NR301E

Sep/19/2013

General Descriptions

NR301E is the low saturation voltage type Io=1.0A linear regulator IC built in the exposed SOIC8 package.
The output voltage Vo 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.

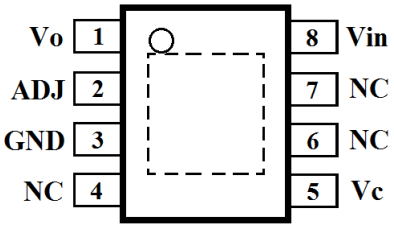
Features & Benefits

- 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)





Pin Assign

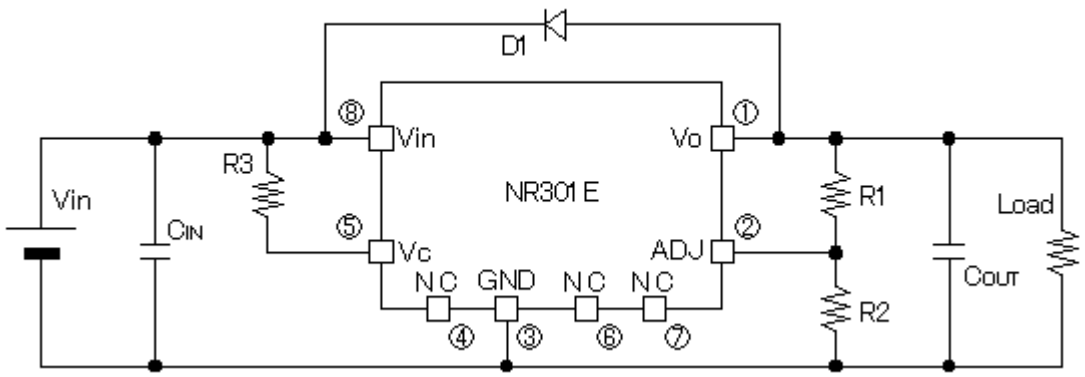
Electrical Characteristics

- Input voltage: *Vin*=2.7V to 27V（Recommeded）
- Reference voltage:V_{FB} = 1.0V ±1.5%
- Output current: I_o= 1.0A
- Difference in input and output:V_{DIF} = typ. 0.6V

Applications

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

Typical Application Circuit



CIN：1μF／50V, COUT：1μF／50V, R1：39kΩ+1kΩ, R2：10kΩ

NR301E

Series Line-up

Products name	Vin(max)	Io(max)	Vc(on/off)	V_{DIF}
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	Vin	30	V	
Vc terminal voltage	4−5	V_C	30	V	Vc≦Vin
ADJ terminal voltage	4−3	V_{ADJ}	5.0	V	
Power Dissipation (1)	—	P_D	1.76	W	Glass-epoxy board mounting in a 30×30mm. (copper area in a 25×25mm)
Thermal Resistance(junction to ambient Air)	—	θj-a	71	°C/W	
Thermal Resistance（junction to Pin No.4）	—	θj-L	26	°C/W	
Junction temperature	—	$T_{J(max)}$	−40～+125	°C	This product builds in an thermal protection circuit. When junction-temperature is more than 135℃,thermal protection often works.
Strage temperature	—	T_{stg}	−40～+125	°C	

(1) Limited by thermal shutdown.
(2) 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 (1)	4−8	Vin	2.7	27	V	
Output current range (1)	4−8	I_O	0	1.0	A	
Output voltage range	—	V_O	1.1	16	V	Refer to Page7
Ambient operating temperature	—	$T_{OP(a)}$	-30	85	°C	
Junction operating temperature	—	$T_{OP(j)}$	-30	100	°C	

(1)Vin and Io are restricted by the use condition because there are relations of PD= (Vin-Vo) ×Io.

Electrical Characteristics

The condition when there is no special mention: Vin＝V_O+1V, V_O＝5V(typ)：R1=10kΩ, R2=39k+1k、Ta= 25℃

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

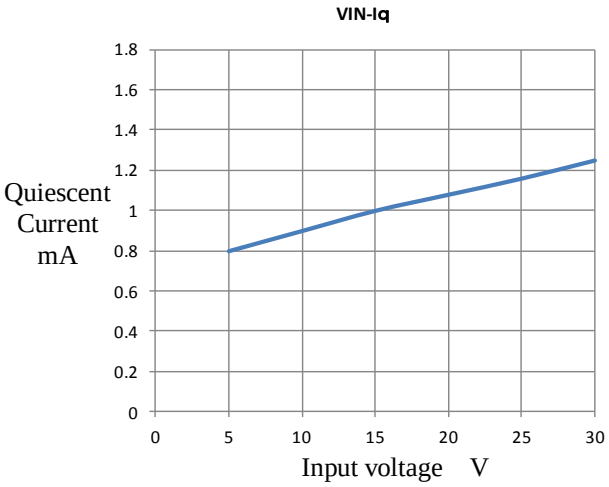
*2 The internal circuit of the Vc-terminal is high impedance, To avoid a un-stable condition, the Vc-terminal must surely pull-up or pull-down.
Because Vc-terminal input level is equal to the LS-TTL, therefore direct-drive is possible.

*3 Is1 is prescribed that the output voltage Vo descend to -5%.

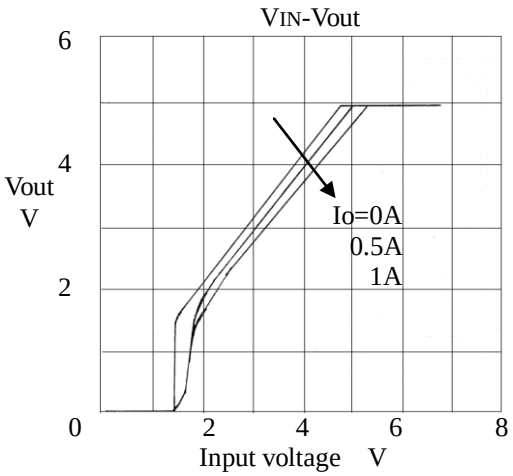
Typical Performance Characteristics

＊Vout＝5V 設定時.(R2=10kΩ) Ta=25℃

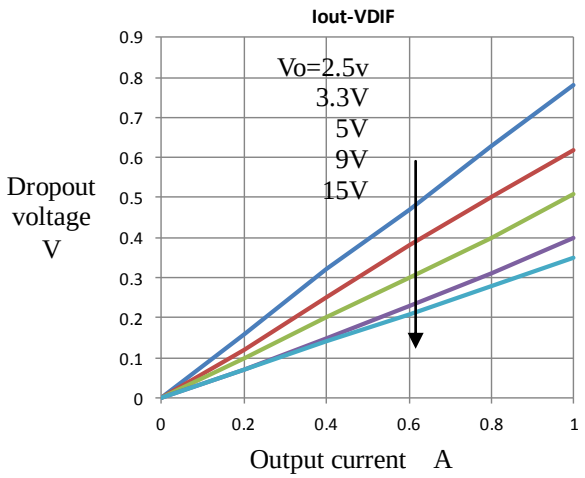
(1) Quiescent Current



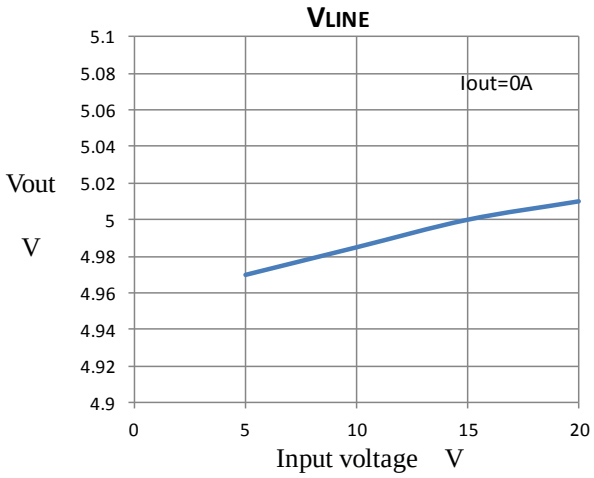
(2)Input voltage vs. Output voltage



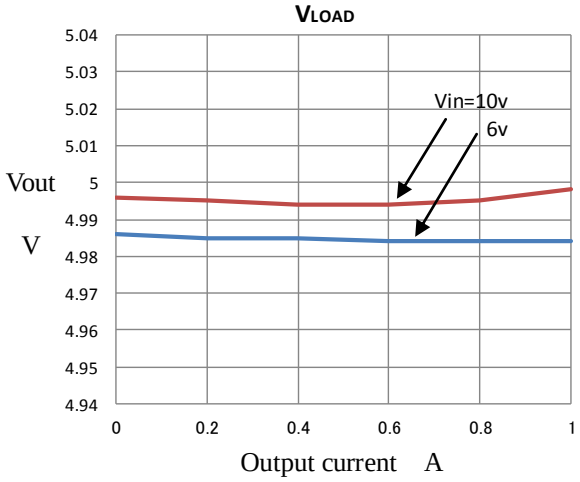
(3)Output current vs. Dropout voltage



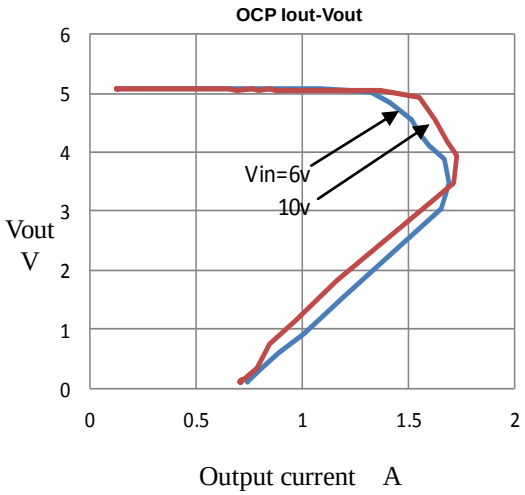
(4)Line regulation



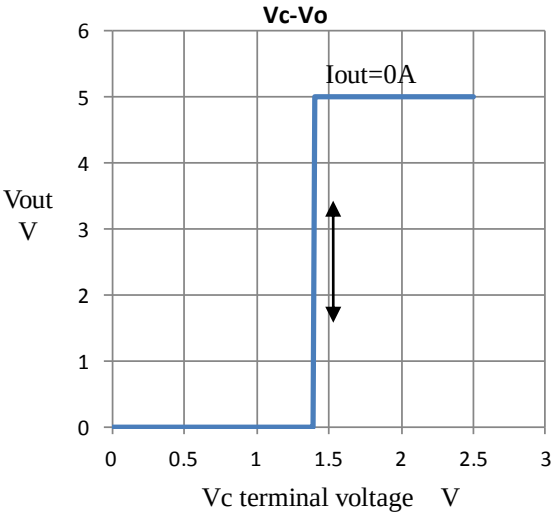
(5)Load regulation



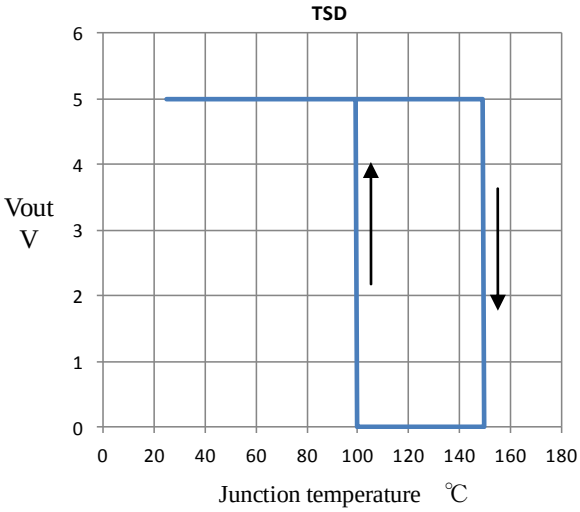
(6)Over current protection



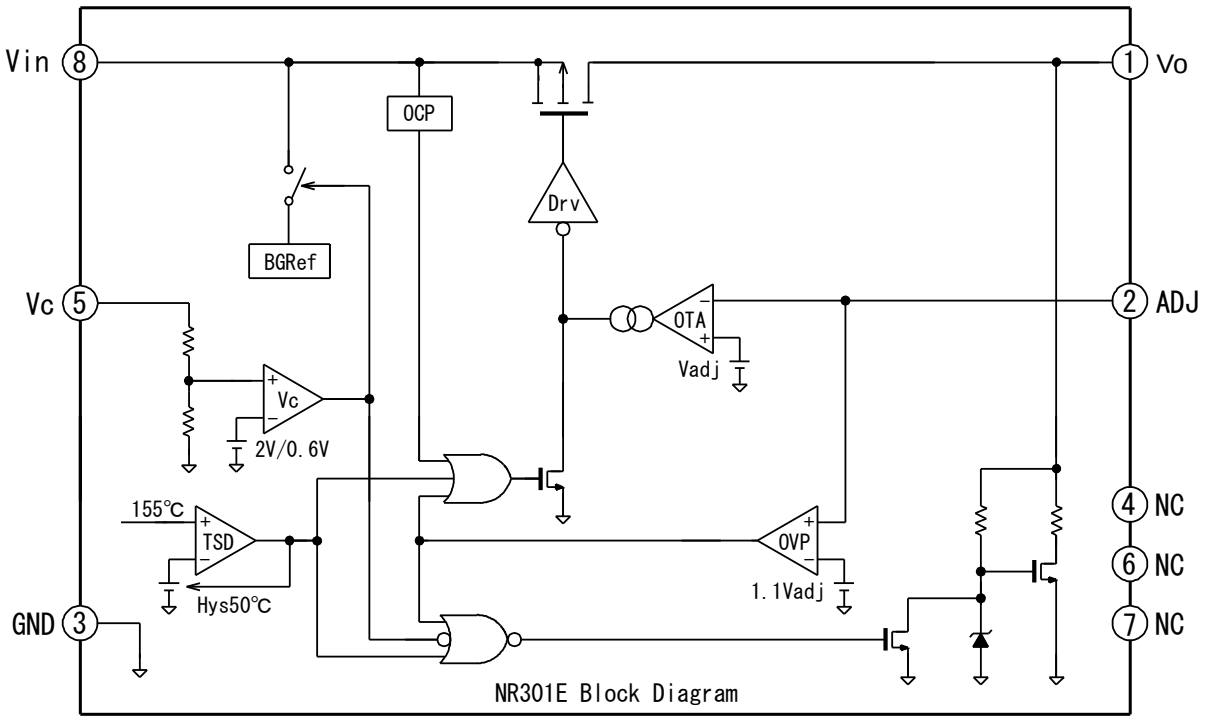
(7)On/Off Control



(８)Thermal shut down

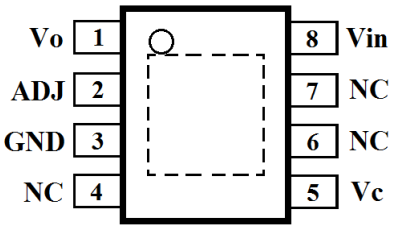


Functional Block Diagram



NR301E Block Diagram

Pin Assignments & Functions

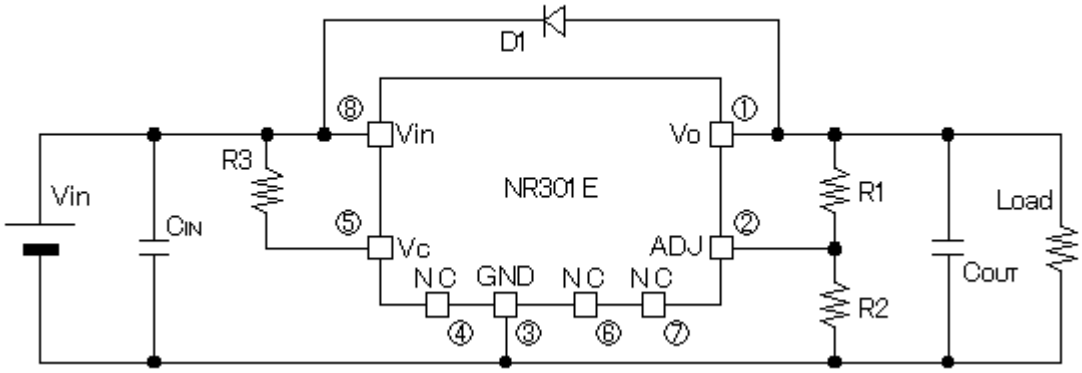


Pin assign & function

Pin No.	Symbol	Description
1	V_O	Output voltage
2	ADJ	Output voltage adjustment
3	GND	Ground
4	NC	No connection
5	V_C	Output ON/OFF control
6	NC	No connection
7		
8	Vin	Input voltage

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

Example Application Circuit



CIN：1μF／50V, COUT：1μF／50V, R1：39kΩ+1kΩ, R2：10kΩ

A precaution in design

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

CIN、COUT　:1uF/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

$$Vo = \frac{R1 + R2}{R2} Vadj \quad R1 = \frac{Vo - Vadj}{Vadj} R2$$

R3　:About handling of the Vc terminal function .

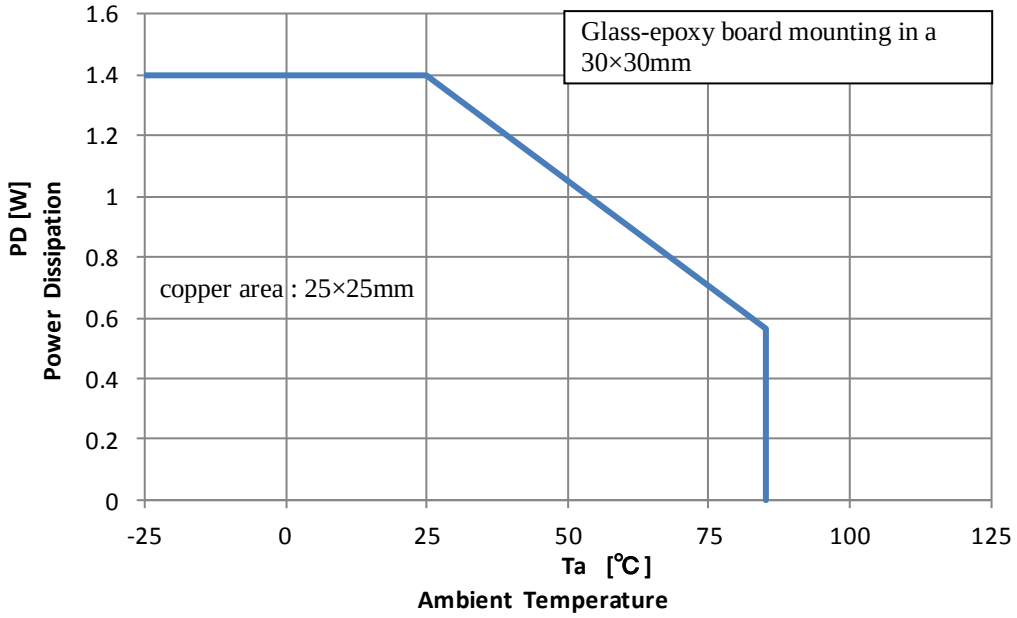
case1）If you don't use Vc function (Vo normally ON), Vc must connect to Vin directly with R3= 0Ω.

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.

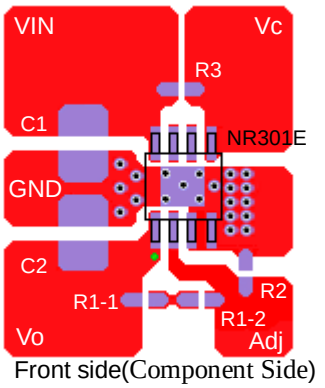
D1　: Diode for the reverse bias protection. When relations between the input voltage and the output voltage are reversed (Vin<Vo),this diode is necessary.

Allowable package power dissipation

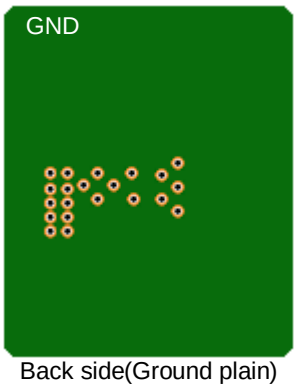


Note:
*The power dissipation is calculated at the junction temperature 125 °C

Pattern Design

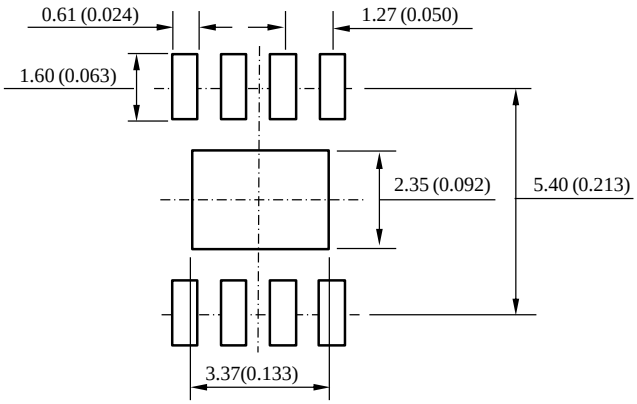


Front side(Component Side)



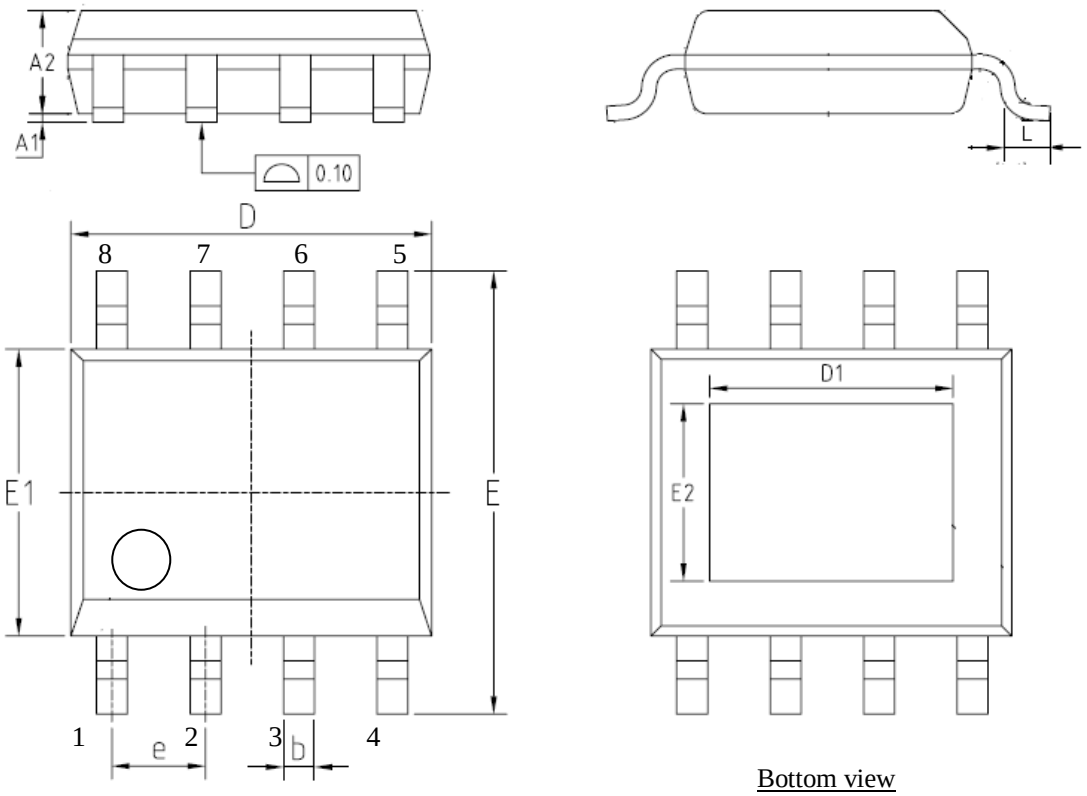
Back side(Ground plain)

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



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

Package Outline (Exposed SOIC8)



Top view

Bottom view

Exposed SOIC8 package Outline

Outside size table

Symbol	Demension		
	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.

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

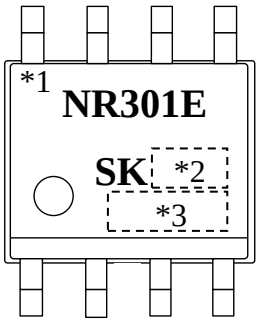
November : N

December : D

3rd letter : manufacturing week

First week to 5th week : 1 to 5

*3. Control number (four digit)



Marking specification

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 1MΩof 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.

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  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.
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