RICOH

RP130x SERIES

# LOW NOISE 150mA LDO REGULATOR

NO.EA-173-131031

## OUTLINE

The RP130x Series are CMOS-based positive voltage regulator ICs with high ripple rejection, low dropout voltage, high output voltage accuracy and extremely low supply current. Each of these ICs consists of a voltage reference unit, an error amplifier, a resistor-net for voltage setting, a short current limit circuit and a chip enable circuit.

These ICs have an excellent low supply current performed by CMOS process, moreover they perform with low dropout voltage due to built-in low ON-resistance. A chip enable function prolongs the battery life.

The input transient response, the load transient response and the ripple rejection have been improved in the RP130x Series compared with the conventional products. Besides achieving low supply current (Typ.38μA).

The range of the operation voltage is capable from 1.7V to 6.5V and the range of the output voltage is capable from 1.2V to 5.3V for this product, which is wider range as our conventional product R1114x series.

The output voltage of these ICs is fixed with high accuracy. Since the packages for these ICs are DFN(PLP)1010-4, SOT-23-5 and SC-82AB, therefore high density mounting of the ICs on boards is possible.

## FEATURES

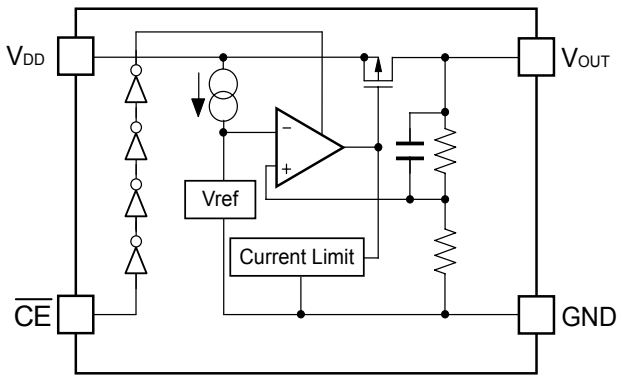
- Supply Current ..... Typ. 38μA
- Supply Current (Standby Mode) ..... Typ. 0.1 μA
- Ripple Rejection..... Typ. 80dB (f=1kHz)
- Input Voltage Range ..... 1.7V to 6.5V
- Output Voltage Range ..... 1.2V to 5.3V (0.1V steps)
  (For other voltages, please refer to MARK INFORMATIONS.)
- Output Voltage Accuracy ..... ±1.0% ($V_{OUT}$>2.0V, $T_{opt}$=25°C)
- Temperature-Drift Coefficient of Output Voltage..... Typ. ±20ppm/°C
- Dropout Voltage ..... Typ. 0.32V ($I_{OUT}$=150mA, $V_{OUT}$=2.8V)
- Line Regulation..... Typ. 0.02%/V
- Packages ..... DFN(PLP)1010-4, SC-82AB, SOT-23-5
- Built-in Fold Back Protection Circuit ..... Typ. 40mA
- Ceramic capacitors are recommended to be used with this IC ..... 0.47μF or more

## APPLICATIONS

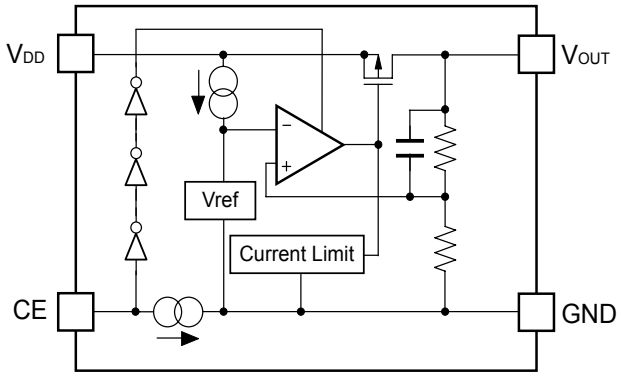
- Power source for battery-powered equipment.
- Power source for portable communication equipment.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for high stable reference voltage.

# BLOCK DIAGRAMS

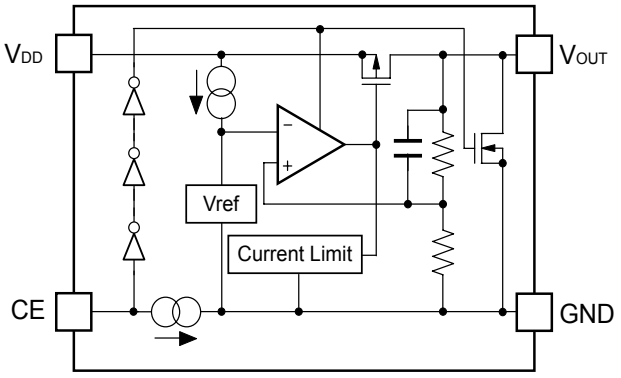
**RP130xxx1A**




**RP130xxx1B**




**RP130xxx1D**



# SELECTION GUIDE

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

| Product Name | Package | Quantity per Reel | Pb Free | Halogen Free |
|---|---|---|---|---|
| RP130Kxx1∗-TR | DFN(PLP)1010-4 | 10,000 pcs | Yes | Yes |
| RP130Qxx1∗-TR-FE | SC-82AB | 3,000 pcs | Yes | Yes |
| RP130Nxx1∗-TR-FE | SOT-23-5 | 3,000 pcs | Yes | Yes |

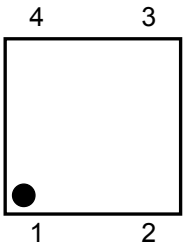
xx : Set Output Voltage ($V_{SET}$)
Fixed Type: 12 to 53 Stepwise setting with 0.1V increment in the range from 1.2V to 5.3V
Exception: 1.25V=RP130x121∗5-TR
1.85V=RP130x181∗5-TR
2.85V=RP130x281∗5-TR

∗ : CE pin polarity and auto discharge function at off state are options as follows.
A: active low, without auto discharge function at off state.
B: active high, without auto discharge function at off state.
D: active high, with auto discharge function at off state.

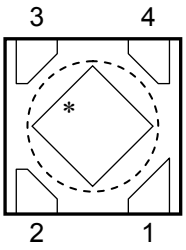
# PIN CONFIGURATIONS

● **DFN(PLP)1010-4**

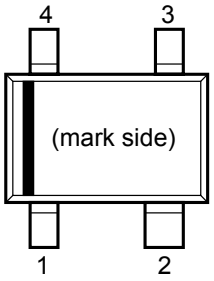
**Top View**



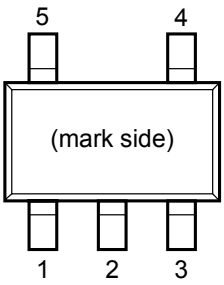

**Bottom View**




● **SC-82AB**




● **SOT-23-5**




# PIN DESCRIPTIONS

● **DFN(PLP)1010-4**

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

∗) Tab is GND level. (They are connected to the reverse side of this IC.)
The tab is better to be connected to the GND, but leaving it open is also acceptable.

● **SC-82AB**

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

● **SOT-23-5**

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

# ABSOLUTE MAXIMUM RATINGS

| Symbol | Item | Rating | Unit |
|---|---|---|---|
| $V_{IN}$ | Input Voltage | 7.0 | V |
| $V_{CE}$ | Input Voltage (CE Pin) | −0.3 to 7.0 | V |
| $V_{OUT}$ | Output Voltage | −0.3 to $V_{IN}$+0.3 | V |
| $I_{OUT}$ | Output Current | 200 | mA |
| $P_D$ | Power Dissipation (DFN(PLP)1010-4)* | 400 | mW |
| | Power Dissipation (SC-82AB)* | 380 | |
| | Power Dissipation (SOT-23-5)* | 420 | |
| Topt | Operating Temperature Range | −40 to 85 | °C |
| Tstg | Storage Temperature Range | −55 to 125 | °C |

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

**ABSOLUTE MAXIMUM RATINGS**

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

# ELECTRICAL CHARACTERISTICS

$V_{IN}$=$V_{SET}$+1V ($V_{OUT}$>1.5V), $V_{IN}$=2.5V ($V_{OUT}$ ≤1.5V), $I_{OUT}$=1mA, $C_{IN}$=$C_{OUT}$=0.47µF, unless otherwise noted.
The specifications surrounded by [ ] are guaranteed by Design Engineering at - 40ºC ≤ Ta ≤ 85ºC.

- **RP130xxx1A**

**(Ta=25°C)**

| Symbol | Item | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | Ta=25°C | $V_{SET}$ > 2.0V | x 0.99 | | x 1.01 | V |
| | | | $V_{SET}$ ≤ 2.0V | -20 | | +20 | mV |
| | | -40°C ≤ Ta ≤ 85°C | $V_{SET}$ > 2.0V | [x 0.985] | | [x 1.015] | V |
| | | | $V_{SET}$ ≤ 2.0V | [-30] | | [+30] | mV |
| $I_{LIM}$ | Output Current Limit | | | [150] | | | mA |
| $\Delta V_{OUT}$ /$\Delta I_{OUT}$ | Load Regulation | 1mA ≤ $I_{OUT}$ ≤ 150mA | | | 10 | [30] | mV |
| $V_{DIF}$ | Dropout Voltage | Please see the table (Dropout Voltage) on below page. | | | | | |
| $I_{SS}$ | Supply Current | $I_{OUT}$=0mA | | | 38 | [58] | µA |
| Istandby | Supply Current (Standby) | $V_{CE}$=$V_{IN}$ | | | 0.1 | 1.0 | µA |
| $\Delta V_{OUT}$ /$\Delta V_{IN}$ | Line Regulation | $V_{SET}$+0.5V ≤ $V_{IN}$ ≤ 6.5V | | | 0.02 | [0.10] | %/V |
| RR | Ripple Rejection | f=1kHz, Ripple 0.2Vp-p<br>$V_{IN}$=$V_{SET}$+1V<br>$I_{OUT}$=30mA<br>(In case that $V_{OUT}$ ≤ 2.0V, $V_{IN}$=3.0V) | | | 80 | | dB |
| $V_{IN}$ | Input Voltage | | | [1.7] | | [6.5] | V |
| $\Delta V_{OUT}$ /$\Delta$Ta | Output Voltage Temperature Coefficient | - 40°C ≤ Ta ≤ 85°C | | | ±20 | | ppm /°C |
| $I_{SC}$ | Short Current Limit | $V_{OUT}$=0V | | | 40 | | mA |
| $V_{CEH}$ | $\overline{CE}$ Input Voltage "H" | | | [1.0] | | | µA |
| $V_{CEL}$ | $\overline{CE}$ Input Voltage "L" | | | | | [0.4] | |
| en | Output Noise | BW=10Hz to 100kHz<br>$I_{OUT}$=30mA | | | 20 x$V_{SET}$ | | µVrms |

All test items listed under *Electrical Characteristics* are done under the pulse load condition (Tj≈Ta=25ºC) except for Output Noise, Ripple Rejection, and Output Voltage Temperature Coefficient.

$V_{IN}$=$V_{SET}$+1V ($V_{OUT}$>1.5V), $V_{IN}$=2.5V ($V_{OUT}$ ≤1.5V), $I_{OUT}$=1mA, $C_{IN}$=$C_{OUT}$=0.47µF, unless otherwise noted.
The specifications surrounded by [ ] are guaranteed by Design Engineering at - 40ºC ≤ Ta ≤ 85ºC.

- **RP130xxx1B/D**

**(Ta=25°C)**

| Symbol | Item | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | Ta=25°C | $V_{SET}$ > 2.0V | x 0.99 | | x 1.01 | V |
| | | | $V_{SET}$ ≤ 2.0V | -20 | | +20 | mV |
| | | -40°C ≤ Ta ≤ 85°C | $V_{SET}$ > 2.0V | [x 0.985] | | [x 1.015] | V |
| | | | $V_{SET}$ ≤ 2.0V | [-30] | | [+30] | mV |
| $I_{LIM}$ | Output Current Limit | | | [150] | | | mA |
| $\Delta V_{OUT}$ /$\Delta I_{OUT}$ | Load Regulation | 1mA ≤ $I_{OUT}$ ≤ 150mA | | | 10 | [30] | mV |
| $V_{DIF}$ | Dropout Voltage | Please see the table (Dropout Voltage) on next page. | | | | | |
| $I_{SS}$ | Supply Current | $I_{OUT}$=0mA | | | 38 | [58] | µA |
| Istandby | Supply Current (Standby) | $V_{CE}$=$V_{IN}$ | | | 0.1 | 1.0 | µA |
| $\Delta V_{OUT}$ /$\Delta V_{IN}$ | Line Regulation | $V_{SET}$+0.5V ≤ $V_{IN}$ ≤ 6.5V | | | 0.02 | [0.10] | %/V |
| RR | Ripple Rejection | f=1kHz, Ripple 0.2Vp-p<br>$V_{IN}$=$V_{SET}$+1V<br>$I_{OUT}$=30mA<br>(In case that $V_{OUT}$ ≤ 2.0V, $V_{IN}$=3.0V) | | | 80 | | dB |
| $V_{IN}$ | Input Voltage | | | [1.7] | | [6.5] | V |
| $\Delta V_{OUT}$ /$\Delta$Ta | Output Voltage Temperature Coefficient | - 40°C ≤ Ta ≤ 85°C | | | ±20 | | ppm /°C |
| $I_{SC}$ | Short Current Limit | $V_{OUT}$=0V | | | 40 | | mA |
| $I_{PD}$ | CE Pull-down Current | | | | 0.4 | | µA |
| $V_{CEH}$ | $\overline{CE}$ Input Voltage "H" | | | [1.0] | | | µA |
| $V_{CEL}$ | $\overline{CE}$ Input Voltage "L" | | | | | [0.4] | |
| en | Output Noise | BW=10Hz to 100kHz<br>$I_{OUT}$=30mA | | | 20 x$V_{SET}$ | | µVrms |
| $R_{LOW}$ | Nch ON Resistance for Auto Discharge (D version Only) | $V_{IN}$=4.0V<br>$V_{CE}$=0V | | | 30 | | Ω |

All test items listed under *Electrical Characteristics* are done under the pulse load condition (Tj≈Ta=25ºC) except for Output Noise, Ripple Rejection, and Output Voltage Temperature Coefficient.

The specifications surrounded by ⬚ are guaranteed by Design Engineering at - 40ºC ≤ Ta ≤ 85ºC.

### Dropout Voltage

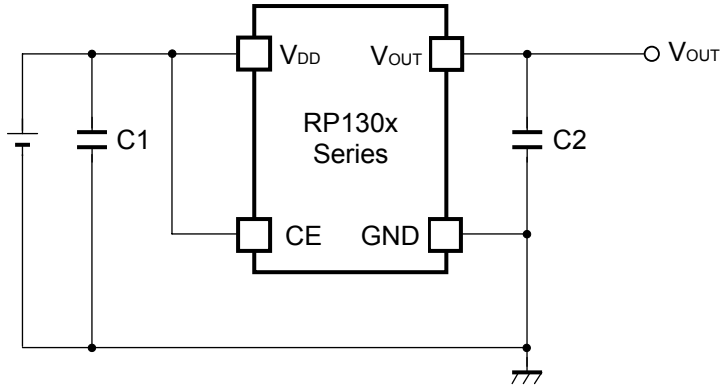
(Ta=25°C)

| Output Voltage $V_{OUT}$ (V) | Dropout Voltage $V_{DIF}$ (V) | | |
|---|---|---|---|
| | Condition | TYP. | MAX. |
| 1.2V ≤ $V_{SET}$ < 1.5V | $I_{OUT}$ = 150mA | 0.67 | 1.00 |
| 1.5V ≤ $V_{SET}$ < 1.7V | | 0.54 | 0.81 |
| 1.7V ≤ $V_{SET}$ < 2.0V | | 0.46 | 0.68 |
| 2.0V ≤ $V_{SET}$ < 2.5V | | 0.41 | 0.60 |
| 2.5V ≤ $V_{SET}$ < 4.0V | | 0.32 | 0.51 |
| 4.0V ≤ $V_{SET}$ | | 0.24 | 0.37 |

**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.

# TYPICAL APPLICATION




(External Components)
Ceramic Capacitor C2 0.47μF MURATA GRM155B30J474KE18B

# 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 0.47μF or more.

If a tantalum capacitor is used, and its ESR (Equivalent Series Resistance) of C2 is large, the loop oscillation may result. Because of this, select C2 carefully considering its frequency characteristics.

**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 0.47μF 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.

# PACKAGE INFORMATION

- **Power Dissipation (DFN(PLP)1010-4)**

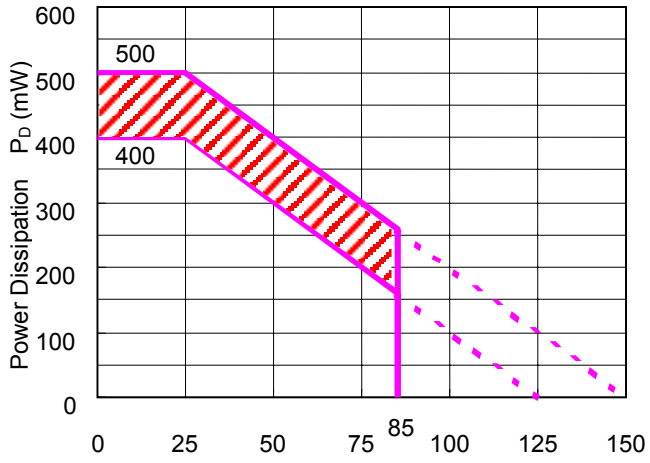
Power Dissipation ($P_D$) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

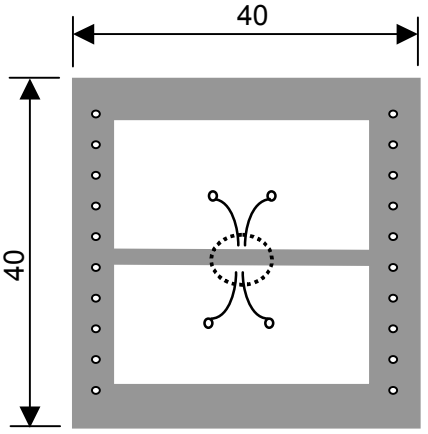
| | **Standard Test Land Pattern** |
|---|---|
| Environment | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plastic (Double sided) |
| Board Dimensions | 40mm x 40mm x 1.6mm |
| Copper Ratio | Top side: Approx. 50%, Back side: Approx. 50% |
| Through-holes | $\phi$ 0.54mm x 24pcs |

Measurement Result (Ta=25°C, Tjmax=125°C)

| | **Standard Test Land Pattern** |
|---|---|
| Power Dissipation | 400mW(Tjmax=125°C)<br>500mW(Tjmax=150°C) |
| Thermal Resistance | θja = (125-25°C)/0.4W= 250°C/W |
| | θjc=67°C/W |




**Power Dissipation**

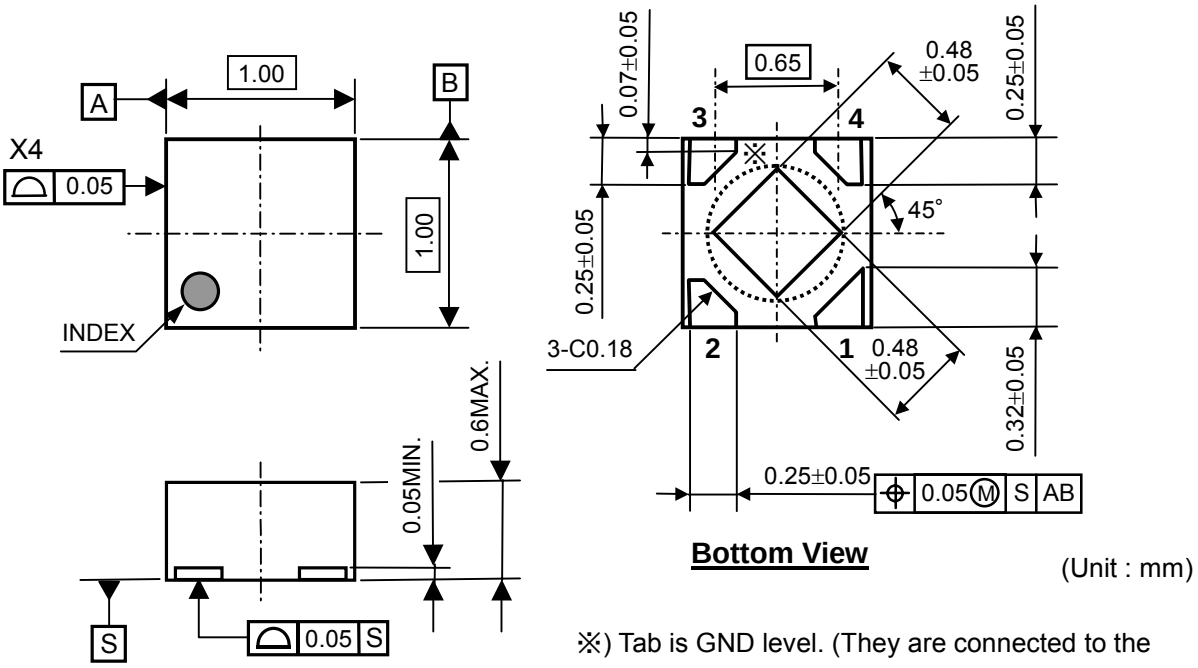



**Measurement Board Pattern**
**IC Mount Area (Unit:mm)**

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

| Operating Time | Estimated years<br>(Operating four hours/day) |
|---|---|
| 13,000 hours | 9years |

- **Package Dimensions (DFN(PLP)1010-4)**

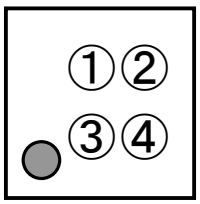



(Unit : mm)

※) Tab is GND level. (They are connected to the reverse side of this IC.)
The tab is better to be connected to the GND, but leaving it open is also acceptable.

- **Mark Specifications (DFN(PLP)1010-4)**

①②: Product Code … **Please refer to RP130K Series Mark Specification Table**
③④: Lot Number … Alphanumeric Serial Number



- **RP130K Series Mark Specification Table (DFN(PLP)1010-4)**

RP130Kxx1A

| Part Number | ①② | $V_{SET}$ |
|---|---|---|
| RP130K121A | RA | 1.2V |
| RP130K131A | RB | 1.3V |
| RP130K141A | RC | 1.4V |
| RP130K151A | RD | 1.5V |
| RP130K161A | RE | 1.6V |
| RP130K171A | RF | 1.7V |
| RP130K181A | RG | 1.8V |
| RP130K191A | RJ | 1.9V |
| RP130K201A | RK | 2.0V |
| RP130K211A | RL | 2.1V |
| RP130K221A | RM | 2.2V |
| RP130K231A | RN | 2.3V |
| RP130K241A | RP | 2.4V |
| RP130K251A | RQ | 2.5V |
| RP130K261A | RR | 2.6V |
| RP130K271A | RS | 2.7V |
| RP130K281A | RT | 2.8V |
| RP130K291A | RV | 2.9V |
| RP130K301A | RW | 3.0V |
| RP130K311A | RX | 3.1V |
| RP130K321A | RY | 3.2V |
| RP130K331A | RZ | 3.3V |
| RP130K341A | SA | 3.4V |
| RP130K351A | SB | 3.5V |
| RP130K361A | SC | 3.6V |
| RP130K371A | SD | 3.7V |
| RP130K381A | SE | 3.8V |
| RP130K391A | SF | 3.9V |
| RP130K401A | SG | 4.0V |
| RP130K411A | SH | 4.1V |
| RP130K421A | SJ | 4.2V |
| RP130K431A | SK | 4.3V |
| RP130K441A | SL | 4.4V |
| RP130K451A | SM | 4.5V |
| RP130K461A | SN | 4.6V |
| RP130K471A | SP | 4.7V |
| RP130K481A | SQ | 4.8V |
| RP130K491A | SR | 4.9V |
| RP130K501A | SS | 5.0V |
| RP131K511A | SV | 5.1V |
| RP131K521A | SW | 5.2V |
| RP131K531A | SX | 5.3V |
| RP131K121A5 | SU | 1.25V |
| RP130K181A5 | RH | 1.85V |
| RP130K281A5 | RU | 2.85V |

RP130Kxx1B

| Part Number | ①② | $V_{SET}$ |
|---|---|---|
| RP130K121B | TA | 1.2V |
| RP130K131B | TB | 1.3V |
| RP130K141B | TC | 1.4V |
| RP130K151B | TD | 1.5V |
| RP130K161B | TE | 1.6V |
| RP130K171B | TF | 1.7V |
| RP130K181B | TG | 1.8V |
| RP130K191B | TJ | 1.9V |
| RP130K201B | TK | 2.0V |
| RP130K211B | TL | 2.1V |
| RP130K221B | TM | 2.2V |
| RP130K231B | TN | 2.3V |
| RP130K241B | TP | 2.4V |
| RP130K251B | TQ | 2.5V |
| RP130K261B | TR | 2.6V |
| RP130K271B | TS | 2.7V |
| RP130K281B | TT | 2.8V |
| RP130K291B | TV | 2.9V |
| RP130K301B | TW | 3.0V |
| RP130K311B | TX | 3.1V |
| RP130K321B | TY | 3.2V |
| RP130K331B | TZ | 3.3V |
| RP130K341B | UA | 3.4V |
| RP130K351B | UB | 3.5V |
| RP130K361B | UC | 3.6V |
| RP130K371B | UD | 3.7V |
| RP130K381B | UE | 3.8V |
| RP130K391B | UF | 3.9V |
| RP130K401B | UG | 4.0V |
| RP130K411B | UH | 4.1V |
| RP130K421B | UJ | 4.2V |
| RP130K431B | UK | 4.3V |
| RP130K441B | UL | 4.4V |
| RP130K451B | UM | 4.5V |
| RP130K461B | UN | 4.6V |
| RP130K471B | UP | 4.7V |
| RP130K481B | UQ | 4.8V |
| RP130K491B | UR | 4.9V |
| RP130K501B | US | 5.0V |
| RP131K511B | UV | 5.1V |
| RP131K521B | UW | 5.2V |
| RP131K531B | UX | 5.3V |
| RP131K121B5 | UU | 1.25V |
| RP130K181B5 | TH | 1.85V |
| RP130K281B5 | TU | 2.85V |

RP130Kxx1D

| Part Number | ①② | $V_{SET}$ |
|---|---|---|
| RP130K121D | VA | 1.2V |
| RP130K131D | VB | 1.3V |
| RP130K141D | VC | 1.4V |
| RP130K151D | VD | 1.5V |
| RP130K161D | VE | 1.6V |
| RP130K171D | VF | 1.7V |
| RP130K181D | VG | 1.8V |
| RP130K191D | VJ | 1.9V |
| RP130K201D | VK | 2.0V |
| RP130K211D | VL | 2.1V |
| RP130K221D | VM | 2.2V |
| RP130K231D | VN | 2.3V |
| RP130K241D | VP | 2.4V |
| RP130K251D | VQ | 2.5V |
| RP130K261D | VR | 2.6V |
| RP130K271D | VS | 2.7V |
| RP130K281D | VT | 2.8V |
| RP130K291D | VV | 2.9V |
| RP130K301D | VW | 3.0V |
| RP130K311D | VX | 3.1V |
| RP130K321D | VY | 3.2V |
| RP130K331D | VZ | 3.3V |
| RP130K341D | WA | 3.4V |
| RP130K351D | WB | 3.5V |
| RP130K361D | WC | 3.6V |
| RP130K371D | WD | 3.7V |
| RP130K381D | WE | 3.8V |
| RP130K391D | WF | 3.9V |
| RP130K401D | WG | 4.0V |
| RP130K411D | WH | 4.1V |
| RP130K421D | WJ | 4.2V |
| RP130K431D | WK | 4.3V |
| RP130K441D | WL | 4.4V |
| RP130K451D | WM | 4.5V |
| RP130K461D | WN | 4.6V |
| RP130K471D | WP | 4.7V |
| RP130K481D | WQ | 4.8V |
| RP130K491D | WR | 4.9V |
| RP130K501D | WS | 5.0V |
| RP131K511D | WV | 5.1V |
| RP131K521D | WW | 5.2V |
| RP131K531D | WX | 5.3V |
| RP131K121D5 | WU | 1.25V |
| RP130K181D5 | VH | 1.85V |
| RP130K281D5 | VU | 2.85V |

## • Power Dissipation (SC-82AB)

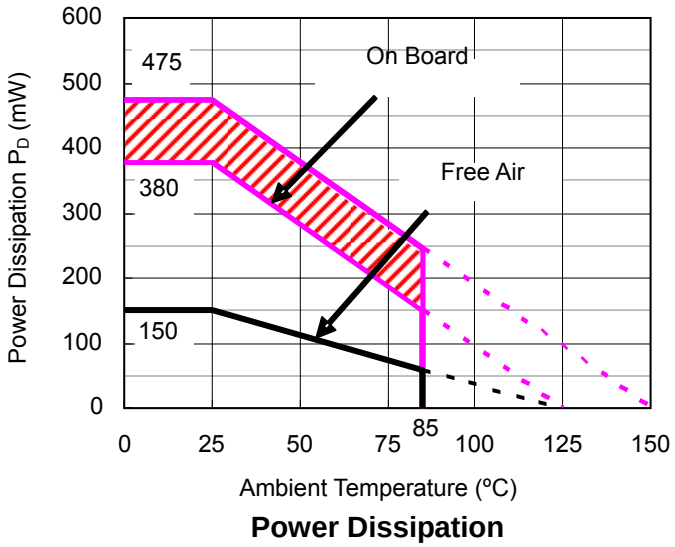
Power Dissipation ($P_D$) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

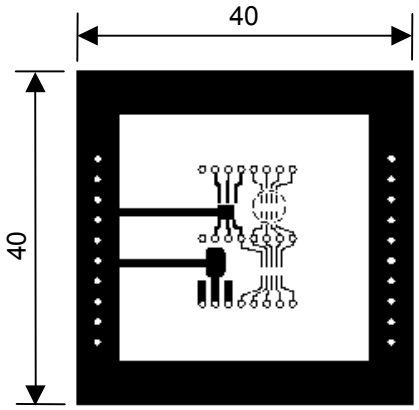
| | Standard Land Pattern |
|---|---|
| Environment | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plastic (Double Layers) |
| Board Dimensions | 40mm x 40mm x 1.6mm |
| Copper Ratio | Top side: Approx. 50%, Back side: Approx. 50% |
| Through-hole | ϕ0.5mm x 44pcs |

Measurement Result (Ta=25ºC)

| | Standard Land Pattern | Free Air |
|---|---|---|
| **Power Dissipation** | 380mW (Tjmax=125°C)<br>475mW (Tjmax=150°C) | 150mW (Tjmax=125°C) |
| Thermal Resistance | θja=(125-25°C)/0.38W=263°C/W | 667°C/W |




**Power Dissipation**



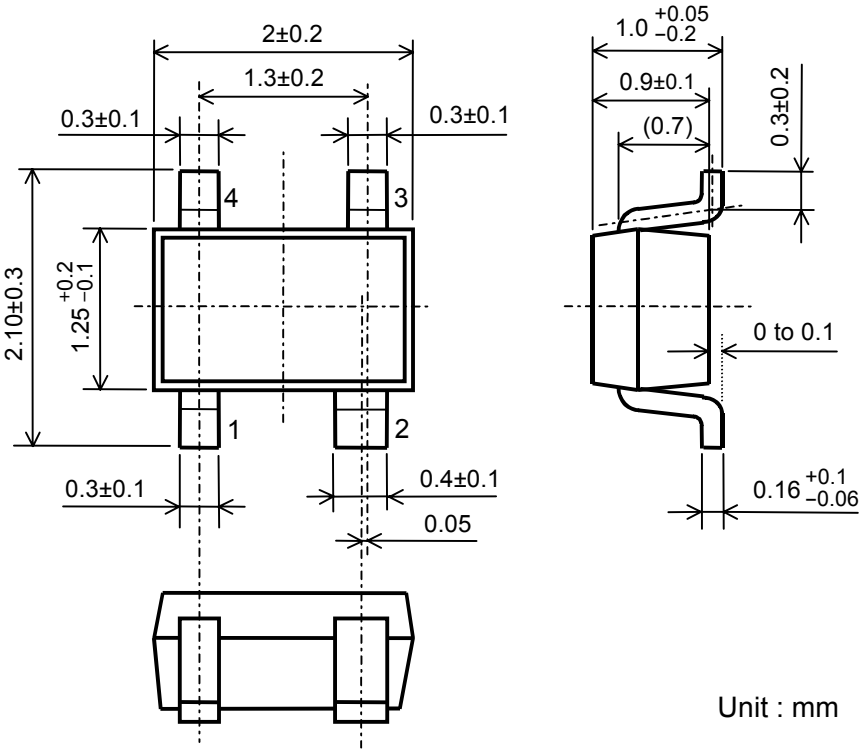

**Measurement Board Pattern**

IC Mount Area (Unit : mm)

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

| Operating Time | Estimated years (Operating four hours/day) |
|---|---|
| 13,000 hours | 9years |

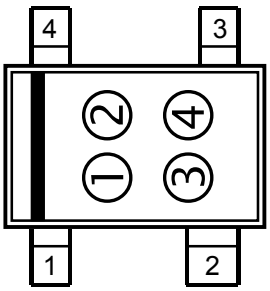
- **Package Dimensions (SC-82AB)**




Unit : mm

- **Mark Specifications (SC-82AB)**

①②: Product Code … **Please refer to RP130Q Series Mark Specification Table**
③④: Lot Number … Alphanumeric Serial Number



- **RP130Q Series Mark Specification Table (SC-82AB)**

**RP130Qxx1A**

| Part Number | ①② | $V_{SET}$ |
|---|---|---|
| RP130Q121A | AA | 1.2V |
| RP130Q131A | AB | 1.3V |
| RP130Q141A | AC | 1.4V |
| RP130Q151A | AD | 1.5V |
| RP130Q161A | AE | 1.6V |
| RP130Q171A | AF | 1.7V |
| RP130Q181A | AG | 1.8V |
| RP130Q191A | AJ | 1.9V |
| RP130Q201A | AK | 2.0V |
| RP130Q211A | BA | 2.1V |
| RP130Q221A | BB | 2.2V |
| RP130Q231A | BC | 2.3V |
| RP130Q241A | BD | 2.4V |
| RP130Q251A | BE | 2.5V |
| RP130Q261A | BF | 2.6V |
| RP130Q271A | BG | 2.7V |
| RP130Q281A | BH | 2.8V |
| RP130Q291A | BK | 2.9V |
| RP130Q301A | CA | 3.0V |
| RP130Q311A | CB | 3.1V |
| RP130Q321A | CC | 3.2V |
| RP130Q331A | CD | 3.3V |
| RP130Q341A | CE | 3.4V |
| RP130Q351A | CF | 3.5V |
| RP130Q361A | CG | 3.6V |
| RP130Q371A | CH | 3.7V |
| RP130Q381A | CJ | 3.8V |
| RP130Q391A | CK | 3.9V |
| RP130Q401A | DA | 4.0V |
| RP130Q411A | DB | 4.1V |
| RP130Q421A | DC | 4.2V |
| RP130Q431A | DD | 4.3V |
| RP130Q441A | DE | 4.4V |
| RP130Q451A | DF | 4.5V |
| RP130Q461A | DG | 4.6V |
| RP130Q471A | DH | 4.7V |
| RP130Q481A | DJ | 4.8V |
| RP130Q491A | DK | 4.9V |
| RP130Q501A | EA | 5.0V |
| RP130Q511A | ED | 5.1V |
| RP130Q521A | EE | 5.2V |
| RP130Q531A | EF | 5.3V |
| RP130Q121A5 | EC | 1.25V |
| RP130Q181A5 | AH | 1.85V |
| RP130Q281A5 | BJ | 2.85V |

**RP130Qxx1B**

| Part Number | ①② | $V_{SET}$ |
|---|---|---|
| RP130Q121B | FA | 1.2V |
| RP130Q131B | FB | 1.3V |
| RP130Q141B | FC | 1.4V |
| RP130Q151B | FD | 1.5V |
| RP130Q161B | FE | 1.6V |
| RP130Q171B | FF | 1.7V |
| RP130Q181B | FG | 1.8V |
| RP130Q191B | FJ | 1.9V |
| RP130Q201B | FK | 2.0V |
| RP130Q211B | GA | 2.1V |
| RP130Q221B | GB | 2.2V |
| RP130Q231B | GC | 2.3V |
| RP130Q241B | GD | 2.4V |
| RP130Q251B | GE | 2.5V |
| RP130Q261B | GF | 2.6V |
| RP130Q271B | GG | 2.7V |
| RP130Q281B | GH | 2.8V |
| RP130Q291B | GK | 2.9V |
| RP130Q301B | HA | 3.0V |
| RP130Q311B | HB | 3.1V |
| RP130Q321B | HC | 3.2V |
| RP130Q331B | HD | 3.3V |
| RP130Q341B | HE | 3.4V |
| RP130Q351B | HF | 3.5V |
| RP130Q361B | HG | 3.6V |
| RP130Q371B | HH | 3.7V |
| RP130Q381B | HJ | 3.8V |
| RP130Q391B | HK | 3.9V |
| RP130Q401B | JA | 4.0V |
| RP130Q411B | JB | 4.1V |
| RP130Q421B | JC | 4.2V |
| RP130Q431B | JD | 4.3V |
| RP130Q441B | JE | 4.4V |
| RP130Q451B | JF | 4.5V |
| RP130Q461B | JG | 4.6V |
| RP130Q471B | JH | 4.7V |
| RP130Q481B | JJ | 4.8V |
| RP130Q491B | JK | 4.9V |
| RP130Q501B | KA | 5.0V |
| RP130Q511B | KD | 5.1V |
| RP130Q521B | KE | 5.2V |
| RP130Q531B | KF | 5.3V |
| RP130Q121B5 | KC | 1.25V |
| RP130Q181B5 | FH | 1.85V |
| RP130Q281B5 | GJ | 2.85V |

**RP130Qxx1D**

| Part Number | ①② | $V_{SET}$ |
|---|---|---|
| RP130Q121D | LA | 1.2V |
| RP130Q131D | LB | 1.3V |
| RP130Q141D | LC | 1.4V |
| RP130Q151D | LD | 1.5V |
| RP130Q161D | LE | 1.6V |
| RP130Q171D | LF | 1.7V |
| RP130Q181D | LG | 1.8V |
| RP130Q191D | LJ | 1.9V |
| RP130Q201D | LK | 2.0V |
| RP130Q211D | MA | 2.1V |
| RP130Q221D | MB | 2.2V |
| RP130Q231D | MC | 2.3V |
| RP130Q241D | MD | 2.4V |
| RP130Q251D | ME | 2.5V |
| RP130Q261D | MF | 2.6V |
| RP130Q271D | MG | 2.7V |
| RP130Q281D | MH | 2.8V |
| RP130Q291D | MK | 2.9V |
| RP130Q301D | NA | 3.0V |
| RP130Q311D | NB | 3.1V |
| RP130Q321D | NC | 3.2V |
| RP130Q331D | ND | 3.3V |
| RP130Q341D | NE | 3.4V |
| RP130Q351D | NF | 3.5V |
| RP130Q361D | NG | 3.6V |
| RP130Q371D | NH | 3.7V |
| RP130Q381D | NJ | 3.8V |
| RP130Q391D | NK | 3.9V |
| RP130Q401D | PA | 4.0V |
| RP130Q411D | PB | 4.1V |
| RP130Q421D | PC | 4.2V |
| RP130Q431D | PD | 4.3V |
| RP130Q441D | PE | 4.4V |
| RP130Q451D | PF | 4.5V |
| RP130Q461D | PG | 4.6V |
| RP130Q471D | PH | 4.7V |
| RP130Q481D | PJ | 4.8V |
| RP130Q491D | PK | 4.9V |
| RP130Q501D | QA | 5.0V |
| RP130Q511D | QD | 5.1V |
| RP130Q521D | QE | 5.2V |
| RP130Q531D | QF | 5.3V |
| RP130Q121D5 | QC | 1.25V |
| RP130Q181D5 | LH | 1.85V |
| RP130Q281D5 | MJ | 2.85V |

- **Power Dissipation (SOT-23-5)**

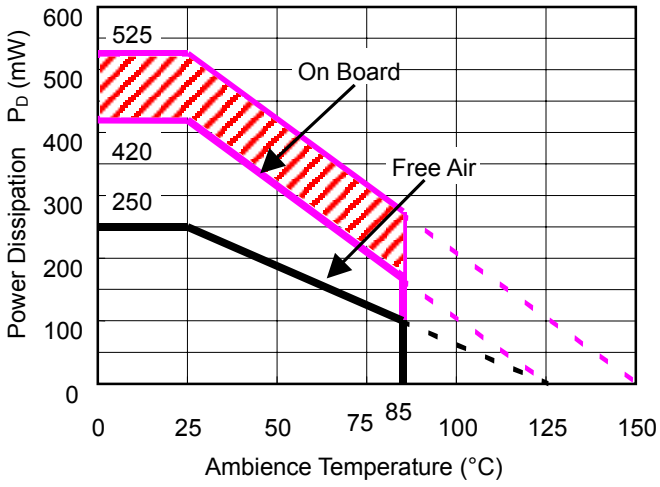
Power Dissipation ($P_D$) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:
(Power Dissipation (SOT-23-5) is substitution of SOT-23-6.)

Measurement Conditions

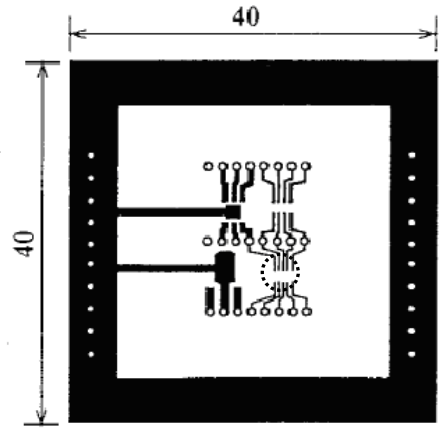
| | **Standard Test Land Pattern** |
|---|---|
| Environment | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plastic (Double sided) |
| Board Dimensions | 40mm x 40mm x 1.6mm |
| Copper Ratio | Top side: Approx. 50%, Back side: Approx. 50% |
| Through-holes | $\phi$ 0.5mm x 44pcs |

Measurement Result (Ta=25°C, Tjmax=125°C)

| | **Standard Land Pattern** | **Free Air** |
|---|---|---|
| Power Dissipation | 420mW(Tjmax=125°C)<br>525mW(Tjmax=150°C) | 250mW |
| Thermal Resistance | $\theta$ja = (125-25°C)/0.42W= 238°C/W | 400°C/W |




**Power Dissipation**

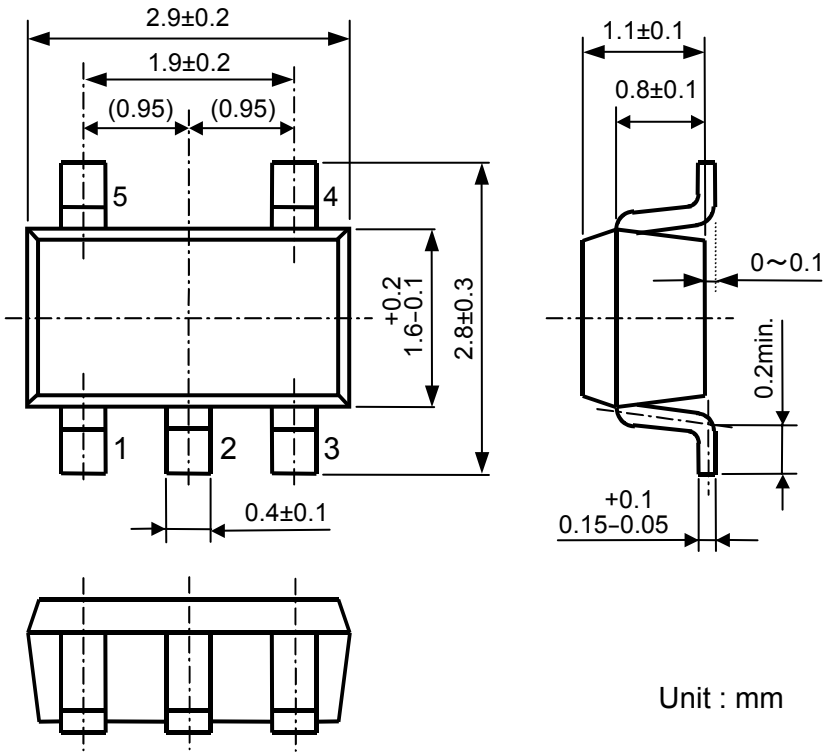



**Measurement Board Pattern**
IC Mount Area (Unit: mm)

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

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

- **Package Dimensions (SOT-23-5)**

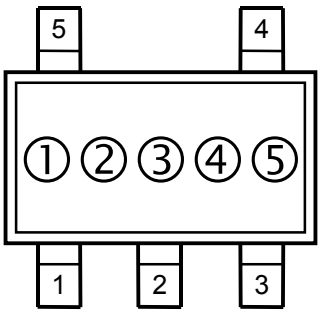



Unit : mm

- **Mark Specifications (SOT-23-5)**

①②③: Product Code … **Please refer to RP130N Series Mark Specification Table**

④⑤: Lot Number … Alphanumeric Serial Number



- **RP130N Series Mark Specification Table (SOT-23-5)**

**RP130Nxx1A**

| Part Number | ①②③ | $V_{SET}$ |
|---|---|---|
| RP130N121A | H0A | 1.2V |
| RP130N131A | H0B | 1.3V |
| RP130N141A | H0C | 1.4V |
| RP130N151A | H0D | 1.5V |
| RP130N161A | H0E | 1.6V |
| RP130N171A | H0F | 1.7V |
| RP130N181A | H0G | 1.8V |
| RP130N191A | H0J | 1.9V |
| RP130N201A | H0K | 2.0V |
| RP130N211A | H0L | 2.1V |
| RP130N221A | H0M | 2.2V |
| RP130N231A | H0N | 2.3V |
| RP130N241A | H0P | 2.4V |
| RP130N251A | H0Q | 2.5V |
| RP130N261A | H0R | 2.6V |
| RP130N271A | H0S | 2.7V |
| RP130N281A | H0T | 2.8V |
| RP130N291A | H0V | 2.9V |
| RP130N301A | H0W | 3.0V |
| RP130N311A | H0X | 3.1V |
| RP130N321A | H0Y | 3.2V |
| RP130N331A | H0Z | 3.3V |
| RP130N341A | J0A | 3.4V |
| RP130N351A | J0B | 3.5V |
| RP130N361A | J0C | 3.6V |
| RP130N371A | J0D | 3.7V |
| RP130N381A | J0E | 3.8V |
| RP130N391A | J0F | 3.9V |
| RP130N401A | J0G | 4.0V |
| RP130N411A | J0H | 4.1V |
| RP130N421A | J0J | 4.2V |
| RP130N431A | J0K | 4.3V |
| RP130N441A | J0L | 4.4V |
| RP130N451A | J0M | 4.5V |
| RP130N461A | J0N | 4.6V |
| RP130N471A | J0P | 4.7V |
| RP130N481A | J0Q | 4.8V |
| RP130N491A | J0R | 4.9V |
| RP130N501A | J0S | 5.0V |
| RP130N511A | J0V | 5.1V |
| RP130N521A | J0W | 5.2V |
| RP130N531A | J0X | 5.3V |
| RP130N121A5 | J0U | 1.25V |
| RP130N181A5 | H0H | 1.85V |
| RP130N281A5 | H0U | 2.85V |

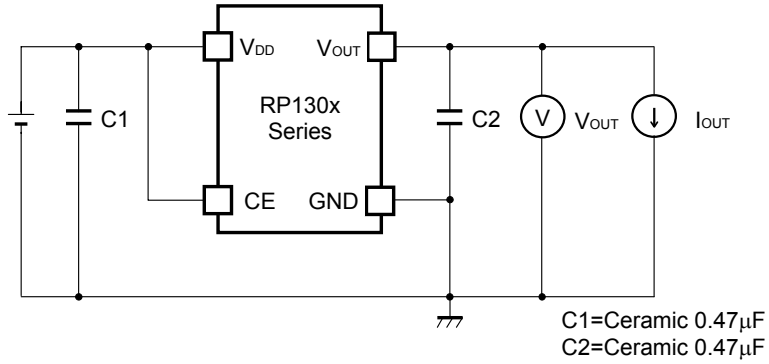
**RP130Nxx1B**

| Part Number | ①②③ | $V_{SET}$ |
|---|---|---|
| RP130N121B | H1A | 1.2V |
| RP130N131B | H1B | 1.3V |
| RP130N141B | H1C | 1.4V |
| RP130N151B | H1D | 1.5V |
| RP130N161B | H1E | 1.6V |
| RP130N171B | H1F | 1.7V |
| RP130N181B | H1G | 1.8V |
| RP130N191B | H1J | 1.9V |
| RP130N201B | H1K | 2.0V |
| RP130N211B | H1L | 2.1V |
| RP130N221B | H1M | 2.2V |
| RP130N231B | H1N | 2.3V |
| RP130N241B | H1P | 2.4V |
| RP130N251B | H1Q | 2.5V |
| RP130N261B | H1R | 2.6V |
| RP130N271B | H1S | 2.7V |
| RP130N281B | H1T | 2.8V |
| RP130N291B | H1V | 2.9V |
| RP130N301B | H1W | 3.0V |
| RP130N311B | H1X | 3.1V |
| RP130N321B | H1Y | 3.2V |
| RP130N331B | H1Z | 3.3V |
| RP130N341B | J1A | 3.4V |
| RP130N351B | J1B | 3.5V |
| RP130N361B | J1C | 3.6V |
| RP130N371B | J1D | 3.7V |
| RP130N381B | J1E | 3.8V |
| RP130N391B | J1F | 3.9V |
| RP130N401B | J1G | 4.0V |
| RP130N411B | J1H | 4.1V |
| RP130N421B | J1J | 4.2V |
| RP130N431B | J1K | 4.3V |
| RP130N441B | J1L | 4.4V |
| RP130N451B | J1M | 4.5V |
| RP130N461B | J1N | 4.6V |
| RP130N471B | J1P | 4.7V |
| RP130N481B | J1Q | 4.8V |
| RP130N491B | J1R | 4.9V |
| RP130N501B | J1S | 5.0V |
| RP130N511B | J1V | 5.1V |
| RP130N521B | J1W | 5.2V |
| RP130N531B | J1X | 5.3V |
| RP130N121B5 | J1U | 1.25V |
| RP130N181B5 | H1H | 1.85V |
| RP130N281B5 | H1U | 2.85V |

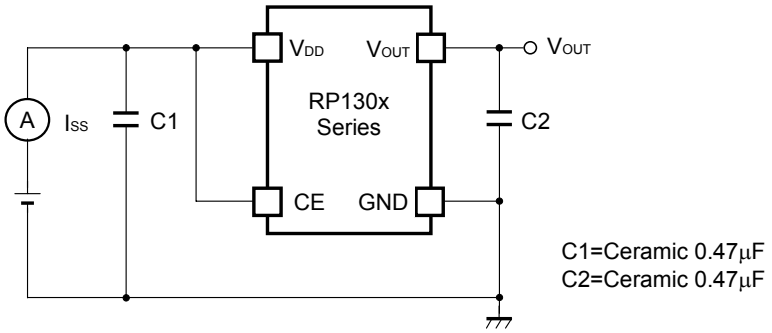
**RP130Nxx1D**

| Part Number | ①②③ | $V_{SET}$ |
|---|---|---|
| RP130N121D | H2A | 1.2V |
| RP130N131D | H2B | 1.3V |
| RP130N141D | H2C | 1.4V |
| RP130N151D | H2D | 1.5V |
| RP130N161D | H2E | 1.6V |
| RP130N171D | H2F | 1.7V |
| RP130N181D | H2G | 1.8V |
| RP130N191D | H2J | 1.9V |
| RP130N201D | H2K | 2.0V |
| RP130N211D | H2L | 2.1V |
| RP130N221D | H2M | 2.2V |
| RP130N231D | H2N | 2.3V |
| RP130N241D | H2P | 2.4V |
| RP130N251D | H2Q | 2.5V |
| RP130N261D | H2R | 2.6V |
| RP130N271D | H2S | 2.7V |
| RP130N281D | H2T | 2.8V |
| RP130N291D | H2V | 2.9V |
| RP130N301D | H2W | 3.0V |
| RP130N311D | H2X | 3.1V |
| RP130N321D | H2Y | 3.2V |
| RP130N331D | H2Z | 3.3V |
| RP130N341D | J2A | 3.4V |
| RP130N351D | J2B | 3.5V |
| RP130N361D | J2C | 3.6V |
| RP130N371D | J2D | 3.7V |
| RP130N381D | J2E | 3.8V |
| RP130N391D | J2F | 3.9V |
| RP130N401D | J2G | 4.0V |
| RP130N411D | J2H | 4.1V |
| RP130N421D | J2J | 4.2V |
| RP130N431D | J2K | 4.3V |
| RP130N441D | J2L | 4.4V |
| RP130N451D | J2M | 4.5V |
| RP130N461D | J2N | 4.6V |
| RP130N471D | J2P | 4.7V |
| RP130N481D | J2Q | 4.8V |
| RP130N491D | J2R | 4.9V |
| RP130N501D | J2S | 5.0V |
| RP130N511D | J2V | 5.1V |
| RP130N521D | J2W | 5.2V |
| RP130N531D | J2X | 5.3V |
| RP130N121D5 | J2U | 1.25V |
| RP130N181D5 | H2H | 1.85V |
| RP130N281D5 | H2U | 2.85V |

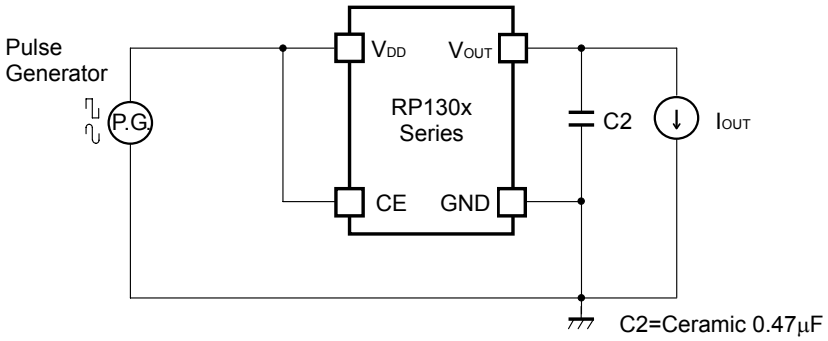
# TEST CIRCUITS



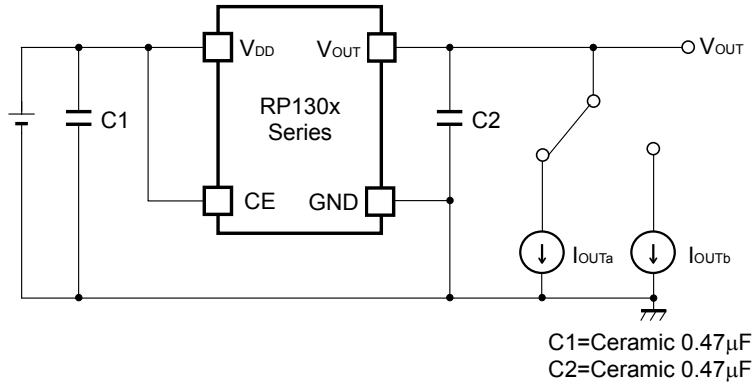

**Basic Test Circuit**




**Supply Current Test Circuit**




**Ripple Rejection Test Circuit**

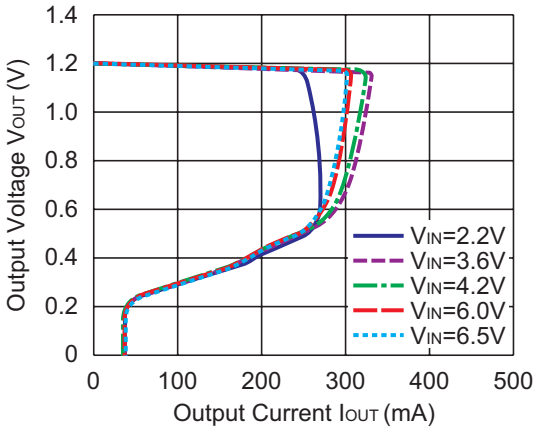



**Load Transient Response Test Circuit**

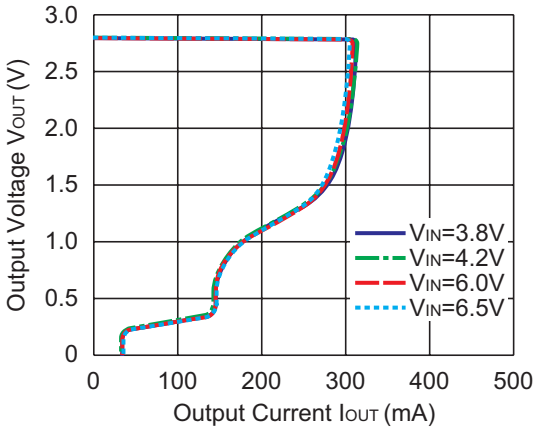
# TYPICAL CHARACTERISTICS

### 1) Output Voltage vs. Output Current (C1=0.47µF, C2=0.47µF, Topt=25°C)

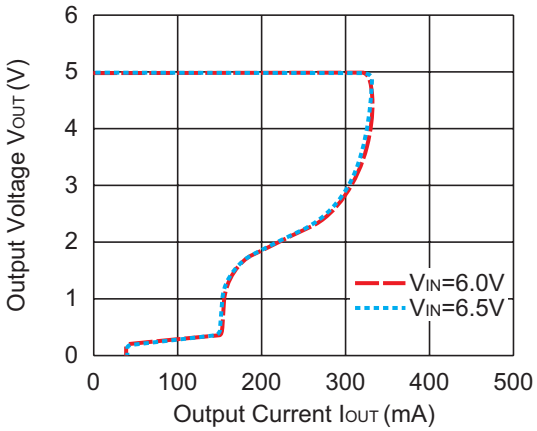
**RP130x121x**




**RP130x281x**

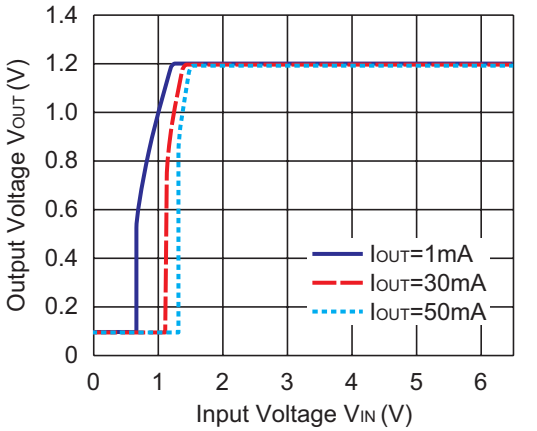



**RP130x501x**

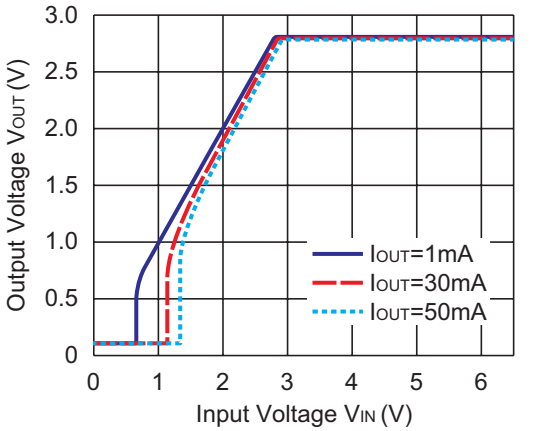



### 2) Output Voltage vs. Input Voltage (C1=0.47µF, C2=0.47µF, Topt=25°C)

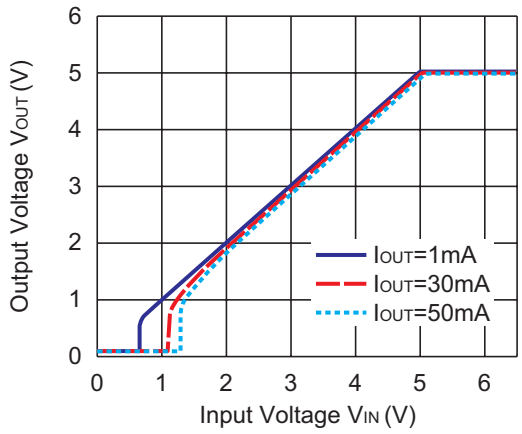
**RP130x121x**




**RP130x281x**

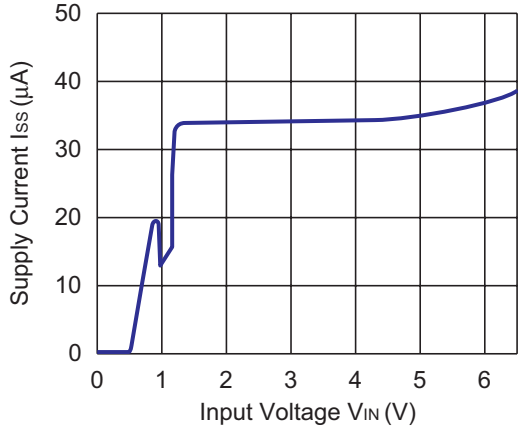


**RP130x501x**

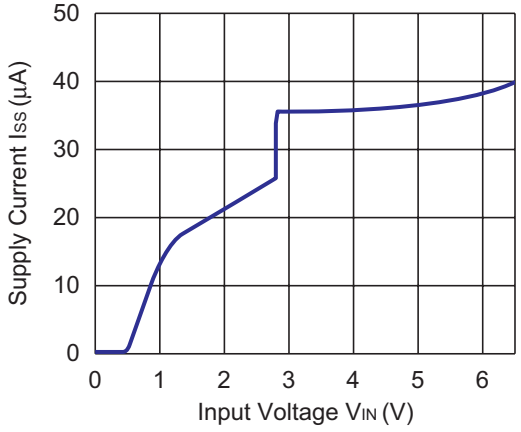



### 3) Supply Current vs. Input Voltage (C1=0.47µF, C2=0.47µF, Topt=25°C)

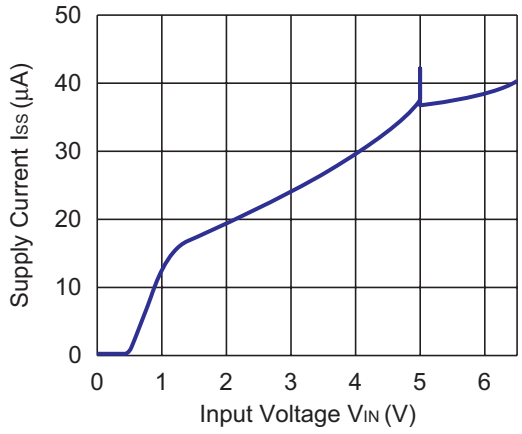
**RP130x121x**




**RP130x281x**

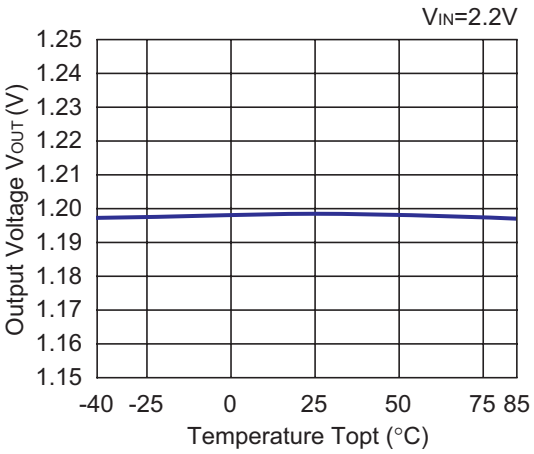



**RP130x501x**

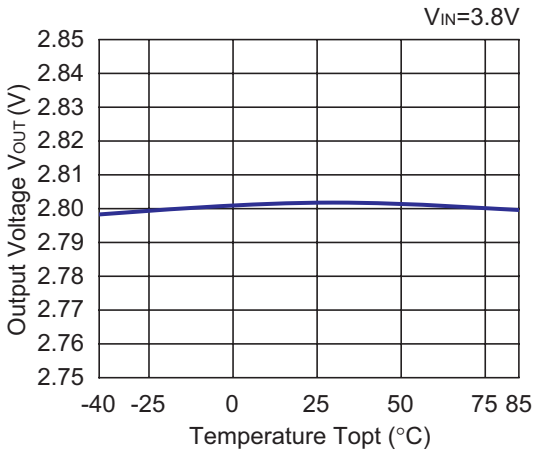


### 4) Output Voltage vs. Temperature ($I_{OUT}$=1mA, C1=0.47µF, C2=0.47µF)

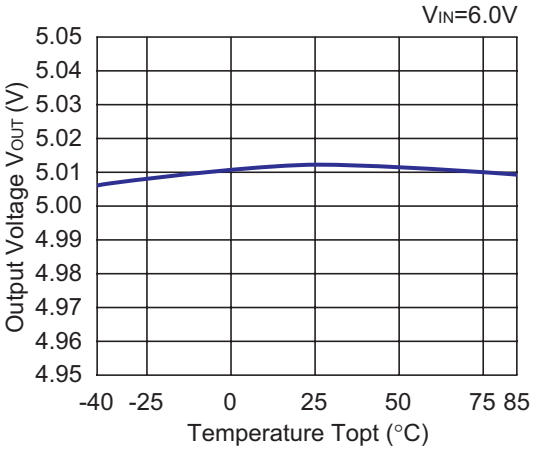
**RP130x121x**




**RP130x281x**

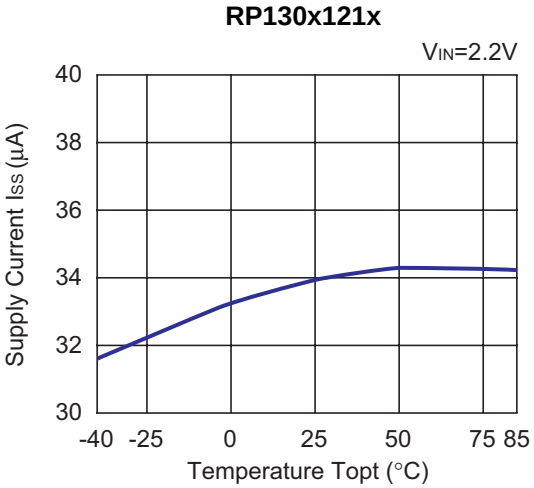



**RP130x501x**

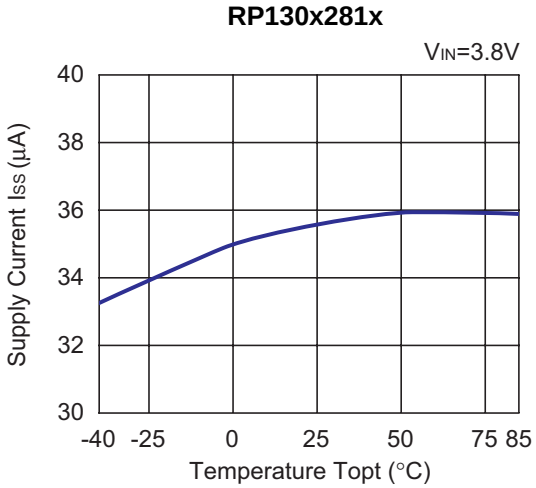



### 5) Supply Current vs. Temperature ($I_{OUT}$=0mA, C1=0.47µF, C2=0.47µF)

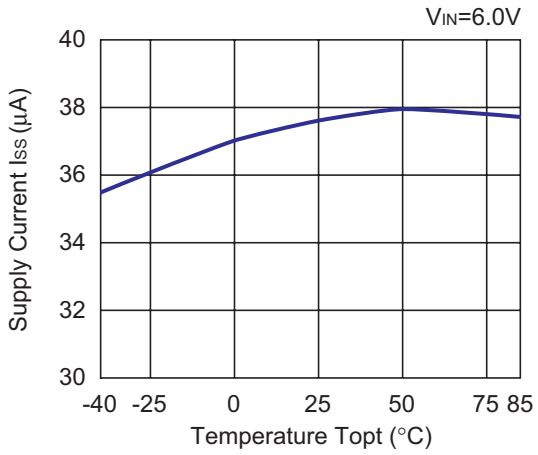
**RP130x121x**




**RP130x281x**

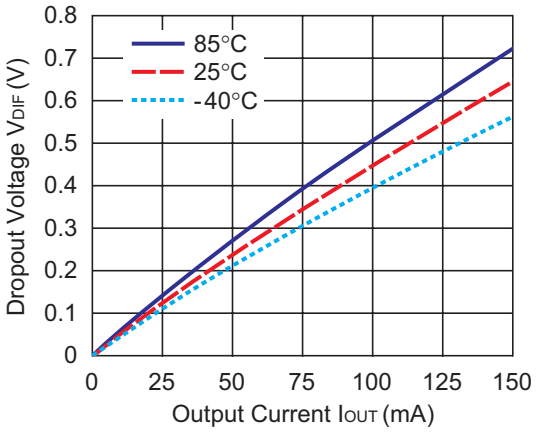


**RP130x501x**

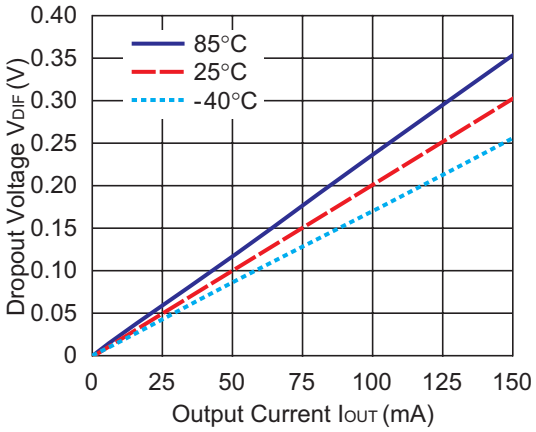



## 6) Dropout Voltage vs. Output Current (C1=0.47µF, C2=0.47µF)

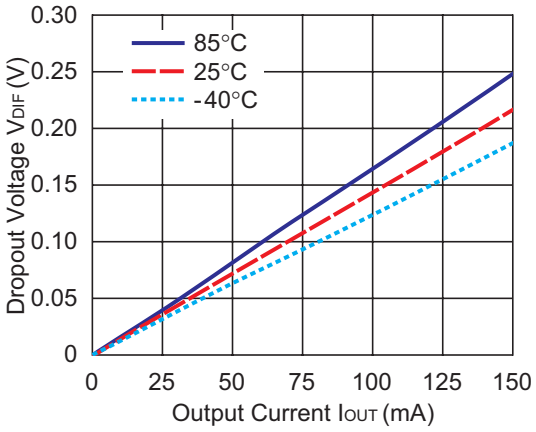
**RP130x121x**



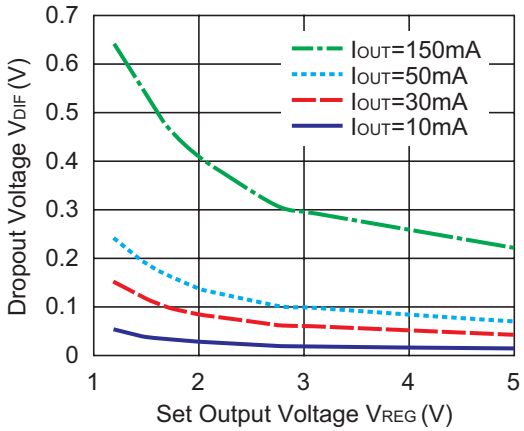

**RP130x281x**




**RP130x501x**

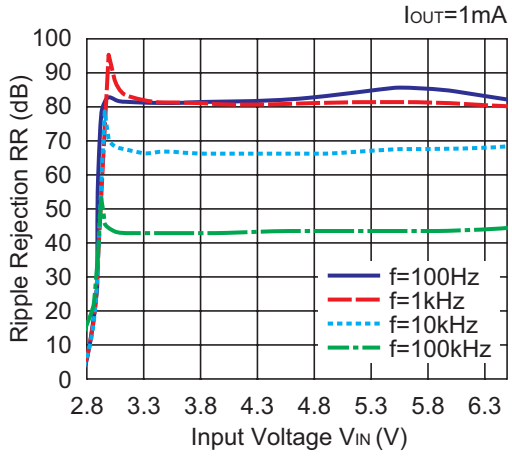


### 7) Dropout Voltage vs. Set Output Voltage (C1=0.47µF, C2=0.47µF)

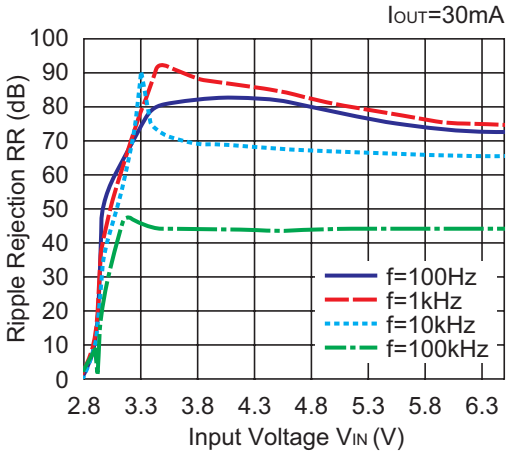



### 8) Ripple Rejection vs. Input Bias Voltage (C1=none, C2=0.47µF, Ripple=0.2Vp-p, Topt=25°C)

**RP130x281x**

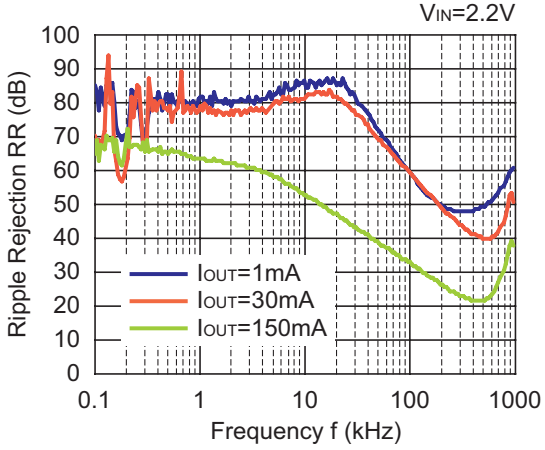



**RP130x281x**

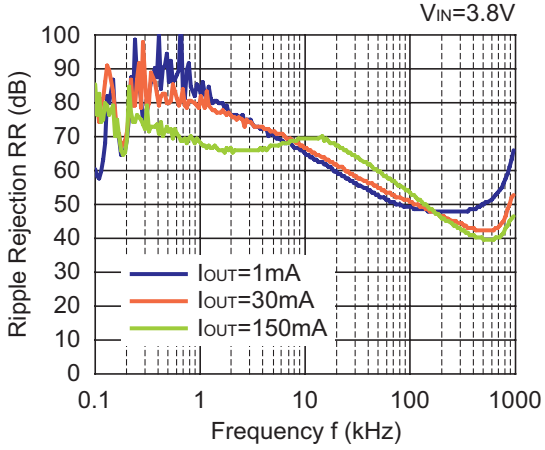



### 9) Ripple Rejection vs. Frequency (C1=none, C2=0.47µF, Ripple=0.2Vp-p, Topt=25°C)

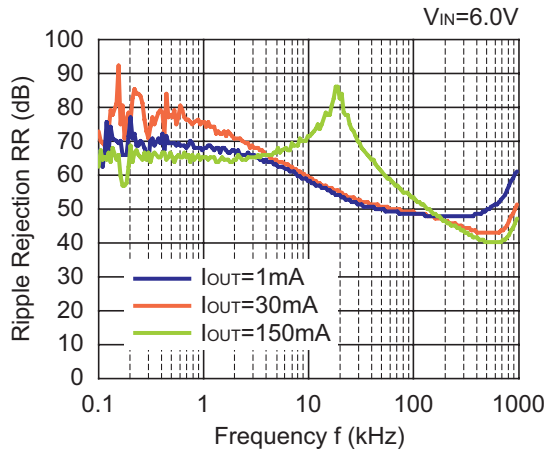
**RP130x121x**




**RP130x281x**

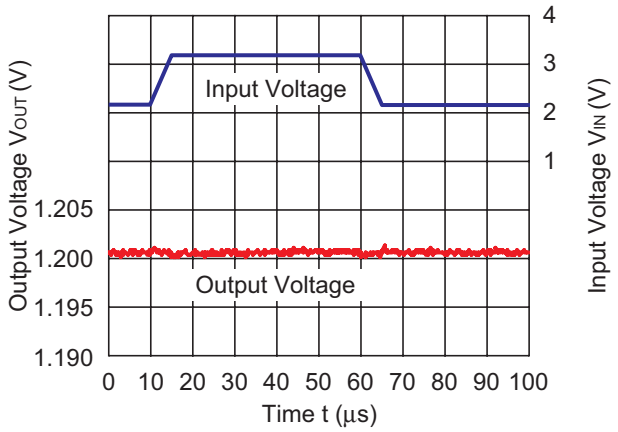


**RP130x501x**

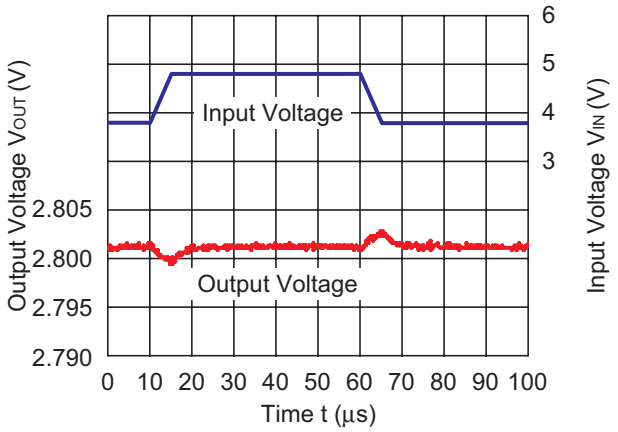



## 10) Input Transient Response (IOUT=30mA, tr=tf=5µs, C1=none, C2=0.47µF, Topt=25°C)

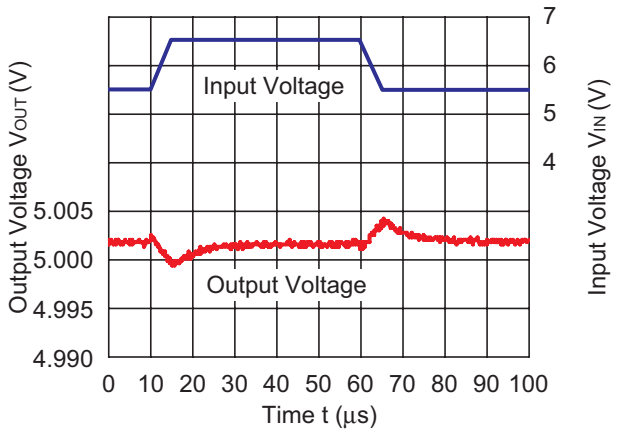
**RP130x121x**




**RP130x281x**

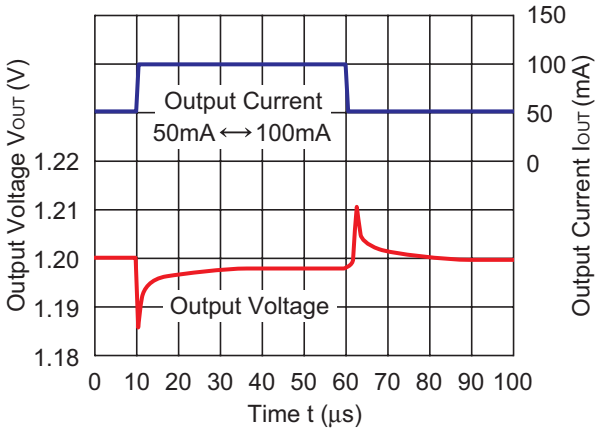



**RP130x501x**

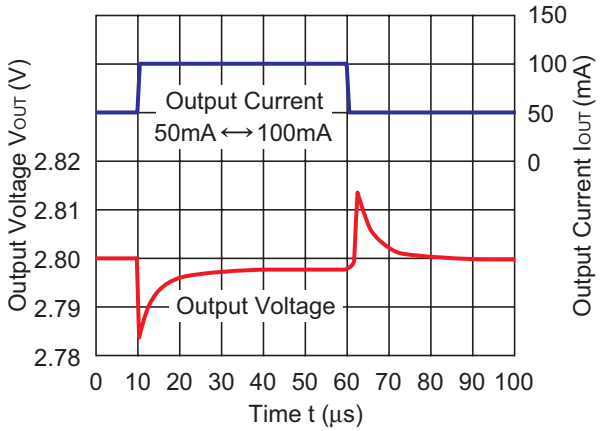


### 11) Load Transient Response ($t_r$=$t_f$=0.5µs, $C_1$=0.47µF, $C_2$=0.47µF, $I_{OUT}$=50mA↔100mA, $T_{opt}$=25°C)

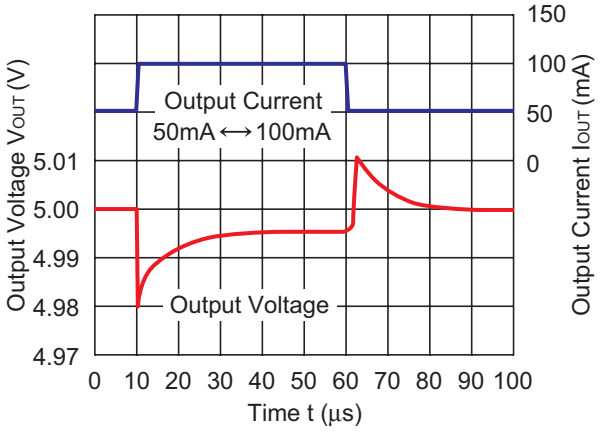
**RP130x121x**




**RP130x281x**

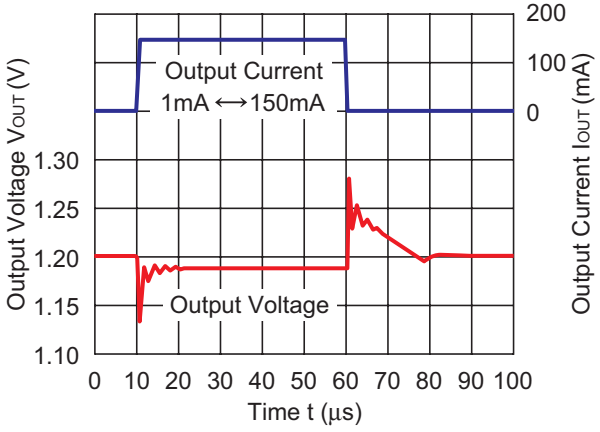



**RP130x501x**

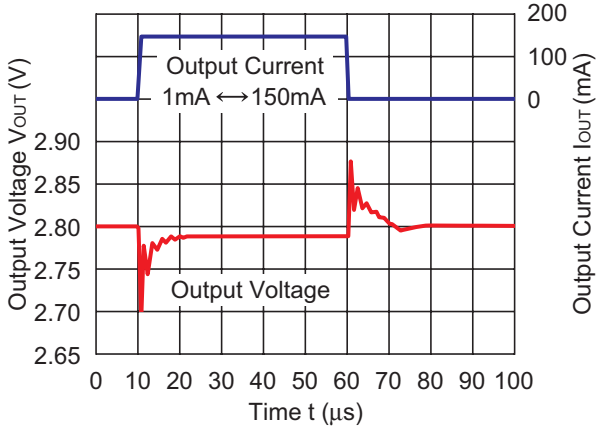



### 12) Load Transient Response ($t_r$=$t_f$=0.5µs, $C_1$=0.47µF, $C_2$=0.47µF, $I_{OUT}$=1mA↔150mA, $T_{opt}$=25°C)

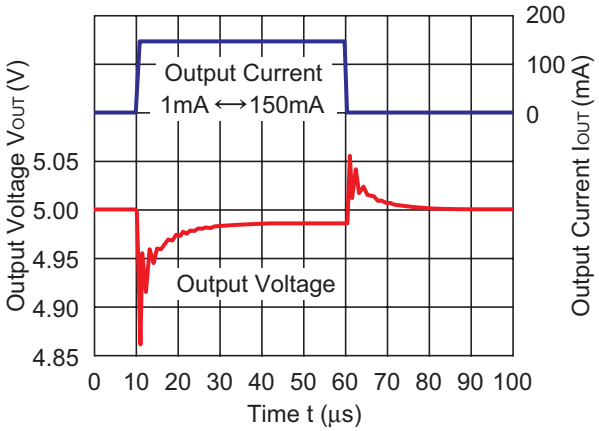
**RP130x121x**




**RP130x281x**

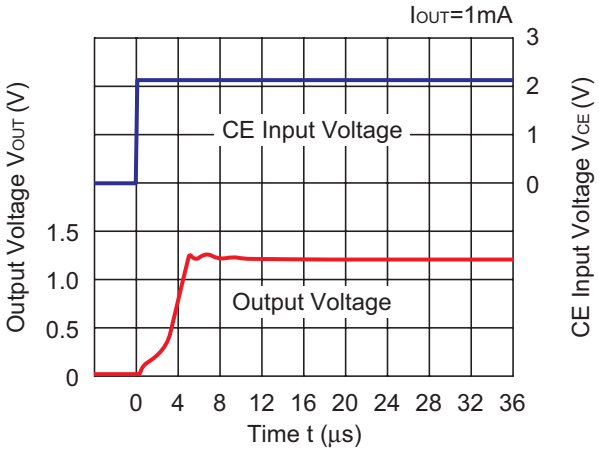


**RP130x501x**

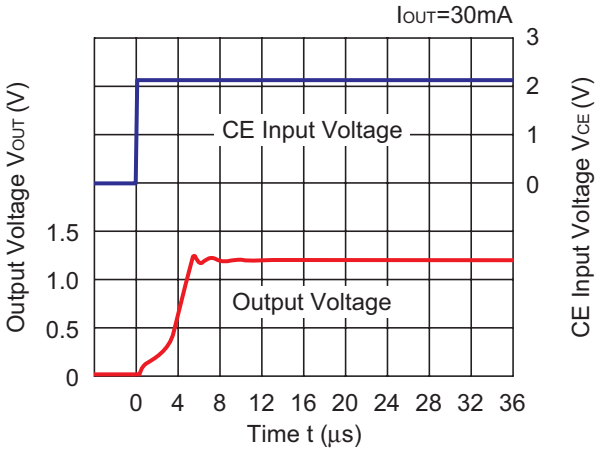



## 13) Turn On Speed with CE pin (C1=0.47µF, C2=0.47µF, Topt=25°C)

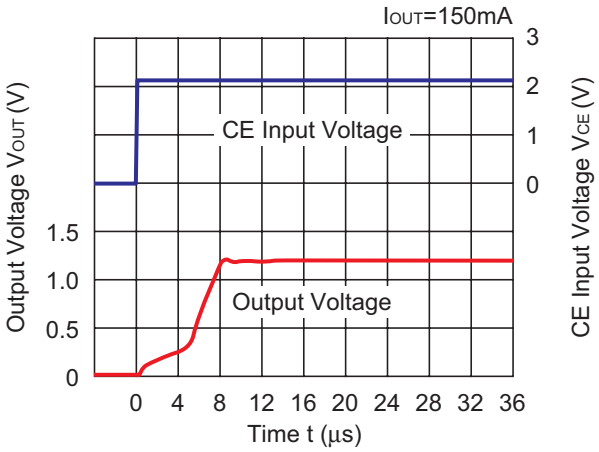
**RP130x121x**



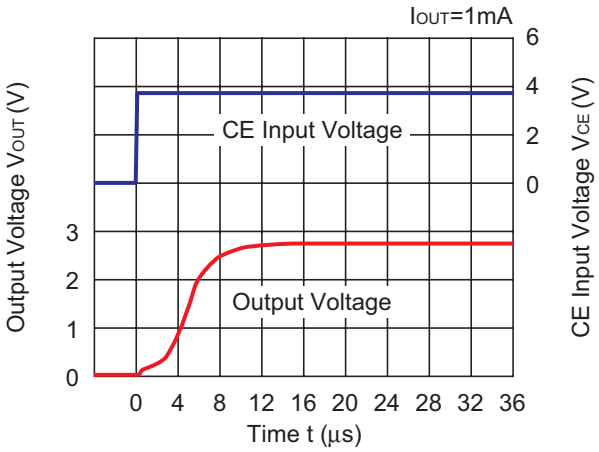

**RP130x121x**



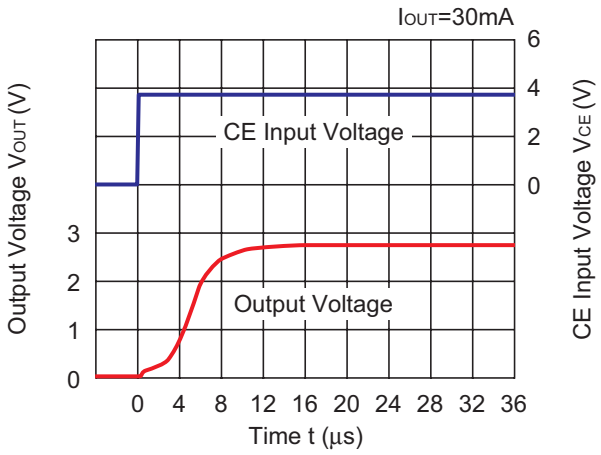

**RP130x121x**



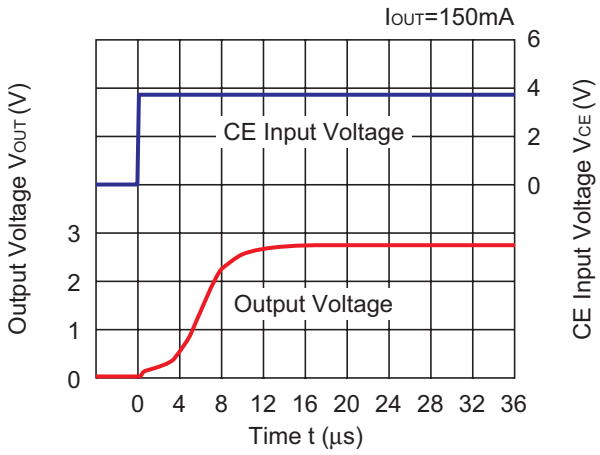

**RP130x281x**



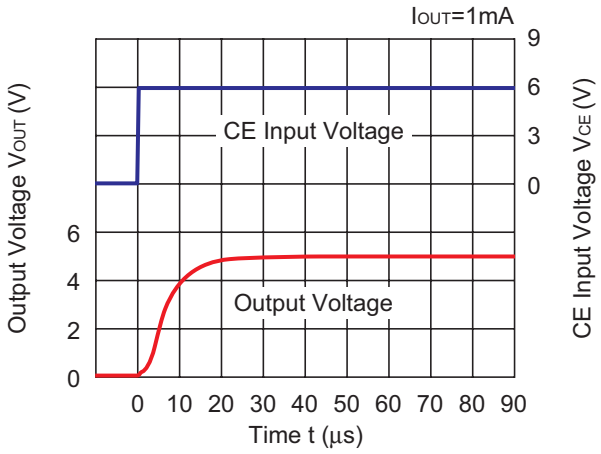
**RP130x281x**



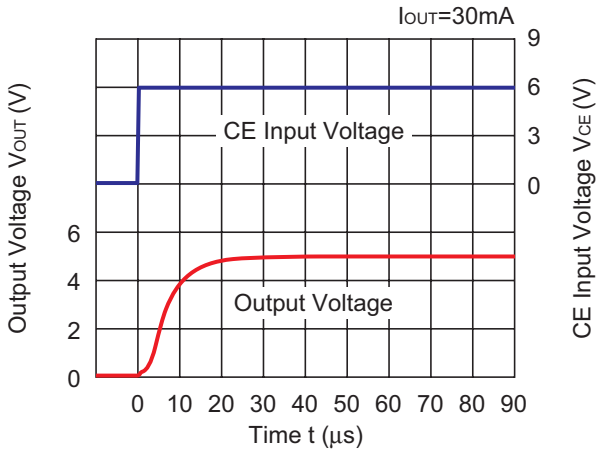

**RP130x281x**



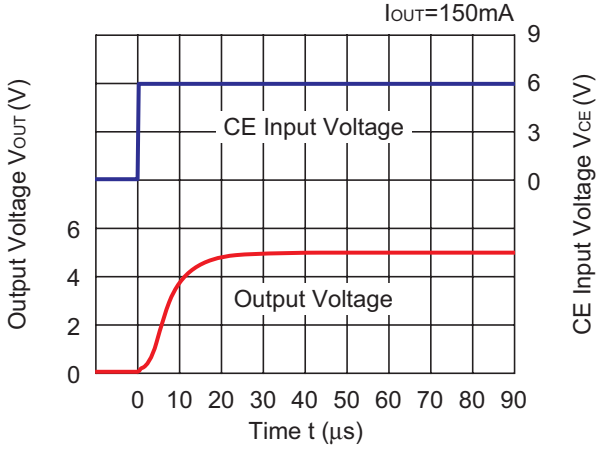

**RP130x501x**




**RP130x501x**

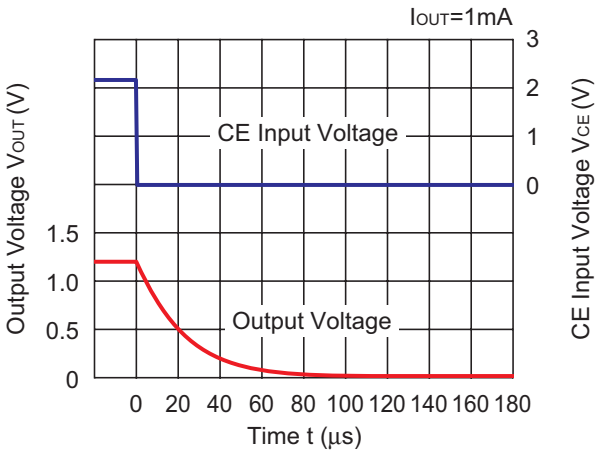



**RP130x501x**

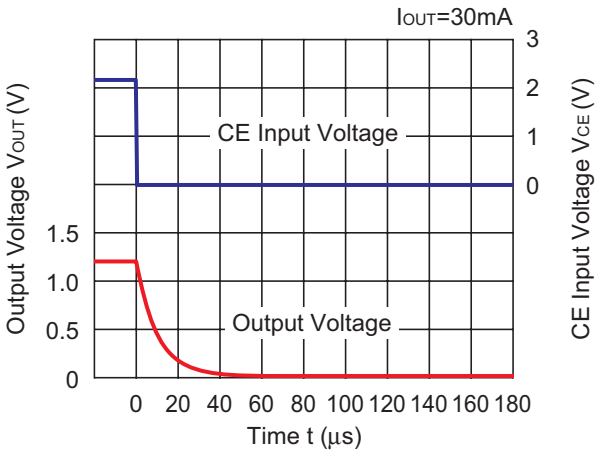


### 14) Turn Off Speed with CE pin (D Version) (C1=0.47µF, C2=0.47µF, Topt=25°C)

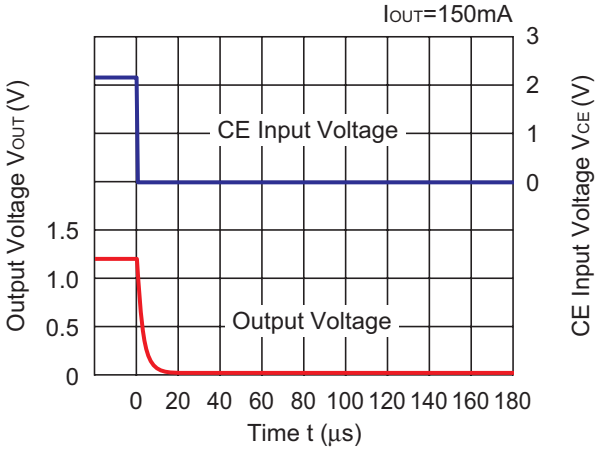
**RP130x121D**



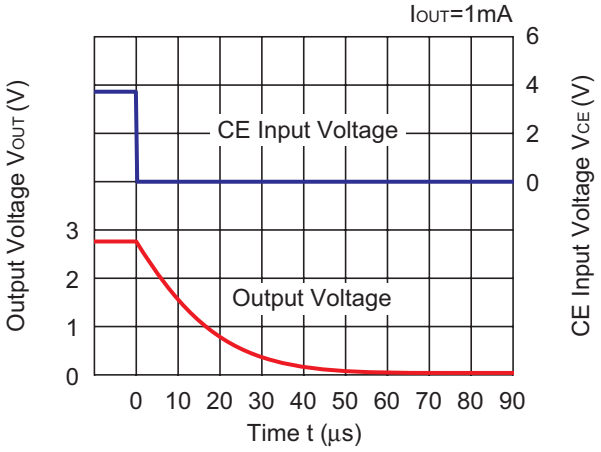

**RP130x121D**



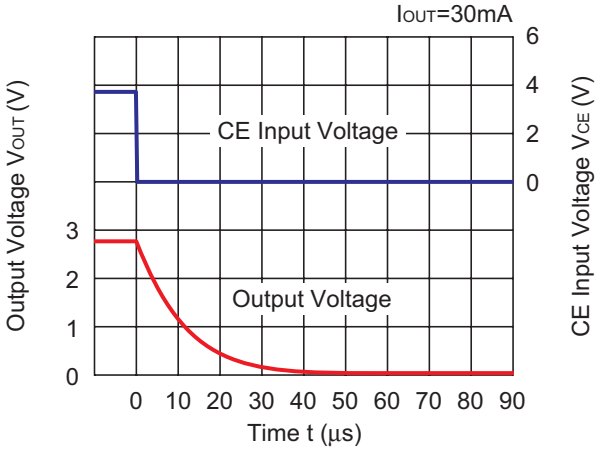

**RP130x121D**



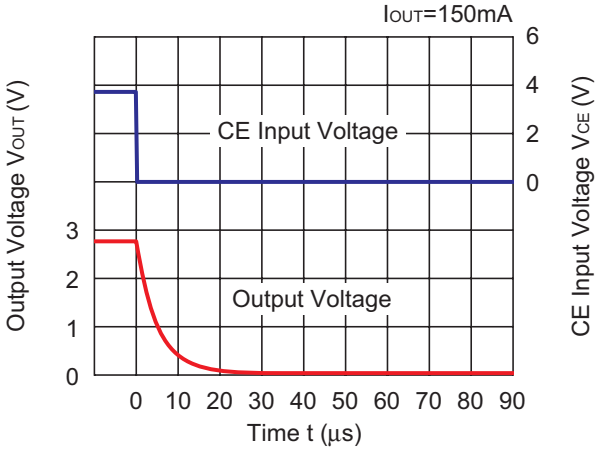

**RP130x281D**



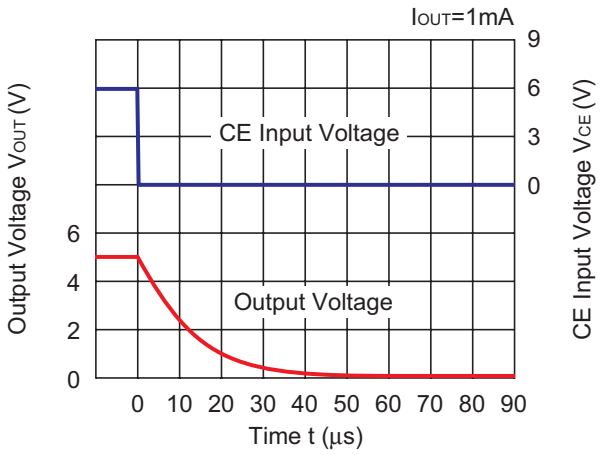

**RP130x281D**



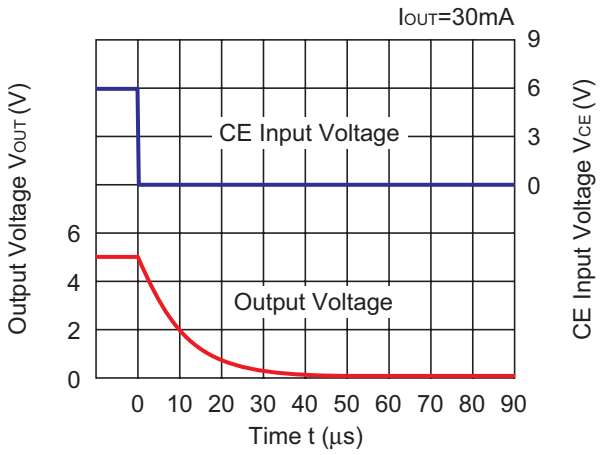

**RP130x281D**



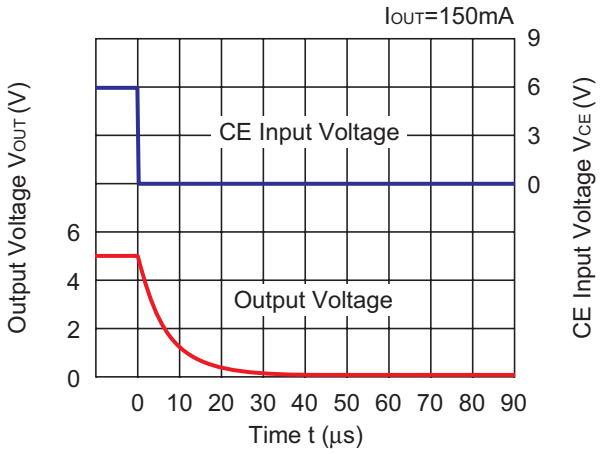
**RP130x501D**



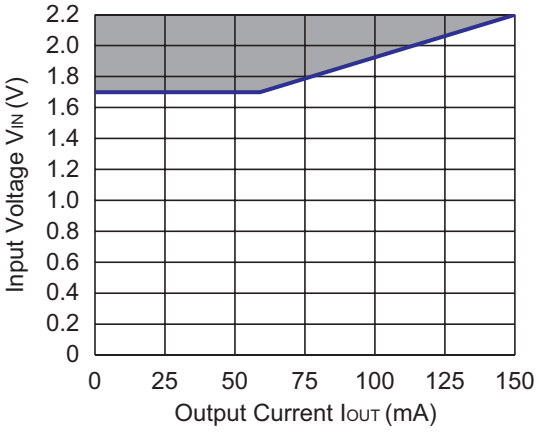

**RP130x501D**




**RP130x501D**




### 15) Minimum Operating Voltage (C1=0.47µF, C2=0.47µF)




Hatched area is available for 1.2V output.

# ESR vs. Output Current

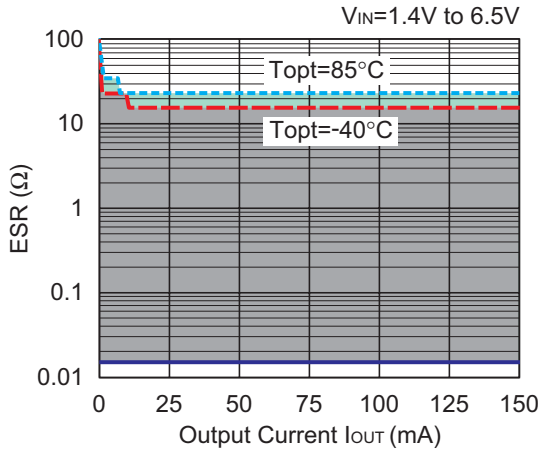
When using these ICs, consider the following points:

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

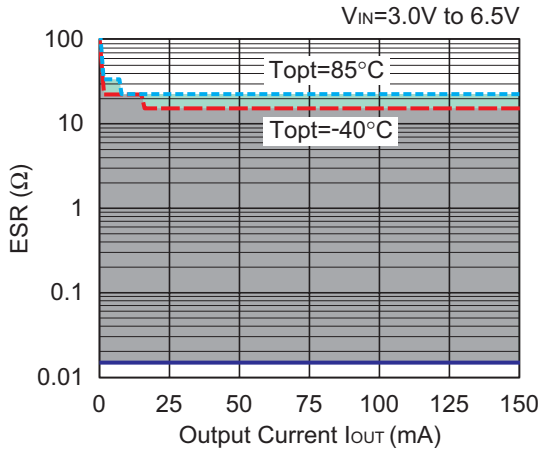
**Measurement conditions**

Frequency Band : 10Hz to 3MHz
Temperature : –40°C to 85°C
C1, C2 : 0.47μF

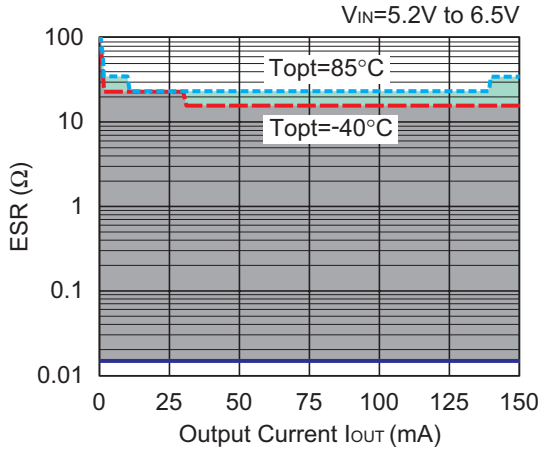
**RP130x121x**




**RP130x281x**




**RP130x501x**



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