# TM2001 2.4-2.5GHz Front End Module

## General Description

The TM2001 manufactured on LTCC technology is a high integration front-end module for wireless application between 2.4 to 2.5GHz ISM band. Consisting of a low noise amplifier and a high efficiency power amplifier, the TM2001 offers significant increases in operating range and performance. It is offered in a 5 X 5mm surface mount module optimized for a 50Ω system. This high efficiency device makes it ideal for *Bluetooth*, Wireless Data Terminal and portable battery powered equipment. The device also features analog power control to optimize transmit power while maximizing battery life in portable equipments. The power control function also eliminates the need for directional couplers, detector diodes and other power control circuitry. This allows the device to be directly driven by the DAC output. All modules are screened at operating frequency prior to delivery for guaranteed performance.

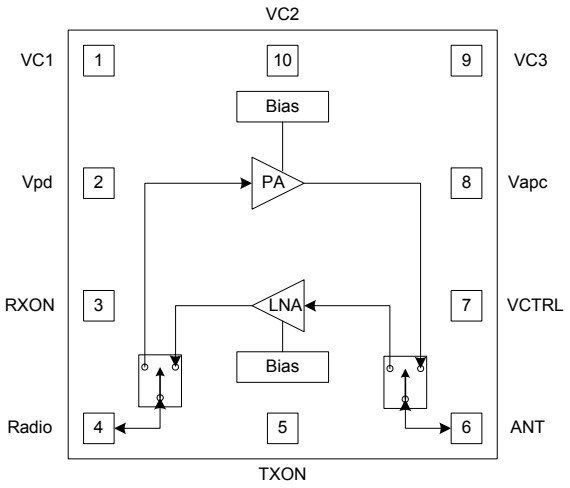
## Features

- Consisting of a LNA and a PA
- Operating Mode: Bi-directional, Time Division Duplex
- 5mm x 5 mm Ultra Small Package
- Analog Gain Control and Power Control
- Internally Matched to 50Ω
- High Efficiency
- High Integration Module

## Applications

- Bluetooth™ PA (Class 1).
- Wireless Data Terminal.
- Dual Band Cordless Handset.
- Portable Battery Powered Equipment.

**Functional Block diagram**





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## Absolute Maximum Ratings

| Parameter | Maximum Rating | Unit |
|---|---|---|
| VCC Supply Voltage | 0 to 6 | V |
| APC Control Voltage | 0 to 6 | V |
| APC Current (Maximum) | + 10 | mA |
| RF Input Power | + 5 | dBm |
| Operating Temperature | -40 to +85 | $^{o}$C |
| Storage Temperature | -55 to +150 | $^{o}$C |

**Notes:**

1. Operation of this device in excess of any maximum rating as specified above may cause permanent damage to the device.
2. **Caution! ESD Sensitive Device.**

## Specification Summary

1. Transmitting Mode

VC1=VC2=VC3=Vpd=3.3V, Vapc=2.8V, VCTRL=0V, TX=High (3.3V), RX=Low (0V)

| Parameter | Min. | Typical | Max. | Unit | Condition |
|---|---|---|---|---|---|
| Operating Frequency Range | | 2.4 to 2.5 | | GHz | |
| Maximum Output Power | | +21 | | dBm | |
| Power Added Efficiency | | 26 | | % | Pout=+20dBm |
| Harmonics: 2Fo, 3Fo | | -33, -33 | | dBc | Pout=+20 dBm |
| Gain | 20 | 22 | | dB | Pin=-30dBm |
| Power Supply Voltage | | 3.3 | | V | |
| Power Supply Current | | 115 | | mA | Pout=+20dBm |
| Quiscent Current | | 46 | | mA | No RF Input |
| Shut Down Supply Current | | 10 | | uA | Vpd=0.0V |

2. Receiving Mode

VC1=VC2=VC3=VCTRL=3.3V, Vapc=Vpd=0V, TX=Low (0V), RX=High (3.3V)

| Parameter | Min. | Typical | Max. | Unit | Condition |
|---|---|---|---|---|---|
| Operating Frequency Range | | 2.4 to 2.5 | | GHz | |
| Gain | 10 | 12 | | dB | |
| Power Supply Voltage | | 3.3 | | V | |
| Power Supply Current | | 6 | | mA | Pin=-30dBm |
| Shut Down Supply Current | | 10 | | uA | VCTRL=0V |
| Noise Figure | | 2.3 | | mA | Pin=-30dBm |


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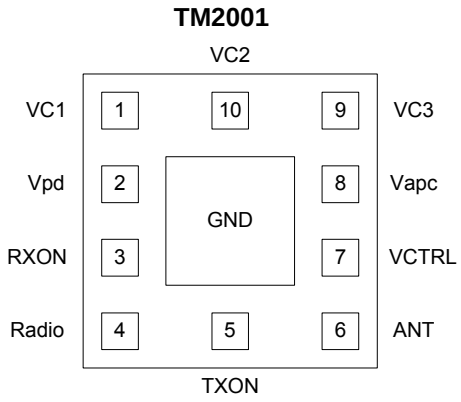
## Pin Assignment




## Functional Pin Description

| Name | Pin # | Description |
|---|---|---|
| VC1 | 1 | DC supply for first stage of Power Amplifier |
| Vpd | 2 | Bias control about output power and gain. Control internal PA ON/OFF. |
| RXON | 3 | Control TX/RX path |
| Radio | 4 | The input port of TX, the output port of RX |
| TXON | 5 | Control TX/RX path |
| ANT | 6 | The output port of TX, the input port of RX |
| VCTRL | 7 | Control internal LNA ON/OFF |
| Vapc | 8 | Analog power control of PA |
| VC3 | 9 | DC supply for second stage of PA |
| VC2 | 10 | DC supply for internal LNA |
| GND | GND | This pin must be connected to ground |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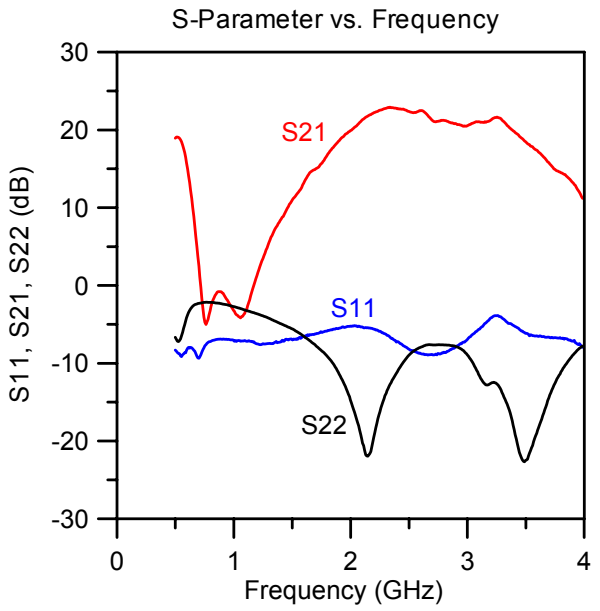
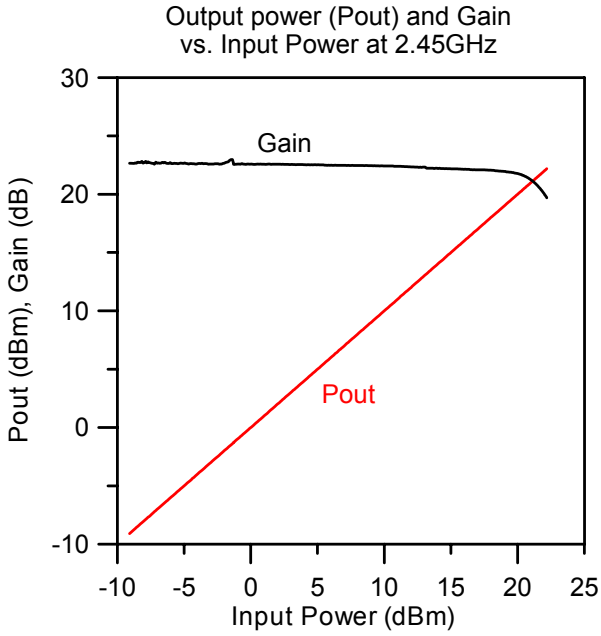
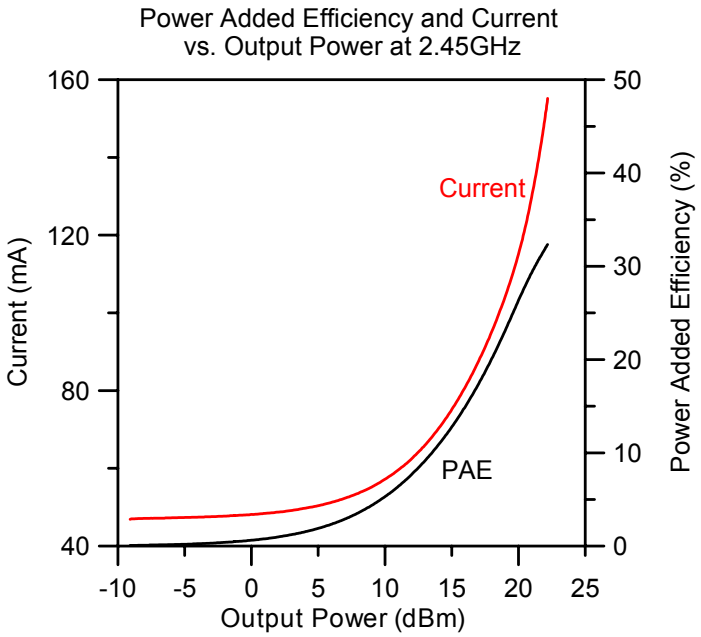
## Performance Data

Transmitting Mode





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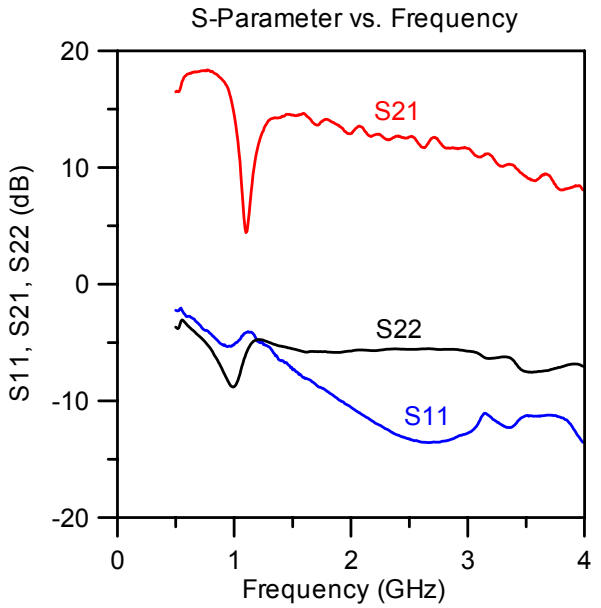
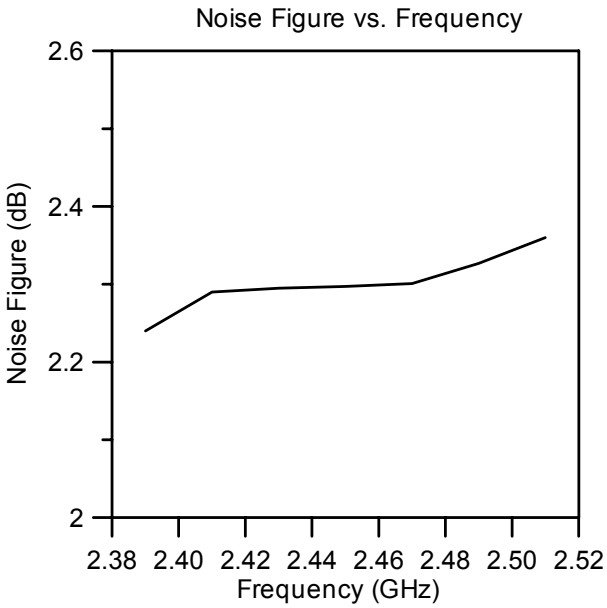
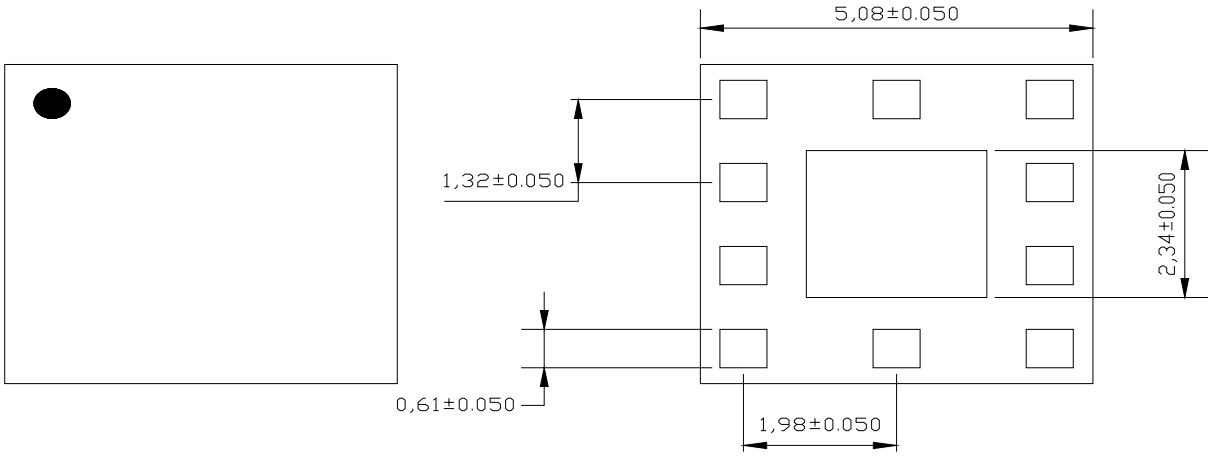
Receiving Mode




## Package Information





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