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**SMALL PACKAGE  
VOLTAGE REGULATOR  
RQ5RW SERIES**

**APPLICATION MANUAL**



**ELECTRONIC DEVICES DIVISION**

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8. Please contact Ricoh sales representatives should you have any questions or comments concerning the products or the technical information.

June 1995

# RQ5RW SERIES

## APPLICATION MANUAL

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SMALL PACKAGE VOLTAGE REGULATOR

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## RQ5RW SERIES

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### OUTLINE

The RQ5RW Series are voltage regulator ICs with high accuracy output voltage and ultra-low supply current developed by CMOS process. Each of these ICs consists of a voltage reference unit, an error amplifier, resistors for setting output voltage and a current limit circuit.

The output voltage of these ICs is fixed with high accuracy.

Even if V<sub>OUT</sub> is shorted to GND, the included current limit circuit protects the ICs from the destruction.

Furthermore, these ICs have a chip enable function, so that the supply current on standby can be minimized.

Since the package for these ICs are SC-82AB(Super Mini-mold)package, high density mounting of the ICs on boards is possible.

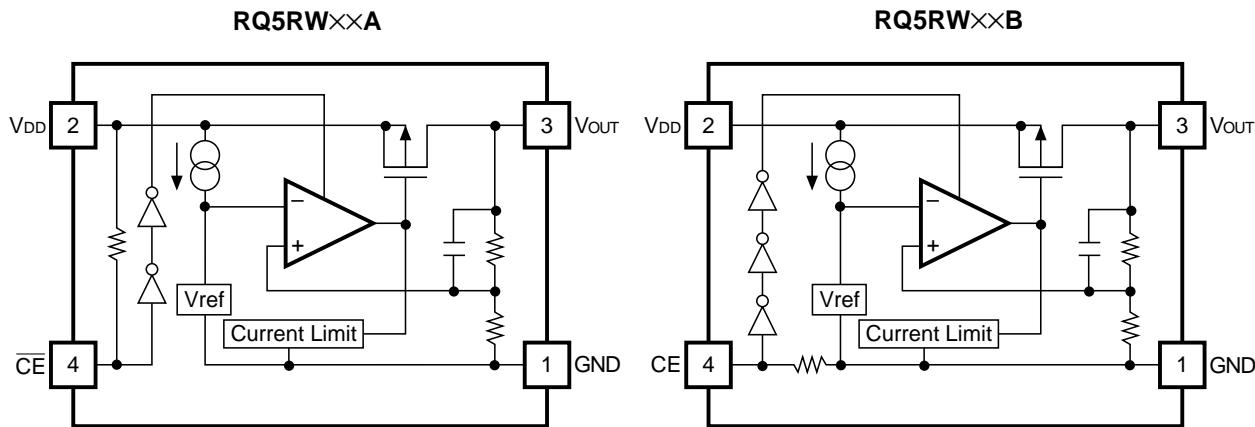
### FEATURES

- Ultra-Low Supply Current.....TYP. 1.5µA
- Standby Current .....TYP. 0.1µA
- Dropout Voltage.....TYP. 40mV (I<sub>OUT</sub>=1mA, RQ5RW30A/B)
- Low Temperature-Drift Coefficient of  
    Output Voltage.....TYP. ±100ppm/°C
- Excellent Line Regulation.....TYP. 0.05%/V
- High Accuracy Output Voltage.....±2.0%
- Ultra-Small Package .....SC-82AB (Super Mini-mold)
- Built-in Current Limit Circuits

### APPLICATIONS

- Power source for battery-powered equipment.
- Power source for cameras, VCRs, camcorders, hand-held audio instruments and hand-held communication equipment.
- Precision voltage references.

## BLOCK DIAGRAM



## SELECTION GUIDE

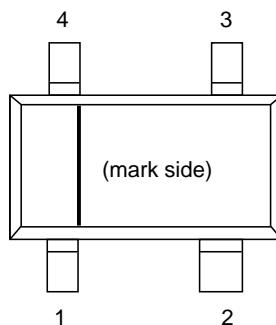
The output voltage, the active type, the packing type and the taping type for the ICs can be selected at the user's request. The selection can be made by designating the part number as shown below:

RQ5RWxxxx-xx ← Part Number  
 ↑↑↑  
 a b c d

Code	Contents
a	Setting Output Voltage (VOUT) : Stepwise setting with a step of 0.1V in the range of 2.0V to 6.0V is possible.
b	Designation of Chip enable Active Type : A : "L" active type B : "H" active type
c	Designation of Packing Type : A : Taping B : Antistatic bag (for Sample only)
d	Designation of Taping Type : TR (refer to Taping Specifications)

## PIN CONFIGURATION

• SC-82AB



## PIN DESCRIPTION

Pin No.	Symbol	Pin Description
1	GND	Ground Pin
2	VDD	Input Pin
3	VOUT	Output Pin
4	$\overline{CE}$ or CE	Chip Enable Pin

## ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
VIN	Input Voltage	9	V
VCE	Input Voltage for CE/ $\overline{CE}$ Pin	-0.3 to VIN +0.3	V
VOUT	Output Voltage	-0.3 to VIN +0.3	V
IOUT	Output Current	150	mA
PD	Power Dissipation	150	mW
Topt	Operating Temperature	-40 to +85	°C
Tstg	Storage Temperature	-55 to +125	°C

### ABSOLUTE MAXIMUM RATINGS

Absolute Maximum ratings are threshold limit values that must not be exceeded even for an instant under any conditions. Moreover, such values for any two items must not be reached simultaneously. Operation above these absolute maximum ratings may cause degradation or permanent damage to the device. These are stress ratings only and do not necessarily imply functional operation below these limits.

## ELECTRICAL CHARACTERISTICS

### • RQ5RW30A

Topt=25°C

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
VOUT	Output Voltage	VIN=5.0V 10µA≤IOUT≤10mA	2.940	3.000	3.060	V
IOUT	Output Current	VIN=5.0V	50			mA
$\frac{\Delta V_{\text{OUT}}}{\Delta I_{\text{OUT}}}$	Load Regulation	VIN=5.0V 1mA≤IOUT≤50mA		40	60	mV
VDIF	Dropout Voltage	IOUT=1mA		40	60	mV
Iss	Supply Current	VIN=5.0V		1.5	3.0	µA
Istandby	Standby Current	VIN=5.0V, VCE=5.0V		0.1	1.0	µA
$\frac{\Delta V_{\text{OUT}}}{\Delta V_{\text{IN}}}$	Line Regulation	IOUT=1mA VOUT+0.5V≤VIN≤8V	0	0.05	0.20	%/V
VIN	Input Voltage				8.0	V
$\frac{\Delta V_{\text{OUT}}}{\Delta T_{\text{opt}}}$	Output Voltage Temperature Coefficient	IOUT=10mA -40°C≤Topt≤85°C		±100		ppm/°C
Ilim	Short Current Limit			40		mA
RPU	Pull up resistance for $\overline{\text{CE}}$ pin		1.5	4.0	12.0	MΩ
VCEH	$\overline{\text{CE}}$ Input Voltage "H"		1.5			V
VCEL	$\overline{\text{CE}}$ Input Voltage "L"				0.25	V

## • RQ5RW30B

Topt=25°C

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
VOUT	Output Voltage	VIN=5.0V 10µA≤IOUT≤10mA	2.940	3.000	3.060	V
IOUT	Output Current	VIN=5.0V	50			mA
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	VIN=5.0V 1mA≤IOUT≤50mA		40	60	mV
VDIF	Dropout Voltage	IOUT=1mA		40	60	mV
Iss	Supply Current	VIN=5.0V		1.5	3.0	µA
Istandby	Standby Current	VIN=5.0V, VCE=GND		0.1	1.0	µA
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	IOUT=1mA VOUT+0.5V≤VIN≤8V	0	0.05	0.20	%/V
VIN	Input Voltage				8.0	V
$\frac{\Delta V_{OUT}}{\Delta T_{opt}}$	Output Voltage Temperature Coefficient	IOUT=1mA -40°C≤Topt≤85°C		±100		ppm/°C
Ilim	Short Current Limit			40		mA
RPD	Pull down resistance for CE pin		1.5	4.0	12.0	MΩ
VCEH	CE Input Voltage "H"		1.5			V
VCEL	CE Input Voltage "L"				0.25	V

**ELECTRICAL CHARACTERISTICS BY OUTPUT VOLTAGE**

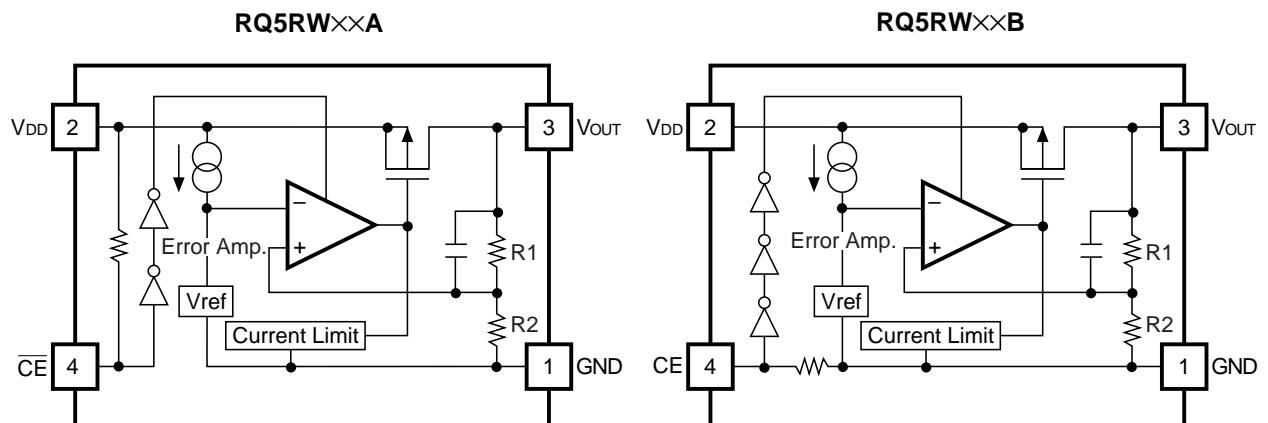
Topt=25°C

Part Number	Output Voltage				Output Current			Load Regulation			Dropout Votage			
	Vout(V)				Iout(mA)			ΔVout/ΔIout(mV)			VDIF(mV)			
	Conditions	MIN.	TYP.	MAX.	Conditions	MIN.	TYP.	Conditions	TYP.	MAX.	Conditions	TYP.	MAX.	
RQ5RW20	VIN–VOUT =2.0V Iout =10µA≤ 10mA	1.960	2.000	2.040	35	30	45	1mA≤ Iout ≤35mA	60	90	50	75	40	60
RQ5RW21		2.058	2.100	2.142										
RQ5RW22		2.156	2.200	2.244										
RQ5RW23		2.254	2.300	2.346										
RQ5RW24		2.352	2.400	2.448										
RQ5RW25		2.450	2.500	2.550										
RQ5RW26		2.548	2.600	2.652										
RQ5RW27		2.646	2.700	2.754										
RQ5RW28		2.744	2.800	2.856										
RQ5RW29		2.842	2.900	2.958										
RQ5RW30	VIN–VOUT =2.0V Iout =10µA≤ 10mA	2.940	3.000	3.060	50	40	60	1mA≤ Iout ≤50mA	35	55	30	45	25	40
RQ5RW31		3.038	3.100	3.162										
RQ5RW32		3.136	3.200	3.264										
RQ5RW33		3.234	3.300	3.366										
RQ5RW34		3.332	3.400	3.468										
RQ5RW35		3.430	3.500	3.570										
RQ5RW36		3.528	3.600	3.672										
RQ5RW37		3.626	3.700	3.774										
RQ5RW38		3.724	3.800	3.876										
RQ5RW39		3.822	3.900	3.978										
RQ5RW40	VIN–VOUT =2.0V Iout =10µA≤ 10mA	3.920	4.000	4.080	65	50	70	1mA≤ Iout ≤65mA	25	40	25	40	25	40
RQ5RW41		4.018	4.100	4.182										
RQ5RW42		4.116	4.200	4.284										
RQ5RW43		4.214	4.300	4.386										
RQ5RW44		4.312	4.400	4.488										
RQ5RW45		4.410	4.500	4.590										
RQ5RW46		4.508	4.600	4.692										
RQ5RW47		4.606	4.700	4.794										
RQ5RW48		4.704	4.800	4.896										
RQ5RW49		4.802	4.900	4.998										
RQ5RW50	VIN–VOUT =2.0V Iout =10µA≤ 10mA	4.900	5.000	5.100	80	60	90	1mA≤ Iout ≤80mA	25	40	25	40	25	40
RQ5RW51		4.998	5.100	5.202										
RQ5RW52		5.096	5.200	5.304										
RQ5RW53		5.194	5.300	5.406										
RQ5RW54		5.292	5.400	5.508										
RQ5RW55		5.390	5.500	5.610										
RQ5RW56		5.488	5.600	5.712										
RQ5RW57		5.586	5.700	5.814										
RQ5RW58		5.684	5.800	5.916										
RQ5RW59		5.782	5.900	6.018										
RQ5RW60		5.880	6.000	6.120										

## ELECTRICAL CHARACTERISTICS BY OUTPUT VOLTAGE (common characteristics)

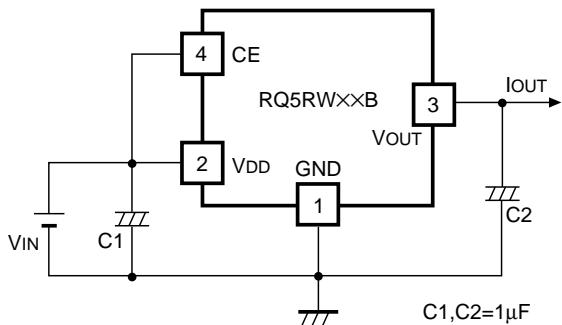
Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
Iss	Supply Current	VIN=setVOUT+2.0V		1.5	3.0	µA
Istandby	Standby Current	VIN=setVOUT+2.0V VCE=VIN(RQ5RWxxA), VCE=GND(RQ5RWxxB)		0.1	1.0	µA
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	IOUT=1mA setVOUT+0.5V≤VIN≤8V	0	0.05	0.20	%/V
VIN	Input Voltage				8.0	V
$\frac{\Delta V_{OUT}}{\Delta T_{OPT}}$	Output Voltage Temperature Coefficient	IOUT=10mA -40°C≤T <sub>OPT</sub> ≤85°C		±100		ppm/°C
I <sub>lim</sub>	Short Current Limit			40		mA
R <sub>PU/R<sub>PD</sub></sub>	$\overline{CE}$ Pull-up / CE Pull-down Resistance		1.5	4.0	12.0	MΩ
V <sub>CEH</sub>	$\overline{CE}/CE$ Input Voltage "H"		1.5			V
V <sub>CEL</sub>	$\overline{CE}/CE$ Input Voltage "L"				0.25	V

## OPERATION

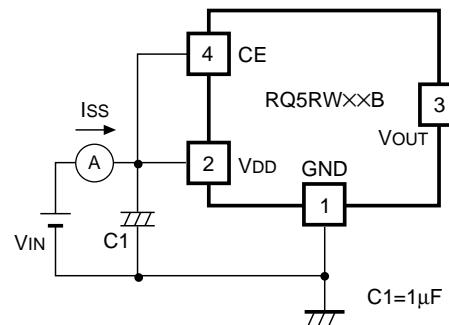


In these ICs, Output Voltage  $V_{OUT}$  is detected by Feed-back Registers  $R_1$ ,  $R_2$ , and the detected Output Voltage is compare with a reference voltage by Error Amplifier, so that a constant voltage is output.  
A current limit circuit working for Short Protect and a chip enable circuit are included.

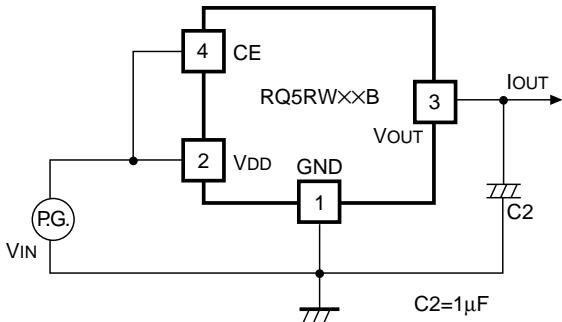
## TEST CIRCUITS



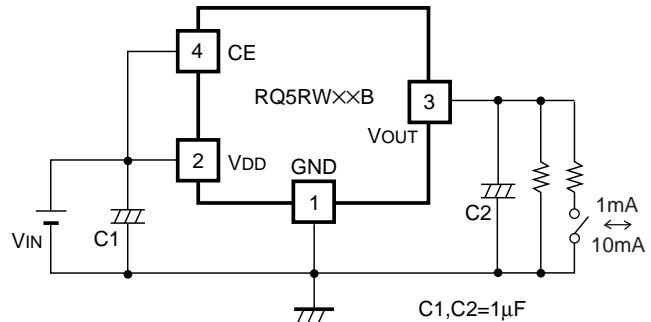
Standard Test Circuit



Test Circuit for Supply Current



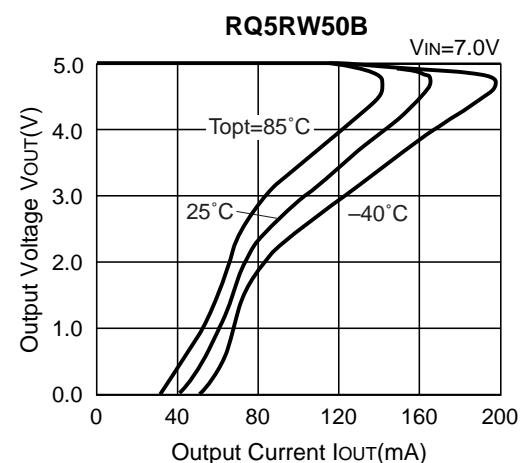
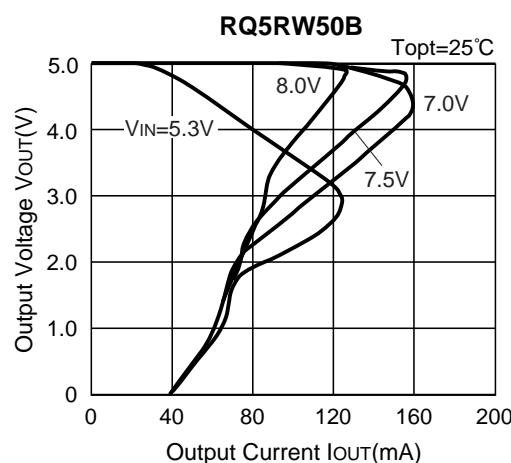
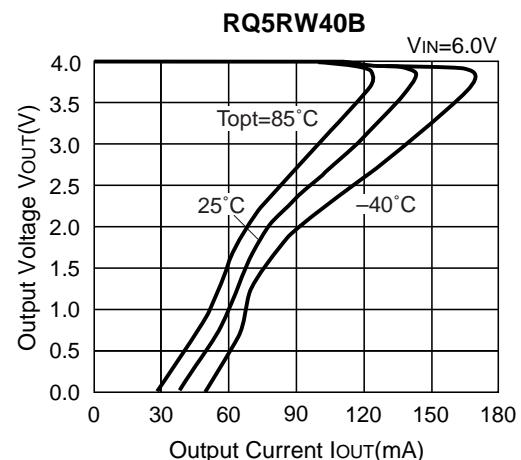
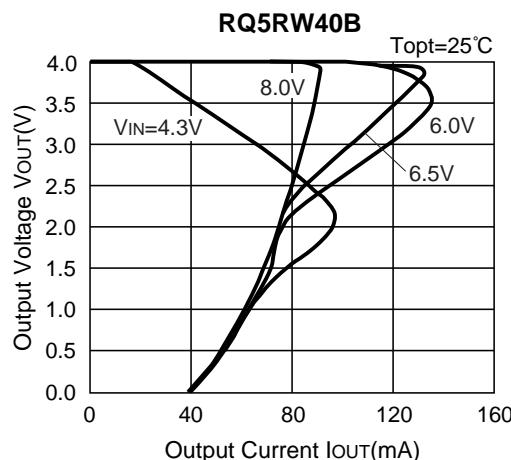
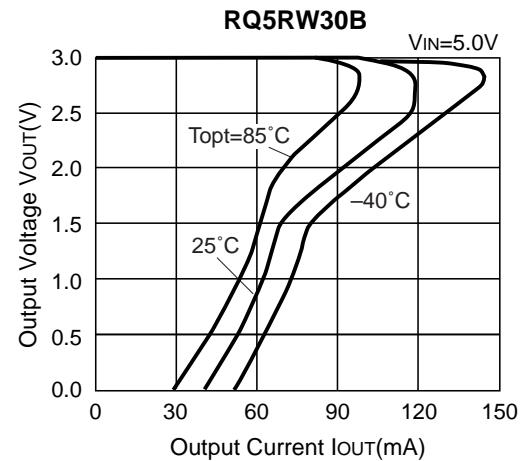
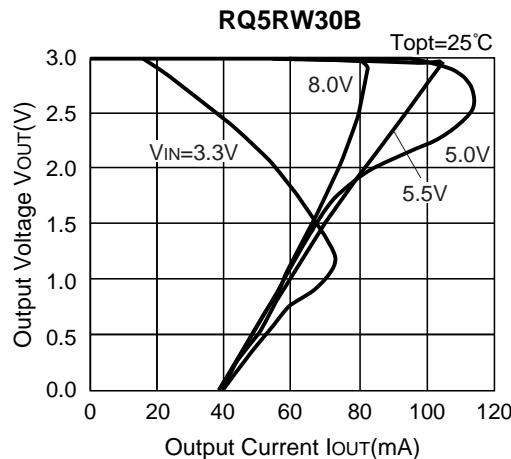
Test Circuit for Ripple Rejection and Line Transient Response



Test Circuit for Load Transient Response

## TYPICAL CHARACTERISTICS

### 1) Output Voltage vs. Output Current

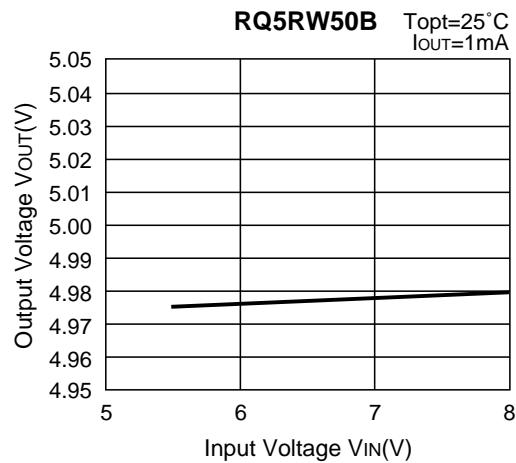
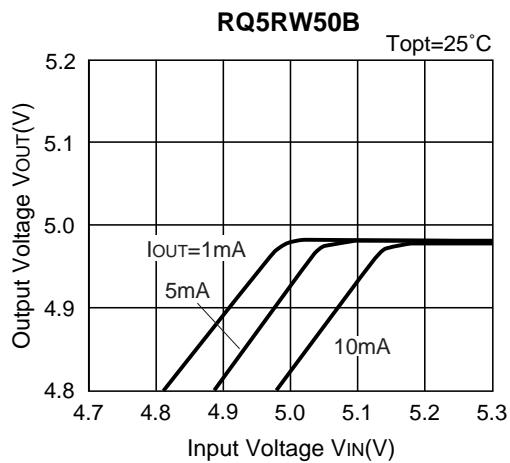
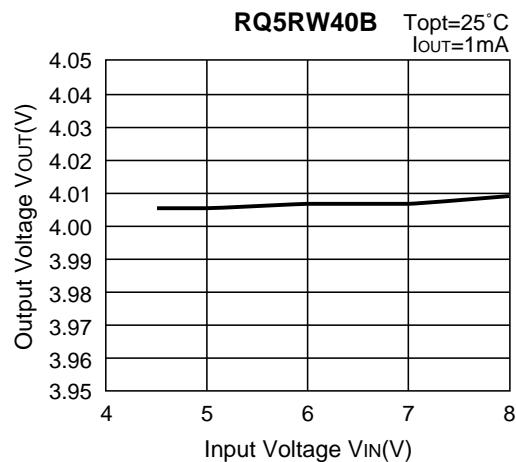
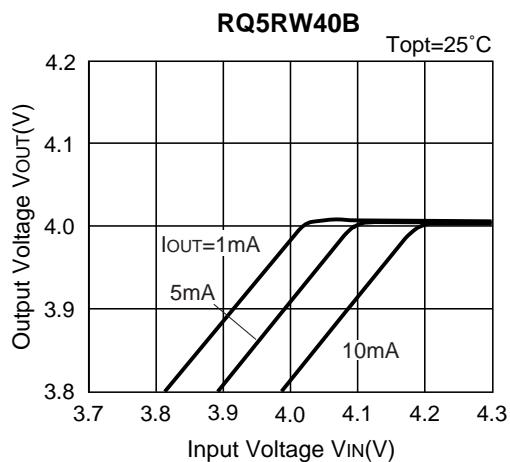
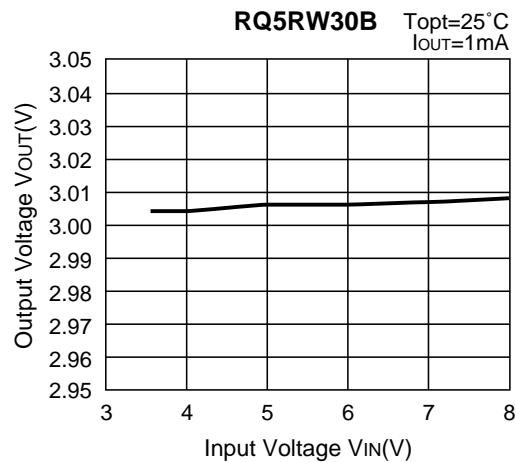
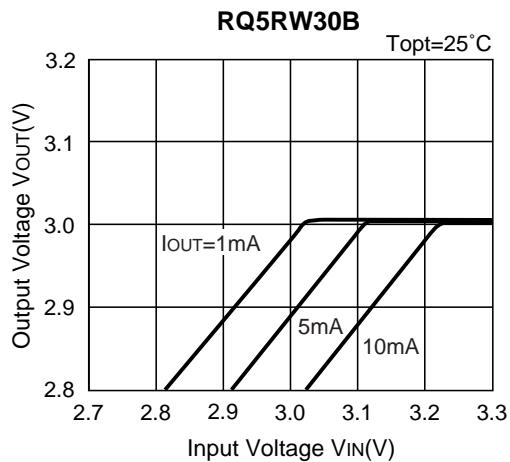


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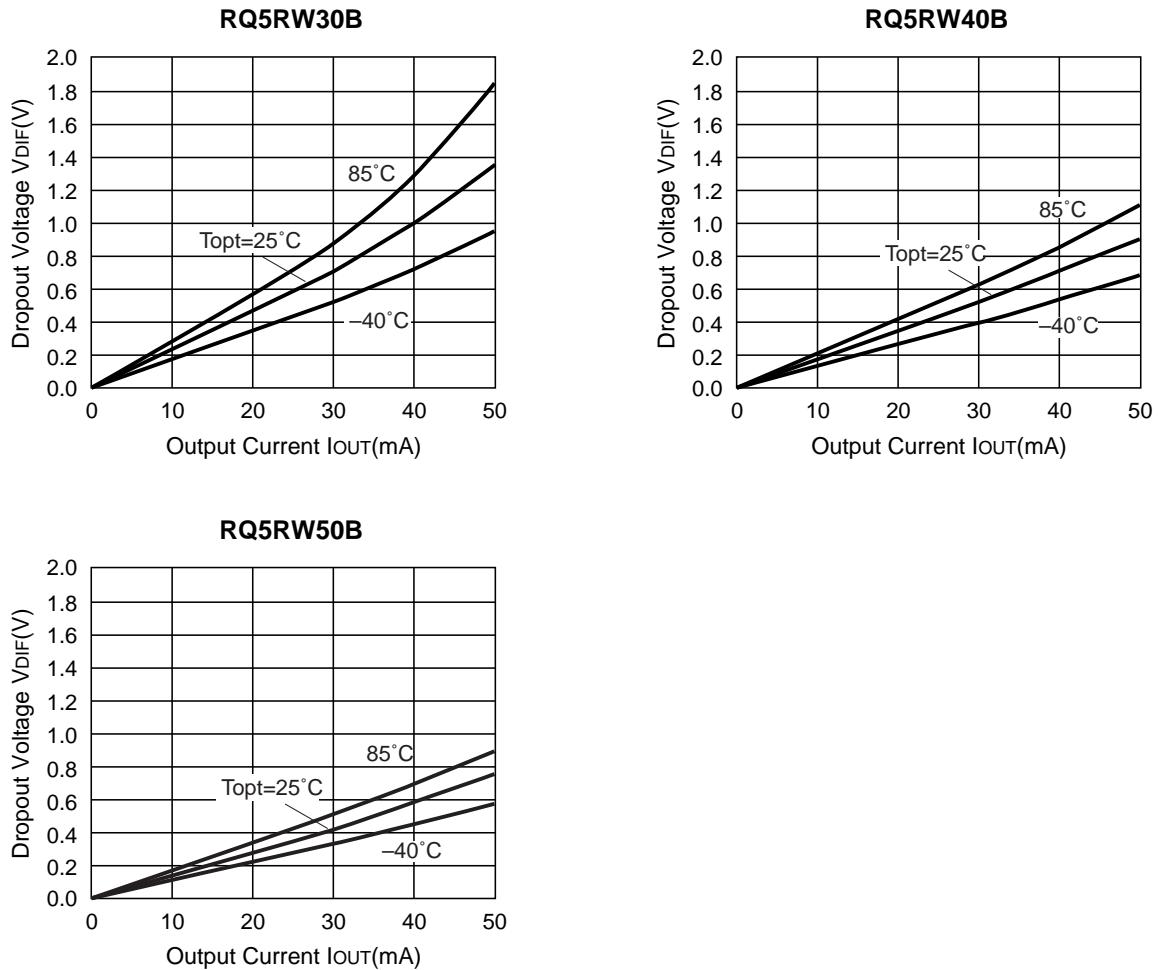
## RQ5RW

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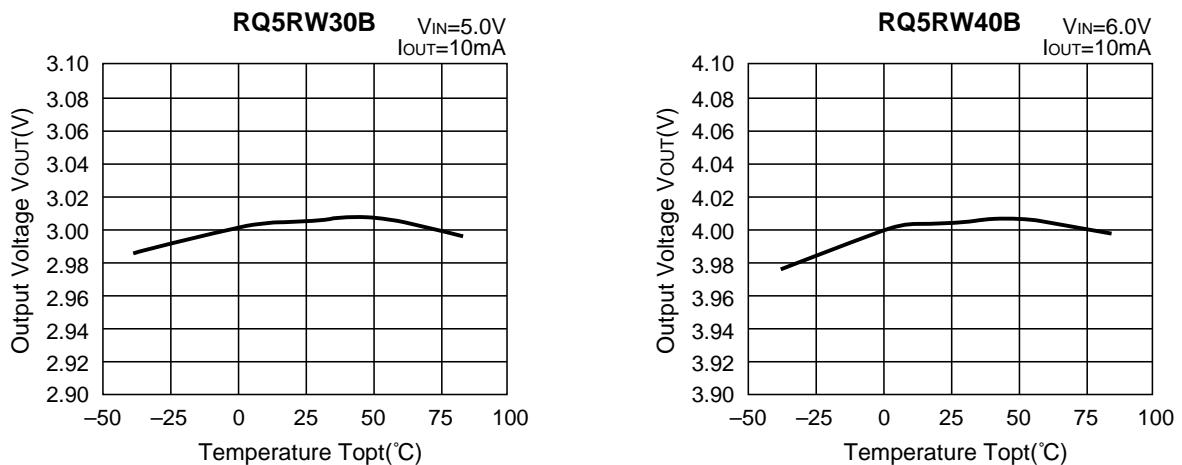
### 2) Output Voltage vs. Input Voltage

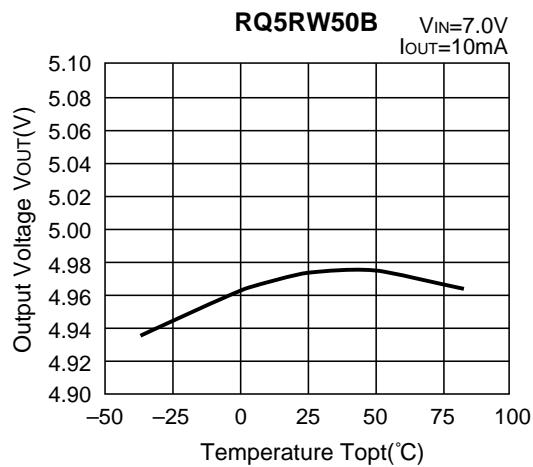


### 3) Dropout Voltage vs. Output Current

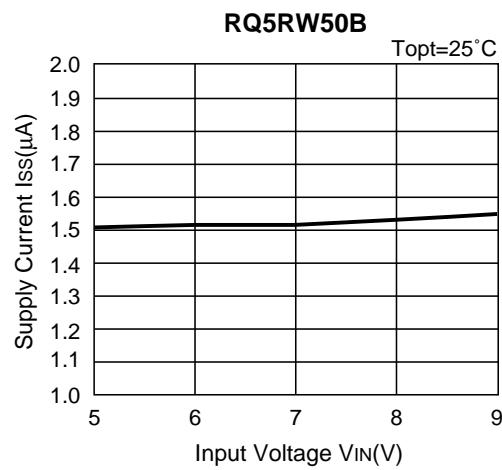
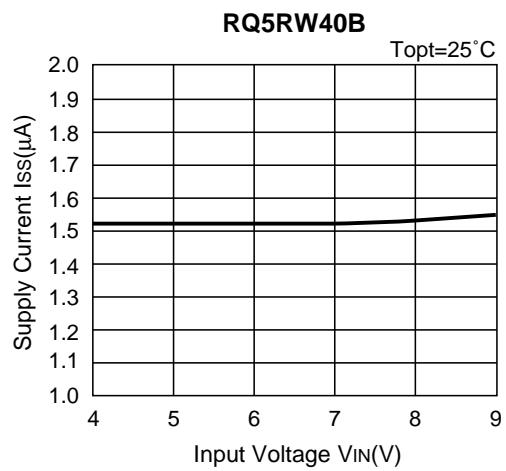
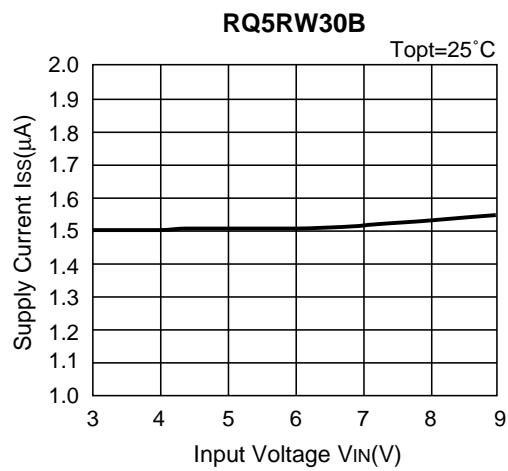


### 4) Output Voltage vs. Temperature

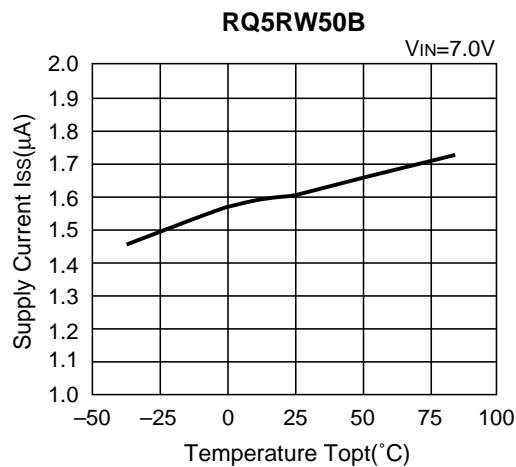
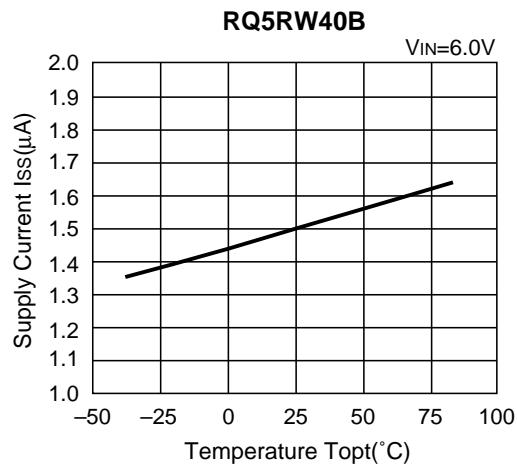
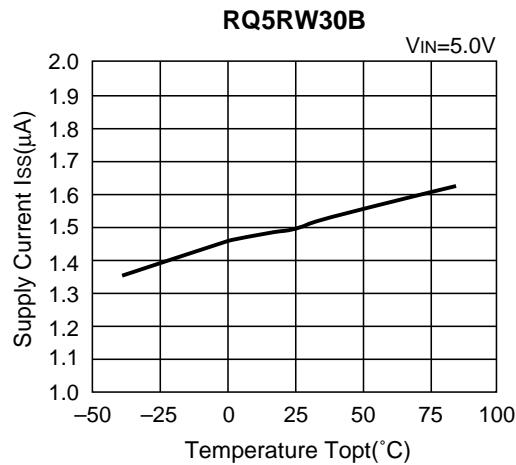




### 5) Supply Current vs. Input Voltage

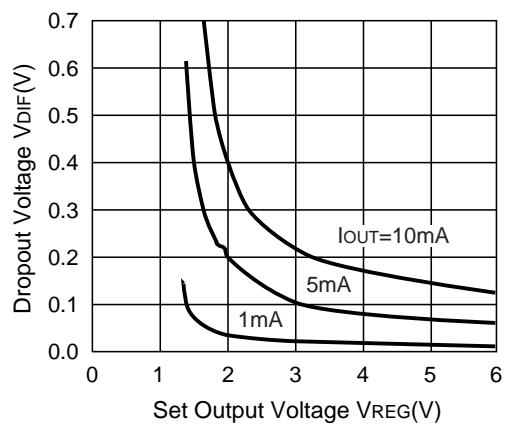


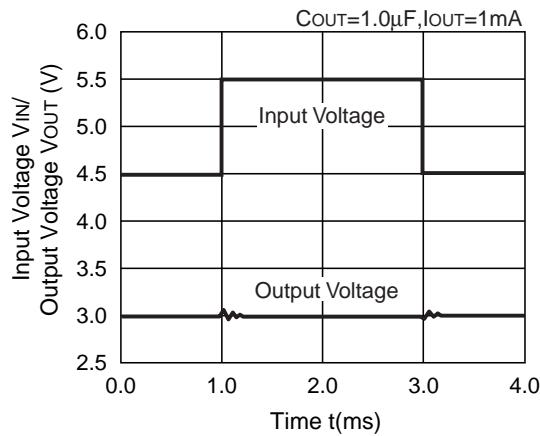
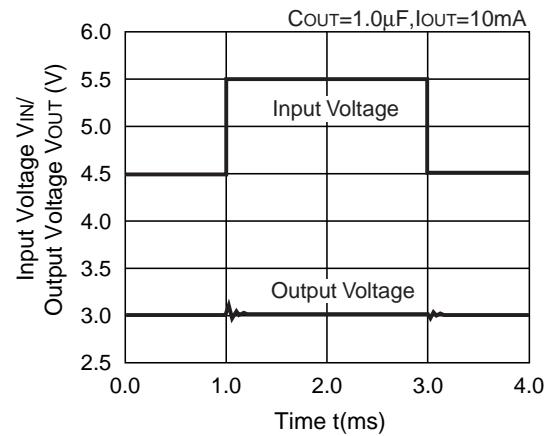
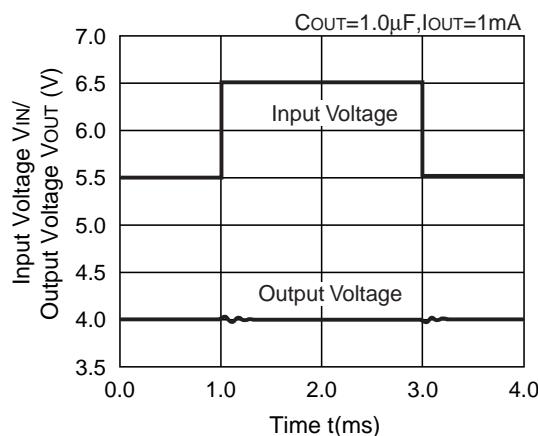
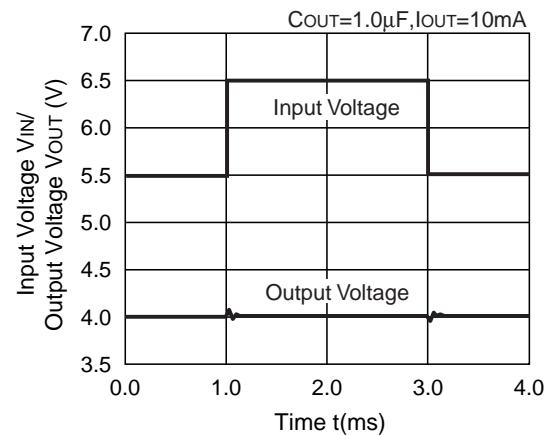
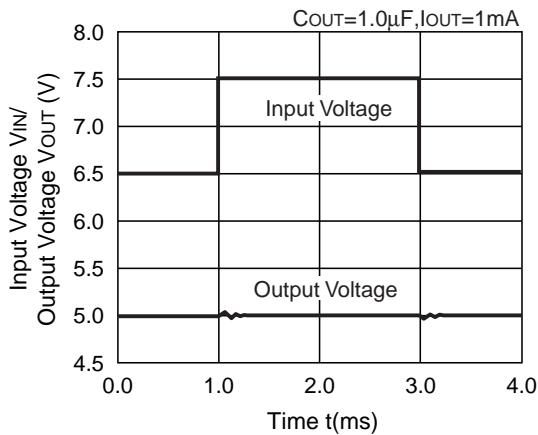
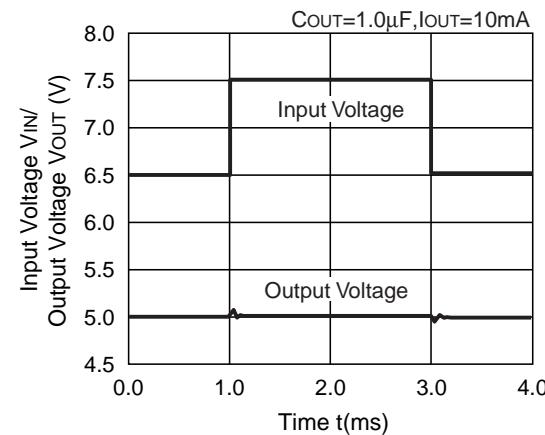
## 6) Supply Current vs. Temperature



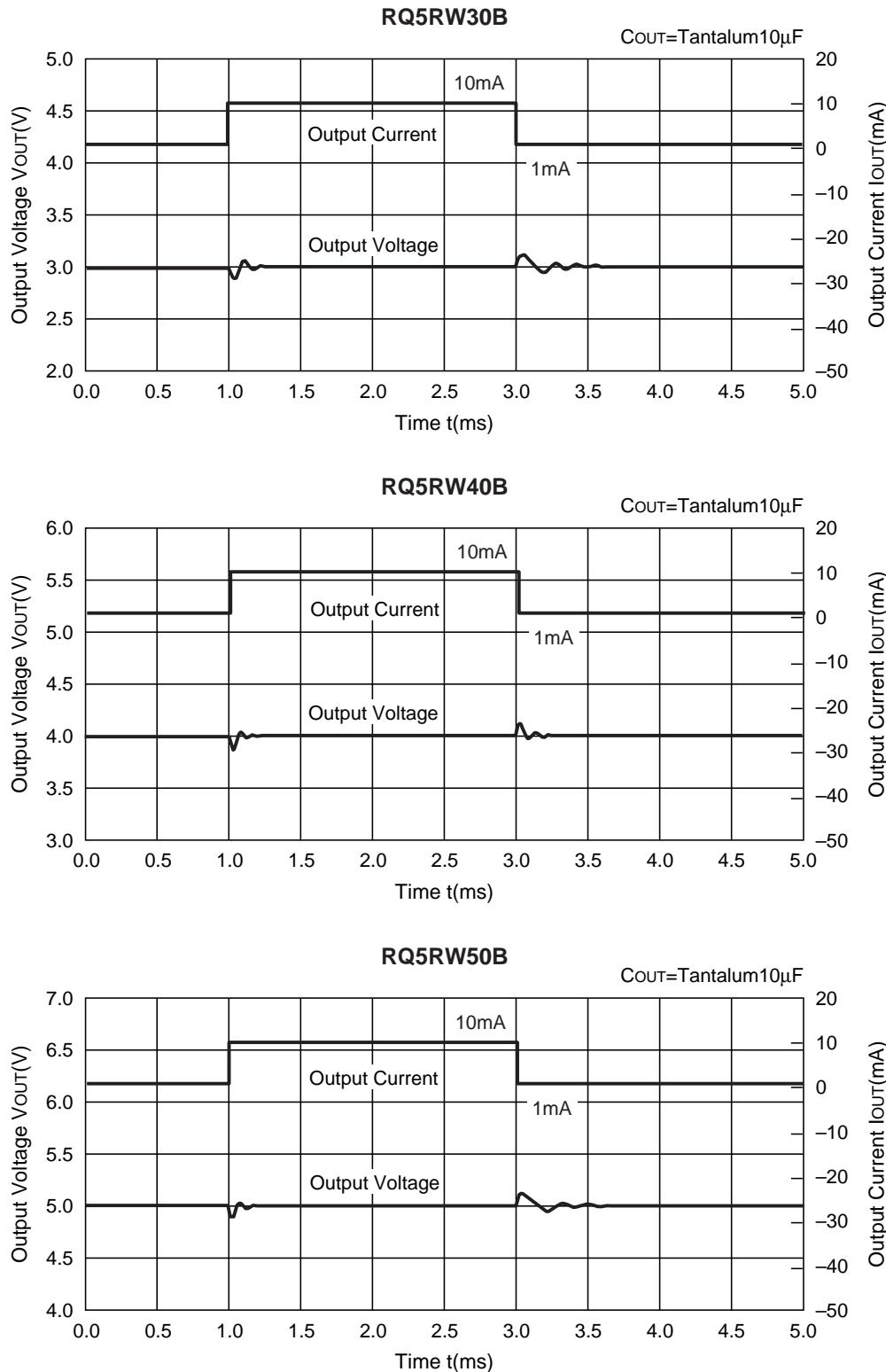
## 7) Dropout Voltage vs. Set Output Voltage

**RQ5RWXXB**



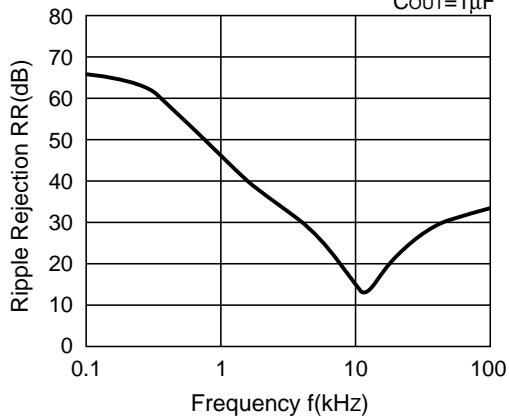
**8) Line Transient Response****RQ5RW30B****RQ5RW30B****RQ5RW40B****RQ5RW40B****RQ5RW50B****RQ5RW50B**

## 9) Load Transient Response

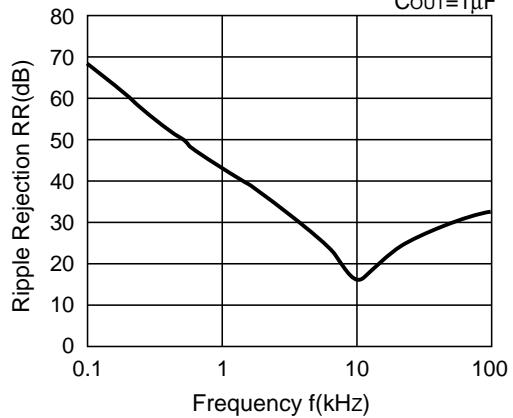


**10) Ripple Rejection****RQ5RW30B**

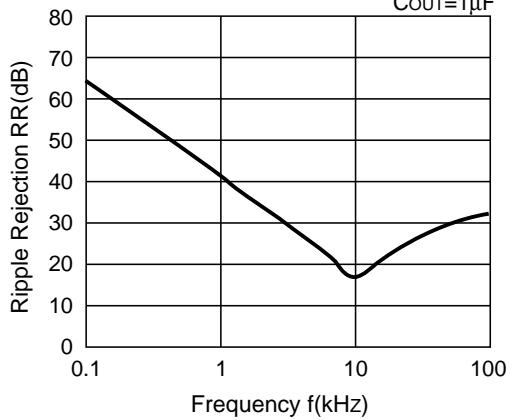
$V_{IN}=5V_{DC}+0.5V_{p-p}$   
 $I_{OUT}=10mA$   
 $C_{OUT}=1\mu F$

**RQ5RW40B**

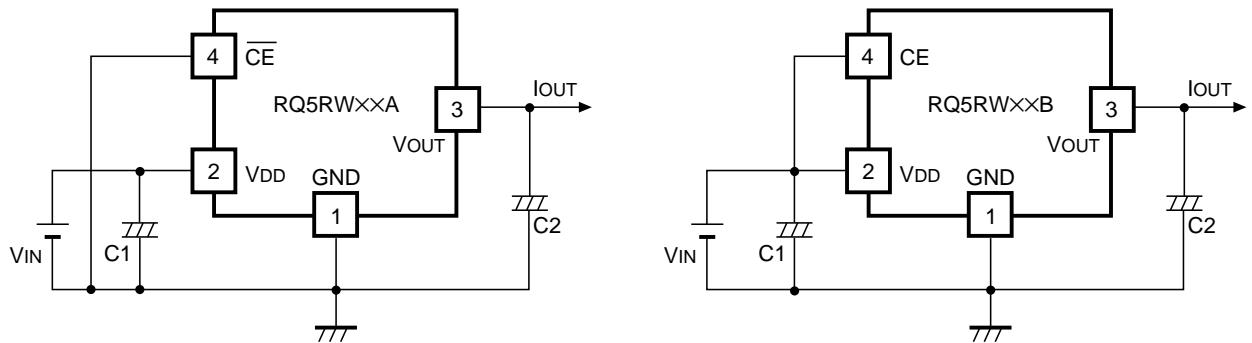
$V_{IN}=6V_{DC}+0.5V_{p-p}$   
 $I_{OUT}=10mA$   
 $C_{OUT}=1\mu F$

**RQ5RW50B**

$V_{IN}=7V_{DC}+0.5V_{p-p}$   
 $I_{OUT}=10mA$   
 $C_{OUT}=1\mu F$



## TYPICAL APPLICATION

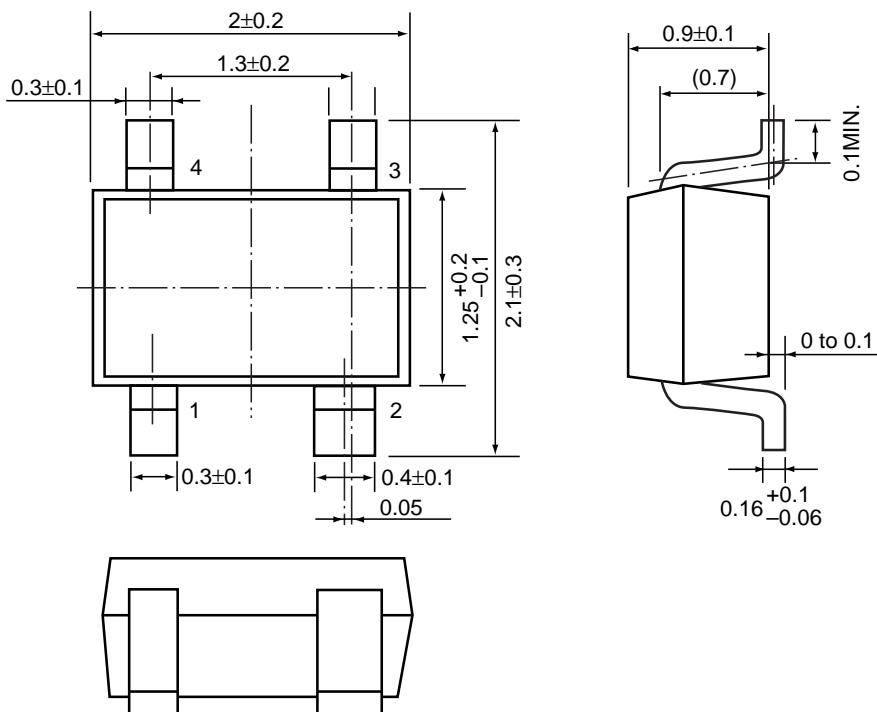


In RQ5RW Series, a constant voltage can be obtained without using Capacitor C1 and C2. However, when the wire connected VIN is long, use Capacitor C1. Output noise can be reduced by using Capacitor 2.

Insert Capacitors C1 and C2 with the capacitance of 0.1 $\mu$ F to 0.2 $\mu$ F between Input/Output Pins and GND Pin with minimum wiring.

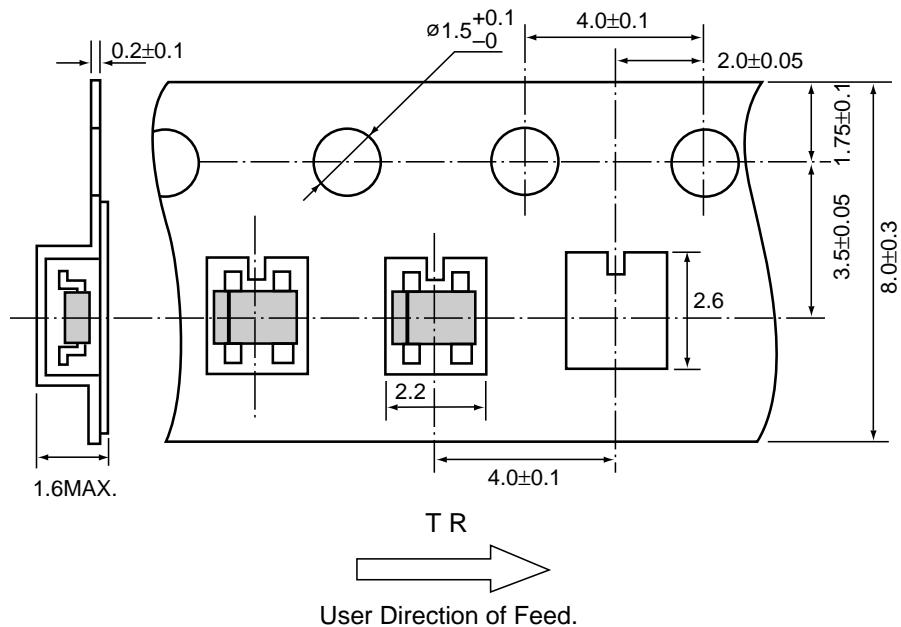
## PACKAGE DIMENSION (Unit : mm)

- SC-82AB



## TAPING SPECIFICATION (Unit : mm)

- SC82AB





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Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

#### Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помошь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помошь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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