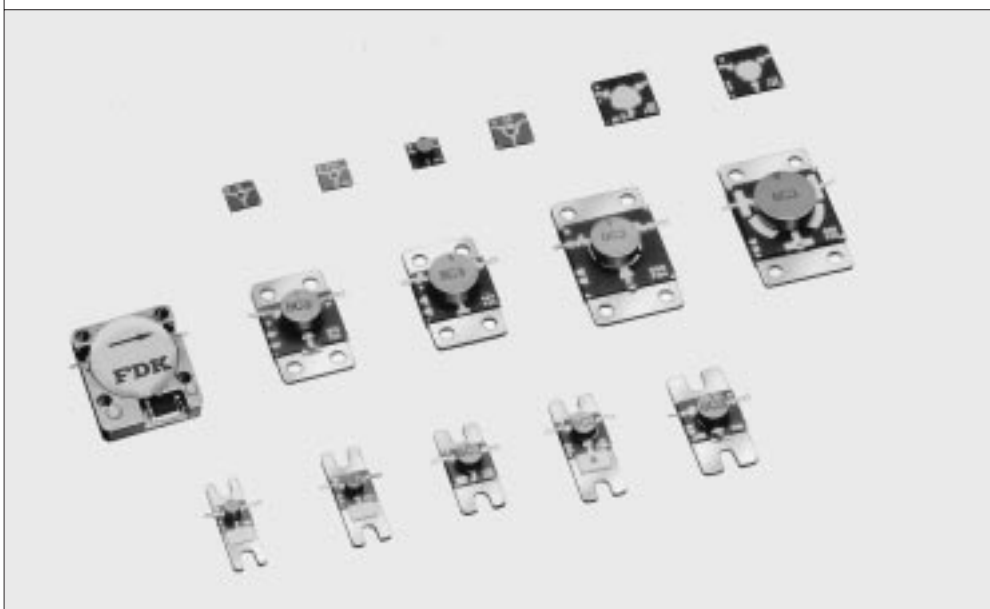


# DROP-IN CIRCULATORS/ISOLATORS FOR MICROWAVE



FDK offers a wide selection of drop-in circulators / isolators using microwave ferrites. These drop-in products include easy-handling carrier type isolators, high-power carrier type isolators, and millimeter-wave substrate type circulators for operation over a broad frequency band, from micro to millimeter-wave ranges. Our drop-in circulators / isolators are used to reduce the size and boost the performance of many types of microwave equipment.

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# Drop-in circulators / isolators (General use; 3 to 80GHz)

## Features

- Broad choice of products covering a wide frequency range.
- Furnished with tab terminals that allow easy connection with strip lines.
- Easy mounting with screws in carrier type isolators.
- Minimum space requirement due to minute size.
- Revolutionary high-power isolators boasting a 10W.CW power absorption capability.

## Applications

- Microwave radio equipment
- Satellite communications equipment
- Satellite broadcasting equipment
- Microwave amplifiers
- Microwave oscillators
- Radars
- Wireless LAN

## Carrier type circulators

### Specifications

Part No.	Frequency range (GHz)	Isolation (dB)min.	Insertion loss (dB)max.	Reflection loss (dB)min.	V.S.W.R. (50Ω)max.	Handling power (W.CW)	Power absorption (W.CW)	Operating temp. range (°C)	Carrier shape No.	Document No. MW-C-○○○
CK-□02802△801	2.7 ~ 2.9	18	0.7	19	1.25	10	—	-10 ~ +60	80	136
CK-□11825△441	10.5 ~13.0	18	0.5	19	1.25	5	—	-30 ~ +70	44	101
CK-□13128△441	11.7 ~14.5	18	0.5	19	1.25	5	—	-30 ~ +70	44	102
CK-□14520△441	13.5 ~15.5	18	0.5	19	1.25	5	—	-30 ~ +70	44	100

Remarks) □ : Rotational direction △ : C = Without tab, G = With silver-plated copper tab, L = With pure-gold tab

## Carrier type isolators for high-power absorption

### Specifications

Part No.	Frequency range (GHz)	Isolation (dB)min.	Insertion loss (dB)max.	Reflection loss (dB)min.	V.S.W.R. (50Ω)max.	Handling power (W.CW)	Power absorption (W.CW)	Operating temp. range (°C)	Carrier shape No.	Document No. MW-C-○○○
CK-□P03906△701	3.6 ~4.2	20	0.4	21	1.2	20	10	-10 ~ +60	70	068
CK-□P04708△701	4.3 ~5.1	20	0.4	21	1.2	20	10	-10 ~ +60	70	086
CK-□P05509△701	5.0 ~5.9	20	0.4	21	1.2	20	10	-10 ~ +60	70	074
CK-□P06514△611	5.8 ~7.2	20	0.4	21	1.2	20	10	-10 ~ +60	61	069
CK-□P07013△611	6.3 ~7.6	20	0.4	21	1.2	20	10	-10 ~ +60	61	082
CK-□P07915△611	7.1 ~8.6	20	0.4	21	1.2	20	10	-10 ~ +60	61	070
CK-□P11825△411	10.5 ~13.0	18	0.5	19	1.25	10	5	-30 ~ +70	41	083
CK-□P13128△411	11.7 ~14.5	18	0.5	19	1.25	10	5	-30 ~ +70	41	084
CK-□P14520△411	13.5 ~15.5	18	0.5	19	1.25	10	5	-30 ~ +70	41	085

Remarks) □ : Rotational direction △ : D = Without tab, H = With silver-plated copper tab, M = With pure-gold tab

**Drop-in circulators / isolators (General use; 3 to 80GHz)**

**Carrier type isolators**

**Specifications**

Part No.	Frequency range (GHz)	Isolation (dB)min.	Insertion loss (dB)max.	Reflection loss (dB)min.	V.S.W.R. (50Ω)max.	Handling power (W.CW)	Power absorption (W.CW)	Operating temp. range (°C)	Carrier shape No.	Document No. MW-C-○○○
CK-□02802△801	2.7~2.9	18	0.7	19	1.25	10	2	-10~+60	80	134
CK-□03103△802	2.9~3.2	18	0.5	19	1.25	10	2	-10~+60	80	135
CK-□03501△701	3.4~3.5	20	0.4	21	1.2	10	2	-10~+60	70	094
CK-□03906△701	3.6~4.2	20	0.4	21	1.2	10	2	-10~+60	70	030
CK-□04708△701	4.3~5.1	20	0.4	21	1.2	10	2	-10~+60	70	038
CK-□05509△701	5.0~5.9	20	0.4	21	1.2	10	2	-10~+60	70	033
CK-□06514△611	5.8~7.2	20	0.4	21	1.2	10	2	-10~+60	61	031
CK-□06514△701	5.8~7.2	20	0.4	21	1.2	10	2	-10~+60	70	117
CK-□07013△611	6.3~7.6	20	0.4	21	1.2	10	2	-10~+60	61	035
CK-□07915△611	7.1~8.6	20	0.4	21	1.2	10	2	-10~+60	61	036
CK-□07915△701	7.1~8.6	20	0.4	21	1.2	10	2	-10~+60	70	118
CK-□10040△511	8.0~12.0	16	0.6	15.5	1.4	10	2	-20~+80	51	058
CK-□09623△511	8.4~10.7	18	0.5	19	1.25	10	2	-10~+60	51	037
CK-□09505△521	9.25~9.75	15	0.8	14	1.5	1	0.1	-10~+50	52	072
CK-□11825△402	10.5~13.0	18	0.5	19	1.25	1	0.25	-30~+70	40	025
CK-□11825△411	10.5~13.0	18	0.5	19	1.25	5	1	-30~+70	41	075
CK-□11825△441	10.5~13.0	18	0.5	19	1.25	1	0.25	-30~+70	44	128
CK-□13128△402	11.7~14.5	18	0.5	19	1.25	1	0.25	-30~+70	40	027
CK-□13128△411	11.7~14.5	18	0.5	19	1.25	5	1	-30~+70	41	024
CK-□13128△441	11.7~14.5	18	0.5	19	1.25	1	0.25	-30~+70	44	106
CK-□14520△402	13.5~15.5	18	0.5	19	1.25	1	0.25	-30~+70	40	077
CK-□14520△411	13.5~15.5	18	0.5	19	1.25	5	1	-30~+70	41	081
CK-□14520△441	13.5~15.5	18	0.5	19	1.25	1	0.25	-30~+70	44	127
CK-□18030△311	16.5~19.5	17	0.8	17	1.33	5	1	-30~+70	31	067
CK-□18524△313	17.3~19.7	17	0.8	17	1.33	5	1	-30~+70	31	099
CK-□19535△211	17.7~21.2	17	0.8	17	1.33	5	1	-30~+70	21	098
CK-□19535△311	17.7~21.2	17	0.8	17	1.33	5	1	-30~+70	31	022
CK-□22730△211	21.2~24.2	17	0.8	17	1.33	5	1	-30~+70	21	057
CK-□26030△211	24.5~27.5	17	0.8	17	1.33	5	1	-30~+70	21	097
CK-□29040△211	27.0~31.0	17	1.5	17	1.33	5	1	-30~+70	21	078

Remarks) □ : Rotational direction △ : D = Without tab, H = With silver-plated copper tab, M = With pure-gold tab

## Drop-in circulators / isolators (General use; 3 to 80GHz)

### Shapes and dimensions

Carrier shapes [Unit : mm]	Shape 80	Shape 70	Shape 61
Carrier thickness	1.2	1.2	1.2
Terminal height	2.2	2.2 <sup>*1</sup>	1.85
Mounted height	6.0max.	6.0max.	5.5max.

Carrier shapes [Unit : mm]	Shape 52	Shape 51	Shape 44
Carrier thickness	1.0	1.0	0.3
Terminal height	1.65	1.65	1.0
Mounted height	4.0max.	5.5max.	5.0max.

Carrier shapes [Unit : mm]	Shape 41	Shape 40	Shape 31	Shape 21
Carrier thickness	1.0	1.0	1.2	1.2
Terminal height	1.65	1.65	1.6	1.6 <sup>*2</sup>
Mounted height	5.5max.	5.5max.	4.3max.	5.0max.

\* 1 : The terminal height of CK-□05509△701 is 1.85mm. \* 2 : The terminal height of CK-□26030△211, CK-□29040△211 is 1.47mm.

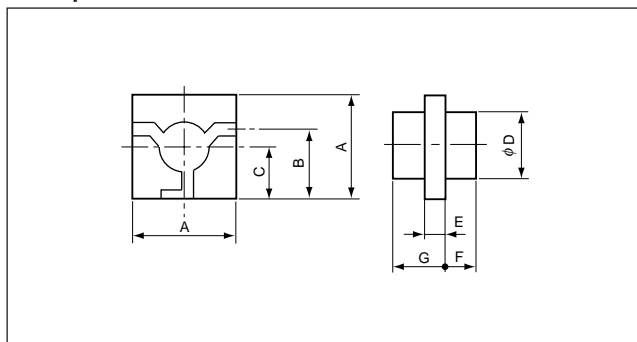
**Drop-in circulators / isolators (General use; 3 to 80GHz)**

**Substrate type circulators**

**Specifications**

Part No.	Frequency range (GHz)	Isolation (dB) min.	Insertion loss (dB) max.	Reflection loss (dB) min.	V.S.W.R. (50Ω) max.	Handling power (W.CW)	Operating temp. range (°C)	Dimensions(mm)							Document No. MW-C-○○○
								A	B	C	D	E	F	G	
CK-□19535A301	17.7 ~ 21.2	17	0.8	17	1.33	5.0	-10 ~ +60	6	4.4	3.0	4.2	0.38	4.0	1.7	048
CK-□22523A201	21.3 ~ 23.6	17	0.8	17	1.33	5.0	-10 ~ +60	5	3.4	2.5	3.5	0.38	3.5	2.9	021
CK-□26530A201	25.0 ~ 28.0	17	0.8	17	1.33	5.0	-10 ~ +60	5	3.4	2.5	3.2	0.38	4.0	1.7	020
CK-□29040A201	27.0 ~ 31.0	17	0.8	17	1.33	5.0	-10 ~ +60	5	3.4	2.5	3.2	0.254	4.0	1.6	019
CK-□36540A101	34.5 ~ 38.5	17	0.8	17	1.33	2.0	-10 ~ +60	4	2.9	2.0	1.8	0.254	3.5	1.5	107
CK-□38325A101	37.0 ~ 39.5	17	1.0	17	1.33	2.0	-10 ~ +60	4	2.9	2.0	1.8	0.254	3.5	1.5	108
CK-□42020A101	40.5 ~ 42.5	17	1.5	17	1.33	2.0	-10 ~ +60	4	2.9	2.0	1.8	0.254	3.5	1.5	109
CK-□59515A101	58.75 ~ 60.25	15	2.0	15	1.43	2.0	-10 ~ +60	4	2.7	2.0	1.8	0.2	3.5	2.0	103
CK-□60515A101	59.75 ~ 61.25	15	2.0	15	1.43	2.0	-10 ~ +60	4	2.7	2.0	1.8	0.2	3.5	2.0	120
CK-□76510A101	76.0 ~ 77.0	15	2.5	15	1.43	1.0	-10 ~ +60	3	2.2	1.5	1.8	0.18	3.5	0.18	123

**Shapes and dimensions**



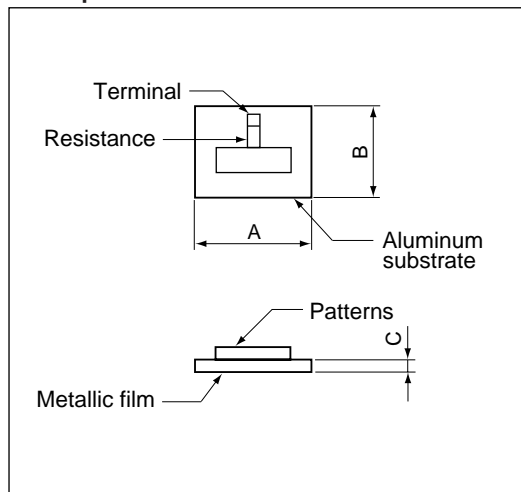
**Dummy loads**

You can convert a substrate type circulator to an isolator by adding a dummy load to a circulator.

**Specifications**

Part No.	Frequency range (GHz)	V.S.W.R. (50 Ω)	Dimensions (mm)			Document No. MW-C-○○○
			A	B	C	
CD-20GDL	17.7 ~ 21.2	1.25	4	2.5	0.38	055
CD-22GDL	21.2 ~ 24.0	1.25	4	2.5	0.38	059
CD-26GDL	25.0 ~ 28.0	1.33	4	2.5	0.38	056
CD-290GDL	26.0 ~ 34.0	1.33	3	2.0	0.25	110
CD-360GDL	34.5 ~ 38.5	1.33	3	2.0	0.25	080
CD-380GDL	36.0 ~ 40.0	1.33	3	2.0	0.25	111
CD-600GDL	58.0 ~ 61.0	1.33	2	1.5	0.2	105
CD-760GDL	76.0 ~ 78.0	1.3	1.2	1.0	0.18	124

**Shapes and dimensions**



**Drop-in circulators / isolators (General use; 3 to 80GHz)**

**Substrate type isolators (nonmagnetizer mount type)**

**Specifications**

Part No.	Frequency range (GHz)	Isolation (dB)min.	Insertion loss (dB)max.	Reflection loss (dB)min.	V.S.W.R. (50Ω)max.	Handling power (W.CW)	Power absorption (W.CW)	Operating temp. range (°C)	Dimensions (mm)					Document No. MW-C-○○○
									A	B	C	D	E	
CK-□11825 △ 401	10.5 ~ 13.0	18	0.5	19	1.25	1.5	0.5	-30 ~ +70	7	5.5	4	3.5	0.65	116
CK-□13128 △ 401	11.7 ~ 14.5	18	0.5	19	1.25	1.5	0.5	-30 ~ +70	7	5.5	4	3.5	0.65	112
CK-□14520 △ 401	13.5 ~ 15.5	18	0.5	19	1.25	1.5	0.5	-30 ~ +70	7	5.5	4	3.5	0.65	113

Remarks) □ : Rotational direction, △ : B = Without tab, F = With silver-plated copper tab, K = With pure-gold tab

**Substrate type isolators (magnetizer mount type)**

**Specifications**

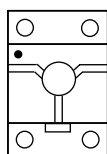
Part No.	Frequency range (GHz)	Isolation (dB)min.	Insertion loss (dB)max.	Reflection loss (dB)min.	V.S.W.R. (50Ω)max.	Handling power (W.CW)	Power absorption (W.CW)	Operating temp. range (°C)	Dimensions (mm)					Document No. MW-C-○○○
									A	B	C	D	E	
CK-□12D △	10.5 ~ 13.0	18	0.5	19	1.25	1	0.25	-30 ~ +70	7	5.5	4	4.2	0.65	088,119,121
CK-□13D △	11.7 ~ 14.5	18	0.5	19	1.25	1	0.25	-30 ~ +70	7	5.5	4	4.2	0.65	089,090,091
CK-□15D △	13.5 ~ 15.5	18	0.5	19	1.25	1	0.25	-30 ~ +70	7	5.5	4	4.2	0.65	092,093,122

Remarks) □ : Rotational direction, △ : A1 = Without tab, RA2 = With silver-plated copper tab, RK3 = With pure-gold tab

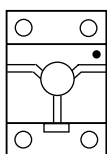
**Indication of rotational direction**

● **Carrier type isolators**

The direction of rotation is shown by a white dot on the input port.



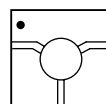
Clockwise (R)



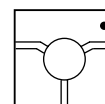
Counterclockwise (L)

● **Substrate type circulators**

The direction of rotation is shown by a white dot on the input port.



Clockwise (R)



Counterclockwise (L)

**Drop-in circulators / isolators (General use; 3 to 80GHz)**

What the part number means

● Example for carrier type

$\frac{\text{CK}}{\text{①}} - \frac{\square}{\text{②}} \frac{039}{\text{③}} \frac{06}{\text{④}} \frac{\triangle}{\text{⑤}} \frac{70}{\text{⑥}} \frac{1}{\text{⑦}}$

● Example for carrier / high-power type

$\frac{\text{CK}}{\text{①}} - \frac{\square}{\text{②}} \frac{\text{P}}{\text{⑧}} \frac{039}{\text{③}} \frac{06}{\text{④}} \frac{\triangle}{\text{⑤}} \frac{70}{\text{⑥}} \frac{1}{\text{⑦}}$

- ① Generic code for general use products.
- ② Rotational direction (R =Clockwise, L =Counterclockwise).
- ③ Center frequency in 100MHz (rounded up at 10MHz unit).
- ④ Frequency range in 100MHz (rounded up at 10MHz unit).
- ⑤ Input and output terminal type(D =Without tab, H =With silver-plated copper tab, M =With pure-gold tab).

[ Tab dimensions ](Unit =mm)

Silver-plated copper tab	.....	3~ 15GHz : 0.6 <sup>w</sup> ×0.03 <sup>t</sup>
		15~ 24GHz : 0.38 <sup>w</sup> ×0.03 <sup>t</sup>
		24~ 30GHz : 0.2 <sup>w</sup> ×0.03 <sup>t</sup>
Pure-gold tab	.....	3~ 15GHz : 0.6 <sup>w</sup> ×0.02 <sup>t</sup>
		15~ 24GHz : 0.38 <sup>w</sup> ×0.02 <sup>t</sup>
		24~ 30GHz : 0.2 <sup>w</sup> ×0.02 <sup>t</sup>

- ⑥ Carrier shape
- ⑦ Development No. (1 to 9)
- ⑧ "P" : Code for high-power type isolators.

## Drop-in circulators / isolators (Base station use; 1.5 to 3GHz)

### Drop-in circulators/isolators (CB series ; 1.5~3GHz Bands)

#### Features

- Compact size, lightweight
- Handling power : 80W, Power absorption : 30W

#### Applications

- Mobile, wireless communication devices of base station
- PCS, PHS, IMT-2000, 1.5PDC

#### Specifications

Part No.	Frequency range (MHz)	Isolation (dB)min.	Insertion loss (dB)max.	Reflection loss (dB)min.	V.S.W.R. (50Ω)max.	Handling power (W.CW)	Power absorption (W.CW)	Operating temp. range (°C)	Document No. MW-C-○○○
CB-□1489024H181	1477 ~ 1501	20	0.35	21	1.2	80	30	-20 ~ +80	133
CB-□1907031H182	1892 ~ 1923	20	0.35	21	1.2	80	30	-20 ~ +80	131
CB-□1960060H181	1930 ~ 1990	20	0.35	21	1.2	80	30	-20 ~ +80	130
CB-□2120140H181	2050 ~ 2190	20	0.35	21	1.2	80	30	-20 ~ +80	132
CB-□2640040H181	2620 ~ 2660	20	0.35	21	1.2	80	30	-20 ~ +80	137

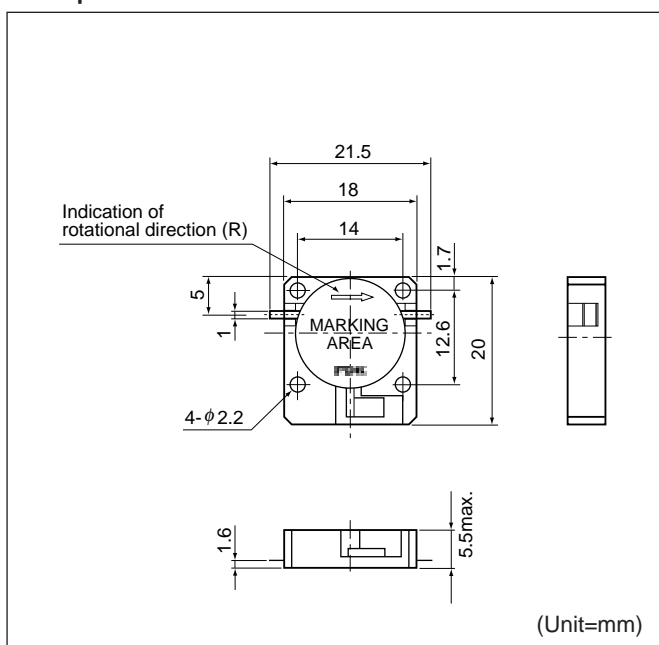
Remarks □: Rotational direction

#### Customized specifications

[FDK designs and manufactures customized products of the center frequency range shown below (refer to the following characteristic examples)].

Center frequency (GHz)	Bandwidth (MHz)	Isolation (dB)min.	Insertion loss (dB)max.	Reflection loss (dB)min.	V.S.W.R. (50Ω)max.	Handling power (W.CW)	Power absorption (W.CW)	Operating temp. range (°C)	Document No. MW-C-○○○
1.8 ~ 2.6	50	20	0.35	21	1.2	80	30	-20 ~ +80	129
1.8 ~ 2.6	100	18	0.4	18	1.3	80	30	-20 ~ +80	129

#### Shapes and dimensions



#### Naming of part number

CB- □ 1907 031 H 18 1

①    ②    ③    ④    ⑤    ⑥    ⑦

- ① Generic code for base station use products
- ② Rotational direction  
(R = Clockwise, L = Counterclockwise)
- ③ Center frequency (Unit = MHz)
- ④ Frequency bandwidth (Unit = MHz)
- ⑤ Input and output terminal type  
(H = with silver plated copper tab)
- ⑥ Shape
- ⑦ Development No.



# Microwave ferrites

Capitalizing on its vast accumulation of ferrite material know-how, FDK supplies many variations of low-loss, high-performance microwave ferrites. The frequency selection ranges from VHF and UHF to millimeter waves for both spinel and garnet type ferrites.

## Features

- Low loss ensured by narrow magnetic line-widths ( $\Delta H$ ) and low dielectric loss levels ( $\tan \delta \epsilon$ ).
- Operation at any frequency made possible by a wide selection of saturation magnetization levels.
- Variegated shape selection offered to facilitate users' precision processing work.
- Proven mechanical strength.

## Applications

- Microwave communications equipment
- Receivers for satellite broadcast and satellite communications
- Microwave components (circulators, isolators, phase shifters, switches, etc.)

## ■ Spinel and garnet type ferrite materials



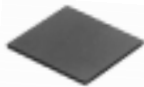


### Specifications

Material	Saturation magnetization $4\pi M_s$ (G) [(T)]	Line width $\Delta H$ (Oe) max. [(kA/m)]	Dielectric constant $\epsilon$	Dielectric loss $\tan \delta \epsilon$ max.	Curie temp. $T_c$ (°C) min.	Saturation flux density $B_s$ (G) [(T)]	Residual flux density $B_r$ (G) [(T)]	Coercive force $H_c$ (Oe) [(A/m)]	Squareness ratio $B_r/B_{20}$	Density $d$ (g/cm <sup>3</sup> )	Document No. MW-M-○○○	
Spinel type	M31	5000±5% [0.500]	150 [11.937]	13±5%	$5 \times 10^{-4}$	300	4300 [0.430]	3200 [0.320]	0.8 [63.662]	0.74	5.3±0.1	002
	M21	2850±5% [0.285]	350 [27.853]	12±5%	$6 \times 10^{-4}$	230	2300 [0.230]	2000 [0.200]	1.4 [111.409]	0.87	4.5±0.1	003
	M23	2000±5% [0.200]	250 [19.895]	11.5±5%	$6 \times 10^{-4}$	180	1650 [0.165]	1400 [0.140]	1.1 [87.535]	0.85	4.5±0.1	004
Garnet type	Y10	1780±5% [0.178]	55 [4.377]	13.5±5%	$5 \times 10^{-4}$	270	1600 [0.160]	1230 [0.123]	1.0 [79.578]	0.77	5.05±0.1	005
	Y13	1200±5% [0.120]	55 [4.377]	13±5%	$5 \times 10^{-4}$	220	1080 [0.108]	920 [0.092]	1.2 [95.493]	0.85	5.0±0.1	006
	Y15	800±5% [0.080]	55 [4.377]	13±5%	$5 \times 10^{-4}$	200	730 [0.073]	600 [0.060]	1.2 [95.493]	0.82	5.0±0.1	008
	Y16	650±5% [0.065]	55 [4.37]	13±5%	$5 \times 10^{-4}$	170	500 [0.050]	390 [0.039]	1.3 [103.451]	0.78	5.0±0.1	009
	Y17	450±5% [0.045]	55 [4.377]	13±5%	$5 \times 10^{-4}$	140	390 [0.039]	260 [0.026]	1.2 [95.493]	0.67	5.0±0.1	010

NOTE :  $\Delta H$ ,  $\epsilon$ , and  $\tan \delta \epsilon$  values were measured at a frequency level of 10 GHz.  $B_s$ ,  $B_r$ ,  $H_c$  and  $B_r / B_{20}$  are reference values.

**Microwave ferrites**

**Shapes and dimensions**

Shape	Disk	Rod	Plate	Bar	Triangular plate
External appearance					
Dimensional range	Diameter : 65mm max. Thickness : 4mm max.	Diameter : 30mm max. Length : 50mm max.	Long side : 50mm max. Thickness : 4mm max.	Short side : 10mm max. Length : 50mm max.	Side : 60mm max. Thickness : 5mm max.

**Naming of product number**

$$\frac{M31}{\textcircled{1}} \quad \frac{D\textcircled{2}\textcircled{2}.\textcircled{2}}{\textcircled{2}} \quad / \quad \frac{\textcircled{2}\textcircled{2}.\textcircled{2}}{\textcircled{3}} \quad / \quad \frac{\textcircled{2}\textcircled{2}.\textcircled{2}}{\textcircled{4}}$$

- ① Name of material used.
- ② Outer dimensions (D=Disk diameter, P=Plate long side, B=Bar length, T=Triangular plate side, R=Rod diameter).
- ③ Length of short side (for plates and bars).
- ④ Thickness or length.



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