

OUTLINE

The R5511x Series are CMOS-based voltage regulator(LDO) ICs equipped with a voltage detector(VD). LDO function of the R5511x has features of high ripple rejection, low dropout voltage, high output voltage accuracy, and low supply current. Each of these ICs consists of a voltage reference unit, an error amplifier, resistors for setting output voltage, a current limit circuit, a voltage detector, and a chip enable circuit. The output of built-in voltage detector is Nch open drain type. (With the mask option CMOS output type is also available.)

The output voltage and the detector threshold voltage are fixed in the IC. Low supply current by the merit of CMOS process and the built-in transistor with low ON-resistance make low dropout voltage. These regulators in the R5511x Series are remarkable improvement on the current regulators in terms of ripple rejection, input transient response, and load transient response. Furthermore, the R5511x series can supervise input voltage (the input voltage means the input level for V_{DD} or V_{SEN} pin) with built-in detector. Thus, the R5511x series are suitable not only for cellular handsets but also for power supply for CD-drives, DVD-drives, and so forth.

Since the packages for these ICs are the SON-6, SOT-23-5, SOT-89-5 package, high density mounting of the ICs on boards is possible.

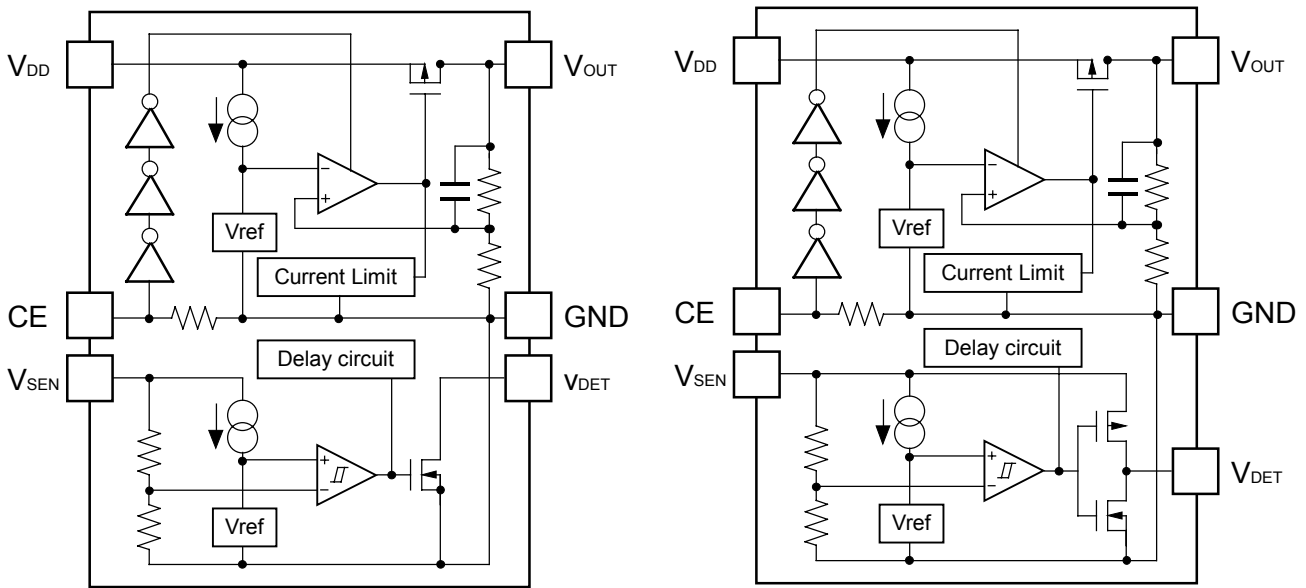
FEATURES

- Low Supply Current Typ. 50 μ A (VR)
 - Low Standby Current Typ. 0.1 μ A (VR)
 - High Ripple Rejection Typ. 75dB (f=1kHz) (VR)
 - Output Current Min. 300mA
 - High Output Voltage Accuracy $\pm 1.5\%$ ($V_{OUT} \geq 2.0V$), 30mV($2.0V > V_{OUT} > 1.5V$), 2.0%($1.5V \geq V_{OUT}$)
 $\pm 1.5\%$ ($V_{DET} \geq 2.0V$), 30mV($2.0V > V_{DET} > 1.5V$), 2.0%($1.5V \geq V_{DET}$)
 - Low Dropout Voltage..... Typ. 0.1V ($V_{OUT}=3.0V$, $I_{OUT}=100mA$) (VR)
 - Built-in Current Limit Circuits (VR)
 - Low Temperature-drift Coefficient of Output Voltage Typ. $\pm 100ppm/^{\circ}C$
 - Absolute Maximum Voltage 6.5V
 - Small Packages SON-6,SOT-23-5, SOT-89-5
 - Built-in Reset Delay Circuits A: (Delay time=1ms, Hysteresis5%)
B: (Delay time=20ms, Hysteresis5%)
C: (Delay time; 60ms, Hysteresis5%)
D: (Delay time; 240ms, no Hysteresis)
- *Delay time:120ms/ With or without hysteresis can be designated with user's request
- Ceramic Capacitor Recommendation..... $C_{IN}=C_{OUT}$ =Ceramic Capacitor 1.0 μ F or more.

APPLICATIONS

- CD-drives and DVD-drives
- Power source for Cellular Phone

BLOCK DIAGRAMS



*In case 5-pin package is selected, V_{SEN} is connected to V_{DD} or V_{OUT} inside the chip.

SELECTION GUIDE

The output voltage setting code number, hysteresis, output delay time, V_{SENSE} connection option, the detector output type, the taping type can be selected at the user's request.

The selection can be made by designating the part number as follows;

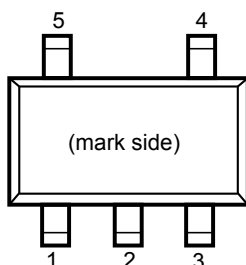
R5511xxxxxx-xx ←Part Number
 ↑ ↑ ↑ ↑ ↑
 a b cd e

Code	Contents
a	Designation of the package: H: SOT-89-5, D: SON-6, N: SOT23-5
b	Designation of option; Serial number code of Output voltage and Detector Threshold setting, with/without hysteresis
c	Designation of Output Delay Time; A: 1ms, B: 20ms, C: 60ms, D: 240ms
d	Designation of Supervised pin, Detector Output type A: V _{DD} monitor Nch Open drain (5-pin package) B: V _{OUT} monitor Nch Open drain (5-pin package) C: V _{SEN} monitor Nch Open drain (6-pin package) D: V _{SEN} monitor CMOS Output (6-pin package)
e	Designation of Taping Type

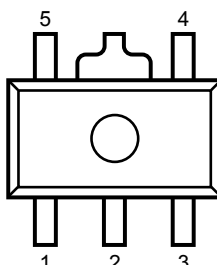
*With Hysteresis / No delay time version can be designated.

PIN CONFIGURATION

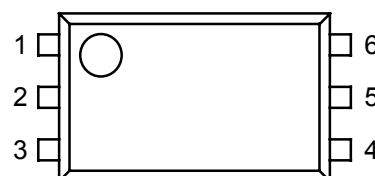
● SOT-23-5



● SOT-89-5



● SON-6



PIN DESCRIPTIONS

● SOT-23-5

Pin No	Symbol
1	CE
2	GND
3	V _{DET}
4	V _{DD}
5	V _{OUT}

● SOT-89-5

Pin No	Symbol
1	V _{DET}
2	GND
3	CE
4	V _{OUT}
5	V _{DD}

● SON-6

Pin No	Symbol
1	CE
2	GND
3	V _{OUT}
4	V _{DD}
5	V _{SEN}
6	V _{DET}

Symbol	Description
V _{OUT}	Voltage Regulator Output Pin
V _{DD}	Input and SENSE Pin of Voltage Detector
GND	Ground Pin
V _{DET}	Voltage Detector Output Pin (When the voltage detector detects the lowering voltage than setting threshold level, the output voltage level is "L". While V _{DD} Input Level at reset detection or before crossing threshold level from higher voltage than it, the output voltage level is "H".)
CE	Chip Enable Pin
V _{SEN}	V _{DET} SENSE Pin (In case of 5-lead packages, V _{SEN} is connected V _{DD} or V _{OUT} inside the package.)

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	6.5	V
V_{CE}	Input Voltage (CE Input Pin) *Note	6.5	V
V_{SEN}	Input Voltage (V_{SEN} Pin)	6.5	V
V_{DET}	Output Voltage (V_{DET} Output pin)	CMOS Output : $-0.3 \sim V_{IN} + 0.3$ Ncn Open Drain : $-0.3 \sim 6.5$	V
V_{OUT}	Output Voltage	$-0.3 \sim V_{IN} + 0.3$	V
I_{OUT}	Output Current	400	mA
P_D	Power Dissipation (SON-6)	150	mW
	Power Dissipation (SOT-23-5)	250	
	Power Dissipation (SOT-89-5)	500	
T_{opt}	Operating Temperature	$-40 \sim 85$	$^{\circ}\text{C}$
T_{stg}	Storage Temperature	$-55 \sim 125$	$^{\circ}\text{C}$

ELECTRICAL CHARACTERISTICS

• R5511

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage				6.0	V
I_{SS1}	Quiescent Current 1	$V_{IN} - V_{OUT} = 1.0\text{V}$		50	80	μA
I_{SS2}	Quiescent Current 2	$V_{IN} = -V_{DET} - 0.1\text{V}$, $V_{CE} = 0\text{V}$		1.5	3.0	μA
I_{SS3}	Quiescent Current 3	$V_{IN} = -V_{DET} + 1.0\text{V}$, $V_{CE} = 0\text{V}$		1.5	3.0	μA

• VR Part

Topt=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V _{OUT}	Output voltage	V _{IN} -V _{OUT} =1.0V I _{OUT} =30mA *Note1	×0.985 (-30mV) ×0.980		×1.015 (+30mV) ×1.020	V
I _{OUT}	Output Current	V _{IN} -V _{OUT} = 1.0V	300			mA
ΔV _{OUT} /ΔI _{OUT}	Load regulation	V _{IN} -V _{OUT} = 1.0V 1mA ≤ I _{OUT} ≤ 100mA *Note2		5	15	mV
V _{DIF}	Dropout Voltage	Refer to the Electrical Characteristics by Output Voltage				V
ΔV _{OUT} /ΔV _{IN}	Line regulation	I _{OUT} =30mA V _{OUT} +0.5V ≤ V _{IN} ≤ 6.0V		0.05	0.15	%/V
RR	Ripple Rejection	f=1kHz, Ripple 0.5Vp-p V _{IN} -V _{REG1} =1.0V		75		dB
ΔV _{OUT} /ΔT	Output Voltage Temperature Coefficient	I _{OUT} =30mA -40°C ≤ Topt ≤ 85°C		±100		ppm/°C
I _{LIM}	Short Current Limit	V _{OUT} = 0V		50		mA
R _{PD}	Pull-down resistance for CE pin		2	5	14	MΩ
V _{CEH}	CE Input Voltage "H"		1.1		V _{IN}	V
V _{CEL}	CE Input Voltage "L"		0.0		0.3	V

*Note1: ±1.5% (V_{OUT} ≥ 2.0V), 30mV(2.0V>V_{OUT}>1.5V), 2.0%(1.5V ≥ V_{OUT})

*Note2: Guaranteed by Design.

• VD Part

Topt=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
-V _{DET}	Detector Threshold	*Note3	×0.985 (-30mV) ×0.980		×1.015 (+30mV) ×1.020	V
V _{HYS}	Detector Threshold Hysteresis	Delay Time: 0ms, 20ms, 60ms	-V _{DET} ×0.03	-V _{DET} ×0.05	-V _{DET} ×0.07	V
I _{OL}	Output Current	Refer to Electrical Characteristics by Detector Threshold				mA
I _{OH} (CMOS Output)						
V _{DDL}	Minimum Operating Voltage			0.65	0.80	V
Δ-V _{DET} /ΔT	Detector Threshold Temperature Coefficient	-40°C ≤ Topt ≤ 85°C		±100		ppm/°C
t _{PLH}	Output Delay Time	Delay time=1ms	0.5	1.0	2.8	ms
		Delay time=20ms	16	20	24	
		Delay time=60ms	50	60	70	
		Delay time=240ms	200	240	280	

*Note3: ±1.5% (V_{OUT} ≥ 2.0V), 30mV(2.0V>V_{OUT}>1.5V), 2.0%(1.5V ≥ V_{OUT})

• Electrical Characteristics by Output Voltage

Output Voltage V_{OUT} (V)	Dropout Voltage (mV)		
	Condition	V_{DIF}	
		Typ.	Max.
$1.2V \leq V_{SET} < 1.5V$	$I_{OUT} = 100mA$	180	280
$1.5V \leq V_{SET} < 1.8V$		160	220
$1.8V \leq V_{SET} < 2.2V$		140	200
$2.2V \leq V_{SET} < 2.8V$		120	170
$2.8V \leq V_{SET} \leq 4.0V$		100	150

• Electrical Characteristics by Detector Threshold

Nch Open Drain Type

Detector Threshold $-V_{DET}$ (V)	Output Current (mA)				
	Condition		I_{OL}		
			Min.	Typ.	Max.
$1.2V \leq V_{DSET} < 1.6V$	$V_{DD} = 1.1V$	$V_{DS} = 0.5V$	1.1	2.8	5.0
$1.6V \leq V_{DSET} < 3.1V$	$V_{DD} = 1.5V$		3.0	6.0	10.0
$3.1V \leq V_{DSET} \leq 5.0V$	$V_{DD} = 3.0V$		8.0	11.0	15.0

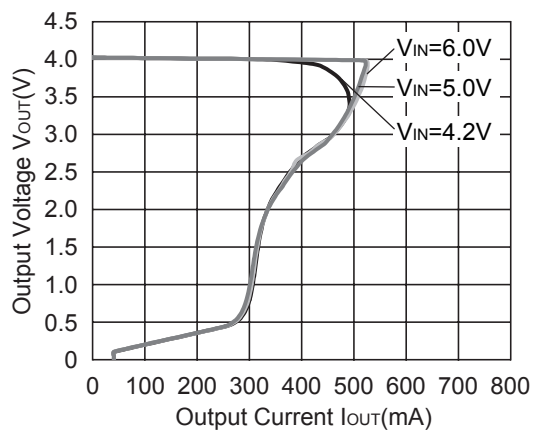
CMOS Output Type

Detector Threshold $-V_{DET}$ (V)	Output Current (mA)			
	Condition	I_{OH}		
		Min.	Typ.	Max.
$1.2V \leq V_{DSET} < 1.6V, V_S = 1.7V$	$V_{DD} = V_S$ $V_{DS} = V_S \times 0.8$	0.10	0.20	0.35
$1.6V \leq V_{DSET} < 3.1V, V_S = 3.3V$		0.55	0.90	1.40
$3.1V \leq V_{DSET} \leq 5.0V, V_S = 5.4V$		1.50	2.10	2.90

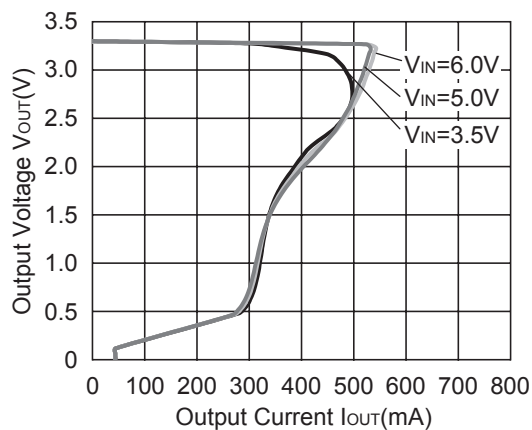
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current (Topt=25°C)

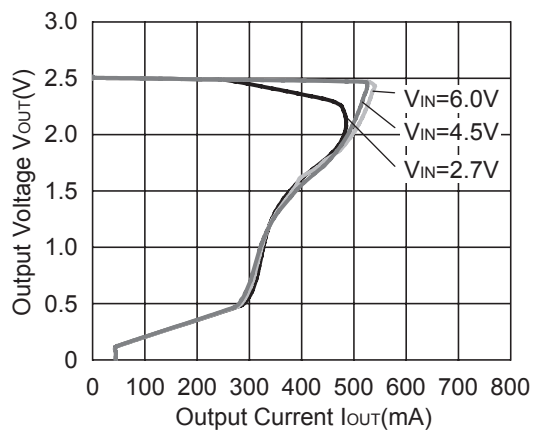
R5511x (VR=4.0V)



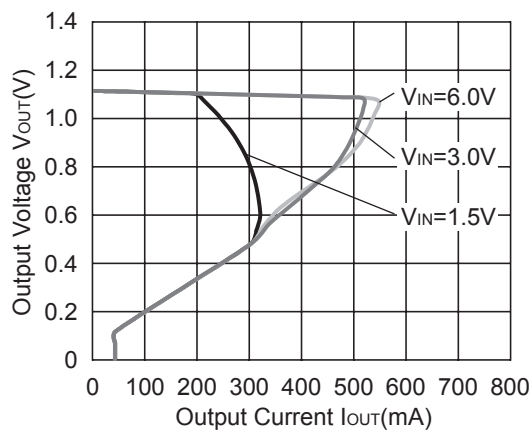
R5511x (VR=3.3V)



R5511x (VR=2.5V)

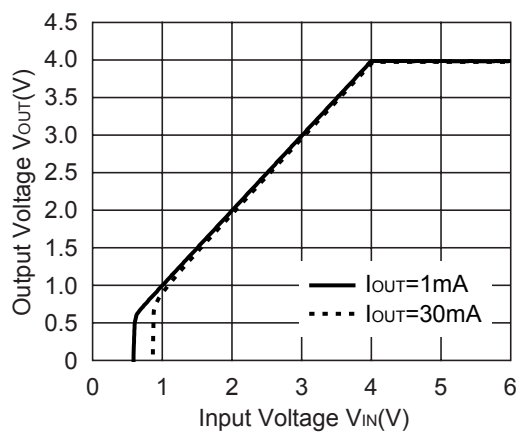


R5511x (VR=1.2V)

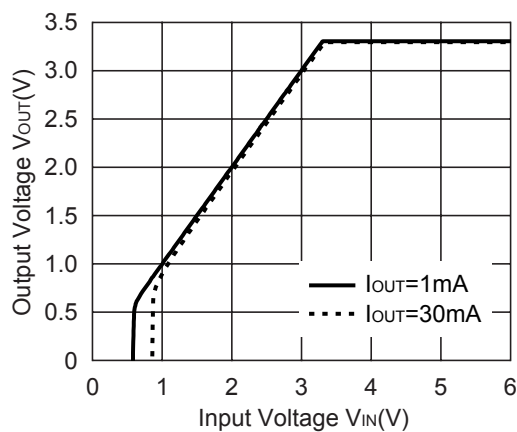


2) Input Voltage vs. Output Voltage (Topt=25°C)

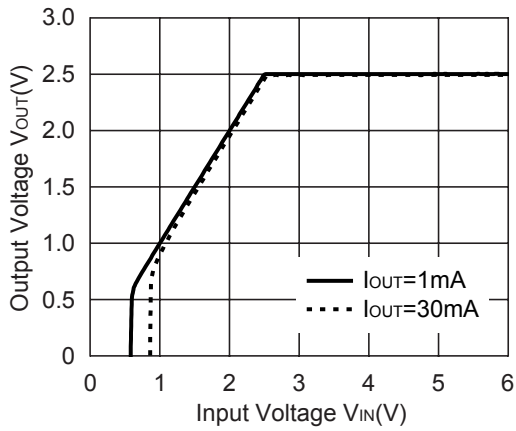
R5511x (VR=4.0V)



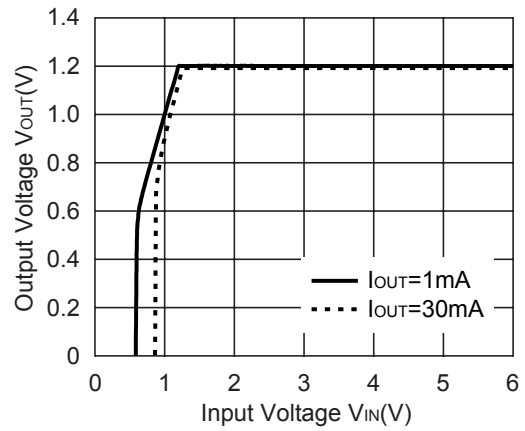
R5511x (VR=3.3V)



R5511x (VR=2.5V)

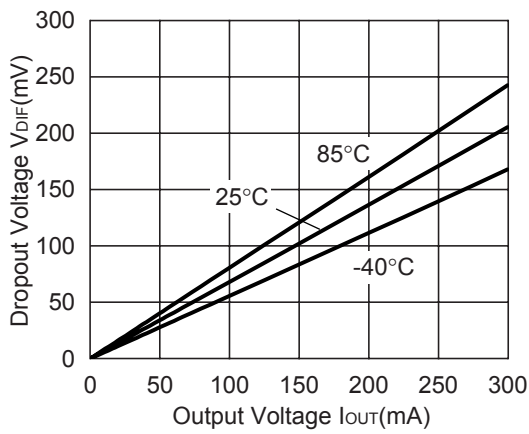


R5511x (VR=1.2V)

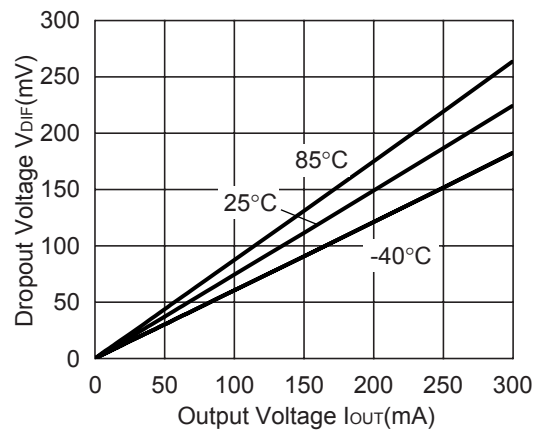


3) Dropout Voltage vs. Output Current

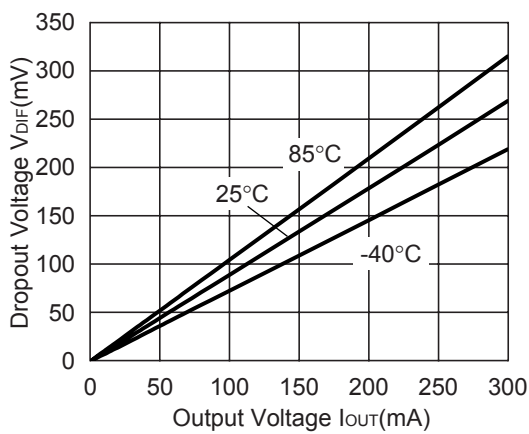
R5511x (VR=4.0V)



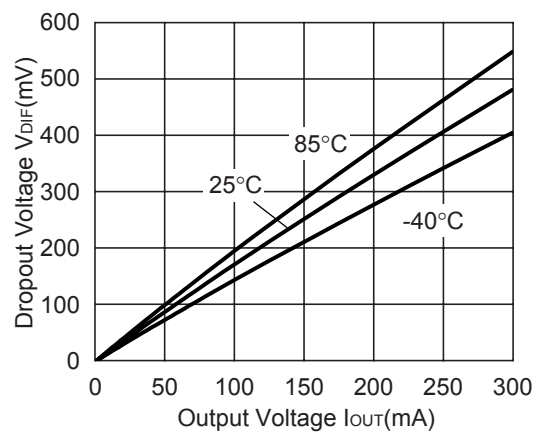
R5511x (VR=3.3V)



R5511x (VR=2.5V)

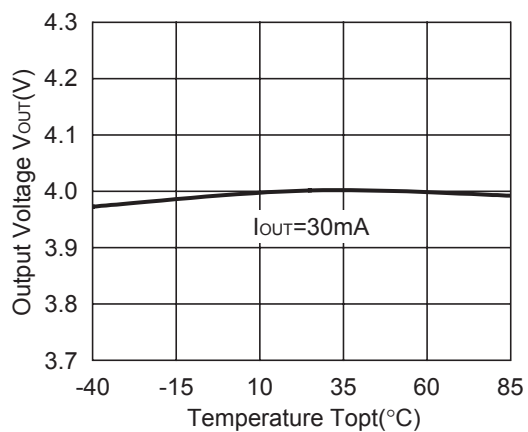


R5511x (VR=1.2V)

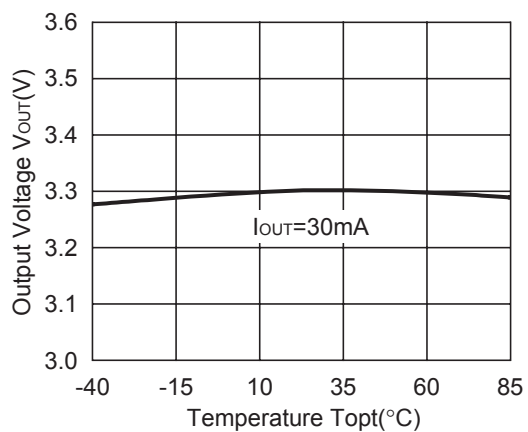


4) Output Voltage vs. Temperature

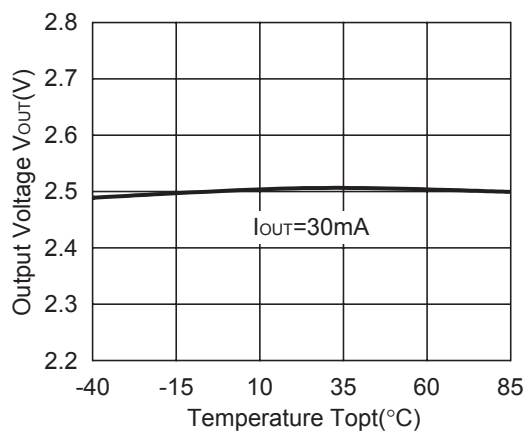
R5511x (VR=4.0V)



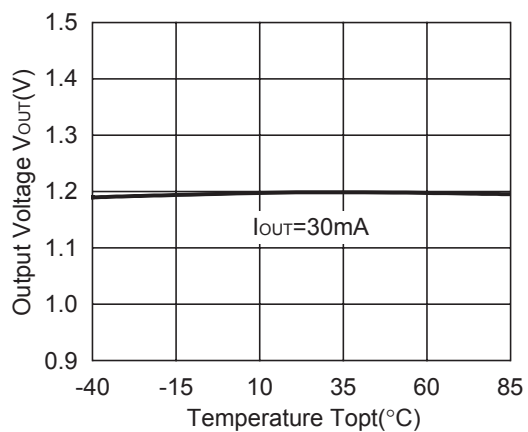
R5511x (VR=3.3V)



R5511x (VR=2.5V)

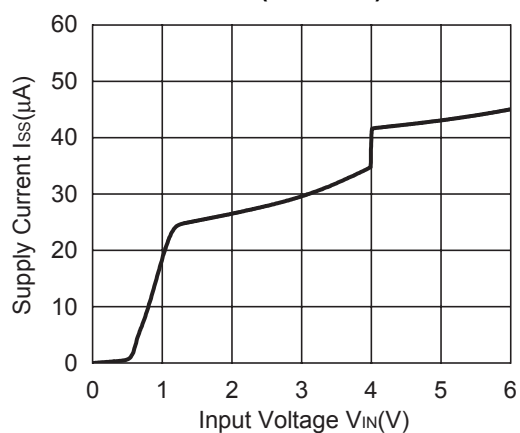


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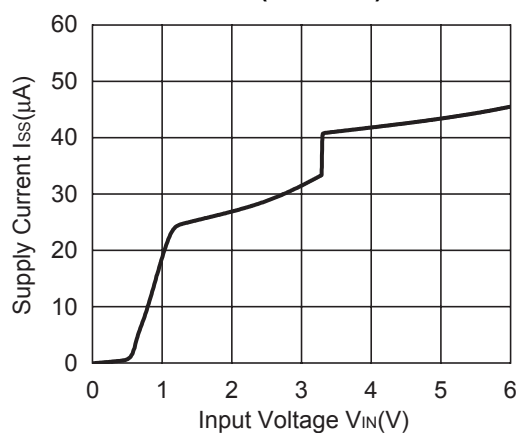


5) Supply Current vs. Input Voltage (Topt=25°C)

R5511x (VR=4.0V)

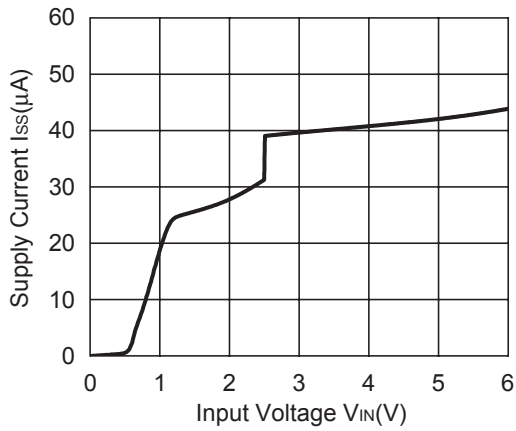


R5511x (VR=3.3V)

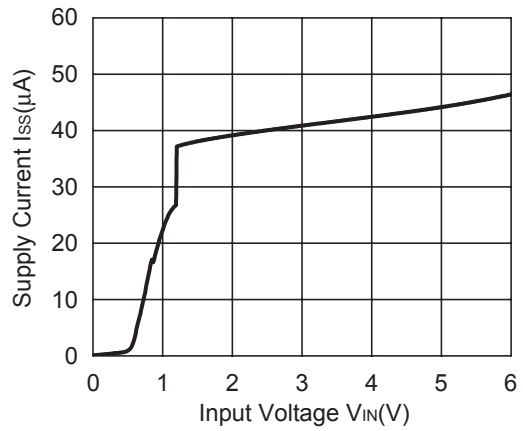


R5511x

R5511x (VR=2.5V)

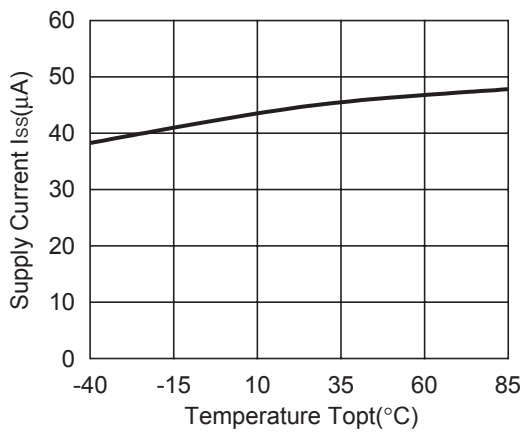


R5511x (VR=1.2V)

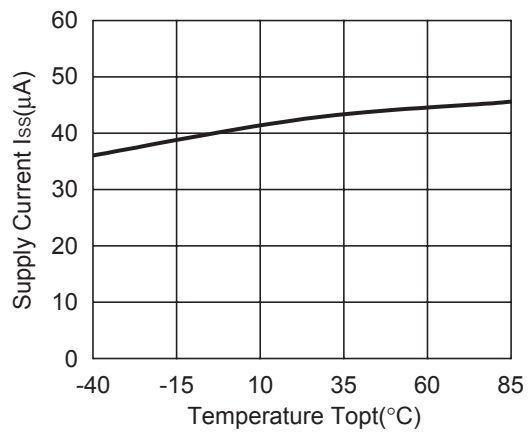


6) Supply Current vs. Temperature

R5511x (VR=4.0V)

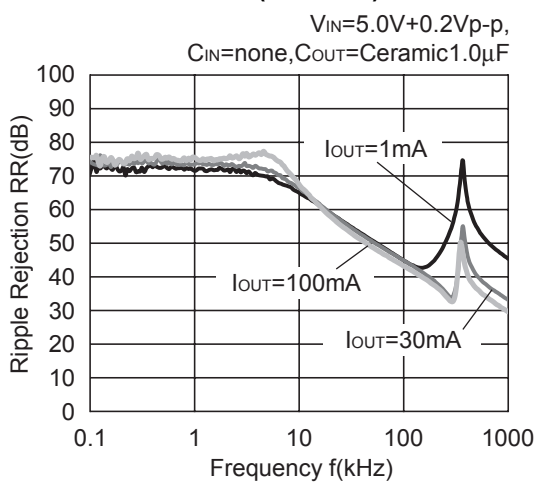


R5511x (VR=1.2V)

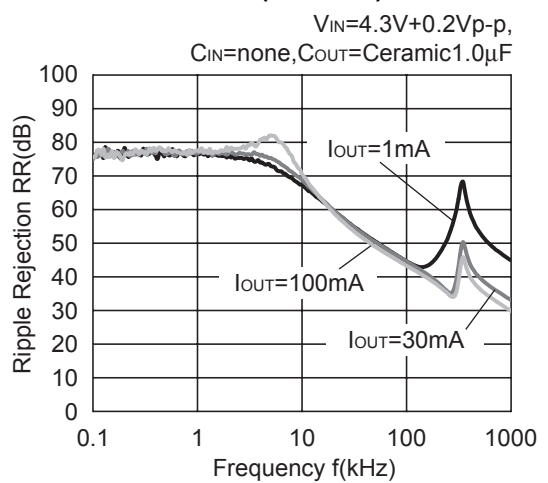


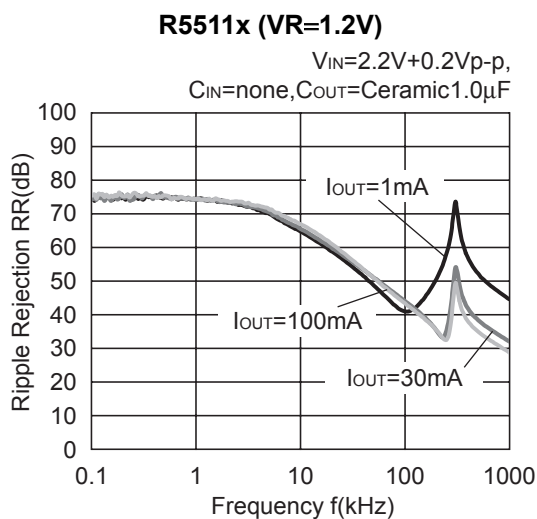
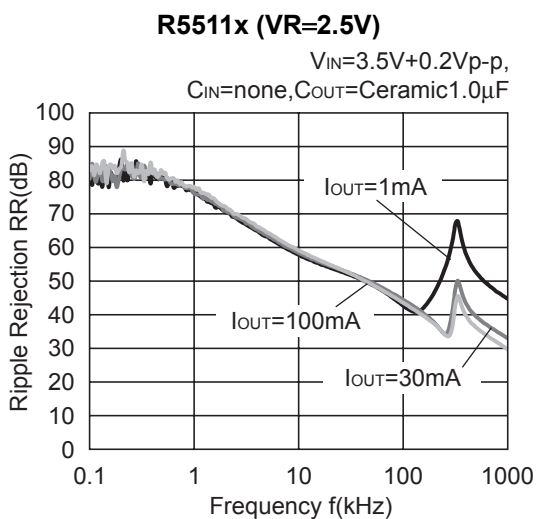
7) Ripple Rejection vs. Temperature (T_{opt}=25°C)

R5511x (VR=4.0V)

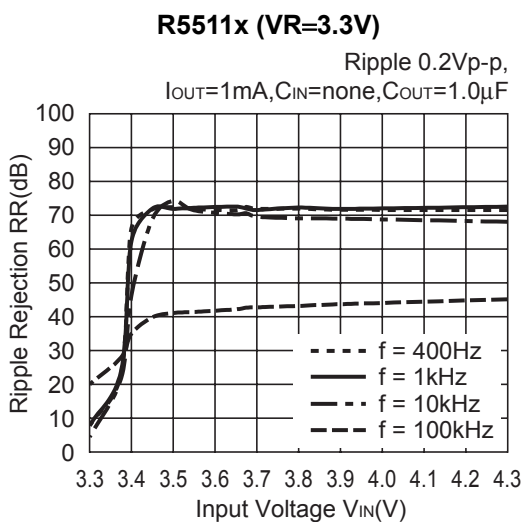
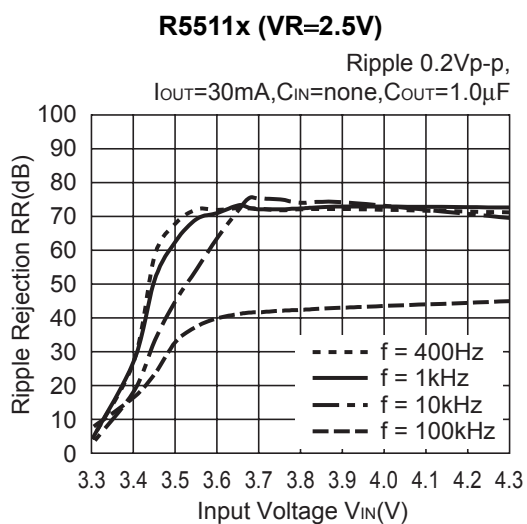
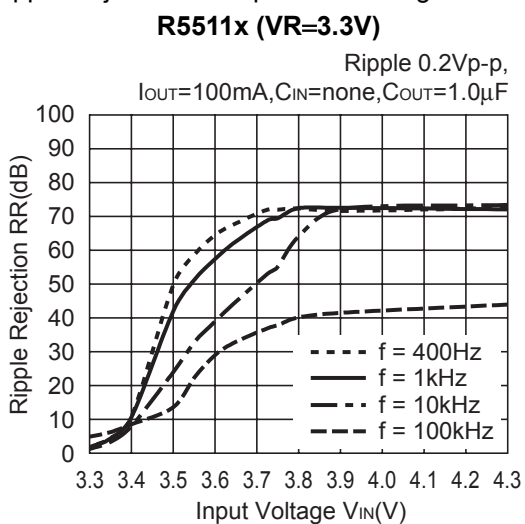


R5511x (VR=3.3V)



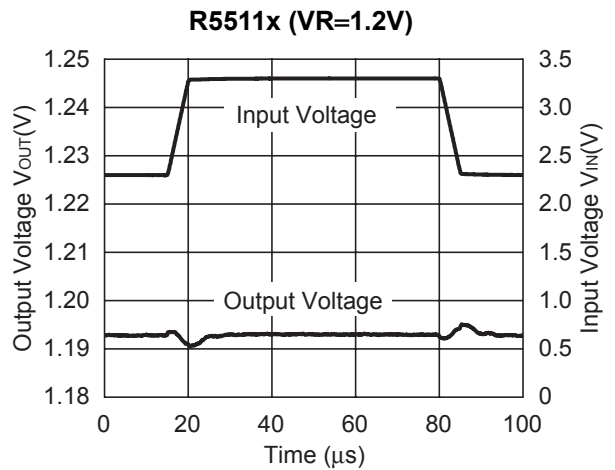
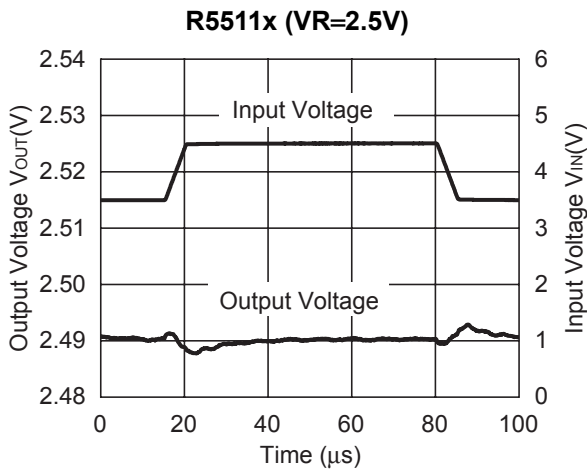
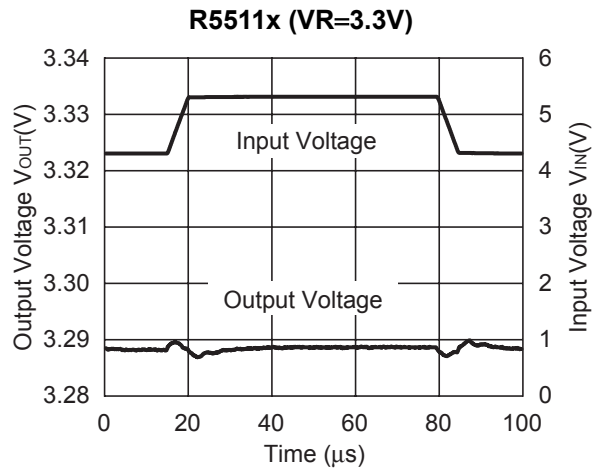
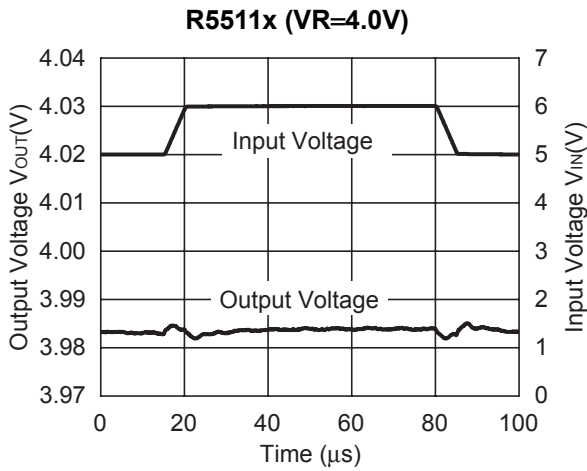


8) Ripple Rejection vs. Input Bias Voltage

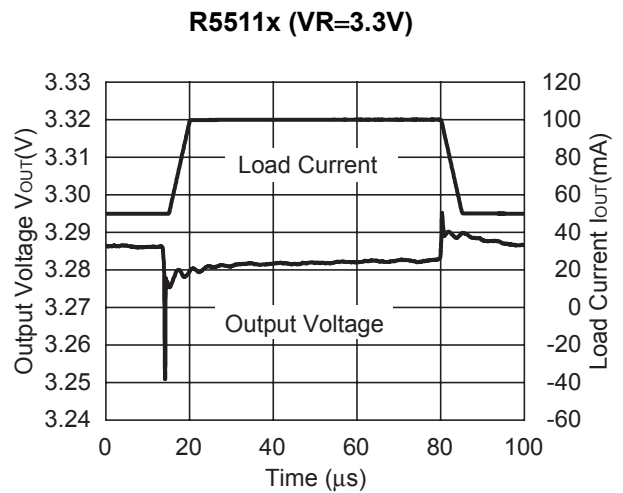
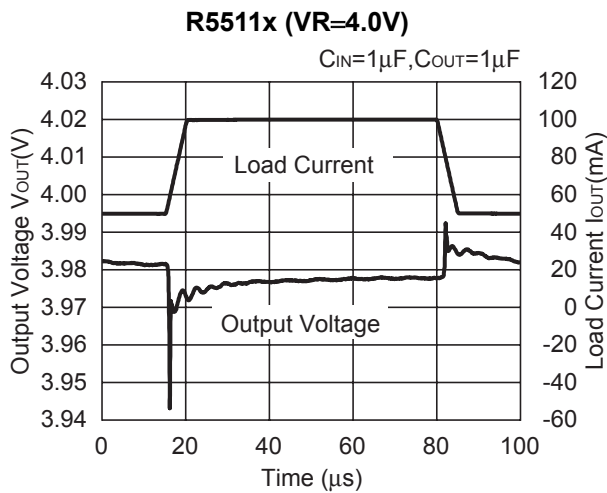


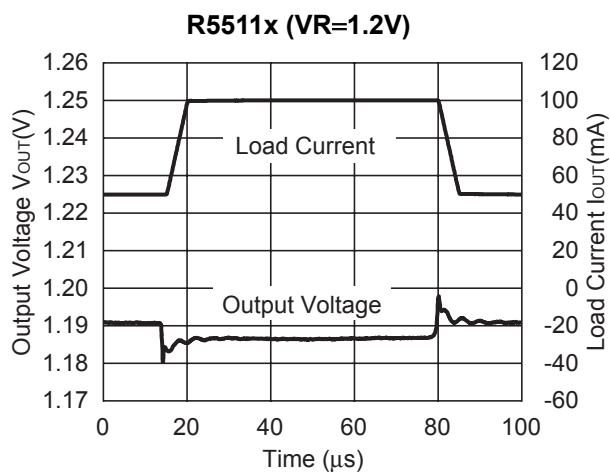
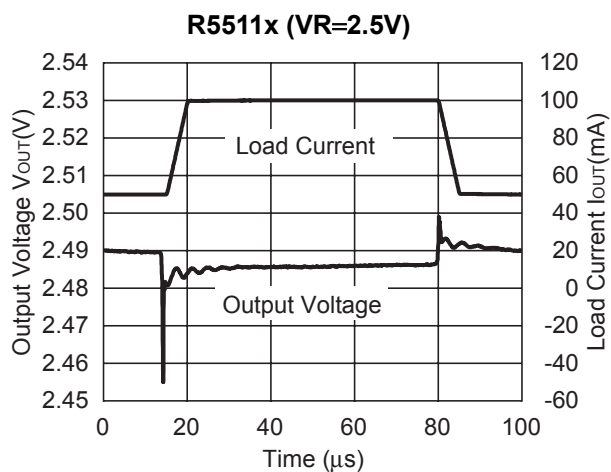
R5511x

9) Input Transient Response

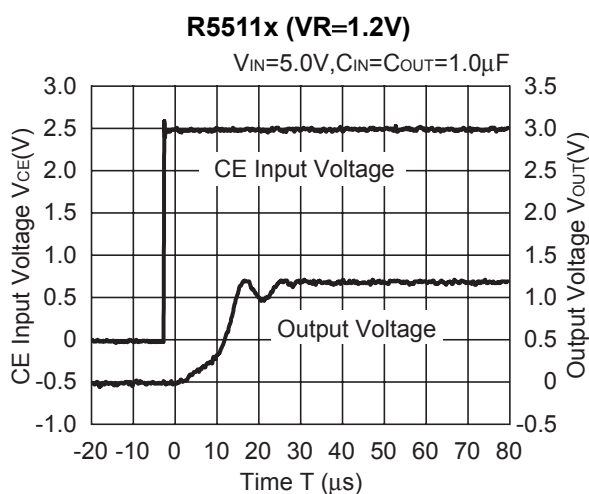
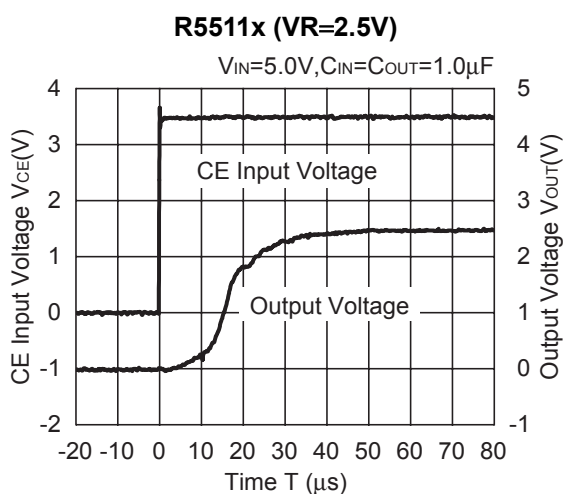
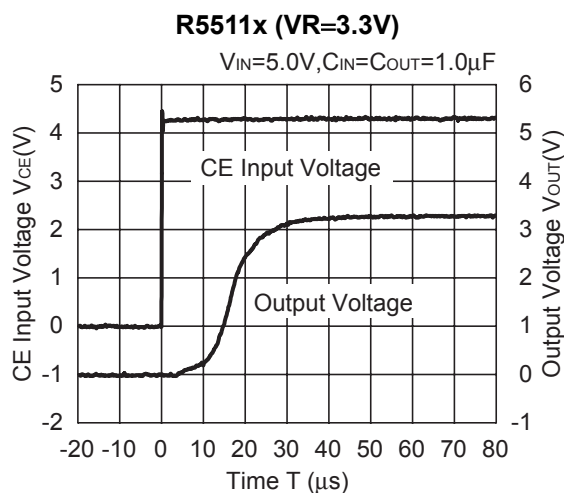
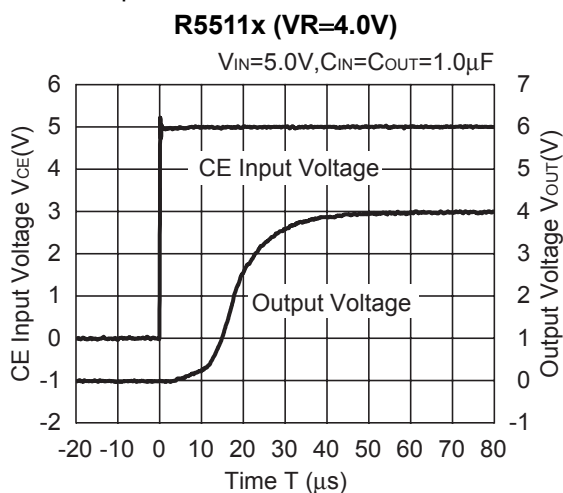


10) Load Transient Response





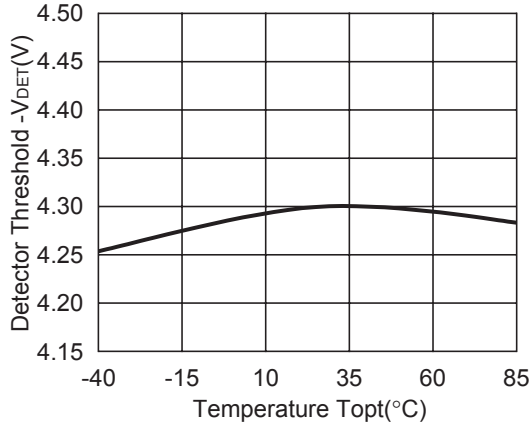
11) Turn-on Speed with CE



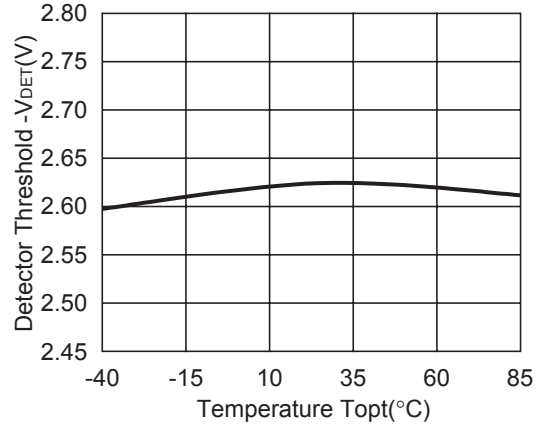
R5511x

12) Detector Threshold vs. Temperature

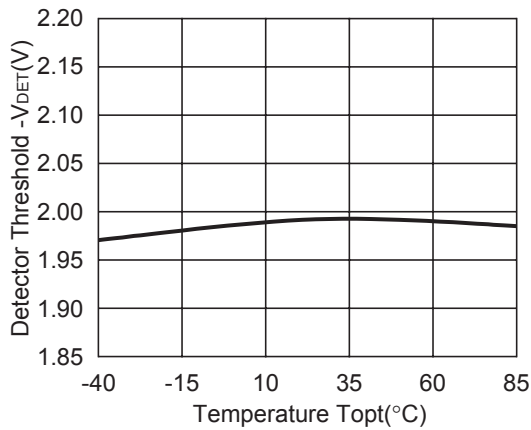
R5511x (-V_{DET}=4.3V)



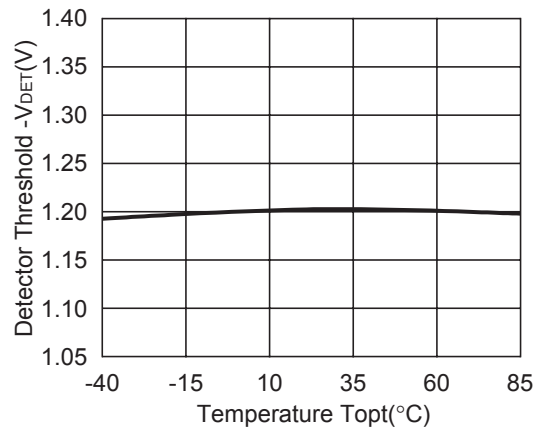
R5511x (-V_{DET}=2.63V)



R5511x (-V_{DET}=2.0V)

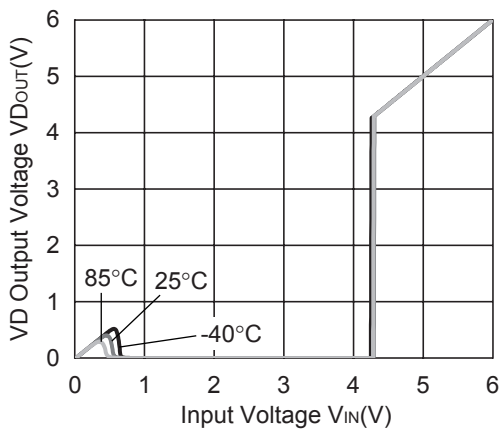


R5511x (-V_{DET}=1.2V)

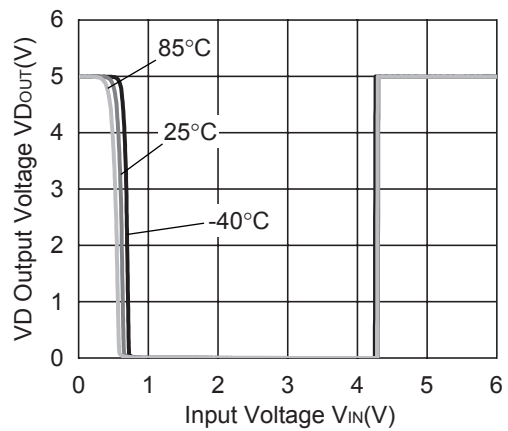


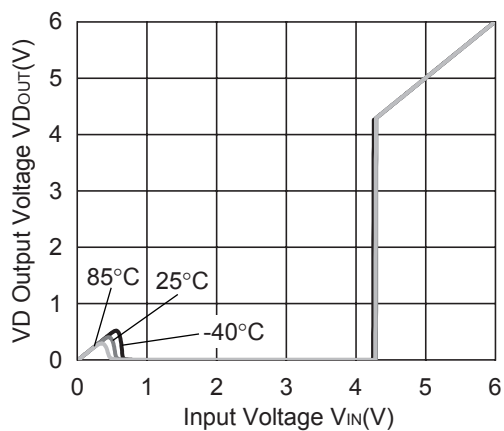
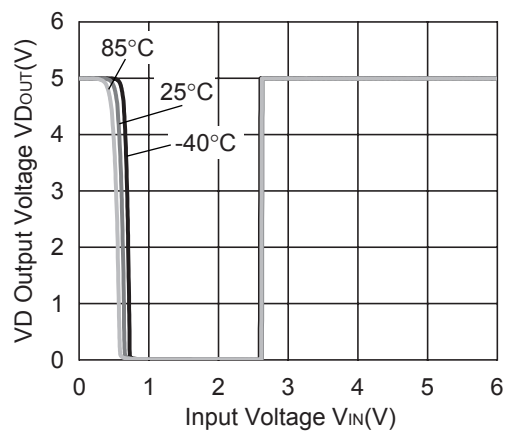
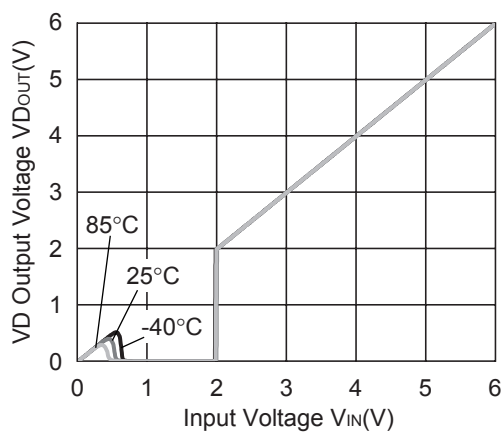
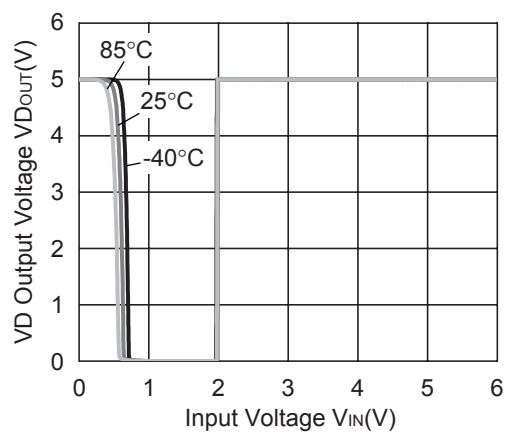
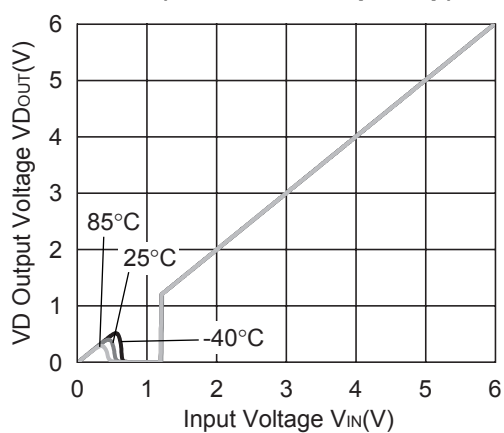
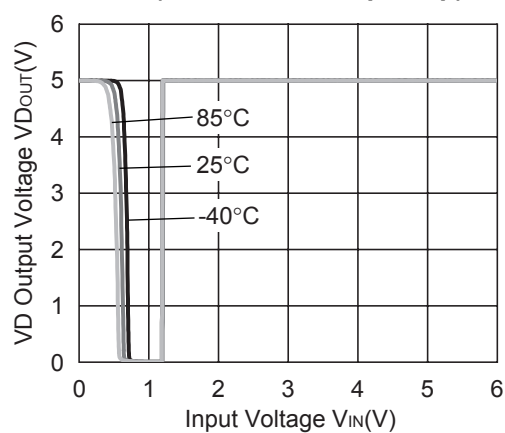
13) Detector Output Voltage vs. Input Voltage

R5511x (-V_{DET}=4.3V V_{DD} pull-up)



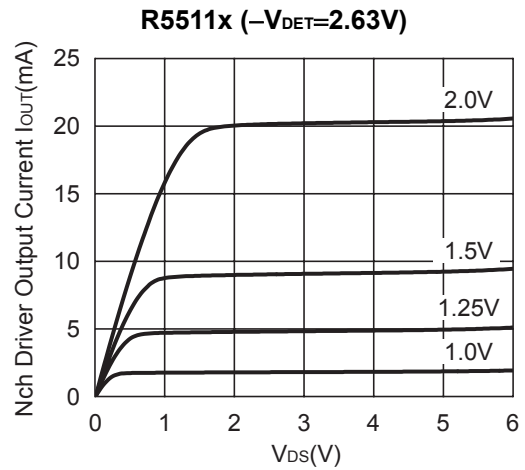
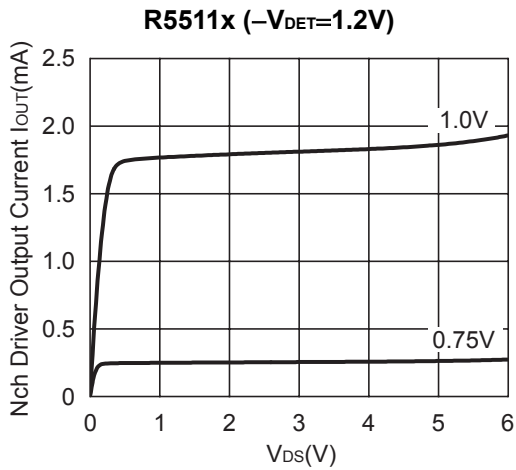
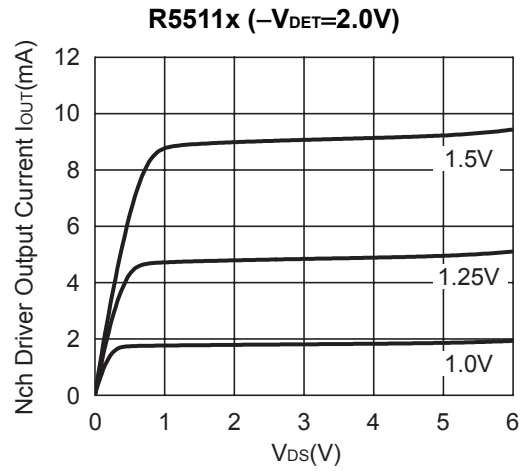
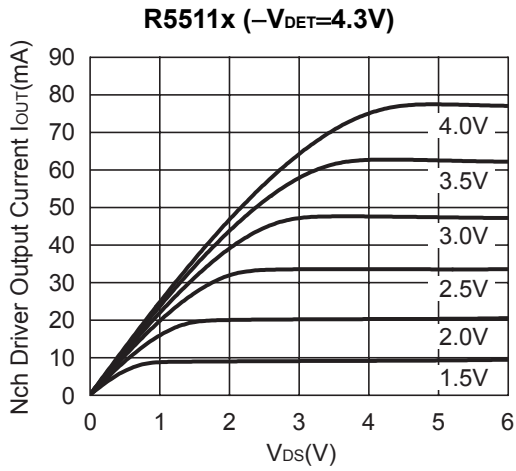
R5511x (-V_{DET}=4.3V 5.0V pull-up)



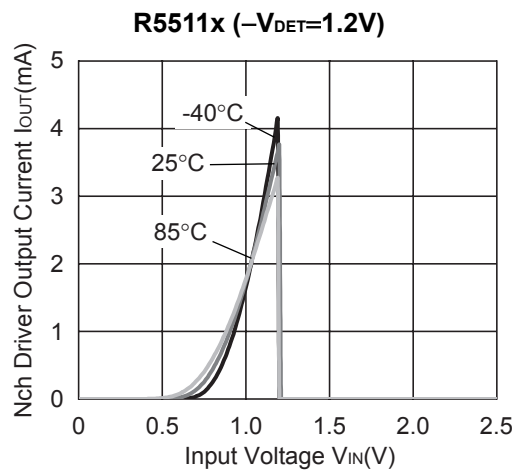
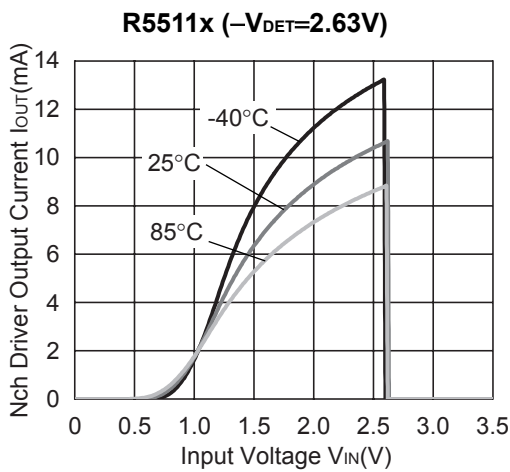
R5511x ($-V_{DET}=2.63V$ V_{DD} pull-up)R5511x ($-V_{DET}=2.63V$ 5.0V pull-up)R5511x ($-V_{DET}=2.0V$ V_{DD} pull-up)R5511x ($-V_{DET}=2.0V$ 5.0V pull-up)R5511x ($-V_{DET}=1.2V$ V_{DD} pull-up)R5511x ($-V_{DET}=1.2V$ 5.0V pull-up)

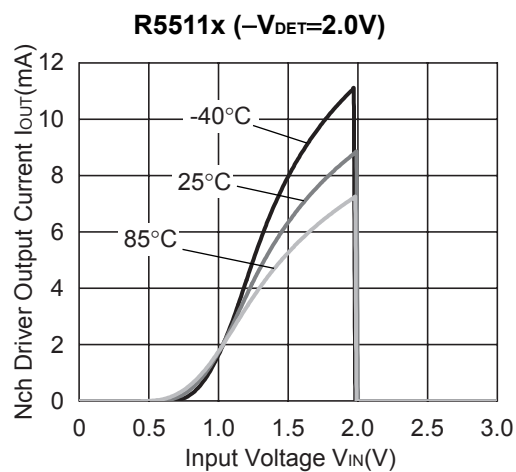
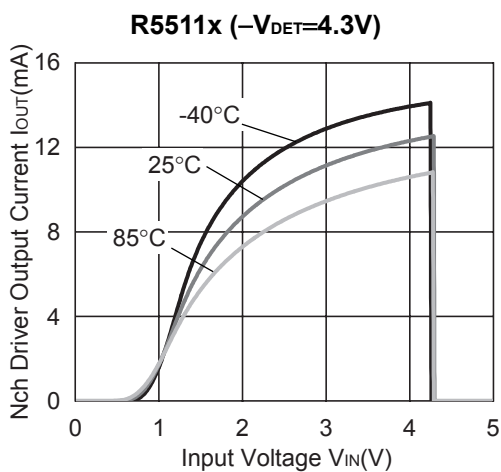
R5511x

14) Nch Driver Output Current vs. V_{DS}



15) Nch Driver Output Current vs. Input Voltage





16) Released Delay Time vs. Temperature

