

RICOH

R1161x SERIES

3-MODE 300mA LDO REGULATOR

NO.EA-106-140530

OUTLINE

The R1161x Series are CMOS-based voltage regulator ICs with high output voltage accuracy, low supply current, and low ON-resistance. Each of these voltage regulator ICs consists of a voltage reference unit, an error amplifier, resistors for setting output voltage, a current limit circuit, and a chip enable circuit.

These ICs perform with low dropout voltage and a chip enable function. To prevent the destruction by over current, current limit circuit is included. The R1161x Series have 3-mode. One is standby mode with CE or standby control pin. Standby mode realizes ultra small consumption current off mode. Other two modes are realized with ECO pin. Fast Transient Mode (FT mode) and Low Power Mode (LP mode) are alternative with ECO pin. Consumption current is reduced at Low Power Mode compared with Fast Transient Mode. Output voltage is maintained between FT mode and LP mode.

The output voltage of these ICs is internally fixed with high accuracy. Since the packages for these ICs are SOT-23-5, SON-6, and HSON-6, high density mounting of the ICs on boards is possible.

FEATURES

- Supply Current Typ. 3.5 μ A (Low Power Mode, $V_{OUT}<1.6V$),
Typ. 80 μ A (Fast Transient Mode, $V_{OUT}<1.8V$)
Typ. 60 μ A (Fast Transient Mode, $V_{OUT} \geq 1.8V$)
- Standby Mode Typ. 0.1 μ A
- Dropout Voltage Typ. 0.48V ($I_{OUT}=300mA$ Output Voltage=1.0V Type)
Typ. 0.31V ($I_{OUT}=300mA$ Output Voltage=1.5V Type)
Typ. 0.23V ($I_{OUT}=300mA$ Output Voltage=3.0V Type)
- Ripple Rejection Typ. 65dB ($f=1kHz$, FT Mode)
- Temperature-Drift Coefficient of Output Voltage Typ. $\pm 100ppm/^{\circ}C$
- Line Regulation Typ. 0.01%/V (at Fast Transient Mode)
- Output Voltage Accuracy $\pm 2.0\%$ ($\pm 3.0\%$ at LP Mode)
- Packages SOT-23-5, SON-6,
HSON-6
- Output Voltage 0.8V to 3.3V (0.1V steps)
(For other voltages, please refer to MARK INFORMATIONS.)
- Input Voltage Min. 1.40V ($V_{OUT} \geq 1.0V$)
Min. 1.45V ($V_{OUT}<1.0V$)
- Built-in fold-back protection circuit Typ. 50mA (Current at short mode)
- External Capacitors $C_{IN} = C_{OUT} =$ Tantalum 1.0 μ F ($V_{OUT}<1.0V$)
 $C_{IN} = C_{OUT} =$ Ceramic 1.0 μ F ($V_{OUT} \geq 1.0V$)

APPLICATIONS

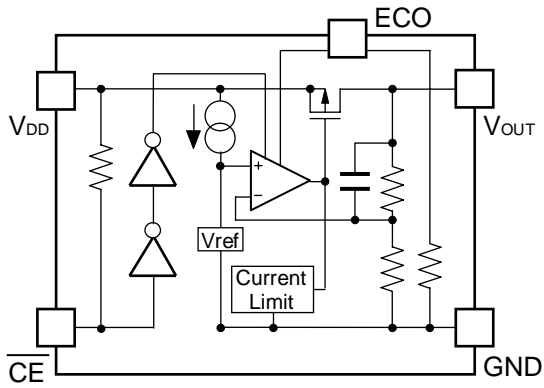
- Precision Voltage References.
- Power source for electrical appliances such as cameras, VCRs and hand-held communication equipment.
- Power source for battery-powered equipment.

* R1116Dxx1 (SON-6) is the limited product and R1116Dxx2 (HSON-6) is the discontinued product. As of March in 2015.

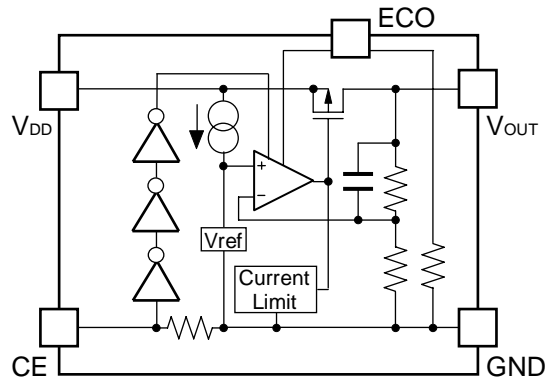
R1161x

BLOCK DIAGRAM

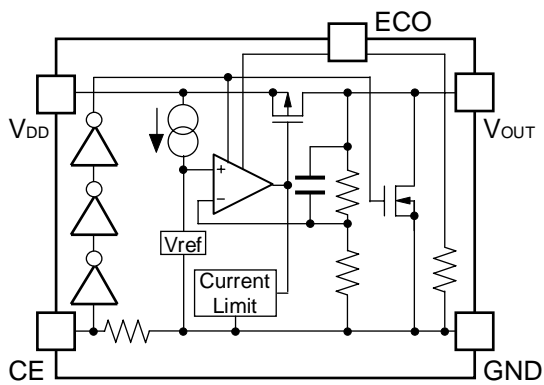
R1161xxxxA



R1161xxxxB



R1161xxxxD



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R1161x

SELECTION GUIDE

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

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R1161Nxx1*-TR-FE	SOT-23-5	3,000 pcs	Yes	Yes
R1161Dxx1*-TR-FE	SON-6	3,000 pcs	Yes	Yes
R1161Dxx2*-TR-FE	HSON-6	3,000 pcs	Yes	Yes

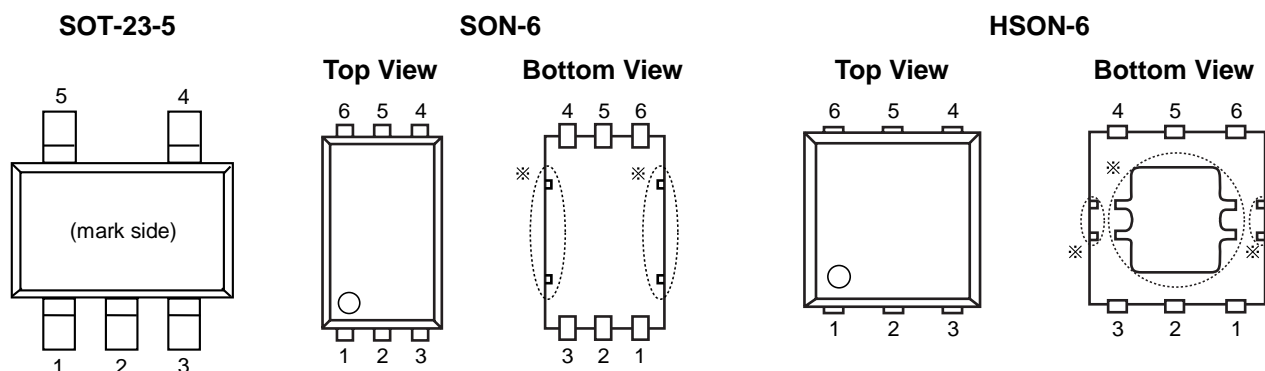
xx: The output voltage can be designated in the range from 0.8V(08) to 3.3V(33) in 0.1V steps.
(For other voltages, please refer to MARK INFORMATIONS.)

* : CE pin polarity and auto discharge function at off state are options as follows.

- (A) "L" active type, without auto discharge function at off state
- (B) "H" active type, without auto discharge function at off state
- (D) "H" active type, with auto discharge function at off state

R1161x

PIN CONFIGURATIONS



PIN DESCRIPTIONS

• SOT-23-5

Pin No.	Symbol	Description
1	V_{DD}	Input Pin
2	GND	Ground Pin
3	\overline{CE} or CE	Chip Enable Pin
4	ECO	MODE alternative pin
5	V_{OUT}	Output pin

• SON-6, HSON-6

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

*) Tab and tab suspension leads are GND level. (They are connected to the reverse side of the IC.)

The tab is better to be connected to the GND, but leaving it open is also acceptable.

The tab suspension leads should be open and do not connect to other wires or land patterns.

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R1161x

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V _{IN}	Input Voltage	6.5	V
V _{ECO}	Input Voltage (ECO Pin)	-0.3 ~ 6.5	V
V _{CE}	Input Voltage (\overline{CE} /CE Pin)	-0.3 ~ 6.5	V
V _{OUT}	Output Voltage	-0.3 ~ V _{IN} +0.3	V
I _{OUT}	Output Current	350	mA
P _D	Power Dissipation (SOT23-5)*	420	mW
P _D	Power Dissipation (SON-6) *	500	
P _D	Power Dissipation (HSON-6) *	900	
T _{opt}	Operating Temperature Range	-40 ~ 85	°C
T _{stg}	Storage Temperature Range	-55 ~ 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.

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.

R1161x

ELECTRICAL CHARACTERISTICS

• R1161xxxxA

T_{opt}=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V _{OUT}	Output Voltage (FT Mode)	V _{IN} =Set V _{OUT} +1V, V _{ECO} =V _{IN} 1μA ≤ I _{OUT} ≤ 30mA ^{Note 1}	×0.98 (-30mV)		×1.02 (30mV)	V
	Output Voltage (LP Mode)	V _{IN} =Set V _{OUT} +1V, V _{ECO} =GND 1μA ≤ I _{OUT} ≤ 30mA ^{Note 2}	×0.97 (-45mV)		×1.03 (45mV)	V
I _{OUT}	Output Current	V _{IN} -V _{OUT} =1.0V	300			mA
ΔV _{OUT} / ΔI _{OUT}	Load Regulation (FT Mode)	V _{IN} =Set V _{OUT} +1V, V _{ECO} =V _{IN} 1mA ≤ I _{OUT} ≤ 300mA		40	70	mV
ΔV _{OUT} / ΔI _{OUT}	Load Regulation (LP Mode)	V _{IN} =Set V _{OUT} +1V, V _{ECO} =GND 1mA ≤ I _{OUT} ≤ 100mA		15	30	mV
V _{DIF}	Dropout Voltage	Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE				
I _{SS1}	Supply Current (FT Mode)	V _{IN} =Set V _{OUT} +1V V _{ECO} =V _{IN} , V _{OUT} <1.8V		80	111	μA
		V _{IN} =Set V _{OUT} +1V V _{ECO} =V _{IN} , V _{OUT} ≥ 1.8V		60	90	μA
I _{SS2}	Supply Current (LP Mode)	V _{IN} =Set V _{OUT} +1V, V _{OUT} <1.6V, V _{ECO} =GND		3.5	8.0	μA
		V _{IN} =Set V _{OUT} +1V V _{OUT} ≥ 1.6V, V _{ECO} =GND		4.5	9.0	μA
I _{standby}	Supply Current (Standby)	V _{IN} =V _{CE} =Set V _{OUT} +1V, V _{ECO} =GND or V _{IN}		0.1	1.0	μA
ΔV _{OUT} / ΔV _{IN}	Line Regulation (FT Mode)	Set V _{OUT} +0.5V ≤ V _{IN} ≤ 6.0V I _{OUT} =30mA, V _{ECO} =V _{IN} Set V _{OUT} ≤ 0.9V: 1.4V ≤ V _{IN} ≤ 6.0V		0.01	0.15	%/V
ΔV _{OUT} / ΔV _{IN}	Line Regulation (LP Mode)	Set V _{OUT} +0.5V ≤ V _{IN} ≤ 6.0V I _{OUT} =30mA, V _{ECO} =GND Set V _{OUT} ≤ 0.9V: 1.4V ≤ V _{IN} ≤ 6.0V		0.05	0.20	%/V
RR	Ripple Rejection (FT Mode)	f = 1kHz, Ripple 0.2Vp-p V _{IN} =Set V _{OUT} +1V I _{OUT} =30mA, V _{ECO} =V _{IN}		65		dB
V _{IN}	Input Voltage		1.4		6.0	V
ΔV _{OUT} / ΔT _{opt}	Output Voltage Temperature Coefficient	I _{OUT} =30mA -40°C ≤ T _{opt} ≤ 85°C		±100		ppm /°C
I _{lim}	Short Current Limit	V _{OUT} =0V		50		mA
R _{PU}	\overline{CE} Pull-up Resistance		1.87	5.00	12.00	MΩ
R _{PD}	ECO Pull-down Resistance		1.87	5.00	12.00	MΩ
V _{CEH}	\overline{CE} , ECO Input Voltage "H"		1.0		6.0	V
V _{CEL}	\overline{CE} , ECO Input Voltage "L"		0.0		0.3	V
V _{EN}	Output Noise	BW=10Hz to 100kHz		30		μVrms

Note1: ±30mV tolerance for V_{OUT} ≤ 1.5V.

Note2: ±45mV tolerance for V_{OUT} ≤ 1.5V.

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R1161x

● R1161xxxxB/D

T_{opt}=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V _{OUT}	Output Voltage (FT Mode)	V _{IN} =Set V _{OUT} +1V, V _{ECO} =V _{IN} 1μA ≤ I _{OUT} ≤ 30mA ^{Note 1}	×0.98 (-30mV)		×1.02 (30mV)	V
	Output Voltage (LP Mode)	V _{IN} =Set V _{OUT} +1V, V _{ECO} =GND 1μA ≤ I _{OUT} ≤ 30mA ^{Note 2}	×0.97 (-45mV)		×1.03 (45mV)	V
I _{OUT}	Output Current	V _{IN} -V _{OUT} =1.0V	300			mA
ΔV _{OUT} / ΔI _{OUT}	Load Regulation (FT Mode)	V _{IN} =Set V _{OUT} +1V, V _{ECO} =V _{IN} 1mA ≤ I _{OUT} ≤ 300mA		40	70	mV
ΔV _{OUT} / ΔI _{OUT}	Load Regulation (LP Mode)	V _{IN} =Set V _{OUT} +1V, V _{ECO} =GND 1mA ≤ I _{OUT} ≤ 100mA		15	30	mV
V _{DIF}	Dropout Voltage	Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE				
I _{SS1}	Supply Current (FT Mode)	V _{IN} =Set V _{OUT} +1V V _{ECO} =V _{IN} , V _{OUT} <1.8V		80	111	μA
		V _{IN} =Set V _{OUT} +1V V _{ECO} =V _{IN} , V _{OUT} ≥ 1.8V		60	90	μA
I _{SS2}	Supply Current (LP Mode)	V _{IN} =Set V _{OUT} +1V, V _{OUT} <1.6V, V _{ECO} =GND		3.5	8.0	μA
		V _{IN} =Set V _{OUT} +1V, V _{OUT} ≥ 1.6V, V _{ECO} =GND		4.5	9.0	μA
I _{standby}	Supply Current (Standby)	V _{IN} =Set V _{OUT} +1V, V _{CE} =GND, V _{ECO} =GND or V _{IN}		0.1	1.0	μA
ΔV _{OUT} / ΔV _{IN}	Line Regulation (FT Mode)	Set V _{OUT} +0.5V ≤ V _{IN} ≤ 6.0V I _{OUT} =30mA, V _{ECO} =V _{IN} Set V _{OUT} ≤ 0.9V: 1.4V ≤ V _{IN} ≤ 6.0V		0.01	0.15	%/V
ΔV _{OUT} / ΔV _{IN}	Line Regulation (LP Mode)	Set V _{OUT} +0.5V ≤ V _{IN} ≤ 6.0V I _{OUT} =30mA, V _{ECO} =GND Set V _{OUT} ≤ 0.9V: 1.4V ≤ V _{IN} ≤ 6.0V		0.05	0.20	%/V
RR	Ripple Rejection (FT Mode)	f=1kHz, Ripple 0.2Vp-p V _{IN} =Set V _{OUT} +1V I _{OUT} =30mA, V _{ECO} =V _{IN}		65		dB
V _{IN}	Input Voltage		1.4		6.0	V
ΔV _{OUT} / ΔT _{opt}	Output Voltage Temperature Coefficient	I _{OUT} =30mA -40°C ≤ T _{opt} ≤ 85°C		±100		ppm /°C
I _{lim}	Short Current Limit	V _{OUT} =0V		50		mA
R _{PDC}	CE Pull-down Resistance		1.87	5.00	12.00	MΩ
R _{PDE}	ECO Pull-down Resistance		1.87	5.00	12.00	MΩ
V _{CEH}	CE, ECO Input Voltage "H"		1.0		6.0	V
V _{CEL}	CE, ECO Input Voltage "L"		0.0		0.3	V
V _{EN}	Output Noise	BW=10Hz to 100kHz		30		μV _{rms}
R _{LOW}	Nch On Resistance for auto discharge (applied to D version only)	V _{CE} =0V		60		Ω

Note1: ±30mV tolerance for V_{OUT} ≤ 1.5V.

Note2: ±45mV tolerance for V_{OUT} ≤ 1.5V.

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R1161x

ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE

$T_{opt}=25^{\circ}\text{C}$

Output Voltage V_{OUT} (V)	Dropout Voltage V_{DIF} (V)				
	Condition	V_{DIF} (ECO=H)		V_{DIF} (ECO=L)	
		Typ.	Max.	Typ.	Max.
$0.8=V_{OUT}$	$I_{OUT}=300\text{mA}$	0.620	0.850	0.670	0.900
$0.9=V_{OUT}$		0.550	0.780	0.590	0.800
$1.0 \leq V_{OUT} < 1.5$		0.480	0.700	0.510	0.750
$1.5 \leq V_{OUT} < 2.6$		0.310	0.450	0.320	0.480
$2.6 \leq V_{OUT} \leq 3.3$		0.230	0.350	0.240	0.375

TEST CIRCUITS

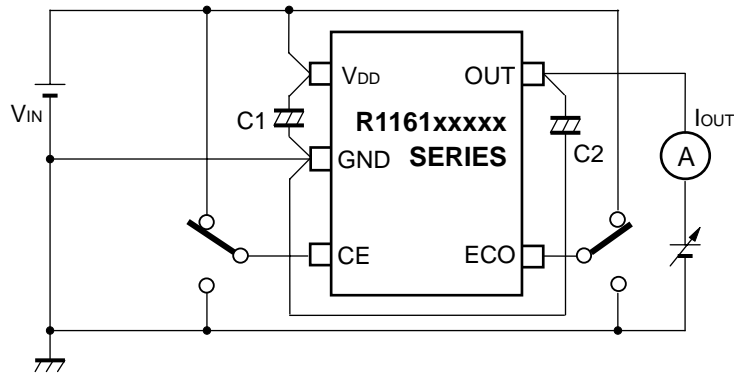


Fig.1 Output Voltage vs. Output Current Test Circuit

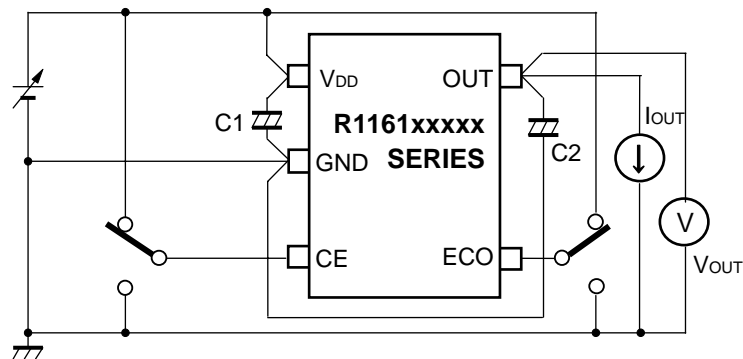


Fig.2 Output Voltage vs. Input Voltage Test Circuit

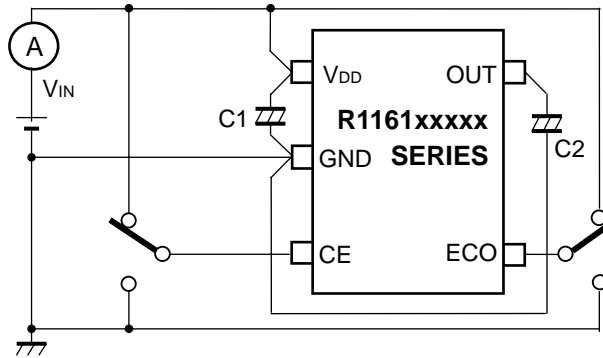


Fig.3 Supply Current vs. Input Voltage Test Circuit

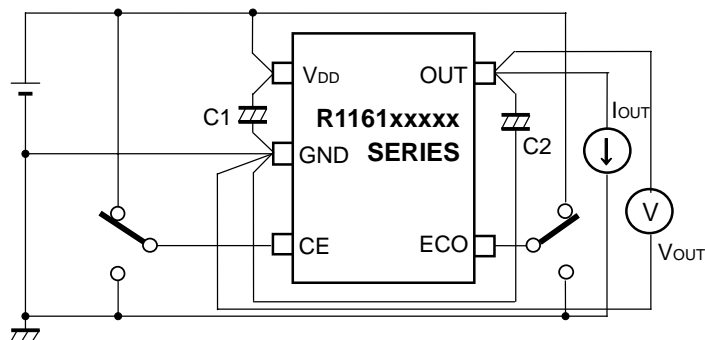


Fig.4 Output Voltage vs. Temperature Test Circuit

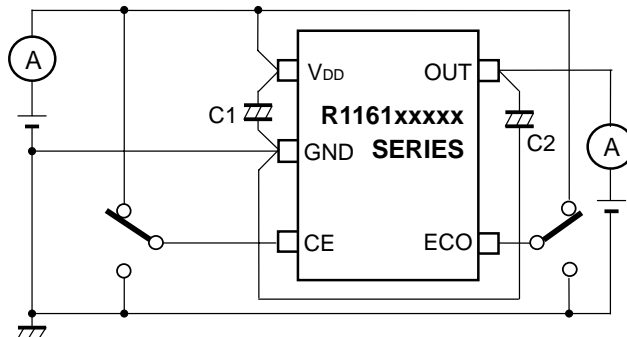


Fig.5 Supply Current vs. Temperature Test Circuit

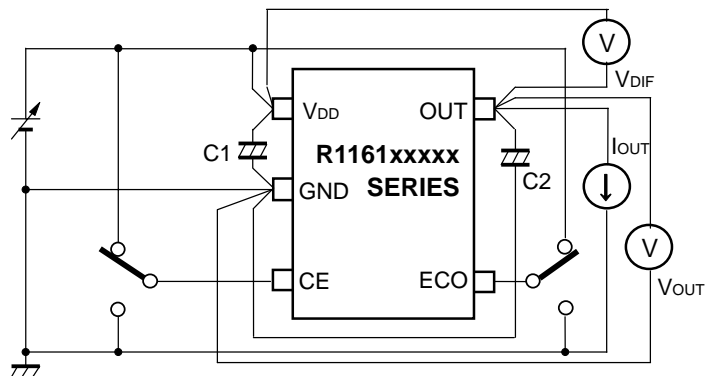


Fig. 6 Dropout Voltage vs. Output Current/ Set Output Voltage Test Circuit

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R1161x

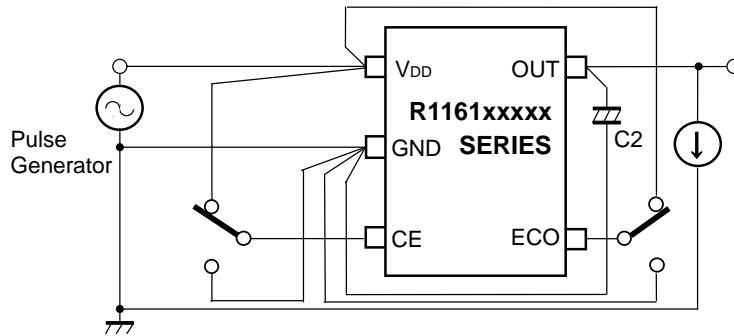


Fig. 7 Ripple Rejection Test Circuit

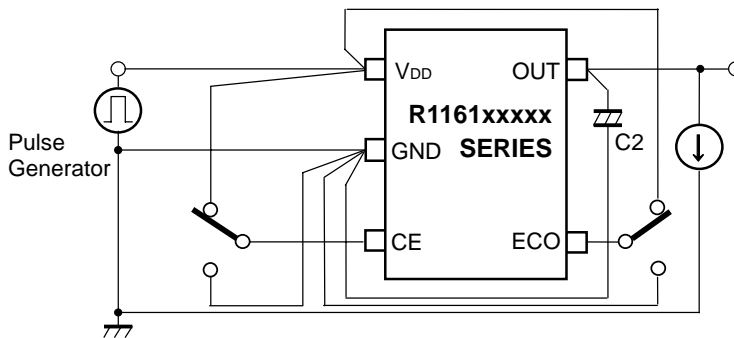


Fig.8 Input Transient Response Test Circuit

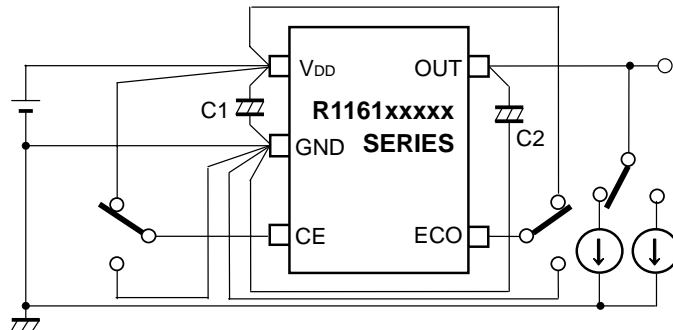


Fig.9 Load Transient Response Test Circuit

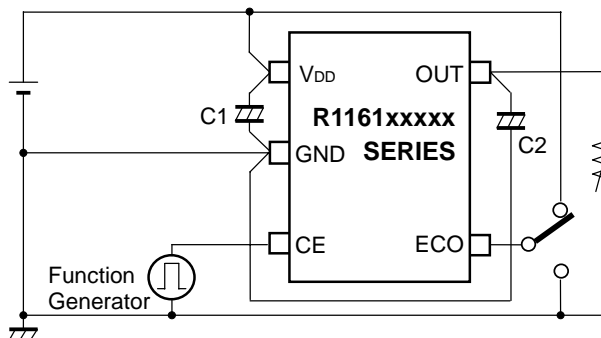


Fig.10 Turn on Speed with CE pin Test Circuit

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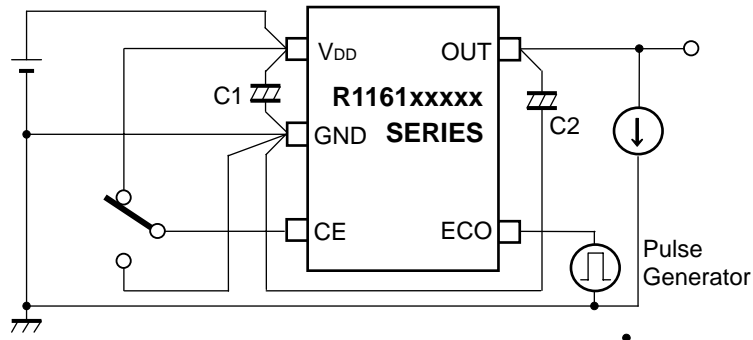


Fig.11 MODE Transient Response Test Circuit

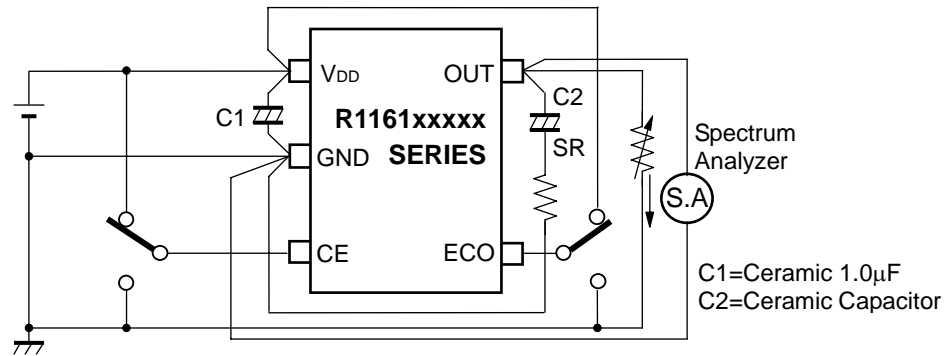
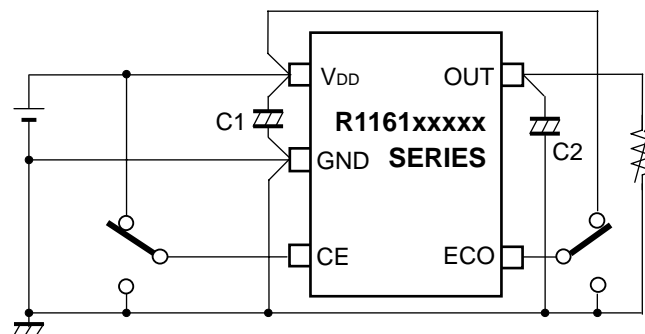


Fig.12 Output Noise Test Circuit(I_{OUT} vs. ESR)

TYPICAL APPLICATION



(External Components)

Output Capacitor; 1.0 μ F or more capacity ceramic Type (If V_{OUT}<1.0V, Tantalum type is recommended)

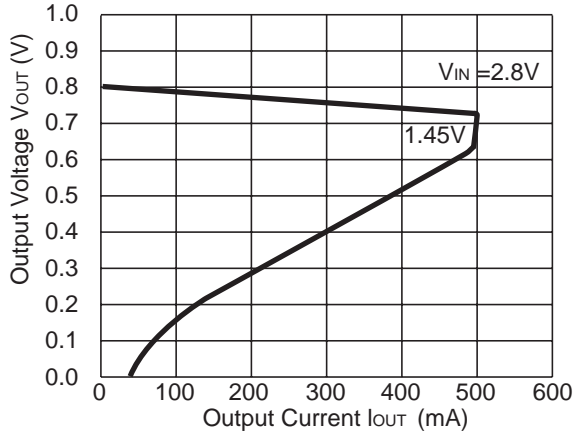
Input Capacitor; 1.0 μ F or more capacity ceramic Type

R1161x

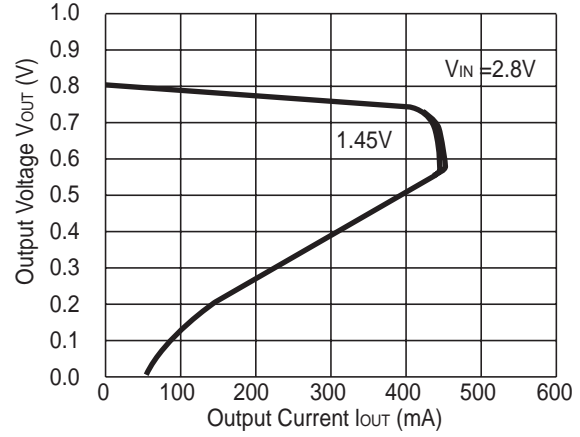
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current

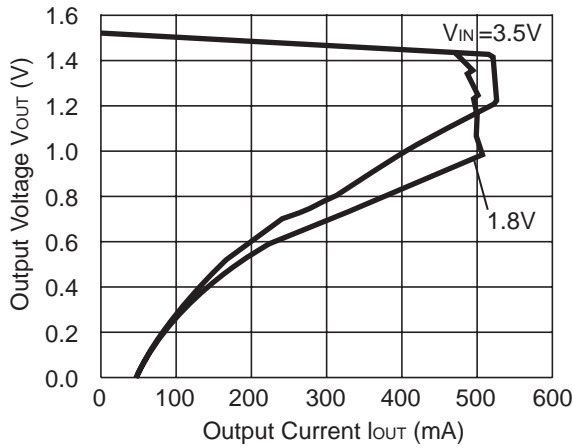
R1161x08xx (ECO=H)



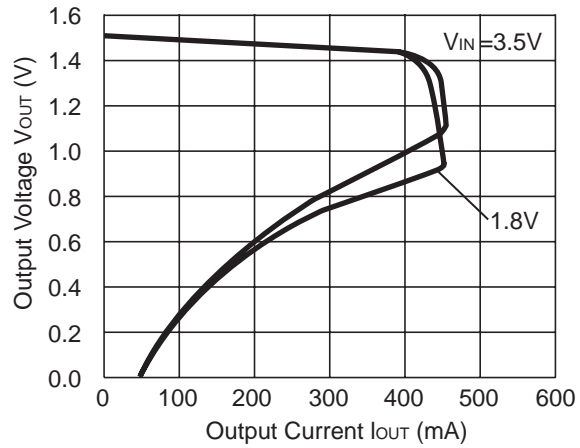
R1161x08xx (ECO=L)



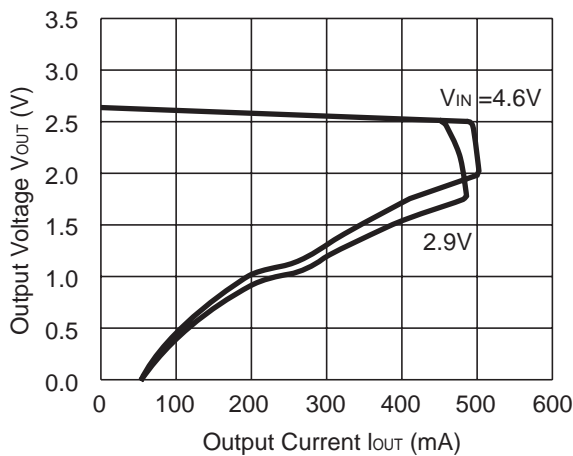
R1161x15xx (ECO=H)



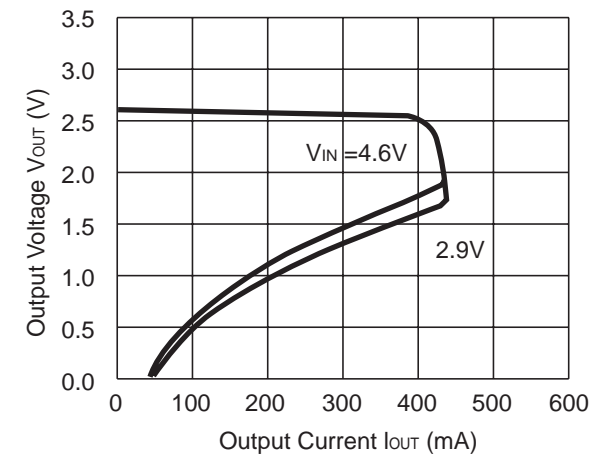
R1161x15xx (ECO=L)

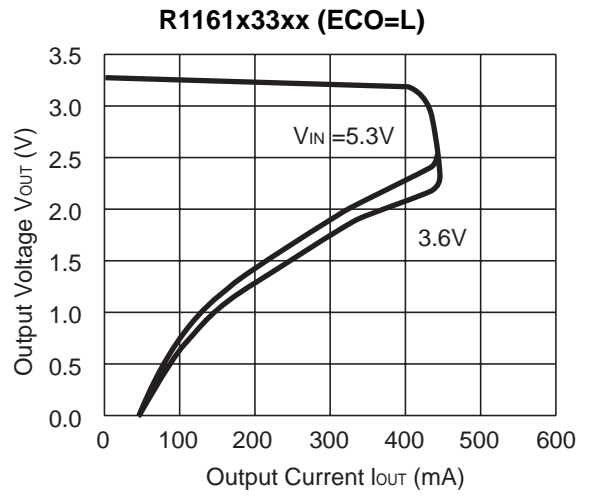
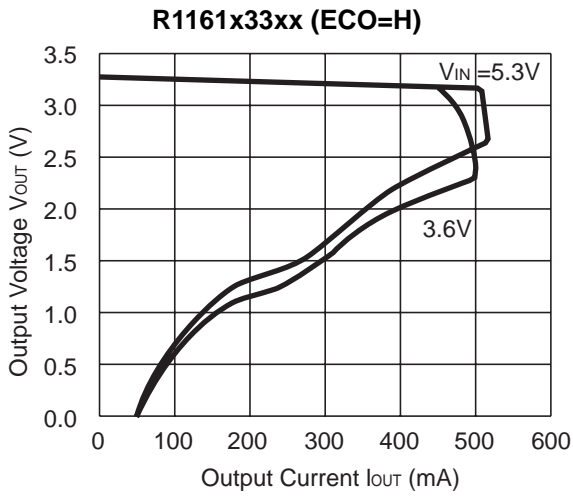


R1161x26xx (ECO=H)

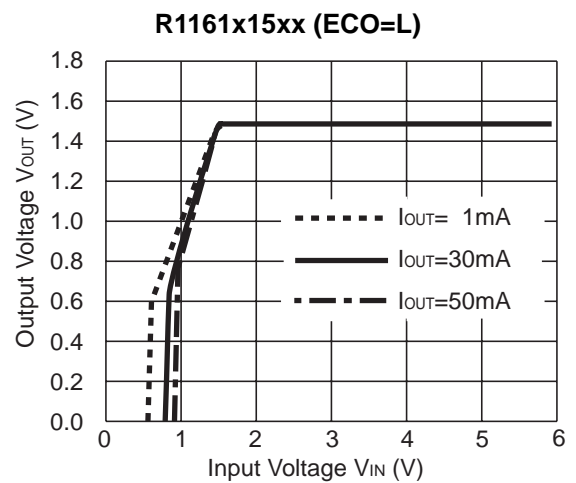
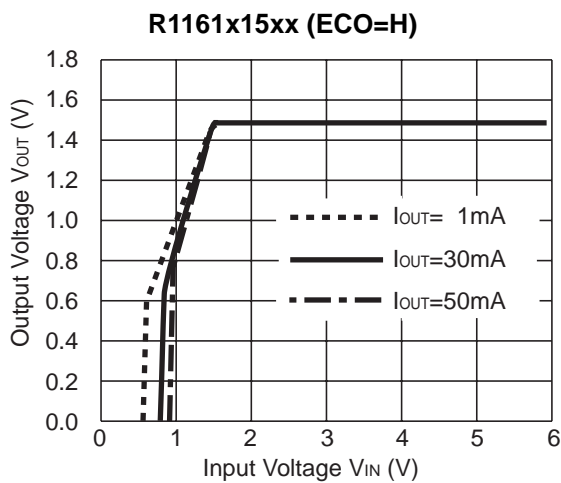
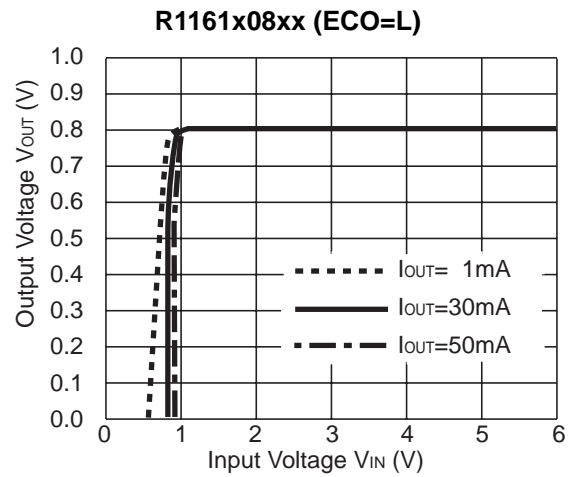
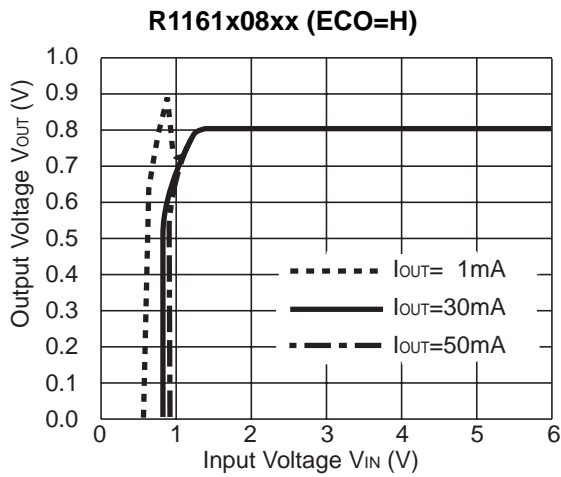


R1161x26xx (ECO=L)



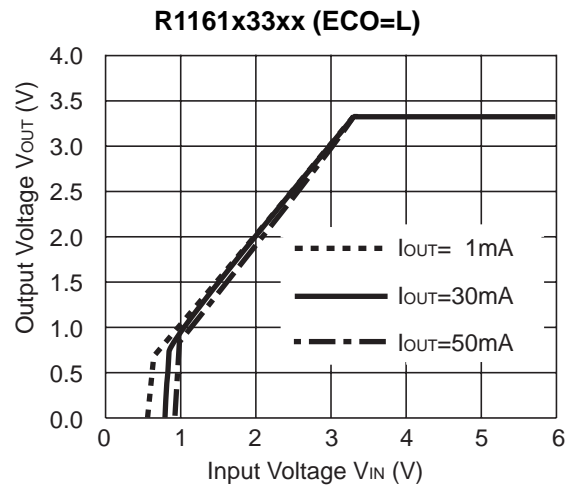
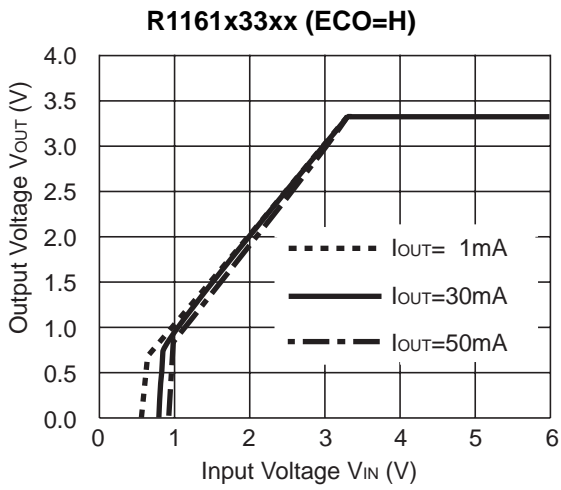
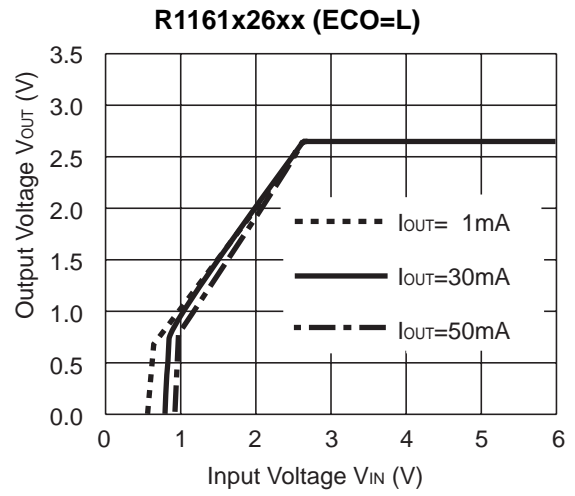
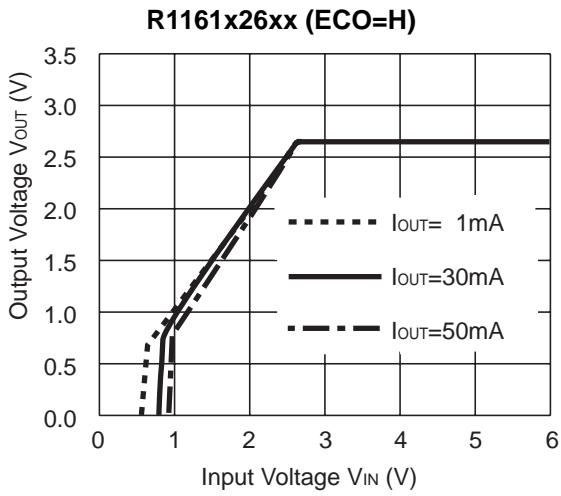


2) Output Voltage vs. Input Voltage

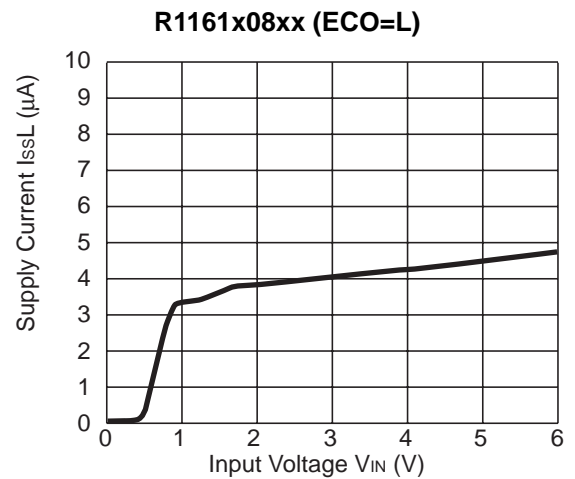
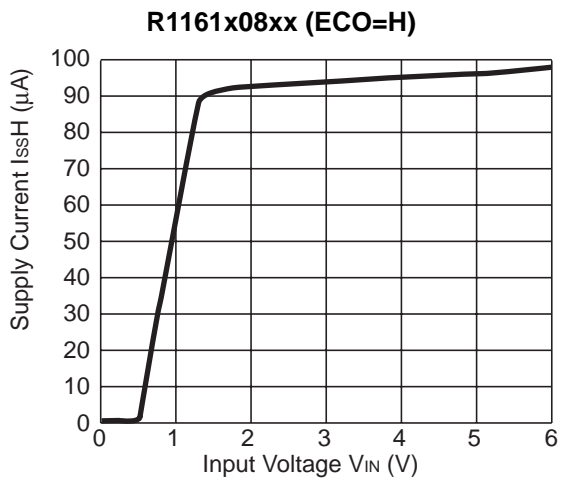


* R1116Dxx1 (SON-6) is the limited product and R1116Dxx2 (HSON-6) is the discontinued product. As of March in 2015.

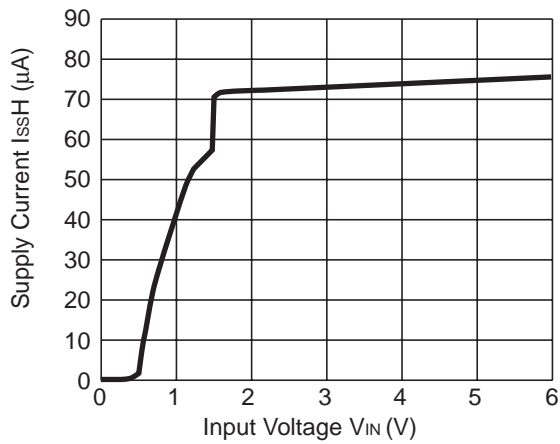
R1161x



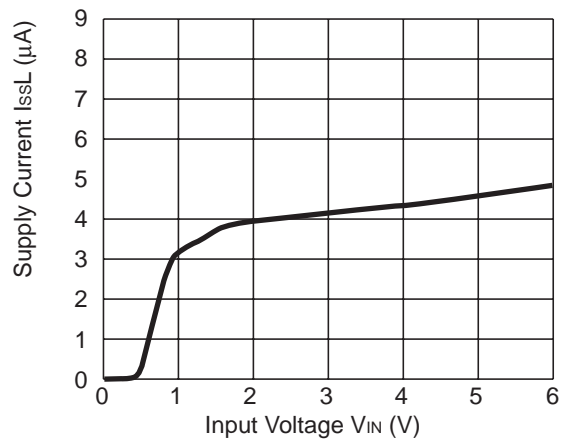
3) Supply Current vs. Input Voltage



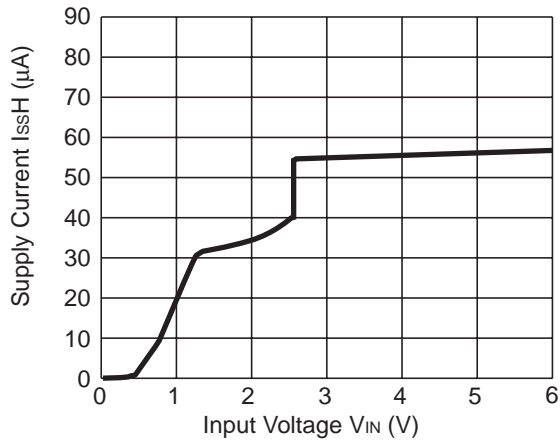
R1161x15xx (ECO=H)



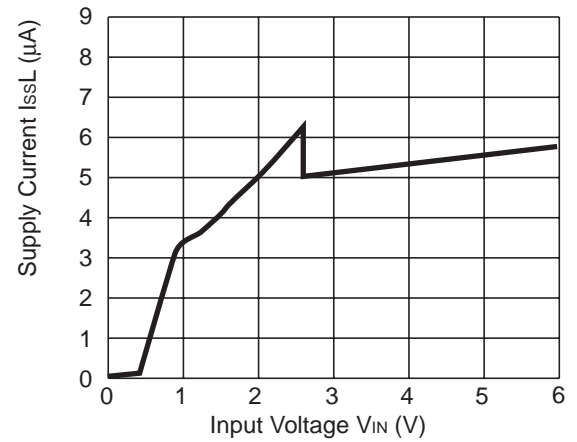
R1161x15xx (ECO=L)



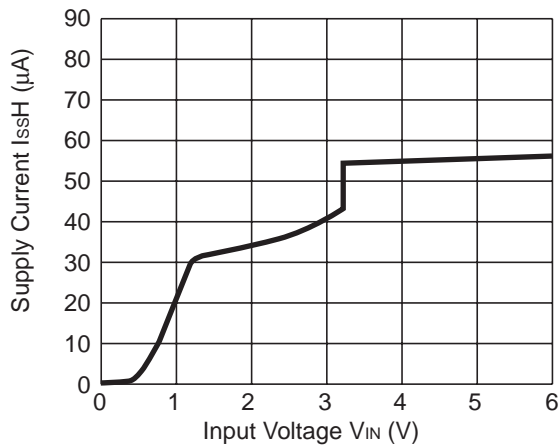
R1161x26xx (ECO=H)



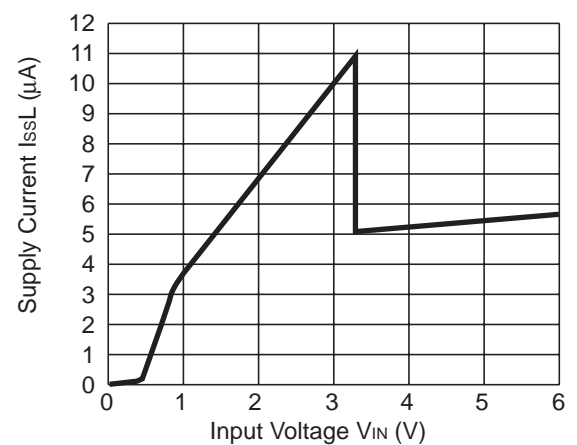
R1161x26xx (ECO=L)



R1161x33xx (ECO=H)

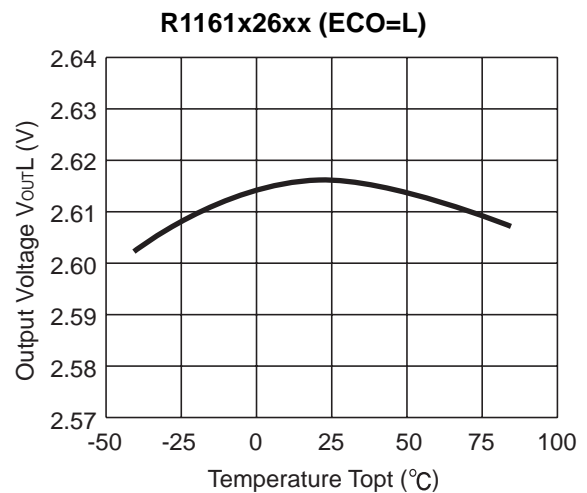
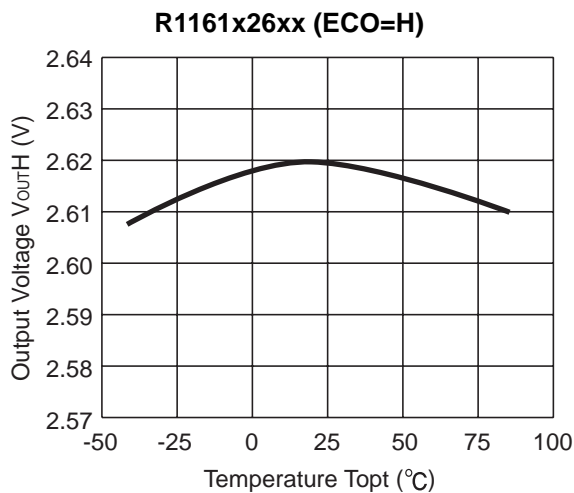
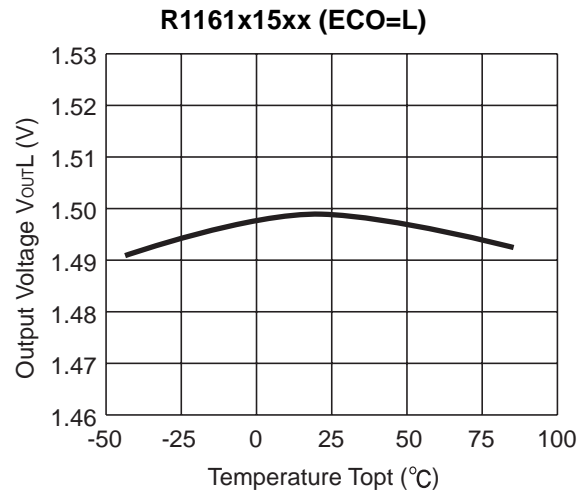
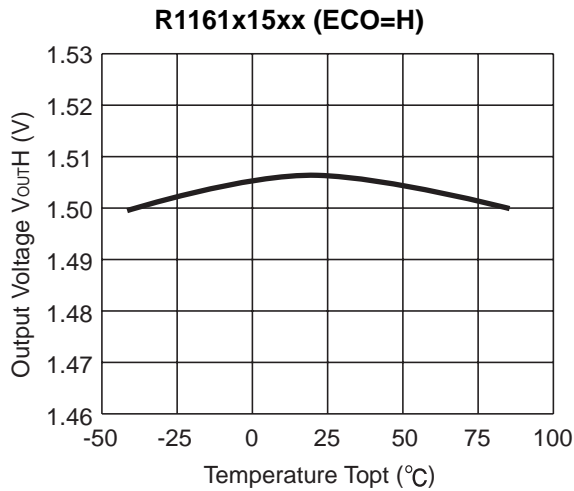
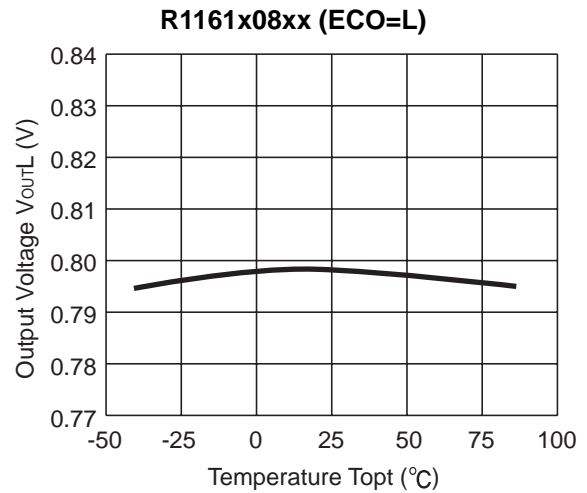
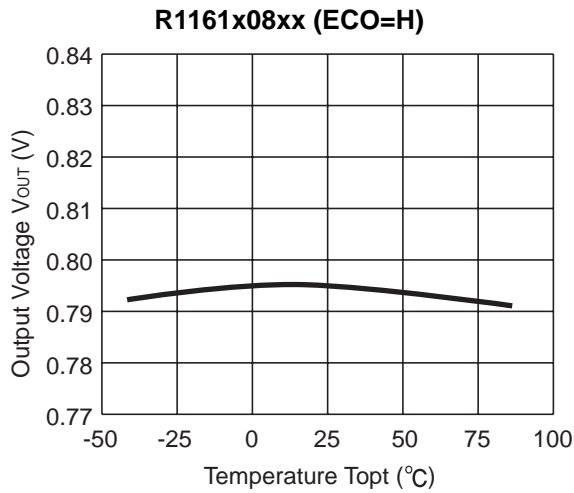


R1161x33xx (ECO=L)

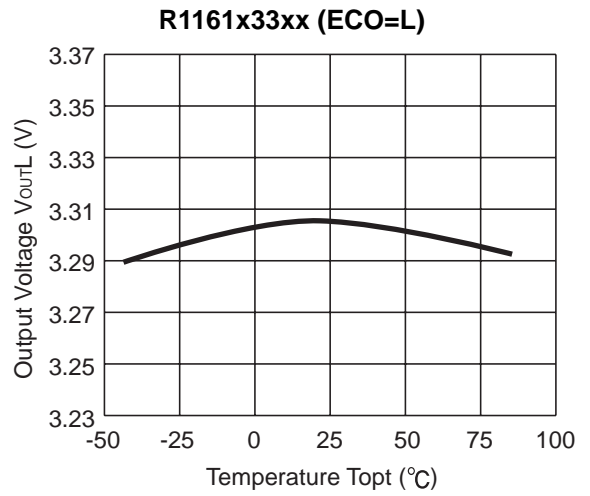
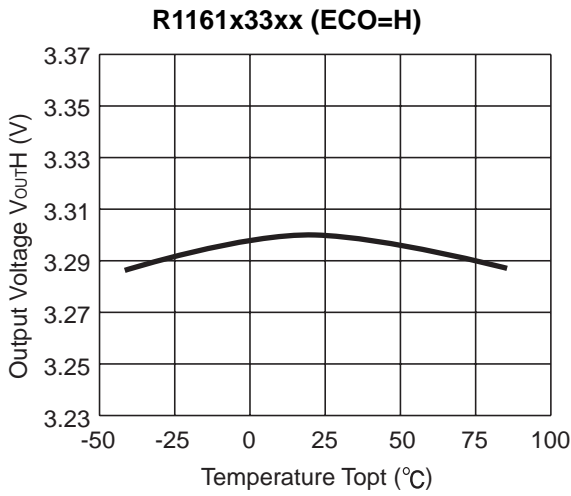


R1161x

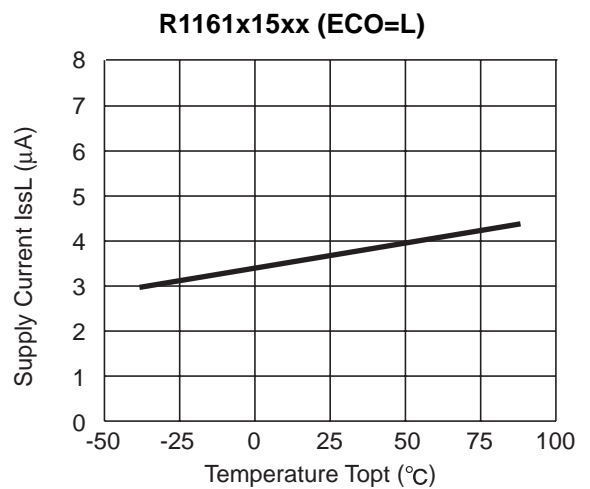
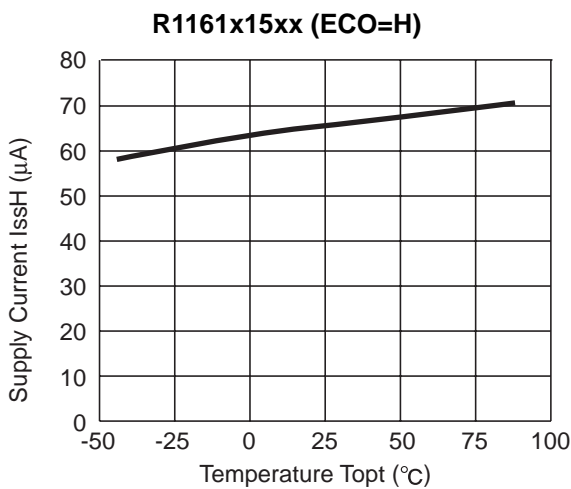
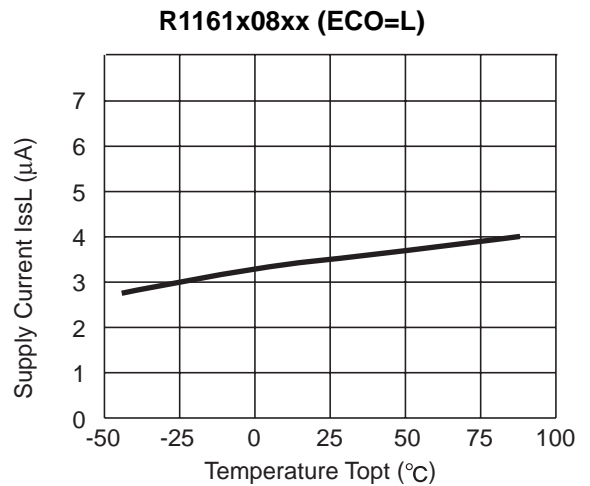
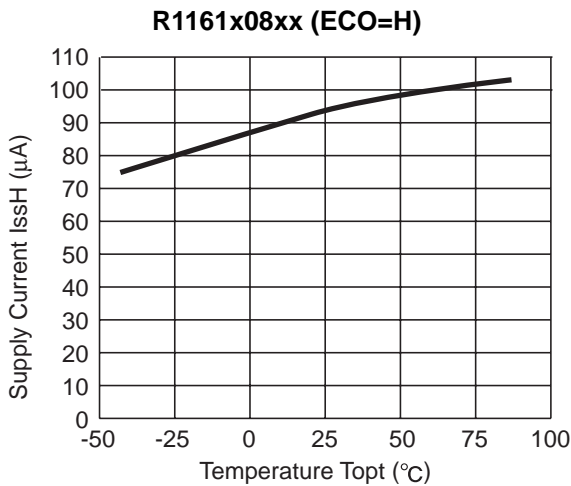
4) Output Voltage vs. Temperature



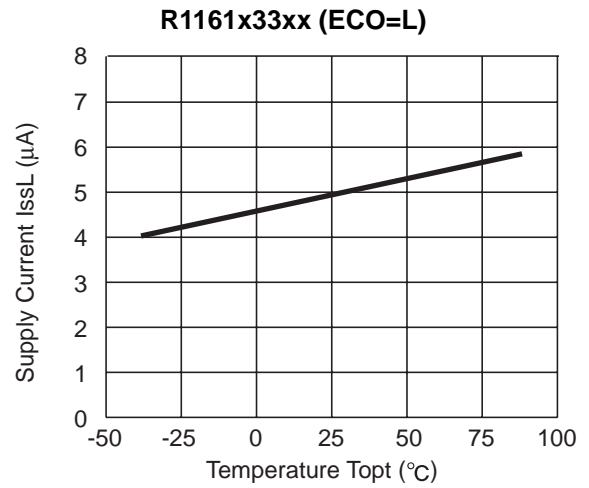
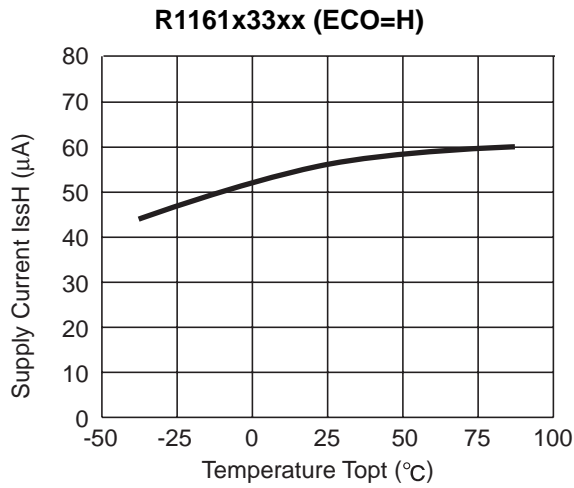
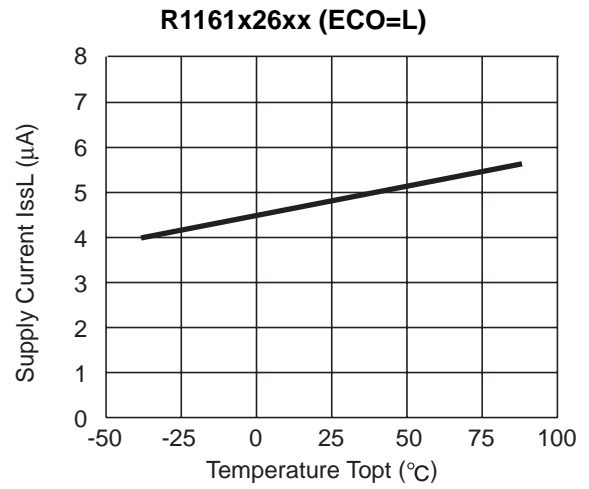
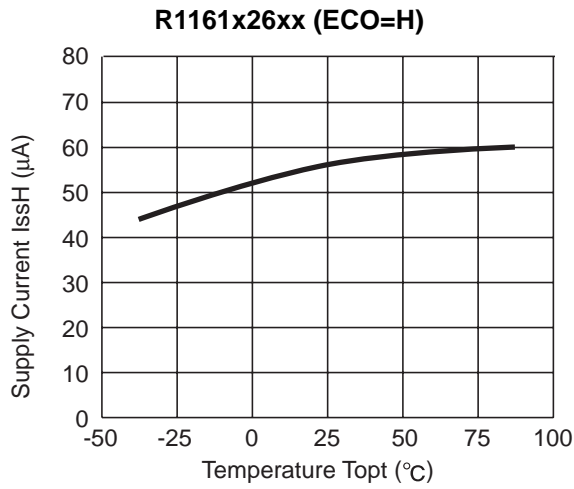
* R1116Dxx1 (SON-6) is the limited product and R1116Dxx2 (HSON-6) is the discontinued product. As of March in 2015.



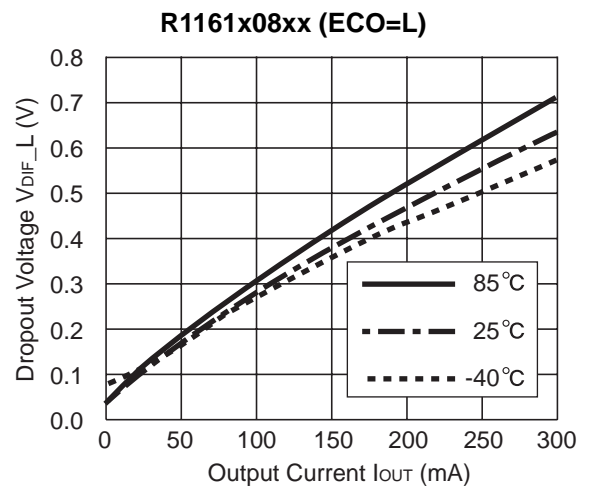
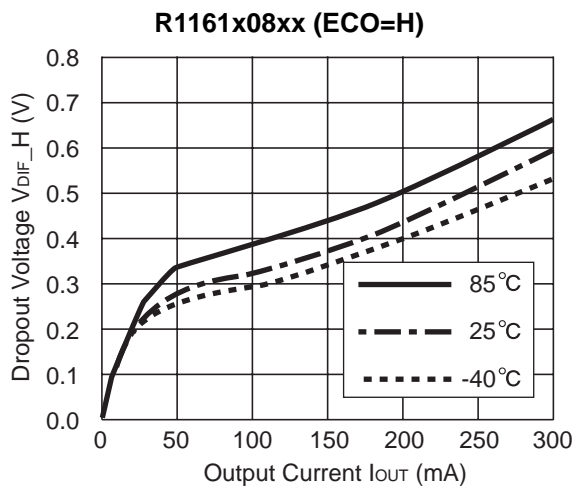
5) Supply Current vs. Temperature

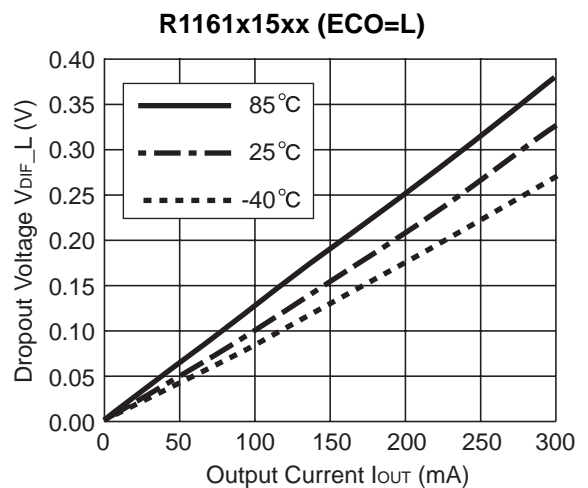
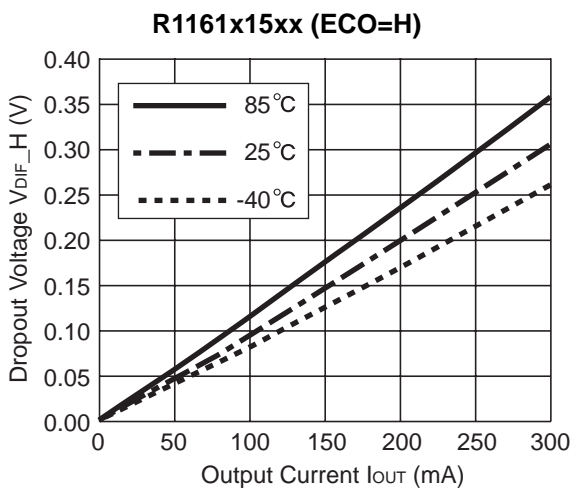
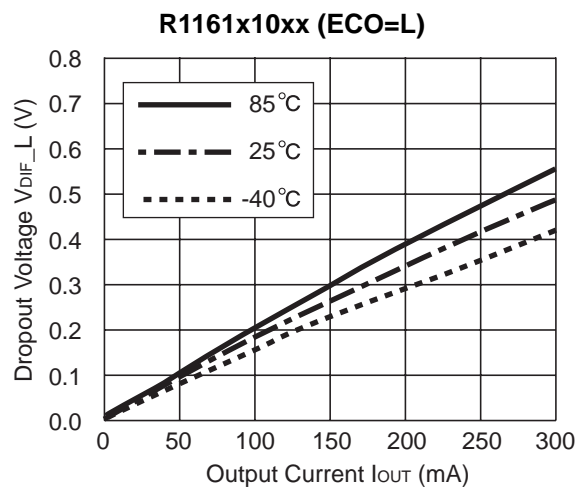
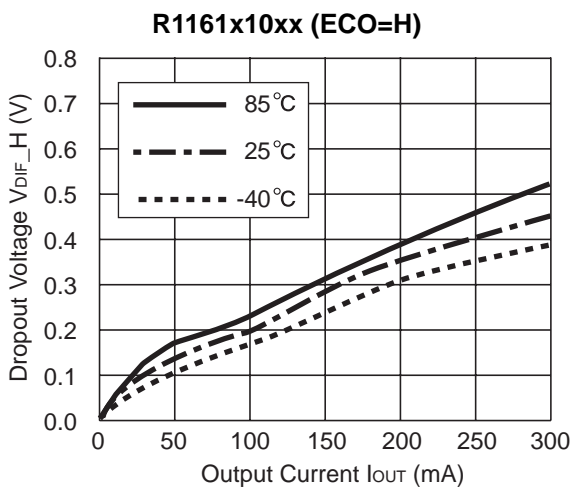
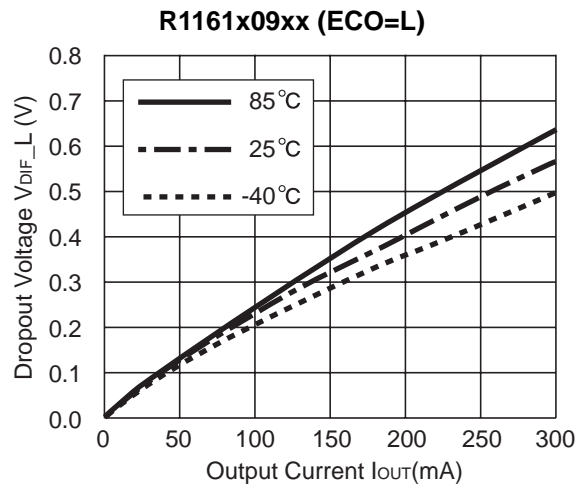
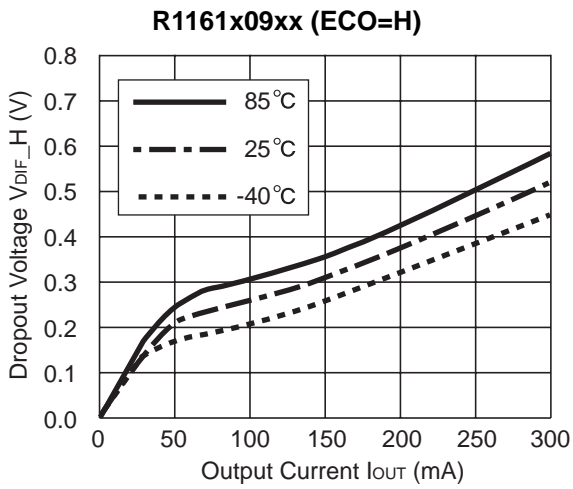


R1161x



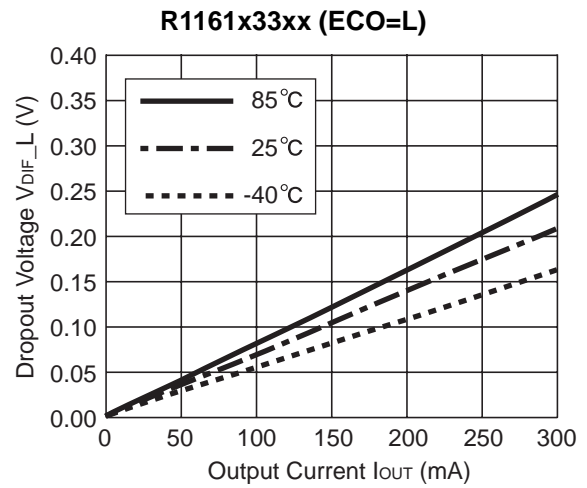
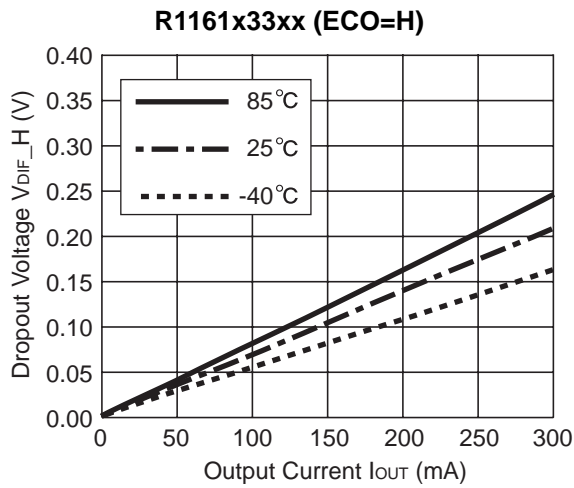
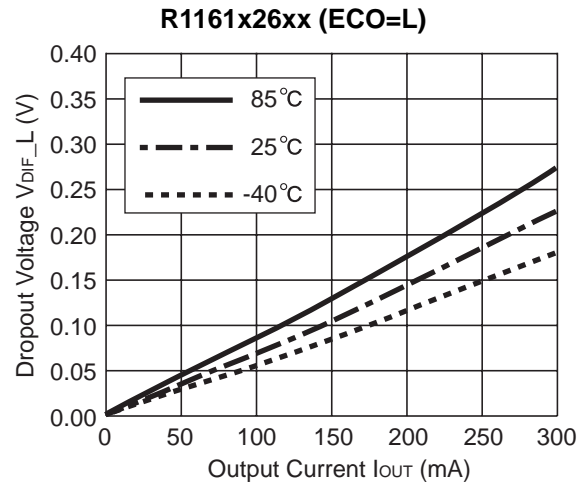
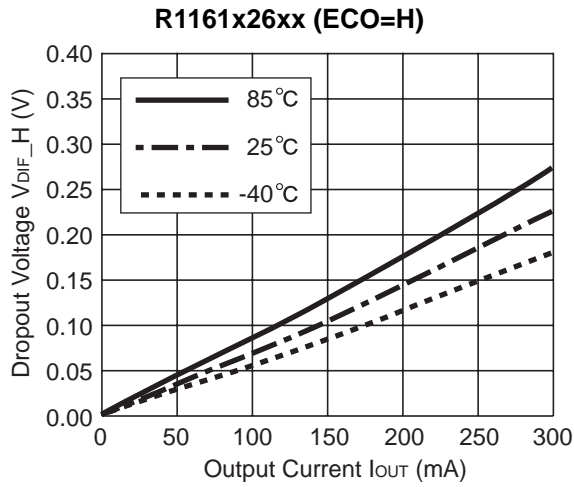
6) Dropout Voltage vs. Output Current



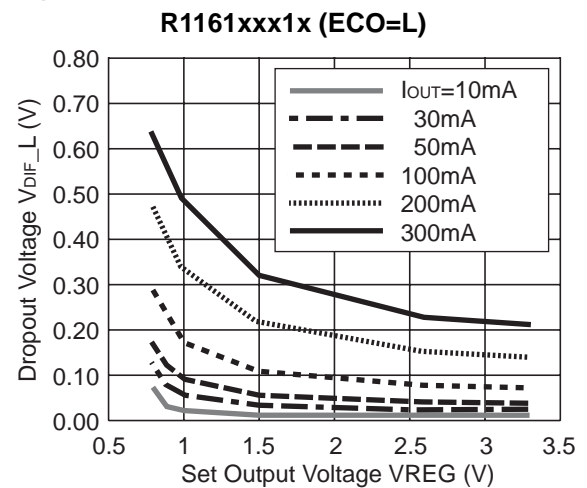
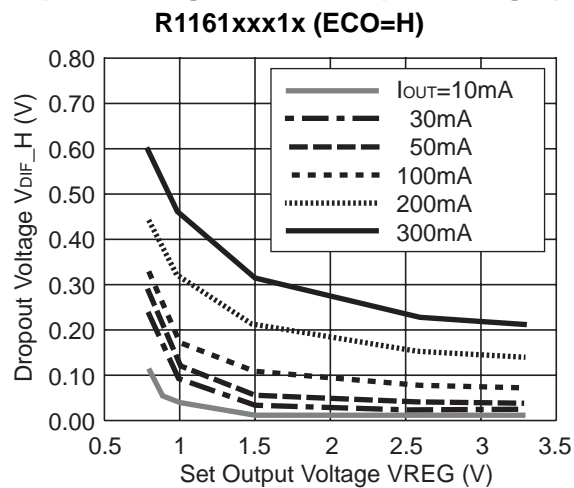


* R116Dxx1 (SON-6) is the limited product and R116Dxx2 (HSON-6) is the discontinued product. As of March in 2015.

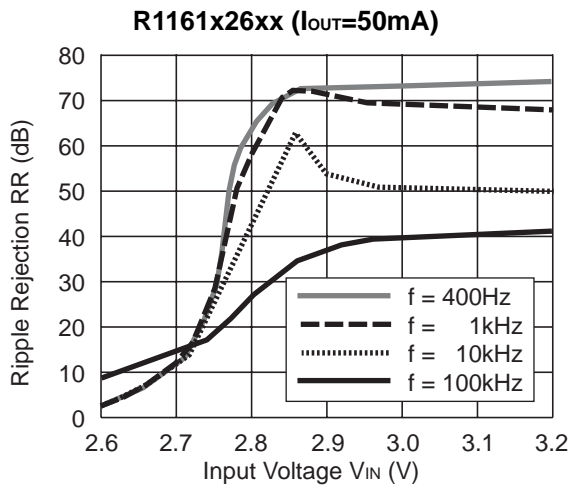
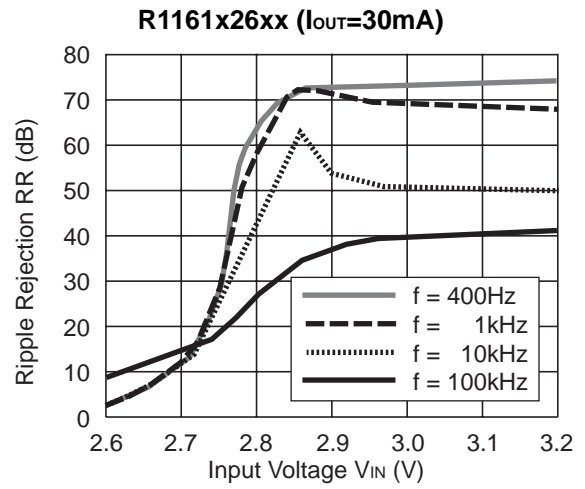
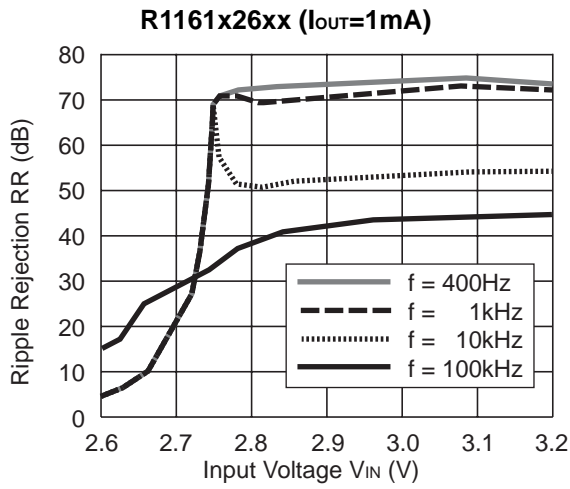
R1161x



7) Dropout Voltage vs. Set Output Voltage ($T_{opt}=25^{\circ}\text{C}$)



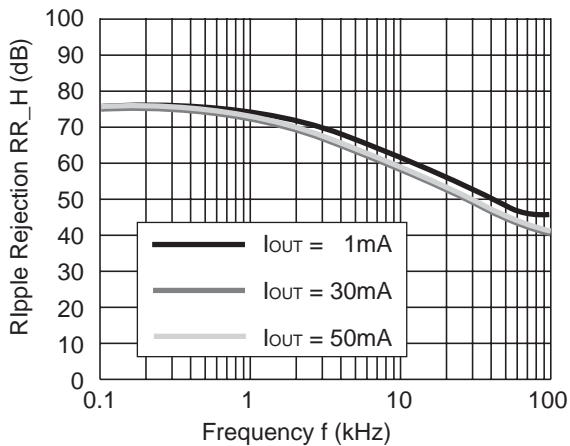
8) Ripple Rejection vs. Input Bias (Topt=25°C CIN=none, COUT=Ceramic 1.0μF Ripple 0.2Vp-P)



9) Ripple Rejection vs. Frequency (CIN=none)

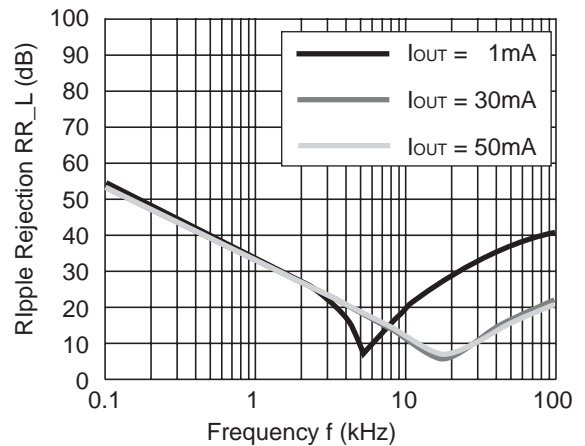
R1161x08xx (ECO=H)

V_{IN}=1.8V_{DC}+0.2Vp-p,
C_{OUT}=Tantal 1.0μF



R1161x08xx (ECO=L)

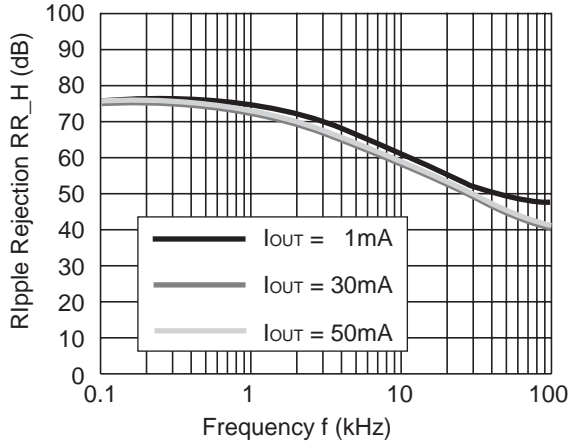
V_{IN}=1.8V_{DC}+0.2Vp-p,
C_{OUT} = Tantal 1.0μF



R1161x

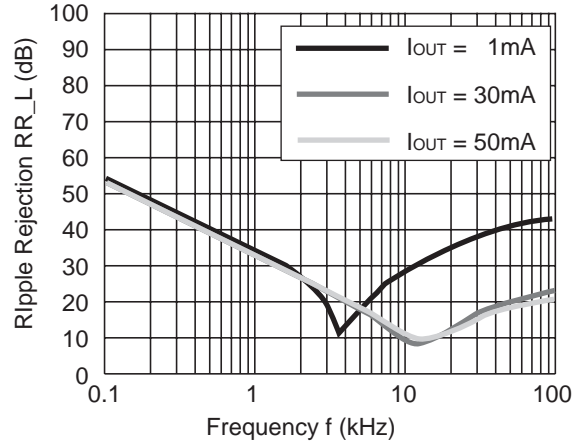
R1161x08xx (ECO=H)

$V_{IN}=1.8V_{DC}+0.2V_{p-p}$,
 $C_{OUT}=\text{Tantal } 2.2\mu\text{F}$



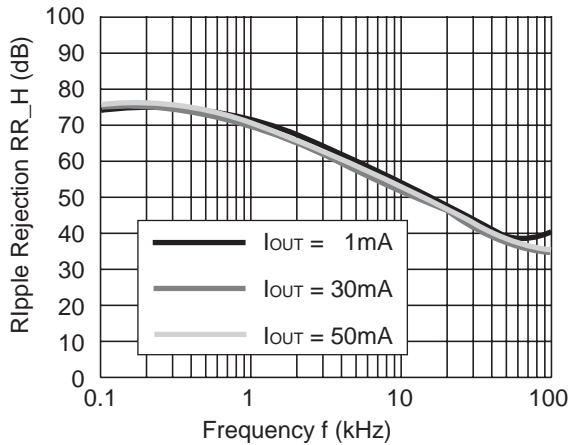
R1161x08xx (ECO=L)

$V_{IN}=1.8V_{DC}+0.2V_{p-p}$,
 $C_{OUT}=\text{Tantal } 2.2\mu\text{F}$



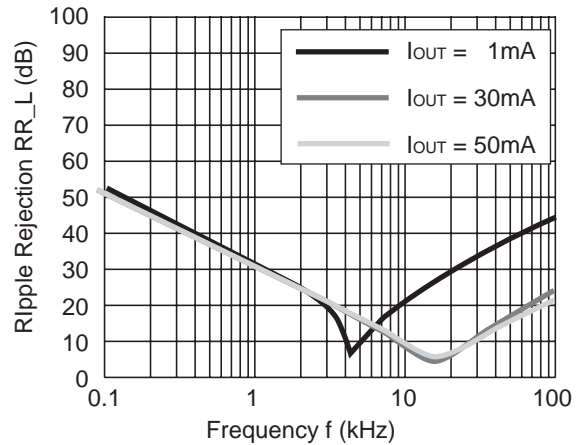
R1161x10xx (ECO=H)

$V_{IN}=2.0V_{DC}+0.2V_{p-p}$,
 $C_{OUT}=\text{Ceramic } 1.0\mu\text{F}$



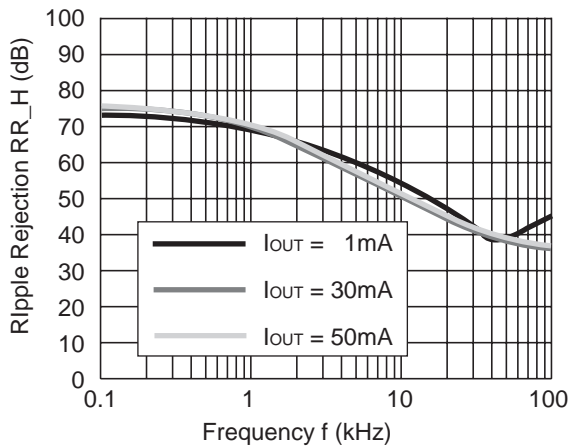
R1161x10xx (ECO=L)

$V_{IN}=2.0V_{DC}+0.2V_{p-p}$,
 $C_{OUT}=\text{Ceramic } 1.0\mu\text{F}$



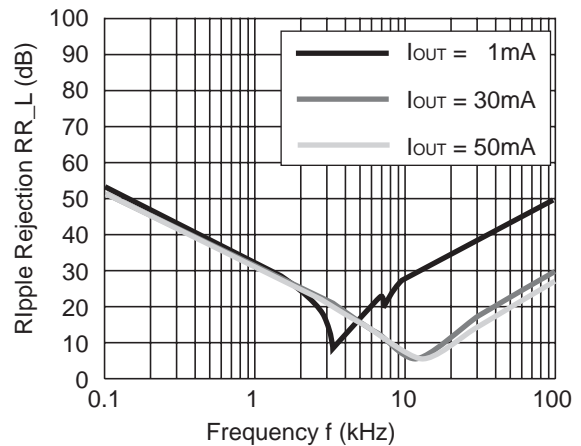
R1161x10xx (ECO=H)

$V_{IN}=2.0V_{DC}+0.2V_{p-p}$,
 $C_{OUT}=\text{Ceramic } 2.2\mu\text{F}$



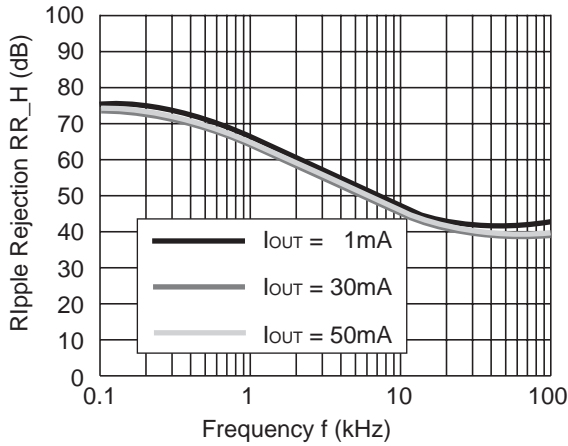
R1161x10xx (ECO=L)

$V_{IN}=2.0V_{DC}+0.2V_{p-p}$,
 $C_{OUT}=\text{Ceramic } 2.2\mu\text{F}$



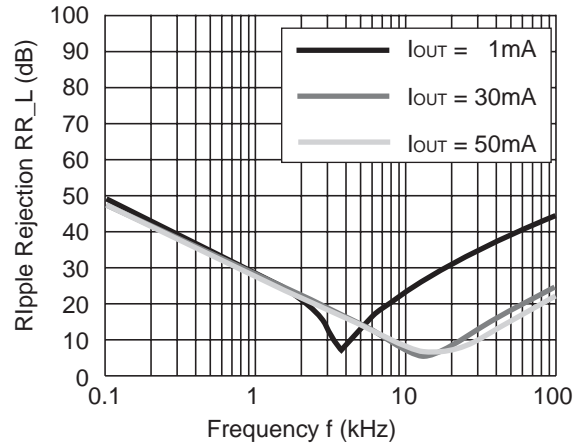
R1161x15xx (ECO=H)

$V_{IN}=2.5V_{DC}+0.2V_{p-p}$,
 $C_{OUT}=1.0\mu F$



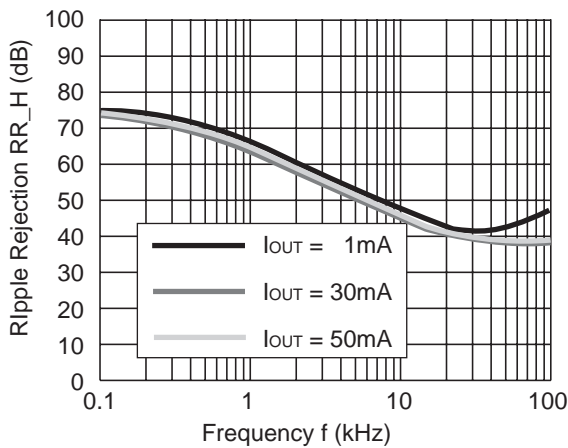
R1161x15xx (ECO=L)

$V_{IN}=2.5V_{DC}+0.2V_{p-p}$,
 $C_{OUT}=1.0\mu F$



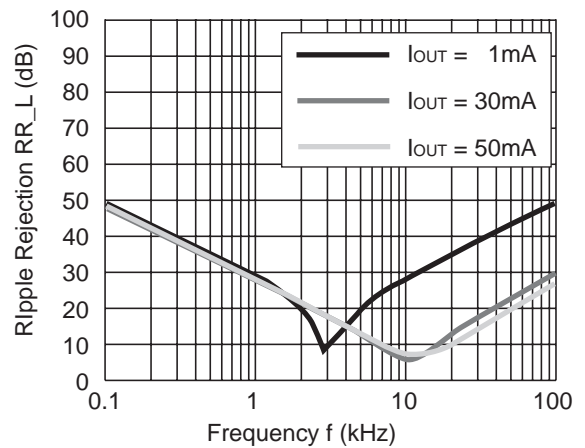
R1161x15xx (ECO=H)

$V_{IN}=2.5V_{DC}+0.2V_{p-p}$,
 $C_{OUT}=2.2\mu F$



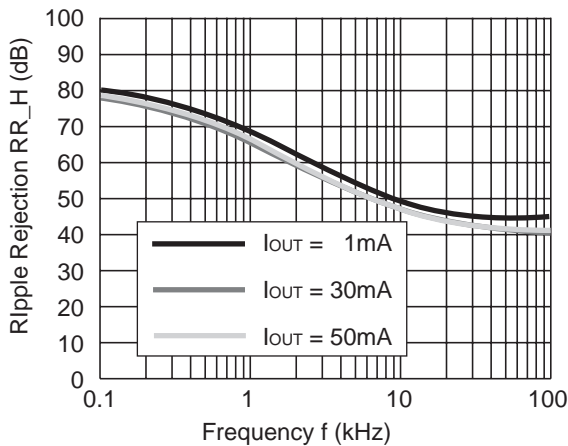
R1161x15xx (ECO=L)

$V_{IN}=2.5V_{DC}+0.2V_{p-p}$,
 $C_{OUT}=2.2\mu F$



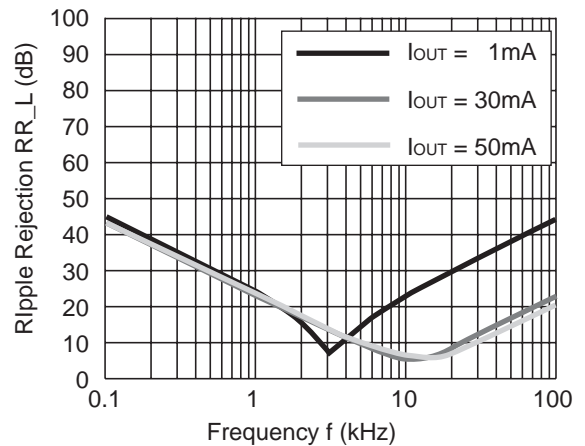
R1161x26xx (ECO=H)

$V_{IN}=3.6V_{DC}+0.2V_{p-p}$,
 $C_{OUT} = \text{Ceramic } 1.0\mu F$



R1161x26xx (ECO=L)

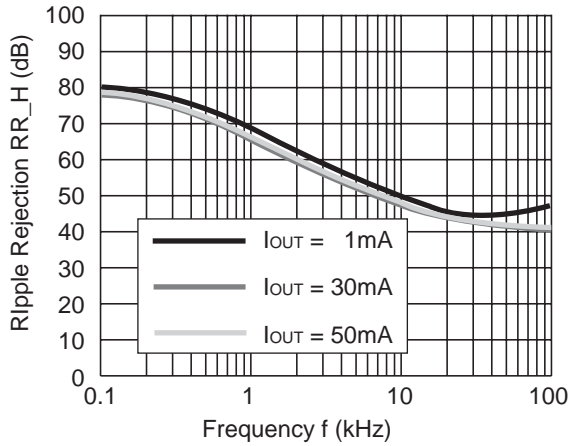
$V_{IN}=3.6V_{DC}+0.2V_{p-p}$,
 $C_{OUT} = \text{Ceramic } 1.0\mu F$



R1161x

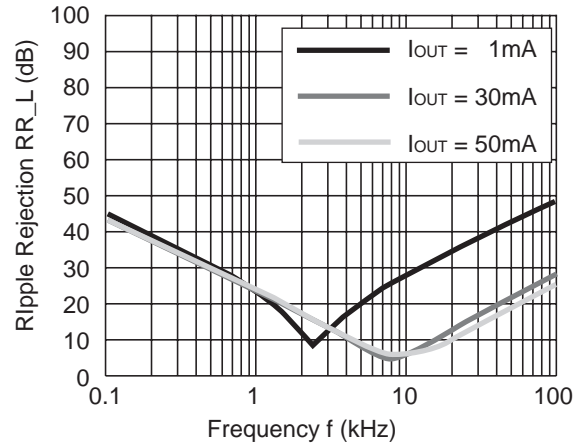
R1161x26xx (ECO=H)

$V_{IN}=3.6V_{DC}+0.2V_{p-p}$,
 $C_{OUT} = \text{Ceramic } 2.2\mu F$



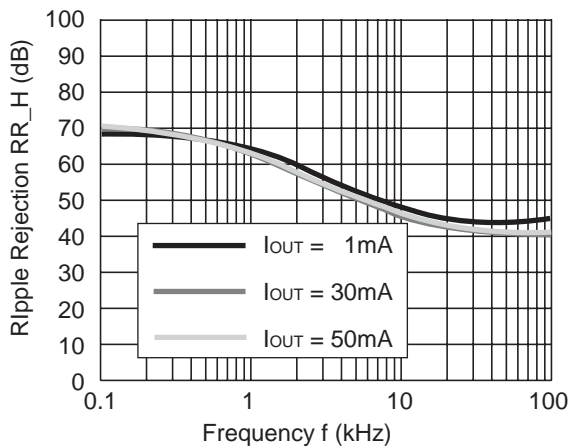
R1161x26xx (ECO=L)

$V_{IN}=3.6V_{DC}+0.2V_{p-p}$,
 $C_{OUT} = \text{Ceramic } 2.2\mu F$



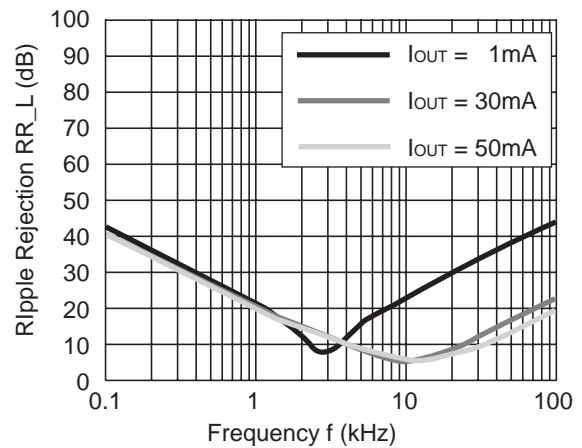
R1161x33xx (ECO=H)

$V_{IN}=4.3V_{DC}+0.2V_{p-p}$,
 $C_{OUT} = \text{Ceramic } 1.0\mu F$



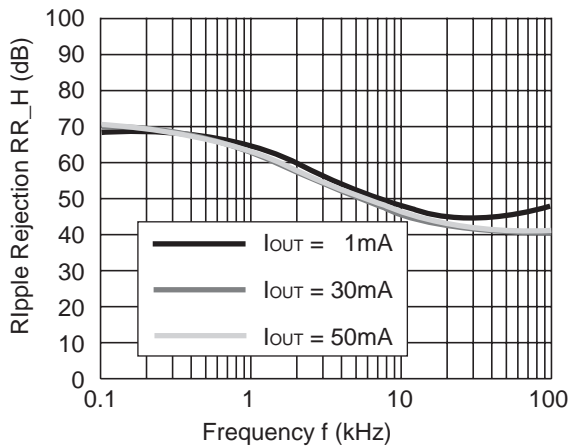
R1161x33xx (ECO=L)

$V_{IN}=4.3V_{DC}+0.2V_{p-p}$,
 $C_{OUT} = \text{Ceramic } 1.0\mu F$



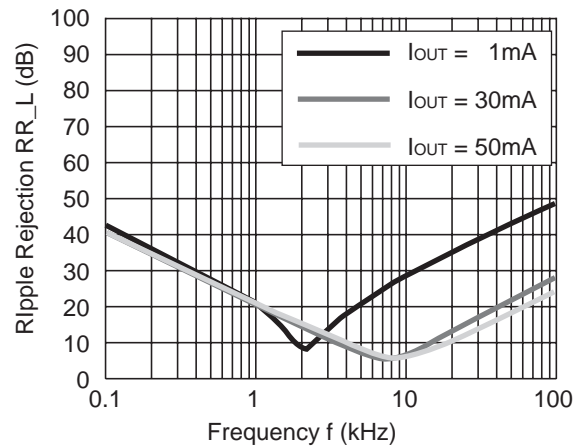
R1161x33xx (ECO=H)

$V_{IN}=4.3V_{DC}+0.2V_{p-p}$,
 $C_{OUT} = \text{Ceramic } 2.2\mu F$



R1161x33xx (ECO=L)

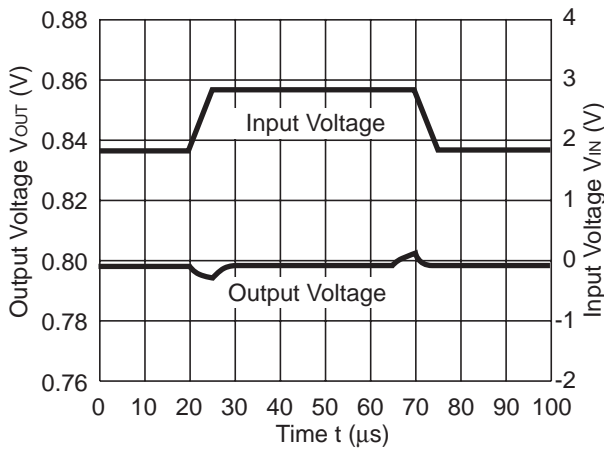
$V_{IN}=4.3V_{DC}+0.2V_{p-p}$,
 $C_{OUT} = \text{Ceramic } 2.2\mu F$



10) Input Transient Response ($C_{IN} = \text{none}$, $t_r=t_f=5\mu\text{s}$)

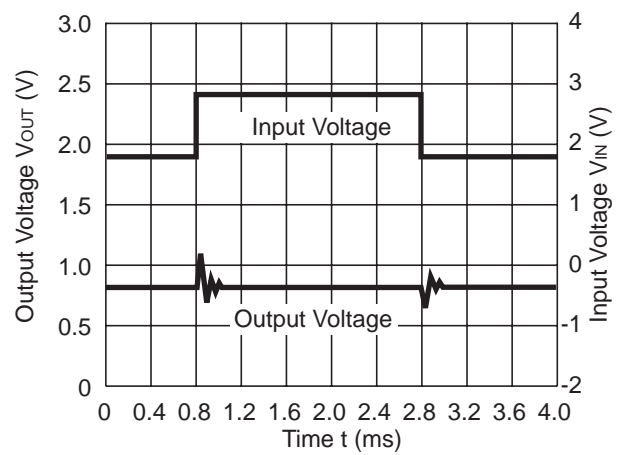
R1161x08xx (ECO=H)

$I_{OUT}=30\text{mA}$,
 $C_{OUT} = \text{Tantalum } 1.0\mu\text{F}$



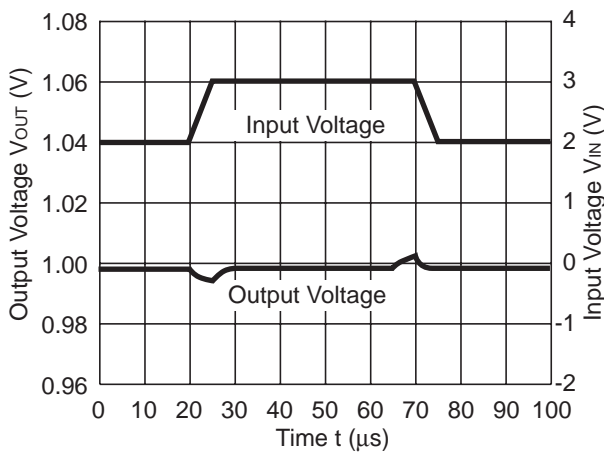
R1161x08xx (ECO=L)

$I_{OUT}=10\text{mA}$,
 $C_{OUT} = \text{Tantalum } 1.0\mu\text{F}$



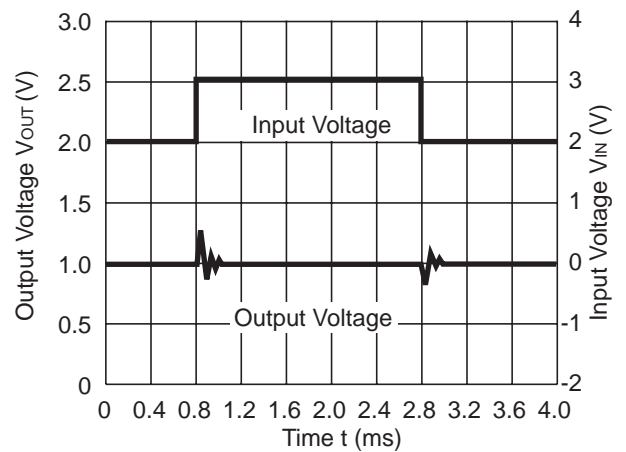
R1161x10xx (ECO=H)

$I_{OUT}=30\text{mA}$,
 $C_{OUT} = \text{Ceramic } 1.0\mu\text{F}$



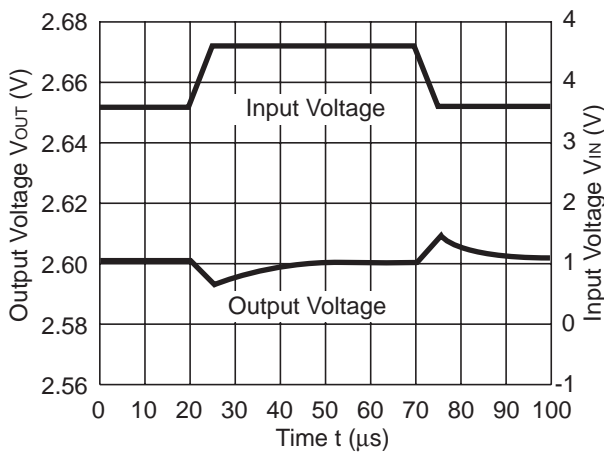
R1161x10xx (ECO=L)

$I_{OUT}=10\text{mA}$,
 $C_{OUT} = \text{Ceramic } 1.0\mu\text{F}$



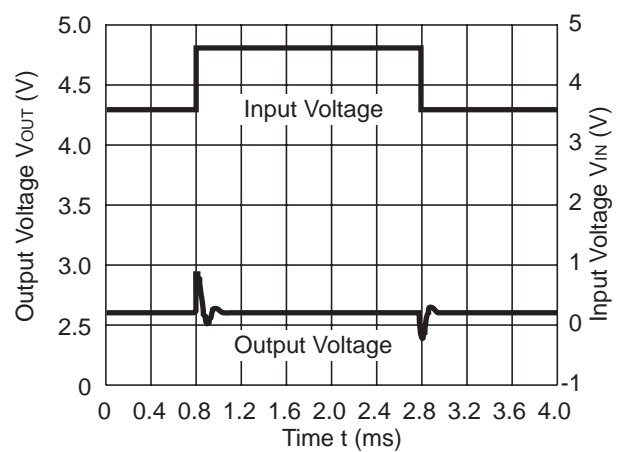
R1161x26xx (ECO=H)

$I_{OUT}=30\text{mA}$,
 $C_{OUT} = \text{Ceramic } 1.0\mu\text{F}$



R1161x26xx (ECO=L)

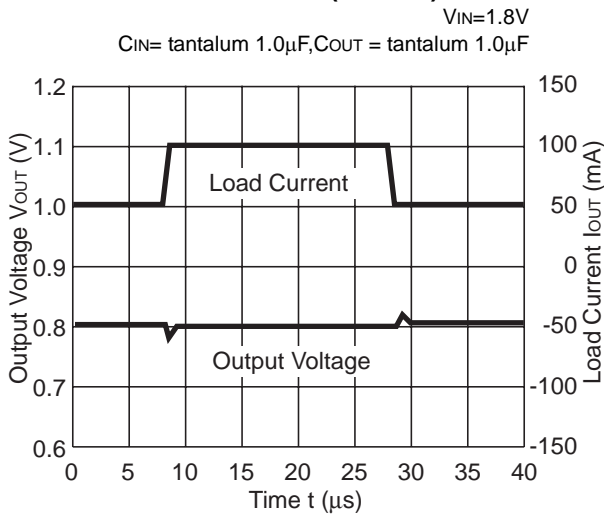
$I_{OUT}=10\text{mA}$,
 $C_{OUT} = \text{Ceramic } 1.0\mu\text{F}$



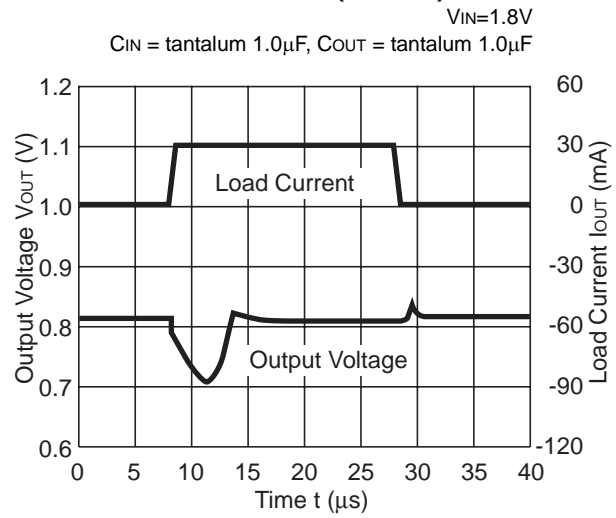
R1161x

11) Load Transient Response ($t_r=t_f=0.5\mu s$)

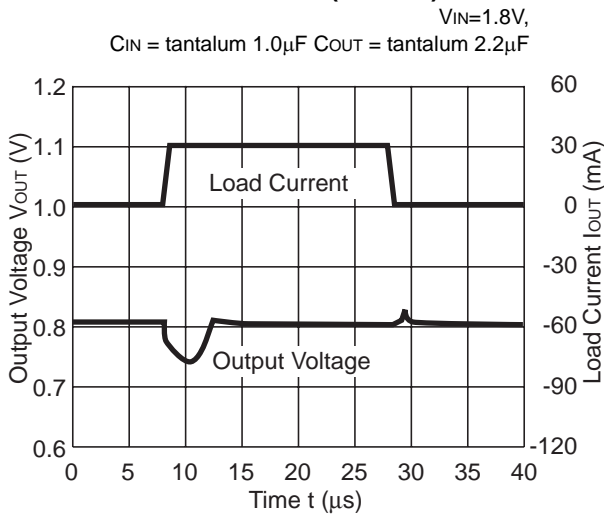
R1161x08xx (ECO=H)



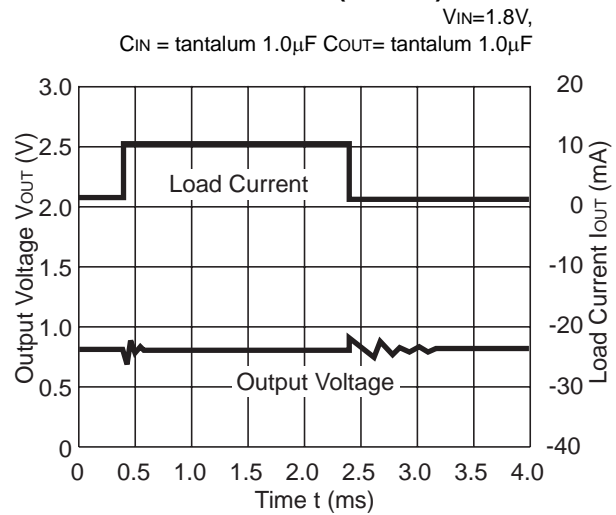
R1161x08xx (ECO=H)



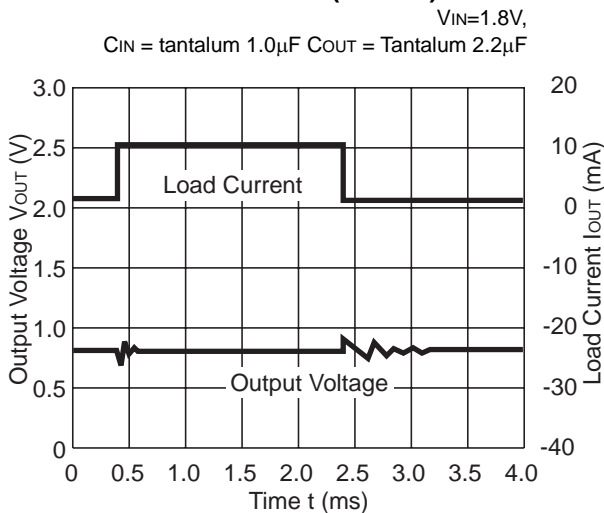
R1161x08xx (ECO=H)



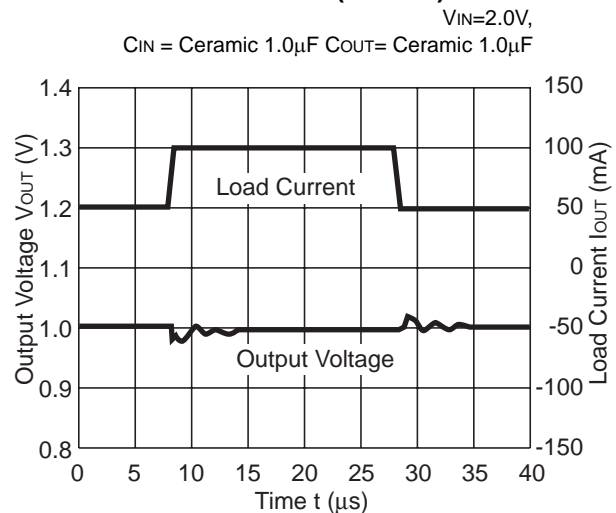
R1161x08xx (ECO=L)

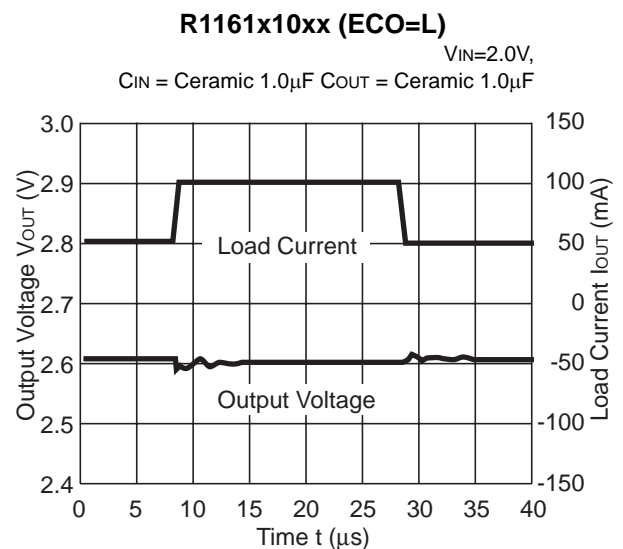
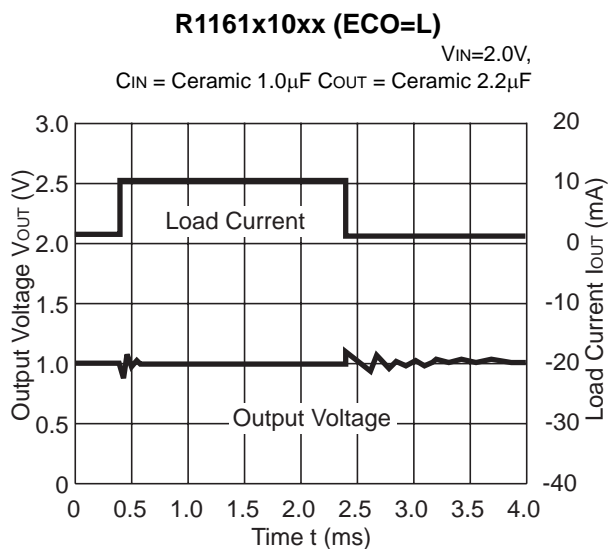
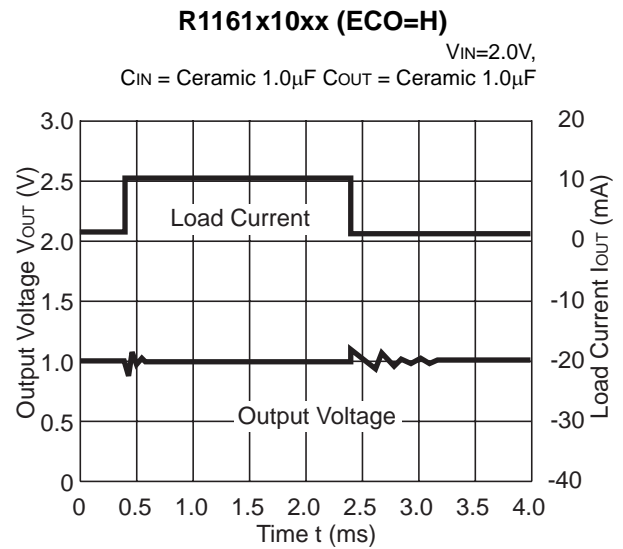
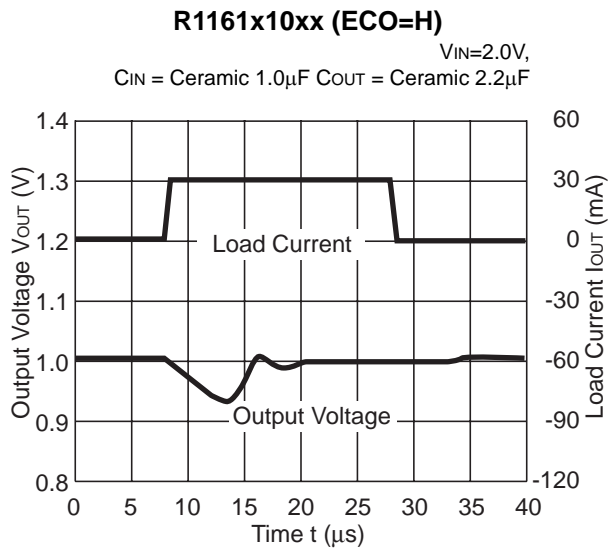
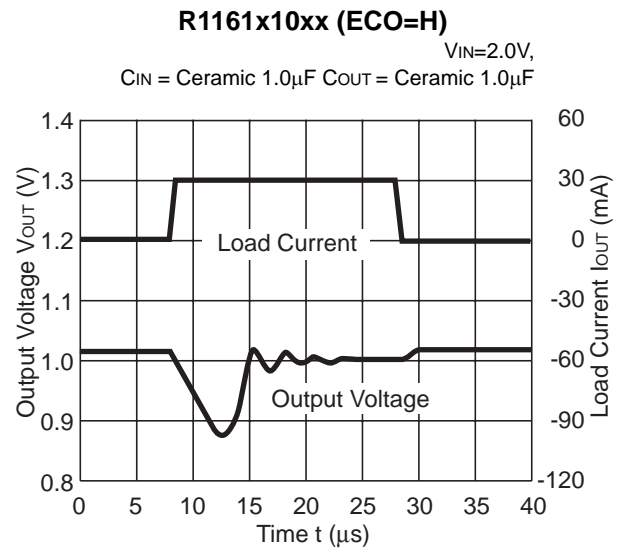
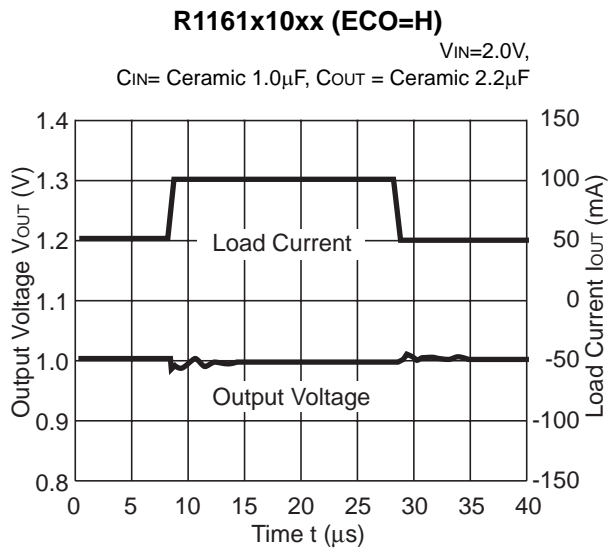


R1161x08xx (ECO=L)



R1161x10xx (ECO=H)

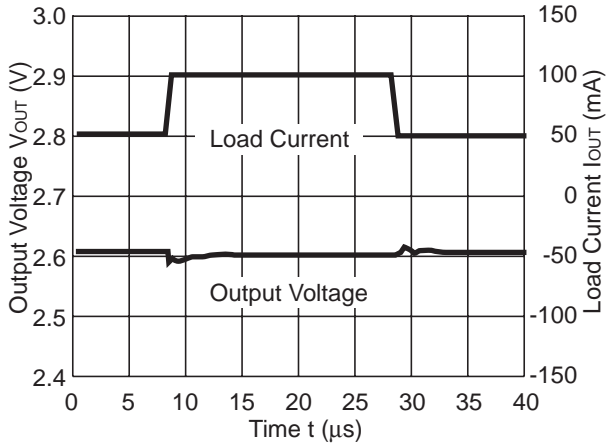




R1161x

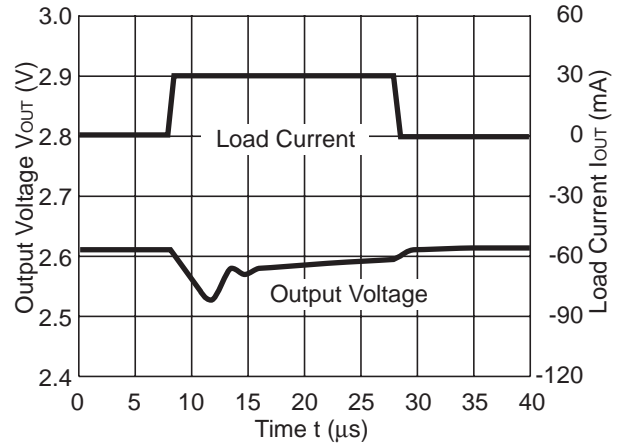
R1161x26xx (ECO=H)

$V_{IN}=3.6V$,
 C_{IN} = Ceramic $1.0\mu F$ C_{OUT} = Ceramic $2.2\mu F$



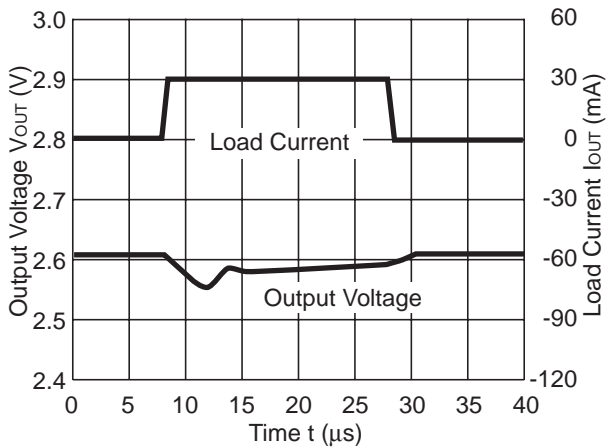
R1161x26xx (ECO=H)

$V_{IN}=3.6V$,
 C_{IN} = Ceramic $1.0\mu F$ C_{OUT} = Ceramic $1.0\mu F$



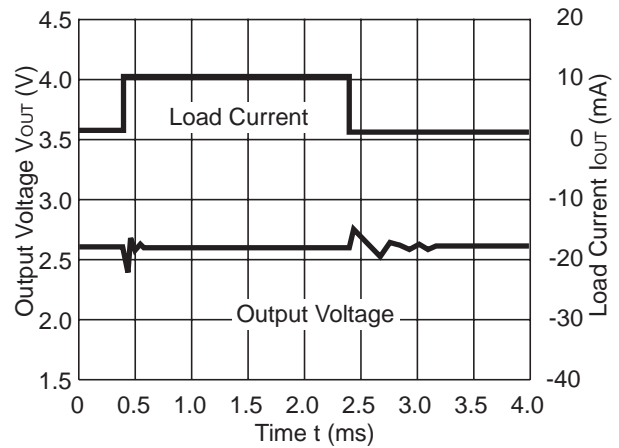
R1161x26xx (ECO=L)

$V_{IN}=3.6V$,
 C_{IN} = Ceramic $1.0\mu F$ C_{OUT} = Ceramic $2.2\mu F$



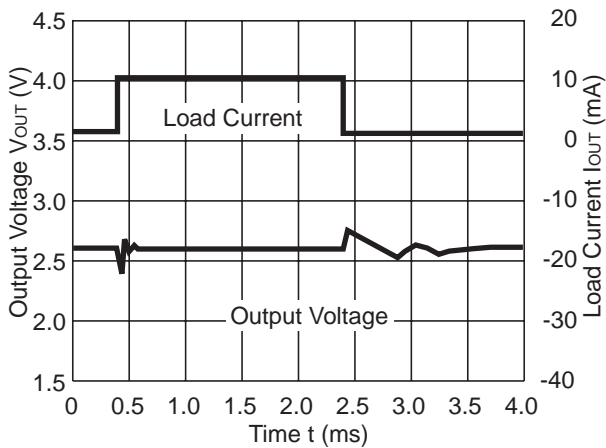
R1161x26xx (ECO=L)

$V_{IN}=3.6V$,
 C_{IN} = Ceramic $1.0\mu F$ C_{OUT} = Ceramic $1.0\mu F$



R1161x26xx (ECO=L)

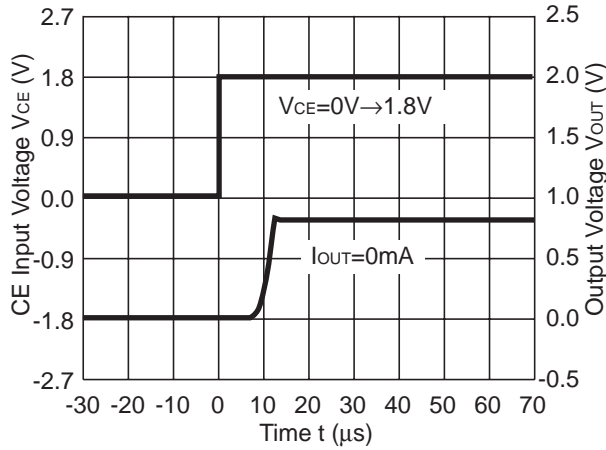
$V_{IN}=3.6V$,
 C_{IN} = Ceramic $1.0\mu F$ C_{OUT} = Ceramic $2.2\mu F$



12) Turn on speed with CE pin

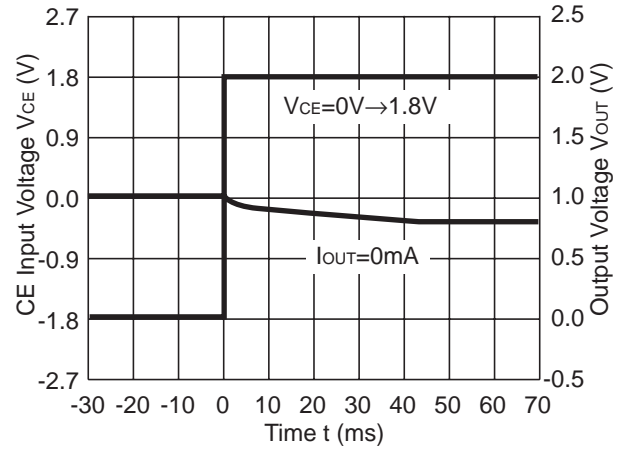
R1161x08xx (ECO=H)

$V_{IN}=1.8V$, C_{IN} = Tantalum $1.0\mu F$
 C_{OUT} = Tantalum $1.0\mu F$



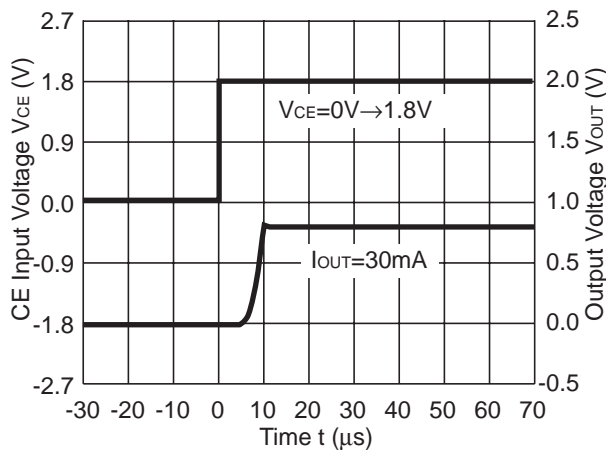
R1161x08xx (ECO=L)

$V_{IN}=1.8V$, C_{IN} = Tantalum $1.0\mu F$
 C_{OUT} = Tantalum $1.0\mu F$



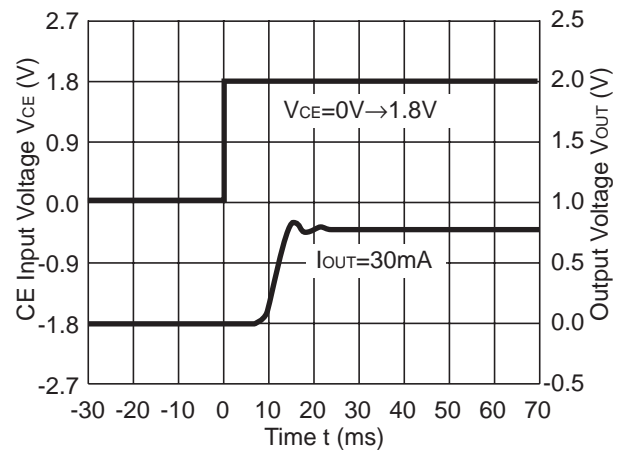
R1161x08xx (ECO=H)

$V_{IN}=1.8V$, C_{IN} = Tantalum $1.0\mu F$
 C_{OUT} = Tantalum $1.0\mu F$



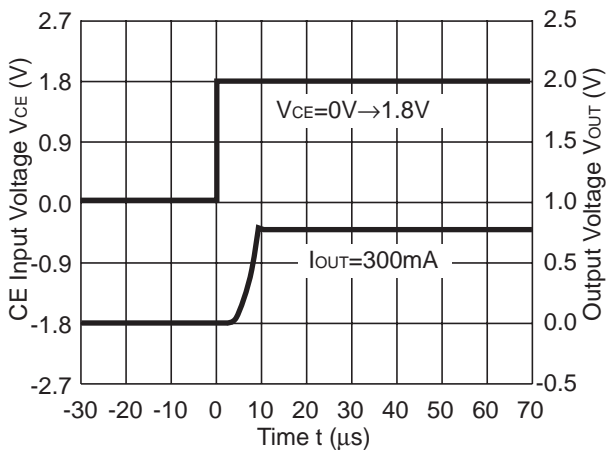
R1161x08xx (ECO=L)

$V_{IN}=1.8V$, C_{IN} = Tantalum $1.0\mu F$
 C_{OUT} = Tantalum $1.0\mu F$



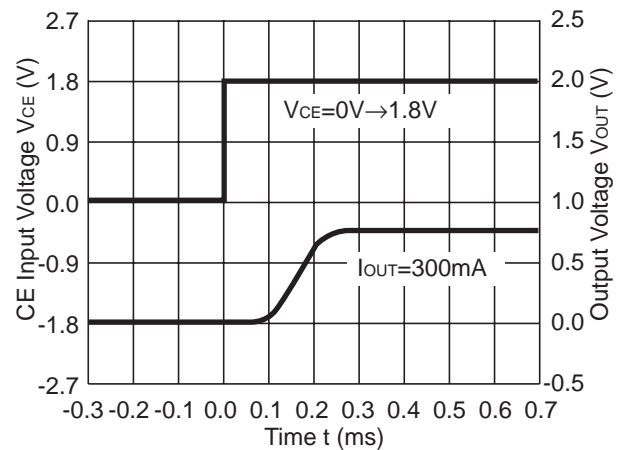
R1161x08xx (ECO=H)

$V_{IN}=1.8V$, C_{IN} = Tantalum $1.0\mu F$
 C_{OUT} = Tantalum $1.0\mu F$



R1161x08xx (ECO=L)

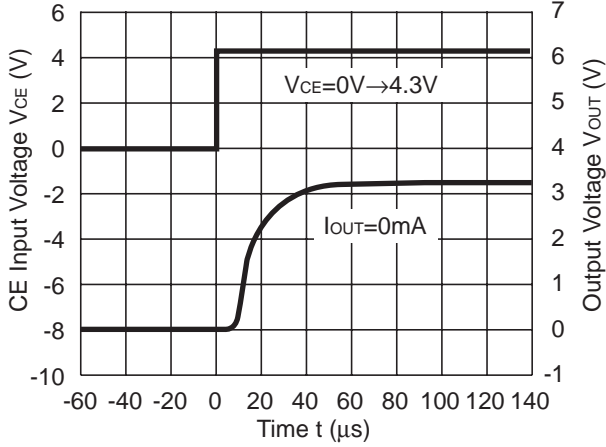
$V_{IN}=1.8V$, C_{IN} = Tantalum $1.0\mu F$
 C_{OUT} = Tantalum $1.0\mu F$



R1161x

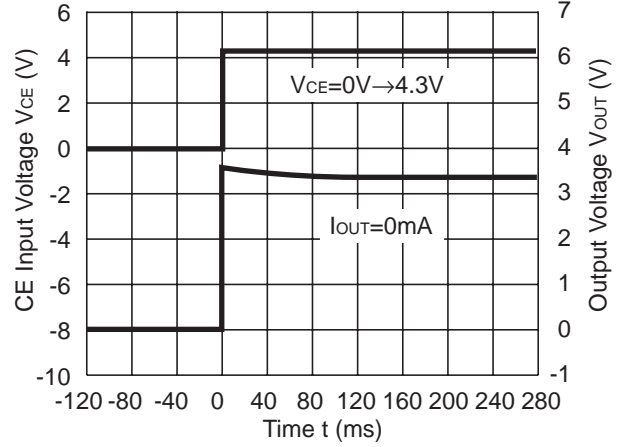
R1161x33xx (ECO=H)

$V_{IN}=4.3V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$



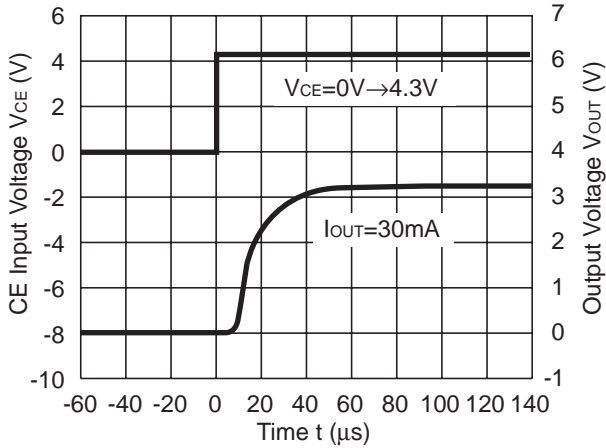
R1161x33xx (ECO=L)

$V_{IN}=4.3V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$



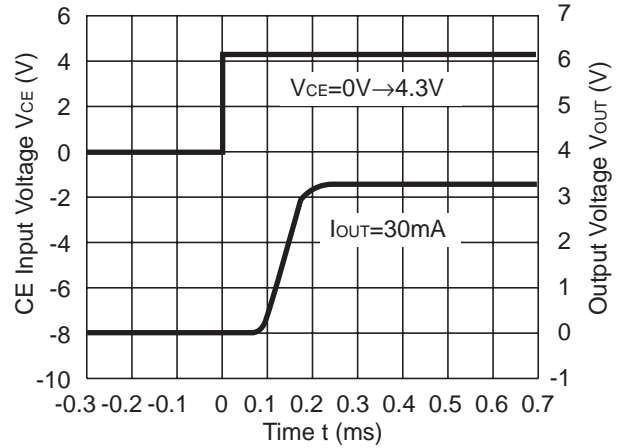
R1161x33xx (ECO=H)

$V_{IN}=4.3V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$



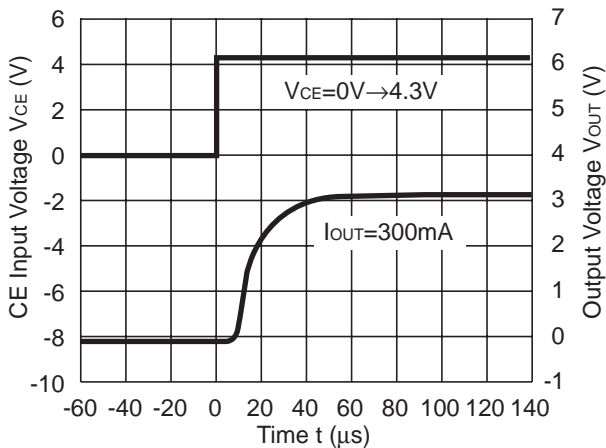
R1161x33xx (ECO=L)

$V_{IN}=4.3V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$



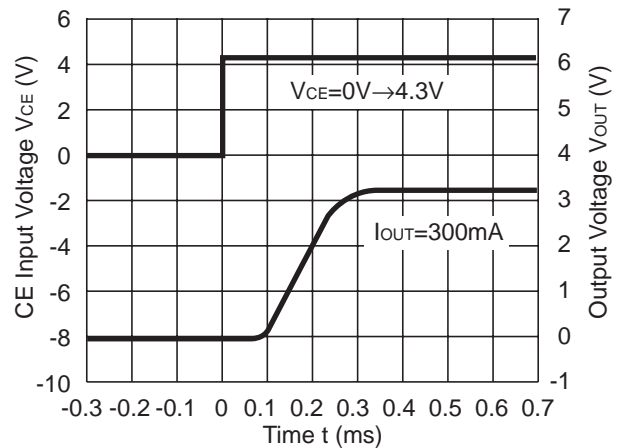
R1161x33xx (ECO=H)

$V_{IN}=4.3V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$



R1161x33xx (ECO=L)

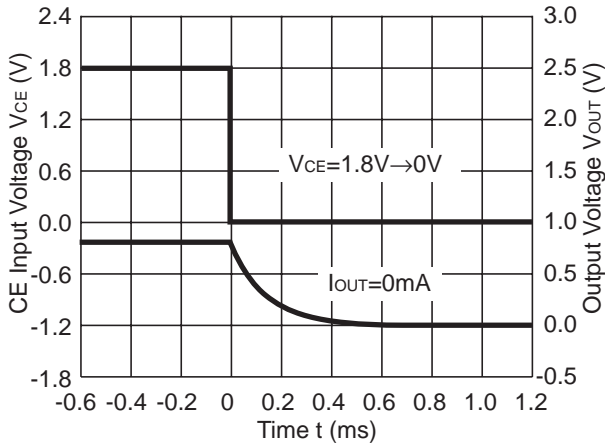
$V_{IN}=4.3V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$



13) Turn-off Speed with CE

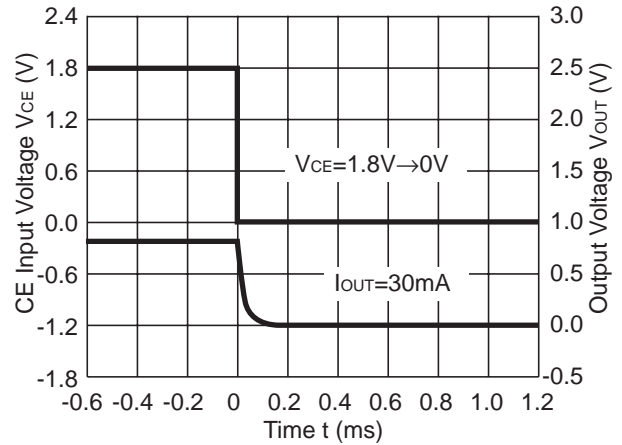
R1161x08xD

$V_{IN}=1.8V$, C_{IN} = Tantalum $1.0\mu F$
 C_{OUT} = Tantalum $1.0\mu F$



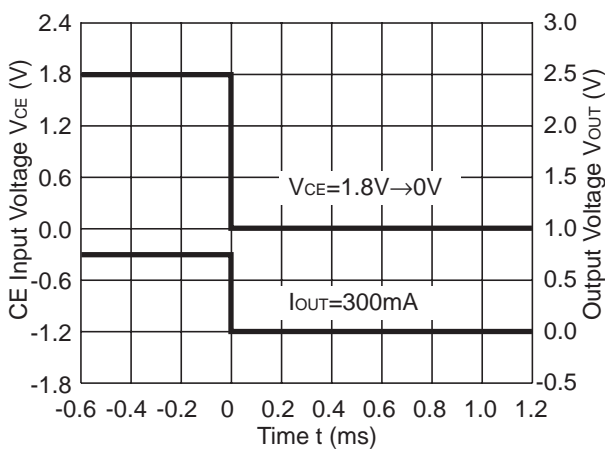
R1161x08xD

$V_{IN}=1.8V$, C_{IN} = Tantalum $1.0\mu F$
 C_{OUT} = Tantalum $1.0\mu F$



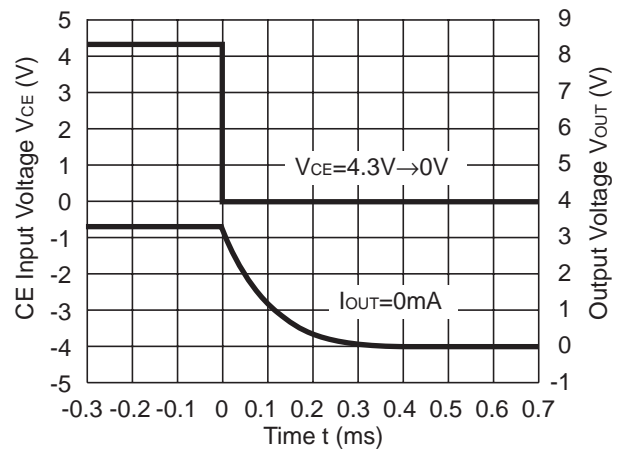
R1161x08xD

$V_{IN}=1.8V$, C_{IN} = Tantalum $1.0\mu F$
 C_{OUT} = Tantalum $1.0\mu F$



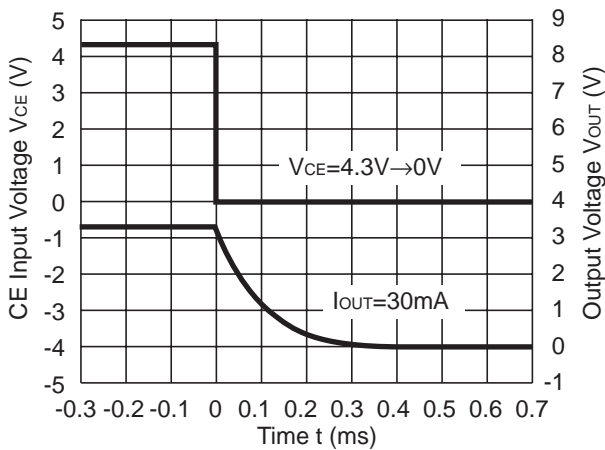
R1161x33xD

$V_{IN}=4.3V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$



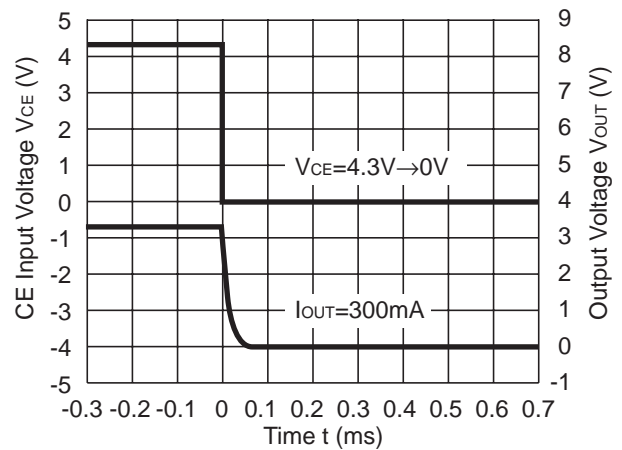
R1161x33xD

$V_{IN}=4.3V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$



R1161x33xD

$V_{IN}=4.3V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$

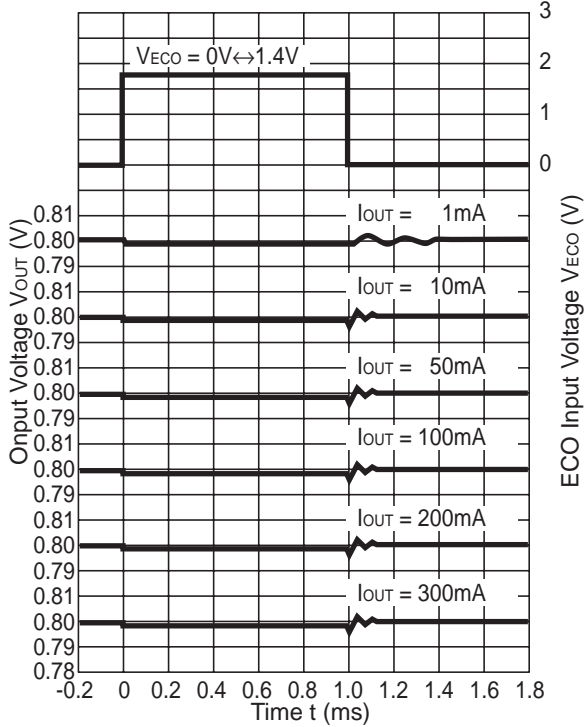


R1161x

14) Output Voltage at Mode alternative point

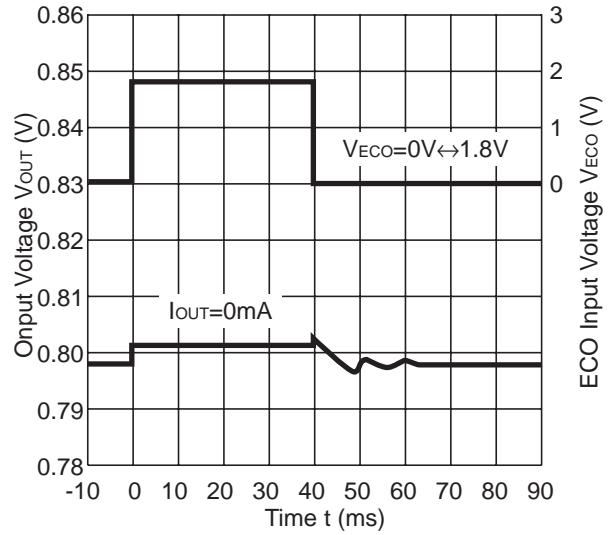
R1161x08xx

$V_{IN}=1.8V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Tantalum $1.0\mu F$



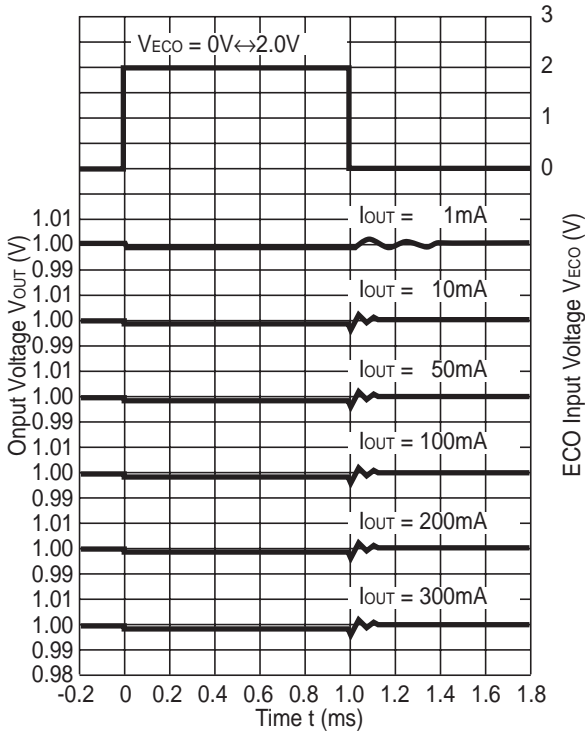
R1161x08xx

$V_{IN}=1.8V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Tantalum $1.0\mu F$



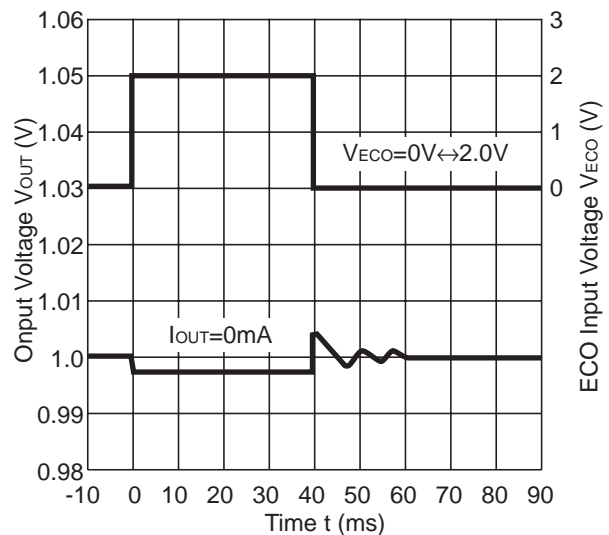
R1161x10xx

$V_{IN}=2.0V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$



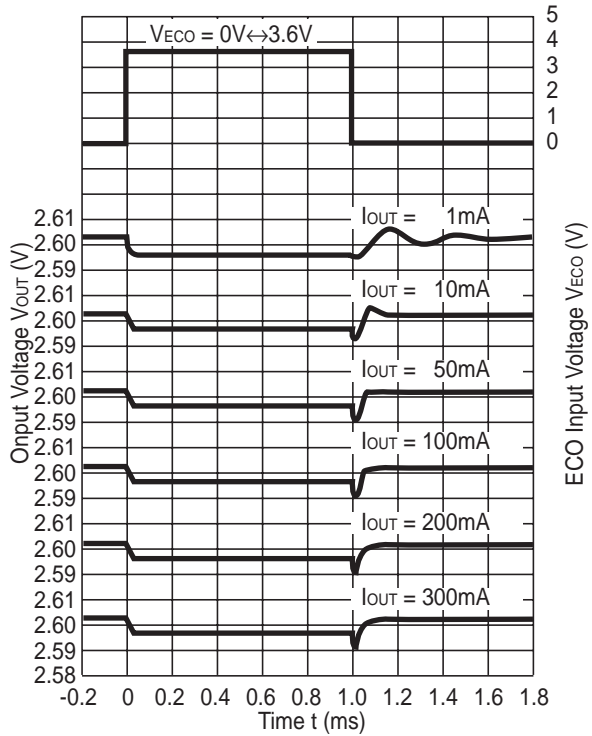
R1161x10xx

$V_{IN}=2.0V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$



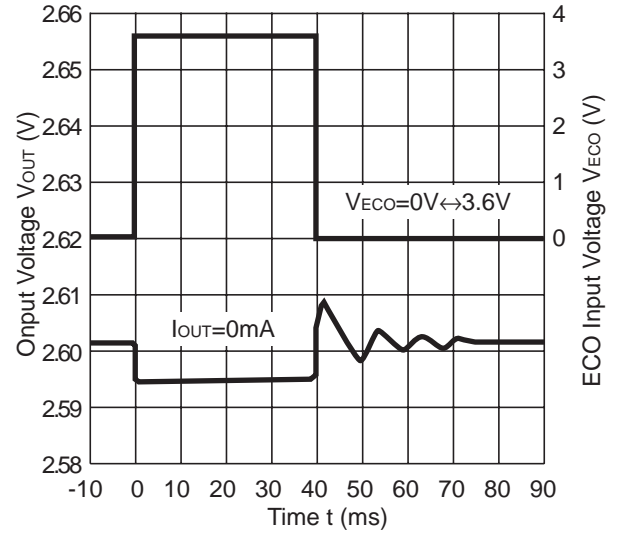
R1161x26xx

$V_{IN}=3.6V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$



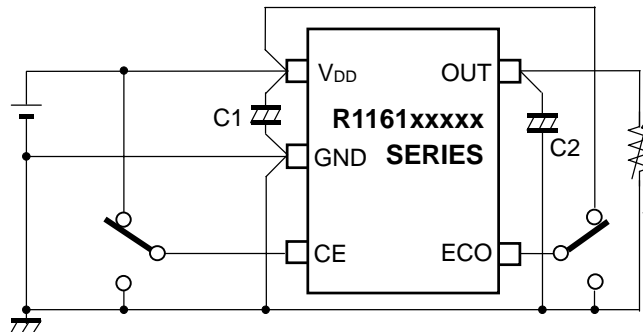
R1161x26xx

$V_{IN}=3.6V$, C_{IN} = Ceramic $1.0\mu F$
 C_{OUT} = Ceramic $1.0\mu F$



R1161x

TECHNICAL NOTES



When using these ICs, consider the following points:

1. Mounting on PCB

Make V_{DD} and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with as much as $1.0\mu\text{F}$ capacitor between V_{DD} and GND pin as close as possible.

Set external components, especially the output capacitor as close as possible to the ICs and make wiring as short as possible.

2. Phase Compensation

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, be sure to use a $1.0\mu\text{F}$ more capacitor C2 with good frequency characteristics and ESR (Equivalent Series Resistance).

Output Voltage	Recommended Value of C2
$V_{OUT} < 1.0\text{V}$	$1.0\mu\text{F}$ or more Tantalum Capacitor
$1.0\text{V} \leq V_{OUT}$	$1.0\mu\text{F}$ or more Ceramic Capacitor

(Note: When the additional ceramic capacitors are connected to the Output Pin with Output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB.)

If you use a tantalum type capacitor and ESR value of the capacitor is large, output might be unstable. Evaluate your circuit with considering frequency characteristics.

Depending on the capacitor size, manufacturer, and part number, the bias characteristics and temperature characteristics are different. Evaluate the circuit with actual using capacitors.

ESR vs. Output Current

When using these ICs, consider the following points:

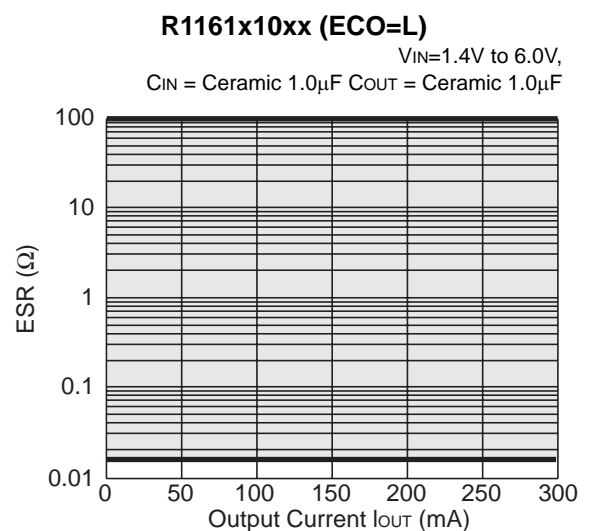
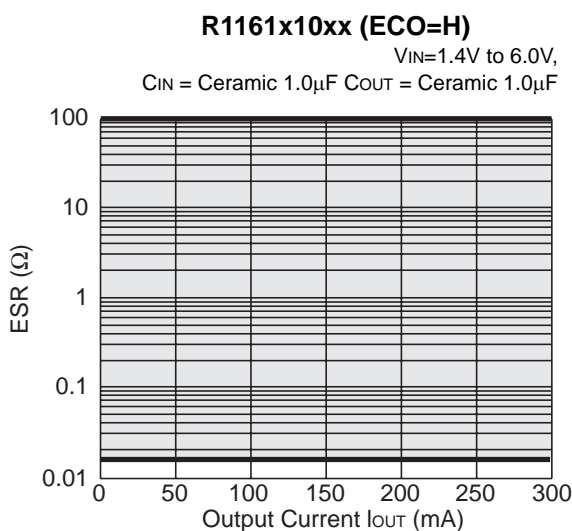
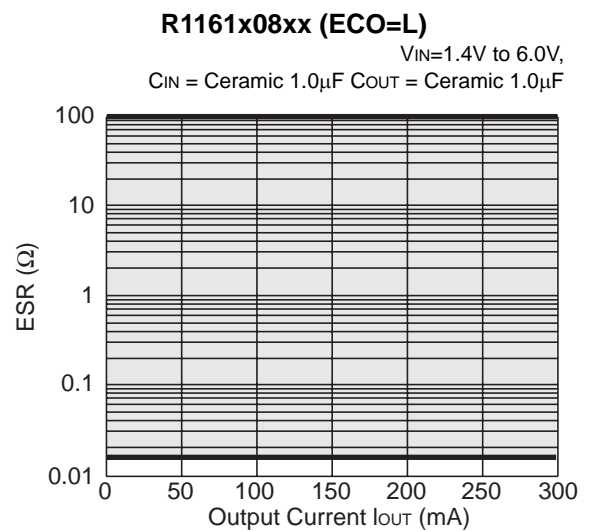
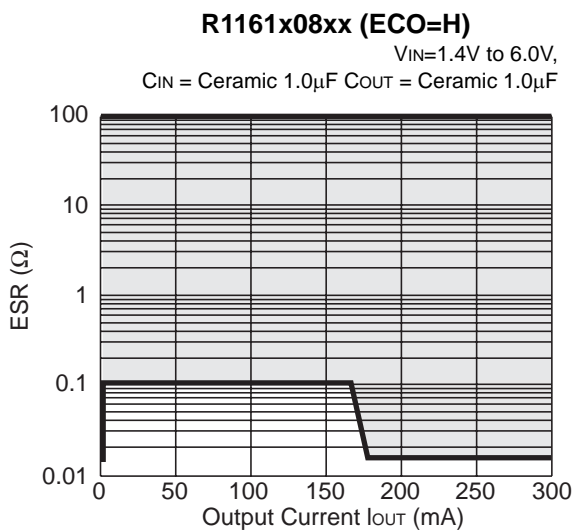
In these ICs, phase compensation is made for securing stable operation even if the output current is varied. For this purpose, be sure to use a capacitor C_{OUT} with good frequency characteristics and ESR (Equivalent Series Resistance) in the range described as follows:

The relations between I_{OUT} (Output Current) and ESR of Output Capacitor are shown below.

The conditions when the white noise level is under $40\mu V$ (Avg.) are marked as the hatched area in the graph.

<Test conditions>

- (1) Frequency band: 10Hz to 2MHz
- (2) Temperature: 25°C

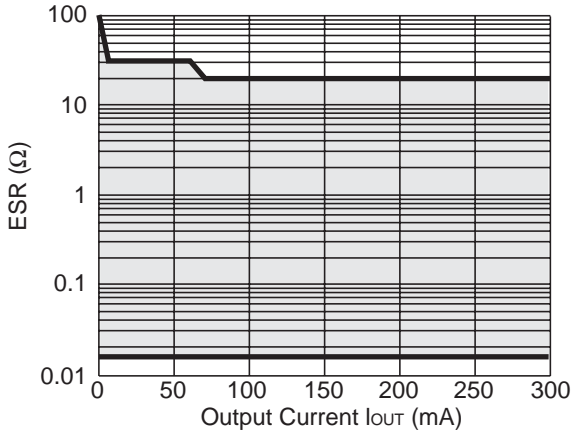


* R1116Dxx1 (SON-6) is the limited product and R1116Dxx2 (HSON-6) is the discontinued product. As of March in 2015.

R1161x

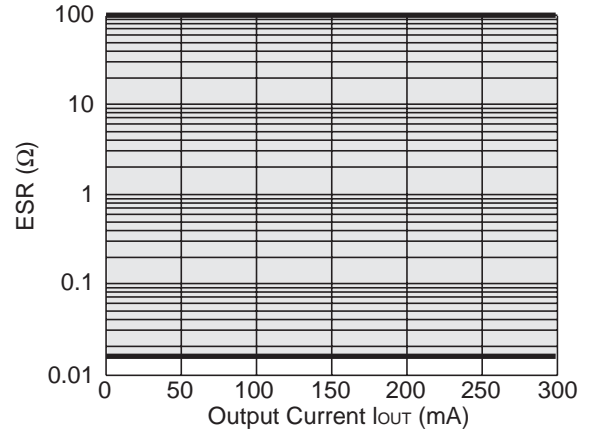
R1161x26xx (ECO=H)

$V_{IN}=3.0V$ to $6.0V$,
 C_{IN} = Ceramic $1.0\mu F$ C_{OUT} = Ceramic $1.0\mu F$



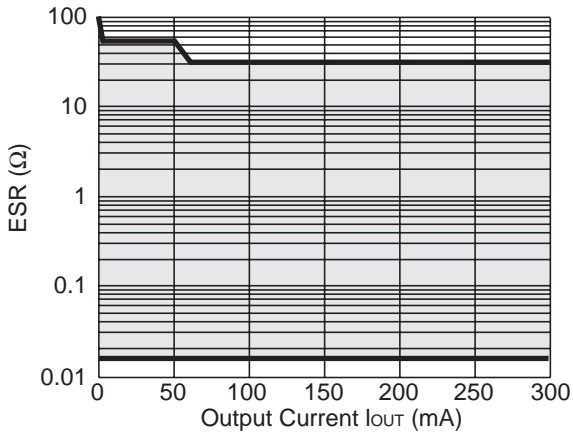
R1161x26xx (ECO=L)

$V_{IN}=3.0V$ to $6.0V$,
 C_{IN} = Ceramic $1.0\mu F$ C_{OUT} = Ceramic $1.0\mu F$



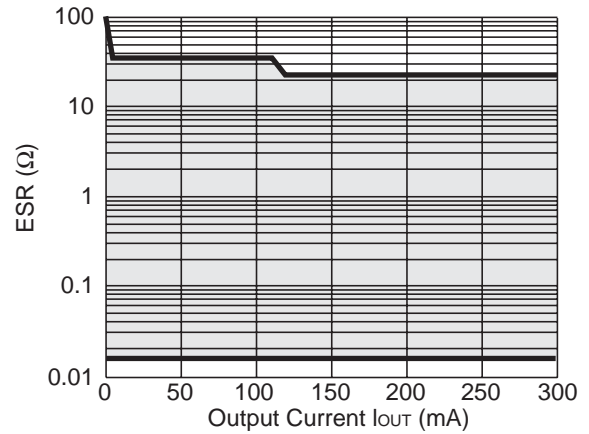
R1161x15xx (ECO=H)

$V_{IN}=2.0V$ to $6.0V$,
 C_{IN} = Ceramic $1.0\mu F$ C_{OUT} = Ceramic $1.0\mu F$



R1161x30xx (ECO=H)

$V_{IN}=3.6V$ to $6.0V$,
 C_{IN} = Ceramic $1.0\mu F$ C_{OUT} = Ceramic $1.0\mu F$





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