PQ05RF2/21/2V Series

2A Output, Low Power-Loss Voltage Regulators

■ Features

- Low power-loss (Dropout voltage: MAX. 0.5V)
- Compact resin full-mold package.
- Built-in ON/OFF control terminal (PQ05RF2/PQ05RF21 series)
- Built-in output voltage minute adjustment terminal (ripple rejection is improved) (PQ05RF2V series)

■ Model Line-ups

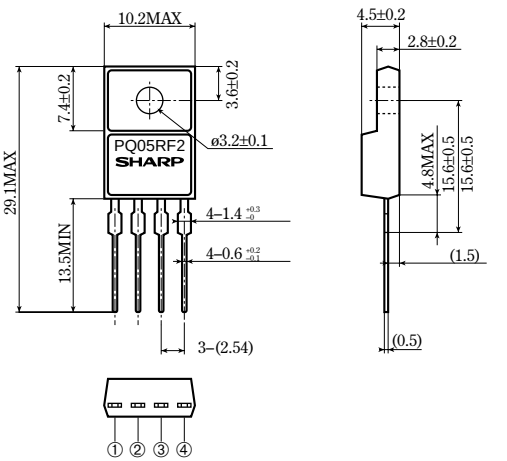
Output voltage	5V Output	9V Output	12V Output	15V Output
Output voltage precision:±5%	PQ05RF2	PQ09RF2	PQ12RF2	PQ15RF2
Output voltage precision:±2.5%	PQ05RF21	PQ09RF21	PQ12RF21	PQ15RF21
Minute adjustment (Output voltage adjustment range:±10%)	PQ05RF2V	PQ09RF2V	PQ12RF2V	PQ15RF2V

■ Applications

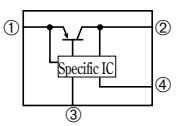
- Series power supply for various electronic equipment such as VCRs, electronic munic instruments

■ Outline Dimensions

(Unit : mm)



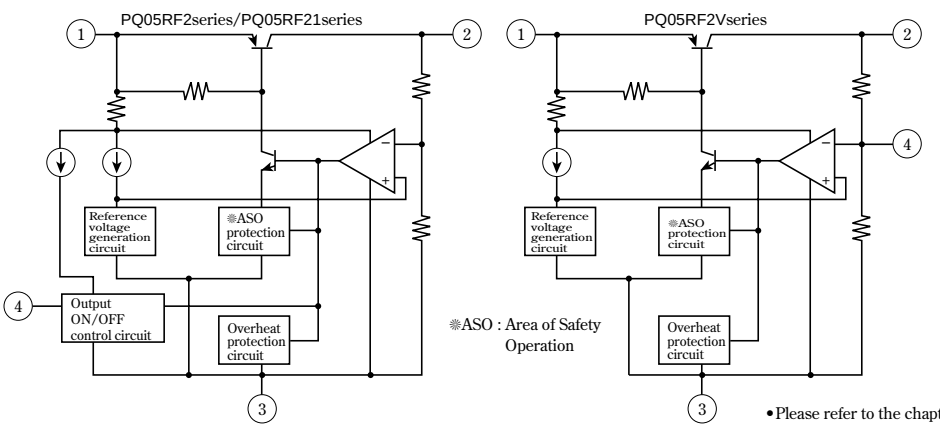
Internal connection diagram



PQ05RF2/21series
① DC input (V_{IN})
② DC output (V_O)
③ GND
④ ON/OFF control terminal (V_C)

PQ05RF2Vseries
① DC input (V_{IN})
② DC output (V_O)
③ GND
④ Output voltage minute adjustment terminal (V_{ADJ})

■ Equivalent Circuit Diagram



• Please refer to the chapter " Handling Precautions ".

SHARP

■ Absolute Maximum Ratings

(T_a=25˚C)

Parameter		Symbol	Rating	Unit
※1 Input voltage		V_{IN}	35	V
※1 ON/OFF control terminal voltage	PQ05RF2 series	V_C	35	V
	PQ05RF21 series			
Output current		I_O	2	A
Power dissipation(No heat sink)		P_{D1}	1.5	W
Power dissipation(With infinite heat sink)		P_{D2}	18	W
※2 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 All are open except GND and applicable terminals.

※2 Overheat protection may operate at 125<=T_j<=150˚C.

■ Electrical Characteristics

(Unless otherwise specified, condition shall be I_O=1A, T_a=25˚C, ※3)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output voltage	PQ05RF2/PQ05RF2V	V_O	–	4.75	5.0	5.25	V
	PQ09RF2/PQ09RF2V			8.55	9.0	9.45	
	PQ12RF2/PQ12RF2V			11.4	12.0	12.6	
	PQ15RF2/PQ15RF2V			14.25	15.0	15.75	
	PQ05RF21			4.88	5.0	5.12	
	PQ09RF21			8.78	9.0	9.22	
	PQ12RF21			11.7	12.0	12.3	
	PQ15RF21			14.63	15.0	15.37	
Load regulation		R_{egL}	I_O=5mA to 2A	–	0.5	2.0	%
Line regulation		R_{egI}	※4	–	0.5	2.5	%
Temperature coefficient of output voltage		TcVo	T_j=0 to 125˚C	–	±0.02	–	%/˚C
Ripple rejection	PQ05RF2/PQ05RF21Series	RR	I_O=0.5A Refer to Fig.2	45	55	–	dB
	PQ05RF2VSeries			55	–	–	dB
Dropout voltage		V_{I-O}	※5, I_O=2A	–	–	0.5	V
ON-state voltage for control	PQ05RF2/PQ05RF21Series	$V_{C(ON)}$	–	2.0 ※6	–	–	V
ON-state current for current	PQ05RF2/PQ05RF21Series	$I_{C(ON)}$	V_C=2.7V	–	–	20	µA
OFF-state voltage for control	PQ05RF2/PQ05RF21Series	$V_{C(OFF)}$	–	–	–	0.8	V
OFF-state current for control	PQ05RF2/PQ05RF21Series	$I_{C(OFF)}$	V_C=0.4V	–	–	–0.4	mA
Quiescent current		I_q	I_O=0	–	–	10	mA
Output voltage minute adjustment range	PQ05RF2V	$V_{O(ADJ)}$	–	4.5	5.0	5.5	V
	PQ09RF2V			8.1	9.0	9.9	
	PQ12RF2V			10.8	12.0	13.2	
	PQ15RF2V			13.5	15.0	16.5	

※3 PQ05RF2 Series: V_{IN}=7V, PQ09RF2 Series: V_{IN}=15V, PQ12RF2 Series:V_{IN}=18V, PQ15RF2 Series: V_{IN}=23V

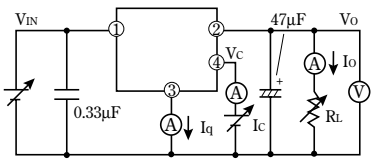
※4 PQ05RF2/PQ05RF21/PQ05RF2V: V_{IN}=6 to 12V PQ09RF2/PQ09RF21/PQ09RF2V: V_{IN}=10 to 25V
PQ12RF2/PQ12RF21/PQ12RF2V: V_{IN}=13 to 29V PQ15RF2/PQ15RF21/PQ15RF2V: V_{IN}=16 to 32V

※5 Input voltage shall be the value when output voltage is 95% in comparison with the initial value.

※6 In case of opening control terminal ④, output voltage turns on.(PQ05RF2/PQ05RF21 Series)

Fig. 1 Test Circuit

PQ05RF2/PQ05RF21series



PQ05RF2Vseries

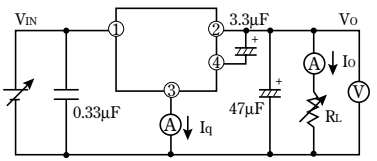
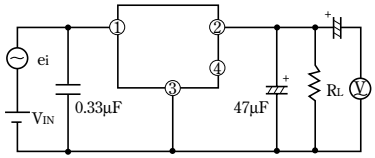


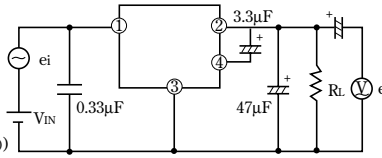
Fig. 2 Test Circuit of Ripple Rejection

PQ05RF2/PQ05RF21series



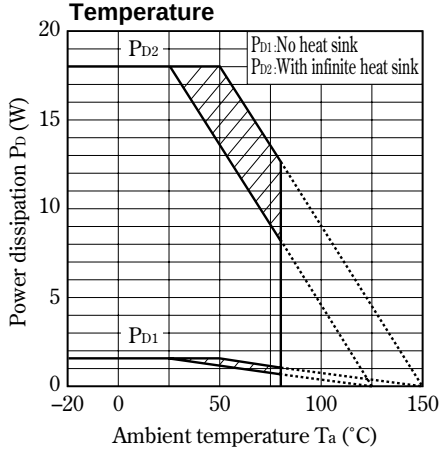
f=120Hz(sine wave)
ei(rms)=0.5V
RR=20 log(ei(rms)/eo(rms))

PQ05RF2Vseries



f=120Hz(sine wave)
ei(rms)=0.5V
RR=20 log(ei(rms)/eo(rms))

Fig. 3 Power Dissipation vs. Ambient Temperature



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

Fig. 4 Overcurrent Protection Characteristics (Typical value)

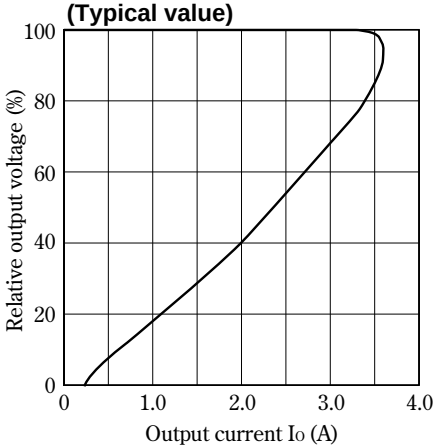


Fig. 5 Output Voltage Minute Adjustment Characteristics (PQ05RF2V)

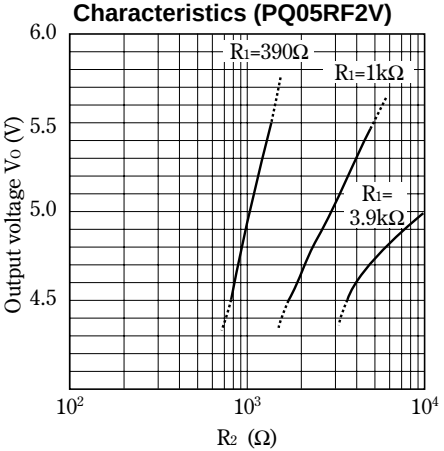


Fig. 6 Output Voltage Minute Adjustment Characteristics (PQ09RF2V)

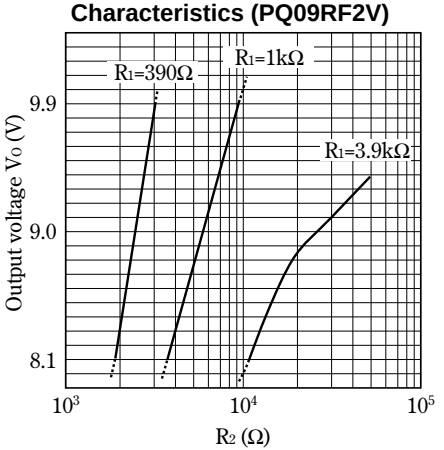


Fig. 7 Output Voltage Minute Adjustment Characteristics (PQ12RF2V)

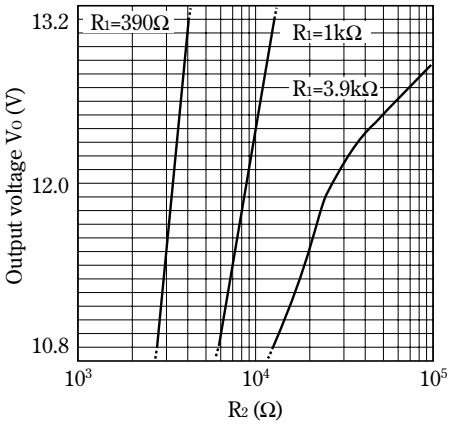


Fig. 8 Output Voltage Minute Adjustment Characteristics (PQ15RF2V)

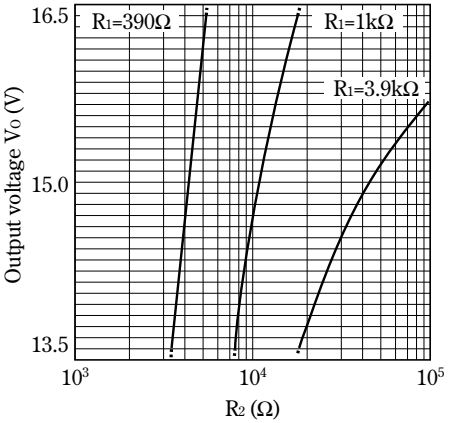


Fig. 9 Output Voltage Deviation vs. Junction Temperature (PQ05RF2/PQ05RF21/PQ05RF2V)

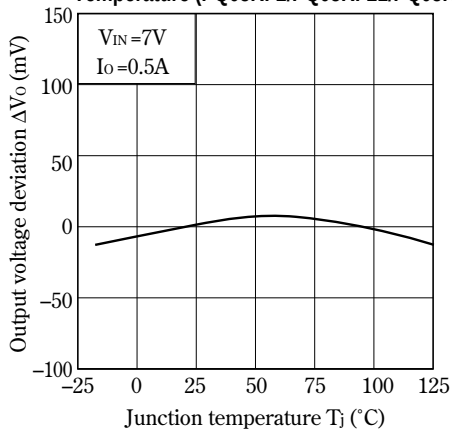


Fig.10 Output Voltage Deviation vs. Junction Temperature (PQ09RF2/PQ09RF21/PQ09RF2V)

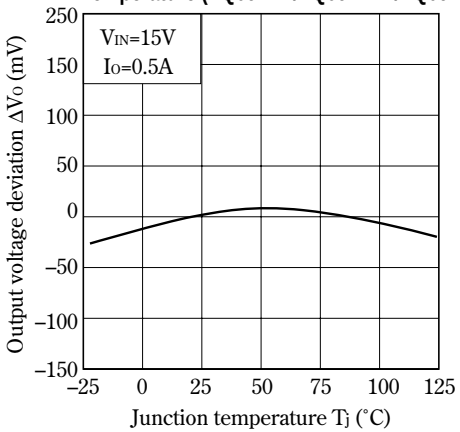


Fig.11 Output Voltage Deviation vs. Junction Temperature (PQ12RF2/PQ12RF21/PQ12RF2V)

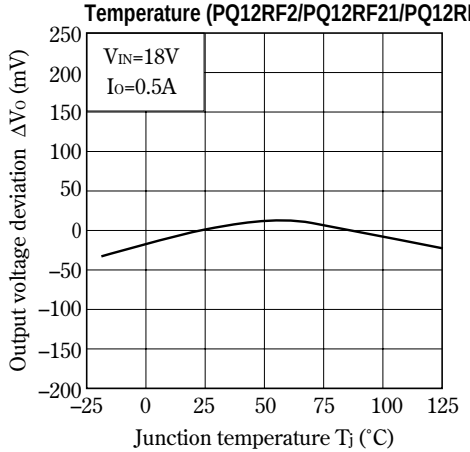


Fig.12 Output Voltage Deviation vs. Junction Temperature (PQ15RF2/PQ15RF21/PQ15RF2V)

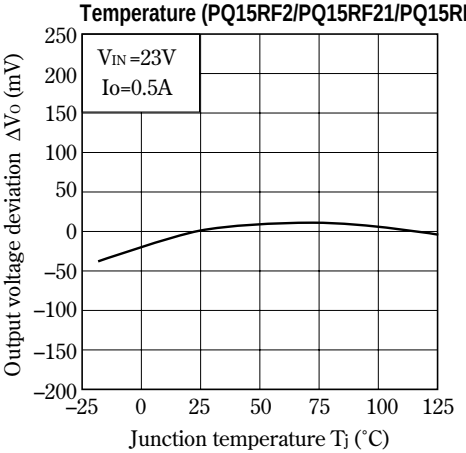


Fig.13 Output Voltage vs. Input Voltage (PQ05RF2/PQ05RF21/PQ05RF2V)

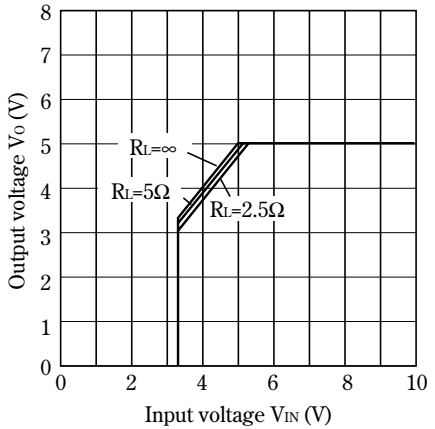


Fig.14 Output Voltage vs. Input Voltage (PQ09RF2/PQ09RF21/PQ09RF2V)

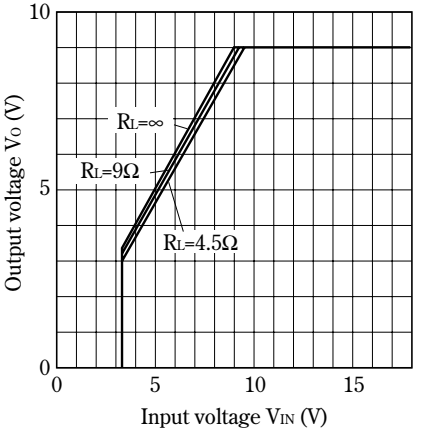


Fig.15 Output Voltage vs. Input Voltage (PQ12RF2/PQ12RF21/PQ12RF2V)

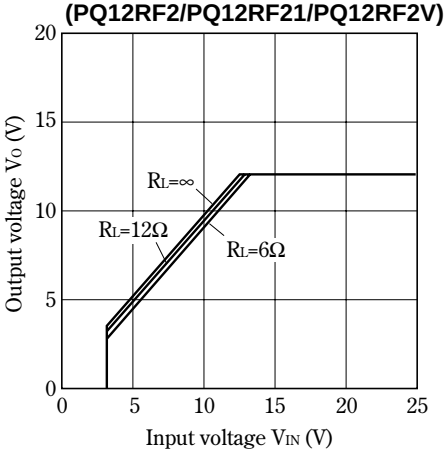


Fig.16 Output Voltage vs. Input Voltage (PQ15RF2/PQ15RF21/PQ15RF2V)

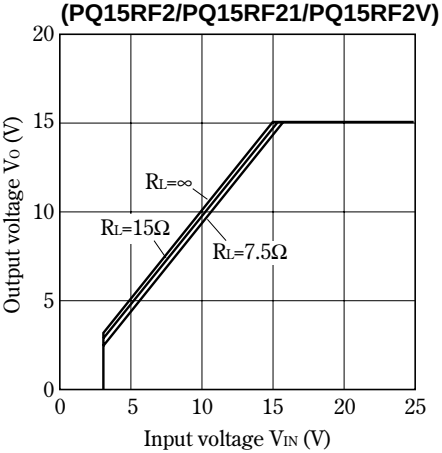


Fig.17 Circuit Operating Current vs. Input Voltage (PQ05RF2/PQ05RF21/PQ05RF2V)

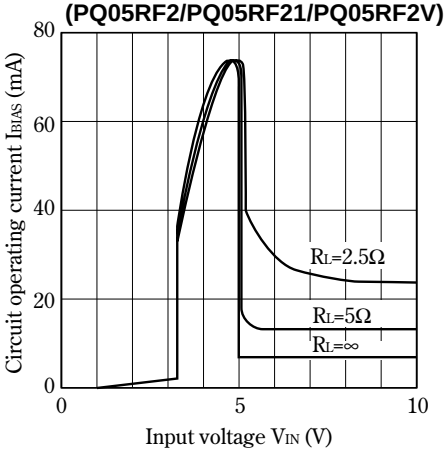


Fig.18 Circuit Operating Current vs. Input Voltage (PQ09RF2/PQ09RF21/PQ09RF2V)

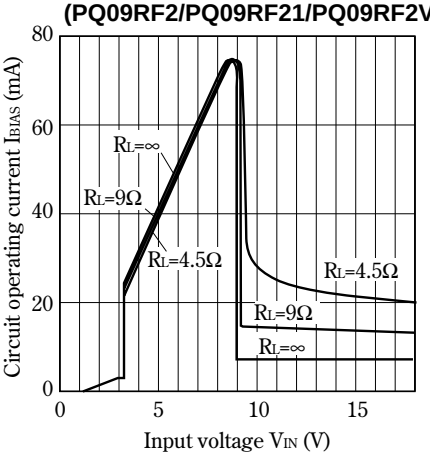


Fig.19 Circuit Operating Current vs. Input Voltage (PQ12RF2/PQ12RF21/PQ12RF2V)

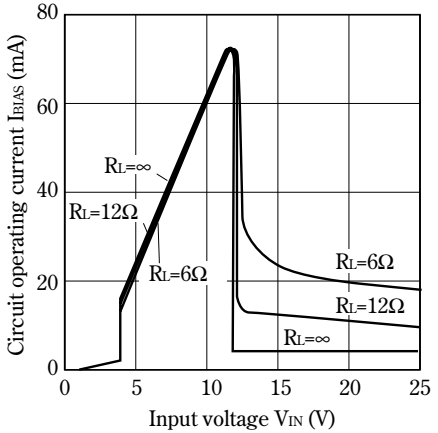


Fig.20 Circuit Operating Current vs. Input Voltage (PQ15RF2/PQ15RF21/PQ15RF2V)

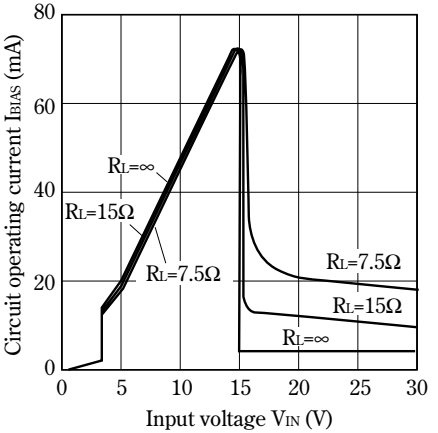


Fig.21 Dropout Voltage vs. Junction Temperature

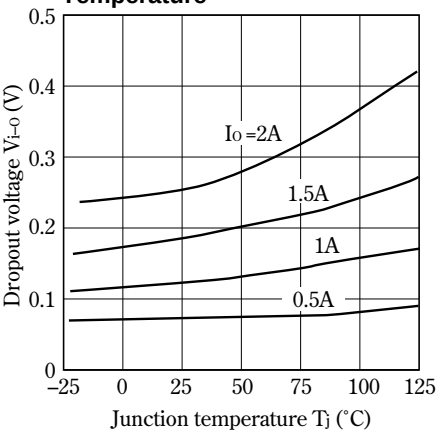


Fig.22 Quiescent Current vs. Junction Temperature

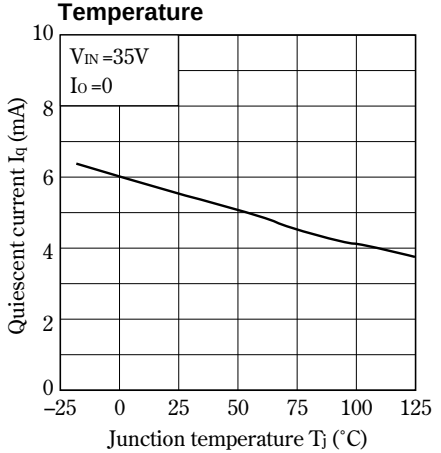


Fig.23 Ripple Rejection vs. Input Ripple Frequency
(PQ05RF2/PQ05RF21/PQ09RF2/PQ09RF21/PQ12RF2/ PQ12RF21/PQ15RF2/PQ15RF21)

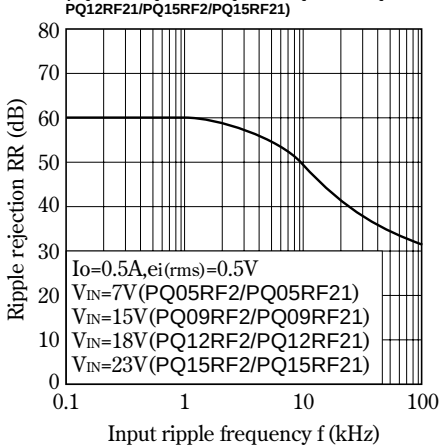


Fig.24 Ripple Rejection vs. Input Ripple Frequency (PQ05RF2V/PQ09RF2V/PQ12RF2V/PQ15RF2V)

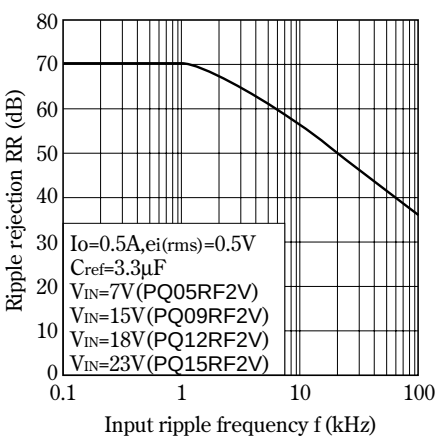
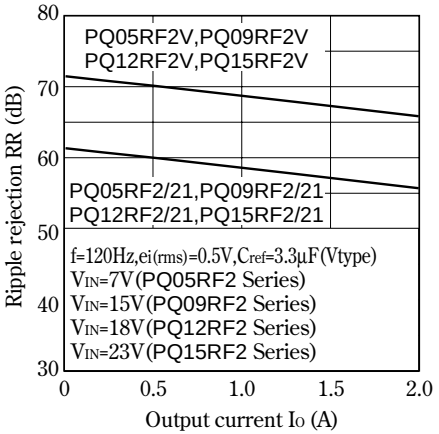
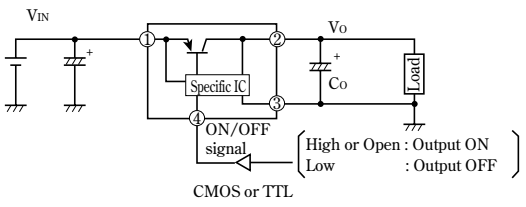


Fig.25 Ripple Rejection vs. Output Current

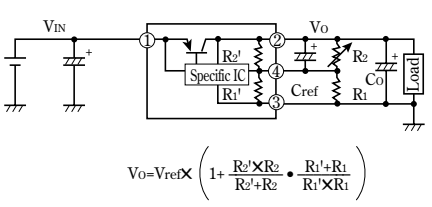


■ Typical Application

PQ05RF2/PQ05RF21 Series



PQ05RF2V Series



$$V_O = V_{ref} \times \left(1 + \frac{R_2' \times R_2}{R_2' + R_2} \bullet \frac{R_1' + R_1}{R_1' \times R_1}\right)$$

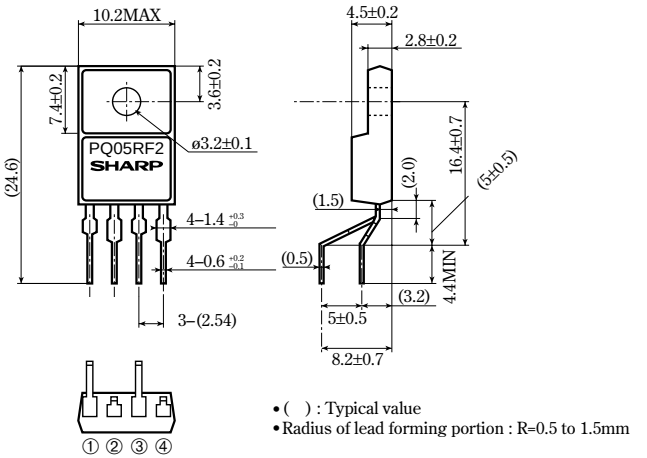
V_{ref} Nearly=1.26V,R_1' Nearly=390Ω
PQ05RF2V : R_2'Nearly=1.16kΩ
PQ09RF2V : R_2'Nearly=2.40kΩ
PQ12RF2V : R_2'Nearly=3.32kΩ
PQ15RF2V : R_2'Nearly=4.45kΩ
(Note) R_1' and R_2' are built in a specific IC.

■ Model Line-ups for Lead Forming Type

Output voltage	5V Output	9V Output	12V Output	15V Output
Output voltage precision:±5%	PQ05RF2A	PQ09RF2A	PQ12RF2A	PQ15RF2A
Output voltage precision:±2.5%	PQ05RF2B	PQ09RF2B	PQ12RF2B	PQ15RF2B

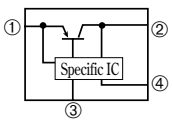
■ Outline Dimensions (PQ05RF2A/PQ05RF2B Series)

(Unit : mm)



• ( ) : Typical value
• Radius of lead forming portion : R=0.5 to 1.5mm

Internal connection diagram



PQ05RF2/21series
① DC input (V_{IN})
② DC output (V_O)
③ GND
④ ON/OFF control terminal (V_C)

PQ05RF2Vseries
① DC input (V_{IN})
② DC output (V_O)
③ GND
④ Output voltage minute adjustment terminal (V_{ADJ})

Note) The value of absolute maximum ratings and electrical characteristics is same as ones of PQ05RF2/21series.

■ Precautions for Use

(1) Minute adjustment of output voltage (PQ05RF2V series)

If the external resistor is attached to the terminals ②, ③ and ④, minute adjustment of output voltage is possible. (Refer to the example of basic circuit (PQ05RF2V series) and Fig.5 to 8.)

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  (i) The devices in this publication are designed for use in general electronic equipment designs such as:
  --- Personal computers
  --- 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:
  --- Transportation control and safety equipment (i.e., aircraft, trains, automobiles, etc.)
  --- Traffic signals
  --- Gas leakage sensor breakers
  --- Alarm equipment
  --- Various safety devices, etc.

  (iii) SHARP devices shall not be used for or in connection with equipment that requires an extremely high level of reliability and safety such as:
  --- Space applications
  --- Telecommunication equipment [trunk lines]
  --- Nuclear power control equipment
  --- Medical and other life support equipment (e.g., scuba).

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