

General Description

The ETM2009 is a front-end MCM Module and uses an advanced Gallium Arsenide (GaAs) process. The front-end module consists of a Power Amplifier (PA), Low-Noise Amplifier (LNA) and two RF single pole double throw (SPDT) Switch. This device makes it ideal for IEEE 802.11.b/g, Bluetooth, 2.4 Ghz Audio/Video, Wireless Data Terminal and portable battery powered equipment. The PA delivers +23dBm (maximum) output power with a high Power Added Efficiency (PAE) 41%. The noise figure of LNA is below 1.8dB. The RF SPDT Switch has very low insertion loss 0.4dB in the 2.4GHz to 2.5GHz range. The device is packaged in a QFN 4mm by 4mm 20L package.

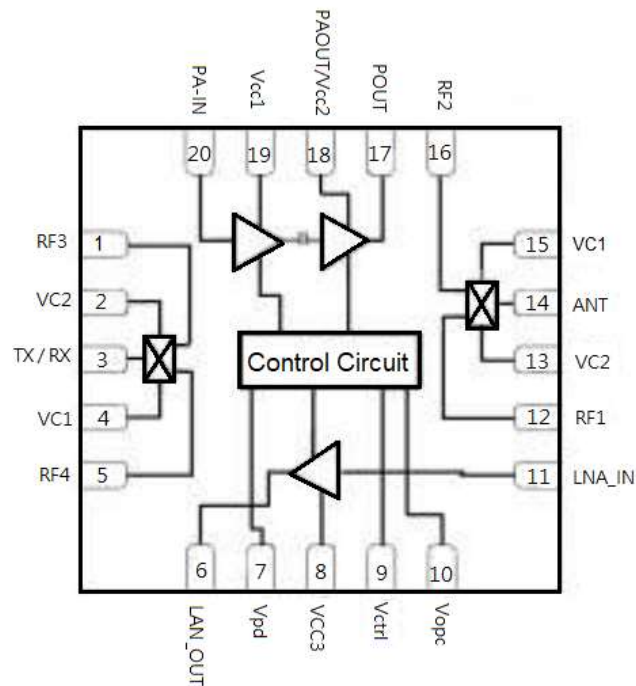
Features

- High Efficient Power Amplifier: 41% at Pout = 23dBm
- P-1dB: +21dBm Typical @ +3.3V
- Low-Noise Amplifier (NF typical 1.8dB)
- Low Insertion Loss: 0.4dB @ 2.45GHz
- IIP3: 55dBm @ Input Power up to 20dBm
- QFN 4x4 mm 20L with thermal ground ultra small plastic package
- Green, MSL 1

Applications

- Bluetooth™ PA (Class 1)
- Wireless Data Terminal
- Wireless Audio
- Portable Battery Powered Equipment

Functional Block Diagram



Absolute Maximum Ratings

Parameter	Maximum Rating	Unit
VCC1, VCC2 and VCC3 Supply Voltage	0 to 6	V
Vctrl, Vpd and Vpd Control Voltage	0 to 6	V
Switch Control VC1, VC2	-6.0 to +6.0 ^{Note}	V
RF Switch input Power (>500MHz)	33	dBm
Storage Temperature	-55 to +150	°C
Power Supply Current	350	mA

Note |VC1-VC2| ≤ 6.0V

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

Power Amplifier

Parameter	Min.	Typical	Max.	Unit	Condition
Operating Frequency Range		2.4 to 2.5		GHz	
Maximum Output Power		+23		dBm	
PA Supply Current		100		mA	VCC1=VCC2=Vpd=3.3V, Vapc=2.8V, Pout=20dBm
Power Added Efficiency		30		%	Pout=20dBm,
Harmonics: 2Fo, 3Fo		-35,-32		dBc	Pout=20dBm
PA Small Signal Gain	23	25		dB	P _{IN} =-30dBm
Quiescent Current		47		mA	VCC1=VCC2=VCC3=3.3V Vpd=3.3V, Vapc=2.8V,
P ₁ dB		21		dBm	VCC1=VCC2=Vpd=3.3V, Vapc=2.8V

Low Noise Amplifier

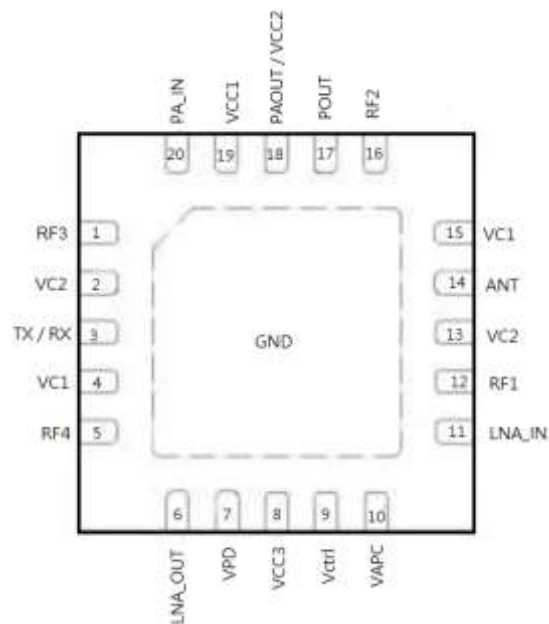
Parameter	Min.	Typical	Max.	Unit	Condition
Operating Frequency Range		2.4 to 2.5		GHz	
Quiescent Current		7		mA	VCC3=Vctrl=3.3V, Pin=-30 dBm
Noise Figure		1.8		dB	
LNA Gain		13		dB	VCC3=Vctrl=3.3V, Pin=-30 dBm

RF SPDT Switch

Parameter	Min.	Typ.	Max.	Unit	Test Conditions
Insertion Loss		0.3	0.4	dB	Input Power +25dBm DC-1.0GHz
		0.4	0.5	dB	1.0-2.0GHz
		0.4	0.6	dB	2.0-3.0GHz
Isolation	24	26		dB	Input Power +25dBm DC-1.0GHz
	22	24		dB	1.0-2.0GHz
	21	23		dB	2.0-3.0GHz
VSWR		1.2	1.4		DC-1.0GHz
		1.2	1.4		1.0-2.0GHz
		1.5	1.6		2.0-3.0GHz
Input Power for 1 dB compression		30		dBm	2.5GHz
Second Harmonics		-75		dBc	f=2.5GHz, Pin=25dBm
Third Harmonics		-80		dBc	f=2.5GHz, Pin=25dBm
Intermodulation Intercept Point (IIP3)		55		dBm	For two tones (f=2.5GHz, 2.501GHz) @ Input power +20dBm
Switch Time		50		ns	
Control Current		4	100	μA	Input Power +25dBm

Notes: All measurements made in 50Ω system, unless otherwise specified. DC=500MHz.

Functional Pin Description



Name	Pin #	Description
RF3	1	TR/RX Switch RF Port
VC2	2	TR/RX Switch, TR/RX-RF4 Control Voltage
TX/RX	3	Control the gain of PA
VC1	4	TR/RX Switch, TR/RX-RF3 Control Voltage
RF4	5	TR/RX Switch RF Port
LNA_OUT	6	LNA output
VPD	7	PA Gain Control
VCC3	8	LNA Vcc
Vctrl	9	LNA ON/OFF control pin
VAPC	10	Control the output power of PA
LNA_IN	11	LNA input
RF1	12	ANT Switch, RF Port
VC2	13	RF Switch, ANT-RF2 Control Voltage
ANT	14	ANT I/O Port
VC1	15	RF Switch, ANT-RF1 Control Voltage

RF2	16	ANT Switch, RF Port
POUT	17	PA Output port
PAOUT/VCC2	18	PA 2 nd stage Vcc and Power output pin
VCC1	19	PA 1 st stage Vcc
PA_IN	20	PA input. A matching network with DC block required.
GND	center pad	This pin must be connected to ground

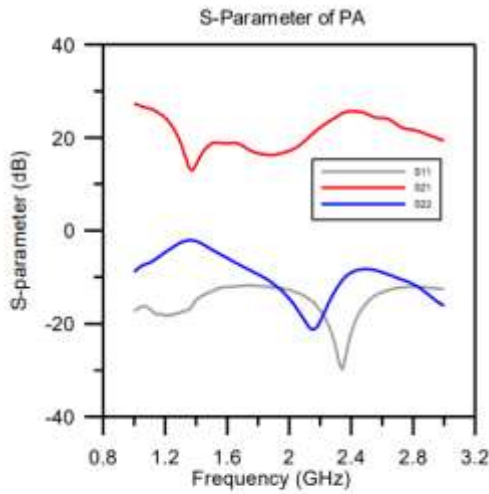
SW Truth Table

VC1	VC2	ANT – RF2	ANT – RF1
High	Low	Isolation	Insertion Loss
Low	High	Insertion Loss	Isolation

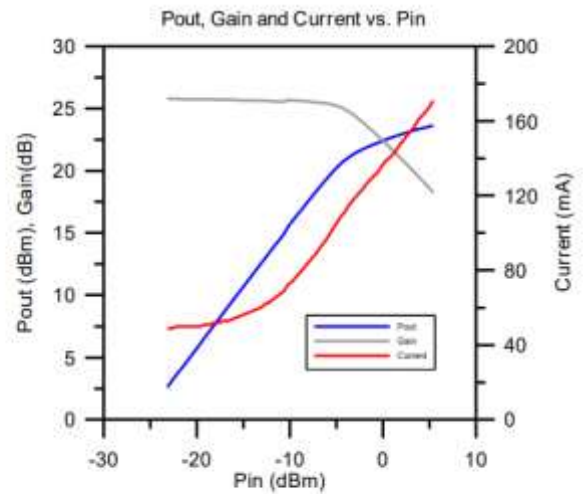
VC1	VC2	TX/RX– RF4	TX/RX – RF3
High	Low	Isolation	Insertion Loss
Low	High	Insertion Loss	Isolation

High: 3V to 5V Low: -0.2V to 0.2V

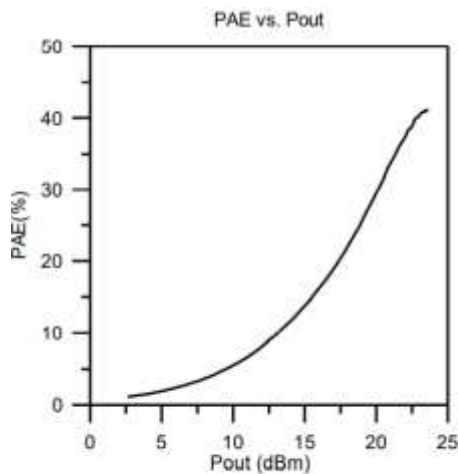
Typical Characteristics



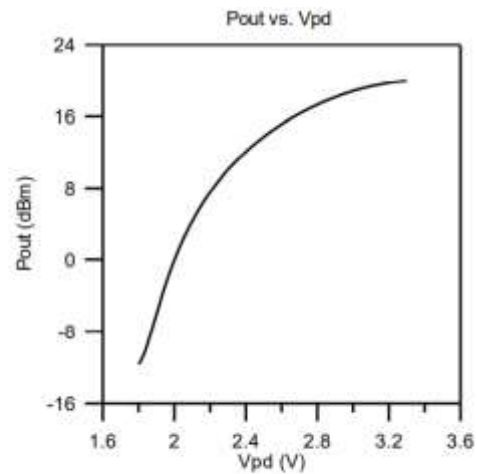
VCC1=VCC2=Vpd=3.3V, Vapc=2.8V and Pin=-30dBm



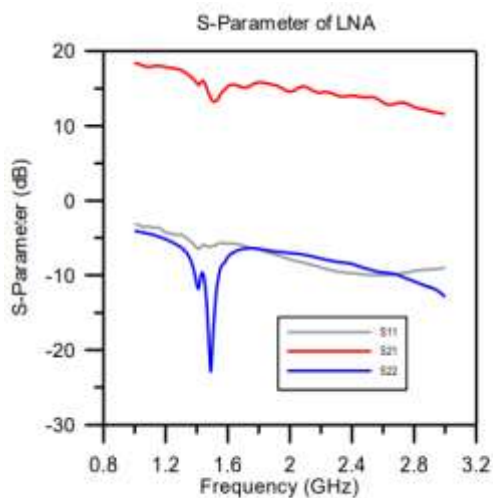
VCC1=VCC2=Vpd=3.3V
Vapc=2.8V and Freq=2.45GHz



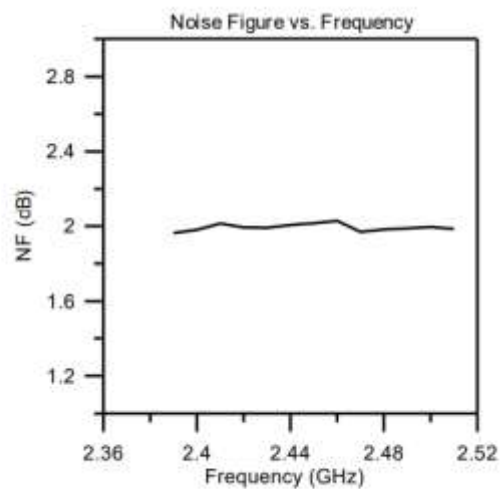
VCC1=VCC2=Vpd=3.3V,
Vapc=2.8V, Freq=2.45GHz



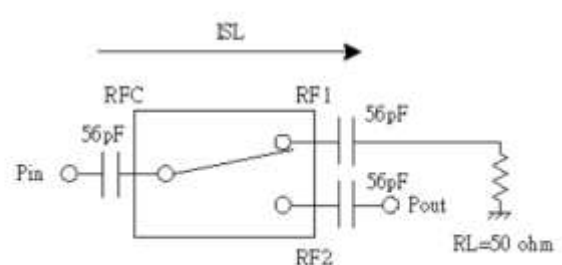
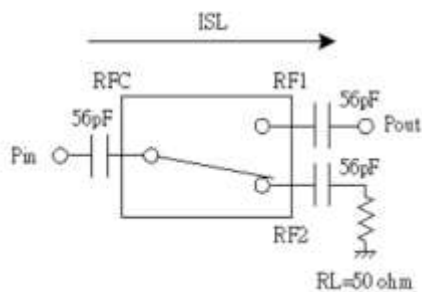
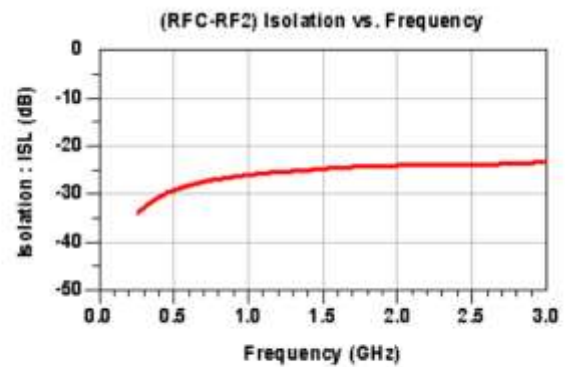
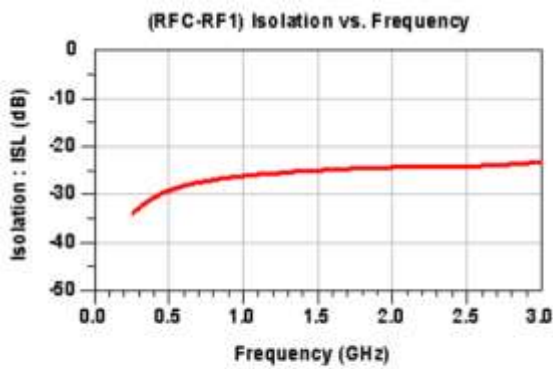
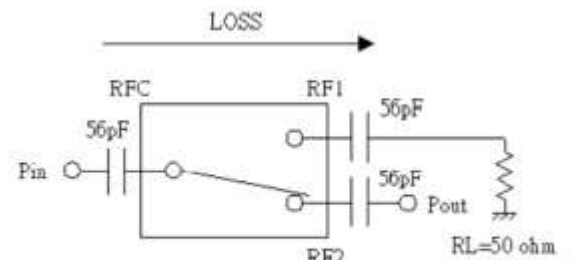
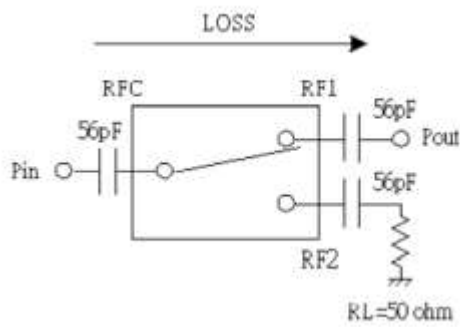
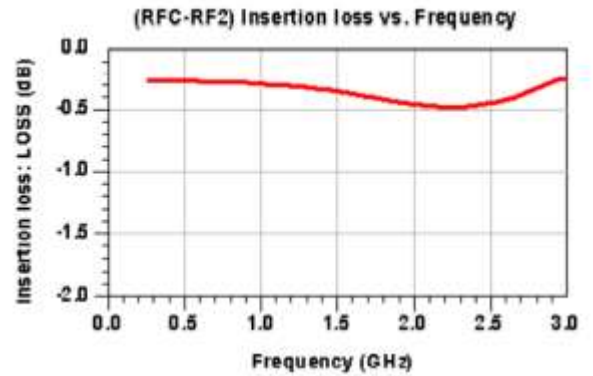
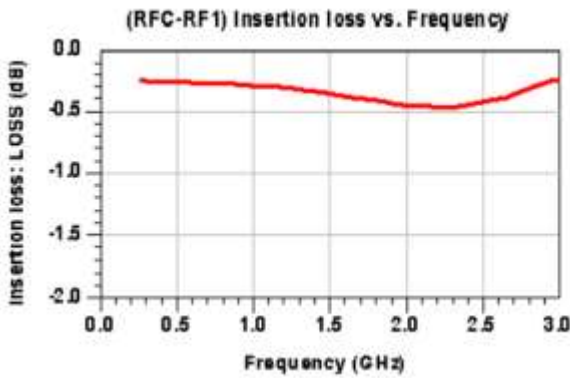
VCC1=VCC2=3.3, Vapc=2.8V
Pin=-5.25dBm, Freq=2.45GHz

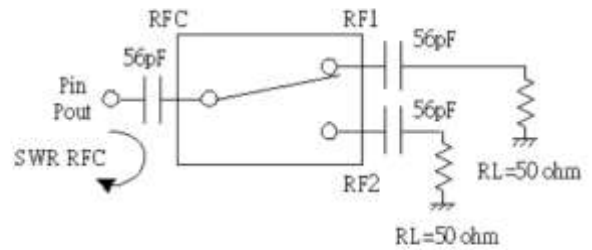
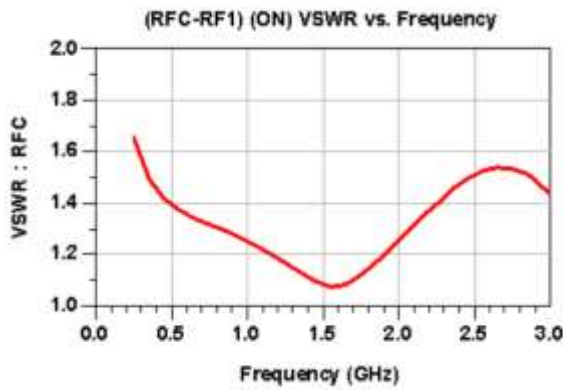
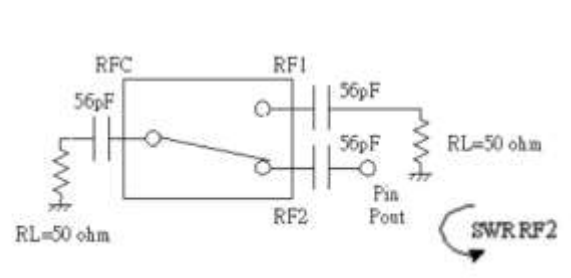
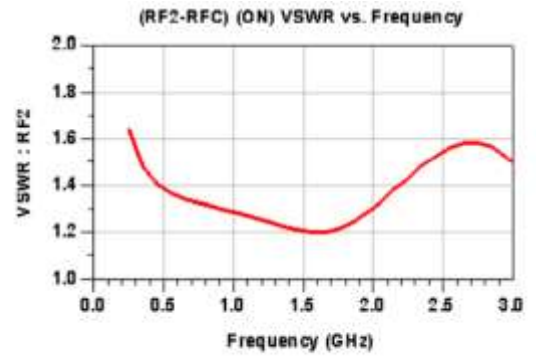
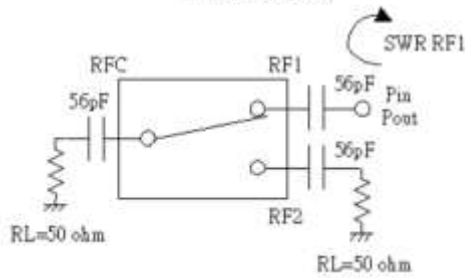
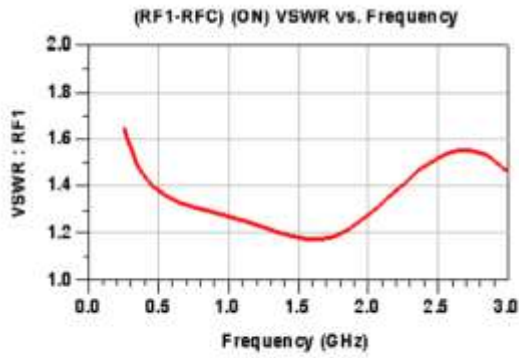


VCC3=Vctrl=3.3V, Pin=-30dBm

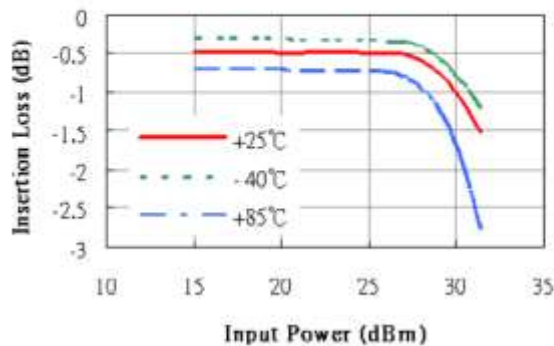


Switch Typical Characteristics (Vcc=0V/3.0V , Pin=0dBm) [following RFC is pin10 ANT]

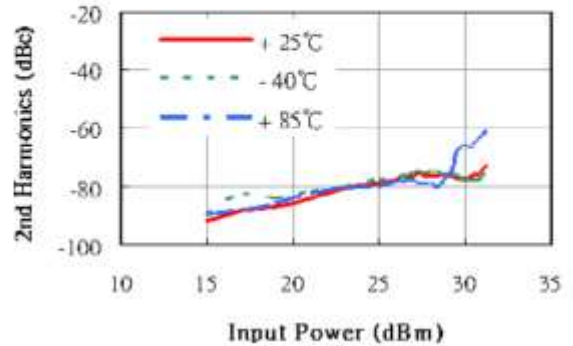




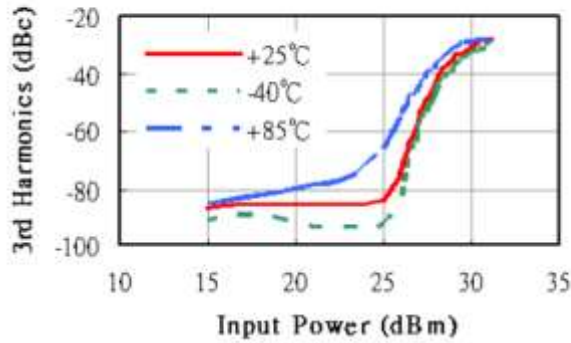
Insertion Loss vs. Input Power
(Vcc=0V/3.0V, 2.5GHz@-40°C,+25°C,+80°C)



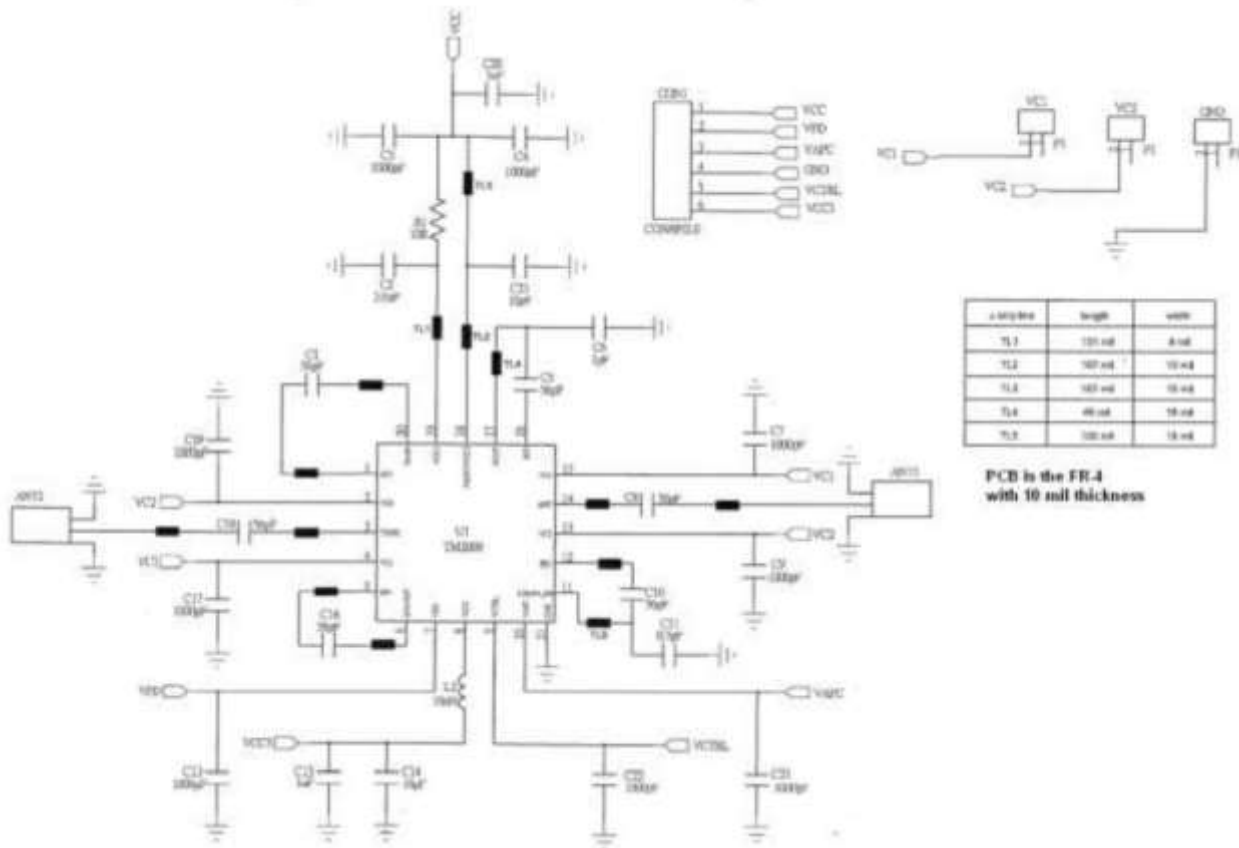
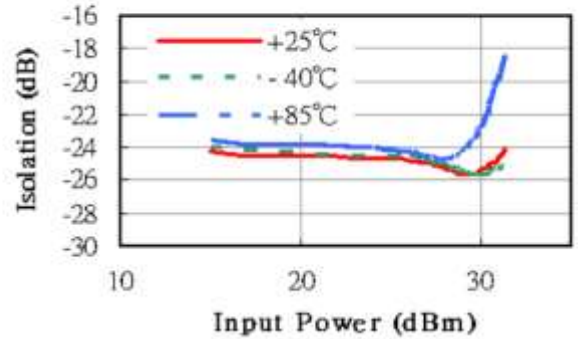
2nd Harmonics vs. Ambient Temperature
(Vcc=0V/3.0V, 2.5GHz@-40°C,+25°C,+80°C)



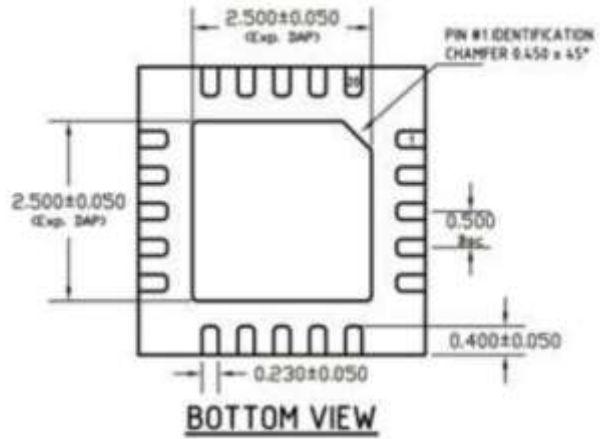
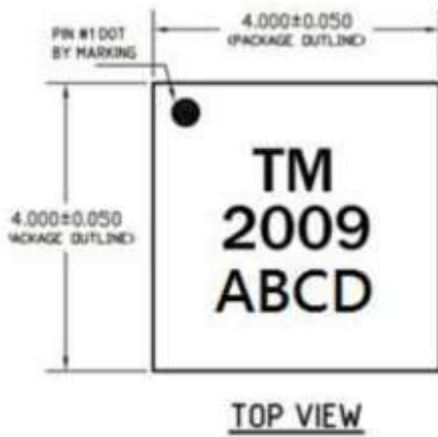
3rd Harmonics vs. Ambient Temperature
 (Vcc=0V/3.0V, 2.5GHz@-40°C,+25°C,+80°C)



Isolation vs. Input Power
 (Vcc=0V/3.0V, 2.5GHz@-40°C,+25°C,+80°C)



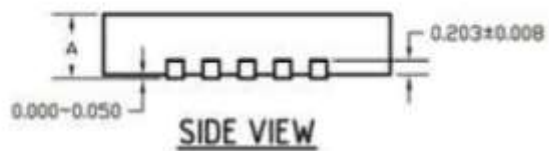
Package Dimension



NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. GFN AND TQFN SHARE THE EXPOSE OUTLINE BUT WITH DIFFERENT THICKNESS.

A	GFN	
	MAX.	1.000
NOM.	0.850	
MIN.	0.800	



Product Marking

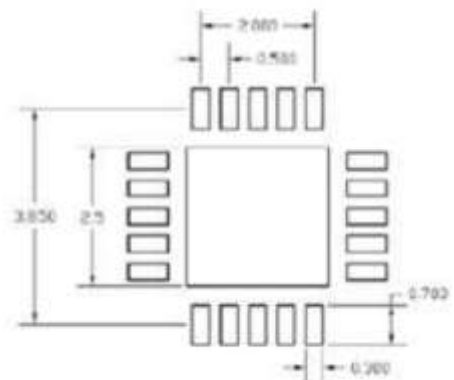


ABCD means lot number

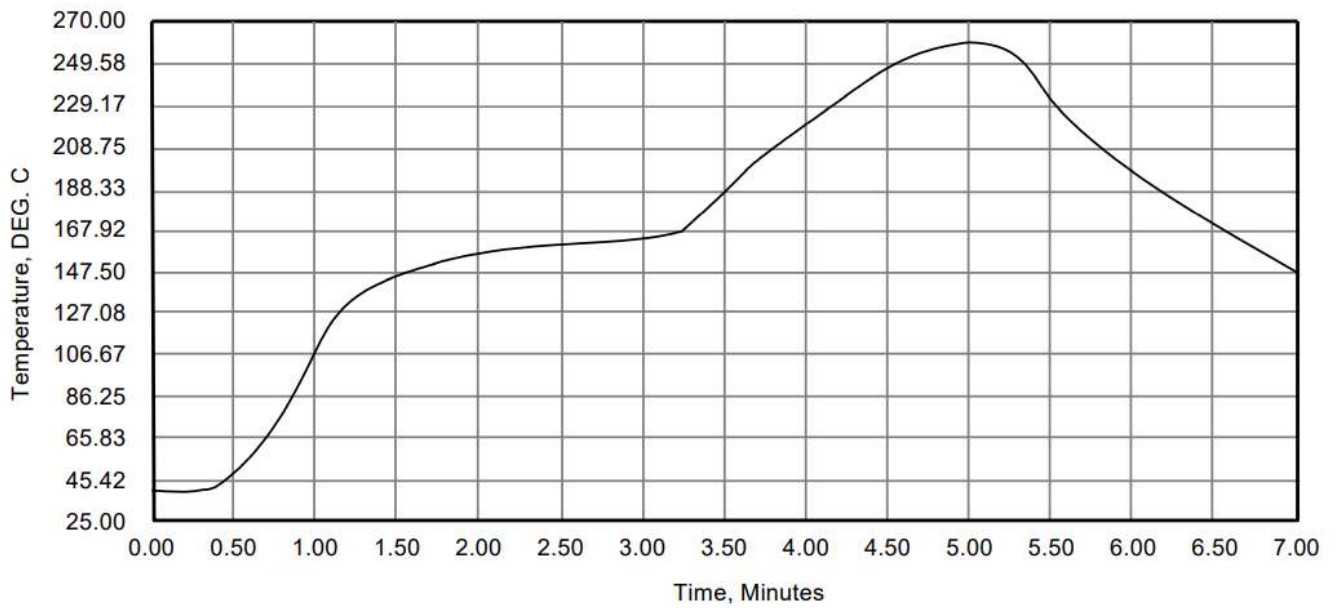
PCB Land Pattern

Dimension in mm

- — PCB PAD
- ⊙ — Through hole diameter: 0.22mm



SMT Reflow Profile



Ordering Information

ETM2009 □ GR

Q2 = QFN4*4