

# PQ1CG3032FZ/ PQ1CG3032RZ

## TO-220 Type Chopper Regulator

### ■ Features

1. Maximum switching current:3.5A
2. Built-in ON/OFF control function
3. Built-in soft start function to suppress overshoot of output voltage in power on sequence or ON/OFF control sequence
4. Built-in oscillation circuit  
(Oscillation frequency:TYP. 150kHz)
5. Built-in overheat/overcurrent protection function
6. TO-220 package
7. Variable output voltage  
(Output variable range: $V_{ref}$  to  $35V/-V_{ref}$  to  $-30V$ )  
[Possible to select step-down output/inverting output according to external connection circuit]
8. **PQ1CG3032FZ**:Zigzag forming  
**PQ1CG3032RZ**:Self-stand forming

### ■ Applications

1. CTV
2. Digital OA equipment
3. Facsimiles, printers and other OA equipment
4. Personal computers and amusement equipment

### ■ Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Rating	Unit
*1 Input voltage	$V_{IN}$	40	V
Output adjustment terminal voltage	$V_{ADJ}$	7	V
Dropout voltage	$V_{I-O}$	41	V
*2 Output-COM voltage	$V_{OUT}$	-1	V
*3 ON/OFF control voltage	$V_C$	-0.3 to +40	V
Switching current	$I_{SW}$	3.5	A
*4 Power dissipation	$P_{D1}$	1.4	W
	$P_{D2}$	14	W
*5 Junction temperature	$T_j$	150	°C
Operating temperature	$T_{opr}$	-20 to +80	°C
Storage temperature	$T_{stg}$	-40 to +150	°C
*6 Soldering temperature	$T_{sol}$	260	°C

\*1 Voltage between  $V_{IN}$  terminal and COM terminal

\*2 Voltage between  $V_{OUT}$  terminal and COM terminal

\*3 Voltage between ON/OFF control and COM terminal

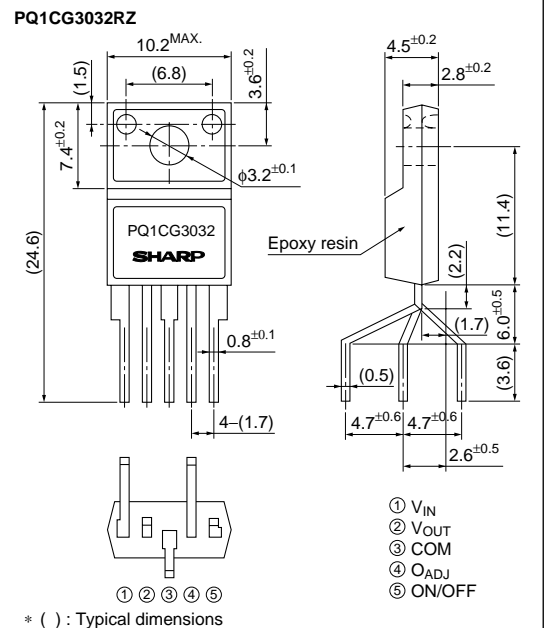
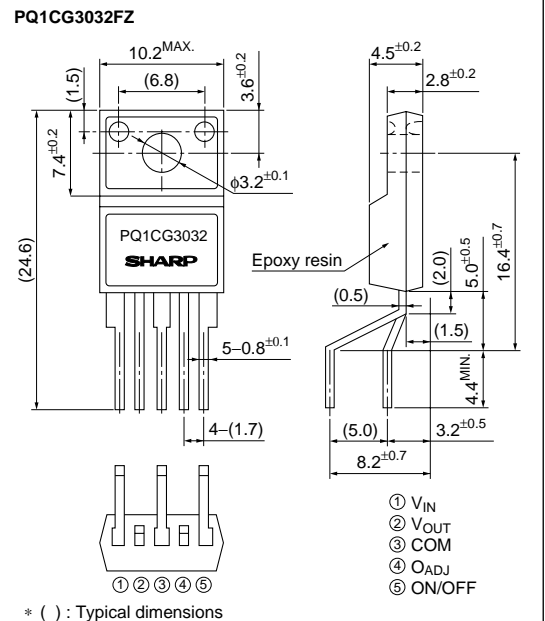
\*4  $P_p$ :With infinite heat sink

\*5 Over heat protection may operate at the condition  $T_j=125^\circ\text{C}$  to  $150^\circ\text{C}$

\*6 For 10s

### ■ Outline Dimensions

(Unit : mm)



■ Electrical Characteristics (Unless otherwise specified, condition shall be  $V_{IN}=12V$ ,  $I_o=0.5A$ ,  $V_o=5V$ , ON-OFF terminals is open,  $T_a=25^\circ C$ )

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output saturation voltage	$V_{SAT}$	$I_{sw}=3A$	—	1.4	1.8	V
Reference voltage	$V_{ref}$	—	1.235	1.26	1.285	V
Reference voltage temperature fluctuation	$\Delta V_{ref}$	$T_j=0$ to $125^\circ C$	—	$\pm 0.5$	—	%
Load regulation	$ R_{egL} $	$I_o=0.5$ to $3A$	—	0.2	1.5	%
Line regulation	$ R_{egI} $	$V_{IN}=8$ to $35V$	—	1	2.5	%
Efficiency	$\eta$	$I_o=3A$	—	80	—	%
Oscillation frequency	$f_o$	—	135	150	165	kHz
Oscillation frequency temperature fluctuation	$\Delta f_o$	$T_j=0$ to $125^\circ C$	—	$\pm 2$	—	%
Overcurrent detecting level	$I_L$	—	3.6	4.7	5.8	A
Charge current	$I_{CHG}$	②, ④ terminals is open, ⑤ terminal	—	-10	—	$\mu A$
Threshold input voltage	$V_{THL}$	Duty ratio=0%, ④ terminal=0V, ⑤ terminal	—	1.3	—	V
	$V_{THH}$	Duty ratio=100%, ④ terminal is open, ⑤ terminal	—	2.3	—	V
ON threshold voltage	$V_{TH(ON)}$	④ terminal=0V, ⑤ terminal	0.7	0.8	0.9	V
Stand-by current	$I_{SD}$	$V_{IN}=40V$ , ⑤ terminal=0V	—	140	400	$\mu A$
Output OFF-state consumption current	$I_{QS}$	$V_{IN}=40V$ , ⑤ terminal=0.9V	—	8	16	mA

Fig.1 Standard Test Circuit

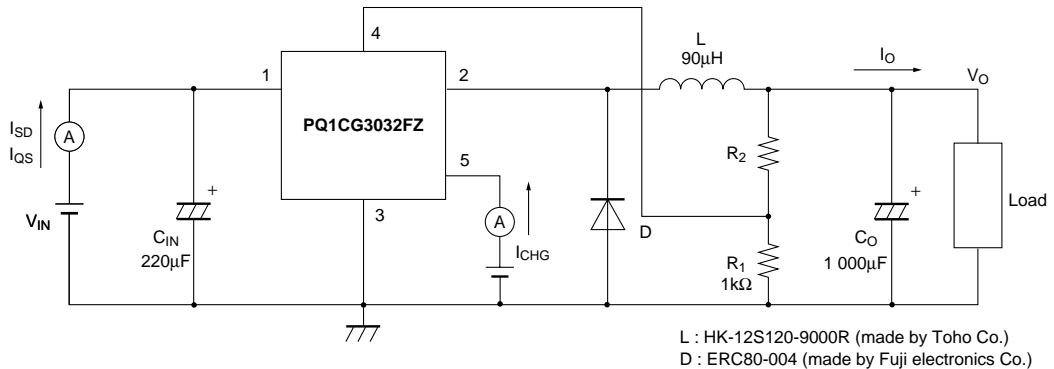
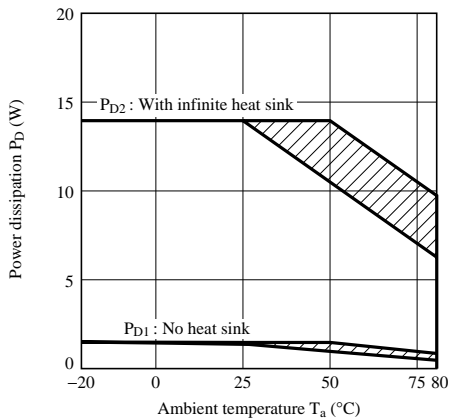


Fig.2 Power Dissipation vs. Ambient Temperature



Note) Oblique line prtion:Overheat protection may operate in this area

Fig.3 Overcurrent Protection Characteristics (Typical Value)

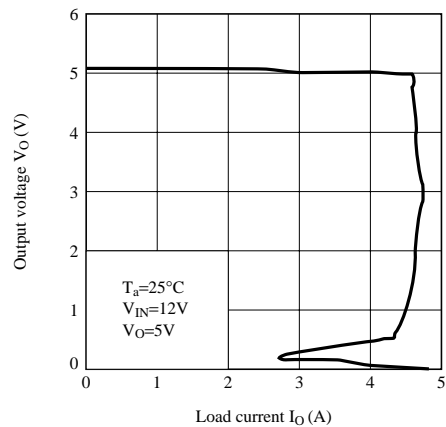


Fig.4 Efficiency vs. Input Voltage

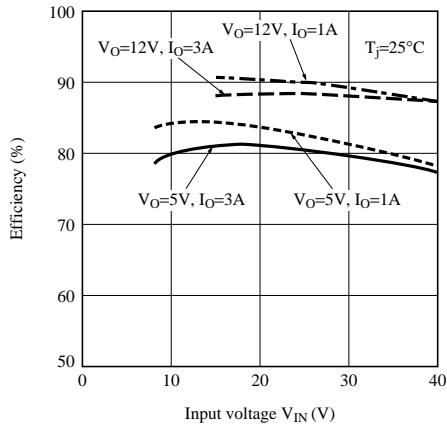


Fig.5 Output Saturation Voltage vs. Switching Current

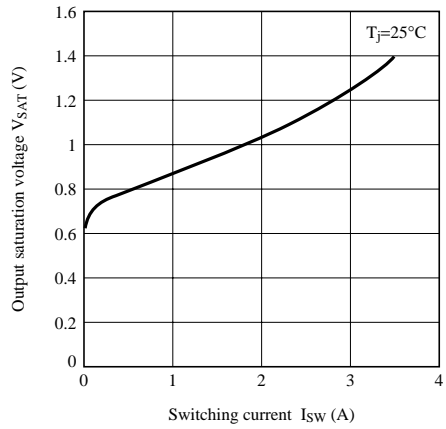


Fig.6 Stand by Current vs. Input Voltage

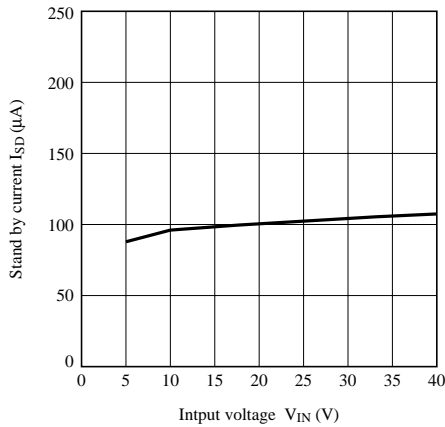


Fig.7 Reference Voltage Fluctuation vs. Junction Temperature

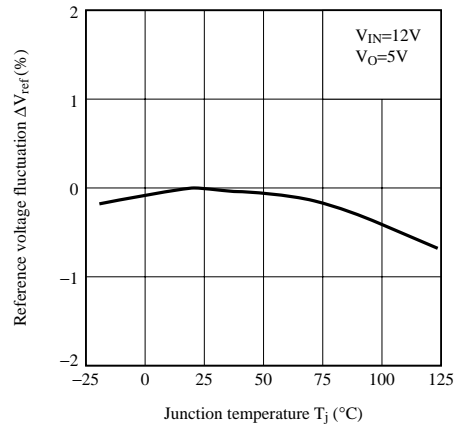


Fig.8 Load Regulation vs. Output Current

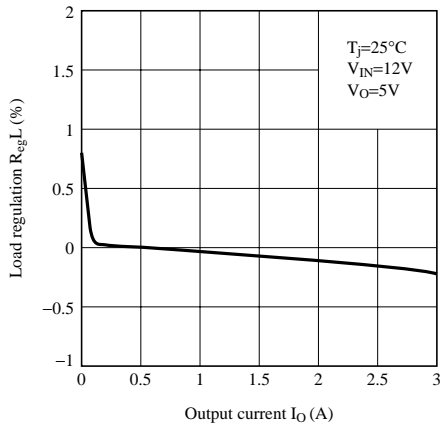
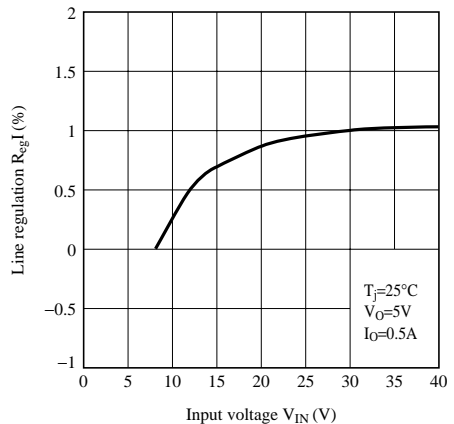
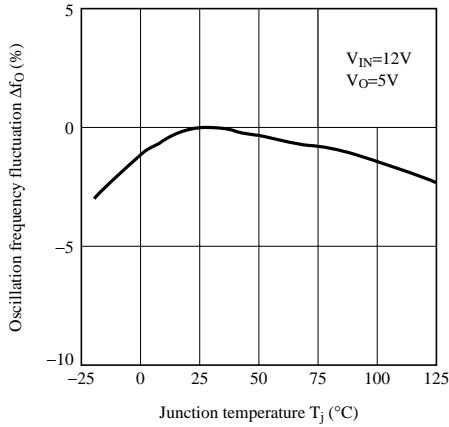


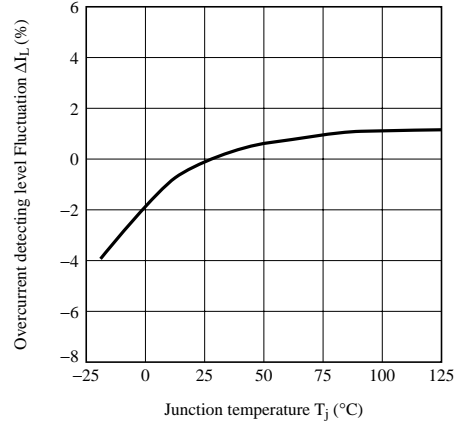
Fig.9 Line Regulation vs. Input Voltage



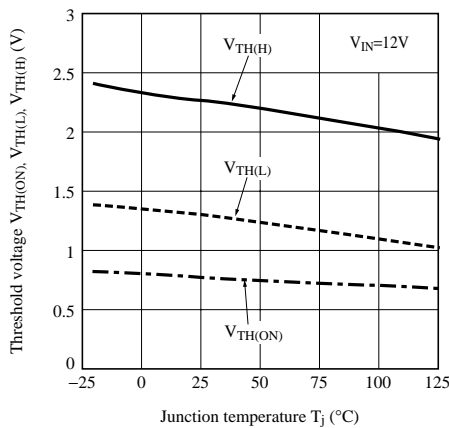
**Fig.10 Oscillation Frequency Fluctuation vs. Junction Temperature**



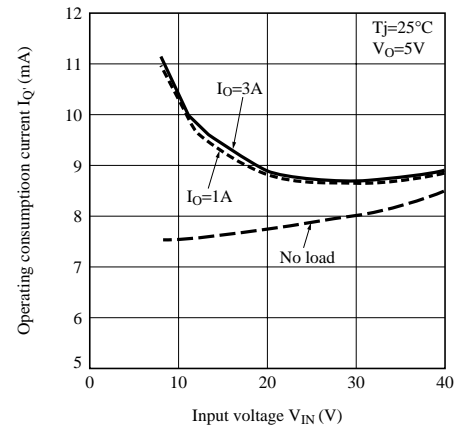
**Fig.11 Overcurrent Detection Level Fluctuation vs. Junction Temperature**



**Fig.12 Threshold Voltage vs. Junction Temperature**



**Fig.13 Operating Consumption Current vs. Input Voltage**



**Fig.14 Block Diagram**

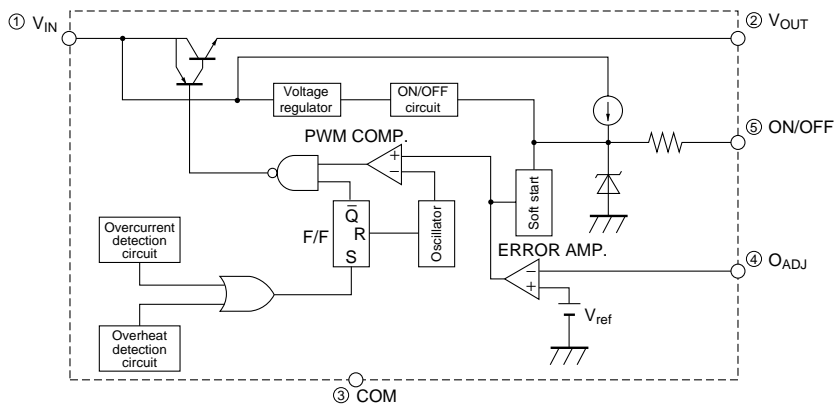


Fig.15 Step Down Type Circuit Diagram

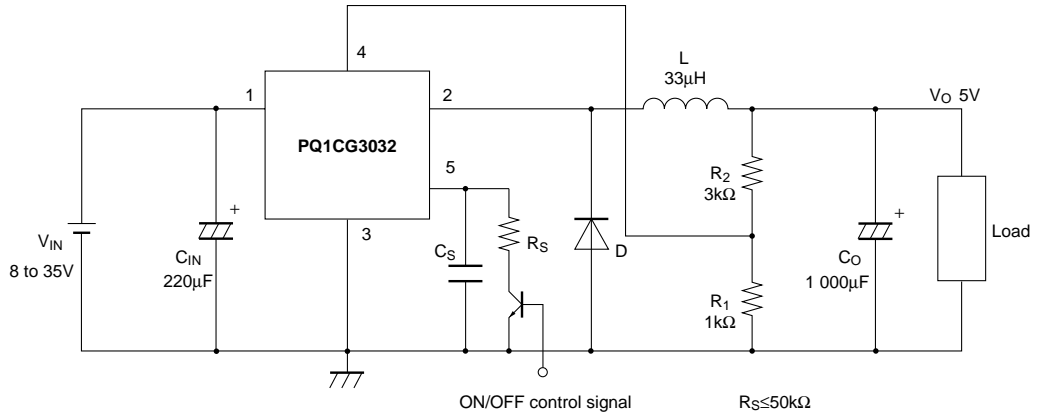
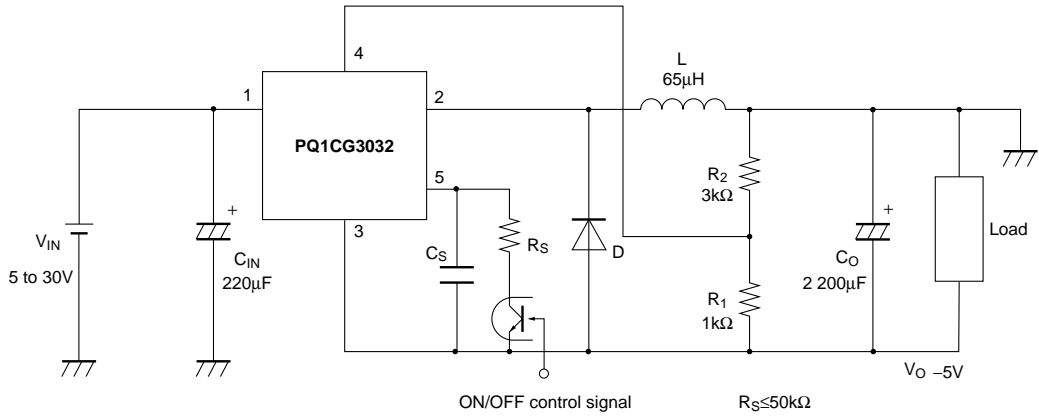
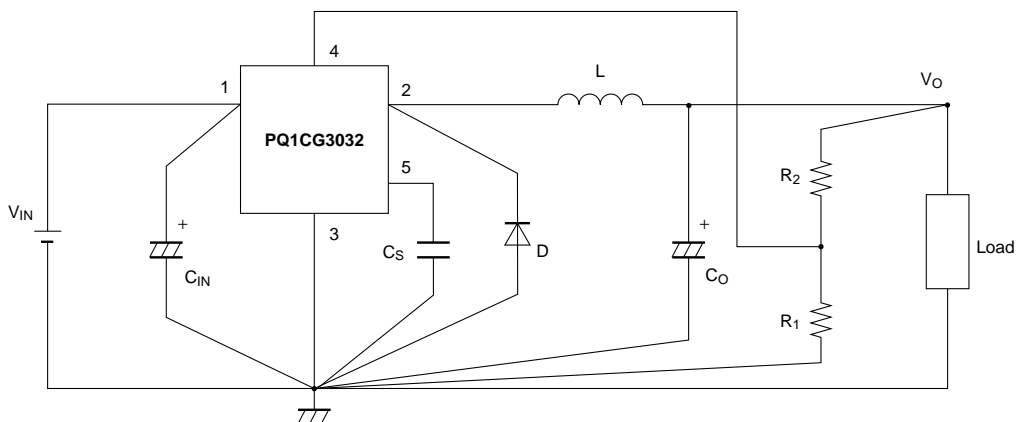


Fig.16 Polarity Inversion Type Circuit Diagram



## ■ Precautions for Use

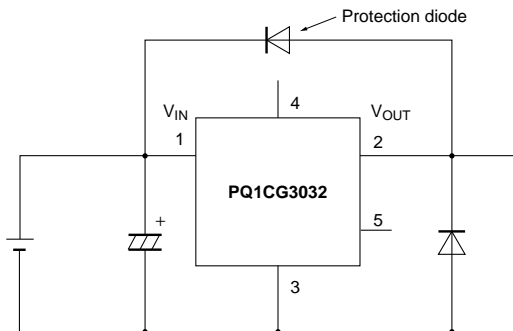


### 1. External connection

- (1) Wiring condition is very important. Noise associated with wiring inductance may cause problems.

For minimizing inductance, it is recommended to design the thick and short pattern (between large current diodes, input/output capacitors, and terminal 1,2.) Single-point grounding (as indicated) should be used for best results.

- (2) High switching speed and low forward voltage type schottky barrier diode should be recommended for the catch-diode D because it affects the efficiency. Please select the diode which the current rating is at least 1.2 times greater than maximum switching current.
- (3) The output ripple voltage is highly influenced by ESR (Equivalent Series Resistor) of output capacitor, and can be minimized by selecting Low ESR capacitor.
- (4) An inductor should not be operated beyond its maximum rated current so that it may not saturate.
- (5) When voltage that is higher than  $V_{IN}$  ①, is applied to  $V_{OUT}$  ②, there is the case that the device is broken. Especially, in case  $V_{IN}$  ① is shorted to GND in normal condition, there is the case that the device is broken since the charged electric charge in output capacitor ( $C_O$ ) flows into input side. In such case a schottky barrier diode or a silicon diode shall be recommended to connect as the following circuit.



■ ON/OFF Control Terminal

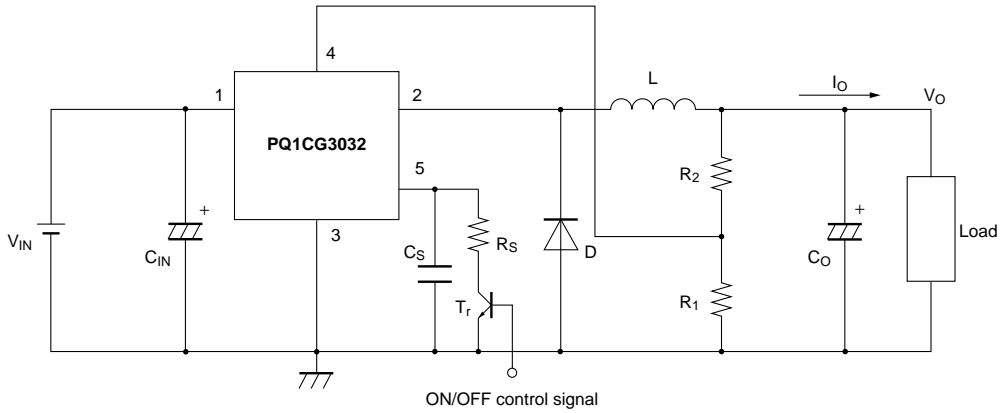
1. In the following circuit, when ON/OFF control terminal ⑤ becomes low by switching transistor  $T_r$  on, output voltage may be turned OFF and the device becomes stand-by mode. Dissipation current at stand-by mode becomes Max.400 $\mu$ A.

2. Soft start

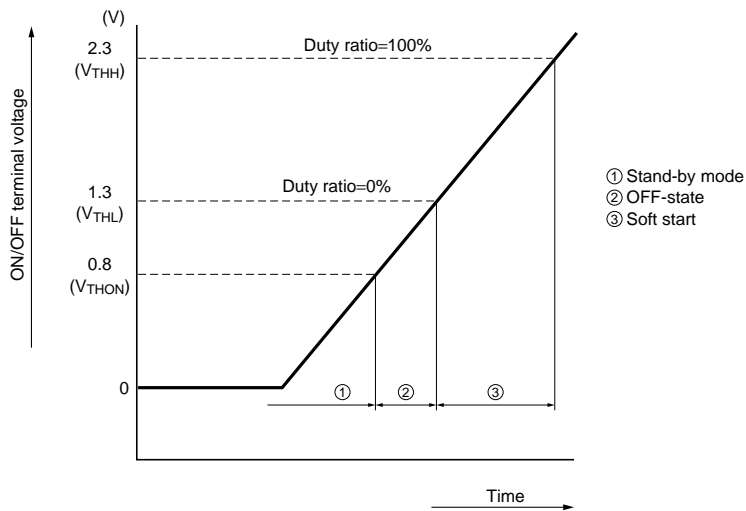
When capacitor  $C_s$  is attached, output pulse gradually expanded and output voltage will start softly.

3. ON/OFF control with soft startup

For ON/OFF control with capacitor  $C_s$ , be careful not to destroy a transistor  $T_r$  by discharge current from  $C_s$ , adding a resistor restricting discharge current of  $C_s$ .



■ ON-OFF Terminal Voltage vs. Time



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