

DIGITALLY CONTROLLED, 360-DEG. PIN DIODE PHASE SHIFTER

SERIES DQ

GENERAL INFORMATION: KDI/Triangle's Series DQ digitally controlled PIN-diode phase shifters vary the phase of a microwave signal in response to a TTL-compatible logic input signal. All standard units are 8-bit, 0-to-360-deg. phase shifters. The least significant bit is 1.406 deg. and the most significant bit is 180 deg. The DQ Series is very fast, and provides low amplitude ripple and excellent phase accuracy over octave and multi-octave bandwidths.

Standard units are supplied with full-band coverage and one optimized (narrowband) frequency band. The optimized frequency is selected by applying TTL signals to the "band-select" pins on the unit's DB-25P connector. Up to eight optimized narrowband segments, single frequencies, wideband segments, or combinations of the three can be specified. All must fall within overall bandwidth of the unit.

FREQUENCY COVERAGE: 0.5 to 12.4 GHz, and 10-percent bandwidths from 12 to 18 GHz.

RF IMPEDANCE: 50 ohms

DC REQUIREMENTS: +5 V at 85 mA, +15 V at 160 mA, and -15 V at 100 mA.

CONTROL: 8-bit TTL compatible.

RF POWER HANDLING: +20 dBm operating (+13 dBm for DQ-52) and +30 dBm survival (+23 dBm for DQ-52).

TEMPERATURE: Operating temperature range is -20 to +70°C, and -65 to +125°C nonoperating. Phase accuracy and amplitude variation specifications are maintained over the full range of operating temperatures. At +70°C, add 1 dB to insertion loss specifications. Units with an operating temperature range of -55 to +95°C are available at approximately 10 percent additional cost. The specifications are the same.

REPEATABILITY: ±1.0 deg.

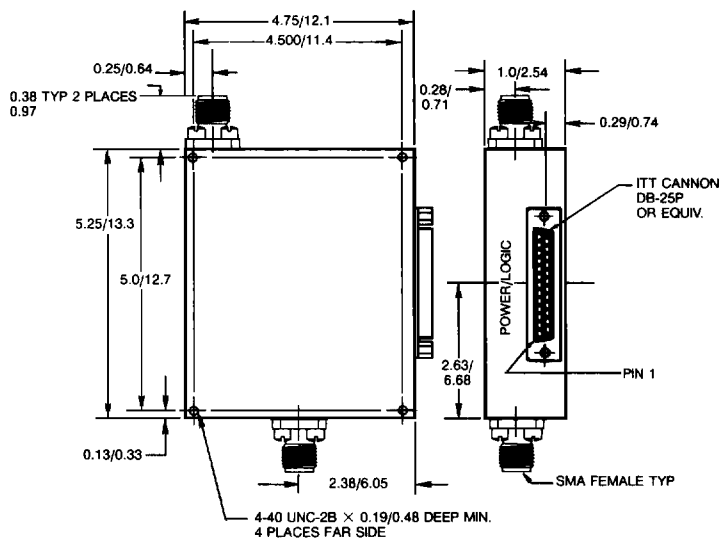
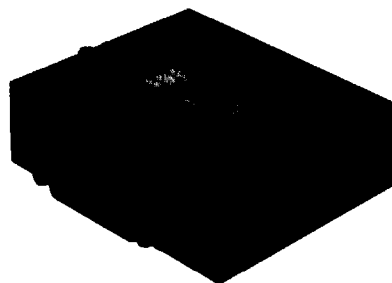
SWITCHING SPEED: 250 ns from any phase setting to any other phase setting.

CONNECTORS: SMA female standard, others on request. Mating multipin connector is supplied with each unit (ITT Cannon DB-25S or equivalent).

ENVIRONMENT: MIL-E-5400.

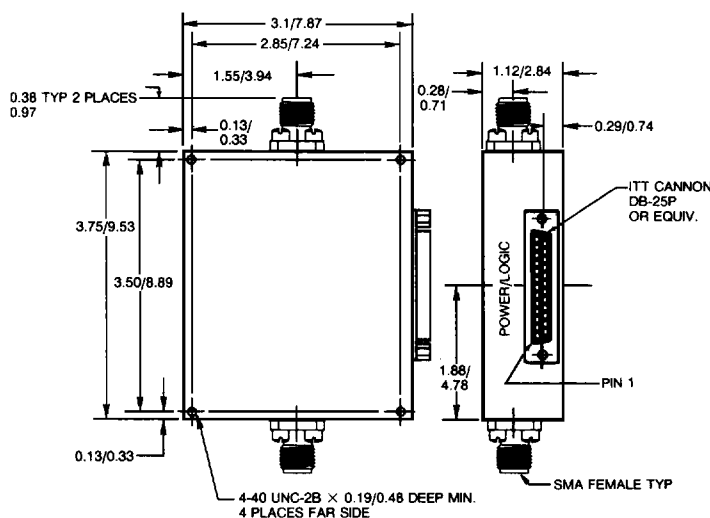
NOTES:

1. Phase accuracy includes frequency flatness and linearity.
2. Monotonicity is guaranteed.
3. Standard units are supplied with full-band coverage and one optimized (narrowband) frequency band. Full-band coverage is obtained by applying a logic 0 to pins 11, 12, and 13 (See Table 4). Optimized-band coverage is obtained by applying a logic 1 to pin 11 and logic 0 to pins 12 and 13.
4. Special frequency band selection is optional. Selection is made via a 3-bit band-selection input using TTL binary logic, allowing up to eight possible bands or single frequencies or combinations to be accessed. These optimized frequencies must fall within the full bands of standard models. (See "Frequency Band Optimization", p. 1). There is an extra charge for this option. This charge depends on the number of bands selected.



OUTLINE 1

DIMENSIONS IN INCHES/CENTIMETERS



OUTLINE 2

DIMENSIONS IN INCHES/CENTIMETERS

TABLE 1

Model No.	Frequency Range GHz	Phase Accuracy Max. (± Deg.) Band		Amplitude Variation at any Frequency Max. (± dB) Band		Insertion Loss Max. (dB) Band		VSWR	Optimized Bands Frequency Range GHz	Outline
		Full	Optimized (Note C)	Full	Optimized	Full	Optimized (Note A)			
DQ-52	0.5-2.0	15	10	2.0	1.1	12.5	11.5	2.0:1 (Note B)	0.7- 1.6	1
DQ-24	2.0-4.0	10	7	1.0	0.8	11.0	10.0	1.6:1	2.7- 3.7	2
DQ-26	2.0-6.0	12	8	1.5	1.1	11.5	10.5	1.8:1	2.6- 5.2	2
DQ-48	4.0-8.0	10	8	1.25	1.0	11.5	11.0	1.6:1	5.0- 7.2	2
DQ-42	4.0-12.0	12	10	1.75	1.25	12.0	11.0	1.8:1	5.0-10.6	2
DQ-81	8.0-12.4	8	5	1.0	0.8	11.75	11.0	1.7:1	9.2-10.2	2

Note A: Insertion loss slope is approximately linear, with maximum insertion loss occurring at the high frequency end of the band (Table 3). For example, the maximum insertion loss for the DQ-24 is 11 dB at 4 GHz and the approximate insertion loss at 2 GHz is 9 dB.

Note B: For the DQ-52, maximum VSWR over the optimized band is 1.7:1.

Note C: The smallest step size (LSB) is 1.41 deg. Its accuracy is about ±0.2 deg. When any phase setting is advanced or decreased by an LSB, the phase will advance or decrease by 1.41 ±0.2 deg. When the phase shifter is aligned at KDI/Triangle, the phase is normalized at all logic zeroes (0-deg. phase shift). The overall phase accuracy will be approximately as is shown in Table 2. Beyond ±60 deg., the worst-case accuracy is governed by the value listed in Table 1.

TABLE 2 OVERALL PHASE ACCURACY FOR SMALL PHASE SHIFTS (deg.)

For DQ-52	For DQ-24, DQ-48, DQ-81	For DQ-26, DQ-42
from -10 to +10; ±2.0	from -10 to +10; ±1.0	from -10 to +10; ±1.5
from -30 to +30; ±6.0	from -30 to +30; ±3.0	from -30 to +30; ±4.5
from -60 to +60; ±12.0	from -60 to +60; ±7.0	from -60 to +60; ±10.0

TABLE 3 INSERTION LOSS FOR ALL UNITS

DQ-52	12.5 dB at 2 GHz	9.5 dB at 0.5 GHz
DQ-24	11.0 dB at 4 GHz	9.0 dB at 2.0 GHz
DQ-26	11.5 dB at 6 GHz	9.0 dB at 2.0 GHz
DQ-48	11.5 dB at 8 GHz	9.5 dB at 4.0 GHz
DQ-42	12.0 dB at 12 GHz	9.0 dB at 4.0 GHz
DQ-81	11.75 dB at 12.4 GHz	10.0 dB at 8.0 GHz

TABLE 4

	BAND SELECTION LOGIC		
	PIN 11	PIN 12	PIN 13
FULL	0	0	0
OPTIMIZED	1	0	0

POWER/CONTROL PIN CONNECTIONS

PIN	FUNCTION
1	No connection
2 to 9	Logic inputs
10	No connection
11 to 13	Band select
14 to 19	No connection
20	Digital ground
21	Analog (chassis) ground
22	+5 VDC
23	-15 VDC
24	+15 VDC
25	No connection

Pin 2 is the least significant bit

The +15 VDC and -15 VDC supplies are returned directly to the chassis ground (pin 21). The +5 VDC supply has a separate ground return (digital ground, pin 20). Depending on the user's system performance requirements (switching speed, noise susceptibility, transients, etc.), all ground connections can be tied together to form a common ground.

