

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

New Product

MITSUBISHI STANDARD LINEAR IC

M62238FP

CONSTANT VOLTAGE CONSTANT CURRENT CONTROL+2 SYSTEM LED CONTROL IC

DESCRIPTION

M62238FP is a constant voltage/current control IC with high accuracy ref. voltage($1.265V \pm 1.0\%$) most suitable for charger control. Built-in OP Amps for voltage/current control and 2 system LED drivers allow for compact design with a small number of external components. LED indications automatically change from "RED" meaning "during charging" to "GREEN" meaning "charge completion"

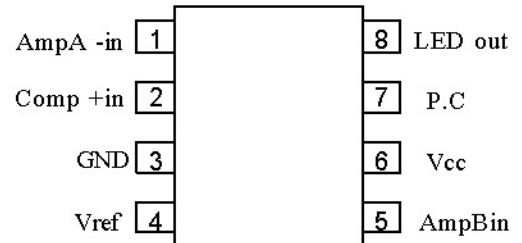
FEATURES

- *Operating power supply voltage range-----2.5-15V
- *High accuracy ref. voltage----- $1.265V \pm 1.0\%$
- *PC terminal output current-----20mA
- *LED terminal output current-----10mA

APPLICATION

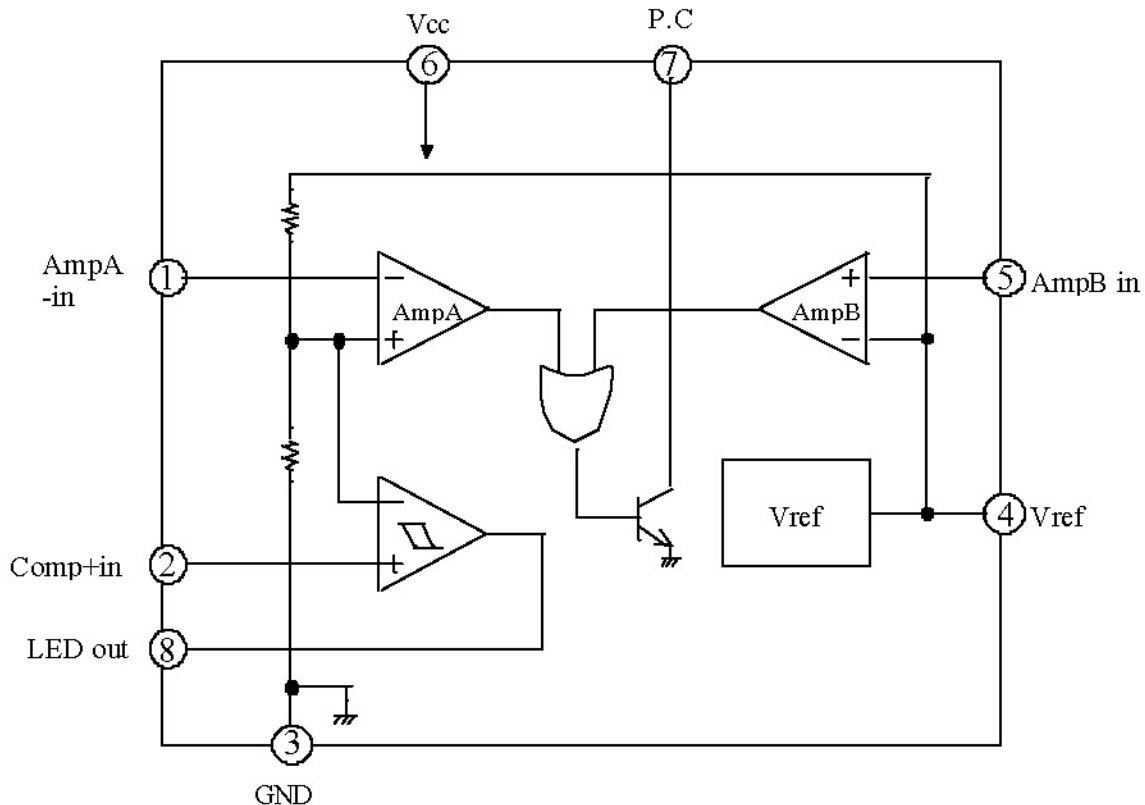
Charger for MP3 player, PDA, and so forth

PIN CONFIGURATION(TOP VIEW)



OUTLINE 8P2S-A

BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS(Ta=25deg.,unless otherwise specified.)

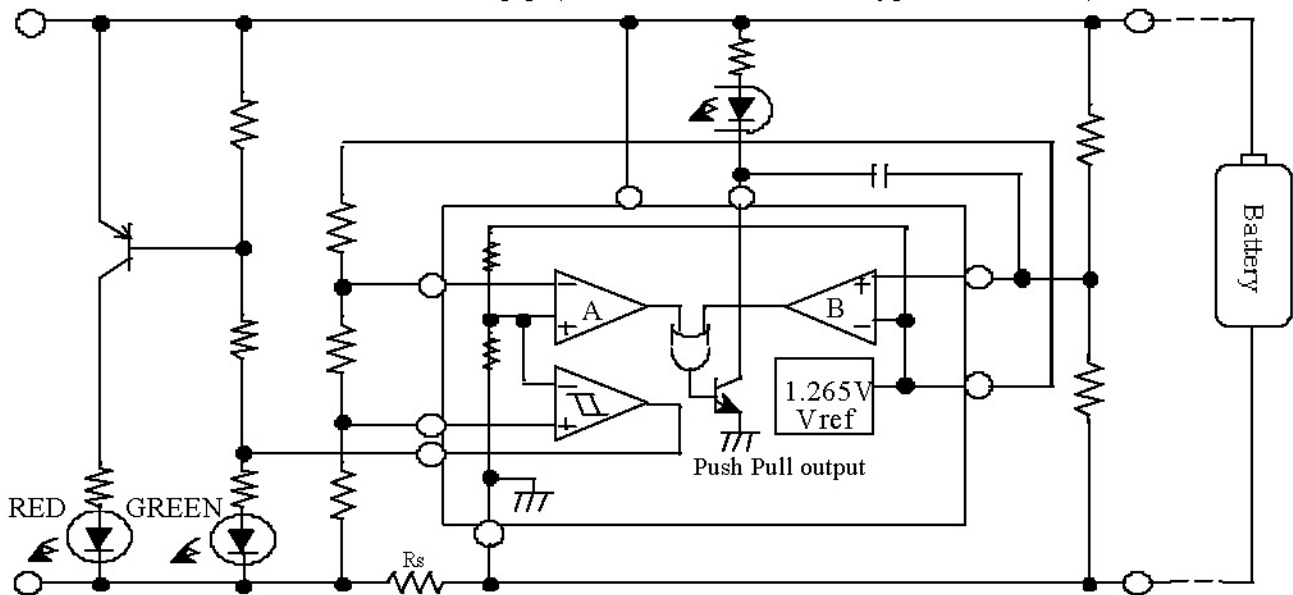
Symbol	Parameter	Conditions	Ratings	Unit	
Vcc	Supply voltage		16	V	
VP.C	P.C terminal voltage		16	V	
IP.C	P.C terminal input current		20	mA	
ILED+	LED terminal input current		10	mA	
ILED-	LED terminal output current		-10	mA	
Iref.	Vref terminal output current		-5	mA	
VID	Input differential voltage	Amp.A	16	V	
		Amp.B	9	V	
		LED	Vcc \square 5V	5	V
		Comp.	Vcc < 5V	Vcc	V
Pd	Power dissipation		440	mW	
K θ	Thermal derating	Ta \square 25deg.	4.4	mW/deg.	
Topr.	Operating temperature		-20~75	deg.	
Tstg.	Storage temperature		-40~125	deg.	

ELECTRICAL CHARACTERISTICS (Vcc=6V, Ta=25deg. unless otherwise specified.)

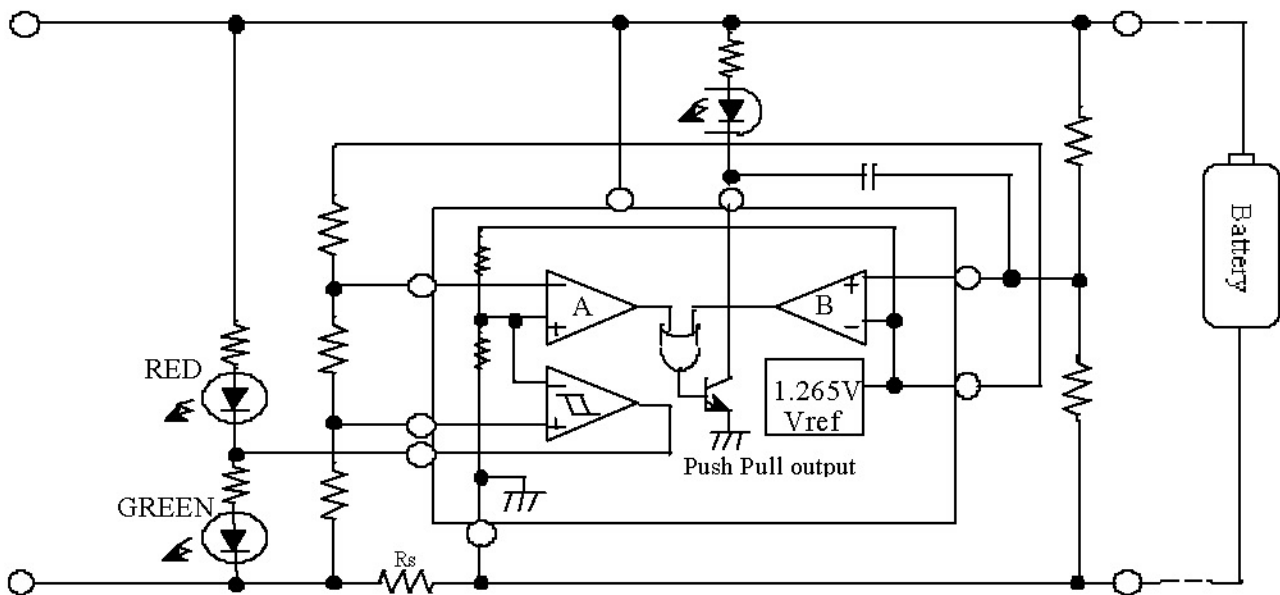
	Symbol	Parameter	Conditions	Ratings			Unit
				MIN.	TYP.	MAX.	
ALL	Vcc	Supply voltage		2.5	—	15.0	V
	Icc	Supply current	IP.C=0,Iref=0, ILED=open		2.0		mA
	Vref	Ref.voltage	Iref=0,IP.C=5mA, ILED=open	1.252	1.265	1.278	V
	delta Vref	Ref.voltage regulation	Iref=0~2mA	—	10	30	mV
P.C	Vsat	P.C terminal sat. volt.	IP.C=10mA	—	0.2	0.4	V
	IP.CLEAK	P.C terminal leak current	VP.C=6V	—	—	2	\square A
AMP.A(Note1)	VIO	Input offset voltage		—	0.5	2.5	mV
	IB-	Input bias current		—	-100	—	nA
	GVO	Open voltage gain		—	80	—	dB
	SVRR	Supply voltage rejection ratio		—	70	—	dB
	SR	Slew rate		—	0.5	—	V/ \square sec
AMP.A(Note2)	VIO	Input offset voltage		—	0.5	3.5	mV
	IB-	Input bias current		—	-100	—	nA
	GVO	Open voltage gain		—	80	—	dB
	SVRR	Supply voltage rejection ratio		—	70	—	dB
	SR	Slew rate		—	0.5	—	V/ \square sec
LED comp.	VLEDH	LED output 'H' voltage	ILED= -10mA	Vcc-12	—	—	V
	VLEDL	LED output 'L' voltage	ILED= +10mA	—	0.2	0.4	V
	VTH	Threshold voltage		—	0.633	—	V
	SVRR	Hysterisis voltage		—	18	—	mV
	SR	Slew rate		—	0.5	—	V/ \square sec

Note1. Amp A+in,-in terminal for input, PC terminal for output Note2. Amp B+in,-in terminal for input, PC terminal for output

APPLICATION CIRCUIT EXAMPLE [1] (when cathode common type LED is used)



APPLICATION CIRCUIT EXAMPLE [2] (when separate LED's are used)



Constant current control(Quick charge)

Inverting input and non-inverting input voltage of Amp A is controlled to be equal. By this, charge current is controlled by the voltage between current detection resistor R_s .(Non-inverting input voltage of Amp.A is the divided voltage by resistors inside of this device.) In this case, non-inverting input voltage of comparator is lower than that of inverting one. So the output of comparator is 'L' to make 'RED' LED turn on.

Constant voltage control

When the charge voltage reaches the full charge voltage by constant current charge, control is switched from Amp.A to Amp.B. Then charge current starts to decrease gradually. Comparator output switches to 'H' to make 'GREEN' LED turn on when charge current set by the resistors of comparator non-inverting input becomes the inverting input voltage.

(Comparator inverting input voltage is the divided voltage by resistors inside of the chip equal to non-inverting voltage of Amp.A.)

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3. How to set the constants for constant current constant voltage control

1) When constant current control is operative as explained in 1, inverting input terminal of Amp A and non-inverting input terminal are under imaginary shortcircuited condition.

Therefore, these two terminals are controlled to be equal in potential.(Vref/2)

Therefore, equations below represent the constant current control operation.

(I1: each current for R1, R2, and R3 when constant current control is operative.)

$$V_{ref} + I_1 \times R_s = I_1 \times (R_1 + R_2 + R_3) \text{-----(1)}$$

$$V_{ref} / 2 = I_1 \times R_1 \text{-----(2)}$$

$$(V_{ref} / 2) + I_1 \times R_s = I_1 \times (R_2 + R_3) \text{-----(3)}$$

2) When constant voltage control is operative as explained in 2, I_{s1} current gradually decreases to make LED comparator output invert when the current becomes that of I_{s2}. Below equations represent the status above.

(I₂: each current for R1, R2, and R3 when constant voltage control is operative and the current is I_{s2}.)

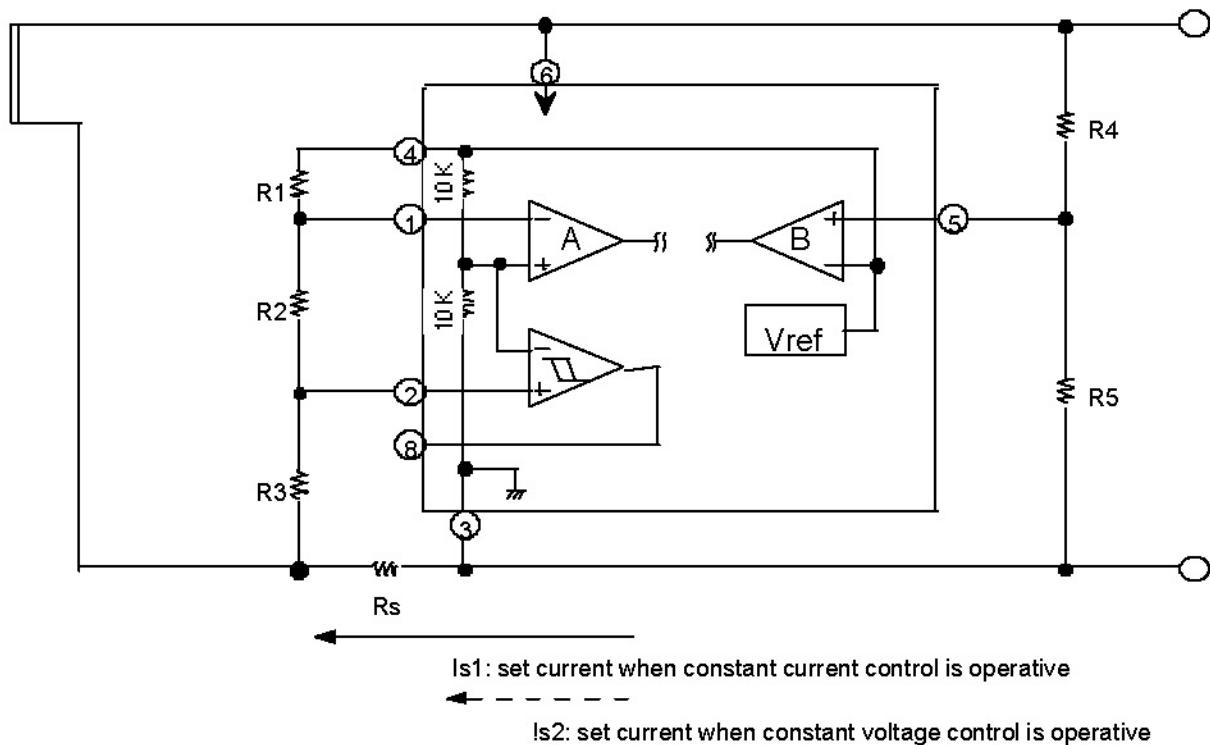
$$V_{ref} + I_2 \times R_s = I_2 \times (R_1 + R_2 + R_3) \text{-----(4)}$$

$$V_{ref} / 2 = I_2 \times (R_1 + R_2) \text{-----(5)}$$

$$(V_{ref} / 2) + I_2 \times R_s = I_2 \times R_3 \text{-----(6)}$$

3) How to set constant voltage control voltage V_{batt}

$$V_{batt} = V_{ref} \times [(R_4 + R_5) / R_5] \text{-----(7)}$$



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4. Examples for setting the constants for constant current constant voltage control(R1-R5)
 Constant voltage control voltage=4.2V, constant current control current $I_{s1}=600\text{mA}$, switch current for LED comparator at constant voltage control= 100mA , Detection resistor $R_s=1\text{ohm}$
 (Set the suitable current for I1 with ref. voltage load capability taken into account)

Given I1 for R1, R2, and R3 is $100\mu\text{A}$,
 From (1), $R1+R2+R3=18650(\text{ohm})$ ($V_{\text{ref}}=1.265\text{V}$)
 From (2), $R1=6325(\text{ohm})$
 From (3), $R2+R3=12325(\text{ohm})$
 From (4), $I_2=(V_{\text{ref}}+I_s \times R_s)/(R1+R2+R3)=73.19(\mu\text{A})$
 From (5), $R2=(V_{\text{ref}}/(2 \times I_2))-R1=2317(\text{ohm})$
 From (6), $R3=10008(\text{ohm})$
 How to set R4, R5 for constant voltage control
 Given $R5=2.2\text{kohm}$,
 From (7), $V_{\text{batt}}=1.265 \times [(R4+2.2\text{k})$
 $9420=1.265 \times (R4+2.2\text{k})$
 $R4=5.1\text{k}(\text{ohm})$

