

PRELIMINARY DATA SHEET

AS179-000: GaAs SPDT Switch 300 kHz–3 GHz Medium Power

Applications

- General purpose medium power switch in telecommunication applications
- Transceiver transmit-receive switch in 802.11b/g WLAN, etc., systems

Features

- Broadband: 300 kHz–3 GHz
- Low insertion loss: 0.3 dB @ 900 MHz
- High isolation: 25 dB @ 900 MHz
- $P_{1\text{ dB}}$: +30 dBm @ 3 V control voltage
- IP3: +43 dBm @ 3 V control voltage
- Low DC power consumption
- 100% RF tested in die form
- Lead (Pb)-free
- ESD class 0

Description

The AS179-000 is a monolithic SPDT switch fabricated using Skyworks proprietary GaAs PHEMTs as the switching elements. This wideband switch operates with RF signals from 300 kHz–3 GHz. The RF signal paths within the AS179-000 are bilateral. The J_1 and J_2 RF input/output terminals are reflective.

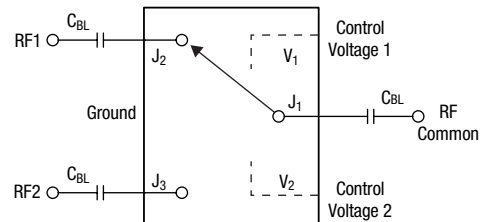
Switching is controlled via a pair of high-impedance control voltage inputs. Depending upon the logic voltage level applied to the control voltage pins, the common RF pin (J_1) is connected to one of two switched RF pins (J_2 or J_3) via a low insertion loss path, while the path between the RF common and the other RF pin is in its high isolation state.

DC power consumption is very low, 100 μ A nominal with control voltage of 3 V. The switch can operate over the temperature range of -40° C to 85° C.

NEW Skyworks offers lead (Pb)-free “environmentally friendly” packaging that is RoHS compliant (European Parliament for the Restriction of Hazardous Substances).



Functional Block Diagram



DC blocks required on all RF ports for positive control voltage operation.

Absolute Maximum Ratings

Characteristic	Value
RF input power ($V_{CTL} = 0\text{ V}/7\text{ V}$)	6 W, $f > 500\text{ MHz}$ 2 W, $100 > f > 500\text{ MHz}$ 315 mW, $f = 300\text{ kHz}^{(1)}$
Control voltage range	-0.2 V $\leq V_C \leq$ 8 V
Operating temperature range	-40 °C to +85 °C
Storage temperature range	-40 °C to +150 °C

Performance is guaranteed only under the conditions listed in the specifications table and is not guaranteed under the full range(s) described by the Absolute Maximum specifications. Exceeding any of the absolute maximum/minimum specifications may result in permanent damage to the device and will void the warranty.

1. Derate linearly for 300 kHz < f < 100 MHz.

CAUTION: Although this device is designed to be as robust as possible, Electrostatic Discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions must be employed at all times.

Electrical Specifications at 25 °C

Parameter	Frequency	Min.	Typ.	Max.	Unit
Insertion loss	300 kHz–1.0 GHz		0.30	0.4	dB
	1.0–2.0 GHz		0.30	0.4	dB
	2.0–3.0 GHz		0.35	0.5	dB
Isolation	300 kHz–1.0 GHz	22	25		dB
	1.0–2.0 GHz	20	22		dB
	2.0–3.0 GHz	20	22		dB
VSWR ⁽¹⁾	300 kHz–3.0 GHz		1.1:1	1.3:1	

V_{CTL} = 0 V/3 V, T = 25° C, P_{INPUT} = 0 dBm, Z₀ = 50 Ω, unless otherwise noted.

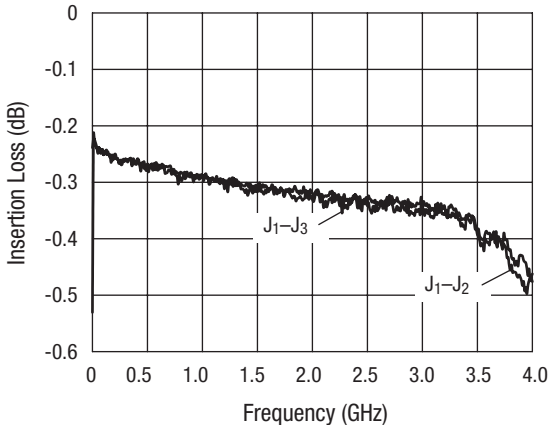
1. Insertion loss state.

Operating Characteristics at 25 °C

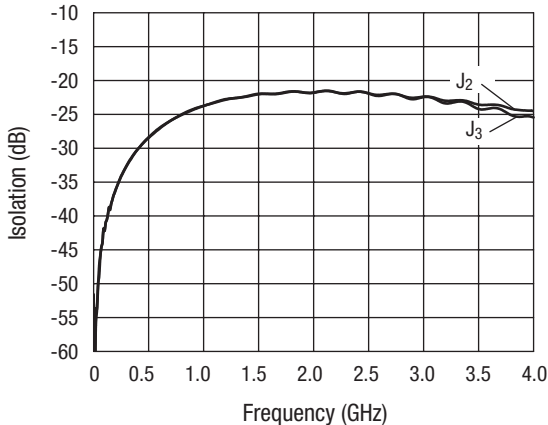
Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching characteristics	Rise, fall (10/90% or 90/10% RF)			10		ns
	On, off (50% CTL to 90/10% RF)			20		ns
	Video feedthru (T _{RISE} = 1 ns, measurement BW = 500 MHz)			25		mV
Input power for 1 dB compression (IP _{1 dB})	V _{CTL} = 0/3 V	0.5–3.0 GHz		30		dBm
	V _{CTL} = 0/5 V	0.5–3.0 GHz		34		dBm
Input Intermodulation intercept point (IIP3)	For two-tone input power +5 dBm V _{CTL} = 0/3 V V _{CTL} = 0/5 V	0.5–3.0 GHz		43		dBm
		0.5–3.0 GHz		50		dBm
Θ _{JC}				15		°C/W
Control voltages	V _{LOW} = 0 to 0.2 V @ 20 μA max. V _{HIGH} = 3 V @ 100 μA max. to 5 V @ 100 μA max.					

V_{CTL} = 0 V/3 V, T = 25° C, P_{INPUT} = 0 dBm, Z₀ = 50 Ω, unless otherwise noted.

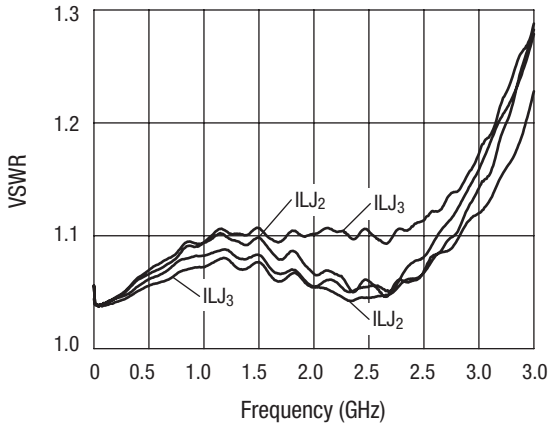
Typical Performance Data



Insertion Loss vs. Frequency

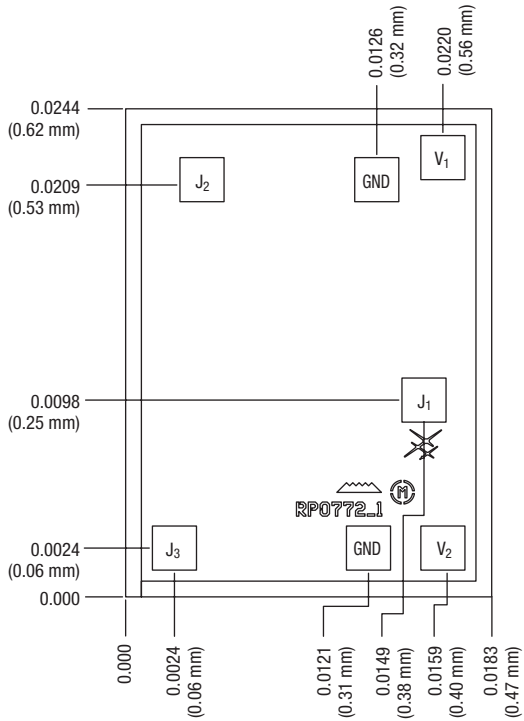


Isolation vs. Frequency



VSWR vs. Frequency

Die Outline



Bond pad dimensions: 0.0022 (0.06 mm) square.
 Bond pad metalization: Gold.
 Backside metalization: None.
 Die thickness 0.008 ± 0.001 (0.203 ± 0.025).
 Dimensions in inches (mm).

Port Descriptions

Parameter	Description
J ₁	RF Common — RF input/output port that is connected via low impedance path to either RF1 or RF2, depending upon the voltage applied to control voltage pin. External DC block required for positive control voltages.
J ₂ , J ₃	RF Input/Output — RF input/output port that is connected via low impedance path to either RF common (J ₁) or to ground, depending upon the voltage levels applied to Control Voltage pins. External DC block required for positive control voltages.
V ₁ , V ₂	Control Voltage Inputs — Combination of voltage logic levels applied to these pins determine the state of the RF paths between J ₁ and J ₂ /J ₃ .
GND	Ground — Should be down-bonded to circuit ground

Truth Table

V _{CTL1}	V _{CTL2}	J ₁ -J ₂	J ₁ -J ₃
V _{HIGH}	0	Isolation	Insertion loss
0	V _{HIGH}	Insertion loss	Isolation
0	0	Not allowed	Not allowed
V _{HIGH}	V _{HIGH}	Not allowed	Not allowed

Theory of Operation

The AS179-000 Single Pole Double Throw (SPDT) switch comprises two RF signal paths, one of which connects the RF common pin (J₁) to RF1 (J₂) and the other connects RF common to RF2 (J₃). Depending upon the logic voltage levels applied to the control voltage pins (V₁ and V₂), one of these paths is in its minimum insertion loss state while the other is in its high isolation state. When these logic levels are toggled, the state of each of the paths toggles accordingly.

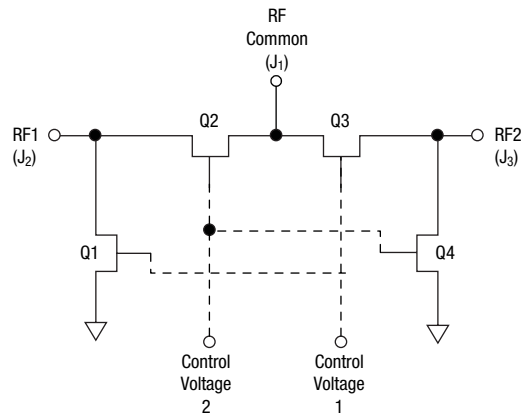
Starting at the RF common pin, each signal path is comprised of a depletion mode PHEMT, Q2 or Q3, in series with the signal path, followed by another depletion mode PHEMT, Q1 or Q4, in shunt with the signal path. A HI logic level applied to the control voltage pin V₁ and a low logic level applied to the control voltage pin V₂ forces the path between RF common and RF1 into its high isolation state and the other path, from RF common to RF2, into its low insertion loss state.

The shunt PHEMT to common, Q1 or Q4, is biased to produce minimum impedance when the signal path of which it is part is placed into its isolation state. Consequently, the magnitude of the reflection coefficient looking into this pin is close to 1, that is, the VSWR looking into that port approaches infinity.

The AS179-000 can operate with control voltage from 3 V up to 5 V.

The logic threshold voltage for the control voltage pin is one half of the minimum high control voltage. The impedance looking into each of the control voltage pins is several tens of kilohms. For positive control voltage, DC blocks are required on each RF port.

Simplified Block Diagram

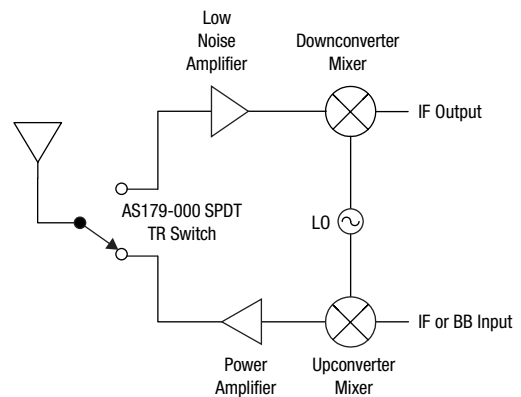


Applications

The AS179-000 SPDT switch can be used in a number of ways: it can be used to select one of two loads, it can also be used to alternately connect an antenna to a radio transmitter and receiver, etc.

Transmit Receive Switch

A SPDT switch can be used as a transmit-receive (TR) switch, to alternately connect a transmitter and a receiver to a single antenna in a single duplex system.



Ordering Information

Model Name	Operating Temperature Range	Ordering Part Number	Package Description
AS179-000 GaAs SPDT switch	-40 °C to +85 °C	AS179-000	Wafer on plastic-ring film frame

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