

## ■ 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)

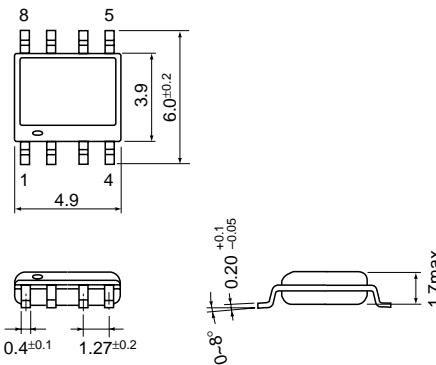
- For step-down power-supply circuit (maximum output duty = up to 100%)
- Open collector output
- PWM-type switching power supply control
- Low-voltage operation ( $V_{CC} = 3.6$  to 22V)
- Latch-mode short-circuit protection function (no malfunction by noise)
- Soft-start function
- Undervoltage lockout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

### FA7617CP(N)

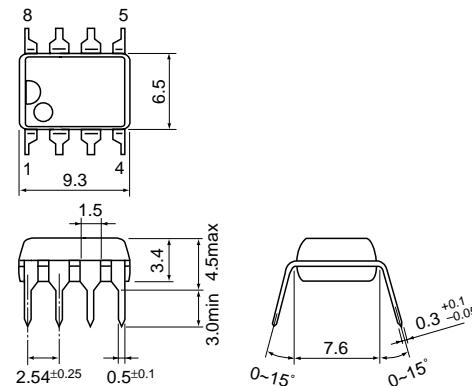
- For flyback transformer-type power-supply circuit (maximum output duty = 67% typical)
- Open collector output
- PWM-type switching power supply control
- Low-voltage operation ( $V_{CC} = 3.6$  to 22V)
- Latch-mode short-circuit protection function (no malfunction by noise)
- Soft-start function
-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

## ■ Dimensions, mm

### • SOP-8



### • DIP-8

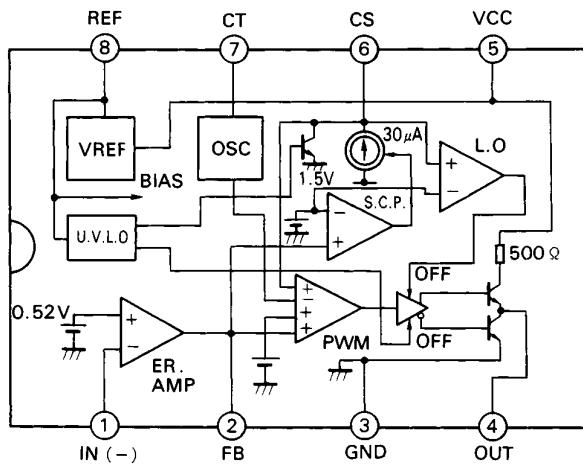


## ■ Applications

- Battery power supply for portable equipment

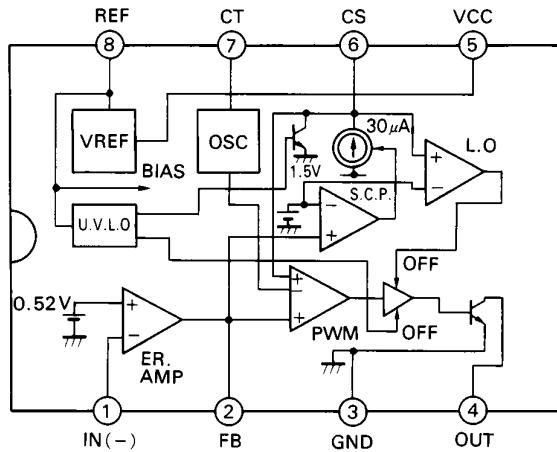
■ Block diagram

• FA7610CP(N)



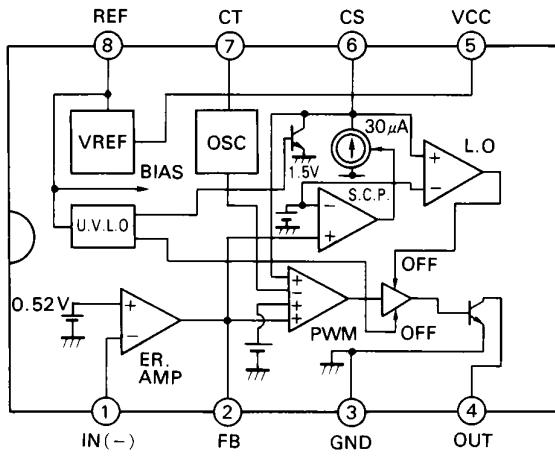
Pin No.	Pin symbol	Description
1	IN (-)	Inverting input to error amplifier
2	FB	Error amplifier output
3	GND	Ground
4	OUT	Output
5	VCC	Power supply
6	CS	Capacitor for soft-start, short-circuit protection and delay
7	CT	Oscillator timing capacitor
8	REF	Reference voltage output (2.5V)

• 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	Vcc	22	22	V
Reference voltage output current	Ior	5	5	mA
Output current	Io	±50	80	mA
Total power dissipation	Pd	400	400	mW
Operating temperature	Topr	-20 to +85	-20 to +85	°C
Storage temperature	Tstg	-40 to +150	-40 to +150	°C

### ■ Recommended operating conditions

Item	Symbol	FA7610C		FA7612/17C		Unit
		Min.	Max.	Min.	Max.	
Supply voltage	Vcc	3.6	20	3.6	20	V
Feedback resistance	RNF	100		100		kΩ
Oscillator timing capacitor	Ct	220	22,000	220	22,000	pF
Oscillator timing resistance	Rt	10	100	10	100	kΩ
Oscillation frequency	fosc	5	200	5	500	kHz

### ■ Electrical characteristics (Ta = 25°C, Vcc = 6V, Rt = 33kΩ, Ct = 1000pF)

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

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Output voltage	VREF	Ior = 1mA	2.528	2.580	2.632	V
Line regulation	LINE	Vcc = 3.6 to 20V, Ior = 1mA		4	12	mV
Load regulation	LOAD	Ior = 0.1 to 1mA		1	6	mV
Output voltage variation due to temperature change	VTC1	Ta = -20 to +25°C	-1		1	%
	VTC2	Ta = +25 to +85°C	-1		1	%

#### Oscillator section Common to FA7610C/12C/17C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Oscillation frequency	fosc	Ct = 1000pF, Rt = 33kΩ	100	111	122	kHz
Frequency variation 1 (due to supply voltage change)	fdV	Vcc = 3.6 to 20V		1		%
Frequency variation 2 (due to temperature change)	fdT	Ta = -20 to +85°C		5		%

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

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Reference voltage	Vb		0.515	0.525	0.535	V
Input bias current	IB			5	100	nA
Open-loop voltage gain	Av		70			dB
Unity-gain bandwidth	Gb			0.6		MHz
Maximum output voltage (Pin 2)	Vom+	RNF = 100kΩ		VREF-0.2		V
	Vom-	RNF = 100kΩ			200	mV
Output source current (Pin 2)	Iom+	Vom = 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)	VTH0	Duty cycle = 0%	0.85	0.95		0.85	0.95		0.85	0.95		V
Input threshold voltage (pin 2)	VTH50	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	%

## FA7610CP(N)/FA7612CP(N)/FA7617CP(N)

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

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input bias current (Pin 6)	I <sub>BCS</sub>			80	300	nA
Input threshold voltage (Pin 6)	V <sub>TH CS0</sub>	Duty cycle = 0%		0.22	0.32	V
Input threshold voltage (Pin 6)	V <sub>TH CS50</sub>	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 <sub>TH PC</sub>		1.20	1.50	1.80	V
Charge current (Pin 6)	I <sub>CHG</sub>	Pin 6 = 0V, Pin 2 = 2V	20	30	40	μA
Latch-mode threshold voltage (Pin 6)	V <sub>TH LA</sub>		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 <sub>TH ON</sub>			2.70		V
ON-to-OFF threshold voltage	V <sub>TH OFF</sub>			2.52		V
Voltage hysteresis	V <sub>HYS</sub>		60	180		mV

### Output section

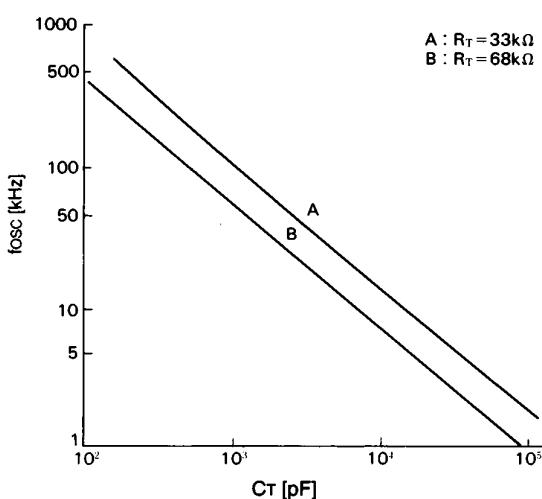
Item	Symbol	Test condition	FA7610C			FA7612C/17C			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
H-level output voltage (Pin 4)	V <sub>OH</sub>	R <sub>L</sub> = 10kΩ	3.5	4.0	—	—	—	—	V
L-level output voltage (Pin 4)	V <sub>OL</sub>	Output sink current = 20mA		0.25	0.65		0.9	1.5	V
Output source current (Pin 4)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

### Overall device

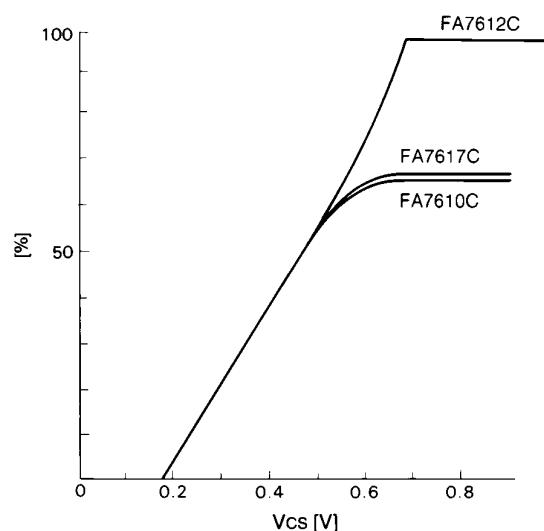
Item	Symbol	Test condition	FA7610C			FA7612C/17C			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Supply current	I <sub>CC LA</sub>	Latch mode		1.6	2.2		1.5	2.2	mA
Operating-state supply current	I <sub>CC AV</sub>	R <sub>L</sub> = ∞ Duty cycle = 50%		2.6	3.8		1.8	3.0	mA

■ Characteristic curves ( $T_a = 25^\circ\text{C}$ )

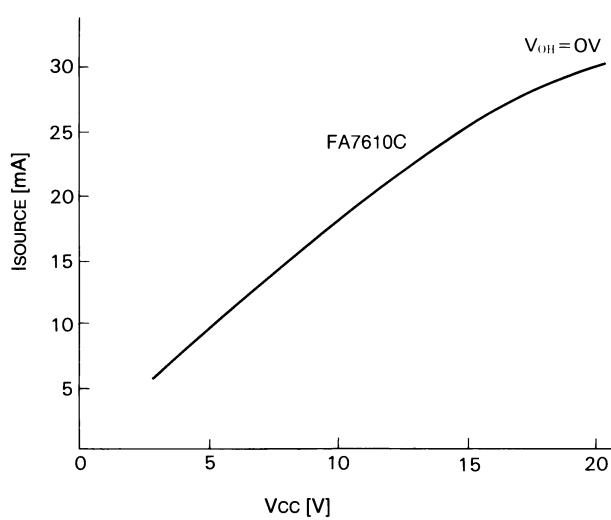
Oscillation frequency( $f_{osc}$ ) vs.  
timing capacitor capacitance( $C_T$ )



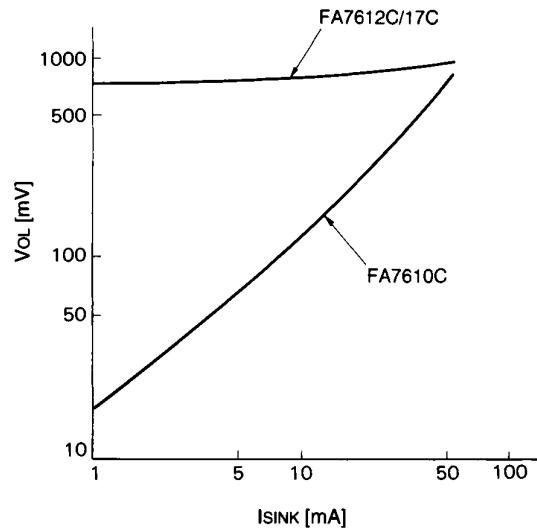
Output duty cycle vs. CS terminal voltage( $V_{cs}$ )



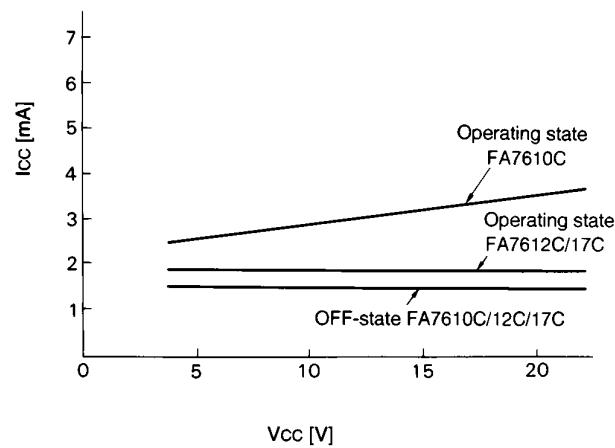
Output source current ( $I_{source}$ ) vs.  
supply voltage( $V_{cc}$ )



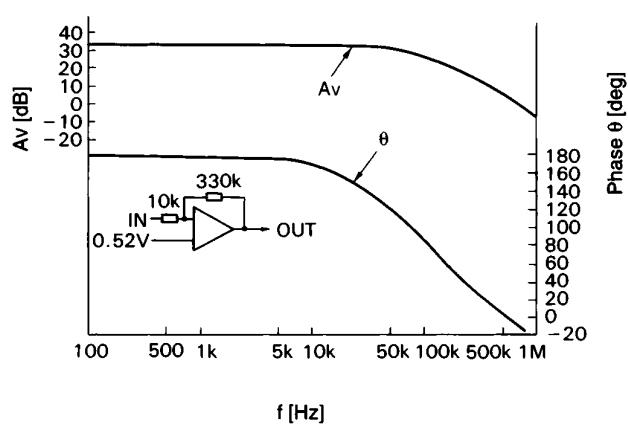
L-level output voltage( $V_{OL}$ ) vs. output sink current ( $I_{SINK}$ )



Supply current( $I_{CC}$ ) vs. supply voltage( $V_{cc}$ )



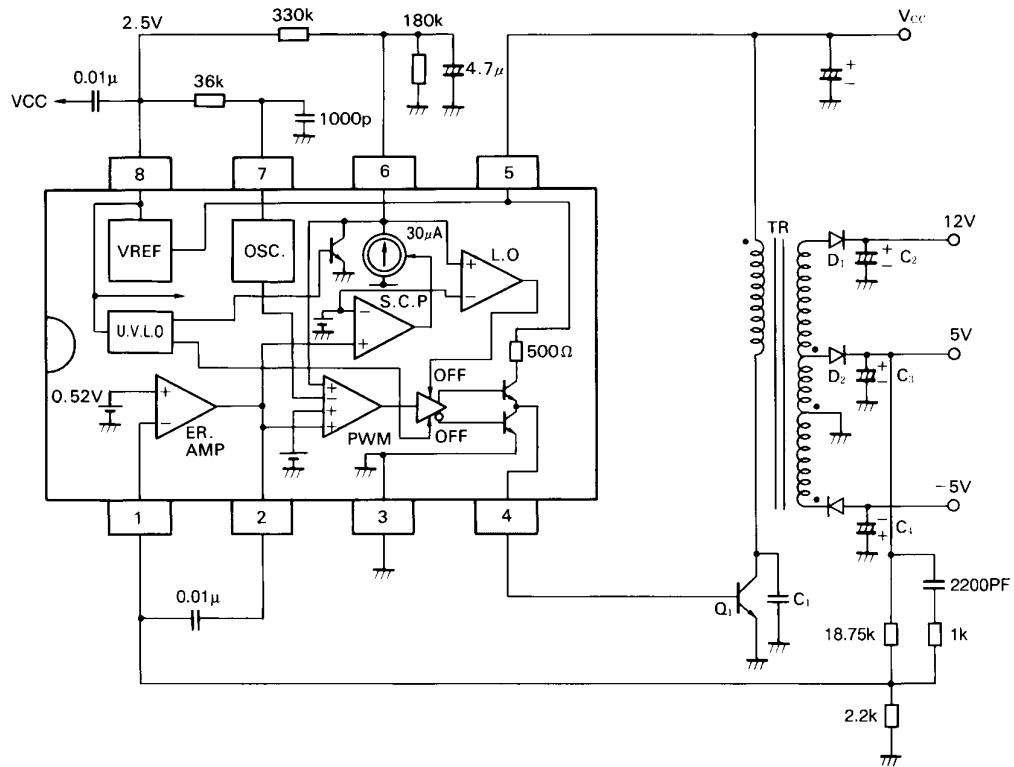
Error amplifier frequency( $f$ ) vs. voltage gain( $AV$ ) / phase ( $\theta$ )



■ Application circuit

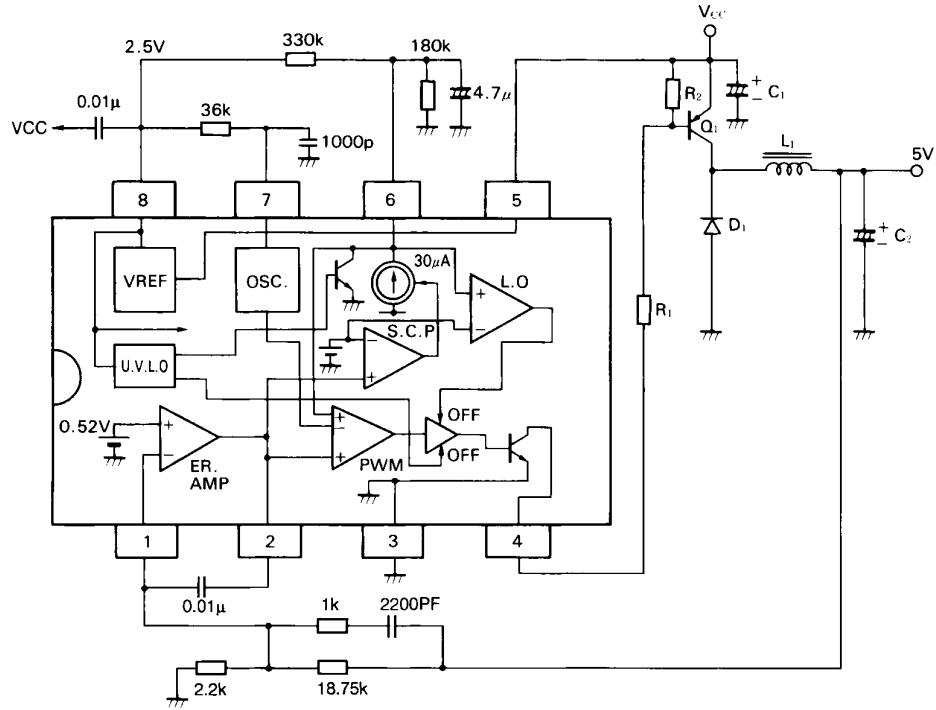
• FA7610CP(N)

Flyback-transformer type converter circuit



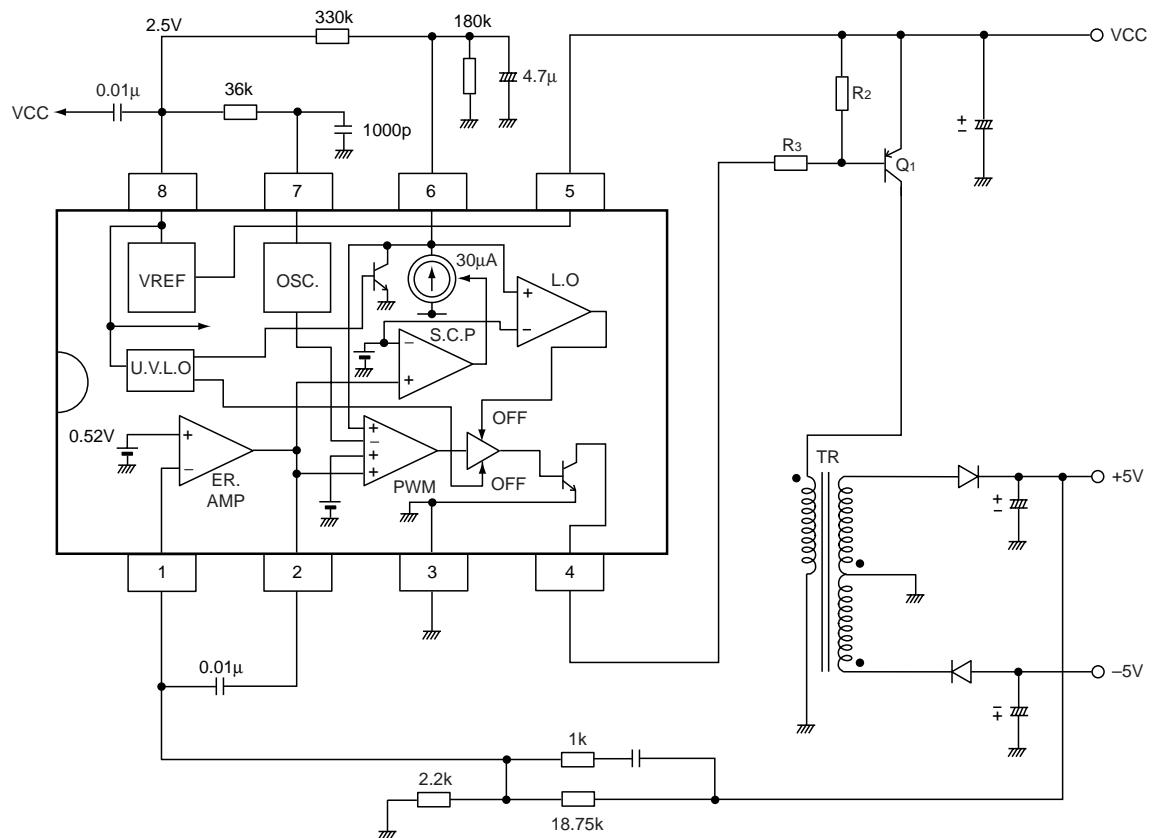
• FA7612CP(N)

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.*