CEL

# NEC's VARIABLE GAIN AMPLIFIER

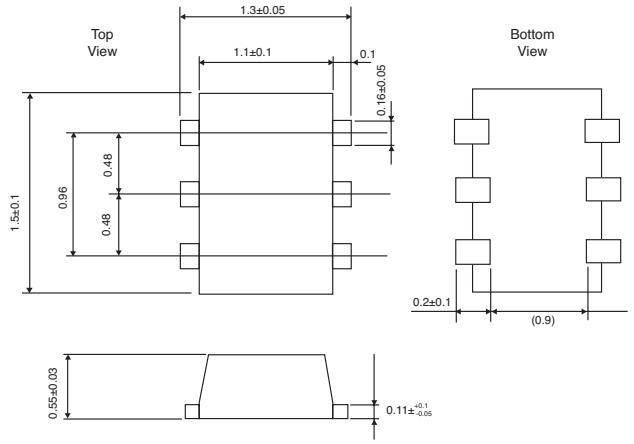
# UPC8204TK

## FEATURES

- **OPERATING FREQUENCY:**
  f = 0.8 GHz to 2.5 GHz
- **MAXIMUM POWER GAIN:**
  $G_{PMAX}$ = 14.5 dB TYP at f = 1.9 GHz
  $G_{PMAX}$ = 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:**
  $V_{CC}$ = 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°C, $V_{CC}$ = $V_{OUT}$ = 3.0 V, $Z_S$ = $Z_L$ = 50Ω, External matched output port)

| PART NUMBER<br>PACKAGE OUTLINE | | | UPC8204TK<br>TK | | |
|---|---|---|---|---|---|
| **SYMBOLS** | **PARAMETERS AND CONDITIONS** | **UNITS** | **MIN** | **TYP** | **MAX** |
| $I_{CC}$ | Circuit Current (no signal) | mA | 8.5 | 11.5 | 15.0 |
| $G_{PMAX}$ | Maximum Power Gain, f = 1.9 GHz, $P_{IN}$ = -20 dBm<br>f = 2.4 GHz, $P_{IN}$ = -20 dBm | dB | 11.5<br>11.0 | 14.5<br>14.0 | 17.5<br>17.0 |
| GCR | Gain Control Range (note 1) f = 1.9 GHz, $P_{IN}$ = -20 dBm<br>f = 2.4 GHz, $P_{IN}$ = -20 dBm | dB | 35<br>35 | 40<br>40 | –<br>– |
| $P_{O(1dB)}$ | 1 dB Compression Output Power, f = 1.9 GHz, $G_{PMAX}$<br>f = 2.4 GHz, $G_{PMAX}$ | dBm | +2.0<br>+2.0 | +5.0<br>+5.0 | –<br>– |
| $RL_{IN}$ | Input Return Loss, f = 1.9 GHz, $G_{PMAX}$<br>f = 2.4 GHz, $G_{PMAX}$ | dB | 8<br>9 | 11<br>13 | –<br>– |
| ISL | Isolation, f = 1.9 GHz, $G_{PMAX}$<br>f = 2.4 GHz, $G_{PMAX}$ | dB | 25<br>25 | 30<br>30 | –<br>– |
| NF | Noise Figure, f = 1.9 GHz, $G_{PMAX}$<br>f = 2.4 GHz, $G_{PMAX}$ | dB | –<br>– | 7.5<br>7.5 | 10.0<br>10.0 |

Notes:
1. Gain control range GCR specification:
GCR = $G_{PMAX}$ - $G_{PMIN}$ (dB) Conditions $G_{PMAX}$ at $V_{AGC}$ = $V_{CC}$, $G_{PMIN}$ at $V_{AGC}$ = 0 V

## ABSOLUTE MAXIMUM RATINGS[1] ($T_A$ = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|---|---|---|---|
| $V_{CC}$ | Supply Voltage $T_A$ = 25°C | V | 3.6 |
| $I_{CC}$ | Total Circuit Current $T_A$ = 25°C | mW | 30 |
| $V_{AGC}$ | Gain Control Voltage $T_A$ = 25°C | V | 3.6 |
| $P_D$ | Power Dissipation $T_A$ = 85°C (note) | mW | 203 |
| $T_A$ | Operating Ambient Temperature | °C | -40 to +85 |
| $T_{STG}$ | Storage Temperature | °C | -55 to +150 |
| $P_{IN}$ | Input Power | dBm | +5 |

Notes:

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

## RECOMMENDED OPERATING CONDITIONS

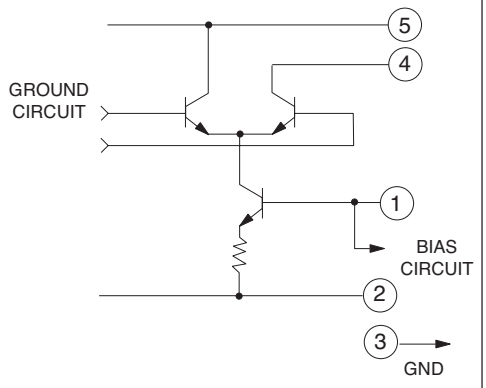
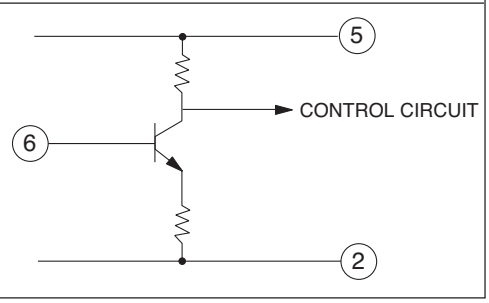
| SYMBOLS | PARAMETERS | UNITS | MIN | TYP | MAX |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | V | 2.7 | 3.0 | 3.3 |
| $T_A$ | Operating Ambient Temperature | °C | -40 | +25 | +85 |
| $f_{in}$ | Operating Frequency Range | GHz | 0.8 | – | 2.5 |
| $V_{AGC}$ | Gain Control Voltage | V | 0 | – | 3.3 |

## SERIES PRODUCTS

| Parameter / Part No. | $I_{CC}$ (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 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $G_{PMAX}$ (dB) | GCR (dB) | NF (dB) | $G_{PMAX}$ (dB) | GCR (dB) | NF (dB) | $G_{PMAX}$ (dB) | GCR (dB) | NF (dB) | $G_{PMAX}$ | 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 |

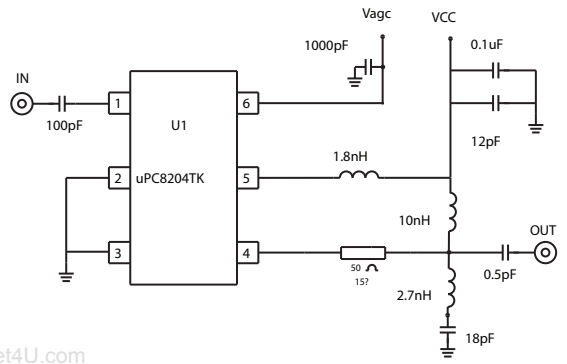
Note:
1. Typical performance. Please refer to Electrical Charateristics in detail.
( ): Reference

## 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<br>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 $V_{CC}$ 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 | $V_{CC}$ | 2.7~3.3 | — | Supply voltage pin. this pin must be equipped with bypass capacitor (eg 1000 pF) to minimize its RF impedance. |   |
| 6 | $V_{AGC}$ | 0~3.3 | — | Gain control pin. | |

## APPLICATION CIRCUIT

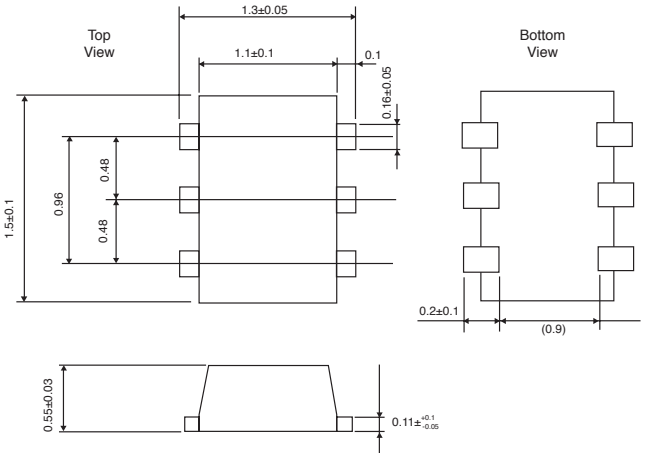
f = 2.4 GHz



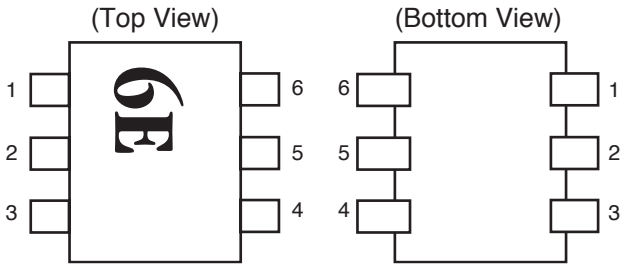



## OUTLINE DIMENSIONS (Units in mm)

**6-PIN LEAD-LESS MINIMOLD**




## PIN CONNECTIONS




| PIN NO. | PIN NAME |
|---|---|
| 1 | INPUT |
| 2 | GND |
| 3 | GND |
| 4 | OUTPUT |
| 5 | $V_{CC}$ |
| 6 | $V_{AGC}$ |

## 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).

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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 | |
|---|---|---|---|
| Lead (Pb) | < 1000 PPM | -A | -AZ |
| | | 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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