

## 300 mA Ultra-small Dual LDO Regulator

No. EA-202-230523

### OUTLINE

The RP154x is a CMOS-based voltage regulator that provides high ripple rejection, low dropout voltage, high output voltage accuracy, and low supply current. Internally, the RP154x consists of a voltage reference unit, an error amplifier, resistors for setting output voltage, a short current limit circuit and a chip enable circuit.

The RP154x is available in fixed output voltage options. Besides the low supply current by CMOS, the RP154x offers a low dropout voltage by built-in low ON resistance  $r_{ON}$  as well as an extended battery life by a chip enable function. Compared with the existing CMOS-based regulators, the RP154x is further improved in ripple rejection, line transient response, and load transient response. All these features allow the RP154x to become ideal power sources for hand-held communication equipment.

The RP154x is offered in a 6-pin SOT-23-6 package for a single input type and an 8-pin DFN1216-8 package for a dual input type. Both packages are equipped with two LDOs which can achieve high-density mounting.

### FEATURES

- Supply Current ..... Typ. 50  $\mu$ A x 2 (VR1 & VR2)
- Standby Current ..... Typ. 0.1 $\mu$ A x 2 (VR1 & VR2)
- Input Voltage Range ..... 1.4 V to 5.25 V
- Output Voltage Range ..... 0.8 V to 3.7 V (0.1 V steps)
- Output Voltage Accuracy .....  $\pm 1.0\%$  ( $V_{SET} > 2.0$  V,  $T_a = 25^\circ$ C)
- Temperature-Drift Coefficient of Output Voltage ..... Typ.  $\pm 80$  ppm/ $^\circ$  C
- Dropout Voltage ..... Typ. 0.25 V ( $I_{OUT} = 300$  mA,  $V_{SET} = 2.5$  V)
- Ripple Rejection ..... Typ. 75 dB ( $f = 1$  kHz)
- Line Regulation ..... Typ. 0.02%/V
- Packages ..... DFN1216-8, SOT-23-6
- Short-current Limit Circuit ..... Typ. 60 mA
- Overcurrent Protection Circuit
- Ceramic Capacitor Compatible ..... 1.0  $\mu$ A or more

### APPLICATIONS

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

## SELECTION GUIDE

The set output voltage, the package type and the auto discharge function<sup>(1)</sup> are user-selectable options.

### Selection Guide

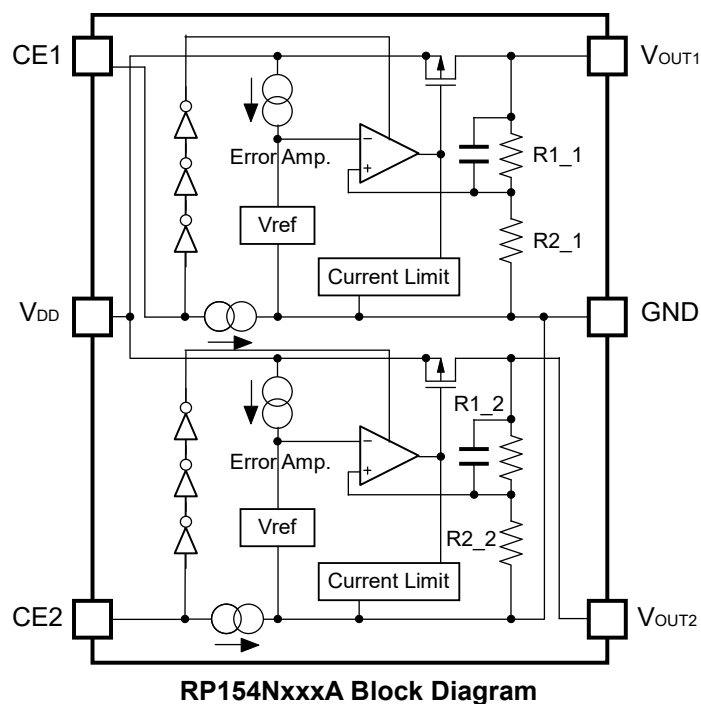
| Product Name     | Package   | Quantity per Reel | Pb Free | Halogen Free |
|------------------|-----------|-------------------|---------|--------------|
| RP154L0xx*-E2    | DFN1216-8 | 5,000 pcs         | Yes     | Yes          |
| RP154N0xx*-TR-FE | SOT-23-6  | 3,000 pcs         | Yes     | Yes          |

xx: Specify the combination of set output voltage ( $V_{SET}$ ) within the range of 0.8 V to 3.7 V in 0.1 V step.

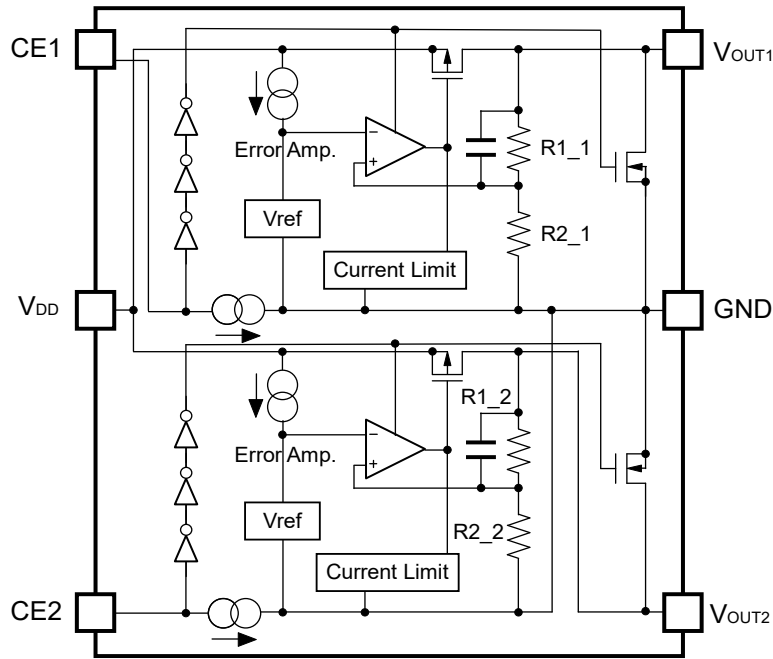
\*: The auto discharge function at off state are options as follows.

- (A) Auto-discharge function not included, Active-high
- (B) Auto-discharge function included, Active-high

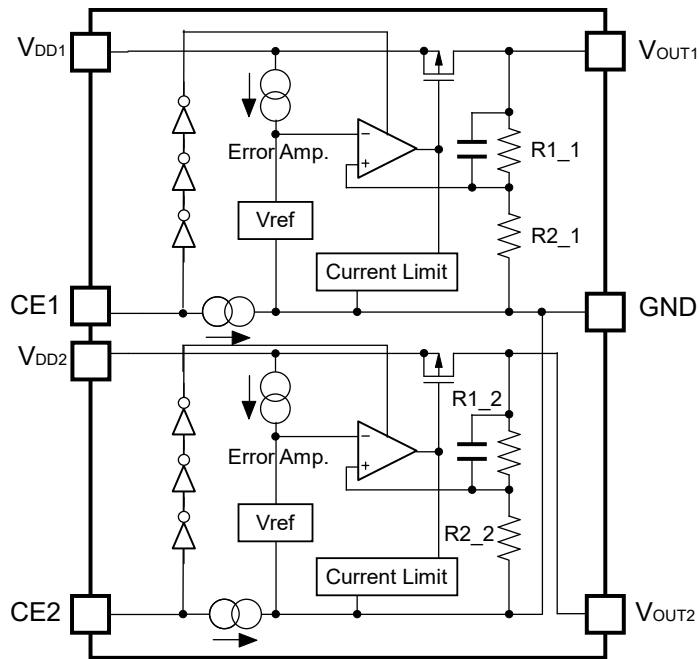
## BLOCK DIAGRAMS



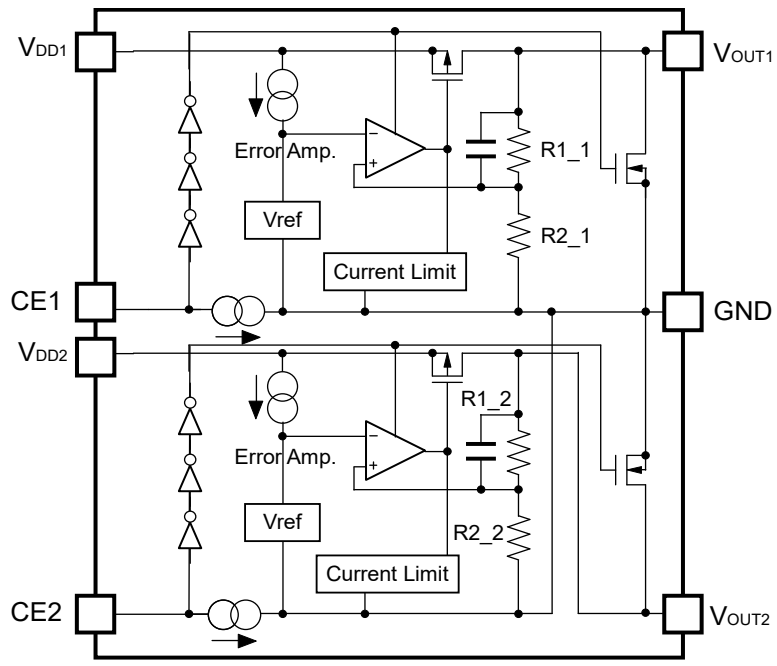
<sup>(1)</sup> Auto-discharge function quickly lowers the output voltage to 0 V by releasing the electrical charge accumulated in the external capacitor when the chip enable signal is switched from the active mode to the standby mode.



RP154NxxxB Block Diagram

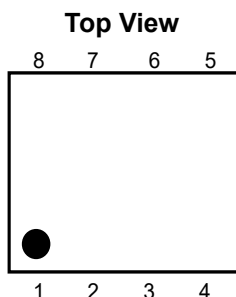


RP154LxxxA Block Diagram

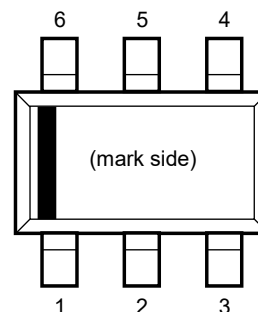
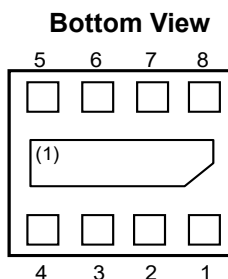


RP154LxxxB Block Diagram

## PIN DESCRIPTIONS



**DFN1216-8 Pin Configuration**



**SOT-23-6 Pin Configuration**

### DFN1216-8 Pin Description

| Pin No. | Symbol | Description                    |
|---------|--------|--------------------------------|
| 1       | GND    | Ground Pin <sup>(2)</sup>      |
| 2       | VOUT1  | Output Pin 1                   |
| 3       | VOUT2  | Output Pin 2                   |
| 4       | GND    | Ground Pin <sup>(2)</sup>      |
| 5       | CE2    | Chip Enable Pin 2, Active-high |
| 6       | VDD2   | Input Pin                      |
| 7       | VDD1   | Input Pin                      |
| 8       | CE1    | Chip Enable Pin 1, Active-high |

### SOT-23-6 Pin Description

| Pin No. | Symbol | Description                    |
|---------|--------|--------------------------------|
| 1       | CE1    | Chip Enable Pin 1 ("H" Active) |
| 2       | VDD    | Input Pin                      |
| 3       | CE2    | Chip Enable Pin 2 ("H" Active) |
| 4       | VOUT2  | Output Pin 2                   |
| 5       | GND    | Ground Pin                     |
| 6       | VOUT1  | Output Pin 1                   |

<sup>(1)</sup> 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.

<sup>(2)</sup> The GND pin must be wired together when it is mounted on board.

## ABSOLUTE MAXIMUM RATINGS

### Absolute Maximum Ratings

| Symbol               | Item  | Rating                 | Unit |    |
|----------------------|---|------------------------|------|----|
| $V_{IN}$             | Input Voltage   | 6.0                    | V    |    |
| $V_{CE}$             | Input Voltage (CE Pin)  | -0.3 to 6.0            | V    |    |
| $V_{OUT1}, V_{OUT2}$ | Output Voltage  | -0.3 to $V_{IN} + 0.3$ | V    |    |
| $I_{OUT1}, I_{OUT2}$ | Output Current  | 400                    | mA   |    |
| $P_D$                | Power Dissipation <sup>(1)</sup><br>(JEDEC STD. 51-7 Test Land Pattern) | DFN1216-8              | 1700 | mW |
|                      |   | SOT-23-6               | 660  |    |
| $P_D$                | Power Dissipation (DFN1216-8) <sup>(2)</sup>                            | 625                    | mW   |    |
|                      | Power Dissipation (SOT-23-6) <sup>(1)</sup>                             | 420                    |      |    |
| $T_j$                | Junction Temperature Range  | -40 to 125             | ° C  |    |
| $T_{stg}$            | Storage Temperature Range   | -55 to 125             | ° C  |    |

#### ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause permanent damage 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

### Recommended Operating Conditions

| Symbol   | Item                        | Rating      | Unit |
|----------|-----------------------------|-------------|------|
| $V_{IN}$ | Operating Input Voltage     | 1.4 to 5.25 | V    |
| $T_a$    | Operating Temperature Range | -40 to 85   | °C   |

#### RECOMMENDED OPERATING CONDITIONS

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 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.

<sup>(1)</sup> Refer to *POWER DISSIPATION* for detailed information.

<sup>(2)</sup> Refer to *POWER DISSIPATION* for detailed information.

## ELECTRICAL CHARACTERISTICS

$V_{IN} = V_{SET} > +1.0\text{ V}$  ( $V_{SET} > 1.5\text{ V}$ ),  $V_{IN} = 2.5\text{ V}$  ( $V_{SET} \leq 1.5\text{ V}$ ),  $I_{OUT} = 1\text{ mA}$ ,  $C_{IN} = C_{OUT} = 1.0\text{ }\mu\text{F}$ , unless otherwise noted,

$V_{SET}$  = Set Output Voltage

The specification in   is checked and guaranteed by design engineering at  $-40^{\circ}\text{C} \leq T_a \leq 85^{\circ}\text{C}$ .

### VR1/VR2 Electrical Characteristics

( $T_a = 25^{\circ}\text{C}$ )

| Symbol                                  | Item  | Conditions  | Min.  | Typ.  | Max.   | Unit  |    |
|---|---|---|---|---|--|---|----|
| $V_{OUT}$                               | Output Voltage                                  | $T_a = 25^{\circ}\text{C}$  | $V_{SET} > 2.0\text{ V}$  | $\times 0.99$   | $\times 1.01$  | V   |    |
|   |   |   | $V_{SET} \leq 2.0\text{ V}$                                       | -20   | 20   | mV  |    |
|   |   | $-40^{\circ}\text{C} \leq T_a \leq 85^{\circ}\text{C}$  | $V_{SET} > 2.0\text{ V}$  | <span style="border: 1px solid black; padding: 0 2px;">×0.97</span> |  | <span style="border: 1px solid black; padding: 0 2px;">×1.03</span> | V  |
|   |   |   | $V_{SET} \leq 2.0\text{ V}$                                       | <span style="border: 1px solid black; padding: 0 2px;">-60</span>   |  | <span style="border: 1px solid black; padding: 0 2px;">60</span>    | mV |
| $I_{OUT}$                               | Output Current                                  |   | <span style="border: 1px solid black; padding: 0 2px;">300</span> |   |  | mA  |    |
| $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ | Load Regulation                                 | $1\text{ mA} \leq I_{OUT} \leq 300\text{ mA}$   |   | 15  | <span style="border: 1px solid black; padding: 0 2px;">40</span>   | mV  |    |
| $V_{DIF}$                               | Dropout Voltage                                 | <b>Refer to Dropout Voltage by Set Output Voltage.</b>  |   |   |  |   |    |
| $I_{SS}$                                | Supply Current                                  | $I_{OUT} = 0\text{ mA}$   |   | 50  | <span style="border: 1px solid black; padding: 0 2px;">75</span>   | $\mu\text{A}$   |    |
| $I_{standby}$                           | Standby Current                                 | $V_{CE} = 0\text{ V}$   |   | 0.1   | 1.0  | $\mu\text{A}$   |    |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN}}$  | Line Regulation                                 | $V_{SET} + 0.5\text{ V} \leq V_{IN} \leq 5.25\text{ V}$ ( $V_{IN} \geq 1.4\text{ V}$ )  |   | 0.02  | <span style="border: 1px solid black; padding: 0 2px;">0.10</span> | %/V   |    |
| RR                                      | Ripple Rejection                                | $f = 1\text{ kHz}$ , Ripple $0.2\text{ V}_{p-p}$<br>$V_{IN} = V_{SET} + 1.0\text{ V}$ , $I_{OUT} = 30\text{ mA}$<br>(When $V_{SET} \leq 2.0\text{ V}$ , $V_{IN} = 3.0\text{ V}$ ) |   | 75  |  | dB  |    |
| $V_{IN}$                                | Input Voltage <sup>(1)</sup>                    |   | <span style="border: 1px solid black; padding: 0 2px;">1.4</span> |   | <span style="border: 1px solid black; padding: 0 2px;">5.25</span> | V   |    |
| $\frac{\Delta V_{OUT}}{\Delta T_a}$     | Output Voltage Temperature Coefficient          | $-40^{\circ}\text{C} \leq T_a \leq 85^{\circ}\text{C}$  |   | $\pm 80$  |  | ppm/ $^{\circ}\text{C}$   |    |
| $I_{SC}$                                | Short Current Limit                             | $V_{OUT} = 0\text{ V}$  |   | 60  |  | mA  |    |
| $I_{PD}$                                | CE Pull-down Current                            |   |   | 0.3   | <span style="border: 1px solid black; padding: 0 2px;">0.6</span>  | $\mu\text{A}$   |    |
| $V_{CEH}$                               | CE Input Voltage "H"                            |   | <span style="border: 1px solid black; padding: 0 2px;">1.0</span> |   |  | V   |    |
| $V_{CEL}$                               | CE Input Voltage "L"                            |   |   |   | <span style="border: 1px solid black; padding: 0 2px;">0.4</span>  | V   |    |
| en                                      | Output Noise                                    | $BW = 10\text{ Hz} \sim 100\text{ kHz}$   |   | 75  |  | $\mu\text{V}_{rms}$   |    |
| $R_{LOW}$                               | Low Output Nch Tr. ON Resistance (of B version) | $V_{IN} = 4.0\text{ V}$ , $V_{CE} = 0\text{ V}$   |   | 50  |  | $\Omega$  |    |

All of unit are tested and specified under load conditions such that  $T_j \approx T_a = 25^{\circ}\text{C}$  except for Output Noise, Ripple Rejection, Output Voltage Temperature Coefficient and Thermal Shutdown.

<sup>(1)</sup> The maximum Input Voltage of *ELECTRICAL CHARACTERISTICS* is 5.25 V. In case of exceeding this specification, the IC must be operated on condition that the Input Voltage is up to 5.5 V and the total operating time is within 500 hrs.

**ELECTRICAL CHARACTERISTICS (continued)**

The specification in  is checked and guaranteed by design engineering at  $-40^{\circ}\text{C} \leq T_a \leq 85^{\circ}\text{C}$ .

**Dropout Voltage by Set Output Voltage**

(Ta = 25° C)

| Set Output Voltage<br>$V_{\text{SET}}$ (V) | Dropout Voltage $V_{\text{DIF}}$ (V) |      |                               |
|--|--------------------------------------|------|-------------------------------|
|  | Condition                            | Typ. | Max.                          |
| $V_{\text{SET}} = 0.8$                     | $I_{\text{OUT}} = 300 \text{ mA}$    | 0.56 | <input type="checkbox"/> 0.72 |
| $V_{\text{SET}} = 0.9$                     |                                      | 0.51 | <input type="checkbox"/> 0.65 |
| $1.0 \leq V_{\text{SET}} < 1.2$            |                                      | 0.46 | <input type="checkbox"/> 0.59 |
| $1.2 \leq V_{\text{SET}} < 1.4$            |                                      | 0.39 | <input type="checkbox"/> 0.50 |
| $1.4 \leq V_{\text{SET}} < 1.7$            |                                      | 0.35 | <input type="checkbox"/> 0.44 |
| $1.7 \leq V_{\text{SET}} < 2.1$            |                                      | 0.30 | <input type="checkbox"/> 0.39 |
| $2.1 \leq V_{\text{SET}} < 2.5$            |                                      | 0.26 | <input type="checkbox"/> 0.34 |
| $2.5 \leq V_{\text{SET}} < 3.0$            |                                      | 0.25 | <input type="checkbox"/> 0.30 |
| $3.0 \leq V_{\text{SET}} \leq 3.7$         |                                      | 0.22 | <input type="checkbox"/> 0.29 |



RP154xxxxx Product-specific Electrical Characteristics

| Product Name | VR1                                 |       |       |   |       |       |                       |      | VR2                                 |       |       |   |       |       |                       |      |
|--------------|-------------------------------------|-------|-------|---|-------|-------|-----------------------|------|-------------------------------------|-------|-------|---|-------|-------|-----------------------|------|
|              | V <sub>OUT</sub> [V]<br>(Ta = 25°C) |       |       | V <sub>OUT</sub> [V]<br>(-40°C ≤ Ta ≤ 85°C) |       |       | ΔV <sub>DIF</sub> [V] |      | V <sub>OUT</sub> [V]<br>(Ta = 25°C) |       |       | V <sub>OUT</sub> [V]<br>(-40°C ≤ Ta ≤ 85°C) |       |       | ΔV <sub>DIF</sub> [V] |      |
|              | Min.                                | Typ.  | Max.  | Min.  | Typ.  | Max.  | Typ.                  | Max. | Min.                                | Typ.  | Max.  | Min.  | Typ.  | Max.  | Typ.                  | Max. |
| RP154x001x   | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 |
| RP154x002x   | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 |
| RP154x003x   | 1.480                               | 1.500 | 1.520 | 1.440                                       | 1.500 | 1.560 | 0.35                  | 0.44 | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 |
| RP154x004x   | 1.180                               | 1.200 | 1.220 | 1.140                                       | 1.200 | 1.260 | 0.39                  | 0.50 | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 |
| RP154x005x   | 3.267                               | 3.300 | 3.333 | 3.201                                       | 3.300 | 3.399 | 0.22                  | 0.29 | 1.180                               | 1.200 | 1.220 | 1.140                                       | 1.200 | 1.260 | 0.39                  | 0.50 |
| RP154x006x   | 3.267                               | 3.300 | 3.333 | 3.201                                       | 3.300 | 3.399 | 0.22                  | 0.29 | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 |
| RP154x007x   | 2.822                               | 2.850 | 2.878 | 2.765                                       | 2.850 | 2.935 | 0.25                  | 0.30 | 2.822                               | 2.850 | 2.878 | 2.765                                       | 2.850 | 2.935 | 0.25                  | 0.30 |
| RP154x008x   | 2.822                               | 2.850 | 2.878 | 2.765                                       | 2.850 | 2.935 | 0.25                  | 0.30 | 2.574                               | 2.600 | 2.626 | 2.522                                       | 2.600 | 2.678 | 0.25                  | 0.30 |
| RP154x009x   | 2.970                               | 3.000 | 3.030 | 2.910                                       | 3.000 | 3.090 | 0.22                  | 0.29 | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 |
| RP154x010x   | 2.970                               | 3.000 | 3.030 | 2.910                                       | 3.000 | 3.090 | 0.22                  | 0.29 | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 |
| RP154x011x   | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 | 1.480                               | 1.500 | 1.520 | 1.440                                       | 1.500 | 1.560 | 0.35                  | 0.44 |
| RP154x012x   | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 | 2.574                               | 2.600 | 2.626 | 2.522                                       | 2.600 | 2.678 | 0.25                  | 0.30 |
| RP154x013x   | 3.267                               | 3.300 | 3.333 | 3.201                                       | 3.300 | 3.399 | 0.22                  | 0.29 | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 |
| RP154x014x   | 3.267                               | 3.300 | 3.333 | 3.201                                       | 3.300 | 3.399 | 0.22                  | 0.29 | 3.267                               | 3.300 | 3.333 | 3.201                                       | 3.300 | 3.399 | 0.22                  | 0.29 |
| RP154x015x   | 1.480                               | 1.500 | 1.520 | 1.440                                       | 1.500 | 1.560 | 0.35                  | 0.44 | 2.475                               | 2.500 | 2.525 | 2.425                                       | 2.500 | 2.575 | 0.25                  | 0.30 |
| RP154x016x   | 1.480                               | 1.500 | 1.520 | 1.440                                       | 1.500 | 1.560 | 0.35                  | 0.44 | 2.970                               | 3.000 | 3.030 | 2.910                                       | 3.000 | 3.090 | 0.22                  | 0.29 |
| RP154x017x   | 2.475                               | 2.500 | 2.525 | 2.425                                       | 2.500 | 2.575 | 0.25                  | 0.30 | 2.970                               | 3.000 | 3.030 | 2.910                                       | 3.000 | 3.090 | 0.22                  | 0.29 |
| RP154x018x   | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 |
| RP154x019x   | 1.480                               | 1.500 | 1.520 | 1.440                                       | 1.500 | 1.560 | 0.35                  | 0.44 | 2.574                               | 2.600 | 2.626 | 2.522                                       | 2.600 | 2.678 | 0.25                  | 0.30 |
| RP154x020x   | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 |
| RP154x021x   | 1.180                               | 1.200 | 1.220 | 1.140                                       | 1.200 | 1.260 | 0.39                  | 0.50 | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 |
| RP154x022x   | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 | 1.180                               | 1.200 | 1.220 | 1.140                                       | 1.200 | 1.260 | 0.39                  | 0.50 |
| RP154x023x   | 2.475                               | 2.500 | 2.525 | 2.425                                       | 2.500 | 2.575 | 0.25                  | 0.30 | 2.475                               | 2.500 | 2.525 | 2.425                                       | 2.500 | 2.575 | 0.25                  | 0.30 |
| RP154x024x   | 3.267                               | 3.300 | 3.333 | 3.201                                       | 3.300 | 3.399 | 0.22                  | 0.29 | 2.970                               | 3.000 | 3.030 | 2.910                                       | 3.000 | 3.090 | 0.22                  | 0.29 |
| RP154x025x   | 2.970                               | 3.000 | 3.030 | 2.910                                       | 3.000 | 3.090 | 0.22                  | 0.29 | 2.970                               | 3.000 | 3.030 | 2.910                                       | 3.000 | 3.090 | 0.22                  | 0.29 |

RP154xxxxx Product-specific Electrical Characteristics

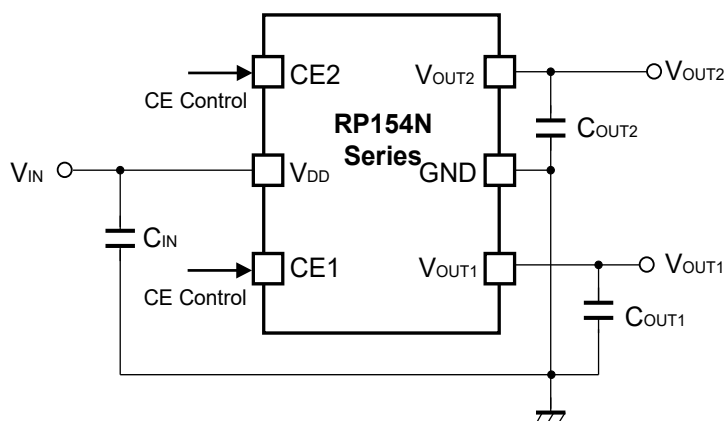
| Product Name | VR1                                 |       |       |   |       |       |                       |      | VR2                                 |       |       |   |       |       |                       |      |
|--------------|-------------------------------------|-------|-------|---|-------|-------|-----------------------|------|-------------------------------------|-------|-------|---|-------|-------|-----------------------|------|
|              | V <sub>OUT</sub> [V]<br>(Ta = 25°C) |       |       | V <sub>OUT</sub> [V]<br>(-40°C ≤ Ta ≤ 85°C) |       |       | ΔV <sub>DIF</sub> [V] |      | V <sub>OUT</sub> [V]<br>(Ta = 25°C) |       |       | V <sub>OUT</sub> [V]<br>(-40°C ≤ Ta ≤ 85°C) |       |       | ΔV <sub>DIF</sub> [V] |      |
|              | Min.                                | Typ.  | Max.  | Min.  | Typ.  | Max.  | Typ.                  | Max. | Min.                                | Typ.  | Max.  | Min.  | Typ.  | Max.  | Typ.                  | Max. |
| RP154x026x   | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 | 3.069                               | 3.100 | 3.131 | 3.007                                       | 3.100 | 3.193 | 0.22                  | 0.29 |
| RP154x027x   | 2.277                               | 2.300 | 2.323 | 2.231                                       | 2.300 | 2.369 | 0.26                  | 0.34 | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 |
| RP154x028x   | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 | 0.980                               | 1.000 | 1.020 | 0.940                                       | 1.000 | 1.060 | 0.46                  | 0.59 |
| RP154x029x   | 1.480                               | 1.500 | 1.520 | 1.440                                       | 1.500 | 1.560 | 0.35                  | 0.44 | 1.480                               | 1.500 | 1.520 | 1.440                                       | 1.500 | 1.560 | 0.35                  | 0.44 |
| RP154x030x   | 1.180                               | 1.200 | 1.220 | 1.140                                       | 1.200 | 1.260 | 0.39                  | 0.50 | 2.871                               | 2.900 | 2.929 | 2.813                                       | 2.900 | 2.987 | 0.25                  | 0.30 |
| RP154x031x   | 2.624                               | 2.650 | 2.676 | 2.571                                       | 2.650 | 2.729 | 0.25                  | 0.30 | 2.822                               | 2.850 | 2.878 | 2.765                                       | 2.850 | 2.935 | 0.25                  | 0.30 |
| RP154x032x   | 3.267                               | 3.300 | 3.333 | 3.201                                       | 3.300 | 3.399 | 0.22                  | 0.29 | 2.822                               | 2.850 | 2.878 | 2.765                                       | 2.850 | 2.935 | 0.25                  | 0.30 |
| RP154x033x   | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 | 2.871                               | 2.900 | 2.929 | 2.813                                       | 2.900 | 2.987 | 0.25                  | 0.30 |
| RP154x034x   | 3.069                               | 3.100 | 3.131 | 3.007                                       | 3.100 | 3.193 | 0.22                  | 0.29 | 3.069                               | 3.100 | 3.131 | 3.007                                       | 3.100 | 3.193 | 0.22                  | 0.29 |
| RP154x035x   | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 | 2.673                               | 2.700 | 2.727 | 2.619                                       | 2.700 | 2.781 | 0.25                  | 0.30 |
| RP154x036x   | 0.980                               | 1.000 | 1.020 | 0.940                                       | 1.000 | 1.060 | 0.46                  | 0.59 | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 |
| RP154x037x   | 1.180                               | 1.200 | 1.220 | 1.140                                       | 1.200 | 1.260 | 0.39                  | 0.50 | 2.475                               | 2.500 | 2.525 | 2.425                                       | 2.500 | 2.575 | 0.25                  | 0.30 |
| RP154x038x   | 1.680                               | 1.700 | 1.720 | 1.640                                       | 1.700 | 1.760 | 0.30                  | 0.39 | 3.069                               | 3.100 | 3.131 | 3.007                                       | 3.100 | 3.193 | 0.22                  | 0.29 |
| RP154x039x   | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 | 2.475                               | 2.500 | 2.525 | 2.425                                       | 2.500 | 2.575 | 0.25                  | 0.30 |
| RP154x040x   | 1.480                               | 1.500 | 1.520 | 1.440                                       | 1.500 | 1.560 | 0.35                  | 0.44 | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 |
| RP154x041x   | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 | 2.673                               | 2.700 | 2.727 | 2.619                                       | 2.700 | 2.781 | 0.25                  | 0.30 |
| RP154x042x   | 2.673                               | 2.700 | 2.727 | 2.619                                       | 2.700 | 2.781 | 0.25                  | 0.30 | 2.673                               | 2.700 | 2.727 | 2.619                                       | 2.700 | 2.781 | 0.25                  | 0.30 |
| RP154x043x   | 2.871                               | 2.900 | 2.929 | 2.813                                       | 2.900 | 2.987 | 0.25                  | 0.30 | 2.871                               | 2.900 | 2.929 | 2.813                                       | 2.900 | 2.987 | 0.25                  | 0.30 |
| RP154x044x   | 1.680                               | 1.700 | 1.720 | 1.640                                       | 1.700 | 1.760 | 0.30                  | 0.39 | 2.970                               | 3.000 | 3.030 | 2.910                                       | 3.000 | 3.090 | 0.22                  | 0.29 |
| RP154x045x   | 1.730                               | 1.750 | 1.770 | 1.690                                       | 1.750 | 1.810 | 0.30                  | 0.39 | 2.970                               | 3.000 | 3.030 | 2.910                                       | 3.000 | 3.090 | 0.22                  | 0.29 |
| RP154x046x   | 2.970                               | 3.000 | 3.030 | 2.910                                       | 3.000 | 3.090 | 0.22                  | 0.29 | 3.069                               | 3.100 | 3.131 | 3.007                                       | 3.100 | 3.193 | 0.22                  | 0.29 |
| RP154x047x   | 1.730                               | 1.750 | 1.770 | 1.690                                       | 1.750 | 1.810 | 0.30                  | 0.39 | 3.069                               | 3.100 | 3.131 | 3.007                                       | 3.100 | 3.193 | 0.22                  | 0.29 |
| RP154x048x   | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 | 3.069                               | 3.100 | 3.131 | 3.007                                       | 3.100 | 3.193 | 0.22                  | 0.29 |
| RP154x049x   | 2.475                               | 2.500 | 2.525 | 2.425                                       | 2.500 | 2.575 | 0.25                  | 0.30 | 3.069                               | 3.100 | 3.131 | 3.007                                       | 3.100 | 3.193 | 0.22                  | 0.29 |
| RP154x050x   | 3.069                               | 3.100 | 3.131 | 3.007                                       | 3.100 | 3.193 | 0.22                  | 0.29 | 3.267                               | 3.300 | 3.333 | 3.201                                       | 3.300 | 3.399 | 0.22                  | 0.29 |

RP154xxxxx Product-specific Electrical Characteristics

| Product Name | VR1                                 |       |       |   |       |       |                       |      | VR2                                 |       |       |   |       |       |                       |      |
|--------------|-------------------------------------|-------|-------|---|-------|-------|-----------------------|------|-------------------------------------|-------|-------|---|-------|-------|-----------------------|------|
|              | V <sub>OUT</sub> [V]<br>(Ta = 25°C) |       |       | V <sub>OUT</sub> [V]<br>(-40°C ≤ Ta ≤ 85°C) |       |       | ΔV <sub>DIF</sub> [V] |      | V <sub>OUT</sub> [V]<br>(Ta = 25°C) |       |       | V <sub>OUT</sub> [V]<br>(-40°C ≤ Ta ≤ 85°C) |       |       | ΔV <sub>DIF</sub> [V] |      |
|              | Min.                                | Typ.  | Max.  | Min.  | Typ.  | Max.  | Typ.                  | Max. | Min.                                | Typ.  | Max.  | Min.  | Typ.  | Max.  | Typ.                  | Max. |
| RP154x051x   | 3.564                               | 3.600 | 3.636 | 3.492                                       | 3.600 | 3.708 | 0.22                  | 0.29 | 3.564                               | 3.600 | 3.636 | 3.492                                       | 3.600 | 3.708 | 0.22                  | 0.29 |
| RP154x052x   | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 | 2.970                               | 3.000 | 3.030 | 2.910                                       | 3.000 | 3.090 | 0.22                  | 0.29 |
| RP154x053x   | 2.822                               | 2.850 | 2.878 | 2.765                                       | 2.850 | 2.935 | 0.25                  | 0.30 | 3.069                               | 3.100 | 3.131 | 3.007                                       | 3.100 | 3.193 | 0.22                  | 0.29 |
| RP154x054x   | 1.180                               | 1.200 | 1.220 | 1.140                                       | 1.200 | 1.260 | 0.39                  | 0.50 | 1.180                               | 1.200 | 1.220 | 1.140                                       | 1.200 | 1.260 | 0.39                  | 0.50 |
| RP154x055x   | 3.663                               | 3.700 | 3.737 | 3.589                                       | 3.700 | 3.811 | 0.22                  | 0.29 | 3.663                               | 3.700 | 3.737 | 3.589                                       | 3.700 | 3.811 | 0.22                  | 0.29 |
| RP154x056x   | 1.080                               | 1.100 | 1.120 | 1.040                                       | 1.100 | 1.160 | 0.46                  | 0.59 | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 |
| RP154x057x   | 1.080                               | 1.100 | 1.120 | 1.040                                       | 1.100 | 1.160 | 0.46                  | 0.59 | 1.180                               | 1.200 | 1.220 | 1.140                                       | 1.200 | 1.260 | 0.39                  | 0.50 |
| RP154x058x   | 0.980                               | 1.000 | 1.020 | 0.940                                       | 1.000 | 1.060 | 0.46                  | 0.59 | 3.267                               | 3.300 | 3.333 | 3.201                                       | 3.300 | 3.399 | 0.22                  | 0.29 |
| RP154x059x   | 0.880                               | 0.900 | 0.920 | 0.840                                       | 0.900 | 0.960 | 0.51                  | 0.65 | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 |
| RP154x060x   | 0.880                               | 0.900 | 0.920 | 0.840                                       | 0.900 | 0.960 | 0.51                  | 0.65 | 0.880                               | 0.900 | 0.920 | 0.840                                       | 0.900 | 0.960 | 0.51                  | 0.65 |
| RP154x061x   | 1.180                               | 1.200 | 1.220 | 1.140                                       | 1.200 | 1.260 | 0.39                  | 0.50 | 2.970                               | 3.000 | 3.030 | 2.910                                       | 3.000 | 3.090 | 0.22                  | 0.29 |
| RP154x062x   | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 | 2.871                               | 2.900 | 2.929 | 2.813                                       | 2.900 | 2.987 | 0.25                  | 0.30 |
| RP154x063x   | 3.267                               | 3.300 | 3.333 | 3.201                                       | 3.300 | 3.399 | 0.22                  | 0.29 | 1.480                               | 1.500 | 1.520 | 1.440                                       | 1.500 | 1.560 | 0.35                  | 0.44 |
| RP154x064x   | 1.080                               | 1.100 | 1.120 | 1.040                                       | 1.100 | 1.160 | 0.46                  | 0.59 | 2.871                               | 2.900 | 2.929 | 2.813                                       | 2.900 | 2.987 | 0.25                  | 0.30 |
| RP154x065x   | 2.772                               | 2.800 | 2.828 | 2.716                                       | 2.800 | 2.884 | 0.25                  | 0.30 | 2.475                               | 2.500 | 2.525 | 2.425                                       | 2.500 | 2.575 | 0.25                  | 0.30 |
| RP154x066x   | 0.780                               | 0.800 | 0.820 | 0.740                                       | 0.800 | 0.860 | 0.56                  | 0.72 | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 |
| RP154x067x   | 3.267                               | 3.300 | 3.333 | 3.201                                       | 3.300 | 3.399 | 0.22                  | 0.29 | 2.475                               | 2.500 | 2.525 | 2.425                                       | 2.500 | 2.575 | 0.25                  | 0.30 |
| RP154x068x   | 1.280                               | 1.300 | 1.320 | 1.240                                       | 1.300 | 1.360 | 0.39                  | 0.50 | 1.780                               | 1.800 | 1.820 | 1.740                                       | 1.800 | 1.860 | 0.30                  | 0.39 |
| RP154x069x   | 1.680                               | 1.700 | 1.720 | 1.640                                       | 1.700 | 1.760 | 0.30                  | 0.39 | 1.480                               | 1.500 | 1.520 | 1.440                                       | 1.500 | 1.560 | 0.35                  | 0.44 |
| RP154x070x   | 1.180                               | 1.200 | 1.220 | 1.140                                       | 1.200 | 1.260 | 0.39                  | 0.50 | 1.280                               | 1.300 | 1.320 | 1.240                                       | 1.300 | 1.360 | 0.39                  | 0.50 |
| RP154x071x   | 1.080                               | 1.100 | 1.120 | 1.040                                       | 1.100 | 1.160 | 0.46                  | 0.59 | 3.267                               | 3.300 | 3.333 | 3.201                                       | 3.300 | 3.399 | 0.22                  | 0.29 |

## APPLICATION INFORMATION

### TYPICAL APPLICATION CIRCUIT

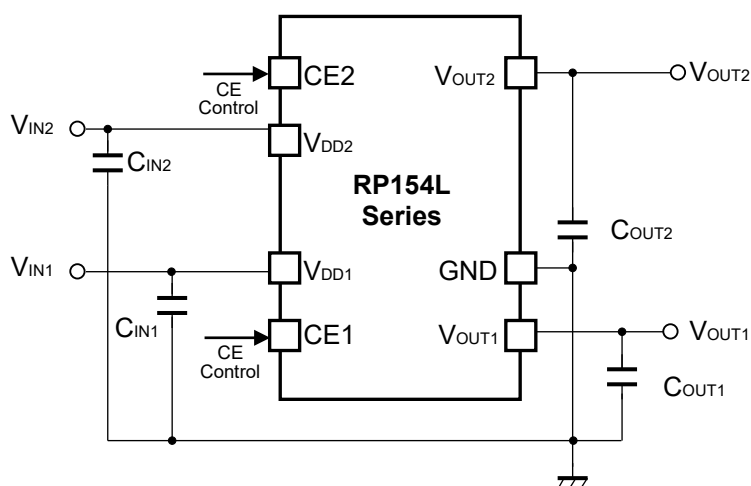


$C_{IN} = C_{OUT1} = C_{OUT2} = \text{Ceramic } 1.0 \mu\text{F}$

**RP154NxxxA/B Typical Application Circuit**

#### External Components

| Symbol               | Description  |
|----------------------|--|
| $C_{OUT1}, C_{OUT2}$ | Ceramic Capacitor, 1.0 $\mu\text{F}$ , Murata: GRM155B31A105KE15 |



$C_{IN1} = C_{IN2} = C_{OUT1} = C_{OUT2} = \text{Ceramic } 1.0 \mu\text{F}$

**RP154LxxxA/B Typical Application Circuit**

#### External Components

| Symbol               | Description  |
|----------------------|--|
| $C_{OUT1}, C_{OUT2}$ | Ceramic Capacitor, 1.0 $\mu\text{F}$ , Murata: GRM155B31A105KE15 |

## TECHNICAL NOTES

### Phase Compensation

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use capacitors (1.0  $\mu$ F or more) for  $C_{OUT1}$  and  $C_{OUT2}$  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 the tantalum capacitor is used and its ESR (Equivalent Series Resistance) is too large, the output may be unstable, therefore, fully evaluation is necessary.

### PCB Layout

Make VDD and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect capacitors with a capacitance value as much as 1.0  $\mu$ F or more between VDD and GND pin, and as close as possible to the pins ( $C_{IN1}$ /  $C_{IN2}$ ).

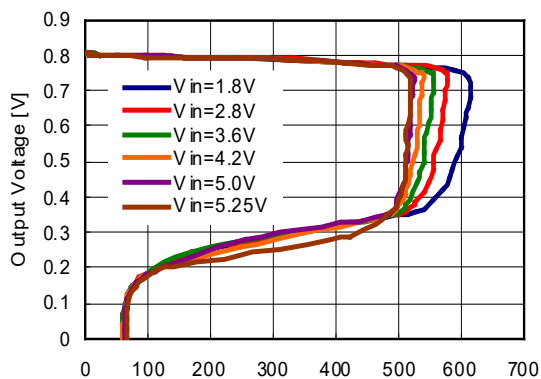
Set external components, especially the output capacitors, as close as possible to the ICs, and make wiring as short as possible ( $C_{OUT1}$ /  $C_{OUT2}$ ).

## TYPICAL CHARACTERISTICS

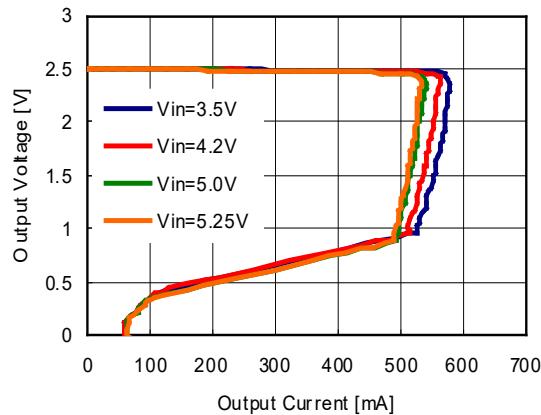
Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

### 1) Output Voltage vs. Output Current ( $C_{IN} = 1.0 \mu F$ , $C_{OUT1} = C_{OUT2} = 1.0 \mu F$ , $T_a = 25^\circ C$ )

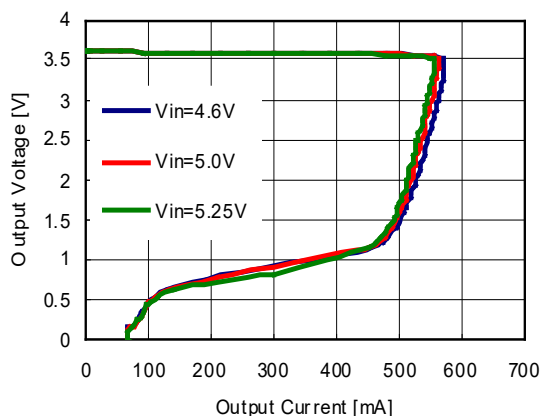
0.8V (VR1/VR2)



2.5V (VR1/VR2)

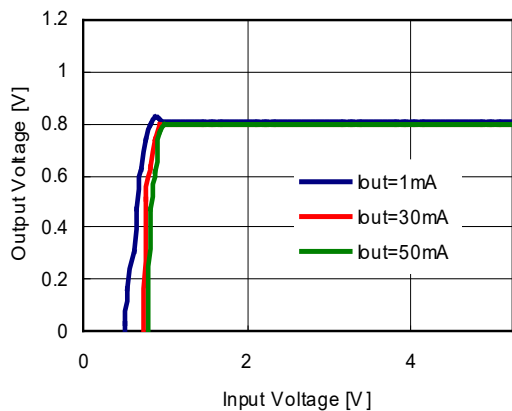


3.6V (VR1/VR2)

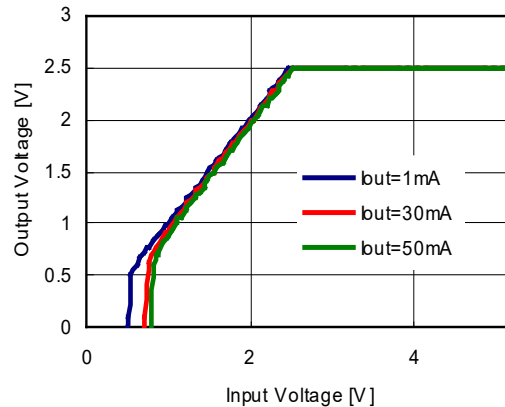


### 2) Output Voltage vs. Input Voltage ( $C_{IN} = 1.0 \mu F$ , $C_{OUT1} = C_{OUT2} = 1.0 \mu F$ , $T_a = 25^\circ C$ )

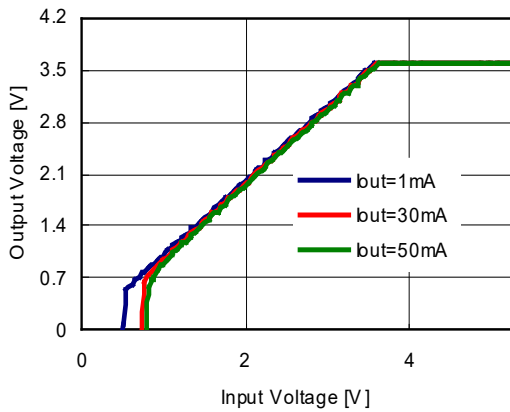
0.8V (VR1/VR2)



2.5V (VR1/VR2)

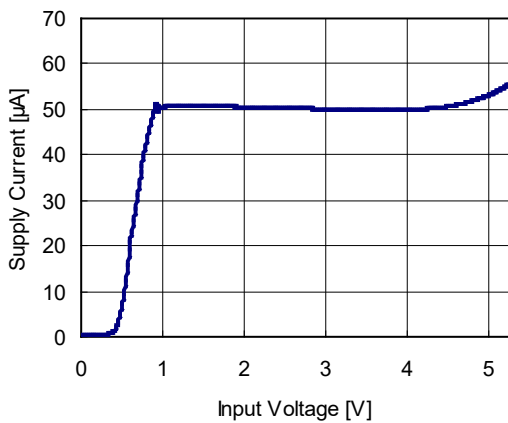


3.6V(VR1/VR2)

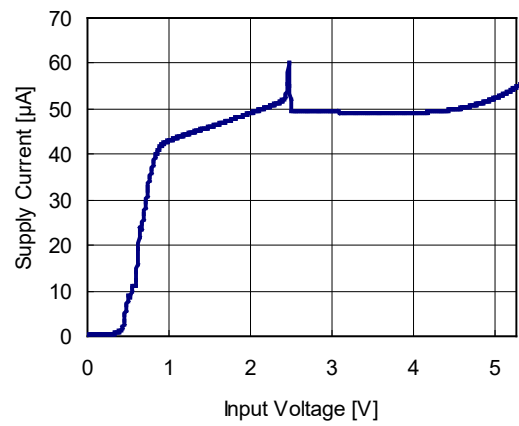


3) Supply Current vs. Input Voltage ( $C_{IN} = 1.0 \mu F$ ,  $C_{OUT1} = C_{OUT2} = 1.0 \mu F$ ,  $T_a = 25^\circ C$ )

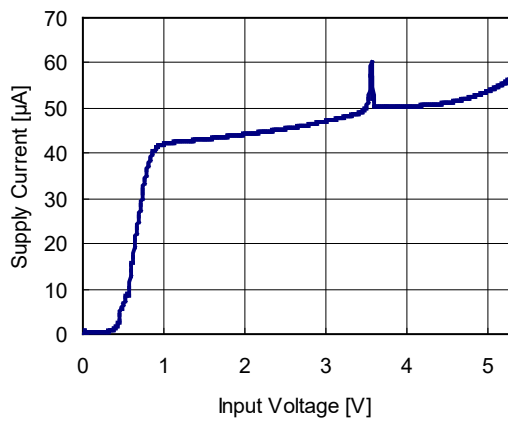
0.8V(VR1/VR2)



2.5V(VR1/VR2)

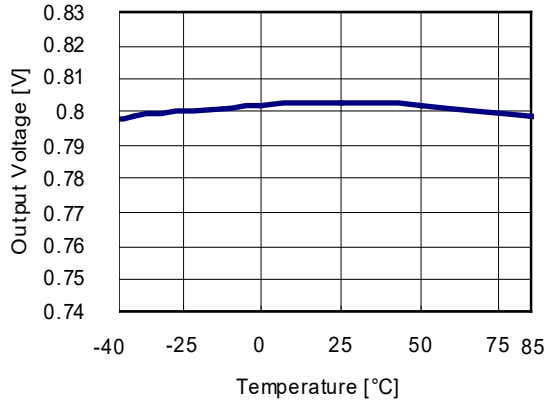


3.6V(VR1/VR2)

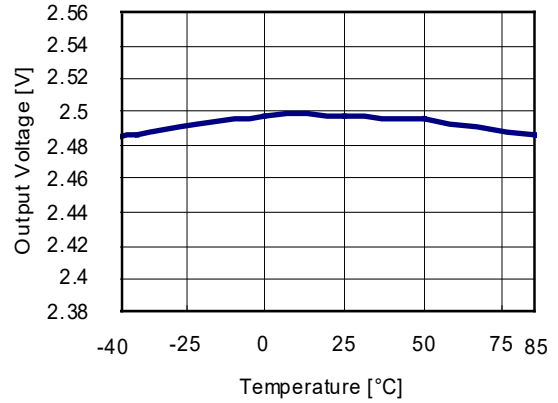


4) Output Voltage vs. Temperature ( $C_{IN} = 1.0 \mu F$ ,  $C_{OUT1} = C_{OUT2} = 1.0 \mu F$ ,  $I_{OUT} = 5 \text{ mA}$ )

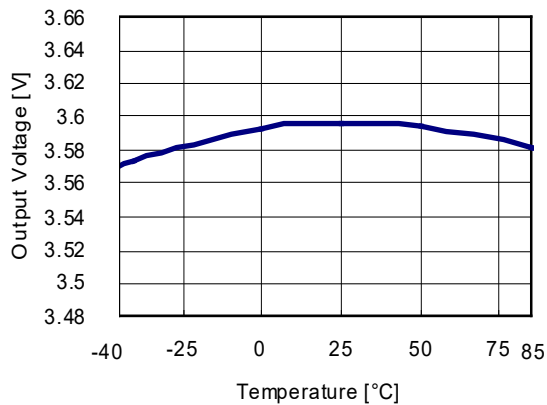
0.8V(VR1/VR2)



2.5V(VR1/VR2)

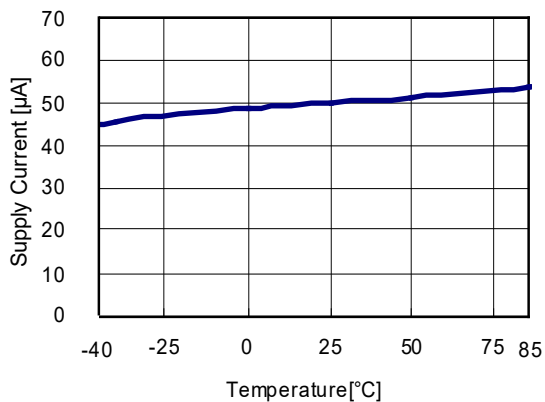


3.6V(VR1/VR2)

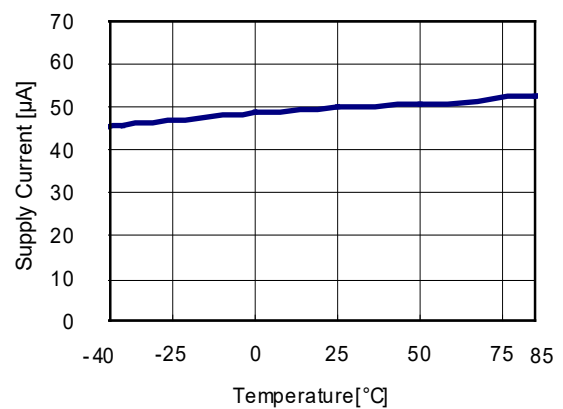


5) Supply Current vs. Temperature ( $C_{IN} = 1.0 \mu F$ ,  $C_{OUT1} = C_{OUT2} = 1.0 \mu F$ )

0.8V(VR1/VR2)

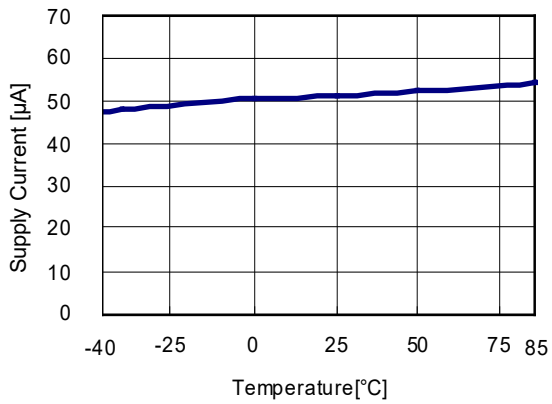


2.5V(VR1/VR2)



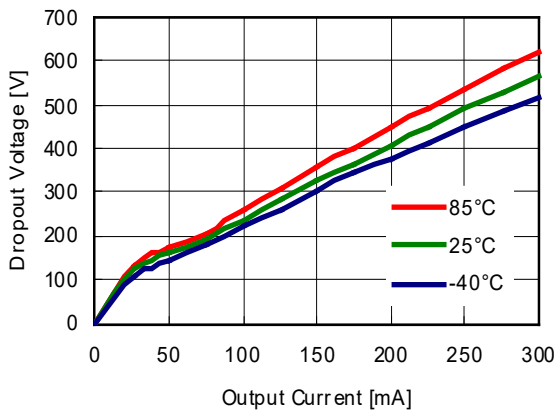


3.6V(VR1/VR2)

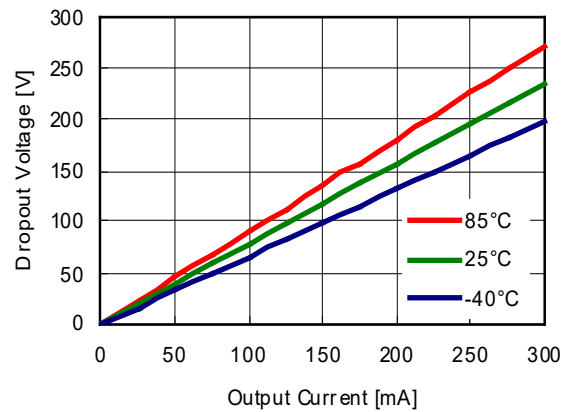


6) Dropout Voltage vs. Output Current ( $C_{IN} = 1.0 \mu F, C_{OUT1} = C_{OUT2} = 1.0 \mu F$ )

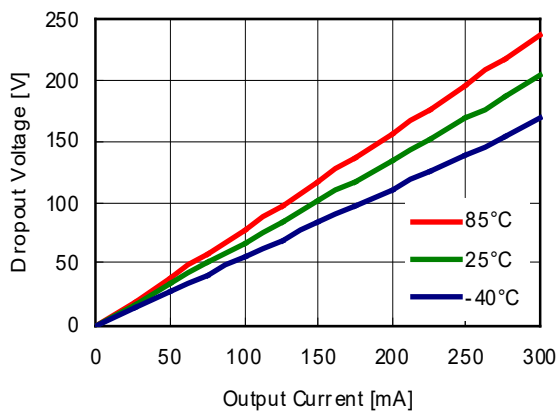
0.8V(VR1/VR2)



2.5V(VR1/VR2)

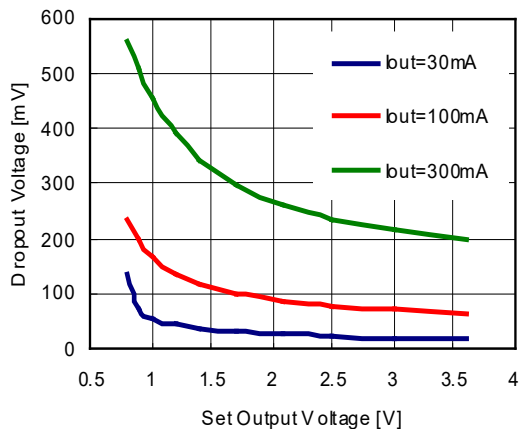


3.6V(VR1/VR2)



7) Dropout Voltage vs. Set Output Voltage

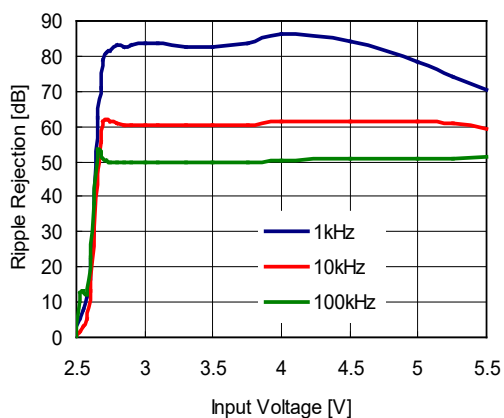
(VR1/VR2)



8) Ripple Rejection vs. Input Voltage (C<sub>IN</sub> = none, C<sub>OUT1</sub> = C<sub>OUT2</sub> = 1.0 μF, Ripple = 0.2 Vp-p, Ta = 25°C)

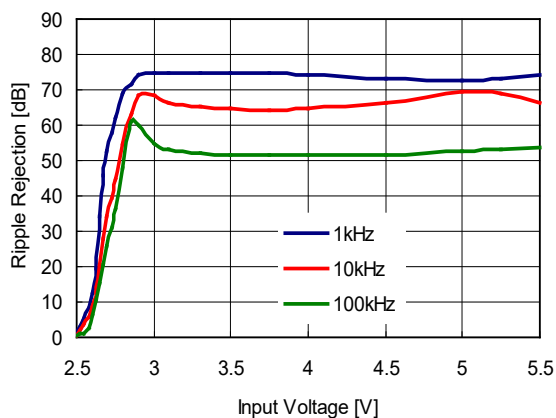
2.5V(VR1/VR2)

I<sub>out</sub>=1mA



2.5V(VR1/VR2)

I<sub>out</sub>=30mA

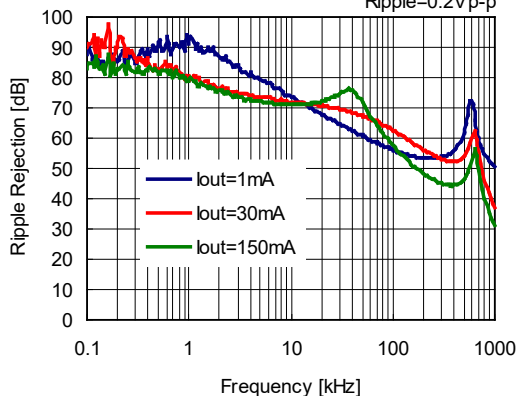


9) Ripple Rejection vs. Frequency (C<sub>IN</sub> = none, C<sub>OUT1</sub> = C<sub>OUT2</sub> = 1.0 μF, Ta = 25°C)

0.8V(VR1/VR2)

V<sub>in</sub>=3V

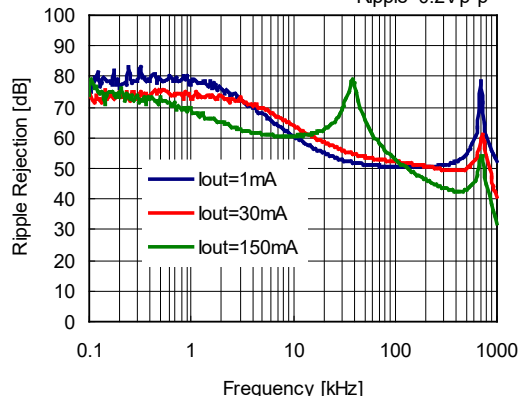
Ripple=0.2Vp-p

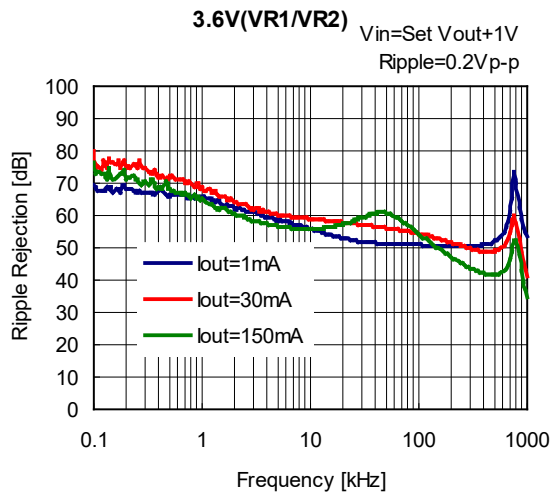


2.5V(VR1/VR2)

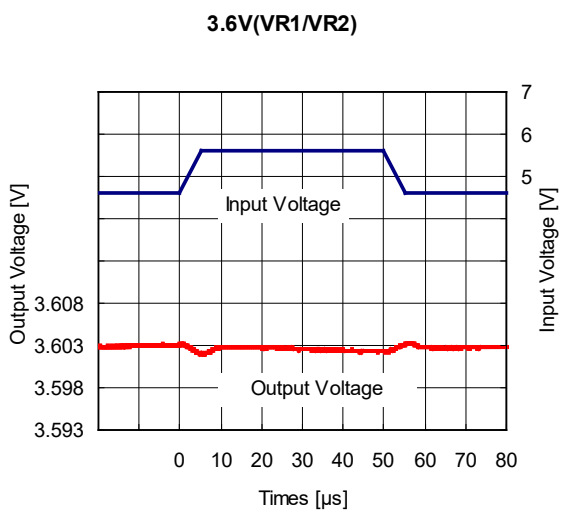
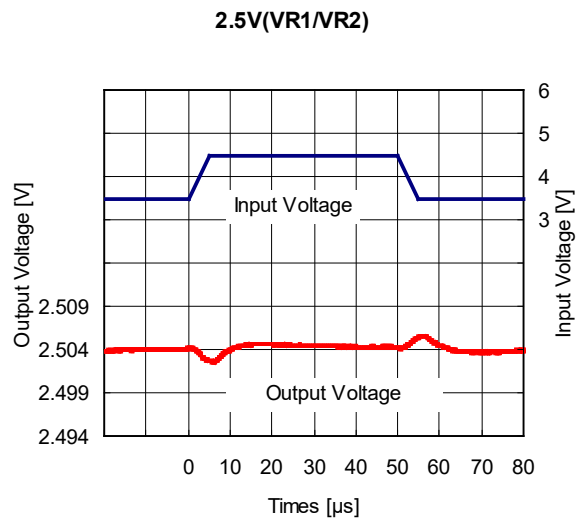
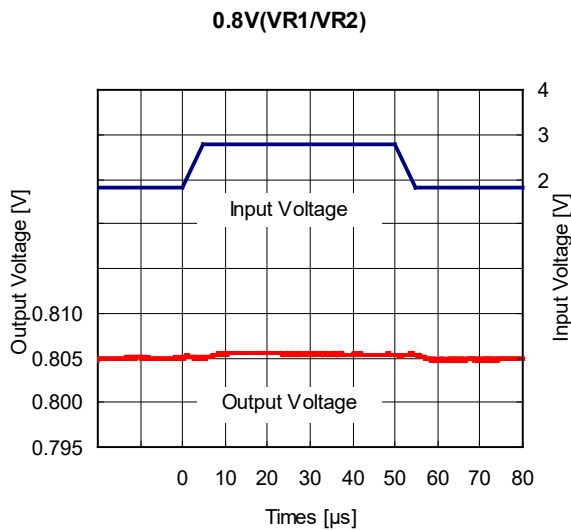
V<sub>in</sub>=Set Vout+1V

Ripple=0.2Vp-p

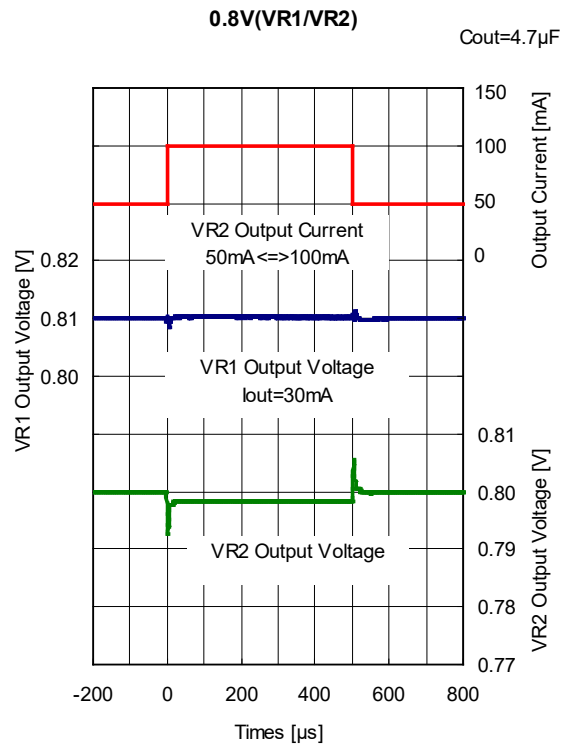
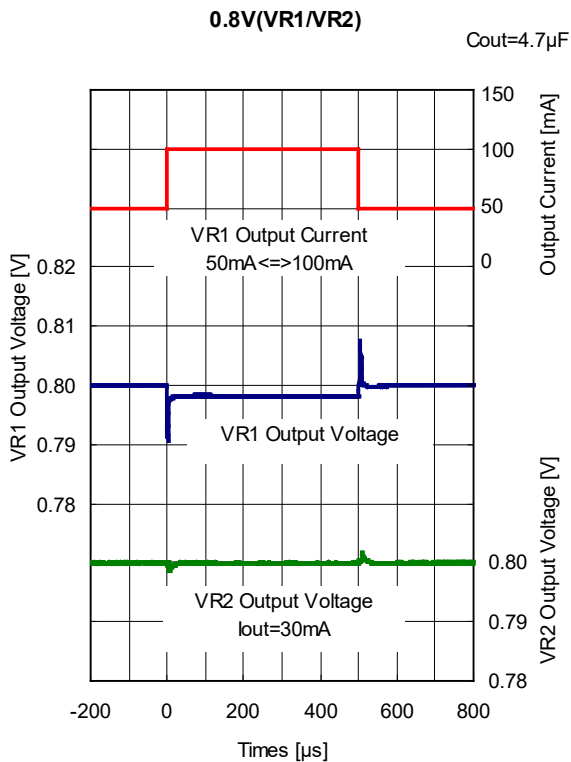
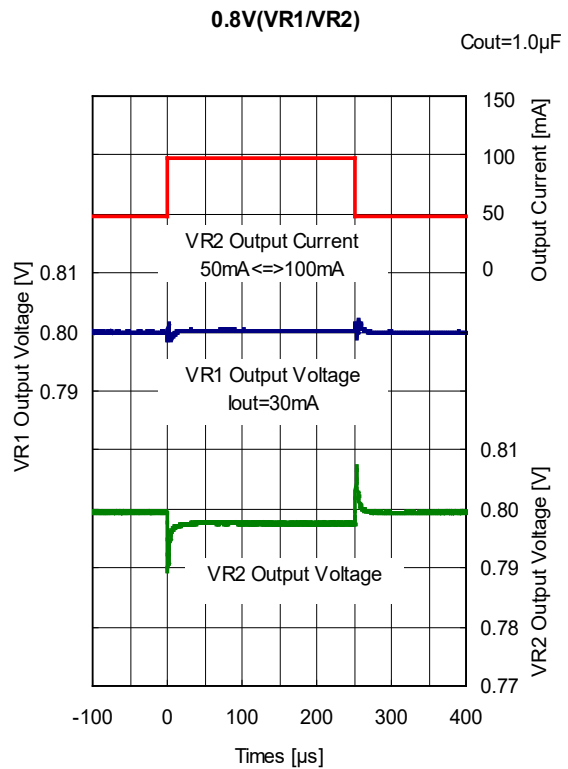
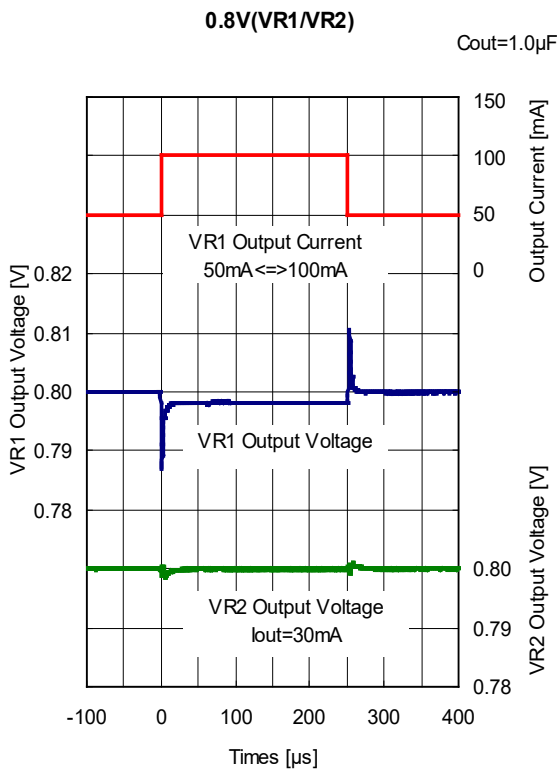


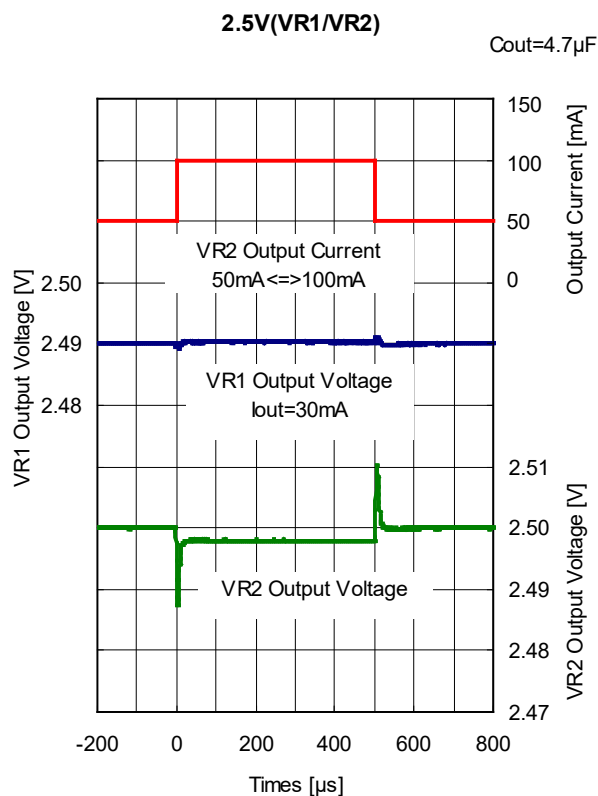
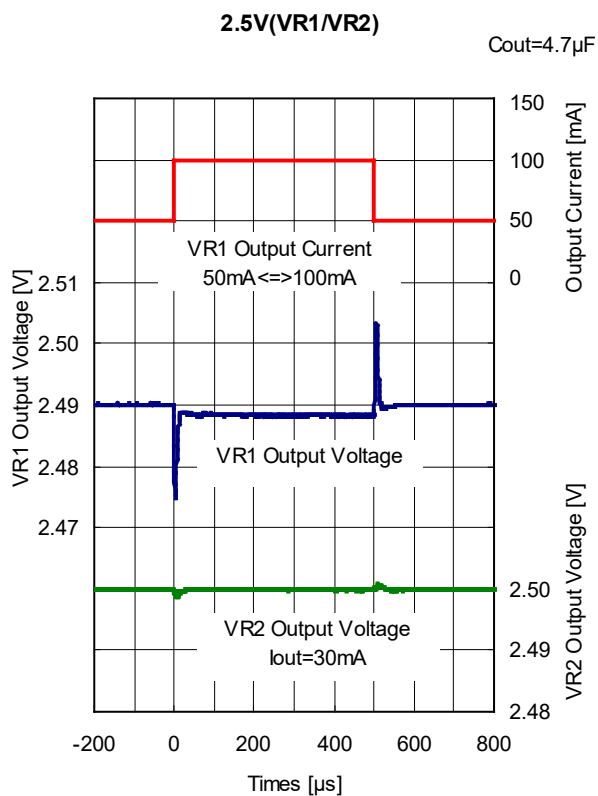
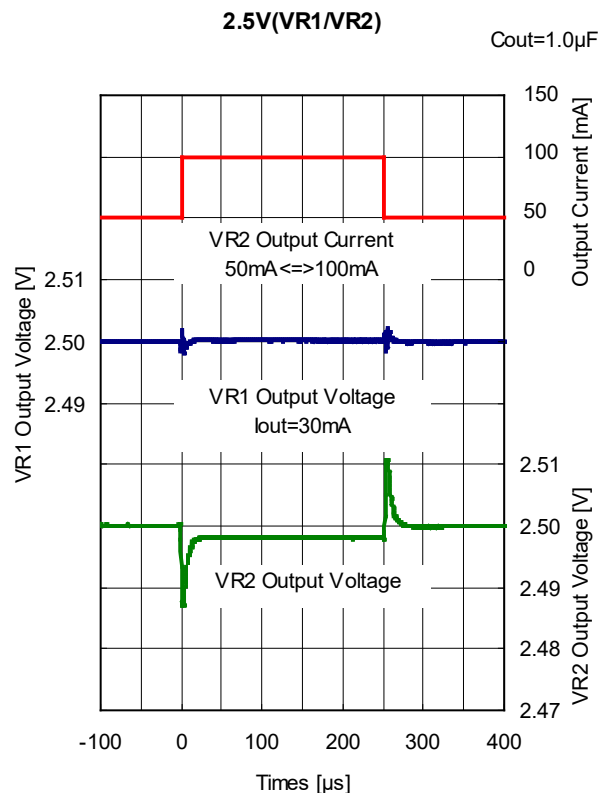
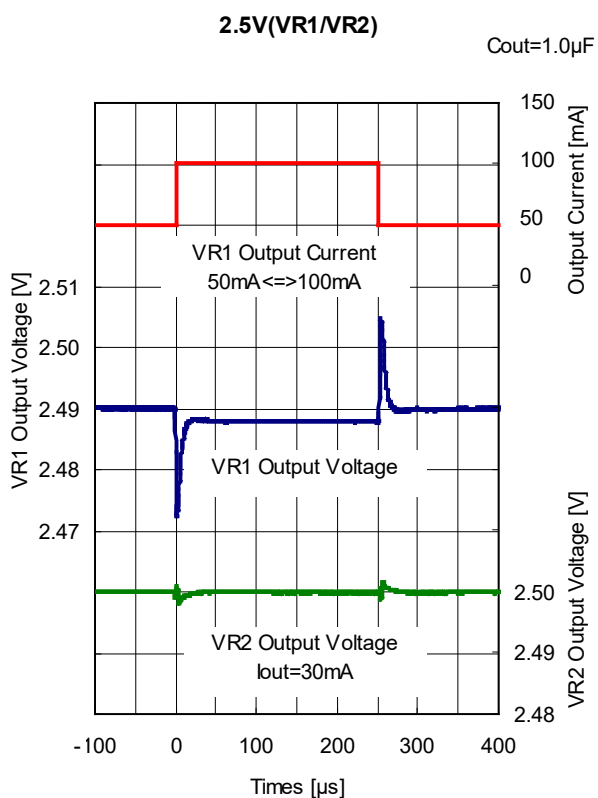


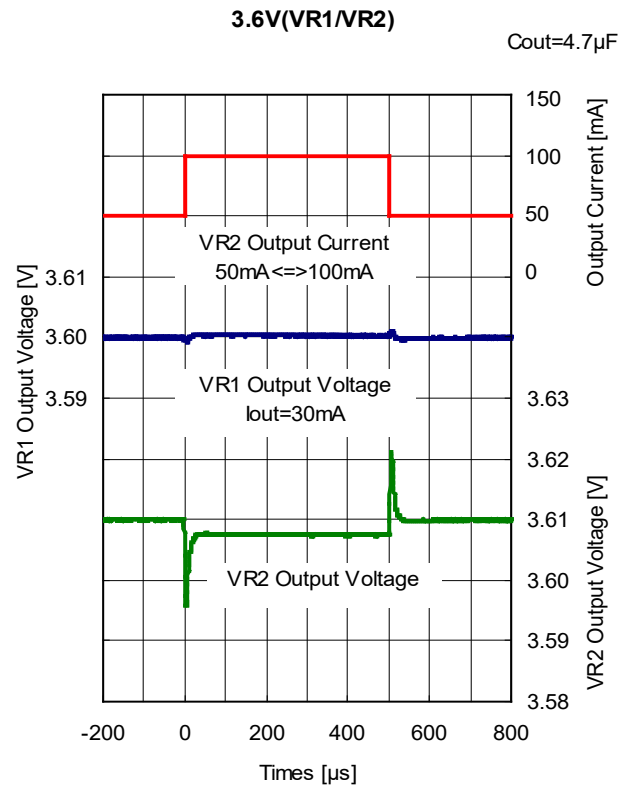
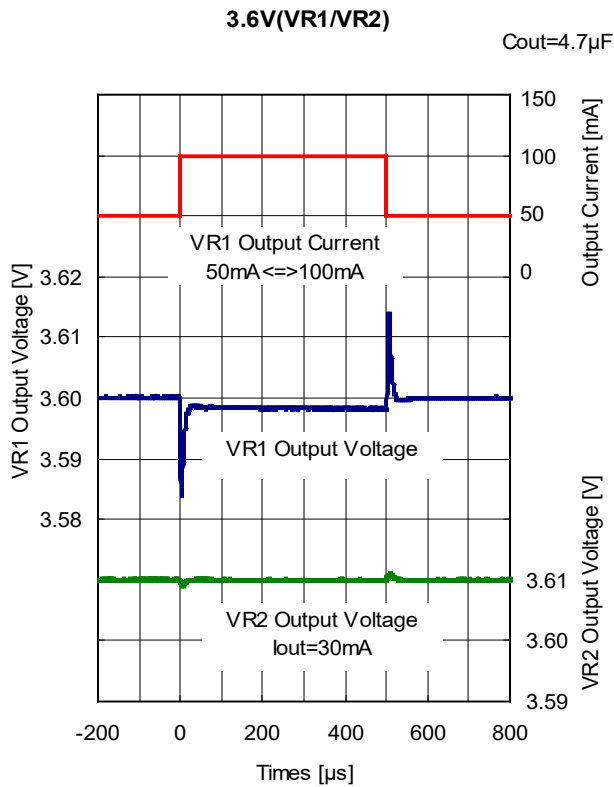
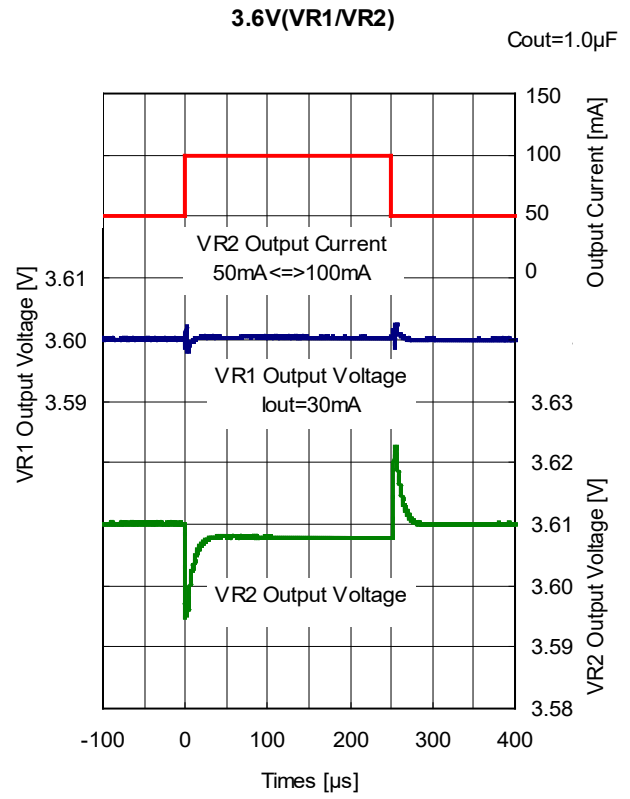
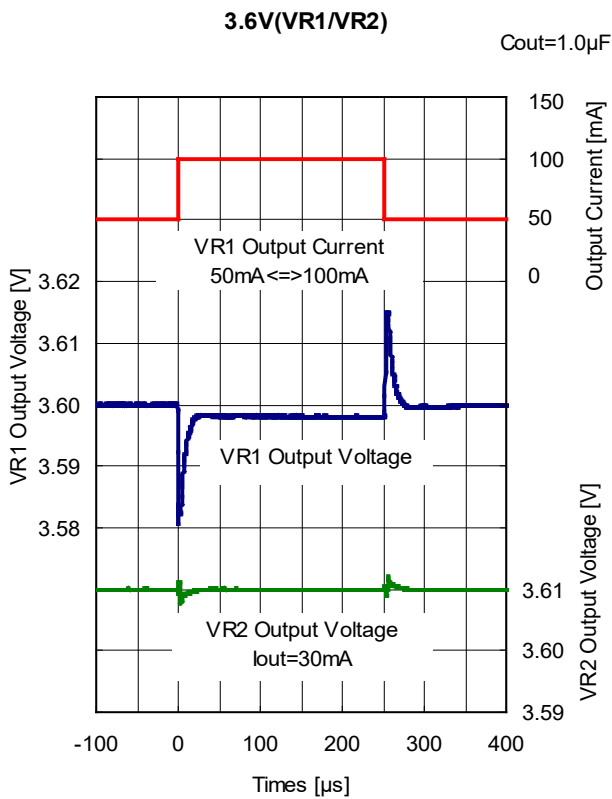
**10) Input Transient Response ( $C_{IN} = \text{none}$ ,  $C_{OUT1} = C_{OUT2} = 1.0 \mu F$ ,  $t_r = t_f = 5 \mu s$ ,  $T_a = 25^\circ C$ )**

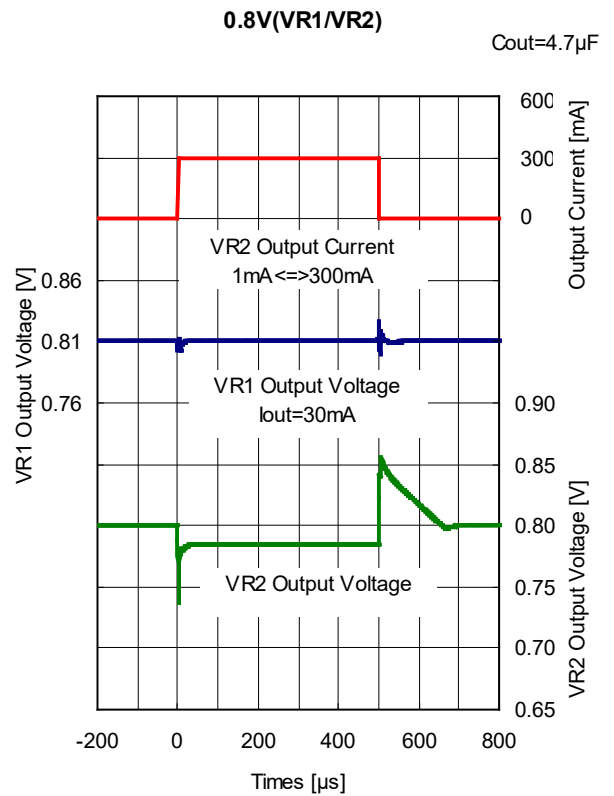
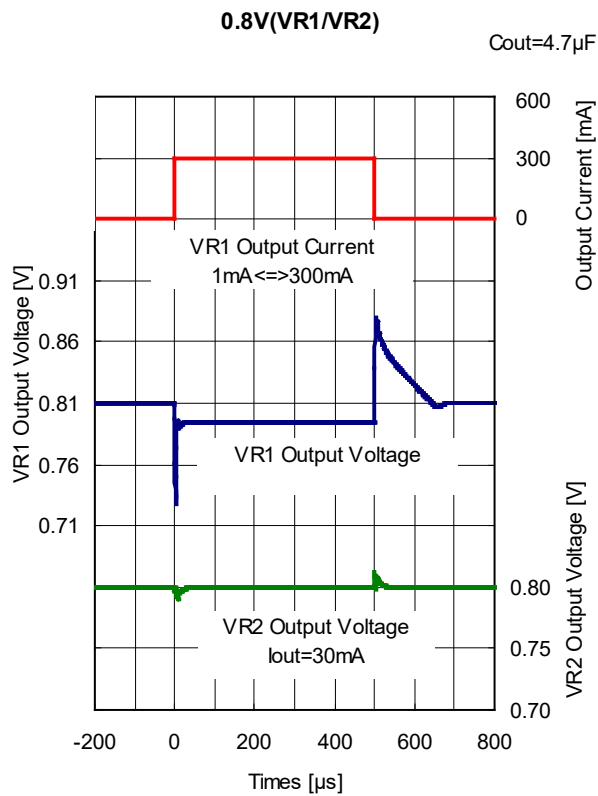
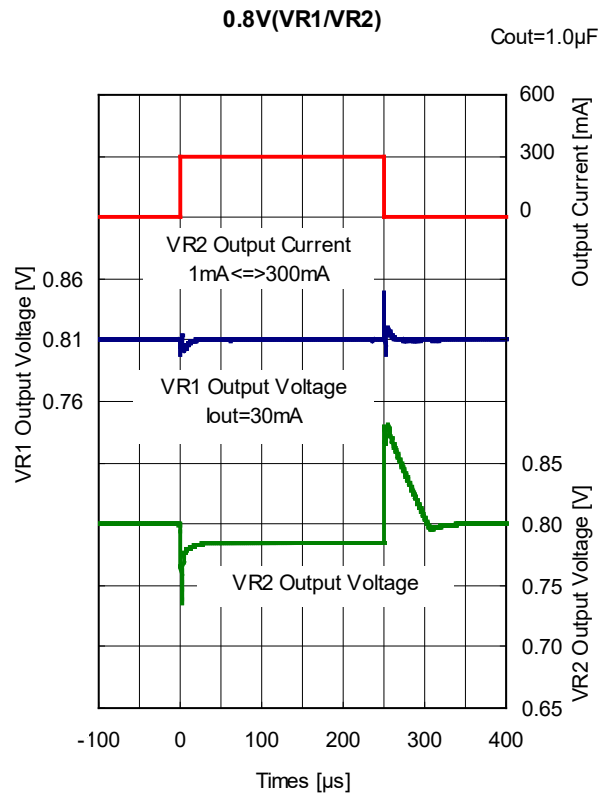
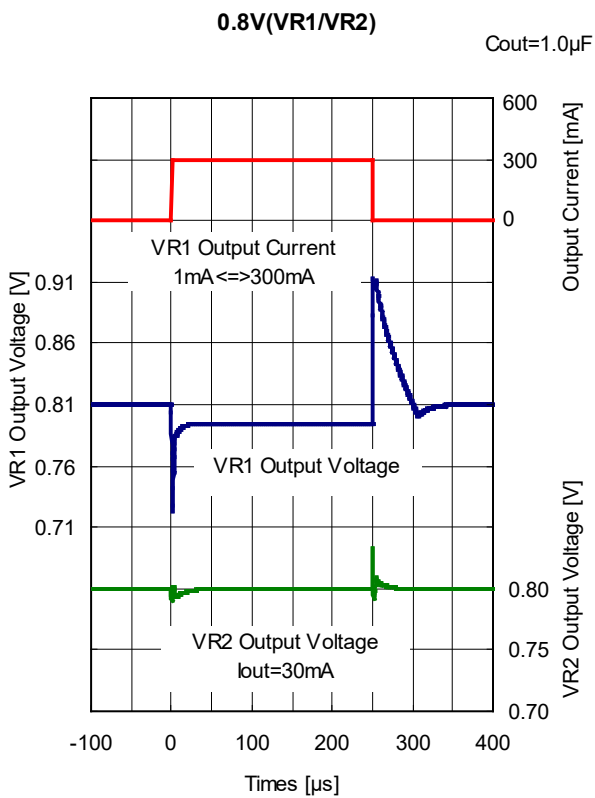


11) Load Transient Response ( $C_{IN} = 1.0 \mu F$ ,  $C_{OUT1} = C_{OUT2} = 1.0 \mu F$ ,  $t_r = t_f = 0.5 \mu s$ ,  $T_a = 25^\circ C$ )



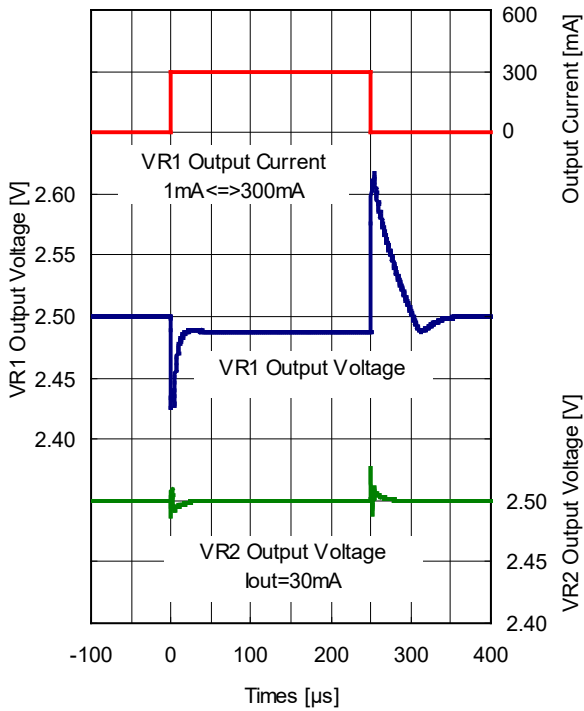






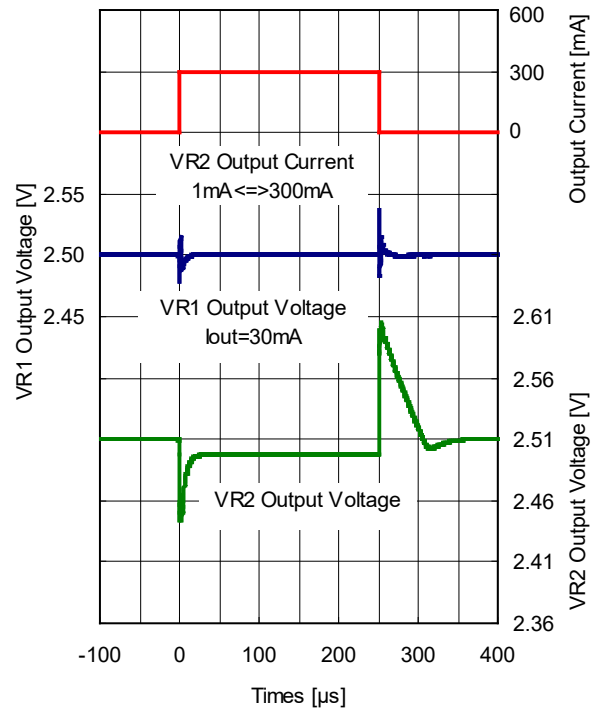
2.5V(VR1/VR2)

Cout=1.0μF



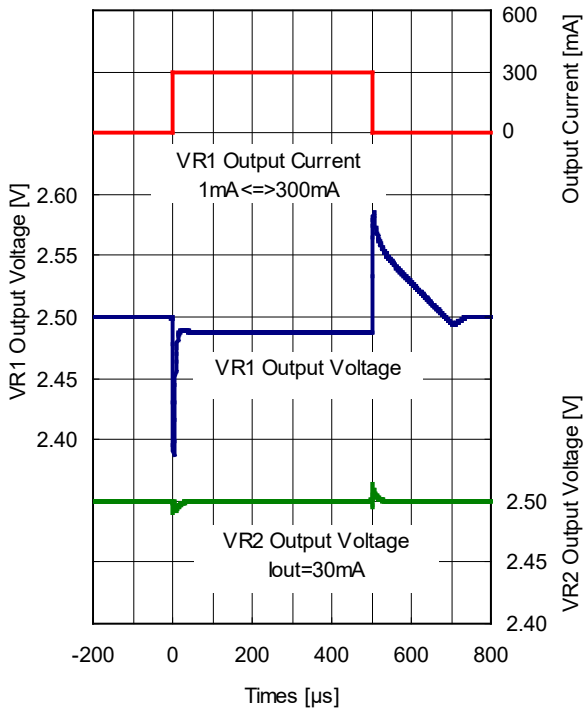
2.5V(VR1/VR2)

Cout=1.0μF



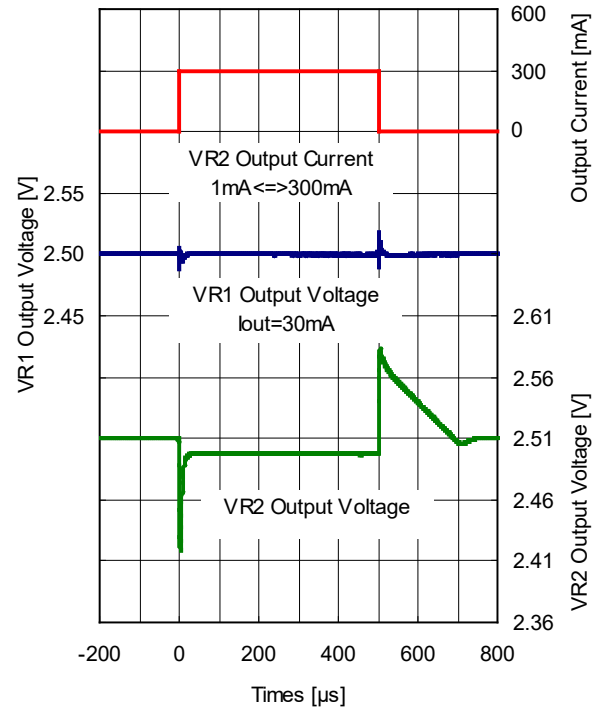
2.5V(VR1/VR2)

Cout=4.7μF

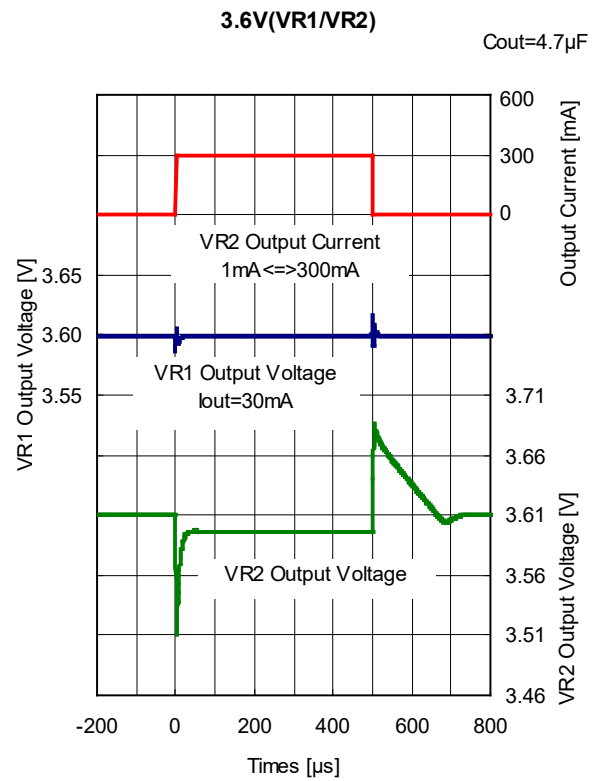
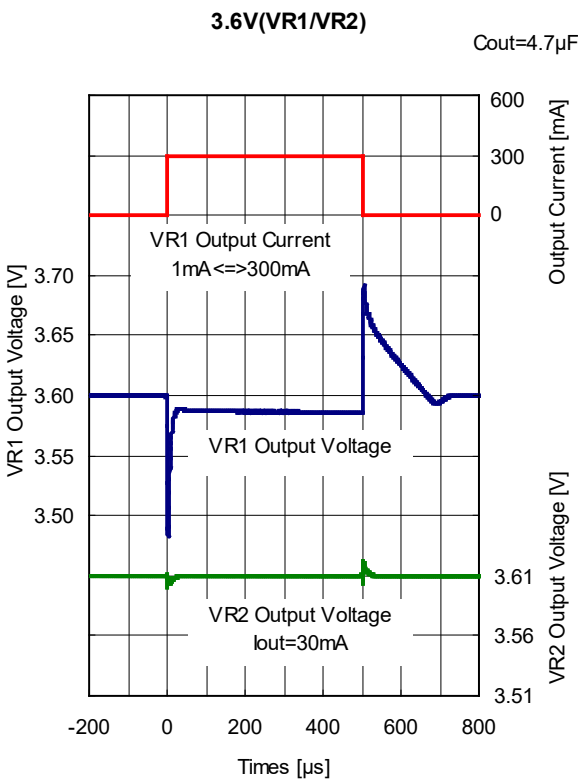
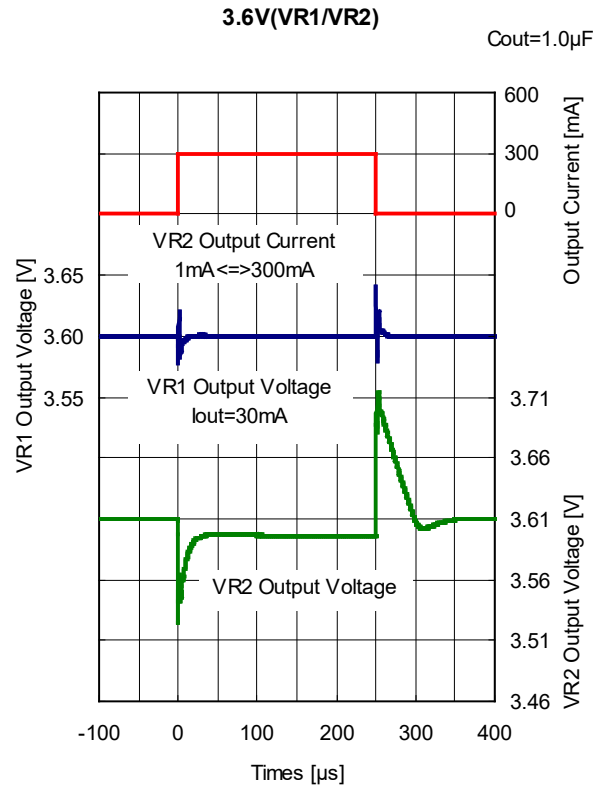
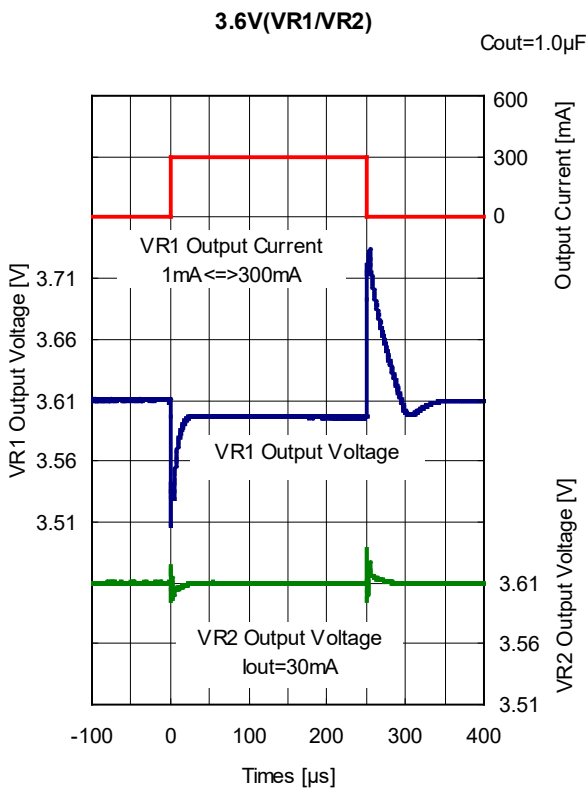


2.5V(VR1/VR2)

Cout=4.7μF

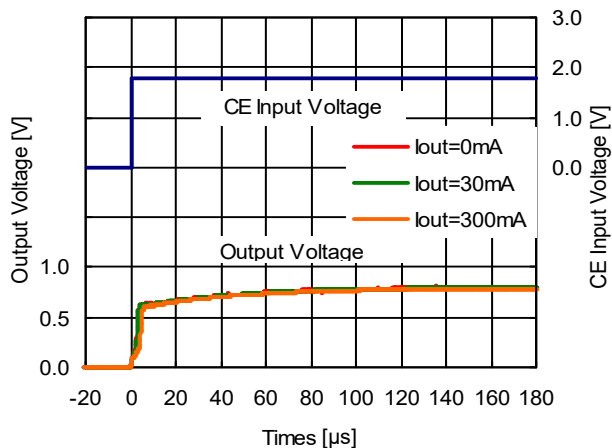




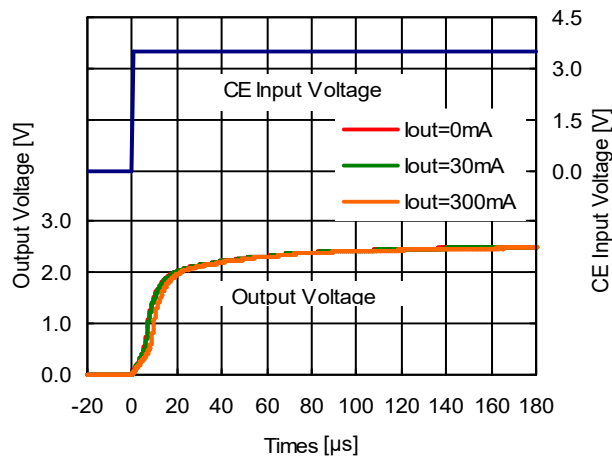


12) Turn On Speed with CE pin ( $C_{IN} = 1.0 \mu F$ ,  $C_{OUT1} = C_{OUT2} = 1.0 \mu F$ ,  $T_a = 25^\circ C$ )

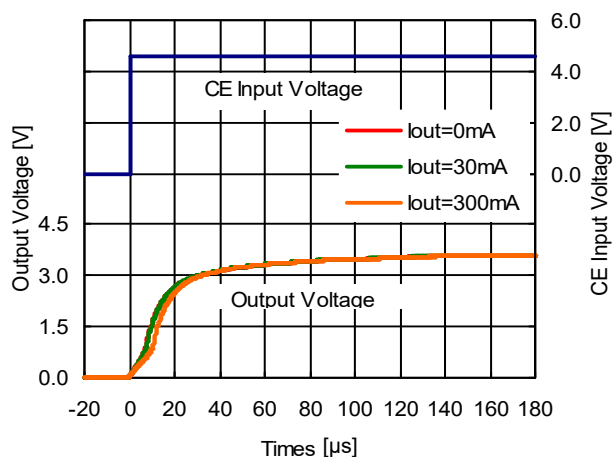
0.8V(VR1/VR2)



2.5V(VR1/VR2)

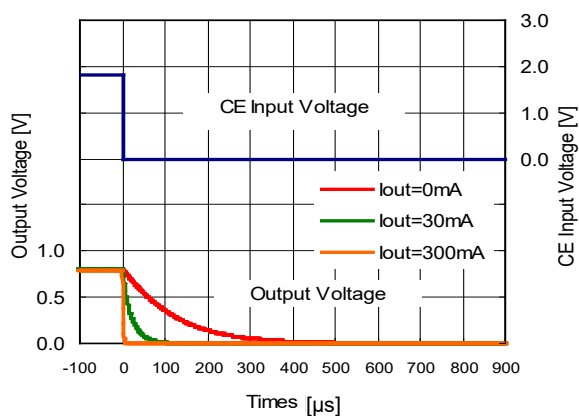


3.6V(VR1/VR2)

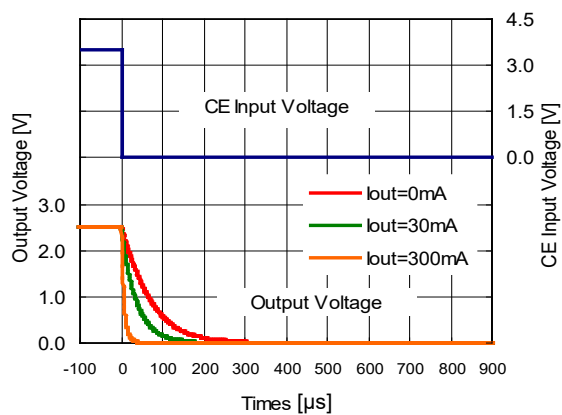


13) Turn Off Speed with CE pin (RP154xxxxB) ( $C_{IN} = 1.0 \mu F$ ,  $C_{OUT1} = C_{OUT2} = 1.0 \mu F$ ,  $T_a = 25^\circ C$ )

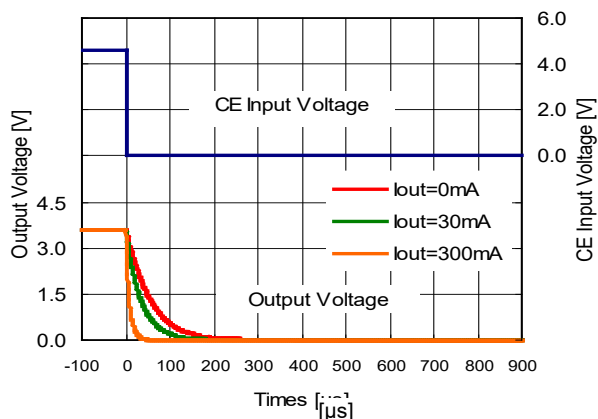
0.8V(VR1/VR2)



2.5V(VR1/VR2)

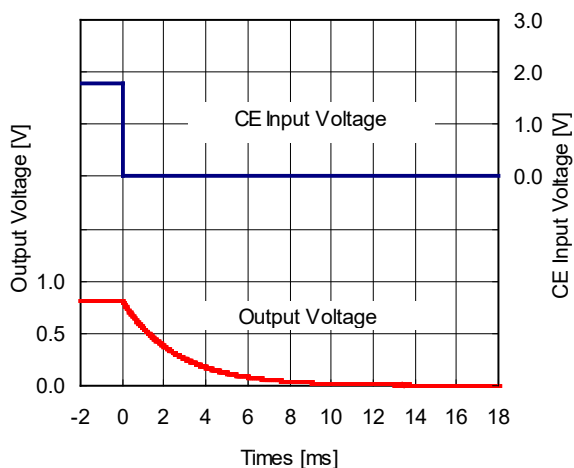


3.6V(VR1/VR2)

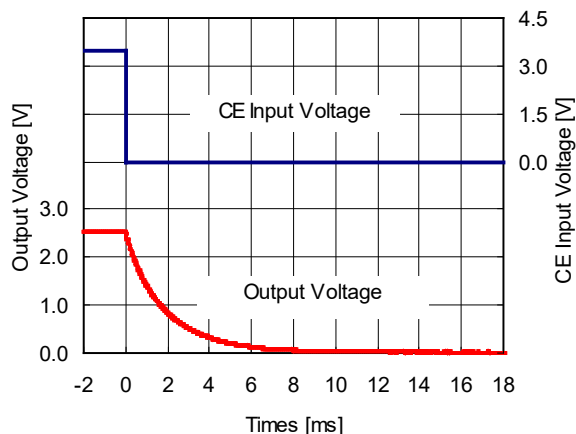


14) Turn Off Speed with CE pin (RP154xxxxA) (C<sub>IN</sub> = 1.0 μF, C<sub>OUT1</sub> = C<sub>OUT2</sub> = 1.0 μF, I<sub>OUT</sub> = 0 mA, Ta = 25°C)

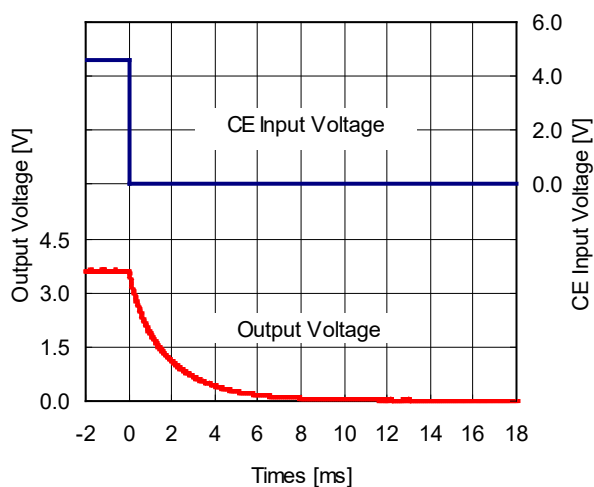
0.8V(VR1/VR2)



2.5V(VR1/VR2)



3.6V(VR1/VR2)



## 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  $40 \mu\text{V}$  (Avg.) are marked as the hatched area in the graph.

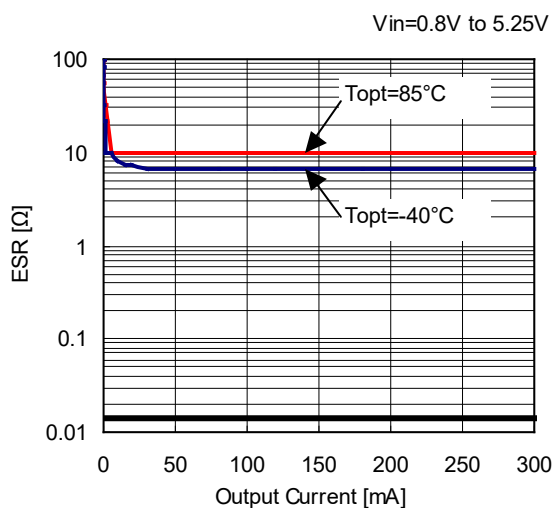
### Measurement conditions

Frequency Band: 10 Hz to 2 MHz

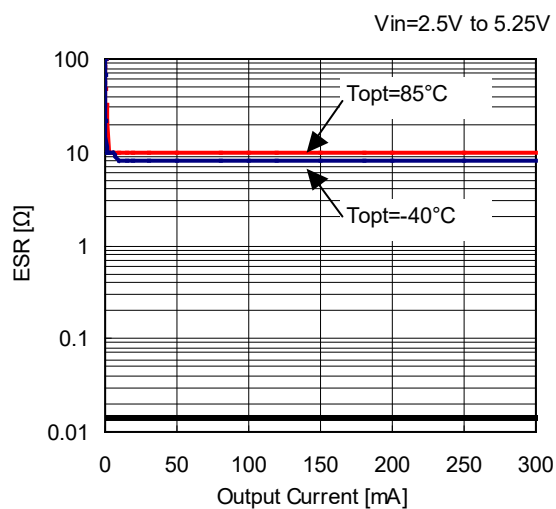
Temperature:  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$

$C_{IN}$ ,  $C_{OUT1}$ ,  $C_{OUT2}$ :  $1.0 \mu\text{F}$

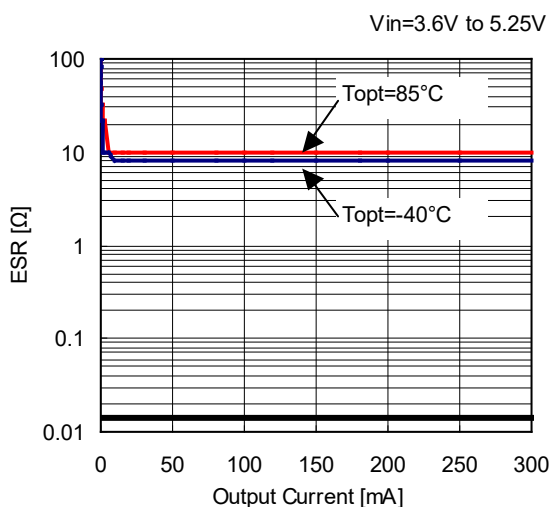
0.8V(VR1/VR2)



2.5V(VR1/VR2)



3.6V(VR1/VR2)



The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

**Measurement Conditions**

| Item             | Measurement Conditions   |
|------------------|--|
| Environment      | Mounting on Board (Wind Velocity = 0 m/s)  |
| Board Material   | Glass Cloth Epoxy Plastic (Four-Layer Board)   |
| Board Dimensions | 76.2 mm × 114.3 mm × 0.8 mm  |
| Copper Ratio     | Outer Layer (First Layer): Less than 95% of 50 mm Square<br>Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square<br>Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square |
| Through-holes    | φ 0.2 mm × 25 pcs  |

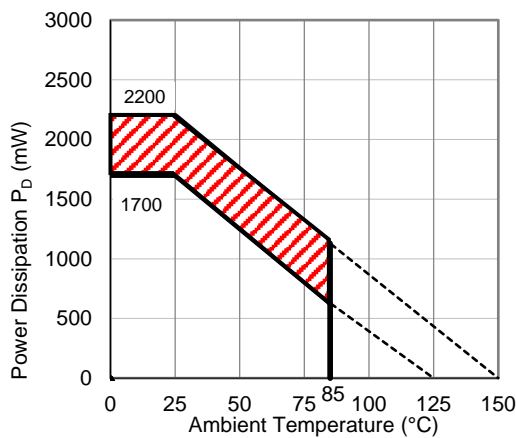
**Measurement Result**

(Ta = 25°C, Tjmax = 125°C)

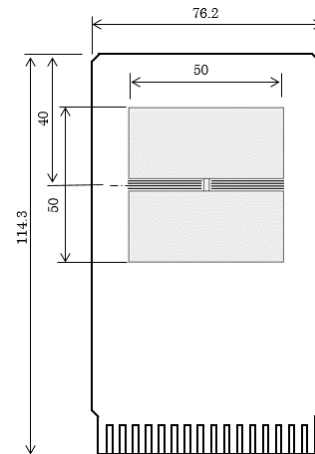
| Item                                     | Measurement Result |
|--|--------------------|
| Power Dissipation                        | 1700 mW            |
| Thermal Resistance (θja)                 | θja = 56°C/W       |
| Thermal Characterization Parameter (ψjt) | ψjt = 18°C/W       |

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



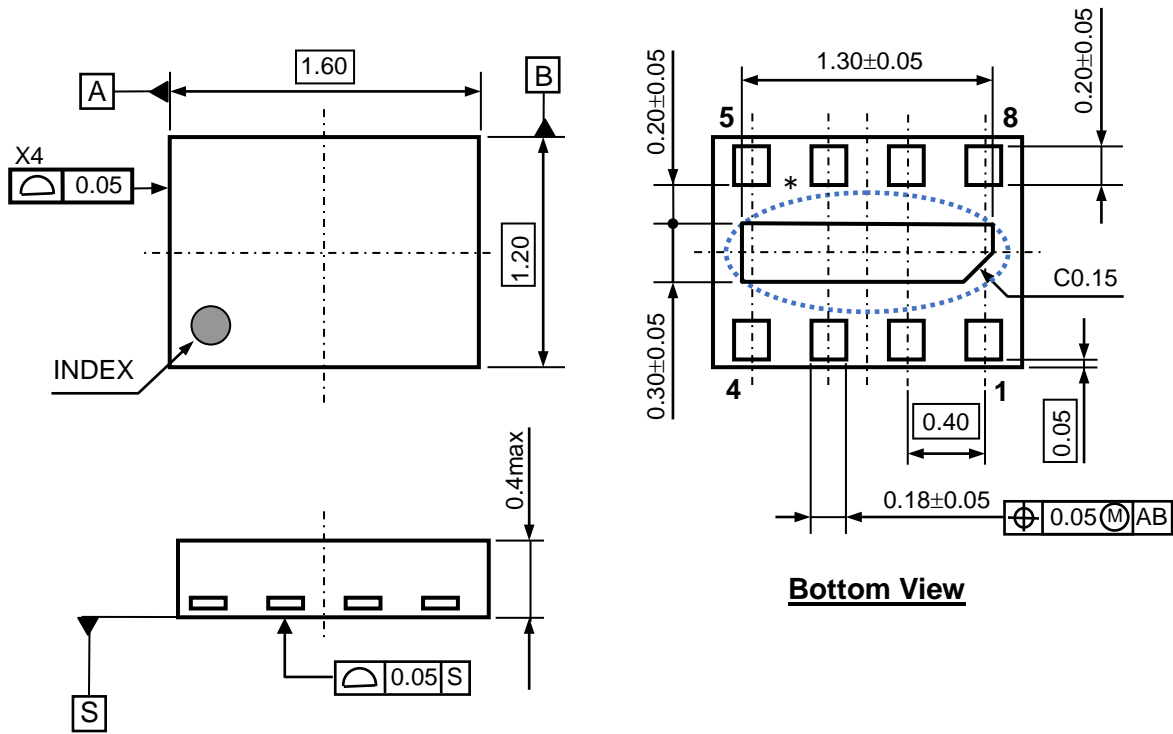
**Power Dissipation vs. Ambient Temperature**



**Measurement Board Pattern**

The above graph shows the power dissipation of the package at Tjmax = 125°C and Tjmax = 150°C. Operating the device in the hatched range might have a negative influence on its lifetime. The total hours of use and the total years of use must be limited as follows:

| Total Hours of Use | Total Years of Use (4 hours/day) |
|--------------------|----------------------------------|
| 13,000 hours       | 9 years                          |



UNIT: mm

DFN1216-8 Package Dimensions

\* The tab on the bottom of the package shown by blue circle is a substrate potential (GND). It is recommended that this tab be connected to the ground plane on the board but it is possible to leave the tab floating.

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

**Measurement Conditions**

| Item             | Measurement Conditions   |
|------------------|--|
| Environment      | Mounting on Board (Wind Velocity = 0 m/s)  |
| Board Material   | Glass Cloth Epoxy Plastic (Four-Layer Board)   |
| Board Dimensions | 76.2 mm × 114.3 mm × 0.8 mm  |
| Copper Ratio     | Outer Layer (First Layer): Less than 95% of 50 mm Square<br>Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square<br>Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square |
| Through-holes    | φ 0.3 mm × 7 pcs   |

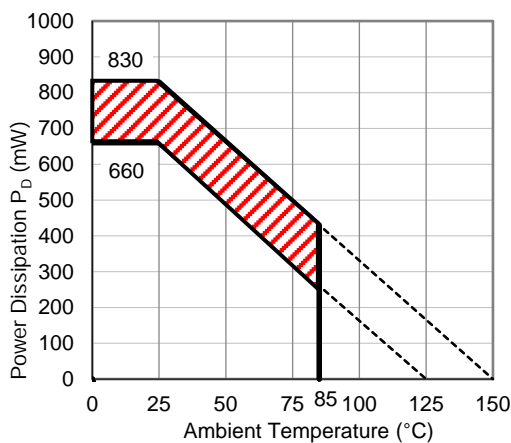
**Measurement Result**

(Ta = 25°C, Tjmax = 125°C)

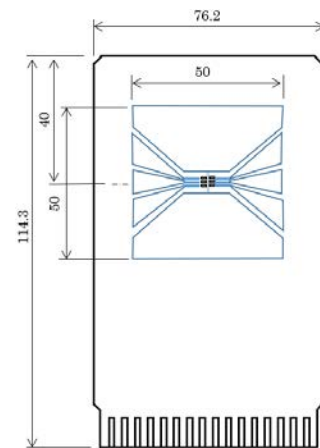
| Item                                     | Measurement Result |
|--|--------------------|
| Power Dissipation                        | 660 mW             |
| Thermal Resistance (θja)                 | θja = 150°C/W      |
| Thermal Characterization Parameter (ψjt) | ψjt = 51°C/W       |

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



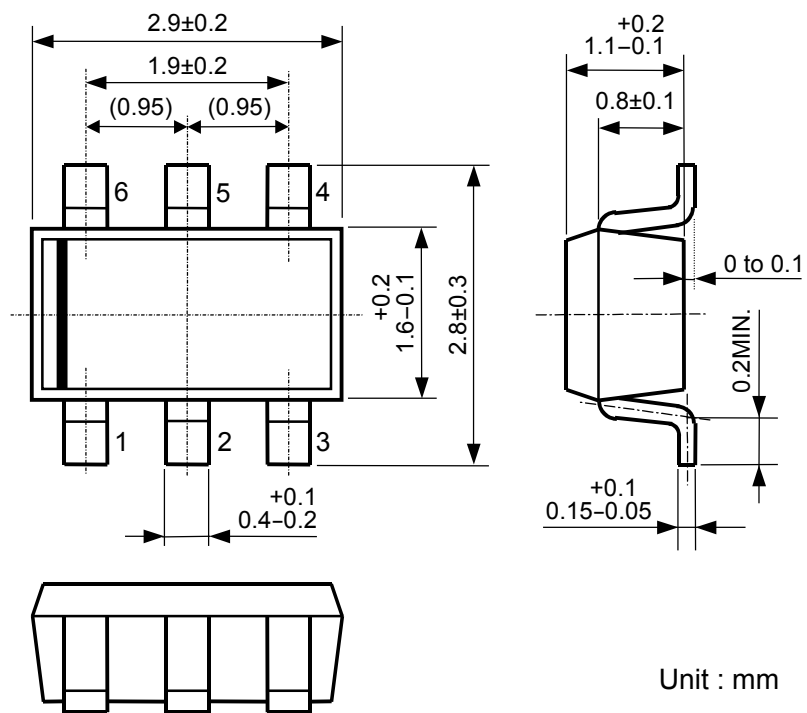
**Power Dissipation vs. Ambient Temperature**



**Measurement Board Pattern**

The above graph shows the power dissipation of the package at Tjmax = 125°C and Tjmax = 150°C. Operating the device in the hatched range might have a negative influence on its lifetime. The total hours of use and the total years of use must be limited as follows:

| Total Hours of Use | Total Years of Use (4 hours/day) |
|--------------------|----------------------------------|
| 13,000 hours       | 9 years                          |



Unit : mm

SOT-23-6 Package Dimensions



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  - Traffic control system
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  - 8-1. **Quality Warranty Period**

In the case of a product purchased through an authorized distributor or directly from us, the warranty period for this product shall be one (1) year after delivery to your company. For defective products that occurred during this period, we will take the quality warranty measures described in section 8-2. However, if there is an agreement on the warranty period in the basic transaction agreement, quality assurance agreement, delivery specifications, etc., it shall be followed.
  - 8-2. **Quality Warranty Remedies**

When it has been proved defective due to manufacturing factors as a result of defect analysis by us, we will either deliver a substitute for the defective product or refund the purchase price of the defective product.

Note that such delivery or refund is sole and exclusive remedies to your company for the defective product.
  - 8-3. **Remedies after Quality Warranty Period**

With respect to any defect of this product found after the quality warranty period, the defect will be analyzed by us. On the basis of the defect analysis results, the scope and amounts of damage shall be determined by mutual agreement of both parties. Then we will deal with upper limit in Section 8-2. This provision is not intended to limit any legal rights of your company.
9. Anti-radiation design is not implemented in the products described in this document.
10. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
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12. Warning for handling Gallium and Arsenic (GaAs) products (Applying to GaAs MMIC, Photo Reflector). These products use Gallium (Ga) and Arsenic (As) which are specified as poisonous chemicals by law. For the prevention of a hazard, do not burn, destroy, or process chemically to make them as gas or power. When the product is disposed of, please follow the related regulation and do not mix this with general industrial waste or household waste.
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