NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC311

PRECISION VOLTAGE COMPARATOR

DESCRIPTION

The μPC311 is a voltage comparator that has input currents more than a hundred times lower than devices like conventional standard type of 710. It is also designed to operate over a wide range of supply voltages; from ±15 V op amp supplies down to the single 5 V supply used for IC logic. Its output is compatible with HNIL, DTL and TTL as well as MOS circuits.

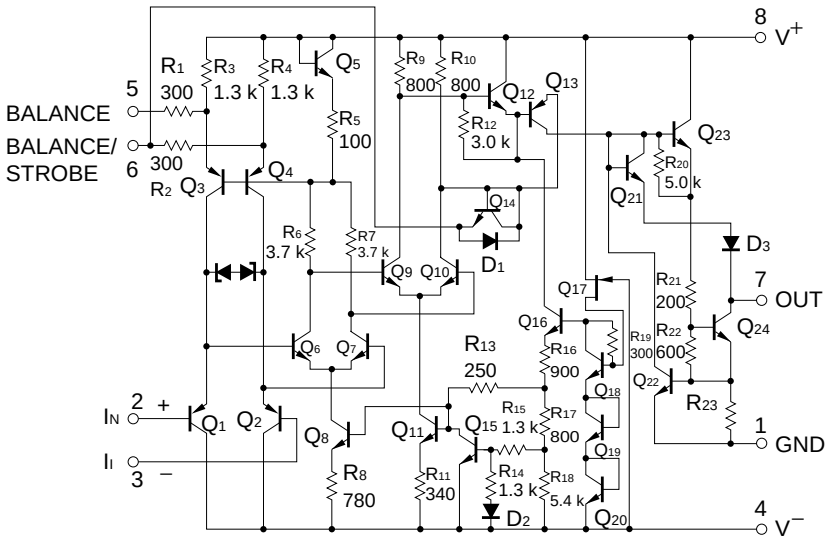
FEATURES

- Operate from single 5 V supply
- Maximum input current: 250 nA
- Maximum offset current: 50 nA
- Fast transient response: 200 ns TYP.

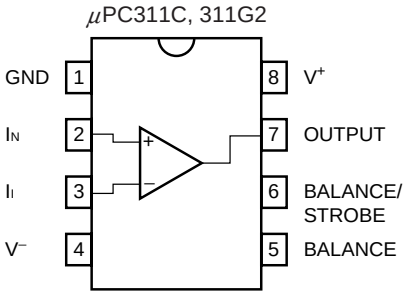
ORDERING INFORMATION

Part Number	Package
μPC311C	8-pin plastic DIP (7.62 mm (300))
μPC311G2	8-pin plastic SOP (5.72 mm (225))

EQUIVALENT CIRCUIT (1/2 Circuit)



PIN CONFIGURATION (Top View)



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The mark ★ shows major revised points.

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Parameter		Symbol	Ratings	Unit
Voltage between V^+ and V^- Note 1		$V^+ - V^-$	–0.3 to +36	V
Differential Input Voltage		V_{ID}	±30	V
Input Voltage Note 2		V_I	V^-–0.3 to V^+ +0.3	V
Output to Negative Supply Voltage Note 3		$V_O - V^-$	–0.3 to +40	V
Ground to Negative Supply Voltage Note 3		$V_{GND} - V^-$	–0.3 to +30	V
Power Dissipation	C Package Note 4	P_T	350	mW
	G2 Package Note 5		440	mW
Output Short Circuit Duration Note 6			10	sec
Operating Ambient Temperature		T_A	–20 to +80	°C
Storage Temperature		T_{stg}	–55 to +125	°C

Notes 1. Reverse connection of supply voltage can cause destruction.

2. The input voltage should be allowed to input without damage or destruction. Even during the transition period of supply voltage, power on/off etc., this specification should be kept. The normal operation will establish when the both inputs are within the Common Mode Input Voltage Range of electrical characteristics.

3. This specification is the voltage which should be allowed to supply to the output and GND terminal from external without damage or destruction. Even during the transition period of supply voltage, power on/off etc., this specification should be kept.

4. Thermal derating factor is –5.0 mW/°C when operating ambient temperature is higher than 55°C.

5. Thermal derating factor is –4.4 mW/°C when operating ambient temperature is higher than 25°C.

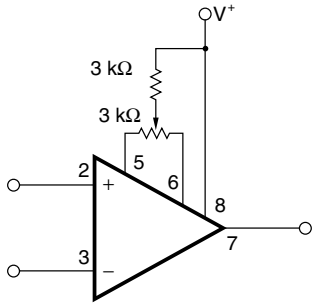
6. Pay careful attention to the total power dissipation not to exceed the absolute maximum ratings, Note 4 and Note 5.

RECOMMENDED OPERATING CONDITIONS

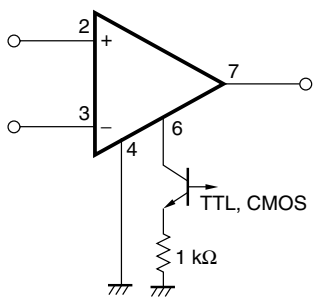
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage (Split)	$V^{\pm}$	±4		±16	V
Supply Voltage (V^- = GND)	V^+	+5		+32	V

TYPICAL CONNECTIONS

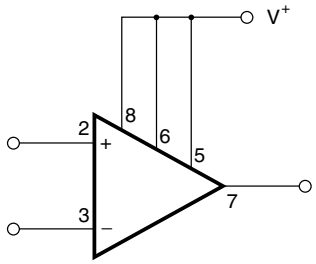
OFFSET VOLTAGE NULL CIRCUIT



STROBING CIRCUIT



FAST RESPONSE CIRCUIT
(INCREASING INPUT STAGE CURRENT)

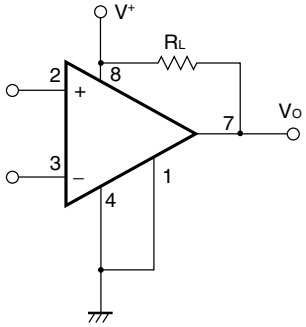


ELECTRICAL CHARACTERISTICS (T_A = 25°C, $V^{\pm}$ = ±15 V)

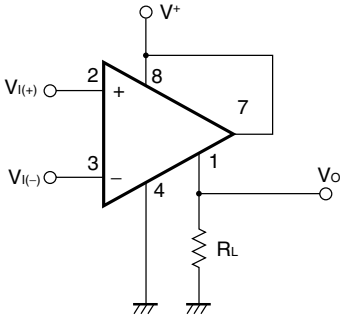
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input Offset Voltage	V_{IO}	$V^+ - V^-$ = 5 to 30 V, $R_S \leq 50$ kΩ		±2.0	±7.5	mV
Input Offset Current	I_{IO}	$V^+ - V^-$ = 5 to 30 V		±6.0	±50	nA
Input Bias Current	I_B	$V^+ - V^-$ = 5 to 30 V		100	250	nA
Voltage Gain	A_V	R_L = 1.0 kΩ		200,000		
Response Time		Input step 100 mV, Overdrive 5 mV		200		ns
Output Saturation Voltage	V_{OL}	$V_I \leq$ 10 mV, I_O = 50 mA		0.75	1.5	V
Strobe ON Current				3.0		mA
Output Leakage Current	I_{OLEAK}	$V_I \geq$ 10 mV, V_O = 35 V		0.2	50	nA
Positive Supply Current	I^+	I_O = 0 A		5.1	7.5	mA
Negative Supply Current	I^-	I_O = 0 A		4.1	5.0	mA
Input Offset Voltage	V_{IO}	$V^+ - V^-$ = 5 to 30 V, $R_S \leq 50$ kΩ, T_A = 0 to 70°C			±10	mV
Input Offset Current	I_{IO}	$V^+ - V^-$ = 5 to 30 V, T_A = 0 to 70°C			±70	nA
Input Bias Current	I_B	$V^+ - V^-$ = 5 to 30 V, T_A = 0 to 70°C			300	nA
Common Mode Input Voltage Range	V_{ICM}		±13.0 −14.5	±13.8 −14.7		V
Output Saturation Voltage	V_{OL}	$V^+ \geq$ 4.5 V, V^- = 0 V, $V_I \leq$ −10 mV, I_O = 8 mA		0.23	0.4	V

TYPICAL APPLICATION CIRCUIT

OPEN COLLECTOR OUTPUT



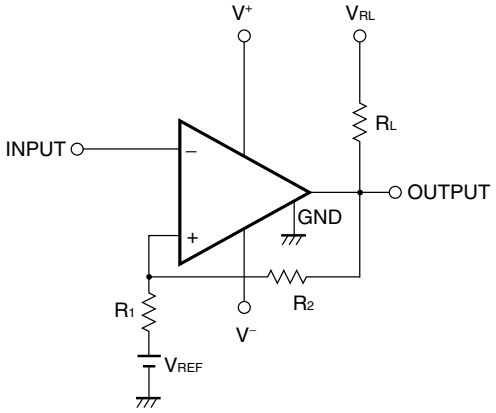
EMITTER FOLLOWER OUTPUT



Input polarity is reversed when 1pin (GND) is used as an output

$V_N > V_I \rightarrow V_O$: Low

COMPARATOR with HYSTERESIS CIRCUIT



Threshold Voltage

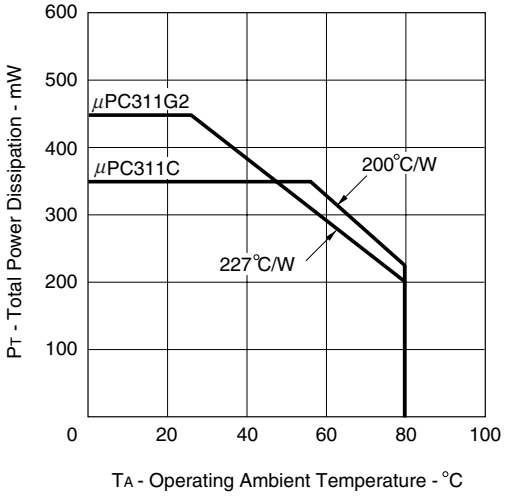
$$V_{TH\,(High)} \fallingdotseq V_{REF} + \frac{R_1}{R_L + R_2 + R_1}(V_{RL} - V_{REF})$$

$$V_{TH\,(Low)} \fallingdotseq V_{REF} - \frac{R_1}{R_1 + R_2}(V_{REF} - V_{OL})$$

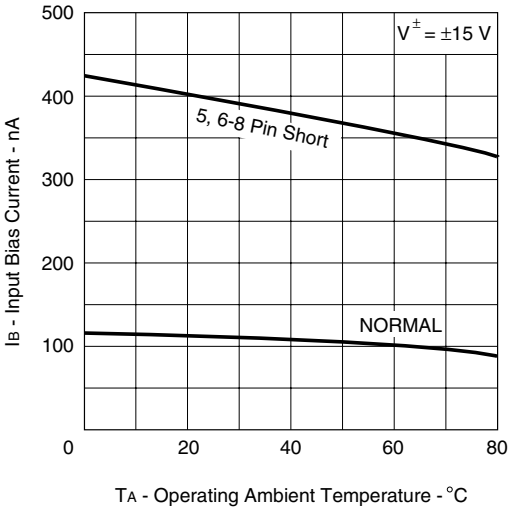
($V_{RL} > V_{REF} > V_{OL}$)

TYPICAL PERFORMANCE CHARACTERISTICS (T_A = 25°C, TYP.)

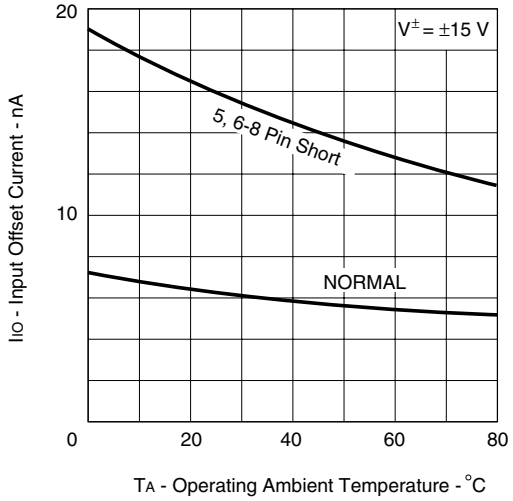
POWER DISIPATION



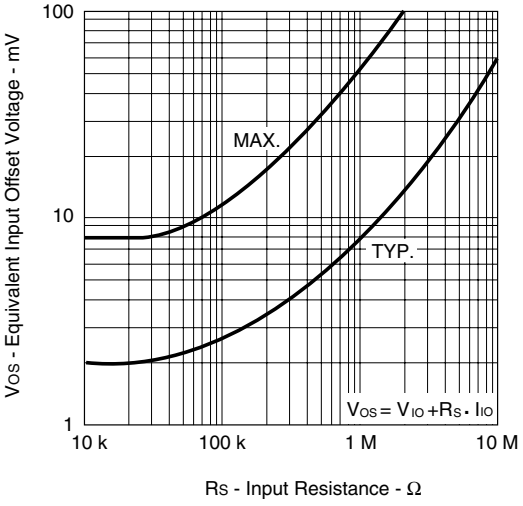
INPUT BIAS CURRENT



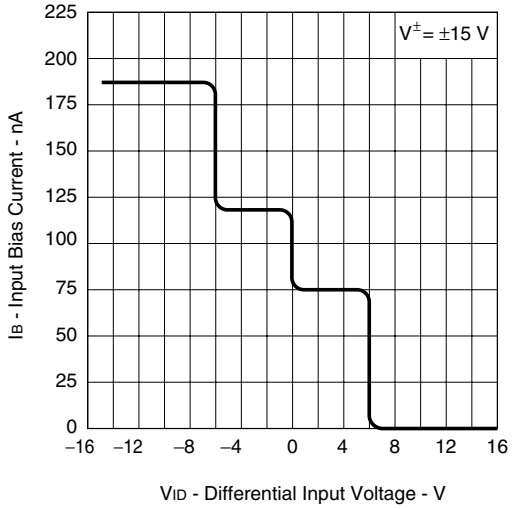
INPUT OFFSET CURRENT



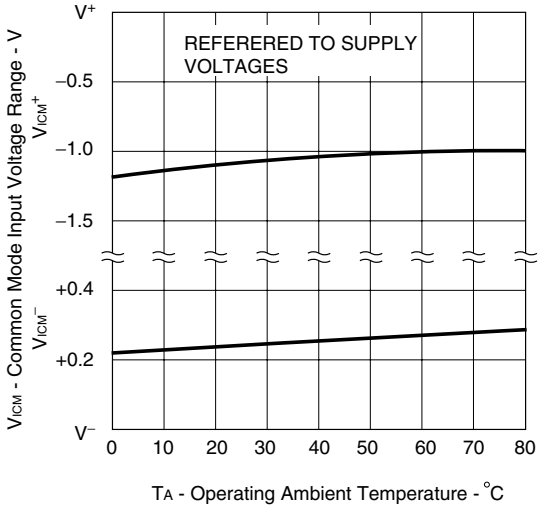
OFFSET ERROR



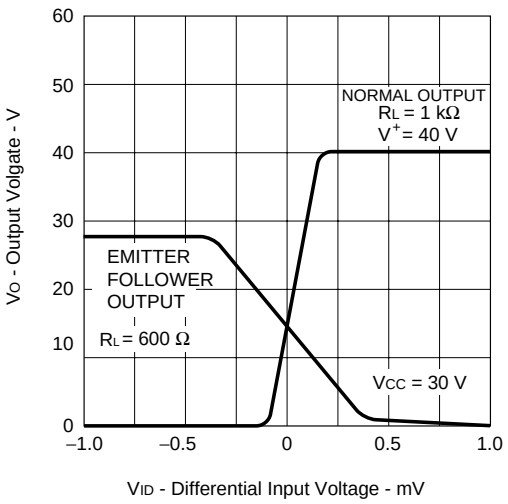
INPUT CURRENT



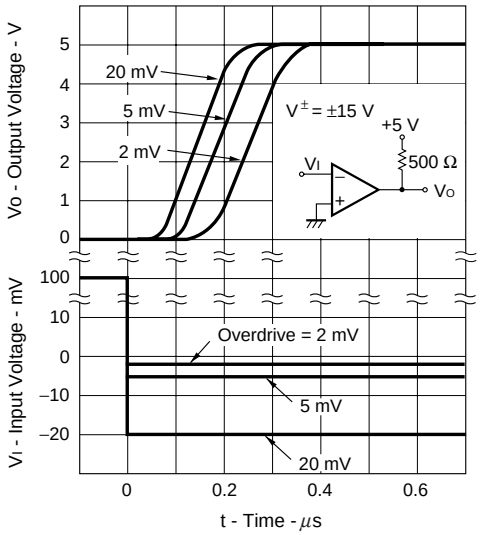
COMMON MODE INPUT VOLTAGE



TRANSFERFUNCTION



★ RESPONSE TIME FOR VARIOUS INPUT OVEERDRIVES



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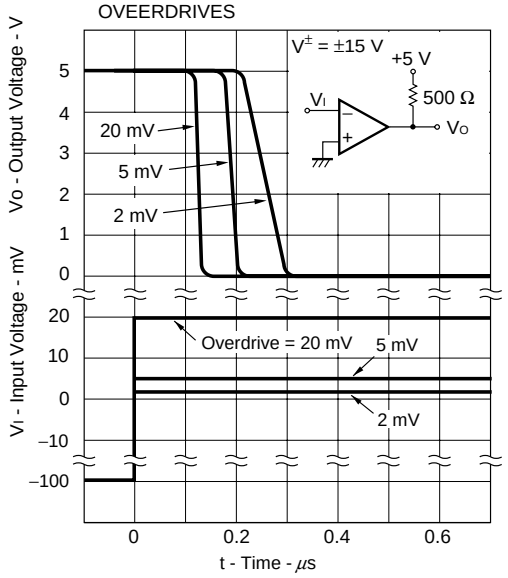

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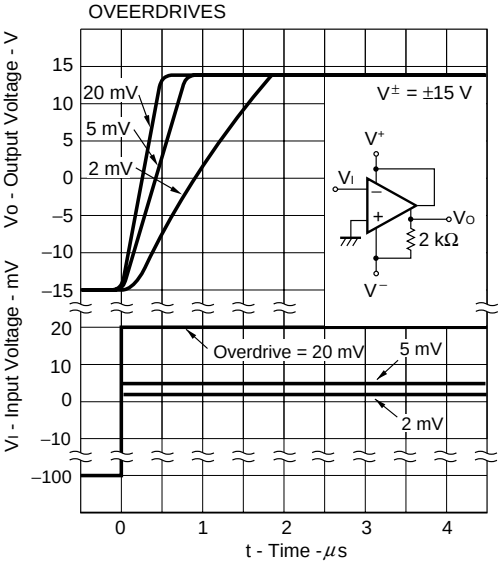

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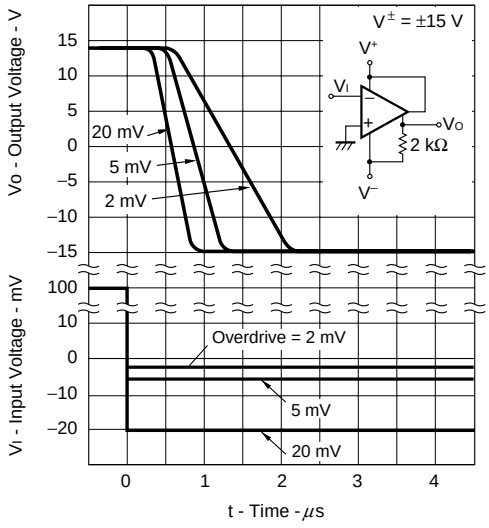
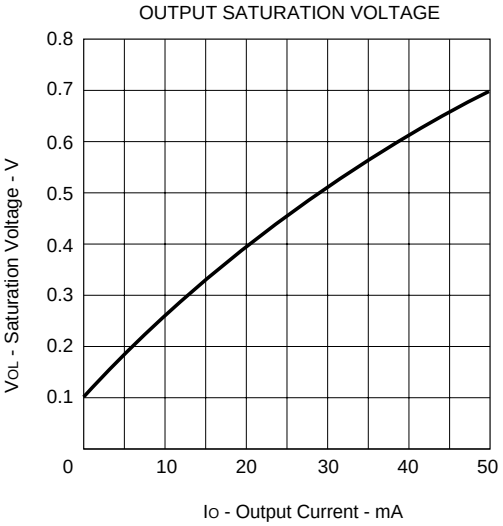
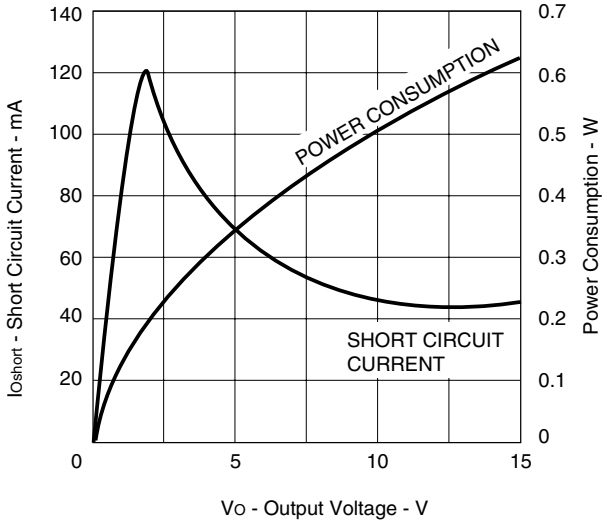


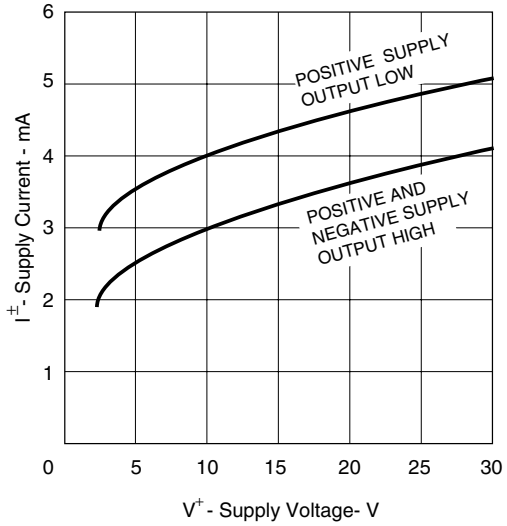
OUTPUT SATURATION VOLTAGE



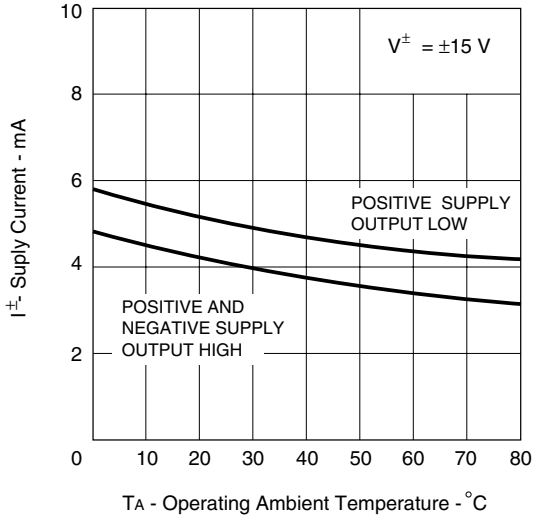
OUTPUT LIMITING CHARACTERISTICS



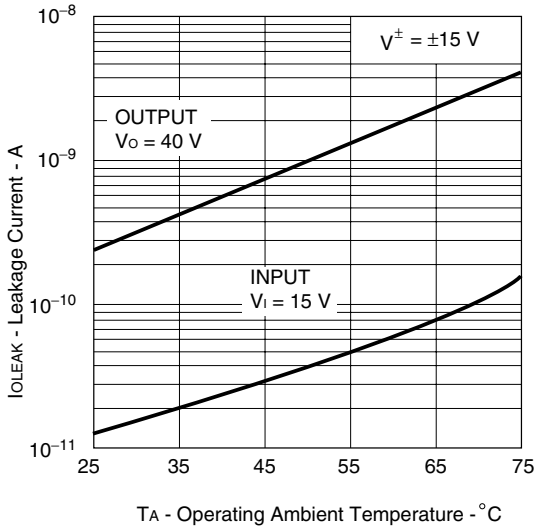
SUPPLY CURRENT



SUPPLY CURRENT

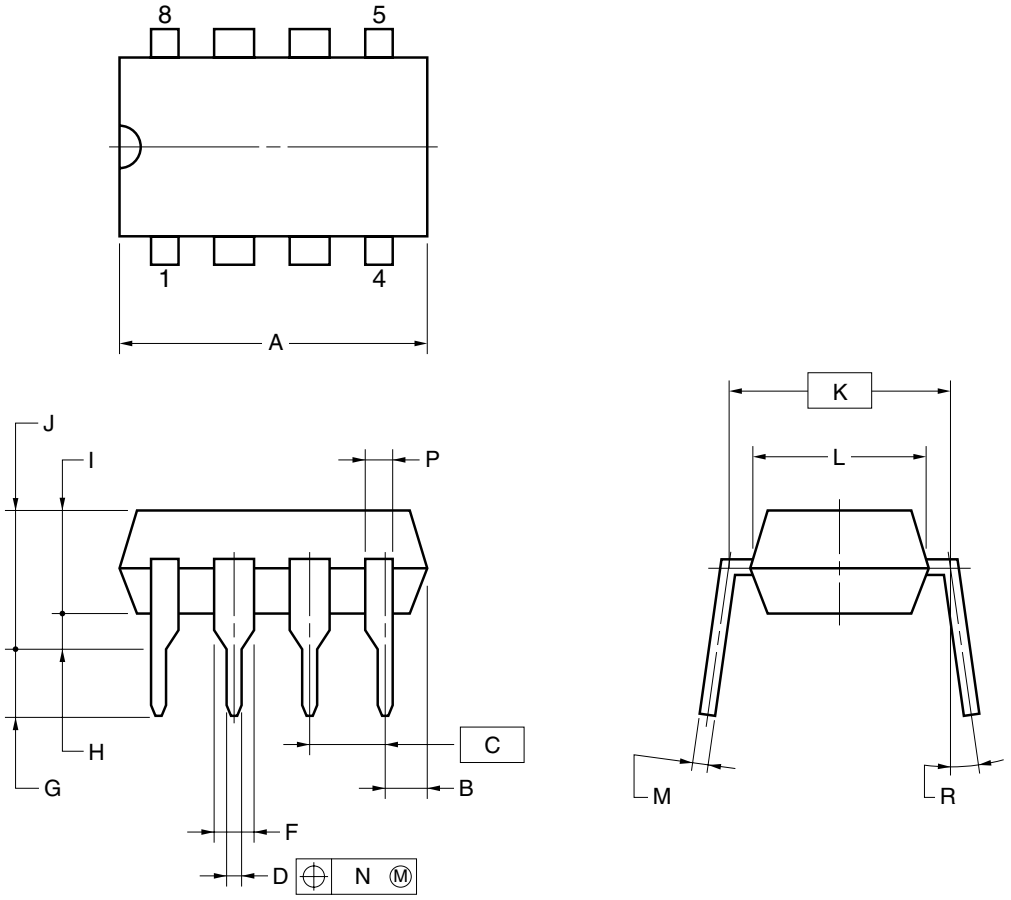


LEAKAGE CURRENTS



PACKAGE DRAWINGS (Unit : mm)

8-PIN PLASTIC DIP (7.62mm(300))



NOTES

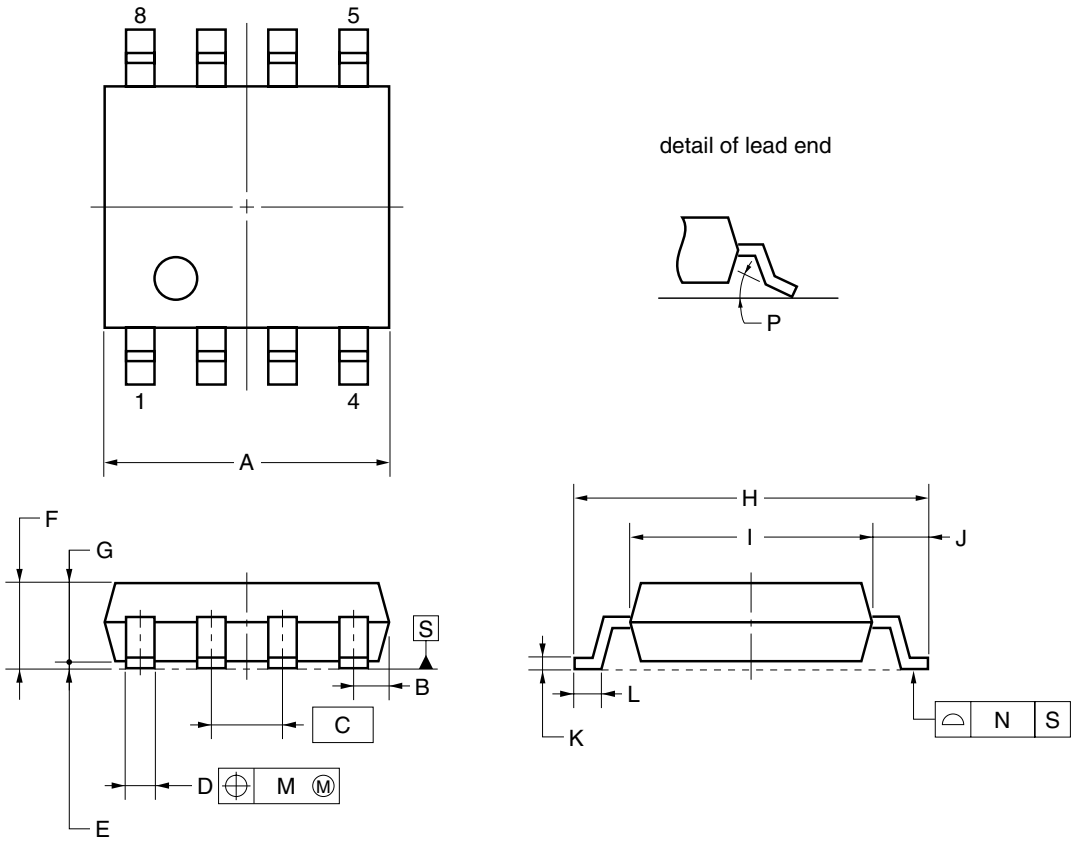
1. Each lead centerline is located within 0.25 mm of its true position (T.P.) at maximum material condition.

2. Item "K" to center of leads when formed parallel.

ITEM	MILLIMETERS
A	10.16 MAX.
B	1.27 MAX.
C	2.54 (T.P.)
D	0.50±0.10
F	1.4 MIN.
G	3.2±0.3
H	0.51 MIN.
I	4.31 MAX.
J	5.08 MAX.
K	7.62 (T.P.)
L	6.4
M	$0.25^{+0.10}_{-0.05}$
N	0.25
P	0.9 MIN.
R	0~15°

P8C-100-300B,C-2

8-PIN PLASTIC SOP (5.72 mm (225))



NOTE

Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	$5.2^{+0.17}_{-0.20}$
B	0.78 MAX.
C	1.27 (T.P.)
D	$0.42^{+0.08}_{-0.07}$
E	0.1±0.1
F	1.59±0.21
G	1.49
H	6.5±0.3
I	4.4±0.15
J	1.1±0.2
K	$0.17^{+0.08}_{-0.07}$
L	0.6±0.2
M	0.12
N	0.10
P	$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$

S8GM-50-225B-6

★ RECOMMENDED SOLDERING CONDITIONS

The μPC311 should be soldered and mounted under the following recommended conditions.

For soldering methods and conditions other than those recommended below, contact an NEC Electronics sales representative.

For technical information, see the following website.

Semiconductor Device Mount Manual (http://www.necel.com/pkg/en/mount/index.html)

Type of Surface Mount Device

μPC311G2: 8-pin plastic SOP (5.72 mm (225))

Process	Conditions	Symbol
Infrared Ray Reflow	Peak temperature: 230°C or below (Package surface temperature), Reflow time: 30 seconds or less (at 210°C or higher), Maximum number of reflow processes: 1 time.	IR30-00-1
Vapor Phase Soldering	Peak temperature: 215°C or below (Package surface temperature), Reflow time: 40 seconds or less (at 200°C or higher), Maximum number of reflow processes: 1 time.	VP15-00-1
Wave Soldering	Solder temperature: 260°C or below, Flow time: 10 seconds or less, Maximum number of flow processes: 1 time, Pre-heating temperature: 120°C or below (Package surface temperature).	WS60-00-1
Partial Heating Method	Pin temperature: 300°C or below, Heat time: 3 seconds or less (Per each side of the device).	–

Caution Apply only one kind of soldering condition to a device, except for "partial heating method", or the device will be damaged by heat stress.

Type of Through-hole Device

μPC311C: 8-pin plastic DIP (7.62 mm (300))

Process	Conditions
Wave Soldering (only to leads)	Solder temperature: 260°C or below, Flow time: 10 seconds or less.
Partial Heating Method	Pin temperature: 300°C or below, Heat time: 3 seconds or less (per each lead).

Caution For through-hole device, the wave soldering process must be applied only to leads, and make sure that the package body does not get jet soldered.

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