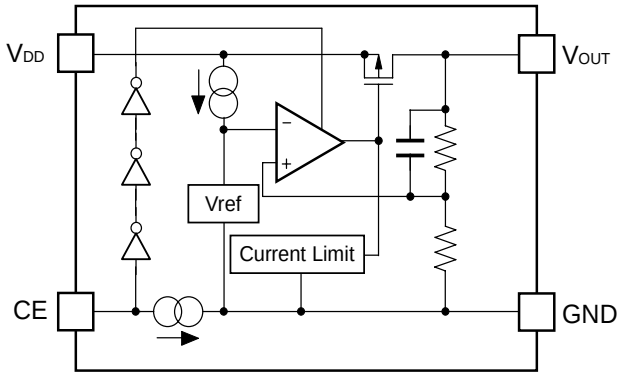
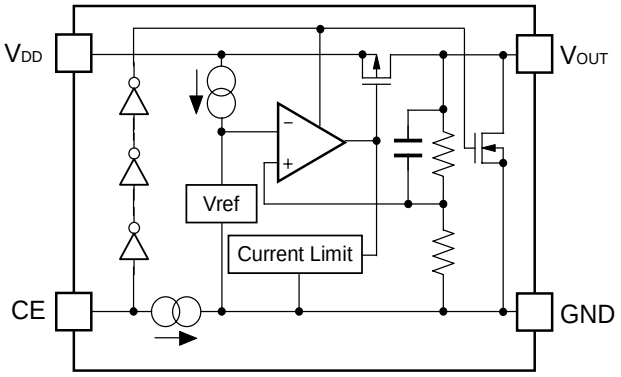
# BLOCK DIAGRAMS

**RP102xxx1B**




**RP102xxx1D**




# SELECTION GUIDE

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

| Product Name | Package | Quantity per Reel | Pb Free | Halogen Free |
|---|---|---|---|---|
| RP102Zxx1∗-TR-F | WLCSP-4-P2 | 5,000 pcs | Yes | Yes |
| RP102Kxx1∗-TR | DFN(PLP)1820-6 | 5,000 pcs | Yes | Yes |
| RP102Nxx1∗-TR-FE | SOT-23-5 | 3,000 pcs | Yes | Yes |

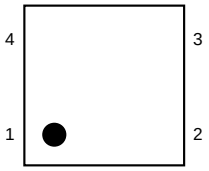
xx: The output voltage can be designated in the range from 1.2V(12) to 3.3V(33) in 0.1V steps.
(For other voltages, please refer to MARK INFORMATIONS.)

∗ : CE pin polarity and auto discharge function at off state are options as follows.
(B) "H" active, without auto discharge function at off state
(D) "H" active, with auto discharge function at off state

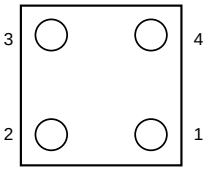
# PIN CONFIGURATIONS

● **WLCSP-4-P2**

**Mark Side**

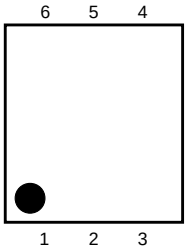



**Bump Side**

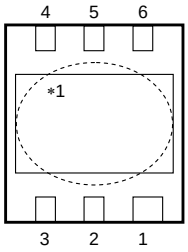



● **DFN(PLP)1820-6**

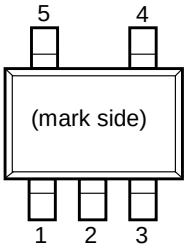
**Top View**




**Bottom View**




● **SOT-23-5**




# PIN DESCRIPTION

● **WLCSP-4-P2**

| Pin No | Symbol | Pin Description |
|---|---|---|
| 1 | $V_{DD}$ | Input Pin |
| 2 | CE | Chip Enable Pin ("H" Active) |
| 3 | GND | Ground Pin |
| 4 | $V_{OUT}$ | Output Pin |

● **DFN(PLP)1820-6**

| Pin No | Symbol | Pin Description |
|---|---|---|
| 1 | $V_{OUT}$ | Output Pin*2 |
| 2 | $V_{OUT}$ | Output Pin*2 |
| 3 | GND | Ground Pin |
| 4 | CE | Chip Enable Pin ("H" Active) |
| 5 | $V_{DD}$ | Input Pin*2 |
| 6 | $V_{DD}$ | Input Pin*2 |

∗1) Tab is GND level. (They are connected to the reverse side of this IC.)
The tab is better to be connected to the GND, but leaving it open is also acceptable.
∗2) No.1 pin and No.2 pin, No.5 pin and No.6 pin of DFN(PLP)1820-6 package must be wired when it is mounted on board.

● **SOT-23-5**

| Pin No | Symbol | Pin Description |
|---|---|---|
| 1 | $V_{DD}$ | Input Pin |
| 2 | GND | Ground Pin |
| 3 | CE | Chip Enable Pin ("H" Active) |
| 4 | NC | No Connection |
| 5 | $V_{OUT}$ | Output Pin |

# ABSOLUTE MAXIMUM RATINGS

| Symbol | Item | Rating | Unit |
|---|---|---|---|
| $V_{IN}$ | Input Voltage | 6.0 | V |
| $V_{CE}$ | Input Voltage (CE Pin) | 6.0 | V |
| $V_{OUT}$ | Output Voltage | –0.3 to $V_{IN}$+0.3 | V |
| $I_{OUT}$ | Output Current | 400 | mA |
| $P_D$ | Power Dissipation (WLCSP-4-P2) * | 530 | mW |
| | Power Dissipation (SOT-23-5) * | 420 | |
| | Power Dissipation (DFN(PLP)1820-6) * | 880 | |
| Topt | Operating Temperature Range | –40 to 85 | °C |
| Tstg | Storage Temperature Range | –55 to 125 | °C |

∗) For Power Dissipation, please refer to PACKAGE INFORMATION.

**ABSOLUTE MAXIMUM RATINGS**

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field.
The functional operation at or over these absolute maximum ratings is not assured.

**RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)**

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge.
And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

# ELECTRICAL CHARACTERISTICS

- **RP102xxx1B/D**

$V_{IN}$=Set $V_{OUT}$+1V for $V_{OUT}$ options grater than 1.5V. $V_{IN}$=2.5V for $V_{OUT} \leqq$ 1.5V.
$I_{OUT}$=1mA, $C_{IN}$=$C_{OUT}$=1μF, unless otherwise noted.

Topt=25°C

| Symbol | Item | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | $V_{IN}$=Set $V_{OUT}$+1V | $V_{OUT}$ > 2.0V | ×0.992 | | ×1.008 | V |
| | | | $V_{OUT} \leqq$ 2.0V | −16 | | +16 | mV |
| $I_{OUT}$ | Output Current | | | 300 | | | mA |
| $\Delta V_{OUT}/\Delta I_{OUT}$ | Load Regulation | 1mA ≦ $I_{OUT}$ ≦ 150mA | | | 10 | 20 | mV |
| | | 1mA ≦ $I_{OUT}$ ≦ 300mA | | | 20 | 40 | |
| $V_{DIF}$ | Dropout Voltage | Refer to the following table | | | | | |
| $I_{SS}$ | Supply Current | $I_{OUT}$=0mA | | | 50 | 70 | μA |
| Istandby | Supply Current (Standby) | $V_{CE}$=0V | | | 0.1 | 2.0 | μA |
| $\Delta V_{OUT}/\Delta V_{IN}$ | Line Regulation | Set $V_{OUT}$+0.5V ≦ $V_{IN}$ ≦ 5V | | | 0.02 | 0.10 | %/V |
| RR | Ripple Rejection | f=1kHz, Ripple 0.2Vp-p<br>$V_{IN}$=Set $V_{OUT}$+1V, $I_{OUT}$=30mA<br>(In case that $V_{OUT} \leqq$ 2V, $V_{IN}$=3V) | | | 80 | | dB |
| $V_{IN}$ | Input Voltage* | | | 1.7 | | 5.25 | V |
| $\Delta V_{OUT}/\Delta Topt$ | Output Voltage Temperature Coefficient | −40°C ≦ Topt ≦ 85°C | | | ±20 | | ppm /°C |
| $I_{SC}$ | Short Current Limit | $V_{OUT}$=0V | | | 50 | | mA |
| $I_{PD}$ | CE Pull-down Current | | | 0.05 | 0.3 | 0.6 | μA |
| $V_{CEH}$ | CE Input Voltage “H” | | | 1.1 | | | V |
| $V_{CEL}$ | CE Input Voltage “L” | | | | | 0.3 | V |
| en | Output Noise | BW=10Hz to 100kHz, $I_{OUT}$=30mA | | | 30 | | μVrms |
| $R_{LOW}$ | Low Output Nch Tr. ON Resistance (of D version) | $V_{IN}$=4V<br>$V_{CE}$=0V | | | 30 | | Ω |

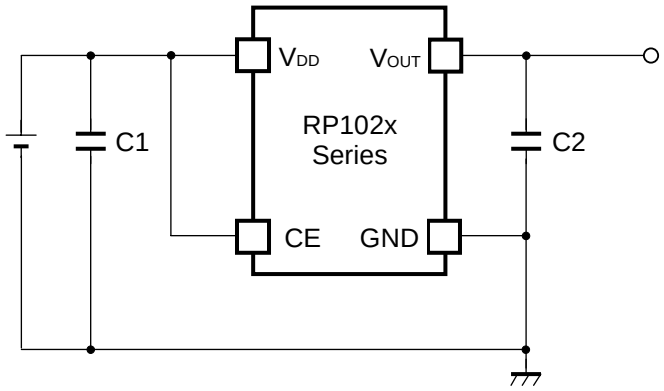
*) The maximum Input Voltage of the ELECTRICAL CHARACTERISTICS is 5.25V. In case of exceeding this specification, the IC must be operated on condition that the Input Voltage is up to 5.5V and the total operating time is within 500hrs.

- **Electrical Characteristics by Output Voltage**

Topt=25°C

| Output Voltage $V_{OUT}$ (V) | Dropout Voltage $V_{DIF}$ (V) | | | | | |
|---|---|---|---|---|---|---|
| | Condition | Typ. | Max. | Condition | Typ. | Max. |
| 1.2V ≦ $V_{OUT}$ < 1.5V | $I_{OUT}$=150mA | 0.145 | - | $I_{OUT}$=300mA | 0.290 | 0.500 |
| 1.5V ≦ $V_{OUT}$ < 1.7V | | 0.110 | 0.160 | | 0.220 | 0.320 |
| 1.7V ≦ $V_{OUT}$ < 2.0V | | 0.100 | 0.140 | | 0.200 | 0.280 |
| 2.0V ≦ $V_{OUT}$ < 2.5V | | 0.085 | 0.120 | | 0.170 | 0.240 |
| 2.5V ≦ $V_{OUT}$ < 2.8V | | 0.070 | 0.100 | | 0.140 | 0.200 |
| 2.8V ≦ $V_{OUT}$ ≦ 3.3V | | 0.060 | 0.095 | | 0.120 | 0.190 |

# TYPICAL APPLICATION




(External Components)
C2 1.0μF MURATA: GRM155B31A105KE15

# TECHNICAL NOTES

When using these ICs, consider the following points:

**Phase Compensation**

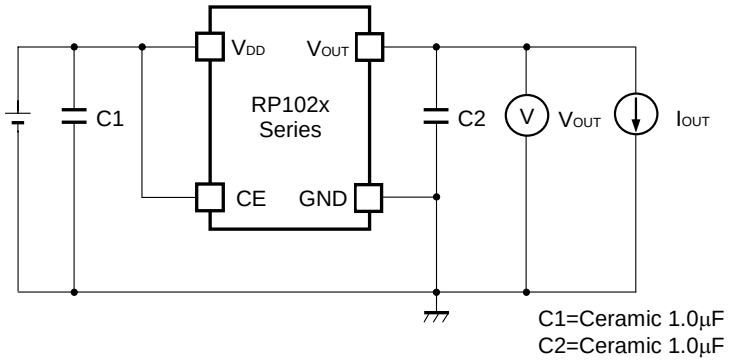
In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C2 with good frequency characteristics and ESR (Equivalent Series Resistance). (Note: If additional ceramic capacitors are connected with parallel to the output 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.)

**PCB Layout**

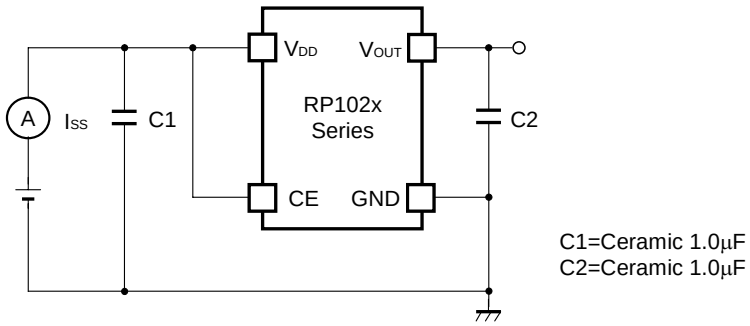
Make $V_{DD}$ and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with a capacitance value as much as 1.0μF or more between $V_{DD}$ and GND pin, and as close as possible to the pins.

Set external components, especially the output capacitor C2, as close as possible to the ICs, and make wiring as short as possible.

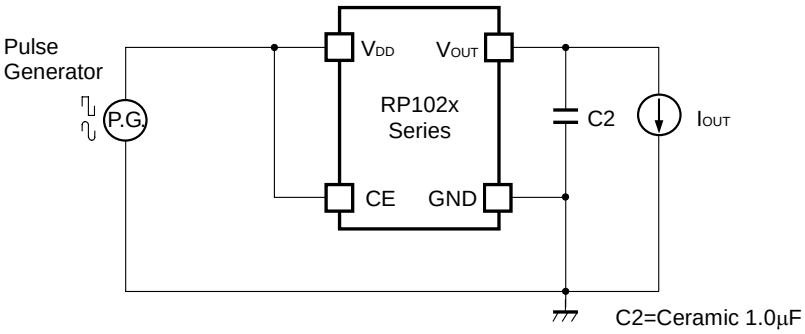
# TEST CIRCUITS



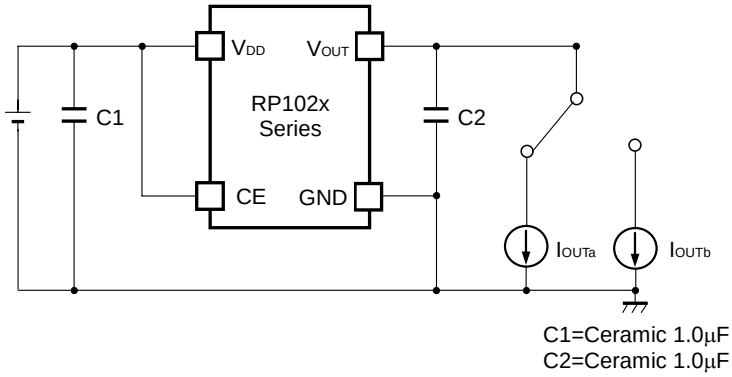

**Basic Test Circuit**




**Test Circuit for Supply Current**




**Test Circuit for Ripple Rejection**

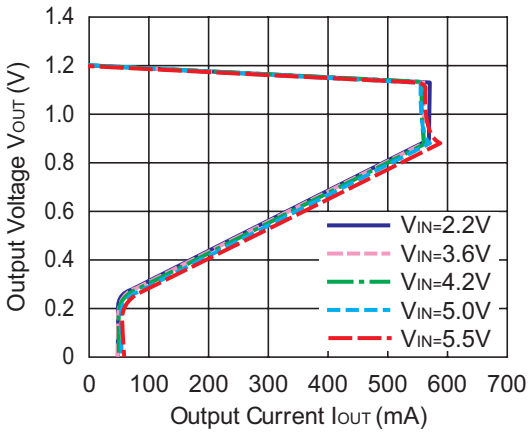



**Test Circuit for Load Transient Response**

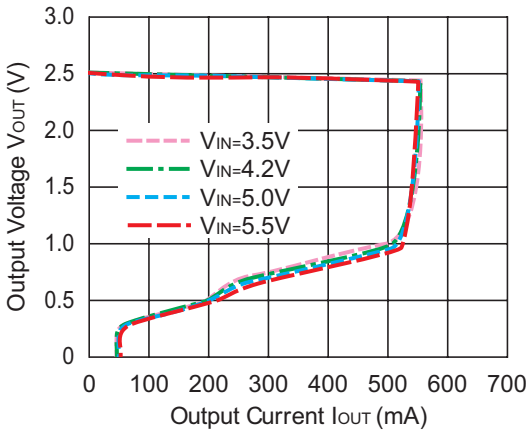
# TYPICAL CHARACTERISTIC

## 1) Output Voltage vs. Output Current ($C_{IN}$=1.0µF, $C_{OUT}$=1.0µF, Topt=25°C)

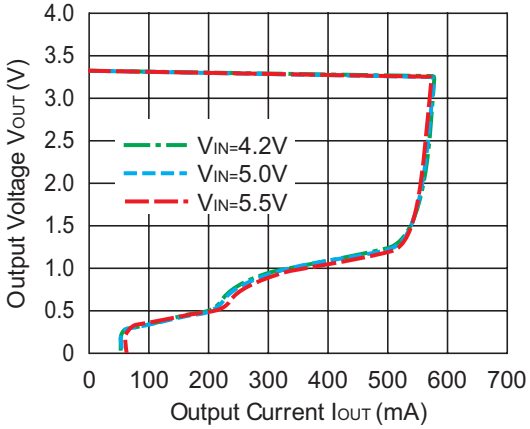
**RP102x121x**




**RP102x251x**

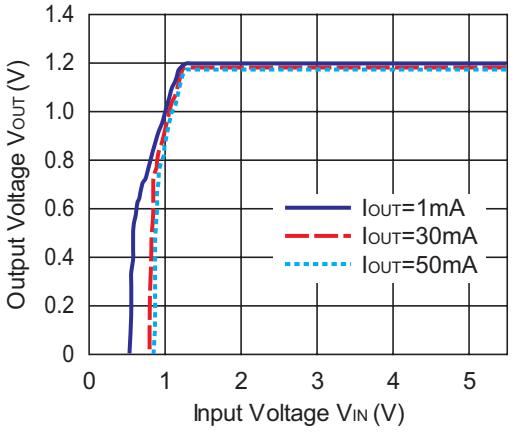



**RP102x331x**

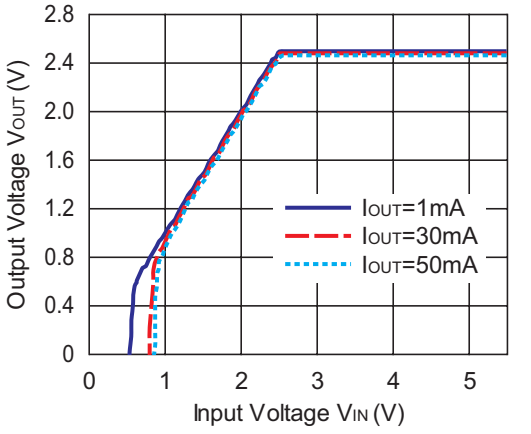



## 2) Output Voltage vs. Input Voltage ($C_{IN}$=1.0µF, $C_{OUT}$=1.0µF, Topt=25°C)

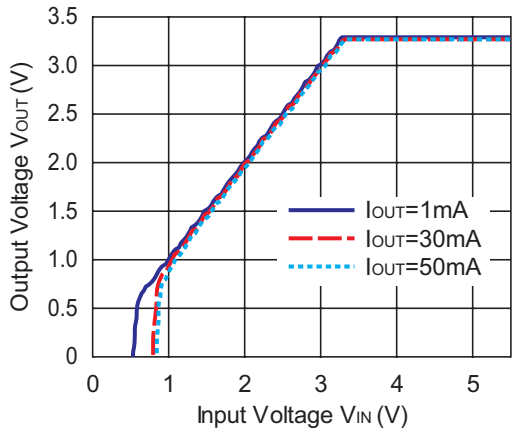
**RP102x121x**




**RP102x251x**

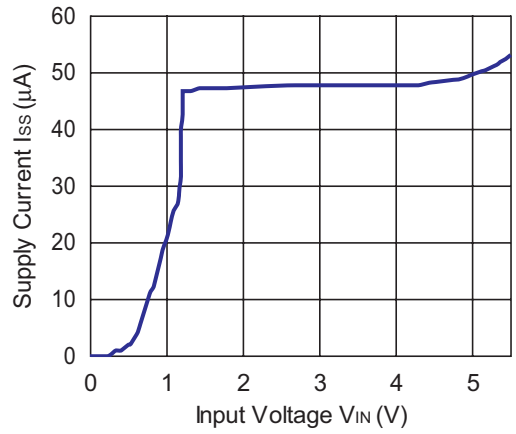


**RP102x331x**

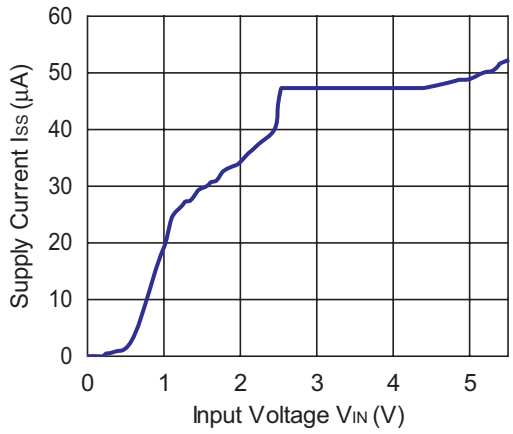



### 3) Supply Current vs. Input Voltage ($C_{IN}$=1.0µF, $C_{OUT}$=1.0µF, Topt=25°C)

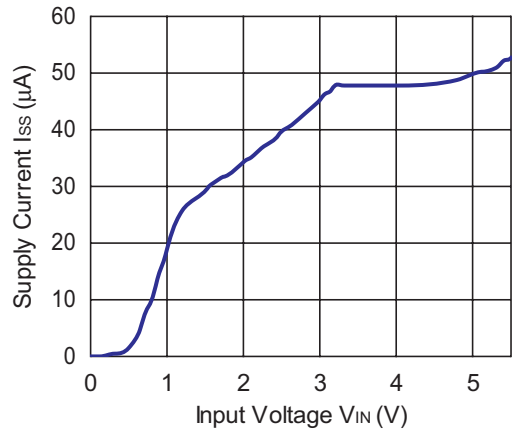
**RP102x121x**




**RP102x251x**

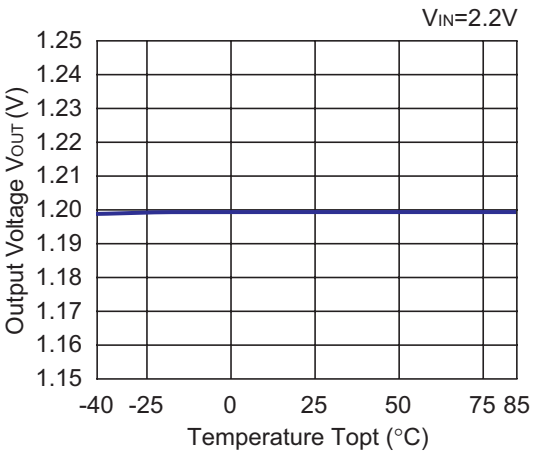



**RP102x331x**

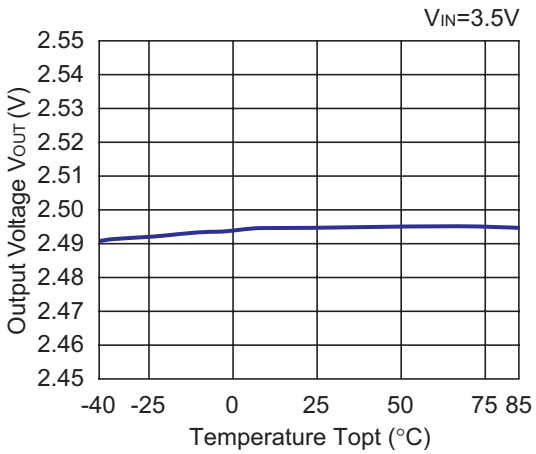


### 4) Output Voltage vs. Temperature ($C_{IN}$=1.0µF, $C_{OUT}$=1.0µF, $I_{OUT}$=1mA)

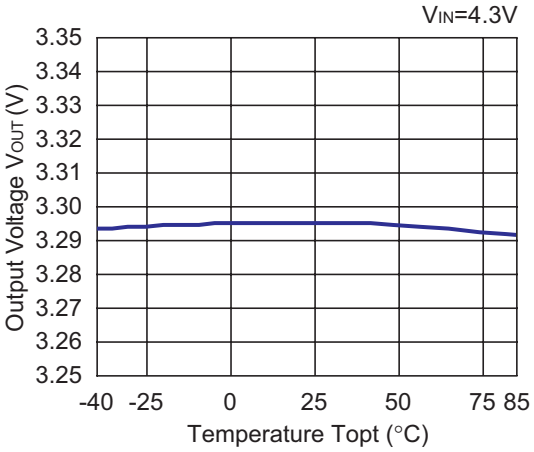
**RP102x121x**




**RP102x251x**

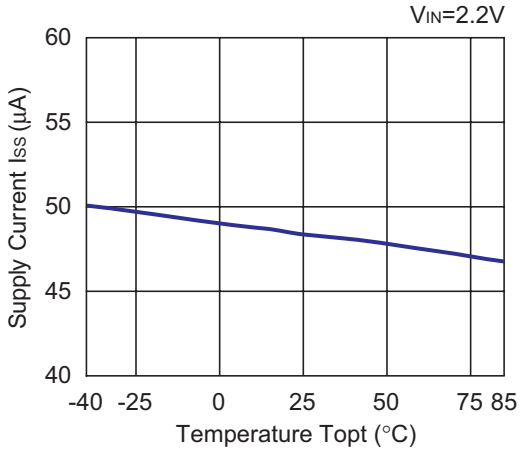



**RP102x331x**

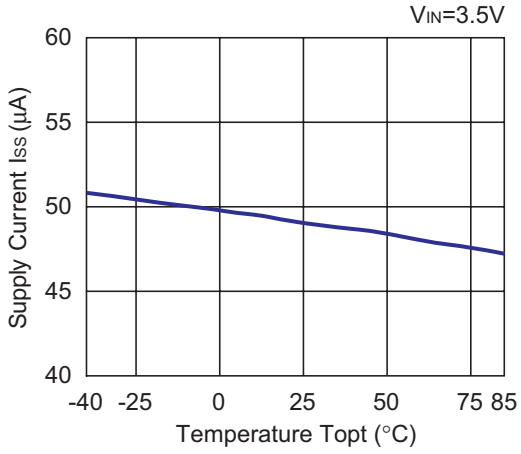



### 5) Supply Current vs. Temperature ($C_{IN}$=1.0µF, $C_{OUT}$=1.0µF, $I_{OUT}$=0mA)

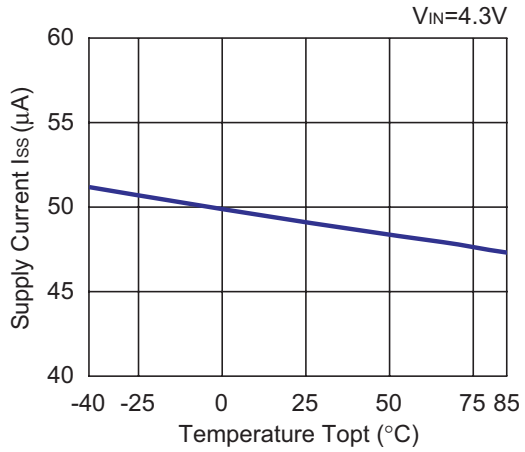
**RP102x121x**




**RP102x251x**

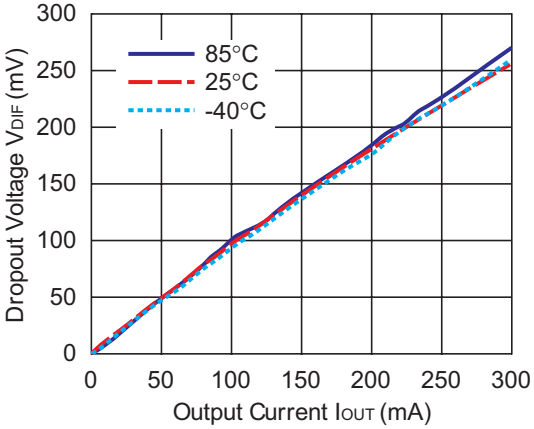


**RP102x331x**




## 6) Dropout Voltage vs. Output Current ($C_{IN}$=1.0µF, $C_{OUT}$=1.0µF)

**RP102x121x**

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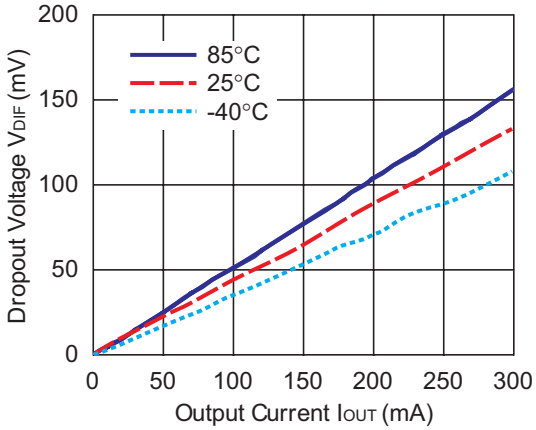


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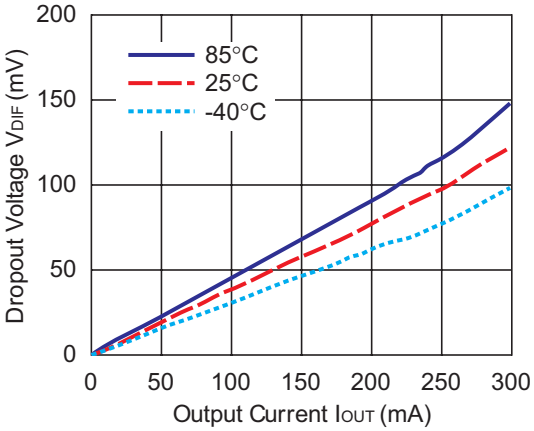
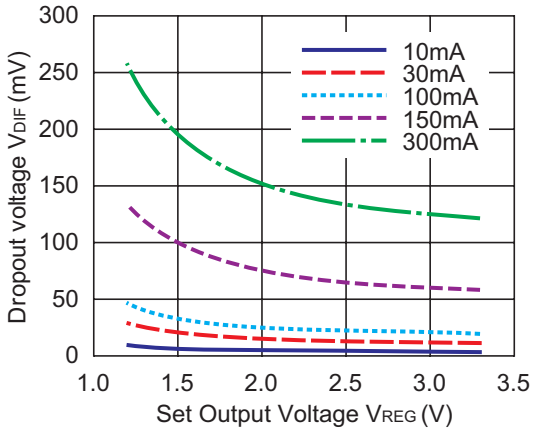
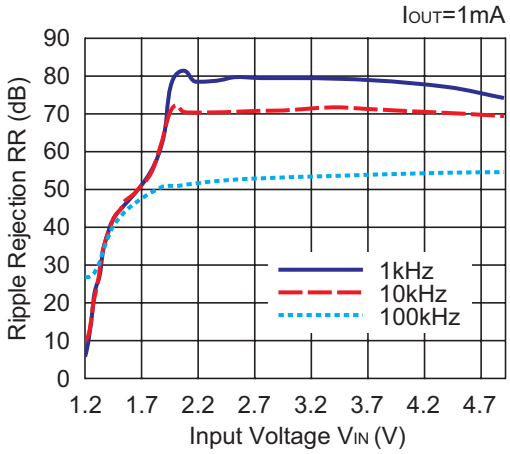


### 7) Dropout Voltage vs Set Output Voltage ($C_{IN}$=1.0µF, $C_{OUT}$=1.0µF, Topt=25°C)

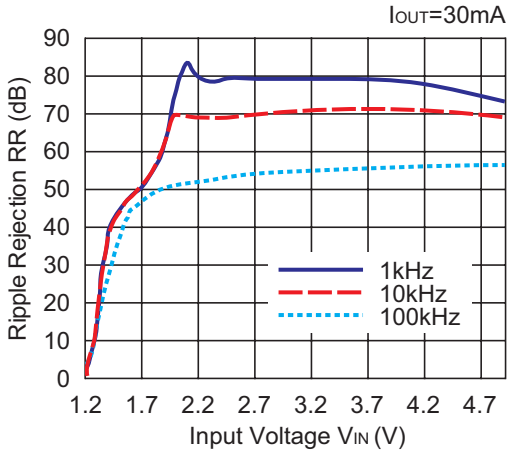



### 8) Ripple Rejection vs. Input Bias Voltage ($C_{IN}$=none, $C_{OUT}$=1.0µF, Ripple=0.2Vp-p, Topt=25°C)

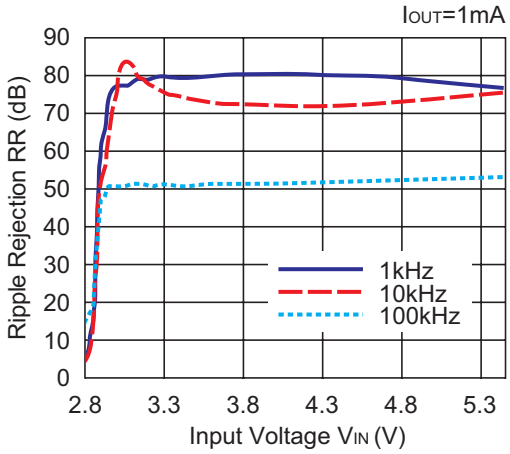
**RP102x121x**



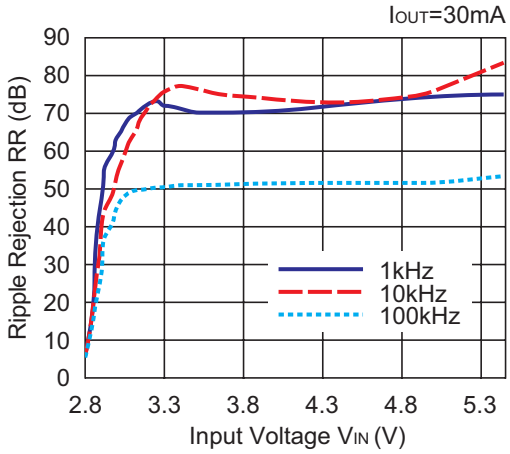

**RP102x121x**




**RP102x281x**

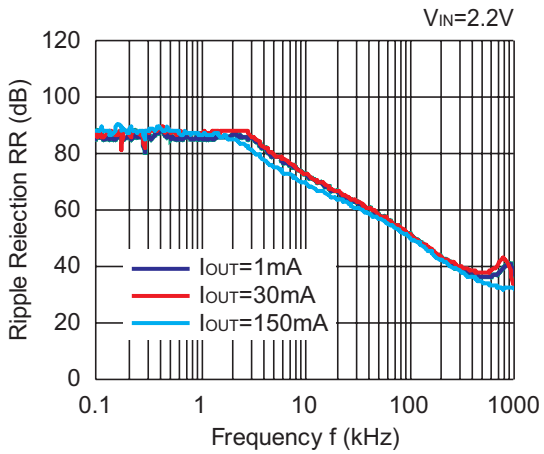



**RP102x281x**

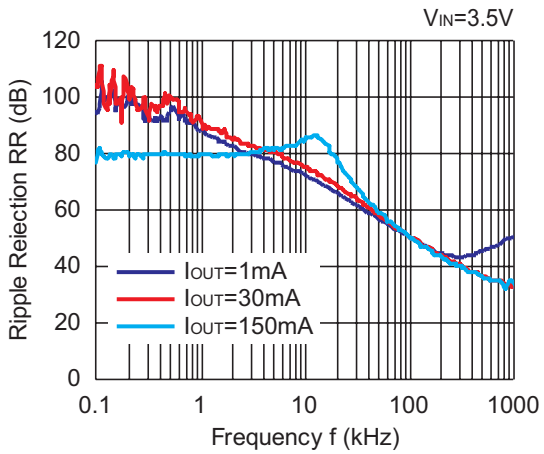


## 9) Ripple Rejection vs. Frequency ($C_{IN}$=1.0µF, $C_{OUT}$=1.0µF, Ripple=0.2Vp-p)

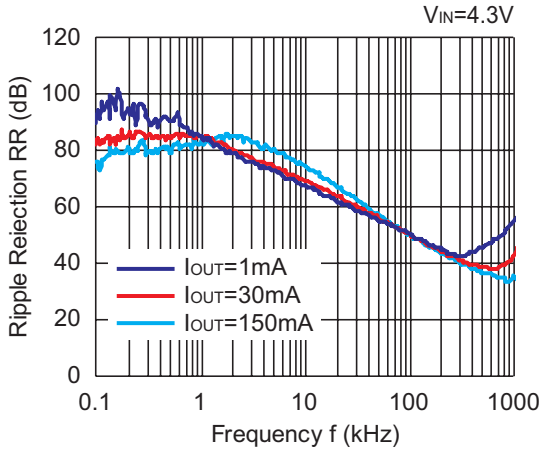
**RP102x121x**



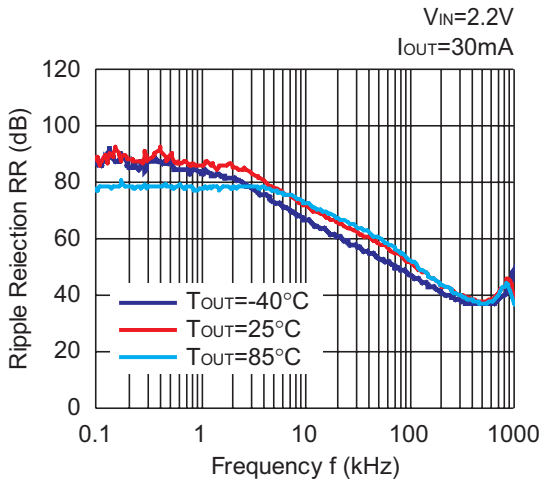

**RP102x251x**




**RP102x331x**




**RP102x121x**

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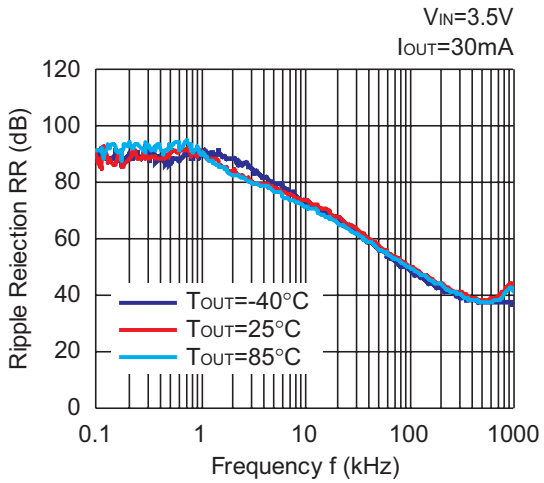

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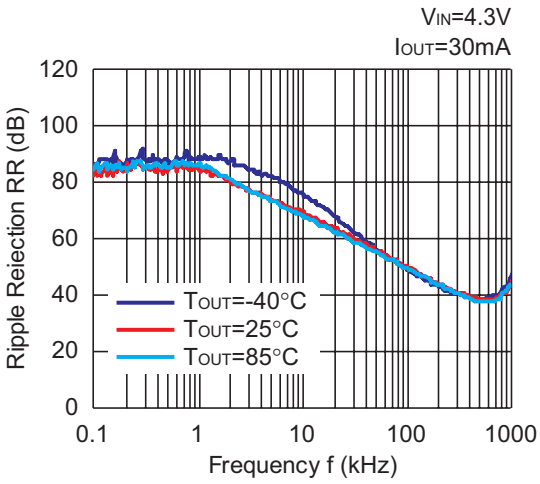
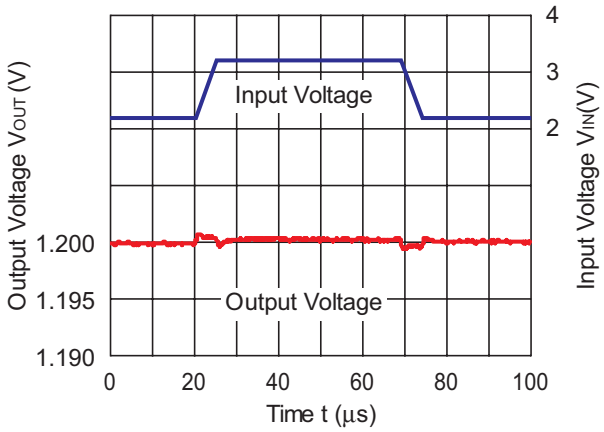



**10) Input Transient Response ($C_{IN}$=none, $C_{OUT}$=1.0µF, $I_{OUT}$=30mA, tr=tf=5µs, Topt=25°C)**

**RP102x121x**

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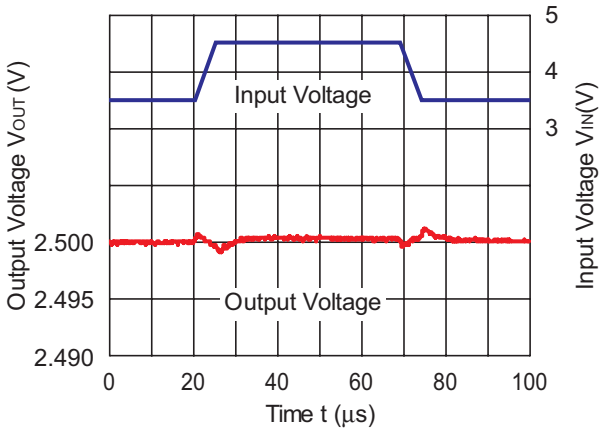
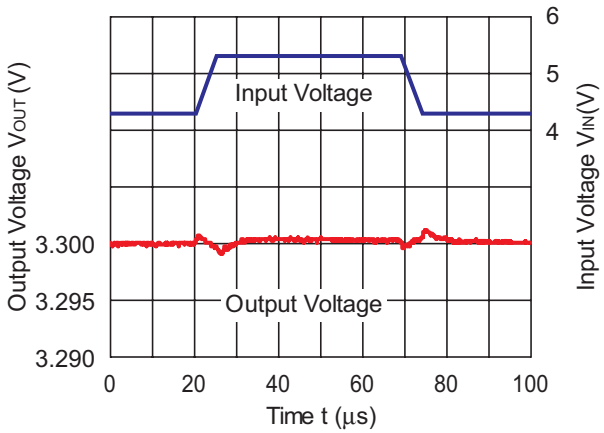
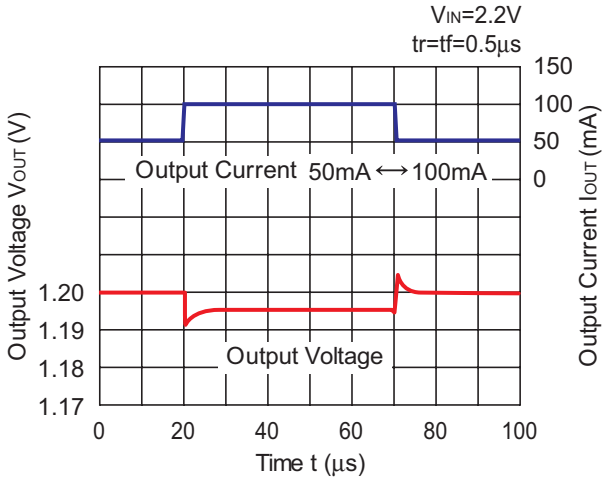



**RP102x331x**



## 11) Load Transient Response ($C_{OUT}$=1.0µF, Topt=25°C)

**RP102x121x**

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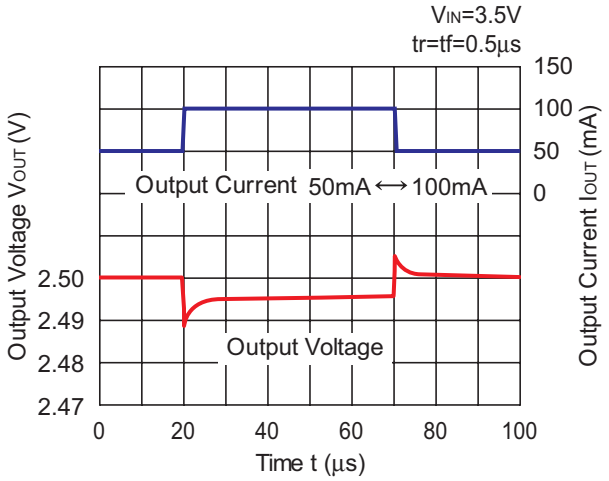


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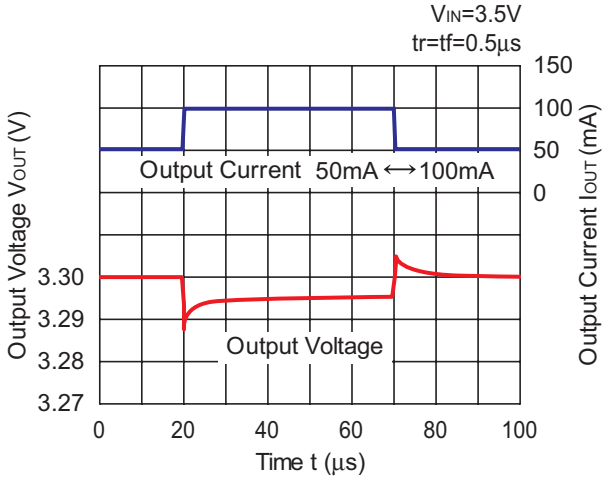
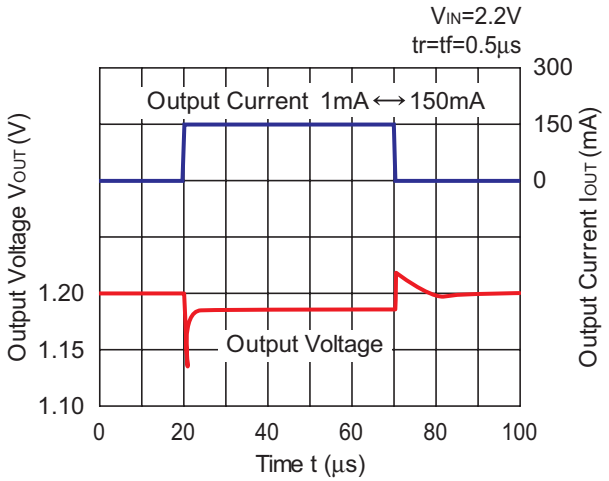



**RP102x121x**

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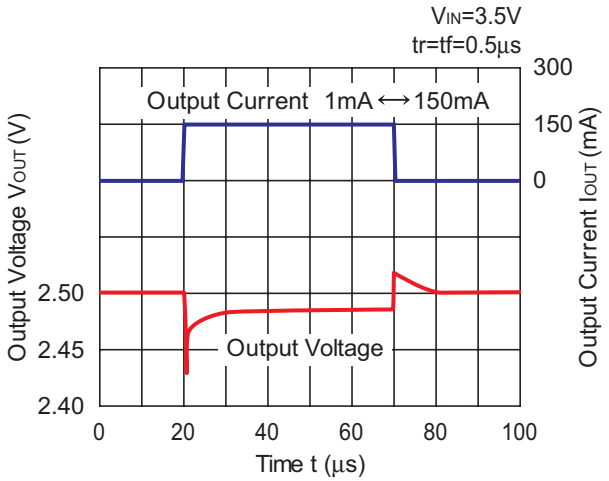

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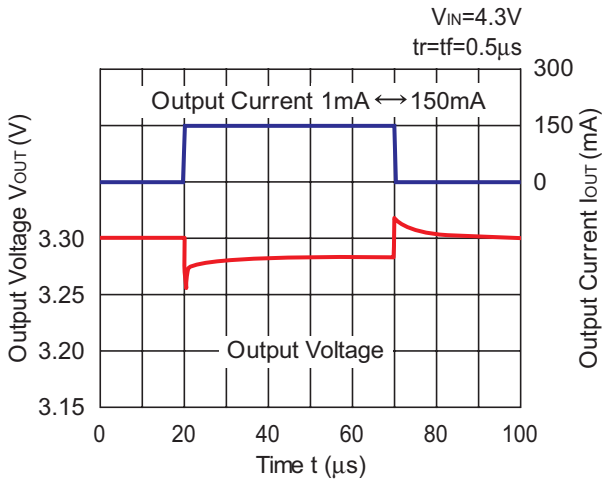
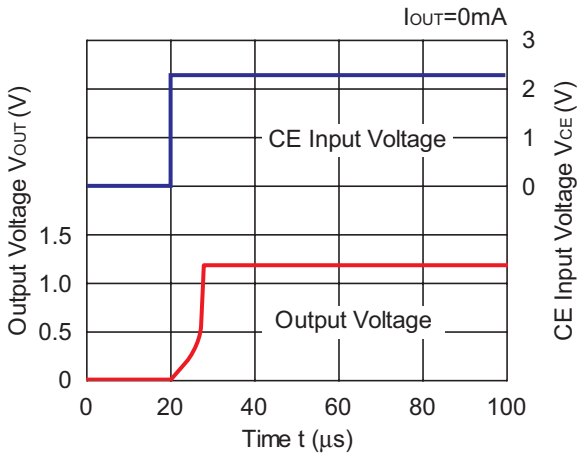
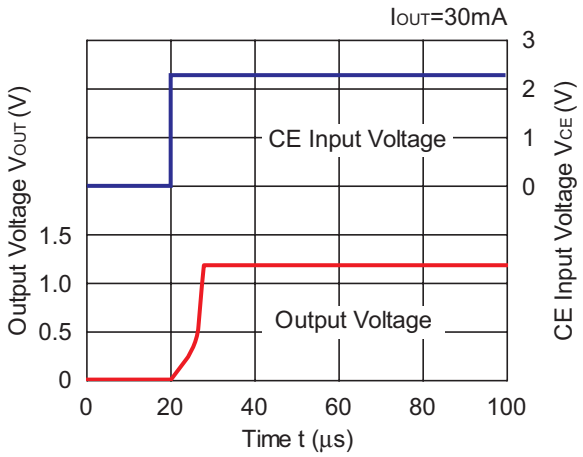



## 12) Turn On Speed with CE pin ($C_{IN}$=1.0µF, $C_{OUT}$=1.0µF, Topt=25°C)

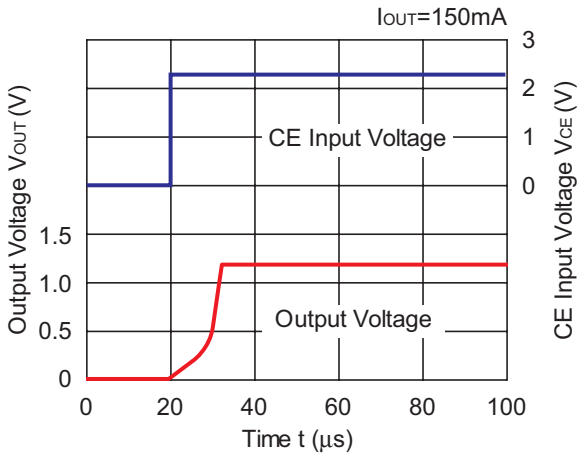
**RP102x121x**




**RP102x121x**




**RP102x121x**



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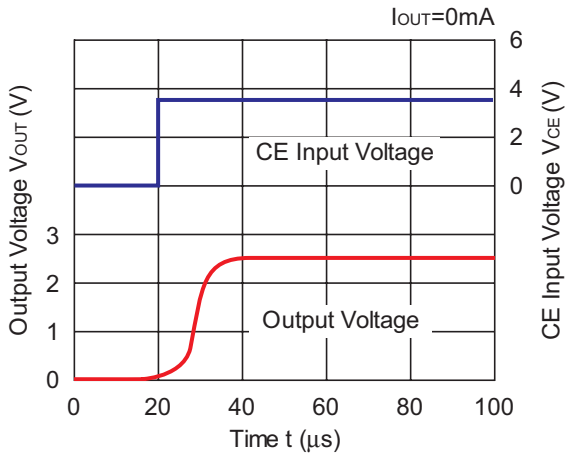


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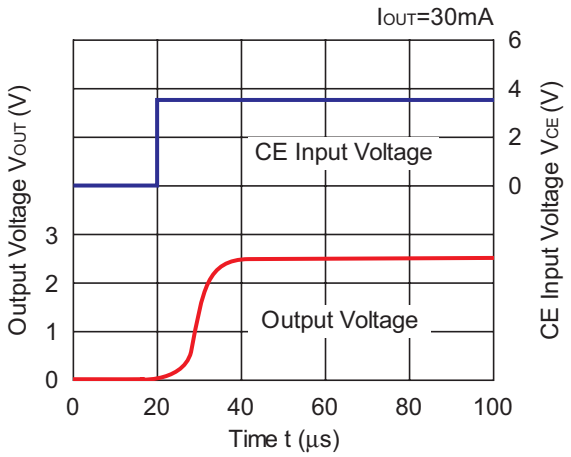


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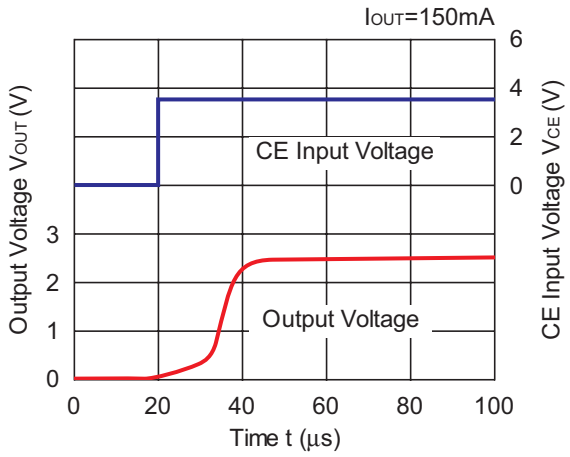


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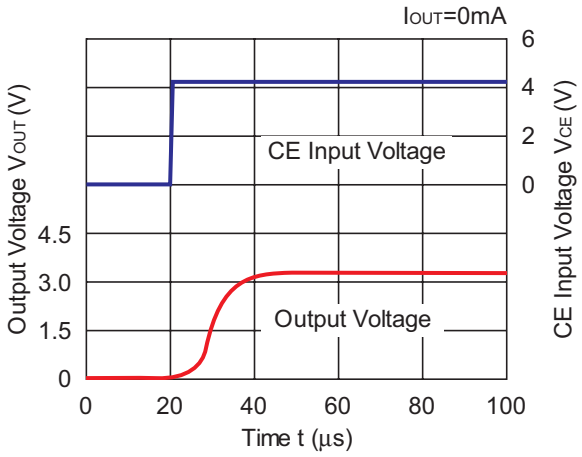


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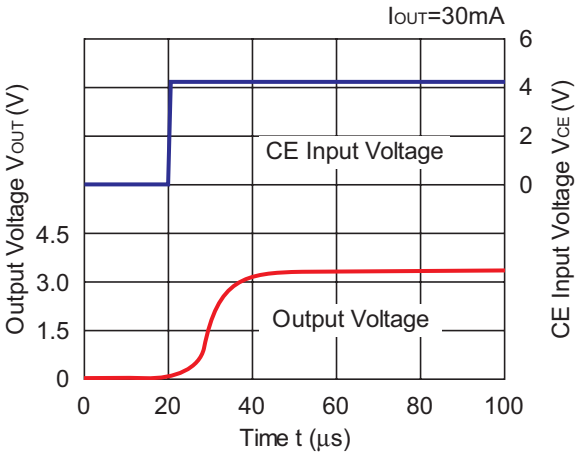

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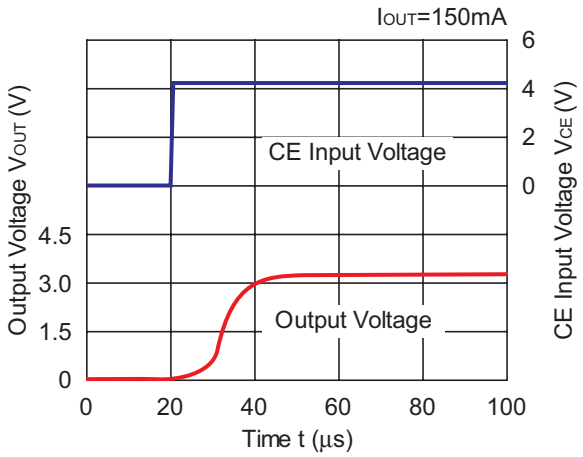
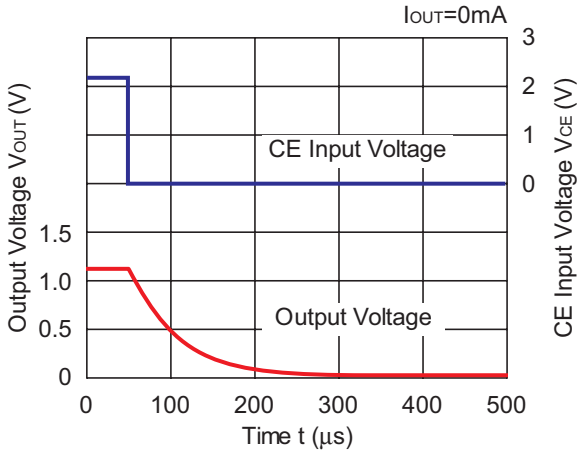



### 13) Turn OFF Speed with CE pin (D Version) ($C_{IN}$=1.0µF, $C_{OUT}$=1.0µF, Topt=25°C)

**RP102x121D**

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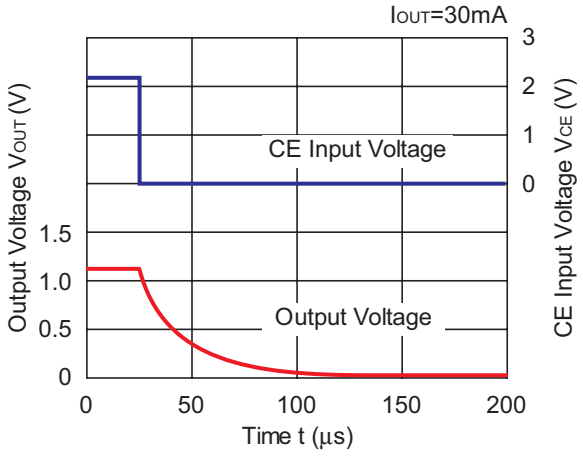


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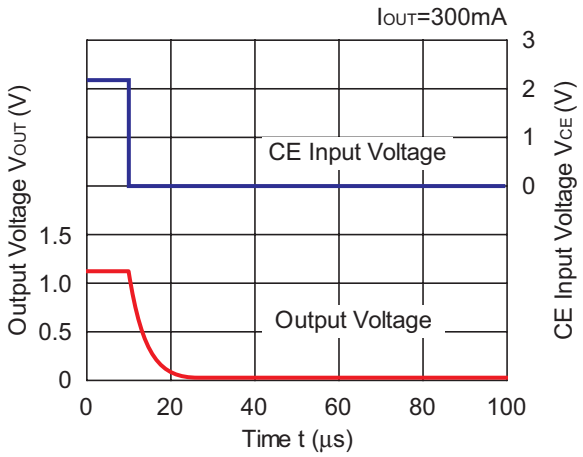

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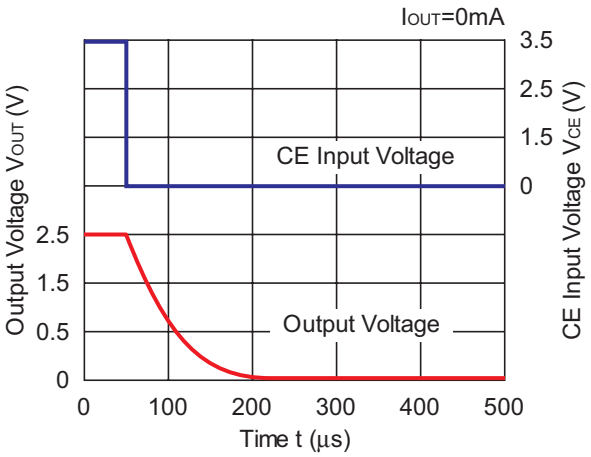


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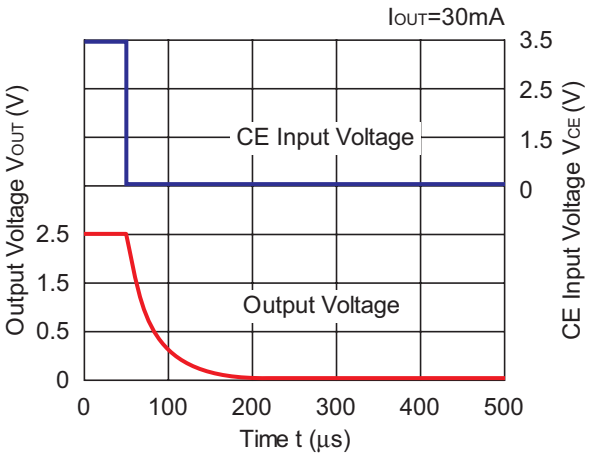


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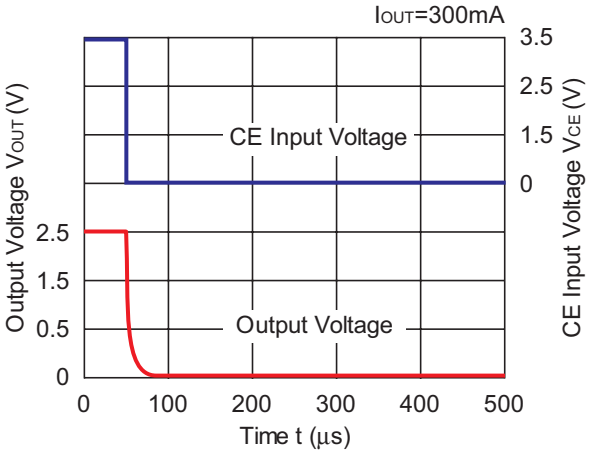


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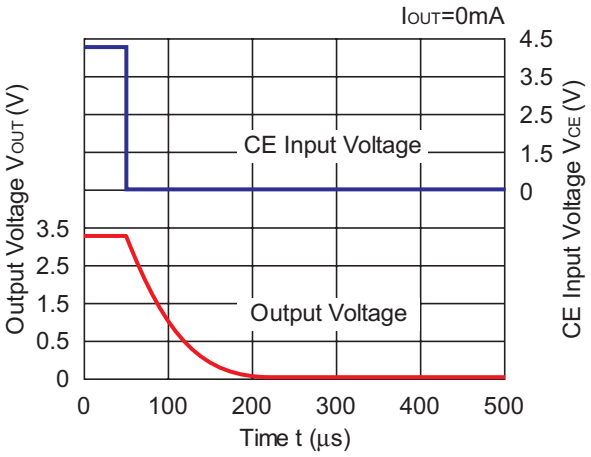


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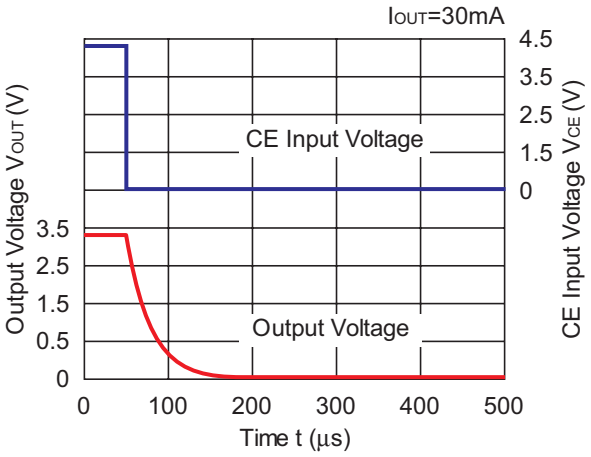

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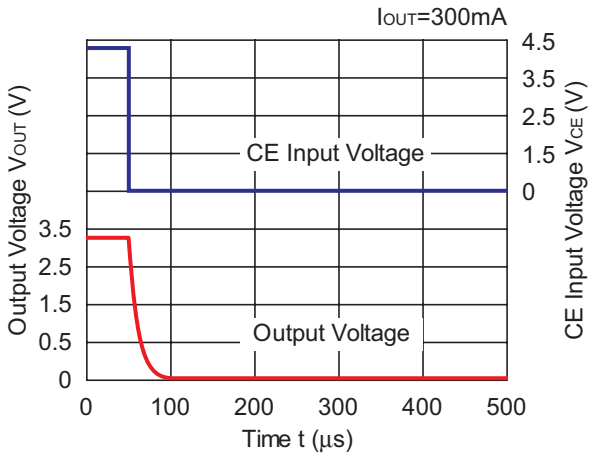


# ESR vs. Output Current

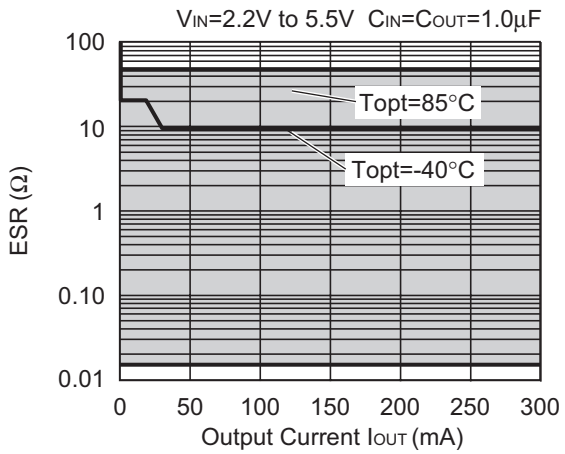
When using these ICs, consider the following points:

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

**Measurement conditions**

Frequency Band: 10Hz to 2MHz
Temperature: −40°C to 85°C

**RP102x121x**

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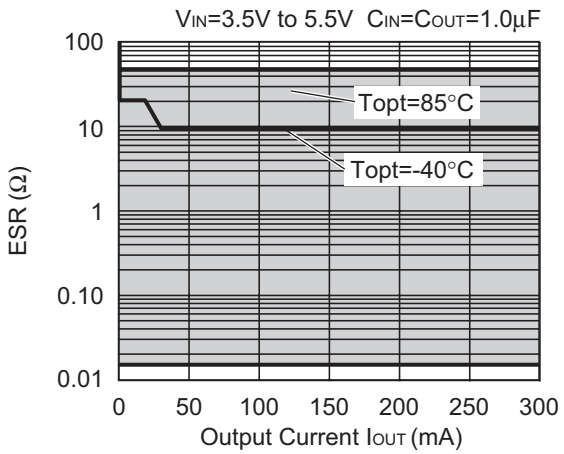


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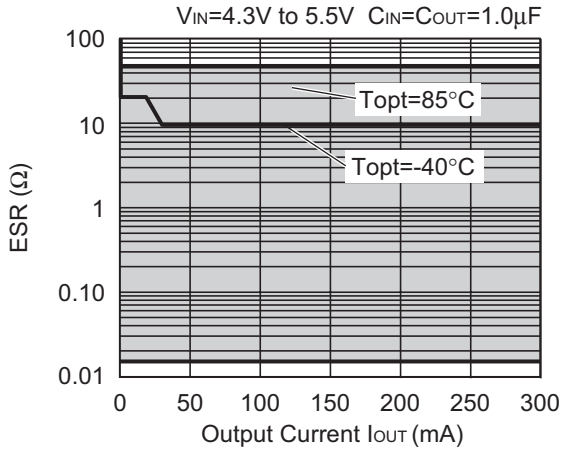

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## RICOH COMPANY., LTD. Electronic Devices Company

■Ricoh presented with the Japan Management Quality Award for 1999.
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■Ricoh awarded ISO 14001 certification.
The Ricoh Group was awarded ISO 14001 certification, which is an international standard for environmental management systems, at both its domestic and overseas production facilities. Our current aim is to obtain ISO 14001 certification for all of our business offices.

RoHS Compliant
Ricoh completed the organization of the Lead-free production for all of our products. After Apr. 1, 2006, we will ship out the lead free products only. Thus, all products that will be shipped from now on comply with RoHS Directive.

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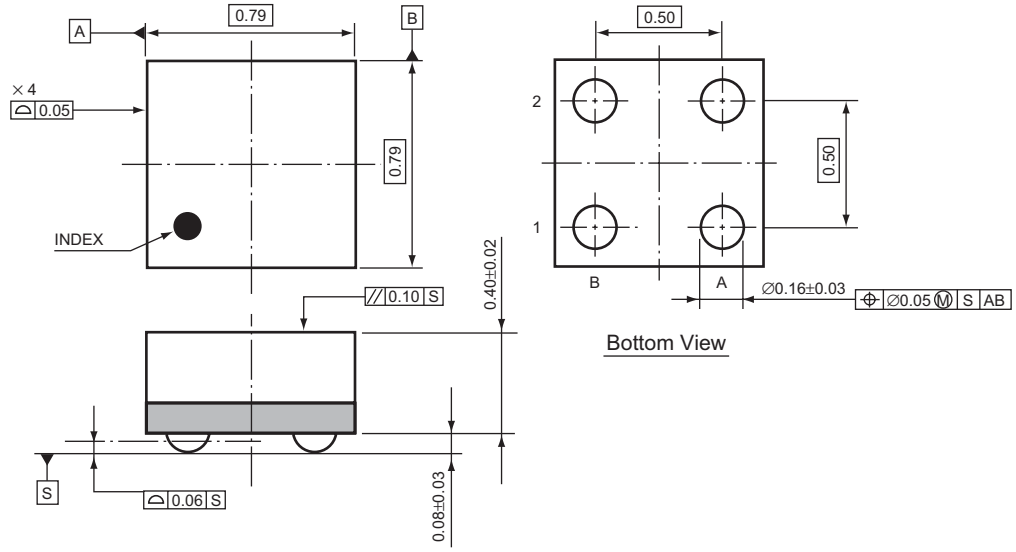
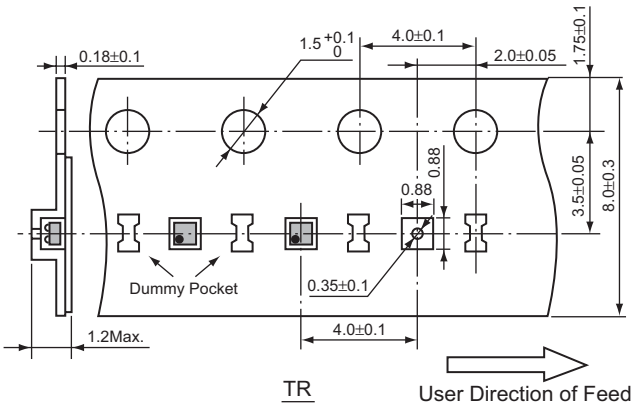
- **WLCSP-4-P2**

Unit: mm

## PACKAGE DIMENSIONS

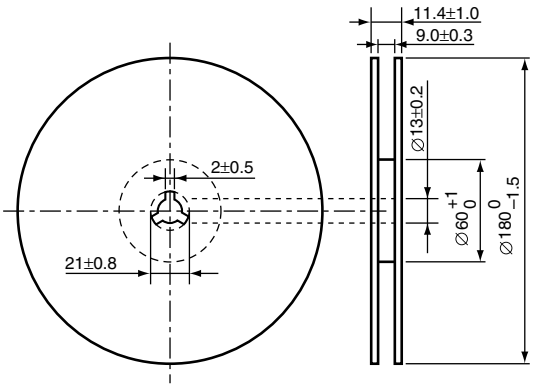



## TAPING SPECIFICATION




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

(1reel=5,000pcs)



# POWER DISSIPATION (WLCSP-4-P2)

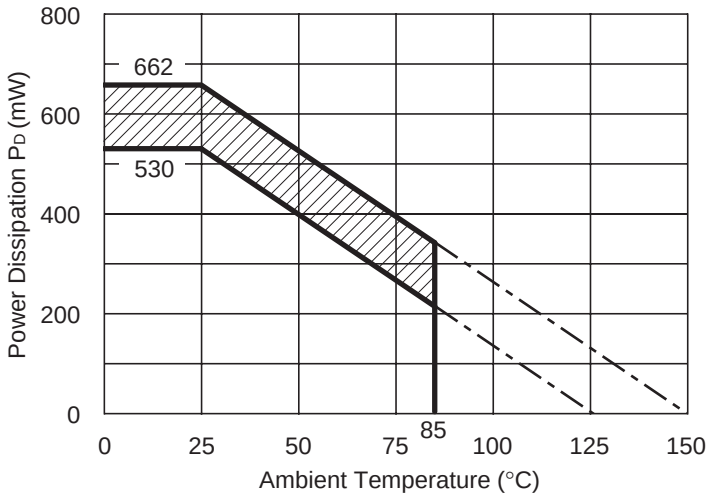
This specification is at mounted on board. Power Dissipation ($P_D$) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

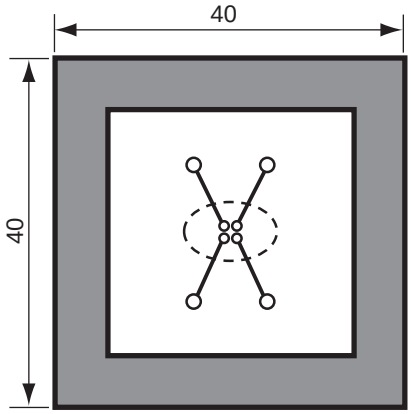
| | Standard Land Pattern |
|---|---|
| Environment | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plastic (Double sided) |
| Board Dimensions | 40mm × 40mm × 1.6mm |
| Copper Ratio | Top side : Approx. 50%, Back side : Approx. 50% |
| Through-holes | ϕ0.5mm × 4pcs |

Measurement Results (Topt=25°C, Tjmax=125°C)

| | Standard Land Pattern |
|---|---|
| Power Dissipation | 530mW |
| Thermal Resistance | θja=(125−25°C)/0.53W=189°C/W |




**Power Dissipation**




**Measurement Board Pattern**

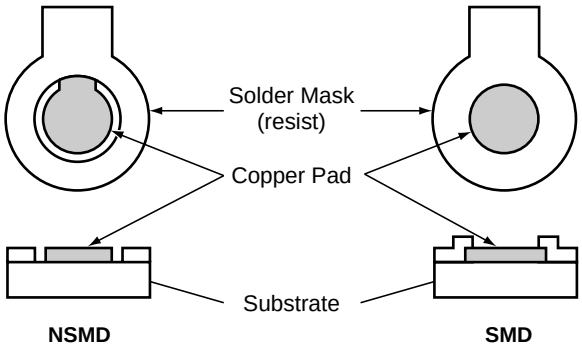
IC Mount Area (Unit: mm)

The above graph shows the Power Dissipation of the package based on Tjmax=125°C and Tjmax=150°C.
Operating the IC in the shaded area in the graph might have an influence it's lifetime.
Operating time must be within the time limit described in the table below, in case of operating in the shaded area.

| Product Name | Operating time | Estimated years* |
|---|---|---|
| RP102Z | 13,000 hrs | 9 years |

*The volume is calculated on the supposition that operating four hours/day.

# RECOMMENDED LAND PATTERN




(Unit : mm)

**NSMD and SMD Pad Definition**

| Pad definition | Copper Pad | Solder Mask Opening |
|---|---|---|
| NSMD (Non-Solder Mask defined) | 0.20mm | Min. 0.30mm |
| SMD (Solder Mask defined) | Min. 0.30mm | 0.20mm |

* Pad layout and size can be modified by customers material, equipment, method.
* Please adjust pad layout according to your conditions.
* Recommended Stencil Aperture Size....ø0.3mm
* Since lead free WL-CSP components are not compatible with the tin/lead solder process, you shall not mount lead free WL-CSP components using the tin/lead solder paste.

## Bucaroff, Dan

**From:** kenshiro_tanaka@e-devices.ricoh.co.jp
**Sent:** Tuesday, February 10, 2015 12:26 AM
**To:** Ciobanu, Catalina
**Cc:** Alan.Sue@ricoh-usa.com; takashi_kobayashi@e-devices.ricoh.co.jp; yohko_wakayama@e-devices.ricoh.co.jp; tomohiro_okamoto@e-devices.ricoh.co.jp
**Subject:** Re: PO 100091240

Hi Catalina

Sorry for my late reply.
Please see below.

Sample PN: RP102Z181D-F
Reel PN: RP102Z181D-TR-F
Reel Qty: 5,000pcs
Price: USD0.08 (1 reel)
Because your requested Qty is 1,000pcs which is smaller than our Reel MOQ, we would like to ship samples by free of charge.
So could you change PO PN to RP102Z181D-F? Price is ok with 0(Zero).
Could you kindly let us know platform name using this LDO?

Sample PN: RP110L251D
Reel PN: RP110L251D-TR
Reel Qty: 10,000pcs
Price: USD0.03 (1 reel)
Your PN and Price are ok because we will ship 1,000pcs by free of charge too.
Could you kindly let us know platform name using this LDO?

Best regards,
Ken
---
***E-mail Address has been changed

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RICOH COMPANY, LTD.
North America Supporting team
Overseas Sales Department

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"Ciobanu,
Catalina"

<cciobanu@qti.qualcomm.com>

2015/02/06 15:43

宛先
Yohko Wakayama/S/REDC@REDC

cc
"Alan.Sue@ricoh-usa.com" <Alan.Sue@ricoh-usa.com>, Kenshiro Tanaka/S/REDC@REDC, Takashi Kobayashi/S/REDC@REDC

件名
PO 100091240

Hi Yohko,

Please find attached PO 100091240. These are new parts. Please provide price, reel size and standard lead times for these 2 parts I placed PO for:
281-67677-01R8 / MPN RP102Z181D-TR-F
281-79991-02R5 / RP110L251D

Please also provide delivery dates.

Thank you,

Catalina Ciobanu
Phone: (858) 651 ? 0778
5525 Morehouse Drive
San Diego, CA 92121
[添付ファイル "100091240_0.pdf" は Kenshiro Tanaka/S/REDC が削除しました]