

* RP170Q (SC-88A) is the discontinued product as of April, 2016.

RICOH

RP170x SERIES

300mA 10V INPUT LDO REGULATOR

NO.EA-205-160425

OUTLINE

The RP170x Series are CMOS-based LDO regulators featuring 300mA output current. Because of the 10V maximum input voltage, RP170x can be used in 2 cell lithium-ion battery powered portable appliances and besides a portable equipment. The supply current is Typ. 23 μ A though an excellent response characteristics.

The output voltage range from 1.2V is possible. The output voltage accuracy and temperature-drift coefficient of output voltage of the RP170x Series are excellent.

RP170x has a fold-back protection circuit and a thermal shutdown circuit. Moreover, a standby mode with ultra low supply current can be realized with the chip enable function.

SC-88A, SOT-23-5 and SOT-89-5 with high power dissipation packages are available.

FEATURES

- Supply Current Typ. 23 μ A
- Standby Mode Typ. 0.1 μ A
- Dropout Voltage..... Typ. 0.20V ($I_{OUT}=100mA$, $V_{OUT}=3.0V$)
Typ. 0.77V ($I_{OUT}=300mA$, $V_{OUT}=2.8V$)
- Ripple Rejection Typ. 70dB ($f=1kHz$)
- Temperature-Drift Coefficient of Output Voltage Typ. $\pm 80ppm/^{\circ}C$
- Line Regulation Typ. 0.02%/V
- Output Voltage Accuracy $\pm 1.0\%$
- Packages..... SC-88A, SOT-23-5, SOT-89-5
- Input Voltage Range 2.6V to 10.0V
- Output Voltage Range 1.2V to 6.0V (0.1V steps)
(For other voltages, please refer to MARK INFORMATIONS.)
- Built-in Fold Back Protection Circuit..... Typ. 40mA (Current at short mode)
- Built-in Thermal Shutdown Circuit..... Shutdown Temperature at 165 $^{\circ}C$
- Built-in Constant Slope Circuit (Soft-start Function)
- Ceramic capacitors are recommended to be used with this IC 1.0 μ F or more

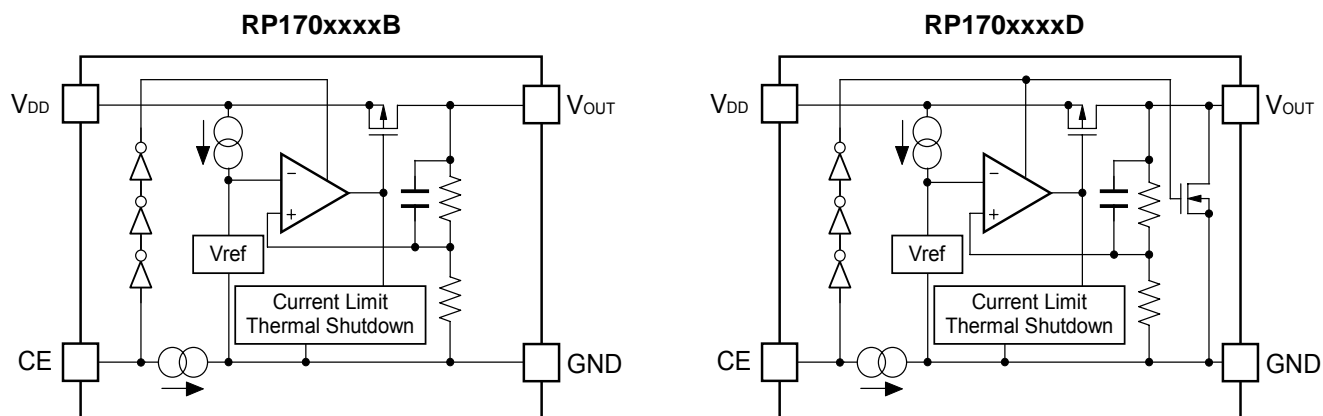
APPLICATIONS

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

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BLOCK DIAGRAMS



SELECTION GUIDE

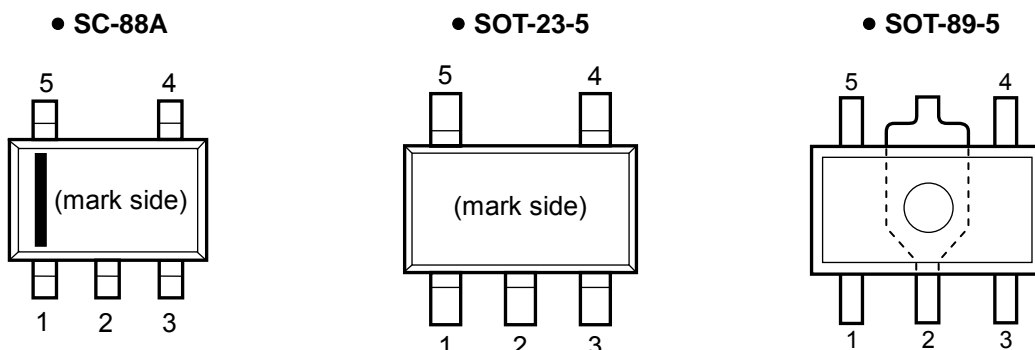
The output voltage, auto discharge function, and package for the ICs can be selected at the user's request.

| Product Name | Package | Quantity per Reel | Pb Free | Halogen Free |
|------------------|----------|-------------------|---------|--------------|
| RP170Qxx2*-TR-FE | SC-88A | 3,000 pcs | Yes | Yes |
| RP170Nxx1*-TR-FE | SOT-23-5 | 3,000 pcs | Yes | Yes |
| RP170Hxx1*-T1-FE | SOT-89-5 | 1,000 pcs | Yes | Yes |

xx: The output voltage can be designated in the range from 1.2V(12) to 6.0V(60) in 0.1V steps.
(For other voltages, please refer to MARK INFORMATIONS.)

* : The auto discharge function at off state are options as follows.
(B) without auto discharge function at off state
(D) with auto discharge function at off state

PIN CONFIGURATIONS



PIN DESCRIPTIONS

• SC-88A

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

• SOT-23-5

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

• SOT-89-5

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

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ABSOLUTE MAXIMUM RATINGS

| Symbol | Item | Rating | Unit |
|-----------|-------------------------------|----------------------|------|
| V_{IN} | Input Voltage | 12 | V |
| V_{CE} | Input Voltage (CE Pin) | 12 | V |
| V_{OUT} | Output Voltage | -0.3 to $V_{IN}+0.3$ | V |
| I_{OUT} | Output Current | 330 | mA |
| P_D | Power Dissipation* (SC-88A) | 380 | mW |
| | Power Dissipation* (SOT-23-5) | 420 | |
| | Power Dissipation* (SOT-89-5) | 900 | |
| T_{opt} | Operating Temperature Range | -40 to 85 | °C |
| T_{stg} | Storage Temperature Range | -55 to 125 | °C |

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

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field.

The functional operation at or over these absolute maximum ratings is not assured.

RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

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

ELECTRICAL CHARACTERISTICS

• RP170xxxxB/D

V_{IN} =Set $V_{OUT}+1V$, $I_{OUT}=1mA$, unless otherwise noted.

 values indicate $-40^{\circ}C \leq T_{opt} \leq 85^{\circ}C$, unless otherwise noted.

$T_{opt}=25^{\circ}C$

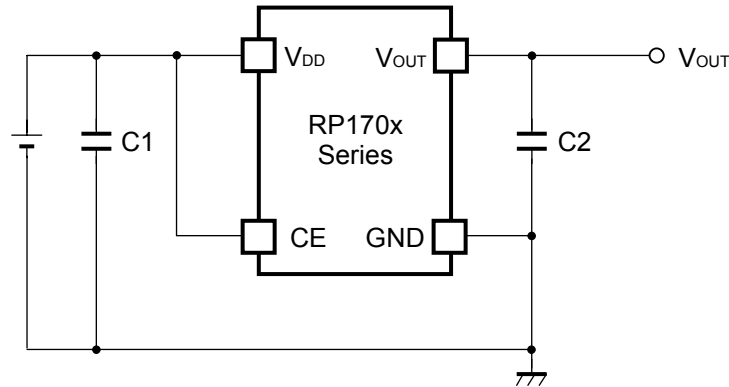
| Symbol | Item | Conditions | Min. | Typ. | Max. | Unit | |
|---------------------------------|---|---|---|---|---|---|----|
| V_{OUT} | Output Voltage | $T_{opt}=25^{\circ}C$ | $V_{OUT} > 1.5V$ | $\times 0.99$ | | $\times 1.01$ | V |
| | | | $V_{OUT} \leq 1.5V$ | -15 | | +15 | mV |
| | | $-40^{\circ}C \leq T_{opt} \leq 85^{\circ}C$ | $V_{OUT} > 1.5V$ | $\times 0.974$ | | $\times 1.023$ | V |
| | | | $V_{OUT} \leq 1.5V$ | -40 | | +35 | mV |
| I_{OUT} | Output Current | | 300 | | | mA | |
| $\Delta V_{OUT}/\Delta I_{OUT}$ | Load Regulation | $0.1mA \leq I_{OUT} \leq 300mA$ | | 10 | 70 | mV | |
| V_{DIF} | Dropout Voltage | $I_{OUT}=300mA$ | $1.2V \leq V_{OUT} < 1.3V$ | | 1.400 | 1.800 | V |
| | | | $1.3V \leq V_{OUT} < 1.5V$ | | 1.350 | 1.750 | |
| | | | $1.5V \leq V_{OUT} < 1.8V$ | | 1.200 | 1.550 | |
| | | | $1.8V \leq V_{OUT} < 2.3V$ | | 0.980 | 1.300 | |
| | | | $2.3V \leq V_{OUT} < 3.0V$ | | 0.770 | 1.080 | |
| | | | $3.0V \leq V_{OUT} < 4.0V$ | | 0.600 | 0.850 | |
| | | | $4.0V \leq V_{OUT} \leq 6.0V$ | | 0.500 | 0.750 | |
| I_{SS} | Supply Current | $I_{OUT}=0mA$ | | 23 | 40 | μA | |
| $I_{standby}$ | Standby Current | $V_{IN}=10.0V$, $V_{CE}=GND$ | | 0.1 | 1.0 | μA | |
| $\Delta V_{OUT}/\Delta V_{IN}$ | Line Regulation | Set $V_{OUT}+0.5V \leq V_{IN} \leq 10.0V$ (In case that $V_{OUT} \leq 2.1V$, $2.6V \leq V_{IN} \leq 10.0V$) | | 0.02 | 0.2 | %/V | |
| RR | Ripple Rejection | $f=1kHz$, Ripple $0.2Vp-p$, $I_{OUT}=30mA$ (In case that $V_{OUT} < 2.0V$, $V_{IN}=3.0V$) | | 70 | | dB | |
| V_{IN} | Input Voltage | | 2.6 | | 10 | V | |
| $\Delta V_{OUT}/\Delta T_{opt}$ | Output Voltage Temperature Coefficient | $-40^{\circ}C \leq T_{opt} \leq 85^{\circ}C$ | | ± 80 | | ppm/ $^{\circ}C$ | |
| I_{SC} | Short Current Limit | $V_{OUT}=0V$ | | 40 | | mA | |
| I_{PD} | CE Pull-down Current | | | 0.30 | | μA | |
| V_{CEH} | CE Input Voltage "H" | | 1.7 | | | V | |
| V_{CEL} | CE Input Voltage "L" | | | | 0.8 | V | |
| T_{TSD} | Thermal Shutdown Temperature | Junction Temperature | | 165 | | $^{\circ}C$ | |
| T_{TSR} | Thermal Shutdown Released Temperature | Junction Temperature | | 110 | | $^{\circ}C$ | |
| en | Output Noise | BW=10Hz to 100kHz | | 100 | | μV_{rms} | |
| R_{LOW} | Low Output Nch Tr. ON Resistance (of D version) | $V_{IN}=7.0V$ $V_{CE}=0V$ | | 250 | | Ω | |

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

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TYPICAL APPLICATION



(External Components)

C2 1.0 μ F MURATA: GRM155B31A105KE15

TECHNICAL NOTES

When using these ICs, consider the following points:

Phase Compensation

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C2 with 1.0 μ F or more and good ESR (Equivalent Series Resistance).

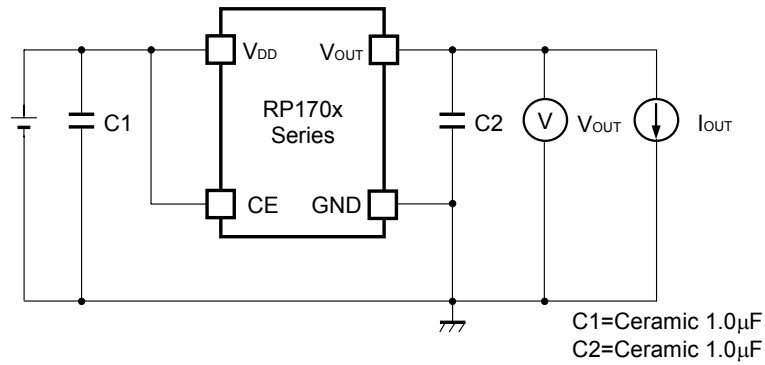
(Note: If additional ceramic capacitors are connected with parallel to the output pin with an output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB.)

PCB Layout

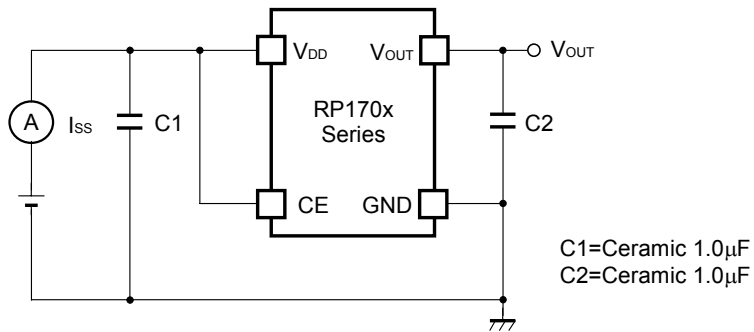
Make V_{DD} and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with a capacitance value as much as 1.0 μ F or more between V_{DD} and GND pin, and as close as possible to the pins.

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

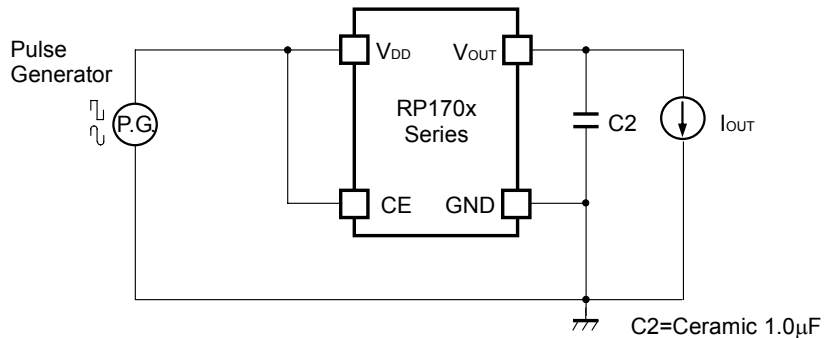
TEST CIRCUITS



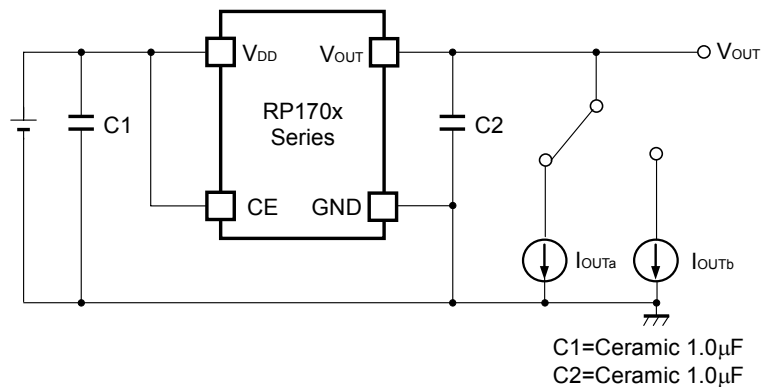
Basic Test Circuit



Test Circuit for Supply Current



Test Circuit for Ripple Rejection



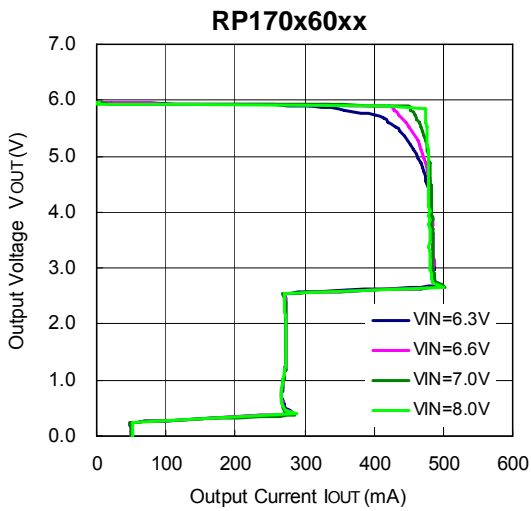
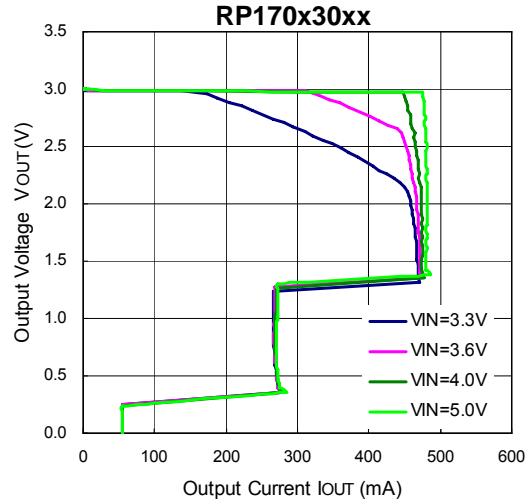
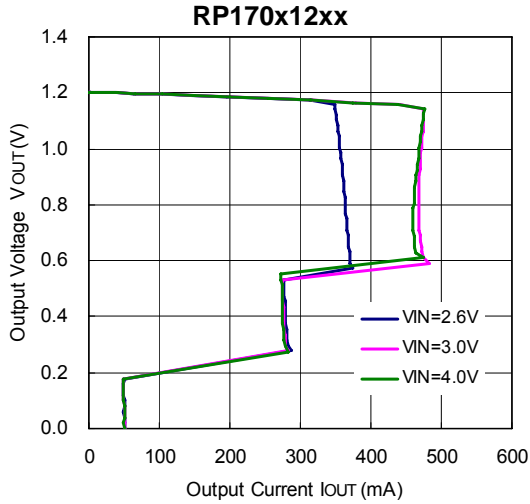
Test Circuit for Load Transient Response

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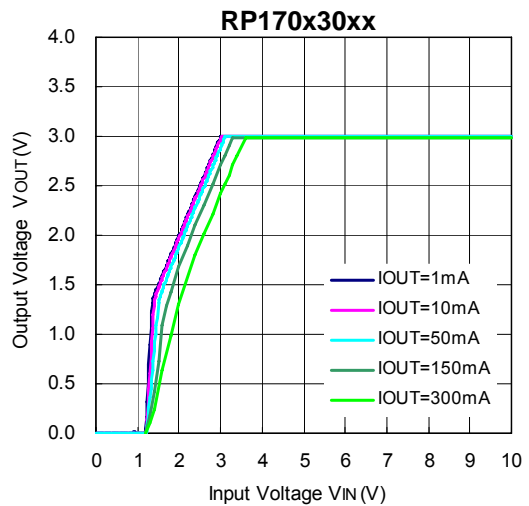
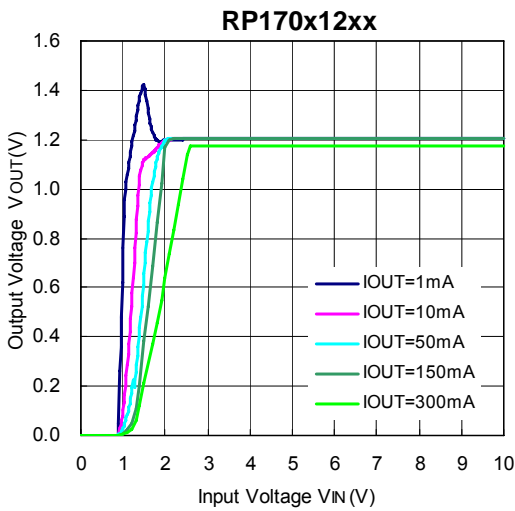
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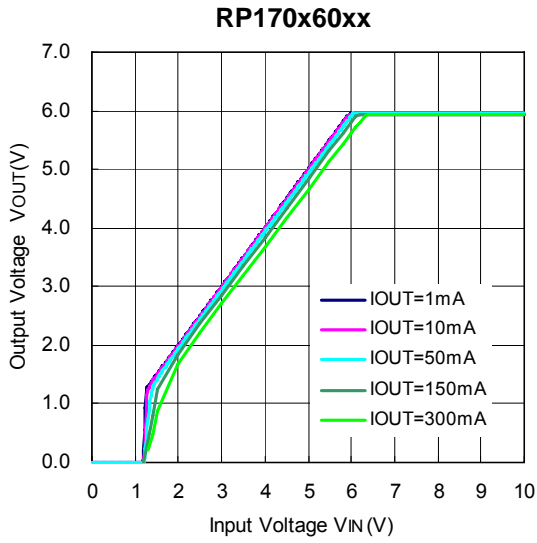
TYPICAL CHARACTERISTICS

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

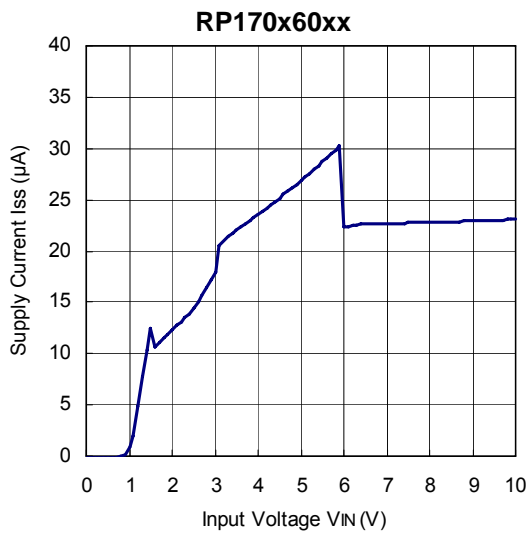
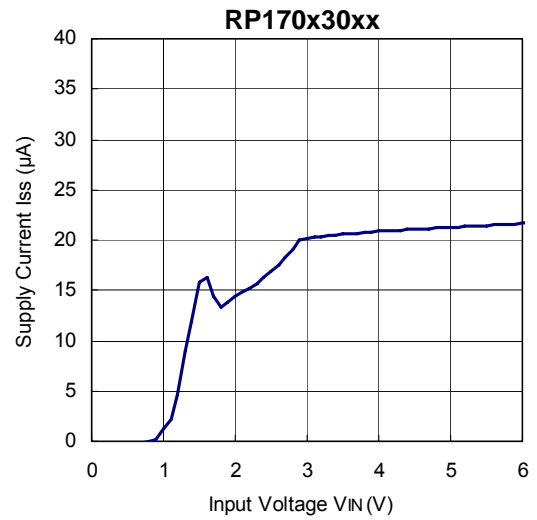
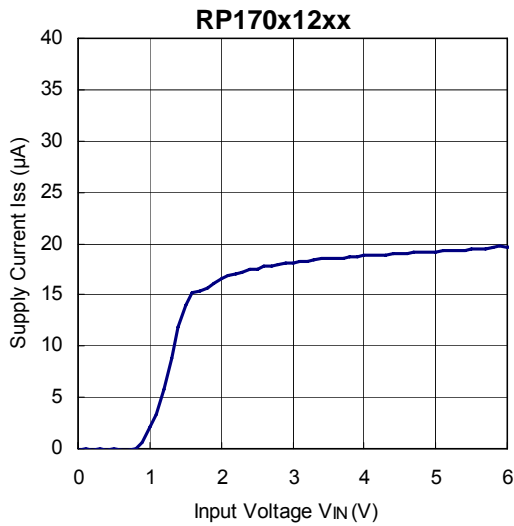


2) Output Voltage vs. Input Voltage (T_{opt}=25°C)





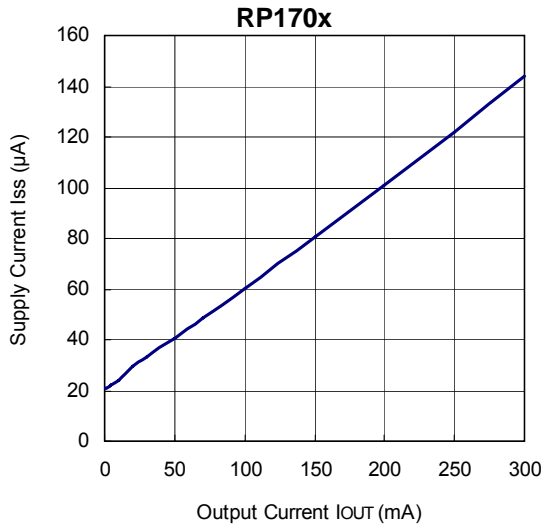
3) Supply Current vs. Input Voltage ($T_{opt}=25^{\circ}C$)



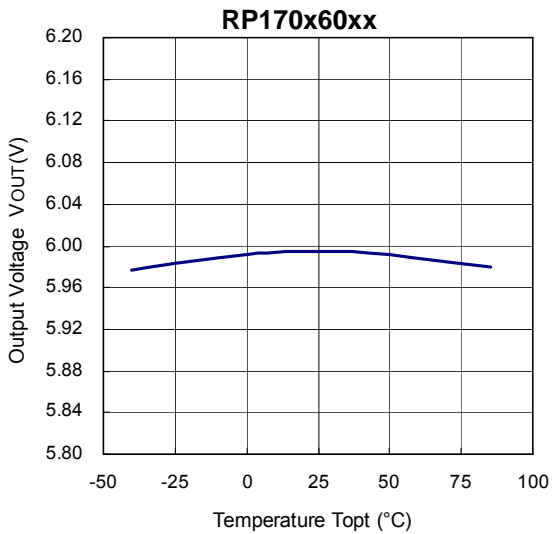
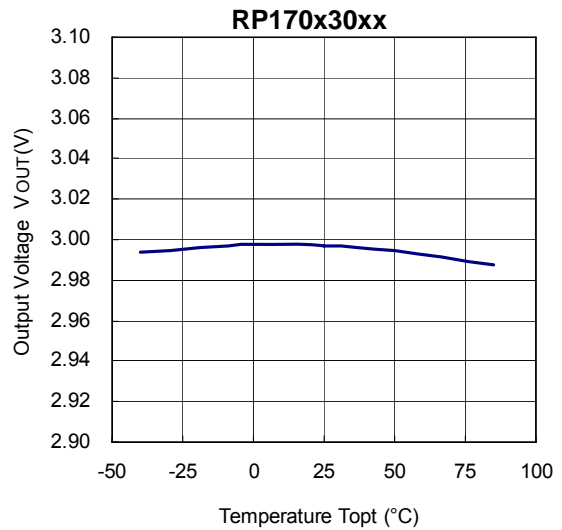
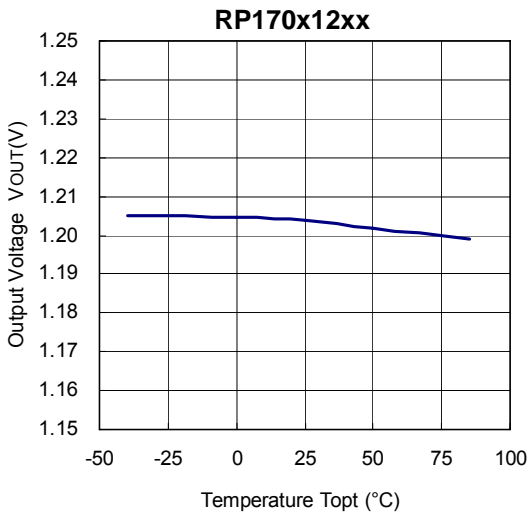
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4) Supply Current vs. Output Current (T_{opt}=25°C)



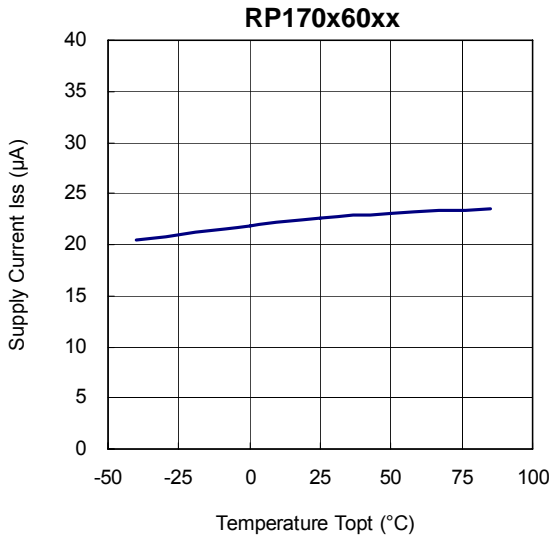
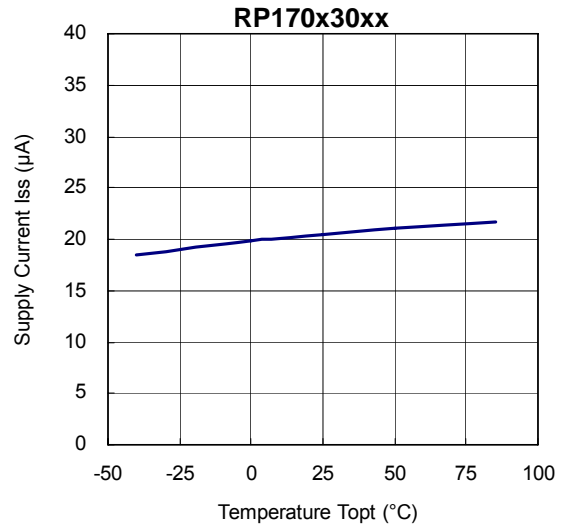
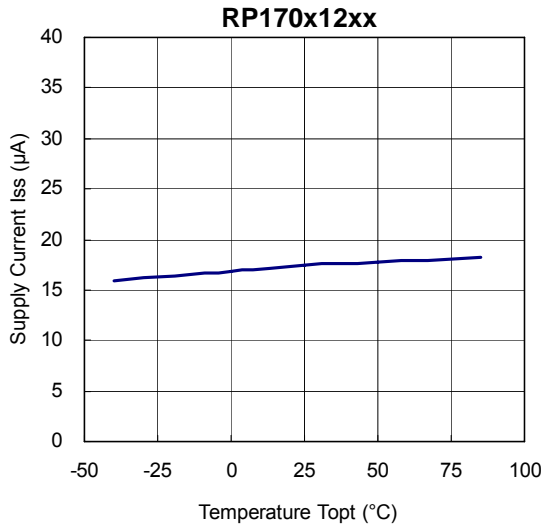
5) Output Voltage vs. Temperature



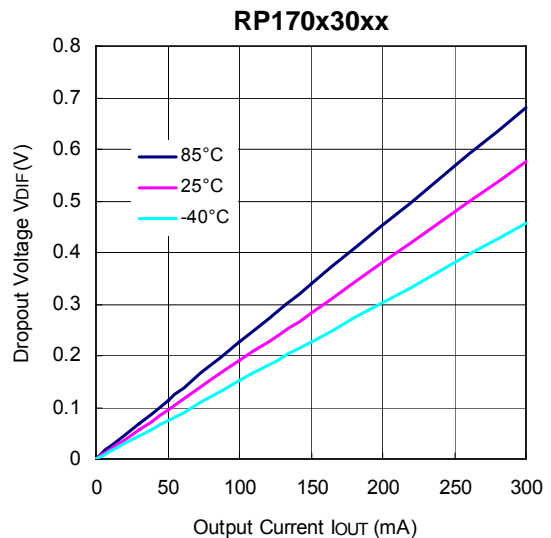
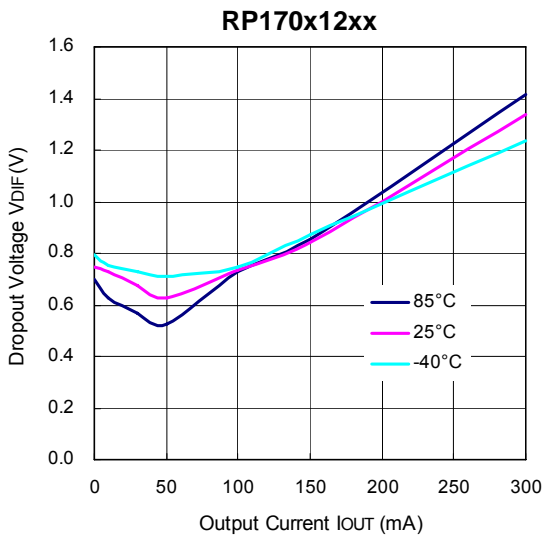
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6) Supply Current vs. Temperature

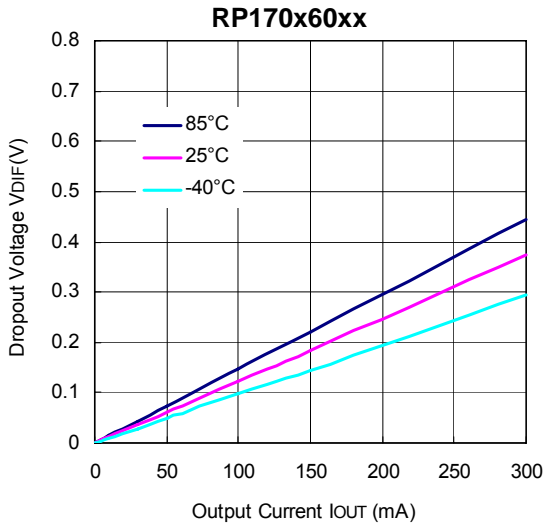


7) Dropout Voltage vs. Output Current

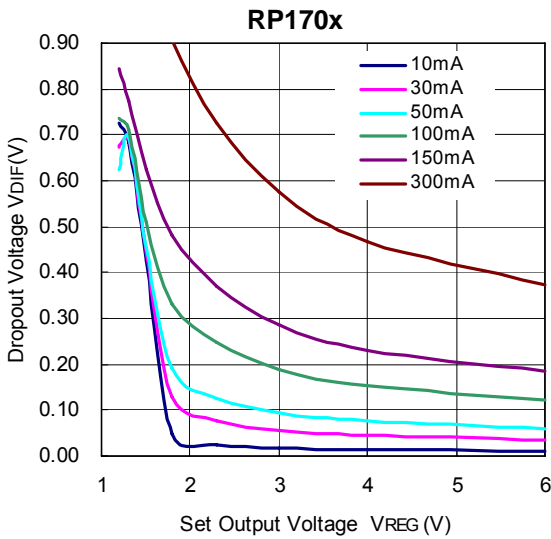


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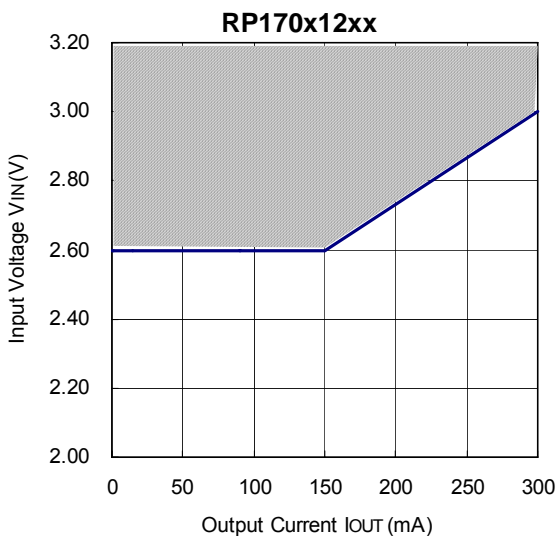
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8) Dropout Voltage vs. Set Output Voltage (T_{opt}=25°C)

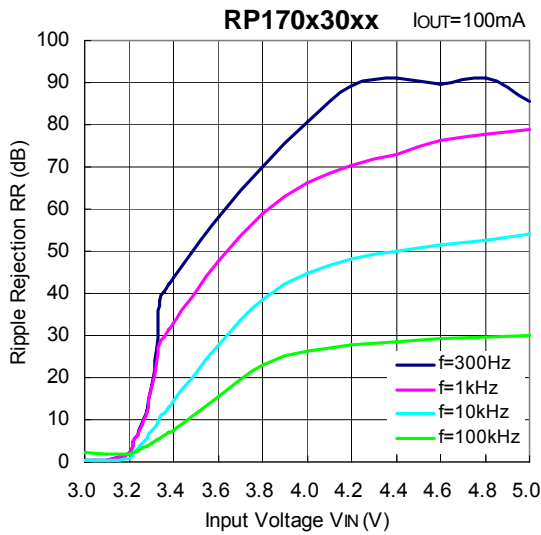
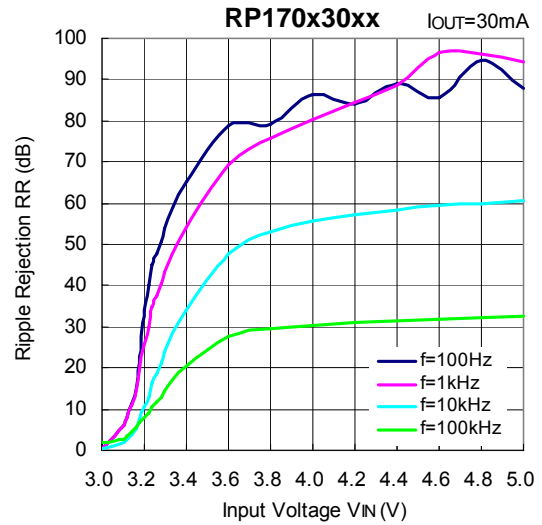
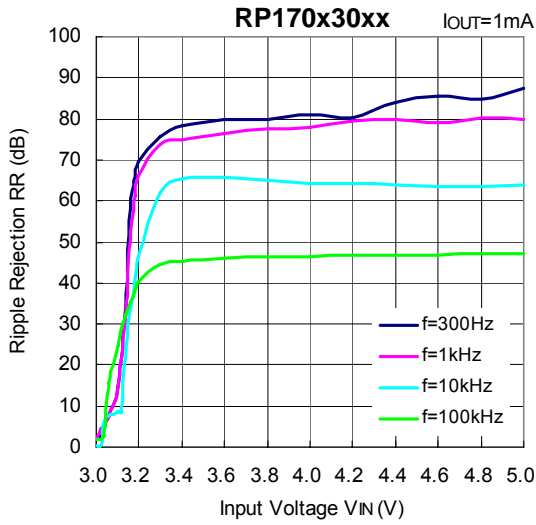


9) Minimum Operating Voltage

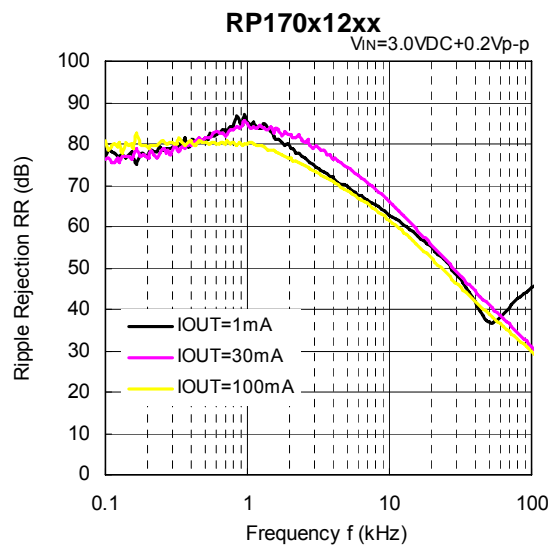
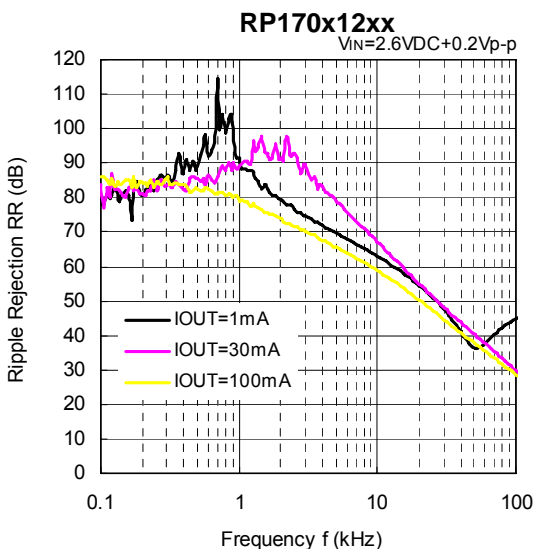


Hatched area is available for 1.2V output

10) Ripple Rejection vs. Input Bias Voltage (C1=none, C2=Ceramic 1.0μF, Ripple=0.2Vp-p, T_{opt}=25°C)

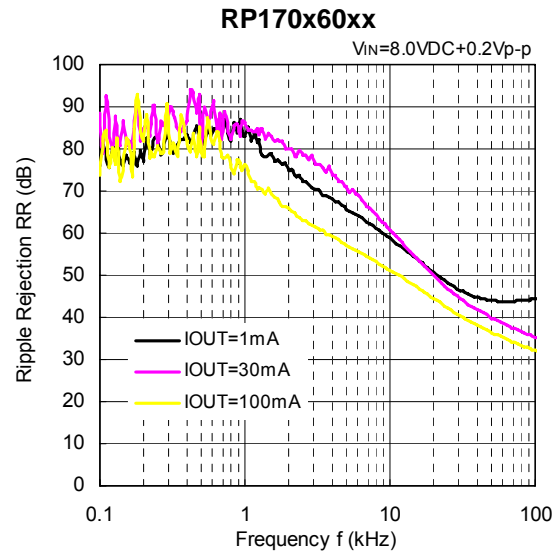
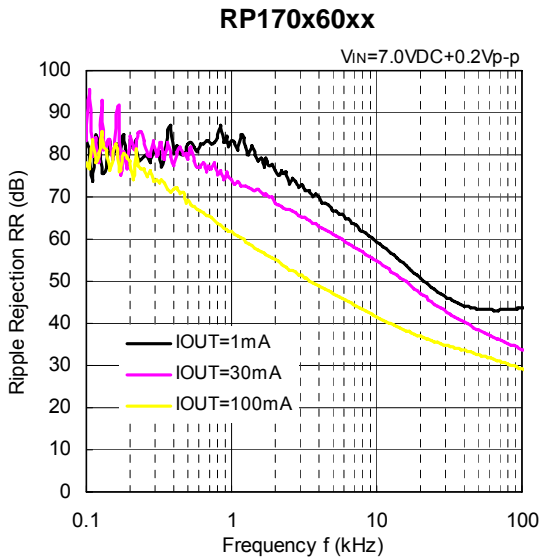
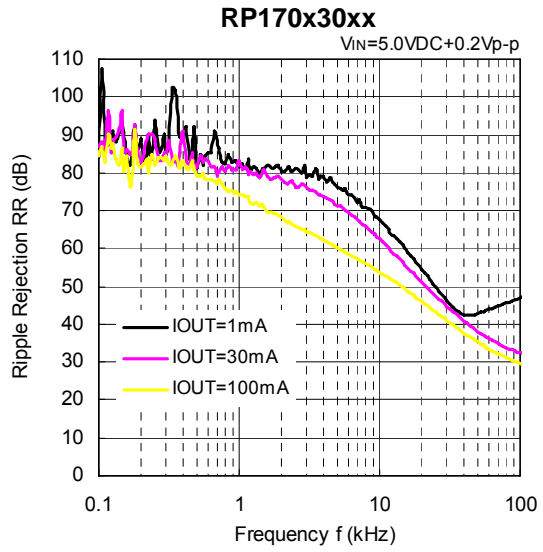
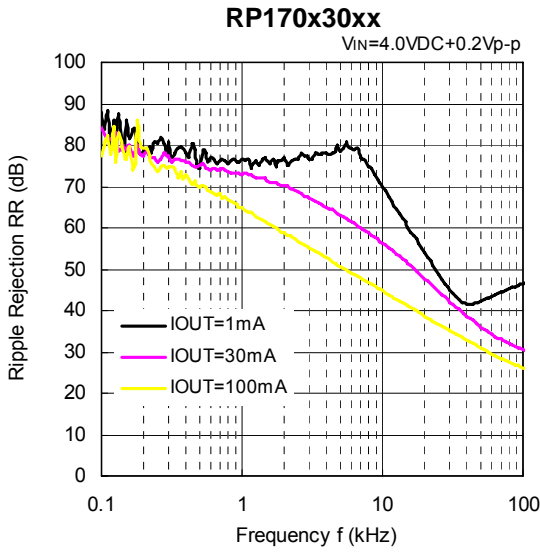


11) Ripple Rejection vs. Frequency (C1=none, C2=Ceramic 1.0μF, T_{opt}=25°C)

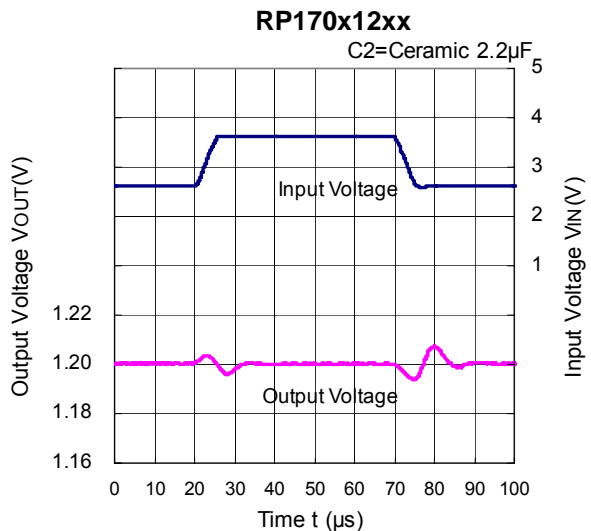
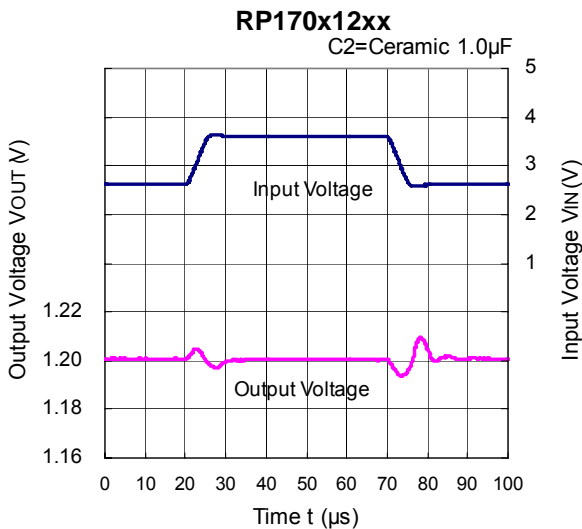


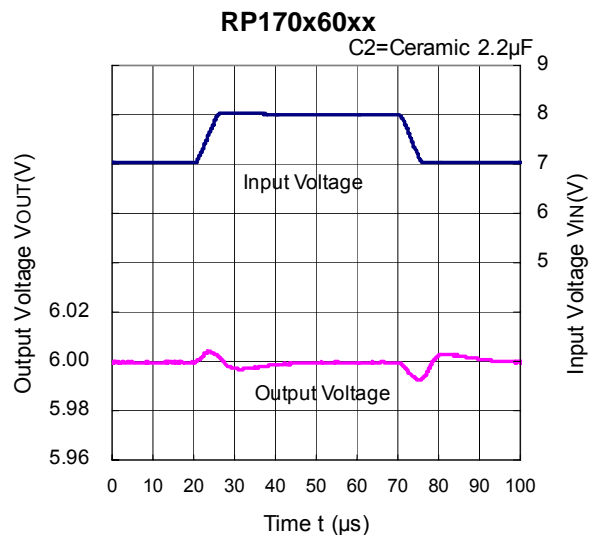
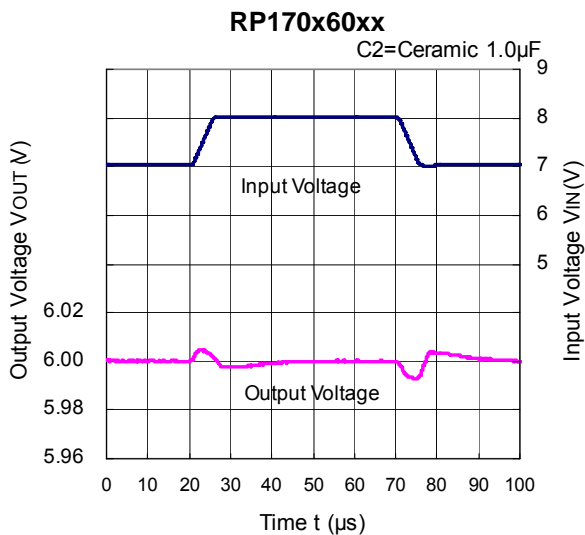
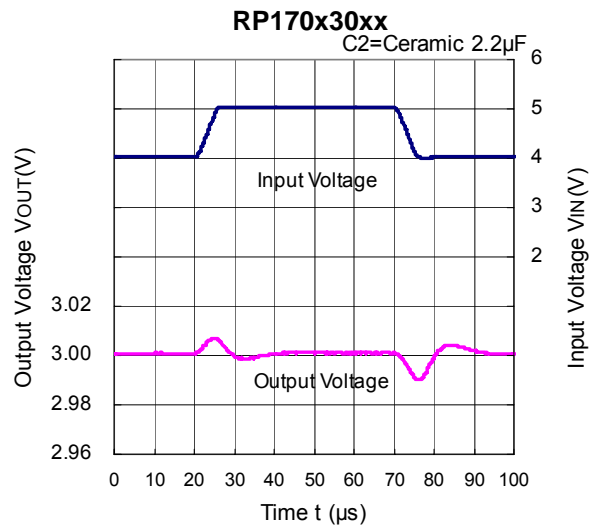
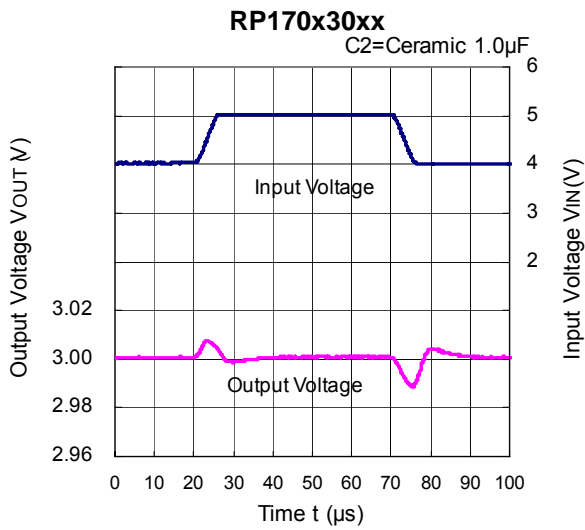
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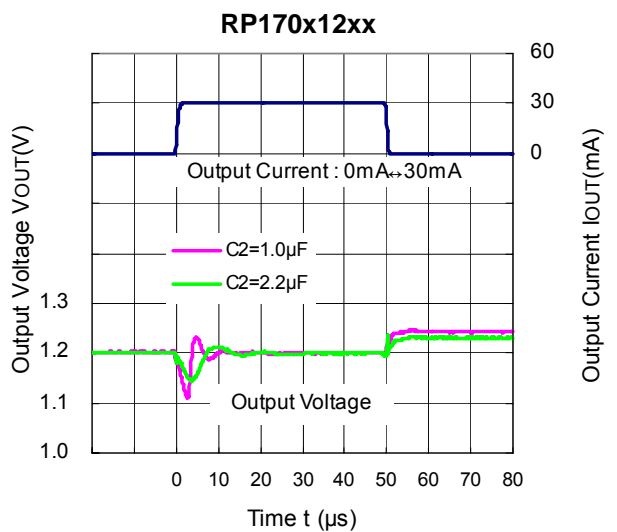
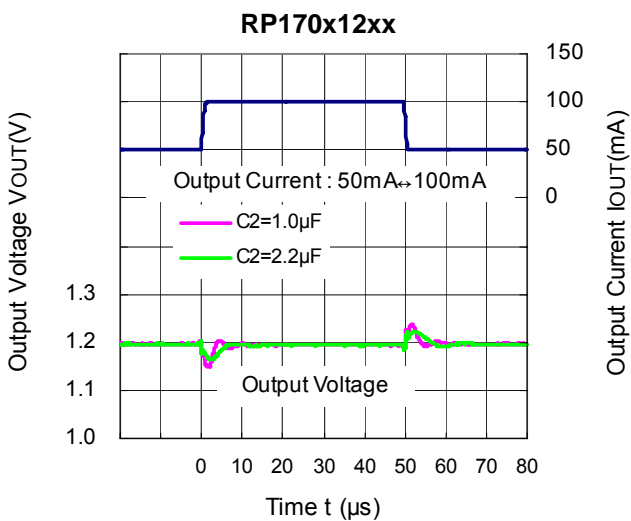


12) Input Transient Response (C1=none, IOUT=30mA, tr=tf=5μs, Topt=25°C)



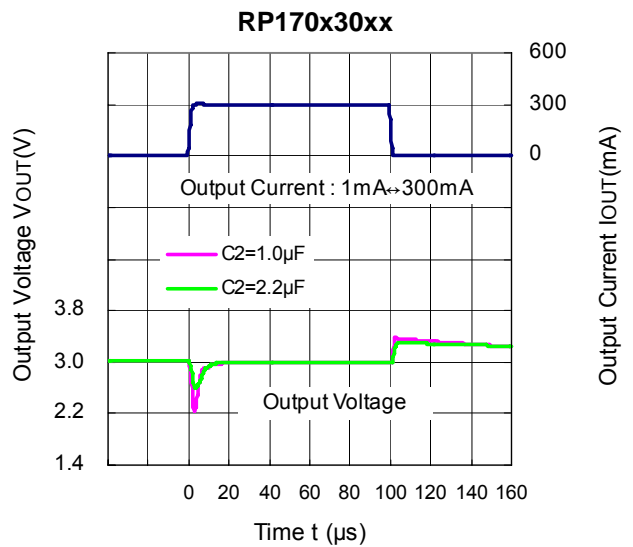
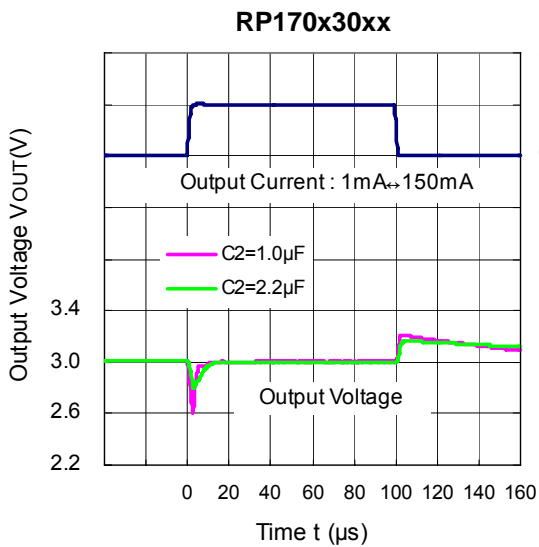
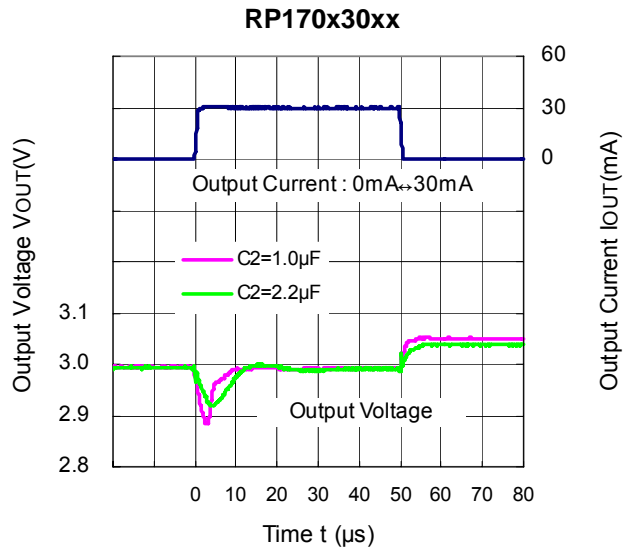
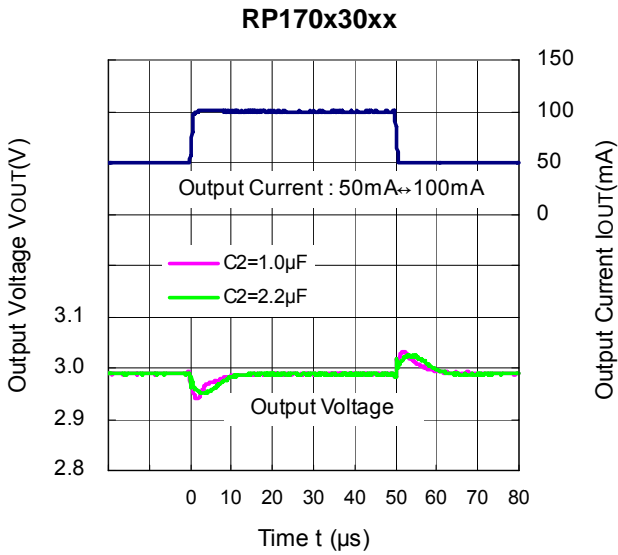
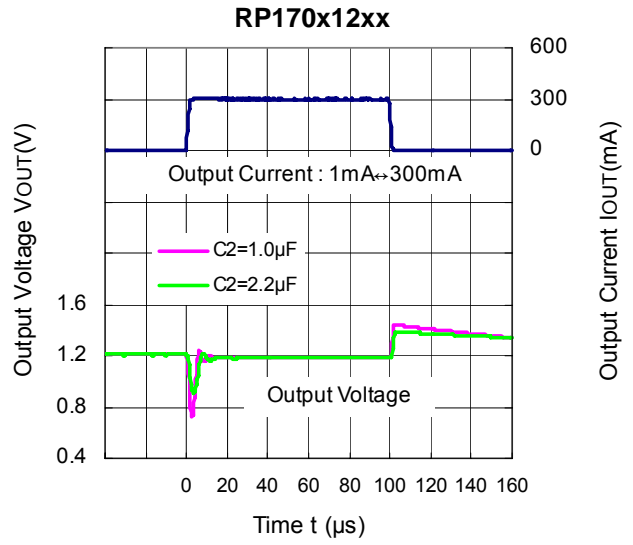
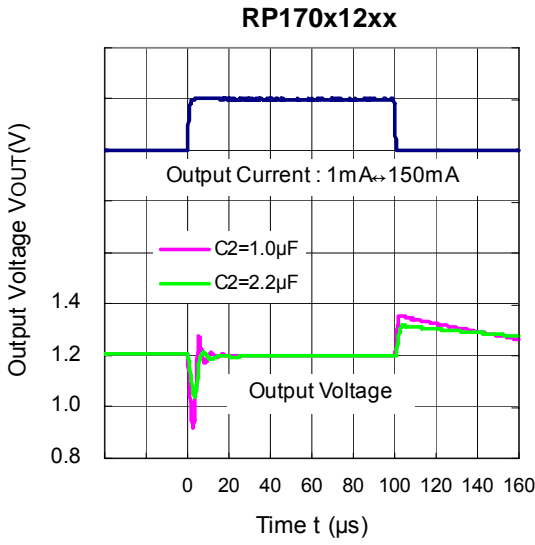


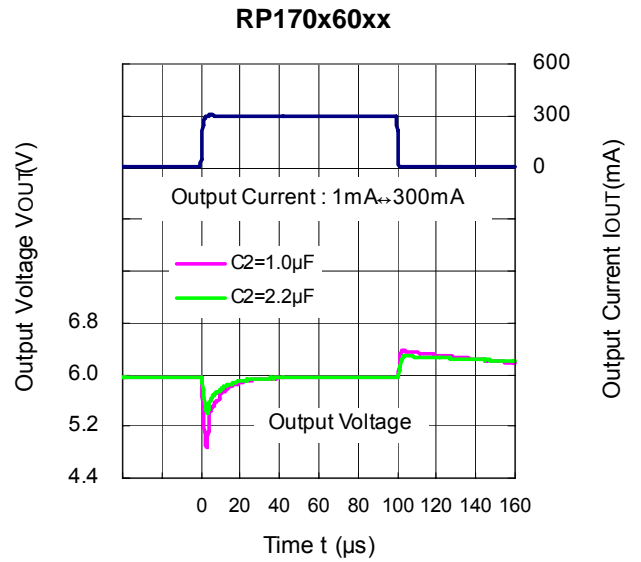
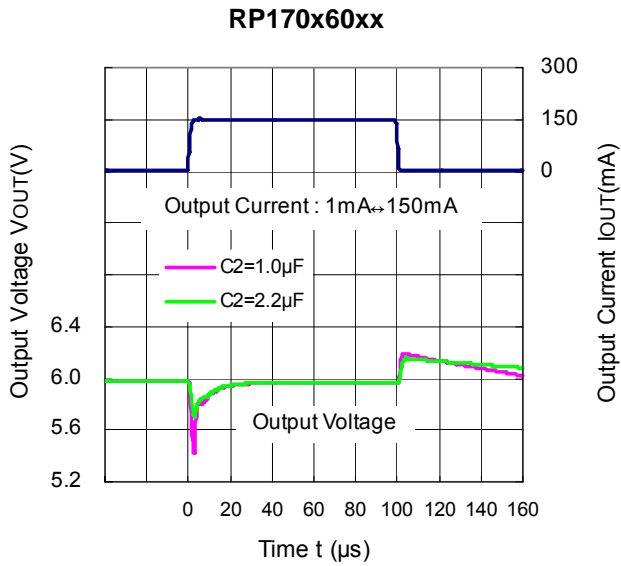
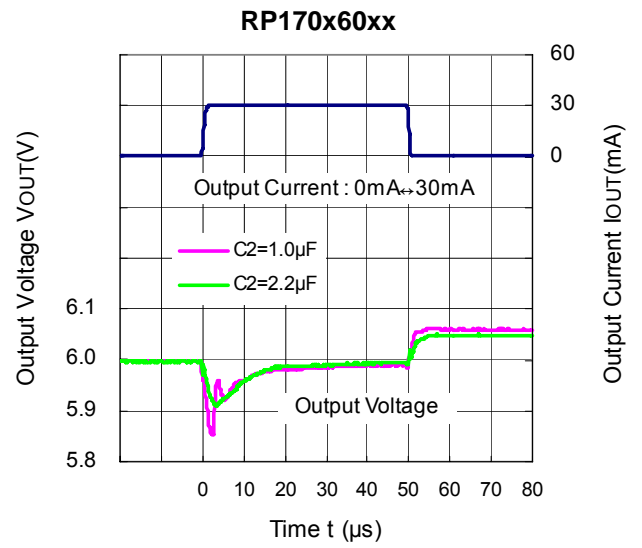
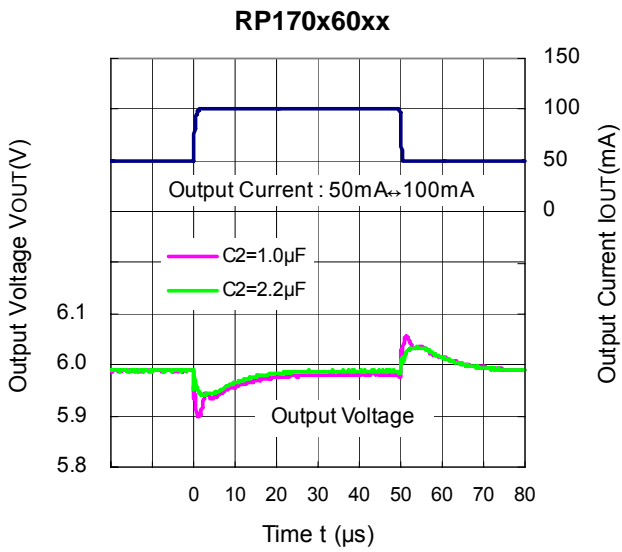
13) Load Transient Response (C1=Ceramic 1.0 μ F, $t_r=t_f=500ns$, $T_{opt}=25^{\circ}C$)



RP170x

NO.EA-205-160425

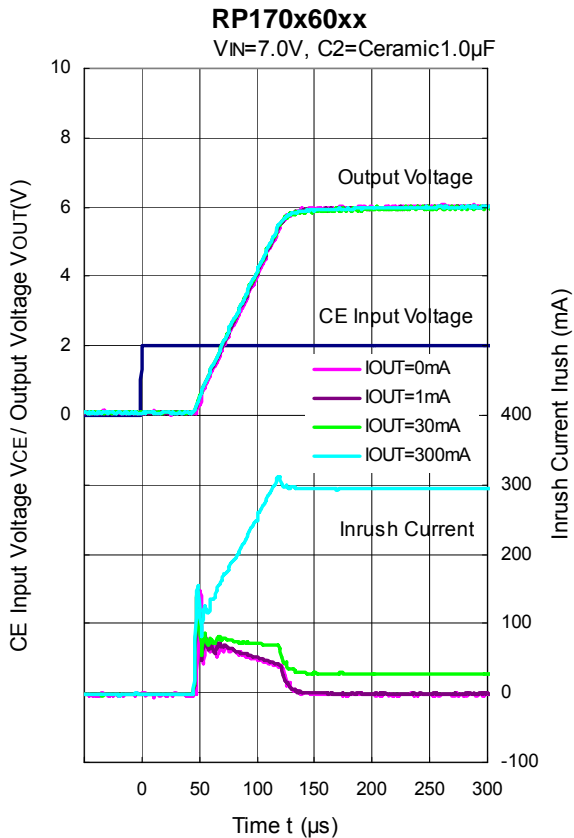
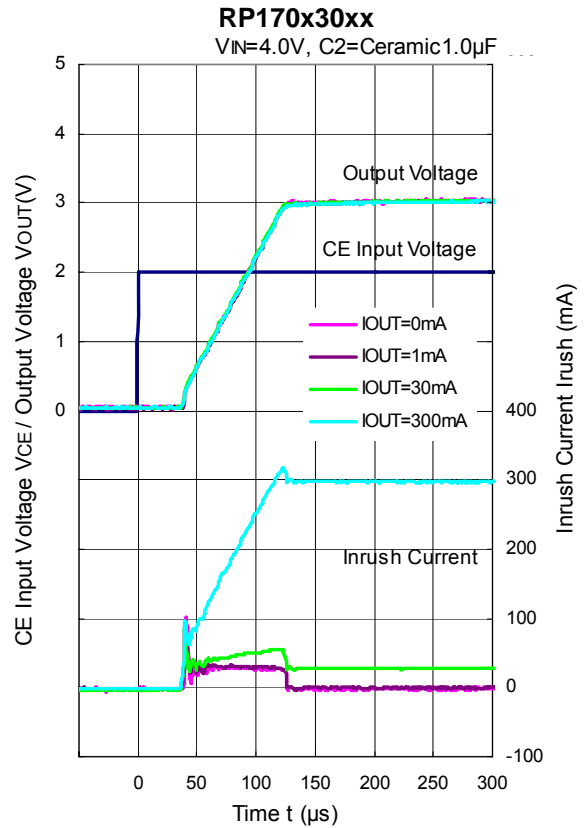
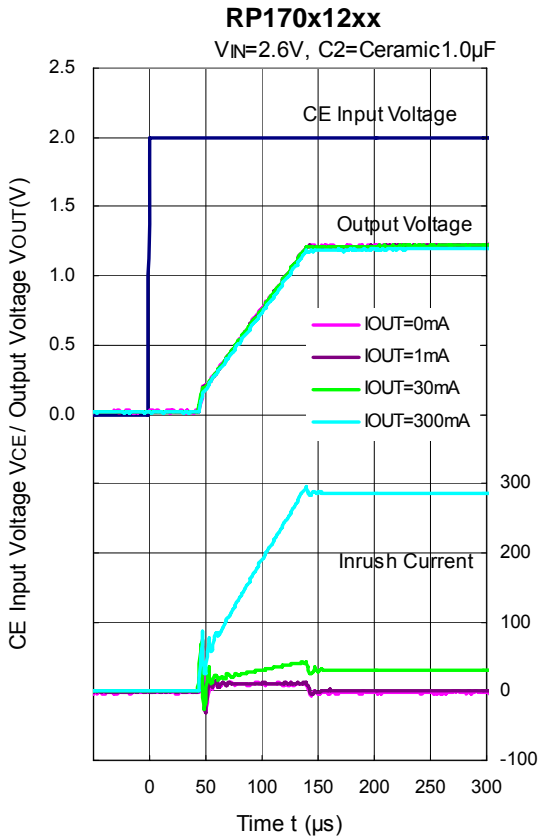


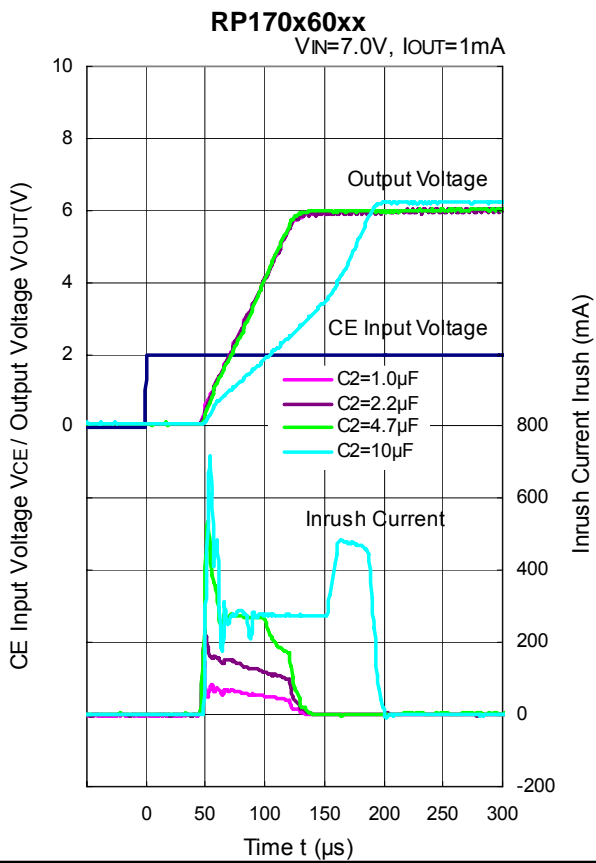
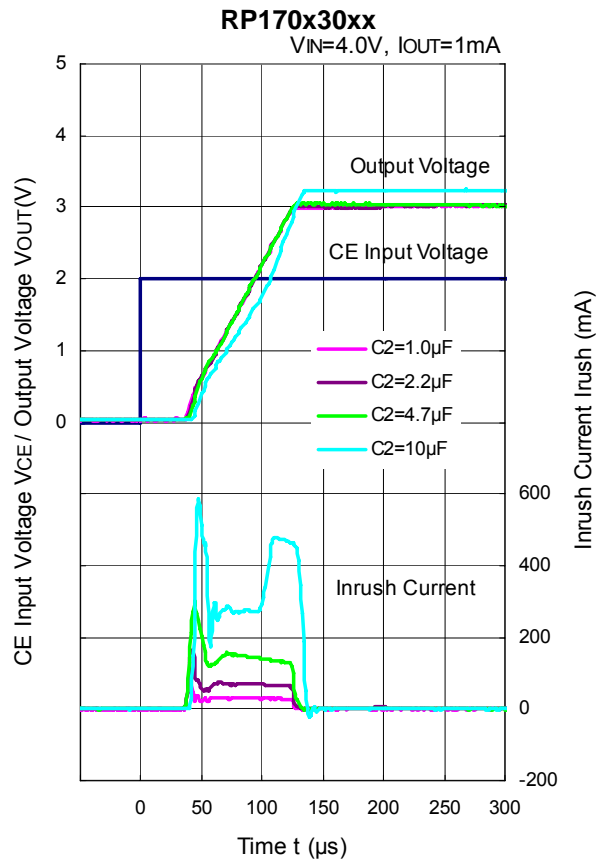
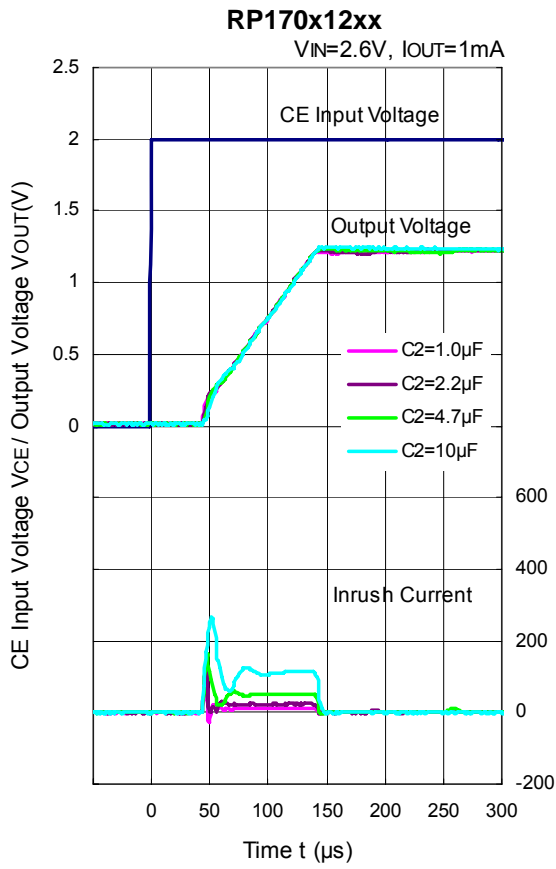


RP170x

NO.EA-205-160425

14) Turn On Speed with CE pin (C1=Ceramic 1.0μF, T_{opt}=25°C)



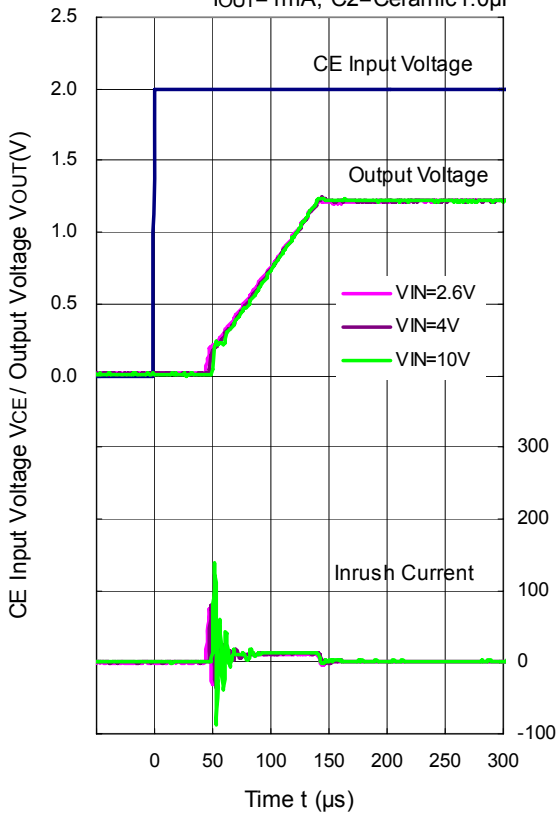


RP170x

NO.EA-205-160425

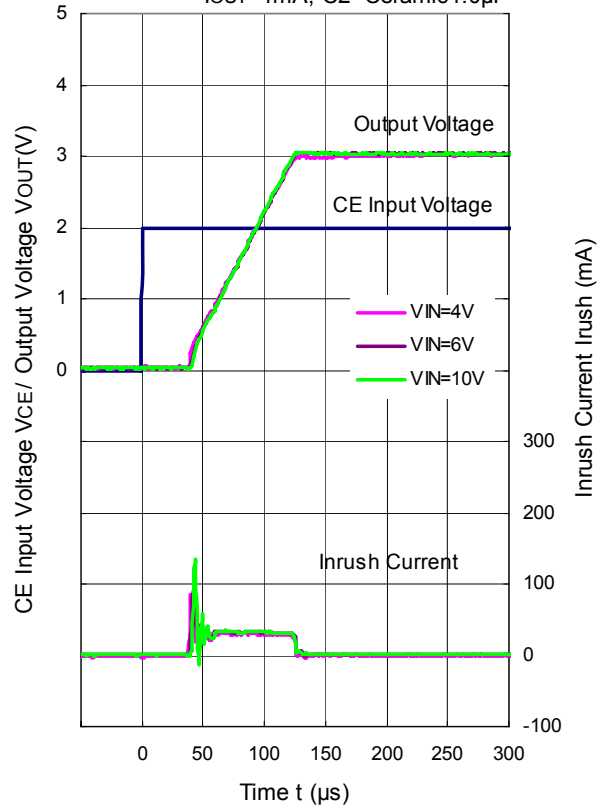
RP170x12xx

I_{OUT}=1mA, C₂=Ceramic1.0μF



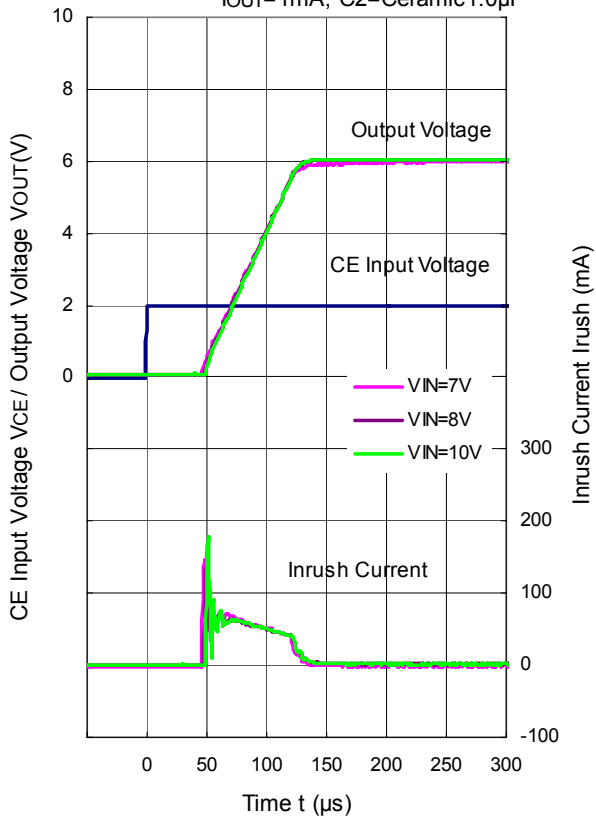
RP170x30xx

I_{OUT}=1mA, C₂=Ceramic1.0μF

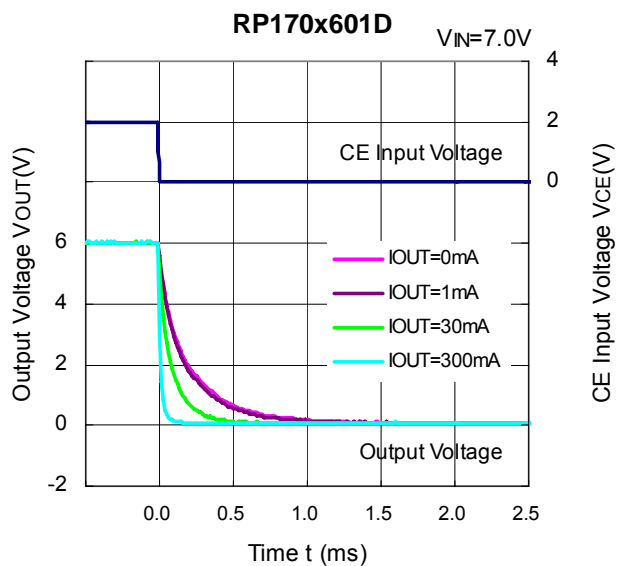
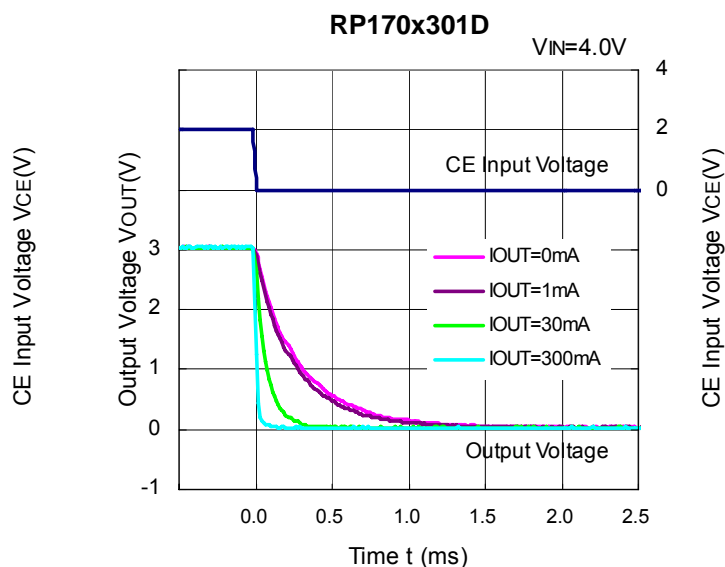
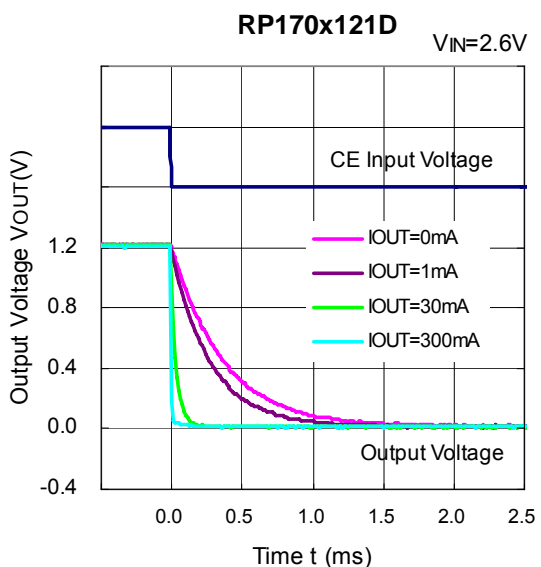


RP170x60xx

I_{OUT}=1mA, C₂=Ceramic1.0μF



15) Turn Off Speed with CE pin (D Version) (C1=Ceramic 1.0 μ F, T_{opt}=25°C)



RP170x

NO.EA-205-160425

ESR vs. Output Current

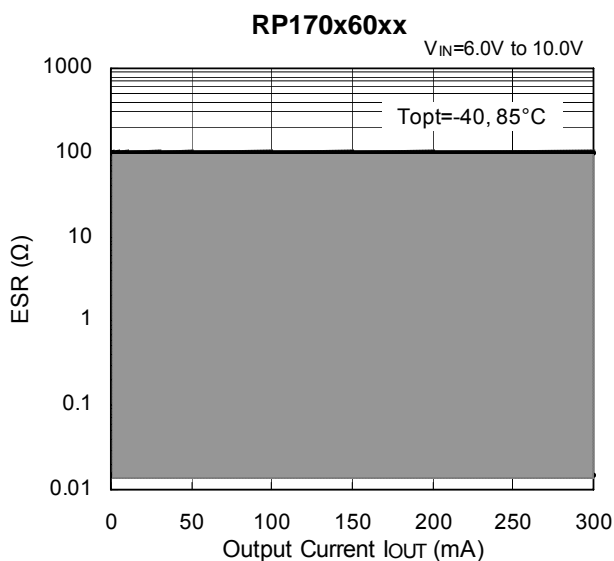
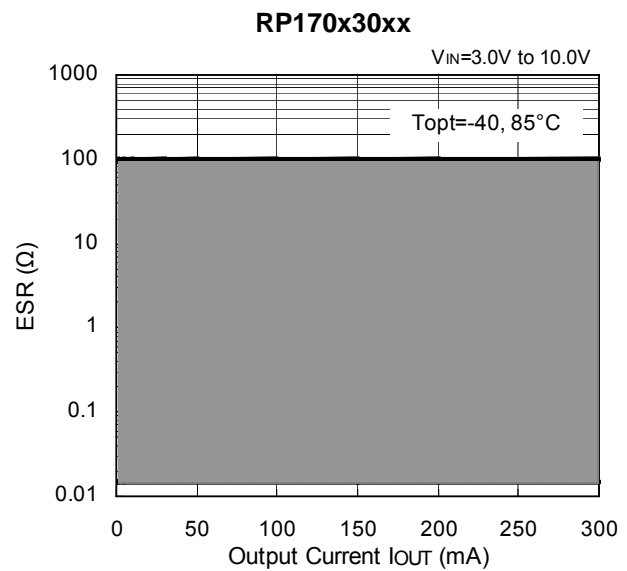
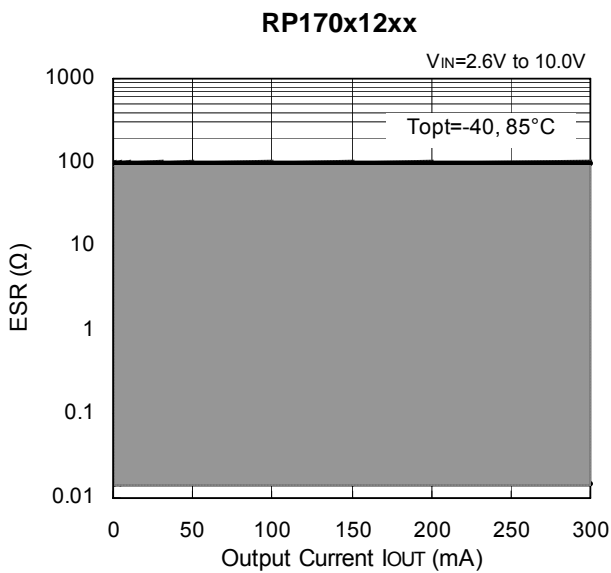
Ceramic type output capacitor is recommended for this series; however, the other output capacitors with low ESR also can be used. The relations between I_{OUT} (Output Current) and ESR of an output capacitor are shown below. The conditions when the white noise level is under $40\mu\text{V}$ (Avg.) are marked as the hatched area in the graph.

Measurement conditions

Frequency Band : 10Hz to 2MHz

Temperature : -40°C to 85°C

C1, C2 : Ceramic $1.0\mu\text{F}$ (Murata GRM155B31A105KE)



PACKAGE INFORMATION

• Power Dissipation (SC-88A)

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

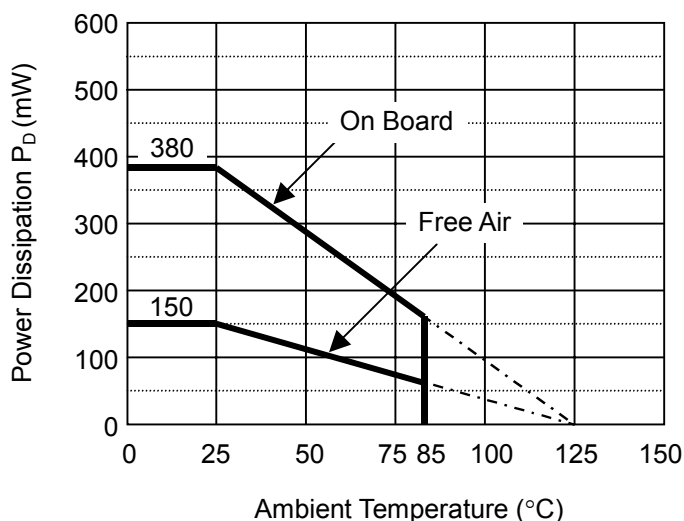
Measurement Conditions

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

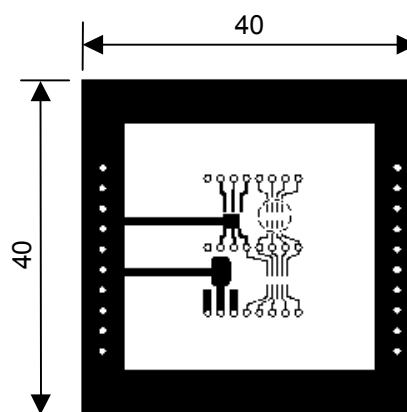
Measurement Result

($T_a=25^\circ\text{C}$, $T_{j\text{max}}=125^\circ\text{C}$)

| | Standard Land Pattern | Free Air |
|--------------------|---|--|
| Power Dissipation | 380mW | 150mW |
| Thermal Resistance | $\theta_{ja}=(125-25^\circ\text{C})/0.38\text{W}=263^\circ\text{C/W}$ $\theta_{jc}=75^\circ\text{C/W}$ | $\theta_{ja}=(125-25^\circ\text{C})/0.15\text{W}=667^\circ\text{C/W}$ - |



Power Dissipation



Measurement Board Pattern

○ IC Mount Area (Unit : mm)

* RP170Q (SC-88A) is the discontinued product as of April, 2016.

RP170x

NO.EA-205-160425

RP170Q Series marking list table

PKG: SC-88A (Non-promotion)

RP170Qxx2B

| Product Name | ①②③④ | Vset |
|--------------|-------------|------|
| RP170Q122B | AA01 | 1.2V |
| RP170Q132B | AA03 | 1.3V |
| RP170Q142B | AA04 | 1.4V |
| RP170Q152B | AA05 | 1.5V |
| RP170Q162B | AA06 | 1.6V |
| RP170Q172B | AA07 | 1.7V |
| RP170Q182B | AA08 | 1.8V |
| RP170Q192B | AA10 | 1.9V |
| RP170Q202B | AA11 | 2.0V |
| RP170Q212B | AA12 | 2.1V |
| RP170Q222B | AA13 | 2.2V |
| RP170Q232B | AA14 | 2.3V |
| RP170Q242B | AA15 | 2.4V |
| RP170Q252B | AA16 | 2.5V |
| RP170Q262B | AA17 | 2.6V |
| RP170Q272B | AA18 | 2.7V |
| RP170Q282B | AA19 | 2.8V |
| RP170Q292B | AA21 | 2.9V |
| RP170Q302B | AA22 | 3.0V |

| Product Name | ①②③④ | Vset |
|--------------|-------------|------|
| RP170Q312B | AA23 | 3.1V |
| RP170Q322B | AA24 | 3.2V |
| RP170Q332B | AA25 | 3.3V |
| RP170Q342B | AA26 | 3.4V |
| RP170Q352B | AA27 | 3.5V |
| RP170Q362B | AA28 | 3.6V |
| RP170Q372B | AA29 | 3.7V |
| RP170Q382B | AA30 | 3.8V |
| RP170Q392B | AA31 | 3.9V |
| RP170Q402B | AA32 | 4.0V |
| RP170Q412B | AA33 | 4.1V |
| RP170Q422B | AA34 | 4.2V |
| RP170Q432B | AA35 | 4.3V |
| RP170Q442B | AA36 | 4.4V |
| RP170Q452B | AA37 | 4.5V |
| RP170Q462B | AA38 | 4.6V |
| RP170Q472B | AA39 | 4.7V |
| RP170Q482B | AA40 | 4.8V |
| RP170Q492B | AA41 | 4.9V |
| RP170Q502B | AA42 | 5.0V |

| Product Name | ①②③④ | Vset |
|--------------|-------------|-------|
| RP170Q512B | AA43 | 5.1V |
| RP170Q522B | AA44 | 5.2V |
| RP170Q532B | AA45 | 5.3V |
| RP170Q542B | AA46 | 5.4V |
| RP170Q552B | AA47 | 5.5V |
| RP170Q562B | AA48 | 5.6V |
| RP170Q572B | AA49 | 5.7V |
| RP170Q582B | AA50 | 5.8V |
| RP170Q592B | AA51 | 5.9V |
| RP170Q602B | AA52 | 6.0V |
| | | |
| RP170Q122B5 | AA02 | 1.25V |
| RP170Q182B5 | AA09 | 1.85V |
| RP170Q282B5 | AA20 | 2.85V |

RP170Qxx2D

| Product Name | ①②③④ | Vset |
|--------------|-------------|------|
| RP170Q122D | AB01 | 1.2V |
| RP170Q132D | AB03 | 1.3V |
| RP170Q142D | AB04 | 1.4V |
| RP170Q152D | AB05 | 1.5V |
| RP170Q162D | AB06 | 1.6V |
| RP170Q172D | AB07 | 1.7V |
| RP170Q182D | AB08 | 1.8V |
| RP170Q192D | AB10 | 1.9V |
| RP170Q202D | AB11 | 2.0V |
| RP170Q212D | AB12 | 2.1V |
| RP170Q222D | AB13 | 2.2V |
| RP170Q232D | AB14 | 2.3V |
| RP170Q242D | AB15 | 2.4V |
| RP170Q252D | AB16 | 2.5V |
| RP170Q262D | AB17 | 2.6V |
| RP170Q272D | AB18 | 2.7V |
| RP170Q282D | AB19 | 2.8V |
| RP170Q292D | AB21 | 2.9V |
| RP170Q302D | AB22 | 3.0V |

| Product Name | ①②③④ | Vset |
|--------------|-------------|------|
| RP170Q312D | AB23 | 3.1V |
| RP170Q322D | AB24 | 3.2V |
| RP170Q332D | AB25 | 3.3V |
| RP170Q342D | AB26 | 3.4V |
| RP170Q352D | AB27 | 3.5V |
| RP170Q362D | AB28 | 3.6V |
| RP170Q372D | AB29 | 3.7V |
| RP170Q382D | AB30 | 3.8V |
| RP170Q392D | AB31 | 3.9V |
| RP170Q402D | AB32 | 4.0V |
| RP170Q412D | AB33 | 4.1V |
| RP170Q422D | AB34 | 4.2V |
| RP170Q432D | AB35 | 4.3V |
| RP170Q442D | AB36 | 4.4V |
| RP170Q452D | AB37 | 4.5V |
| RP170Q462D | AB38 | 4.6V |
| RP170Q472D | AB39 | 4.7V |
| RP170Q482D | AB40 | 4.8V |
| RP170Q492D | AB41 | 4.9V |
| RP170Q502D | AB42 | 5.0V |

| Product Name | ①②③④ | Vset |
|--------------|-------------|-------|
| RP170Q512D | AB43 | 5.1V |
| RP170Q522D | AB44 | 5.2V |
| RP170Q532D | AB45 | 5.3V |
| RP170Q542D | AB46 | 5.4V |
| RP170Q552D | AB47 | 5.5V |
| RP170Q562D | AB48 | 5.6V |
| RP170Q572D | AB49 | 5.7V |
| RP170Q582D | AB50 | 5.8V |
| RP170Q592D | AB51 | 5.9V |
| RP170Q602D | AB52 | 6.0V |
| | | |
| RP170Q122D5 | AB02 | 1.25V |
| RP170Q182D5 | AB09 | 1.85V |
| RP170Q282D5 | AB20 | 2.85V |

* RP170Q (SC-88A) is the discontinued product as of April, 2016.

RP170x

NO.EA-205-160425

• Power Dissipation (SOT-23-5)

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.)

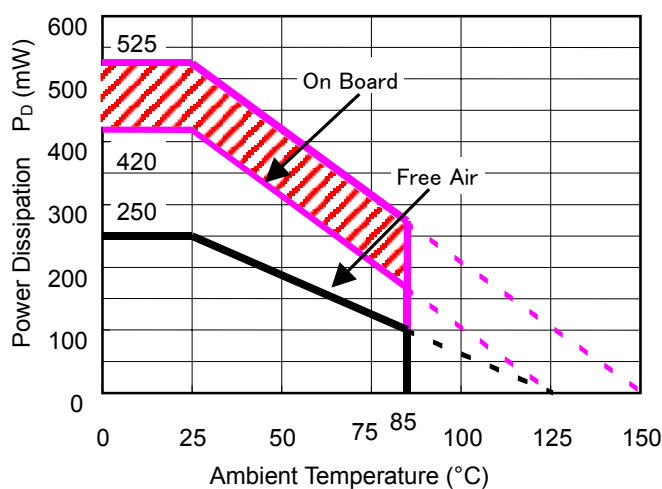
Measurement Conditions

| | Standard Land Pattern |
|------------------|---|
| Environment | Mounting on Board (Wind Velocity=0m/s) |
| Board Material | Glass Cloth Epoxy Plastic (Double-sided) |
| Board Dimensions | 40mm x 40mm x 1.6mm |
| Copper Ratio | Topside: Approx. 50%, Backside: Approx. 50% |
| Through-holes | ϕ 0.5mm x 44pcs |

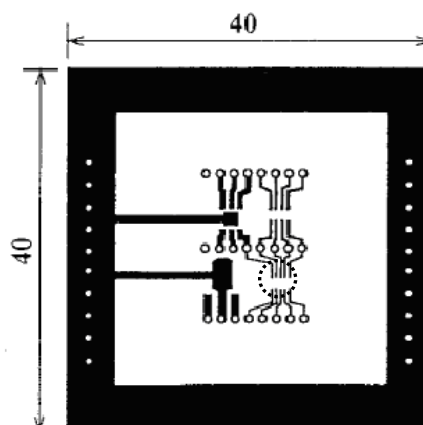
Measurement Result

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

| | Standard Land Pattern | Free Air |
|--------------------|--|---|
| Power Dissipation | 420mW ($T_{j\max}=125^\circ\text{C}$) 525mW ($T_{j\max}=150^\circ\text{C}$) | 250mW ($T_{j\max}=125^\circ\text{C}$) |
| Thermal Resistance | $\theta_{ja} = (125-25^\circ\text{C})/0.42\text{W} = 238^\circ\text{C/W}$ | 400 $^\circ\text{C/W}$ |



Power Dissipation



Measurement Board Pattern

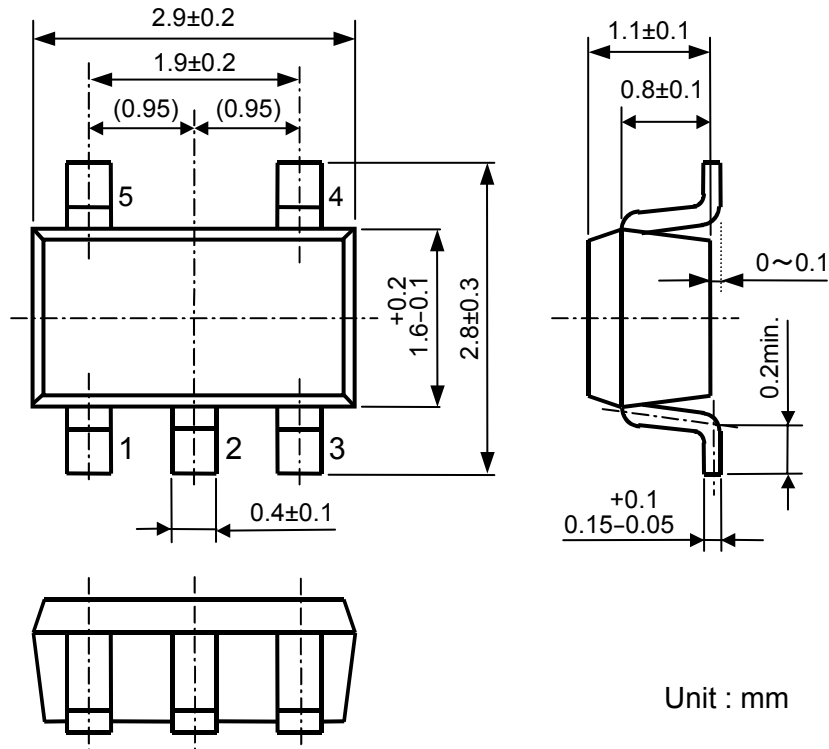
○ IC Mount Area (Unit: mm)

The above graph shows the Power Dissipation of the package based on $T_{j\max}=125^\circ\text{C}$ and $T_{j\max}=150^\circ\text{C}$. Operating the IC in the shaded area in the graph might have an influence it's lifetime.

Operating time must be within the time limit described in the table below, in case of operating in the shaded area.

| Operating Time | Estimated years (Operating 4 hours/day) |
|----------------|--|
| 9,000 hours | 6 years |

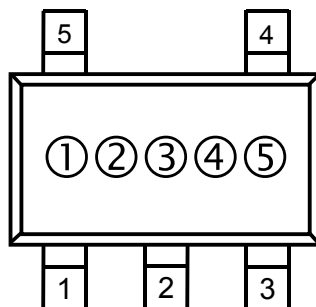
● Package Dimensions (SOT-23-5)



● Mark Specification (SOT-23-5)

①②③: Product Code ... Refer to the marking list table

④⑤: Lot No. ... Alphanumeric Serial Number



* RP170Q (SC-88A) is the discontinued product as of April, 2016.

RP170x

NO.EA-205-160425

RP170N Series marking list table

PKG: SOT-23-5

RP170Nxx1B

| Product Name | ①②③ | Vset |
|--------------|------------|------|
| RP170N121B | FAA | 1.2V |
| RP170N131B | FAC | 1.3V |
| RP170N141B | FAD | 1.4V |
| RP170N151B | FAE | 1.5V |
| RP170N161B | FAF | 1.6V |
| RP170N171B | FAG | 1.7V |
| RP170N181B | FAH | 1.8V |
| RP170N191B | FAK | 1.9V |
| RP170N201B | FAL | 2.0V |
| RP170N211B | FAM | 2.1V |
| RP170N221B | FAN | 2.2V |
| RP170N231B | FAP | 2.3V |
| RP170N241B | FAQ | 2.4V |
| RP170N251B | FAR | 2.5V |
| RP170N261B | FAS | 2.6V |
| RP170N271B | FAT | 2.7V |
| RP170N281B | FAU | 2.8V |
| RP170N291B | FAW | 2.9V |
| RP170N301B | FAX | 3.0V |

| Product Name | ①②③ | Vset |
|--------------|------------|------|
| RP170N311B | FAY | 3.1V |
| RP170N321B | FAZ | 3.2V |
| RP170N331B | GAA | 3.3V |
| RP170N341B | GAB | 3.4V |
| RP170N351B | GAC | 3.5V |
| RP170N361B | GAD | 3.6V |
| RP170N371B | GAE | 3.7V |
| RP170N381B | GAF | 3.8V |
| RP170N391B | GAG | 3.9V |
| RP170N401B | GAH | 4.0V |
| RP170N411B | GAJ | 4.1V |
| RP170N421B | GAK | 4.2V |
| RP170N431B | GAL | 4.3V |
| RP170N441B | GAM | 4.4V |
| RP170N451B | GAN | 4.5V |
| RP170N461B | GAP | 4.6V |
| RP170N471B | GAQ | 4.7V |
| RP170N481B | GAR | 4.8V |
| RP170N491B | GAS | 4.9V |
| RP170N501B | GAT | 5.0V |

| Product Name | ①②③ | Vset |
|--------------|------------|-------|
| RP170N511B | GAU | 5.1V |
| RP170N521B | GAV | 5.2V |
| RP170N531B | GAW | 5.3V |
| RP170N541B | GAX | 5.4V |
| RP170N551B | GAY | 5.5V |
| RP170N561B | GAZ | 5.6V |
| RP170N571B | HAA | 5.7V |
| RP170N581B | HAB | 5.8V |
| RP170N591B | HAC | 5.9V |
| RP170N601B | HAD | 6.0V |
| | | |
| RP170N121B5 | FAB | 1.25V |
| RP170N181B5 | FAJ | 1.85V |
| RP170N281B5 | FAV | 2.85V |

RP170Nxx1D

| Product Name | ①②③ | Vset |
|--------------|------------|------|
| RP170N121D | FBA | 1.2V |
| RP170N131D | FBC | 1.3V |
| RP170N141D | FBD | 1.4V |
| RP170N151D | FBE | 1.5V |
| RP170N161D | FBF | 1.6V |
| RP170N171D | FBG | 1.7V |
| RP170N181D | FBH | 1.8V |
| RP170N191D | FBK | 1.9V |
| RP170N201D | FBL | 2.0V |
| RP170N211D | FBM | 2.1V |
| RP170N221D | FBN | 2.2V |
| RP170N231D | FBP | 2.3V |
| RP170N241D | FBQ | 2.4V |
| RP170N251D | FBR | 2.5V |
| RP170N261D | FBS | 2.6V |
| RP170N271D | FBT | 2.7V |
| RP170N281D | FBU | 2.8V |
| RP170N291D | FBW | 2.9V |
| RP170N301D | FBX | 3.0V |

| Product Name | ①②③ | Vset |
|--------------|------------|------|
| RP170N311D | FBY | 3.1V |
| RP170N321D | FBZ | 3.2V |
| RP170N331D | GBA | 3.3V |
| RP170N341D | GBB | 3.4V |
| RP170N351D | GBC | 3.5V |
| RP170N361D | GBD | 3.6V |
| RP170N371D | GBE | 3.7V |
| RP170N381D | GBF | 3.8V |
| RP170N391D | GBG | 3.9V |
| RP170N401D | GBH | 4.0V |
| RP170N411D | GBJ | 4.1V |
| RP170N421D | GBK | 4.2V |
| RP170N431D | GBL | 4.3V |
| RP170N441D | GBM | 4.4V |
| RP170N451D | GBN | 4.5V |
| RP170N461D | GBP | 4.6V |
| RP170N471D | GBQ | 4.7V |
| RP170N481D | GBR | 4.8V |
| RP170N491D | GBS | 4.9V |
| RP170N501D | GBT | 5.0V |

| Product Name | ①②③ | Vset |
|--------------|------------|-------|
| RP170N511D | GBU | 5.1V |
| RP170N521D | GBV | 5.2V |
| RP170N531D | GBW | 5.3V |
| RP170N541D | GBX | 5.4V |
| RP170N551D | GBY | 5.5V |
| RP170N561D | GBZ | 5.6V |
| RP170N571D | HBA | 5.7V |
| RP170N581D | HBB | 5.8V |
| RP170N591D | HBC | 5.9V |
| RP170N601D | HBD | 6.0V |
| | | |
| RP170N121D5 | FBB | 1.25V |
| RP170N181D5 | FBJ | 1.85V |
| RP170N281D5 | FBV | 2.85V |

* RP170Q (SC-88A) is the discontinued product as of April, 2016.

RP170x

NO.EA-205-160425

● **Power Dissipation (SOT-89-5)**

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:

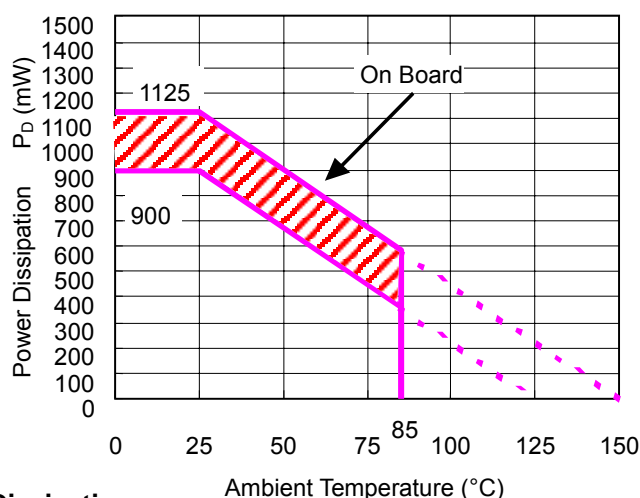
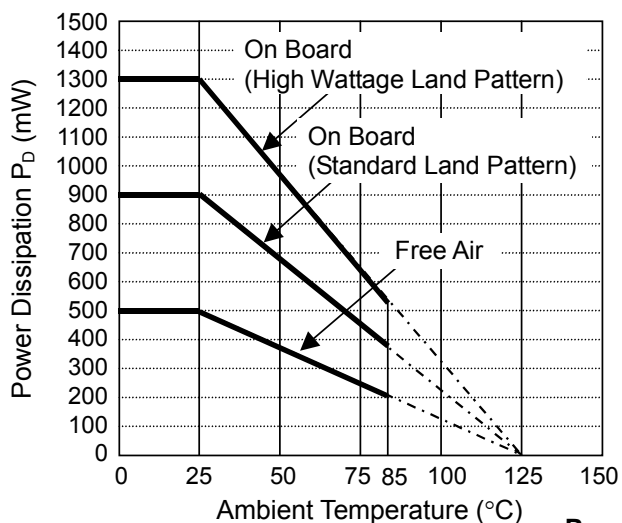
Measurement Conditions

| | High Wattage Land Pattern | Standard Land Pattern |
|------------------|--|--|
| Environment | Mounting on Board (Wind velocity=0m/s) | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plastic (Double-sided) | Glass cloth epoxy plastic (Double-sided) |
| Board Dimensions | 30mm * 30mm * 1.6mm | 50mm * 50mm * 1.6mm |
| Copper Ratio | Top side: Approx. 20% Back side: Approx. 100% | Top side: Approx. 10% Back side: Approx. 100% |
| Through-hole | $\phi 0.85\text{mm} * 10\text{pcs}$ | - |

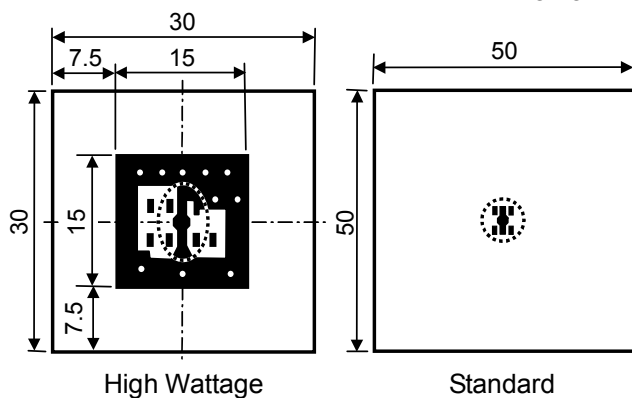
Measurement Result

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

| | High Wattage Land Pattern | Standard Land Pattern | Free Air |
|--------------------|---------------------------|---|-----------------------|
| Power Dissipation | 1300mW | 900mW ($T_{j\text{max}}=125^\circ\text{C}$) 1125mW ($T_{j\text{max}}=150^\circ\text{C}$) | 500mW |
| Thermal Resistance | 77°C/W | 111°C/W | 200°C/W |



Power Dissipation



Measurement Board Pattern

○ IC Mount Area Unit: mm

- The above graph shows the Power Dissipation of the package based on $T_{j\text{max}}=125^\circ\text{C}$ and $T_{j\text{max}}=150^\circ\text{C}$.

Operating the IC in the shaded area in the graph might have an influence it's lifetime.

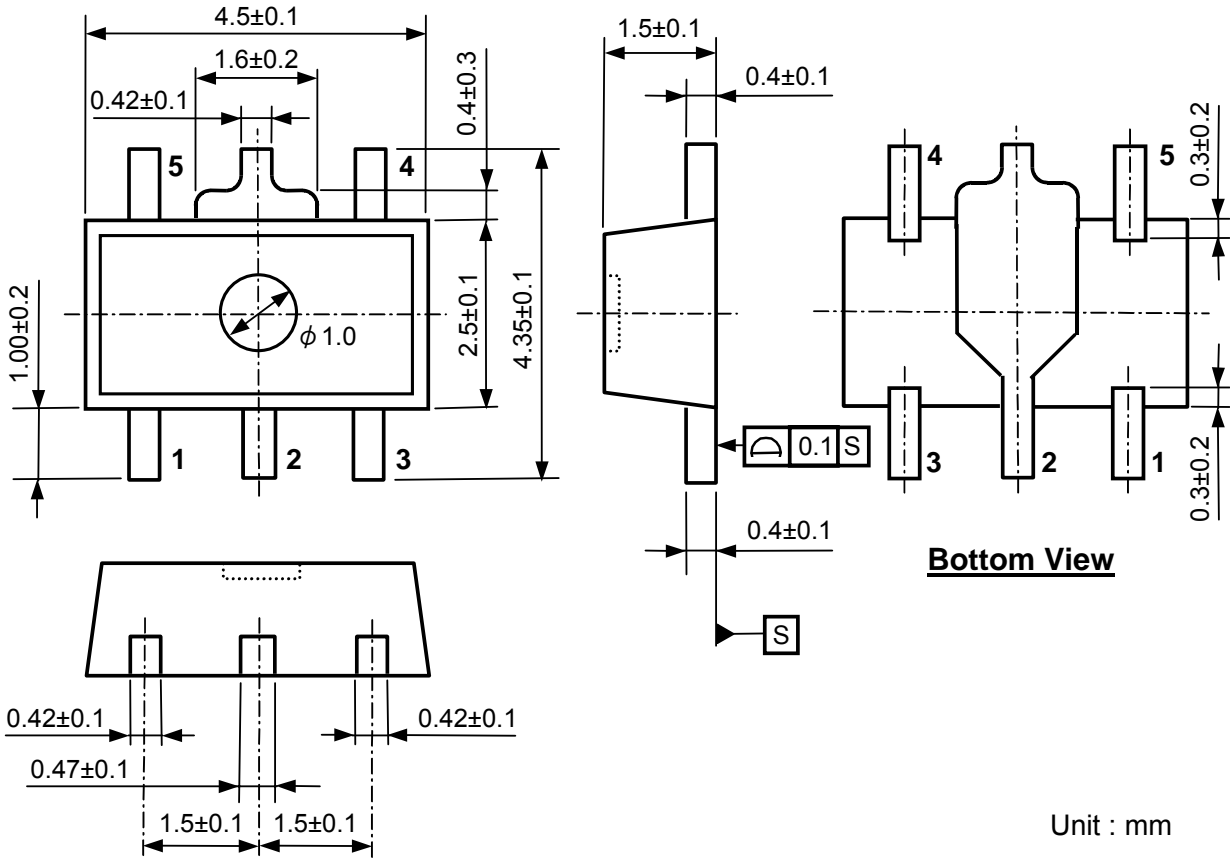
Operating time must be within the time limit described in the table below, in case of operating in the shaded area.

| Operating Time | Estimated years (Operating four hours/day) |
|----------------|---|
| 9,000 hours | 6years |

RP170x

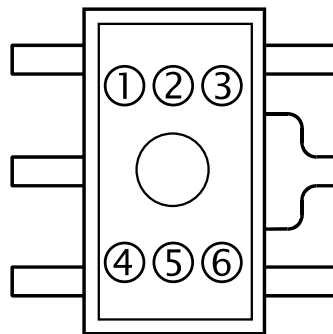
NO.EA-205-160425

• **Package Dimensions (SOT-89-5)**



• **Mark Specification (SOT-89-5)**

- ①②③④ : Product Code.....Refer to the mark list table
- ⑤⑥ : Lot No.Alphanumeric serial number.



* RP170Q (SC-88A) is the discontinued product as of April, 2016.

RP170x

NO.EA-205-160425

RP170H Series marking list table

PKG: SOT-89-5

RP170Hxx1B

| Product Name | ①②③④ | Vset |
|--------------|-------------|------|
| RP170H121B | Y12B | 1.2V |
| RP170H131B | Y13B | 1.3V |
| RP170H141B | Y14B | 1.4V |
| RP170H151B | Y15B | 1.5V |
| RP170H161B | Y16B | 1.6V |
| RP170H171B | Y17B | 1.7V |
| RP170H181B | Y18B | 1.8V |
| RP170H191B | Y19B | 1.9V |
| RP170H201B | Y20B | 2.0V |
| RP170H211B | Y21B | 2.1V |
| RP170H221B | Y22B | 2.2V |
| RP170H231B | Y23B | 2.3V |
| RP170H241B | Y24B | 2.4V |
| RP170H251B | Y25B | 2.5V |
| RP170H261B | Y26B | 2.6V |
| RP170H271B | Y27B | 2.7V |
| RP170H281B | Y28B | 2.8V |
| RP170H291B | Y29B | 2.9V |
| RP170H301B | Y30B | 3.0V |

| Product Name | ①②③④ | Vset |
|--------------|-------------|------|
| RP170H311B | Y31B | 3.1V |
| RP170H321B | Y32B | 3.2V |
| RP170H331B | Y33B | 3.3V |
| RP170H341B | Y34B | 3.4V |
| RP170H351B | Y35B | 3.5V |
| RP170H361B | Y36B | 3.6V |
| RP170H371B | Y37B | 3.7V |
| RP170H381B | Y38B | 3.8V |
| RP170H391B | Y39B | 3.9V |
| RP170H401B | Y40B | 4.0V |
| RP170H411B | Y41B | 4.1V |
| RP170H421B | Y42B | 4.2V |
| RP170H431B | Y43B | 4.3V |
| RP170H441B | Y44B | 4.4V |
| RP170H451B | Y45B | 4.5V |
| RP170H461B | Y46B | 4.6V |
| RP170H471B | Y47B | 4.7V |
| RP170H481B | Y48B | 4.8V |
| RP170H491B | Y49B | 4.9V |
| RP170H501B | Y50B | 5.0V |

| Product Name | ①②③④ | Vset |
|--------------|-------------|-------|
| RP170H511B | Y51B | 5.1V |
| RP170H521B | Y52B | 5.2V |
| RP170H531B | Y53B | 5.3V |
| RP170H541B | Y54B | 5.4V |
| RP170H551B | Y55B | 5.5V |
| RP170H561B | Y56B | 5.6V |
| RP170H571B | Y57B | 5.7V |
| RP170H581B | Y58B | 5.8V |
| RP170H591B | Y59B | 5.9V |
| RP170H601B | Y60B | 6.0V |
| | | |
| RP170H121B5 | Y01B | 1.25V |
| RP170H181B5 | Y02B | 1.85V |
| RP170H281B5 | Y03B | 2.85V |

RP170Hxx1D

| Product Name | ①②③④ | Vset |
|--------------|-------------|------|
| RP170H121D | Y12D | 1.2V |
| RP170H131D | Y13D | 1.3V |
| RP170H141D | Y14D | 1.4V |
| RP170H151D | Y15D | 1.5V |
| RP170H161D | Y16D | 1.6V |
| RP170H171D | Y17D | 1.7V |
| RP170H181D | Y18D | 1.8V |
| RP170H191D | Y19D | 1.9V |
| RP170H201D | Y20D | 2.0V |
| RP170H211D | Y21D | 2.1V |
| RP170H221D | Y22D | 2.2V |
| RP170H231D | Y23D | 2.3V |
| RP170H241D | Y24D | 2.4V |
| RP170H251D | Y25D | 2.5V |
| RP170H261D | Y26D | 2.6V |
| RP170H271D | Y27D | 2.7V |
| RP170H281D | Y28D | 2.8V |
| RP170H291D | Y29D | 2.9V |
| RP170H301D | Y30D | 3.0V |

| Product Name | ①②③④ | Vset |
|--------------|-------------|------|
| RP170H311D | Y31D | 3.1V |
| RP170H321D | Y32D | 3.2V |
| RP170H331D | Y33D | 3.3V |
| RP170H341D | Y34D | 3.4V |
| RP170H351D | Y35D | 3.5V |
| RP170H361D | Y36D | 3.6V |
| RP170H371D | Y37D | 3.7V |
| RP170H381D | Y38D | 3.8V |
| RP170H391D | Y39D | 3.9V |
| RP170H401D | Y40D | 4.0V |
| RP170H411D | Y41D | 4.1V |
| RP170H421D | Y42D | 4.2V |
| RP170H431D | Y43D | 4.3V |
| RP170H441D | Y44D | 4.4V |
| RP170H451D | Y45D | 4.5V |
| RP170H461D | Y46D | 4.6V |
| RP170H471D | Y47D | 4.7V |
| RP170H481D | Y48D | 4.8V |
| RP170H491D | Y49D | 4.9V |
| RP170H501D | Y50D | 5.0V |

| Product Name | ①②③④ | Vset |
|--------------|-------------|-------|
| RP170H511D | Y51D | 5.1V |
| RP170H521D | Y52D | 5.2V |
| RP170H531D | Y53D | 5.3V |
| RP170H541D | Y54D | 5.4V |
| RP170H551D | Y55D | 5.5V |
| RP170H561D | Y56D | 5.6V |
| RP170H571D | Y57D | 5.7V |
| RP170H581D | Y58D | 5.8V |
| RP170H591D | Y59D | 5.9V |
| RP170H601D | Y60D | 6.0V |
| | | |
| RP170H121D5 | Y01D | 1.25V |
| RP170H181D5 | Y02D | 1.85V |
| RP170H281D5 | Y03D | 2.85V |



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