ULTRA SMALL PACKAGE VOLTAGE REGULATOR

NO.EA-048-111020

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 and SON1612-6, high density mounting of the ICs on boards is possible.

FEATURES

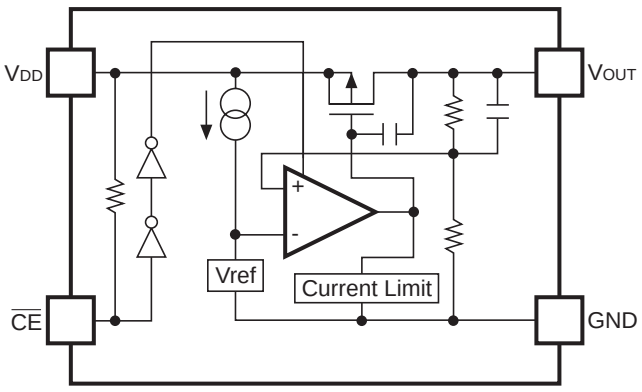
- Supply Current ..... Typ. 1.5μA
  (except pull-up/pull-down current for $\overline{CE}$ /CE pin)
- Standby Current ..... Typ. 0.1μA (applied to A/B version)
- Dropout Voltage ..... Typ. 40mV (I_{OUT}=1mA, Rx5RW30A/B/C)
- Temperature-Drift Coefficient of Output Voltage ..... Typ. ±100ppm/°C
- Line Regulation ..... Typ. 0.05%/V
- Input Voltage Range ..... Max. 8.0V
- Output Voltage Range ..... 1.5V to 6.0V (0.1V steps)
- Output Voltage Accuracy ..... ±2.0%
- Packages SC-82AB, SON1612-6
- Built-in Current Limit Circuits

APPLICATIONS

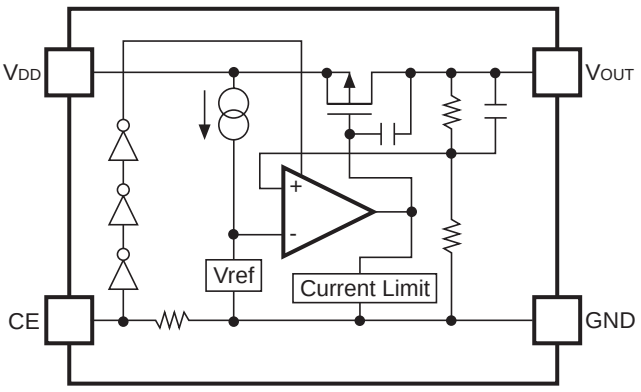
- Power source for battery-powered equipment.
- Power source for cameras, VCRs, camcorders, hand-held audio instruments and hand-held communication equipment.
- Precision voltage references.

BLOCK DIAGRAMS

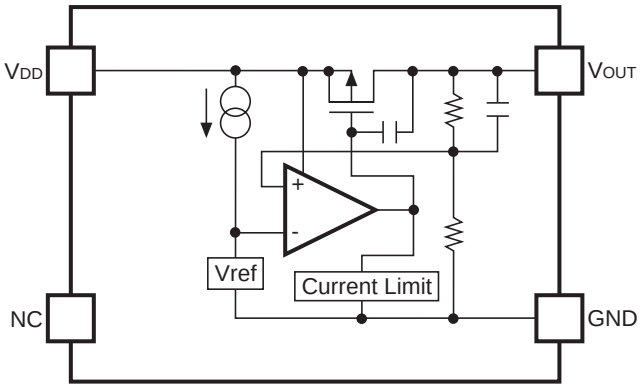
Rx5RWxxA



Rx5RWxxB



Rx5RWxxC



SELECTION GUIDE

The output voltage, chip enable polarity, and package, etc. for the ICs can be selected at the user's request.

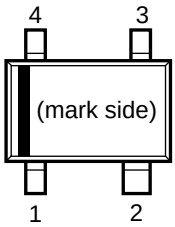
Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
RD5RWxx∗A-TR-FE	SON1612-6	4,000 pcs	Yes	Yes
RQ5RWxx∗A-TR-FE	SC-82AB	3,000 pcs	Yes	Yes

xx: The output voltage can be designated in the range from 1.5V(15) to 6.0V(60) in 0.1V steps.

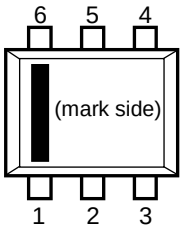
∗ : CE pin polarity are options as follows.
(A) "L" active
(B) "H" active
(C) without chip enable

PIN CONFIGURATION

● **SC-82AB**



● **SON1612-6**



PIN DESCRIPTION

● **SC-82AB**

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 ("L" active/"H" active) or No Connection

● **SON1612-6**

Pin No	Symbol	Pin Description
1	$\overline{CE}$ or CE or NC	Chip Enable Pin ("L" active/"H" active) 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	9.0	V
V_{CE}	Input Voltage for $\overline{CE}$ /CE Pin (applied to A/B version)	−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 (SC-82AB) *	380	mW
	Power Dissipation (SON1612-6) *	500	
Topt	Operating Temperature	−40 to +85	°C
Tstg	Storage Temperature	−55 to +125	°C

*) For Power Dissipation, please refer to PACKAGE INFORMATION.

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field.
The functional operation at or over these absolute maximum ratings is not assured.

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
$I_{standby}$	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	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
I_{SC}	Short Current Limit			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
$I_{standby}$	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	0.05	0.20	%/V
V_{IN}	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
I_{SC}	Short Current Limit			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**

Topt=25°C

Symbol	Item	Conditions	Min.	Tyo.	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	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
I_{SC}	Short Current Limit			40		mA

RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

ELECTRICAL CHARACTERISTICS BY OUTPUT VOLTAGE

Topt=25°C

Part Number	Output Voltage				Output Current		Load Regulation			Dropout Voltage		
	V_{OUT} (V)				I_{OUT} (mA)		$\Delta V_{OUT}/\Delta I_{OUT}$ (mV)			V_{DIF} (mV)		
	Conditions	Min.	Typ.	Max.	Conditions	Min.	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								
Rx5RW24		2.352	2.400	2.448							50	75
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		25	40
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								
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

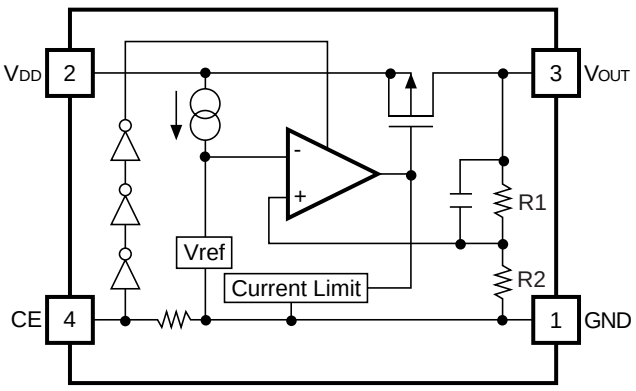
Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
I_{SS}	Supply Current	V_{IN}=Set V_{OUT}+2.0		1.5	3.0	μA
$I_{standby}$	Standby Current	V_{IN}=Set V_{OUT}+2.0V V_{CE}=V_{IN} (Rx5RWxxA), V_{CE}=GND (Rx5RWxxB)		0.1	1.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	I_{OUT}=1mA Set V_{OUT}+0.5V≤V_{IN}≤8V	0	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
I_{SC}	Short Current Limit			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

RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

OPERATION

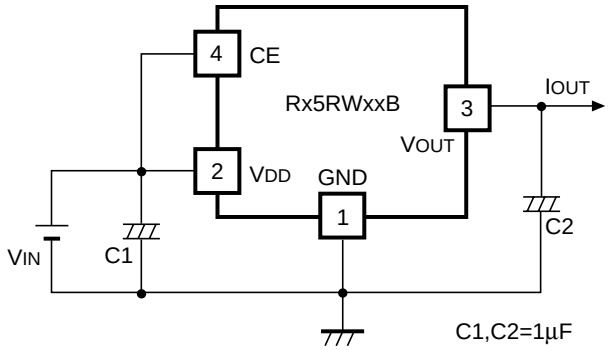
Rx5RWxxB



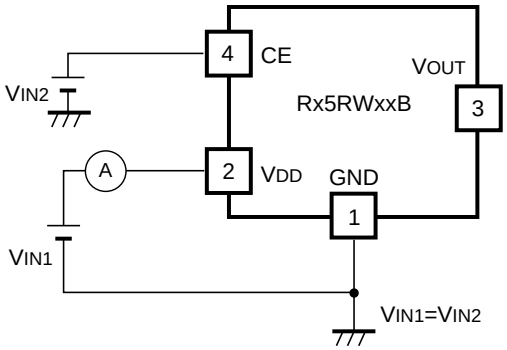
In these ICs, output voltage V_{OUT} is detected by Feedback Registers R1, R2, and the detected output voltage is compare with a reference voltage by the error amplifier, so that a constant voltage is output.

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

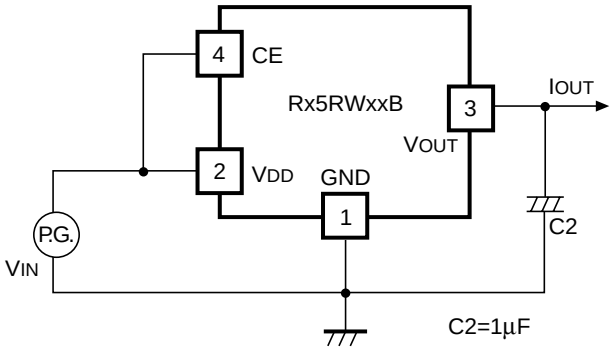
TEST CIRCUITS



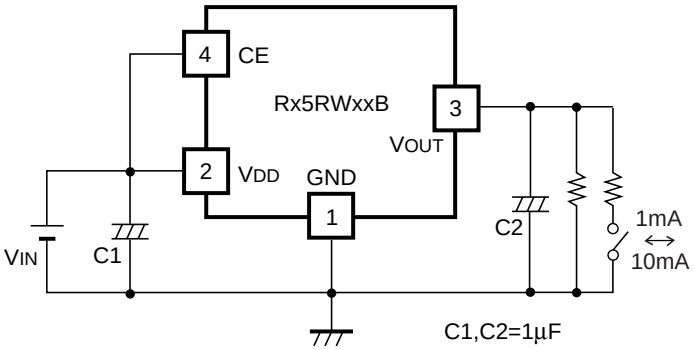
Standard Test Circuit



Supply Current Test Circuit

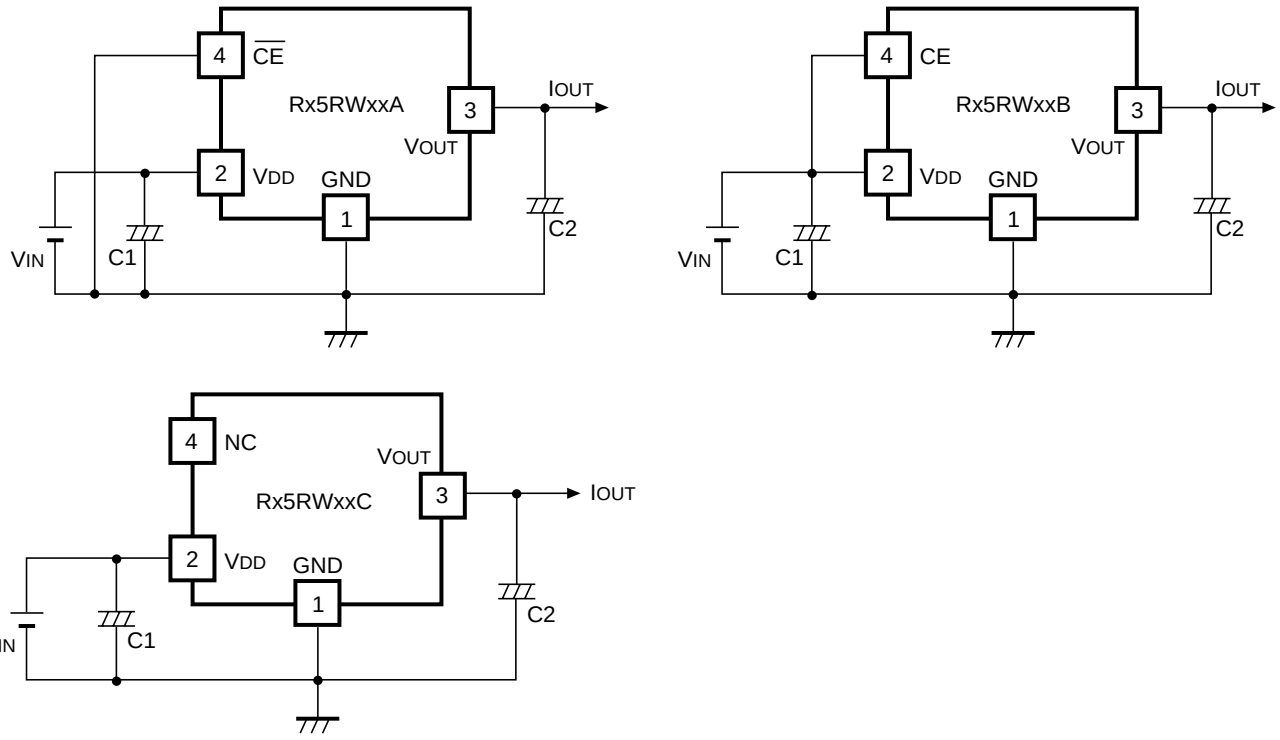


Ripple Rejection and Line Transient Response Test Circuit



Load Transient Response Test Circuit

TYPICAL APPLICATION



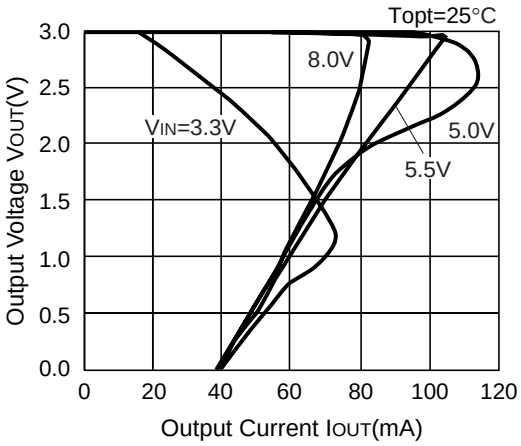
In Rx5RW Series, a constant voltage can be obtained without using capacitors, C1 and C2. However, when the wire connected V_{IN} is long, use capacitor C1. Output noise can be reduced with using capacitor 2.

Insert capacitors C1 and C2 with the capacitance of 0.1μF to 2μF between input/output pins and GND pin with minimum wiring.

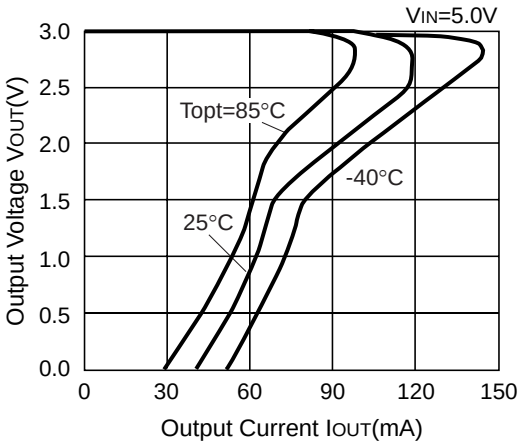
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current

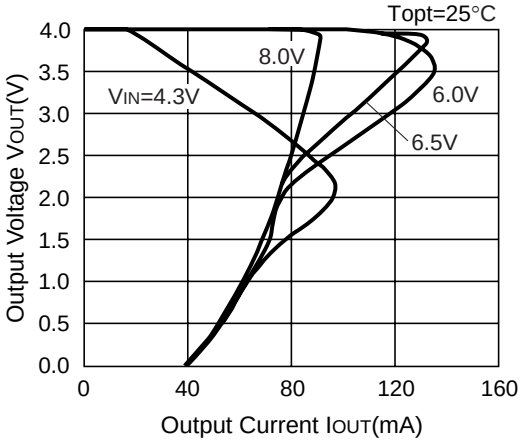
Rx5RW30B



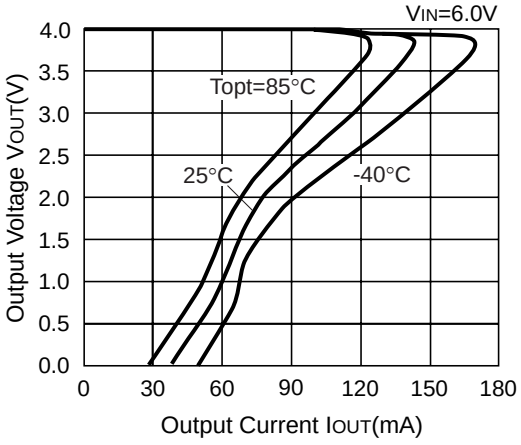
Rx5RW30B



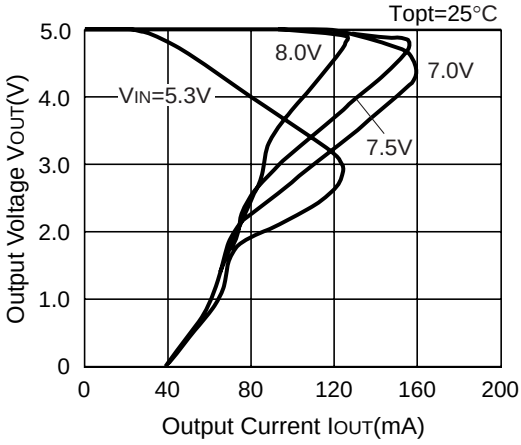
Rx5RW40B



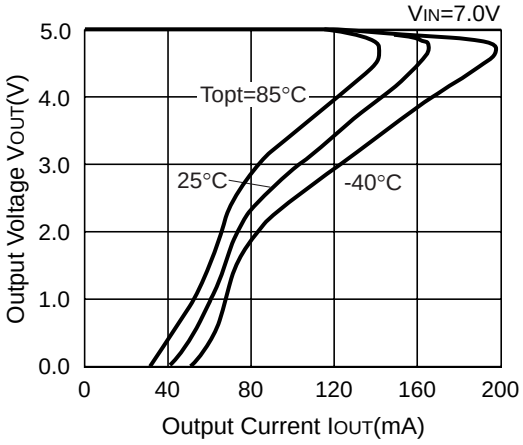
Rx5RW40B



Rx5RW50B

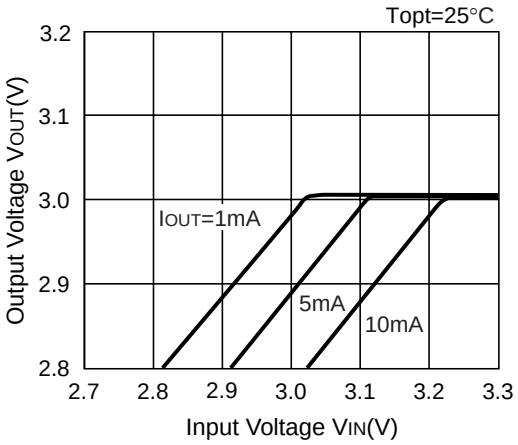


Rx5RW50B

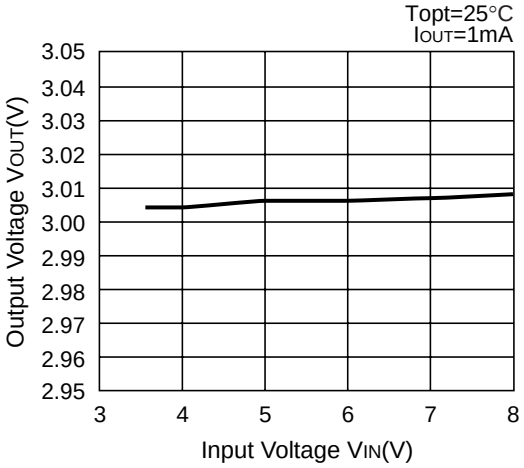


2) Output Voltage vs. Input Voltage

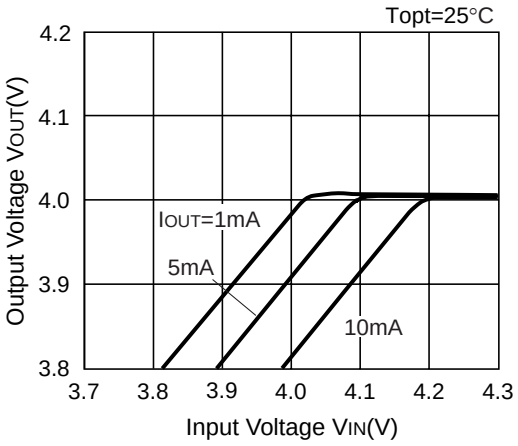
Rx5RW30B



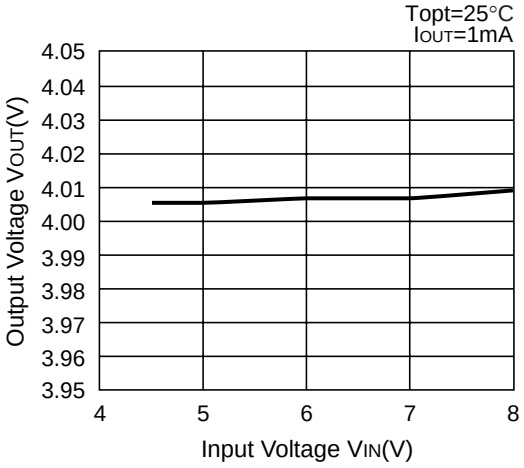
Rx5RW30B



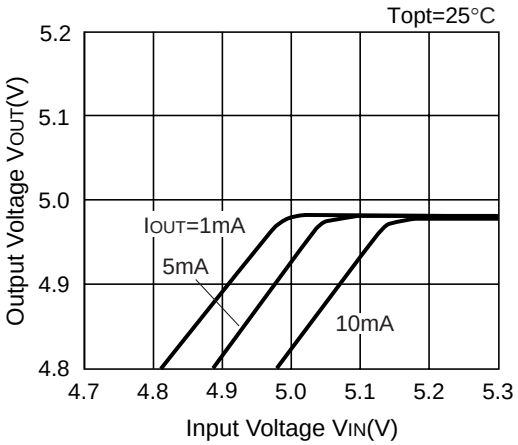
Rx5RW40B



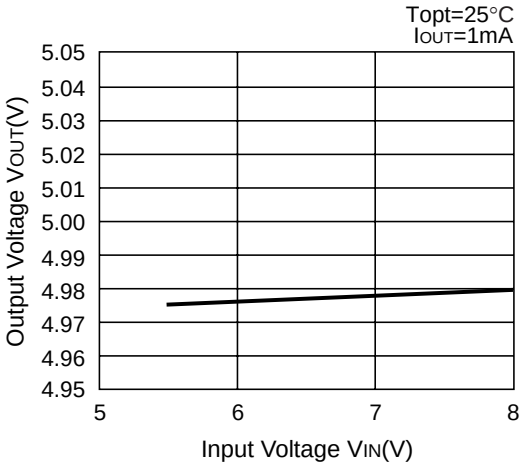
Rx5RW40B



Rx5RW50B

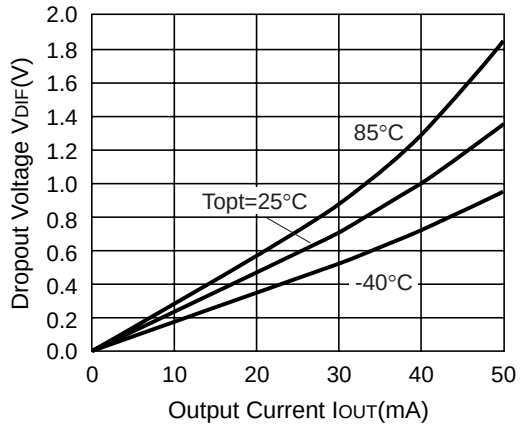


Rx5RW50B

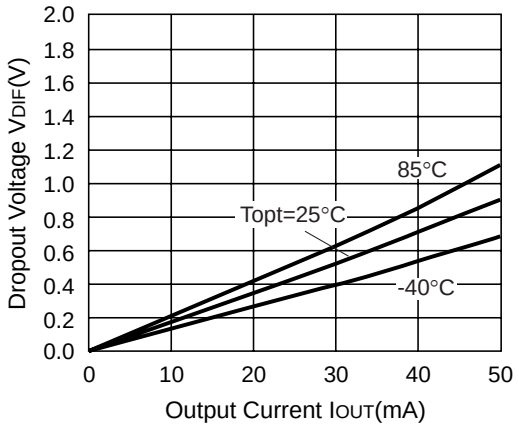


3) Dropout Voltage vs. Output Current

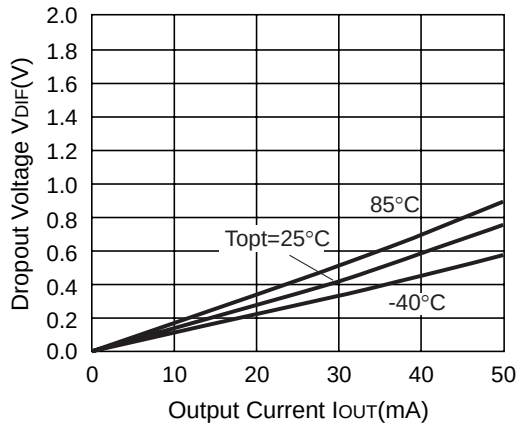
Rx5RW30B



Rx5RW40B

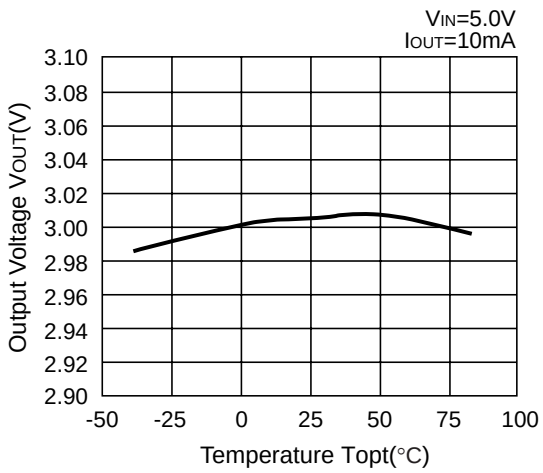


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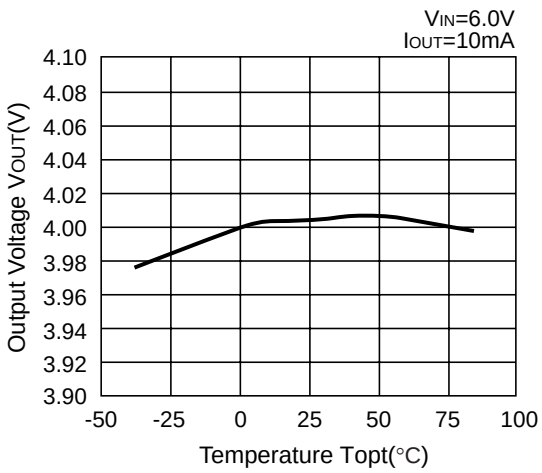


4) Output Voltage vs. Temperature

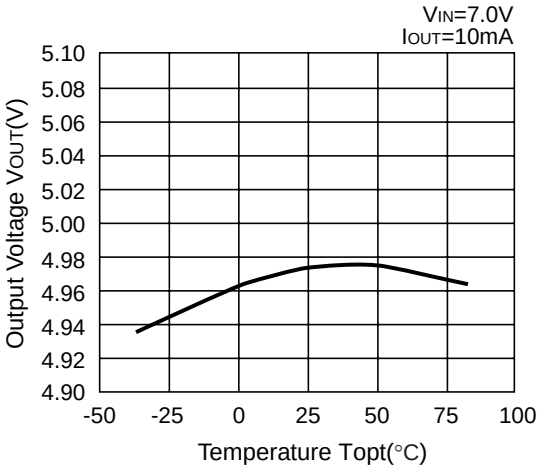
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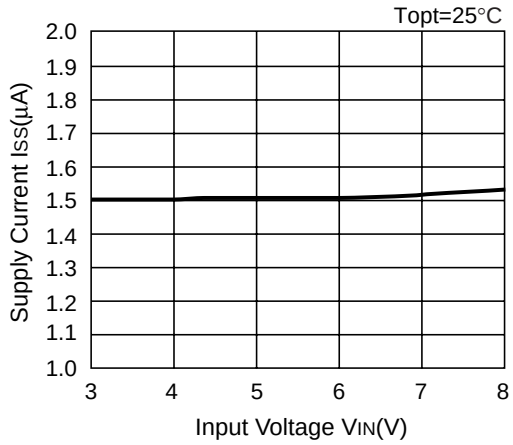


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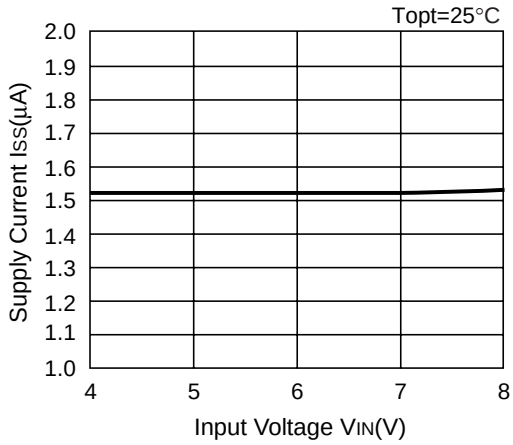


5) Supply Current vs. Input Voltage

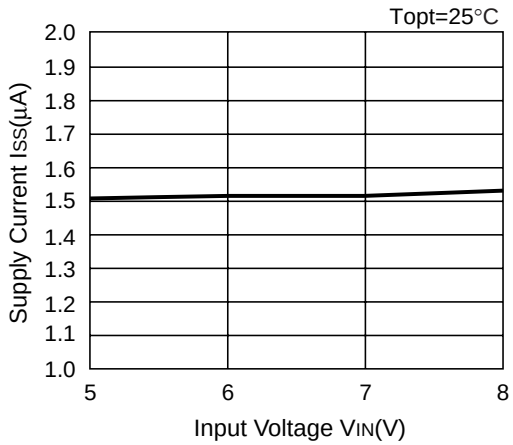
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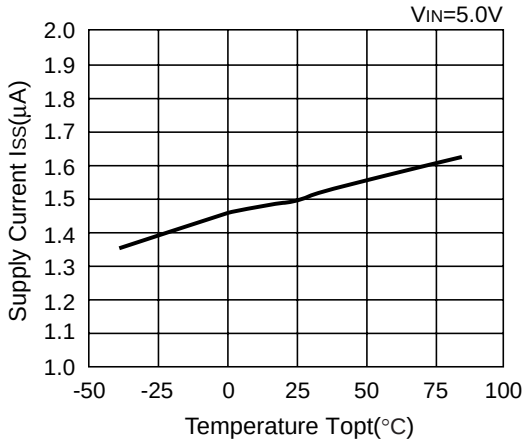


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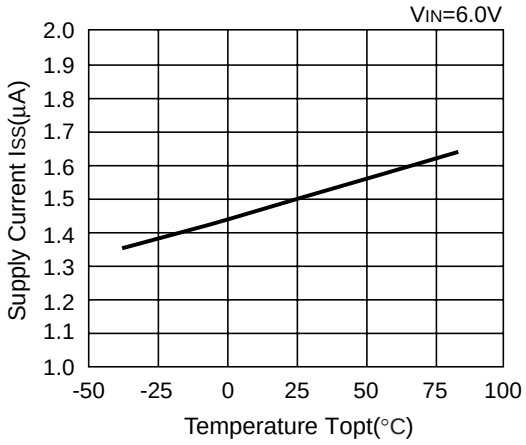


6) Supply Current vs. Temperature

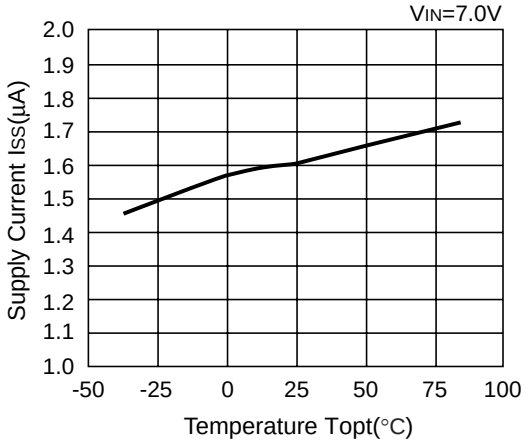
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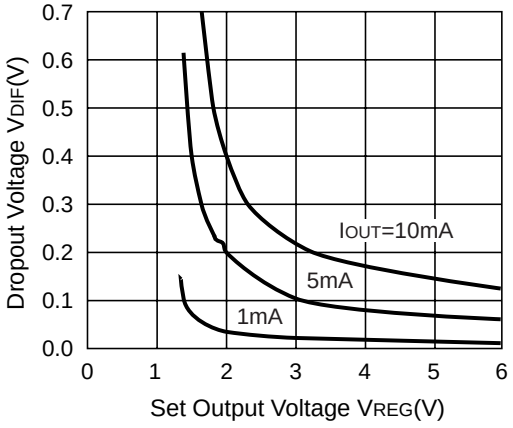


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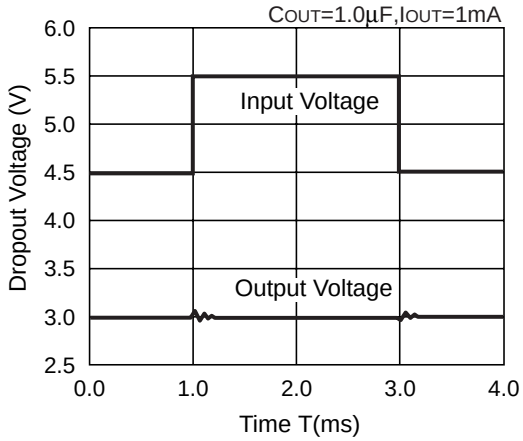
7) Dropout Voltage vs. Set Output Voltage

Rx5RWxxB

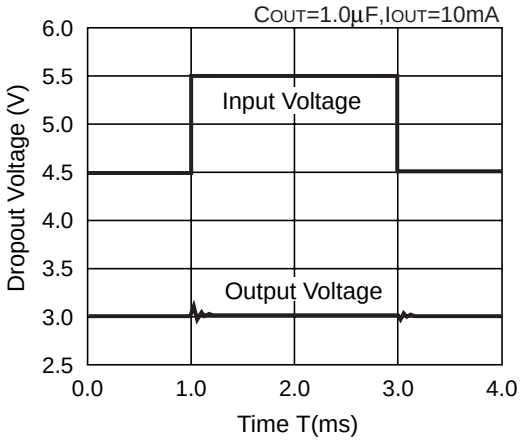


8) Line Transient Response

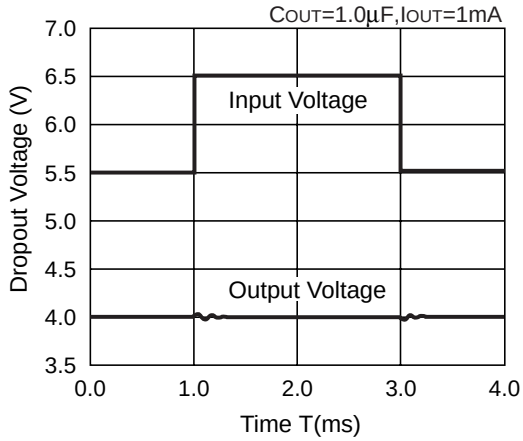
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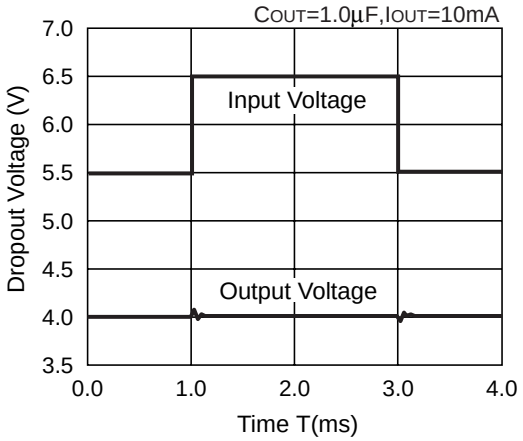
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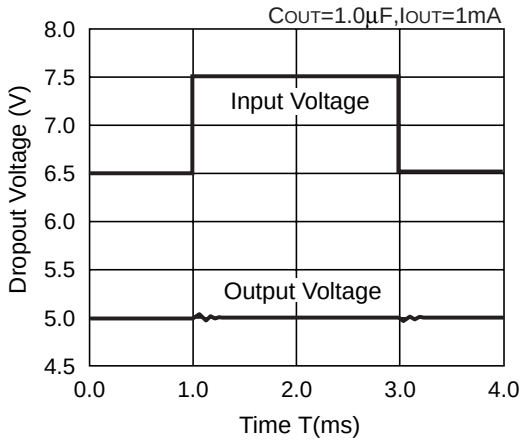
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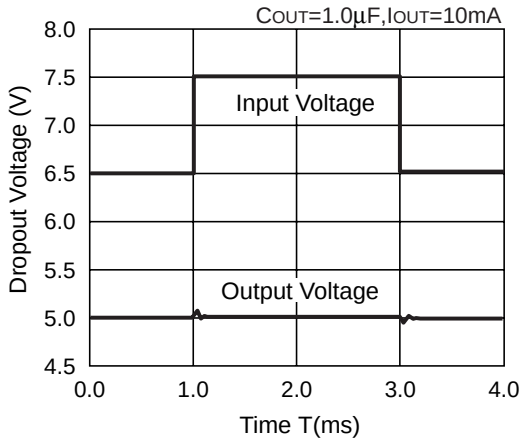
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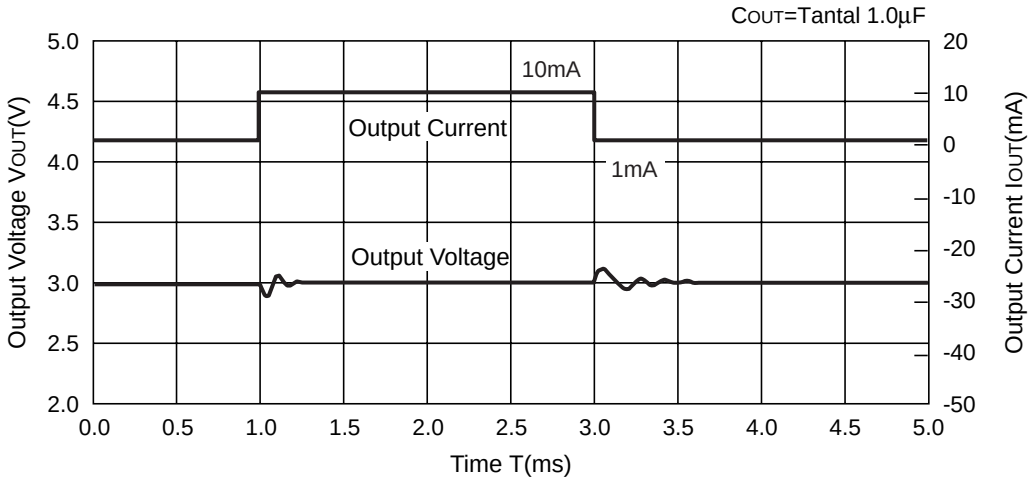


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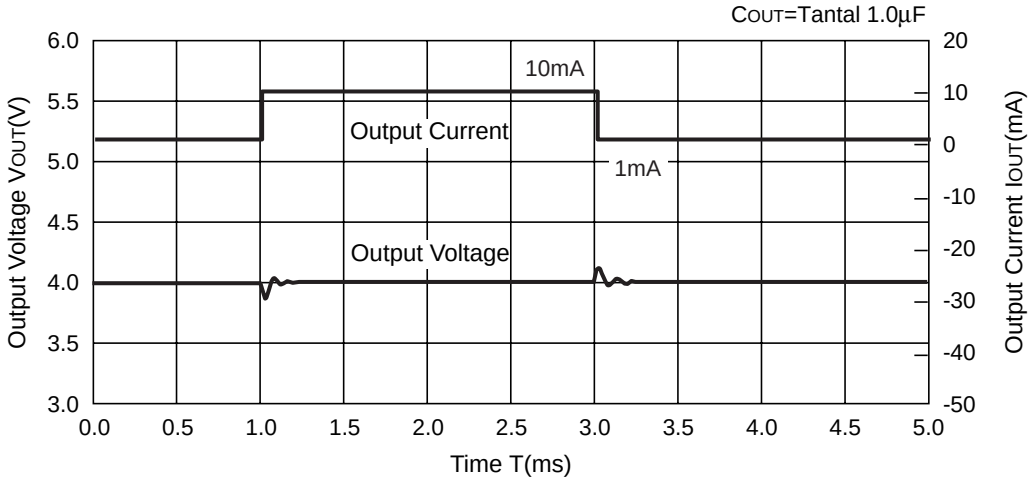


9) Load Transient Response

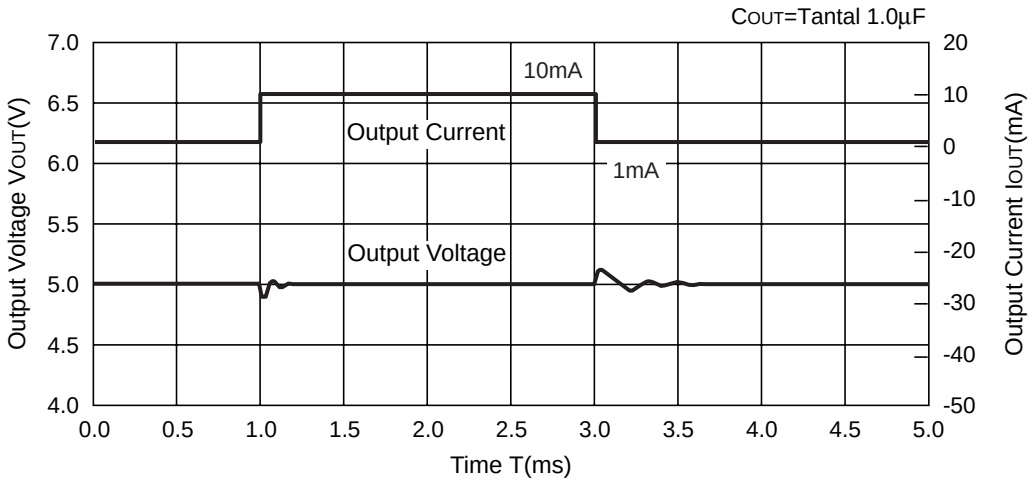
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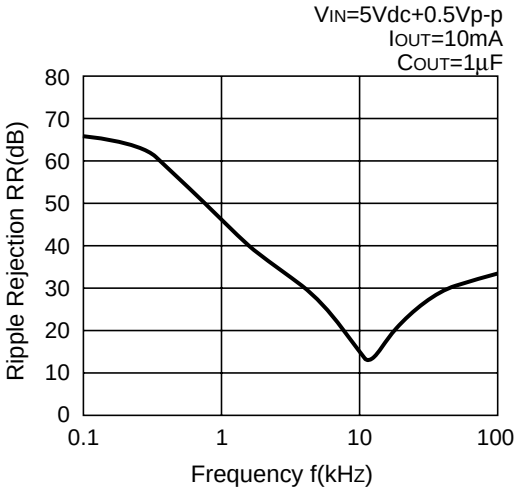


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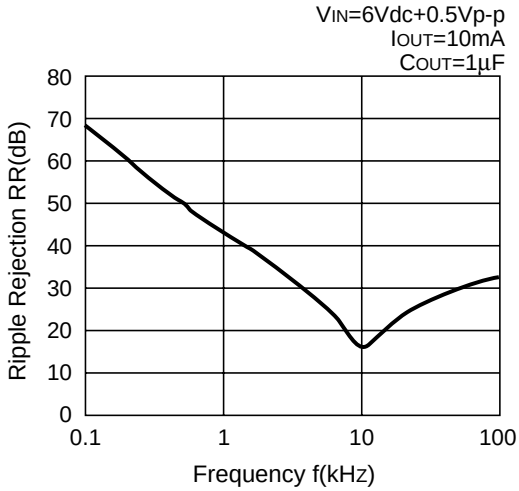


10) Ripple Rejection

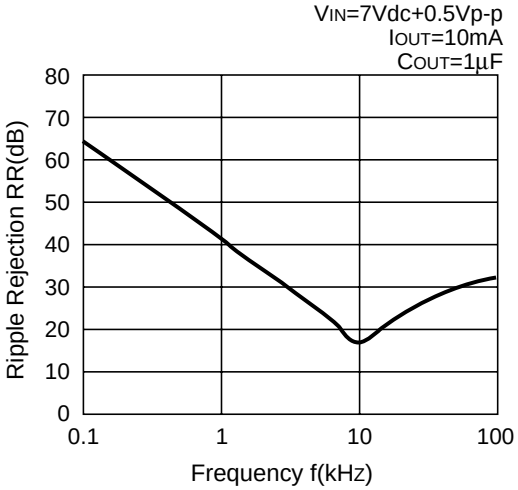
Rx5RW30B



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9. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
10. There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or our distributor before attempting to use AOI.
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