CVSEL=H)

Item	Symbol	Measurement circuit	Measuring conditions
Supply current 1	Icc1	A	Measure the current of I1-I10 when R8=(Irapchg=500mA setting) and IF10=500mA.
Leak current	Ileak	A	1. Measure the current of I10 when VF1=0V and VF10=4.2V. 2. Measure the current of I10 when VF10=4.25V (charge completion mode).
Reset detection voltage	Vpor	B	When gradually increasing VF1 from 2.3V to 2.7V under the condition of VF9=3.2V and VF10=3.2V, the VF1 when I9 exceeds 100µA should be Vpor.
Adaptor detection voltage	Vadp	C	When gradually increasing VF1 from 2.3V to 4.0V under the condition of VF10=3.2V, the VF1 when V3 changes from H to L should be Vadp.
VSENSE pin discharge current 1	Idischg1	B	Measure the current of I9 when VF 9=4.5V to 3.2V after being kept under the condition of VF10=3.2V and VF9=4.5V and entering into error mode.
VSENSE pin discharge current 2	Idischg2	B	Measure the current of I9 immediate after increasing VF1 from 2.3V to 5.0V when VF9=3.2V and VF10=3.2V.
Fast-charge start detection voltage	Vqchgon	A	When gradually increasing VF10 from 2.9V to 3.1V under the condition of VF10=2.5V, the VF10 when  I10  exceeds 530mA should be Vqchgon.
Fast-charge start detection voltage hysteresis	Vqchgonhys	A	When gradually decreasing VF10 from 3.1V to 2.7V under the condition of VF10=3.5V, the VF10 when  I10  falls below 530mA should be Vqchgon2. Vqchgonhys=Vqchgon-Vqchgon2
Recharge detection voltage	Vrechg1 Vrechg2	C	When CVSEL=H, gradually decreasing VF10 from 4.00V to 3.80V, and when CVSEL=L, gradually decreasing VF10 from 3.90V to 3.70V after being kept in the condition of VF10=4.25V and entering into charge completion mode, the VF10 when the charging restarts ( I10 >1mA) and V3=H to L should be Vrechg1(CVSEL=H), Vrechg2(CVSEL=L).
Regulation voltage	Vchg1 Vchg2	A	Measure the voltage of V9 in fast charge mode and when IF10=-5mA ( IF10 >Ifc). Vchg1=CVSEL=H, Vchg2=CVSEL=L
Charge stop I/O potential difference 1	Vdef1	A	When gradually decreasing VF1 from 4.1V to 4.0V under the condition of fast charge mode, VF1=4.1V, and VF10=4.0V, the V1-V10 when the charging stops ( I10 <1mA) should be Vdef1.
Charge stop I/O potential difference 2	Vdef2	A	When gradually increasing VF1 from 4.0V to 4.1V under the condition of fast charge mode, VF1=4.0V, and VF10=4.0V, the V1-V10 when the charging restarts ( I10 >1mA) should be Vdef2.
Battery overvoltage detection voltage	Vov	C	When gradually increasing VF10 from 4.27V to 4.43V under the condition of VF10=4.25V, the VF10 when V3 becomes blinking (repeating H⇔L, charge error mode) should be Vov.
Forced charge current	Istart	A	Measure the current of I10 immediately after increasing VF1 from 2.3V to 5.0V when VF10=3.6V and R8=75kΩ.
Trickle-charge current	Iprechg	A	Measure the current of I10 when VF10=2.6V and R8=75kΩ.
Fast-charge current	Irapchg	A	Measure the current of I10 when VF10=3.6V and R8=75kΩ.
Charge completion current	Ifc	B	When gradually increasing VF9 from 4.1V to 4.2V under the condition of VF9=3.6V and VF10=Vqchgon, the  I10  immediately before V3=L to H and the charging stops ( I10 >1mA) should be Ifc.

note : \*1 The parameter is guaranteed by design.



Item	Symbol	Measurement circuit	Measuring circuit
Chip temperature detection 1 (*1)	Ttreg1	A	When gradually increasing chip temperature from 83°C to 103°C under the condition of fast charge mode, VF1=5V, and VF10=4V, the chip temperature when I10 drops to the value that is 1C (I10 when chip temperature is 25°C)× 95% should be Ttreg1.
Chip temperature detection 2 (*1)	Ttreg2	A	When gradually increasing chip temperature from 85°C to 120°C under the condition of fast charge mode, VF1=5V, and VF10=4V, the chip temperature when I10 drops to the value that is 0.2C (I10 when chip temperature is 125°C)×105% should be Ttreg2.
Chip temperature detection difference (*1)	Tdtreg	A	Tdtreg=Ttreg2 -Ttreg1
Thermal shutdown temperature (*1)	Tsd	C	When gradually increasing chip temperature from 143°C to 163°C under the condition of fast charge mode, VF1=5V, and VF10=3.2V, the chip temperature when V3 becomes blinking (repeating H⇔L, charge error mode) and the charging stops ( I10  < 1mA) should be Tsd.
Temperature detecting reference voltage	V <sub>DD</sub>	D	Measure the voltage of V5 when VF6=1.0V and VF10=3.6V.
Temperature detecting reference terminal current (*1)	I <sub>DD</sub>	D	When gradually decreasing IF5 under the condition of VF6=1.0V and VF10=3.6V, the  IF5  when V5=V <sub>DD</sub> ×90% should be I <sub>DD</sub> .
Charge stop battery temperature detection voltage (Low temperature)	VthSL	D	When gradually increasing VF6 from 1.0V to 2.0V under the condition of fast charge mode, VF6=1.0V, and VF10=3.6V, the VF6 when V3=L to H and the charging stops ( I10 <1mA) should be VthSL.
Charge recovery battery temperature detection voltage (Low temperature)	VthRL	D	When gradually decreasing VF6 from 2.0V to 1.0V under the condition of charge stop temperature detection mode, VF6=2.0V, and VF10=3.6V, the VF6 when V3=H to L and the charging restarts ( I10 >1mA) should be VthRL.
Charge stop battery temperature detection voltage (High temperature)	VthSH	D	When gradually decreasing VF6 from 1.0V to 0V under the condition of fast charge mode, VF6=1.0V, and VF10=3.6V, the VF6 when V3=L to H and the charging stops( I10 <1mA) should be VthSH.
Charge recovery battery temperature detection voltage (High temperature)	VthRH	D	When gradually increasing VF6 from 0V to 1.0V under the condition of charge stop temperature detection mode, VF6=0V, and VF10=3.6V, the VF6 when V3=High to Low and the charging restarts( I10 >1mA) should be VthRH.
CVSEL pin Low-level input voltage	VcvselL	C	Measurement conditions are as Vchg, more than voltage of VF7 from which the voltage of V9 is set to Vchg1 is set to VcvselH, and below voltage used as Vchg2 is set to VcvselL.
CVSEL pin High-level input voltage	VcvselH		
CVSEL pin Low-level input current	IcvselL	A	Measure the current of I7 under the condition of fast charge mode, VF7=0V, and VF10=3.6V.
CVSEL pin High-level input current	IcvselH	A	Measure the current of I7 under the condition of fast charge mode, VF7=5V, and VF10=3.6V.
LED output pin Low-level voltage	VledL	A	Measure the voltage of V3 under the condition of fast charge mode, IF3=10mA, and VF10=3.6V.
LED output pin leak current	Iledleak	E	Measure the current of I3 when VF3=5V and VF10=4.25V (charge completion mode).
Series pass Tr On resistance	Ron	A	Measure the voltage of V1-V10 under the condition of fast charge mode, VF1=4.0V, and IF10= -200mA. Ron=(V1-V10)/200mA

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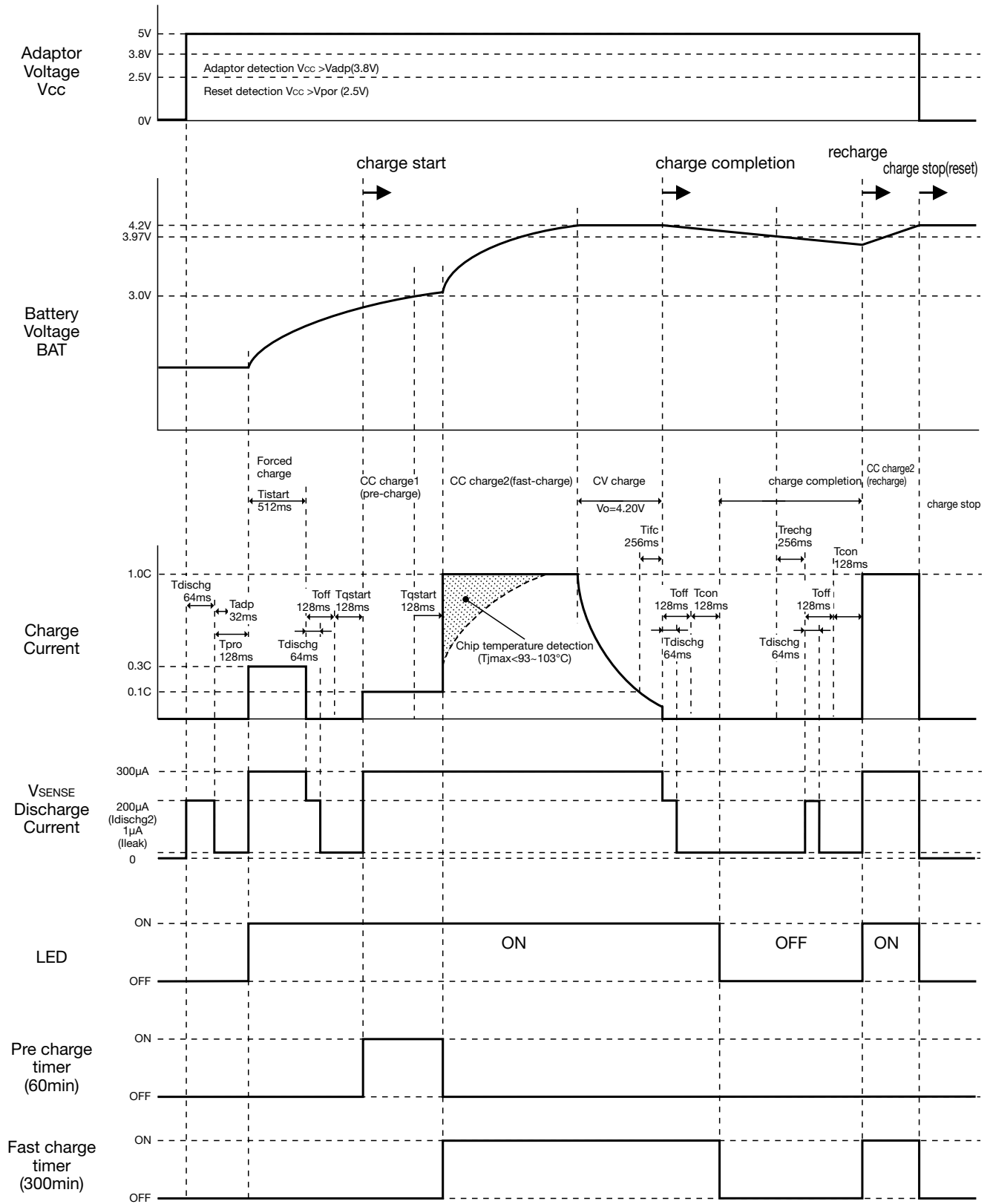
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Item	Symbol	Measurement circuit	Measuring circuit
V <sub>SENSE</sub> pin discharge time (*1)	Tdischg	B	When increasing VF1 from 2.3V to 5.0V under the condition of VF9=3.6V and VF10=3.6V, measure the time from when VF1>2.5V(Vpor) to when the current of I9 drops below 100μA.
AC Adaptor connection detection time (*1)	Tadp	C	1. After being kept for 128ms and more (more than Tpro) under the condition of VF10=3.6V and VF1=2.3V to 3.6V, measure the time from when VF1>3.8V(Vadp) to when V3=High to Low when increasing VF1 from 3.6V to 5.0V. 2. When decreasing VF10 from 5.0V to 3.6V under the condition of fast charge mode and VF10=3.2V, measure the time from when VF1<3.8V(Vadp) to when the fast charge stops( I10 <1mA).
	Tadp2	C	When decreasing VF1 from 5.0V to 2.0V in fast charge mode and when VF10=3.6V, measure the time from when VF1<2.5V(Vpor) to when V3=Low to High.
Forced charge time (*1)	Tistart	C	When increasing VF1 from 2.3V to 5.0V under the condition of VF10=3.6V, measure the time from forced charge start( I10 >1mA) to forced charge stop( I10 <1mA).
Forced charge OFF time (*1)	Toff	C	After increasing VF1 from 2.3V to 5.0V under the condition of VF10=3.6V, the half time from forced charge stop( I10 <1mA) to fast charge start( I10 >1mA) should be Toff.
Battery voltage detection time (*1)	Tcon	C	When decreasing VF10 from 4.25V to 3.8V after charge complete mode under the condition of VF10=4.25V, the half time from when the current of I9 exceeds 100μA to when V3=Low to High and the charging restarts( I10 >1mA) should be Tcon.
Fast charge start voltage detection time (*1)	Tqstart	C	When R8=75kΩ, after increasing VF1 from 2.3V to 5.0V under the condition of VF10=3.2V, the half time from forced charge stop( I10 <1mA) to fast charge start( I10 >1mA) should be Tqstart.
Charge completion current detection time (*1)	Tifc	F	When decreasing IF10 from -80mA to -30mA under the condition of fast charge mode and R8=75kΩ, measure the time from when IF10>-56mA(I <sub>fc</sub> ) to when the charging stops (I10>-1mA).
Recharge start voltage detection time (*1)	Trechg	C	When decreasing VF10 from 4.25V to 3.8V after charge completion mode under the condition of VF10=4.25V, measure the time from when VF10<3.97V(Vrechg) to when the current of I9 exceeds 100μA.
Trickle-charge timer (*1)	Tdchg	C	When decreasing VF7 from 5.0V to 0V under the condition of trickle charge mode, VF7=5.0V, VF10=2.6V, measure the time from when VF10<0.5V(Vt <sub>mr</sub> ) to when V3 starts blinking (V3=H to L, charge error mode) and the charging stops ( I10 <1mA).
Fast-charge timer (*1)	Tchg	C	When decreasing VF7 from 5.0V to 0V under the condition of fast charge mode, VF7=5.0V, VF10=3.6V, measure Tchg2 that is the time from when VF10<0.5V(Vt <sub>mr</sub> ) to when V3 starts blinking (V3= H to L, charge error mode) and the charging stops ( I10 <1mA).
Battery overvoltage detection time (*1)	Tov	C	When increasing VF10 from 3.6V to 4.5V under the condition of fast charge mode and VF10=3.6V, measure the time from when VF10>4.35V(Vov) to when V3 starts blinking (V3 = H to L, charge error mode).
Charge stop battery temperature detection time (*1)	Tpro	C	When increasing (decreasing) VF6 from 1.0V to 2.0V(0V) under the condition of fast charge mode, VF6=1.0V, and VF10=3.6V, measure the time from when VF6>Vth1(VF6<Vth5) to when V3=L to H and the charging stops( I10 <1mA).
Charge recovery battery temperature detection time (*1)	Tpro	C	When decreasing (increasing) VF6 from 2.0V(0V) to 1.0V under the condition of charge stop detection mode, VF6=2.0V(0V), and VF10=3.6V, measure the time from when VF6<Vth1R(VF6>Vth5R) to when V3=H to L and the charging restarts ( I10 >1mA).

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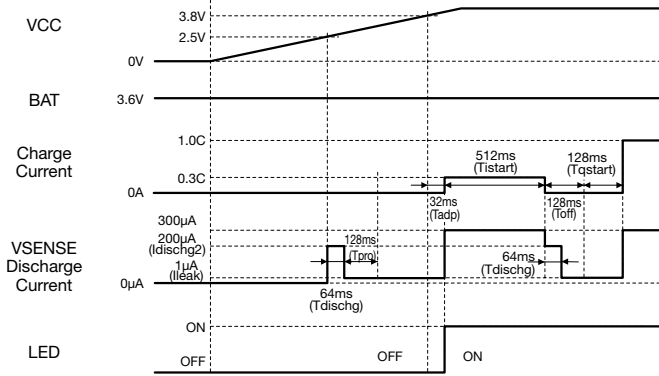
**Timing Chart** (\*All typ. numeric value)

**Normal charge**

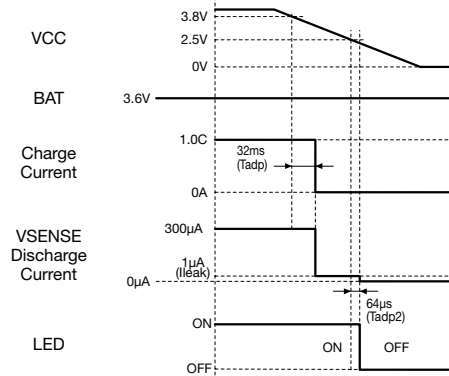


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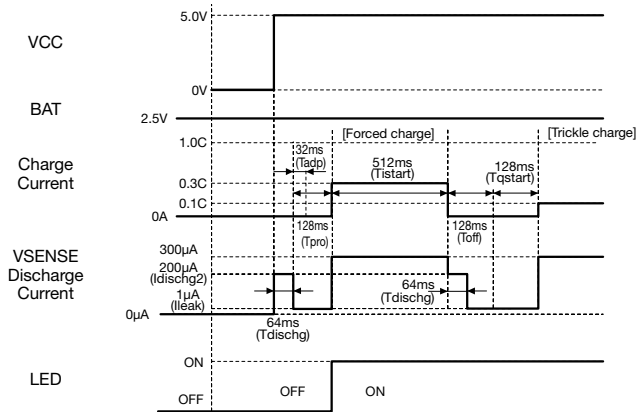
**Input Adaptor**



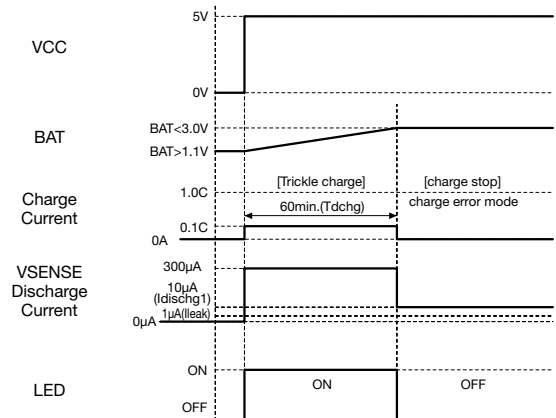
**Release Adaptor**



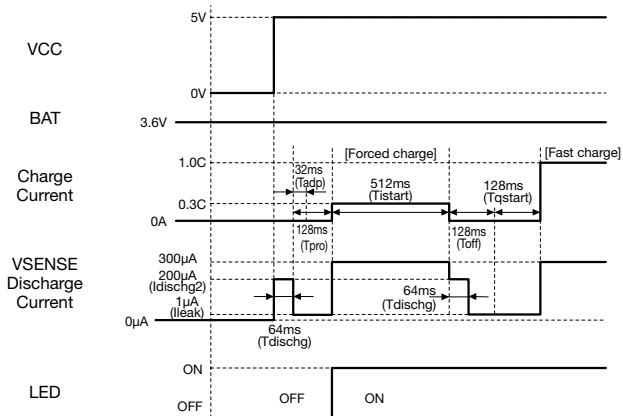
**0V < BAT < 3.0V, Charge start (trickle charge)**



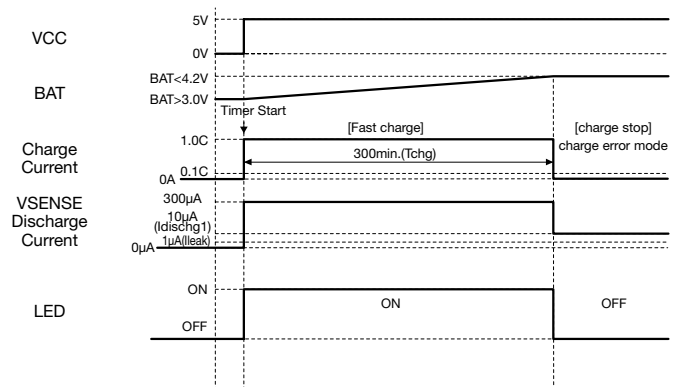
**Trickle charge timeup**



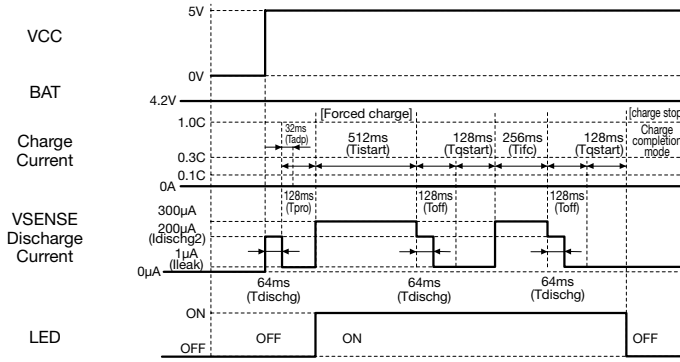
**3.0V < BAT < 4.2V, Charge start (fast charge)**



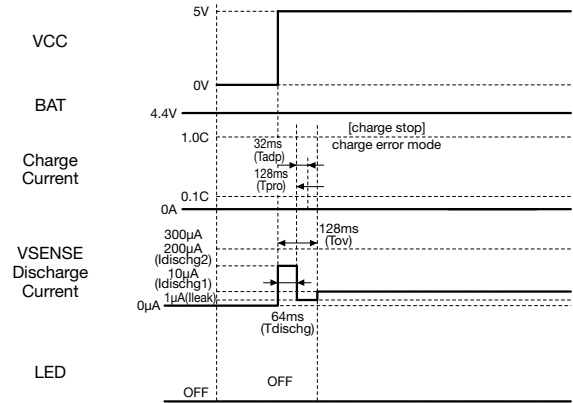
**Fast charge timeup**



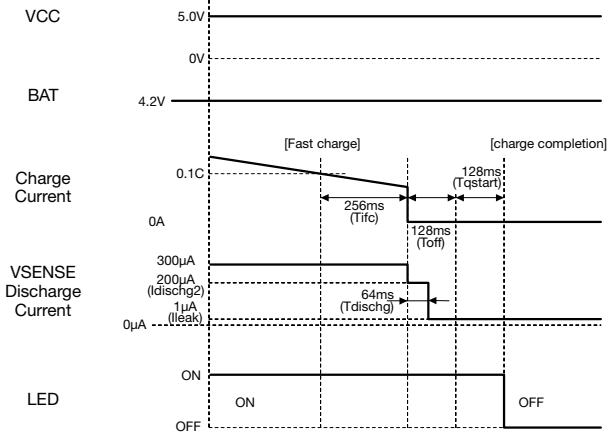
**BAT=4.2V, Charge start (charge completion)**



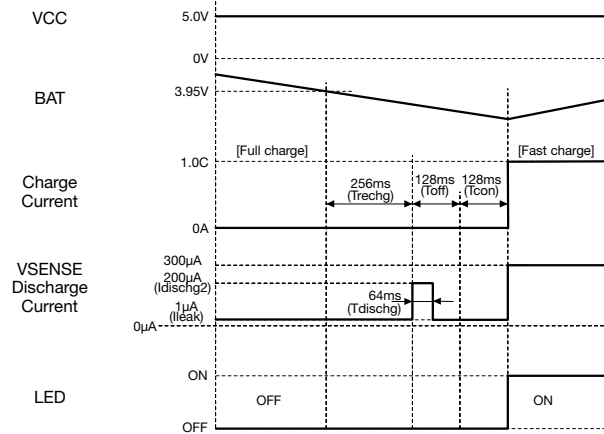
**BAT>4.35V, Charge start (battery overvoltage)**



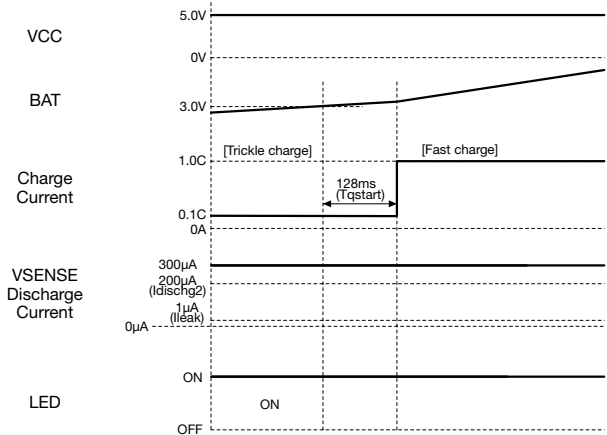
**Full charge detection**



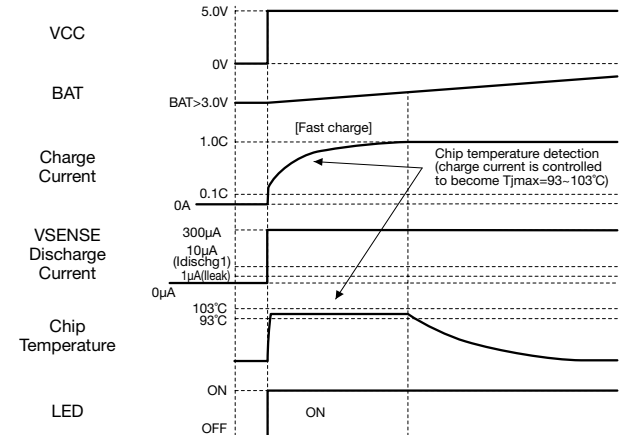
**Recharge detection**



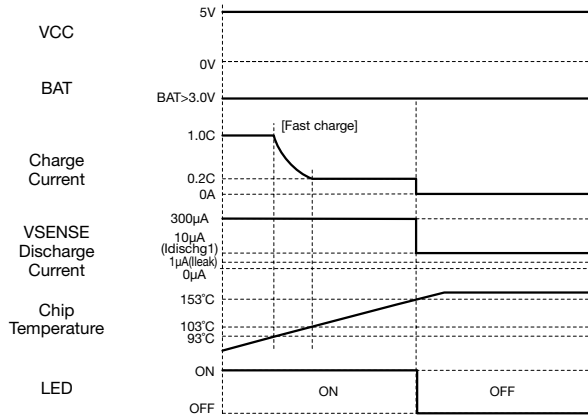
**Fast-charge start voltage detection**



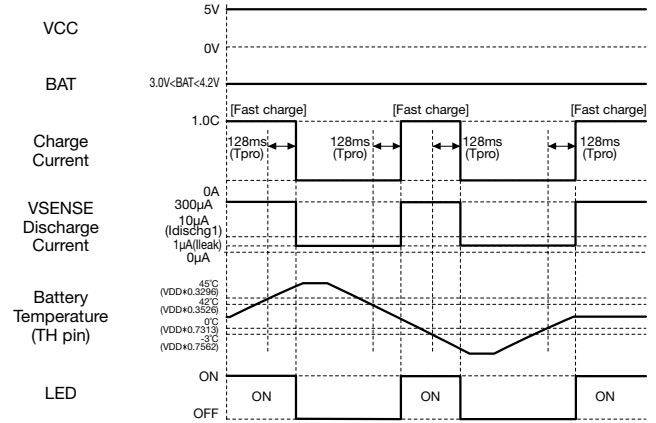
**Chip temperature detection**



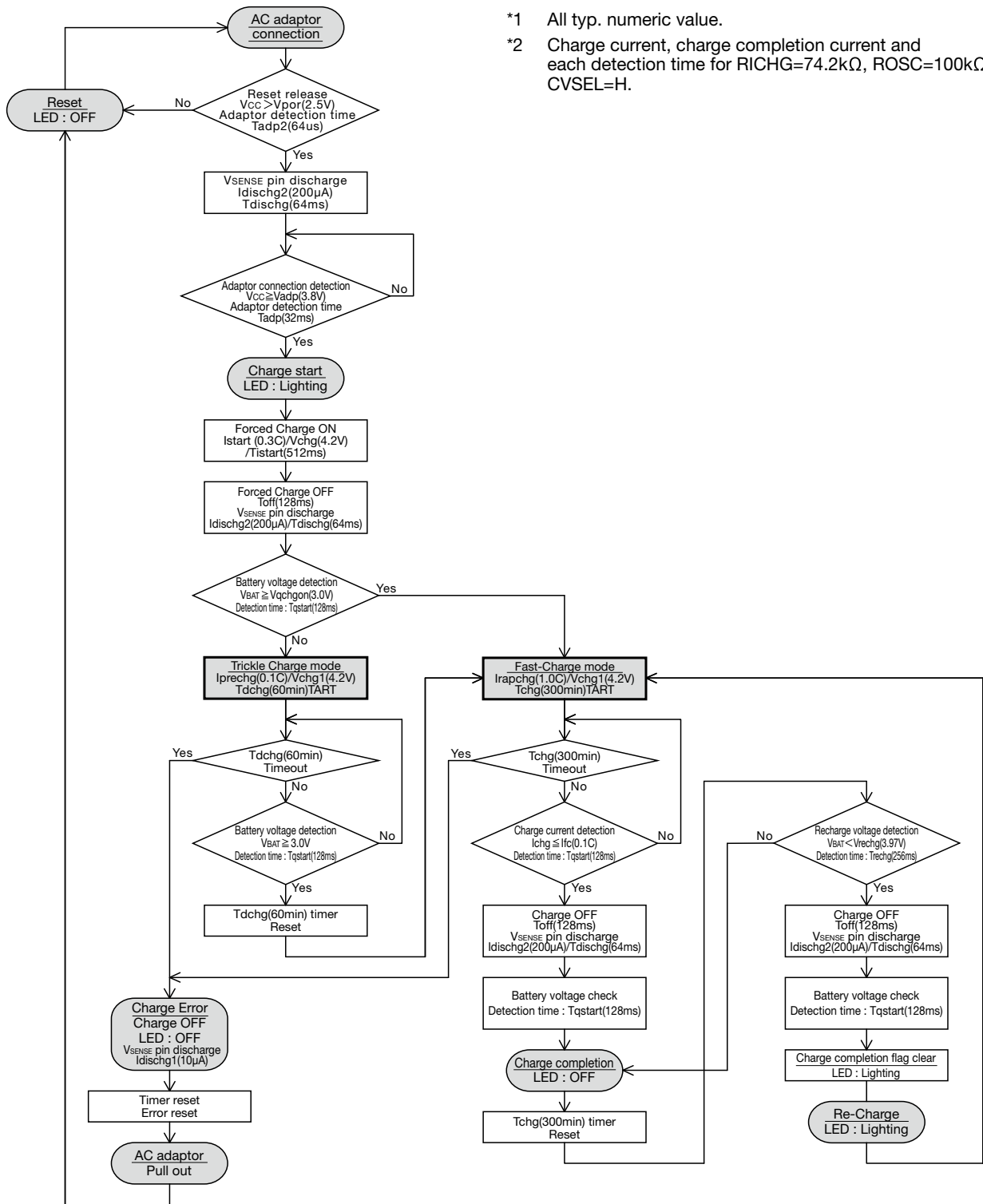
**Thermal shutdown**



**Battery temperature detection**



Flow Chart

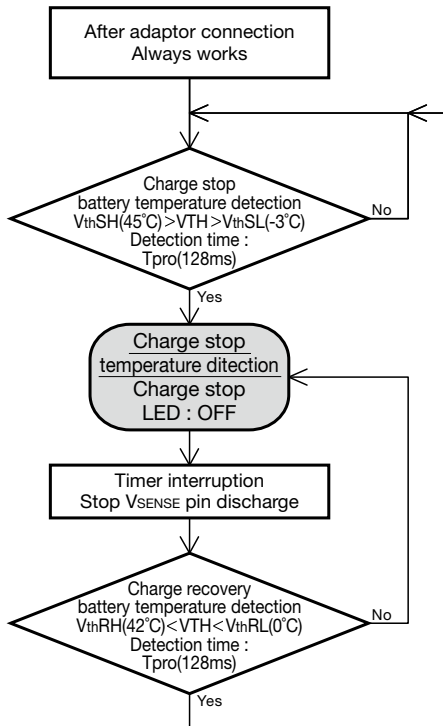
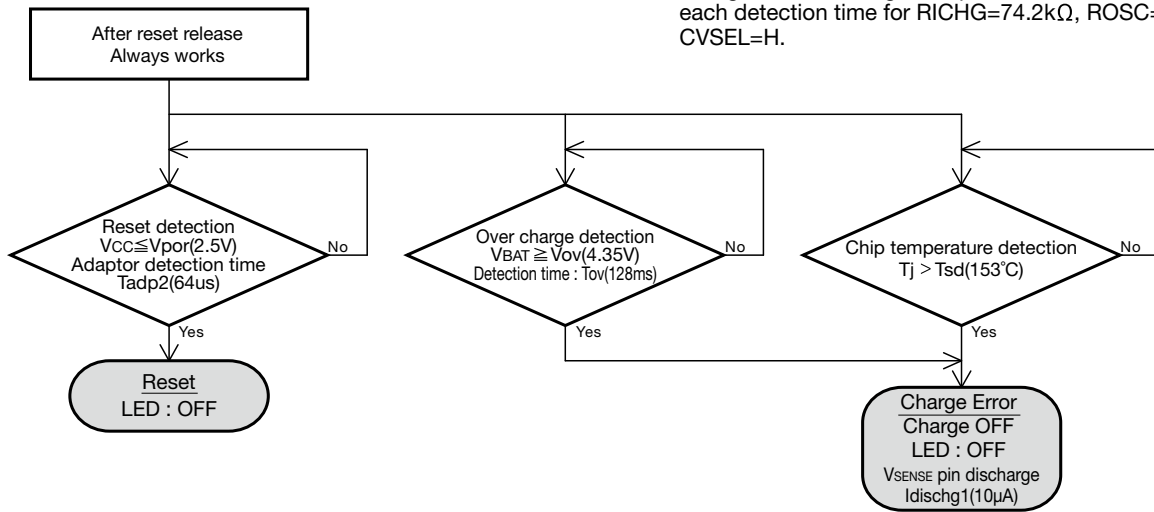


- \*1 All typ. numeric value.
- \*2 Charge current, charge completion current and each detection time for RICHG=74.2kΩ, ROSC=100kΩ, CVSEL=H.

Protection function (Always detected)

\*1 All typ. numeric value.

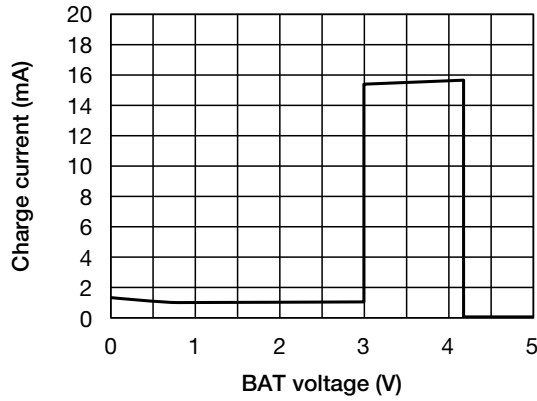
\*2 Charge current, charge completion current and each detection time for RICHG=74.2kΩ, ROSC=100kΩ, CVSEL=H.



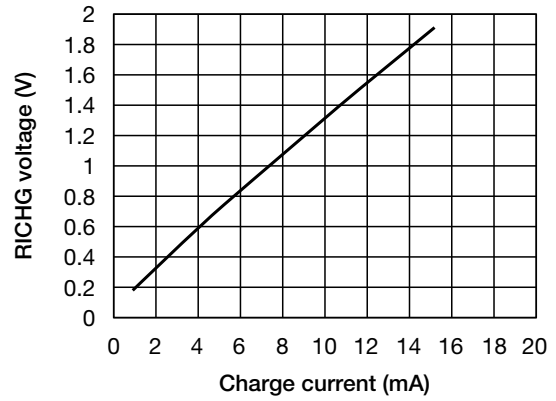


**Characteristics** (Except where noted otherwise  $V_{CC}=5.0V$ ,  $R_{ICHG}=74.2k\Omega$ ,  $R_{OSC}=100k\Omega$ ,  $CVSEL=H$ ,  $T_a=25^\circ C$ )

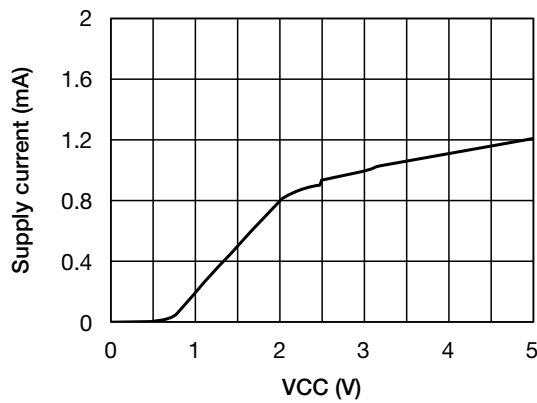
**Charge current - BAT voltage**



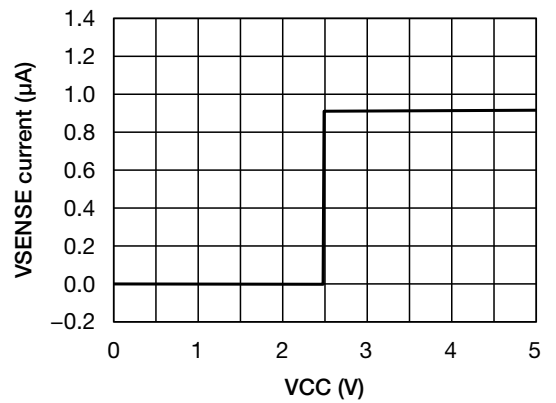
**RICHG voltage - Charge current**



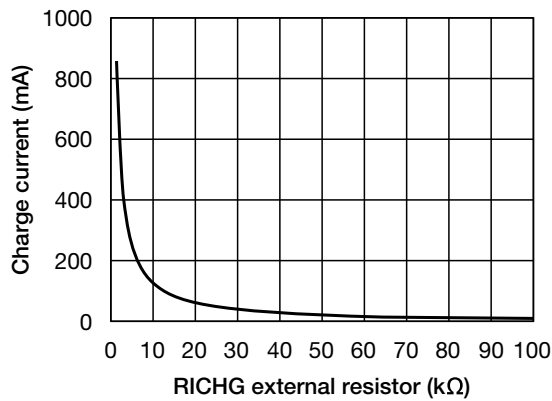
**Supply current - VCC**



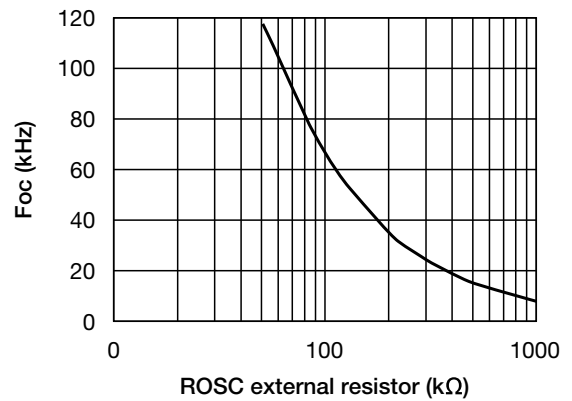
**VSENSE current - VCC**



**Charge current - RICHG external resistor**



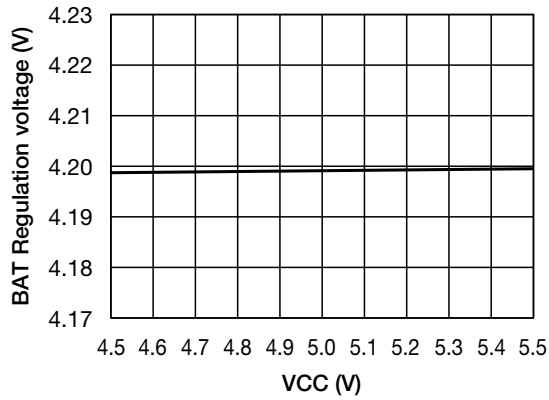
**Foc - ROSC external resistor**



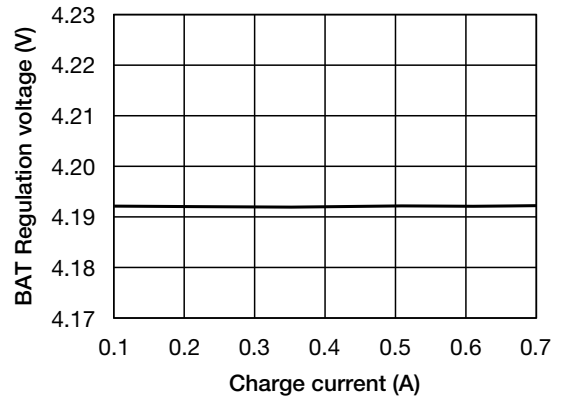
Note : \* These are typical characteristics.

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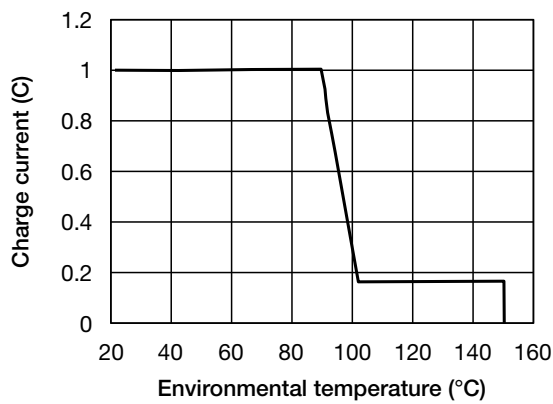
■ Line regulation



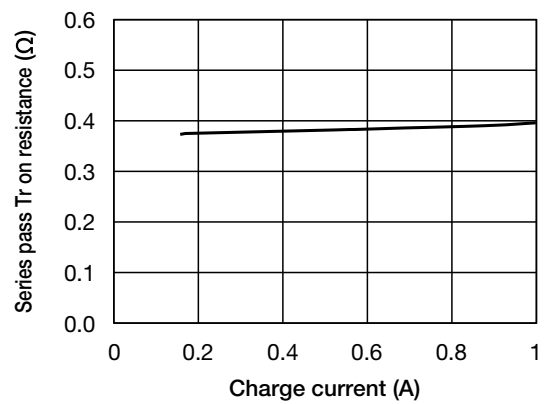
■ Load regulation



■ Chip temperature control · Thermal shutdown



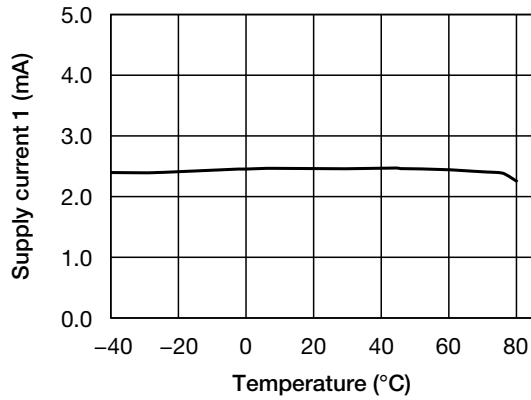
■ Series pass Tr on resistance - Charge current



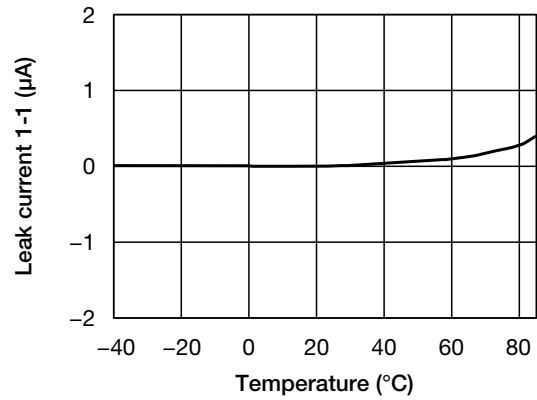
note : \* These are typical characteristics.

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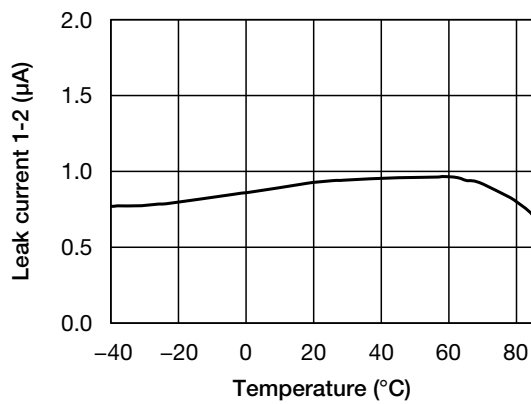
Supply current



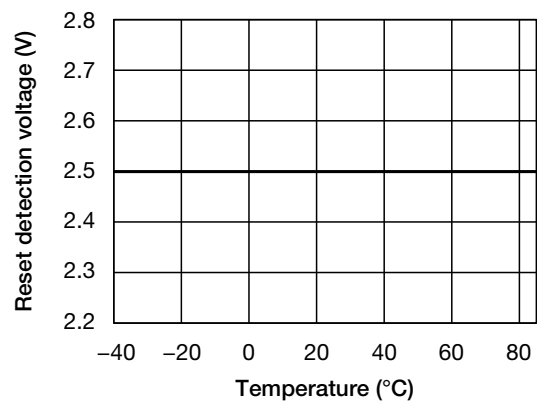
Leak current 1-1



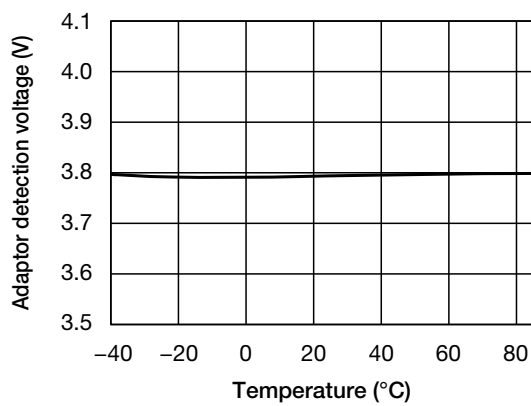
Leak current 1-2



Reset detection voltage



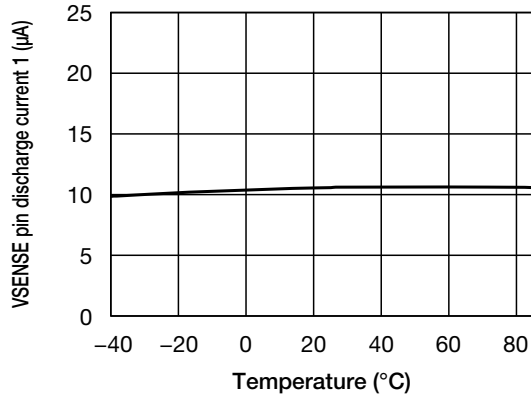
Adaptor detection voltage



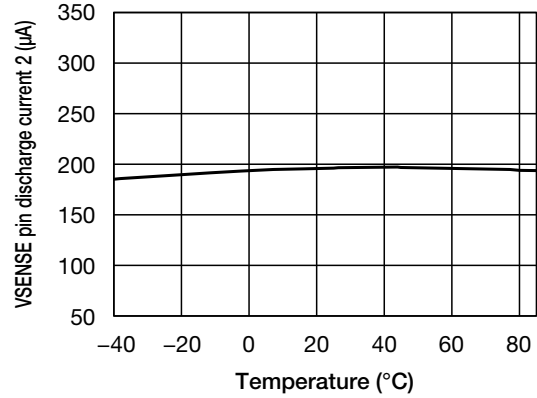
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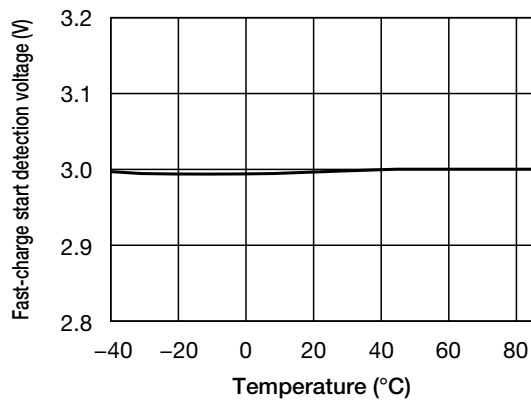
■ VSENSE pin discharge current 1



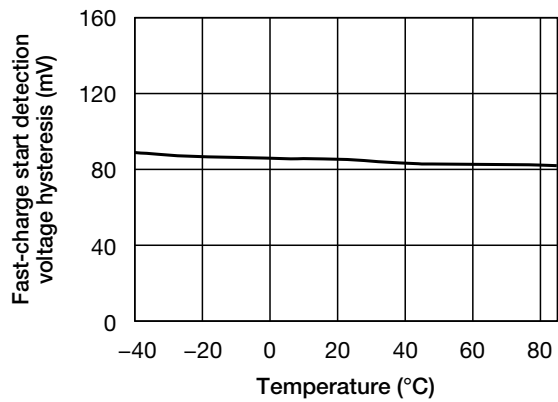
■ VSENSE pin discharge current 2



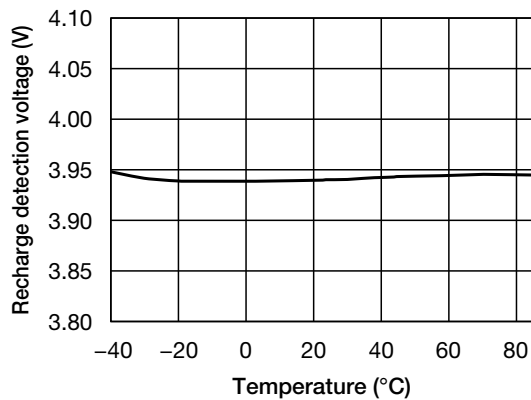
■ Fast-charge start detection voltage



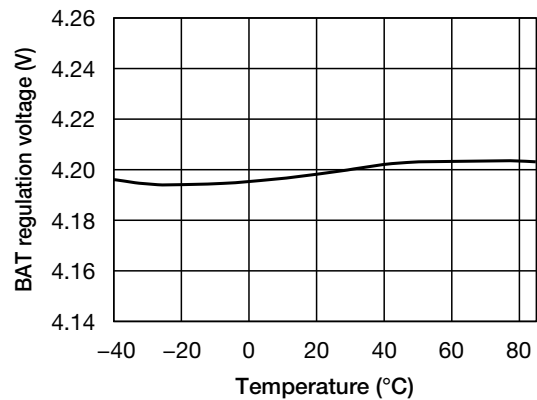
■ Fast-charge start detection voltage hysteresis



■ Recharge detection voltage



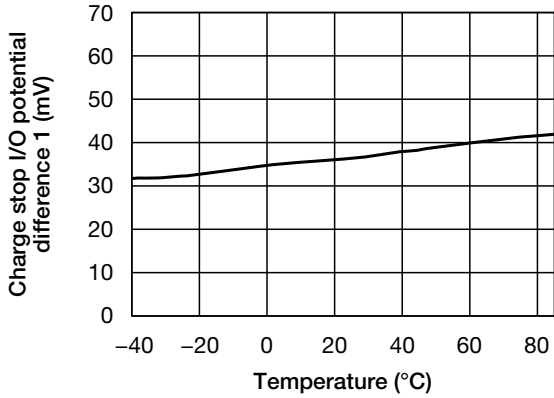
■ BAT regulation voltage



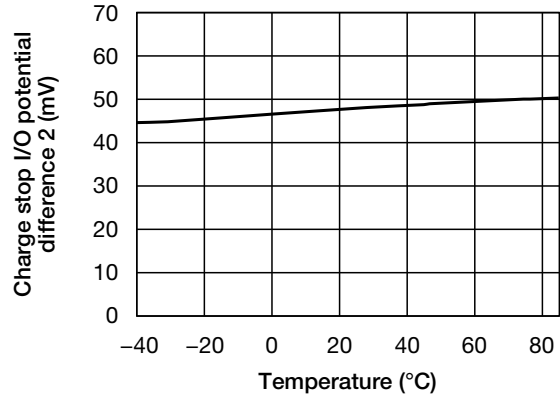
Note : \* These are typical characteristics.

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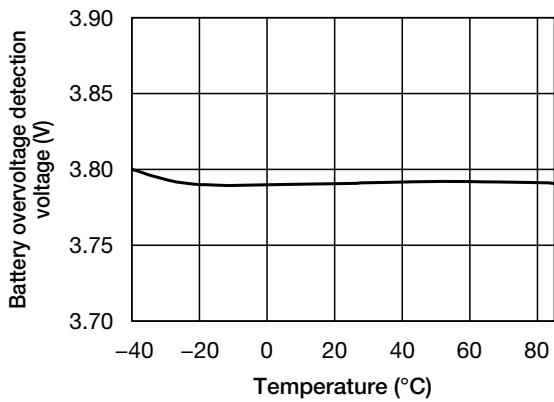
■ Charge stop I/O potential difference 1



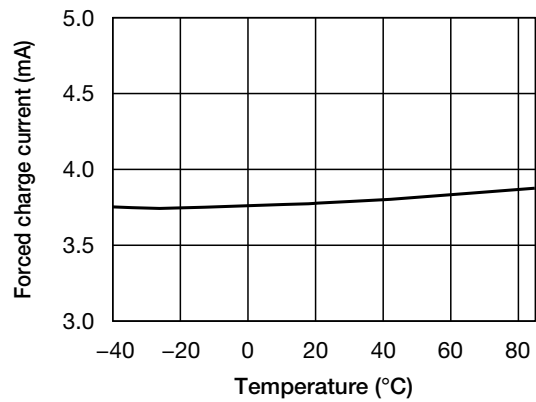
■ Charge stop I/O potential difference 2



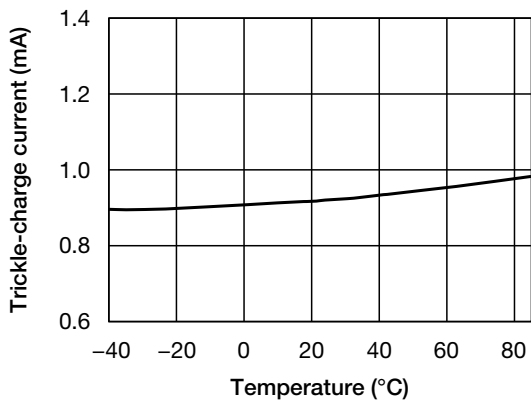
■ Battery overvoltage detection voltage



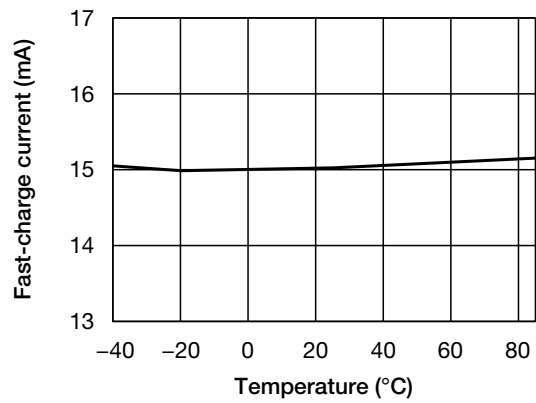
■ Forced charge current



■ Trickle charge current



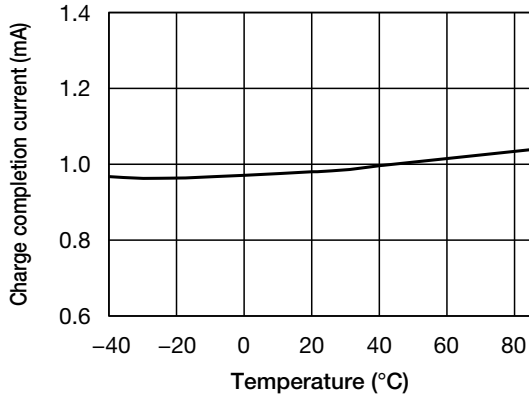
■ Fast-charge current



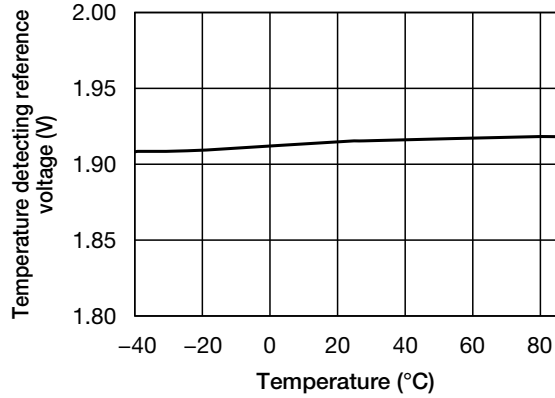
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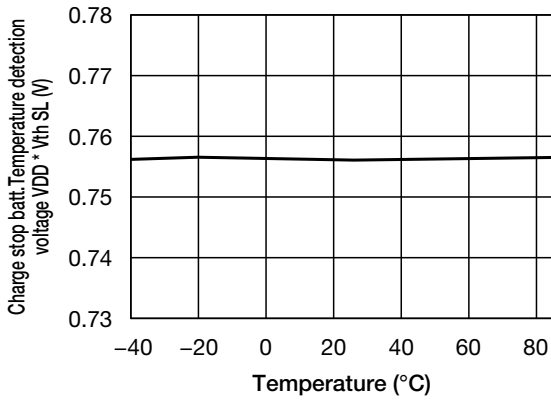
■ Charge completion current



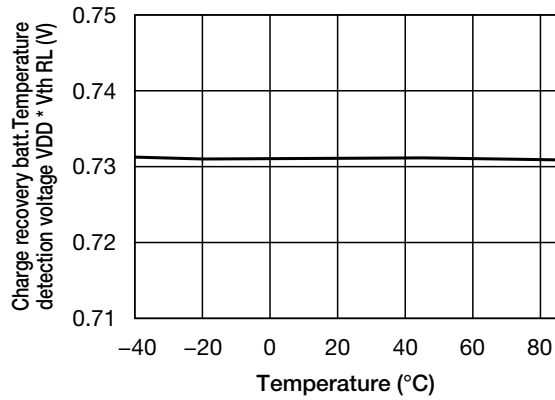
■ Temperature detecting reference voltage



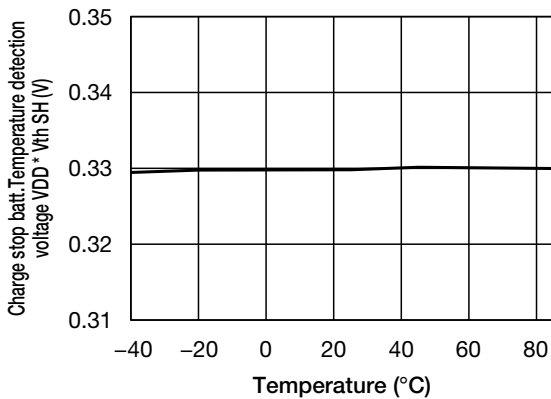
■ Charge stop Batt. temperature detection voltage (Low temperature)



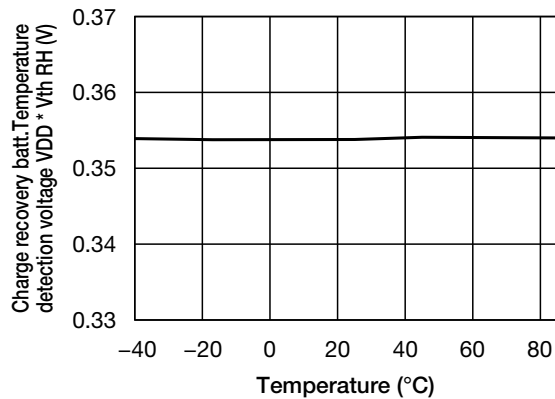
■ Charge recovery Batt. temperature detection voltage (Low temperature)



■ Charge stop Batt. temperature detection voltage (High temperature)



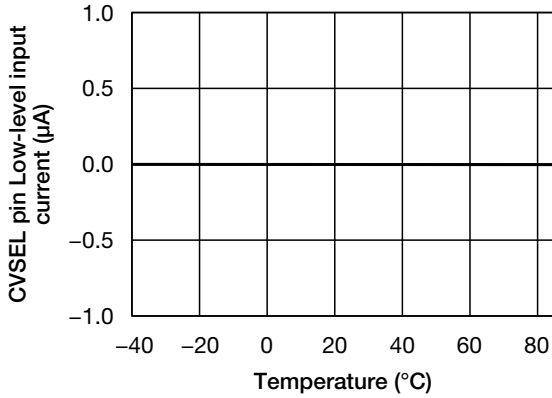
■ Charge recovery Batt. temperature detection voltage (High temperature)



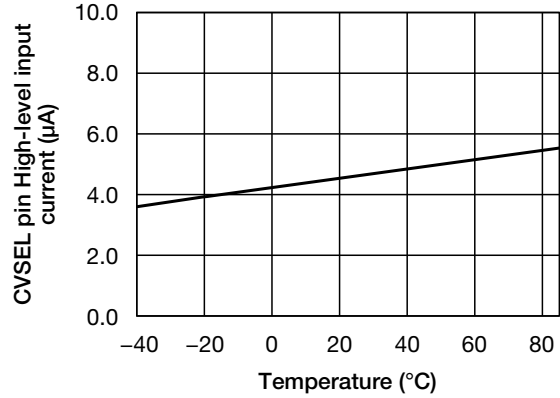
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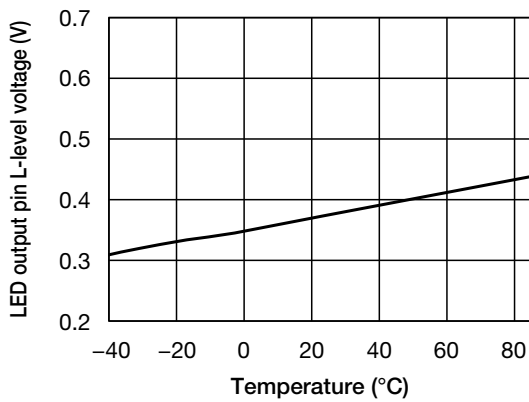
■ CVSEL pin Low-level input current



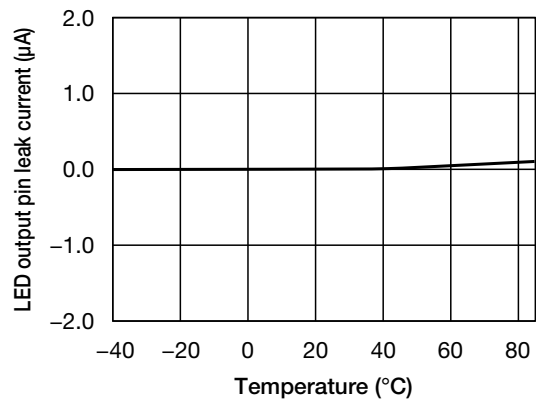
■ CVSEL pin High-level input current



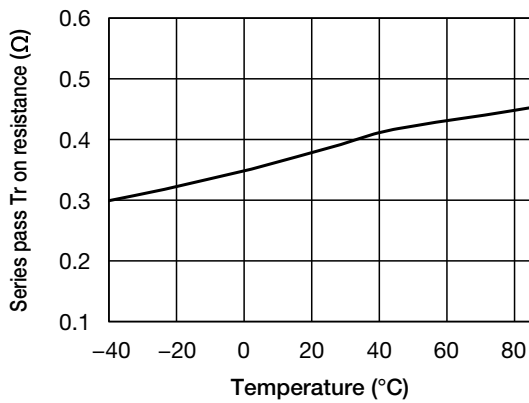
■ LED output pin Low-level voltage



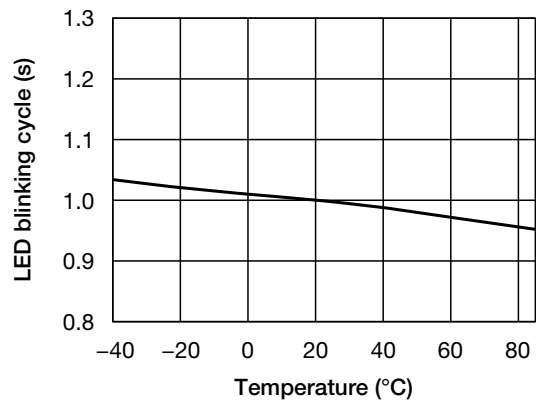
■ LED output pin leak current



■ Series pass Tr on resistance



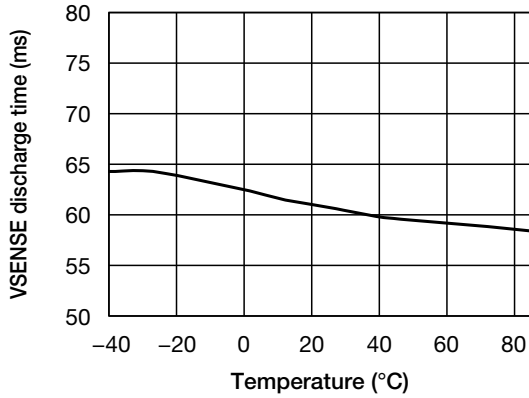
■ LED blinking cycle



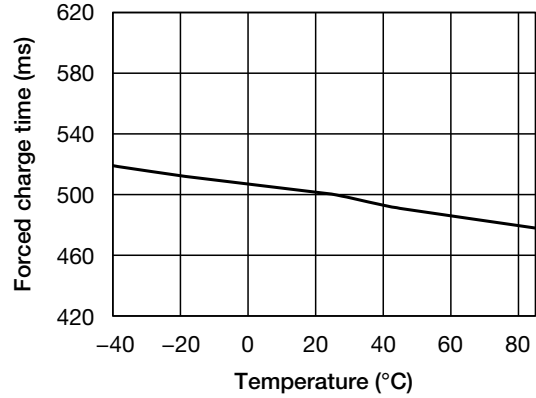
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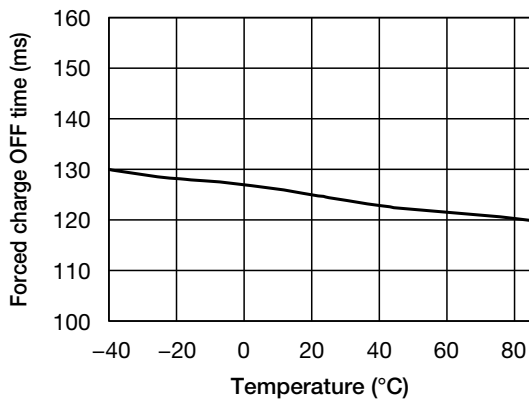
■ VSENSE pin discharge time



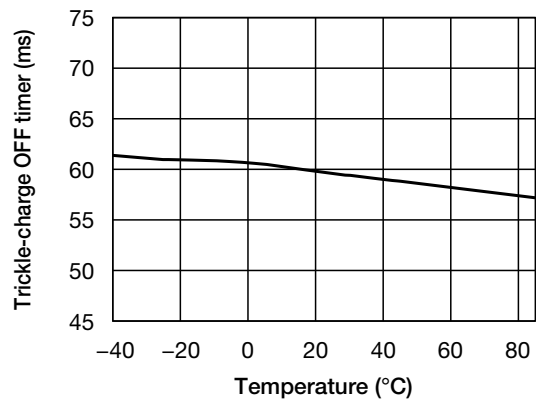
■ Forced charge time



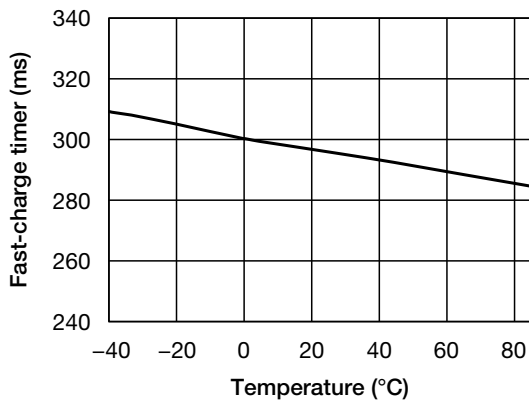
■ Forced charge OFF time



■ Trickle-charge timer



■ Fast-charge timer

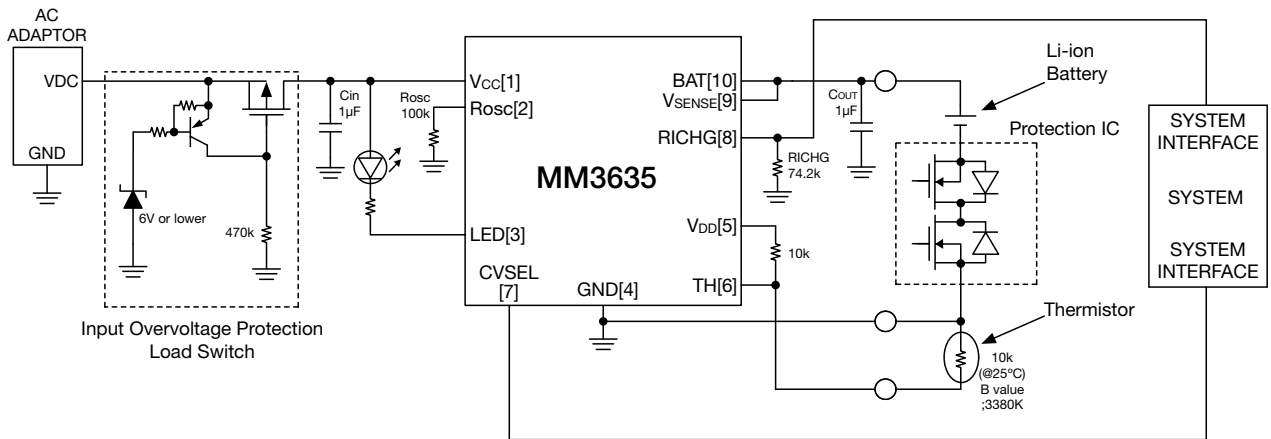


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Application Circuit



- We 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.