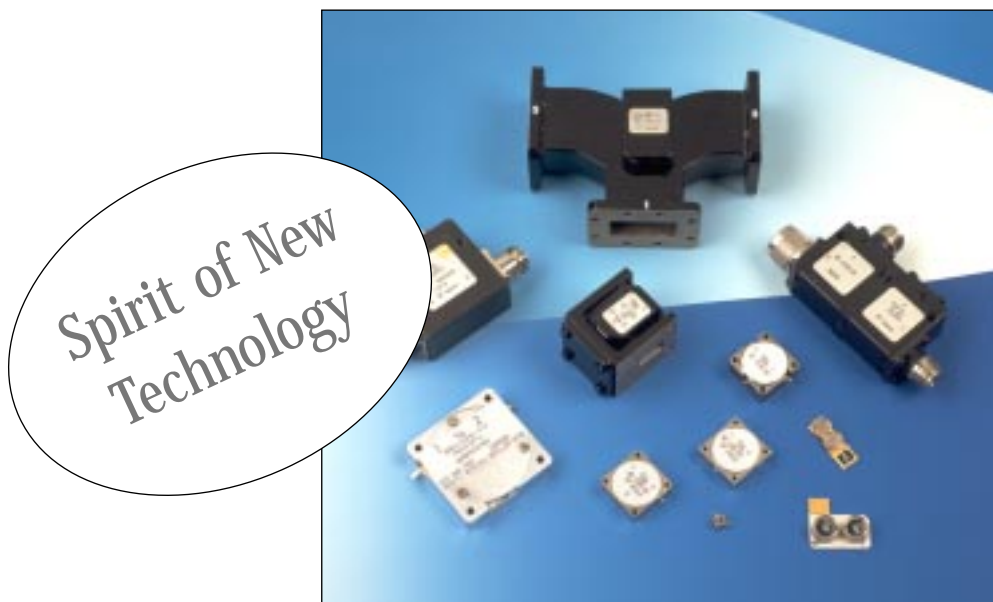




# FERRITE DEVICES

## CONTENTS



**PAGE**

- ▶ CIRCULATORS AND ISOLATORS SPECIFIC REQUEST ..... 15-2
- ▶ TECHNICAL INFORMATION ..... 15-3
- ▶ DROP-IN CIRCULATORS & ISOLATORS ..... 15-9
- ▶ COAXIAL DEVICES ..... 15-19
- ▶ WAVEGUIDE DEVICES ..... 15-34
- ▶ DESIGN AID ..... 15-50
- ▶ HOW TO ORDER? ..... 15-56
- ▶ QUALITY ASSURANCE ..... 15-57

All specifications contained in that catalog are subject to change without notice.

Specific request



# ▶ CIRCULATOR AND ISOLATOR SPECIFIC REQUEST

ISOLATOR

CIRCULATOR

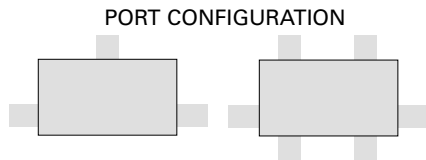
TECHNOLOGY (drop-in, waveguide, etc.)	:	_____	
PART NUMBER (if existing)	:	_____	
OPERATING FREQUENCY	:	_____	
PACKAGE/DIMENSIONS	:	_____	
INPUT POWER (CW/Peak)	:	_____	
REVERSE POWER for isolator (CW/Peak)	:	_____	
<hr/>			
INSERTION LOSS	:	_____	dB
ISOLATION	:	_____	dB
V.S.W.R.	:	_____	
OPERATING TEMPERATURE RANGE	:	_____	° C

- COAXIAL
- WAVEGUIDE

Waveguide reference:

CONNECTORS (or flanges) AND TERMINATIONS

Port # 1: \_\_\_\_\_ Port # 3: \_\_\_\_\_  
 Port # 2: \_\_\_\_\_ Port # 4: \_\_\_\_\_



Please, indicate the direction of circulation (outline):

ENVIRONMENTAL CONDITIONS	
SPACE	<input type="checkbox"/>
MILITARY	<input type="checkbox"/>
COMMERCIAL	<input type="checkbox"/>
AIRBORNE	<input type="checkbox"/>
NAVAL	<input type="checkbox"/>

**Please fax this sheet to the sales office it may concern**

FM: ..... Company: .....  
 Phone: ..... Fax: .....

TO: TEMEX Attention of M.: .....

COMMENTS: .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....



# ▶ TECHNICAL INFORMATION

## TECHNOLOGY

### Y-Junction circulator

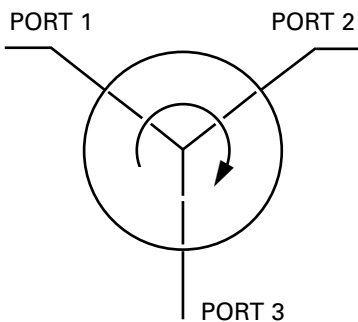


FIG. 1

The Y-junction circulator uses [spinel ferrites](#) or [garnet ferrites](#) in the presence of a magnetic bias field, to provide a non-reciprocal effect. A 3-port circulator (shown in figure 1) is the basic model, which can be used to explain how it operates.

If a signal is applied at port # 1, it will emerge from port # 2 with a loss characteristic called "insertion loss". Typical values of insertion loss: 0.1 to 0.5 dB.

In the reverse direction, there will be leakage at port # 3 from the incoming signal at port # 1. This leakage called isolation is typically 20 dB below incoming power at port # 1.

Due to the "3rd order symmetry" of the Y-junction, the behavior is the same for the other ports, with respect to port # 1 to port # 2, port # 2 to port # 3 and port # 3 to port # 1. The circulator's role is to pass energy, for instance, in the RF-head of a radar, assuring high isolation between the high power transmitter and the sensitive low power receiver ([figure 2](#)).

The Y-junction exists in three main technologies:

- [Coaxial devices](#): these feature triplate technology with coaxial connectors.
- [Drop-in circulators](#): in triplate or microstrip technology.
- [Waveguide devices](#): it consist of three waveguides forming an H-plane junction in either a "T" or a "Y"-symmetrical structure.

When very high power is needed, the technology uses a four-port differential phase shift duplexer.

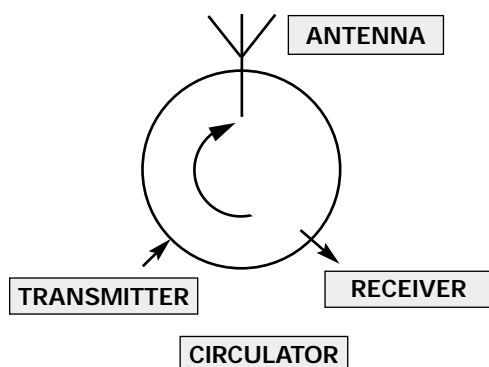


FIG. 2

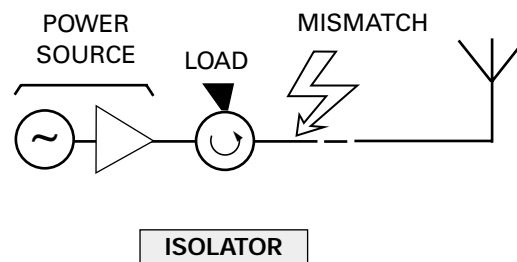


FIG. 3

Technical information /Technology



A Y-junction circulator can be made into an isolator by adding an internal termination on port # 3, for example.

The device passes signals with low loss (port # 1 to port # 2) and with high loss in the opposite direction.

It is used to "isolate" one microwave device from another. It can, for example, protect expensive, high-power RF sources from variations in loading conditions or mismatching (see figure 3).

*4-Port differential phase shift circulator*

This four-port-device is normally used with one load, such as a high-power circulator (duplexer), or with two dummy loads, such as a high-power isolator.

This circulator consists of three basic parts:

- Hybrid folded magic tee
- Twin parallel ferrite phase shift sections
- 3 dB coupler

*Resonance isolator - Waveguide devices*

By magnetically biasing a ferrite inside a waveguide, the non-reciprocal effect is obtained: with low losses in one direction and high losses (isolation) in the opposite direction.

Those isolators are only used for low and medium power (see figure 4).

The ferrite material has to dissipate the return power due to mismatch.

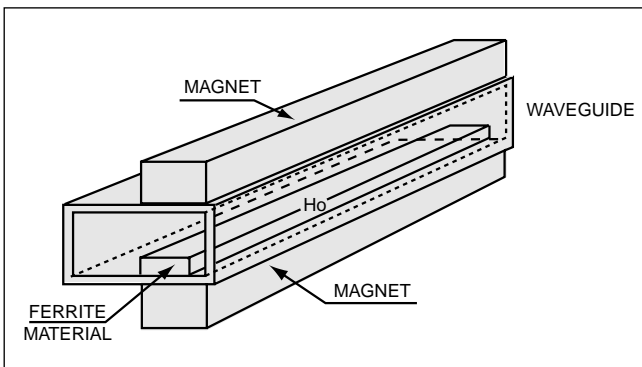


FIG. 4

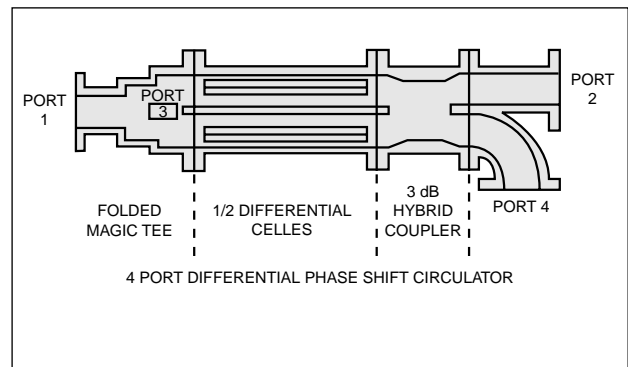


FIG. 5

*Ferrite switches*

These devices change the polarity of the magnetic bias (N → S) and the RF-signal direction of circulation. This is made by a coil instead of a magnet. This technology is used for ferrite switches in both product lines:

- Y-junction
- 4-port differential phase shift device

ELECTRICAL FEATURES

All the parameters given in this section (insertion loss, isolation, VSWR, power) are absolute maximum ratings assured in the operating temperature range. **Typical values are obviously better.**

Insertion loss (I.L.)

If a signal is applied at port # 1, it will emerge from port # 2 with a loss characteristic called insertion loss, which will be the ratio of the output signal to the input signal expressed in dB:

$$I.L \text{ dB} = 10 \log_{10} \left[ \frac{P_{in}}{P_{out}} \right]$$

Typical values: 0.1 to 0.4 dB.

Isolation

- **For an isolator:**

If a signal is applied at port # 2, it will emerge from port # 1 with a high insertion loss called isolation, which is also expressed in dB (ratio of the output signal to the input signal).

- **For a circulator:**

For a circulator, it should be noted that this parameter is not applicable. But it is common to use this parameter as if the circulator could be made into an isolator by terminating one port (e.g. port # 3) with a matched load. The isolation measured is dependent on the VSWR of both the termination and the circulator port.

Typical values: -20 to -30 dB

VSWR

The reflection coefficient magnitude  $|\rho|$  characterizes the reflective property of each port of an isolator or circulator (see Fig. 6).

$$|\rho| = \sqrt{\frac{P_{refl}}{P_{in}}}$$

It is useful to use the voltage standing wave ratio (VSWR)

$$VSWR = \frac{1 + |\rho|}{1 - |\rho|}$$

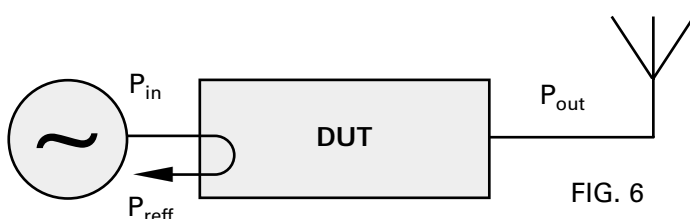


FIG. 6

Typical values: 1.07: 1 to 1.25: 1

Technical information / Electrical features



Effect of an isolator on VSWR (Fig.7)

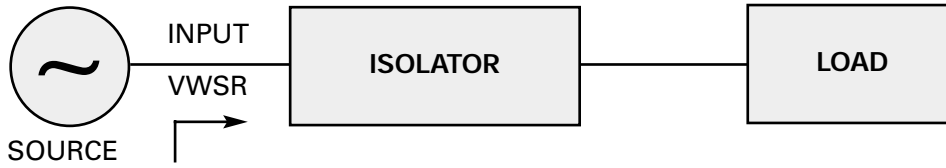


FIG. 7

The effective input VSWR of an isolator will vary at a function of the load VSWR. If the output load mismatch is increased, energy is reflected at the termination port, attenuated by the isolation and then reflected back to the input. This effect increases the total input VSWR observed at the input.

**Example:**

The load VSWR is 10: 1, the isolator has 18 dB isolation, which improves the input VSWR to 1.20: 1.

*Temperature range*

The performance of a circulator or isolator is limited by ferrite and magnet material behavior in the operating temperature range.

In this catalog, for each device the main specifications are given:

- at room temperature: 25° C,
- over a specified temperature range.

*Power rating*

The input power to a ferrite device can be supplied from a CW or a pulsed source. For pulsed source, peak and average power should be specified, pulse duration and duty cycle are also needed in order to determine an adequate safety margin.

*Average power*

For high power products, average power is limited by the dissipation in the ferrite. Adequate cooling is necessary to insure the ferrite material does not reach excessive temperature. There are three kinds of cooling: liquid, forced air or natural convection.

*Peak power*

To avoid breakdown or arcing, special ferrite materials are designed. Frequency of operation and peak-power level determine whether the waveguide circulator should be pressurized or unpressurized with dry air or gas (N<sub>2</sub> or SF<sub>6</sub>).

### Load VSWR

Power rating of a ferrite device depends on the mismatch at the output port (load VSWR); for instance, for an isolator, if load VSWR is 2: 1, more than 10% of the input power is reflected inside the ferrite device to the internal load.

In case of short-circuit (infinite load VSWR), the ferrite device has to handle the equivalent of twice the input CW-power, and the equivalent of a peak power equal to 4 times the input power, based on the higher internal voltage levels.

Therefore, the time-duration of short circuit or high load VSWR is needed in order to determine an adequate safety margin.

### Third order intermodulation products (IMP<sub>32</sub>)

Harmonics and third order intermodulation products appear when non-linear elements are used such as ferrite materials, metal welds, surface finish, etc.

When two tones -  $F_1$  and  $F_2$  - are applied to a ferrite device, the relative amplitudes of  $2F_1 - F_2$  and  $2F_2 - F_1$  are critical in some communication systems and should be specified when ordering (see Fig. 8).

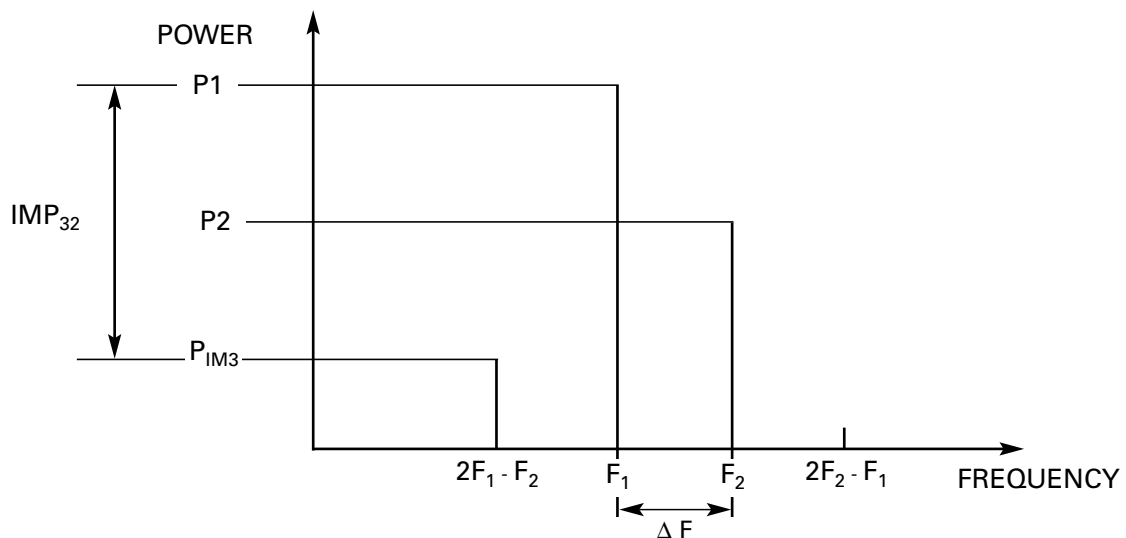


FIG. 8

- Test conditions (to be specified)
  - $F_1$  and  $F_2$ ,
  - $P_1$  and  $P_2$  in W or dBm.
- Third order intermodulation products
  - $P_{IM3}$  in dBm or,
  - $IMP_{32} = P_{IM3} - P_1$  in dBc.

Technical information / Electrical features



*Intermodulation parameters*

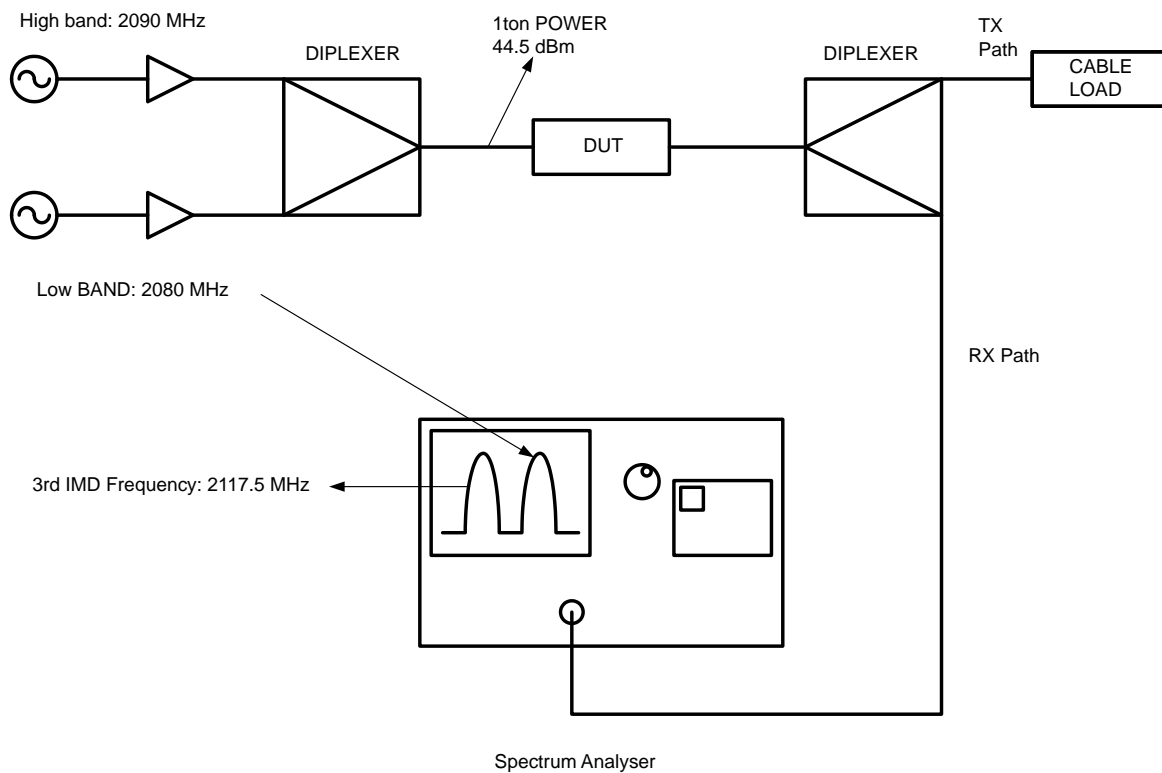
Base stations are using modulation signal that TEMEX may not have.

In order to design and to provide data about intermodulation level 3, TEMEX is using a two tones (channels) measurement.

The following conditions are used for the measurements:

- 1. Power on each channel: defined by the customer or minimum 25 Watt if not specified.  
Frequencies of each two tones: taken at the center of the bandwidth
- 2. Forward intermodulation F1, P1, F2, P2, as input signals will give a forward Intermodulation level IMP3
- 3. Reverse intermodulation F1, P1 in input, F2, P2 at the output, as input signals will give a reverse intermodulation level IMP3
- 4. F1 and F2 are two tones with 20 MHz difference

*Test set up*







# ▶ DROP-IN CIRCULATORS & ISOLATORS

## Selection Guide

	<u>PAGE</u>
<u>INTRODUCTION</u>	<u>15-10</u>
<u>HIGH POWER SUBMINIATURE SMD ISOLATORS</u>	<u>15-11</u>
- <u>FREQUENCY RANGE:</u> <u>370 - 470 MHz ; SIZE 10 X 10</u>	<u>15-12</u>
<u>800 - 900 MHz ; SIZE 10 X 10</u>	<u>15-12</u>
<u>1800 - 1900 MHz ; SIZE 10 X 10</u>	<u>15-12</u>
<u>HIGH POWER WIDE BAND SUBMINIATURE SMD ISOLATORS</u>	
- <u>FREQUENCY RANGE:</u> <u>370 - 470 MHz ; SIZE 12 X 12</u>	<u>15-13</u>
<u>MINIATURIZED DROP-IN ISOLATORS &amp; CIRCULATORS</u>	<u>15-14</u>



## Introduction



## INTRODUCTION

For more than 10 years, TEMEX designs miniaturized drop-in circulators and isolators.

Today, patented designs, space qualified drop-in assemblies and time proven circulators and isolators are available.

Current production of drop-in devices is covering frequency ranges from HF, VHF, UHF and up to 18 GHz.

New technologies of drop-in devices have been developed these last years:

- Patented designs with magnetical and electrical shieldings,
- Wide band devices,
- Operating with various substrates,
- Integrated substrates,
- Double cell circulator designs,
- Integrated functions (diode limitors, etc.),
- Low mass sub-systems for satellite pay-load integration,
- Technological process (SMD & micro-electronic applications MMIC compatible).

Automated brazing benches, cycling and ageing benches, S-parameters networks analyzers with automated test benches are the basic tools used by TEMEX for mass production capacity. In addition, test set-up for 3rd order intermodulation products for VHF/UHF frequency bands, power handling capability and clean room for space components and assemblies are available in our facility.

### *Custom components*

TEMEX capability has broadened to custom sub-systems which integrate circulators, terminations, limitors, detectors, etc.

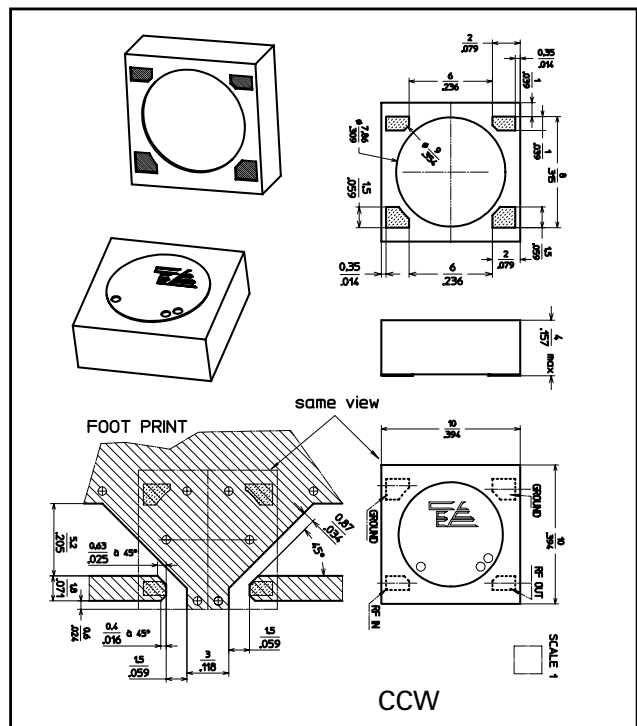
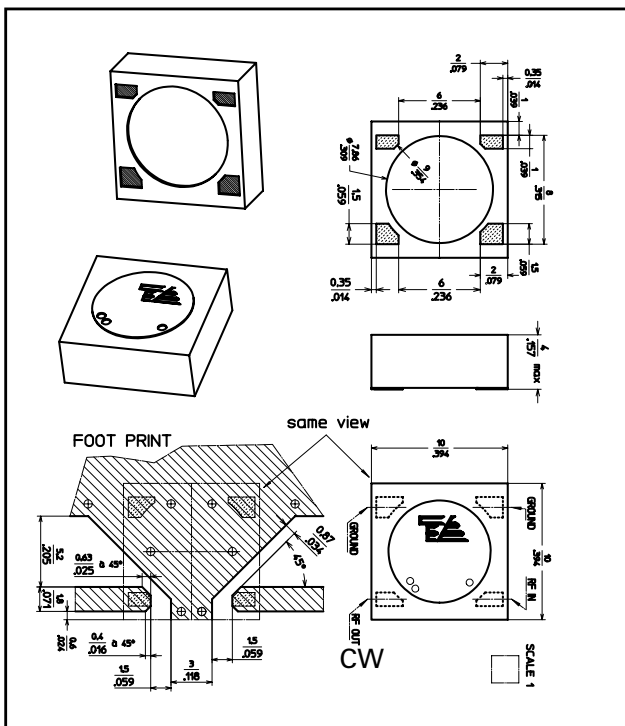
Furthermore, the following presentation of some products is only a resume of our expertise and our engineering staff stands ready to design and produce custom components to state-of-art specification.

### HIGH POWER SUBMINIATURE SMD ISOLATORS

#### Description

TEMEX surface mount isolators, designed for cellular applications, with high performance at low cost. These designs are suitable for IR reflow assembly at 235° C. Delivered in tape and reel, they are available at the main cellular frequency band. Reel of 500 pieces are delivered in sealed pack with P/N and date code. Custom product are available upon request.

#### Outline drawings



High power Subminiature SMD isolators



*Frequency range 370 - 470 MHz ; Size 10 x 10 mm  
UB11XX (clock wise) and UB12XX (counterclock wise) Series*

**Features**

- Typical: 15 dB isolation, 0.8 dB insertion loss
- Low cost product

*Frequency range 800 - 900 MHz ; Size 10 x 10 mm  
UC11XX (clock wise) and UC12XX (counterclock wise) Series*

**Features**

- Typical: 18 dB isolation, 0.5 dB insertion loss
- Input power 10 W-CW
- Low cost product
- Available in tape and reel

*Frequency range 1800 - 1900 MHz ; Size 10 x 10 mm  
UD11XX (clock wise) and UD12XX (counterclock wise) Series*

**Features**

- Typical: 18 dB isolation, 0.6 dB insertion loss
- Available frequency bands:
  - 1710 - 1780 MHz      1805 - 1880 MHz
  - 1850 - 1980 MHz      1930 - 1990 MHz
- Low cost product

**Electrical specifications**

**UB11XX ; UB12XX**

Parameters	Units	Frequency bandwidth		
		10	20	30
Available frequency range	MHz	478 - 484	380 - 400	370 - 400
		410 - 420	410 - 433	410 - 440
		450 - 470		
Isolation	dB	15	13	10
Insertion loss	dB	0.8	1.0	1.25
Return loss	dB	15	13	10

Performance warranted over temperature range: -20, +70° C

**UC11XX ; UC12XX**

Parameters	Units	-40 to +85° C	
		Min.	Max.
Custom frequency bandwidth	MHz	5	20
Isolation	dB	15	
Insertion loss	dB		0.7
Return loss	dB		14
Forwarder power	Watts		10
Reverse power (1)	Watts		3

CW P/N	CCW P/N	Frequency (MHz)
UC1134-08	UC1234-08	819-854
UC1130-01	UC1230-01	869-894
UC1134-06	UC1234-06	880-915
UC1134-12	UD1234-12	885-920
UC1134-00	UC1234-00	925-960

(1) Continuous power during 2 mn

**UD11XX ; UD12XX**

Parameters	Units	-20 to +70° C	
		Min.	Max.
Custom frequency bandwidth	MHz	5	20
Isolation	dB	15	
Insertion loss	dB		0.9
Return loss	dB		15
Forwarder power (1)	Watts		10
Reverse power (2)	Watts		3

Performance warranted over temperature range: -20, +70° C

(1) Continuous power

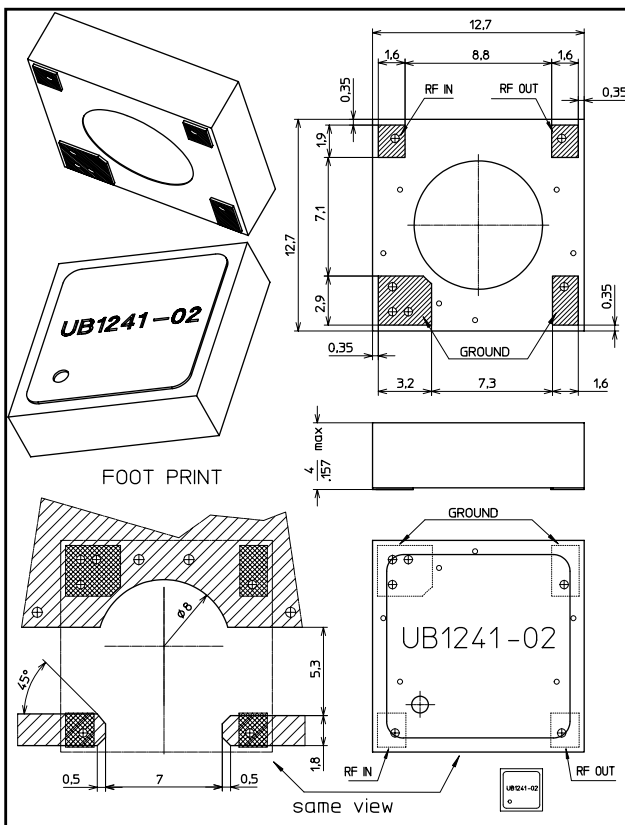
(2) Continuous power during 2 mn

### HIGH POWER WIDE BAND SUBMINIATURE SMD ISOLATORS

#### Description

TEMEX surface mount isolators, designed for cellular applications, with high performance at low cost. These designs are suitable for IR reflow assembly at 235° C. Delivered in tape and reel, they are available at the main cellular frequency band. Reel of 500 pieces are delivered in sealed pack with P/N and date code. Custom product are available upon request.

#### Outline drawings



*Frequency range 370 - 470 MHz ; Size 12 x 12 mm  
UB11XX (clock wise) and UB12XX (counterclock wise) Series*

#### Features

- Typical: 12 dB isolation, 1 dB insertion loss
- Broadband product: 50 MHz
- Low cost product

#### UB114X ; UB124X

Parameters	Units	Min.	Max.
Isolation	dB	10	
Insertion loss	dB		1.15
Return loss	dB		10
Forwarder power (1)	Watts		10
Reverse power (2)	Watts		3

Performance warranted over temperature range: -20, +70° C

- (1) Continuous power
- (2) Continuous power during 2 mn

Miniaturized drop-in circulators & isolators



## MINIATURIZED DROP-IN CIRCULATORS & ISOLATORS

TEMEX has designed a line of miniaturized drop-in circulators and isolators covering the frequency ranges from **75 MHz** to **18 GHz**.

These circulators and isolators are designed to be used for applications where **space saving** and **magnetic shielding** are required, to avoid any detuning when operating close to magnetic field or ferrous materials:

- Cellular applications such as **NMT**, **AMPS**, **CT-1**, **CT-2**, **TACS**, **E-TACS**, **GSM**, **JDC**, **DECT**, **DCS**, **PCS**, **WLAN** and any communication base stations: **TFTS**, **INMARSAT** etc.
- Broadcasting applications: **DAB**, etc.
- Microstrip sub-systems
- Airborne equipment
- Missiles
- Radars / phase array antennas
- Satellite pay loads
- Earth stations

Circulators and isolators are available under standard packages with "standard inch" dimensions.

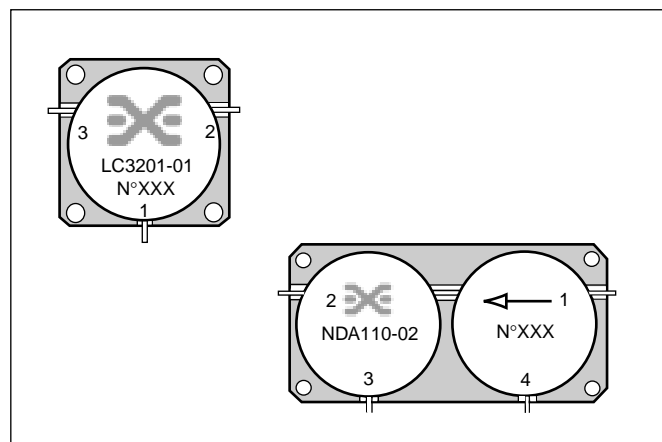
Isolators integrate the load which is:

- Up to 60 W-CW power handling capability for VHF/UHF bands,
- 1 W-CW power handling capability for microwave frequency bands.

For microwave applications, circulators are available in round package. Isolators are available in flange type package with or without through mounting holes.

Depending on the requested isolation, one or two cell designs are available in the VHF/UHF band as standard packages.

The drop-in design allows easy and fast installation into stripline and microstrip assemblies with mounting screws or soldering with conductive epoxy glue.



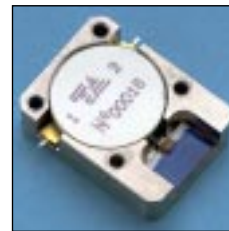
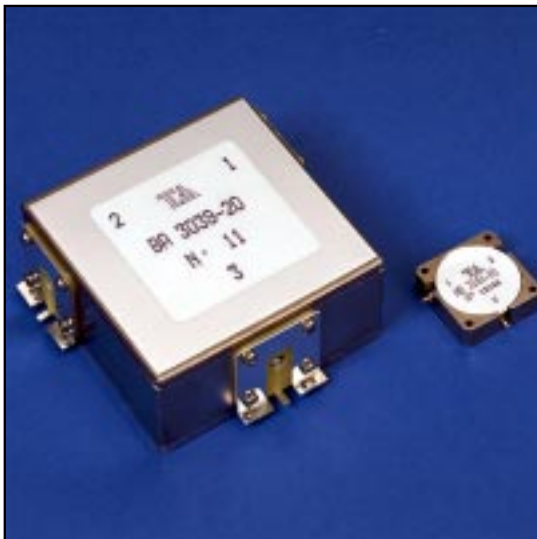
Test jigs for different packages are available for customer's incoming inspection.

### 3-Port circulators & isolators

Model		Frequency range (MHz)	Isolation (dB)		Insertion loss (dB)		V.S.W.R. max.	Power (W-CW)		Case	Operating temperature °C
Circulator	Isolator		typ.	min.	typ.	max.		Input	Load*		
NB3040	NB1040	380-430	22	20	0.3	0.4		100	60	T58	-10 to +55
NC3104	NC1104	890-960	23	20	0.3	0.4	1.25	100	60	T42	-10 to +55
NC3106	NC1106	920-960	25	20	0.3	0.4	1.25	100	60	T42	-10 to +55
ND3100	ND1100	1030-1090	22	20	0.3	0.5	1.25	100	10	T42	-10 to +55
ND3141	ND1141	1270-1400	22	20	0.3	0.5	1.25	30	3	T42	-10 to +55
ND3161	ND1161	1452-1492	22	20	0.3	0.4	1.25	30	0.3	T42	-10 to +55
ND3162	ND1162	1525-1661	22	20	0.3	0.5	1.25	30	3	T42	-10 to +55
ND3183	ND1183	1710-1785	22	20	0.3	0.4	1.25	30	3	T44	-10 to +55
ND3184	ND1184	1805-1880	22	20	0.3	0.4	1.25	50	50	T44	-10 to +55
ND3181	ND1181	1805-1880	23	20	0.3	0.4	1.25	50	50	T42	-10 to +55
ND3186	ND1186	1930-1990	23	20	0.3	0.4	1.25	50	50	T44	-10 to +55
ND3182	ND1182	1930-1990	23	20	0.3	0.4	1.25	50	50	T42	-10 to +55
	NE1101	2100-2300	23	20	0.3	0.4	1.25	10	1	T44	-10 to +55
	NE1120	2300-2500	23	20	0.3	0.4	1.25	10	1	T44	-10 to +55
	NE1130	2700-2900	23	20	0.3	0.4	1.25	150	15	T44	-30 to +70
	NF1100	2700-3100	23	20	0.4	0.5	1.3	150	15	T44	-30 to +70
NG3142		5400 - 5900	22	20	0.3	0.4	1.22	1	1	T53	-30 to +70
NG3140	NG1140	5650 - 5850	25	23	0.3	0.4	1.25	10	1	T45	-30 to +70
	NJ1101	7900 - 8400	20	17	0.5	0.6	1.50	10	1	NJ1	-40 to +85
	NJ1111	8500 - 9500	20	17	0.6	0.7	1.50	10	1	NJ1	-40 to +85
	NJ1139	9820- 12600	18	16	0.6	0.7	1.45	1	1	NJ1	-40 to +85
NJ3130		11000- 11500	22	20	0.4	0.5	1.25	20		NJ3	-40 to +85
NJ3151		13000- 14000	22	20	0.4	0.5	1.25	30		NJ3	-40 to +90
	NJ1140	13000- 14000	22	20	0.6	0.8	1.50	10	2	NJ1	-45 to +125
	NJ1161	14000- 14500	22	20	0.5	0.6	1.25	20	1	NJ1	-45 to +125
	NJ1162	14500- 15500	22	20	0.5	0.6	1.50	10	1	NJ1	-40 to +85
	NJ1160	15500 - 16000	22	20	0.5	0.6	1.50	10	1	NJ1	-40 to +85

\* Notes:

- For an isolator: power of the integrated load, 10 W-load optional,
- For a circulator: reflected power handling capability.





Miniaturized drop-in circulators & isolators



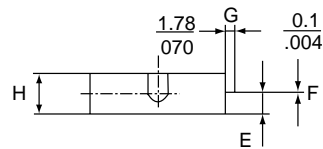
## Outline drawings

### 3-Port circulators & isolators

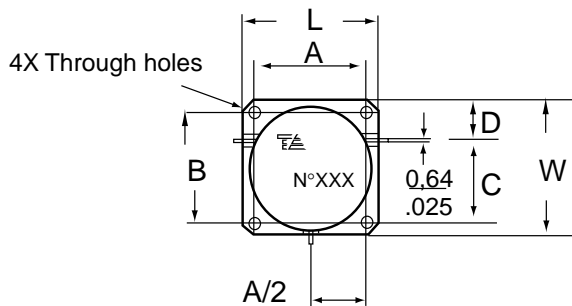
Dimensions in mm

Case	L	W	H	A	B	C	D	E	F	G	Ø Holes
<a href="#">T42</a>	25.4	Circ.: 25.4 Iso.: 31.75 max.	7.62	20.83	20.83	15.36	7.75	3.81	0.64	1.78	2.1
<a href="#">T44</a>	19.05	Circ.: 19.05 Iso.: max. 25.4	6.35	14.50	14.50	10.57	6.20	3.13	0.64	1.78	2.03
<a href="#">T45</a>	12.7	Circ.: 12.7 Iso.: max. 12.7	6.35	9.65	9.65	6.85	4.32	3	0.63	1.8	1.9 or M2.5
<a href="#">T54</a>	51.5	51.5 Iso.: max. 51.5	12	41.8	41.8	34.15	12.5	3.5	2	1.75	3.3 M2.5
<a href="#">T58</a>	51	51 Iso.: max. 51	19	42	42	34	12.5	4.2	0.5	7	3.5

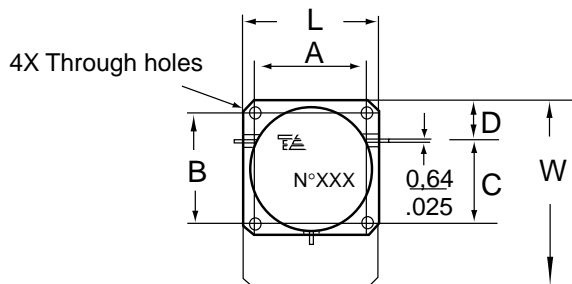
#### T42 - T44 - T45 - T54 - T58 SERIES



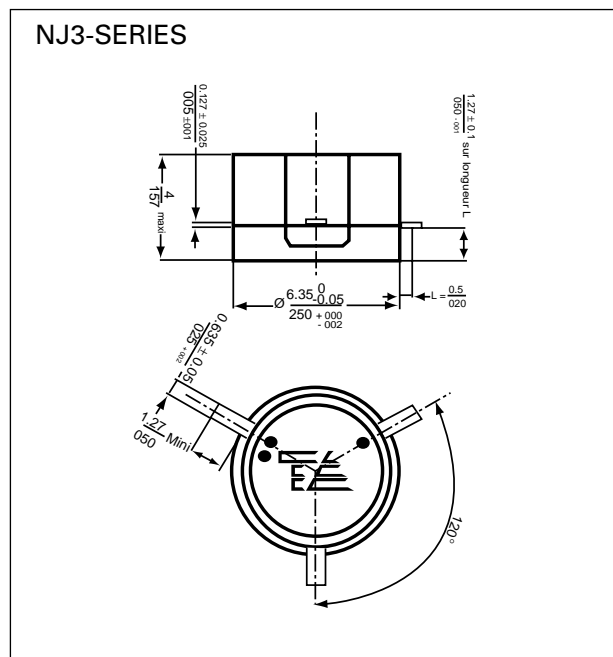
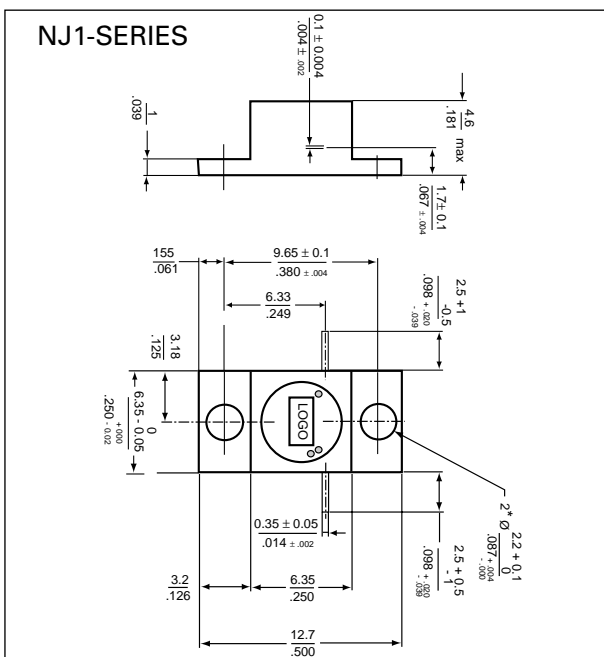
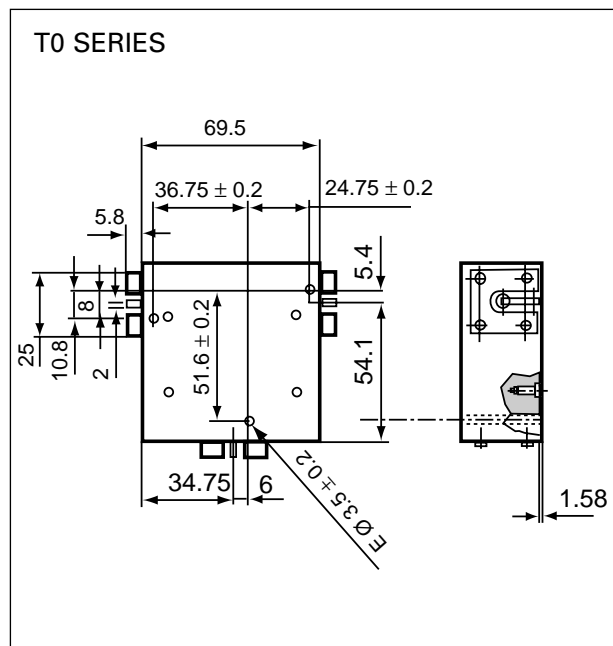
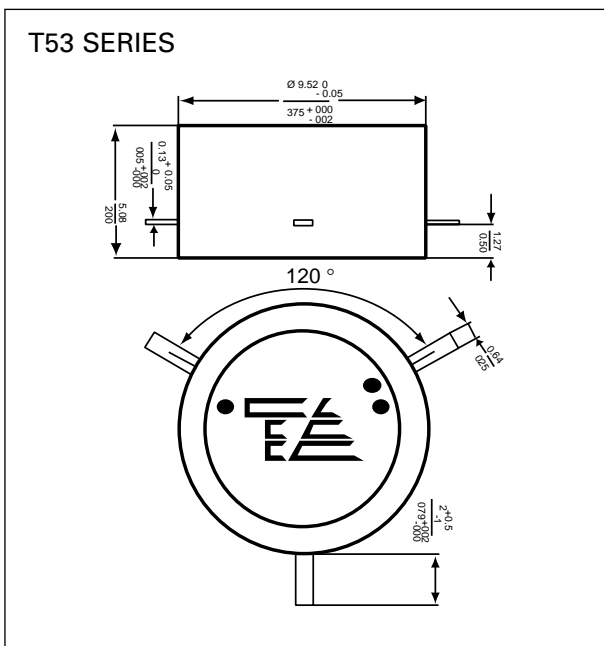
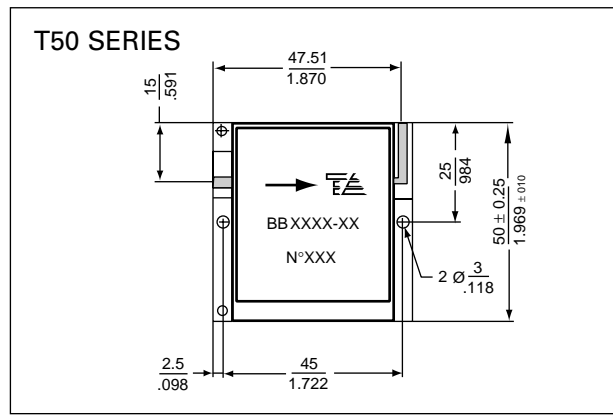
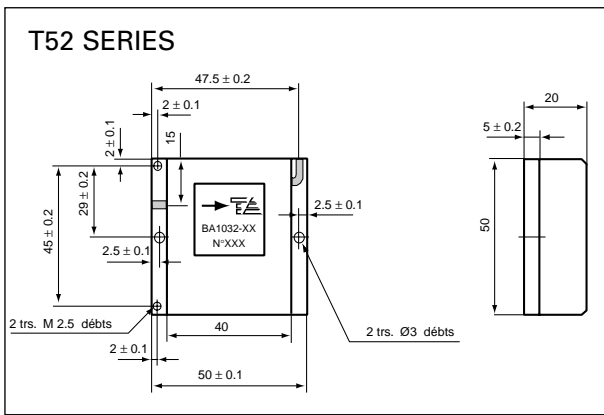
Circulator



Circulator







## Miniaturized drop-in circulators & isolators



### 4-Port circulators

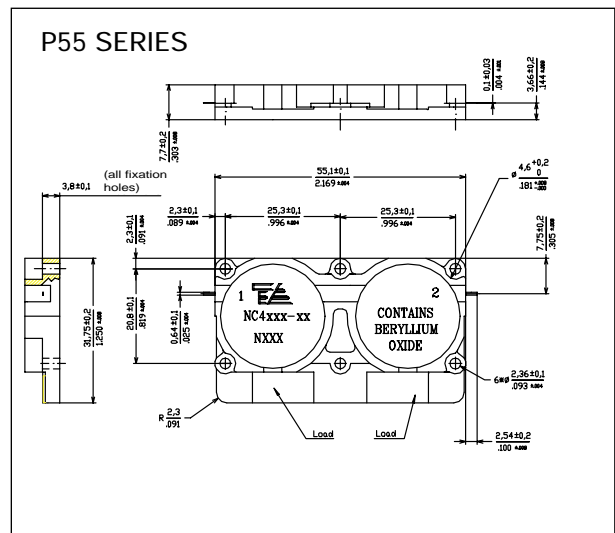
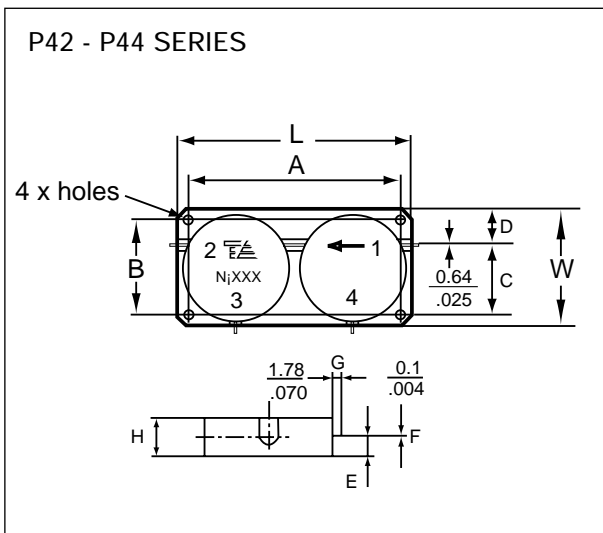
Model Circulator	Frequency range (MHz)	Isolation (dB)		Insertion loss (dB)		V.S.W.R.		Power (W-CW) Input	Case	Operating temperature
		typ.	min	typ.	max	typ.	max			
NC4112	920-960	46	40	0.4	0.7	1.20	1.25	100	P55	-10° to +55° C
NC4116	920-960	46	40	0.4	0.7	1.20	1.25	100	P42	-10° to +55° C
ND4112	1805-1880*	46	40	0.4	0.7	1.20	1.25	100	P55	-10° to +55° C
ND4224	1805-1880*	46	40	0.4	0.7	1.20	1.25	100	P44	-10° to +55° C
ND4117	1805-1880*	46	40	0.4	0.7	1.20	1.25	100	P42	-10° to +55° C

\*Also available in 1930-1990 MHz Band.  
Customized devices available

### Outline drawings

Dimensions in mm

Case	L	W	H	A	B	C	D	E	F	G	Ø Holes
P42	50.8	25.40	7.62	46.23	20.83	15.36	7.75	3.81	3.81	3.81	2.1
P44	38.1	19.05	6.35	33.50	14.50	10.57	6.35	2.00	2.00	2.00	2.5



### How to order?

Please specify:

- Model number,
- Center frequency and desired bandwidth, or frequency range,
- Direction of circulation (clockwise or counter clockwise).

### Test jig

Drop-in miniaturized circulators and isolators are measured in custom designed test jigs, in order to simulate operating environmental conditions. Special customer application and environmental details must be specified when ordering, to avoid correlation problems between TEMEX tests and customer results. TEMEX test jig is recommended to verify product performances.

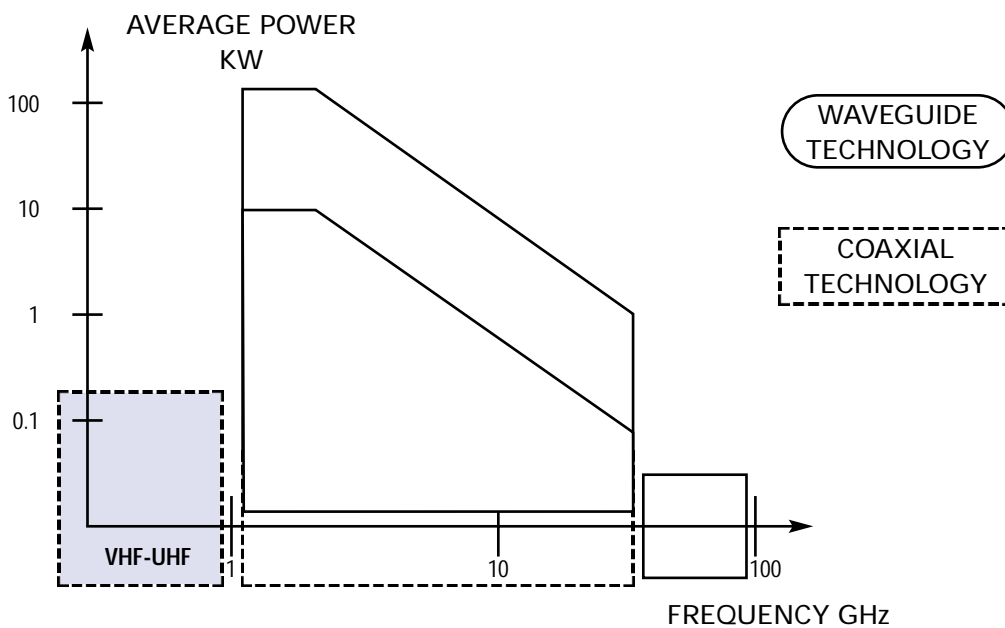
 **COAXIAL DEVICES****Selection Guide**

	PAGE
<u>VHF/UHF COAXIAL CIRCULATORS &amp; ISOLATORS</u>	<u>15-20</u>
<b>NEW !</b> <u>LOW COST</u>	<u>15-22</u>
<u>STANDARD</u>	<u>15-23</u>
<u>PACKAGES 3-PORT</u>	<u>15-24</u>
<u>PACKAGES 4-PORT</u>	<u>15-26</u>
<u>STANDARD COAXIAL DEVICES 1 TO 18 GHz</u>	<u>15-28</u>
<u>PACKAGES</u>	<u>15-31</u>
<u>CONNECTORS &amp; TABS</u>	<u>15-33</u>

VHF / UHF coaxial circulators & isolators



VHF / UHF COAXIAL CIRCULATORS & ISOLATORS



VHF / UHF coaxial circulators & isolators

General description

TEMEX supplies a wide range of coaxial HF/VHF and UHF circulators covering the frequency range down to 27 MHz.

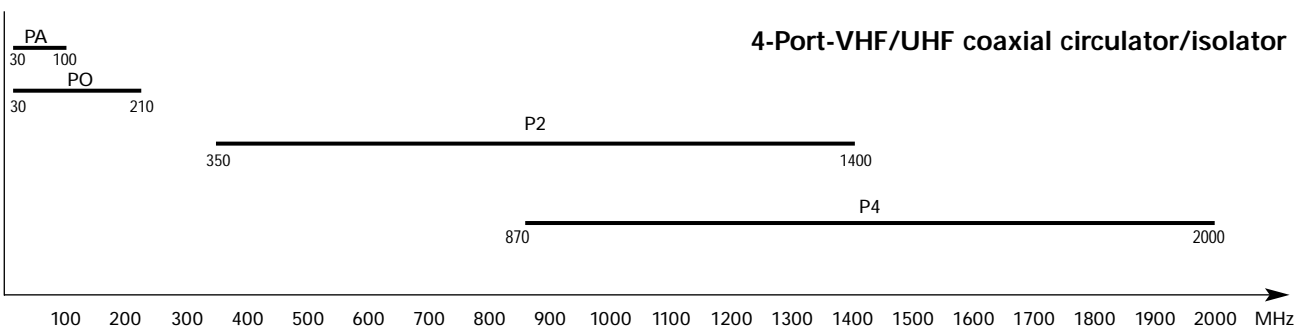
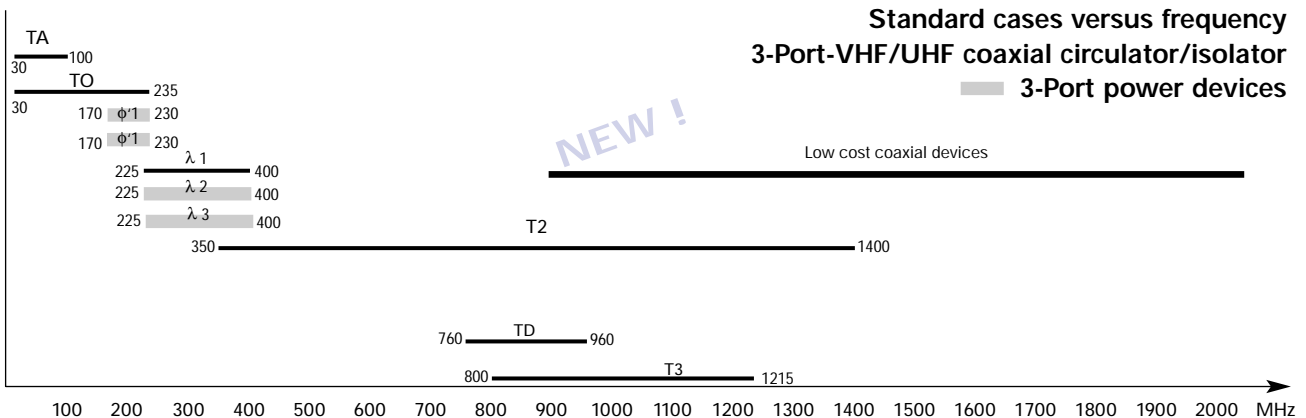
TEMEX uses only in-house produced [ferrite materials](#) and therefore offers state-of-the-art features such as low-insertion loss, high isolation in various rugged and space saving packages:

- The "T" series is our standard design for three port junctions. Circulators are equipped with KMR/SMA connectors and isolators with an internal load of 1 W average/60 W peak, N female connectors for input power higher than 60 W-CW.
- Wide-band ferrite device, such as those in the  $\lambda$  series package, enables coverage of the 225 - 400 MHz band for high power up to 300 W-CW/1 kW peak.
- New low cost coaxial devices have been specially designed for cellular base stations. Case of circulators and isolators are made with aluminum casting in order to drastically reduce cost and deliveries.

Designed for the wide-band application in the 170 to 1215 MHz frequency range, TEMEX power circulators  $\phi$  series provide low insertion loss and high isolation. They are specifically designed to feature low 3rd order inter-modulation products with power up to 2000 W-CW.

They are suitable for telecommunication and broadcasting applications.

- In order to improve isolation, **four-port circulators and isolators** are produced by optimally integrating two single-junction circulators in a single package. The insertion loss of four-port circulators includes two pass-through ferrite junctions. They are typically used in telecommunications and radio-telephone applications.
- Options such as configuration, frequency range, connector type and location, tab (drop-in) configuration, wider temperature range, high power, etc., are **available upon request**.



## VHF / UHF coaxial circulators & isolators



**NEW !** *Low cost coaxial circulators & isolators*  
*3-Port circulators & isolators*

Circulator	Isolator	Frequency range (MHz)	Average power max. W	Specification in temp. range			Temperature range °C	Outline drawing	Connector female
				Isolation min. dB	Inser. loss max. dB	VSWR max			
BC3062	BC1062	920 - 960	50	20	0.4	1.25	-10 to +55	<a href="#">T15</a>	N
BC3060	BC1060	920 - 960	50	20	0.4	1.25	-10 to +55	T12	SMA
BC3080	BC1080	920 - 960	60	23	0.3	1.25	-10 to +55	<a href="#">T59</a>	N
BD3067	BD1067	1805 - 1880*	50	20	0.3	1.20	-10 to +55	T12	SMA
BD1062	BD3062	1805 - 1880*	50	20	0.3	1.20	-10 to +55	<a href="#">T15</a>	N
BE1070	BE3070	2100 - 2180	50	23	0.3	1.20	-10 to +55	T12	SMA

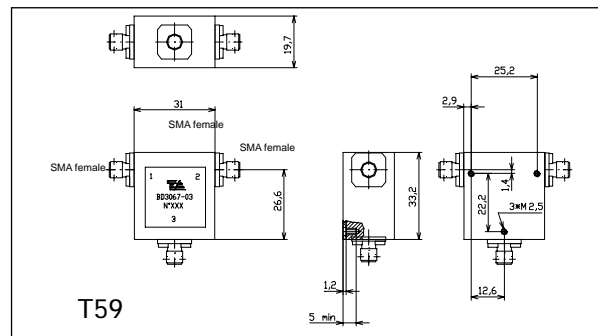
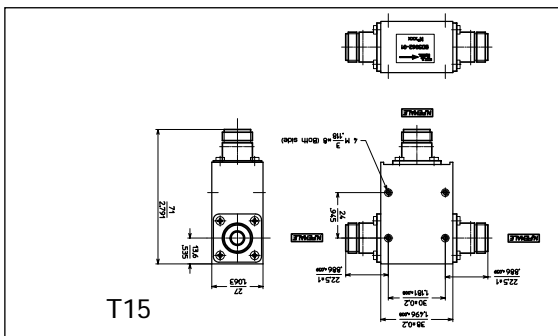
\* Available in 1930 - 1990 MHz band

### 4-Port circulators & isolators

Type	Frequency range (MHz)	Average power max. W	Specification in temp. range			Temperature range °C	Outline drawing	Connector female
			Isolation min. dB	Inser. loss max. dB	VSWR max			
BB4110	380 - 430	100	45	0.8	1.25	-10 to +55	<a href="#">P2</a>	N
BB4111	406 - 470	100	40	0.8	1.25	-10 to +55	<a href="#">P2</a>	N
BB4112	424 - 428	100	50	0.5	1.25	-10 to +55	<a href="#">P2</a>	N
BB4113	460 - 468	100	50	0.5	1.25	-10 to +55	<a href="#">P2</a>	N
BB4003	470 - 600	50	35	1.1	1.30	-10 to +55	<a href="#">P2</a>	N
BC4107	870 - 960	50	45	0.7	1.25	-10 to +55	<a href="#">P4</a>	N
BC4108	917 - 960	65	50	0.5	1.20	-10 to +55	<a href="#">P4</a>	N
BC4109	935 - 960	65	50	0.5	1.20	-10 to +55	<a href="#">P4</a>	N

Customized devices available

For more 50 W-CW input power, cooling is necessary by conduction via heat sink ( $R_{TH} = 0.4^{\circ} C / W$  max)



### How to order?

Please specify:

- Model number,
- Center frequency and desired bandwidth, or frequency range,
- Direction of circulation (clockwise or counter clockwise).



**VHF / UHF coaxial circulators & isolators**
*Standard coaxial circulators & isolators*
*3-Port circulators & isolators*

Circulator	Isolator	Frequency range (MHz)	Avg. power max. W	Peak power max. kW	Specifications at 25° C			Spec. in temperature range			Temperature range °C	Outline drawing	Connector (female)
					Isolation min. dB	Inse. loss max. dB	VSWR max.	Isolation min. dB	Inse. loss max. dB	VSWR max.			
BA3038		27	60		15	1.0	1.40	15	1.0	1.40	-40 to +70	<a href="#">T0</a>	N <sup>(3)</sup>
BA3011	BA1011	62-72	20		18	0.8	1.30	17	1	1.35	-10 to +55	<a href="#">T0</a>	SMA
BA3021		68-88	100		18	0.8	1.30	17	1	1.35	-10 to +55	<a href="#">T0</a>	N <sup>(3)</sup>
BA3015	BA1015	72-88	50		18	0.8	1.30	17	1	1.35	-10 to +55	<a href="#">T0</a>	SMA
BA3010	BA1010	88-108	100		18	0.8	1.30	17	1	1.35	-10 to +55	<a href="#">T0</a>	N <sup>(3)</sup>
BA3012	BA1012	105-145	50		18	0.8	1.30	16	1	1.40	-10 to +55	<a href="#">T0</a>	SMA
BA3040		138-155	250		23	0.35	1.20	22	0.4	1.25	0 to +70	<a href="#">T0</a>	N <sup>(3)</sup>
BA3013		155-174	250		23	0.35	1.20	22	0.4	1.25	0 to +70	<a href="#">T0</a>	N <sup>(3)</sup>
BA3016	BA1016	165-200	100		18	0.8	1.30	17	1	1.35	-10 to +55	<a href="#">T0</a>	N <sup>(3)</sup>
BA3029		174-225	100		18	0.8	1.30	17	1	1.35	-10 to +55	<a href="#">T0</a>	N <sup>(3)</sup>
BA3017	BA1017	200-235	100		18	0.8	1.30	17	1	1.35	-10 to +55	<a href="#">T0</a>	N <sup>(3)</sup>
BA3017		216-230	250	1.00	32	0.3	1.12	30	0.5	1.15	+20 to +70	<a href="#">T0</a>	N <sup>(3)</sup>
BA3039		216-230	325	1.20	26	0.2	1.18	20	0.4	1.25	+20 to +70	<a href="#">T0</a>	N <sup>(3)</sup>
BB3028	BB1028	200-400 <sup>(5)</sup>	250		25	0.3	1.20	20	0.4	1.25	-20 to +70	<a href="#">T57</a>	N
BB3001 <sup>(2)</sup>	BB1001 <sup>(2)</sup>	225-400	60	0.25	20	0.8	1.25	16	0.8	1.40	-40 to +70	<a href="#">T1</a>	SMA
BB3006 <sup>(2)</sup>	BB1006 <sup>(2)</sup>	225-400	100	0.25	20	0.8	1.25	17	0.8	1.40	-40 to +70	<a href="#">T1</a>	N
BB3007 <sup>(1,2)</sup>		225-400	200	1.00	17	0.7	1.35	14	0.8	1.50	-40 to +60	<a href="#">T2</a>	N
BB3011 <sup>(2)</sup>		225-400	300	1.00	14	1	1.50	14	1	1.50	-40 to +80	<a href="#">T56</a>	N <sup>(3)</sup>
BB3019	BB1019	350-400	200 <sup>(4)</sup>		20	0.3	1.25	18	0.6	1.30	-10 to +55	<a href="#">T2</a>	N <sup>(3)</sup>
BB3080	BB1080	378-512	200 <sup>(4)</sup>		20	0.3	1.25	18	0.6	1.30	-10 to +55	<a href="#">T2</a>	N <sup>(3)</sup>
BB3025	BB1025	405-450	200 <sup>(4)</sup>		20	0.3	1.25	18	0.6	1.30	-10 to +55	<a href="#">T2</a>	N <sup>(3)</sup>
BB3038	BB1038	405-470			16	0.75	1.37	16	0.75	1.37		<a href="#">T50</a>	SMA
BB3023	BB1023	415-430	100		18	0.6	1.30	18	0.6	1.30	-10 to +55	<a href="#">T2</a>	N <sup>(3)</sup>
BB3031	BB1031	415-454			19	0.7	1.30	19	0.7	1.30	-30 to +60	<a href="#">T50</a>	SMA
BB3026	BB1026	450-500	200 <sup>(4)</sup>		20	0.3	1.25	18	0.6	1.30	-10 to +55	<a href="#">T2</a>	N <sup>(3)</sup>
BC3019		610-960	50		15	1.1	1.55	15	1.1	1.55	-40 to +95	<a href="#">T0</a>	SMA/INT
BC3041	BC1041	700-860	200 <sup>(4)</sup>		20	0.3	1.25	18	0.6	1.30	-10 to +55	<a href="#">T2</a>	N <sup>(3)</sup>
BC3019		760-960	50		19	0.5	1.30	16	0.5	1.45	-40 to +95	<a href="#">T0</a>	SMA
BC3006	BC1006	800-960	50		20	0.4	1.25	18	0.5	1.30	-10 to +55	<a href="#">T3</a>	SMA
BD3003	BD1003	960-1215	50		19	0.4	1.30	17	0.5	1.35	-40 to +85	<a href="#">T3</a>	SMA
BD3040		960-1215	100	10.00	20	0.45	1.25	20	0.45	1.25	-10 to +65	<a href="#">T2</a>	N <sup>(3)</sup>

*4-Port circulators & isolators*

Type	Frequency range (MHz)	Avg. power max. W	Peak power max. kW	Specifications at 25° C			Spec. in temperature range			Temperature range °C	Outline drawing	Connector (female)
				Isolation min. dB	Inse. loss max. dB	VSWR max.	Isolation min. dB	Inse. loss max. dB	VSWR max.			
BA4140	138 - 155	250	5	45	0.8	1.25	45	0.8	1.25	0 to +70	<a href="#">P0</a>	N
BA4113	155 - 174	250	5	45	0.8	1.25	45	0.8	1.25	0 to +70	<a href="#">P0</a>	N
BA4217	200 - 207	100	0	50	1.0	1.30	45	1.0	1.30	-10 to +55	<a href="#">P0</a>	N
BD4013	960 - 1215	100	5	38	1.0	1.30	35	1.2	1.35	-30 to +70	<a href="#">P2</a>	N

<sup>(1)</sup> High power device.

<sup>(2)</sup> Specifications are absolute maximum ratings at high power (listed Avg. power).

<sup>(3)</sup> With SMA, N connectors or tab integrations depending on max. power level request.

<sup>(4)</sup> 200 W-CW on 3: 1 continuous load VSWR. Permanent short circuit duration: 3 sec. max.

100 W-CW on permanent short circuit handling, cooling by conduction via a heat sink ( $R_{TH} = 0.4^\circ \text{C/W max.}$ ).

<sup>(5)</sup> 10 % bandwidth.

For more than 50 W-CW input power, cooling is necessary by conduction via heat sink ( $R_{TH} = 0.4^\circ \text{C/W max.}$ )

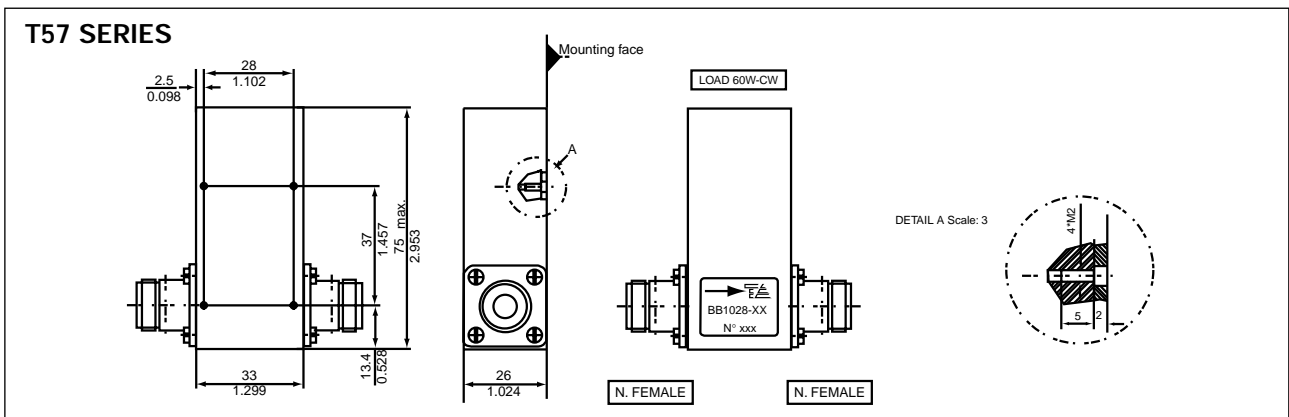
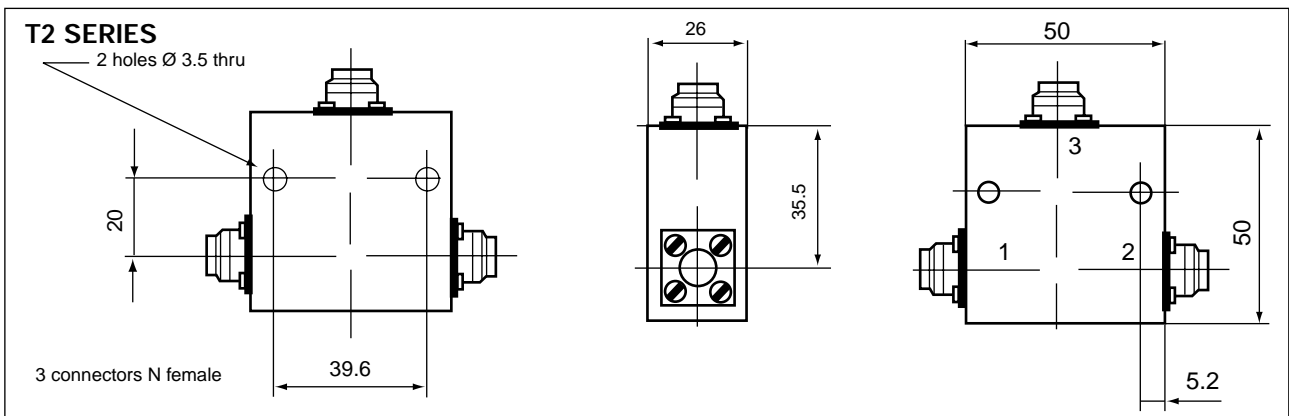
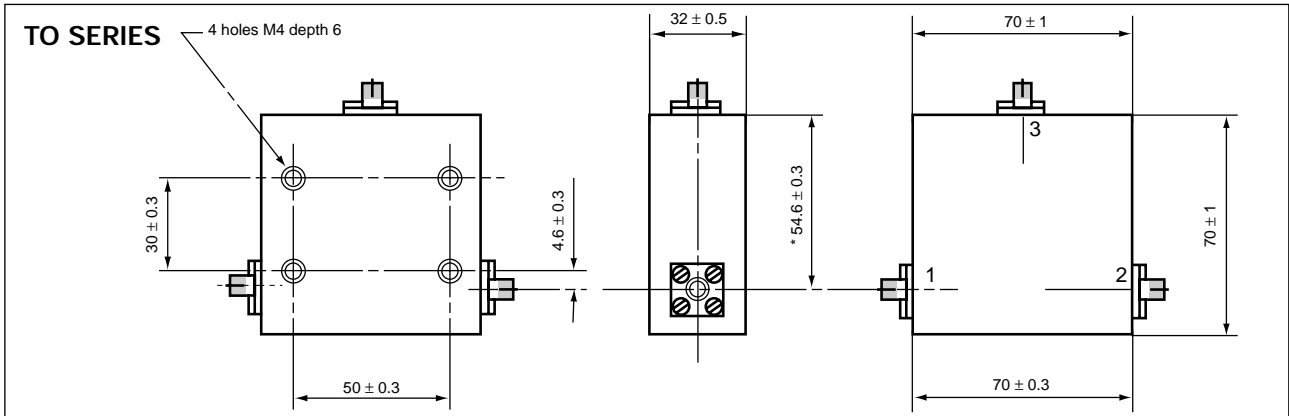
VHF / UHF coaxial circulators & isolators



VHF / UHF 3-Port devices - packages

**NOTE:**

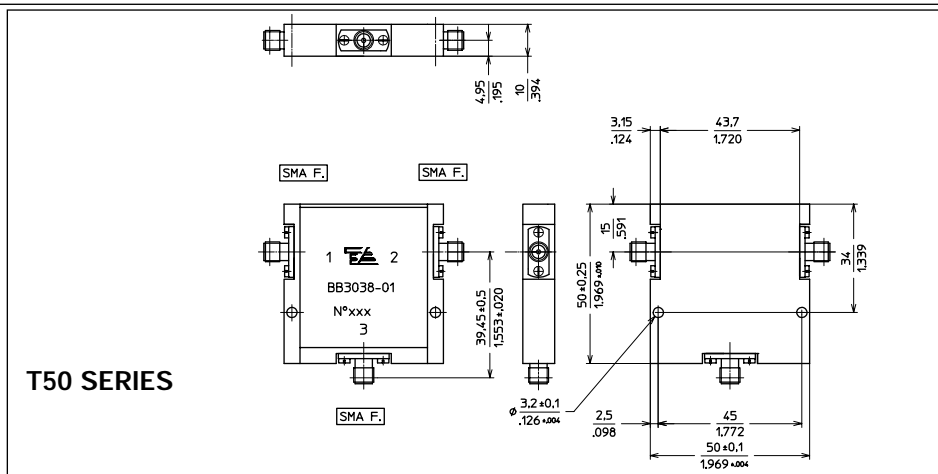
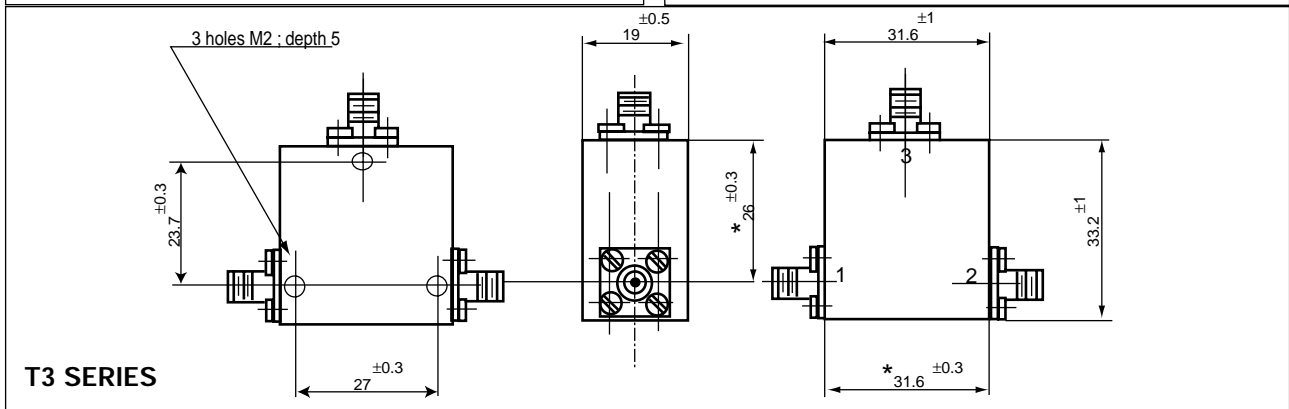
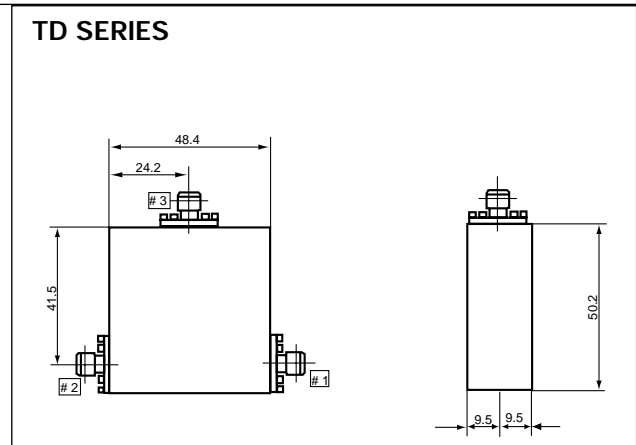
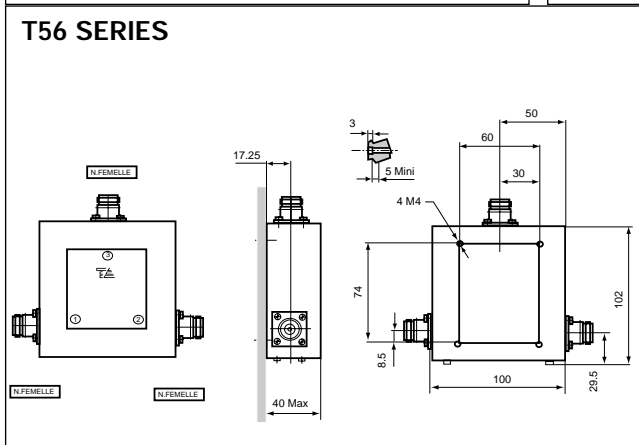
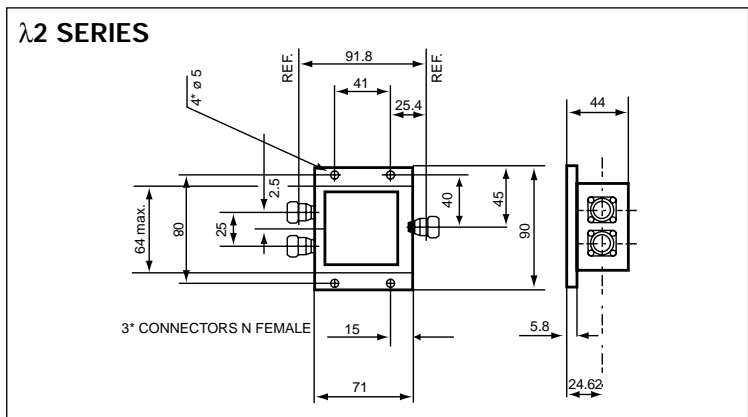
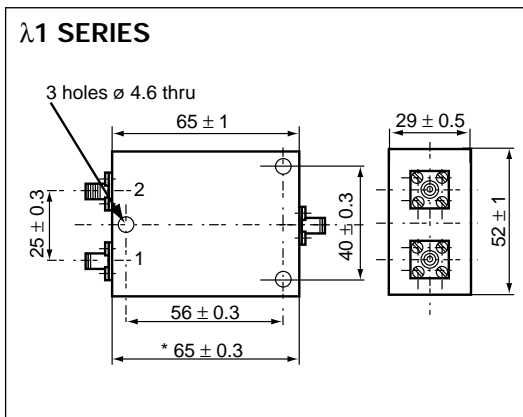
On request: reverse direction  
 Dimensions in mm  
 Tolerances  $\pm 0.5$



All dimensions supporting an asterisk (\*) are measured "under flanges"

SALES OFFICES





All dimensions supporting an asterisk (\*) are measured "under flanges"

## VHF / UHF coaxial circulators & isolators



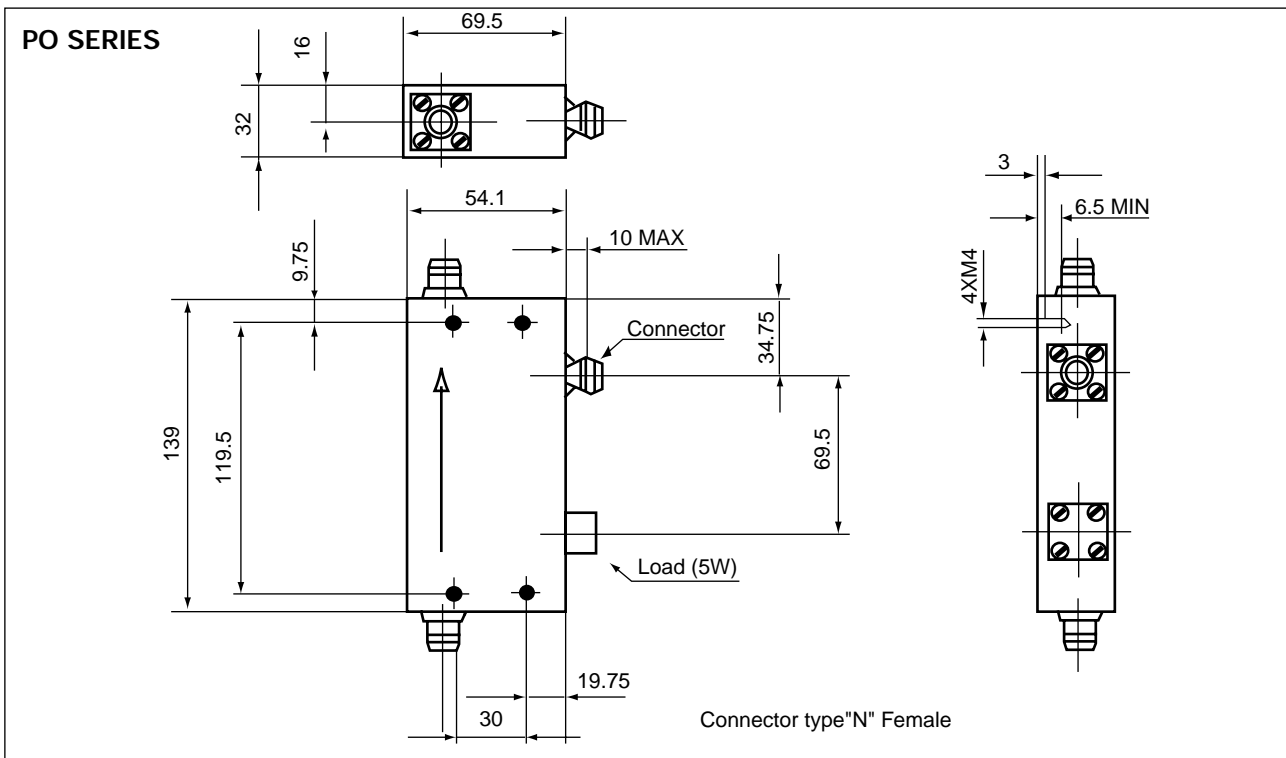
### VHF / UHF 4-Port devices - packages

#### Features

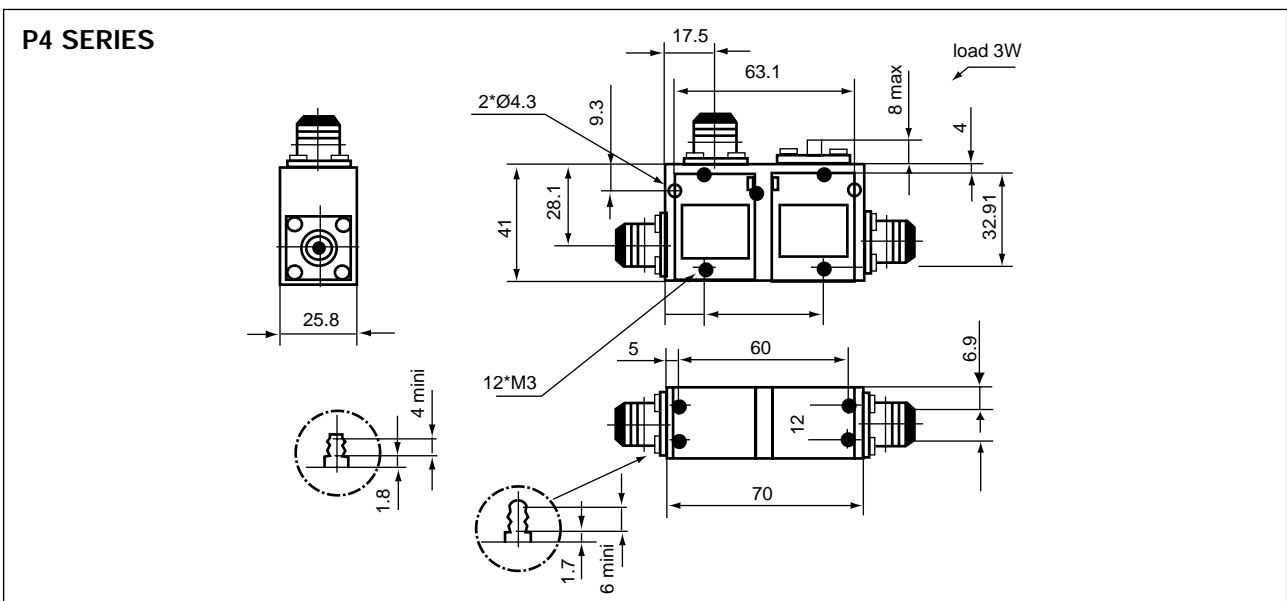
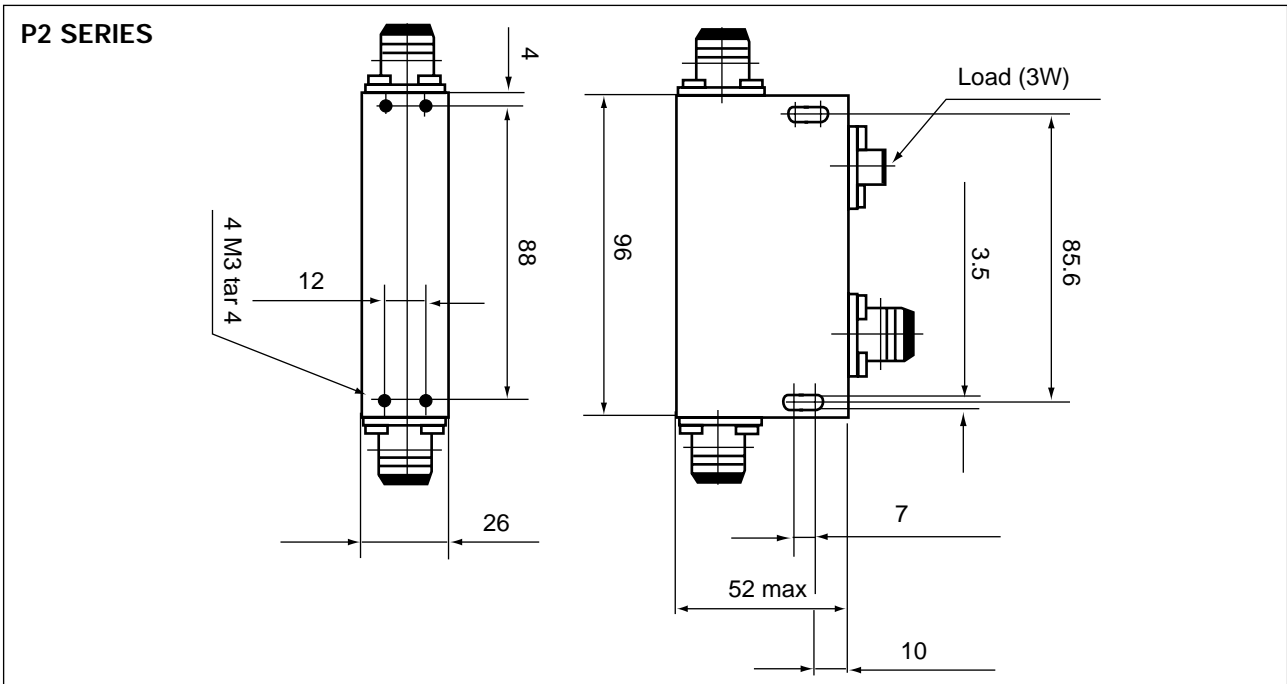
- [KMR/SMA female connectors](#)  
(except where noted)
- [KMR/SMA male connectors](#)  
available upon request
- Tabs for microstrip or stripline applications available upon request  
(IT50 - IT17 - IT27)

#### NOTE:

On request: reverse direction  
 Dimensions in mm  
 Tolerances  $\pm 0.5$   
 On request "H" configuration



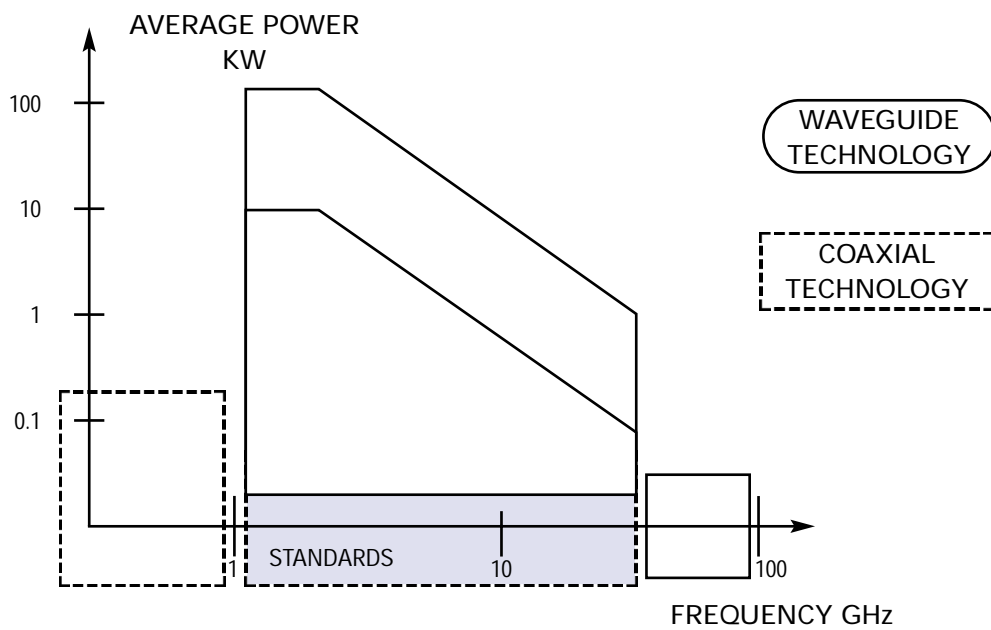
All dimensions supporting an asterisk (\*) are measured "under flanges".



Standard coaxial devices 1 to 18 GHz



STANDARD COAXIAL DEVICES 1 TO 18 GHz





*General information*

TEMEX offers the worldwide market a broad range of coaxial circulators and isolators, covering the frequency range 1 GHz to 18 GHz.

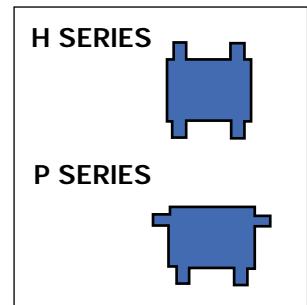
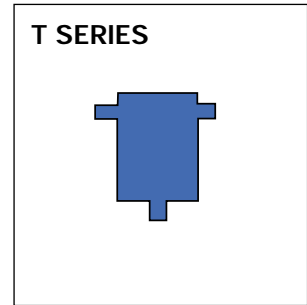
This catalog describes standard three-port circulators and isolators.

*General description*

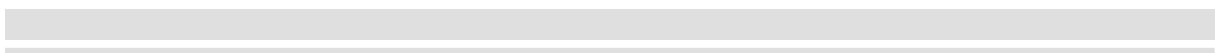
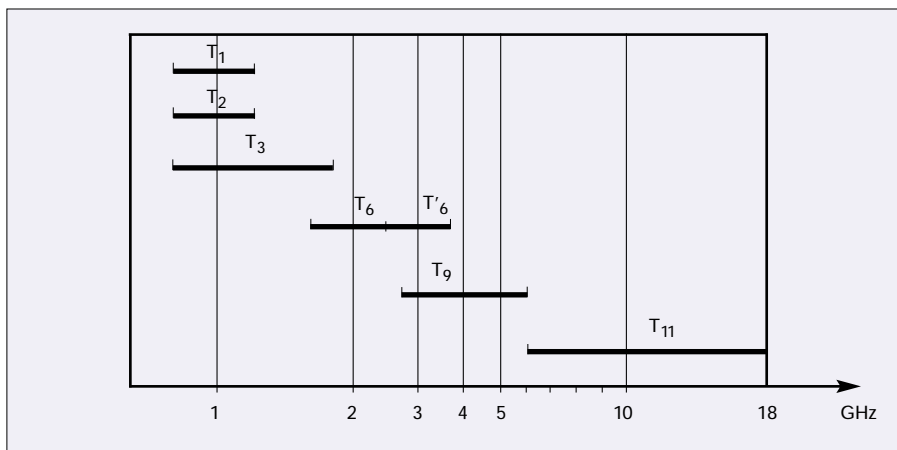
4-port are available upon request, based on standard 3-port designs. Please consult your local sales offices for further information.

These devices are used for popular bandwidth, with an average power of 10, 20, 30, 50 W depending on the frequency.

- Seven standards "T" packages.
- The standard unit has KMR/SMA female connectors and when used as an isolator, an internal 60 W peak/1 W AVG termination on port 3.
- T1 and T2 series are dedicated to high average power applications.



**Standard cases versus frequency**



Standard coaxial devices 1 to 18 GHz



Electrical specifications

Type		Frequency range (GHz)	Specifications at 25° C			Spec. in temperature range			Circulator		Temperature range ° C	Weight g. approx.
Circulator	Isolator		Isolation min. dB	Inser. loss max dB	VSWR max	Isolation min. dB	Inser. loss max dB	VSWR max	Avg. power max W	Peak power max kW		
<b>Outline drawing</b> <b>T1: 50.8 x 50.3 x 32 mm approx.</b>												
BD3037 <sup>(1,2)</sup>	-	1.452 - 1.492	22	0.2	1.20	20	0.3	1.25	250	2.5	0 to +55	450
BD3063 <sup>(1,2)</sup>	-	1.452 - 1.492	20	0.2	1.22	18	0.3	1.30	350	4.0	0 to +55	50
<b>Outline drawing</b> <b>T2: 50 x 50 x 26 mm approx.</b>												
BD3064 <sup>(1,2)</sup>	-	1.452 - 1.492	22	0.2	1.20	20	0.3	1.25	100	1.0	0 to +55	380
<b>Outline drawing</b> <b>T3: 31.6 x 33.2 x 19 mm approx.</b>												
BD3017	BD1017	1.2 - 1.4	19	0.4	1.30	18	0.5	1.30	50	1.0	-10 to +55	110
BD3018	BD1018	1.4 - 1.7	19	0.4	1.30	18	0.5	1.30	50	1.0	-10 to +55	110
<b>Outline drawing</b> <b>T6: 25.4 x 25.8 x 13.7 mm approx.</b>												
BE3019	BE1019	2.2 - 2.4	20	0.4	1.25	18	0.5	1.30	10	0.5	-10 to +55	60
<b>Outline drawing</b> <b>T'6: 25.4 x 25.8 x 13.7 mm approx.</b>												
BE3026	BE1026	2.7 - 3.1	20	0.4	1.25	18	0.5	1.30	10	0.1	-10 to +55	60
<b>Outline drawing</b> <b>T9: 22 x 25 x 14 mm approx.</b>												
BE3027	BE1027	2.8 - 3.1	23	0.3	1.20	20	0.4	1.25	20	0.5	-10 to +70	55
BF3005	BF1005	3.1 - 3.5	23	0.3	1.20	20	0.4	1.25	20	0.5	-10 to +70	55
BF3007	BF1007	3.7 - 4.2	23	0.3	1.20	20	0.4	1.25	20	0.5	-10 to +70	55
<b>Outline drawing</b> <b>T11: 12.7 x 17.2 x 12.8 mm approx.</b>												
BH3005	BH1005	5.9 - 6.4	20	0.3	1.25	20	0.4	1.25	30	0.3	-25 to +70	25
BH3006	BH1006	6.4 - 7.1	20	0.3	1.25	20	0.4	1.25	30	0.3	-25 to +70	25
BH3007	BH1007	7.1 - 7.8	20	0.3	1.25	20	0.4	1.25	30	0.3	-25 to +70	25
BI3003	BI1003	7.8 - 8.7	20	0.3	1.25	20	0.4	1.25	30	0.3	-25 to +70	25
BI3004	BI1004	8.5 - 9.6	20	0.4	1.25	20	0.5	1.25	30	0.3	-25 to +70	25
BJ3011	BJ1011	9.6 - 10.6	20	0.4	1.25	20	0.5	1.25	30	0.3	-25 to +70	25
BJ3012	BJ1012	10.6 - 11.7	20	0.4	1.25	20	0.5	1.25	30	0.3	-25 to +70	25
BJ3014	BJ1014	12.5 - 13.5	20	0.4	1.25	20	0.5	1.25	30	0.3	-25 to +70	25
BJ3009	BJ1009	13.5 - 14.5	20	0.4	1.25	20	0.5	1.25	30	0.3	-25 to +70	25

Other frequencies available on request ; please consult your local sales office.

Notes:

- (1) With tab integrations (ITN1/ITN2) or N types connectors
- (2) Devices need to be mounted on an heat suite with thermal resistance of 0.4° C/W max

## Packages

### Features

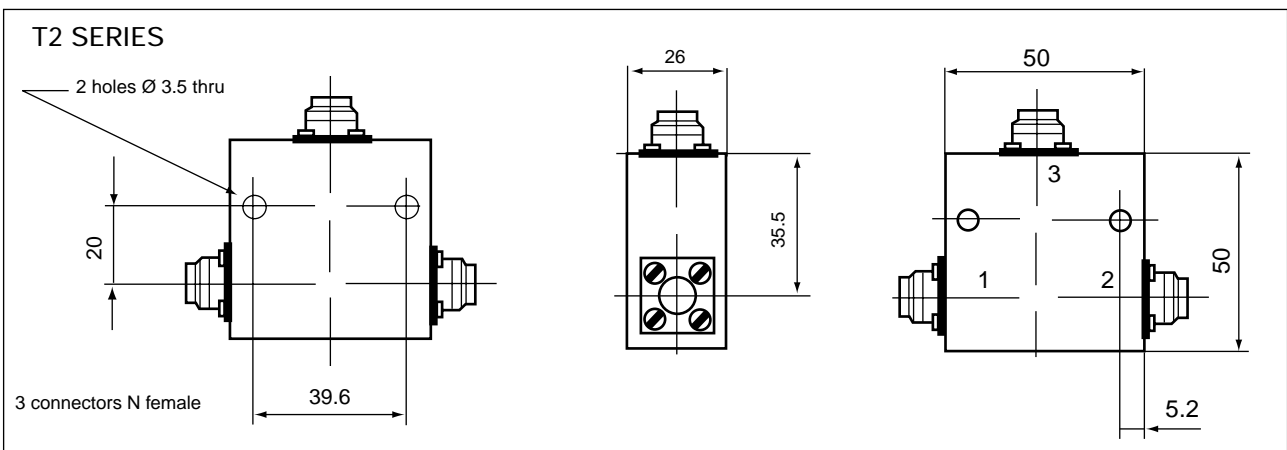
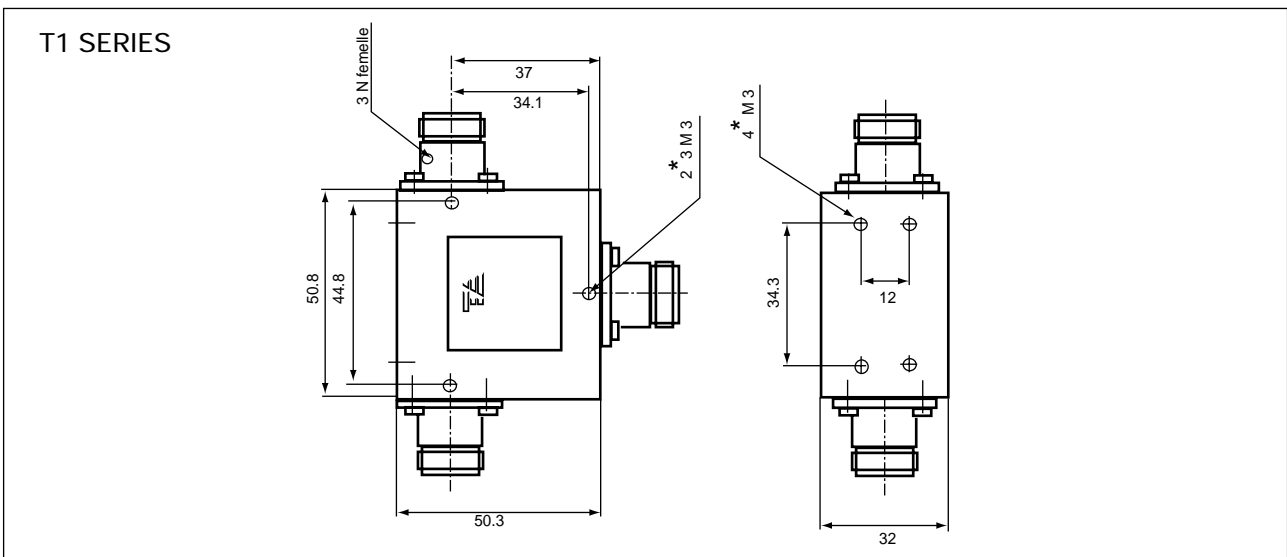
- [KMR/SMA female connectors](#) (except where noted).
- [KMR/SMA male connectors](#) available upon request.
- Tabs for microstrip or stripline applications available upon request ([IT50 - IT17 - IT27](#)).

### T1 Series

### T2 Series

All dimensions in mm

Case	L	W	H	A	B	C	D	E	F	G	Ø Holes
T1	50.8	50.3	32	44.8	34.1	0	37	25.4	3 (2 plces up) 25.4 (1 plce down)	4	3 x M3
T2	50	50	26	39.6	-	20	35.5	25	5.2	Through	2 x 3.5



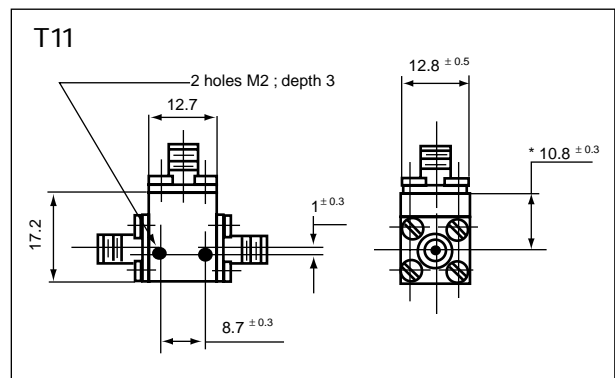
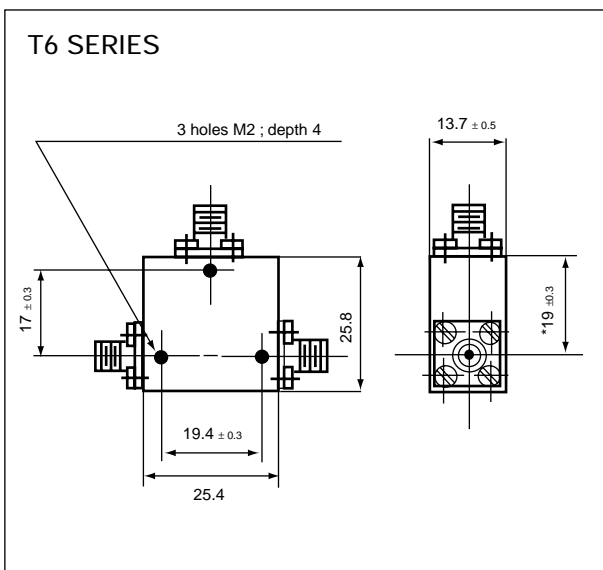
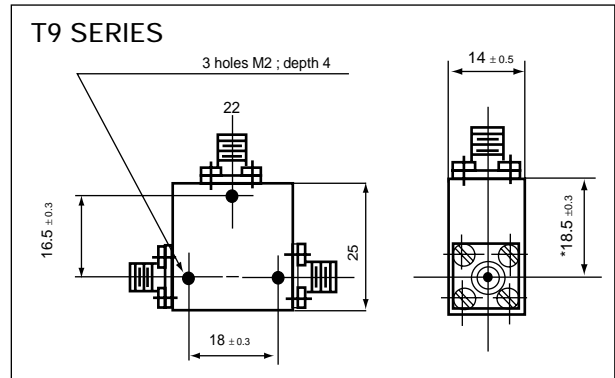
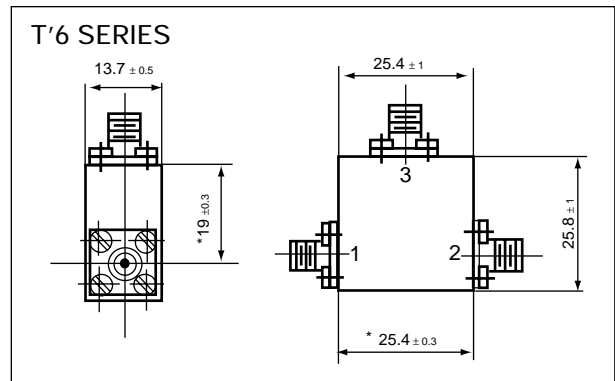
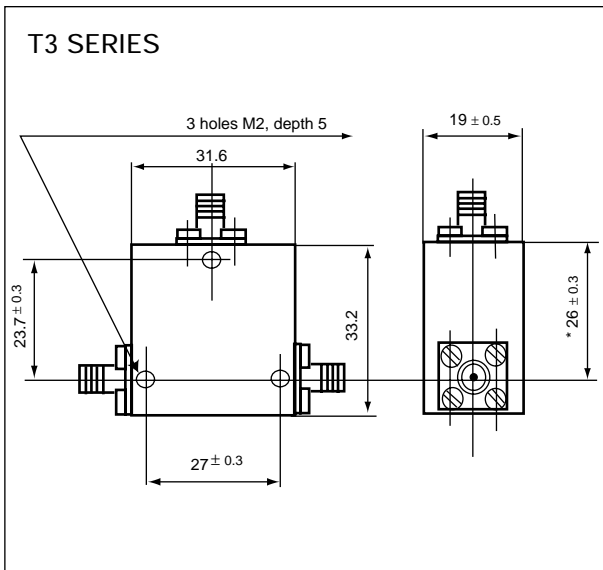
Standard coaxial devices 1 to 18 GHz



## Packages

### Features

- [KMR/SMA female connectors](#) (except where noted).
- [KMR/SMA male connectors](#) available upon request.
- Tabs for microstrip or stripline applications available upon request ([IT50 - IT17 - IT27](#)).

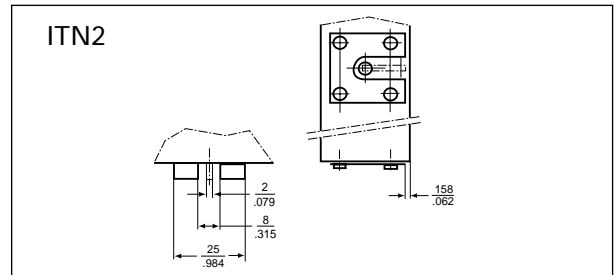
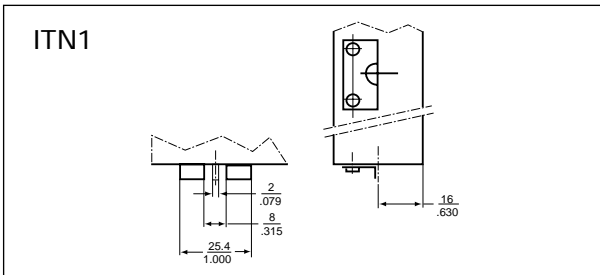


All dimensions supporting an asterisk(\*) are measured "under flanges".

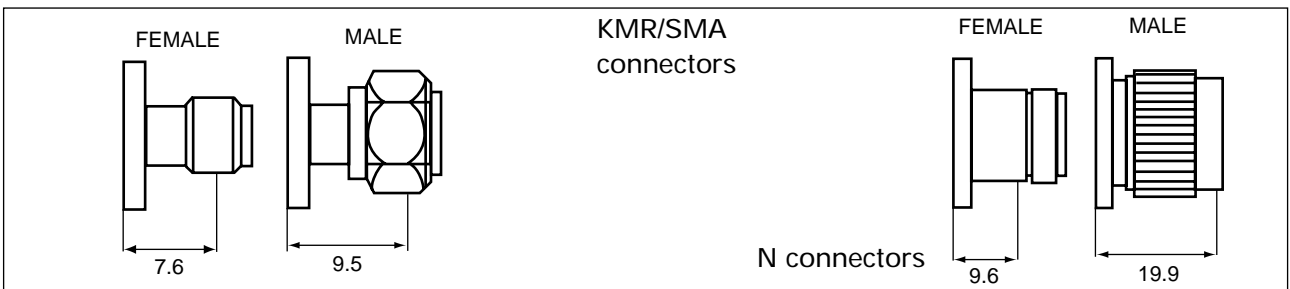


**CONNECTORS & TABS**

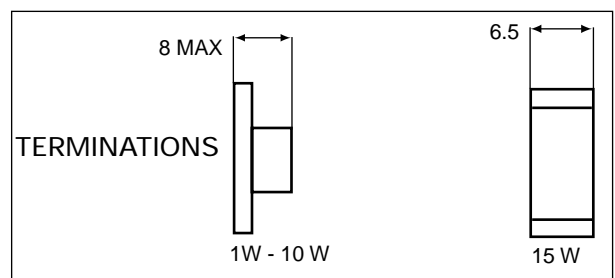
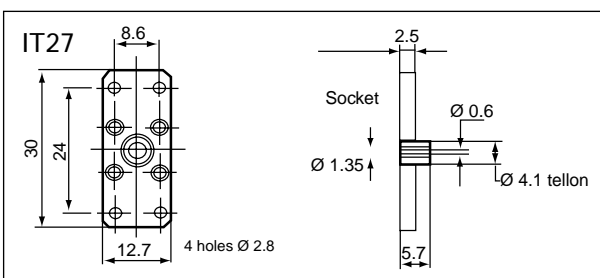
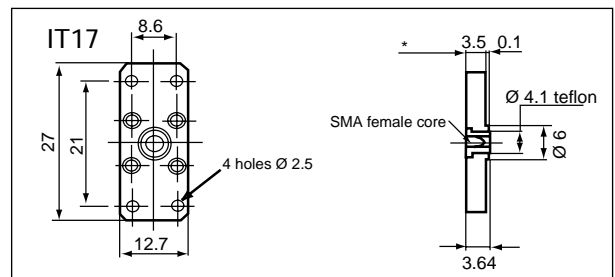
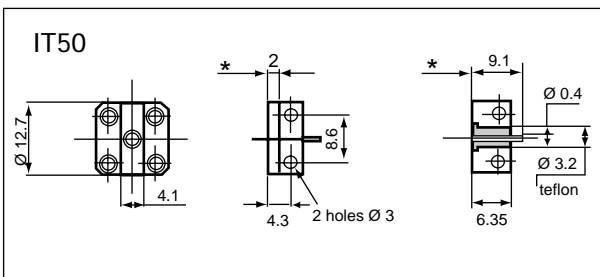
Depending on power handling, connectorized devices are available with integrations at any place, instead of the N connectors: on requirements, we can offer devices with, N, SMA or TAB style connections.



**Connectors**



**Tabs and terminations**

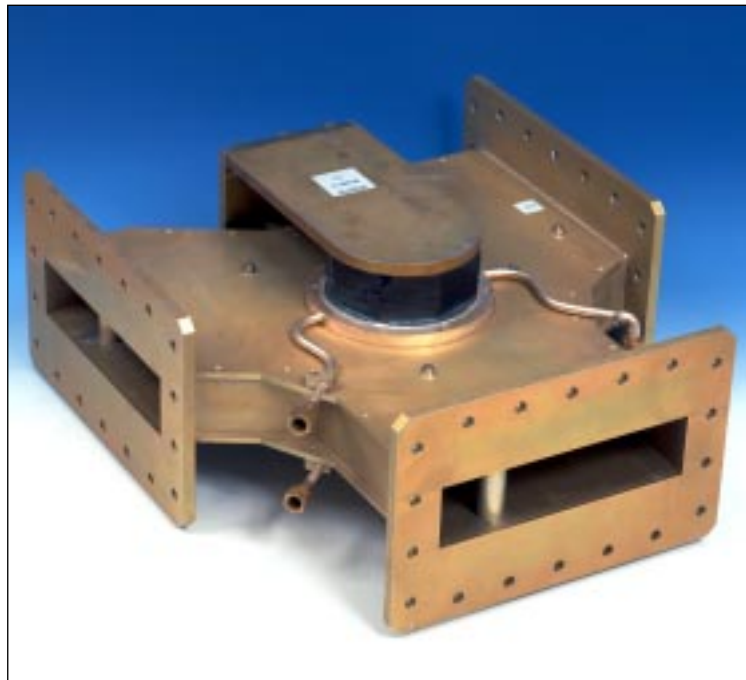




# ▶ WAVEGUIDE DEVICES

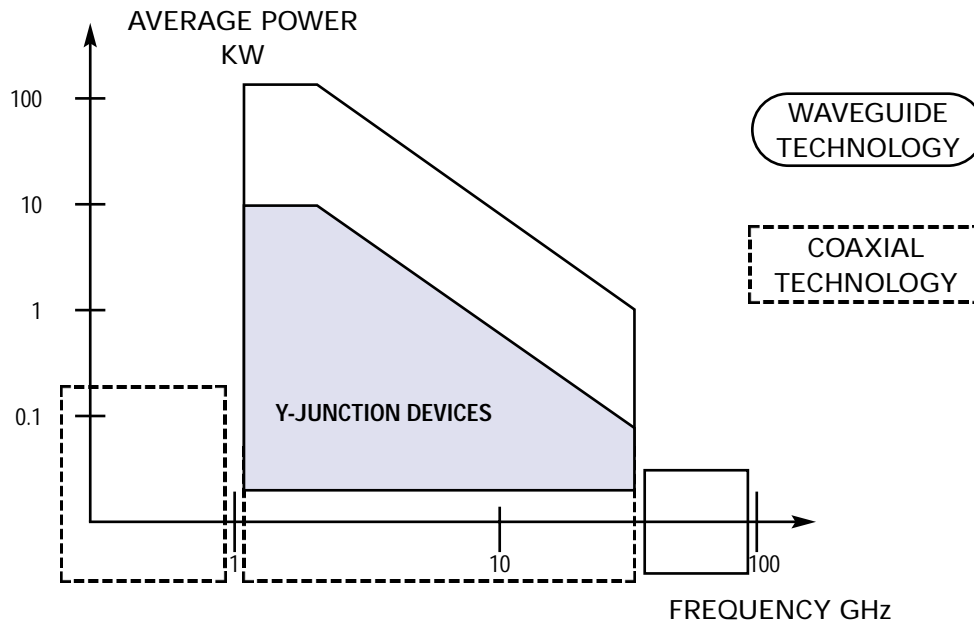
## Selection Guide

	PAGE
<a href="#"><u>Y-JUNCTION 352 MHz TO 18 GHz</u></a>	<a href="#"><u>15-35</u></a>
<a href="#"><u>4-PORT DIFFERENTIAL PHASE SHIFT CIRCULATORS</u></a>	<a href="#"><u>15-42</u></a>
<a href="#"><u>MILLIMETER WAVEGUIDE DEVICES 18 TO 40 GHz</u></a>	<a href="#"><u>15-48</u></a>





## Y-JUNCTION WAVEGUIDE DEVICES 352 MHz TO 18 GHz



### General description

TEMEX' success in [ferrite material](#) and ferrite component manufacturing is due largely to our approach towards computer-aided engineering design and advanced manufacturing technology (numerical controlled fabrication).

Low-insertion loss and high isolation are not the only criteria to consider when designing junction circulators. Broadband, high power handling capability, low 3rd order intermodulation products and low RF leakage are also important.

TEMEX' R & D teams developed new materials and technologies, thereby increasing the average power handling for most of the junction circulators. Over the past years, CW-power handling has tripled.

Three-port junctions are available in T- or Y- configurations in the most popular waveguide standards. Circulators can be cascaded to form four- or five-port devices. Water cooling is required on several of the high-power devices.

When size is critical, TEMEX supplies compact and miniaturized isolators. They work on narrow-band and low-power applications of up to 10 W mean power. Y-junction circulators are either cast or machined.

Options such as direction of circulation, frequency range, temperature range, and magnetic and electrical shielding are available upon request.

Y-Junction waveguide devices 352 MHz to 18 GHz

Electrical characteristics

Notes	Type	Frequency range (GHz)	Bandwidth (MHz)	Avg. power max. W	Peak power max. kW	Specifications at 25° C			Spec. in temperature range			Temperature range ° C	Flange	Dimensions mm approx.	Weight kg. approx.
						Isolation min. dB	Ins. loss max. dB	VSWR max.	Isolation min. dB	Ins. loss max. dB	VSWR max.				
<b>WR2300 waveguide (R3)</b>															
	FB3002	0.352	±10	1300 K	1300	-	-	-	20	0.15	1.20	+25	UDR 3	2000 x 1600 x 800	1300
<b>WR1800 waveguide (R5)</b>															
4-8	FB3001	0.4333	±0.5	200 K	6000	-	-	-	25	0.2	1.10	+30	UDR 5	1500 x 1500 x 700	1500
<b>WR975 waveguide (R9)</b>															
	FC3003	0.915	± 2	50 K	50	18	0.2	1.30	15	0.2	1.45	25 ± 5	UDR 9	500 x 389 x 213	41
<b>WR340 waveguide (R26)</b>															
4-5	FE3005	2.450	± 25	3 K	3	-	-	-	20	0.15	1.20	+5 to +45	UG 554/U	180 x 190 x 105	6
1-4-9	FE3002	2.450	± 25	6 K	6	-	-	-	20	0.15	1.20	+10 to +40	UG554/U	180 x 190 x 127	6
10-1-4-9	FE1021	2.450	± 25	6K	6	-	-	-	20	0.15	1.20	+10 to +40	UG554/U	180 x 230 x 115	6.3
10-1-4-5	FE1022	2.450	±25	3K	3	-	-	-	20	0.15	1.20	+10 to +40	UG554/U	180 x 230 x 115	6.3
<b>WR284 waveguide (R32)</b>															
4-5	FE3036	2.450	±25	3K	3	-	-	-	20	0.25	1.20	+10 to +40	CPR284F	148 x 182 x 106	4.5
1-2-4-5	FE3007	2.850 - 3.300	FULL	1.5 K	100	23	0.3	1.15	20	0.3	1.20	0 to +55	CMR284	180 x 160 x 99	
	FE3001	2.998	± 5	2.5 K	2500	-	-	-	30	0.15	1.10	+35 to +45	CPR284 F	203 x 155 x 182	
<b>WR229 waveguide (R40)</b>															
	FF3004	3.4 - 3.8	FULL	150	10	30	0.2	1.07	26	0.2	1.10	0 to +50	CMR229	127 x 121 x 51	0.5
	FF3003	3.7 - 4.2	FULL	150	10	30	0.2	1.07	26	0.2	1.10	0 to +50	CMR229	127 x 121 x 51	0.5
<b>WR187 waveguide (R48)</b>															
	FG3004	4.4 - 5	FULL	25	-	28	0.2	1.10	28	0.2	1.10	0 to +50	UER48	118 x 115 x 47	0.5
	FG3005	4.4 - 5	FULL	1.5 K	-	25	0.2	1.15	20	0.3	1.15	-10 to +55	UER48	120 x 120 x 74	1.9
	FG3007	5.4 - 5.9	FULL	1.5 K	70	23	0.3	1.15	23	0.3	1.15	0 to +60	UG407	120 x 120 x 95	1.9
<b>WR137 waveguide (R70)</b>															
3-4	FH3013	5.925 - 6.425	FULL	300	-	32	0.1	1.05	28	0.1	1.08	+5 to +50	CMR137F	83 x 83 x 40	0.23
	FH3008	5.925 - 6.425	FULL	1 K	-	25	0.15	1.15	20	0.2	1.15	-10 to +50	CMR137F	83 x 83 x 75	0.4
3-4	FH3006	5.850 - 6.425	FULL	3.5 K	-	25	0.15	1.15	25	0.15	1.15	-10 to +50	CPR137F	83 x 125 x 86	1.4
	FH3007	5.850 - 6.425	FULL	6 K	-	25	0.15	1.15	25	0.15	1.15	-10 to +50	CPR137F	83 x 125 x 86	
7	FH3001	5.925 - 7.110	FULL	30	-	28	0.1	1.08	28	0.1	1.10	0 to +50	CMR137F	83 x 82 x 40	0.23
	FH3009	6.425 - 7.110	FULL	25	10	32	0.1	1.05	28	0.1	1.08	0 to +55	CMR137F	83 x 82 x 40	0.23
	FH3010	6.425 - 7.110	FULL	25	10	32	0.1	1.05	28	0.1	1.08	0 to +55	CMR137F	120 x 90 x 39	0.23
	FH3011	7.110 - 7.700	FULL	25	-	30	0.15	1.06	28	0.15	1.08	0 to +55	CMR137F	83 x 80 x 50	0.7
<b>WR112 waveguide (R84)</b>															
4	FH3022	7.1 - 8.5	FULL	20	-	-	-	-	20	0.2	1.22	-5 to +70	UBR84	68 x 67 x 51	0.3
	FH3003	7.5 - 8.5	FULL	25	5	25	0.2	1.15	20	0.3	1.20	0 to +60			
	FI3002	7.9 - 8.4	FULL	200	-	25	0.2	1.15	20	0.3	1.20	0 to +60			
	FI3005	7.9 - 8.4	FULL	4.3 K	-	25	0.15	1.15	25	0.15	1.15	-10 to +60			

Notes:

- 1 Water cooled
- 2 Pressurization SF<sub>6</sub> - 10 PSIG
- 3 Forced air cooled
- 4 Into external load 2: 1 continuous
- 5 Short circuit handling 10 ms duration
- 6 Max. avg. power into matched load only
- 7 Low third order intermodulation products
- 8 Water cooled at 30° C and Pressurization SF<sub>6</sub> - 1.5 PSIG
- 9 Permanent short circuit handling
- 10 Isolator with integrated water load

Outline drawings [see page 15-38](#) and following.

**Y-Junction waveguide devices 352 MHz to 18 GHz**

Notes	Type	Frequency range (GHz)	Bandwidth (MHz)	Avg. power max. W	Peak power max. kW	Specification at 25° C			Spec. in temperature range			Temperature range ° C	Flange	Dimensions mm approx.	Weight kg. approx.
						Isolation min. dB	Ins. loss max. dB	VSWR max.	Isolation min. dB	Ins. loss max. dB	VSWR max.				
<b>WR90 Waveguide (R100)</b>															
2	FJ3007	8.2 - 10.5	FULL	25	5	21	0.3	1.20	20	0.4	1.20	-20 to +85	UG 39/U	60 x 52 x 41	0.2
	FJ3004	8.5 - 9.6	FULL	300	110	22	0.4	1.20	18	0.5	1.30	-40 to +85	UG 39/U	60 x 52 x 41	0.2
	FJ3001	9.4 - 9.7	FULL	20	5	26	0.3	1.10	26	0.3	1.10	-30 to +85	UG 39/U	57 x 57 x 41	0.3
	FJ3019	10.5 - 12.2	FULL	25	5	25	0.3	1.15	20	0.5	1.20	-10 to +50	UG 39/U	60 x 52 x 41	0.2
<b>WR75 Waveguide (R120)</b>															
	FJ3020	10.7 - 11.7	FULL	25	5	30	0.2	1.07	26	0.2	1.12	-20 to +60	UBR120	44.5 x 44.5 x 38	0.19
	FJ3021	11.7 - 12.5	FULL	25	5	30	0.2	1.07	26	0.2	1.12	-20 to +60	UBR120	44.5 x 44.5 x 38	0.16
	FJ3022	12.5 - 13.5	FULL	25	5	30	0.2	1.07	26	0.2	1.12	-20 to +60	UBR120	44.5 x 44.5 x 38	0.14
	FJ3018	14 - 14.5	FULL	25	5	30	0.2	1.07	26	0.2	1.12	-20 to +60	UBR120	44.5 x 44.5 x 38	0.15
3-6	FJ3017	14 - 14.5	FULL	450	0.5	25	0.1	1.15	25	0.1	1.15	-10 to +60	UBR120	44.5x44.5x51.2	0.18
3-6	FJ3011	14 - 14.5	FULL	200	0.2	28	0.25	1.05	25	0.25	1.15	-10 to +50	UDR120	61 x 55 x 58	0.7
3-6	FJ3010	14 - 14.5	FULL	2 K	2	28	0.25	1.05	25	0.25	1.15	-10 to +50	UDR120	61 x 63 x 90	0.7
<b>WR62 Waveguide (R140)</b>															
8	FJ3023	12.5 - 14	FULL	15	5	22	0.3	1.20	20	0.3	1.20	-40 to +70	UG419/U	38 x 40 x 35	0.14
	FJ3004	15.5 - 17	FULL	15	5	22	0.3	1.20	20	0.3	1.20	0 to +60	UG419/U	38 x 40 x 35	0.14
	FJ3025	16 - 17	FULL	55	55	22	0.4	1.20	18	0.5	1.30	-40 to +90	UG419/U	38 x 40 x 35	0.14
<b>WR51 Waveguide (R180)</b>															
	FJ3001	17.7 - 19.7	FULL	-	-	25	0.3	1.15	23	0.3	1.15	0 to + 50	SPECIAL	38 x 40 x 32	0.1

**Notes:**

- 1 Water cooled
- 2 Pressurization air - 15 PSIG
- 3 Forced air cooled
- 4 Into external load 2 : 1 continuous
- 5 Short circuit handling 10 ms duration
- 6 Max. avg. power into matched load only
- 7 Low third order intermodulation products
- 8 Pressurization air 30 PSIG

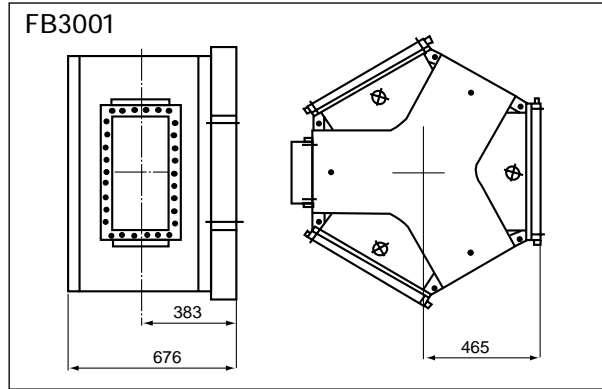
Outline drawings [see page 15-38](#) and following.

Y-Junction waveguide devices 352 MHz to 18 GHz

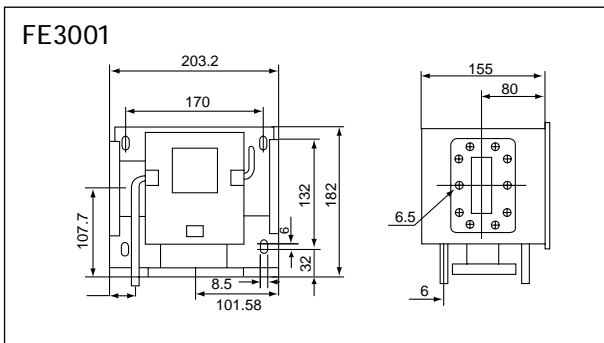


*Outline drawings*

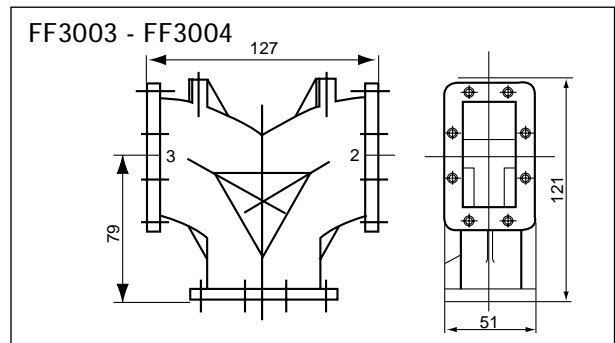
**R5**  
**WR1800 waveguide**



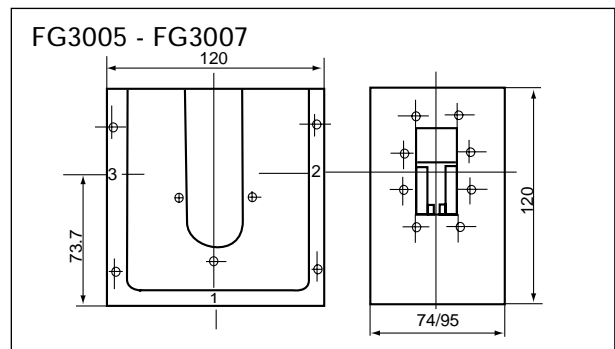
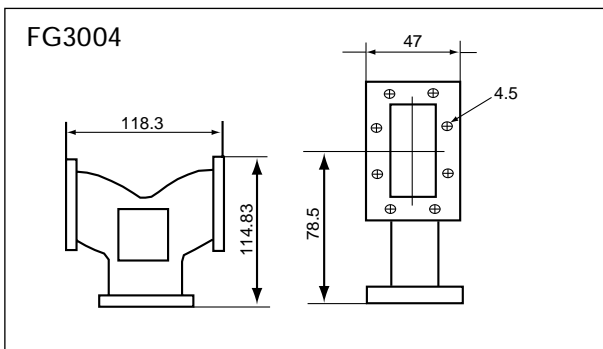
**R32**  
**WR284 waveguide**



**R40**  
**WR229 waveguide**

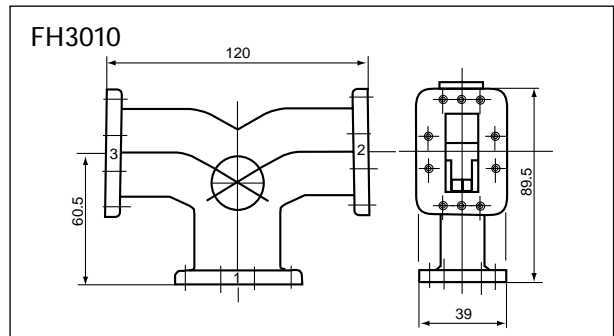
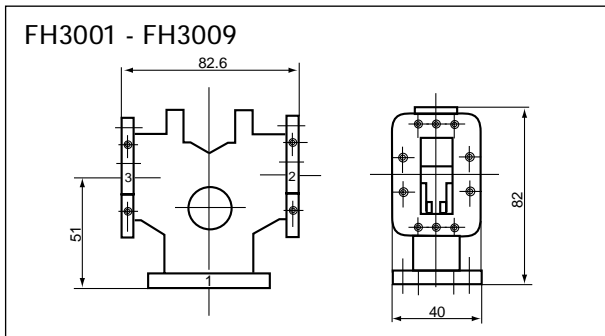


**R48**  
**WR187 waveguide**

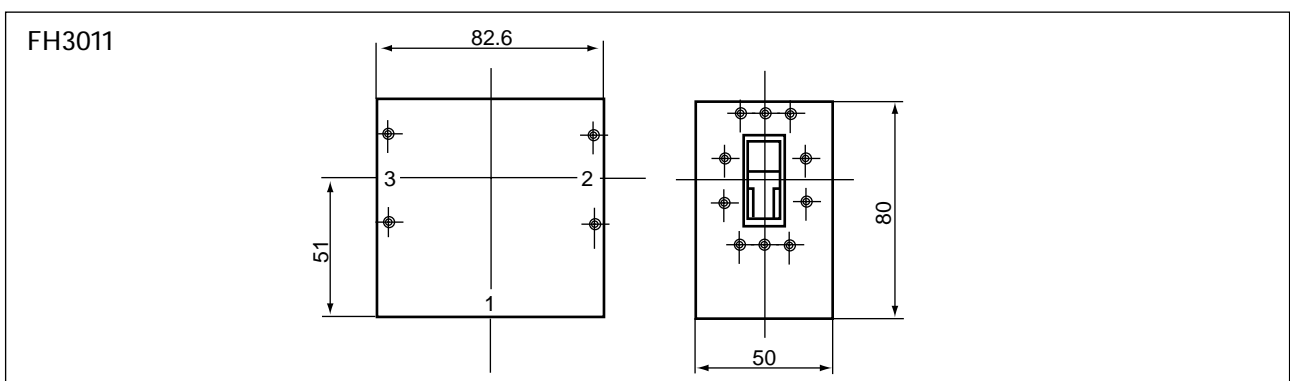
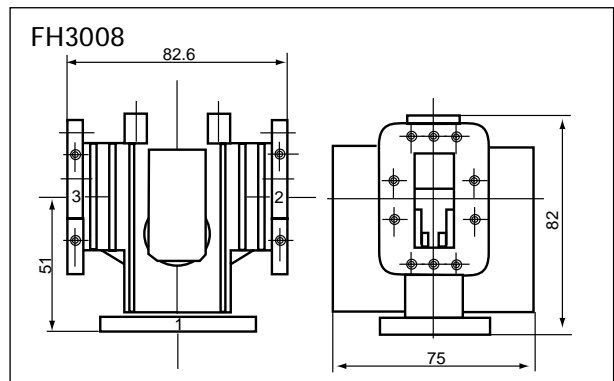
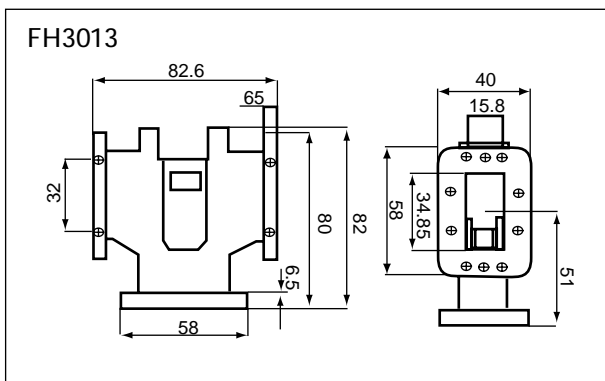
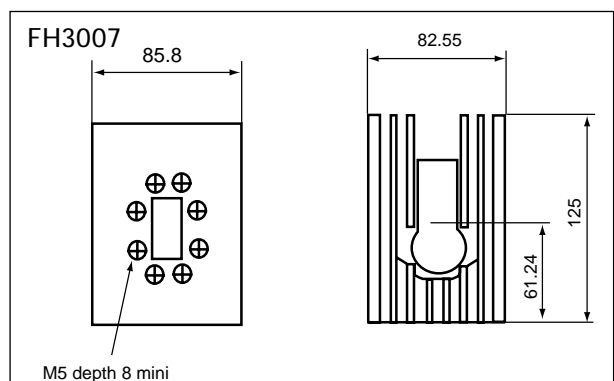
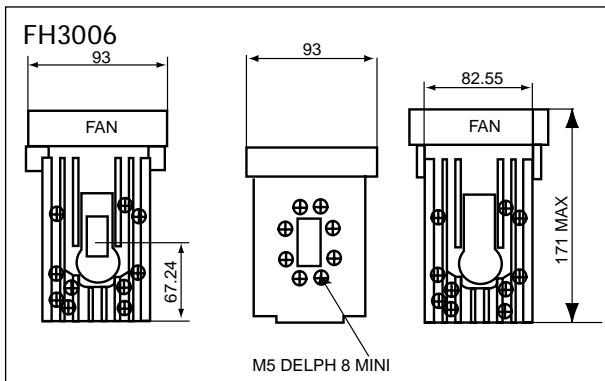


Y-Junction waveguide devices 352 MHz to 18 GHz

**R70**  
**WR137 waveguide**



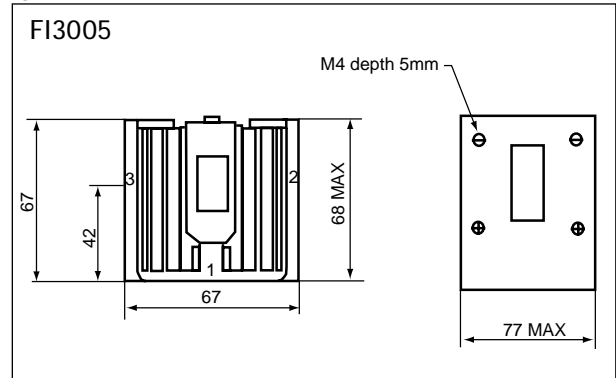
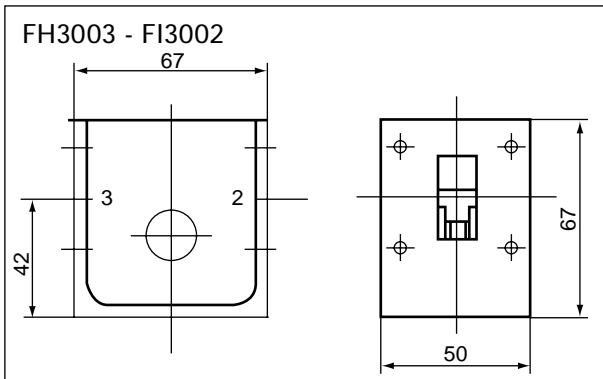
**R70**  
**WR137 waveguide**



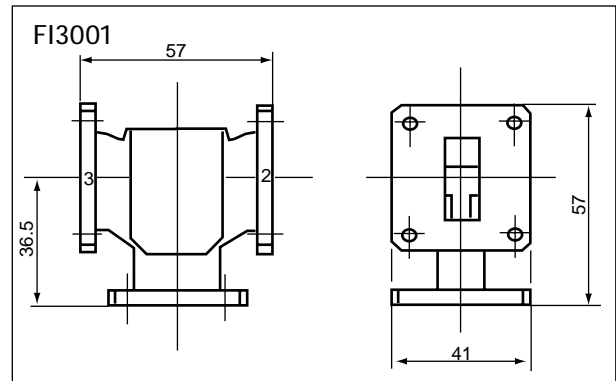
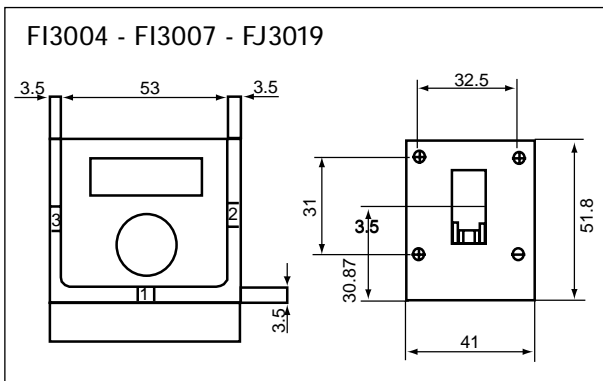
Y-Junction waveguide devices 352 MHz to 18 GHz



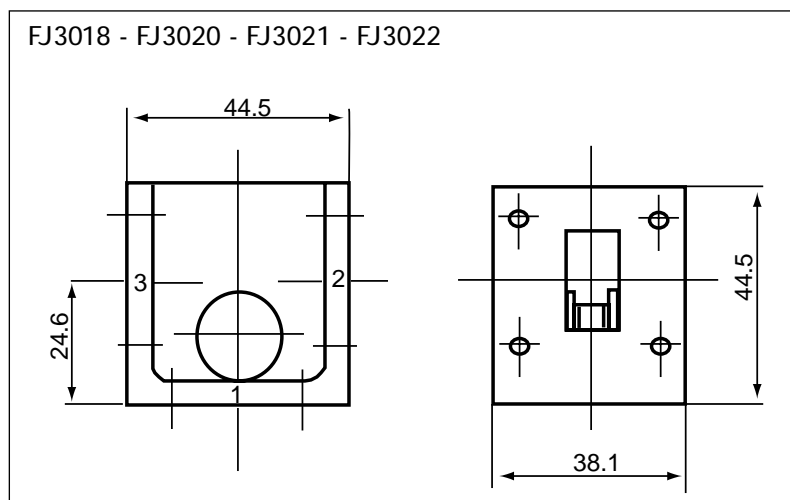
**R84**  
**WR112 waveguide**



**R100**  
**WR90 waveguide**



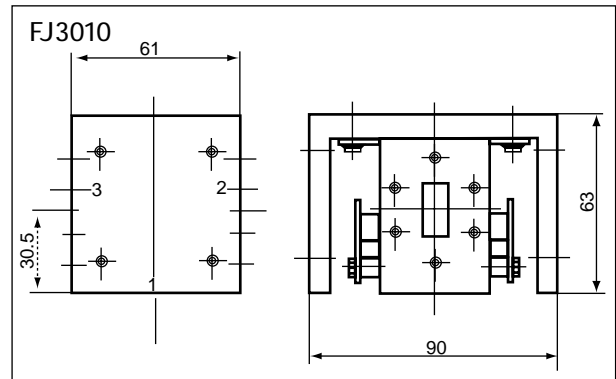
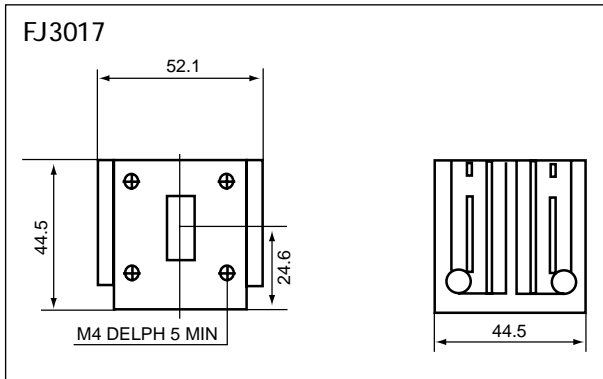
**R120**  
**WR75 waveguide R180**



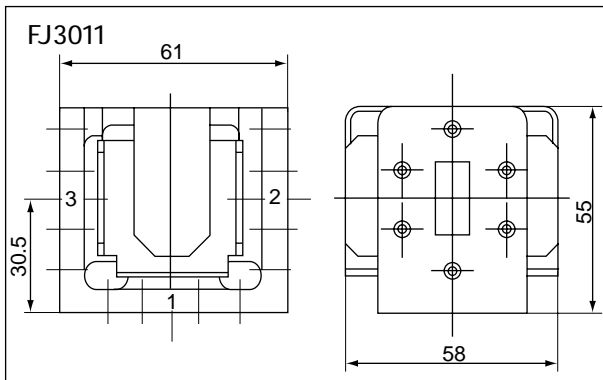


Y-Junction waveguide devices 352 MHz to 18 GHz

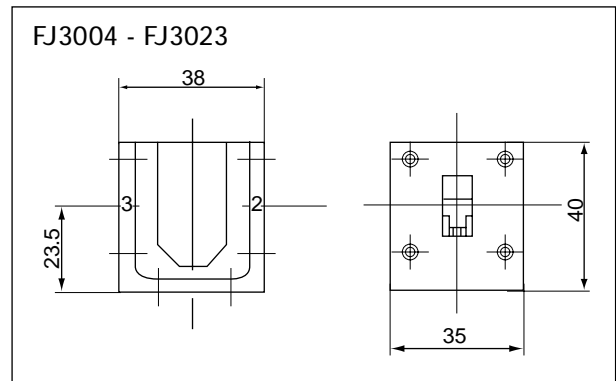
**R120**  
**WR75 waveguide**



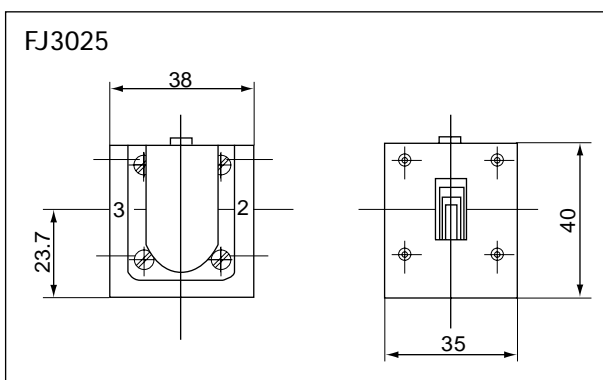
**R120**  
**WR75 waveguide**



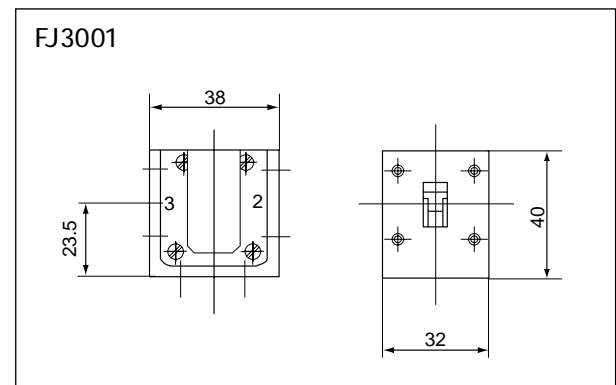
**R140**  
**WR62 waveguide**



**R140**  
**WR62 waveguide**



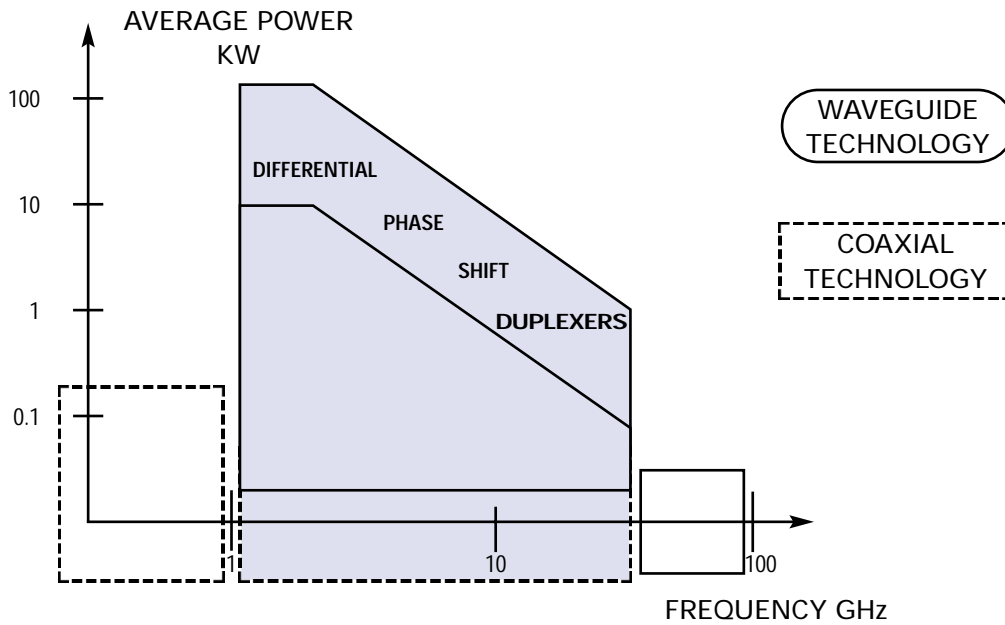
**R180**  
**WR51 waveguide**



4-Port waveguide differential phase shift circulators (Duplexers)



4-PORT WAVEGUIDE DIFFERENTIAL PHASE SHIFT CIRCULATORS (DUPLXERS)



*General description*

Designed for use in both high-peak and high-mean power applications, TEMEX differential phase shift circulators offer high isolation while maintaining low-insertion loss.

These ruggedly constructed circulators can operate under the most severe environmental conditions, according to MIL-SPEC.

The addition of specific heat sinks, or liquid cooling jackets increases mean power handling; for example, of up to 200 kW-CW at 1.250 GHz.

Casting techniques can be used for pressurized waveguide in order to reduce leakage and weight, especially for airborne radar.

In-house [ferrite materials](#) facilities, computer-aided design, and experienced research and development teams, allow TEMEX to offer customers specific designs with optimal features.

With the addition of a suitable waveguide load and a dummy load on the appropriate port, a 4-port differential phase shift circulator may be operated as a high-power isolator.

The reflected power that will be absorbed in the dummy load, or the output mismatch - (V.S.W.R.)- should be specified when ordering.

Options such as direction of circulation, mechanical output ports E-bend or H-bend are available upon request.

**4-Port waveguide differential phase shift circulators (Duplexers)**
*Electrical characteristics*

Notes	Type	Frequency range (GHz)	Bandwidth (MHz)	Avg. power max. W	Peak power max. kW	Specifications at 25° C			Spec. in temperature range			Temperature range °C	Flange	Length mm approx.	Weight kg. approx.	
						Isolation. min. dB	Inse. loss max. dB	VSWR max.	Isolation min. dB	Inse. loss max. dB	VSWR max.					
<b>WR975 waveguide (R9)</b>																
1-5	FC6001	1.000	-	350 K	350	-	-	-	20	0.15	1.10	25 ± 3	UDR 9	3044	-	
<b>WR650 waveguide (R14)</b>																
1-4	FD6001	1.250-1.350	FULL	6 K	6500	20	0.5	1.15	20	0.5	1.15	-10 to +50	CPR 650	2075	80	
1-7	FD6002	1.250-1.350	FULL	200 K	2000	20	0.2	1.15	20	0.2	1.15	+10 to +40	CPR 650	2136	130	
<b>WR340 waveguide (R26)</b>																
1	FE6002	2.450	± 25	50 K	50	23	0.2	1.15	20	0.25	1.20	+10 to +30	UG 554A/U	1125	43	
<b>WR284 waveguide (R32)</b>																
2-4	FE6004	2.700-2.900	FULL	3 K	1500	25	0.4	1.20	25	0.4	1.20	0 to +65	SPECIAL	600	25	
1	FE6005	2.900-3.100	FULL	10 K	660	25	0.4	1.20	25	0.4	1.20	0 to +50	SPECIAL	965	19	
1-5-7	FE6001	2.900-3.100	FULL	6 K	6000	20	0.3	1.15	20	0.3	1.15	0 to +50	CPR 284F	635	40	
1-6	FE6003	2.995-3.005	FULL	7 K	15000	20	0.2	1.05	20	0.2	1.05	+15 to +30	SPECIAL	902	80	
<b>WR187 waveguide (R48)</b>																
2	FG4201	4.4-5	FULL	2 K	2	23	0.2	1.12	23	0.2	1.12	-10 to +40	UER 48	588	8	
<b>WR137 waveguide (R70)</b>																
2	FH6002	5.925-6.425	FULL	1.5 K	-	22	0.15	1.07	20	0.2	1.15	-10 to +65	CPR 137	418	4.8	
2	FH6000	5.925-6.425	FULL	3 K	-	22	0.15	1.07	20	0.2	1.15	-10 to +65	CPR 137	418	4.8	
<b>WR112 waveguide (R84)</b>																
	FI6006	7.9-8.4	FULL	1.8 K	-	30	0.2	1.10	30	0.2	1.10	-10 to +70	UG 138/U	324	1.6	
2-4	FI6007	8.5-9.6	FULL	300	250	25	0.5	1.15	23	0.5	1.15	0 to +60	UG 138/U	324	1.6	
2-4	FI6003	8.8-9.4	FULL	250	250	25	0.5	1.15	25	0.5	1.15	0 to +60	UG 138/U	254	0.7	
<b>WR90 waveguide (R100)</b>																
2-4	FI6001	8.5-9.6	FULL	300	250	20	0.5	1.20	20	0.5	1.20	-40 to +70	UG 135/U	176	0.52	
3	FI6008	9-9.6	FULL	540	180	22	0.4	1.20	20	0.5	1.20	-40 to +70	UG 135/U	152	0.52	
2-4	FJ6013	9.6-10.4	FULL	1500	50	-	-	-	20	0.3	1.15	-40 to +70	UG 135/U	200	0.5	
	FJ6008	9.9-10.5	FULL	500	-	22	0.3	1.20	20	0.5	1.20	-30 to +60	UG 135/U	207	1	
1	FJ6004	10-10.25	FULL	2.5 K	-	25	0.25	1.10	20	0.35	1.15	0 to +60	UG 39/U	246	2.1	
<b>WR75 waveguide (R120)</b>																
1	FJ6007	11.7-12.5	FULL	1 K	2	25	0.25	1.15	20	0.3	1.20	0 to +60	UBR 120	257	2.2	
<b>WR62 waveguide (R140)</b>																
2	FJ6001	14-14.5	FULL	2.5 K	2.5	25	0.25	1.15	22	0.3	1.20	-10 to +55	UG 419/U	223	3.2	
	FJ6009	15.7-17	FULL	150	60	20	0.4	1.15	20	0.4	1.15	-10 to +70	UG 419/U	171	0.55	

**Notes:**

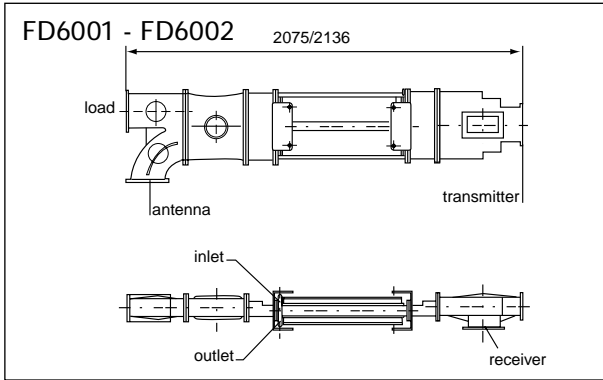
- |   |  |
|---|--|
| 1 Water cooled                          | 5 Can operate with permanent short circuit |
| 2 Air cooled                            | 6 Pressurized SF <sub>6</sub> (45 PSIG)    |
| 3 Air cooled pressurized 30 PSIG (2 kg) | 7 Pressurized SF <sub>6</sub> (15 PSIG)    |
| 4 Pressurized 15 PSIG (1.1 kg)          |  |

4-Port waveguide differential phase shift circulators (Duplexers)

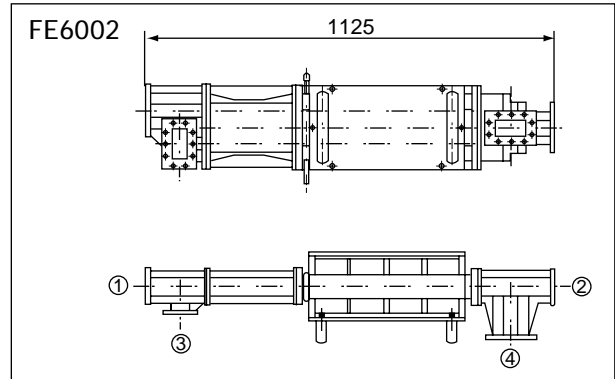


*Outline drawings*

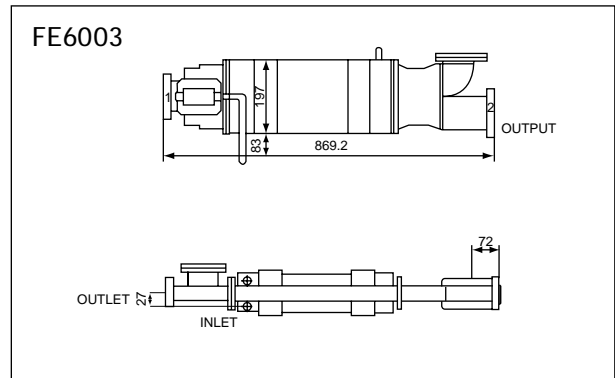
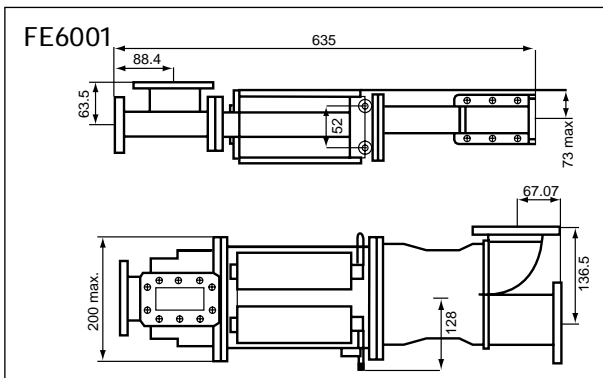
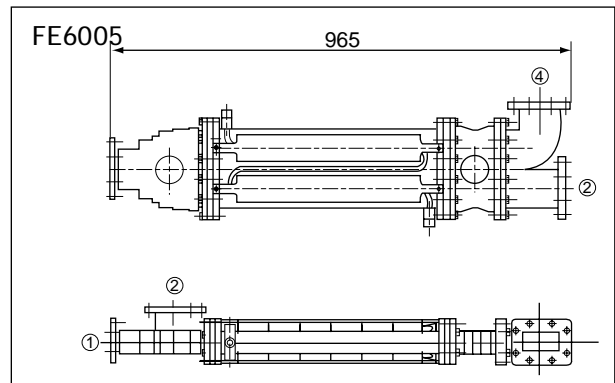
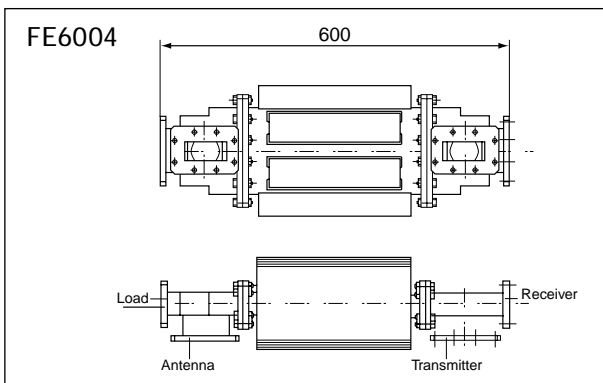
**R14**  
**WR650 waveguide**



**R26**  
**WR340 waveguide**

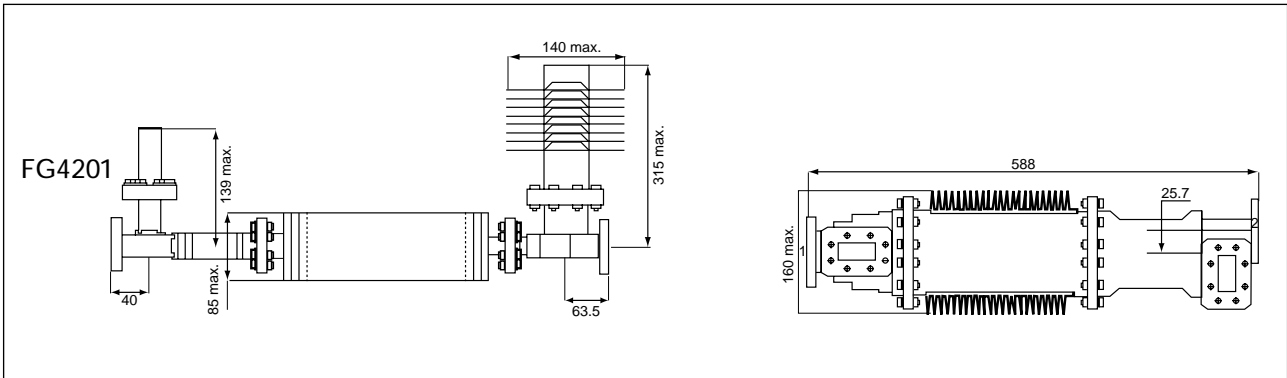


**R32**  
**WR284 waveguide**

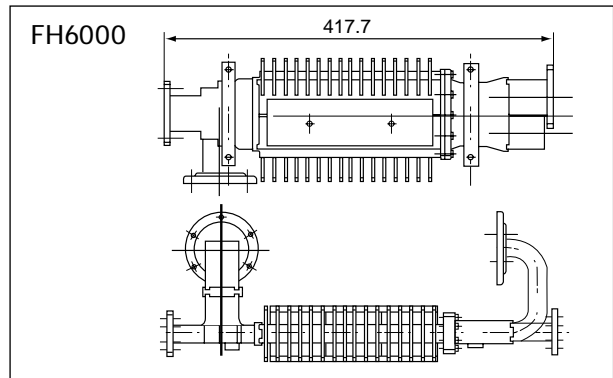
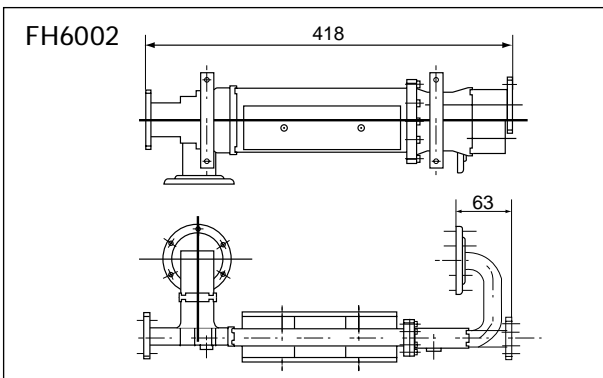


4-Port waveguide differential phase shift circulators (Duplexers)

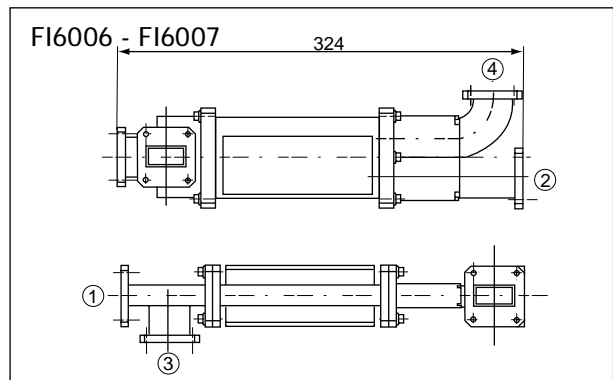
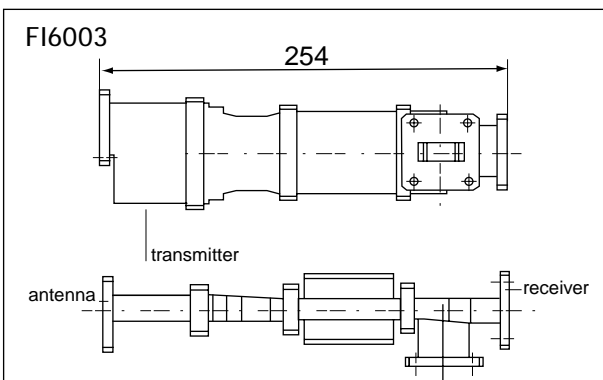
**R48**  
**WR187 waveguide**



**R70**  
**WR137 waveguide**



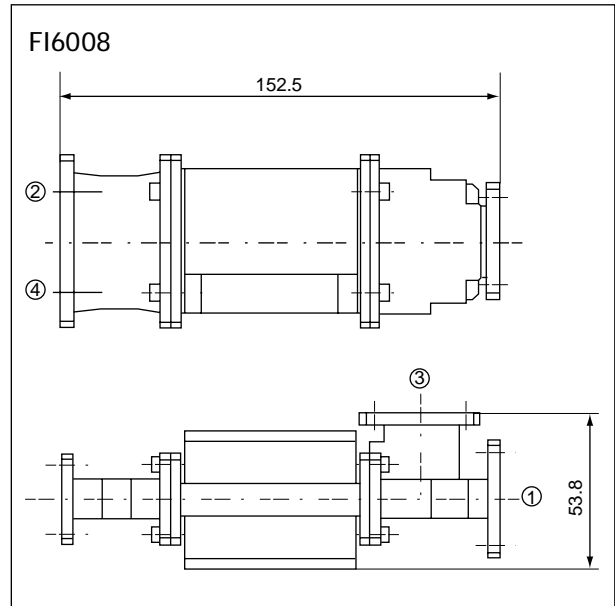
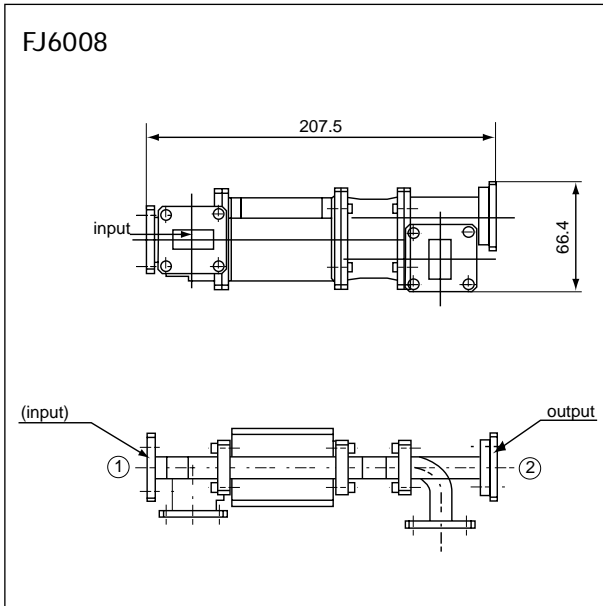
**R84**  
**WR112 waveguide**



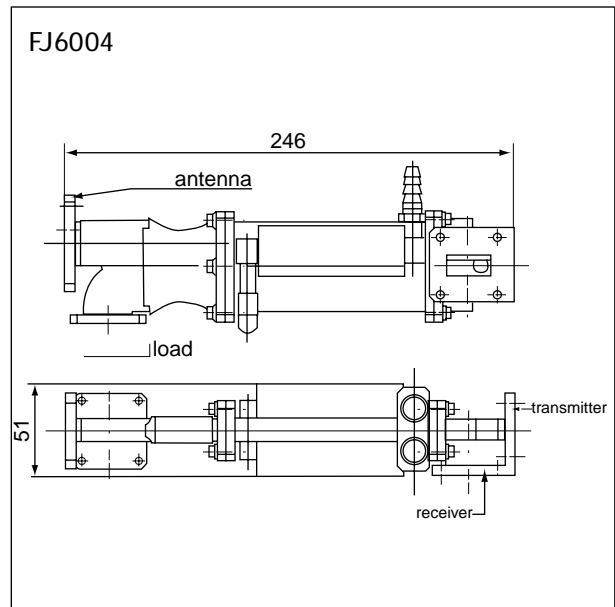
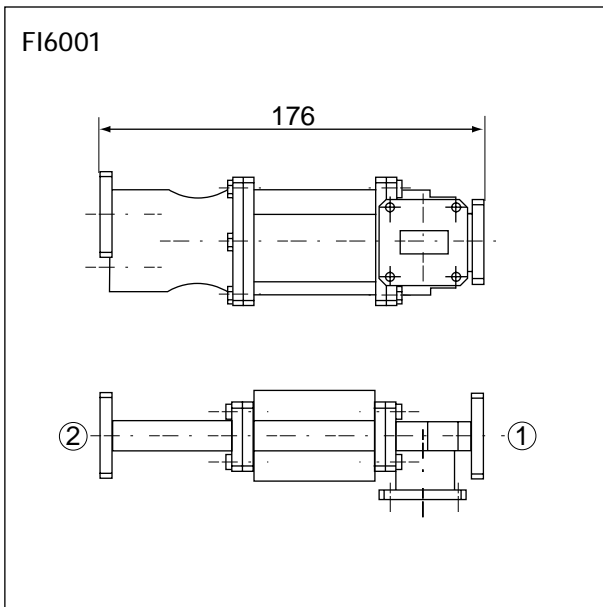
4-Port waveguide differential phase shift circulators (Duplexers)



R100  
WR90 waveguide



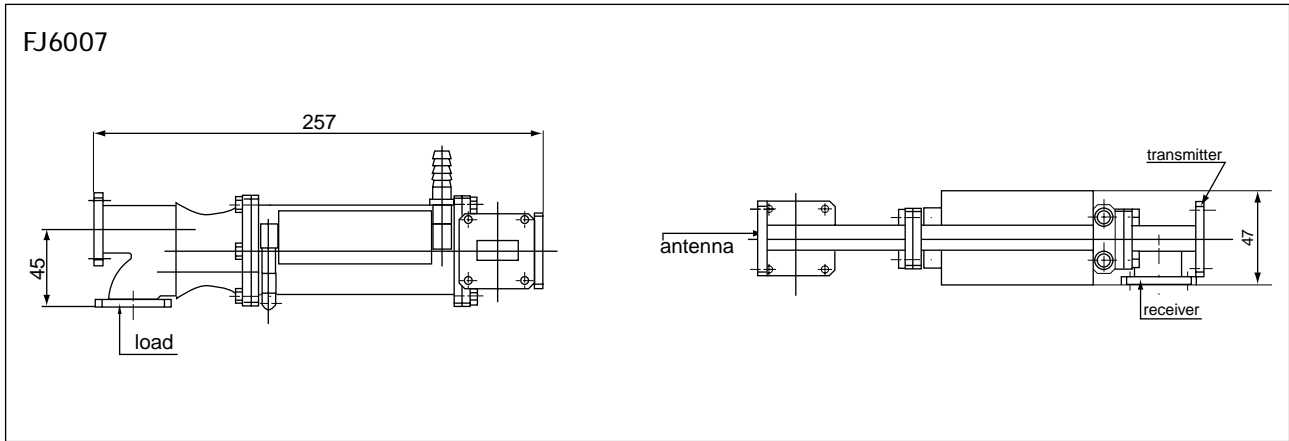
R100  
WR90 waveguide



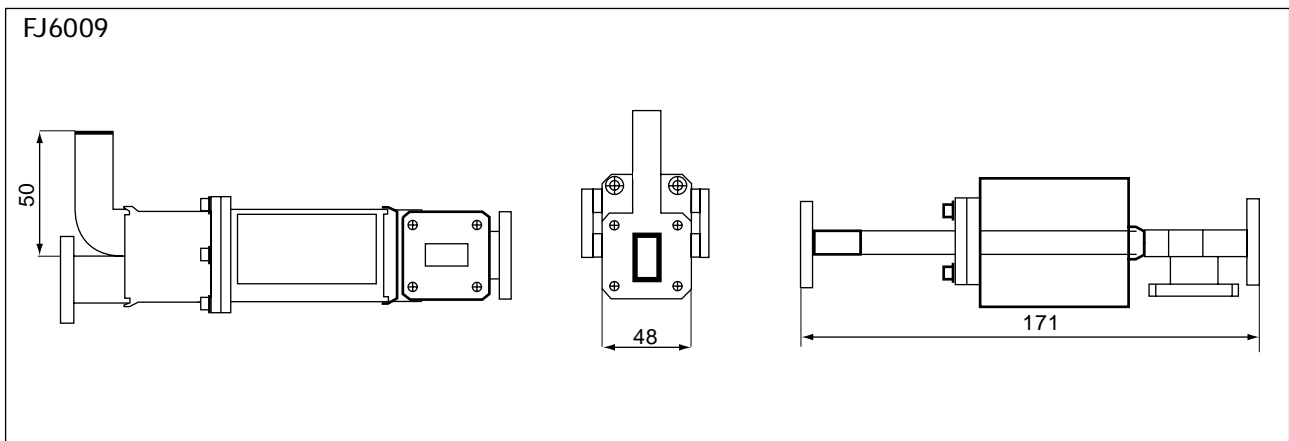
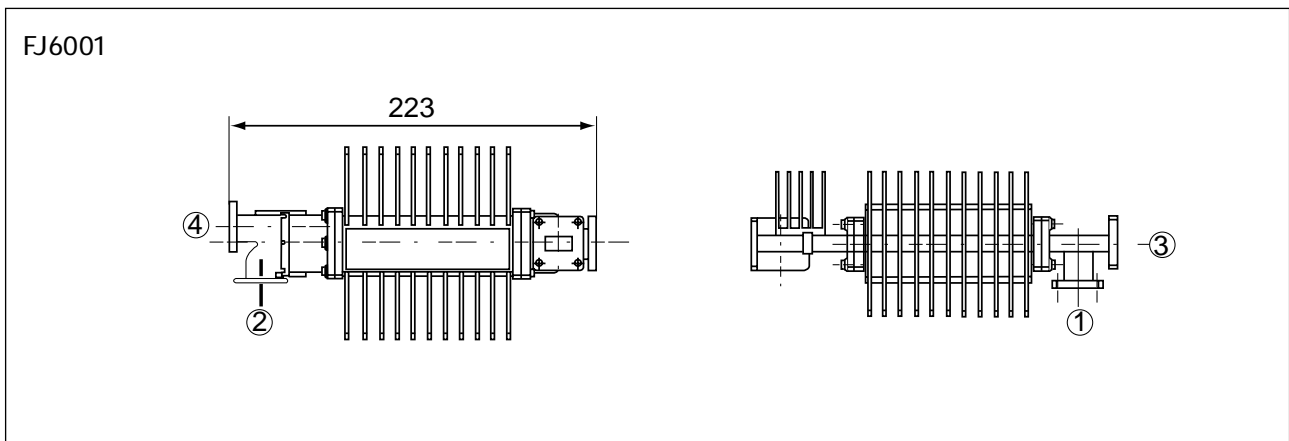
4-Port waveguide differential phase shift circulators (Duplexers)



**R120**  
**WR75 waveguide**



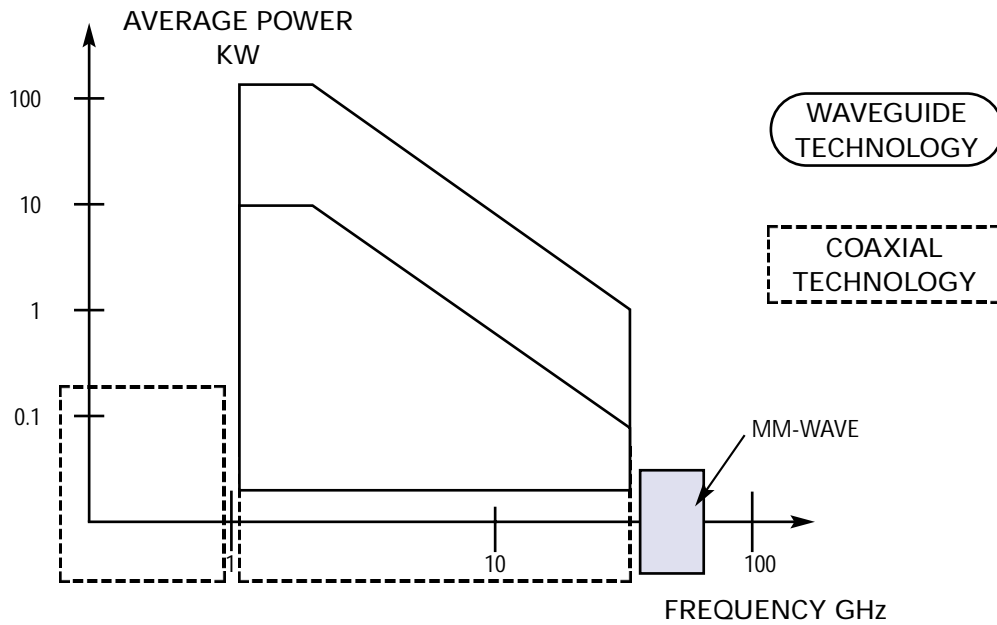
**R140**  
**WR62 waveguide**



Millimeter waveguide devices 18 to 40 GHz



## MILLIMETER WAVEGUIDE DEVICES 18 TO 40 GHz



### General information

TEMEX is actively involved in the in-house development of [ferrite materials](#) used in millimeter wave circulators, isolators and duplexers.

Our proprietary CAD software is the result of years of microwave device design experience. This has enabled us to optimize technological features in three product lines:

- Y-junction circulators (H-plane configuration),
- Miniature isolators (these are Y-junctions with an internal termination),
- 4-port differential phase shift circulators.

These devices cover 18 to 94 GHz in seven standard waveguide sizes with an average power up to 1500 W at 30 GHz.

Options such as direction of circulation, Y- or T- shaped junctions, compact size, specific flanges and cascaded devices are available upon request.

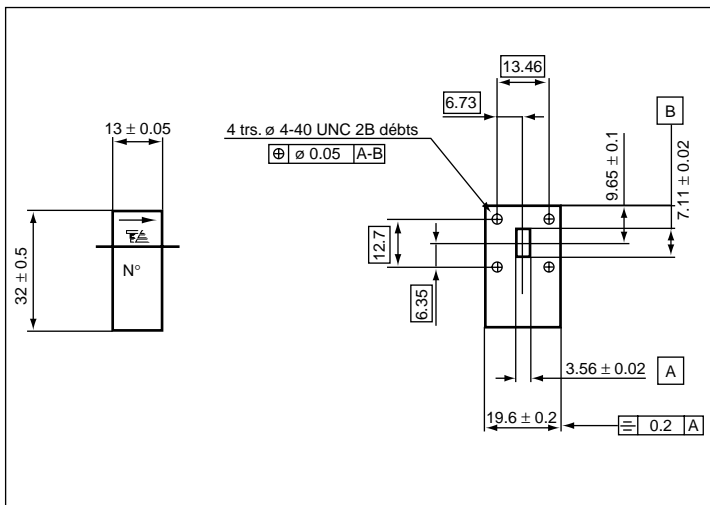
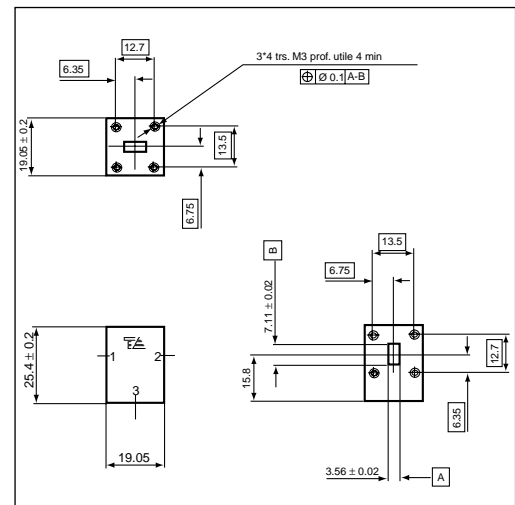


*Electrical characteristics*

Notes	Type	Frequency range (GHz)	Bandwidth (MHz)	Avg. power max. W	Peak power max. kW	Specifications at 25° C			Spec. in temperature range			Temperature range ° C	Flange	Dimensions mm approx.	Weight g. approx.	
						Isolation min. dB	Inse. loss max. dB	VSWR max.	Isolation min. dB	Inse. loss max. dB	VSWR max.					
<b>WR42 waveguide (R220)</b>																
2	FJ3008	18-21	FULL	15	2	23	0.4	1.15	20	0.5	1.20	-40 to +70	UG 597/U	32 x 32 x 26	80	
<b>WR28 waveguide (R320)</b>																
2	FK3001	27-32	FULL	2	2	20	0.4	1.25	20	0.5	1.25	-10 to +60	UG599/U	30 x 31 x 24	80	
2	FK3007	33-37	FULL	2	2	20	0.4	1.25	20	0.5	1.25	-10 to +60	UG599/U	30 x 31 x 24	80	
3-4	FK6001	34.5-35.5	FULL	50	50	20	0.5	1.20	20	0.5	1.20	-10 to +85	UG599/U	127 x 44 x 35	320	
2	FK3002	35-40	FULL	2	2	20	0.4	1.25	20	0.5	1.25	-10 to +60	UG599/U	30 x 31 x 24	80	
1	<a href="#">FK1016</a>	37-39.5	FULL	1	-	20	0.3	1.20	17	0.5	1.25	-30 to +80	UG599/U	13 x 32 x 19.6	-	
1	<a href="#">FK3016</a>	37-39.5	FULL	1	-	20	0.3	1.20	17	0.5	1.25	-30 to +80	UG599/U	13 x 32 x 19.6	-	

**NOTES:**

- (1) Miniature isolator
- (2) Y-Junction circulator
- (3) 4-port differential phase shift circulator (duplexer)
- (4) Air cooled pressurized 2 kg

*Outline drawings*

**FK1016-01**

**FK3016-01**




▶ DESIGN AID

## Selection Guide

	PAGE
<u>INTERNATIONAL DESIGNATIONS FOR STANDARD RECTANGULAR WAVEGUIDES</u>	<u>15-51</u>
<u>INTERNATIONAL DESIGNATIONS FOR FLANGES</u>	<u>15-53</u>
<u>EFFECT OF VSWR ON TRANSMITTED POWER</u>	<u>15-55</u>

## International designations for standard rectangular waveguides

## INTERNATIONAL DESIGNATIONS FOR STANDARD RECTANGULAR WAVEGUIDES

FREQUENCY RANGE (TE <sub>01</sub> MODE) GHz	WAVEGUIDE SIZE						NORM: MIL - W - 85 (USA)						NORM: NATO		
	OUTER DIMENSIONS mm		INNER DIMENSIONS mm		TOLERANCES WALL THICKNESS ±mm mm		DESIGNATION M - 85 - ( )						DESIGNATION NGW - ( )		
	WIDTH (a)	HEIGHT (b)	WIDTH (a)	HEIGHT (b)			Ag	Cu	BRASS or (Cu + Ag)*	ALUMINUM ALLOY 1100 6061 6063	Al	Ag	BRASS		
1	0.320 - 0.490	593.8	301.7	584.2	292.1				1-001 1-002 1-161						
2	0.340 - 0.535	543.0	276.3	533.4	266.7				1-003 1-004 1-162						
3	0.410 - 0.620	436.6	235.0	457.2	228.6				1-005 1-006 1-163	1-A01					
4	0.490 - 0.750	387.6	196.9	381.0	190.5				1-007 1-008 1-164	1-A02					
5	0.640 - 0.975	298.5	152.4	292.1	146.05				1-009 1-010 1-165	1-A03					
6	0.755 - 1.150	254.0	130.2	247.65	123.82				1-011 1-012 1-166	1-A04					
7	0.960 - 1.46	195.6	97.8	195.58	97.79				1-013 1-014 1-167	1-A05					
8	1.13 - 1.73	169.2	86.6	165.10	82.55	0.33	2.03	1-015 1-017	1-018 1-019 1-168	1-A06		3A06			
9	1.45 - 2.20	133.6	68.8	129.54	64.77	0.26	2.03	1-021 1-023	1-025 1-026 1-169						
10	1.72 - 2.61	113.3	58.7	109.22	54.61	0.22	2.03	1-027 1-031	1-029 1-030 1-170	1-A08		3A08			
11	2.12 - 3.20			88.9	44.45	0.17	2.03								
12	2.17 - 3.30	90.42	47.24	86.36	43.18	0.17	2.3	1-033 1-037	1-035 1-036 1-171	1-A09		3A09			
13	2.60 - 3.95	76.20	38.10	72.14	34.04	0.14	2.03	1-039 1-043	1-041 1-042 1-172	1-A10		3A10			
14	3.22 - 4.90	61.42	32.33	58.17	29.08	0.12	1.63	1-045 1-049	1-047 1-048 1-173						
15	3.95 - 6.00	50.80	25.40	47.55	22.15	0.095	1.63	1-051 1-055	1-053 1-054 1-174	1-A12		3A12			
16	4.65 - 7.05	43.64	23.44	40.39	20.19	0.081	1.63	1-057 1-061	1-059 1-060 1-175						
17	5.4 - 8.2	38.10	19.05	34.85	15.80	0.070	1.63	1-063 1-067	1-065 1-066 1-176	1-A14		3A14			
18	6.55 - 10.0	31.75	15.88	28.50	12.62	0.06	1.63	1-069 1-073	1-071 1-072 1-177	1-A15		3A15			
19	8.2 - 12.5	25.40	12.70	22.86	10.16	0.05	1.27	1-075 1-079	1-077 1-078 1-078	1-A16		3A16			
20	9.8 - 15.0	21.59	12.06	19.05	9.52	0.04	1.27	1-081 1-085	1-083 1-084 1-179						
21	11.9 - 18.0	17.83	9.93	15.80	7.90	0.03	1.02	1-093 1-087 1-089	1-090 1-091 1-180	1-A18 6-A18		3A18			
22	14.5 - 22.0	14.99	8.51	12.95	6.48	0.026	1.02	1-094 1-096	1-097 1-098 1-181						
23	18.0 - 26.5	12.70	6.35	10.67	4.32	0.022	1.02	1-106 1-100 1-102	1-103 1-104 1-182	1-A20 6-A20		3A20			
24	22.0 - 33.0	10.67	6.35	8.64	4.32	0.020	1.02	1-113 1-107 1-109	1-110 1-111 1-183						
25	26.5 - 40.0	9.14	5.59	7.11	3.56	0.020	1.02	3-006 3-007 3-008*	3-009	6-A22					
26	33.0 - 50.0	7.72	4.88	5.69	2.845	0.020	1.02	3-010 3-012 3-013*	3-013	6-A23					
27	40.0 - 60.0	6.81	4.42	4.78	2.39	0.020	1.02	3-014 3-015 3-016*							
28	50.0 - 75.0	5.79	3.91	3.79	1.88	0.020	1.02	3-017 3-018 3-019*		6-A25					
29	60.0 - 90.0	5.13	3.58	3.10	1.55	0.015	1.02	3-020 3-021 3-022*		6-A26					
30	75.0 - 110.0	4.57	3.30	2.54	1.27	0.010	1.02	3-023 3-024 3-025*							
31	90.0 - 140.0	3.56	2.54	2.032	1.016	0.008	0.76	3-026 3-027 3-028*							
32	110.0 - 170.0	3.175	2.35	1.651	0.826	0.0064	0.76	3-029 3-030 3-031*							
33	140.0 - 220.0	2.819	2.172	1.296	0.648	0.0064	0.76	3-032 3-033 3-034*							
34	170.0 - 260.0	2.616	2.070	1.092	0.546	0.0051	0.76	3-035 3-036 3-037*							
35	220.0 - 325.0	2.388	1.956	0.864	0.432	0.0051	0.76	3-038 3-039 3-040*							

(2) Pulse length: 1μs - Breakdown strength (dry air): 15 KV/cm - P = 15 psia

International designations for standard rectangular waveguides



NORM: UK	NORM: JAN (USA)		NORM: EIA (USA)	E.I.C. OFFICIAL NORM	TE <sub>10</sub> MODE CUT-OFF FREQUENCY	THEORETICAL ATTENUATION		THEORETICAL max PEAK POWER		COPPER GUIDE (ΔT = 110°C)		
	DESIGNATION WG - ( )	DESIGNATION RG - ( )		DESIGNATION WR - ( )		OFFICIAL DESIGNATION R - ( )	GHz	dB/100m	AT: MW		MAX MEAN POWER AT: KW	
	Ag	*Cu-Ag	Al			1.25f <sub>c</sub>	1.9f <sub>c</sub>	1.25f <sub>c</sub>	1.9f <sub>c</sub>	1.25f <sub>c</sub>	1.9f <sub>c</sub>	
1	00		290	2300	3	0.256	0.164	0.099	153	212	5900	8500
2	0		291	2100	4	0.281	0.173	0.109	120	173	4500	6800
3	1		201	1800	5	0.328	0.180	0.122	93.4	132	3200	4900
4	2		202	1500	6	0.393	0.220	0.160	67.6	93.3	2100	3100
5	3		203	1150	8	0.513	0.336	0.240	35	53.8	1150	1700
6	4		204	975	9	0.605	0.440	0.305	27	38.5	760	1200
7	5		205	770	12	0.766	0.635	0.436	17.2	24.1	450	700
8	6	69	103	650	14	0.908	0.88	0.58	118	17.1	300	480
9	7	337	338	510	18	1.157	1.123	0.84	7.5	10.6	180	270
10	8	104	105	430	22	1.373	1.63	1.08	5.2	7.5	115	190
11	9					1.686						
12	9A	112	113	340	26	1.737	2.21	1.54	3.4	4.7	72	110
13	10	48	75	284	32	2.078	2.40	1.64	2.18	3.1	45	67
14	11A	340	341	229	40	2.579	3.92	2.78	1.56	2.14	30	46
15	12	49	95	187	48	3.155	5.79	4.00	0.94	1.32	18	24
16	13	343	344	159	58	3.714	6.62	6.00	0.754	0.983	12	19
17	14	50	106	137	70	4.285	8.19	6.47	0.554	0.696	8	12
18	15	51	68	112	84	5.260	11.5	8.91	0.355	0.454	51	7.6
19	16	52	67	90	100	6.560	17.9	12.4	0.206	0.896	32	4.5
20	17	346	347	75	120	7.873	21.2	14.8	0.166	0.229	24	3.4
21	18	107	91	349	140	9.490	26.7	19.6	0.119	0.157	16	2.2
22	19	353	**352	351	51	11.578	36.5	36.4	0.079	0.106	100	1.4
23	20	66	53	121	42	14.080	57.1	42	0.043	0.058	0.53	0.8
24	21		*357	34	260	17.368	53	36.8	0.034	0.047	0.4	0.6
25	22	96	*271	28	320	21.100	72	49.2	0.023	0.32	0.28	0.4
26	23	97	**272	22	400	26.350	101	68	0.014	0.020	0.17	0.26
27	24		*358	19	500	31.410	127	89	0.010	0.014	0.14	0.20
28	25	98	*273	15	620	39.900	188	128	0.0063	0.0090		
29	26	99	*274	12	740	48.400	257	172	0.0042	0.060		
30	27		*359	10	900	59.050	330	232	0.0028	0.0040		
31	28	138	*278	8	1200	73.840	500	325	0.0018	0.0026		
32	29	136	*276	7	1400	90.485	715	449	0.0012	0.0017		
33	30	135	*275	5	1800	115.75	1010	633	0.00071	0.00107		
34	31	137	*277	4	2200	137.52	1260	833	0.00052	0.00075		
35	32	139		3	2600	173.29	1660	1140	0.00035	0.00047		

## INTERNATIONAL DESIGNATIONS FOR FLANGES

FLANGES											WAVEGUIDE		CIRCULAR PIN FLANGE	
OFFICIAL DESIGNATIONS: IEC NORM											NORM: EIA WR - ( )	NORM: IEC R - ( )	NORM: EIA WR - ( )	NORM: EIA WR - ( )
FLANGE					WAVEGUIDE									
C <sup>(1)</sup> A B C IEC-P <sup>(2)</sup> D E U <sup>(3)</sup> F					R - ( )						BRASS			
CA-R()	CB-R()	PA-R()	PB-R()	PC-R()	PD-R()	PF-R()	UA-R()	UB-R()	UD-R()	UE-R()				
1					X				X		2300	3		
2					X				X		2100	4		
3					X				X		1800	5		
4					X				X		1500	6		
5					X				X		1150	8		
6					X				X		975	9		
7					X				X		770	12		
8					X				X		650	14		
9					X				X		510	18		
10					X				X		430	22		
11					X				X		340	26		
12	X		X		X		X		X	X	284	32		
13					X				X	X	229	40		
14	X		X		X		X		X	X	187	48		
15	X		X		X		X		X	X	159	58		
16	X		X		X		X		X	X	137	70		
17		X		X	X			X	X	X	112	84		
18		X		X	X			X	X	X	90	100		
19			X		X			X	X		75	120		
20		X		X	X			X	X		62	140		
21					X				X		51	180		
22		X		X	X			X			42	220		
23				X							34	260		
24		X		X	X			X			28	320	381	67 B005
25				X							22	400	383	67 B006
26				X							19	500	383 N	67 B007
27						X					15	620	385	67 B008
28						X					12	740	387	67 B009
29						X					10	900	387 M	67 B010
30						X					8	1200	387 M	74 - 001
31											7	1400	387 M	74 - 002
32											5	1800	387 M	74 - 003
33											4	2200		
34											3	2600		
35								UH-R						
36								X					35	
37								X					41	

**NOTES:**

- (1) pressurizable with "choke flanges"
- (2) pressurizable
- (3) no-pressurizable

International designations for flanges

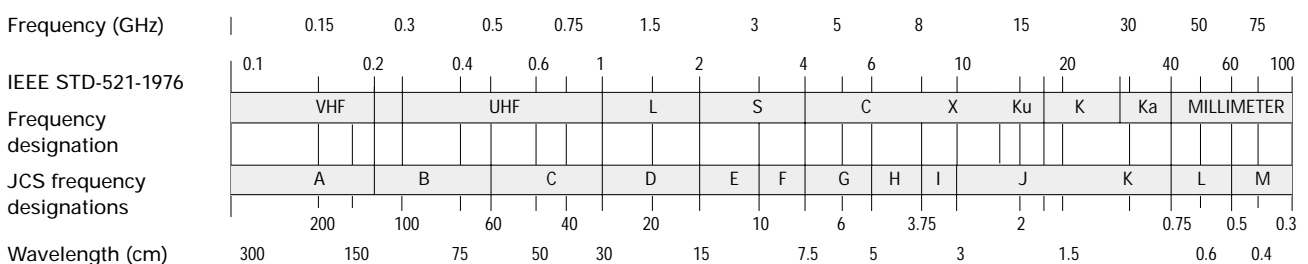


FLANGES												
NORM: JAN UG - ( ) / U										NORM: EIA CPR - ( )	NORM: EIA CMR - ( )	
"STANDARD"								"CHOKE FLANGE"		F: FLAT	F: FLAT	
BRASS				ALUMINUM ALLOY				BRASS	ALUMINUM ALLOY	G: GROOVE		
"FLAT"	~ CMR	~ CPR-F	~ CPR-G	"FLAT"	~ CMR	~ CPR-F	~ CPR-G					
1										2300		
2										2100		
3										1800		
4										1500		
5										1150		
6										975		
7										770		
8	417 B		1714	1362	418 B		1720	1343		650		
9			1715	1718			1717	1719		510		
10	435 A B		1716	1344	437 A		1711	1345		430		
11	553 A		1712	1346	554 A		1713	1747		340		
12	53	1479	1724	1348	584	1484	1725	1349	54 A	585 A	284	284
13			1726	1350			1727	1351			229	229
14	149 A	1475	1728	1352	407	1480	1729	1353	148 B C	406 A B	187	187
15			1730	1354			1731	1355			159	159
16	344	1476	1732	1356	441	1481	1733	1357	343 A B	440 A B	137	137
17	51	1477	1734	1358	138	1482	1735	1359	52 A B	137 A	112	112
18	39	1478	1736	1360	135	1483	1737	1371	40 A	136 A	90	90
19												
20	419				1665				541 A	1666		
21					597				596 A	596 A		
22	505											
23												
24	599								600 A B			
25	599 N	1521										
26	599 N											
27	599 M	1523										
28	599 M	1522										
29												
30												
31												
32												
33												
34												
35												
36												
37												

## Effect of V.S.W.R. on transmitted power

**EFFECT OF V.S.W.R. ON TRANSMITTED POWER**

V.S.W.R.	V.S.W.R. dB	RETURN LOSS dB	TRANS. LOSS dB	VOLT REFL. COEFF.	POWER TRANS %	POWER REFL. %	V.S.W.R.	V.S.W.R. dB	RETURN LOSS dB	TRANS. LOSS dB	VOLT REFL. COEFF.	POWER TRANS %	POWER REFL. %
1.00	.0	∞	.000	.00	100.0	.0	1.64	4.3	12.3	.263	.24	94.1	5.9
1.01	.1	46.1	.000	.00	100.0	.0	1.66	4.4	12.1	.276	.25	93.8	6.2
1.02	.2	40.1	.000	.01	100.0	.0	1.68	4.5	11.9	.289	.25	93.6	6.4
1.03	.3	36.6	.001	.01	100.0	.0	1.70	4.5	11.7	.302	.26	93.3	6.7
1.04	.3	34.2	.002	.02	100.0	.0	1.72	4.7	11.5	.315	.26	93.0	7.0
1.05	.4	32.3	.003	.02	99.9	.1	1.74	4.8	11.4	.329	.27	92.7	7.3
1.06	.5	30.7	.004	.03	99.9	.1	1.76	4.9	11.2	.342	.28	92.4	7.6
1.07	.6	29.4	.005	.03	99.9	.1	1.78	5.0	11.0	.356	.28	92.1	7.9
1.08	.7	28.3	.006	.04	99.9	.1	1.80	5.1	10.9	.370	.29	91.8	8.2
1.09	.7	27.3	.008	.04	99.8	.2	1.82	5.2	10.7	.384	.29	91.5	8.5
1.10	.8	26.4	.010	.05	99.8	.2	1.84	5.3	10.6	.398	.30	91.3	8.7
1.11	.9	24.7	.012	.05	99.7	.3	1.86	5.4	10.4	.412	.30	91.0	9.0
1.12	1.0	24.9	.014	.06	99.7	.3	1.88	5.5	10.3	.426	.31	90.7	9.3
1.13	1.1	24.3	.016	.06	99.6	.4	1.90	5.6	10.2	.440	.31	90.4	9.6
1.14	1.1	23.7	.019	.07	99.6	.4	1.92	5.7	10.0	.454	.32	90.1	9.9
1.15	1.2	23.1	.021	.07	99.5	.5	1.94	5.8	9.9	.468	.32	89.8	10.2
1.16	1.3	22.6	.024	.07	99.5	.5	1.96	5.8	9.8	.483	.32	89.5	10.5
1.17	1.4	22.1	.027	.08	99.4	.6	1.98	5.9	9.7	.497	.33	89.2	10.8
1.18	1.4	21.7	.030	.08	99.3	.7	2.00	6.0	9.5	.512	.33	88.9	11.1
1.19	1.5	21.2	.033	.09	99.2	.8	2.50	8.0	7.4	.881	.43	81.6	18.4
1.20	1.6	20.8	.036	.09	99.2	.8	3.00	9.5	6.0	1.249	.50	75.0	25.0
1.21	1.7	20.4	.039	.10	99.1	.9	3.50	10.9	5.1	1.603	.56	69.1	30.9
1.22	1.7	20.1	.043	.10	99.0	1.0	4.00	12.0	4.4	1.938	.60	64.0	36.0
1.23	1.8	19.7	.046	.10	98.9	1.1	4.50	13.1	3.9	2.255	.64	59.5	40.5
1.24	1.9	19.4	.050	.11	98.9	1.1	5.00	14.0	3.5	2.553	.67	55.6	44.4
1.25	1.9	19.1	.054	.11	98.9	1.2	5.50	14.8	3.2	2.834	.69	52.1	47.9
1.26	2.0	18.8	.058	.12	98.7	1.3	6.00	15.6	2.9	3.100	.71	49.0	51.0
1.27	2.1	18.5	.062	.12	98.6	1.4	6.50	16.3	2.7	3.351	.73	46.2	53.8
1.28	2.1	18.2	.066	.12	98.5	1.5	7.00	16.9	2.5	3.590	.75	43.7	56.2
1.29	2.2	17.9	.070	.13	98.4	1.6	7.50	17.5	2.3	3.817	.76	41.5	58.5
1.30	2.3	17.7	.075	.13	98.3	1.7	8.00	18.1	2.2	4.033	.78	39.5	60.5
1.32	2.4	17.2	.083	.14	98.1	1.9	8.50	18.6	2.1	4.240	.79	37.7	62.3
1.34	2.5	16.8	.093	.15	97.9	2.1	9.00	19.1	1.9	4.437	.80	36.0	64.0
1.36	2.7	16.3	.102	.15	97.7	2.3	9.50	19.6	1.8	4.626	.81	34.5	65.5
1.38	2.8	15.9	.112	.16	97.5	2.5	10.00	20.0	1.7	4.807	.82	33.1	66.9
1.40	2.9	15.6	.122	.17	97.2	2.8	11.00	20.8	1.6	5.149	.83	30.6	69.4
1.42	3.0	15.2	.133	.17	97.0	3.0	12.00	21.6	1.5	5.466	.85	28.4	71.6
1.44	3.2	14.9	.144	.18	96.7	3.3	13.00	22.3	1.3	5.762	.86	26.5	73.5
1.46	3.3	14.6	.155	.19	96.5	3.5	14.00	22.9	1.2	6.040	.87	24.9	75.1
1.48	3.4	14.3	.166	.19	96.3	3.7	15.00	23.5	1.2	6.301	.88	23.4	76.6
1.50	3.5	14.0	.177	.20	96.0	4.0	16.00	24.1	1.1	6.547	.88	22.1	77.9
1.52	3.6	13.7	.189	.21	95.7	4.3	17.00	24.6	1.0	6.780	.89	21.0	79.0
1.54	3.8	13.4	.201	.21	95.5	4.5	18.00	25.1	1.0	7.002	.89	19.9	80.1
1.56	3.9	13.2	.213	.22	95.2	4.8	19.00	25.6	.9	7.212	.90	19.0	81.0
1.58	4.0	13.0	.225	.22	94.9	5.1	20.00	26.0	.9	7.413	.90	18.1	81.9
1.60	4.1	12.7	.238	.23	94.7	5.3	25.00	28.0	.7	8.299	.92	14.8	85.2
1.62	4.2	12.5	.250	.24	94.4	5.6	30.00	29.5	.6	9.035	.94	12.5	87.5

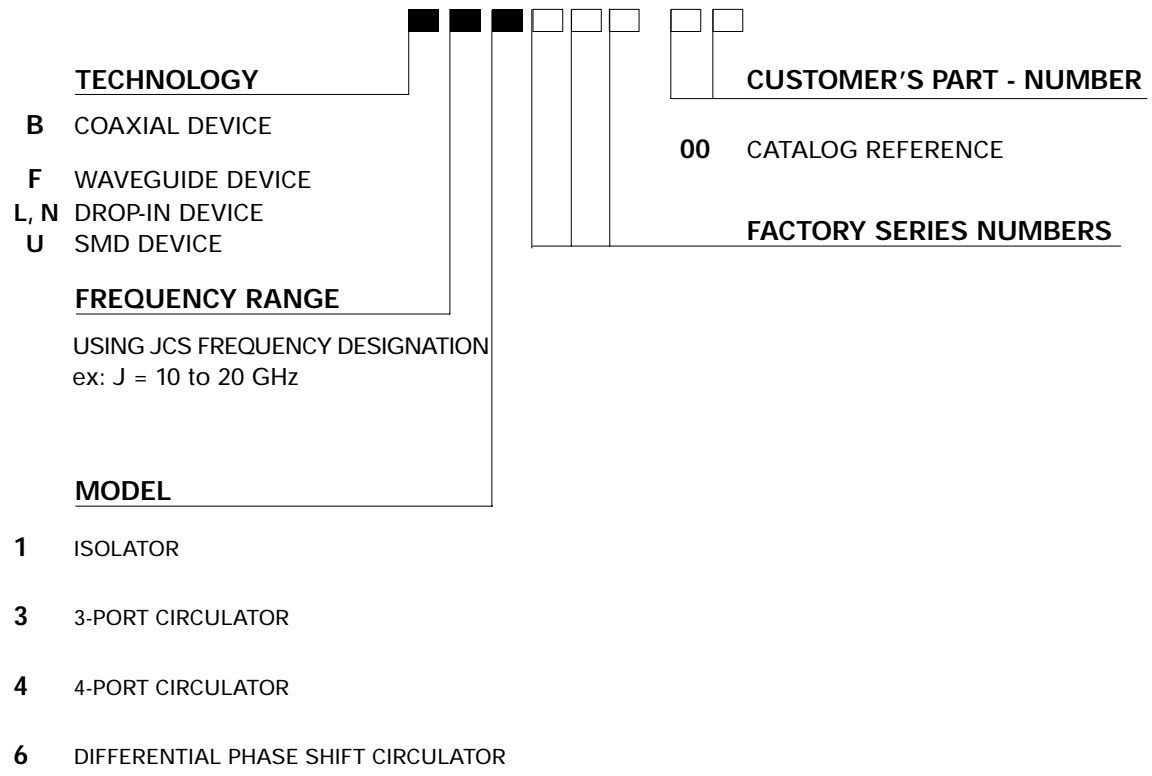
**Frequency Designation Chart**


How to order



# ▶ HOW TO ORDER?

FOR INSTANCE: **B J 1 0 0 9 - 0 0**  
**X X X X X X - X X**

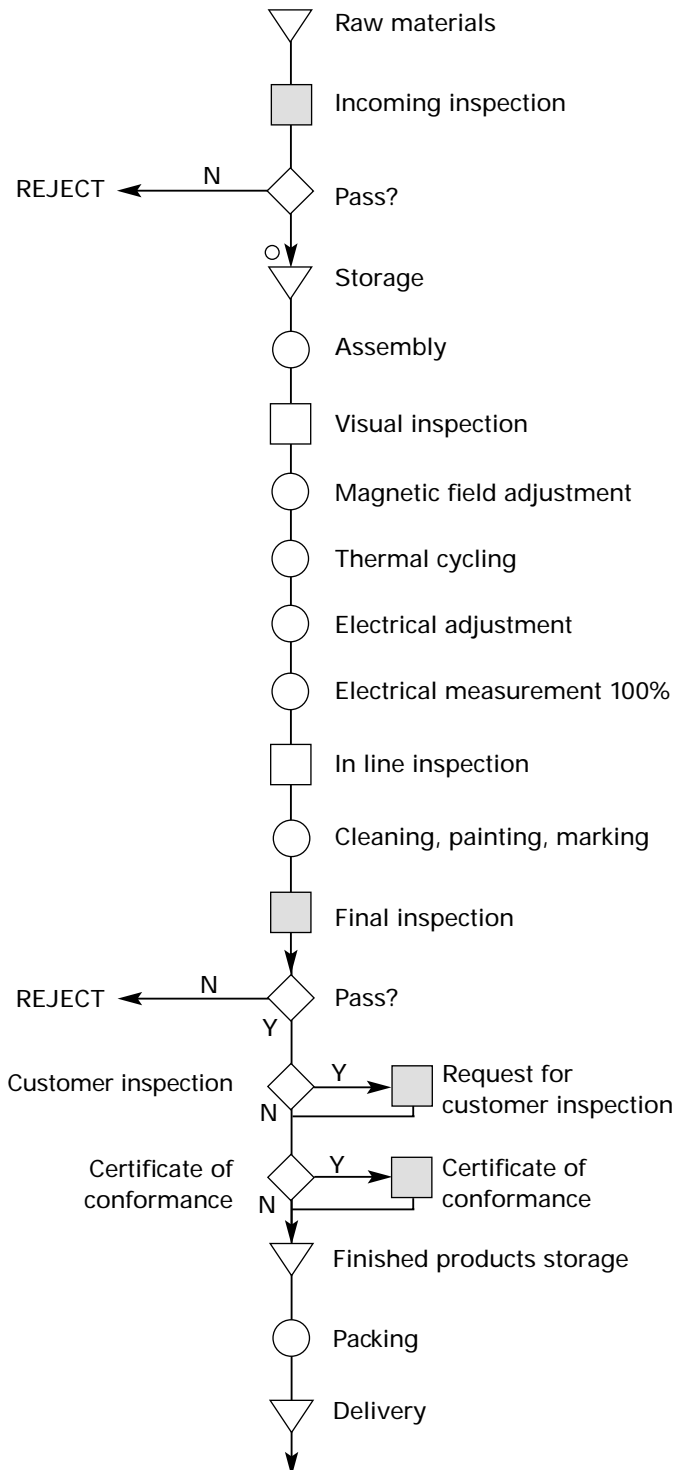






# ▶ QUALITY ASSURANCE

## Manufacturing flow-chart



## Overview

TEMEX Quality Assurance programme is based on the requirements of ISO9001-2000. Beyond these requirements, TEMEX defines "quality" as customer satisfaction; and to assure that, the TEMEX Quality Assurance team works closely with engineering and production groups.

The Company is actively involved in industry task groups concerned with microwave component standards, i.e:

- electrical measuring methods and test conditions: i.e NFC 96-316 (for microwave devices, circulators and isolators).

The high quality of our custom designs is the result of close cooperation between the engineering teams of the customer and those at TEMEX.

Reproducibility is ensured by rigorous control of all procedures and operations, per MILQ9858A.



Quality assurance



After temperature stabilization, the quality level of delivered models is periodically checked by sampling, according to the tests hereunder and the testing procedures defined in the relevant specifications.

CONDITIONS TESTS		5	6	7	8	DOCUMENTS		
						NFC	IEC	MIL-STD
K L	Thermal shocks	- 25°C + 70°C 5 cycles - 30 mn	-40°C +85°C 5 cycles -30 mn	-40°C +100°C 5 cycles - 30 mn	-55°C +125°C 5 cycles - 30 mn	20-714 Na Test Nb Test	68-2-14 Na Test Nb Test	202 F Method 107 F
M	Mechanical shocks	30g 11 ms 3 shocks 3 axes	50g 11 ms 3 shocks 3 axes	100g 6 ms 3 shocks 3 axes	Detail SP	20-727 Ea Test	68-2-27 Ea Test	202 F Method 202 D
N	Sinusoidal vibrations	10 Hz 55 Hz 10 g 3 axes 5 cycles 15 mn	10 Hz 500 Hz 10 g 3 axes 5 cycles 15 mn	10 Hz 2000 Hz 10 g 3 axes 5 cycles 20 mn	10 Hz 2000 Hz 20 g 3 axes 5 cycles 20 mn	20-706 Fc Test	68-2-6 Fc Test	202 F Method 201 A
P	Constant acceleration	20 g 3 axes 5 mn	50 g 3 axes 5 mn	100 g 3 axes 1 mn	200 g 3 axes 1 mn	20-707 Ga Test	68-2-7 Ga Test	202 F Method 212 A
R	Seal	Method 1 Qk test	Method 2 Qc test	Not applicable	Detail SP	20-717 Q Test	68-2-17 Q Test	202 F Method 112 C
S	Damp heat steady state	4 days 40°C - 93%	10 days 40°C - 93%	21 days 40°C - 93%	Detail SP	20-703 Ca Test	68-2-3 Ca Test	202 F Method 103 B
T	Solderability	Soldering heat Method Tb 260°C <sup>(1)</sup>	Tab termination solderability method Ta 235°C <sup>(2)</sup>	Not applicable	Detail SP	20-720 Tb Test Method 1A Ta Test Method 1	68-2-20 A <sup>(1)</sup> 68-2-20 <sup>(2)</sup>	202 F Method 208 F