

# AMF SATCOM AMPLIFIERS

ULTRA LOW NOISE LNAs



- S-BAND
- C-BAND
- X-BAND
- Ku-BAND
- Ka-BAND



Introduction



S-Band



C-Band



X-Band



Ku-Band



Ka-Band



40 – 60 GHz Low Noise



Outline Drawings

# TABLE OF CONTENTS

CONTENTS	PAGE
<b>INTRODUCTION</b>	
Technology	3
Waveguide Designations	3
Noise Temperature, Noise Figure and Noise Factor	3
Cascaded Noise Figure	4
Noise Temperature vs. Noise Figure	4
<b>AMFW ULTRA LOW NOISE S-BAND WAVEGUIDE LNAs</b>	
Features and Options	5
Electrical Specifications	6
Outline Drawing	7
Ordering Information, Typical Applications	8
<b>AMFW ULTRA LOW NOISE C-BAND WAVEGUIDE LNAs</b>	
Features and Options	9
Electrical Specifications	10
Outline Drawing	11
Ordering Information, Typical Applications	12
Noise Temperature vs. Ambient Temperature	14
<b>AMFW ULTRA LOW NOISE X-BAND WAVEGUIDE LNAs</b>	
Features and Options	15
Electrical Specifications	16
Outline Drawing	17
Ordering Information, Typical Applications	18
Noise Temperature vs. Ambient Temperature	20
<b>AMFW ULTRA LOW NOISE Ku-BAND WAVEGUIDE LNAs</b>	
Features and Options	21
Electrical Specifications	22
Outline Drawing	23
Ordering Information, Typical Applications	24
Noise Temperature vs. Ambient Temperature	26
<b>AMFW ULTRA LOW NOISE Ka-BAND WAVEGUIDE LNAs</b>	
Features and Options	27
Electrical Specifications	28
Outline Drawing	29
Ordering Information, Typical Applications	30
<b>ADDITIONAL WAVEGUIDE AMPLIFIERS</b>	31
<b>40 TO 60 GHz LOW-NOISE AMPLIFIERS</b>	32
<b>OUTLINE DRAWINGS</b>	33
<b>FLANGE OUTLINE DRAWINGS</b>	42
<b>AMFW AMPLIFIER INSTALLATION INSTRUCTIONS</b>	44
<b>ISO 9001:2000</b>	45
<b>GENERAL INFORMATION</b>	45
<b>WARRANTY</b>	46

## TECHNOLOGY

MITEQ's AMF Series of SATCOM amplifiers capitalize on technology developed at MITEQ during the past 37 years. This technology had been mainly in support of the radiometry community providing state-of-the-art low noise amplifier designs. Based upon a hybrid Microwave-Integrated-Circuit (MIC) approach, MITEQ utilizes chip-and-wire-construction to minimize losses to the input stage, as well as supporting the subtle adjustments needed to achieve the optimum match for VSWR and noise figure. The chip-and-wire-construction allows MITEQ the ability to do non-standard bands to meet the customers unique requirements.

MITEQ's SATCOM amplifiers are offered with and without the use of input isolators. In both cases, feedback is the technique used in the input stage to facilitate impedance matching for an optimum balance of power (VSWR) and noise figure.

## WAVEGUIDE DESIGNATIONS

EIA DESIGNATION	RCSC DESIGNATION	FREQUENCY RANGE
WR650	WG6	1.12 to 1.70 GHz
WR430	WG8	1.70 to 2.60 GHz
WR340	WG9A	2.10 to 3.00 GHz
WR284	WG10	2.60 to 3.95 GHz
WR229	WG11A	3.30 to 4.90 GHz
WR187	WG12	3.95 to 5.85 GHz
WR159	WG13	4.90 to 7.05 GHz
WR137	WG14	5.85 to 8.20 GHz
WR112	WG15	7.05 to 10 GHz
WR90	WG16	8.20 to 12.4 GHz
WR75	WG17	10 to 15 GHz
WR62	WG18	12.4 to 18 GHz
WR51	WG19	15 to 22 GHz
WR42	WG20	18 to 26.5 GHz
WR28	WG22	25.5 to 40 GHz
WR22	WG23	33 to 50 GHz
WR19	WG24	40 to 60 GHz
WR15	WG25	50 to 75 GHz
WR12	WG26	60 to 90 GHz
WR10	WG27	75 to 110 GHz
WR8	WG28	90 to 140 GHz
WR6	N/A	110 to 170 GHz
WR5	N/A	140 to 220 GHz
WR3	N/A	220 to 325 GHz
WRD180	N/A	18 to 40 GHz

## NOISE TEMPERATURE, NOISE FIGURE AND NOISE FACTOR

The basic formulas are:

$$\text{Noise Factor (F)} = \text{SNR}_i / \text{SNR}_o = (\text{Signal}_{\text{input}} / \text{Noise}_{\text{input}}) / (\text{Signal}_{\text{output}} / \text{Noise}_{\text{output}})$$

$$\text{Noise Figure (NF)} = 10 \times \log (\text{Noise Factor}) \quad [\text{in dB}]$$

$$\text{Noise Temperature (T)} = 290 \times 10^{(\text{Noise Figure}/10)-1} \quad [\text{in K}]$$

Note: Log must be to base 10. When using calculators and spreadsheets, make sure that base 10 is selected. As a test,  $10 \times \log(2)$  should give an answer of +3 dB.

## CASCADED NOISE FIGURE

The basic formula is:

$$\text{Noise Figure}_{\text{total}} = \text{NF}_1 + (\text{NF}_2 - 1) / G_1 + (\text{NF}_3 - 1) / G_1 G_2 + \dots$$

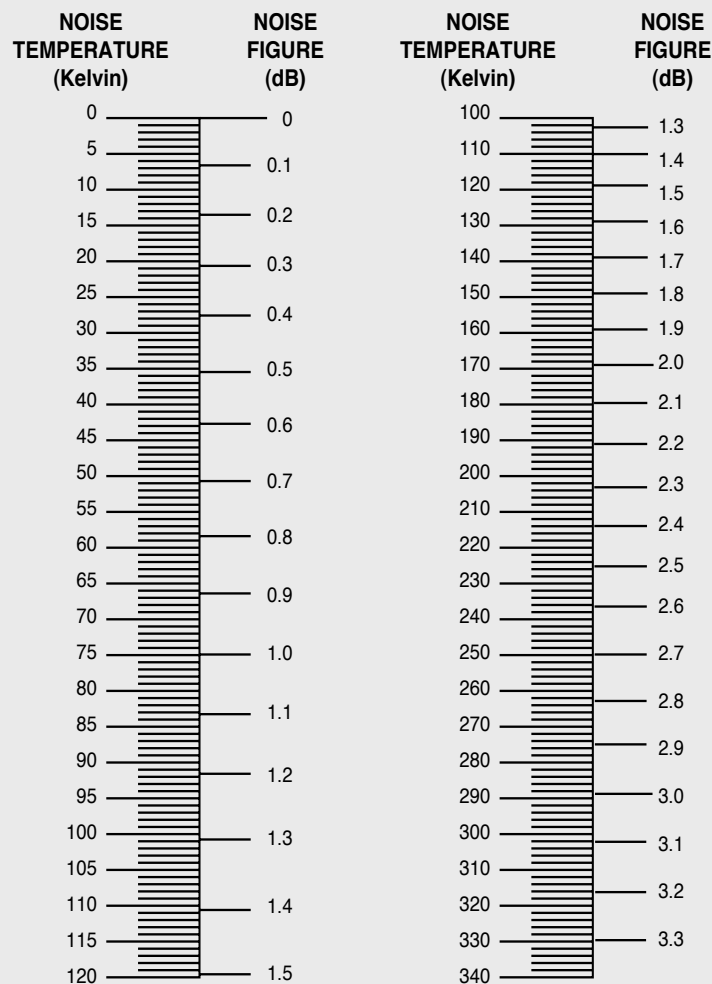
where

- $G_1$  and  $\text{NF}_1$  are the gain and noise figure of the first amplifier in the cascade.
- $G_2$  and  $\text{NF}_2$  are the gain and noise figure of the second amplifier in the cascade.
- $\text{NF}_3$  is the noise figure of the third amplifier in the cascade.

It should be noted that the noise figure contributions of any components after the first amplifier stage will be negligible if that first-stage amplifier has sufficiently high gain.

If a passive device (one with loss) is included in the cascade, the insertion loss of the device would be inserted into the formula as value less than 1 (minus value in dB). Also, the noise figure of the device would be equal to the inverse of the gain (positive value in dB).

## NOISE TEMPERATURE VERSUS NOISE FIGURE



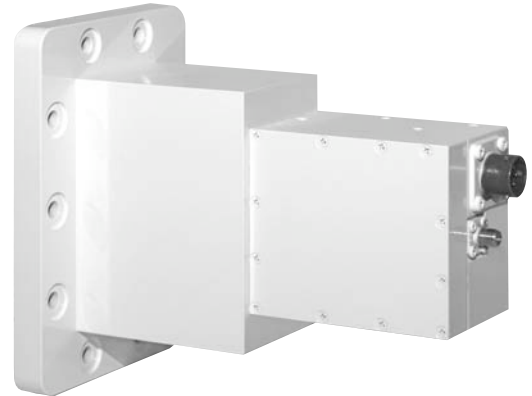
## AMFW ULTRA LOW NOISE S-BAND WAVEGUIDE LNAs

### FEATURES

- Noise temperatures as low as 30 K
- Internal regulation and reverse voltage protection
- CPR340F input waveguide and SMA female output
- Fully weatherproof
- Compliant vs. MIL-STD-810E for Salt/Fog
- Two-year product warranty
- Pressurizable waveguide

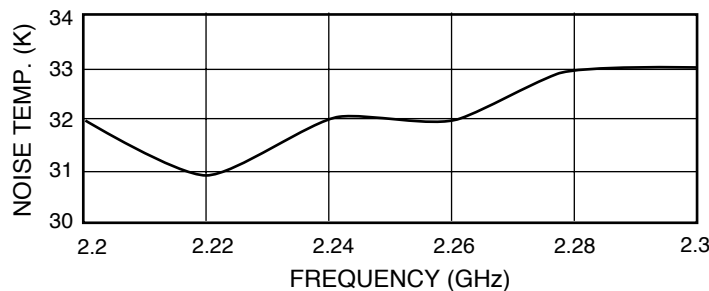
### OPTIONS

- Fault alarm circuitry
  - Form-C, contact closure
  - Fully integrated
- DC bias applied through the RF output
- 110/220 VAC internal power supplies
  - Fully integrated
  - CE certified
- DC bias of -24 VDC
- Higher output powers
  - P1 dB of +15 dBm, min.; OIP3 of +25 dBm, min.
  - P1 dB of +20 dBm, min.; OIP3 of +30 dBm, min.
  - P1 dB of +23 dBm, min.; OIP3 of +33 dBm, min.
- Improved gain variation vs. temperature
  - 3 dB, P-P, max.
- N-type female RF output connector
- CPR430F input waveguide
  - Requires a change in outline drawing
  - Please consult factory for details
- Input limiter protection up to 2 watts CW
  - Please consult factory for details
- Customer specified gain windows
  - Please consult factory for details



MITEQ's AMFW catalog line of SATCOM waveguide amplifiers utilizes PHEMTs offering the lowest noise figures available in the various frequency bands associated with S-band satellite communication. Achieving noise temperatures as low as 30 K, these amplifiers have been designed using state-of-the-art technology and can be used in either fixed or transportable applications. The high-reliability design of these S-band amplifiers allows MITEQ to offer a standard two-year warranty on units that consistently experience the harsh environments involved with satellite base-station operation.

**TYPICAL NOISE TEMPERATURE DATA  
MODEL AMFW-5F-022023-05-10P**



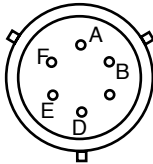
## AMFW ULTRA LOW NOISE S-BAND WAVEGUIDE LNAs

### ELECTRICAL SPECIFICATIONS

PARAMETERS	NOTES	MINIMUM	NOMINAL/TYPICAL	MAXIMUM
Standard frequency options		2.1 GHz 2.2 GHz 2.2 GHz		2.4 GHz 2.3 GHz 2.4 GHz
Standard gain options		70 dB 60 dB 50 dB 40 dB	72 dB 64 dB 54 dB 44 dB	
Gain flatness	Full band per 40 MHz		0.7 dB, P-P 0.3 dB, P-P	1 dB, P-P 0.4 dB, P-P
Gain variation vs. temperature (-40 to +60°C)	Standard Option -TC		4.25 dB, P-P 2.5 dB, P-P	5 dB, P-P 3 dB, P-P
Gain stability, constant temperature	Short (10 minutes) Medium (24 hours) Long (1 week)			±0.10 dB ±0.20 dB ±0.50 dB
Noise temperature options	At +23°C case temp.		28 K 33 K 38 K 43 K 46 K	30 K 35 K 40 K 45 K 50 K
Input VSWR			1.2:1	1.25:1
Output VSWR			1.35:1	1.5:1
Output power at 1 dB compression	Standard Option -P1 Option -P2 Option -23P	+10 dBm +15 dBm +20 dBm +23 dBm	+13 dBm +18 dBm +23 dBm +25 dBm	
Output third order intercept point	Standard Option -P1 Option -P2 Option -23P	+20 dBm +25 dBm +30 dBm +33 dBm	+23 dBm +28 dBm +32 dBm +34 dBm	
Group delay, per 40 MHz	Linear Parabolic Ripple			0.01 ns/MHz 0.001 ns/MHz <sup>2</sup> 0.3 ns, P-P
AM/PM conversion	-5 dBm output			0.05 dB/°
Max. input without damage				+10 dBm CW
DC voltage requirements		+14.5 VDC	+15 VDC	+28 VDC
DC current	Standard Options -P1 or -P2		175 mA 275 mA	250 mA 425 mA
Temperature range Operating Storage		-40°C -50°C		+60°C +80°C
MTBF	Ground benign		250,000 hours	
Weight	May vary with Options		1400 grams	

# AMFW ULTRA LOW NOISE S-BAND WAVEGUIDE LNAs

## CONNECTOR INFORMATION



### STANDARD LNA

Pin A	+12 VDC to +28 VDC
Pin B	Ground
Pin C	Ground
Pin D	Not Used
Pin E	Not Used
Pin F	Not Used

### LNA WITH POWER SUPPLY

Pin A	110 VAC/220 VAC
Pin B	Ground
Pin C	110 VAC/220 VAC
Pin D	Not Used
Pin E	Not Used
Pin F	Not Used

### LNA WITH FAULT ALARM

Pin A	+15 VDC to +28 VDC
Pin B	Ground
Pin C	Ground
Pin D	Alarm, Normally Open
Pin E	Alarm, Common Connection
Pin F	Alarm, Normally Closed

### LNA WITH ALARM AND SUPPLY

Pin A	110 VAC/220 VAC
Pin B	Ground
Pin C	110 VAC/220 VAC
Pin D	Alarm, Normally Open
Pin E	Alarm, Common Connection
Pin F	Alarm, Normally Closed

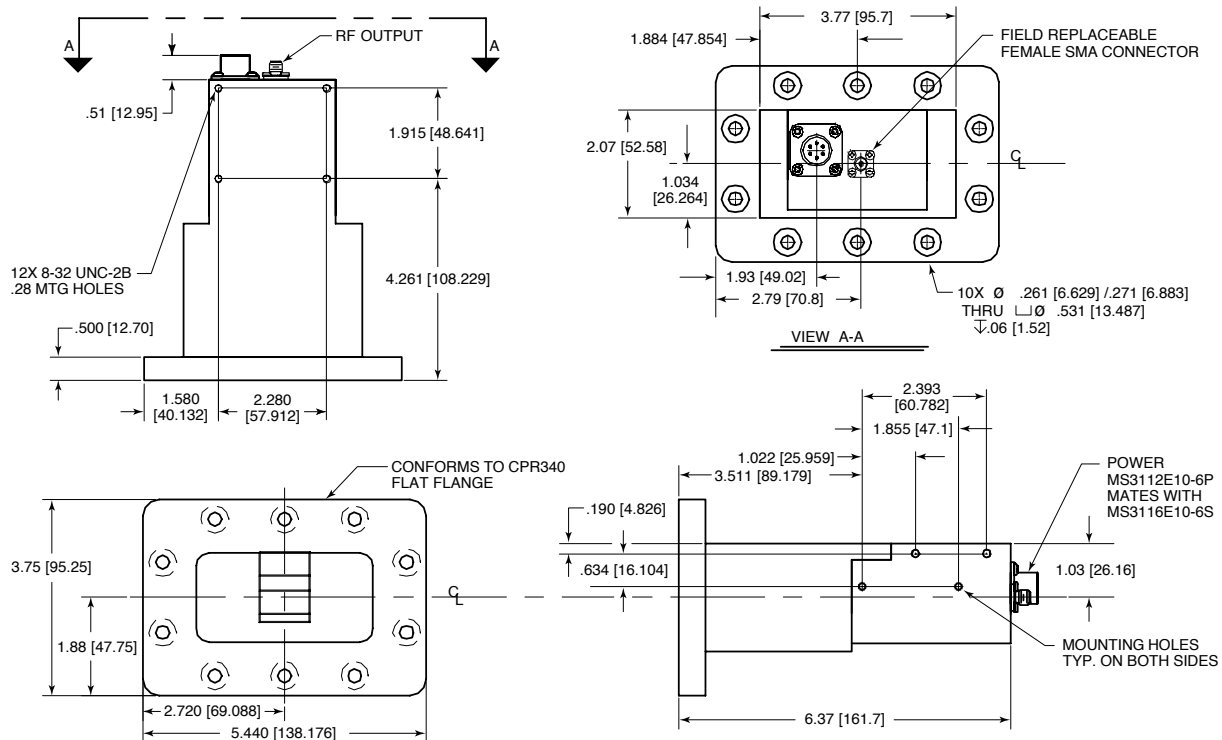
### FAULT ALARM

MITEQ's AMFW Series SATCOM LNAs Fault Alarm Option (-F) consists of a closed contact non-latching relay with status pins on the MS3112E10-6P connector. The fault alarm is set to alarm when the current draw of the AMFW SATCOM LNA exceeds a nominal window range, which is precision set at the factory. In normal operating conditions, the relay is normally open across Pins D and E, and closed across Pins E and F. In the fault-state, the relay is closed across Pins D and E, and open across Pins E and F. The fault alarm will return to a no-fault state if the LNAs current returns to within the nominal window range. Typical switching time is <5 msec. The relay contacts are rated for 1A maximum at room temperature.

Part Number : MS3112E10-6P (Mating MS3116F10-6S provided with each LNA.)

## OUTLINE DRAWING

159554



Note: Dimensions shown in brackets [ ] are in millimeters.

# AMFW ULTRA LOW NOISE S-BAND WAVEGUIDE LNAs

## AVAILABLE OPTIONS

Fault alarm .....Add suffix -F\*  
 DC bias through the RF output  
 with DC connector .....Add suffix -C  
 DC bias through the RF output  
 without DC connector .....Add suffix -CP  
 Solder bias pin .....Add suffix -B  
 110 VAC/220 VAC operation .....Add suffix -O\*  
 DC power supply at -24 VDC .....Add suffix -NEG\*  
 Output P1 dB of +15 dBm .....Add suffix -P1  
 Output P1 dB of +20 dBm .....Add suffix -P2  
 Output P1 dB of +23 dBm .....Add suffix -23P  
 3 dB, P-P, gain change vs. temperature .....Add suffix -TC  
 N-type female output connector .....Add suffix -N  
 CPR430F input waveguide .....Add suffix -430F\*\*  
 Limiter .....Add suffix -L\*\*\*

\* Specifications compliant temperature range limited to -15 to +60°C.

\*\* Outline drawing changes to 148029.

\*\*\* Limiter adds loss and increases noise temperature.

## OTHER AVAILABLE OPTIONS (Call factory for details)

Customer specified frequency ranges

Customer specified gain windows

Phase matching

Amplitude matching

Front-end protection (input limiter)

### Example:

Model Number ..... AMFW-7S-0210024-35-F-L

Operating frequency range ..... 2.1–2.4 GHz

Noise temperature ..... 35°K

Gain ..... 60 dB

Options ..... Internal limiter and fault alarm

## ORDERING INFORMATION

**AMFW-xx-xxxxxxxxxx-xx**

### Minimum Gain Designation (dB)

5S = 40

6S = 50

7S = 60

8S = 70

### Frequency Designation (GHz)

02100240 = 2.1 – 2.4

02200230 = 2.2 – 2.3

02200240 = 2.2 – 2.4

### Maximum Noise Temperature (K)

30 = 30

35 = 35

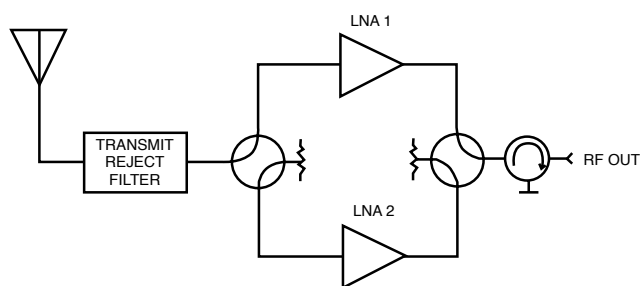
40 = 40

45 = 45

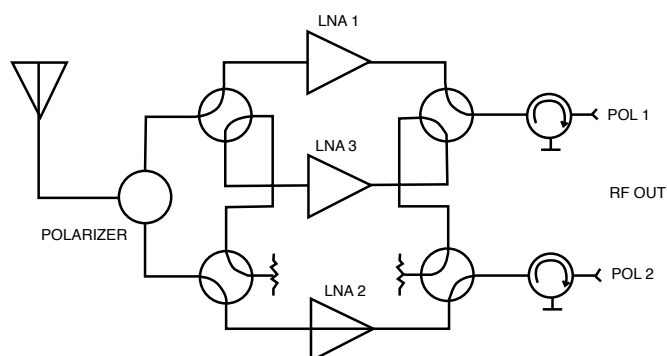
50 = 50

## TYPICAL APPLICATIONS

### 1:1 Redundant Systems



### 1:2 Redundant Systems





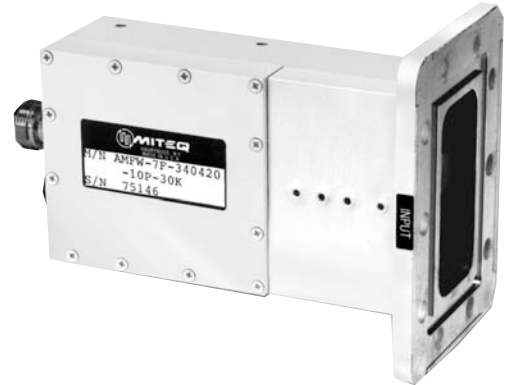
## AMFW ULTRA LOW NOISE C-BAND WAVEGUIDE LNAs

### FEATURES

- Noise temperatures as low as 28 K
- Internal regulation and reverse voltage protection
- CPR229G grooved input and N-type female output
- Fully weatherproof
- Compliant vs. MIL-STD-810E for Salt/Fog
- Two-year product warranty
- Pressurizable waveguide

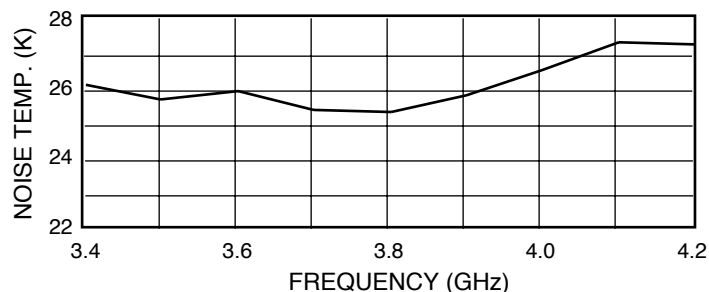
### OPTIONS

- Fault alarm circuitry
  - Form-C, contact closure
  - Fully integrated
- DC bias applied through the RF output
- 110/220 VAC internal power supplies
  - Fully integrated
  - CE certified
- DC bias of -24 VDC
- Higher output powers
  - P1 dB of +15 dBm, min.; OIP3 of +25 dBm, min.
  - P1 dB of +20 dBm, min.; OIP3 of +30 dBm, min.
  - P1 dB of +23 dBm, min.; OIP3 of +33 dBm, min.
- Improved gain variation vs. temperature
  - 3 dB, P-P, max.
- SMA female RF output connector
- Integrated transmit/reject filter
  - Upper band edge at 4.2 GHz
  - Rejection of 20 dB, min., at 5.2 GHz
- Input limiter protection up to 25 watts CW
  - Please consult factory for details
- Customer specified gain windows
  - Please consult factory for details



MITEQ's AMFW catalog line of SATCOM waveguide amplifiers utilizes PHEMTs offering the lowest noise figures available in the various frequency bands associated with C-band satellite communication. Achieving noise temperatures as low as 28 K, these amplifiers have been designed using state-of-the-art technology and can be used in either fixed or transportable applications. The high-reliability design of these C-band amplifiers allows MITEQ to offer a standard two-year warranty on units that consistently experience the harsh environments involved with satellite base-station operation.

**TYPICAL NOISE TEMPERATURE DATA  
MODEL AMFW-7S-340420-28**



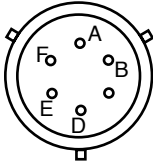
## AMFW ULTRA LOW NOISE C-BAND WAVEGUIDE LNAs

### ELECTRICAL SPECIFICATIONS

PARAMETERS	NOTES	MINIMUM	NOMINAL/TYPICAL	MAXIMUM
Standard frequency options		3.4 GHz 3.4 GHz 3.6 GHz 4.0 GHz 4.4 GHz		4.2 GHz 4.8 GHz 4.2 GHz 4.8 GHz 4.8 GHz
Standard gain options		70 dB 60 dB 50 dB 40 dB	72 dB 64 dB 54 dB 44 dB	
Gain flatness	Full band per 40 MHz		0.7 dB, P-P 0.3 dB, P-P	1 dB, P-P 0.4 dB, P-P
Gain variation vs. temperature (-40 to +60°C)	Standard Option -TC		4.25 dB, P-P 2.5 dB, P-P	5 dB, P-P 3 dB, P-P
Gain stability, constant temperature	Short (10 minutes) Medium (24 hours) Long (1 week)			±0.10 dB ±0.20 dB ±0.50 dB
Noise temperature options	At +23°C case temp.		26 K 28 K 33 K 38 K 43 K	28 K 30 K 35 K 40 K 45 K
Input VSWR			1.2:1	1.25:1
Output VSWR			1.35:1	1.5:1
Output power at 1 dB compression	Standard Option -P1 Option -P2 Option -23P	+10 dBm +15 dBm +20 dBm +23 dBm	+13 dBm +18 dBm +23 dBm +25 dBm	
Output third order intercept point	Standard Option -P1 Option -P2 Option -23P	+20 dBm +25 dBm +30 dBm +33 dBm	+23 dBm +28 dBm +32 dBm +34 dBm	
Group delay, per 40 MHz	Linear Parabolic Ripple			0.01 ns/MHz 0.001 ns/MHz <sup>2</sup> 0.3 ns, P-P
AM/PM conversion	-5 dBm output			0.05 dB/°
Max. input without damage				+10 dBm CW
DC voltage requirements		+12 VDC	+15 VDC	+28 VDC
DC current	Standard Options -P1 or -P2		175 mA 275 mA	250 mA 425 mA
Temperature range Operating Storage		-40°C -50°C		+60°C +80°C
MTBF	Ground benign		250,000 hours	
Weight	May vary with Options		600 grams	

# AMFW ULTRA LOW NOISE C-BAND WAVEGUIDE LNAs

## CONNECTOR INFORMATION



### STANDARD LNA

Pin A	+12 VDC to +28 VDC
Pin B	Ground
Pin C	Ground
Pin D	Not Used
Pin E	Not Used
Pin F	Not Used

### LNA WITH POWER SUPPLY

Pin A	110 VAC/220 VAC
Pin B	Ground
Pin C	110 VAC/220 VAC
Pin D	Not Used
Pin E	Not Used
Pin F	Not Used

### LNA WITH FAULT ALARM

Pin A	+15 VDC to +28 VDC
Pin B	Ground
Pin C	Ground
Pin D	Alarm, Normally Open
Pin E	Alarm, Common Connection
Pin F	Alarm, Normally Closed

### LNA WITH ALARM AND SUPPLY

Pin A	110 VAC/220 VAC
Pin B	Ground
Pin C	110 VAC/220 VAC
Pin D	Alarm, Normally Open
Pin E	Alarm, Common Connection
Pin F	Alarm, Normally Closed

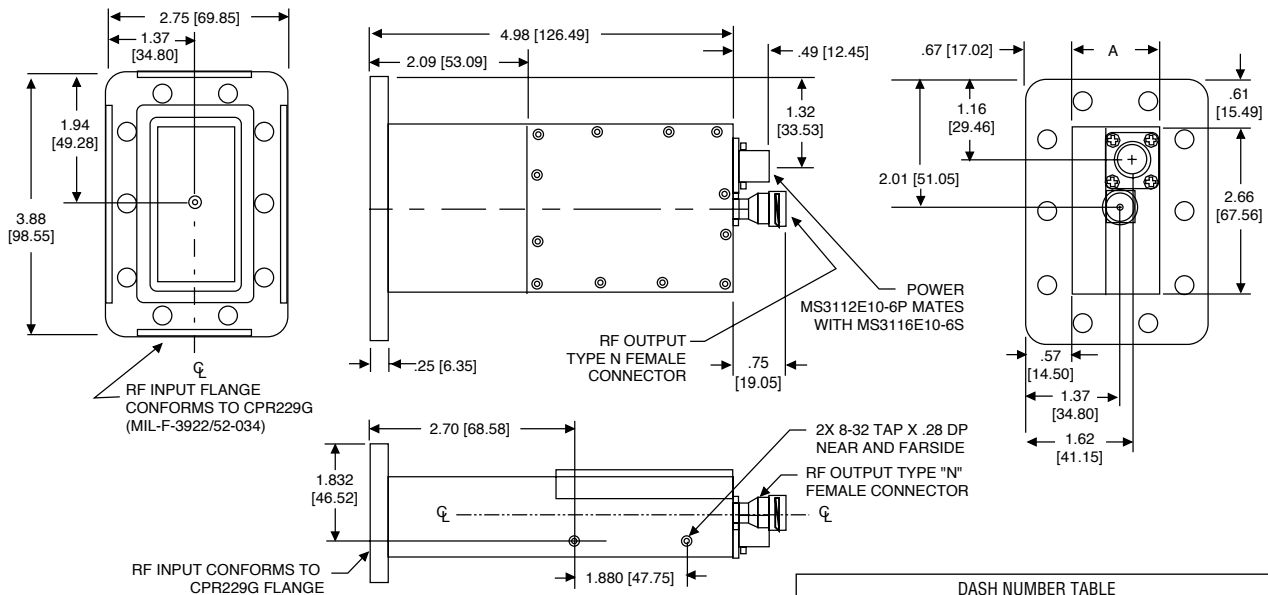
### FAULT ALARM

MITEQ's AMFW Series SATCOM LNAs Fault Alarm Option (-F) consists of a closed contact non-latching relay with status pins on the MS3112E10-6P connector. The fault alarm is set to alarm when the current draw of the AMFW SATCOM LNA exceeds a nominal window range, which is precision set at the factory. In normal operating conditions, the relay is normally open across Pins D and E, and closed across Pins E and F. In the fault-state, the relay is closed across Pins D and E, and open across Pins E and F. The fault alarm will return to a no-fault state if the LNAs current returns to within the nominal window range. Typical switching time is <5 msec. The relay contacts are rated for 1A maximum at room temperature.

Part Number : MS3112E10-6P (Mating MS3116F10-6S provided with each LNA.)

## OUTLINE DRAWING

125063



#### Notes:

- Standard unit as shown, flat flange is optional.
- SMA field replaceable connector option available.
- As an option, a flat cover plate can be used to replace the multi-pin connector when a bias-tee is installed.

#### Note:

Dimensions shown in brackets [ ] are in millimeters.

DASH NUMBER TABLE			
DASH NO.	DIM. A	OPTION P/N SUFFIX	DESCRIPTION
-1	1.59 [40.39]	N/A	Standard LNA
-1	1.59 [40.39]	-F	LNA with Optional Fault Alarm
-2	2.30 [58.42]	-O	LNA with Optional 100-240 VAC Power Supply
-2	2.30 [58.42]	-O, -F	LNA with Optional Fault Alarm and 100-240 VAC Power Supply

# AMFW ULTRA LOW NOISE C-BAND WAVEGUIDE LNAs

## AVAILABLE OPTIONS

Fault alarm .....Add suffix -F\*  
 DC bias through the RF output  
 with DC connector .....Add suffix -C  
 DC bias through the RF output  
 without DC connector .....Add suffix -CP  
 Solder bias pin .....Add suffix -B  
 110 VAC / 220 VAC operation .....Add suffix -O\*  
 DC power supply at -24 VDC .....Add suffix -NEG\*  
 Output P1 dB of +15 dBm .....Add suffix -P1  
 Output P1 dB of +20 dBm .....Add suffix -P2  
 Output P1 dB of +23 dBm .....Add suffix -23P  
 3 dB, P-P, gain change vs. temperature .....Add suffix -TC  
 SMA female output connector .....Add suffix -SMA  
 Internal transmit/reject filter .....Add suffix -TRF\*\*  
 Limiter .....Add suffix -L\*\*\*

\* Specifications compliant temperature range limited  
 to -15 to +60°C.

\*\* Rejection of 20 dB, min., above 5.2 GHz.

\*\*\* Limiter adds loss and increases noise temperature.

## OTHER AVAILABLE OPTIONS (Call factory for details)

Customer specified frequency ranges

Customer specified gain windows

Phase matching

Amplitude matching

Front-end protection (input limiter)

### Example:

Model Number ..... AMFW-6S-03600420-35-F

Operating frequency range ..... 3.6–4.2 GHz

Noise temperature ..... 35°K

Gain ..... 50 dB

Option ..... Fault alarm

## ORDERING INFORMATION

**AMFW-xx-xxxxxxxx-xx**

### Minimum Gain Designation (dB)

5S = 40

6S = 50

7S = 60

8S = 70

### Frequency Designation (GHz)

03400420 = 3.4 – 4.2

03400480 = 3.4 – 4.8

03600420 = 3.6 – 4.2

04000480 = 4.0 – 4.8

04400480 = 4.4 – 4.8

### Maximum Noise Temperature (K)

28 = 28

30 = 30

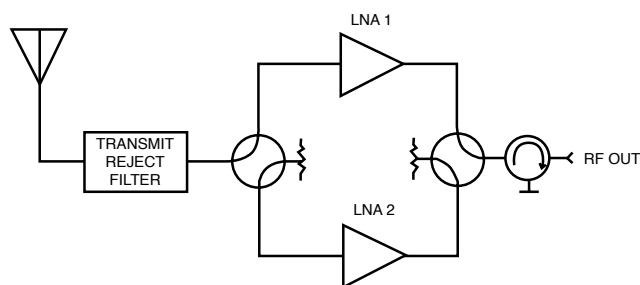
35 = 35

40 = 40

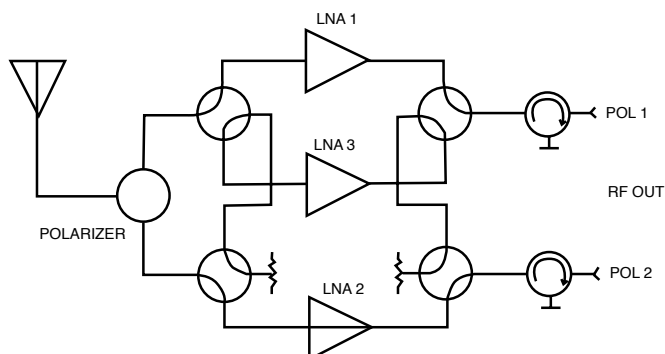
45 = 45

## TYPICAL APPLICATIONS

### 1:1 Redundant Systems



### 1:2 Redundant Systems



## **AMFW C-Band Amplifier Noise Temperature vs. Ambient Temperature**

Noise temperature vs. ambient temperature for an AMFW C-band amplifier can be approximated by the equation:

$$(NT_2 / NT_1) = (T_2 / T_1)^{1.5}$$

where:

$NT_2$  = Noise Temperature at Case Temperature 2

$NT_1$  = Noise Temperature at Case Temperature 1

$T_2$  = Case Temperature 2 in °K

$T_1$  = Case Temperature 1 in °K

(The conversion is °K = °C + 273)

For the condition where the initial case temperature is at +23°C ( $T_1 = 296^\circ\text{K}$ ), the ratio  $NT_2/NT_1$  can be summarized by the following table:

<b>AMBIENT TEMPERATURE, <math>T_2</math> (in °C)</b>	<b>RATIO <math>NT_2 / NT_1</math></b>
0	0.89
+23	1.00
+40	1.09
+50	1.14
+60	1.19

### **EXAMPLE**

- An AMFW C-band amplifier is specified to have a noise temperature of 30°K when the case temperature is at +23°C.
- What is the noise temperature when the case temperature is at +50°C?  
From the table,  $NT_2/NT_1$  at +50°C is 1.14.  
 $NT_2 = 1.14 \times 30^\circ\text{K} = 34.2^\circ\text{K}$  at +50°C case temperature

## AMFW ULTRA LOW NOISE X-BAND WAVEGUIDE LNAs

### FEATURES

- Noise temperatures as low as 45 K
- Internal regulation and reverse voltage protection
- CPR112G grooved input and SMA-female output
- Fully weatherproof
- Compliant vs. MIL-STD-810E for Salt/Fog
- Two-year product warranty
- Pressurizable waveguide

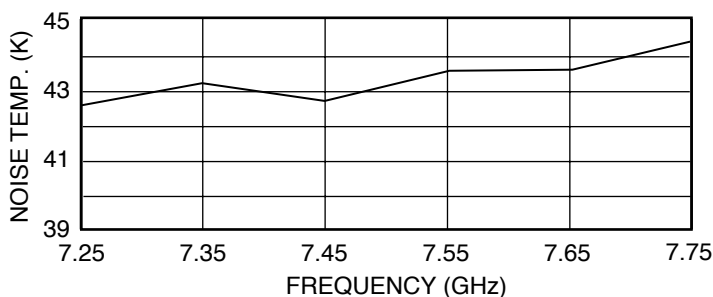
### OPTIONS

- Fault alarm circuitry
  - Form-C, contact closure
  - Fully integrated
- DC bias applied through the RF output
- 110/220 VAC internal power supplies
- Fully integrated
- CE certified
- DC bias of -24 VDC
- Higher output powers
  - P1 dB of +15 dBm, min.; OIP3 of +25 dBm, min.
  - P1 dB of +20 dBm, min.; OIP3 of +30 dBm, min.
  - P1 dB of +23 dBm, min.; OIP3 of +33 dBm, min.
- Improved gain variation vs. temperature
  - 3 dB, P-P, max.
- N-type female RF output connector
- Integrated transmit/reject filter
  - Requires a change in outline drawing
  - Rejection of 40 dB, min., from 4 to 6.9 GHz
  - Rejection of 30 dB, min., at 7 and 7.9 GHz
  - Rejection of 40 dB, min., from 8 to 12 GHz
- Input limiter protection up to 25 watts CW
  - Please consult factory for details
- Customer specified gain windows
  - Please consult factory for details



MITEQ's AMFW catalog line of SATCOM waveguide amplifiers utilizes PHEMTs offering the lowest noise figures available in the various frequency bands associated with X-band satellite communication. Achieving noise temperatures as low as 45 K, these amplifiers have been designed using state-of-the-art technology and can be used in either fixed or transportable applications. The high-reliability design of these X-band amplifiers allows MITEQ to offer a standard two-year warranty on units that consistently experience the harsh environments involved with satellite base-station operation.

**TYPICAL NOISE TEMPERATURE DATA  
MODEL AMFW-7S-725775-45**



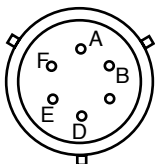
## AMFW ULTRA LOW NOISE X-BAND WAVEGUIDE LNAs

### ELECTRICAL SPECIFICATIONS

PARAMETERS	NOTES	MINIMUM	NOMINAL/TYPICAL	MAXIMUM
Standard frequency options		7.10 GHz 7.10 GHz 7.25 GHz 7.25 GHz 8.00 GHz		7.75 GHz 8.40 GHz 7.75 GHz 8.40 GHz 8.40 GHz
Standard gain options		70 dB 60 dB 50 dB 40 dB	72 dB 64 dB 54 dB 44 dB	
Gain flatness	Full band per 40 MHz		1.4 dB, P-P 0.3 dB, P-P	2 dB, P-P 0.4 dB, P-P
Gain variation vs. temperature (-40 to +60°C)	Standard Option -TC		4.4 dB, P-P 2.65 dB, P-P	5 dB, P-P 3 dB, P-P
Gain stability, constant temperature	Short (10 minutes) Medium (24 hours) Long (1 week)			±0.10 dB ±0.20 dB ±0.50 dB
Noise temperature options at +23°C case temperature	7.25 – 7.75 GHz All frequency ranges		44 K 48 K 52 K 57 K 62 K	45 K 50 K 55 K 60 K 65 K
Input VSWR	7.25 – 7.75 GHz All frequencies		1.22:1 1.36:1	1.25:1 1.5:1
Output VSWR			1.4:1	1.5:1
Output power at 1 dB compression	Standard Option -P1 Option -P2 Option -23P	+10 dBm +15 dBm +20 dBm +23 dBm	+13 dBm +18 dBm +23 dBm +25 dBm	
Output third order intercept point	Standard Option -P1 Option -P2 Option -23P	+20 dBm +25 dBm +30 dBm +33 dBm	+23 dBm +28 dBm +32 dBm +34 dBm	
Group delay, per 40 MHz	Linear Parabolic Ripple			0.01 ns/MHz 0.001 ns/MHz <sup>2</sup> 0.3 ns, P-P
AM/PM conversion	-5 dBm output			0.05 dB/°
Max. input without damage				+10 dBm CW
DC voltage requirements		+12 VDC	+15 VDC	+28 VDC
DC current	Standard Options -P1 or -P2		195 mA 345 mA	275 mA 475 mA
Temperature range Operating Storage		-40°C -50°C		+60°C +80°C
MTBF	Ground benign		250,000 hours	
Weight	May vary with Options		450 grams	

# AMFW ULTRA LOW NOISE X-BAND WAVEGUIDE LNAs

## CONNECTOR INFORMATION



### STANDARD LNA

Pin A	+12 VDC to +28 VDC
Pin B	Ground
Pin C	Ground
Pin D	Not Used
Pin E	Not Used
Pin F	Not Used

### LNA WITH POWER SUPPLY

Pin A	110 VAC/220 VAC
Pin B	Ground
Pin C	110 VAC/220 VAC
Pin D	Not Used
Pin E	Not Used
Pin F	Not Used

### LNA WITH FAULT ALARM

Pin A	+15 VDC to +28 VDC
Pin B	Ground
Pin C	Ground
Pin D	Alarm, Normally Open
Pin E	Alarm, Common Connection
Pin F	Alarm, Normally Closed

### LNA WITH ALARM AND SUPPLY

Pin A	110 VAC/220 VAC
Pin B	Ground
Pin C	110 VAC/220 VAC
Pin D	Alarm, Normally Open
Pin E	Alarm, Common Connection
Pin F	Alarm, Normally Closed

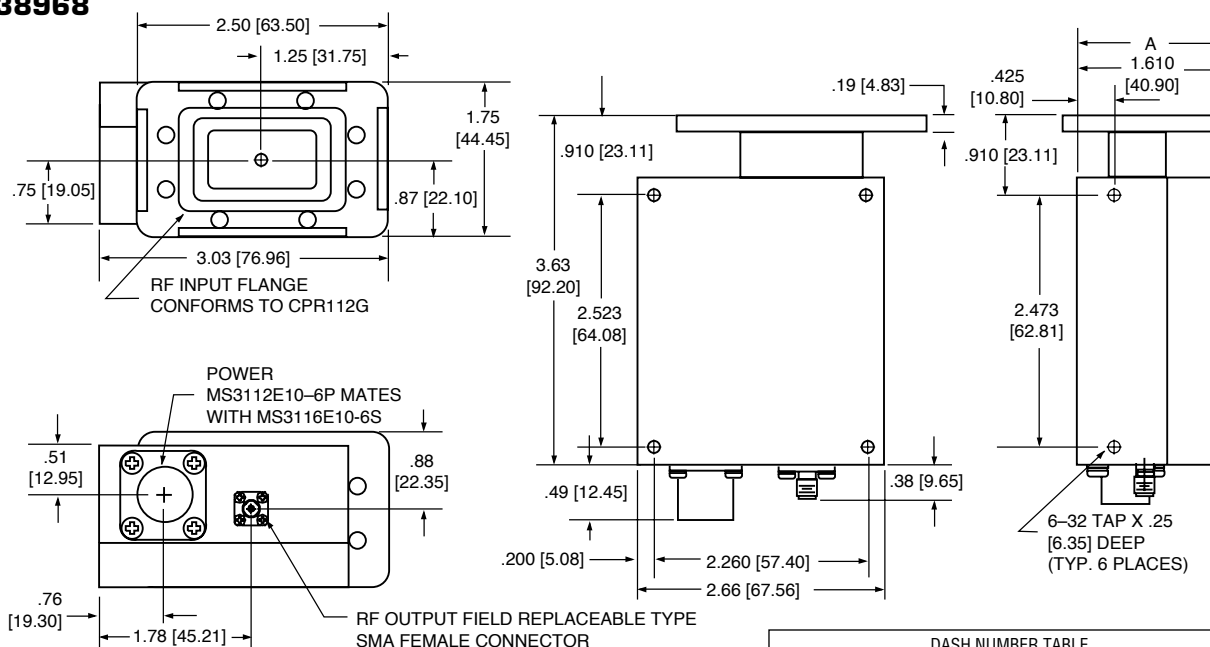
### FAULT ALARM

MITEQ's AMFW Series SATCOM LNAs Fault Alarm Option (-F) consists of a closed contact non-latching relay with status pins on the MS3112E10-6P connector. The fault alarm is set to alarm when the current draw of the AMFW SATCOM LNA exceeds a nominal window range, which is precision set at the factory. In normal operating conditions, the relay is normally open across Pins D and E, and closed across Pins E and F. In the fault-state, the relay is closed across Pins D and E, and open across Pins E and F. The fault alarm will return to a no-fault state if the LNAs current returns to within the nominal window range. Typical switching time is <5 msec. The relay contacts are rated for 1A maximum at room temperature.

Part Number : MS3112E10-6P (Mating MS3116F10-6S provided with each LNA.)

## OUTLINE DRAWING

138968



#### Notes:

- Standard unit as shown, flat flange is optional.
- Type N field replaceable connector option available.
- Contact MITEQ for various pin out configurations.
- As an option, a flat cover plate can be used to replace the multi-pin connector when a bias-tee is installed.

Note: Dimensions shown in brackets [ ] are in millimeters.

DASH NO.	DIM. A	OPTION P/N SUFFIX	DESCRIPTION
-1	1.69 [42.69]	N/A	Standard LNA
-1	1.69 [42.69]	-F	LNA with Optional Fault Alarm
-2	2.40 [60.96]	-0	LNA with Optional 100-240 VAC Power Supply
-2	2.40 [60.96]	-0, -F	LNA with Optional Fault Alarm and 100-240 VAC Power Supply



# AMFW ULTRA LOW NOISE X-BAND WAVEGUIDE LNAs

## AVAILABLE OPTIONS

Fault alarm .....Add suffix -F\*  
 DC bias through the RF output  
 with DC connector .....Add suffix -C  
 DC bias through the RF output  
 without DC connector .....Add suffix -CP  
 Solder bias pin .....Add suffix -B  
 110 VAC/220 VAC operation .....Add suffix -O\*  
 DC power supply at -24 VDC .....Add suffix -NEG\*  
 Output P1 dB of +15 dBm .....Add suffix -P1  
 Output P1 dB of +20 dBm .....Add suffix -P2  
 Output P1 dB of +23 dBm .....Add suffix -23P  
 3 dB, P-P, gain change vs. temperature .....Add suffix -TC  
 N-type female output connector .....Add suffix -N  
 Internal transmit/reject filter .....Add suffix -TRF\*\*  
 Limiter .....Add suffix -L\*\*\*

\* Specifications compliant temperature range limited to -15 to +60°C.

\*\* Rejection of 30 dB, min., at 7 and 7.9 GHz. Outline drawing changes to 135805.

\*\*\* Limiter adds loss and increases noise temperature.

## OTHER AVAILABLE OPTIONS (Call factory for details)

Customer specified frequency ranges  
 Customer specified gain windows  
 Phase matching  
 Amplitude matching  
 Front-end protection (input limiter)

### Example:

Model Number ..... AMFW-7S-07250775-65-P2-TC  
 Operating frequency range ..... 7.25–7.75 GHz  
 Noise temperature ..... 65°K  
 Gain ..... 60 dB  
 P1dB ..... 23 dBm  
 Option ..... Temperature compensation

## ORDERING INFORMATION

**AMFW-xx-xxxxxxxxxx-xx**

### Minimum Gain Designation (dB)

5S = 40  
 6S = 50  
 7S = 60  
 8S = 70

### Frequency Designation (GHz)

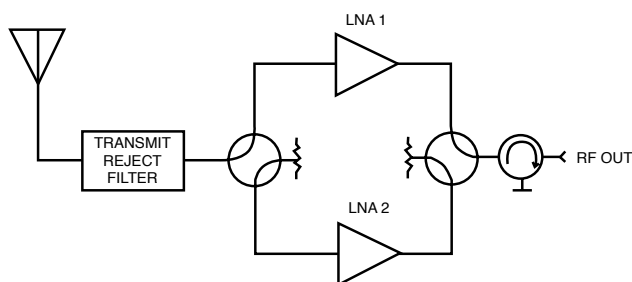
07100775 = 7.10 – 7.75  
 07100840 = 7.10 – 8.40  
 07250775 = 7.25 – 7.75  
 07250840 = 7.25 – 8.40  
 08000840 = 8.00 – 8.40

### Maximum Noise Temperature (K)

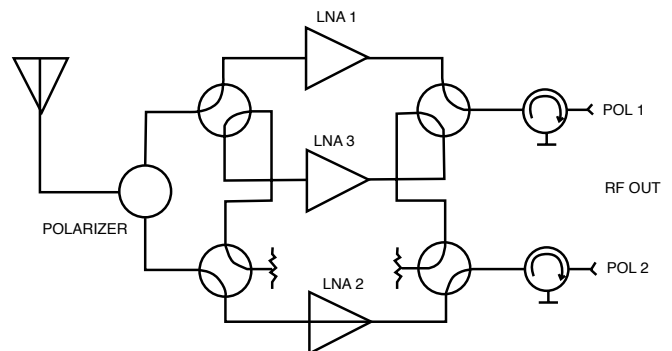
4S = 45 (7.25 to 7.75 GHz only)  
 50 = 50  
 55 = 55  
 60 = 60  
 65 = 65

## TYPICAL APPLICATIONS

### 1:1 Redundant Systems



### 1:2 Redundant Systems



## AMFW X-Band Amplifier Noise Temperature vs. Ambient Temperature

Noise temperature vs. ambient temperature for an AMFW X-band amplifier can be approximated by the equation:

$$(NT_2 / NT_1) = (T_2 / T_1)^{1.6}$$

where:

$NT_2$  = Noise Temperature at Case Temperature 2

$NT_1$  = Noise Temperature at Case Temperature 1

$T_2$  = Case Temperature 2 in °K

$T_1$  = Case Temperature 1 in °K

(The conversion is °K = °C + 273)

For the condition where the initial case temperature is at +23°C ( $T_1 = 296^\circ\text{K}$ ), the ratio  $NT_2/NT_1$  can be summarized by the following table:

AMBIENT TEMPERATURE, $T_2$ (in °C)	RATIO $NT_2 / NT_1$
0	0.88
+23	1.00
+40	1.09
+50	1.15
+60	1.21

### EXAMPLE

- An AMFW X-band amplifier is specified to have a noise temperature of 45°K when the case temperature is at +23°C.
- What is the noise temperature when the case temperature is at +50°C?  
From the table,  $NT_2/NT_1$  at +50°C is 1.15.  
 $NT_2 = 1.15 \times 45^\circ\text{K} = 51.75^\circ\text{K}$  at +50°C case temperature

## AMFW ULTRA LOW NOISE Ku-BAND WAVEGUIDE LNAs

### FEATURES

- Noise temperatures as low as 60 K
- Internal regulation and reverse voltage protection
- WR75 input and SMA-female output
- Fully weatherproof
- Compliant vs. MIL-STD-810E for Salt/Fog
- Two-year product warranty
- Pressurizable waveguide

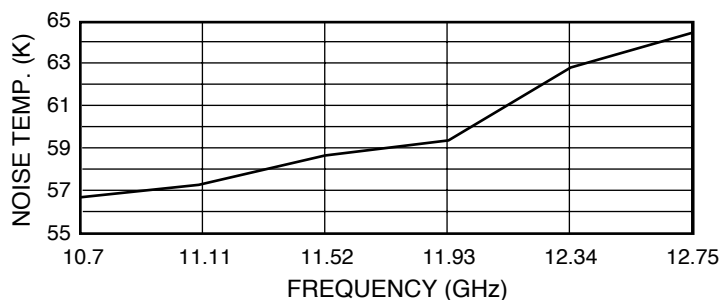
### OPTIONS

- Fault alarm circuitry
  - Form-C, contact closure
  - Fully integrated
- DC bias applied through the RF output
- 110/220 VAC internal power supplies
  - Fully integrated
  - CE certified
- DC bias of -24 VDC
- Higher output powers
  - P1 dB of +15 dBm, min.; OIP3 of +25 dBm, min.
  - P1 dB of +20 dBm, min.; OIP3 of +30 dBm, min.
  - P1 dB of +23 dBm, min.; OIP3 of +33 dBm, min.
- Improved gain variation vs. temperature
  - 3 dB, P-P, max.
- N-type female RF output connector
- Integrated transmit/reject filter
  - Upper band edge at 12.75 GHz
  - Rejection of 20 dB, min., at 13.5 GHz
- Input limiter protection up to 25 watts CW
  - Please consult factory for details
- Customer specified gain windows
  - Please consult factory for details



MITEQ's AMFW catalog line of SATCOM waveguide amplifiers utilizes PHEMTs offering the lowest noise figures available in the various frequency bands associated with Ku-band satellite communication. Achieving noise temperatures as low as 60 K, these amplifiers have been designed using state-of-the-art technology and can be used in either fixed or transportable applications. The high-reliability design of these Ku-band amplifiers allows MITEQ to offer a standard two-year warranty on units that consistently experience the harsh environments involved with satellite base-station operation.

**TYPICAL NOISE TEMPERATURE DATA  
MODEL AMFW-7S-107128-65**



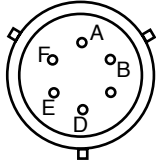
# AMFW ULTRA LOW NOISE Ku-BAND WAVEGUIDE LNAs

## ELECTRICAL SPECIFICATIONS

PARAMETERS	NOTES	MINIMUM	NOMINAL/TYPICAL	MAXIMUM
Standard frequency options		10.70 GHz 10.95 GHz 10.95 GHz 11.40 GHz 11.70 GHz 12.20 GHz		12.75 GHz 11.70 GHz 12.75 GHz 12.20 GHz 12.75 GHz 12.75 GHz
Standard gain options		70 dB 60 dB 50 dB 40 dB	72 dB 64 dB 54 dB 44 dB	
Gain flatness	Full band per 40 MHz		1.45 dB, P-P 0.3 dB, P-P	2 dB, P-P 0.4 dB, P-P
Gain variation vs. temperature (-40 to +60°C)	Standard Option -TC		4.35 dB, P-P 2.45 dB, P-P	5 dB, P-P 3 dB, P-P
Gain stability, constant temperature	Short (10 minutes) Medium (24 hours) Long (1 week)			±0.10 dB ±0.20 dB ±0.50 dB
Noise temperature options at +23°C case temperature	Up to 12.2 GHz  All frequencies		58 K 63 K 67 K 72 K 76 K	60 K 65 K 70 K 75 K 80 K
Input VSWR			1.23:1	1.25:1
Output VSWR			1.42:1	1.5:1
Output power at 1 dB compression	Standard Option -P1 Option -P2 Option -23P	+10 dBm +15 dBm +20 dBm +23 dBm	+13 dBm +18 dBm +23 dBm +25 dBm	
Output third order intercept point	Standard Option -P1 Option -P2 Option -23P	+20 dBm +25 dBm +30 dBm +33 dBm	+23 dBm +28 dBm +32 dBm +34 dBm	
Group delay, per 40 MHz	Linear Parabolic Ripple			0.01 ns/MHz 0.001 ns/MHz <sup>2</sup> 0.3 ns, P-P
AM/PM conversion	-5 dBm output			0.05 dB/°
Max. input without damage				+10 dBm CW
DC voltage requirements		+12 VDC	+15 VDC	+28 VDC
DC current	Standard Options -P1 or -P2		205 mA 360 mA	275 mA 475 mA
Temperature range				
Operating		-40°C		+60°C
Storage		-50°C		+80°C
MTBF	Ground benign		250,000 hours	
Weight	May vary with Options		600 grams	

# AMFW ULTRA LOW NOISE Ku-BAND WAVEGUIDE LNAs

## CONNECTOR INFORMATION



### STANDARD LNA

Pin A	+12 VDC to +28 VDC
Pin B	Ground
Pin C	Ground
Pin D	Not Used
Pin E	Not Used
Pin F	Not Used

### LNA WITH POWER SUPPLY

Pin A	110 VAC/220 VAC
Pin B	Ground
Pin C	110 VAC/220 VAC
Pin D	Not Used
Pin E	Not Used
Pin F	Not Used

### LNA WITH FAULT ALARM

Pin A	+15 VDC to +28 VDC
Pin B	Ground
Pin C	Ground
Pin D	Alarm, Normally Open
Pin E	Alarm, Common Connection
Pin F	Alarm, Normally Closed

### LNA WITH ALARM AND SUPPLY

Pin A	110 VAC/220 VAC
Pin B	Ground
Pin C	110 VAC/220 VAC
Pin D	Alarm, Normally Open
Pin E	Alarm, Common Connection
Pin F	Alarm, Normally Closed

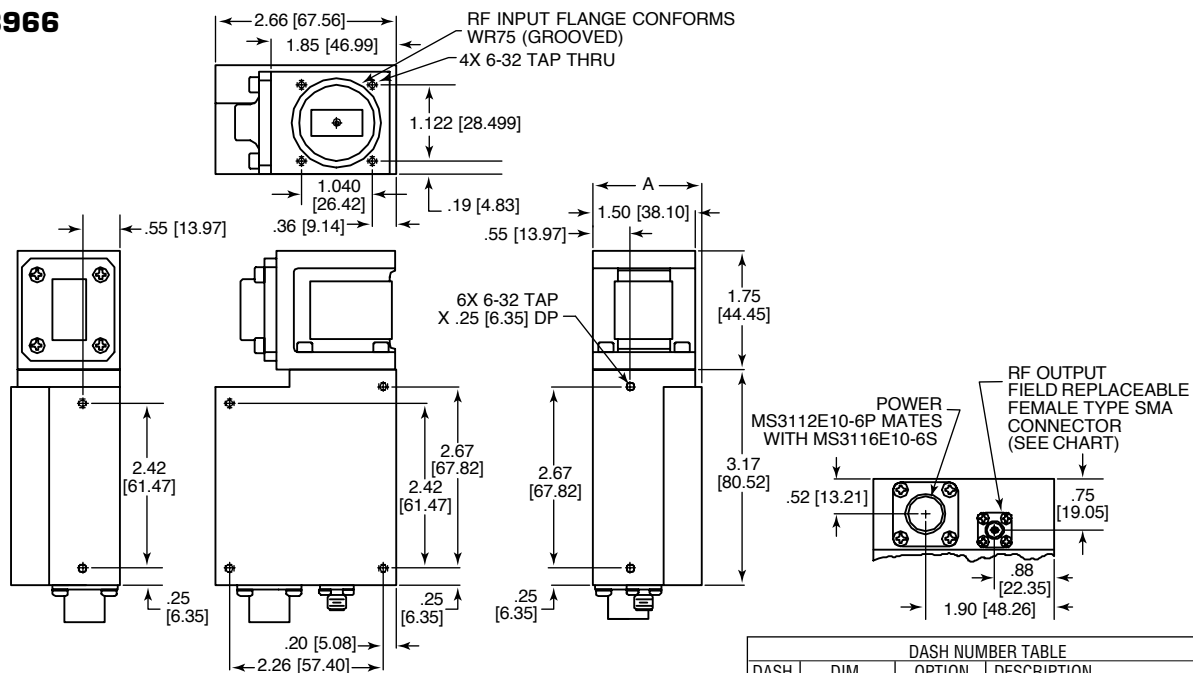
### FAULT ALARM

MITEQ's AMFW Series SATCOM LNAs Fault Alarm Option (-F) consists of a closed contact non-latching relay with status pins on the MS3112E10-6P connector. The fault alarm is set to alarm when the current draw of the AMFW SATCOM LNA exceeds a nominal window range, which is precision set at the factory. In normal operating conditions, the relay is normally open across Pins D and E, and closed across Pins E and F. In the fault-state, the relay is closed across Pins D and E, and open across Pins E and F. The fault alarm will return to a no-fault state if the LNAs current returns to within the nominal window range. Typical switching time is <5 msec. The relay contacts are rated for 1A maximum at room temperature.

Part Number : MS3112E10-6P (Mating MS3116F10-6S provided with each LNA.)

## OUTLINE DRAWING

138966



### Notes:

- Standard unit as shown, flat flange is optional.
- Type N field replaceable connector option available.
- As an option, a flat cover plate can be used to replace the multi-pin connector when a bias-tee is installed.

Note: Dimensions shown in brackets [ ] are in millimeters.

DASH NUMBER TABLE			
DASH NO.	DIM. A	OPTION P/N SUFFIX	DESCRIPTION
-1	1.69 [42.93]	N/A	Standard LNA
-1	1.69 [42.93]	-F	LNA with Optional Fault Alarm
-2	2.40 [60.96]	-0	LNA with Optional 100-240 VAC Power Supply
-2	2.40 [60.96]	-0, -F	LNA with Optional Fault Alarm and 100-240 VAC Power Supply

# AMFW ULTRA LOW NOISE Ku-BAND WAVEGUIDE LNAs

## AVAILABLE OPTIONS

Fault alarm .....Add suffix -F\*  
 DC bias through the RF output  
 with DC connector .....Add suffix -C  
 DC bias through the RF output  
 without DC connector .....Add suffix -CP  
 Solder bias pin .....Add Suffix -B  
 110 VAC/220 VAC operation .....Add suffix -O\*  
 DC power supply at -24 VDC .....Add suffix -NEG\*  
 Output P1 dB of +15 dBm .....Add suffix -P1  
 Output P1 dB of +20 dBm .....Add suffix -P2  
 Output P1 dB of +23 dBm .....Add suffix -23P  
 3 dB, P-P, gain change vs. temperature .....Add suffix -TC  
 N-type female output connector .....Add suffix -N  
 Internal transmit/reject filter .....Add suffix -TRF\*\*  
 Limiter .....Add suffix -L\*\*\*

\* Specifications compliant temperature range limited to -15 to +60°C.

\*\* Rejection of 20 dB, min., at 13.5 GHz.

\*\*\* Limiter adds loss and increases noise temperature.

## OTHER AVAILABLE OPTIONS (Call factory for details.)

Customer specified frequency ranges  
 Customer specified gain windows  
 Phase matching  
 Amplitude matching  
 Front-end protection (input limiter)

### Example:

Model Number ..... AMFW-7S-10701275-70-N  
 Operating frequency range ..... 10.7–12.75 GHz  
 Noise temperature ..... 70°K  
 Gain ..... 60 dB  
 Option ..... Type N female output connector

## ORDERING INFORMATION

**AMFW-xx-xxxxxxxxxx-xx**

### Nominal Gain Designation (dB)

5S = 40 dB  
 6S = 50 dB  
 7S = 60 dB  
 8S = 70 dB

### Frequency Designation (GHz)

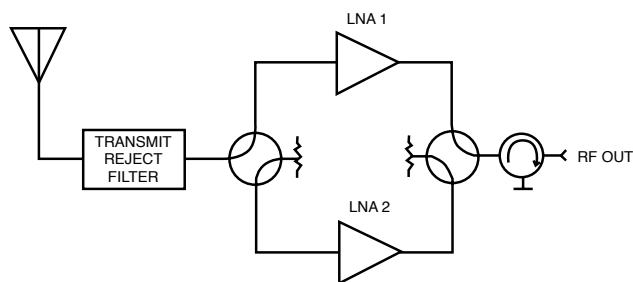
10701275 = 10.70 – 12.75  
 10951170 = 10.95 – 11.70  
 10951280 = 10.95 – 12.75  
 11401280 = 11.40 – 12.75  
 11701280 = 11.70 – 12.75

### Maximum Noise Temperature (K)

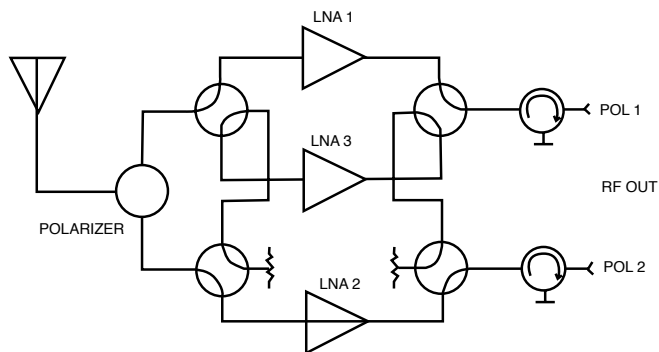
60 = 60 (only available in units operating up to 12.2 GHz)  
 65 = 65  
 70 = 70  
 75 = 75  
 80 = 80

## TYPICAL APPLICATIONS

### 1:1 Redundant Systems



### 1:2 Redundant Systems



## **AMFW Ku-Band Amplifier Noise Temperature vs. Ambient Temperature**

Noise temperature vs. ambient temperature for an AMFW Ku-band amplifier can be approximated by the equation:

$$(NT_2 / NT_1) = (T_2 / T_1)^{1.8}$$

where:

$NT_2$  = Noise Temperature at Case Temperature 2

$NT_1$  = Noise Temperature at Case Temperature 1

$T_2$  = Case Temperature 2 in °K

$T_1$  = Case Temperature 1 in °K

(The conversion is °K = °C + 273)

For the condition where the initial case temperature is at +23°C ( $T_1 = 296^\circ\text{K}$ ), the ratio  $NT_2/NT_1$  can be summarized by the following table:

<b>AMBIENT TEMPERATURE, <math>T_2</math> (in °C)</b>	<b>RATIO <math>NT_2 / NT_1</math></b>
0	0.86
+23	1.00
+40	1.11
+50	1.17
+60	1.24

### **EXAMPLE**

- An AMFW Ku-band amplifier is specified to have a noise temperature of 65°K when the case temperature is at +23°C.
- What is the noise temperature when the case temperature is at +50°C?  
From the table,  $NT_2/NT_1$  at +50°C is 1.17.  
 $NT_2 = 1.17 \times 65^\circ\text{K} = 76.05^\circ\text{K}$  at +50°C case temperature

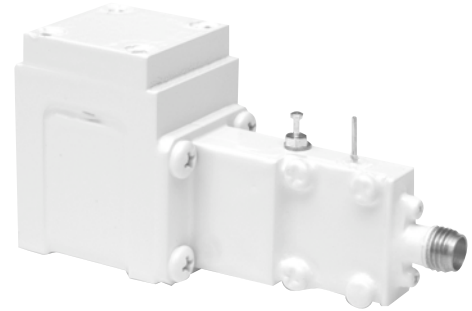
## AMFW ULTRA LOW NOISE Ka-BAND WAVEGUIDE LNAs

### FEATURES

- Noise temperatures as low as 100 K
- Internal regulation and reverse voltage protection
- WR42 input and SMA-female output
- Fully weatherproof
- Two-year product warranty
- Pressurizable waveguide

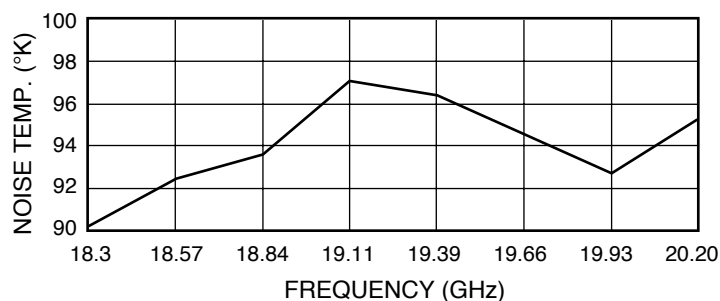
### OPTIONS

- Fault alarm circuitry
  - Form-C, contact closure
  - Fully integrated
- DC bias applied through the RF output
- 110/220 VAC internal power supplies
  - Fully integrated
  - CE certified
- DC bias of -24 VDC
- Higher output powers
  - P1 dB of +15 dBm, min.; OIP3 of +25 dBm, min.
  - P1 dB of +20 dBm, min.; OIP3 of +30 dBm, min.
  - P1 dB of +23 dBm, min.; OIP3 of +33 dBm, min.
- Improved gain variation vs. temperature
  - 3 dB, P-P, max.
- 2.4 mm female RF output connector
- Input limiter protection up to 4.5 watts CW
  - Please consult factory for details
- Customer specified frequency bands
  - Please consult factory for details
- Customer specified gain windows
  - Please consult factory for details



MITEQ's AMFW catalog line of SATCOM waveguide amplifiers utilizes PHEMTs offering the lowest noise figures available in the various frequency bands associated with Ka-band satellite communication. Achieving noise temperatures as low as 100 K, these amplifiers have been designed using state-of-the-art technology and can be used in either fixed or transportable applications. The high-reliability design of these Ka-band amplifiers allows MITEQ to offer a standard two-year warranty on units that consistently experience the harsh environments involved with satellite base-station operation.

**TYPICAL NOISE TEMPERATURE DATA  
MODEL AMFW-6F-183202-110K-13P**





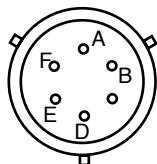
# AMFW ULTRA LOW NOISE Ka-BAND WAVEGUIDE LNAs

## ELECTRICAL SPECIFICATIONS

PARAMETERS	NOTES	MINIMUM	NOMINAL/TYPICAL	MAXIMUM
Standard frequency options		17.0 GHz 17.7 GHz 17.7 GHz 17.7 GHz 18.1 GHz 19.7 GHz 20.2 GHz		22.0 GHz 20.2 GHz 21.2 GHz 22.0 GHz 21.2 GHz 20.2 GHz 21.2 GHz
Standard gain options		60 dB 50 dB 40 dB 30 dB	62 dB 54 dB 44 dB 35 dB	
Gain flatness	Full band per 40 MHz		2.15 dB, P-P 0.3 dB, P-P	3 dB, P-P 0.4 dB, P-P
Gain variation vs. temperature (-40 to +60°C)	Standard Option -TC		4.45 dB, P-P 2.65 dB, P-P	5 dB, P-P 3 dB, P-P
Gain stability, constant temperature	Short (10 minutes) Medium (24 hours) Long (1 week)			±0.10 dB ±0.20 dB ±0.50 dB
Noise temperature options at +23°C case temperature	Up to 20.2 GHz Up to 21.3 GHz All frequencies		98 K 107 K 116 K 123 K 131 K	100 K 110 K 120 K 130 K 140 K
Input VSWR	With input isolator		1.22:1	1.25:1
Output VSWR	With output isolator		1.28:1	1.3:1
Output power at 1 dB compression	Standard Option -15P Option -20P Option -23P	+10 dBm +15 dBm +20 dBm +23 dBm	+13 dBm +18 dBm +23 dBm +25 dBm	
Output third order intercept point	Standard Option -15P Option -20P Option -23P	+20 dBm +25 dBm +30 dBm +33 dBm	+23 dBm +28 dBm +32 dBm +34 dBm	
Group delay, per 40 MHz	Linear Parabolic Ripple			0.01 ns/MHz 0.001 ns/MHz <sup>2</sup> 0.3 ns, P-P
AM/PM conversion	-10 dBm output			0.05 dB/°
Max. input without damage				+10 dBm CW
DC voltage requirements		+12 VDC	+15 VDC	+28 VDC
DC current	Standard Options -P1 or -P2		225 mA 375 mA	275 mA 475 mA
Temperature range Operating Storage		-40°C -50°C		+60°C +80°C
MTBF	Ground benign		200,000 hours	
Weight	May vary with Options		125 grams	

# AMFW ULTRA LOW NOISE Ka-BAND WAVEGUIDE LNAs

## CONNECTOR INFORMATION



### STANDARD LNA

Pin A	+12 VDC to +28 VDC
Pin B	Ground
Pin C	Ground
Pin D	Not Used
Pin E	Not Used
Pin F	Not Used

### LNA WITH POWER SUPPLY

Pin A	110 VAC/220 VAC
Pin B	Ground
Pin C	110 VAC/220 VAC
Pin D	Not Used
Pin E	Not Used
Pin F	Not Used

### LNA WITH FAULT ALARM

Pin A	+15 VDC to +28 VDC
Pin B	Ground
Pin C	Ground
Pin D	Alarm, Normally Open
Pin E	Alarm, Common Connection
Pin F	Alarm, Normally Closed

### LNA WITH ALARM AND SUPPLY

Pin A	110 VAC/220 VAC
Pin B	Ground
Pin C	110 VAC/220 VAC
Pin D	Alarm, Normally Open
Pin E	Alarm, Common Connection
Pin F	Alarm, Normally Closed

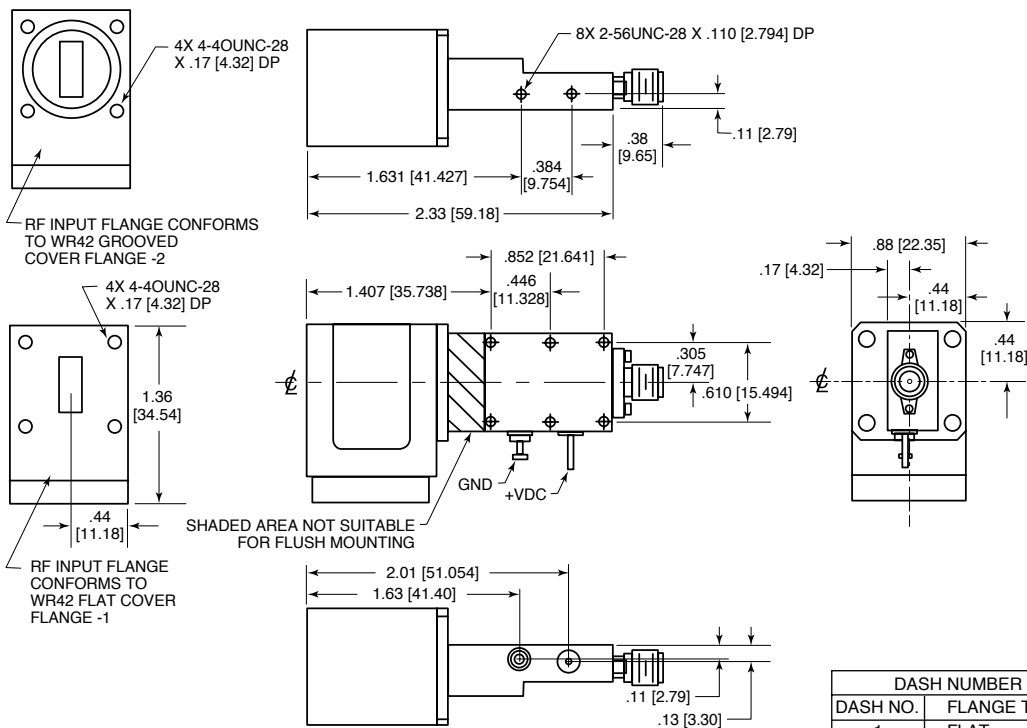
### FAULT ALARM

MITEQ's AMFW Series SATCOM LNAs Fault Alarm Option (-F) consists of a closed contact non-latching relay with status pins on the MS3112E10-6P connector. The fault alarm is set to alarm when the current draw of the AMFW SATCOM LNA exceeds a nominal window range, which is precision set at the factory. In normal operating conditions, the relay is normally open across Pins D and E, and closed across Pins E and F. In the fault-state, the relay is closed across Pins D and E, and open across Pins E and F. The fault alarm will return to a no-fault state if the LNAs current returns to within the nominal window range. Typical switching time is <5 msec. The relay contacts are rated for 1A maximum at room temperature.

Part Number : MS3112E10-6P (Mating MS3116F10-6S provided with each LNA.)

## OUTLINE DRAWING

131596



Note: Dimensions shown in brackets [ ] are in millimeters.

# AMFW ULTRA LOW NOISE Ka-BAND WAVEGUIDE LNAs

## AVAILABLE OPTIONS

Fault alarm .....Add suffix -F\*  
 DC bias through the RF output  
 with DC connector .....Add suffix -C  
 DC bias through the RF output  
 without DC connector .....Add suffix -CP  
 110 VAC/220 VAC operation .....Add suffix -O\*  
 DC power supply at -24 VDC .....Add suffix -NEG\*  
 Output P1 dB of +15 dBm .....Add suffix -15P  
 Output P1 dB of +20 dBm .....Add suffix -20P  
 Output P1 dB of +23 dBm .....Add suffix -23P  
 3 dB, P-P, gain change vs. temperature .....Add suffix -TC  
 2.4 mm female output connector .....Add suffix -24M  
 Weatherproof enclosure .....Add suffix -WP\*\*  
 Limiter .....Add suffix -L\*\*\*  
 \* Specifications compliant temperature range limited  
 to -15 to +60°C.  
 \*\* Outline changes to 148201.  
 \*\*\* Limiter adds loss and increases noise temperature.

## OTHER AVAILABLE OPTIONS (Call factory for details.)

Customer specified frequency ranges  
 Customer specified gain windows  
 Phase matching  
 Amplitude matching  
 Front-end protection (input limiter)

### Example:

Model Number ..... AMFW-4F-17702020-120  
 Operating frequency range ..... 17.7–20.2 GHz  
 Noise temperature ..... 120°K  
 Gain ..... 30 dB

## ORDERING INFORMATION

**AMFW-xx-xxxxxxxx-xxx**

### Minimum Gain Designation (dB)

4F = 30 dB  
 5F = 40 dB  
 6F = 50 dB  
 7F = 60 dB

### Frequency Designation (GHz)

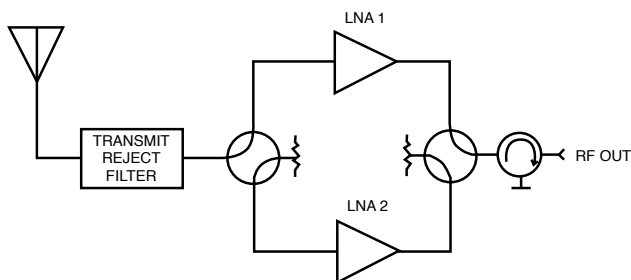
17002200 = 17.0 – 22.0  
 17702020 = 17.7 – 20.2  
 17702120 = 17.7 – 21.2  
 17702200 = 17.7 – 22.0  
 18102120 = 18.1 – 21.2  
 19702020 = 19.7 – 21.2  
 20202120 = 20.2 – 21.2

### Maximum Noise Temperature (K)

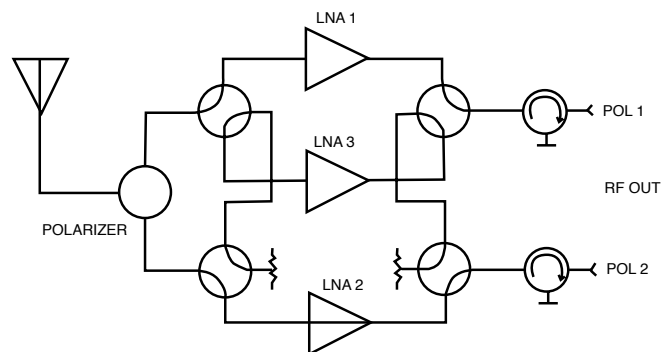
100 = 100 (only available in units operating up to 20.2 GHz)  
 110 = 110 (only available in units operating up to 21.3 GHz)  
 120 = 120  
 130 = 130  
 140 = 140

## TYPICAL APPLICATIONS

### 1:1 Redundant Systems



### 1:2 Redundant Systems



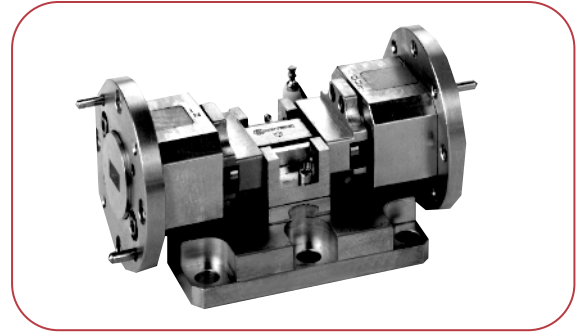
## ADDITIONAL WAVEGUIDE AMPLIFIERS

MODEL NUMBER	OPERATING FREQ. RANGE (GHz)	GAIN (dB, Min.)	GAIN FLATNESS (±dB, Max.)	NOISE TEMP (K, Max.)	OUTPUT 1 dB COMP (+dBm, Min.)	VSWR IN/OUT (Max.)	NOMINAL DC CURRENT (mA @+15V)	OUTLINE NO.
AMFW-7S-340500-35-10P	3.4 – 5	60	1	35	10	2:1	225	125063
AMFW-7S-360480-42-15P	3.6 – 4.8	60	0.5	42	15	1.5:1	225	125063
AMFW-3F-540590-50-10P	5.4 – 5.9	30	0.5	50	10	1.5:1	125	126487
AMFW-4S-560780-60-11P	5.6 – 7.8	30	2	60	11	2:1	150	139170
AMFW-7S-710840-50-10P	7.1 – 8.4	60	1	50	10	1.5:1	200	138968
AMFW-6S-770850-50-10P	7.7 – 8.5	50	1	50	10	1.5:1	150	138968
AMFW-5S-800840-45-UG138	8 – 8.4	45	0.5	45	10	1.5:1	150	127534
AMFW-5S-800850-55-13P	8 – 8.5	40	0.75	55	13	1.3:1/1.5:1	150	138968
AMFW-6S-800900-50-20P	8 – 9	55	0.75	50	20	1.5:1	400	138968
AMFW-4F-080120-90-10P	8 – 12	40	1.5	90	10	2:1	150	126133
AMFW-4F-850950-95-10P	8.5 – 9.5	30	0.75	95	10	1.5:1	150	126133
AMFW-6S-102128-75-13P	10.2 – 12.8	50	1.5	75	13	1.4:1/1.8:1	200	138966
AMFW-6S-107133-70-10P	10.7 – 13.3	50	1	70	10	1.3:1/1.5:1	200	138966
AMFW-6S-109145-120-13P	10.9 – 14.5	50	1.5	120	13	1.3:1/1.5:1	200	138966
AMFW-6F-120180-170-10P	12 – 18	45	2	170	10	2:1	200	127539
AMFW-5F-124160-250-18P	12.4 – 16	28	2	250	18	2:1	350	127539
AMFW-6S-126152-90-10P	12.6 – 15.2	50	1	90	10	1.5:1/2:1	200	127539
AMFW-7S-137145-85-10P	13.7 – 14.5	60	0.75	85	10	1.8:1	225	138966
AMFW-7S-145155-110-10P	14.5 – 15.5	60	0.5	110	10	2:1	225	138966
AMFW-6F-175220-180-10P	17.5 – 22	50	1.5	180	10	1.5:1/2:1	250	131596
AMFW-8S-177212-125-13P	17.7 – 21.2	60	1	125	13	1.5:1/2:1	275	141050
AMFW-4F-180220-140-10P	18 – 22	30	1.5	140	10	2:1	150	131596
AMFW-6F-180265-200-10P	18 – 26.5	40	2	200	10	2.3:1/2:1	200	128869
AMFW-6F-181213-125-20P	18.1 – 21.3	46	1	125	20	1.3:1	325	131596
AMFW-6F-183188-110-10P	18.3 – 18.8	30	0.5	110	10	1.5:1/2:1	150	131596
AMFW-6F-183202-115-10P	18.3 – 20.2	50	1	115	10	1.3/2:1	200	131596

## 40 TO 60 GHz LOW-NOISE AMPLIFIERS

### FEATURES

- Low noise figure up to 60 GHz
- Linear phase and group delay
- WR22 and WR19 waveguide interfaces available
- Miniaturized for drop-in applications
- Hermetic sealed package
- Military temperature range applications



### ELECTRICAL SPECIFICATIONS

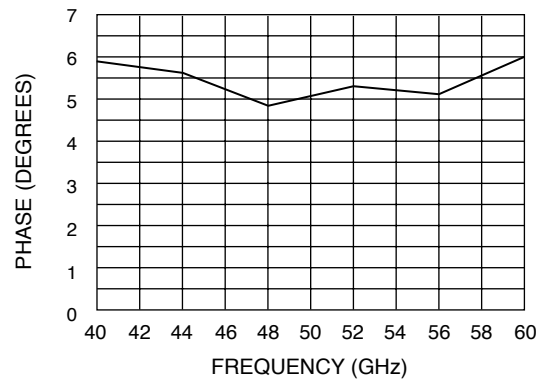
PARAMETERS *	UNITS	JSW4-40006000-60-0P
Frequency range	GHz	40–60
Gain	dB, min.	18
Gain flatness	dB	±2.5
Noise figure	dB	6
Input/output VSWR	Max.	2.5:1
Reverse isolation	dB	35
P1dB	dBm	0
DC power	mA	175/15 VDC
Outline drawing	N/A	131031

\* Electrical parameters are specified at 23°C.

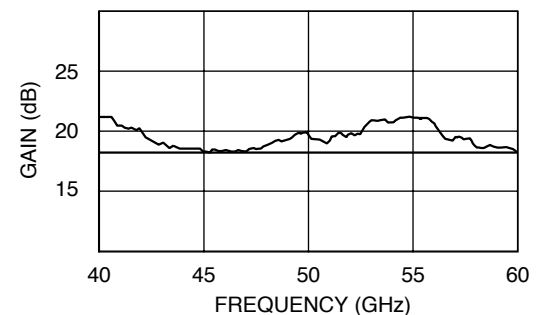
Typical temperature coefficients:

Gain vs. temperature	dB per °C:	0.033
Noise figure vs. temperature	dB per °C:	0.062
Phase vs. temperature	Deg.per °C:	0.4

NOISE FIGURE vs. FREQUENCY



GAIN vs. FREQUENCY



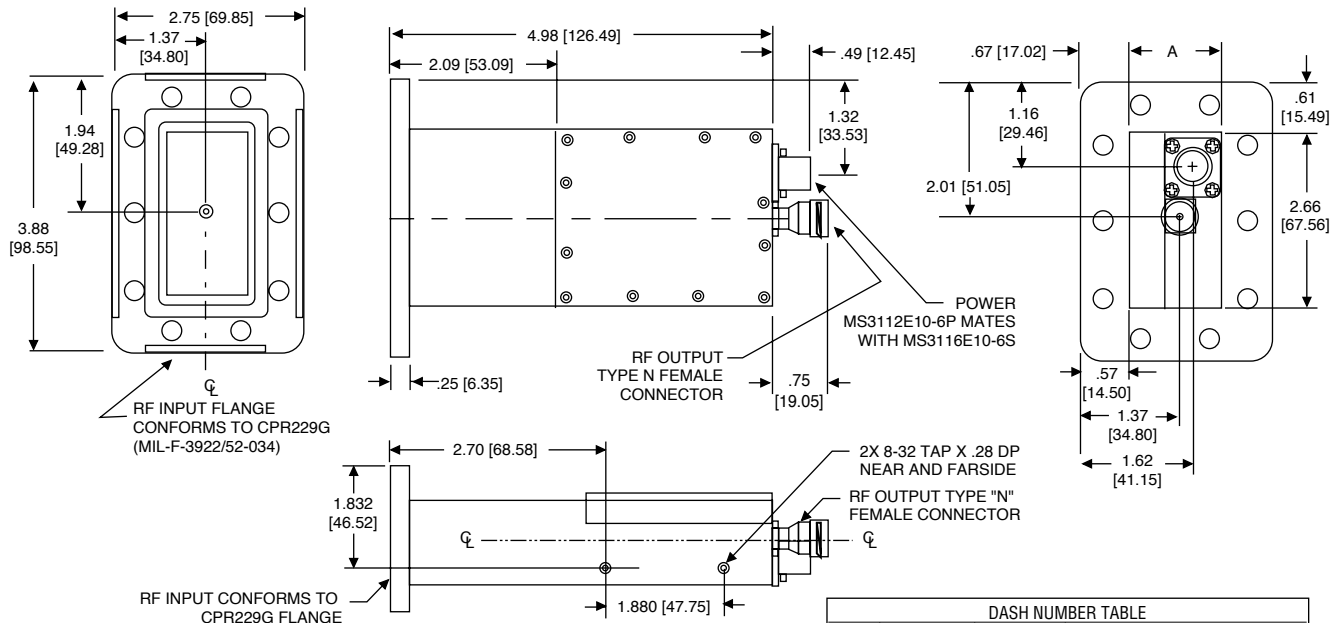
MODEL NUMBER	OPERATING FREQ. RANGE (GHz)	GAIN (dB, Min.)	FLATNESS (±dB, Max.)	NOISE TEMP (K, Max.)	OUTPUT 1 dB COMP (+dBm, Min.)	VSWR IN/OUT (Max.)	NOMINAL DC CURRENT (mA @+15V)	OUTLINE NO.
JDMWK2-26004000-26-10P	26 – 40	30	4	2.6**	10	2:1/2:1	150	132079
JSW5-33005000-50-0P	33 – 50	25	3	5**	0	3:1	150	130002
JSWV5-40005000-45-5P*	40 – 50	21	2.5	4.5**	+5	2:1	125	129013
JSWV5-40006000-60-0P*	40 – 60	20	2.8	6**	+0	2.75:1	150	129013
JDMWV2-59006500-50-10P*	59 – 65	25	3	5**	10	2.75/2.5	250/-30	148725
JDMWV2-55006700-50-10P*	55 – 67	25	3	5**	10	3:1	150/-30	148725
JSDW4-18004000-35-5P**	18 – 40	22	3.2	3.5**	5	2.5:1	180	131031

\* WV indicates waveguide in, coax (V) out.

\*\* Denotes noise temperature in dB.

# OUTLINE DRAWINGS

## 125063

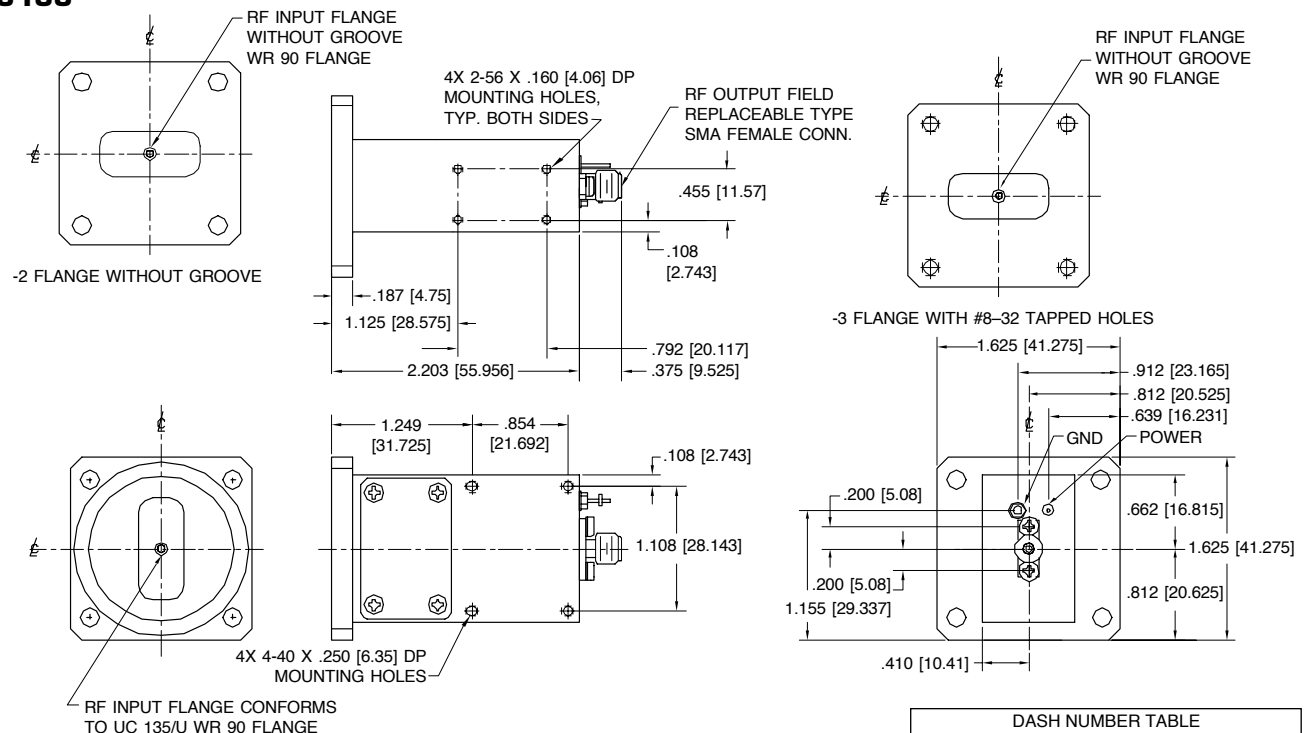


### Notes:

1. Standard unit as shown, flat flange is optional.
2. SMA field replaceable connector option available.
3. As an option, a flat cover plate can be used to replace the multi-pin connector when a bias-tee is installed.

DASH NUMBER TABLE			
DASH NO.	DIM. A	OPTION P/N SUFFIX	DESCRIPTION
-1	1.59 [40.39]	N/A	Standard LNA
-1	1.59 [40.39]	-F	LNA with Optional Fault Alarm
-2	2.30 [58.42]	-0	LNA with Optional 100-240 VAC Power Supply
-2	2.30 [58.42]	-0, -F	LNA with Optional Fault Alarm and 100-240 VAC Power Supply

## 126133

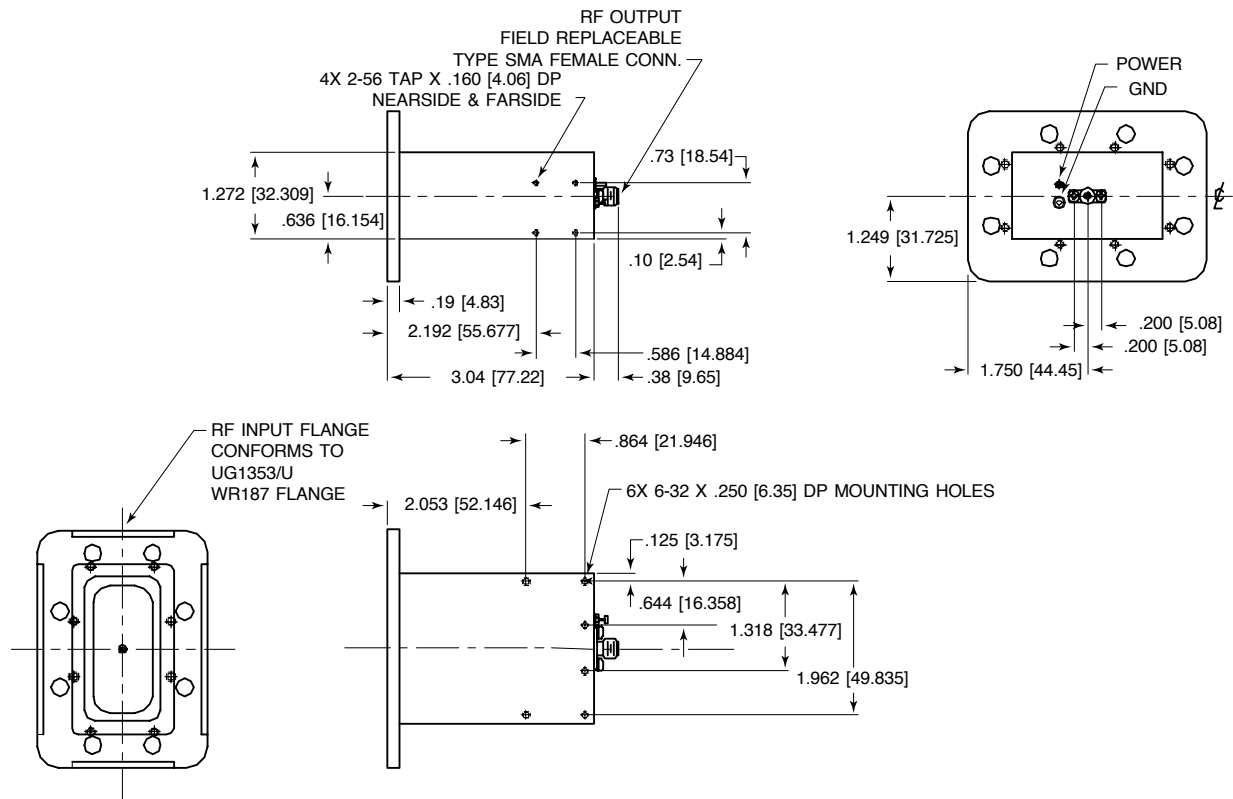


DASH NUMBER TABLE	
-1	AS SHOWN
-2	FLANGE W/O GROOVE
-3	FLANGE W/#8-32 TAPPED HOLES

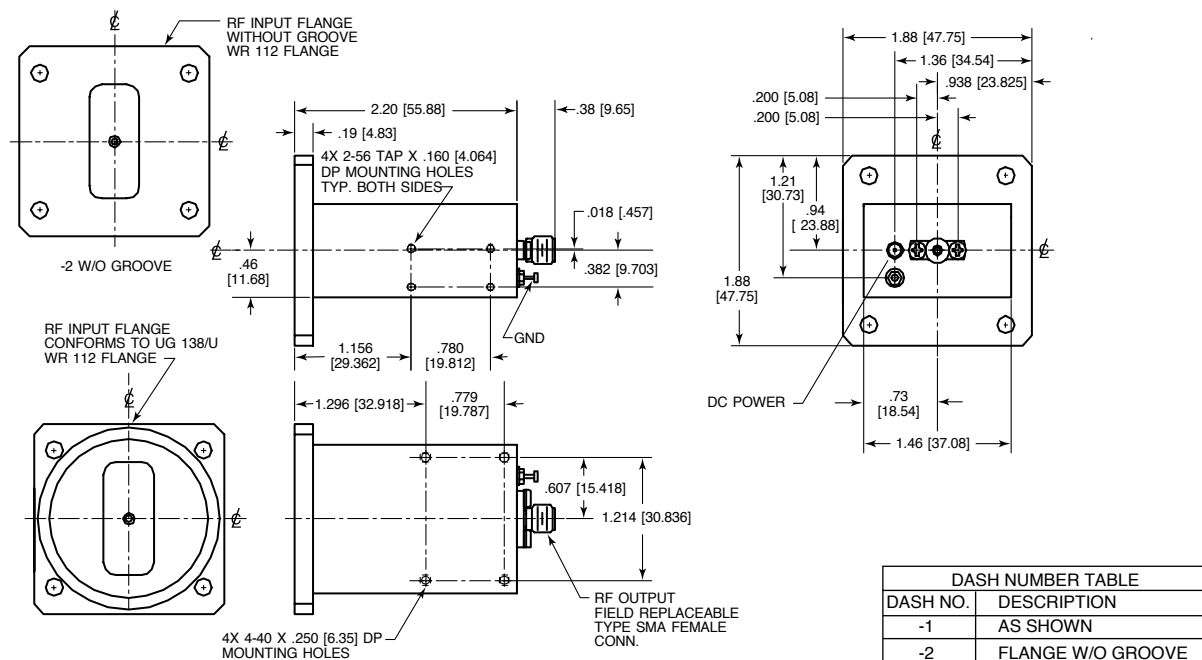
NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.

## OUTLINE DRAWINGS (CONT.)

**126487**



**127534**



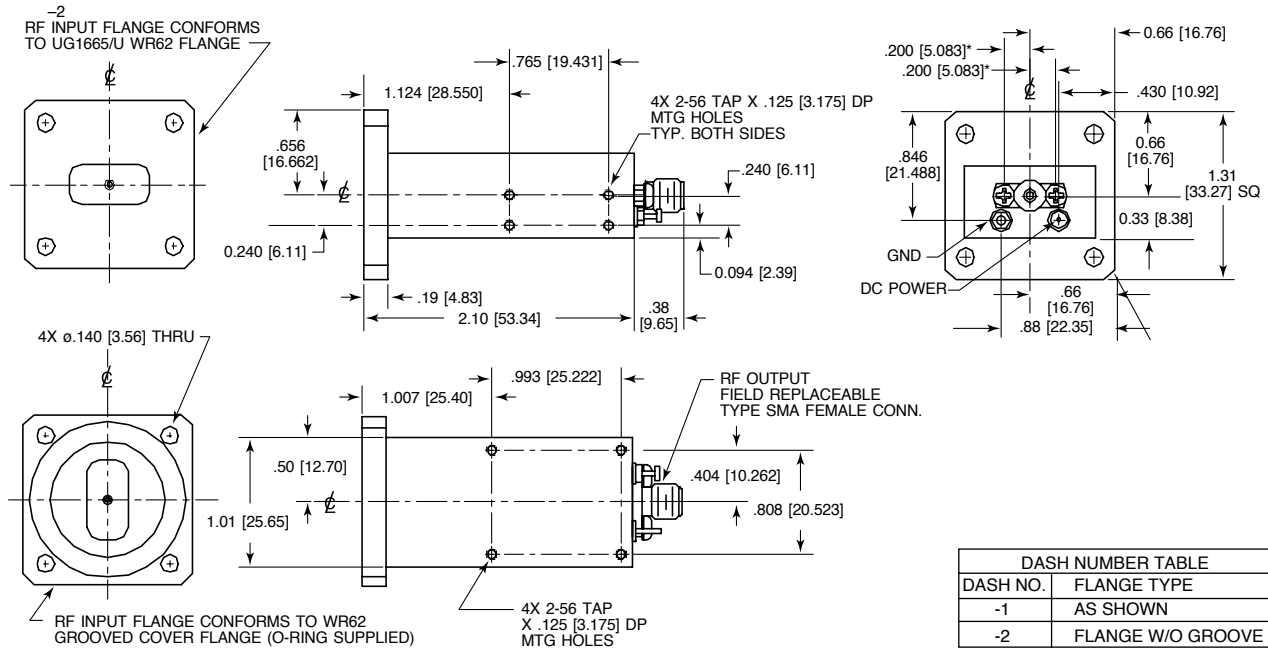
DASH NUMBER TABLE	
DASH NO.	DESCRIPTION
-1	AS SHOWN
-2	FLANGE W/O GROOVE

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.

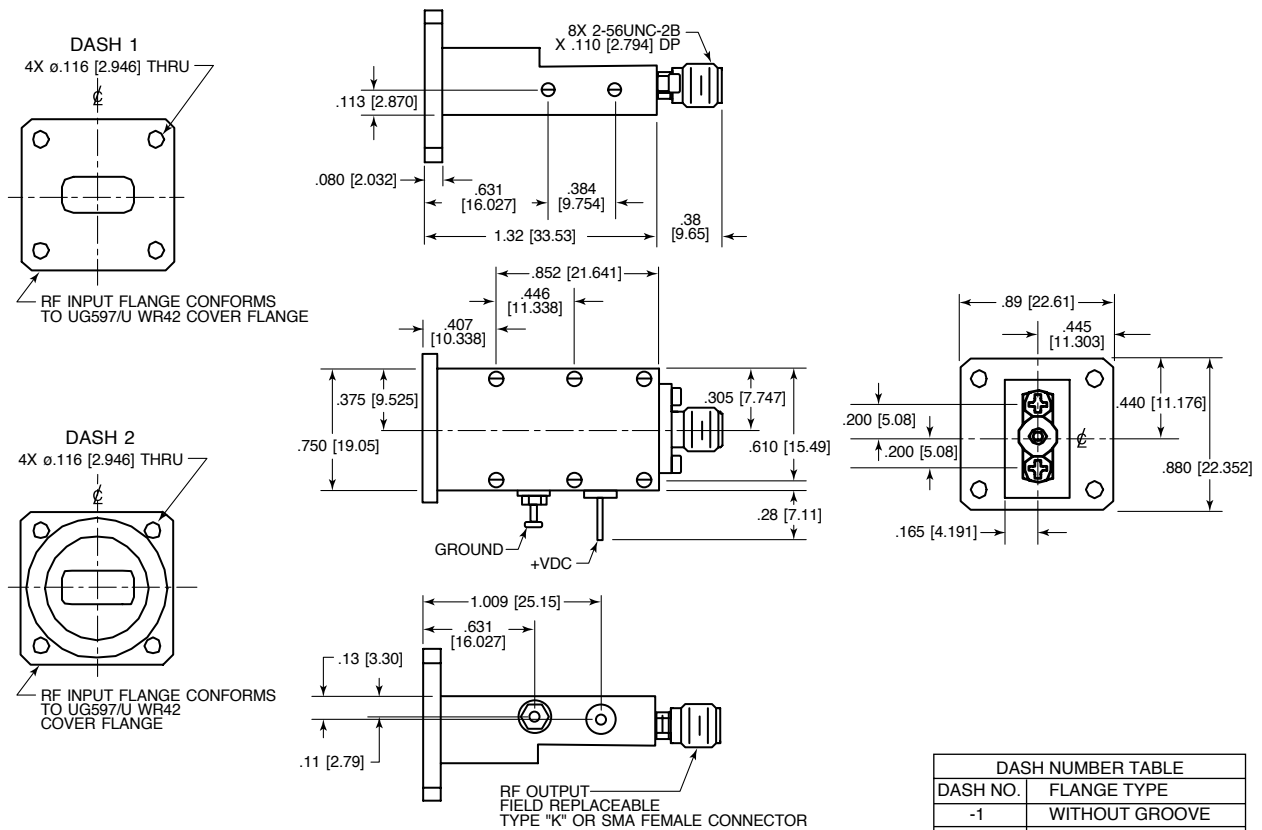


# OUTLINE DRAWINGS (CONT.)

**127539**



**128869**

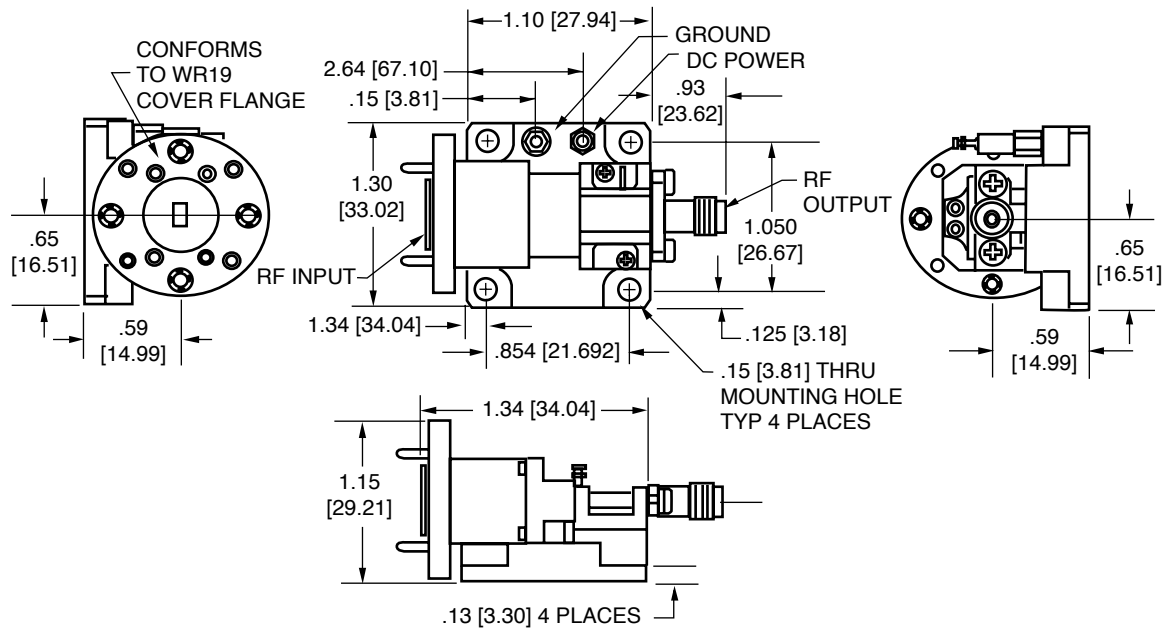


NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.

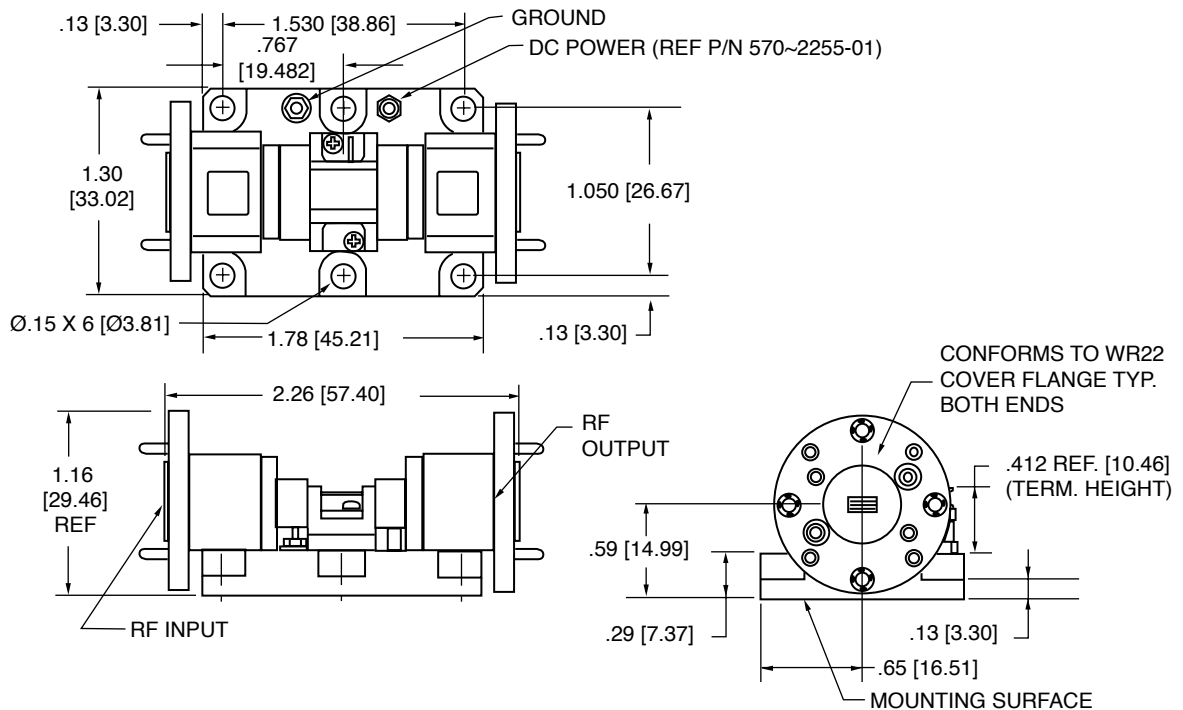


## OUTLINE DRAWINGS (CONT.)

**129013**



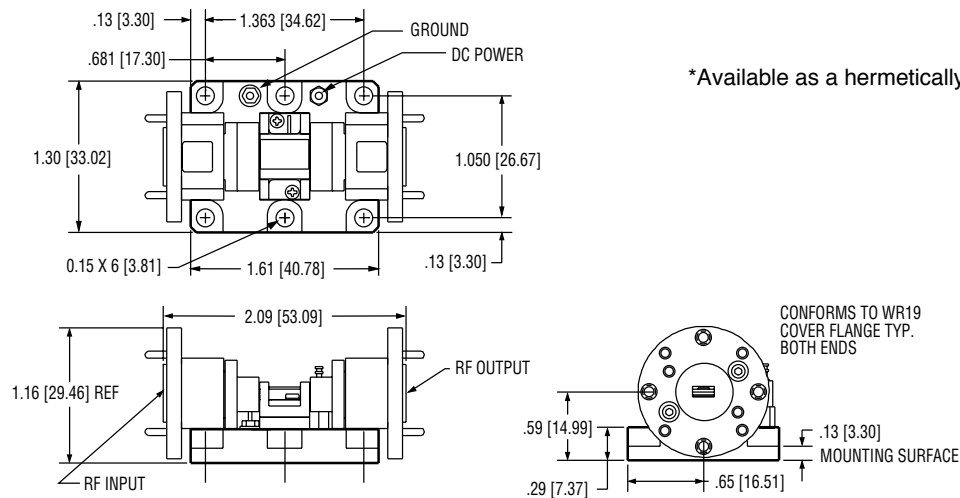
**130002**



NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.

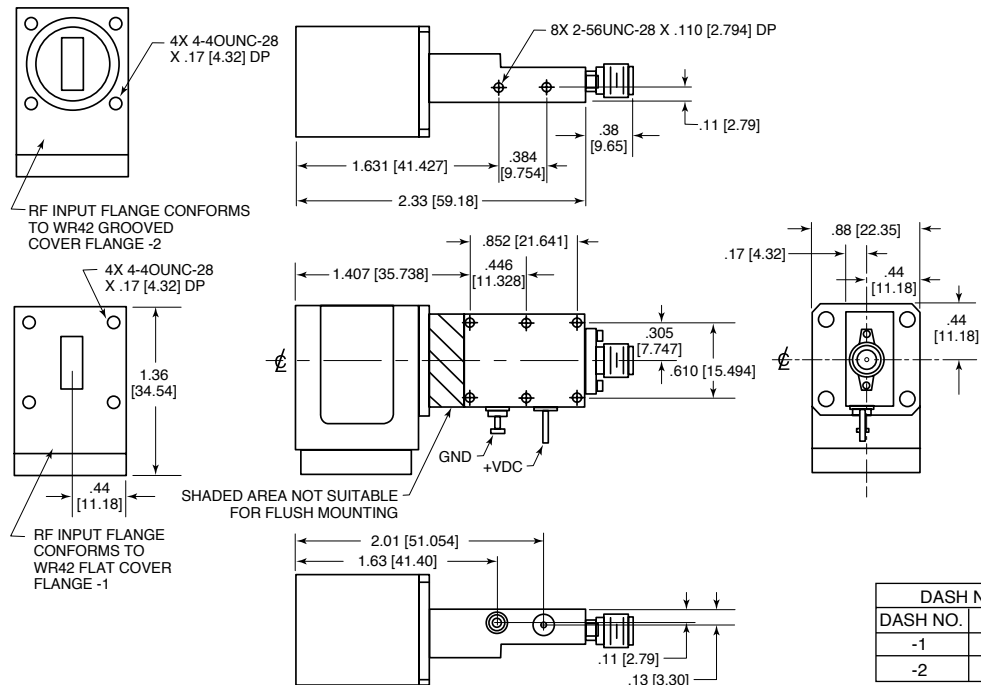
## OUTLINE DRAWINGS (CONT.)

**131031**



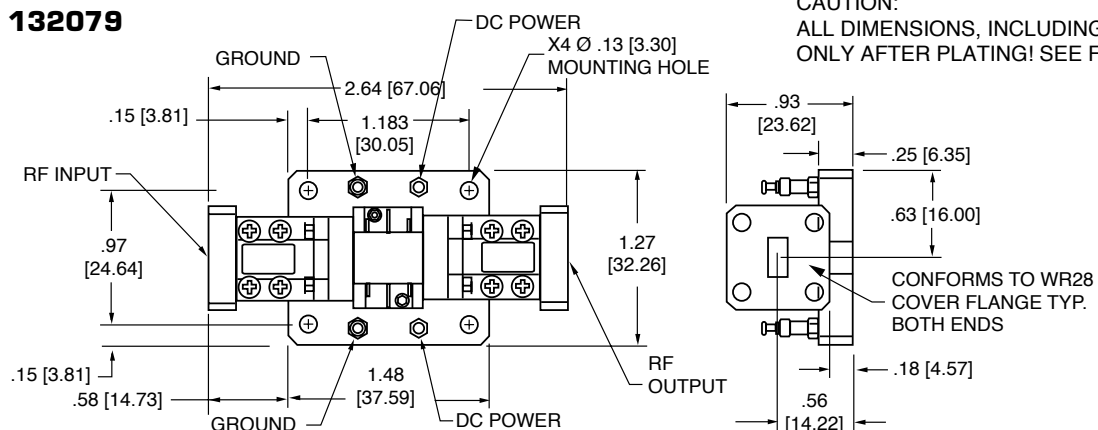
\*Available as a hermetically sealed package.

**131596**



DASH NUMBER TABLE	
DASH NO.	FLANGE TYPE
-1	FLAT
-2	GROOVED

**132079**

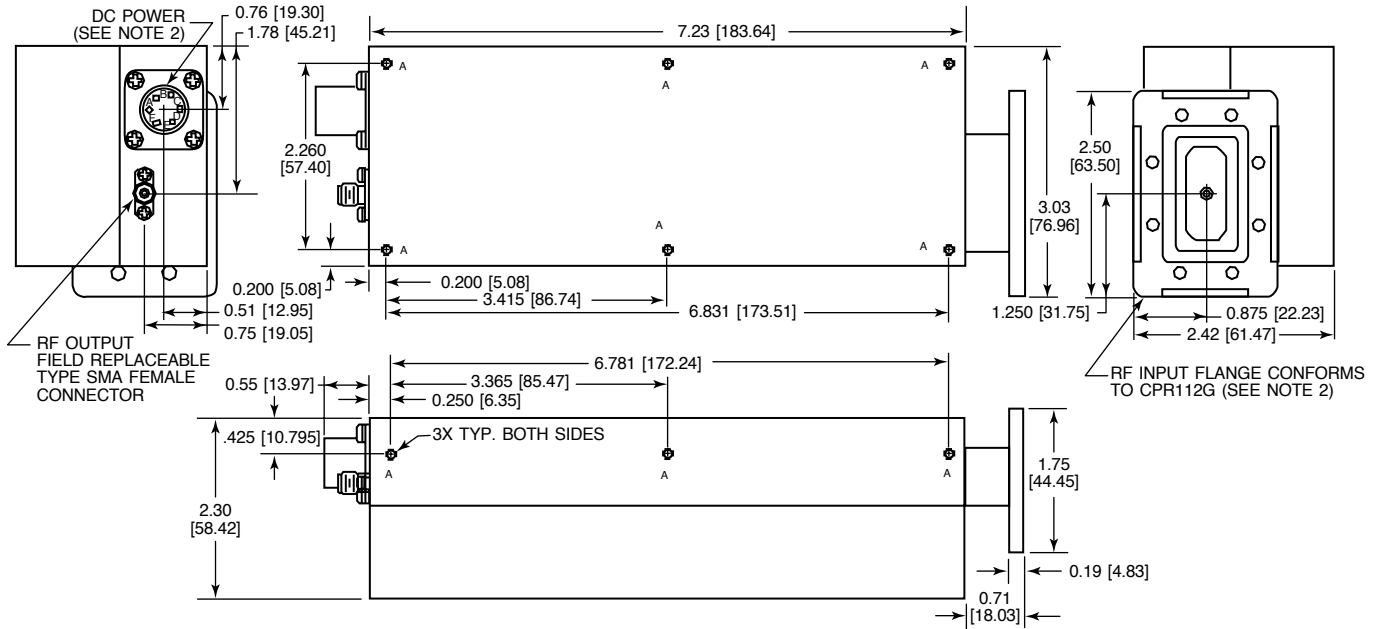


**CAUTION:**  
ALL DIMENSIONS, INCLUDING TAPPED HOLES, APPLY ONLY AFTER PLATING! SEE FINISH BOX FOR FINISH.

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.

## OUTLINE DRAWINGS (CONT.)

### 135805



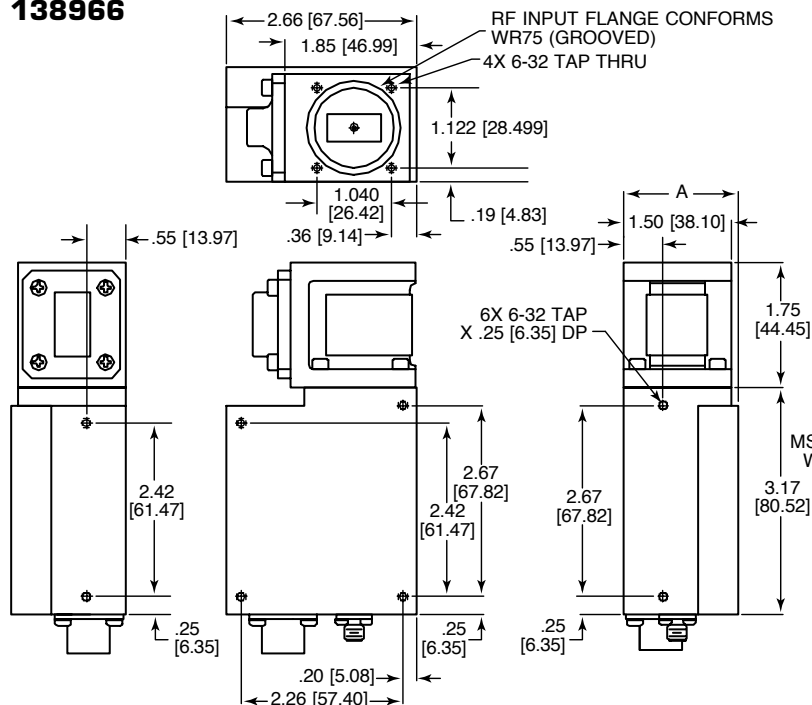
#### NOTES:

- STANDARD UNIT AS SHOWN, FLAT FLANGE IS OPTIONAL.
- MS3112E10-6P MATES W/MS3116E10-6S.

CONNECTOR PIN ASSIGNMENTS	
PIN	FUNCTION
A	+15 VDC
B	Ground
C	Ground
D*	Normally Open (fault)
E*	Common
F*	Normally Closed (operate)

\*These functions are used only with fault alarm option.

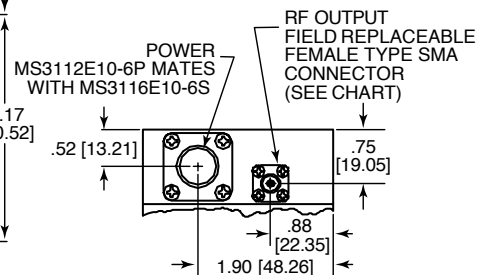
### 138966



DASH NUMBER TABLE			
DASH NO.	DIM. A	OPTION P/N SUFFIX	DESCRIPTION
-1	1.68 [42.93]	N/A	Standard LNA
-1	1.68 [42.93]	-F	LNA with Optional Fault Alarm
-2	2.30 [58.97]	-0	LNA with Optional 100-240 VAC Power Supply
-2	2.30 [58.97]	-0, -F	LNA with Optional Fault Alarm and 100-240 VAC Power Supply

#### Notes:

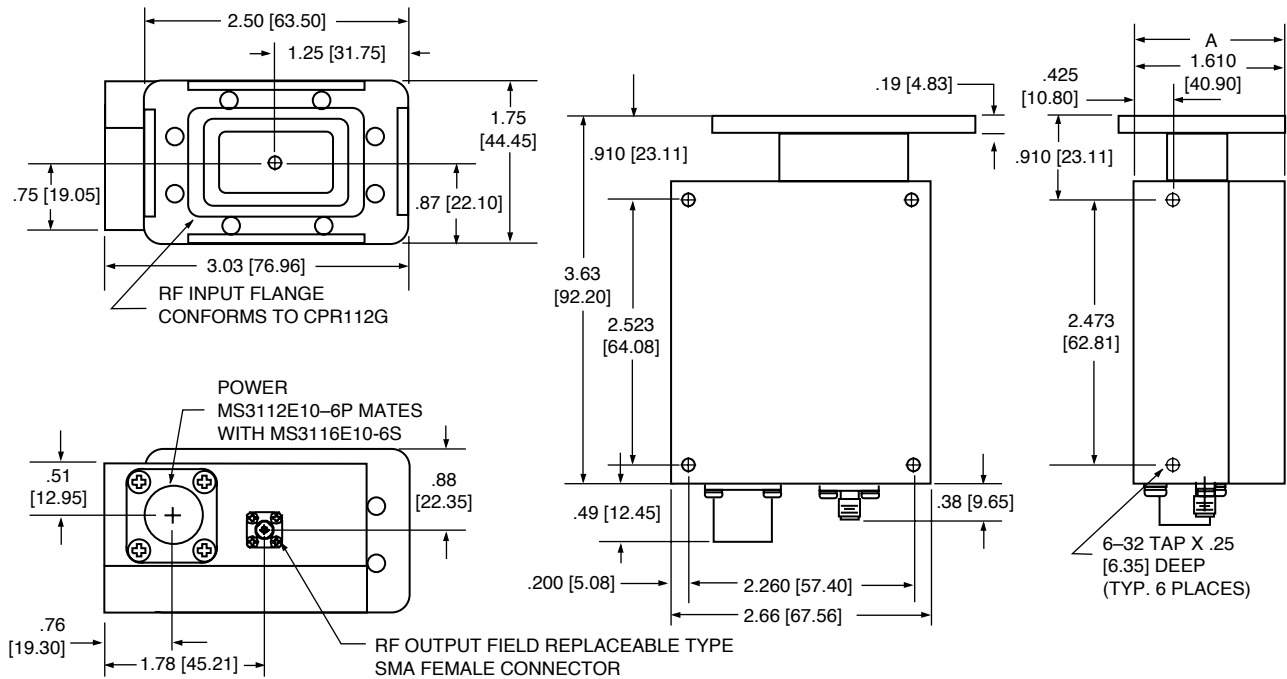
- Standard unit as shown, flat flange is optional.
- Type N field replaceable connector option available.
- As an option, a flat cover plate can be used to replace the multi-pin connector when a bias-tee is installed.



NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.

## OUTLINE DRAWINGS (CONT.)

**138968**

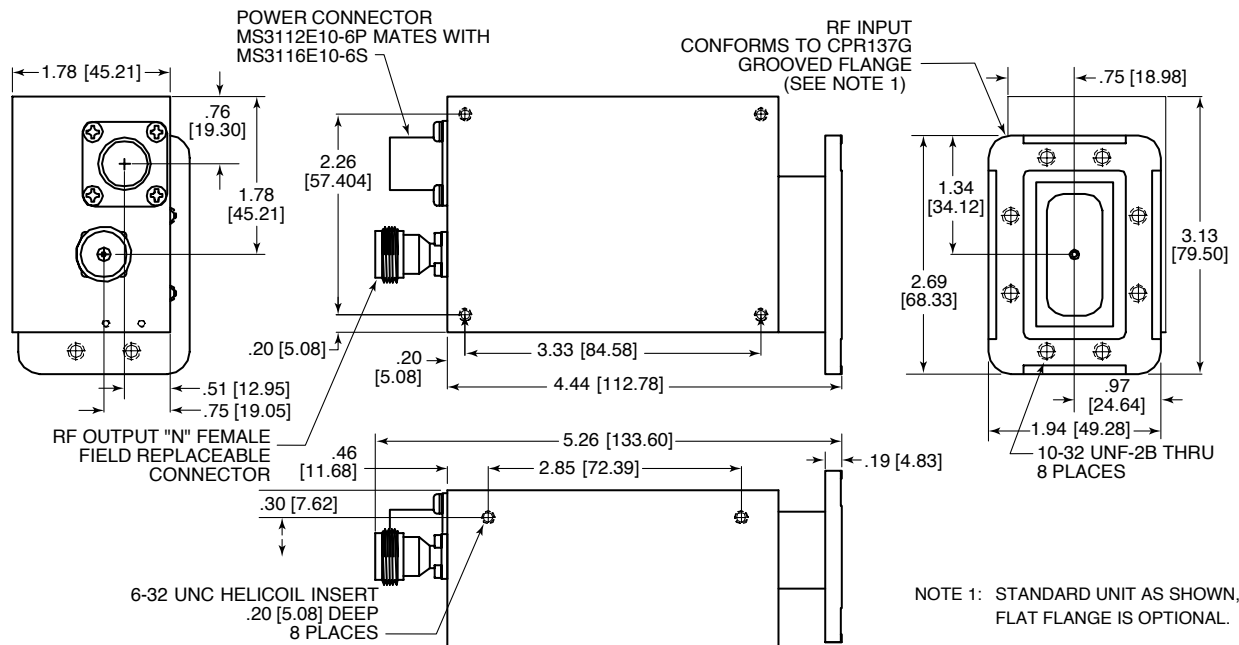


**Notes:**

1. Standard unit as shown, flat flange is optional.
2. Type N field replaceable connector option available.
3. Contact MITEQ for various pin out configurations.
4. As an option, a flat cover plate can be used to replace the multi-pin connector when a bias-tee is installed.

DASH NUMBER TABLE			
DASH NO.	DIM. A	OPTION P/N SUFFIX	DESCRIPTION
-1	1.69 [42.69]	N/A	Standard LNA
-1	1.69 [42.69]	-F	LNA with Optional Fault Alarm
-2	2.40 [60.96]	-0	LNA with Optional 100-240 VAC Power Supply
-2	2.40 [60.96]	-0, -F	LNA with Optional Fault Alarm and 100-240 VAC Power Supply

**139170**

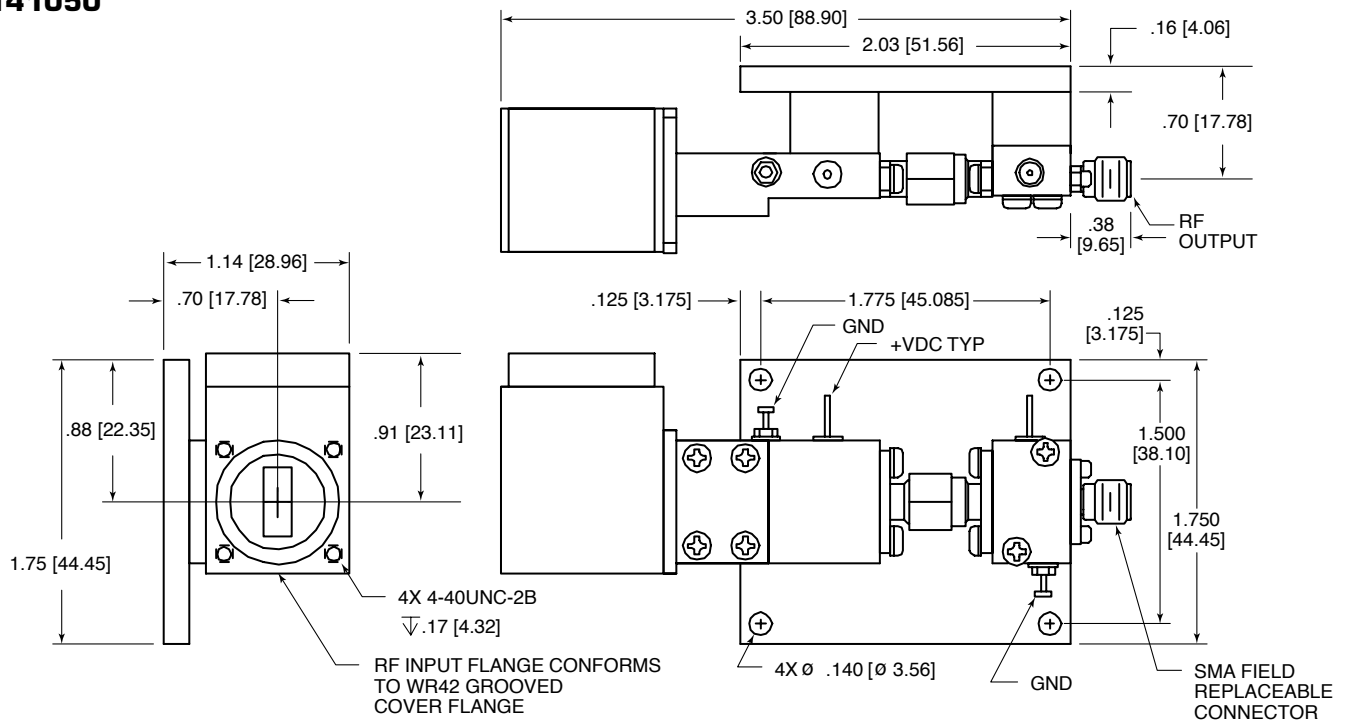


NOTE 1: STANDARD UNIT AS SHOWN, FLAT FLANGE IS OPTIONAL.

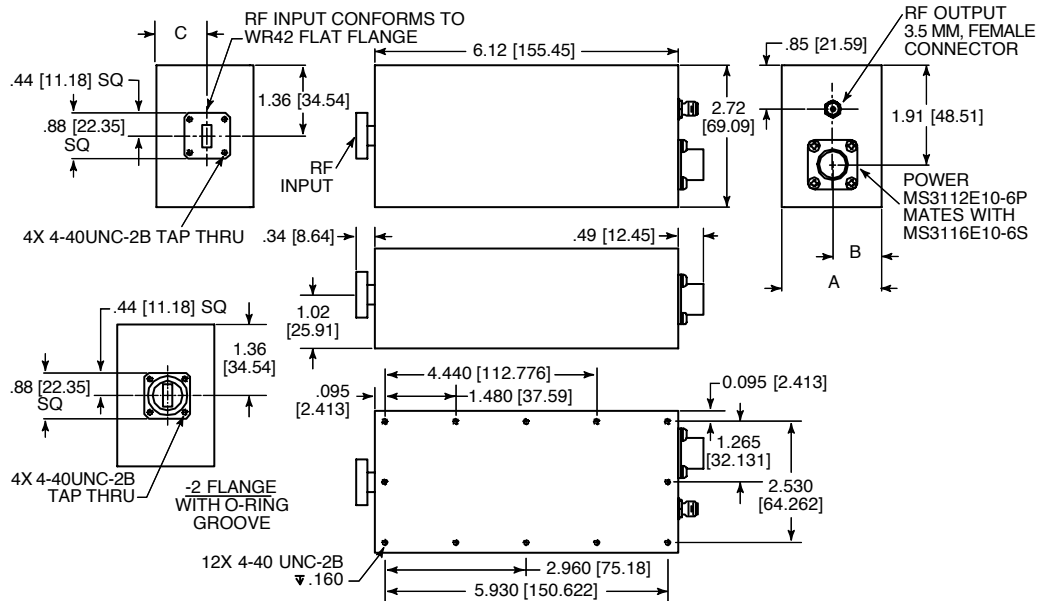
NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.

## OUTLINE DRAWINGS (CONT.)

### 141050



### 148201



CONNECTOR PIN ASSIGNMENTS	
PIN	FUNCTION
A	+15 VDC
B	Ground
C	Ground
D	Normally Open (optional)
E	Common (optional)
F	Normally Closed (optional)

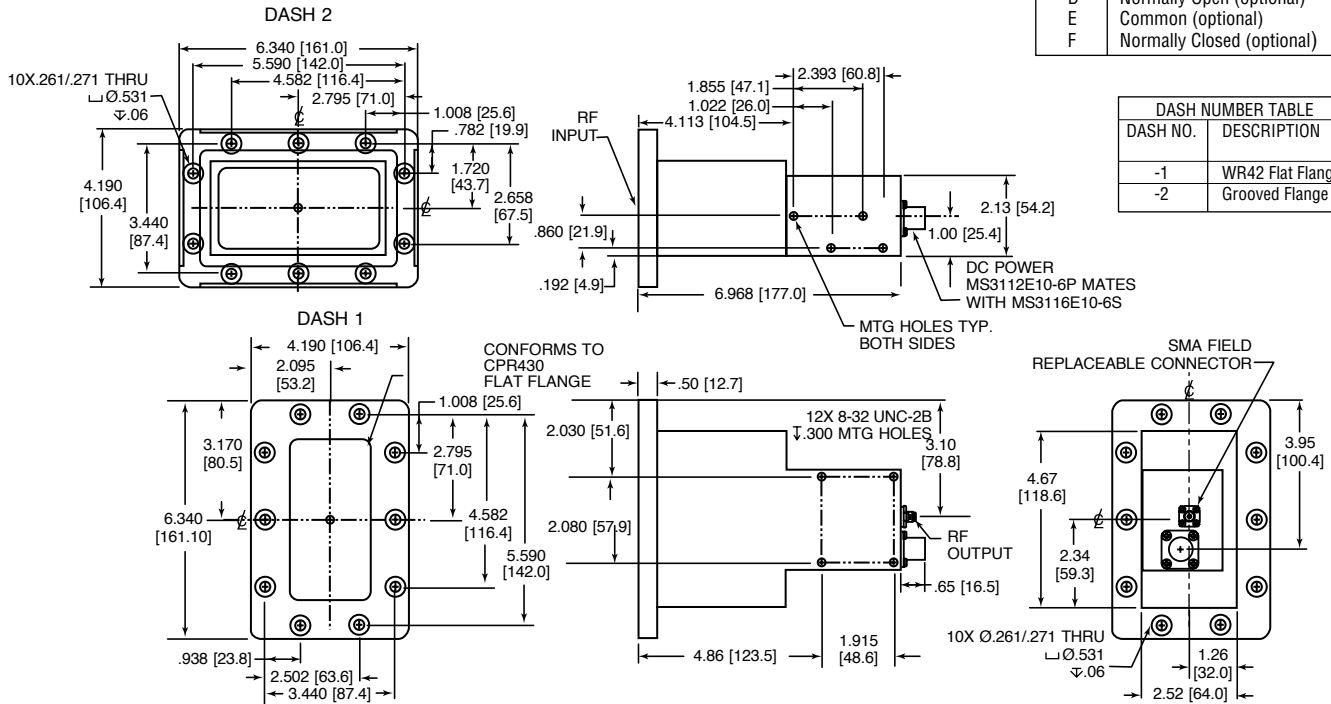
DASH NUMBER TABLE				
DASH NO.	DIM. A	DIM. B	DIM. C	DESCRIPTION
-1	1.91 [48.51]	0.93 [23.62]	1.02 [25.91]	WR42 Flat Flange
-2	1.91 [48.51]	0.93 [23.62]	1.02 [25.91]	WR42 Grooved Flange
-3	2.75 [69.85]	1.77 [44.96]	1.86 [47.24]	WR42 Flat Flange, 100-240 VAC Power Supply
-4	2.75 [69.85]	1.77 [44.96]	1.86 [47.24]	WR42 Grooved Flange, 100-240 VAC Power Supply

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.

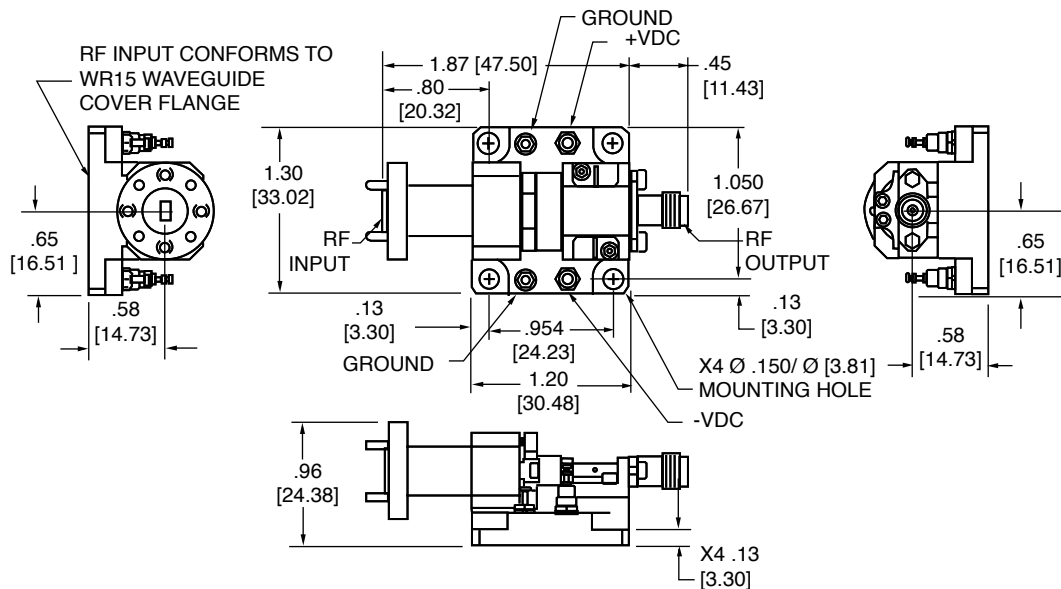
# OUTLINE DRAWINGS (CONT.)

**148029**

CONNECTOR PIN ASSIGNMENTS	
PIN	FUNCTION
A	+15 VDC
B	Ground
C	Ground
D	Normally Open (optional)
E	Common (optional)
F	Normally Closed (optional)



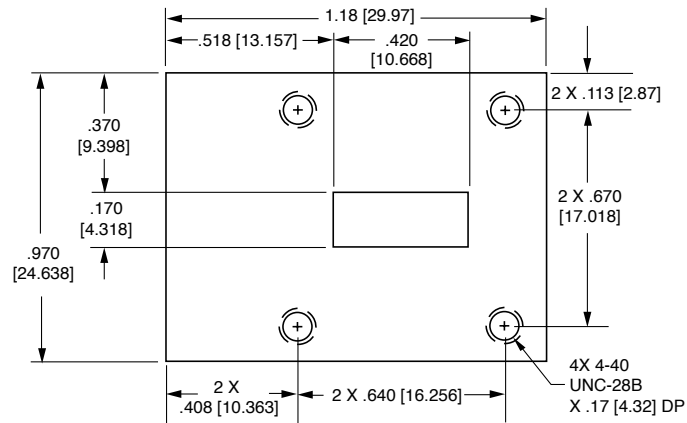
**148725**



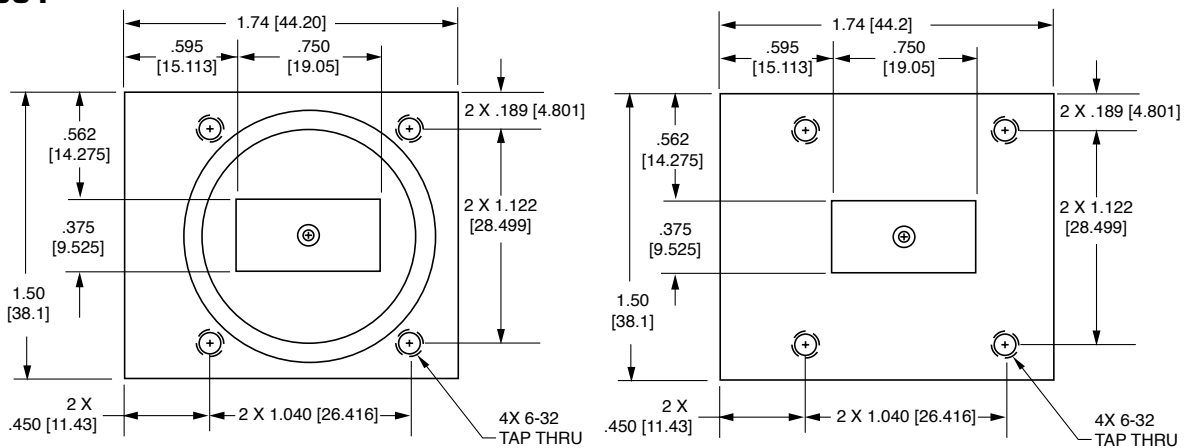
NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.

# FLANGE OUTLINE DRAWINGS

## 161500

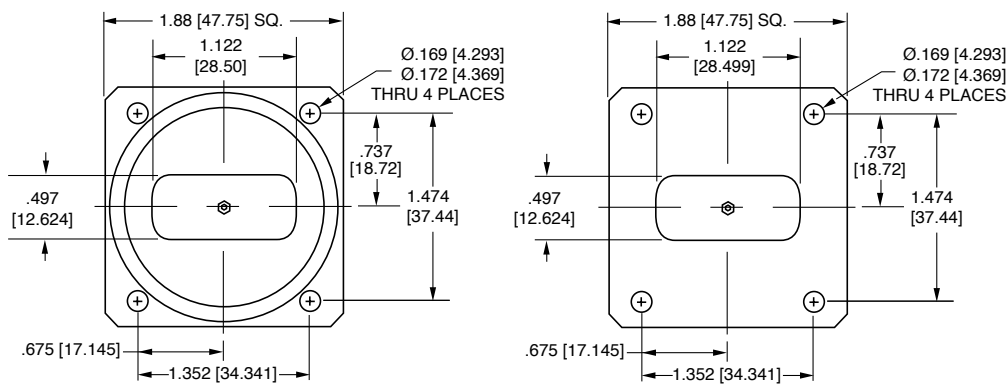


## 161501



DASH NUMBER TABLE		
DASH NO.	PART NO.	TYPE
-1	138966	GROOVED
-2	138966	NONE

## 161502

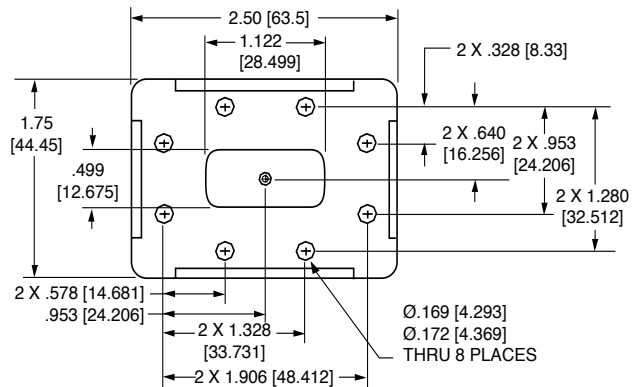
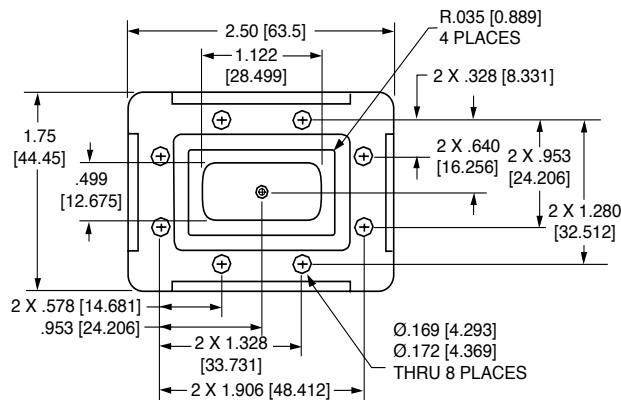


DASH NUMBER TABLE		
DASH NO.	PART NO.	TYPE
-1	127534	GROOVED
-2	127534	NONE

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.

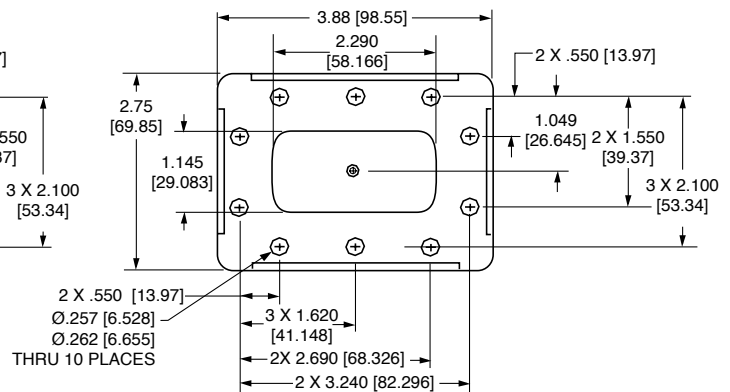
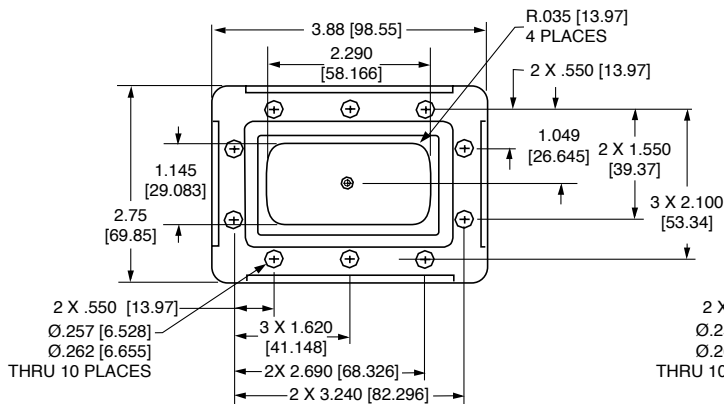
## FLANGE OUTLINE DRAWINGS (CONT.)

### 161503



DASH NUMBER TABLE		
DASH NO.	PART NO.	TYPE
-1	138968	GROOVED
-2	138968	NONE

### 161504



DASH NUMBER TABLE		
DASH NO.	PART NO.	TYPE
-1	125063	GROOVED
-2	125063	NONE

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.



## AMPLIFIER INSTALLATION INSTRUCTIONS

The SATCOM low-noise amplifiers produced by MITEQ's AMF Amplifier Department have been assembled, aligned, tested and inspected to ensure compliant performance. As with any piece of electronic equipment, proper installation is essential to guarantee optimal performance and reliability.

When installing an AMFW amplifier, the following precautions must be taken into consideration. Deviation from any of these precautions may void the applicable MITEQ warranty.

### ELECTROSTATIC PRECAUTIONS

MITEQ's AMFW low-noise amplifiers contain parts that are extremely sensitive to damage by electrostatic discharge (ESD). For this reason, standard ESD precautionary procedures must be used when handling these assemblies. Grounding wrist bands and anti-static bags are considered standard equipment in protecting against ESD damage.

### OTHER HANDLING CONSIDERATIONS

The plating/priming/painting process used to produce the AMFW amplifiers was verified by an independent test lab through a 96-hour, aggravated Salt Fog test. However, any nicks and/or scratches that may appear in a units finish will jeopardize its ability to withstand harsh environments. For this reason, extreme care must be taken when handling these units so that the external finish is not damaged in any way.

### THERMAL CONSTRAINTS

While most of the AMFW amplifiers produced are specified to operate from -40 to +60°C, the specific operating range for each LNA is defined on the Final Test Data Sheet supplied with each unit. Operating these devices outside these temperature ranges could cause permanent damage to the internal electrical circuitry.

### MOUNTING REQUIREMENTS

The mounting hardware to be used when installing SATCOM low-noise amplifiers produced by MITEQ's AMF Amplifier Department is defined in the following table. Care should be taken not to exceed the torque defined.

AMPLIFIER BAND	OUTLINE	CHASSIS MOUNTING HOLES	CHASSIS MOUNTING HARDWARE TORQUE	WAVEGUIDE FLANGE MOUNTING HOLES
C	125063	8 - 32	19 ± 1 in-lbs.	Conforms to CPR229G
X	138968	6 - 32	12 ± 1 in-lbs.	Conforms to CPR112G
Ku	138966	6 - 32	12 ± 1 in-lbs.	Conforms to WR75

As stated in the "Other Handling Considerations" section, throughout the installation process extreme care must be taken when handling these amplifiers so that the external finish is not damaged in any way.

Before fastening the waveguide flange with the proper hardware, acceptable weatherproofing techniques (for example, a flange gasket) must be used between the flange face and the contact surface. The waveguide requires gasketing for pressurization.

After the required hardware has been properly torqued and the installation complete, all exposed hardware and the areas of the amplifier where hardware has come in contact should be coated with a commercial form of weatherproofing material, (an example of such a material would be canned urethane paint). This will help protect the hardware and any areas of the amplifier's chassis that might have been marred during the installation process.

Finally, so as to protect the enclosed contacts from the environment, the chassis-mounted connector and its supplied mate must be properly engaged.

### EMI RATINGS

Certain models are certified to RE102, radiated emissions, E field, 10 kHz to 18 GHz, and RS103, radiated susceptibility, E field, 10 kHz to 40 GHz.

## ISO 9001:2000 CERTIFIED

MITEQ attained its original ISO 9001 registration in June 1993, when fewer than 1500 companies were registered. ISO 9001 has since become a recognized standard for quality in over 90 countries. Nationally, it is accepted by an ever-increasing number of government agencies in place of longstanding military specifications covering quality and inspection criteria. Among those are MIL-Q-9858 and MIL-I-45208.

MITEQ's quality system is certified to ISO 9001 by National Quality Assurance USA (NQA), an accredited registrar of the American National Standards Institute - Registration Accreditation Board (ANSI-RAB). NQA performs a quality audit at MITEQ every six months to assure continued compliance to the standard. Additionally, MITEQ's internal auditing system, coupled with regular management reviews, assures that the quality system is effective, updated and constantly improved.



## GENERAL INFORMATION

### PRICING AND TERMS

A quotation on any item in the catalog is available by contacting the factory. All quotations, unless otherwise noted, are valid for 60 days from the date of issue, F.O.B. (FCA) Hauppauge, NY 11788. Pricing does not include customer or government source inspection unless otherwise noted. On international orders, an irrevocable letter of credit may be required. MITEQ accepts these credit cards:



### QUANTITY DISCOUNTS

A quantity discount is generally available on most catalog items. Due to the wide variety of devices in the catalog, it is not possible to provide a standard discount schedule. When quantities are involved, please contact the factory and the appropriate information will be provided.



### SOURCE INSPECTION

Government / customer source inspection is available on any item upon receipt of the complete written confirmation of purchase order items, including the prime government contract number. Source inspection with respect to some products increases the unit price and extends delivery because of duplicate standard final inspection and testing. It is recommended wherever possible that a Certificate of Compliance be substituted for source inspection to minimize price and delivery delays.

### SHIPPING INFORMATION

Unless instructed otherwise by the customer, we will ship UPS in the U.S. F.O.B. (FCA) Hauppauge. Air freight will be used as the primary international means of shipment. Please indicate at time of purchase what method of shipment you require.

### RETURNED MATERIAL

When returning material for repair or replacement, please ensure that there is complete information included with the shipment, giving a detailed description of the reason for its return, the date and purchase order on which it was obtained, and the exact address to which the material is to be reshipped. All returns must arrive freight, postage, duties and handling prepaid.

### REPAIR COSTS

Warranty repairs will be made at no cost to the customer. Units out of warranty, or those which have been mishandled, will require approval by the customer for the charges involved before the repairs can be accomplished. We will provide an estimate for the cost of the repair, which can be applied to the repair, if approval is granted. For those items that are deemed beyond repair, or where the customer may decide not to repair the unit, an evaluation fee and handling charge will be applicable.

### APPLICATION ENGINEERING

We maintain a large support staff of engineers who are experts in specific areas of microwave technology. Each has an engineering background that combines both a formal engineering education with training and experience in product design. As further technical support, we make available the services of our engineering and scientific staff, who may be consulted on more advanced circuit designs or application problems.

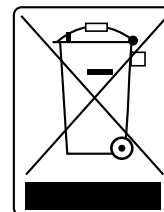
### DRAWINGS AND SPECIFICATIONS

The material presented in this catalog was current at the time of publication. MITEQ Inc.'s continuing product improvement program makes it necessary to reserve the right to change our mechanical and electrical specifications without notice. If either of these parameters is critical, please contact the factory to verify that the information is current.

## WARRANTY

1. MITEQ, Inc. warrants to the purchaser that each of its products, when shipped will be free from defects in material and workmanship and will perform in full accordance with applicable specifications. The limit of liability under this warranty is at MITEQ, Inc.'s option to repair or replace any product or part thereof which shall within: (a) three years of delivery for indoor equipment, (b) two years of delivery for outdoor equipment and (c) one year of delivery for integrated assemblies or equipment having RF output powers equal to or greater than +24 dBm, be returned by the purchaser to MITEQ, Inc., at 100 Davids Drive, Hauppauge, New York, 11788, and shall, as determined by examination by MITEQ, Inc., prove defective in material and/or workmanship. Warranty returns must first be authorized in writing by MITEQ, Inc. Disassembly of any MITEQ, Inc. product by anyone other than an authorized representative of MITEQ, Inc. voids this warranty in its entirety. MITEQ, Inc. reserves the right to make changes in any of its products without incurring any obligation to make the same changes on previously delivered products.
2. Components and subsystems having been repaired by MITEQ, Inc. shall be warranted for that repair for ninety (90) days. For products that are still within the original warranty period as described above, the original warranty (if longer) will take precedence. For all SATCOM products, that portion of the system that is repaired, will be warranted for one year.
3. As a condition to the warranties provided for herein, the Buyer will prepay the shipping charges for all products returned to MITEQ, Inc. for repair and MITEQ, Inc. will pay the return shipping with the exception of rack mountable hardware returned from outside the United States in which case the buyer will pay the shipping charges.
4. The buyer will pay the cost of inspecting and testing any goods returned under the warranty or otherwise which are found to meet the applicable specifications or which are not defective or not covered by the warranty.
5. Products sold by MITEQ, Inc. shall not be considered defective or non-conforming to the Buyers' order if they (a) satisfactorily fulfill the performance requirements that were (i) provided by the Buyer to MITEQ, Inc. or (ii) as published in the Sellers' product specification literature, or (b) or in accordance with any written or verbal agreement between the Buyer and MITEQ, Inc., or (c) are in accordance with samples approved by the Buyer.  
This warranty shall not apply to any products or parts thereof which have been subject to accident, negligence, alteration, abuse or misuse. MITEQ, Inc. makes no warranty whatsoever in respect to accessories or parts not supplied by it.
6. Limitations of Warranty, Damages and Liability  
EXCEPT AS EXPRESSLY SET FORTH HEREIN, THERE ARE NO WARRANTIES, CONDITIONS, GUARANTEES OR REPRESENTATIONS AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTIES, CONDITIONS, GUARANTEES OR REPRESENTATIONS, WHETHER EXPRESSED OR IMPLIED, IN LAW OR IN FACT, ORAL OR IN WRITING.  
  
MITEQ, INC.'S AGGREGATE LIABILITY IN DAMAGES OR OTHERWISE SHALL NOT EXCEED THE PAYMENT, IF ANY, RECEIVED BY MITEQ, INC. FOR THE UNIT OF PRODUCT OR SERVICE FURNISHED OR TO BE FURNISHED, AS THE CASE MAY BE, WHICH IS THE SUBJECT OF CLAIM OR DISPUTE. IN NO EVENT SHALL MITEQ, INC. BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL, OR SPECIAL DAMAGES, HOWSOEVER CAUSED.
7. All matters regarding this warranty shall be interpreted in accordance with the laws of the State of New York and any controversy that cannot be settled directly shall be settled by arbitration in New York, New York in accordance with the rules then prevailing of the American Arbitration Association, and judgement upon the award rendered may be entered in any court having jurisdiction thereof.
8. As required by Article 10(3) and Article 11(2) of Directive 2002/96/EC (WEEE Directive) of the European Parliament and the Council of the European Union, and in accordance with European Standard EN 50419, MITEQ Inc. labels its products with the following symbol:

This symbol indicates that the product cannot be thrown into the trash, and must be collected and treated in accordance with Directive 2002/96/EC and local regulations.



**MITEQ FEDERAL SUPPLY CODE**  
**Our Federal Supply Code is: 33592**