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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/inversing 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)

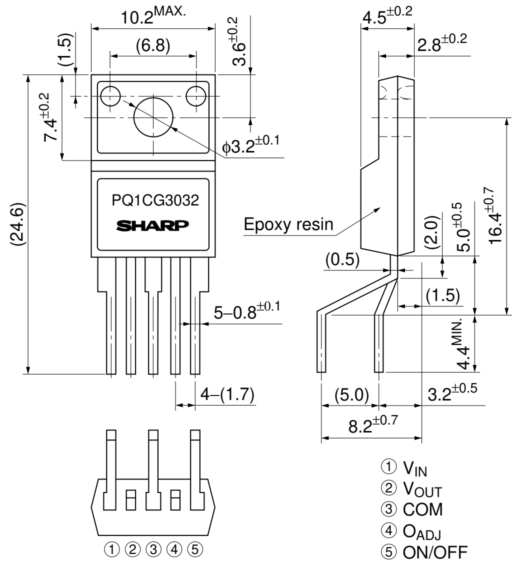
Parameter	Symbol	Rating	Unit
*1 Input voltage	V_{IN}	40	V
Output adjustment terminal voltage	V_{ADJ}	7	V
Dropout voltage	V_{I-O}	41	V
*2 Output-COM voltage	V_{OUT}	−1	V
*3 ON/OFF control voltage	V_C	−0.3 to +40	V
Switching current	I_{SW}	3.5	A
*4 Power dissipation	P_{D1}	1.4	W
	P_{D2}	14	W
*5 Junction 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_D:With infinite heat sink
*5 Over heat protection may operate at the condition T_j=125˚C to 150˚C
*6 For 10s

■ Outline Dimensions

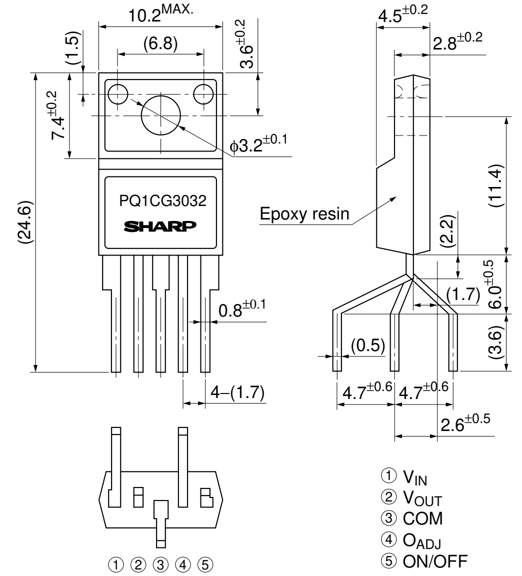
(Unit : mm)

PQ1CG3032FZ



∗ ( ) : Typical dimensions

PQ1CG3032RZ



∗ ( ) : Typical dimensions

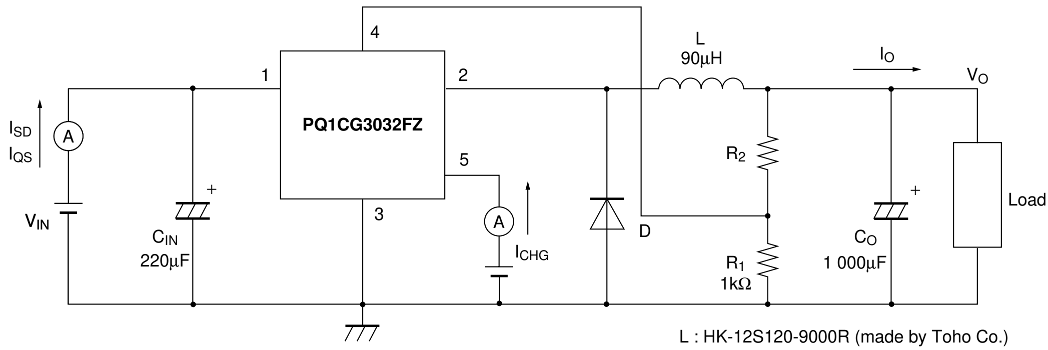
Notice In the absence of confirmation by device specification sheets, SHARP takes no responsibility for any defects that may occur in equipment using any SHARP devices shown in catalogs, data books, etc. Contact SHARP in order to obtain the latest device specification sheets before using any SHARP device.
Internet Internet address for Electronic Components Group http://www.sharp.co.jp/ecg/

■ 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˚C)

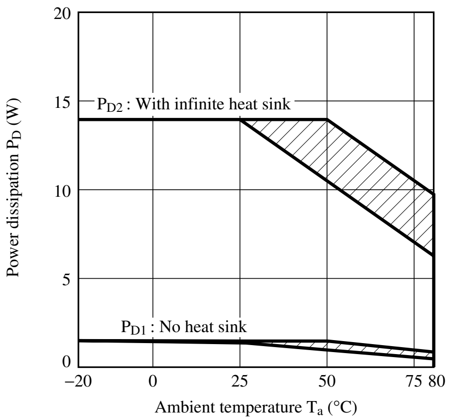
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output saturation voltage	V_{SAT}	I_{SW}=3A	–	1.4	1.8	V
Reference voltage	V_{ref}	–	1.235	1.26	1.285	V
Reference voltage temperature fluctuation	ΔV_{ref}	T_j=0 to 125˚C	–	±0.5	–	%
Load regulation	$\lvert R_{eg}L \rvert$	I_O=0.5 to 3A	–	0.2	1.5	%
Line regulation	$\lvert R_{eg}I \rvert$	V_{IN}=8 to 35V	–	1	2.5	%
Efficiency	η	I_O=3A	–	80	–	%
Oscillation frequency	f_O	–	135	150	165	kHz
Oscillation frequency temperature fluctuation	Δf_O	T_j=0 to 125˚C	–	±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	–	μA
Threshold input voltage	V_{THL}	Duty ratio=0%,④ terminal=0V,⑤ terminal	–	1.3	–	V
	V_{THH}	Duty ratio=100%,④ terminals 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	μA
Output OFF-state consumption current	I_{QS}	V_{IN}=40V,⑤ terminal=0.9V	–	8	16	mA

Fig.1 Standard Test Circuit



L : HK-12S120-9000R (made by Toho Co.)
D : ERC80-004 (made by Fuji electronics Co.)

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)

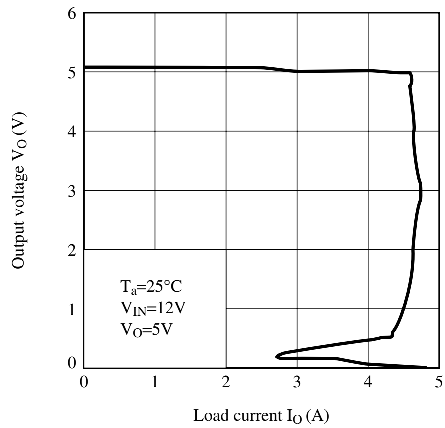


Fig.4 Efficiency vs. Input Voltage

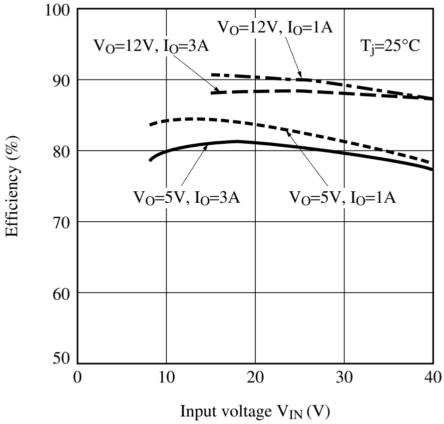


Fig.5 Output Saturation Voltage vs. Switching Current

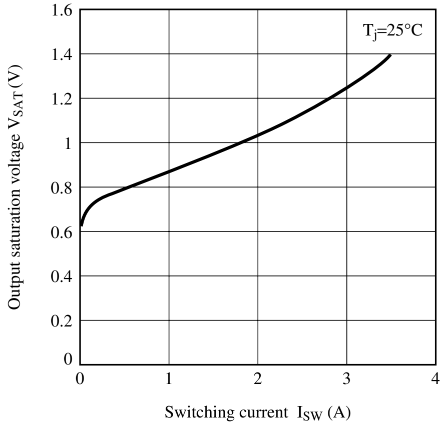


Fig.6 Stand by Current vs. Intput Voltage

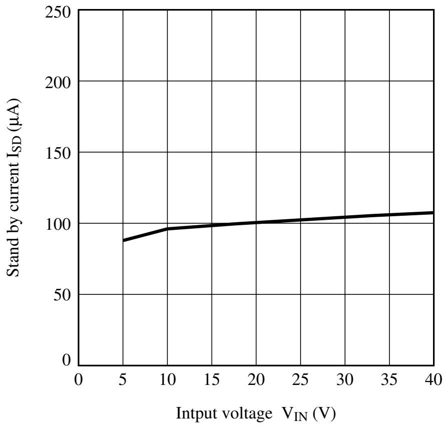


Fig.7 Reference Voltage Fluctuation vs. Junction Temperature

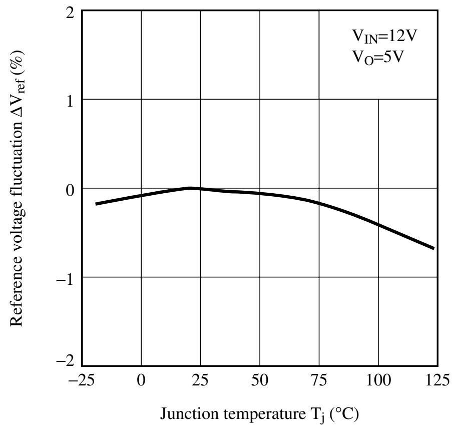


Fig.8 Load Regulation vs. Output Current

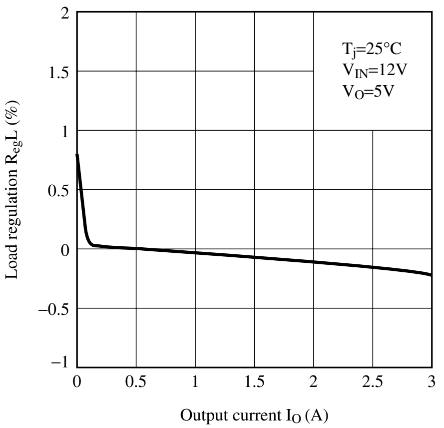


Fig.9 Line Regulation vs. Input Voltage

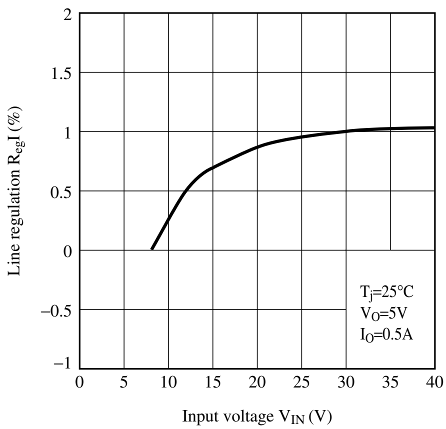


Fig.10 Oscillation Frequency Fluctuation vs. Junction Temperature

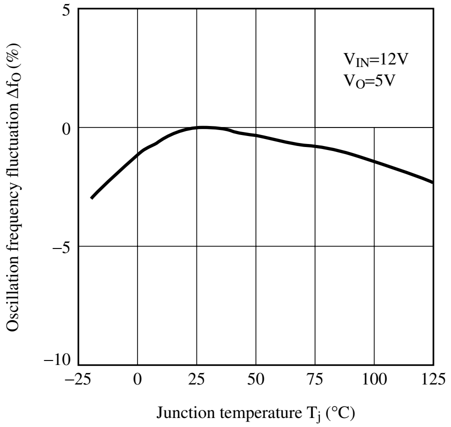


Fig.11 Overcurrent Detection Level Fluctuation vs. Junction Temperature

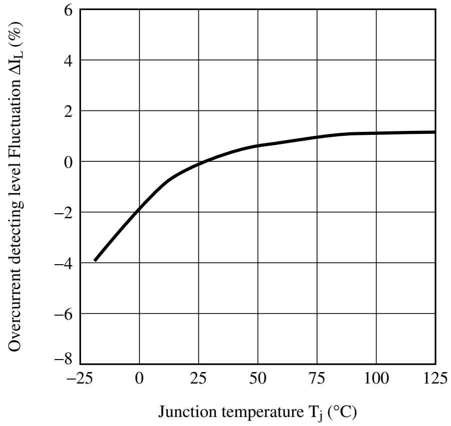


Fig.12 Threshold Voltage vs. Junction Temperature

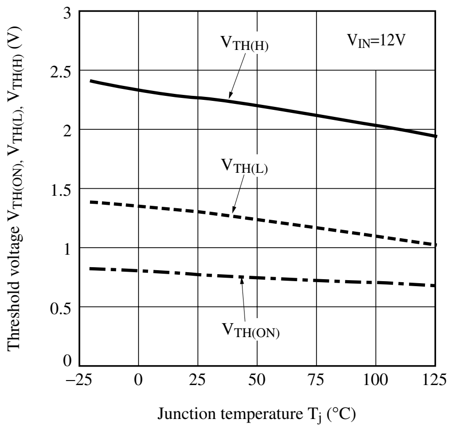


Fig.13 Operating Consumption Current vs. Input Voltage

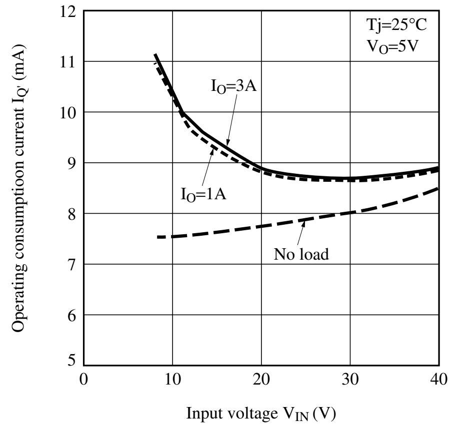


Fig.14 Block Diagram

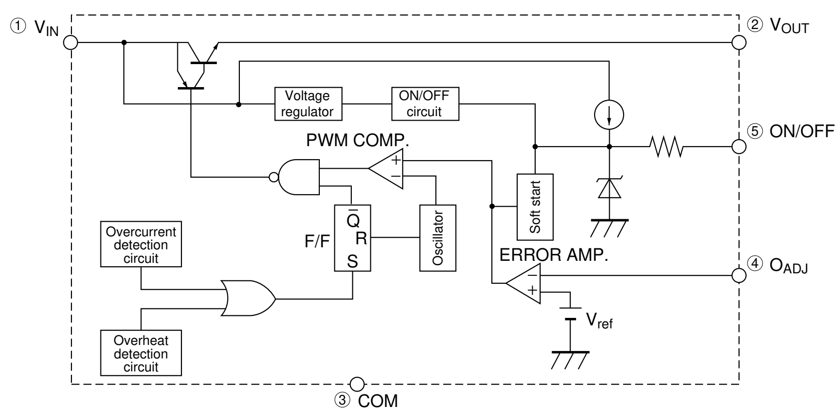


Fig.15 Step Down Type Circuit Diagram

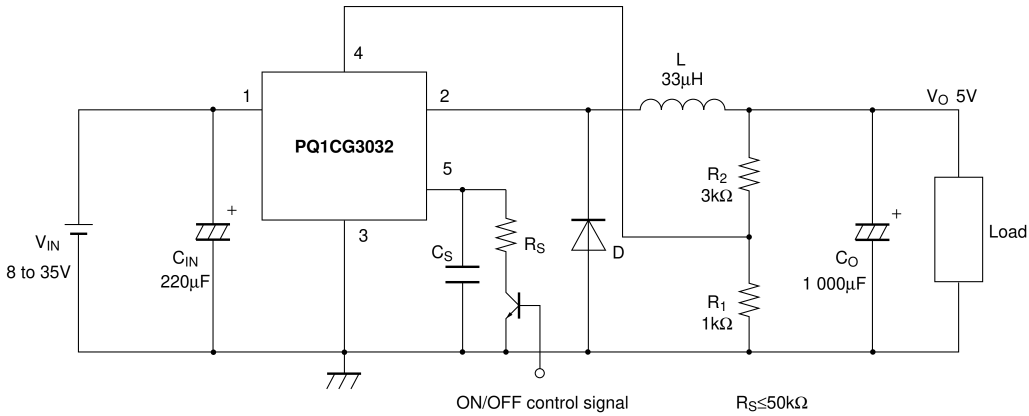
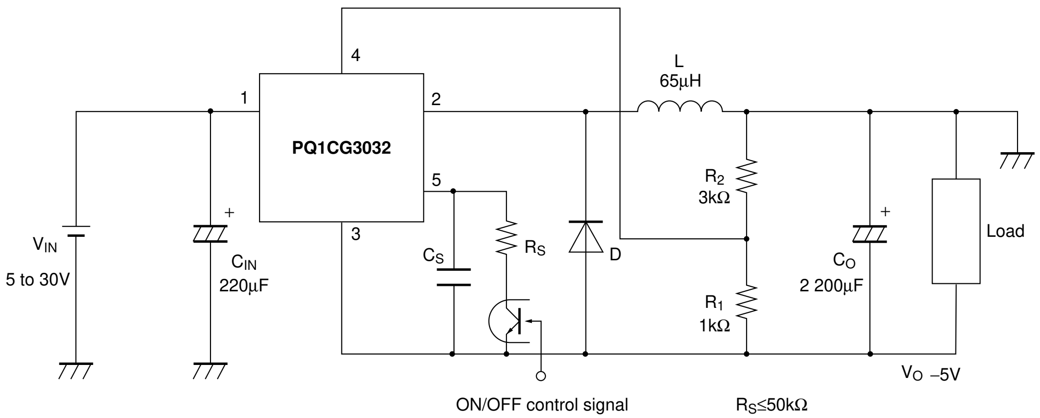
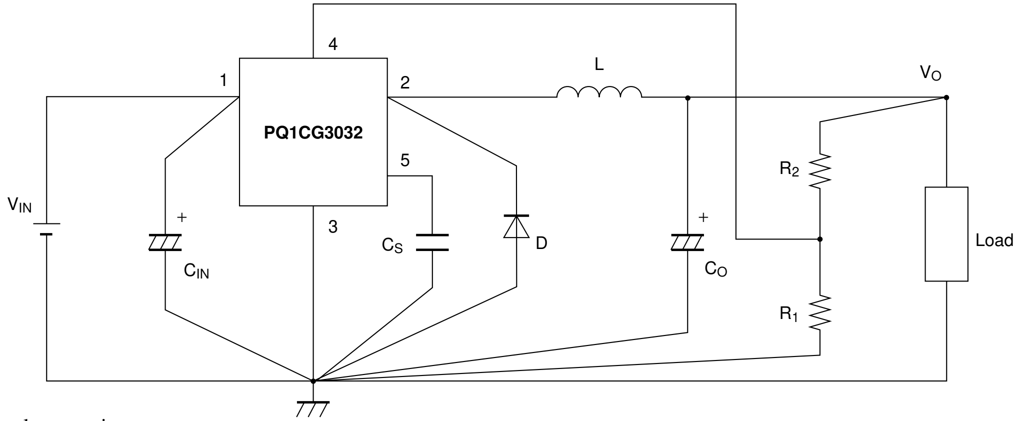


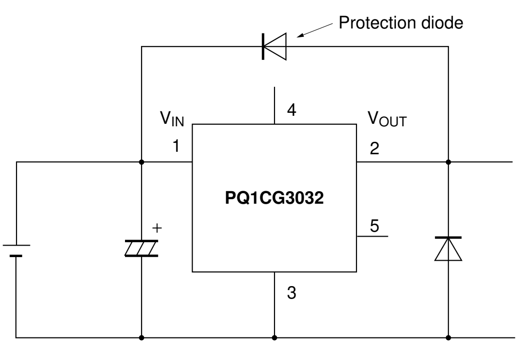
Fig.16 Polarity Inversion Type Circuit Diagram



■ Precautions for Use

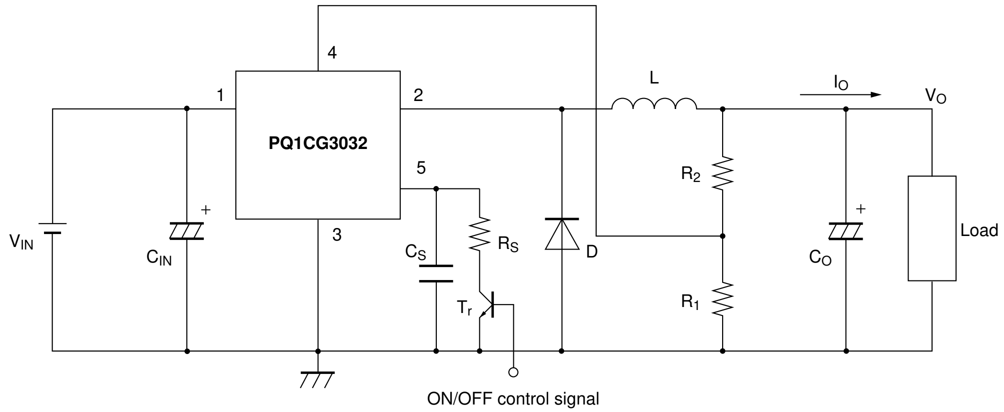


1. External connection
   (1) Wiring condition is very important. Noise associated with wiring inductance may cause problems. For minimizing inductance, it is recommended to design the thick and short pattern (between large current diodos, input/output capacitors, and terminal 1,2.) Single-point grounding (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 swiching 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} ①is 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 schottly barrier diode or a silicon diode shall be recommended to connect as the following circuit.

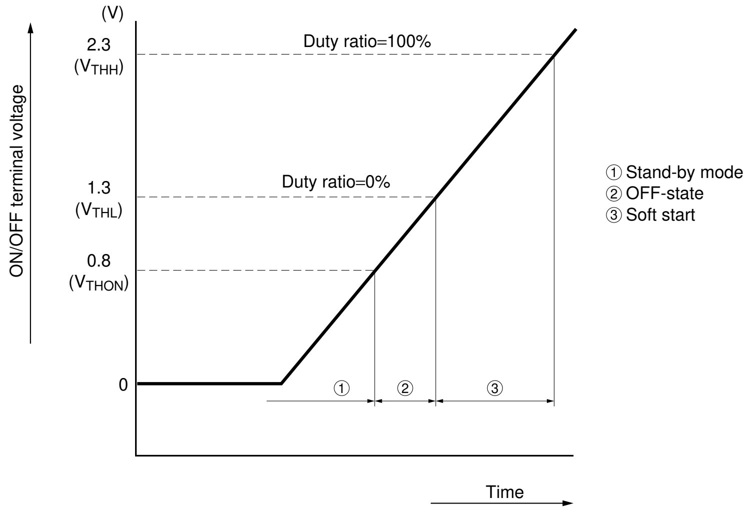


■ ON/OFF Control Terminal

1. In the following circuit,when ON/OFF control terminal ⑤ becomes low by switching transistor Tr on, output voltage may be turned OFF and the device becomes stand-by mode. Dissipation current at stand-by mode becomes Max.400µA.
2. Soft start
   When capacitor Cs 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 Tr 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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— Office automation equipment
— Telecommunication equipment [terminal]
— Test and measurement equipment
— Industrial control
— Audio visual equipment
— Consumer electronics

(ii) Measures such as fail-safe function and redundant design should be taken to ensure reliability and safety when SHARP devices are used for or in connection with equipment that requires higher reliability such as:

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— Traffic signals
— Gas leakage sensor breakers
— Alarm equipment
— Various safety devices, etc.

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— Telecommunication equipment [trunk lines]
— Nuclear power control equipment
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