

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA7289P, TA7289F

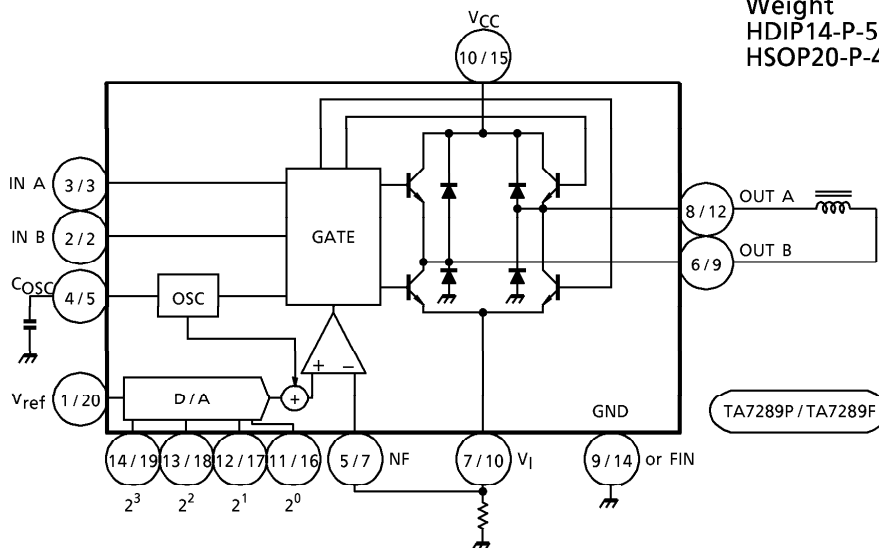
PWM STEPPING MOTOR DRIVER

The TA7289P, TA7289F are PWM solenoid driver designed especially for use high efficiency stepping motor control. It consist of 1.5A peak current drive capable output full bridge driver, oscillation circuit for PWM switching, 4bit D-A for output current control and TTL compatible input circuit.

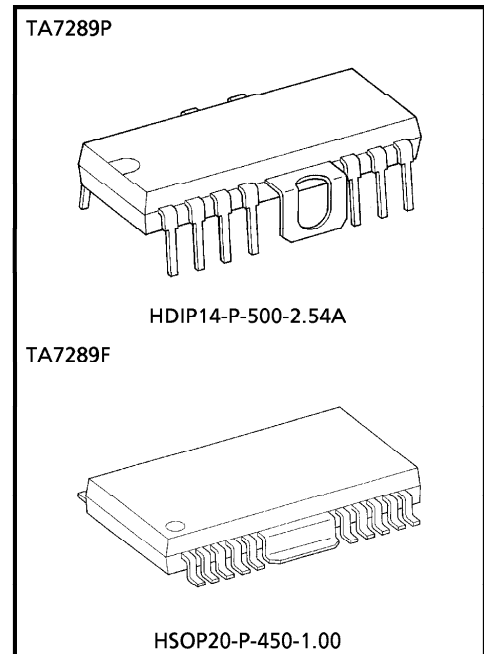
FEATURES

- Wide Range of Operating Voltage
: V_{CC} (opr.) Min. = 6~27V
- High Current Capability : I_O Max = 1.5A (PEAK)
- LS-TTL Compatible Control Inputs (IN A, IN B)
- Few External Components Required.
- Build-in 4bit DAC.

BLOCK DIAGRAM



(Note) Pin ①, ④, ⑥, ⑧, ⑪ of TA7289F are all NC (Non-connection)



Weight
 HDIP14-P-500-2.54A : 3.00g (Typ.)
 HSOP20-P-450-1.00 : 0.79g (Typ.)

961001EBA2

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PIN FUNCTION

PIN No.		PIN SYMBOL	FUNCTIONAL DESCRIPTION
P	F		
1	20	V _{ref}	NF voltage supply input terminal
2	2	IN B	Signal input terminal
3	3	IN A	Signal input terminal
4	5	COSC	Internal oscillation frequency input terminal
5	7	NF	Output current detection terminal
6	9	OUT B	Output B terminal
7	10	V _I	Comparator input terminal
8	12	OUT A	Output A terminal
9	14	GND	GND terminal
10	15	V _{CC}	Power voltage supply terminal
11	16	2 ⁰	D/A input terminal
12	17	2 ¹	D/A input terminal
13	18	2 ²	D/A input terminal
14	19	2 ³	D/A input terminal
FIN	FIN	GND	GND terminal

(Note) Pin ①, ④, ⑥, ⑧, ⑪ of TA7289F are all NC (Non-connection)

FUNCTION

IN A	IN B	OUT A	OUT B	MODE
L	L	OFF	OFF	STOP
H	L	H	L	CW / CCW
L	H	L	H	CCW / CW
H	H	OFF	OFF	STOP

INPUT CIRCUIT (IN A, IN B)

Input circuit is shown in Fig.1 IN A and IN B are TTL compatible "Low Active" type and have a hysteresis of 0.8V Typ at T_j = 25°C.

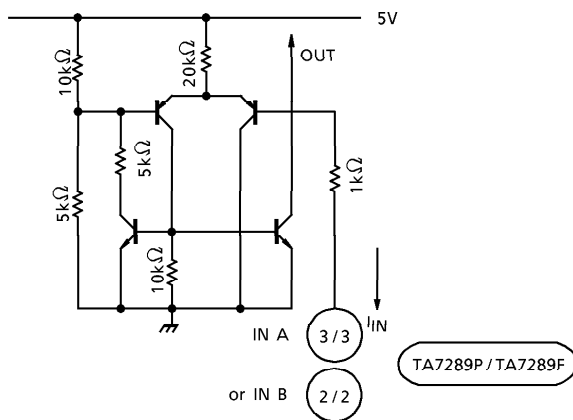


Fig.1

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D/A AND V_{ref} CIRCUIT

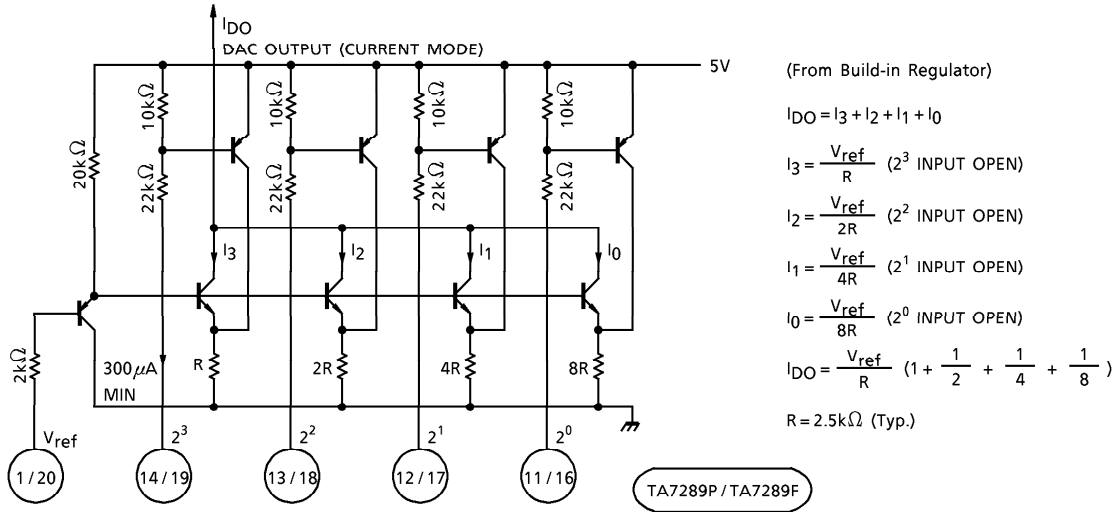
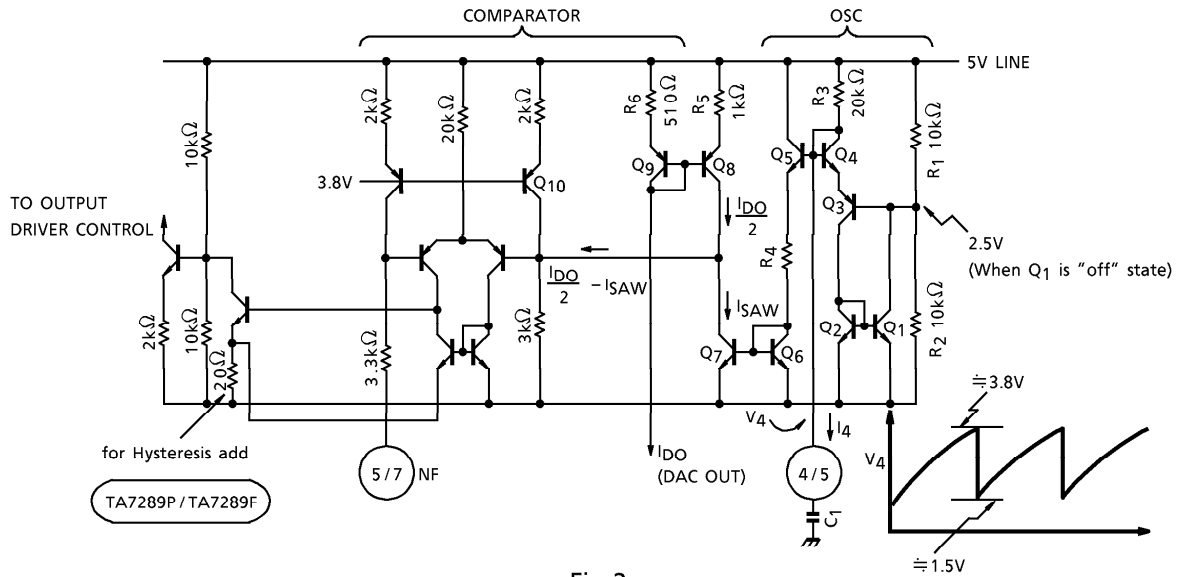


Fig.2

I_{DO} of current mode DAC output is proportional to multiplied voltage of V_{ref} (PIN ① (or ⑳)) and DAC inputs. DAC inputs are all "low active" type and required input current of 300μA MIN for each input terminal.

OSC AND COMPARATOR



Sawtooth OSC circuit consists of Q₁ through Q₄ and R₁ through R₃.

R₁ and R₂ are voltage divider of 5V build-in regulator.

Q₁ is turned "off" when V₄ is less than the voltage of 2.5V + V_{BE} Q₄ + V_{BE} Q₃ approximately equal to 3.8V. V₄ is increased by C₁ charging of I₄. Q₁ and Q₂ are turned "ON" when V₄ becomes V₄ - H level.

Lower level of V₄ (V₄ - L) is equal to V_{BE} Q₄ + V_{BE} Q₃ + V_{SAT} Q₁ approximately equal to 1.5V.

V₄ is calculated by following equation.

$$V_4 = 5 \cdot (1 - e^{-\frac{1}{C_1 \cdot R_3} \cdot t}) \dots\dots\dots ①$$

Assuming that V₄ = 1.5V (t = t₁) and = 3.8V (t = t₂).

C₁ is external capacitance connected to Pin ④ (or ⑤) and R₃ is on-chip 20kΩ resistor.

Therefore, OSC frequency is calculated as follows.

$$t_1 = -C_1 \cdot R_3 \cdot \ln \left(1 - \frac{1.5}{5}\right) \dots\dots\dots ②$$

$$t_2 = -C_1 \cdot R_3 \cdot \ln \left(1 - \frac{3.8}{5}\right) \dots\dots\dots ③$$

$$f_{OSC} = \frac{1}{t_1 - t_2} = \frac{1}{C_1 \cdot (R_3 \cdot \ln \left(1 - \frac{1.5}{5}\right) - R_3 \cdot \ln \left(1 - \frac{3.8}{5}\right))}$$

$$= \frac{1}{21.4 C_1} \text{ (kHz) (Unit of } C_1 \text{ is } \mu\text{F)}$$

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Supply Voltage		V _{CC}	30	V
		V _{ref}	30	
Reference Voltage		V _{IN}	7	
		V _I	2	
Output Current	TA7289P	I _O (MAX.)	1.5	A
	TA7289F		0.8	
	TA7289P	I _O (AVE.)	0.7	
	TA7289F		0.3	
Power Dissipation	TA7289P	P _D (Note)	2.3	W
	TA7289F		1.0	
Operating Temperature		T _{opr}	- 30~85	°C
Storage Temperature		T _{stg}	- 55~150	°C

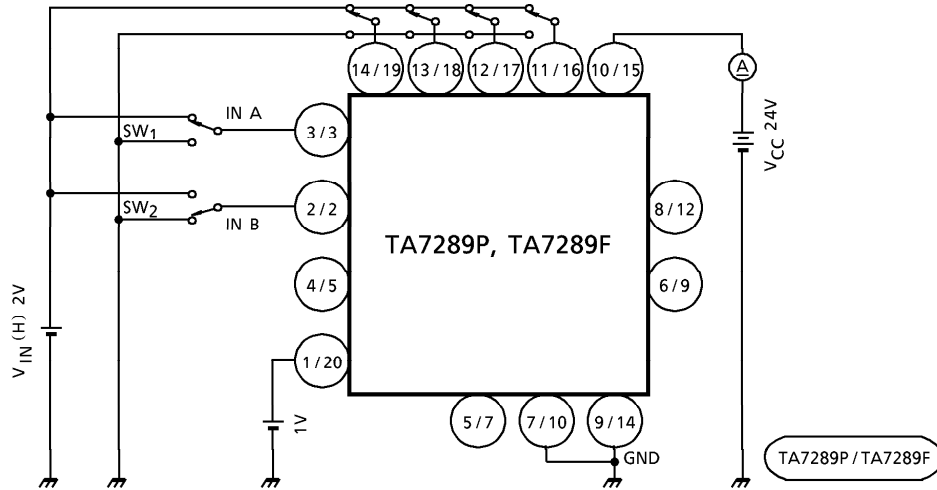
(Note) NO HEAT SINK

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{CC} = 24V$, $T_a = 25^\circ C$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current	I_{CC1}	1	CW / CCW	12	20	30	mA
	I_{CC2}		STOP	12	20	30	
	I_{CC3}		CW / CCW mode, $2^0 \sim 2^3 : H$	12	20	30	
	I_{CC4}		CW / CCW mode, $2^0 \sim 2^3 : L$	13	23	32	
Output Voltage	$V_{IN(H)}$	2	IN A IN B, Source type.	2.0	—	7.0	V
	$V_{IN(L)}$			-0.4	—	0.8	
Input Hysteresis Width	ΔV_{IN}	2	—	—	0.8	—	V
Input Current	I_{IN1}	2	IN A, IN B $V_{IN} = 0V$ Source type	—	25	35	μA
	I_{IN2}		$2^0, 2^1, 2^2, 2^3$ $V_{IN} = 0V$ Source type	90	160	200	
Output Saturation Voltage	$V_{SAT U1}$	3	$I_{OUT} = 0.2A$	—	1.1	1.5	V
	$V_{SAT L1}$			—	0.8	1.1	
	$V_{SAT U2}$		$I_{OUT} = 0.7A$	—	1.2	1.7	
	$V_{SAT L2}$			—	0.9	1.3	
	$V_{SAT U3}$		$I_{OUT} = 1.5A$	—	1.8	2.6	
	$V_{SAT L3}$			—	1.2	1.9	
Control Supply Voltage	V_{ref}	—	—	GND	—	2.0	V
Control Supply Current	I_{ref}	2	$V_{ref} = 0 \sim 2.0V$	—	25	35	μA
Diode Forward Voltage	V_{FU}	4	$I_F = 1.5A$	—	2.6	3.3	V
	V_{FL}			—	0.8	1.1	
Output Leakage Current	I_{L-U}	5	$V_L = 30V$	—	—	50	μA
	I_{L-L}		$V_L = 30V$	—	—	50	
NF Terminal Current	I_{NF}	6	Source type $V_{NF} = 0 \sim 2.0V$ $T_j = 0 \sim 125^\circ C$	180	300	490	μA
Internal Supply Output Voltage	V_{CC2}	6	—	—	5	—	V
Resistor for Oscillation (R3)	R_{OSC}	6	$T_j = 0 \sim 125^\circ C$	13	20	32	$k\Omega$

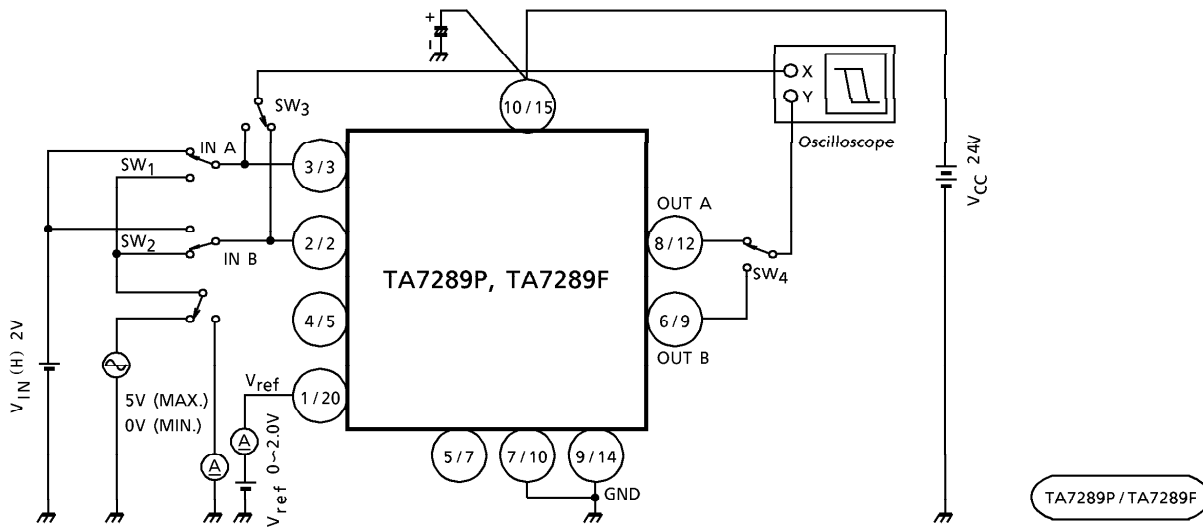
TEST CIRCUIT 1

$I_{CC1, 2, 3, 4}$



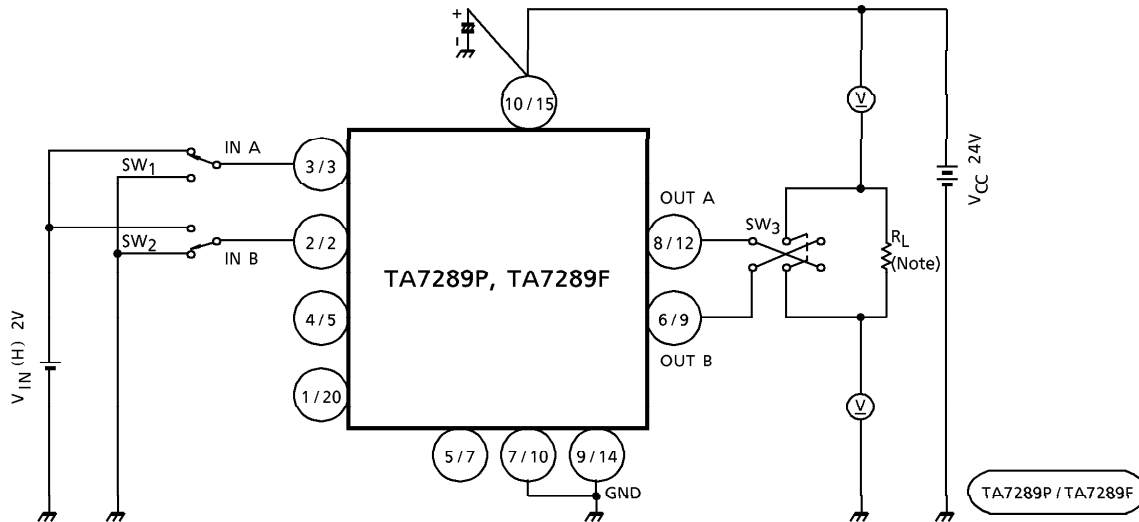
TEST CIRCUIT 2

$V_{IN(H)}, (L), I_{IN1, 2}, \Delta V_{IN}, I_{ref}$



TEST CIRCUIT 3

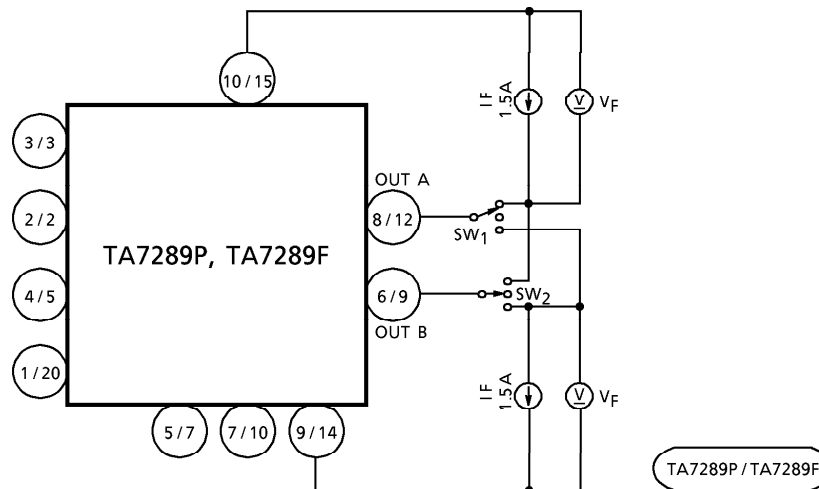
V_{SAT} U1, L1, U2, L2, U3, L3



(Note) Calibrate I_{OUT} to 0.2A/0.7A/1.5A by R_L

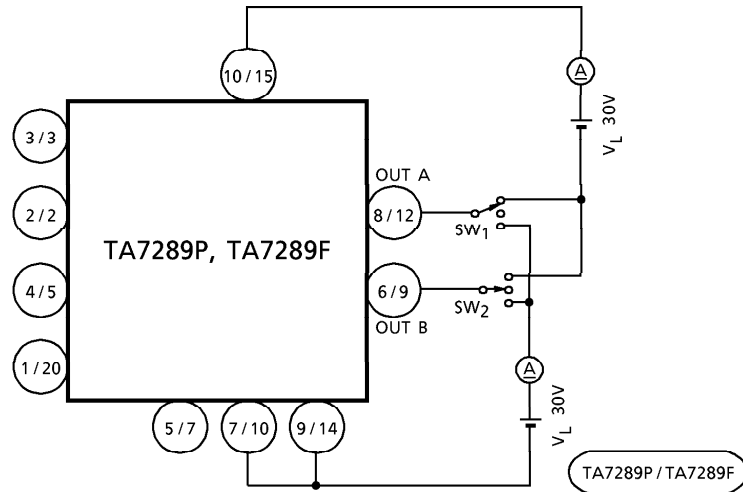
TEST CIRCUIT 4

V_{FU} , V_{FL}



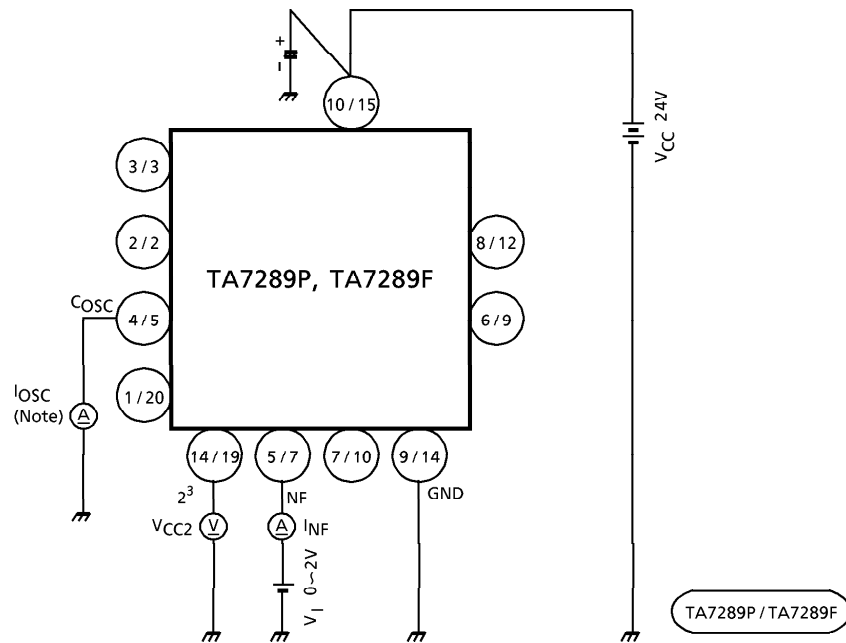
TEST CIRCUIT 5

I_{L-U} , I_{L-L}



TEST CIRCUIT 6

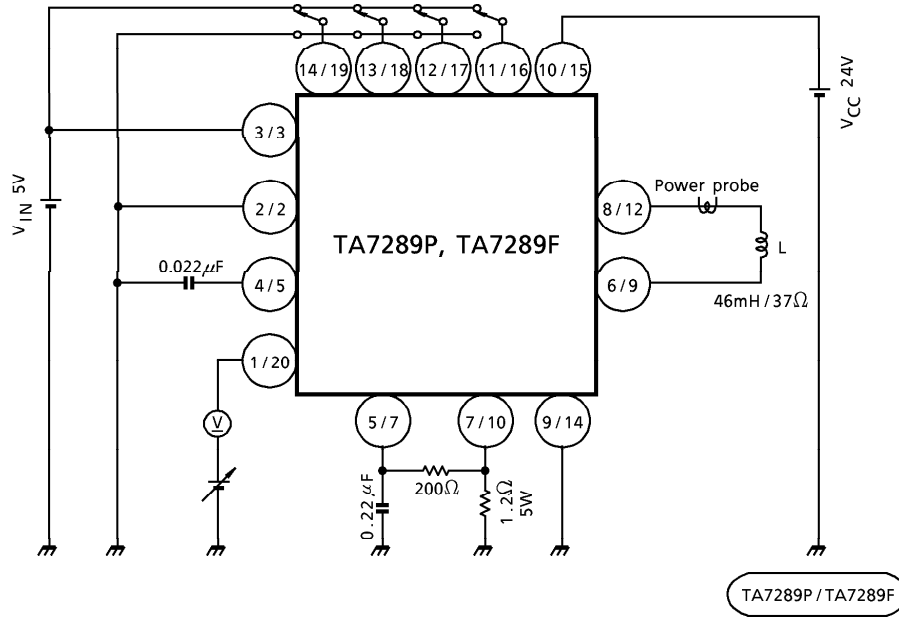
I_{NF} , V_{CC2} , R_{OSC}



$$\text{(Note) } R_{OSC} = \frac{V_{CC2} \text{ (V)}}{I_{OSC} \text{ (A)}} \text{ } (\Omega)$$

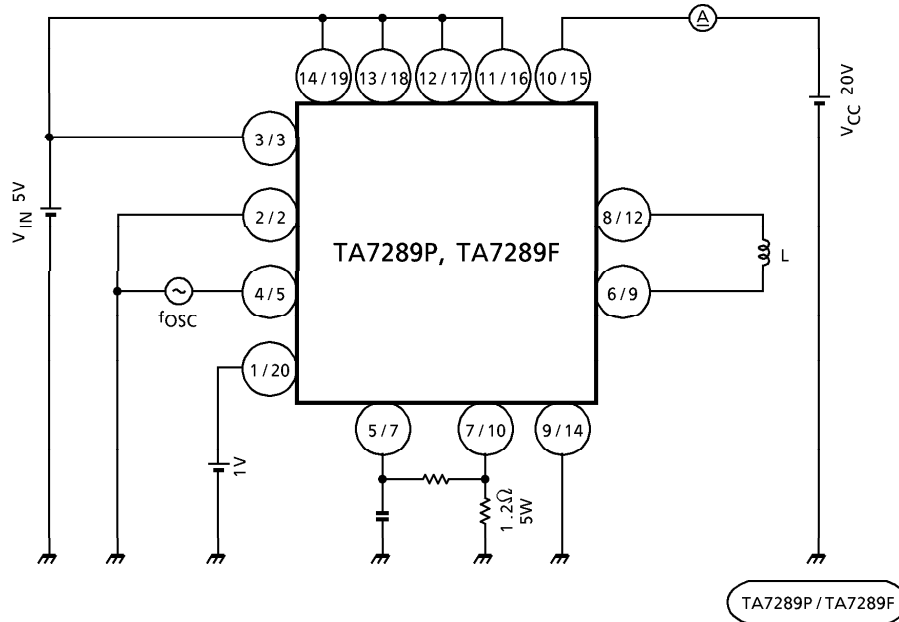
TEST CIRCUIT 7

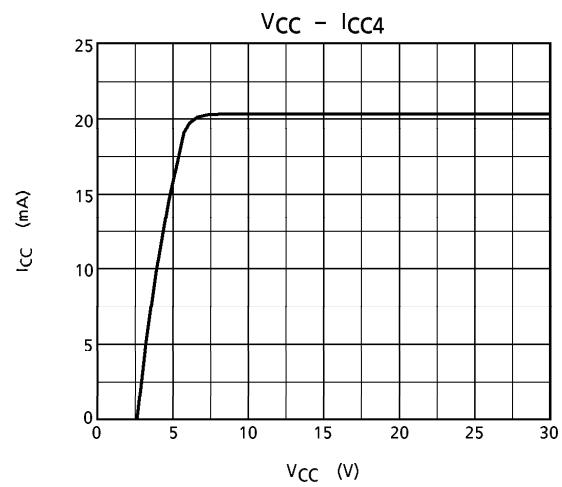
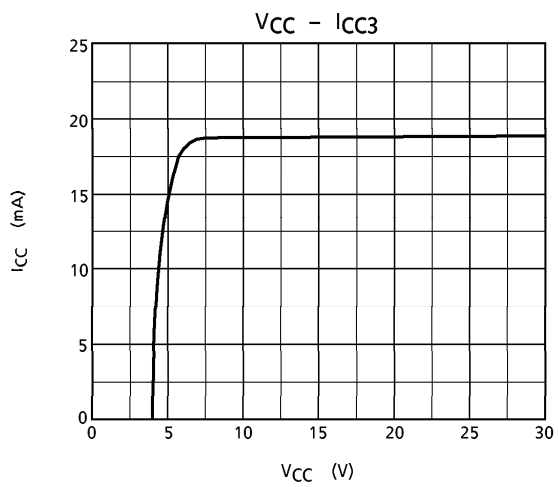
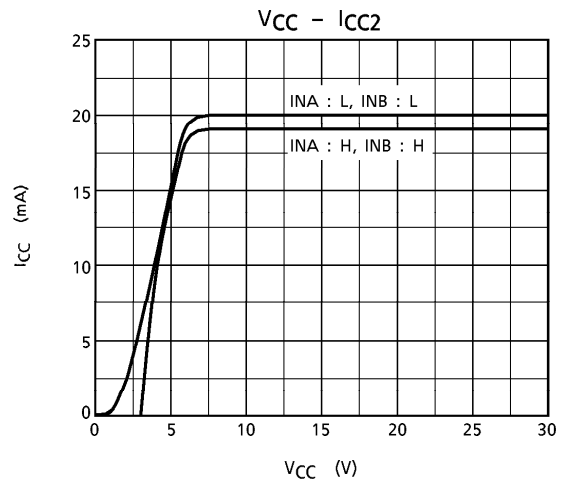
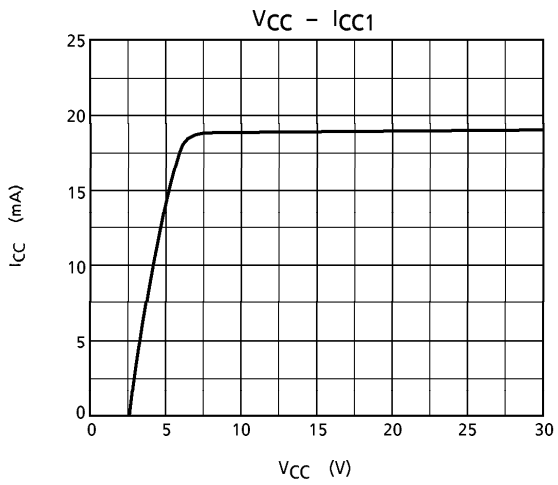
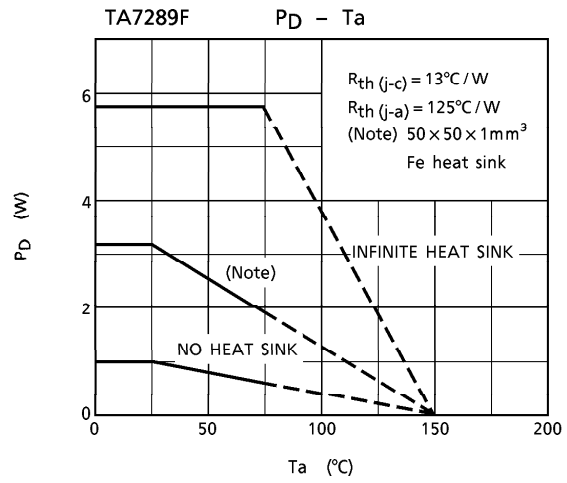
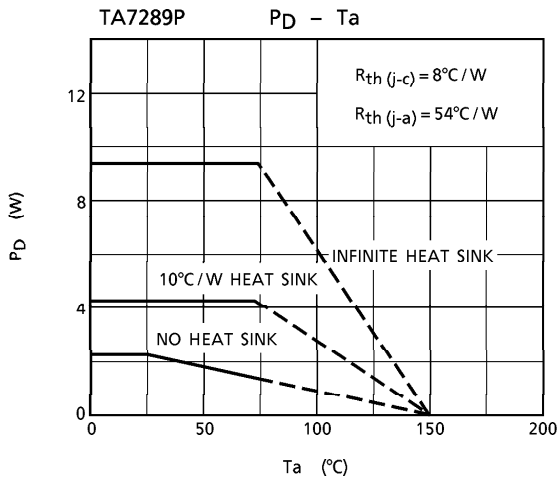
I_{OUT} - V_{ref} CHARACTERISTIC, I_{OUT} -D/A CHARACTERISTIC

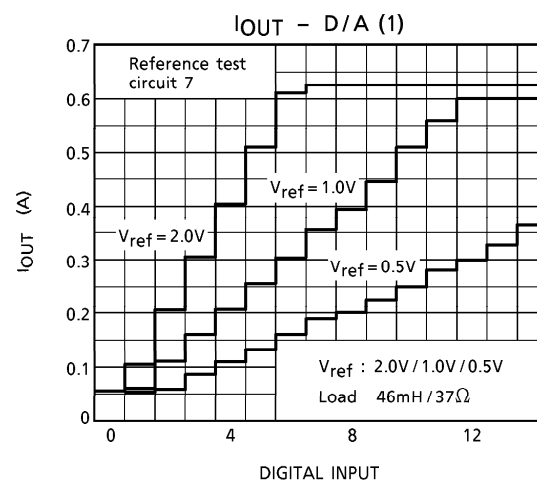
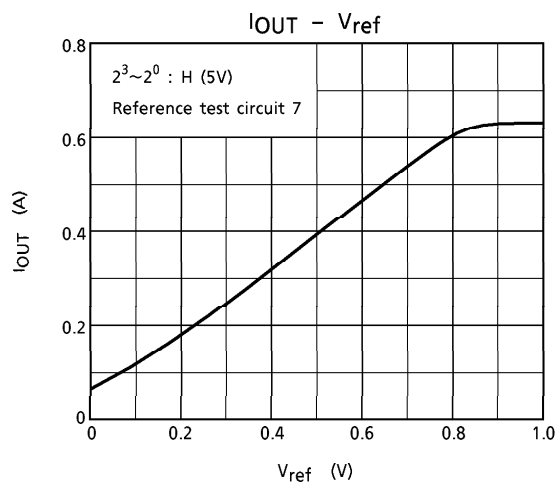
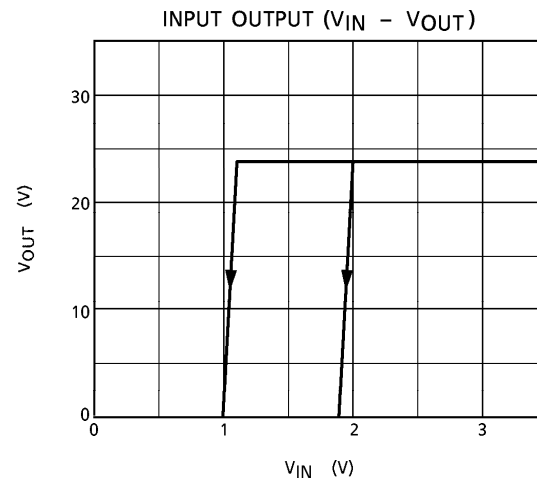
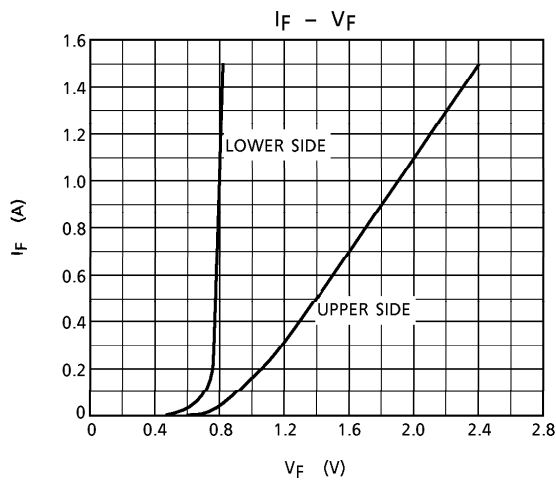
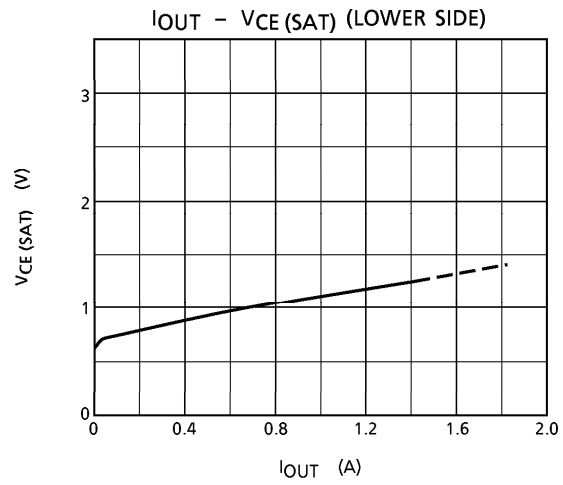
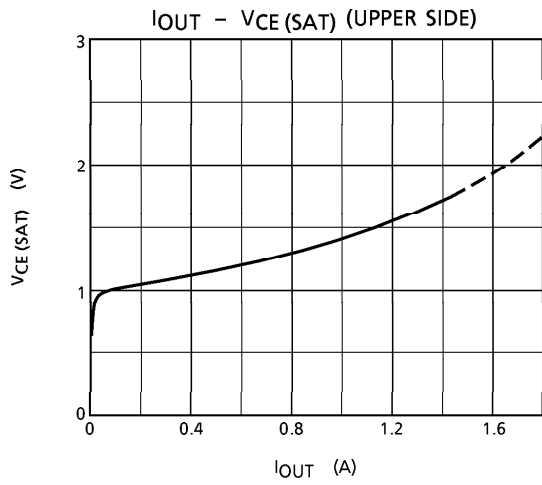


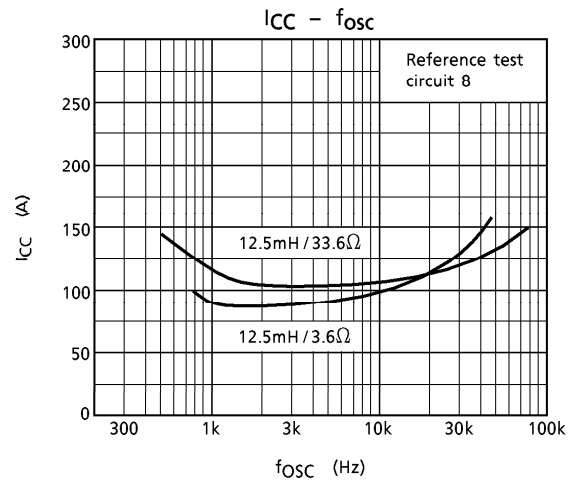
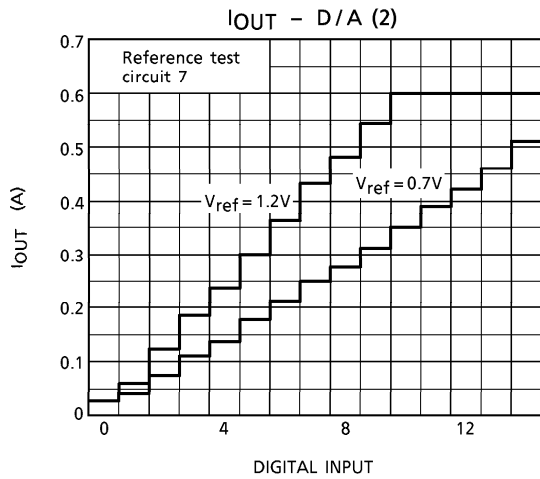
TEST CIRCUIT 8

I_{CC} -FREQUENCY CHARACTERISTIC

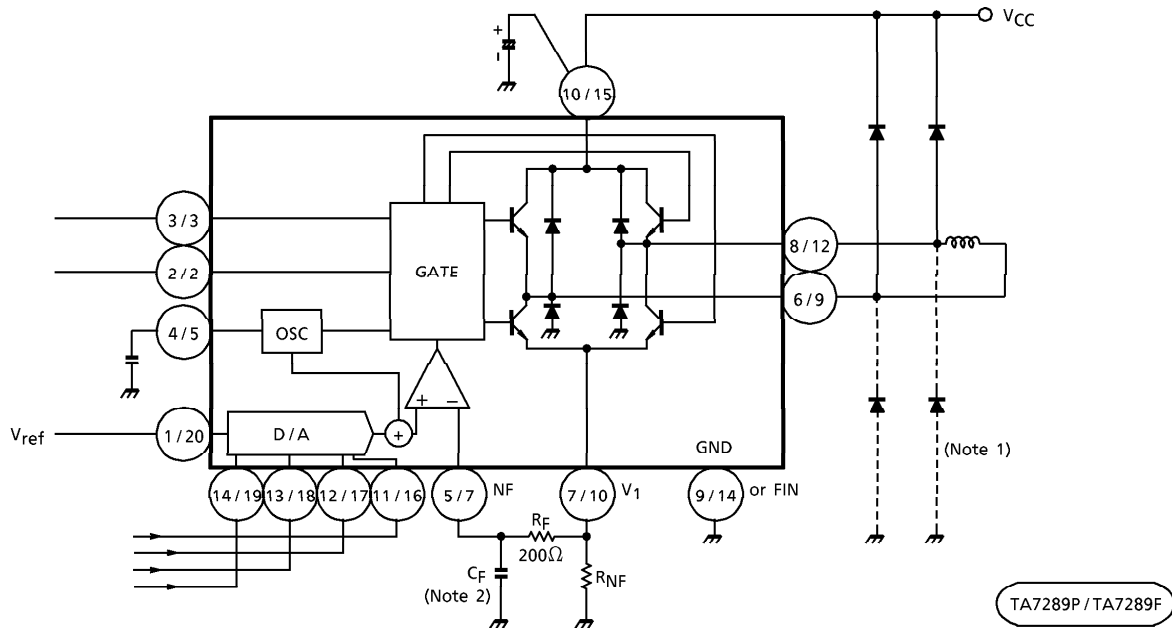








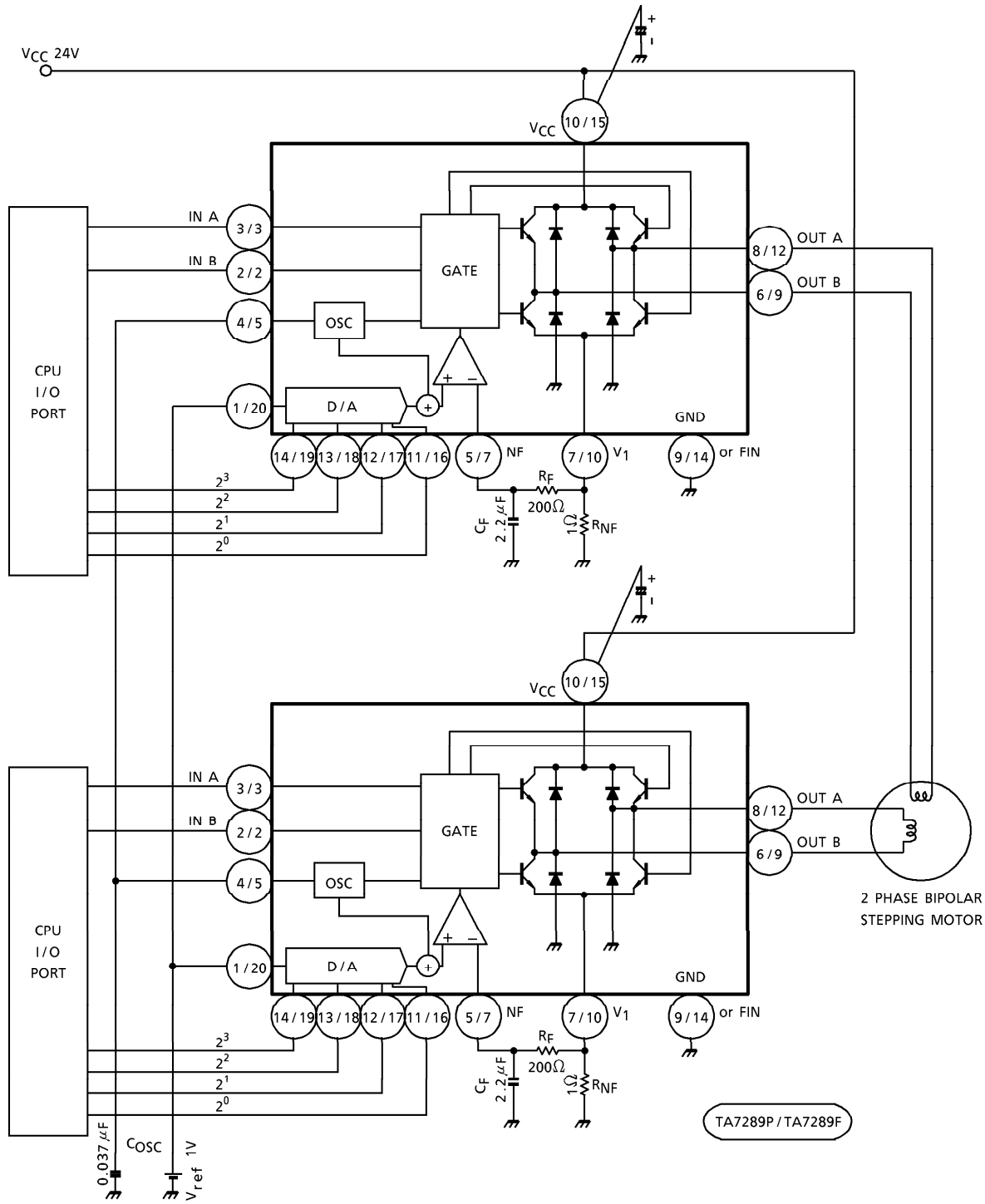
APPLICATION CIRCUIT 1



- (Note 1) Connect if required.
- (Note 2) Recommended R_F value is approximately 200Ω .
And C_F value is concerned with the OSC frequency.
We recommend to select optimum value of C_F under the experimental consideration of noise cutting and time delay characteristics.
- (Note 3) Utmost care is necessary in the design of the output line, V_{CC} and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

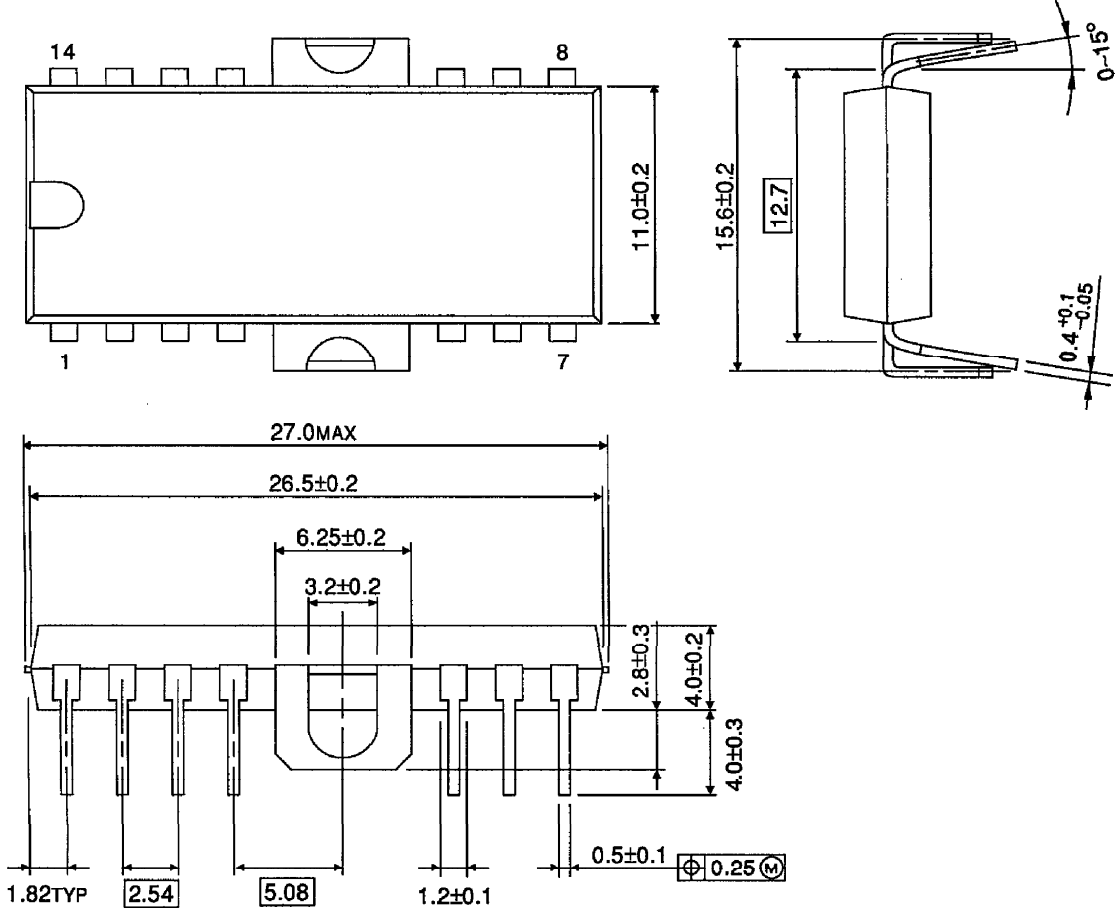
TA7289P / TA7289F

APPLICATION CIRCUIT 2 (PWM chopper stepping motor driver)



OUTLINE DRAWING
HDIP14-P-500-2.54A

Unit : mm

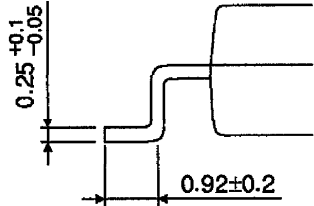
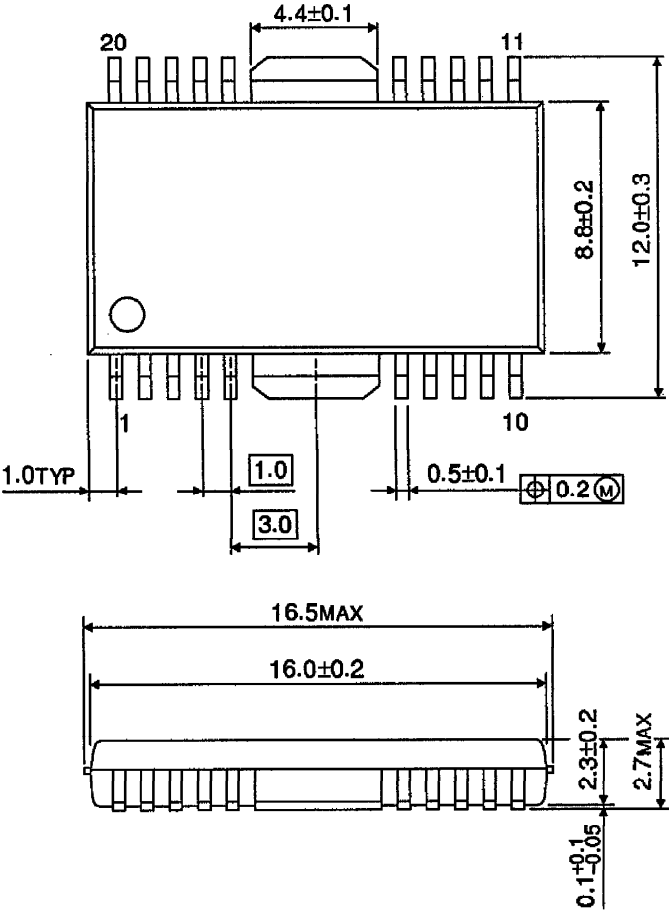


Weight : 3.00g (Typ.)

OUTLINE DRAWING

HSOP20-P-450-1.00

Unit : mm



Weight : 0.79g (Typ.)