

# Beamforming

# Butler Matrices

## Product Catalog



**MICABLE**  
8x8 Butler Matrix  
SA-07-8B024073  
2.4-7.25GHz S/N-E03601

Phase Table

Input Output	A1	A2	A3	A4	A5	A6	A7	A8
B1	-112.5	-202.5	-135	-225	-112.5	-202.5	-180	-270
B2	45	-247.5	-157.5	-180	-90	-337.5	-247.5	
B3	47.5	0	-90	-247.5	-337.5	-135	-225	
B4	90	-112.5	-225	-315	-225	-292.5	-202.5	
B5	135	-225	-315	-22.5	-112.5	-90	-180	
B6	135	-337.5	-247.5	-90	0	-247.5	-157.5	
B7	37.5	-90	-180	-157.5	-247.5	-45	-135	
B8	180	-202.5	-112.5	-225	-135	-202.5	-112.5	

**MICABLE**  
4x4 Butler Matrix  
SA-07-4B024073  
2.4-7.25GHz S/N-E00701

Phase Table

Input Output	A1	A2	A3	A4
B1	-45°	-135°	-90°	-180°
B2	-90°	0°	-225°	-135°
B3	-135°	-225°	0°	-90°
B4	-180°	-90°	-135°	-45°

For Wi-Fi / Mobile Phone / Base Station / IoT Test



## What is Butler Matrix ?

A **butler matrix** is a beamforming network used to feed a phased array of antenna elements.

Its purpose is to control the direction of a beam or beams of radio transmission. It consists of an  $N \times N$  matrix of hybrid couplers and fixed-value phase shifters where  $N$  is some power of 2. The device has  $N$  input ports (the beam ports) to which power is applied, and  $N$  output ports (the element ports) to which  $N$  antenna elements are connected.

The **butler matrix** feeds power to the elements with a progressive phase difference between elements such that the beam of radio transmission is in the desired direction. The beam direction is controlled by switching power to the desired beam port. More than one beam, or even all  $N$  of them can be activated simultaneously.

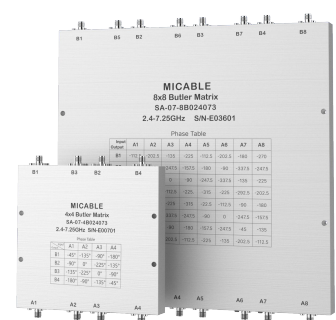
## Application & Advantage of Butler Matrix

The typical application is to keep the beam of the base station always point to the mobile user while expanding the coverage of signal.

**Advantage** Compared with active phase and amplitude control network, **butler matrix** is a **low-cost, high accuracy, stable and reliable beamforming solution!**

## Innovative Products from MiCable Performance & Characteristics

- Top high accuracy in the market!
- Unbelievable very wide instantaneous bandwidth!
- Ultra low loss!
- Higher input/output power!
- Very high channel isolation!
- Small size!
- Any butler matrix configuration available!
- Frequency can go up to 53GHz even higher!



Almost all the specifications are the **“best”** or **“unimaginable”** in the market!

## Capability of MiCable

- ✓ **We can realize very wideband butler matrix.**  
Bandwidth can be 3-octave, frequency up to 53GHz even higher
- ✓ **We can offer the higher phase control accuracy, better signal output consistency and higher input/output signal in the market.**
- ✓ **We can realize various configuration.**  
4x4, 8x8, 16x16, 32x16, 64x16.....

## MiCable Butler Matrix & Specifications Index

Frequency Range (GHz)	0.6~6		6~12		12~24		24~53	
Any given bandwidth within freq. range (MHz)	200		400		600		1000	
Specifications	AMP. Unbal. dB(Max.)	Phase Accuracy Deg.(Max.)	AMP. Unbal. dB(Max.)	Phase Accuracy Deg.(Max.)	AMP. Unbal. dB(Max.)	Phase Accuracy Deg.(Max.)	AMP. Unbal. dB(Max.)	Phase Accuracy Deg.(Max.)
4 x 4	±0.4	±2.0	±0.5	±5.0	±0.6	±6.0	±0.8	±8.0
8 x 8	±0.5	±3.0						
16 x 16	±0.6	±4.0						
32 x 16	±0.7	±5.0						



Part Number	Frequency Range* (GHz)	VSWR :1(Max.)	Insertion Loss** dB(Max.)	Amplitude Unbal. dB(Max.)	Amplitude Flatness dB(Max.)	Phase Accuracy Deg.(Max.)	Isolation dB(Min.)	Dimension LxWxH(mm)
SA-07-4B006050	0.617-0.821	1.4	8.2	±1.1	±0.8	±10	17	203.2x160.0x40.6
	0.832-0.96	1.4	8.2	±1.1	±0.7	±9	17	203.2x160.0x40.6
	1.427-1.71	1.4	8.3	±0.9	±0.7	±9	16	203.2x160.0x40.6
	1.71-2.2	1.5	8.5	±0.9	±0.8	±10	15	203.2x160.0x40.6
	2.496-2.69	1.5	8.7	±0.9	±0.7	±9	14	203.2x160.0x40.6
	3.3-4.2	1.5	8.9	±1.0	±0.7	±12	14	203.2x160.0x40.6
	4.4-5	1.5	9.2	±1.0	±0.8	±12	14	203.2x160.0x40.6
SA-07-4B006073	0.617-0.96	1.4	8.2	±1.1	±0.8	±11	17	203.2x175.3x40.6
	1.427-2.69	1.5	8.7	±1.0	±1.0	±10	14	203.2x175.3x40.6
	3.3-5	1.5	9.2	±1.0	±1.0	±12	14	203.2x175.3x40.6
	5.15-7.25	1.6	9.8	±1.1	±1.1	±12	13	203.2x175.3x40.6
SA-07-4B007022	0.7-2.2	1.3	7.8	±0.8	±0.8	±8	16	111.8x254x16.5
	0.7-0.915	1.2	7.2	±0.5	±0.5	±5	18	111.8x254x16.5
	1.427-1.785	1.3	7.5	±0.6	±0.5	±6	16	111.8x254x16.5
	1.85-2.2	1.3	7.8	±0.6	±0.6	±6	16	111.8x254x16.5
SA-07-4B017022	1.7-2.2	1.3	7.0	±0.5	±0.4	±3	18	101.6x106.7x16.5
SA-07-4B020060	2-6	1.5	7.8	±0.9	±0.8	±8	14	101.6x122x16.5
	2.4-2.5	1.4	7.3	±0.5	±0.3	±4	15	101.6x122x16.5
	5.18-5.83	1.5	7.7	±0.6	±0.4	±5	14	101.6x122x16.5
SA-07-4B020070	2-7	1.6	8.0	±1.0	±0.9	±10	14	101.6x122x16.5
SA-07-4B024073	2.4-2.5	1.4	7.3	±0.5	±0.3	±4	14	101.6x106.7x16.5
	5.18-5.83	1.5	7.7	±0.6	±0.4	±5	13	101.6x106.7x16.5
	5.9-7.25	1.5	7.8	±0.7	±0.5	±6	13	101.6x106.7x16.5
SA-07-4B023025	2.3-2.5	1.3	7.0	±0.4	±0.4	±3	18	101.6x106.7x16.5
SA-07-4B024028	2.4-2.8	1.3	7.3	±0.4	±0.5	±3	18	101.6x106.7x16.5
SA-07-4B048060	4.8-6	1.5	7.6	±0.5	±0.6	±4	16	101.6x91.5x16.5
SA-07-4B057059	5.7-5.9	1.5	7.5	±0.4	±0.5	±4	16	101.6x91.5x16.5
SA-07-4B058060	5.85-5.95	1.5	7.5	±0.4	±0.3	±4	16	101.6x91.5x16.5
SA-07-4B060080	6-8	1.5	8.0	±0.5	±0.8	±5	14	101.6x91.5x16.5
SA-07-4B180400	18-40	2.0	12.0	±1.2	±2.0	±15	10	144.8x101.6x16.5
SA-07-4B240430	24-43	2.0	12.4	±1.2	±2.0	±15	10	144.8x101.6x16.5
SA-07-4B242275	24.2-27.5	1.9	10.8	±0.8	±0.8	±10	10	144.8x101.6x16.5
SA-07-4B265295	26.5-29.5	1.9	11.0	±0.8	±0.8	±10	10	144.8x101.6x16.5
SA-07-4B370400	37-40	2.0	12.0	±0.8	±0.8	±10	10	144.8x101.6x16.5



\* All units are wideband, can meet performance according to listed frequencies

\*\* Theoretical I.L. included

### 8x8 Butler Matrices

Part Number	Frequency Range* (GHz)	VSWR :1(Max.)	Insertion Loss** dB(Max.)	Amplitude Unbal. dB(Max.)	Amplitude Flatness dB(Max.)	Phase Accuracy Deg.(Max.)	Isolation dB(Min.)	Dimension LxWxH(mm)
SA-07-8B006050	0.617-0.821	1.4	12.3	±1.4	±1.2	±12	17	316×157.5×68.6
	0.832-0.96	1.4	12.3	±1.4	±1.0	±12	17	316×157.5×68.6
	1.427-1.71	1.4	12.7	±1.3	±1.0	±11	16	316×157.5×68.6
	1.71-2.2	1.5	12.9	±1.2	±1.2	±11	15	316×157.5×68.6
	2.496-2.69	1.5	13.2	±1.2	±1.0	±12	14	316×157.5×68.6
	3.3-4.2	1.5	14.0	±1.3	±1.1	±14	14	316×157.5×68.6
	4.4-5	1.5	14.5	±1.3	±1.2	±14	14	316×157.5×68.6
SA-07-8B006073	0.617-0.96	1.4	12.0	±1.5	±1.4	±13	17	316×172.7×68.6
	1.427-2.69	1.5	13.2	±1.4	±1.6	±12	14	316×172.7×68.6
	3.3-5	1.5	14.6	±1.4	±1.6	±14	14	316×172.7×68.6
	5.15-7.25	1.6	15.9	±1.5	±1.7	±14	13	316×172.7×68.6
SA-07-8B020060	2-6	1.6	12.0	±1.2	±1.2	±12	12	205.7x233.8x16.5
	2.4-2.5	1.5	11.4	±0.7	±0.5	±8	13	205.7x233.8x16.5
	5.18-5.83	1.6	12.0	±0.9	±0.6	±10	12	205.7x233.8x16.5
SA-07-8B024073	2.4-2.5	1.5	11.2	±0.6	±0.4	±8	13	205.7x205.7x16.5
	5.18-5.83	1.5	11.6	±0.8	±0.5	±10	12	205.7x205.7x16.5
	5.9-7.25	1.55	11.8	±0.9	±0.7	±12	12	205.7x205.7x16.5
SA-07-8B023025	2.3-2.5	1.4	10.8	±0.6	±0.5	±4	16	205.7x205.7x16.5
SA-07-8B024028	2.4-2.8	1.4	11.2	±0.6	±0.6	±4	16	205.7x205.7x16.5
SA-07-8B048060	4.8-6	1.6	11.5	±0.8	±1.0	±6	14	205.7x157.5x16.5
SA-07-8B060080	6-8	1.6	12.0	±0.8	±1.0	±8	13	205.7x157.5x16.5
SA-07-8B060180	6-18	1.8	14.5	±1.3	±2.0	±15	8	205.7x198.3x16.5
	6-8	1.7	12.0	±1.0	±0.7	±12	9	205.7x198.3x16.5
	8-12	1.7	13.0	±0.9	±0.8	±12	9	205.7x198.3x16.5
	12-18	1.8	14.5	±1.0	±1.0	±14	8	205.7x198.3x16.5



\* All units are wideband, can meet performance according to listed frequencies

\*\* Theoretical I.L. included

**16x16 & 32x16 Butler Matrices**

Part Number	Structure	Frequency Range* (GHz)	VSWR :1(Max.)	Insertion Loss** dB(Max.)	Amplitude Unbal. dB(Max.)	Amplitude Flatness dB(Max.)	Phase Accuracy Deg.(Max.)	Isolation dB(Min.)	Dimension LxWxH(mm)
SA-07-16B017022	16x16	1.7-2.2	1.4	15.0	±0.8	±0.8	±4	14	2U
SA-07-16B020060	16x16	2.3-2.7	1.6	17.0	±1.2	±0.8	±12	10	2U
	16x16	3.3-3.8	1.6	18.0	±1.2	±0.8	±12	9	2U
	16x16	4.4-5	1.7	19.0	±1.2	±0.8	±14	8	2U
SA-07-16B023024	16x16	2.3-2.4	1.4	14.8	±0.5	±0.5	±4	15	2U
SA-07-16B023027	16x16	2.3-2.7	1.4	15.2	±0.7	±0.8	±4	14	2U
SA-07-16B023038	16x16	2.3-2.7	1.5	15.0	±1.0	±0.8	±8	12	2U
	16x16	3.3-3.8	1.6	16.0	±1.0	±0.8	±10	10	2U
SA-07-16B023050	16x16	2.3-2.7	1.6	17.0	±1.2	±0.8	±12	10	2U
	16x16	4.4-5	1.7	19.0	±1.2	±0.8	±14	8	2U
SA-07-16B024027	16x16	2.496-2.696	1.4	14.7	±0.6	±0.6	±4	14	2U
SA-07-16B025036	16x16	2.57-2.62	1.4	15.4	±0.6	±0.6	±4	14	2U
	16x16	2.57-3.6	1.5	16.0	±0.9	±1.0	±6	13	2U
	16x16	3.4-3.6	1.5	16.0	±0.7	±0.7	±4	13	2U
SA-07-16B033038	16x16	3.3-3.8	1.5	16.0	±0.8	±1.0	±5	13	2U
SA-07-16B033050	16x16	3.3-3.8	1.6	15.5	±1.0	±0.8	±8	10	2U
	16x16	4.4-5	1.6	16.5	±1.0	±0.8	±10	10	2U
SA-07-16B034036	16x16	3.4-3.6	1.5	15.0	±0.6	±0.7	±4	13	2U
SA-07-3216B017022	32x16	1.7-2.2	1.5	18.4	±0.9	±1.0	±5	13	3U
SA-07-3216B023024	32x16	2.3-2.4	1.5	18.3	±0.6	±0.6	±5	13	3U
SA-07-3216B023027	32x16	2.3-2.7	1.5	18.6	±0.8	±0.9	±5	13	3U
SA-07-3216B024027	32x16	2.496-2.696	1.5	18.0	±0.7	±0.7	±5	13	3U
SA-07-3216B033038	32x16	3.3-3.8	1.6	19.6	±1.0	±1.2	±6	12	3U
SA-07-3216B034036	32x16	3.4-3.6	1.6	18.5	±0.7	±0.8	±5	12	3U



\* All units are wideband, can meet performance according to listed frequencies

\*\* Theoretical I.L. included



Scan for Datasheet

2024

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