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

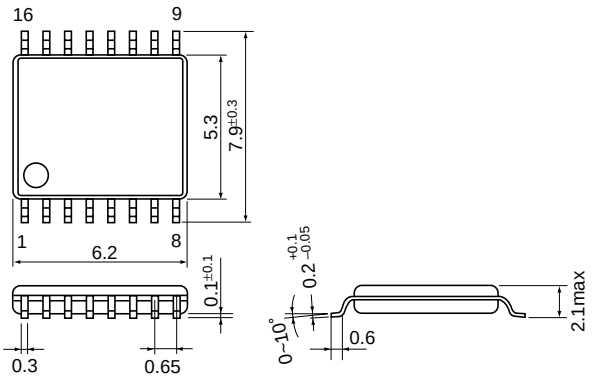
- Low-voltage operation (V_{CC} = 2.5 to 22V)
- Open collector output
- Latch-mode short-circuit protection function (no malfunction due to electrical noise)
- Soft-strat function
- Output ON/OFF control function
- Low standby current (Max. 10μA)
- Not many external discrete components needed

■ Applications

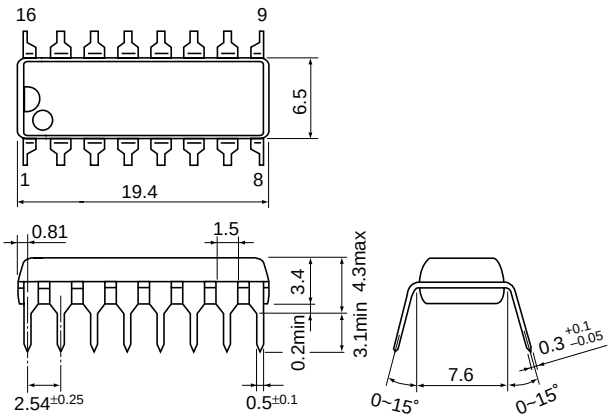
- Battery power supply for portable equipment

■ Dimensions, mm

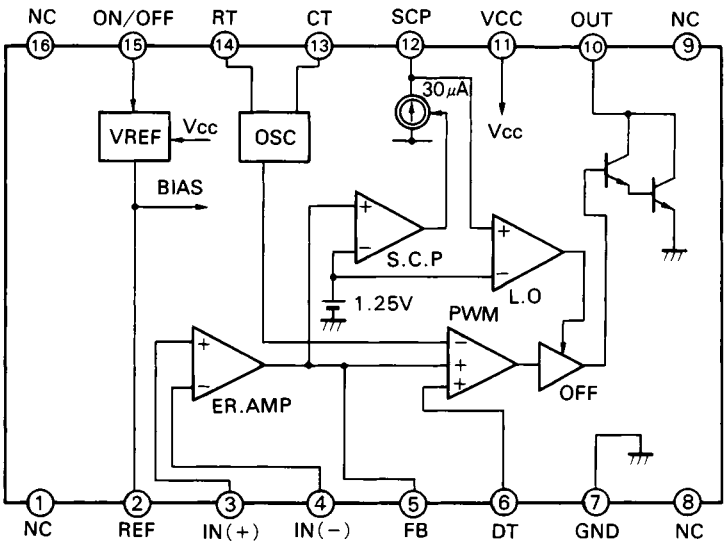
● SSOP-16



● 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_{CC}	22	V
Reference voltage output current	I_{OR}	5	mA
Output sink current	I_{SINK}	50	mA
Total power dissipation	P_d	400	mW
Operating temperature	T_{opr}	–20 to +85	°C
Storage temperature	T_{stg}	–40 to +150	°C

■ Recommended operating conditions

Item	Symbol	Min.	Max.	Unit
Supply voltage	V_{CC}	2.5	20	V
Feedback resistance	R_{NF}	100		kΩ
Oscillator timing capacitor	C_T	220	22,000	pF
Oscillator timing resistance	R_T	4.7	100	kΩ
Oscillation frequency	f_{OSC}	10	500	kHz

■ Electrical characteristics (Ta = 25°C, V_{CC} = 5V, f_{OSC} = 100kHz)

Reference voltage section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Output voltage	V_{REF}	I_{OR} = 1mA	1.210	1.235	1.260	V
Line regulation	L_{INE}	V_{CC} = 2.5 to 20V		1	5	mV
Load regulation	L_{OAD}	I_{OR} = 0.1 to 1mA		5	10	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

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Oscillation frequency	f_{OSC}	C_T = 1000pF, R_T = 4.7kΩ	120	140	160	kHz
Frequency variation 1 (due to supply voltage change)	f_{dV}	V_{CC} = 2.5 to 20V		2		%
Frequency variation 2 (due to temperature change)	f_{dT}	Ta = –20 to +85°C		4		%

Error amplifier section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input bias current	I_{B+}	Pin 3 = 1.25V		0.1	1.0	μA
	$I_{B–}$	Pin 4 = 1.25V		0.1	1.0	μA
Open-loop voltage gain	A_V		70			dB
Unity-gain bandwidth	G_B			1.0		MHz
Maximum output voltage (Pin 5)	V_{OM+}	R_{NF} = 200kΩ	4.8			V
	$V_{OM–}$	R_{NF} = 200kΩ			200	mV
Output source current (Pin 5)	I_{OM+}	V_{OM} = 1V	25	50	100	μA

PWM comparator section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input threshold voltage (Pin 5)	V_{TH0}	Duty cycle = 0%		0.80	0.90	V
Input threshold voltage (Pin 5)	V_{TH50}	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_{BDT}			0.3	1.0	μA
Input threshold voltage (Pin 6)	$V_{TH\ DT0}$	Duty cycle = 0%		0.10	0.20	V
Input threshold voltage (Pin 6)	$V_{TH\ DT50}$	Duty cycle = 50%		0.47		V

Short-circuit protection circuit section

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input threshold voltage (Pin 5)	$V_{TH\ PC}$		2.05	2.35	2.65	V
Charge current (Pin 12)	I_{CHG}	Pin 12 = 0V, Pin 6, Pin 5 = 2V	15	35	55	μA
Latch-mode threshold voltage (Pin 12)	V_L		0.90	1.20	1.50	V

Output section

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

Output ON/OFF circuit section

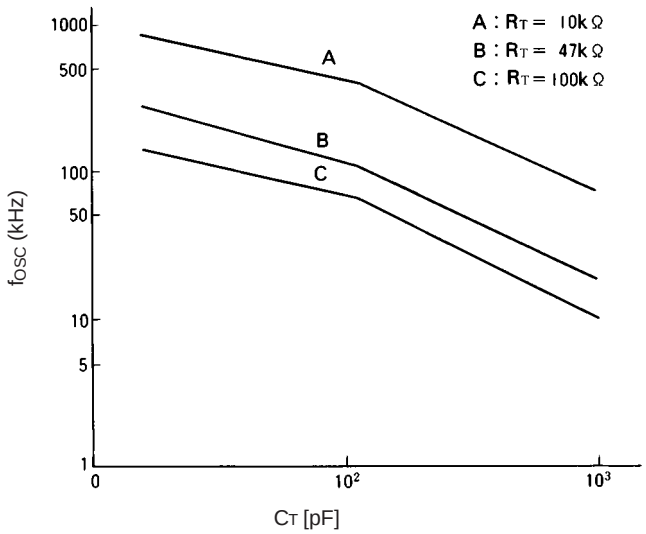
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input current (Pin 15)	$I_{ON/OFF}$	Pin 15 = 5V	0.5	1.0	2.0	mA
OFF-to-ON threshold voltage (Pin 15)	$V_{TH\ ON}$		0.6	0.8	1.0	V

Overall device

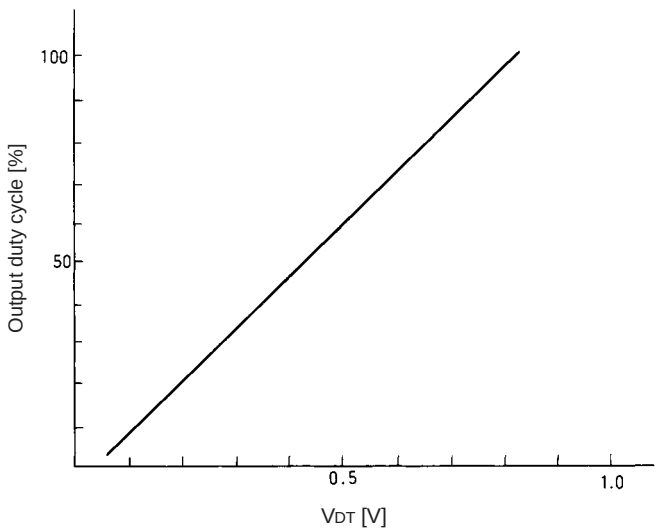
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Standby current	$I_{CC\ ST}$	Pin 15 = 0V		0.5	10	μA
Supply current	$I_{CC\ LA}$	Latch mode		1.5	2.5	mA
Operating-state supply current	$I_{CC\ AV}$	$R_L = \infty$ Duty cycle = 50%		2.0	4.0	mA

■ Characteristic curves (Ta = 25°C)

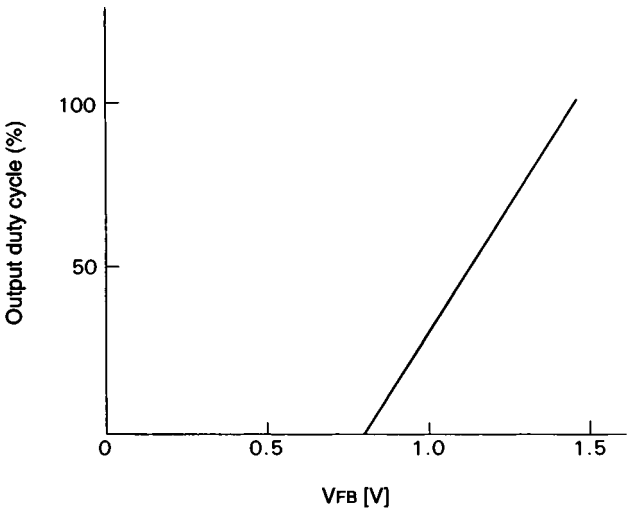
Oscillation frequency (f_{OSC}) vs. timing capacitor capacitance (C_T)



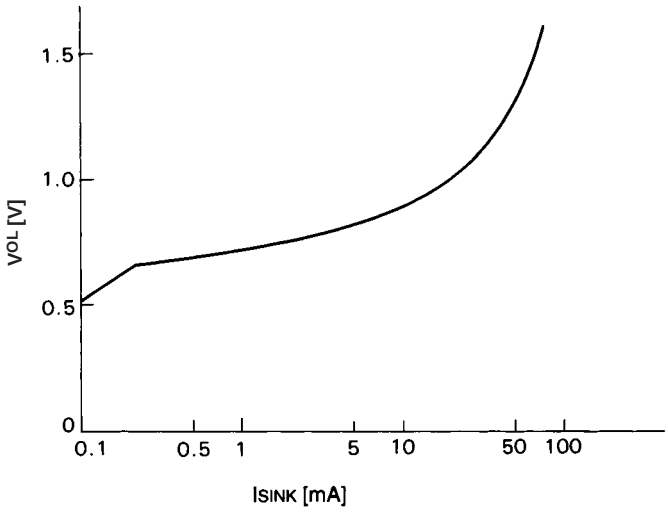
Output duty cycle vs. DT terminal voltage (V_{DT})



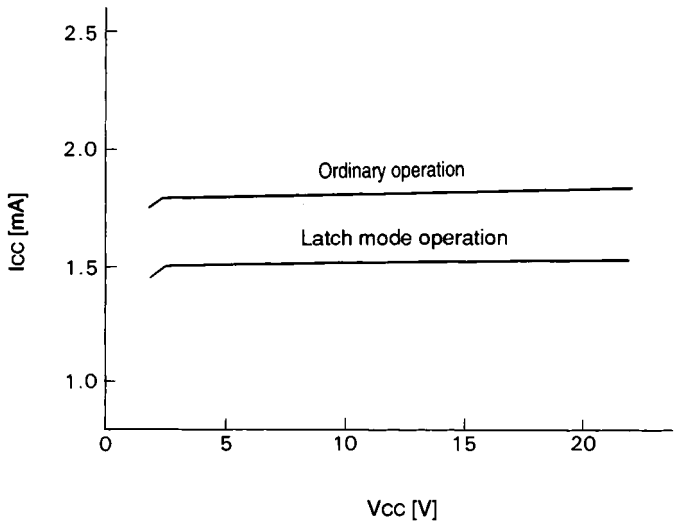
Output duty cycle vs. FB terminal voltage (V_{FB})



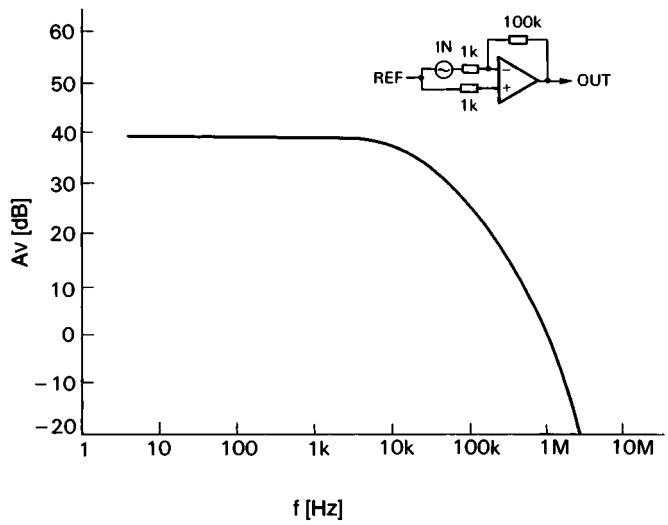
L-level output voltage (V_{OL}) vs. output sink current (I_{SINK})



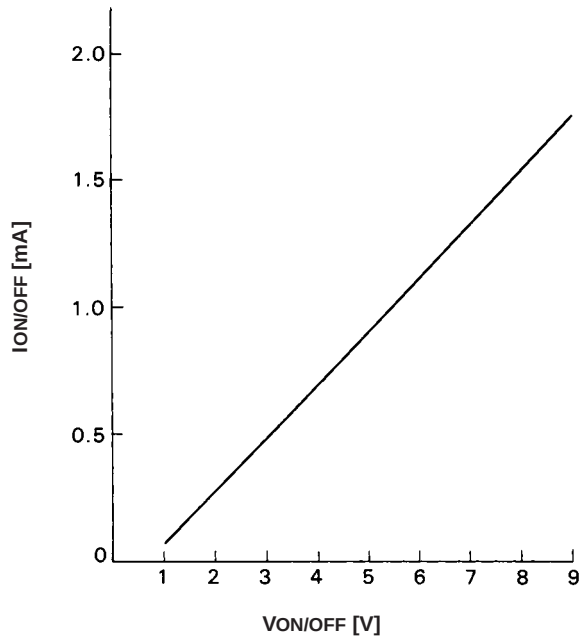
Supply current (I_{CC}) vs. supply voltage (V_{CC})



Error amplifier frequency (f) vs. voltage gain (A_V)

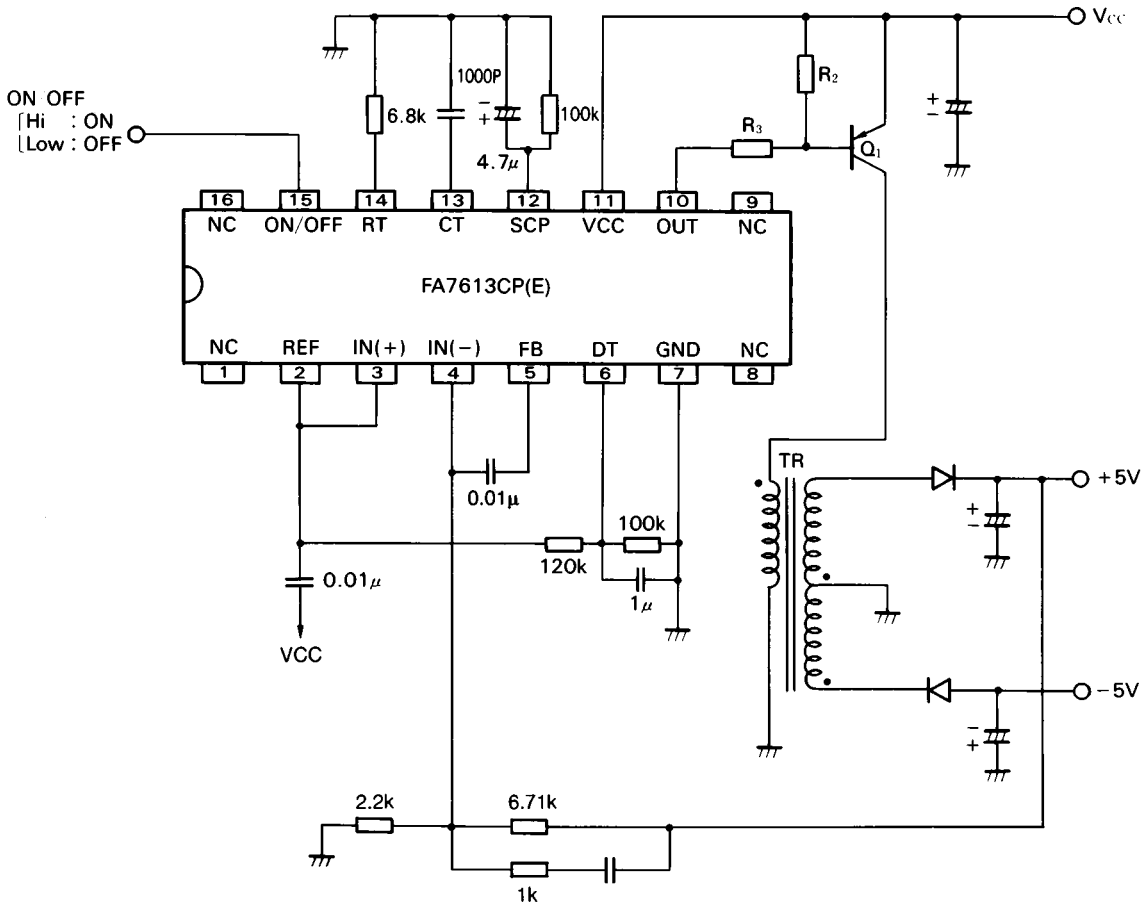


Output ON/OFF control terminal input current ($I_{ON/OFF}$) vs. voltage($V_{ON/OFF}$)



■ 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.