



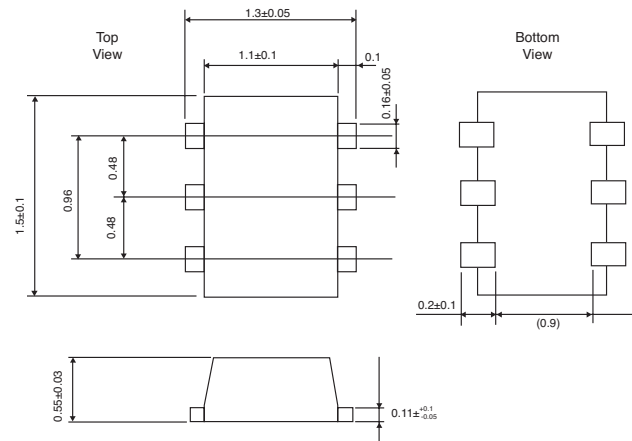
# NEC's VARIABLE GAIN AMPLIFIER

## UPC8204TK

### FEATURES

- **OPERATING FREQUENCY:**  
f = 0.8 GHz to 2.5 GHz
- **MAXIMUM POWER GAIN:**  
GPMAX = 14.5 dB TYP at f = 1.9 GHz  
GPMAX = 14.0 dB TYP at f = 2.4 GHz
- **GAIN CONTROL RANGE:**  
GCR = 40 dB TYP at f = 1.9 GHz  
GCR = 40 dB TYP at f = 2.4 GHz
- **SUPPLY VOLTAGE:**  
VCC = 2.7 to 3.3 V
- **HIGH DENSITY SURFACE MOUNTING:**  
6-pin Lead-less minimold package

### OUTLINE DIMENSIONS (Units in mm)



### APPLICATION

- 0.8 GHz to 2.5 GHz transmitter/receiver systems
- PHS/PCS/Mobile Communication
- WLAN
- Cordless Phone
- Fixed Wireless Service

### DESCRIPTION

NEC's UPC8204TK is a silicon monolithic integrated circuit designed as variable gain amplifier. The package is 6-pin lead-less minimold suitable for surface mount.

This IC is manufactured using NEC's 30 GHz  $f_{max}$  UHS0 (Ultra High Speed Process) silicon bipolar process.

This IC has the same circuit current as conventional UPC8119T and UPC8120T, but it operates at higher frequency and features a wider gain control range.

### ELECTRICAL CHARACTERISTICS,

(Unless otherwise specified,  $T_A = +25^\circ\text{C}$ ,  $V_{CC} = V_{OUT} = 3.0\text{ V}$ ,  $Z_S = Z_L = 50\Omega$ , External matched output port)

PART NUMBER PACKAGE OUTLINE			UPC8204TK TK		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
I <sub>CC</sub>	Circuit Current (no signal)	mA	8.5	11.5	15.0
G <sub>PMAX</sub>	Maximum Power Gain, f = 1.9 GHz, P <sub>IN</sub> = -20 dBm f = 2.4 GHz, P <sub>IN</sub> = -20 dBm	dB	11.5 11.0	14.5 14.0	17.5 17.0
GCR	Gain Control Range (note 1) f = 1.9 GHz, P <sub>IN</sub> = -20 dBm f = 2.4 GHz, P <sub>IN</sub> = -20 dBm	dB	35 35	40 40	— —
P <sub>o(1dB)</sub>	1 dB Compression Output Power, f = 1.9 GHz, G <sub>PMAX</sub> f = 2.4 GHz, G <sub>PMAX</sub>	dBm	+2.0 +2.0	+5.0 +5.0	— —
R <sub>LIN</sub>	Input Return Loss, f = 1.9 GHz, G <sub>PMAX</sub> f = 2.4 GHz, G <sub>PMAX</sub>	dB	8 9	11 13	— —
ISL	Isolation, f = 1.9 GHz, G <sub>PMAX</sub> f = 2.4 GHz, G <sub>PMAX</sub>	dB	25 25	30 30	— —
NF	Noise Figure, f = 1.9 GHz, G <sub>PMAX</sub> f = 2.4 GHz, G <sub>PMAX</sub>	dB	— —	7.5 7.5	10.0 10.0

Notes:

1. Gain control range GCR specification:

GCR = G<sub>PMAX</sub> - G<sub>PMIN</sub> (dB) Conditions G<sub>PMAX</sub> at V<sub>AGC</sub> = V<sub>CC</sub>, G<sub>PMIN</sub> at V<sub>AGC</sub> = 0 V

**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** (TA = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
Vcc	Supply Voltage TA = 25°C	V	3.6
Icc	Total Circuit Current TA = 25°C	mW	30
VAGC	Gain Control Voltage TA = 25°C	V	3.6
PD	Power Dissipation TA = 85°C (note)	mW	203
TA	Operating Ambient Temperature	°C	-40 to +85
TSTG	Storage Temperature	°C	-55 to +150
PIN	Input Power	dBm	+5

Notes:

1. Mounted on a 50 x 50 x 1.6 mm epoxy glass PWB (TA = +85°C).

**RECOMMENDED OPERATING CONDITIONS**

SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
Vcc	Supply Voltage	V	2.7	3.0	3.3
TA	Operating Ambient Temperature	°C	-40	+25	+85
fin	Operating Frequency Range	GHz	0.8	-	2.5
VAGC	Gain Control Voltage	V	0	-	3.3

**SERIES PRODUCTS**

Parameter Part No.	Icc (mA)	0.95 GHz output port matching frequency			1.44 GHz output port matching frequency			1.9 GHz output port matching frequency			2.4 GHz output port matching frequency		
		GPMAX (dB)	GCR (dB)	NF (dB)	GPMAX (dB)	GCR (dB)	NF (dB)	GPMAX (dB)	GCR (dB)	NF (dB)	GPMAX	GCR	NF
UPC8119T	11.0	12.5	50	8.5	13.0	45	7.5	(12.5)	(22)	(7.2)	-	-	-
UPC8120T	11.0	13.0	50	9.0	13.5	45	7.5	(13.0)	(22)	(7.3)	-	-	-
UPC8204TK	11.5	-	-	-	-	-	-	14.0	40	7.5	14.0	35	7.5

Note:

1. Typical performance. Please refer to Electrical Characteristics in detail.

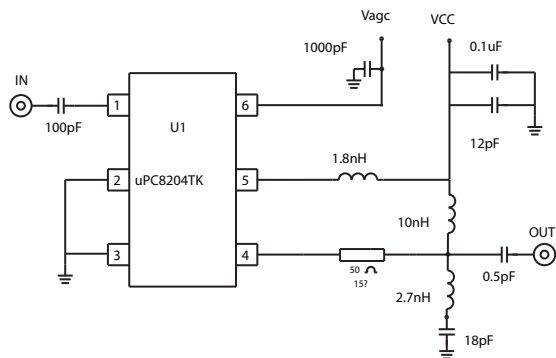
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**PIN FUNCTIONS**

Pin No.	Symbol	Applied Voltage	Pin Voltage	Description	Equivalent Circuit
1	INPUT	—	1.2	RF input pin This pin should be coupled with capacitor (eg 1000 pF) for DC cut. Input return loss can be improved with external impedance matching circuit.	
2	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. Ground pins must be connected together with wide ground pattern to decrease impedance difference.	
3	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. Ground pins must be connected together with wide ground pattern to decrease impedance difference.	
4	OUTPUT	Voltage as same as Vcc through external inductor	—	RF output pin. This pin is designed as open collector of high impedance. This pin must be externally equipped with matching circuits.	
5	Vcc	2.7~3.3	—	Supply voltage pin. this pin must be equipped with bypass capacitor (eg 1000 pF) to minimize its RF impedance.	
6	VAGC	0~3.3	—	Gain control pin.	

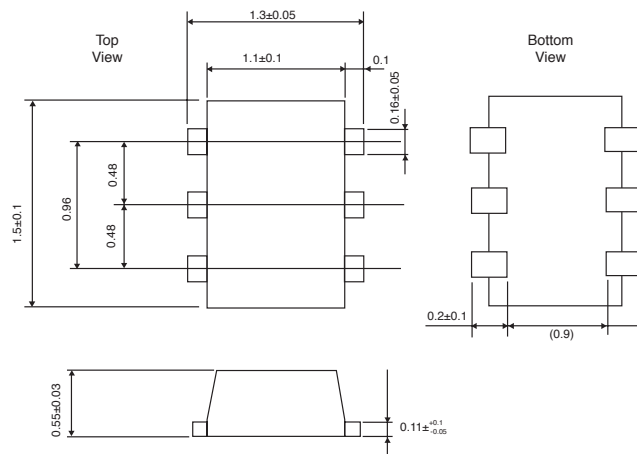
APPLICATION CIRCUIT

f = 2.4 GHz

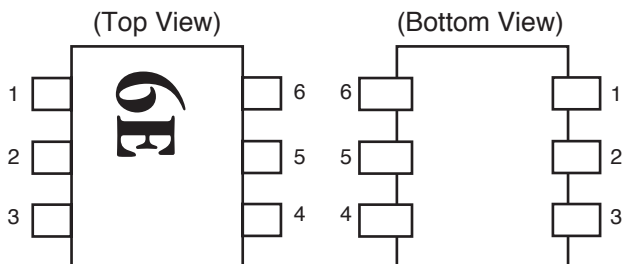


OUTLINE DIMENSIONS (Units in mm)

6-PIN LEAD-LESS MINIMOLD



PIN CONNECTIONS



PIN NO.	PIN NAME
1	INPUT
2	GND
3	GND
4	OUTPUT
5	VCC
6	VAGC

ORDERING INFORMATION

PART NUMBER	PACKAGE	PACKING INFORMATION
UPC8204TK-E2-A	TK	6-pin lead-less minimold

Note:  
To order evaluation samples, contact sales office  
(p/n: UPC8204TK).

Life Support Applications

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

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06/06/2005

Subject: Compliance with EU Directives

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CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (\*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

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