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RP113Q SERIES

LOW NOISE 150mA LDO REGULATOR

NO.EA-211-131030

OUTLINE

The RP113Q Series are CMOS-based voltage regulator ICs with high output voltage accuracy, extremely low supply current, low ON-resistance, and high ripple rejection. Each of these ICs consists of a voltage reference unit, an error amplifier, resistor-net for voltage setting, a current limit circuit, and a chip enable circuit.

These ICs perform with low dropout voltage and a chip enable function. The line transient response and load transient response of the RP113Q Series are excellent, thus these ICs are very suitable for the power supply for hand-held communication equipment.

The output voltage of these ICs is fixed with high accuracy.

The electrical specifications of the RP113Q Series are completely same as the RP103x Series. Only the difference is the package for the RP113Qxx2. The package of RP113Q Series is small 5-pin SC-88A.

The pin layout of the RP113Qxx2 is different from the RP103Qxx2. Depending on the preference of the package or pinout, various options are available among RP113Q and RP103x Series.

FEATURES

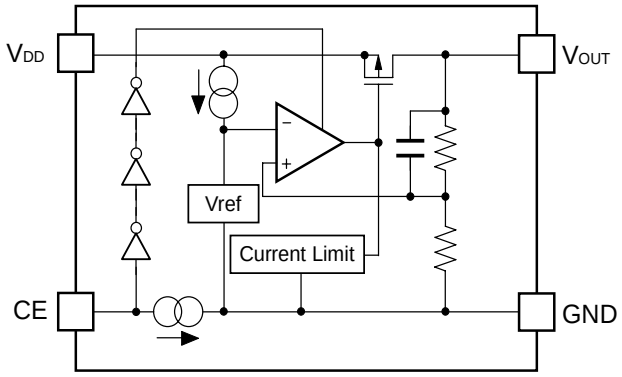
- Supply Current ..... Typ. 36μA
- Standby Mode ..... Typ. 0.1μA
- Dropout Voltage..... Typ. 0.21V (I_{OUT}=150mA, V_{OUT}=2.8V)
- Ripple Rejection ..... Typ. 75dB (f=1kHz)
- Temperature-Drift Coefficient of Output Voltage ..... Typ. ±30ppm/°C
- Line Regulation ..... Typ. 0.02%/V
- Output Voltage Accuracy..... ±1.0%
- Package SC-88A
- Input Voltage Range..... 1.7V to 5.25V
- Output Voltage Range..... 1.2V to 3.3V (0.1V steps)
  (For other voltages, please refer to MARK INFORMATIONS.)
- Built-in Fold Back Protection Circuit..... Typ. 40mA (Current at short mode)
- Ceramic capacitors are recommended to be used with this IC .... 0.47μF or more

APPLICATIONS

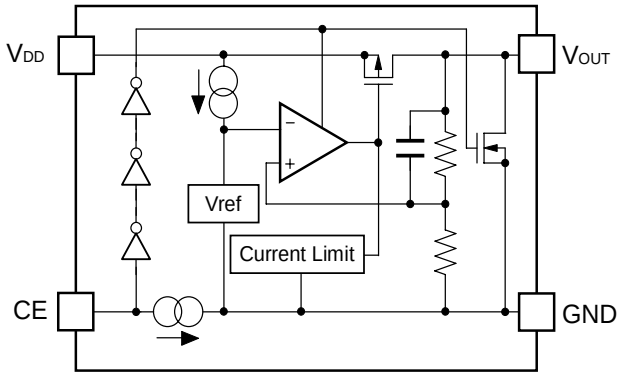
- Power source for portable communication equipment.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.
- Power source for home appliances.

BLOCK DIAGRAMS

RP113Qxx2B



RP113Qxx2D



SELECTION GUIDE

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

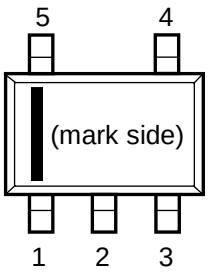
Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
RP113Qxx2∗-TR-FE	SC-88A	3,000 pcs	Yes	Yes

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

∗ : 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

- **SC-88A**



PIN DESCRIPTIONS

- **SC-88A**

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

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	6.0	V
V_{CE}	Input Voltage (CE Pin)	6.0	V
V_{OUT}	Output Voltage	–0.3 to V_{IN}+0.3	V
I_{OUT}	Output Current	180	mA
P_D	Power Dissipation* (SC-88A)	380	mW
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

- **RP113Qxx2B/D**

V_{IN}= Set V_{OUT} + 1V for V_{OUT} options greater than 1.5V, V_{IN}=2.5V for $V_{OUT} \leqq$ 1.5V, I_{OUT}=1mA, C_{IN}=C_{OUT}=0.47µF, unless otherwise noted.

The specifications surrounded by [ ] are guaranteed by Design Engineering at - 40°C ≤ Ta ≤85°C.

Ta=25°C

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
V_{OUT}	Output Voltage (*1)	Ta=25°C	V_{OUT} x 0.99 (-20mV)		V_{OUT} x 1.01 (20mV)	V
		-40°C ≦ Ta ≦ 85°C	[V_{OUT} x 0.985 (-30mV)]		[V_{OUT} x 1.015 (30mV)]	
I_{OUT}	Output Current		[150]			mA
ΔV_{OUT} /ΔI_{OUT}	Load Regulation	1mA ≦ I_{OUT} ≦ 150mA		10	[30]	mV
V_{DIF}	Dropout Voltage	Please see the data table on next page				
I_{SS}	Supply Current	I_{OUT} = 0mA		36	[50]	µA
Istandby	Supply Current (Standby)	V_{CE} = 0V		0.1	1.0	µA
ΔV_{OUT} /ΔV_{IN}	Line Regulation	$_{SET}V_{OUT}$ +0.5V ≦ V_{IN} ≦ 5.0V		0.02	[0.10]	%/V
RR	Ripple Rejection	f = 1kHz, Ripple 0.2Vp-p V_{IN} = $_{SET}V_{OUT}$ +1V, I_{OUT} = 30mA (In case that $V_{OUT} \leqq$ 2.0V, V_{IN}=3V)		75		dB
V_{IN}	Input Voltage (*2)		[1.7]		[5.25]	V
ΔV_{OUT} /ΔT	Output Voltage Temperature Coefficient	- 40°C ≦ Ta ≦ 85°C		±30		ppm /°C
I_{LIM}	Short Current Limit	V_{OUT} = 0V		40		mA
I_{PD}	CE Pull-down Current			0.3		µA
V_{CEH}	CE Input Voltage "H"		[1.1]			V
V_{CEL}	CE Input Voltage "L"				[0.3]	V
en	Output Noise	BW = 10Hz to 100kHz I_{OUT} = 30mA		60		µVrms
R_{LOW}	Nch On Resistance for Auto Discharge (D Version Only)	V_{IN} = 4.0V, V_{CE} = 0V		30		Ω

(*1) $V_{OUT} \leqq$ 2.0V ±20mV accuracy (- 40°C ≦ Ta ≦ 85°C ±30mV accuracy)

(*2) If Input Voltage range is between 5.25V and 5.5V, the total operational time must be within 500hrs

All of unit are tested and specified under load conditions such that Tj ≈Ta=25°C except for Output Noise, Ripple Rejection and Output Voltage Temperature Coefficient items.

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

Dropout Voltage

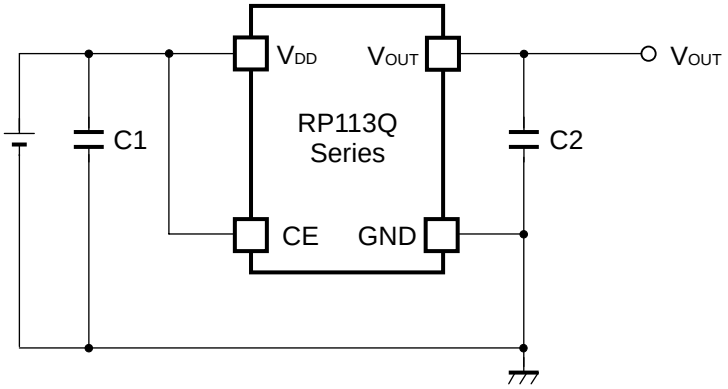
Ta=25°C

V_{OUT} (V)	Dropout Voltage (V)		
	Condition	TYP.	MAX.
1.2V ≦ V_{OUT} < 1.5V	I_{OUT}=150mA	0.500	0.620
1.5V ≦ V_{OUT} < 1.7V		0.380	0.470
1.7V ≦ V_{OUT} < 2.0V		0.340	0.420
2.0V ≦ V_{OUT} < 2.5V		0.280	0.360
2.5V ≦ V_{OUT} < 2.8V		0.220	0.300
2.8V ≦ V_{OUT} ≦ 3.3V		0.210	0.270

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

PCB Layout

Make V_{DD} and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with a capacitance value as much as 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 (SC-88A)**

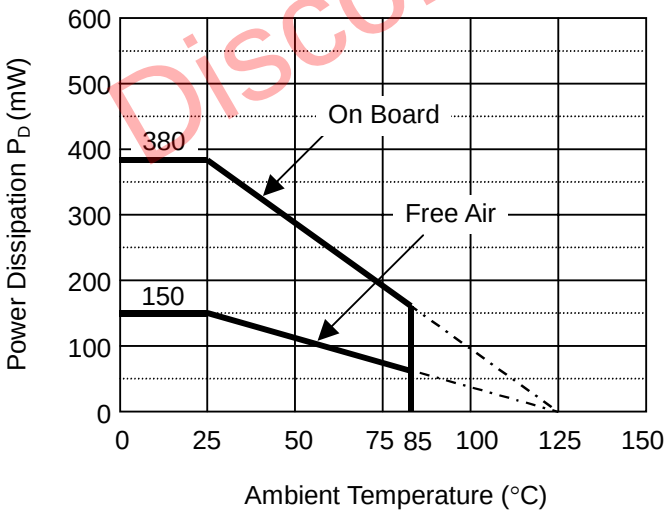
Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below;

* Measurement Conditions

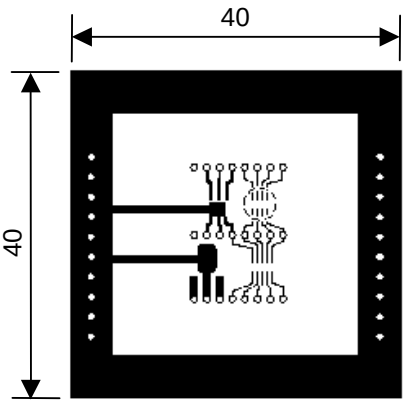
	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double Layers)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-hole	ϕ0.5mm × 44pcs

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

	Standard Land Pattern	**Free Air**
Power Dissipation	380mW	150mW
Thermal Resistance	θja=(125-25°C)/0.38W=263°C/W	θja=(125-25°C)/0.15W=667°C/W
	θjc=75°C/W	-



Power Dissipation



Measurement Board Pattern

IC Mount Area (Unit: mm)

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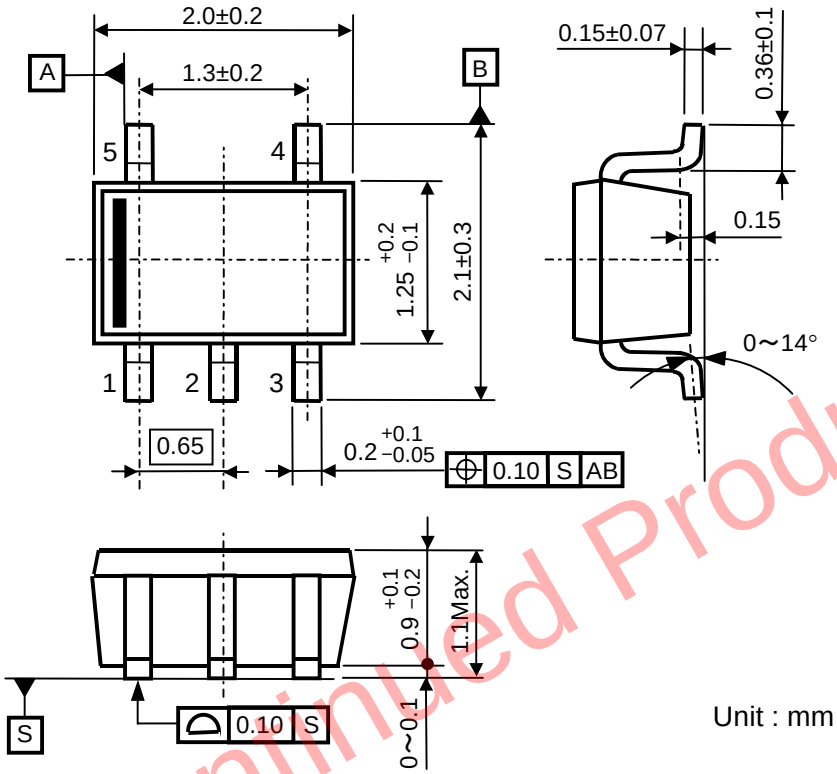
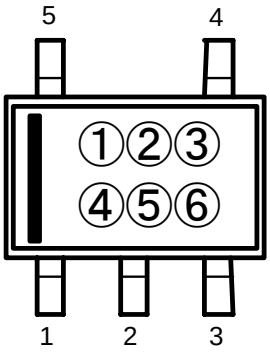
- **Package Dimensions (SC-88A)**



Unit : mm

- **Mark Specification (SC-88A)**

①②③④: Product Code …Refer to the marking list table
⑤⑥ : Alphanumeric serial number.



- **RP113Qxx2 Series marking list table (SC-88A)**

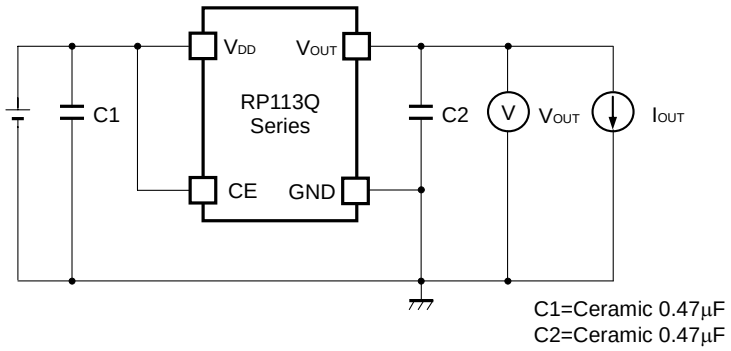
RP113Qxx2B

Part Number	①②③④	V_{SET}
RP113Q122B	**J001**	1.2V
RP113Q132B	**J002**	1.3V
RP113Q152B	**J003**	1.5V
RP113Q182B	**J004**	1.8V
RP113Q192B	**J006**	1.9V
RP113Q202B	**J007**	2.0V
RP113Q212B	**J008**	2.1V
RP113Q232B	**J009**	2.3V
RP113Q252B	**J010**	2.5V
RP113Q262B	**J011**	2.6V
RP113Q272B	**J012**	2.7V
RP113Q282B	**J013**	2.8V
RP113Q292B	**J015**	2.9V
RP113Q302B	**J016**	3.0V
RP113Q312B	**J017**	3.1V
RP113Q322B	**J018**	3.2V
RP113Q332B	**J019**	3.3V
RP113Q182B5	**J005**	1.85V
RP113Q282B5	**J014**	2.85V

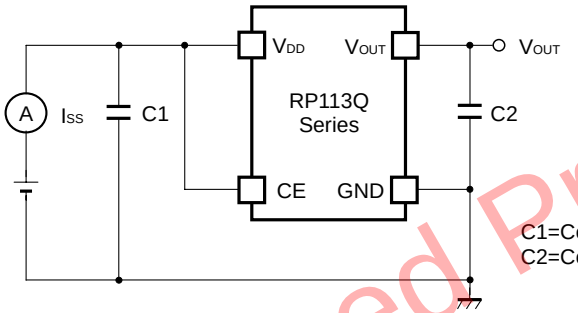
RP113Qxx2D

Part Number	①②③④	V_{SET}
RP113Q122D	**K001**	1.2V
RP113Q132D	**K002**	1.3V
RP113Q152D	**K003**	1.5V
RP113Q182D	**K004**	1.8V
RP113Q192D	**K006**	1.9V
RP113Q202D	**K007**	2.0V
RP113Q212D	**K008**	2.1V
RP113Q232D	**K009**	2.3V
RP113Q252D	**K010**	2.5V
RP113Q262D	**K011**	2.6V
RP113Q272D	**K012**	2.7V
RP113Q282D	**K013**	2.8V
RP113Q292D	**K015**	2.9V
RP113Q302D	**K016**	3.0V
RP113Q312D	**K017**	3.1V
RP113Q322D	**K018**	3.2V
RP113Q332D	**K019**	3.3V
RP113Q182D5	**K005**	1.85V
RP113Q282D5	**K014**	2.85V

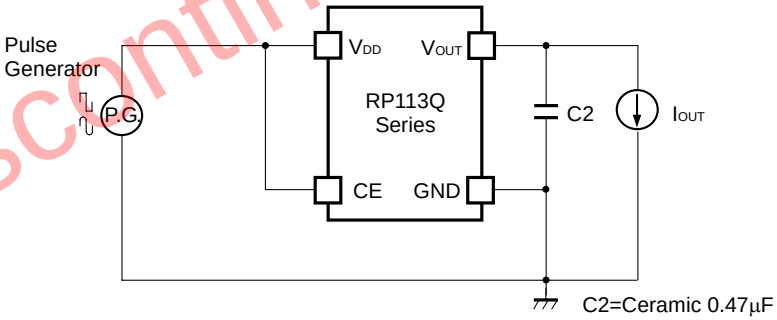
TEST CIRCUITS



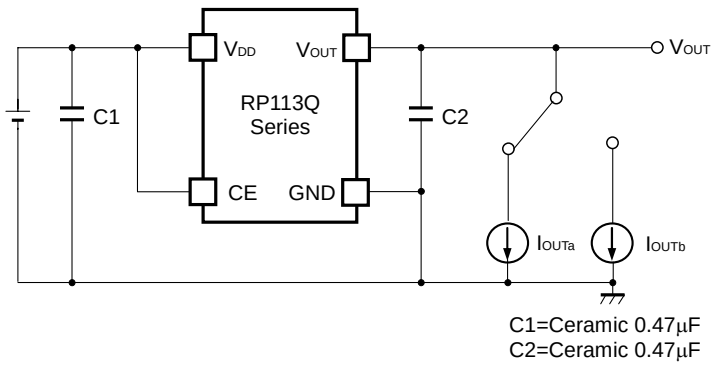
Basic Test Circuit



Supply Current Test Circuit



Ripple Rejection Test Circuit

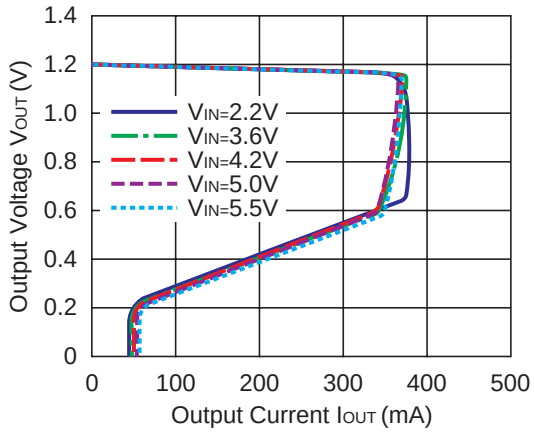


Load Transient Response Test Circuit

TYPICAL CHARACTERISTICS

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

RP113Q122x



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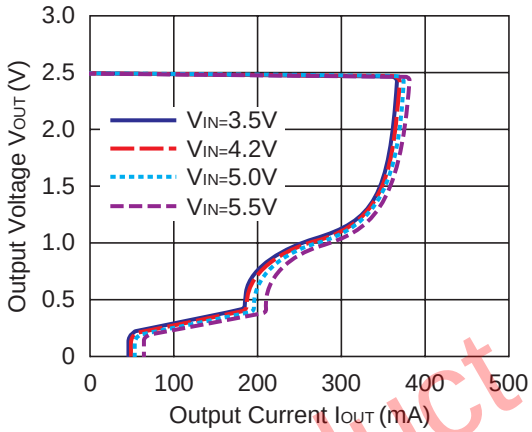

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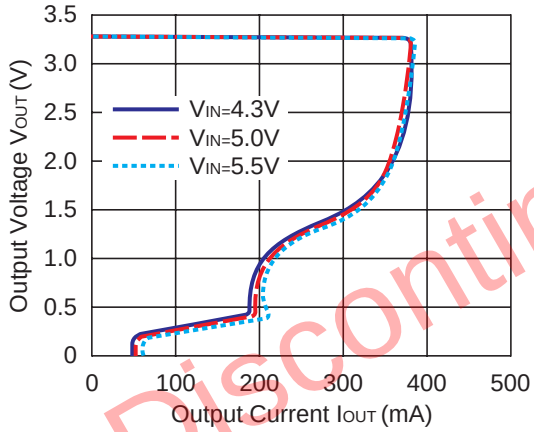
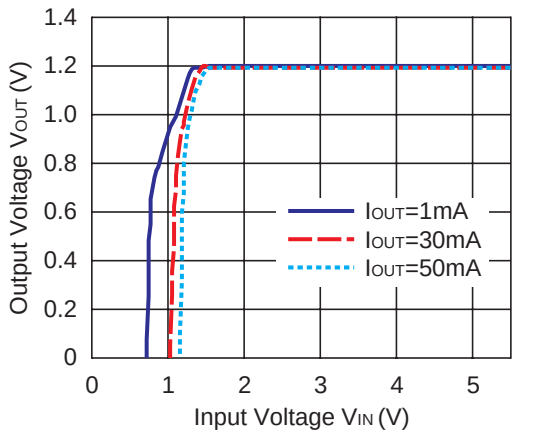


2) Output Voltage vs. Input Voltage (C1=0.47µF, C2=0.47µF, Topt=25°C)

RP113Q122x



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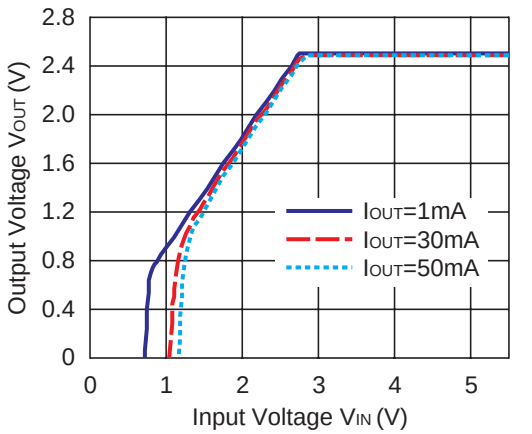

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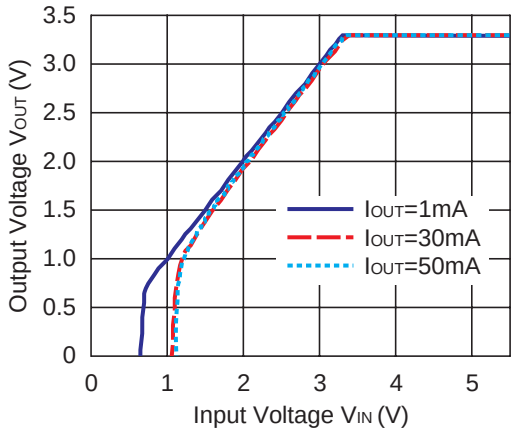
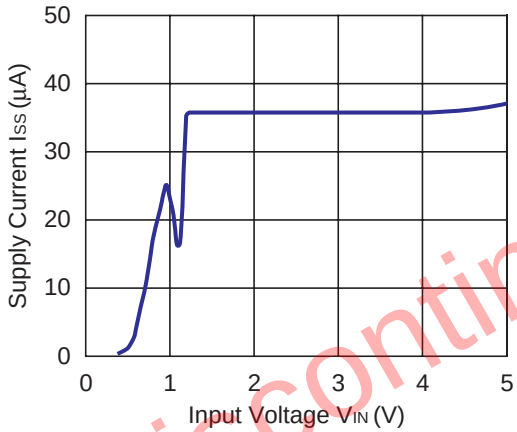


3) Supply Current vs. Input Voltage (C1=0.47µF, C2=0.47µF, Topt=25°C)

RP113Q122x



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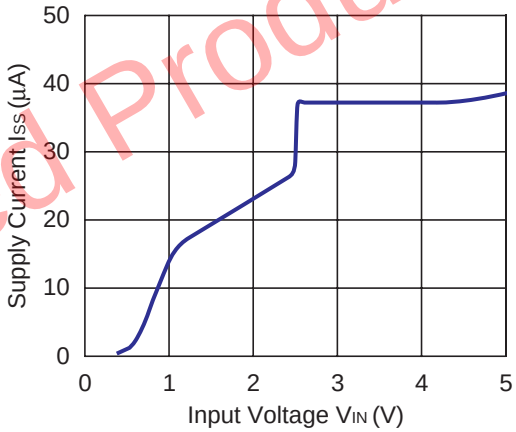

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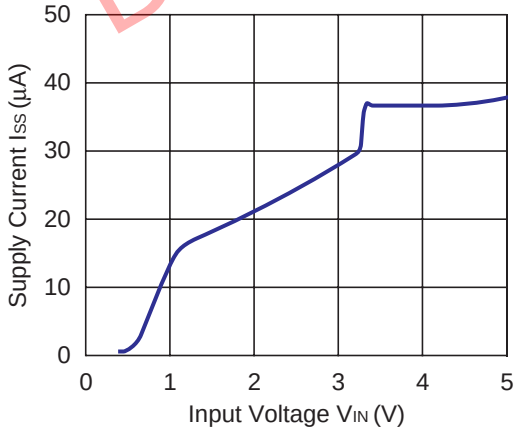
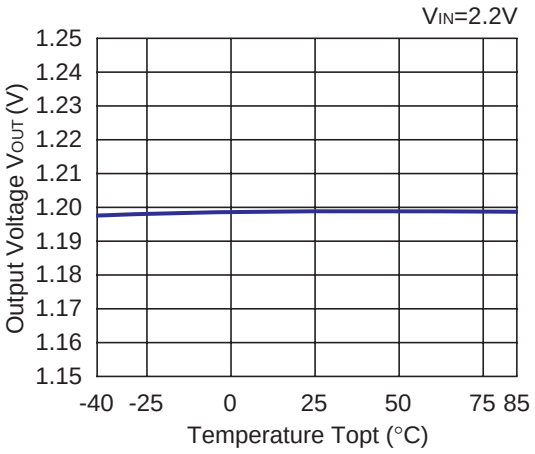


4) Output Voltage vs. Temperature (C1=0.47µF, C2=0.47µF, I_{OUT}=1mA)

RP113Q122x



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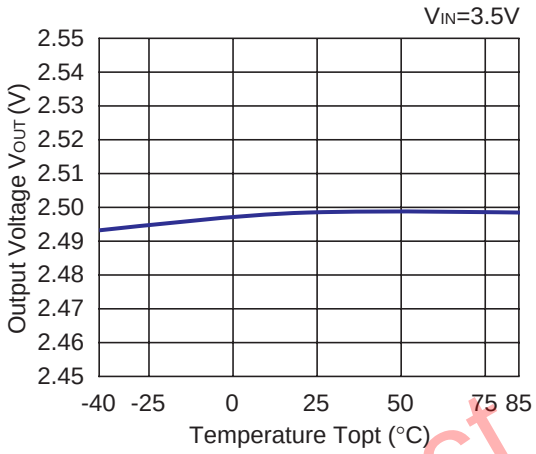

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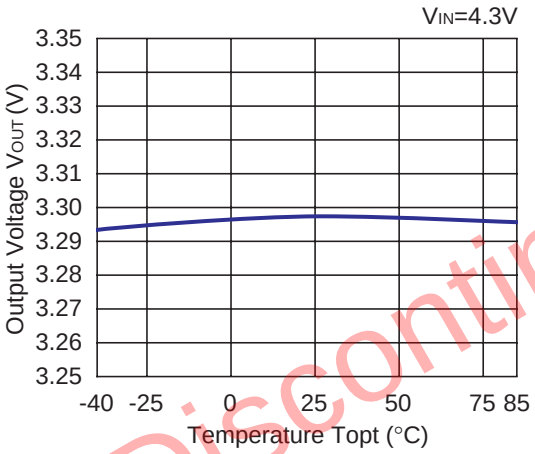
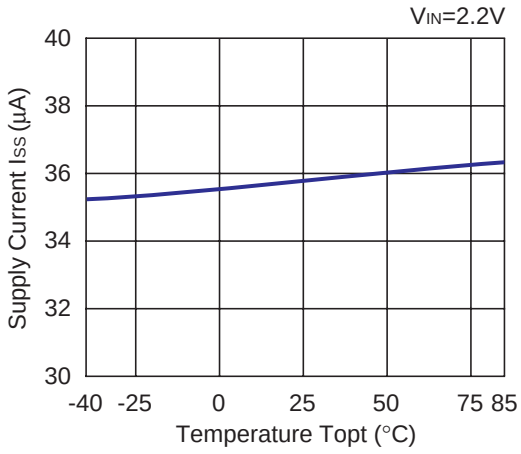


5) Supply Current vs. Temperature (C1=0.47µF, C2=0.47µF, I_{OUT}=0mA)

RP113Q122x



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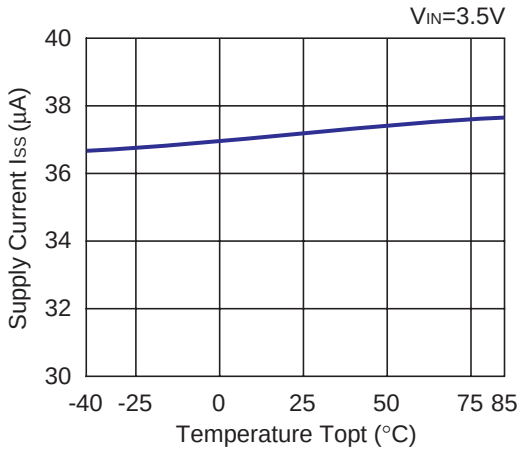

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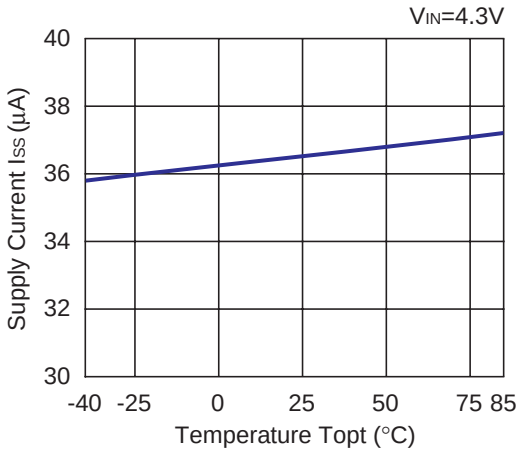
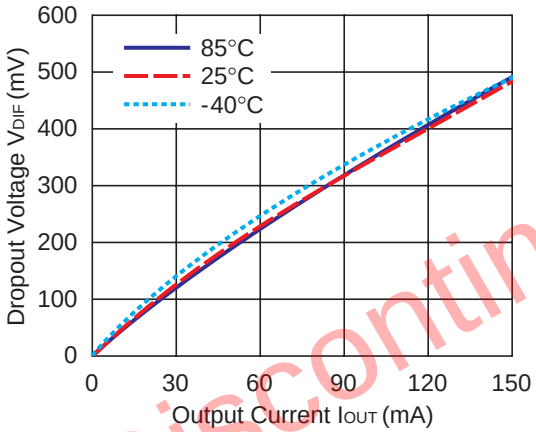


6) Dropout Voltage vs. Output Current (C1=0.47µF, C2=0.47µF)

RP113Q122x



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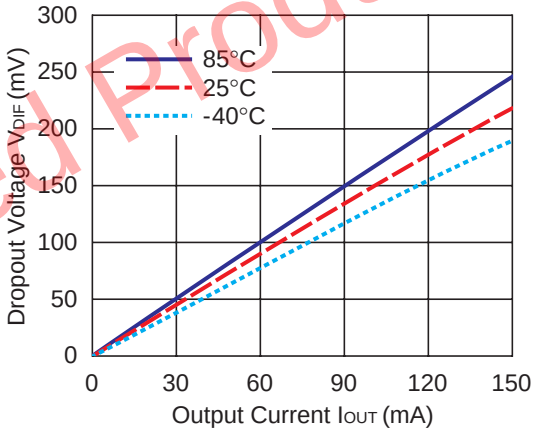

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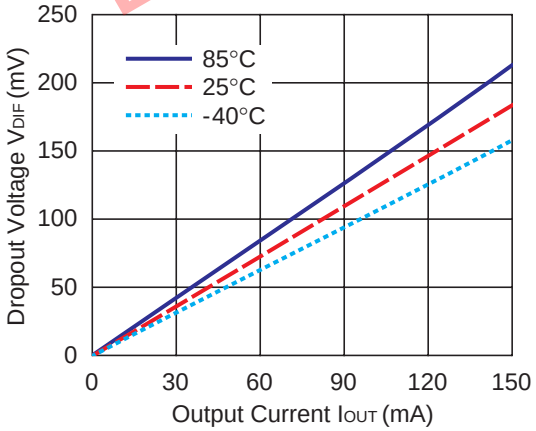
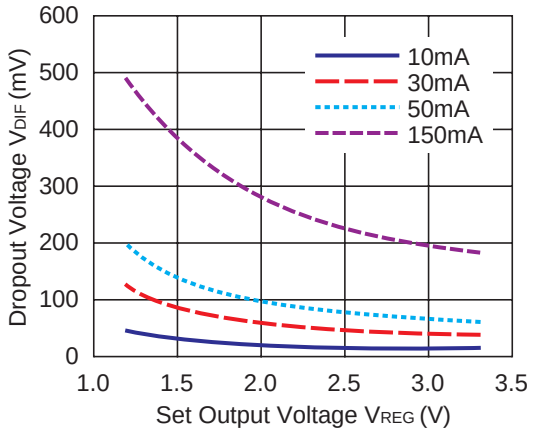
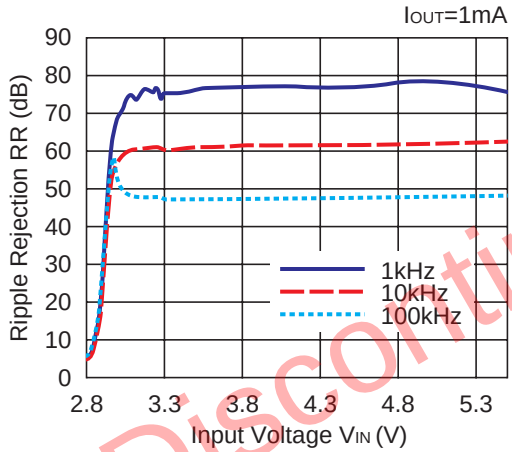


7) Dropout Voltage vs. Set Output Voltage (C1=0.47µF, C2=0.47µF, Topt=25°C)

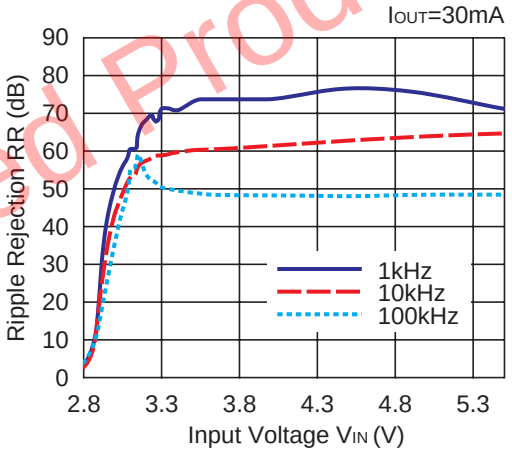


8) Ripple Rejection vs. Input Bias Voltage (C1=0.47µF, C2=0.47µF, Ripple=0.2Vp-p, Topt=25°C)

RP113Q282x

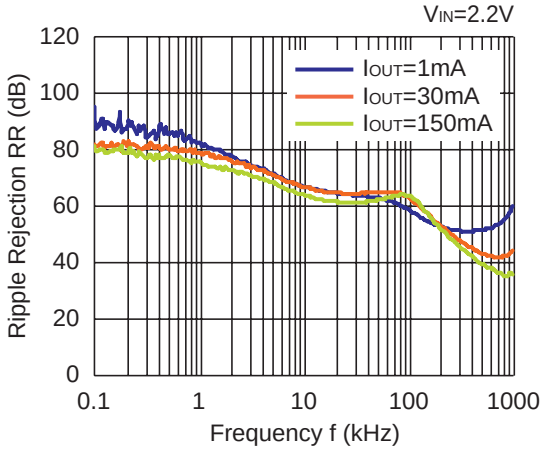


RP113Q282x

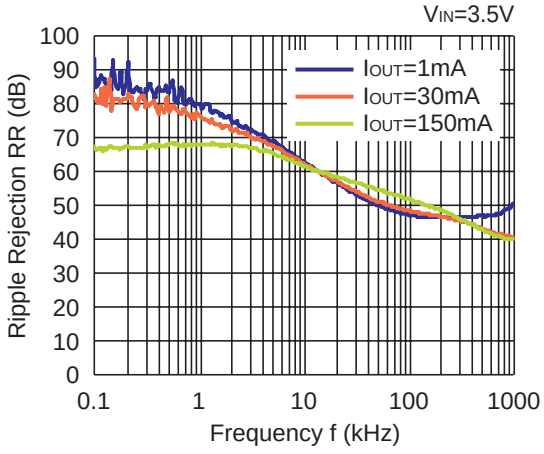


9) Ripple Rejection vs. Frequency (C1=none, C2=0.47µF, Ripple=0.2Vp-p)

RP113Q122x



RP113Q252x



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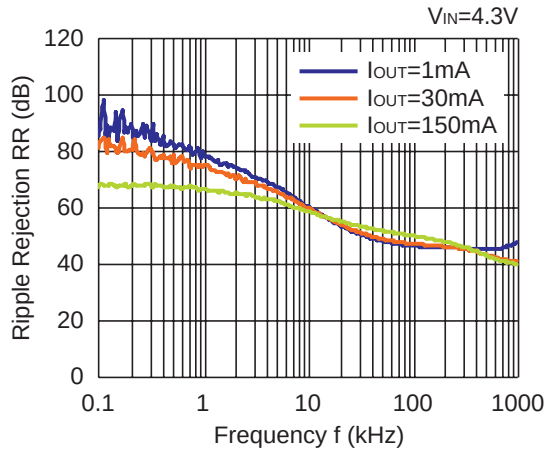
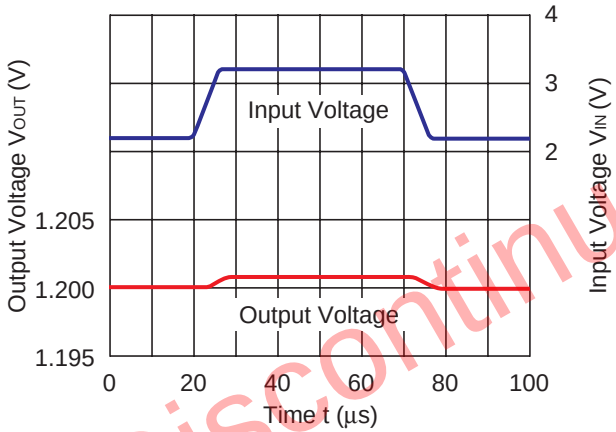


10) Input Transient Response (C1=none, C2=0.47µF, IOUT=30mA, tr=tf=5µs, Topt=25°C)

RP113Q122x



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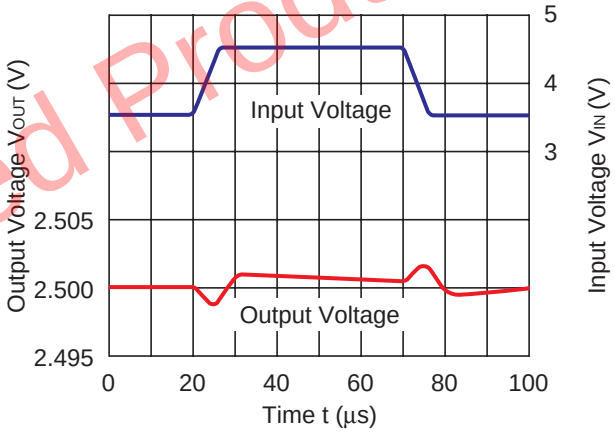

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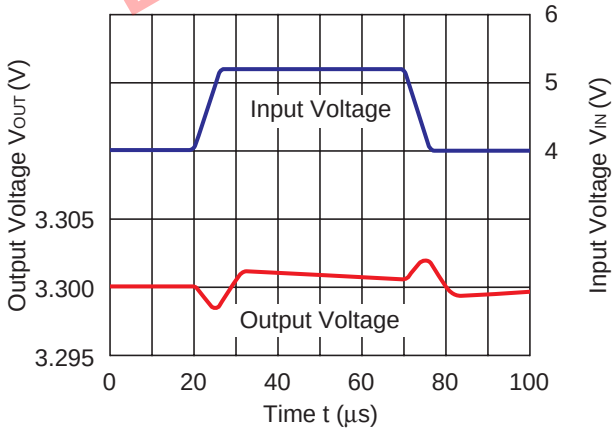
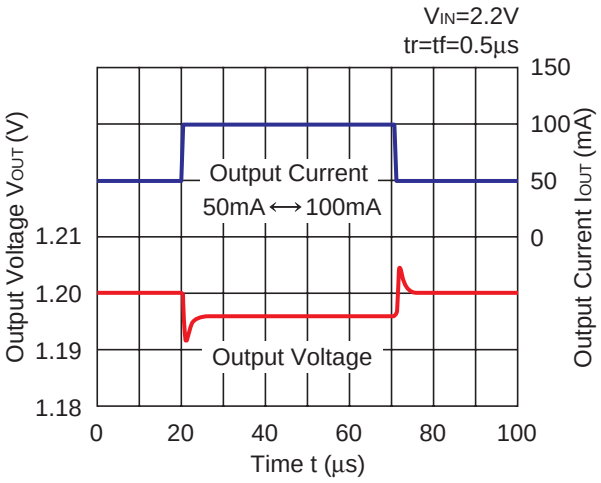


11) Load Transient Response (C1=0.47µF, C2=0.47µF, Topt=25°C)

RP113Q122x



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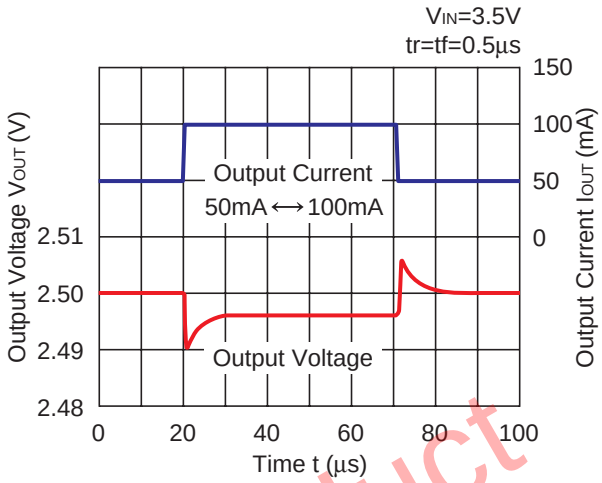

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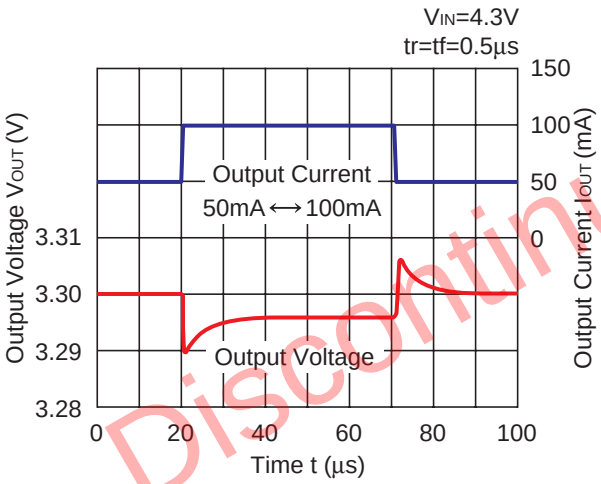

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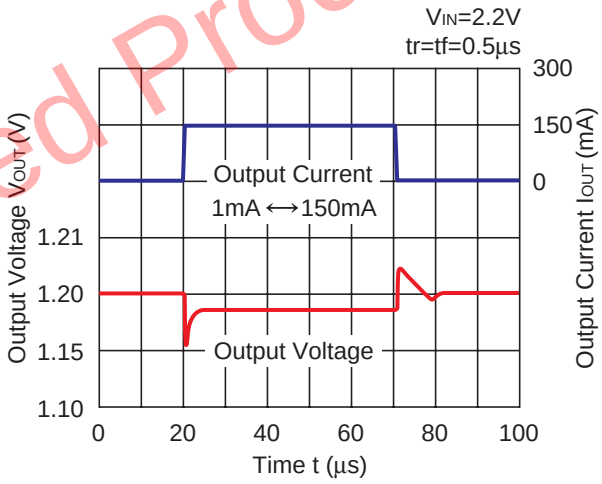

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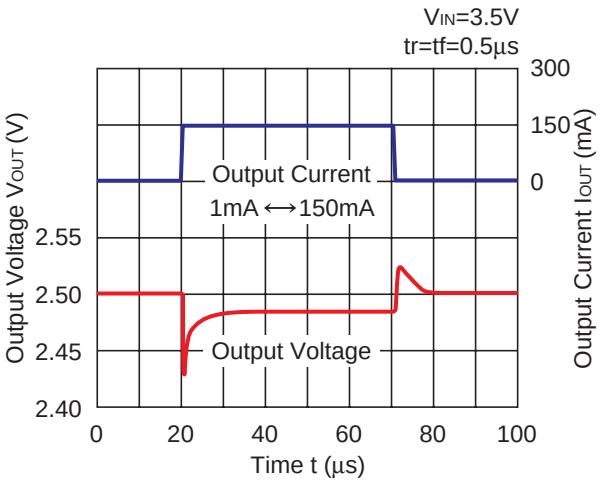

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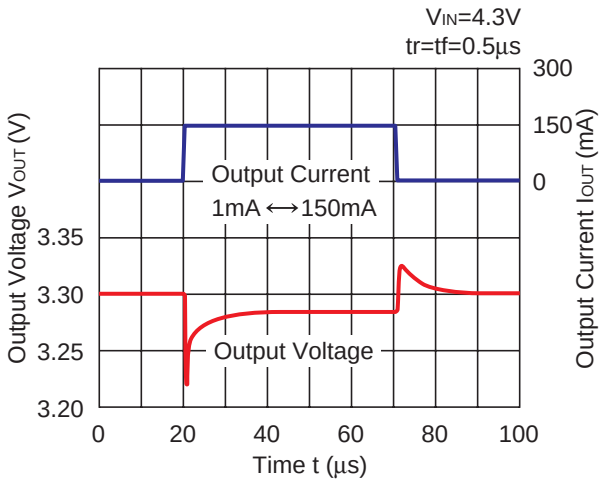
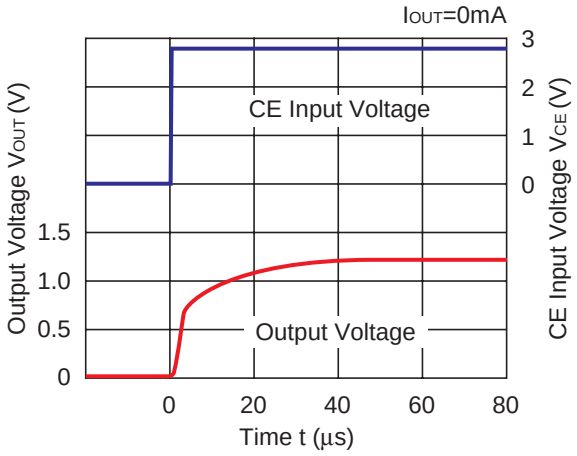


12) Turn On Speed with CE pin (C1=0.47µF, C2=0.47µF, Topt=25°C)

RP113Q122x



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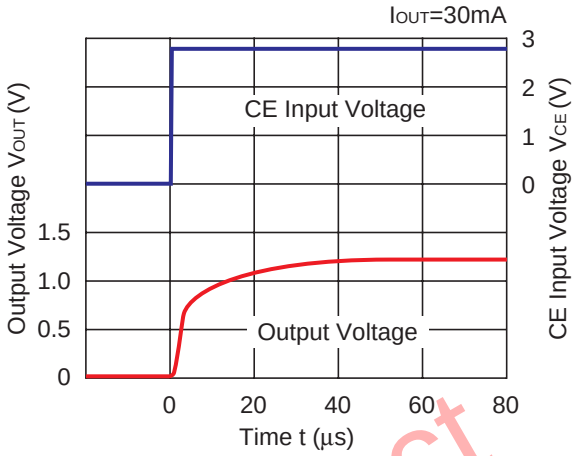

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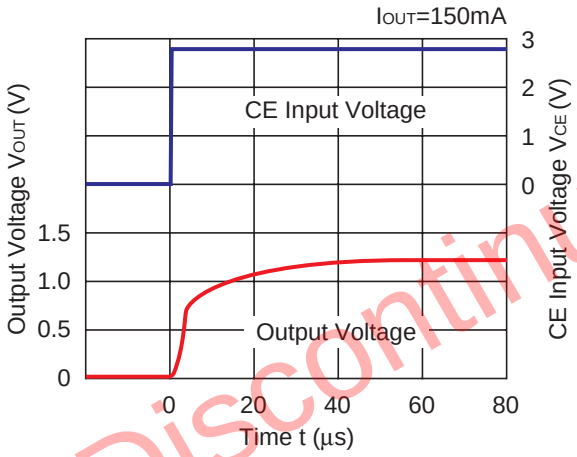

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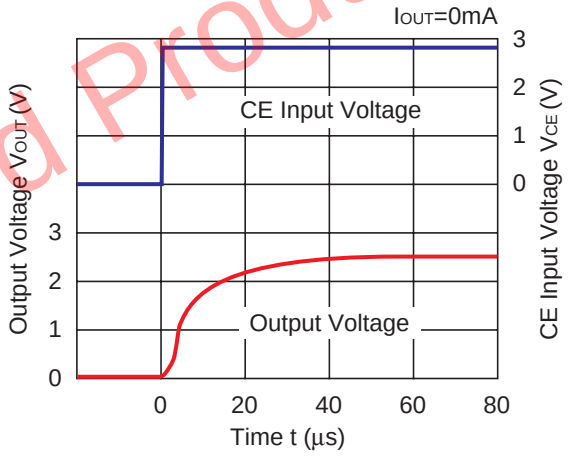

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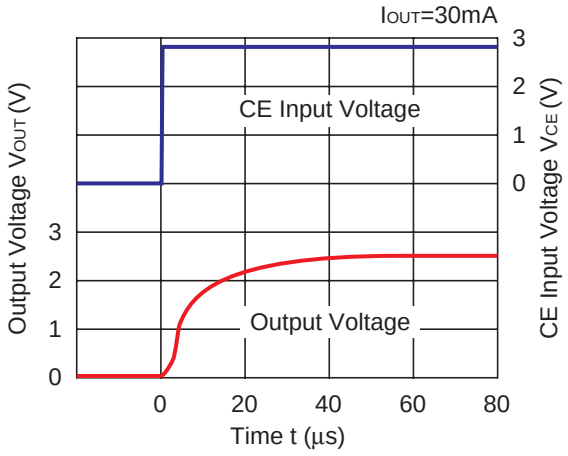

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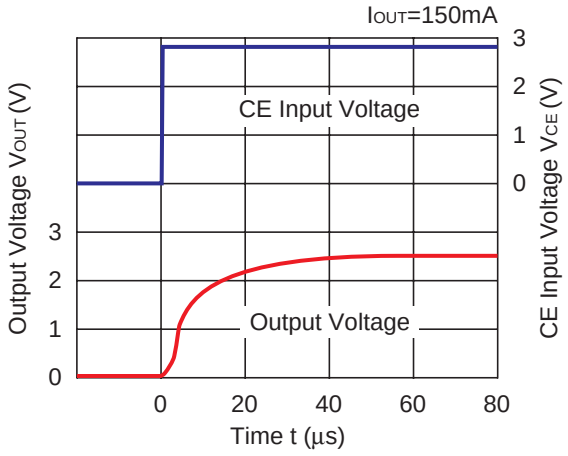

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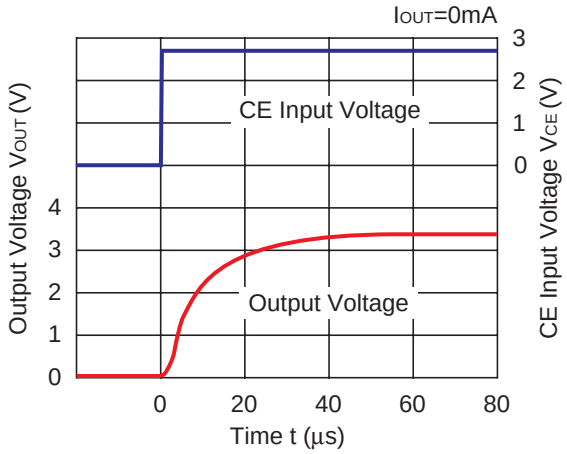

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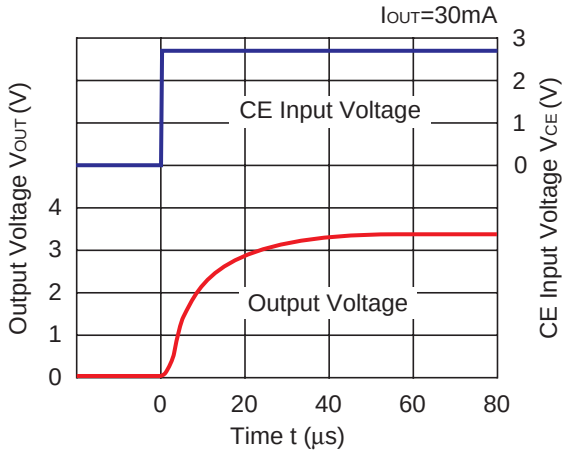

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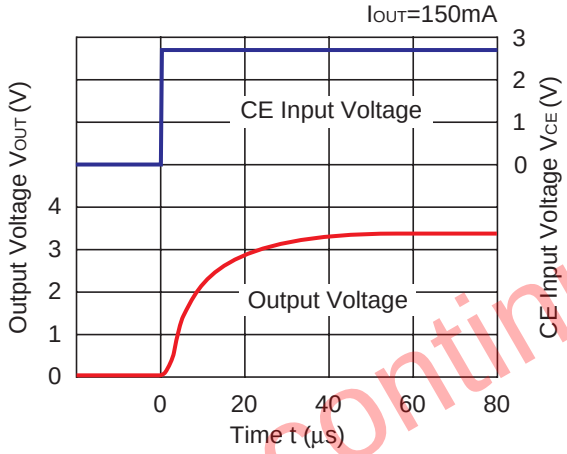
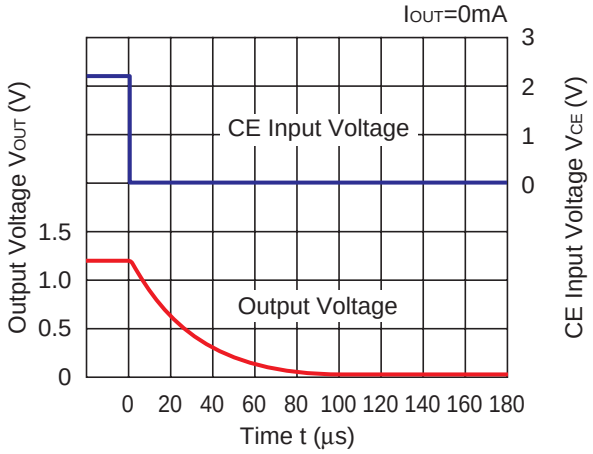


13) Turn Off Speed with CE pin (D Version) (C1=0.47µF, C2=0.47µF, Topt=25°C)

RP113Q122D



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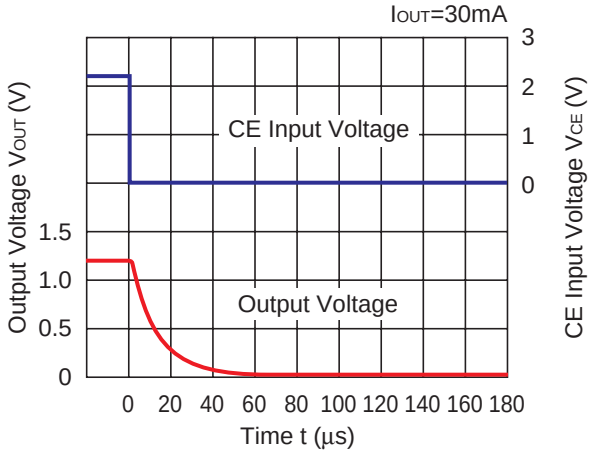

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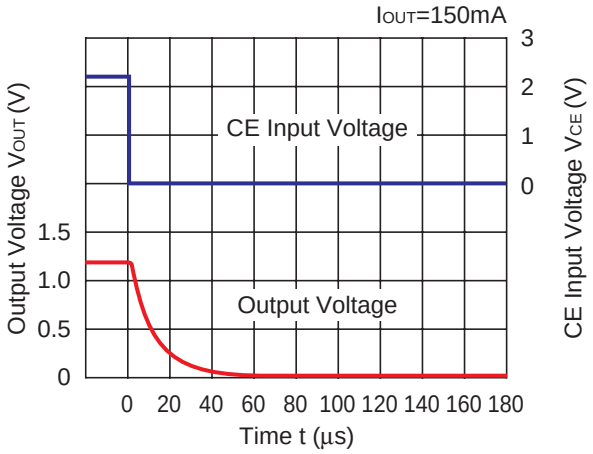

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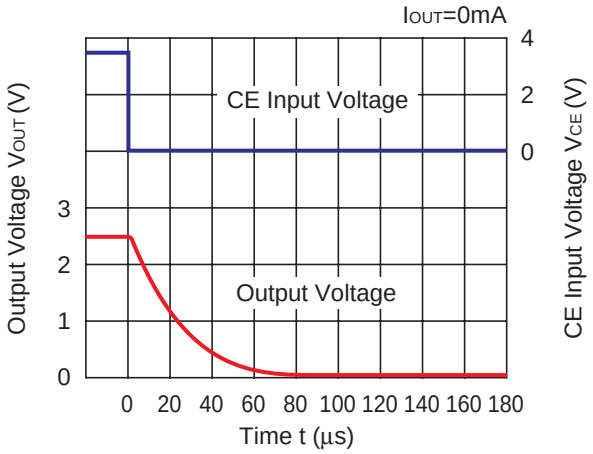

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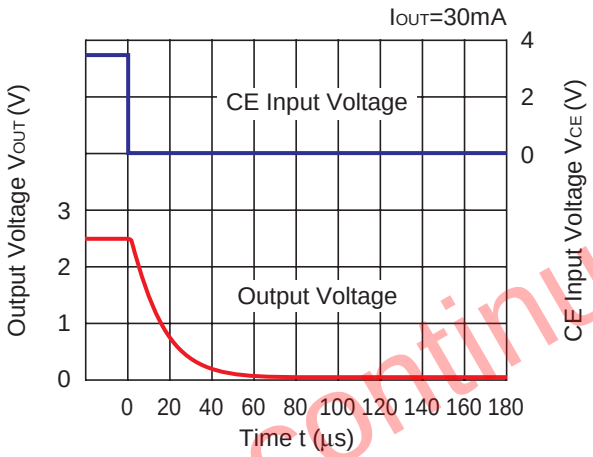

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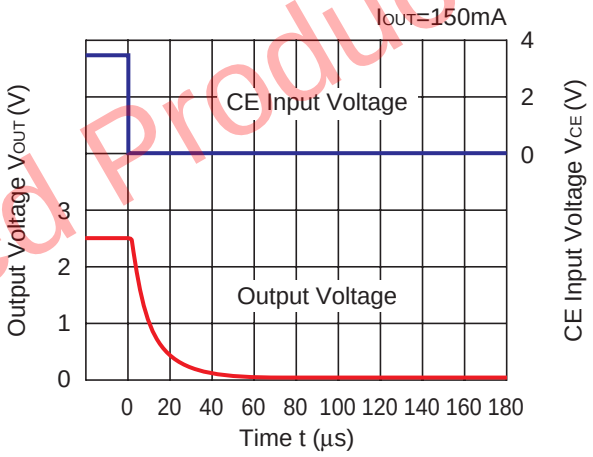

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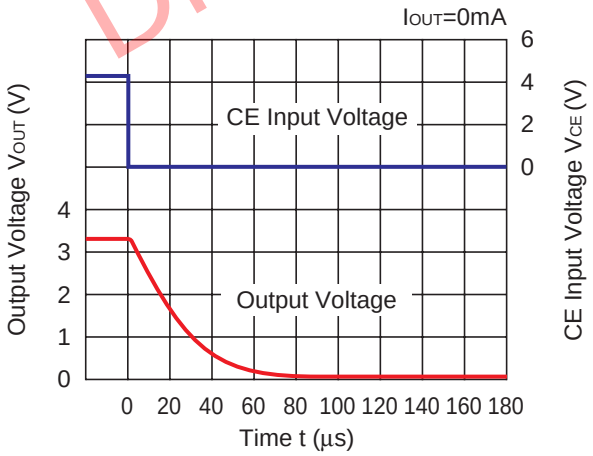

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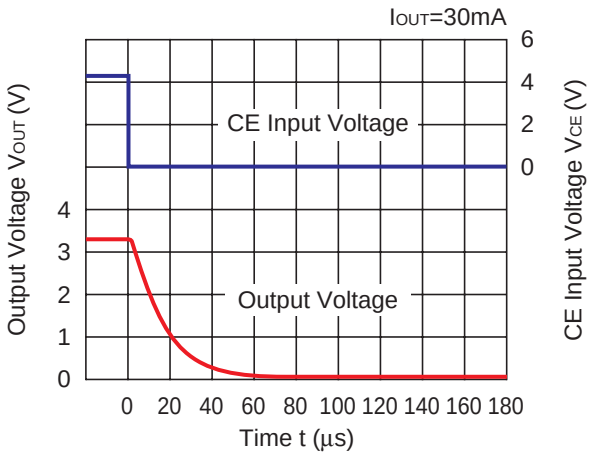

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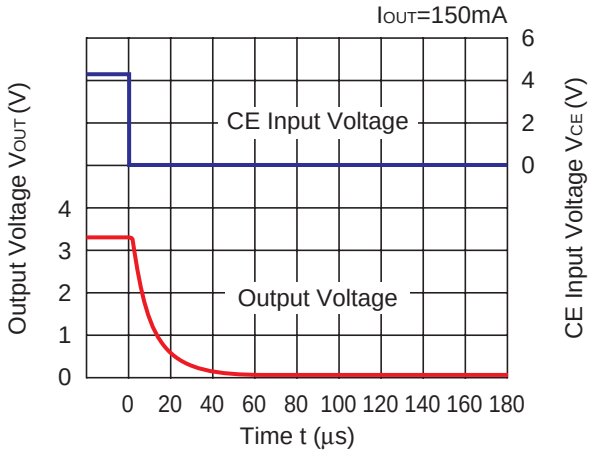
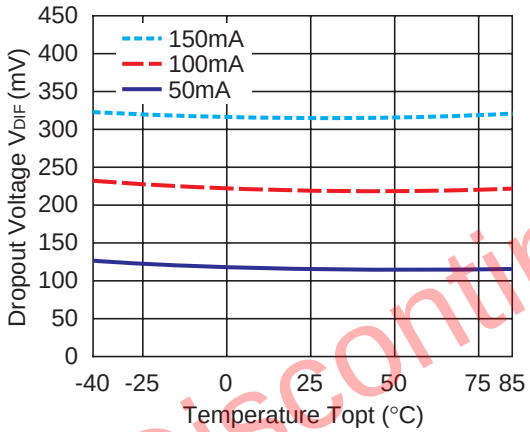
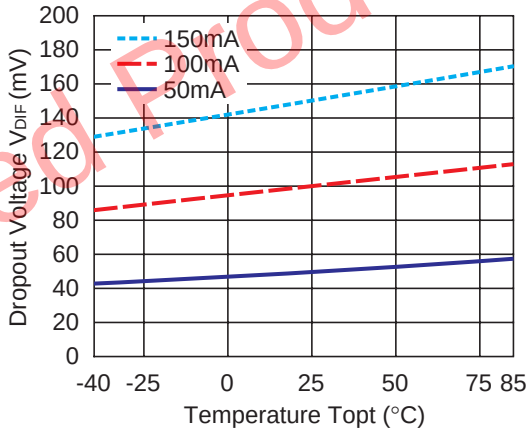


14) Dropout Voltage vs. Temperature (C1=0.47µF, C2=0.47µF)

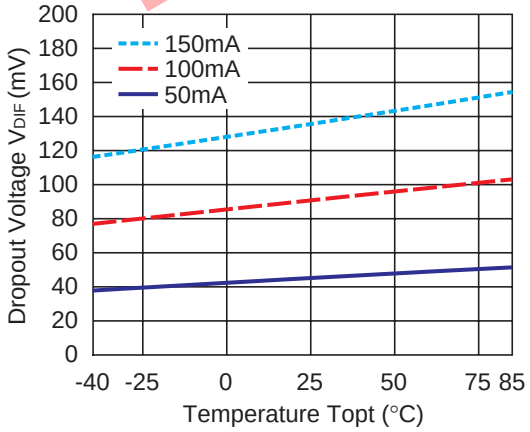
RP113Q122x



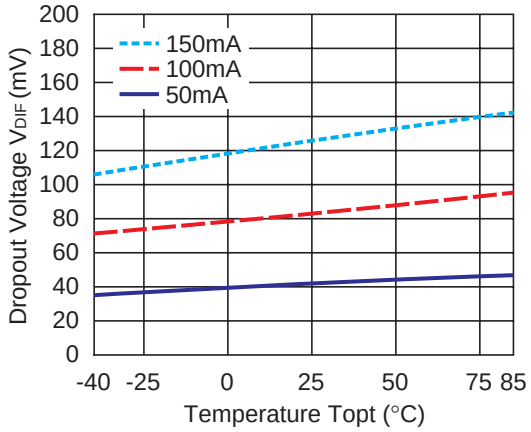
RP113Q252x



RP113Q302x



RP113Q332x



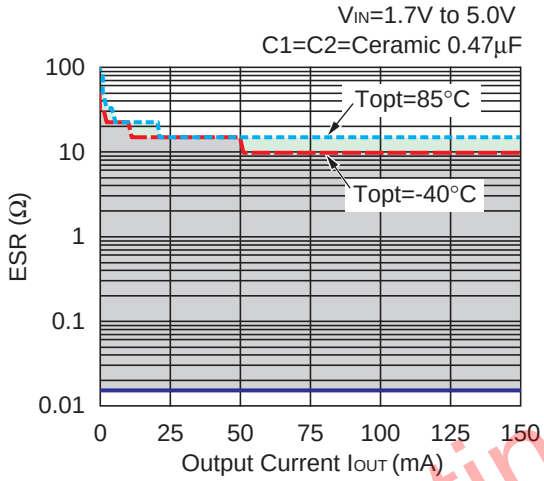
ESR vs. Output Current

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 40µV (Avg.) are marked as the hatched area in the graph.

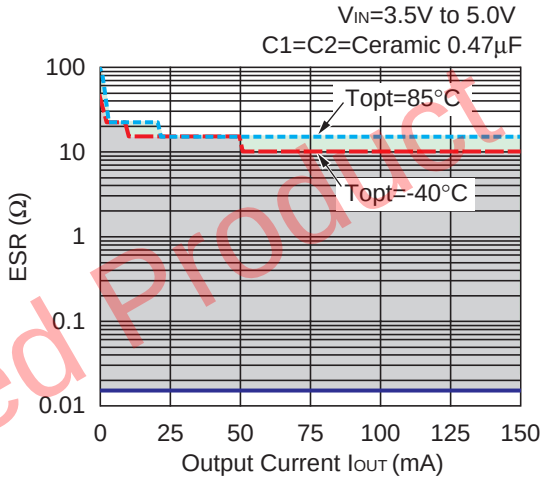
Measurement conditions

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

RP113Q122x



RP113Q332x



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Halogen Free

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