

# RICOH

## R5325x SERIES

### 150mA 2ch LDO REGULATOR

NO.EA-127-0606

#### OUTLINE

The R5325x Series are CMOS-based voltage regulator ICs with high output voltage accuracy, low supply current (Typ. 3.0 $\mu$ 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 R5325x 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 PLP1820-6 package, 2ch LDO regulators are included in each, high density mounting of the ICs on boards is possible.

#### FEATURES

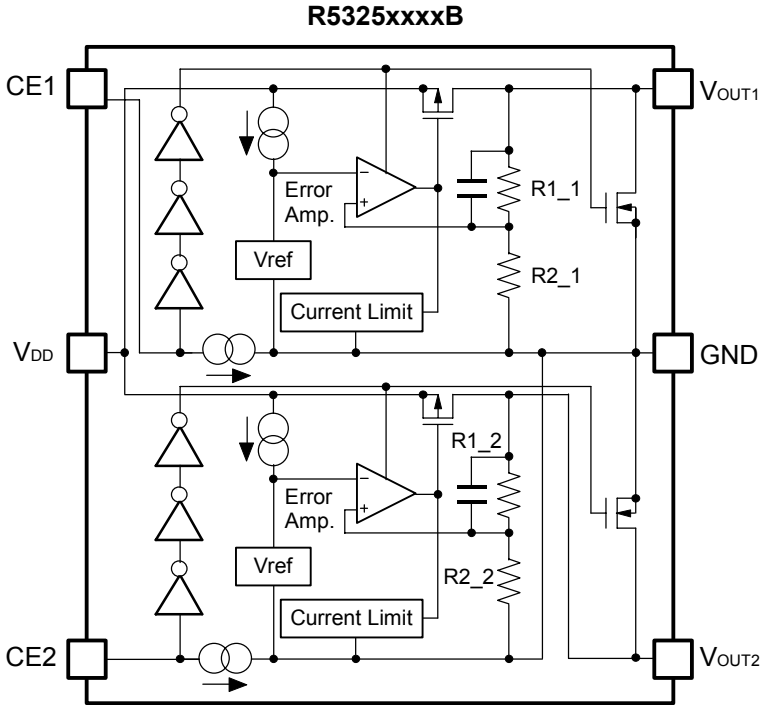
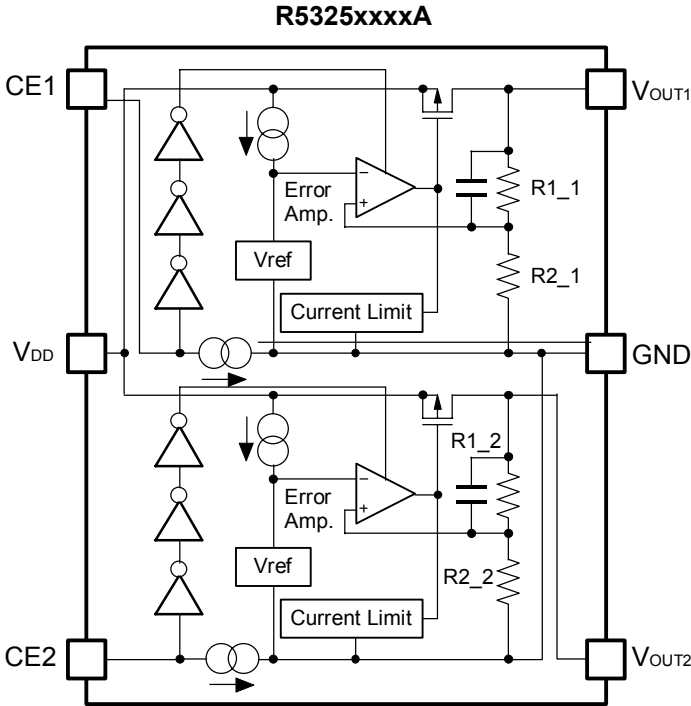
- Input Voltage ..... 1.5V to 6.0V
- Output Voltage ..... 1.2V to 4.0V
- High Output Voltage Accuracy .....  $\pm 1.0\%$  ( $V_{OUT} \geq 1.5V$ )
- Low Supply Current ..... Typ. 3.0 $\mu$ A (VR1, VR2)
- Standby Current ..... Typ. 0.1 $\mu$ A (VR1, VR2)
- Low Dropout Voltage ..... Typ. 0.2V ( $I_{OUT}=150mA, V_{OUT}=3.0V$ )
- High Ripple Rejection ..... Typ. 55dB ( $f=1kHz$ )
- Built-in fold-back protection circuit ..... Typ. 50mA (Current at short mode)
- Low Temperature-Drift Coefficient of Output Voltage.... Typ.  $\pm 100ppm/^{\circ}C$
- Excellent Line Regulation ..... Typ. 0.02%/V
- Built-in chip enable circuit (active "H")
- Fast Transient Response Time from large load current to small load current (50% less than R5323x)
- Small Packages ..... SOT-23-6, PLP1820-6
- Ceramic Capacitor is recommended. (0.1 $\mu$ 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.

R5325x

BLOCK DIAGRAMS

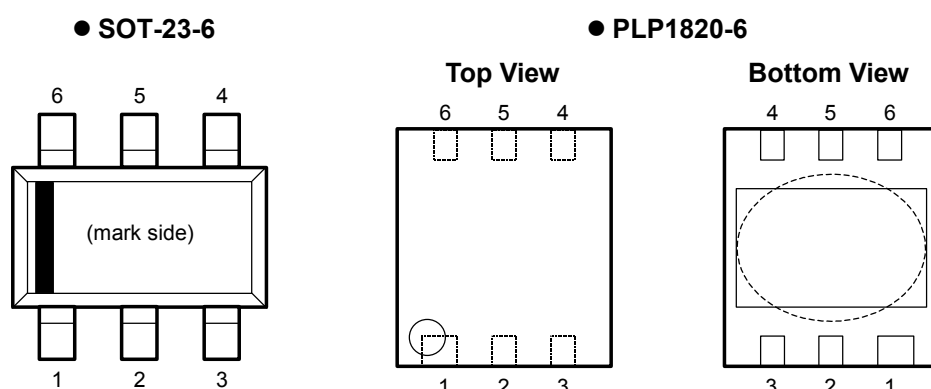


## SELECTION GUIDE

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;

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

Code	Contents
a	Designation of Package Type: N: SOT-23-6 K: PLP1820-6
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 (PLP1820-6)


**R5325x****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

## ● PLP1820-6

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 reverse 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)	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) *Note1	420	mW
	Power Dissipation (PLP1820-6) *Note1	880	
$T_{opt}$	Operating Temperature Range	-40 to 85	°C
$T_{stg}$	Storage Temperature Range	-55 to 125	°C

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

## ELECTRICAL CHARACTERISTICS

### • R5325xxxxA/B

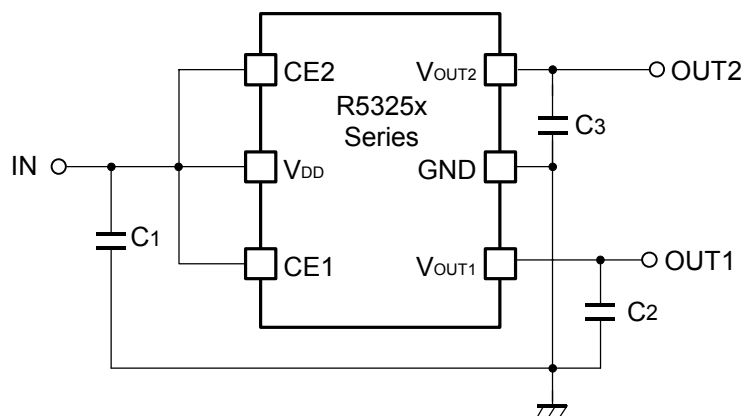
T<sub>opt</sub>=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V <sub>OUT</sub>	Output voltage	V <sub>IN</sub> =Set I <sub>OUT</sub> +1V 1mA ≤ I <sub>OUT</sub> ≤ 30mA	V <sub>OUT</sub> ≥ 1.5V ×0.99		×1.01	V
			V <sub>OUT</sub> < 1.5V -15mV		+15mV	
I <sub>OUT</sub>	Output Current	V <sub>IN</sub> -V <sub>OUT</sub> =1.0V	150			mA
ΔV <sub>OUT</sub> /ΔI <sub>OUT</sub>	Load regulation	V <sub>IN</sub> =Set V <sub>OUT</sub> +1V 1mA ≤ I <sub>OUT</sub> ≤ 150mA		30	80	mV
V <sub>DIF</sub>	Dropout Voltage	Refer to the Electrical Characteristics by Output Voltage				
I <sub>SS</sub>	Supply Current	V <sub>IN</sub> =Set V <sub>OUT</sub> +1V		3	7	μA
I <sub>standby</sub>	Supply Current (Standby)	V <sub>IN</sub> =Set V <sub>OUT</sub> +1V V <sub>CE</sub> =GND		0.1	1.0	μA
ΔV <sub>OUT</sub> /ΔV <sub>IN</sub>	Line regulation	Set V <sub>OUT</sub> +0.5V ≤ V <sub>IN</sub> ≤ 6.0V I <sub>OUT</sub> =30mA		0.1	0.3	%/V
RR	Ripple Rejection	f=1kHz Ripple 0.5Vp-p V <sub>IN</sub> -V <sub>OUT</sub> =1.0V, I <sub>OUT</sub> =30mA (In case that V <sub>OUT</sub> ≤ 1.7V, V <sub>IN</sub> =Set V <sub>OUT</sub> +1.2V)		55		dB
V <sub>IN</sub>	Input Voltage		1.5		6.0	V
ΔV <sub>OUT</sub> /ΔT <sub>opt</sub>	Output Voltage Temperature Coefficient	I <sub>OUT</sub> =30mA -40°C ≤ T <sub>opt</sub> ≤ 85°C		±100		ppm/°C
I <sub>LIM</sub>	Short Current Limit	V <sub>OUT</sub> =0V		50		mA
I <sub>PD</sub>	CE Pull-down Constant Current		0.15	0.30	0.55	μA
V <sub>CEH</sub>	CE Input Voltage "H"		1.0		6.0	V
V <sub>CEL</sub>	CE Input Voltage "L"		0.0		0.4	V
en	Output Noise	BW=10Hz to 100kHz		30		μVrms
R <sub>LOW</sub>	Low Output Nch Tr. ON Resistance (of B version)	V <sub>CE</sub> =0V		50		Ω

**R5325x**

- **Electrical Characteristics by Output Voltage**

Output Voltage $V_{OUT}$ (V)	Dropout Voltage $V_{DIF}$ (V)		
	Condition	Typ.	Max.
$1.2V \leq V_{OUT} < 1.3V$	$I_{OUT} = 150mA$	0.55	0.85
$1.3V \leq V_{OUT} < 1.4V$		0.48	0.74
$1.4V \leq V_{OUT} < 1.5V$		0.43	0.68
$1.5V \leq V_{OUT} < 2.0V$		0.40	0.59
$2.0V \leq V_{OUT} < 2.8V$		0.27	0.39
$2.8V \leq V_{OUT} < 4.0V$		0.21	0.28
$V_{OUT}=4.0V$		0.17	0.23

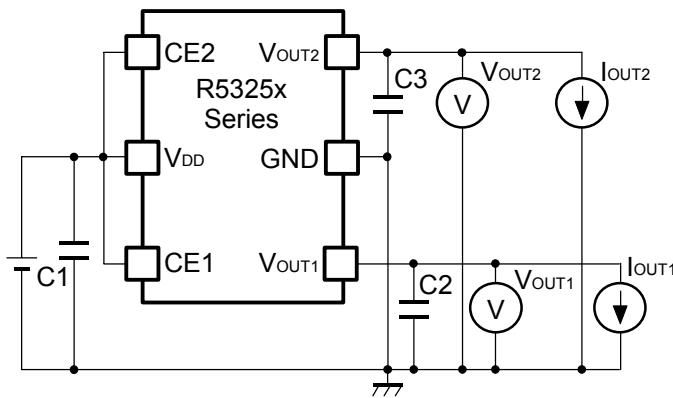
**TYPICAL APPLIATION**

(External Components)

Output Capacitor; Ceramic Type  $C_1, C_2, C_3$ 

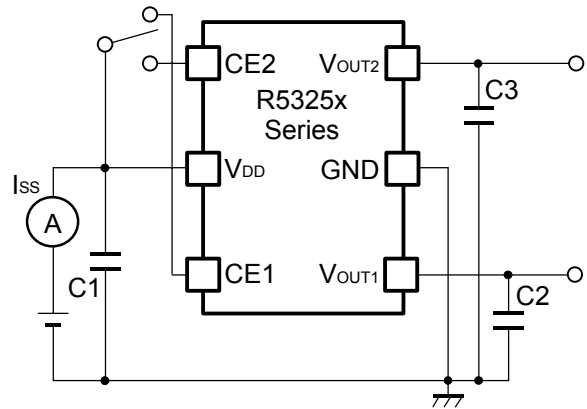
0.1 $\mu$ F	Kyocera	CM05B104K06AB
	Murata	GRM155B31C104KA87B
1.0 $\mu$ F	Kyocera	CM05X5R105K06AB
	TDK	C1005JB0J105K
	Murata	GRM155B30J105KE18B

## TEST CIRCUIT



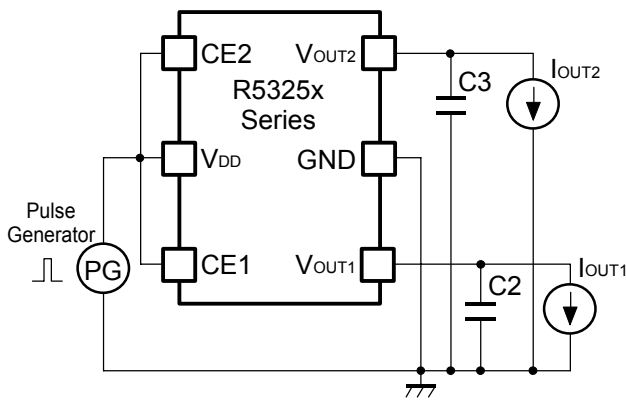
\* C1= C2= C3=Ceramic 0.1 $\mu$ F

**Fig.1 Standard test Circuit**



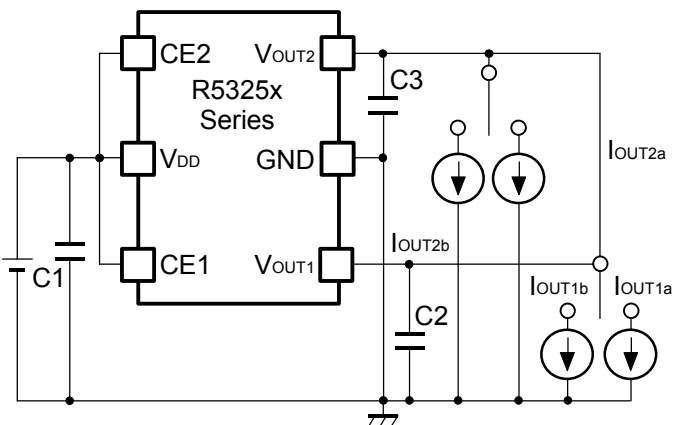
\* C1= C2= C3=Ceramic 0.1 $\mu$ F

**Fig.2 Supply Current Test Circuit**



\* C2= C3=Ceramic 0.1 $\mu$ F

**Fig.3 Ripple Rejection, Line Transient Response Test Circuit**



\* C1= C2= C3=Ceramic 0.1 $\mu$ F

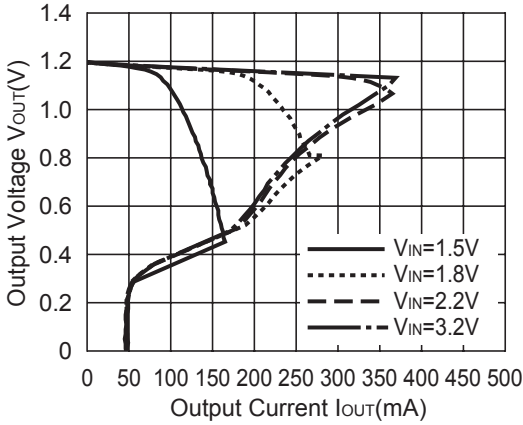
**Fig.4 Load Transient Response Test Circuit**

R5325x

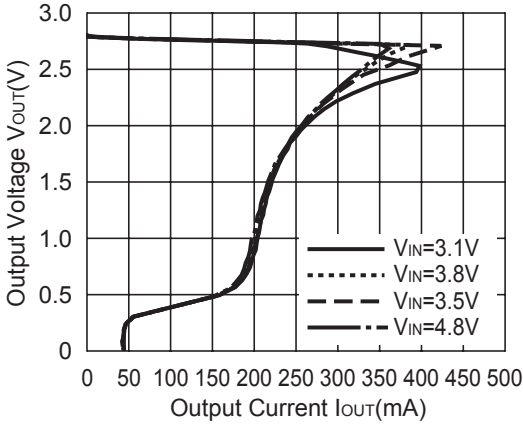
# TYPICAL CHARACTERISTICS

## 1) Output Voltage vs. Output Current (T<sub>opt</sub>=25°C)

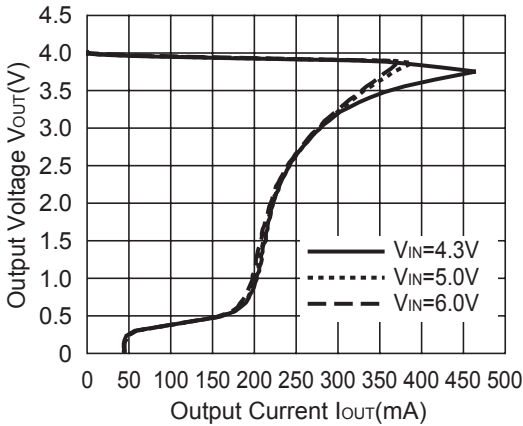
1.2V (VR1/VR2)



2.8V (VR1/VR2)

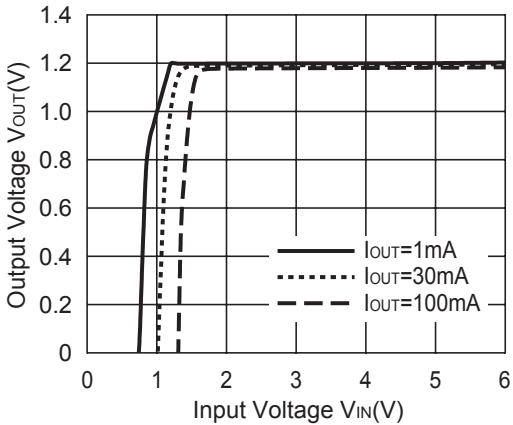


4.0V (VR1/VR2)

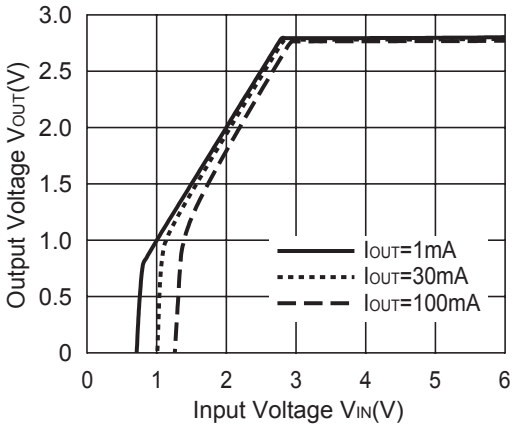


## 2) Output Voltage vs. Input Voltage (T<sub>opt</sub>=25°C)

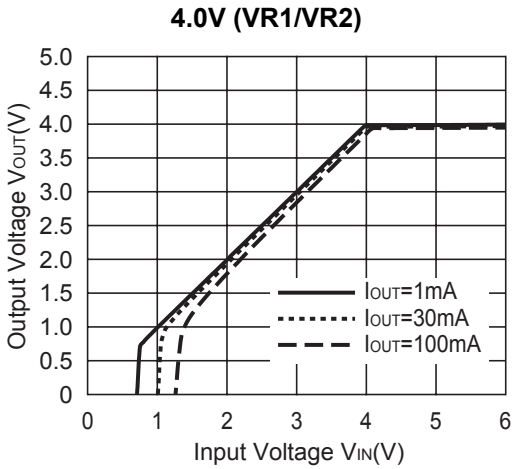
1.2V (VR1/VR2)



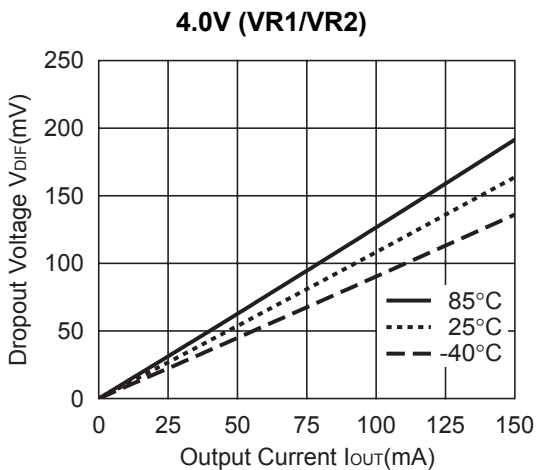
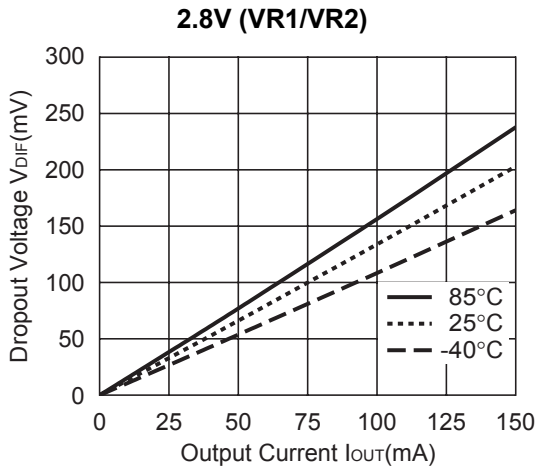
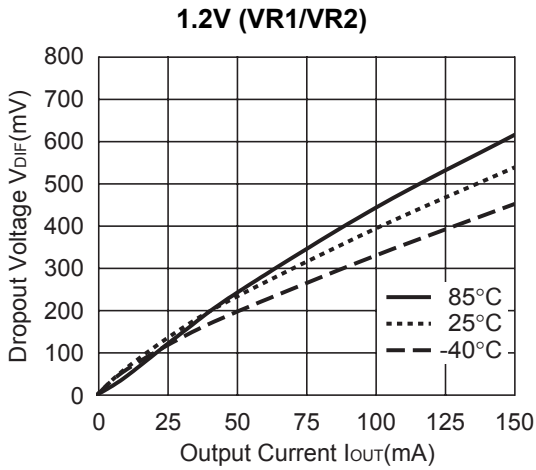
2.8V (VR1/VR2)







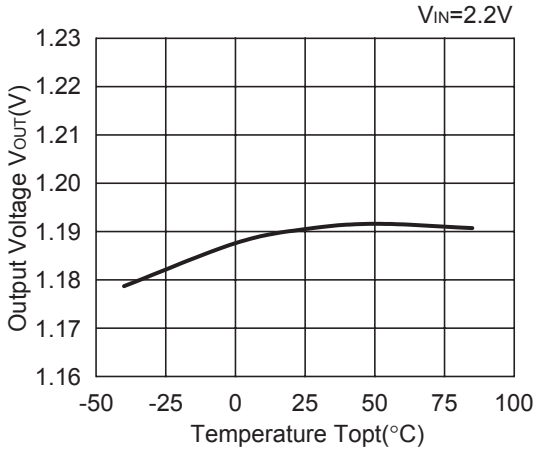
**3) Dropout Voltage vs. Output Current**



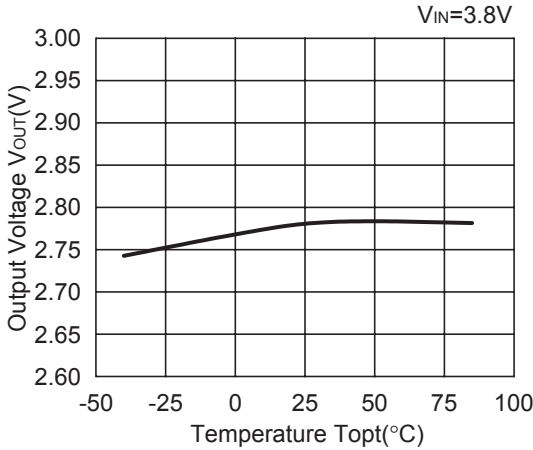
**R5325x**

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

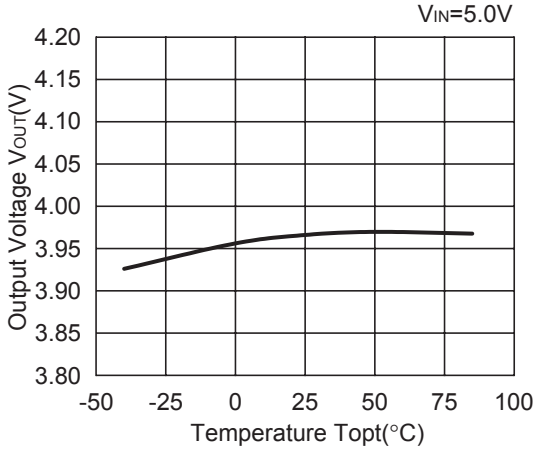
**1.2V (VR1/VR2)**



**2.8V (VR1/VR2)**

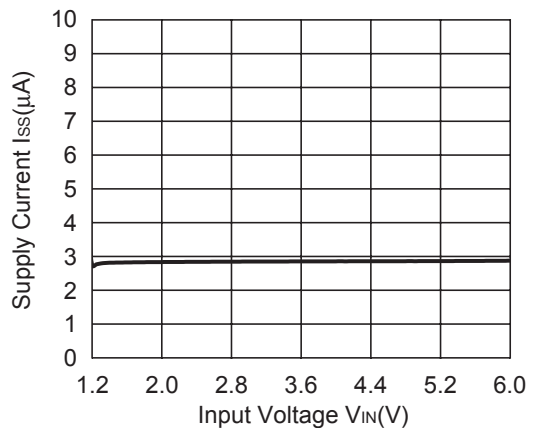


**4.0V (VR1/VR2)**

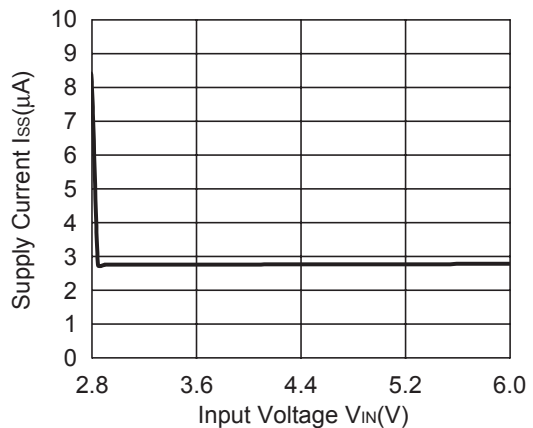


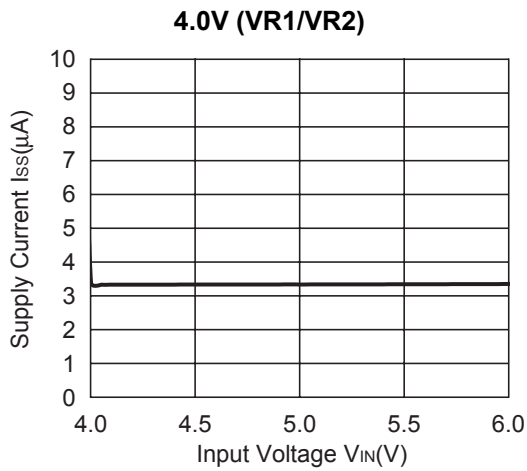
**5) Supply Current vs. Input Voltage ( $T_{opt}=25^{\circ}C$ )**

**1.2V (VR1/VR2)**

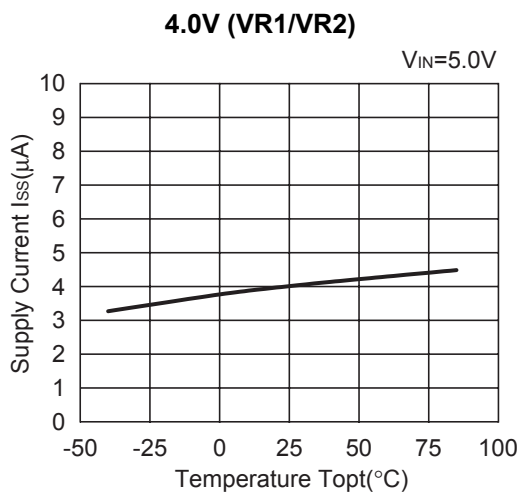
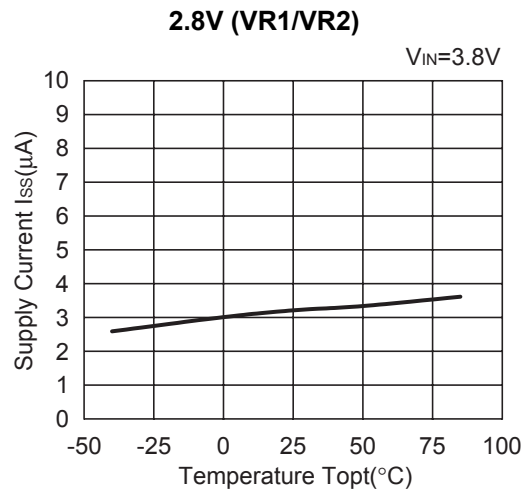
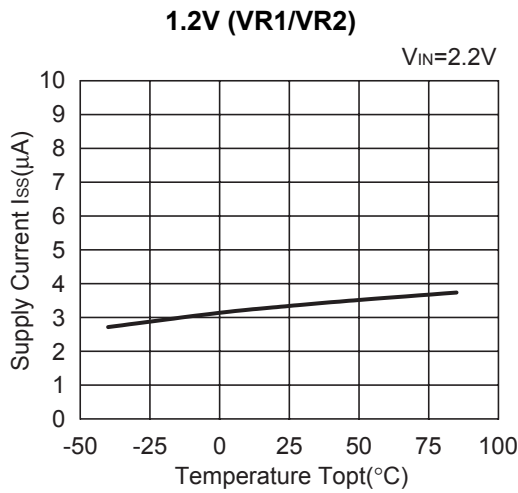


**2.8V (VR1/VR2)**





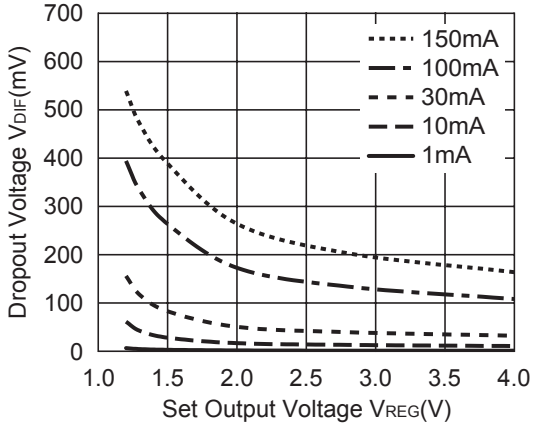
**6) Supply Current vs. Temperature**



**R5325x**

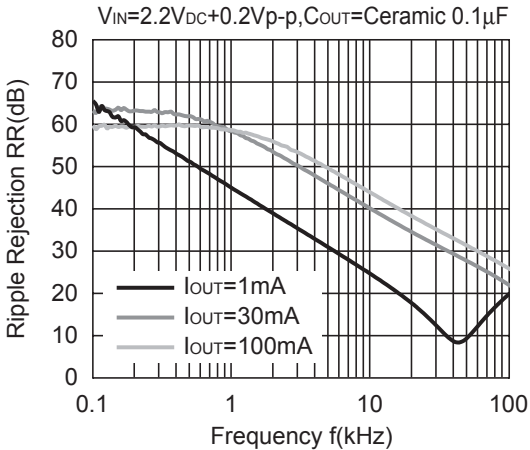
**7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)**

**VR1/VR2**

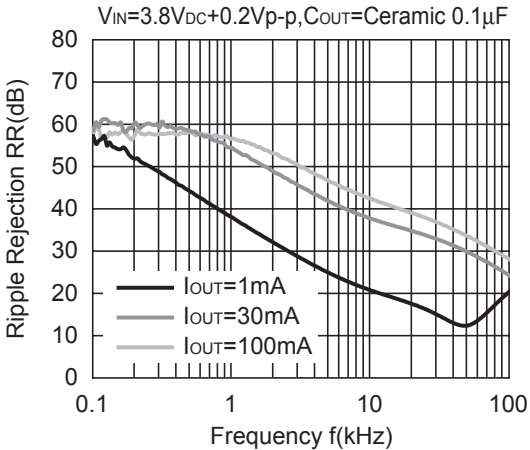


**8) Ripple Rejection vs. Frequency (Topt=25°C, COUT=0.1μF)**

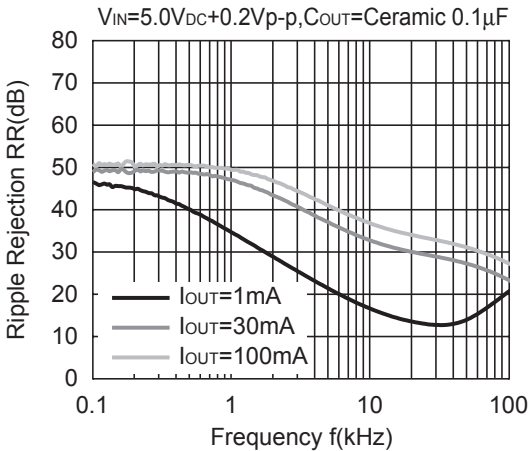
**1.2V (VR1/VR2)**



**2.8V (VR1/VR2)**

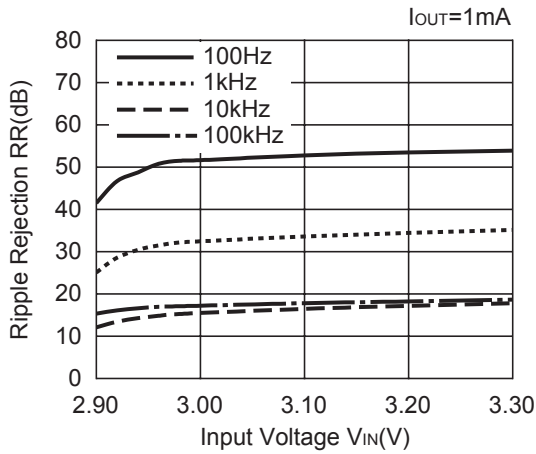


**4.0V (VR1/VR2)**

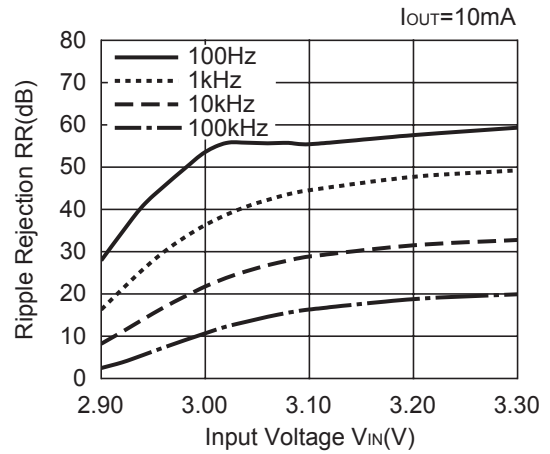


9) Ripple Rejection vs. Input Voltage (DC bias),  $T_{opt}=25^{\circ}C$ , Ripple 0.2Vp-p

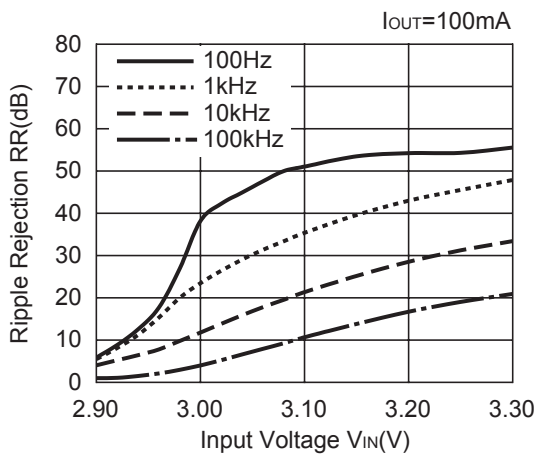
2.8V (VR1/VR2)



2.8V (VR1/VR2)

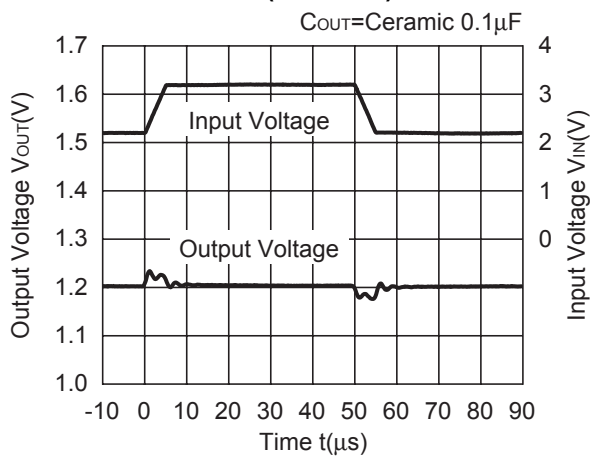


2.8V (VR1/VR2)

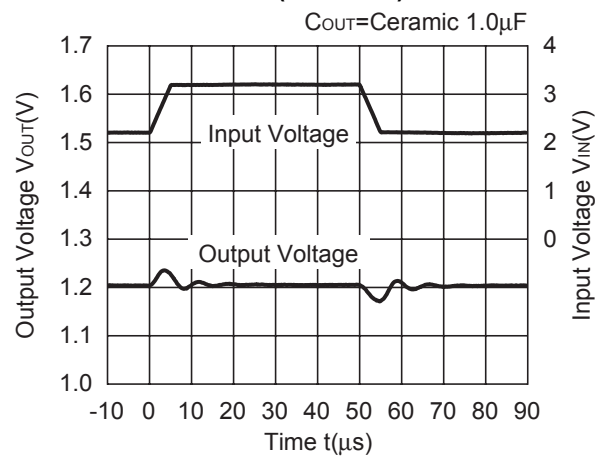


10) Input Transient Response( $C_{IN}=none$ ,  $T_r=T_f=5\mu s$ ,  $I_{out}=30mA$ )

1.2V (VR1/VR2)

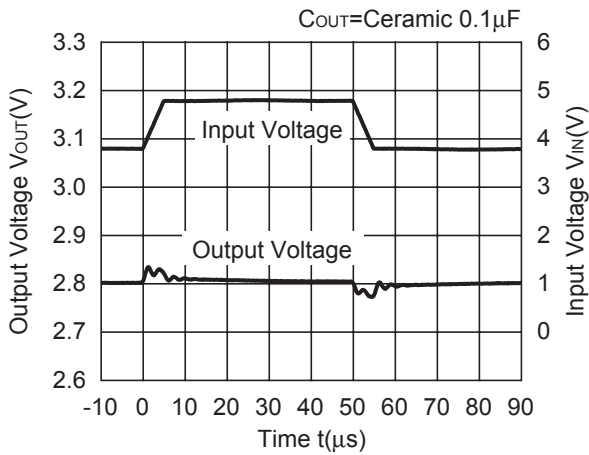


1.2V (VR1/VR2)

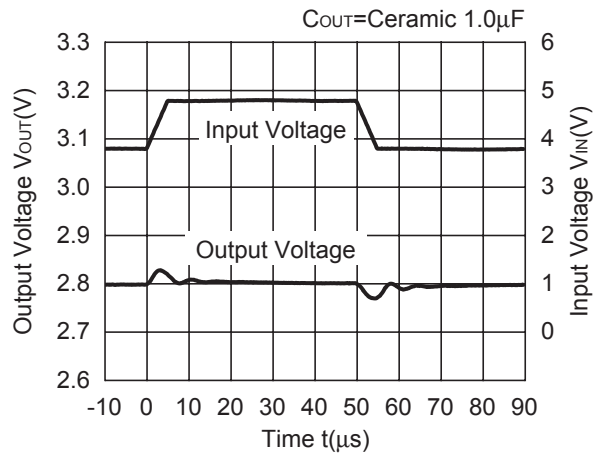


**R5325x**

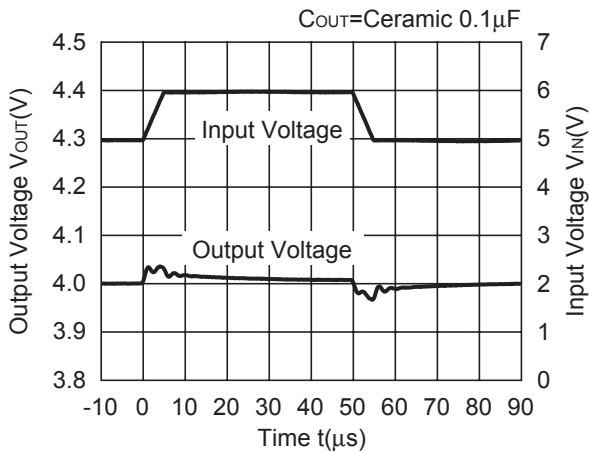
**2.8V (VR1/VR2)**



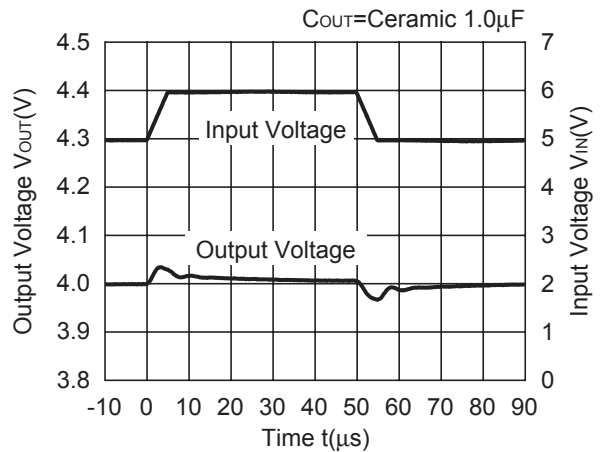
**2.8V (VR1/VR2)**



**4.0V (VR1/VR2)**

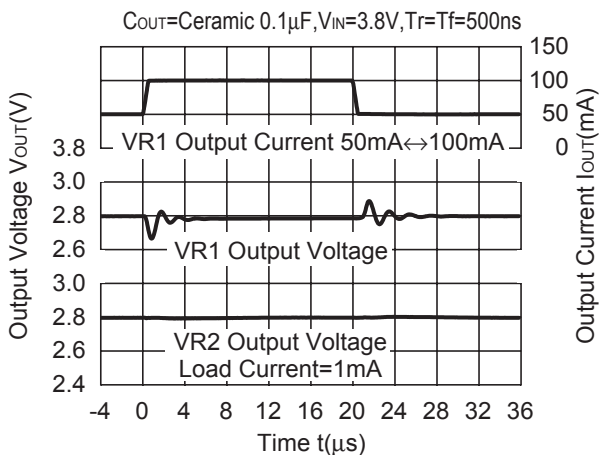


**4.0V (VR1/VR2)**

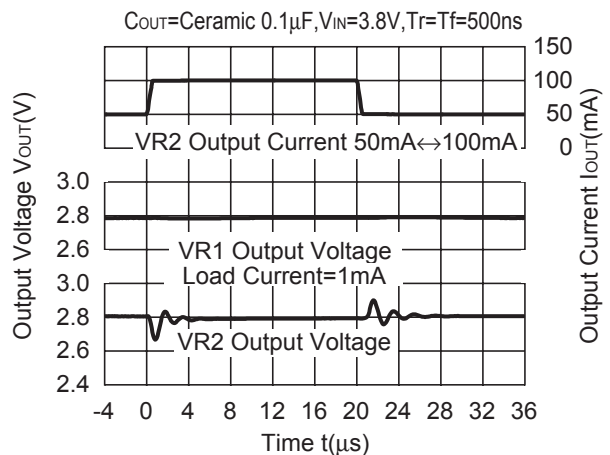


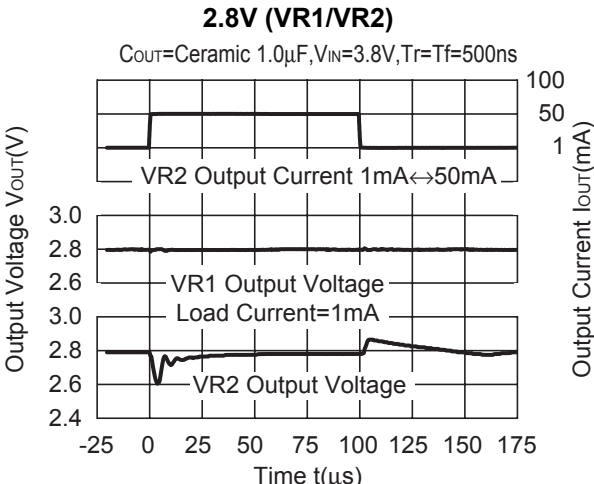
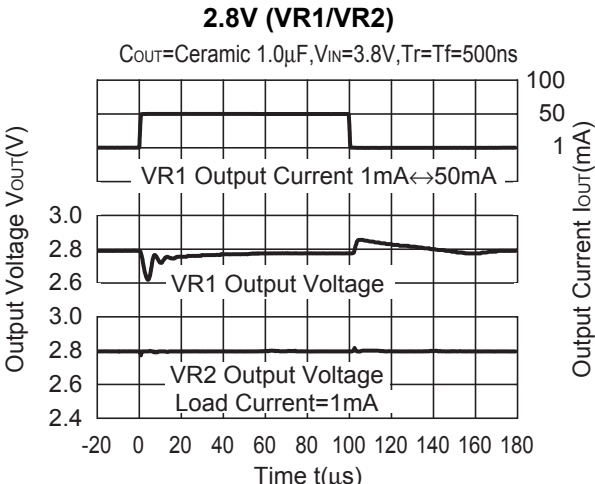
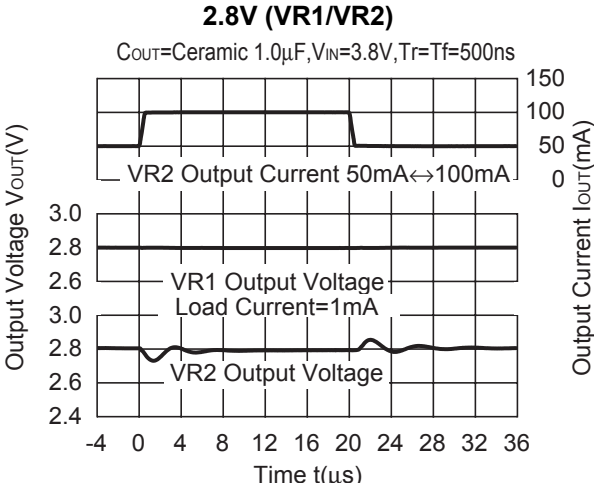
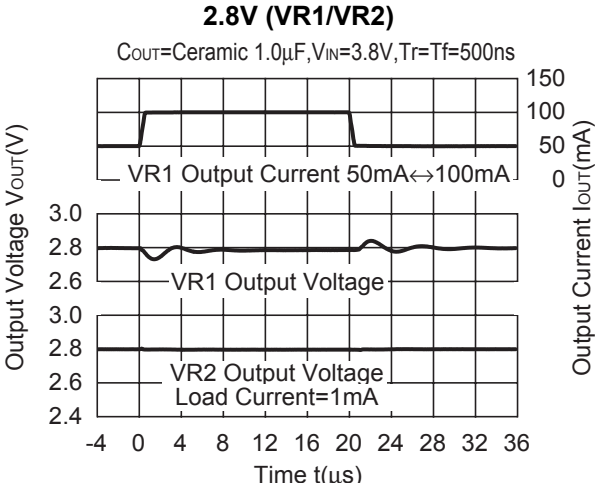
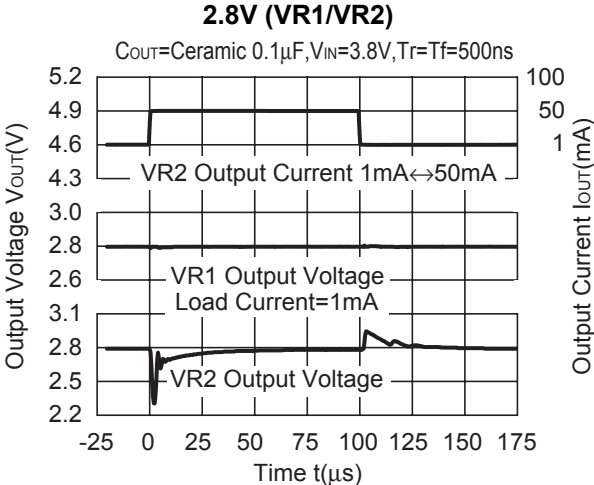
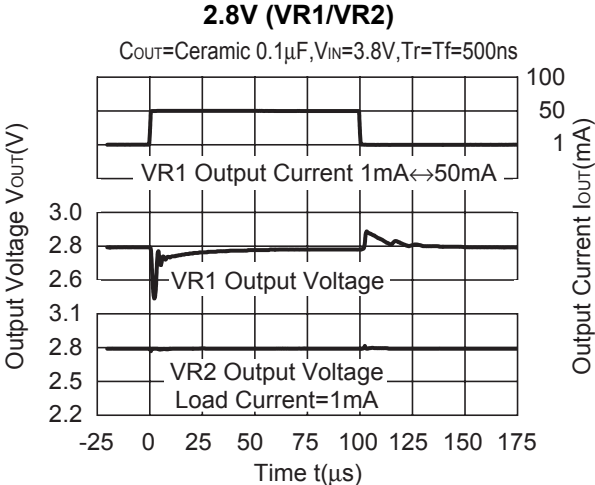
**11) Load Transient Response ( $C_{IN} = \text{Ceramic } 0.1\mu\text{F}$ )**

**2.8V (VR1/VR2)**

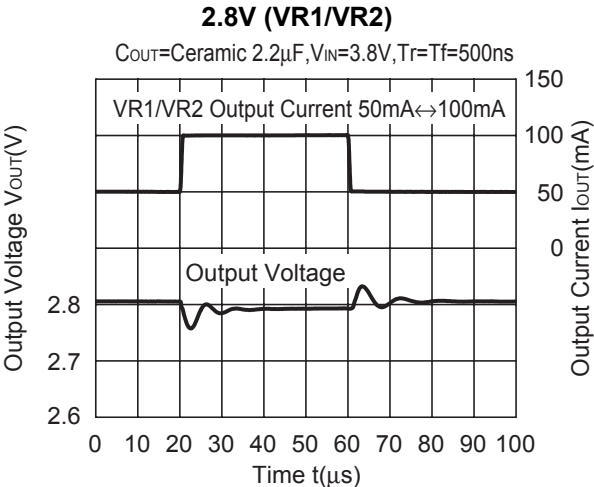


**2.8V (VR1/VR2)**

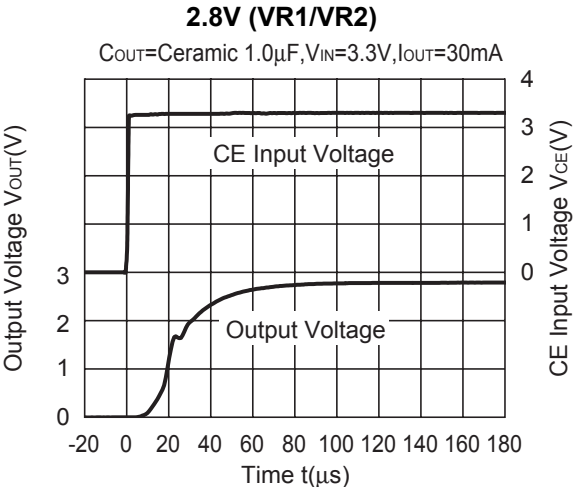
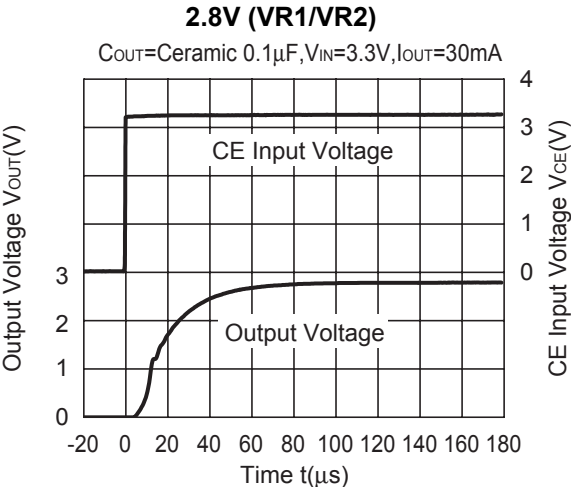
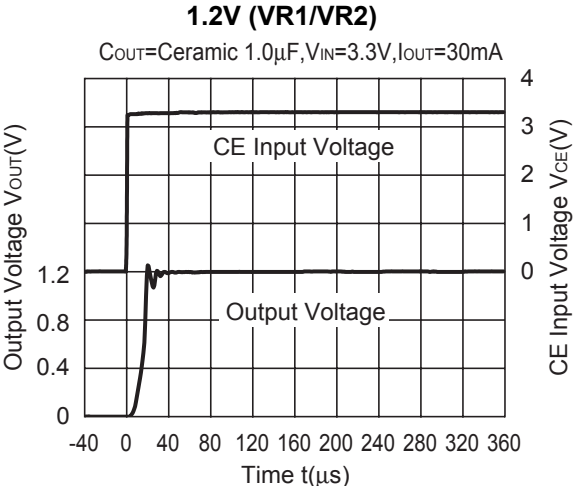
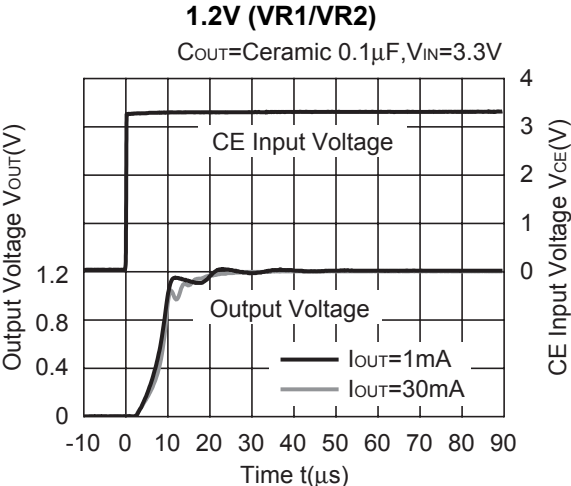




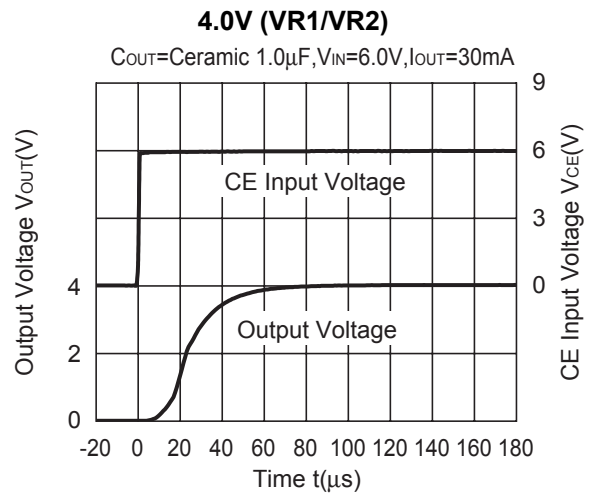
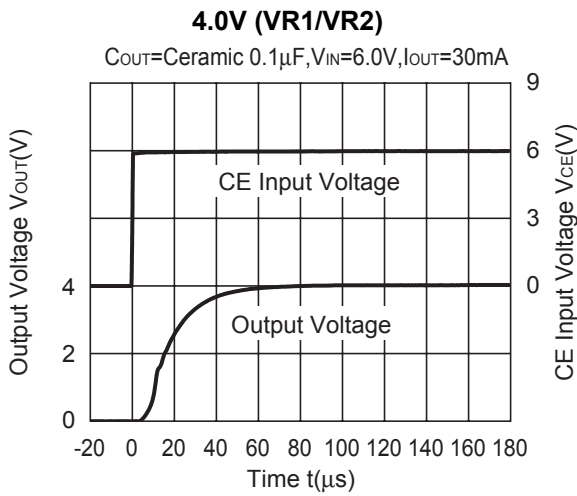
R5325x



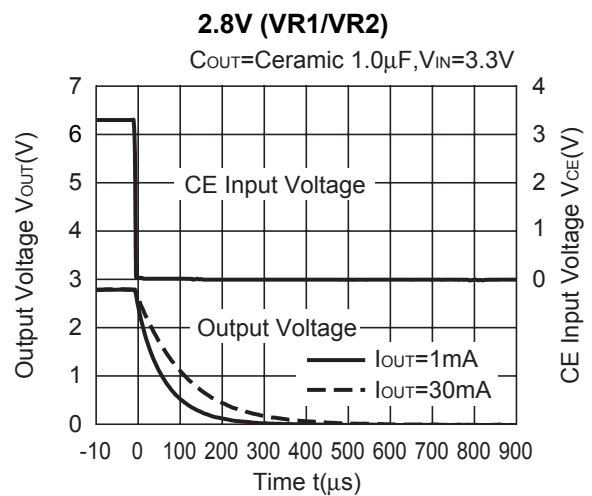
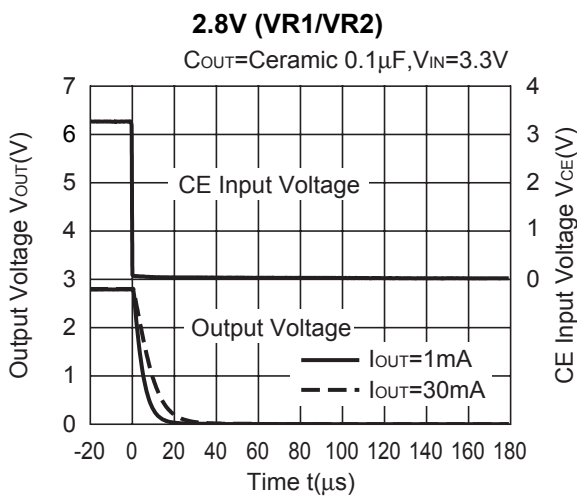
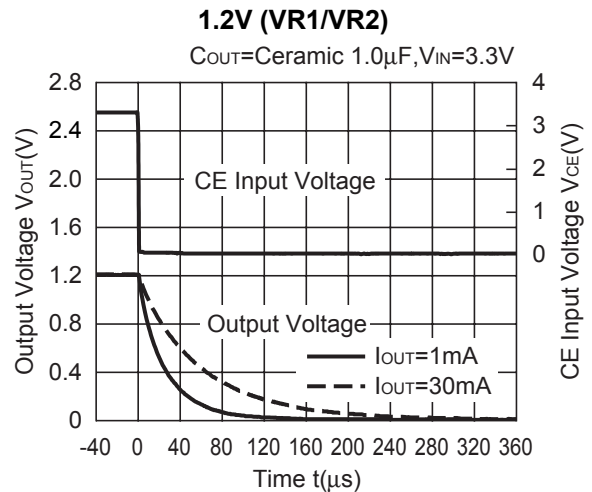
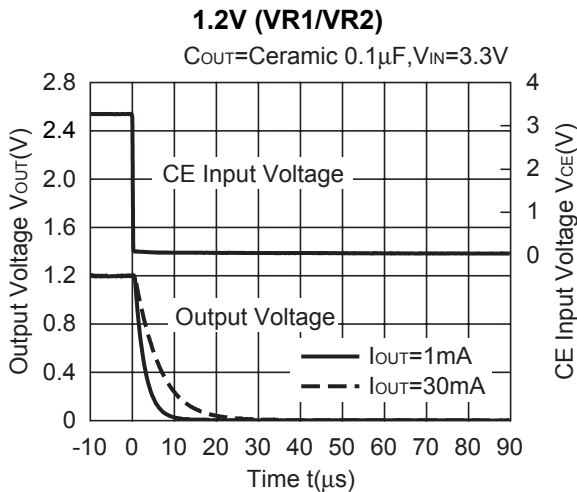
12) Turn on Speed by CE signal C<sub>IN</sub>=Ceramic 0.1μF



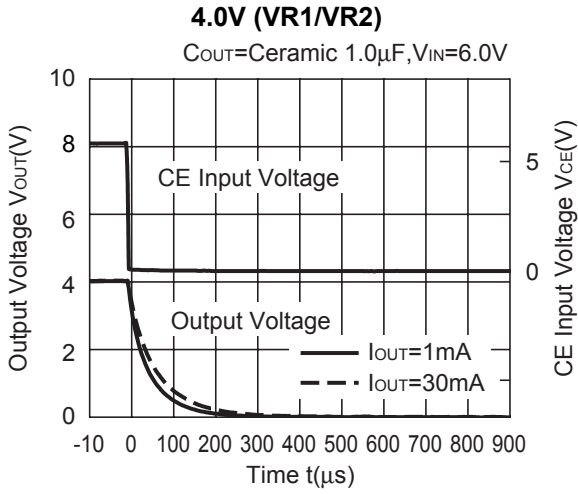
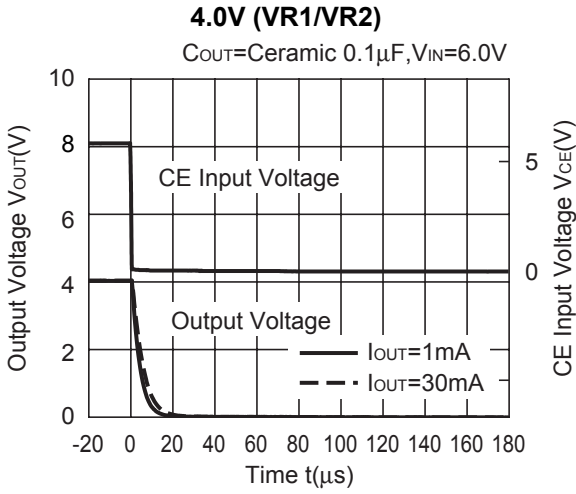




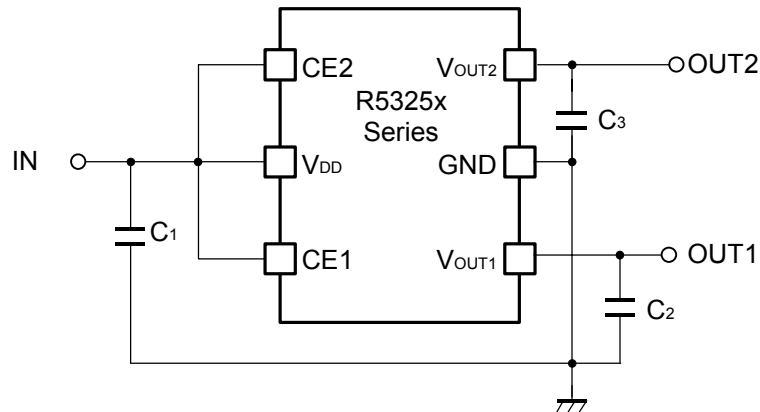
**13) Turn-off Speed with CE Signal  $C_{IN}$ =Ceramic 0.1 $\mu$ F(B version)**



R5325x



## TECHNICAL NOTES



(External Components)

Output Capacitor; Ceramic Type	C <sub>1</sub> , C <sub>2</sub> , C <sub>3</sub>	
0.1μF	Kyocera	CM05B104K06AB
	Murata	GRM155B31C104KA87B
1.0μF	Kyocera	CM05X5R105K06AB
	TDK	C1005JB0J105K
	Murata	GRM155B30J105KE18B

### 1. Mounting on PCB

Make V<sub>DD</sub> 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 1.0μF or more as C<sub>1</sub> between V<sub>DD</sub> 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 C<sub>2</sub> 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.

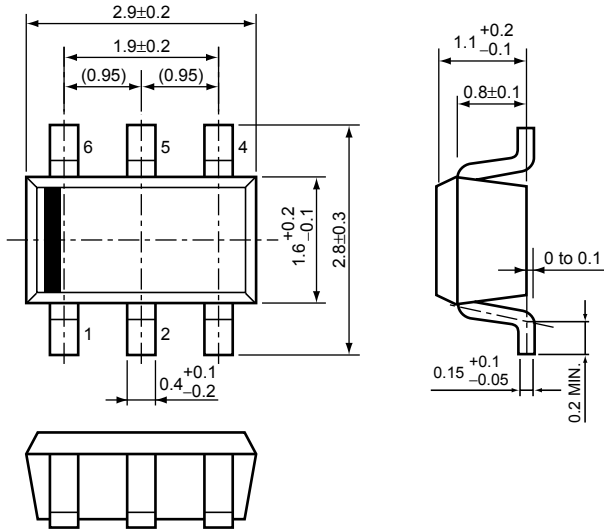
PACKAGE INFORMATION

PE-SOT-23-6-0510

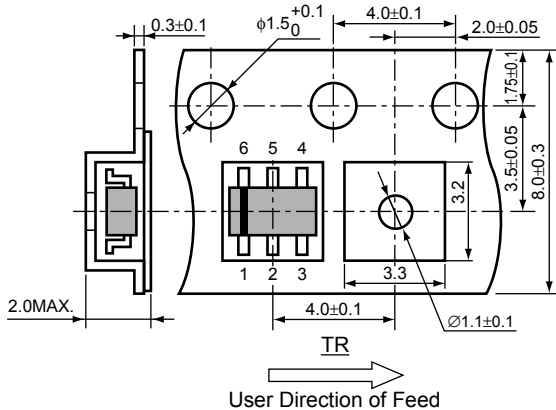
• SOT-23-6 (SC-74)

Unit: mm

PACKAGE DIMENSIONS

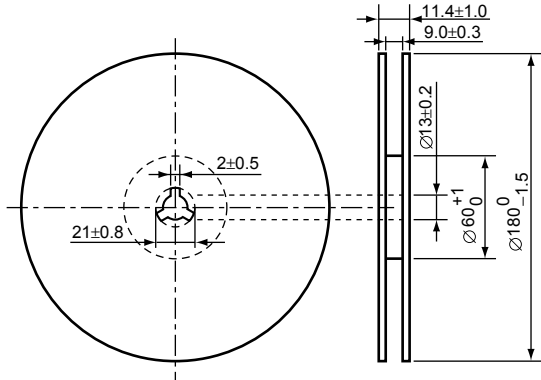


TAPING SPECIFICATION



TAPING REEL DIMENSIONS

(1reel=3000pcs)



**PACKAGE INFORMATION****PE-SOT-23-6-0510****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:

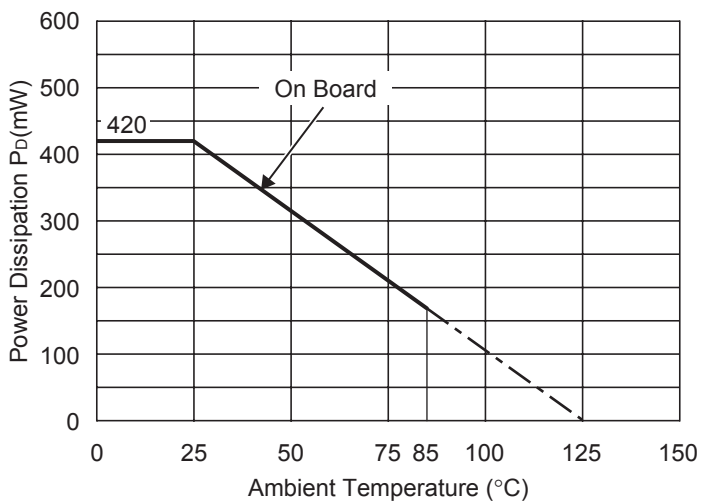
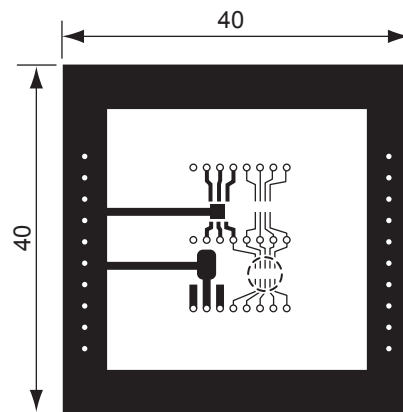
## Measurement Conditions

	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

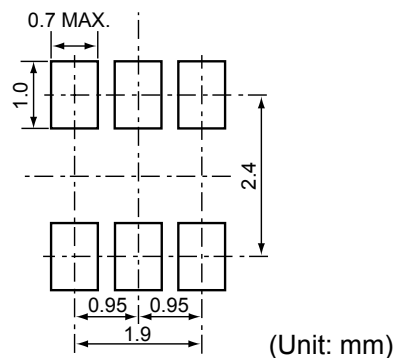
## Measurement Result

(T<sub>opt</sub>=25°C, T<sub>jmax</sub>=125°C)

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

**Power Dissipation****Measurement Board Pattern**

○ IC Mount Area Unit : mm

**RECOMMENDED LAND PATTERN****RICOH**

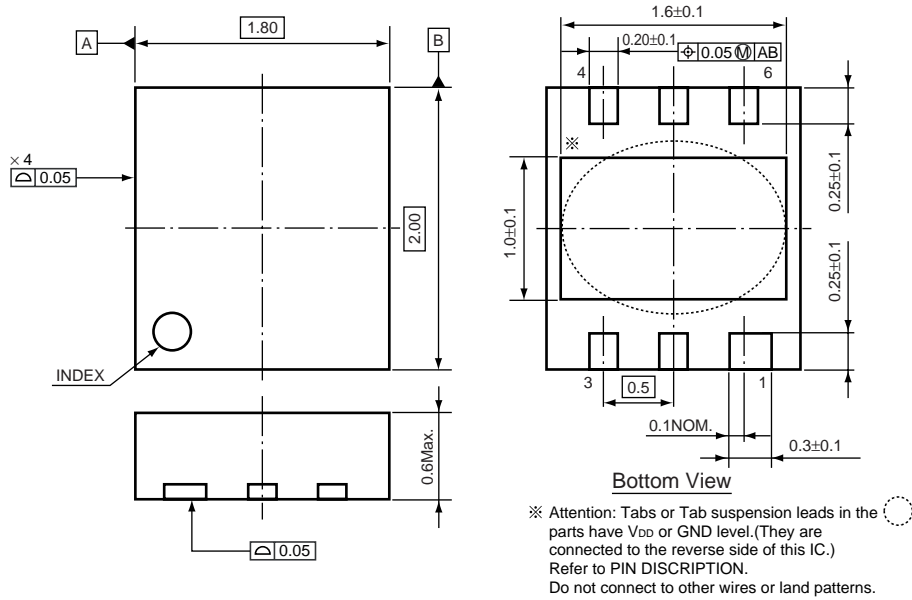
**PACKAGE INFORMATION**

**PE-PLP1820-6-0611**

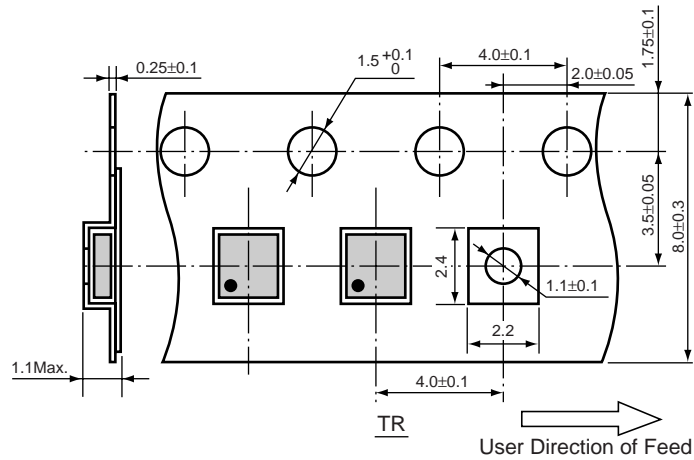
• PLP1820-6

Unit: mm

**PACKAGE DIMENSIONS**

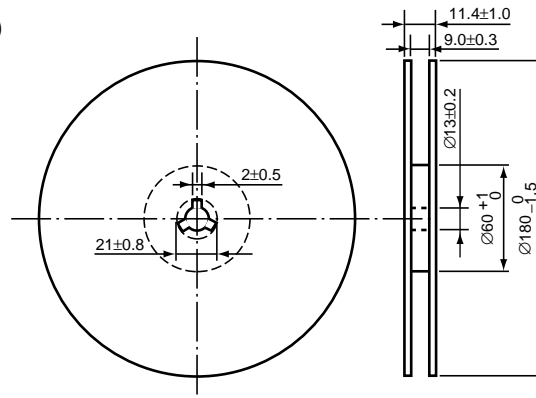


**TAPING SPECIFICATION**



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

(1reel=5000pcs)  
 (R5323K,R5325K : 1reel=3000pcs)



**PACKAGE INFORMATION****PE-PLP1820-6-0611****POWER DISSIPATION (PLP1820-6)**

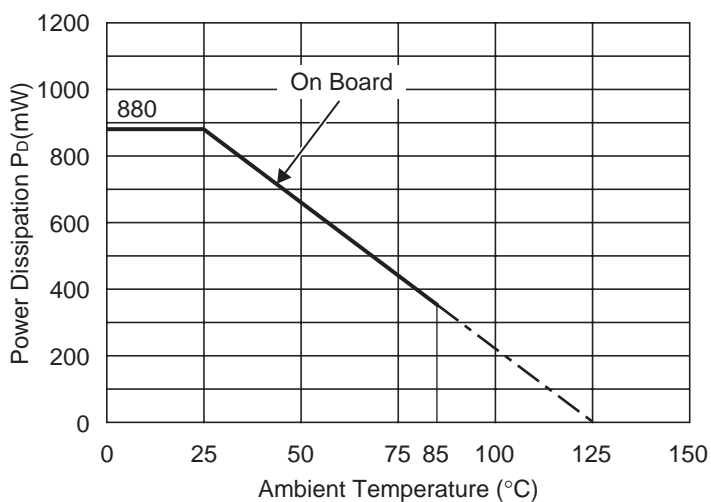
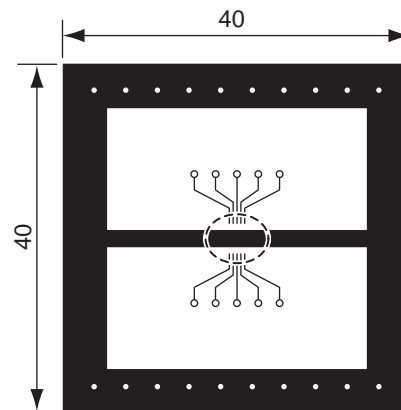
This specification is at mounted on board. Power Dissipation ( $P_D$ ) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

**Measurement Conditions**

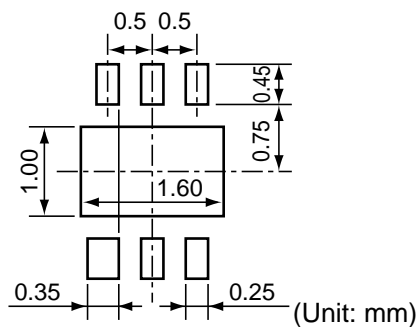
	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plactic (Double sided)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side : Approx. 50% , Back side : Approx. 50%
Through-hole	φ0.54mm × 30pcs

**Measurement Result**(T<sub>opt</sub>=25°C, T<sub>jmax</sub>=125°C)

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

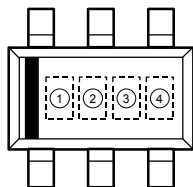
**Power Dissipation****Measurement Board Pattern**

○ IC Mount Area Unit : mm

**RECOMMENDED LAND PATTERN****RICOH**

## R5325N SERIES MARK SPECIFICATION

### • SOT-23-6 (SC-74)



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

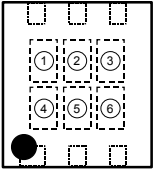
③, ④ : Lot Number

### • Part Number vs. Product Code

Part Number	Product Code	
	①	②
R5325N001B	W	1
R5325N002B	W	2
R5325N003B	W	3
R5325N004B	W	4
R5325N005B	W	5
R5325N006B	W	6
R5325N007B	W	7
R5325N008B	W	8
R5325N009B	W	9
R5325N010B	W	A
R5325N011B	W	B
R5325N012B	W	C
R5325N013B	W	D
R5325N014B	W	G
R5325N015B	W	H
R5325N016B	W	E
R5325N017B	W	F
R5325N018B	W	J
R5325N019B	W	K
R5325N020B	W	L
R5325N021B	W	M
R5325N022B	W	N
R5325N023B	W	P
R5325N024B	W	Q
R5325N025B	W	R
R5325N026B	W	S
R5325N027B	W	T
R5325N028B	W	U
R5325N029B	W	V

Part Number	Product Code	
	①	②
R5325N001A	Y	1
R5325N002A	Y	2
R5325N003A	Y	3
R5325N004A	Y	4
R5325N005A	Y	5
R5325N006A	Y	6
R5325N007A	Y	7
R5325N008A	Y	8
R5325N009A	Y	9
R5325N010A	Y	A
R5325N011A	Y	B
R5325N012A	Y	C
R5325N013A	Y	D
R5325N014A	Y	G
R5325N015A	Y	H
R5325N016A	Y	E
R5325N017A	Y	F
R5325N018A	Y	J
R5325N019A	Y	K
R5325N020A	Y	L
R5325N021A	Y	M
R5325N022A	Y	N
R5325N023A	Y	P
R5325N024A	Y	Q
R5325N025A	Y	R
R5325N026A	Y	S
R5325N027A	Y	T
R5325N028A	Y	U
R5325N029A	Y	V



**MARK INFORMATION****ME-R5325K-0612****R5325K SERIES MARK SPECIFICATION**● **PLP1820-6**

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			
	①	②	③	④
R5325K001B	D	0	0	1
R5325K002B	D	0	0	2
R5325K003B	D	0	0	3
R5325K004B	D	0	0	4
R5325K005B	D	0	0	5
R5325K006B	D	0	0	6
R5325K007B	D	0	0	7
R5325K008B	D	0	0	8
R5325K009B	D	0	0	9
R5325K010B	D	0	1	0
R5325K011B	D	0	1	1
R5325K012B	D	0	1	2
R5325K013B	D	0	1	3
R5325K014B	D	0	1	4
R5325K015B	D	0	1	5
R5325K016B	D	0	1	6
R5325K017B	D	0	1	7
R5325K018B	D	0	1	8
R5325K019B	D	0	1	9
R5325K020B	D	0	2	0
R5325K021B	D	0	2	1
R5325K022B	D	0	2	2
R5325K023B	D	0	2	3
R5325K024B	D	0	2	4
R5325K025B	D	0	2	5
R5325K026B	D	0	2	6
R5325K027B	D	0	2	7
R5325K028B	D	0	2	8
R5325K029B	D	0	2	9

Part Number	Product Code			
	①	②	③	④
R5325K001A	R	0	0	1
R5325K002A	R	0	0	2
R5325K003A	R	0	0	3
R5325K004A	R	0	0	4
R5325K005A	R	0	0	5
R5325K006A	R	0	0	6
R5325K007A	R	0	0	7
R5325K008A	R	0	0	8
R5325K009A	R	0	0	9
R5325K010A	R	0	1	0
R5325K011A	R	0	1	1
R5325K012A	R	0	1	2
R5325K013A	R	0	1	3
R5325K014A	R	0	1	4
R5325K015A	R	0	1	5
R5325K016A	R	0	1	6
R5325K017A	R	0	1	7
R5325K018A	R	0	1	8
R5325K019A	R	0	1	9
R5325K020A	R	0	2	0
R5325K021A	R	0	2	1
R5325K022A	R	0	2	2
R5325K023A	R	0	2	3
R5325K024A	R	0	2	4
R5325K025A	R	0	2	5
R5325K026A	R	0	2	6
R5325K027A	R	0	2	7
R5325K028A	R	0	2	8
R5325K029A	R	0	2	9