mmTron
Unleashing the mmWave Frontier

TMC178
25-29 GHz LO Buffer+LO Filter+Mixer

Product Features

- RF frequency: 25 to 29 GHz
- LO frequency: 6 to 9 GHz
- IF frequency: 4 to 8 GHz
- Conversion Gain: -12 dB
- IP1dB: 5 dBm
- Die Size: X=2.5, Y=2.8, Z=0.1 mm
- Package Size: X=5, Y=5, Z=0.9 mm
- DC Bias Point: 5 VDC, 400 mA

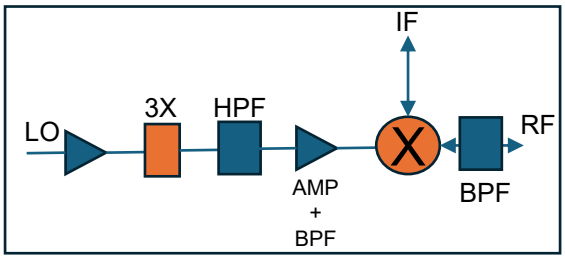
Applications

- Fixed Wireless Access
- Military Radar, EW

Product Description

The TMC178 is a 25-29 GHz, highly integrated up/down converter die product with built-in LO buffer, LO multiplier and LO filter. TMC178 is designed for use in fixed wireless access, Military Radar, and EW applications. The TMC178 has ESD protection and is a 50Ω matched design and require one single DC bias. All ports (LO, IF and RF) have shunt inductors to ground for ruggedness. External series coupling capacitors would be necessary if there are external DC voltages present on these ports. To ensure rugged and reliable operation and moisture protection, the TMC178 is designed with additional passivation for maximum reliability. Both bond pad and backside metallization of TMC178-D bare die are Au-based that is compatible standard wire bonding and die attach methods. TMC178 can be biased with a single 5V. TMC178-P5 is the packaged version in standard 20-pin 5x5 QFN.

Functional Block Diagram



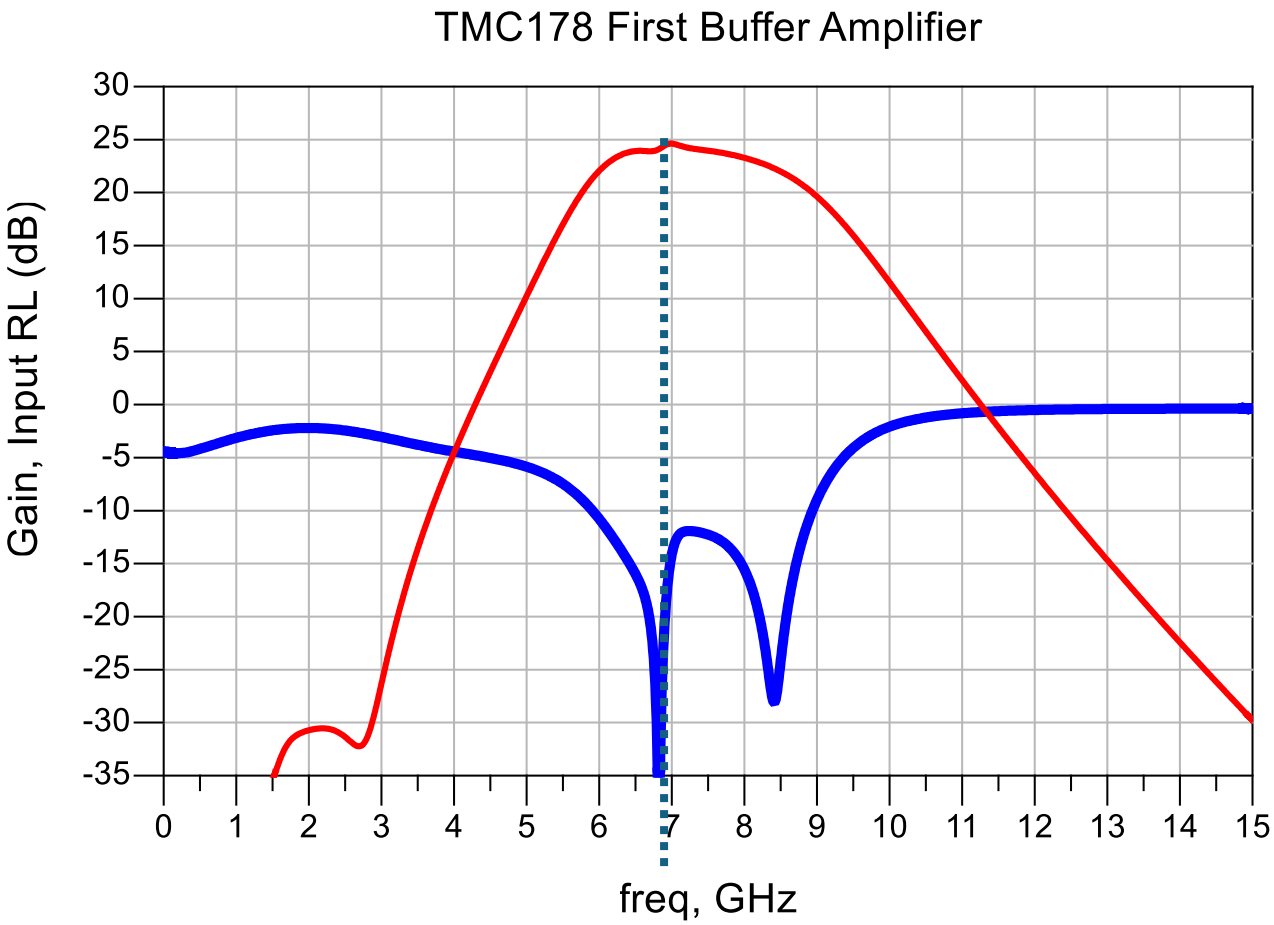
*Add off chip bypassing for VD pad 100pF

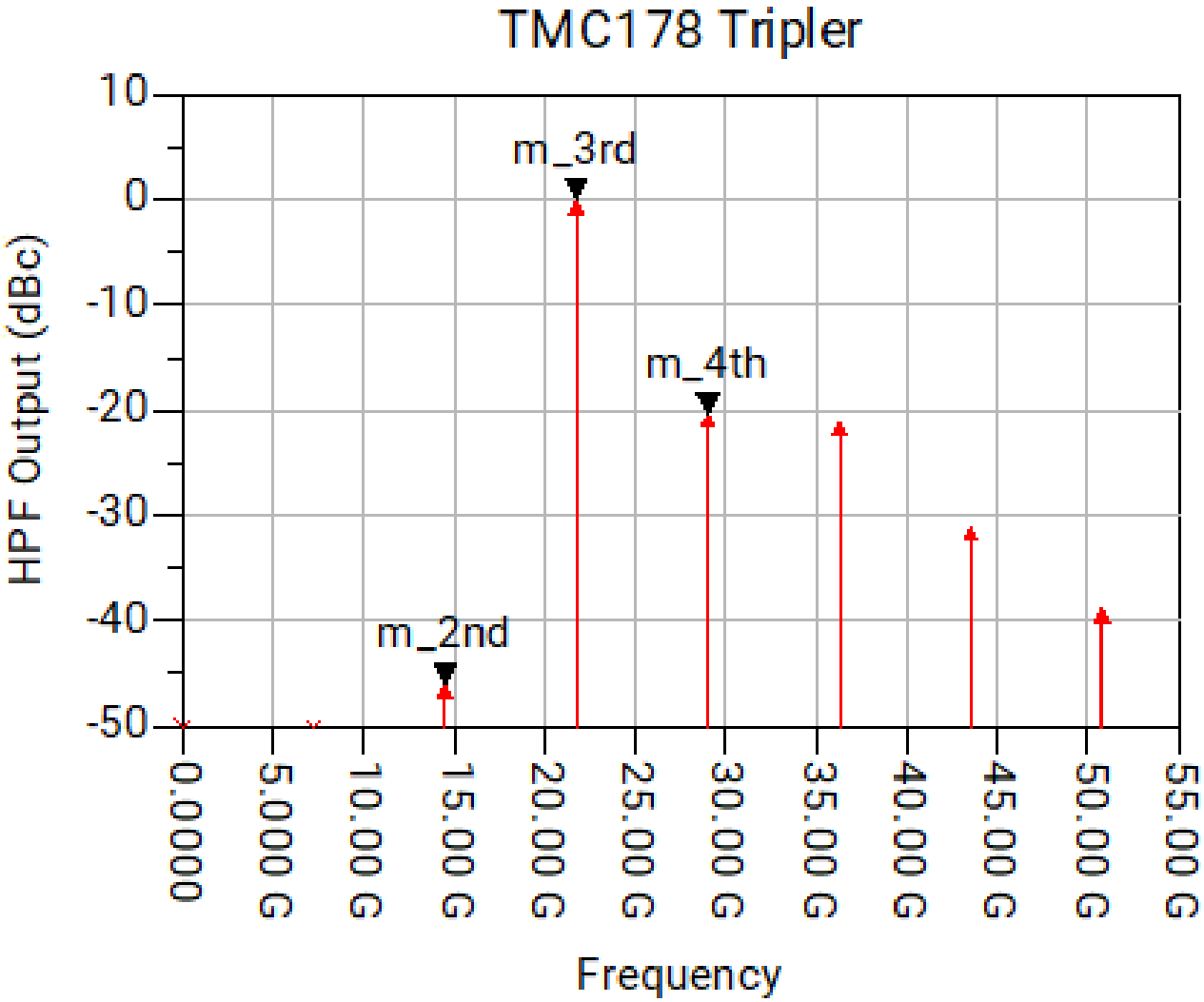
Ordering Information

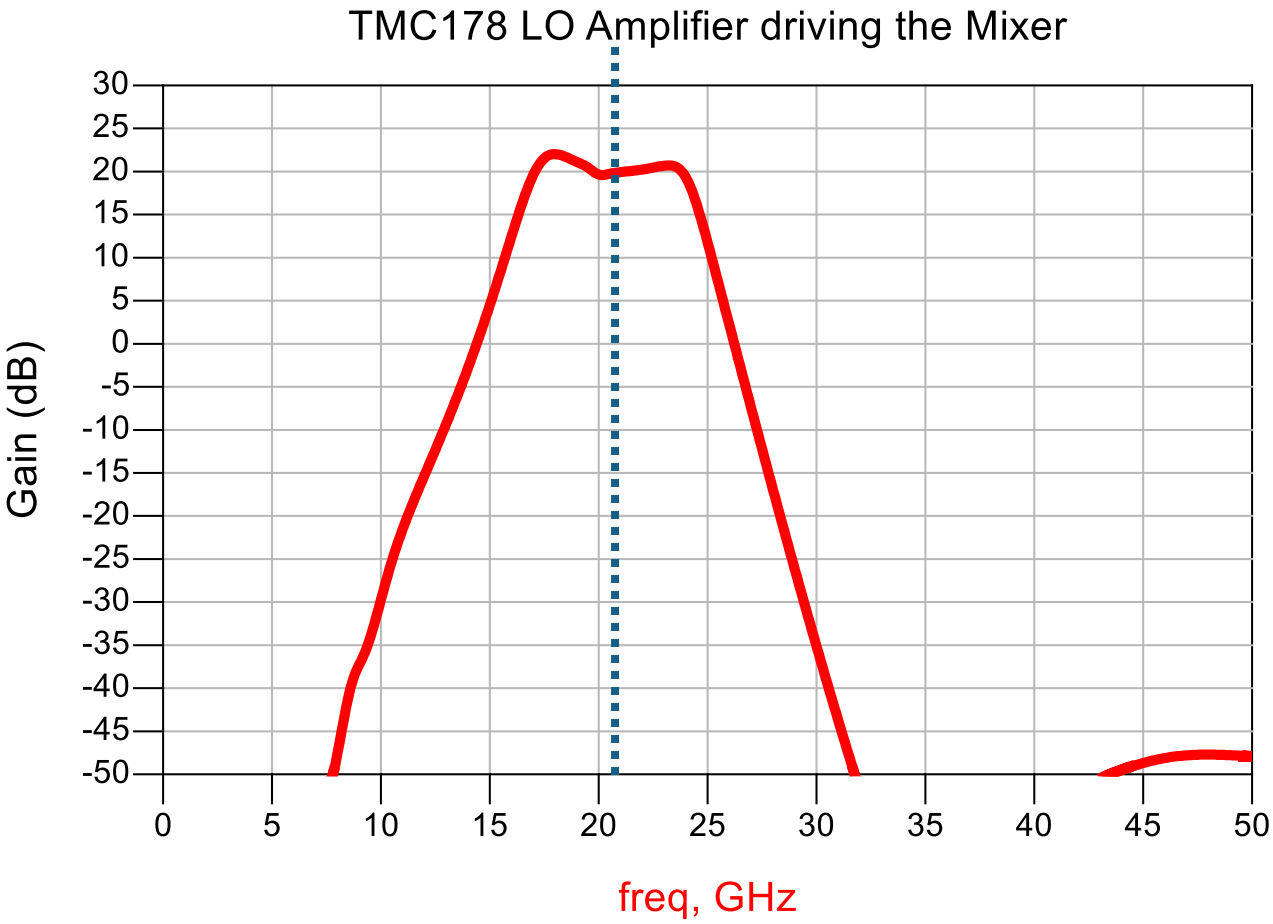
Part No.	Description
TMC178-D	Bare Die
TMC178-P5	Packaged Version

	min	Typ	Max	Units
LO Input Frequency	6	7	8	GHz
RF Frequency	25	27	29	GHz
IF Frequency	4	6	8	GHz
LO Input Drive	-5	0	+5	dBm
Conversion Gain		-12		dB
Input P1dB		5		dBm
LO Return Loss		-10		dB
RF Return Loss		-10		dB
IF Return Loss		-10		dB
Bias Voltage	4	5	6	V
Bias Current		400		mA

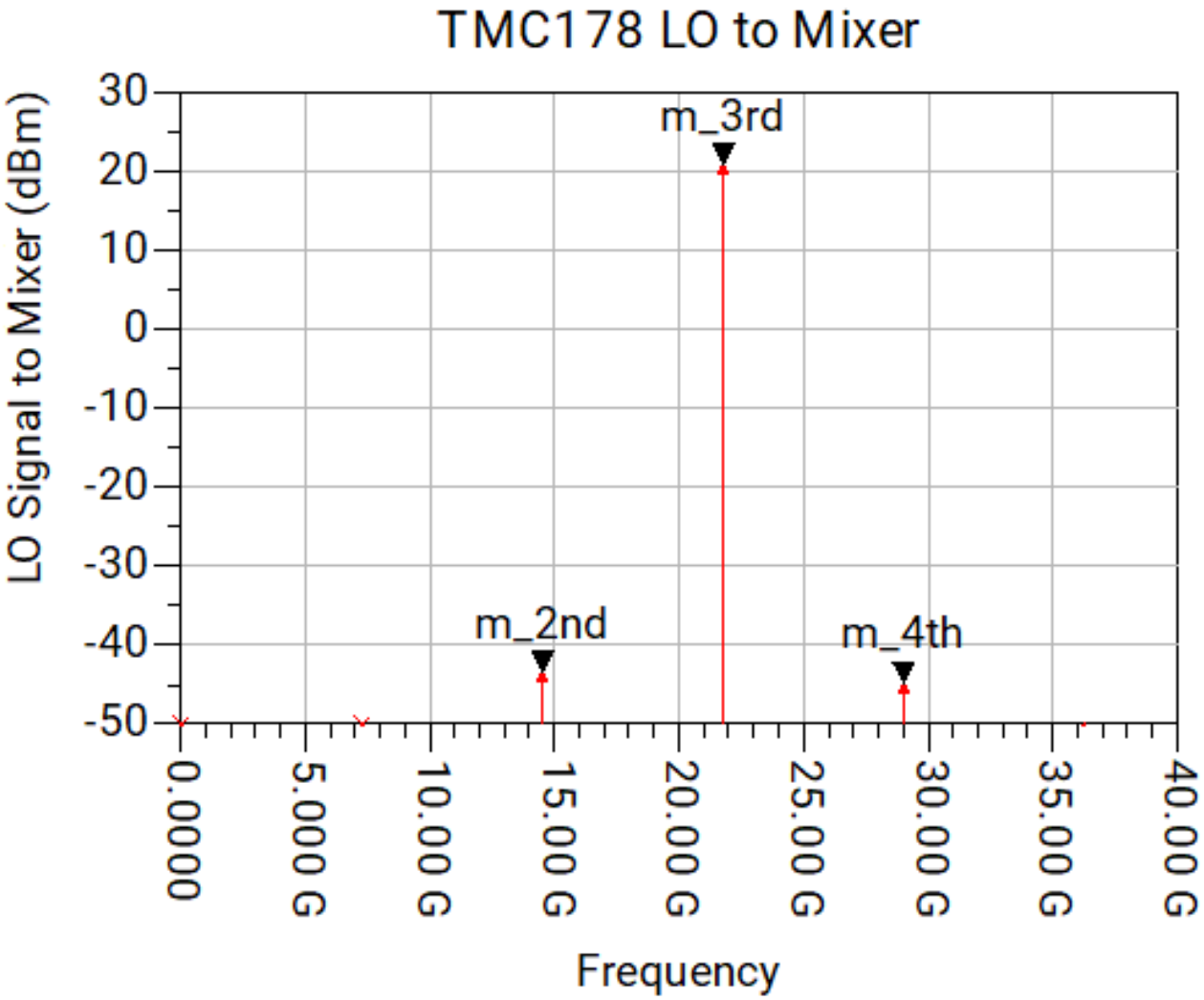
	min	Typ	Max	Units
LO Tripler fundamental Rejection		-50		dBc
LO Tripler Second Harmonic Rejection		-30		dBc

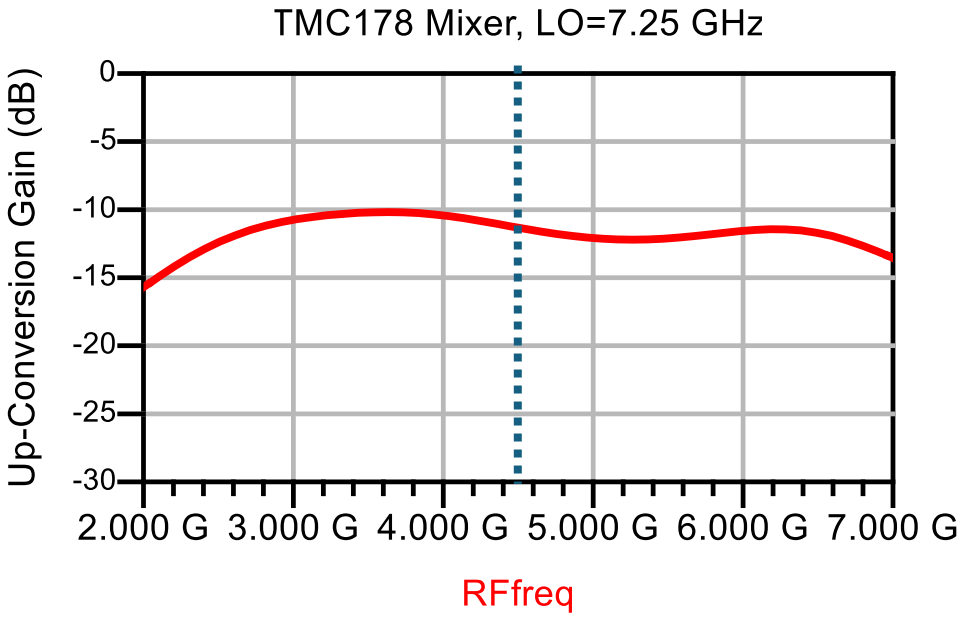

TMC178 First Buffer Amplifier
Gain, Input RL (dB)
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
freq, GHz

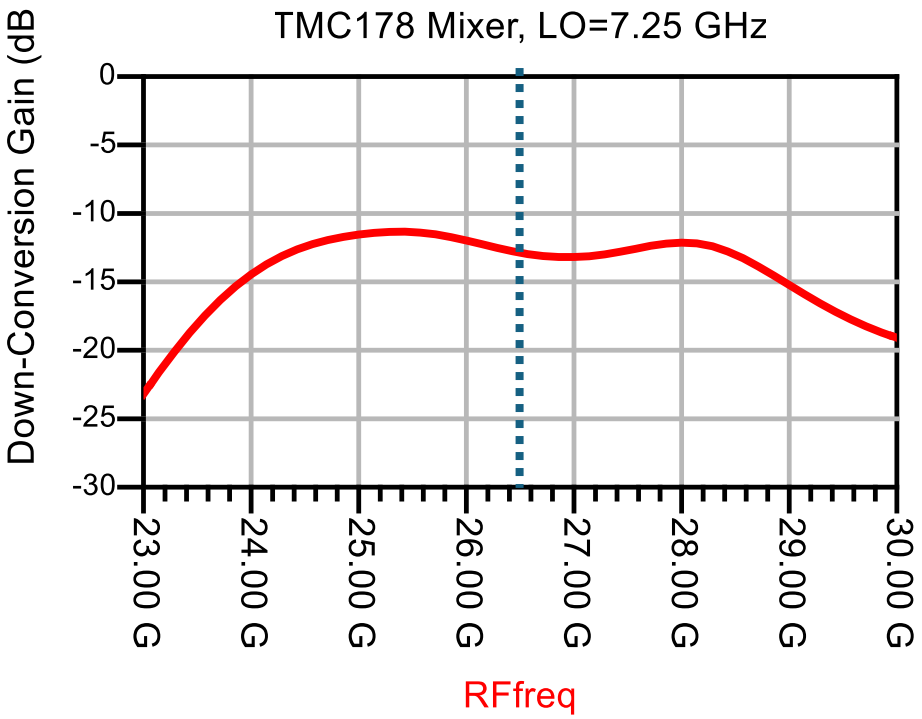

TMC178 Tripler
HPF Output (dBc)
10
0
-10
-20
-30
-40
-50
m_3rd
m_4th
m_2nd
0.0000
5.000 G
10.00 G
15.00 G
20.00 G
25.00 G
30.00 G
35.00 G
40.00 G
45.00 G
50.00 G
55.00 G
Frequency

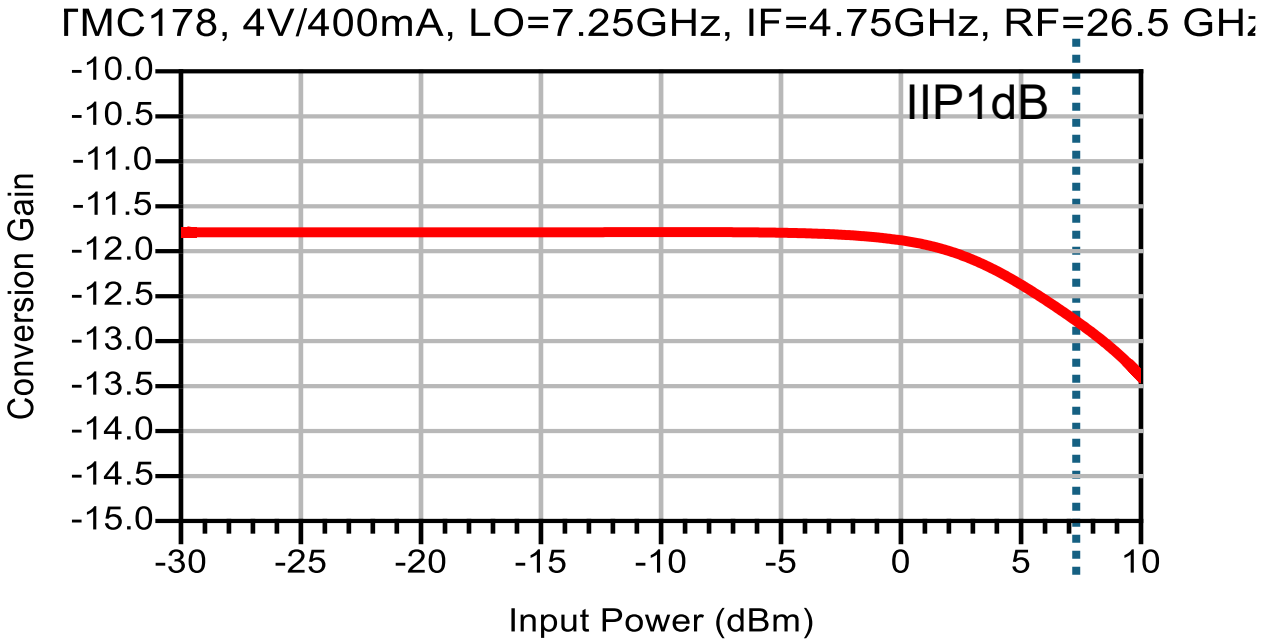


LO amplifier that drives the mixer acts as bandpass rejecting the unwanted harmonics.


TMC178 LO to Mixer
LO Signal to Mixer (dBm)
30
20
10
0
-10
-20
-30
-40
-50
m_3rd
m_2nd
m_4th
0.0000
5.000 G
10.00 G
15.00 G
20.00 G
25.00 G
30.00 G
35.00 G
40.00 G
Frequency


TMC178 Mixer, LO=7.25 GHz
Up-Conversion Gain (dB)
0
-5
-10
-15
-20
-25
-30
2.000 G
3.000 G
4.000 G
5.000 G
6.000 G
7.000 G
RFfreq


TMC178 Mixer, LO=7.25 GHz
Down-Conversion Gain (dB
0
-5
-10
-15
-20
-25
-30
23.00 G
24.00 G
25.00 G
26.00 G
27.00 G
28.00 G
29.00 G
30.00 G
RFfreq


TMC178, 4V/400mA, LO=7.25GHz, IF=4.75GHz, RF=26.5 GHz
IIP1dB
Conversion Gain
-10.0
-10.5
-11.0
-11.5
-12.0
-12.5
-13.0
-13.5
-14.0
-14.5
-15.0
-30
-25
-20
-15
-10
-5
0
5
10
Input Power (dBm)

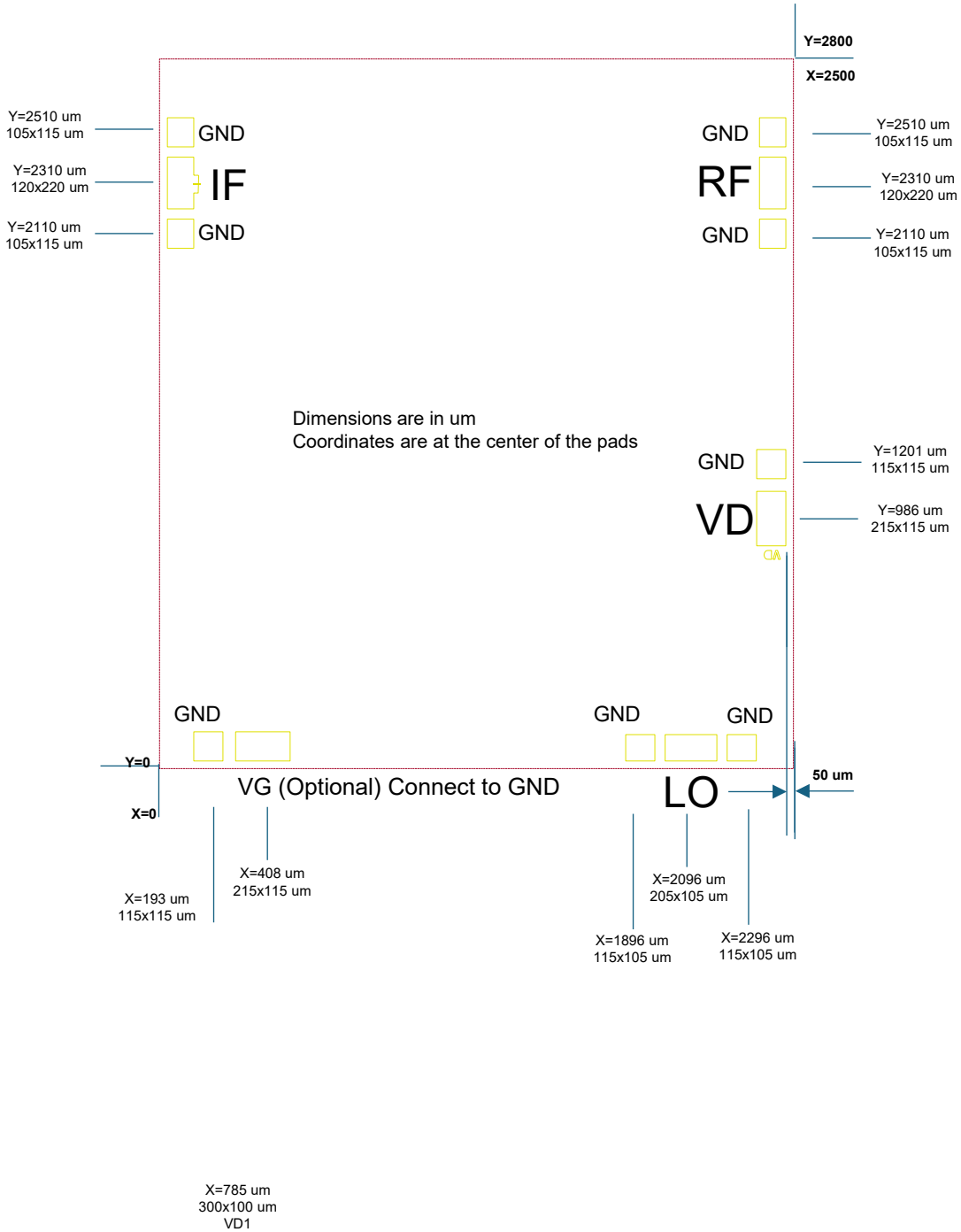
Recommended Biasing

The TMC178 is operated with one positive supply VD.

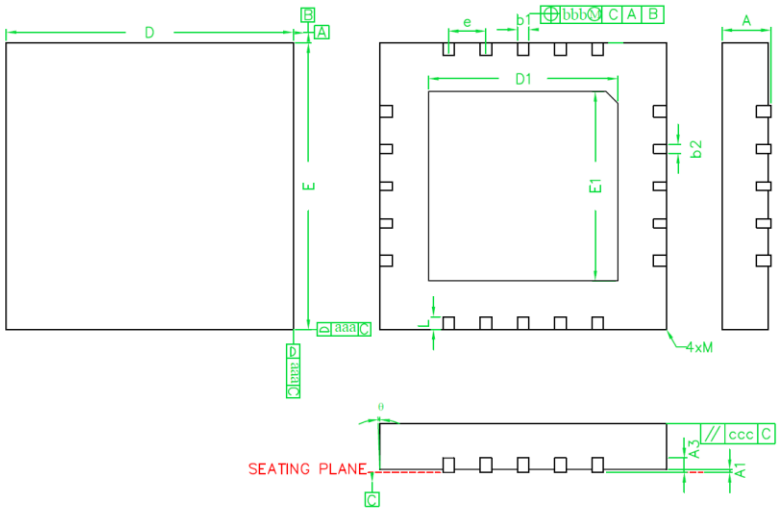
Assembly Techniques

The TMC178 is fabricated using a GaAs-based semiconductor material structure and may be used packaged in a standard overmold or an air-cavity QFN or used as a die.

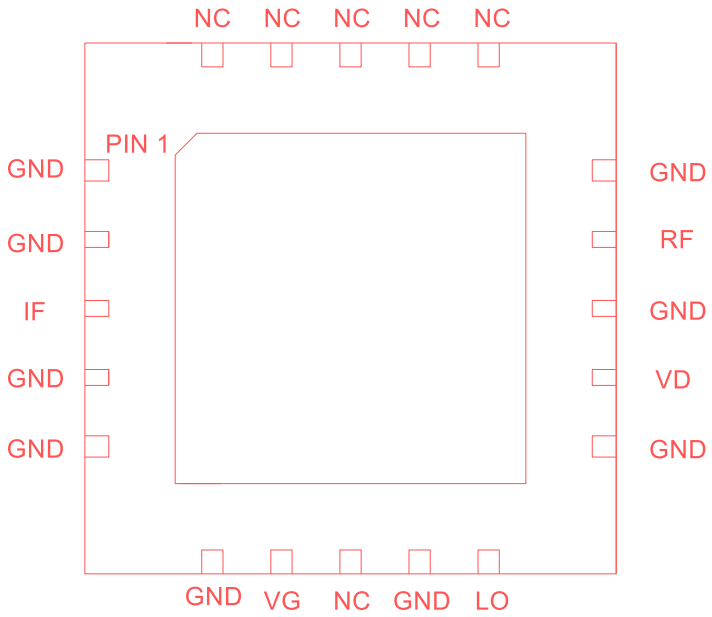
Layout Drawing



Package Drawing, 5x5, 20-pin, 0.65mm pitch



SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	0.80	0.90	1.00
A1	0	0.02	0.05
A3	----	0.25REF.	----
b1	0.15	0.20	0.25
b2	0.10	0.15	0.20
D	4.90	5.00	5.10
D1	----	3.30BSC	----
E	4.90	5.00	5.10
E1	----	3.30BSC	----
e	----	0.65BSC	----
L	0.18	0.23	0.28
θ	0	----	12°
aaa	----	0.25	----
bbb	----	0.10	----
ccc	----	0.10	----
M	----	----	0.05



DXF file is available upon request



Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. mmTron Inc. recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications. III-V MMICs are ESD-sensitive. Preventative ESD measures must be employed in all aspects of storage, handling, and assembly. MMIC ESD precautions, handling considerations, and die-attach and bonding methods are critical factors in successful III-V MMIC performance and reliability.



RoHS Compliant

This part is RoHS compliant, meeting the requirements of the EU Restriction of Hazardous Substances Directive 2002/95/EC, commonly known as RoHS. Six substances are regulated: lead, mercury, cadmium, chromium VI (hexavalent chromium), polybrominated biphenyls (PBB), and polybrominated biphenyl ethers (PBDE). RoHS compliance requires that any residual concentration of these substances is below the Directive's maximum concentration values (MCV): cadmium 100ppm by weight and all others 1000ppm by weight.

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