

## Excellent Integrated System Limited

Stocking Distributor

Click to view price, real time Inventory, Delivery & Lifecycle Information:

[Sanken](#)  
[NR301E](#)

For any questions, you can email us directly:

[sales@integrated-circuit.com](mailto:sales@integrated-circuit.com)

## Io=1A, Vin=27V, eSOIC8 Linear Regulator IC

# NR301E

Sep./19/2014

### General Descriptions

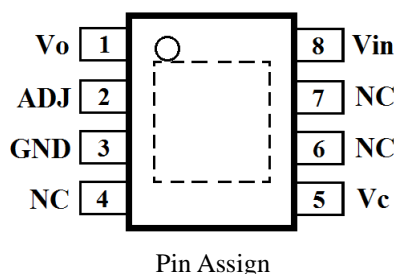
NR301E is the low saturation voltage type  $I_o=1.0A$  linear regulator IC built in the exposed SOIC8 package. The output voltage  $V_o$  is adjustable by the external resistor. In this IC, start-up and shut-down are possible by the external signal input. Over-current protection and thermal protection are built in as a protection function. A low-ESR capacitor like a ceramics capacitor can be used for the output capacitor.

### Features & Benefits

- The output voltage is adjustable by the external resistor.
- Start-up and shut-down are possible when a VC terminal is used. (External signal input)
- Ceramics capacitor is possible to use as the output capacitor.
- Protection Functions
  - Over current protection(OCP)
  - Thermal protection with temperature hysteresis . (TSD)

### Package

- Package Name : Exposed SOIC 8
- Exposed pad is a radiator on back-side of package.
- Surface mount 8-pin package  
Exposed SOIC 8(HSOP8)



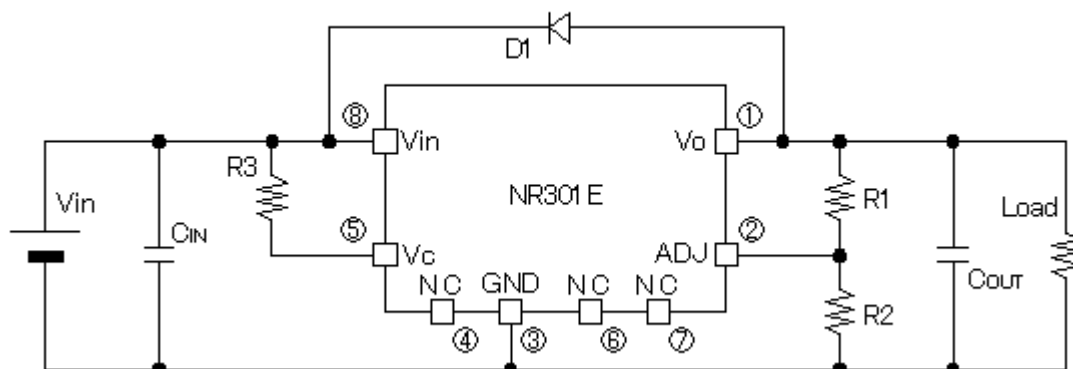
### Electrical Characteristics

- Input voltage:  $V_{in}=2.7V$  to  $27V$  (Recommended)
- Reference voltage:  $V_{FB} = 1.0V \pm 1.5\%$
- Output current:  $I_o = 1.0A$
- Difference in input and output:  $V_{DIF} = \text{typ. } 0.6V$

### Applications

- For local regulator circuit
- LCD-TV/STB/DVD/Blu-Ray
- Audio/PC
- USB output protection

### Typical Application Circuit



$C_{IN} : 1 \mu F / 50V, C_{OUT} : 1 \mu F / 50V, R_1 : 39k\Omega + 1k\Omega, R_2 : 10k\Omega$

## Io=1A, Vin=27V, eSOIC8 Linear Regulator IC

# NR301E

Sep./19/2014

### Series Line-up

Products name	Vin(max)	Io(max)	Vc(on/off)	V <sub>DIF</sub>
NR301E	30V	1A	2V/0.6V	0.6V@1A,0.3V@0.5A

### Absolute Maximum Ratings

\*The condition when there is no special mention: Ta=25°C

Parameter	terminal	Symbol	Ratings	Units	Conditions
DC input voltage	4-8	V <sub>in</sub>	30	V	
Vc terminal voltage	4-5	V <sub>C</sub>	30	V	V <sub>C</sub> ≤ V <sub>in</sub>
ADJ terminal voltage	4-3	V <sub>ADJ</sub>	5.0	V	
Power Dissipation <sup>(1)</sup>	—	P <sub>D</sub>	1.4	W	Glass-epoxy board mounting in a 30×30mm. (copper area in a 25×25mm)
Thermal Resistance(junction to ambient Air)	—	θ <sub>j-a</sub>	71	°C/W	
Thermal Resistance (junction to Pin No.4)	—	θ <sub>j-L</sub>	26	°C/W	
Junction temperature	—	T <sub>J(max)</sub>	-40~+125	°C	This product builds in an thermal protection circuit. When junction-temperature is more than 135°C,thermal protection often works.
Strage temperature	—	T <sub>stg</sub>	-40~+125	°C	

<sup>(1)</sup> Limited by thermal shutdown.

<sup>(2)</sup> The temperature detection of thermal shutdown is about 155°C (Typical).

### Recommended Operating Conditions

\*The condition when there is no special mention: Ta=25°C

Parameter	terminal	Symbol	Ratings		Units	Conditions
			MIN	MAX		
Input voltage range <sup>(1)</sup>	4-8	V <sub>in</sub>	2.7	27	V	
Output current range <sup>(1)</sup>	4-8	I <sub>O</sub>	0	1.0	A	
Output voltage range	—	V <sub>O</sub>	1.1	16	V	Refer to Page7
Ambient operating temperature	—	T <sub>OP(a)</sub>	-30	85	°C	
Junction operating temperature	—	T <sub>OP(j)</sub>	-30	100	°C	

<sup>(1)</sup>V<sub>in</sub> and I<sub>O</sub> are restricted by the use condition because there are relations of PD= (V<sub>in</sub>-V<sub>O</sub>) ×I<sub>O</sub>.

**Io=1A, Vin=27V, eSOIC8 Linear Regulator IC**

# NR301E

Sep./19/2014

**Electrical Characteristics**

 The condition when there is no special mention:  $V_{in}=V_o+1V$ ,  $V_o=5V(\text{typ})$  :  $R1=10k\Omega$ ,  $R2=39k+1k$ ,  $T_a=25^\circ\text{C}$ 

Parameter	Symbol	Ratings			Units	Conditions	
		MIN	TYP	MAX			
Reference voltage	$V_{ADJ}$	0.985	1.00	1.015	V	$I_o=10\text{mA}$	
Line regulation	$\Delta V_{LINE}$	—	25	50	mV	$V_{in}=6\sim 15V$ , $I_o=10\text{mA}$	
Load regulation	$\Delta V_{LOAD}$	—	30	60	mV	$I_o=0\sim 1A$	
Difference in input and output	$\Delta V_{DIF}$	—	0.3	0.4	V	$I_o=0.5A$	
		—	0.6	0.8	V	$I_o=1A$	
Supply Current(Non-operating)	$I_q$	0.5	0.9	1.6	mA	$I_o=0\text{mA}$ , $V_c=2V$	
Shutdown Supply Current	$I_{q(OFF)}$	—	0	1	uA	$V_c=0V$	
Output voltage temperature coefficient	$\Delta V_o/\Delta T_a$	—	$\pm 0.5$	—	mV/ $^\circ\text{C}$	$T_j=0\sim 100^\circ\text{C}$	
Power supply rejection ratio	R.REJ	—	55	—	dB	$V_o=5V$ , $I_o=0.1A$ , $f=100\sim 120\text{Hz}$	
Output voltage control terminal voltage *2	$V_o$ :ON	$V_{C(H)}$	2.0	—	—	V	$I_o=10\text{mA}$
	$V_o$ :OFF	$V_{C(L)}$	—	—	0.6	V	$I_o=10\text{mA}$
Output voltage control terminal current *2	$V_o$ :ON	$V_{C(IH)}$	—	4	40	uA	$V_c=2.0V$
	$V_o$ :OFF	$V_{C(IL)}$	-2	0	0.1	uA	$V_c=0V$
Over current protection threshold *3	$I_{S1}$	1.1	—	—	A	$V_{in}=7V$	
Thermal shutdown threshold temperature	TSD	135	155	—	$^\circ\text{C}$	—	
Thermal shutdown restart hysteresis of temperature	$TSD_{(HYS)}$	—	50	—	$^\circ\text{C}$	—	

\*2 The internal circuit of the  $V_c$ -terminal is high impedance, To avoid a un-stable condition, the  $V_c$ -terminal must surely pull-up or pull-down.

Because  $V_c$ -terminal input level is equal to the LS-TTL, therefore direct-drive is possible.

\*3  $I_{S1}$  is prescribed that the output voltage  $V_o$  descend to -5%.

**Io=1A, Vin=27V, eSOIC8 Linear Regulator IC**

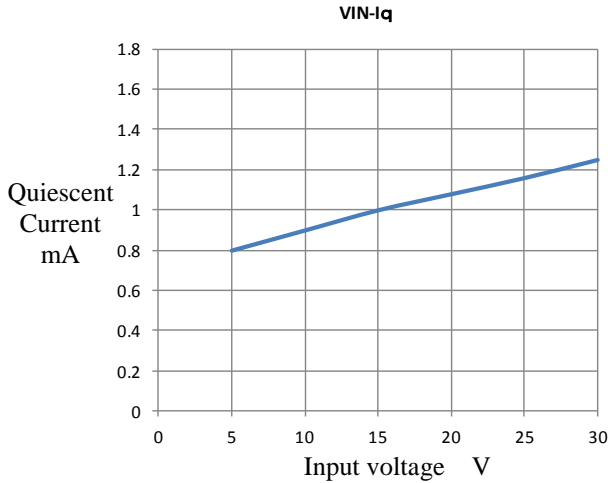
**NR301E**

Sep./19/2014

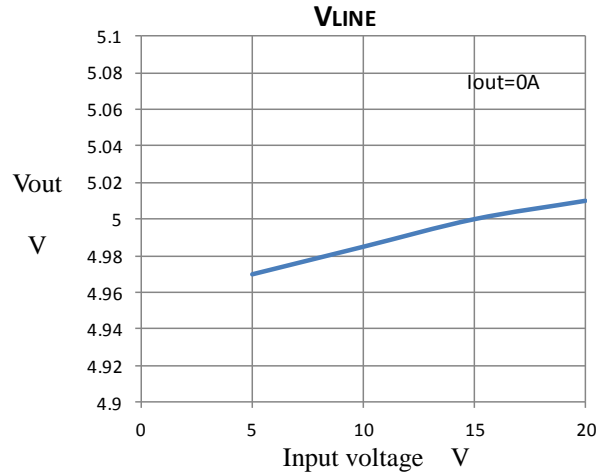
**Typical Performance Characteristics**

\* Vout = 5V 設定時.(R2=10kΩ) Ta=25°C

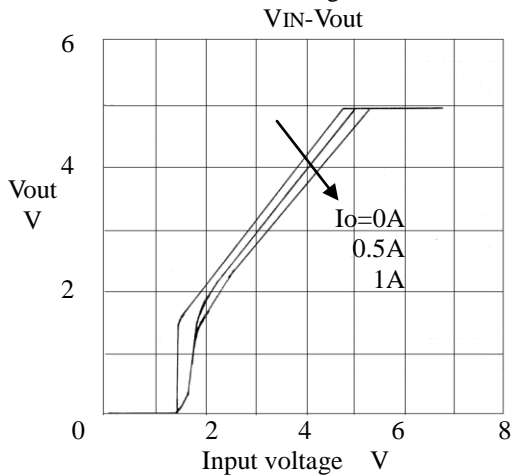
(1) Quiescent Current



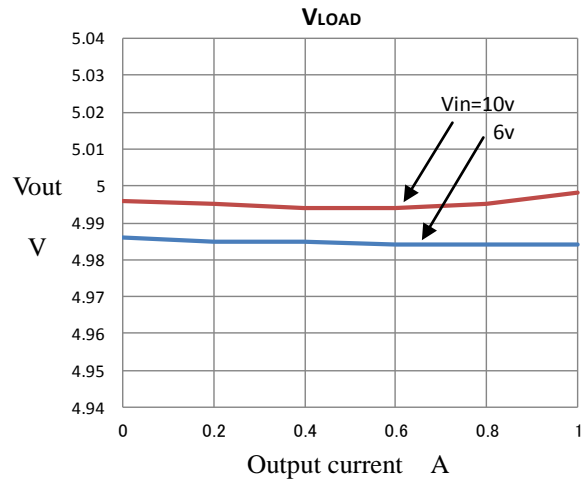
(4) Line regulation



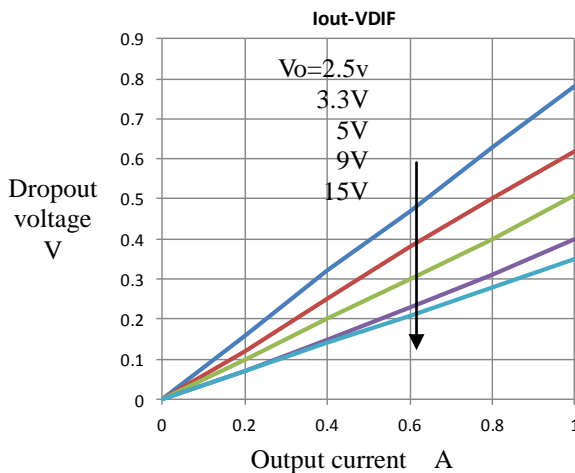
(2) Input voltage vs. Output voltage



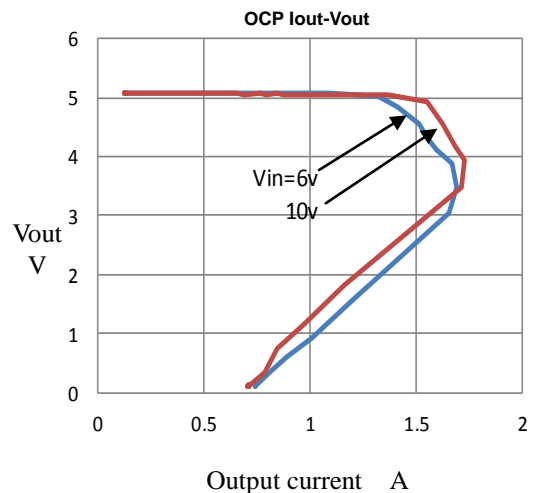
(5) Load regulation



(3) Output current vs. Dropout voltage



(6) Over current protection

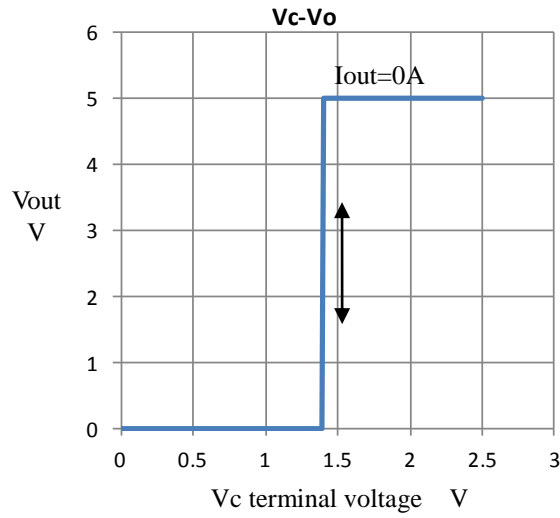


**Io=1A, Vin=27V, eSOIC8 Linear Regulator IC**

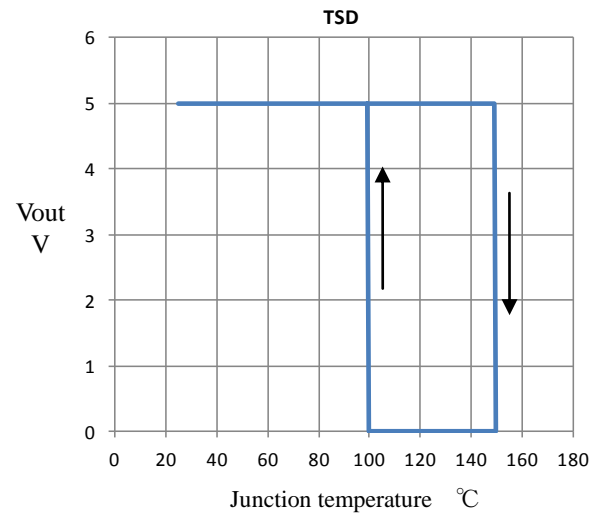
**NR301E**

Sep./19/2014

(7) On/Off Control



(8) Thermal shut down

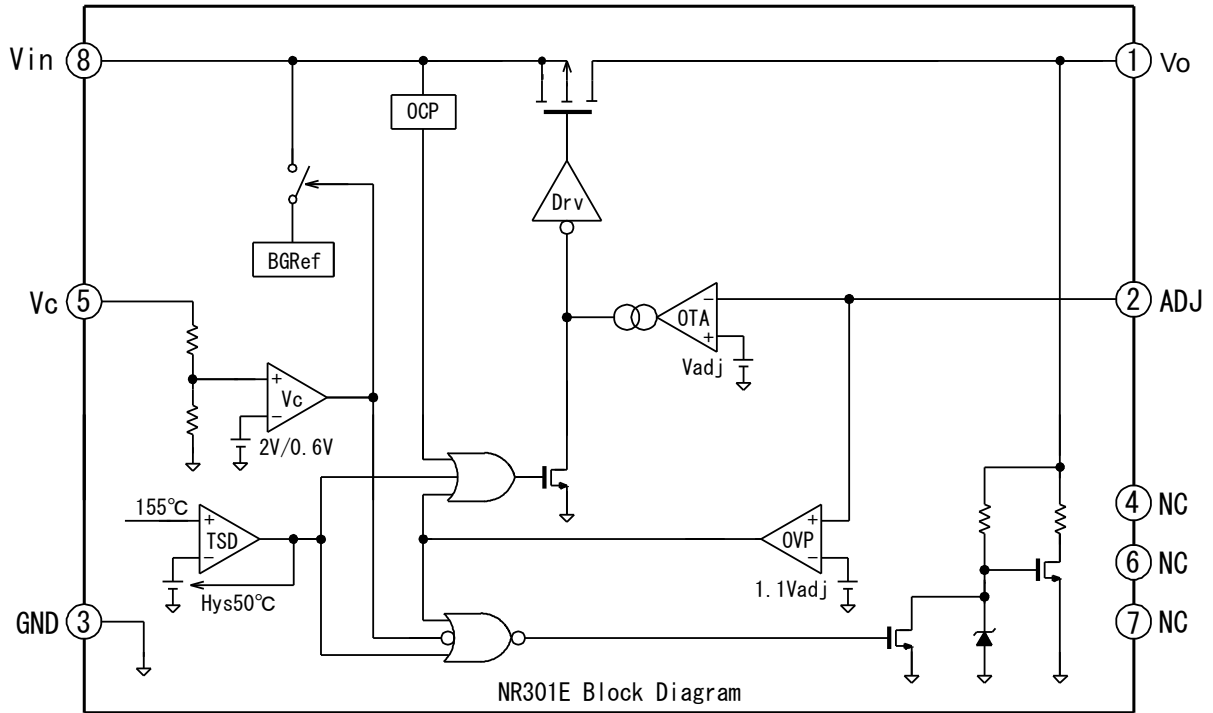


**Io=1A, Vin=27V, eSOIC8 Linear Regulator IC**

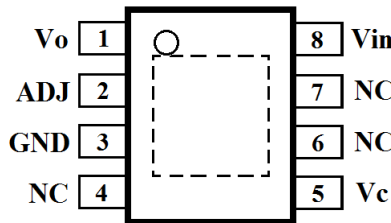
**NR301E**

Sep./19/2014

**Functional Block Diagram**



**Pin Assignments & Functions**



Pin assign & function

Pin No.	Symbol	Description
1	V <sub>O</sub>	Output voltage
2	ADJ	Output voltage adjustment
3	GND	Ground
4	NC	No connection
5	V <sub>c</sub>	Output ON/OFF control
6	NC	No connection
7		
8	V <sub>in</sub>	Input voltage

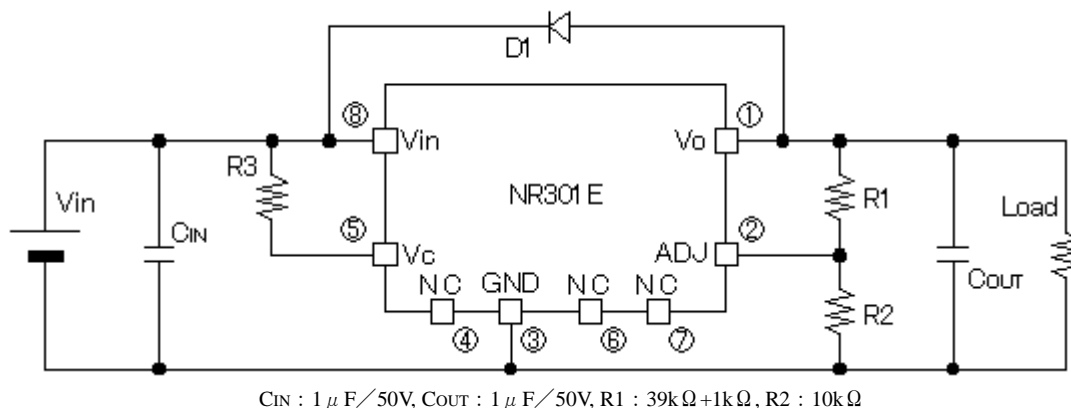
\*Back side FIN(Exposed thermal pad): Sub- straight (Ground)

**Io=1A, Vin=27V, eSOIC8 Linear Regulator IC**

**NR301E**

Sep./19/2014

**Example Application Circuit**



**A precaution in design**

In case of the Vo=5V and Vin=6V.

CIN, COUT : 1μF/16V

R1, R2 : It is controlled so that ADJ-GND voltage may be 1V (typ).

R1 : 39k+1k(A resistor for the fine tuning),

R2 : 10k

$$V_o = \frac{R_1 + R_2}{R_2} V_{adj} \quad R_1 = \frac{V_o - V_{adj}}{V_{adj}} R_2$$

R3 : About handling of the Vc terminal function .

case1) If you don't use Vc function ( Vo normally ON ), Vc must connect to Vin directly with R3= 0Ω.

case2) If you use Vc function (Vo ON/OFF) by TTL-Logic signal, R3 is unnecessary. Input a TTL-Logic signal to Vc directly.

case3) If you use Vc function (Vo ON/OFF) by the condition of open-collector or open-drain, You must connect pull-up resistor R3 between Vin and Vc.

D1 : Diode for the reverse bias protection. When relations between the input voltage and the output voltage are reversed (Vin<Vo),this diode is necessary.

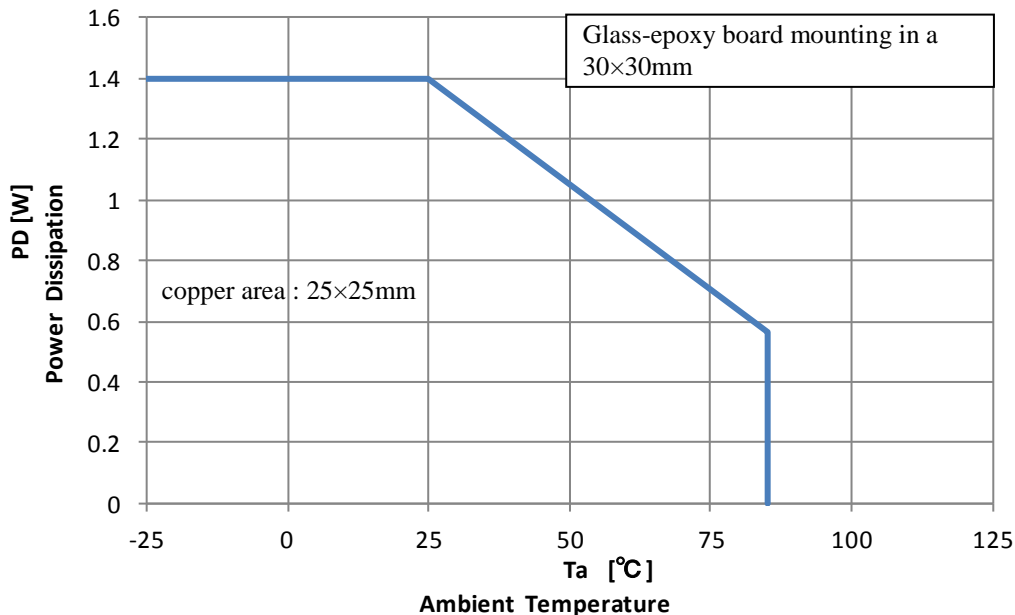


**Io=1A, Vin=27V, eSOIC8 Linear Regulator IC**

**NR301E**

Sep./19/2014

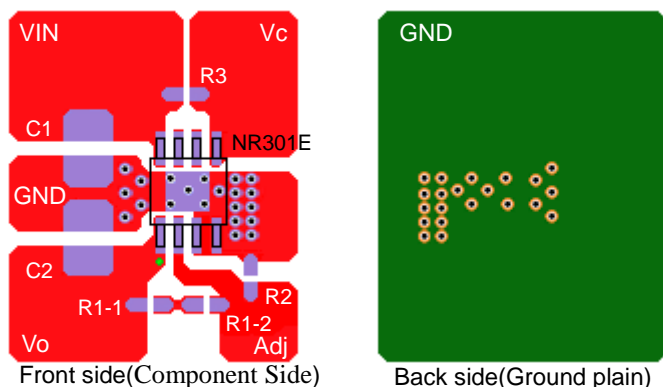
**Allowable package power dissipation**



Note:

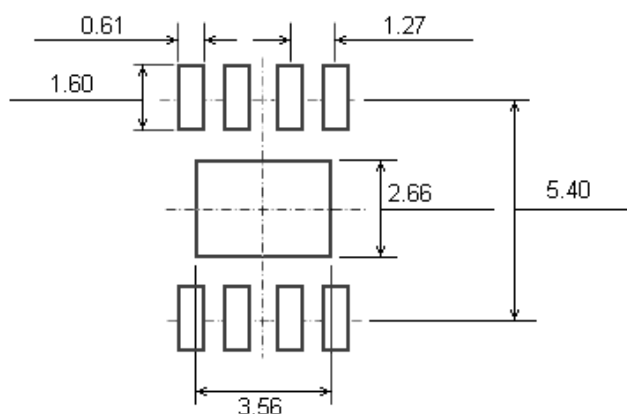
\*The power dissipation is calculated at the junction temperature 125 °C

**Pattern Design**



Note:

Size of the PCB is about 28mm × 40mm t=1.6mm (double sided board, copper foil thickness=35 μ m)



Note:

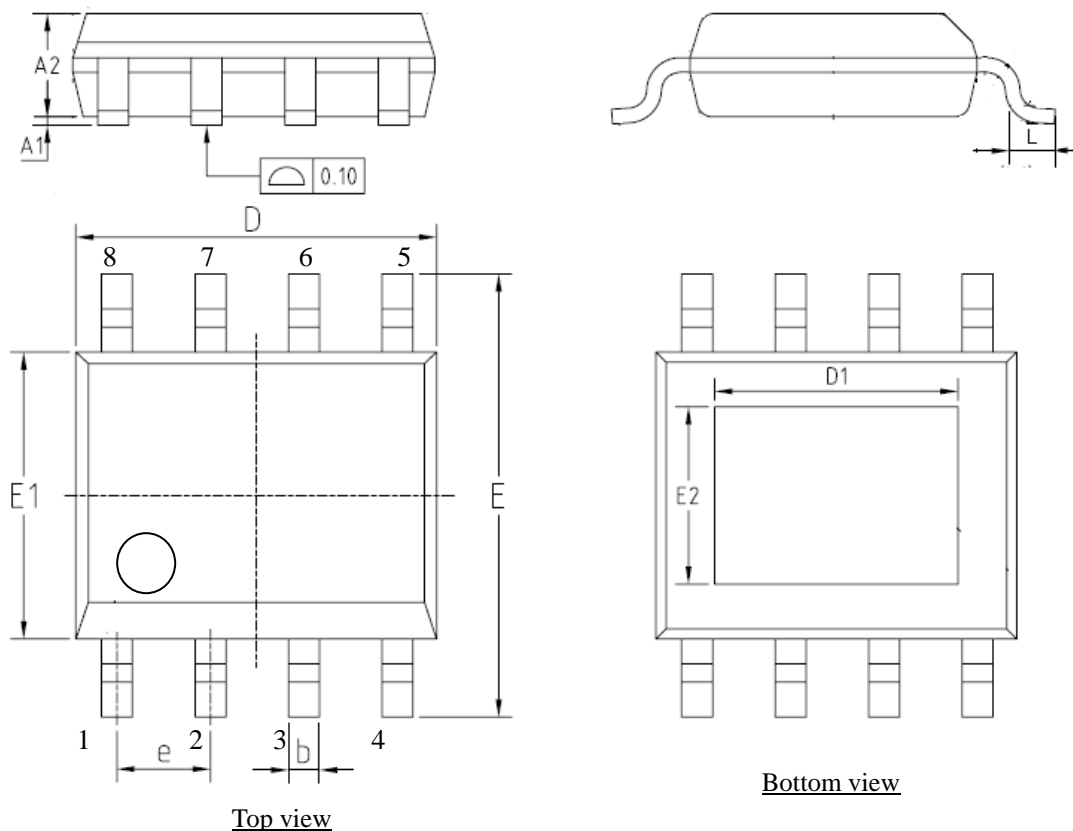
1) Dimension is in millimeters, dimension in bracket is in inches.  
 2) Drawing is not to scale.

**Io=1A, Vin=27V, eSOIC8 Linear Regulator IC**

**NR301E**

Sep./19/2014

**Package Outline (Exposed SOIC8)**



Exposed SOIC8 package Outline

Outside size table

Symbol	Dimension		
	MIN	TYP	MAX
A1	0	0.10	0.15
A2	1.25	1.40	1.65
b	0.38	—	0.51
D	4.80	4.90	5.00
D1	3.10	3.30	3.50
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
E2	2.20	2.40	2.60
e	—	1.27	—
L	0.45	0.60	0.80

Notes:

- 1) Dimension is in millimeters(mm).
- 2) Drawing is not to scale.

**Io=1A, Vin=27V, eSOIC8 Linear Regulator IC**

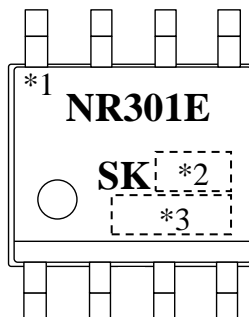
**NR301E**

Sep./19/2014

**Marking of NR301E**

Laser marking, specifications are based on the following.

- \*1. Product number
- \*2. Lot number (three digit)
  - 1st letter : The last digit of the year
  - 2nd letter : Month
  - January to September : 1 to 9
  - October : O
  - November : N
  - December : D
- 3rd letter : manufacturing week
  - First week to 5th week : 1 to 5
- \*3. Control number (four digit)



Marking specification

## **Io=1A, Vin=27V, eSOIC8 Linear Regulator IC**

# **NR301E**

Sep./19/2014

### **OPERATING PRECAUTIONS**

Reliability can be affected adversely by improper storage environments and handling methods. Please observe the following cautions.

#### **Heat dissipation and reliability**

Thermal performance of the surface mount package IC depends on the material and area size of PCB and its copper plane. Design thermal condition with sufficient margin

#### **Parallel operation**

The parallel operation to increase the current is not available.

#### **Thermal shut down**

The NR301E has a thermal protection circuit.

This circuit protects the IC from the heat generation by the over load.

This circuit cannot guarantee the long-term reliability against the continuously over load status.

#### **Cautions for Storage**

- Ensure that storage conditions comply with the standard temperature (5 to 35°C) and the standard relative humidity (around 40 to 75%); avoid storage locations that experience extreme changes in temperature or humidity.
- Avoid locations where dust or harmful gases are present and avoid direct sunlight.
- Reinspect for rust on leads and solderability of products that have been stored for a long time.

#### **Cautions for Testing and Handling**

- When tests are carried out during inspection testing and other standard test periods, protect the products from power surges from the testing products, shorts between the product pins, and wrong connections. In addition, avoid tests exceeded ratings

#### **Soldering**

When soldering the products, please be sure to minimize the working time, within the following limits.

- Reflow Preheat ; 180°C / 90±30s  
Heat ; 250°C / 10±1s (260°C peak ,2times)
- Soldering iron ; 380±10°C / 3.5±0.5s (1time)

#### **Electrostatic Discharge**

- When handling the products, the operator must be grounded. Grounded wrist straps worn should have at least 1MΩ of resistance from the operator to ground to prevent shock hazard, and it should be placed near the operator.
- Workbenches where the products are handled should be grounded and be provided with conductive table and floor mats.
- When using measuring equipment such as a curve tracer, the equipment should be grounded.
- When soldering the products, the head of a soldering irons or the solder bath must be grounded in order to prevent leak voltages generated by them from being applied to the products.
- The products should always be stored and transported in Sanken shipping containers or conductive containers, or be wrapped in aluminum foil.

## Io=1A, Vin=27V, eSOIC8 Linear Regulator IC

# NR301E

Sep./19/2014

### IMPORTANT NOTES

- The contents in this document are subject to changes, for improvement and other purposes, without notice. Make sure that this is the latest revision of the document before use.
- Application and operation examples described in this document are quoted for the sole purpose of reference for the use of the products herein and Sanken can assume no responsibility for any infringement of industrial property rights, intellectual property rights or any other rights of Sanken or any third party which may result from its use.
- Although Sanken undertakes to enhance the quality and reliability of its products, the occurrence of failure and defect of semiconductor products at a certain rate is inevitable. Users of Sanken products are requested to take, at their own risk, preventative measures including safety design of the equipment or systems against any possible injury, death, fires or damages to the society due to device failure or malfunction.
- Sanken products listed in this document are designed and intended for the use as components in general purpose electronic equipment or apparatus (home appliances, office equipment, telecommunication equipment, measuring equipment, etc.).  
When considering the use of Sanken products in the applications where higher reliability is required (transportation equipment and its control systems, traffic signal control systems or equipment, fire/crime alarm systems, various safety devices, etc.), please contact your nearest Sanken sales representative to discuss, prior to the use of the products herein.  
The use of Sanken products without the written consent of Sanken in the applications where extremely high reliability is required (aerospace equipment, nuclear power control systems, life support systems, etc.) is strictly prohibited.
- In the case that you use Sanken semiconductor products or design your products by using Sanken semiconductor products, the reliability largely depends on the degree of derating to be made to the rated values. Derating may be interpreted as a case that an operation range is set by derating the load from each rated value or surge voltage or noise is considered for derating in order to assure or improve the reliability. In general, derating factors include electric stresses such as electric voltage, electric current, electric power etc., environmental stresses such as ambient temperature, humidity etc. and thermal stress caused due to self-heating of semiconductor products. For these stresses, instantaneous values, maximum values and minimum values must be taken into consideration.  
In addition, it should be noted that since power devices or IC's including power devices have large self-heating value, the degree of derating of junction temperature affects the reliability significantly.
- When using the products specified herein by either (i) combining other products or materials therewith or (ii) physically, chemically or otherwise processing or treating the products, please duly consider all possible risks that may result from all such uses in advance and proceed therewith at your own responsibility.
- Anti radioactive ray design is not considered for the products listed herein.
- Sanken assumes no responsibility for any troubles, such as dropping products caused during transportation out of Sanken's distribution network.
- The contents in this document must not be transcribed or copied without Sanken's written consent.