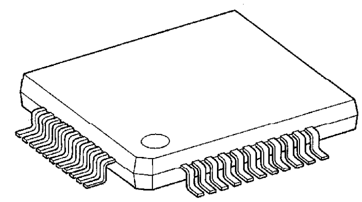
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

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.



QFP44-P-1414-0.80B

Weight : 1.15g (Typ.)

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

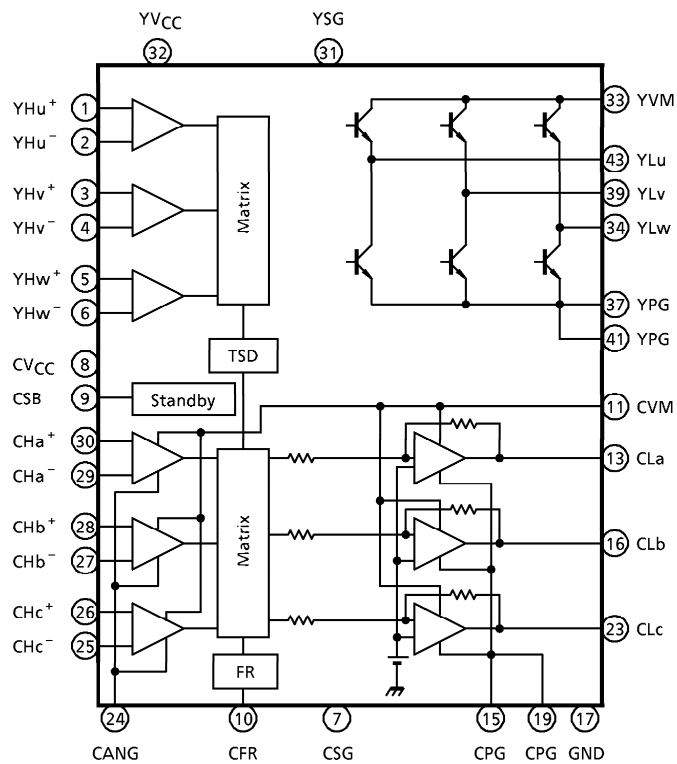
〈 Capstan section 〉

- Soft switching drive
- Bi-direction drive
- Built-in standby circuit

〈 Cylinder section 〉

- Hard switching drive
- One direction drive

BLOCK DIAGRAM



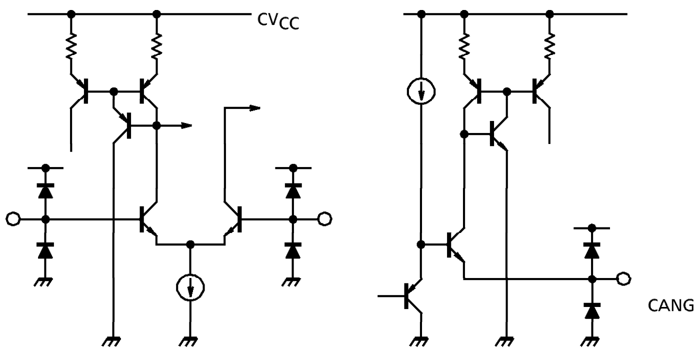
PIN FUNCTION

PIN No.	SYMBOL	FUNCTION	PIN No.	SYMBOL	FUNCTION
1	YHu^{+}	u-phase Hall amp positive input pin	23	CLc	c-phase drive output pin
2	YHu^{-}	u-phase Hall amp negative input pin	24	CANG	Hall amp gain control pin
3	YHv^{+}	v-phase Hall amp positive input pin	25	CHc^{-}	c-phase Hall amp negative input pin
4	YHv^{-}	v-phase Hall amp negative input pin	26	CHc^{+}	c-phase Hall amp positive input pin
5	YHw^{+}	w-phase Hall amp positive input pin	27	CHb^{-}	b-phase Hall amp negative input pin
6	YHw^{-}	w-phase Hall amp negative input pin	28	CHb^{+}	b-phase Hall amp positive input pin
7	CSG	Small signal section GND	29	CHa^{-}	a-phase Hall amp negative input pin
8	CV_{CC}	Small signal supply voltage input pin	30	CHa^{+}	a-phase Hall amp positive input pin
9	CSB	Standby pin	31	YSG	Small signal section GND
10	CFR	Forward / reverse switching pin	32	YV_{CC}	Small signal section supply voltage input pin
11	CV_{M}	Output section drive voltage input pin	33	YV_{M}	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>

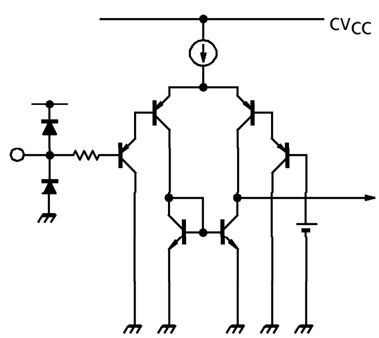
- Hall amp circuit



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 1kΩ~several kΩ.

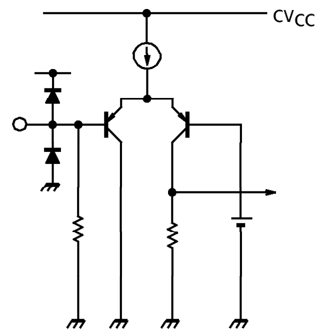
- Standby circuit



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

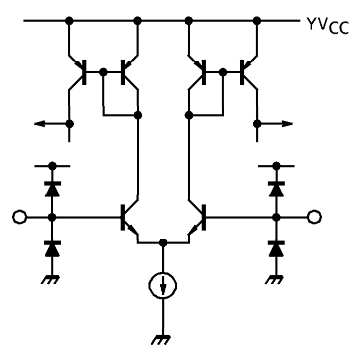
In an open state, the circuit causes the motor to rotate forward.

- Output circuit

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

<Cylinder section>

- Hall amp circuit

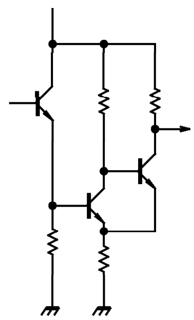


The Hall amp is a differential amp, and the common-phase input voltage range is $YV_{CMR} = 1.3 \sim YV_{CC} - 1.3$ [V]. For signals from Hall elements, input sinusoidal waves. Noise, etc., which causes malfunction when found in signals, must be prevented by a condenser.
This circuit has a high gain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

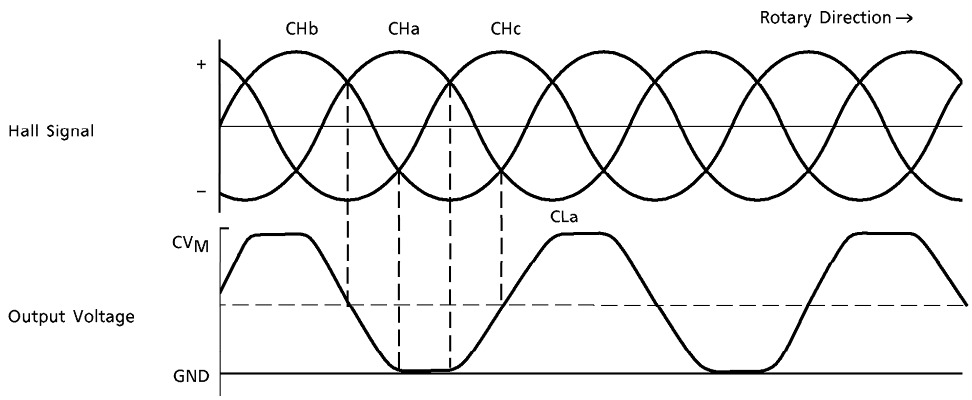


When the temperature exceeds $T_j = 170°C$ (Typ.) (design target value), the output circuits in the capstan and cylinder sections are turned off. This circuit has an approximately 30°C Hysteresis, and the recovery temperature is $T_j = 140°C$ (Typ.) (design target value).

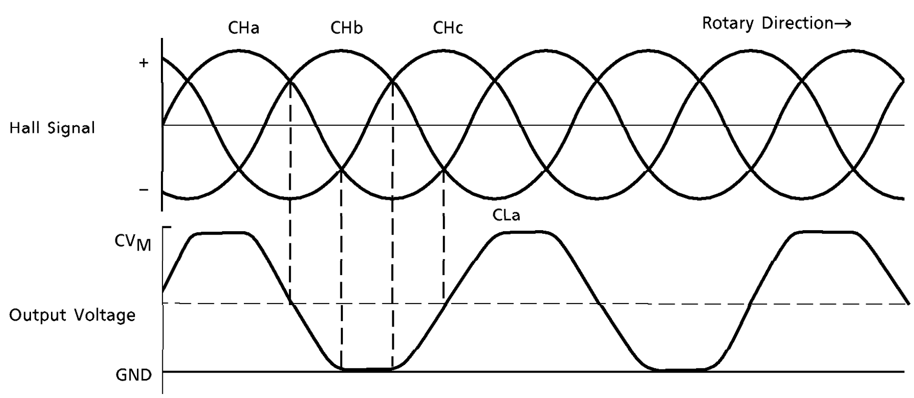
TRUTH TABLE / TIMING CHART
<Capstan section>

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)

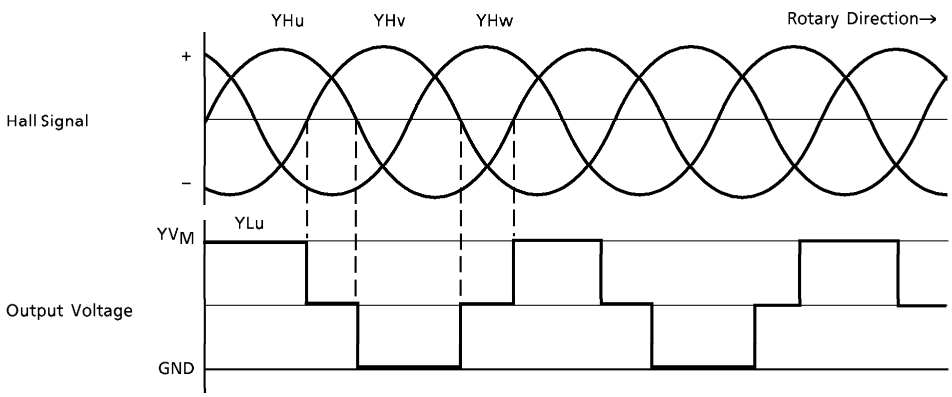


(Reverse rotation)



<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_{CC}	10	10	V
Output Section Supply Voltage	V_M	10	10	V
Output Current	I_O	1.5	1.5	A
Power Dissipation	P_D	(Note 1) 1		W
Operating Temperature	T_{opr}	−20~75		°C
Storage Temperature	T_{stg}	−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_{CC}	4.2~6.0	V
Output Section Supply Voltage	CV_M	2.8~8.0	V

CYLINDER SECTION

CHARACTERISTIC	SYMBOL	OPERATING RANGE	UNIT
Small Signal Section Supply Voltage	YV_{CC}	4.2~6.0	V
Output Section Supply Voltage	YV_M	1.5~8.0	V

ELECTRICAL CHARACTERISTICS
CAPSTAN SECTION (CV_{CC} = 5.0V, CV_M = 3V, Ta = 25°C)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply Current		CI_{CC1}	1	Output open, standby	—	60	80	μA
		CI_{CC2}	1	Output open, start	—	5	8	mA
		CI_{M1}	2	Output open, standby	—	2	5	mA
		CI_{M2}	2	Output open, start	—	7	12	mA
Hall Amp Circuit	Input Current	CI_H	3	CV_{CMR} = 2.5V	—	—	5	μA
	Common-Phase Voltage Range	CV_{CMR}	4		1.4	—	2.8	V
	Input Sensitivity	CV_H	5	(Note)	20	—	—	mV_{p-p}
	Hall Input Output Voltage Gain	CG_{VHO}	5	RANGLE = 6.8kΩ	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	ΔCV_{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	CI_{INS}	11	CV_S = 0V	—	—	5	μA
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	CI_{INF}	12	CV_F = 5.0V	—	—	70	μA
Thermal Shutdown Circuit Operating Temperature		T_{SD}	—	(Junction temperature)	—	170	—	°C

(Note) Defined by output functioning

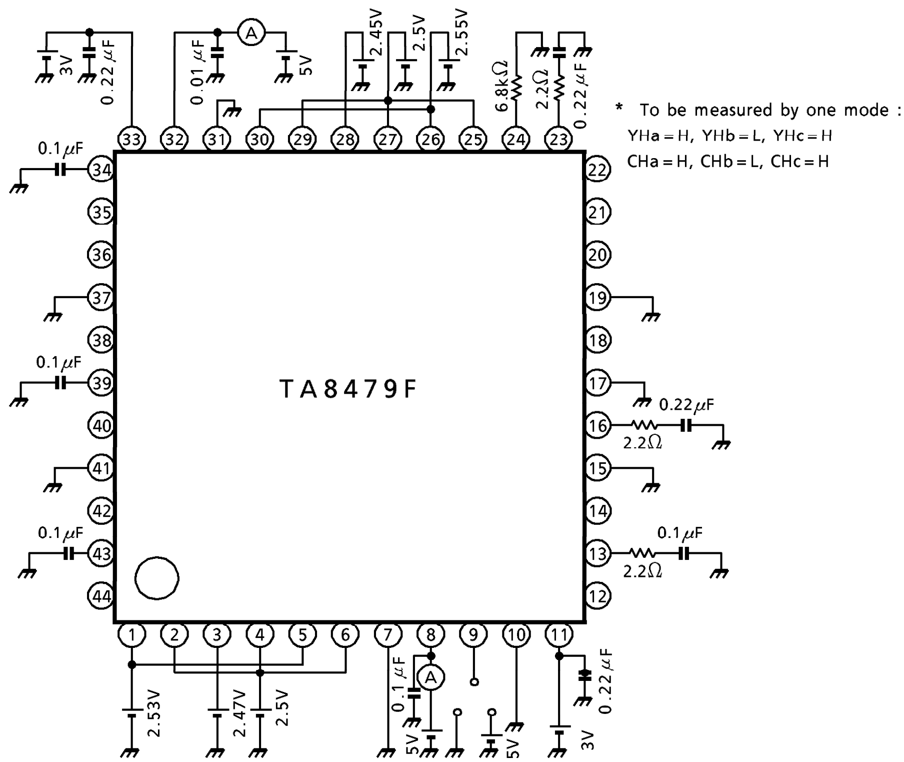
CYLINDER SECTION (YV_{CC} = 5.0V, YV_M = 3V, Ta = 25°C)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	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	μA
	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	μA
	Leakage Current (Lower Side)	YV_{OL} (L)	10	YV_M = 10V	—	—	10	μA
Thermal Shutdown Operating Temperature		T_{SD}	—		—	170	—	°C

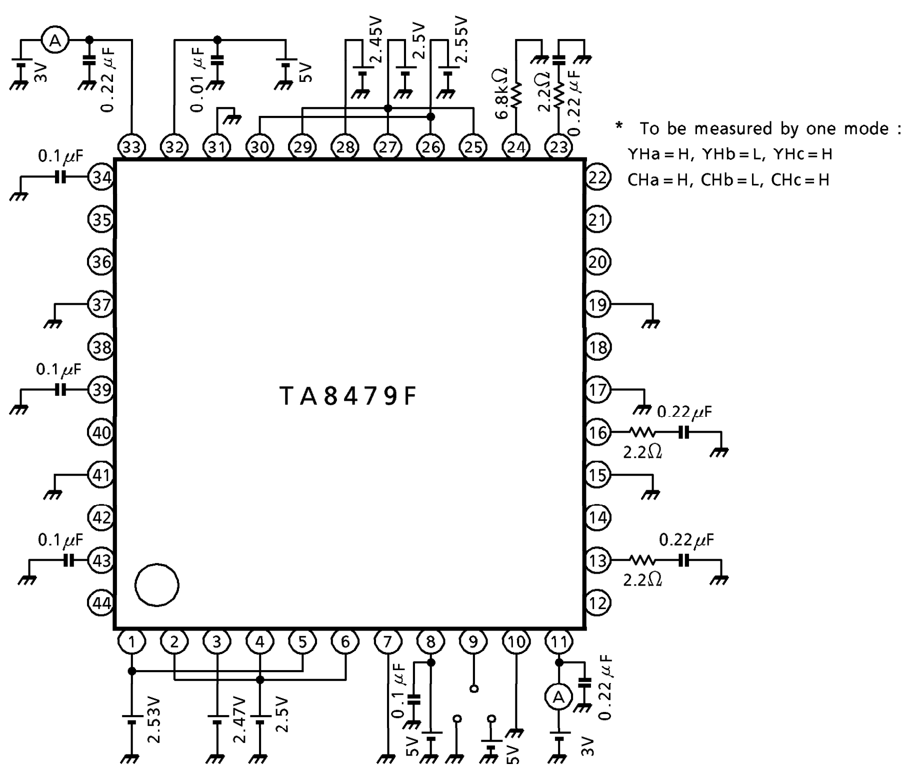
(Note) Defined by output functioning

TEST CIRCUIT

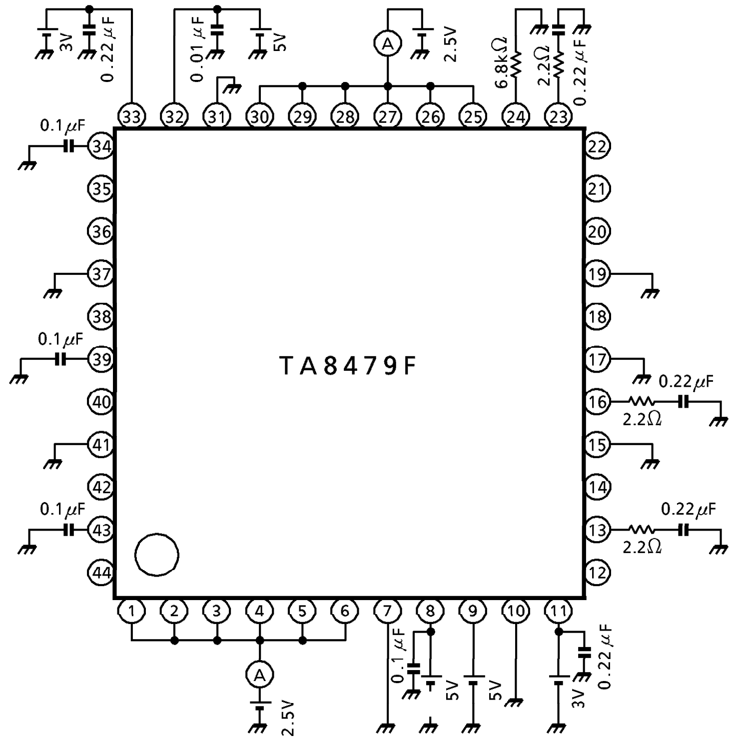
1. YI_{CC}, CI_{CC1}, CI_{CC2}



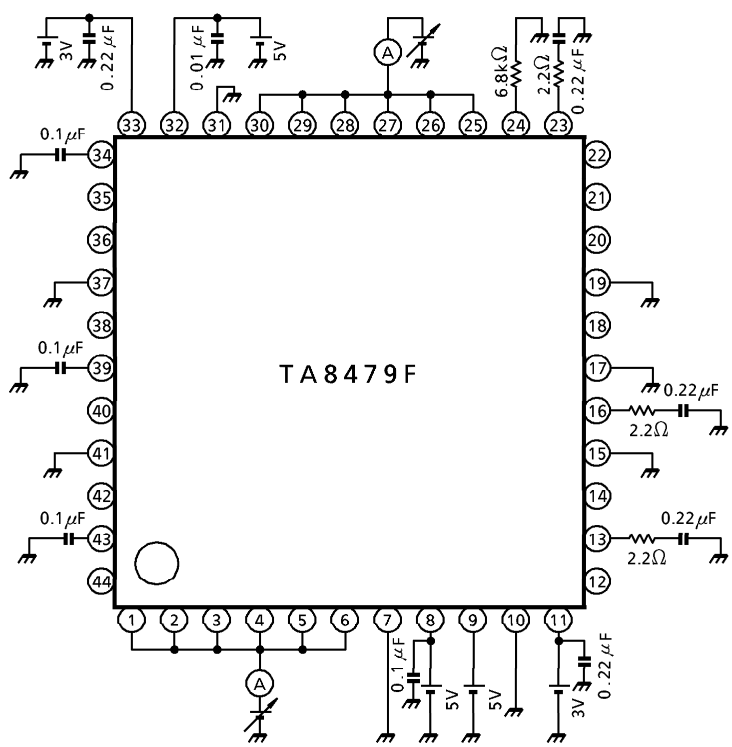
2. YI_{M}, CI_{M1}, CI_{M2}



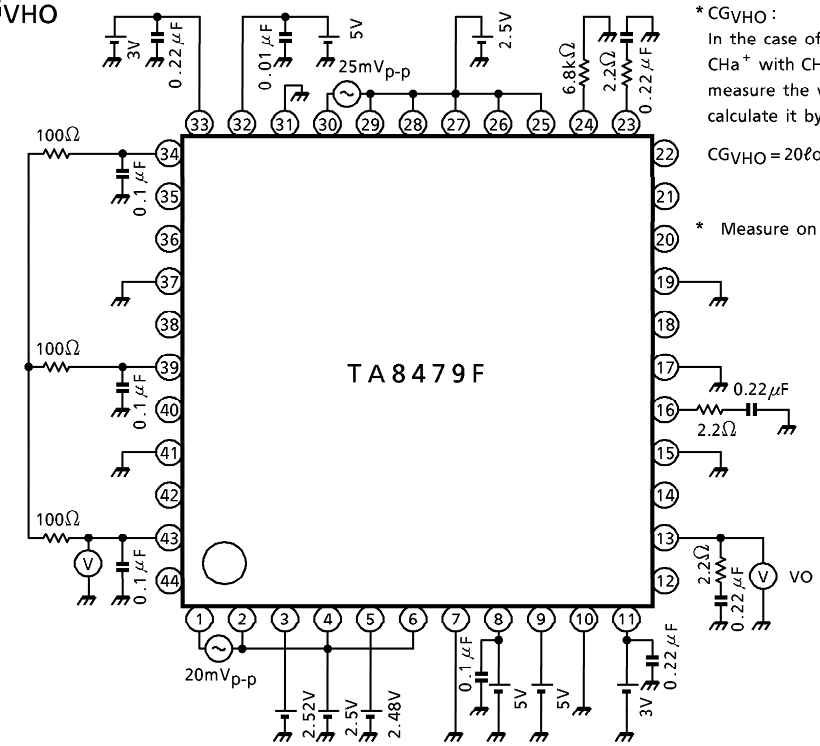
3. YI_H, CI_H



4. YV_{CMR}, CV_{CMR}



5. YV_H, CV_H, CG_{VHO}

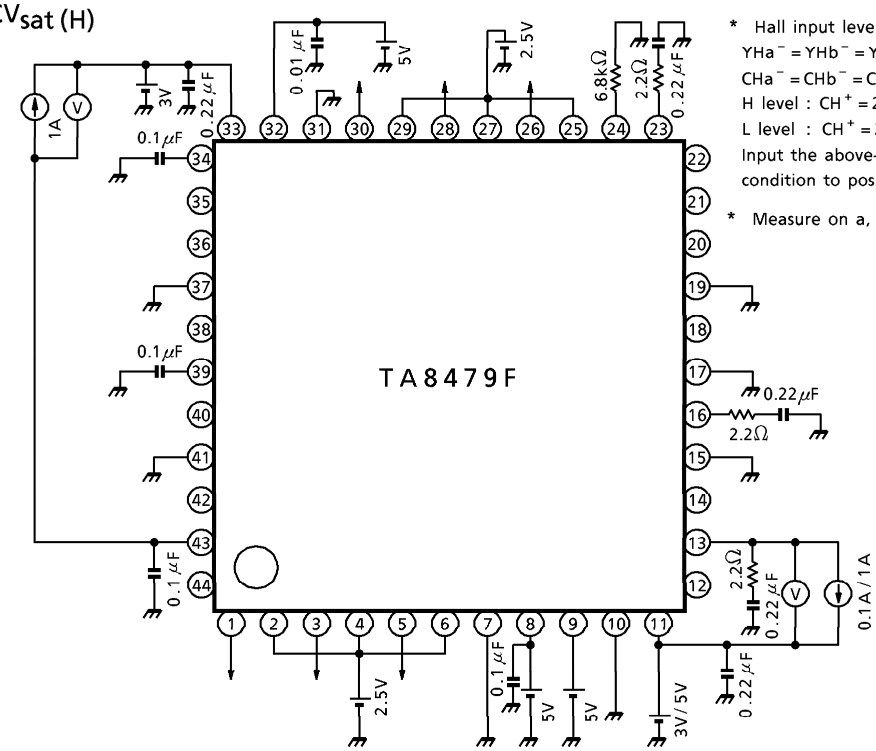


* CG_{VHO} :
In the case of a-phase CG_{VHO}, change CHa^+ with $CHa^- = CHb^- = CHc^- = 2.5V$, measure the voltage of CLa in that case, and calculate it by the following formula :

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

* Measure on a, b, and c phases.

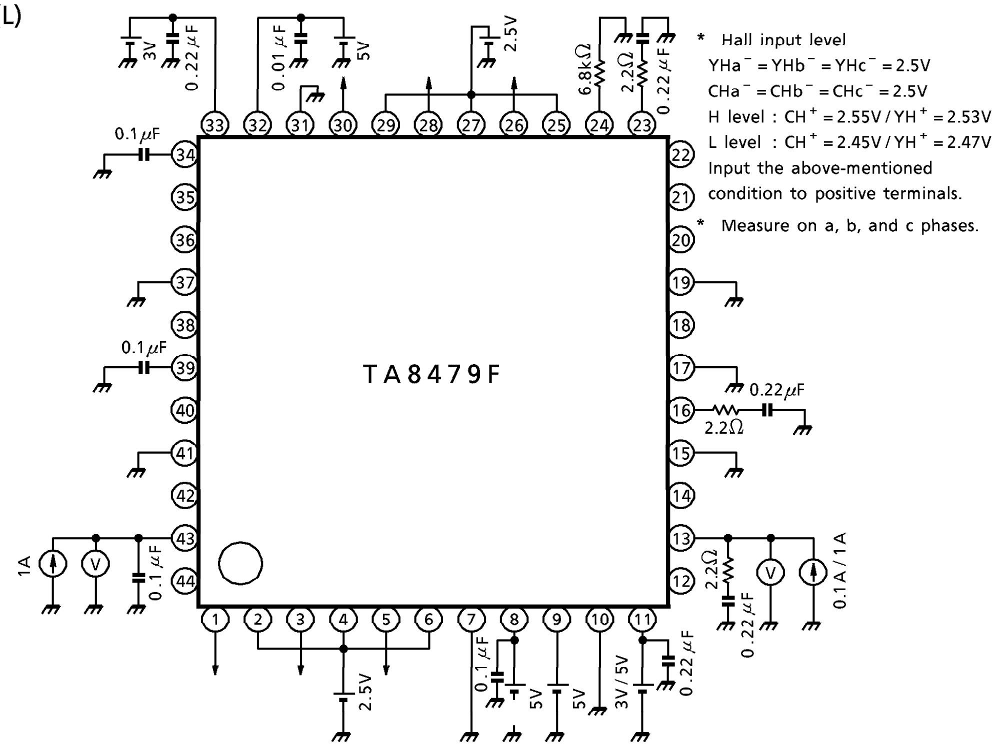
6. $YV_{sat\,(H)}$, $CV_{sat\,(H)}$



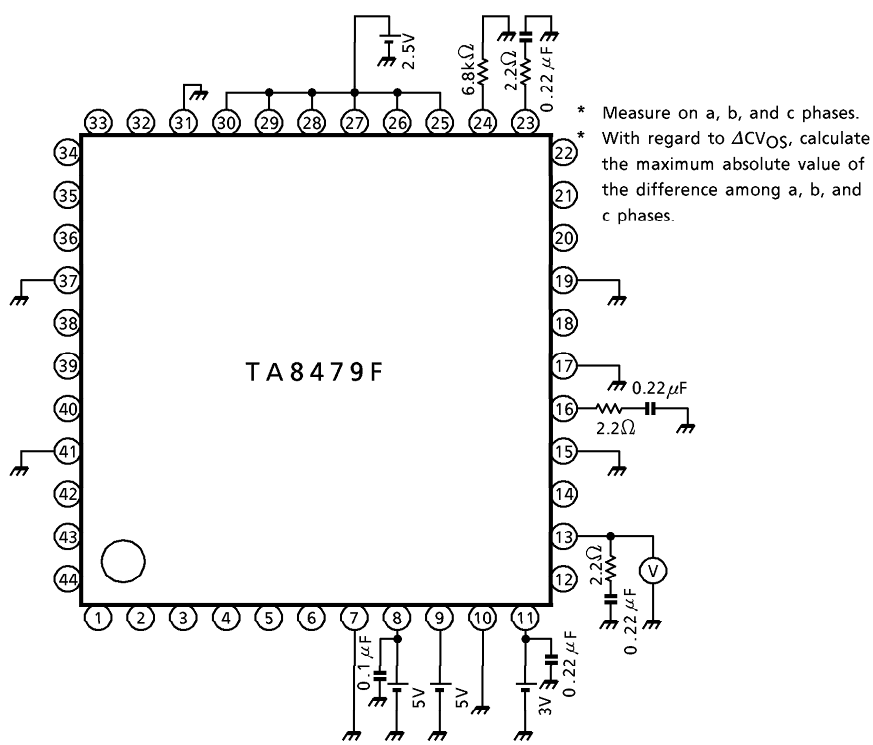
* Hall input level
$YHa^- = YHb^- = YHc^- = 2.5V$
$CHa^- = CHb^- = CHc^- = 2.5V$
H level : $CH^+ = 2.55V$ / $YH^+ = 2.53V$
L level : $CH^+ = 2.45V$ / $YH^+ = 2.47V$
Input the above-mentioned condition to positive terminals.

* Measure on a, b, and c phases.

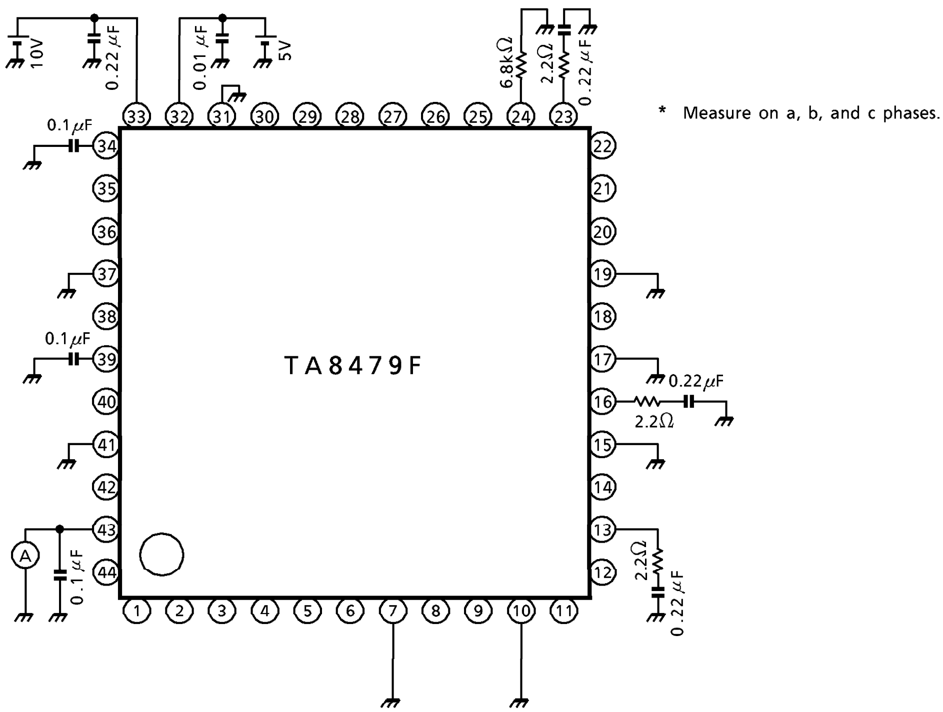
7. $YV_{sat(L)}$, $CV_{sat(L)}$



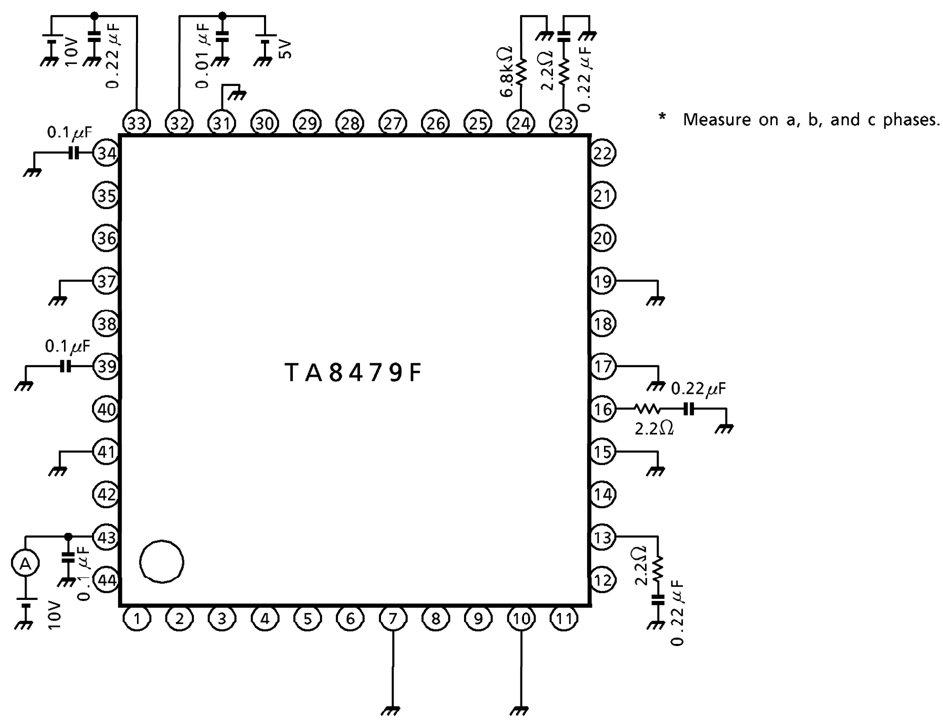
8. CV_{OS}, ΔCV_{OS}



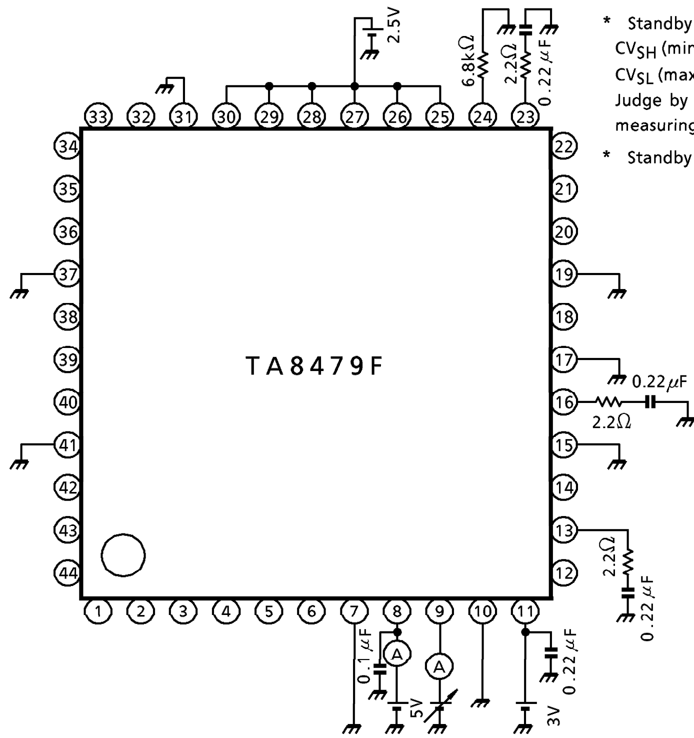
9. YI_{OL} (H)



10. YI_{OL} (L)

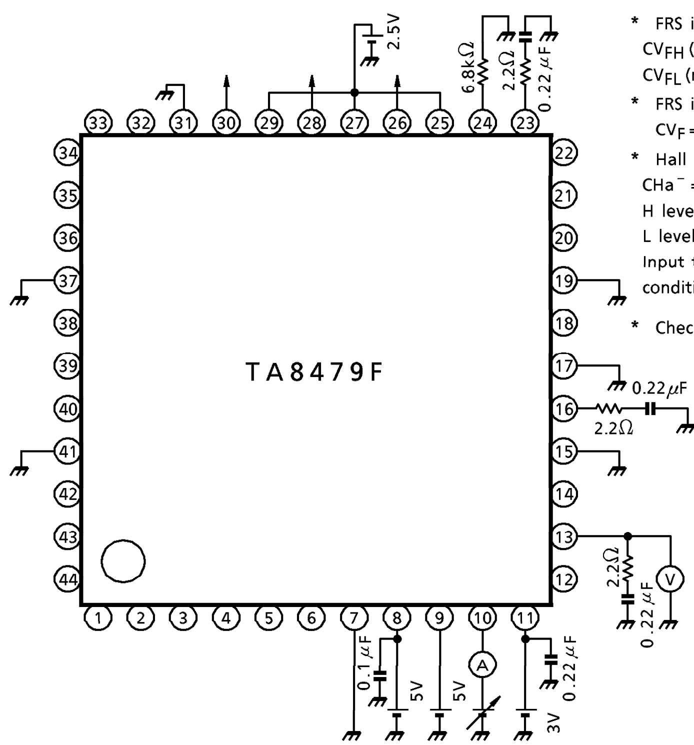


11. CV_{SH}, CV_{SL}, CI_{INS}



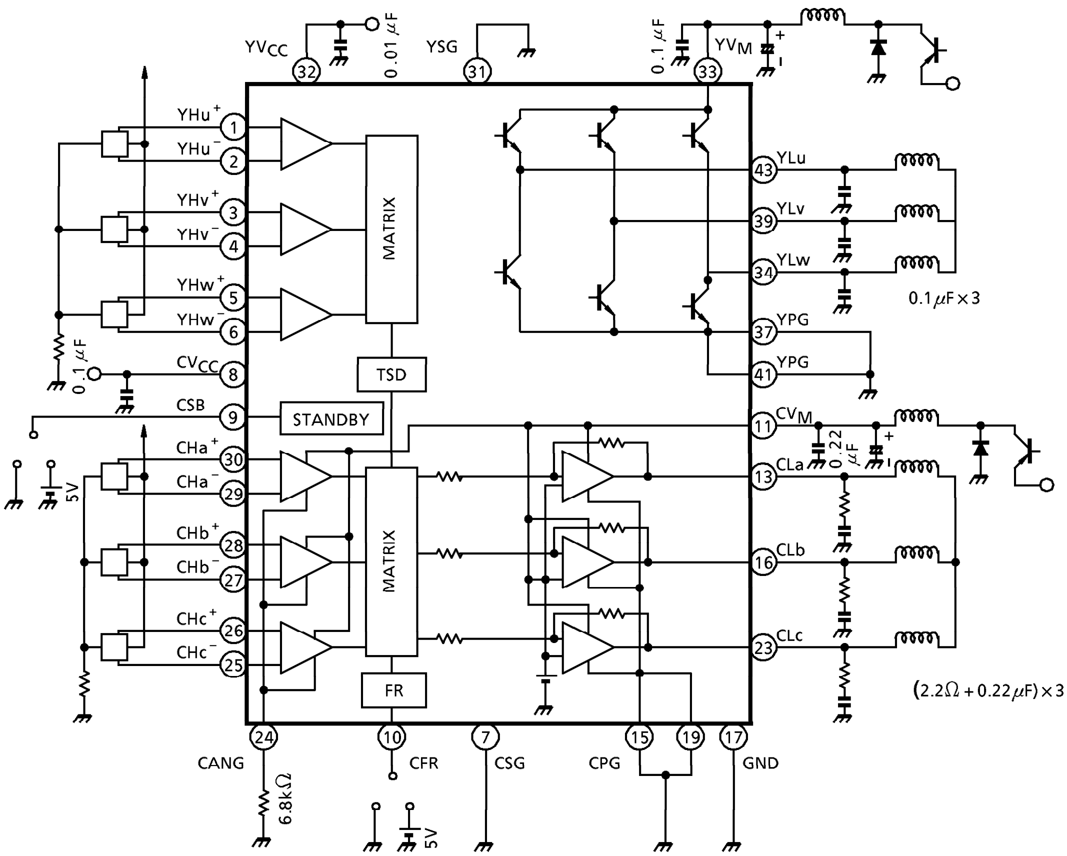
* Standby input voltage :
  CV_{SH} (min) = 3.0V
  CV_{SL} (max) = 1.2V
  Judge by switching input voltage and measuring CI_{CC}.
* Standby input current when CV_S = 0V

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



* FRS input voltage :
  CV_{FH} (min) = 3.5V
  CV_{FL} (max) = 1.2V
* FRS input current when CV_F = 5V
* Hall input level
  $CHa^- = CHb^- = CHc^-$ = 2.5V
  H level : CH^+ = 2.55V
  L level : CH^+ = 2.45V
  Input the above-mentioned condition to positive terminals.
* Check with a-phase output.

APPLICATION CIRCUIT

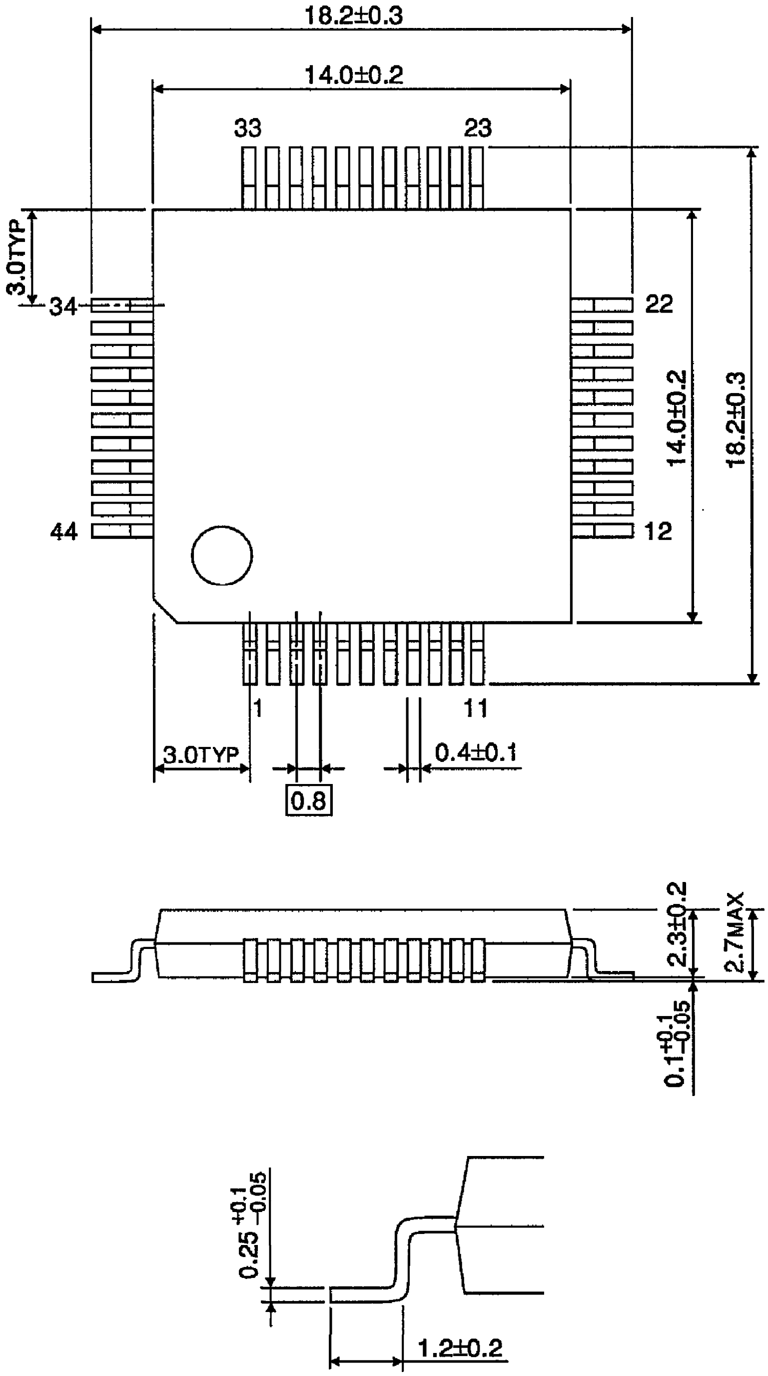


(Note) Utmost care is necessary in the design of the output line, YV_M, CV_M and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

OUTLINE DRAWING

QFP44-P-1414-0.80B

Unit : mm



Weight : 1.15g (Typ.)