

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

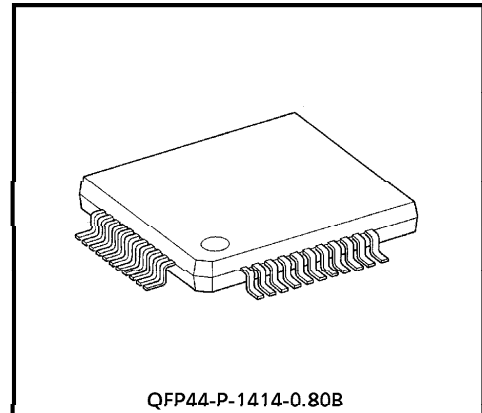
# TA8479F

## 3 PHASE FULL WAVE BRUSHLESS DC MOTOR DRIVER IC FOR VIDEO CAMERA

TA8479F is a capstan / cylinder motor 1-chip driver IC for video camera. Enclosing the capstan and cylinder sections in one package saves space and makes patterning the set board easier.

### FEATURES

- Capstan / Cylinder Motor Driver in 1 Chip
- 3 Phase Full Wave Drive~Voltage Control / Voltage Drive Mode
- Package : QFP44
- Built-in Thermal Shutdown Circuit
  - 〈 Capstan section 〉
    - Soft switching drive
    - Bi-direction drive
    - Built-in standby circuit
  - 〈 Cylinder section 〉
    - Hard switching drive
    - One direction drive



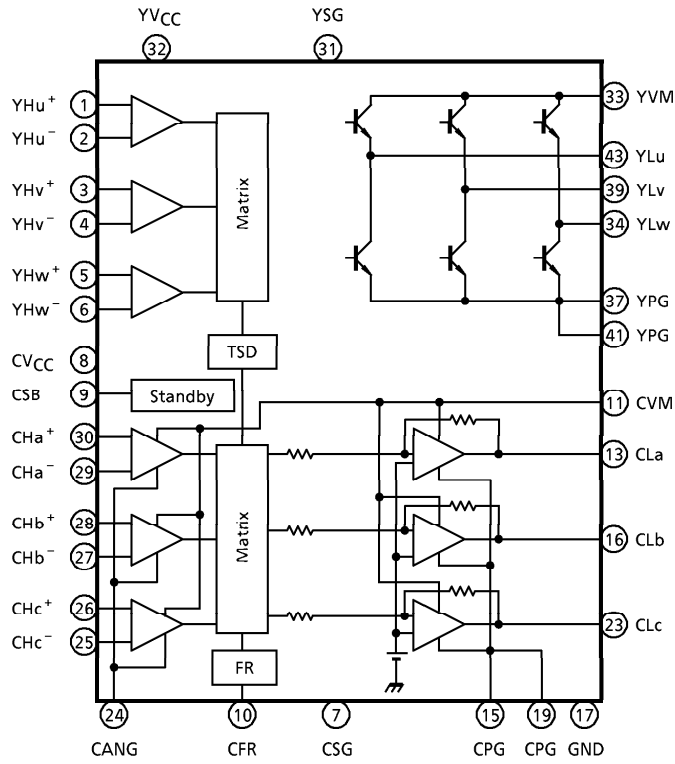
QFP44-P-1414-0.80B

Weight : 1.15g (Typ.)

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BLOCK DIAGRAM



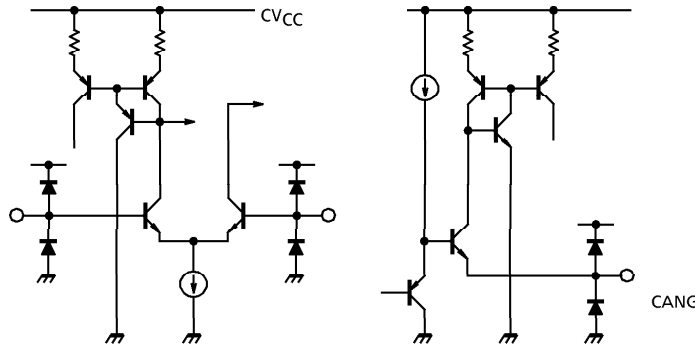
## PIN FUNCTION

PIN No.	SYMBOL	FUNCTION	PIN No.	SYMBOL	FUNCTION
1	YHu <sup>+</sup>	u-phase Hall amp positive input pin	23	CLc	c-phase drive output pin
2	YHu <sup>-</sup>	u-phase Hall amp negative input pin	24	CANG	Hall amp gain control pin
3	YHv <sup>+</sup>	v-phase Hall amp positive input pin	25	CHc <sup>-</sup>	c-phase Hall amp negative input pin
4	YHv <sup>-</sup>	v-phase Hall amp negative input pin	26	CHc <sup>+</sup>	c-phase Hall amp positive input pin
5	YHw <sup>+</sup>	w-phase Hall amp positive input pin	27	CHb <sup>-</sup>	b-phase Hall amp negative input pin
6	YHw <sup>-</sup>	w-phase Hall amp negative input pin	28	CHb <sup>+</sup>	b-phase Hall amp positive input pin
7	CSG	Small signal section GND	29	CHa <sup>-</sup>	a-phase Hall amp negative input pin
8	CVCC	Small signal supply voltage input pin	30	CHa <sup>+</sup>	a-phase Hall amp positive input pin
9	CSB	Standby pin	31	YSG	Small signal section GND
10	CFR	Forward / reverse switching pin	32	YVCC	Small signal section supply voltage input pin
11	CVM	Output section drive voltage input pin	33	YVM	Output section drive voltage input pin
12	NC		34	YLw	w-phase drive output pin
13	CLa	a-phase drive output pin	35	NC	
14	NC		36	NC	
15	CPG	Output section GND	37	YPG	Output section GND
16	CLb	b-phase drive output pin	38	NC	
17	GND	GND pin	39	YLv	v-phase drive output pin
18	NC		40	NC	
19	CPG	Output section GND	41	YPG	Output section GND
20	NC		42	NC	
21	NC		43	YLu	u-phase drive output pin
22	NC		44	NC	

EXPLANATION OF SECTIONS

<Capstan section>

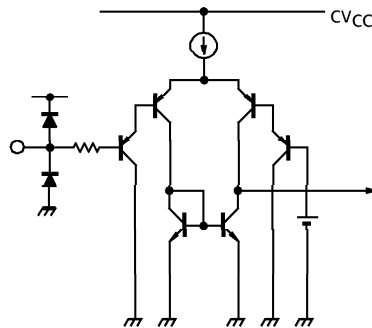
- Hall amp circuit



The Hall amp is a differential amp, and the common-phase input voltage range is  $CV_{CMR} = 1.4 \sim 2.8 [V]$ . For signals from Hall elements, input sinusoidal waves. Noise, etc. which causes malfunctions when found in signals, must be prevented by a condenser.

Grounding the CANG pin with a resistor makes it possible to change the input/output gains in the Hall amp. Determine the resistance value within  $1k\Omega \sim$  several  $k\Omega$ .

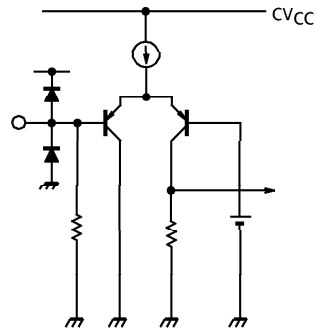
- Standby circuit



A standby state turns off all circuits in the capstan section except for the standby circuit.

- H : Start
- L : Standby

- FR circuit



- H : Reverse rotation
- L : Forward rotation

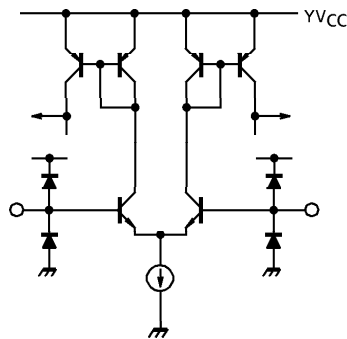
In an open state, the circuit causes the motor to rotate forward.

- Output circuit

This IC uses an amplitude control mode to control output currents by changing output amplitude.

<Cylinder section>

- Hall amp circuit

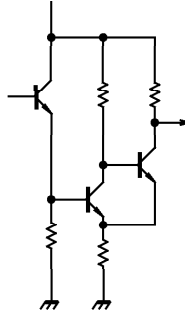


The Hall amp is a differential amp, and the common-phase input voltage range is  $YV_{CMR} = 1.3 \sim YV_{CC} - 1.3$  [V]. For signals from Hall elements, input sinusoidal waves. Noise, etc., which causes malfunction when found in signals, must be prevented by a condenser. This circuit has a high gain amp at the latter stage, making the input sensitivity as high as about 20mV<sub>p-p</sub> (Typ.).

- Output circuit

This circuit uses a hard switching drive mode and controls output currents by changing the emitter-collector voltage of the Pw Tr.

- Thermal shutdown circuit



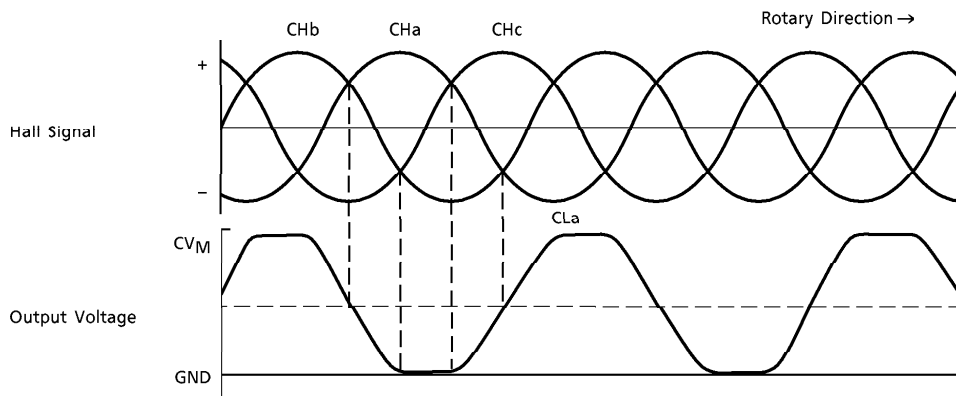
When the temperature exceeds  $T_j = 170^\circ\text{C}$  (Typ.) (design target value), the output circuits in the capstan and cylinder sections are turned off. This circuit has an approximately  $30^\circ\text{C}$  Hysteresis, and the recovery temperature is  $T_j = 140^\circ\text{C}$  (Typ.) (design target value).

**TRUTH TABLE / TIMING CHART**

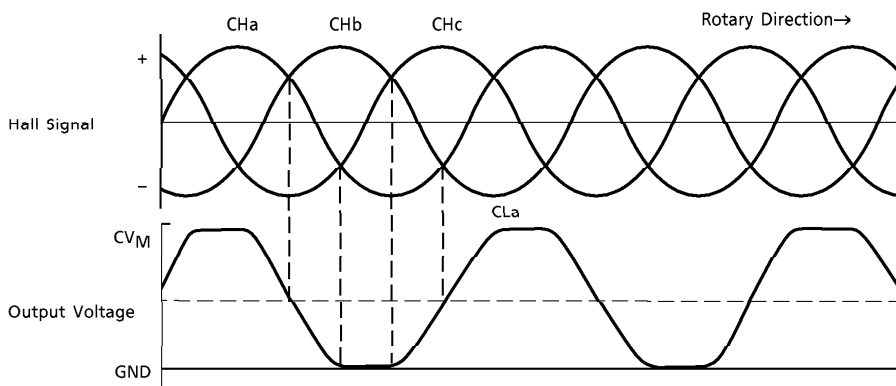
<Capstan section >

CHa	CHb	CHc	CLa	CLb	CLc	
L	H	L	H	L	M	(Forward Rotation) $CLa = - (CHa - CHb)$ $CLb = - (CHb - CHc)$ $CLc = - (CHc - CHa)$ CFR = "L"
H	H	L	M	L	H	
H	L	L	L	M	H	
H	L	H	L	H	M	
L	L	H	M	H	L	
L	H	H	H	M	L	
H	L	L	H	M	L	(Reverse Rotation) $CLa = CHa - CHb$ $CLb = CHb - CHc$ $CLc = CHc - CHa$ CFR = "H"
H	H	L	M	H	L	
L	H	L	L	H	M	
L	H	H	L	M	H	
L	L	H	M	L	H	
H	L	H	H	L	M	

(Forward rotation)

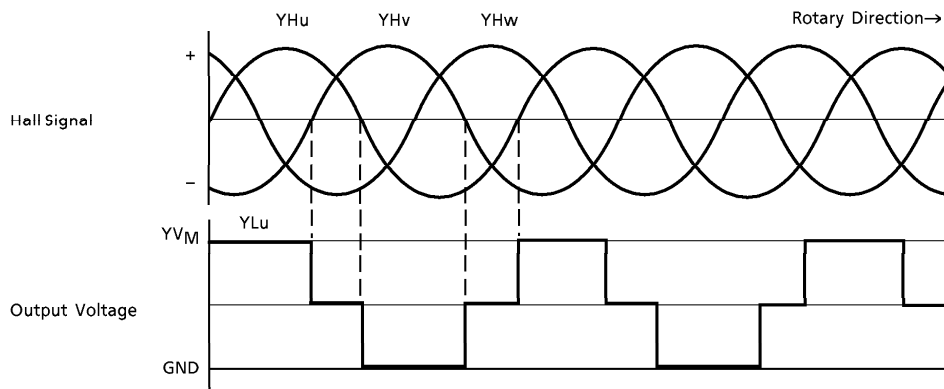


(Reverse rotation)



<Cylinder section>

YHu	YHv	YHw	YLu	YLv	YLw	
H	L	L	H	M	L	$YLu = YHu - YHv$ $YLv = YHv - YHw$ $YLw = YHw - YHu$
H	H	L	M	H	L	
L	H	L	L	H	M	
L	H	H	L	M	H	
L	L	H	M	L	H	
H	L	H	H	L	M	





**MAXIMUM RATINGS** (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING		UNIT
		CAPSTAN SECTION	CYLINDER SECTION	
Small Signal Section Supply Voltage	V <sub>CC</sub>	10	10	V
Output Section Supply Voltage	V <sub>M</sub>	10	10	V
Output Current	I <sub>O</sub>	1.5	1.5	A
Power Dissipation	P <sub>D</sub>	(Note 1) 1		W
Operating Temperature	T <sub>opr</sub>	- 20~75		°C
Storage Temperature	T <sub>stg</sub>	- 55~150		°C

(Note 1) When mounted on board (100×100×1.6mm Cu 24%)

**OPERATING SUPPLY VOLTAGE RANGE** (Ta = 25°C)

## CAPSTAN SECTION

CHARACTERISTIC	SYMBOL	OPERATING RANGE	UNIT
Small Signal Section Supply Voltage	CV <sub>CC</sub>	4.2~6.0	V
Output Section Supply Voltage	CV <sub>M</sub>	2.8~8.0	V

## CYLINDER SECTION

CHARACTERISTIC	SYMBOL	OPERATING RANGE	UNIT
Small Signal Section Supply Voltage	YV <sub>CC</sub>	4.2~6.0	V
Output Section Supply Voltage	YV <sub>M</sub>	1.5~8.0	V

## ELECTRICAL CHARACTERISTICS

CAPSTAN SECTION ( $CV_{CC} = 5.0V$ ,  $CV_M = 3V$ ,  $T_a = 25^\circ C$ )

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply Current		Cl <sub>CC1</sub>	1	Output open, standby	—	60	80	$\mu A$
		Cl <sub>CC2</sub>	1	Output open, start	—	5	8	mA
		Cl <sub>M1</sub>	2	Output open, standby	—	2	5	mA
		Cl <sub>M2</sub>	2	Output open, start	—	7	12	mA
Hall Amp Circuit	Input Current	Cl <sub>H</sub>	3	$CV_{CMR} = 2.5V$	—	—	5	$\mu A$
	Common-Phase Voltage Range	$CV_{CMR}$	4		1.4	—	2.8	V
	Input Sensitivity	$CV_H$	5	(Note)	20	—	—	mV <sub>p-p</sub>
	Hall Input Output Voltage Gain	CG <sub>VHO</sub>	5	RANGLE = $6.8k\Omega$	20	23	26	dB
Output Circuit	Saturation Voltage (Upper Side + Lower side)	$CV_{sat}$ (H + L)	6	$I_O = 0.1A$ , $CV_M = 3V$ , $CV_H = 50mV_{p-p}$	—	1.3	1.8	V
				$I_O = 1.0A$ , $CV_M = 5V$ , $CV_H = 50mV_{p-p}$	—	2.3	2.8	
	Quiescent Voltage	$CV_{OS}$	8		1.05	1.25	1.45	V
	Quiescent Voltage Difference	$\Delta CV_{OS}$	8		—	—	80	mV
Standby Circuit	Input Voltage (H)	$CV_{SH}$	11	(Start)	3.0	—	$CV_{CC}$	V
	Input Voltage (L)	$CV_{SL}$	11	(Stop)	0	—	1.2	V
	Input Current	Cl <sub>INS</sub>	11	$CV_S = 0V$	—	—	5	$\mu A$
FR Circuit	Input Voltage (H)	$CV_{FH}$	12	(Reverse rotation)	3.0	—	$CV_{CC}$	V
	Input Voltage (L)	$CV_{FL}$	12	(Forward rotation)	0	—	1.2	V
	Input Current	Cl <sub>INF</sub>	12	$CV_F = 5.0V$	—	—	70	$\mu A$
Thermal Shutdown Circuit Operating Temperature		$T_{SD}$	—	(Junction temperature)	—	170	—	$^\circ C$

(Note) Defined by output functioning

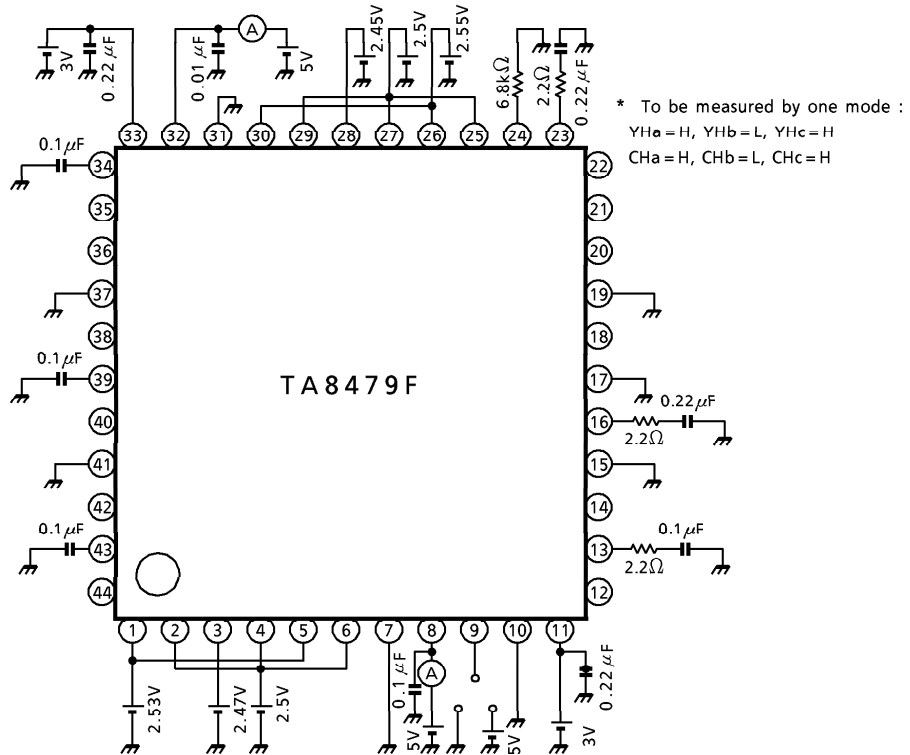
CYLINDER SECTION ( $YV_{CC} = 5.0V$ ,  $YV_M = 3V$ ,  $T_a = 25^\circ C$ )

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply Current		$YI_{CC}$	1	Output open	—	5	8	mA
		$YI_M$	2	Output open	—	25	40	mA
Hall Amp Circuit	Input Current	$YI_H$	3	$YV_{CMR} = 2.5V$	—	—	5	$\mu A$
	Common-Phase Input Voltage Range	$YV_{CMR}$	4		1.3	—	$YV_{CC} - 1.3$	V
	Input Sensitivity	$YV_H$	5	(Note)	20	—	—	$mV_{p-p}$
Output Circuit	Saturation Voltage (Upper Side + Lower side)	$YV_{sat} (H + L)$	6	$I_O = 1.0A$ , $YV_H = 30mV_{p-p}$	—	2.2	2.7	V
	Leakage Current (Upper Side)	$YV_{OL} (H)$	9	$YV_M = 10V$	—	—	10	$\mu A$
	Leakage Current (Lower Side)	$YV_{OL} (L)$	10	$YV_M = 10V$	—	—	10	$\mu A$
Thermal Shutdown Operating Temperature		$T_{SD}$	—		—	170	—	$^\circ C$

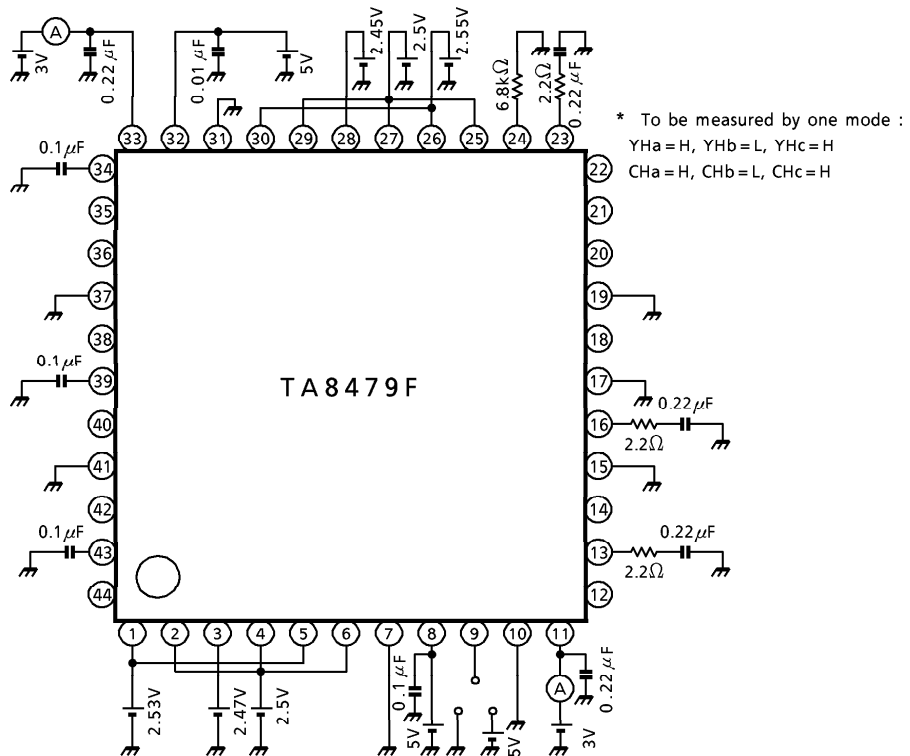
(Note) Defined by output functioning

TEST CIRCUIT

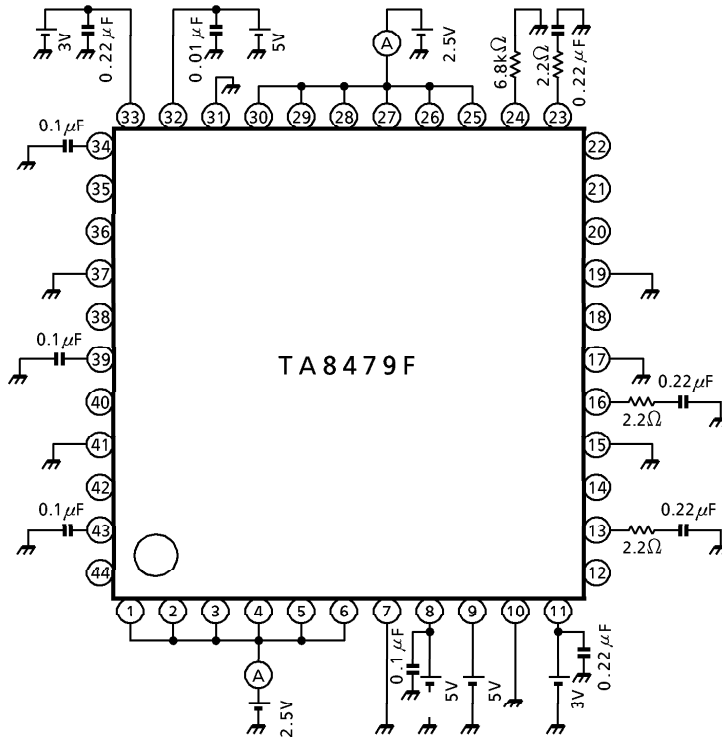
1. Y<sub>CC</sub>, C<sub>CC1</sub>, C<sub>CC2</sub>



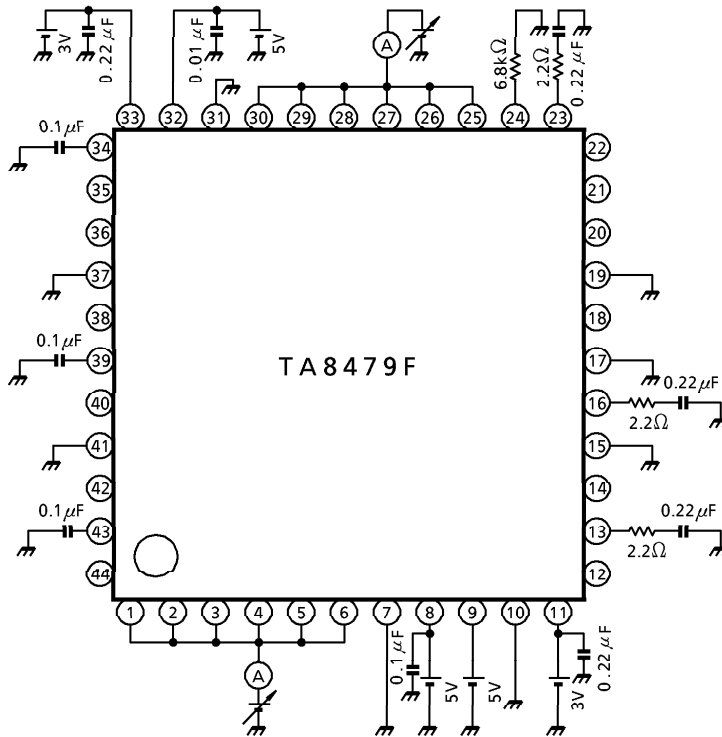
2. Y<sub>M</sub>, C<sub>M1</sub>, C<sub>M2</sub>



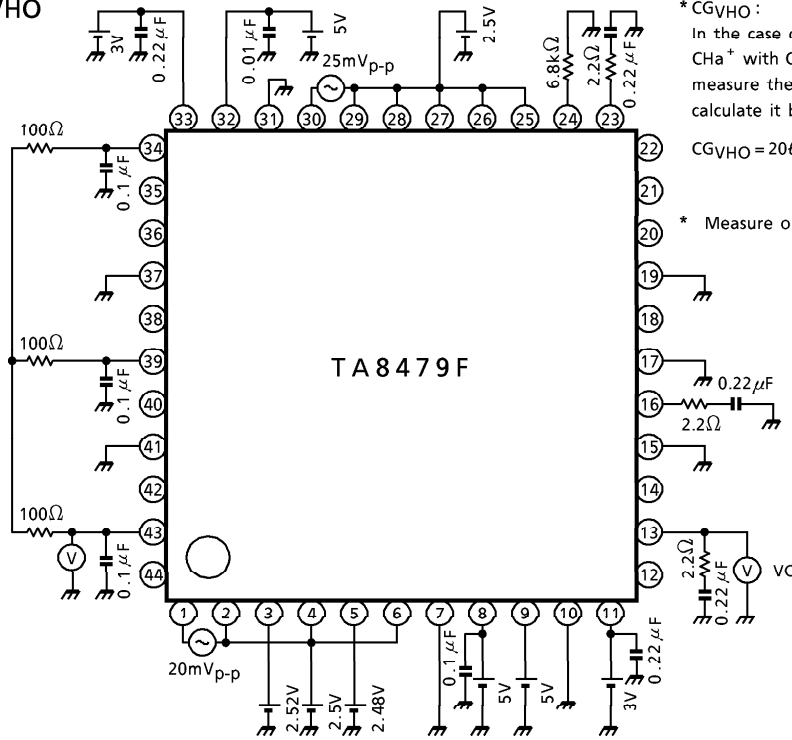
3.  $YI_H, CI_H$



4.  $YV_{CMR}, CV_{CMR}$



5.  $Y_{VH}$ ,  $CV_H$ ,  $CG_{VHO}$

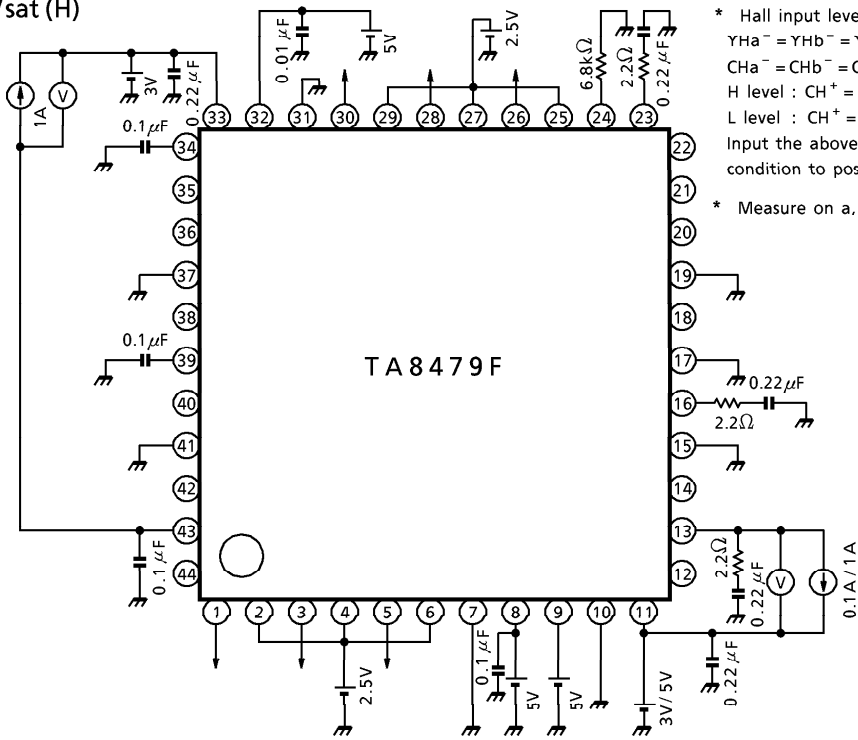


\*  $CG_{VHO}$  :  
 In the case of a-phase  $CG_{VHO}$ , change  $CHa^+$  with  $CHa^- = CHb^- = CHc^- = 2.5V$ , measure the voltage of  $CLa$  in that case, and calculate it by the following formula :  

$$CG_{VHO} = 20 \log \frac{V_O(2.525) - V_O(2.475)}{2.525 - 2.475} \text{ (dB)}$$

\* Measure on a, b, and c phases.

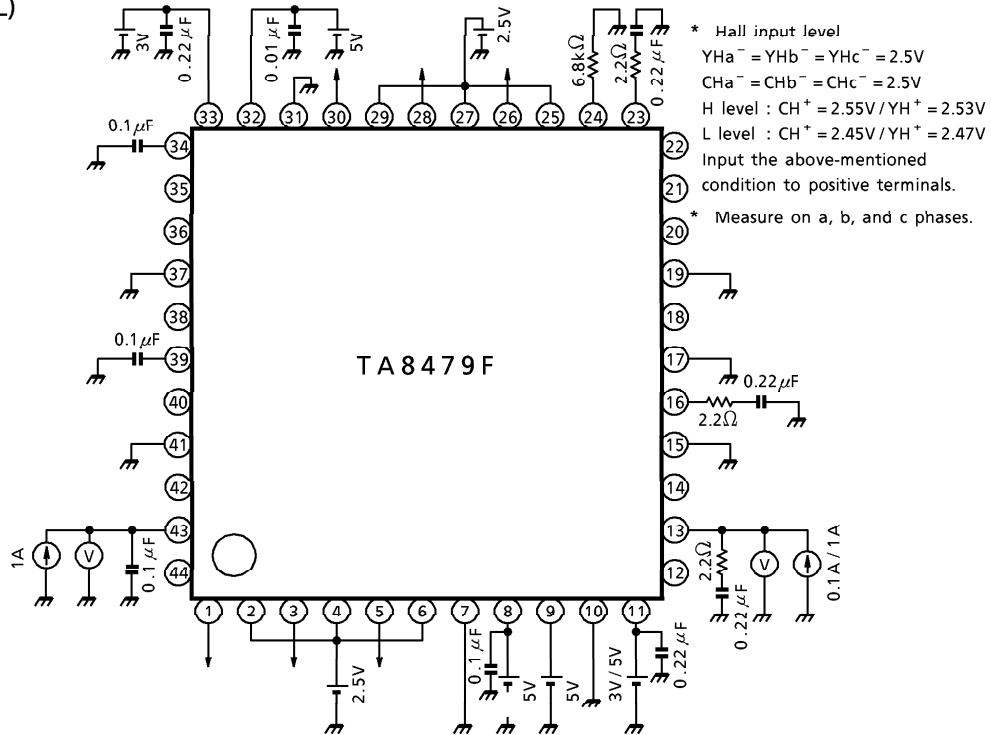
6.  $Y_{Vsat(H)}$ ,  $CV_{sat(H)}$



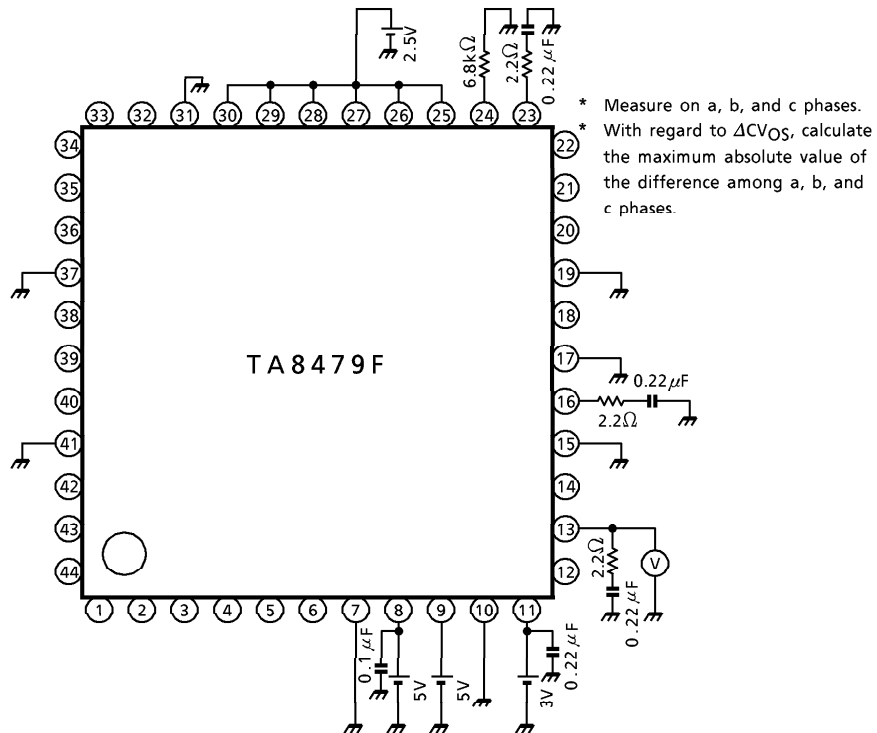
\* Hall input level  
 $YHa^- = YHb^- = YHc^- = 2.5V$   
 $CHa^- = CHb^- = CHc^- = 2.5V$   
 H level :  $CH^+ = 2.55V / YH^+ = 2.53V$   
 L level :  $CH^+ = 2.45V / YH^+ = 2.47V$   
 Input the above-mentioned condition to positive terminals.

\* Measure on a, b, and c phases.

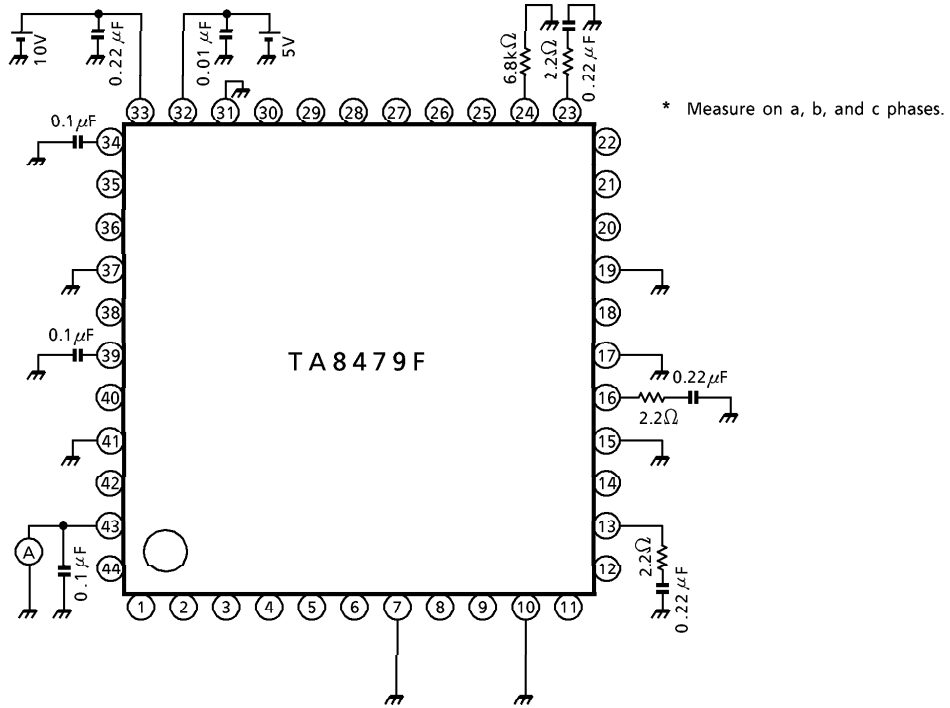
7.  $V_{sat(L)}$ ,  $C_{Vsat(L)}$



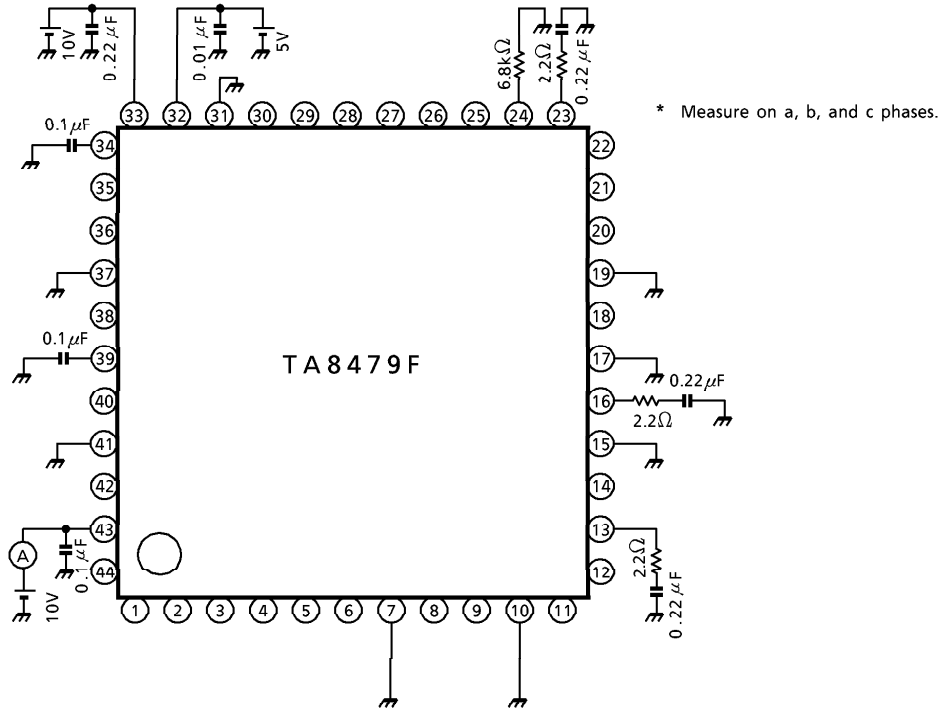
8.  $C_{VOS}$ ,  $\Delta C_{VOS}$



9. YIOL (H)

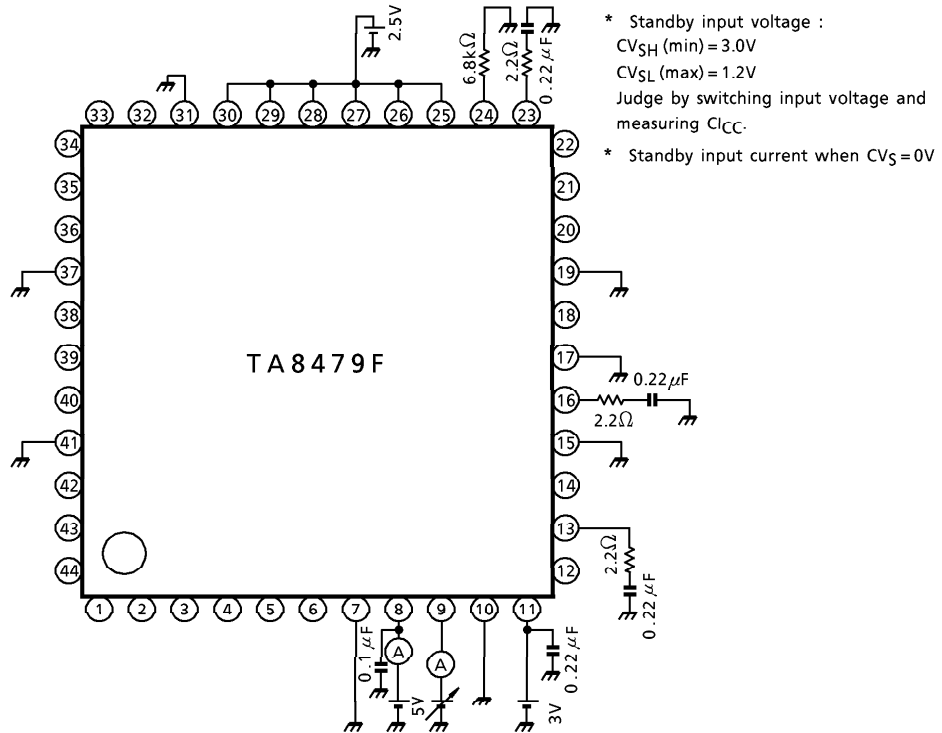


10. YIOL (L)

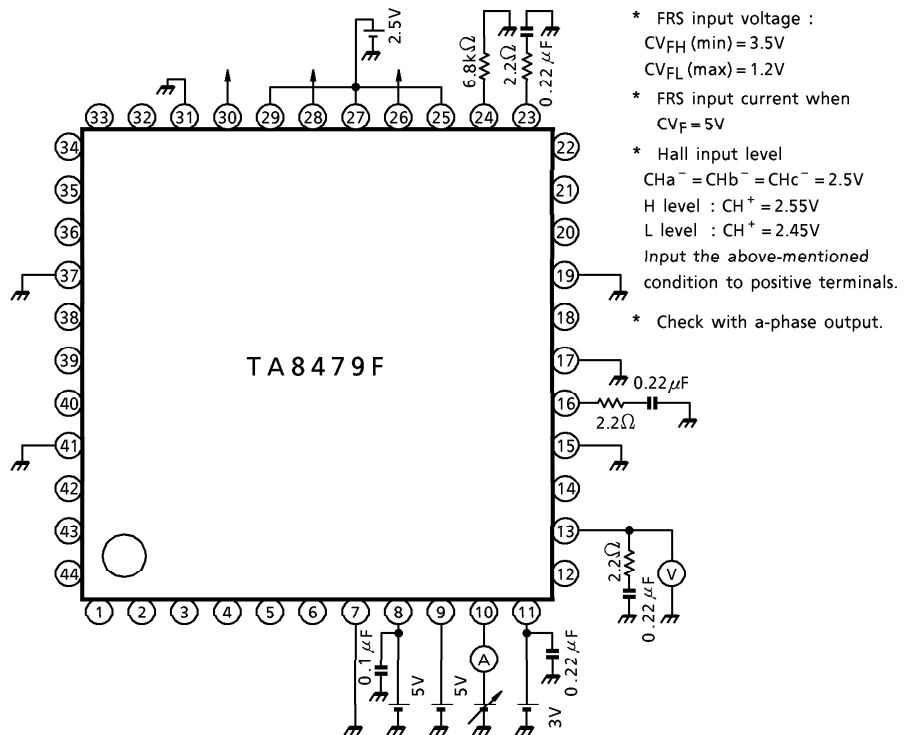




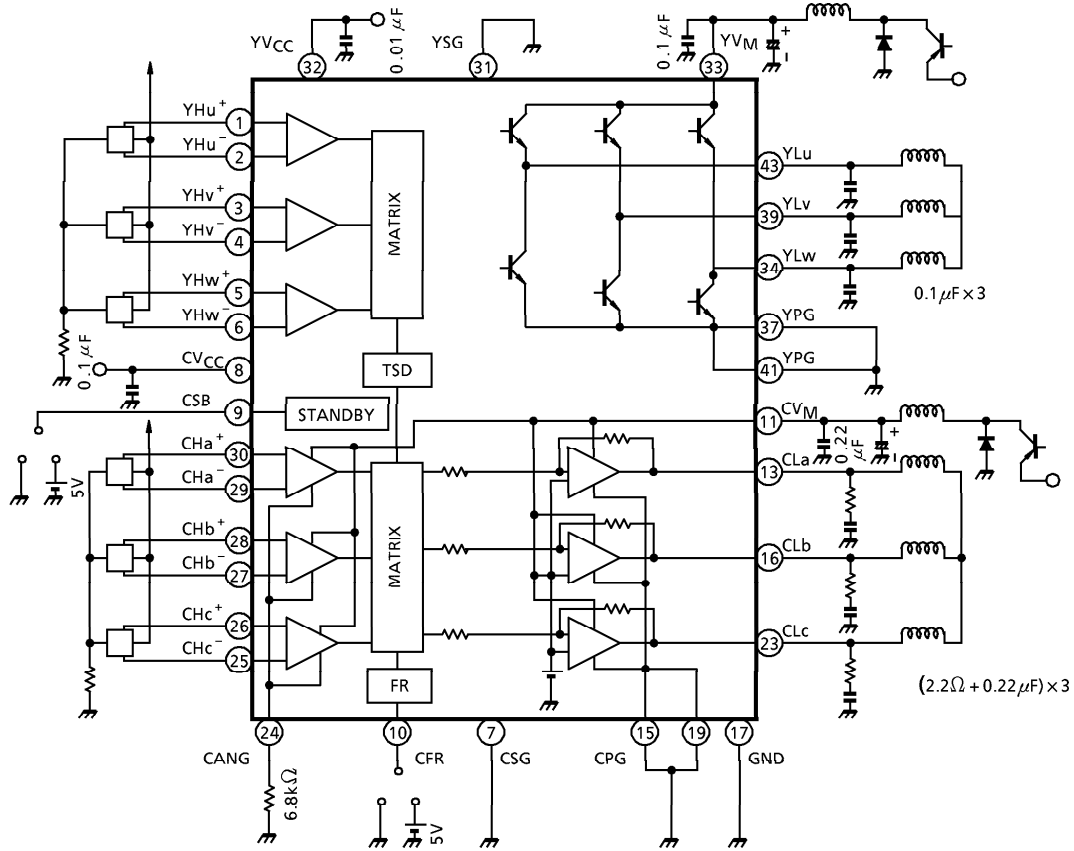
11.  $CV_{SH}$ ,  $CV_{SL}$ ,  $CI_{INS}$



12.  $CV_{FH}$ ,  $CV_{FL}$ ,  $CI_{INF}$



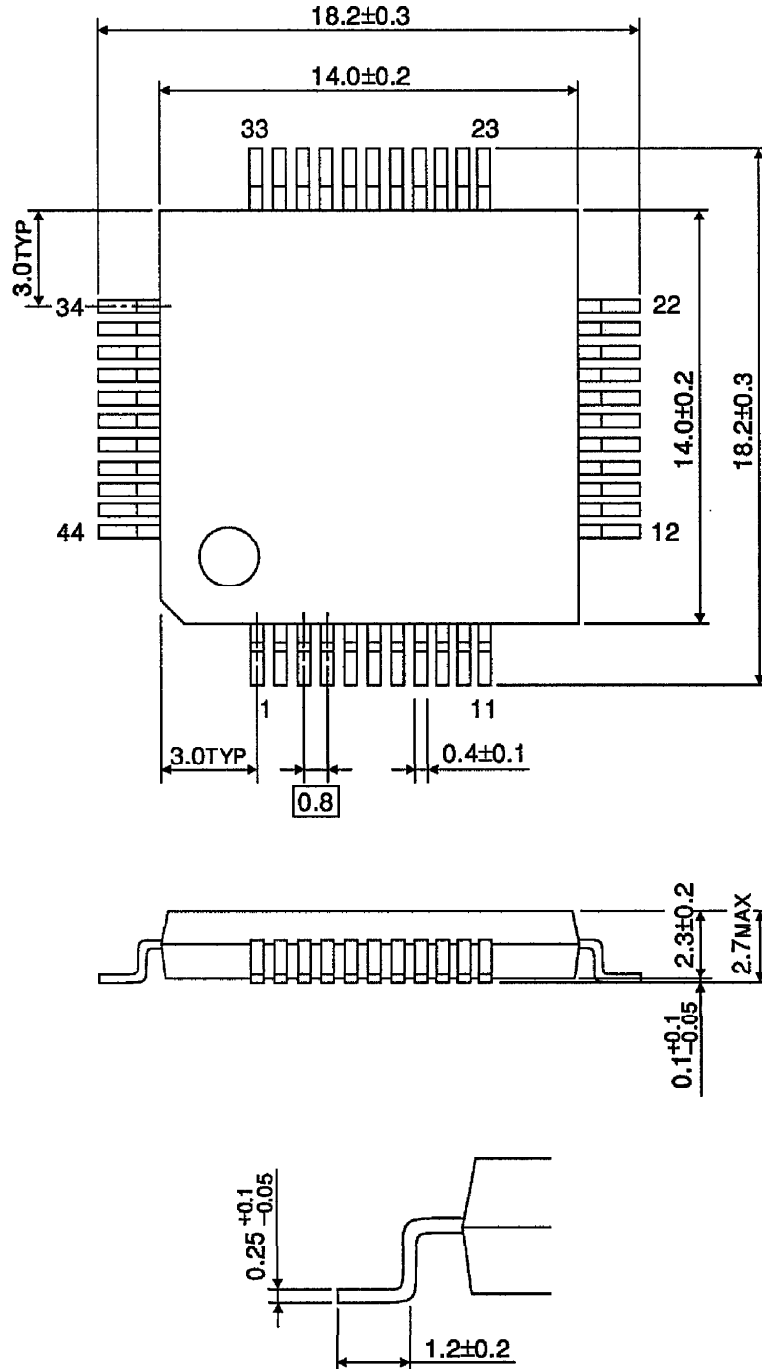
APPLICATION CIRCUIT



(Note) Utmost care is necessary in the design of the output line, YVM, CVM and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

OUTLINE DRAWING  
QFP44-P-1414-0.80B

Unit : mm



Weight : 1.15g (Typ.)