42-V Input, 150-mA Output High Voltage and Low Quiescent Current LDO

FEATURES

- **Wide Input Voltage Range: 3.6 V to 42 V**
- **Fixed Output:**
  1.2V,1.5V,1.8V,2.5V,2.8 V,3 V, 3.3 V and 5 V
- **±1% Output Accuracy Under Room Temperature**
- **Ultra-Low Quiescent Current: 2 μA**
- **Maximum Output Current: 150 mA**
- **Low Dropout Voltage: 100 mV at 50 mA**
- **High PSRR: 60 dB at 100 Hz**
- **Current Limit and Thermal Protection**
- **Junction Temperature Range: −40°C to +125°C**

APPLICATIONS

- **Handheld Devices with Battery Power Supply**
- **POS and Power Tools**
- **Meters and Smoke Detector**
- **Industrial Control**
- **Wireless and IoT Modules**

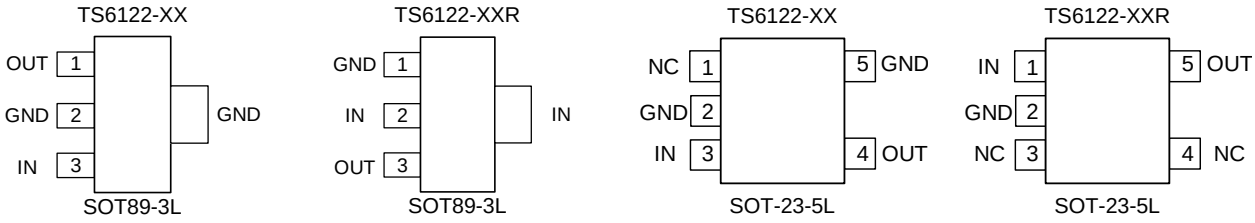
PRODUCT DESCRIPTION

The TS6122 series products are high-performance and low dropout linear regulators. The TS6122 series products support a maximum 42 V input voltage and 150 mA output current with low quiescent current and high PSRR. The TS6122 series products are stable with a 2.2 μF to 22 μF output capacitor, and a 4.7 μF ceramic capacitor is recommended.

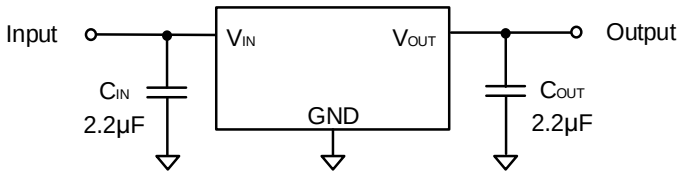
The TS6122 series products have a high PSRR with 60dB at 100Hz.This feature makes TS6122 series products suitable for power-sensitive applications with high noise from the previous stage power supply. 2 μA ultra-low quiescent current makes the TS6122 series products ideal choices for portable devices with battery power supply. Current-limit and thermal overload protection circuits improve the reliability under heavy load conditions.

The TS6122 series products provide fixed output voltage options from 1.2 V to 5 V with ±2% voltage accuracy over operating conditions. The TS6122 series products are guaranteed over the junction temperature range from −40°C to +125°C.

PIN ASSIGNMENTS



TYPICAL APPLICATION



ORDERING INFORMATION

Model	Part Number	Eco Plan	Package	V_{OUT}(V)	Package Marking	Container, Pack Qty
TS6122-XX	TS6122XXSOT893L	RoHS	SOT89-3L	X.X	6122-XX	Reel, 1000
TS6122-XXR	TS6122XXSOT893LR	RoHS	SOT89-3L	X.X	6122-XXR	Reel, 1000
TS6122-XX	TS6122XXSOT235L	RoHS	SOT-23-5L	X.X	22XX	Reel, 3000
TS6122-XXR	TS6122XXSOT235LR	RoHS	SOT-23-5L	X.X	22XXR	Reel, 3000

ABSOLUTE MAXIMUM RATINGS

Over operating free-air temperature range (unless otherwise noted) (1)

Parameter	Min	Max	Unit
Input Voltage	-0.3	45	V
Output Voltage	-0.3	6	V
Maximum Operating Power Dissipation@T_A=25°C SOT89-3L		2.0	W
Junction Temperature Range	-40	150	°C
Storage Temperature Range	-65	150	°C
Lead Temperature (Soldering, 10s)		260	°C
ESD HBM	±4000V		
ESD MM	±400V		
ESD CDM	±1500V		

(1) Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Min	Max	Unit
Input Voltage	3.6	42	V
Output Current(V_{IN} = V_{OUT} + 1V)	0	150	mA
Operating Junction Temperature Range	-40	125	°C

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjects to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

ELECTRICAL CHARACTERISTICS:TS6122

Boldface limits apply over the specified temperature range, **T_J = −40℃ to +125℃.**

At T_J = +25℃, V_{IN} = $V_{OUT(NOM)}$+1V or 3.6V, C_{OUT} = 2.2 μF (unless otherwise noted)(2)

Parameter		Operating Conditions		Min	Typ	Max	Unit
V_{OUT}	Output Voltage Accuracy	I_{OUT} = 0mA	T_J = 25℃	-1%		1%	
			T_J = −40℃ to +125℃	**-2%**		**2%**	
$\triangle V_{OUT}$	Line Regulation	V_{IN} = $V_{OUT(NOM)}$ + 1V, or V_{IN} ≥ 3.6V I_{OUT} = 1mA			1	10	mV
	Load Regulation	I_{OUT} = 1mA to 150mA			5	20	mV
V_{DO}	Dropout Voltage(3)	V_{IN} = 0.98 × $V_{OUT(NOM)}$	I_{OUT} = 50mA		100	180	mV
			I_{OUT} = 100mA		220	390	mV
			I_{OUT} = 150mA		340	600	mV
UVLO	V_{IN} Under-Voltage Lock-out	V_{IN} rising			3.0	3.5	V
I_{OUT}	Output Current	V_{OUT} in regulation		0		150	mA
I_{CL}	Output Current Limit	V_{OUT} = 0.9 × $V_{OUT(NOM)}$		150		500	mA
PSRR	Power Supply Rejection Ratio	I_{OUT} = 10mA	f = 100Hz		60		dB
			f = 1kHz		60		dB
			f = 10kHz		55		dB
V_N	Output Noise Voltage	I_{OUT} = 10mA, BW = 10Hz to 100kHz			150		μV_{RMS}
		I_{OUT} = 10mA, BW = 100Hz to 100kHz			80		μV_{RMS}
I_Q	Quiescent Current	I_{OUT} = 0mA			2	5	μA
		I_{OUT} = 150mA			600		μA
T_{SD}	Thermal Shutdown Threshold				160		ºC
	Hysteresis				25		ºC
θ_{JA}	SOT89-3L				63		ºC/W
θ_{JC}	SOT89-3L				9.4		ºC/W

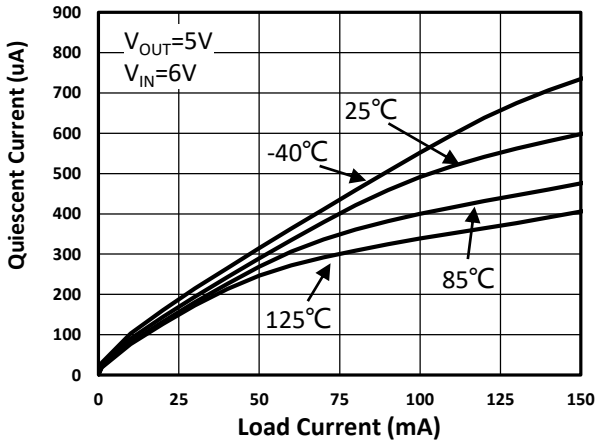
(2) Test time of each parameter is within 5ms. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

(3) Dropout voltage is the minimum input to output voltage differential needed to maintain regulation at a specified output current. In dropout, the output voltage will be equal to V_{IN} – V_{DO}.

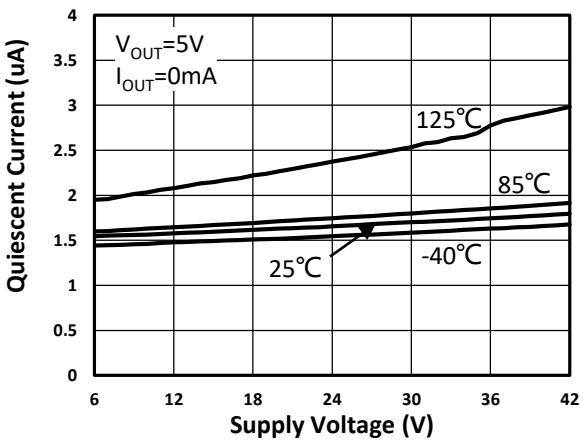
TYPICAL CHARACTERISTICS

At T_J = +25°C, V_{IN} = $V_{OUT(NOM)}$+1V or 3.6V, C_{OUT} = 2.2 µF (unless otherwise noted)

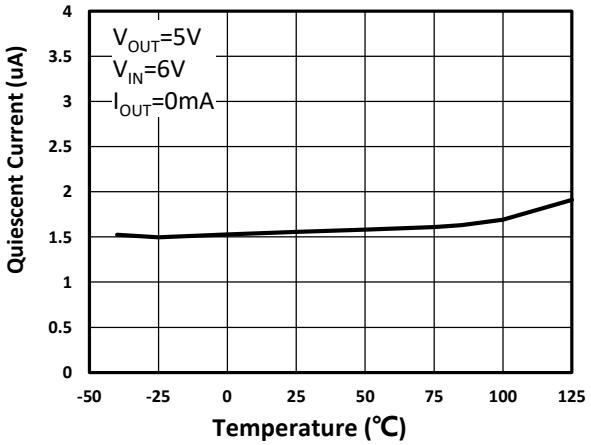
Quiescent Current vs Load Current



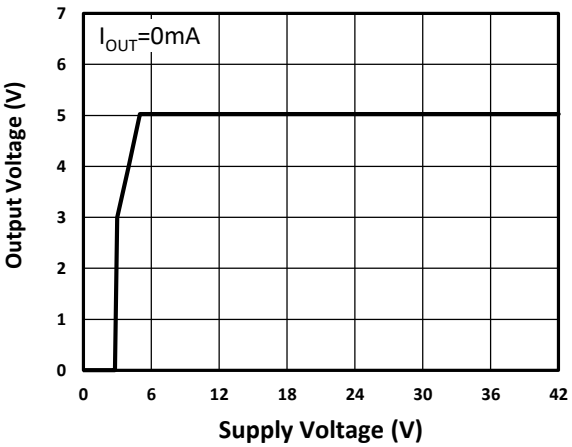
Quiescent Current vs Supply Voltage



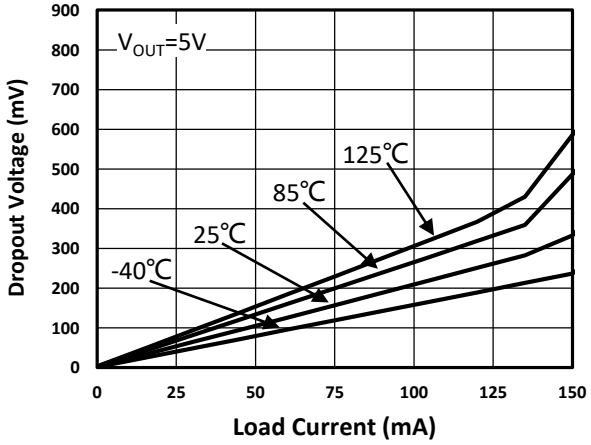
Quiescent Current vs Temperature



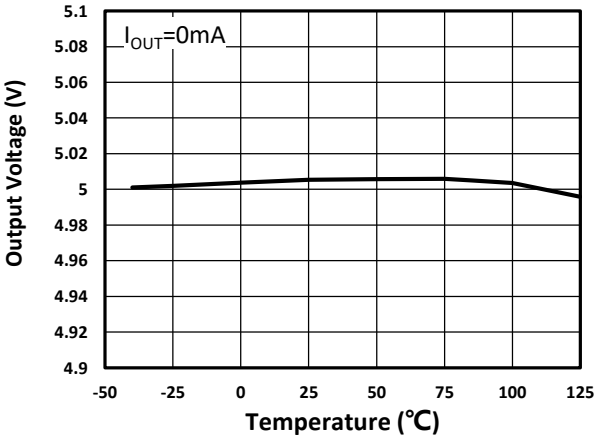
Output Voltage vs Supply Voltage



Dropout Voltage vs Load Current



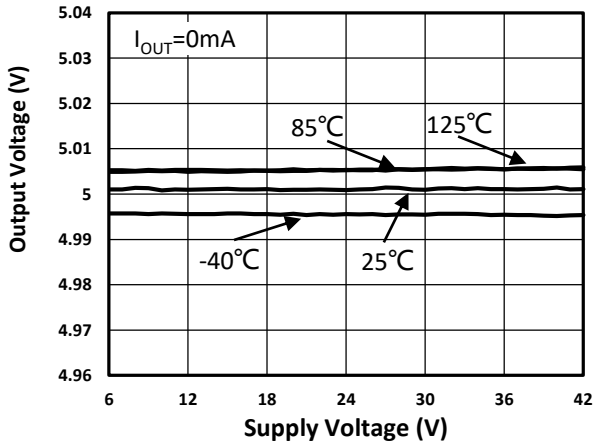
Output Voltage vs Temperature



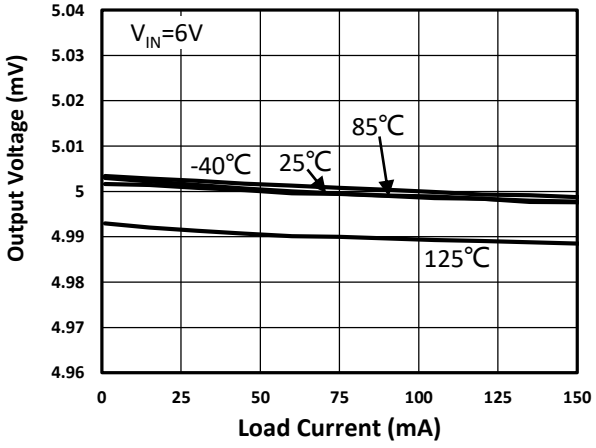
TYPICAL CHARACTERISTICS (CONTINUE)

At T_J = +25°C, V_{IN} = $V_{OUT(NOM)}$+1V or 3.6V, C_{OUT} = 2.2 µF (unless otherwise noted)

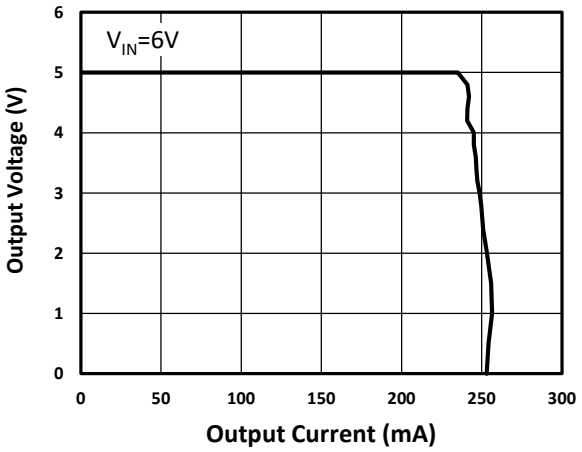
Output Voltage vs Supply Voltage



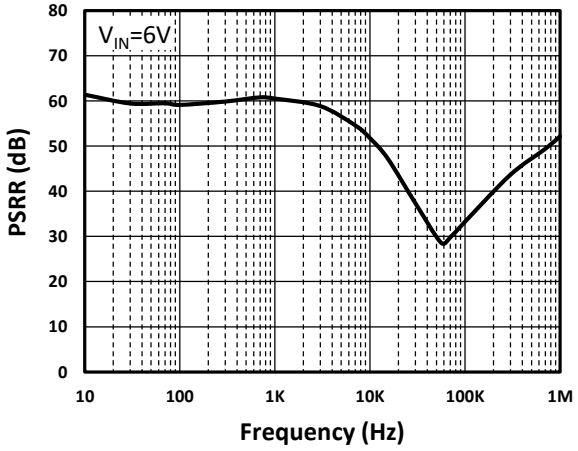
Output Voltage vs Load Current



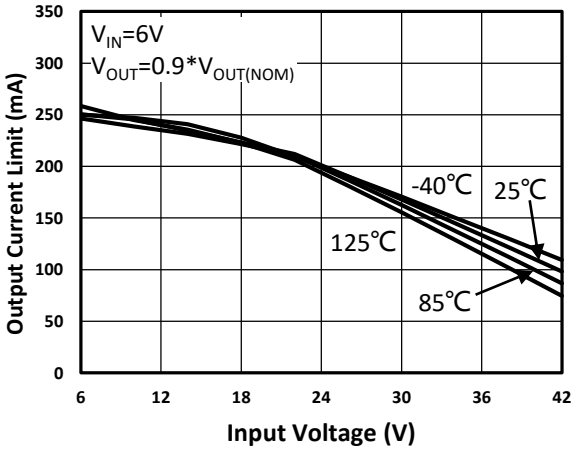
Output Current vs Output Voltage



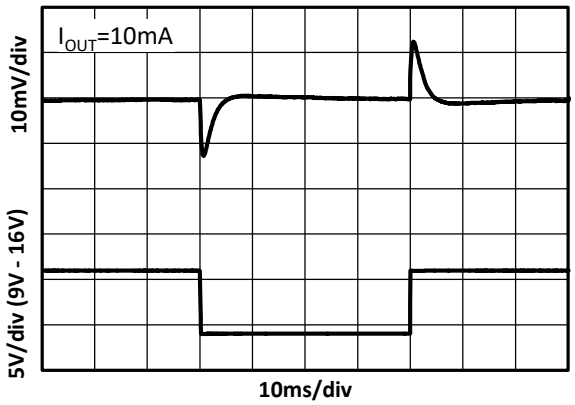
Power Supply Rejection Ratio



Output Current Limit vs Input Voltage



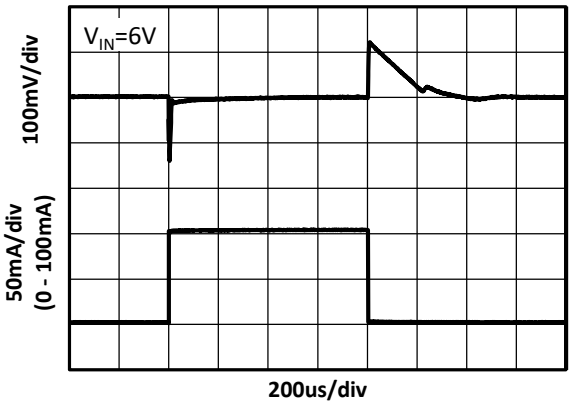
Line Transient (V_{OUT} = 5 V)



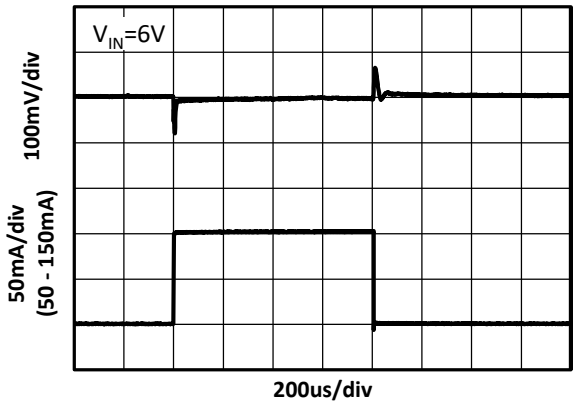
TYPICAL CHARACTERISTICS (CONTINUE)

At T_J = +25°C, V_{IN} = $V_{OUT(NOM)}$+1V or 3.6V, C_{OUT} = 2.2 µF (unless otherwise noted)

Load Transient (V_{OUT} = 5 V)



Load Transient (V_{OUT} = 5 V)



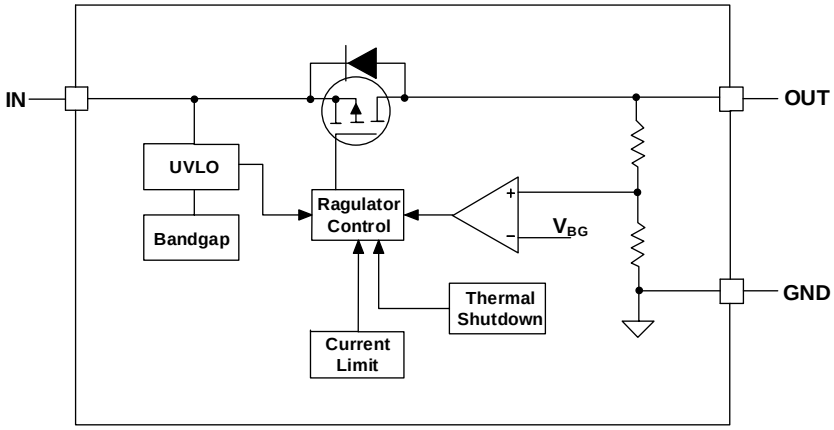
DETAILED DESCRIPTION

Overview

The TS6122 series products are 150mA wide input range linear regulators with a very low quiescent current. These voltage regulators operate from 3.6V to 42V and consume 2μA of quiescent current at no load.

The TS6122 series products are available in fixed output voltage versions of 1.2V,1.5V,1.8V,2.5V,2.8V,3V,3.3V, and 5V with ±2% output voltage accuracy over operating conditions.

Functional Block Diagram



Feature Description

Under-Voltage Shutdown

This device has an integrated under-voltage lock-out (UVLO) circuit to shut down the output if the input voltage (V_{IN}) falls below an internal UVLO threshold (V_{UVLO}). This threshold limit ensures that the regulator does not latch into an unknown state during low-input-voltage conditions. If the input voltage has a negative transient that drops below the UVLO threshold and recovers, the regulator shuts down and powers up with a normal power-up sequence when the input voltage is above the required level.

Regulated Output Voltage

The TS6122 series products are available in fixed voltage versions of 1.2V,1.5V,1.8V,2.5V,2.8V,3V, 3.3 V, and 5V. When the input voltage is higher than $V_{OUT(NOM)}$ + V_{DO} or 3.6V, the output pin is the regulated output based on the selected voltage version. When the input voltage falls below $V_{OUT(NOM)}$ + V_{DO} or 3.6V, the output pin tracks the input voltage minus the dropout voltage based on the load current. When the input voltage drops below the UVLO threshold, the output keeps shutting off.

Current Limit

This device features current-limit protection to keep the device in a safe operating area when an overload or output short-to-ground condition occurs. This limit protects the device from excessive power dissipation. For example, during a short-circuit condition on the output, fault protection limits the current through the pass element to ILIMIT to protect the device from excessive power dissipation.

Thermal Shutdown

This device incorporates a thermal shutdown (T_{SD}) circuit as a protection from overheating. For continuous normal operation, the junction temperature must not exceed the T_{SD} trip point. The junction temperature exceeding the T_{SD} trip point causes the output to turn off. When the junction temperature falls below the T_{SD} trip point minus thermal shutdown hysteresis, the output turns on again.

APPLICATION and IMPLEMENTATION

NOTE

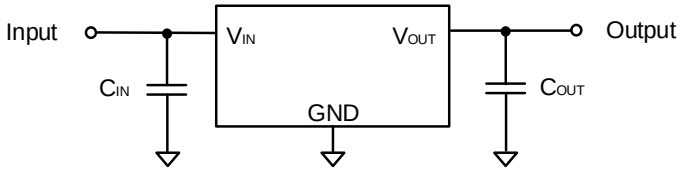
Information in the following applications sections is not part of the Trusignal's component specification and Trusignal does not warrant its accuracy or completeness. Trusignal's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

● Application Information

The TS6122 series products are 42V 150mA wide input range linear regulators with a very low quiescent current. The following application schematic shows a typical usage of the TS6122 series.

● Typical Application

The picture shows the typical application schematic of the TS6122 series.



➢ Input Capacitor and Output Capacitor

Trusignal recommends adding a 2.2μF or greater capacitor with a 0.1μF bypass capacitor in parallel at IN pin to keep the input voltage stable. An aluminum electrolytic capacitor or other capacitors with high capacitance is suggested for the system power with a large voltage spike. The voltage rating of the capacitors must be greater than the maximum input voltage.

To ensure loop stability, the TS6122 series requires an output capacitor with an effective capacitance value of 2.2μF to 22μF. Trusignal recommends selecting an X5R or X7R type 4.7μF ceramic capacitor withs low ESR over the temperature range.

Both input capacitors and output capacitors must be placed as close to the device pins as possible.

➢ Power Dissipation

During normal operation, LDO junction temperature should not exceed 125°C. Use the equations below to calculate the power dissipation and estimate the junction temperature.

The power dissipation can be calculated using Equation 1.

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_{GND} \quad (1)$$

The junction temperature can be estimated using Equation 2. θ_{JA} is the junction-to-ambient thermal resistance (See Section Thermal Information).

$$T_J = T_A + P_D \times \theta_{JA} \quad (2)$$

● Layout Guideline

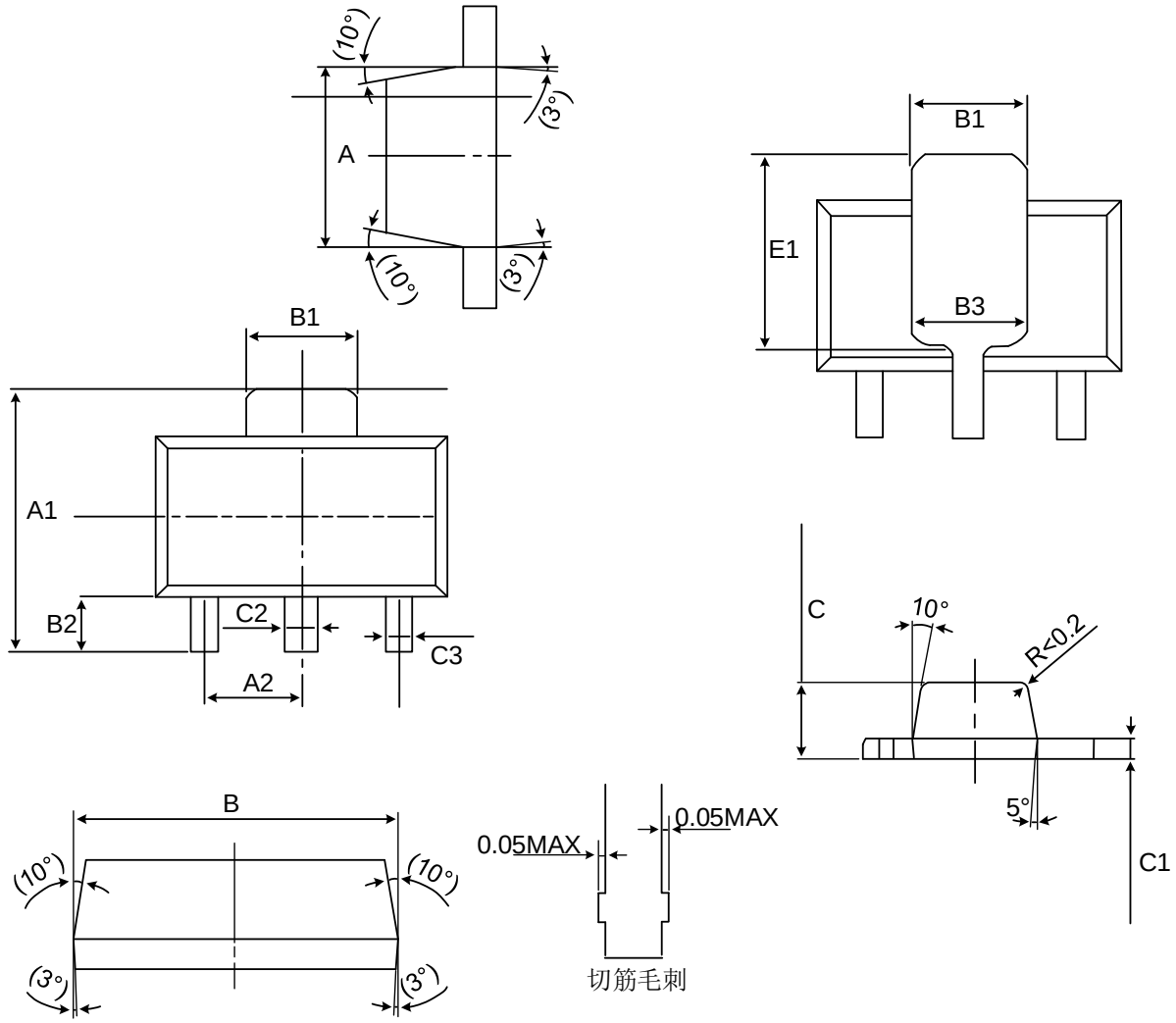
Both input capacitors and output capacitors must be placed as close to the device pins as possible.

It is recommended to bypass the input pin to ground with a 0.1μF bypass capacitor. The loop area formed by the bypass capacitor connection, the IN pin, and the GND pin of the system must be as small as possible.

It is recommended to use wide trace lengths or thick copper weight to minimize I×R drop and heat dissipation.

MECHANICAL DIMENSIONS

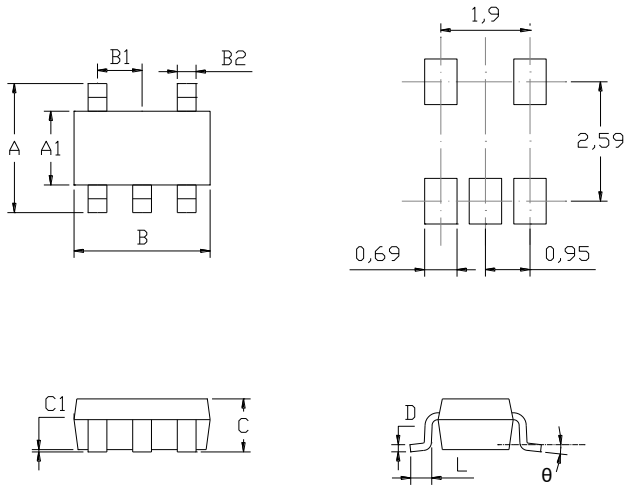
SOT89-3L PACKAGE MECHANICAL DRAWING



SOT89-3L PACKAGE MECHANICAL DATA

Common dimensions units measure=millimeter			
symbol	min	nom	max
A	2.35	2.45	2.55
A1	4.00	4.10	4.20
A2	1.45	1.50	1.55
B	4.40	4.50	4.60
B1		1.55 REF	
B2	1.00	1.10	1.20
B3		1.63 REF	
C	1.45	1.50	1.55
C1	0.39	0.40	0.41
C2	0.40	0.48	0.55
C3	0.35	0.40	0.45
E1	2.65	2.75	2.85

SOT-23-5L PACKAGE MECHANICAL DRAWING

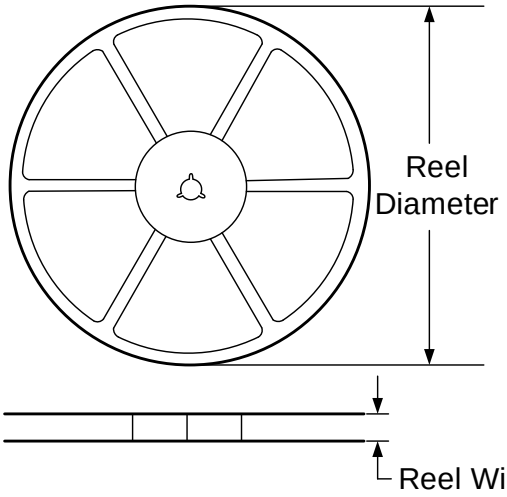


SOT-23-5L PACKAGE MECHANICAL DATA

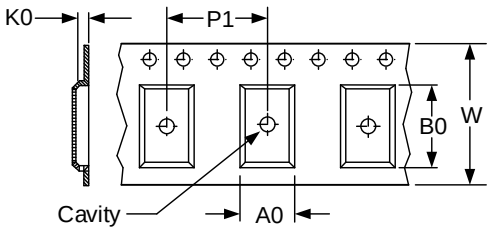
symbol	dimensions			
	millimeters		inches	
	min	max	min	max
A	2.65	2.95	0.104	0.116
A1	1.50	1.70	0.059	0.067
B	2.82	3.02	0.111	0.119
B1	0.95		0.0374	
B2	0.30	0.50	0.012	0.020
C		1.25		0.049
C1	0.00	0.10	0.0000	0.004
L	0.30	0.60	0.012	0.024
D	0.10	0.20	0.004	0.008
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION

REEL DIMENSIONS

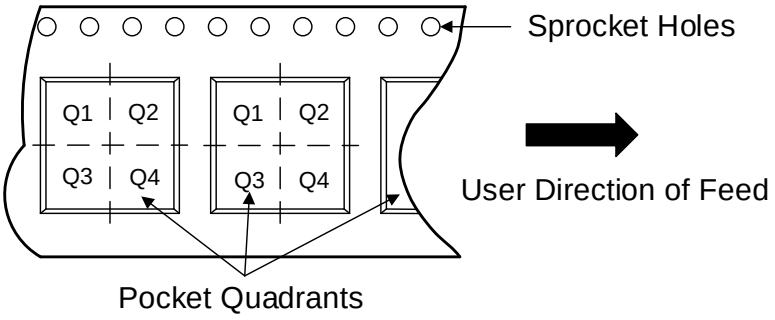


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component width thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

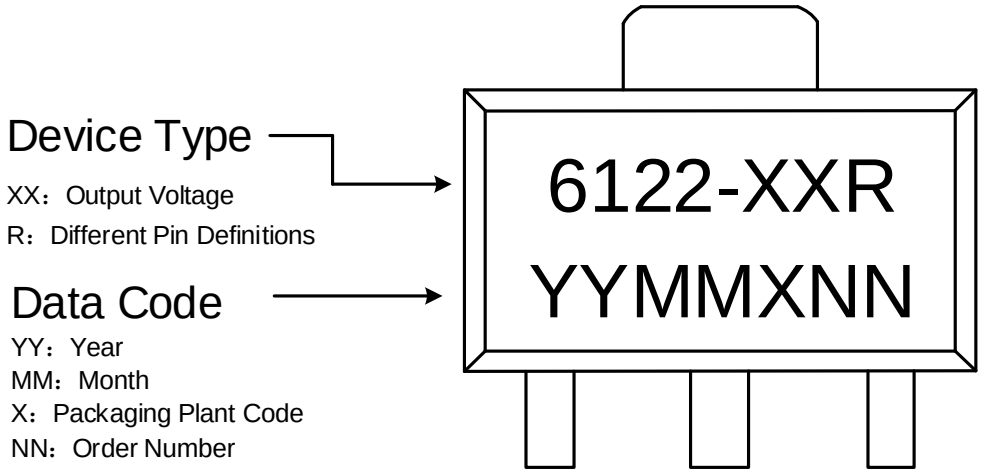
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



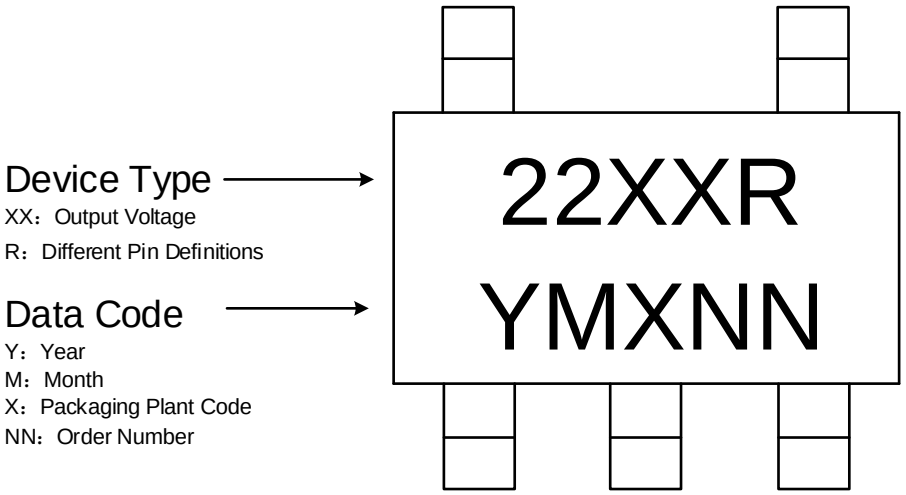
Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TS6122XXSOT893L	SOT89-3L	3	1000	330.0	13.0	4.8	4.43	1.85	8.0	12.0	Q3
TS6122XXSOT893LR	SOT89-3L	3	1000	330.0	13.0	4.8	4.43	1.85	8.0	12.0	Q3
TS6122XXSOT235L	SOT-23-5L	5	3000	180.0	9.0	3.2	3.3	1.4	4.0	8.0	Q3
TS6122XXSOT235LR	SOT-23-5L	5	3000	180.0	9.0	3.2	3.3	1.4	4.0	8.0	Q3

DEVICE PACKAGE MARKING

SOT89-3L PACKAGE MARKING



SOT-23-5L PACKAGE MARKING



REVISION HISTORY

NOTE: Page numbers for previous revisions may be different from that of the current version.

2022/06/12 — REV KY0.0.0

Initial version……...all pages

2023/10/07 — REV KY0.0.0 to REV KY1.0.0

Update parameters related to ***Maximum Output Current***…...……..……...all pages

2023/12/05 — REV KY1.0.0 to REV KY1.1.0

Added ***SOT-23-5L*** package…...……..……..1、2、10

2024/03/20 — REV KY1.1.0 to REV KY1.1.1

Update ***Container, Pack Qty***…...……..……..2、11

2024/03/31 — REV KY1.1.1 to REV KY1.1.2

Update ***SOT-23-5LR*** package…...……..……..1、2、10

2024/04/25 — REV KY1.1.2 to REV KY1.2.2

Add Device Package Marking…...……..……..12

2024/05/13 — REV KY1.1.2 to REV KY1.2.3

Update Package Marking…...……..……..2

CONTACT INFORMATION

Trusignal Microelectronics

Phone: +86 512-65923982
Fax: +86 512-65923995
Email: support@kunyuanic.com; support@kunyuanic.com;