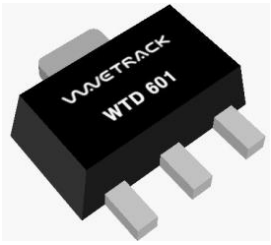
5~6000MHz InGaP/GaAs HBT 0.25W Drive MMIC Amplifier

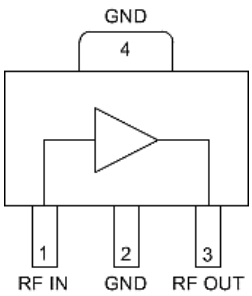
General Description

The WTD601 is a general RF gain boosting amplifier MMIC that have high linearity & gain performance. The device features flat high gain with excellent in/out return loss. The amplifier typically provides 16dB gain, 37.5dBm OIP3 and 4.8dB Noise Figure while drawing 88mA current at 1.9GHz. The device is packaged in a lead-free/green/RoHS-compliant industry-standard SOT-89 package.

The WTD601 is designed a Darlington-pair amplifier using high reliability InGap/GaAs HBT process.

Functional Block Diagram





Features

- 5~6000MHz
- P1dB = 24.10dBm @1900MHz
- Gain = 16.0 dB @1900MHz
- OIP3 = 37.5 dBm @1900MHz
- NF = 4.8 dB @1900MHz
- IRL= 19.0dB and ORL=14.9dB
- 50 Ohm Cascadable Drive amplifier
- Unconditionally Stable
- +5V Single Supply, 88mA Current
- Industry Standard SOT-89 Package

Applications

- Cellular / PCS / 3G / LTE repeaters
- Wireless Data / WLAN
- CATV & Cable Modem
- ISM
- Microwave Radio

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage(V_{CC})	5.5 V
Max Device Current(I_D)	100 mA
Max RF Input Power	20 dBm
Operating Temperature(T_L)	-40 to +85°C
Storage Temperature	-65 to +150°C
ESD Sensitivity (Human Body Model : HBM)	Class 1C
Moisture Sensitivity Level (MSL)	MSL1

Note.

1. Stress under Absolute Maximum Ratings may result in permanent damage to the device.
2. Extended application of Absolute Maximum ratings condition to the device may reduce device reliability.
3. These rating are not intended for continuous normal operation.
   - ✓ HBM : Class 1C in accordance with JEDEC Standard JESD22-A114B
   - ✓ MSL : MSL1 in accordance with JEDEC Standard J-STD-020

ESD CAUTION

	ESD (electrostatic discharge) sensitive device. Although this product features proprietary protection circuitry, damage may occur on devices subjected to high energy ESD.

Typical Performance at Key Operating Frequencies

Vcc = +5V, T_A=25°C, unless otherwise noted. (I_D = 88mA)

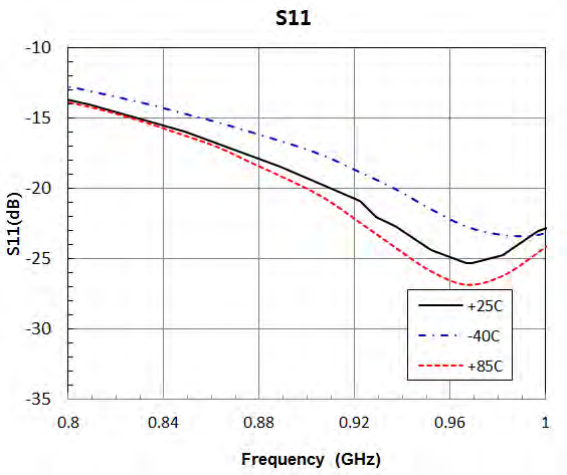
Parameter	900MHz	1900MHz	2140MHz	2600MHz	Unit
S21	20.7	16.0	15.0	13.3	dB
OIP3	37.0	37.5	38.0	37.0	dBm
P1dB	24.0	24.1	23.9	23.8	dBm
S11	-20.0	-19.0	-20.3	-20.7	dB
S22	-16.0	-14.9	-18.0	-28.5	dB
S12	-28.0	-24.3	-23.5	-22.2	dB
NF	4.5	4.84	4.82	4.95	dB

Note.

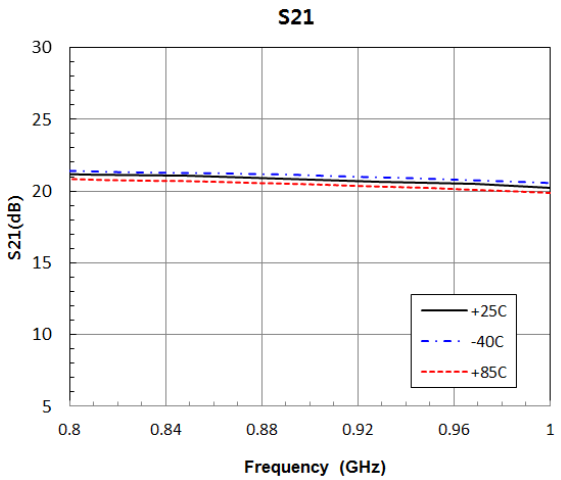
1. Typical RF performance measured on a Wavetrack evaluation board.
2. RF performance data taken with application circuit element values.
3. OIP3 measured with two tones at an output 8dBm per tone separated 1MHz.
4. Z_S = Z_L = 50 ohm .

S-Parameter (@900MHz)

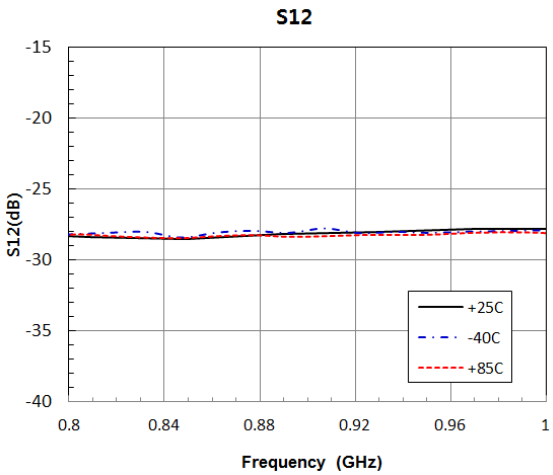
Input Return Loss



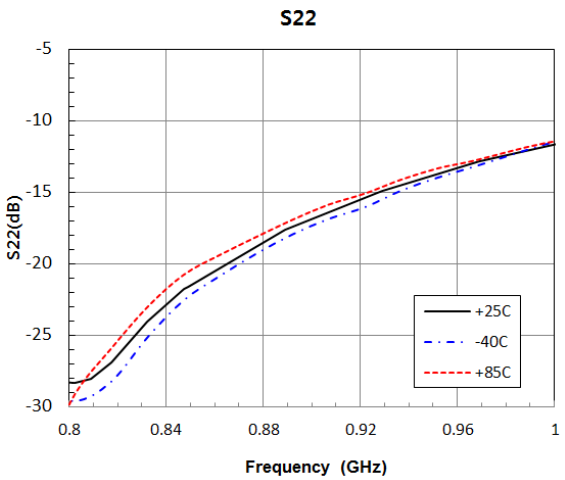
Broadband Gain



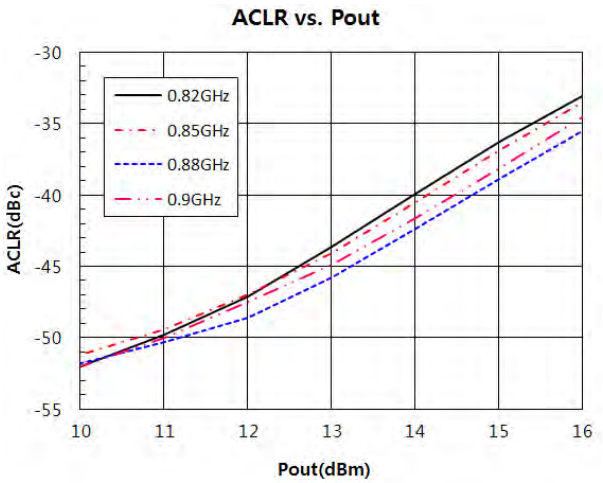
Reverse isolation

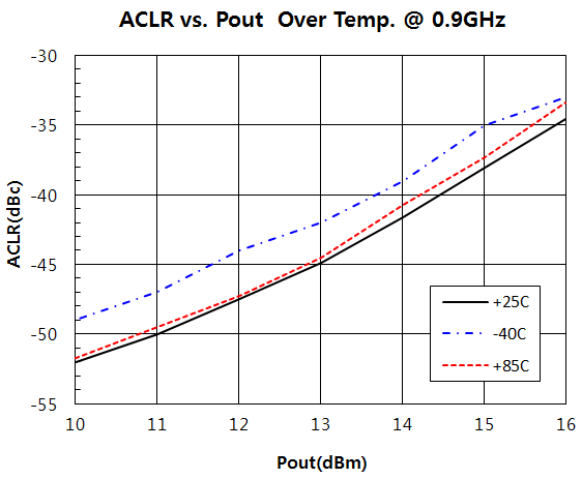


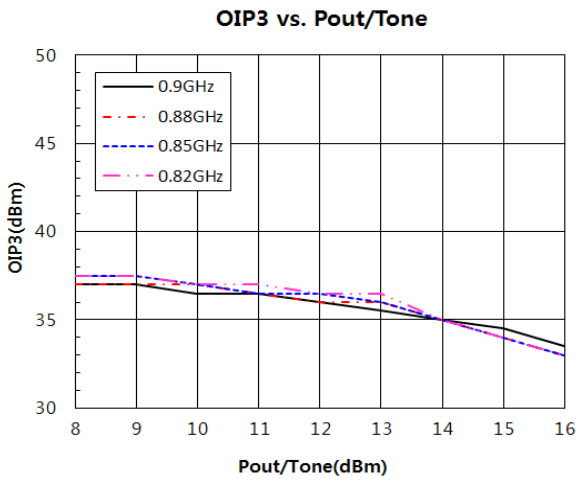
Output Return Loss

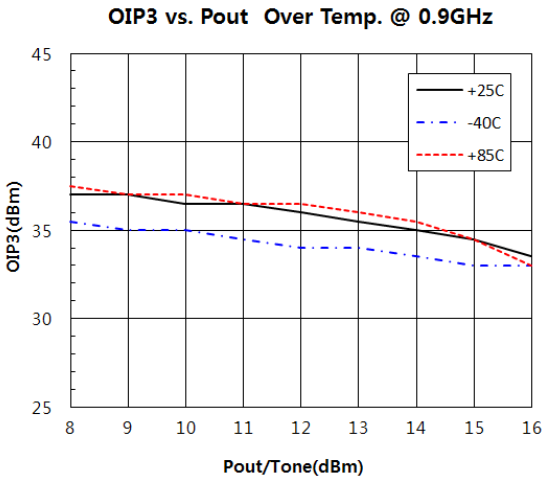


ACLR & OIP3 vs Pout (@900MHz)

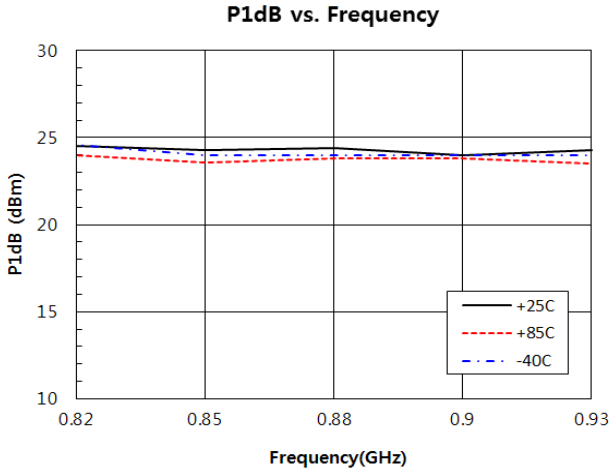




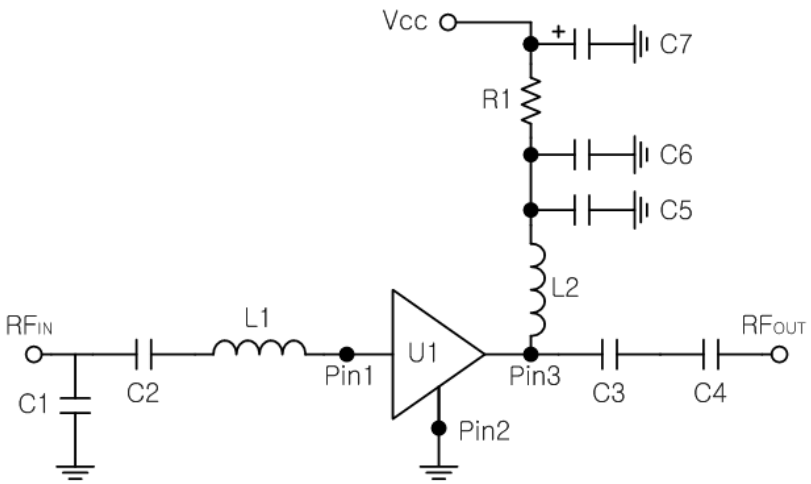




P1-dB (@900MHz)



Application Circuit Schematic (@900MHz)



Note.

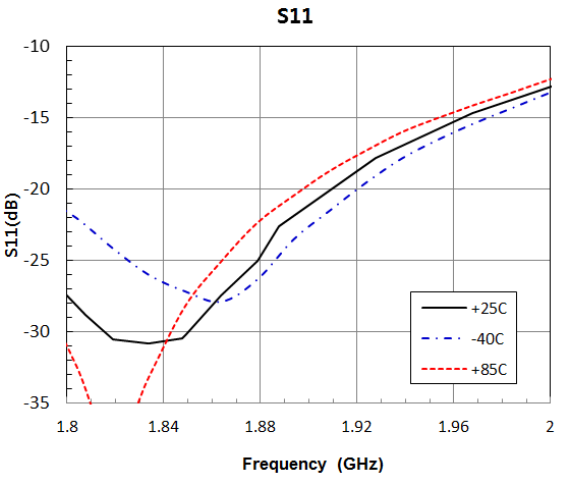
1. Application circuit schematic shows the basic connection for operating WTD601.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values (@900MHz)

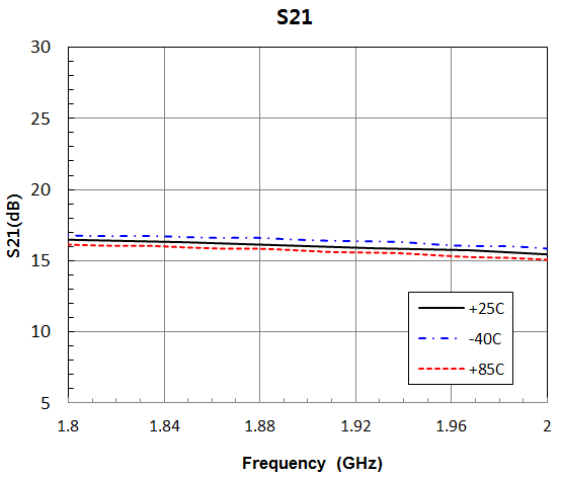
Reference	Value	Unit	Description	Manufacture
U1	WTD601	-	RF Drive Amplifier	WAVETRACK
C1	6	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	30	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C6	1000	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C7	0.1	[uF]	Tantalum Capacitor	Samsung
L1	39	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	0	[Ω]	Resistor Chip	Samsung

S-Parameter (@1900MHz)

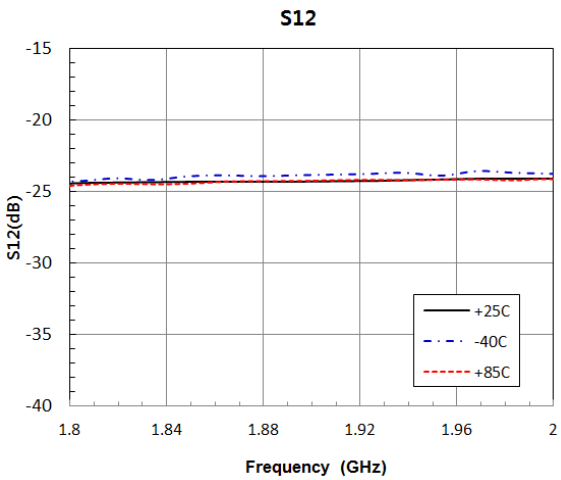
Input Return Loss



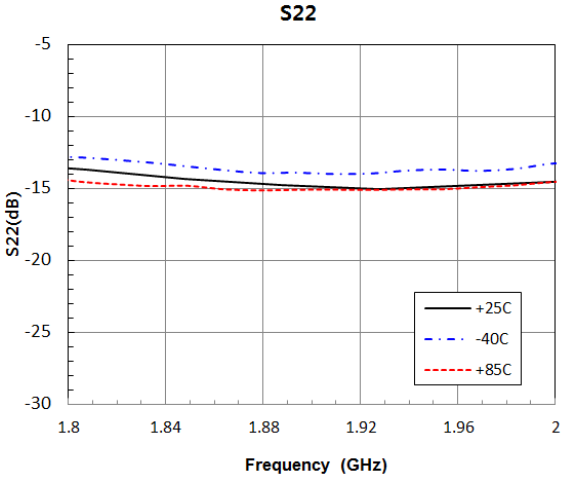
Broadband Gain



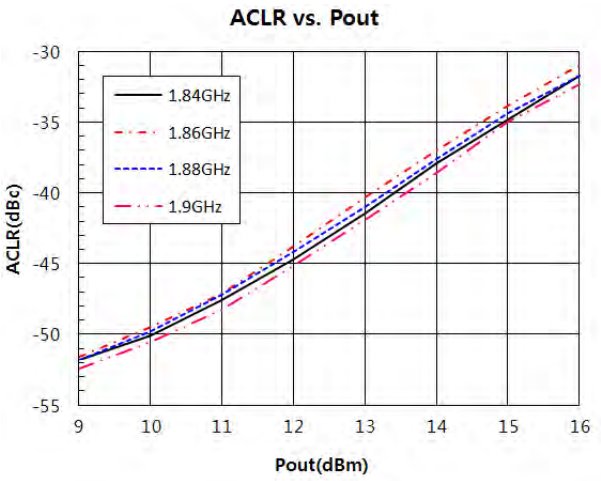
Reverse isolation

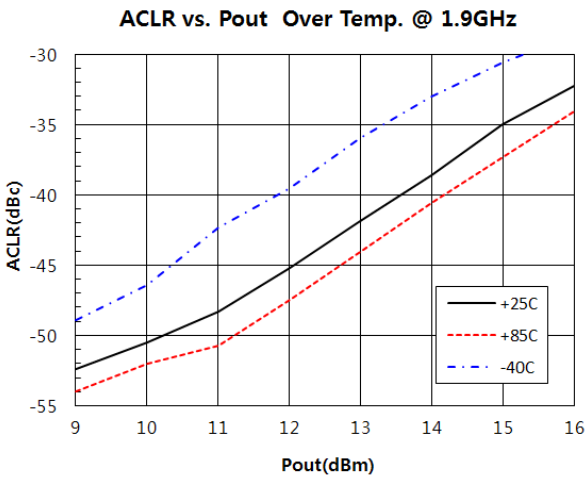


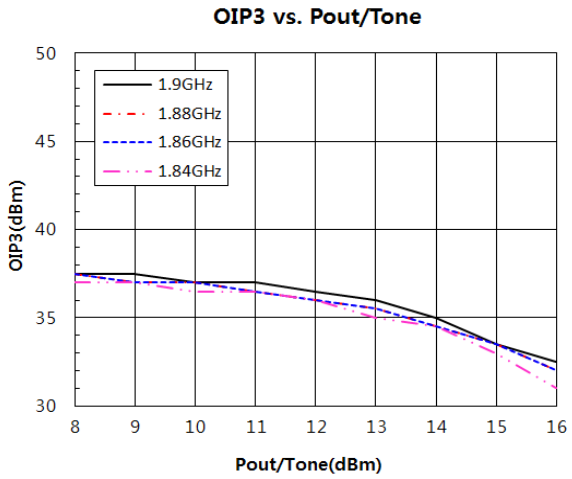
Output Return Loss

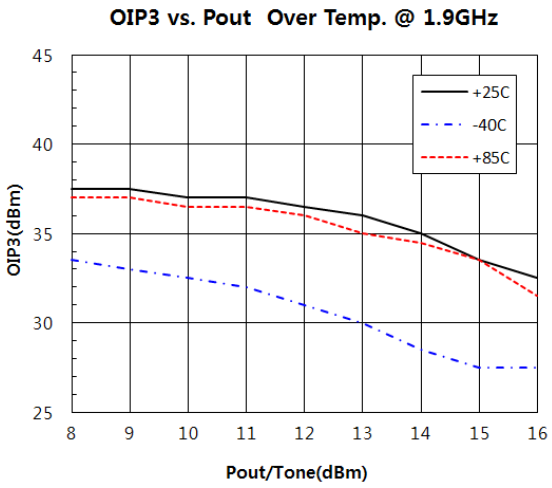


ACLR & OIP3 vs Pout (@1900MHz)

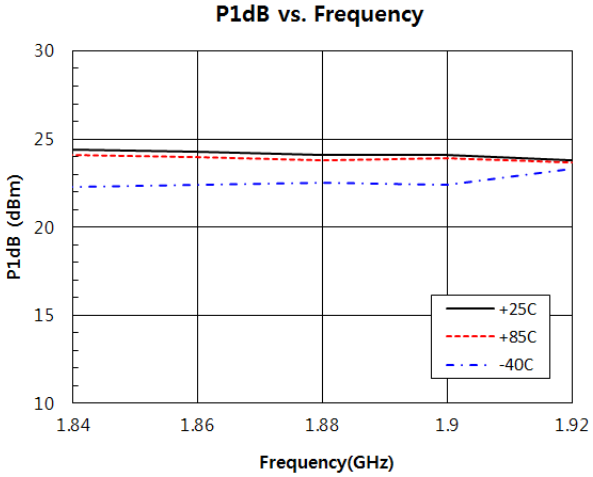




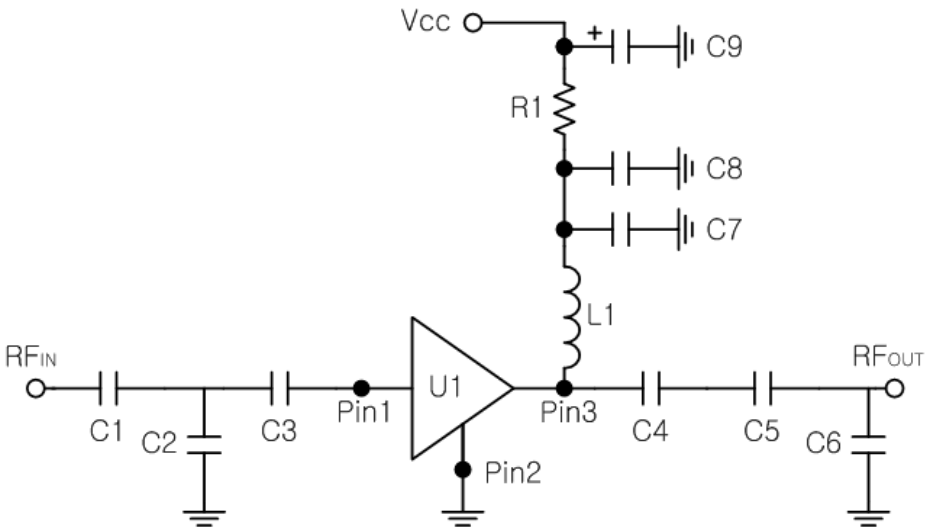




P1-dB (@1900MHz)



Application Circuit Schematic (@1900MHz)



Note.

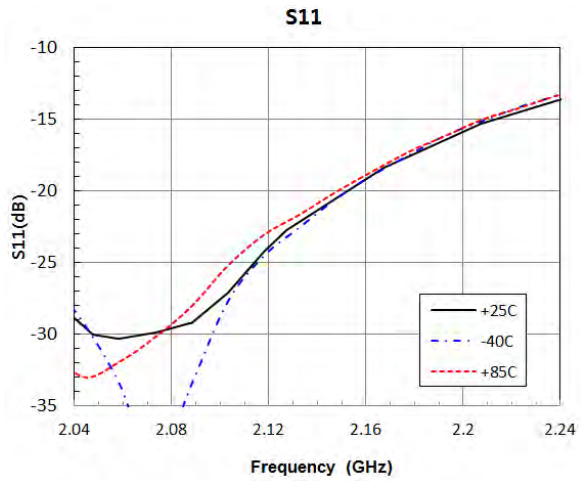
1. Application circuit schematic shows the basic connection for operating WTD601.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values (@1900MHz)

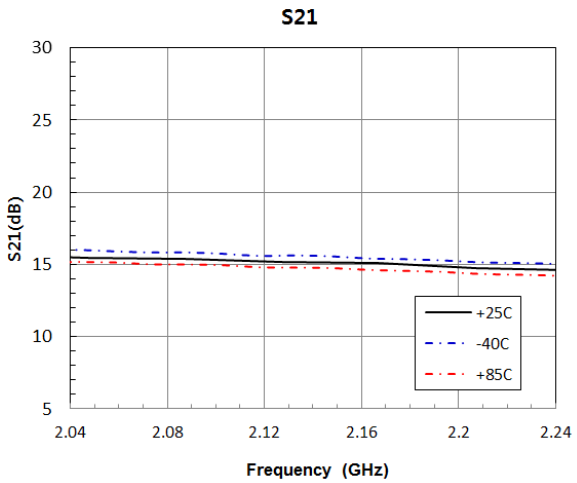
Reference	Value	Unit	Description	Manufacture
U1	WTD601	-	RF Gain Block Amplifier	WAVETRACK
C1	20	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	2	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	20	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	20	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	20	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C6	1	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C7	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C8	1000	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C9	0.1	[uF]	Tantalum Capacitor	Samsung
L1	22	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	0	[Ω]	Resistor Chip	Samsung

S-Parameter (@2140MHz)

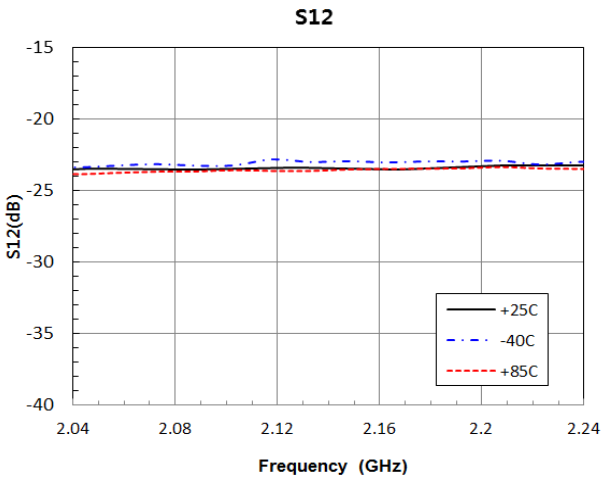
Input Return Loss



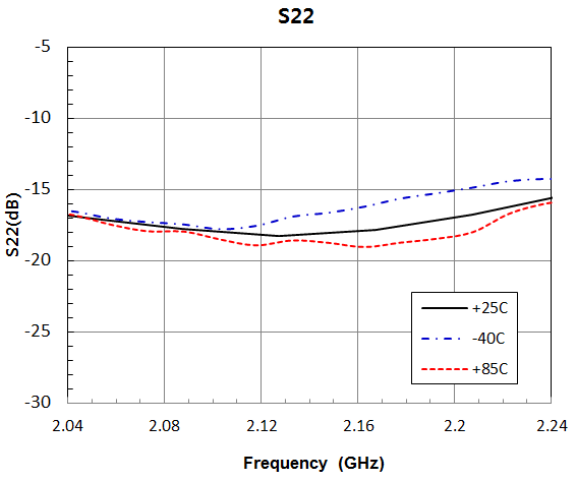
Broadband Gain



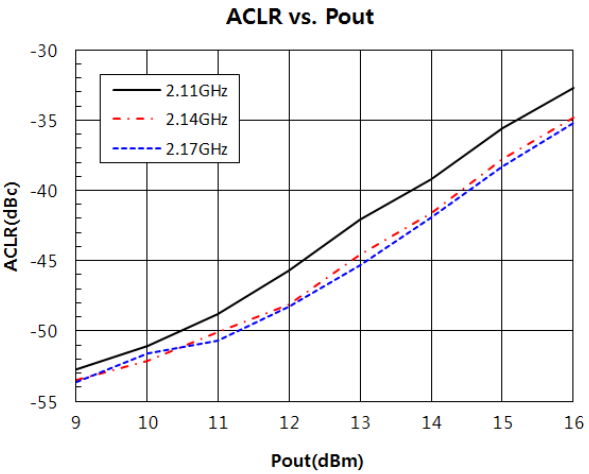
Reverse isolation

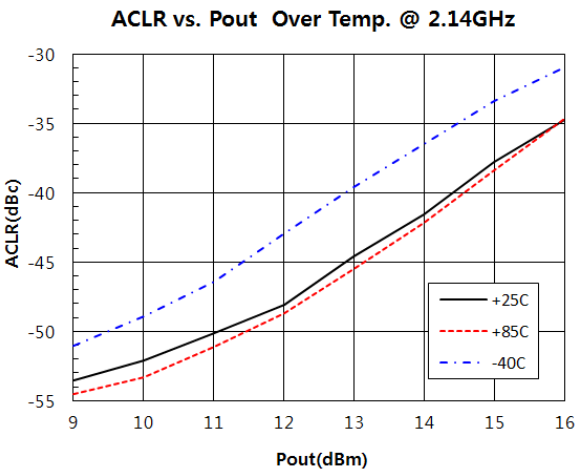


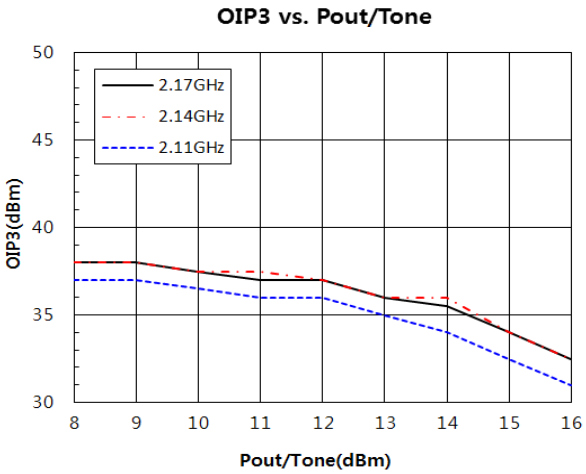
Output Return Loss

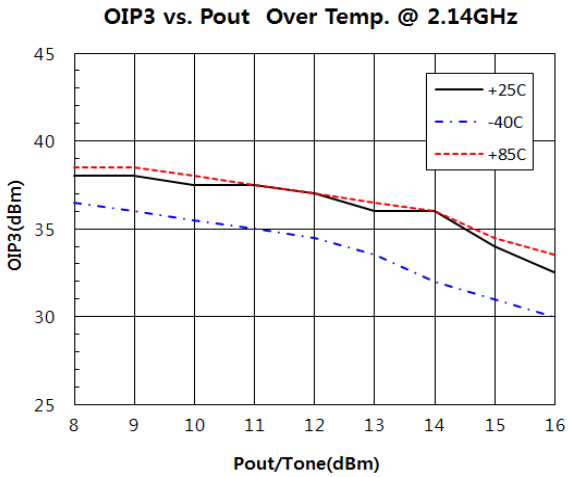


ACLR & OIP3 vs Pout (@2140MHz)

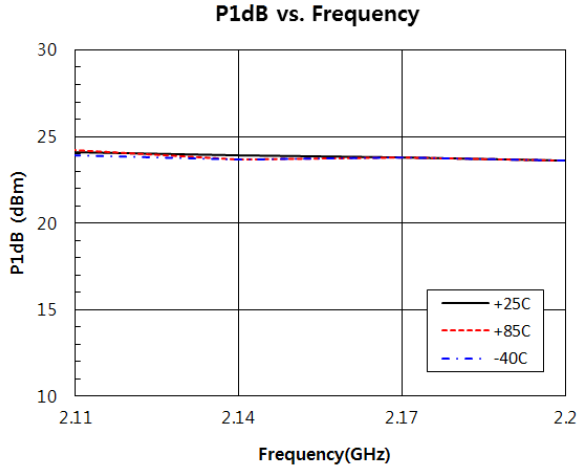




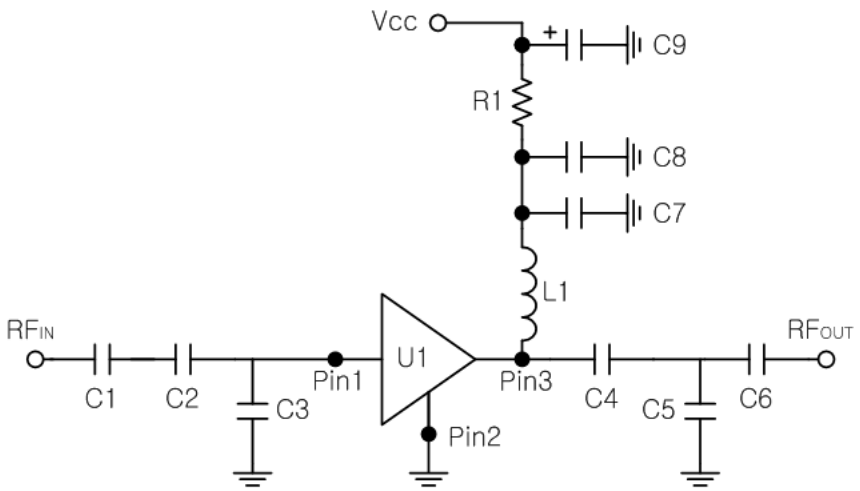




P1-dB (@2140MHz)



Application Circuit Schematic (@2140MHz)



Note.

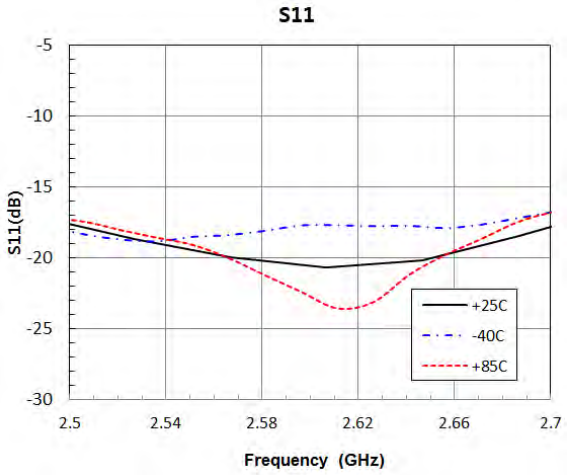
1. Application circuit schematic shows the basic connection for operating WTD601.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values (@2140MHz)

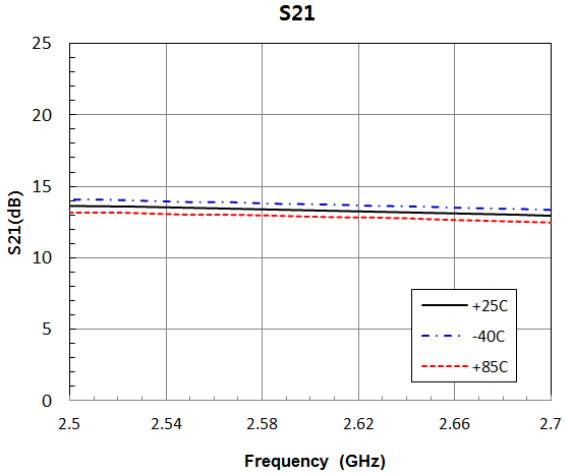
Reference	Value	Unit	Description	Manufacture
U1	WTD601	-	RF Drive Amplifier	WAVETRACK
C1	20	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	20	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	1.5	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	20	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	1.5	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C6	20	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C7	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C8	1000	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C9	0.1	[uF]	Tantalum Capacitor	Samsung
L1	22	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	0	[Ω]	Resistor Chip	Samsung

S-Parameter (@2600MHz)

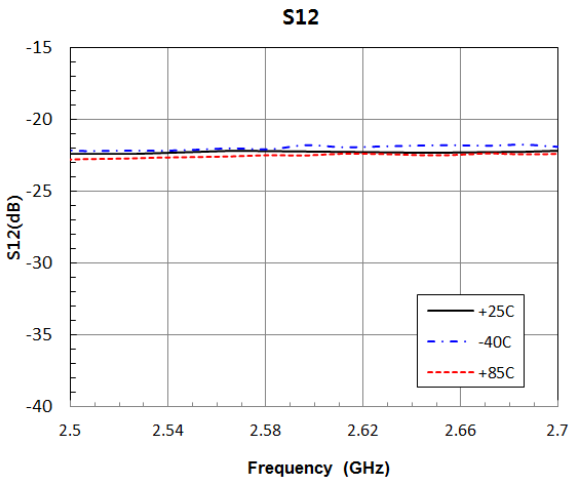
Input Return Loss



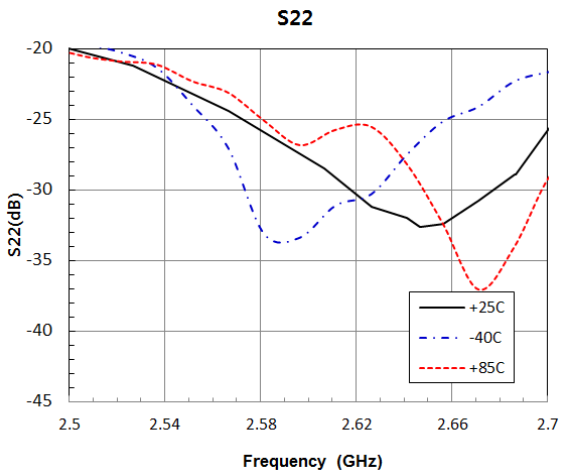
Broadband Gain



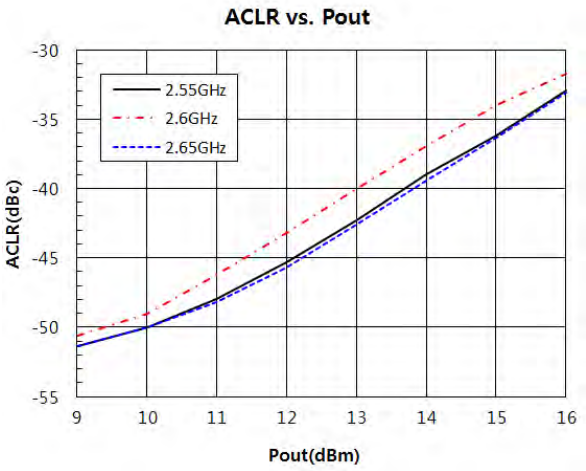
Reverse isolation

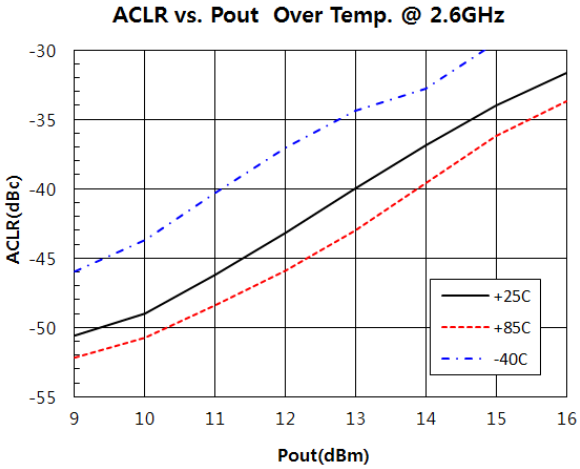


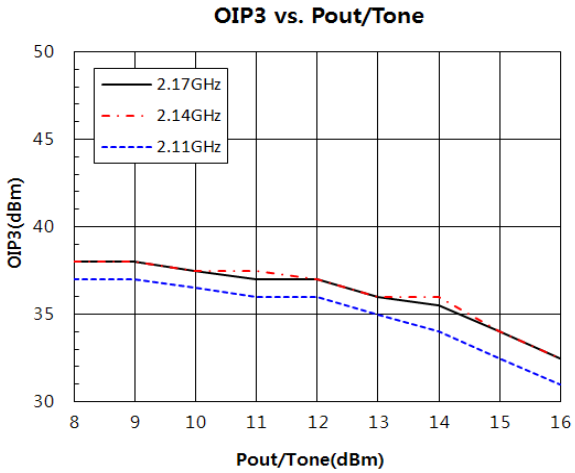
Output Return Loss

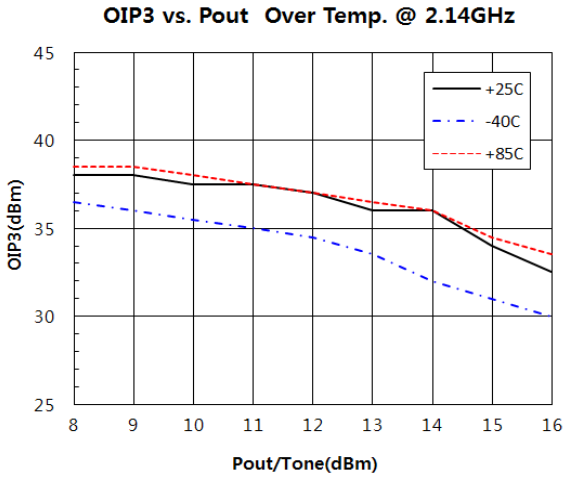


ACLR & OIP3 vs Pout (@2600MHz)

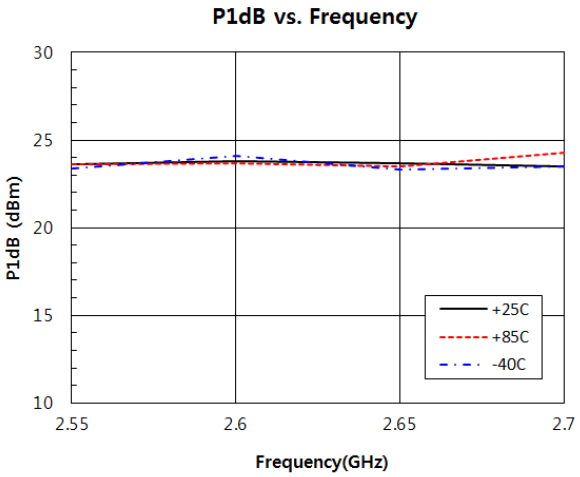




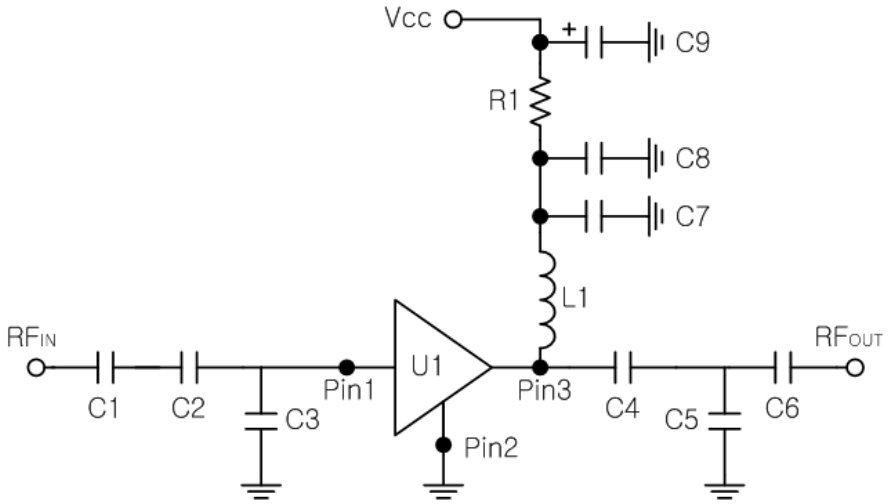




P1-dB (@2600MHz)



Application Circuit Schematic (@2600MHz)



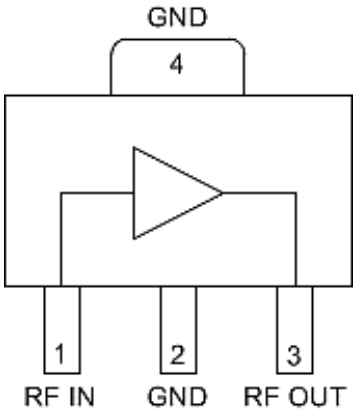
Note.

1. Application circuit schematic shows the basic connection for operating WTD601.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values (@2600MHz)

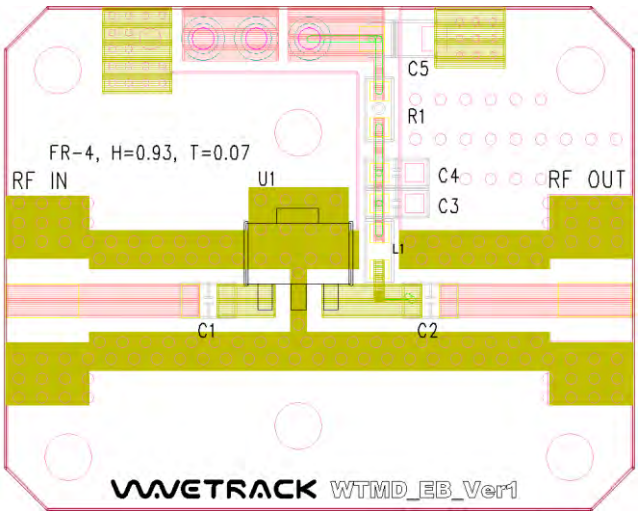
Reference	Value	Unit	Description	Manufacture
U1	WTD601	-	RF Drive Amplifier	WAVETRACK
C1	20	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	20	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	1.0	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	20	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	1.0	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C6	20	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C7	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C8	1000	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C9	0.1	[uF]	Tantalum Capacitor	Samsung
L1	22	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	0	[Ω]	Resistor Chip	Samsung

Pin Configuration and Function Descriptions



Pin Number	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor.
2	GND	Connection to ground. Use via holes as close to the device ground leads as possible to reduce ground path inductance.
3	RF OUT	RF output pin. DC voltage is present on this pin. DC blocking capacitor is necessary. An RF choke is needed to feed DC bias.

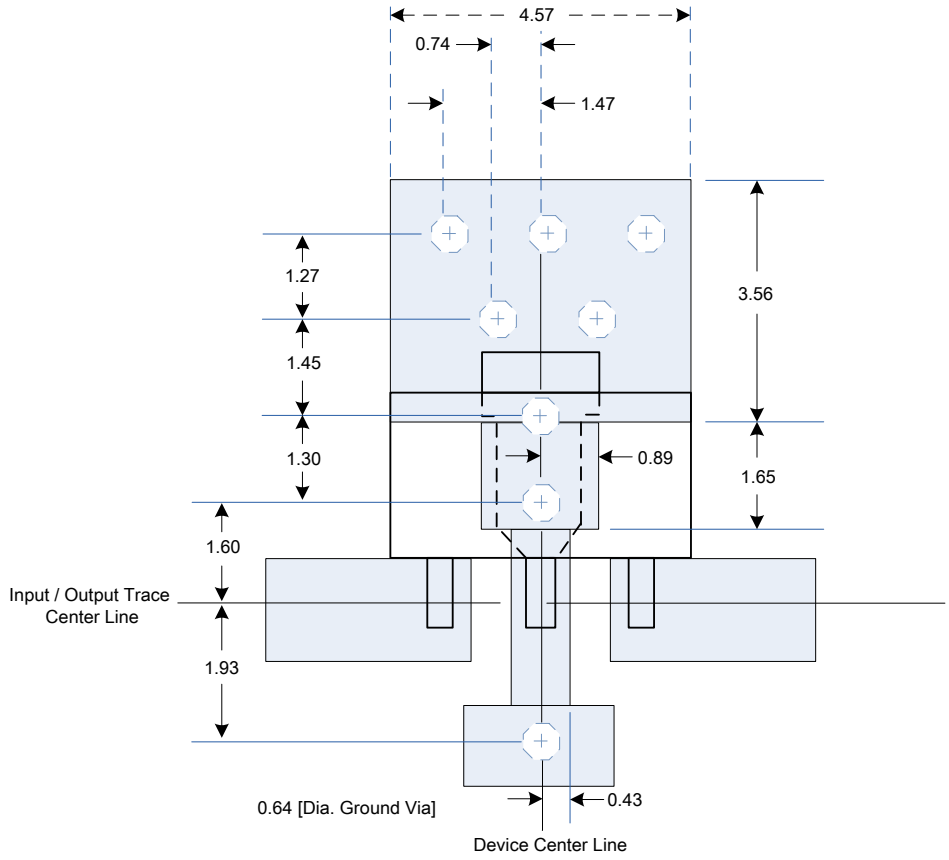
Application Circuit Layout



Note.

1. Package bottom must be connected to RF/DC ground.
2. Provide a large ground pad area under device ground pin.
3. A sufficient number of via holes should be used to connect the top and bottom ground plane.
4. The circuit board used in the application should apply RF circuit design techniques.
5. RF lines should have 50 ohm impedance.
   - ✓ Circuit board material : FR-4
   - ✓ Circuit board height : 0.93mm :

Recommended PCB Land Pattern



Note.

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating
3. Solder the copper pad on the backside of the device package to the ground plane.
4. Provide a large ground pad area under device pins 1,2,3 with many plated via holes as shown.
5. Dimensions not given for 50ohm line.
6. Scale accordingly for different board thickness and dielectric contacts.
7. We recommend 1 or 2ounce copper.

Package Information & Outline Drawing

- **Marking : Manufacture**

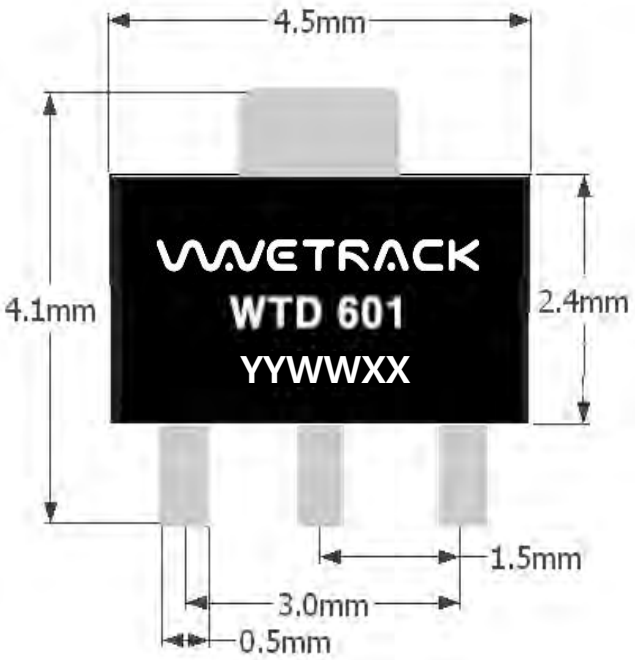
  Part Number – WTMXXX

  Lot code - YYWWXX

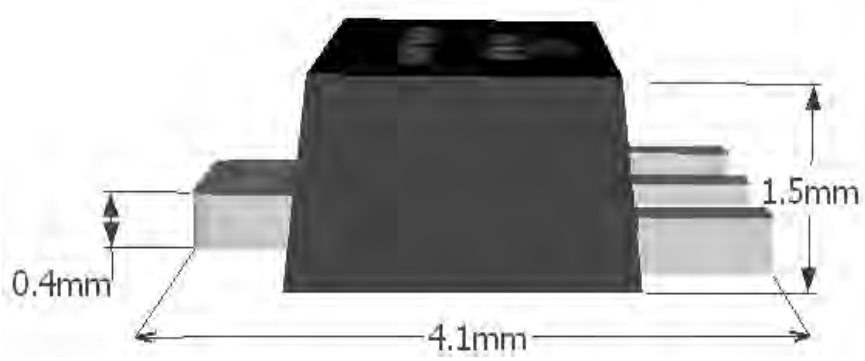
  YY = Year / WW = Working Week / XX = Wafer No.

- **Outline Drawing : Millimeters**

TOP VIEW



SIDE VIEW



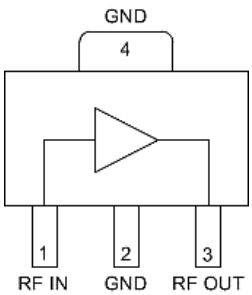
5~6000MHz InGaP/GaAs HBT MMIC Amplifier

General Description

The WTM102 is a general RF gain boosting amplifier MMIC that have high linearity & gain performance. The device features flat high gain with excellent in/out return loss. The amplifier typically provides 21.5dB gain, 32dBm OIP3 and 3.2dB Noise Figure while drawing 77mA current at 1.9GHz. The device is packaged in a lead-free/green/RoHS-compliant industry-standard SOT-89 package.

The WTM102 is designed a Darlington-pair amplifier using high reliability InGap/GaAs HBT process.

Functional Block Diagram



Features

- 5~6000MHz
- P1dB = 19.3 dBm @1900MHz
- Gain = 21.5 dB @1900MHz
- OIP3 = 32 dBm @1900MHz
- NF = 3.2 dB @1900MHz
- IRL= 12dB and ORL = 13dB
- 50 Ohm Cascadable Gain Block
- Unconditionally Stable
- +5V Single Supply, 77mA Current
- Industry Standard SOT-89 Package

Applications

- Cellular / PCS / 3G / LTE repeaters
- Wireless Data / WLAN
- CATV & Cable Modem
- ISM
- Microwave Radio

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage(V_{CC})	5.5 V
Max Device Current(I_D)	100 mA
Max RF Input Power	20 dBm
Operating Temperature(T_L)	-40 to +85°C
Storage Temperature	-65 to +150°C
ESD Sensitivity (Human Body Model : HBM)	Class 1C
Moisture Sensitivity Level (MSL)	MSL1

Note.

1. Stress under Absolute Maximum Ratings may result in permanent damage to the device.
2. Extended application of Absolute Maximum ratings condition to the device may reduce device reliability.
3. These rating are not intended for continuous normal operation.
   - ✓ HBM : Class 1C in accordance with JEDEC Standard JESD22-A114B
   - ✓ MSL : MSL1 in accordance with JEDEC Standard J-STD-020

ESD CAUTION

	ESD (electrostatic discharge) sensitive device. Although this product features proprietary protection circuitry, damage may occur on devices subjected to high energy ESD.

Typical Performance at Key Operating Frequencies

Vcc = +5V, T_A=25°C, unless otherwise noted. (I_D = 77mA)

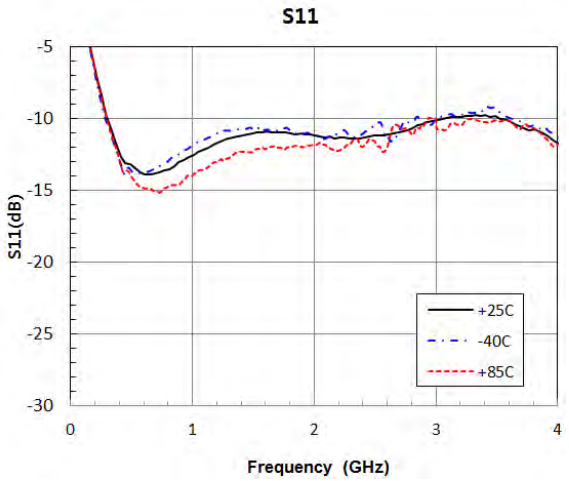
Parameter	900MHz	1900MHz	2140MHz	2650MHz	Unit
S21	22.0	21.5	21.1	20.7	dB
OIP3	34.5	32	30.0	30.0	dBm
P1dB	20.5	19.3	19.0	17.4	dBm
S11	-13.0	-12.0	-11.3	-11.0	dB
S22	-13.2	-13.0	-14.1	-11.4	dB
S12	-23.2	-23.5	-23.3	-23.1	dB
NF	3.0	3.2	3.3	3.3	dB

Note.

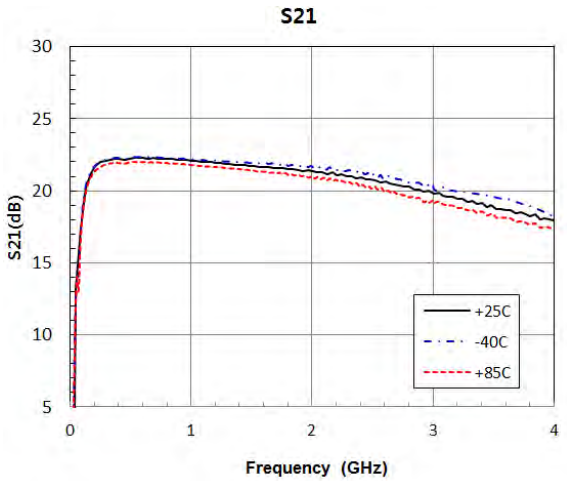
1. Typical RF performance measured on a Wavetrack evaluation board.
2. RF performance data taken with application circuit element values.
3. OIP3 measured with two tones at an output 5dBm per tone separated 1MHz.
4. Z_S = Z_L = 50 ohm .

S-Parameter

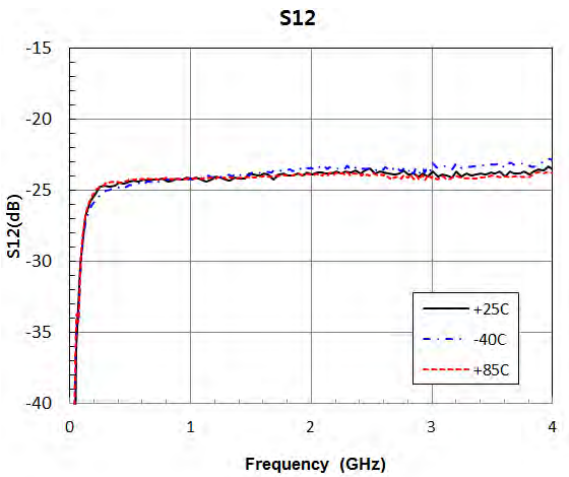
Input Return Loss



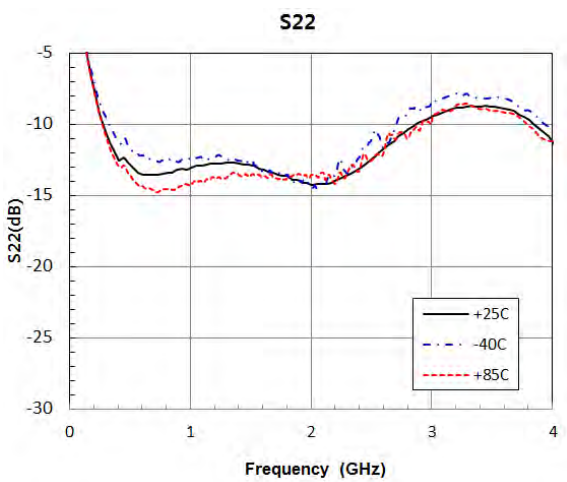
Broadband Gain



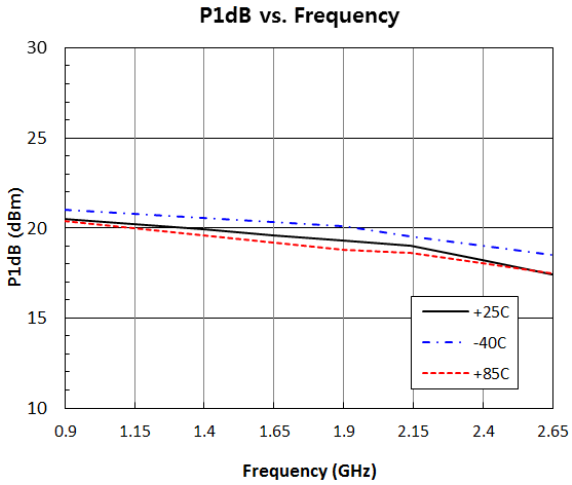
Reverse isolation

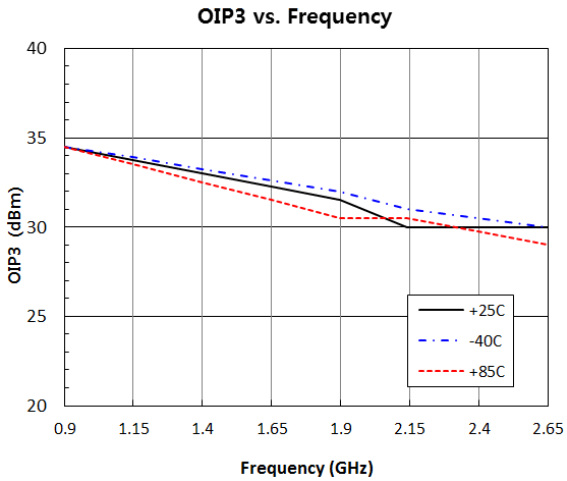


Output Return Loss



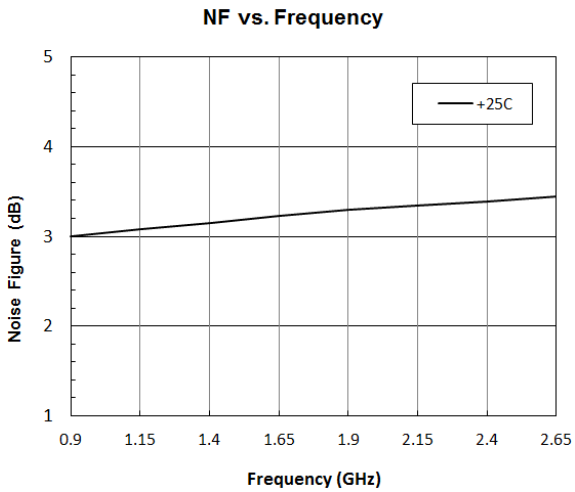
P1-dB & OIP3



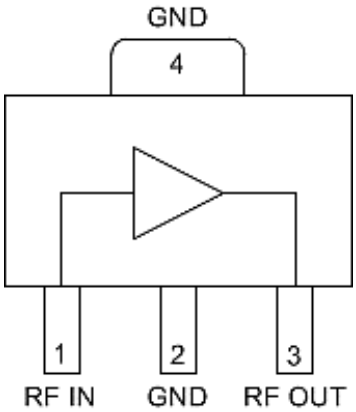


Note. +5dBm / Tone Output Power

Noise Figure

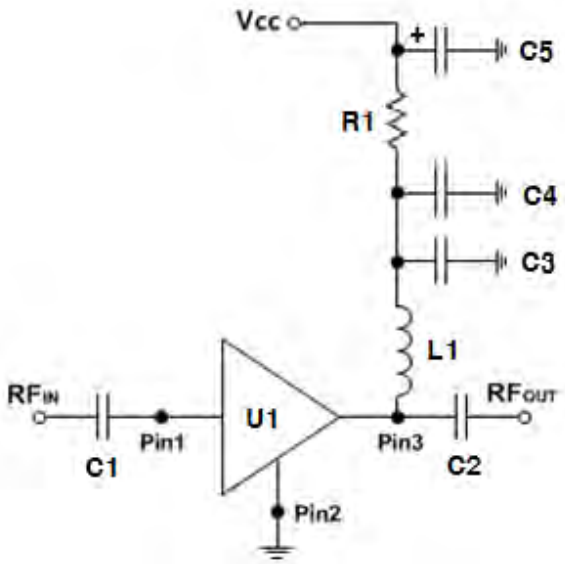


Pin Configuration and Function Descriptions



Pin Number	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor.
2	GND	Connection to ground. Use via holes as close to the device ground leads as possible to reduce ground path inductance.
3	RF OUT	RF output pin. DC voltage is present on this pin. DC blocking capacitor is necessary. An RF choke is needed to feed DC bias.

Application Circuit Schematic



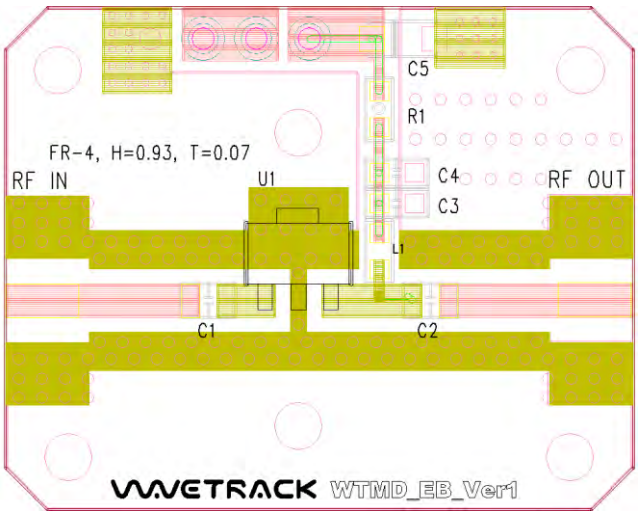
Note.

1. Application circuit schematic shows the basic connection for operating WTM102.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values

Reference	Value	Unit	Description	Manufacture
U1	WTM102	-	RF Gain Block Amplifier	WAVETRACK
C1	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	10	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	10	[uF]	Tantalum Capacitor	Samsung
L1	39	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	0	[Ω]	Resistor Chip	Samsung

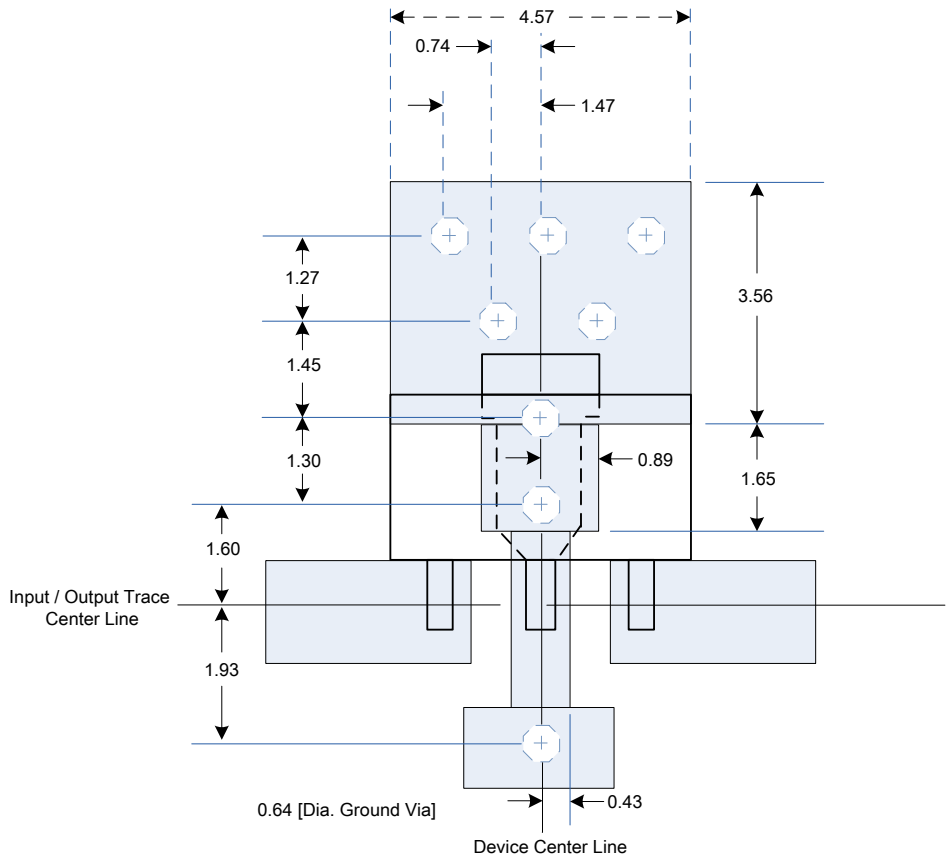
Application Circuit Layout



Note.

1. Package bottom must be connected to RF/DC ground.
2. Provide a large ground pad area under device ground pin.
3. A sufficient number of via holes should be used to connect the top and bottom ground plane.
4. The circuit board used in the application should apply RF circuit design techniques.
5. RF lines should have 50 ohm impedance.
   - ✓ Circuit board material : FR-4
   - ✓ Circuit board height : 0.93mm :

Recommended PCB Land Pattern



Note.

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating
3. Solder the copper pad on the backside of the device package to the ground plane.
4. Provide a large ground pad area under device pins 1,2,3 with many plated via holes as shown.
5. Dimensions not given for 50ohm line.
6. Scale accordingly for different board thickness and dielectric contacts.
7. We recommend 1 or 2ounce copper.

Package Information & Outline Drawing

- **Marking : Manufacture**

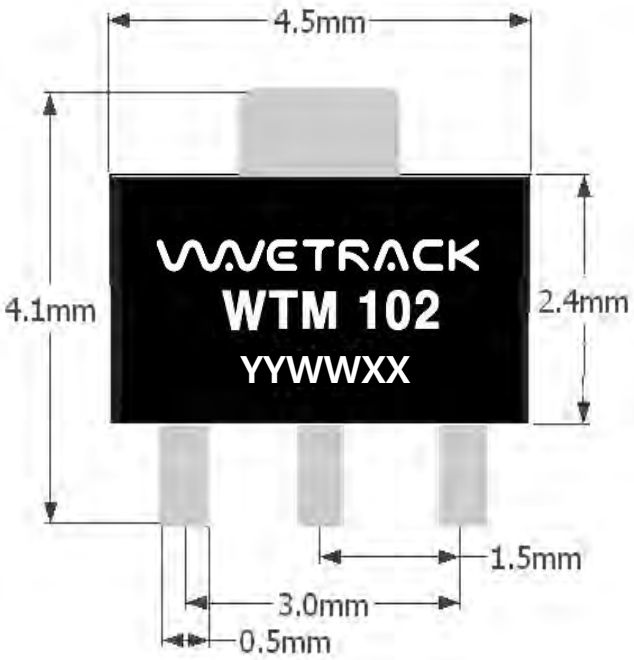
  Part Number – WTMXXX

  Lot code - YYWWXX

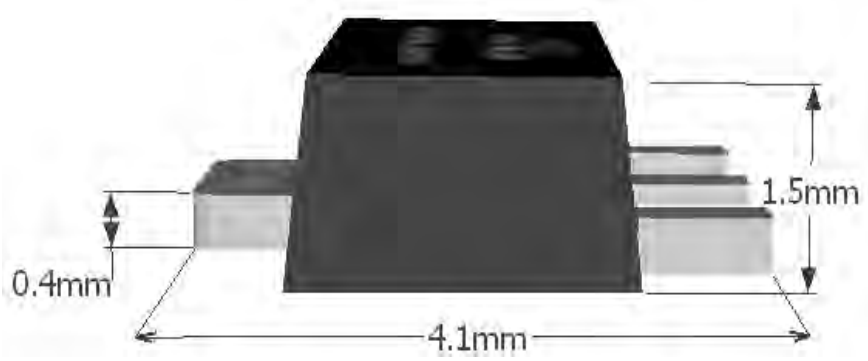
  YY = Year / WW = Working Week / XX = Wafer No.

- **Outline Drawing : Millimeters**

TOP VIEW



SIDE VIEW



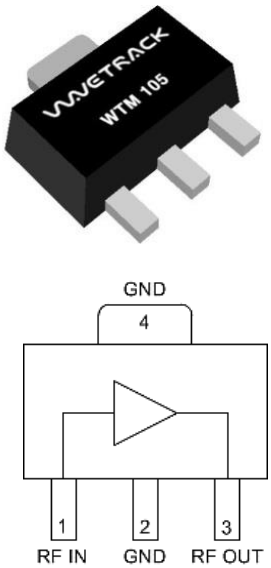
5~6000MHz InGaP/GaAs HBT MMIC Amplifier

General Description

The WTM105 is a general RF gain boosting amplifier MMIC that have high linearity & gain performance. The device features flat high gain with excellent in/out return loss. The amplifier typically provides 19.9dB gain, 33.5dBm OIP3 and 3.4dB Noise Figure while drawing 85mA current at 1.9GHz. The device is packaged in a lead-free/green/RoHS-compliant industry-standard SOT-89 package.

The WTM105 is designed a Darlington-pair amplifier using high reliability InGap/GaAs HBT process.

Functional Block Diagram



Features

- 5~6000MHz
- P1dB = 19.7 dBm @1900MHz
- Gain = 19.9 dB @1900MHz
- OIP3 = 33.5 dBm @1900MHz
- NF = 3.4 dB @1900MHz
- IRL= 11 dB and ORL=15 dB
- 50 Ohm Cascadable Gain Block
- Unconditionally Stable
- +5V Single Supply, 85 mA Current
- Industry Standard SOT-89 Package

Applications

- Cellular / PCS / 3G / LTE repeaters
- Wireless Data / WLAN
- CATV & Cable Modem
- ISM
- Microwave Radio

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage(V_{CC})	5.5 V
Max Device Current(I_D)	100 mA
Max RF Input Power	20 dBm
Operating Temperature(T_L)	-40 to +85°C
Storage Temperature	-65 to +150°C
ESD Sensitivity (Human Body Model : HBM)	Class 1C
Moisture Sensitivity Level (MSL)	MSL1

Note.

1. Stress under Absolute Maximum Ratings may result in permanent damage to the device.
2. Extended application of Absolute Maximum ratings condition to the device may reduce device reliability.
3. These rating are not intended for continuous normal operation.
   - ✓ HBM : Class 1C in accordance with JEDEC Standard JESD22-A114B
   - ✓ MSL : MSL1 in accordance with JEDEC Standard J-STD-020

ESD CAUTION

	ESD (electrostatic discharge) sensitive device. Although this product features proprietary protection circuitry, damage may occur on devices subjected to high energy ESD.

Typical Performance at Key Operating Frequencies

Vcc = +5V, T_A=25°C, unless otherwise noted. (I_D = 85mA)

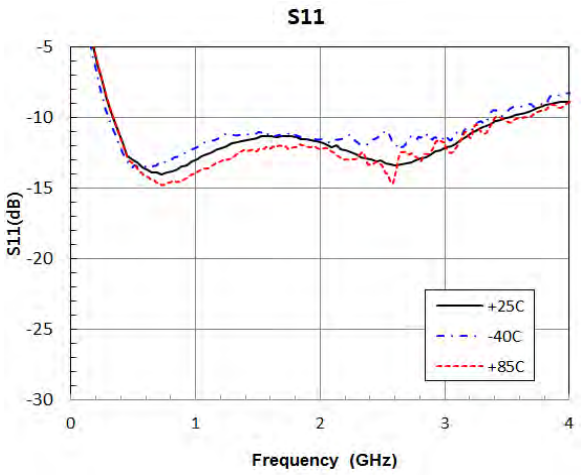
Parameter	900MHz	1900MHz	2140MHz	2650MHz	Unit
S21	20.0	19.9	19.8	19.7	dB
OIP3	39.5	33.5	32.5	31.0	dBm
P1dB	20.9	19.7	19.2	17.8	dBm
S11	-13.4	-11.5	-12.1	-13.3	dB
S22	-13.5	-15.2	-16.1	-13.2	dB
S12	-22.2	-22.5	-22.3	-22.1	dB
NF	3.2	3.4	3.5	3.5	dB

Note.

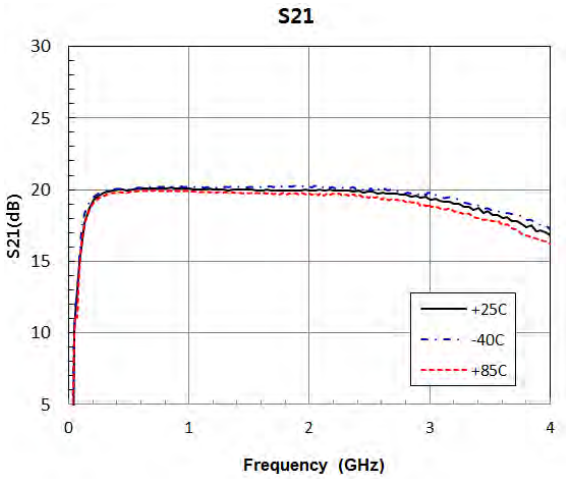
1. Typical RF performance measured on a Wavetrack evaluation board.
2. RF performance data taken with application circuit element values.
3. OIP3 measured with two tones at an output 5dBm per tone separated 1MHz.
4. Z_S = Z_L = 50 ohm .

S-Parameter

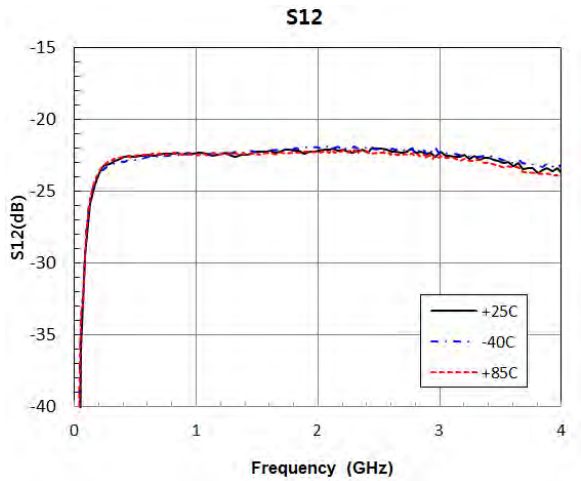
Input Return Loss



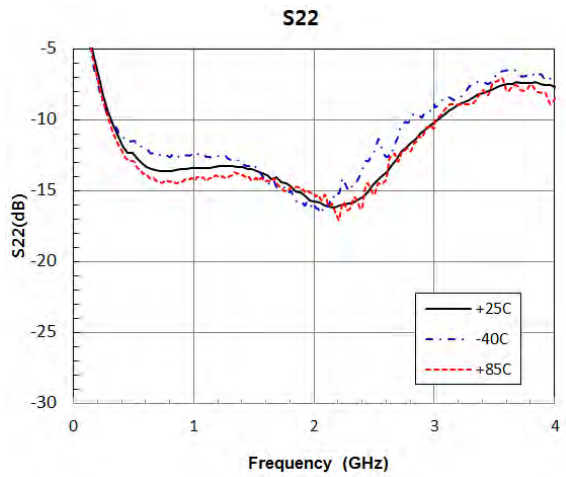
Broadband Gain



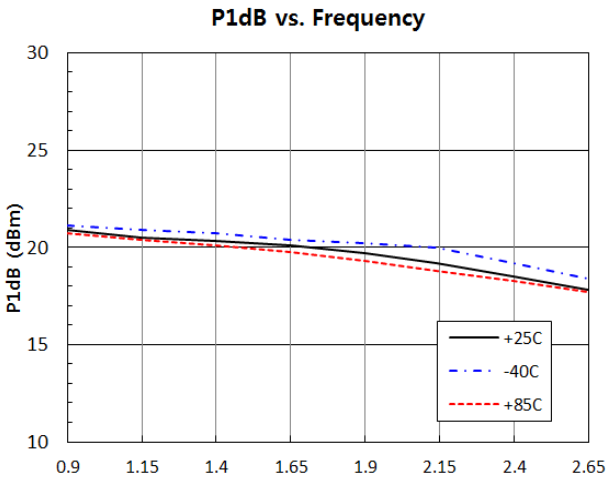
Reverse isolation

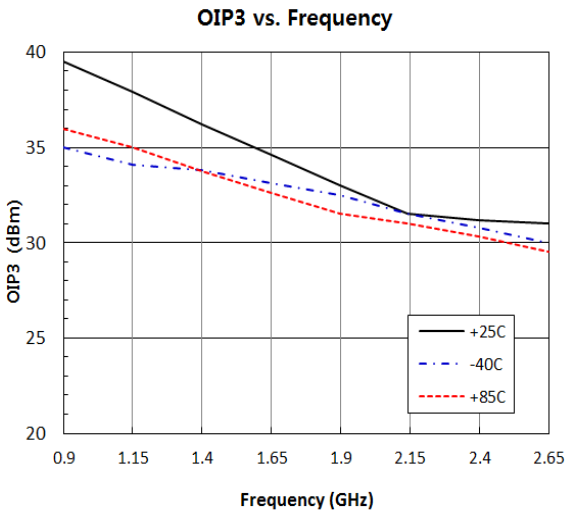


Output Return Loss



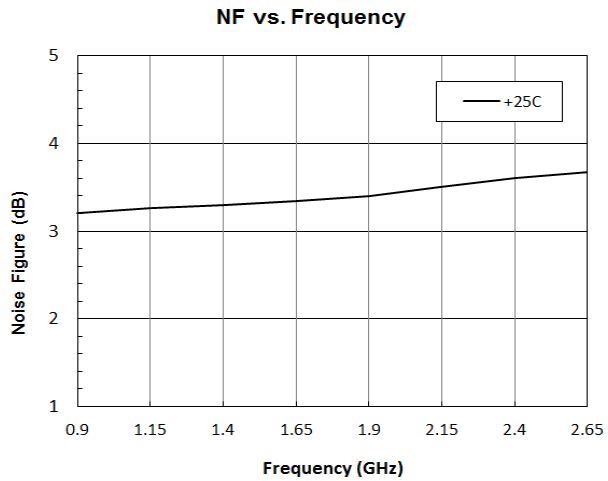
P1-dB & OIP3



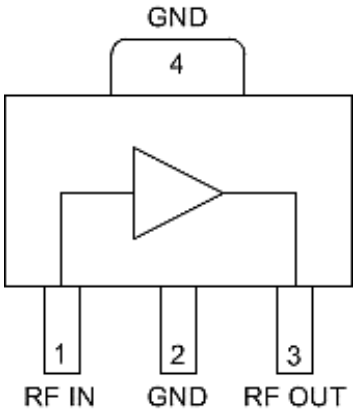


Note. +5dBm / Tone Output Power

Noise Figure

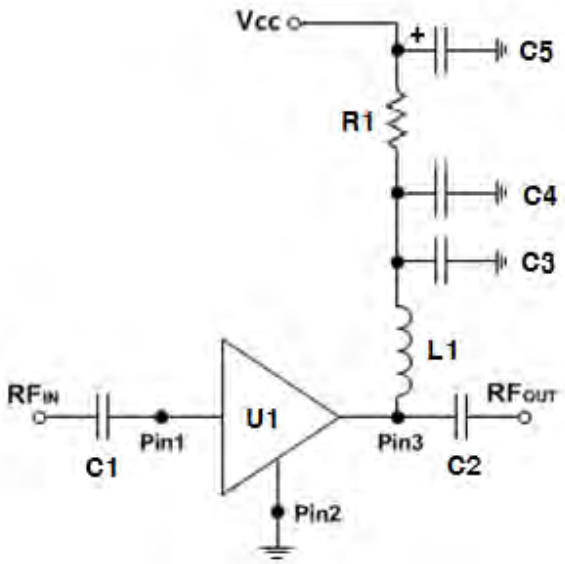


Pin Configuration and Function Descriptions



Pin Number	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor.
2	GND	Connection to ground. Use via holes as close to the device ground leads as possible to reduce ground path inductance.
3	RF OUT	RF output pin. DC voltage is present on this pin. DC blocking capacitor is necessary. An RF choke is needed to feed DC bias.

Application Circuit Schematic



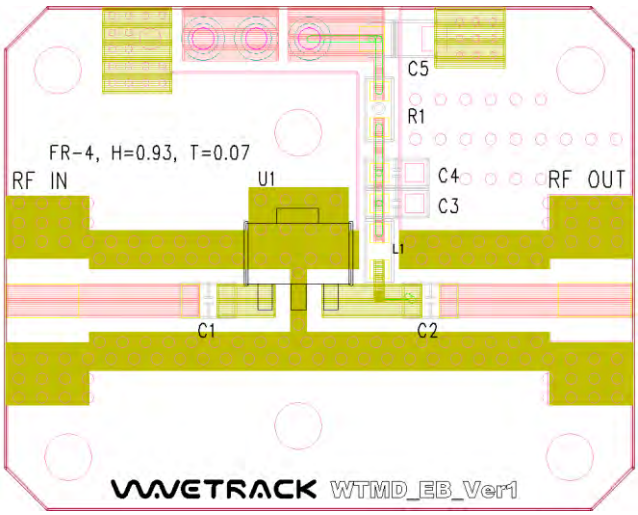
Note.

1. Application circuit schematic shows the basic connection for operating WTM105.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values

Reference	Value	Unit	Description	Manufacture
U1	WTM105	-	RF Gain Block Amplifier	WAVETRACK
C1	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	10	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	10	[uF]	Tantalum Capacitor	Samsung
L1	39	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	0	[Ω]	Resistor Chip	Samsung

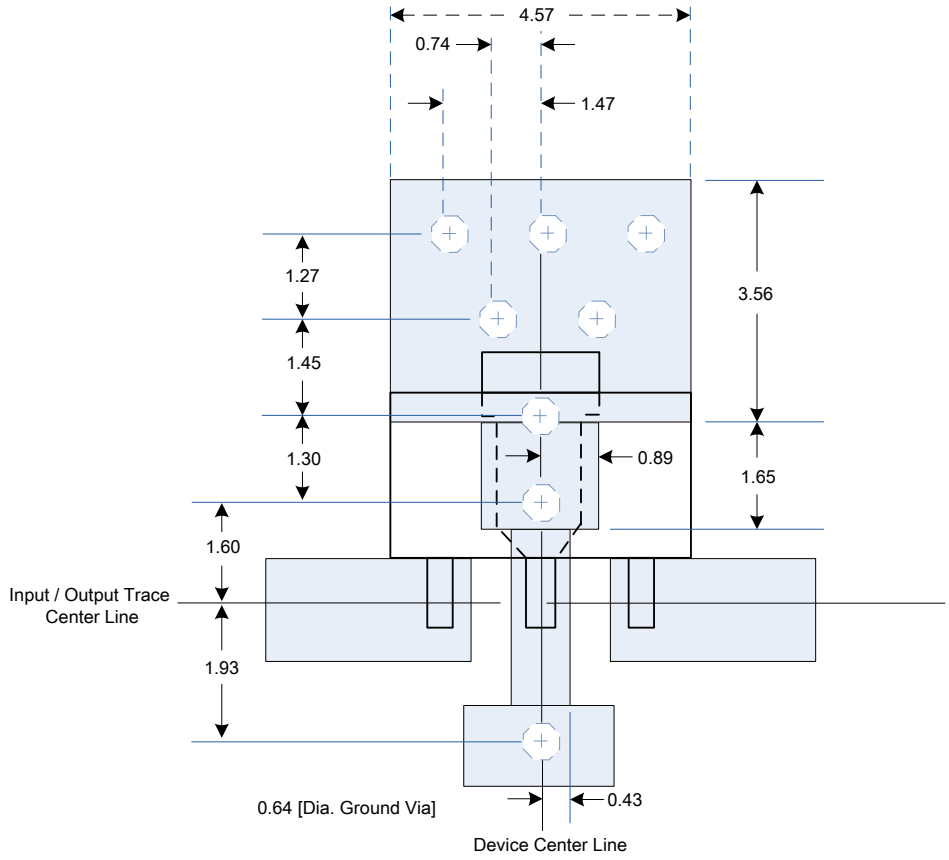
Application Circuit Layout



Note.

1. Package bottom must be connected to RF/DC ground.
2. Provide a large ground pad area under device ground pin.
3. A sufficient number of via holes should be used to connect the top and bottom ground plane.
4. The circuit board used in the application should apply RF circuit design techniques.
5. RF lines should have 50 ohm impedance.
   - ✓ Circuit board material : FR-4
   - ✓ Circuit board height : 0.93mm :

Recommended PCB Land Pattern



Note.

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating
3. Solder the copper pad on the backside of the device package to the ground plane.
4. Provide a large ground pad area under device pins 1,2,3 with many plated via holes as shown.
5. Dimensions not given for 50ohm line.
6. Scale accordingly for different board thickness and dielectric contacts.
7. We recommend 1 or 2ounce copper.

Package Information & Outline Drawing

- **Marking : Manufacture**

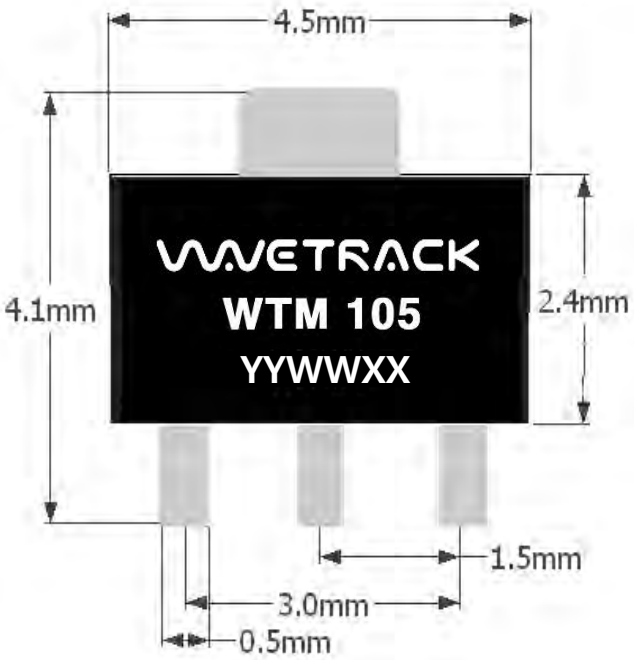
  Part Number – WTMXXX

  Lot code - YYWWXX

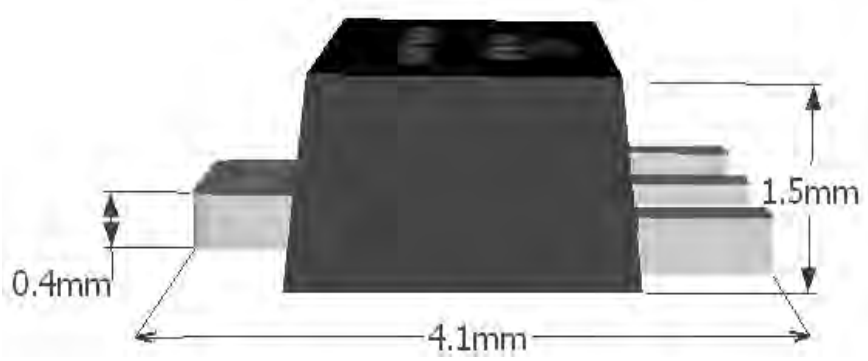
  YY = Year / WW = Working Week / XX = Wafer No.

- **Outline Drawing : Millimeters**

TOP VIEW



SIDE VIEW



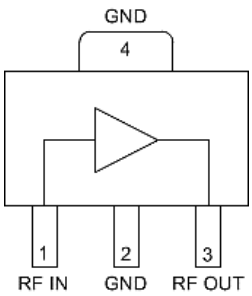
5~6000MHz InGaP/GaAs HBT MMIC Amplifier

General Description

The WTM106 is a general RF gain boosting amplifier MMIC that have high linearity & gain performance. The device features flat high gain with excellent in/out return loss. The amplifier typically provides 18.6dB gain, 30.5dBm OIP3 and 3.4dB Noise Figure while drawing 55mA current at 1.9GHz. The device is packaged in a lead-free/green/RoHS-compliant industry-standard SOT-89 package.

The WTM106 is designed a Darlington-pair amplifier using high reliability InGap/GaAs HBT process.

Functional Block Diagram



Features

- 5~6000MHz
- P1dB = 17.7dBm @1900MHz
- Gain = 18.6 dB @1900MHz
- OIP3 = 30.5 dBm @1900MHz
- NF = 3.4 dB @1900MHz
- IRL= 12dB and ORL=14dB
- 50 Ohm Cascadable Gain Block
- Unconditionally Stable
- +5V Single Supply, 55mA Current
- Industry Standard SOT-89 Package

Applications

- Cellular / PCS / 3G / LTE repeaters
- Wireless Data / WLAN
- CATV & Cable Modem
- ISM
- Microwave Radio

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage(V_{CC})	5.5 V
Max Device Current(I_D)	100 mA
Max RF Input Power	20 dBm
Operating Temperature(T_L)	-40 to +85°C
Storage Temperature	-65 to +150°C
ESD Sensitivity (Human Body Model : HBM)	Class 1C
Moisture Sensitivity Level (MSL)	MSL1

Note.

1. Stress under Absolute Maximum Ratings may result in permanent damage to the device.
2. Extended application of Absolute Maximum ratings condition to the device may reduce device reliability.
3. These rating are not intended for continuous normal operation.
   - ✓ HBM : Class 1C in accordance with JEDEC Standard JESD22-A114B
   - ✓ MSL : MSL1 in accordance with JEDEC Standard J-STD-020

ESD CAUTION

	ESD (electrostatic discharge) sensitive device. Although this product features proprietary protection circuitry, damage may occur on devices subjected to high energy ESD.

Typical Performance at Key Operating Frequencies

Vcc = +5V, T_A=25°C, unless otherwise noted. (I_D = 55mA)

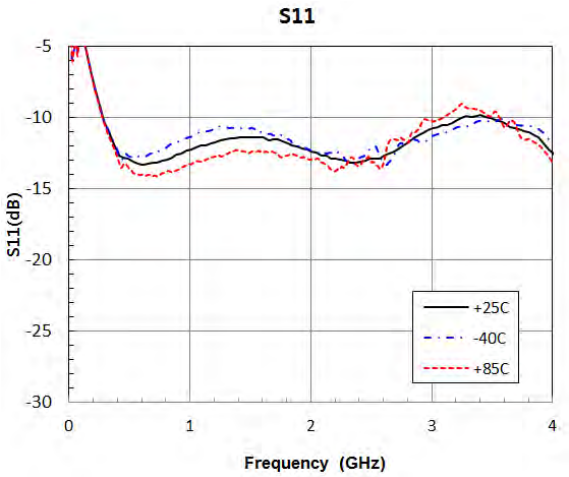
Parameter	900MHz	1900MHz	2140MHz	2650MHz	Unit
S21	18.4	18.6	18.6	18.5	dB
OIP3	31.5	30.5	29.0	26.5	dBm
P1dB	17.8	17.7	17.2	15.2	dBm
S11	-12.5	-12.1	-12.8	-13.3	dB
S22	-13.5	-15.2	-16.1	-12.5	dB
S12	-12.5	-14.3	-15.4	-12.5	dB
NF	3.2	3.4	3.4	3.4	dB

Note.

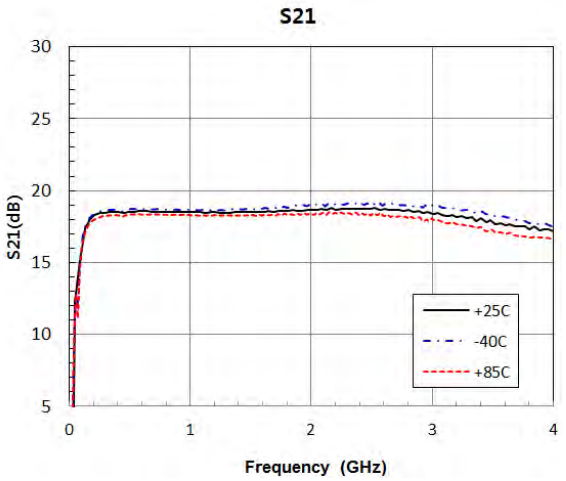
1. Typical RF performance measured on a Wavetrack evaluation board.
2. RF performance data taken with application circuit element values.
3. OIP3 measured with two tones at an output 5dBm per tone separated 1MHz.
4. $Z_S = Z_L = 50$ ohm .

S-Parameter

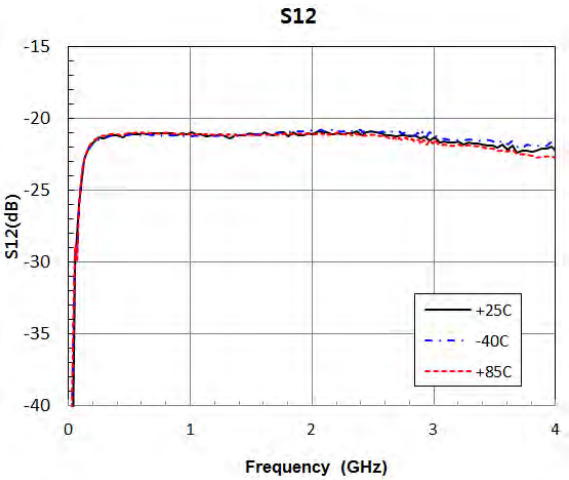
Input Return Loss



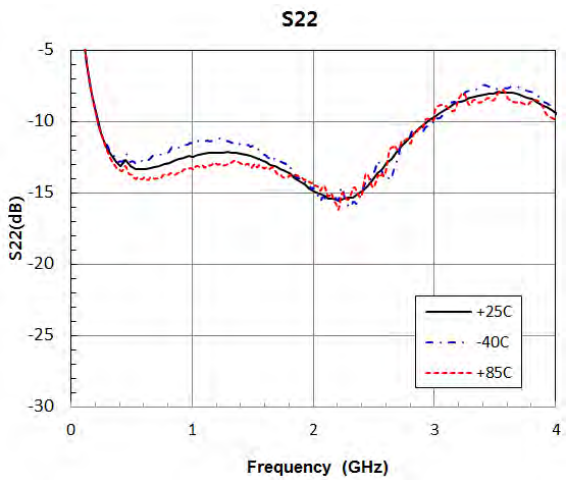
Broadband Gain



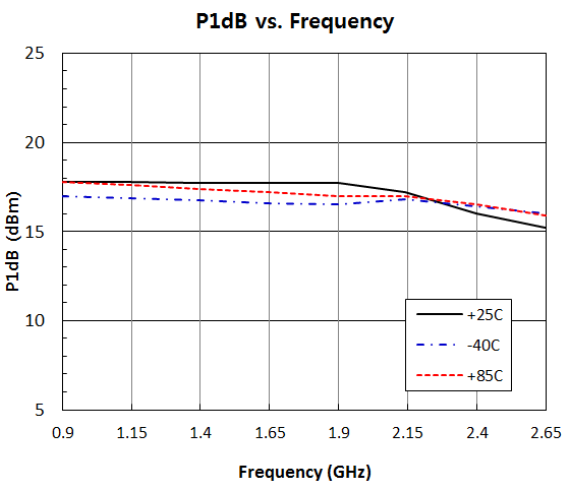
Reverse isolation

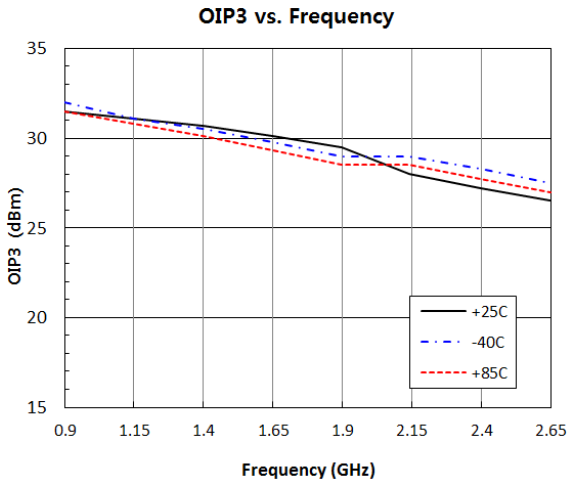


Output Return Loss



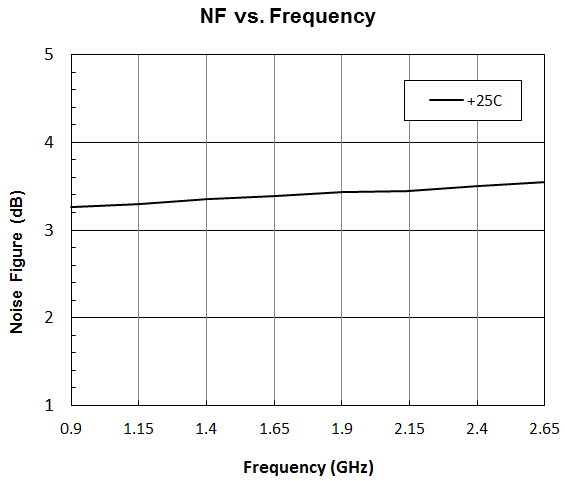
P1-dB & OIP3



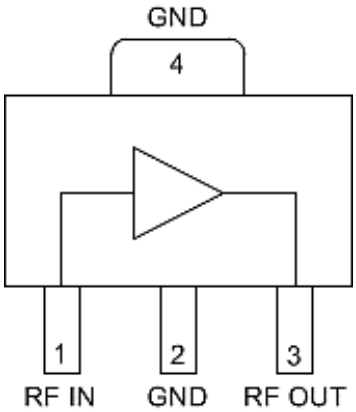


Note. +5dBm / Tone Output Power

Noise Figure

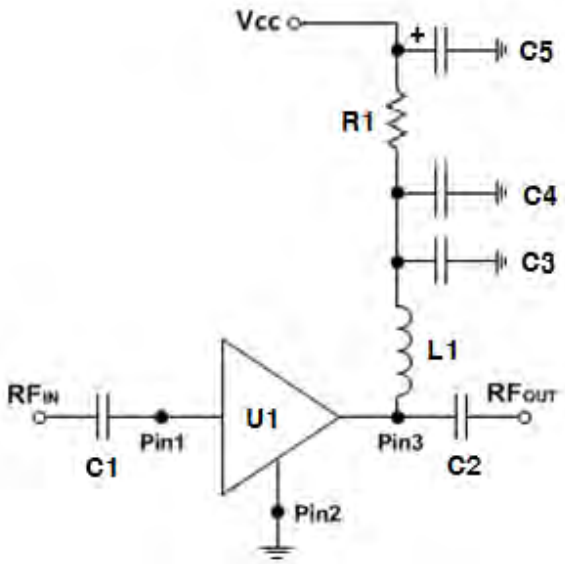


Pin Configuration and Function Descriptions



Pin Number	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor.
2	GND	Connection to ground. Use via holes as close to the device ground leads as possible to reduce ground path inductance.
3	RF OUT	RF output pin. DC voltage is present on this pin. DC blocking capacitor is necessary. An RF choke is needed to feed DC bias.

Application Circuit Schematic



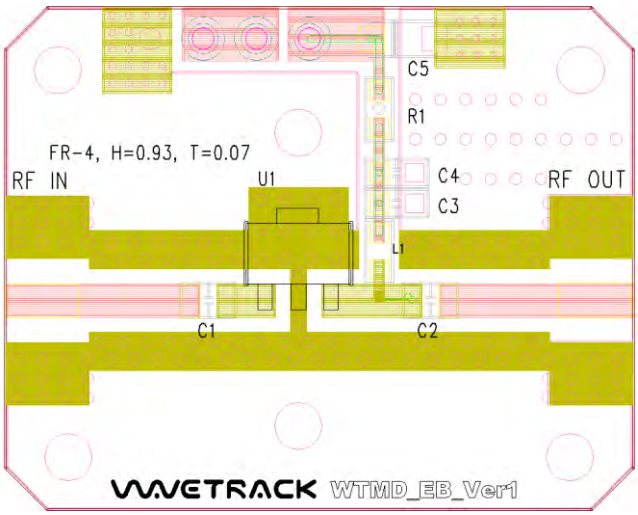
Note.

1. Application circuit schematic shows the basic connection for operating WTM106.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values

Reference	Value	Unit	Description	Manufacture
U1	WTM106	-	RF Gain Block Amplifier	WAVETRACK
C1	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	10	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	10	[uF]	Tantalum Capacitor	Samsung
L1	39	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	0	[Ω]	Resistor Chip	Samsung

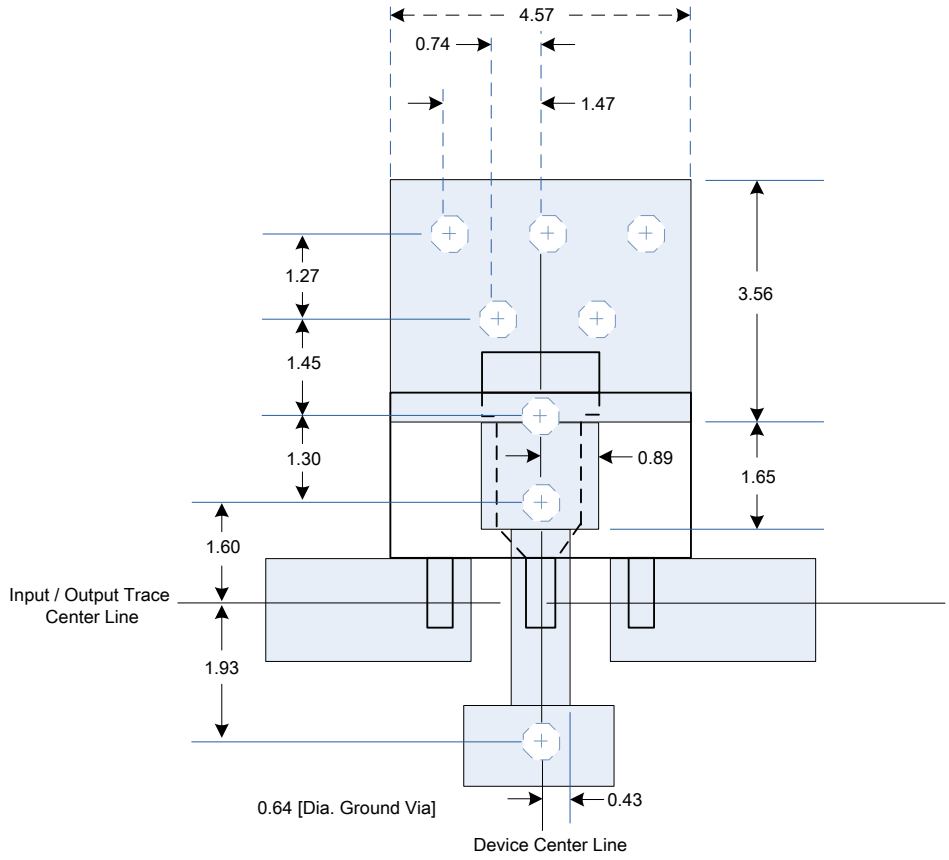
Application Circuit Layout



Note.

1. Package bottom must be connected to RF/DC ground.
2. Provide a large ground pad area under device ground pin.
3. A sufficient number of via holes should be used to connect the top and bottom ground plane.
4. The circuit board used in the application should apply RF circuit design techniques.
5. RF lines should have 50 ohm impedance.
   - ✓ Circuit board material : FR-4
   - ✓ Circuit board height : 0.93mm :

Recommended PCB Land Pattern



Note.

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating
3. Solder the copper pad on the backside of the device package to the ground plane.
4. Provide a large ground pad area under device pins 1,2,3 with many plated via holes as shown.
5. Dimensions not given for 50ohm line.
6. Scale accordingly for different board thickness and dielectric contacts.
7. We recommend 1 or 2ounce copper.

Package Information & Outline Drawing

- **Marking : Manufacture**

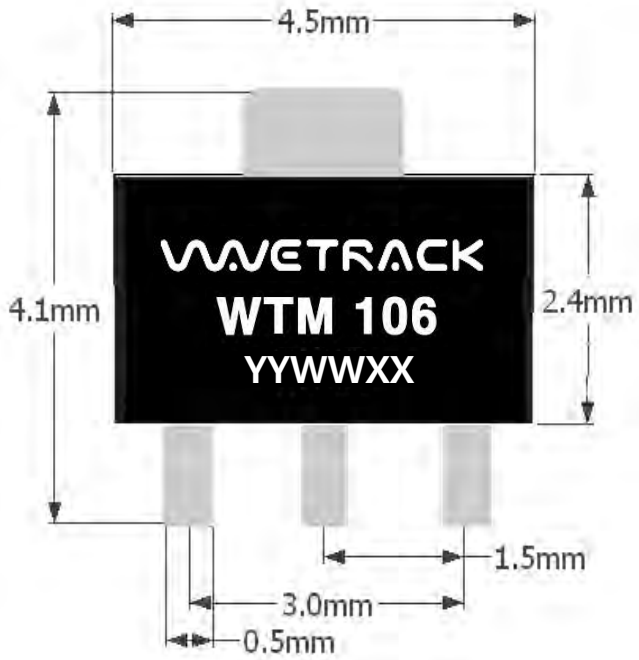
  Part Number – WTMXXX

  Lot code - YYWWXX

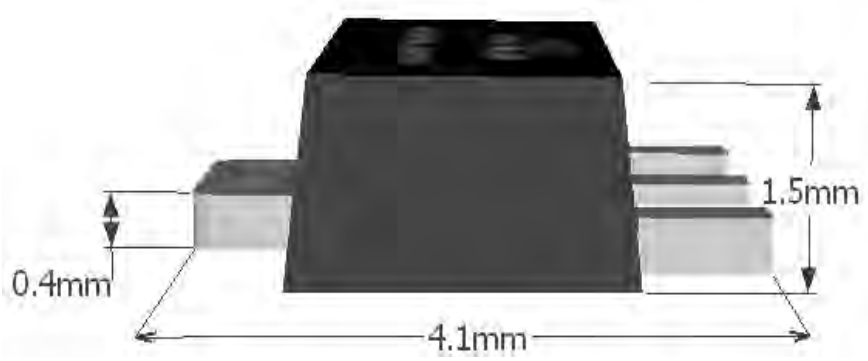
  YY = Year / WW = Working Week / XX = Wafer No.

- **Outline Drawing : Millimeters**

TOP VIEW



SIDE VIEW



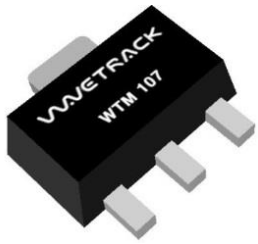
5~6000MHz InGaP/GaAs HBT MMIC Amplifier

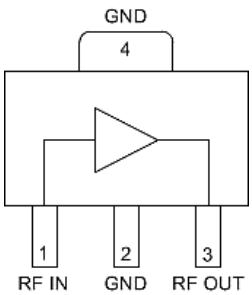
General Description

The WTM107 is a general RF gain boosting amplifier MMIC that have high linearity & gain performance. The device features flat high gain with excellent in/out return loss. The amplifier typically provides 17.2dB gain, 28.5dBm OIP3 and 3.3dB Noise Figure while drawing 46mA current at 1.9GHz. The device is packaged in a lead-free/green/RoHS-compliant industry-standard SOT-89 package.

The WTM107 is designed a Darlington-pair amplifier using high reliability InGap/GaAs HBT process.

Functional Block Diagram





Features

- 5~6000MHz
- P1dB = 15.6 dBm @1900MHz
- Gain = 17.2 dB @1900MHz
- OIP3 = 28.5 dBm @1900MHz
- NF = 3.3 dB @1900MHz
- IRL= 13dB and ORL=13dB
- 50 Ohm Cascadable Gain Block
- Unconditionally Stable
- +5V Single Supply, 46mA Current
- Industry Standard SOT-89 Package

Applications

- Cellular / PCS / 3G / LTE repeaters
- Wireless Data / WLAN
- CATV & Cable Modem
- ISM
- Microwave Radio

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage(V_{CC})	5.5 V
Max Device Current(I_D)	100 mA
Max RF Input Power	20 dBm
Operating Temperature(T_L)	-40 to +85°C
Storage Temperature	-65 to +150°C
ESD Sensitivity (Human Body Model : HBM)	Class 1C
Moisture Sensitivity Level (MSL)	MSL1

Note.

1. Stress under Absolute Maximum Ratings may result in permanent damage to the device.
2. Extended application of Absolute Maximum ratings condition to the device may reduce device reliability.
3. These rating are not intended for continuous normal operation.
   - ✓ HBM : Class 1C in accordance with JEDEC Standard JESD22-A114B
   - ✓ MSL : MSL1 in accordance with JEDEC Standard J-STD-020

ESD CAUTION

	ESD (electrostatic discharge) sensitive device. Although this product features proprietary protection circuitry, damage may occur on devices subjected to high energy ESD.

Typical Performance at Key Operating Frequencies

Vcc = +5V, T_A=25°C, unless otherwise noted. (I_D = 46mA)

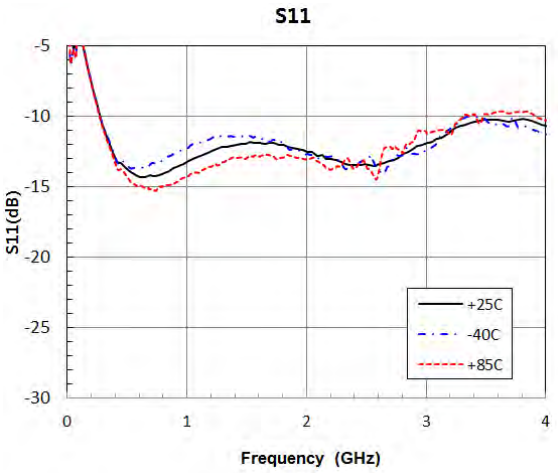
Parameter	900MHz	1900MHz	2140MHz	2650MHz	Unit
S21	17.0	17.2	17.3	17.4	dB
OIP3	31.0	28.5	27.5	24.5	dBm
P1dB	15.9	15.6	15.2	12.7	dBm
S11	-13.5	-13.2	-13.7	-12.3	dB
S22	-13.3	-13.2	-12.7	-12.3	dB
S12	-19.5	-19.3	-19.4	-20.5	dB
NF	3.2	3.3	3.3	3.3	dB

Note.

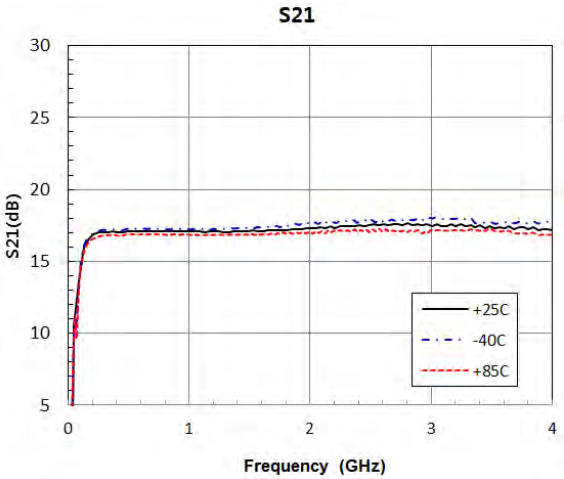
1. Typical RF performance measured on a Wavetrack evaluation board.
2. RF performance data taken with application circuit element values.
3. OIP3 measured with two tones at an output 5dBm per tone separated 1MHz.
4. $Z_S = Z_L = 50$ ohm .

S-Parameter

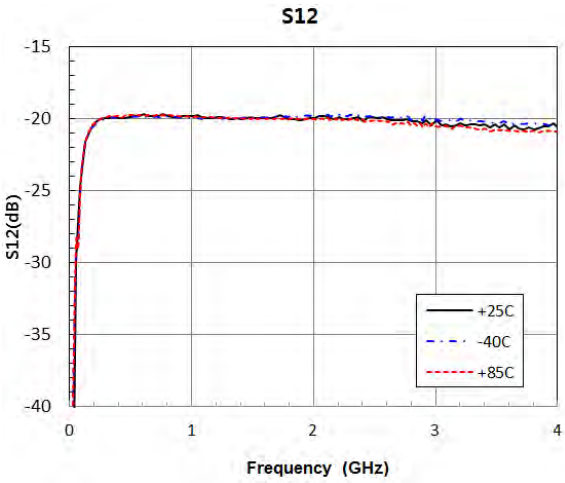
Input Return Loss



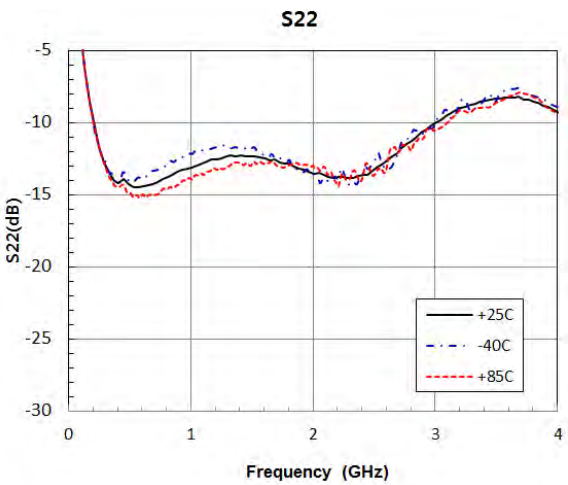
Broadband Gain



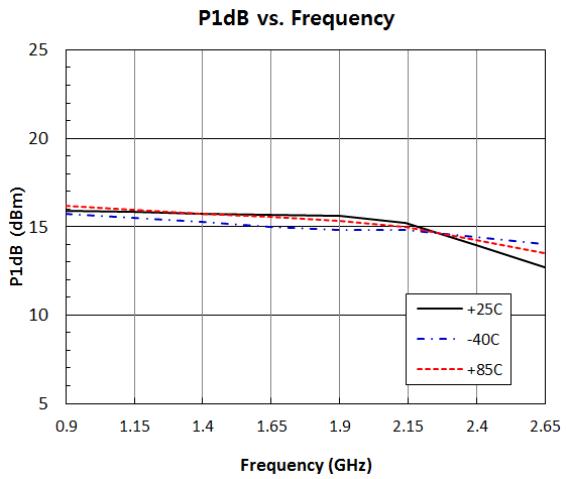
Reverse isolation

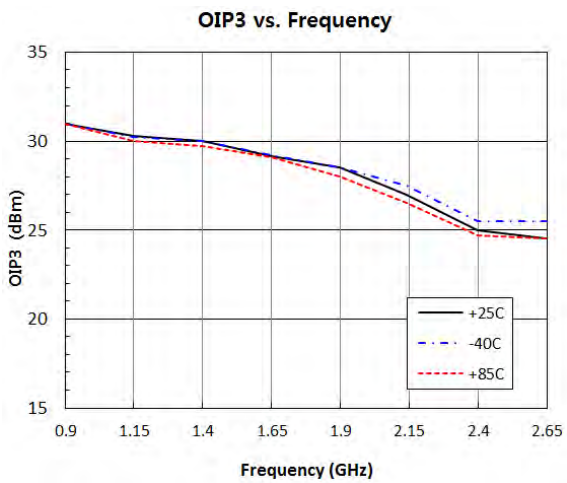


Output Return Loss



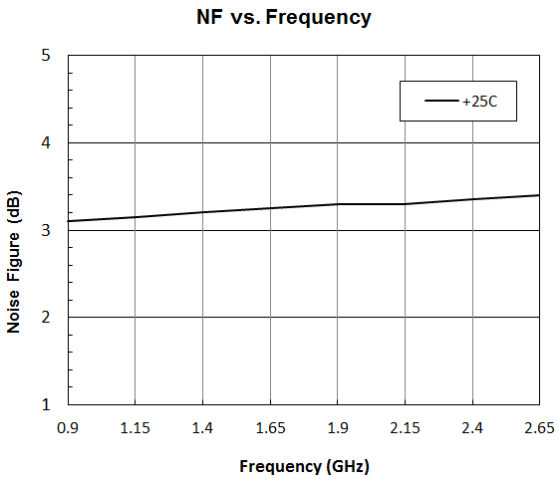
P1-dB & OIP3



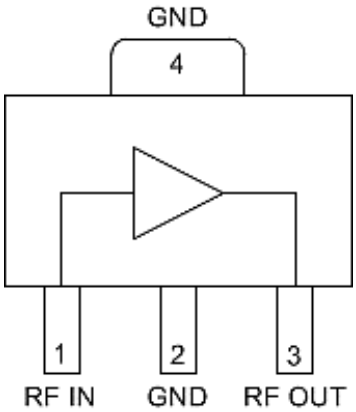


Note. +5dBm / Tone Output Power

Noise Figure



Pin Configuration and Function Descriptions



Pin Number	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor.
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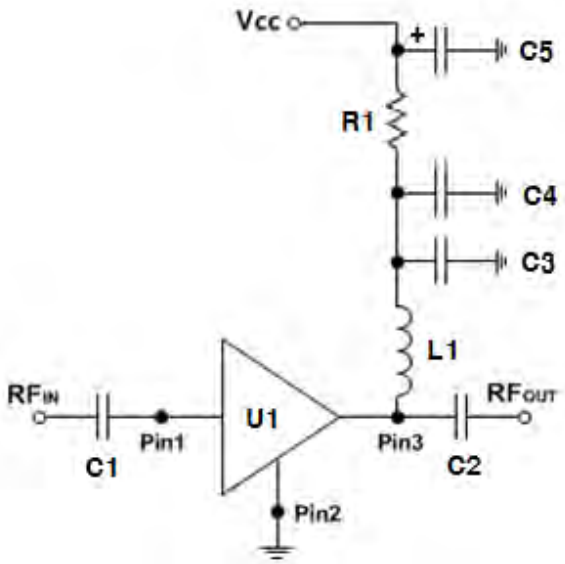
Application Circuit Schematic



Note.

1. Application circuit schematic shows the basic connection for operating WTM107.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values

Reference	Value	Unit	Description	Manufacture
U1	WTM107	-	RF Gain Block Amplifier	WAVETRACK
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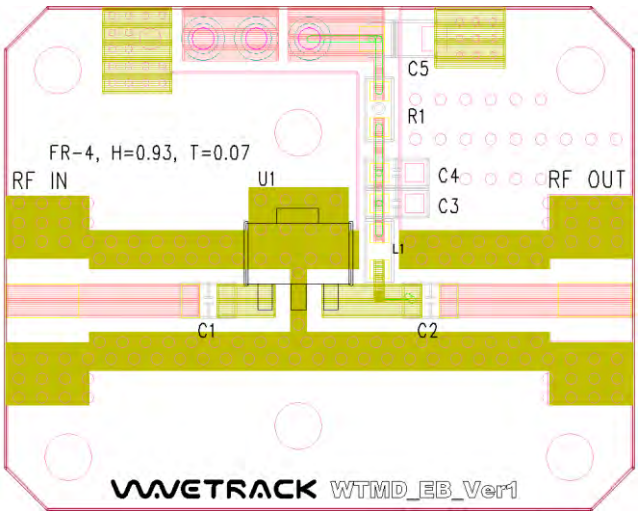
C2	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	10	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	10	[uF]	Tantalum Capacitor	Samsung
L1	39	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	0	[Ω]	Resistor Chip	Samsung

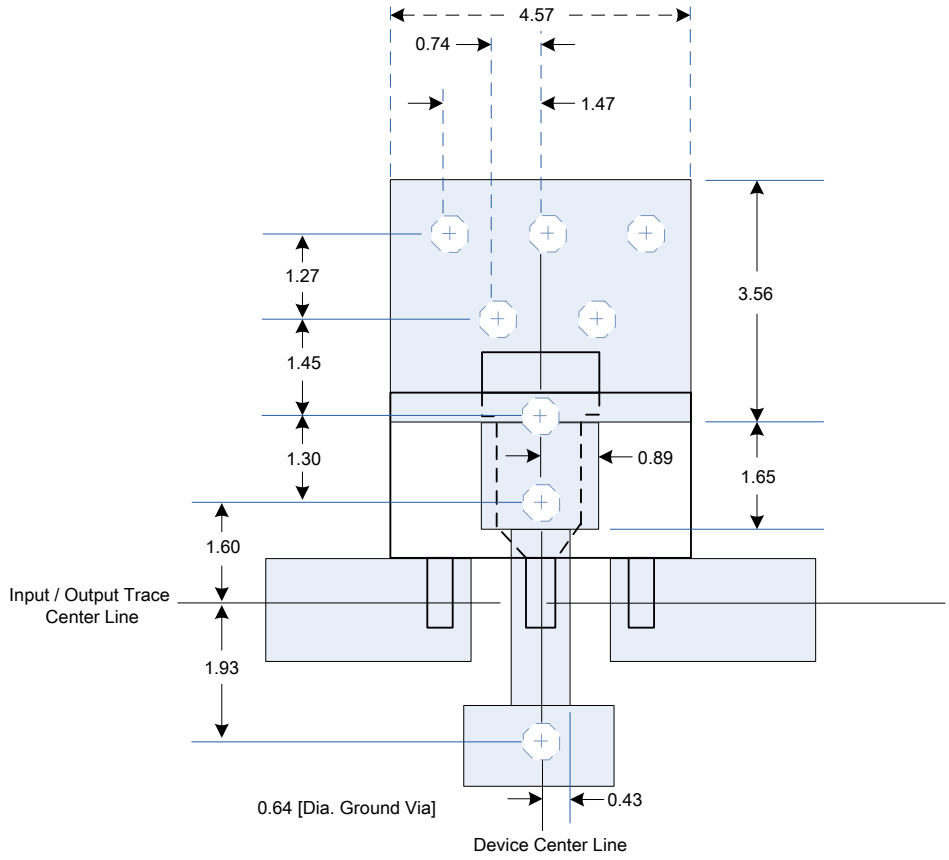
Application Circuit Layout



Note.

1. Package bottom must be connected to RF/DC ground.
2. Provide a large ground pad area under device ground pin.
3. A sufficient number of via holes should be used to connect the top and bottom ground plane.
4. The circuit board used in the application should apply RF circuit design techniques.
5. RF lines should have 50 ohm impedance.
   - ✓ Circuit board material : FR-4
   - ✓ Circuit board height : 0.93mm :

Recommended PCB Land Pattern



Note.

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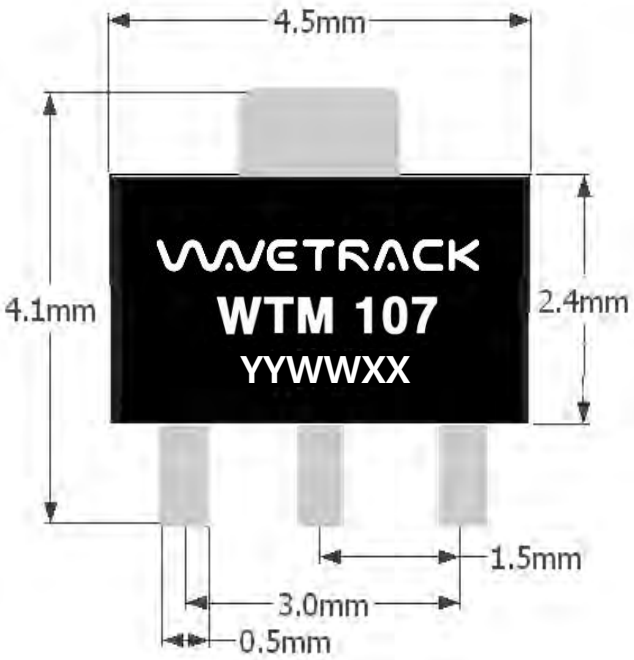
  Lot code - YYWWXX

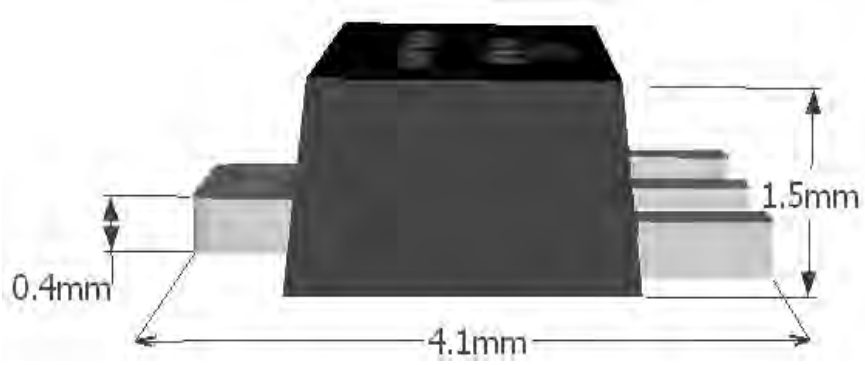
  YY = Year / WW = Working Week / XX = Wafer No.

- **Outline Drawing : Millimeters**

TOP VIEW



SIDE VIEW



5~6000MHz InGaP/GaAs HBT MMIC Amplifier

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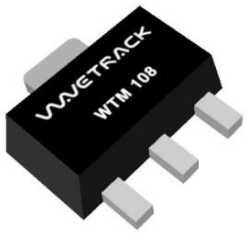

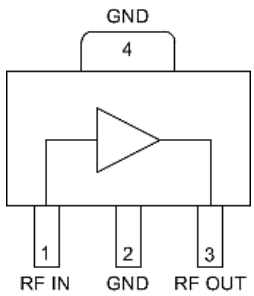

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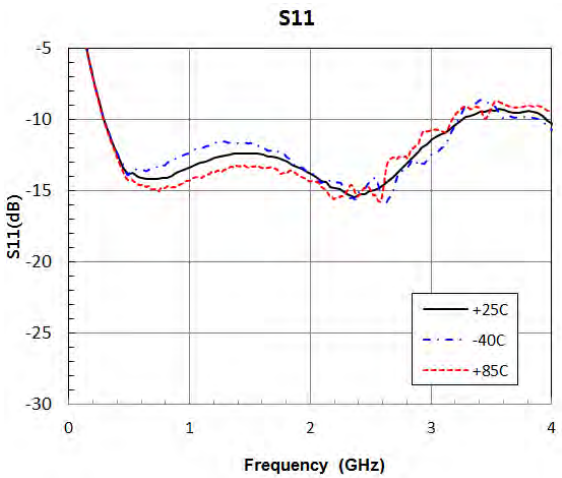
P1dB	20.0	18.8	18.5	18.5	dBm
S11	-13.7	-13.3	-14.6	-14.3	dB
S22	-13.6	-14.0	-14.6	-11.1	dB
S12	-19.5	-19.3	-19.4	-20.5	dB
NF	3.6	3.8	3.9	3.8	dB

Note.

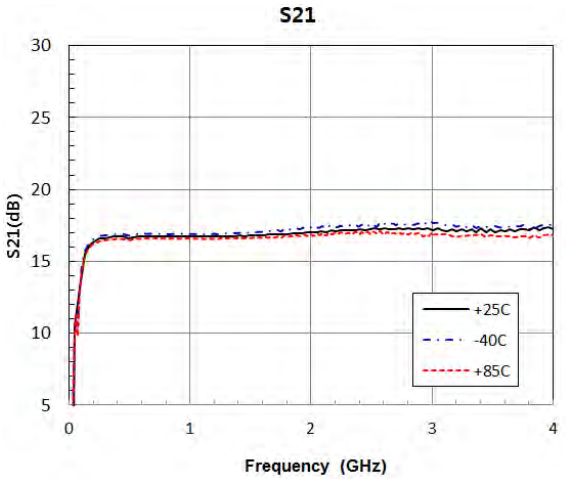
1. Typical RF performance measured on a Wavetrack evaluation board.
2. RF performance data taken with application circuit element values.
3. OIP3 measured with two tones at an output 5dBm per tone separated 1MHz.
4. Z_S = Z_L = 50 ohm .

S-Parameter

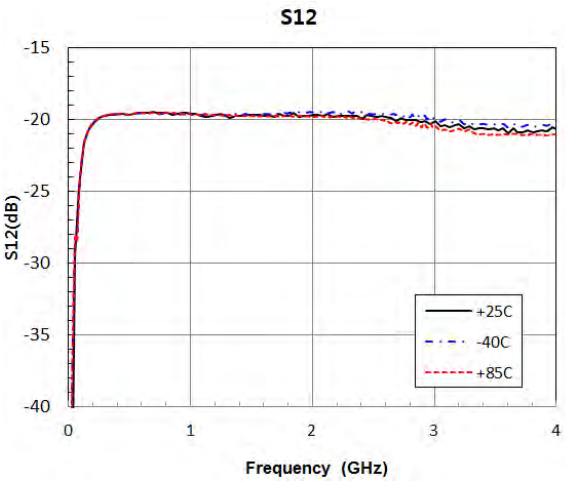
Input Return Loss



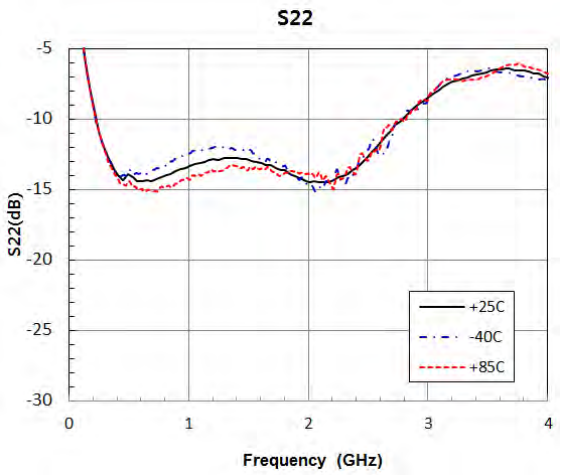
Broadband Gain



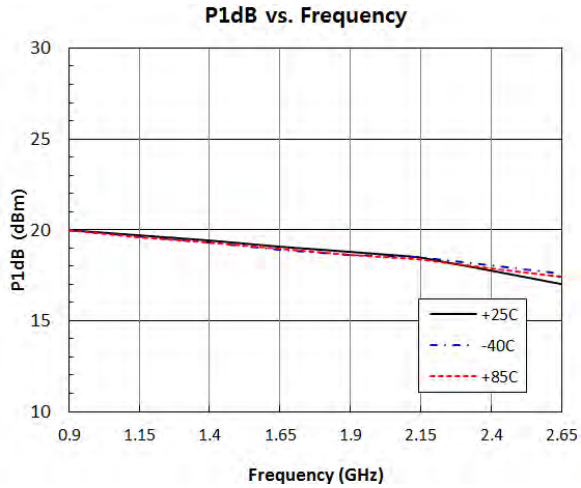
Reverse isolation

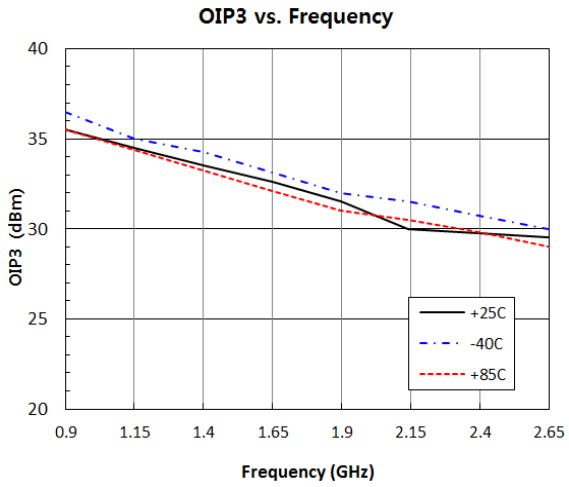


Output Return Loss



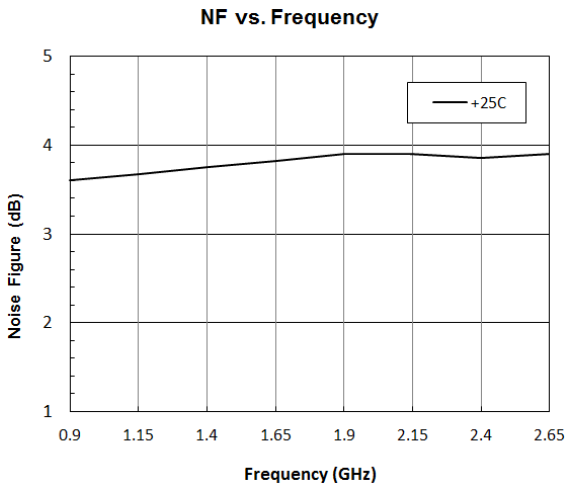
P1-dB & OIP3



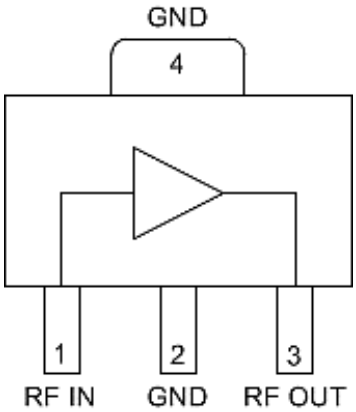


Note. +5dBm / Tone Output Power

Noise Figure

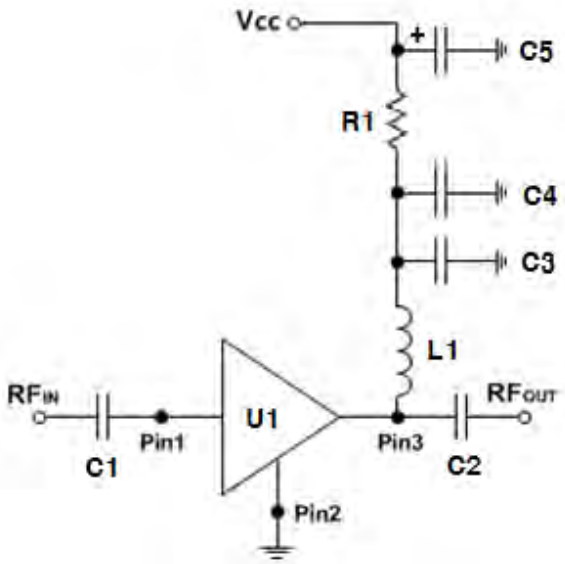


Pin Configuration and Function Descriptions



Pin Number	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor.
2	GND	Connection to ground. Use via holes as close to the device ground leads as possible to reduce ground path inductance.
3	RF OUT	RF output pin. DC voltage is present on this pin. DC blocking capacitor is necessary. An RF choke is needed to feed DC bias.

Application Circuit Schematic



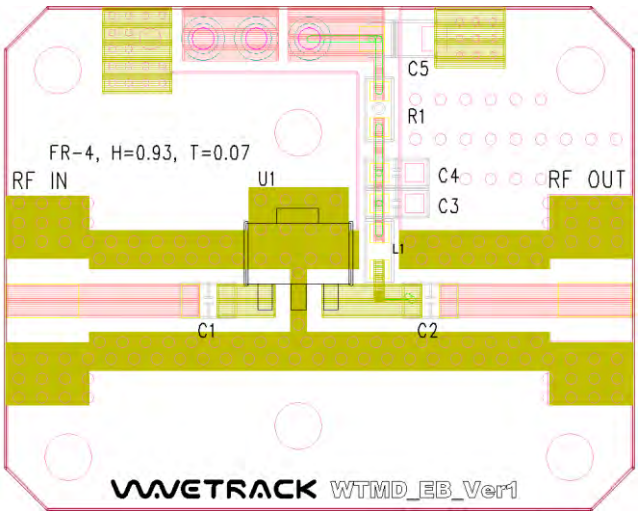
Note.

1. Application circuit schematic shows the basic connection for operating WTM108.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values

Reference	Value	Unit	Description	Manufacture
U1	WTM108	-	RF Gain Block Amplifier	WAVETRACK
C1	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	10	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	10	[uF]	Tantalum Capacitor	Samsung
L1	39	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	0	[Ω]	Resistor Chip	Samsung

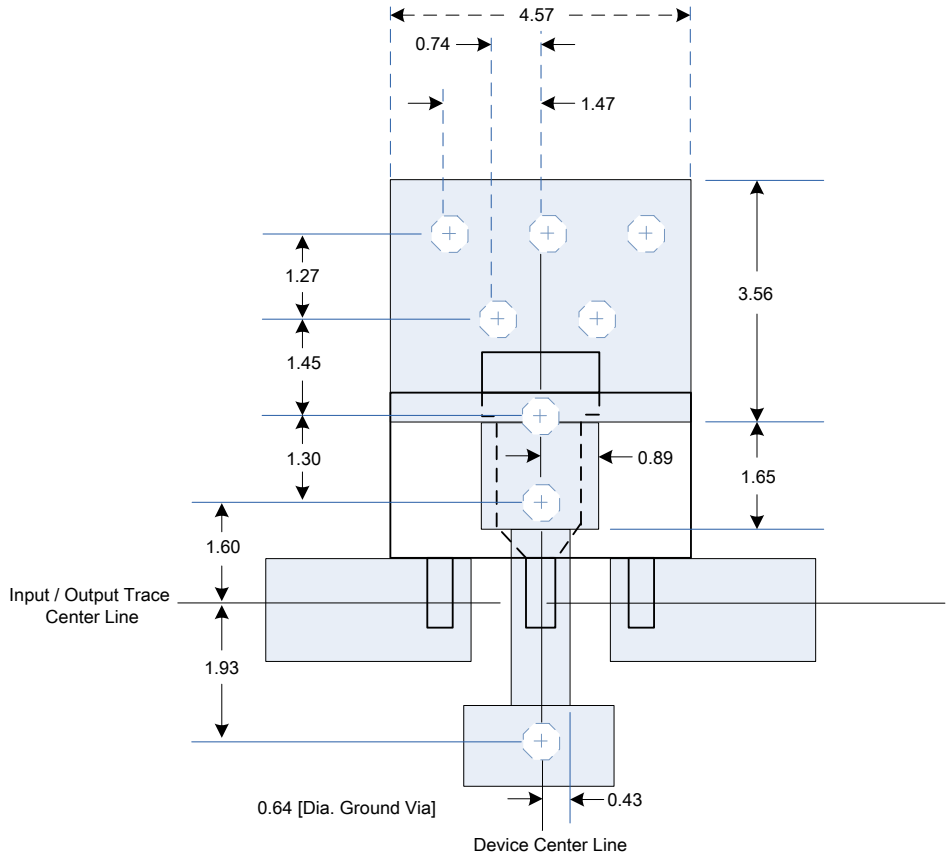
Application Circuit Layout



Note.

1. Package bottom must be connected to RF/DC ground.
2. Provide a large ground pad area under device ground pin.
3. A sufficient number of via holes should be used to connect the top and bottom ground plane.
4. The circuit board used in the application should apply RF circuit design techniques.
5. RF lines should have 50 ohm impedance.
   - ✓ Circuit board material : FR-4
   - ✓ Circuit board height : 0.93mm :

Recommended PCB Land Pattern



Note.

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating
3. Solder the copper pad on the backside of the device package to the ground plane.
4. Provide a large ground pad area under device pins 1,2,3 with many plated via holes as shown.
5. Dimensions not given for 50ohm line.
6. Scale accordingly for different board thickness and dielectric contacts.
7. We recommend 1 or 2ounce copper.

Package Information & Outline Drawing

- **Marking : Manufacture**

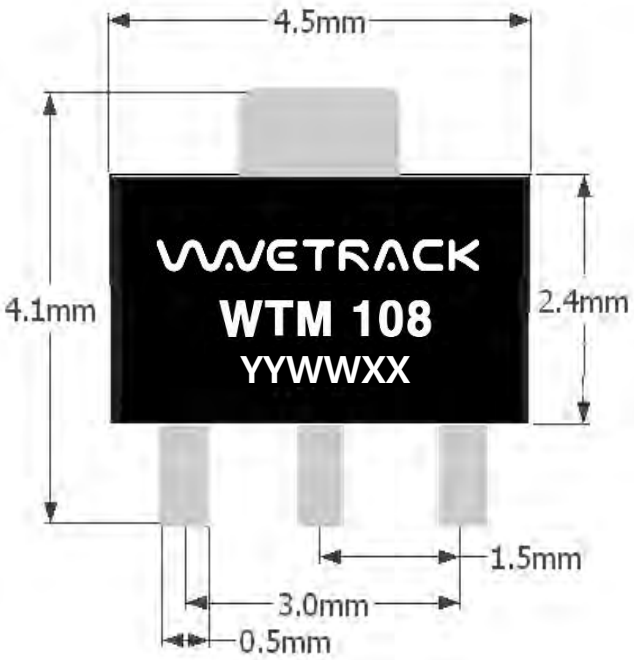
  Part Number – WTMXXX

  Lot code - YYWWXX

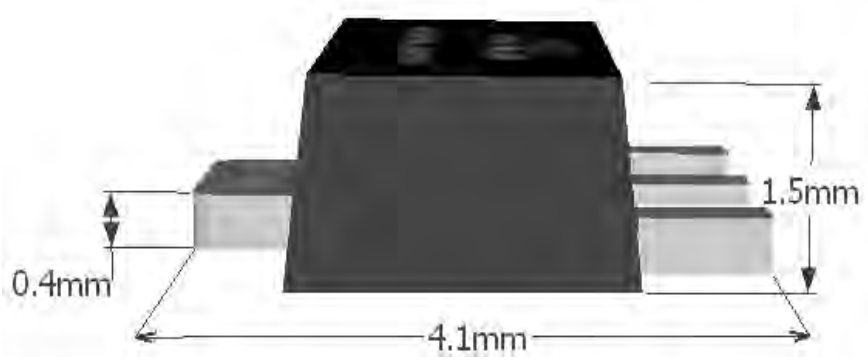
  YY = Year / WW = Working Week / XX = Wafer No.

- **Outline Drawing : Millimeters**

TOP VIEW



SIDE VIEW



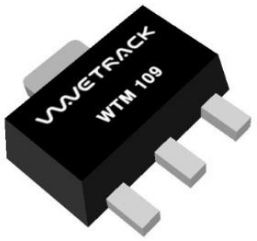
5~6000MHz InGaP/GaAs HBT MMIC Amplifier

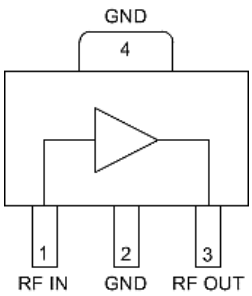
General Description

The WTM109 is a general RF gain boosting amplifier MMIC that have high linearity & gain performance. The device features flat high gain with excellent in/out return loss. The amplifier typically provides 15.8dB gain, 27.5dBm OIP3 and 3.7dB Noise Figure while drawing 45mA current at 1.9GHz. The device is packaged in a lead-free/green/RoHS-compliant industry-standard SOT-89 package.

The WTM109 is designed a Darlington-pair amplifier using high reliability InGap/GaAs HBT process.

Functional Block Diagram





Features

- 5~6000MHz
- P1dB = 15.3 dBm @1900MHz
- Gain = 15.8 dB @1900MHz
- OIP3 = 27.5 dBm @1900MHz
- NF = 3.7 dB @1900MHz
- IRL= 15dB and ORL=13dB
- 50 Ohm Cascadable Gain Block
- Unconditionally Stable
- +5V Single Supply, 45mA Current
- Industry Standard SOT-89 Package

Applications

- Cellular / PCS / 3G / LTE repeaters
- Wireless Data / WLAN
- CATV & Cable Modem
- ISM
- Microwave Radio

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage(V_{CC})	5.5 V
Max Device Current(I_D)	100 mA
Max RF Input Power	20 dBm
Operating Temperature(T_L)	-40 to +85°C
Storage Temperature	-65 to +150°C
ESD Sensitivity (Human Body Model : HBM)	Class 1C
Moisture Sensitivity Level (MSL)	MSL1

Note.

1. Stress under Absolute Maximum Ratings may result in permanent damage to the device.
2. Extended application of Absolute Maximum ratings condition to the device may reduce device reliability.
3. These rating are not intended for continuous normal operation.
   - ✓ HBM : Class 1C in accordance with JEDEC Standard JESD22-A114B
   - ✓ MSL : MSL1 in accordance with JEDEC Standard J-STD-020

ESD CAUTION

	ESD (electrostatic discharge) sensitive device. Although this product features proprietary protection circuitry, damage may occur on devices subjected to high energy ESD.

Typical Performance at Key Operating Frequencies

Vcc = +5V, T_A=25°C, unless otherwise noted. (I_D = 45mA)

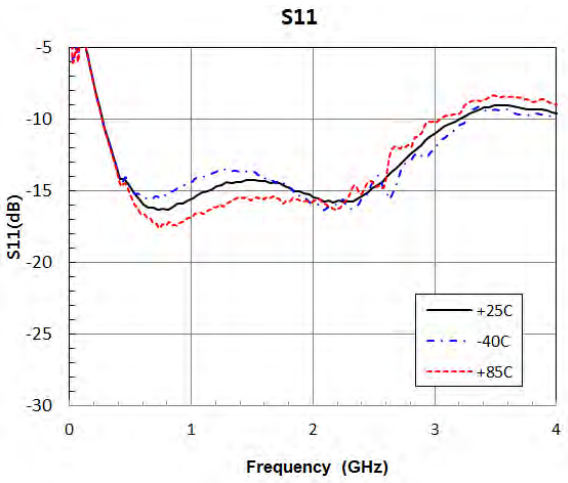
Parameter	900MHz	1900MHz	2140MHz	2650MHz	Unit
S21	15.6	15.8	15.9	16.0	dB
OIP3	28.5	27.5	27.0	25.0	dBm
P1dB	15.2	15.3	15.0	12.5	dBm
S11	-15.9	-15.1	-15.7	-13.7	dB
S22	-15.2	-13.5	-13.3	-10.6	dB
S12	-18.5	-18.8	-19.0	-19.5	dB
NF	3.5	3.7	3.7	3.7	dB

Note.

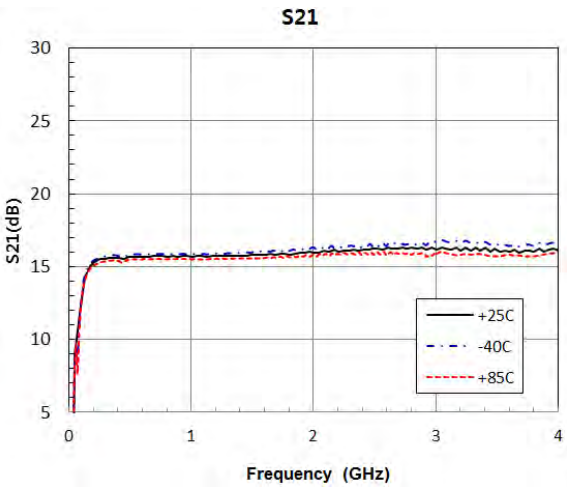
1. Typical RF performance measured on a Wavetrack evaluation board.
2. RF performance data taken with application circuit element values.
3. OIP3 measured with two tones at an output 5dBm per tone separated 1MHz.
4. Z_S = Z_L = 50 ohm .

S-Parameter

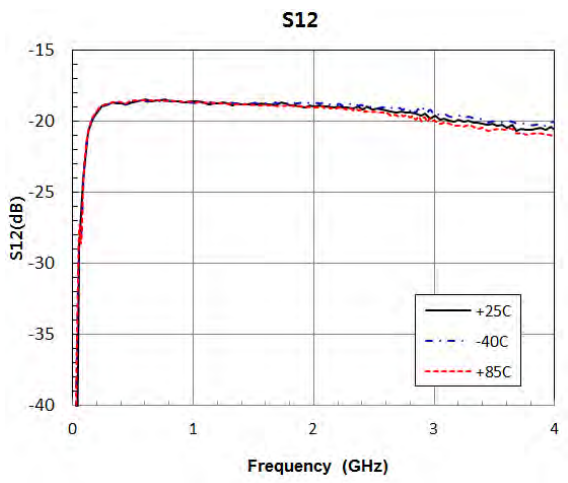
Input Return Loss



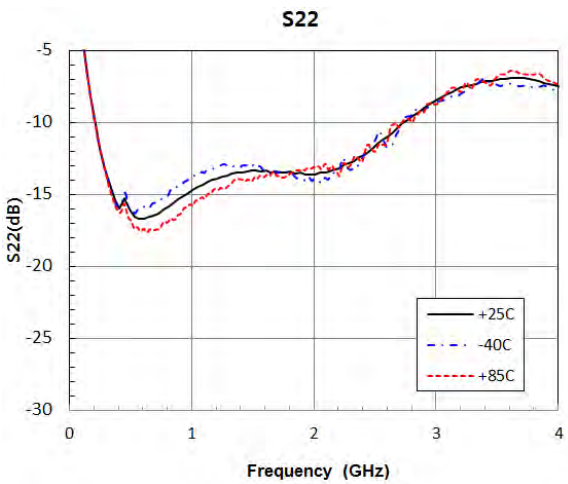
Broadband Gain



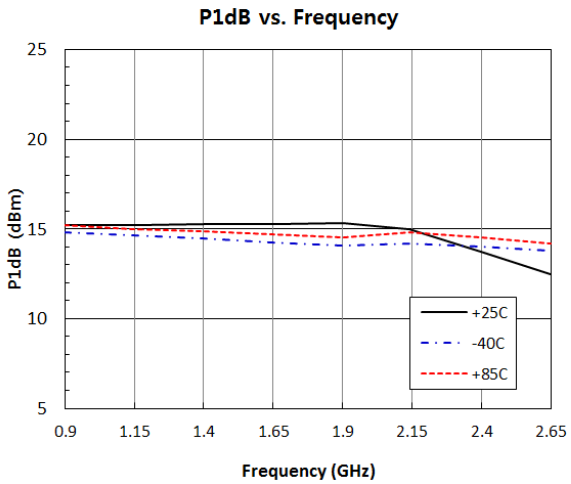
Reverse isolation

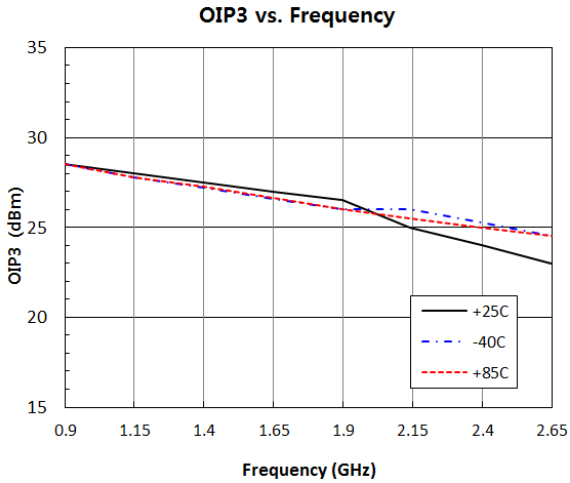


Output Return Loss



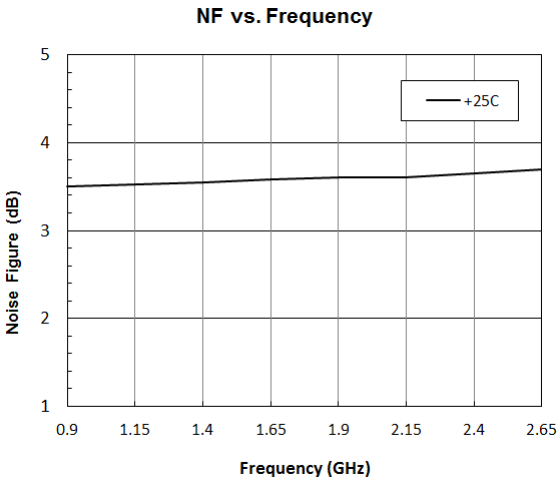
P1-dB & OIP3



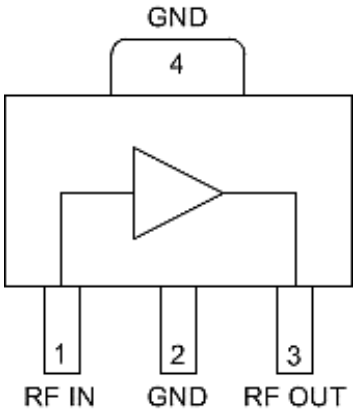


Note. +5dBm / Tone Output Power

Noise Figure

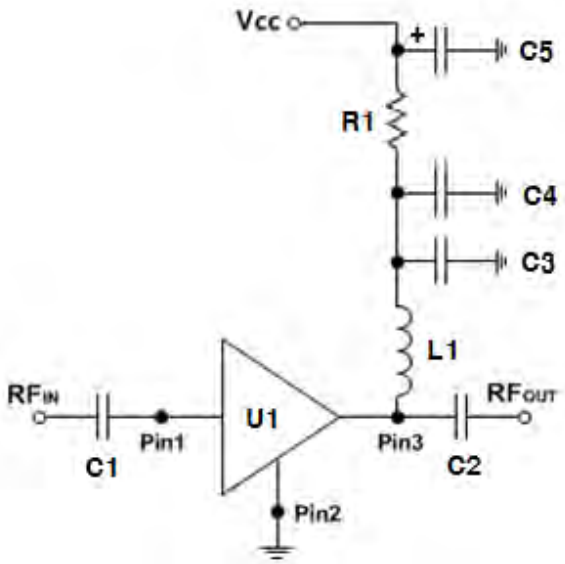


Pin Configuration and Function Descriptions



Pin Number	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor.
2	GND	Connection to ground. Use via holes as close to the device ground leads as possible to reduce ground path inductance.
3	RF OUT	RF output pin. DC voltage is present on this pin. DC blocking capacitor is necessary. An RF choke is needed to feed DC bias.

Application Circuit Schematic



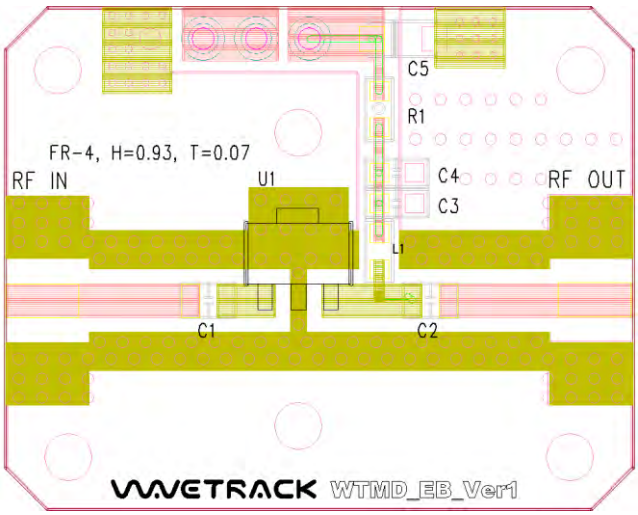
Note.

1. Application circuit schematic shows the basic connection for operating WTM109.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values

Reference	Value	Unit	Description	Manufacture
U1	WTM109	-	RF Gain Block Amplifier	WAVETRACK
C1	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	10	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	10	[uF]	Tantalum Capacitor	Samsung
L1	39	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	0	[Ω]	Resistor Chip	Samsung

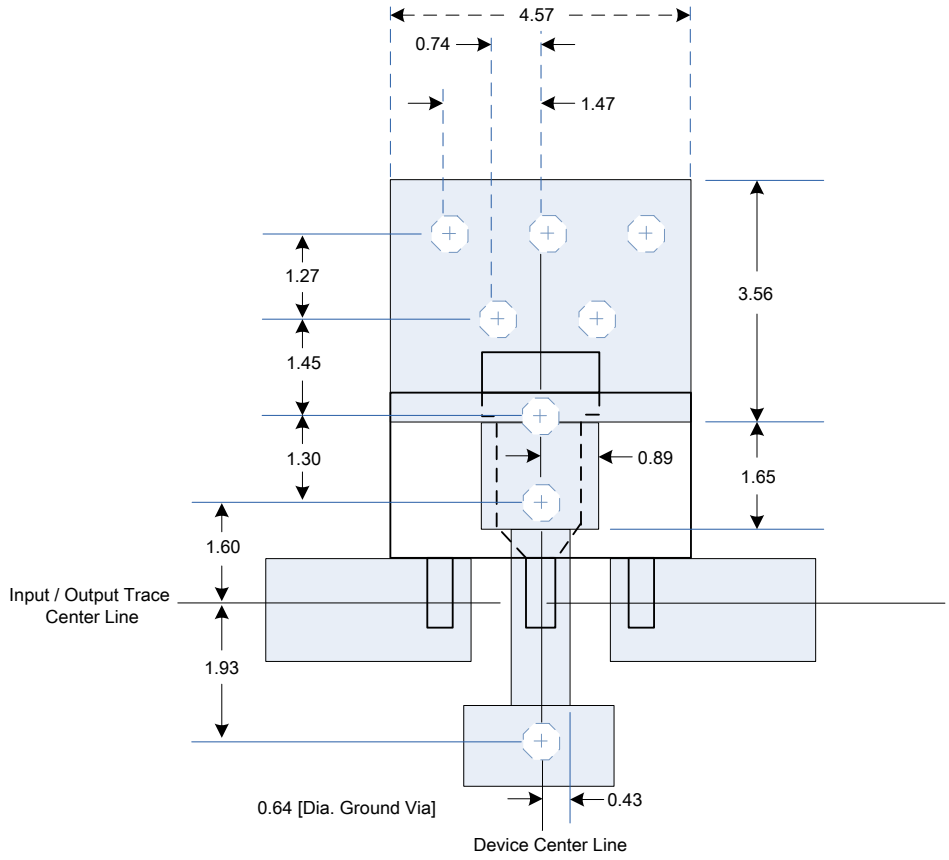
Application Circuit Layout



Note.

1. Package bottom must be connected to RF/DC ground.
2. Provide a large ground pad area under device ground pin.
3. A sufficient number of via holes should be used to connect the top and bottom ground plane.
4. The circuit board used in the application should apply RF circuit design techniques.
5. RF lines should have 50 ohm impedance.
   - ✓ Circuit board material : FR-4
   - ✓ Circuit board height : 0.93mm :

Recommended PCB Land Pattern



Note.

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating
3. Solder the copper pad on the backside of the device package to the ground plane.
4. Provide a large ground pad area under device pins 1,2,3 with many plated via holes as shown.
5. Dimensions not given for 50ohm line.
6. Scale accordingly for different board thickness and dielectric contacts.
7. We recommend 1 or 2ounce copper.

Package Information & Outline Drawing

- **Marking : Manufacture**

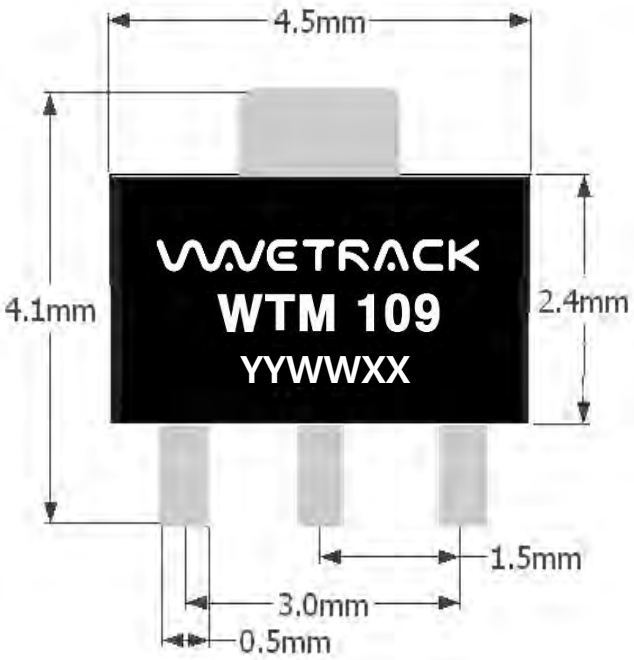
  Part Number – WTMXXX

  Lot code - YYWWXX

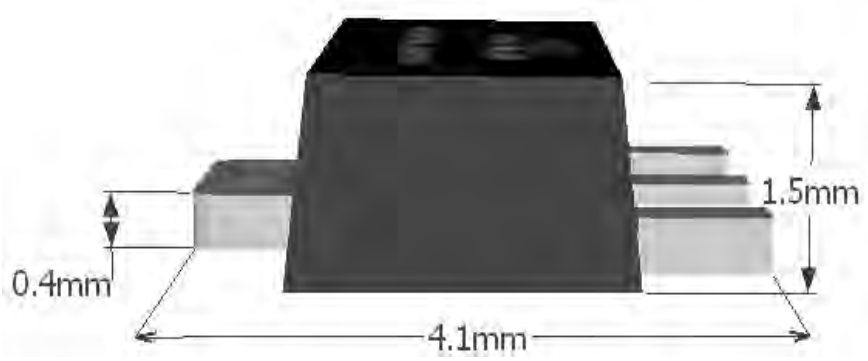
  YY = Year / WW = Working Week / XX = Wafer No.

- **Outline Drawing : Millimeters**

TOP VIEW



SIDE VIEW



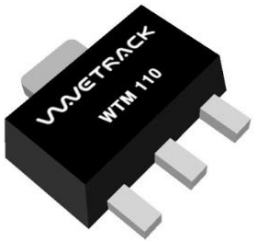
5~6000MHz InGaP/GaAs HBT MMIC Amplifier

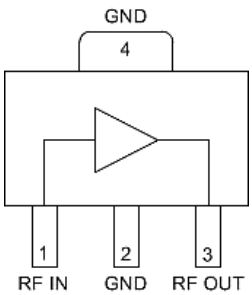
General Description

The WTM110 is a general RF gain boosting amplifier MMIC that have high linearity & gain performance. The device features flat high gain with excellent in/out return loss. The amplifier typically provides 15.6dB gain, 32dBm OIP3 and 4.3dB Noise Figure while drawing 76mA current at 1.9GHz. The device is packaged in a lead-free/green/RoHS-compliant industry-standard SOT-89 package.

The WTM110 is designed a Darlington-pair amplifier using high reliability InGap/GaAs HBT process.

Functional Block Diagram





Features

- 5~6000MHz
- P1dB = 18.8 dBm @1900MHz
- Gain = 15.6 dB @1900MHz
- OIP3 = 32.0 dBm @1900MHz
- NF = 4.3 dB @1900MHz
- IRL= 13dB and ORL=13dB
- 50 Ohm Cascadable Gain Block
- Unconditionally Stable
- +5V Single Supply, 76mA Current
- Industry Standard SOT-89 Package

Applications

- Cellular / PCS / 3G / LTE repeaters
- Wireless Data / WLAN
- CATV & Cable Modem
- ISM
- Microwave Radio

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage(V_{CC})	5.5 V
Max Device Current(I_D)	100 mA
Max RF Input Power	20 dBm
Operating Temperature(T_L)	-40 to +85°C
Storage Temperature	-65 to +150°C
ESD Sensitivity (Human Body Model : HBM)	Class 1C
Moisture Sensitivity Level (MSL)	MSL1

Note.

1. Stress under Absolute Maximum Ratings may result in permanent damage to the device.
2. Extended application of Absolute Maximum ratings condition to the device may reduce device reliability.
3. These rating are not intended for continuous normal operation.
   - ✓ HBM : Class 1C in accordance with JEDEC Standard JESD22-A114B
   - ✓ MSL : MSL1 in accordance with JEDEC Standard J-STD-020

ESD CAUTION

	ESD (electrostatic discharge) sensitive device. Although this product features proprietary protection circuitry, damage may occur on devices subjected to high energy ESD.

Typical Performance at Key Operating Frequencies

Vcc = +5V, T_A=25°C, unless otherwise noted. (I_D = 76mA)

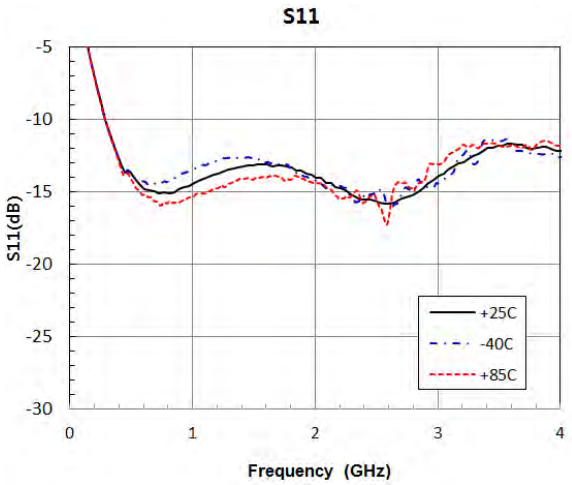
Parameter	900MHz	1900MHz	2140MHz	2650MHz	Unit
S21	15.3	15.6	15.7	15.8	dB
OIP3	36.0	32.0	31.5	30.5	dBm
P1dB	19.7	18.8	18.8	18.8	dBm
S11	-14.7	-13.6	-14.5	-14.5	dB
S22	-14.5	-13.3	-13.5	-11.7	dB
S12	-18.6	-18.9	-19.1	-19.5	dB
NF	4.0	4.3	4.3	4.3	dB

Note.

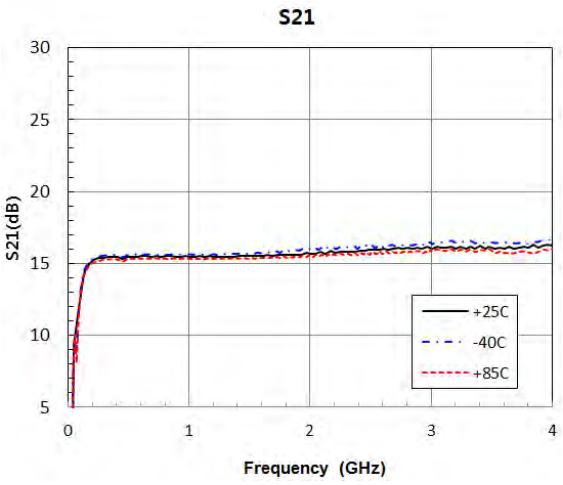
1. Typical RF performance measured on a Wavetrack evaluation board.
2. RF performance data taken with application circuit element values.
3. OIP3 measured with two tones at an output 5dBm per tone separated 1MHz.
4. Z_S = Z_L = 50 ohm .

S-Parameter

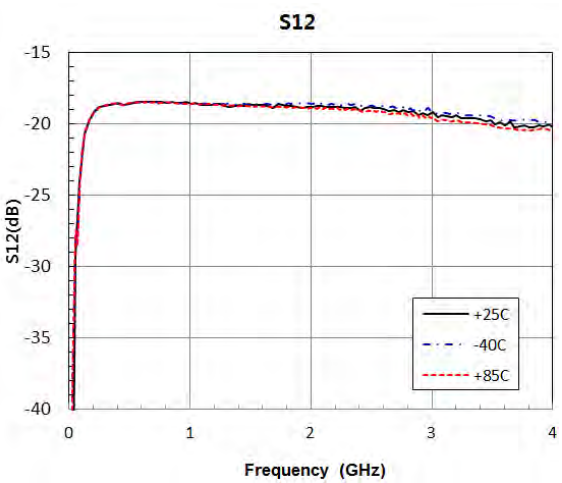
Input Return Loss



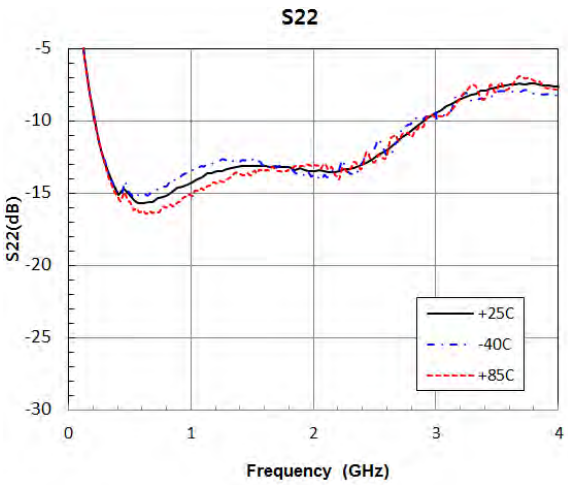
Broadband Gain



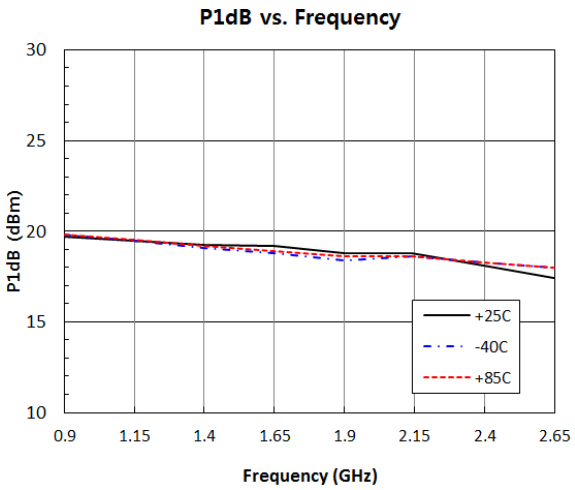
Reverse isolation

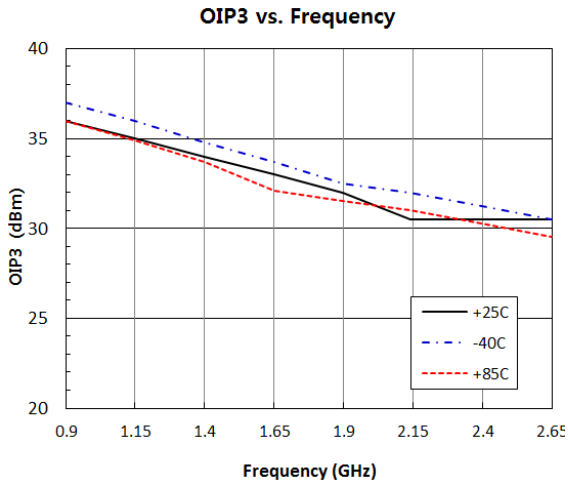


Output Return Loss



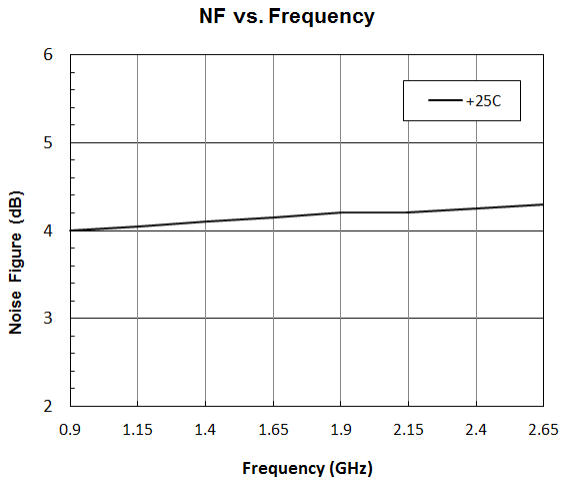
P1-dB & OIP3



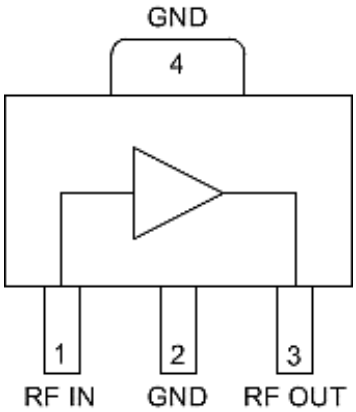


Note. +5dBm / Tone Output Power

Noise Figure

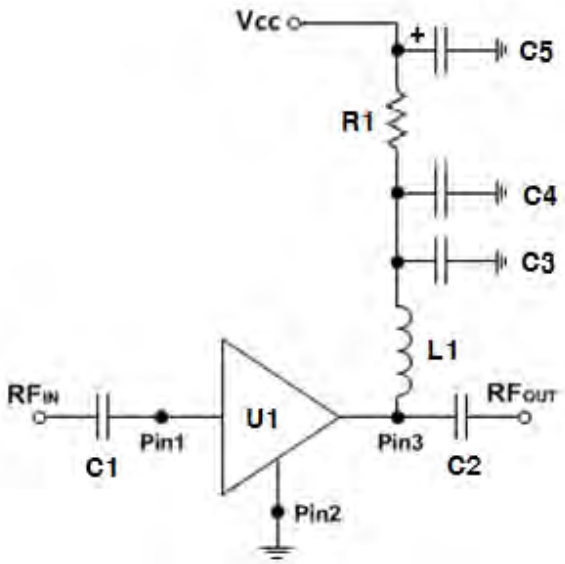


Pin Configuration and Function Descriptions



Pin Number	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor.
2	GND	Connection to ground. Use via holes as close to the device ground leads as possible to reduce ground path inductance.
3	RF OUT	RF output pin. DC voltage is present on this pin. DC blocking capacitor is necessary. An RF choke is needed to feed DC bias.

Application Circuit Schematic



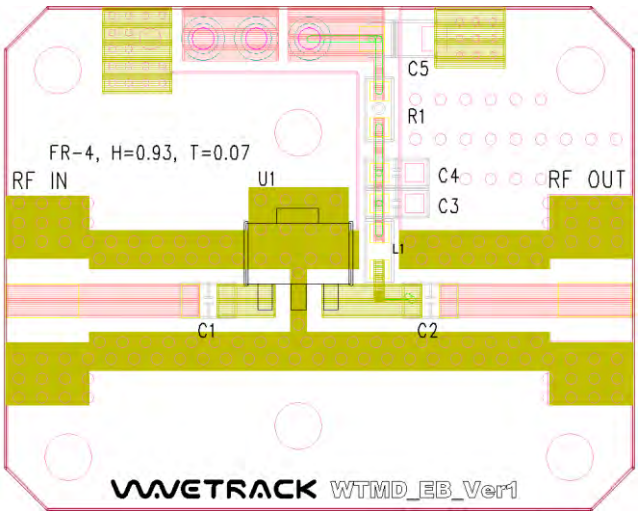
Note.

1. Application circuit schematic shows the basic connection for operating WTM110.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values

Reference	Value	Unit	Description	Manufacture
U1	WTM110	-	RF Gain Block Amplifier	WAVETRACK
C1	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	10	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	10	[uF]	Tantalum Capacitor	Samsung
L1	39	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	0	[Ω]	Resistor Chip	Samsung

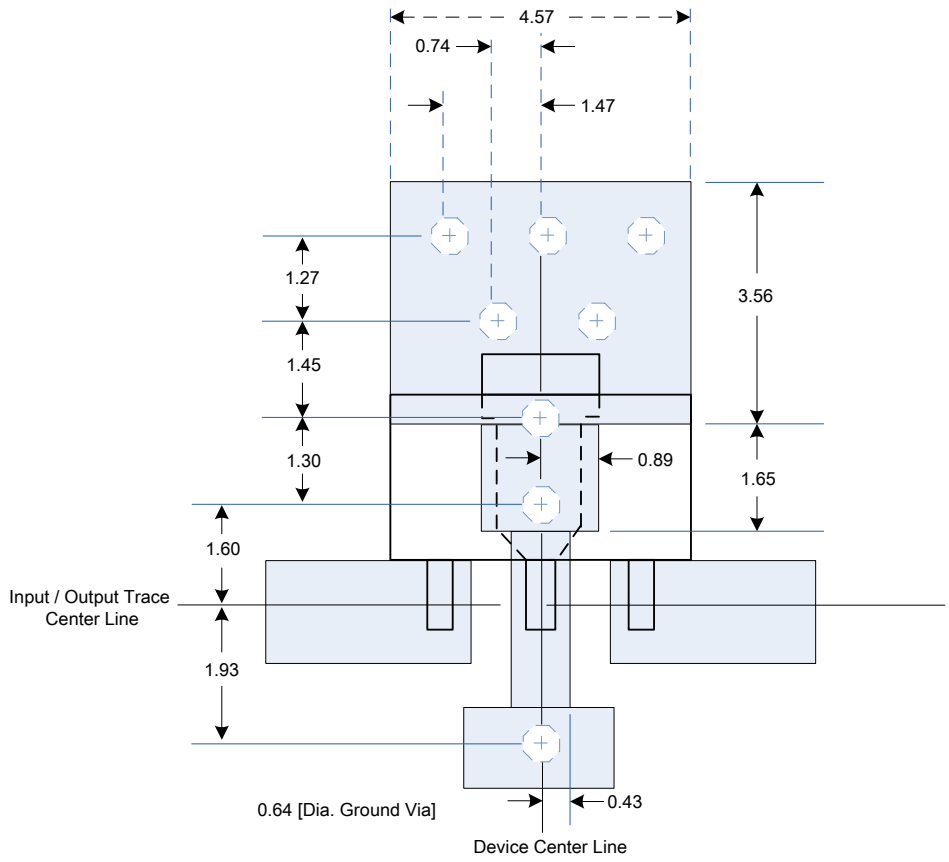
Application Circuit Layout



Note.

1. Package bottom must be connected to RF/DC ground.
2. Provide a large ground pad area under device ground pin.
3. A sufficient number of via holes should be used to connect the top and bottom ground plane.
4. The circuit board used in the application should apply RF circuit design techniques.
5. RF lines should have 50 ohm impedance.
   - ✓ Circuit board material : FR-4
   - ✓ Circuit board height : 0.93mm :

Recommended PCB Land Pattern



Note.

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating
3. Solder the copper pad on the backside of the device package to the ground plane.
4. Provide a large ground pad area under device pins 1,2,3 with many plated via holes as shown.
5. Dimensions not given for 50ohm line.
6. Scale accordingly for different board thickness and dielectric contacts.
7. We recommend 1 or 2ounce copper.

Package Information & Outline Drawing

- **Marking : Manufacture**

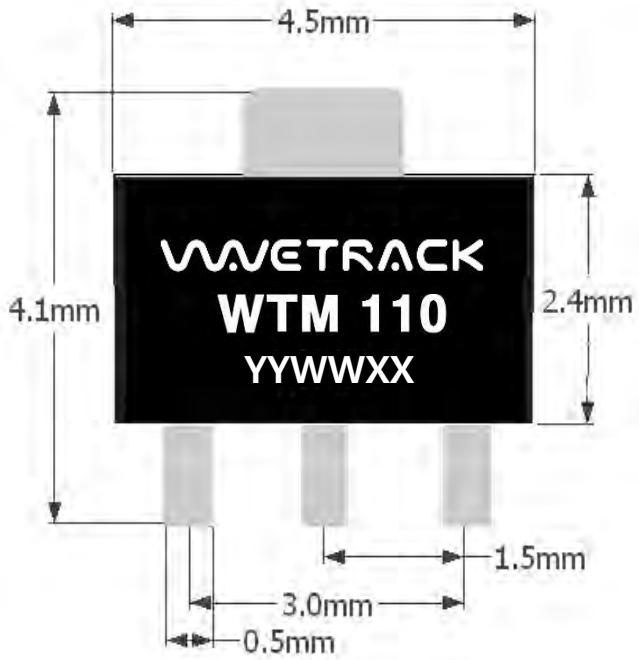
  Part Number – WTMXXX

  Lot code - YYWWXX

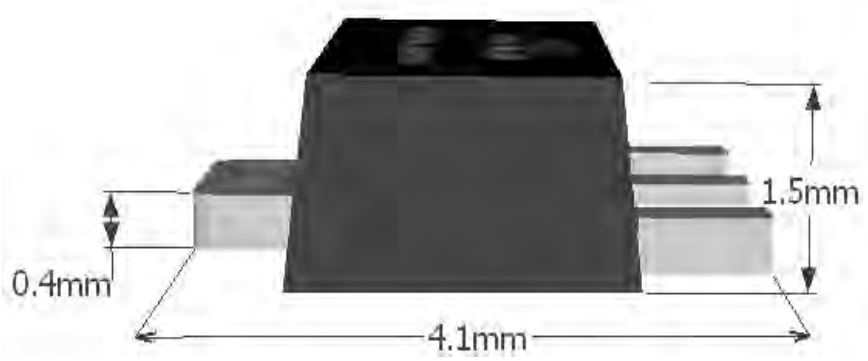
  YY = Year / WW = Working Week / XX = Wafer No.

- **Outline Drawing : Millimeters**

TOP VIEW



SIDE VIEW



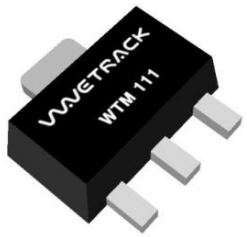
5~6000MHz InGaP/GaAs HBT MMIC Amplifier

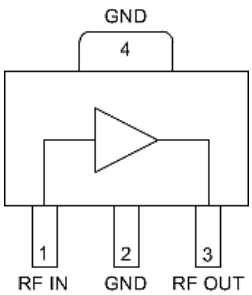
General Description

The WTM111 is a general RF gain boosting amplifier MMIC that have high linearity & gain performance. The device features flat high gain with excellent in/out return loss. The amplifier typically provides 14.1dB gain, 32.5dBm OIP3 and 4.0dB Noise Figure while drawing 73mA current at 1.9GHz. The device is packaged in a lead-free/green/RoHS-compliant industry-standard SOT-89 package.

The WTM111 is designed a Darlington-pair amplifier using high reliability InGap/GaAs HBT process.

Functional Block Diagram





Features

- 5~6000MHz
- P1dB = 17.6 dBm @1900MHz
- Gain = 14.1 dB @1900MHz
- OIP3 = 32.5 dBm @1900MHz
- NF = 4.0 dB @1900MHz
- IRL= 13dB and ORL=13dB
- 50 Ohm Cascadable Gain Block
- Unconditionally Stable
- +5V Single Supply, 73mA Current
- Industry Standard SOT-89 Package

Applications

- Cellular / PCS / 3G / LTE repeaters
- Wireless Data / WLAN
- CATV & Cable Modem
- ISM
- Microwave Radio

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage(V_{CC})	5.5 V
Max Device Current(I_D)	100 mA
Max RF Input Power	20 dBm
Operating Temperature(T_L)	-40 to +85°C
Storage Temperature	-65 to +150°C
ESD Sensitivity (Human Body Model : HBM)	Class 1C
Moisture Sensitivity Level (MSL)	MSL1

Note.

1. Stress under Absolute Maximum Ratings may result in permanent damage to the device.
2. Extended application of Absolute Maximum ratings condition to the device may reduce device reliability.
3. These rating are not intended for continuous normal operation.
   - ✓ HBM : Class 1C in accordance with JEDEC Standard JESD22-A114B
   - ✓ MSL : MSL1 in accordance with JEDEC Standard J-STD-020

ESD CAUTION

	ESD (electrostatic discharge) sensitive device. Although this product features proprietary protection circuitry, damage may occur on devices subjected to high energy ESD.

Typical Performance at Key Operating Frequencies

Vcc = +5V, T_A=25°C, unless otherwise noted. (I_D = 73mA)

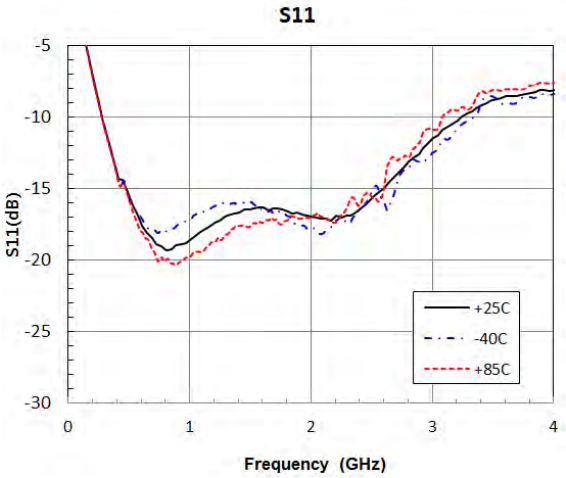
Parameter	900MHz	1900MHz	2140MHz	2650MHz	Unit
S21	14.0	14.1	14.2	14.3	dB
OIP3	36.0	32.5	30.5	29.0	dBm
P1dB	19.3	17.6	17.4	16.8	dBm
S11	-18.9	-16.7	-17.1	-14.5	dB
S22	-17.7	-13.0	-12.3	-9.7	dB
S12	-17.3	-17.9	-18.1	-18.5	dB
NF	3.8	4.0	4.0	4.0	dB

Note.

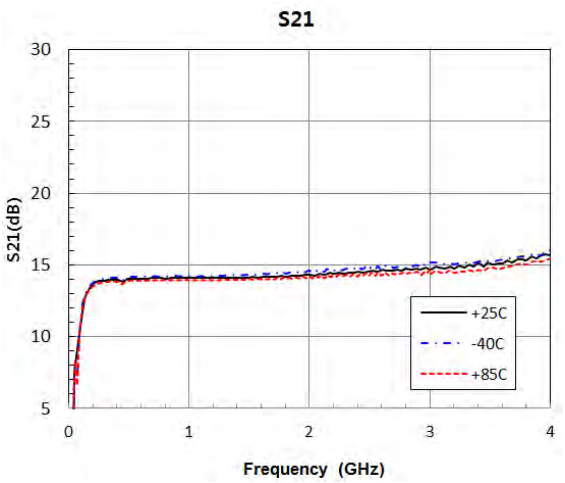
1. Typical RF performance measured on a Wavetrack evaluation board.
2. RF performance data taken with application circuit element values.
3. OIP3 measured with two tones at an output 5dBm per tone separated 1MHz.
4. Z_S = Z_L = 50 ohm .

S-Parameter

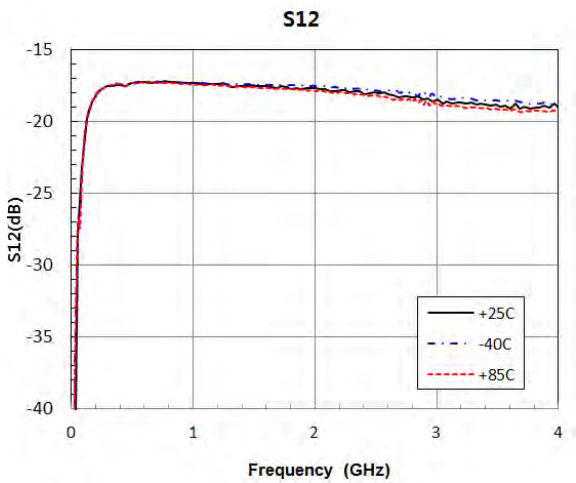
Input Return Loss



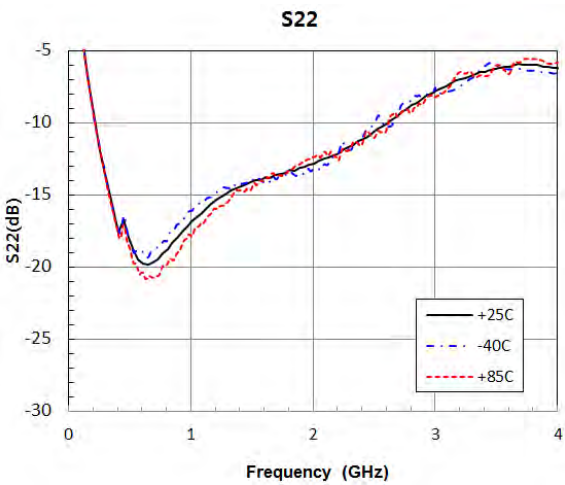
Broadband Gain



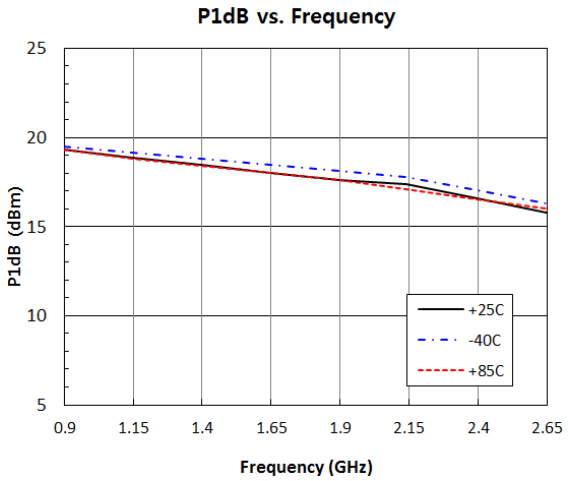
Reverse isolation

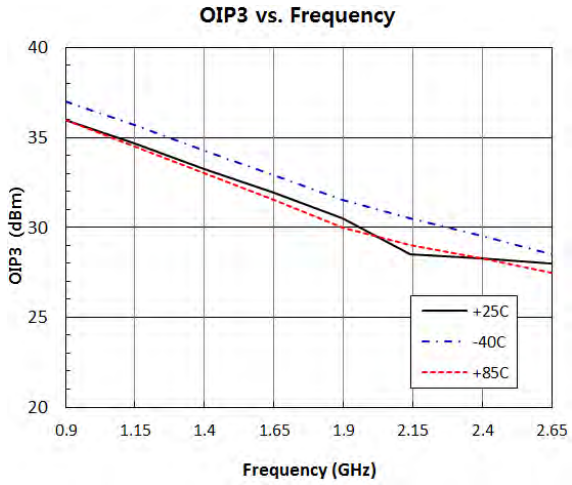


Output Return Loss



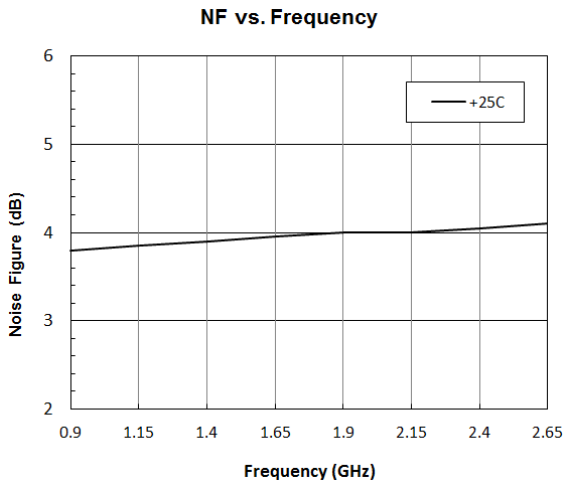
P1-dB & OIP3



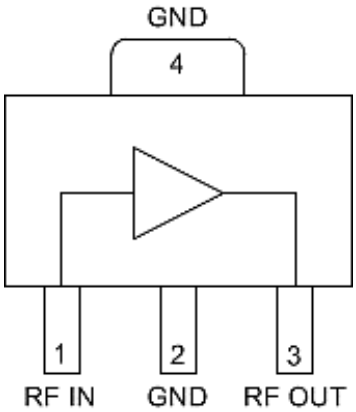


Note. +5dBm / Tone Output Power

Noise Figure

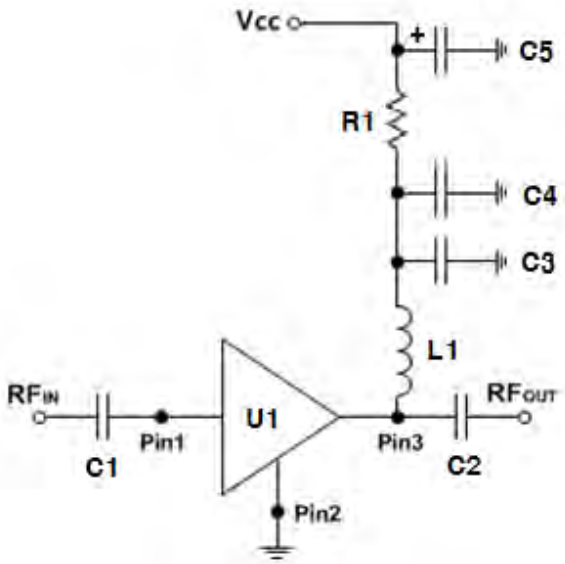


Pin Configuration and Function Descriptions



Pin Number	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor.
2	GND	Connection to ground. Use via holes as close to the device ground leads as possible to reduce ground path inductance.
3	RF OUT	RF output pin. DC voltage is present on this pin. DC blocking capacitor is necessary. An RF choke is needed to feed DC bias.

Application Circuit Schematic



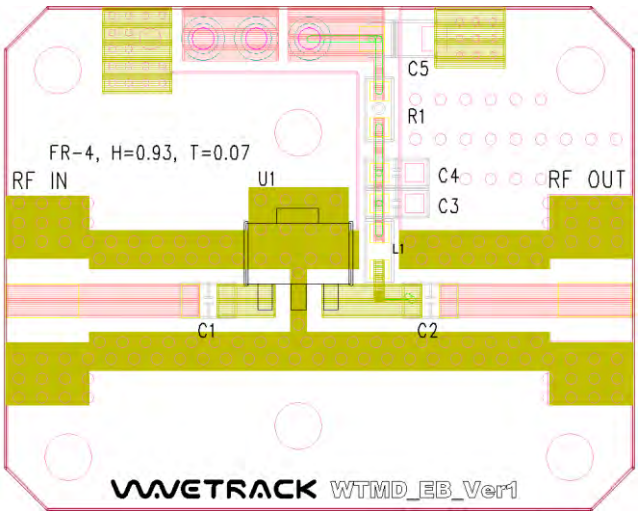
Note.

1. Application circuit schematic shows the basic connection for operating WTM111.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values

Reference	Value	Unit	Description	Manufacture
U1	WTM111	-	RF Gain Block Amplifier	WAVETRACK
C1	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	10	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	10	[uF]	Tantalum Capacitor	Samsung
L1	39	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	0	[Ω]	Resistor Chip	Samsung

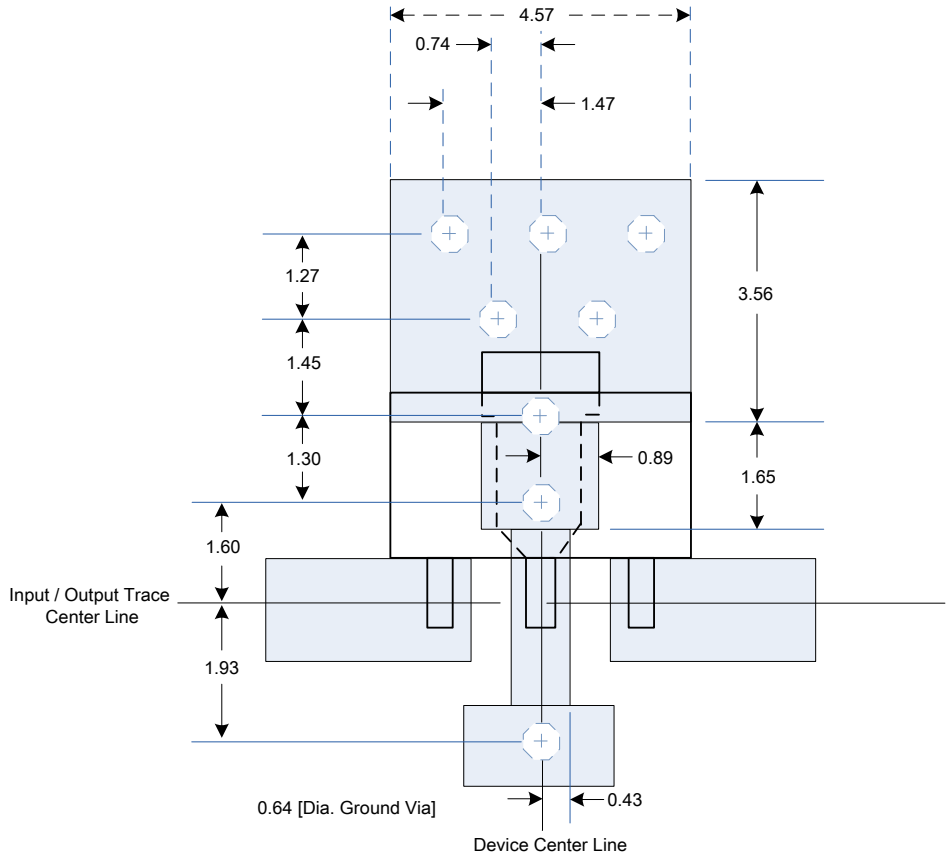
Application Circuit Layout



Note.

1. Package bottom must be connected to RF/DC ground.
2. Provide a large ground pad area under device ground pin.
3. A sufficient number of via holes should be used to connect the top and bottom ground plane.
4. The circuit board used in the application should apply RF circuit design techniques.
5. RF lines should have 50 ohm impedance.
   - ✓ Circuit board material : FR-4
   - ✓ Circuit board height : 0.93mm :

Recommended PCB Land Pattern



Note.

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating
3. Solder the copper pad on the backside of the device package to the ground plane.
4. Provide a large ground pad area under device pins 1,2,3 with many plated via holes as shown.
5. Dimensions not given for 50ohm line.
6. Scale accordingly for different board thickness and dielectric contacts.
7. We recommend 1 or 2ounce copper.

Package Information & Outline Drawing

- **Marking : Manufacture**

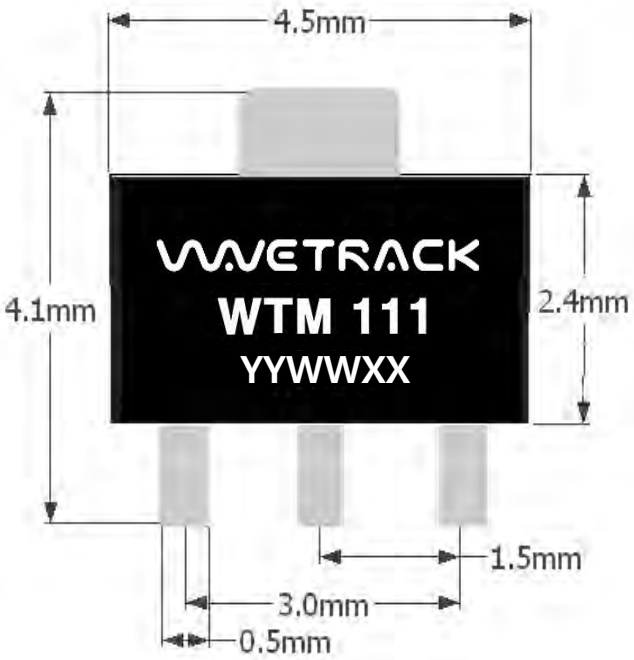
  Part Number – WTMXXX

  Lot code - YYWWXX

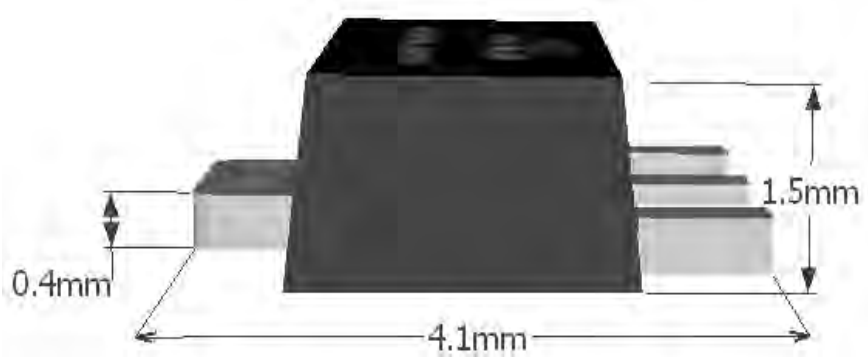
  YY = Year / WW = Working Week / XX = Wafer No.

- **Outline Drawing : Millimeters**

TOP VIEW



SIDE VIEW



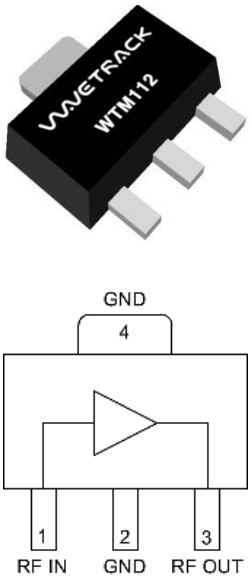
5~1000MHz InGaP/GaAs HBT MMIC Amplifier

General Description

The WTM112 is a general RF gain boosting amplifier MMIC that have high linearity & gain performance. The device features flat high gain with excellent in/out return loss. The amplifier typically provides 26.5dB gain, 39.6dBm OIP3 and 3.9dB Noise Figure while drawing 96mA current at 140MHz. The device is packaged in a lead-free/green/RoHS-compliant industry-standard SOT-89 package.

The WTM112 is designed a Darlington-pair amplifier using high reliability InGap/GaAs HBT process.

Functional Block Diagram



Features

- 5~1000MHz
- P1dB = 20.5 dBm @140MHz
- Gain = 26.5 dB @140MHz
- OIP3 = 39.6 dBm @140MHz
- NF = 3.9 dB @140MHz
- IRL= 18.6dB and ORL=15.4dB
- 50 Ohm Cascadable Gain Block
- Unconditionally Stable
- +5V Single Supply, 96mA Current
- Industry Standard SOT-89 Package

Applications

- Cellular / PCS / 3G / LTE repeaters
- Wireless Data / WLAN
- CATV & Cable Modem
- ISM
- Microwave Radio

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage(V_{CC})	5.5 V
Max Device Current(I_D)	100 mA
Max RF Input Power	20 dBm
Operating Temperature(T_L)	-40 to +85°C
Storage Temperature	-65 to +150°C
ESD Sensitivity (Human Body Model : HBM)	Class 1C
Moisture Sensitivity Level (MSL)	MSL1

Note.

1. Stress under Absolute Maximum Ratings may result in permanent damage to the device.
2. Extended application of Absolute Maximum ratings condition to the device may reduce device reliability.
3. These rating are not intended for continuous normal operation.
   - ✓ HBM : Class 1C in accordance with JEDEC Standard JESD22-A114B
   - ✓ MSL : MSL1 in accordance with JEDEC Standard J-STD-020

ESD CAUTION

	ESD (electrostatic discharge) sensitive device. Although this product features proprietary protection circuitry, damage may occur on devices subjected to high energy ESD.

Typical Performance at Key Operating Frequencies

Vcc = +5V, T_A=25°C, unless otherwise noted. (I_D = 96mA)

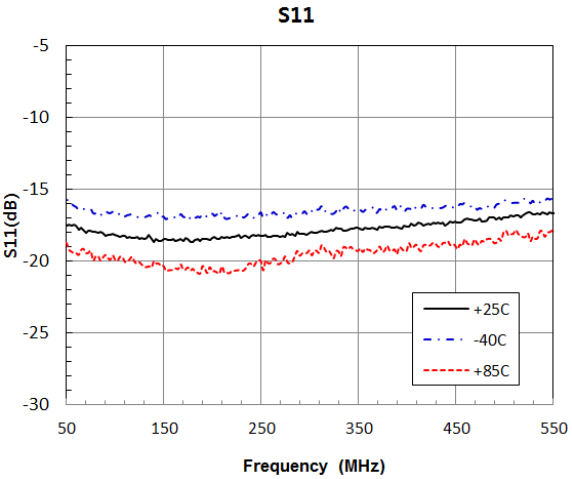
Parameter	80MHz	140MHz	250MHz	500MHz	Unit
S21	26.6	26.5	26.4	26.0	dB
OIP3	39.5	39.6	37.0	36.6	dBm
P1dB	20.4	20.5	20.6	20.5	dBm
S11	-18	-18.6	-18.2	-16.9	dB
S22	-14.6	-15.4	-14.9	-12.3	dB
S12	-30.7	-30.5	-30.8	-30.8	dB
NF	3.5	3.6	3.9	3.7	dB

Note.

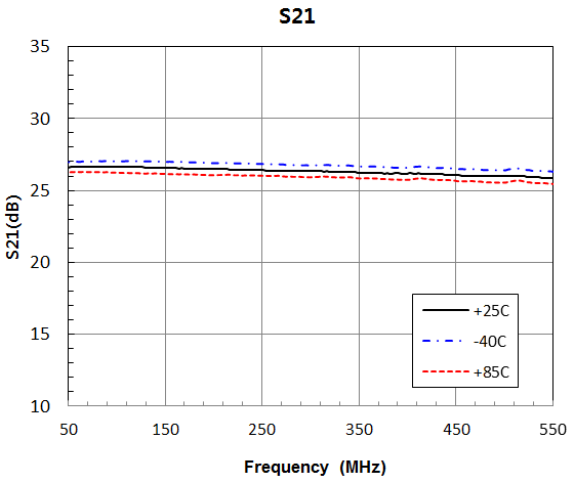
1. Typical RF performance measured on a Wavetrack evaluation board.
2. RF performance data taken with application circuit element values.
3. OIP3 measured with two tones at an output 5dBm per tone separated 1MHz.
4. $Z_S = Z_L = 50$ ohm .

S-Parameter

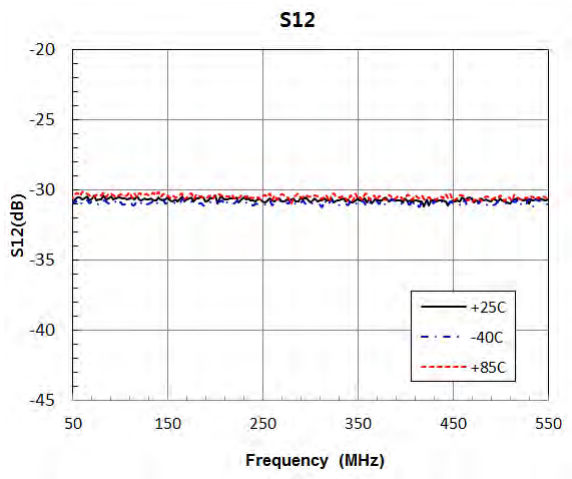
Input Return Loss



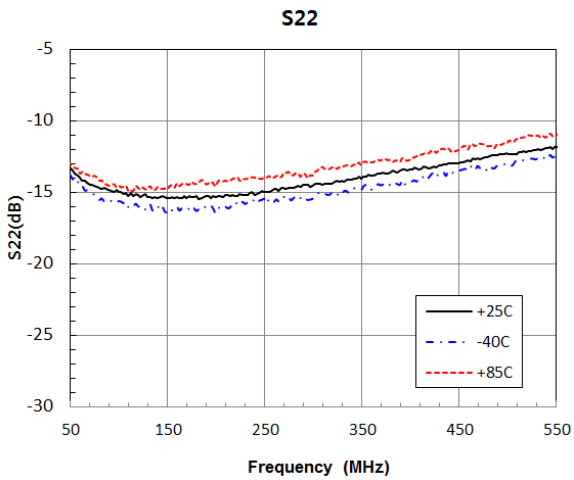
Broadband Gain



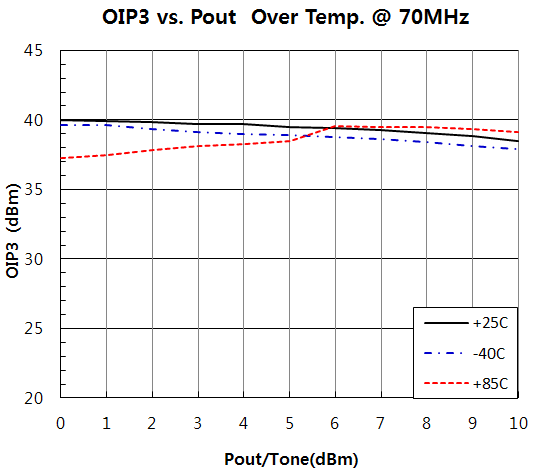
Reverse isolation

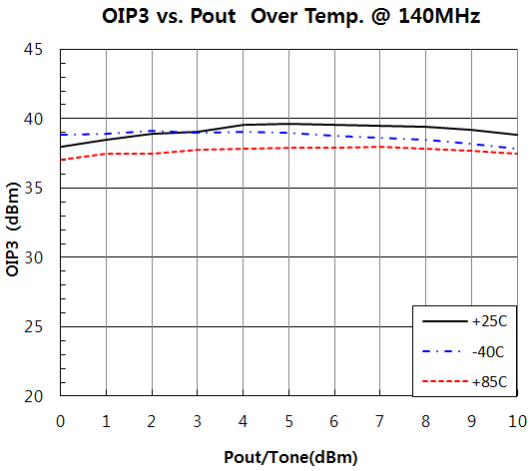


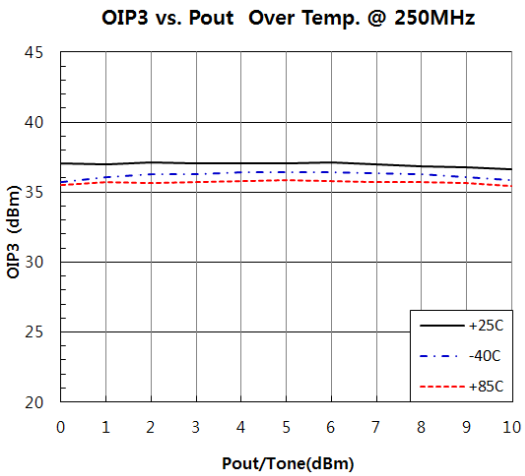
Output Return Loss

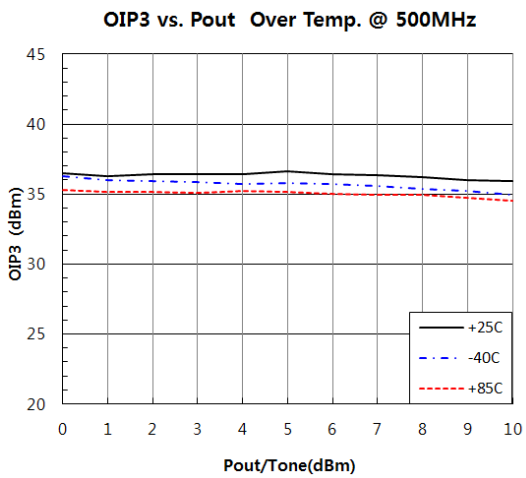


OIP3 vs Pout

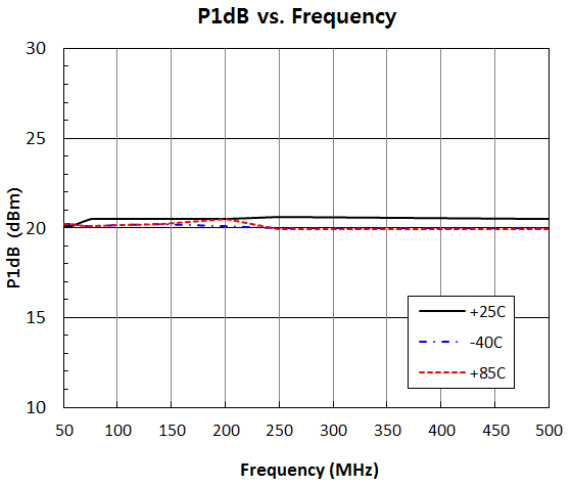


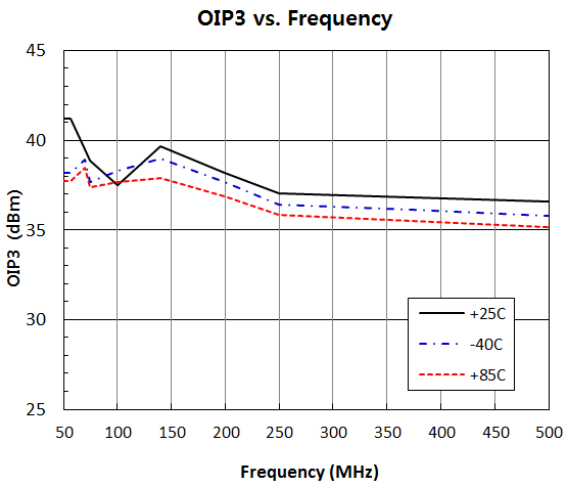






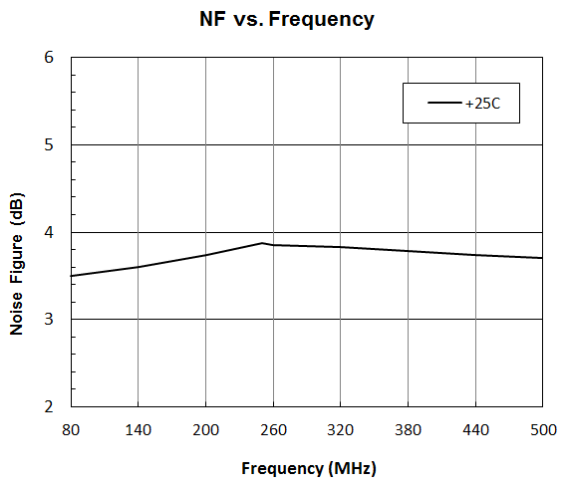
P1-dB & OIP3



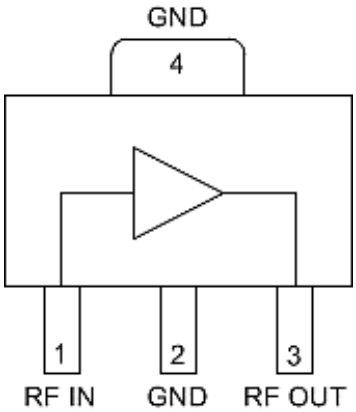


Note. +5dBm / Tone Output Power

Noise Figure

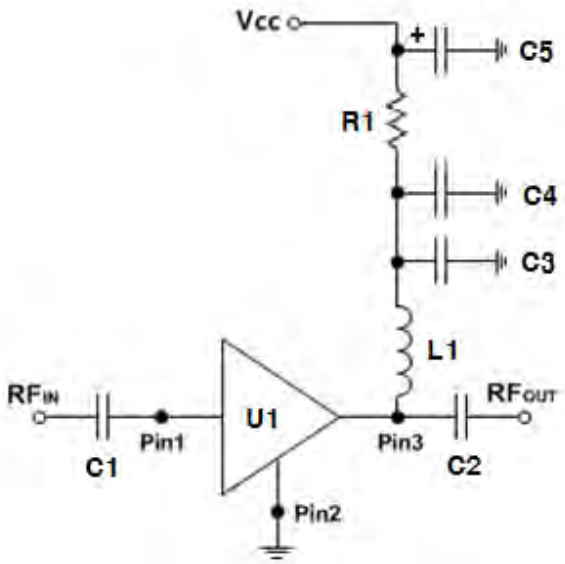


Pin Configuration and Function Descriptions



Pin Number	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor.
2	GND	Connection to ground. Use via holes as close to the device ground leads as possible to reduce ground path inductance.
3	RF OUT	RF output pin. DC voltage is present on this pin. DC blocking capacitor is necessary. An RF choke is needed to feed DC bias.

Application Circuit Schematic



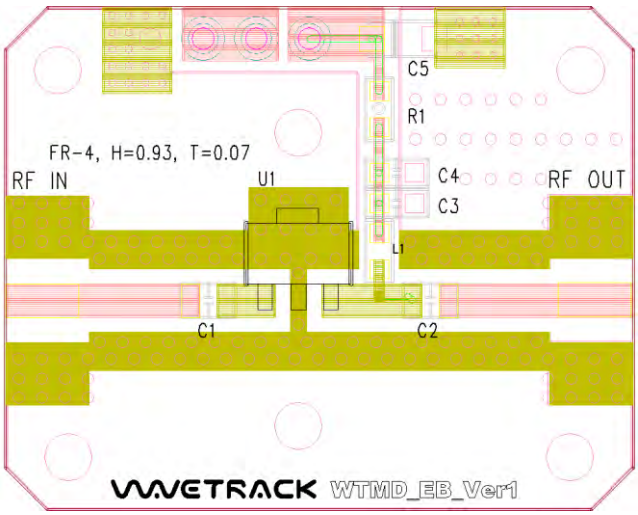
Note.

1. Application circuit schematic shows the basic connection for operating WTM112.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values

Reference	Value	Unit	Description	Manufacture
U1	WTM112	-	RF Gain Block Amplifier	WAVETRACK
C1	6.8	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	6.8	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	1000	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	10	[uF]	Tantalum Capacitor	Samsung
L1	680	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	3.9	[Ω]	Resistor Chip	Samsung

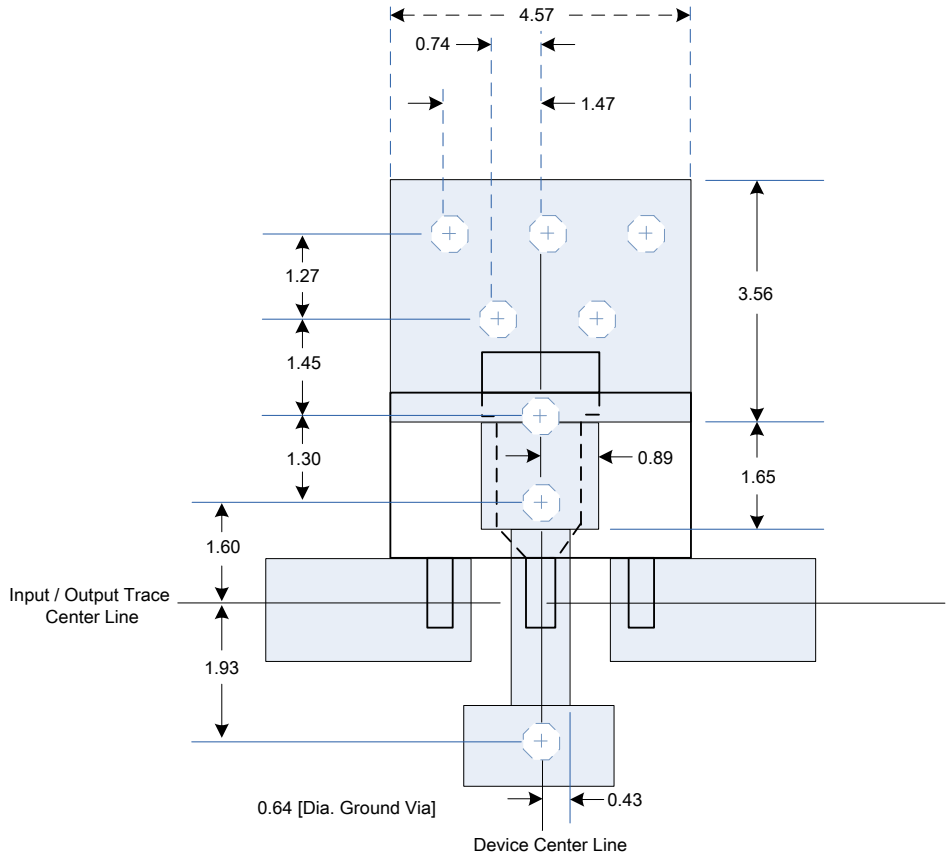
Application Circuit Layout



Note.

1. Package bottom must be connected to RF/DC ground.
2. Provide a large ground pad area under device ground pin.
3. A sufficient number of via holes should be used to connect the top and bottom ground plane.
4. The circuit board used in the application should apply RF circuit design techniques.
5. RF lines should have 50 ohm impedance.
   - ✓ Circuit board material : FR-4
   - ✓ Circuit board height : 0.93mm :

Recommended PCB Land Pattern



Note.

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating
3. Solder the copper pad on the backside of the device package to the ground plane.
4. Provide a large ground pad area under device pins 1,2,3 with many plated via holes as shown.
5. Dimensions not given for 50ohm line.
6. Scale accordingly for different board thickness and dielectric contacts.
7. We recommend 1 or 2ounce copper.

Package Information & Outline Drawing

- **Marking : Manufacture**

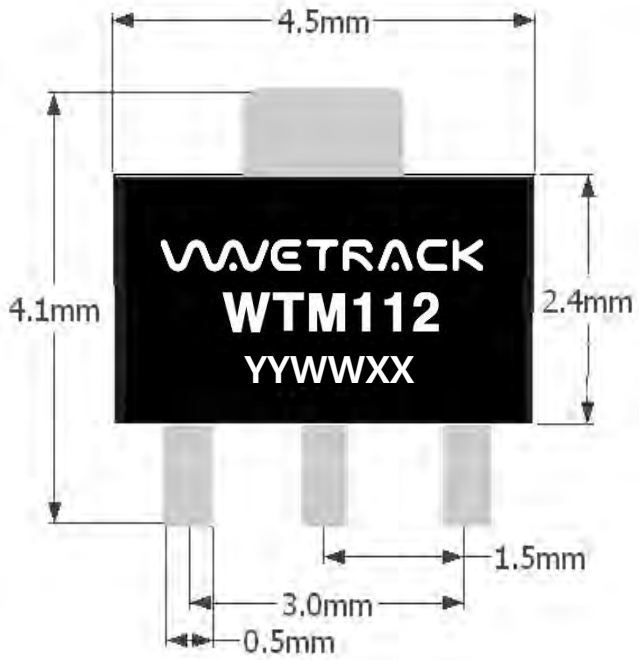
  Part Number – WTMXXX

  Lot code - YYWWXX

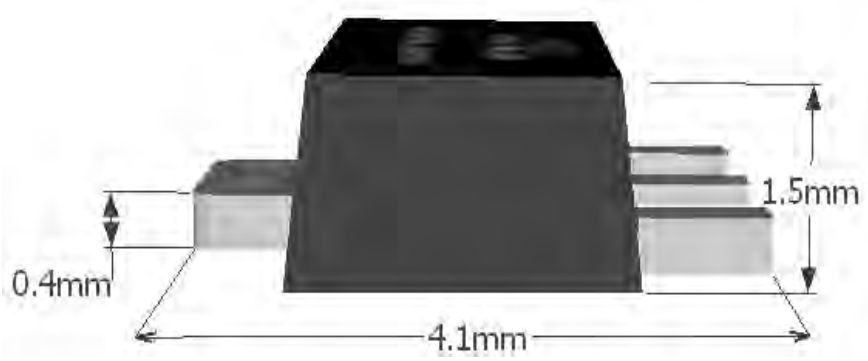
  YY = Year / WW = Working Week / XX = Wafer No.

- **Outline Drawing : Millimeters**

TOP VIEW



SIDE VIEW



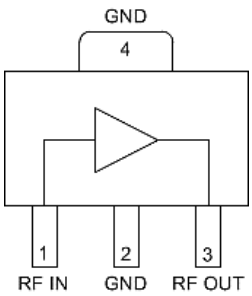
5~1000MHz InGaP/GaAs HBT MMIC Amplifier

General Description

The WTM114 is a general RF gain boosting amplifier MMIC that have high linearity & gain performance. The device features flat high gain with excellent in/out return loss. The amplifier typically provides 17.6dB gain, 41.5dBm OIP3 and 5.4dB Noise Figure while drawing 77mA current at 70MHz. The device is packaged in a lead-free/green/RoHS-compliant industry-standard SOT-89 package.

The WTM114 is designed a Darlington-pair amplifier using high reliability InGap/GaAs HBT process.

Functional Block Diagram



Features

- 5~1000MHz
- P1dB = 23.1 dBm @70MHz
- Gain = 17.6 dB @70MHz
- OIP3 = 41.5 dBm @70MHz
- NF = 5.4 dB @70MHz
- IRL= 15.8dB and ORL=18.7dB
- 50 Ohm Cascadable Gain Block
- Unconditionally Stable
- +5V Single Supply, 77mA Current
- Industry Standard SOT-89 Package

Applications

- Cellular / PCS / 3G / LTE repeaters
- Wireless Data / WLAN
- CATV & Cable Modem
- ISM
- Microwave Radio

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage(V_{CC})	5.5 V
Max Device Current(I_D)	100 mA
Max RF Input Power	20 dBm
Operating Temperature(T_L)	-40 to +85°C
Storage Temperature	-65 to +150°C
ESD Sensitivity (Human Body Model : HBM)	Class 1C
Moisture Sensitivity Level (MSL)	MSL1

Note.

1. Stress under Absolute Maximum Ratings may result in permanent damage to the device.
2. Extended application of Absolute Maximum ratings condition to the device may reduce device reliability.
3. These rating are not intended for continuous normal operation.
   - ✓ HBM : Class 1C in accordance with JEDEC Standard JESD22-A114B
   - ✓ MSL : MSL1 in accordance with JEDEC Standard J-STD-020

ESD CAUTION

	ESD (electrostatic discharge) sensitive device. Although this product features proprietary protection circuitry, damage may occur on devices subjected to high energy ESD.

Typical Performance at Key Operating Frequencies

Vcc = +5V, T_A=25°C, unless otherwise noted. (I_D = 77mA)

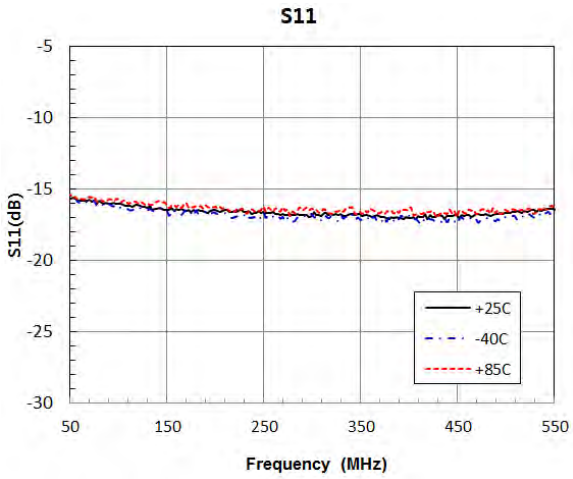
Parameter	70MHz	140MHz	250MHz	500MHz	Unit
S21	17.6	17.5	17.4	17.0	dB
OIP3	41.5	37.4	38.2	36.3	dBm
P1dB	23.1	23.2	23.4	22.9	dBm
S11	-15.8	-16.4	-16.6	-16.7	dB
S22	-18.7	-18.9	-18.7	-17.4	dB
S12	-22.8	-22.8	-23.0	-23.5	dB
NF	5.4	5.5	5.6	5.8	dB

Note.

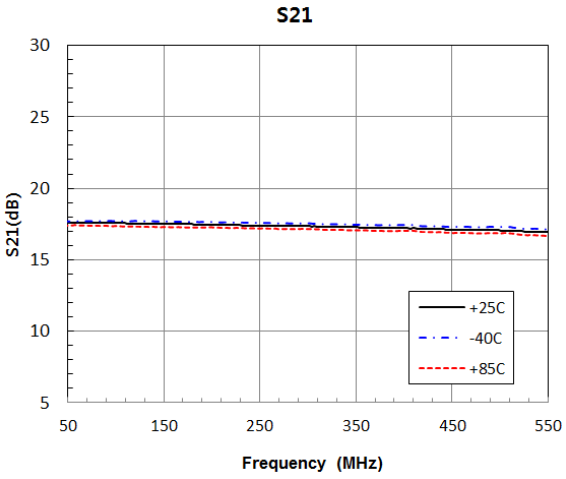
1. Typical RF performance measured on a Wavetrack evaluation board.
2. RF performance data taken with application circuit element values.
3. OIP3 measured with two tones at an output 5dBm per tone separated 1MHz.
4. Z_S = Z_L = 50 ohm .

S-Parameter

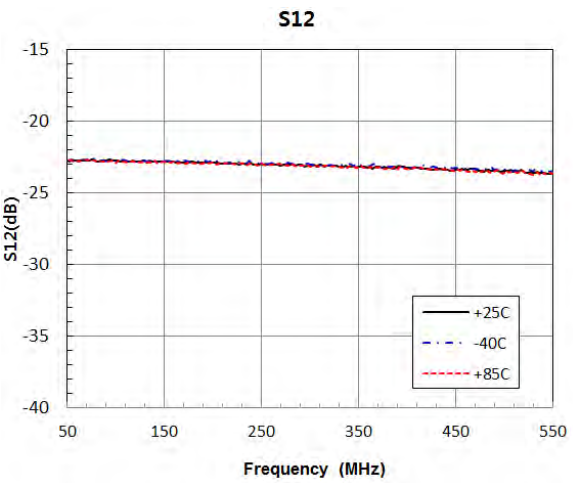
Input Return Loss



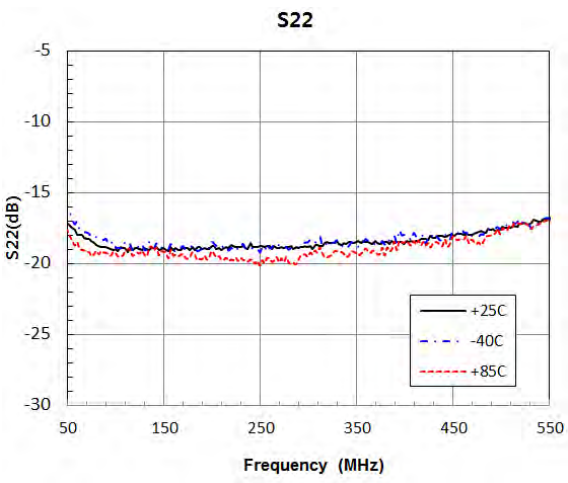
Broadband Gain



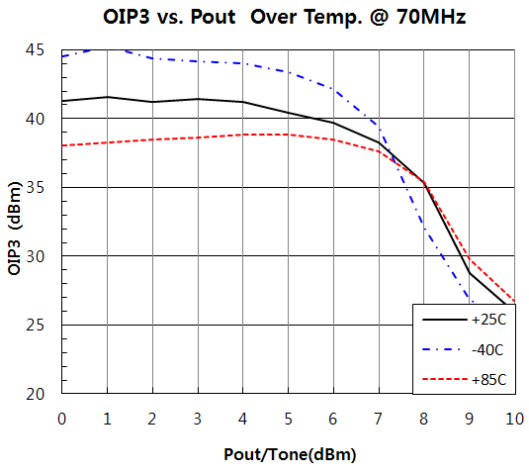
Reverse isolation

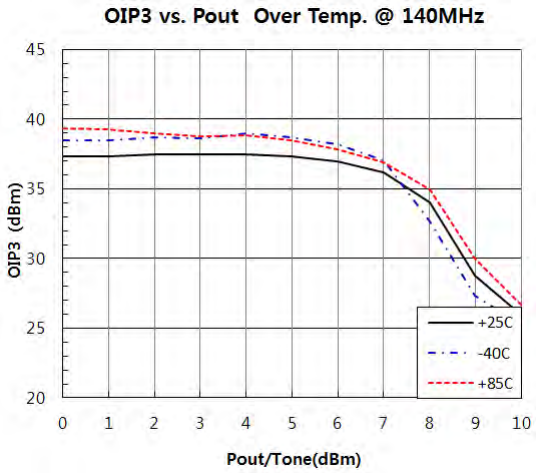


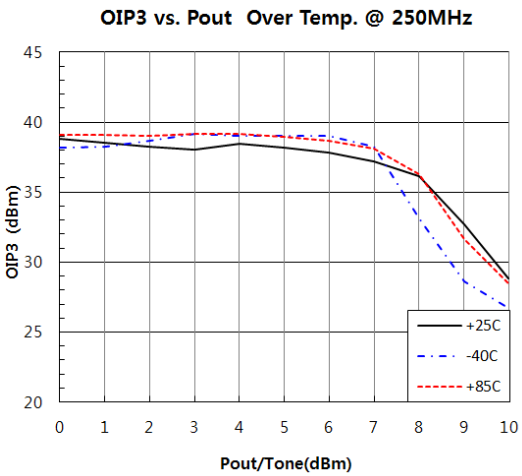
Output Return Loss

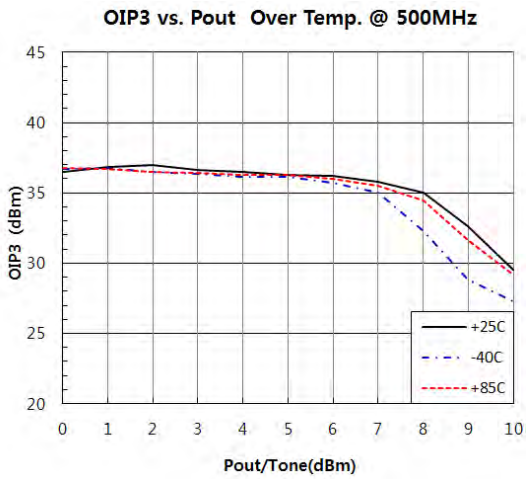


OIP3 vs Pout

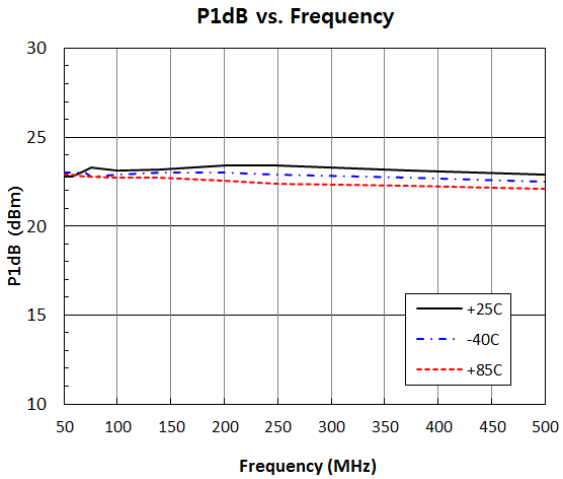


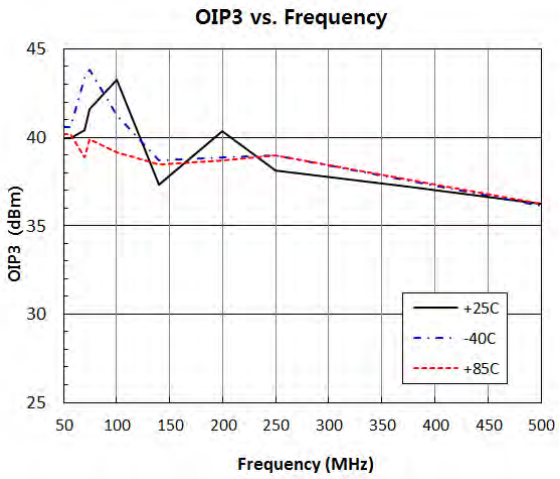






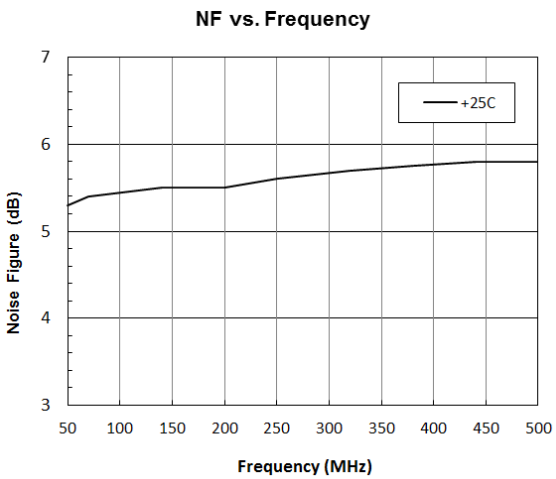
P1-dB & OIP3



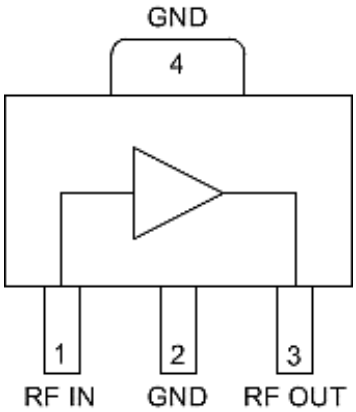


Note. +5dBm / Tone Output Power

Noise Figure

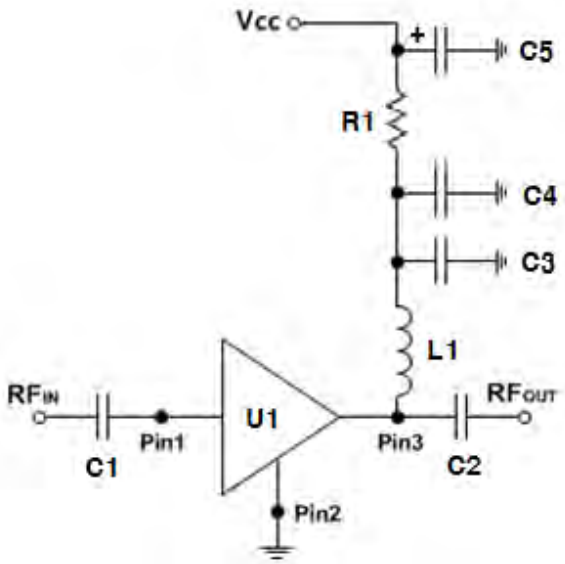


Pin Configuration and Function Descriptions



Pin Number	Function	Description
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor.
2	GND	Connection to ground. Use via holes as close to the device ground leads as possible to reduce ground path inductance.
3	RF OUT	RF output pin. DC voltage is present on this pin. DC blocking capacitor is necessary. An RF choke is needed to feed DC bias.

Application Circuit Schematic



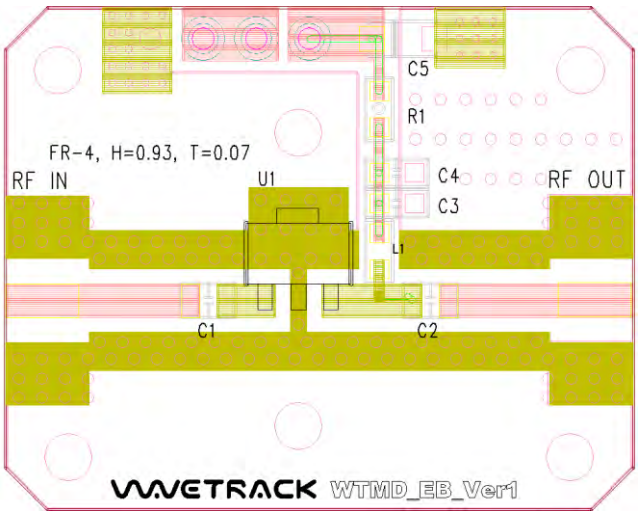
Note.

1. Application circuit schematic shows the basic connection for operating WTM114.
2. A 5V dc bias is supplied to the amplifier through the bias inductor(L1) connected to RF out (Pin3).
3. However, for optimum performance at customer board, the value of L1 may vary with board design.
4. To get RF performance at under 100MHz, the bias inductor (L1) must be optimized.

Application Circuit Element Values

Reference	Value	Unit	Description	Manufacture
U1	WTM114	-	RF Gain Block Amplifier	WAVETRACK
C1	6.8	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C2	6.8	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C3	100	[pF]	Cap. Chip 0402, 5%, 10V	Samsung
C4	1000	[nF]	Cap. Chip 0402, 5%, 10V	Samsung
C5	10	[uF]	Tantalum Capacitor	Samsung
L1	680	[nH]	Inductor. 0402, 5%, Ceramic	Samsung
R1	5.1	[Ω]	Resistor Chip	Samsung

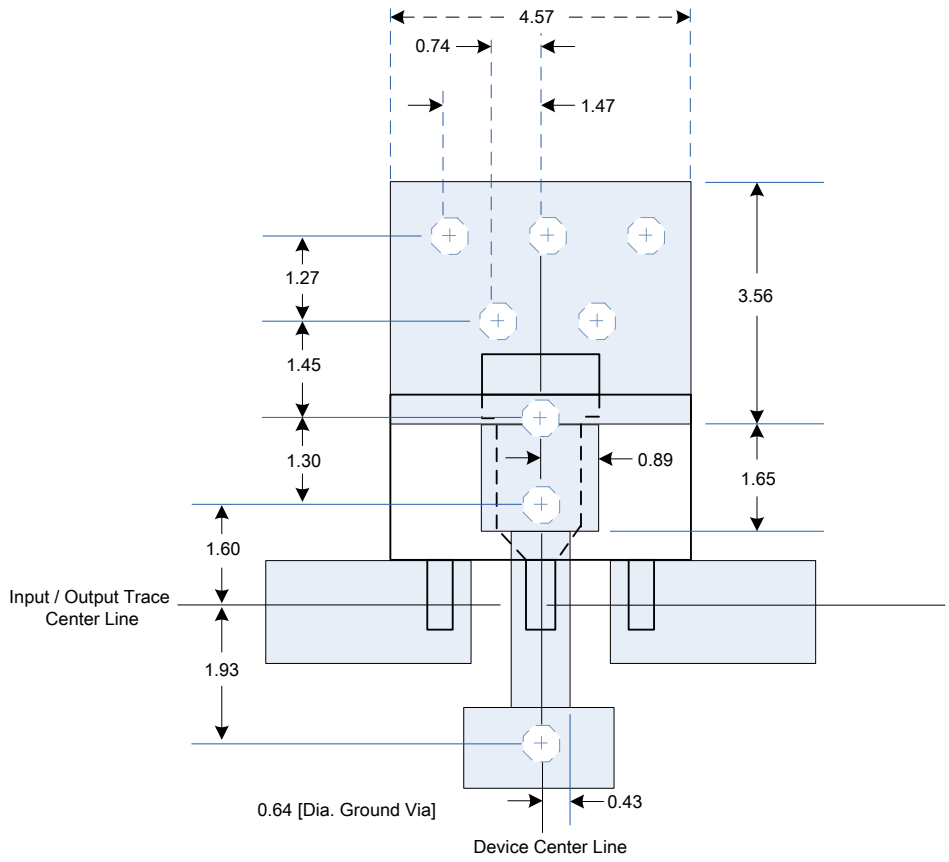
Application Circuit Layout



Note.

1. Package bottom must be connected to RF/DC ground.
2. Provide a large ground pad area under device ground pin.
3. A sufficient number of via holes should be used to connect the top and bottom ground plane.
4. The circuit board used in the application should apply RF circuit design techniques.
5. RF lines should have 50 ohm impedance.
   - ✓ Circuit board material : FR-4
   - ✓ Circuit board height : 0.93mm :

Recommended PCB Land Pattern



Note.

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating
3. Solder the copper pad on the backside of the device package to the ground plane.
4. Provide a large ground pad area under device pins 1,2,3 with many plated via holes as shown.
5. Dimensions not given for 50ohm line.
6. Scale accordingly for different board thickness and dielectric contacts.
7. We recommend 1 or 2ounce copper.

Package Information & Outline Drawing

- **Marking : Manufacture**

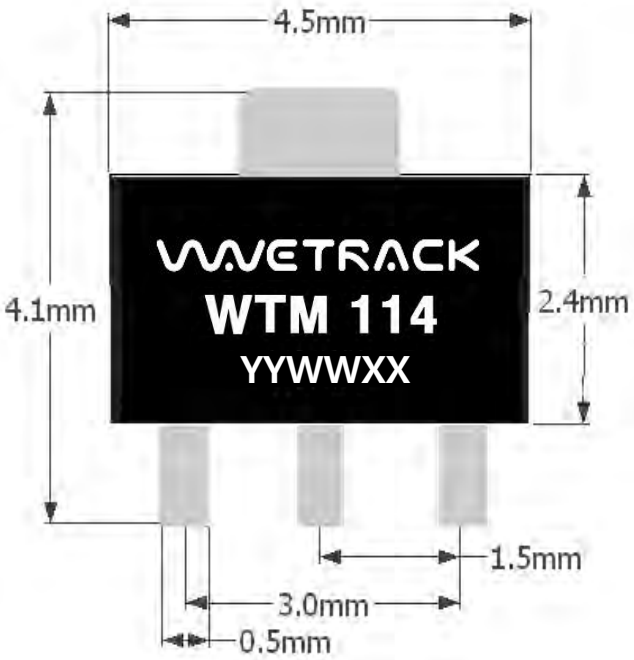
  Part Number – WTMXXX

  Lot code - YYWWXX

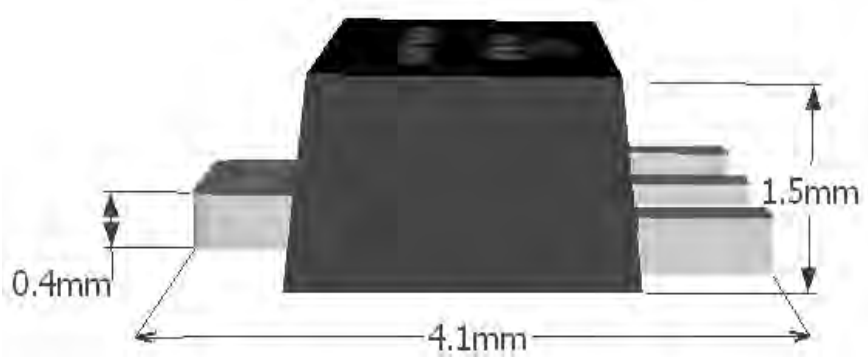
  YY = Year / WW = Working Week / XX = Wafer No.

- **Outline Drawing : Millimeters**

TOP VIEW



SIDE VIEW



WTM401

High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 700~1400MHz

General Description

The WTM401 is a high linearity and dynamic range passive mixer with an integrated LO driver amplifier in an ultra-small lead-free/green/RoHS-compliant MSOP-8 package. The Mixer MMIC is able to operate across from 700MHz to 1500MHz frequency range to achieve +31dBm Input IP3 while drawing a very low 42mA on 5V and 23mA on 3.3V.

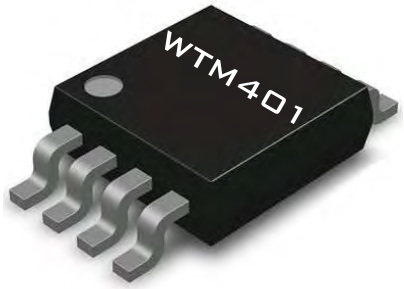
The WTM401 is designed a full-matched 50ohm MMIC mixer using high reliability GaAs FET process.

Features

- +33.1dBm Input IP3
- 10.2 dB Conversion Loss
- RF range: 700~1400 MHz
- LO range: 600~1600 MHz
- IF range: 50~300 MHz
- 38mA @+5V Supply/24mA @ +3.3V Supply
- 0 dBm LO drive level
- No External choke inductor
- Very High LO to RF isolation

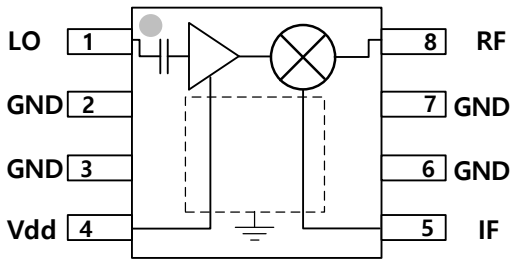
Applications

- Cellular / PCS / 3G / LTE repeaters
- Wireless Data / WLAN
- CATV & Cable Modem
- ISM band application
- Microwave Radio



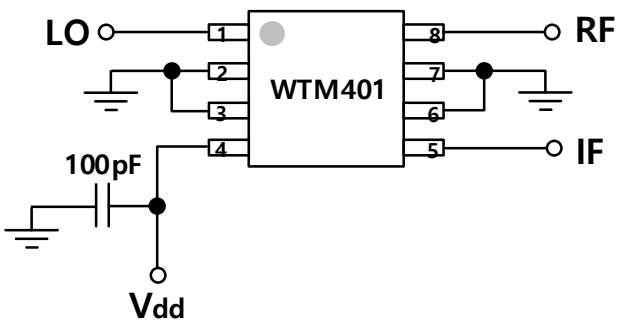
MSOP-8 Exposed Pad Package

Functional Block Diagram



Preliminary

Typical Application Configuration



High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 700~1400MHz

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage(V_D)	5.5 V
Max Device Current(I_D)	70 mA
Max IF/RF Input Power	25 dBm
Max LO Drive Input Power	10 dBm
Operating Temperature(T_L)	-40 to +105°C
Storage Temperature	-65 to +150°C
ESD Sensitivity(HMB)	Class 1A
Moisture Sensitivity Level	MSL2

Preliminary

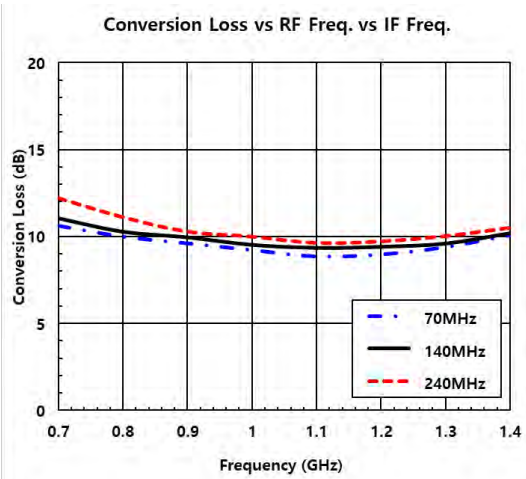
Typical Performance

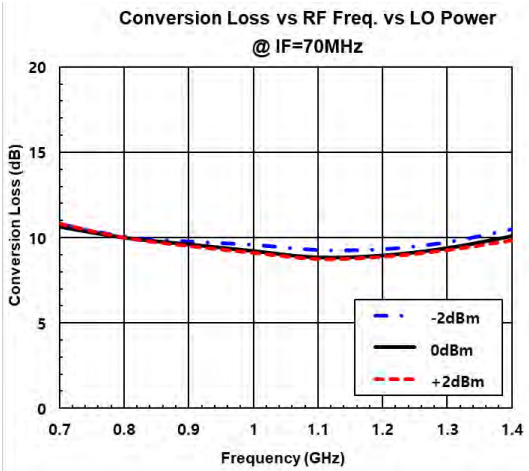
Parameter	3.3V			5.0V			Units
Frequency range RF	**0.8**	**1.0**	**1.3**	**0.8**	**1.0**	**1.3**	**GHz**
Frequency range LO	**0.56 ~0.94**	**0.76~ 1.14**	**1.06~ 1.44**	**0.56 ~0.94**	**0.76~ 1.14**	**1.06~ 1.44**	**GHz**
Frequency range IF	**50 ~ 300**			**50 ~ 300**			**MHz**
Conversion Loss	**9.9**	**9.2**	**8.9**	**10.0**	**9.2**	**9.3**	**dB**
LO to RF Isolation	**18.1**	**15.4**	**13.1**	**15.5**	**14.0**	**11.3**	**dB**
LO to IF Isolation	**26.8**	**24.1**	**22.6**	**22.4**	**21.1**	**20.2**	**dB**
RF to IF Isolation	**21.7**	**28.7**	**37.0**	**21.5**	**27.1**	**35.7**	**dB**
Input IP3	**33.1**	**26.0**	**28.9**	**28.6**	**24.7**	**29.2**	**dBm**
Input P1dB	**19**	**19**	**19**	**21**	**22**	**22**	**dBm**
Supply current	**24.0**	**22.6**	**22.9**	**38.3**	**37.6**	**38.0**	**mA**

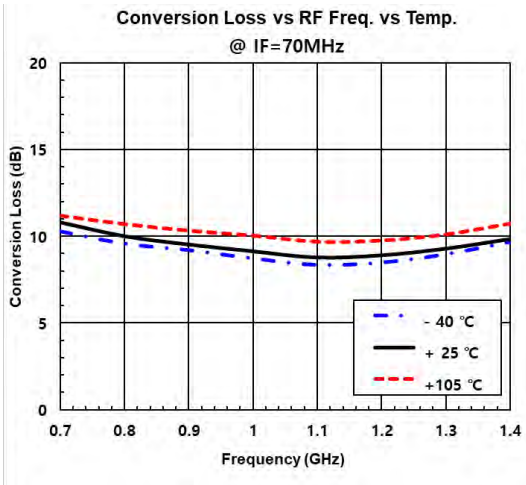
Input IP_3 Test Condition : Tone Spacing=1MHz, RF Input power = 0 dBm/tone, LO driver = 0dBm, T_L=25°C, Z_S=Z_L=50, IF Freq.=70MHz, Converting with low-side LO Freq.

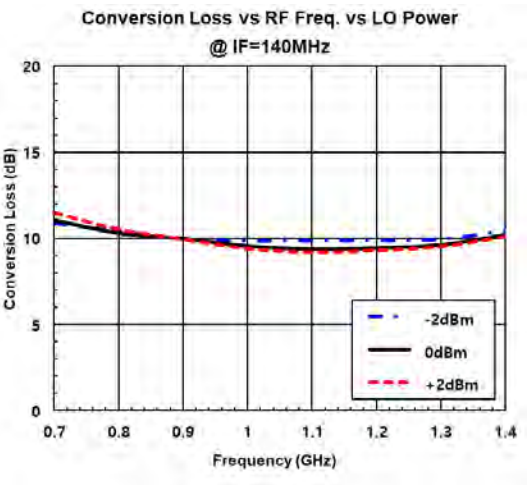
High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 700~1400MHz

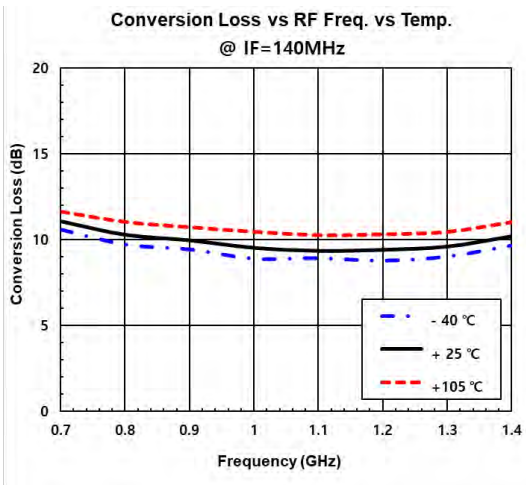
Down conversion Performance @Vdd=3.3V Supply

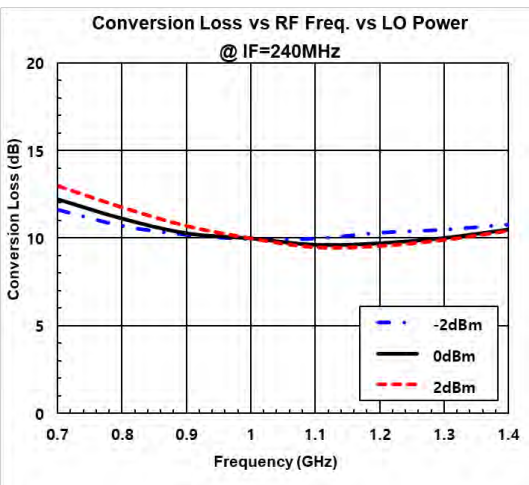








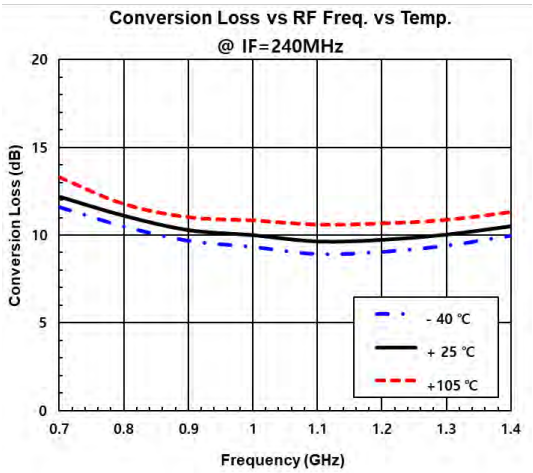


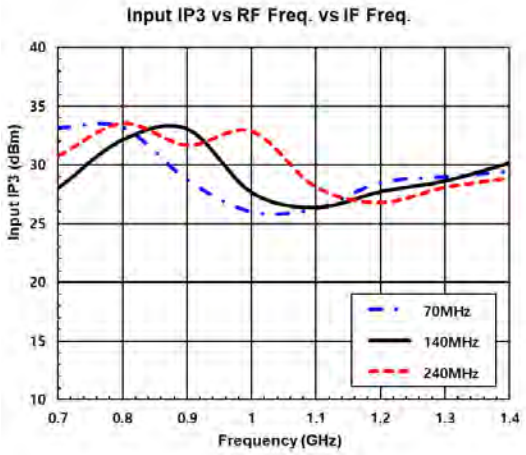


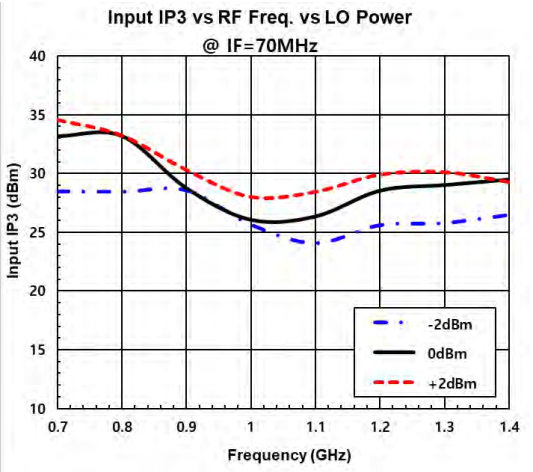
Preliminary

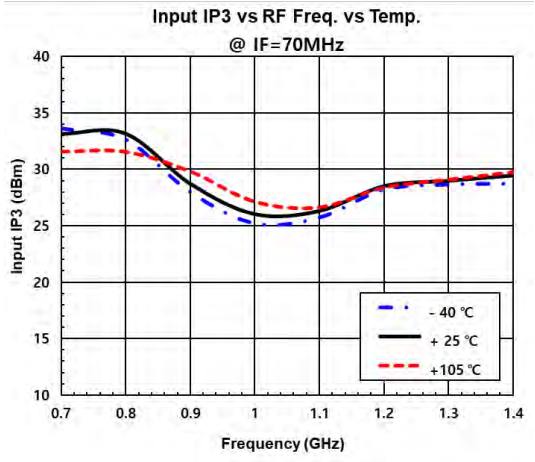
High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 700~1400MHz

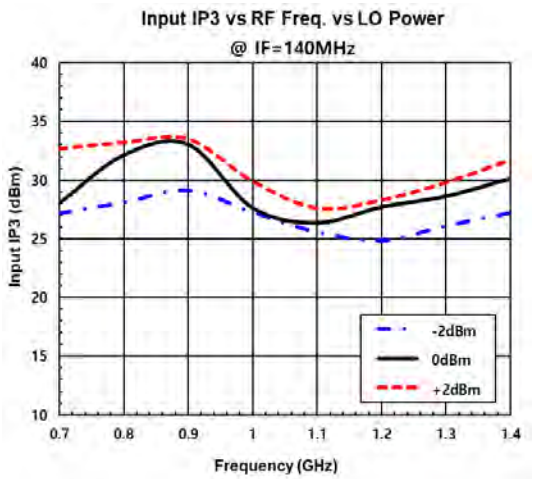
Down conversion Performance @Vdd=3.3V Supply

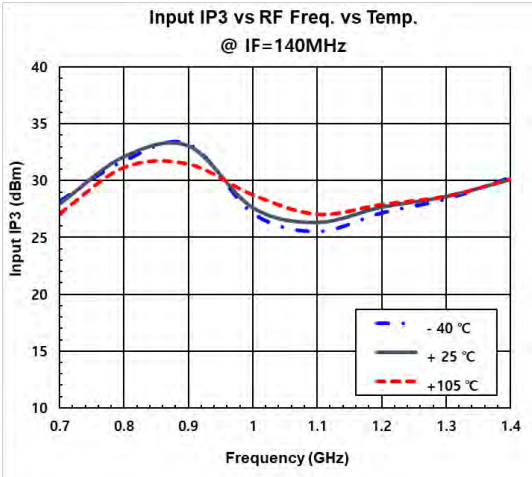








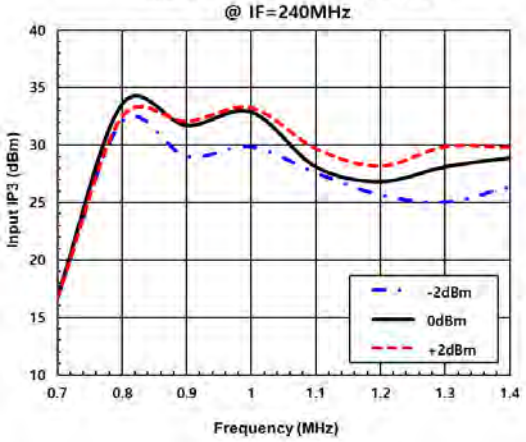




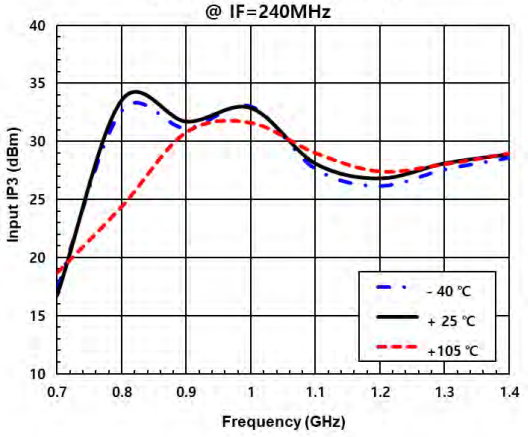
High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 700~1400MHz

Down conversion Performance @Vdd=3.3V Supply

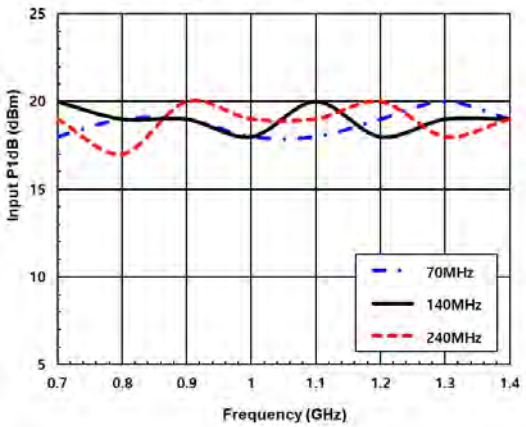
Input IP3 vs RF Freq. vs LO Power
@ IF=240MHz



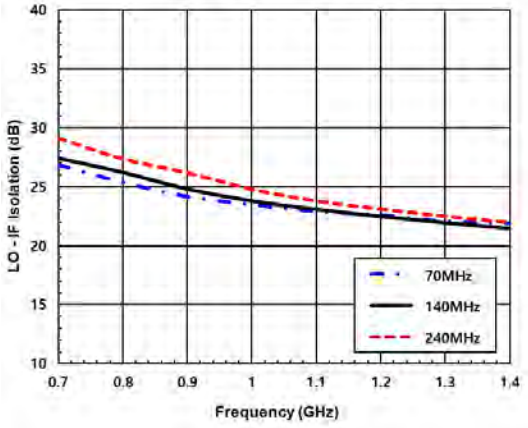
Input IP3 vs RF Freq. vs Temp.
@ IF=240MHz



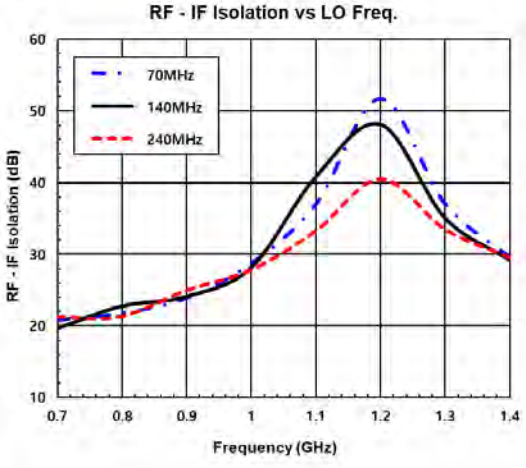
Input P1dB vs RF Freq.



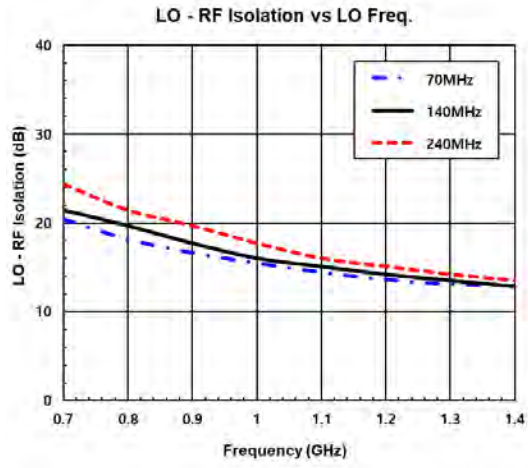
LO - IF Isolation vs LO Freq.



RF - IF Isolation vs LO Freq.



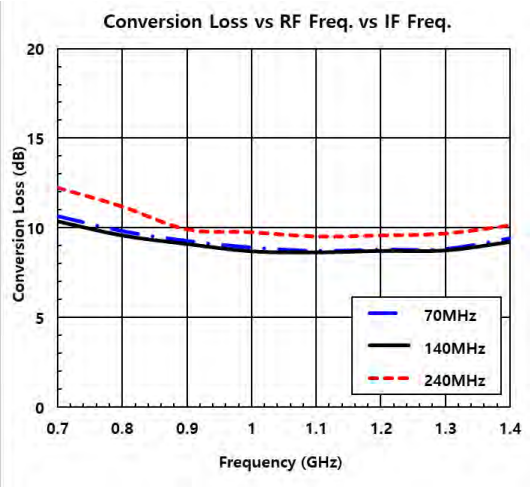
LO - RF Isolation vs LO Freq.

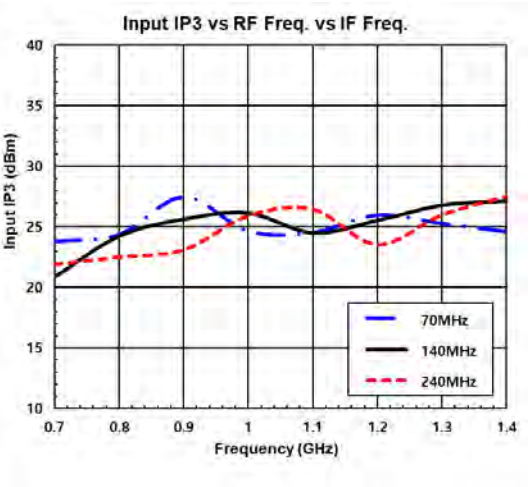


Preliminary

High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 700~1400MHz

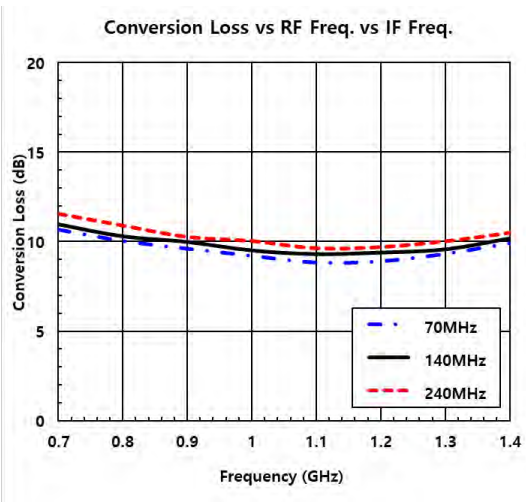
Up conversion Performance @Vdd=3.3V Supply

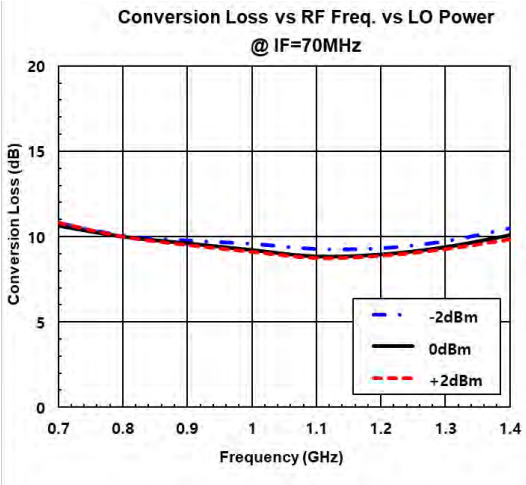


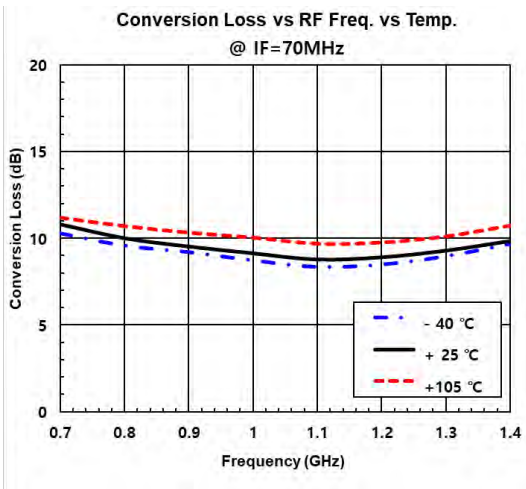


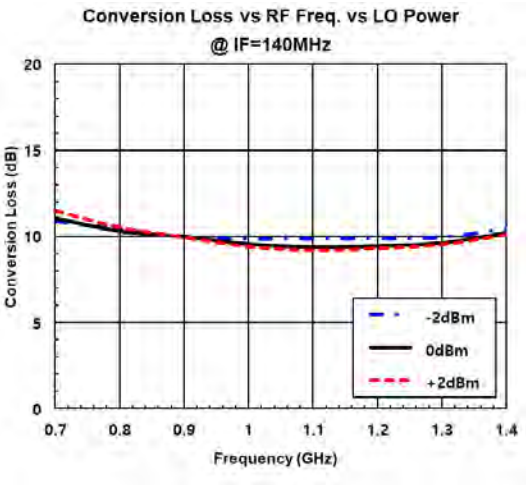
High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 700~1400MHz

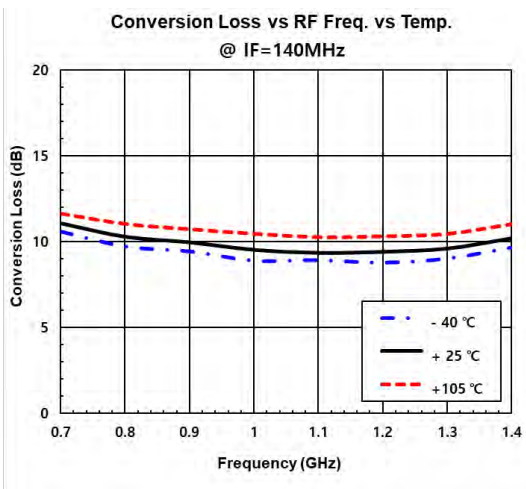
Down conversion Performance @Vdd=5V Supply

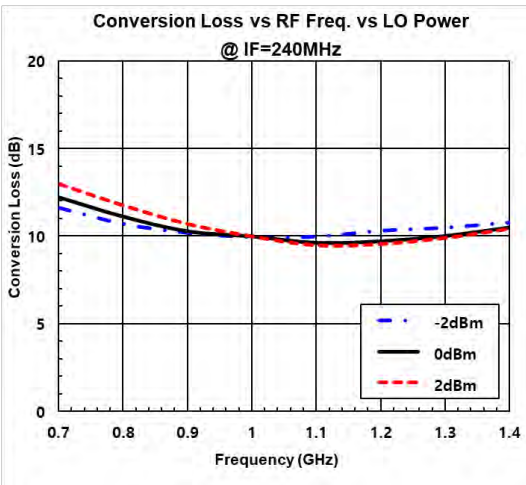








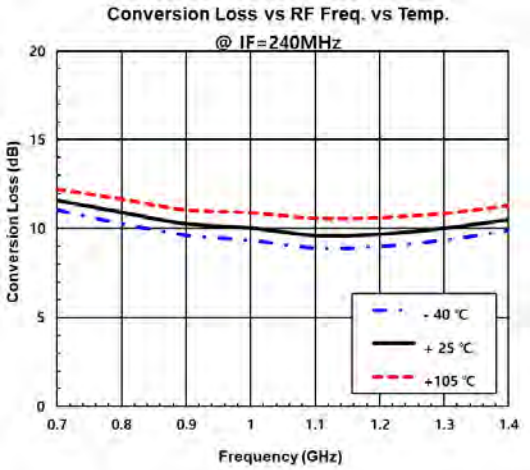


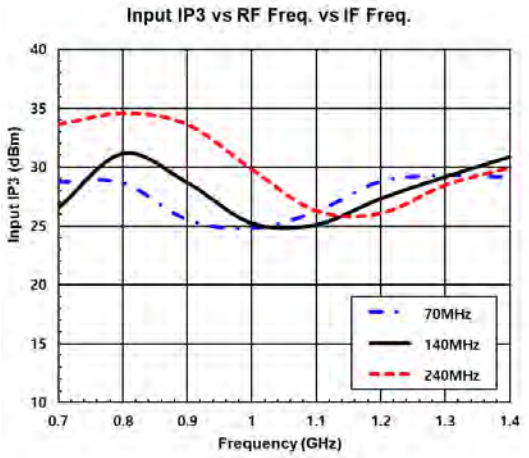


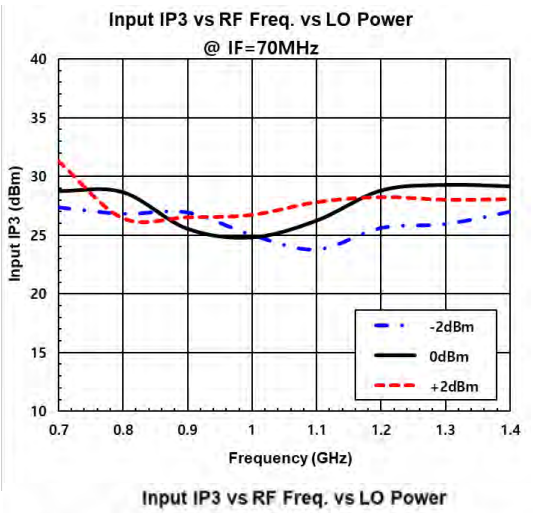
Preliminary

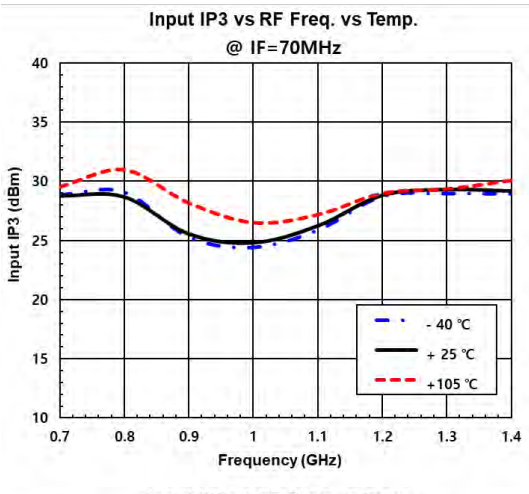
High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 700~1400MHz

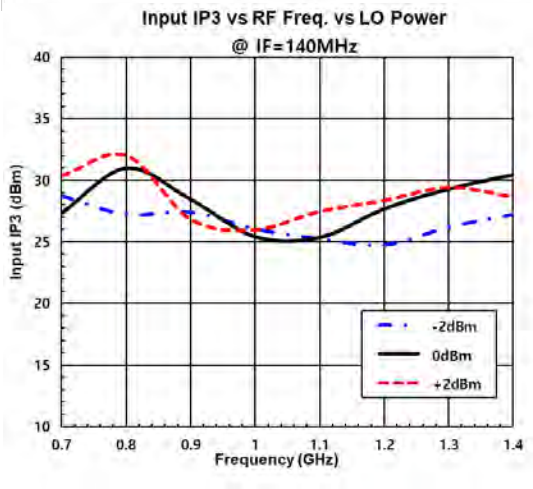
Down conversion Performance @Vdd=5V Supply

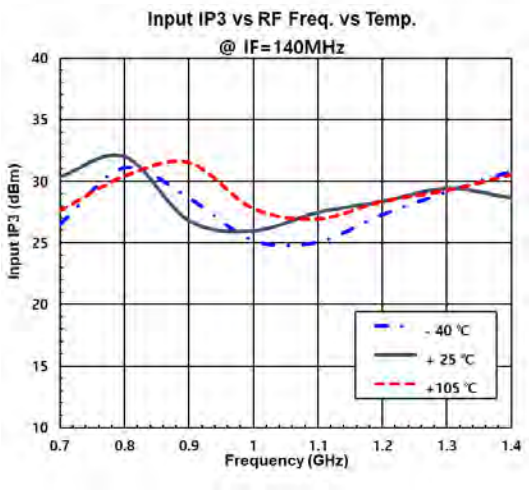






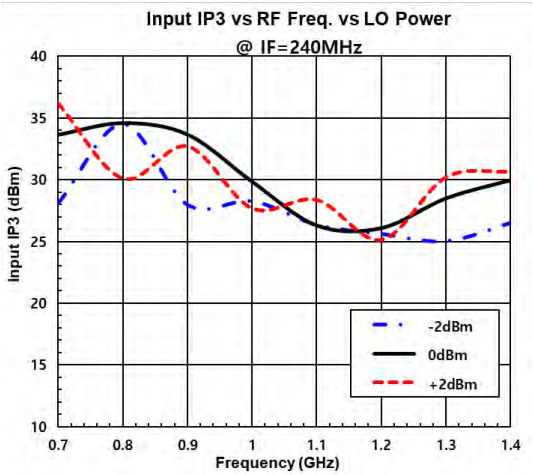


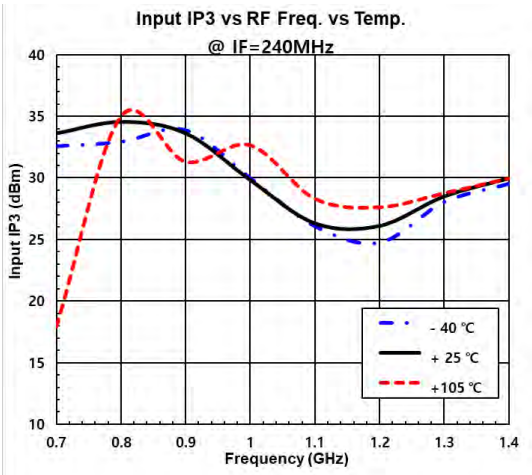


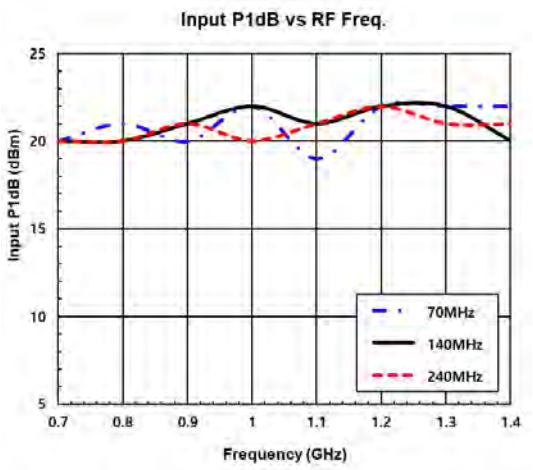


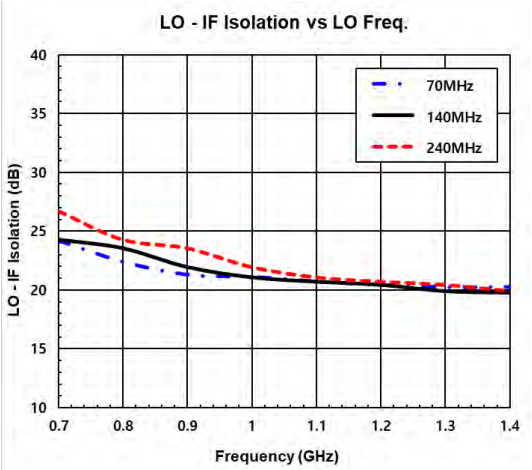
High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 700~1400MHz

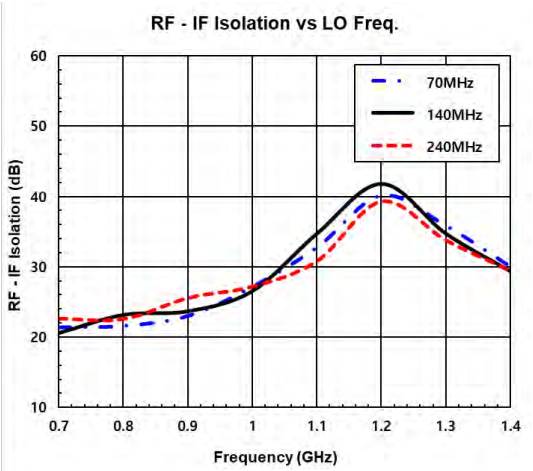
Down conversion Performance @Vdd=5V Supply

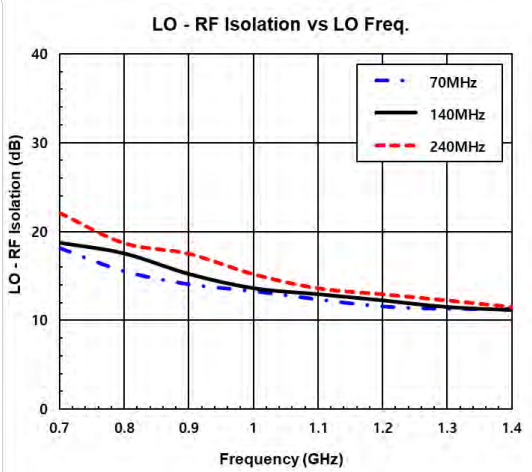






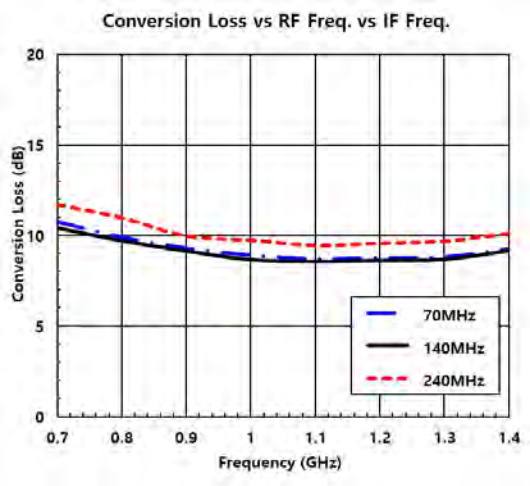


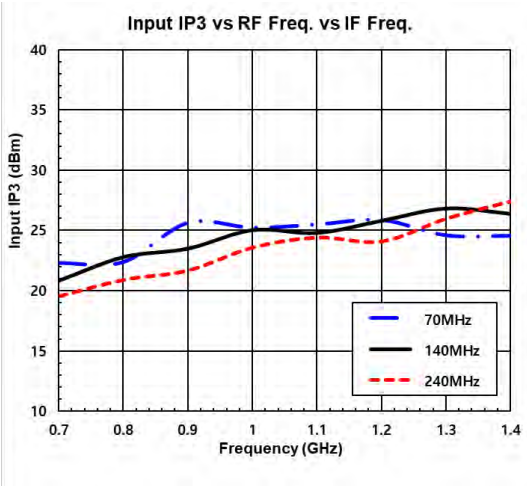




High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 700~1400MHz

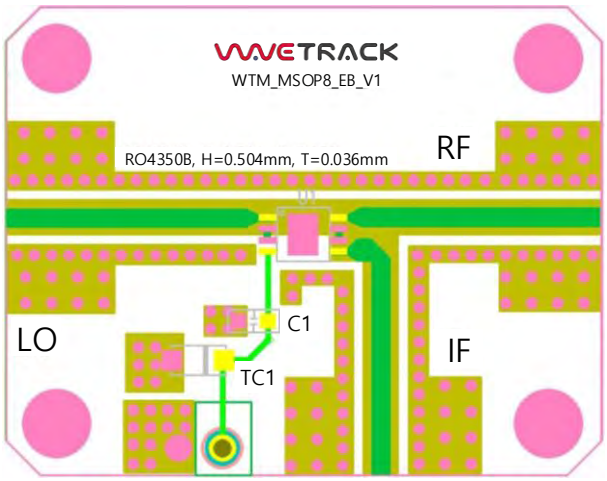
Up conversion Performance @Vdd=5V Supply



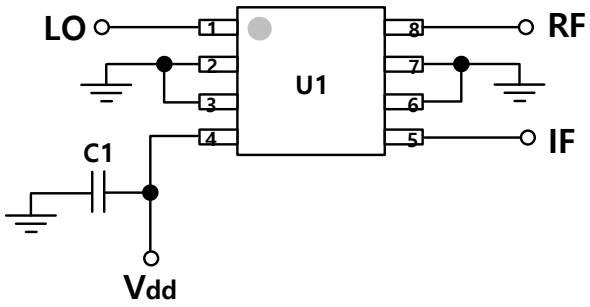


High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 700~1400MHz

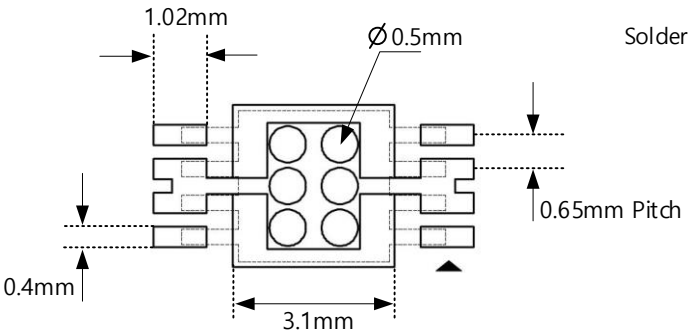
PCB layout and Reference design

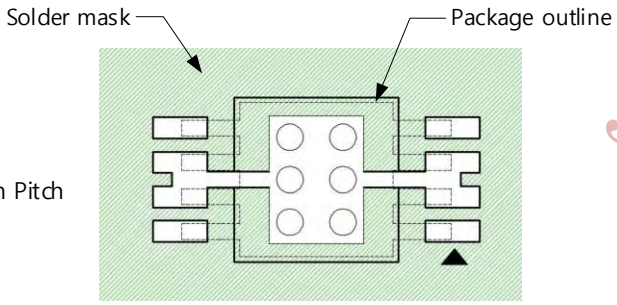


Eval. PCB layout
(Rogers RO4350B, H=0.504mm, T=1/2 oz)



Reference Design





Mounting Configuration

Bill of Material

Reference	Value	Description	Manufacture
U1	WTM401	RF Mixer MMIC	WAVETRACK
C1	100 [pF]	Cap. Chip 0402, 5%, 10V	Samsung
TC1	10[uF]	Tantalum Capacitor	Samsung

High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 700~1400MHz

Package Dimension & Marking

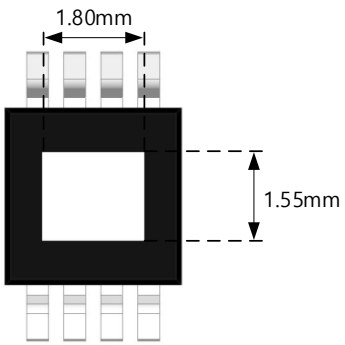
- **Marking : Manufacture**

  Part Number – W401S3

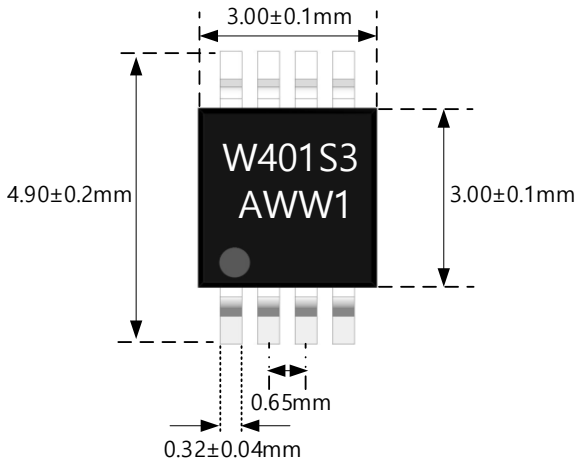
  Lot code – AWW1

  A = Year / WW = Working Week / 1 = Wafer No.

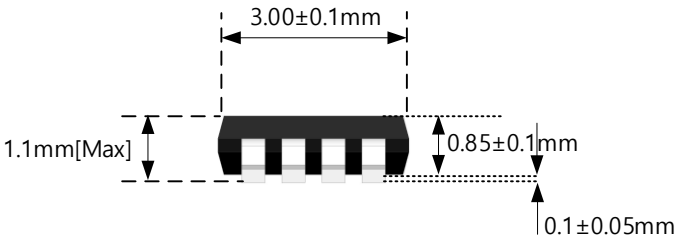
- **Dimension : Millimeters**

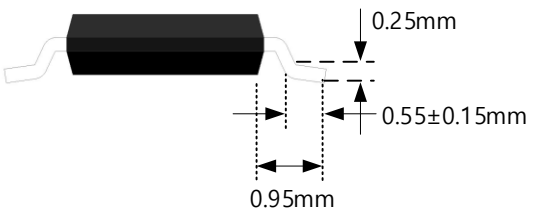


Bottom Exposed pad Dimension



Top Dimension





Side Dimension

High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 1700~2700MHz

General Description

The WTM402 is a high linearity and dynamic range passive mixer with an integrated LO driver amplifier in an ultra-small lead-free/green/RoHS-compliant MSOP-8 package. The Mixer MMIC is able to operate across from 1700MHz to 2700MHz frequency range to achieve +29.7dBm Input IP3 while drawing a very low 35mA on 5V and 23mA on 3.3V.

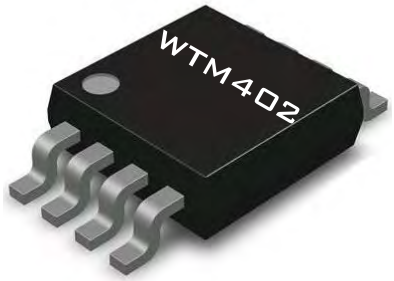
The WTM402 is designed a full-matched 50ohm MMIC mixer using high reliability GaAs FET process.

Features

- +29.7dBm Input IP3
- 9.6 dB Conversion Loss
- RF range: 1700~2700 MHz
- LO range: 1560~2840 MHz
- IF range: 50~300 MHz
- 35mA @+5V Supply/23mA @ +3.3V Supply
- 0 dBm LO drive level
- No External choke inductor

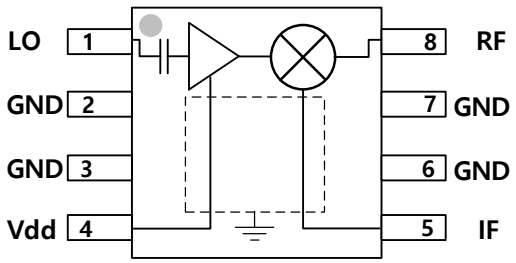
Applications

- Cellular / PCS / 3G / LTE repeaters
- Wireless Data / WLAN
- CATV & Cable Modem
- ISM band application
- Microwave Radio



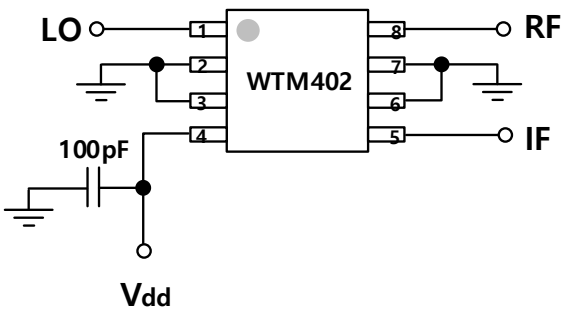
MSOP-8 Exposed Pad Package

Functional Block Diagram



Preliminary

Typical Application Configuration



High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 1700~2700MHz

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage(V_D)	6.0 V
Max Device Current(I_D)	60 mA
Max IF/RF Input Power	25 dBm
Max LO Drive Input Power	10 dBm
Operating Temperature(T_L)	-40 to +105°C
Storage Temperature	-65 to +150°C
ESD Sensitivity(HMB)	Class 1B
Moisture Sensitivity Level	MSL2

Typical Performance

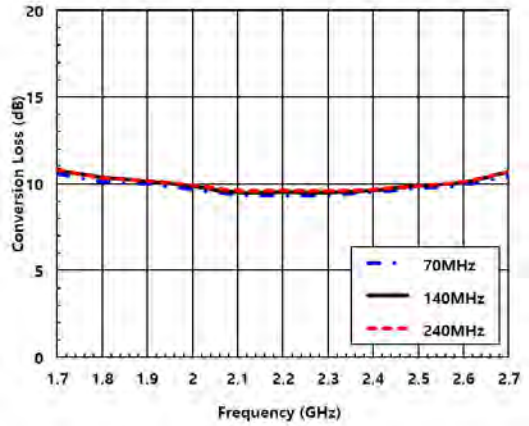
Parameter	3.3V			5.0V			Units
Frequency range RF	**1.8**	**2.1**	**2.6**	**1.8**	**2.1**	**2.6**	**GHz**
Frequency range LO	**1.56 ~1.94**	**1.86~ 2.24**	**2.36~ 2.74**	**1.56 ~1.94**	**1.86~ 2.24**	**2.36~ 2.74**	**GHz**
Frequency range IF	**50 ~ 300**			**50 ~ 300**			**MHz**
Conversion Loss	**10.1**	**9.2**	**9.9**	**10.6**	**9.4**	**10.0**	**dB**
LO to RF Isolation	**11.0**	**8.8**	**8.7**	**7.9**	**5.7**	**6.6**	**dB**
LO to IF Isolation	**16.6**	**22.6**	**31.3**	**13.4**	**19.2**	**30.1**	**dB**
RF to IF Isolation	**14.2**	**21.7**	**23.7**	**14.0**	**21.1**	**23.4**	**dB**
Input IP3	**29.3**	**29.7**	**29.1**	**34.6**	**28.3**	**28.0**	**dBm**
Input P1dB	**21**	**22**	**19**	**19**	**20**	**21**	**dBm**
Supply current	**21.2**	**23.5**	**27.5**	**32.5**	**35.3**	**43.7**	**mA**

Input IP_3 Test Condition : Tone Spacing=1MHz, RF Input power = 0 dBm/tone, LO driver = 0dBm, T_L=25°C, Z_S=Z_L=50, IF Freq.=70MHz, Converting with low-side LO Freq.

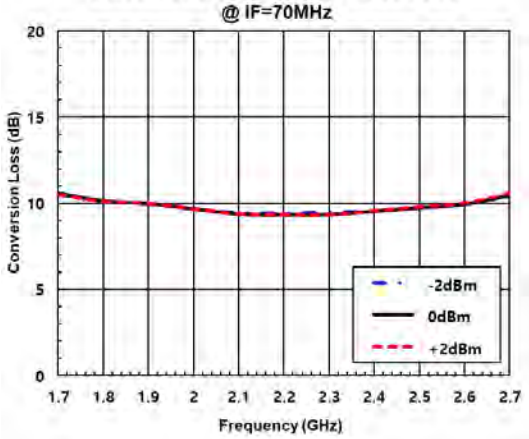
High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 1700~2700MHz

Down conversion Performance @Vdd=3.3V Supply

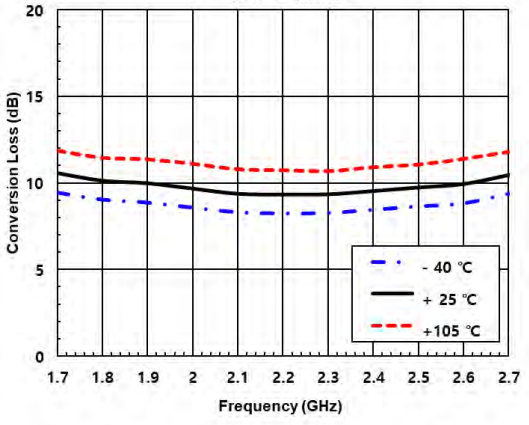
Conversion Loss vs RF Freq. vs IF Freq.



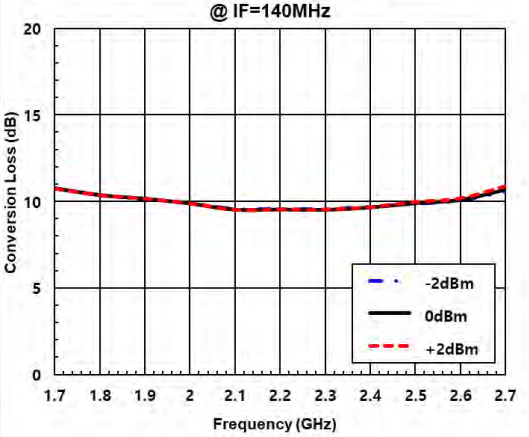
Conversion Loss vs RF Freq. vs LO Power @ IF=70MHz



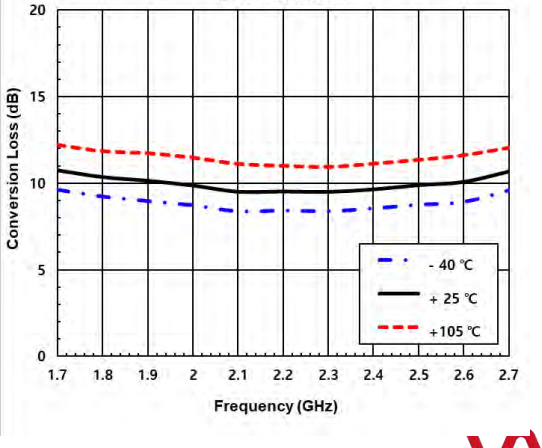
Conversion Loss vs RF Freq. vs Temp. @ IF=70MHz



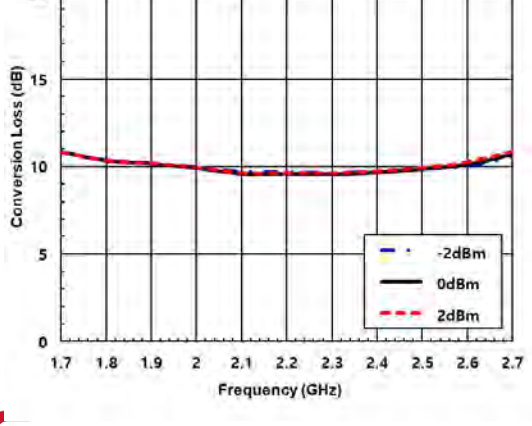
Conversion Loss vs RF Freq. vs LO Power @ IF=140MHz



Conversion Loss vs RF Freq. vs Temp. @ IF=140MHz

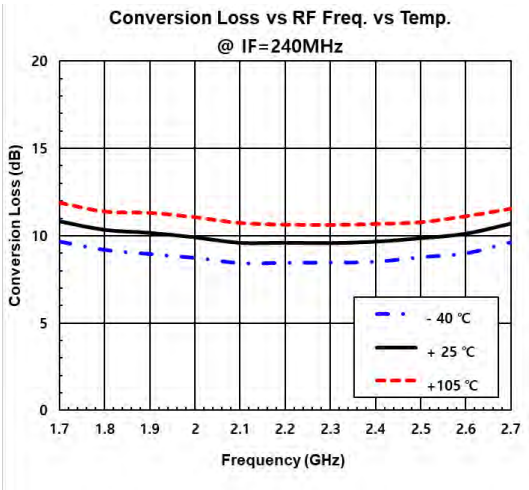


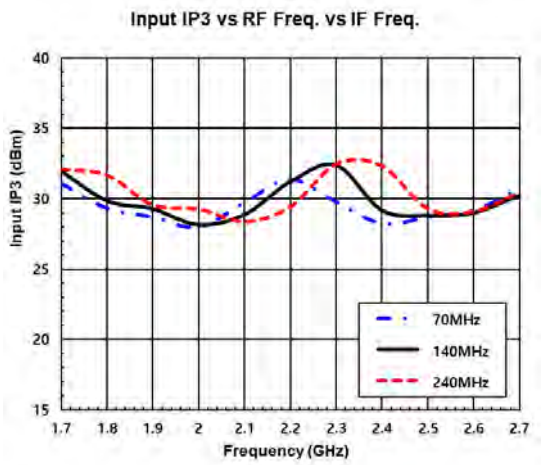
Conversion Loss vs RF Freq. vs LO Power @ IF=240MHz

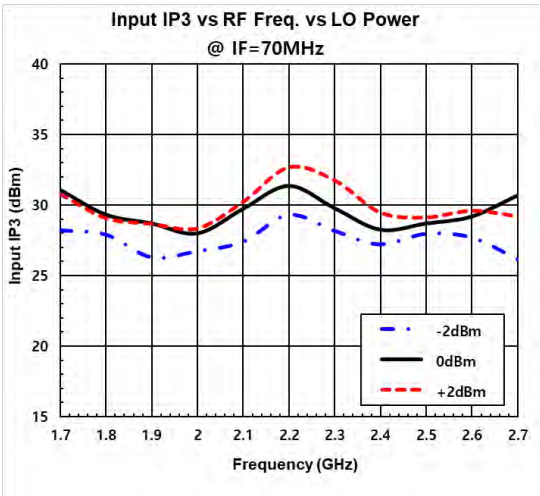


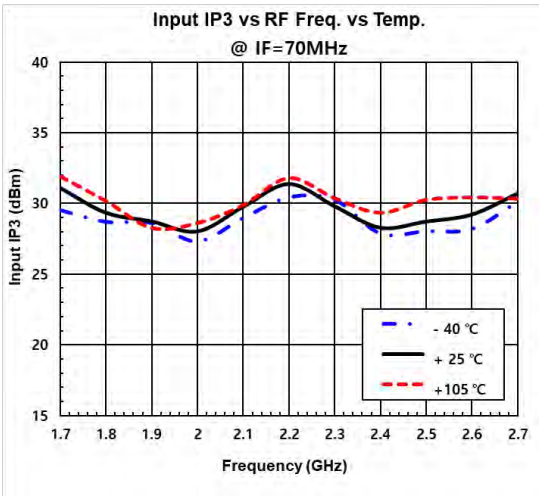
High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 1700~2700MHz

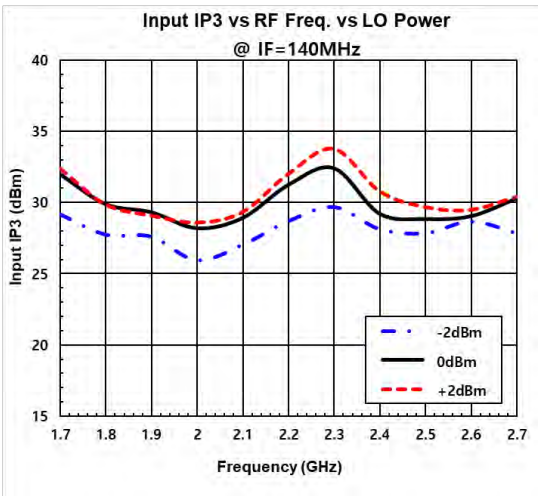
Down conversion Performance @Vdd=3.3V Supply

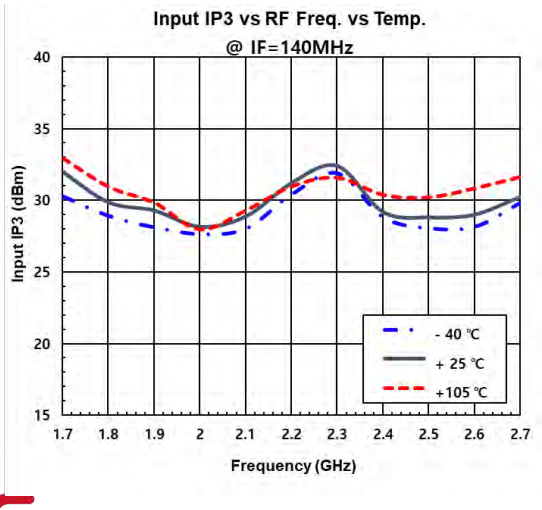








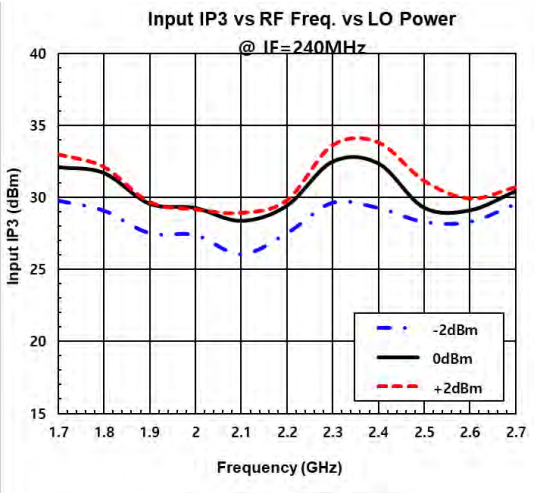


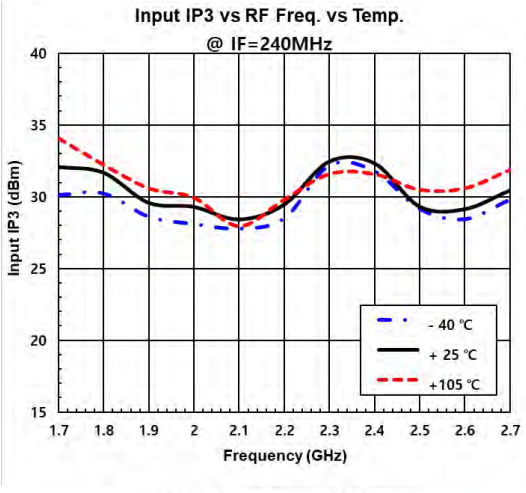


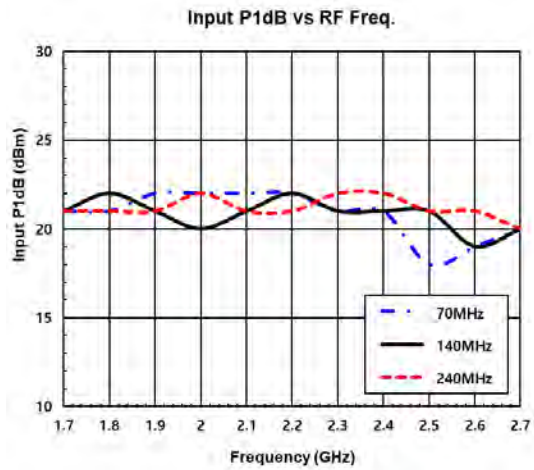
Preliminary

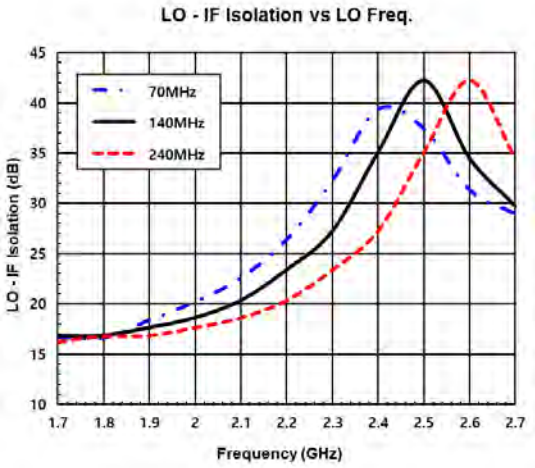
High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 1700~2700MHz

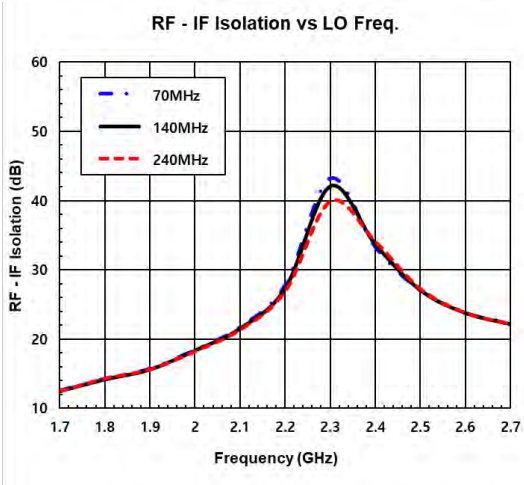
Down conversion Performance @Vdd=3.3V Supply

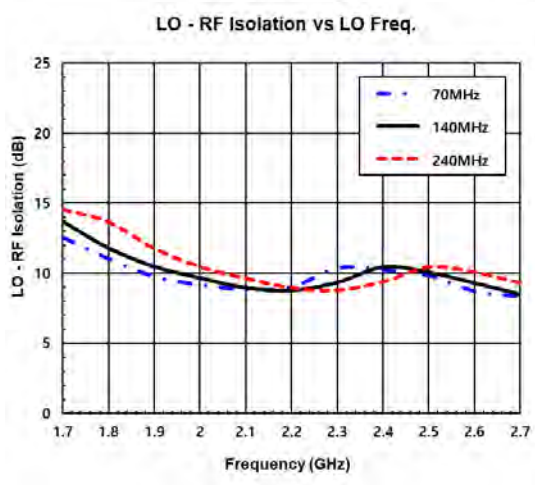






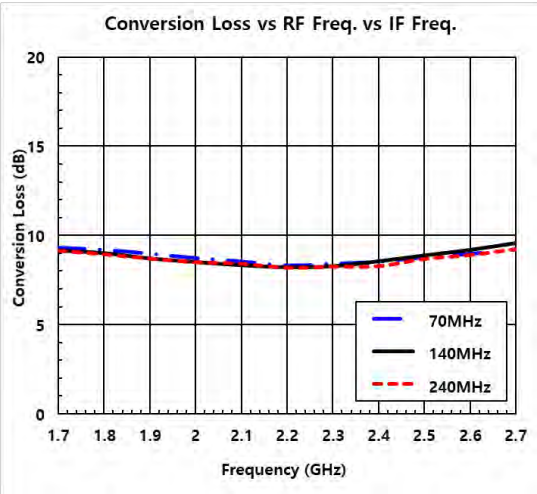


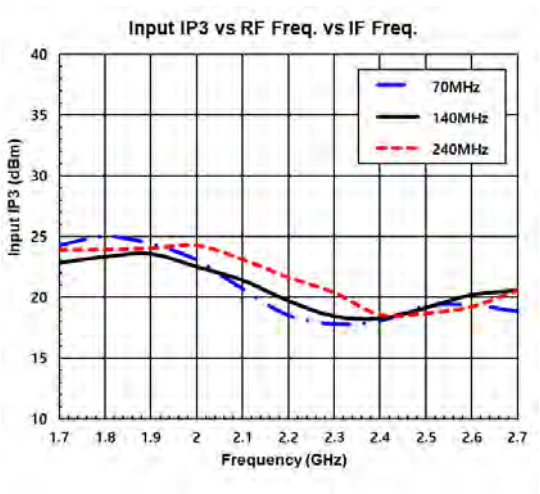




High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 1700~2700MHz

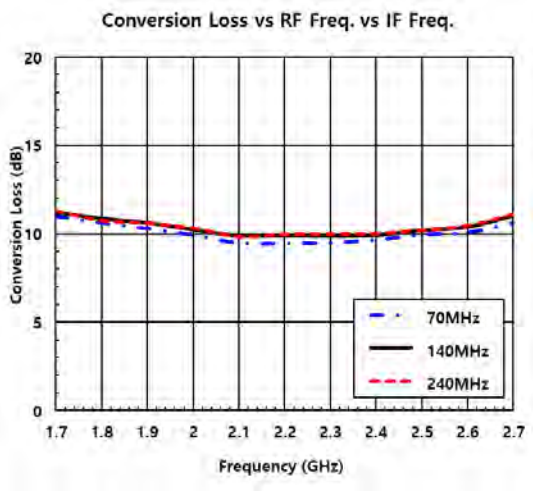
Up conversion Performance @Vdd=3.3V Supply

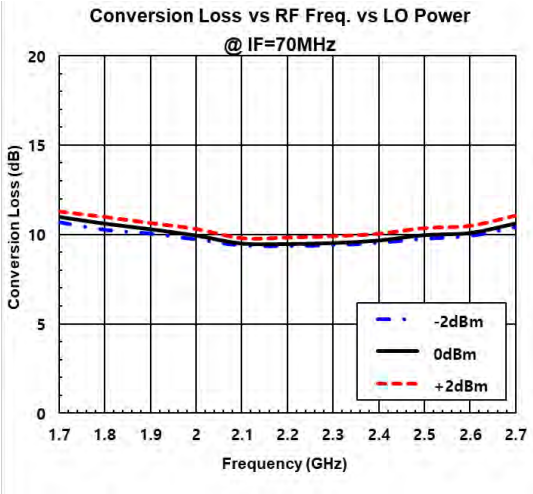


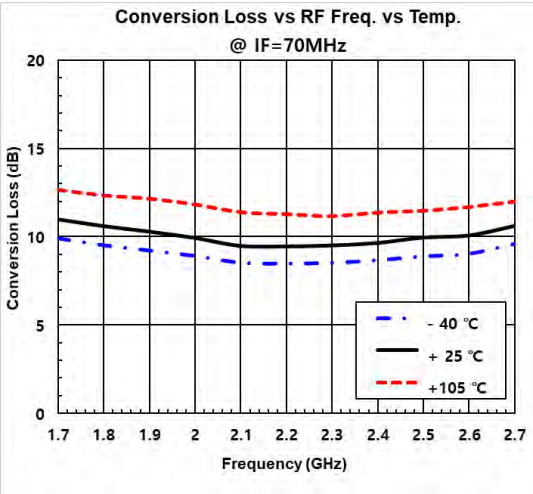


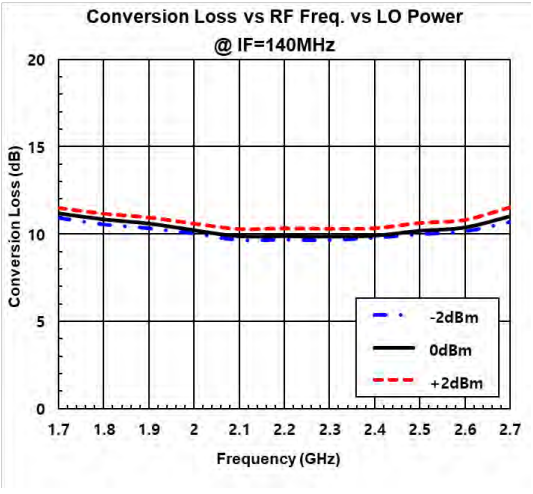
High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 1700~2700MHz

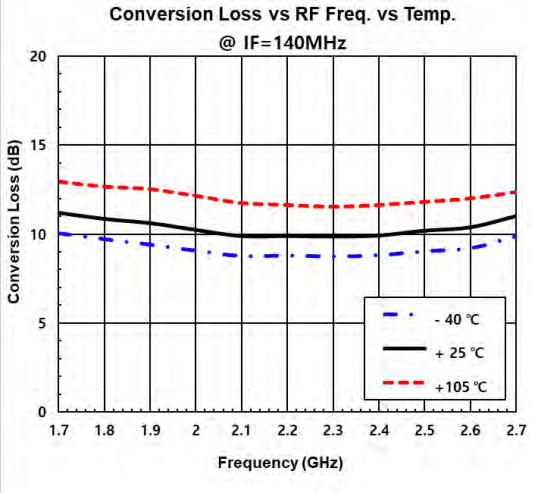
Down conversion Performance @Vdd=5V Supply

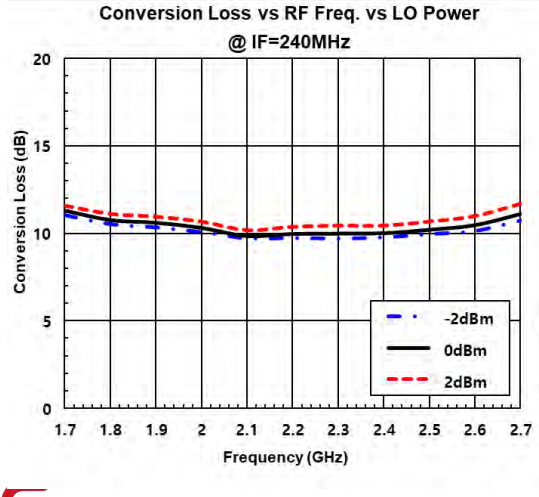








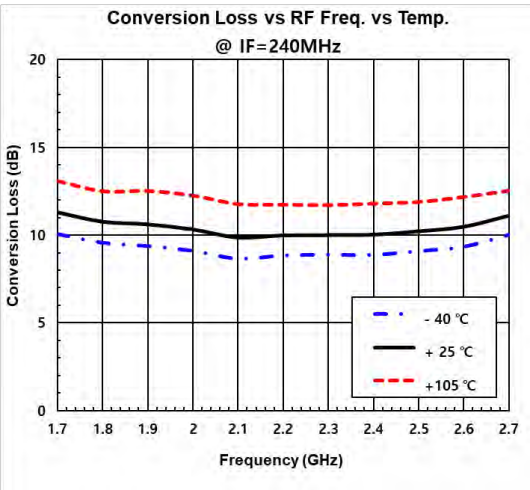


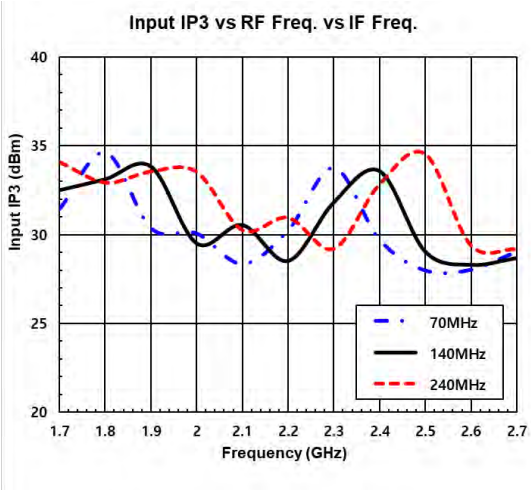


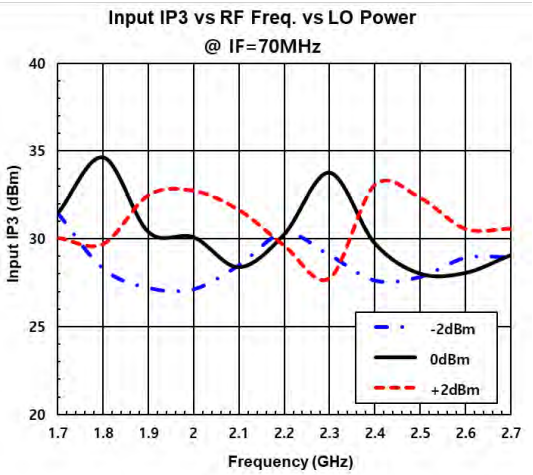
Preliminary

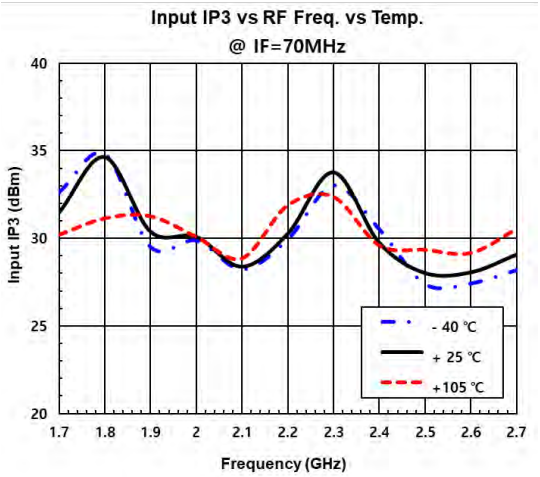
High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 1700~2700MHz

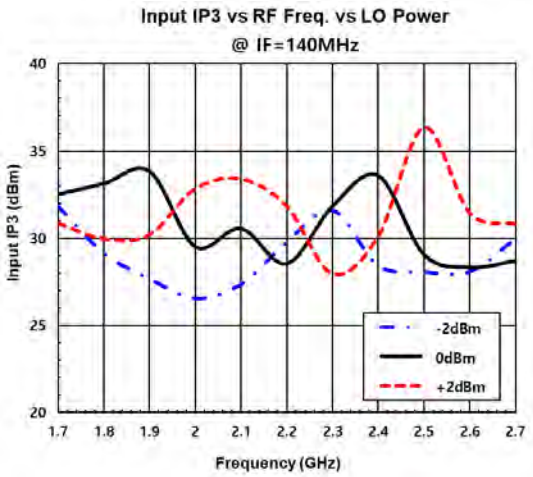
Down conversion Performance @Vdd=5V Supply

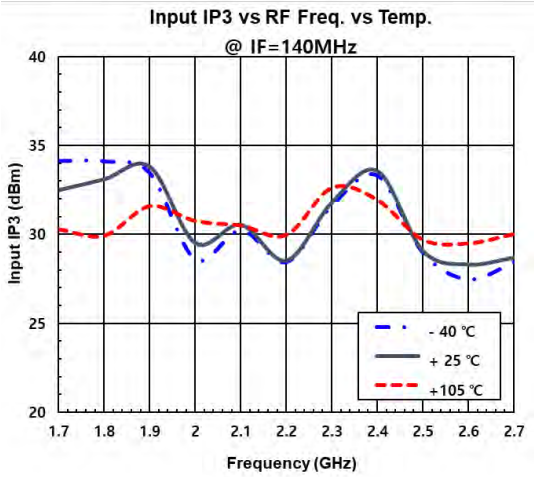






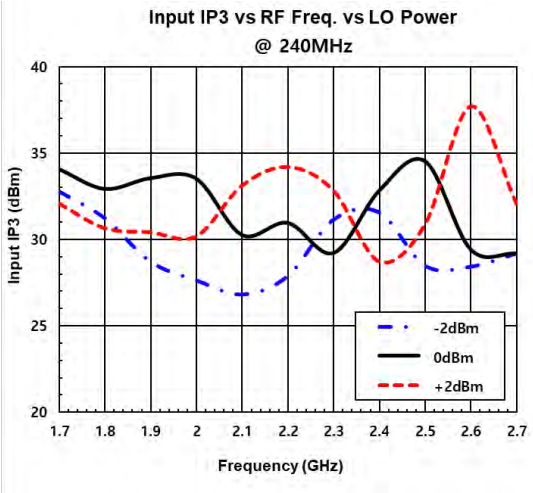


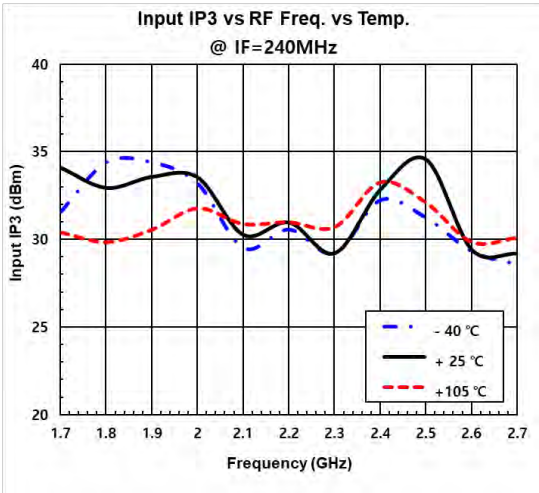


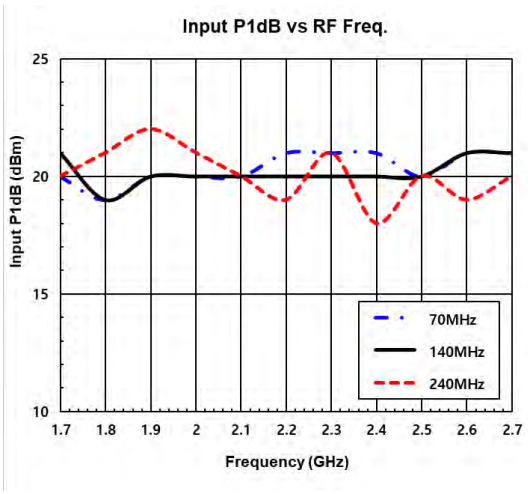


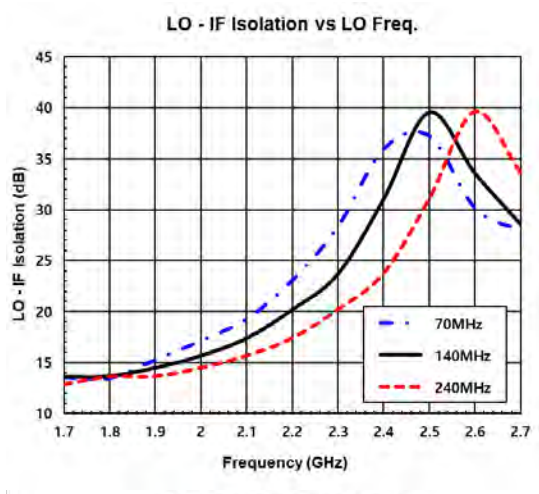
High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 1700~2700MHz

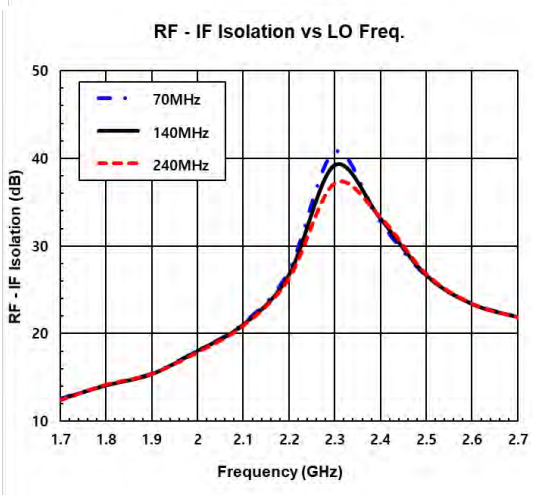
Down conversion Performance @Vdd=5V Supply

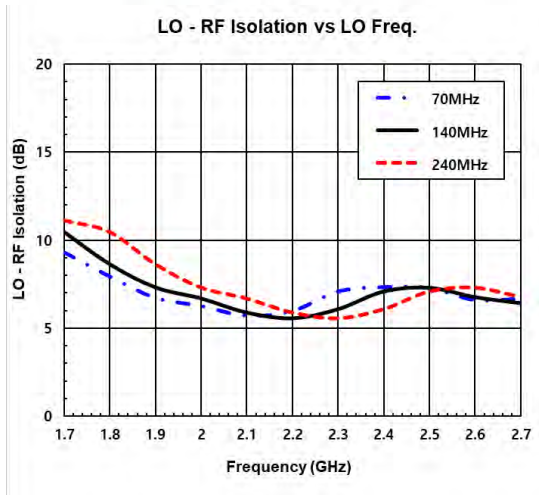






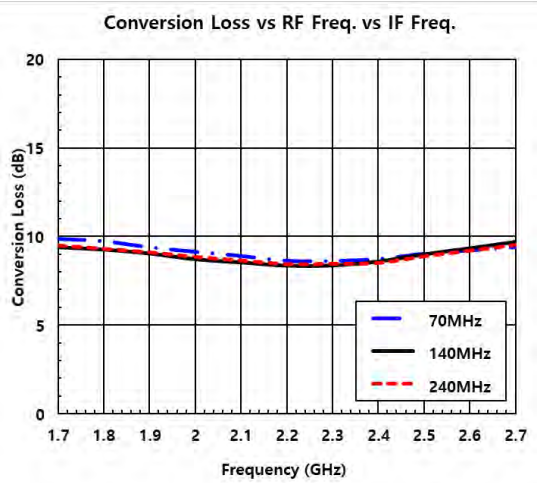


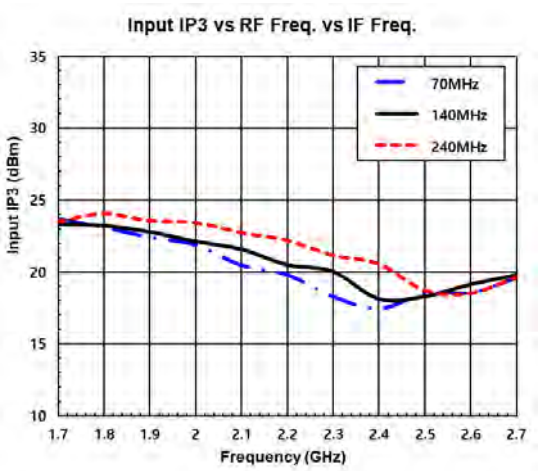




High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 1700~2700MHz

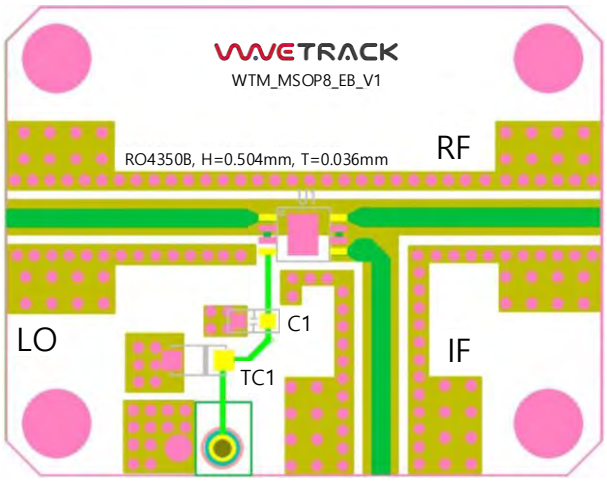
Up conversion Performance @Vdd=5V Supply



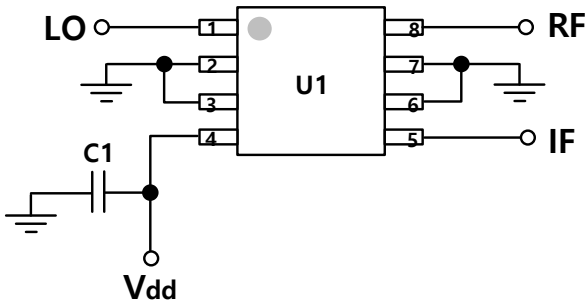


High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 1700~2700MHz

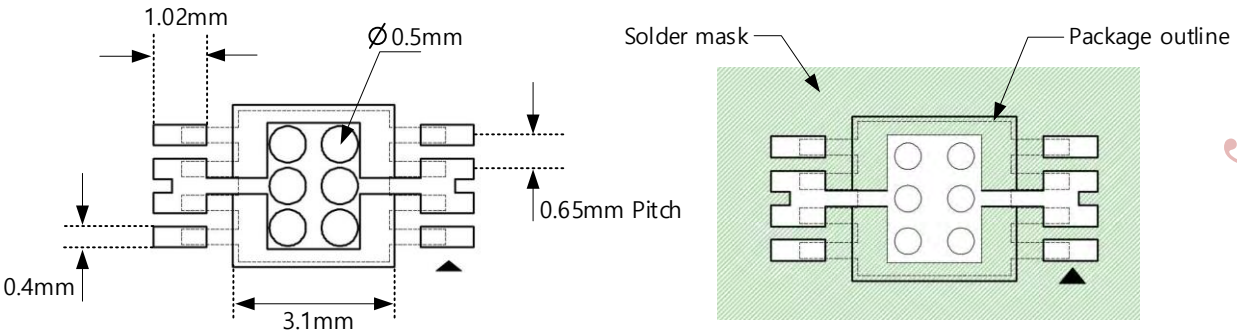
PCB layout and Reference design



Eval. PCB layout
(Rogers RO4350B, H=0.504mm, T=1/2 oz)



Reference Design



Mounting Configuration

Bill of Material

Reference	Value	Description	Manufacture
U1	WTM401	RF Mixer MMIC	WAVETRACK
C1	100 [pF]	Cap. Chip 0402, 5%, 10V	Samsung
TC1	10[uF]	Tantalum Capacitor	Samsung

High IIP3 GaAs MMIC Mixer with Integrated LO amplifier 1700~2700MHz

Package Dimension & Marking

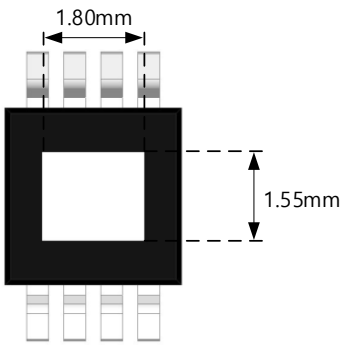
- **Marking : Manufacture**

  Part Number – W402S1

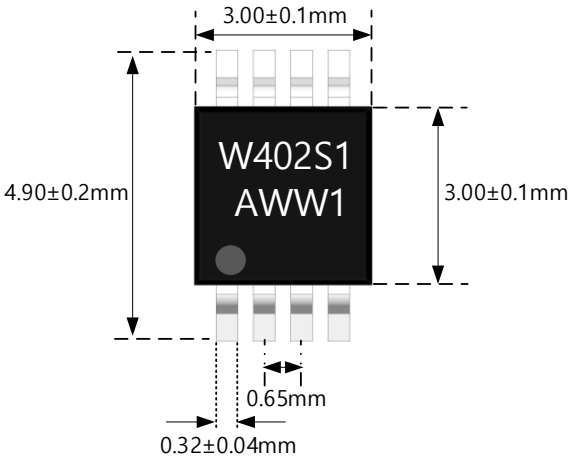
  Lot code – AWW1

  A = Year / WW = Working Week / 1 = Wafer No.

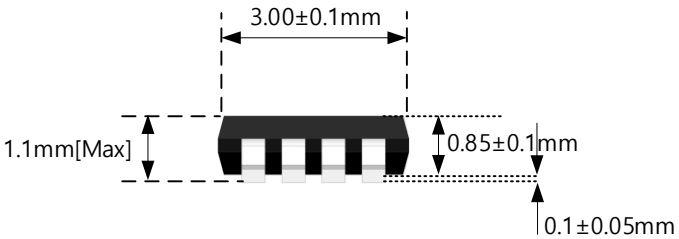
- **Dimension : Millimeters**

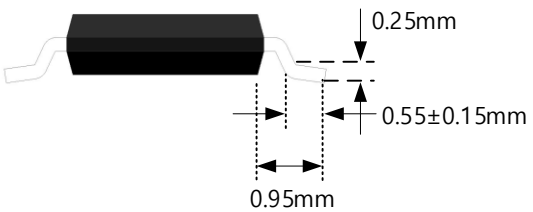


Bottom Exposed pad Dimension



Top Dimension





Side Dimension