PQ05RF2/21/2V Series 2A Output, Low Power-Loss Voltage Regulators

■ General Description

The sharp's PQ05RF2/PQ05RF21/PQ05RF2V series 4-terminal low power-loss voltage regulators provide 2A output and employ the compact full-mold package. They are multi-function regulators with overcurrent protection function and overheat protection function which are best suited for constant voltage power supply for various electronic equipment such as VCRs and electronic musical instruments.

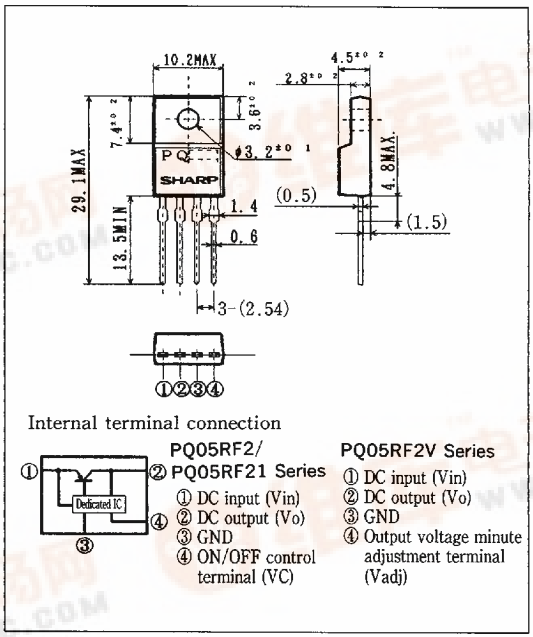
■ Features

(1) Compact resin full-mold package.
(2) Low power-loss (voltage difference between input and output : MAX. 0.5V)
(3) Built-in ON/OFF control terminal (PQ05RF2/PQ05RF21 series)
(4) With output voltage minute adjusting terminal (ripple rejection is improved) (PQ05RF2V series)

■ Model Line-ups

	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

■ Outline Dimensions (Unit : mm)

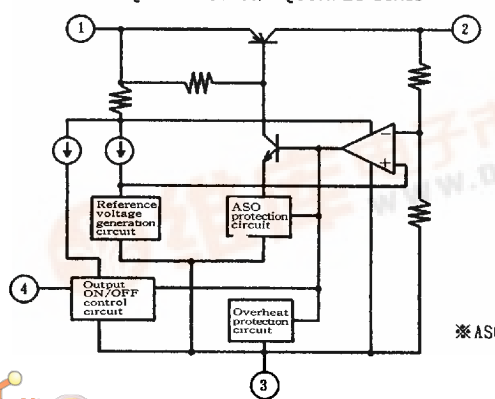


■ Applications

Series power supply for various electronic equipment such as personal computers

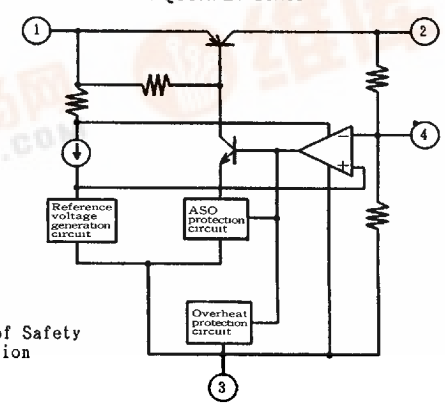
■ Equivalent Circuit Diagram

PQ05RF2 Series/PQ05RF21 Series



※ASO: Area of Safety Operation

PQ05RF2V Series



■ Absolute Maximum Ratings (Ta=25°C)

Parameter		Symbol	Rating	Unit
*1Input voltage		V_{in}	35	V
*1ON/OFF control terminal voltage	PQ05RF2series	V_c	35	V
	PQ05RF21Series			
Output current		I_o	2	A
Power dissipation (no heat sink)		Pd1	1.5	W
Power dissipation (with infinite heat sink)		Pd2	18	W
*2Junction temperature		Tj	150	°C
Operating temperature		T_{opr}	−20 to + 80	°C
Storage temperature		T_{stg}	−40 to +150	°C
*3Soldering temperature		T_{sol}	260	°C

*1 All are open except GND and applicable terminals.
*2 Overheat protection operates at Tj>125°C
*3 For 10 s.

■ Electrical Characteristics

Unless otherwise specified condition shall be I_o=1A, Ta=25°C, *4)

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		$R_{eg}L$	I_o=5mA to 2A	—	0.5	2.0	%
Line regulation		$R_{eg}I$	*5	—	0.5	2.5	%
Temperature coefficient of output voltage		T_cV_o	Tj=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	—		
Dropout voltage		V_{i-o}	*6, I_o=2A	—	—	0.5	V
ON-state voltage for control	PQ05RF2/PQ05RF21Series	$V_{c(on)}$	—	2.0*6	—	—	V
ON-state current for control	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	

*4 PQ05RF2Series: Vin=7V, PQ09RF2Series: V_{in}=15V, PQ12RF2Series: V_{in}=18V, PQ15RF2Series: V_{in}=23V
*5 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
*6 Input voltage shall be the value when output voltage is 95% in comparison with the initial value.
*7 In case of opening control terminal, output voltage turns on. (PQ05RF2/PQ05RF21Series)

Fig. 1 Test Circuit

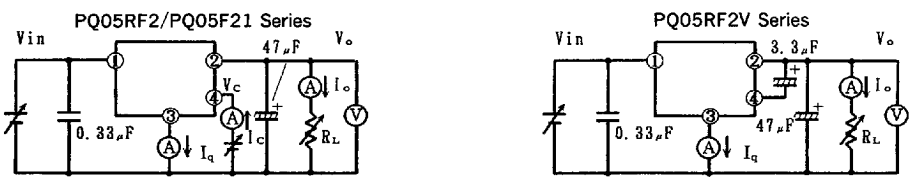
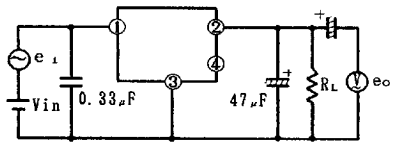


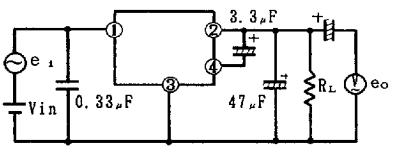
Fig. 2 Test Circuit of Ripple Rejection

PQ05RF2/PQ05RF21 Series



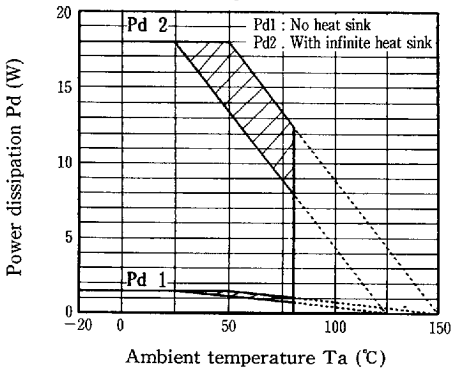
f=120Hz (sine wave)
ei=0.5Vrms
RR=20 log (ei/eo)

PQ05RF2V Series



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

Fig. 3 Power Dissipation vs. Ambient Temperature



Note) Oblique line portion : Operating are of overheat protection

Fig. 4 Overcurrent Protection Characteristics (Typical value)

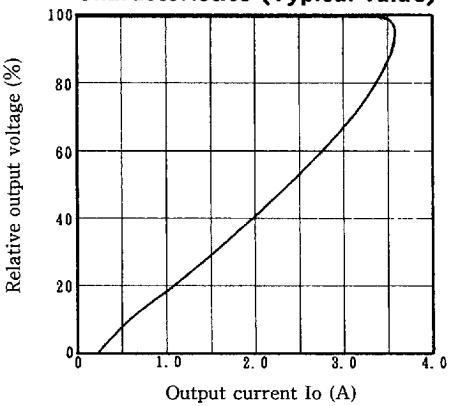


Fig. 5 Output Voltage Minute Adjustment Characteristics (PQ05RF2V)

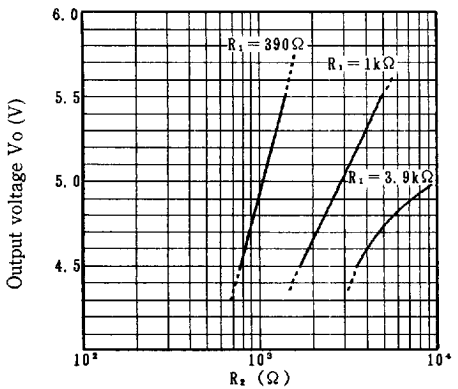


Fig. 6 Output Voltage Minute Adjustment Characteristics (PQ09RF2V)

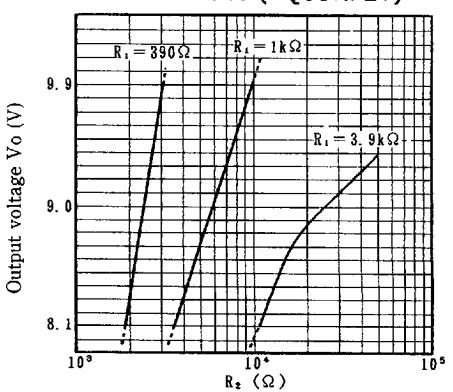


Fig. 7 Output Voltage Minute Adjustment Characteristics (PQ12RF2V)

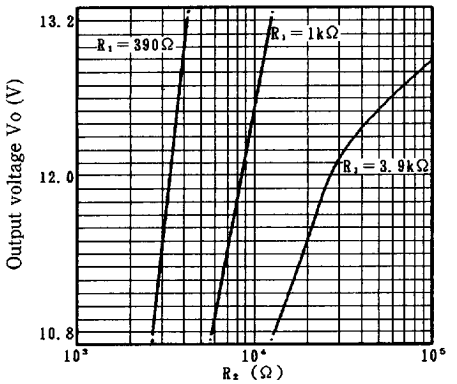


Fig. 8 Output Voltage Minute Adjustment Characteristics (PQ15RF2V)

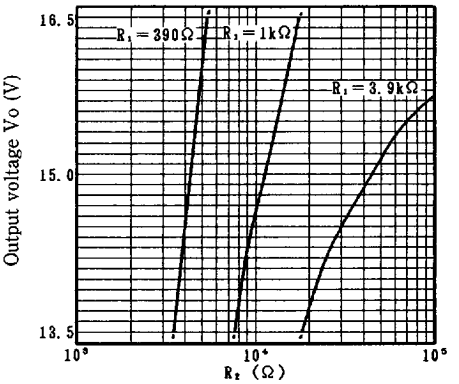


Fig. 9 Output Voltage Deviation vs. Junction Temperature (PQ05RF2/PQ05RF21/PQ05RF2V)

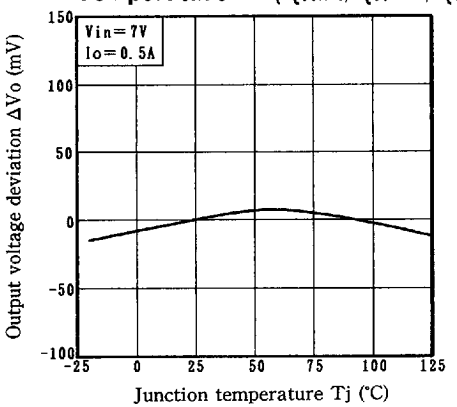


Fig. 10 Output Voltage Deviation vs. Junction Temperature (PQ09RF2/PQ09RF21/PQ09RF2V)

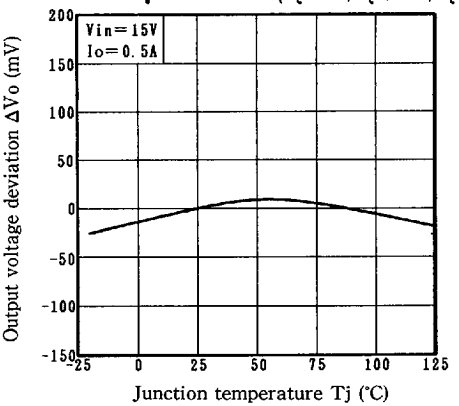


Fig. 11 Output Voltage Deviation vs. Junction Temperature (PQ12RF2/PQ12RF21/PQ12RF2V)

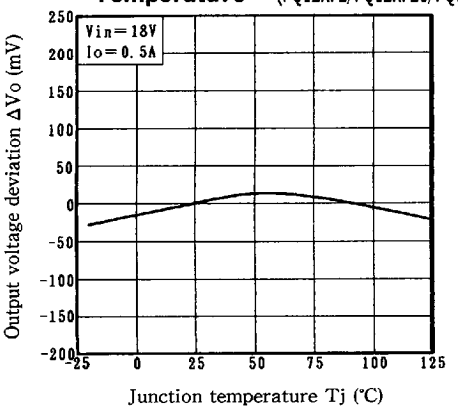


Fig. 12 Output Voltage Deviation vs. Junction Temperature (PQ15RF2/PQ15RF21/PQ15RF2V)

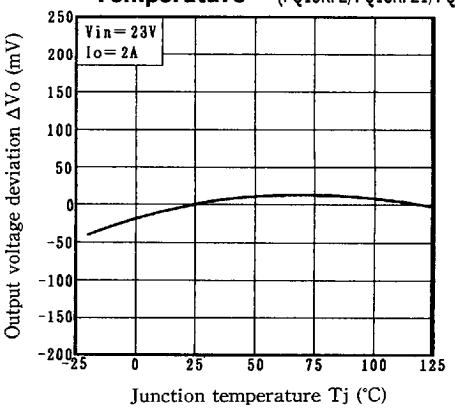


Fig. 13 Output Voltage vs. Input Voltage (PQ05RF2/PQ05RF21/PQ05RF2V)

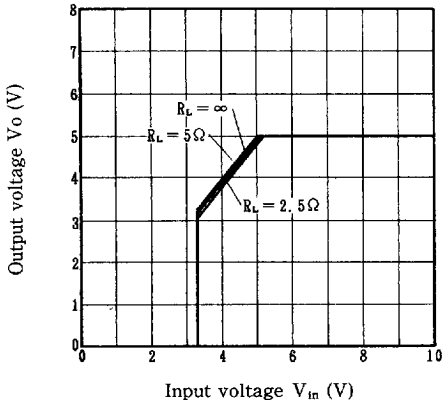


Fig. 14 Output Voltage vs. Input Voltage (PQ09RF2/PQ09RF21/PQ09RF2V)

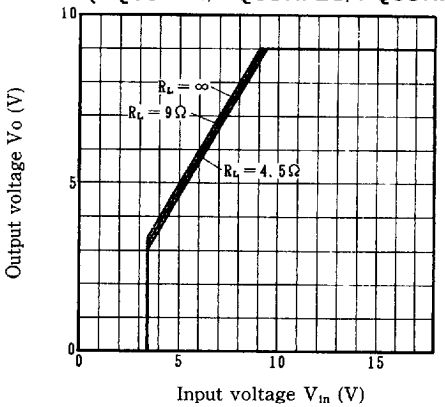


Fig. 15 Output Voltage vs. Input Voltage (PQ12RF2/PQ12RF21/PQ12RF2V)

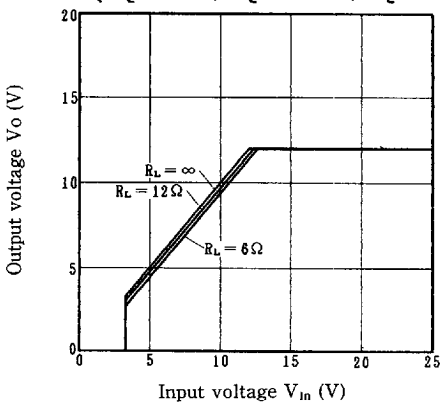


Fig. 16 Output Voltage vs. Input Voltage (PQ15RF2/PQ15RF21/PQ15RF2V)

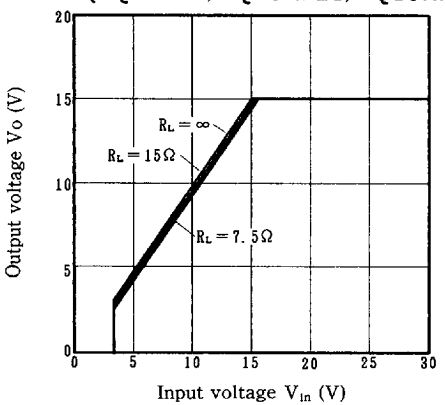


Fig. 17 Circuit Operating Current vs. Input Voltage (PQ05RF2/PQ05RF21/PQ05RF2V)

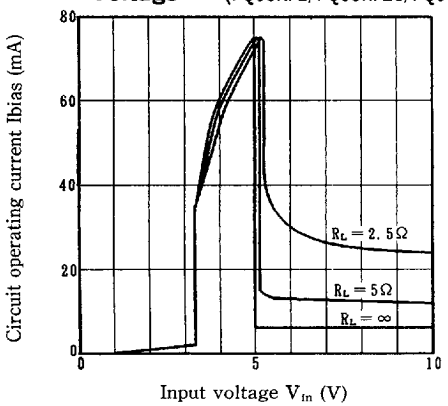


Fig. 18 Circuit Operating Current vs. Input Voltage (PQ09RF2/PQ09RF21/PQ09RF2V)

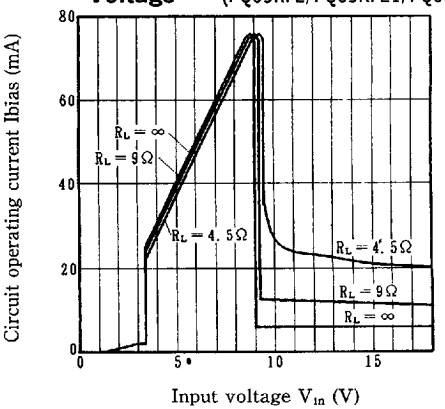


Fig. 19 Circuit Operating Current vs. Input Voltage (PQ12RF2/PQ12RF21/PQ12RF2V)

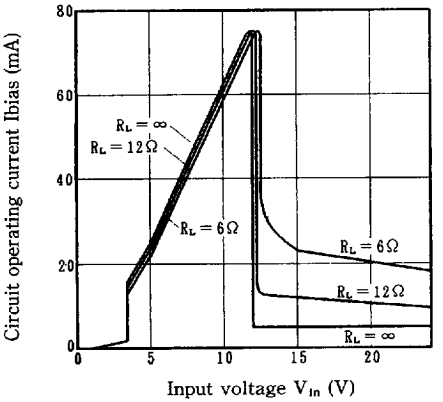


Fig. 20 Circuit Operating Current vs. Input Voltage (PQ15RF2/PQ15RF21/PQ15RF2V)

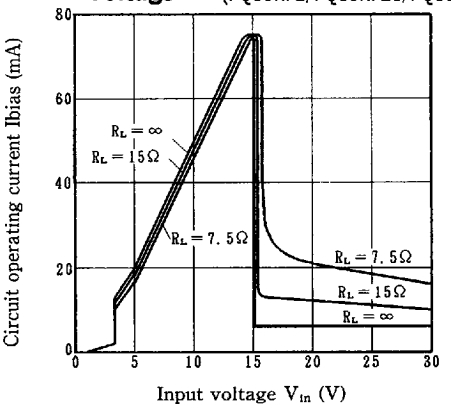


Fig. 21 Dropout Voltage vs. Junction Temperature

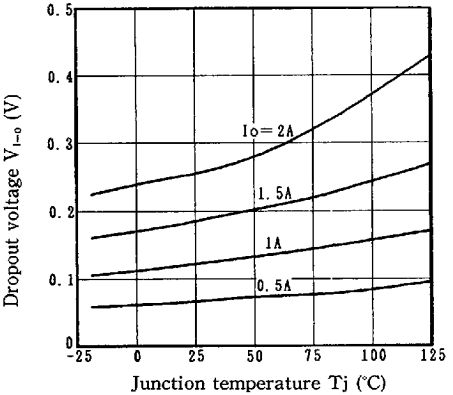


Fig. 22 Quiescent Current vs. Junction Temperature

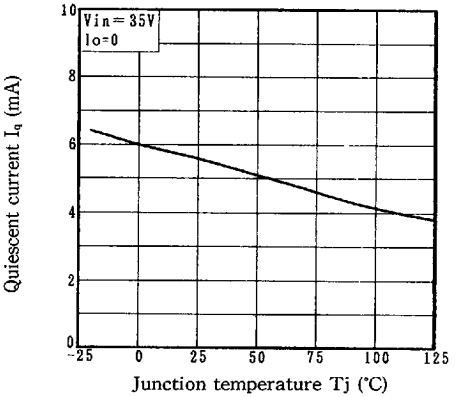


Fig. 23 Ripple Rejection vs. Input Ripple Frequency
(PQ05RF2/PQ05RF21/PQ09RF2/PQ09RF21/PQ12RF2/PQ12RF21/PQ15RF2/PQ15RF21)

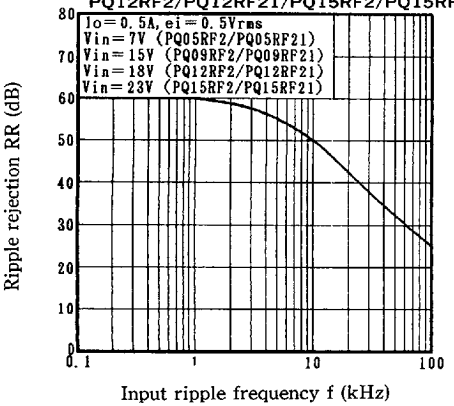


Fig. 24 Ripple Rejection vs. Input Ripple Frequency
(PQ05RF2V/PQ09RF2V/PQ12RF2V/PQ15RF2V)

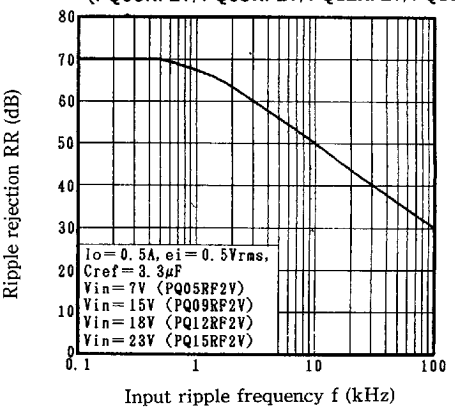
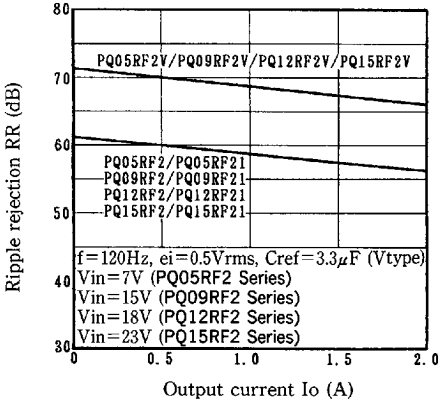
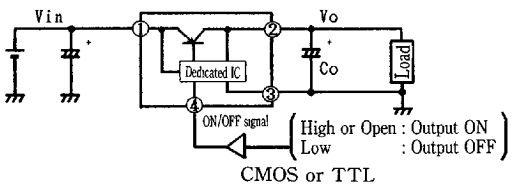


Fig. 25 Ripple Rejection vs. Output Current

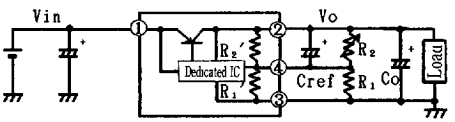


■ Typical Application

PQ05RF2/PQ05RF21 Series



PQ05RF2V Series



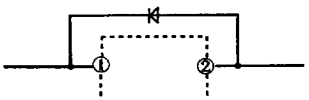
$$V_o = V_{ref} \times \left(1 + \frac{R_2' \times R_2}{R_2' + R_2} \cdot \frac{R_1' + R_1}{R_1' \times R_1}\right)$$

$V_{ref} \fallingdotseq 1.26V$, $R_1' \fallingdotseq 390\Omega$
PQ05RF2V : $R_2' \fallingdotseq 1.16k\Omega$
PQ09RF2V : $R_2' \fallingdotseq 2.40k\Omega$
PQ12RF2V : $R_2' \fallingdotseq 3.32k\Omega$
PQ15RF2V : $R_2' \fallingdotseq 4.45k\Omega$

(Note) R1' and R2' are built in a dedicated IC.

■ Precautions for Use

(1) If voltage exceeding the voltage of DC input terminal ① is applied to the output terminal ②, the element may be damaged, Especially when the DC input terminal ① is short-circuited to GND in ordinary operating state, the output terminal voltage rises above the voltage of DC input terminal, charges accumulated in the output capacitor Co flow to the input side, causing damage to the element. In this case connect the ordinary silicon diode as shown in the figure.



(2) 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).

Note:
The specification is subject to change for improvement.
Cares when handling:
Be sure to observe the requirements described in the specification and data book.