ULTRA SMALL PACKAGE VOLTAGE REGULATOR

RX5RW SERIES

OUTLINE

The RX5RW Series are CMOS-based voltage regulator ICs with high accuracy output voltage and ultra-low supply current developed. Each of these ICs consists of a driver transistor, a voltage reference unit, an error amplifier, resistors for setting output volt-age and a current limit circuit.

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

Even if V_{OUT} is shorted to GND, the included current limit circuit protects the ICs from the destruction. Furthermore, RX5RWxxA/B have a chip enable function, so that the supply current on standby can be minimized.

Since the packages for these ICs are SC-82AB (Super Mini-mold) package and SON1612-6(Under Development), high density mounting of the ICs on boards is possible.

FEATURES

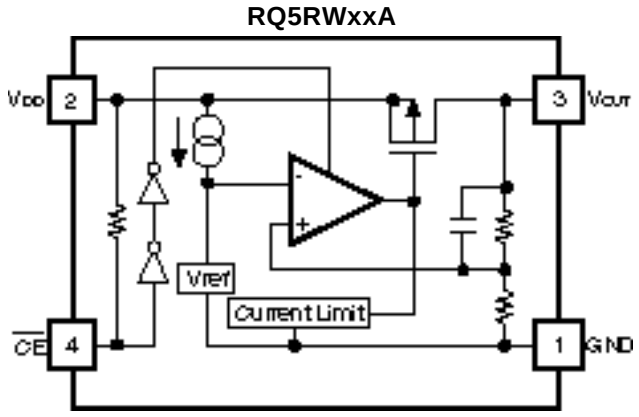
- Ultra-Low Supply Current .....Typ. 1.5µA
  (except pull-up/pull-down current for $\overline{CE}$ /CE pin)
- Standby Current .....Typ. 0.1µA
- Dropout Voltage .....Typ. 40mV (I_{OUT}=1mA, RX5RW30A/B)
- Low Temperature-Drift Coefficient of Output Voltage Typ. ±100ppm/°C
- Excellent Line Regulation .....Typ. 0.05%/V
- High Accuracy Output Voltage .....±2.0%
- Ultra-Small Package .....SC-82AB, SON1612-6(Under Development)
- Built-in Current Limit Circuits

APPLICATIONS

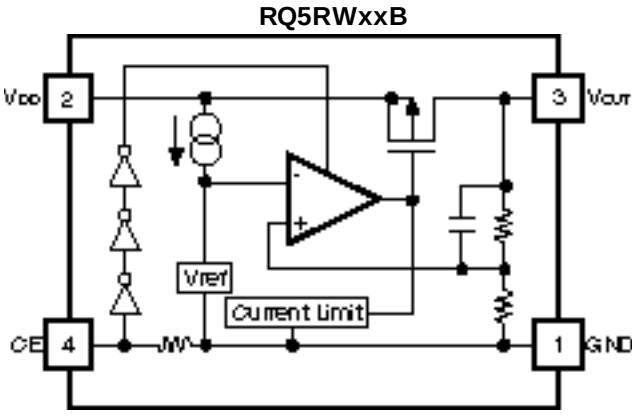
- Power source for battery-powered equipment.
- Power source for cameras, VCRs, camcorders, hand-held audio instruments and hand-held communication equipment.
- Precision voltage references.

BLOCK DIAGRAMS

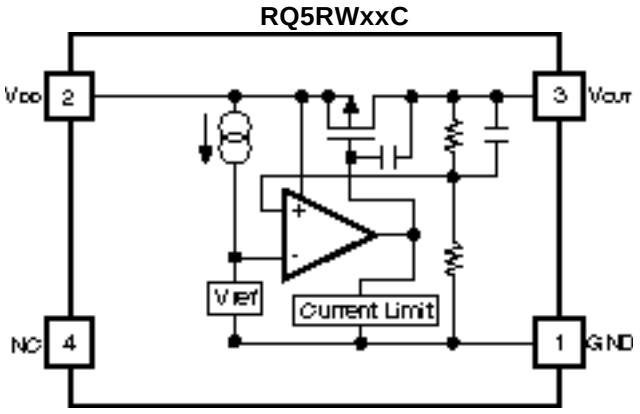
RQ5RWxxA



RQ5RWxxB



RQ5RWxxC



SELECTION GUIDE

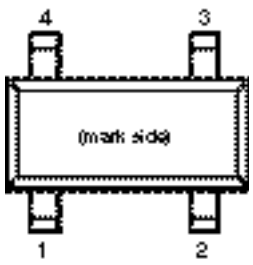
The output voltage, the active type, and the packing type for the ICs can be selected at the user's request. The selection can be made with designating the part number as shown below:

RX5RW xxxx-xx ←Part Number
↑ ↑ ↑↑ ↑
a b cd e

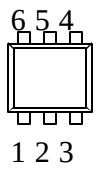
Code	Contents
a	**Designation of Package Type** **Q: SC82-AB D:SON1612-6(Under Development)**
b	Setting Output Voltage (V_{OUT}): Stepwise setting with a step of 0.1V in the range of 1.5V to 6.0V is possible.
c	Designation of Chip enable Active Type: A: “L” active type C: no chip enable type B: “H” active type
d	Designation of Packing Type: A: Taping B: Antistatic bag (for Sample only)
e	Designation of Taping Type: TR (refer to Taping Specifications)

PIN CONFIGURATION

●SC82-AB



●SON1612-6(Under Development)



PIN DESCRIPTION

RQ5RW

Pin No.	Symbol	Pin Description
1	GND	Ground Pin
2	V_{DD}	Input Pin
3	V_{OUT}	Output Pin
4	$\overline{CE}$ or CE or NC	Chip Enable Pin or No Connection

RD5RW (Under Development)

Pin No.	Symbol	Pin Description
1	$\overline{CE}$ or CE or NC	Chip Enable Pin or No Connection
2	V_{DD}	Input Pin
3	V_{OUT}	Output Pin
4	NC	No Connection
5	V_{DD}	Input Pin
6	GND	Ground Pin

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	9	V
V_{CE}	Input Voltage for $\overline{CE}$ /CE Pin	-0.3 to V_{IN} +0.3	V
V_{OUT}	Output Voltage	-0.3 to V_{IN} +0.3	V
I_{OUT}	Output Current	150	mA
P_D	Power Dissipation(SC82-AB)	150	mW
	Power Dissipation(SON1612-6)-(Under development)	500*Note1	
Topt	Operating Temperature	–40 to +85	°C
Tstg	Storage Temperature	–55 to +125	°C

*Note 1: This specification is at mounted on board.

P_D depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

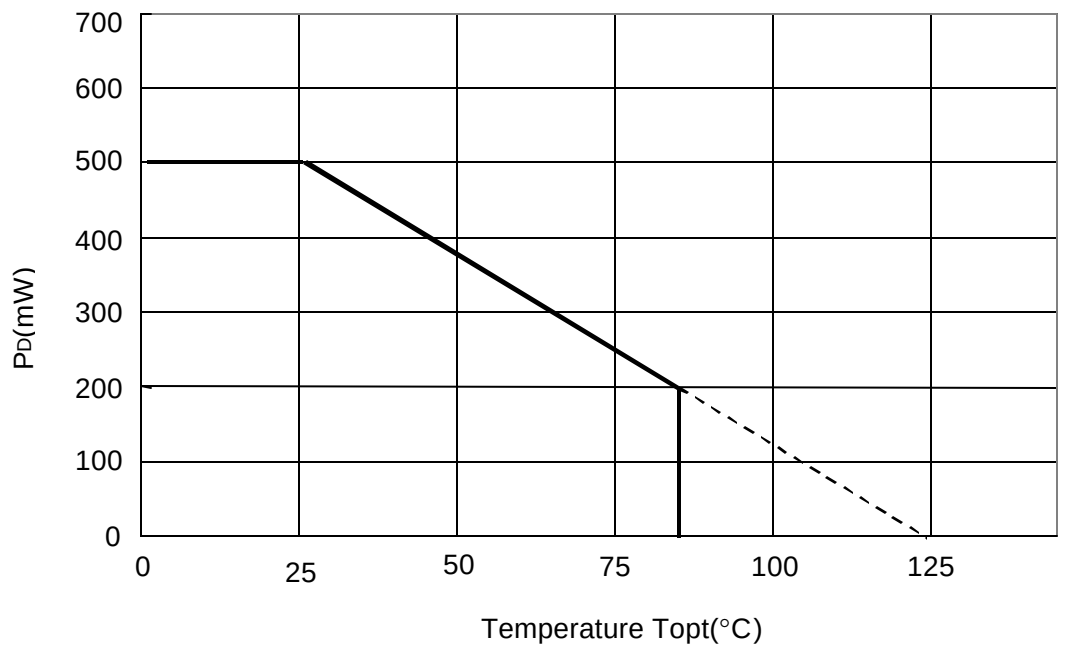
*Measurement Conditions

Environment: Mounted on board (Wind velocity 0m/s)

Board Material: FR-4 (2-layer)

Board dimensions: 40mm x 40mm x t1.6mm

Copper Area: 50%



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

- **RX5RW30A**

Topt=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	V_{IN}=5.0V 10µA≤I_{OUT}≤10mA	2.940	3.000	3.060	V
I_{OUT}	Output Current	V_{IN}=5.0V	50			mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	V_{IN}=5.0V, 1mA≤I_{OUT}≤50mA		40	60	mV
V_{DIF}	Dropout Voltage	I_{OUT}=1mA		40	60	mV
I_{SS}	Supply Current	V_{IN}=5.0V		1.5	3.0	µA
Istandby	Standby Current	V_{IN}=5.0V, V_{CE}=5.0V		0.1	1.0	µA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	I_{OUT}=1mA V_{OUT}+0.5V≤V_{IN}≤8V	0.00	0.05	0.20	%/V
V_{IN}	Input Voltage				8.0	V
$\Delta V_{OUT}/\Delta Topt$	Output Voltage Temperature Coefficient	I_{OUT}=10mA -40°C≤Topt≤85°C		±100	ppm/°C	
Ilim	Short Current Limit	V_{OUT}=0V		40		mA
R_{PU}	Pull up resistance for CE pin		1.5	4.0	12.0	MΩ
V_{CEH}	$\overline{CE}$ Input Voltage “H”		1.5			V
V_{CEL}	$\overline{CE}$ Input Voltage “L”		0.25			V

- **RX5RW30B**

Topt=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	V_{IN}=5.0V 10μA≤I_{OUT}≤10mA	2.940	3.000	3.060	V
I_{OUT}	Output Current	V_{IN}=5.0V	50			mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	V_{IN}=5.0V 1mA≤I_{OUT}≤50mA		40	60	mV
V_{DIF}	Dropout Voltage	I_{OUT}=1mA		40	60	mV
I_{SS}	Supply Current	V_{IN}=5.0V		1.5	3.0	μA
Istandby	Standby Current	V_{IN}=5.0V, V_{CE}=GND		0.1	1.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	I_{OUT}=1mA V_{OUT}+0.5V≤V_{IN}≤8V	0.00	0.05	0.20	%/V
VIN	Input Voltage				8.0	V
$\Delta V_{OUT}/\Delta$Topt	Output Voltage Temperature Coefficient	I_{OUT}=1mA -40°C≤Topt≤85°C		±100		ppm/°C
Ilim	Short Current Limit	V_{OUT}=0V		40		mA
R_{PD}	Pull down resistance for CE pin		1.5	4.0	12.0	MΩ
V_{CEH}	CE Input Voltage “H”		1.5			V
V_{CEL}	CE Input Voltage “L”		0.25			V

- **RX5RW30C**

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	V_{IN}=5.0V 10μA≤I_{OUT}≤10mA	2.940	3.000	3.060	V
I_{OUT}	Output Current	V_{IN}=5.0V	50			mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	V_{IN}=5.0V 1mA≤I_{OUT}≤50mA		40	60	mV
V_{DIF}	Dropout Voltage	I_{OUT}=1mA		40	60	mV
I_{SS}	Supply Current	V_{IN}=5.0V		1.5	3.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	I_{OUT}=1mA 3.5V≤V_{IN}≤8.0V	0.00	0.05	0.20	%/V
V_{IN}	Input Voltage				8.0	V
$\Delta V_{OUT}/\Delta$Topt	Output Voltage Temperature Coefficient	I_{OUT}=10mA -40°C≤Topt≤85°C		±100		ppm/°C
Ilim	Short Current Limit			40		mA

ELECTRICAL CHARACTERISTICS BY OUTPUT VOLTAGE

Topt=25°C

Part Number	Output Voltage				Output Current			Load Regulation			Dropout Voltage		
	V_{OUT} (V)				I_{OUT} (mA)			DV_{OUT}/DI_{OUT} (mV)			V_{DIF} (mV)		
	Conditions	Min.	Typ.	Max.	Conditions	Min.	Typ.	Conditions	Typ.	Max.	Conditions	Typ.	Max.
RX5RW15	V_{IN}-V_{OUT}=2.0V 10μA≤I_{OUT}≤10mA	1.470	1.500	1.530	V_{IN}-V_{OUT}=2.0V	35		V_{IN}-V_{OUT}=2.0V 1mA≤I_{OUT}≤35mA	30	45	I_{OUT}=1mA	120	200
RX5RW16		1.568	1.600	1.632								90	135
RX5RW17		1.666	1.700	1.734									
RX5RW18		1.764	1.800	1.836								60	90
RX5RW19		1.862	1.900	1.938									
RX5RW20		1.960	2.000	2.040									
RX5RW21		2.058	2.100	2.142									
RX5RW22		2.156	2.200	2.244									
RX5RW23		2.254	2.300	2.346								50	75
RX5RW24		2.352	2.400	2.448									
RX5RW25		2.450	2.500	2.550									
RX5RW26		2.548	2.600	2.652									
RX5RW27		2.646	2.700	2.754									
RX5RW28		2.744	2.800	2.856								40	60
RX5RW29		2.842	2.900	2.958									
RX5RW30		2.940	3.000	3.060		50		V_{IN}-V_{OUT}=2.0V 1mA≤I_{OUT}≤50mA	40	60			
RX5RW31		3.038	3.100	3.162									
RX5RW32		3.136	3.200	3.264								35	55
RX5RW33		3.234	3.300	3.366									
RX5RW34		3.332	3.400	3.468									
RX5RW35		3.430	3.500	3.570									
RX5RW36		3.528	3.600	3.672								30	45
RX5RW37		3.626	3.700	3.774									
RX5RW38		3.724	3.800	3.876									
RX5RW39		3.822	3.900	3.978									
RX5RW40		3.920	4.000	4.080		65		V_{IN}-V_{OUT}=2.0V 1mA≤I_{OUT}≤65mA	50	70			
RX5RW41		4.018	4.100	4.182									
RX5RW42		4.116	4.200	4.284									
RX5RW43		4.214	4.300	4.386									
RX5RW44		4.312	4.400	4.488									
RX5RW45		4.410	4.500	4.590									
RX5RW46		4.508	4.600	4.692									
RX5RW47		4.606	4.700	4.794									
RX5RW48		4.704	4.800	4.896									
RX5RW49		4.802	4.900	4.998								25	40
RX5RW50		4.900	5.000	5.100		80		V_{IN}-V_{OUT}=2.0V 1mA≤I_{OUT}≤80mA	60	90			
RX5RW51		4.998	5.100	5.202									
RX5RW52		5.096	5.200	5.304									
RX5RW53		5.194	5.300	5.406									
RX5RW54		5.292	5.400	5.508									
RX5RW55		5.390	5.500	5.610									
RX5RW56		5.488	5.600	5.712									
RX5RW57		5.586	5.700	5.814									
RX5RW58		5.684	5.800	5.916									
RX5RW59		5.782	5.900	6.018									
RX5RW60		5.880	6.000	6.120									

ELECTRICAL CHARACTERISTICS BY OUTPUT VOLTAGE

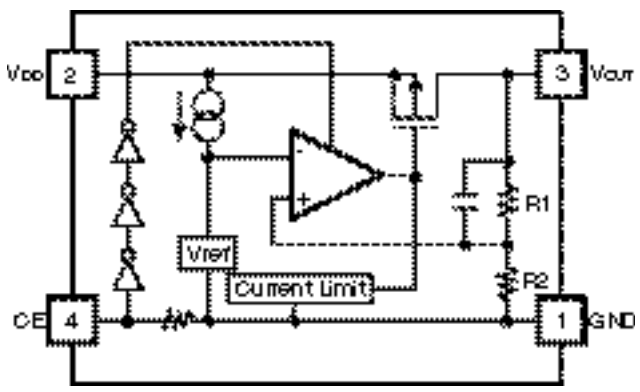
(common characteristics)

Topt=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
I_{SS}	Supply Current	V_{IN}=setV_{OUT}+2.0V		1.5	3.0	μA
Istandby	Standby Current	V_{IN}=setV_{OUT}+2.0V V_{CE}=V_{IN} (RX5RWxxA), V_{CE}=GND (RX5RWxxB)		0.1	1.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	I_{OUT}=1mA setV_{OUT}+0.5V≤V_{IN}≤8V	0.00	0.05	0.20	%/V
V_{IN}	Input Voltage				8.0	V
$\Delta V_{OUT}/\Delta$Topt	Output Voltage Temperature Coefficient	I_{OUT}=10mA -40°C≤Topt≤85°C		±100		ppm/°C
Ilim	Short Current Limit	V_{OUT}=0V		40		mA
R_{PU}/R_{PD}	$\overline{CE}$ Pull-up / CE Pull-down Resistance	applied to A/B version	1.5	4.0	12.0	MΩ
V_{CEH}	$\overline{CE}$ /CE Input Voltage “H”	applied to A/B version	1.5			V
V_{CEL}	$\overline{CE}$ /CE Input Voltage “L”	applied to A/B version			0.25	V

OPERATION

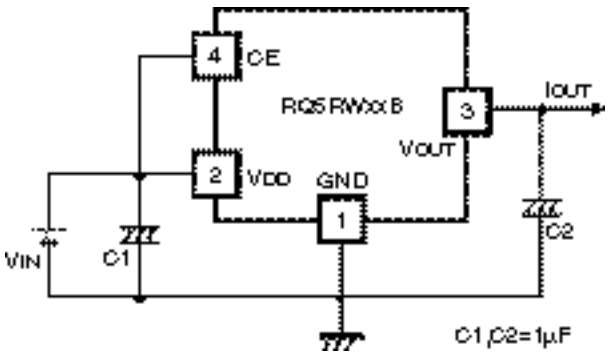
RQ5RWxxB



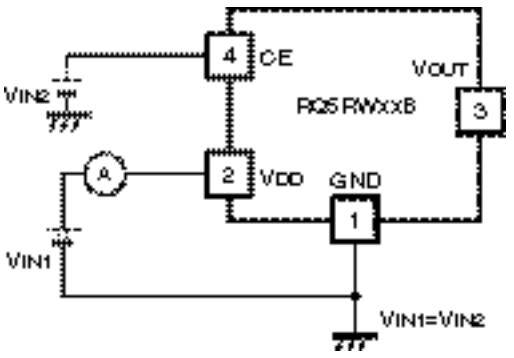
In these ICs, output voltage V_{OUT} is detected by Feedback Registers R1, R2, and the detected output voltage is compare with a reference voltage by the error amplifier, so that a constant voltage is output.

A current limit circuit working for short protect, and a chip enable circuit are included.

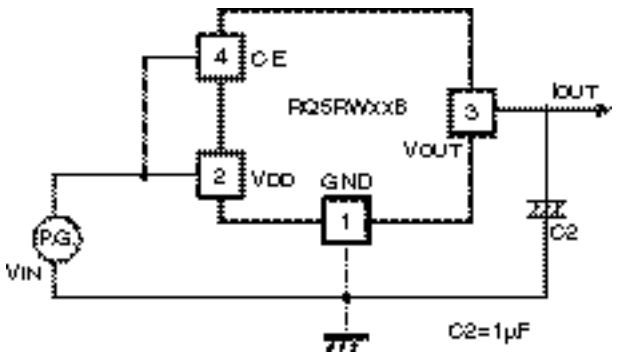
TEST CIRCUITS



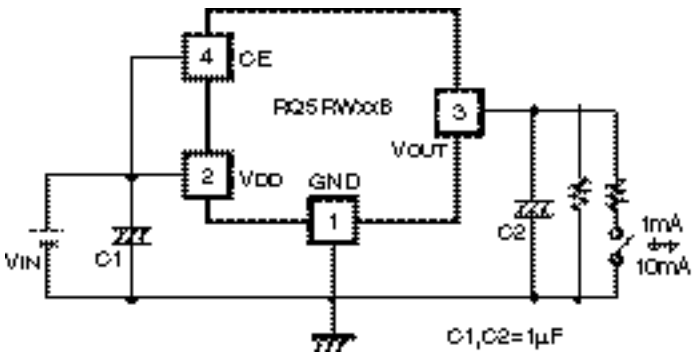
Standard Test Circuit



Test Circuit for Supply Current



Test Circuit for Ripple Rejection and Line Transient Response

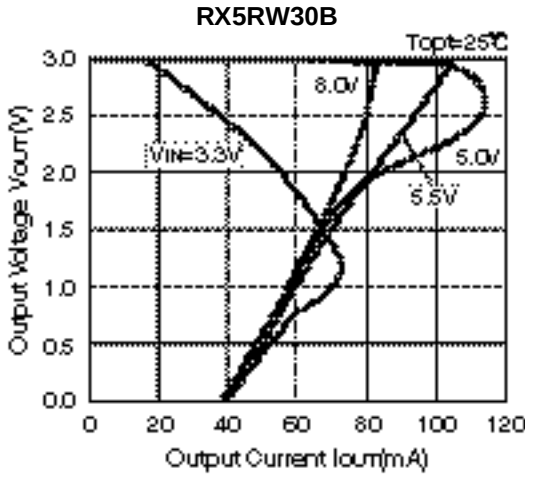


Test Circuit for Load Transient Response

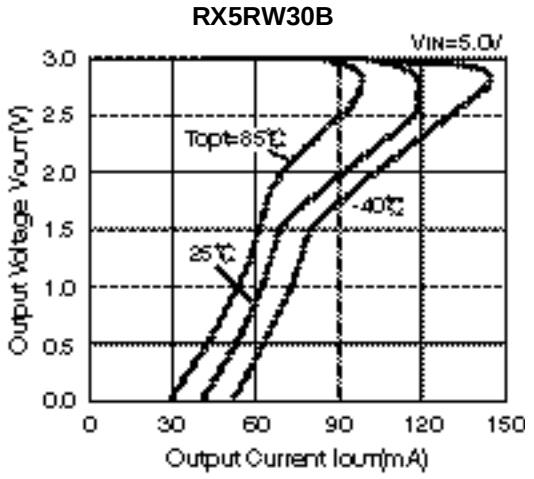
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current

RX5RW30B



RX5RW30B



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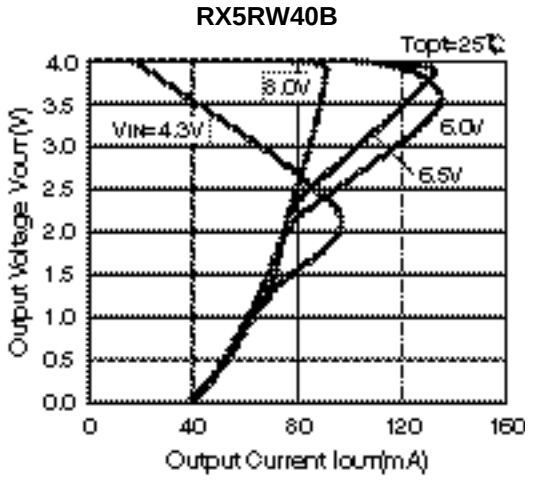

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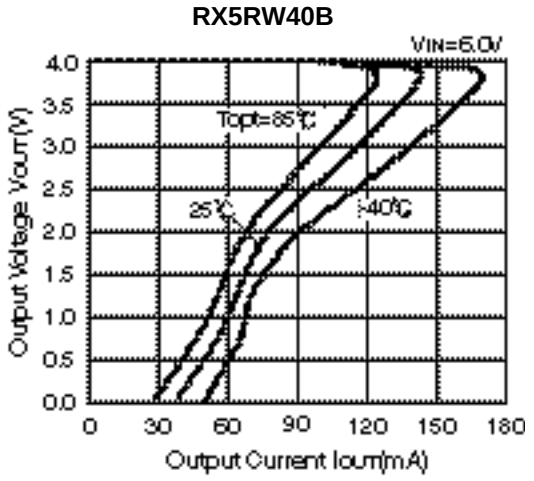

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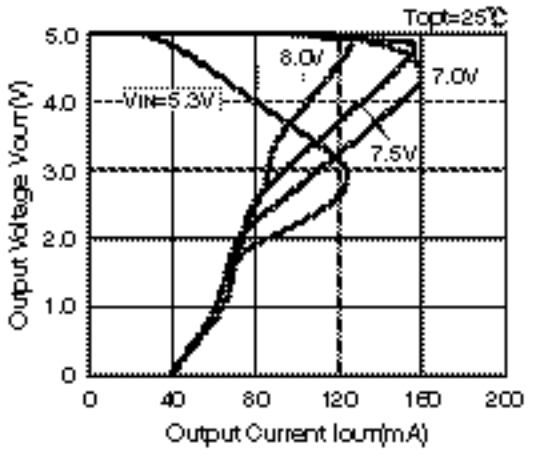

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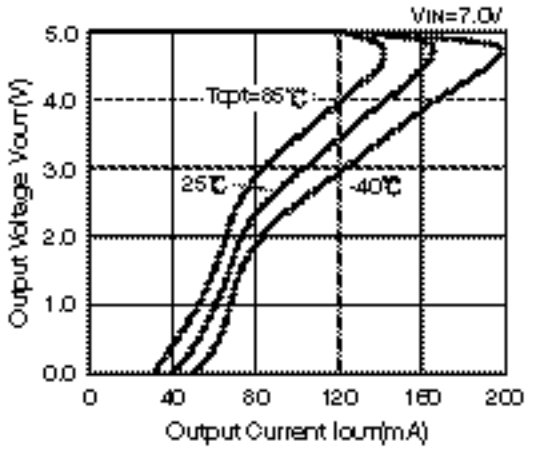
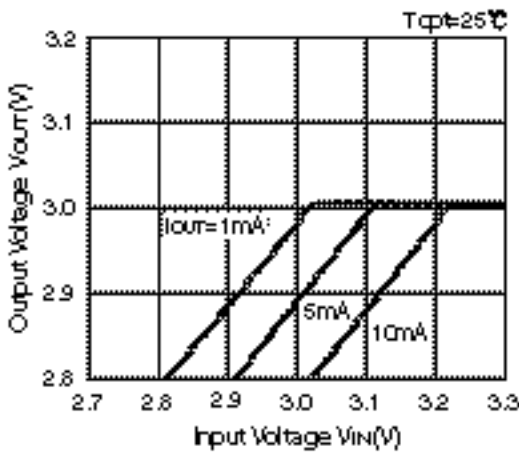
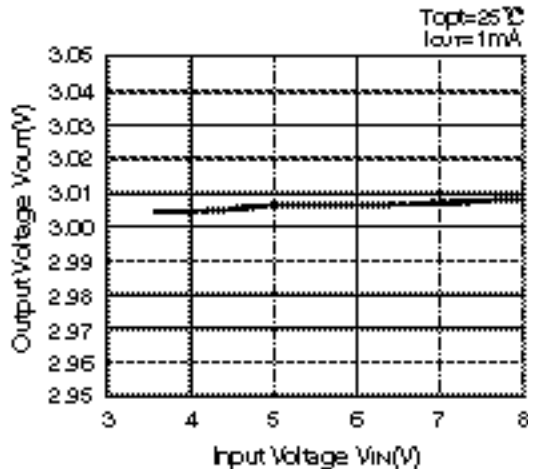


2) Output Voltage vs. Input Voltage

RX5RW30B



RX5RW30B



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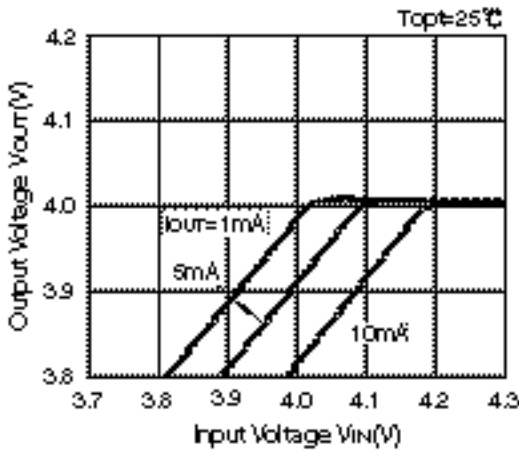

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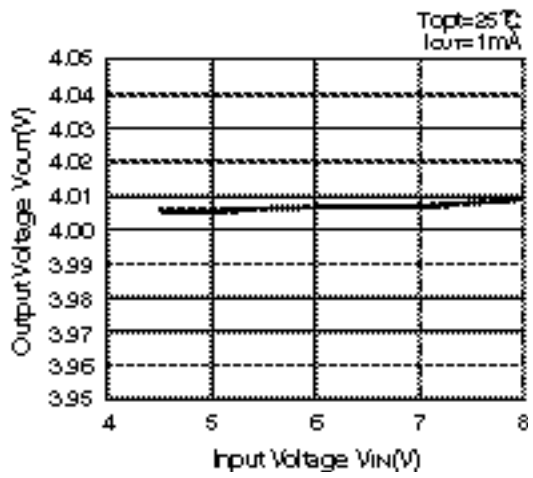
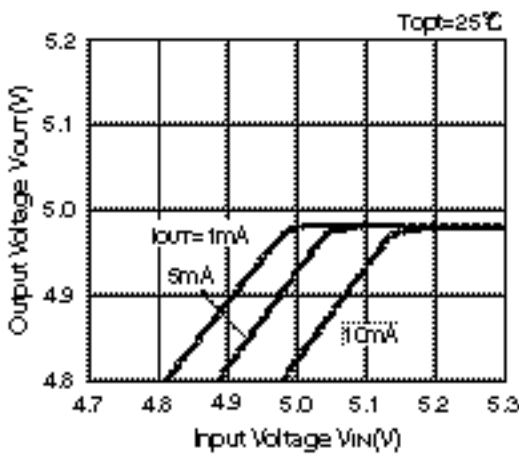
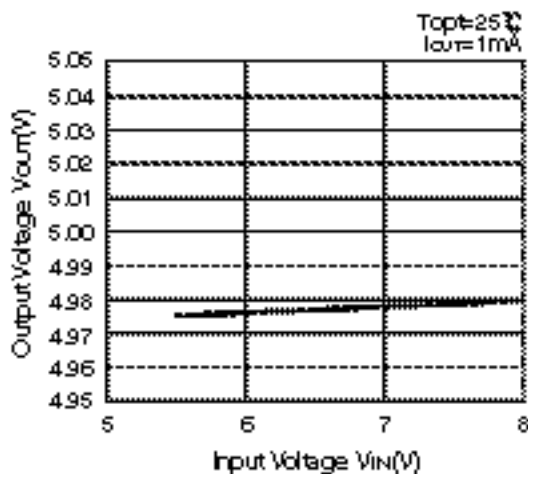


RX5RW50B

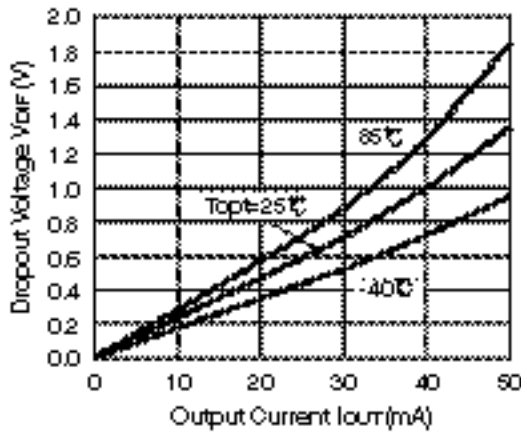


RX5RW50B



3) Dropout Voltage vs. Output Current

RX5RW30B



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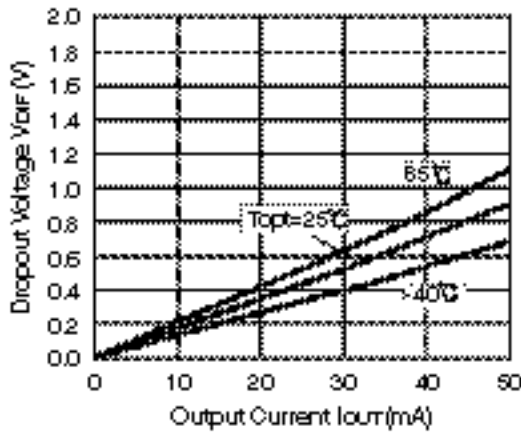
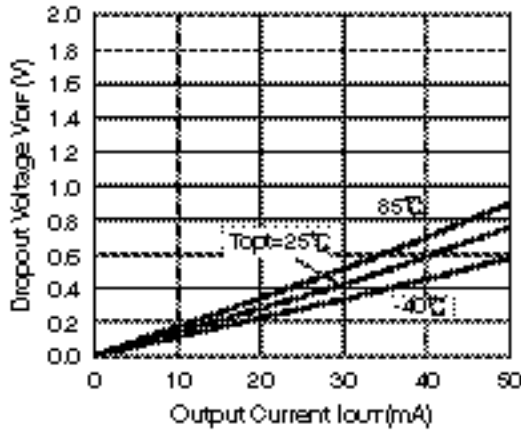
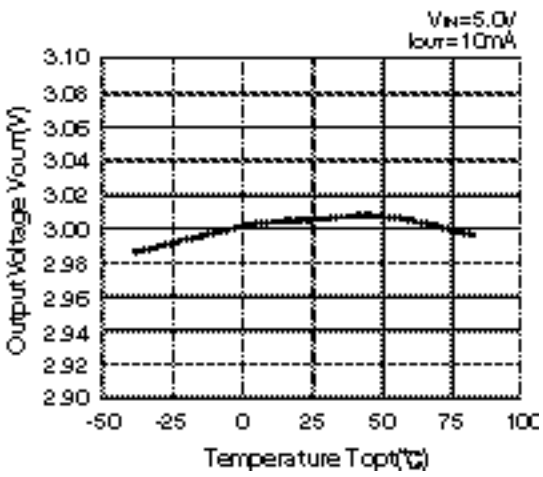


RX5RW50B



4) Output Voltage vs. Temperature

RX5RW30B



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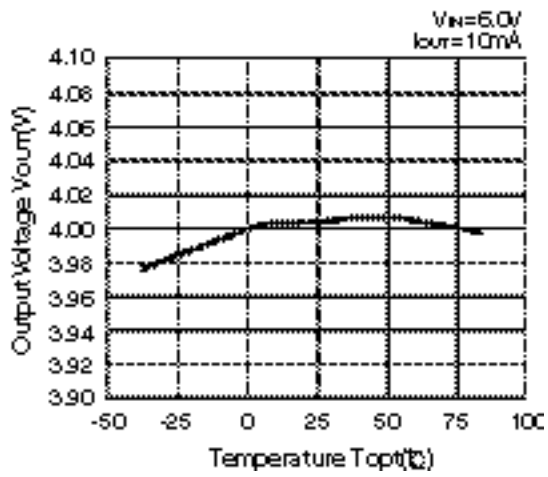
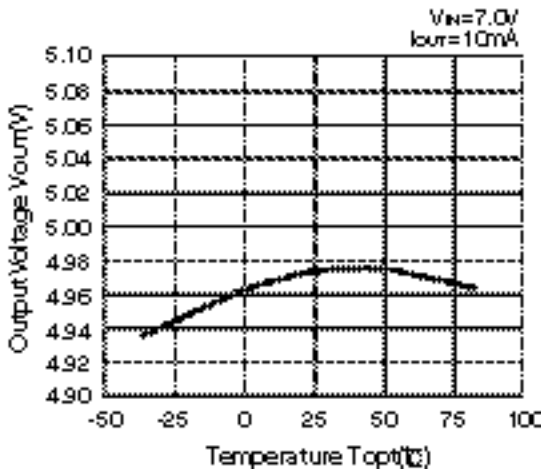
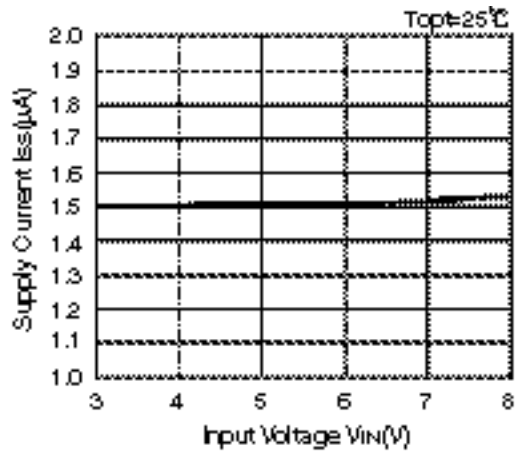


RX5RW50B



5) Supply Current vs. Input Voltage

RX5RW30B



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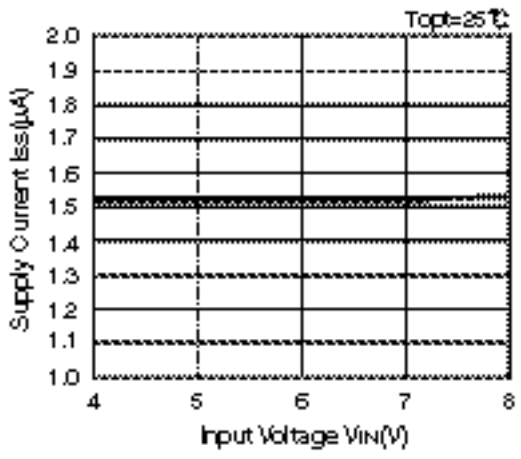

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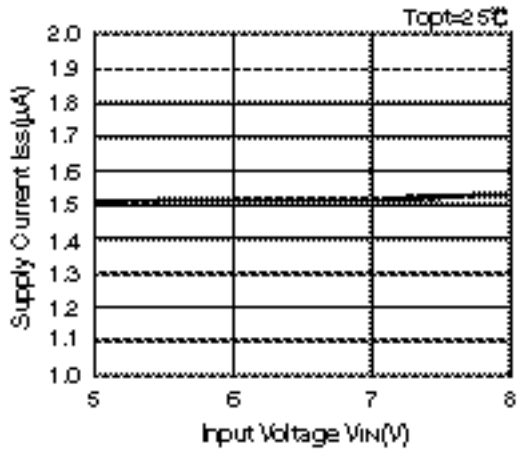
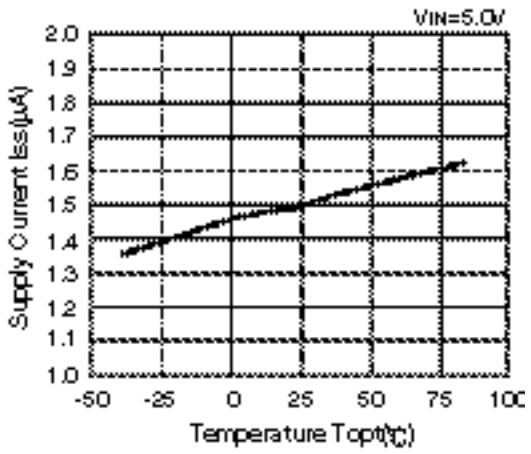


6) Supply Current vs. Temperature

RX5RW30B



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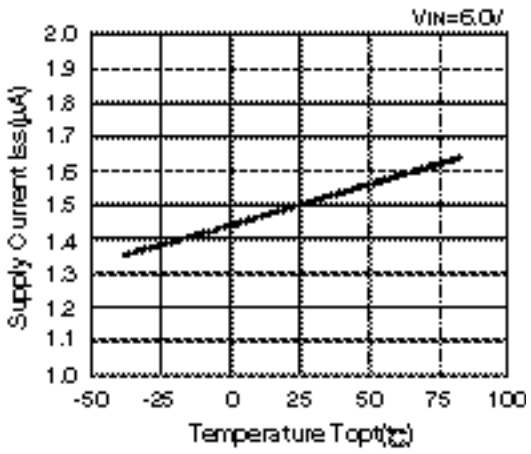

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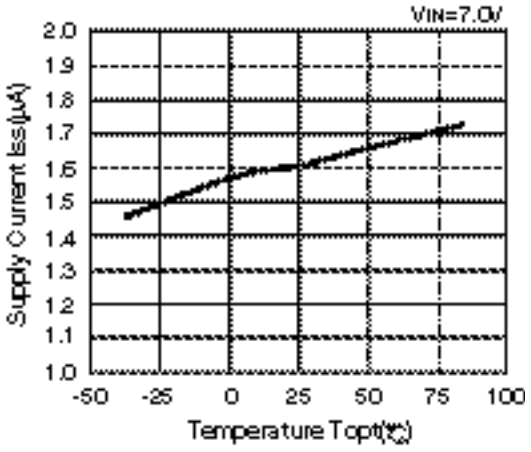
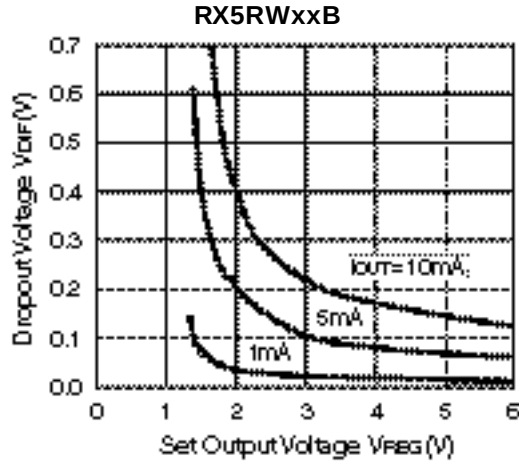


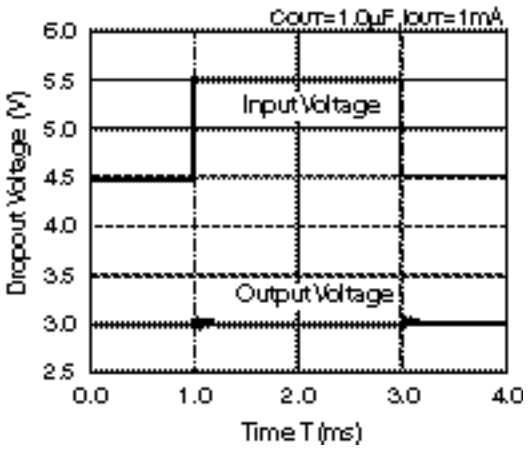
7) Dropout Voltage vs. Set Output Voltage

RX5RWxxB

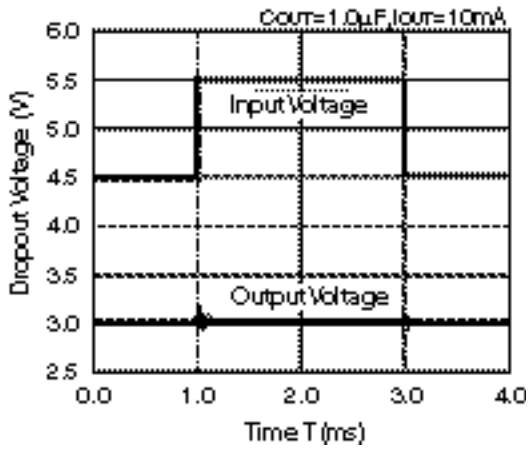


8) Line Transient Response

RX5RW30B



RX5RW30B



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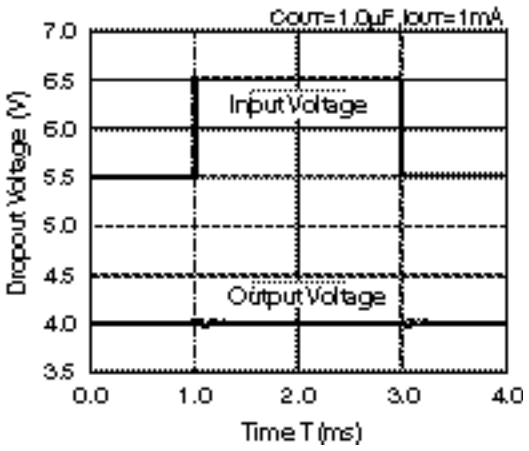

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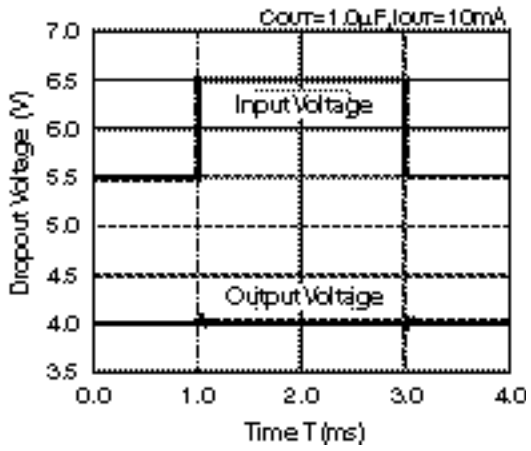

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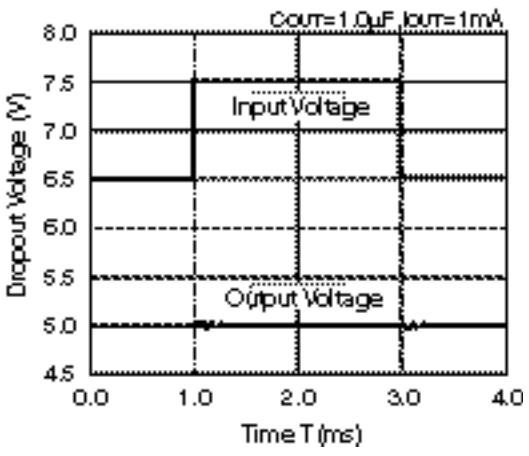

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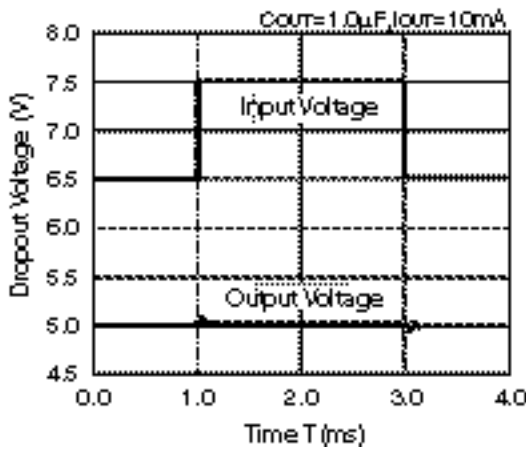
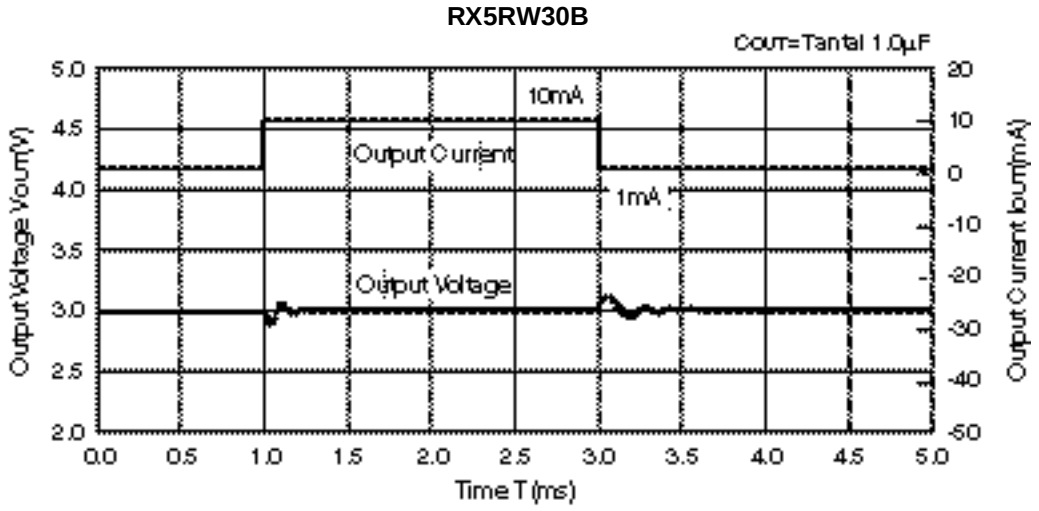


9) Load Transient Response

RX5RW30B



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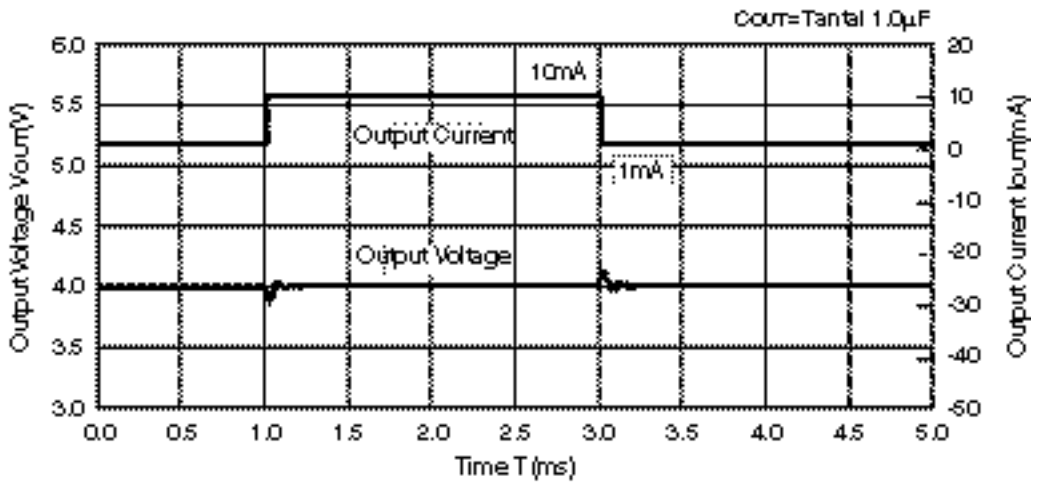

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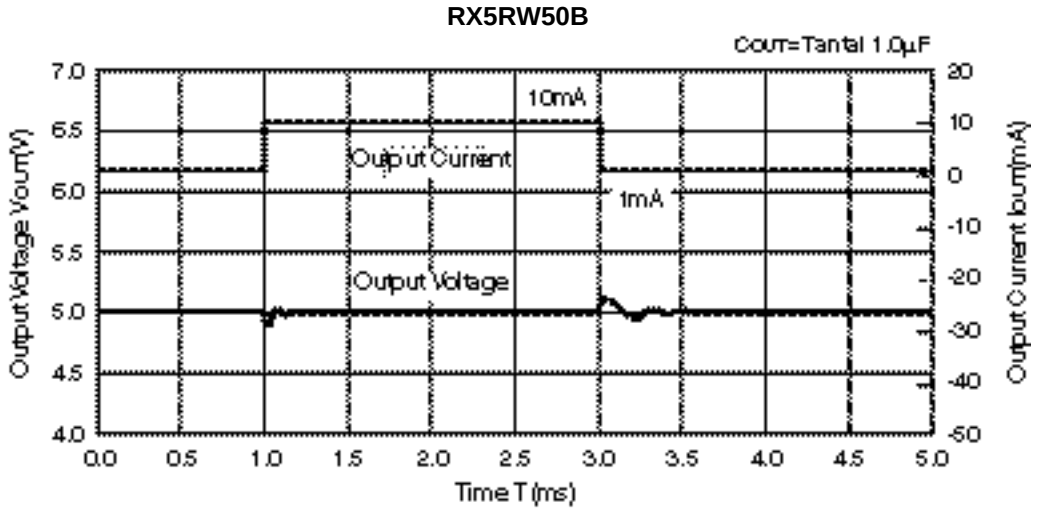
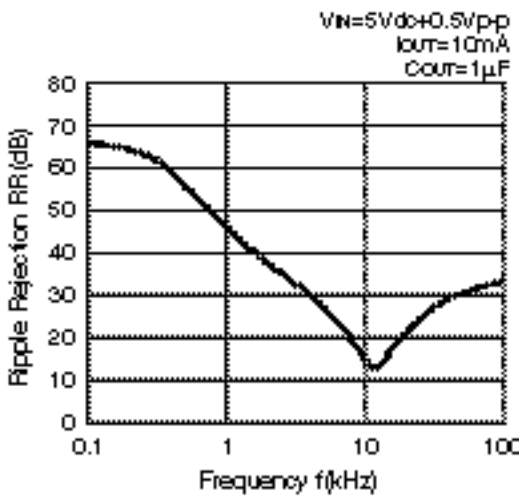


10) Ripple Rejection

RX5RW30B



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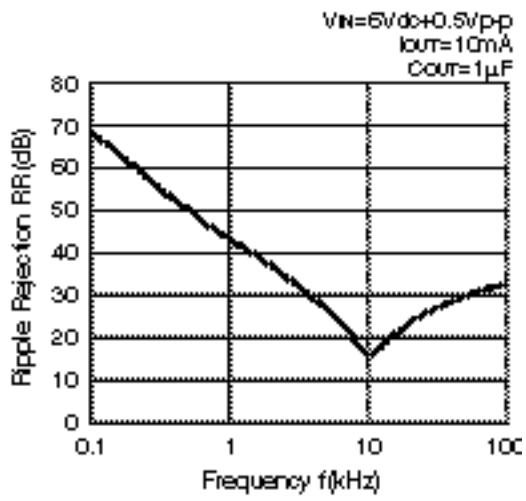

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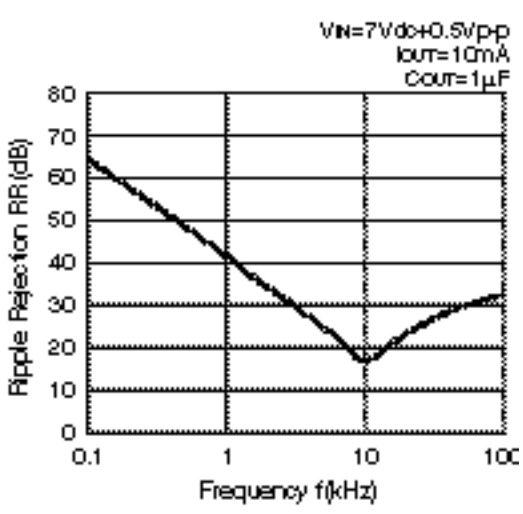
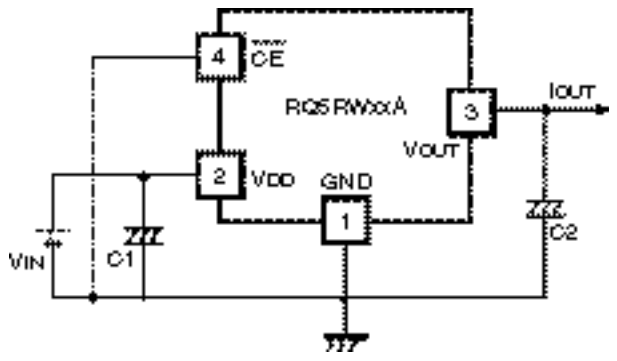
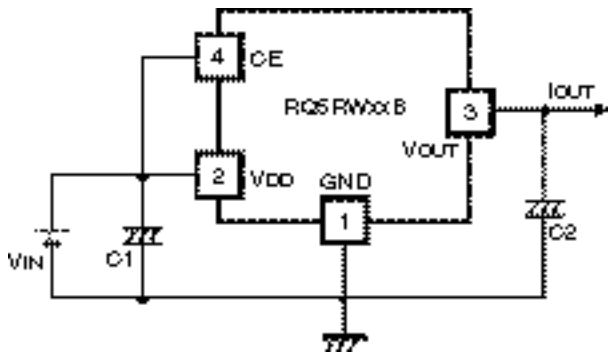
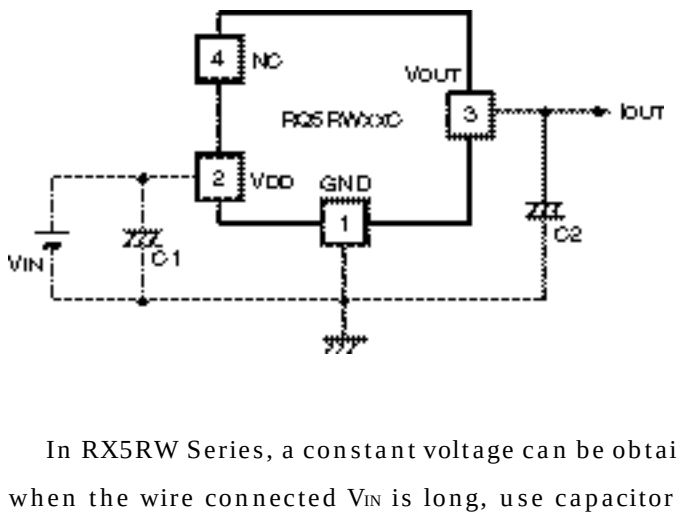


TYPICAL APPLICATION







In RX5RW Series, a constant voltage can be obtained without using capacitors, C1 and C2. However, when the wire connected V_{IN} is long, use capacitor C1. Output noise can be reduced with using capacitor 2.

Insert capacitors C1 and C2 with the capacitance of 0.1µF to 0.22µF between input/output pins and GND pin with minimum wiring.