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## 120mA 2ch LDO REGULATORS

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NO.EA-077-0606

### OUTLINE

The R5322N Series are voltage regulator ICs with high output voltage accuracy, low supply current, low dropout, and high ripple rejection by CMOS process. 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 due to built-in transistor with low ON resistance, and a chip enable function and prolong the battery life of each system. The line transient response and load transient response of the R5322N Series are excellent, thus these ICs are very suitable for the power supply for hand-held communication equipment.

The output voltage of these ICs is internally fixed with high accuracy. Since the package for these ICs is SOT-23-6W package, and include 2ch LDO regulators each, high density mounting of the ICs on boards is possible.

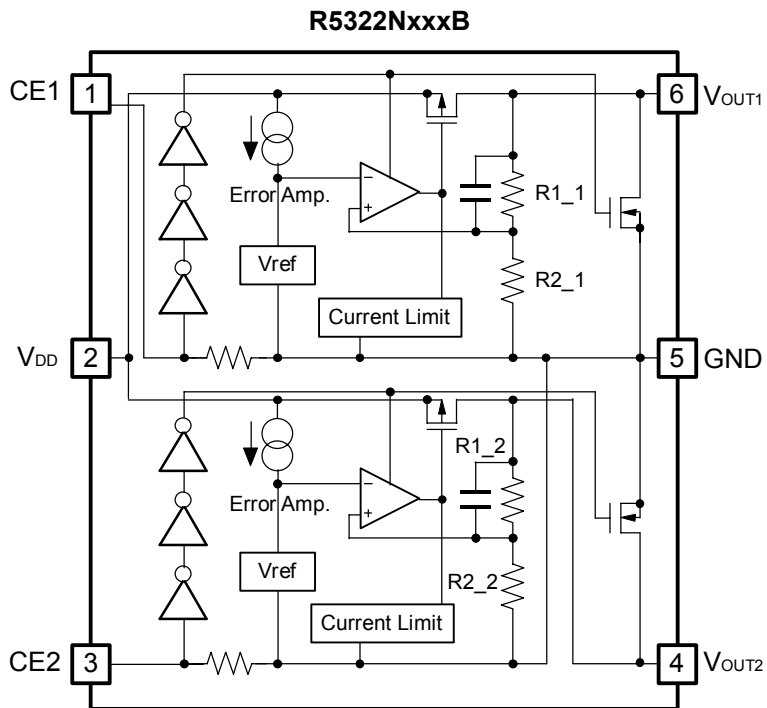
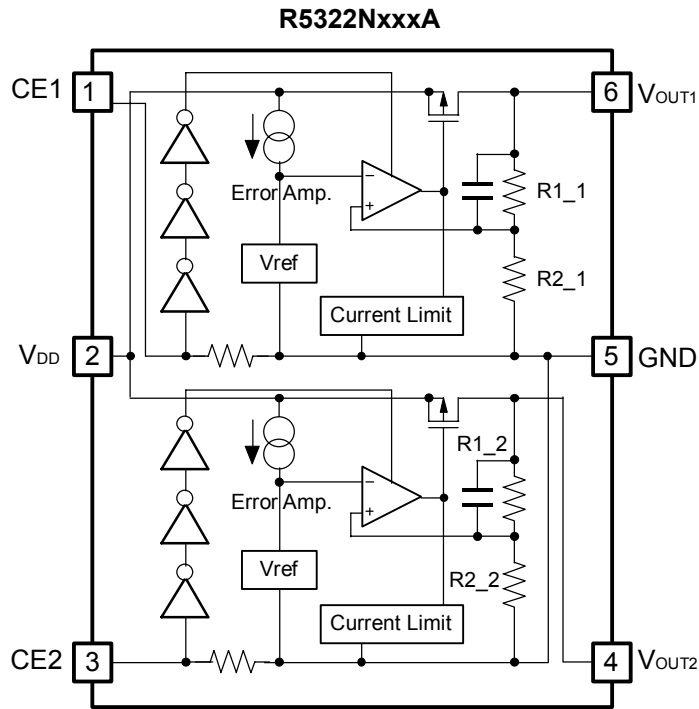
### FEATURES

- Ultra-Low Supply Current..... Typ. 75 $\mu$ A (VR1, VR2)
- Standby Current ..... Typ. 0.1 $\mu$ A (VR1, VR2)
- Output Voltage ..... 1.5V to 4.0V
- Low Dropout Voltage..... Typ. 0.15V ( $I_{OUT}=100\text{mA}$ ,  $V_{OUT}=3.0\text{V}$ )
- High Ripple Rejection ..... Typ. 75dB ( $f=1\text{kHz}$ )
- High Output Voltage Accuracy .....  $\pm 2.0\%$
- Low Temperature-Drift Coefficient of Output Voltage.... Typ.  $\pm 100\text{ppm}/^\circ\text{C}$
- Excellent Line Regulation ..... Typ. 0.05%/V
- Small Packages ..... SOT-23-6W
- Built-in chip enable circuit (A/B: active high)
- Built-in fold-back protection circuit ..... Typ. 40mA (Current at short mode)

### APPLICATIONS

- Power source for cellular phones such as GSM, CDMA and various kinds of PCS.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.

### BLOCK DIAGRAMS



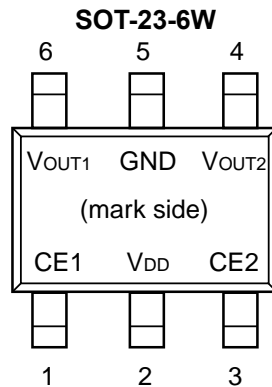
## SELECTION GUIDE

The output voltage, mask option, and the taping type for the ICs can be selected at the user's request.  
The selection can be made with designating the part number as shown below;

R5322Nxxxx-xx-X ← Part Number  
 ↑ ↑ ↑ ↑  
 a b c d

Code	Contents
a	Setting combination of 2ch Output Voltage ( $V_{OUT}$ ) : Serial Number for Voltage Setting, Stepwise setting with a step of 0.1V in the range of 1.5V to 4.0V is possible for each channel.
b	Designation of Mask Option : A Version: without auto discharge function at OFF state. B Version: with auto discharge function at OFF state.
c	Designation of Taping Type : Ex. TR (refer to Taping Specifications; TR type is the standard direction.)
d	Designation of Composition of pin plating. -F : Lead free plating

## PIN CONFIGURATION



## PIN DESCRIPTIONS

- SOT-23-6W

Pin No	Symbol	Pin Description
1	CE1	Chip Enable Pin 1
2	V <sub>DD</sub>	Input Pin
3	CE2	Chip Enable Pin 2
4	V <sub>OUT2</sub>	Output Pin 2
5	GND	Ground Pin
6	V <sub>OUT1</sub>	Output Pin 1

## ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V <sub>IN</sub>	Input Voltage	6.5	V
V <sub>CE</sub>	Input Voltage (CE Pin)	-0.3 to V <sub>IN</sub> + 0.3	V
V <sub>OUT</sub>	Output Voltage	-0.3 to V <sub>IN</sub> + 0.3	V
I <sub>OUT1</sub>	Output Current 1	130	mA
I <sub>OUT2</sub>	Output Current 2	130	mA
P <sub>D</sub>	Power Dissipation (SOT-23-6W) <sup>*Note1</sup>	430	mW
T <sub>opt</sub>	Operating Temperature Range	-40 to 85	°C
T <sub>stg</sub>	Storage Temperature Range	-55 to 125	°C

Note1: For Power Dissipation please refer to PACKAGE INFORMATION to be described.

## ELECTRICAL CHARACTERISTICS

### • R5322NxxxA/B

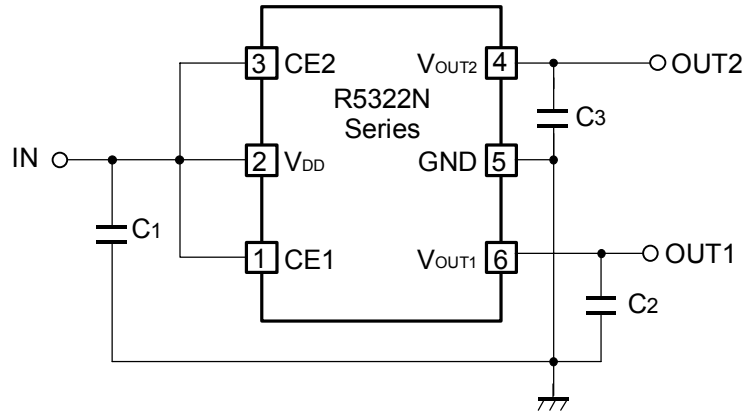
$T_{opt}=25^{\circ}\text{C}$

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
$V_{OUT}$	Output voltage	$V_{IN}=\text{Set } V_{OUT}+1\text{V},$ $1\text{mA} \leq I_{OUT} \leq 30\text{mA}$	$\times 0.98$		$\times 1.02$	V
$I_{OUT}$	Output Current	$V_{IN}-V_{OUT}=1.0\text{V}$	120			mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load regulation	$V_{IN}=\text{Set } V_{OUT}+1\text{V},$ $1\text{mA} \leq I_{OUT} \leq 120\text{mA}$		12	40	mV
$V_{DIF}$	Dropout Voltage	Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE				
$I_{SS}$	Supply Current	$V_{IN}=\text{Set } V_{OUT}+1\text{V}$		75	150	$\mu\text{A}$
$I_{standby}$	Supply Current (Standby)	$V_{IN}=V_{CE}=\text{Set } V_{OUT}+1\text{V}$		0.1	1.0	$\mu\text{A}$
$\Delta V_{OUT}/\Delta V_{IN}$	Line regulation	Set $V_{OUT}+0.5\text{V} \leq V_{IN} \leq 6.0\text{V}$ $I_{OUT}=30\text{mA}$ (In case that $V_{OUT} \leq 1.6,$ $2.2\text{V} \leq V_{IN} \leq 6.0$ ))		0.05	0.20	%/V
RR	Ripple Rejection	$f=1\text{kHz},$ Ripple $0.5\text{Vp-p},$ $V_{IN}=\text{Set } V_{OUT}+1\text{V}, I_{OUT}=30\text{mA}$		75		dB
$V_{IN}$	Input Voltage		2.2		6.0	V
$\Delta V_{OUT}/\Delta T_{opt}$	Output Voltage Temperature Coefficient	$I_{OUT}=30\text{mA}$ $-40^{\circ}\text{C} \leq T_{opt} \leq 85^{\circ}\text{C}$		$\pm 100$		ppm/ $^{\circ}\text{C}$
$I_{lim}$	Short Current Limit	$V_{OUT}=0\text{V}$		40		mA
$R_{PD}$	CE Pull-down Resistance		1.5	4.0	16.0	$\text{M}\Omega$
$V_{CEH}$	CE Input Voltage "H"		1.5		$V_{IN}$	V
$V_{CEL}$	CE Input Voltage "L"		0.0		0.3	V
en	Output Noise	$\text{BW}=10\text{Hz to } 100\text{kHz}$		30		$\mu\text{Vrms}$
$R_{LOW}$	Low Output Nch Tr. ON Resistance (of B version)	$V_{CE}=0\text{V}$		70		$\Omega$

### • Electrical Characteristics by Output Voltage

Output Voltage $V_{OUT}$ (V)	Dropout Voltage $V_{DIF}$ (V)		
	Condition	Typ.	Max.
$1.5\text{V} \leq V_{OUT} < 1.6\text{V}$	$I_{OUT} = 120\text{mA}$	0.36	0.70
$1.7\text{V} \leq V_{OUT} < 1.8\text{V}$		0.30	0.50
$1.9\text{V} \leq V_{OUT} < 2.0\text{V}$		0.28	0.45
$2.1\text{V} \leq V_{OUT} < 2.7\text{V}$		0.24	0.40
$2.8\text{V} \leq V_{OUT} < 4.0\text{V}$		0.18	0.30

## TYPICAL APPLIATION



(External Components)  
Output Capacitor; Tantalum Type

TEST CIRCUIT

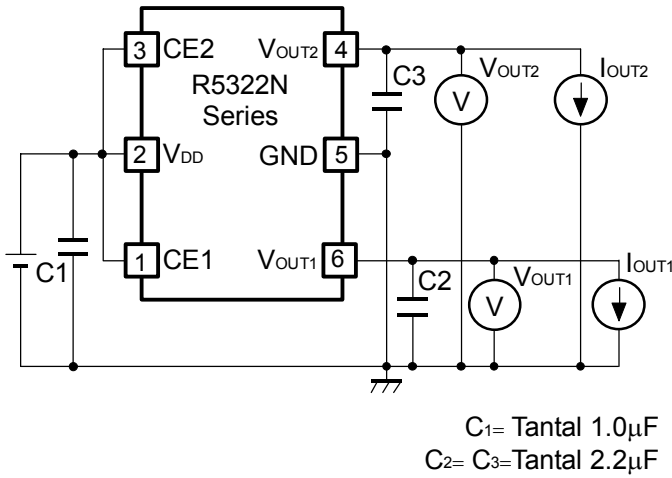


Fig.1 Standard test Circuit

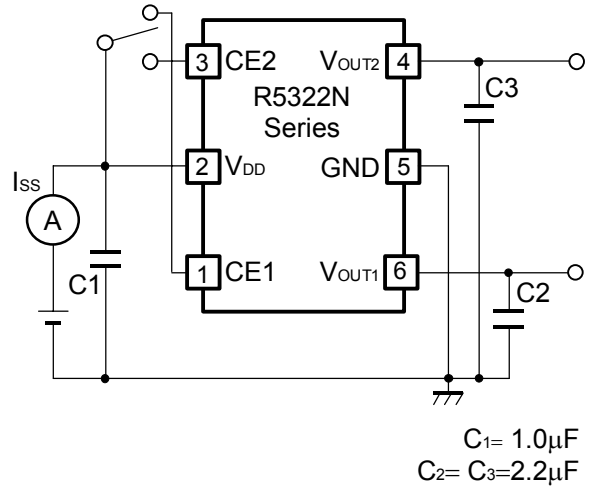


Fig.2 Supply Current Test Circuit

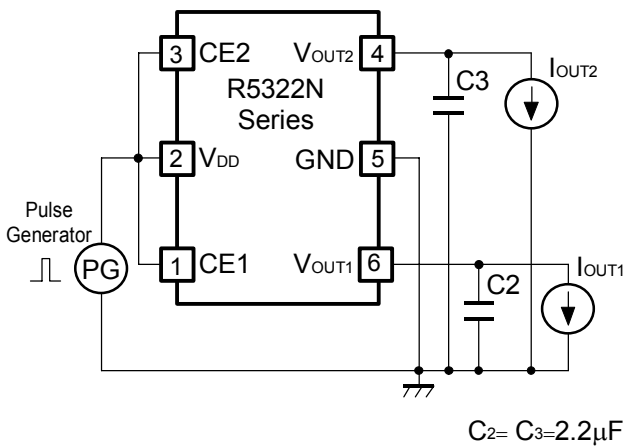


Fig.3 Ripple Rejection, Line Transient Response Test Circuit

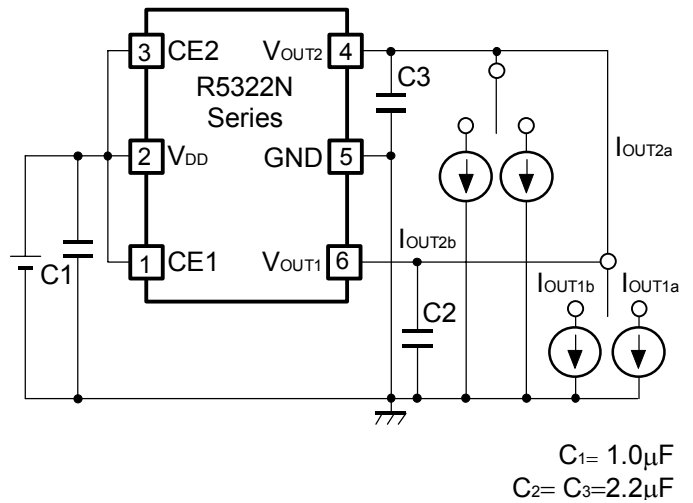
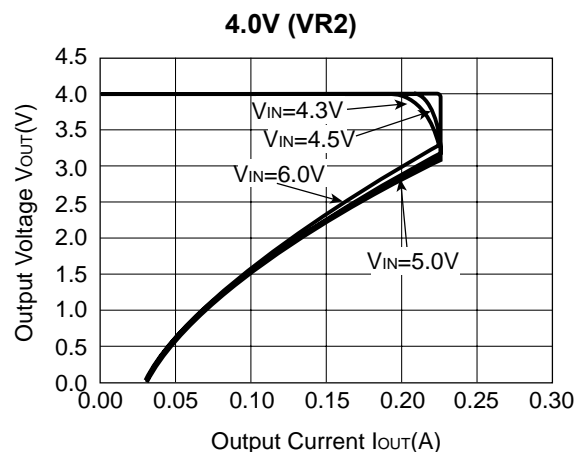
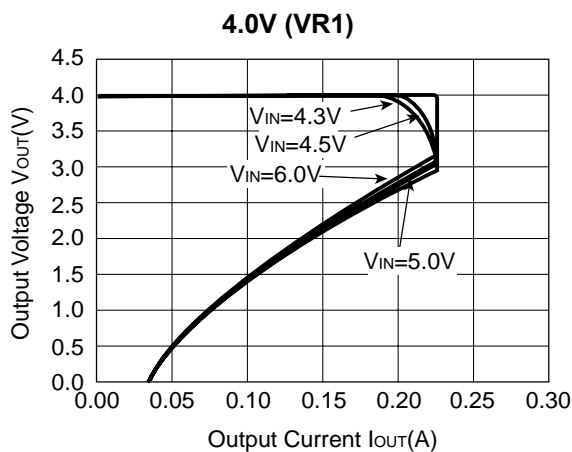
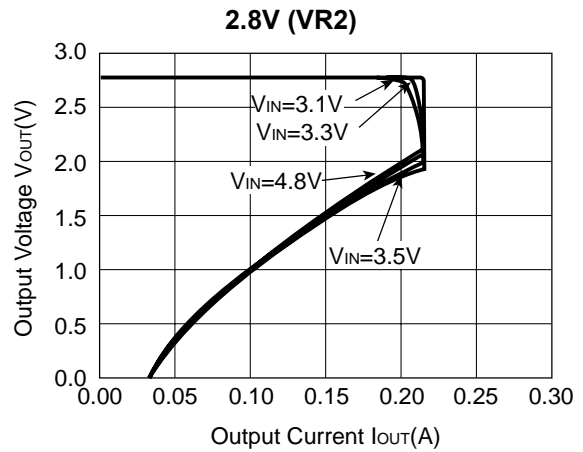
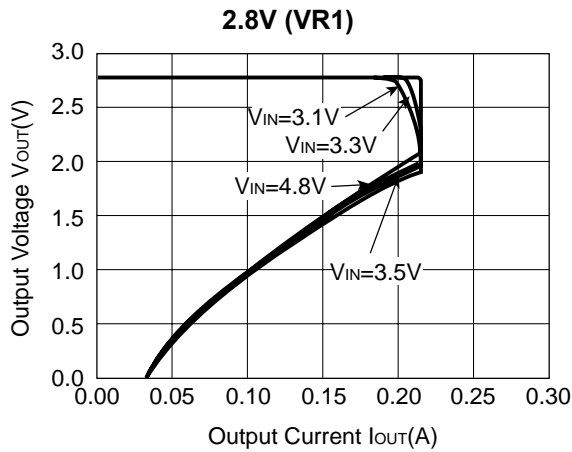
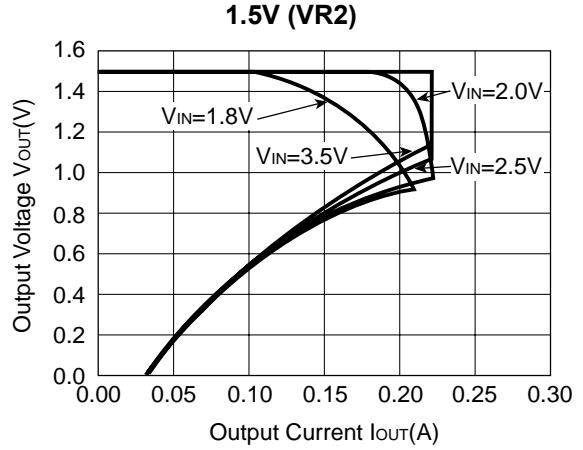
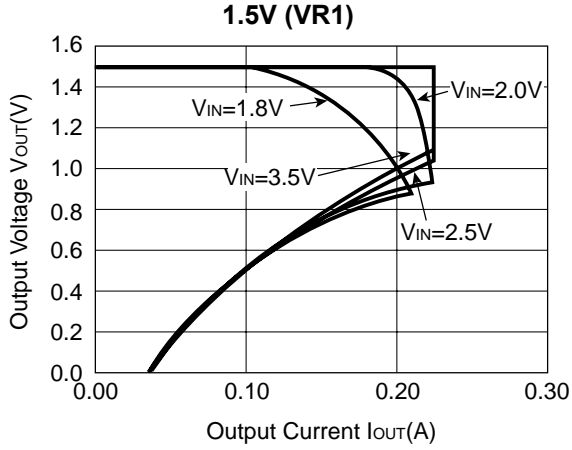


Fig.4 Load Transient Response Test Circuit

## TYPICAL CHARACTERISTICS

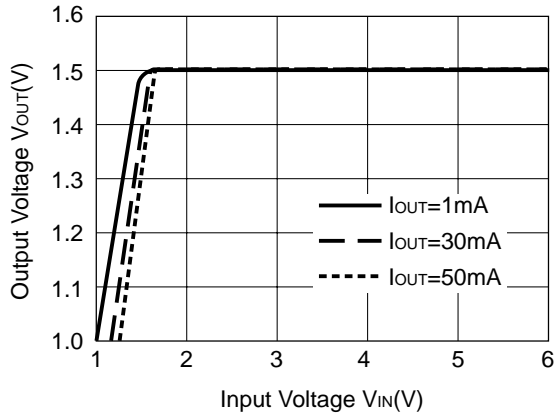
### 1) Output Voltage vs. Output Current



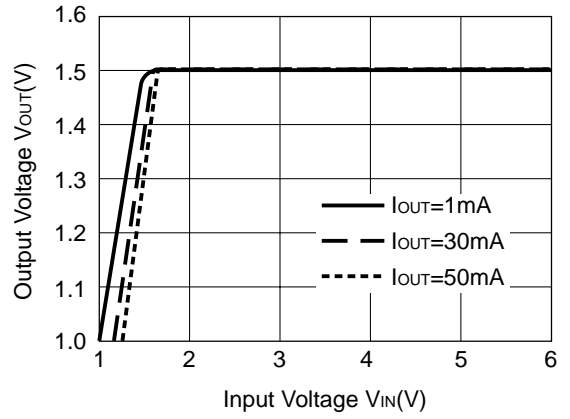


2) Output Voltage vs. Input Voltage

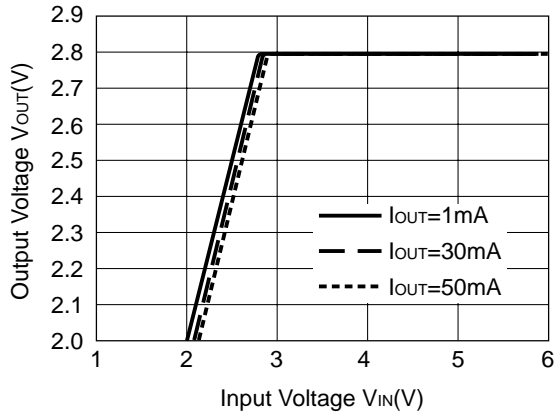
1.5V (VR1)



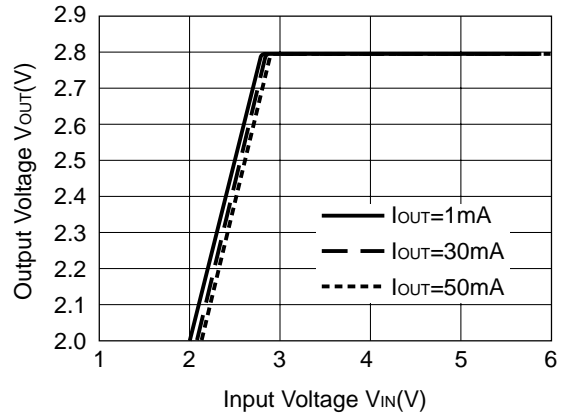
1.5V (VR2)



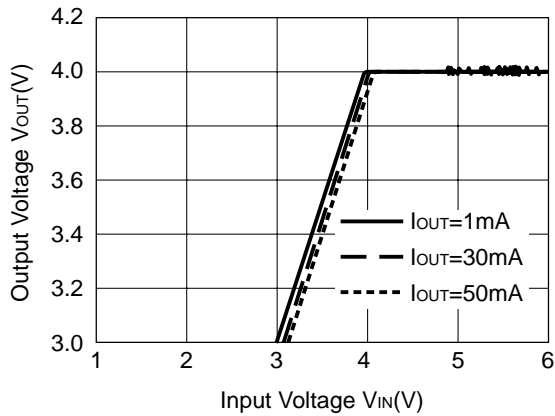
2.8V (VR1)



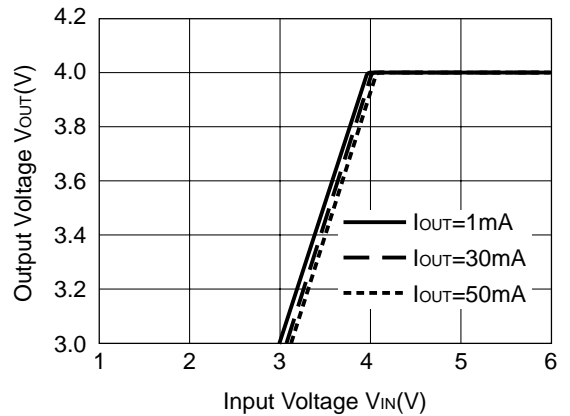
2.8V (VR2)



4.0V (VR1)

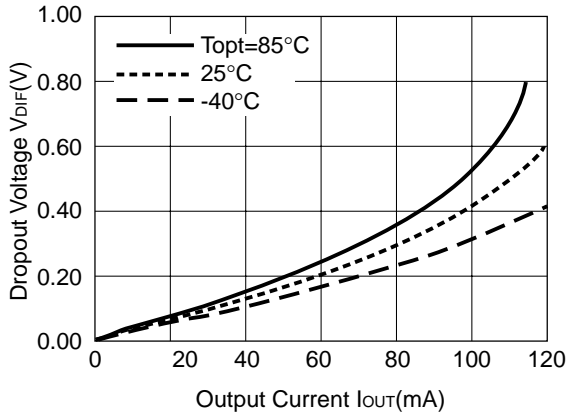


4.0V (VR2)

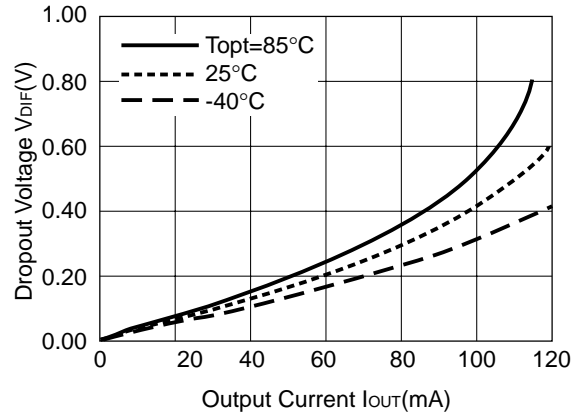


3) Dropout Voltage vs. Temperature

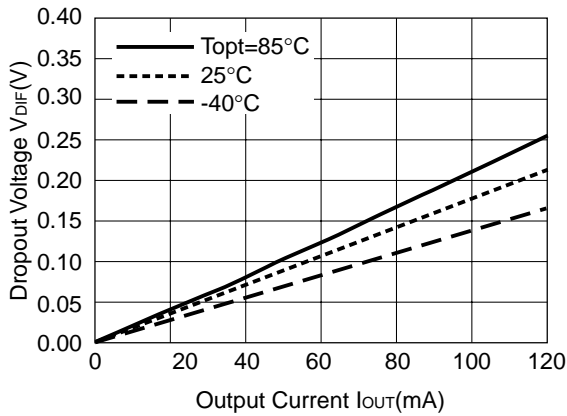
1.5V (VR1)



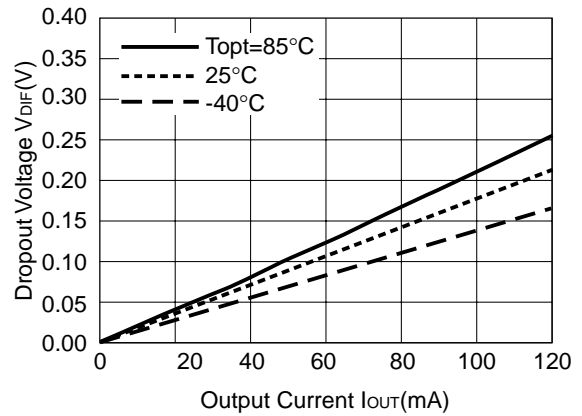
1.5V (VR2)



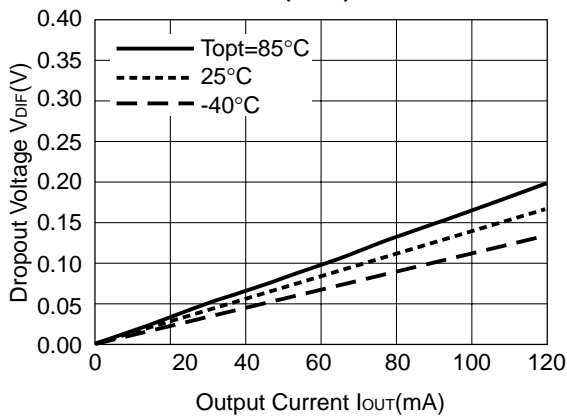
2.8V (VR1)



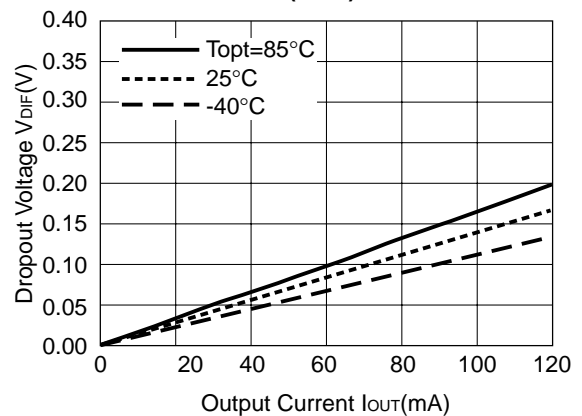
2.8V (VR2)



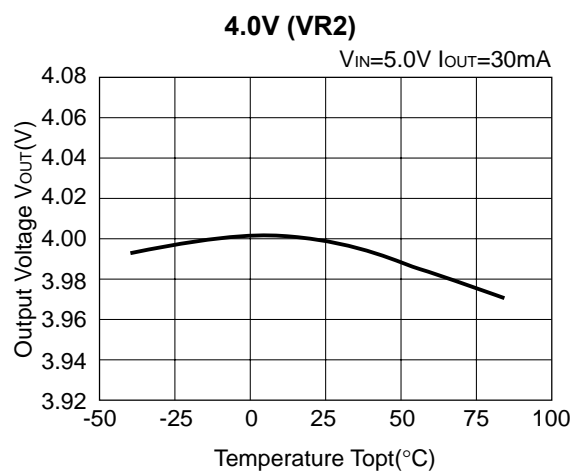
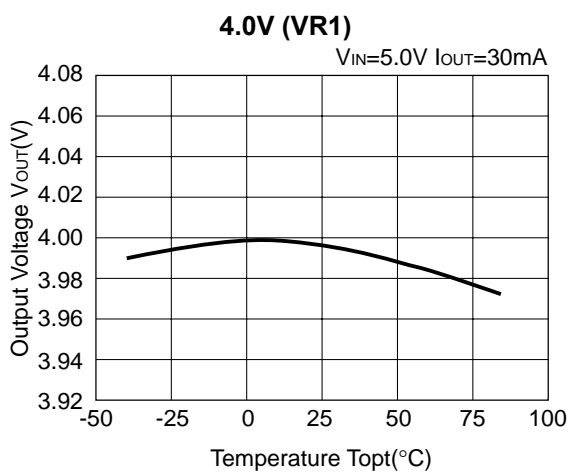
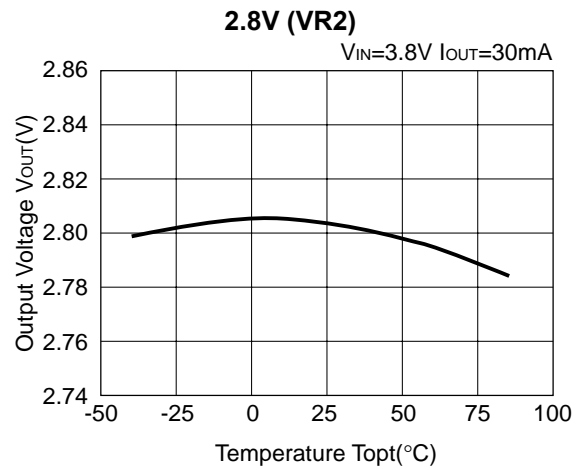
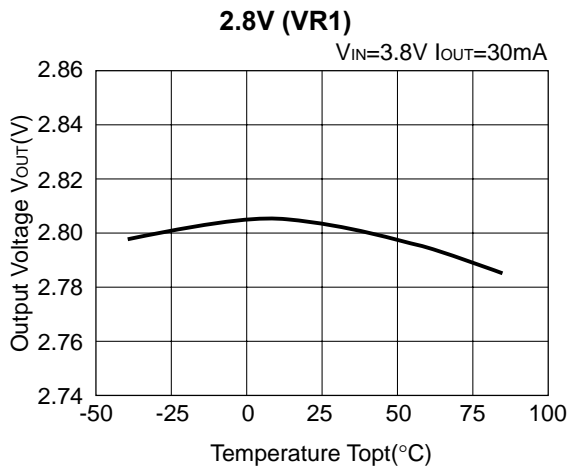
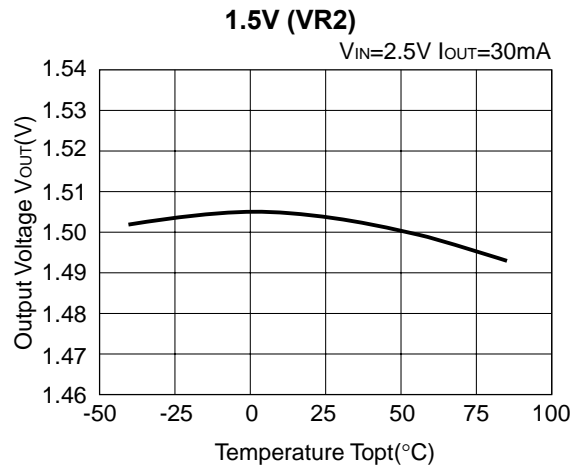
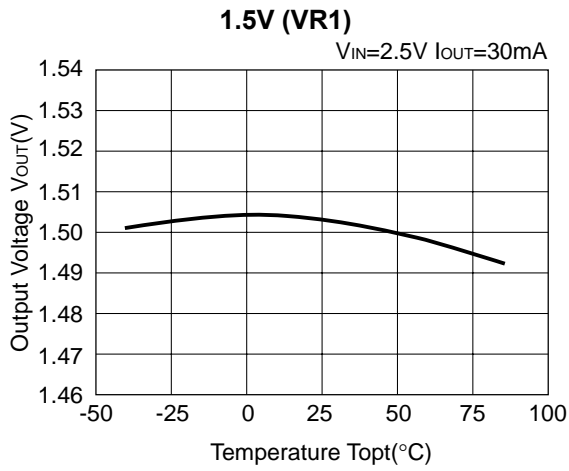
4.0V (VR1)



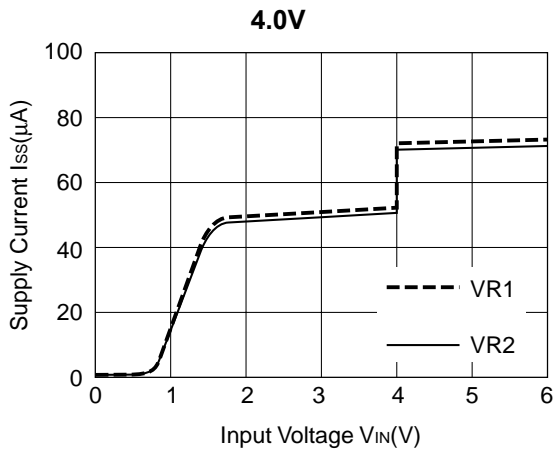
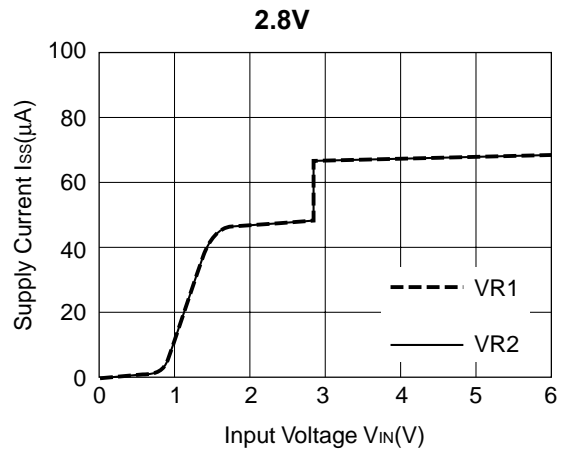
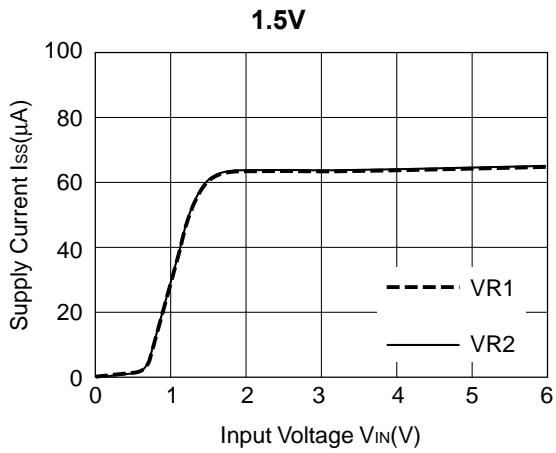
4.0V (VR2)



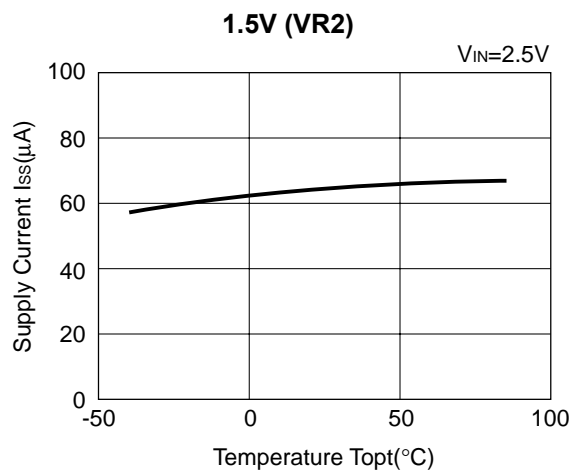
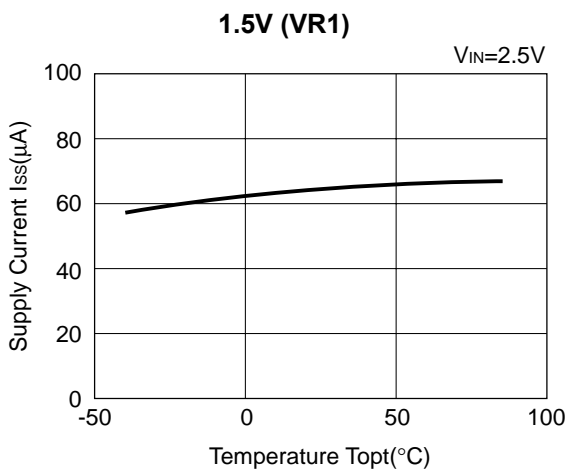
4) Output Voltage vs. Temperature

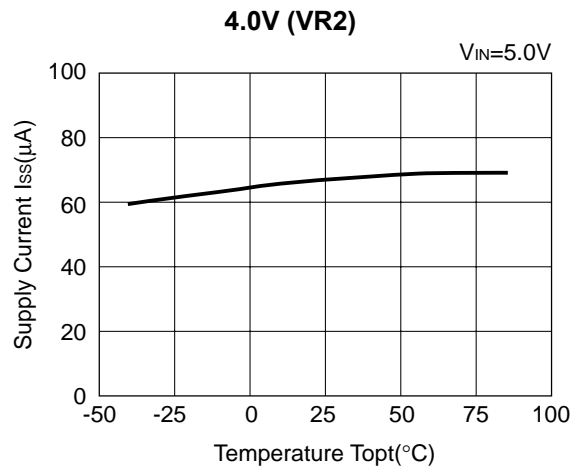
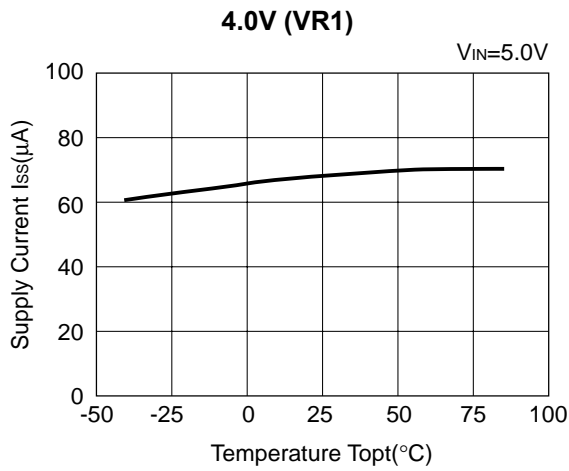
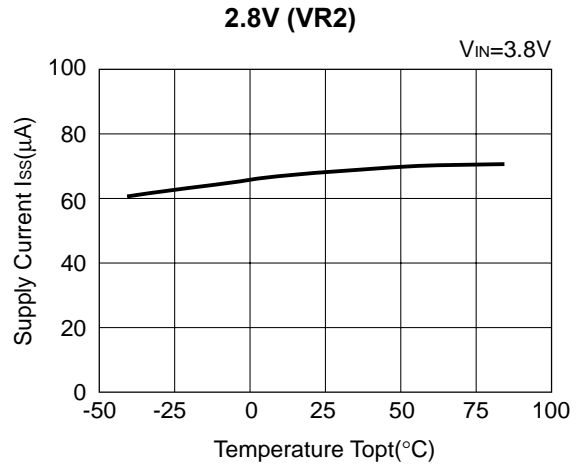
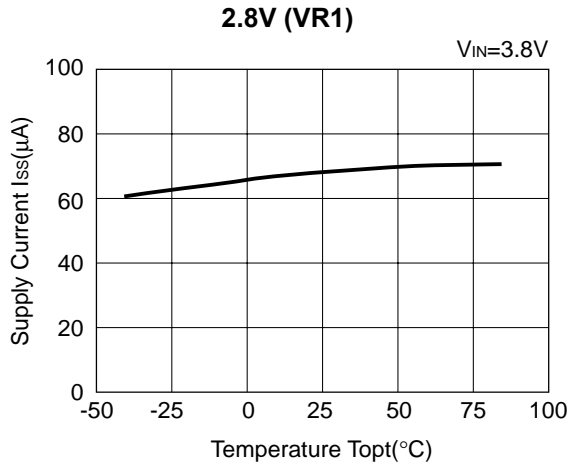


5) Supply Current vs. Input Voltage

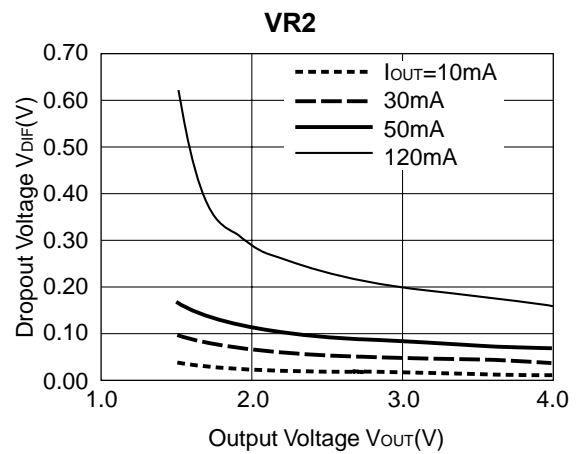
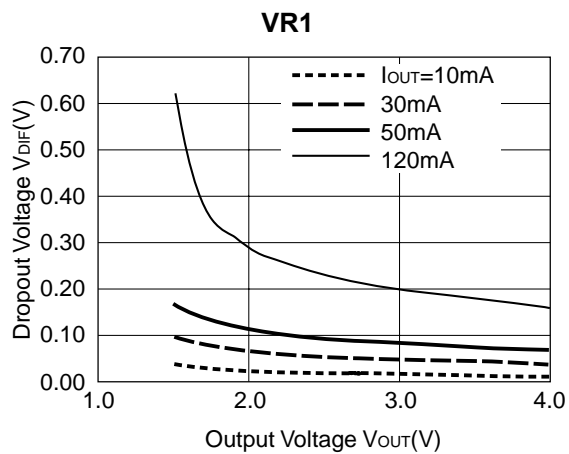


6) Supply Current vs. Temperature

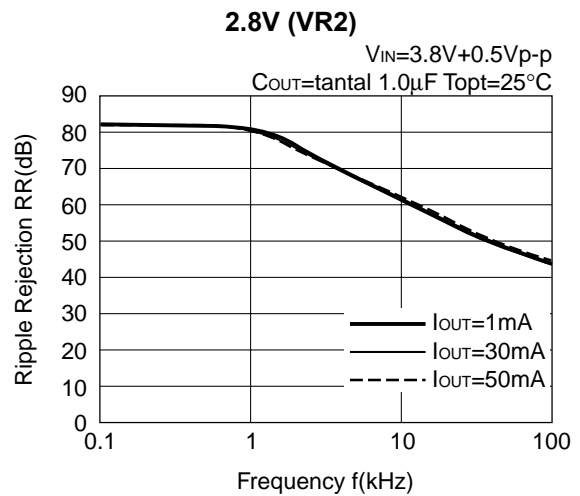
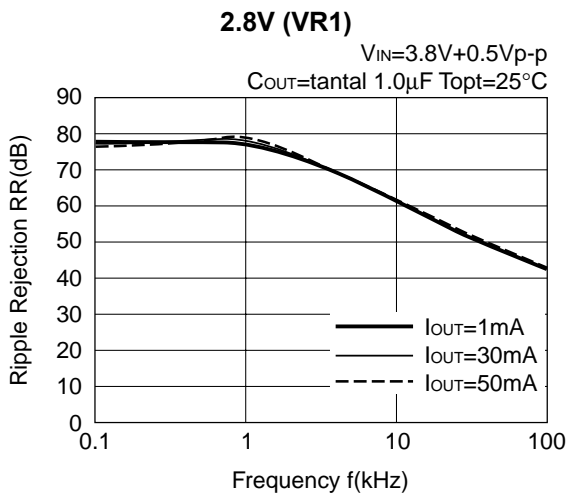
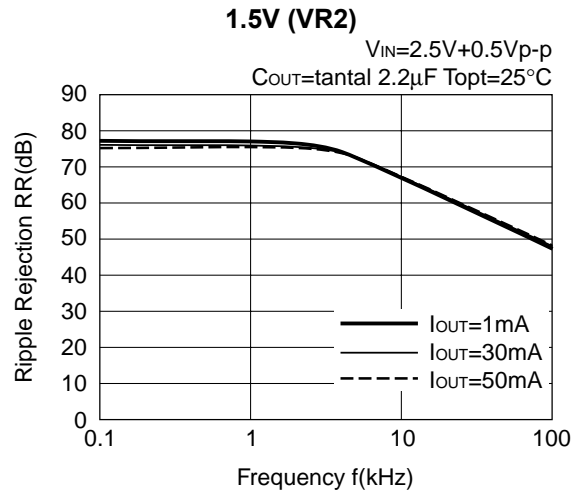
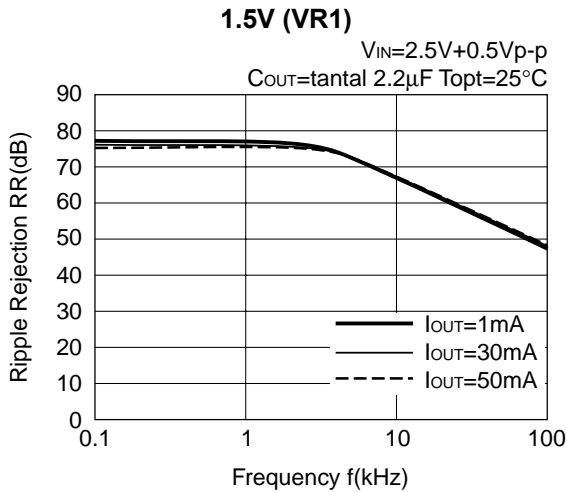
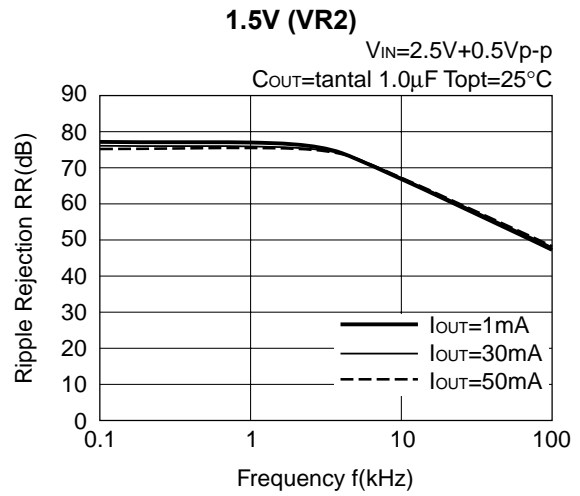
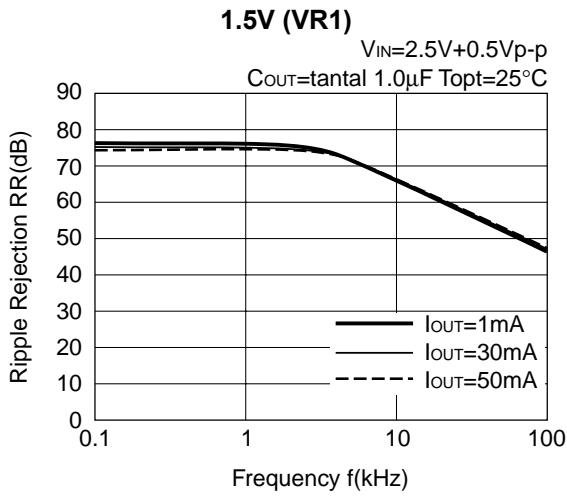


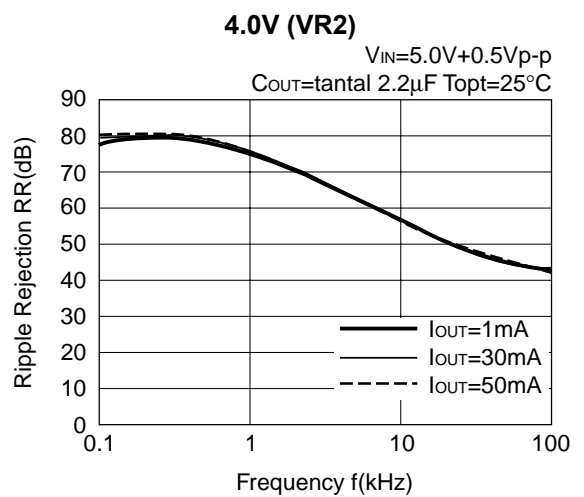
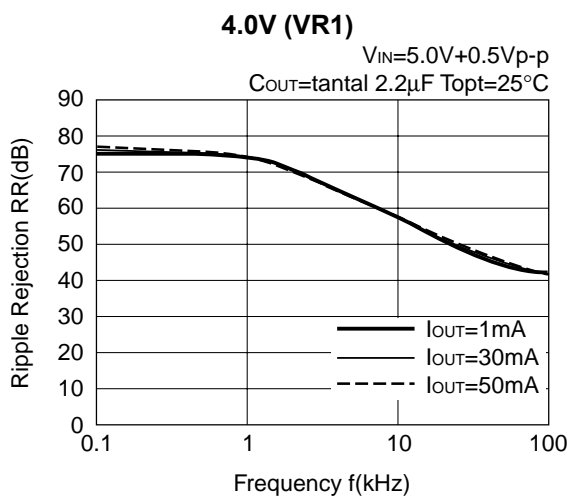
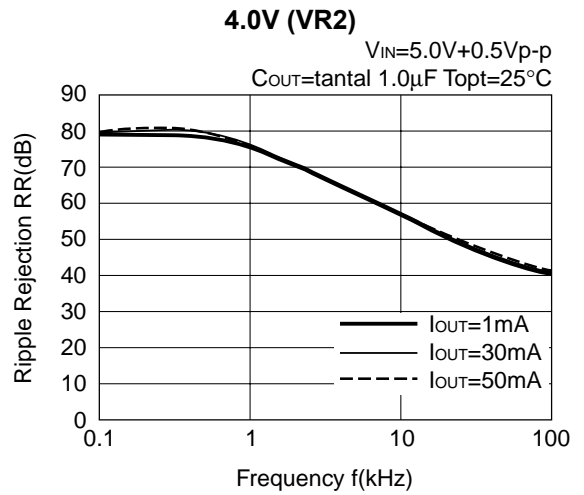
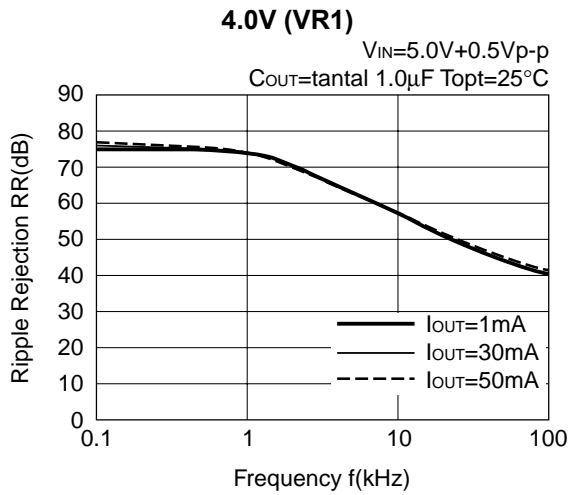
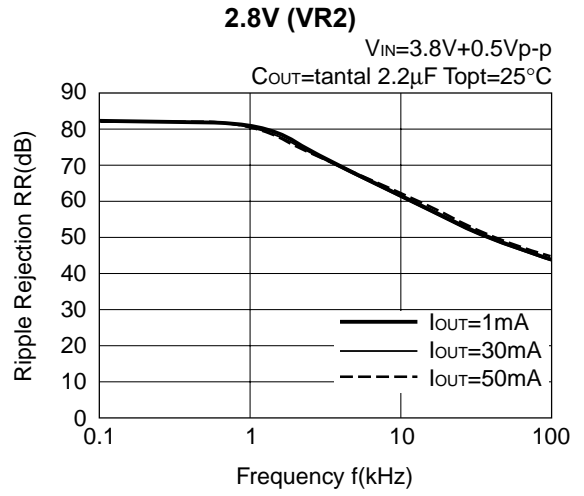
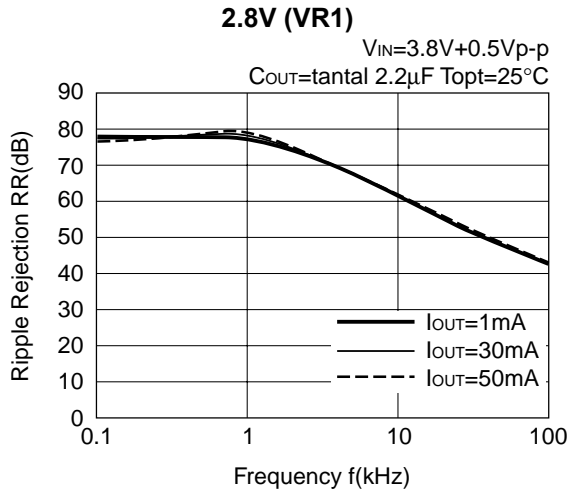


7) Dropout Voltage vs. Set Output Voltage

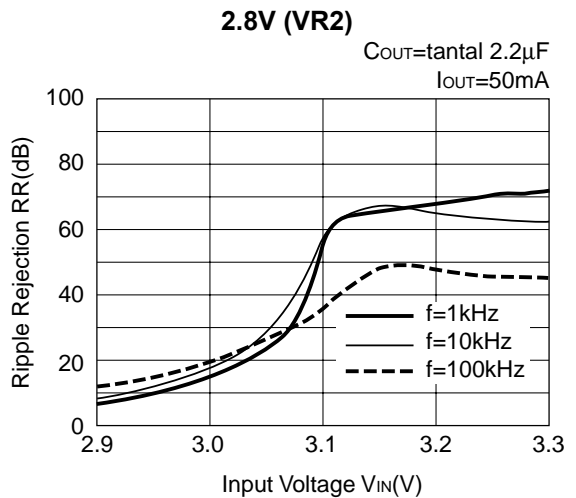
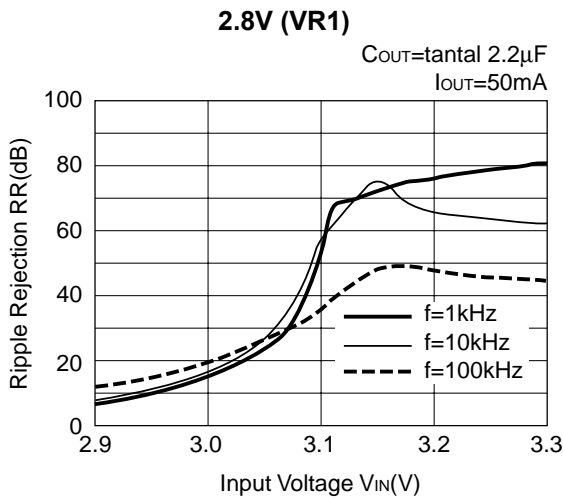
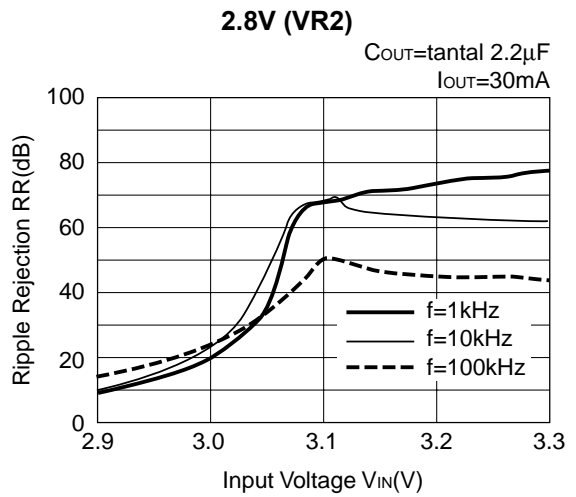
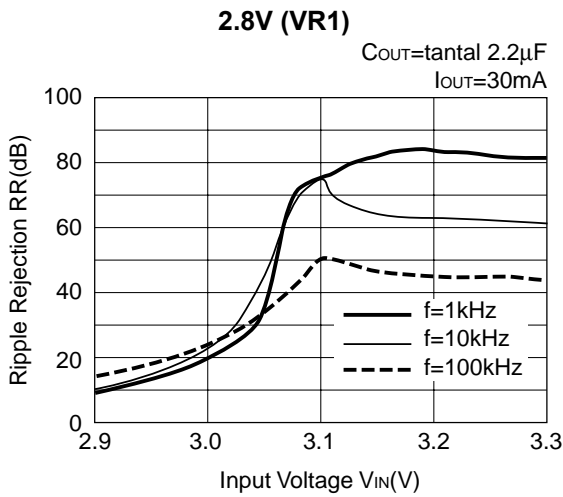
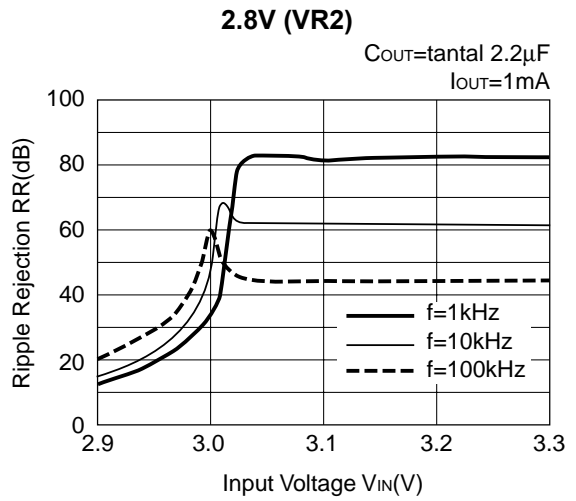
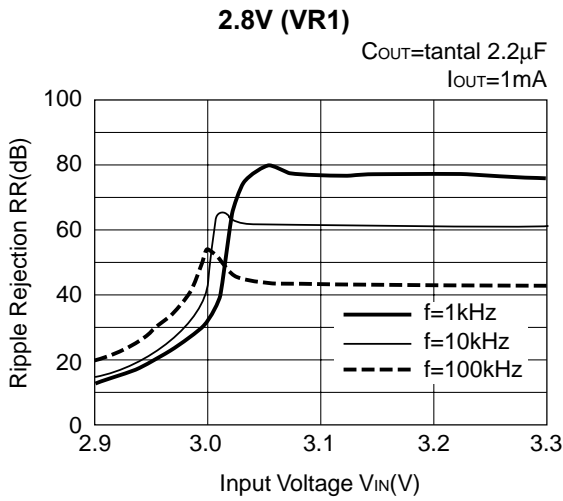


8) Ripple Rejection vs. Frequency





9) Ripple Rejection vs. Input Voltage (DC bias)

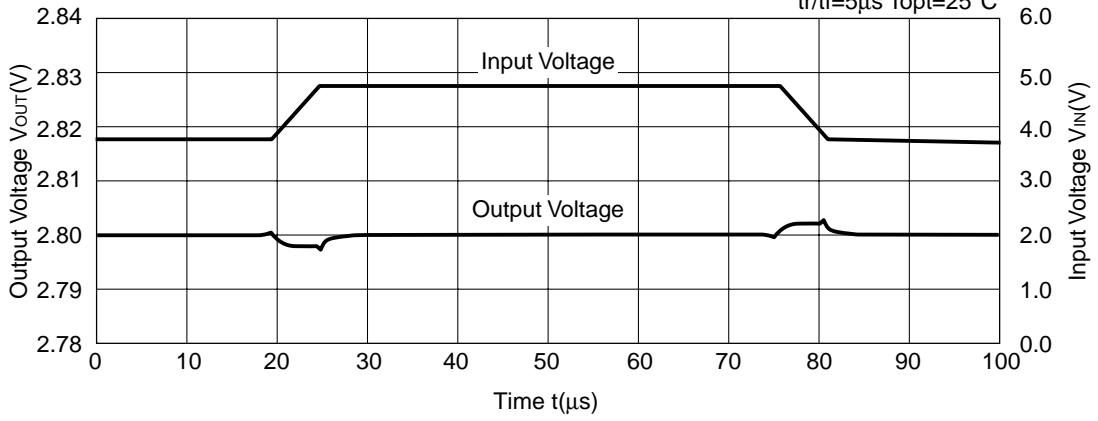




10) Input Transient Response

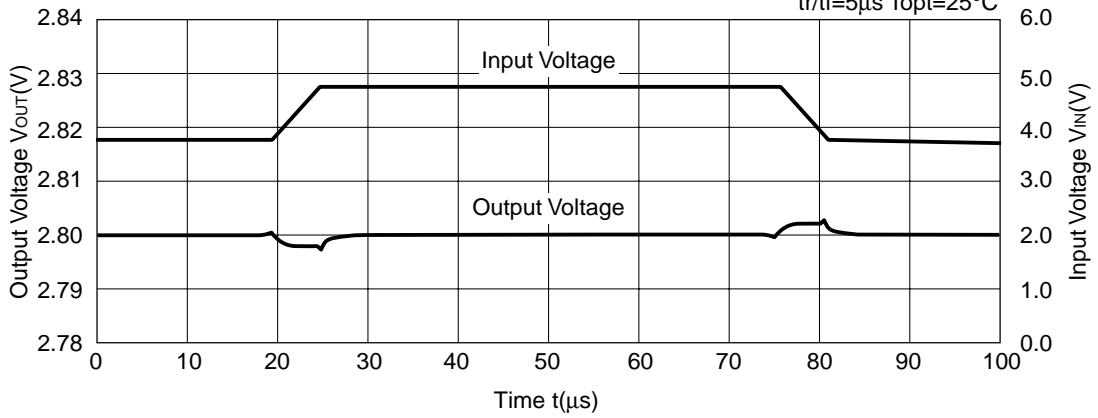
**R5322N001x (2.8V, VR1)**

$I_{OUT}=30mA$   $C_{OUT}=\text{tantal } 1.0\mu F$   
 $tr/tf=5\mu s$   $T_{opt}=25^{\circ}C$



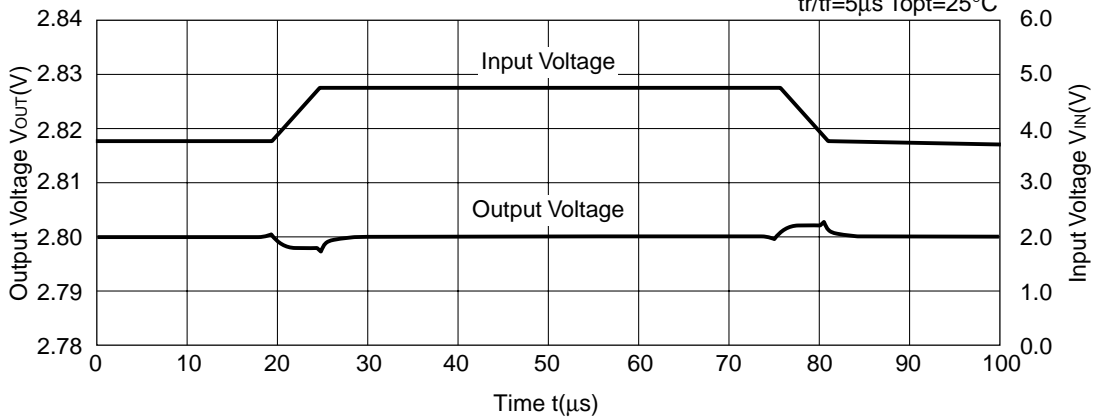
**R5322N001x (2.8V, VR1)**

$I_{OUT}=30mA$   $C_{OUT}=\text{tantal } 2.2\mu F$   
 $tr/tf=5\mu s$   $T_{opt}=25^{\circ}C$



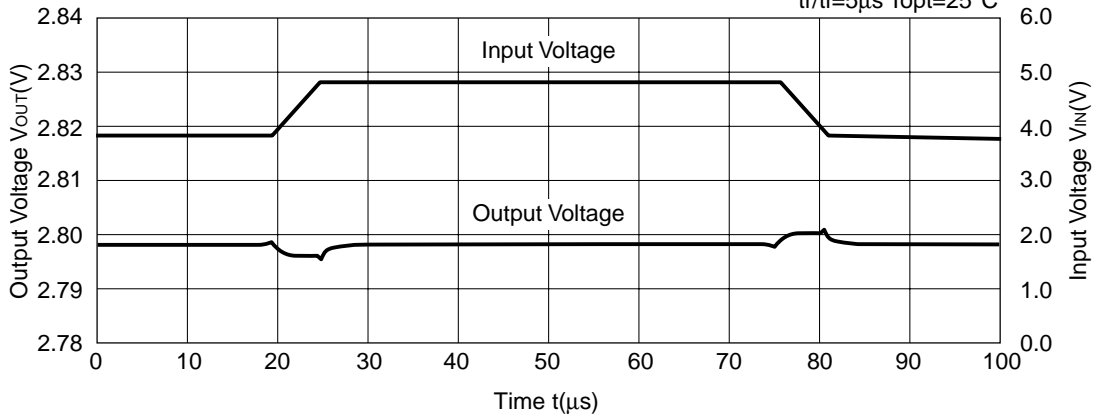
**R5322N001x (2.8V, VR1)**

$I_{OUT}=30mA$   $C_{OUT}=\text{tantal } 6.8\mu F$   
 $tr/tf=5\mu s$   $T_{opt}=25^{\circ}C$



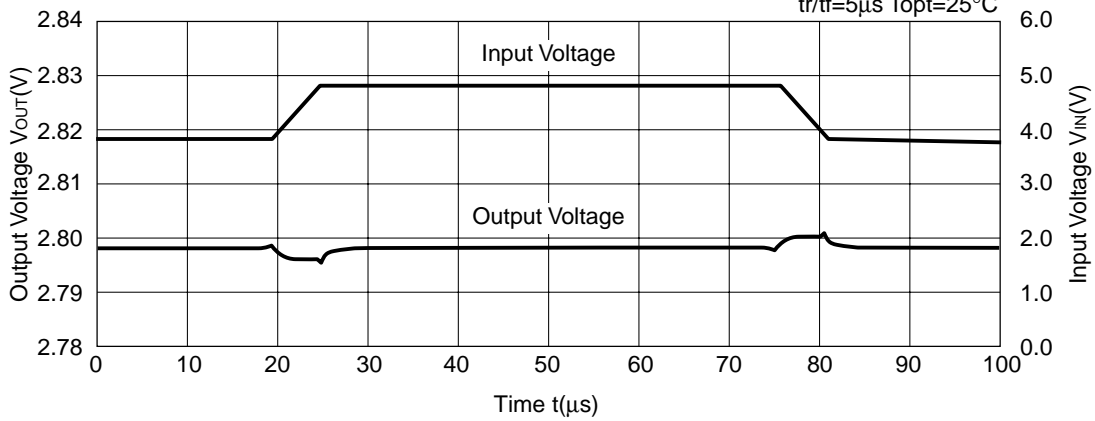
**R5322N001x (2.8V, VR2)**

$I_{OUT}=30\text{mA}$   $C_{OUT}=\text{tantal } 1.0\mu\text{F}$   
 $tr/tf=5\mu\text{s}$   $T_{opt}=25^\circ\text{C}$



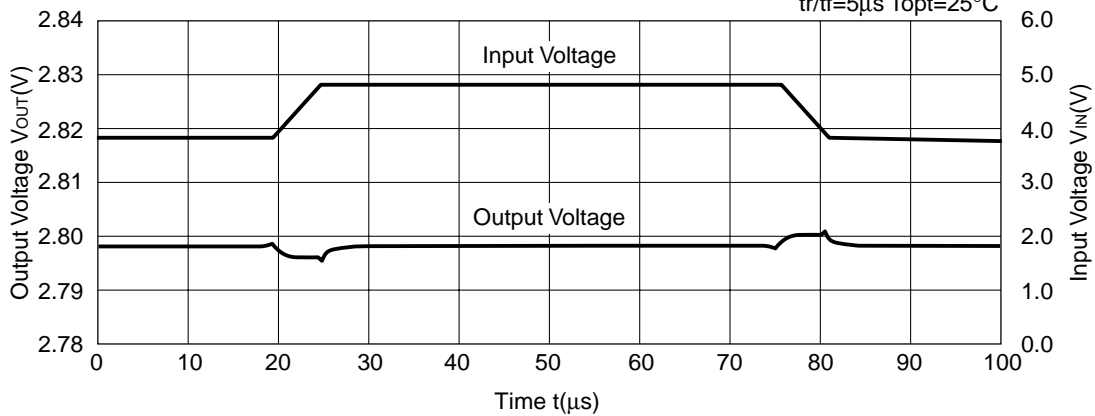
**R5322N001x (2.8V, VR2)**

$I_{OUT}=30\text{mA}$   $C_{OUT}=\text{tantal } 2.2\mu\text{F}$   
 $tr/tf=5\mu\text{s}$   $T_{opt}=25^\circ\text{C}$



**R5322N001x (2.8V, VR2)**

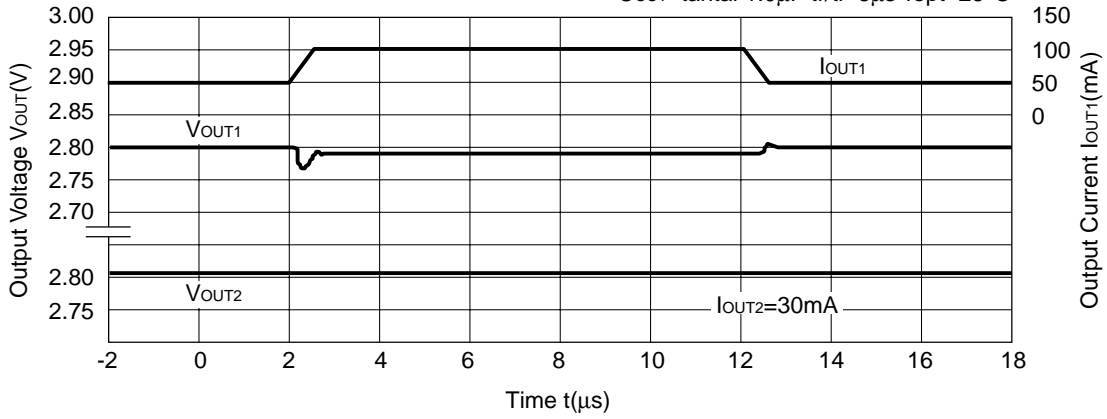
$I_{OUT}=30\text{mA}$   $C_{OUT}=\text{tantal } 6.8\mu\text{F}$   
 $tr/tf=5\mu\text{s}$   $T_{opt}=25^\circ\text{C}$



11) Load Transient Response

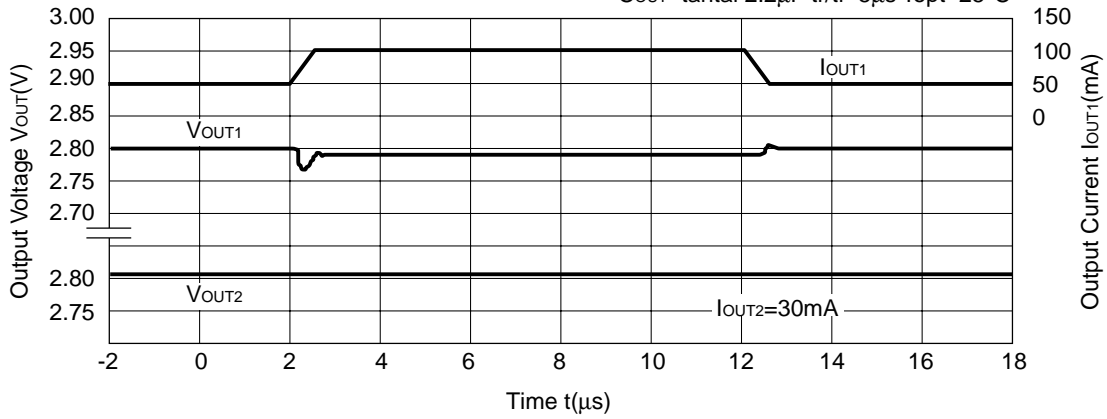
**R5322N001x (VR1=2.8V)**

$I_{OUT}=50\text{mA} \leftrightarrow 100\text{mA}$   $V_{IN}=3.8\text{V}$   $C_{IN}=\text{tantal } 1.0\mu\text{F}$   
 $C_{OUT}=\text{tantal } 1.0\mu\text{F}$   $t_r/t_f=5\mu\text{s}$   $T_{opt}=25^\circ\text{C}$



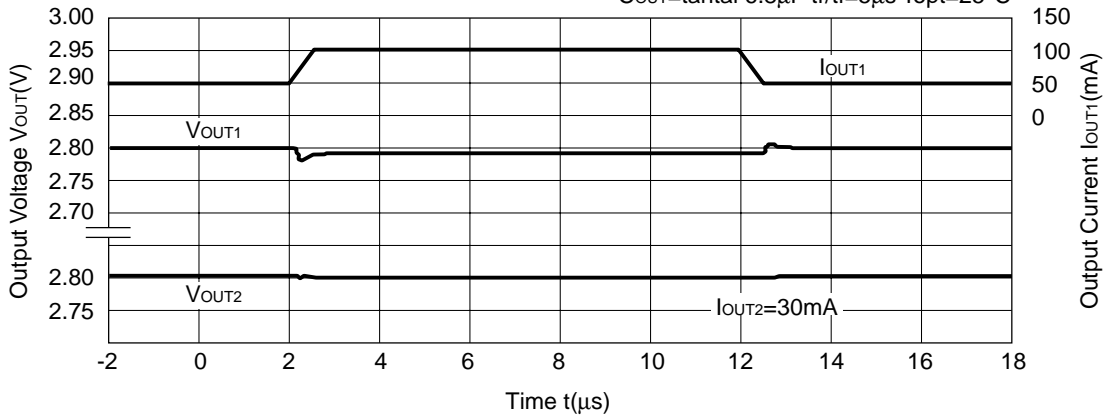
**R5322N001x (VR1=2.8V)**

$I_{OUT}=50\text{mA} \leftrightarrow 100\text{mA}$   $V_{IN}=3.8\text{V}$   $C_{IN}=\text{tantal } 1.0\mu\text{F}$   
 $C_{OUT}=\text{tantal } 2.2\mu\text{F}$   $t_r/t_f=5\mu\text{s}$   $T_{opt}=25^\circ\text{C}$



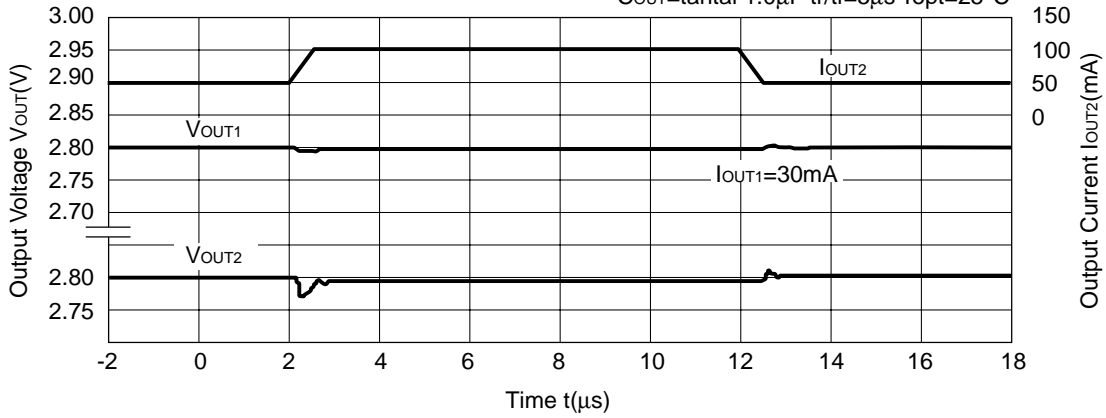
**R5322N001x (VR1=2.8V)**

$I_{OUT}=50\text{mA} \leftrightarrow 100\text{mA}$   $V_{IN}=3.8\text{V}$   $C_{IN}=\text{tantal } 1.0\mu\text{F}$   
 $C_{OUT}=\text{tantal } 6.8\mu\text{F}$   $t_r/t_f=5\mu\text{s}$   $T_{opt}=25^\circ\text{C}$



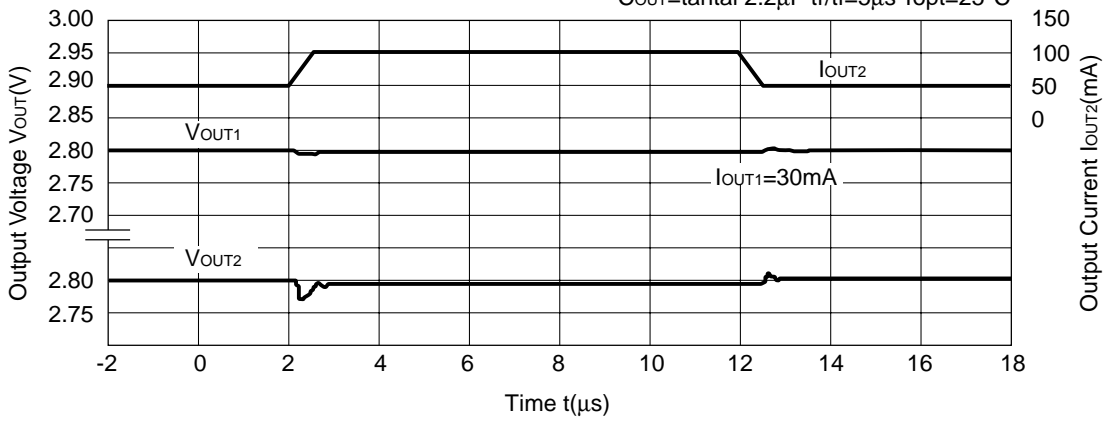
**R5322N001x (VR2=2.8V)**

$I_{OUT}=50\text{mA} \leftrightarrow 100\text{mA}$   $V_{IN}=3.8\text{V}$   $C_{IN}=\text{tantal } 1.0\mu\text{F}$   
 $C_{OUT}=\text{tantal } 1.0\mu\text{F}$   $t_r/t_f=5\mu\text{s}$   $T_{opt}=25^\circ\text{C}$



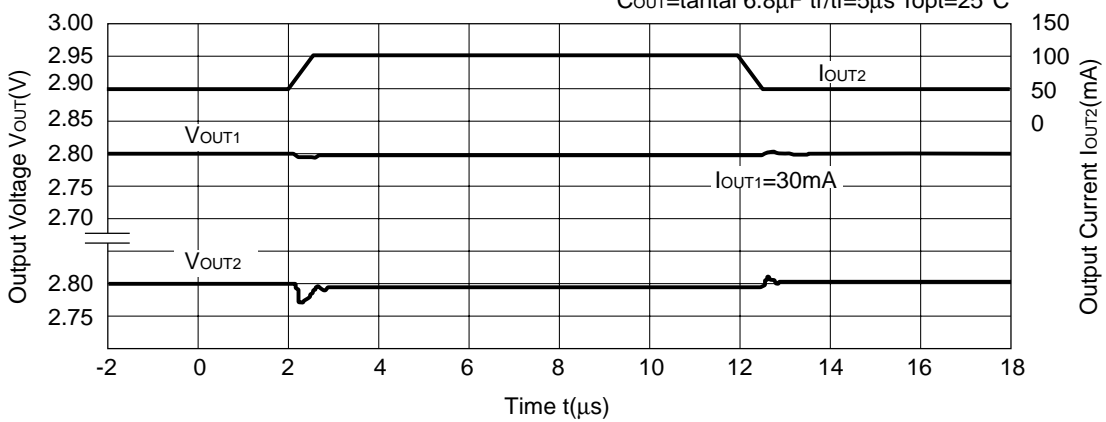
**R5322N00x (VR2=2.8V)**

$I_{OUT}=50\text{mA} \leftrightarrow 100\text{mA}$   $V_{IN}=3.8\text{V}$   $C_{IN}=\text{tantal } 1.0\mu\text{F}$   
 $C_{OUT}=\text{tantal } 2.2\mu\text{F}$   $t_r/t_f=5\mu\text{s}$   $T_{opt}=25^\circ\text{C}$



**R5322N00x (VR2=2.8V)**

$I_{OUT}=50\text{mA} \leftrightarrow 100\text{mA}$   $V_{IN}=3.8\text{V}$   $C_{IN}=\text{tantal } 1.0\mu\text{F}$   
 $C_{OUT}=\text{tantal } 6.8\mu\text{F}$   $t_r/t_f=5\mu\text{s}$   $T_{opt}=25^\circ\text{C}$



## TECHNICAL NOTES

When using these ICs, consider the following points:

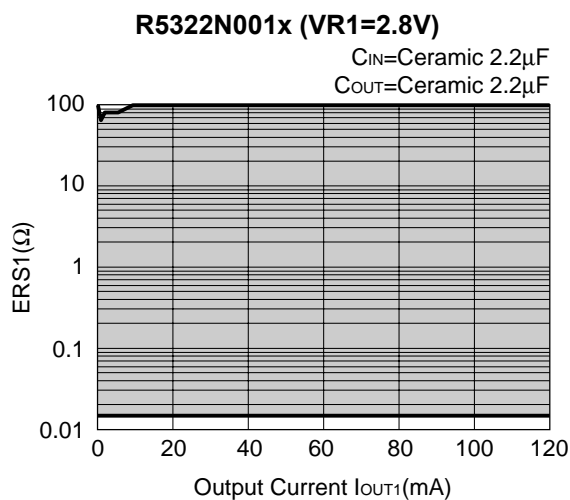
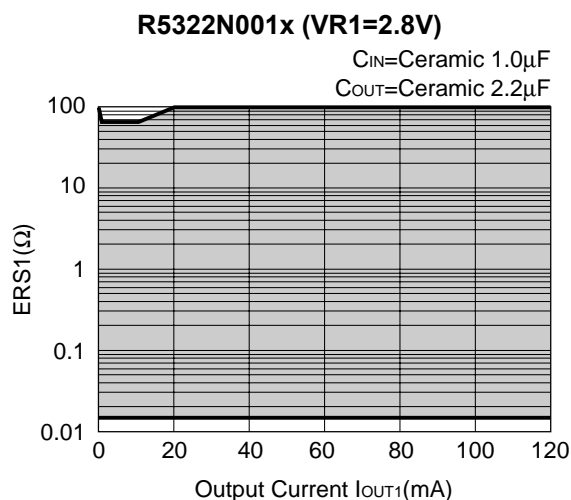
In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, be sure to use a 2.2 $\mu$ F or more capacitance  $C_{OUT}$  with good frequency characteristics and ESR (Equivalent Series Resistance) of which is in the range described as follows:

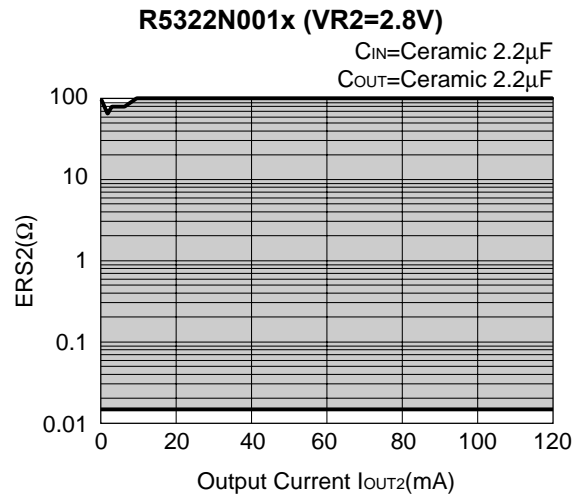
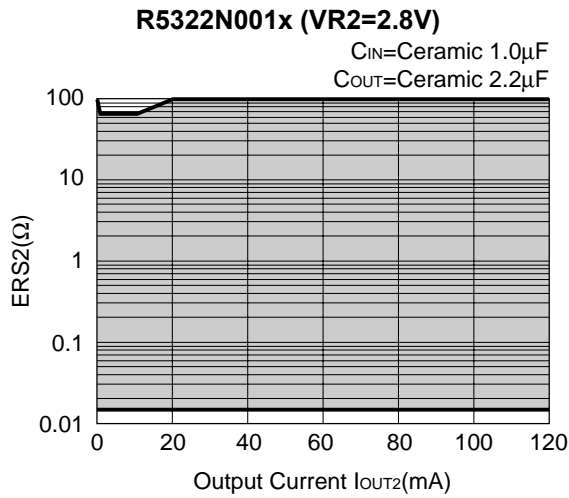
The relations between  $I_{OUT}$  (Output Current) and ESR of Output Capacitor are shown below. The conditions when the white noise level is under 40 $\mu$ V (Avg.) are marked as the hatched area in the graph.

(Note: When a ceramic capacitor is connected to the Output Pin as Output capacitor for phase compensation, the operation might be unstable unless as much as 1W resistor is connected between the capacitor and GND instead of ESR. Test these ICs with as same external components as ones to be used on the PCB.)

<Test conditions>

- (1)  $V_{IN}=3.8V$
- (2) Frequency band: 10Hz to 2MHz
- (3) Temperature: 25°C



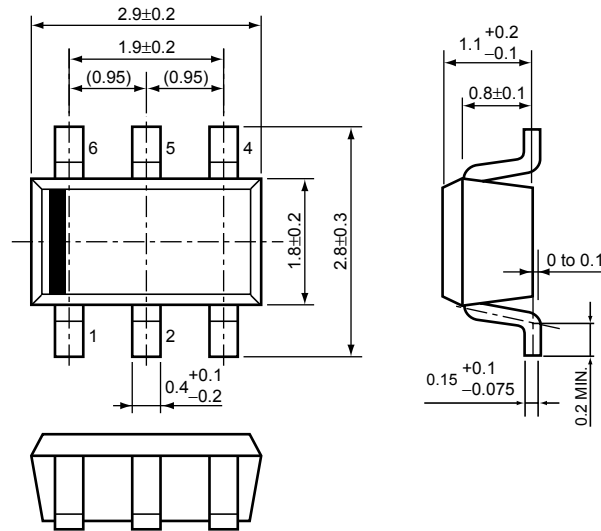


- Make  $V_{DD}$  and GND line sufficient. When the impedance of these is high, the noise might be picked up or not work correctly.
- Connect the capacitor with a capacitance of 1 $\mu$ F or more between  $V_{DD}$  and GND as close as possible.
- Set external components, especially Output Capacitor, as close as possible to the ICs and make wiring shortest.

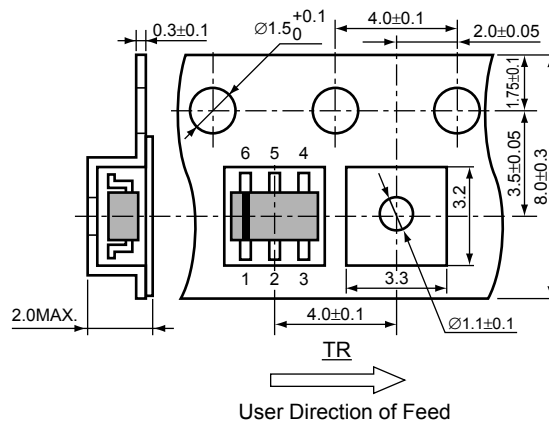
- SOT-23-6W

Unit: mm

### PACKAGE DIMENSIONS

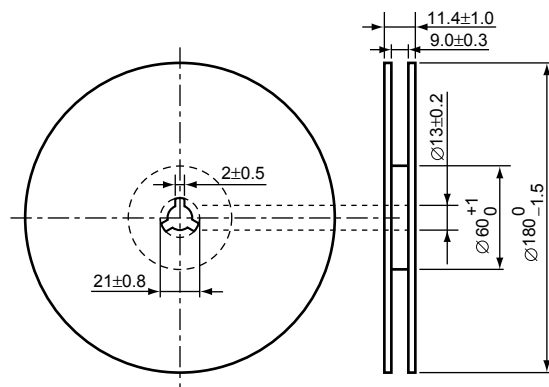


### TAPING SPECIFICATION



### TAPING REEL DIMENSIONS

(1reel=3000pcs)



### POWER DISSIPATION (SOT-23-6W)

This specification is at mounted on board. Power Dissipation ( $P_D$ ) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

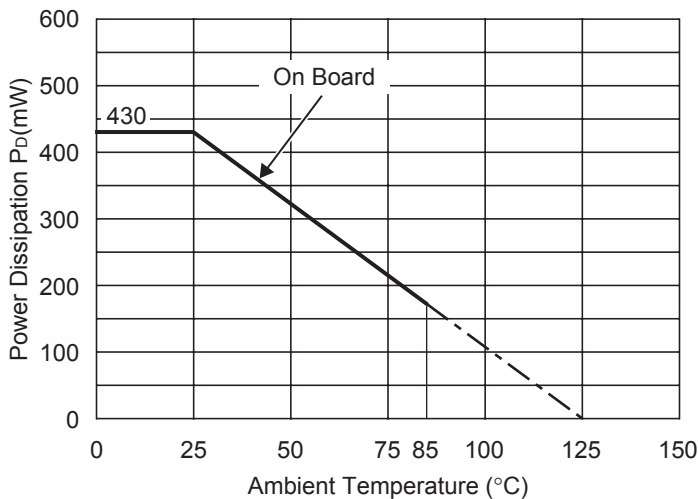
Measurement Conditions

	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plactic (Double sided)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side : Approx. 50% , Back side : Approx. 50%
Through-hole	φ0.5mm × 44pcs

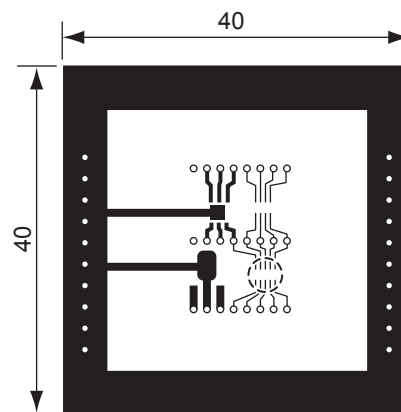
Measurement Result

( $T_{opt}=25^{\circ}C, T_{jmax}=125^{\circ}C$ )

	Standard Land Pattern
Power Dissipation	430mW
Thermal Resistance	$\theta_{ja}=(125-25^{\circ}C)/0.43W=233^{\circ}C/W$



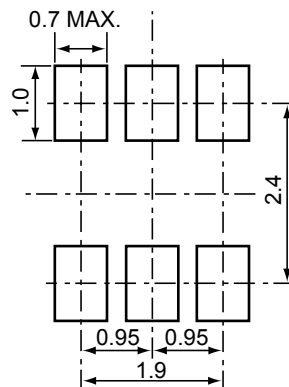
Power Dissipation



Measurement Board Pattern

○ IC Mount Area Unit : mm

### RECOMMENDED LAND PATTERN (SOT-23-6W)

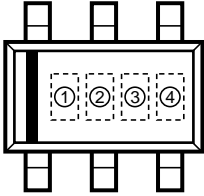


(Unit: mm)



## R5322N SERIES MARK SPECIFICATION

### • SOT-23-6W



①, ② : Product Code (refer to Part Number vs. Product Code)

③, ④ : Lot Number

### • Part Number vs. Product Code

Part Number	Product Code	
	①	②
R5322N001B-TR	H	0
R5322N002B-TR	H	1
R5322N003B-TR	H	2
R5322N004B-TR	H	3
R5322N005B-TR	H	4
R5322N001A-TR	H	5
R5322N002A-TR	H	6
R5322N003A-TR	H	7
R5322N006B-TR	H	8
R5322N007B-TR	H	9
R5322N008B-TR	H	A
R5322N009B-TR	H	B
R5322N010B-TR	H	C