

PQ30RV1/PQ30RV11/PQ30RV2/PQ30RV21

Variable Output Low Power-Loss Voltage Regulators

Features

- Compact resin full-mold package
- Low power-loss (Dropout voltage: MAX.0.5V)
- Variable output voltage(setting range: 1.5 to 30V)
- Built-in output ON/OFF control function

Applications

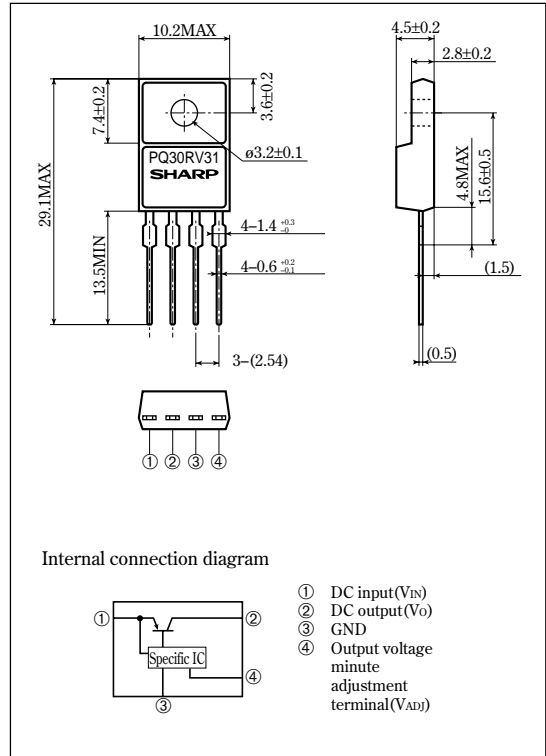
- Power supply for print concentration control of electronic typewriters with display
- Series power supply for motor drives
- Series power supply for VCRs and TVs

Model Line-ups

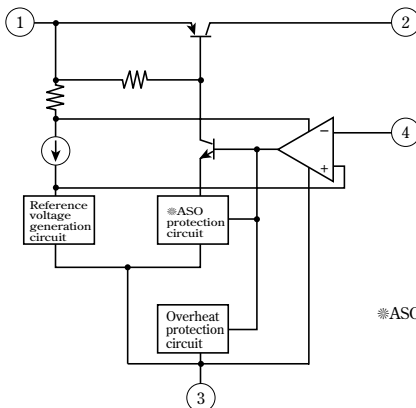
Output voltage precision	1A output	2A output
Reference voltage precision:±4%	PQ30RV1	PQ30RV2
Reference voltage precision:±2%	PQ30RV11	PQ30RV21

Outline Dimensions

(Unit : mm)



Equivalent Circuit Diagram



•Please refer to the chapter " Handling Precautions ".

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Absolute Maximum Ratings

(T_a=25°C)

Parameter	Symbol	Rating	Unit
*#1 Input voltage	V _{IN}	35	V
*#1 Output voltage adjustment voltage	V _{ADJ}	7	V
Output current	PQ30RV1/PQ30RV11	1	A
	PQ30RV2/PQ30RV21	2	
Power dissipation(No heat sink)	P _{D1}	1.5	W
Power dissipation (With infinite heat sink)	PQ30RV1/PQ30RV11	15	W
	PQ30RV2/PQ30RV21	18	
*#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 T_j≥125°C.

Electrical Characteristics

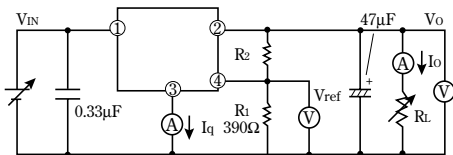
Unless otherwise specified, condition shall be
 V_{IN}=15V, V_O=10V, I_O=0.5A, R₁=390Ω(PQ30RV1/PQ30RV11)
 V_{IN}=15V, V_O=10V, I_O=1.0A, R₁=390Ω(PQ30RV2/PQ30RV21)

(T_a=25°C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	
Input voltage	V _{IN}	-	4.5	-	35	V	
Output voltage	V _O	R ₂ =94Ω to 8.5kΩ	1.5	-	30	V	
		R ₂ =84Ω to 8.7kΩ					
Load regulation	RegL	I _O =5mA to 1A	-	0.3	1.0	%	
		I _O =5mA to 2A	-	0.5	1.0		
Line regulation	RegI	V _{IN} =11 to 28V	-	0.5	2.5	%	
Ripple rejection	RR	C _{ref} =0	Refer to Fig. 2	45	55	-	dB
		C _{ref} =3.3μF		55	65	-	
Reference voltage	V _{ref}	PQ30RV1/PQ30RV2	1.20	1.25	1.30	V	
		PQ30RV11/PQ30RV21	1.225	1.25	1.275		
Temperature coefficient of reference voltage	TcV _{ref}	T _j =0 to 125°C	-	±1.0	-	%	
Dropout voltage	V _{i-O}	*#3, I _O =0.5A	-	-	0.5	V	
		*#3, I _O =2A	-	-	0.5		
Quiescent current	I _q	I _O =0	-	-	7	mA	

*#3 Input voltage shall be the value when output voltage is 95% in comparison with the initial value.

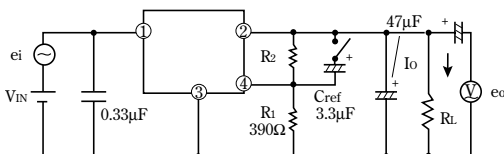
Fig. 1 Test Circuit



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

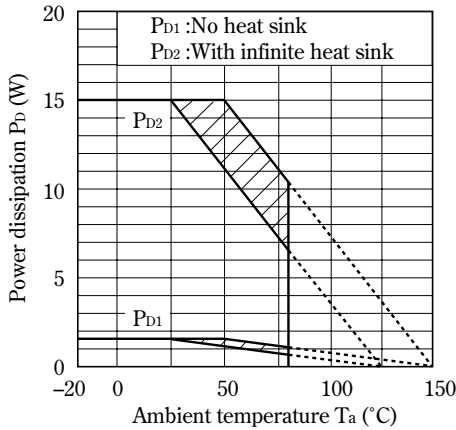
[R₁=390Ω, V_{ref} Nearly=1.25V]

Fig. 2 Test Circuit of Ripple Rejection



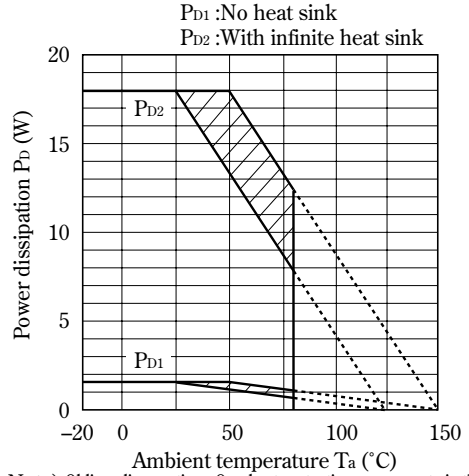
I_O=0.5A
 f=120Hz(sine wave)
 e_i(rms)=0.5V
 RR=20 log(e_i(rms)/e_o(rms))

Fig. 3 Power Dissipation vs. Ambient Temperature (PQ30RV1/PQ30RV11)



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

Fig. 4 Power Dissipation vs. Ambient Temperature (PQ30RV2/PQ30RV21)



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

Fig. 5 Overcurrent Protection Characteristics (PQ30RV1/PQ30RV11)

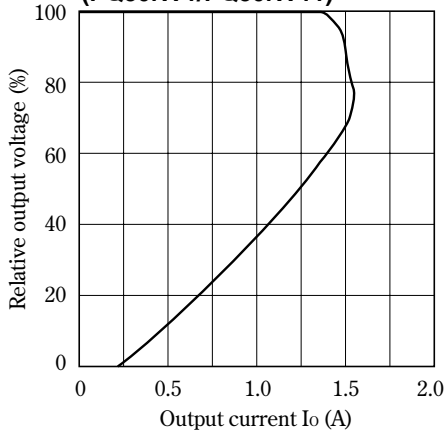


Fig. 6 Overcurrent Protection Characteristics (PQ30RV2/PQ30RV21)

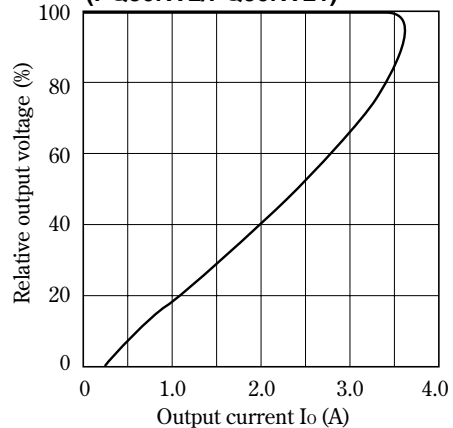


Fig. 7 Output Voltage Adjustment Characteristics

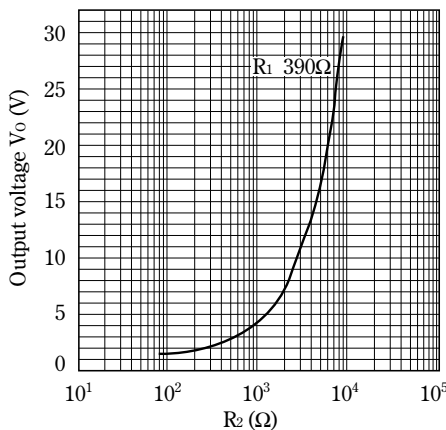


Fig. 8 Reference Voltage Deviation vs. Junction Temperature

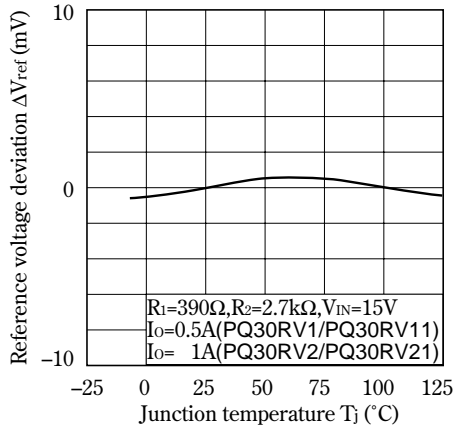


Fig. 9 Output Voltage vs. Input Voltage (PQ30RV1/PQ30RV11)

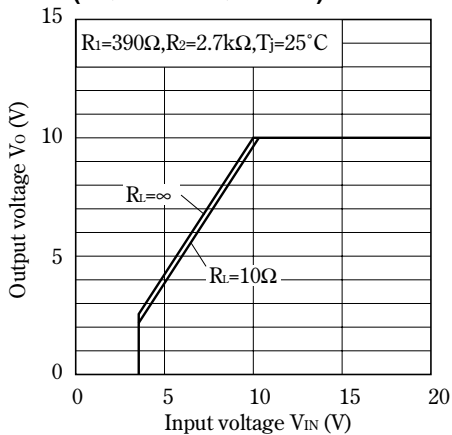


Fig.10 Output Voltage vs. Input Voltage (PQ30RV2/PQ30RV21)

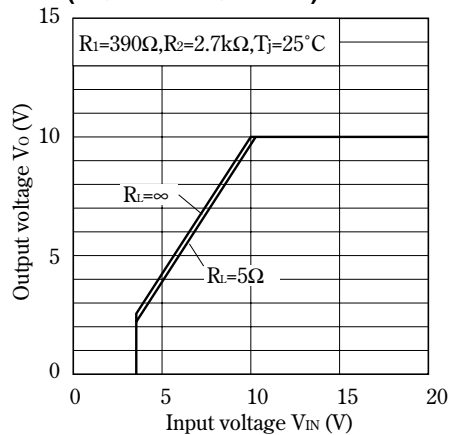


Fig.11 Dropout Voltage vs. Junction Temperature (PQ30RV1/PQ30RV11)

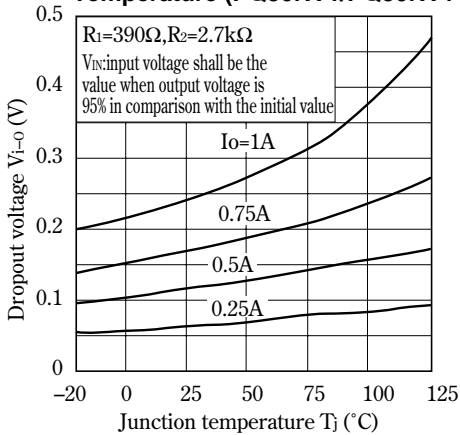


Fig.12 Dropout Voltage vs. Junction Temperature (PQ30RV2/PQ30RV21)

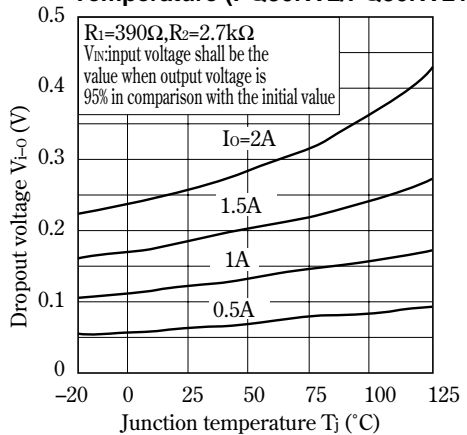


Fig.13 Quiescent Current vs. Junction Temperature

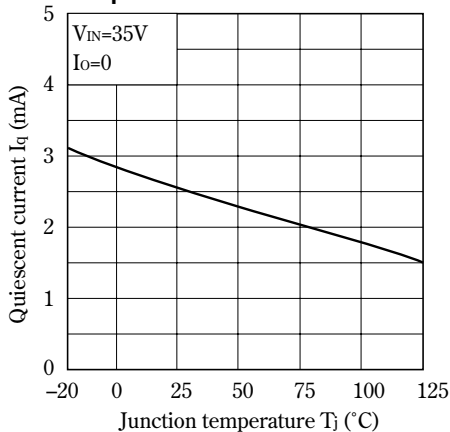


Fig.14 Ripple Rejection vs. Input Ripple Frequency (PQ30RV1/PQ30RV11)

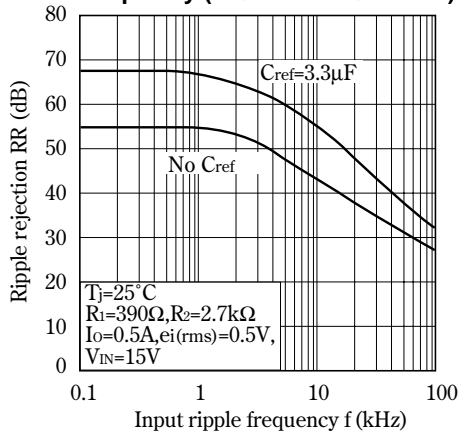


Fig.15 Ripple Rejection vs. Input Ripple Frequency (PQ30RV2/PQ30RV21)

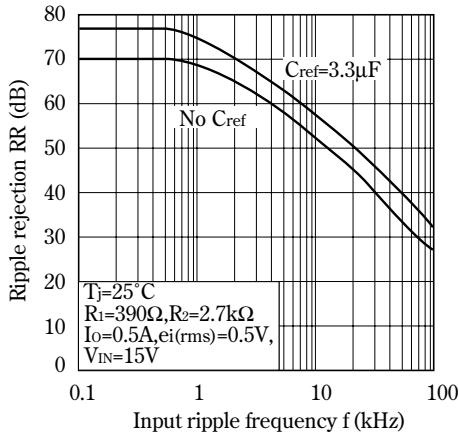


Fig.16 Ripple Rejection vs. Output Current (PQ30RV1/PQ30RV11)

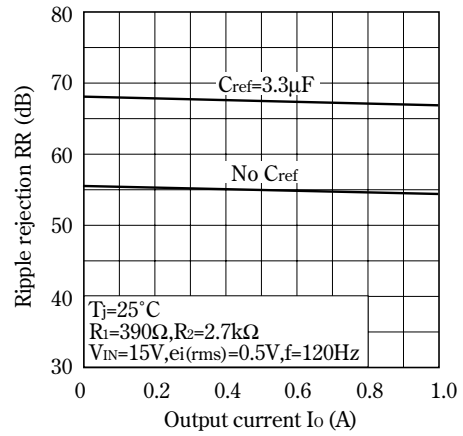


Fig.17 Ripple Rejection vs. Output Current (PQ30RV2/PQ30RV21)

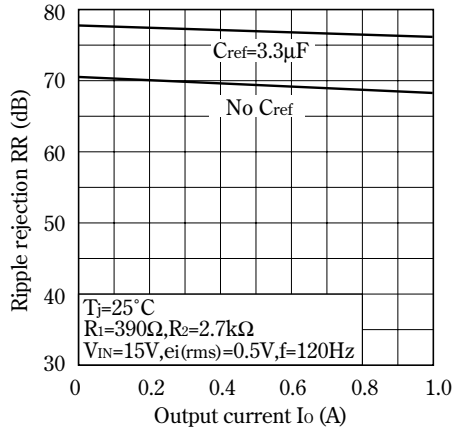


Fig.18 Output Peak Current vs. Dropout Voltage (PQ30RV1/PQ30RV11)

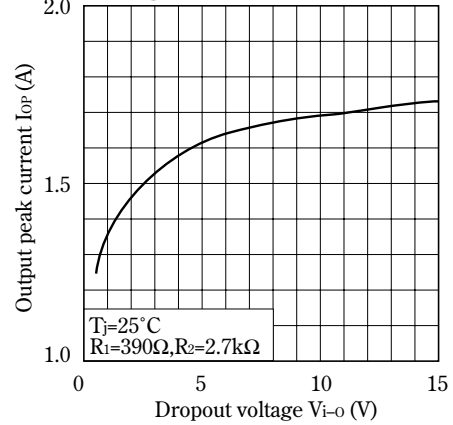


Fig.19 Output Peak Current vs. Dropout Voltage (PQ30RV2/PQ30RV21)

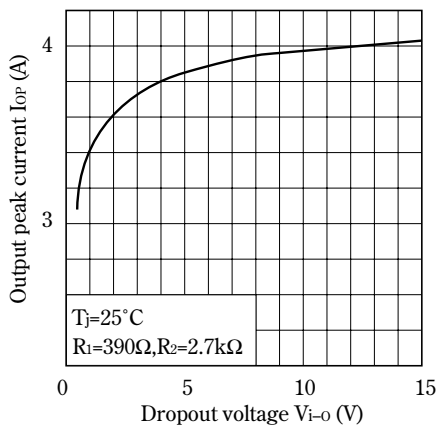


Fig.20 Output Peak Current vs. Junction Temperature (PQ30RV1/PQ30RV11)

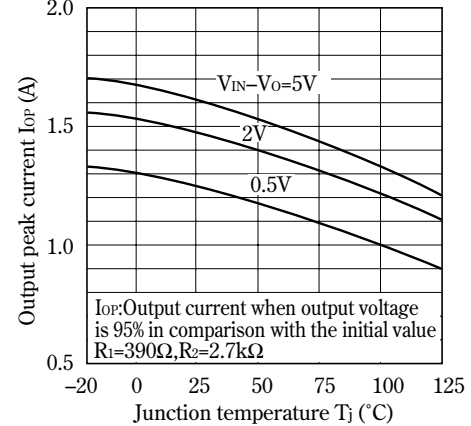
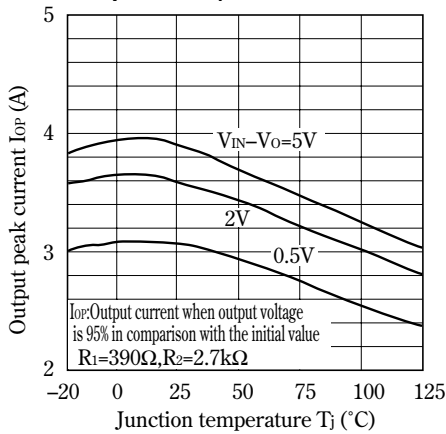
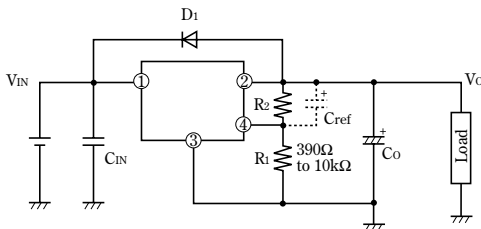


Fig.21 Output Peak Current vs. Junction Temperature (PQ30RV2/PQ30RV21)



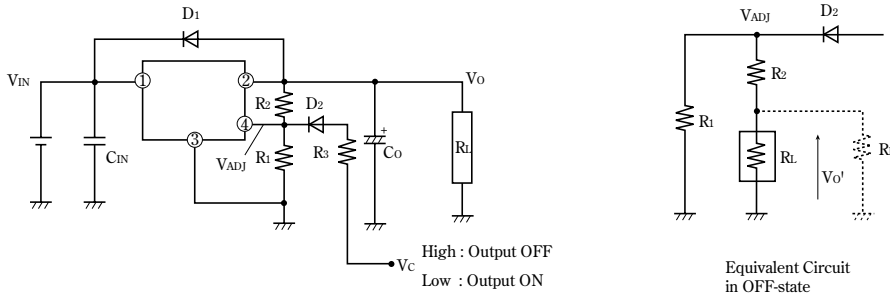
■ Standard Connection



- D1 : This device is necessary to protect the element from damage when reverse voltage may be applied to the regulator in case of input short-circuiting.
- Cref : This device is necessary when it is required to enhance the ripple rejection or to delay the output start-up time(※1). (※1)Otherwise, it is not necessary. (Care must be taken since Cref may raise the gain, facilitating oscillation.) (※1)The output start-up time is proportional to CrefXR2.
- CIN, CO : Be sure to mount the devices CIN and CO as close to the device terminal as possible so as to prevent oscillation. The standard specification of CIN and CO is 0.33μF and 47μF, respectively. However, adjust them as necessary after checking.
- R1, R2 : These devices are necessary to set the output voltage. The output voltage Vo is given by the following formula:

$$V_o = V_{ref} \times (1 + R_2/R_1)$$
 (Vref is 1.25V TYP)
 The standard value of R1 is 390Ω. But value up to 10kΩ does not cause any trouble.

■ ON/OFF Operation



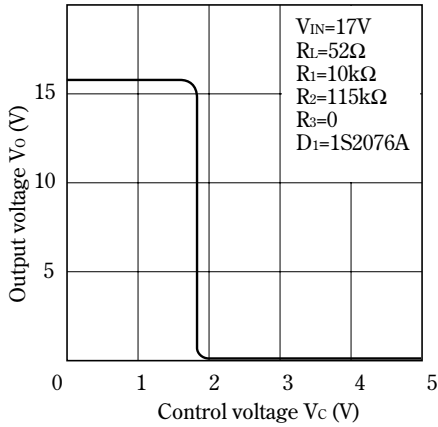
- ON/OFF operation is available by mounting externally D₂ and R₃.
- When V_{ADJ} is forcibly raised above V_{ref}(1.25V TYP) by applying the external signal, the output is turned off (pass transistor of regulator is turned off). When the output is OFF, V_{ADJ} must be higher than V_{ref} MAX., and at the same time must be lower than maximum rating 7V.
In OFF-state, the load current flows to R_L from V_{ADJ} through R₂. Therefore the value of R₂ must be as high as possible.
- $V_o' = V_{ADJ} \times R_L / (R_L + R_2)$
occurs at the load. OFF-state equivalent circuit R₁ up to 10kΩ is allowed. Select as high value of R₁ and R₂ as possible in this range. In some case, as output voltage is getting lower (V_o < 1V), impedance of load resistance rises. In such condition, it is sometime impossible to obtain the minimum value of V_o'. So add the dummy resistance indicated by R_D in the figure to the circuit parallel to the load.

■ An Example of ON/OFF Circuit Using the 1-chip Microcomputer Output Port(PQ30RV1)

<Specification>
 Output port of microcomputer
 V_{OH}(max)=0.5 V
 V_{OH}(min)=2.4 V (I_{OH}=0.2mA)
 MAX. rating of I_{OH}=0.5mA
 Output should be set as follows.
 15.6V R_L=52Ω(I_O=0.3A)

From $V_o = 1.25V(1 + R_2/R_1)$ we get $V_o = 15.6V$.
 $R_2/R_1 = 11.48$
 Assuming that V_F(max)=0.8V for D₂ in case of V_{OH}(min)=2.4V, we get $V_{ADJ} = V_{OH}(min) - V_F(max) = 2.4V - 0.8V = 1.6V$. From V_{ref}(max)=1.3V we get R₃=0Ω
 If R₁=10kΩ, we get $R_2 = 11.48 \times R_1 = 114.8k\Omega$ and I_{OH} as follows, ignoring R_L (52Ω):
 $I_{OH} = 1.6V \times (R_1 + R_2) / R_1 \times R_2$
 $= 1.6V \times (10k\Omega + 114.8k\Omega) / 10k\Omega \times 114.8k\Omega = 0.17mA$
 Hence, I_{OH} < 0.2mA. Therefore V_{OH}(min) is ensured.
 Next, assuming that V_F(min)=0.5V for D₂ in case of V_{OH}(max), we get:
 $I_{OH} = (5V - 0.5V) (R_1 + R_2) / R_1 \times R_2 = 0.49mA$ which is less than the rating.
 Figure 1 shows the V_o-V_c characteristics when R₁=10kΩ, R₂=115kΩ, R₃=0Ω, V_{IN}=17V, R_L=52Ω, and D₁=1S2076A(Hitachi).

Output Voltage vs. Control Voltage(PQ30RV1)

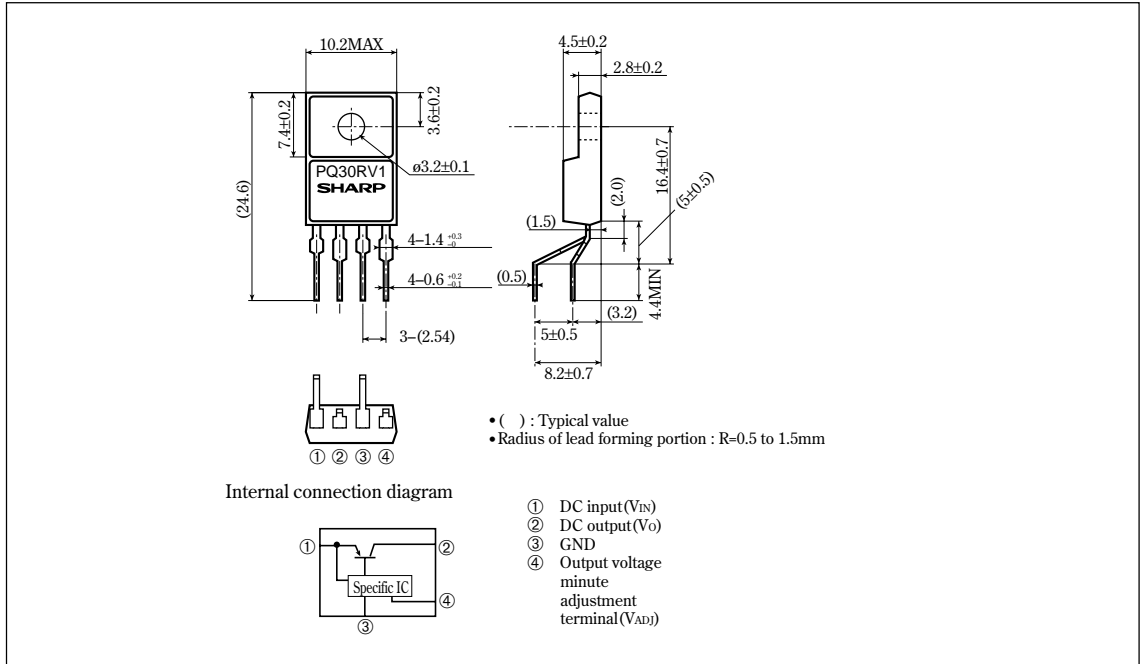


Model Line-ups for Lead Forming Type

Output current	1A output	2A output
Output voltage precision:±2.5%	PQ30RV1B	PQ30RV2B

Outline Dimensions(PQ30RV1B/PQ30RV2B)

(Unit : mm)



Note) The value of absolute maximum ratings and electrical characteristics is same as ones of PQ30RV1/2 series.

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