

150mA Dual LDO REGULATOR

NO.EA-127-071112

OUTLINE

The R5325x Series are CMOS-based voltage regulator ICs with high output voltage accuracy, low supply current (Typ. 3.0 μ A), low dropout, and fast transient response. 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 prolongs the battery life of each system. The line transient response and load transient response of the R5325x Series are excellent, thus these ICs are very suitable for the power supply for hand-held communication equipment.

The supply current at no load of R5325x Series is remarkably reduced compared with R5323x Series. The mode change signal to reduce the supply current is not necessary.

The output voltage of these ICs is internally fixed with high accuracy ($\pm 1.0\%$). Since the packages for these ICs are SOT-23-6 and DFN(PLP)1820-6 package, dual LDO regulators are included in each, high density mounting of the ICs on boards is possible.

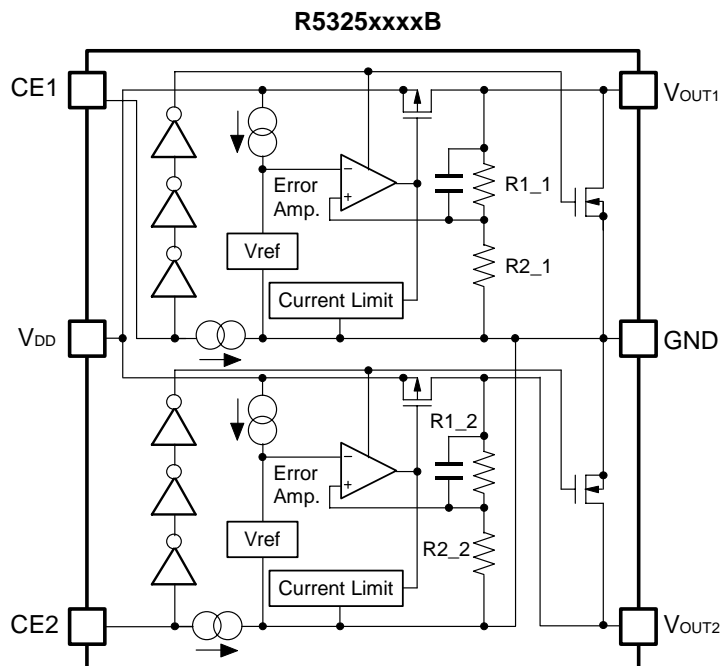
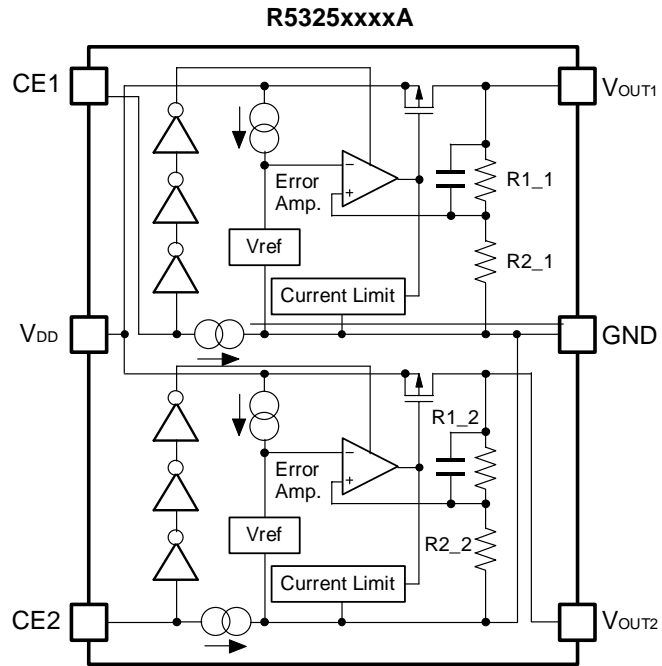
FEATURES

- Input Voltage 1.5V to 6.0V
- Output Voltage 1.2V to 4.0V
- Output Voltage Accuracy $\pm 1.0\%$
- Supply Current Typ. 3.0 μ A (VR1, VR2)
- Standby Current Typ. 0.1 μ A (VR1, VR2)
- Dropout Voltage Typ. 0.2V ($I_{OUT}=150\text{mA}$, $V_{OUT}=3.0\text{V}$)
- Ripple Rejection Typ. 55dB ($f=1\text{kHz}$)
- Built-in fold-back protection circuit Typ. 50mA (Current at short mode)
- Temperature-Drift Coefficient of Output Voltage Typ. $\pm 100\text{ppm}/^\circ\text{C}$
- Line Regulation Typ. 0.1%/V
- Built-in chip enable circuit (active "H")
- Fast Transient Response Time from large load current to small load current. (50% less than R5323x)
- Packages SOT-23-6, DFN(PLP)1820-6
- Ceramic Capacitor is recommended. (0.1 μ F or more)

APPLICATIONS

- Power source for handheld communication equipment.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.

BLOCK DIAGRAMS



SELECTION GUIDE

The output voltage, auto discharge function*, and the taping type for the ICs can be selected at the user's request.

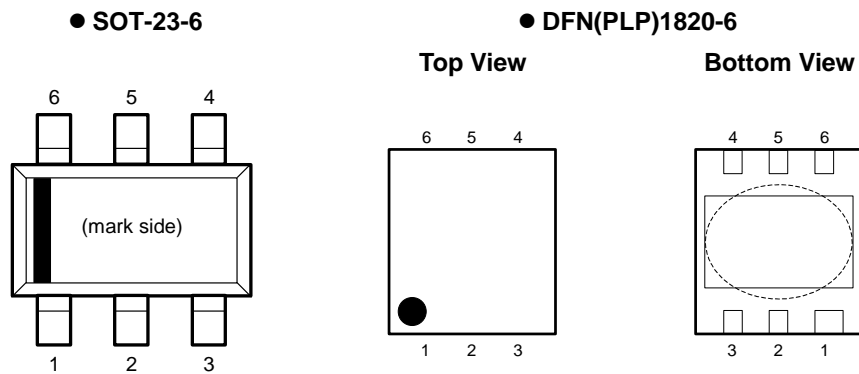
The selection can be made with designating the part number as shown below;

R5325xxxxx-xx-x ←Part Number
 ↑ ↑ ↑ ↑ ↑
 a b c d e

Code	Contents
a	Designation of Package Type: N: SOT-23-6 K: DFN(PLP)1820-6
b	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 1.2V to 4.0V is possible for each channel.
c	Designation of Mask Option: A version: without auto discharge function* at OFF state. B version: with auto discharge function* at OFF state.
d	Designation of Taping Type: Ex. TR (refer to Taping Specifications; TR type is the standard direction.)
e	Designation of composition of plating: -F : Lead free plating (SOT-23-6) None : Au plating (DFN(PLP)1820-6)

*) When the mode is into standby with CE signal, auto discharge transistor turns on, and it makes the turn-off speed faster than normal type.

PIN CONFIGURATION




PIN DESCRIPTIONS

● SOT-23-6

Pin No.	Symbol	Description
1	V_{OUT1}	Output Pin 1
2	V_{DD}	Input Pin
3	V_{OUT2}	Output Pin 2
4	CE2	Chip Enable Pin 2
5	GND	Ground Pin
6	CE1	Chip Enable Pin 1

● DFN(PLP)1820-6

Pin No.	Symbol	Description
1	V_{OUT2}	Output Pin 2
2	V_{DD}	Input Pin
3	V_{OUT1}	Output Pin 1
4	CE1	Chip Enable Pin 1
5	GND	Ground Pin
6	CE2	Chip Enable Pin 2

* Tab in the  parts have GND level.
 (They are connected to the back side of this IC.)
 Do not connect to other wires or land patterns.

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	6.5	V
V_{CE}	Input Voltage (CE Pin)	-0.3 to 6.5	V
V_{OUT}	Output Voltage	-0.3 to $V_{IN} + 0.3$	V
I_{OUT1}, I_{OUT2}	Output Current	200	mA
P_D	Power Dissipation (SOT-23-6) *	420	mW
	Power Dissipation (DFN(PLP)1820-6) *	880	
T_{opt}	Operating Temperature Range	-40 to 85	°C
T_{stg}	Storage Temperature Range	-55 to 125	°C

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

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum ratings are threshold limit values that must not be exceeded ever for an instant under any conditions. Moreover, such values for any two items must not be reached simultaneously. Operation above these absolute maximum ratings may cause degradation or permanent damage to the device. These are stress ratings only and do not necessarily imply functional operation below these limits.

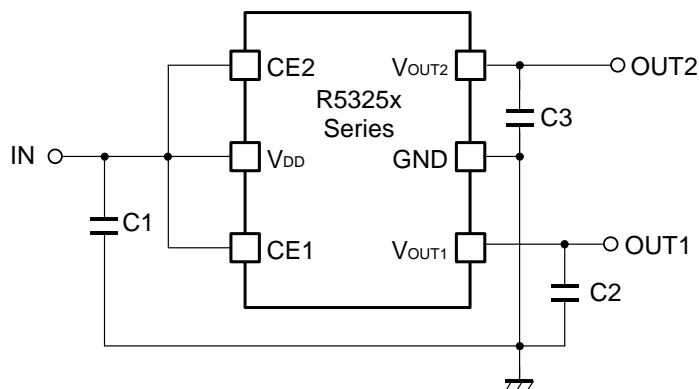
ELECTRICAL CHARACTERISTICS

• R5325xxxxA/B

T_{opt}=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V _{OUT}	Output voltage	V _{IN} =Set V _{OUT} +1V I _{OUT} =1mA	V _{OUT} ≥ 1.5V ×0.99		×1.01 +15mV	V
I _{OUT}	Output Current	V _{IN} -V _{OUT} =1.0V	150			mA
ΔV _{OUT} /ΔI _{OUT}	Load regulation	V _{IN} =Set V _{OUT} +1V 1mA ≤ I _{OUT} ≤ 150mA		30	80	mV
V _{DIF}	Dropout Voltage	I _{OUT} =150mA	1.2V ≤ V _{OUT} < 1.3V	0.55	0.85	V
			1.3V ≤ V _{OUT} < 1.4V	0.48	0.74	
			1.4V ≤ V _{OUT} < 1.5V	0.43	0.68	
			1.5V ≤ V _{OUT} < 2.0V	0.40	0.59	
			2.0V ≤ V _{OUT} < 2.8V	0.27	0.39	
			2.8V ≤ V _{OUT} < 4.0V	0.21	0.28	
			V _{OUT} = 4.0V	0.17	0.23	
I _{SS}	Supply Current	V _{IN} =Set V _{OUT} +1V, I _{OUT} =0mA		3	7	μA
I _{standby}	Standby Current	V _{IN} =6V V _{CE} =GND		0.1	1.0	μA
ΔV _{OUT} /ΔV _{IN}	Line regulation	Set V _{OUT} +0.5V ≤ V _{IN} ≤ 6.0V I _{OUT} =30mA		0.1	0.3	%/V
RR	Ripple Rejection	f=1kHz Ripple 0.5Vp-p V _{IN} -V _{OUT} =1.0V, I _{OUT} =30mA (In case that V _{OUT} ≤ 1.7V, V _{IN} =Set V _{OUT} +1.2V)		55		dB
V _{IN}	Input Voltage		1.5		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
I _{PD}	CE Pull-down Constant Current		0.15	0.30	0.55	μA
V _{CEH}	CE Input Voltage "H"		1.0		6.0	V
V _{CEL}	CE Input Voltage "L"		0		0.4	V
e _n	Output Noise	BW=10Hz to 100kHz		30		μVrms
R _{LOW}	Low Output Nch Tr. ON Resistance (of B version)	V _{CE} =0V		50		Ω

TYPICAL APPLICATION



(External Components)

Output Capacitor; Ceramic Type

0.1 μ F	Kyocera	CM05B104K06AB
	Murata	GRM155B31C104KA87B
1.0 μ F	Kyocera	CM05X5R105K06AB
	TDK	C1005JB0J105K
	Murata	GRM155B30J105KE18B

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 with a capacitance value as much as 0.1 μ F or more as C1 between V_{DD} and GND pin, and as close as possible to the pins.

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

2. Phase Compensation

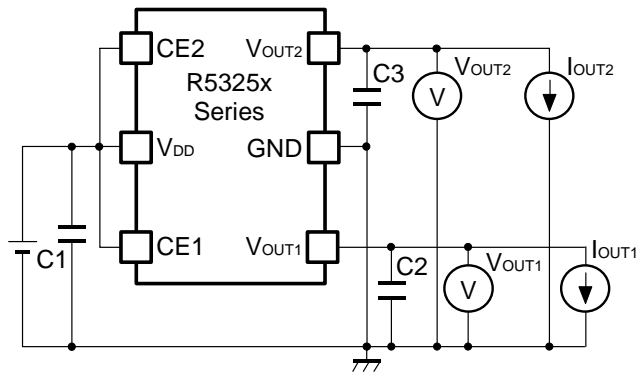
In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C2 and C3 with good frequency characteristics and ESR (Equivalent Series Resistance).

(Note: If additional ceramic capacitors are connected with parallel to the output pin with an 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.

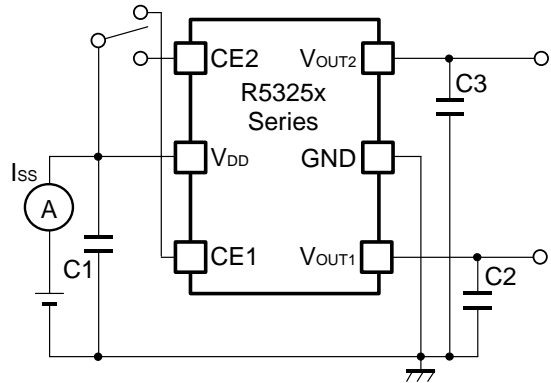
Depending on the capacitor size, manufacturer, and part number, the bias characteristics and temperature characteristics are different. Evaluate the circuit with actual using capacitors.

TEST CIRCUIT



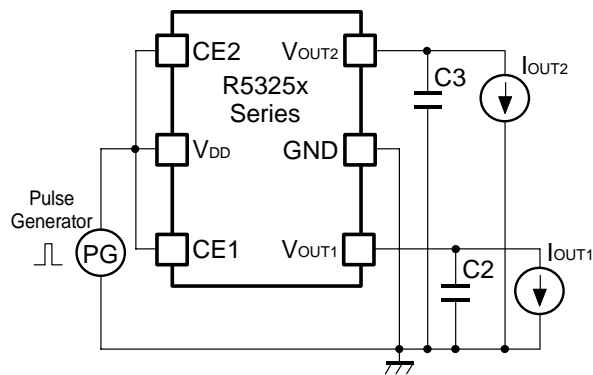
* C1=C2=C3=Ceramic 0.1 μ F

Fig.1 Standard test Circuit



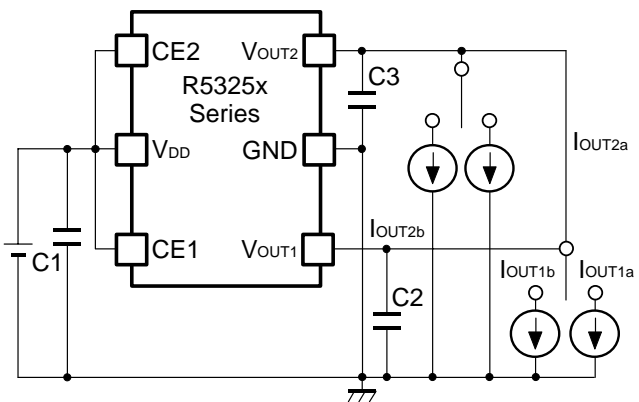
* C1=C2=C3=Ceramic 0.1 μ F

Fig.2 Supply Current Test Circuit



* C2=C3=Ceramic 0.1 μ F

Fig.3 Ripple Rejection, Line Transient Response Test Circuit

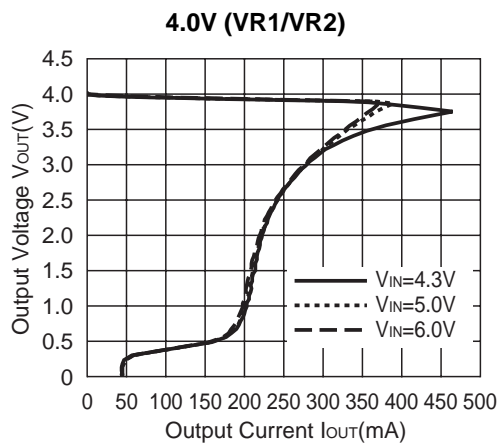
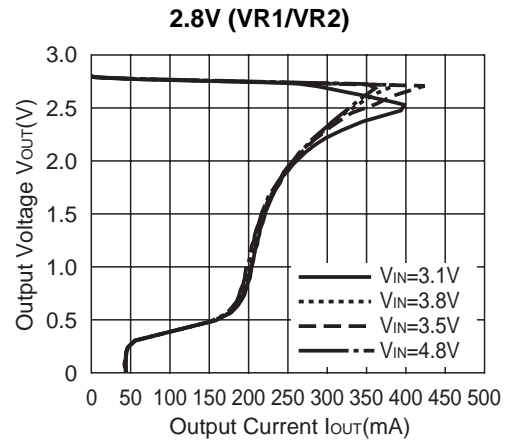
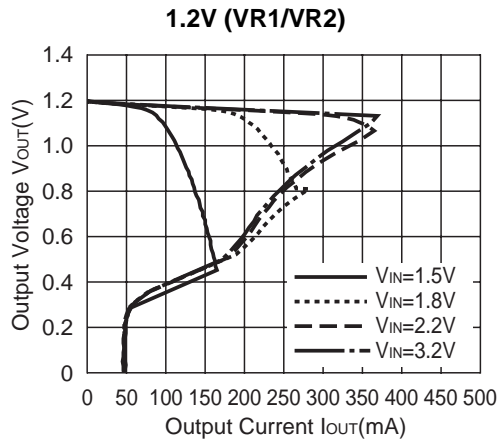


* C1=C2=C3=Ceramic 0.1 μ F

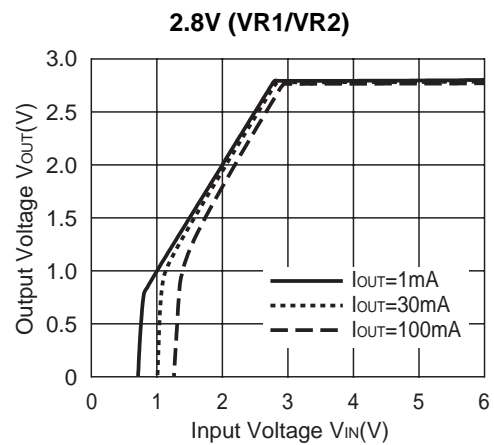
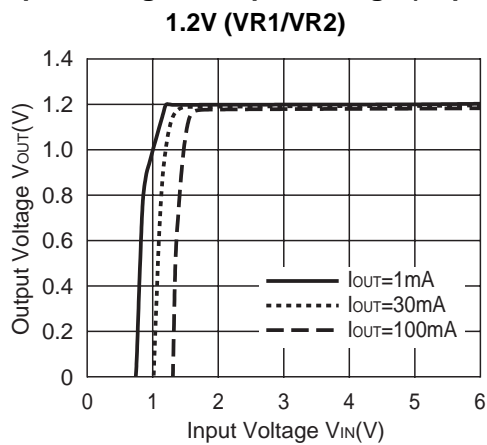
Fig.4 Load Transient Response Test Circuit

TYPICAL CHARACTERISTICS

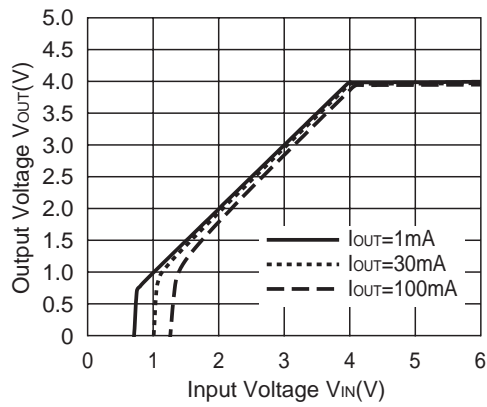
1) Output Voltage vs. Output Current (T_{opt}=25°C)



2) Output Voltage vs. Input Voltage (T_{opt}=25°C)

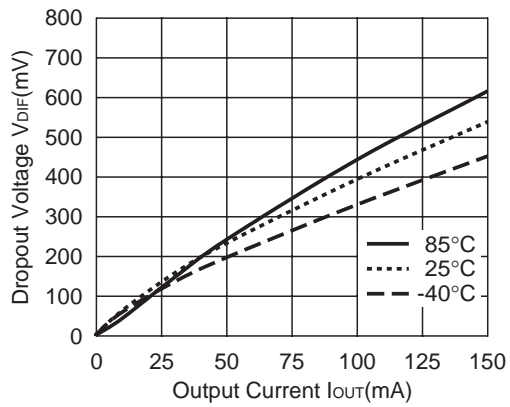


4.0V (VR1/VR2)

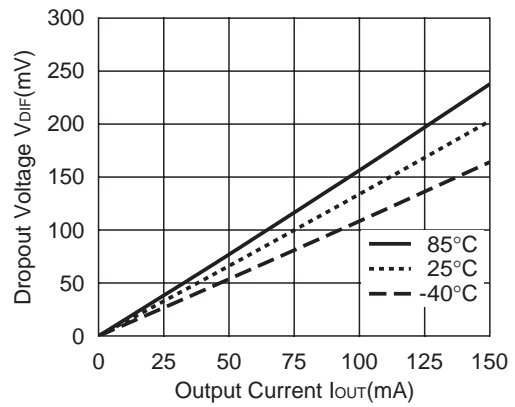


3) Dropout Voltage vs. Output Current

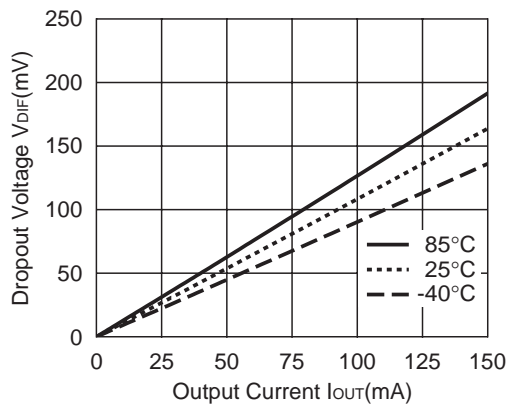
1.2V (VR1/VR2)



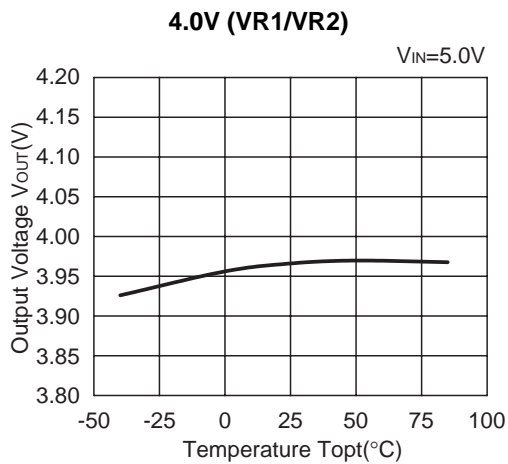
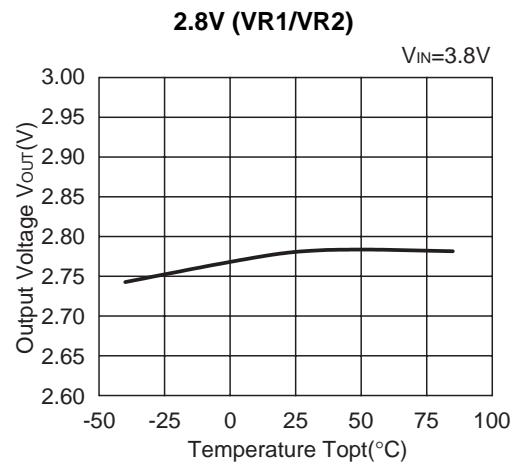
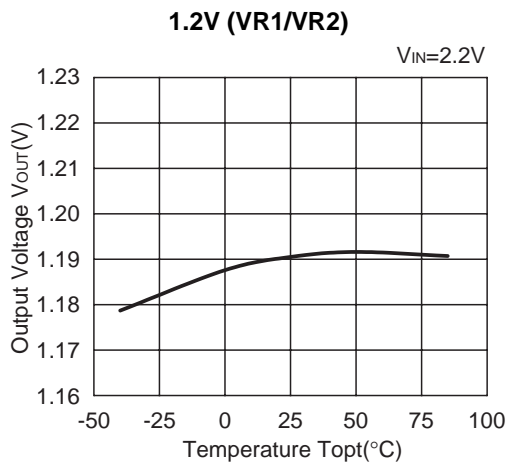
2.8V (VR1/VR2)



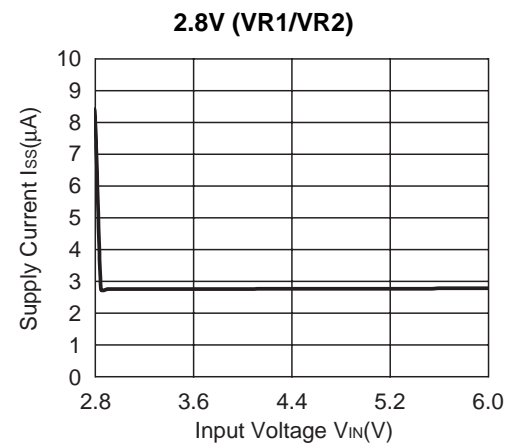
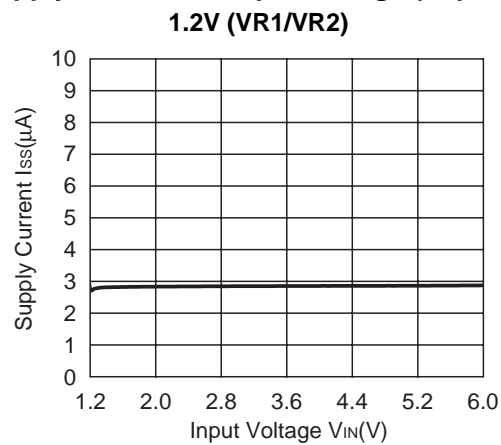
4.0V (VR1/VR2)

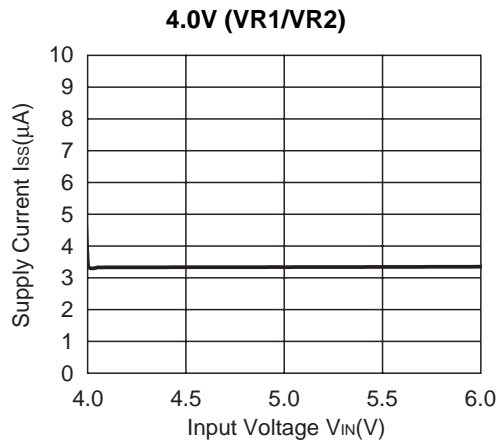


4) Output Voltage vs. Temperature ($I_{OUT}=30mA$)

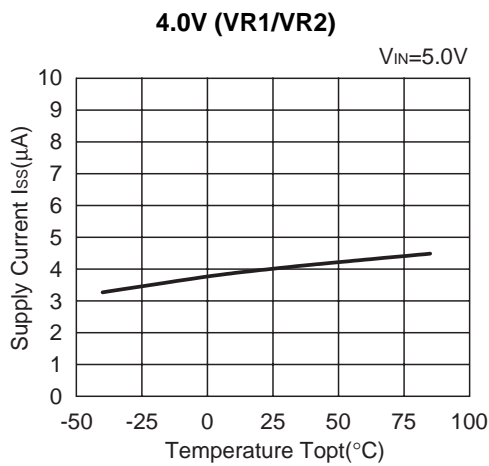
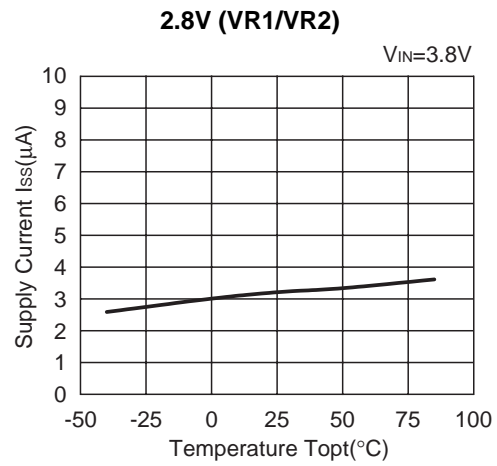
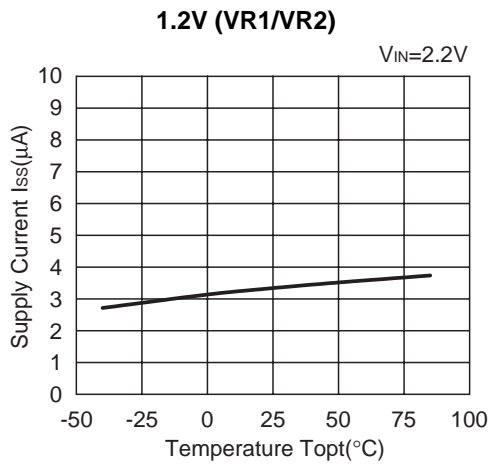


5) Supply Current vs. Input Voltage ($T_{opt}=25^{\circ}C$)

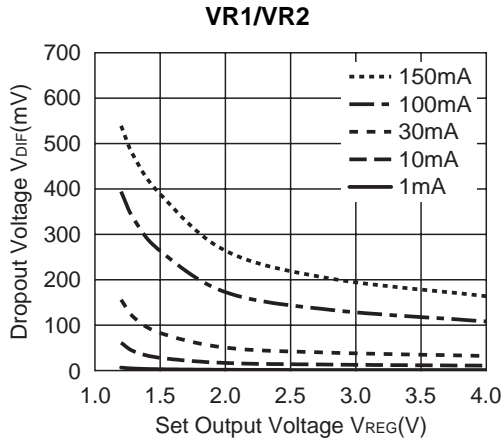




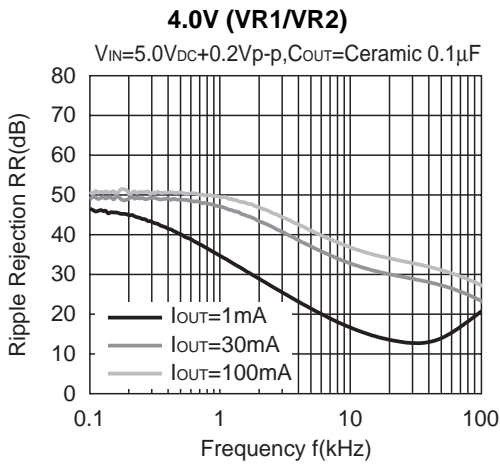
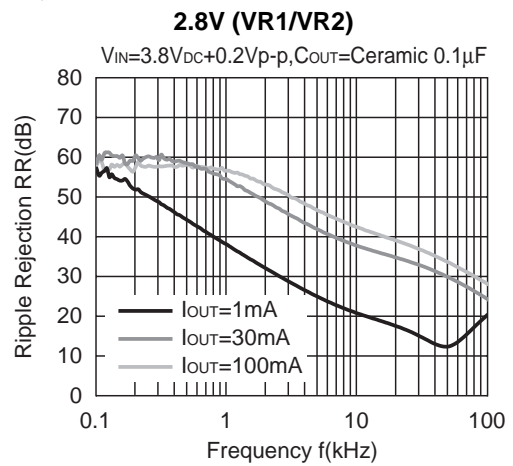
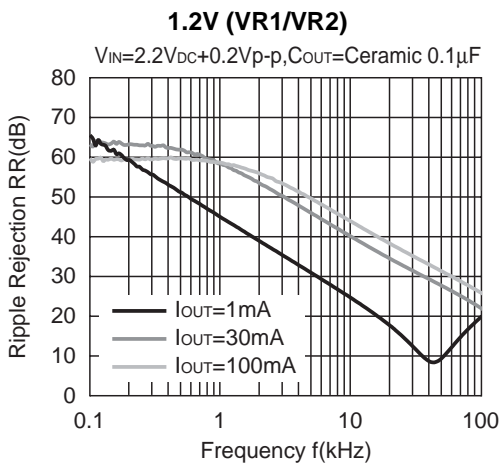
6) Supply Current vs. Temperature



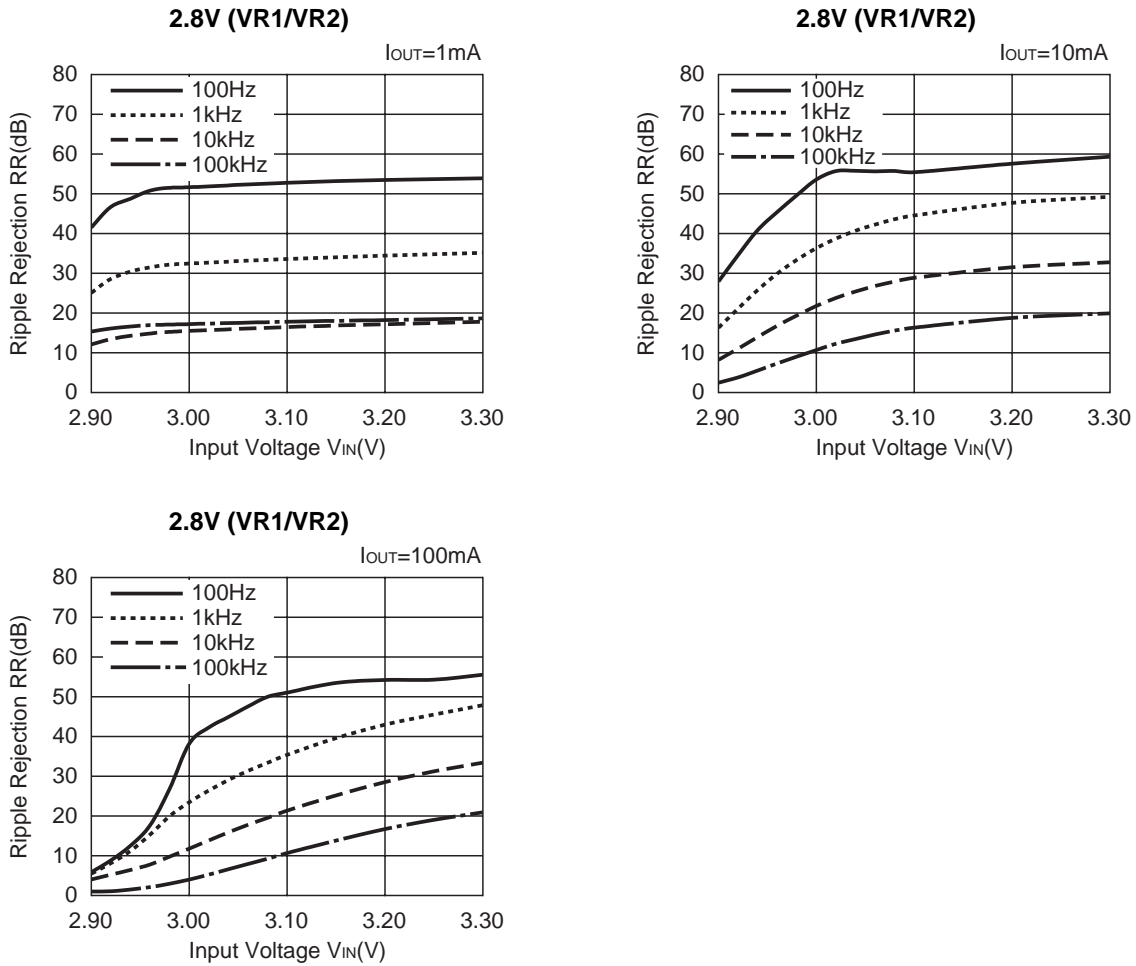
7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)



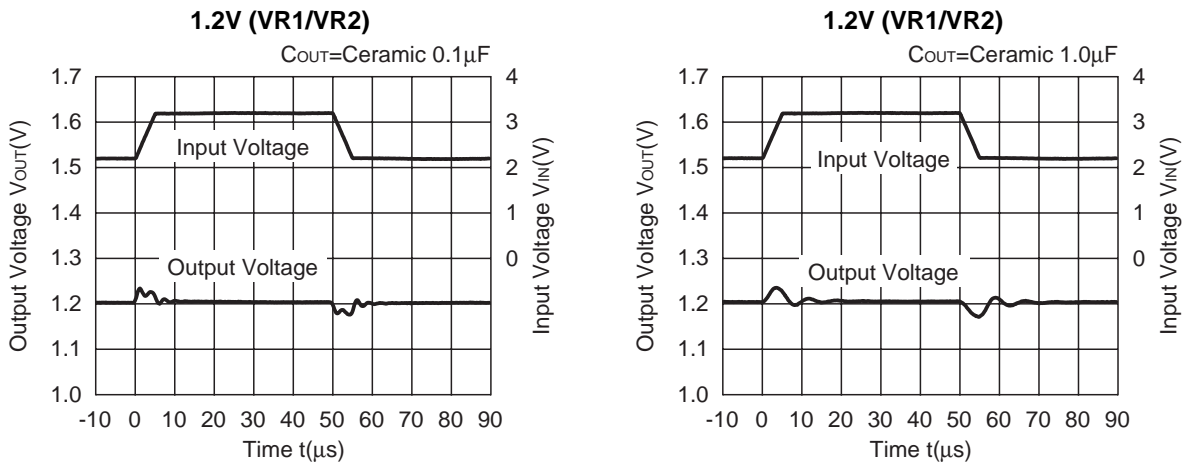
8) Ripple Rejection vs. Frequency (Topt=25°C, C_{OUT}=0.1μF)

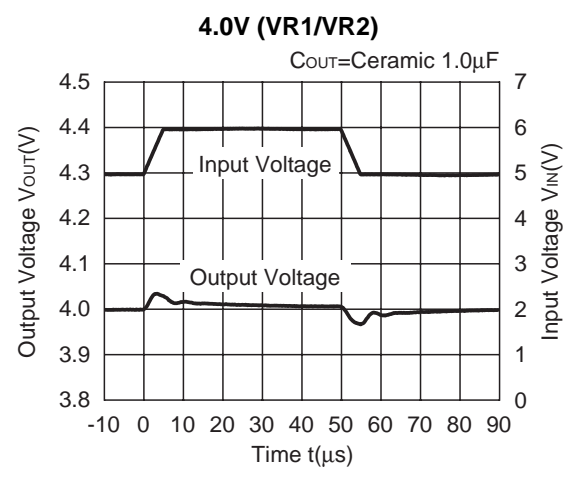
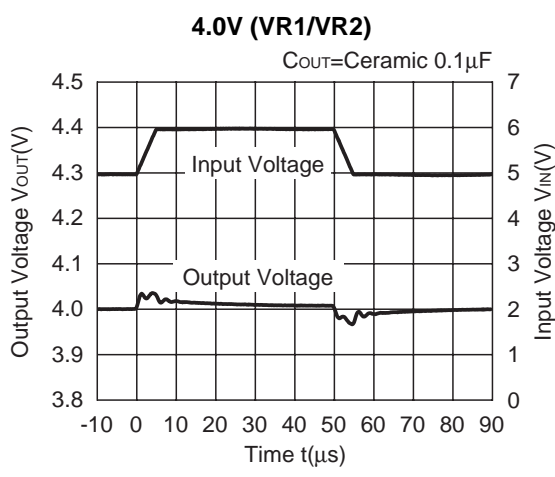
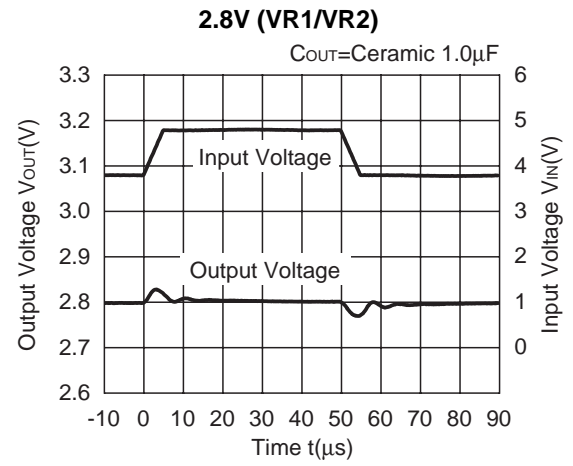
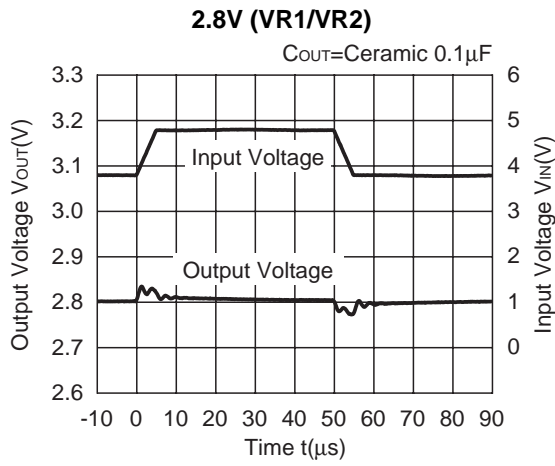


9) Ripple Rejection vs. Input Voltage (DC bias) (T_{opt}=25°C, Ripple 0.2Vp-p)

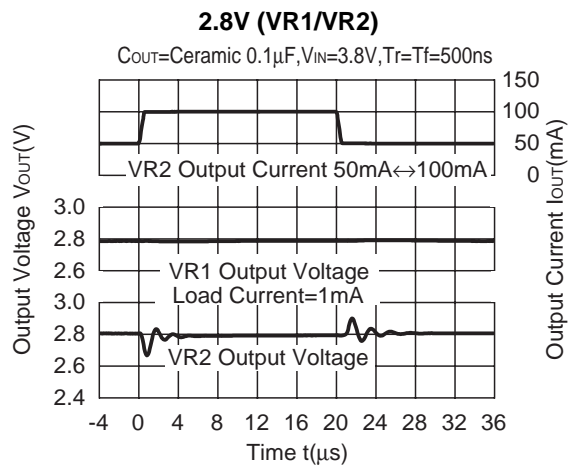
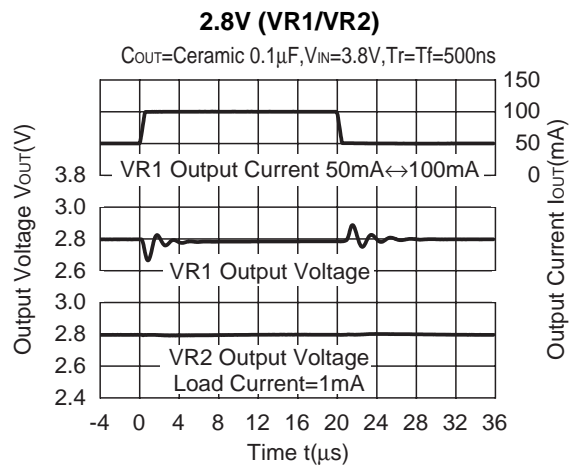


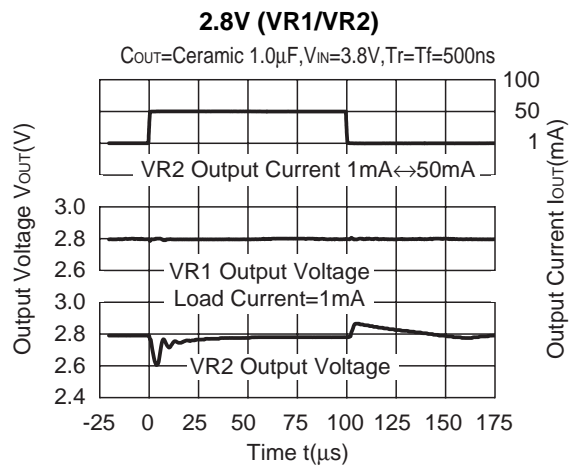
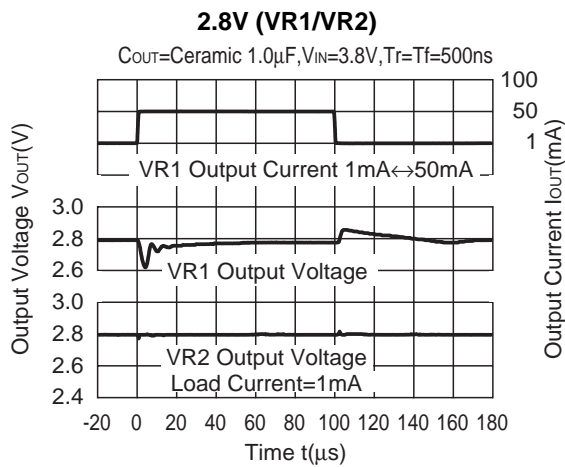
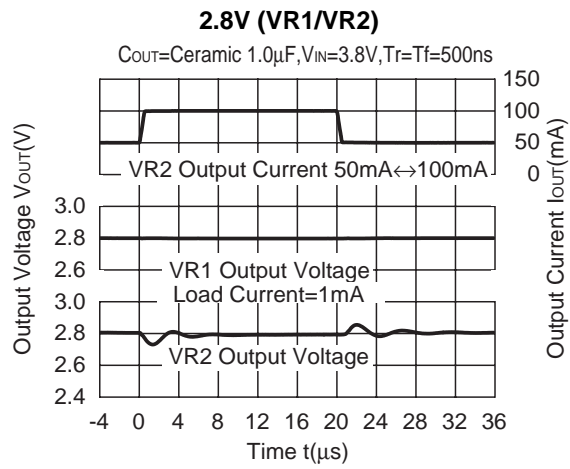
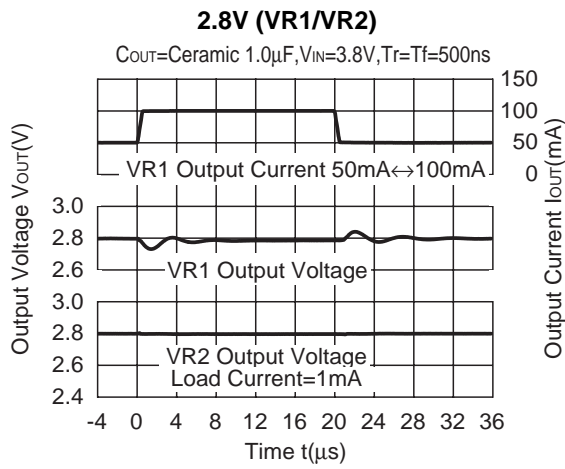
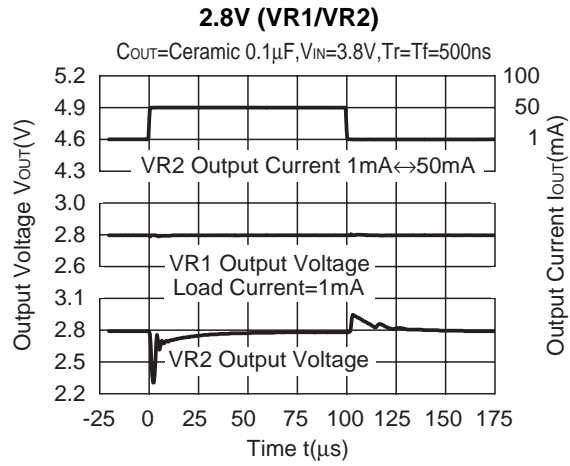
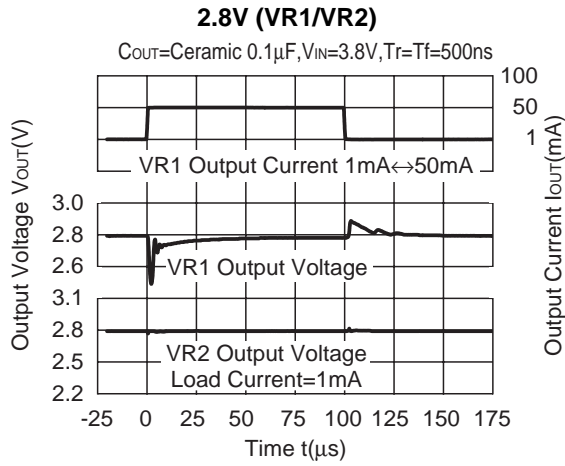
10) Input Transient Response (C_{IN}=none, tr=tf=5μs, I_{OUT}=30mA)

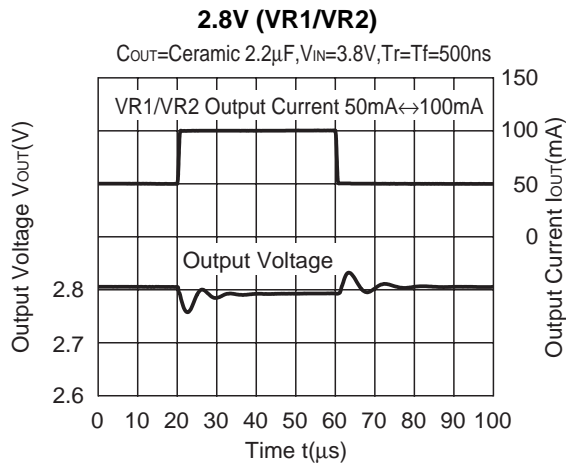




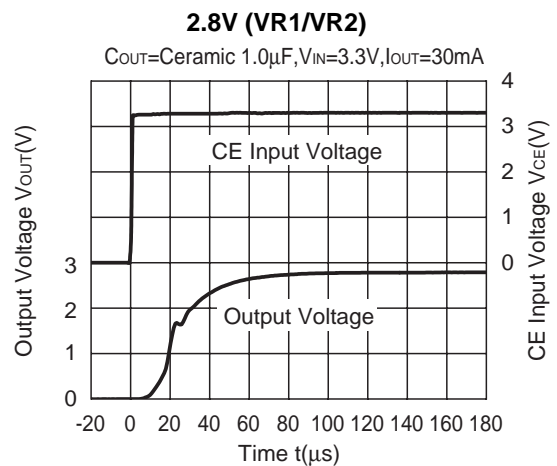
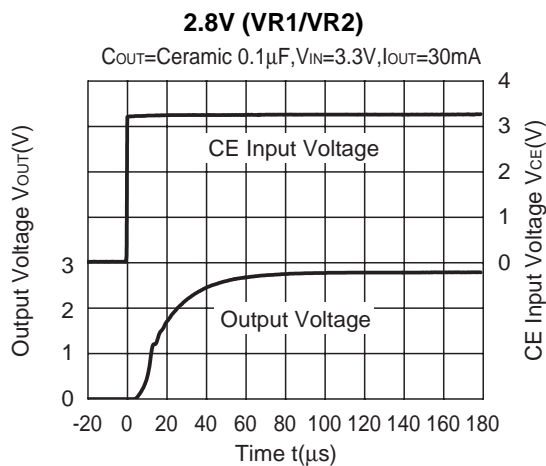
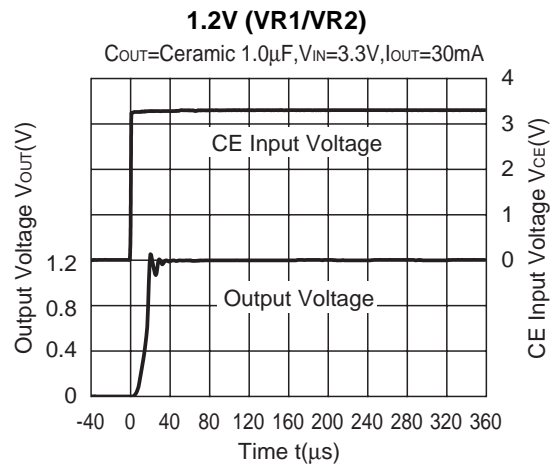
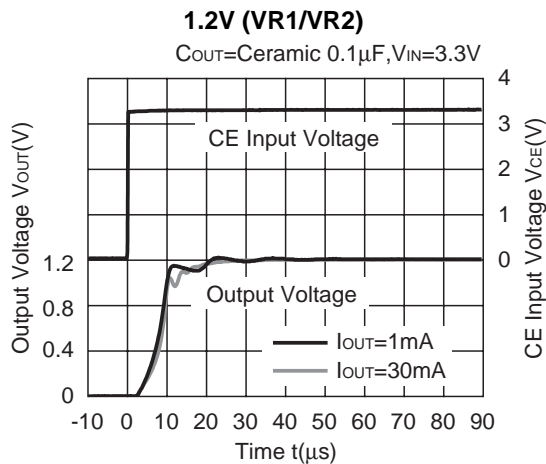
11) Load Transient Response ($C_{IN} = \text{Ceramic } 0.1\mu\text{F}$)

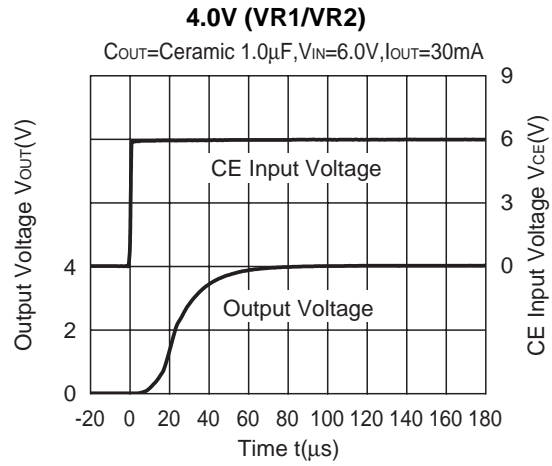
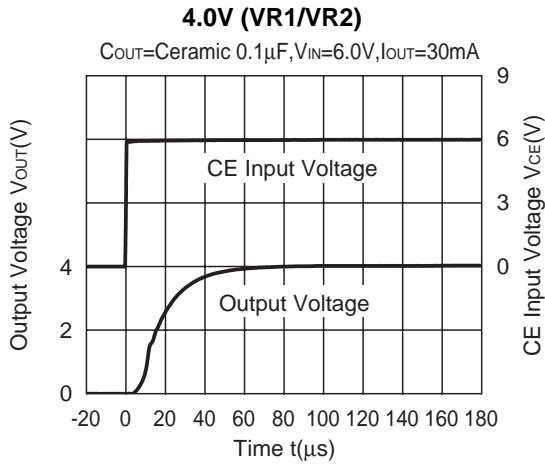




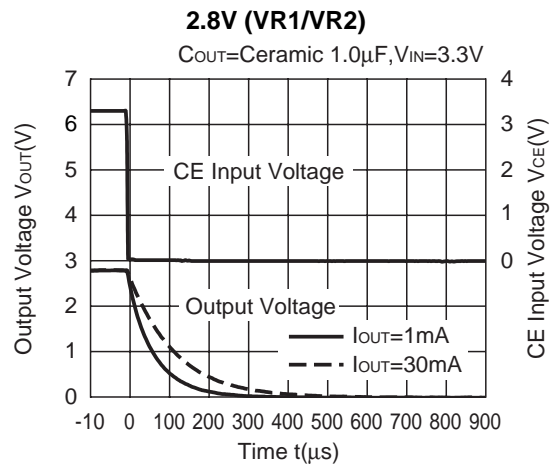
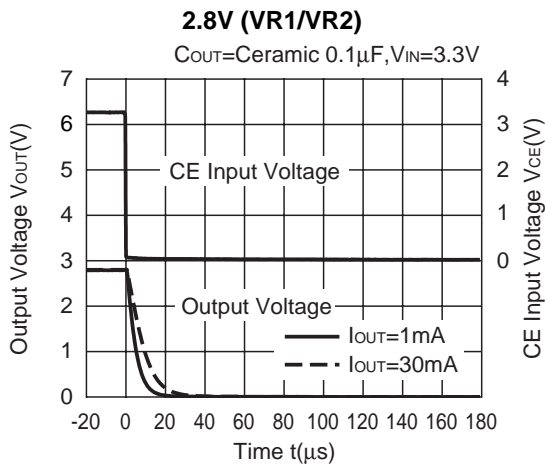
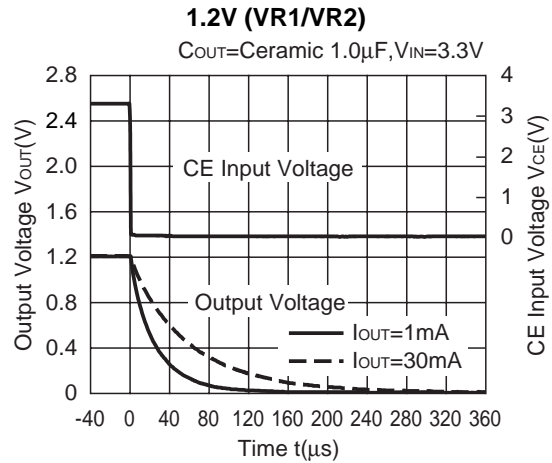
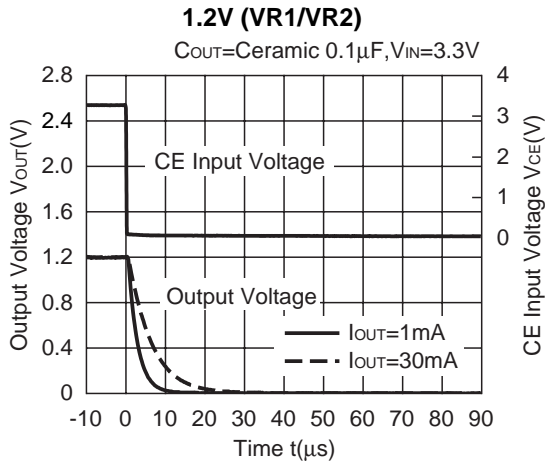


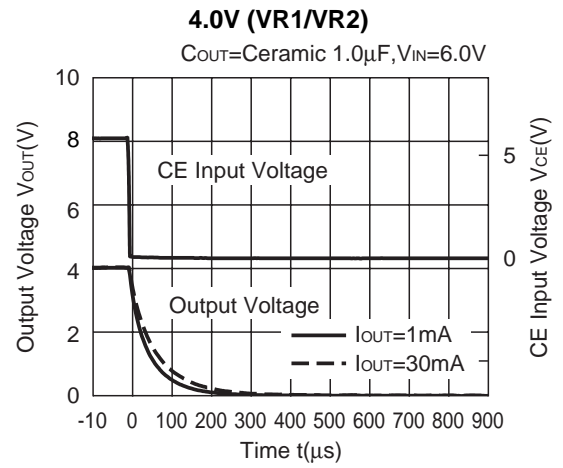
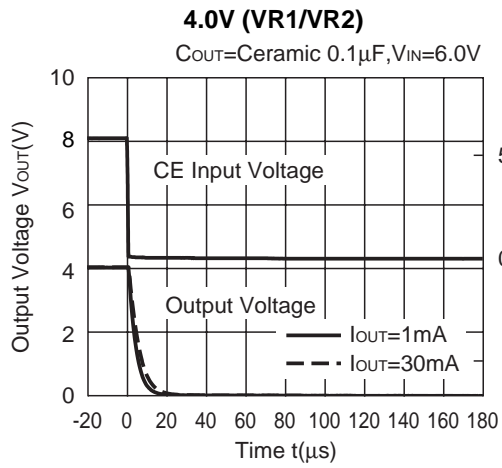
12) Turn on Speed by CE signal ($C_{IN} = \text{Ceramic } 0.1\mu\text{F}$)





13) Turn-off Speed with CE Signal (B version) (C_{IN} =Ceramic 0.1 μ F)

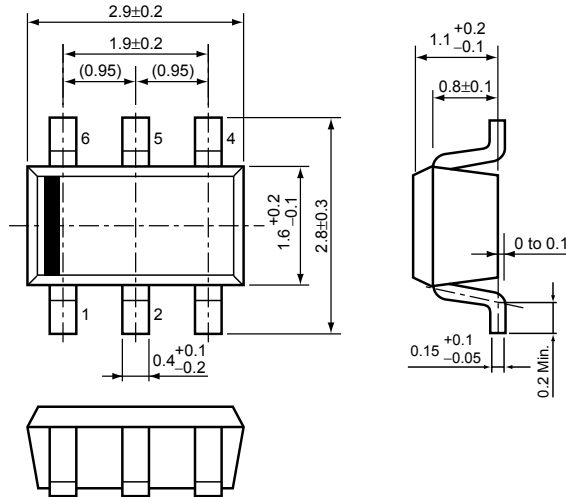




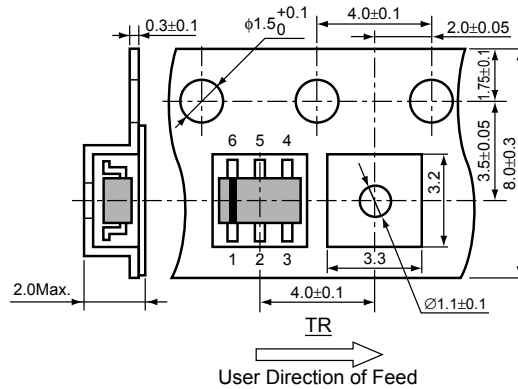
• SOT-23-6 (SC-74)

Unit: mm

PACKAGE DIMENSIONS

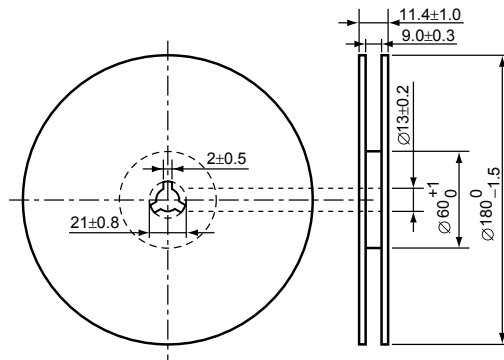


TAPING SPECIFICATION



TAPING REEL DIMENSIONS REUSE REEL (EIAJ-RRM-08Bc)

(1reel=3000pcs)



POWER DISSIPATION (SOT-23-6)

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:

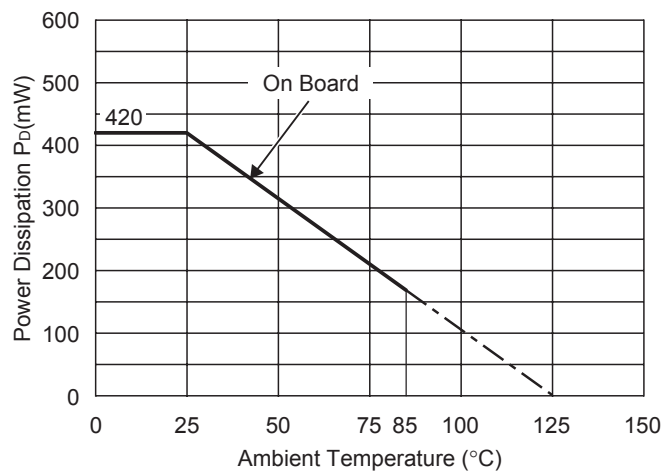
Measurement Conditions

	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

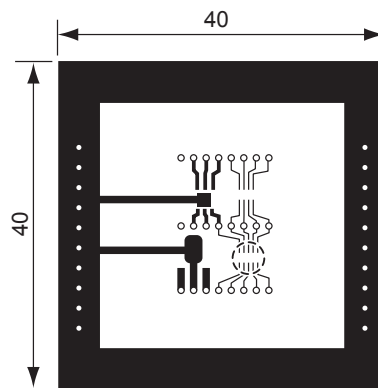
Measurement Result

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

	Standard Land Pattern	Free Air
Power Dissipation	420mW	250mW
Thermal Resistance	$\theta_{ja}=(125-25^{\circ}C)/0.42W=263^{\circ}C/W$	400°C/W



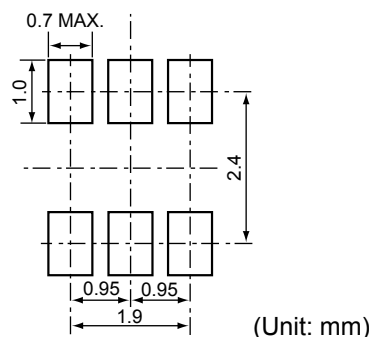
Power Dissipation



Measurement Board Pattern

○ IC Mount Area Unit : mm

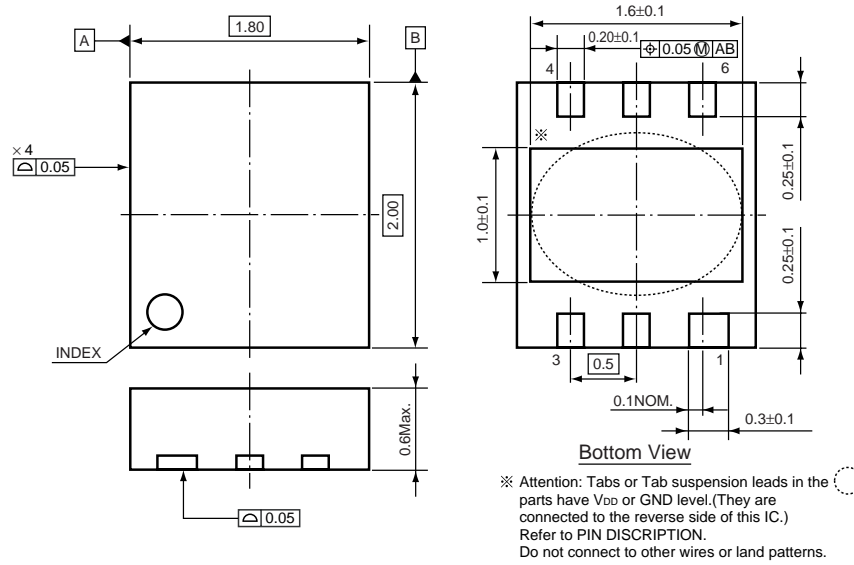
RECOMMENDED LAND PATTERN



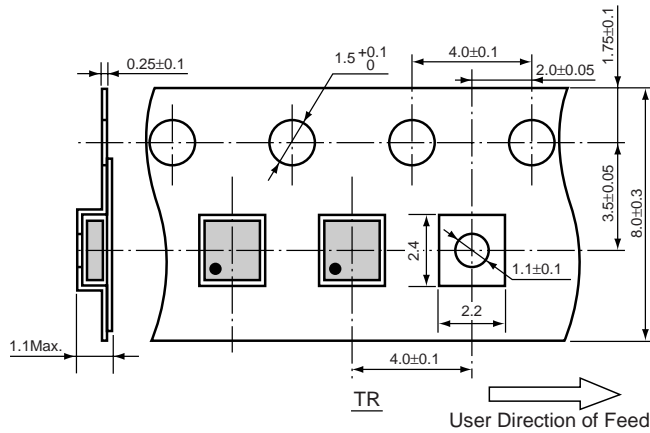
• DFN(PLP)1820-6

Unit: mm

PACKAGE DIMENSIONS



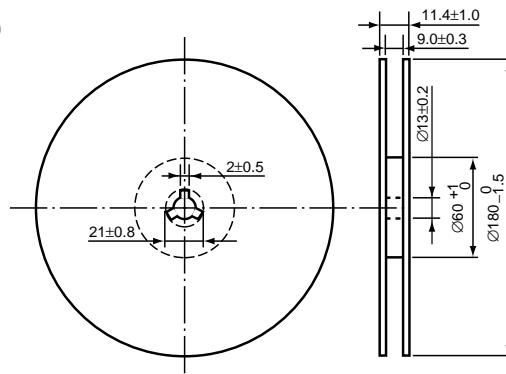
TAPING SPECIFICATION



TAPING REEL DIMENSIONS REUSE REEL (EIAJ-RRM-08Bc)

(1reel=5000pcs)

(R5323K,R5325K : 1reel=3000pcs)



POWER DISSIPATION (DFN(PLP)1820-6)

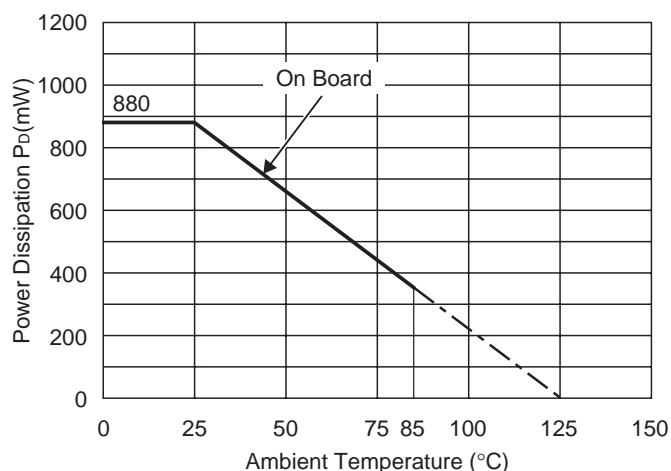
This specification is at mounted on board. Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

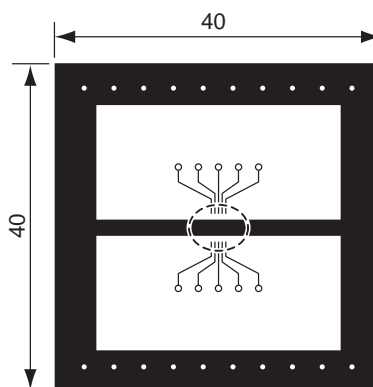
	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side : Approx. 50% , Back side : Approx. 50%
Through-hole	φ0.54mm × 30pcs

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

	Standard Land Pattern
Power Dissipation	880mW
Thermal Resistance	$\theta_{ja}=(125-25^{\circ}C)/0.88W=114^{\circ}C/W$



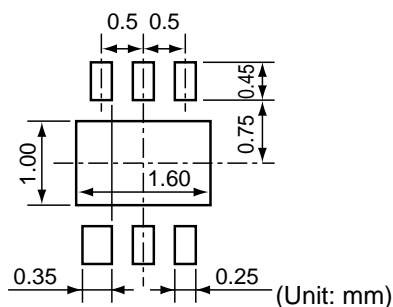
Power Dissipation



Measurement Board Pattern

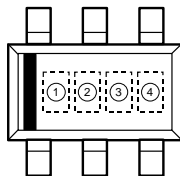
○ IC Mount Area Unit : mm

RECOMMENDED LAND PATTERN



R5325N SERIES MARK SPECIFICATION

● SOT-23-6 (SC-74)



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

③, ④ : Lot Number

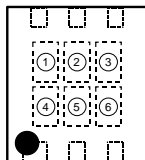
● Part Number vs. Product Code

Part Number	Product Code		Set V _{OUT}	
	①	②	VR1	VR2
R5325N001B	W	1	2.8V	2.8V
R5325N002B	W	2	2.8V	1.8V
R5325N003B	W	3	1.8V	3.0V
R5325N004B	W	4	2.5V	3.0V
R5325N005B	W	5	1.8V	2.5V
R5325N006B	W	6	1.8V	3.3V
R5325N007B	W	7	2.5V	2.8V
R5325N008B	W	8	1.2V	1.2V
R5325N009B	W	9	1.5V	1.6V
R5325N010B	W	A	1.5V	2.8V
R5325N011B	W	B	3.0V	3.0V
R5325N012B	W	C	3.1V	3.1V
R5325N013B	W	D	2.7V	1.8V
R5325N014B	W	G	1.8V	2.6V
R5325N015B	W	H	3.3V	3.3V
R5325N016B	W	E	2.85V	2.85V
R5325N017B	W	F	2.9V	2.9V
R5325N018B	W	J	1.2V	2.6V
R5325N019B	W	K	2.8V	2.9V
R5325N020B	W	L	1.2V	1.8V
R5325N021B	W	M	2.5V	1.2V
R5325N022B	W	N	2.7V	2.85V
R5325N023B	W	P	1.2V	2.8V
R5325N024B	W	Q	1.2V	3.0V
R5325N025B	W	R	2.5V	2.9V
R5325N026B	W	S	1.2V	2.7V
R5325N027B	W	T	2.9V	1.8V
R5325N028B	W	U	1.5V	1.8V
R5325N029B	W	V	1.3V	2.8V
R5325N030B	W	W	3.45V	2.3V
R5325N031B	W	X	1.3V	1.8V
R5325N032B	W	Y	1.8V	1.8V
R5325N033B	W	Z	3.1V	3.0V

Part Number	Product Code		Set V _{OUT}	
	①	②	VR1	VR2
R5325N001A	Y	1	2.8V	2.8V
R5325N002A	Y	2	2.8V	1.8V
R5325N003A	Y	3	1.8V	3.0V
R5325N004A	Y	4	2.5V	3.0V
R5325N005A	Y	5	1.8V	2.5V
R5325N006A	Y	6	1.8V	3.3V
R5325N007A	Y	7	2.5V	2.8V
R5325N008A	Y	8	1.2V	1.2V
R5325N009A	Y	9	1.5V	1.6V
R5325N010A	Y	A	1.5V	2.8V
R5325N011A	Y	B	3.0V	3.0V
R5325N012A	Y	C	3.1V	3.1V
R5325N013A	Y	D	2.7V	1.8V
R5325N014A	Y	G	1.8V	2.6V
R5325N015A	Y	H	3.3V	3.3V
R5325N016A	Y	E	2.85V	2.85V
R5325N017A	Y	F	2.9V	2.9V
R5325N018A	Y	J	1.2V	2.6V
R5325N019A	Y	K	2.8V	2.9V
R5325N020A	Y	L	1.2V	1.8V
R5325N021A	Y	M	2.5V	1.2V
R5325N022A	Y	N	2.7V	2.85V
R5325N023A	Y	P	1.2V	2.8V
R5325N024A	Y	Q	1.2V	3.0V
R5325N025A	Y	R	2.5V	2.9V
R5325N026A	Y	S	1.2V	2.7V
R5325N027A	Y	T	2.9V	1.8V
R5325N028A	Y	U	1.5V	1.8V
R5325N029A	Y	V	1.3V	2.8V
R5325N026A	Y	W	3.45V	2.3V
R5325N027A	Y	X	1.3V	1.8V
R5325N028A	Y	Y	1.8V	1.8V
R5325N029A	Y	Z	3.1V	3.0V

R5325K SERIES MARK SPECIFICATION

• DFN(PLP)1820-6



① to ④ : Product Code (refer to Part Number vs. Product Code)

⑤, ⑥ : Lot Number

• Part Number vs. Product Code

Part Number	Product Code				Set V _{OUT}	
	①	②	③	④	VR1	VR2
R5325K001B	D	0	0	1	2.8V	2.8V
R5325K002B	D	0	0	2	2.8V	1.8V
R5325K003B	D	0	0	3	1.8V	3.0V
R5325K004B	D	0	0	4	2.5V	3.0V
R5325K005B	D	0	0	5	1.8V	2.5V
R5325K006B	D	0	0	6	1.8V	3.3V
R5325K007B	D	0	0	7	2.5V	2.8V
R5325K008B	D	0	0	8	1.2V	1.2V
R5325K009B	D	0	0	9	1.5V	1.6V
R5325K010B	D	0	1	0	1.5V	2.8V
R5325K011B	D	0	1	1	3.0V	3.0V
R5325K012B	D	0	1	2	3.1V	3.1V
R5325K013B	D	0	1	3	2.7V	1.8V
R5325K014B	D	0	1	4	1.8V	2.6V
R5325K015B	D	0	1	5	3.3V	3.3V
R5325K016B	D	0	1	6	2.85V	2.85V
R5325K017B	D	0	1	7	2.9V	2.9V
R5325K018B	D	0	1	8	1.2V	2.6V
R5325K019B	D	0	1	9	2.8V	2.9V
R5325K020B	D	0	2	0	1.2V	1.8V
R5325K021B	D	0	2	1	2.5V	1.2V
R5325K022B	D	0	2	2	2.7V	2.85V
R5325K023B	D	0	2	3	1.2V	2.8V
R5325K024B	D	0	2	4	1.2V	3.0V
R5325K025B	D	0	2	5	2.5V	2.9V
R5325K026B	D	0	2	6	1.2V	2.7V
R5325K027B	D	0	2	7	2.9V	1.8V
R5325K028B	D	0	2	8	1.5V	1.8V
R5325K029B	D	0	2	9	1.3V	2.8V
R5325K030B	D	0	3	0	3.45V	2.3V
R5325K031B	D	0	3	1	1.3V	1.8V
R5325K032B	D	0	3	2	1.8V	1.8V
R5325K033B	D	0	3	3	3.1V	3.0V

Part Number	Product Code				Set V _{OUT}	
	①	②	③	④	VR1	VR2
R5325K001A	R	0	0	1	2.8V	2.8V
R5325K002A	R	0	0	2	2.8V	1.8V
R5325K003A	R	0	0	3	1.8V	3.0V
R5325K004A	R	0	0	4	2.5V	3.0V
R5325K005A	R	0	0	5	1.8V	2.5V
R5325K006A	R	0	0	6	1.8V	3.3V
R5325K007A	R	0	0	7	2.5V	2.8V
R5325K008A	R	0	0	8	1.2V	1.2V
R5325K009A	R	0	0	9	1.5V	1.6V
R5325K010A	R	0	1	0	1.5V	2.8V
R5325K011A	R	0	1	1	3.0V	3.0V
R5325K012A	R	0	1	2	3.1V	3.1V
R5325K013A	R	0	1	3	2.7V	1.8V
R5325K014A	R	0	1	4	1.8V	2.6V
R5325K015A	R	0	1	5	3.3V	3.3V
R5325K016A	R	0	1	6	2.85V	2.85V
R5325K017A	R	0	1	7	2.9V	2.9V
R5325K018A	R	0	1	8	1.2V	2.6V
R5325K019A	R	0	1	9	2.8V	2.9V
R5325K020A	R	0	2	0	1.2V	1.8V
R5325K021A	R	0	2	1	2.5V	1.2V
R5325K022A	R	0	2	2	2.7V	2.85V
R5325K023A	R	0	2	3	1.2V	2.8V
R5325K024A	R	0	2	4	1.2V	3.0V
R5325K025A	R	0	2	5	2.5V	2.9V
R5325K026A	R	0	2	6	1.2V	2.7V
R5325K027A	R	0	2	7	2.9V	1.8V
R5325K028A	R	0	2	8	1.5V	1.8V
R5325K029A	R	0	2	9	1.3V	2.8V
R5325K030A	R	0	3	0	3.45V	2.3V
R5325K031A	R	0	3	1	1.3V	1.8V
R5325K032A	R	0	3	2	1.8V	1.8V
R5325K033A	R	0	3	3	3.1V	3.0V