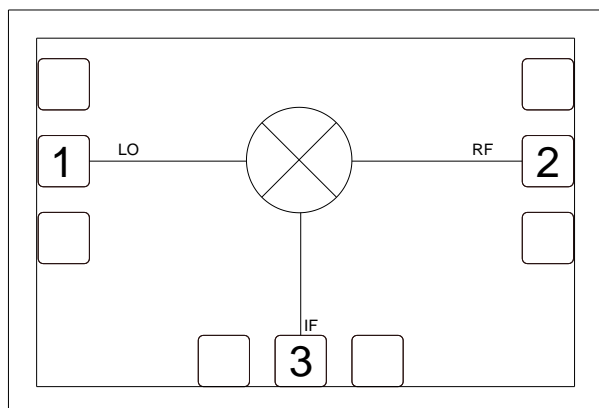


### Product Overview

The CMD178 is a general purpose double balanced mixer die that can be used for up- and downconverting applications between 11 and 21 GHz. The CMD178 has very high isolation to both the RF and IF ports due to the optimized balun structures, and can operate with an LO drive level as low as +9 dBm. The CMD178 can easily be configured as an image reject mixer or single sideband modulator with external hybrids and power splitters.

### Functional Block Diagram



### Key Features

- Low Conversion Loss
- High Isolation
- Wide IF Bandwidth
- Passive Double Balanced Topology
- Small Die Size: 1160 um x 790 um

### Ordering Information

Part No.	Description
CMD178	11-21 GHz Fundamental Mixer, 100 Piece WP Sample

### Electrical Performance (IF = 100 MHz, LO = +13 dBm, T<sub>A</sub> = 25 °C, F = 21 GHz)

Parameter	Min	Typ.	Max	Units
Frequency Range, RF & LO		11 - 21		GHz
Frequency Range, IF	DC	-	6	GHz
Conversion Loss	-	6	-	dB
LO to RF Isolation	-	45	-	dB
LO to IF Isolation	-	45	-	dB
RF to IF Isolation	-	26	-	dB
Input P1dB	-	9	-	dBm

Unless otherwise noted, all measurements performed as a downconverter, IF = 100 MHz

## Absolute Maximum Ratings

Parameter	Rating
RF / IF Input Power	+22 dBm
LO Drive	+22 dBm
Operating Temperature	-40 to 85 °C
Storage Temperature	-55 to 150 °C
Thermal Resistance, $\theta_{JC}$	470 °C/W
Power Dissipation, $P_{diss}$	138 mW

Exceeding any one or combination of the maximum ratings may cause permanent damage to the device.

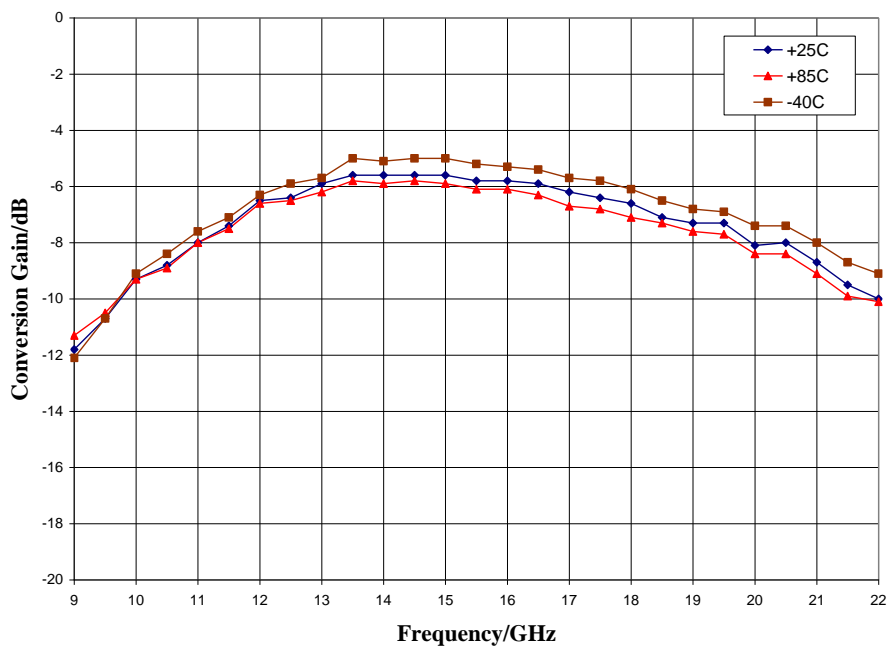
## Electrical Specifications (IF = 100 MHz, LO = +13 dBm, $T_A$ = 25 °C)

Parameter	Min	Typ.	Max	Min	Typ.	Max	Units
Frequency Range, RF & LO	13 - 17			11 - 21			GHz
Frequency Range, IF	DC	-	6	DC	-	6	GHz
Conversion Loss	-	6	8	-	7	10	dB
Noise Figure (SSB)	-	6	8		7	10	dB
LO to RF Isolation	-	43	-	-	43	-	dB
LO to IF Isolation	31	48	-	23	38	-	dB
RF to IF Isolation	17	25	-	14	25	-	dB
Input P1dB	-	9	-	-	9	-	dBm
Input IP3	-	16	-	-	16	-	dBm

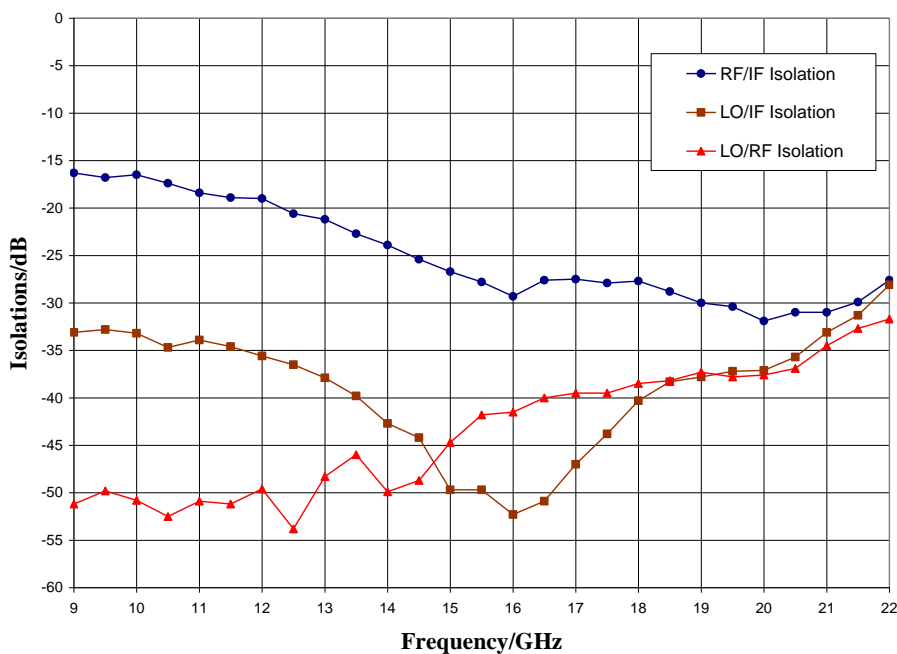
Unless otherwise noted, all measurements performed as a downconverter, IF = 100 MHz

## Typical Performance

Conversion Gain vs. Temperature, LO = +13 dBm, IF = 100 MHz USB

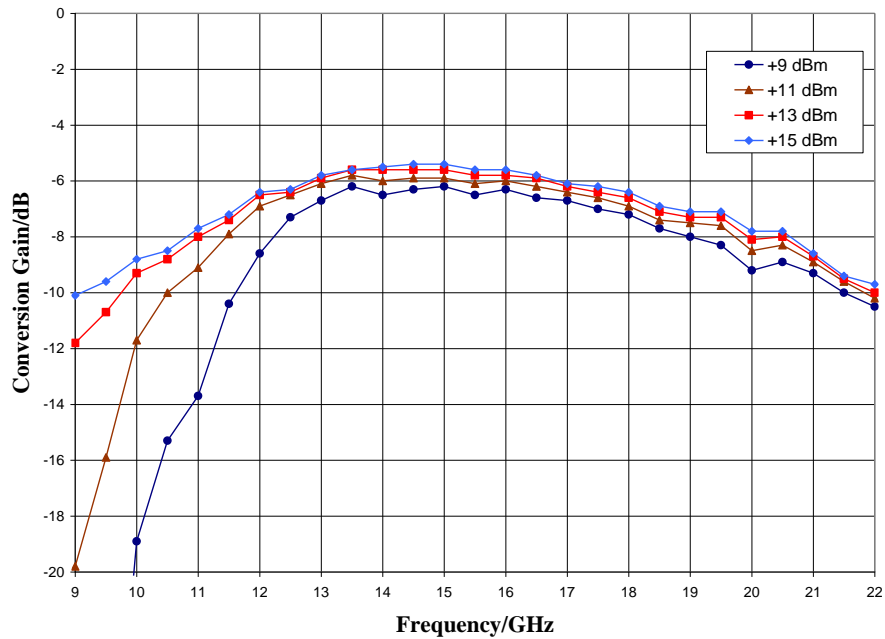


Isolation, LO = +13 dBm

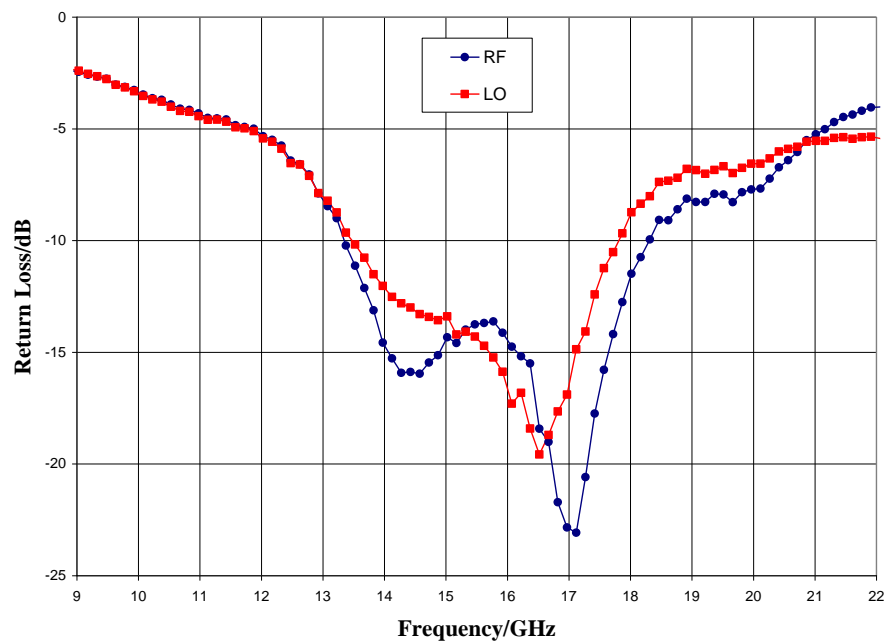


## Typical Performance

Conversion Gain vs. LO Drive, IF = 100 MHz USB

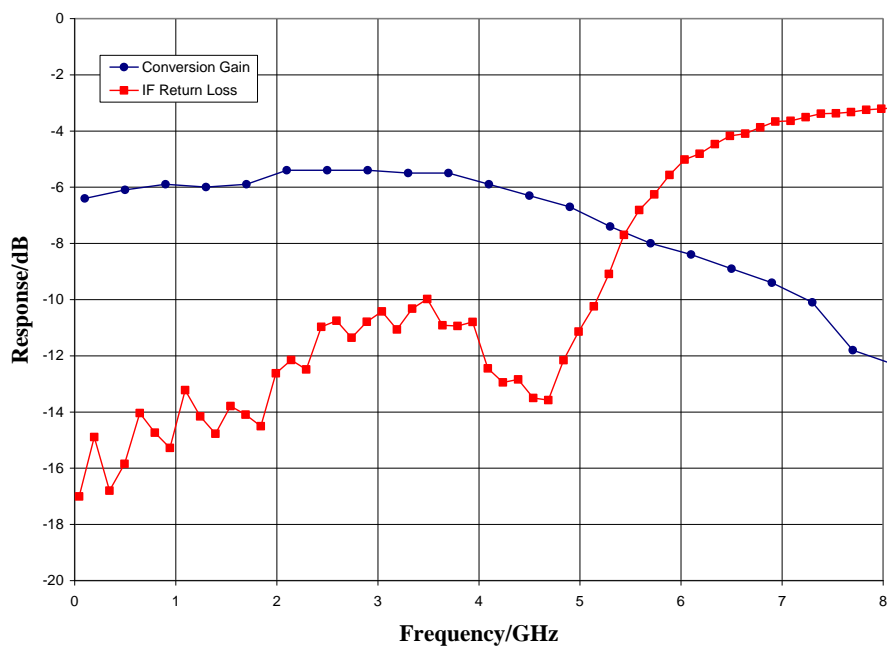


Return Loss, LO = + 13 dBm

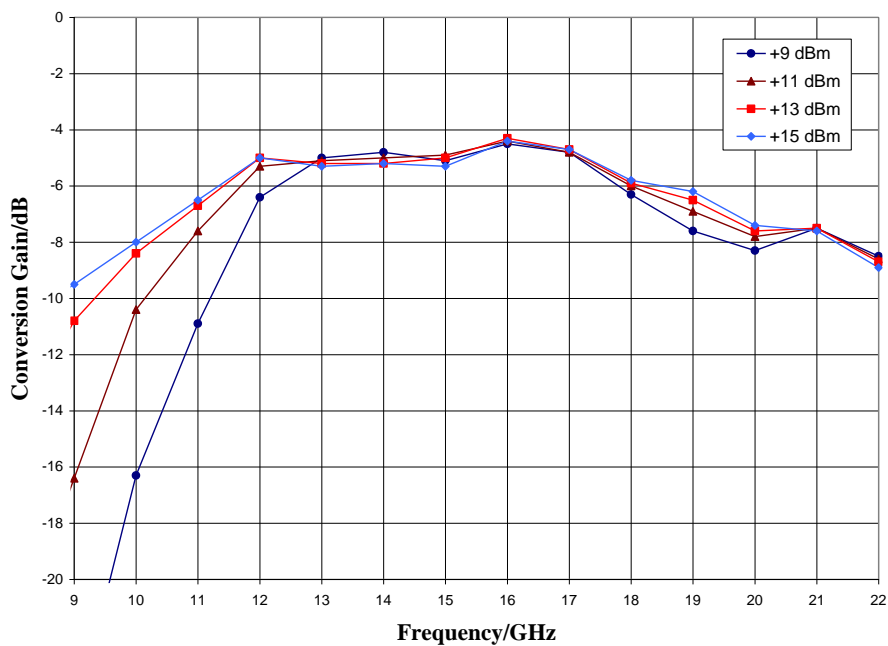


## Typical Performance

IF Bandwidth, LO = +13 dBm

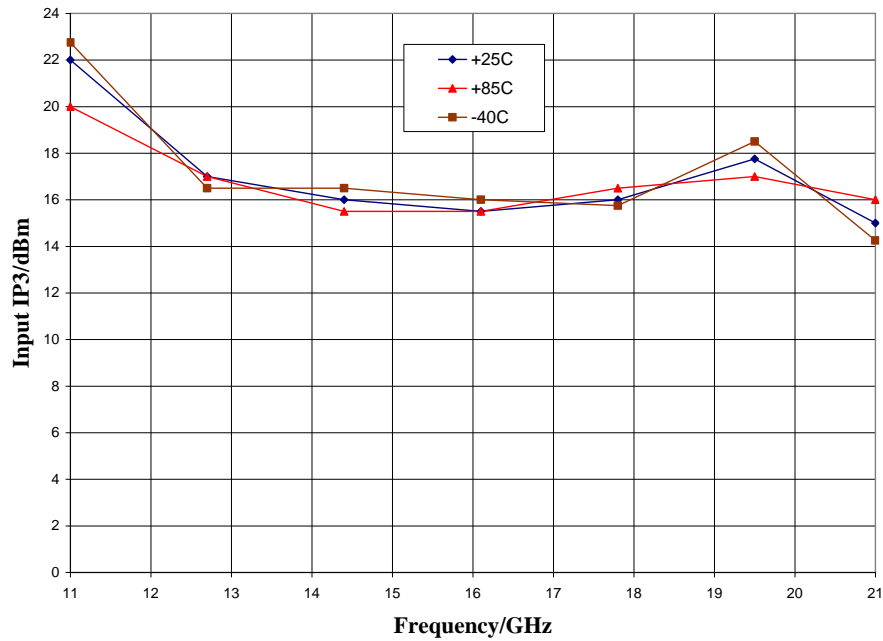


Upconverter Performance, Conversion Gain vs. LO Drive, IF Input = 100 MHz

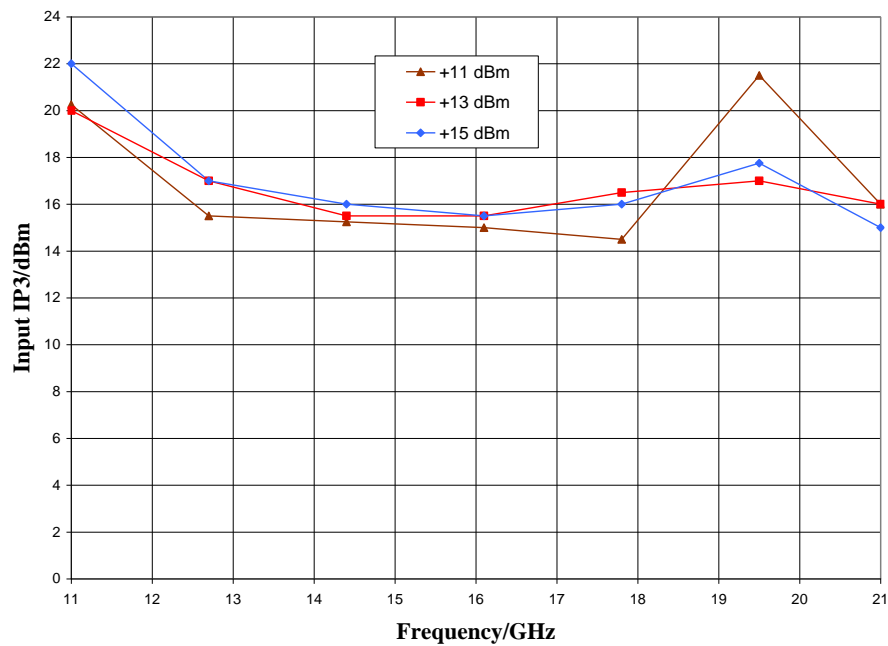


## Typical Performance

Input IP3 vs. Temperature, LO = +15 dBm, IF = 100 MHz

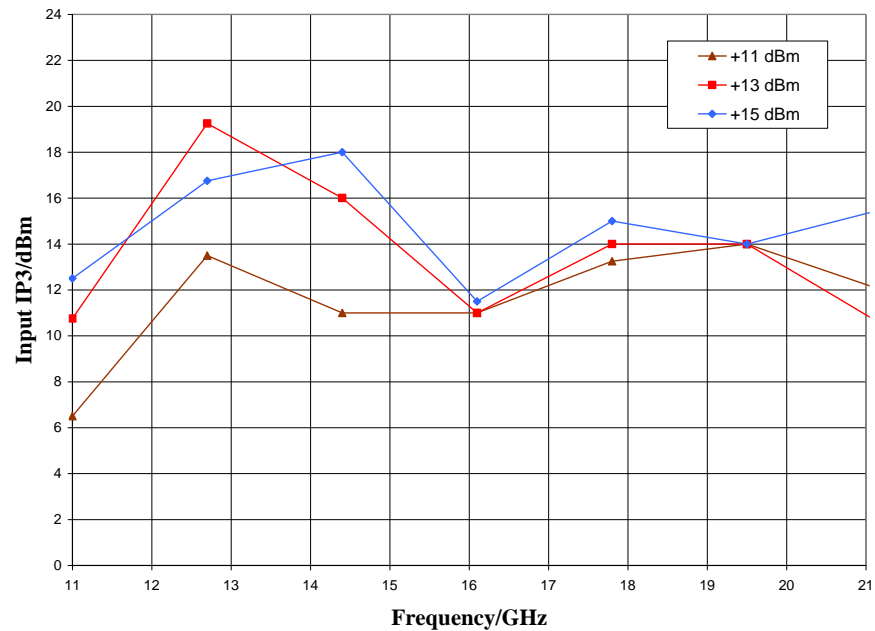


Input IP3 vs. LO Drive, IF = 100 MHz

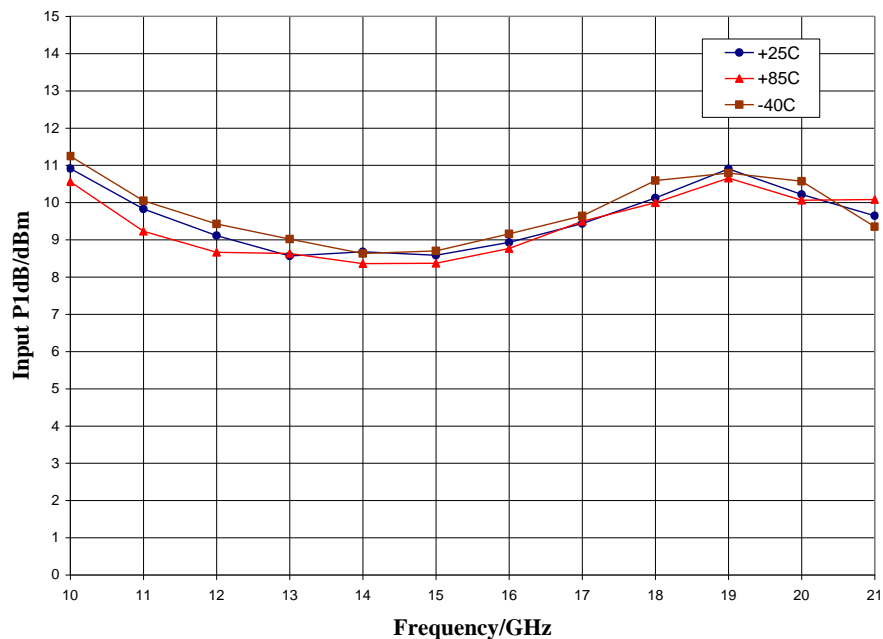


## Typical Performance

Upconverter Performance, Input IP3 vs. LO Drive, IF Input = 500 MHz



Input P1dB vs. Temperature, LO = +13 dBm, IF = 100 MHz USB



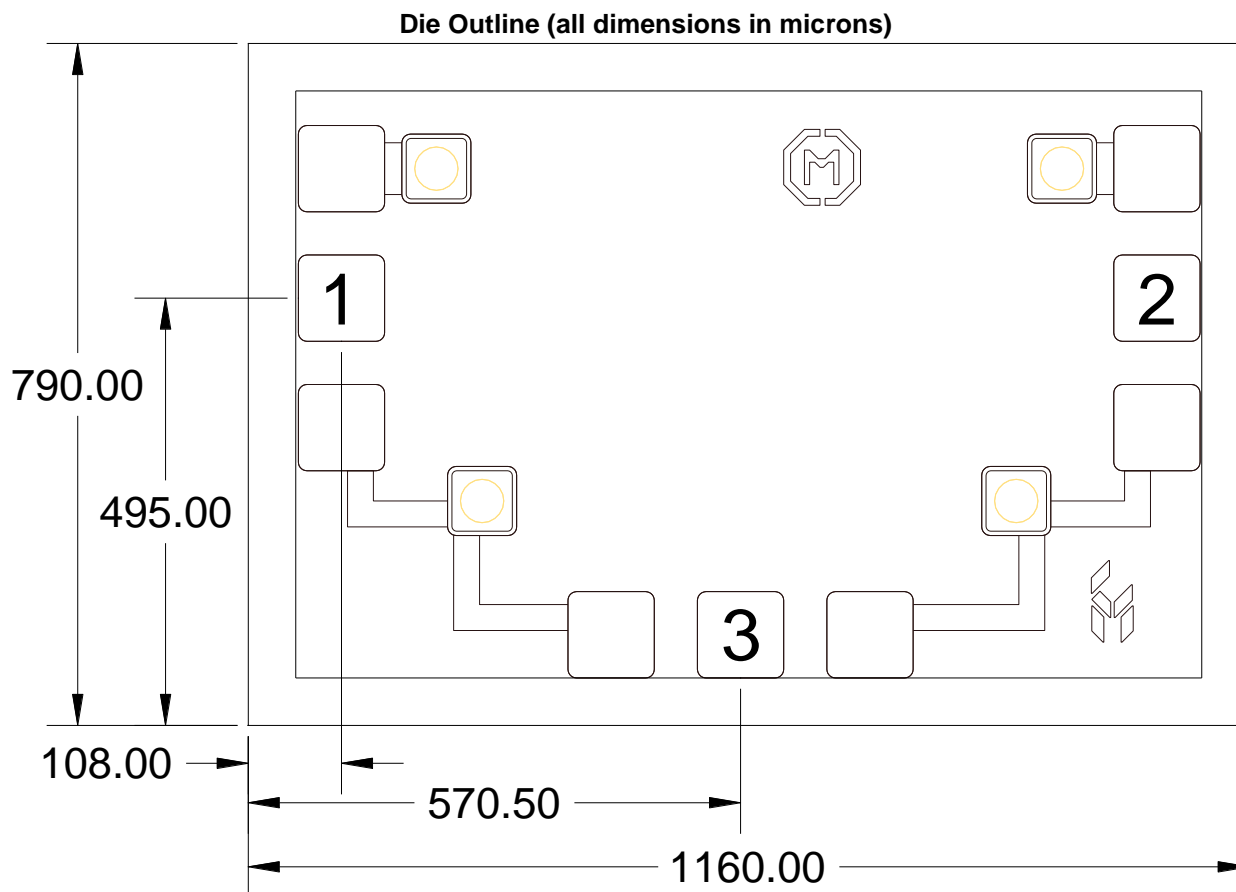
Typical Performance

MxN Spurious Outputs

	nLO				
mRF	0	1	2	3	4
0	xx	25	33	> 90	> 90
1	28	0	47	40	> 90
2	72	64	64	67	75
3	> 90	> 90	> 90	64	> 90
4	> 90	> 90	> 90	> 90	> 90
RF = 15.1 GHz @ -10 dBm LO = 15.0 GHz @ +13 dBm All values in dBc below the IF output power level (1RF - 1LO)					



## Mechanical Information

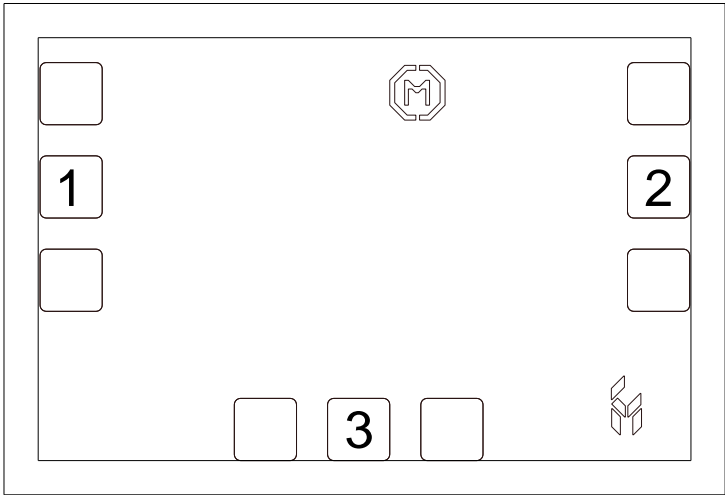


**Notes:**

1. No connection required for unlabeled pads
2. Backside is RF and DC ground
3. Backside and bond pad metal: Gold
4. Die is 100 microns thick
5. All bond pads (1, 2, 3) are 100 x 100 microns square

Pin Description

Pad Diagram



Functional Description

Pin	Function	Description	Schematic
1	LO	This pin is DC coupled and matched to 50 ohms.	
2	RF	This pin is DC coupled and matched to 50 ohms.	
3	IF	This pin is DC coupled. For applications not requiring operation to DC, this port should be DC blocked externally using a series capacitor whose value has been chosen to pass the necessary IF frequency range. For operation to DC, this pin must not source or sink more than 16 mA of current or part non-function or part failure may result.	
Backside	Ground	Connect to RF / DC ground	

## Applications Information

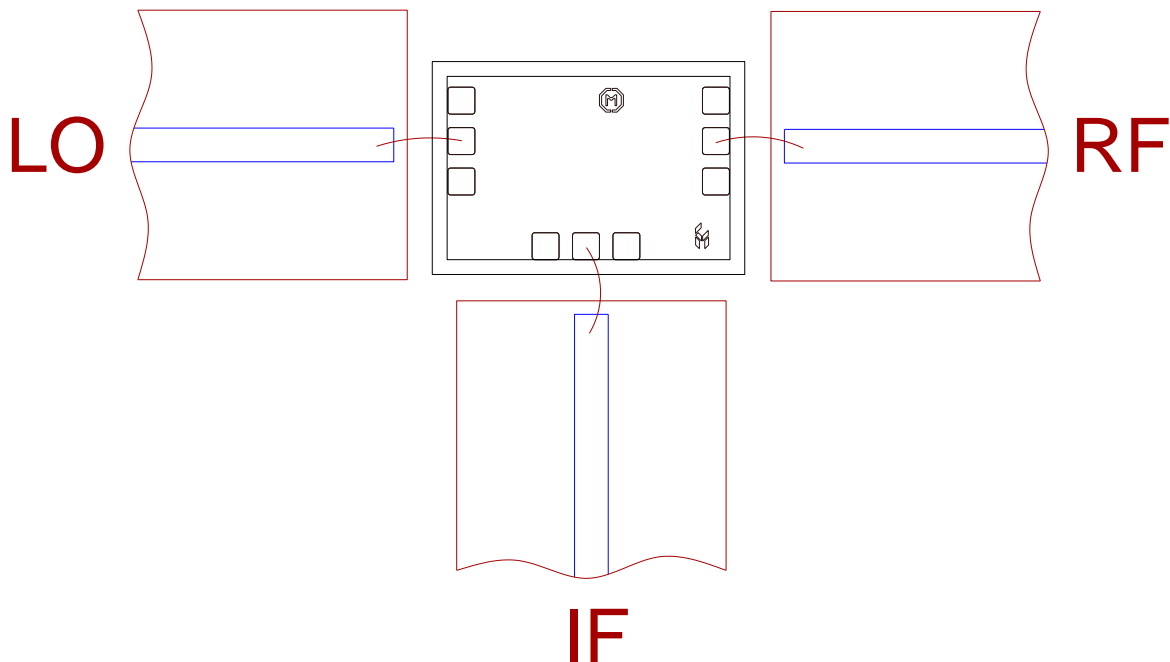
### Assembly Guidelines

The backside of the CMD178 is RF ground. Die attach should be accomplished with electrically and thermally conductive epoxy only. Eutectic attachment is not recommended. Standard assembly procedures should be followed for high frequency devices. The top surface of the semiconductor should be made planar to the adjacent RF transmission lines.

RF connections should be made as short as possible to reduce the inductive effect of the bond wire. Use of a 0.8 mil thermosonic wedge bonding is highly recommended as the loop height will be minimized.

The semiconductor is 100  $\mu\text{m}$  thick and should be handled by the sides of the die or with a custom collet. Do not make contact directly with the die surface as this will damage the monolithic circuitry. Handle with care.

### Assembly Diagram



**GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.**

## Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1A	ESDA / JEDEC JS-001-2012



Caution!  
ESD-Sensitive Device

## RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead Free
- Antimony Free
- TBBP-A (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- SVHC Free
- Halogen Free
- PFOS Free

## Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

**Web:** [www.qorvo.com](http://www.qorvo.com)

**Tel:** 1-844-890-8163

**Email:** [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

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