

To all our customers

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

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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

# M62254FP

## Standard Battery Charger Controller

### DESCRIPTION

The M62254FP is designed as standard battery charger controller. The M62254FP has functions which require for the battery charge control on single chip. Not only the combination of M62254 and MCU capable of handling battery charge control, but also it is capable of monitoring battery temperature, prevent from over current or voltage, using minimal peripherals. It also has feedback function to the primary source of SW power supply, which can be used to control feedback of charge current and output voltage.

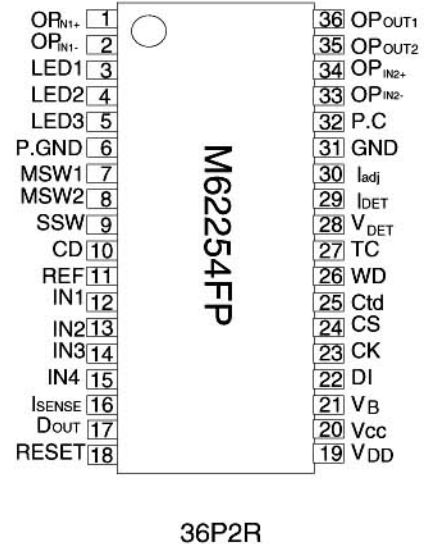
### FEATURE

- Built-in Reset circuit and WDT function
- Built-in Multiplexer and Level magnification circuit with 4 input ports
- Built-in two standard stand alone OPamp
- Built-in Sub-switch circuit with feedback function
- Built-in 3 line serial data interface function
- Built-in Low input/output operation 5V voltage regulator function
- Built-in Charge current/output voltage control circuit

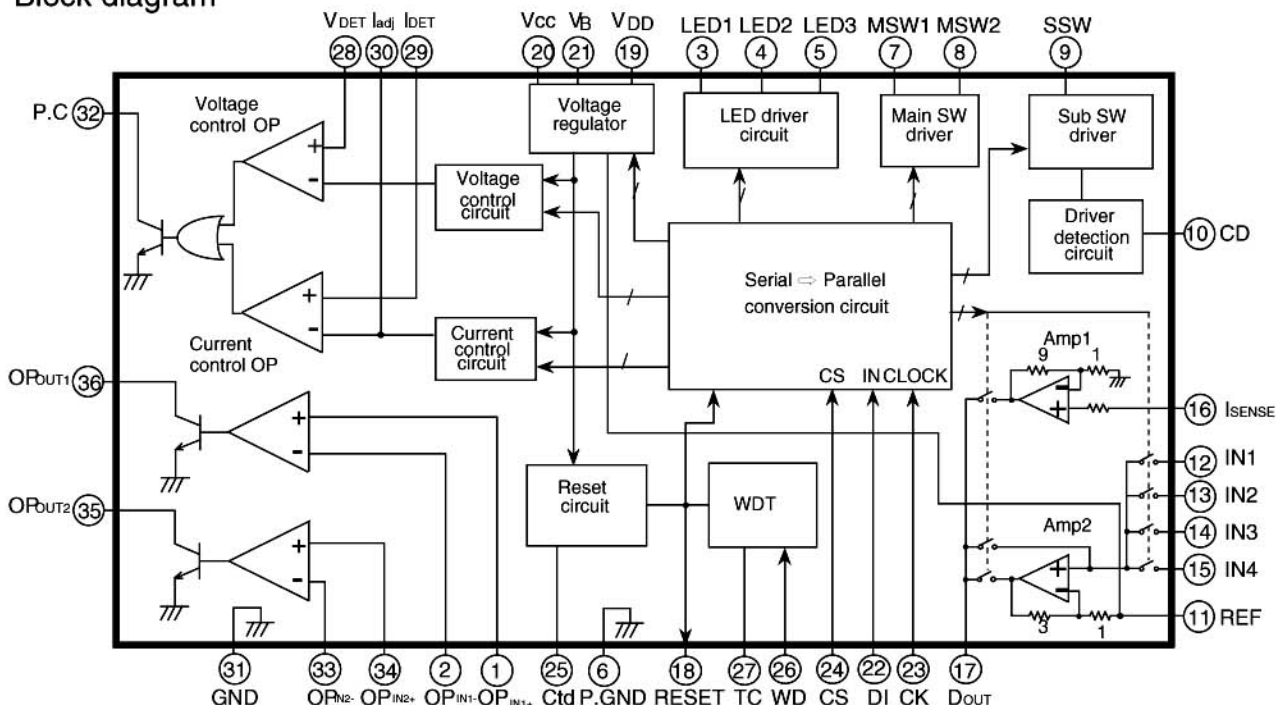
### APPLICATIONS

- Video camera, Hand carry telephone and general battery charger for other digital equipments

Pin layout(Top view)



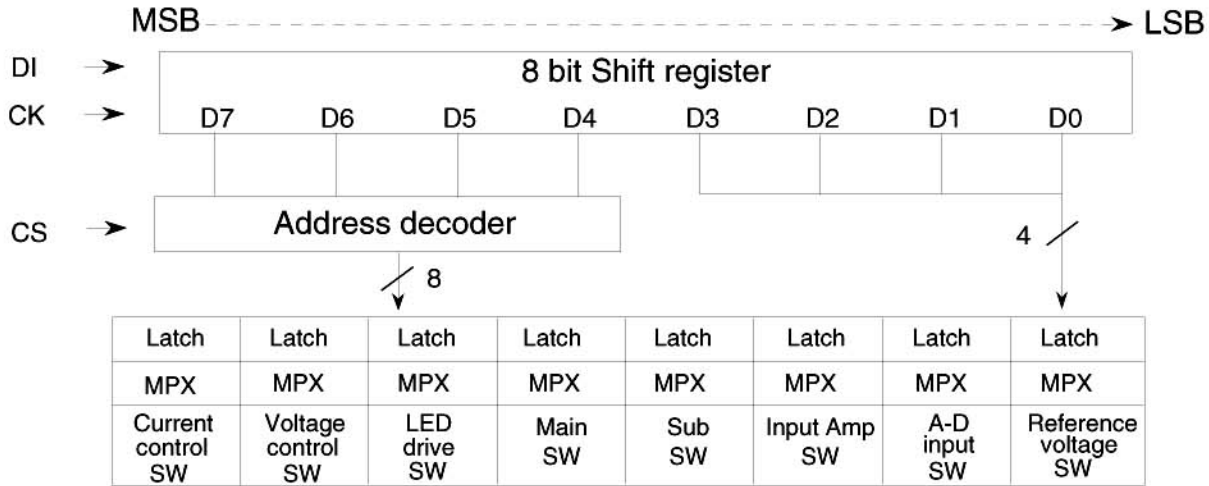
Block diagram



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## «Digital Data Format»



## «Data Setting»

| Control Function     | Address |    |    |    | Data |    |    |    | Description                                                                             |
|----------------------|---------|----|----|----|------|----|----|----|-----------------------------------------------------------------------------------------|
|                      | D7      | D6 | D5 | D4 | D3   | D2 | D1 | D0 |                                                                                         |
| RESET                | 0       | 0  | 0  | 0  | -    | -  | -  | -  | All SW is OFF<br>A-D reference voltage=0.4V<br>Voltage setting reference voltage = 4.0V |
| Current control      | 0       | 0  | 0  | 1  | -    | -  | -  | -  | See Table 1                                                                             |
| Voltage control      | 0       | 0  | 1  | 0  | -    | -  | -  | -  | See Table 2                                                                             |
| LED driver select    | 0       | 0  | 1  | 1  | -    | -  | -  | -  | See Table 3                                                                             |
| Main SW              | 0       | 1  | 0  | 0  | -    | -  | -  | -  | See Table 4                                                                             |
| Sub SW               | 0       | 1  | 0  | 1  | -    | -  | -  | -  | See Table 5                                                                             |
| Amp.select           | 0       | 1  | 1  | 0  | -    | -  | -  | -  | See Table 6                                                                             |
| A-D input select     | 0       | 1  | 1  | 1  | -    | -  | -  | -  | See Table 7                                                                             |
| A-D Reference select | 1       | 0  | 0  | 0  | -    | -  | -  | -  | See Table 8                                                                             |

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Table1: Current control data

| D3 | D2 | D1 | D0 | Current control OPamp input voltage | Current Ratio |
|----|----|----|----|-------------------------------------|---------------|
| 0  | 0  | 0  | 0  | 0V                                  | 0             |
| 0  | 0  | 0  | 1  | 20mV                                | 1/16          |
| 0  | 0  | 1  | 0  | 40mV                                | 1/8           |
| 0  | 0  | 1  | 1  | 80mV                                | 1/4           |
| 0  | 1  | 0  | 0  | 160mV                               | 1/2           |
| 0  | 1  | 0  | 1  | 240mV                               | 3/4           |
| 0  | 1  | 1  | 0  | 320mV                               | 1             |
| 0  | 1  | 1  | 1  | –                                   | Trickle       |

\* During trickle charge, use constant voltage mode and charge directly to the battery using external resistor

\* 20mV is selected at RESET

Table2: Voltage control data

| D3 | D2 | D1 | D0 | Voltage control OPamp input voltage | Voltage Ratio |
|----|----|----|----|-------------------------------------|---------------|
| 0  | 0  | 0  | 0  | 0V                                  | 10            |
| 0  | 0  | 0  | 1  | 0.4V                                | 1             |
| 0  | 0  | 1  | 0  | 0.8V                                | 2             |
| 0  | 0  | 1  | 1  | 1.2V                                | 3             |
| 0  | 1  | 0  | 0  | 1.6V                                | 4             |
| 0  | 1  | 0  | 1  | 2.0V                                | 5             |
| 0  | 1  | 1  | 0  | 2.4V                                | 6             |
| 0  | 1  | 1  | 1  | 2.8V                                | 7             |
| 1  | 0  | 0  | 0  | 3.2V                                | 8             |
| 1  | 0  | 0  | 1  | 3.6V                                | 9             |
| 1  | 0  | 1  | 0  | 4.0V                                | 10            |
| 1  | 0  | 1  | 1  | 4.4V                                | 11            |
| 1  | 1  | 0  | 0  | 4.8V                                | 12            |

\* Output port of MCU can be used to control the voltage and current settings

\* 4.0V is selected at RESET

Table3: LED driver select

| D2 | D1 | D0 | LED3 | LED2 | LED1 |
|----|----|----|------|------|------|
| 0  | 0  | 0  | OFF  | OFF  | OFF  |
| 0  | 0  | 1  | OFF  | OFF  | ON   |
| 0  | 1  | 0  | OFF  | ON   | OFF  |
| 0  | 1  | 1  | OFF  | ON   | ON   |
| 1  | 0  | 0  | ON   | OFF  | OFF  |
| 1  | 0  | 1  | ON   | OFF  | ON   |
| 1  | 1  | 0  | ON   | ON   | OFF  |
| 1  | 1  | 1  | ON   | ON   | ON   |

Table4: Main SW

| D1 | D0 | SW1        | SW2 |
|----|----|------------|-----|
| 0  | 0  | OFF        | OFF |
| 0  | 1  | OFF        | ON  |
| 1  | 0  | ON         | OFF |
| 1  | 1  | Not Select |     |

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Table5: Sub SW

| D0 | SW  |
|----|-----|
| 0  | OFF |
| 1  | ON  |

Table6: Amp. select

| D1 | D0 | State              |
|----|----|--------------------|
| 0  | 0  | Select Amp1 output |
| 0  | 1  | Select Amp2 input  |
| 1  | 0  | Select Amp2 output |

\* Amp1 output is selected at RESET

Table7: A-D input select

| D1 | D0 | State          |
|----|----|----------------|
| 0  | 0  | Select input 1 |
| 0  | 1  | Select input 2 |
| 1  | 0  | Select input 3 |
| 1  | 1  | Select input 4 |

\* Input 1 is selected at RESET

Table8: A-D Reference voltage select

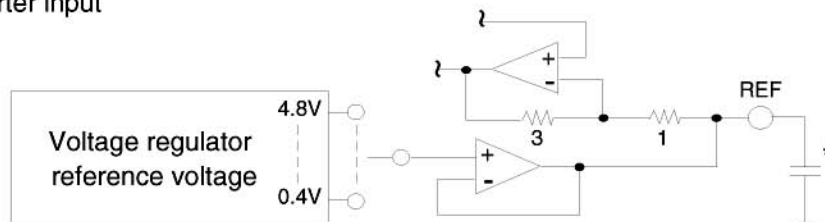
| D3 | D2 | D1 | D0 | State       |
|----|----|----|----|-------------|
| 0  | 0  | 0  | 0  | Select 0V   |
| 0  | 0  | 0  | 1  | Select 0.4V |
| 0  | 0  | 1  | 0  | Select 0.8V |
| 0  | 0  | 1  | 1  | Select 1.2V |
| 0  | 1  | 0  | 0  | Select 1.6V |
| 0  | 1  | 0  | 1  | Select 2.0V |
| 0  | 1  | 1  | 0  | Select 2.4V |
| 0  | 1  | 1  | 1  | Select 2.8V |
| 1  | 0  | 0  | 0  | Select 3.2V |
| 1  | 0  | 0  | 1  | Select 3.6V |
| 1  | 0  | 1  | 0  | Select 4.0V |
| 1  | 0  | 1  | 1  | Select 4.4V |
| 1  | 1  | 0  | 0  | Select 4.8V |

\* 0.4V is selected at RESET

Note: All outputs will be OFF at RESET

## «Function block descriptions»

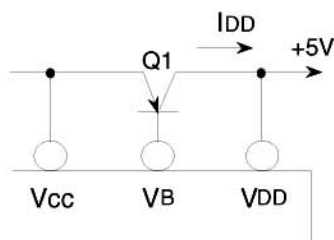
## (1) A-D converter input



\*Connect few 1000pF capacitor to stabilize the reference voltage

Select the desire reference voltage to be detected by serial data from the MCU. The input voltage level of IN1~IN4 will be magnified 4 times using selected reference voltage as a center. This magnified data will be return to the A-D input port of the MCU. As result, accuracy of the A-D converter of the MCU will be increased by 2 bit.

## (2) +5V voltage regulator



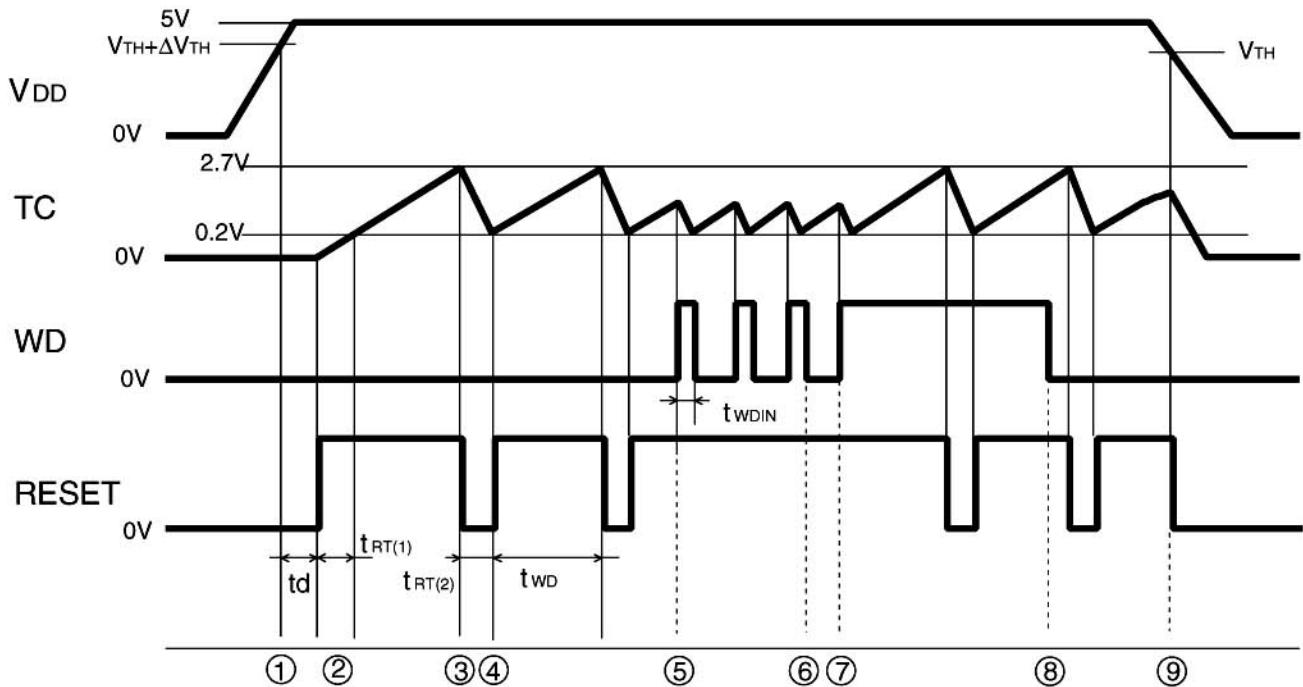
since it is capable of driving external PNP Tr. base up to 20mA, it can supply current of  $I_{DD\ MAX} = 20mA \times Q1hFE$ .

Also, since this is low I/O type power source, it can operate  $V_{CC\ MIN} = V_{CC} - V_{DD} = 0.1V$ .

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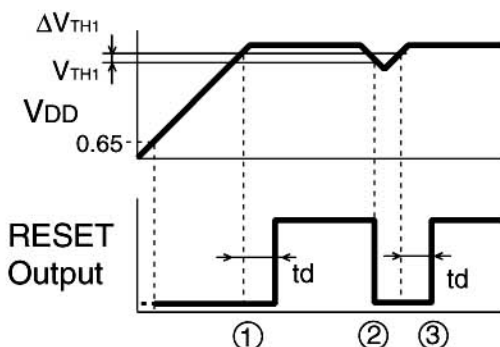
## Standard Battery Charger Controller

## (3) Watch Dog Timer



- ① When VDD reaches 4.75V ( $V_{TH1} + \Delta V_{TH1}$ ); after fixed amount of time ( $t_d$ ), Reset pin outputs "High" and begin charging of the condenser connected TC pin.
- ② ③ When TC pin reaches 2.7V ( $V_{TH2(H)}$ ); the condenser connected TC pin begin discharge, and the Reset pin outputs "Low". During the Reset outputs "High" for the first time; the time of charge will be  $t_{WD} + t_{RT(1)}$ , since TC pin begin charging its condenser starting from 0V.
- ④ When TC pin drops to 0.2V ( $V_{TH2(L)}$ ); the Reset will outputs "High" again. At same time, TC pin will begin charging again. Unless correct clock input is given to WD pin, the TC pin will repeats the charging from 0.2V to 2.7V, and the Reset will also repeats "High" during the two cycle, and "Low" during  $t_{RT(2)}$  cycle.
- ⑤ ⑥ When correct clock input is given to WD pin before TC pin reaches 2.7V, the Reset holds "High" output.
- ⑦ ⑧ When incorrect clock is given to WD pin, the TC pin will repeats the charging from 0.2V to 2.7V, and the Reset will also repeats "High" during the  $t_{WD}$  cycle, and "Low" during  $t_{RT(2)}$  cycle.
- ⑨ When VDD drops down to 4.25V ( $V_{TH1}$ ), the Reset circuit will function, and it will output "Low" to Reset pin and TC pin changes to discharging state.

## (4) Reset circuit



- ① When VDD reaches 4.75V ( $V_{TH1} + \Delta V_{TH1}$ ), the Reset outputs "High" after fixed amount of time ( $t_d$ ).
- ② When VDD drops below 4.25V ( $V_{TH1}$ ), the Reset outputs "Low".
- ③ When VDD reaches 4.75V ( $V_{TH1} + \Delta V_{TH1}$ ) again, the Reset outputs "High" after fixed amount of time ( $t_d$ ). Also, Reset output will be "Low" until VDD reaches 0.65V(typ).

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## Word description:

- $t_d$  : The time after  $V_{DD}$  reaching Reset release voltage to "High" Reset output.  
 $t_{RT(1)}$  : The time TC pin voltage changes from 0V to  $V_{TH2(L)}$ , when  $V_{DD}$  is given.  
 $t_{WD}$  : The time TC pin voltage changes from  $V_{TH2(L)}$  to  $V_{TH2(H)}$ .  
 $t_{RT(2)}$  : The time TC pin voltage changes from  $V_{TH2(H)}$  to  $V_{TH2(L)}$ .

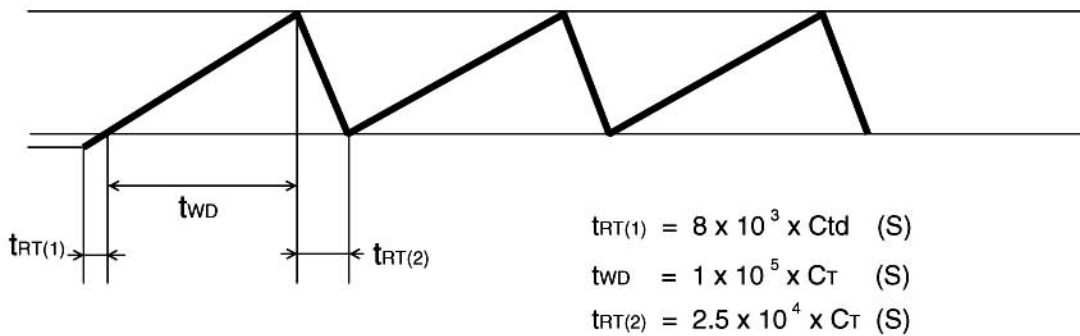
1. Regarding the pin (25) (Ctd pin) capacity and the delay time ( $t_d$ )

The delay time ( $t_d$ ) of Reset output can be found using following equation.

$$t_d = 2 \times 10^5 \times C_{td} \text{ (S)}$$

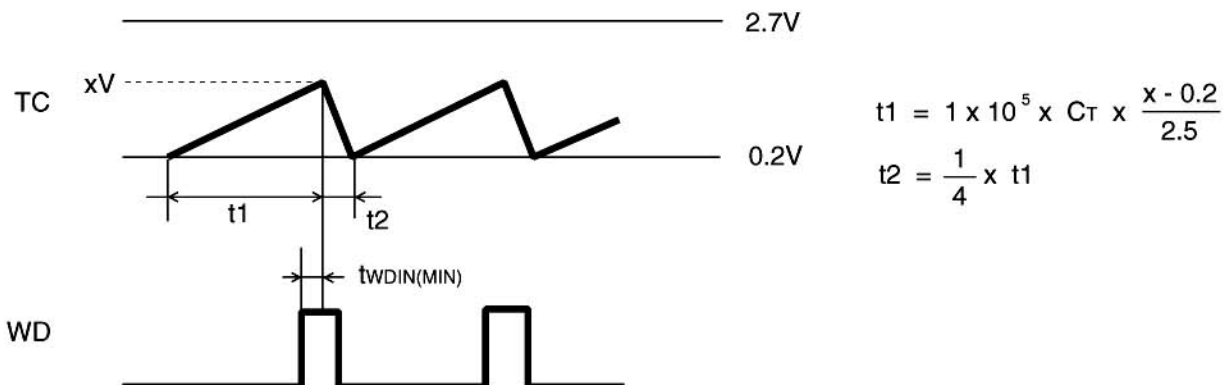
## 2. Regarding charge and discharge of pin (27) (TC pin)

When incorrect clock is given to the WD pin, the voltage level of TC pin will be changed as show below.



## 3. Regarding the input clock, input pulse width, charging time, and discharging time of pin (26) (WD pin)

When correct clock is given to the WD pin, the voltage level of TC pin will be changed as show below.



Please, set the pulse width ( $t_{WDIN}$ ) more than  $t_{WDIN(MIN)}$ .

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### Pin description

| Pin #  | Symbol      | Description                                                                                                                                         |
|--------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 24     | CS          | The serial data input pin which used to receives 8 bit wide serial data.                                                                            |
| 23     | CK          | The shift clock input pin which takes the input signal of DI pin to 8 bit shift register by the rising edge of the clock signal.                    |
| 22     | DI          | When CS pin is "Low", this pin can receive the data into the 8 bit shift register. The each bit will be latched at rising edge of the clock signal. |
| 17     | DOUT        | The output pin of the amplified A-D input.                                                                                                          |
| 11     | REF         | The reference voltage output pin of the A-D converter.                                                                                              |
| 12~15  | IN1~4       | The A-D converter input pin.                                                                                                                        |
| 16     | ISENSE      | The current sense input pin.                                                                                                                        |
| 10     | CD          | The input pin for the current detection to feed back of sub-switch driver.                                                                          |
| 9      | SSW         | The sub-switch driver output pin.                                                                                                                   |
| 7, 8   | MSW1~2      | The main switch driver output pin. (Open collector)                                                                                                 |
| 3~5    | LED1~3      | The LED driver output pin. (Open collector)                                                                                                         |
| 19     | VDD         | The stabilized +5V output pin.                                                                                                                      |
| 21     | VB          | The pre-drive pin which used to connect the external PNP Tr.                                                                                        |
| 20     | Vcc         | The power supply pin.                                                                                                                               |
| 29     | IDET        | The current detection input pin.                                                                                                                    |
| 30     | Iadj        | The input pin for current detection adjustment.                                                                                                     |
| 28     | VDET        | The voltage detection input pin.                                                                                                                    |
| 32     | P.C         | The feedback pin for voltage and current control.                                                                                                   |
| 2, 33  | OPIN1-,IN2- | The inverted input pin of Op. amp.                                                                                                                  |
| 1, 34  | OPIN1+,IN2+ | The non-inverted input pin of Op. amp.                                                                                                              |
| 36, 35 | OPOUT1,2    | The Op. amp. output pin. (Open collector output)                                                                                                    |
| 31     | GND         | The ground pin.                                                                                                                                     |
| 6      | P.GND       | The ground pin of power unit. (Main switch driver and LED driver)                                                                                   |
| 18     | RESET       | The output pin of Reset and WDT. (Pulled up to VDD)                                                                                                 |
| 27     | TC          | The pin used to connect capacitor to determine the time constant of WDT.                                                                            |
| 26     | WD          | The input pin of the WDT.                                                                                                                           |
| 25     | Ctd         | The pin used to connect capacitor to determine delay time the output after the Reset.                                                               |

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## Standard Battery Charger Controller

## Absolute Maximum Ratings

| Items                     | Symbols          | Condition | Ratings         | Unit  |
|---------------------------|------------------|-----------|-----------------|-------|
| Power supply voltage      | V <sub>CC</sub>  |           | 16              | V     |
| Main switch drive current | I <sub>SW</sub>  |           | 200             | mA    |
| Sub switch drive current  | I <sub>SUB</sub> |           | -5              | mA    |
| LED drive current         | I <sub>LED</sub> |           | 30              | mA    |
| Regulator output current  | I <sub>B</sub>   |           | 20              | mA    |
| P.C drive current         | I <sub>PC</sub>  |           | 10              | mA    |
| Main switch max. voltage  | V <sub>SW</sub>  |           | V <sub>CC</sub> | V     |
| Sub switch max. voltage   | V <sub>SUB</sub> |           | V <sub>CC</sub> | V     |
| LED max. drive voltage    | V <sub>LED</sub> |           | V <sub>CC</sub> | V     |
| P.C max. voltage          | V <sub>PC</sub>  |           | V <sub>CC</sub> | V     |
| Power dissipation         | P <sub>d</sub>   |           | 650             | mW    |
| Thermal derating ratio    | K <sub>θ</sub>   |           | 6.5             | mW/°C |
| Operating temperature     | T <sub>opr</sub> |           | -20~+85         | °C    |
| Storage temperature       | T <sub>stg</sub> |           | -40~+125        | °C    |

Electrical Characteristics (T<sub>a</sub>=25°C, V<sub>CC</sub>=12V, I<sub>SW</sub>=50mA, I<sub>LED</sub>=20mA unless specified otherwise)

| Block           | Items                             | Symbols                | Conditions                        | Standard             |                                    |      | Unit |
|-----------------|-----------------------------------|------------------------|-----------------------------------|----------------------|------------------------------------|------|------|
|                 |                                   |                        |                                   | Min                  | Typ                                | Max  |      |
| 5V power supply | Power supply voltage              | V <sub>CC</sub>        |                                   | V <sub>DD</sub> +0.2 |                                    | 15   | V    |
|                 | Circuit current                   | I <sub>CC</sub>        |                                   |                      | 15                                 |      | mA   |
|                 | Stabilized voltage output         | V <sub>DD</sub>        | I <sub>B</sub> = 10mA             | 4.75                 | 5.00                               | 5.25 | V    |
|                 | Input variable ratio              | Reg-in                 | V <sub>DD</sub> + 0.2V            |                      | 50                                 | 200  | mV   |
|                 | Load variable ratio               | Reg-L                  | I <sub>DD</sub> = 1~100mA         |                      | 10                                 | 100  | mV   |
|                 | Ripple remove ratio               | R.R                    | f = 120Hz, V <sub>in</sub> = 0dbm |                      | 60                                 |      | dB   |
| WDT / RESET     | Min. I/O voltage difference       | V <sub>DEF</sub>       |                                   |                      | 0.2                                |      | V    |
|                 | V <sub>DD</sub> detection voltage | V <sub>TH1</sub>       |                                   | 4.05                 | 4.25                               | 4.45 | V    |
|                 | Hysteresis voltage                | ΔV <sub>TH1</sub>      |                                   | 30                   | 50                                 | 80   | mV   |
|                 | WD input current                  | I <sub>WD</sub>        | V <sub>WD</sub> = +5V             |                      | 0.15                               |      | mA   |
|                 | WD "H" input voltage              | V <sub>WDH</sub>       |                                   | 3.5                  |                                    |      | V    |
|                 | WD "L" input voltage              | V <sub>WDL</sub>       |                                   |                      |                                    | 1.5  | V    |
|                 | TC charge current                 | I <sub>TCH</sub>       |                                   |                      | 25                                 |      | μA   |
|                 | TC discharge current              | I <sub>TCL</sub>       |                                   |                      | 100                                |      | μA   |
|                 | Reset output saturation voltage   | V <sub>RESL</sub>      | I <sub>RES</sub> = 1mA            |                      | 0.2                                | 0.4  | V    |
|                 | WDT time                          | t <sub>WD</sub>        |                                   |                      | 1×10 <sup>5</sup> C <sub>T</sub>   |      | S    |
|                 | Reset timer time                  | t <sub>RT</sub>        |                                   |                      | 2.5×10 <sup>4</sup> C <sub>T</sub> |      | S    |
|                 | Reset output delay time           | t <sub>d</sub>         |                                   |                      | 2×10 <sup>5</sup> C <sub>Td</sub>  |      | S    |
|                 | Min. input pulse width            | t <sub>WDIN(MIN)</sub> |                                   | 5                    | 10                                 | 20   | μs   |

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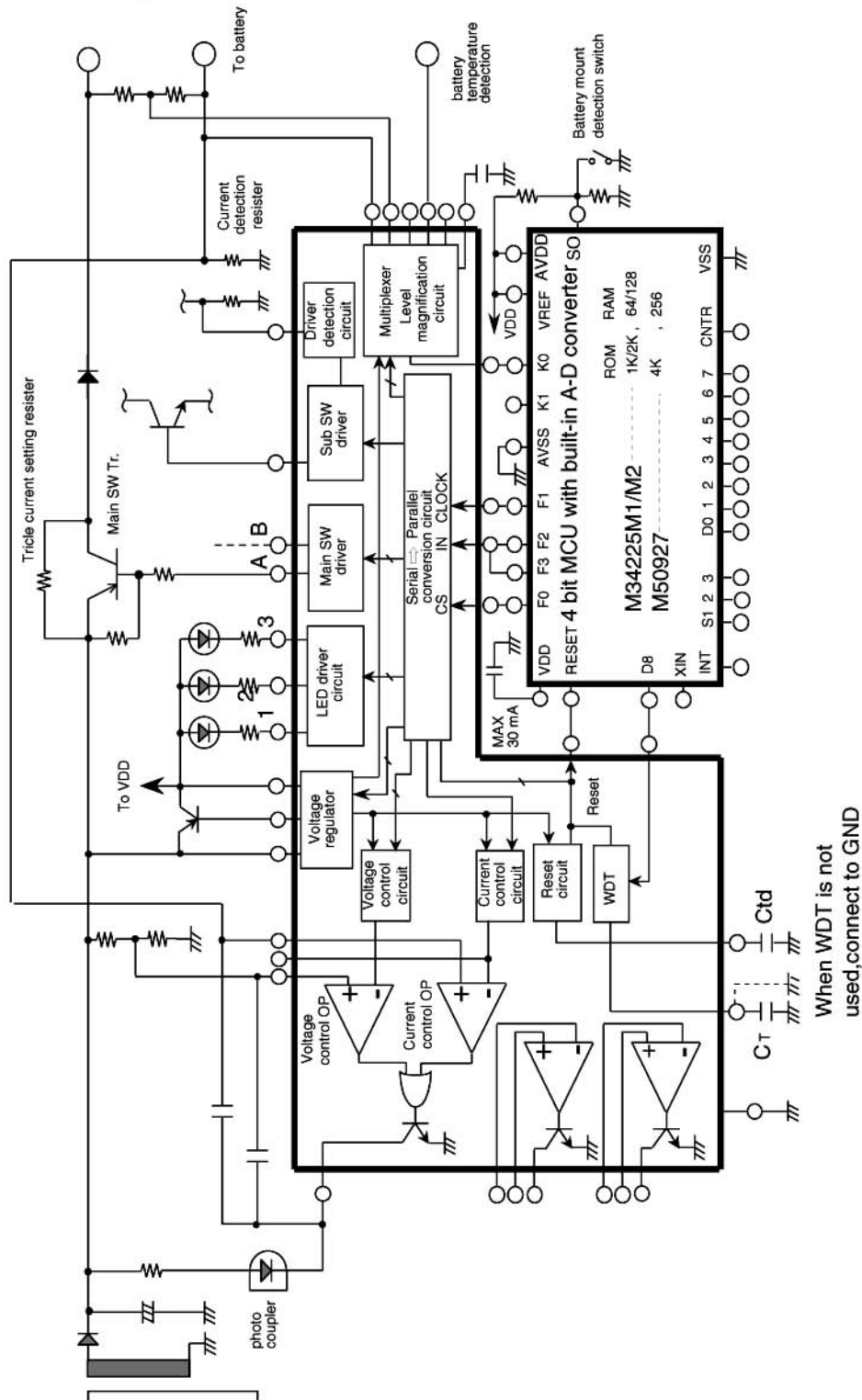
Electrical Characteristics (Ta=25°C, Vcc=12V, Isw=50mA, ILED=20mA unless specified otherwise)

|              | Items                      | Symbols | Conditions | Standard |     |       | Unit |
|--------------|----------------------------|---------|------------|----------|-----|-------|------|
|              |                            |         |            | Min      | Typ | Max   |      |
| Driver       | Main SW "L" output voltage | VsatM   | Im=50mA    |          | 0.8 | 1.2   | V    |
|              | Sub SW "L" output voltage  | Vsats   | Is=5mA     |          | 0.8 | 1.2   | V    |
|              | LED "L" output voltage     | VsatL   | ILED=20mA  |          | 0.8 | 1.2   | V    |
|              | Sub SW detection voltage   | VCD     |            |          | 1.0 |       | V    |
| Control Op.  | Input voltage range        | VIN     |            | 0        |     | Vcc-2 | V    |
|              | Input bias current         |         |            | -1       |     |       | μA   |
|              | P.C "L" output voltage     | VPCL    | IPC=5mA    |          | 0.2 | 0.4   | V    |
|              |                            |         |            |          |     |       |      |
| Op Amp.      | Input offset voltage       | Vio     |            |          | 2   | 7     | mV   |
|              | Input bias current         | IIB     |            | -100     |     |       | nA   |
|              | Input offset current       | IIO     |            |          |     | 100   | nA   |
|              | Phase input range          | VICM    |            | -0.3     |     | Vcc-2 | V    |
|              | Open loop gain             | AV      |            | 80       |     |       | dB   |
|              | Through rate               | SR      |            |          |     |       | V/μs |
|              | Output voltage range       | VOR     |            | 0.2      | 4   | Vcc   | V    |
|              | Output sink current        | Isink   |            | 20       |     |       | mA   |
| Voltage Mag. | ISENSE input voltage range | VISENSE |            |          |     | 0.5   | V    |
|              | IN input voltage range     | VIN     | Vcc ≥ 7V   | 0.2      |     | 5     | V    |
|              |                            |         | Vcc = 5.5V | 0.2      |     | 3.5   | V    |
|              | IN input current           | IIN     |            | -100     |     |       | nA   |
|              |                            |         |            |          |     |       |      |

# M62254FP

Standard Battery Charger Controller

## <Application example of M62254FP>



# M62254FP

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## <Application example of M62254FP>

