PQ1CZ1

Surface Mount Type Chopper Regulator

Features

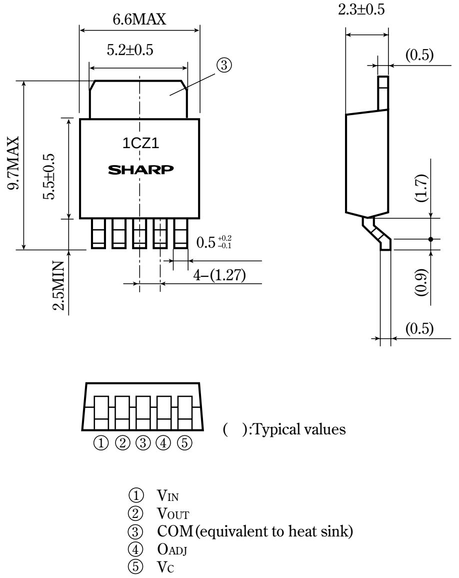
- Surface mount type package (equivalent to SC-63, 5-terminal type)
- Variable output voltage (V_{ref} to 35V/-V_{ref} to -30V)
- Built-in ON/OFF control function
- Built-in overheat protection function and overcurrent protection function
- Built-in soft start function

Applications

- Personal computers
- Word processors
- Printers
- Car audio equipment

Outline Dimensions

(Unit : mm)



Absolute Maximum Ratings

(T_a=25˚C)

Parameter	Symbol	Rating	Unit
※1 Input voltage	V_{IN}	40	V
Error input voltage	V_{ADJ}	7	V
Input-output voltage	V_{I-O}	41	V
Switching current	I_{SW}	1.5	A
※2 Voltage between output and COM	V_{OUT}	−1	V
※3 ON/OFF control voltage	V_C	−0.3 to 40	V
※4 Power dissipation	P_D	8	W
Junction temperature	T_j	150	˚C
Operating temperature	T_{opr}	−20 to +80	˚C
Storage temperature	T_{stg}	−40 to +150	˚C
Soldering temperature	T_{sol}	260 (For 10s)	˚C

※1 Voltage between V_{IN} terminal and COM terminal.
※2 Voltage between V_{OUT} terminal and COM terminal.
※3 Voltage between Vc terminal and COM terminal.
※4 With infinite heat sink, Refer to Fig.1

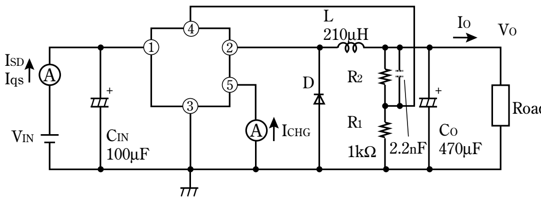
• Please refer to the chapter " Handling Precautions ".

■ Electrical Characteristics

(Unless otherwise specified, condition shall be V_{IN}=12V, I_O=0.2A, V_O=5V,⑤terminal is open, T_a=25˚C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output saturation voltage	V_{SAT}	I_O=1A, no L,D,C_O	—	0.9	1.5	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=0.2 to 1A	—	0.1	1.5	%
Line regulation	$\lvert R_{eg}I \rvert$	V_{IN}=8 to 35V	—	0.5	2.5	%
Efficiency	η	I_O=1A	—	82	—	%
Oscillation frequency	fo	—	80	100	120	kHz
Oscillation frequency temperature fluctuation	Δfo	T_j=0 to 125˚C	—	±2	—	%
Maximum duty	D_{MAX}	④terminal = open	90	—	—	%
Overcurrent detecting level	I_L	No L,D,C_O	1.55	2	2.6	A
Charge current	I_{CHG}	②,④ terminals are open	–15	–10	–5	µA
Input threshold voltage	V_{THL}	Duty=0%, ④ terminal =0V, ⑤ terminal	1.95	2.25	2.55	V
	V_{THH}	Duty=D_{MAX}, ④terminal is open., ⑤ terminal	3.25	3.55	3.85	
ON threshold voltage	$V_{TH(ON)}$	④ terminal=0V, ⑤ terminal	1.05	1.4	1.75	V
Stand-by current	I_{SD}	V_{IN}=40V, ⑤ terminal =0V	—	150	400	µA
Output OFF-state dissipation current	I_{qs}	V_{IN}=40V, ④ terminal =3V	—	8	12	mA

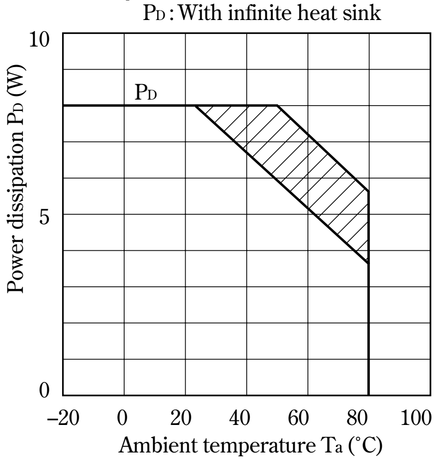
Fig. 1 Test Circuit



Output voltage $[V_O]=V_{ref}\times\left(1+\frac{R_2}{R_1}\right)$ V

L : HK-HK-14D100-2110(made by Toho Co.)
D : ERC80-004(made by Fuji electronics Co.)

Fig. 2 Power Dissipation vs. Ambient Temperature



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

Fig. 3 Overcurrent Protection Characteristics (Typical Value)

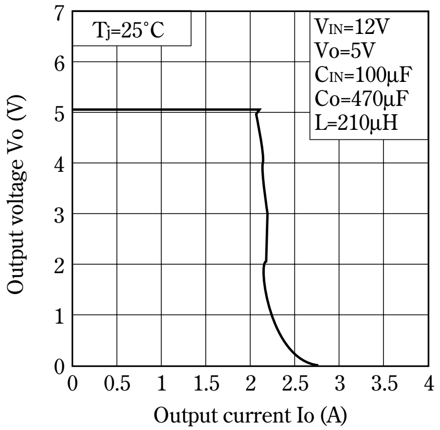


Fig. 4 Efficiency vs. Input Voltage

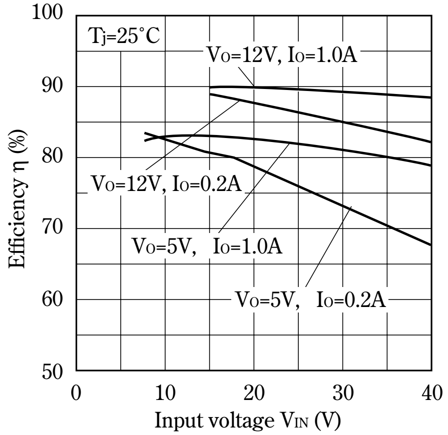


Fig. 5 Switching Current vs. Output Saturation Voltage

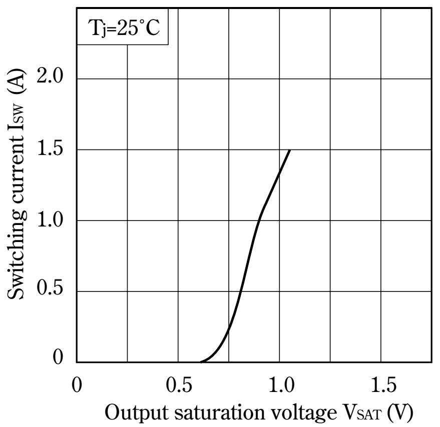


Fig. 6 Stand-by Current vs. Input Voltage

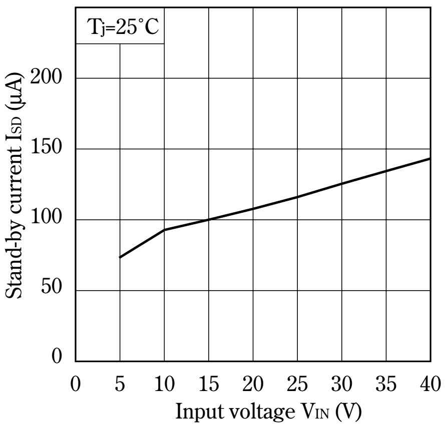


Fig. 7 Reference Voltage Fluctuation vs. Junction Temperature

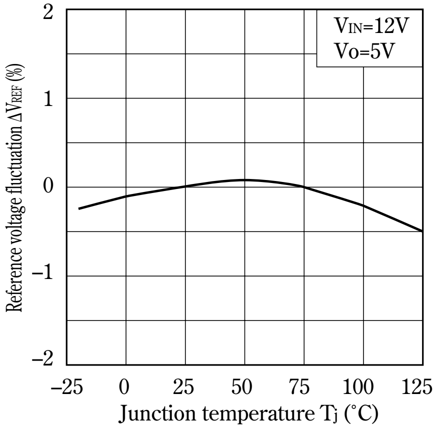


Fig. 8 Load Regulation vs. Output Current

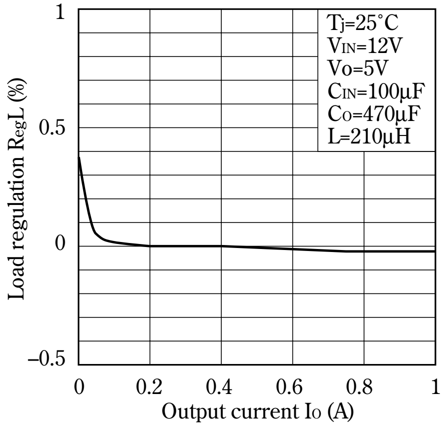


Fig. 9 Line Regulation vs. Input Voltage

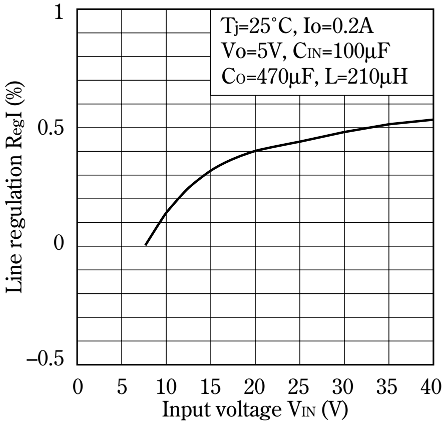


Fig.10 Oscillation Frequency Fluctuation vs. Junction Temperature

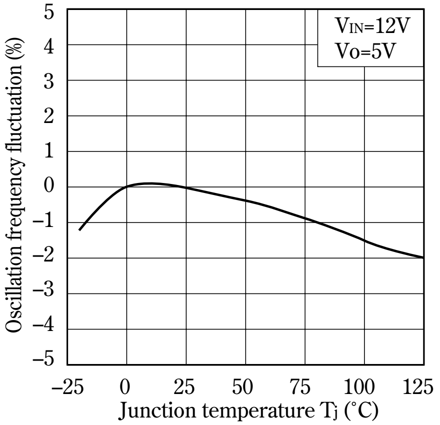


Fig.11 Overcurrent Detecting Level Fluctuation vs. Junction Temperature

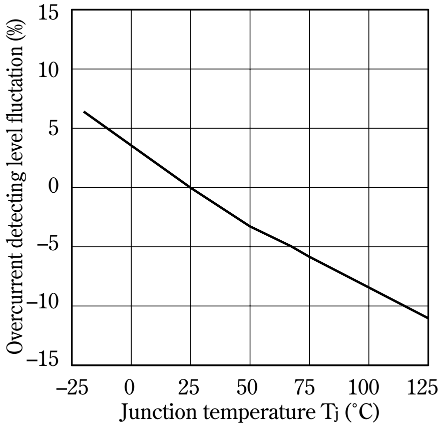


Fig.12 Threshold Voltage vs. Junction Temperature

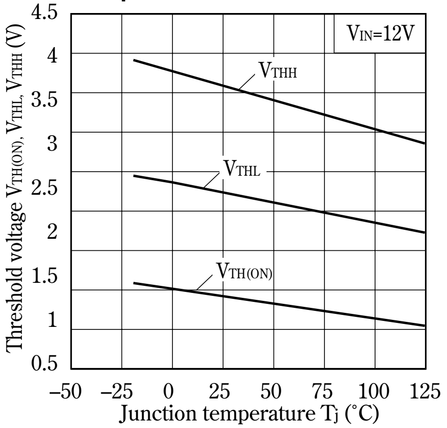


Fig.13 Operating Dissipation Current vs. Input Voltage

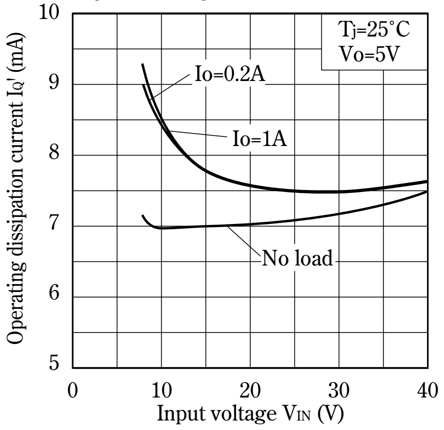
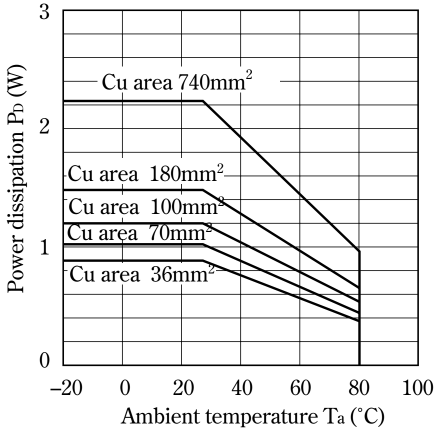
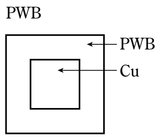


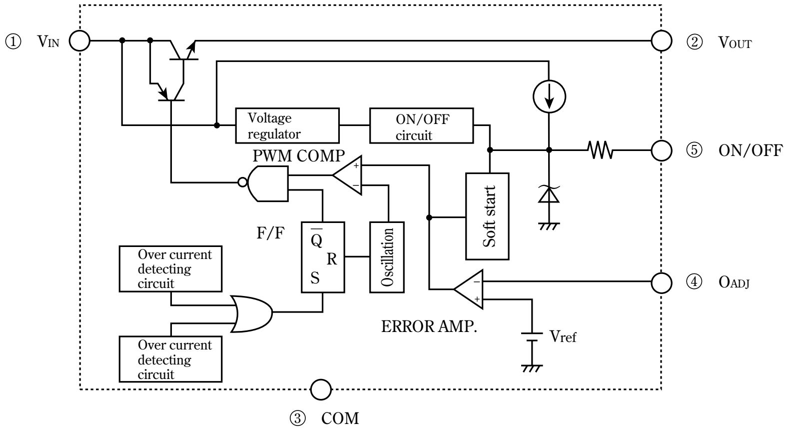
Fig.14 Power Dissipation vs. Ambient Temperature (Typical Value)



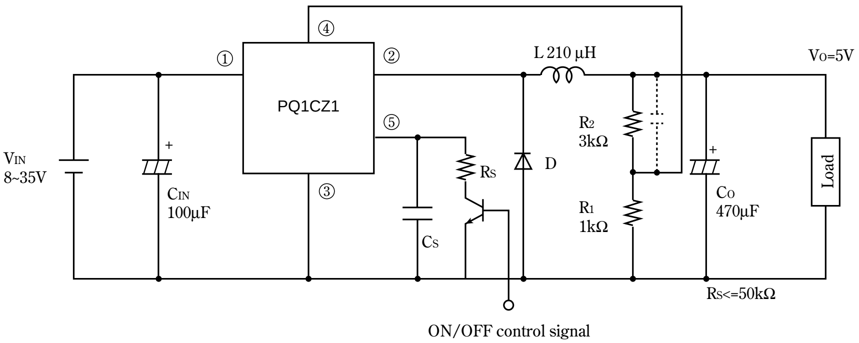


Material	: Glass-cloth epoxy resin
Size	: 50 X 50 X 1.6mm
Cu thickness	: 35µm

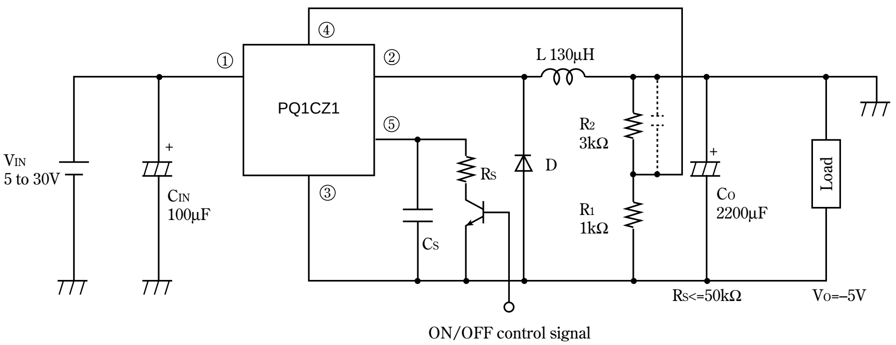
Block Diagram



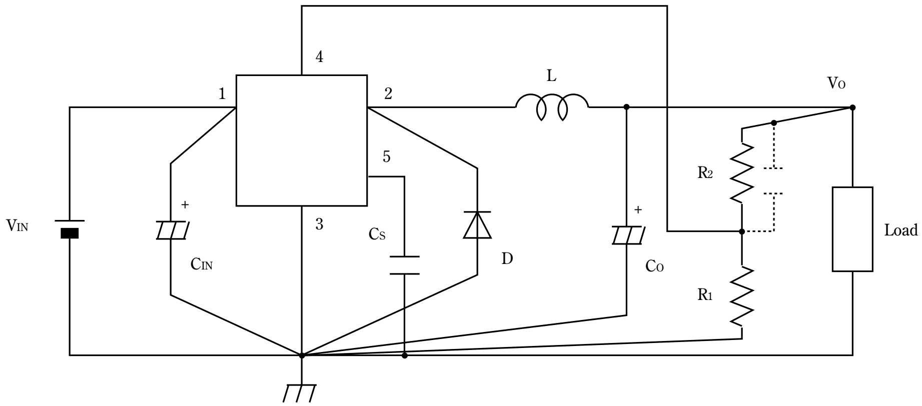
Step Down Type Circuit Diagram (5V output)



Polarity Inversion Type Circuit Diagram (-5V output)



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 When output voltage is not stable, it can be improved by attaching capacitor (from several nF to several dozens nF) to external resistor R_2.

③ 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.

④ The output ripple voltage is highly influenced by ESR (Equivalent Series Resistor) of output capacitor, and can be minimized by selecting Low ESR capacitor.

⑤ An inductor should not be operated beyond its maximum rated current so that it may not saturate.

Thermal Protection Design

Internal power dissipation (P) of device is generally obtained by the following equation.

$P = I_{SW}$ (Average.) x V_{SAT} x D' + V_{IN} (voltage between V_{IN} to COM terminal) x I_q' (consumption current)

Step down type

$$D'(\text{Duty}) = \frac{T_{on}}{T(\text{period})} = \frac{V_O + V_F}{V_{IN} - V_{SAT} + V_F}$$

I_{SW} (Average) = I_O (Output current.)

Polarity inversion type

$$D'(\text{Duty}) = \frac{T_{on}}{T(\text{period})} = \frac{|V_O| + V_F}{V_{IN} + |V_O| - V_{SAT} + V_F}$$

$$I_{SW}(\text{Average}) = \frac{1}{1 - D'} \times I_O(\text{Output current.})$$

V_F : Forward voltage of the diode

When ambient temperature Ta and power dissipation P_D (MAX) during operation are determined, use Cu plate which allows the element to operate within the safety operation area specified by the derating curve. Insufficient radiation gives an unfavorable influence to the normal operation and reliability of the device.

In the external area of the safety operation area shown by the derating curve, the overheat protection circuit may operate to shut-down output. However, please avoid keeping such condition for a long time.

■ ON/OFF Control Terminal

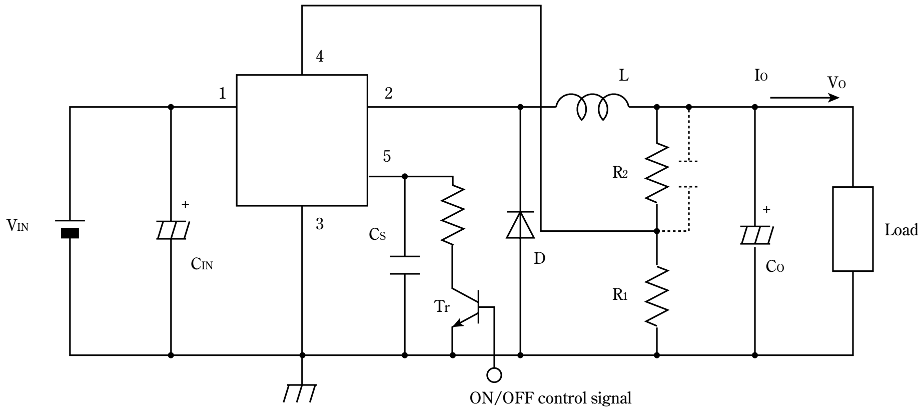
In the following circuit,when ON/OFF control terminal ⑤ becomes low by switching transistor Tr on, output voltage may be turned OFF and the device becomes stand-by mode. Dissipation current at stand-by mode becomes Max.400µA.

<Soft start>

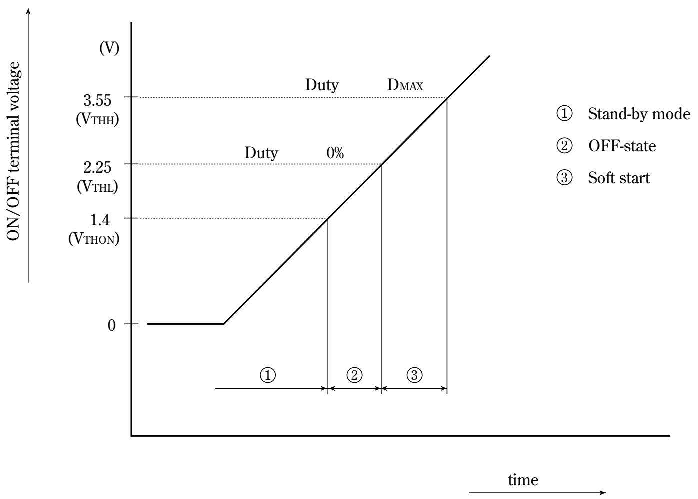
When capacitor Cs is attached, output pulse gradually expanded and output voltage will start softly.

<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.



Step Down Voltage Circuit



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  --- Office automation equipment
  --- Telecommunication equipment [terminal]
  --- Test and measurement equipment
  --- Industrial control
  --- Audio visual equipment
  --- Consumer electronics

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