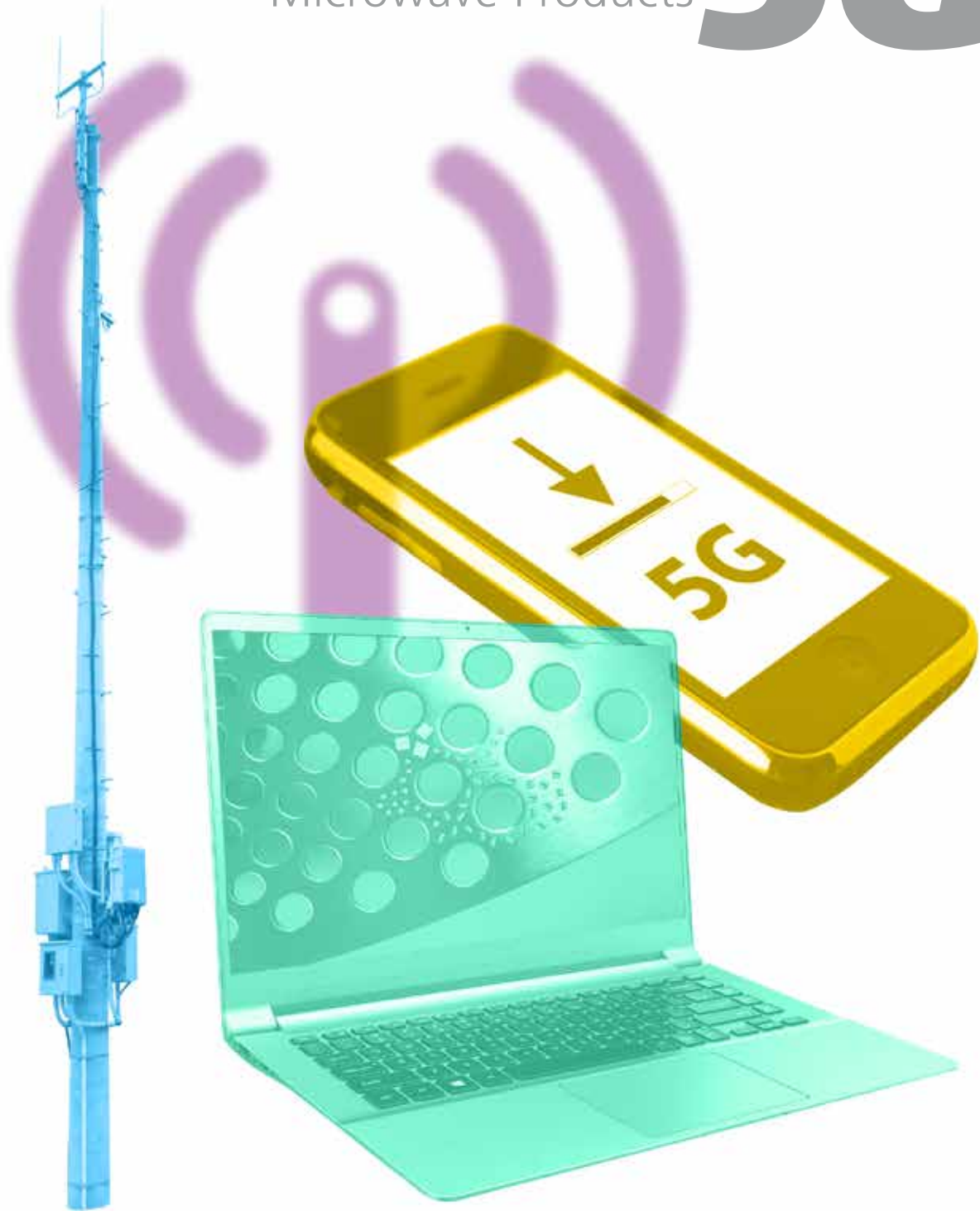


# *Evolution to* **5G**

Microwave Products



DLI•JohansonMFG•Novacap•Syfer•Voltronics

# DLI's Evolution

# the

DLI's Microwave Products integrate two core competencies that have been honed for over 40 years; ceramic expertise and thin film manufacturing. Utilizing our high permittivity and temperature stable dielectric materials allows the product to be designed smaller than competition and offer higher selectivity in filtering applications. Combining the dielectric materials with our thin film fabrication and test capabilities allows our designers to push the limits of the materials and offer highly repeatable results for difficult microwave design solutions.

Over 10 years of designing custom solutions for very demanding defense and telecom applications has allowed DLI to create a catalog offering of Filters, Power Dividers and other passive devices such as Directional couplers shown here. In addition, we continue to support custom requests and offer many other solutions such as Cavity Filters (1-5% bandwidth), Diplexers, Gain Equalizers, etc. not featured here. Please see our website at [www.dilabs.com](http://www.dilabs.com)

## Benefits/Advantages

- Temperature Stable (-55 to +125 °C)
- EAR99
- Surface Mount Assembly up to 42 GHz
- Lower Cost of Manufacturing Assembly
- Power Handling (up to 40 Watts)
- High Repeatability – Precision Thin Film Fabrication

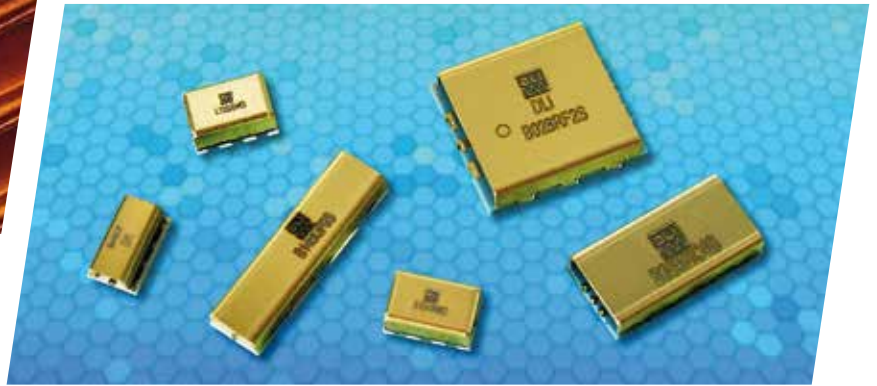


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# to 5G - story to date.

## Typical Applications

- Microwave Radar
- Test Equipment
- Switch Filter Banks
- Satellite and Radio Communications
- Synthesizer and filter banks
- 5G Base Stations



## RoHS Compliance Statement

DLI is a leading supplier to the electronic components market and is fully committed to offering products supporting Restriction of Hazardous Substances (RoHS) directives. All of our Dielectric formulations are RoHS compliant and we offer a broad range of capacitors with RoHS compliant terminations. DLI complies with the requirements of the individual customer and will maintain product offerings that meet the demands of our industry.

## Quality and Environmental Policy

DLI's reputation for quality and environmental responsibility is based on a commitment not only to meet our customers' requirements, but to exceed their expectations. The entire organization, beginning with top management, strives to achieve excellence in designing, manufacturing and delivering High Q Capacitors and proprietary thin film components for niche high frequency applications, while maintaining safe and healthy working conditions. Furthermore, DLI commits to achieve these goals in an environmentally responsible manner through our commitment to comply with environmental regulations and pollution prevention initiatives. DLI strives to continually improve the effectiveness of our Quality and Environmental Management System through the establishment and monitoring of objectives and targets.



# SM Bandpass Filters



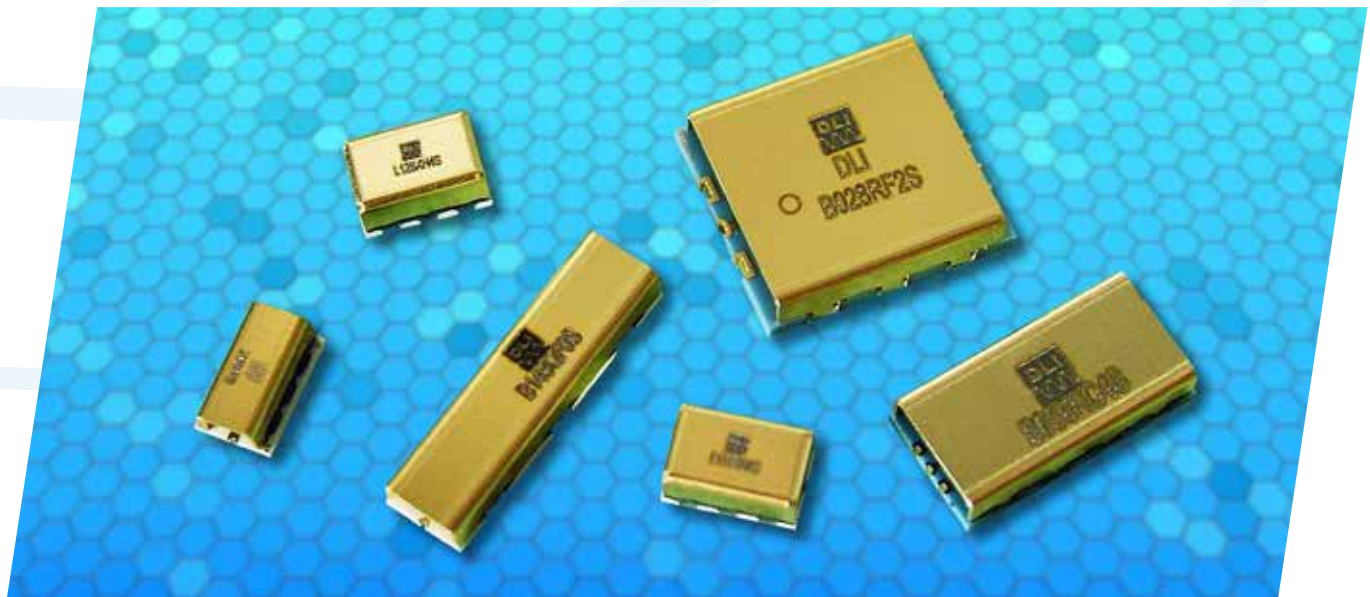
Utilizing DLI's high permittivity, COG/NP0 ceramics allow for small size, temperature stable performance over frequency and high reliability in environmentally challenging conditions. This series of bandpass filters was designed to span the popular 1.22-28 GHz frequency range. The compact size and surface mount attachment allow for low cost of manufacturing without sacrificing performance and repeatability. Designed for use on PCB 8-12 mils thick with a permittivity of 3.0-3.8.

## Features

- Small Size
- Fully Shielded Component
- Frequency Stable over Temperature
- Operating Temp: -55°C to +125°C
- Characteristic Impedance: 50Ω

## Specifications

Part Number	Center Frequency	Passband	Insertion Loss (@Fc)		VSWR 50Ω System	Rejection		Length Inches (mm)	Width Inches (mm)	Height Inches (mm)
			@ 25°C	-40°C to +85°C						
B012MD5S	1.227 GHz	1.22 to 1.23 GHz	3.5 dB	4.2 dB	2.0:1	dc to 0.925 GHz (30 dB)	1.45 to 2.5 GHz (35 dB)	0.670 (17.02)	0.600 (15.24)	0.100 (2.36)
B016MD6S	1.575 GHz	1.57 to 1.58 GHz	3.5 dB	4.2 dB	2.0:1	dc to 1.175 GHz (40 dB)	1.875 to 3.0 GHz (40 dB)	0.670 (17.02)	0.600 (15.24)	0.100 (2.36)
B028RF2S	3 GHz	2 to 4 GHz	2.5 dB	3.0 dB	1.63:1	dc to 1.25 GHz (40 dB)	4.85 to 6 GHz (40 dB)	0.450 (11.43)	0.400 (10.16)	0.113 (2.87)
B033ND5S	3.3 GHz	3.1 to 3.5 GHz	2.0 dB	3.2 dB	2.0:1	dc to 2.6 GHz (30 dB)	4 to 6 GHz (40 dB)	0.393 (9.98)	0.353 (8.97)	0.128 (3.25)
B057MD7S	5.7 GHz	5.5 to 6.1 GHz	2.3 dB	2.8 dB	1.67:1	dc to 4.65 GHz (34 dB)	6.85 to 16 GHz (30 dB)	0.475 (12.1)	0.275 (7.00)	0.103 (2.62)
B056RC4S	6 GHz	4 to 8 GHz	3.0 dB	3.5 dB	1.5:1	dc to 3 GHz (40 dB)	9.5 to 12 GHz (40 dB)	0.450 (11.43)	0.230 (5.84)	0.100 (2.54)
B060NC5S	6 GHz	5.5 to 6.5 GHz	2.0 dB	3.0 dB	1.29:1	dc to 4.9 GHz (30 dB)	7.1 to 14 GHz (40 dB)	0.500 (12.7)	0.200 (5.08)	0.088 (2.24)
B080MB5S	8 GHz	7.5 to 8.5 GHz	2.0 dB	3.0 dB	1.29:1	dc to 6.8 GHz (40 dB)	9.2 to 18 GHz (40 dB)	0.500 (12.7)	0.180 (4.57)	0.100 (2.54)
B096QC2S	10 GHz	8 to 12 GHz	2.5 dB	3.0 dB	2.0:1	dc to 6 GHz (40 dB)	14 to 18 GHz (40 dB)	0.400 (10.86)	0.180 (4.57)	0.100 (2.54)
B120MB1S	12 GHz	11.5 to 12.5 GHz	2.0 dB	3.0 dB	1.29:1	dc to 10.6 GHz (40 dB)	13.2 to 20 GHz (40 dB)	0.525 (13.34)	0.225 (5.72)	0.090 (2.27)
B148QF0S	15 GHz	12 to 18 GHz	3.6 dB	4.2 dB	1.63:1	dc to 7.6 GHz (40 dB)	22.5 to 25.0 GHz (30 dB)	0.550 (13.97)	0.150 (3.81)	0.098 (2.49)
B161LA0S	16 GHz	15.5 to 16.5 GHz	4.0 dB	6.0 dB	1.67:1	dc to 14.7 GHz (40 dB)	17.2 to 22 GHz (40 dB)	0.695 (17.65)	0.250 (6.35)	0.093 (2.36)
B280LB0S	28 GHz	27 to 29 GHz	1.5 dB	2.0 dB	2.0:1	dc to 25.5 GHz (30 dB)	30.2 to 35 GHz (30 dB)	0.350 (8.89)	0.120 (3.05)	0.098 (2.49)
B280LA0S	28 GHz	27.5 to 28.5 GHz	4.0 dB	4.5 dB	2.0:1	dc to 26.1 GHz (30 dB)	30 to 37 GHz (30 dB)	0.550 (14.00)	0.140 (3.56)	0.083 (2.11)
B424MEZ5	42.5 GHz	39.7 to 45.3 GHz	1.5 dB	2 dB	2.0:1	dc to 37 GHz(30dB)	47.5 to 60 GHz (30dB)	0.236 (6.00)	0.08 (2.03)	0.065 (1.65)



# Lowpass Filters

DLI introduces its new high frequency surface mountable catalog low pass filters. These LPF's incorporate DLI's low loss high permittivity ceramics which provide small size and temperature stability. The catalog LPF's are offered in a variety of frequency bands, which offers a drop in solution for high frequency attenuation.

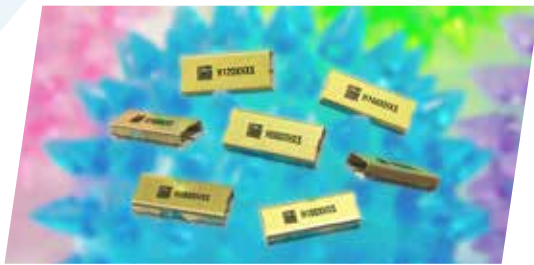
## Features

- Small Size
- Fully Shielded Component
- Frequency Stable over Temperature
- Solder Surface Mountable
- Excellent Repeatability
- Operating Temp: -55°C to +125°C
- Characteristic Impedance: 50Ω
- 100% Tested & Inspected



## Specifications

Part Number	3 dB Cutoff	Passband	Max Insertion Loss in Passband	Min VSWR in Passband	Min Rejection	Length Inches (mm)	Width Inches (mm)	Height Inches (mm)
L050XF9S	5 GHz	DC - 4 GHz	1 dB	1.288:1	6 - 16 GHz (35 dB)	0.220 (5.58)	0.180 (4.57)	0.103 (2.62)
L065XG9S	6.5 GHz	DC - 6 GHz	1.3 dB	1.22:1	7.9 - 22.4 GHz (35 dB)	0.220 (5.58)	0.180 (4.57)	0.103 (2.62)
L095XG9S	9.5 GHz	DC - 9 GHz	1.3 dB	1.12:1	11.5 - 32 GHz (30 dB)	0.220 (5.58)	0.140 (3.56)	0.103 (2.62)
L117XH4S	11.7 GHz	DC - 11 GHz	1 dB	1.43:1	17.6 - 30 GHz (40 dB)	0.220 (5.58)	0.140 (3.56)	0.103 (2.62)
L128XH4S	12.8 GHz	DC - 12 GHz	1.2 dB	1.38:1	18.8 - 32 GHz (40 dB)	0.220 (5.58)	0.140 (3.56)	0.103 (2.62)
L157XG3S	15.7 GHz	DC - 15 GHz	2.2 dB	1.3:1	19.9 - 32.2 GHz (40 dB)	0.220 (5.58)	0.140 (3.56)	0.103 (2.62)
L185XF4S	18.5 GHz	DC - 18 GHz	2.2 dB	1.4:1	20.5 - 40 GHz (25 dB)	0.220 (5.58)	0.140 (3.56)	0.098 (2.49)
L204XF4S	20.4 GHz	DC - 20 GHz	1.8 dB	1.43:1	23 - 43 GHz (30 dB)	0.220 (5.58)	0.140 (3.56)	0.098 (2.49)
L254XF3S	25.4 GHz	DC - 25 GHz	1.4 dB	1.3:1	29 - 50 GHz (30 dB)	0.220 (5.58)	0.140 (3.56)	0.098 (2.49)

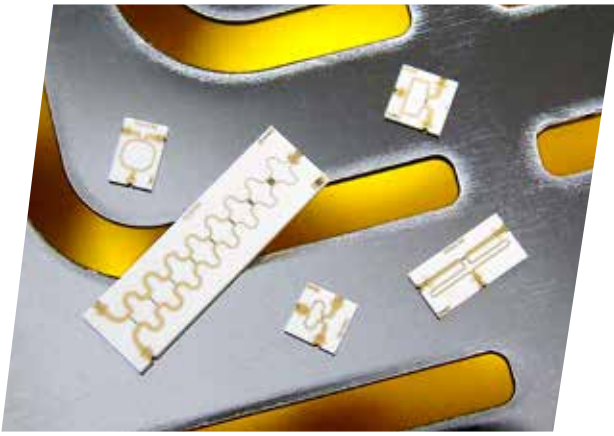


# Highpass Filters

DLI introduces its new high frequency surface mountable catalog Highpass filters. These HPF's incorporate DLI's low loss high permittivity ceramics which provide small size and temperature stability. The catalog HPF's are offered in a variety of frequency bands, which offers a drop in solution for high frequency attenuation.

## Specifications

Part Number	3dB cutoff	Passband	Typical Insertion Loss in Passband	Minimum VSWR in Passband	Minimum Rejection	Usable Temp. Range	Length inches (mm)	Width inches (mm)	Height inches (mm)
H060XHXS	6 GHz	6.5 - 20 GHz	1dB	1.43:1	DC - 3.5 GHz (30dB)	-55 to +125°C	0.450 (11.43)	0.200 (5.08)	0.093 (2.362)
H080XHXS	8 GHz	8.5 - 22 GHz	1dB	1.43:1	DC - 5 GHz (30dB)	-55 to +125°C	0.450 (11.43)	0.200 (5.08)	0.093 (2.362)
H100XHXS	10 GHz	10.5 - 23 GHz	1dB	1.43:1	DC - 5.5 GHz (30dB)	-55 to +125°C	0.450 (11.43)	0.175 (4.445)	0.083 (2.108)
H120XHXS	12 GHz	12.5 - 30 GHz	1dB	1.43:1	DC - 9 GHz (30dB)	-55 to +125°C	0.450 (11.43)	0.175 (4.445)	0.083 (2.108)
H140XHXS	14 GHz	14.5 - 28 GHz	1dB	1.43:1	DC - 9.5 GHz (30dB)	-55 to +125°C	0.450 (11.43)	0.175 (4.445)	0.083 (2.108)
H160XHXS	16 GHz	16.5 - 32.5 GHz	1dB	1.43:1	DC - 12.1 GHz (30dB)	-55 to +125°C	0.450 (11.43)	0.175 (4.445)	0.083 (2.108)
H182XHXS	18.2 GHz	18.75 - 28 GHz	1dB	1.7:1	DC - 14 GHz (30dB)	-55 to +125°C	0.450 (11.43)	0.175 (4.445)	0.083 (2.108)



DLI introduces its new high frequency surface mountable and wire bondable Wilkinson Power Dividers. These Power Dividers incorporate DLI's low loss high permittivity ceramics which provide small size and temperature stability along with integrated resistors. The compact size, broad band performance and ease of integration make these power dividers ideal anywhere board space is of a premium and quality signal splitting or combining is required.

#### Features

- Broad Band 2 to 18 GHz Frequency Coverage
- Low Excess Insertion Loss
- High Isolation
- Excellent Phase and Amplitude Balance
- Well matched on All Ports
- No External Resistors Required
- Compact Solder Surface Mount Package



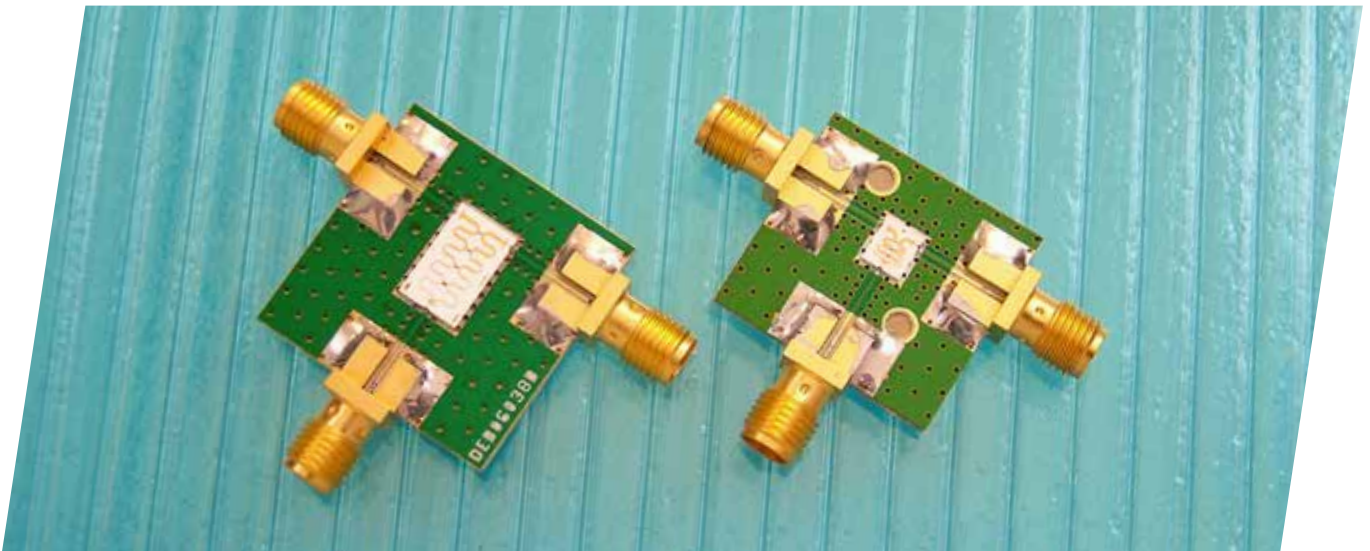
# Power Dividers

## Specifications

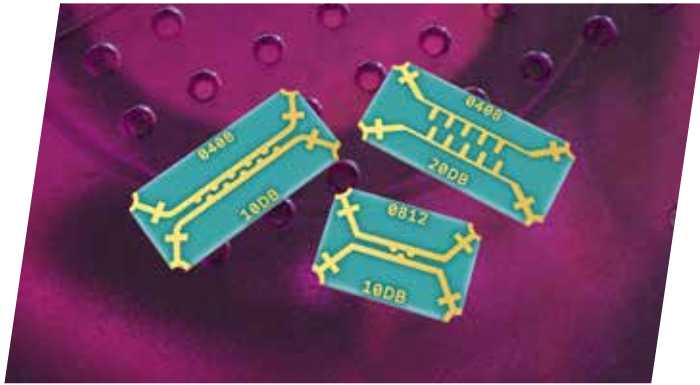
Part Number	Frequency Range	Amplitude Balance Max. (dB)	Phase Balance Max. (degrees)	Excess Insertion Loss Typ. (dB)	Return Loss Typ. (dB)	Isolation Typ. (dB)	Input Power as a Splitter Max. (W) <sup>2</sup>	Mounting	Config.	Size Inches
<b>PDW06407</b>	2 to 18 GHz	±0.25	±5.0	2.5	18	20	TBD	SMT	2-Way	0.600 x 0.180 x 0.020
<b>PDW06933</b>	2 to 18 GHz	±0.25	±5.0	2.5	18	20	TBD	Chip & Wire	2-Way	0.600 x 0.180 x 0.020
<b>PDW06038</b>	2 to 10 GHz	±0.25	±3.0	0.8	20	20	5	SMT	2-Way	0.400 x 0.250 x 0.020
<b>PDW06041</b>	2 to 10 GHz	±0.25	±3.0	0.8	20	20	5	Chip & Wire	2-Way	0.400 x 0.250 x 0.020
<b>PDW05758</b>	6 to 18 GHz	±0.25	±3.0	0.7	20	25	5	SMT	2-Way	0.185 x 0.160 x 0.020
<b>PDW06011</b>	6 to 18 GHz	±0.25	±3.0	0.7	20	25	5	Chip & Wire	2-Way	0.185 x 0.160 x 0.020
<b>PDW06089</b>	6 to 18 GHz	±0.5	±3.0	1.0	14	14	TBD	SMT	4-Way	0.250 x 0.300 x 0.020
<b>PDW06398</b>	5 to 7 GHz	±0.25	±5.0	0.25	20	18	TBD	SMT	2-Way	0.120 x 0.240 x 0.015
<b>PDW06399</b>	9 to 11 GHz	±0.25	±5.0	0.25	20	15	TBD	SMT	2-Way	0.150 x 0.100 x 0.015
<b>PDW06400</b>	11 to 13 GHz	±0.25	±5.0	0.5	25	20	TBD	SMT	2-Way	0.130 x 0.130 x 0.015
<b>PDW06401</b>	15 to 17 GHz	±0.25	±5.0	0.5	25	20	TBD	SMT	2-Way	0.120 x 0.120 x 0.015
<b>PDW06984</b>	25 to 32 GHz	±0.25	±3.0	0.8	15	15	TBD	SMT	2-Way	0.085 x 0.095 x 0.010
<b>PDW07069</b>	25 to 32 GHz	±0.25	±5.0	1.0	15	15	TBD	SMT	4-Way	0.140 x 0.170 x 0.010

1) Electrical Specifications at 25°C; Over Temperature Performance TBD.

2) Load VSWR not to Exceed 1.2:1; Base Temperature not to Exceed 85°C.



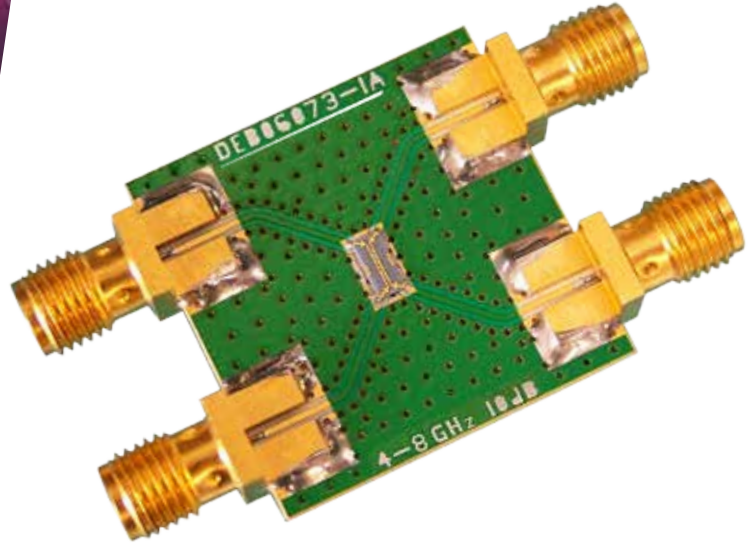
# Couplers



DLI's surface mount directional coupler series span the frequency spectrum of C, X and Ku bands. Both 10dB and 20dB coupling values are available within each frequency band both with a common footprint for maximum flexibility. These couplers incorporate DLI's low loss high permittivity ceramics which provide small size and temperature stability. These couplers offer a turnkey surface mount solution for high frequency power monitoring. Custom solutions are also available.

## Features

- Small Size
- High Directivity
- Frequency Stable over Temperature
- Solder Surface Mountable
- Excellent Repeatability
- Operating Temp: -55°C to +125°C
- Characteristic Impedance: 50Ω
- Flexible PCB Feed Line Configurations



## Specifications

Part Number	Frequency Range (GHz)	Mean Coupling Value (dB)	Passband Coupling Variation Typ. (dB)	Insertion Loss Typ. (dB)	Return Loss Typ. (dB)	Isolation Typ. (dB)	Directivity Typ. (dB)	Size Inches
FPC06073	4 to 8	10	± 1.5	0.3	20	30	20	0.170 x 0.080 x 0.015
FPC06076	4 to 8	20	± 1.5	0.3	20	40	20	0.170 x 0.080 x 0.015
FPC06074	8 to 12	10	± 1.0	0.3	14	25	15	0.120 x 0.080 x 0.015
FPC06077	8 to 12	25	± 1.0	0.3	15	30	10	0.120 x 0.080 x 0.015
FPC06075	12 to 18	10	± 0.5	0.3	15	25	14	0.100 x 0.080 x 0.015
FPC06078	12 to 18	20	± 1	0.3	15	35	14	0.100 x 0.080 x 0.015
FPC07181	20 to 40	20	± 1.5	0.3	20	34	14	0.065 x 0.050 x 0.010
FPC07182	20 to 40	10	± 1.5	0.3	20	28	18	0.065 x 0.050 x 0.010
FPC07183	24 to 33	3	± 0.5	0.5	15	15	12	0.180 x 0.110 x 0.010
FPC06700	5.9 to 6.5	3	1	0.5	15	20	20	0.425 x 0.250 x 0.020
FPC06701	10.7 to 12.75	3	1	0.5	15	20	20	0.255 x 0.155 x 0.015
FPC06633	8.5 to 11	3	1	0.5	15	20	20	0.286 x 0.180 x 0.015
FPC06913	6 to 18	20	1	0.3	15	20	20	0.180 x 0.110 x 0.015
FPC06719	6 to 18	10	1	0.3	15	20	20	0.255 x 0.100 x 0.015
FPC07180	2 to 18	20	4.5	0.8	15	20	20	0.630 x 0.150 x 0.020
FPC06881	DC to 40	20	NA	0.5	15	20	20	0.060 x 0.088 x 0.010
FPC06882	DC to 40	30	NA	0.5	15	30	30	0.060 x 0.088 x 0.010





# knowles

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Knowles Capacitors designs, manufactures and sells special electronic components. Our products are used in military, space, telecom infrastructure, medical and industrial applications where function and reliability are crucial.



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