LOW NOISE 150mA LDO REGULATOR

NO.EA-257-100311

OUTLINE

The RP119N Series are CMOS-based Low Noise 150mA LDO regulator ICs with the features of low supply current, low On resistance transistor, and high ripple rejection. Each of the ICs consists of the following components: a voltage reference unit, an error amplifier, a resistor-net for voltage setting, a current limit circuit and a chip enable circuit.

The RP119N Series minimize the dropout voltage, and also prolong the battery life of each IC. Each of the ICs provides the excellent input transient response and load transient response. Therefore, the ICs are ideal for being used for power supply IC in handheld communication equipment. The package for the RP119N Series is the small-sized SOT-23-5, which enables the high-density mounting board.

FEATURES

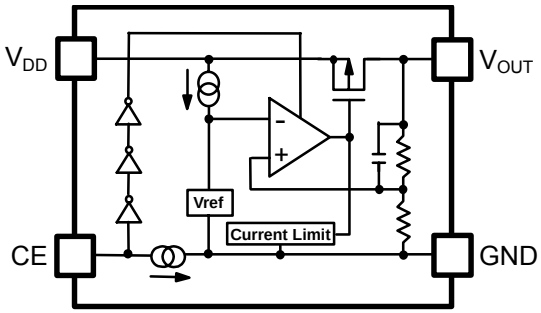
- Supply Current ..... Typ. 50μA
- Supply Current (Standby Mode) ..... Typ. 0.1μA
- Dropout Voltage ..... Typ. 0.25V (I_{OUT}=150mA, V_{OUT}=2.5V)
- Ripple Rejection ..... Typ. 75dB (f=1kHz, V_{OUT}=2.5V)
- Output Voltage Temperature Coefficient ..... Typ. ±30ppm/°C
- Line Regulation ..... Typ. 0.02%/V
- Output Voltage Accuracy ..... ±2.0%
- Packages SOT-23-5
- Input Voltage Range ..... 1.9V to 5.25V
- Output Voltage Range ..... 1.8V to 3.6V
- Built-in Short Current Limit Circuit ..... Typ. 40mA
- Ceramic Capacitor (recommended to use)……..……0.1μF or more

APPLICATIONS

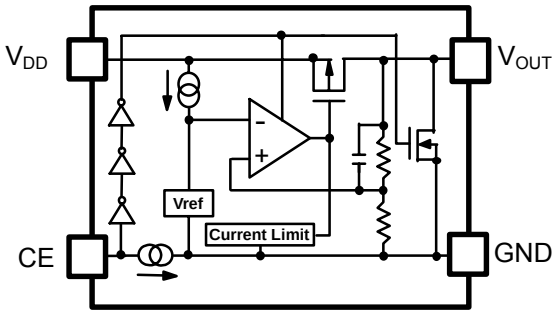
- Power source for handheld communication equipments.
- Power source for battery-powered equipments.
- Power source for electrical appliances such as cameras, VCRs and camcorders.

BLOCK DIAGRAMS

RP119Nxx1B



RP119Nxx1D



SELECTION GUIDE

In the RP119x Series, the following features are selectable at the request of users: Output Voltages, Auto-discharge function, Taping Types, and etc.

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
RP119Nxx1B-TR-FE	SOT-23-5	3,000	Yes	Yes
RP119Nxx1D-TR-FE			Yes	Yes

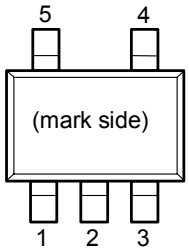
xx: Output voltage (V_{OUT}) for each IC can be selected from 1.8V to 3.6V in the increment of 0.1V.

The second decimal point of voltage is described as below.
1.85V: RP119N181x5
2.85V: RP119N281x5

∗: CE pin polarity and Auto-discharge function are selectable from below.
(B) “H” Active without Auto-discharge function at off state
(D) “H” Active with Auto-discharge function at off state

PIN CONFIGURATION

SOT-23-5



PIN DESCRIPTIONS

SOT-23-5

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	Ratings		Unit
V_{IN}	Input Voltage	6.0		V
V_{CE}	Input Voltage (CE Pin)	6.0		V
V_{OUT}	Output Voltage	-0.3 ~ V_{IN} + 0.3		V
I_{OUT}	Output Current	180		mA
P_D	Power Dissipation *	SOT-23-5	420	mW
Ta	Ambient Temperature Range	-40 ~ 85		°C
Tstg	Storage Temperature Range	-55 ~ 125		°C

* For Power Dissipation, please refer to the “Package Information”.

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the lifetime 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

Unless otherwise noted,

V_{IN}=Set V_{OUT}+1.0V(V_{OUT}>1.5), I_{OUT}=1mA, C_{IN}=C_{OUT}=0.1µF.

The values in ☐ are applicable under the condition of -40°C ≦ Ta ≦ 85°C.

RP119Nxx1B/D **(Ta=25ºC)**

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	Ta=25°C	x0.98		x1.02	V
I_{OUT}	Output Current		150			mA
ΔV_{OUT} /ΔI_{OUT}	Load Regulation	1mA ≦ I_{OUT} ≦ 150mA		5	30	mV
V_{DIF}	Dropout Voltage	Please refer to the table of “Dropout Voltages”.				
I_{SS}	Supply Current	I_{OUT}=0mA		50	70	µA
Istandby	Supply Current (Standby Mode)	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}+1.0V, I_{OUT}=30mA		75		dB
V_{IN}	Input Voltage *		1.9		5.25	V
ΔV_{OUT} /ΔTa	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”		1.0			V
V_{CEL}	CE Input Voltage “L”				0.4	V
en	Output Noise	BW=10Hz ~ 100kHz		20 x V_{OUT}		µVrms
R_{LOW}	Nch On Resistance for Auto-discharge (D version only)	V_{IN}=4.0V V_{CE}=0V		60		Ω

The values in ☐ have been tested and guaranteed by Design Engineering.

All products were tested under Pulse Load Condition (Tj ≈ Ta= 25ºC). However, the following categories were not tested on the products: Output Noise, Ripple Rejection, and Output Voltage Temperature Coefficient.

* The maximum input voltage of the electrical characteristics is 5.25V. In case of exceeding this value, the maximum input voltage cannot be over 5.5V and the total operating time has to be within 500 hrs.

Dropout Voltages **(Ta=25°C)**

Dropout Voltages V_{OUT} (V)	Dropout Voltage V_{DIF} (V)		
	Condition	TYP.	MAX.
1.8 ≦ V_{OUT}<2.1	I_{OUT}=150mA	0.33	0.48
2.1 ≦ V_{OUT}<2.5		0.28	0.40
2.5 ≦ V_{OUT}<3.0		0.25	0.35
3.0 ≦ V_{OUT} ≦ 3.6		0.23	0.32

The values in ☐ have been tested and guaranteed by Design Engineering.

TEST CIRCUITS

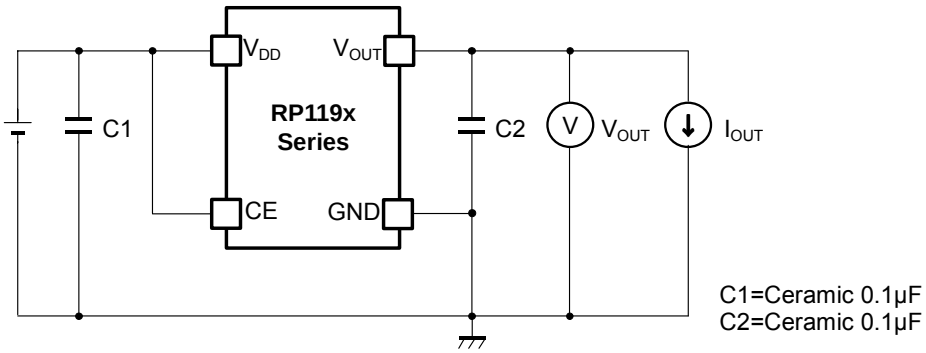


Fig.1 Basic Test Circuit

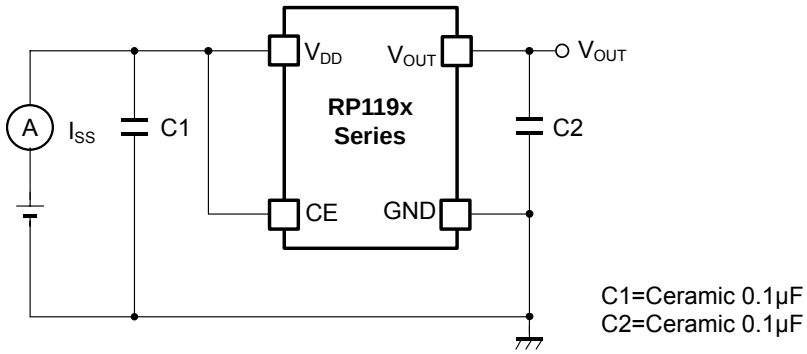


Fig.2 Test Circuit for Supply Current

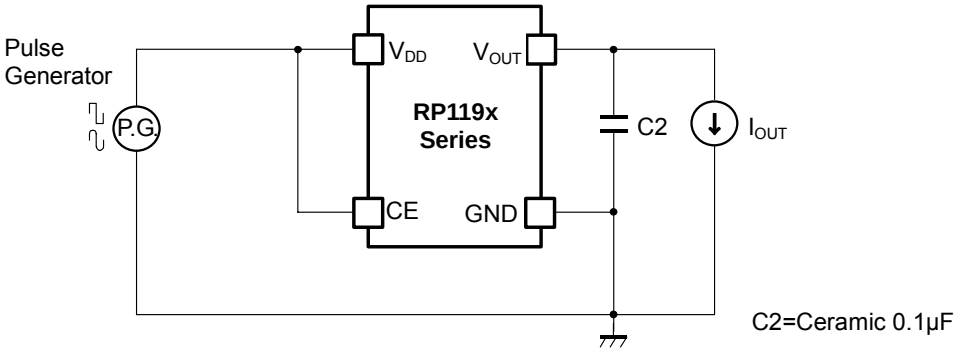


Fig.3 Test Circuit for Ripple Rejection

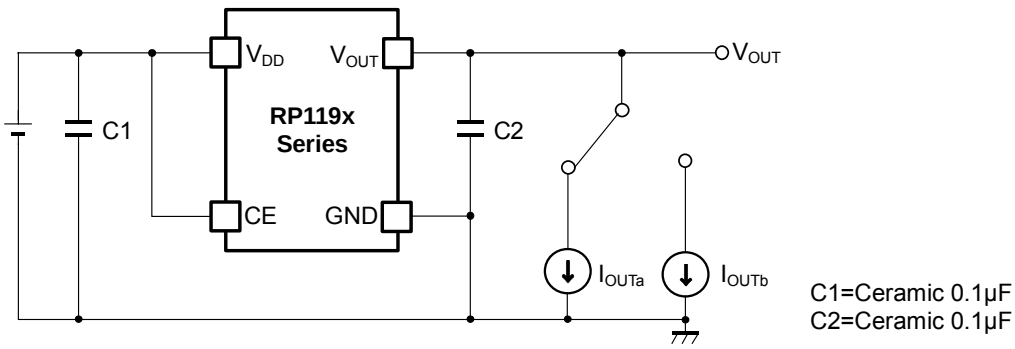


Fig.4 Test Circuit for Load Transient Response

TECHNICAL NOTES

When using the ICs, please note the following points.

Phase Compensation

The RP119N Series are using output capacitor as phase compensation in order to secure the stable operation even when the output load is varied. Therefore, the capacitor C2 has to be placed and it has to be 1.0µF or more.

In case of using a tantalum capacitor, the output may result in unstable if the Equivalent Series Resistance (ESR) value is high. Therefore, the careful evaluations on the PCB including frequency characteristics are required.

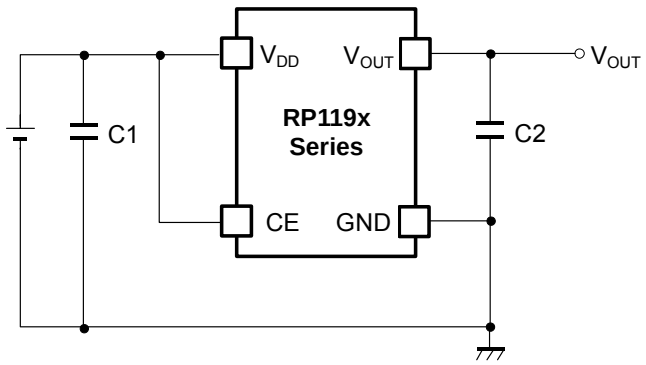
PCB Layout

The impedances of V_{DD} line and GND line has to be low as possible. The high impedances may result in the unstable operation or a noise pickup. The capacitor C1 between V_{DD} and GND should be 1.0µF or more. The line from V_{DD} to the capacitor C1, and the line from the capacitor C1 to GND must be wired as short as possible.

The capacitor C2 is placed between V_{OUT} and GND as phase compensation. The line from V_{OUT} to the capacitor C2, and the line from the capacitor C2 to GND must be wired as short as possible. Please refer to the “Basic Test Circuit” below.

Basic Test Circuit

RP119N Series



External Components
C1, C2: Ceramic Capacitor 0.1µF, muRata: GRM155B31C104KA87B

POWER DISSIPATION (SOT-23-5)

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

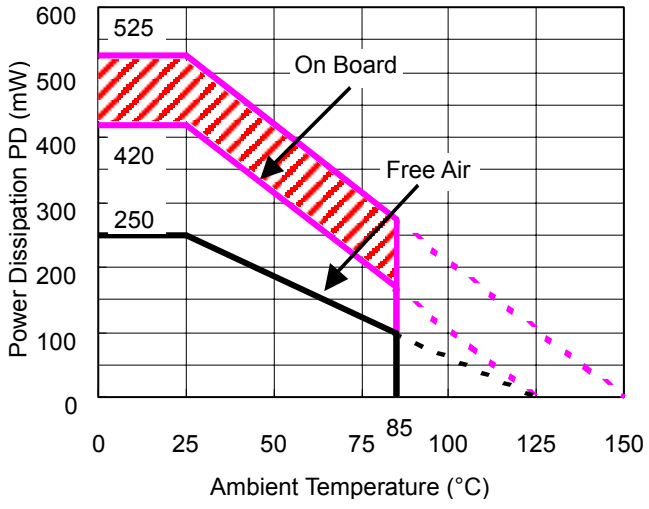
(Power Dissipation (SOT-23-5) is substitution of SOT-23-6.)

Measurement Conditions:

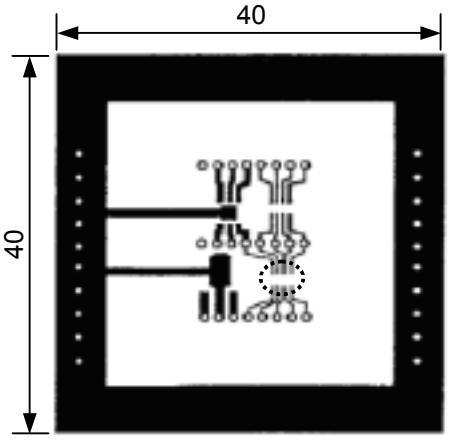
	Standard Test Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-holes	φ 0.5mm × 44pcs

Measurement Results: **(Ta=25°C)**

	Standard Land Pattern	Free Air
Power Dissipation	420mW (Tjmax=125°C) 525mW (Tjmax=150°C)	250mW
Thermal Resistance	θja = (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 under the conditions of Tjmax=125°C and Tjmax=150°C.

The operation of the IC within the shaded range in the graph might have an affect on the IC's lifetime. The operation time of the IC must be remained within the time limit described in the table below.

Operating Time	Estimated Years (Operating four hours/day)
TBD hours	TBD years