

## 3-MODE 150mA LDO REGULATOR with the Reverse Current Protection

NO.EA-118-0605

### OUTLINE

The R1163x Series consist of CMOS-based voltage regulator ICs with high output voltage accuracy and low supply current. These ICs perform with the chip enable function and realize a standby mode with ultra low supply current. To prevent the destruction by over current, the current limit circuit is included. The R1163x Series have 3-mode. One is standby mode with CE or standby control pin. Other two modes are realized with ECO pin™. Fast Transient Mode (FT mode) and Low Power Mode (LP mode) are alternative with ECO pin™. Consumption current is reduced at Low Power Mode compared with Fast Transient Mode. The output voltage is maintained between FT mode and LP mode.

Further, the reverse current protection circuit is built-in. Therefore, if a higher voltage than  $V_{DD}$  pin is forced to the output pin, the reverse current to  $V_{DD}$  pin is very small (Max.  $0.1\mu A$ ), so it is suitable for backup circuit.

Since the packages for these ICs are SOT-23-5, thin SON-6, and PLP1616-6 packages, high density mounting of the ICs on boards is possible.

### FEATURES

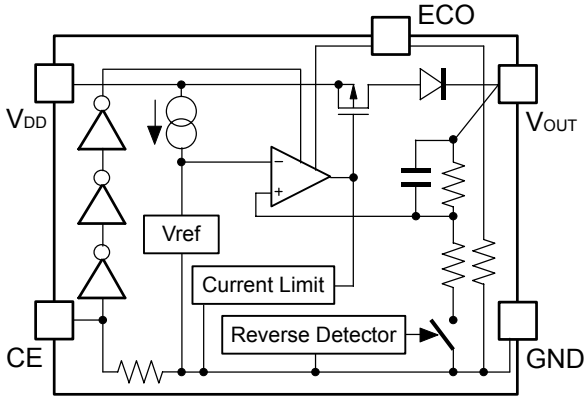
- Ultra-Low Supply Current..... Typ.  $6.0\mu A$  (Low Power Mode),  
Typ.  $70\mu A$  (Fast Transient Mode)
- Standby Mode ..... Typ.  $0.6\mu A$
- Reverse Current..... Max.  $0.1\mu A$
- Low Dropout Voltage..... Typ.  $0.25V$  ( $I_{OUT}=150mA$  Output Voltage= $3.0V$  Type)
- High Ripple Rejection ..... Typ.  $70dB$  ( $f=1kHz$ , FT Mode)
- Low Temperature-Drift Coefficient of Output Voltage Typ.  $\pm 100ppm/^{\circ}C$
- Excellent Line Regulation ..... Typ.  $0.02\%/V$
- High Output Voltage Accuracy .....  $\pm 1.5\%$  ( $\pm 2.5\%$  at LP Mode)
- Small Package ..... SOT-23-5 (Super Mini-mold), SON-6, PLP1616-6
- Output Voltage ..... Stepwise setting with a step of  $0.1V$   
in the range of  $1.5V$  to  $4.0V$  is possible
- Built-in fold-back protection circuit ..... Typ.  $40mA$  (Current at short mode)
- Performs with Ceramic Capacitors .....  $C_{IN}=1.0\mu F, C_{OUT}=\text{Ceramic } 0.47\mu F$

### APPLICATIONS

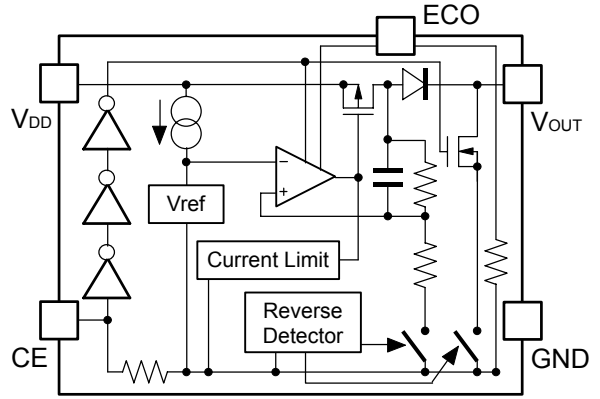
- Precision Voltage References.
- Power source for electrical appliances such as cameras, VCRs and hand-held communication equipment.
- Power source for battery-powered equipment.

**BLOCK DIAGRAM**

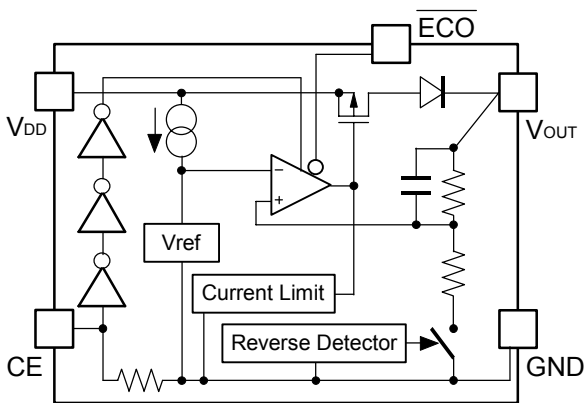
**R1163xxx1B**



**R1163xxx1D**



**R1163xxx1E**



## SELECTION GUIDE

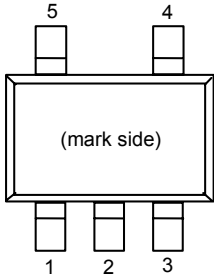
The output voltage, the auto-discharge function, the package and the taping type for the ICs can be selected at the user's request. The selection can be available by designating the part number as shown below;

R1163xx1x-xx ←Part Number  
 ↑ ↑    ↑    ↑  
 a b    c    d

| Code | Contents   |
|------|--|
| a    | Designation of Package Type :<br>N: SOT-23-5 (Mini-mold)<br>D: SON-6<br>K: PLP1616-6   |
| b    | Setting Output Voltage ( $V_{OUT}$ ) :<br>Stepwise setting with a step of 0.1V in the range of 1.5V to 4.0V is possible.<br>New options: 2.85V type: R1163x281x5-xx, 1.85V type: R1163x181x5-xx,<br>2.75V E version type: R1163x271E5-xx.                                  |
| c    | Designation of Chip Enable Option :<br>B: "H" active type and without the auto-discharge function.<br>D: "H" active and with the auto-discharge function.<br>E: "H" active type and without auto-discharge function.<br>ECO logic reverse type (Low Power mode at ECO="H") |
| d    | Designation of Taping Type :<br>Refer to Taping Specifications;TR type is the standard direction.  |

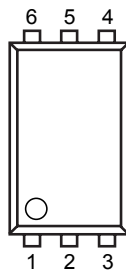
## PIN CONFIGURATIONS

SOT-23-5

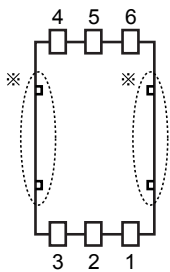


SON-6

Top View

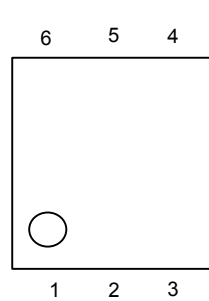


Bottom View

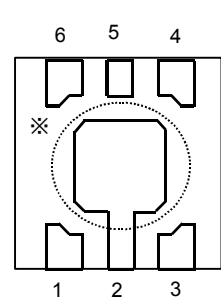


PLP1616-6

Top View



Bottom View




## PIN DISCRIPTIONS

### • SOT-23-5

| Pin No | Symbol           | Pin Description      |
|--------|------------------|----------------------|
| 1      | V <sub>DD</sub>  | Input Pin            |
| 2      | GND              | Ground Pin           |
| 3      | CE               | Chip Enable Pin      |
| 4      | ECO              | MODE alternative pin |
| 5      | V <sub>OUT</sub> | Output pin           |


### SON-6

| Pin No | Symbol           | Pin Description      |
|--------|------------------|----------------------|
| 1      | V <sub>DD</sub>  | Input Pin            |
| 2      | NC               | No Connection        |
| 3      | V <sub>OUT</sub> | Output pin           |
| 4      | ECO              | MODE alternative pin |
| 5      | GND              | Ground Pin           |
| 6      | CE               | Chip Enable Pin      |

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

### • PLP1616-6

| Pin No | Symbol           | Pin Description      |
|--------|------------------|----------------------|
| 1      | V <sub>OUT</sub> | Output pin           |
| 2      | GND              | Ground Pin           |
| 3      | ECO              | MODE alternative pin |
| 4      | CE               | Chip Enable pin      |
| 5      | NC               | No Connection        |
| 6      | V <sub>DD</sub>  | Input Pin            |

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

## ABSOLUTE MAXIMUM RATINGS

| Symbol    | Item                           | Rating     | Unit |
|-----------|--------------------------------|------------|------|
| $V_{IN}$  | Input Voltage                  | 6.5        | V    |
| $V_{ECO}$ | Input Voltage (ECO Pin)        | -0.3 ~ 6.5 | V    |
| $V_{CE}$  | Input Voltage (CE Pin)         | -0.3 ~ 6.5 | V    |
| $V_{OUT}$ | Output Voltage                 | -0.3 ~ 6.5 | V    |
| $I_{OUT}$ | Output Current                 | 180        | mA   |
| $P_D$     | Power Dissipation (SOT-23-5) * | 420        | mW   |
|           | Power Dissipation (SON-6) *    | 500        |      |
|           | Power Dissipation (PLP1616-6)* | 560        |      |
| $T_{opt}$ | Operating Temperature Range    | -40 ~ 85   | °C   |
| $T_{stg}$ | Storage Temperature Range      | -55 ~ 125  | °C   |

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

## ELECTRICAL CHARACTERISTICS

R1163xxx1B/D

Topt=25°C

| Symbol                                   | Item  | Conditions   | Min.   | Typ.     | Max.   | Unit       |
|--|---|--|--------|----------|--------|------------|
| V <sub>OUT</sub>                         | Output Voltage  | V <sub>IN</sub> =Set V <sub>OUT</sub> +1V, V <sub>ECO</sub> =V <sub>IN</sub><br>1mA ≤ I <sub>OUT</sub> ≤ 30mA  | ×0.985 |          | ×1.015 | V          |
|  |   | V <sub>IN</sub> =Set V <sub>OUT</sub> +1V, V <sub>ECO</sub> =GND<br>1mA ≤ I <sub>OUT</sub> ≤ 30mA  | ×0.975 |          | ×1.025 |            |
| ΔV <sub>OUT</sub>                        | Output Voltage Deviation<br>between FT Mode and LP Mode                             | V <sub>IN</sub> =Set V <sub>OUT</sub> +1V, I <sub>OUT</sub> =30mA<br>V <sub>OUT</sub> ≥ 2.0V   | -1.2   | 0.0      | 1.2    | %          |
|  |   | V <sub>OUT</sub> ≤ 2.0V  | -24    | 0        | +24    | mV         |
| I <sub>OUT</sub>                         | Output Current  | V <sub>IN</sub> -V <sub>OUT</sub> =1.0V  | 150    |          |        | mA         |
| ΔV <sub>OUT</sub> /<br>ΔI <sub>OUT</sub> | Load Regulation(FT Mode)  | V <sub>IN</sub> =Set V <sub>OUT</sub> +1V, V <sub>ECO</sub> =V <sub>IN</sub><br>1mA ≤ I <sub>OUT</sub> ≤ 150mA   |        | 20       | 40     | mV         |
|  | Load Regulation(LP Mode)  | V <sub>IN</sub> =Set V <sub>OUT</sub> +1V, V <sub>ECO</sub> =GND<br>1mA ≤ I <sub>OUT</sub> ≤ 150mA   |        | 10       | 45     |            |
| V <sub>DIF</sub>                         | Dropout Voltage   | Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE  |        |          |        |            |
| I <sub>SS1</sub>                         | Supply Current(FT Mode)   | V <sub>IN</sub> =Set V <sub>OUT</sub> +1V<br>V <sub>ECO</sub> =V <sub>IN</sub> , I <sub>OUT</sub> =0mA   |        | 70       | 100    | μA         |
| I <sub>SS2</sub>                         | Supply Current(LP Mode)   | V <sub>IN</sub> =Set V <sub>OUT</sub> +1V<br>V <sub>ECO</sub> =GND, I <sub>OUT</sub> =0mA  |        | 6.0      | 10.0   | μA         |
| I <sub>standby</sub>                     | Supply Current (Standby)  | V <sub>IN</sub> =Set V <sub>OUT</sub> +1V, V <sub>CE</sub> = GND<br>V <sub>ECO</sub> =GND  |        | 0.4      | 1.0    | μA         |
| ΔV <sub>OUT</sub> /<br>ΔV <sub>IN</sub>  | Line Regulation(FT Mode)  | Set V <sub>OUT</sub> +0.5V ≤ V <sub>IN</sub> ≤ 6.0V<br>I <sub>OUT</sub> =30mA, V <sub>ECO</sub> =V <sub>IN</sub>   |        | 0.02     | 0.10   | %V         |
|  | Line Regulation(LP Mode)  | Set V <sub>OUT</sub> +0.5V ≤ V <sub>IN</sub> ≤ 6.0V<br>I <sub>OUT</sub> =30mA, V <sub>ECO</sub> =GND   |        | 0.05     | 0.20   |            |
| RR                                       | Ripple Rejection(FT Mode)   | f=1kHz<br>f=10kHz,<br>Ripple 0.2Vp-p, V <sub>IN</sub> =Set V <sub>OUT</sub> +1V<br>I <sub>OUT</sub> = 30mA, V <sub>ECO</sub> = V <sub>IN</sub><br>If V <sub>OUT</sub> ≤ 1.7V, then<br>V <sub>IN</sub> = Set V <sub>OUT</sub> +1V |        | 70<br>60 |        | dB         |
| V <sub>IN</sub>                          | Input Voltage   |  | 2.0    |          | 6.0    | V          |
| ΔV <sub>OUT</sub> /<br>ΔT                | Output Voltage<br>Temperature Coefficient   | I <sub>OUT</sub> =30mA<br>-40°C ≤ Topt ≤ 85°C  |        | ±100     |        | ppm<br>/°C |
| I <sub>LIM</sub>                         | Short Current Limit   | V <sub>OUT</sub> =0V   |        | 40       |        | mA         |
| I <sub>PD</sub>                          | CE Pull-down<br>Constant Current  |  |        | 0.3      | 0.6    | μA         |
| R <sub>PD</sub>                          | ECO Pull-down Resistance  |  | 2      | 5        | 30     | MΩ         |
| V <sub>CEH</sub>                         | CE, ECO Input Voltage "H"   |  | 1.0    |          | 6.0    | V          |
| V <sub>CEL</sub>                         | CE, ECO Input Voltage "L"   |  | 0.0    |          | 0.4    | V          |
| en                                       | Output Noise "H" (FT Mode)  | BW=10Hz to 100kHz  |        | 30       |        | μVrms      |
|  | Output Noise "L" (LP Mode)  | BW=10Hz to 100kHz  |        | 40       |        |            |
| R <sub>LOW</sub>                         | Nch Tr. On Resistance for<br>auto-discharge function<br>(Applied only to D version) | V <sub>CE</sub> =0V  |        | 60       |        | Ω          |
| I <sub>REV</sub>                         | Reverse Current   | V <sub>OUT</sub> >.5V, 0V ≤ V <sub>IN</sub> ≤ 6V   |        | 0.0      | 0.1    | μA         |

## R1163xxx1E

T<sub>opt</sub>=25°C

| Symbol                                   | Item  | Conditions  | Min.                       | Typ.     | Max.                       | Unit       |
|--|---|---|----------------------------|----------|----------------------------|------------|
| V <sub>OUT</sub>                         | Output Voltage  | V <sub>IN</sub> = Set V <sub>OUT</sub> +1V V <sub>ECO</sub> =GND<br>1mA ≤ I <sub>OUT</sub> ≤ 30mA   | V <sub>OUT</sub><br>×0.985 |          | V <sub>OUT</sub><br>×1.015 | V          |
|  |   | V <sub>IN</sub> = Set V <sub>OUT</sub> +1V V <sub>ECO</sub> =V <sub>IN</sub><br>1mA ≤ I <sub>OUT</sub> ≤ 30mA   | V <sub>OUT</sub><br>×0.975 |          | V <sub>OUT</sub><br>×1.025 |            |
| ΔV <sub>OUT</sub>                        | Output Voltage Deviation<br>between FT Mode and LP Mode | V <sub>IN</sub> = Set V <sub>OUT</sub> +1V, I <sub>OUT</sub> =30mA<br>V <sub>OUT</sub> ≥ 2.0V   | -1.2                       | 0.0      | 1.2                        | %          |
|  |   | V <sub>OUT</sub> ≤ 2.0V   | -24                        | 0        | +24                        | mV         |
| I <sub>OUT</sub>                         | Output Current  | V <sub>IN</sub> - V <sub>OUT</sub> = 1.0V   | 150                        |          |                            | mA         |
| ΔV <sub>OUT</sub> /<br>ΔI <sub>OUT</sub> | Load Regulation (FT Mode)                               | V <sub>IN</sub> =Set V <sub>OUT</sub> +1V, V <sub>ECO</sub> =GND<br>1mA ≤ I <sub>OUT</sub> ≤ 150mA  |                            | 20       | 40                         | mV         |
|  | Load Regulation (LP Mode)                               | V <sub>IN</sub> = Set V <sub>OUT</sub> +1V, V <sub>ECO</sub> =V <sub>IN</sub><br>1mA ≤ I <sub>OUT</sub> ≤ 150mA   |                            | 20       | 45                         |            |
| V <sub>DIF</sub>                         | Dropout Voltage   | Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE   |                            |          |                            |            |
| I <sub>SS1</sub>                         | Supply Current (FT Mode)                                | V <sub>IN</sub> = Set V <sub>OUT</sub> +1V<br>V <sub>ECO</sub> = GND, I <sub>OUT</sub> =0mA   |                            | 70       | 100                        | μA         |
| I <sub>SS2</sub>                         | Supply Current (LP Mode)                                | V <sub>IN</sub> = Set V <sub>OUT</sub> +1V<br>V <sub>ECO</sub> = V <sub>IN</sub> , I <sub>OUT</sub> =0mA  |                            | 6.0      | 10.0                       | μA         |
| I <sub>standby</sub>                     | Supply Current (Standby)                                | V <sub>IN</sub> = Set V <sub>OUT</sub> +1V, V <sub>CE</sub> = GND<br>V <sub>ECO</sub> =GND  |                            | 0.6      | 1.0                        | μA         |
| ΔV <sub>OUT</sub> /<br>ΔV <sub>IN</sub>  | Line Regulation (FT Mode)                               | Set V <sub>OUT</sub> +0.5V ≤ V <sub>IN</sub> ≤ 6.0V<br>I <sub>OUT</sub> = 30mA, V <sub>ECO</sub> = GND  |                            | 0.02     | 0.10                       | %V         |
|  | Line Regulation (LP Mode)                               | Set V <sub>OUT</sub> +0.5V ≤ V <sub>IN</sub> ≤ 6.0V<br>I <sub>OUT</sub> = 30mA, V <sub>ECO</sub> = V <sub>IN</sub>  |                            | 0.05     | 0.20                       |            |
| RR                                       | Ripple Rejection (FT Mode)                              | f = 1kHz<br>f = 10kHz,<br>Ripple 0.2Vp-p<br>V <sub>IN</sub> = Set V <sub>OUT</sub> +1V<br>I <sub>OUT</sub> = 30mA, V <sub>ECO</sub> = GND<br>If V <sub>OUT</sub> ≤ 1.7V, then<br>V <sub>IN</sub> = Set V <sub>OUT</sub> +1V |                            | 70<br>60 |                            | dB         |
| V <sub>IN</sub>                          | Input Voltage   |   | 2.0                        |          | 6.0                        | V          |
| ΔV <sub>OUT</sub> /<br>ΔT                | Output Voltage<br>Temperature Coefficient               | I <sub>OUT</sub> = 30mA<br>-40°C ≤ T <sub>opt</sub> ≤ 85°C  |                            | ±100     |                            | ppm<br>/°C |
| I <sub>LIM</sub>                         | Short Current Limit                                     | V <sub>OUT</sub> = 0V   |                            | 40       |                            | mA         |
| I <sub>PD</sub>                          | CE Pull-down<br>Constant Current                        |   |                            | 0.3      | 0.6                        | μA         |
| V <sub>CEH</sub>                         | CE, ECO Input Voltage "H"                               |   | 1.0                        |          | 6.0                        | V          |
| V <sub>CEL</sub>                         | CE, ECO Input Voltage "L"                               |   | 0.0                        |          | 0.4                        | V          |
| en                                       | Output Noise "H" (FT Mode)                              | BW = 10Hz to 100kHz   |                            | 30       |                            | μVrms      |
|  | Output Noise "L" (LP Mode)                              | BW = 10Hz to 100kHz   |                            | 40       |                            |            |
| I <sub>REV</sub>                         | Reverse Current   | V <sub>OUT</sub> >0.5V, 0V ≤ V <sub>IN</sub> ≤ 6V   |                            | 0.0      | 0.1                        | μA         |

## ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE

Topt = 25°C

| Output Voltage<br>$V_{OUT}$ (V) | Dropout Voltage (V)      |                  |       |                  |       |
|---------------------------------|--------------------------|------------------|-------|------------------|-------|
|                                 | Condition                | $V_{DIF}(ECO=H)$ |       | $V_{DIF}(ECO=L)$ |       |
|                                 |                          | Typ.             | Max.  | Typ.             | Max.  |
| $1.5 \leq V_{OUT} < 1.6$        | $I_{OUT} = 150\text{mA}$ | 0.400            | 0.680 | 0.420            | 0.680 |
| $1.6 \leq V_{OUT} < 1.7$        |                          | 0.380            | 0.550 | 0.390            | 0.550 |
| $1.7 \leq V_{OUT} < 1.8$        |                          | 0.350            | 0.520 | 0.370            | 0.520 |
| $1.8 \leq V_{OUT} < 2.0$        |                          | 0.340            | 0.490 | 0.350            | 0.490 |
| $2.0 \leq V_{OUT} < 2.8$        |                          | 0.290            | 0.425 | 0.300            | 0.425 |
| $2.8 \leq V_{OUT} \leq 4.0$     |                          | 0.250            | 0.350 | 0.250            | 0.350 |

## 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, be sure to use a  $0.47\mu\text{F}$  or more ceramic capacitor  $C_{OUT}$ .

(Test these ICs with as same external components as ones to be used on the PCB.)

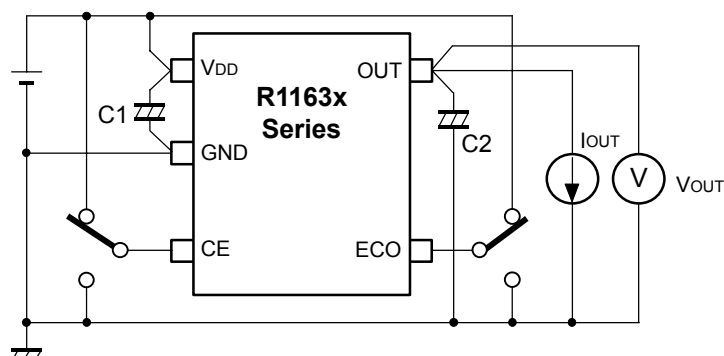
When a tantalum capacitor is used with this IC, if the equivalent series resistor (ESR) of the capacitor is large, output voltage may be unstable.

### PCB Layout

Make  $V_{DD}$  and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor with as much as  $1.0\mu\text{F}$  capacitor between  $V_{DD}$  and GND pin as close as possible.

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

## TYPICAL APPLICATION



\*External Components

Ex. : C1: Ceramic Capacitor  $1.0\mu\text{F}$

C2 : Ceramic Capacitor  $0.47\mu\text{F}$  (Murata GRM40B474K)

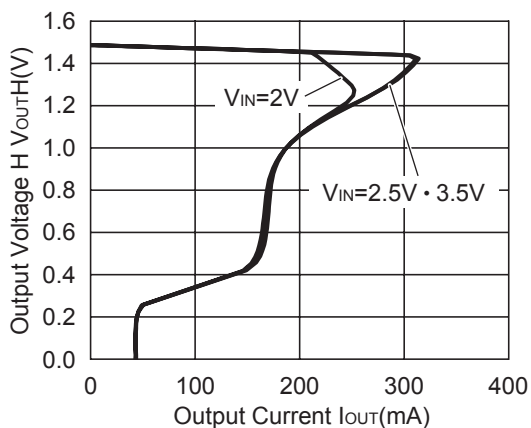


## TYPICAL CHARACTERISTICS

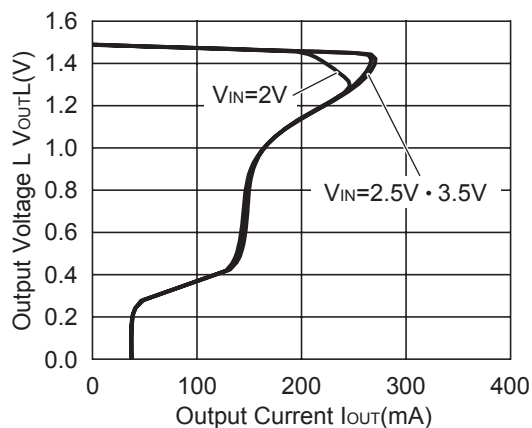
Unless otherwise provided, capacitors are ceramic type.

### 1) Output Voltage vs. Output Current

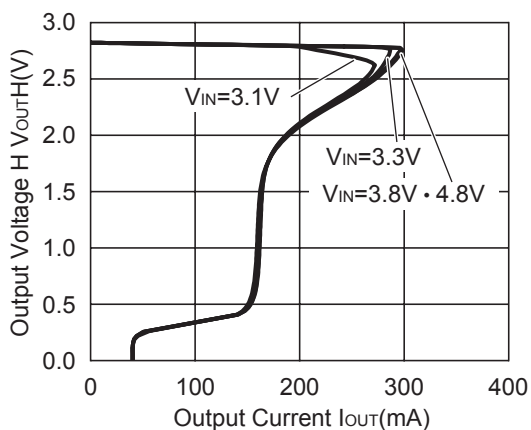
**R1163x151x ECO=H**



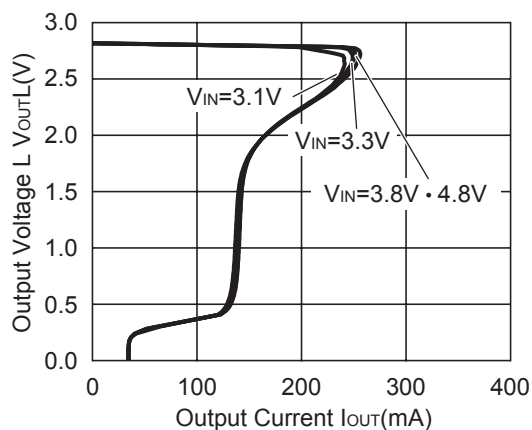
**R1163x151x ECO=L**



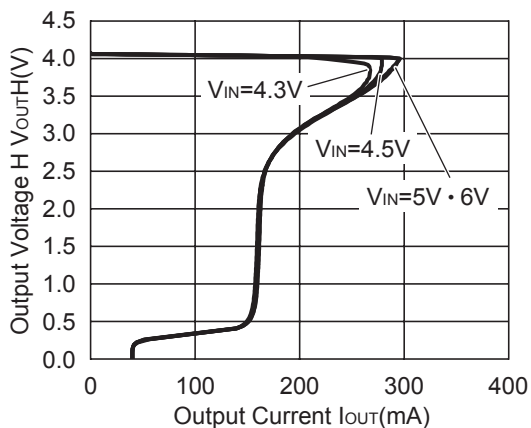
**R1163x281x ECO=H**



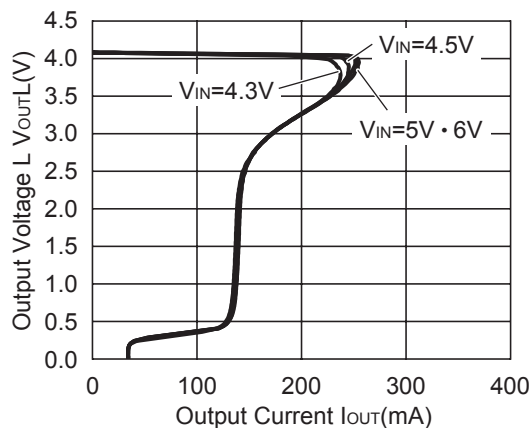
**R1163x281x ECO=L**



**R1163x40x ECO=H**

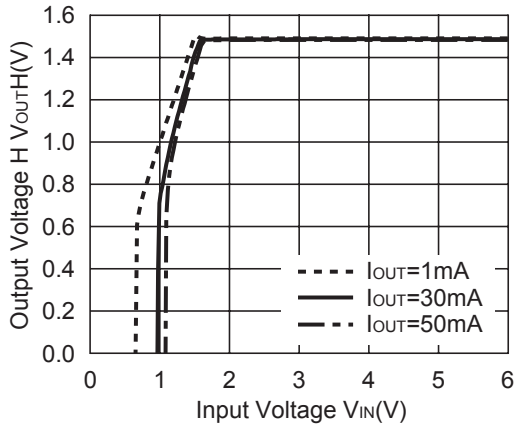


**R1163x40x ECO=L**

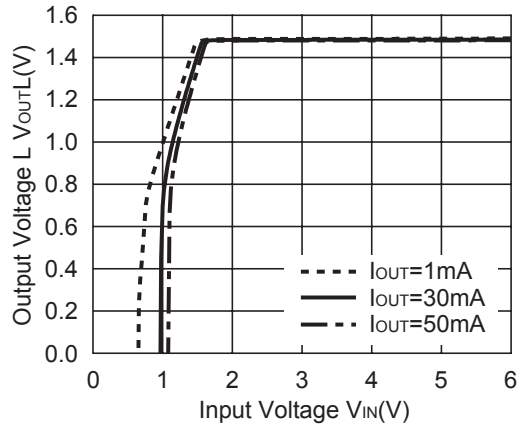


2) Output Voltage vs. Input Voltage

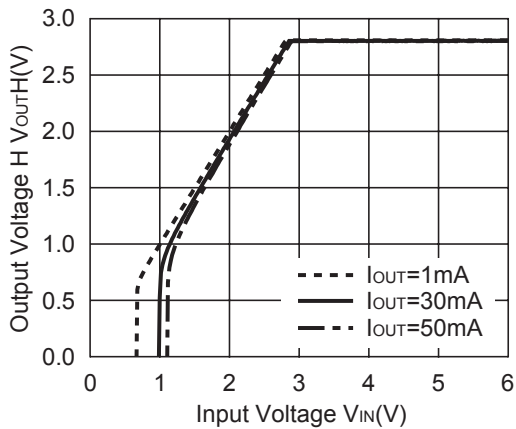
R1163x151x ECO=H



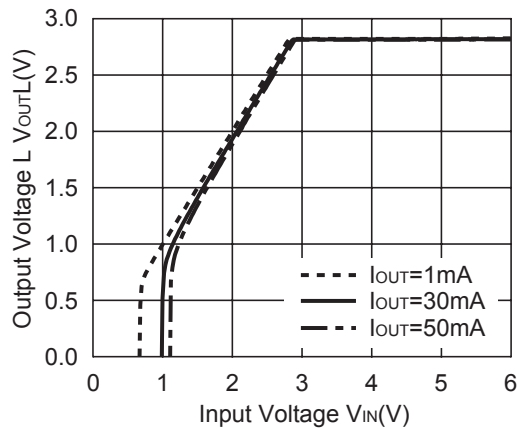
R1163x15x ECO=L



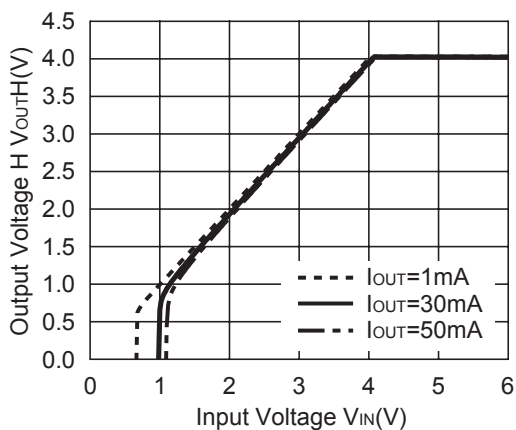
R1163x28x ECO=H



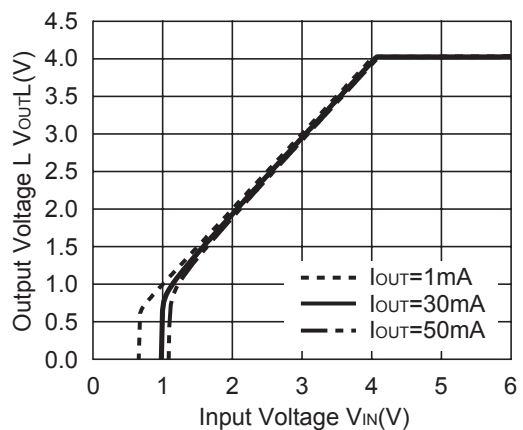
R1163x28x ECO=L



R1163x40x ECO=H

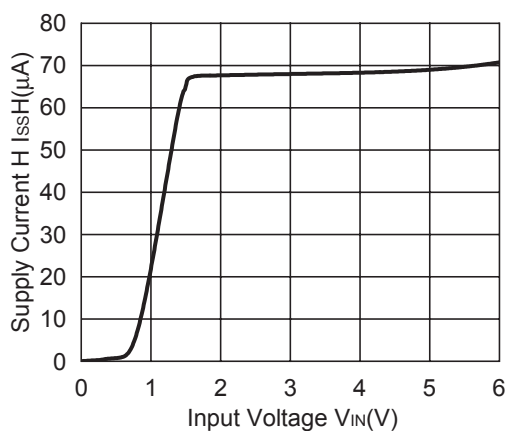


R1163x40x ECO=L

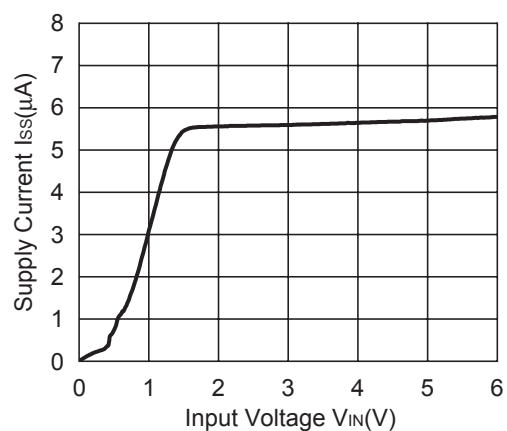


## 3) Supply Current vs. Input Voltage

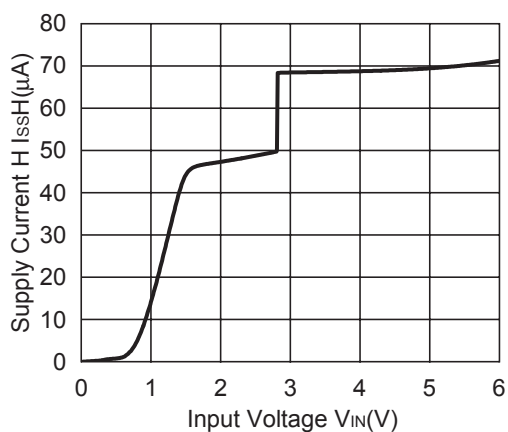
R1163x151x ECO=H



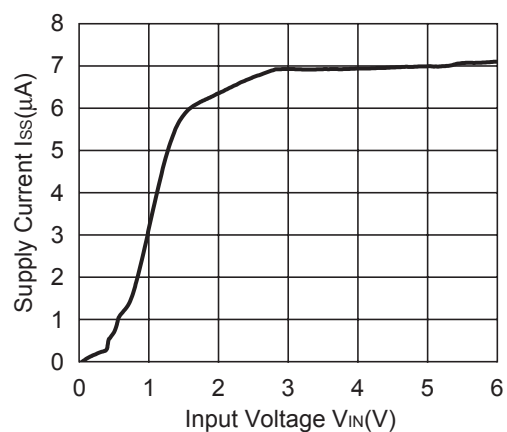
R1163x151x ECO=L



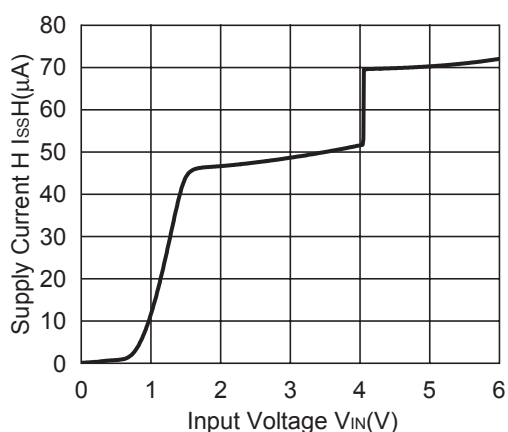
R1163x281x ECO=H



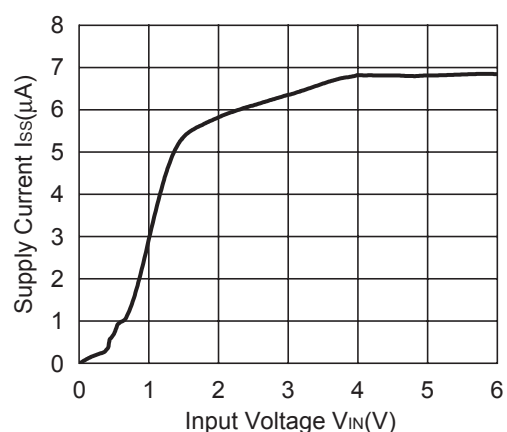
R1163x281x ECO=L



R1163x401x ECO=H

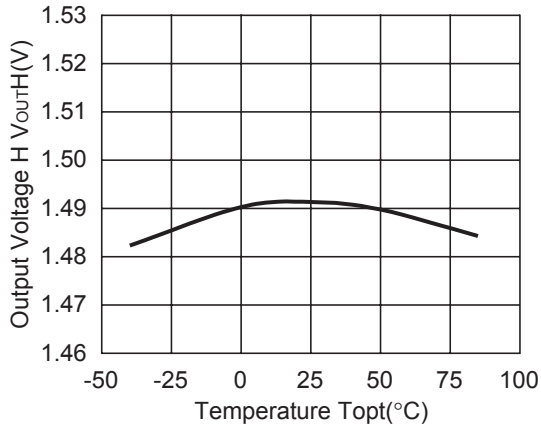


R1163x401x ECO=L

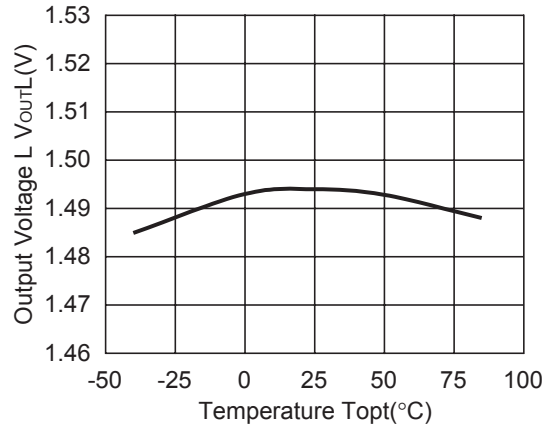


4) Output Voltage vs. Temperature

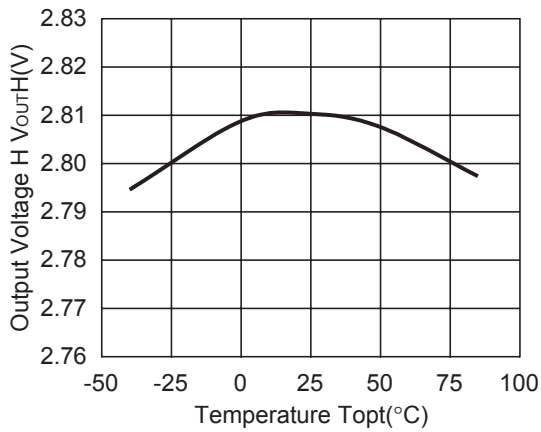
R1163x151x ECO=H



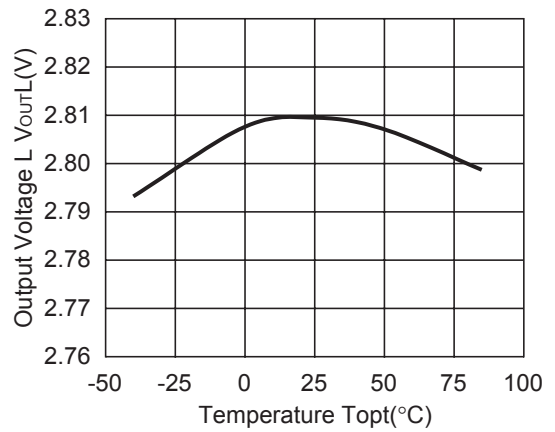
R1163x151x ECO=L



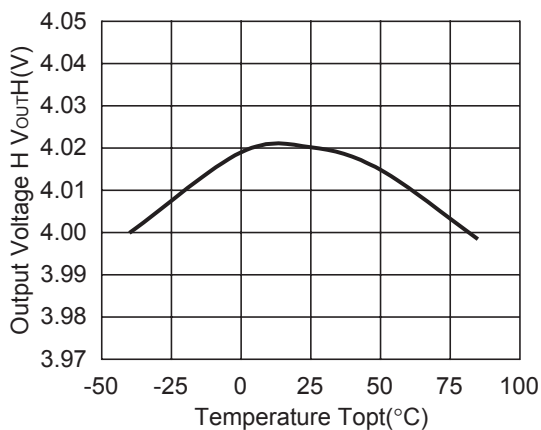
R1163x281x ECO=H



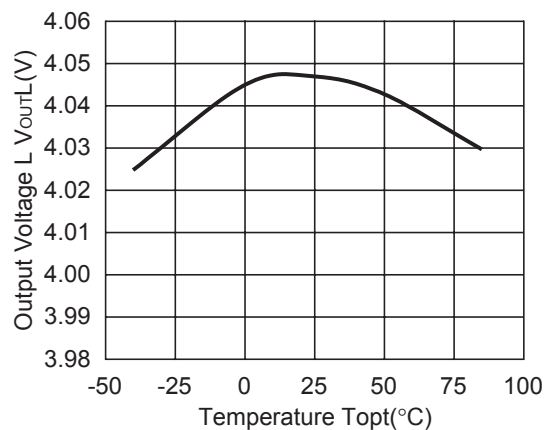
R1163x281x ECO=L



R1163x401x ECO=H

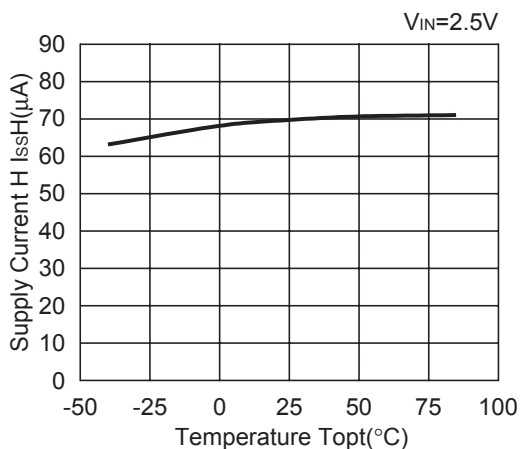


R1163x401x ECO=L

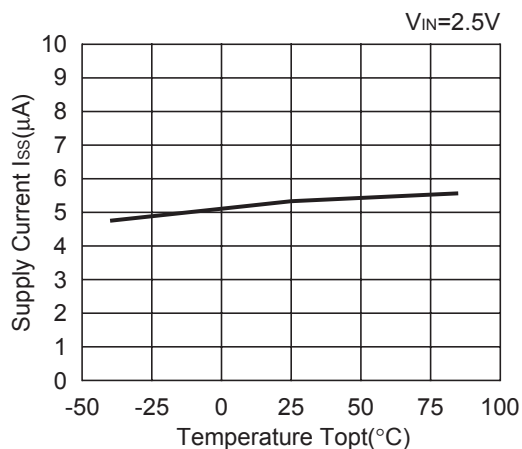


5) Supply Current vs. Temperature

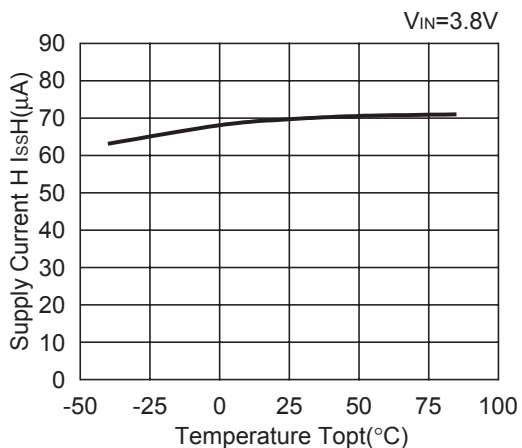
R1163x151x ECO=H



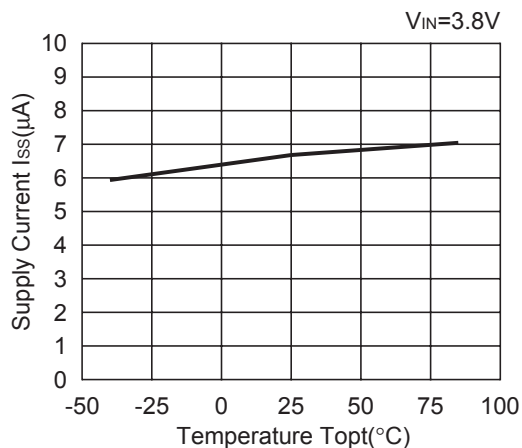
R1163x151x ECO=L



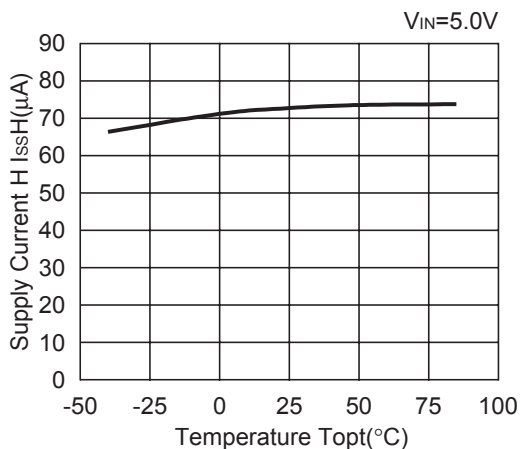
R1163x281x ECO=H



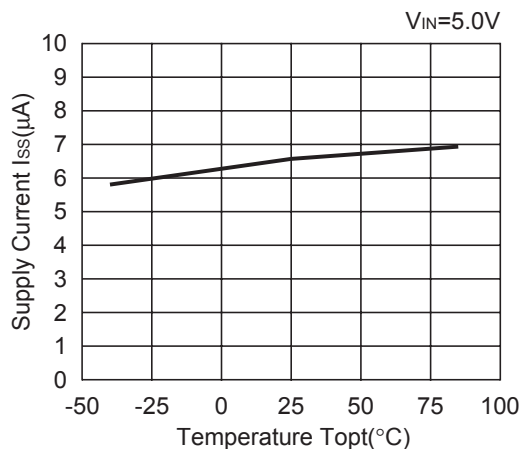
R1163x281x ECO=L



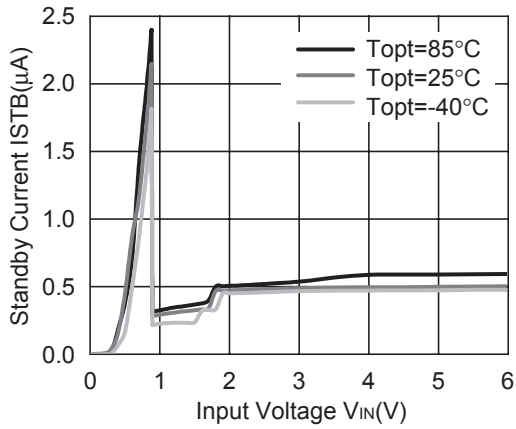
R1163x401x ECO=H



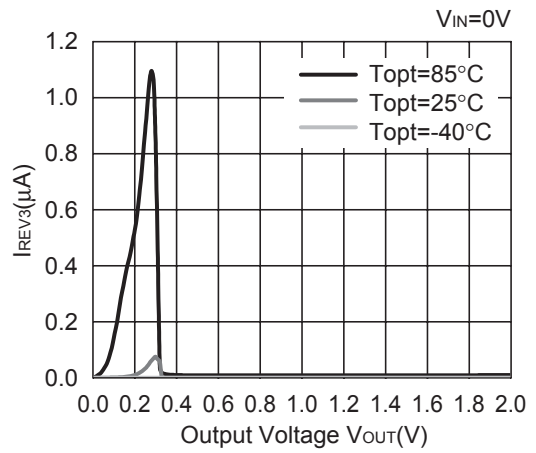
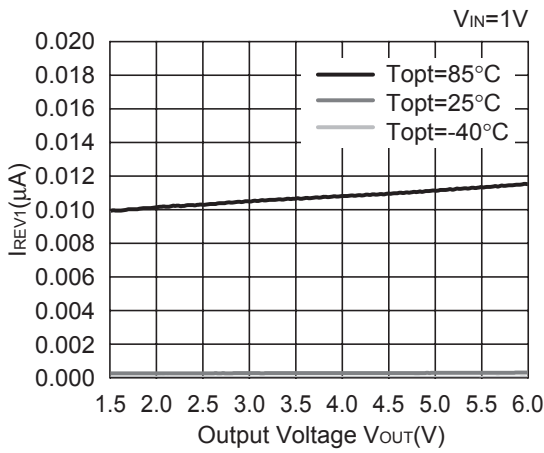
R1163x401x ECO=L



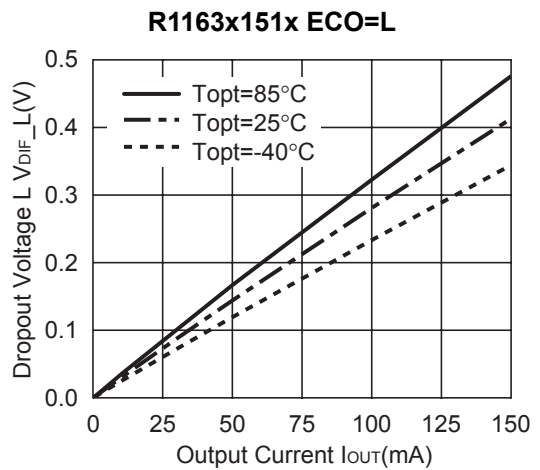
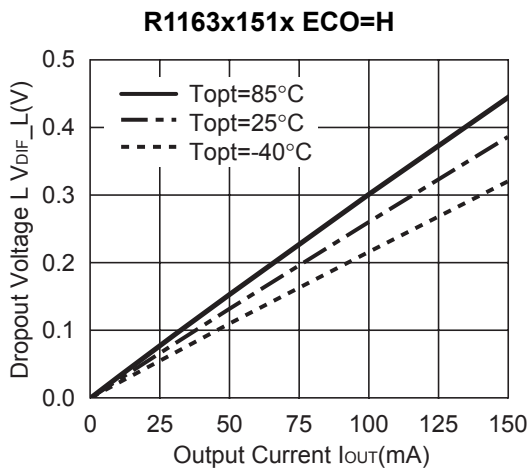
6) Standby Current vs. Input Voltage



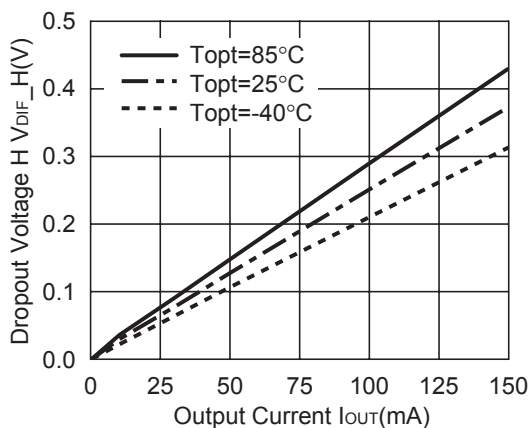
7) Reverse Current vs. Output Voltage



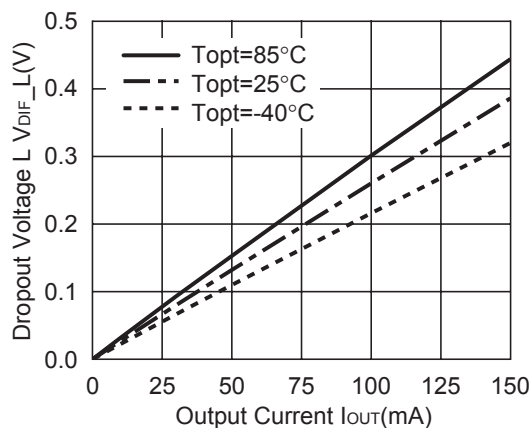
8) Dropout Voltage vs. Output Current



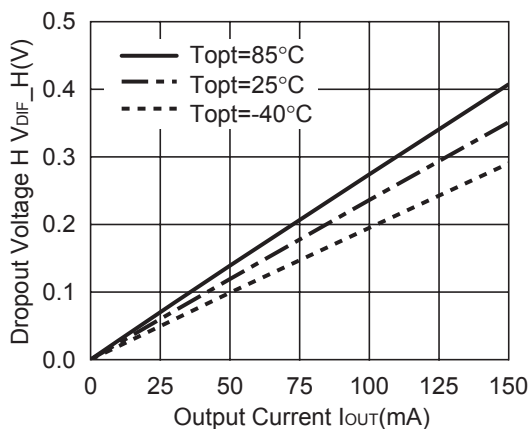
R1163x161x ECO=H



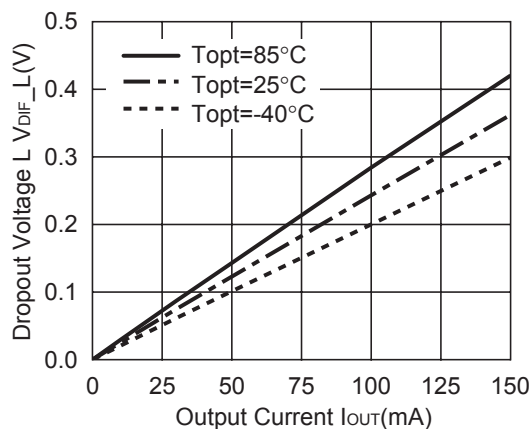
R1163x161x ECO=L



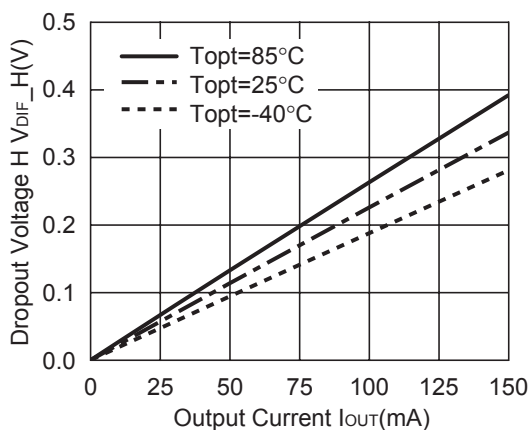
R1163x171x ECO=H



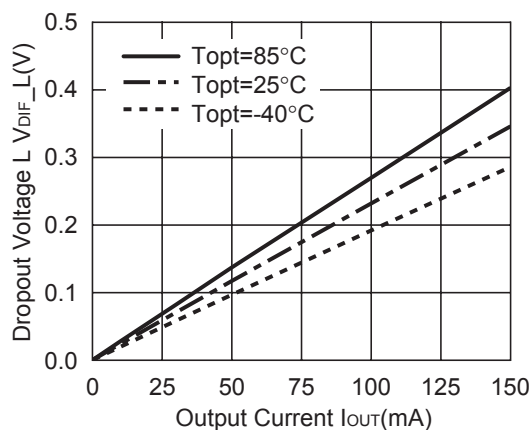
R1163x171x ECO=L



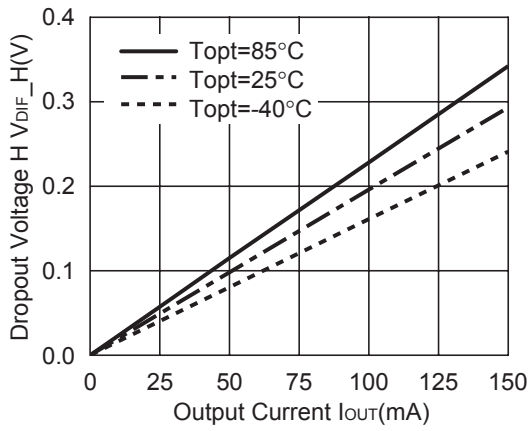
R1163x181x ECO=H



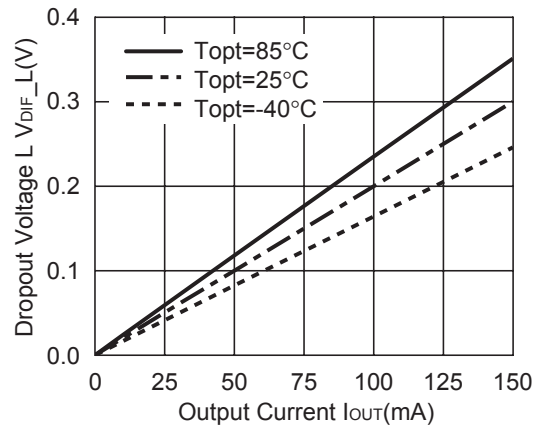
R1163x181x ECO=L



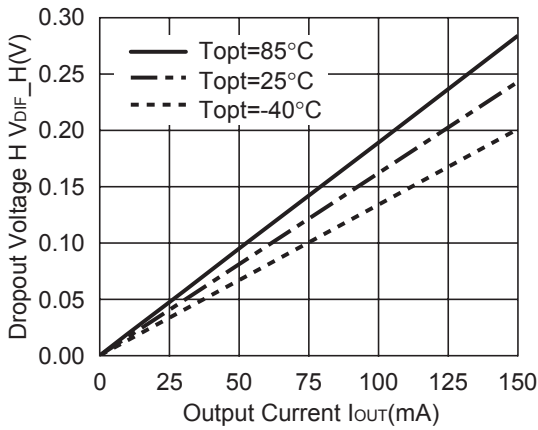
R1163x211x ECO=H



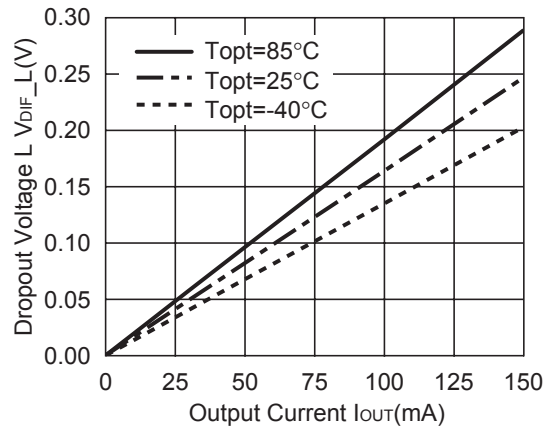
R1163x211x ECO=L



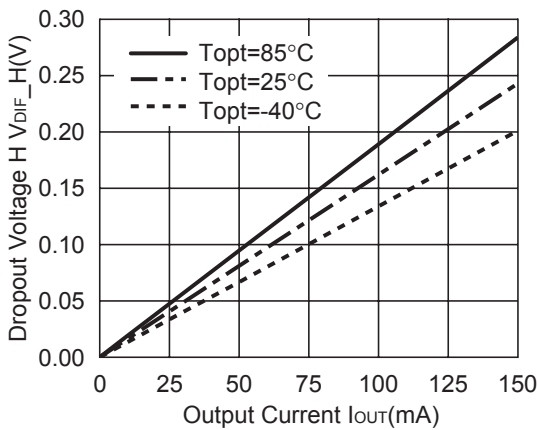
R1163x281x ECO=H



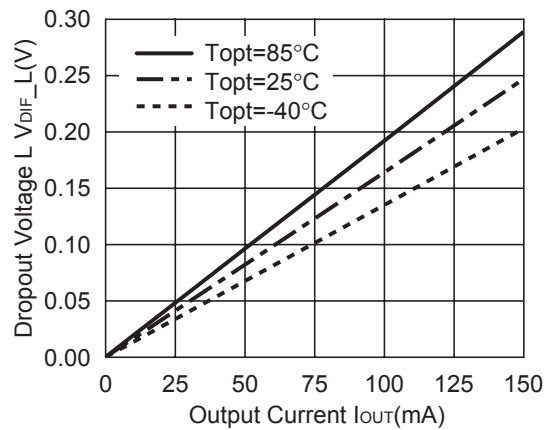
R1163x281x ECO=L



R1163x401x ECO=H



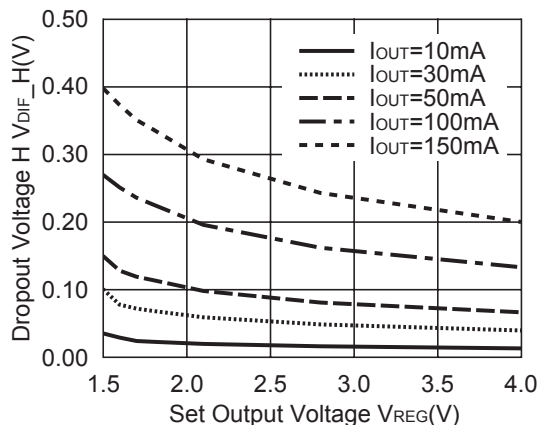
R1163x401x ECO=L



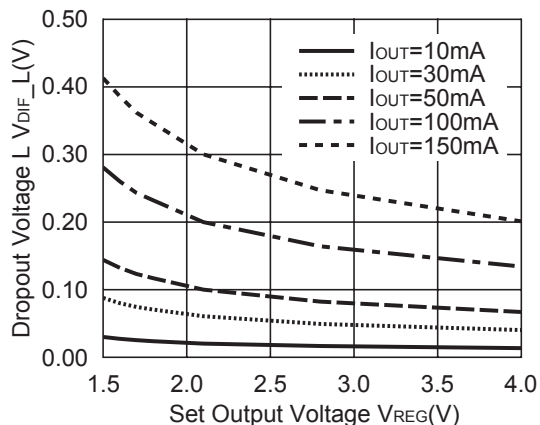


9) Dropout Voltage vs. Set Output Voltage

R1163x ECO=H



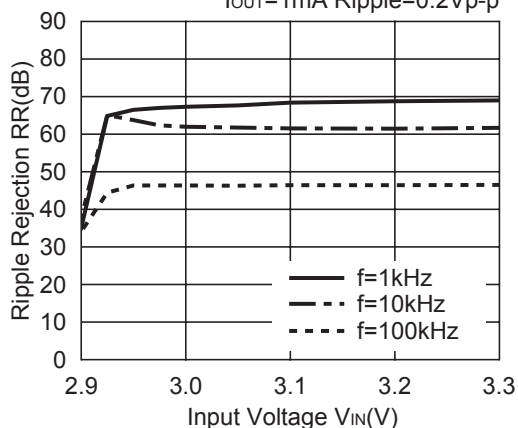
R1163x ECO=L



10) Ripple Rejection vs. Input Bias Voltage

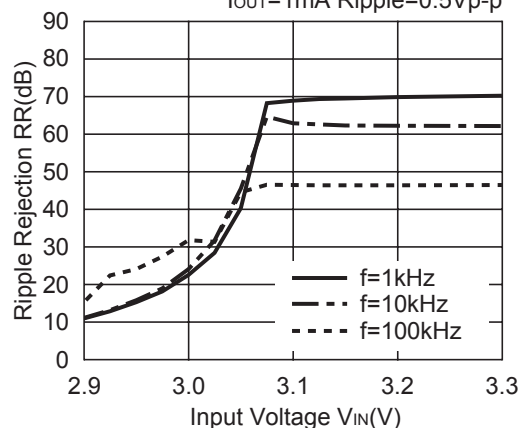
R1163x281x ECO=H

$C_{IN}$ =none,  $C_{OUT}$ =0.47 $\mu$ F,  
 $I_{OUT}$ =1mA Ripple=0.2Vp-p



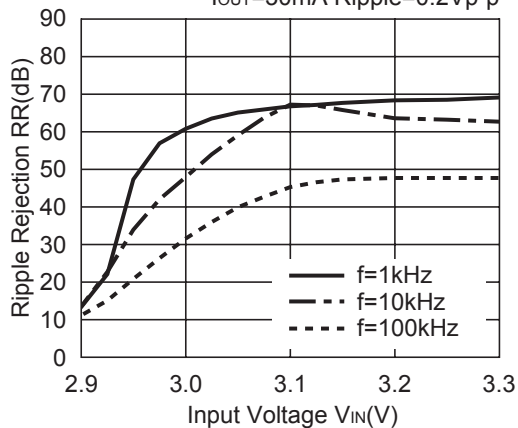
R1163x281x ECO=L

$C_{IN}$ =none,  $C_{OUT}$ =0.47 $\mu$ F,  
 $I_{OUT}$ =1mA Ripple=0.5Vp-p



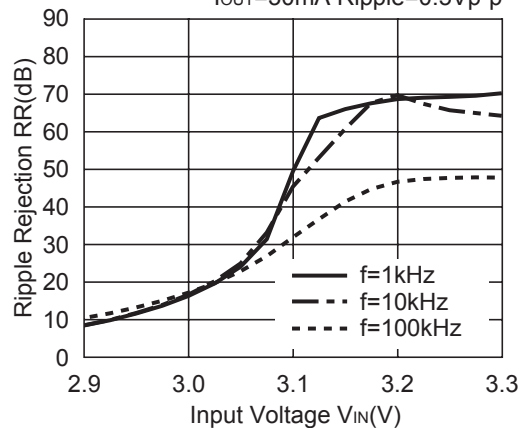
R1162x281x ECO=H

$C_{IN}$ =none,  $C_{OUT}$ =0.47 $\mu$ F,  
 $I_{OUT}$ =30mA Ripple=0.2Vp-p



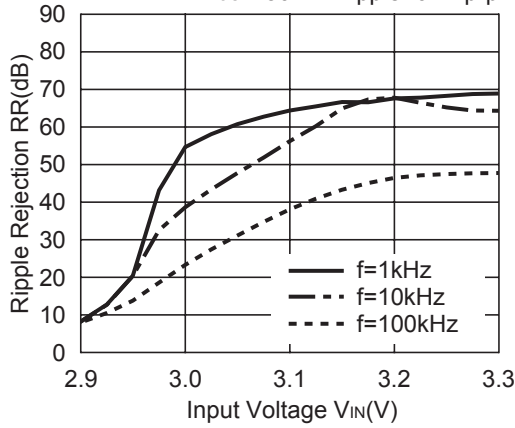
R1162x281x ECO=L

$C_{IN}$ =none,  $C_{OUT}$ =0.47 $\mu$ F,  
 $I_{OUT}$ =30mA Ripple=0.5Vp-p



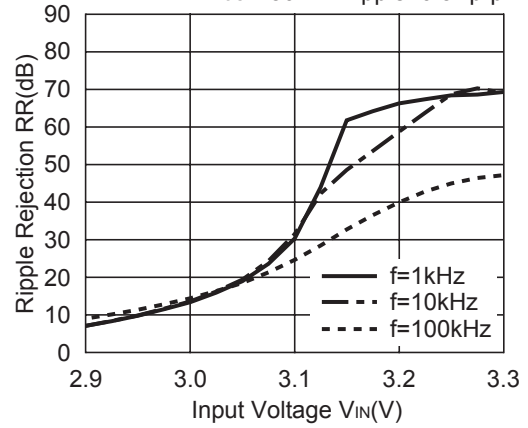
**R1163x281x ECO=H**

$C_{IN}$ =none,  $C_{OUT}$ =0.47 $\mu$ F,  
 $I_{OUT}$ =50mA Ripple=0.2Vp-p



**R1163x281x ECO=H**

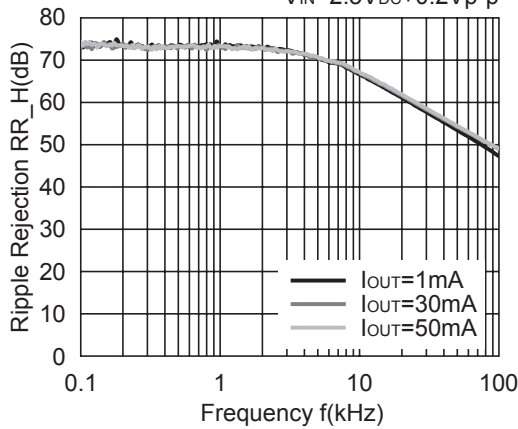
$C_{IN}$ =none,  $C_{OUT}$ =0.47 $\mu$ F,  
 $I_{OUT}$ =50mA Ripple=0.5Vp-p



**11) Ripple Rejection vs. Frequency( $C_{IN}$ =none)**

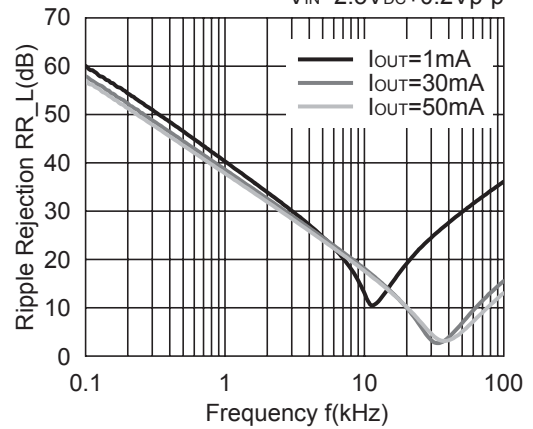
**R1163x151x ECO=H**

$C_{IN}$ =none,  $C_{OUT}$ =0.47 $\mu$ F,  
 $V_{IN}$ =2.5V $_{DC}$ +0.2Vp-p



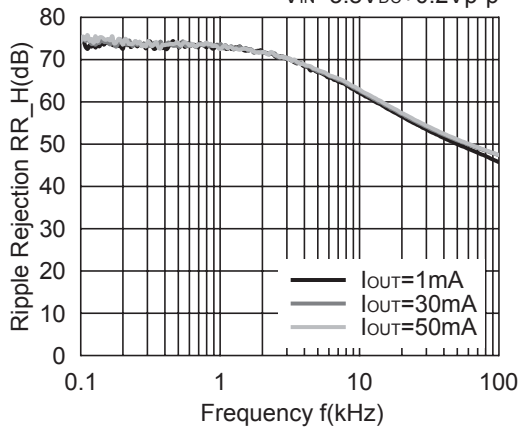
**R1163x151x ECO=L**

$C_{IN}$ =none,  $C_{OUT}$ =0.47 $\mu$ F,  
 $V_{IN}$ =2.5V $_{DC}$ +0.2Vp-p



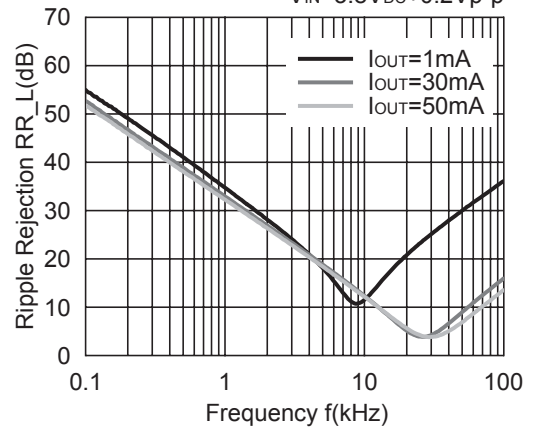
**R1163x281x ECO=H**

$C_{IN}$ =none,  $C_{OUT}$ =0.47 $\mu$ F,  
 $V_{IN}$ =3.8V $_{DC}$ +0.2Vp-p



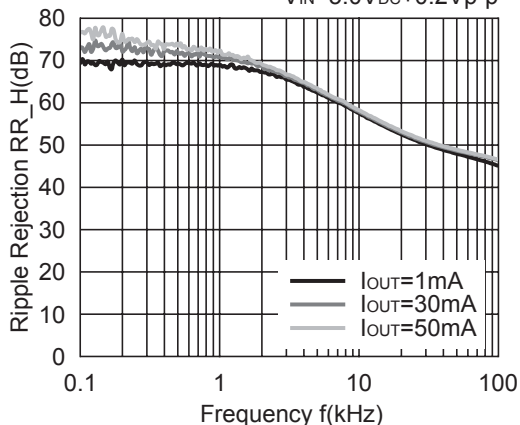
**R1163x281x ECO=L**

$C_{IN}$ =none,  $C_{OUT}$ =0.47 $\mu$ F,  
 $V_{IN}$ =3.8V $_{DC}$ +0.2Vp-p



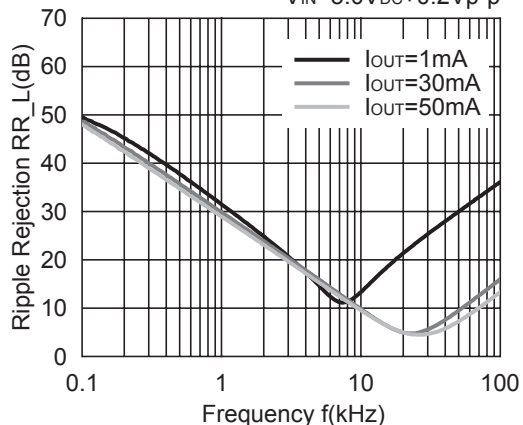
**R1163x401x ECO=H**

$C_{IN}=none, C_{OUT}=0.47\mu F,$   
 $V_{IN}=5.0V_{DC}+0.2V_{p-p}$



**R1163x401x ECO=L**

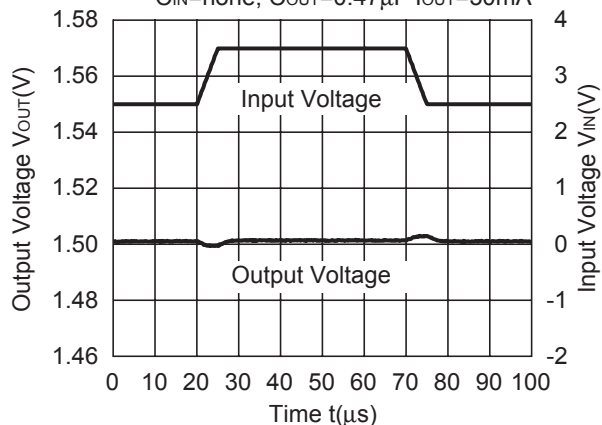
$C_{IN}=none, C_{OUT}=0.47\mu F,$   
 $V_{IN}=5.0V_{DC}+0.2V_{p-p}$



**12) Input Transient Response**

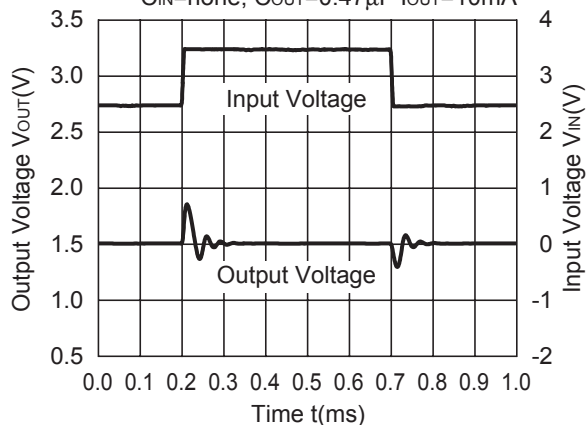
**R1163x151x ECO=H**

$C_{IN}=none, C_{OUT}=0.47\mu F, I_{OUT}=30mA$



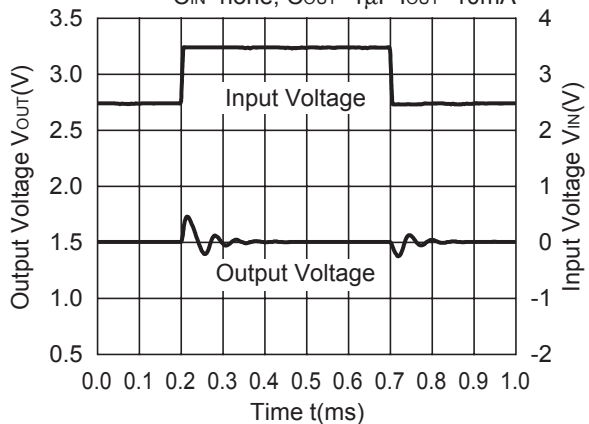
**R1163x151x ECO=L**

$C_{IN}=none, C_{OUT}=0.47\mu F, I_{OUT}=10mA$



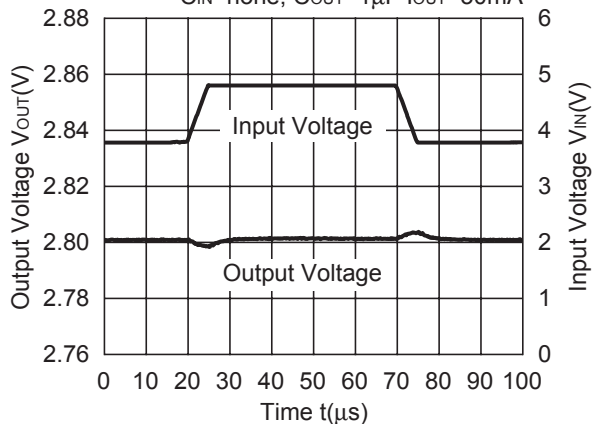
**R1163x151x ECO=L**

$C_{IN}=none, C_{OUT}=1\mu F, I_{OUT}=10mA$



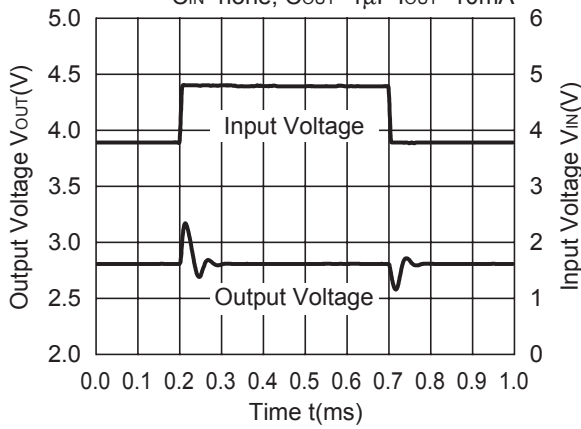
**R1163x281x ECO=H**

$C_{IN}=none, C_{OUT}=1\mu F, I_{OUT}=30mA$



**R1163x281x ECO=H**

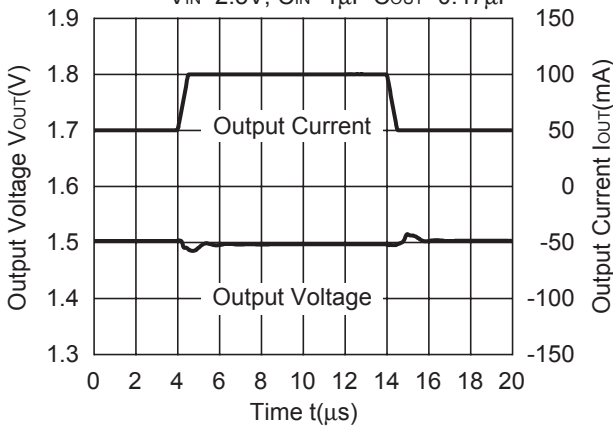
$C_{IN}=none, C_{OUT}=1\mu F, I_{OUT}=10mA$



**13) Load Transient Response**

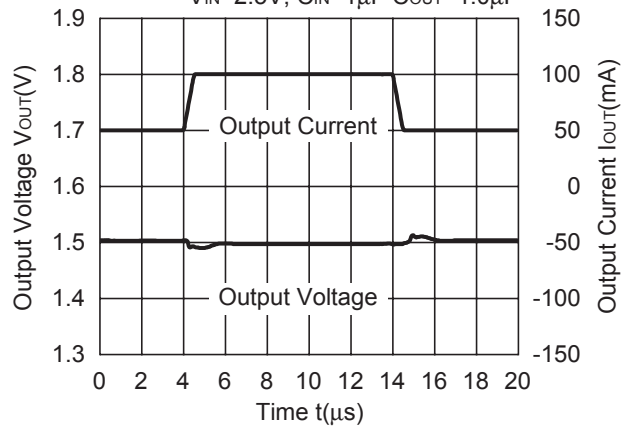
**R1163x151x ECO=H**

$V_{IN}=2.5V, C_{IN}=1\mu F, C_{OUT}=0.47\mu F$



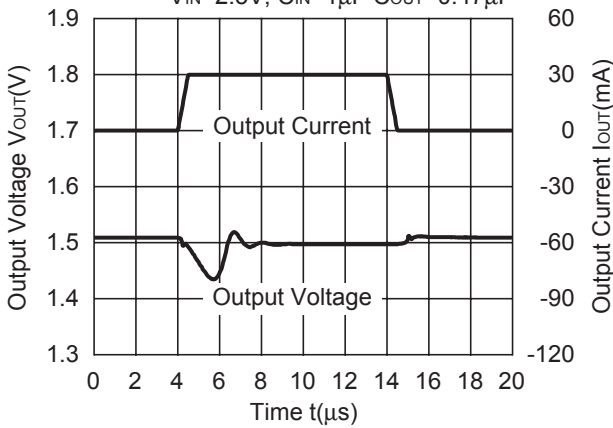
**R1163x151x ECO=H**

$V_{IN}=2.5V, C_{IN}=1\mu F, C_{OUT}=1.0\mu F$



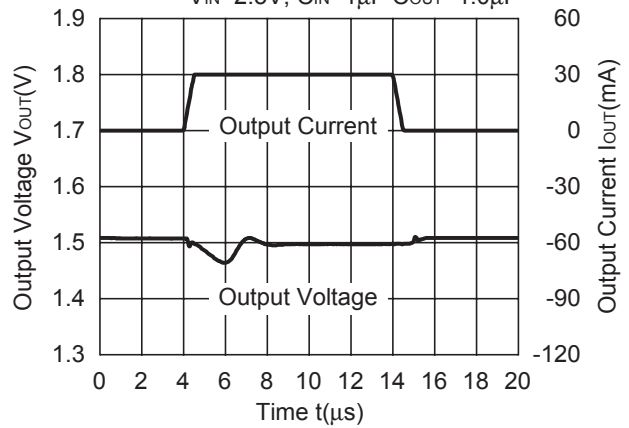
**R1163x151x ECO=H**

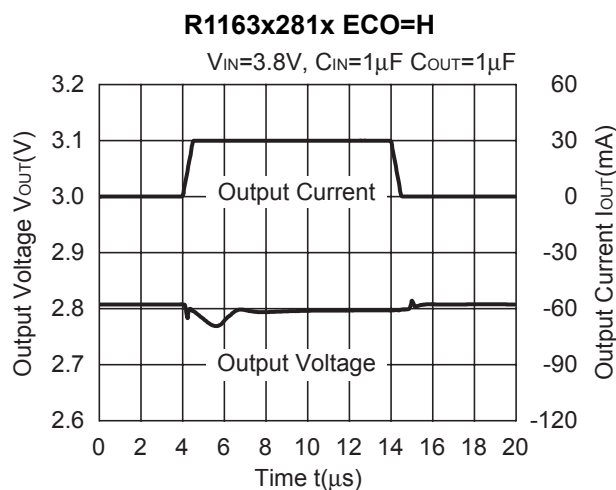
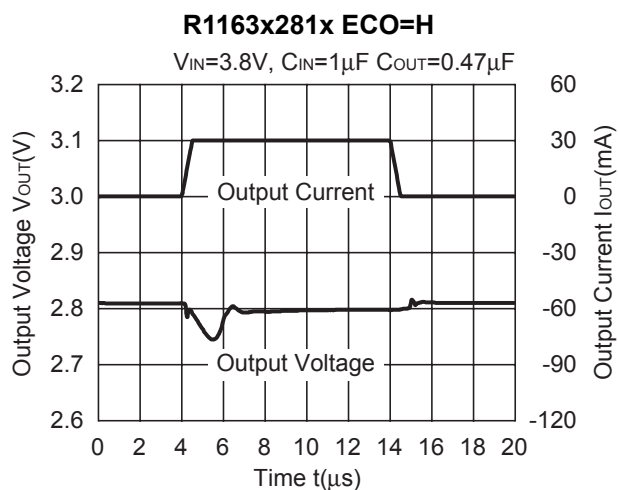
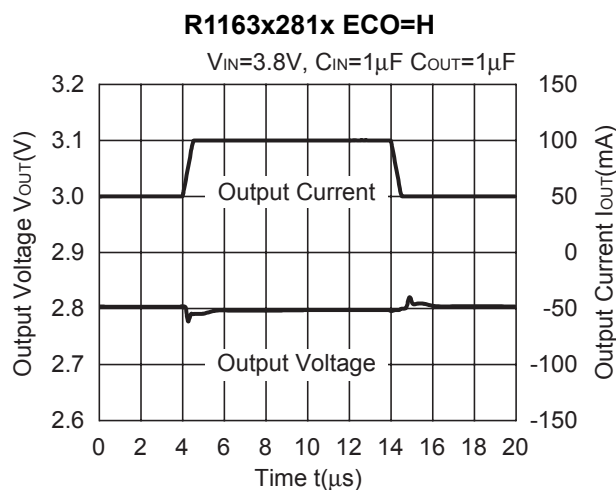
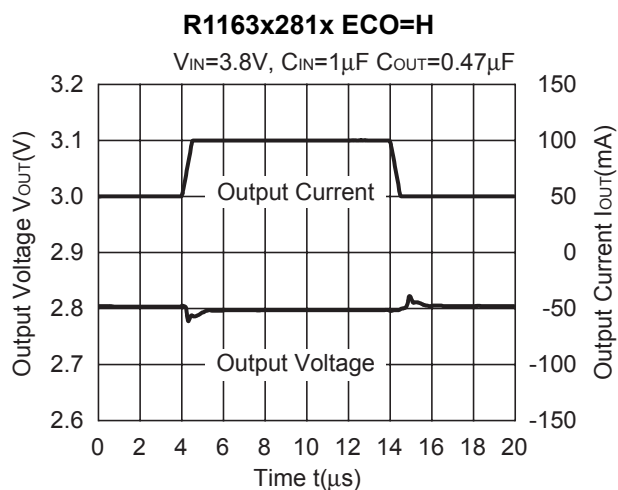
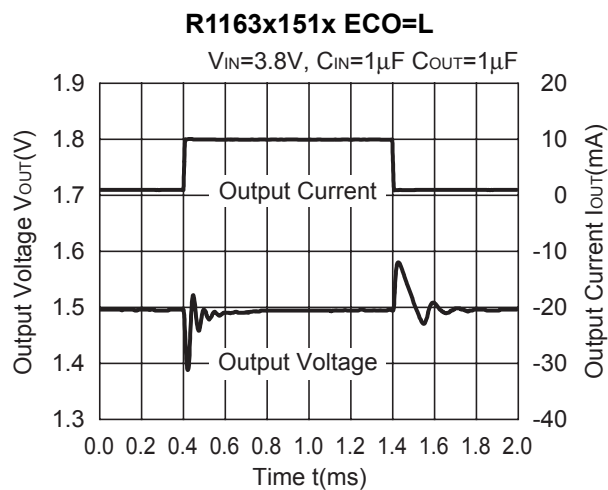
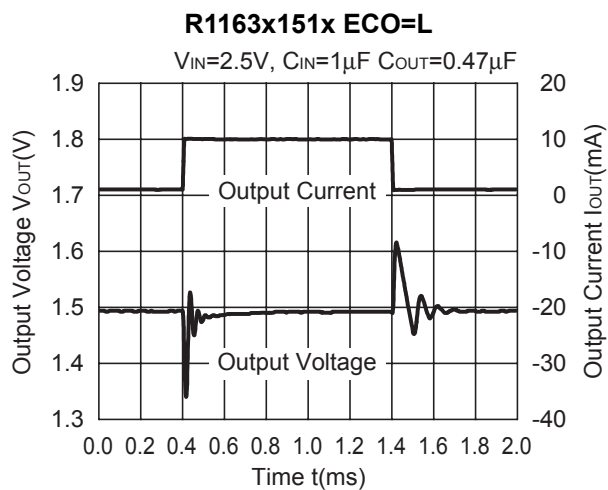
$V_{IN}=2.5V, C_{IN}=1\mu F, C_{OUT}=0.47\mu F$

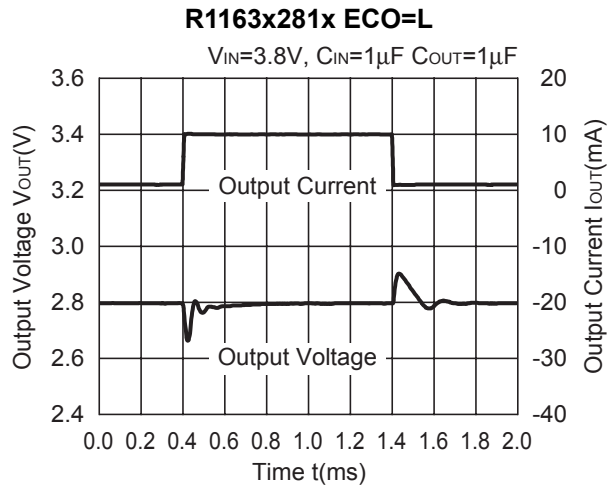
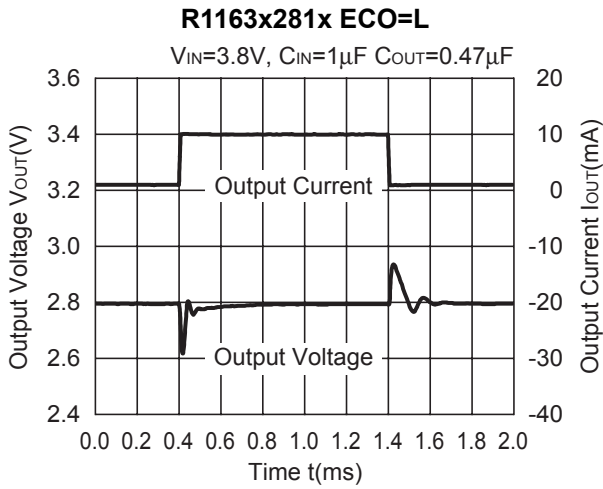


**R1163x151x ECO=H**

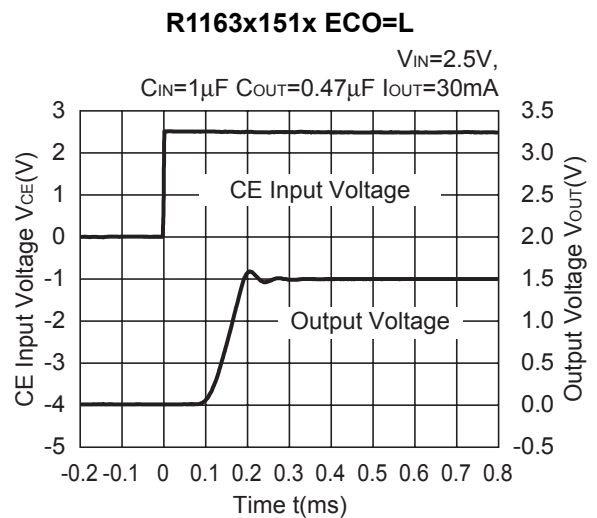
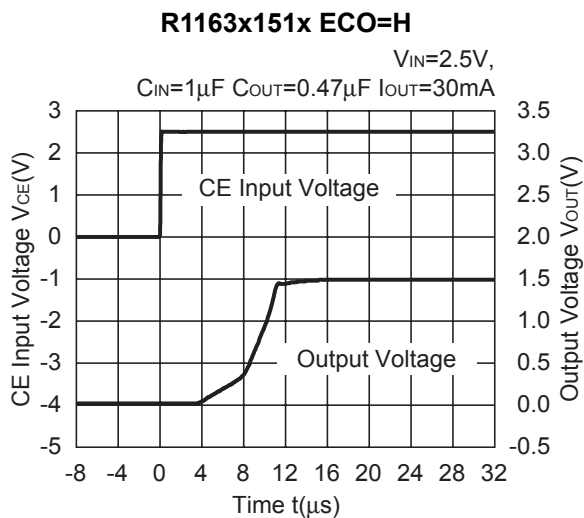
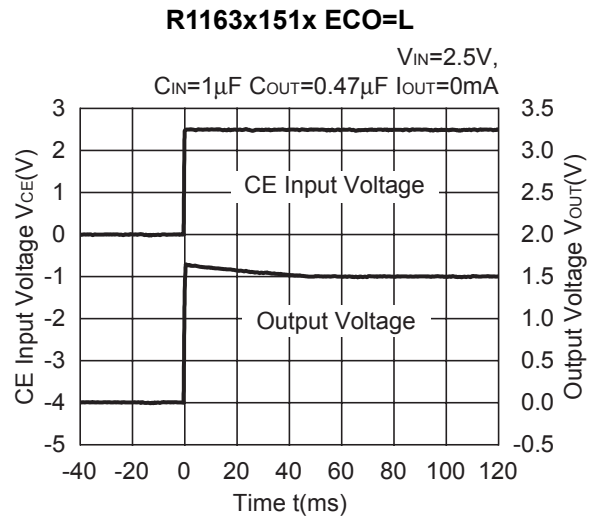
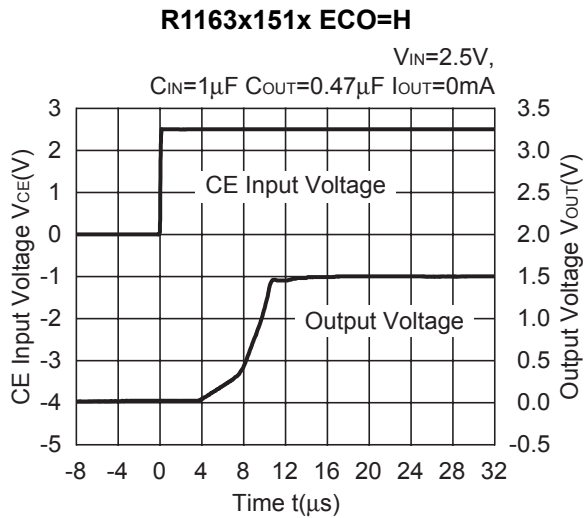
$V_{IN}=2.5V, C_{IN}=1\mu F, C_{OUT}=1.0\mu F$



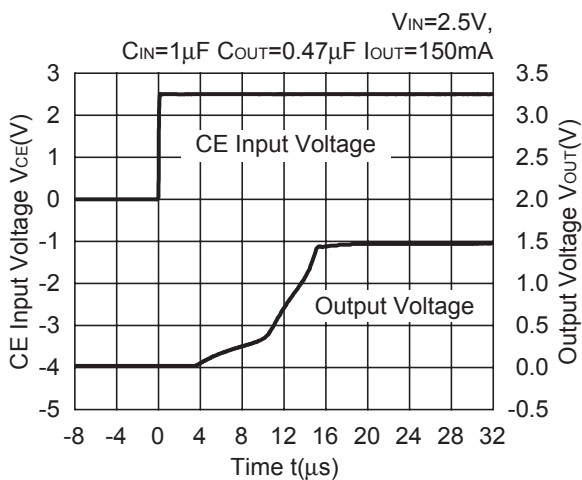




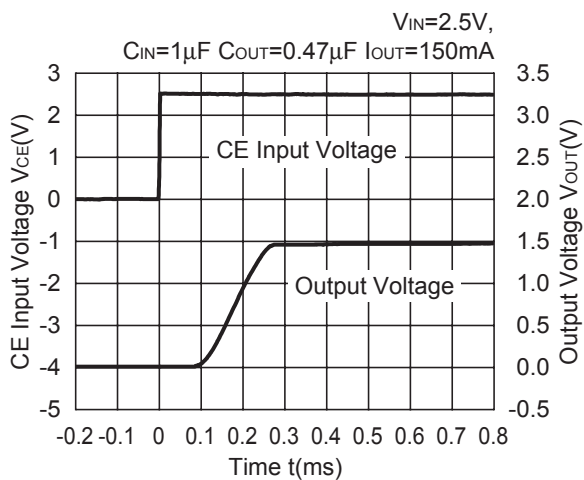
14) Turn on speed with CE pin



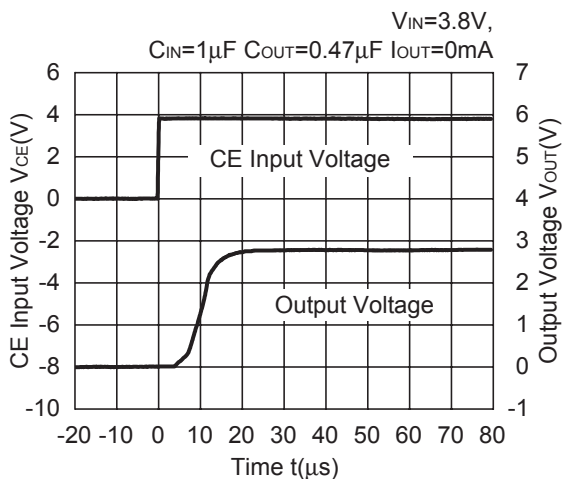
**R1163x151x ECO=H**



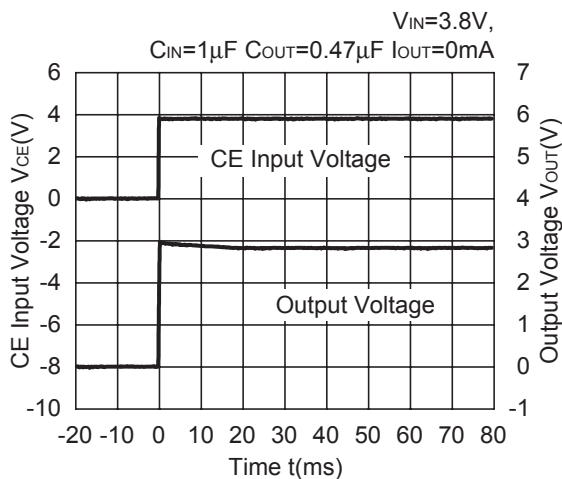
**R1163x151x ECO=L**



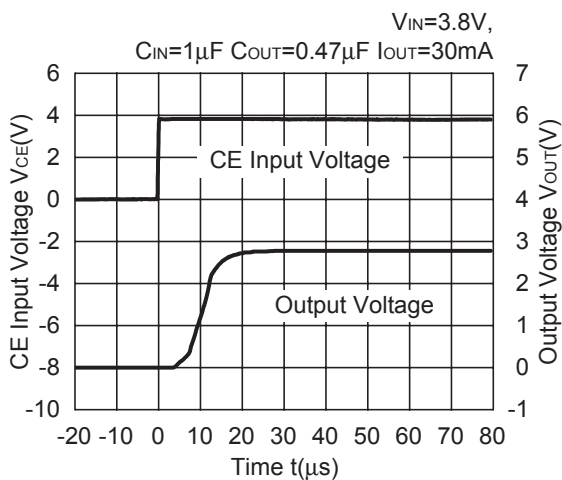
**R1163x281x ECO=H**



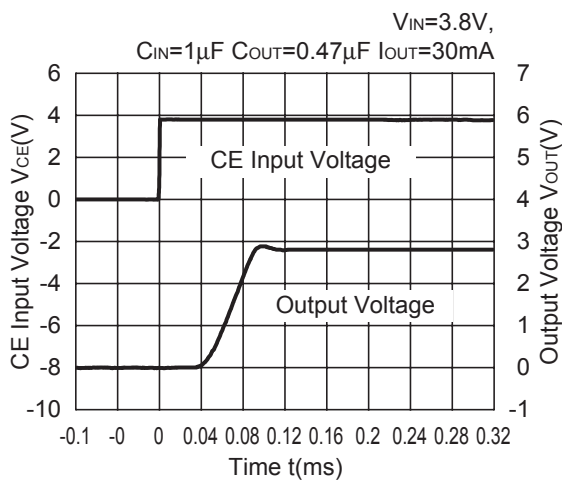
**R1163x281x ECO=L**



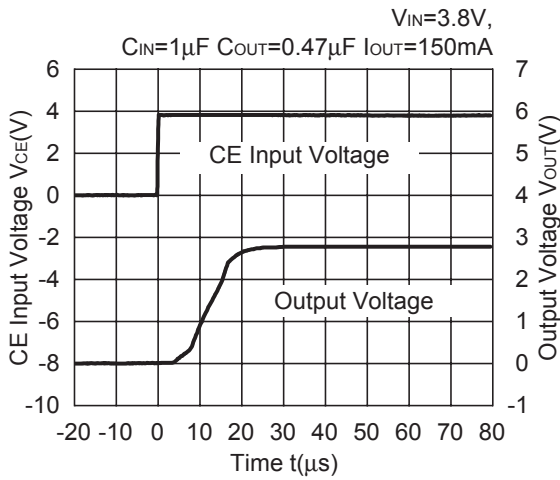
**R1163x281x ECO=H**



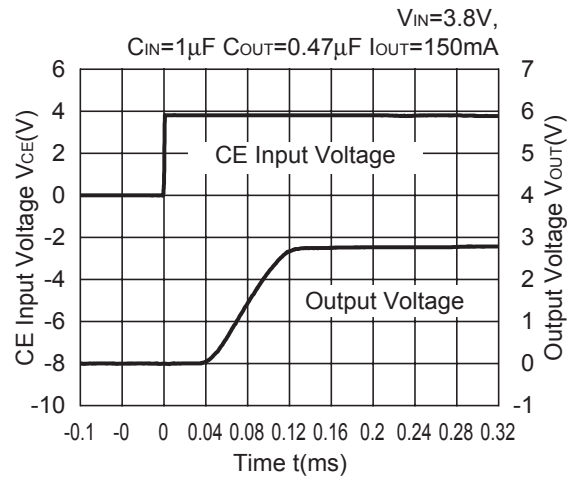
**R1163x281x ECO=L**



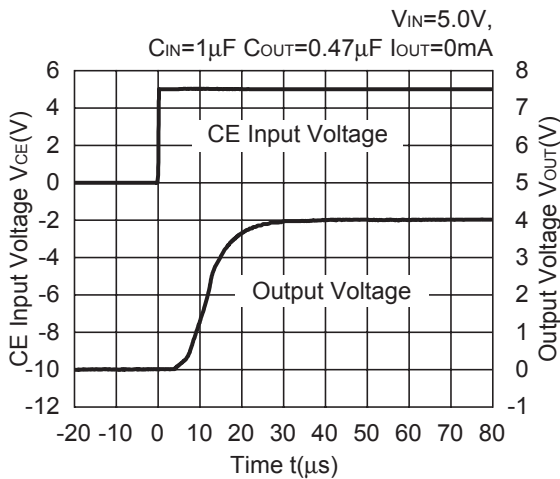
**R1163x281x ECO=H**



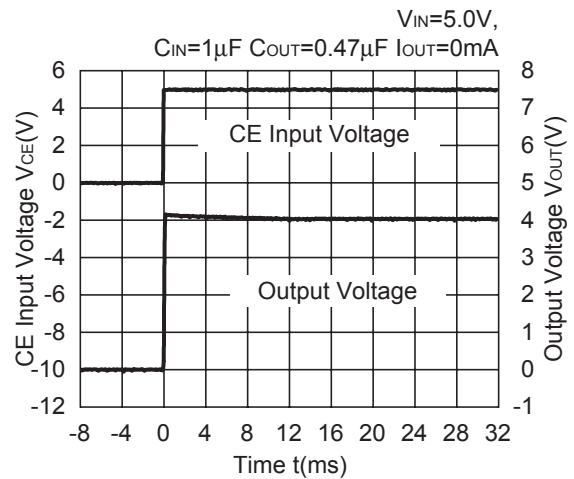
**R1163x281x ECO=L**



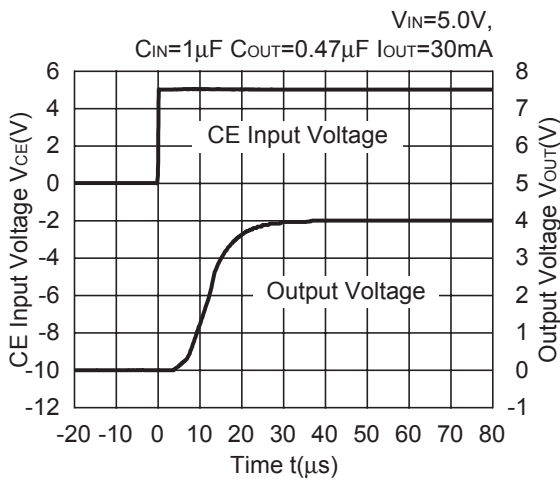
**R1163x401x ECO=H**



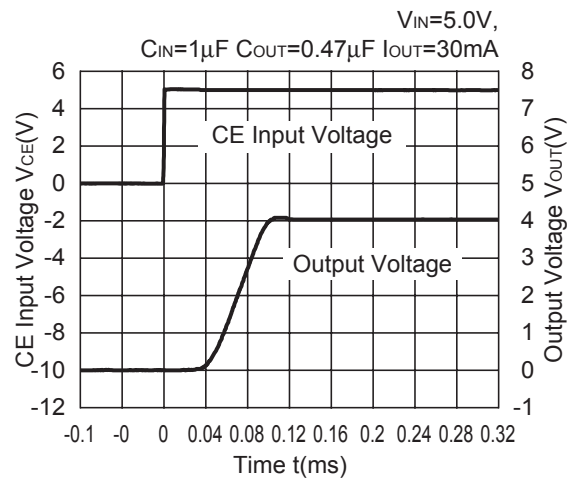
**R1163x401x ECO=L**



**R1163x401x ECO=H**

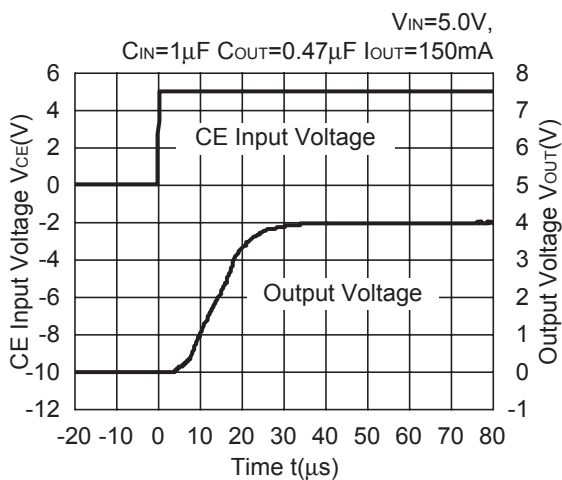


**R1163x401x ECO=L**

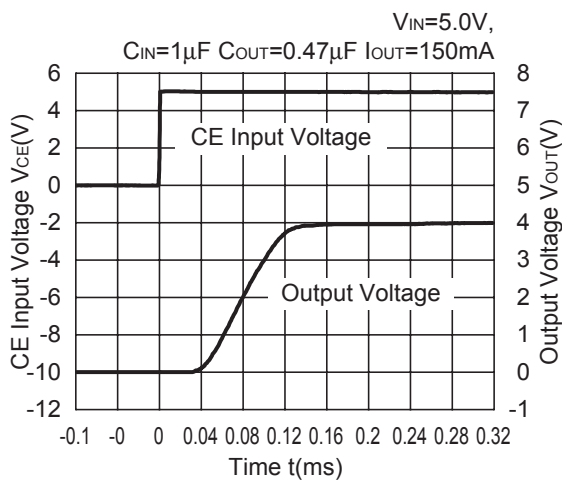




**R1163x401x ECO=H**

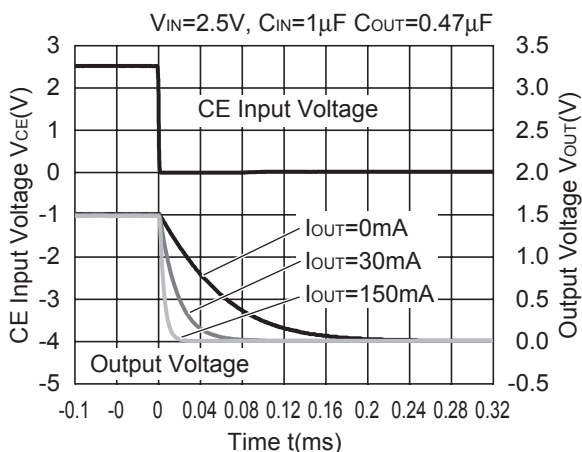


**R1163x401x ECO=L**

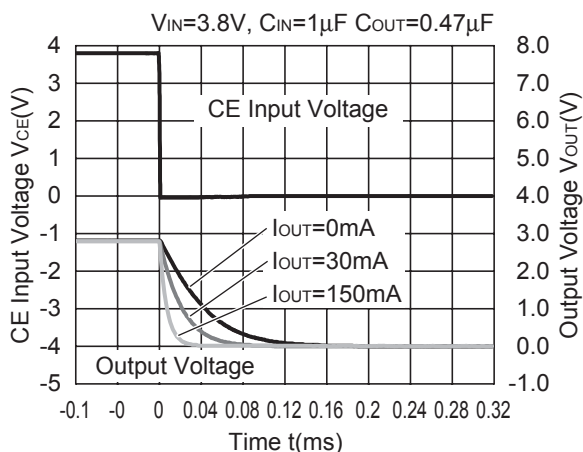


**15) Turn off speed with CE pin**

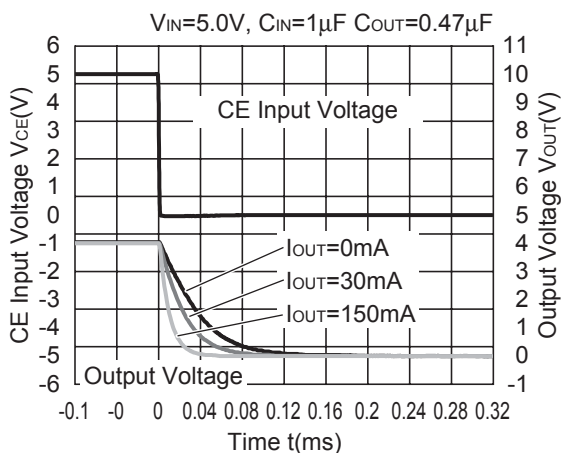
**R1163x151xD**



**R1163x281xD**



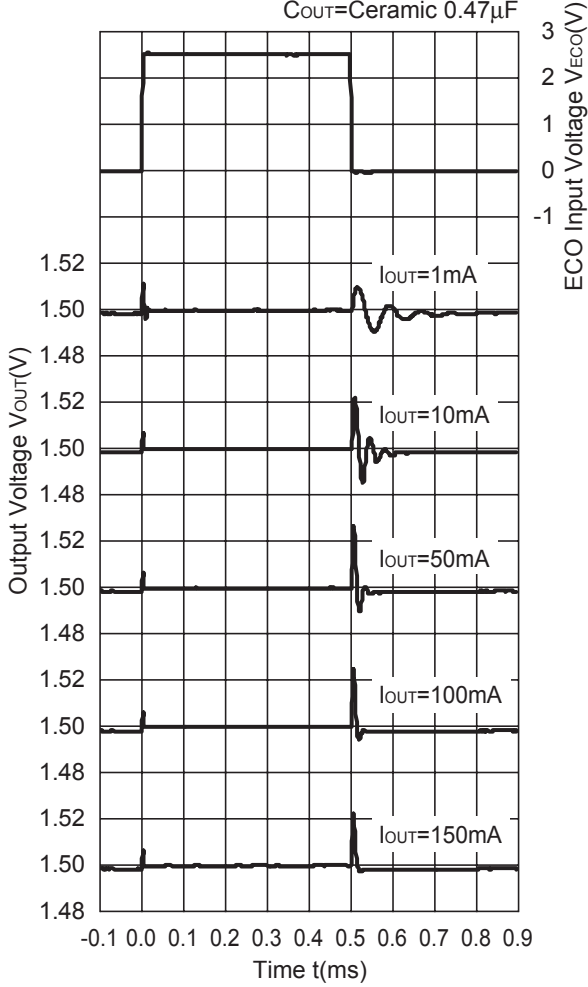
**R1163x401xD**



16) Output Voltage at Mode alternative point

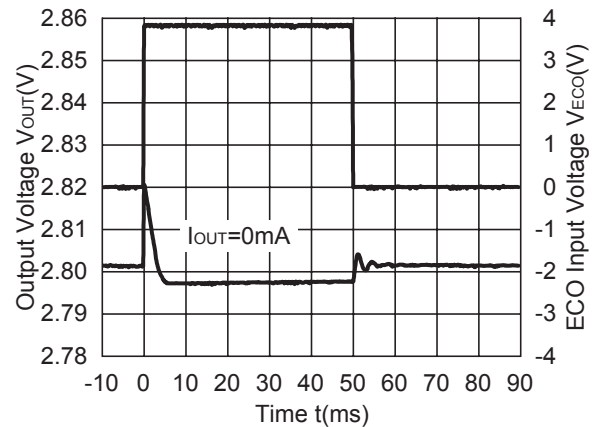
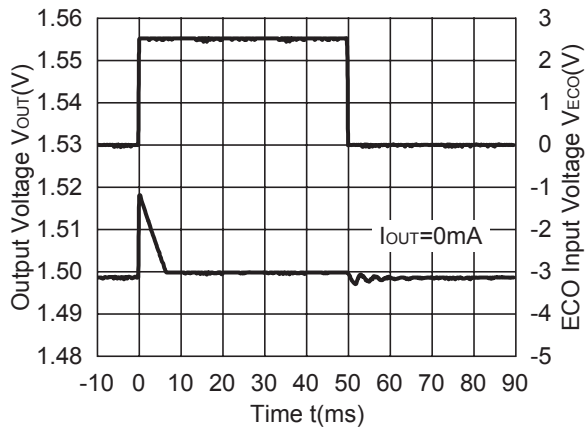
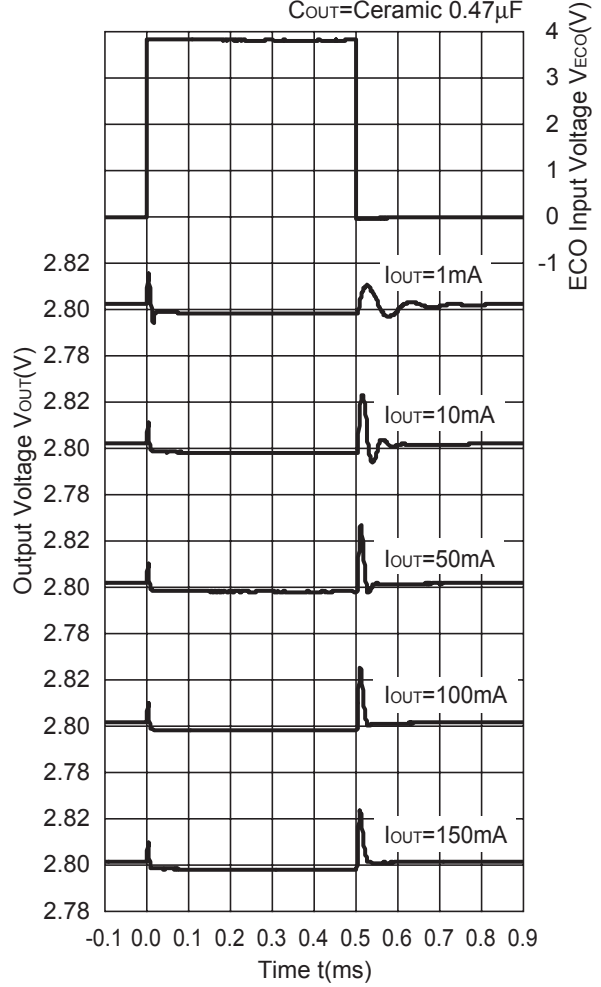
**R1163x151B/D**

$V_{IN}=2.5V$ ,  $C_{IN}$ =Ceramic  $1.0\mu F$ ,  
 $C_{OUT}$ =Ceramic  $0.47\mu F$



**R1163x281B/D**

$V_{IN}=3.8V$ ,  $C_{IN}$ =Ceramic  $1.0\mu F$ ,  
 $C_{OUT}$ =Ceramic  $0.47\mu F$



## TECHNICAL NOTES

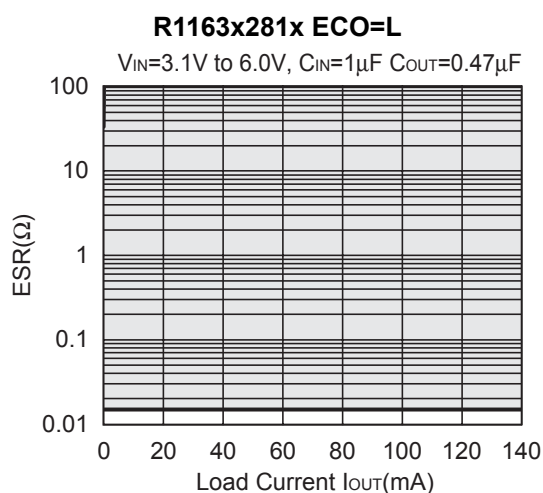
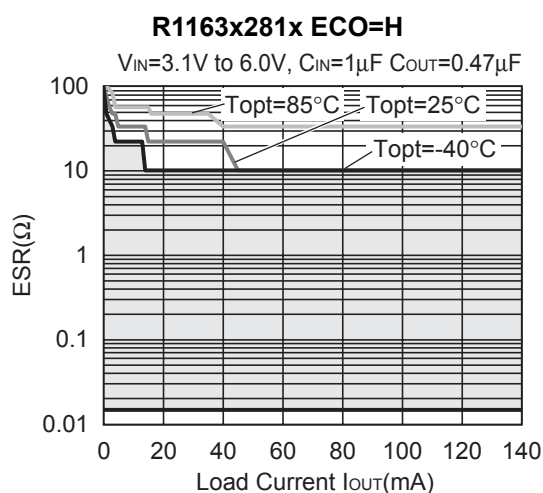
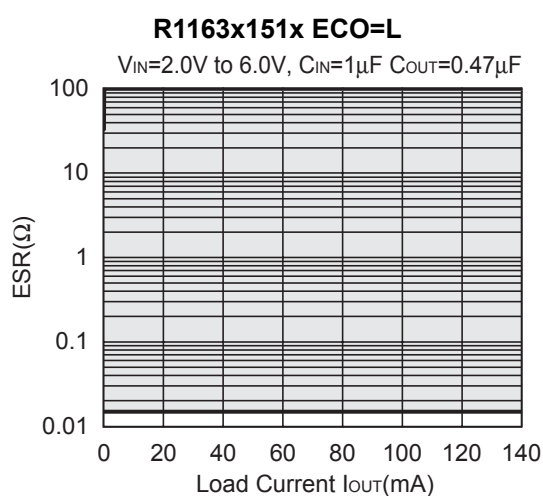
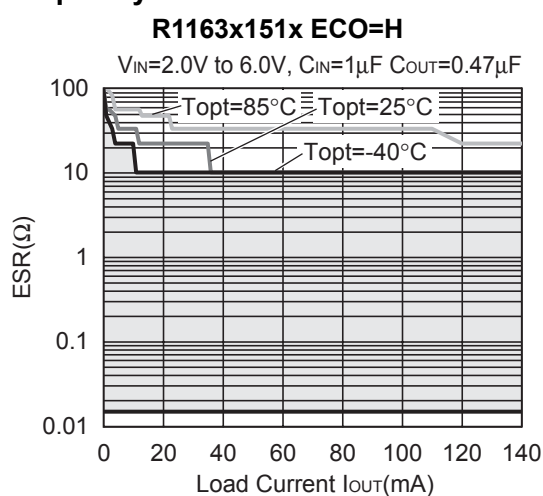
When using these ICs, consider the following points:

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

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

### <Test conditions>

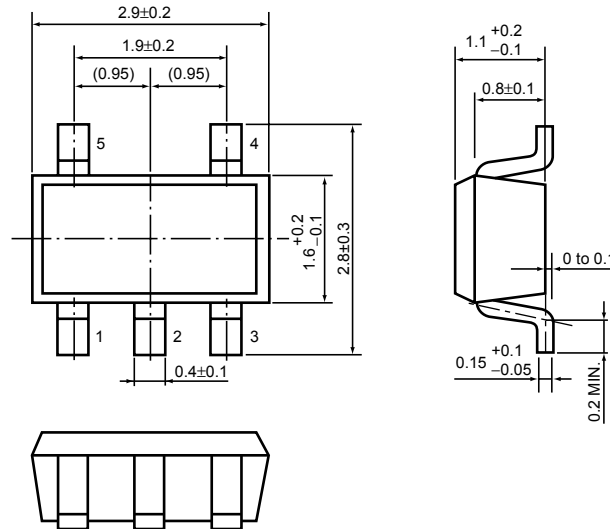
#### (1) Frequency band: 10Hz to 2MHz



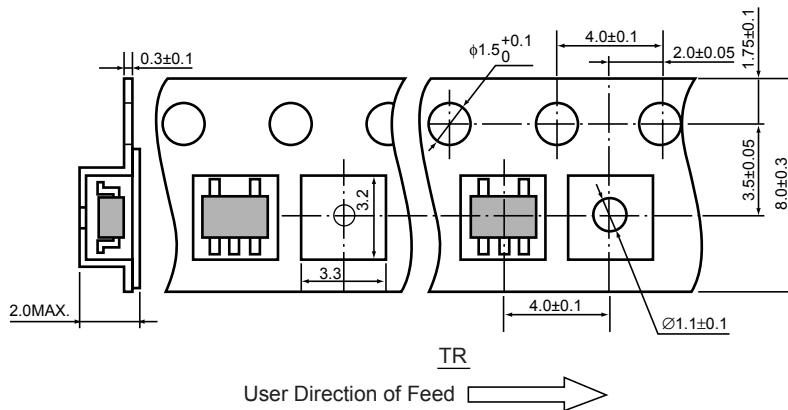
- SOT-23-5 (SC-74A)

Unit: mm

### PACKAGE DIMENSIONS

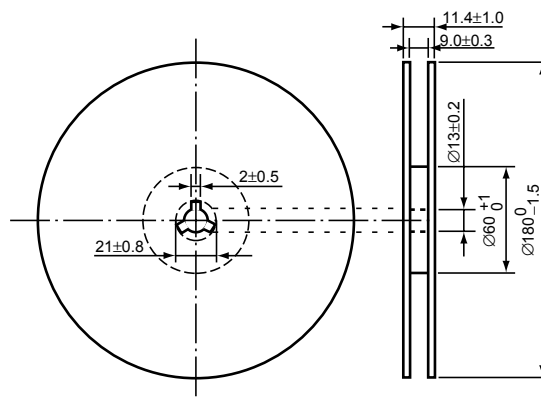


### TAPING SPECIFICATION



### TAPING REEL DIMENSIONS

(1reel=3000pcs)



### POWER DISSIPATION (SOT-23-5)

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:

(Power Dissipation (SOT-23-5) is substitution of SOT-23-6.)

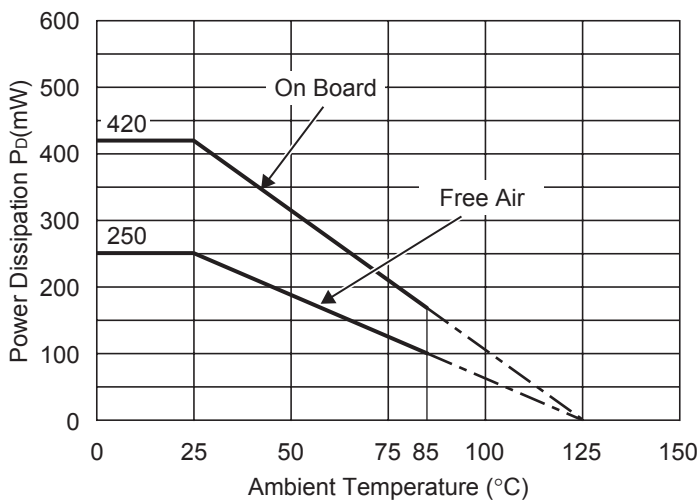
Measurement Conditions

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

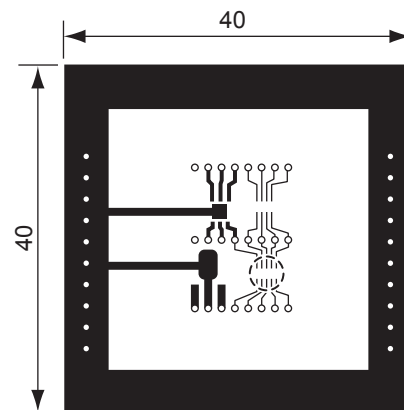
Measurement Result

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

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



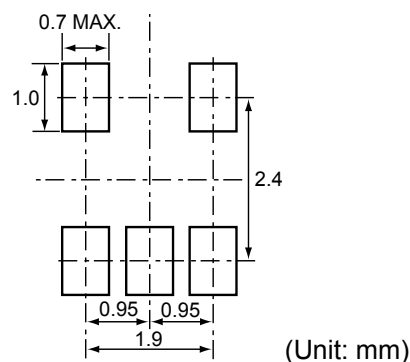
Power Dissipation



Measurement Board Pattern

○ IC Mount Area Unit : mm

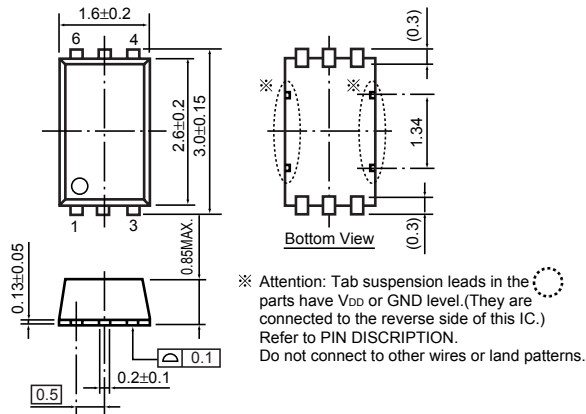
### RECOMMENDED LAND PATTERN



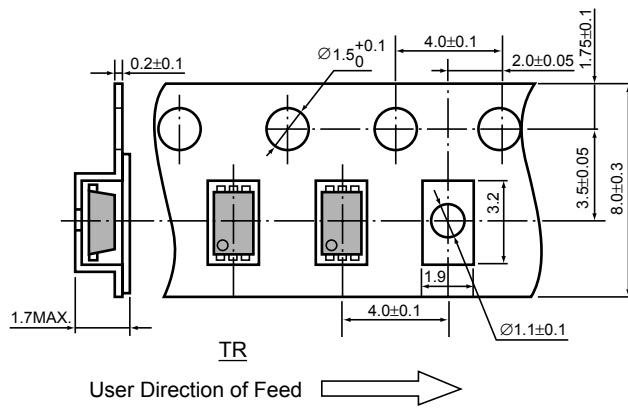
• SON-6

Unit: mm

PACKAGE DIMENSIONS



TAPING SPECIFICATION



TAPING REEL DIMENSIONS

(1reel=3000pcs)



### POWER DISSIPATION (SON-6)

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

Measurement Conditions

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

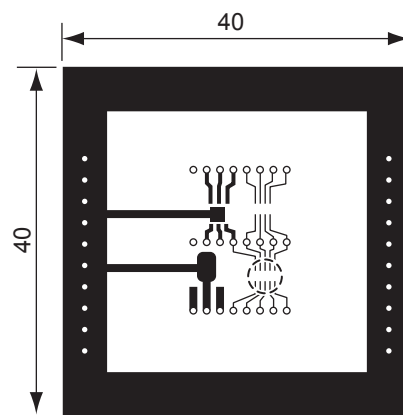
Measurement Result

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

|                    |   |          |
|--------------------|---|----------|
|                    | Standard Land Pattern                               | Free Air |
| Power Dissipation  | 500mW   | 250mW    |
| Thermal Resistance | $\theta_{ja}=(125-25^{\circ}C)/0.5W=200^{\circ}C/W$ | -        |



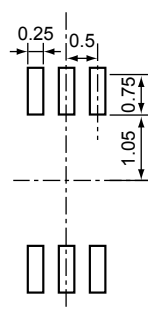
Power Dissipation



Measurement Board Pattern

○ IC Mount Area (Unit : mm)

### RECOMMENDED LAND PATTERN

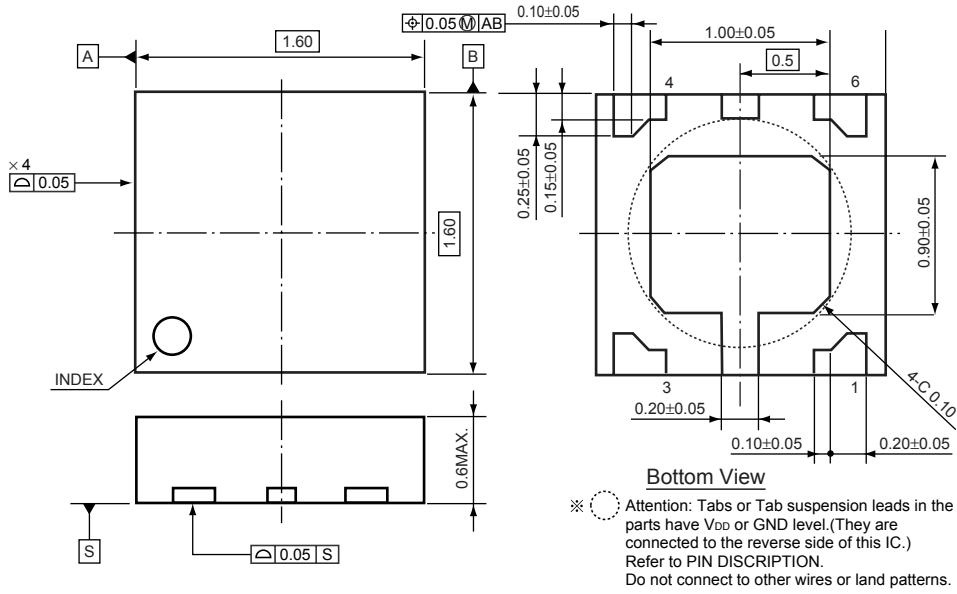


(Unit: mm)

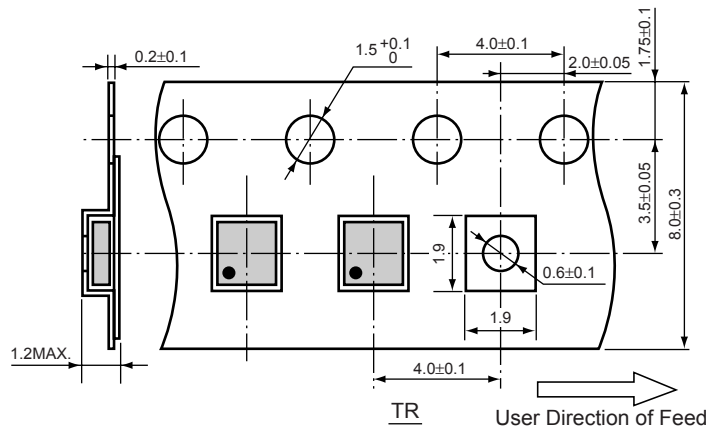
● PLP1616-6

Unit: mm

PACKAGE DIMENSIONS

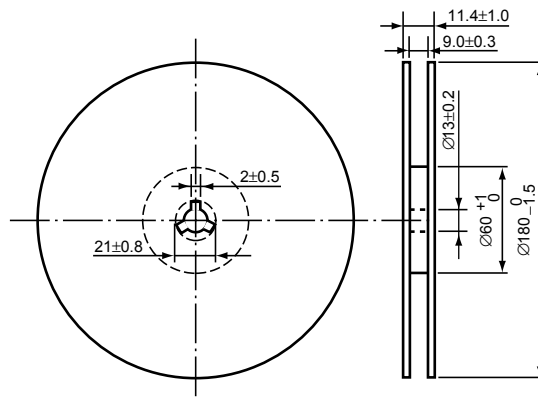


TAPING SPECIFICATION



TAPING REEL DIMENSIONS

(1reel=5000pcs)





## POWER DISSIPATION (PLP1616-6)

This specification is at mounted on board. Power Dissipation ( $P_D$ ) depends on conditions of mounting on board.

This specification is based on the measurement at the condition below:

(PLP1616-6 is a reference value calculated from the PLP1820-6 package.)

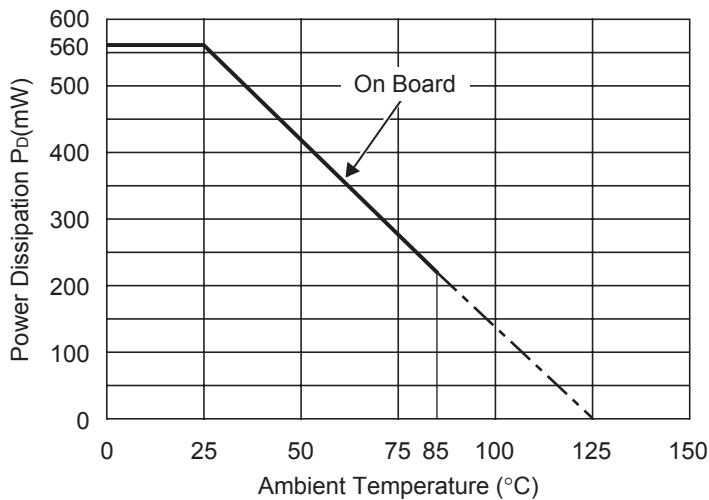
### Measurement Conditions

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

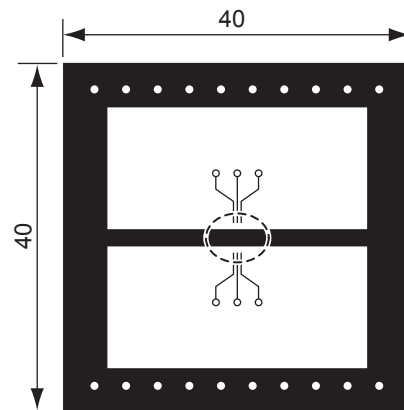
### Measurement Result

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

|                    | Standard Land Pattern   |
|--------------------|---|
| Power Dissipation  | 560mW   |
| Thermal Resistance | $\theta_{ja}=(125-25^{\circ}\text{C})/0.56\text{W}=179^{\circ}\text{C/W}$ |



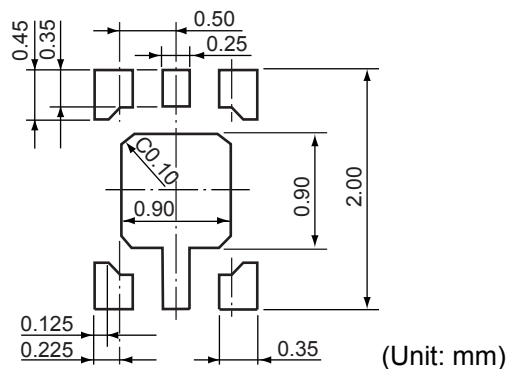
Power Dissipation



Measurement Board Pattern

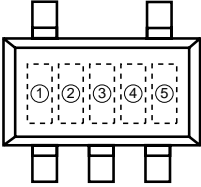
○ IC Mount Area Unit : mm

## RECOMMENDED LAND PATTERN



**R1163N SERIES MARK SPECIFICATION**

● **SOT-23-5 (SC-74A)**



①, ②, ③ : Product Code (refer to Part Number vs. Product Code)

④, ⑤ : Lot Number

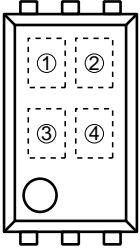
● **Part Number vs. Product Code**

| Part Number | Product Code |   |   |
|-------------|--------------|---|---|
|             | ①            | ② | ③ |
| R1163N151B  | V            | 1 | 5 |
| R1163N161B  | V            | 1 | 6 |
| R1163N171B  | V            | 1 | 7 |
| R1163N181B  | V            | 1 | 8 |
| R1163N191B  | V            | 1 | 9 |
| R1163N201B  | V            | 2 | 0 |
| R1163N211B  | V            | 2 | 1 |
| R1163N221B  | V            | 2 | 2 |
| R1163N231B  | V            | 2 | 3 |
| R1163N241B  | V            | 2 | 4 |
| R1163N251B  | V            | 2 | 5 |
| R1163N261B  | V            | 2 | 6 |
| R1163N271B  | V            | 2 | 7 |
| R1163N281B  | V            | 2 | 8 |
| R1163N291B  | V            | 2 | 9 |
| R1163N301B  | V            | 3 | 0 |
| R1163N311B  | V            | 3 | 1 |
| R1163N321B  | V            | 3 | 2 |
| R1163N331B  | V            | 3 | 3 |
| R1163N341B  | V            | 3 | 4 |
| R1163N351B  | V            | 3 | 5 |
| R1163N361B  | V            | 3 | 6 |
| R1163N371B  | V            | 3 | 7 |
| R1163N381B  | V            | 3 | 8 |
| R1163N391B  | V            | 3 | 9 |
| R1163N401B  | V            | 4 | 0 |
| R1163N181B5 | V            | 4 | 1 |
| R1163N281B5 | V            | 4 | 2 |

| Part Number | Product Code |   |   |
|-------------|--------------|---|---|
|             | ①            | ② | ③ |
| R1163N151D  | W            | 1 | 5 |
| R1163N161D  | W            | 1 | 6 |
| R1163N171D  | W            | 1 | 7 |
| R1163N181D  | W            | 1 | 8 |
| R1163N191D  | W            | 1 | 9 |
| R1163N201D  | W            | 2 | 0 |
| R1163N211D  | W            | 2 | 1 |
| R1163N221D  | W            | 2 | 2 |
| R1163N231D  | W            | 2 | 3 |
| R1163N241D  | W            | 2 | 4 |
| R1163N251D  | W            | 2 | 5 |
| R1163N261D  | W            | 2 | 6 |
| R1163N271D  | W            | 2 | 7 |
| R1163N281D  | W            | 2 | 8 |
| R1163N291D  | W            | 2 | 9 |
| R1163N301D  | W            | 3 | 0 |
| R1163N311D  | W            | 3 | 1 |
| R1163N321D  | W            | 3 | 2 |
| R1163N331D  | W            | 3 | 3 |
| R1163N341D  | W            | 3 | 4 |
| R1163N351D  | W            | 3 | 5 |
| R1163N361D  | W            | 3 | 6 |
| R1163N371D  | W            | 3 | 7 |
| R1163N381D  | W            | 3 | 8 |
| R1163N391D  | W            | 3 | 9 |
| R1163N401D  | W            | 4 | 0 |
| R1163N181D5 | W            | 4 | 1 |
| R1163N281D5 | W            | 4 | 2 |

## R1163D SERIES MARK SPECIFICATION

• SON-6



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

③, ④ : Lot Number

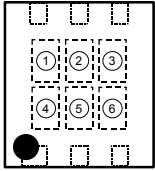
• Part Number vs. Product Code

| Part Number | Product Code |   |
|-------------|--------------|---|
|             | ①            | ② |
| R1163D151B  | S            | 5 |
| R1163D161B  | S            | 6 |
| R1163D171B  | S            | 7 |
| R1163D181B  | S            | 8 |
| R1163D191B  | S            | 9 |
| R1163D201B  | T            | 0 |
| R1163D211B  | T            | 1 |
| R1163D221B  | T            | 2 |
| R1163D231B  | T            | 3 |
| R1163D241B  | T            | 4 |
| R1163D251B  | T            | 5 |
| R1163D261B  | T            | 6 |
| R1163D271B  | T            | 7 |
| R1163D281B  | T            | 8 |
| R1163D291B  | T            | 9 |
| R1163D301B  | U            | 0 |
| R1163D311B  | U            | 1 |
| R1163D321B  | U            | 2 |
| R1163D331B  | U            | 3 |
| R1163D341B  | U            | 4 |
| R1163D351B  | U            | 5 |
| R1163D361B  | U            | 6 |
| R1163D371B  | U            | 7 |
| R1163D381B  | U            | 8 |
| R1163D391B  | U            | 9 |
| R1163D401B  | V            | 0 |
| R1163D181B5 | V            | 1 |
| R1163D281B5 | V            | 2 |

| Part Number | Product Code |   |
|-------------|--------------|---|
|             | ①            | ② |
| R1163D151D  | W            | 5 |
| R1163D161D  | W            | 6 |
| R1163D171D  | W            | 7 |
| R1163D181D  | W            | 8 |
| R1163D191D  | W            | 9 |
| R1163D201D  | X            | 0 |
| R1163D211D  | X            | 1 |
| R1163D221D  | X            | 2 |
| R1163D231D  | X            | 3 |
| R1163D241D  | X            | 4 |
| R1163D251D  | X            | 5 |
| R1163D261D  | X            | 6 |
| R1163D271D  | X            | 7 |
| R1163D281D  | X            | 8 |
| R1163D291D  | X            | 9 |
| R1163D301D  | Y            | 0 |
| R1163D311D  | Y            | 1 |
| R1163D321D  | Y            | 2 |
| R1163D331D  | Y            | 3 |
| R1163D341D  | Y            | 4 |
| R1163D351D  | Y            | 5 |
| R1163D361D  | Y            | 6 |
| R1163D371D  | Y            | 7 |
| R1163D381D  | Y            | 8 |
| R1163D391D  | Y            | 9 |
| R1163D401D  | Z            | 0 |
| R1163D181D5 | Z            | 1 |
| R1163D281D5 | Z            | 2 |

**R1163K SERIES MARK SPECIFICATION**

● **PLP1616-6**



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

⑤, ⑥ : Lot Number

● **Part Number vs. Product Code**

| Part Number | Product Code |   |   |   |
|-------------|--------------|---|---|---|
|             | ①            | ② | ③ | ④ |
| R1163K151B  | M            | 1 | 5 | B |
| R1163K161B  | M            | 1 | 6 | B |
| R1163K171B  | M            | 1 | 7 | B |
| R1163K181B  | M            | 1 | 8 | B |
| R1163K191B  | M            | 1 | 9 | B |
| R1163K201B  | M            | 2 | 0 | B |
| R1163K211B  | M            | 2 | 1 | B |
| R1163K221B  | M            | 2 | 2 | B |
| R1163K231B  | M            | 2 | 3 | B |
| R1163K241B  | M            | 2 | 4 | B |
| R1163K251B  | M            | 2 | 5 | B |
| R1163K261B  | M            | 2 | 6 | B |
| R1163K271B  | M            | 2 | 7 | B |
| R1163K281B  | M            | 2 | 8 | B |
| R1163K291B  | M            | 2 | 9 | B |
| R1163K301B  | M            | 3 | 0 | B |
| R1163K311B  | M            | 3 | 1 | B |
| R1163K321B  | M            | 3 | 2 | B |
| R1163K331B  | M            | 3 | 3 | B |
| R1163K341B  | M            | 3 | 4 | B |
| R1163K351B  | M            | 3 | 5 | B |
| R1163K361B  | M            | 3 | 6 | B |
| R1163K371B  | M            | 3 | 7 | B |
| R1163K381B  | M            | 3 | 8 | B |
| R1163K391B  | M            | 3 | 9 | B |
| R1163K401B  | M            | 4 | 0 | B |
| R1163K181B5 | M            | 1 | 8 | 5 |
| R1163K281B5 | M            | 2 | 8 | 5 |

| Part Number | Product Code |   |   |   |
|-------------|--------------|---|---|---|
|             | ①            | ② | ③ | ④ |
| R1163K151D  | N            | 1 | 5 | D |
| R1163K161D  | N            | 1 | 6 | D |
| R1163K171D  | N            | 1 | 7 | D |
| R1163K181D  | N            | 1 | 8 | D |
| R1163K191D  | N            | 1 | 9 | D |
| R1163K201D  | N            | 2 | 0 | D |
| R1163K211D  | N            | 2 | 1 | D |
| R1163K221D  | N            | 2 | 2 | D |
| R1163K231D  | N            | 2 | 3 | D |
| R1163K241D  | N            | 2 | 4 | D |
| R1163K251D  | N            | 2 | 5 | D |
| R1163K261D  | N            | 2 | 6 | D |
| R1163K271D  | N            | 2 | 7 | D |
| R1163K281D  | N            | 2 | 8 | D |
| R1163K291D  | N            | 2 | 9 | D |
| R1163K301D  | N            | 3 | 0 | D |
| R1163K311D  | N            | 3 | 1 | D |
| R1163K321D  | N            | 3 | 2 | D |
| R1163K331D  | N            | 3 | 3 | D |
| R1163K341D  | N            | 3 | 4 | D |
| R1163K351D  | N            | 3 | 5 | D |
| R1163K361D  | N            | 3 | 6 | D |
| R1163K371D  | N            | 3 | 7 | D |
| R1163K381D  | N            | 3 | 8 | D |
| R1163K391D  | N            | 3 | 9 | D |
| R1163K401D  | N            | 4 | 0 | D |
| R1163K181D5 | N            | 1 | 8 | 5 |
| R1163K281D5 | N            | 2 | 8 | 5 |

| Part Number | Product Code |   |   |   |
|-------------|--------------|---|---|---|
|             | ①            | ② | ③ | ④ |
| R1163K151E  | P            | 1 | 5 | E |
| R1163K161E  | P            | 1 | 6 | E |
| R1163K171E  | P            | 1 | 7 | E |
| R1163K181E  | P            | 1 | 8 | E |
| R1163K191E  | P            | 1 | 9 | E |
| R1163K201E  | P            | 2 | 0 | E |
| R1163K211E  | P            | 2 | 1 | E |
| R1163K221E  | P            | 2 | 2 | E |
| R1163K231E  | P            | 2 | 3 | E |
| R1163K241E  | P            | 2 | 4 | E |
| R1163K251E  | P            | 2 | 5 | E |
| R1163K261E  | P            | 2 | 6 | E |
| R1163K271E  | P            | 2 | 7 | E |
| R1163K281E  | P            | 2 | 8 | E |
| R1163K291E  | P            | 2 | 9 | E |
| R1163K301E  | P            | 3 | 0 | E |
| R1163K311E  | P            | 3 | 1 | E |
| R1163K321E  | P            | 3 | 2 | E |
| R1163K331E  | P            | 3 | 3 | E |
| R1163K341E  | P            | 3 | 4 | E |
| R1163K351E  | P            | 3 | 5 | E |
| R1163K361E  | P            | 3 | 6 | E |
| R1163K371E  | P            | 3 | 7 | E |
| R1163K381E  | P            | 3 | 8 | E |
| R1163K391E  | P            | 3 | 9 | E |
| R1163K401E  | P            | 4 | 0 | E |
| R1163K181E5 | P            | 1 | 8 | 5 |
| R1163K281E5 | P            | 2 | 8 | 5 |