Description

The PJ9400 is a high accuracy, low noise, high speed CMOS Linear regulator with low power consumption and low dropout voltage, which provide large output currents even when the difference of the input-output voltage is small. The devices offer a new level of cost effective performance in cellular phones, laptop and notebook computers, and other portable devices.

The current limiter's fold-back circuit also operates as a short circuit protection and an output current limiter at the output pin.

Standard products are Pb-free and Halogen-free.

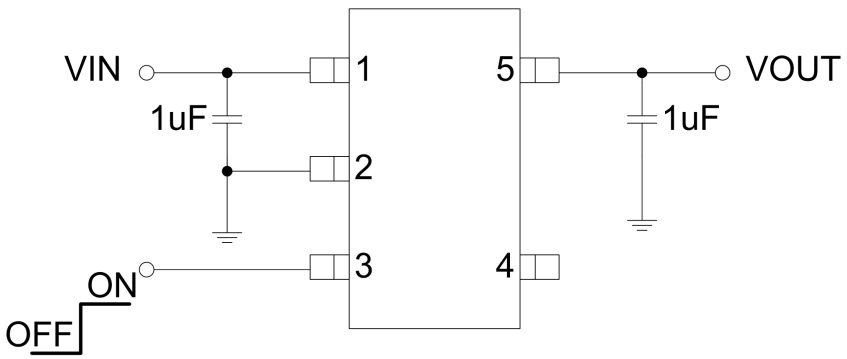
Features

- Wide Input Voltage Range: 1.5V~8V
- Maximum Output Current: 400mA @ VOUT=3.3V
- Standard Fixed Output Voltage Options: 1.1V~3.4V(customized by every 0.1V step)
- Low Quiescent Current: 0.5μA(Typ.)
- PSRR=60dB@1KHz
- Low Dropout : 180mV @ I_{OUT}=100mA
- Low Output Voltage Accuracy: ±2%
- Shut-down Current: <1μA
- Short Circuit Protection
- Current Limiting Protection
- Available Packages: SOT-89, SOT-23-3, SOT-23-5 and DFN1x1-4L

Applications

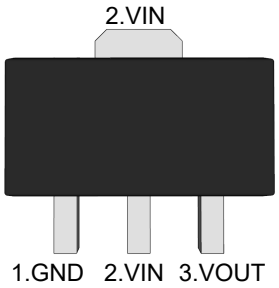
- Radio Control Systems
- Cellphones, Radiophone, Digital Cameras
- Bluetooth, Wireless Handsets

Typical Application Circuit



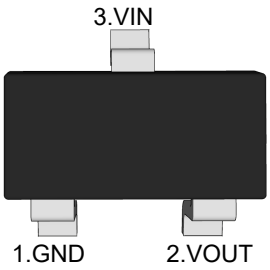
Pin Distribution

SOT-89



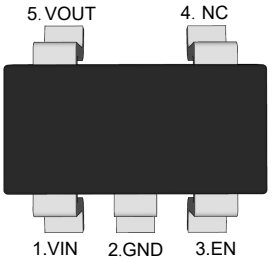
(Top View)

SOT-23-3



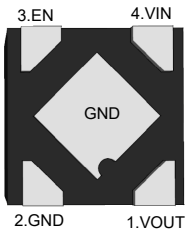
(Top View)

SOT-23-5



(Top View)

DFN1x1-4L



(Bottom View)

Functional Pin Description

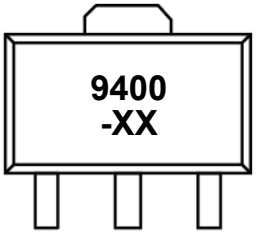
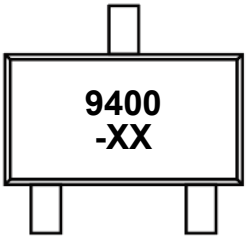
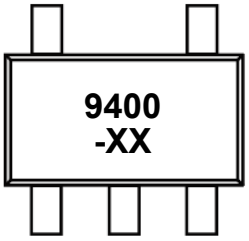
Pin Name	Pin Function
VIN	Power Input Voltage
GND	Ground
EN	Chip Enable (Active High). Note that this pin is high impedance
NC	NO Connected
VOUT	Output Voltage

Ordering Information

PJ9400□□□□

- Package Type
  SQ:SOT-89 SC:SOT-23-3 SE:SOT-23-5
  DE:DFN1x1-4L
- Output Voltage
  1.1V~3.4V by 0.1V step.
  For example, 28 means product outputs 2.8V
- Output current tap
  L : 400mA

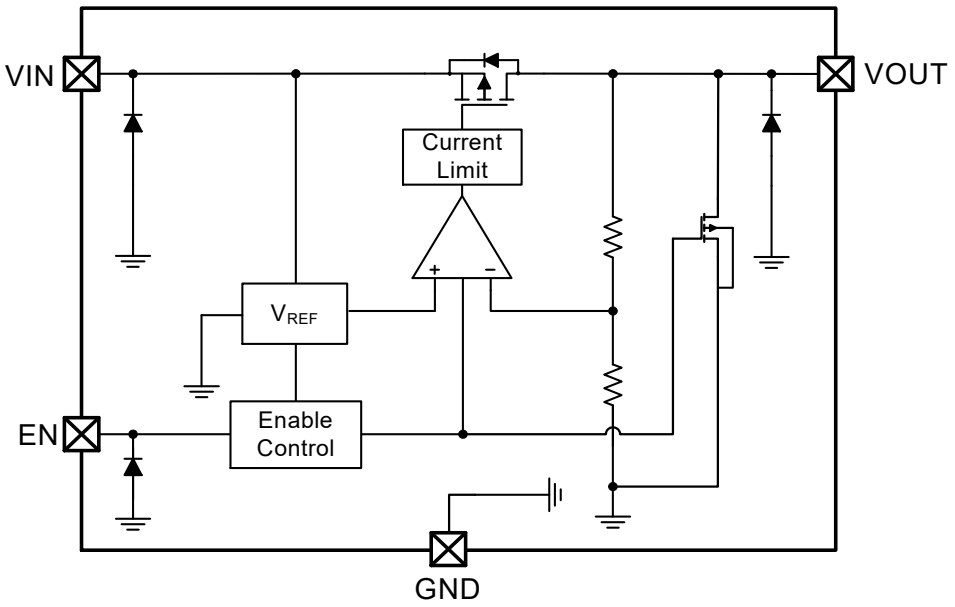
Ordering Information Continue

Orderable Device	Package	Reel (inch)	Package Qty (PCS)	Eco Plan Note1	MSL Level	Marking Code
PJ9400LXXSQ Note2	SOT-89	7/13	1000/3000	RoHS & Green	MSL1	 XX:Output Voltage e.g. 3.0:3.0V
PJ9400LXXSC Note2	SOT-23-3	7	3000	RoHS & Green	MSL3	 XX:Output Voltage e.g. 3.0:3.0V
PJ9400LXXSE Note2	SOT-23-5	7	3000	RoHS & Green	MSL3	 XX:Output Voltage e.g. 3.0:3.0V
PJ9400LXXDE Note2	DFN1x1-4L	7	1000	RoHS & Green	MSL1	 E:Product Code e.g. E: PJ9400 Series XX:Output Voltage e.g. 30:30V

Note:

1. RoHS: PJ defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials.
   Green: PJ defines "Green" to mean Halogen-Free and Antimony-Free.
2. XX indicates 1.1V~3.4V by 0.1V step. For example, 28 means product outputs 2.8V

Function Block Diagram



Absolute Maximum Ratings Note3

Ratings at 25℃ ambient temperature unless otherwise specified.

Parameter		Value	Unit
Input Voltage	V_{IN}	-0.3 ~ +9	V
Maximum Load Current		450	mA
Power Dissipation	SOT-89	600	mW
	SOT-23-3	400	mW
	SOT-23-5	400	mW
	DFN1x1-4L	400	mW
Thermal Resistance,Junction-to-Ambient	SOT-89	250	°C/W
	SOT-23-3	400	°C/W
	SOT-23-5	400	°C/W
	DFN1x1-4L	400	°C/W
Operating Ambient Temperature		-40 ~ +85	°C
Junction Temperature		-40 ~ +125	°C
Storage temperature range		-55 ~ +150	°C
Lead Temperature		260°C,10S	--
ESD Voltage	HBM	3.5	KV

Note3: Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect.

Recommended Operating Conditions

Parameter	Value	Unit
Supply Voltage	1.5~8	V
Maximum Output Current	400	mA
Operating Ambient Temperature	-40 ~ +85	°C

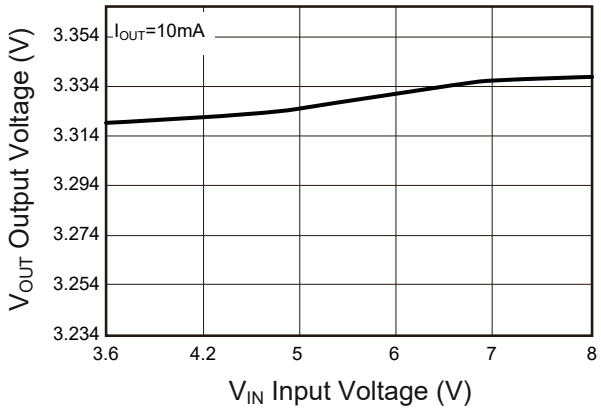
Electrical Characteristics

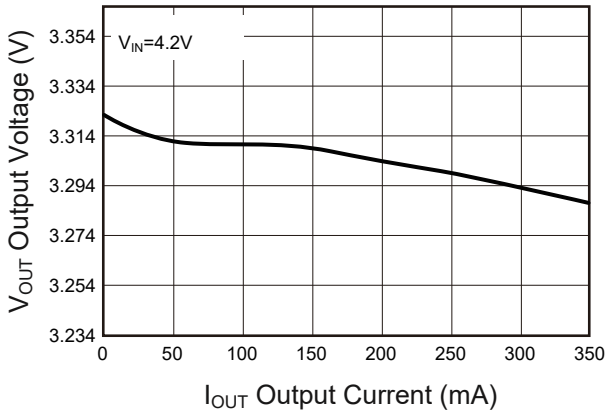
(V_{OUT}=3.3V, C_{IN}=1μF, C_{OUT}=1μF, T_A=25℃ , unless otherwise noted.)

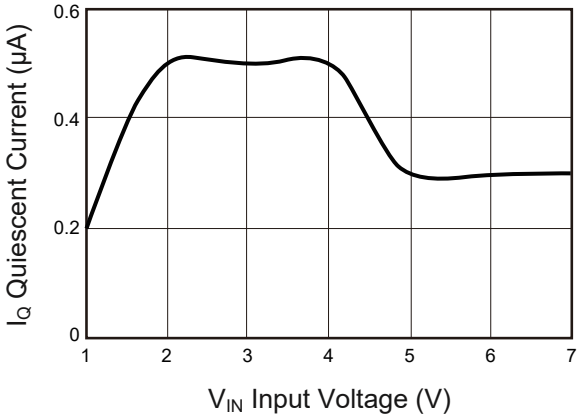
Parameter		Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Input Voltage		V_{IN}		1.5	--	8	V
Output Voltage Accuracy		ΔV_{OUT}	I_{OUT}=1mA	-2	--	+2	%
Quiescent Current		I_Q	V_{OUT}=3.3V, I_{OUT}=0	--	0.5	--	μA
Shut-down Current		I_{SHDN}	V_{EN}=0V	--	--	1	μA
Dropout Voltage		V_{DROP}	V_{OUT}=3.3V, I_{OUT}=100mA	--	180	--	mV
			V_{OUT}=3.3V, I_{OUT}=200mA	--	400	--	
Line Regulation		ΔV_{LINE}	V_{IN}=2.7V~5.5V,I_{OUT}=1mA	--	0.01	0.15	%
Load Regulation		ΔV_{LOAD}	1mA<I_{OUT}<300mA,V_{OUT}=3.3V	--	200	--	mV
Current Limit		I_{LIM}	V_{IN}=V_{EN}=4.5V	--	400	--	mA
Short Current		I_{SHORT}	V_{EN}=V_{IN}, VOUT Short to GND with 1Ω	--	35	--	mA
EN Input Current		I_{EN}	V_{EN}= 0~ 5.5V	--	--	1	μA
EN Input Threshold	Logic Low	V_{IL}	V_{IN}=5.5V, V_{OUT}=0V	--	--	0.4	V
	Logic High	V_{IH}	V_{IN}=5.5V, I_{OUT}=1mA	1.2	--	V_{IN}	
Power Supply Rejection Rate		PSRR	V_{IN}=$5V_{DC}$+$0.5V_{P-P}$ f=1KHz, I_{OUT}=10mA	--	60	--	dB

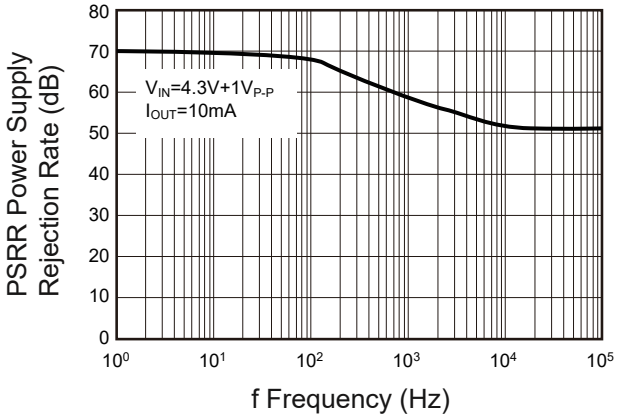
Typical Electrical Curves

(V_{IN}=4.5V,V_{OUT}=3.3V, C_{IN}=1μF, C_{OUT}=1μF, T_A=25℃ , unless otherwise noted, Package:SOT-23-5)

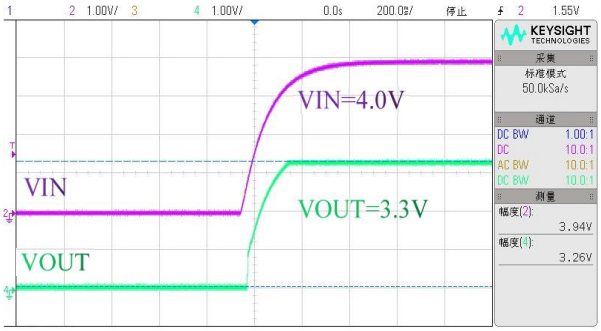


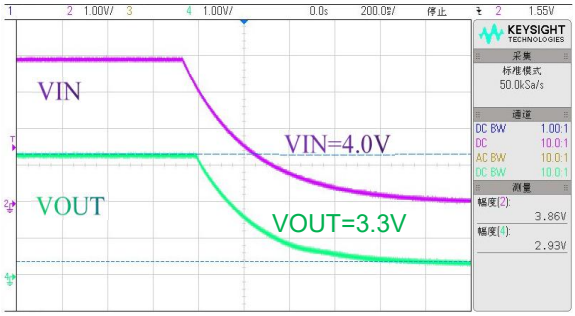




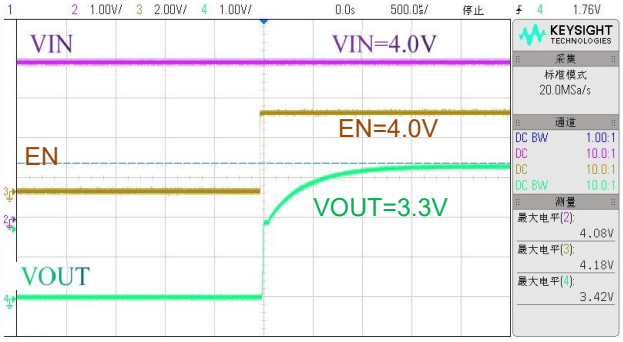


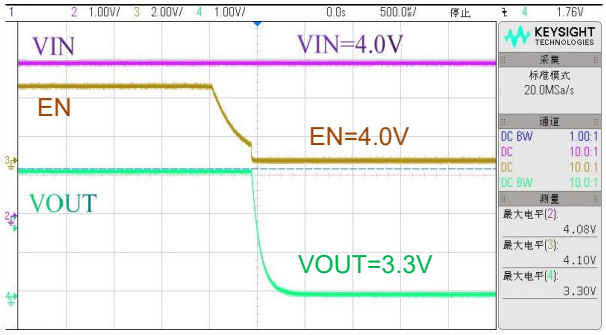
Power ON / OFF



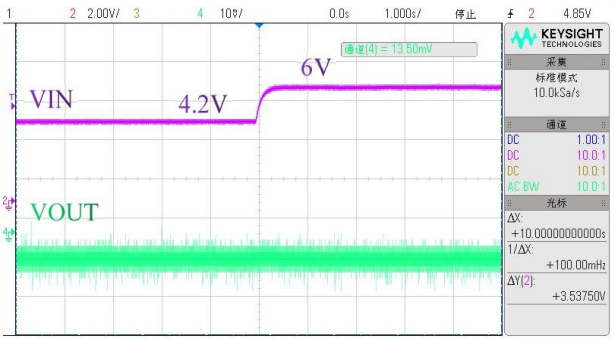


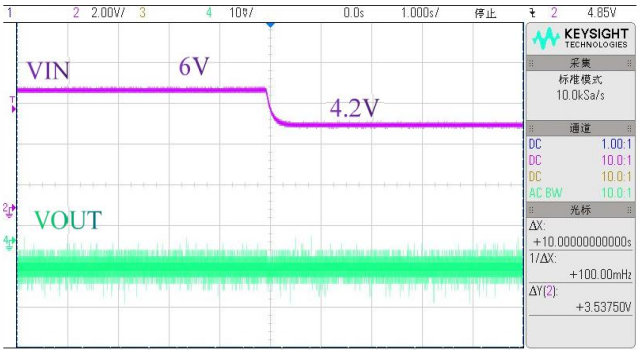
EN ON/OFF



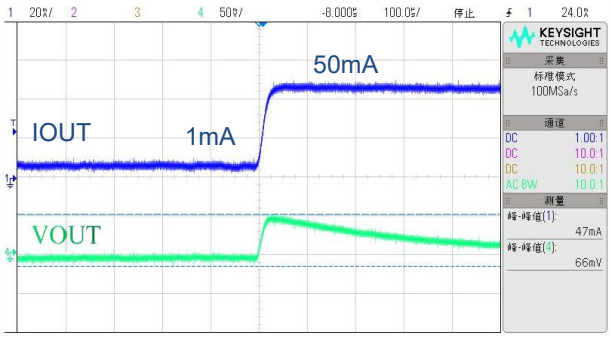


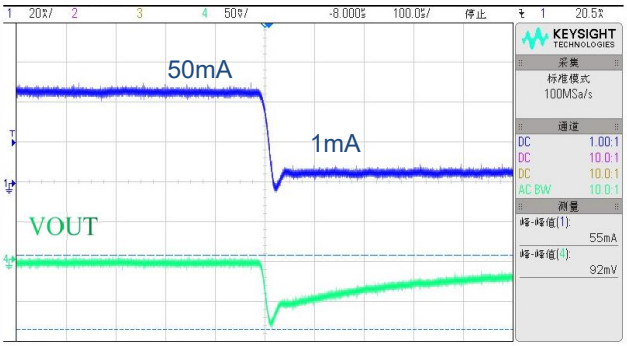
Line Transient





Load Transient





Functional Description

Input Capacitor

A 1μF ceramic capacitor is recommended to connect between VIN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both VIN and GND. The input capacitor should be at least equal to, or greater than, the output capacitor for good load transient performance。

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1μF to 10μF, Equivalent Series Resistance (ESR) is from 5mΩ to 500mΩ, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to OUT and GND pins.

ON/OFF Input Operation

The PJ9400 EN pin is internally held low by a 1-MΩ resistor to GND. The PJ9400 is turned on by setting the EN pin higher than VIH threshold, and is turned off by pulling it lower than VIL threshold. If this feature is not used, the EN pin should be tied to IN pin to keep the regulator output on at all time.

Low Quiescent Current

Cellular phone baseband internal digital circuits typically operate all the time. That requires LDO stays on at all times. However, in the standby mode, the microprocessor consumes only around 100~300μA. Since the phone stays in standby for the longest percentage of time, using a 0.5μA quiescent current LDO, instead of 100μA, saves 99.5μA and can substantially extends the battery standby time.

The PJ9400, consuming only 0.5μA quiescent current, provides great power saving in portable and low power applications.

Current Limit Protection

When output current at the OUT pin is higher than current limit threshold or the OUT pin is short-circuiting to GND, the current limit protection will be triggered and clamp the output current to a pre-set level to prevent over-current and to protect the regulator from damage due to overheating.

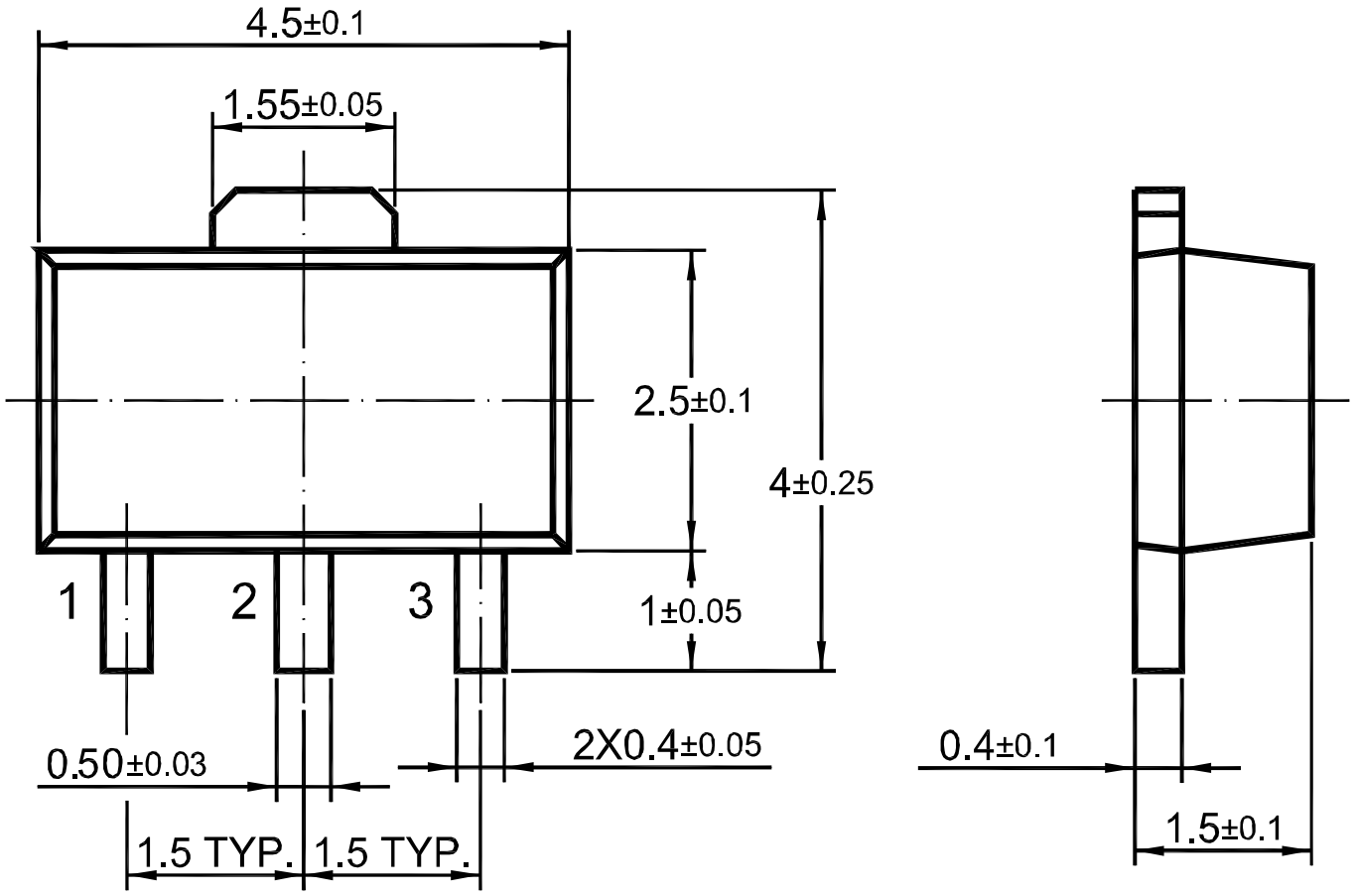
Thermal Overload Protection

The 9400 has internal thermal protection. When the temperature is too high, such as a short circuit in the output pins or a device with a very large load current and a large voltage drop, the internal thermal protection circuit will be triggered, which will shut down the power supply MOSFET and prevent LDO damage. Once the excessive thermal conditions are eliminated and the temperature of the device drops, the thermal protection circuit will restore control of the power MOSFET and allow the LDO device to enter normal operation

Package Outline

SOT-89

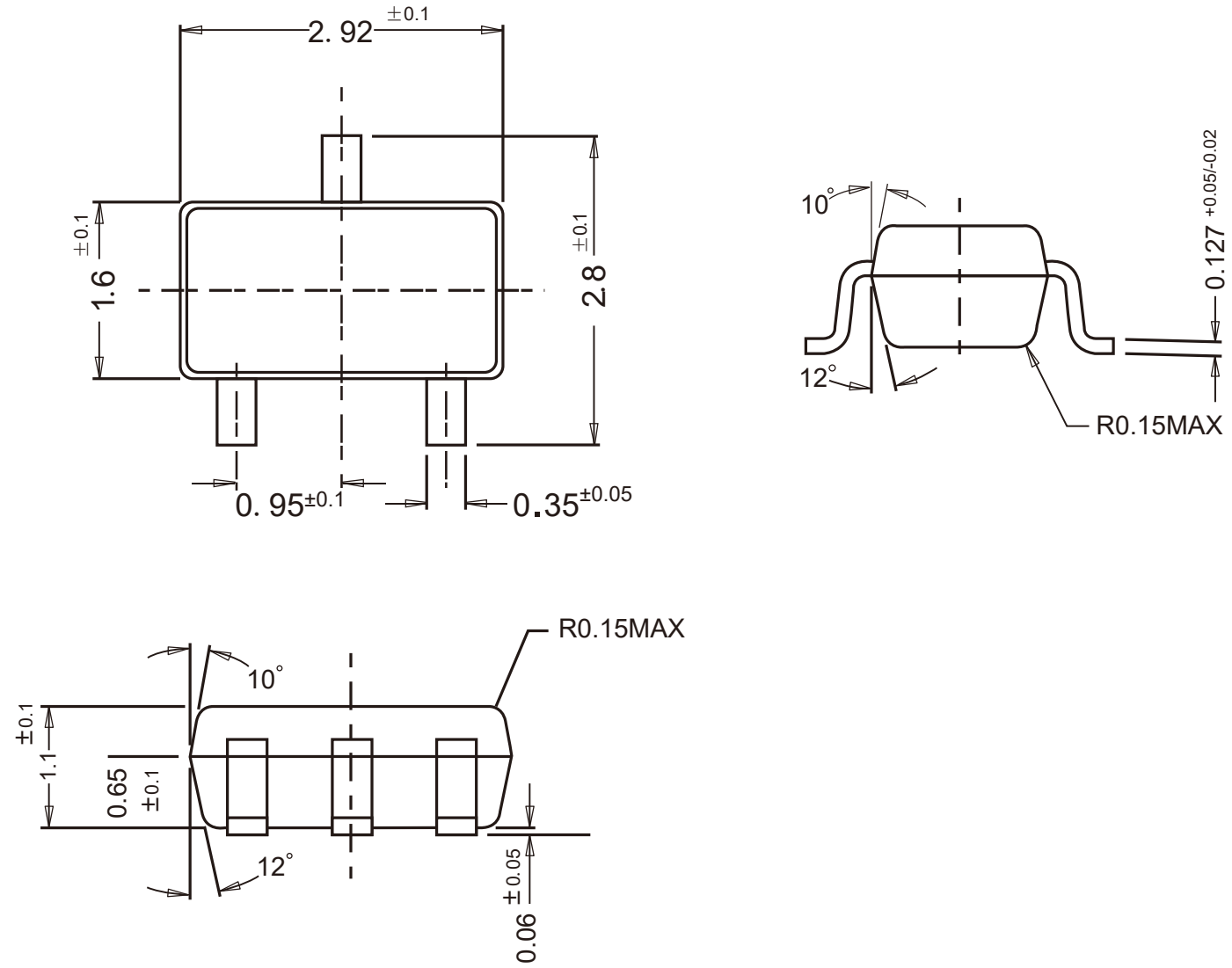
Dimensions in mm



Package Outline

SOT-23-3

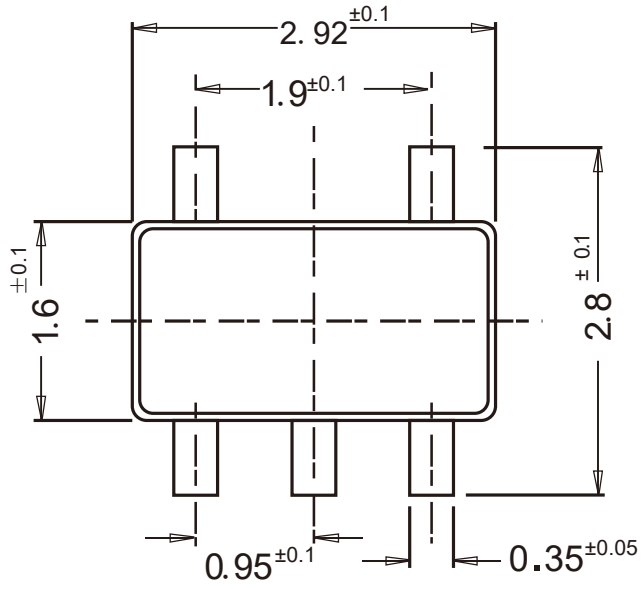
Dimensions in mm

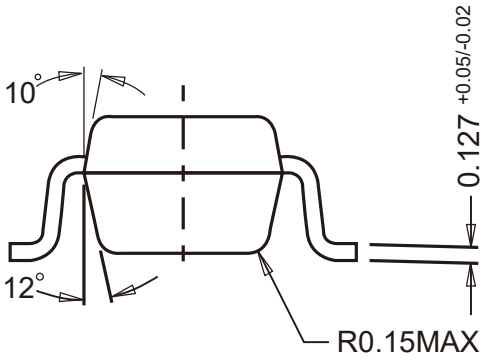


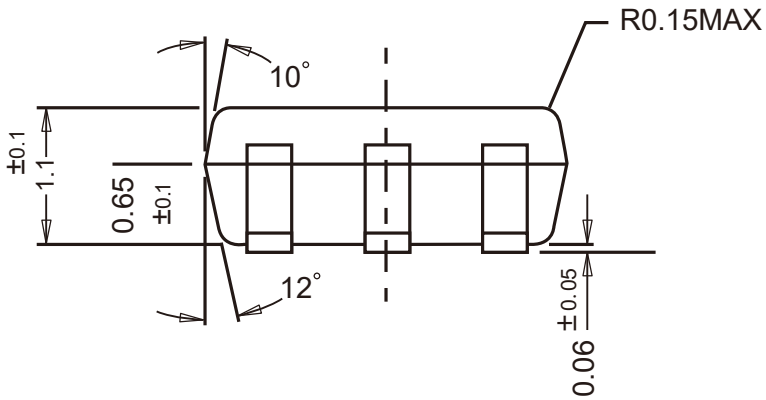
Package Outline

SOT-23-5

Dimensions in mm







Package Outline

DFN1x1-4L
Dimensions in mm