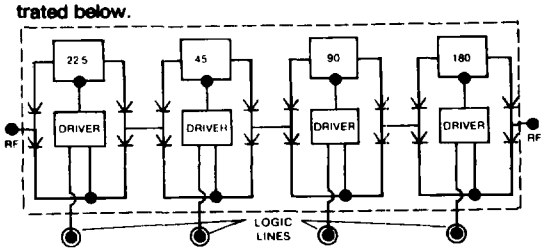
TO OCTAVE BANDWIDTHS

# DIGITAL DIODE PHASE SHIFTERS SERIES DP

**GENERAL INFORMATION:** KDI/Triangle Microwave's switched line digital phase shifters are controllable by binary logic. If a 360° phase shifter having sixteen discrete steps is required, then four logic lines are employed. The smallest phase increment will be 22.5°. This type of phase is illustrated below.




Two advantages of the switched line phase shifter, Series DP, over the digitally controlled analog phase shifter, Series QQ, are faster switching speed, and less change with temperature. The disadvantage is that phase increments smaller than 5.63° are impractical, while the digitally controlled analog device can have increments as small as 0.088° (12 bits) and maintain monotonicity.

**ELECTRICAL PERFORMANCE:** All performance characteristics, especially insertion loss, can be improved over narrower frequency bands. Therefore, the exact frequency band required should be stated when ordering.

**CONFIGURATION:** Special configurations for systems requiring miniaturization can be quoted on request. *Engineering costs for re-configuration are generally small.*

**FREQUENCY COVERAGE:** 0.10 to 18.0 GHz

**RF IMPEDANCE:** 50 Ohms.

**D.C. REQUIREMENTS:** +5 volts at 70 mA, and −5 volts at 70 mA per bit. For each logic line at logic 0, +70 mA is drawn from the +5 V supply and 10 mA from the −5V supply. For each logic line at logic 1, −70 mA is drawn from the 5V supply and 10 mA from the +5 V supply.

**RF POWER:** 200 mW average, 10 watts peak. Phase shifters can be built to handle 40 watts average and 6 kW peak on request.

**TEMPERATURE INFORMATION:** Operating temperature from -55° C to +85° C.

**SWITCHING SPEED:** The switching speed of all models in 500 nanoseconds (750 nanoseconds including storage and delay time). Any model can be switched in 15 nanoseconds (35 nanosec. including storage and delay time) if required. However, the insertion loss will increase by 15%. For example, the DP-51, with 15 nanosec. switching speed, will have Min./Max. insertion loss of 4.6 and 6.9 dB instead of 4.0 and 6.0 dB. If 15 nanoseconds is required add-1 to the model no. (e.g. DP-51-1)

**ENVIRONMENT:** MIL-E-5400

**CONNECTORS:** SMA standard, others on request. Mating Multipin Connector Is Supplied With Each Unit; ITT Cannon MDB1-9SSL or equiv.

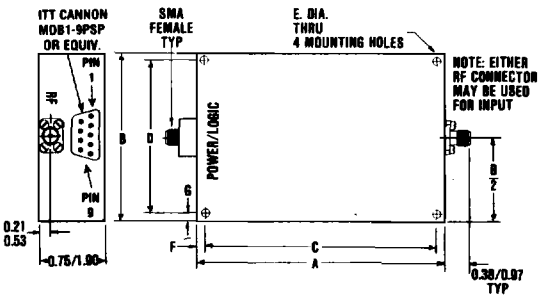
**NOTES:**

**1.** All units include TTL drivers. If a phase shifter is desired without a driver, add -A to the model number when ordering., i.e., DP-44-A. The 0.75 dimension will be 0.44 inches.

**2.** Phase accuracies that are tighter than those listed can be quoted on request.

**3.** Units covering frequency ranges other than those listed can be quoted on request.

**4.** If a narrow frequency bandwidth is required, KDI/Triangle can supply a unit that is electrically optimized for that bandwidth. Mechanical dimensions will remain the same as the standard unit, and the price will generally be lower. Specify the frequency range when ordering a narrow bandwidth model, and a special part number will be assigned.




## POWER LOGIC PIN CONNECTIONS

| PIN | FUNCTION |
|---|---|
| 1-6 | Logic Inputs |
| 7 | GND |
| 8 | +5VDC |
| 9 | -5VDC |

Pin 1 is the least significant bit.

## MECHANICAL OUTLINES

| Out-line | A In./cm. | B In./cm. | C In./cm. | D In./cm. | E DIA In./cm. | F In./cm. | G In./cm. |
|---|---|---|---|---|---|---|---|
| 1 | 9.50/24.13 | 3.50/8.89 | 9.250/23.500 | 3.300/8.380 | 0.093/0.236 | 0.12/0.31 | 0.10/0.25 |
| 2 | 6.50/16.51 | 3.00/7.62 | 6.250/15.880 | 2.800/7.110 | 0.093/0.236 | 0.12/0.31 | 0.10/0.25 |
| 3 | 5.50/13.97 | 2.75/6.99 | 5.250/13.340 | 2.550/6.480 | 0.093/0.236 | 0.12/0.31 | 0.10/0.25 |
| 4 | 4.50/11.43 | 1.50/3.81 | 4.250/10.800 | 1.300/3.300 | 0.093/0.236 | 0.12/0.31 | 0.10/0.25 |
| 5 | 4.25/10.80 | 1.00/2.54 | 4.000/10.160 | 0.800/2.032 | 0.093/0.236 | 0.12/0.31 | 0.10/0.25 |
| 6 | 3.50/8.89 | 1.25/3.18 | 3.250/8.260 | 1.050/2.670 | 0.093/0.236 | 0.12/0.31 | 0.10/0.25 |
| 7 | 5.50/13.97 | 2.25/5.72 | 5.375/13.650 | 2.150/5.460 | 0.093/0.236 | 0.12/0.31 | 0.10/0.25 |
| 8 | 5.00/12.70 | 2.75/6.98 | 4.700/11.940 | 2.450/6.220 | 0.093/0.236 | 0.12/0.31 | 0.10/0.25 |
| 9 | 3.75/9.52 | 3.00/7.62 | 3.450/8.760 | 2.700/6.860 | 0.093/0.236 | 0.12/0.31 | 0.10/0.25 |
| 10 | 3.50/8.89 | 1.00/2.54 | 3.300/8.380 | 0.800/2.030 | 0.093/0.236 | 0.12/0.31 | 0.10/0.25 |
| 11 | 3.50/8.89 | 0.80/2.03 | 3.300/8.380 | 0.600/1.520 | 0.093/0.236 | 0.12/0.31 | 0.10/0.25 |
| 12 | 12.05/30.60 | 6.05/15.40 | 11.700/29.720 | 6.05/15.40 | 0.156/0.396 | 0.18/0.46 | 0.18/0.46 |
| 13 | 7.50/19.05 | 4.00/10.20 | 7.000/17.780 | 4.00/10.20 | 0.156/0.396 | 0.18/0.46 | 0.18/0.46 |
| 14 | 5.50/14.00 | 3.00/7.60 | 5.000/12.700 | 3.00/7.60 | 0.156/0.396 | 0.18/0.46 | 0.18/0.46 |

INCHES / CENTIMETERS XX ±.03 XXX ±.010 / XX ±.08 XXX ±.025

## ELECTRICAL PERFORMANCE

| Model No. | Freq. Range GHz | No. of Bits | No. of Steps | Smallest Bit Size Degrees | Phase Accuracy For Any Value of Phase Typ/Max. ± Degrees | VSWR Max | Insertion Loss Max dB | Amplitude Ripple Max ± dB | Out-line |
|---|---|---|---|---|---|---|---|---|---|
| DP-16 | 0.10-0.20 | 4 | 16** | 11.25 | 3.0/7.0 | 1.50 | 2.5 | 0.25 | 12 |
| DP-20 | 0.20-0.40 | 4 | 16** | 11.25 | 3.0/7.0 | 1.50 | 1.5 | 0.25 | 13 |
| DP-21 | 0.25-0.5 | 4 | 16* | 22.5 | 5/20 | 1.6 | 2.5 | 0.50 | 1 |
| DP-24 | 0.40-0.45 | 5 | 32* | 11.25 | 1.0/4.0 | 1.3 | 1.25 | 0.20 | 2 |
| DP-28 | 0.40-0.50 | 4 | 16** | 11.25 | 3.0/7.0 | 1.50 | 1.4 | 0.25 | 13 |
| DP-30 | 0.50-0.75 | 4 | 16** | 11.25 | 3.0/7.0 | 1.50 | 1.7 | 0.25 | 14 |
| DP-32 | 0.50-1.0 | 5 | 32** | 11.25 | 5/20 | 1.6 | 3.0 | 0.50 | 1 |
| DP-33 | 0.75-1.00 | 4 | 16** | 11.25 | 3.0/7.0 | 1.50 | 1.8 | 0.25 | 14 |
| DP-36 | 0.95-1.22 | 4 | 16** | 11.25 | 3/10 | 1.35 | 2.5 | 0.50 | 2 |
| DP-41 | 1.0-2.0 | 3 | 8* | 45.0 | 5/20 | 1.8 | 4.0 | 0.75 | 2 |
| DP-42 | 1.08-1.10 | 6 | 64* | 5.625 | 1/4 | 1.4 | 2.3 | 0.40 | 7 |
| DP-43 | 1.46-1.54 | 5 | 32** | 5.625 | 3/6 | 1.30 | 2.0 | 0.40 | 3 |
| DP-44 | 1.2-1.5 | 4 | 16* | 22.5 | 3/10 | 1.75 | 2.6 | 0.50 | 8 |
| DP-47 | 1.7-1.9 | 4 | 16* | 22.5 | 2/5 | 1.4 | 2.3 | 0.40 | 8 |
| DP-48 | 1.7-2.4 | 3 | 8** | 22.5 | 5/10 | 1.7 | 3.5 | 0.75 | 8 |
| DP-51 | 2.0-4.0 | 4 | 16* | 22.5 | 5/20 | 2.0 | 5.0 | 1.00 | 3 |
| DP-54 | 2.9-3.1 | 2 | 4* | 90.0 | 1/4 | 1.25 | 1.5 | 0.25 | 6 |
| DP-55 | 3.0-3.5 | 4 | 16* | 22.5 | 3/10 | 1.60 | 2.6 | 0.40 | 9 |
| DP-58 | 4.0-8.0 | 3 | 8* | 45.0 | 5/20 | 2.0 | 6.0 | 1.00 | 4 |
| DP-59 | 4.1-4.3 | 5 | 32* | 11.25 | 2/5 | 1.40 | 2.5 | 0.40 | 4 |
| DP-60 | 5.0-5.1 | 4 | 16* | 22.5 | 1/4 | 1.40 | 2.0 | 0.40 | 10 |
| DP-61 | 8.0-12.4 | 5 | 32* | 11.25 | 5/10 | 2.2 | 8.0 | 0.50 | 4 |
| DP-62 | 7.2-7.8 | 3 | 8* | 45.0 | 1/4 | 1.50 | 2.4 | 0.20 | 11 |
| DP-64 | 9.0-9.5 | 4 | 16* | 22.5 | 2.0/5.0 | 1.50 | 3.5 | 0.40 | 5 |
| DP-67 | 12.4-18.0 | 3 | 8* | 45.0 | 5/20 | 2.2 | 8.0 | 1.50 | 10 |
| DP-72 | 13.2-13.4 | 3 | 8* | 45.0 | 2.0/5.0 | 1.50 | 3.0 | 0.50 | 11 |
| DP-81 | 15.5-16.5 | 4 | 16* | 22.5 | 4.0/8 | 1.60 | 4.0 | 0.50 | 10 |

*Total phase shift, 360° **Total phase shift, 180°

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