

# FA7613CP(E)

Bipolar IC  
For Switching Power Supply Control

## ■ Description

The FA7613CP(E) is a bipolar IC containing basic circuit necessary for PWM-type switching power supply control. The supply voltage range is from 2.5V.

## ■ Features

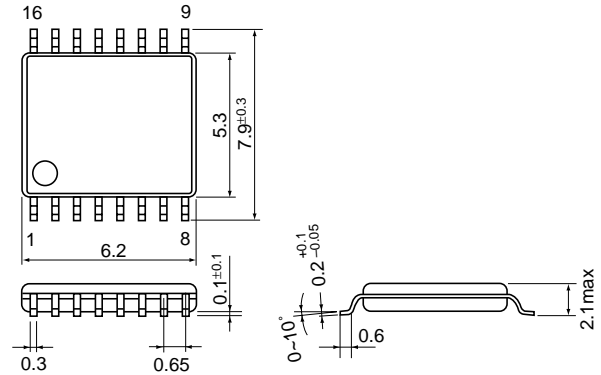
- Low-voltage operation ( $V_{CC} = 2.5$  to  $22V$ )
- Open collector output
- Latch-mode short-circuit protection function (no malfunction due to electrical noise)
- Soft-strat function
- Output ON/OFF control function
- Low standby current (Max.  $10\mu A$ )
- Not many external discrete components needed

## ■ Applications

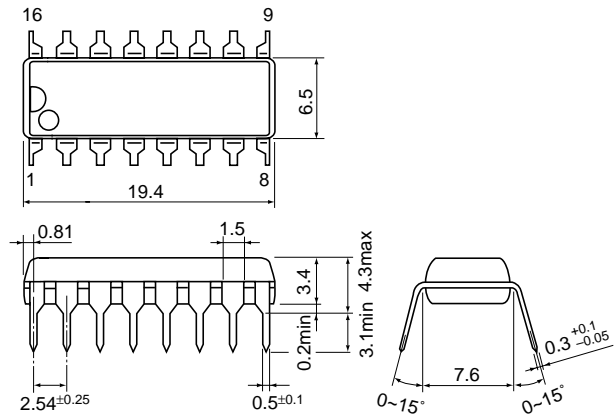
- Battery power supply for portable equipment

## ■ Dimensions, mm

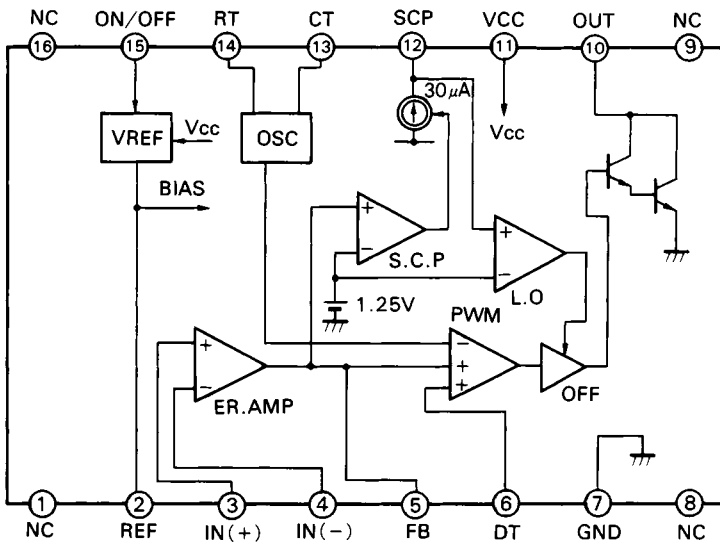
### ● SSOP-16



### ● DIP-16



## ■ Block diagram



Pin No.	Pin symbol	Description
1	NC	—
2	REF	Reference voltage output(1.25V)
3	IN (+)	Non-inverting input to error amplifier
4	IN (-)	Inverting input to error amplifier
5	FB	Error amplifier output
6	DT	Dead time adjustment
7	GND	Ground
8	NC	—
9	NC	—
10	OUT	Output
11	VCC	Power supply
12	SCP	Capacitor for short-circuit protection and delay
13	CT	Oscillator timing capacitor
14	RT	Oscillator timing resistance
15	ON/OFF	Output ON/OFF control
16	NC	—

### ■ Absolute maximum ratings

Item	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	22	V
Reference voltage output current	I <sub>OR</sub>	5	mA
Output sink current	I <sub>SINK</sub>	50	mA
Total power dissipation	P <sub>d</sub>	400	mW
Operating temperature	T <sub>opr</sub>	-20 to +85	°C
Storage temperature	T <sub>stg</sub>	-40 to +150	°C

### ■ Recommended operating conditions

Item	Symbol	Min.	Max.	Unit
Supply voltage	V <sub>CC</sub>	2.5	20	V
Feedback resistance	R <sub>NF</sub>	100		kΩ
Oscillator timing capacitor	C <sub>T</sub>	220	22,000	pF
Oscillator timing resistance	R <sub>T</sub>	4.7	100	kΩ
Oscillation frequency	f <sub>osc</sub>	10	500	kHz

### ■ Electrical characteristics (T<sub>a</sub> = 25°C, V<sub>CC</sub> = 5V, f<sub>osc</sub> = 100kHz)

#### Reference voltage section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Output voltage	V <sub>REF</sub>	I <sub>OR</sub> = 1mA	1.210	1.235	1.260	V
Line regulation	LINE	V <sub>CC</sub> = 2.5 to 20V		1	5	mV
Load regulation	LOAD	I <sub>OR</sub> = 0.1 to 1mA		5	10	mV
Output voltage variation due to temperature change	V <sub>TC1</sub>	T <sub>a</sub> = -20 to +25°C	-1		1	%
	V <sub>TC2</sub>	T <sub>a</sub> = +25 to +85°C	-1		1	%

#### Oscillator section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Oscillation frequency	f <sub>osc</sub>	C <sub>T</sub> = 1000pF, R <sub>T</sub> = 4.7kΩ	120	140	160	kHz
Frequency variation 1 (due to supply voltage change)	f <sub>dV</sub>	V <sub>CC</sub> = 2.5 to 20V		2		%
Frequency variation 2 (due to temperature change)	f <sub>dT</sub>	T <sub>a</sub> = -20 to +85°C		4		%

#### Error amplifier section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input bias current	I <sub>B+</sub>	Pin 3 = 1.25V		0.1	1.0	μA
	I <sub>B-</sub>	Pin 4 = 1.25V		0.1	1.0	μA
Open-loop voltage gain	A <sub>V</sub>		70			dB
Unity-gain bandwidth	G <sub>B</sub>			1.0		MHz
Maximum output voltage (Pin 5)	V <sub>OM+</sub>	R <sub>NF</sub> = 200kΩ	4.8			V
	V <sub>OM-</sub>	R <sub>NF</sub> = 200kΩ			200	mV
Output source current (Pin 5)	I <sub>OM+</sub>	V <sub>OM</sub> = 1V	25	50	100	μA

#### PWM comparator section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input threshold voltage (Pin 5)	V <sub>TH0</sub>	Duty cycle = 0%		0.80	0.90	V
Input threshold voltage (Pin 5)	V <sub>TH50</sub>	Duty cycle = 50%		1.13		V

**Dead time adjustment circuit section**

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input bias current(Pin 6)	I <sub>BDT</sub>			0.3	1.0	μA
Input threshold voltage (Pin 6)	V <sub>TH DT0</sub>	Duty cycle = 0%		0.10	0.20	V
Input threshold voltage (Pin 6)	V <sub>TH DT50</sub>	Duty cycle = 50%		0.47		V

**Short-circuit protection circuit section**

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input threshold voltage (Pin 5)	V <sub>TH PC</sub>		2.05	2.35	2.65	V
Charge current (Pin 12)	I <sub>CHG</sub>	Pin 12 = 0V, Pin 6, Pin 5 = 2V	15	35	55	μA
Latch-mode threshold voltage (Pin 12)	V <sub>L</sub>		0.90	1.20	1.50	V

**Output section**

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
L-level output voltage (Pin 10)	V <sub>OL</sub>	Output sink current = 20mA		1.0	1.5	V

**Output ON/OFF circuit section**

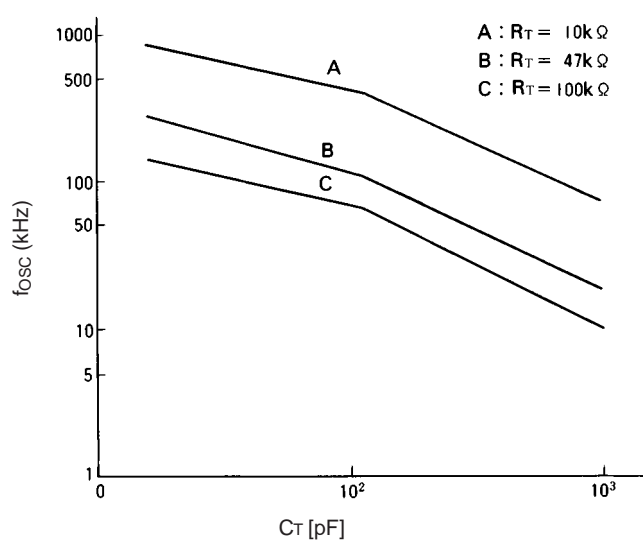
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input current (Pin 15)	I <sub>ON/OFF</sub>	Pin 15 = 5V	0.5	1.0	2.0	mA
OFF-to-ON threshold voltage (Pin 15)	V <sub>TH ON</sub>		0.6	0.8	1.0	V

**Overall device**

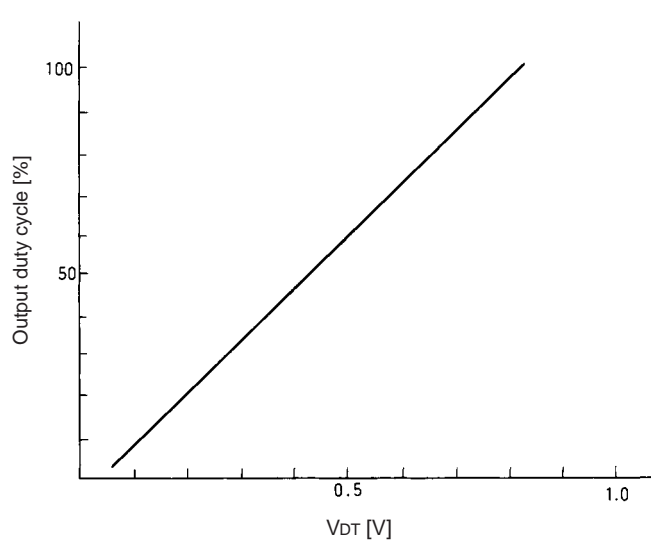
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Standby current	I <sub>CC ST</sub>	Pin 15 = 0V		0.5	10	μA
Supply current	I <sub>CC LA</sub>	Latch mode		1.5	2.5	mA
Operating-state supply current	I <sub>CC AV</sub>	R <sub>L</sub> = ∞ Duty cycle = 50%		2.0	4.0	mA

■ **Characteristic curves (T<sub>a</sub> = 25°C)**

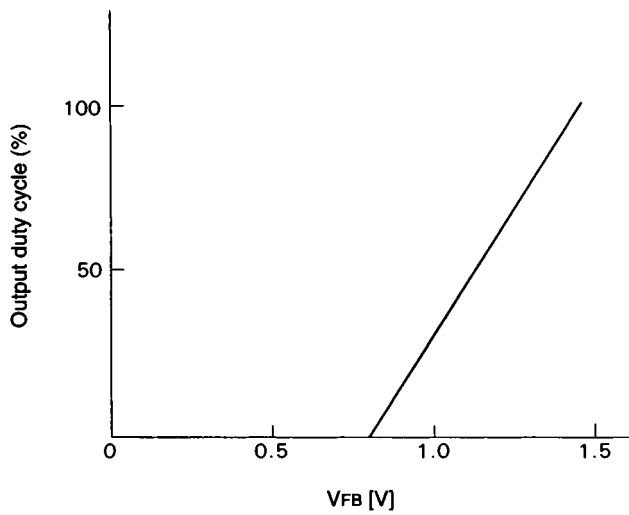
**Oscillation frequency (f<sub>osc</sub>) vs. timing capacitor capacitance (C<sub>T</sub>)**



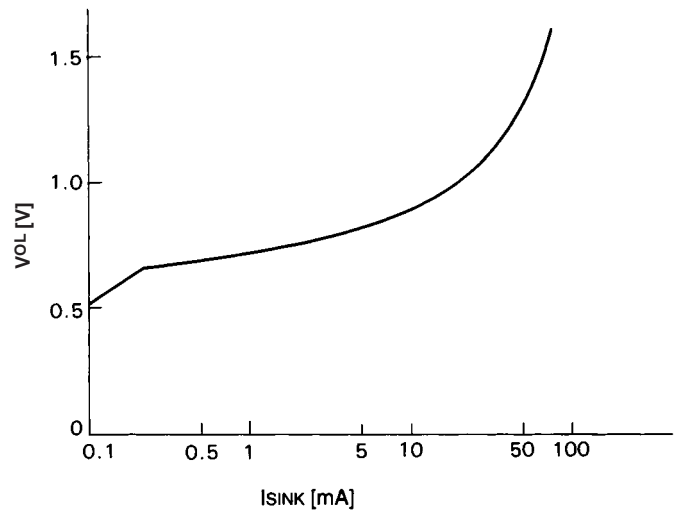
**Output duty cycle vs. DT terminal voltage (V<sub>DT</sub>)**



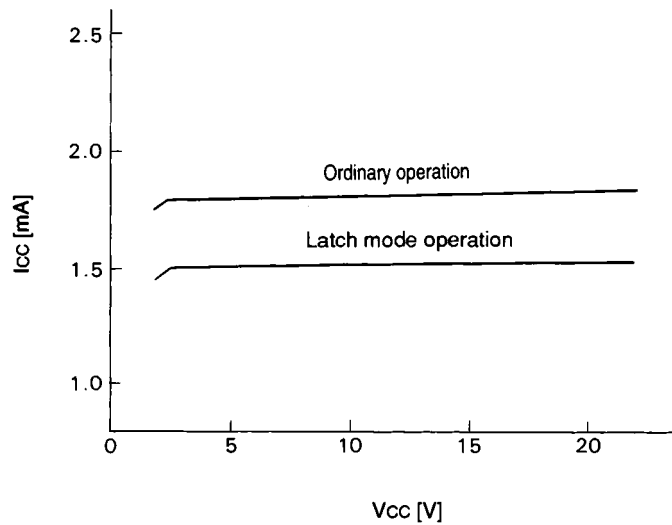
Output duty cycle vs. FB terminal voltage ( $V_{FB}$ )



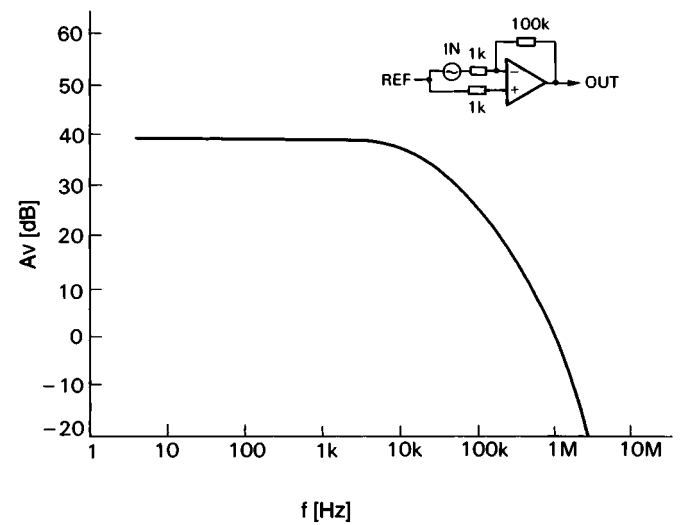
L-level output voltage ( $V_{OL}$ ) vs. output sink current ( $I_{SINK}$ )



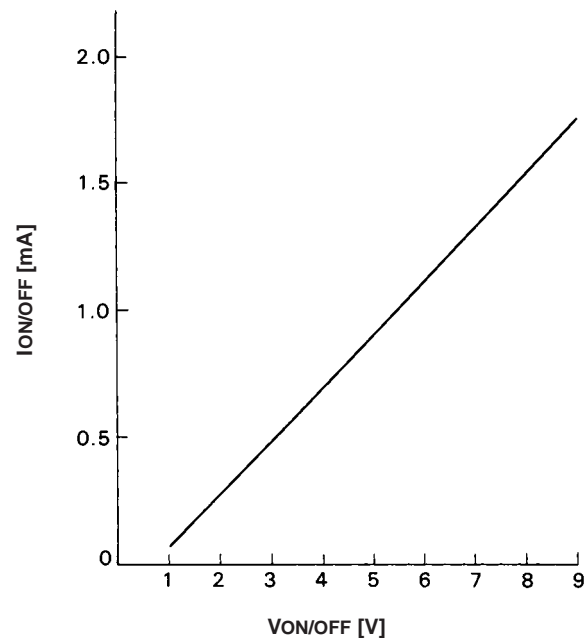
Supply current ( $I_{CC}$ ) vs. supply voltage ( $V_{CC}$ )



Error amplifier frequency ( $f$ ) vs. voltage gain ( $A_v$ )

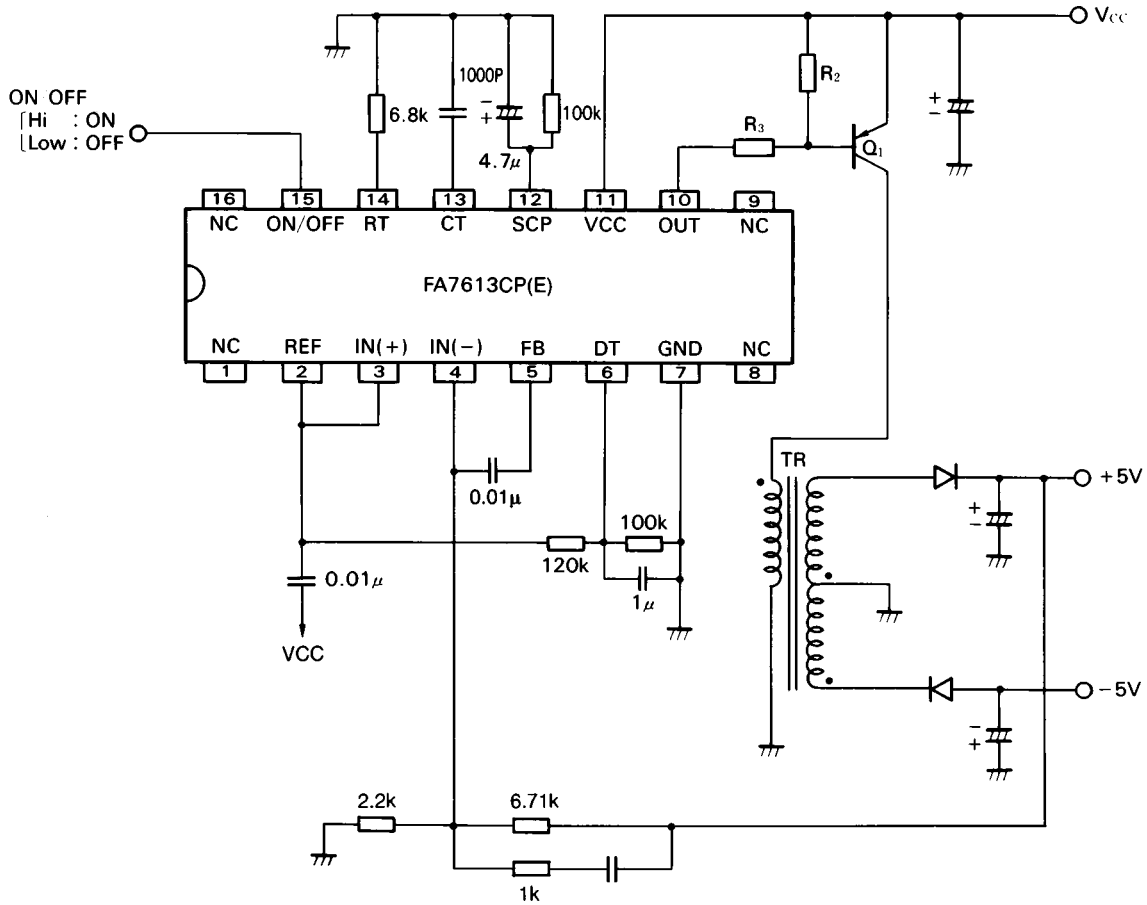


Output ON/OFF control terminal input current ( $I_{ON/OFF}$ ) vs. voltage ( $V_{ON/OFF}$ )



■ Application circuit

● 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.