

RF Product — Phase Comparators



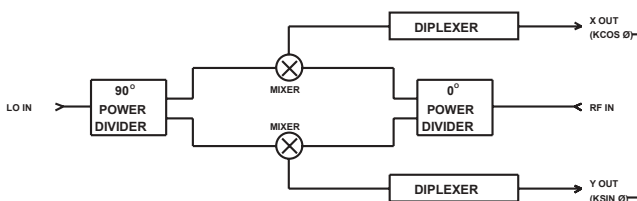
- 0.2 - 1000 MHz Frequency Range
- Up to 33% Bandwidth
- Wide Dynamic Range
- High Phase Stability
- High Accuracy
- PC Mount and Connectorized

Lorch Microwave began manufacturing custom RF and Microwave signal processing components more than 30 years ago. Today, they comprise a portion of a broad product line which includes RF and Microwave filters and Integrated Assemblies.

Phase Accuracy

| Center Frequency (MHz) | Phase Error (°) | | Zero Crossing @ F ₀ (°) |
|------------------------|------------------|-------------------------|------------------------------------|
| | @ F ₀ | @ F ₀ +/- 5% | |
| 0.2-10 | +/- 1.0 | +/- 3.0 | +/- 1.0 |
| 10-100 | +/- 1.5 | +/- 3.5 | +/- 1.0 |
| 100-200 | +/- 1.7 | +/- 4.0 | +/- 1.5 |
| 200-300 | +/- 2.0 | +/- 4.5 | +/- 1.5 |
| 300-400 | +/- 2.5 | +/- 5.0 | +/- 1.7 |
| 400-500 | +/- 2.5 | +/- 5.0 | +/- 2.0 |

Schematic, Phase Comparator



LO/RF Characteristics

| | LO/RF Frequency, F ₀ | Bandwidth | LO Input Level | RF Input Level | Nominal Impedance | VSWR |
|------------------------|---------------------------------|-----------------------|----------------|----------------|-------------------|-------------------------|
| Low-Level Comparators | 0.2-500 MHz | F ₀ +/- 5% | +13 +/- 2 dBm | +3 dBm max. | 50 Ohms | 1.4:1 typ. (1.6:1 max.) |
| High-Level Comparators | 0.2-500 MHz | F ₀ +/- 5% | +20 +/- 2 dBm | +10 dBm max. | 50 Ohms | 1.4:1 typ. (1.6:1 max.) |

X/Y Video Output Characteristics

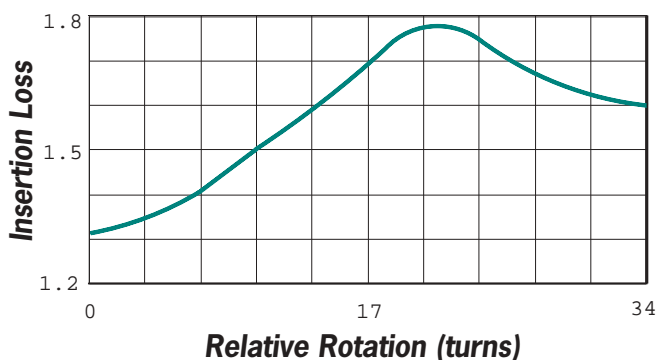
| | "X" Output | "Y" Output | Bandwidth | Nominal Impedance | X/Y Amplitude Balance | Conversion Loss | DC Offset Voltage |
|------------------------|--|------------|-----------|-------------------|-----------------------|-----------------|-------------------|
| Low-Level Comparators | k Cos Ø | k Sin Ø | DC-10% RF | 50 Ohms | +/- 5 mV max. | 11 dB max. | +/- 2 mV typ. |
| High-Level Comparators | k Cos Ø | k Sin Ø | DC-10% RF | 50 Ohms | +/- 5 mV max. | 11 dB max. | +/- 5 mV typ. |
| Low-Level Comparators | Peak Amplitude: 85 mV min. into 50 Ohms, for 0 dBm input at Port RF | | | | | | |
| High-Level Comparators | Peak Amplitude: 190 mV min. into 50 Ohms, for +7 dBm input at Port RF | | | | | | |

Lorch Microwave's CP-13 Series, Low-Level Phase Comparators, are designed to accept RF input signal levels of up to +3 dBm. The CP-20 Series, High-Level Phase Comparators, are designed to accept RF input signal levels of up to +10 dBm.

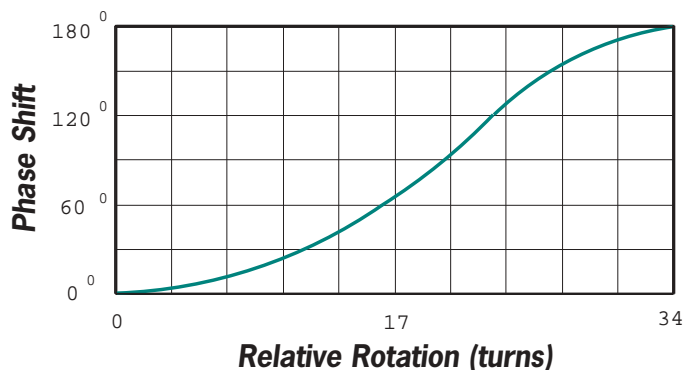


- 10 - 1000 MHz Frequency Range
- 10% Standard Bandwidth
- 0-90°, 0-180° and 0-360° Phase Shift Ranges
- Multi-Turn, Infinite Resolution
- Low Loss, High Phase Stability
- PC Mount and Connectorized

Typical Insertion Loss vs. Relative Rotation



Typical Phase Shift vs. Relative Rotation



Typical Performance Specifications

| Frequency (MHz) | Usable Bandwidth (%) | Phase Shift @ F_0 (°) | Insertion Loss (dB) | VSWR |
|-----------------|----------------------|-------------------------|---------------------|-------|
| 10-250 | 10 | 0-90 | 1.3 | 1.6:1 |
| 10-250 | 10 | 0-180 | 1.7 | 1.6:1 |
| 250-500 | 10 | 0-90 | 1.4 | 1.6:1 |
| 250-500 | 10 | 0-180 | 1.8 | 1.8:1 |

Notes:

- 1) Nominal impedance is 50 Ohms.
- 2) All units rated at 0.5 Watts average, 2 Watts peak.

RF Product — Digital Phase Shifters



- 1 - 1000 MHz Frequency Range
- Up to a Full Octave Bandwidth
- 0-360° Phase Shift
- Integral TTL Driver
- 1-8 Bit Control
- Accuracy to 1/2 Least Significant Bit
- Time Shifter or Frequency Independence

Characteristics

| Parameter | Type 1 | Type 2 |
|-------------|---------------------------|-----------------------------|
| Phase Shift | Independence of Frequency | Proportional to Frequency |
| Group Delay | Constant with Frequency | Proportional to Phase Shift |

Typical Performance Specifications

| Part Number | Type | # Bits | Center Frequency (MHz) | Bandwidth (MHz) | VSWR Typ. | Insertion Loss (dB) Typ. | Phase Error / Bit (°) Typ. |
|------------------|------|--------|------------------------|-----------------|-----------|--------------------------|----------------------------|
| DP-1-6-70-10-75 | 1 | 6 | 70 | 10 | 1.6:1 | 8 | +/- 1.5 |
| DP-1-6-305-30-75 | 1 | 6 | 305 | 30 | 1.6:1 | 8 | +/- 2 |
| DP-1-8-80-8-77 | 1 | 8 | 80 | 8 | 1.6:1 | 9 | +/- 2 |
| DP-1-8-370-5-77 | 1 | 8 | 370 | 5 | 1.6:1 | 9 | +/- 2 |
| DP-2-4-295-10-73 | 2 | 4 | 295 | 10 | 1.6:1 | 5.5 | +/- 1.5 |
| DP-2-6-255-30-75 | 2 | 6 | 255 | 30 | 1.6:1 | 7 | +/- 1.5 |
| DP-2-8-350-3-77 | 2 | 8 | 350 | 3 | 1.8:1 | 9 | +/- 2 |
| DP-2-8-860-80-77 | 2 | 8 | 860 | 80 | 2.0:1 | 9.5 | +/- 3.5 |

Notes:

1) DC power supply requirements: +5VDC @ 20 mA, -5VDC @ 20 mA;

RF input power: +16 dBm max.;

Switching time: 100 ns max.

2) Please specify bit sequence, if other than standards

RF Product — Voltage Controlled Phase Shifters



- 1 - 4000 MHz Frequency Range
- 10%, 20% and 30% Bandwidths
- 0-90°, 0-180° and 0-360° Phase Shift Range
- Low Insertion Loss
- High Phase Stability
- Surface Mount, PC-Mount, Flatpack and Connectorized

Typical Performance Specifications

| Center Frequency (MHz) | % Bandwidth | Phase Shift (°) | Insertion Loss (dB) | VSWR | Max. Input Power (dBm) | Control Voltage (VDC) |
|------------------------|-------------|-----------------|---------------------|-------|------------------------|-----------------------|
| 0.5-50 | 10 | 0-90 | 1.0 | 1.4:1 | 0 | 0-15 |
| 0.5-50 | 10 | 0-180 | 1.5 | 1.5:1 | 0 | 0-15 |
| 0.5-50 | 10 | 0-360 | 3.0 | 1.6:1 | 0 | 0-15 |
| 0.5-50 | 20-30 | 0-90 | 1.2 | 1.5:1 | 0 | 0-15 |
| 0.5-50 | 20-30 | 0-180 | 1.6 | 1.6:1 | 0 | 0-15 |
| 0.5-50 | 20-30 | 0-360 | 3.2 | 1.7:1 | 0 | 0-15 |
| 50-500 | 10 | 0-90 | 1.0 | 1.4:1 | +5 | 0-15 |
| 50-500 | 10 | 0-180 | 1.5 | 1.5:1 | +5 | 0-15 |
| 50-500 | 10 | 0-360 | 3.0 | 1.6:1 | +5 | 0-15 |
| 50-500 | 20-30 | 0-90 | 1.2 | 1.5:1 | +5 | 0-15 |
| 50-500 | 20-30 | 0-180 | 1.6 | 1.6:1 | +5 | 0-15 |
| 50-500 | 20-30 | 0-360 | 3.2 | 1.7:1 | +5 | 0-15 |
| 500-2000 | 10 | 0-90 | 1.5 | 1.6:1 | +10 | 0-10 |
| 500-2000 | 10 | 0-180 | 2.0 | 1.8:1 | +10 | 0-10 |
| 500-2000 | 10 | 0-360 | 4.0 | 1.8:1 | +10 | 0-10 |
| 500-2000 | 20-30 | 0-90 | 1.7 | 1.6:1 | +10 | 0-10 |
| 500-2000 | 20-30 | 0-180 | 2.2 | 1.8:1 | +10 | 0-10 |
| 500-2000 | 20-30 | 0-360 | 4.0 | 2.0:1 | +10 | 0-10 |
| 2000-3000 | 10 | 0-90 | 1.8 | 1.7:1 | +10 | 0-10 |
| 2000-3000 | 10 | 0-180 | 2.3 | 1.8:1 | +10 | 0-10 |
| 2000-3000 | 10 | 0-360 | 4.5 | 2.0:1 | +10 | 0-10 |
| 2000-3000 | 20-30 | 0-90 | 2.0 | 1.8:1 | +10 | 0-10 |
| 2000-3000 | 20-30 | 0-180 | 2.6 | 1.8:1 | +10 | 0-10 |
| 2000-3000 | 20-30 | 0-360 | 5.0 | 2.0:1 | +10 | 0-10 |

RF Products — Voltage Controlled Attenuators

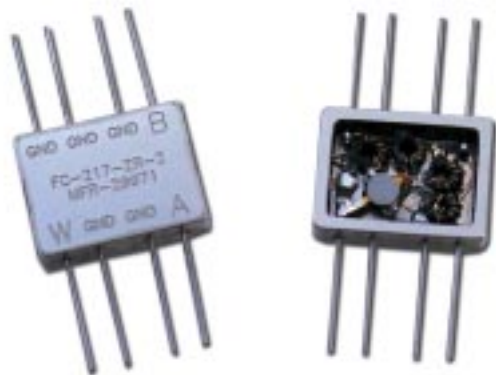


- 1 - 3000 MHz Frequency Range
- Single Control Voltage
- Low Signal Distortion
- Low Insertion Loss
- Wide Attenuation Range
- Surface Mount, PC-Mount, Connectorized

Typical Performance Specifications

| Center Frequency (MHz) | % Bandwidth | Attenuation Range (dB) | Insertion Loss (dB) @ Vc = OVDC | VSWR @ Vc = OVDC | Max. Input Power (dBm) | Control Voltage, VC @ 10 mA max. (VDC) |
|------------------------|-------------|------------------------|---------------------------------|------------------|------------------------|--|
| 0.5-500 | 10 | 0-20 | 0.6 | 1.4:1 | +15 | 0-5 |
| 0.5-500 | 10 | 0-40 | 1.2 | 1.4:1 | +15 | 0-5 |
| 0.5-500 | 20-30 | 0-20 | 0.8 | 1.4:1 | +15 | 0-5 |
| 0.5-500 | 20-30 | 0-40 | 1.6 | 1.4:1 | +15 | 0-5 |
| 500-1000 | 10 | 0-18 | 0.8 | 1.5:1 | +20 | 0-5 |
| 500-1000 | 10 | 0-35 | 1.6 | 1.5:1 | +20 | 0-5 |
| 500-1000 | 20-30 | 0-18 | 0.9 | 1.6:1 | +20 | 0-5 |
| 500-1000 | 20-30 | 0-35 | 1.8 | 1.6:1 | +20 | 0-5 |
| 1000-2000 | 10 | 0-18 | 1.2 | 1.6:1 | +20 | 0-5 |
| 1000-2000 | 10 | 0-35 | 2.4 | 1.6:1 | +20 | 0-5 |
| 1000-2000 | 20-30 | 0-18 | 1.5 | 1.8:1 | +20 | 0-5 |
| 1000-2000 | 20-30 | 0-35 | 3.0 | 1.8:1 | +20 | 0-5 |
| 2000-3000 | 10 | 0-15 | 1.5 | 1.8:1 | +20 | 0-5 |
| 2000-3000 | 10 | 0-30 | 3.0 | 2.0:1 | +20 | 0-5 |
| 2000-3000 | 20-30 | 0-15 | 1.7 | 2.0:1 | +20 | 0-5 |
| 2000-3000 | 20-30 | 0-30 | 3.5 | 2.0:1 | +20 | 0-5 |

RF Product — Broad Band Mixers



- 50 kHz - 4000 MHz Frequency Range
- Wide Range and Optimized Bands
- High Dynamic Range
- Low Insertion Loss
- High Isolation
- PC Mount, Flatpack and Connectorized

Typical Performance Specifications

| Part Number | LO Power | Frequency Range MHz | | Performance Bandwidth, MHz Ports LO & RF | Conversion Loss dB (max.) | Isolation | | 1-dB Input Comp. Level (typ.) | 3rd Order Intercept Point (typ.) |
|----------------|----------|---------------------|---------|---|------------------------------|----------------------|----------------------|----------------------------------|----------------------------------|
| | | Ports LO & RF | Port IF | | | LO - RF dB (min.) | LO - IF dB (min.) | | |
| FC-7-0.05-100 | +7 dBm | 0.05-100 | DC-100 | 0.05-0.1 | 7.5 | 50 | 50 | 0 dBm | +13 dBm |
| | | | | 0.1-10 | 6.0 | 50 | 50 | | |
| | | | | 10-60 | 6.0 | 35 | 30 | | |
| | | | | 60-100 | 7.5 | 35 | 30 | | |
| FC-7-0.2-600 | +7 dBm | 0.2-600 | DC-600 | 0.2-0.4 | 8.0 | 50 | 50 | 0 dBm | +13 dBm |
| | | | | 0.4-40 | 6.0 | 50 | 45 | | |
| | | | | 40-150 | 6.0 | 50 | 35 | | |
| | | | | 150-600 | 8.0 | 40 | 30 | | |
| FC-7-2-1200 | +7 dBm | 2-1200 | DC-1200 | 2-500 | 8.0 | 35 | 30 | 0 dBm | +13 dBm |
| | | | | 500-1000 | 8.0 | 30 | 30 | | |
| | | | | 1000-1200 | 8.5 | 25 | 25 | | |
| FC-10-10-2000 | +10 dBm | 10-2000 | 10-2000 | 10-50 | 7.5 | 40 | 30 | +3 dBm | +15 dBm |
| | | | | 50-500 | 7.5 | 35 | 25 | | |
| | | | | 500-1000 | 8.0 | 30 | 20 | | |
| | | | | 1000-2000 | 9.0 | 25 | 20 | | |
| FC-10-10-3000 | +10 dBm | 10-3000 | 10-2000 | 10-500 | 8.0 | 25 | 20 | +3 dBm | +15 dBm |
| | | | | 500-1000 | 9.0 | 30 | 25 | | |
| | | | | 1000-3000 | 10.0 | 25 | 18 | | |
| FC-20-0.05-100 | +20 dBm | 0.05-100 | DC-100 | 0.05-10 | 6.5 | 45 | 40 | +13 dBm | +27 dBm |
| | | | | 10-60 | 6.5 | 35 | 25 | | |
| | | | | 60-100 | 7.5 | 35 | 25 | | |
| FC-20-0.2-500 | +20 dBm | 0.2-500 | DC-500 | 0.2-25 | 7.0 | 50 | 40 | +13 dBm | +27 dBm |
| | | | | 25-50 | 7.0 | 45 | 35 | | |
| | | | | 50-150 | 7.0 | 30 | 25 | | |
| | | | | 150-500 | 8.0 | 30 | 25 | | |

Notes:

1) Nominal impedance is 50 Ohms.

2) DC polarity is negative.