AN8360NK

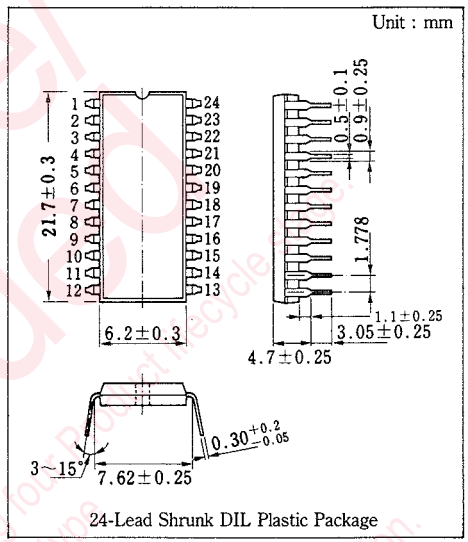
IC for Lead Battery Charger Control

■Outline

The AN8360NK is an integrated circuit suitable for controlling a rapid charging current for a lead battery. It can charge the lead battery safely and efficiently in a short time.

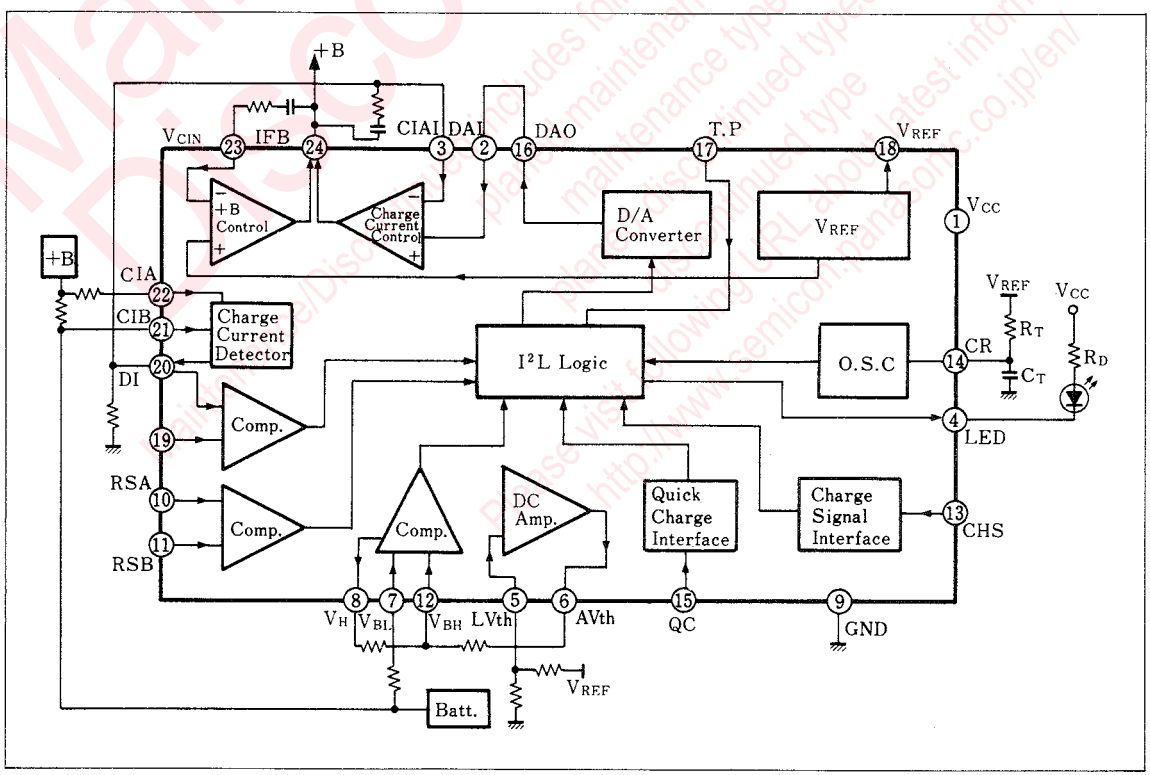
■ Features

- Charge current gradually decreases when charge of lead battery ends (by detecting voltage of battery)
- Charge of lead battery is possible in about an hour
- Charge reference signal is made up of 8-bit D/A converter



24-Lead Shrunk DIL Plastic Package

■ Block Diagram



■ Pin

Pin No.	Pin Name	Pin No.	Pin Name
1	Vcc	13	Charge Signal Input
2	Op. Amp. Input (1)	14	Oscillation Adjust
3	OP. Amp. Input (2)	15	Quick Charge Input
4	LED	16	DAC Output
5	DC. Amp. Input	17	Test Pin
6	DC. Amp. Output	18	Reference Voltage Output
7	CMP. Input (1)	19	LED Control
8	Hysteresis	20	Charge Current Detector (3)
9	GND	21	Charge Current Detector (2)
10	RESET (1)	22	Charge Current Detector (1)
11	RESET (2)	23	+B Adjust
12	COMP. Input (2)	24	Feed Back

■ Absolute Maximum Ratings (Ta=25℃)

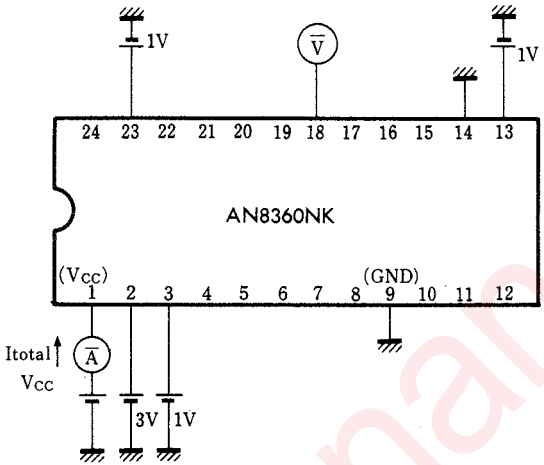
Item	Symbol	Rating	Unit
Supply voltage	V_{CC}	20	V
Supply current	I_{CC}	33	mA
Power dissipation	P_D	660	mW
Operating ambient temperature	T_{opr}	−20~+75	℃
Storage temperature	T_{stg}	−55~+150	℃

■ Electrical Characteristics (Ta=25℃)

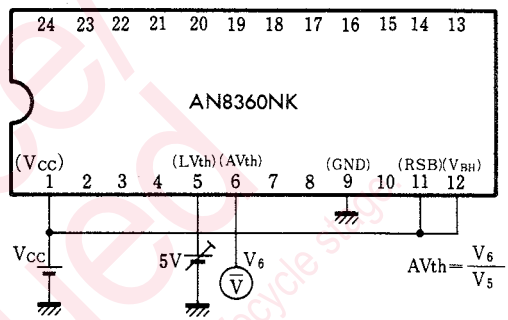
Item	Symbol	Test Circuit	Condition	min.	typ.	max.	Unit
No-load supply current	$I_{tot(1)}$	1	V_{CC}=18V	13.5	19	24.5	mA
Output voltage	V_{REF}	1	V_{CC}=18V	4.5	5	5.5	V
DC voltage amp. factor	A_{Vth}	2	V_{CC}=18V, 1V<V_5<4V	3.36	4	4.64	times
DAOH output voltage	V_{DAOH}	4	V_{CC}=18V	2.5	3.6	4.9	V
DAOL output voltage	V_{DAOL}	4	V_{CC}=18V	0.05	0.13	0.25	V
Linearity	A_{V20}	5	V_{CC}=18V, 18V>V_{22}>15V	0.7	1	1.3	
Oscillation frequency	f_{CR}	3	V_{CC}=18V	18	20	22	Hz
Bit 1 output voltage	ΔV_1	4	V_{CC}=18V		13		mV
Bit 2 output voltage	ΔV_2	4	V_{CC}=18V		26		mV
Bit 3 output voltage	ΔV_3	4	V_{CC}=18V		50		mV
Bit 4 output voltage	ΔV_4	4	V_{CC}=18V		110		mV
Bit 5 output voltage	ΔV_5	4	V_{CC}=18V		220		mV
Bit 6 output voltage	ΔV_6	4	V_{CC}=18V		440		mV
Bit 7 output voltage	ΔV_7	4	V_{CC}=18V		880		mV
Bit 8 output voltage	ΔV_8	4	V_{CC}=18V		1760		V

Note) Operating supply voltage range

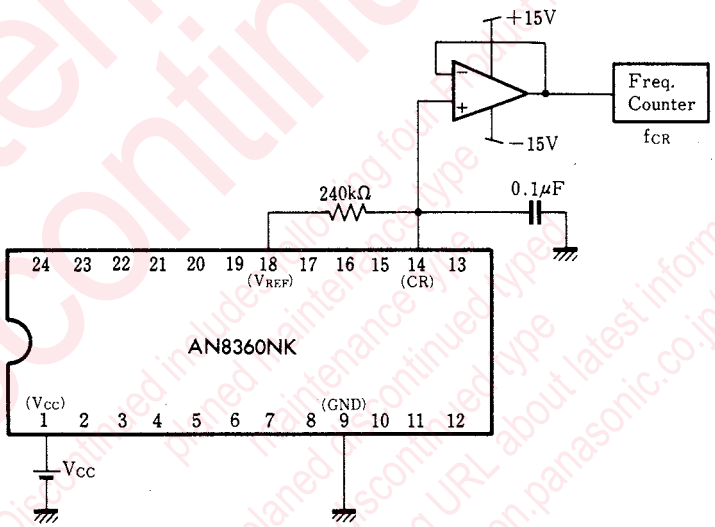
Test Circuit 1 (I_{tot}, V_{REF})



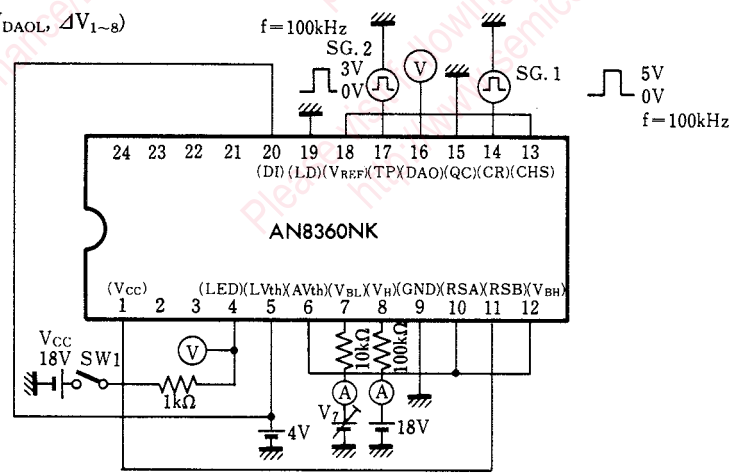
Test Circuit 2 (A_{Vth})



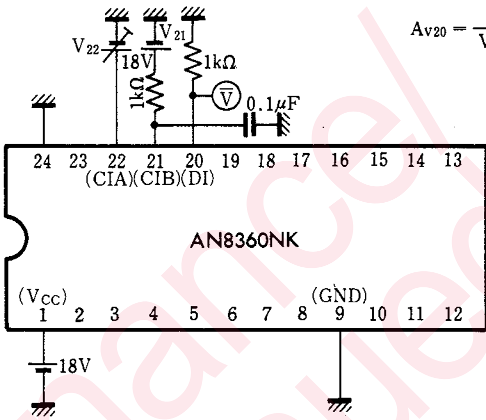
Test Circuit 3 (f_{CR})



Test Circuit 4 (V_{DAOH}, V_{DAOL}, $\Delta V_{1\sim8}$)

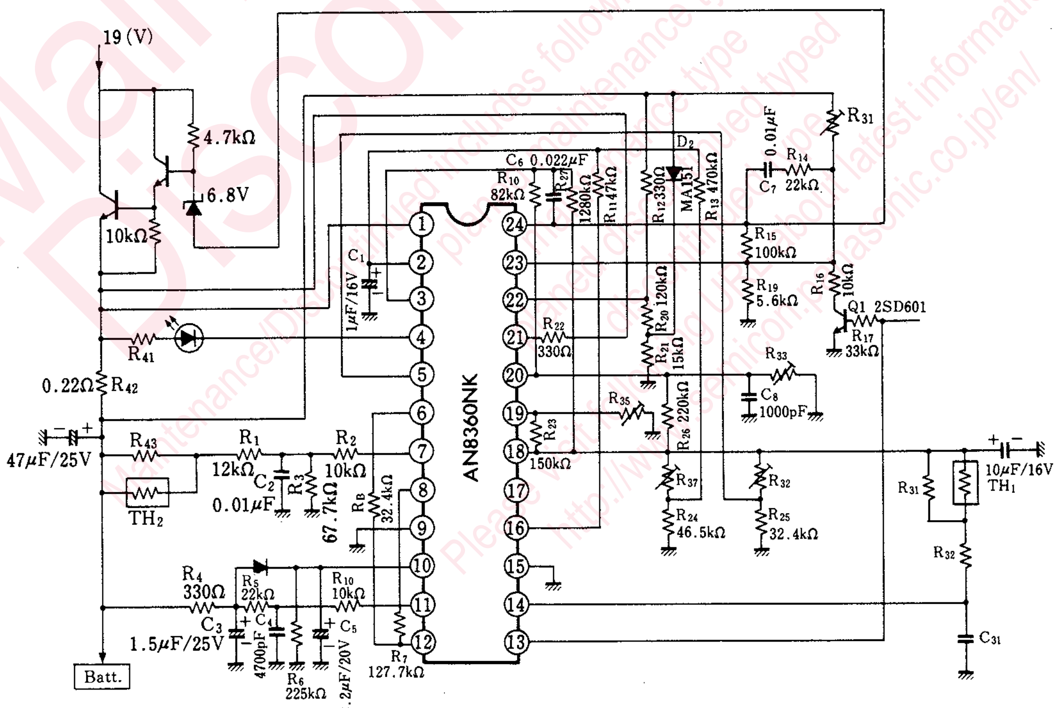


Test Circuit 5 (A_{V20})



$$A_{V20} = \frac{V_{20}}{V_{21} - V_{22}}$$

■ Application Circuit



〔Functioning〕

An application circuit of the AN8360NK is show on a preceding page. This IC enters the charge mode by setting a charge signal to "H".

The following figure shows relations between a charging voltage and a charging current to describe a voltage detection-current sequential reduction type charging system.

This charging system detects a charge condition by detecting a voltage change between battery terminals. When charging starts, a battery terminal voltage rises as shown in the figure below, and simultaneously with this, a battery intcrnal pressure also rises. Rapid charging is usually done with a current exceeding the nominal capacitance value of the battery.

To Perform rapid charging safely and completely, therefore, it is necessary to prevent a rise of this internal pressure.

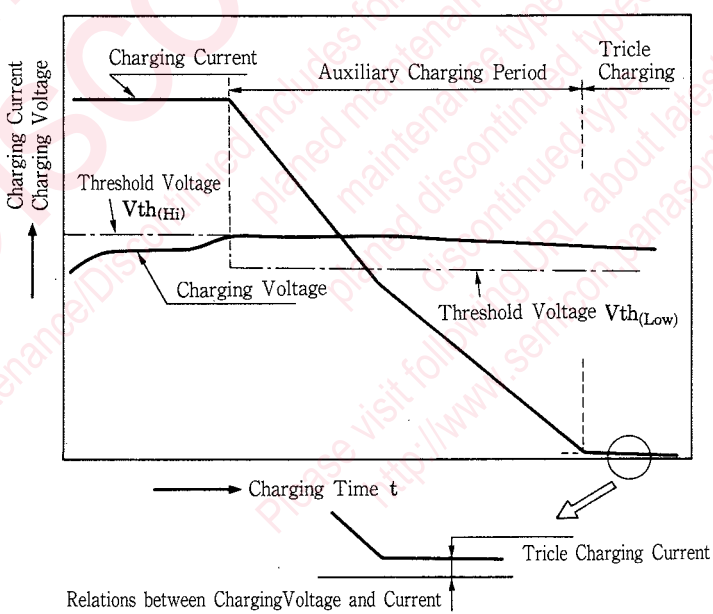
(Charge at about 1 A the battery whose nominal capacitance is 1 Ah.) For this reason, this charging system sets Vth(Mi)to 70—80% of complete charging

When a battery voltage rises along with charging and reaches this Vth(Hi), the system tafers a charging current and performs auxiliary charging, suppressing a rise of the internal pressure.

When charging is completed, tricle charging is perf performed in order to prevent a charging amount from being reduced. For the AN8360NK to perform charging above, threshold voltages Vth(Hi) and Vth(Low) are set by a DC amplifier and the threshold voltage is compared with a battery voltage by a hysteresis comparator, thus controlling how tapering of the charging current is started.

Also, the charging current is voltage-converted by a current detection circuit, and the charging power supply is controlled to that this charging current will follow an 8-bit DAC output voltage. A tapered charging current is produced, by counting down the 8-bit DAC, as its reference signal.

Setting the constants allows rapid charging of 4-12 V lead batteries. A charging time is generally about 80 min., although it depends on a battery condition.



Relations between ChargingVoltage and Current

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