To all our customers

Regarding the change of names mentioned in the document, such as Mitsubishi Electric and Mitsubishi XX, to Renesas Technology Corp.

The semiconductor operations of Hitachi and Mitsubishi Electric were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Mitsubishi Electric, Mitsubishi Electric Corporation, Mitsubishi Semiconductors, and other Mitsubishi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Note : Mitsubishi Electric will continue the business operations of high frequency & optical devices and power devices.

Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

M62242FP

Lithium-Ion BATTERY CHARGER CONTROL IC

Notice:This is not a final specification.
Some parametric limits are subject to change.

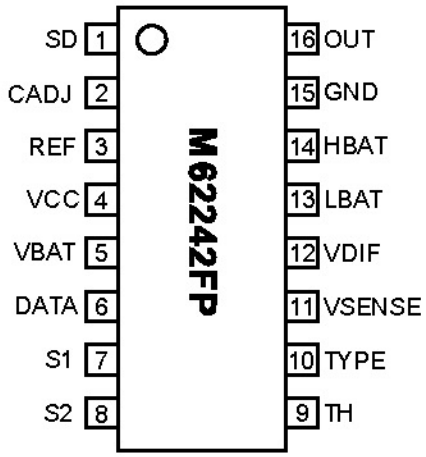
DESCRIPTION

M62242FP is general purpose battery charger designed for 1-2 cell lithium-ion batteries.

Integrating the indispensable circuits for charge control and the interface with MCU[Note1] allows for protections against over-temperature, over-current, and over-voltage as well as charge control corresponding to the kind of battery by the simplified component design.

Note1) Recommended MCU : M34501

PIN configuration(Top view)



Outline 16P2E-A

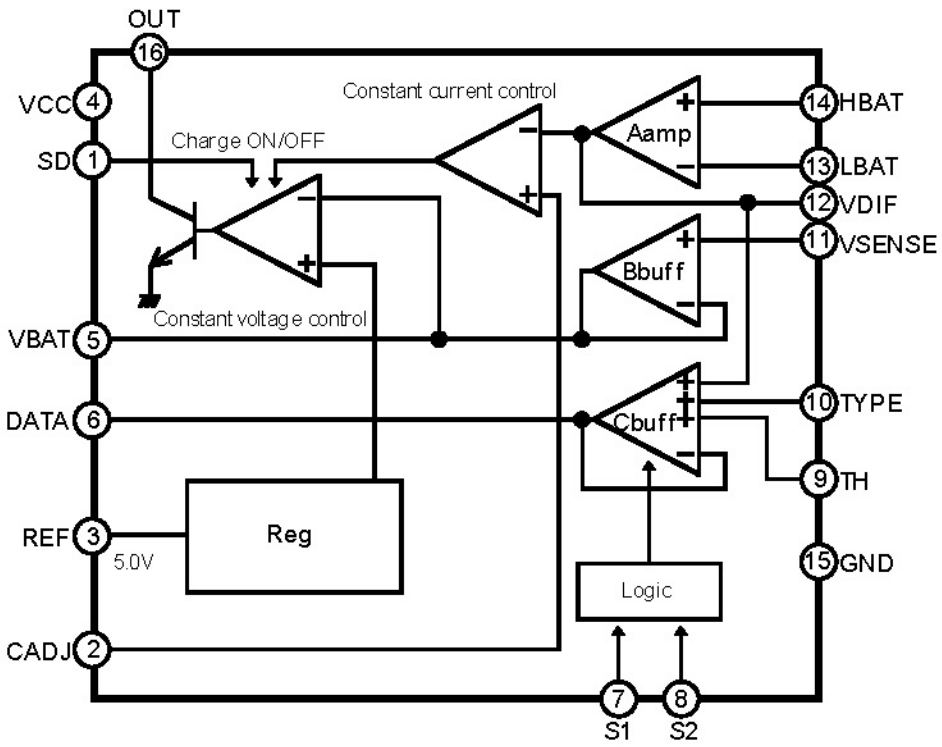
FEATURE

- Built-in accurate reference voltage for full charge detection (4.2V±30mV accuracy, prepared for 4.1V battery voltage)
- Built-in 5V power supply for MCU
- Using with MCU , various charge flow are available.
- Small size 16-pin SSOP package

APPLICATION

Hand held equipments and general battery charger for other digital equipments, etc.

BLOCK DIAGRAM



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DESCRIPTION OF TERMINALS

<table>
<tr><th>Pin</th><th>Name</th><th>I/O</th><th>Function</th></tr>
<tr><td>1</td><td>SD</td><td>I</td><td>Charge ON/OFF pin.
L: charge on H:charge off</td></tr>
<tr><td>2</td><td>CADJ</td><td>I</td><td>Charge current set pin.
Charge current depends on CADJ-pin voltage.For example, setting current detection resistance(Rs) = 0.1Ω , Amplification rate determined by the external resistances = 20 times, and CADJ-pin voltage = 1.62V yields
Charge current = 600mA <1.62-0.42(offset)=0.1*Charge current*20></td></tr>
<tr><td>3</td><td>REF</td><td>O</td><td>Reference voltage output pin.
REF-pin outputs 5.0V reference voltage for MCU and other detector.</td></tr>
<tr><td>4</td><td>VCC</td><td>-</td><td>Power supply.</td></tr>
<tr><td>5</td><td>VBAT</td><td>O</td><td>Battery voltage output pin.</td></tr>
<tr><td>6</td><td>DATA</td><td>I</td><td rowspan="3">Select pin of DATA output.
The output of DATA-pin depends on the conditions of S1,S2-pin.(Noted right figure)
<table>
<tr><td></td><td colspan="2">Input</td><td>Output</td></tr>
<tr><td>Pin name</td><td>S1</td><td>S2</td><td>DATA</td></tr>
<tr><td rowspan="3">Condition</td><td>L</td><td>H</td><td>TYPE</td></tr>
<tr><td>H</td><td>L</td><td>TH</td></tr>
<tr><td colspan="2">other</td><td>VDIF</td></tr>
</table></td></tr>
<tr><td>7</td><td>S1</td><td>I</td></tr>
<tr><td>8</td><td>S2</td><td>O</td></tr>
<tr><td>9</td><td>TH</td><td>I</td><td>Battery temperature input pin.
Reference voltage divided by external resistance and thermistor is input to TH-pin.</td></tr>
<tr><td>10</td><td>TYPE</td><td>I</td><td>Input pin detecting the kind of battery
Reference voltage divided by resistance detecting the kind of battery and external resistance is input to TYPE-pin.</td></tr>
<tr><td>11</td><td>VSENSE</td><td>I</td><td>Battery voltage input pin
Charge voltage is controlled by the comparison between half of VSENSE-pin voltage and 2.1V(inside reference voltage).</td></tr>
<tr><td>12</td><td>VDIF</td><td>O</td><td rowspan="3">Charge current detection pin
Amplified differential voltage, between the current detection resistor(Rs), with the amplification ratio set by the external resistor between HBAT and LBAT is output to VDIF terminal. Charge current is controlled by the comparison of VDIF-pin voltage and CADJ-pin voltage.</td></tr>
<tr><td>13</td><td>LBAT</td><td>I</td></tr>
<tr><td>14</td><td>HBAT</td><td>I</td></tr>
<tr><td>15</td><td>GND</td><td>-</td><td>Ground pin</td></tr>
<tr><td>16</td><td>OUT</td><td>O</td><td>Output pin for charge control
Constant voltage/current charge is done by controlling the gate voltage of external Pch-Tr(PNP-Tr).</td></tr>
</table>

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ABSOLUTE MAXIMUM RATINGS (Ta=25°C VCC=8V,unless otherwise noted)

Parameter	Symbol	Ratings	Unit	Notes
Supply voltage	Vmax	16.0	V	
Power dissipation	Pd	590	mW	This is in the typical condition.(the velocity of the wind is 1m/sec.) Power dissipation is changed by materials of the assembled board and the velocity of the wind.
Operating temperature	Topr	-20~+75	°C	
Storage temperature	Tstg	-40~+125	°C	
OUT pin driving current	Idout	50.0	mA	
REF pin output current	Iref	10.0	mA	

ELECTRICAL CHARACTERISTICS (Ta=25°C VCC=8V,unless otherwise noted)

Block	Parameter	Symbol	Limits			Unit	Notes
			Min.	Typ.	Max.		
Total	Power supply	Vcc	5.3		15.0	V	
	Circuit current (normal mode)	Icc	1.0	2.0	3.0	mA	
	REF-pin referential voltage	Vref	4.88	5.00	5.12	V	Iout=5mA
	Charge control voltage	Vchg	4.17(4.07)	4.20(4.10)	4.23(4.13)	V	4.2Vbattery(4.1Vbattery)
Aamp	VDIF-pin output offset voltage	Vdifo		460		mV	Set at 20 times
	H,LBAT-pin Input bias current	Ihlb		200	400	nA	
	VDIF-pin Output dynamic range	Vdifdr	0.3		Vcc-0.3	V	
Bbuff	VBAT-pin input offset voltage	Vbato	-5	0	5	mV	
	VSENSE-pin Input bias current	Ivsenseb		-50	-100	nA	
	VBAT-pin Output dynamic range	Vbatdr	1.0		Vcc-0.3	V	
Cbuff	DATA-pin Input offset voltage	Vdatao	-5	0	5	mV	
	TYPE,TH,VDIF-pin Input bias current	Ittvb		50	100	nA	
	DATA-pin Output dynamic range	Vdatadr	0.3		Vcc-1.0	V	
Logic	S1,S2 "H"voltage	Vlogich	1.0		REF	V	Same voltage when S1,S2-pin are open.
	S1,S2 "L"voltage	Vlogicl	0		0.5	V	
Out	OUT-pin Output low voltage	Vout			0.6	V	Iout=30mA

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FUNCTIONAL DESCRIPTION

(Each voltage written in following are set in application example)

The value of each timer , over-voltage,low-voltage, over-current and charge full-current etc, are set by MCU.

1.Function of charging(SD="L")

(1) Detection of the battery connection / the battery temperature.When (S1,S2)=(H,L), TH-pin voltage is output from DATA-pin. TH-pin voltage is used for the detection of the battery connection and battery temperature. MCU recognizes the battery connection and the battery temperature. (Noted figure1.)

(2) Detection of the battery type
TYPE-pin voltage is detected to recognize a battery type. When (S1,S2)=(L,H), TYPE-pin voltage is output from DATA-pin. The recognition of the battery type by MCU selects the suitable charge flow. (Note figure1.)

(3) Detection of battery voltage
Since VSENSE-pin voltage(the battery voltage) is always output to VBAT-pin, MCU can always detect the battery voltage.

(4) Set and Control of the charge current
This IC performs the constant charge current function to make CADJ-pin voltage equal to the value (0.1Ω*charge current*20 + offset voltage).
Detecting the offset voltage by MCU after connecting a battery and revising give highly accurate minute current detection. By changing CADJ-pin voltage after detecting the type, the temperature and the voltage of battery by MCU, the charge current can be set arbitrary.

0.1Ω : current detection resistance Rs
20 : Amplication rate determined by external resistances connected to HBAT and LBAT-pin

(5) Control of charge voltage
Charge voltage is controlled by the comparison between the battery voltage and inside reference voltage.

(6) The charge completion
DATA-pin outputs VDIF-pin voltage (which corresponds to charge current) when (S1,S2)=(L,L) or (H,H). If DATA-pin voltage drops below the charge completion voltage, MCU stops charging.

(7) Function of protect
In the following condition, MCU stops charging for battery protection by monitoring the VBAT-pin and the DATA-pin voltage.
Example
* Battery voltage is less than 1.0V (Low-voltage NG)
* Battery voltage is more than 4.5V (Over-voltage NG)
* Charge current is more than 1.2A (Over-current NG)
* Battery temperature is less than -10℃ and more than 60℃ (Temperature NG)
* non-charge completion an hour after charge starts (Charge time up)

2.Function of non-charge(SD="H")
In each abnormal states, charge completion state and non-battery state etc, inputting "H" voltage from MCU to SD-pin makes OUT-pin "H" and then the charge function of this IC stops.

3.Function of recharge
VBAT-pin outputs VSENSE-pin voltage continually even after the charge completion. So MCU restarts charging if VSENSE-pin voltage drops below the set voltage by self-discharge etc.

Figure1.S1,S2,DATA function

	Input		Output
Pin name	S1	S2	DATA
Condition	L	H	TYPE
	H	L	TH
	other		VDIF

*DATA outputs 50us after S1 and S2 input

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Flow chart(Noted Equivalent circuit)

Condition	LED Red	LED Green
Charge	on	off
NG	on/off	off
Completion	off	on
Other	off	off

Function of MCU(M34501)

Function of M62242FP

START

(S1,S2)=(H,L) → DATA ⇐ TH outputs(Detection of battery connection)

Battery Connection/ Temperature

No connecting

Connecting

(S1,S2)=(L,H) → DATA ⇐ TYPE outputs(Detection of battery type)

Battery type

TYPE B

TYPE A

(S1,S2)=(L,L) → DATA ⇐ VDIF outputs(Offset revising)

(S1,S2)=(L,L)

Select resistanceB(3.0kΩ)
SD=L(Precharge start)
5 min timer start

OUT"ON"Charge start
208mACharge constant current
(Precharge)

DATA ⇐ Output TH/VDIF-pin by turns.
(Detection of battery temperature / charge current)
VBAT ⇐ Output VSENSE-pin voltage(Detection of battery voltage)

5min timer

over 5min

L.T.30min

NO

VBAT>2.5V

VBAT>3.0V

YES

Select resistanceD(15kΩ)
SD=L(Quick charge start)
1 hour timer start

Select resistanceA(12kΩ)
SD=L(Quick charge start)
1 hour timer start

654mA Constant current charge start
(Quick charge)
763mA Constant current charge start

1 hour timer

over 1hour

L.T.1hour

Ichg*<70mA

Ichg*<50mA

VSENSE=4.2V

4.2V Constant current voltage start

SD=H(charge stop)

OUT="H"
Charge completion

VBAT<3.90V

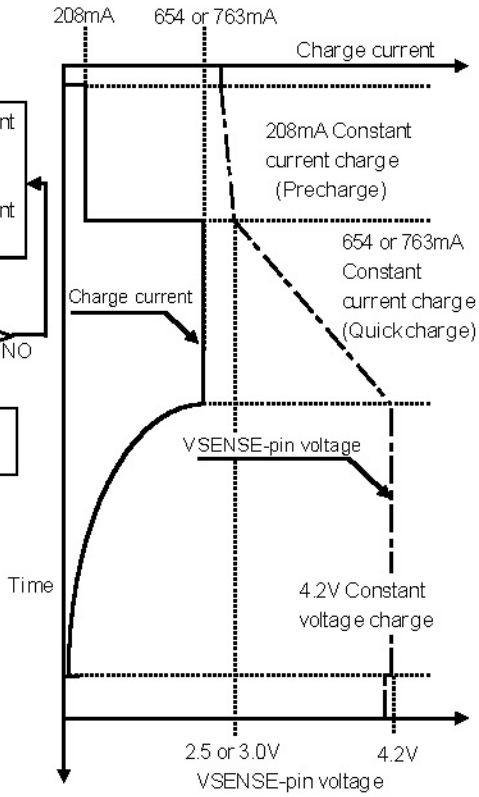
VBAT<3.95V

Recharge

VBAT>4.5V or <1.0V , Ichg*>1.2A
Temperature<-10℃ or >60℃

Noted left is always NG
SD=H(charge stop)

OUT="H"
Charge stop



DATA-pin outputs TYPE/TH/VDIF-pin voltage byturns. VBAT-pin always outputs VSENSE-pin voltage.
Resistance C(1.5kΩ) is selected to charge at 109mA constant current when batteryvoltage is -10℃~0℃ or 50℃~60℃.
Charge stops after recognizing abnormal mode when VBAT>4.5V, VBAT<1.0V, VDIF>3.6V(Ichg*>1.2A), time up,battery temperature <-10℃ or >60℃.
Each detection is decided after coincidence of 3 reading every 0.1s.

Ichg : Charge current

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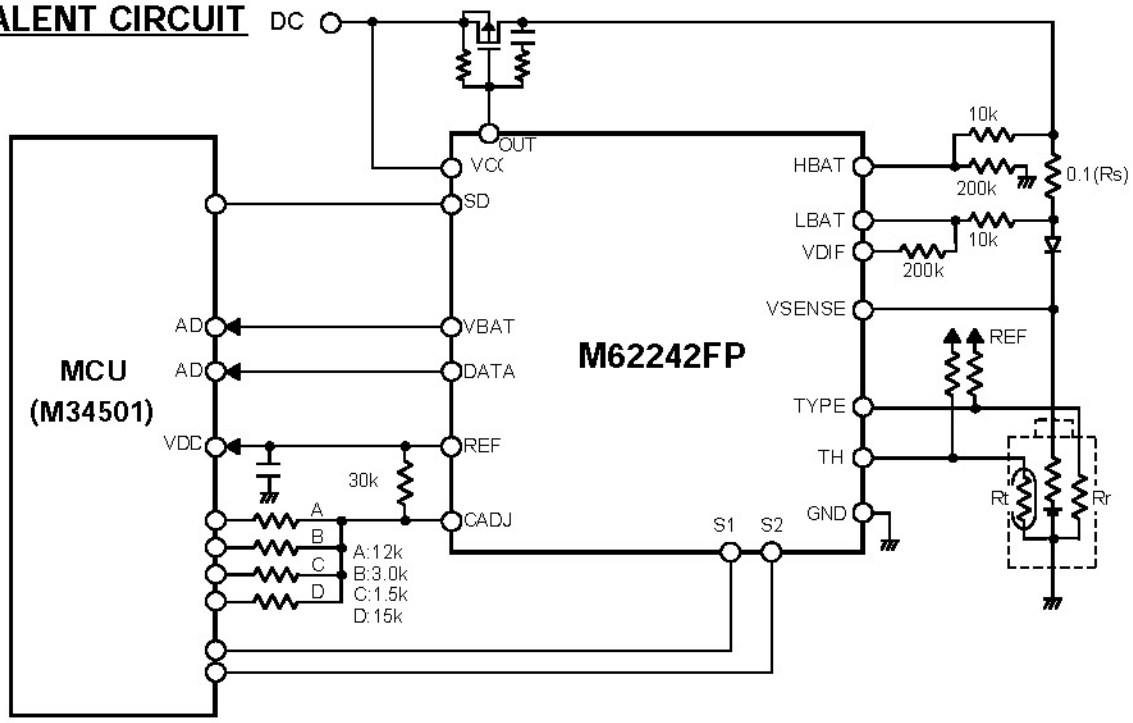
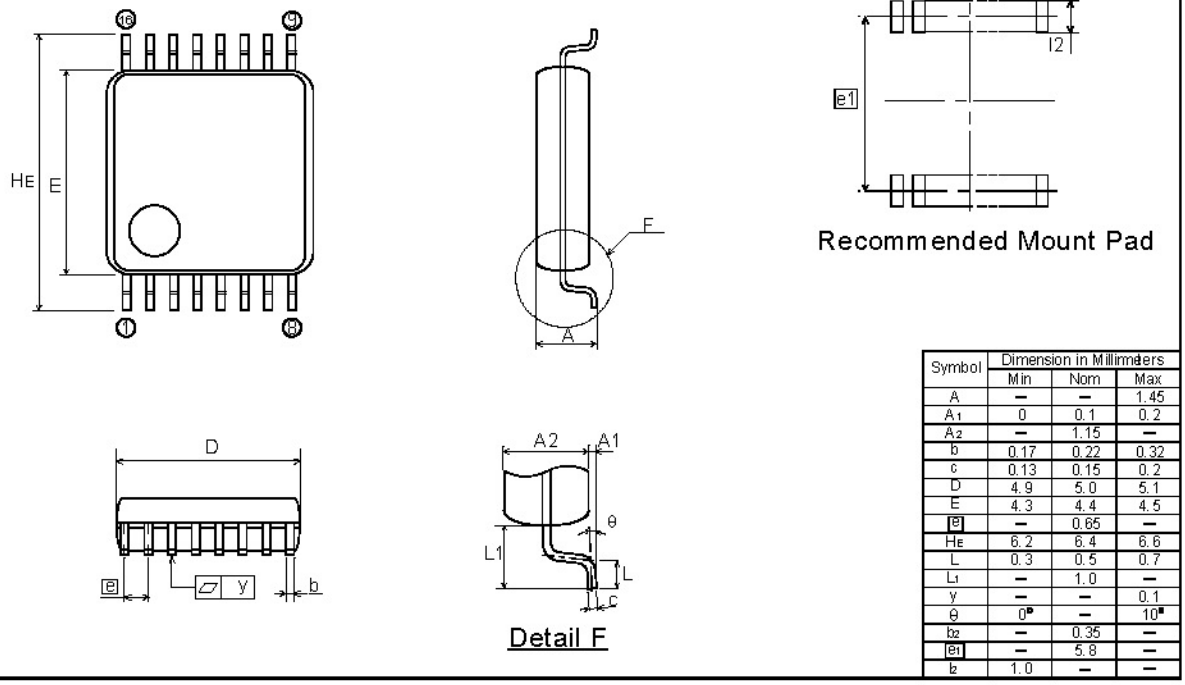
EQUIVALENT CIRCUIT



Package outline

16P2E-A — **Plastic 16pin 225mil SSOP**

EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
SSOP16-P-225-0.65	-	0.06	Alloy42



Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	–	–	1.45
A_1	0	0.1	0.2
A_2	–	1.15	–
b	0.17	0.22	0.32
c	0.13	0.15	0.2
D	4.9	5.0	5.1
E	4.3	4.4	4.5
e	–	0.65	–
H_E	6.2	6.4	6.6
L	0.3	0.5	0.7
L_1	–	1.0	–
y	–	–	0.1
θ	0°	–	10°
b_2	–	0.35	–
e_1	–	5.8	–
l_2	1.0	–	–