# SPDT RF SWITCH

50Ω DC-3000 MHz

## Absorptive RF Switch with internal driver. Single Supply Voltage

## ZX80-DR230+

CASE STYLE: HL1162

| Connectors | Order P/N |
|---|---|
| **SMA** | ZX80-DR230-S+ |

***+RoHS Compliant***
*The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications*

### Product Features

- Low Insertion loss over entire frequency range
- Super High Isolation over entire frequency range
- High Input IP3, +55 dBm typ.
- Single positive supply voltage, +2.7V to +5V
- Unique design-simultaneous switch off of RF1&RF2
- Rigid unibody case

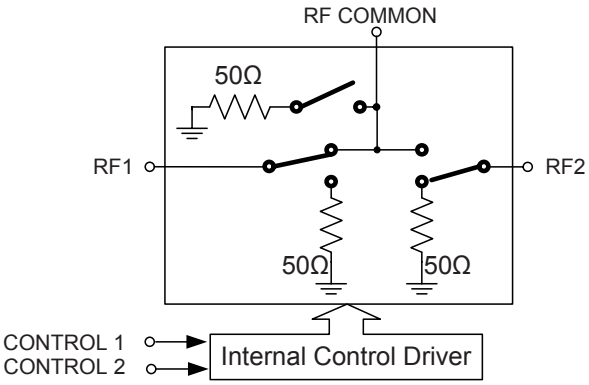
### Typical Applications

- Lab
- Instrumentation
- Test equipment

### General Description

The ZX80-DR230+ is a 50Ω high isolation SPDT RF switch designed for wireless applications, covering a broad frequency range from DC up to 3GHz with low insertion loss. The ZX80-DR230+ operates on a single supply voltage from +2.7V to +5V. This unit includes an internal CMOS control driver with two-pins control. The ZX80-DR230+ is produced using a unique case package for ruggedness and operation in tough environments.

### Functional Diagram



| Parameter | Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Operating Frequency | | DC (note 3) | | 3000 | MHz |
| Insertion Loss | 1 GHz<br>2 GHz<br>3 GHz | | 0.7<br>0.9<br>1.2 | 1.3<br>1.6<br>1.8 | dB |
| Isolation between Common port and RF1/RF2 ports | 1 GHz<br>2 GHz<br>3 GHz | 55<br>46<br>35 | 64<br>50<br>44 | | dB |
| Isolation between RF1 and RF2 ports | 1 GHz<br>2 GHz<br>3 GHz | 60<br>54<br>37 | 63<br>60<br>48 | | dB |
| Return Loss @ Common port | 1 GHz<br>2 GHz<br>3 GHz | | 20<br>17<br>15 | | dB |
| Return Loss @ RF1/RF2 ports | 1 GHz<br>2 GHz<br>3 GHz | | 17<br>15<br>15 | | dB |
| Input IP2 (note 1) | 5 MHz - 1000 MHz | | +80 | | dBm |
| Input IP3 (note 1) | 10 MHz - 3000MHz | | +55 | | dBm |
| Input 1dB Compression (note 1,2) | 1000 MHz | +28 | +31 | | dBm |

Notes:
1. Device linearity degrades below 1 MHz.
2. Note absolute maximum ratings for input power.
3. Lowest Freq. determined by value of coupling capacitors at RF ports.

## DC Electrical Specifications

| Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|
| $V_{DD}$, Supply Voltage | 2.7 | - | 5.0 | V |
| Supply Current ($V_{DD}$ = 5V) | — | 0.5 | 1.0 | mA |
| Control Voltage Low | 0 | — | 0.4 | V |
| Control Voltage High | 2.4 | — | $V_{DD}$ | V |
| Control Current (per pin) | — | 0.5 | 1.0 | mA |

## Switching Specifications

| Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|
| Switching Time, 50% CTRL to 90/10% RF | — | 2.0 | — | μSec |
| Video Feedthrough, 5 MHz - 1000 MHz (note 4) | — | — | 15 | $mV_{p-p}$ |

Note 4: Measured with a 1 nSec risetime,0/3V pulse and 500 MHz bandwidth.

## Absolute Maximum Ratings

| Parameter | Ratings |
|---|---|
| Operating Temperature | -40°C to 85°C |
| Storage Temperature | -55°C to 100°C |
| $V_{DD}$, Supply Voltage | -0.3V Min. 6V Max. |
| Control Voltage | -0.3V Min. 6V Max. |
| ESD, HBM | 1000V |
| RF input power: (note 5)<br>When the common port is connected to the RF port (RF1 or RF2)<br>When the RF port (RF1 or RF2) is not connected to the common port<br>When the common port is not connected to either RF1 or RF2 | <br>+33dBm<br>+24dBm<br>+24dBm |

Note 5: See Truth Table on page 3.

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The RF switch control bits select the desired switch-state, as shown in **Table 1**: Truth Table.

**Table 1: Truth Table.**

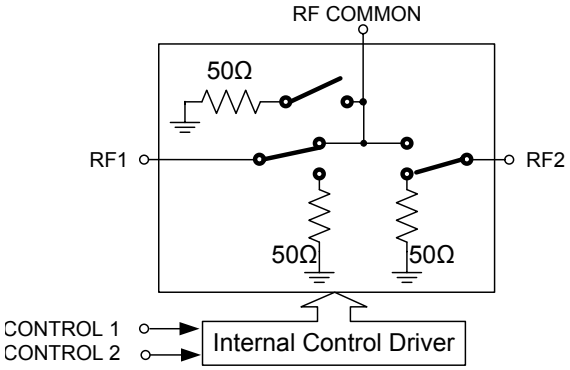
| STATE | Control Input | | RF Input / Output | |
|---|---|---|---|---|
| | Control 1 | Control 2 | RF1 to RF COMMON | RF2 to RF COMMON |
| 1 | Low | Low | OFF | OFF |
| 2 | Low | High | OFF | ON |
| 3 | High | Low | ON | OFF |
| 4 | High | High | N/A | N/A |

**General notes:**

1. When either of the RF1 or RF2 ports is closed (**ON** state), the closed port is connected to the RF Common port.
2. When either of the RF1 or RF2 ports is open (**OFF** state), the open port is connected to an internal 50Ω termination.
3. When both RF1 and RF2 ports are open (**OFF** state), the all three RF ports are connected to an internal 50Ω termination.

**EXAMPLE OF STATE 3**

**Functional Diagram**

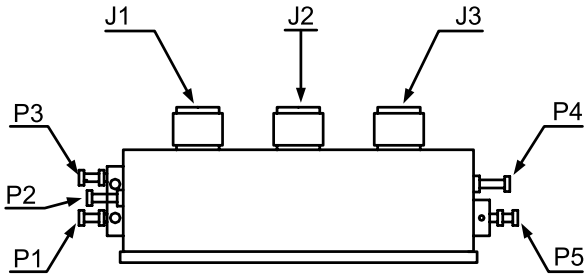



**Pin Description**

| Function | Connection Number | Description | |
|---|---|---|---|
| RF2 | J1 | RF I/O | (note 1) |
| RF COM | J2 | RF Common | (note 1) |
| RF1 | J3 | RF I/O | (note 1) |
| Control 1 | P1 | Control 1 | |
| GND | P2 | Ground | |
| Control 2 | P3 | Control 2 | |
| GND | P4 | Ground | |
| VDD | P5 | Supply voltage | |

Note 1: RF ports J1, J2 and J3 must be at 0 VDC. The RF ports do not require DC blocking capacitors for proper operation if the 0 VDC requirement is met.

**Pin Configuration**




*NOTE: When soldering the DC connections, caution must be used to avoid overheating the DC terminals. See Application Note AN-40-10 .*

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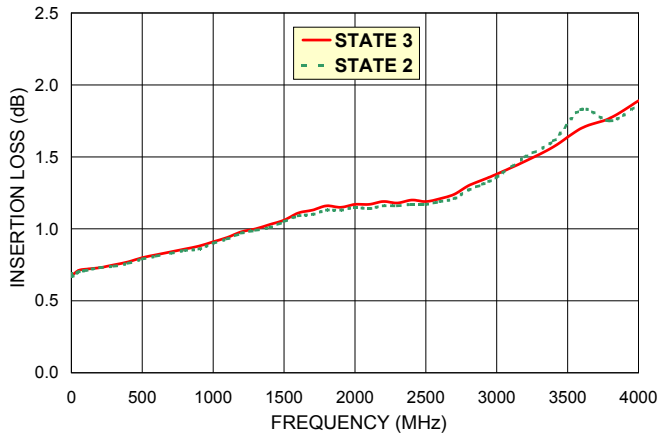
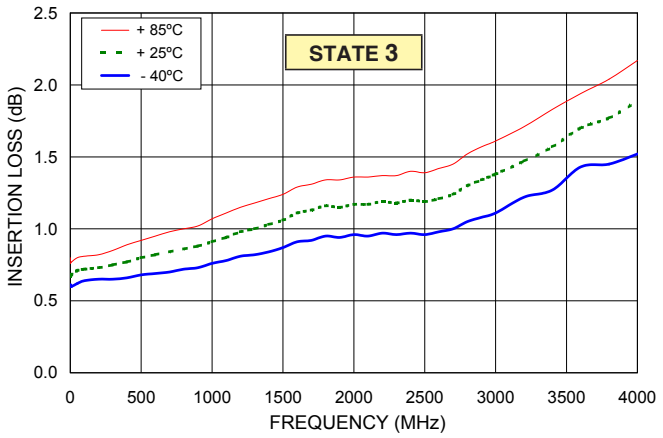
**Typical Performance Curves over various states. For switch state see Truth Table 1 on page 3.**

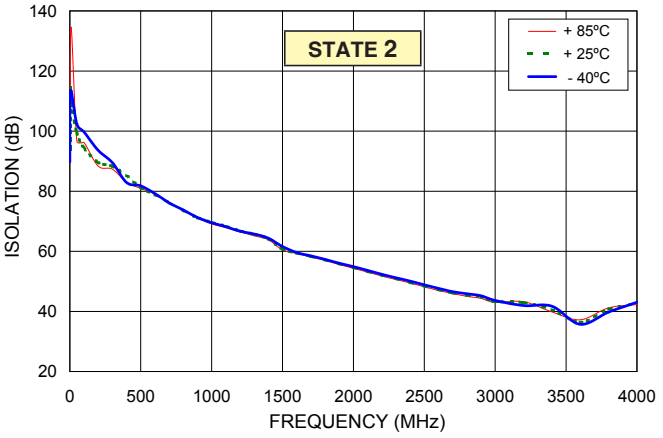
INSERTION LOSS Vs. FREQUENCY @ +25°C



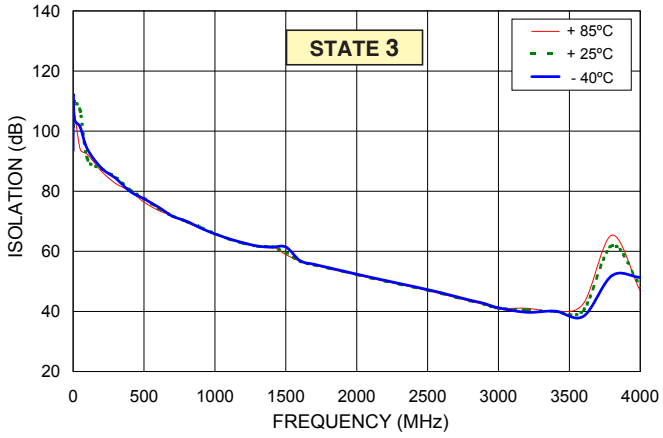

INSERTION LOSS Vs. FREQUENCY



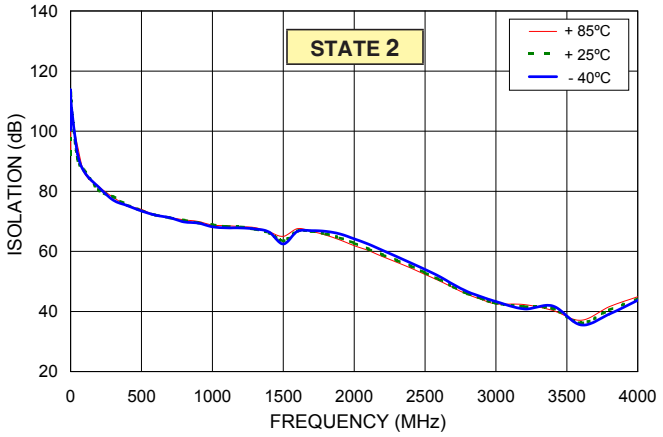

ISOLATION BETWEEN RF1 TO RF COM Vs. FREQUENCY



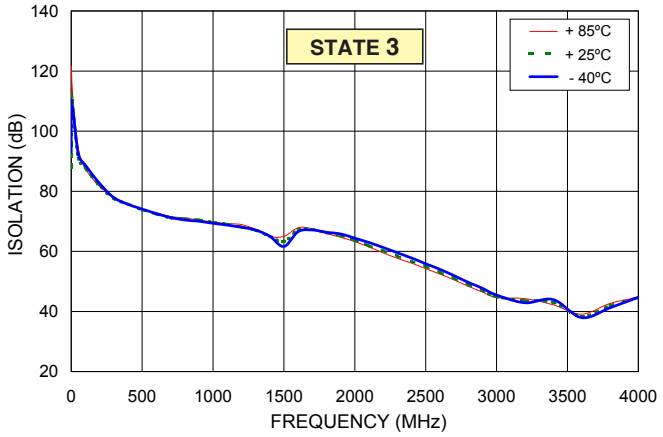

ISOLATION BETWEEN RF2 TO RF COM Vs. FREQUENCY




ISOLATION BETWEEN RF1 TO RF2 Vs. FREQUENCY




ISOLATION BETWEEN RF1 TO RF2 Vs. FREQUENCY

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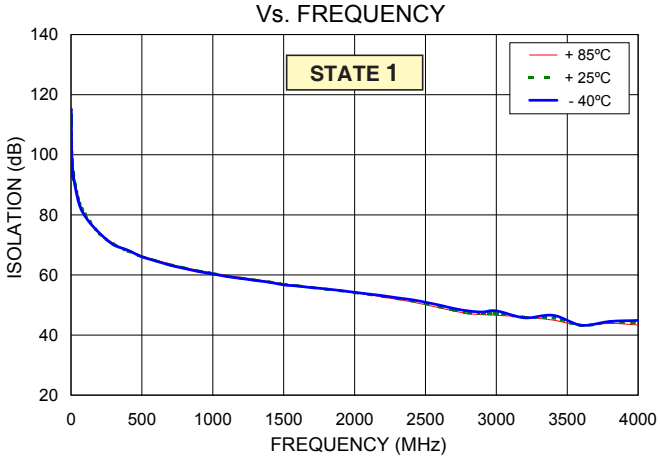
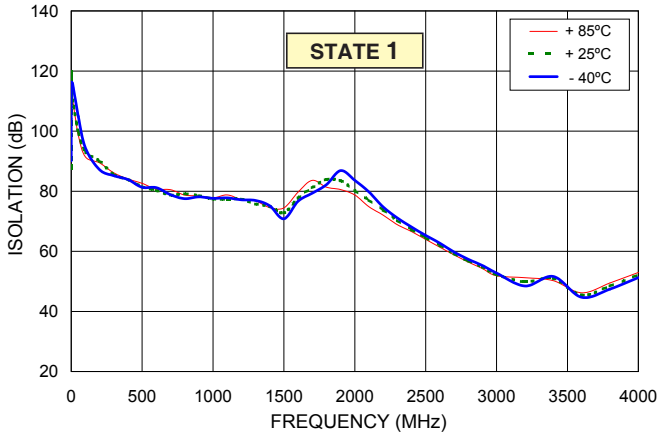
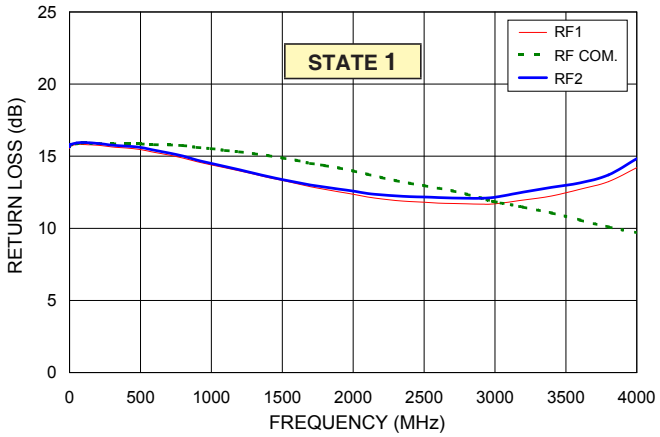
ISOLATION BETWEEN RF1/RF2 TO RF COM
Vs. FREQUENCY



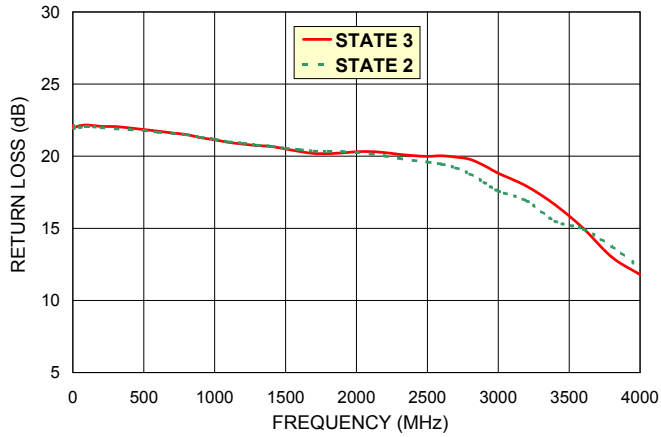

ISOLATION BETWEEN RF1 TO RF2
Vs. FREQUENCY



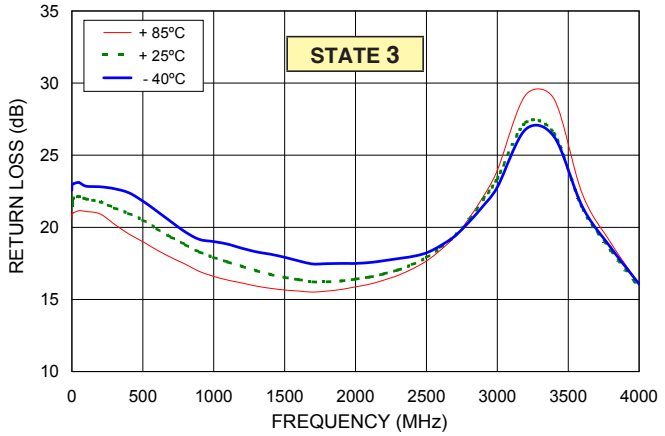

RF RETURN LOSS Vs. FREQUENCY @ +25°C



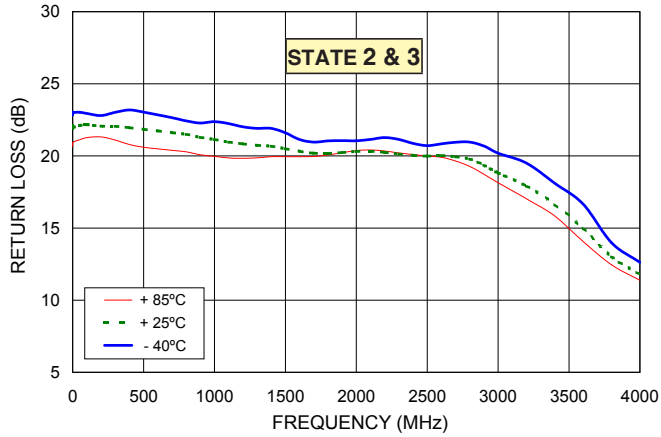

RF COM RETURN LOSS Vs. FREQUENCY @ +25°C




RF1 RETURN LOSS Vs. FREQUENCY




RF COM RETURN LOSS Vs. FREQUENCY

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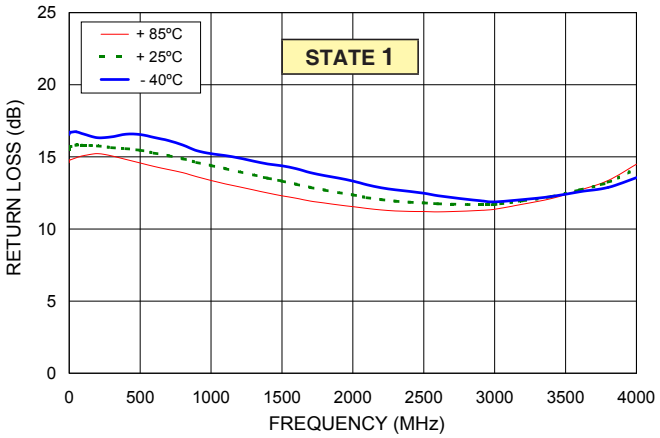
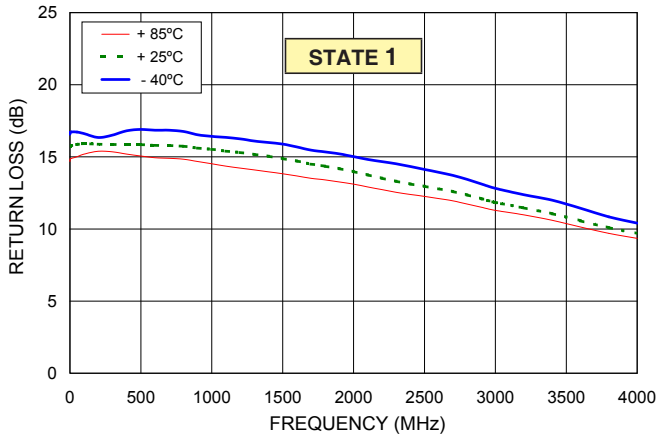
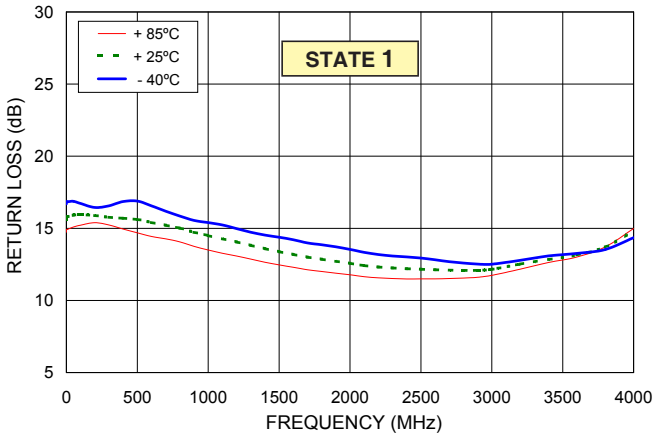


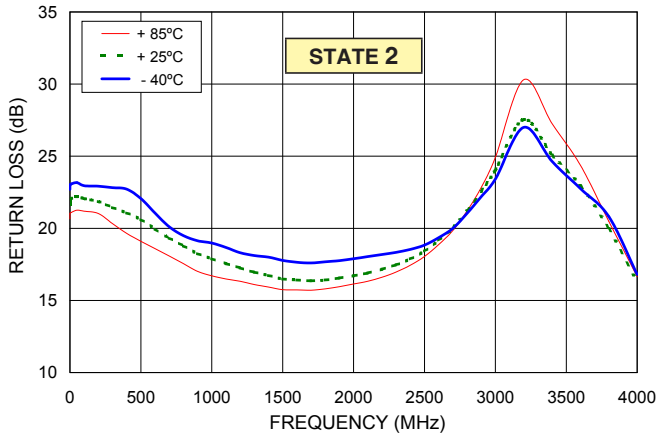

RF COM RETURN LOSS Vs. FREQUENCY



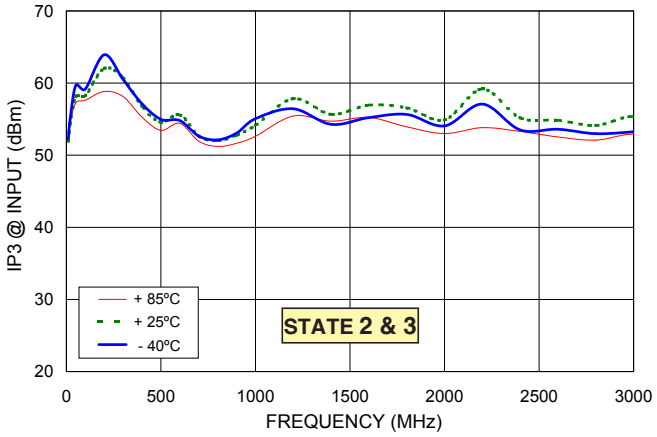

RF2 RETURN LOSS Vs. FREQUENCY



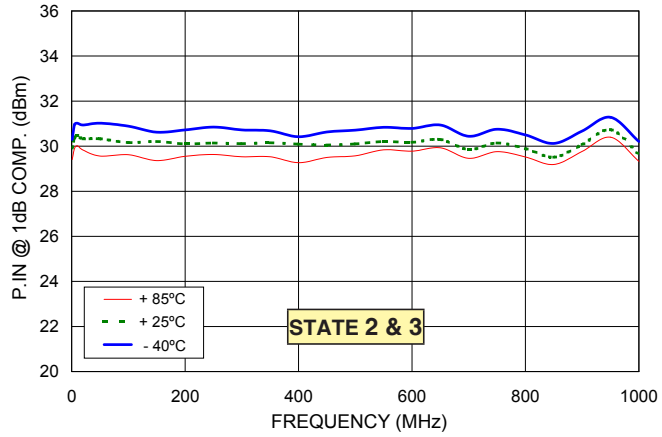

RF2 RETURN LOSS Vs. FREQUENCY




INPUT IP3 Vs. FREQUENCY




POWER IN @ 1dB COMPRESSION Vs. FREQUENCY

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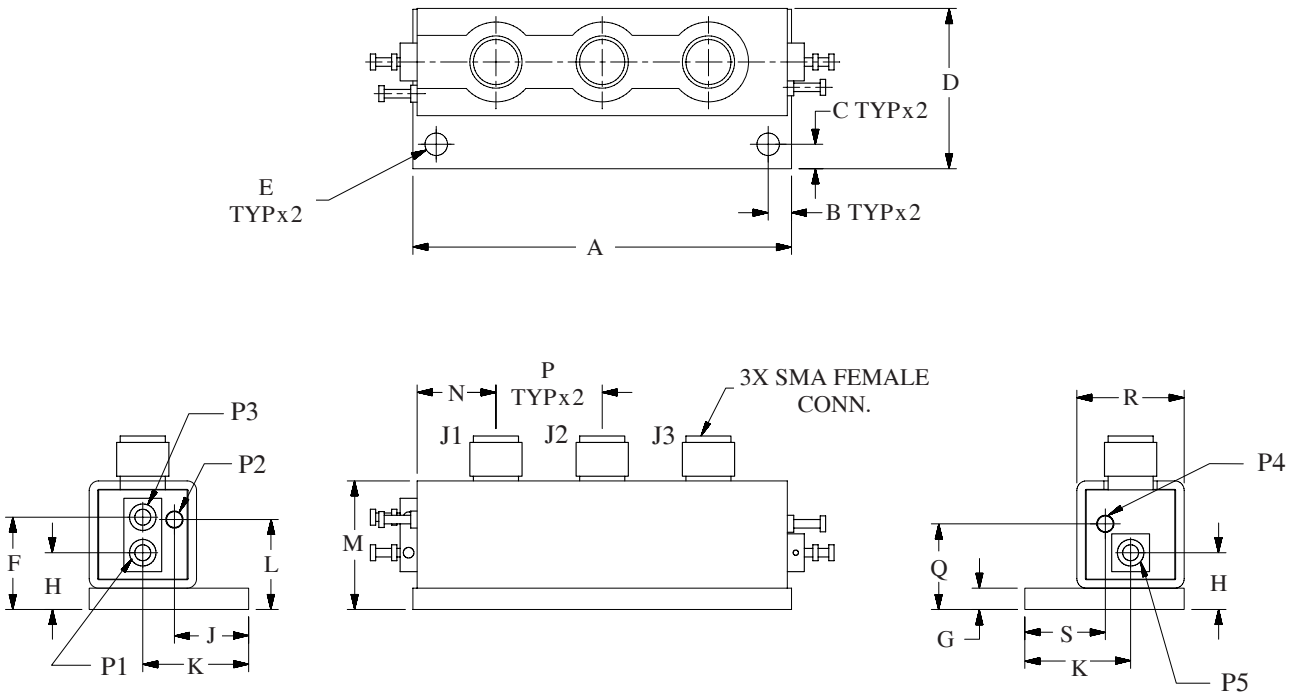
## Outline Drawing (HL1162)




## Outline Dimensions ( inch / mm )

| A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | WT. GRAMS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.780** | **.110** | **.115** | **.750** | **.106** | **.430** | **.100** | **.270** | **.350** | **.500** | **.420** | **.610** | **.370** | **.500** | **.400** | **.500** | **.380** | 56.0 |
| 45.21 | 2.79 | 2.92 | 19.05 | 2.69 | 10.92 | 2.54 | 6.86 | 8.89 | 12.70 | 10.67 | 15.49 | 9.39 | 12.70 | 10.16 | 12.70 | 9.65 | |

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# RF Switch SPDT

# ZX80-DR230+

## *Typical Performance Data*

| FREQ (MHz) | INSERTION LOSS @ Vdd=+3V OVER TEMPERATURE | | | | | |
|---|---|---|---|---|---|---|
| | RF COM-RF1 (dB) *STATE 3** | | | RF COM-RF2 (dB) *STATE 2** | | |
| | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C |
| 0.03 | 0.61 | 0.68 | 0.80 | 0.61 | 0.69 | 0.78 |
| 0.10 | 0.61 | 0.68 | 0.78 | 0.60 | 0.68 | 0.76 |
| 1.00 | 0.60 | 0.67 | 0.76 | 0.59 | 0.67 | 0.75 |
| 10.00 | 0.60 | 0.68 | 0.77 | 0.59 | 0.67 | 0.76 |
| 50.00 | 0.62 | 0.71 | 0.80 | 0.62 | 0.70 | 0.79 |
| 100.00 | 0.64 | 0.72 | 0.81 | 0.63 | 0.71 | 0.79 |
| 200.00 | 0.65 | 0.73 | 0.82 | 0.64 | 0.73 | 0.81 |
| 300.00 | 0.65 | 0.75 | 0.85 | 0.64 | 0.74 | 0.83 |
| 400.00 | 0.66 | 0.77 | 0.89 | 0.65 | 0.76 | 0.87 |
| 500.00 | 0.68 | 0.80 | 0.92 | 0.67 | 0.79 | 0.90 |
| 600.00 | 0.69 | 0.82 | 0.95 | 0.68 | 0.81 | 0.93 |
| 700.00 | 0.70 | 0.84 | 0.98 | 0.70 | 0.83 | 0.95 |
| 800.00 | 0.72 | 0.86 | 1.00 | 0.72 | 0.85 | 0.98 |
| 900.00 | 0.73 | 0.88 | 1.02 | 0.72 | 0.86 | 1.00 |
| 1000.00 | 0.76 | 0.91 | 1.07 | 0.75 | 0.90 | 1.04 |
| 1100.00 | 0.78 | 0.94 | 1.11 | 0.77 | 0.93 | 1.09 |
| 1200.00 | 0.81 | 0.98 | 1.15 | 0.80 | 0.97 | 1.12 |
| 1300.00 | 0.82 | 1.00 | 1.18 | 0.82 | 0.99 | 1.15 |
| 1400.00 | 0.84 | 1.03 | 1.21 | 0.84 | 1.01 | 1.18 |
| 1500.00 | 0.87 | 1.06 | 1.24 | 0.87 | 1.05 | 1.22 |
| 1600.00 | 0.91 | 1.11 | 1.29 | 0.90 | 1.09 | 1.26 |
| 1700.00 | 0.92 | 1.13 | 1.31 | 0.91 | 1.10 | 1.28 |
| 1800.00 | 0.95 | 1.16 | 1.34 | 0.93 | 1.13 | 1.31 |
| 1900.00 | 0.94 | 1.15 | 1.34 | 0.93 | 1.13 | 1.31 |
| 2000.00 | 0.96 | 1.17 | 1.36 | 0.94 | 1.15 | 1.32 |
| 2100.00 | 0.95 | 1.17 | 1.36 | 0.94 | 1.14 | 1.32 |
| 2200.00 | 0.97 | 1.19 | 1.37 | 0.95 | 1.16 | 1.34 |
| 2300.00 | 0.96 | 1.18 | 1.37 | 0.95 | 1.16 | 1.34 |
| 2400.00 | 0.97 | 1.20 | 1.40 | 0.96 | 1.17 | 1.36 |
| 2500.00 | 0.96 | 1.19 | 1.39 | 0.95 | 1.17 | 1.36 |
| 2600.00 | 0.98 | 1.21 | 1.42 | 0.97 | 1.19 | 1.38 |
| 2700.00 | 1.00 | 1.24 | 1.45 | 0.98 | 1.21 | 1.42 |
| 2800.00 | 1.05 | 1.30 | 1.52 | 1.04 | 1.27 | 1.48 |
| 2900.00 | 1.08 | 1.34 | 1.57 | 1.07 | 1.31 | 1.52 |
| 3000.00 | 1.11 | 1.38 | 1.61 | 1.11 | 1.36 | 1.59 |

| FREQ (MHz) | ISOLATION @ Vdd=+3V OVER TEMPERATURE | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RF COM-RF1 (dB) *STATE 2** | | | RF COM-RF2 (dB) *STATE 3** | | | RF1-RF2 (dB) *STATE 3** | | | RF1-RF2 (dB) *STATE 2** | | | RF1-RF2 (dB) *STATE 1** | | |
| | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C |
| 0.03 | 89.73 | 94.01 | 100.85 | 93.46 | 101.47 | 99.91 | 93.00 | 88.02 | 100.88 | 100.32 | 92.21 | 92.62 | 90.14 | 87.58 | 91.27 |
| 0.10 | 106.25 | 101.43 | 105.63 | 99.29 | 107.24 | 103.32 | 110.07 | 104.50 | 107.04 | 113.47 | 102.37 | 108.68 | 104.08 | 119.07 | 100.94 |
| 1.00 | 109.64 | 114.25 | 109.23 | 112.10 | 105.73 | 104.43 | 104.60 | 112.14 | 121.37 | 111.33 | 112.84 | 109.36 | 116.24 | 110.61 | 107.42 |
| 10.00 | 113.35 | 108.84 | 134.49 | 103.90 | 109.75 | 106.29 | 107.86 | 109.10 | 112.58 | 106.46 | 105.94 | 104.85 | 115.81 | 110.37 | 110.14 |
| 50.00 | 102.32 | 99.37 | 96.65 | 101.37 | 106.77 | 94.03 | 92.39 | 90.95 | 94.49 | 92.31 | 90.63 | 94.88 | 104.92 | 99.71 | 98.63 |
| 100.00 | 99.69 | 94.35 | 96.18 | 94.02 | 90.73 | 92.32 | 88.66 | 87.66 | 87.46 | 86.19 | 86.60 | 85.85 | 94.36 | 93.16 | 91.40 |
| 200.00 | 93.61 | 89.60 | 88.36 | 87.69 | 87.52 | 86.64 | 82.62 | 81.77 | 81.66 | 81.30 | 80.38 | 81.51 | 87.19 | 90.04 | 89.44 |
| 300.00 | 89.53 | 88.29 | 87.34 | 84.28 | 84.66 | 82.54 | 77.91 | 77.55 | 78.19 | 77.05 | 78.19 | 77.96 | 85.15 | 85.50 | 86.12 |
| 400.00 | 82.90 | 85.26 | 82.96 | 79.98 | 80.46 | 80.05 | 75.67 | 75.73 | 75.79 | 75.23 | 75.41 | 75.28 | 83.89 | 83.86 | 84.05 |
| 500.00 | 81.78 | 81.21 | 80.94 | 77.50 | 77.67 | 76.37 | 74.07 | 73.81 | 73.98 | 73.45 | 73.58 | 73.95 | 81.29 | 81.51 | 82.63 |
| 600.00 | 79.22 | 78.85 | 79.08 | 74.77 | 74.31 | 73.68 | 72.55 | 72.43 | 72.83 | 72.05 | 72.07 | 71.98 | 81.19 | 80.26 | 80.70 |
| 700.00 | 76.12 | 76.18 | 76.35 | 71.70 | 71.79 | 71.78 | 71.28 | 71.15 | 71.59 | 71.21 | 71.18 | 71.26 | 78.83 | 78.72 | 80.51 |
| 800.00 | 73.76 | 73.58 | 73.70 | 70.03 | 69.92 | 69.57 | 70.45 | 70.85 | 71.12 | 69.81 | 70.37 | 70.47 | 77.54 | 79.16 | 78.74 |
| 900.00 | 71.26 | 71.17 | 71.07 | 67.73 | 68.01 | 67.65 | 70.03 | 70.49 | 70.41 | 69.43 | 69.49 | 69.94 | 78.13 | 78.49 | 78.43 |
| 1000.00 | 69.48 | 69.66 | 69.12 | 65.78 | 65.81 | 65.73 | 69.33 | 69.68 | 69.78 | 68.19 | 68.84 | 68.76 | 77.64 | 77.39 | 77.80 |
| 1100.00 | 68.21 | 68.35 | 67.87 | 64.16 | 64.10 | 64.04 | 68.75 | 69.07 | 69.28 | 67.83 | 68.24 | 68.57 | 77.80 | 77.32 | 78.78 |
| 1200.00 | 66.69 | 66.83 | 66.51 | 62.83 | 62.69 | 62.62 | 68.01 | 68.08 | 68.92 | 67.80 | 68.14 | 68.25 | 77.14 | 77.36 | 77.25 |
| 1300.00 | 65.76 | 65.65 | 65.16 | 61.74 | 61.69 | 61.66 | 67.11 | 67.00 | 67.35 | 67.46 | 67.33 | 67.91 | 76.91 | 75.76 | 76.76 |
| 1400.00 | 64.40 | 64.14 | 63.86 | 61.36 | 61.56 | 61.62 | 65.07 | 65.05 | 65.05 | 66.42 | 66.17 | 66.52 | 75.18 | 74.95 | 74.56 |
| 1500.00 | 61.59 | 60.71 | 60.46 | 61.42 | 59.62 | 58.91 | 61.63 | 63.31 | 64.96 | 62.47 | 63.48 | 64.99 | 70.83 | 72.79 | 74.47 |
| 1600.00 | 59.58 | 59.41 | 59.28 | 56.88 | 56.67 | 56.69 | 66.55 | 67.22 | 67.89 | 66.67 | 66.78 | 67.55 | 76.70 | 77.74 | 79.72 |
| 1700.00 | 58.48 | 58.28 | 58.08 | 55.68 | 55.47 | 55.49 | 67.12 | 67.35 | 67.58 | 66.88 | 66.67 | 66.66 | 79.33 | 81.15 | 83.63 |
| 1800.00 | 57.32 | 57.15 | 56.97 | 54.60 | 54.42 | 54.26 | 66.34 | 66.15 | 65.97 | 66.65 | 65.81 | 65.40 | 82.17 | 83.90 | 81.35 |
| 1900.00 | 56.04 | 55.88 | 55.57 | 53.48 | 53.36 | 53.16 | 65.79 | 65.23 | 64.69 | 65.79 | 64.47 | 63.78 | 86.88 | 83.49 | 80.56 |
| 2000.00 | 54.88 | 54.64 | 54.35 | 52.41 | 52.26 | 52.13 | 64.38 | 63.66 | 63.25 | 64.16 | 62.71 | 61.91 | 83.60 | 80.23 | 78.75 |
| 2100.00 | 53.64 | 53.31 | 53.07 | 51.34 | 51.15 | 51.07 | 62.96 | 61.91 | 61.44 | 62.44 | 60.79 | 60.29 | 79.76 | 77.12 | 74.85 |
| 2200.00 | 52.37 | 52.10 | 51.80 | 50.31 | 50.10 | 49.98 | 61.27 | 60.19 | 59.52 | 60.35 | 58.86 | 58.25 | 74.76 | 73.74 | 72.04 |
| 2300.00 | 51.17 | 50.90 | 50.63 | 49.28 | 49.11 | 48.97 | 59.53 | 58.44 | 57.69 | 58.27 | 57.01 | 56.35 | 71.07 | 70.28 | 68.84 |
| 2400.00 | 50.07 | 49.63 | 49.43 | 48.31 | 48.08 | 47.96 | 57.80 | 56.76 | 56.11 | 56.13 | 55.08 | 54.43 | 68.09 | 67.22 | 66.60 |
| 2500.00 | 48.82 | 48.46 | 48.21 | 47.26 | 47.07 | 46.86 | 55.89 | 55.01 | 54.26 | 53.98 | 52.89 | 52.33 | 65.29 | 64.56 | 63.97 |
| 2600.00 | 47.66 | 47.25 | 46.93 | 46.16 | 45.95 | 45.77 | 54.01 | 53.03 | 52.45 | 51.67 | 50.68 | 50.19 | 62.69 | 61.95 | 61.37 |
| 2700.00 | 46.58 | 46.14 | 45.97 | 44.95 | 44.73 | 44.56 | 51.94 | 50.98 | 50.54 | 49.00 | 48.24 | 47.90 | 59.78 | 59.23 | 58.82 |
| 2800.00 | 45.88 | 45.41 | 45.02 | 43.72 | 43.52 | 43.38 | 49.69 | 48.93 | 48.40 | 46.55 | 45.91 | 45.66 | 57.35 | 56.84 | 56.44 |
| 2900.00 | 45.19 | 44.89 | 44.35 | 42.63 | 42.35 | 42.23 | 47.69 | 46.98 | 46.45 | 44.84 | 44.31 | 43.96 | 55.28 | 54.83 | 54.24 |
| 3000.00 | 43.67 | 43.27 | 43.02 | 41.18 | 41.07 | 40.98 | 45.48 | 44.91 | 44.62 | 43.31 | 42.77 | 42.54 | 52.78 | 52.28 | 51.85 |

***Note:***

| STATE | CONTROL INPUT | | RF Com to RF1 | RF Com to RF2 |
|---|---|---|---|---|
| | Control 1 | Control 2 | | |
| 1 | Low | Low | OFF | OFF |
| 2 | Low | High | OFF | ON |
| 3 | High | Low | ON | OFF |

## *Typical Performance Data*

| FREQ (MHz) | VSWR @ Vdd=+3V OVER TEMPERATURE | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RF COM (:1) *STATE 3** | | | RF COM (:1) *STATE 2** | | | RF1 (:1) *STATE 3** | | | RF1 (:1) *STATE 2** | | | RF2 (:1) *STATE 3** | | | RF2 (:1) *STATE 2** | | | RF COM (:1) *STATE 1** | | | RF1 (:1) *STATE 1** | | | RF2 (:1) *STATE 1** | | |
| | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C |
| 0.03 | 1.16 | 1.17 | 1.21 | 1.16 | 1.17 | 1.21 | 1.16 | 1.18 | 1.21 | 1.35 | 1.40 | 1.46 | 1.34 | 1.40 | 1.45 | 1.16 | 1.18 | 1.20 | 1.35 | 1.39 | 1.45 | 1.35 | 1.40 | 1.46 | 1.34 | 1.40 | 1.45 |
| 0.10 | 1.15 | 1.17 | 1.20 | 1.15 | 1.17 | 1.20 | 1.15 | 1.17 | 1.20 | 1.34 | 1.39 | 1.45 | 1.34 | 1.39 | 1.44 | 1.15 | 1.17 | 1.20 | 1.34 | 1.39 | 1.45 | 1.34 | 1.39 | 1.45 | 1.34 | 1.39 | 1.44 |
| 1.00 | 1.15 | 1.17 | 1.20 | 1.15 | 1.17 | 1.20 | 1.15 | 1.17 | 1.20 | 1.34 | 1.39 | 1.45 | 1.34 | 1.39 | 1.44 | 1.15 | 1.17 | 1.19 | 1.34 | 1.39 | 1.44 | 1.34 | 1.39 | 1.45 | 1.34 | 1.39 | 1.44 |
| 10.00 | 1.15 | 1.17 | 1.20 | 1.15 | 1.17 | 1.20 | 1.15 | 1.17 | 1.20 | 1.34 | 1.39 | 1.44 | 1.34 | 1.39 | 1.44 | 1.15 | 1.17 | 1.19 | 1.34 | 1.39 | 1.44 | 1.34 | 1.39 | 1.44 | 1.34 | 1.39 | 1.44 |
| 50.00 | 1.15 | 1.17 | 1.19 | 1.16 | 1.17 | 1.20 | 1.15 | 1.17 | 1.19 | 1.34 | 1.39 | 1.44 | 1.34 | 1.38 | 1.43 | 1.15 | 1.17 | 1.19 | 1.34 | 1.38 | 1.43 | 1.34 | 1.39 | 1.44 | 1.33 | 1.38 | 1.43 |
| 100.00 | 1.15 | 1.17 | 1.19 | 1.16 | 1.17 | 1.19 | 1.16 | 1.17 | 1.19 | 1.35 | 1.39 | 1.43 | 1.34 | 1.38 | 1.42 | 1.15 | 1.17 | 1.19 | 1.35 | 1.38 | 1.42 | 1.35 | 1.39 | 1.43 | 1.34 | 1.38 | 1.42 |
| 200.00 | 1.16 | 1.17 | 1.19 | 1.17 | 1.17 | 1.18 | 1.16 | 1.18 | 1.20 | 1.36 | 1.39 | 1.42 | 1.35 | 1.38 | 1.41 | 1.15 | 1.18 | 1.19 | 1.36 | 1.38 | 1.41 | 1.36 | 1.39 | 1.42 | 1.35 | 1.38 | 1.41 |
| 300.00 | 1.15 | 1.17 | 1.19 | 1.16 | 1.17 | 1.18 | 1.16 | 1.19 | 1.22 | 1.36 | 1.40 | 1.43 | 1.35 | 1.39 | 1.42 | 1.16 | 1.19 | 1.21 | 1.35 | 1.38 | 1.41 | 1.36 | 1.40 | 1.43 | 1.35 | 1.39 | 1.42 |
| 400.00 | 1.15 | 1.17 | 1.20 | 1.15 | 1.18 | 1.20 | 1.16 | 1.20 | 1.24 | 1.35 | 1.40 | 1.44 | 1.34 | 1.39 | 1.43 | 1.16 | 1.19 | 1.23 | 1.34 | 1.38 | 1.42 | 1.35 | 1.40 | 1.44 | 1.34 | 1.39 | 1.44 |
| 500.00 | 1.15 | 1.18 | 1.21 | 1.15 | 1.18 | 1.20 | 1.18 | 1.21 | 1.25 | 1.35 | 1.41 | 1.46 | 1.34 | 1.40 | 1.45 | 1.17 | 1.21 | 1.25 | 1.33 | 1.38 | 1.43 | 1.35 | 1.41 | 1.46 | 1.33 | 1.40 | 1.45 |
| 600.00 | 1.16 | 1.18 | 1.21 | 1.15 | 1.18 | 1.21 | 1.19 | 1.23 | 1.27 | 1.36 | 1.42 | 1.48 | 1.35 | 1.41 | 1.47 | 1.19 | 1.22 | 1.27 | 1.34 | 1.39 | 1.44 | 1.36 | 1.42 | 1.48 | 1.35 | 1.41 | 1.47 |
| 700.00 | 1.16 | 1.18 | 1.21 | 1.16 | 1.18 | 1.21 | 1.21 | 1.24 | 1.29 | 1.37 | 1.43 | 1.49 | 1.37 | 1.42 | 1.48 | 1.22 | 1.24 | 1.29 | 1.34 | 1.39 | 1.44 | 1.37 | 1.43 | 1.49 | 1.37 | 1.42 | 1.48 |
| 800.00 | 1.16 | 1.18 | 1.21 | 1.16 | 1.18 | 1.21 | 1.23 | 1.26 | 1.31 | 1.39 | 1.44 | 1.51 | 1.39 | 1.43 | 1.49 | 1.24 | 1.26 | 1.31 | 1.34 | 1.39 | 1.44 | 1.39 | 1.44 | 1.51 | 1.38 | 1.43 | 1.49 |
| 900.00 | 1.17 | 1.19 | 1.22 | 1.17 | 1.19 | 1.22 | 1.25 | 1.28 | 1.33 | 1.41 | 1.46 | 1.53 | 1.40 | 1.45 | 1.51 | 1.25 | 1.28 | 1.33 | 1.35 | 1.40 | 1.45 | 1.41 | 1.46 | 1.53 | 1.40 | 1.45 | 1.52 |
| 1000.00 | 1.16 | 1.19 | 1.22 | 1.17 | 1.19 | 1.22 | 1.25 | 1.29 | 1.35 | 1.42 | 1.47 | 1.55 | 1.41 | 1.46 | 1.53 | 1.25 | 1.29 | 1.34 | 1.36 | 1.40 | 1.46 | 1.42 | 1.47 | 1.55 | 1.41 | 1.46 | 1.54 |
| 1100.00 | 1.17 | 1.20 | 1.23 | 1.17 | 1.20 | 1.23 | 1.26 | 1.30 | 1.36 | 1.43 | 1.49 | 1.57 | 1.42 | 1.48 | 1.55 | 1.26 | 1.31 | 1.35 | 1.36 | 1.41 | 1.47 | 1.43 | 1.49 | 1.57 | 1.42 | 1.48 | 1.55 |
| 1200.00 | 1.17 | 1.20 | 1.23 | 1.18 | 1.20 | 1.23 | 1.27 | 1.32 | 1.37 | 1.44 | 1.50 | 1.58 | 1.44 | 1.49 | 1.57 | 1.28 | 1.32 | 1.36 | 1.36 | 1.41 | 1.48 | 1.44 | 1.50 | 1.58 | 1.43 | 1.49 | 1.57 |
| 1300.00 | 1.17 | 1.20 | 1.23 | 1.18 | 1.20 | 1.23 | 1.28 | 1.33 | 1.38 | 1.45 | 1.52 | 1.60 | 1.45 | 1.51 | 1.59 | 1.28 | 1.33 | 1.37 | 1.37 | 1.42 | 1.49 | 1.45 | 1.52 | 1.60 | 1.45 | 1.51 | 1.59 |
| 1400.00 | 1.17 | 1.20 | 1.22 | 1.18 | 1.20 | 1.23 | 1.28 | 1.34 | 1.39 | 1.46 | 1.53 | 1.62 | 1.46 | 1.53 | 1.61 | 1.29 | 1.34 | 1.38 | 1.38 | 1.43 | 1.50 | 1.46 | 1.53 | 1.62 | 1.46 | 1.53 | 1.61 |
| 1500.00 | 1.18 | 1.21 | 1.22 | 1.18 | 1.21 | 1.23 | 1.29 | 1.35 | 1.40 | 1.47 | 1.55 | 1.64 | 1.47 | 1.55 | 1.62 | 1.30 | 1.35 | 1.39 | 1.38 | 1.44 | 1.51 | 1.47 | 1.55 | 1.64 | 1.47 | 1.55 | 1.62 |
| 1600.00 | 1.19 | 1.21 | 1.22 | 1.19 | 1.21 | 1.23 | 1.30 | 1.36 | 1.40 | 1.48 | 1.57 | 1.66 | 1.49 | 1.56 | 1.64 | 1.30 | 1.36 | 1.39 | 1.39 | 1.45 | 1.52 | 1.49 | 1.57 | 1.66 | 1.48 | 1.56 | 1.64 |
| 1700.00 | 1.20 | 1.22 | 1.22 | 1.19 | 1.21 | 1.23 | 1.31 | 1.37 | 1.40 | 1.50 | 1.59 | 1.68 | 1.50 | 1.58 | 1.66 | 1.30 | 1.36 | 1.39 | 1.41 | 1.46 | 1.54 | 1.51 | 1.59 | 1.68 | 1.50 | 1.58 | 1.66 |
| 1800.00 | 1.19 | 1.22 | 1.22 | 1.19 | 1.21 | 1.22 | 1.31 | 1.37 | 1.40 | 1.52 | 1.60 | 1.69 | 1.51 | 1.59 | 1.67 | 1.30 | 1.36 | 1.39 | 1.41 | 1.47 | 1.54 | 1.52 | 1.60 | 1.69 | 1.51 | 1.59 | 1.67 |
| 1900.00 | 1.19 | 1.22 | 1.22 | 1.19 | 1.21 | 1.22 | 1.31 | 1.36 | 1.39 | 1.53 | 1.62 | 1.71 | 1.52 | 1.60 | 1.68 | 1.30 | 1.35 | 1.38 | 1.42 | 1.49 | 1.56 | 1.53 | 1.62 | 1.71 | 1.52 | 1.60 | 1.68 |
| 2000.00 | 1.19 | 1.21 | 1.21 | 1.19 | 1.21 | 1.22 | 1.31 | 1.36 | 1.38 | 1.55 | 1.64 | 1.72 | 1.53 | 1.62 | 1.69 | 1.29 | 1.34 | 1.37 | 1.43 | 1.50 | 1.57 | 1.55 | 1.64 | 1.72 | 1.53 | 1.61 | 1.69 |
| 2100.00 | 1.19 | 1.21 | 1.21 | 1.19 | 1.22 | 1.22 | 1.31 | 1.35 | 1.37 | 1.57 | 1.65 | 1.74 | 1.55 | 1.63 | 1.71 | 1.29 | 1.33 | 1.36 | 1.44 | 1.52 | 1.58 | 1.57 | 1.65 | 1.73 | 1.55 | 1.63 | 1.71 |
| 2200.00 | 1.19 | 1.22 | 1.21 | 1.19 | 1.22 | 1.23 | 1.30 | 1.34 | 1.36 | 1.59 | 1.67 | 1.75 | 1.56 | 1.64 | 1.71 | 1.28 | 1.32 | 1.35 | 1.45 | 1.53 | 1.60 | 1.59 | 1.67 | 1.75 | 1.56 | 1.64 | 1.72 |
| 2300.00 | 1.19 | 1.22 | 1.22 | 1.19 | 1.23 | 1.23 | 1.29 | 1.33 | 1.34 | 1.60 | 1.68 | 1.75 | 1.57 | 1.65 | 1.72 | 1.28 | 1.31 | 1.33 | 1.46 | 1.55 | 1.62 | 1.60 | 1.68 | 1.75 | 1.57 | 1.65 | 1.72 |
| 2400.00 | 1.20 | 1.22 | 1.22 | 1.20 | 1.23 | 1.24 | 1.29 | 1.31 | 1.32 | 1.61 | 1.69 | 1.76 | 1.58 | 1.65 | 1.72 | 1.27 | 1.29 | 1.31 | 1.48 | 1.57 | 1.63 | 1.61 | 1.69 | 1.76 | 1.58 | 1.65 | 1.73 |
| 2500.00 | 1.20 | 1.22 | 1.22 | 1.21 | 1.23 | 1.24 | 1.28 | 1.29 | 1.30 | 1.62 | 1.69 | 1.76 | 1.58 | 1.65 | 1.72 | 1.26 | 1.27 | 1.29 | 1.49 | 1.58 | 1.64 | 1.62 | 1.69 | 1.76 | 1.58 | 1.65 | 1.73 |
| 2600.00 | 1.20 | 1.22 | 1.22 | 1.21 | 1.24 | 1.25 | 1.26 | 1.27 | 1.27 | 1.64 | 1.70 | 1.76 | 1.59 | 1.66 | 1.72 | 1.24 | 1.25 | 1.26 | 1.50 | 1.60 | 1.66 | 1.64 | 1.70 | 1.76 | 1.59 | 1.66 | 1.73 |
| 2700.00 | 1.20 | 1.22 | 1.23 | 1.22 | 1.25 | 1.26 | 1.24 | 1.24 | 1.24 | 1.65 | 1.70 | 1.76 | 1.60 | 1.66 | 1.72 | 1.22 | 1.22 | 1.23 | 1.52 | 1.61 | 1.68 | 1.65 | 1.70 | 1.76 | 1.60 | 1.66 | 1.72 |
| 2800.00 | 1.20 | 1.23 | 1.24 | 1.23 | 1.26 | 1.28 | 1.21 | 1.21 | 1.21 | 1.66 | 1.70 | 1.76 | 1.61 | 1.66 | 1.72 | 1.19 | 1.19 | 1.19 | 1.54 | 1.64 | 1.70 | 1.66 | 1.70 | 1.76 | 1.61 | 1.66 | 1.72 |
| 2900.00 | 1.20 | 1.24 | 1.26 | 1.25 | 1.28 | 1.30 | 1.18 | 1.17 | 1.17 | 1.67 | 1.70 | 1.75 | 1.62 | 1.66 | 1.71 | 1.17 | 1.16 | 1.16 | 1.57 | 1.66 | 1.72 | 1.68 | 1.70 | 1.75 | 1.62 | 1.66 | 1.71 |
| 3000.00 | 1.22 | 1.26 | 1.28 | 1.28 | 1.30 | 1.32 | 1.16 | 1.15 | 1.14 | 1.68 | 1.70 | 1.74 | 1.62 | 1.65 | 1.70 | 1.14 | 1.13 | 1.12 | 1.59 | 1.69 | 1.75 | 1.68 | 1.70 | 1.74 | 1.62 | 1.65 | 1.70 |

***Note:***

| STATE | CONTROL INPUT | | RF Com to RF1 | RF Com to RF2 |
|---|---|---|---|---|
| | Control 1 | Control 2 | | |
| 1 | Low | Low | OFF | OFF |
| 2 | Low | High | OFF | ON |
| 3 | High | Low | ON | OFF |

## *Typical Performance Data*

| FREQ (MHz) | INPUT IP3 @ Vdd=+3V OVER TEMPERATURE | | | | | |
|---|---|---|---|---|---|---|
| | RF COM-RF1 (dBm) *STATE 3** | | | RF COM-RF2 (dBm) *STATE 2** | | |
| | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C |
| 10.00 | 52.29 | 51.92 | 51.86 | 51.85 | 52.10 | 51.27 |
| 20.00 | 55.02 | 54.32 | 54.44 | 54.43 | 54.68 | 53.27 |
| 50.00 | 59.68 | 58.12 | 57.24 | 59.05 | 57.55 | 57.90 |
| 100.00 | 59.17 | 58.26 | 57.62 | 59.60 | 58.53 | 57.76 |
| 200.00 | 63.93 | 62.03 | 58.83 | 63.47 | 61.55 | 58.94 |
| 300.00 | 60.49 | 60.70 | 58.12 | 60.94 | 60.23 | 58.08 |
| 400.00 | 57.13 | 56.77 | 55.27 | 57.49 | 56.87 | 55.26 |
| 500.00 | 54.98 | 54.58 | 53.45 | 55.09 | 54.51 | 53.32 |
| 600.00 | 54.80 | 55.61 | 54.42 | 54.94 | 55.81 | 54.25 |
| 700.00 | 52.66 | 52.64 | 51.94 | 52.69 | 52.68 | 51.87 |
| 800.00 | 52.13 | 52.01 | 51.22 | 52.15 | 51.98 | 51.20 |
| 900.00 | 53.05 | 52.76 | 51.65 | 53.06 | 52.58 | 51.58 |
| 1000.00 | 55.07 | 54.15 | 52.62 | 54.91 | 54.18 | 52.53 |
| 1200.00 | 56.44 | 57.85 | 55.43 | 56.67 | 58.23 | 55.28 |
| 1400.00 | 54.28 | 55.67 | 54.72 | 54.25 | 55.93 | 54.79 |
| 1600.00 | 55.21 | 56.94 | 55.24 | 55.39 | 57.32 | 55.03 |
| 1800.00 | 55.65 | 56.57 | 53.93 | 55.83 | 56.49 | 53.71 |
| 2000.00 | 54.06 | 54.90 | 53.00 | 53.98 | 54.79 | 52.91 |
| 2200.00 | 57.08 | 59.19 | 53.82 | 55.97 | 56.90 | 53.97 |
| 2400.00 | 53.50 | 55.18 | 53.30 | 53.68 | 55.65 | 53.29 |
| 2600.00 | 53.60 | 54.85 | 52.53 | 53.99 | 54.96 | 52.42 |
| 2800.00 | 52.99 | 54.12 | 52.09 | 53.18 | 54.08 | 52.02 |
| 3000.00 | 53.25 | 55.36 | 52.90 | 53.44 | 55.92 | 52.82 |

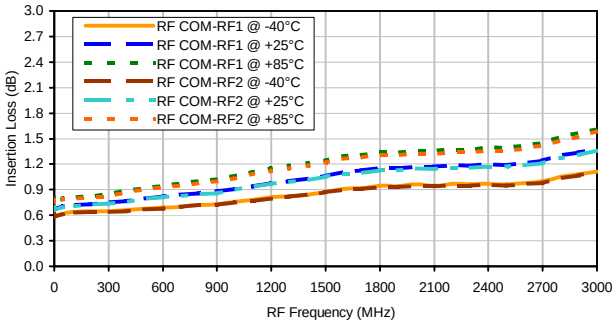
| FREQ (MHz) | INPUT 1dB COMPRESSION @ Vdd=+3V OVER TEMPERATURE | | | | | |
|---|---|---|---|---|---|---|
| | RF COM-RF1 (dBm) *STATE 3** | | | RF COM-RF2 (dBm) *STATE 2** | | |
| | -40°C | +25°C | +85°C | -40°C | +25°C | +85°C |
| 1.00 | 30.30 | 29.92 | 29.41 | 30.29 | 29.89 | 29.40 |
| 5.00 | 30.96 | 30.36 | 29.90 | 30.96 | 30.32 | 29.87 |
| 10.00 | 31.02 | 30.48 | 30.02 | 31.02 | 30.46 | 29.96 |
| 20.00 | 30.94 | 30.33 | 29.83 | 30.91 | 30.27 | 29.79 |
| 50.00 | 31.02 | 30.33 | 29.56 | 31.00 | 30.17 | 29.80 |
| 100.00 | 30.89 | 30.16 | 29.62 | 30.85 | 30.12 | 29.61 |
| 150.00 | 30.62 | 30.21 | 29.36 | 30.66 | 29.80 | 29.40 |
| 200.00 | 30.72 | 30.10 | 29.55 | 30.70 | 30.02 | 29.62 |
| 250.00 | 30.85 | 30.14 | 29.63 | 30.85 | 29.98 | 29.62 |
| 300.00 | 30.72 | 30.11 | 29.53 | 30.69 | 29.88 | 29.53 |
| 350.00 | 30.68 | 30.15 | 29.53 | 30.66 | 30.02 | 29.61 |
| 400.00 | 30.42 | 30.09 | 29.27 | 30.44 | 29.70 | 29.62 |
| 450.00 | 30.63 | 30.05 | 29.50 | 30.58 | 29.83 | 29.53 |
| 500.00 | 30.71 | 30.10 | 29.57 | 30.69 | 29.88 | 29.61 |
| 550.00 | 30.84 | 30.21 | 29.84 | 30.87 | 30.27 | 29.81 |
| 600.00 | 30.79 | 30.17 | 29.78 | 30.81 | 30.20 | 29.75 |
| 650.00 | 30.94 | 30.30 | 29.93 | 30.96 | 30.36 | 29.91 |
| 700.00 | 30.44 | 29.85 | 29.46 | 30.48 | 29.87 | 29.43 |
| 750.00 | 30.75 | 30.14 | 29.76 | 30.77 | 30.21 | 29.75 |
| 800.00 | 30.50 | 29.89 | 29.52 | 30.51 | 29.92 | 29.51 |
| 850.00 | 30.12 | 29.51 | 29.19 | 30.15 | 29.57 | 29.16 |
| 900.00 | 30.67 | 30.07 | 29.77 | 30.71 | 30.15 | 29.78 |
| 950.00 | 31.28 | 30.73 | 30.40 | 31.34 | 30.78 | 30.39 |
| 1000.00 | 30.21 | 29.65 | 29.33 | 30.28 | 29.71 | 29.33 |

***Note:***

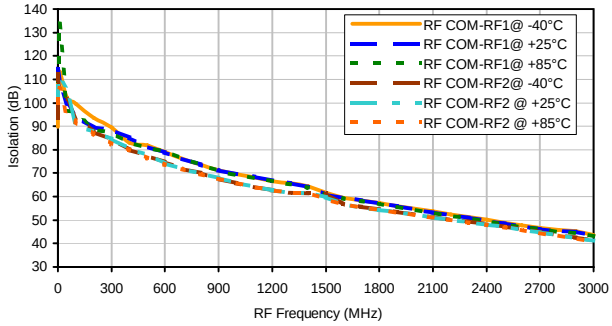
| STATE | CONTROL INPUT | | RF Com to RF1 | RF Com to RF2 |
|---|---|---|---|---|
| | Control 1 | Control 2 | | |
| 1 | Low | Low | OFF | OFF |
| 2 | Low | High | OFF | ON |
| 3 | High | Low | ON | OFF |

## *Typical Performance Curves*

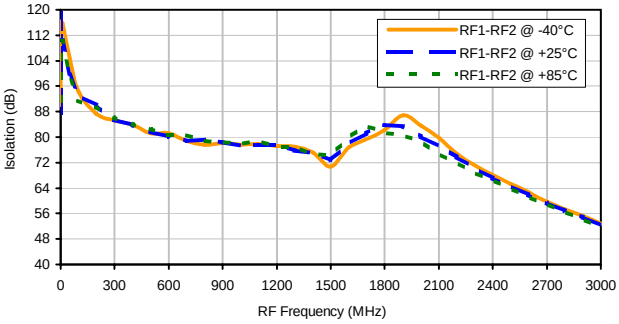
**Insertion Loss @ Vdd=+3V over Temperature**
***RF COM-RF1 (State 3*) & RF COM RF2 (State 2*)***



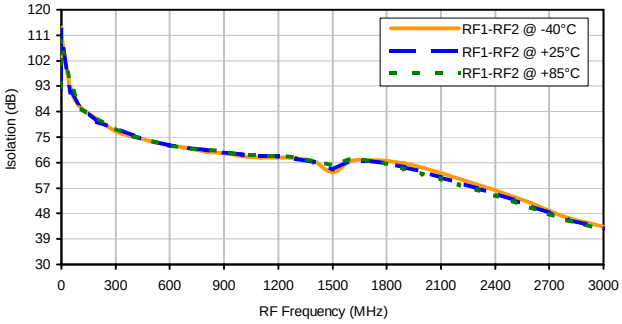

**Isolation @ Vdd=+3V over Temperature**
***RF COM-RF1 (State 2*) & RF COM RF2 (State 3*)***



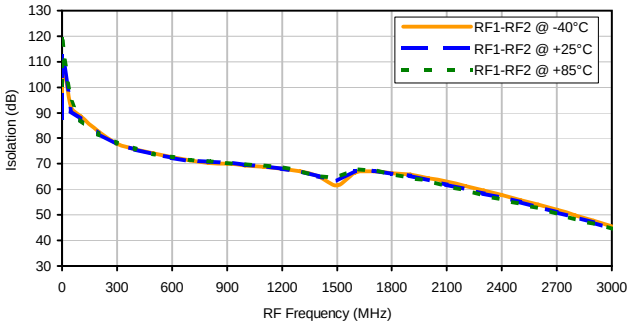

**Isolation @ Vdd=+3V over Temperature**
***RF1-RF2 (State 1*)***



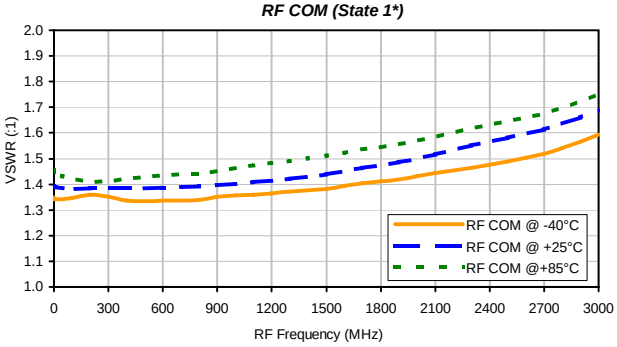

**Isolation @ Vdd=+3V over Temperature**
***RF1-RF2 (State 2*)***



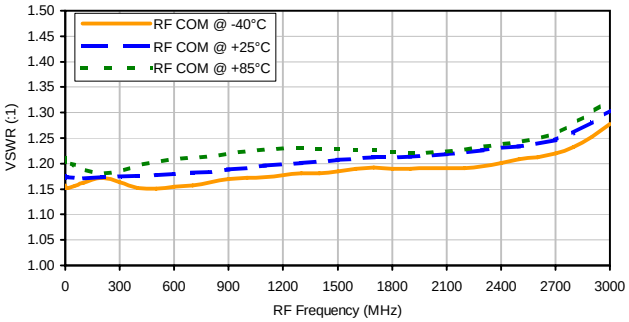

**Isolation @ Vdd=+3V over Temperature**
***RF1-RF2 (State 3*)***



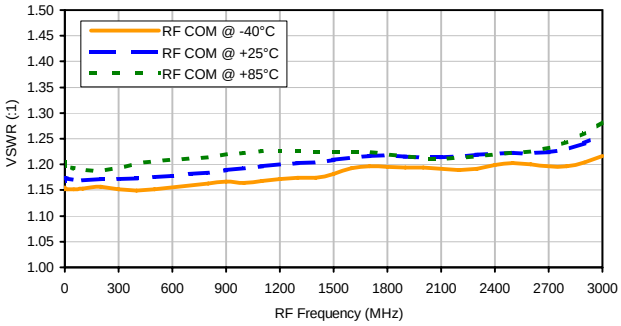

**VSWR @ Vdd=+3V over Temperature**
***RF COM (State 1*)***




**VSWR @ Vdd=+3V over Temperature**
***RF COM (State 2*)***




**VSWR @ Vdd=+3V over Temperature**
***RF COM (State 3*)***

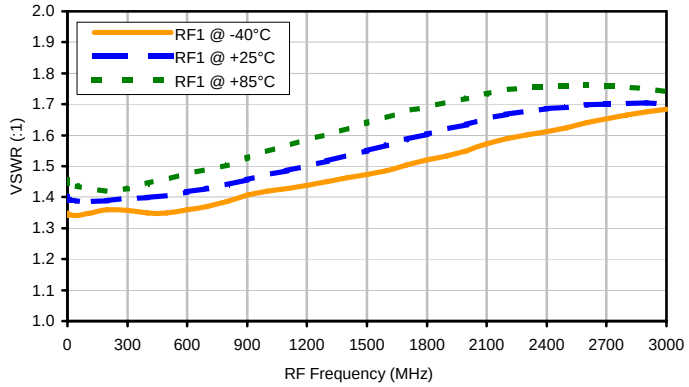



***Note:***

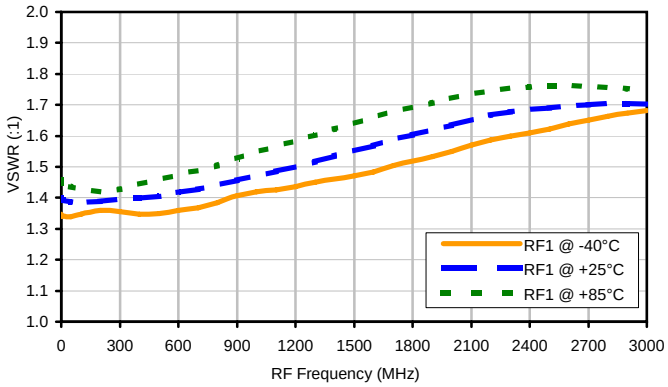
| STATE | CONTROL INPUT | | RF Com to RF1 | RF Com to RF2 |
|---|---|---|---|---|
| | Control 1 | Control 2 | | |
| 1 | Low | Low | OFF | OFF |
| 2 | Low | High | OFF | ON |
| 3 | High | Low | ON | OFF |

## *Typical Performance Curves*

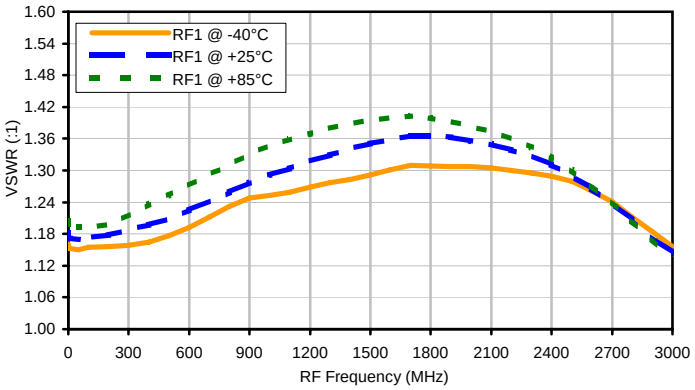
**VSWR @ Vdd=+3V over Temperature**
***RF1 (State 1*)***



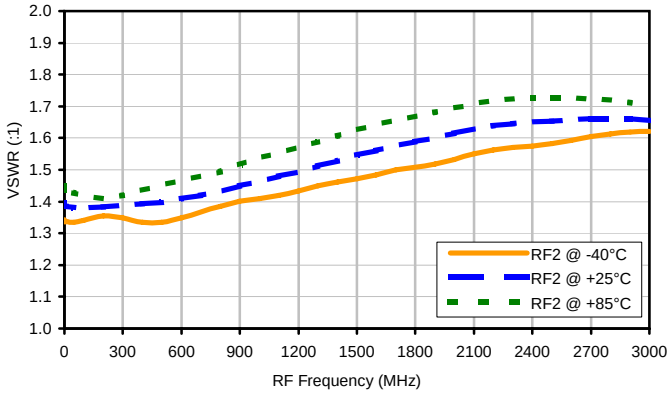

**VSWR @ Vdd=+3V over Temperature**
***RF1 (State 2*)***



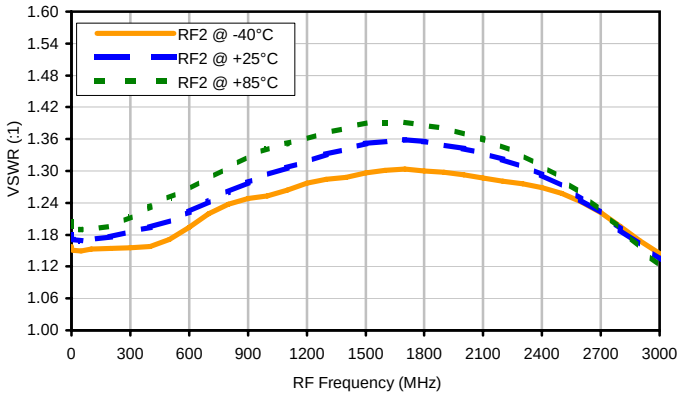

**VSWR @ Vdd=+3V over Temperature**
***RF1 (State 3*)***



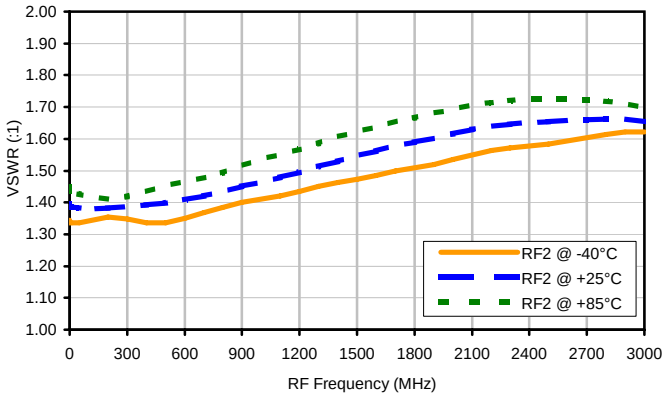

**VSWR @ Vdd=+3V over Temperature**
***RF2 (State 1*)***




**VSWR @ Vdd=+3V over Temperature**
***RF2 (State 2*)***




**VSWR @ Vdd=+3V over Temperature**
***RF2 (State 3*)***

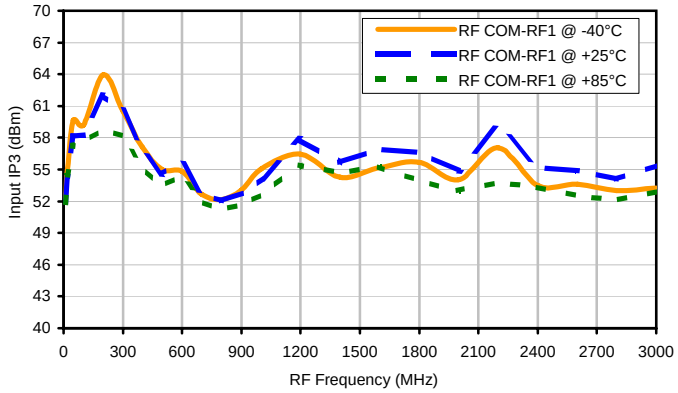



***Note:***

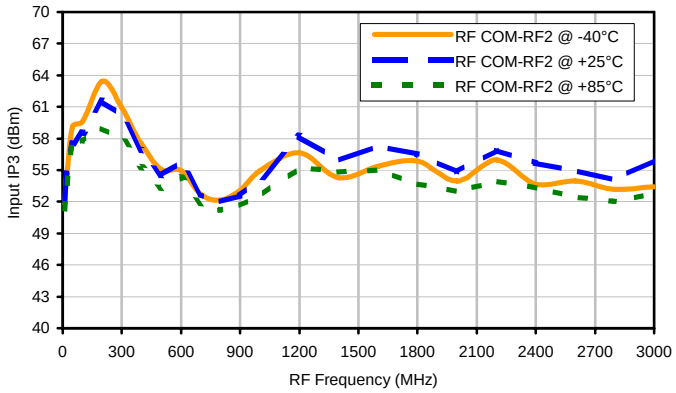
| STATE | CONTROL INPUT | | RF Com to RF1 | RF Com to RF2 |
|---|---|---|---|---|
| | Control 1 | Control 2 | | |
| 1 | Low | Low | OFF | OFF |
| 2 | Low | High | OFF | ON |
| 3 | High | Low | ON | OFF |

## *Typical Performance Curves*

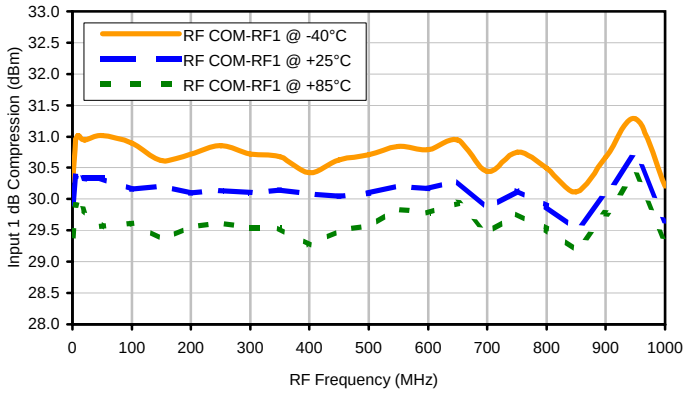
**Input IP3 @ Vdd=+3V over Temperature**
***RF COM-RF1 (State 3*)***



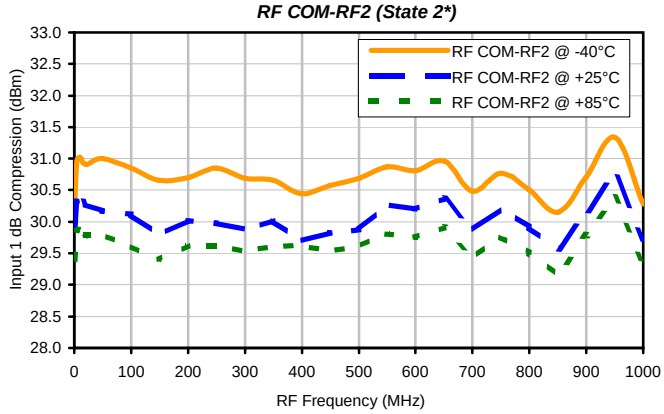

**Input IP3 @ Vdd=+3V over Temperature**
***RF COM -RF2 (State 2*)***




**Input 1dB Compression @ Vdd=+3V over Temperature**
**RF COM-RF1 (State 3*)**




**Input 1dB Compression @ Vdd=+3V over Temperature**
***RF COM-RF2 (State 2*)***



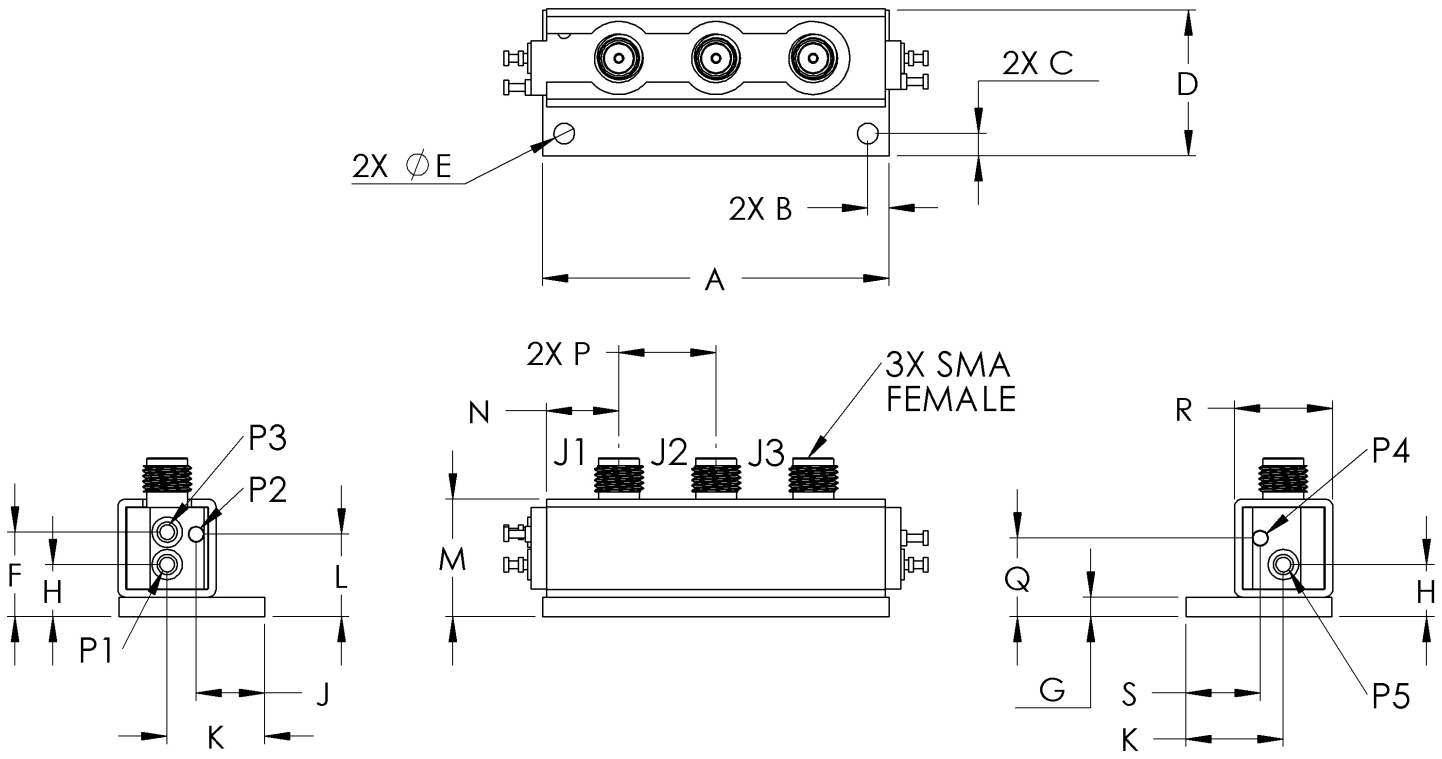

***Note:***

| STATE | CONTROL INPUT | | RF Com to RF1 | RF Com to RF2 |
|---|---|---|---|---|
| | Control 1 | Control 2 | | |
| 1 | Low | Low | OFF | OFF |
| 2 | Low | High | OFF | ON |
| 3 | High | Low | ON | OFF |

# Case Style HL

## Outline Dimensions

**HL1162**




| CASE #. | A | B | C | D | E | F | G | H | J | K | L | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HL1162 | 1.782 (45.26) | .110 (2.79) | .115 (2.92) | .750 (19.05) | .106 (2.69) | .435 (11.04) | .100 (2.54) | .268 (6.79) | .353 (8.97) | .502 (12.75) | .424 (10.76) | .605 (15.37) | .371 (9.42) |

| CASE #. | P | Q | R | S | WT GRAMS |
|---|---|---|---|---|---|
| HL1162 | .500 (12.70) | .404 (10.25) | .505 (12.83) | .383 (9.73) | 56 |

**Dimensions are in inches (mm). Tolerances: 2Pl. ± .03; 3Pl. ± .015**
**Tolerance on hole size and interaxes dimensions to be ± .005.**

### Note:

1. Case material: Brass
2. Case finish: Nickel plate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# Environmental Specifications ENV28T5

All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

| Specification | Test/Inspection Condition | Reference/Spec |
|---|---|---|
| Operating Temperature | -40° to 85°C | Individual Model Data Sheet |
| Storage Temperature | -55° to 100° C<br>Ambient Environment | Individual Model Data Sheet |
| Barometric Pressure | 100,000 Feet | MIL-STD-202, Method 105, Condition D |
| Humidity | 90% RH, 65°C<br>Units may require bake-out after humidity to restore full performance. | MIL-STD-202, Method 103 |
| Thermal Shock | -65° to 125°C, 5 cycles | MIL-STD-202, Method 107, Condition B |
| Vibration (High Frequency) | 20g peak, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36) | MIL-STD-202, Method 204, Condition D |
| Mechanical Shock | 100g, 6ms sawtooth, 3 shocks each direction 3 axes (total 18) | MIL-STD-202, Method 213, Condition I |


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