FA7610CP(N)/12CP(N)/17CP(N)

■ Description

The FA7610CP(N), 7612CP(N) and 7617CP(N) are bipolar ICs containing basic circuits necessary for PWM-type switching power supply control.
To minimize the number of external discrete components, the FA7610CP(N) is provided for a flyback or step-up power-supply circuit, the FA7612CP(N) for a step-down power-supply circuit and FA7617CP(N) for a flyback power supply circuit.

■ Features

FA7610CP(N)

- For flyback transformer-type or step-up power-supply circuit (maximum output duty = 64% typical)
- Totem-pole predriver
- PWM-type switching power supply control
- Low-voltage operation (V_{CC} = 3.6 to 22V)
- Latch-mode short-circuit protection function (no malfunction by noise)
- Soft-start function
- Undervoltage lockout function
- One capacitor shared for short circuit protection and for soft-start to minimize the number of external discrete components

FA7612CP(N)

- For step-down power-supply circuit (maximum output duty = up to 100%)
- Open collector output
- PWM-type switching power supply control
- Low-voltage operation (V_{CC} = 3.6 to 22V)
- Latch-mode short-circuit protection function (no malfunction by noise)
- Soft-start function
- Undervoltage lockout function
- One capacitor shared for short circuit protection and for soft-start to minimize the number of external discrete components

FA7617CP(N)

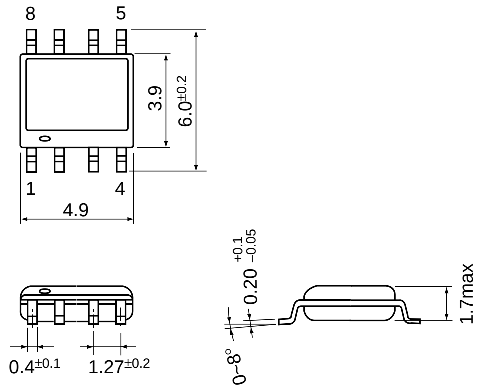
- For flyback transformer-type power-supply circuit (maximum output duty = 67% typical)
- Open collector output
- PWM-type switching power supply control
- Low-voltage operation (V_{CC} = 3.6 to 22V)
- Latch-mode short-circuit protection function (no malfunction by noise)
- Soft-start function
- Undervoltage lockout function
- One capacitor shared for short circuit protection and for soft-start to minimize the number of external discrete components

■ Applications

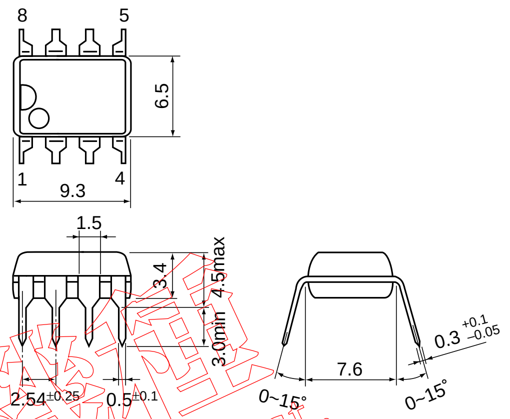
- Battery power supply for portable equipment

■ Dimensions, mm

● SOP-8

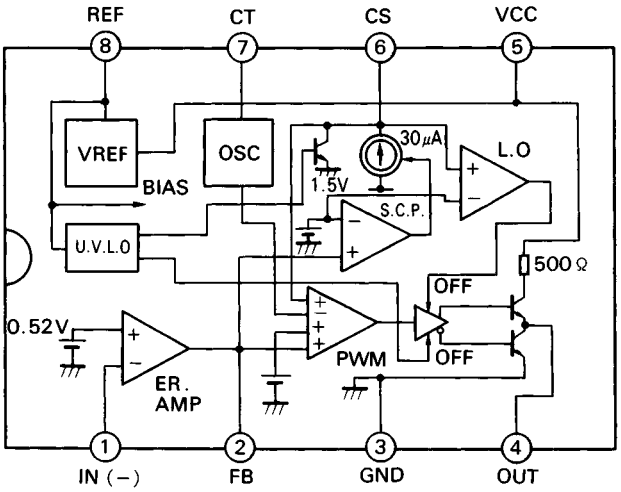


● DIP-8



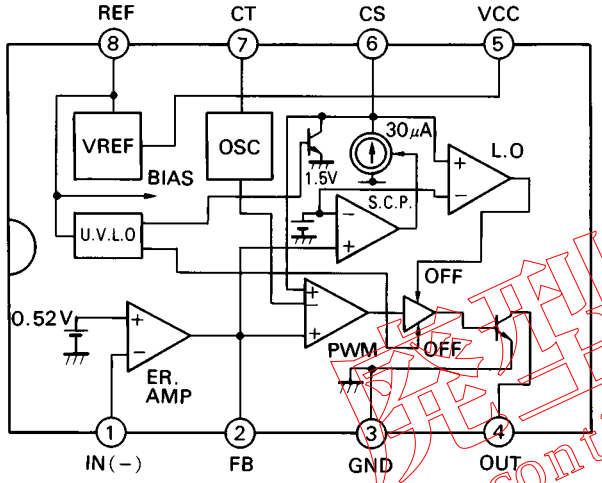
■ Block diagram

● FA7610CP(N)



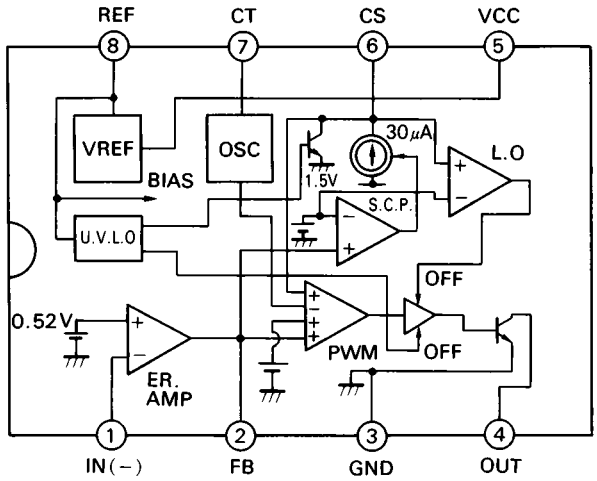
Pin No.	Pin symbol	Description
1	IN (–)	Inverting input to error amplifier
2	FB	Error amplifier output
3	GND	Ground
4	OUT	Output
5	VCC	Power supply
6	CS	Capacitor for soft-start, short-circuit protection and delay
7	CT	Oscillator timing capacitor
8	REF	Reference voltage output (2.5V)

● FA7612CP(N)



Pin No.	Pin symbol	Description
1	IN (–)	Inverting input to error amplifier
2	FB	Error amplifier output
3	GND	Ground
4	OUT	Output
5	VCC	Power supply
6	CS	Capacitor for soft-start, short-circuit protection and delay
7	CT	Oscillator timing capacitor
8	REF	Reference voltage output (2.5V)

● FA7617CP(N)



Pin No.	Pin symbol	Description
1	IN (–)	Inverting input to error amplifier
2	FB	Error amplifier output
3	GND	Ground
4	OUT	Output
5	VCC	Power supply
6	CS	Capacitor for soft-start, short-circuit protection and delay
7	CT	Oscillator timing capacitor
8	REF	Reference voltage output (2.5V)

■ Absolute maximum ratings (Ta = 25°C)

Item	Symbol	Rating		Unit
		FA7610C	FA7612C/17C	
Supply voltage	V_{CC}	22	22	V
Reference voltage output current	I_{OR}	5	5	mA
Output current	I_O	±50	80	mA
Total power dissipation	P_d	400	400	mW
Operating temperature	T_{opr}	–20 to +85	–20 to +85	°C
Storage temperature	T_{stg}	–40 to +150	–40 to +150	°C

■ Recommended operating conditions

Item	Symbol	FA7610C		FA7612/17C		Unit
		Min.	Max.	Min.	Max.	
Supply voltage	V_{CC}	3.6	20	3.6	20	V
Feedback resistance	R_{NF}	100		100		kΩ
Oscillator timing capacitor	C_T	220	22,000	220	22,000	pF
Oscillator timing resistance	R_T	10	100	10	100	kΩ
Oscillation frequency	f_{OSC}	5	200	5	500	kHz

■ Electrical characteristics (Ta = 25°C, V_{CC} = 6V, R_T = 33kΩ, C_T = 1000pF)

Reference voltage section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Output voltage	V_{REF}	I_{OR} = 1mA	2.528	2.580	2.632	V
Line regulation	L_{INE}	V_{CC} = 3.6 to 20V, I_{OR} = 1mA		4	12	mV
Load regulation	L_{OAD}	I_{OR} = 0.1 to 1mA		1	6	mV
Output voltage variation due to temperature change	V_{TC1}	Ta = –20 to +25°C	–1		1	%
	V_{TC2}	Ta = +25 to +85°C	–1		1	%

Oscillator section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Oscillation frequency	f_{OSC}	C_T = 1000pF, R_T = 33kΩ	100	111	122	kHz
Frequency variation 1 (due to supply voltage change)	f_{dV}	V_{CC} = 3.6 to 20V		1		%
Frequency variation 2 (due to temperature change)	f_{dT}	Ta = –20 to +85°C		5		%

Error amplifier section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Reference voltage	V_B		0.515	0.525	0.535	V
Input bias current	I_B			5	100	nA
Open-loop voltage gain	A_V		70			dB
Unity-gain bandwidth	G_B			0.6		MHz
Maximam output voltage (Pin 2)	V_{OM+}	R_{NF} = 100kΩ	V_{REF}–0.2			V
	V_{OM-}	R_{NF} = 100kΩ			200	mV
Output source current (Pin 2)	I_{OM+}	V_{OM} = 1V	40	85	200	μA

PWM comparator section

Item	Symbol	Test condition	FA7610C			FA7612C			FA7617C			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Input threshold voltage (pin 2)	V_{TH0}	Duty cycle = 0%		0.85	0.95		0.85	0.95		0.85	0.95	V
Input threshold voltage (pin 2)	V_{TH50}	Duty cycle = 50%		1.1			1.1			1.1		V
Maximum duty cycle	αM	(Pin 2 = 1.2V)	58	64	75		100		63	67	71	%

Soft-start circuit section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input bias current (Pin 6)	I_{BCS}			80	300	nA
Input threshold voltage (Pin 6)	$V_{TH\ CS0}$	Duty cycle = 0%		0.22	0.32	V
Input threshold voltage (Pin 6)	$V_{TH\ CS50}$	Duty cycle = 50%		0.46		V

Short-circuit protection circuit section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input threshold voltage (Pin 2)	$V_{TH\ PC}$		1.20	1.50	1.80	V
Charge current (Pin 6)	I_{CHG}	Pin 6 = 0V, Pin 2 = 2V	20	30	40	μA
Latch-mode threshold voltage (Pin 6)	$V_{TH\ LA}$		1.20	1.50	1.80	V

Undervoltage lockout circuit section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
OFF-to-ON threshold voltage	$V_{TH\ ON}$			2.70		V
ON-to-OFF threshold voltage	$V_{TH\ OFF}$			2.52		V
Voltage hysteresis	V_{HYS}		60	180		mV

Output section

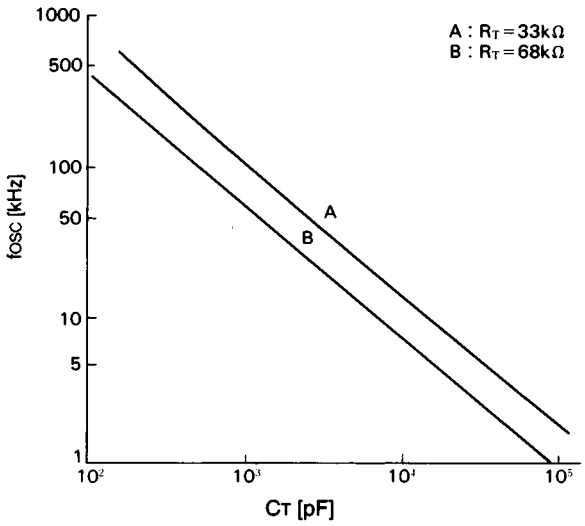
Item	Symbol	Test condition	FA7610C			FA7612C/17C			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
H-level output voltage (Pin 4)	V_{OH}	R_L = 10kΩ	3.5	4.0		—	—	—	V
L-level output voltage (Pin 4)	V_{OL}	Output sink current = 20mA		0.25	0.65		0.9	1.5	V
Output source current (Pin 4)	I_{SOURCE}	Pin 4 = 0V	8	11	14	—	—	—	mA

Overall device

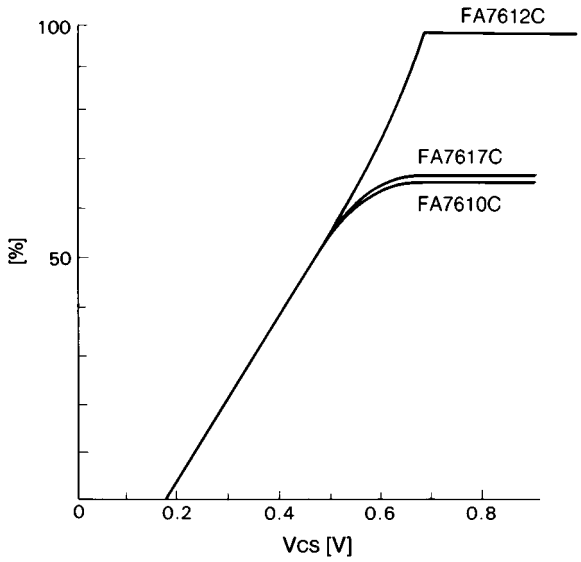
Item	Symbol	Test condition	FA7610C			FA7612C/17C			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Supply current	$I_{CC\ LA}$	Latch mode		1.6	2.2		1.5	2.2	mA
Operating-state supply current	$I_{CC\ AV}$	R_L = ∞ Duty cycle = 50%		2.6	3.8		1.8	3.0	mA

■ Characteristic curves (Ta = 25°C)

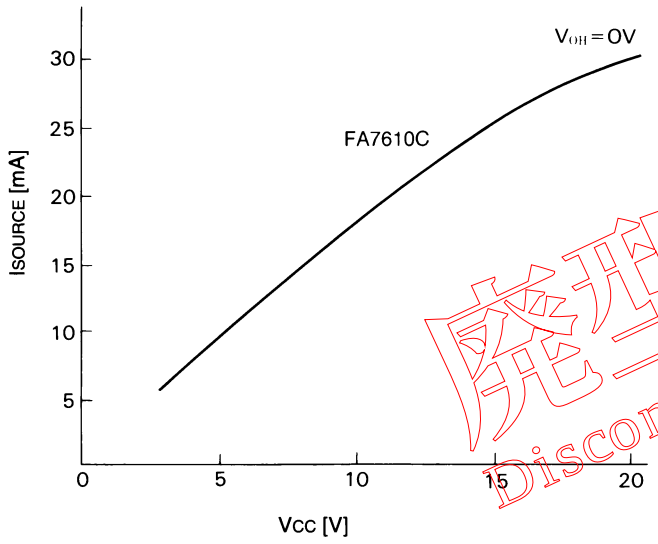
Oscillation frequency(fosc) vs. timing capacitor capacitance(CT)



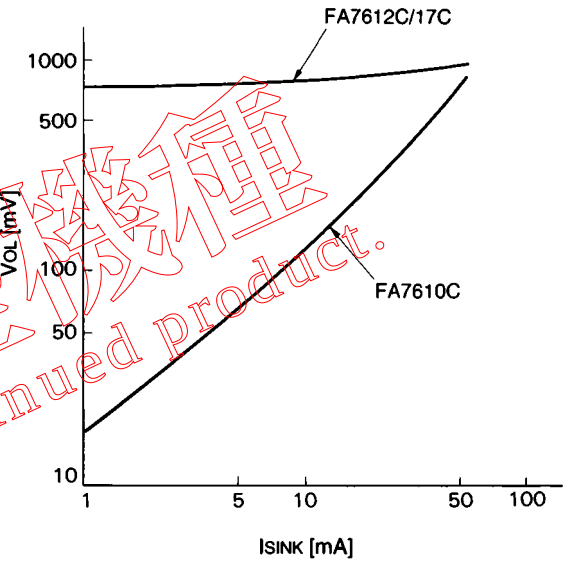
Output duty cycle vs. CS terminal voltage(Vcs)



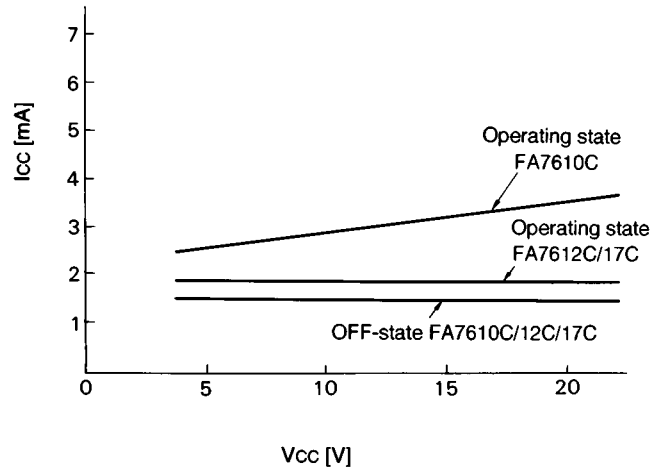
Output source current (Isource) vs. supply voltage(Vcc)



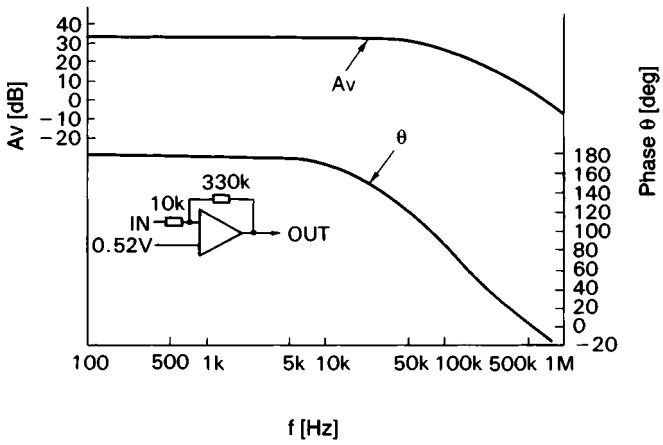
L-level output voltage(VOL) vs. output sink current (ISINK)



Supply current(ICC) vs. supply voltage(Vcc)

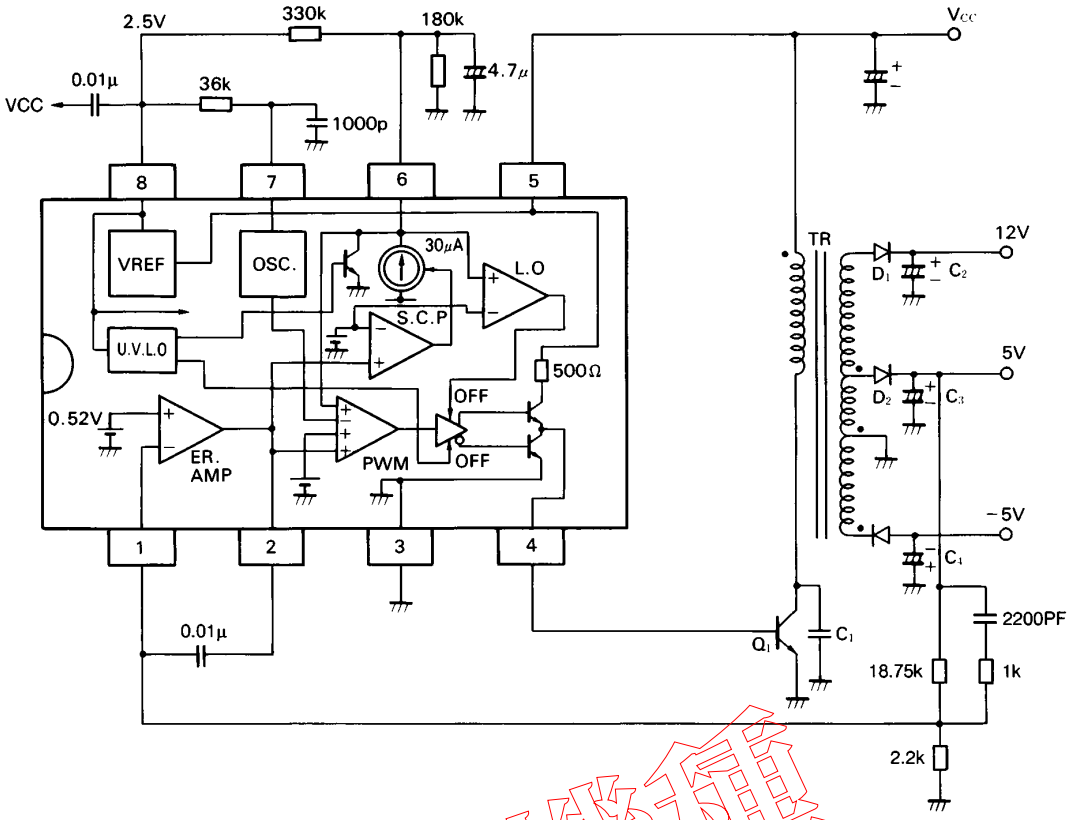


Error amplifier frequency(f) vs. voltage gain(AV) / phase (θ)

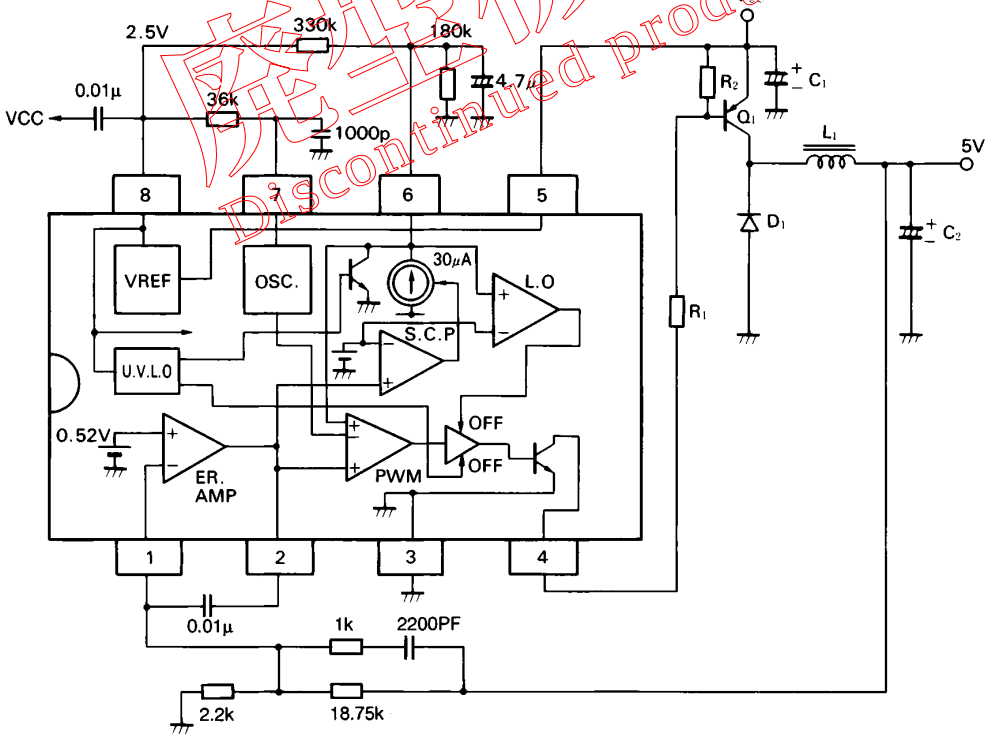


■ Application circuit

● **FA7610CP(N)**
Flyback-transformer type converter circuit

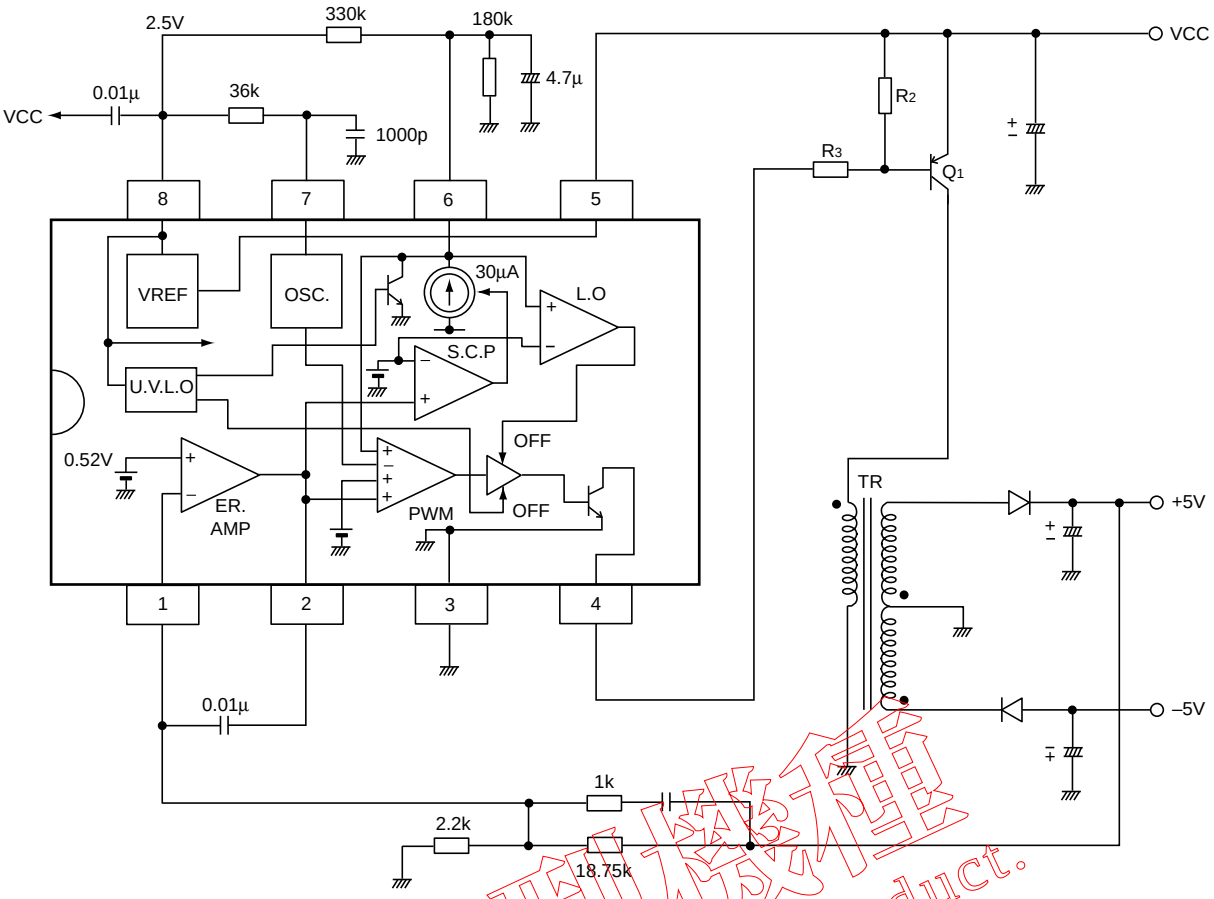


● **FA7612CP(N)**
Chopper type buck converter circuit



● **FA7617CP(N)**

Flyback-transformer type converter circuit



Parts tolerances characteristics are not defined in the circuit design sample shown above. When designing an actual circuit for a product, you must determine parts tolerances and characteristics for safe and economical operation.

Please connect a capacitor, which the value is about 0.01µF to 0.1µF, between VCC and REF terminals in order to prevent from irregular output pulse at start up.