PRELIMINARY DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUITS

μPC8128TA, μPC8151TA, μPC8152TA

SILICON MMIC LOW CURRENT AMPLIFIERS FOR CELLULAR/CORDLESS TELEPHONES

DESCRIPTION

The μPC8128TA, μPC8151TA and μPC8152TA are silicon monolithic integrated circuits designed as buffer amplifiers for cellular / cordless telephones. These amplifiers can realize low current consumption with external chip inductor (example: 1005 size) which can not be realized on internal 50 Ω wideband matched IC. These low current amplifiers operate on 3.0 V.

These ICs are manufactured using NEC's 20 GHz f_T NESAT™ III silicon bipolar process. This process uses silicon nitride passivation film and gold electrodes. These materials can protect chip surface from external pollution and prevent corrosion/migration. Thus, these ICs have excellent performance, uniformity and reliability.

FEATURES

- Low current consumption : μPC8128TA ; I_{CC} = 2.8 mA TYP. @ V_{CC} = 3.0 V
  μPC8151TA ; I_{CC} = 4.2 mA TYP. @ V_{CC} = 3.0 V
  μPC8152TA ; I_{CC} = 5.6 mA TYP. @ V_{CC} = 3.0 V
- Supply voltage : V_{CC} = 2.4 to 3.3 V
- High efficiency : μPC8128TA ; $P_{O\ (1\ dB)}$ = –4.0 dBm TYP. @ f = 1 GHz
  μPC8151TA ; $P_{O\ (1\ dB)}$ = +2.5 dBm TYP. @ f = 1 GHz
  μPC8152TA ; $P_{O\ (1\ dB)}$ = –4.5 dBm TYP. @ f = 1 GHz
- Power gain variation : μPC8128TA, 8151TA ; G_P = 12.5 dB TYP. @ f = 1 GHz
  μPC8152TA ; G_P = 23.0 dB TYP. @ f = 1 GHz
- Operating frequency : 100 to 1 900 MHz (Output port LC matching)
- Excellent isolation : μPC8128TA ; ISL = 39 dB TYP. @ f = 1 GHz
  : μPC8151TA ; ISL = 38 dB TYP. @ f = 1 GHz
  : μPC8152TA ; ISL = 40 dB TYP. @ f = 1 GHz

APPLICATION

- Buffer Amplifiers on 800 to 1 900 MHz cellular / cordless telephones

Caution Electro-static sensitive devices

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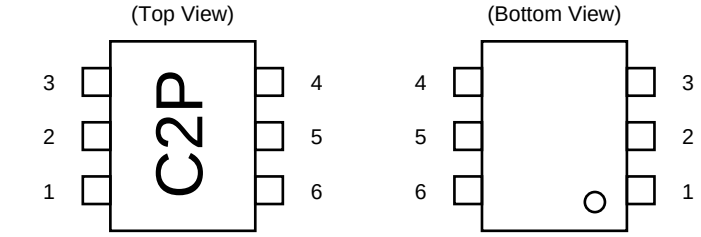
ORDERING INFORMATION

Part Number	Package	Marking	Feature	Supplying Form
μPC8128TA-E3	6-pin minimold	C2P	2.8 mA Low I_{CC}	Embossed tape 8 mm wide. 1, 2, 3 pins face the perforation side of the tape. Qty 3 kpcs/reel.
μPC8151TA-E3		C2U	4 mA High P_O	
μPC8152TA-E3		C2V	5 mA High G_P	

Remark To order evaluation samples, please contact your local NEC sales office.
(Part number for sample order: μPC8128TA, μPC8151TA, μPC8152TA)

PIN CONNECTIONS



Marking is an example of μPC8128TA

Pin No.	Pin Name
1	INPUT
2	GND
3	GND
4	OUTPUT
5	GND
6	V_{CC}

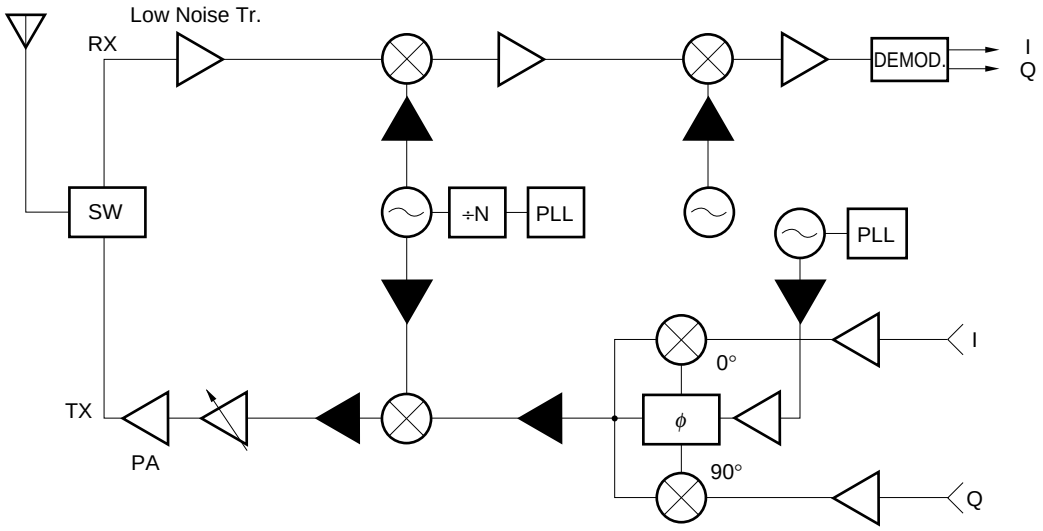
PRODUCT LINE-UP (T_A = +25 °C, V_{CC} = V_{out} = 3.0 V, Z_S = Z_L = 50 Ω)

Parameter / Part No.	I_{CC} (mA)	1.00 GHz output port matching frequency			1.66 GHz output port matching frequency			1.90 GHz output port matching frequency			Package	Marking
		G_P (dB)	ISL (dB)	$P_{O\ (1\ dB)}$ (dB)	G_P (dB)	ISL (dB)	$P_{O\ (1\ dB)}$ (dB)	G_P (dB)	ISL (dB)	$P_{O\ (1\ dB)}$ (dB)		
μPC8128TA	2.8	12.5	39	−4.0	13	39	−4.0	13	37	−4.0	6-pin minimold	C2P
μPC8128TB											6-pin super minimold	
μPC8151TA	4.2	12.5	38	+2.5	15	36	+1.5	15	34	+0.5	6-pin minimold	C2U
μPC8151TB											6-pin super minimold	
μPC8152TA	5.6	23	40	−4.5	19.5	36	−8.5	17.5	35	−8.5	6-pin minimold	C2V
μPC8152TB											6-pin super minimold	

Remark Typical performance. Please refer to ELECTRICAL CHARACTERISTICS in detail.

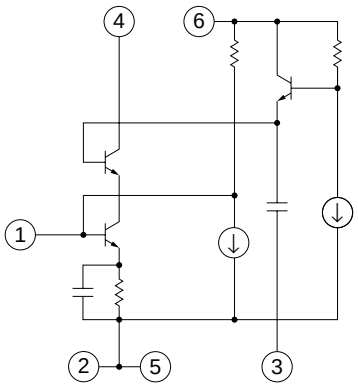
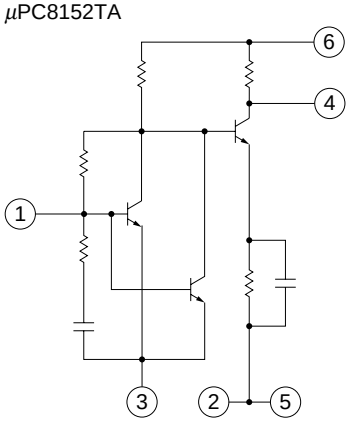
SYSTEM APPLICATION EXAMPLE

Location examples in digital cellular



These ICs can be added to your system around ▲ parts, when you need more isolation or gain. The application herein, however, shows only examples, therefore the application can depend on your kit evaluation.

PIN EXPLANATION

Pin No.	Pin Name	Applied Voltage (V)	Pin Voltage (V)[Note]	Function and Applications	Internal Equivalent Circuit
1	INPUT	–	0.9 1.06 0.80	Signal input pin. A internal matching circuit, configured with resistors, enables 50 Ω connection over a wide band. This pin must be coupled to signal source with capacitor for DC cut.	μPC8128TA, μPC8151TA  μPC8152TA 
2 3 5	GND	0	–	Ground pin. This pin should be connected to system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. All the ground pins must be connected together with wide ground pattern to decrease impedance defference.	
4	OUTPUT	voltage as same as V_{CC} through external inductor	–	Signal output pin. This pin is designed as collector output. Due to the high impedance output, this pin should be externally equipped with LC matching circuit to next stage. For L, a size 1005 chip in-ductor can be chosen.	
6	V_{CC}	2.4 to 3.3	–	Power supply pin. This pin should be externally equipped with bypass capacitor to minimize its inpedance.	

Note Pin voltage is measured at V_{CC} = 3.0 V. Above: μPC8128TA, Center: μPC8151TA, Below: μPC8152TA

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25 °C, Pin 4, Pin 6	3.6	V
Total Circuit Current	I_{CC}	T_A = +25 °C	15	mA
Total Power Dissipation	P_D	Mounted on double sided copper clad 50 × 50 × 1.6 mm epoxy glass PWB (T_A = +85 °C)	280	mW
Operating Ambient Temperature	T_A		−40 to +85	°C
Storage Temperature	T_{stg}		−55 to +150	°C
Input Power	P_{in}	T_A = +25 °C	+5	dBm

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Remarks
Supply Voltage	V_{CC}	2.4	3.0	3.3	V	The same voltage should be applied to pin 4 and pin 6.
Operating Ambient Temperature	T_A	−40	+25	+85	°C	
Operating Frequency	f	0.1	−	1.9	GHz	Matched output port with external LC

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25 °C, V_{CC} = V_{out} = 3.0 V, Z_S = Z_L = 50 Ω, at LC matched frequency)

Parameter	Symbol	Test Conditions	μPC8128TA			μPC8151TA			μPC8152TA			Unit
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Circuit Current	I_{CC}	No signal	1.8	2.8	3.8	2.8	4.2	5.8	4.2	5.6	7.1	mA
Power Gain	G_P	f = 1.00 GHz	9.5	12.5	14.5	9.5	12.5	14.5	20	23	25	dB
		f = 1.66 GHz	10	13	15	12	15	17	16.5	19.5	21.5	
		f = 1.90 GHz	10	13	15	12	15	17	14.5	17.5	19.5	
Isolation	ISL	f = 1.00 GHz	34	39	–	33	38	–	35	40	–	dB
		f = 1.66 GHz	34	39	–	31	36	–	33	38	–	
		f = 1.90 GHz	32	37	–	29	34	–	30	35	–	
Gain 1 dB Compression Output Power	$P_{O\ (1\ dB)}$	f = 1.00 GHz	–7.5	–4.0	–	–1.0	+2.5	–	–7.5	–4.5	–	dBm
		f = 1.66 GHz	–8.5	–4.0	–	–2.5	+1.5	–	–11.5	–8.5	–	
		f = 1.90 GHz	–8.5	–4.0	–	–3.0	+0.5	–	–11.5	–8.5	–	
Saturated Output Power[Note] (P_{in} = –6 dBm)	$P_{O\ (sat)}$	f = 1.00 GHz	–	–	–	–	–	–	–2.5	+0.5	–	dBm
		f = 1.66 GHz	–	–	–	–	–	–	–5.5	–2.5	–	
		f = 1.90 GHz	–	–	–	–	–	–	–6.0	–3.0	–	
Noise Figure	NF	f = 1.00 GHz	–	6.0	7.5	–	6.0	7.5	–	3.5	5.0	dB
		f = 1.66 GHz	–	6.0	7.5	–	6.0	7.5	–	4.0	5.5	
		f = 1.90 GHz	–	6.0	7.5	–	6.0	7.5	–	4.5	6.0	
Input Return Loss (Without matching circuit)	RL_{in}	f = 1.00 GHz	2	5	–	2	5	–	8.5	11.5	–	dB
		f = 1.66 GHz	2	5	–	1	4	–	7.5	10.5	–	
		f = 1.90 GHz	2.5	5.5	–	1	4	–	8.5	11.5	–	

Note Saturated output power is specified only in μPC8152TA which has flat saturated region.

STANDARD CHARACTERISTICS (Unless otherwise specified, T_A = +25 °C, V_{CC} = V_{out} = 3.0 V, Z_S = Z_L = 50 Ω, at LC matched frequency)

Parameter	Symbol	Conditions	Reference Value			Unit
			μPC8128TA	μPC8151TA	μPC8152TA	
Output Return Loss (With external matching circuit)	RL_{out}	f = 1.00 GHz	10	10	15	dB
		f = 1.66 GHz	25	18	7.5	
		f = 1.90 GHz	14	12	7	
3rd Order Intermodulation Distortion ($P_{O\ (each)}$ = –20 dBm)	IM_3	f_1 = 1.000 GHz, f_2 = 1.001 GHz	–50	–62	–51	dBc
		f_1 = 1.660 GHz, f_2 = 1.661 GHz	–46	–56	–43	
		f_1 = 1.900 GHz, f_2 = 1.901 GHz	–46	–54	–42	

TEST CIRCUIT

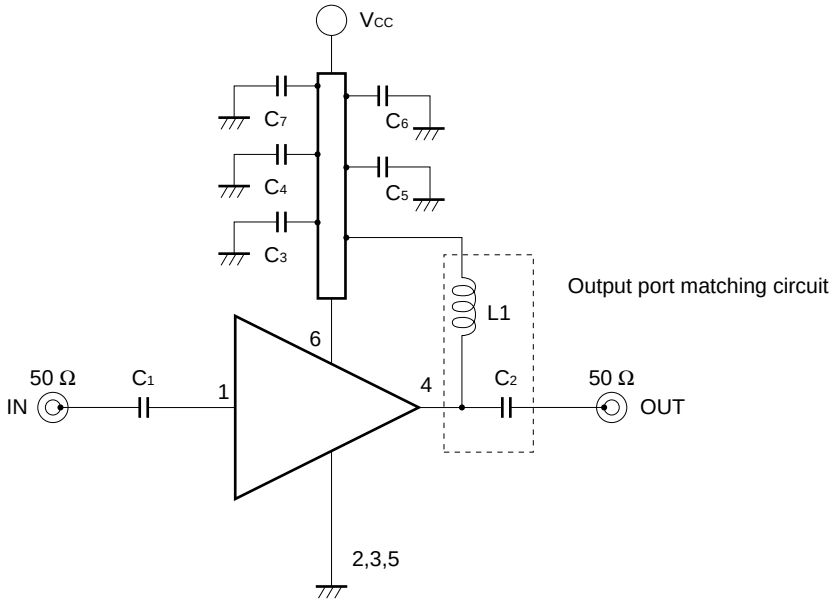
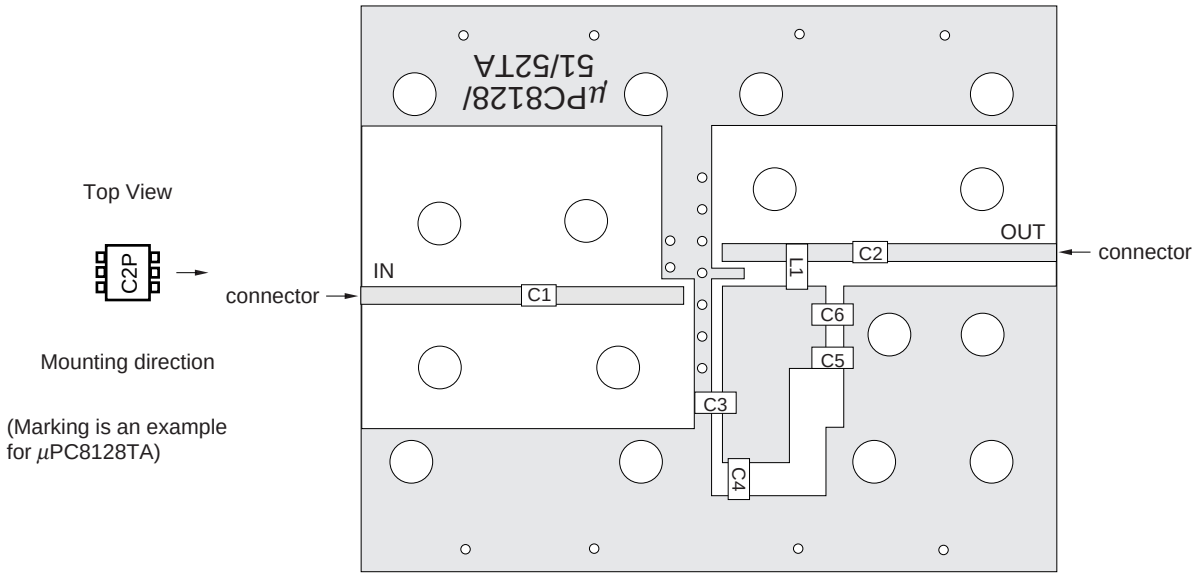


ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD

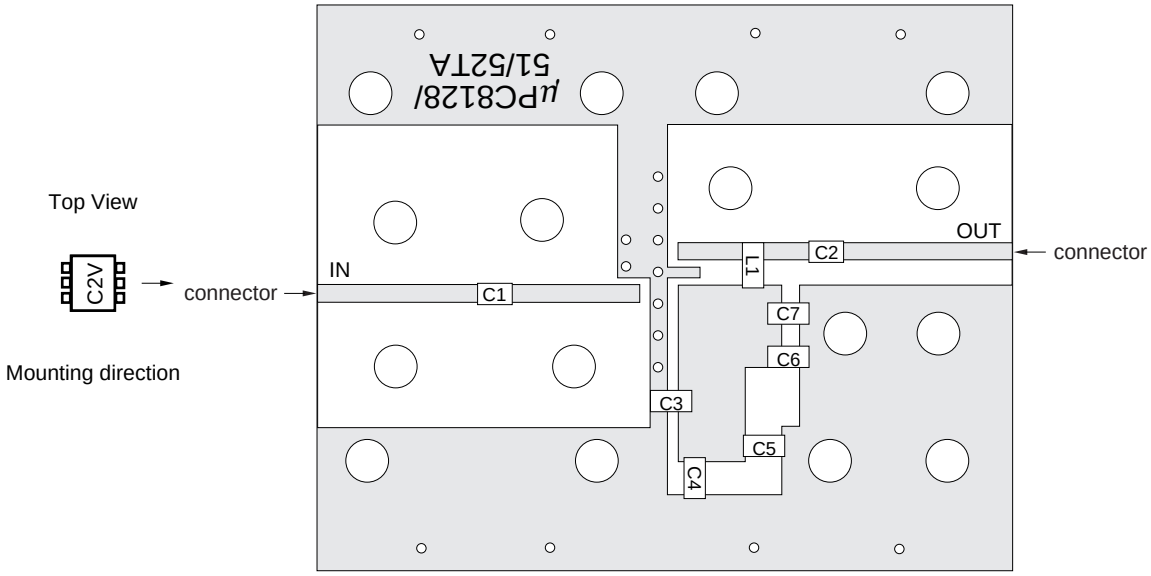
μPC8128TA/μPC8151TA



COMPONENT LIST

	1.00 GHz output port matching	1.66 GHz output port matching	1.90 GHz output port matching
C1, C3 to C6	1 000 pF	1 000 pF	1 000 pF
C2	1.0 pF	0.75 pF	0.75 pF
L1	8.2 nH	3.3 nH	2.7 nH

μPC8152TA



COMPONENT LIST

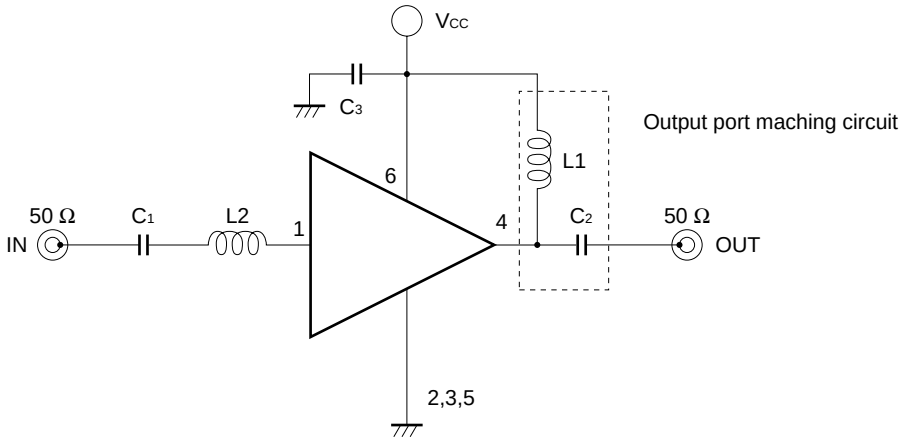
	1.00 GHz output port matching	1.66 GHz output port matching	1.90 GHz output port matching
C1, C3 to C7	1 000 pF	1 000 pF	1 000 pF
C2	1.5 pF	1.0 pF	1.5 pF
L1	8.2 nH	2.7 nH	1.8 nH

NOTES (μPC8128TA, μPC8151TA, μPC8152TA in common)

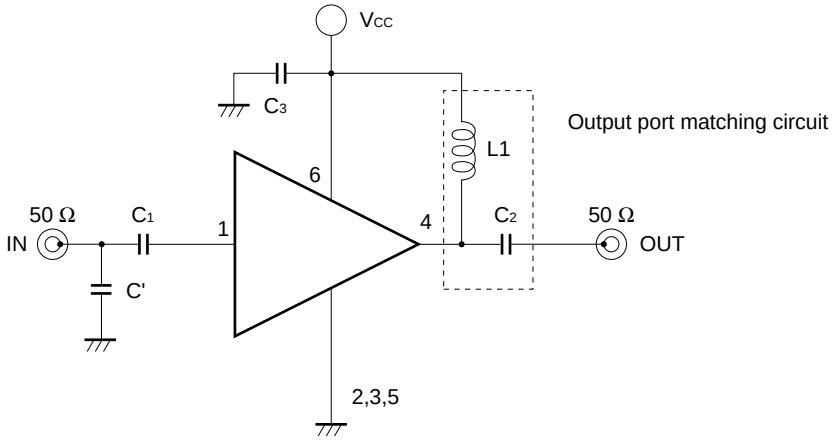
1. 42 × 35 × 0.4 mm double sided copper clad polyimide board.
2. Back side: GND pattern
3. Solder plated on pattern
4. ○ ◯ ◯: Through holes

EXAMPLE OF APPLICATION CIRCUIT (μPC8128TA, μPC8151TA)

In improving RL_{in} of μPC8128TA and μPC8151TA at 1.0 GHz, L2 should be attached.

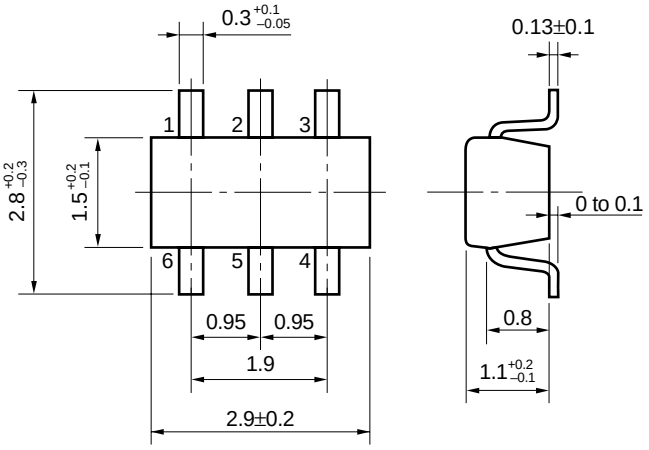


In improving RL_{in} of μPC8128TA and μPC8151TA at 1.66 to 1.9 GHz, C' should be attached.



PACKAGE DIMENSIONS

6 PIN MINIMOLD (UNIT: mm)



NOTES ON CORRECT USE

(1) Observe precautions for handling because of electro-static sensitive devices.
(2) Form a ground pattern as wide as possible to minimize ground impedance (to prevent undesired oscillation). All the ground pins must be connected together with wide ground pattern to decrease impedance difference.
(3) The bypass capacitor should be attached to V_{CC} line.
(4) The inductor (L) should be attached between output and V_{CC} pins. The L and series capacitor (C2) values should be adjusted for applied frequency to match impedance to next stage.
(5) The DC capacitor must be attached to input pin.

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your NEC sales representative.

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Infrared Reflow	Package peak temperature: 235 °C or below Time: 30 seconds or less (at 210 °C) Count: 3, Exposure limit: None[Note]	IR35-00-3
VPS	Package peak temperature: 215 °C or below Time: 40 seconds or less (at 200 °C) Count: 3, Exposure limit: None[Note]	VP15-00-3
Wave Soldering	Soldering bath temperature: 260 °C or below Time: 10 seconds or less Count: 1, Exposure limit: None[Note]	WS60-00-1
Partial Heating	Pin temperature: 300 °C Time: 3 seconds or less (per side of device) Exposure limit: None[Note]	–

Note After opening the dry pack, keep it in a place below 25 °C and 65 % RH for the allowable storage period.

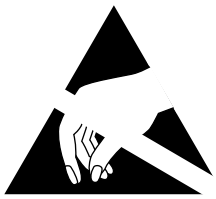
Caution Do not use different soldering methods together (except for partial heating).

For details of recommended soldering conditions for surface mounting, refer to information document **SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E)**.

[MEMO]

[MEMO]

[MEMO]



ATTENTION
OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES

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