## The Big Deal

- Wide bandwidth $\mathrm{DC}^{2}$ to 5000 MHz
- Very fast switching, 20ns typ.
- Low video break thru $30 \mathrm{mVp}-\mathrm{p}$ typ.



## Product Overview

The ZYSW-2-50DR+ is an excellent general purpose SPDT solid state reflective RF switch. With its broad frequency range, fast switching time and excellent RF performance, the ZYSW-2-50DR+ is an excellent replacement for the Mini-Circuits' legacy switch model ZYSW-2-50DR+. Refer app note AN-80-018 for more details. The smaller size and wider bandwidth makes this switch a versatile choice for several RF applications \& systems.

## Key Features

| Feature | $\quad$ Advantages |
| :--- | :--- |
| Integrated CMOS Driver | -Operates at +5 V to -5 V <br> -Low control current allows compatibility with a variety of driver circuits <br> -Fast 20 ns typ.Switching time |
| Excellent for a Variety of Applications <br> From Bench to Integrated Systems | -High speed testers <br> -Automated switching networks <br> -Wireless Infrastructure <br> -Military |
| Excellent RF Performance | -Wide bandwidth: $\mathrm{DC}^{2}$ to 5000 MHz <br> -Low Insertion Loss: 1.4 dB Typ <br> -Low video leakage, 30 mVp m typ.. |

2. All RF connections must be blocked or held at OV DC. Low frequency is determined by value of Coupling capacitors at RF ports.
[^0]
## Reflective RF Switch with Internal Driver <br> Dual Supply Voltage, +5 V to -5 V

## Product Features

- Wide bandwidth, $\mathrm{DC}^{2}$ to 5000 MHz
- Low Insertion loss, 1.4 dB typ.
- Internal driver circuitry
- Fast switching, Rise/fall time, 5 ns typ.
- Wide operating temperature, $-20^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$


CASE STYLE: ZZ121

| Connectors | Model |
| :--- | :--- |
| SMA | ZYSW-2-50DR+ | BRACKET (OPTION "B")

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

## Typical Applications

- Cellular
- ISM, WCDMA, WIMAX
- PCN
- Automated switching networks
- Military


## General Description

The ZYSW-2-50DR+ is a $50 \Omega$ reflective, SPDT RF switch designed for wireless applications, covering a broad frequency range from $\mathrm{DC}^{2}$ to 5000 MHz with low insertion loss. The ZYSW-2-50DR+ operates with a dual supply voltage $\pm 5 \mathrm{~V}$. This unit includes an internal CMOS driver which makes it easier to control switching with standard TTL voltage levels.

Schematic and Application Circuit

2. All RF connections must be blocked or held at OV DC. Low frequency is determined by value of Coupling capacitors at RF ports.

[^1]RF Electrical Specifications, $\mathrm{DC}^{2}-5000 \mathrm{MHz}, \mathrm{T}_{\mathrm{AmB}}=25^{\circ} \mathrm{C}$, Supply Voltage $(+\mathrm{V},-\mathrm{V})=+5 \mathrm{~V},-5 \mathrm{~V}$

| Parameter | Condition (MHz) | Min. | Typ. | Max. | Units |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Frequency Range |  | DC ${ }^{2}$ |  | 5000 | MHz |
| Insertion Loss | $\begin{array}{r} D C^{2}-500 \\ 500-2000 \\ 2000-5000 \end{array}$ | $\begin{aligned} & - \\ & - \end{aligned}$ | $\begin{aligned} & \hline 0.8 \\ & 1.2 \\ & 2.1 \end{aligned}$ | $\begin{aligned} & 1.5 \\ & 1.7 \\ & - \end{aligned}$ | dB |
| Isolation between Common port and RF1/RF2 Ports | $\begin{array}{r} \text { DC }^{2}-500 \\ 500-2000 \\ 2000-5000 \\ \hline \end{array}$ | $\begin{aligned} & 38 \\ & 28 \\ & - \\ & \hline \end{aligned}$ | $\begin{aligned} & 50 \\ & 40 \\ & 18 \\ & \hline \end{aligned}$ | $\begin{aligned} & - \\ & - \end{aligned}$ | dB |
| Return Loss (IN PORT) | $\begin{array}{r} \text { DC }^{2}-3000 \\ 3000-5000 \\ \hline \end{array}$ | - | $\begin{aligned} & 15 \\ & 13 \\ & \hline \end{aligned}$ | — | dB |
| Return Loss @ RF1/RF2 ports (ON STATE) | $\begin{array}{r} \text { DC }^{2}-3000 \\ 3000-5000 \\ \hline \end{array}$ | - | $\begin{aligned} & \hline 18 \\ & 15 \\ & \hline \end{aligned}$ | - | dB |
| Input 1dB Compression ${ }^{(1)}$ | $\begin{array}{r} 10-500 \\ 500-2000 \\ 2000-5000 \\ \hline \end{array}$ | $\begin{aligned} & - \\ & - \end{aligned}$ | $\begin{aligned} & >20 \\ & >24 \\ & >23 \\ & \hline \end{aligned}$ | $\begin{aligned} & - \\ & - \end{aligned}$ | dBm |

DC Electrical Specifications

| Supply Voltage (+V) |  | - | 5 | - | V |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Supply Voltage (-V) |  |  | -5 |  | V |
| Positive Supply Current | $+\mathrm{V}=5 \mathrm{~V}$ |  | 4.5 |  | mA |
| Negative Supply Current | $-\mathrm{V}=-5 \mathrm{~V}$ |  | 3.3 |  | mA |
| Control Voltage Low |  | 0 |  | 0.7 | V |
| Control Voltage High |  | 2.1 |  | 5 | V |
| Control Current |  | - | - | 2 | mA |
| Switching Specifications |  |  |  |  |  |
| Rise/Fall Time (10 to $90 \%$ or 90 to 10\% RF) | $+\mathrm{V}=5 \mathrm{~V},-\mathrm{V}=-5 \mathrm{~V}$ | - | 6 | - | nSec |
| Switching Time ( $50 \%$ CTRL to 90/10\% RF) | $+\mathrm{V}=5 \mathrm{~V},-\mathrm{V}=-5 \mathrm{~V}$ | - | 20 | - | nSec |
| Video Feed through (Control 0-5V, Frequency 1 MHz ) | $+\mathrm{V}=5 \mathrm{~V},-\mathrm{V}=-5 \mathrm{~V}$ | - | 30 | - | $m V_{\text {P-P }}$ |

1. At low frequency ( $<100 \mathrm{MHz}$ ), the dynamic range of switch decreases.

## Absolute Maximum Ratings

| Parameter | Ratings |
| :--- | :---: |
| Operating Temperature | $-20^{\circ} \mathrm{C}$ to $85^{\circ} \mathrm{C}$ |
| Storage Temperature | $-55^{\circ} \mathrm{C}$ to $100^{\circ} \mathrm{C}$ |
| Supply Voltage $(+\mathrm{V} \&-\mathrm{V})$ | $+5.5 \mathrm{~V},-5.5 \mathrm{~V}$ |
| Voltage Control | -0.2 V min,+5.5 V max |
| RF input power ${ }^{3}$ | 31 dBm |
| ESD, HBM | Class $1 \mathrm{~A}(250$ to $<500 \mathrm{~V})$ per JESD22-A114 |

2. All RF connections must be blocked or held at OV DC. Low frequency is determined by value of Coupling capacitors at RF ports.

3 Frequency range of $500-5000 \mathrm{MHz}$.

[^2]Truth Table (State of control voltage selects the desired switch state)

| State of Control Voltage | Switch State - RF IN to |  |
| :--- | :---: | :---: |
|  | RF1 | RF2 |
| Low | ON | OFF |
| High | OFF | ON |
| ON- Iow insertion loss state <br> OFF- Isolation State |  |  |

## Coaxial Configuration



## Coaxial Connections

| Function | Port <br> Number | Description |
| :---: | :---: | :---: |
| RF IN | 3 | RF Common/ SUM Port |
| RF1 | 2 | RF Out \#1/In Port \#1 |
| RF2 | 1 | RF Out \#2/In Port \#2 |
| Control | 4 | TTL Control IN |
| +5 | + V | Positive Supply Voltage |
| -5 | - V | Negative Supply Voltage |

## Notes

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## Outline Drawing (ZZ121)


$\left.\begin{array}{rrrrrrrr}\text { Outline } & \text { Dimensions } & \text { (inch } \\ \text { A } \\ \text { Am }\end{array}\right)$

## Additional Detailed Technical Information

Additional information is available on our web site. To access this information enter the model number on our web site home page.

Performance data, graphs

Case Style: ZZ121

Environmental Ratings: ENV28T16

## Pricing \& Availability Information

[^3]| $\begin{gathered} \text { RF } \\ \text { (MHz) } \end{gathered}$ | INSERTION LOSS |  | ISOLATION |  | ISOLATION |  | RETURN LOSS |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | (dB) |  | (dB) |  | (dB) |  | (dB) |  |  |  |  |  |
|  | RF IN-RF1 (ON1) | $\begin{gathered} \hline \text { RF IN-RF2 } \\ \text { (ON2) } \\ \hline \end{gathered}$ | $\begin{gathered} \text { RF IN-RF1 } \\ \text { (ON2) } \\ \hline \end{gathered}$ | $\begin{gathered} \text { RF IN-RF2 } \\ \text { (ON1) } \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { RF1-RF2 } \\ \text { (ON1) } \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { RF1-RF2 } \\ \text { (ON2) } \\ \hline \end{gathered}$ | RF IN (ON1) | $\begin{aligned} & \hline \text { RF IN } \\ & \text { (ON2) } \end{aligned}$ | $\begin{gathered} \hline \text { RF1 } \\ \text { (ON1) } \\ \hline \end{gathered}$ | $\begin{gathered} \text { RF2 } \\ \text { (ON2) } \end{gathered}$ | $\begin{gathered} \hline \text { RF1 } \\ \text { (OFF1) } \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { RF2 } \\ \text { (OFF2) } \\ \hline \end{gathered}$ |
| 0.1 | 0.66 | 0.66 | 81.37 | 78.55 | 89.66 | 83.26 | 40.86 | 41.37 | 38.64 | 38.41 | 2.13 | 2.13 |
| 0.5 | 0.66 | 0.66 | 89.96 | 87.74 | 102.20 | 82.92 | 43.37 | 44.04 | 40.07 | 39.89 | 2.13 | 2.12 |
| 1 | 0.66 | 0.67 | 83.72 | 98.54 | 84.52 | 89.03 | 45.70 | 45.84 | 41.42 | 41.33 | 2.13 | 2.12 |
| 5 | 0.67 | 0.67 | 81.12 | 83.14 | 88.19 | 97.39 | 46.14 | 46.20 | 41.45 | 41.77 | 2.13 | 2.13 |
| 10 | 0.67 | 0.67 | 83.60 | 84.61 | 84.74 | 84.78 | 45.16 | 45.26 | 41.02 | 41.08 | 2.13 | 2.13 |
| 50 | 0.69 | 0.69 | 69.53 | 69.59 | 71.25 | 71.11 | 42.66 | 42.76 | 40.34 | 40.49 | 2.16 | 2.16 |
| 100 | 0.71 | 0.71 | 63.50 | 63.58 | 65.53 | 65.09 | 38.12 | 37.96 | 39.38 | 39.41 | 2.19 | 2.18 |
| 200 | 0.74 | 0.74 | 57.51 | 57.62 | 59.74 | 59.25 | 33.01 | 33.15 | 35.63 | 35.68 | 2.23 | 2.23 |
| 300 | 0.78 | 0.77 | 54.13 | 54.16 | 56.28 | 55.78 | 29.78 | 29.78 | 32.82 | 32.84 | 2.26 | 2.25 |
| 400 | 0.79 | 0.79 | 51.69 | 51.69 | 53.75 | 53.26 | 27.07 | 27.10 | 30.23 | 30.28 | 2.29 | 2.28 |
| 500 | 0.81 | 0.81 | 49.80 | 49.87 | 51.71 | 51.28 | 24.96 | 24.95 | 28.29 | 28.26 | 2.30 | 2.28 |
| 600 | 0.84 | 0.83 | 48.24 | 48.31 | 50.00 | 49.61 | 23.35 | 23.41 | 26.69 | 26.67 | 2.30 | 2.29 |
| 700 | 0.86 | 0.85 | 46.95 | 47.01 | 48.58 | 48.19 | 21.75 | 21.82 | 25.08 | 25.06 | 2.31 | 2.30 |
| 800 | 0.88 | 0.87 | 45.78 | 45.84 | 47.26 | 46.88 | 20.42 | 20.56 | 23.63 | 23.72 | 2.30 | 2.29 |
| 900 | 0.91 | 0.90 | 44.76 | 44.81 | 46.06 | 45.70 | 19.33 | 19.47 | 22.46 | 22.59 | 2.30 | 2.29 |
| 1000 | 0.93 | 0.92 | 43.86 | 43.89 | 44.95 | 44.62 | 18.34 | 18.49 | 21.35 | 21.49 | 2.31 | 2.30 |
| 1200 | 0.98 | 0.97 | 42.27 | 42.28 | 42.89 | 42.60 | 16.64 | 16.80 | 19.40 | 19.58 | 2.31 | 2.29 |
| 1400 | 1.03 | 1.02 | 40.88 | 40.89 | 41.02 | 40.77 | 15.25 | 15.38 | 17.82 | 18.00 | 2.30 | 2.28 |
| 1600 | 1.09 | 1.08 | 39.66 | 39.66 | 39.31 | 39.11 | 14.13 | 14.28 | 16.66 | 16.86 | 2.34 | 2.31 |
| 1800 | 1.15 | 1.13 | 38.53 | 38.50 | 37.65 | 37.52 | 13.25 | 13.38 | 15.74 | 15.89 | 2.35 | 2.31 |
| 2000 | 1.20 | 1.18 | 37.47 | 37.42 | 36.07 | 36.00 | 12.58 | 12.72 | 15.02 | 15.12 | 2.38 | 2.33 |
| 2200 | 1.25 | 1.23 | 36.46 | 36.39 | 34.60 | 34.60 | 12.08 | 12.19 | 14.59 | 14.65 | 2.45 | 2.39 |
| 2400 | 1.28 | 1.26 | 35.44 | 35.34 | 33.18 | 33.22 | 11.74 | 11.80 | 14.35 | 14.32 | 2.50 | 2.43 |
| 2600 | 1.31 | 1.30 | 34.44 | 34.31 | 31.83 | 31.92 | 11.53 | 11.54 | 14.29 | 14.19 | 2.55 | 2.47 |
| 2800 | 1.35 | 1.34 | 33.46 | 33.28 | 30.54 | 30.68 | 11.38 | 11.38 | 14.36 | 14.22 | 2.63 | 2.54 |
| 3000 | 1.36 | 1.35 | 32.39 | 32.14 | 29.28 | 29.48 | 11.36 | 11.35 | 14.51 | 14.31 | 2.68 | 2.60 |
| 3200 | 1.38 | 1.37 | 31.29 | 30.95 | 28.01 | 28.29 | 11.42 | 11.40 | 14.59 | 14.38 | 2.74 | 2.66 |
| 3400 | 1.40 | 1.39 | 30.12 | 29.73 | 26.75 | 27.11 | 11.54 | 11.51 | 14.67 | 14.55 | 2.81 | 2.75 |
| 3600 | 1.41 | 1.40 | 28.88 | 28.40 | 25.51 | 25.91 | 11.67 | 11.66 | 14.86 | 14.78 | 2.89 | 2.86 |
| 3800 | 1.43 | 1.41 | 27.52 | 26.88 | 24.26 | 24.67 | 11.93 | 11.98 | 15.06 | 15.08 | 2.99 | 2.95 |
| 4000 | 1.44 | 1.42 | 26.06 | 25.30 | 22.92 | 23.37 | 12.31 | 12.43 | 15.50 | 15.63 | 3.14 | 3.10 |
| 4200 | 1.45 | 1.42 | 24.44 | 23.64 | 21.54 | 22.00 | 12.87 | 13.09 | 16.14 | 16.47 | 3.35 | 3.32 |
| 4400 | 1.46 | 1.44 | 22.74 | 21.95 | 20.15 | 20.56 | 13.87 | 14.22 | 17.08 | 17.66 | 3.65 | 3.61 |
| 4600 | 1.48 | 1.47 | 20.98 | 20.26 | 18.73 | 19.04 | 15.30 | 15.77 | 18.62 | 19.55 | 4.08 | 3.97 |
| 4800 | 1.52 | 1.53 | 19.14 | 18.63 | 17.32 | 17.41 | 17.47 | 18.28 | 21.21 | 22.74 | 4.68 | 4.42 |
| 5000 | 1.60 | 1.66 | 17.41 | 17.16 | 15.84 | 15.59 | 21.35 | 23.00 | 26.12 | 29.48 | 5.57 | 5.03 |
| 5500 | 2.20 | 2.45 | 14.39 | 14.53 | 12.30 | 11.30 | 17.72 | 17.53 | 26.39 | 21.92 | 10.02 | 6.62 |
| 6000 | 3.12 | 3.07 | 13.61 | 11.78 | 8.66 | 9.14 | 9.76 | 9.66 | 17.89 | 14.85 | 12.12 | 7.80 |

## Typical Performance Curves




## Case Style



| CASE\# | A | B | C | D | E | F | G | H | J | K | L | M | N |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ZZ121 | 1.25 | 1.25 | .75 | .63 | .38 | .61 | -- | .800 | .800 | .76 | .125 | 1.688 | 2.18 |
|  | $(31.75)$ | $(31.75)$ | $(19.05)$ | $(16.00)$ | $(9.65)$ | $(15.49)$ | -- | $(20.32)$ | $(20.32)$ | $(19.30)$ | $(3.18)$ | $(42.88)$ | $(55.37)$ |


| CASE\# | P | Q | WT.GRAMS |
| :---: | :---: | :---: | :---: |
| ZZ121 | .75 | .07 | 85.0 |
|  | $(1.78)$ |  |  |

Dimensions are in inches (mm). Tolerances: 2 Pl. $\pm .03 ; 3$ Pl. $\pm .015$

## Notes:

1. Case material: Aluminum alloy.
2. Case finish:

For RoHS Case Styles:
Clear chemical conversion coating, non-chrome or trivalent chrome based.
3. Mounting bracket available on request. Add suffix B to part number

## $\square$ Mini-Circuits

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 | $\begin{aligned} & -20^{\circ} \text { to } 85^{\circ} \mathrm{C} \\ & \text { Ambient Environment } \end{aligned}$ | Individual Model Data Sheet |  |
| Storage Temperature | $-55^{\circ}$ to $100^{\circ} \mathrm{C}$ Ambient Environment | Individual Model Data Sheet |  |
| Barometric Pressure | 100,000 Feet | MIL-STD-202, Method 105, Condition D |  |
| Humidity | $90 \% \mathrm{RH}, 65^{\circ} \mathrm{C}$ <br> Units may require bake-out after humidity to restore full performance. | MIL-STD-202, Method 103 |  |
| Vibration (High Frequency) | 20 g peak, $10-2000 \mathrm{~Hz}, 12$ times in each of three perpendicular directions (total 36 ) | MIL-STD-202, Method 204, Condition D |  |
| Mechanical Shock | $100 \mathrm{~g}, 6 \mathrm{~ms}$ sawtooth, 3 shocks each direction 3 axes (total 18) | MIL-STD-202, Method 213, Condition I |  |


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