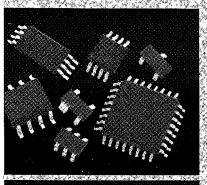
Commercial IC Products

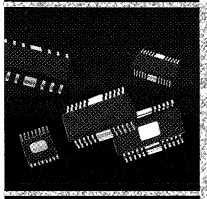
•Switches •Attenuators •Amplifiers

•Directional Couplers •Power Dividers •Mixers

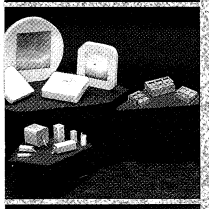
Alpha



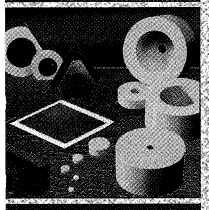
Commercial IC Products: Attenuators, directional couplers, power dividers



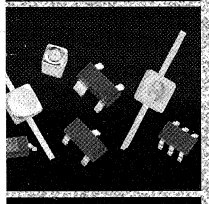
Commercial IC Products: Amplifiers, linear and saturated



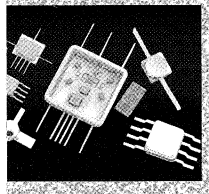
Ceramic Components: Patch antenna elements, bandpass filters and coaxial transmission line elements



Dielectric & Magnetic Materials: Ferrite/garnet disks, triangles, bars and dielectric resonators



Discrete Semiconductors: Varactors, FETs, fixed pad attenuators, chip capacitors, PIN and receiving diodes



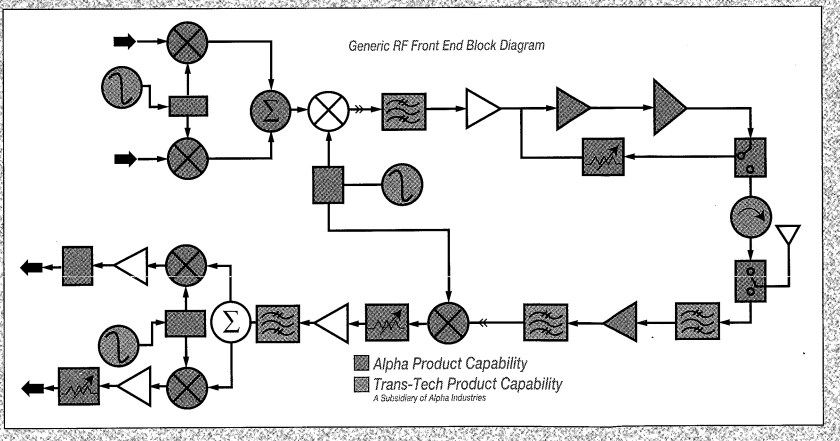
Space Products: die, discrete semiconductors, hybrid MMIC, and packaged devices

Alpha Industries offers you a winning combination of innovative design, sophisticated technical expertise, high volume manufacturing capability, and on-time delivery at a low cost. Alpha is one of the few companies that can bring together many of the critical functions that take place in the RF/microwave portion of today's communication systems.

Alpha designs and manufactures a complete line of RF GaAs integrated circuits, discrete semiconductor devices, components and technical ceramics that serve the needs of manufacturers in the communications industry worldwide. These products reflect Alpha's reputation as a technology innovator and a developer of RF and microwave products that meet the stringent demands of today's commercial markets. Trans-Tech, a subsidiary of Alpha Industries, provides the technical ceramic product solutions that encompass patch antennas, bandpass filters and coaxial transmission line elements.

To find out how our capabilities can meet your specific application needs — call your local representative or distributor (see inside back cover), or visit our web site at **www.alphaind.com**. Our web site provides the latest market and industry news and is updated regularly with technical data, application notes and new product information.

Contact us today and find out how we can work together to provide high-performance, low-cost solutions designed for your specific product requirements.



A Complete Line

Along with a broad diverse range of semiconductors and components, Alpha customers enjoy a wealth of technical expertise, hands-on application engineering, R&D, and the assurance of on-time delivery...even for the most demanding production schedules.

Plastic Packaged Control Products 1

Plastic Packaged Power Amplifiers 2

Passive Products 3

Application Notes 4

Reference Material 5

Part Number Index 6

Warranty / Order Information 7

Commercial IC Products

Commercial IC products represent the principal growth business at Alpha Industries. This technology is based on our engineering and manufacturing competencies for GaAs field effect transistors and passive devices for RF applications.

Alpha's business has focused on efficiencies for high quality, high volume, low cost and high performance semiconductors. This transition is a result of increased worldwide demand for RF commercial IC products for implementation in wireless and other commercial systems.

About This Catalogue

This catalogue contains Alpha's product line of commercial IC products. It includes GaAs IC amplifiers, linear and saturated, switches, attenuators, power dividers and directional couplers. The catalogue is intended to allow the design engineer to readily understand the specifications for Alpha's semiconductor products and to easily select appropriate part numbers.

Manufacturing Capabilities

The manufacturing capability at Alpha has been enhanced by our strong commitment to statistically based manufacturing techniques which provide the process reliability and repeatability required for low cost manufacturing. Continuous improvement techniques and reengineering efforts have led to the formation of highly agile cross functional manufacturing cells. This cell structure along with an integral "pull system" remains the basis for reduced cycle times and low manufacturing costs. Alpha is proud to be a certified ISO 9001 supplier.

Applications Engineering Support

In this catalogue we have supplied comprehensive information in specifying these commercial IC products to enable design engineers to predict and even optimize circuit performance. We recognize, however, that additional information may be needed to better exploit these devices for specific applications. At Alpha we offer the resources of applications engineering to assist in these design efforts.

Contact Us

We welcome your technical inquiries. Sales representatives and distributors are located worldwide and are readily available to support your requirements. Please refer to the inside back cover of this catalogue to find the sales or distributor office located near you.

TÜV CERT

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Plastic Packaged Control Products

FETs and Switches

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
Control FETs							
DC–2.5	General Purpose	0.5–0.7	50–10	43	SOT-23	▶ AF002C1-39	1-2
DC–1.0	High Power	0.2–0.4	23–15	60	SOT-23	▶ AF002C4-39	1-2
SPST Non-Reflective Switches							
0.7–2.5	High Isolation, Dual Pos. CTL	0.7–1.1	53–25	44	SOIC-8	AS121-12	1-8
0.5–3.0	High Isolation, Single Pos. CTL	0.7–1.1	50–40	44	SOIC-8	▶ AS123-12	1-10
DC–2.5	Low Cost, 6 Lead Pkg.	0.7–1.0	48–20	44	SOT-6	▶ AS130-73	1-12
DC–2.5	Low Loss, Dual CTL	0.5–1.2	70–32	46	SOIC-8	AS159-12	1-14
DC–2.5	General Purpose	0.5–1.2	70–32	46	SOIC-8	▶ AS259M1-12	1-16
DC–2.0	Non-Reflective I/O, Single Pos. CTL	0.6–0.8	27–21	45	SOIC-8	AS349-12	1-18
SPDT Switches							
General Purpose Reflective Switches							
DC–3.0	Low Loss	0.4–1.2	60–18	40	MSOP-8	▶ AS104-59	1-22
DC–3.0	Dual Pos. CTL	0.4–1.1	50–13	45	MSOP-8	▶ AS106-59	1-24
0.8–2.5	Single Pos. CTL	1.1–1.4	22–12	38	SOIC-8	AS107-12	1-26
DC-2.5	Low Cost, 6 Lead Pkg.	0.4–0.8	35–13	45	SOT-6	▶ AS125-73	1-28
DC–3.0	General Purpose	0.3–0.8	56–18	46	SOIC-8	▶ AS239-12	1-30
DC–2.5	Low Loss	0.3–0.7	56–20	46	SSOP-8	AS328-62	1-32
DC–2.5	Dual Pos. CTL	0.4–1.1	50–13	45	SOIC-8	AS373-12	1-34
DC–3.0	General Purpose	0.4–1.2	60–18	46	SOIC-8	▶ AS002R2-12	1-36
DC–3.0	General Purpose	0.4–1.2	60–18	40	SOIC-8	▶ ASC02R2-12	1-38
General Purpose Non-Reflective Switches							
DC–3.0	Low Loss w/Driver	0.5–1.1	60–15	37	SOIC-8	▶ AK002M2-12	1-42
DC–2.5	High Isolation	0.8–1.2	60–32	44	MSOP-8	AS131-59	1-44
DC–2.5	General Purpose	0.5–1.2	50–26	46	SOIC-8	▶ AS338-12	1-46
DC–2.5	General Purpose	0.6–1.3	60–25	46	SOIC-8	▶ AS002M2-12	1-48
DC–2.5	General Purpose	0.6–1.3	60–22	40	SOIC-8	▶ ASC02M2-12	1-50

▶ Available through distribution.

Preferred for new designs.

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
High Power Switches							
DC–3.0	Medium Power	0.4–0.9	50–17	56	SOIC-8	AH002R2-12	1-54
DC–3.0	Dual Pos. CTL	0.4–1.2	40–20	55	SOIC-8	AS137-12	1-56
DC–3.0	High IP3	0.6–1.1	50–20	63	SOIC-8	AS144-12	1-58
DC–2.0	1.9 GHz T/R, Pos. CTL	0.4–0.9	40–18	60	MSOP-8	AS150-59	1-60
DC–2.0	0.9 GHz T/R, Pos. CTL	0.4–0.8	40–10	60	SOIC-8	▶ AS277-12	1-62
DC–3.0	1.9 GHz T/R, Pos. CTL	0.4–0.9	40–18	60	SOIC-8	▶ AS278-12	1-64
DC–3.0	General Purpose	0.3–0.6	60–20	61	SOIC-8	AS279-12	1-66
DC–3.0	10 W T/R, High IP3	0.6–1.1	50–20	63	SOIC-8	▶ AW002R2-12	1-68
High Linearity Switches							
DC–2.0	General Purpose	0.3–0.7	45–10	55	MSOP-8	▶ AS103-59	1-72
DC–2.0	Dual CTL	0.3–0.7	42–10	55	MSOP-8	AS116-59	1-74
DC–2.0	Low Cost, 6 Lead Pkg.	0.3–1.0	40–10	55	SOT-6	AS128-73	1-76
DC–2.0	Dual CTL	0.3–1.0	40–10	55	MSOP-8	AS138-59	1-78
DC–2.0	Low Cost, 6 Lead Pkg.	0.3–0.7	42–10	55	SOT-6	▶ AS139-73	1-80
DC–2.0	Pos. CTL	0.3–1.0	40–10	55	SSOP-8	AS358-62	1-82
DC–2.0	Neg. CTL	0.3–1.0	40–10	55	SSOP-8	▶ AS359-62	1-84
High Isolation Switches							
DC–2.5	45 dB ISO @ 0.9 GHz, Pos. CTL	0.5–1.0	70–20	41	SOIC-8	▶ AS118-12	1-88
DC–2.5	35 dB ISO @ 1.9 GHz, Pos. CTL	0.6–0.9	70–29	41	SOIC-8	▶ AS119-12	1-90
DC–2.5	50 dB ISO @ 0.5–2.0 GHz, Pos. CTL	0.6–0.8	70–45	41	SOIC-24	▶ AS148-24	1-92
Diversity/Transfer Switches							
DC–3.0	General Purpose	0.9–1.3	40–18	40	SOIC-8	▶ ADC02D2-12	1-96
DC–2.0	High Power, 2 Line CTL	0.6–1.0	40–8	61	SOIC-16 Wide	AS117-45	1-98
DC–2.0	2 W Transfer Switch	0.5–1.6	19–8	45	SSOP-8	AS126-62	1-100
DC–2.0	Dual Band Transfer Switch	0.5–1.5	20–10	45	MSOP-8	▶ AS127-59	1-102
DC–2.0	PDC T/R w/Acc. Ant.	0.35–1.1	30–20	48	MSOP-8	AS143-59	1-104
DC–2.0	PDC T/R w/Acc. Ant.	0.3–1.2	30–15	49	MSOP-8	AS149-59	1-107
SP4T Non-Reflective Switches							
DC–2.0	High ISO, 3 V CTL	0.5–1.3	60–38	40	LQFP-32	AK115-61	1-112
DC–3.0	High Isolation w/Driver	0.6–1.7	60–28	40	PLCC-28	▶ AK002M4-47	1-114
DC–2.0	High Isolation w/Driver	0.4–1.1	65–40	43	LQFP-32	▶ AS115-61	1-116
DC–2.0	High ISO, 3 V CTL	0.45–0.7	60–37	43	LQFP-32	AS124-61	1-118

▶ Available through distribution.

Preferred for new designs.

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
Attenuators							
Digital							
DC–2.0	4 Bit, LSB 1 dB	0.9–2.0	15	48	SOIC-16	▶ AD210-25	1-122
DC–2.0	4 Bit, LSB 2 dB	1.0–2.0	30	48	SOIC-16	▶ AD220-25	1-124
DC–2.0	3 Bit, LSB 4 dB	1.1–1.9	28	48	SOIC-14	▶ AD230-24	1-126
0.75–2.0	3 Bit, LSB 4 dB, Single Pos. CTL	1.4–2.0	28	48	SOIC-8	AD239-12	1-128
DC–2.0	4 Bit, LSB 4 dB	0.9–2.0	15	48	SOIC-16	AD310-25	1-130
DC–2.0	4 Bit, LSB 2 dB	1.0–2.0	30	48	SOIC-16	AD320-25	1-132
DC–2.0	4 Bit, LSB 2 dB w/Driver	1.2–3.2	30	43	SOIC-16	AK100-25	1-134
DC–2.0	2 Bit, LSB 16 dB w/Driver	1.6–2.5	48	37	SOIC-14	▶ AK002D2-24	1-136
DC–2.0	4 Bit, LSB 1 dB w/Driver	1.4–3.8	15	37	SOIC-14	▶ AK002D4-24	1-138
DC–2.0	4 Bit, LSB 1 dB w/Driver	1.2–3.0	15	24	SOIC-14	AK802D4-24	1-140
DC–1.0	3 Bit, LSB 4 dB	1.2–3.2	28	43	SOIC-14	AT001D3-24	1-142
DC–1.0	4 Bit, LSB 2 dB	1.1–1.6	30	43	SOIC-16	AT001D4-25	1-144
DC–1.0	4 Bit, LSB 3 dB	1.5–3.6	45	43	SOIC-16	▶ AT001D6-25	1-146
VVA							
DC–2.0	15 dB, Single CTL	3.1–3.8	15–7	18	SOT-143	▶ AF002N2-32	1-150
DC–2.5	Dual Control	1.0–1.2	30–25	12	SOIC-8	AT002N3-12	1-152
0.4–2.5	30 dB, Single Pos. CTL	1.7–2.5	30–34	12	SOIC-8	▶ AT002S3-12	1-154
DC–2.0	15 dB, Single CTL	3.1–3.8	15–7	18	SOT-143	▶ AV259-32	1-156

Plastic Packaged Power Amplifiers

Frequency (MHz)	Description	Typical Output Power (dBm)	Typical PAE (%)	Typical Gain (dB)	Supply Voltage (V)	Package	Part Number	Page Number
Linear								
824-849	AMPS, DAMPS, Dual Mode, Single Pos. Supply	31.0 (PEP)	37	26.0	5.80	SSOP-28 Batwing Slug	AP105-69	2-2
1850-1910	PCS, TDMA	31.0 (PEP)	35	28.0	5.80, -4.70	SOIC-16 Slug	AP107-81	2-6
Saturated								
824-849	AMPS, Single Pos. Supply	30.0	60	25.0	4.80	SSOP-28 Batwing Slug	AP104-69	2-12
824-849	AMPS, High Efficiency	30.5	55	25.0	4.80, -2.75	SSOP-16 Slug	AP110-79	2-16
880-915	GSM, High Efficiency	34.5	55	22.5	3.50, -1.70	SSOP-16 Slug	AP112-79	2-18

▶ Available through distribution.

Preferred for new designs.

Passive Products

Plastic Packaged Directional Couplers

Frequency (GHz)	Insertion Loss (db) Typ.	Isolation (db) Typ.	Input VSWR Typ.	Output VSWR Typ.	Coupling (db) Typ.	Coupled Port VSWR Typ.	Package	Part Number	Page Number
0.81–0.96	0.20	30	1.1:1	1.1:1	19.8	1.1:1	SOT-6	DC09-73	3-2
1.42–1.66	0.20	34	1.1:1	1.1:1	18.4	1.1:1	SOT-6	DC15-73	3-5
1.71–1.99	0.20	38	1.1:1	1.1:1	18.8	1.2:1	SOT-6	DC18-73	3-8
2.30–2.60	0.20	33	1.1:1	1.1:1	17.2	1.3:1	SOT-6	DC25-73	3-11

Plastic Packaged Power Dividers

2 Way

Frequency (GHz)	Insertion Loss Less 3 dB Split Typ.	Isolation (db) Typ.	Input VSWR Typ.	Output VSWR Typ.	AMP Balance (db)	Phase Balance (Deg.) Typ.	Total Max. Power w/2.0:1 All Ports	Package	Part Number	Page Number
0.81–0.96	0.40	25	1.2:1	1.3:1	± 0.1	±1.0	1.5 W	SOIC-8	PD09-12	3-16
1.42–1.66	0.40	23	1.2:1	1.2:1	±0.1	±1.0	1.5 W	SOIC-8	PD15-12	3-19
1.71–1.99	0.40	23	1.3:1	1.2:1	±0.1	±1.0	1.5 W	SOIC-8	PD18-12	3-22
0.81–0.96	0.40	25	1.2:1	1.3:1	±0.1	±1.0	1.5 W	SOT-6	PD09-73	3-25
1.42–1.66	0.40	23	1.2:1	1.2:1	±0.1	±1.0	1.5 W	SOT-6	PD15-73	3-28
1.71–1.99	0.40	23	1.3:1	1.2:1	±0.1	±1.0	1.5 W	SOT-6	PD18-73	3-31

4-Way

Frequency (GHz)	Insertion Loss Less 6 dB Split Typ.	Isolation (db) Typ.	Input VSWR Typ.	Output VSWR Typ.	AMP Balance (db)	Phase Balance (Deg.) Typ.	Total Max. Power w/2.0:1 All Ports	Package	Part Number	Page Number
0.81–0.96	1.30	23	1.2:1	1.2:1	±0.4	±6	1.5 W	SOIC-8	PD4W09-12	3-36
1.71–1.99	0.70	25	1.6:1	1.2:1	±0.3	±5	1.5 W	SOIC-8	PD4W18-12	3-39
0.81–0.96	1.30	23	1.2:1	1.2:1	±0.4	±6	1.5 W	MSOP-8	PD4W09-59	3-42
1.71–1.99	0.70	25	1.3:1	1.3:1	±0.3	±5	1.5 W	MSOP-8	PD4W18-59	3-45

Mixers

RF/LO Frequency (GHz)	IF Frequency (GHz)	LO Power (dBm) Typ.	Conversion Loss (dB) Typ.	LO to RF Isolation (dB)	RF to IF Isolation (dB)	RF VSWR Typ.	IP3 (dBm) Typ.	Package	Part Number	Page Number
1.7–2.0	DC–0.3	7	6.5	28	22	1.5:1	11	Ceramic-10L	M18L	3-50
2.3–2.6	DC–0.4	7	5.0	30	23	1.3:1	11	Ceramic-10L	M25L	3-53
3.3–4.3	DC–0.6	7	5.0	30	25	1.5:1	11	Ceramic-10L	M38L	3-56

Section 1

Plastic Packaged Control Products

Control FETs

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
DC–2.5	General Purpose	0.5–0.7	50–10	43	SOT-23	▶ AF002C1-39	1-2
DC–1.0	High Power	0.2–0.4	23–15	60	SOT-23	▶ AF002C4-39	1-2

▶ Available through distribution.

Preferred for new designs.

GaAs IC Control FET Series
DC–2.5 GHz

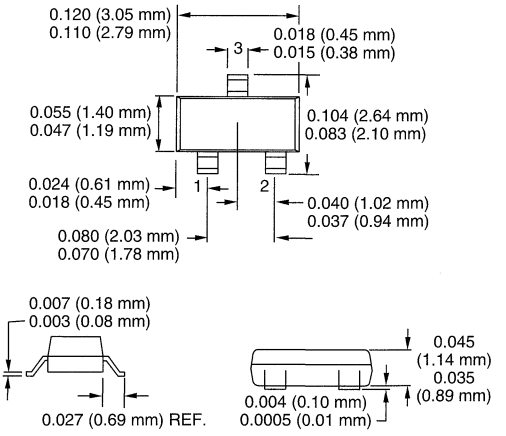
Alpha

AF002C1-39, AF002C4-39

Features

- Low Cost SOT-23 Package
- Series or Shunt Configuration
- Low DC Current Drain
- Ideal Switch Building Blocks
- Pin Diode Replacements
- High Power Antenna Switches

SOT-23



Description

This group of GaAs control FETs can be used in both series and shunt configurations. They incorporate on-chip circuitry that eliminates the need for extra bias components and minimizes power drain to typically 25 µW. These features make the device ideal replacements for PIN diodes, where low DC drain is critical.

Isolation performance degrades at higher frequencies due to package parasitics. They can be tuned out in narrow band applications as shown in the circuit examples on the following pages.

Electrical Specifications at 25°C (0, -5 V)

Part Number[1]	Frequency (GHz)[2]	R_{ON} (Ω)[3]		Insertion Loss (dB)[4,5]		C_{OFF} (pF)[6]		Isolation (db)[5]		$P_{-1\ dB}$ (W)
		Typ.	Max.	Series	Shunt	Typ.	Max.	Series	Shunt	Typ.
AF002C1-39	DC–0.5 GHz	6.4	9.0	0.5	0.1	0.13	0.25	25	12	0.5
	DC–1.0 GHz	6.4	9.0	0.6	0.15	0.13	0.25	17	8	1.0
	DC–2.5 GHz	6.4	9.0	0.7	0.2	0.13	0.25	13	3	1.0
AF002C4-39	DC–0.5 GHz	0.8	1.1	0.2	0.15	1.1	1.5	11	15	6
	DC–1.0 GHz	0.8	1.1	0.25	0.25	1.1	1.5	6	9	10
	DC–2.5 GHz	0.8	1.1	0.3	2.0	1.1	1.5	3	4	10

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF)			6 12		ns ns
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA to -9 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. R_{ON} - resistance in Ω in low impedance state when "0" V is applied to Gate (G).
4. Insertion loss changes by 0.003 dB/°C.
5. Insertion loss and isolation typical values.
6. C_{OFF} - capacitance (pF) in high impedance state when -5 V is applied to Gate (G).

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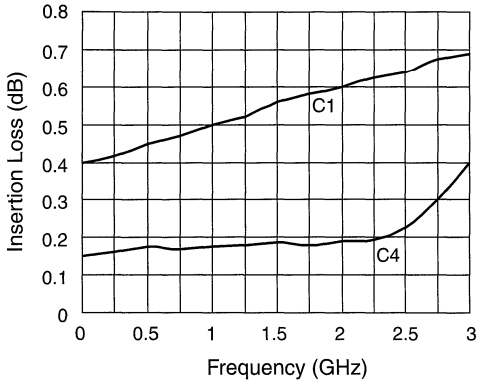
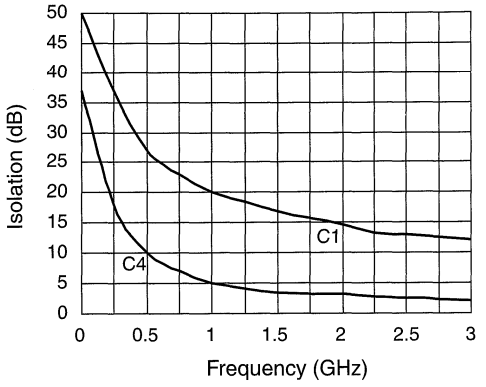
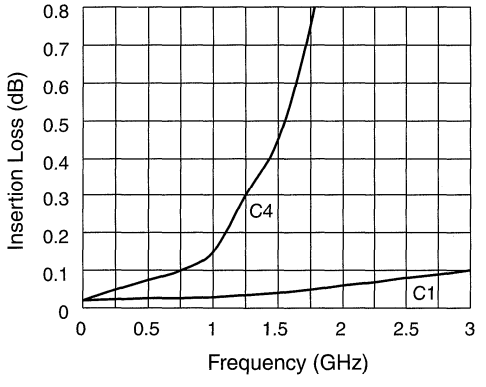
Typical Performance Data (0, -5 V)



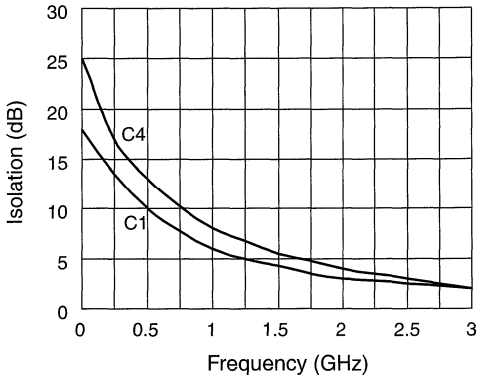
Insertion Loss vs. Frequency Series Configuration



Isolation vs. Frequency Series Configuration



Insertion Loss vs. Frequency Shunt Configuration



Isolation vs. Frequency Shunt Configuration

Absolute Maximum Ratings

AF002C1-39

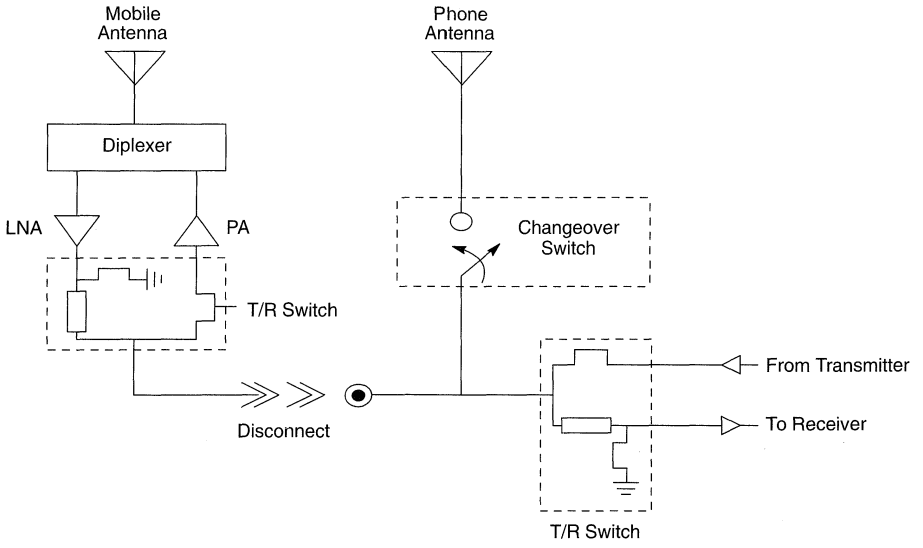
Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -10 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

AF002C4-39

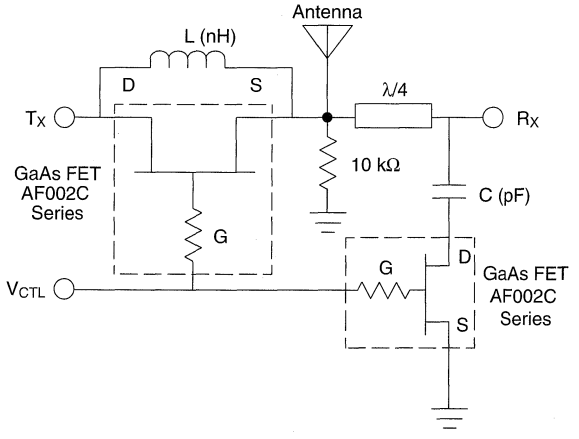
Characteristic	Value
RF Input Power	12 W > 450 MHz, 0/-12 V
Control Voltage	+0.2, -12 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

T/R and Antenna Changeover Switch for Mobile Cellular Systems

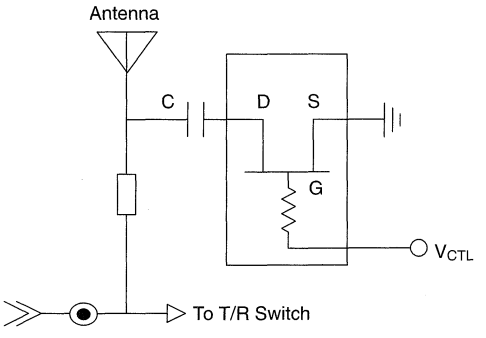


System Block Diagram

T/R Switch Schematic



Changeover Switch Schematic



Truth Table for T/R Switch

V_{CTL} (V)	T_X to Antenna	R_X to Antenna
0	Low Loss	High Isolation
-5	High Isolation	Low Loss

See next page for positive voltage operation.

Truth Table for Changeover Switch

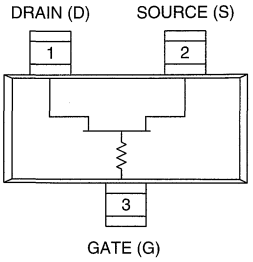
V_{CTL} (V)	Antenna
-5	Connected
0	Isolated

See next page for positive voltage operation.

Component Values for T/R Switch Circuit

Part Number	L (nH)	C (pF)	Freq. (GHz)
AF002C1-39	165	62	.45
AF002C4-39	85	62	.45
AF002C1-39	44	15.6	.90
AF002C4-39	22	15.6	.90

Pin Out



Truth Table

Negative Voltage Operation

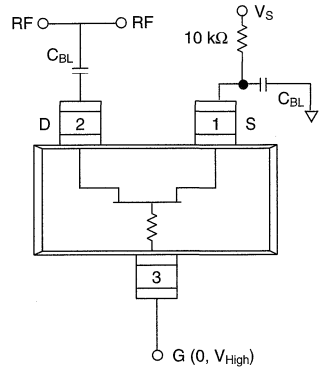
S	D	G	RF Path
Shunt			
GND	RF	-5	Insertion Loss
		0	Isolation
Series			
RF	RF	0	Insertion Loss
		-5	Isolation

Positive Voltage Operation

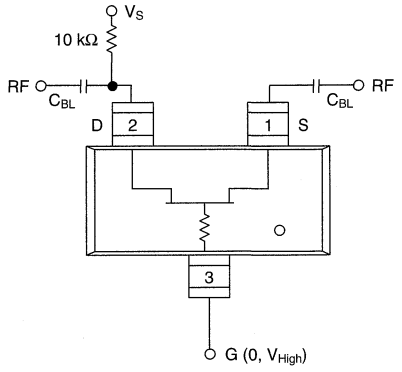
S	D	G	RF Path
Shunt			
GND	RF	0	Insertion Loss
		V_{High}	Isolation
Series			
RF	RF	0	Isolation
		V_{High}	Insertion Loss

V_{High} = +5 V to +9 V ($V_S = V_{High} \pm 0.2$ V)

Positive Voltage Operation



Shunt Configuration



C_{BL} - Chose value for lowest impedance at desired operating frequency.

Series Configuration

SPST Non-Reflective Switches

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
0.7–2.5	High Isolation, Dual Pos. CTL	0.7–1.1	53–25	44	SOIC-8	AS121-12	1-8
0.5–3.0	High Isolation, Single Pos. CTL	0.7–1.1	50–40	44	SOIC-8	▶ AS123-12	1-10
DC–2.5	Low Cost, 6 Lead Pkg.	0.7–1.0	48–20	44	SOT-6	▶ AS130-73	1-12
DC–2.5	Low Loss, Dual CTL	0.5–1.2	70–32	46	SOIC-8	AS159-12	1-14
DC–2.5	General Purpose	0.5–1.2	70–32	46	SOIC-8	▶ AS259M1-12	1-16
DC–2.0	Non-Reflective I/O, Single Pos. CTL	0.6–0.8	27–21	45	SOIC-8	AS349-12	1-18

▶ Available through distribution.

Preferred for new designs.

GaAs IC High Isolation SPST Switch
Non-Reflective Positive Control 0.7–2.0 GHz

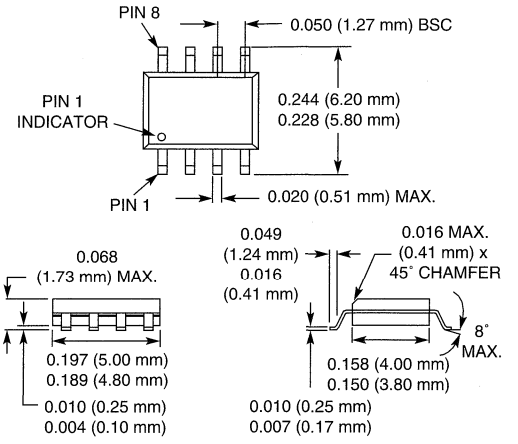
Alpha

AS121-12

Features

- Complementary Positive Control Voltages
- 5 V Operation
- Input and Output Non-Reflective
- High Isolation (46 dB @ 0.9 GHz)

SOIC-8



Description

The AS121-12 SPST IC FET switch is non-reflective on both input and output. This device has been designed for high isolation switching applications and is mounted in the SOIC-8 package. For positive operation, the switch requires DC blocking capacitors on RF lines, a positive supply and two complementary positive controls. Ideal building block for base station switching applications.

Electrical Specifications at 25°C (0, +5 V)

Parameter[1]	Frequency	Min.	Typ.	Max.	Unit
Insertion Loss[2]	0.7–1.0 GHz		0.8	1.0	dB
	1.0–1.8 GHz		1.0	1.2	dB
	1.8–2.0 GHz		1.1	1.3	dB
Isolation	0.7–1.0 GHz	41	46		dB
	1.0–1.8 GHz	43	47		dB
	1.8–2.0 GHz	36	40		dB
VSWR[3]	0.7–1.0 GHz		1.6:1	1.8:1	
	1.0–2.0 GHz		1.4:1	1.6:1	

Operating Characteristics at 25°C (0, +5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[4]	Rise, Fall (10/90% or 90/10% RF)			50		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm +5 V	0.5–2.0 GHz		+43		dBm
Input Power for 1 dB Compression	+5 V	0.9 GHz		+28		dBm
Control Voltage	V_{Low} = 0 to 0.2 V @ 20 µA V_{High} = +5 V @ 100 µA to +7 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. Insertion loss changes by 0.003 dB/°C.
3. Input/output.
4. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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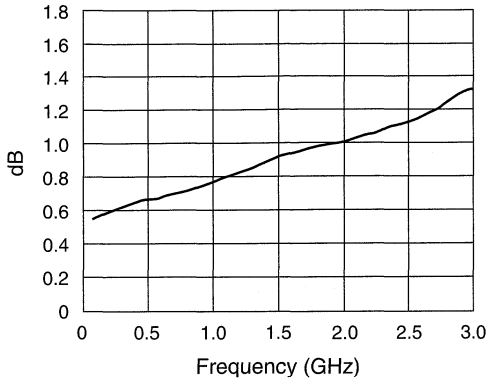
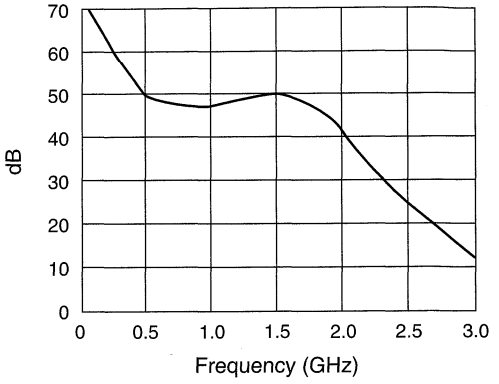
1

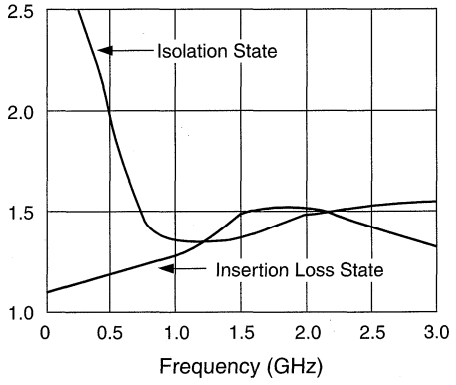
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W Max. > 500 MHz, 0/+8 V
Control Voltage	-0.2, +8 V
Supply Voltage	+8 V
Operating Temperature	-40°C to +125°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

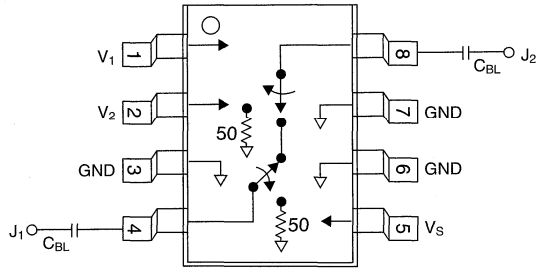
Truth Table

Positive Operation

V_1	V_2	J_1–J_3
0	V_{High}	Insertion Loss
V_{High}	0	Isolation

V_{High} = +5 V to +7 V (V_S = V_{High} ± 0.2 V)

Pin Out



DC blocking capacitors (C_{BL}) must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

GaAs MMIC High Isolation SPST Switch Positive Control 0.7–2.5 GHz

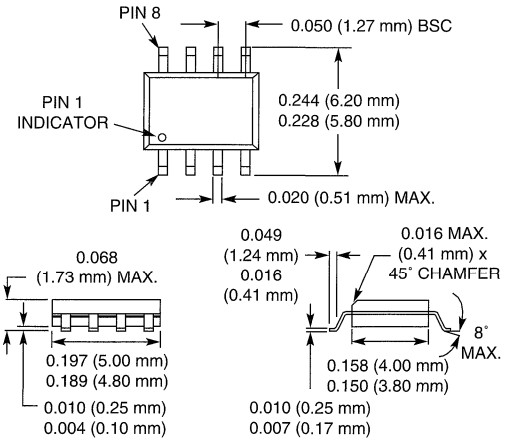
Alpha

AS123-12

Features

- Single Positive Control Voltage
- +5 V Operation
- High Isolation (45 dB @ 0.9 GHz, 52 dB @ 1.9 GHz)
- J_1 Port Non-Reflective

SOIC-8



Description

The AS123-12 SPST IC FET switch is absorptive on the input. The switch features high isolation and low insertion loss. Ideal building block for base station applications where synthesizer isolation is critical. Use in conjunction with the AS148-24 SPDT switch to meet GSM synthesizer switch isolation requirements.

Electrical Specifications at 25°C (0, +5 V)

Parameter[1]	Frequency	Min.	Typ.	Max.	Unit
Insertion Loss[2]	0.7–1.0 GHz		0.7	0.9	dB
	1.0–2.0 GHz		0.8	1.0	dB
	2.0–2.5 GHz		1.2	1.3	dB
Isolation	0.7–1.0 GHz	39	45		dB
	1.0–1.8 GHz	43	47		dB
	1.8–2.0 GHz	47	52		dB
	2.0–2.5 GHz	30	35		dB
VSWR[3]	0.7–1.8 GHz		1.5:1	1.7:1	
	1.8–2.5 GHz		1.7:1	1.8:1	

Operating Characteristics at 25°C (0, +5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[4]	Rise, Fall (10/90% or 90/10% RF)			5		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Input Power For 1 dB Compression		0.5–2.0 GHz		+28		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +5 dBm	0.5–2.0 GHz		+45		dBm
Control Voltage	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +5 V @ 50 µA Max. to +7 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. Insertion loss changes by 0.003 dB/°C.
3. Insertion loss state and J_1 port.
4. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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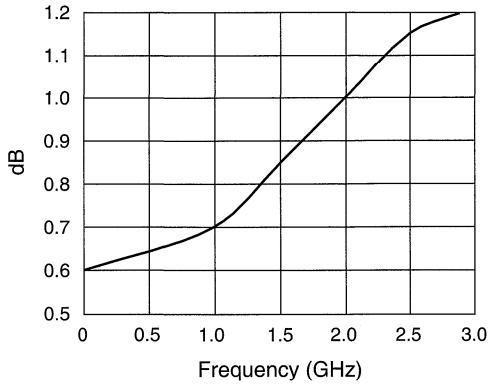
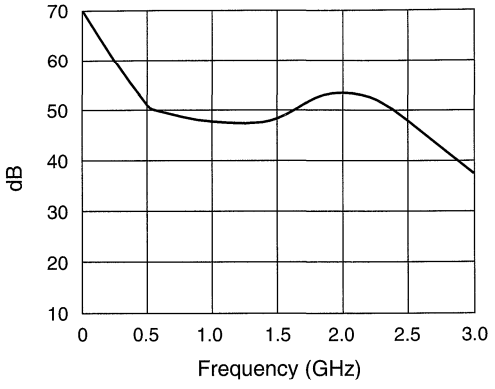
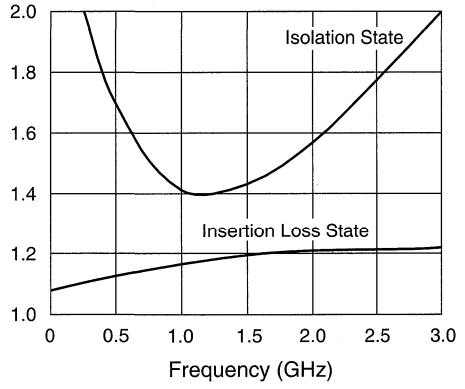
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Truth Table

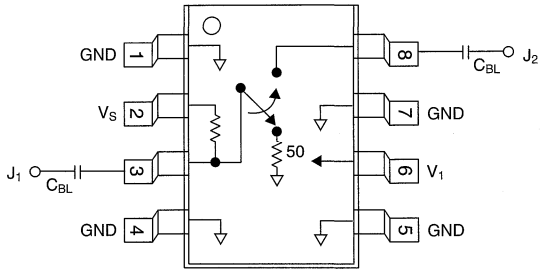
V_1	J_1–J_2
0	Insertion Loss
V_{High}	Isolation

V_{High} = +5 to +7 V ($V_S = V_{High} \pm 0.2$ V)

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W Max. > 500 MHz, 0/+7 V Control
Supply Voltage	+8 V
Control Voltage	-0.2 V, +8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Pin Out



DC blocking capacitors must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

GaAs SPST High Isolation Switch
DC–2.5 GHz

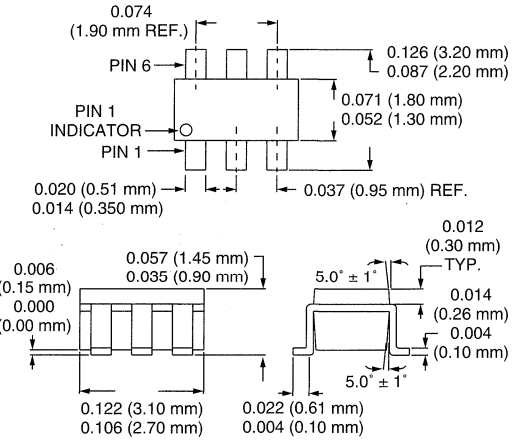
Alpha

AS130-73

Features

- Low Insertion Loss (0.75 dB @ 0.9 GHz)
- Low DC Power Consumption
- Ultra Miniature SOT-6 Lead Package
- Reflective Open, J_1 Port
- Non-Reflective, J_2 Port

SOT-6



Description

The AS130-73 is a high isolation GaAs MMIC FET IC SPST Switch in the SOT-6 low cost plastic package for commercial applications. Switch is matched on J_2 port and reflective on J_1 port when in isolation state.

Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.75	1.0	dB
	DC–1.0 GHz		0.8	1.0	dB
	DC–2.0 GHz		0.9	1.1	dB
	DC–2.5 GHz		1.0	1.2	dB
Isolation	DC–0.5 GHz	46	53		dB
	DC–1.0 GHz	35	41		dB
	DC–2.0 GHz	23	28		dB
	DC–2.5 GHz	18	24		dB
VSWR[4]	DC–1.0 GHz		1.15:1	1.2:1	dB
	DC–2.5 GHz		1.3:1	1.5:1	dB

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			5		ns
	On, Off (50% CTL to 90/10% RF)			10		ns
	Video Feedthru			15		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.5–2.0 GHz		+44		dBm
Input Power For 1 dB Compression		0.5–2.0 GHz		+25		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state and isolation state @ J_2 port.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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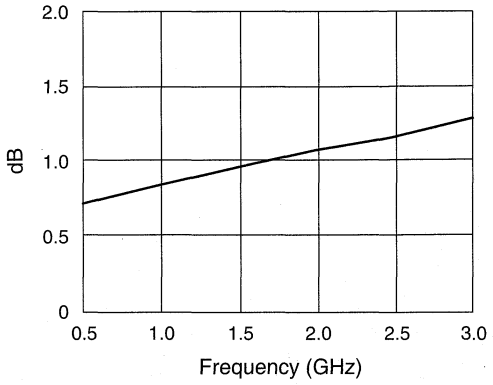
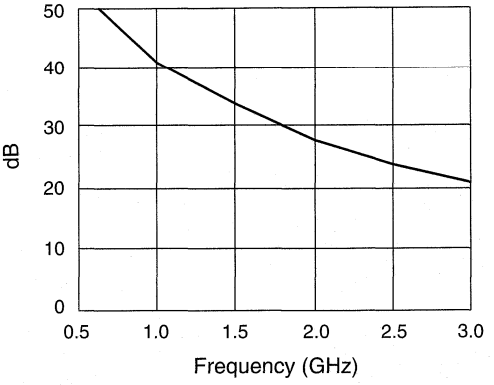
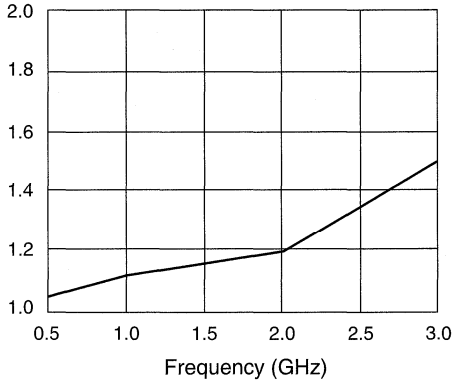
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

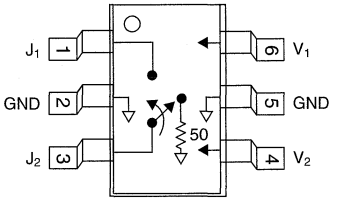
Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W Max > 500 MHz, 0/-8 V Control
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Truth Table

V_1	V_2	J_1–J_2
-5	0	Insertion Loss
0	-5	Isolation

Pin Out



GaAs IC SPST Switch
Non-Reflective DC–2.5 GHz

Alpha

AS159-12

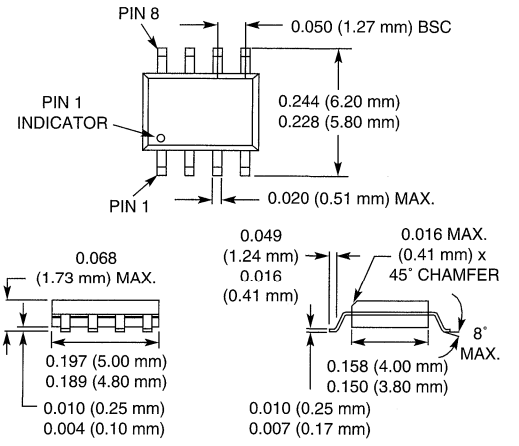
Features

- High Isolation (45 dB @ 0.9 GHz)
- Reflective Open, J_1 Port
- Non-Reflective, J_2 Port
- Low Cost SOIC-8 Plastic Package

Description

The AS159-12 is a non-reflective SPST switch designed for low cost, low power commercial applications. Ideal for use as building blocks for high isolation multi-throw switches.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.8	1.0	dB
	DC–1.0 GHz		0.9	1.2	dB
	DC–2.5 GHz		1.0	1.4	dB
Isolation	DC–0.5 GHz	50	55		dB
	DC–1.0 GHz	45	47		dB
	DC–2.5 GHz	30	34		dB
VSWR[4]	DC–1.0 GHz		1.3:1	1.5:1	
	DC–2.0 GHz		1.5:1	1.7:1	
	DC–2.5 GHz		1.8:1	2.0:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			3		ns
	On, Off (50% CTL to 90/10% RF)			6		ns
	Video Feedthru			20		mV
Input Power for 1 dB Compression		0.5–2.0 GHz		+24		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.5–2.0 GHz		+43		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 20 µA to -9 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state and J_2 port.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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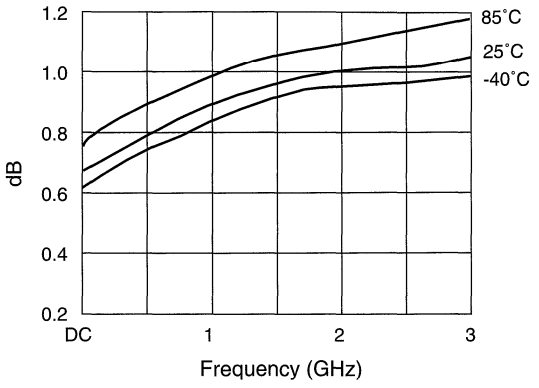
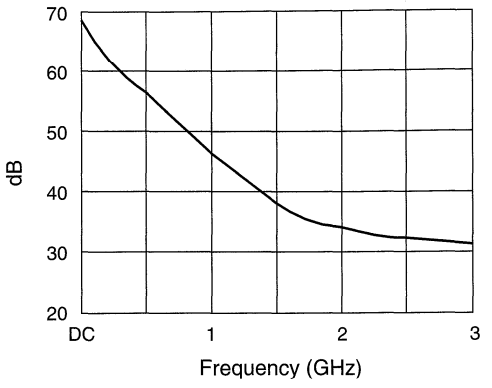
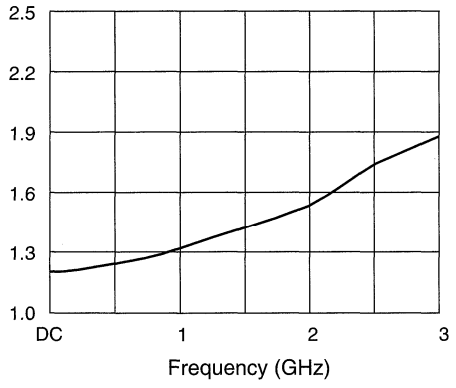
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Truth Table

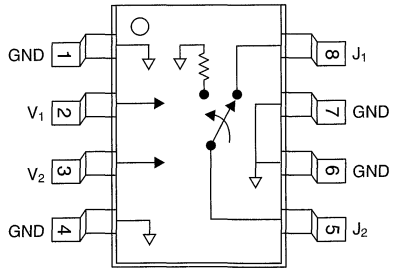
V_1	V_2	J_1–J_2
-5	0	Insertion Loss
0	-5	Isolation

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2.5 W > 500 MHz 0/-8 V, 0.5 W @ 50 MHz 0/8 V
Control Voltage	+0.2 V, -10 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Pin Out



GaAs IC SPST Non-Reflective Switch DC–2.5 GHz

Alpha

AS259M1-12

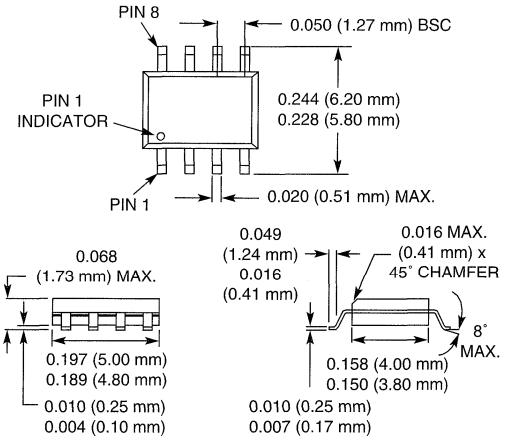
Features

- High Isolation (50 dB @ 0.9 GHz)
- Low DC Drain
- Reflective Open, J_1 Port
- Non-Reflective, J_2 Port

Description

The AS259M1-12 is a non-reflective SPST switch designed for low cost, low power commercial applications. Ideal for use as building blocks for high isolation multi-throw switches.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		.65	0.9	dB
	DC–1.0 GHz		.75	1.0	dB
	DC–2.5 GHz		1.0	1.2	dB
Isolation	DC–0.5 GHz	53	58		dB
	DC–1.0 GHz	45	48		dB
	DC–2.5 GHz	30	35		dB
VSWR[4]	DC–1.0 GHz		1.2:1	1.4:1	
	DC–2.0 GHz		1.3:1	1.6:1	
	DC–2.5 GHz		1.5:1	1.8:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			3		ns
	On, Off (50% CTL to 90/10% RF)			6		ns
	Video Feedthru			20		mV
Input Power For 1 dB Compression		0.50–2.0 GHz		+24		dBm
		0.05 GHz		+16		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–2.0 GHz		+46		dBm
		0.05 GHz		+35		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 20 µA to -9 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state and J_2 Port.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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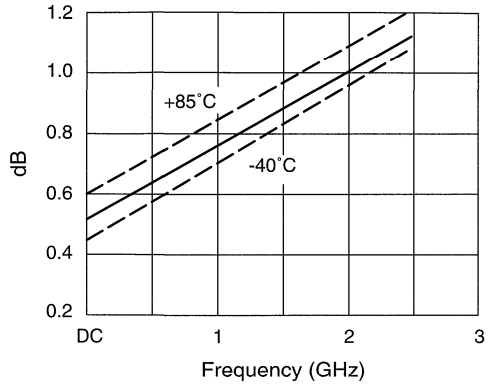
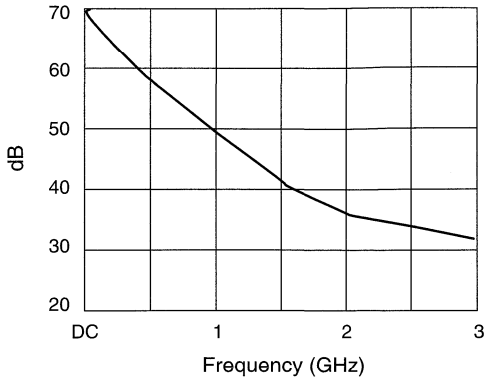
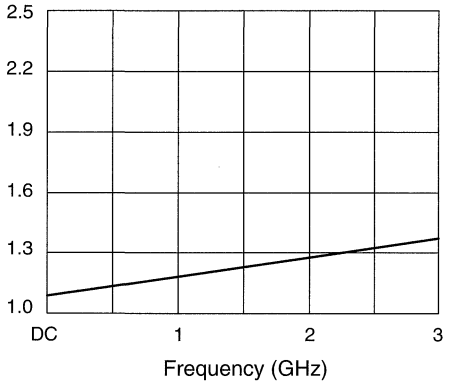
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

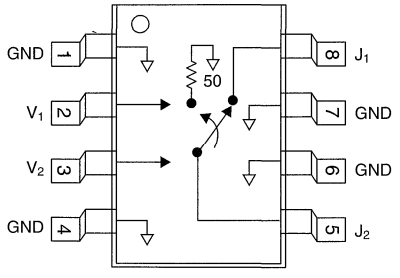
Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -10 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

V_1	V_2	J_1–J_2
-5	0	Insertion Loss
0	-5	Isolation

Pin Out



GaAs IC SPST Positive Control Switch Non-Reflective DC–2.5 GHz

Alpha

AS349-12

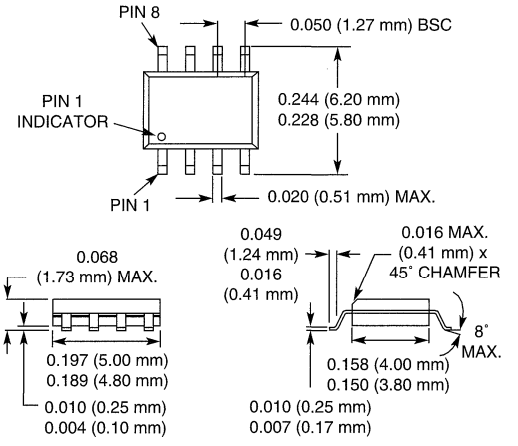
Features

- Single Positive Control Voltage
- +3 V to +5 V Operation
- Input and Output Non-reflective
- High Isolation (45 dB @ 0.9 GHz)

Description

The AS349 is a SPST FET IC switch, non-reflective on both input and output. The switch requires external DC blocking capacitors, positive supply and single positive control. The device is mounted in the SOIC-8 package for surface mounting in commercial switching applications.

SOIC-8



Electrical Specifications at 25°C (0, +5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–1.0 GHz		0.65	0.7	dB
	DC–2.0 GHz		0.9	1.2	dB
	DC–2.5 GHz		1.2	1.5	dB
Isolation	DC–1.0 GHz	40	45		dB
	DC–2.0 GHz	20	24		dB
	DC–2.5 GHz	12	15		dB
VSWR[4]	DC–1.0 GHz		1.1:1	1.4:1	
	DC–2.5 GHz		1.25:1	1.5:1	

Operating Characteristics at 25°C (0, +5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			300		ns
	On, Off (50% CTL to 90/10% RF)			300		ns
	Video Feedthru			10		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.5–2.0 GHz		+45		dBm
Input Power For 1 dB Compression	0/+3 V	0.9 GHz		+20		dBm
	0/+5 V	0.9 GHz		+30		dBm
Control Voltages	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @ 100 µA Max. to +5 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Input/output.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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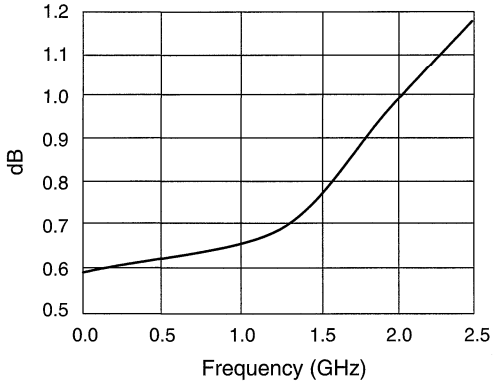
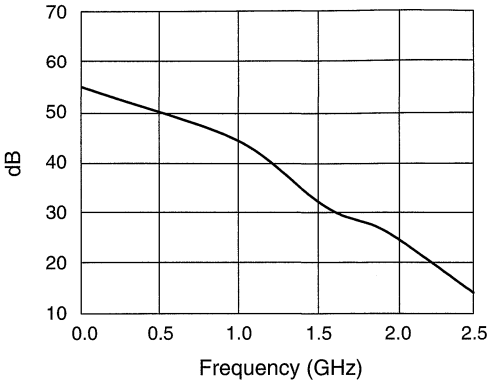
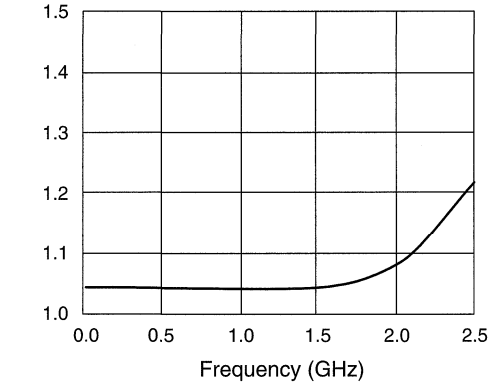
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

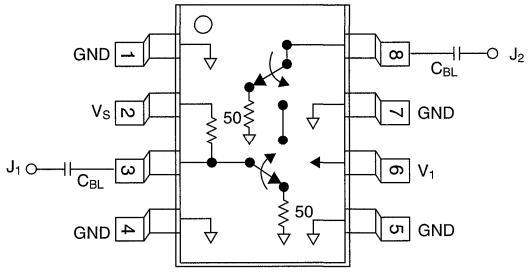
Characteristic	Value
RF Input Power	2.5 W Max. > 500 MHz, 0/+8 V Control
Supply Voltage	+8 V
Control Voltage	-0.2 V, 8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Truth Table

V_1	J_1–J_2
0	Insertion Loss
V_{High}	Isolation

V_{High} = +3 to +5 V ($V_S = V_{High} \pm 0.2$ V)

Pin Out



DC blocking capacitors (C_{BL}) must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz

General Purpose SPDT Reflective Switches

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
DC–3.0	Low Loss	0.4–1.2	60–18	40	MSOP-8	▶ AS104-59	1-22
DC–3.0	Dual Pos. CTL	0.4–1.1	50–13	45	MSOP-8	▶ AS106-59	1-24
0.8–2.5	Single Pos. CTL	1.1–1.4	22–12	38	SOIC-8	AS107-12	1-26
DC-2.5	Low Cost, 6 Lead Pkg.	0.4–0.8	35–13	45	SOT-6	▶ AS125-73	1-28
DC–3.0	General Purpose	0.3–0.8	56–18	46	SOIC-8	▶ AS239-12	1-30
DC–2.5	Low Loss	0.3–0.7	56–20	46	SSOP-8	AS328-62	1-32
DC–2.5	Dual Pos. CTL	0.4–1.1	50–13	45	SOIC-8	AS373-12	1-34
DC–3.0	General Purpose	0.4–1.2	60–18	46	SOIC-8	▶ AS002R2-12	1-36
DC–3.0	General Purpose	0.4–1.2	60–18	40	SOIC-8	▶ ASC02R2-12	1-38

▶ Available through distribution.

Preferred for new designs.

GaAs IC SPDT Switch DC–2.5 GHz

Alpha

AS104-59

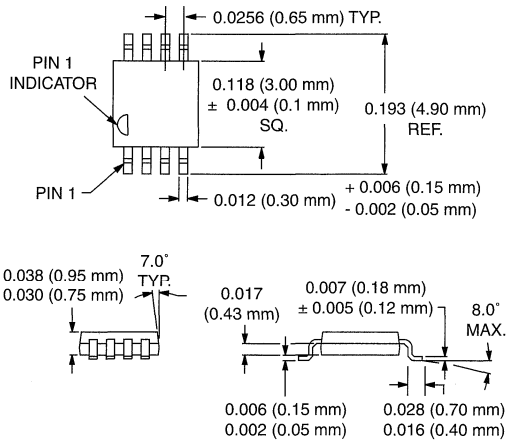
Features

- Miniature MSOP-8 Surface Mount Package
- Low Insertion Loss (0.45 dB @ 0.9 GHz)
- Low DC Power Consumption

Description

The AS104-59 is a low cost IC FET SPDT reflective switch in a plastic MSOP-8 package. It operates with 0 and -5 V, or will operate at +5 and 0 V as shown on the following page. This general purpose SPDT switch is used in various telecommunications applications.

MSOP-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.1 GHz		0.3	0.5	dB
	DC–0.5 GHz		0.4	0.6	dB
	DC–1.0 GHz		0.5	0.7	dB
	DC–2.0 GHz		0.7	1.0	dB
	DC–2.5 GHz		1.0	1.1	dB
Isolation	DC–0.1 GHz	50	55		dB
	DC–0.5 GHz	37	40		dB
	DC–1.0 GHz	30	32		dB
	DC–2.0 GHz	22	25		dB
	DC–2.5 GHz	20	22		dB
VSWR[4]	DC–1.0 GHz		1.2:1	1.3:1	
	DC–2.0 GHz		1.5:1	1.6:1	
	DC–2.5 GHz		1.6:1	1.7:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			10		ns
	On, Off (50% CTL to 90/10% RF)			30		ns
	Video Feedthru			15		mV
Input Power For 1 dB Compression		0.50–2.0 GHz		+22		dBm
		0.05 GHz		+14		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–2.0 GHz		+40		dBm
Control Voltages	V_{Low} = 0 to -2 V @ 20 µA Max.					
	V_{High} = -5 V @ 20 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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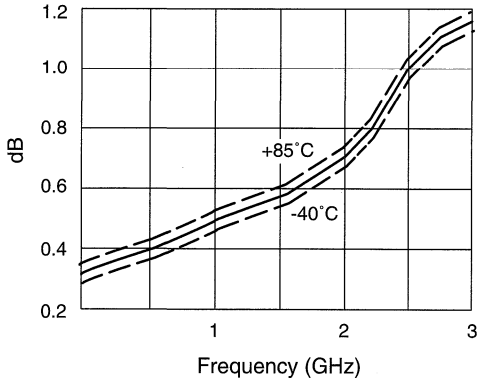
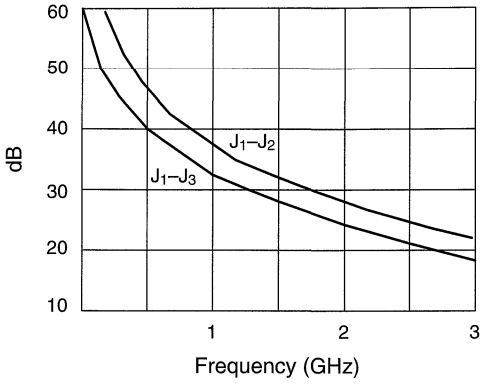
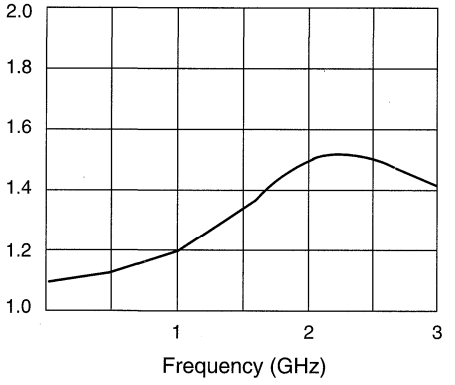
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

Negative Voltage Operation

V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Isolation	Insertion Loss
-5	0	Insertion Loss	Isolation

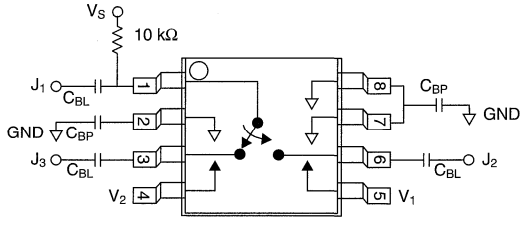
Positive Voltage Operation[1]

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Isolation	Insertion Loss
0	V_{High}	Insertion Loss	Isolation

V_{High} = +5 to +8 V ($V_S = V_{High} \pm 0.2$ V)
1. Refer to Application Notes for further information.

Pin Out

Positive Voltage Operation



External components shown are for positive voltage operation only.
C_{BL} = 100 pF, C_{BP} = 1000 pF for operation >500 MHz.

GaAs IC SPDT Reflective Switch Positive Control DC–2.5 GHz

Alpha

AS106-59

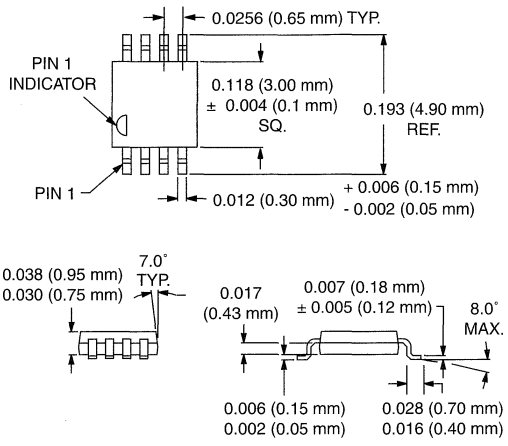
Features

- Low Insertion Loss (0.5 dB @ 900 MHz)
- Complementary Positive Control
- Positive Voltage Supply (+3 to +5 V)
- Low DC Power Consumption

Description

The AS106-59 is a GaAs IC FET SPDT in a miniature MSOP-8 surface mount plastic package. It is ideal for commercial applications where low power consumption, low insertion loss, high linearity and extremely small package size are required. Applications include general purpose T/R switching for wireless communication systems.

MSOP-8



Electrical Specifications at 25°C (0, +3 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.4	0.5	dB
	DC–1.0 GHz		0.5	0.7	dB
	DC–2.0 GHz		1.0	1.2	dB
	DC–2.5 GHz		1.1	1.4	dB
Isolation	DC–0.5 GHz	25	28		dB
	DC–1.0 GHz	18	22		dB
	DC–2.0 GHz	13	15		dB
	DC–2.5 GHz	10	13		dB
VSWR[4]	DC–1.0 GHz		1.2:1	1.5:1	
	DC–2.5 GHz		1.75:1	2.0:1	

Operating Characteristics at 25°C (0, +3 V)

Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			10		ns
	On, Off (50% CTL to 90/10% RF)			20		ns
	Video Feedthru			25		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–2.0 GHz		+45		dBm
Input Power For 1 dB Compression	0/+3	0.50–2.0 GHz		+22		dBm
	0/+5	0.50–2.0 GHz		+28		dBm
Control Voltage	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @ 100 µA Max. to +5 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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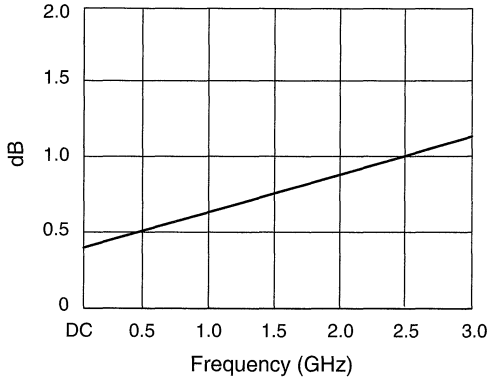
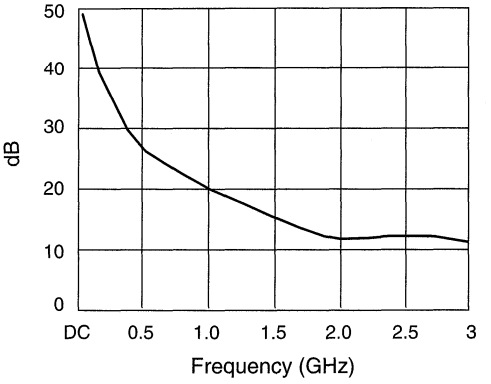
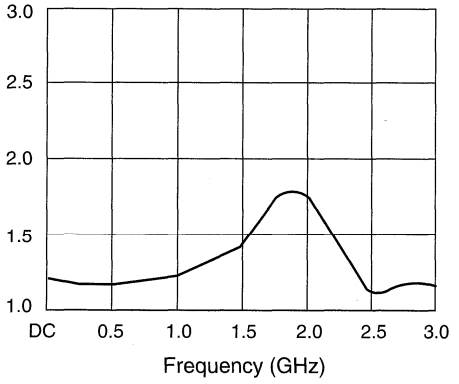
Typical Performance Data (0, +3 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

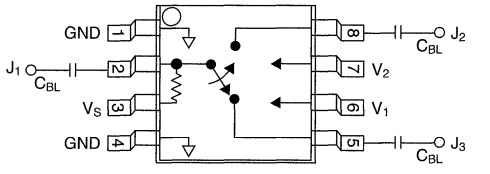
Characteristic	Value
RF Input Power	2 W Max. > 500 MHz 0/+8 V Control
Supply Voltage	+8 V
Control Voltage	0.2 V, +8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
0	V_{High}	Isolation	Insertion Loss
V_{High}	0	Insertion Loss	Isolation

V_{High} = +3 to +5 V (V_S = V_{High} ± 0.2 V)

Pin Out



DC blocking capacitor (C_{BL}) must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC SPDT Single Positive Control Switch 0.8–2.5 GHz

Alpha

AS107-12

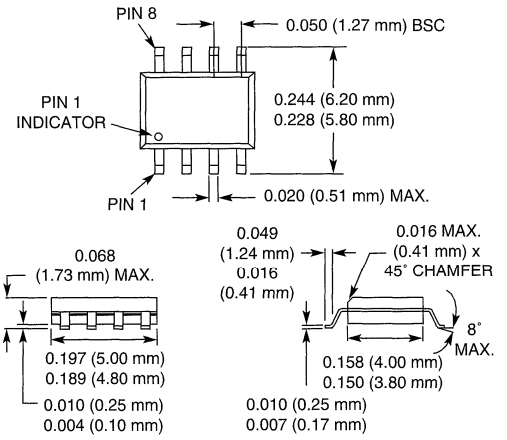
Features

- Low DC Power Consumption
- Supply Voltage (+3 V to +5 V)
- Single Positive Control Voltage (+3 V to +5 V)
- Low Cost SOIC-8 Plastic Package

Description

The AS107-12 is a GaAs IC FET SPDT reflective switch in a SOIC-8 plastic package. This single positive control switch is for low power commercial applications such as cellular and ISM band systems. The part requires a fixed positive voltage and DC blocks on RF ports.

SOIC-8



Electrical Specifications at 25°C (0, +3 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	0.8–1.0 GHz		1.1	1.2	dB
	1.0–2.0 GHz		1.2	1.3	dB
	2.0–2.5 GHz		1.3	1.5	dB
Isolation	0.8–1.0 GHz	20	22		dB
	1.0–2.0 GHz	13	15		dB
	2.0–2.5 GHz	11	12		dB
VSWR[4]	0.8–1.0 GHz		1.5:1		
	1.0–2.0 GHz		1.7:1		
	2.0–2.5 GHz		1.9:1		

Operating Characteristics at 25°C (0, +3 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			100		ns
	On, Off (50% CTL to 90/10% RF)			500		ns
	Video Feedthru			25		mV
Input Power for 1 dB Compression	@ +3 V	0.8–2.0 GHz		+27		dBm
	@ +5 V	0.8–2.0 GHz		+32		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +5 dBm					
	@ +3 V	0.8–2.0 GHz		+38		dBm
	@ +5 V	0.8–2.0 GHz		+42		dBm
Control Voltages	V_{Low} = 0 to +0.2 V @ 20 µA Typ.					
	V_{High} = +3 V @ 100 µA Typ. to +5 V @ 200 µA Typ.					
	$V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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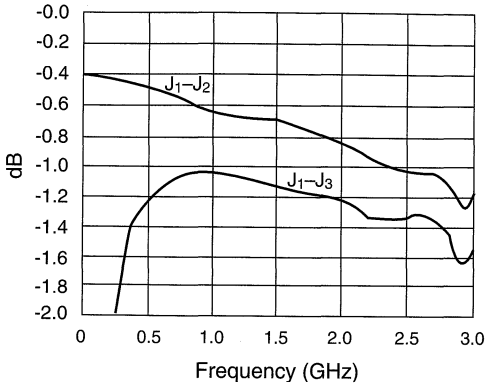
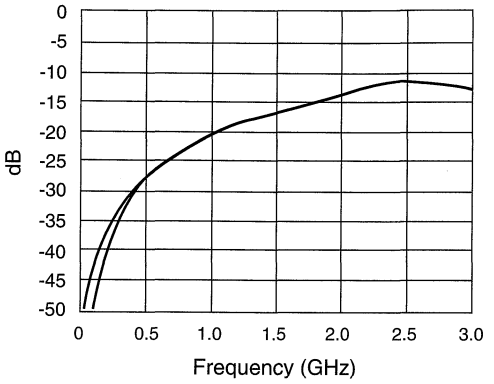
Typical Performance Data (0, +3 V)



Insertion Loss vs. Frequency

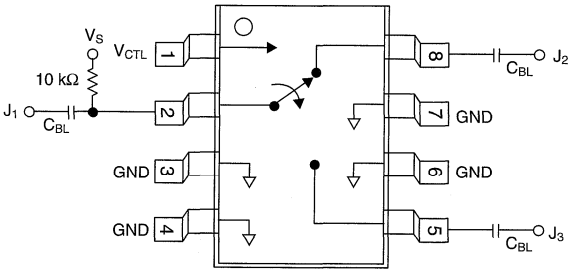


Isolation vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 0.8 GHz 0/+8 V Control
Supply Voltage	+8 V
Control Voltage	-0.2 V, +8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Pin Out



DC blocking (C_{BL}) and biasing resistor must be supplied externally.
C_{BL} = 50 pF for operation >0.8 GHz.

Truth Table

V_{CTL}	J_1–J_2	J_1–J_3
0	Isolation	Insertion Loss
V_{High}	Insertion Loss	Isolation

V_{High} = +3 to +5 V ($V_S = V_{High} \pm 0.2$ V)

GaAs IC SPDT Reflective Switch
Positive Control DC–2.5 GHz

Alpha

AS125-73

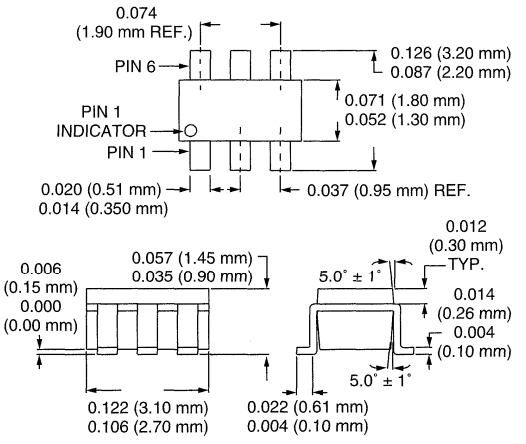
Features

- Low Insertion Loss (0.4 dB @ 0.9 GHz)
- Complementary Positive Control Voltages (0/+3 V to 0/+5 V)
- Positive Voltage Supply (+3 to +5 V)
- Low DC Power Consumption
- Ultra Miniature 6 Lead SOT-6 Package

Description

The AS125-73 is a GaAs IC FET SPDT reflective switch in the SOT-6 plastic package for commercial applications. For positive operation it requires a fixed positive bias (V_S) on the J_1 line and DC blocks on all RF lines. This switch can also be operated with complementary negative voltage (no V_S or blocking caps required). The AS125-73 provides a low cost solution for IF switching requirements in dual band and dual mode subscribers.

SOT-6



Electrical Specifications at 25°C (0, +3 V)

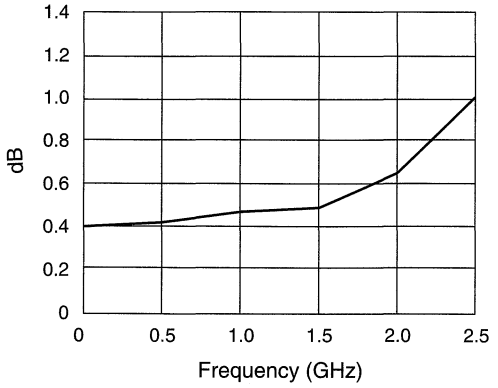
Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.4	0.5	dB
	DC–1.0 GHz		0.45	0.6	dB
	DC–2.0 GHz		0.6	0.8	dB
	DC–2.5 GHz		0.9	1.1	dB
Isolation	DC–0.5 GHz	22	25		dB
	DC–1.0 GHz	17	20		dB
	DC–2.0 GHz	11	14		dB
	DC–2.5 GHz	10	13		dB
VSWR[4]	DC–1.0 GHz		1.2:1	1.3:1	
	DC–2.5 GHz		1.5:1	1.7:1	

Operating Characteristics at 25°C (0, +3 V)

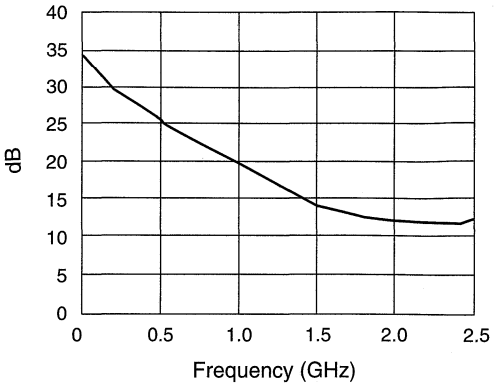
Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			10		ns
	On, Off (50% CTL to 90/10% RF)			20		ns
	Video Feedthru			25		mV
Input Power for 1 dB Compression	0/+3 V	0.5–2.0 GHz		+21		dBm
	0/+5 V	0.5–2.0 GHz		+28		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.5–2.0 GHz		+45		dBm
Control Voltages	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @ 100 µA Max. to +5 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

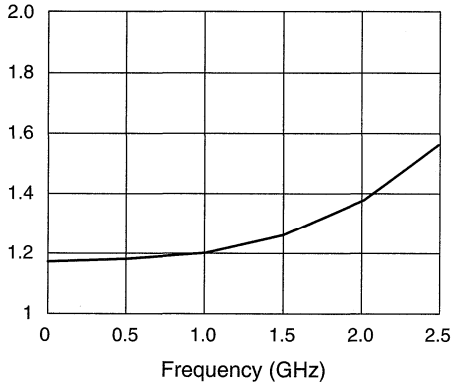
Typical Performance Data (0, +3 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 500 MHz 0/+7 V Control
Control Voltage	-0.2 V, +8 V
Operating Temperature	-40°C to 125°C
Storage Temperature	-50°C to 150°C
Θ_{JC}	25°C/W

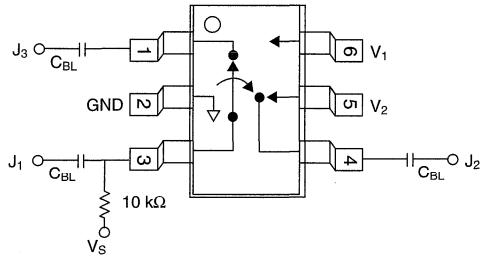
Truth Table

Positive Operation

V_1	V_2	J_1–J_2	J_1–J_3
0	V_{High}	Isolation	Insertion
V_{High}	0	Insertion	Isolation

V_{High} = +3 to +5 V (V_S = V_{High} ± 0.2 V)

Pin Out



DC blocking capacitors (C_{BL}) and biasing resistor must be supplied externally for positive voltage operation.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC SPDT Reflective Switch DC–2.5 GHz

Alpha

AS239-12

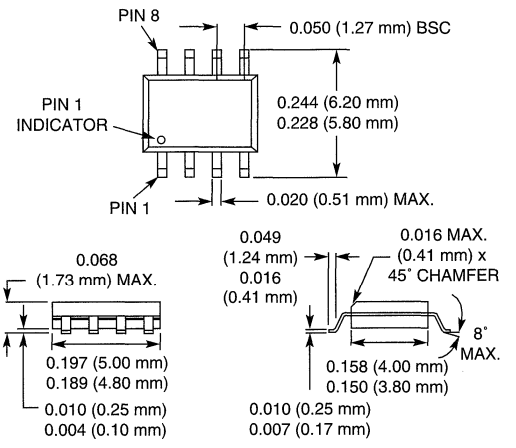
Features

- Low Insertion Loss (0.4 dB @ 1 GHz)
- High Isolation (35 dB @ 1 GHz)
- General Purpose Switching

Description

The AS239-12 is a low cost IC FET SPDT reflective switch in a plastic SOIC-8 package for commercial low cost, low power applications. The switch operates with -5 V, 0 V or operates with +5 V, 0 V when device is "floated" as shown on following page. This general purpose SPDT switch is used in many commercial telecommunication applications.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.1 GHz		0.3	0.6	dB
	DC–0.5 GHz		0.3	0.6	dB
	DC–1.0 GHz		0.4	0.7	dB
	DC–2.0 GHz		0.5	0.8	dB
	DC–2.5 GHz		0.7	0.9	dB
Isolation	DC–0.1 GHz	52	56		dB
	DC–0.5 GHz	40	45		dB
	DC–1.0 GHz	30	35		dB
	DC–2.0 GHz	22	24		dB
	DC–2.5 GHz	17	20		dB
VSWR[4]	DC–2.0 GHz			1.2:1	
	DC–2.5 GHz			1.5:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			8		ns
	On, Off (50% CTL to 90/10% RF)			30		ns
	Video Feedthru			25		mV
Input Power for 1 dB Compression		0.5–2.0 GHz		+27		dBm
		0.05 GHz		+21		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +5 dBm	0.5–2.0 GHz		+46		dBm
		0.05 GHz		+40		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 20 µA to -7 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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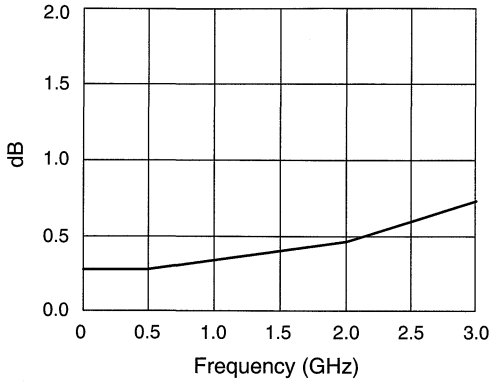
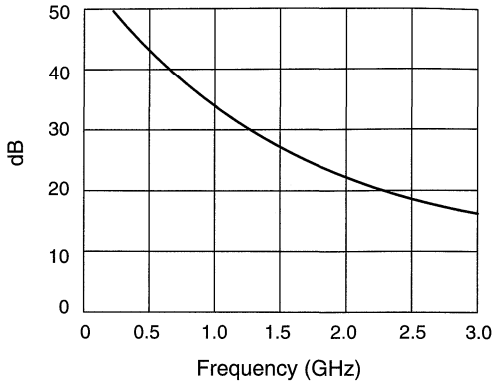
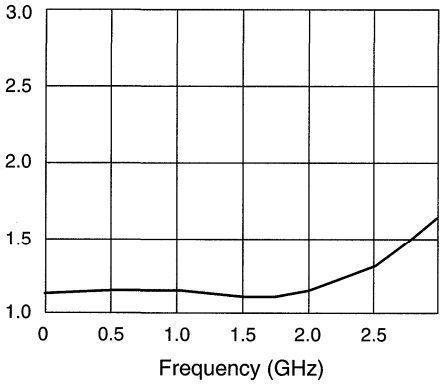
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Truth Table

Negative Operation

V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Isolation	Insertion Loss
-5	0	Insertion Loss	Isolation

Positive Operation[1]

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Isolation	Insertion Loss
0	V_{High}	Insertion Loss	Isolation

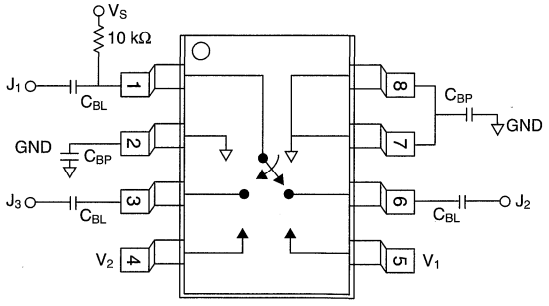
V_{High} = +5 V to +7 V ($V_S = V_{High} \pm 0.2$ V)
1. Refer to Application Notes for further information.

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Pin Out



DC blocking (C_{BL}), bypass (C_{BP}) capacitors and biasing resistor supplied externally. C_{BL} = 100 pF, C_{BP} = 1000 pF for operation >500 MHz.

GaAs IC SPDT Switch DC–2.5 GHz

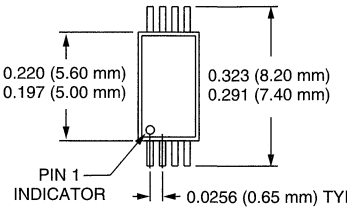
Alpha

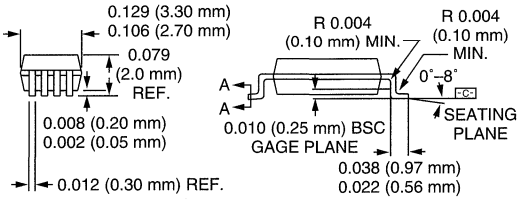
AS328-62

Features

- Low Insertion Loss (0.4 dB @ 0.9 GHz)
- High Isolation (35 dB @ 0.9 GHz)
- General Purpose Switching
- Reflective Short

SSOP-8





Description

The AS328-62 is a low cost IC FET SPDT reflective switch in a plastic SSOP-8 package for commercial low cost, low power applications. The switch operates with -5, 0 V, but operates with +5 V, 0 V when device is "floated". Refer to Application Notes for further information.

Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.1 GHz		0.3	0.6	dB
	DC–0.5 GHz		0.3	0.6	dB
	DC–1.0 GHz		0.4	0.7	dB
	DC–2.0 GHz		0.5	0.8	dB
	DC–2.5 GHz		0.7	0.9	dB
Isolation	DC–0.1 GHz	52	56		dB
	DC–0.5 GHz	40	45		dB
	DC–1.0 GHz	30	35		dB
	DC–2.0 GHz	22	24		dB
	DC–2.5 GHz	17	20		dB
VSWR[4]	DC–2.0 GHz		1.2:1	1.4:1	
	DC–2.5 GHz		1.25:1	1.5:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			8		ns
	On, Off (50% CTL to 90/10% RF)			30		ns
	Video Feedthru			25		mV
Input Power For 1 dB Compression		0.50–2.0 GHz		+27		dBm
		0.05 GHz		+21		dBm
Intermodulation Intercept Point	For Two-tone Input Power +5 dBm	0.50–2.0 GHz		+46		dBm
		0.05 GHz		+40		dBm
Control Voltages	V_{Low} = 0 to -2 V @ 20 µA Max. V_{High} = -5 V @ 20 µA to -7 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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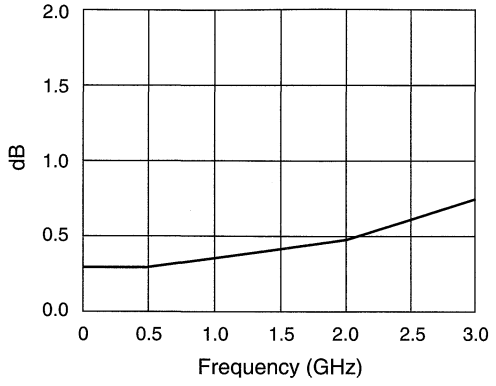
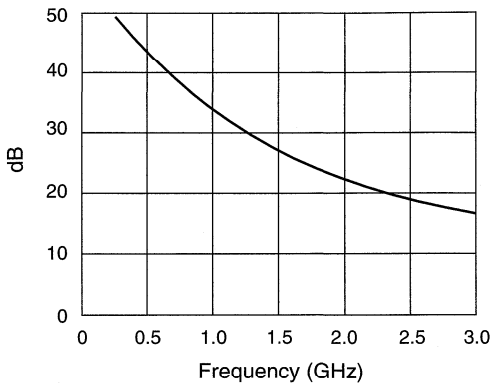
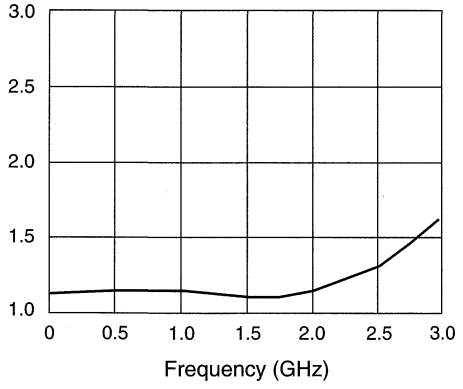
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

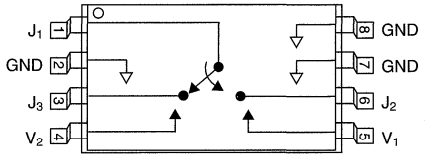
Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Isolation	Insertion Loss
-5	0	Insertion Loss	Isolation

Pin Out



GaAs IC SPDT Reflective Switch Positive Control DC–2.5 GHz

Alpha

AS373-12

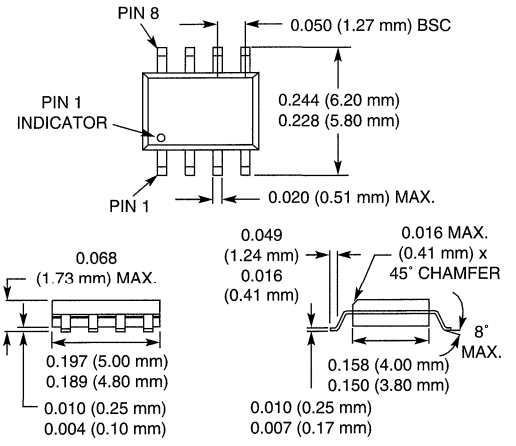
Features

- Low Insertion Loss (<0.5 dB @ 0.9 GHz)
- Complementary Positive Control Voltage
- Positive Voltage Supply (+3 to +5 V)
- Low DC Power Consumption

Description

The AS373-12 is a GaAs IC FET SPDT reflective switch in an SOIC-8 plastic package. It is ideal for commercial switching applications where low power consumption, low insertion loss and high linearity are required. Applications include general purpose T/R switching for wireless communication systems.

SOIC-8



Electrical Specifications at 25°C (0, +5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.4	0.5	dB
	DC–1.0 GHz		0.5	0.7	dB
	DC–2.0 GHz		1.0	1.2	dB
	DC–2.5 GHz		1.1	1.4	dB
Isolation	DC–0.5 GHz	25	28		dB
	DC–1.0 GHz	18	22		dB
	DC–2.0 GHz	13	15		dB
	DC–2.5 GHz	10	13		dB
VSWR[4]	DC–1.0 GHz			1.5:1	
	DC–2.5 GHz			2.0:1	

Operating Characteristics at 25°C (0, +5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			10		ns
	On, Off (50% CTL to 90/10% RF)			20		ns
	Video Feedthru			25		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.5–2.0 GHz		+45		dBm
Input Power for 1 dB Compression	0/+3 V	0.5–2.0 GHz		+22		dBm
	0/+5 V	0.5–2.0 GHz		+28		dBm
Control Voltages	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @ 100 µA Max. to +5 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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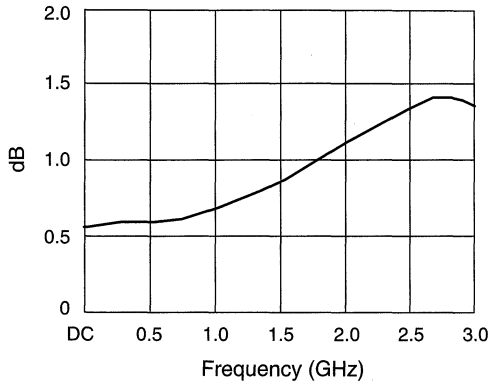
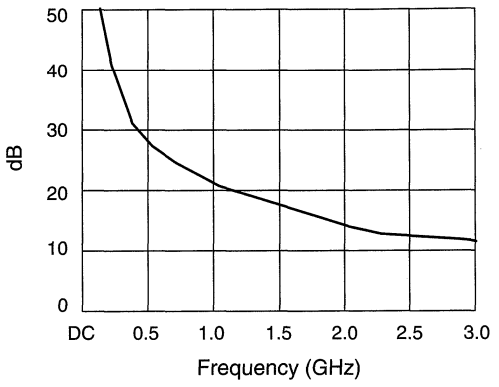
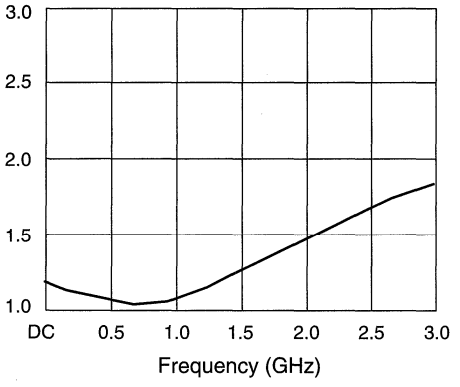
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

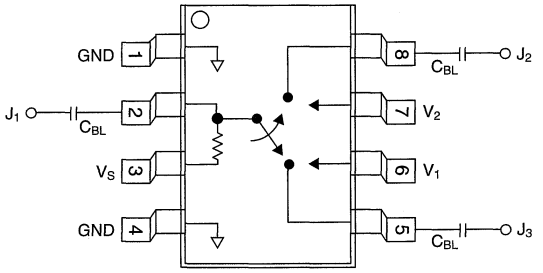
Characteristic	Value
RF Input Power	2 W Max. > 500 MHz, 0/+8 V Control
Supply Voltage	+8 V
Control Voltage	-0.2 V, +8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
0	V_{High}	Isolation	Insertion Loss
V_{High}	0	Insertion Loss	Isolation

V_{High} = +3 to +5 V (V_S = V_{High} ± 0.2 V)

Pin Out



DC blocking capacitors (C_{BL}) must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC SPDT Low Loss Switch
Reflective DC–2.5 GHz

Alpha

AS002R2-12

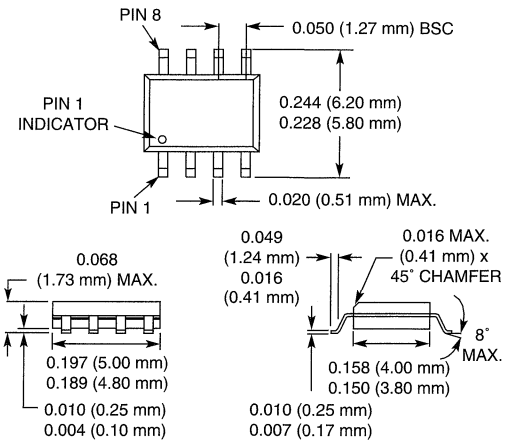
Features

- Low Insertion Loss (0.5 dB @ 0.9 GHz)
- High Isolation (35 dB @ 0.9 GHz)
- Low Power T/R Switch
- Low Cost SOIC-8 Plastic Package

Description

The AS002R2-12 is a low loss IC FET SPDT reflective general purpose switch in a plastic SOIC-8 package for commercial low cost, low power applications. The switch operates with -5, 0 V or 0, +5 V when floated as shown on the following page.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.4	0.5	dB
	DC–1.0 GHz		0.5	0.6	dB
	DC–2.0 GHz		0.7	0.8	dB
	DC–2.5 GHz		0.8	0.9	dB
Isolation	DC–0.5 GHz	40	42		dB
	DC–1.0 GHz	30	32		dB
	DC–2.0 GHz	22	24		dB
	DC–2.5 GHz	18	20		dB
VSWR[4]	DC–0.5 GHz		1.2:1	1.3:1	
	DC–1.0 GHz		1.3:1	1.5:1	
	DC–2.5 GHz		1.5:1	1.7:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			3		ns
	On, Off (50% CTL to 90/10% RF)			6		ns
	Video Feedthru			15		mV
Input Power for 1 dB Compression		0.50–2.0 GHz		+24		dBm
		0.05 GHz		+16		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–2.0 GHz		+46		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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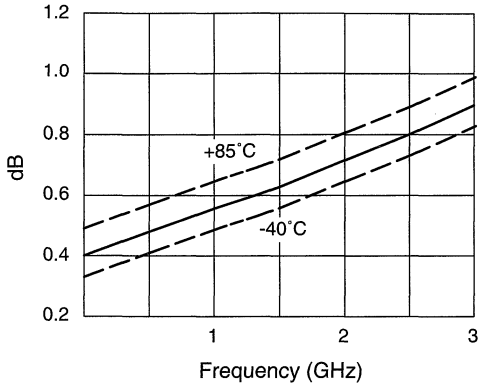
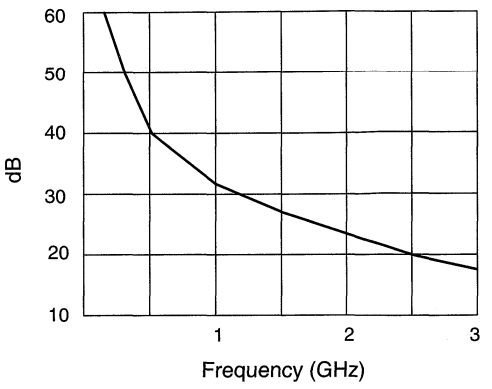
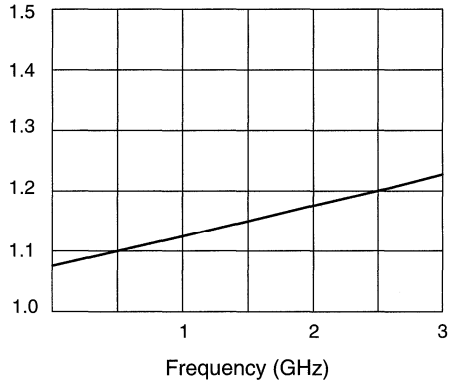
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

Negative Operation

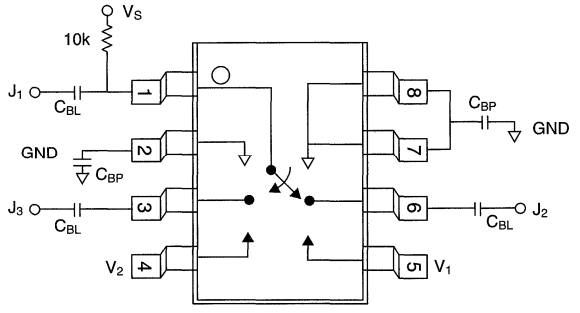
V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Isolation	Insertion Loss
-5	0	Insertion Loss	Isolation

Positive Operation

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Isolation	Insertion Loss
0	V_{High}	Insertion Loss	Isolation

V_{High} = +5 to +8 V (V_S = V_{High} ± 0.2 V)

Pin Out



External components shown are for positive voltage operation only.
C_{BL} = 100 pF, C_{BP} = 1000 pF for operation >500 MHz.

GaAs IC SPDT Switch DC–2.5 GHz

Alpha

ASC02R2-12

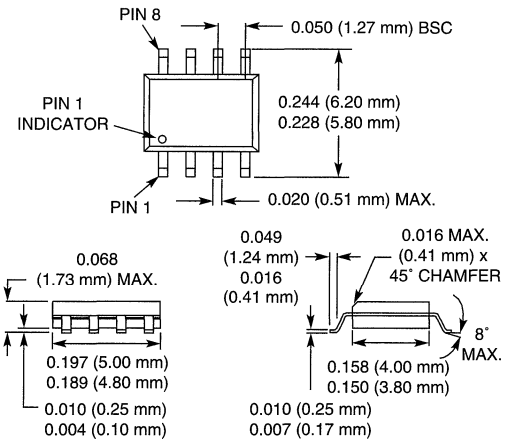
Features

- High Isolation (35 dB @ 0.9 GHz)
- Low Insertion Loss (0.5 dB @ 0.9 GHz)
- Low DC Power Consumption

Description

The ASC02R2-12 is a low cost IC FET SPDT reflective general purpose switch in a plastic SOIC-8 package for commercial low cost, low power applications. The switch operates with -5, 0 V or 0, +5 V when floated as shown on the following page.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.1 GHz		0.4	0.5	dB
	DC–0.5 GHz		0.5	0.6	dB
	DC–1.0 GHz		0.6	0.7	dB
	DC–2.0 GHz		0.8	1.0	dB
	DC–2.5 GHz		1.0	1.1	dB
Isolation	DC–0.1 GHz	55	60		dB
	DC–0.5 GHz	40	42		dB
	DC–1.0 GHz	30	33		dB
	DC–2.0 GHz	20	25		dB
	DC–2.5 GHz	20	22		dB
VSWR[4]	DC–2.0 GHz		1.2:1	1.4:1	
	DC–2.5 GHz		1.5:1	1.7:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			3		ns
	On, Off (50% CTL to 90/10% RF)			6		ns
	Video Feedthru			15		mV
Input Power for 1 dB Compression		0.5–2.0 GHz		+22		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.5–2.0 GHz		40		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 @ 20 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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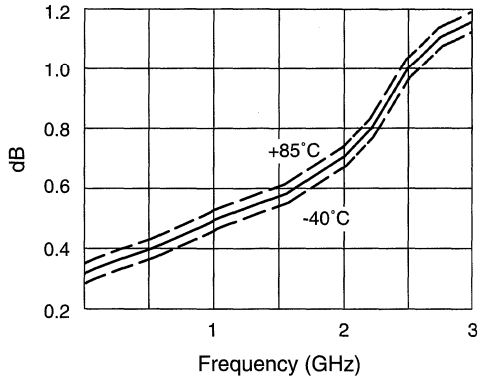
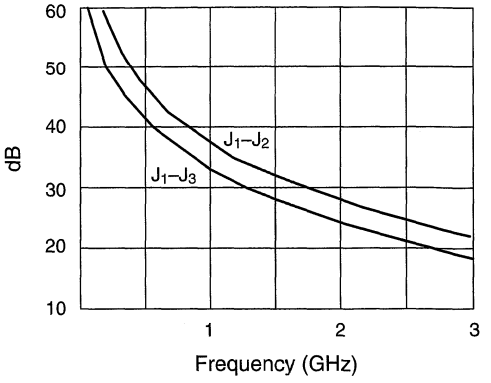
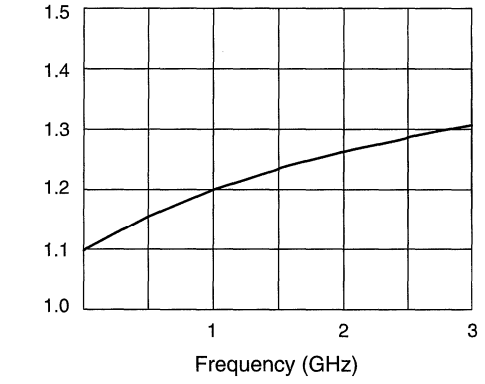
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



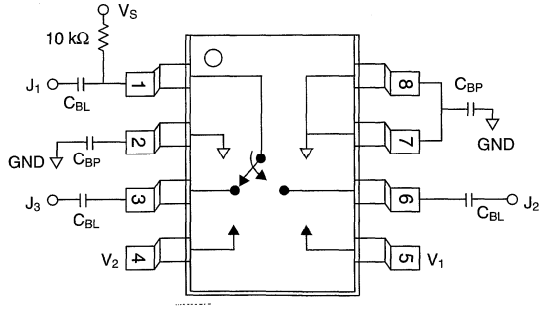
VSWR vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Pin Out



External components shown are for positive voltage operation only. C_{BL} = 100 pF, C_{BP} = 1000 pF. Capacitance values chosen for operation >500 MHz.

Truth Table

Negative Operation

V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Isolation	Insertion Loss
-5	0	Insertion Loss	Isolation

Positive Operation[1]

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Isolation	Insertion Loss
0	V_{High}	Insertion Loss	Isolation

V_{High} = +5 to +8 V (V_S = V_{High} ± 0.2 V)

1. Refer to Application Notes for further information.

General Purpose SPDT Non-Reflective Switches

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
DC–3.0	Low Loss w/Driver	0.5–1.1	60–15	37	SOIC-8	▶ AK002M2-12	1-42
DC–2.5	High Isolation	0.8–1.2	60–32	44	MSOP-8	AS131-59	1-44
DC–2.5	General Purpose	0.5–1.2	50–26	46	SOIC-8	▶ AS338-12	1-46
DC–2.5	General Purpose	0.6–1.3	60–25	46	SOIC-8	▶ AS002M2-12	1-48
DC–2.5	General Purpose	0.6–1.3	60–22	40	SOIC-8	▶ ASC02M2-12	1-50

▶ Available through distribution.

Preferred for new designs.

GaAs IC SPDT Switch With Integral Driver Non-Reflective DC–2.5 GHz

Alpha

AK002M2-12

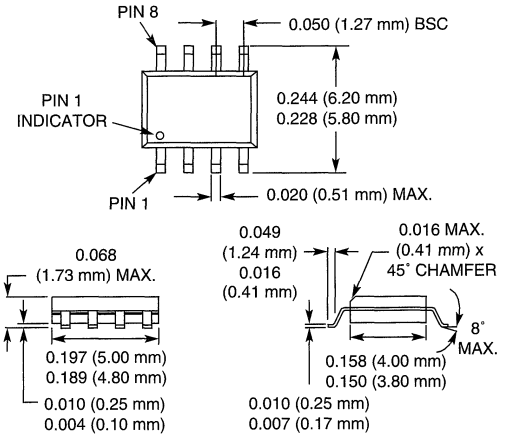
Features

- Low DC Current < 4 mA Total
- Non-Reflective
- Integral Driver ±5 V Supply Voltages
- Low Cost SOIC-8 Plastic Package

Description

The GaAs FET IC SPDT non-reflective switch with integral driver is offered in the SOIC-8 package. These devices are useful as modulators as well as switches in instrumentation and telecommunications applications. The integral driver simplifies the external drive circuit, thus saving PC board space and reducing component count.

SOIC-8



Electrical Specifications at 25°C (+5 V, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.6	0.7	dB
	DC–1.0 GHz		0.7	0.8	dB
	DC–2.0 GHz		0.9	1.0	dB
	DC–2.5 GHz		1.0	1.1	dB
Isolation	DC–0.5 GHz	40	42		dB
	DC–1.0 GHz	30	32		dB
	DC–2.0 GHz	20	23		dB
	DC–2.5 GHz	15	17		dB
VSWR (I/O)[4]	DC–0.5 GHz		1.3:1	1.5:1	
	DC–2.5 GHz		1.6:1	1.8:1	

Operating Characteristics at 25°C (+5 V, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			10		ns
	On, Off (50% CTL to 90/10% RF)			20		ns
	Video Feedthru			30		mV
Input Power for 1 dB Compression		0.5–2.0 GHz		+23		dBm
		0.05 GHz		+15		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.5–2.0 GHz		+37		dBm
		0.05 GHz		+26		dBm
Logic Drives	V_{Low} (0)		0		0.5	V
	V_{High} (1)		4		5	V
Supply Voltage[6,7]	+5 V ± 0.5 V @ 1 mA Typ.		4.5		5.5	V
	-5 V ± 0.20 V @ 4 mA Typ.		-4.8		-5.2	V

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.
6. Supply voltage must be connected before control voltage is applied. Use of toggle switches or other similar components may produce voltage spikes which can cause irreversible damage to the device.
7. Current increases from 4 mA to 5 mA at +85°C.

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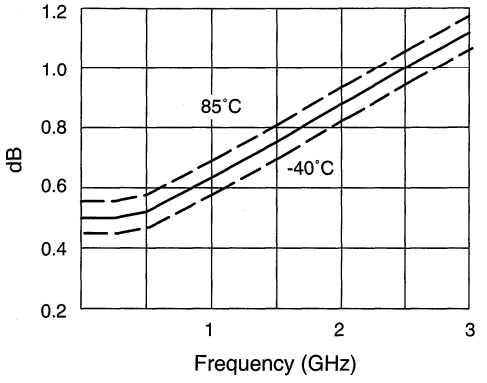
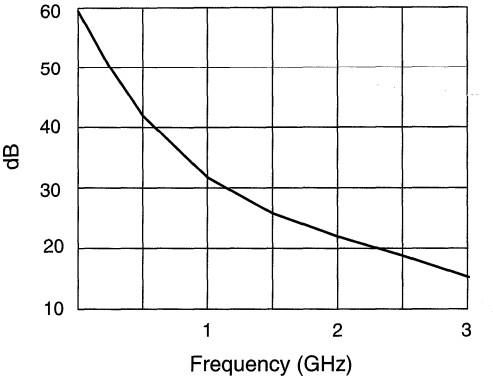
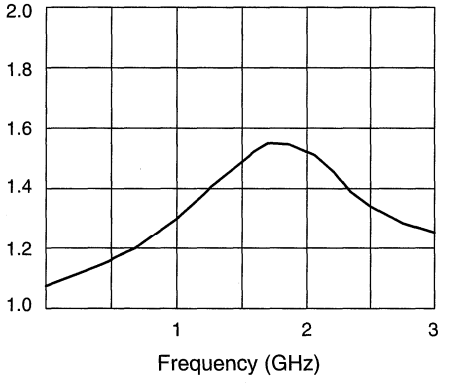
Typical Performance Data (+5 V, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

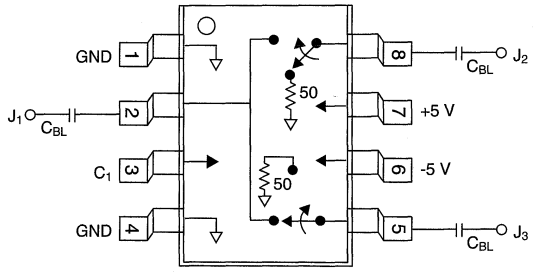
Characteristic	Value
RF Input Power	0.5 W > 500 MHz 0.1 W @ 50 MHz
Bias Voltage	+7 V, -7 V
Control Voltage	-0.2, +7 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	30°C/W

Truth Table

C_1	J_1–J_2	J_1–J_3
1	Insertion Loss	Isolation
0	Isolation	Insertion Loss

"0" = 0.0 to 0.5 V, "1" = 4.0 to 5.0 V.

Pin Out



DC blocking capacitors (C_{BL}) must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

GaAs SPDT Non-Reflective Switch DC–2.5 GHz

Alpha

AS131-59

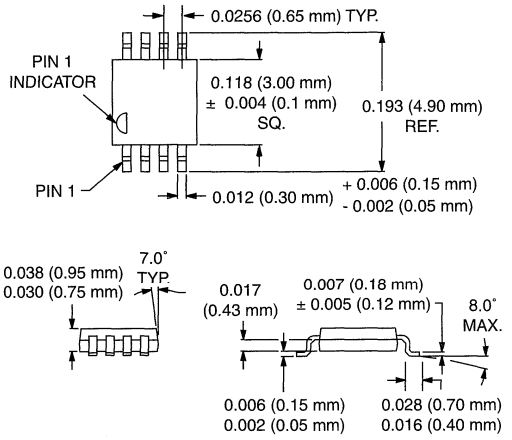
Features

- Low DC Power Consumption
- High Isolation (45 dB @ 0.9 GHz)
- Non-Reflective

Description

The AS131-59 is a high isolation IC FET SPDT non-reflective switch in a plastic MSOP-8 package for commercial applications. The switch operates with -5, 0 V or 0, +5 V when floated as shown on the following page. This general purpose SPDT switch is used in various telecommunications applications.

MSOP-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.8	1.0	dB
	DC–1.0 GHz		0.9	1.1	dB
	DC–2.0 GHz		1.0	1.2	dB
	DC–2.5 GHz		1.1	1.4	dB
Isolation	DC–0.5 GHz	45	55		dB
	DC–1.0 GHz	40	48		dB
	DC–2.0 GHz	30	35		dB
	DC–2.5 GHz	25	32		dB
VSWR[4]	DC–1.0 GHz		1.6:1	1.8:1	
	DC–2.0 GHz		1.4:1	1.6:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			25		ns
	On, Off (50% CTL to 90/10% RF)			30		ns
	Video Feedthru			15		mV
Intermodulation Intercept Point	For Two-tone Input Power +10 dBm	0.9 GHz		+44		dBm
Input Power For 1 dB Compression		0.5–2.0 GHz		+26		dBm
Control Voltages	V_{Low} = 0 to -2 V @ 20 µA Max.					
	V_{High} = -5 V @ 50 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Input/output.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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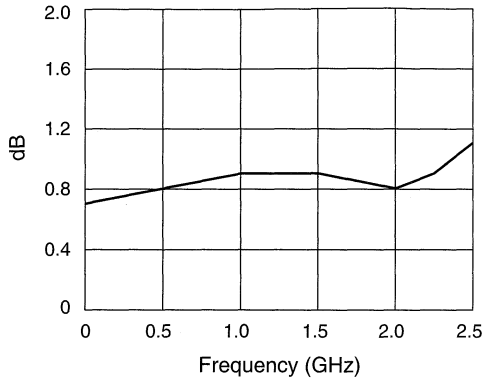
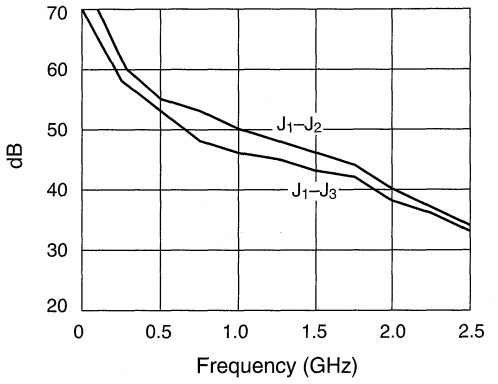
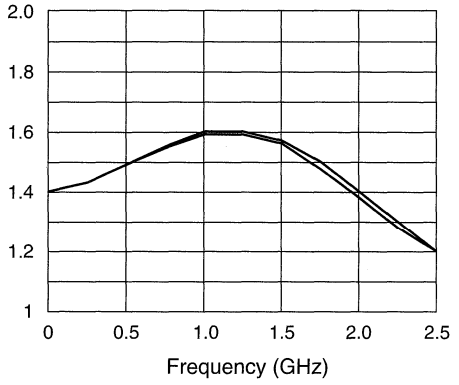
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W Max. > 0.5 GHz 0/-8 V Control
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Truth Table

Negative Operation

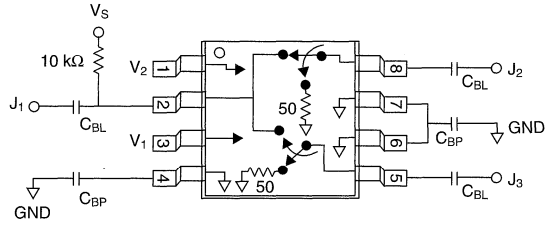
V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Insertion Loss	Isolation
-5	0	Isolation	Insertion Loss

Positive Operation

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Insertion Loss	Isolation
0	V_{High}	Isolation	Insertion Loss

V_{High} = +5 V to +8 V (V_S = V_{High} ± 0.2 V)

Pin Out



External components shown are for positive voltage operation only. C_{BL} = 100 pF, C_{BP} = 1000 pF. Capacitance values chosen for operation >500 MHz.

GaAs IC SPDT Switch
Non-Reflective DC–2.5 GHz

Alpha

AS338-12

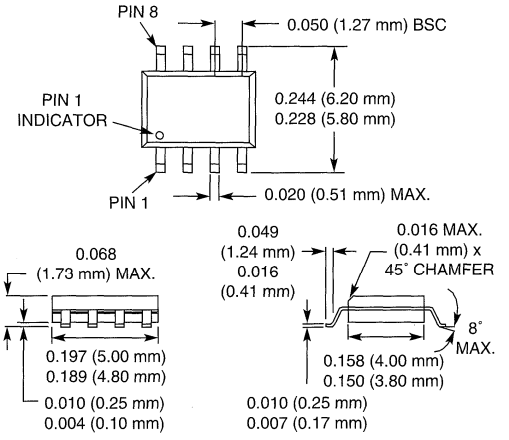
Features

- Low DC Power Consumption
- High Isolation (40 dB @ 0.9 GHz)
- Non-Reflective

Description

The AS338-12 is a low cost IC FET SPDT non-reflective switch in a plastic SOIC-8 package for commercial applications. The switch operates with -5, 0 V or 0, +5 V when 'floated' as shown on the following page. This general purpose SPDT switch is used in various telecommunications applications.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.5	0.7	dB
	DC–1.0 GHz		0.6	0.8	dB
	DC–2.0 GHz		0.7	0.9	dB
	DC–2.5 GHz		1.2	1.4	dB
Isolation	DC–0.5 GHz	43	46		dB
	DC–1.0 GHz	36	39		dB
	DC–2.0 GHz	27	30		dB
	DC–2.5 GHz	23	26		dB
VSWR[4]	DC–0.5 GHz		1.2:1	1.3:1	
	DC–1.0 GHz		1.2:1	1.4:1	
	DC–2.0 GHz		1.3:1	1.5:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			8		ns
	On, Off (50% CTL to 90/10% RF)			30		ns
	Video Feedthru			25		mV
Input Power For 1 dB Compression		0.50–2.0 GHz		+28		dBm
		0.05 GHz		+23		dBm
Intermodulation Intercept Point	For Two-tone Input Power +5 dBm	0.50–2.0 GHz		+46		dBm
		0.05 GHz		+40		dBm
Control Voltages	V_{Low} = 0 to -2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Input/output.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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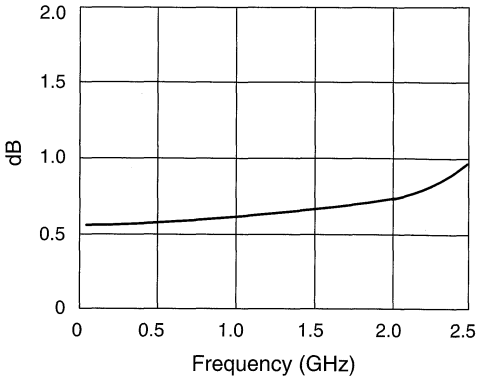
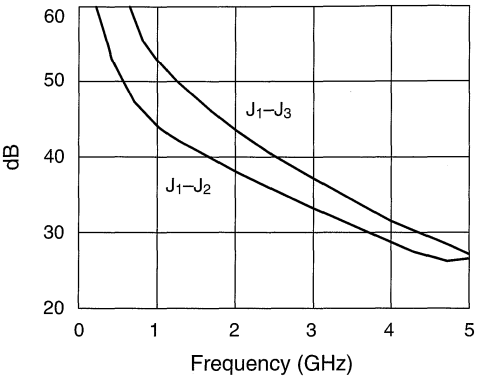
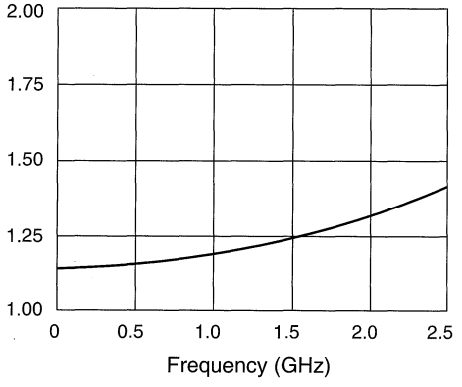
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, 0/-8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

Negative Operation

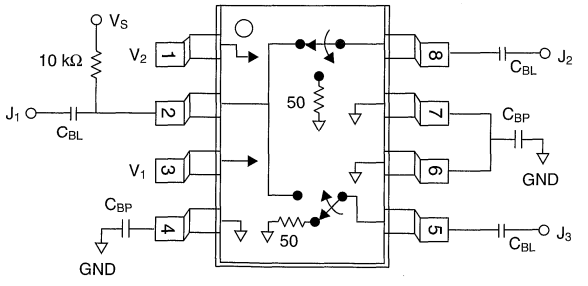
V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Insertion Loss	Isolation
-5	0	Isolation	Insertion Loss

Positive Operation[1]

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Insertion Loss	Isolation
0	V_{High}	Isolation	Insertion Loss

V_{High} = +5 to +8 V (V_S = V_{High} ± 0.2 V)
1. Refer to Application Notes for further information.

Pin Out



External components shown are for positive voltage operation only.
C_{BL} = 100 pF, C_{BP} = 1000 pF for operation >500 MHz.

GaAs IC SPDT Switch
Non-Reflective DC–2.5 GHz

Alpha

AS002M2-12

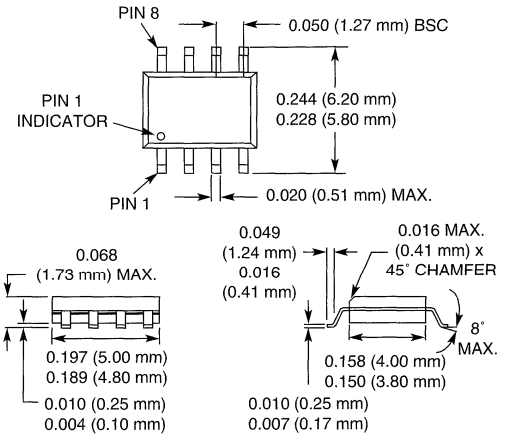
Features

- Low DC Power Consumption
- Non-Reflective
- High Isolation (40 dB @ 1 GHz)

Description

The AS002M2-12 is a low cost IC FET SPDT non-reflective switch in a plastic SOIC-8 package. The switch operates with -5, 0 V or 0, +5 V when 'floated' as shown on the following page. This general purpose SPDT switch is used in various telecommunications applications.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.7	0.8	dB
	DC–1.0 GHz		0.8	0.9	dB
	DC–2.0 GHz		1.1	1.2	dB
	DC–2.5 GHz		1.3	1.4	dB
Isolation	DC–0.5 GHz	42	46		dB
	DC–1.0 GHz	36	40		dB
	DC–2.0 GHz	27	30		dB
	DC–2.5 GHz	23	20		dB
VSWR[4]	DC–0.5 GHz		1.3:1	1.4:1	
	DC–2.0 GHz		1.5:1	1.6:1	
	DC–2.5 GHz		1.6:1	1.8:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			3		ns
	On, Off (50% CTL to 90/10% RF)			6		ns
	Video Feedthru			15		mV
Input Power for 1 dB Compression		0.50–2.0 GHz		+24		dBm
		0.05 GHz		+16		dBm
Intermodulation Intercept Point	For Two-tone Input Power +13 dBm	0.50–2.0 GHz		+46		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Input/output.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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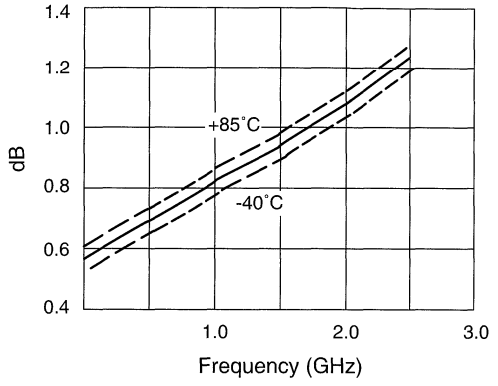
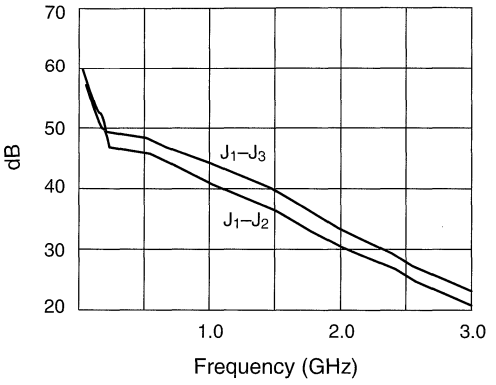
1

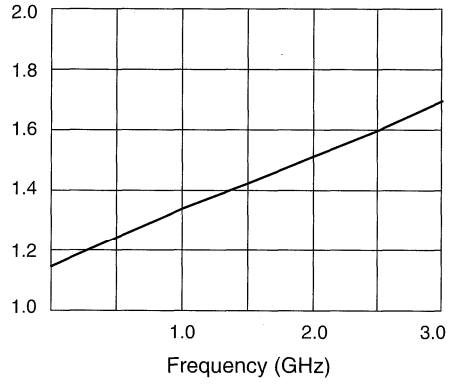
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

Negative Operation

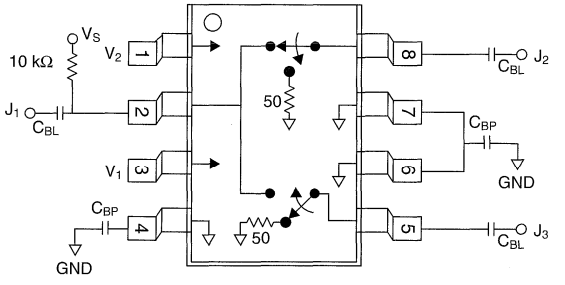
V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Insertion Loss	Isolation
-5	0	Isolation	Insertion Loss

Positive Operation

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Insertion Loss	Isolation
0	V_{High}	Isolation	Insertion Loss

V_{High} = +5 to +8 V (V_S = V_{High} ± 0.2 V)

Pin Out



External components shown are for positive voltage operation only.
C_{BL} = 100 pF, C_{BP} = 1000 pF for operation >500 MHz.

GaAs IC SPDT Switch Non-Reflective DC–2.5 GHz

Alpha

ASC02M2-12

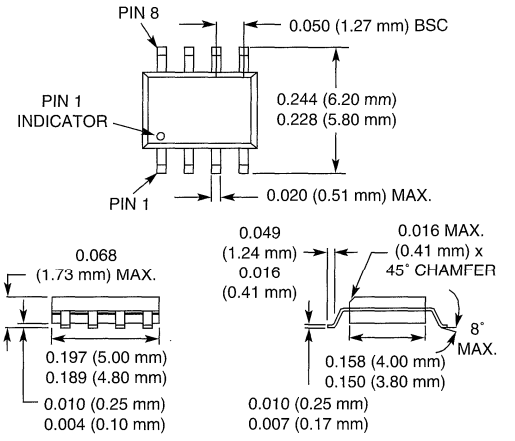
Features

- High Isolation (35 dB @ 0.9 GHz)
- Low DC Power Consumption
- Non-Reflective

Description

The ASC02M2-12 is a low cost IC FET SPDT non-reflective switch in a plastic SOIC-8 package. The switch operates with -5, 0 V or 0, +5 V when floated as shown on the following page. This general purpose SPDT switch is used in various telecommunications applications.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

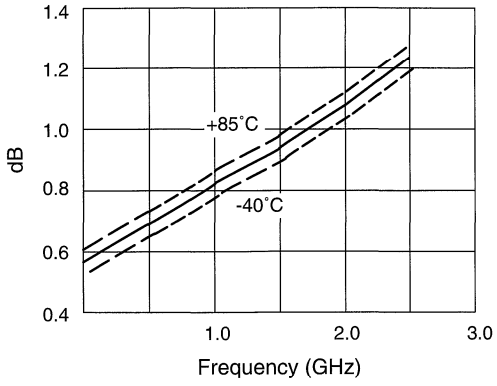
Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.7	0.8	dB
	DC–1.0 GHz		0.8	1.0	dB
	DC–2.0 GHz		1.1	1.2	dB
	DC–2.5 GHz		1.2	1.4	dB
Isolation	DC–0.5 GHz	37	40		dB
	DC–1.0 GHz	32	35		dB
	DC–2.0 GHz	24	26		dB
	DC–2.5 GHz	18	22		dB
VSWR[4]	DC–0.5 GHz		1.3:1	1.4:1	
	DC–2.0 GHz		1.5:1	1.6:1	
	DC–2.5 GHz		1.7:1	1.8:1	

Operating Characteristics at 25°C (0, -5 V)

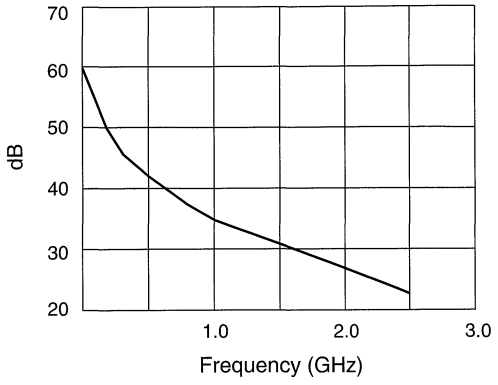
Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			3		ns
	On, Off (50% CTL to 90/10% RF)			6		ns
	Video Feedthru			15		mV
Input Power for 1 dB Compression		0.5–2.0 GHz		+23		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.5–2.0 GHz		+40		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

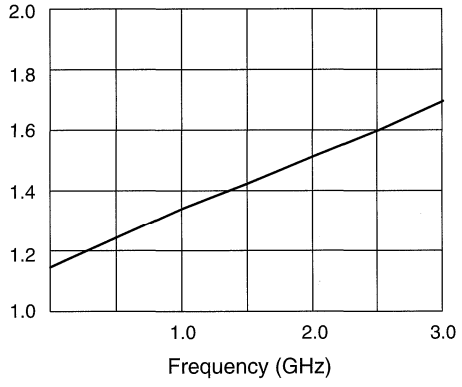
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

Negative Operation

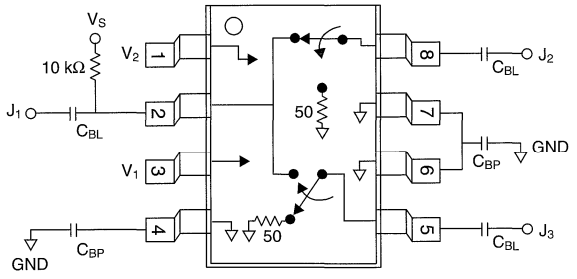
V_1	V_2	J_1–J_2	J_1–J_3
-5	0	Insertion Loss	Isolation
0	-5	Isolation	Insertion Loss

Positive Operation

V_1	V_2	J_1–J_2	J_1–J_3
0	V_{High}	Insertion Loss	Isolation
V_{High}	0	Isolation	Insertion Loss

V_{High} = +5 to +8 V (V_S = V_{High} ± 0.2 V)

Pin Out



External components shown are for positive voltage operation only.
C_{BL} = 100 pF, C_{BP} = 1000 pF for operation >500 MHz.

High Power SPDT Switches

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
DC–3.0	Medium Power	0.4–0.9	50–17	56	SOIC-8	AH002R2-12	1-54
DC–3.0	Dual Pos. CTL	0.4–1.2	40–20	55	SOIC-8	AS137-12	1-56
DC–3.0	High IP3	0.6–1.1	50–20	63	SOIC-8	AS144-12	1-58
DC–2.0	1.9 GHz T/R, Pos. CTL	0.4–0.9	40–18	60	MSOP-8	AS150-59	1-60
DC–2.0	0.9 GHz T/R, Pos. CTL	0.4–0.8	40–10	60	SOIC-8	▶ AS277-12	1-62
DC–3.0	1.9 GHz T/R, Pos. CTL	0.4–0.9	40–18	60	SOIC-8	▶ AS278-12	1-64
DC–3.0	General Purpose	0.3–0.6	60–20	61	SOIC-8	AS279-12	1-66
DC–3.0	10 W T/R, High IP3	0.6–1.1	50–20	63	SOIC-8	▶ AW002R2-12	1-68

▶ Available through distribution.

Preferred for new designs.

GaAs SPDT IC 4 Watt T/R Switch DC–2.5 GHz

Alpha

AH002R2-12

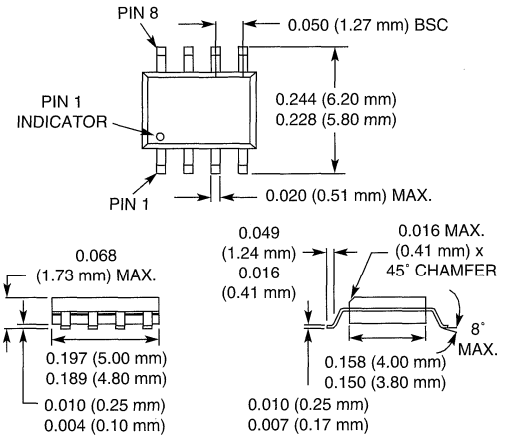
Features

- T/R Switch
- Low Insertion Loss (< 0.5 dB @ 0.9 GHz)
- $P_{-1\ dB} \geq 4$ W, 0.9 GHz, 0/-10 V Control Voltage
- High Linearity (+56 dBm, IP3 @ 0.9 GHz)
- Low DC Power Consumption

Description

The AH002R2-12 is an SPDT reflective FET IC switch designed for low distortion at medium power for cellular radio applications. The switch has a 1 dB compression of 4.0 W at 900 MHz and -10 V control. The switch requires a 0 and -10 V operation for maximum power handling, but will operate at 0/-5 V with reduced performance.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.4	0.45	dB
	DC–1.0 GHz		0.5	0.6	dB
	DC–2.0 GHz		0.65	0.8	dB
	DC–2.5 GHz		0.75	0.9	dB
Isolation	DC–0.5 GHz	33	38		dB
	DC–1.0 GHz	26	30		dB
	DC–2.0 GHz	20	22		dB
	DC–2.5 GHz	17	20		dB
VSWR[4]	DC–0.5 GHz		1.15:1	1.2:1	
	DC–1.0 GHz		1.2:1	1.3:1	
	DC–2.5 GHz		1.3:1	1.5:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			6		ns
	On, Off (50% CTL to 90/10% RF)			12		ns
	Video Feedthru			30		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm, V_{High} = -10 V	0.9 GHz		+56		dBm
Input Power for 1 dB Compression	@-5 V	0.9 GHz		+27		dBm
	@-10 V	0.9 GHz		+35		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 100 µA to -10 V @ 400 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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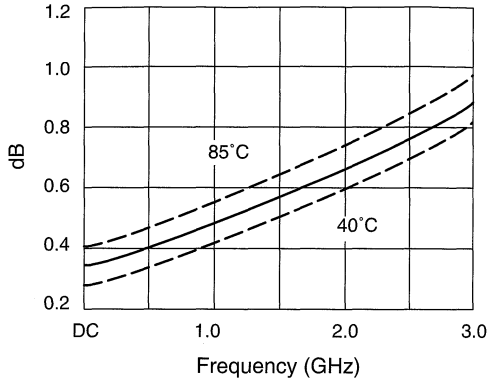
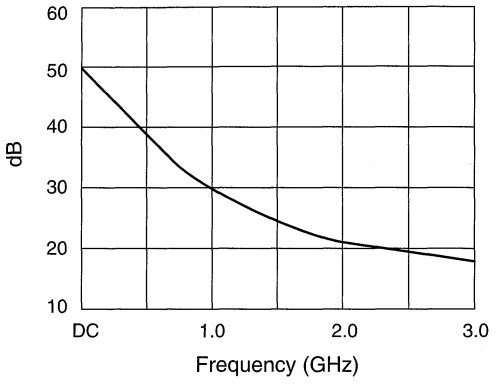
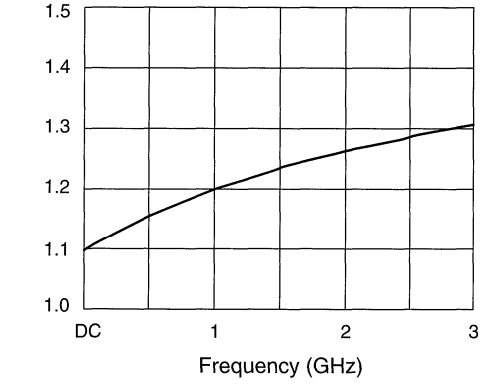
Typical Performance Data (0, -5 V)



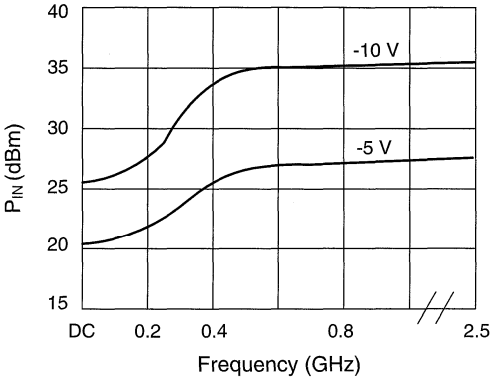
Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency



P_{IN} at 1 dB Compression vs. Frequency and Control Voltage

Absolute Maximum Ratings

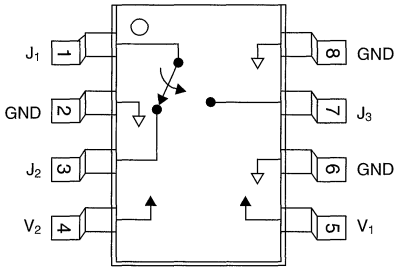
Characteristic	Value
RF Input Power	7.5 W > 500 MHz, 0/-12 V 2.0 W @ 50 MHz, 0/-12 V
Control Voltage	+0.2 V, -12 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Truth Table[1]

V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Insertion Loss	Isolation
-5	0	Isolation	Insertion Loss

1. For positive voltage operation refer to Application Notes.

Pin Out



Mounting Requirements

For high power applications (> 3 W P_{IN}), proper mounting procedures must be followed because heat is transferred through the ground leads.

GaAs IC High Power SPDT Switch
Positive Control DC–2.5 GHz

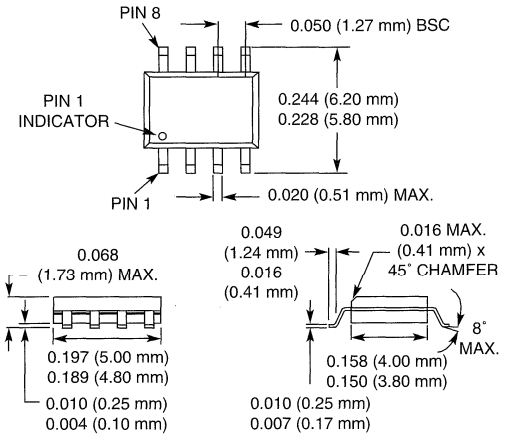
Alpha

AS137-12

Features

- High Linearity (IP3 55 dBm @ 0.9 GHz)
- Low Insertion Loss (0.5 dB @ 0.9 GHz)
- Low DC Power Consumption
- Positive 3 V to 5 V Control Voltage

SOIC-8



Description

The AS137-12 is a FET IC SPDT switch in a SOIC-8 plastic package. This switch has been designed for use where extremely high linearity and low insertion loss are required. It is controlled with positive voltage, eliminating the need for negative voltage. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W. The AS137-12 switch can be used in many analog and digital wireless communication systems including cellular, GSM and DECT applications.

Electrical Specifications at 25°C (0, +5 V)

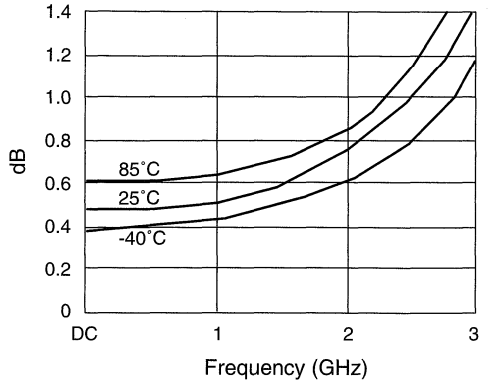
Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–1.0 GHz DC–2.0 GHz DC–2.5 GHz		0.45 0.60 0.90	0.55 0.75 1.20	dB dB dB
Isolation	DC–1.0 GHz DC–2.0 GHz DC–2.5 GHz	18 18 17	21 22 20		dB dB dB
VSWR[4]	DC–1.0 GHz DC–2.0 GHz DC–2.5 GHz		1.20:1 1.25:1 1.30:1	1.3:1 1.3:1 1.4:1	

Operating Characteristics at 25°C (0, +5 V)

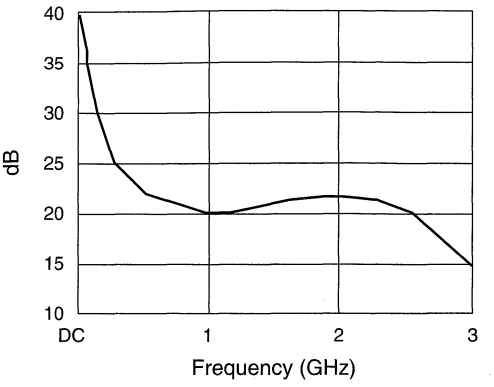
Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru			60 100 50		ns ns mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm @ +5 V	1.9 GHz		+55		dBm
Input Power for 1 dB Compression	@ +3 V @ +5 V	1.9 GHz 1.9 GHz		+28.5 +35		dBm dBm
Control Voltage	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @ 100 µA Max. to +5 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

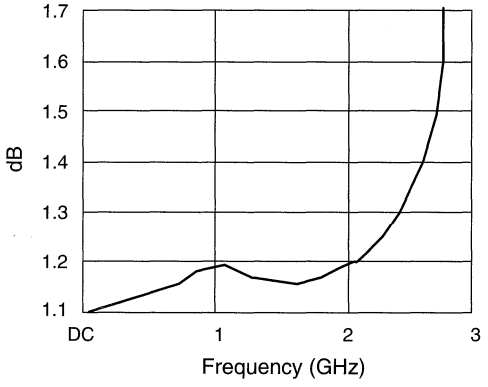
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

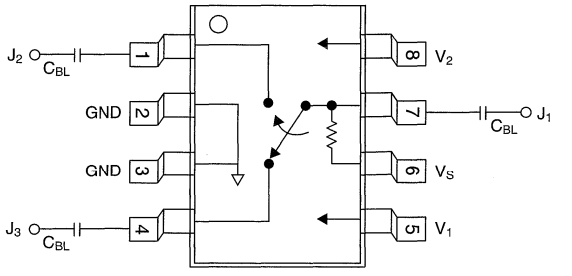
Characteristic	Value
RF Input Power	6 W Max. > 900 MHz, 0/+5 Control
Control Voltage	-0.2 V, +8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	85°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Isolation	Insertion Loss
0	V_{High}	Insertion Loss	Isolation

V_{High} = +3 to +5 V (V_S = V_{High} ± 0.2 V)

Pin Out



DC blocking capacitors C_{BL} must be supplied externally.
C_{BL} = 100 pF.

GaAs IC High Power SPDT Switch DC–2.0 GHz

Alpha

AS144-12

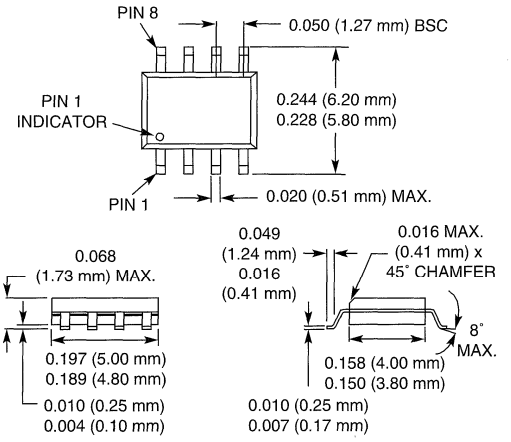
Features

- High Linearity (+61 dBm IP3 @ 0.9 GHz)
- Low Insertion Loss (0.4 dB @ 0.9 GHz)
- Low DC Power Consumption

Description

The AS144-12 is a GaAs IC FET SPDT switch in a SOIC-8 plastic package. This switch has been designed for use where extremely high linearity and low insertion loss are required. Some standard implementations include antenna changeover, T/R and diversity switching over 2 watts. The AS144-12 switch can be used in many analog and digital wireless communications systems including cellular, GSM and DECT applications.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.35	0.5	dB
	DC–1.0 GHz		0.40	0.6	dB
	DC–2.0 GHz		0.60	0.8	dB
Isolation	DC–0.5 GHz	33	40		dB
	DC–1.0 GHz	25	30		dB
	DC–2.0 GHz	17	22		dB
VSWR[4]	DC–2.0 GHz		1.3:1	1.4:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			30		ns
	On, Off (50% CTL to 90/10% RF)			35		ns
	Video Feedthru			12		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	0.9 GHz		+61		dBm
Input Power for 1 dB Compression		0.9 GHz		+33		dBm
Control Voltages	V_{Low} = 0 to -0.2 @ 20 µA Max.					
	V_{High} = -5 V @ 50 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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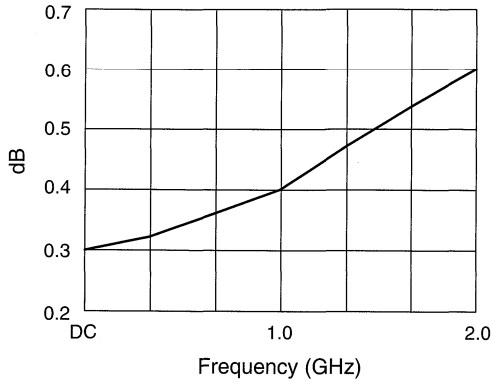
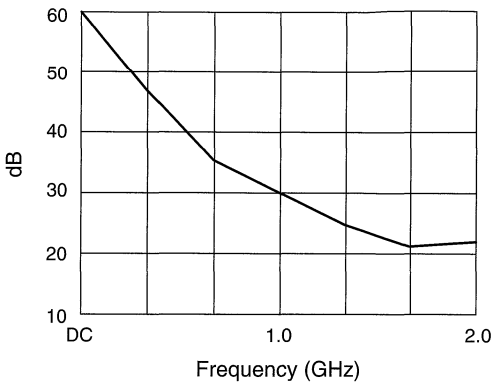
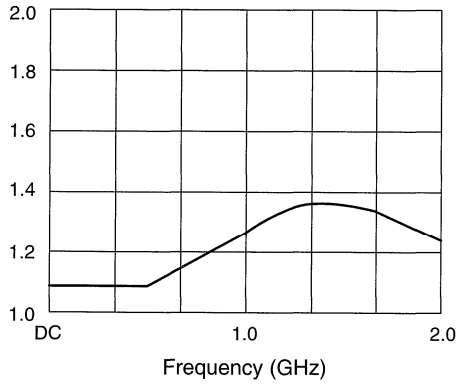
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

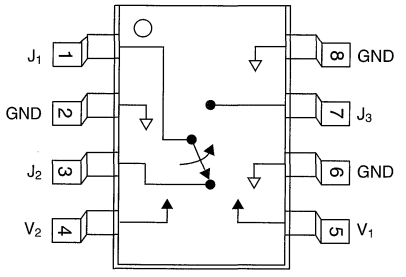
Absolute Maximum Ratings

Characteristic	Value
RF Input Power	5 W Max. > 0.9 GHz, 0/-5 V Control
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	85°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Isolation	Insertion Loss
-5	0	Insertion Loss	Isolation

Pin Out



GaAs IC High Power SPDT Switch
Positive Control DC–3 GHz

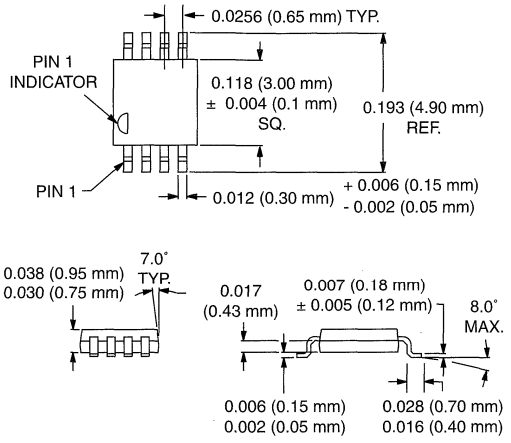
Alpha

AS150-59

Features

- High Linearity (IP3 55 dBm @ 1.9 GHz)
- High Isolation (30 dB @ 1.9 GHz)
- Low Insertion Loss (0.55 dB @ 1.9 GHz)
- Low DC Power Consumption
- Positive 3 V or 5 V Control Voltage

MSOP-8



Description

The AS150-59 is an IC FET SPDT switch in a MSOP-8 plastic package. This switch has been designed for use where extremely high linearity and low insertion loss are required. It is controlled with positive voltage eliminating the need for negative voltage. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W. The AS150-59 switch can be used in many analog and digital wireless communication systems.

Electrical Specifications at 25°C (0, +5 V)

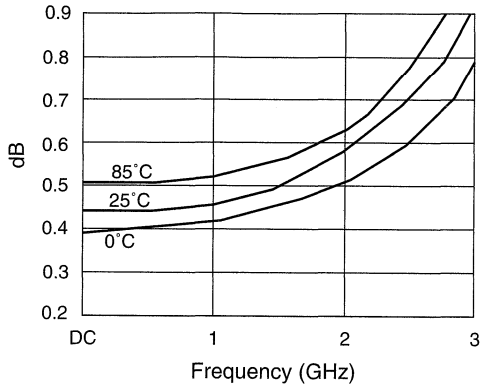
Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–1.0 GHz		0.45	0.55	dB
	1.0–2.0 GHz		0.6	0.75	dB
	2.0–3.0 GHz		0.9	1.2	dB
Isolation	DC–1.0 GHz	19	22		dB
	1.0–2.0 GHz	18	20		dB
	2.0–3.0 GHz	20	23		dB
VSWR[4]	DC–1.0 GHz		1.2:1	1.3:1	
	1.0–2.0 GHz		1.3:1	1.4:1	
	2.0–3.0 GHz		1.7:1	1.8:1	

Operating Characteristics at 25°C (0, +5 V)

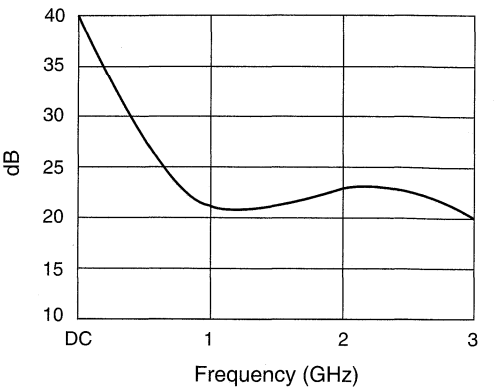
Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			60		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	1.9 GHz		+55		dBm
Input Power for 1 dB Compression	+3 V	1.9 GHz		+28.5		dBm
	+5 V	1.9 GHz		+35		dBm
Control Voltage	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @ 100 µA Max. to +5 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

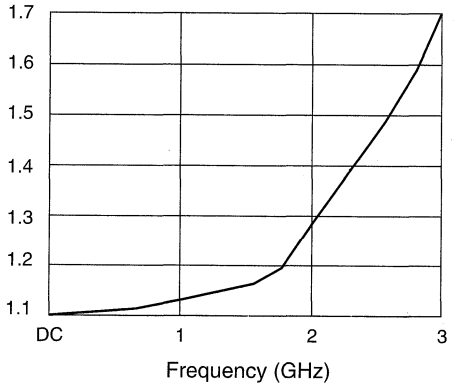
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

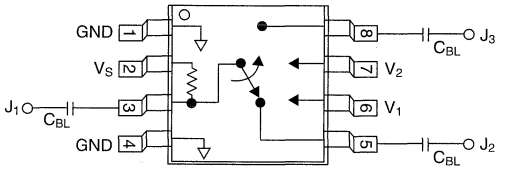
Characteristic	Value
RF Input Power	6 W Max. > 900 MHz, 0/+5 Control
Supply Voltage	+8 V
Control Voltage	-0.2 V, +8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	85°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Isolation	Insertion Loss
0	V_{High}	Insertion Loss	Isolation

V_{High} = +3 to +5 V ($V_S = V_{High} \pm 0.2$ V)

Pin Out



External DC blocking capacitors are required on all RF ports.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC High Power SPDT Switch
Positive Control DC–2 GHz

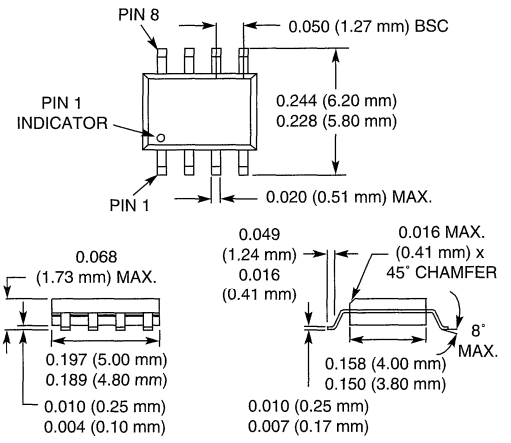
Alpha

AS277-12

Features

- High Linearity (55 dBm IP3 @ 0.9 GHz)
- Low Insertion Loss (0.4 dB @ 0.9 GHz)
- High Isolation (35 dB @ 0.9 GHz)
- Low DC Power Consumption
- Positive 3 V to 5 V Control Voltages

SOIC-8



Description

The AS277-12 is an IC FET SPDT switch in an SOIC-8 plastic package. It is a reflective switch designed for use where extremely high linearity and low insertion loss are required. It is controlled with positive voltage eliminating the need for negative voltage. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W. The AS277-12 switch can be used in many analog and digital wireless communication systems including cellular, GSM and DECT applications.

Electrical Specifications at 25°C (0, +5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–1.0 GHz DC–2.0 GHz		0.4 0.6	0.50 0.75	dB dB
Isolation	DC–1.0 GHz DC–2.0 GHz	30 16	33 18		dB dB
VSWR[4]	DC–1.0 GHz DC–2.0 GHz		1.1:1 1.3:1	1.2:1 1.4:1	

Operating Characteristics at 25°C (0, +5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru			60 100 50		ns ns mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	0.9 GHz		+55		dBm
Input Power for 1 dB Compression		0.9 GHz		+35		dBm
Control Voltage	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @ 100 µA Max. to +5 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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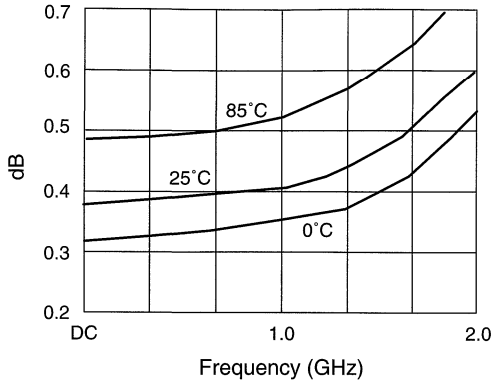
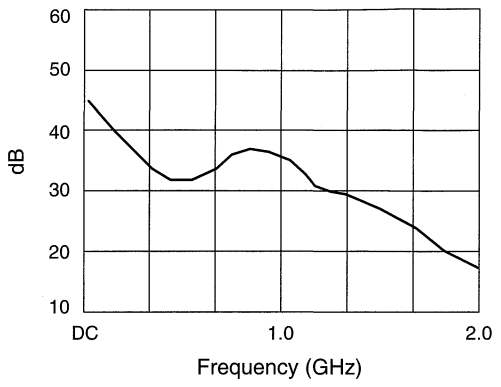
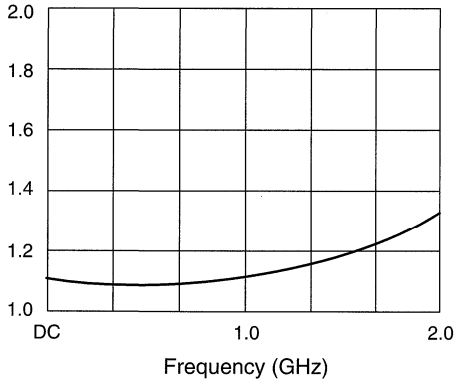
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

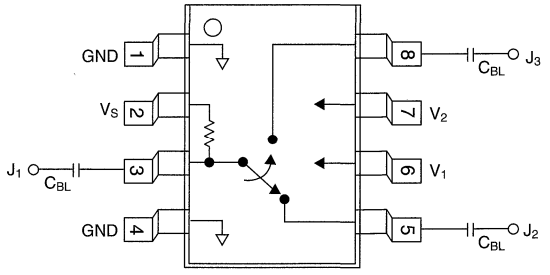
Characteristic	Value
RF Input Power	6 W Max. > 0.9 GHz, 0/+5 V Control
Supply Voltage	+8 V
Control Voltage	-0.2 V, +8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	85°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Isolation	Insertion Loss
0	V_{High}	Insertion Loss	Isolation

V_{High} = +3 to +5 V (V_S = V_{High} ± 0.2 V)

Pin Out



DC blocking capacitors, C_{BL} must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC High Power Positive Control SPDT Switch DC–3 GHz

Alpha

AS278-12

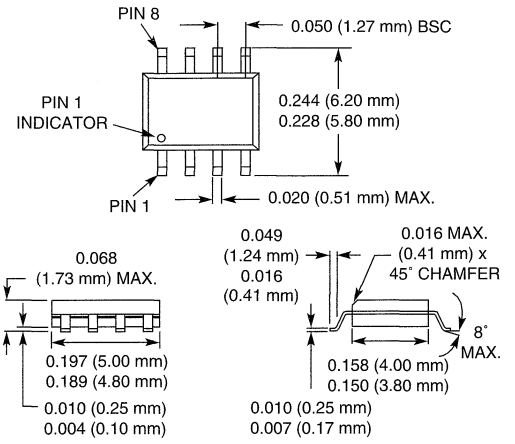
Features

- High Linearity (IP3 55 dBm @ 1.9 GHz)
- High Isolation (30 dB @ 1.9 GHz)
- Low Insertion Loss (0.55 dB @ 1.9 GHz)
- Positive 3 V to 5 V Control Voltage
- Low DC Power Consumption

Description

The AS278-12 is an IC FET SPDT switch in a SOIC-8 plastic package. The AS278-12 has been designed for use where extremely high linearity and low insertion loss are required. It is controlled with positive voltage eliminating the need for negative voltage. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W. The AS278-12 switch can be used in many analog and digital wireless communication systems.

SOIC-8



Electrical Specifications at 25°C (0, +5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–1.0 GHz		0.45	0.55	dB
	1.0–2.0 GHz		0.6	0.75	dB
	2.0–3.0 GHz		0.9	1.2	dB
Isolation	DC–1.0 GHz	20	23		dB
	1.0–1.8 GHz	22	25		dB
	1.8–2.1 GHz	27	31		dB
	2.1–3.0 GHz	10	12		dB
VSWR[4]	DC–1.0 GHz		1.2:1	1.3:1	
	DC–2.0 GHz		1.3:1	1.4:1	
	DC–3.0 GHz		1.7:1	1.8:1	

Operating Characteristics at 25°C (0, +5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			60		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	1.9 GHz		+55		dBm
Input Power for 1 dB Compression	@ +3 V	1.9 GHz		+28.5		dBm
	@ +5 V	1.9 GHz		+35		dBm
Control Voltage	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @ 100 µA Max. to +5 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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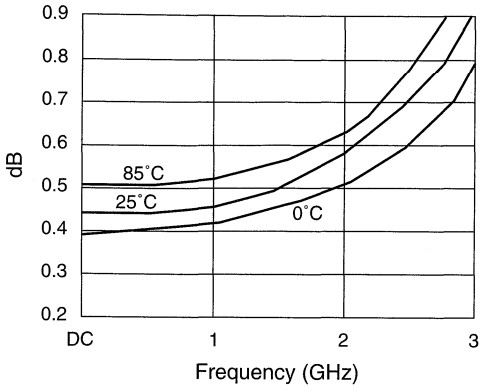
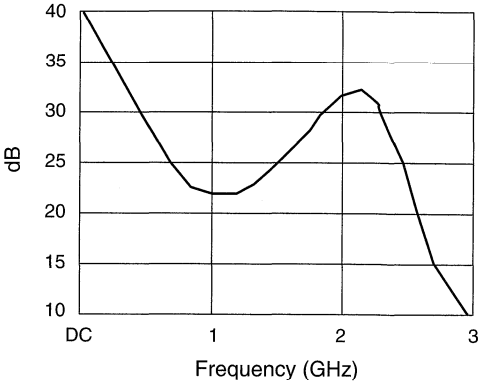
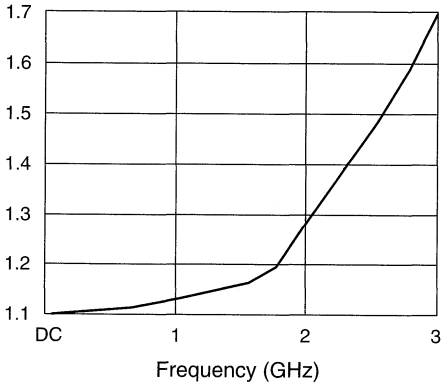
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

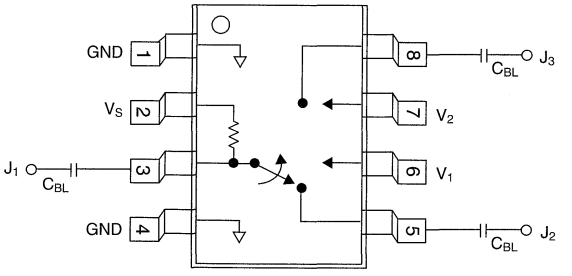
Characteristic	Value
RF Input Power	6 W Max. > 900 MHz, 0/+5 Control
Supply Voltage	+8 V
Control Voltage	-0.2 V, +8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	85°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Isolation	Insertion Loss
0	V_{High}	Insertion Loss	Isolation

V_{High} = +3 to +5 V (V_S = V_{High} ± 0.2 V)

Pin Out



DC block capacitors C_{BL} must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC High Power SPDT Switch
DC–2.0 GHz

Alpha

AS279-12

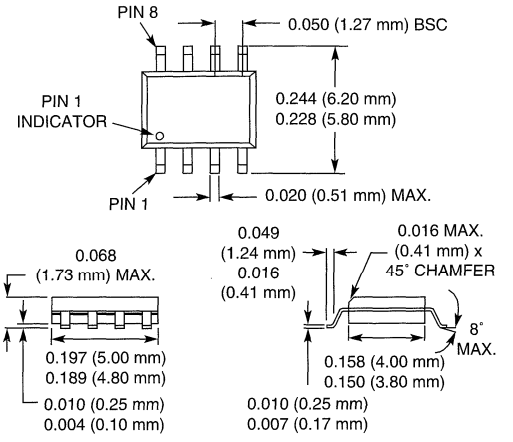
Features

- High Linearity (55 dBm IP3 @ 0.9 GHz)
- Low Insertion Loss (0.4 dB @ 0.9 GHz)
- Low DC Power Consumption

Description

The AS279-12 is a low cost IC FET SPDT switch in an SOIC-8 plastic package. This switch has been designed for use where extremely high linearity and low insertion loss are required. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W. The AS279-12 switch can be used in many analog and digital wireless communication systems including cellular, GSM and DECT applications.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.1 GHz		0.3	0.4	dB
	DC–0.5 GHz		0.35	0.5	dB
	DC–1.0 GHz		0.4	0.6	dB
	DC–2.0 GHz		0.6	0.8	dB
Isolation	DC–0.1 GHz	50	55		dB
	DC–0.5 GHz	33	40		dB
	DC–1.0 GHz	25	30		dB
	DC–2.0 GHz	15	20		dB
VSWR[4]	DC–2.0 GHz		1.3:1	1.4:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			30		ns
	On, Off (50% CTL to 90/10% RF)			35		ns
	Video Feedthru			20		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	0.9 GHz		+55		dBm
Input Power for 1 dB Compression		0.9 GHz		+33		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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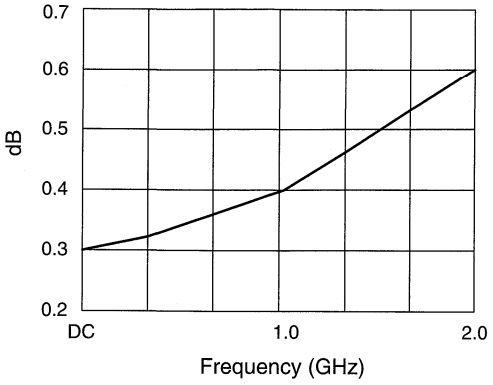
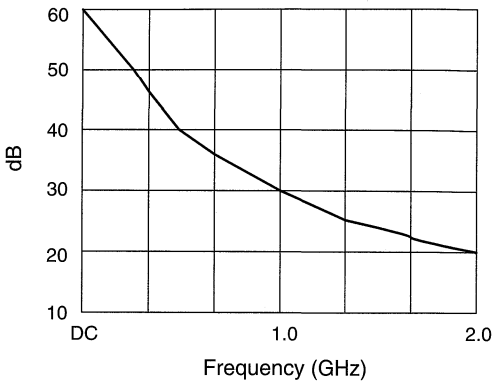
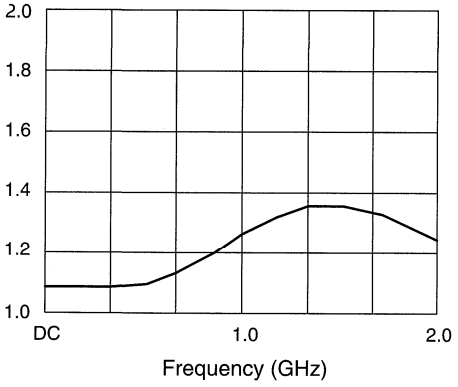
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

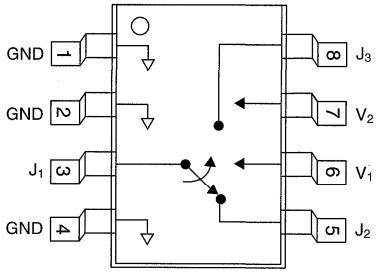
Absolute Maximum Ratings

Characteristic	Value
RF Input Power	5 W Max. > 0.9 GHz, 0/-5 V Control
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	85°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Isolation	Insertion Loss
-5	0	Insertion Loss	Isolation

Pin Out



GaAs SPDT IC 10 Watt T/R Switch
DC–2.5 GHz

Alpha

AW002R2-12

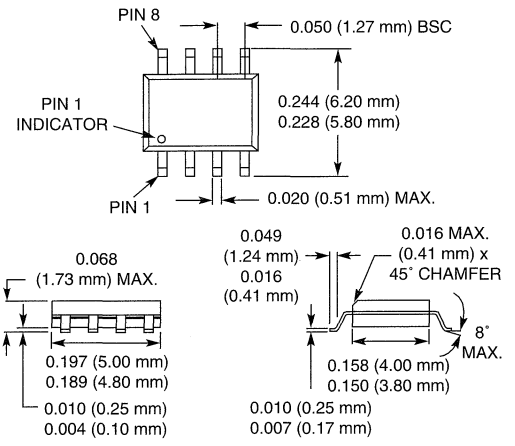
Features

- T/R Switch
- High Isolation (30 dB @ 0.9 GHz)
- Designed for Mobile Radio Applications
- $P_{-1\ dB} \geq 10$ W @ 0.9 GHz
- High Intercept Point (IP3 +63 dBm, @ 0.9 GHz)

Description

The AW002R2-12 is a high power IC FET SPDT switch in a plastic SOIC-8 package. This switch has been designed for use where extremely high linearity is required. It can be controlled with positive, negative or a combination of both voltages. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W. This switch can be used in many analog and digital wireless communication systems including cellular, GSM and PCS applications.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.7	0.8	dB
	DC–1.0 GHz		0.8	0.9	dB
	DC–2.5 GHz		1.0	1.1	dB
Isolation	DC–0.5 GHz	33	37		dB
	DC–1.0 GHz	28	30		dB
	DC–2.5 GHz	20	22		dB
VSWR[4]	DC–1.0 GHz		1.2:1	1.4:1	dB
	DC–2.5 GHz		1.5:1	1.7:1	dB

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			6		ns
	On, Off (50% CTL to 90/10% RF)			12		ns
	Video Feedthru			30		mV
Input Power for 1 dB Compression	5 V	0.9 GHz		+35		dBm
	10 V	0.9 GHz		+40		dBm
Intermodulation Intercept Point	For Two-tone Input Power +13 dBm					
	IP2	0.9 GHz		+75		dBm
	IP3	0.9 GHz		+63		dBm
Control Voltages	$V_{Low} = -12.0\ V \leq V_{Low} \leq 0\ V$, 500 µA Max.					
	$V_{High} = 0\ V \leq V_{High} \leq +12.0\ V$, 500 µA Max.					
	Differential = $+5.0\ V \leq (V_{High} - V_{Low}) < +12.0\ V$					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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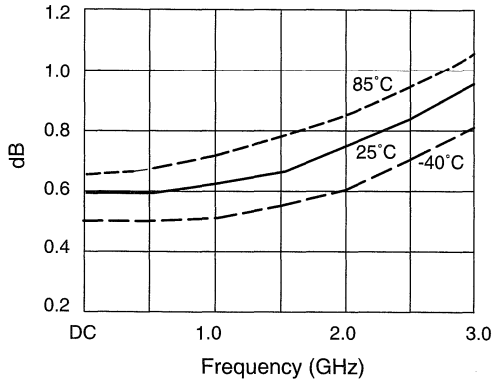
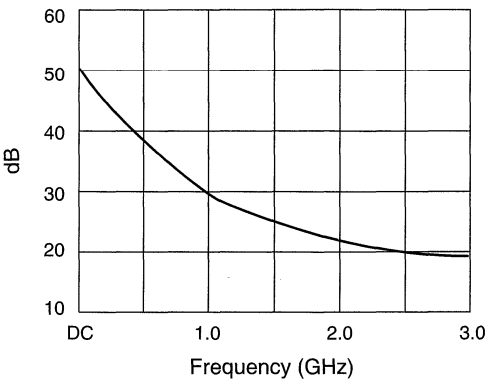
1

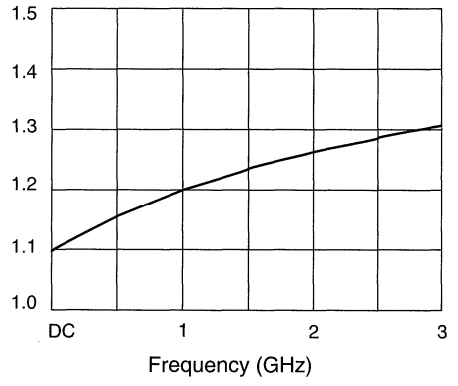
Typical Performance Data (0, -5 V)



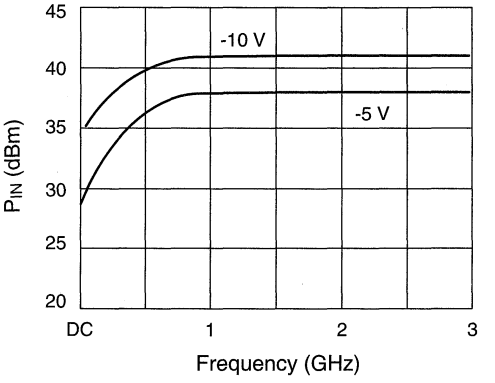
Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency



P_{IN} at 1 dB Compression vs. Frequency and Control Voltage

Absolute Maximum Ratings

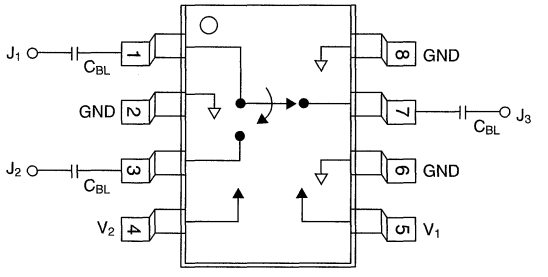
Characteristic	Value
RF Input Power	11 W > 0.9 GHz, 0, -12 V
Control Voltage	$(V_{High} - V_{Low}) < 12$ V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	85°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
V_{Low}	V_{High}	Insertion Loss	Isolation
V_{High}	V_{Low}	Isolation	Insertion Loss

V_{Low} = 0 to -12.0 V
V_{High} = 0 to +12.0 V
Differential = +5.0 V ≤ $(V_{High} - V_{Low}) < +12.0$ V
Refer to Application Notes for further information on differential voltage operation.

Pin Out



External DC blocking capacitors (C_{BL}) are required only if $V_{High} > 0.0$ V.
C_{BL} = 100 pF for operation >500 MHz.

High Linearity SPDT Switches

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
DC–2.0	General Purpose	0.3–0.7	45–10	55	MSOP-8	▶ AS103-59	1-72
DC–2.0	Dual CTL	0.3–0.7	42–10	55	MSOP-8	AS116-59	1-74
DC–2.0	Low Cost, 6 Lead Pkg.	0.3–1.0	40–10	55	SOT-6	AS128-73	1-76
DC–2.0	Dual CTL	0.3–1.0	40–10	55	MSOP-8	AS138-59	1-78
DC–2.0	Low Cost, 6 Lead Pkg.	0.3–0.7	42–10	55	SOT-6	▶ AS139-73	1-80
DC–2.0	Pos. CTL	0.3–1.0	40–10	55	SSOP-8	AS358-62	1-82
DC–2.0	Neg. CTL	0.3–1.0	40–10	55	SSOP-8	▶ AS359-62	1-84

▶ Available through distribution.

Preferred for new designs.

GaAs IC 2 Watt High Linearity Positive Control SPDT Switch DC–2.0 GHz

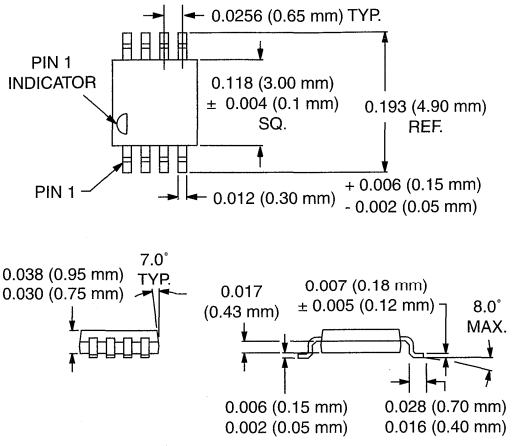
Alpha

AS103-59

Features

- High Linearity (55 dBm IP3 @ 0.9 GHz)
- Low Insertion Loss (0.3 dB @ 0.9 GHz)
- Low DC Power Consumption
- Positive Control Voltage

MSOP-8



Description

The AS103-59 is a FET IC high power SPDT switch in a MSOP-8 plastic package. This switch has been designed for use where extremely high linearity and low insertion loss are required. It can be controlled with positive, negative or a combination of both voltages. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W. It can be used in many analog and digital wireless communication systems including cellular, GSM and DECT applications.

Electrical Specifications at 25°C (0, +5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.3	0.4	dB
	DC–1.0 GHz		0.4	0.6	dB
	DC–2.0 GHz		1.0	1.2	dB
Isolation	DC–0.5 GHz	20	23		dB
	DC–1.0 GHz	15	17		dB
	DC–2.0 GHz	8	10		dB
VSWR[4]	DC–1.0 GHz		1.3:1	1.4:1	
	DC–2.5 GHz		1.3:1	1.6:1	

Operating Characteristics at 25°C (0, +5 V)

Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			60		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	0.9 GHz		+55		dBm
Input Power for 1 dB Compression		0.9 GHz		+35		dBm
Control Voltages	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @ 100 µA Max. to +5 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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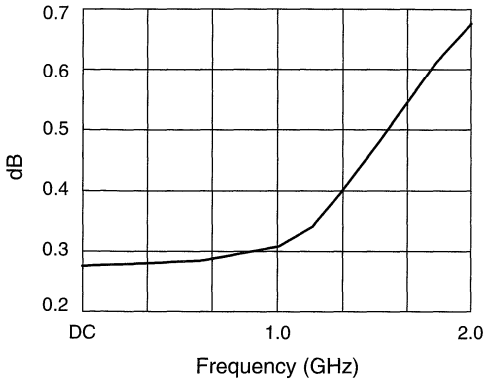
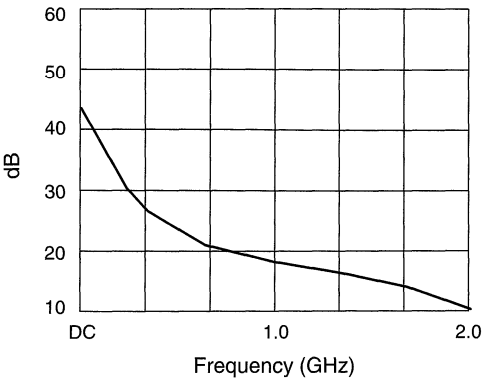
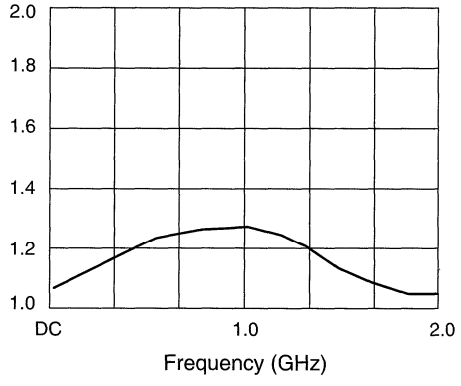
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

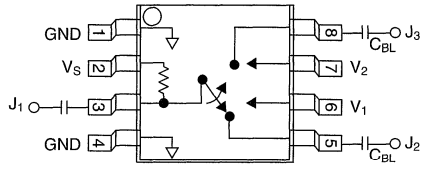
Characteristic	Value
RF Input Power	6 W Max. > 900 MHz, 0/+8 V Control
Supply Voltage	+8 V
Control Voltages	-0.2 V, +8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Isolation	Insertion Loss
0	V_{High}	Insertion Loss	Isolation

V_{High} = +3 to +8 V (V_S = V_{High} ± 0.2 V)

Pin Out



DC blocking capacitors (C_{BL}) must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC 2 Watt High Linearity SPDT Switch DC–2.0 GHz

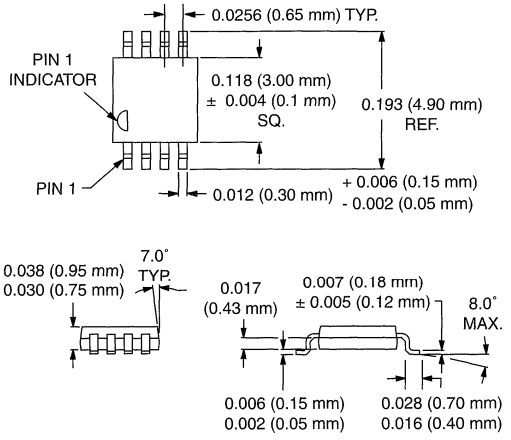
Alpha

AS116-59

Features

- High Linearity (55 dBm IP3 @ 0.9 GHz)
- Low Insertion Loss (0.35 dB @ 0.9 GHz)
- Low DC Power Consumption
- Small MSOP-8 Package

MSOP-8



Description

The AS116-59 is a GaAs FET IC high power SPDT switch in an MSOP-8 package. This switch has been designed for use where extremely high linearity and low insertion loss are required. It can be controlled with positive, negative or a combination of both voltages. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W. The AS116-59 switch can be used in many analog and digital wireless communication systems including cellular applications.

Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.3	0.4	dB
	DC–1.0 GHz		0.4	0.6	dB
	DC–2.0 GHz		1.0	1.2	dB
Isolation	DC–0.5 GHz	20	23		dB
	DC–1.0 GHz	15	17		dB
	DC–2.0 GHz	8	10		dB
VSWR[4]	DC–1.0 GHz		1.3:1	1.4:1	
	DC–2.0 GHz		1.3:1	1.8:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			60		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	0.9 GHz		+55		dBm
Input Power for 1 dB Compression		0.9 GHz		+35		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max.					
	V_{High} = -5 V @ 50 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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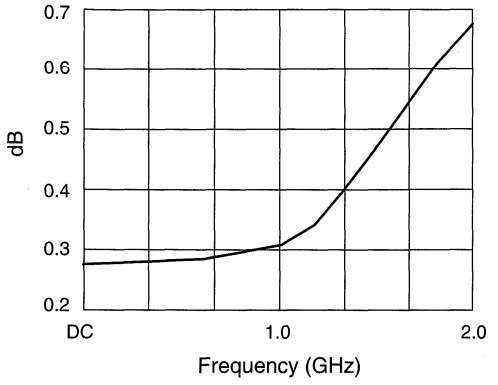
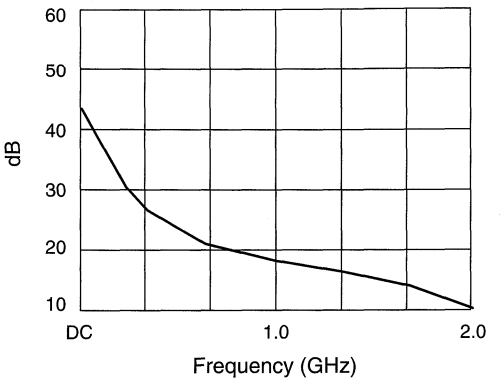
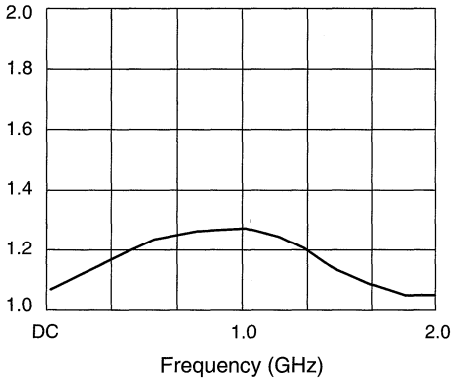
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

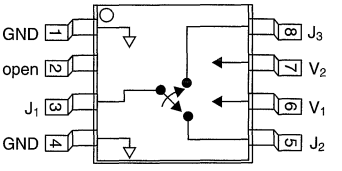
Absolute Maximum Ratings

Characteristic	Value
RF Input Power	6 W Max. > 900 MHz 0/-5 V Control
Control Voltage	+0.2 V, -10 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Isolation	Insertion Loss
-5	0	Insertion Loss	Isolation

Pin Out



GaAs IC 2 Watt High Linearity SPDT Switch DC–2.0 GHz

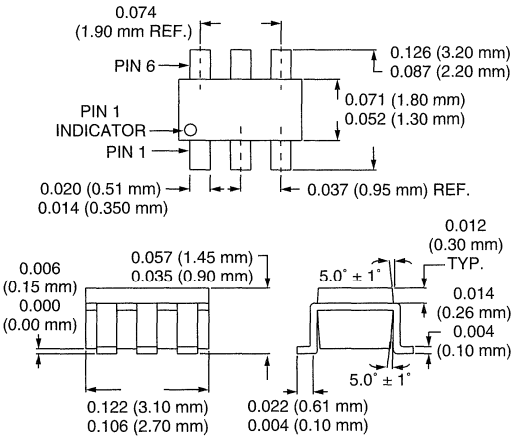
Alpha

AS128-73

Features

- High Linearity (48 dBm IP3 @ 0.9 GHz)
- Low Insertion Loss (0.35 dB @ 0.9 GHz)
- Antenna Changeover and T/R Cellular Switch
- Ultra Miniature SOT-6 Lead Package

SOT-6



Description

The AS128-73 is a FET IC high power SPDT switch in a SOT-6 plastic package. This switch is designed for use where extremely high linearity, low insertion loss and ultraminiature package size are required. It can be controlled with positive, negative or a combination of both voltages. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W. The AS128-73 switch can be used in many analog and digital wireless communication systems including cellular applications.

Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.3	0.4	dB
	DC–1.0 GHz		0.4	0.6	dB
	DC–2.0 GHz		1.0	1.2	dB
Isolation	DC–0.5 GHz	20	23		dB
	DC–1.0 GHz	15	17		dB
	DC–2.0 GHz	8	10		dB
VSWR[4]	DC–1.0 GHz		1.4:1	1.5:1	
	DC–2.0 GHz		1.8:1	2.0:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			60		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	0.9 GHz		+48		dBm
Input Power for 1 dB Compression		0.9 GHz		+33		dBm
Control Voltages	V_{Low} = -10.0 V ≤ V_{Low} ≤ 0 V, 500 µA, Max. V_{High} = 0 V ≤ V_{High} ≤ +10.0 V, 500 µA, Max. Differential = 5.0 V ≤ (V_{High} – V_{Low}) < 10.0 V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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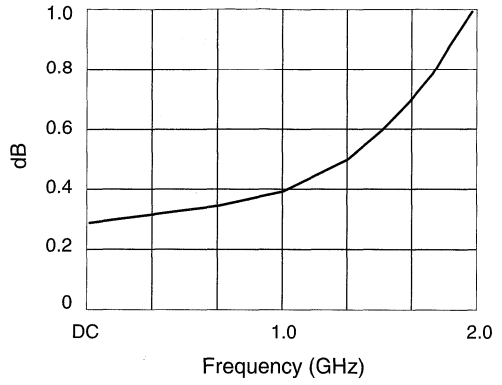
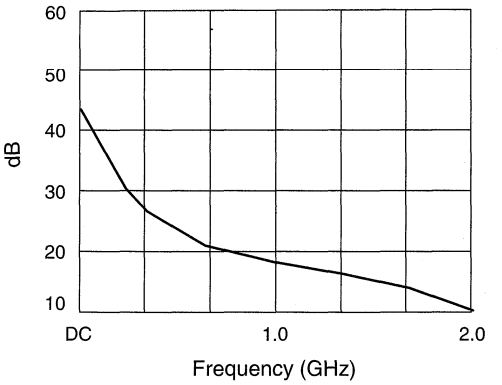
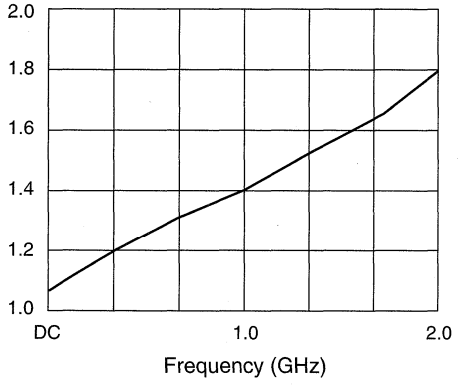
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Truth Table

Negative or Differential Voltage Operation[1]

V_1	V_2	J_1–J_2	J_1–J_3
V_{Low}	V_{High}	Insertion Loss	Isolation
V_{High}	V_{Low}	Isolation	Insertion Loss

1. Where supply voltage is limited and for improved high power linearity a larger differential voltage can be obtained by using a positive voltage for V_{High} along with a negative voltage for V_{Low}. Refer to application notes for further information.

Positive Voltage Operation

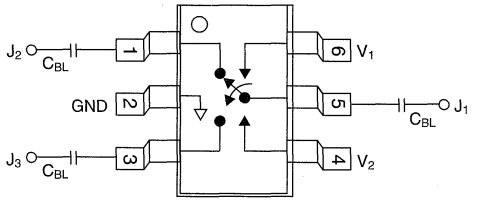
V_1	V_2	J_1–J_2	J_1–J_3
0	V_{High}	Insertion Loss	Isolation
V_{High}	0	Isolation	Insertion Loss

V_{High} = +5 to +10 V ($V_S = V_{High} \pm 0.2$ V)

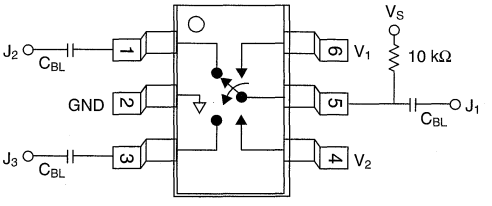
Absolute Maximum Ratings

Characteristic	Value
RF Input Power	6 W Max. > 900 MHz, 0/-5 V Control
Control Voltage	+0.2 V, -10 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Pin Out



Negative and Differential Voltages



Positive Operation

DC block components must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC 2 Watt High Linearity SPDT Switch DC–2 GHz

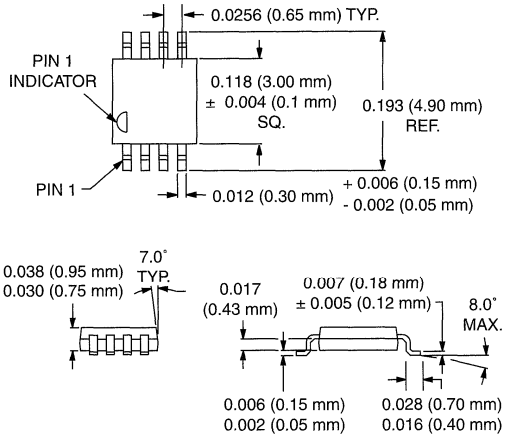
Alpha

AS138-59

Features

- High Linearity (55 dBm IP3 @ 0.9 GHz)
- Low Loss (0.35 dB @ 0.9 GHz)
- Antenna Changeover and T/R Cellular Switch
- -3 to -5 V Operation

MSOP-8



Description

The AS138-59 is a GaAs FET IC high linearity SPDT switch in a MSOP-8 plastic package. This switch is designed for use where extremely high linearity and low insertion loss are required. It can be controlled with positive, negative or a combination of both voltages. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W. The AS138-59 switch can be used in many analog and digital wireless communication systems including cellular applications.

Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.3	0.4	dB
	DC–1.0 GHz		0.4	0.6	dB
	DC–2.0 GHz		1.0	1.2	dB
Isolation	DC–0.5 GHz	20	23		dB
	DC–1.0 GHz	15	17		dB
	DC–2.0 GHz	8	10		dB
VSWR[4]	DC–1.0 GHz		1.3:1	1.4:1	
	DC–2.0 GHz		1.5:1	1.8:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			60		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	0.9 GHz		+55		dBm
Input Power for 1 dB Compression		0.9 GHz		+35		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -3 V @ 50 µA to -5 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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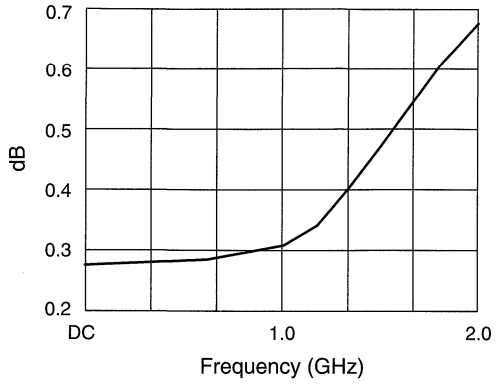
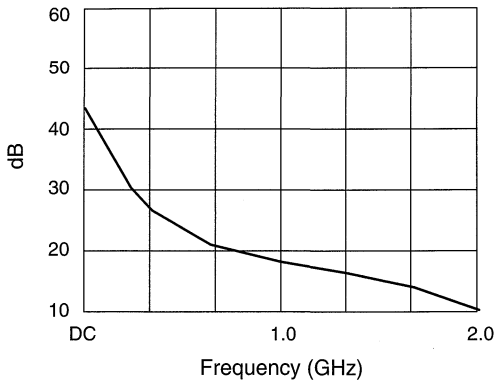
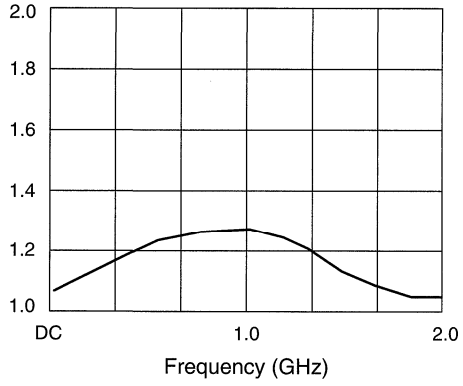
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

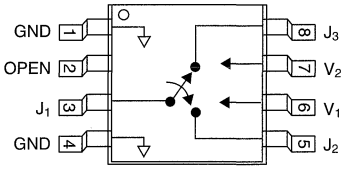
Absolute Maximum Ratings

Characteristic	Value
RF Input Power	6 W Max. > 0.9 MHz, 0/-5 V Control
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Isolation	Insertion Loss
-5	0	Insertion Loss	Isolation

Pin Out



GaAs IC High Linearity Positive Control SPDT Switch DC–2.0 GHz

Alpha

AS139-73

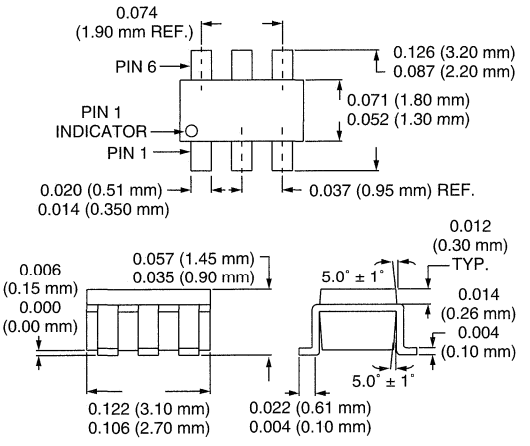
Features

- High Linearity (55 dBm IP3 @ 0.9 GHz)
- Low Insertion Loss (0.35 dB @ 0.9 GHz)
- Low DC Power Consumption
- +3 V to +5 V Operation
- Ultra Miniature SOT-6 Package

Description

The AS139-73 is a GaAs FET IC high linearity SPDT switch in a SOT-6 plastic package. This switch has been designed for use where extremely high linearity, low insertion loss and ultraminiature package size are required. It can be controlled with positive, negative or a combination of both voltages. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W. The AS139-73 switch can be used in many analog and digital wireless communication systems including cellular, GSM and DECT applications.

SOT-6



Electrical Specifications at 25°C (0, +5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.3	0.4	dB
	DC–1.0 GHz		0.4	0.6	dB
	DC–2.0 GHz		1.0	1.2	dB
Isolation	DC–0.5 GHz	20	23		dB
	DC–1.0 GHz	15	17		dB
	DC–2.0 GHz	8	10		dB
VSWR[4]	DC–1.0 GHz		1.3:1	1.4:1	dB
	DC–2.0 GHz		1.3:1	1.8:1	dB

Operating Characteristics at 25°C (0, +5 V)

Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			60		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	0.9 GHz		+55		dBm
Input Power for 1 dB Compression		0.9 GHz		+38		dBm
Control Voltage	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @100 µA Max. to +5 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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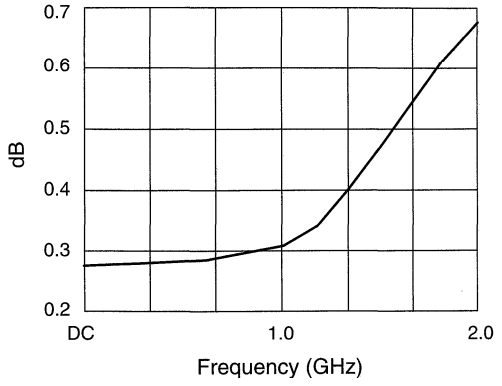
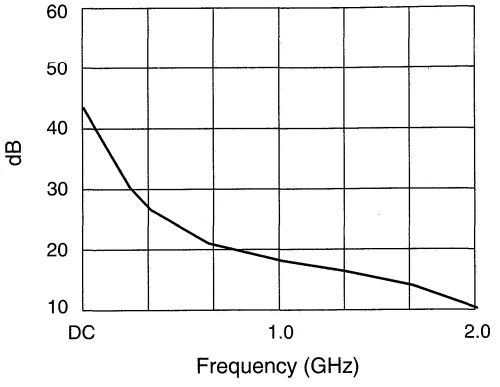
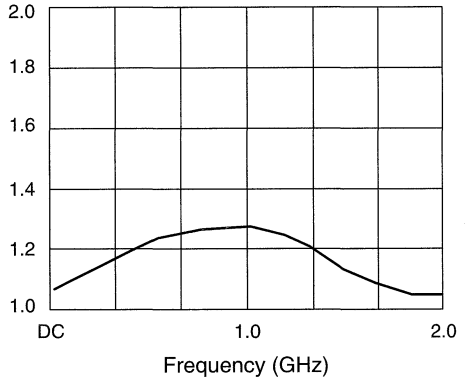
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

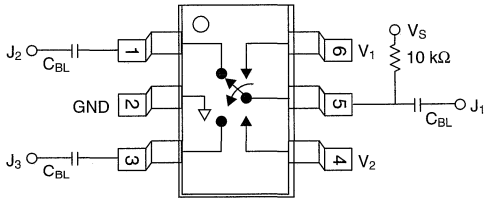
Characteristic	Value
RF Input Power	6 W Max. > 900 MHz, 0/-5 V Control
Control Voltage	-0.2 V, +8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
0	V_{High}	Isolation	Insertion Loss
V_{High}	0	Insertion Loss	Isolation

V_{High} = +3 to +5 V (V_S = V_{High} ± 0.2 V)

Pin Out



DC blocking capacitors (C_{BL}) must be supplied externally.
C_{BL} = 100 pF for operating frequency >500 MHz.

GaAs IC 2 Watt High Linearity Positive Control SPDT Switch DC–2.0 GHz

Alpha

AS358-62

Features

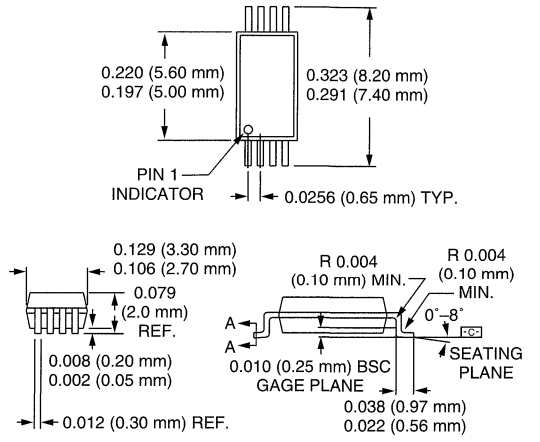
- High Linearity (55 dBm IP3 @ 0.9 GHz)
- Low Insertion Loss (0.35 dB @ 0.9 GHz)
- Antenna Changeover and T/R Cellular Switch
- Positive Control Voltage

Description

The AS358-62 is a GaAs FET IC high linearity SPDT switch in an SSOP-8 plastic package. This switch has been designed for use where extremely high linearity and low insertion loss are required. It can be controlled with positive, negative or a combination of both voltages. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W.

The AS358 switch can be used in many analog and digital wireless communication systems including cellular, GSM and DECT applications.

SSOP-8



Electrical Specifications at 25°C (0, +5 V)

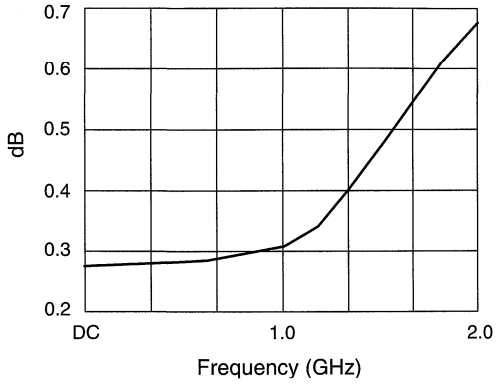
Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.3	0.4	dB
	DC–1.0 GHz		0.4	0.6	dB
	DC–2.0 GHz		1.0	1.2	dB
Isolation	DC–0.5 GHz	20	23		dB
	DC–1.0 GHz	15	17		dB
	DC–2.0 GHz	8	10		dB
VSWR[4]	DC–0.5 GHz		1.3:1	1.4:1	
	DC–1.0 GHz		1.3:1	1.6:1	
	DC–2.0 GHz		1.2:1	1.4:1	

Operating Characteristics at 25°C (0, +5 V)

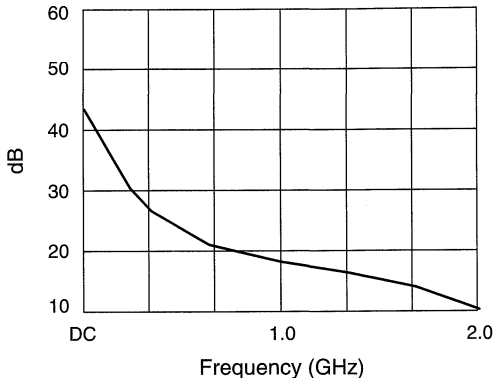
Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			60		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	0.9 GHz		+55		dBm
Input Power for 1 dB Compression		0.9 GHz		+35		dBm
Reverse Intermodulation Products (RIM)	T_X Tone @ +30 dBm, 830 MHz Interference Tone @ +10 dBm, 785 MHz					
	V_{High} 0/+5			-55		dBm
	V_{High} 0/+8.5			-80		dBm
Control Voltage	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @ 100 µA Max. to +9 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

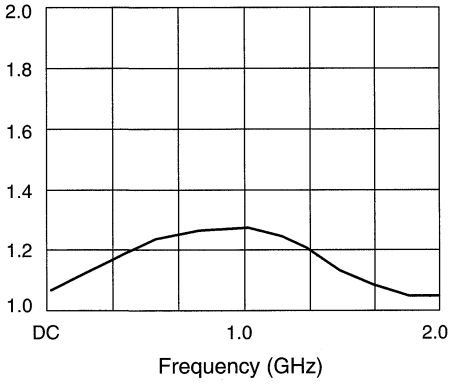
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

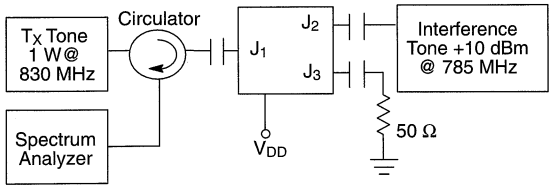
Characteristic	Value
RF Input Power	6 W Max. > 900 MHz, 0 V/+8 V Control
Supply Voltage	+10 V
Control Voltage	-0.2 V, +10 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Truth Table

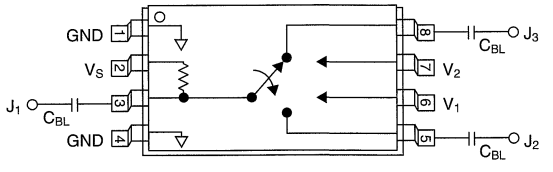
V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Isolation	Insertion Loss
0	V_{High}	Insertion Loss	Isolation

V_{High} = +3 to +9 V ($V_S = V_{High} \pm 0.2$ V)

Reverse Intermodulation Products (RIM) Setup



Pin Out



DC blocking capacitors (C_{BL}) must be supplied externally

GaAs IC 2 Watt High Linearity SPDT Switch DC–2.0 GHz

Alpha

AS359-62

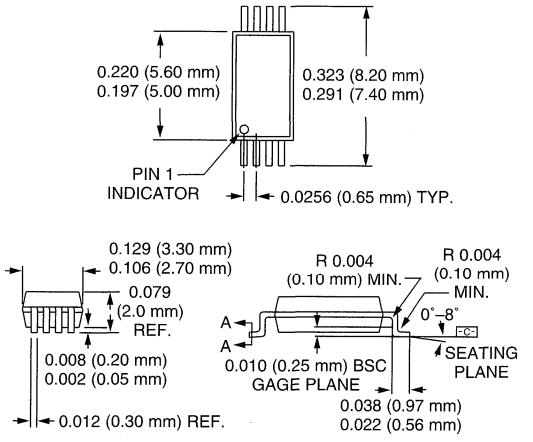
Features

- High Linearity (55 dBm IP3 @ 0.9 GHz)
- Low Insertion Loss (0.35 dB @ 0.9 GHz)
- Antenna Changeover and T/R Cellular Switch

Description

The AS359-62 is a GaAs FET IC SPDT switch in an SSOP-8 plastic package. The switch has been designed for use where extremely high linearity and low insertion loss are required. It can be controlled with positive, negative or a combination of both voltages. Some standard implementations include antenna changeover, T/R and diversity switching over 2 W. The AS359-62 switch can be used in many analog and digital wireless communication systems including cellular, GSM and DECT applications.

SSOP-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.3	0.4	dB
	DC–1.0 GHz		0.4	0.6	dB
	DC–2.0 GHz		1.0	1.2	dB
Isolation	DC–0.5 GHz	20	23		dB
	DC–1.0 GHz	15	17		dB
	DC–2.0 GHz	8	10		dB
VSWR[4]	DC–0.5 GHz		1.3:1	1.4:1	
	DC–2.0 GHz		1.3:1	1.8:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			60		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	0.9 GHz		+55		dBm
Input Power for 1 dB Compression	0/-5 V	0.9 GHz		+35		dBm
	0/-8 V	0.9 GHz		+37		dBm
Reverse Intermodulation Products (RIM)	T_X Tone @ +30 dBm, 830 MHz Interference Tone @ +10 dBm, 785 MHz					
	V_{High} 0/-5 V			-55		dBm
	V_{High} 0/-8.5 V			-80		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -3 V @ 50 µA to -9 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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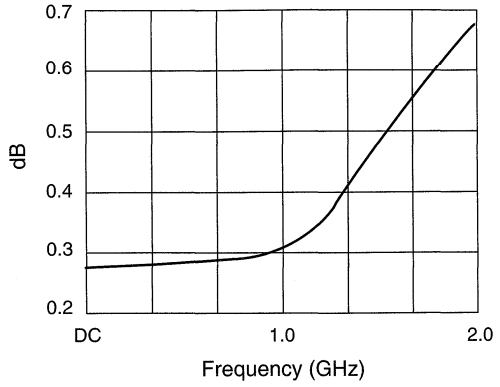
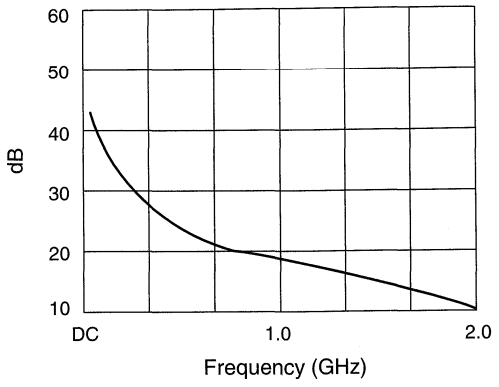
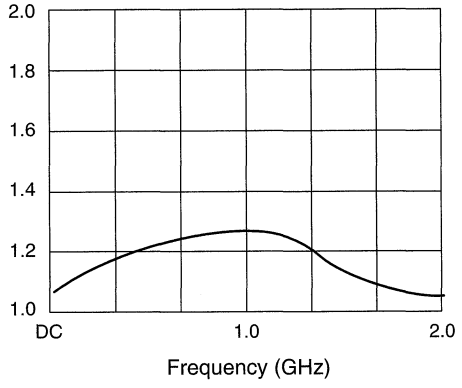
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

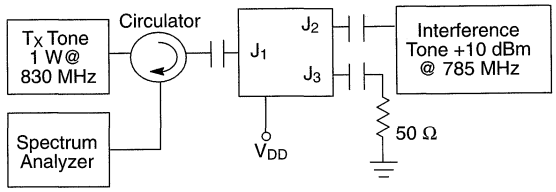
Characteristic	Value
RF Input Power	6 W Max. > 900 MHz, 0 V/-8 V Control
Control Voltage	+0.2 V, -10 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Truth Table

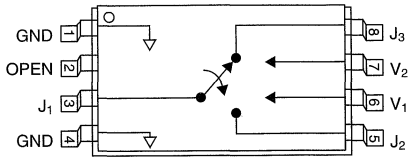
V_1	V_2	J_1–J_2	J_1–J_3
0	V_{High}	Isolation	Insertion Loss
V_{High}	0	Insertion Loss	Isolation

Refer to application note for positive voltage operation.

Reverse Intermodulation Products (RIM) Setup



Pin Out



High Isolation SPDT Switches

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
DC–2.5	45 dB ISO @ 0.9 GHz, Pos. CTL	0.5–1.0	70–20	41	SOIC-8	▶ AS118-12	1-88
DC–2.5	35 dB ISO @ 1.9 GHz, Pos. CTL	0.6–0.9	70–29	41	SOIC-8	▶ AS119-12	1-90
DC–2.5	50 dB ISO @ 0.5–2.0 GHz, Pos. CTL	0.6–0.8	70–45	41	SOIC-24	▶ AS148-24	1-92

▶ Available through distribution.

Preferred for new designs.

GaAs IC High Isolation Positive Control SPDT Switch DC–2.5 GHz

Alpha

AS118-12

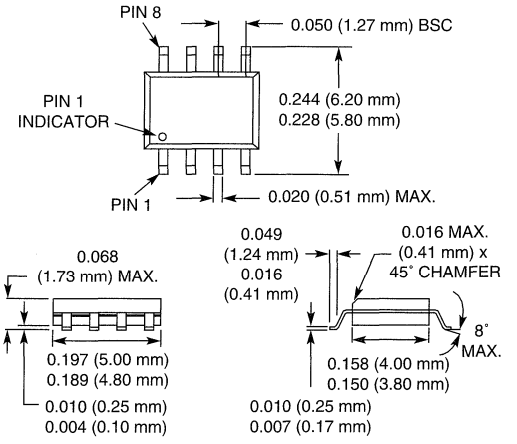
Features

- Positive Control
- High Isolation (45 dB @ 0.9 GHz)
- Low Insertion Loss (0.5 dB @ 0.9 GHz)

Description

The AS118-12 is a reflective SPDT FET IC switch. The switch requires external DC blocking capacitors, positive supply and two positive controls. The device is mounted in a plastic SOIC-8 package for surface mounting and is ideal for use in high isolation switching applications, such as base station synthesizer switching.

SOIC-8



Electrical Specifications at 25°C (0, +5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.55	0.65	dB
	DC–1.0 GHz		0.6	0.7	dB
	DC–2.0 GHz		0.7	0.8	dB
	DC–2.5 GHz		0.9	1.1	dB
Isolation	DC–0.5 GHz	46	50		dB
	DC–1.0 GHz	43	46		dB
	DC–2.0 GHz	24	27		dB
	DC–2.5 GHz	15	18		dB
VSWR[4]	DC–1.0 GHz		1.2:1	1.4:1	
	DC–2.0 GHz		1.4:1	1.7:1	
	DC–2.5 GHz		1.6:1	2.1:1	

Operating Characteristics at 25°C (0, +5 V)

Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			60		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	0.9 GHz		+41		dBm
Input Power for 1 dB Compression		0.9 GHz		+26		dBm
Control Voltages	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @ 100 µA Max. to +5 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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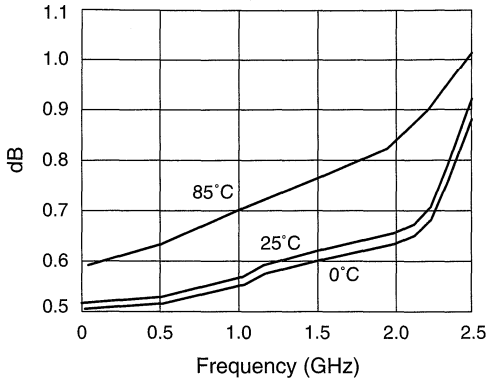
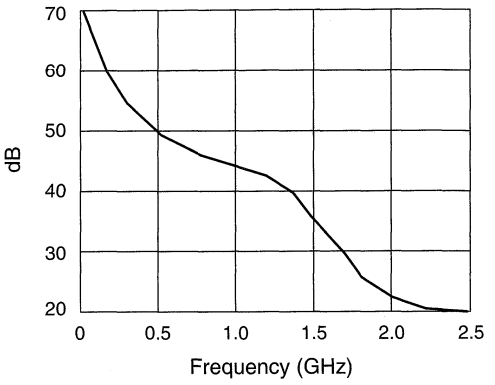
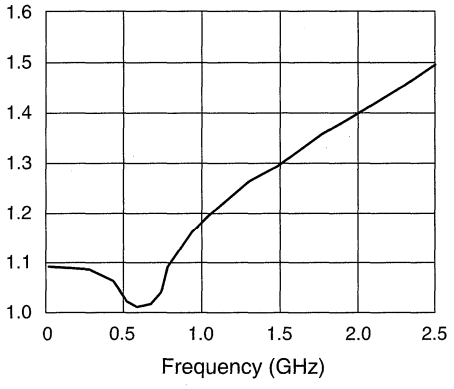
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

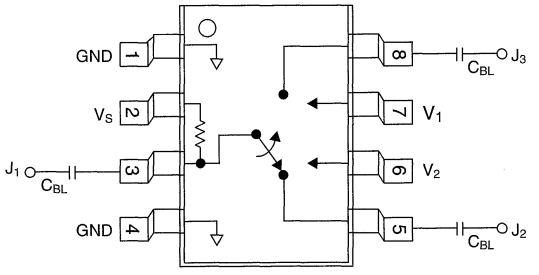
Characteristic	Value
RF Input Power	1 W Max. > 0.9 GHz 0/+5 V Control
Supply Voltage	+8 V
Control Voltage	-0.2 V, +8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	85°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Insertion Loss	Isolation
0	V_{High}	Isolation	Insertion Loss

V_{High} = +3 to +5 V (V_S = V_{High} ± 0.2 V)

Pin Out



DC blocking capacitors (C_{BL}) must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC High Isolation Positive Control SPDT Switch DC–2.5 GHz

Alpha

AS119-12

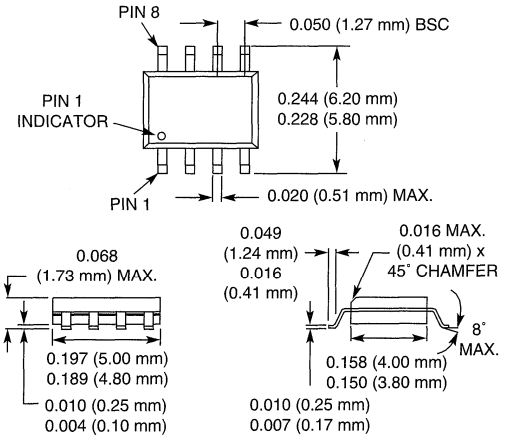
Features

- +3 V to +5 V Operation
- High Isolation (35 dB @ 1.9 GHz)
- Low Cost SOIC-8 Plastic Package

Description

The AS119-12 is a reflective SPDT FET IC switch designed for 1.9 GHz applications requiring high isolation. The switch requires external DC blocking capacitors, positive supply and two positive controls eliminating the need for a negative voltage. The device is mounted in a plastic SOIC-8 package for surface mounting. The AS119-12 can be used in many analog and digital wireless applications.

SOIC-8



Electrical Specifications at 25°C (0, +5 V)

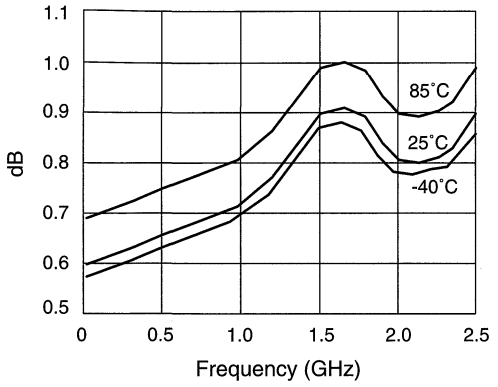
Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.7	0.8	dB
	DC–1.0 GHz		0.8	0.9	dB
	DC–2.0 GHz		0.95	1.1	dB
	DC–2.5 GHz		1.0	1.2	dB
Isolation	DC–0.5 GHz	40	42		dB
	DC–1.0 GHz	35	37		dB
	DC–2.0 GHz	33	35		dB
	DC–2.5 GHz	27	29		dB
VSWR[4]	DC–1.0 GHz		1.2:1	1.3:1	
	DC–2.0 GHz		1.5:1	1.8:1	
	DC–2.5 GHz		1.7:1	2.0:1	

Operating Characteristics at 25°C (0, +5 V)

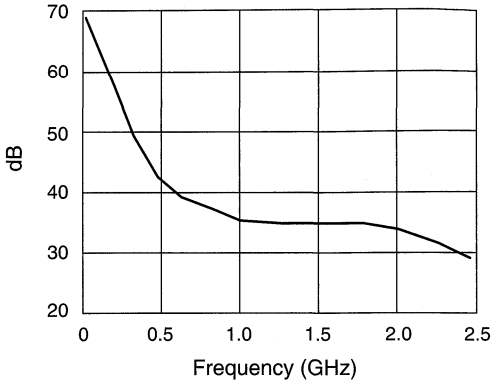
Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			60		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	1.9 GHz		+41		dBm
Input Power for 1 dB Compression		1.9 GHz		+26		dBm
Control Voltages	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @100 µA Max. to +5 V @ 200 µA Max. V_S = V_{High} ± 0.2 V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

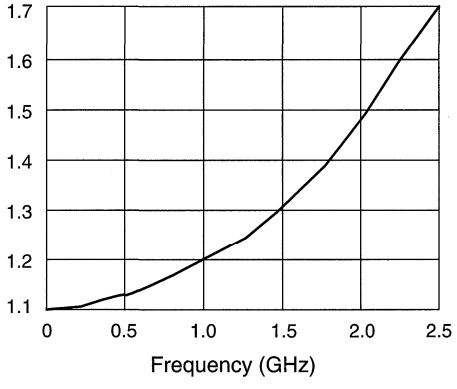
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

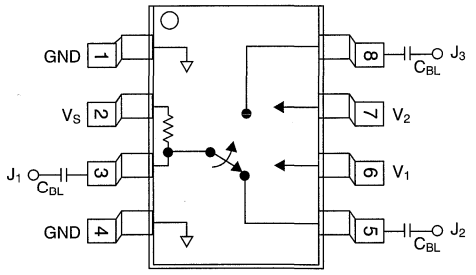
Characteristic	Value
RF Input Power	6 W Max. > 900 MHz 0/+5 V Control
Control Voltage	-0.2 V, +10 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	85°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
0	V_{High}	Insertion Loss	Isolation
V_{High}	0	Isolation	Insertion Loss

V_{High} = +3 to +5 V (V_S = V_{High} ± 0.2 V)

Pin Out



DC blocking capacitors C_{BL} must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC High Isolation Positive Control SPDT Switch DC–2.5 GHz

Alpha

AS148-24

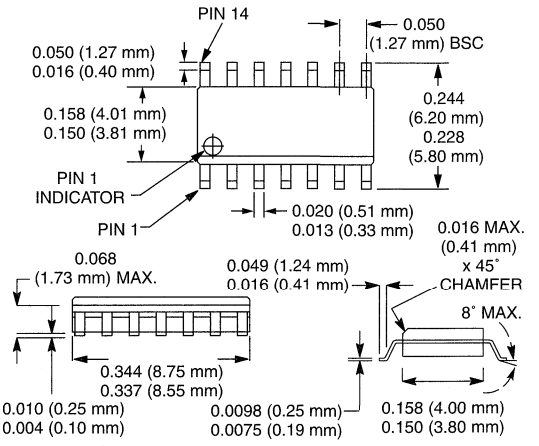
Features

- Positive Voltage Control
- High Isolation (50 dB @ 0.9 GHz and 1.9 GHz)
- Low DC Power Consumption
- Base Station Synthesizer Switch

Description

GaAs FET IC SPDT switch packaged in an SOIC-14 plastic package for low cost commercial applications. Ideal building block for base station dual band applications where synthesizer isolation is critical. Use in conjunction with the AS123-12 SPST switch to meet GSM synthesizer isolation requirement.

SOIC-14



Electrical Specifications at 25°C (0, +5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–1.0 GHz		0.6	0.9	dB
	DC–2.0 GHz		0.8	1.1	dB
	DC–2.5 GHz		1.2	1.4	dB
Isolation	DC–1.0 GHz	44	50		dB
	DC–2.0 GHz	46	50		dB
	DC–2.5 GHz	35	45		dB
VSWR[4]	DC–2.0 GHz		1.3:1	1.5:1	
	DC–2.5 GHz		1.5:1	1.8:1	

Operating Characteristics at 25°C (0, +5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			60		ns
	On, Off (50% CTL to 90/10% RF)			100		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	Two-tone Input Power +10 dBm	0.5–2.0 GHz		+41		dBm
Control Voltage	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +5 V @ 200 µA Max. to +7 V @ 500 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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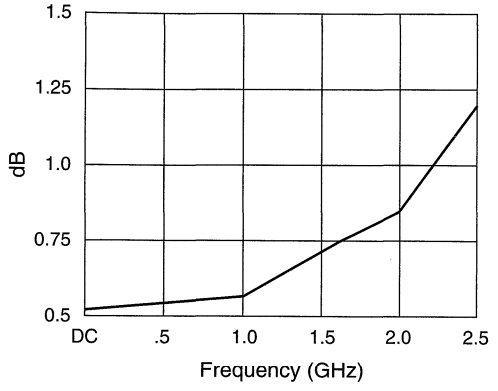
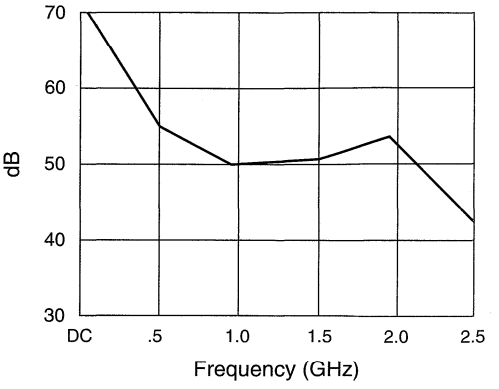
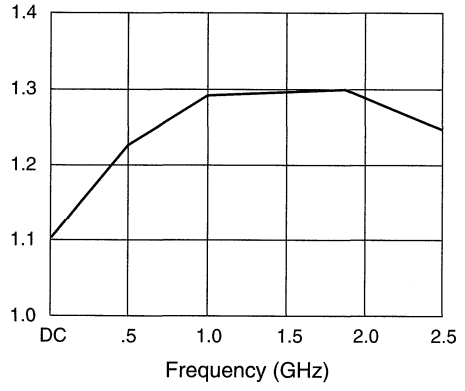
Typical Performance Data (0, +5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

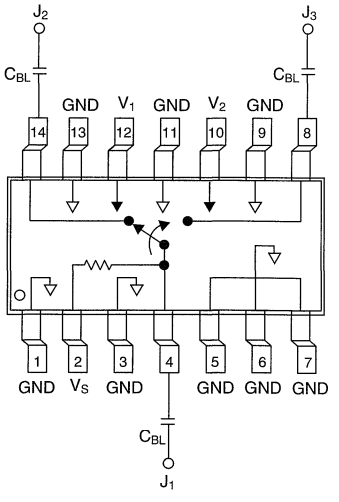
Characteristic	Value
RF Input Power	1 W Max. > 500 MHz 0/+8 V Control
Supply Voltage	+8 V
Control Voltage	-0.2 V, +8 V
Operating Temperature	-30°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
V_{High}	0	Isolation	Insertion Loss
0	V_{High}	Insertion Loss	Isolation

V_{High} = +5 V to +7 V (V_S = V_{High} ± 0.2 V)

Pin Out



DC blocking capacitors (C_{BL}) must be supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

Diversity/Transfer Switches

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
DC–3.0	General Purpose	0.9–1.3	40–18	40	SOIC-8	▶ ADC02D2-12	1-96
DC–2.0	High Power, 2 Line CTL	0.6–1.0	40–8	61	SOIC-16 Wide	AS117-45	1-98
DC–2.0	2 W Transfer Switch	0.5–1.6	19–8	45	SSOP-8	AS126-62	1-100
DC–2.0	Dual Band Transfer Switch	0.5–1.5	20–10	45	MSOP-8	▶ AS127-59	1-102
DC–2.0	PDC T/R w/Acc. Ant.	0.35–1.1	30–20	48	MSOP-8	AS143-59	1-104
DC–2.0	PDC T/R w/Acc. Ant.	0.3–1.2	30–15	49	MSOP-8	AS149-59	1-107

▶ Available through distribution.

Preferred for new designs.

GaAs IC Diversity Switch
DC–2.5 GHz

Alpha

ADC02D2-12

Features

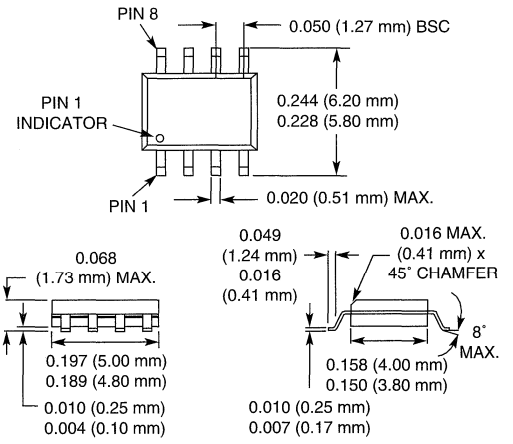
- Low Cost SOIC-8 Plastic Package
- Independent Four Port Switching
- Individual Voltage Control on Each Port

Description

The ADC02D2 is a 4 port switch with independent DC voltage control on each port mounted in the SOIC-8 package.

In transmit or receive applications, the asymmetric design allows for good isolation between transmit and receive path while maintaining medium power handling in transmit port.

SOIC-8



Electrical Specifications at 25°C (0, -5 V)

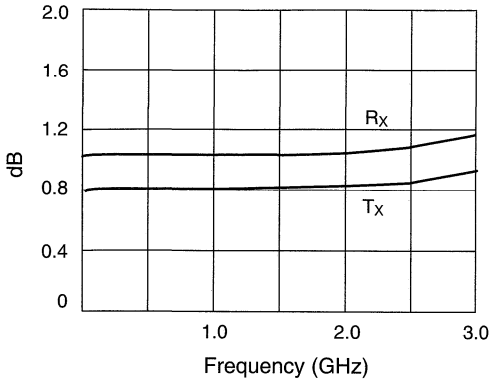
Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		1.0	1.1	dB
Receiver	DC–1.0 GHz		1.0	1.2	dB
(R_X–J_1, J_2)	DC–2.0 GHz		1.1	1.3	dB
	DC–2.5 GHz		1.1	1.4	dB
Insertion Loss	DC–0.5 GHz		0.8	0.9	dB
Transmit	DC–1.0 GHz		0.8	1.0	dB
(T_X–J_1, J_2)	DC–2.0 GHz		0.9	1.1	dB
	DC–2.5 GHz		0.9	1.2	dB
Isolation	DC–0.5 GHz	34	37		dB
(R_X–J_1, J_2)	DC–1.0 GHz	28	30		dB
	DC–2.0 GHz	22	24		dB
	DC–2.5 GHz	20	22		dB
Isolation	DC–0.5 GHz	32	33		dB
(T_X–J_1, J_2)	DC–1.0 GHz	26	27		dB
	DC–2.0 GHz	20	21		dB
	DC–2.5 GHz	18	19		dB
VSWR[4]	DC–1.0 GHz		1.5:1	1.7:1	
	DC–2.5 GHz		1.8:1	2.0:1	

Operating Characteristics at 25°C (0, -5 V)

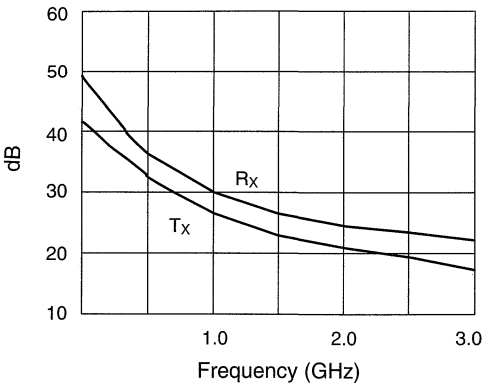
Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			3		ns
	On, Off (50% CTL to 90/10% RF)			6		ns
	Video Feedthru			30		mV
Input Power for 1 dB Compression		0.50–2.0 GHz		+27		dBm
(T_X–J_1, J_2)		0.050 GHz		+18		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–2.0 GHz		+40		dBm
		0.050 GHz		+29		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max.					
	V_{High} = -5 V @ 50 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

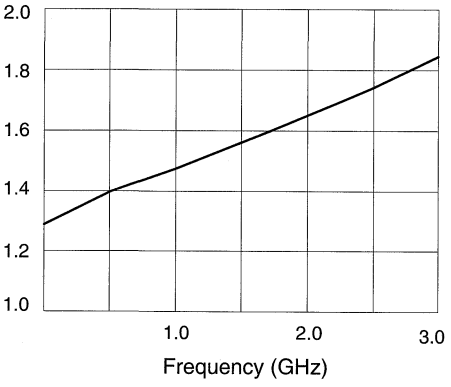
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency (Worst Case)

Absolute Maximum Ratings

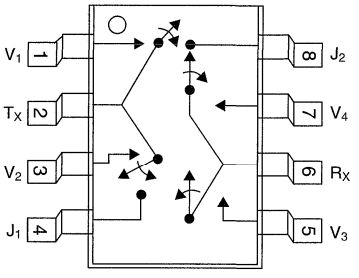
Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -10 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

V_1	V_2	V_3	V_4	"On Paths"
0	-5	-5	-5	T_X–J_2
-5	0	-5	-5	T_X–J_1
-5	-5	0	-5	R_X–J_1
-5	-5	-5	0	R_X–J_2
0	-5	0	-5	T_X–J_2, R_X–J_1
-5	0	-5	0	T_X–J_1, R_X–J_2

Pin Out



GaAs IC High Power Diversity Switch DC–2.0 GHz

Alpha

AS117-45

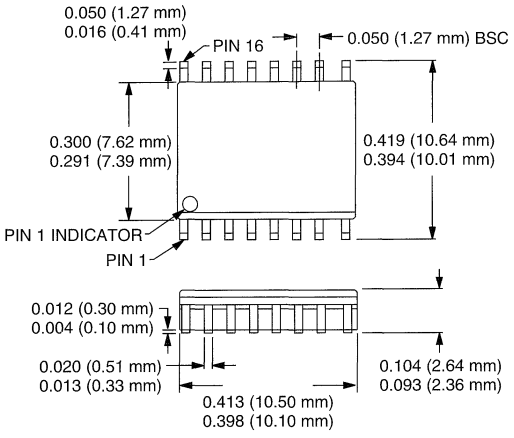
Features

- High Linearity (+61 dBm IP3 @ 0.9 GHz)
- Integrated Decoder Chip that Provides Two-Line Voltage Control
- Independent Four Port Switching
- Portable Radio T/R Switching

Description

The AS117-45 is a 4 port switch with two line control voltage. This device is designed for portable radio T/R switching with up to 10 W power handling capability. The AS117-45 is packaged in a plastic SOIC-16 0.300" (wide body) package.

SOIC-16 Wide



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3] Receive Mode (R_X–J_1, J_2)	DC–1.0 GHz DC–2.0 GHz		0.6 1.7	0.9 2.0	dB dB
Insertion Loss[3] Transmit Mode (Tx–J1, J2)	DC–1.0 GHz DC–2.0 GHz		0.5 1.2	0.7 1.5	dB dB
Isolation Transmit Mode (T_X–R_X)	DC–1.0 GHz DC–2.0 GHz	30 18	33 24		dB dB
Isolation Transmit Mode (T_X–J_1, J_2)	DC–1.0 GHz DC–2.0 GHz	13 8	16 12		dB dB
Isolation Receive Mode (R_X–J_1, J_2)	DC–1.0 GHz DC–2.0 GHz	15 8	19 15		dB dB
VSWR[4]	DC–1.0 GHz DC–2.0 GHz		1.25:1 1.5:1	1.3:1 1.8:1	dB dB

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF)			60 200		ns ns
Input Power for 1 dB Compression		0.90 GHz		+33		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm	0.90 GHz		+61		dBm
Control Voltages	V_{Low} = 0 to -0.2 V@ 20 µA Max. V_{High} = -5 V @ 100 µA Max. to -10 V @ 800 µA Max. V_S = V_{High} ± 0.2					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.

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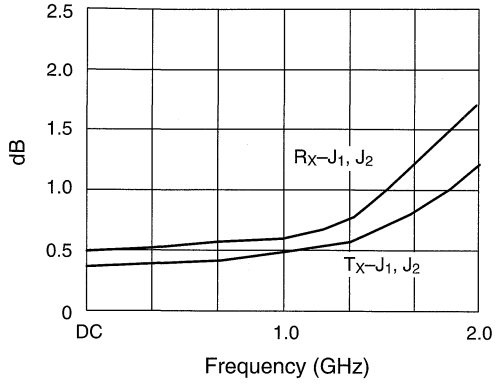
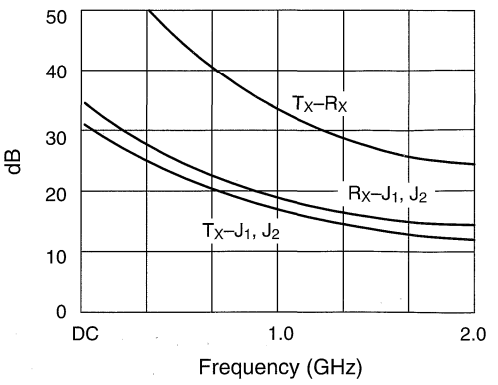
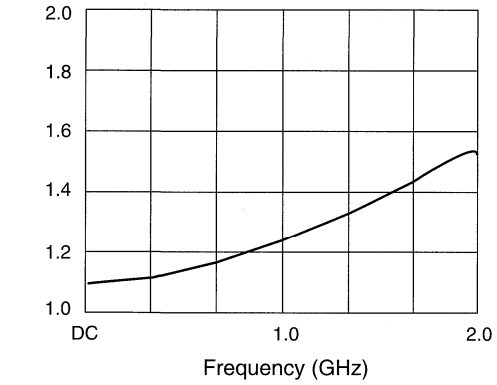
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Truth Table

V_1	V_2	State
0	0	T_X–J_1
V_{High}	0	T_X–J_2
0	V_{High}	R_X–J_1
V_{High}	V_{High}	R_X–J_2

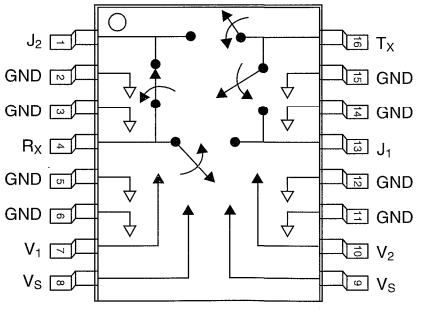
V_{High} = -5 V to -10 V (V_S = V_{High} ± 0.2 V)

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	12 W > 500 MHz, 0/-12 V
Control Voltage	+0.2 V, -12 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Thermal Resistance	87°C/W
Supply Voltage	-12 V

Note: V_S is common therefore only one V_S pin (Pin 8 or Pin 9) needs to be wired.

Pin Out



GaAs IC Transfer Switch DC–2 GHz

Alpha

AS126-62

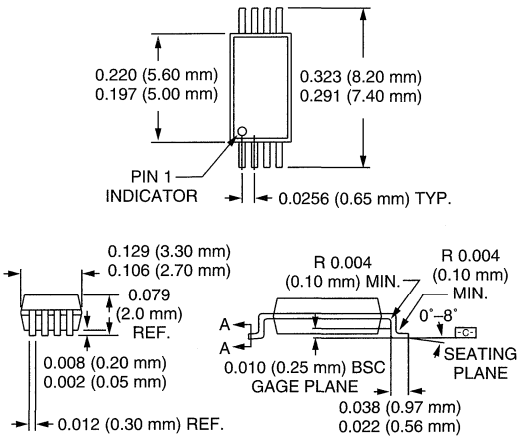
Features

- High Linearity (IP3 45 dBm @ 0.9 GHz)
- Low Insertion Loss (0.6 dB @ 0.9 GHz)
- Simultaneous T/R Switching

Description

The AS126-62 is a 4 port switch designed to combine T/R and antenna changeover switching capability within one device. This switch has two DC voltage controls and is ideal for -5 V applications having low power consumption requirements. The AS126-62 is suitable for cellular wireless communication applications.

SSOP-8



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.55	0.6	dB
	DC–1.0 GHz		0.6	0.7	dB
	DC–2.0 GHz		1.3	1.6	dB
Isolation[4]	DC–0.5 GHz	19	26		dB
	DC–1.0 GHz	13	15		dB
	DC–2.0 GHz	8	11		dB
VSWR[5]	DC–1.0 GHz		1.1:1	1.5:1	
	DC–2.0 GHz		1.3:1	1.8:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[6]	Rise, Fall (10/90% or 90/10% RF)			20		ns
	On, Off (50% CTL to 90/10% RF)			40		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +0 dBm	0.5–2.0 GHz		+45		dBm
Input Power For 1 dB Compression (T_X)		0.5–2.0 GHz		+33		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 10 µA Max. V_{High} = -5 V @ 25 µA to -10 V @ 100 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Any state.
5. Insertion loss state.
6. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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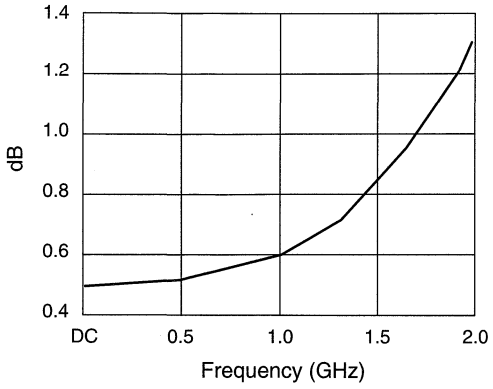
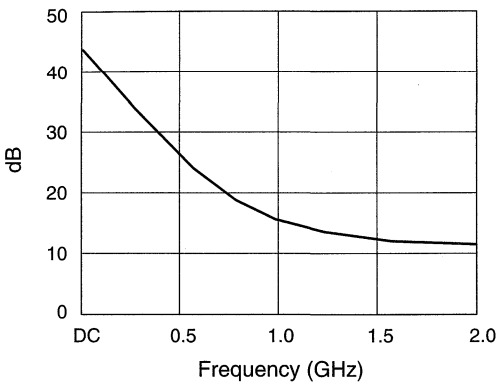
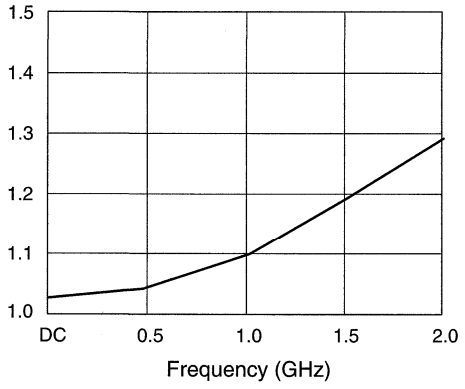
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

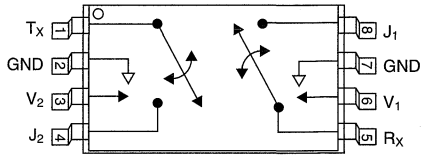
Characteristic	Value
RF Input Power	4 W > 0.5 GHz 0/-5 V Control
Control Voltage	+0.2 V, -10 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

V_1	V_2	T_X–J_2 R_X–J_1	T_X–J_1 R_X–J_2
0	-5	Insertion Loss	Isolation
-5	0	Isolation	Insertion Loss

Pin Out



GaAs IC Transfer Switch DC–2 GHz

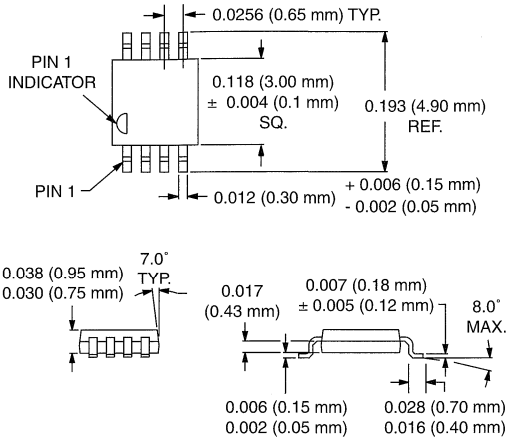
Alpha

AS127-59

Features

- High Linearity (+45 dBm IP3 @ 0.9 GHz)
- Small MSOP-8 Plastic Package
- Low Insertion Loss (0.4 dB @ 0.9 GHz)
- Simultaneous T/R Switching

MSOP-8



Description

The AS127-59 is a 4 port switch designed to combine T/R and antenna changeover switching capability within one device. This switch has two 5 V controls and is ideal for applications requiring low power consumption. The AS127-59 has excellent performance to 2 GHz making it suitable for dual band handset designs.

Electrical Specifications at 25°C (0, -5 V)

		T_X–J_1 or R_X–J_1			T_X–J_2 or R_X–J_2			
Parameter[1]	**Frequency[2]**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Unit**
Insertion Loss[3]	DC–0.5 GHz		0.35	0.5		0.5	0.7	dB
	DC–1.0 GHz		0.45	0.7		0.6	0.9	dB
	DC–2.0 GHz		0.7	1.0		0.85	1.3	dB
Isolation	DC–0.5 GHz	20	25		25	28		dB
	DC–1.0 GHz	13	15		17	20		dB
	DC–2.0 GHz	10	13		14	16		dB
VSWR[4]	DC–1.0 GHz		1.2:1	1.5:1		1.2:1	1.5:1	
	DC–2.0 GHz		1.3:1	1.8:1		1.3:1	1.8:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			20		ns
	On, Off (50% CTL to 90/10% RF)			40		ns
	Video Feedthru			50		mV
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +0 dBm	0.5–2.0 GHz		+45		dBm
Input Power For 1 dB Compression (T_X)		0.5–2.0 GHz		+33		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 25 µA to -8 V @ 100 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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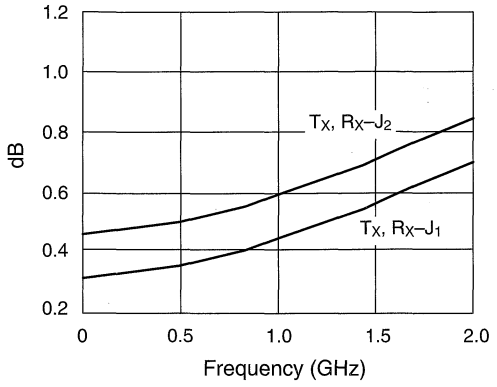
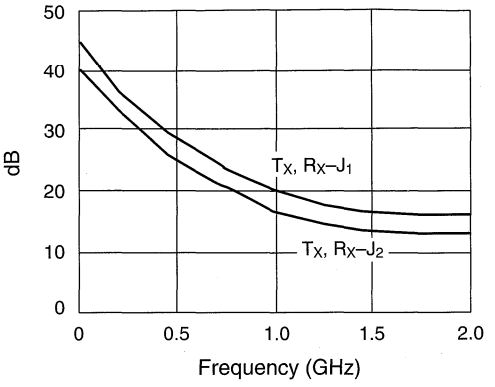
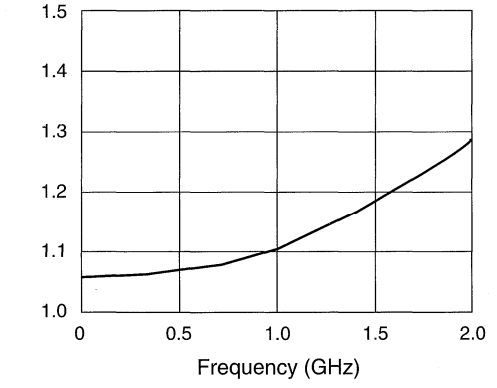
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	4 W > 0.5 GHz, 0/-5 V Control
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Truth Table

Negative Operation

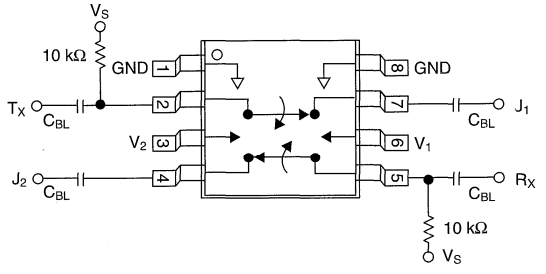
V_1	V_2	T_X–J_2, R_X–J_1	T_X–J_1, R_X–J_2
0	-5	Insertion Loss	Isolation
-5	0	Isolation	Insertion Loss

Positive Operation

V_1	V_2	T_X–J_2, R_X–J_1	T_X–J_1, R_X–J_2
V_{High}	0	Insertion Loss	Isolation
0	V_{High}	Isolation	Insertion Loss

V_{High} = +5 to +8 V (V_S = V_{High} ± 0.2 V)

Pin Out



External components shown are for positive voltage operaton only.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC Receive Diversity T/R Switch DC–2 GHz

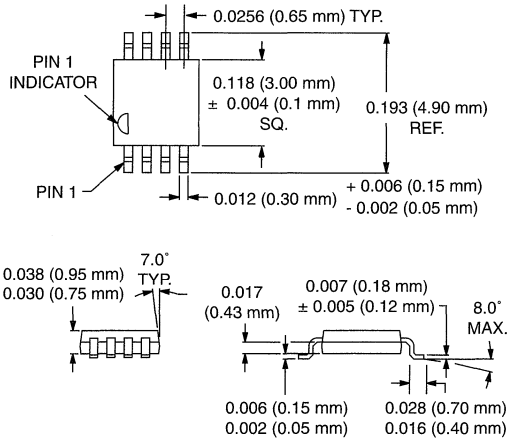
Alpha

AS143-59

Features

- PDC Antenna Switch
- Transmit to Main Antenna
- Receive from Dual Antenna Ports
- Operates with Positive or Differential Voltages
- Low DC Power Consumption

MSOP-8



Description

The AS143-59 is an IC FET T/R switch with receive diversity, ideal for use in PDC handsets and low power base stations. It can be operated with positive 3 V or differential voltage control for high linearity. The switch is packaged in a low cost, miniature MSOP-8 package.

Electrical Specifications at 25°C (-2.75, +2.75 V)

On Path	Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
T_X to M-Antenna	Insertion Loss[3]	DC–1.0 GHz DC–2.0 GHz		0.35 0.50	0.5 0.7	dB dB
	R_X to M-Ant. Iso.	DC–1.0 GHz DC–2.0 GHz	23 15	26 19		dB dB
R_X to M-Antenna	Insertion Loss	DC–1.0 GHz DC–2.0 GHz		0.65 0.9	0.8 1.1	dB dB
	T_X to M-Ant. Iso.	DC–1.0 GHz DC–2.0 GHz	15 9	18 12		dB dB
	R_X to S-Ant. Iso.	DC–1.0 GHz DC–2.0 GHz	20 12	23 15		dB dB
R_X to S-Antenna	Insertion Loss	DC–1.0 GHz DC–2.0 GHz		0.5 0.9	0.6 1.1	dB dB
	T_X to M-Ant. Iso.	DC–1.0 GHz DC–2.0 GHz	20 12	24 15		dB dB
	VSWR[4]	DC–1.0 GHz DC–2.0 GHz		1.5:1 1.7:1		

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.

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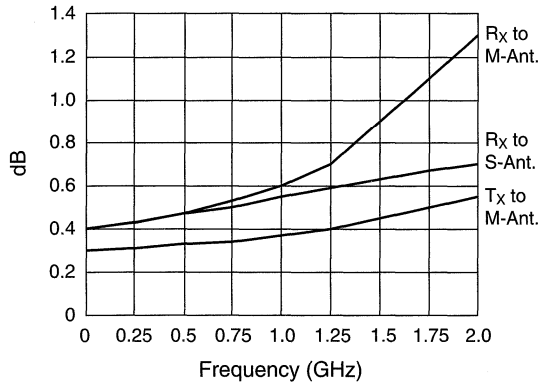
Operating Characteristics at 25°C (-2.75, +2.75 V)

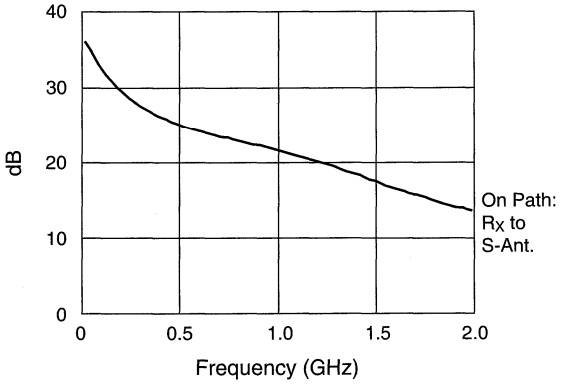
Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics	Rise, Fall Time On, Off Time			75 150		ns ns
Input Power for 1 dB Compression	T_X to M-Ant R_X to M-Ant. R_X to S-Ant.	0.9 GHz		+36 +33 +33		dBm dBm dBm
Intermodulation Intercept Point	For Two-tone Input Power at +13 dBm T_X to M-Ant. R_X to M-Ant.	0.9 GHz		 +49 +48		 dBm dBm
Adjacent Channel Power Performance	T_X to M-Ant (PDC Standard, 30 dBm Input, 100 kHz Detune)			 +69		 dBm
Harmonic Channel Power Performance	30 dBm Input 2nd Harmonic 3rd Harmonic	0.9 GHz		 +67 +82		 dBc dBc
Control Voltages	V_{Low} = -2.8 V ≤ V_{Low} ≤ -6.0 V V_{High} = -0.2 V ≤ V_{High} ≤ +5.0 V Differential = +2.6 V ≤ (V_{High} – V_{Low}) ≤ +10 V					

1. All measurements made in a 50 ohm system, unless otherwise specified.

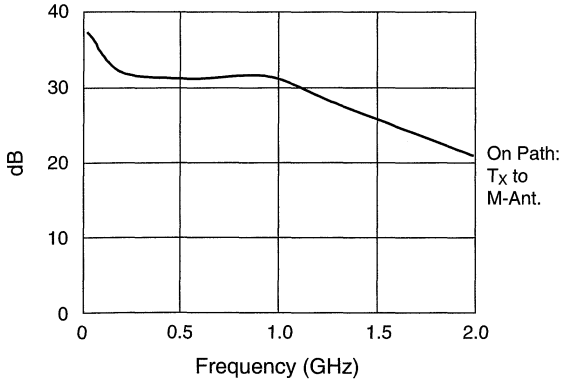
Typical Performance Data (-2.75, +2.75 V)



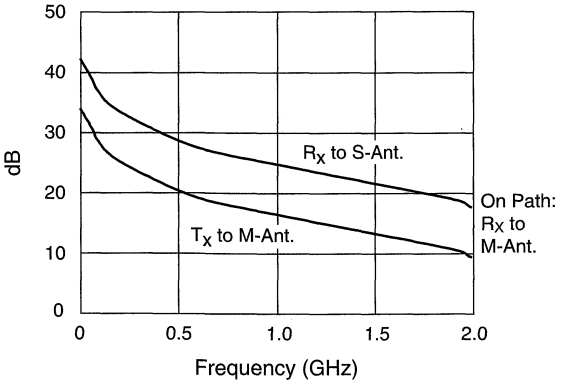
Insertion Loss vs. Frequency



R_X to M-Ant. Isolation vs. Frequency



R_X to M-Ant. Isolation vs. Frequency



T_X to M-Ant. and R_X to S-Ant. Isolation vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	6 W > 500 MHz, 0/-10 V
Positive Voltage Differential Bias	3 V ≤ (V_{High} – V_{Low}) ≤ 10 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

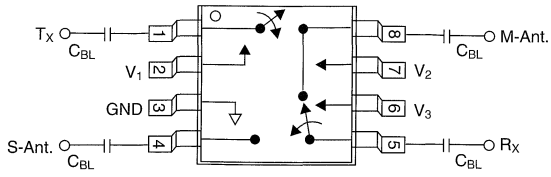
Note: Exceeding these parameters may cause irreversible damage.

Truth Table

V_1	V_2	V_3	T_X M-Ant.	R_X M-Ant.	R_X S-Ant.
V_{High}	V_{Low}	V_{Low}	Insertion Loss	Isolation	Isolation
V_{Low}	V_{High}	V_{Low}	Isolation	Insertion Loss	Isolation
V_{Low}	V_{Low}	V_{High}	Isolation	Isolation	Insertion Loss

V_{Low} = -2.8 to -6 V
V_{High} = -0.2 to +3.0 V

Pin Out



External DC blocking capacitor (C_{BL}) required on all RF ports only if V_{High} > 0 V.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC Receive Diversity T/R Switch DC–2 GHz

Alpha

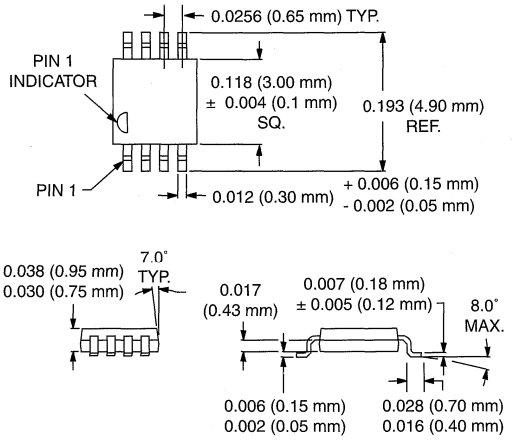
AS149-59

1

Features

- PDC Antenna Switch
- Transmit to Main Antenna
- Receive from Dual Antenna Ports
- Operates with Positive, Negative or Differential Voltages
- Low DC Power Consumption

MSOP-8



Description

The AS149-59 is a GaAs MMIC T/R Switch with receive diversity ideal for use in PDC handsets and low power base stations. It can be operated with positive or negative 3 V or differential biasing for high linearity. The switch is packaged in a low cost, miniature MSOP-8 package.

Electrical Specifications at 25°C (-2.75, +2.75 V)

On Path	Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
T_X to M-Ant.	Insertion Loss[3]	DC–1.0 GHz DC–2.0 GHz		0.35 0.50	0.5 0.7	dB dB
	R_X to M-Ant. Iso.	DC–1.0 GHz DC–2.0 GHz	23 15	26 19		dB dB
R_X to M-Ant.	Insertion Loss	DC–1.0 GHz DC–2.0 GHz		0.65 0.9	0.8 1.1	dB dB
	T_X to M-Ant. Iso.	DC–1.0 GHz DC–2.0 GHz	15 9	18 12		dB dB
	R_X to S-Ant. Iso.	DC–1.0 GHz DC–2.0 GHz	20 12	23 15		dB dB
R_X to S-Ant.	Insertion Loss	DC–1.0 GHz DC–2.0 GHz		0.5 0.9	0.6 1.1	dB dB
	T_X to M-Ant. Iso.	DC–1.0 GHz DC–2.0 GHz	20 12	24 15		dB dB
	VSWR[4]	DC–1.0 GHz DC–2.0 GHz		1.5:1 1.7:1		

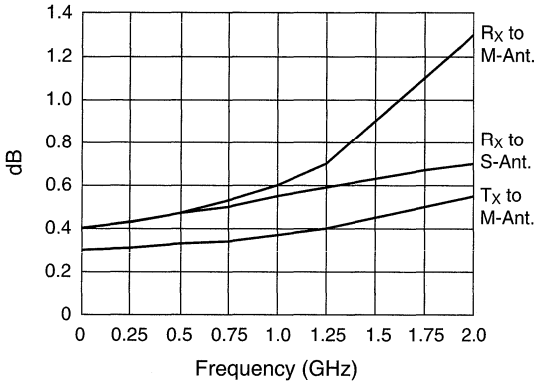
1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Insertion loss state.

Operating Characteristics at 25°C (-2.75, +2.75 V)

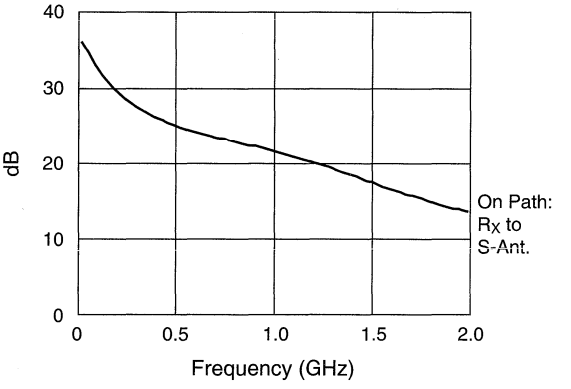
Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics	Rise, Fall Time On, Off Time			75 150		ns ns
Input Power for 1 dB Compression	T_X to M-Ant R_X to M-Ant. R_X to S-Ant.	0.9 GHz		+38 +33 +33		dBm dBm dBm
Intermodulation Intercept Point	For Two-tone Input Power at +13 dBm T_X to M-Ant R_X to M-Ant.	0.9 GHz		 +49 +48		 dBm dBm
Adjacent Channel Power Performance	T_X to M-Ant. (PDC Standard, 30 dBm Input, 100 kHz Detune)			 +69		 dBm
Harmonic Channel Power Performance	30 dBm Input 2nd Harmonic 3rd Harmonic	0.9 GHz		 +67 +82		 dBc dBc
Control Voltages	V_{Low} = -2.8 V ≤ V_{Low} ≤ -4.8 V, 500 µA Max. V_{High} = -0.2 V ≤ V_{High} ≤ +3.2 V, 500 µA Max. Differential = +2.6 V ≤ (V_{High} – V_{Low}) ≤ +8 V					

1. All measurements made in a 50 ohm system, unless otherwise specified.

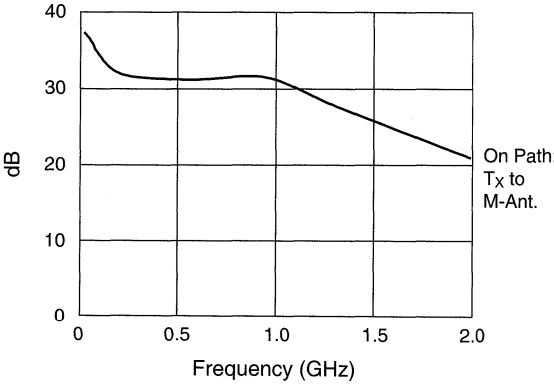
Typical Performance Data (-2.75, +2.75 V)



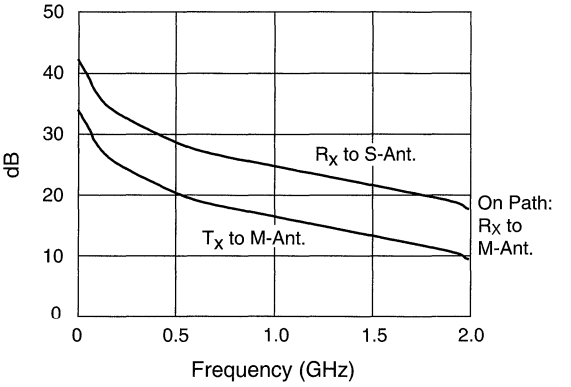
Insertion Loss vs. Frequency



R_X to M-Ant. Isolation vs. Frequency



R_X to M-Ant. Isolation vs. Frequency



T_X to M-Ant. and R_X to S-Ant. Isolation vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	6 W > 500 MHz, 0/-10 V
Positive Voltage Differential Bias	3 V ≤ (V_{High} – V_{Low}) ≤ 10.0 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	25°C/W

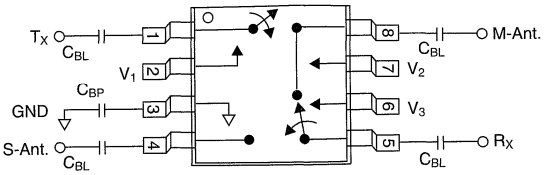
Note: Exceeding these parameters may cause irreversible damage.

Truth Table

V_1	V_2	V_3	T_X M-Ant.	R_X M-Ant.	R_X S-Ant.
V_{High}	V_{Low}	V_{Low}	Insertion Loss	Isolation	Isolation
V_{Low}	V_{High}	V_{Low}	Isolation	Insertion Loss	Isolation
V_{Low}	V_{Low}	V_{High}	Isolation	Isolation	Insertion Loss

V_{Low} = -2.8 to -4.8 V
V_{High} = -0.2 to +3.2 V

Pin Out



DC blocking (C_{BL}) and bypass (C_{BP}) capacitors must be supplied externally only if $V_{High} > 0$ V.

C_{BL} = 100 pF, C_{BP} = 1000 pF for operation >500 MHz.

SP4T Non-Reflective Switches

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
DC–2.0	High ISO, 3 V CTL	0.5–1.3	60–38	40	LQFP-32	AK115-61	1-112
DC–3.0	High Isolation w/Driver	0.6–1.7	60–28	40	PLCC-28	▶ AK002M4-47	1-114
DC–2.0	High Isolation w/Driver	0.4–1.1	65–40	43	LQFP-32	▶ AS115-61	1-116
DC–2.0	High ISO, 3 V CTL	0.45–0.7	60–37	43	LQFP-32	AS124-61	1-118

▶ Available through distribution.

Preferred for new designs.

GaAs IC SP4T Non-Reflective Switch With Integral Driver DC–2 GHz

Alpha

AK115-61

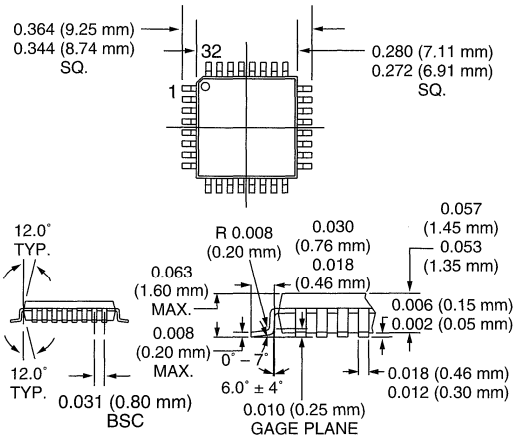
Features

- Integral Driver ±5 V Supply Voltages
- High Isolation (50 dB @ 0.9 GHz)
- Low Insertion Loss (0.7 dB @ 0.9 GHz)
- LQFP-32 Plastic Package
- Non-Reflective All Ports

Description

The AS115-61 is a high isolation SP4T FET IC non-reflective switch with integral driver. The insertion loss is 0.7 dB and isolation is 50 dB at 0.9 GHz. The switch is ideal for cellular base station switch matrices.

LQFP-32



Electrical Specifications at 25°C (+5, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.5	0.7	dB
	DC–1.0 GHz		0.7	0.9	dB
	DC–2.0 GHz		1.1	1.3	dB
Isolation	DC–0.5 GHz	50	58		dB
	DC–1.0 GHz	45	51		dB
	DC–2.0 GHz	35	39		dB
VSWR[4]	DC–1.0 GHz		1.55:1	1.6:1	
	DC–2.0 GHz		1.65:1	1.8:1	

Operating Characteristics at 25°C (+5, -5 V)

Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			15		ns
	On, Off (50% CTL to 90/10% RF)			35		ns
	Video Feedthru			30		mV
Input Power for 1 dB Compression		0.50–2.0 GHz		+26		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–2.0 GHz		+40		dBm
		0.05 GHz		+29		dBm
Control Voltages	V_{Low}		0.0		0.5	V
	V_{High}		4.0		5.0	V
Supply Voltages	+5 V ± 0.5 V @ 3 mA Typ.					
	-5 V ± 0.20 V @ 16 mA Typ.[6,7]					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Input/Output.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.
6. Supply voltage and ground must be connected before control voltage is applied to avoid irreversible damage to the device.
7. Current increases from 16 mA to 20 mA @ +85°C.

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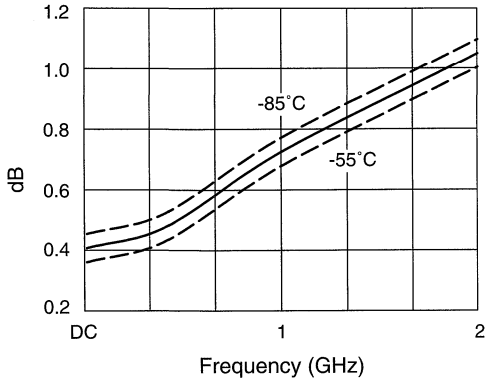
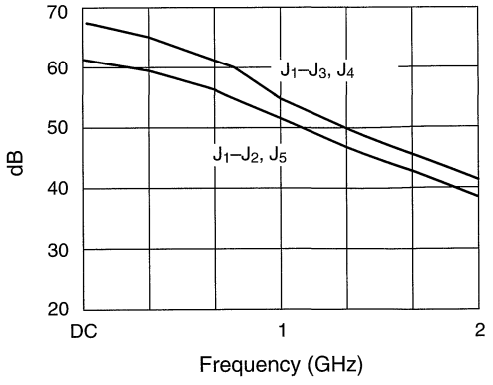
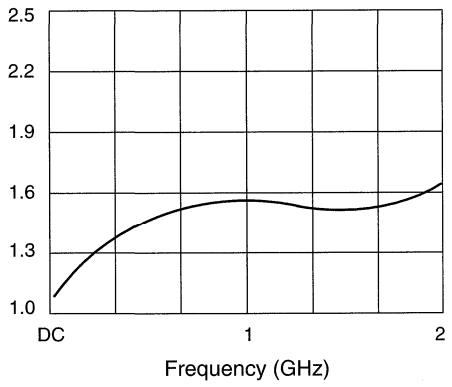
Typical Performance Data (+5, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

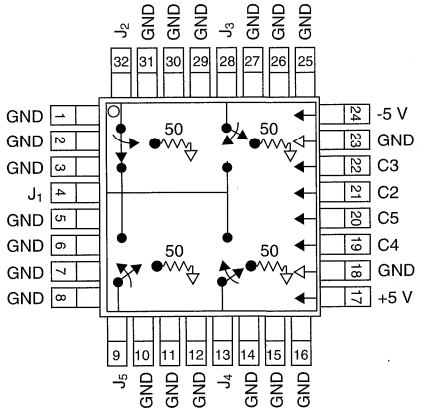
Characteristic	Value
RF Input Power	0.8 W > 500 MHz 0.2 W @ 50 MHz
Supply Voltage	+7.0 V, -7.0 V
Control Voltage	-0.2 V, +7.0 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	30°C/W

Truth Table

Insertion Loss Path J_1 to:	J_2	J_3	J_4	J_5
	C2	C3	C4	C5
J_2	0	1	1	1
J_3	1	0	1	1
J_4	1	1	0	1
J_5	1	1	1	0

"0" = 0.0 to 0.5 V, "1" = 4.0 to 5.0 V

Pin Out



GaAs IC SP4T Non-Reflective Switch With Integral Driver DC–3 GHz

Alpha

AK002M4-47

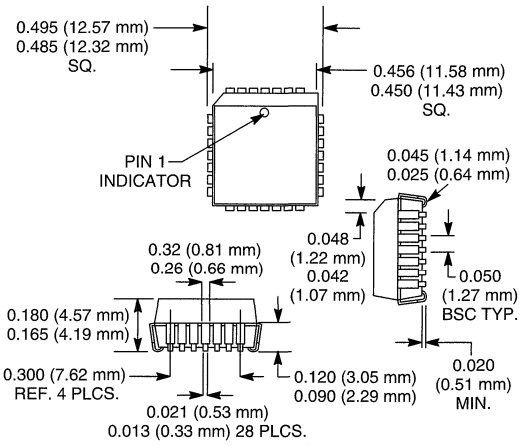
Features

- Integral Driver ±5 V Supply Voltages
- PLCC-28 Plastic Package
- Single Voltage Control for Each Port
- Non-Reflective on All Ports
- Base Station Switch Matrix Applications

Description

The AK002M4-47 is a SP4T non-reflective FET IC switch. The switch consists of a GaAs SP4T chip and an integral driver. This unit is ideal for cellular base station switch matrices.

PLCC-28



Electrical Specifications at 25°C (+5, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.8	1.1	dB
	DC–1.0 GHz		1.0	1.4	dB
	DC–2.0 GHz		1.3	1.6	dB
	DC–3.0 GHz		1.8	2.1	dB
Isolation	DC–0.5 GHz	48	51		dB
	DC–1.0 GHz	40	42		dB
	DC–2.0 GHz	29	33		dB
	DC–3.0 GHz	25	28		dB
VSWR[4]	DC–0.5 GHz		1.3:1	1.5:1	
	DC–1.0 GHz		1.5:1	1.7:1	
	DC–3.0 GHz		1.7:1	1.9:1	

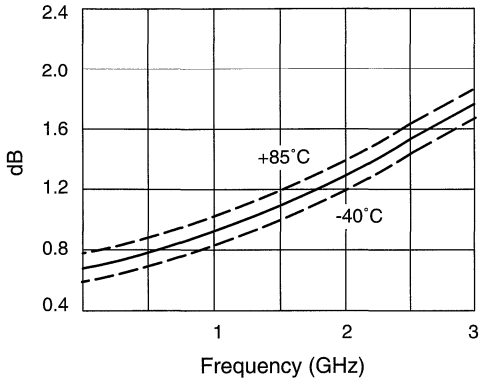
Operating Characteristics at 25°C (+5, -5 V)

Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			15		ns
	On, Off (50% CTL to 90/10% RF)			35		ns
	Video Feedthru			30		mV
Input Power for 1 dB Compression		0.50–3.0 GHz		+24		dBm
		0.05 GHz		+16		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–3.0 GHz		+40		dBm
		0.05 GHz		+29		dBm
Control Voltages	V_{Low}		0.0		0.5	V
	V_{High}		4.0		5.0	V
Supply Voltages	+5 V ± 0.5 V @ 3 mA Typ.					
	-5 V ± 0.20 V @ 16 mA Typ.[6,7]					

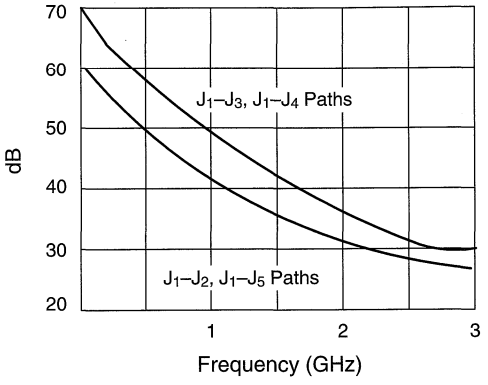
1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Input/Output.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.
6. Supply voltage and ground must be connected before control voltage is applied to avoid irreversible damage to the device.
7. Current increases from 16 mA to 20 mA @ +85°C.

1

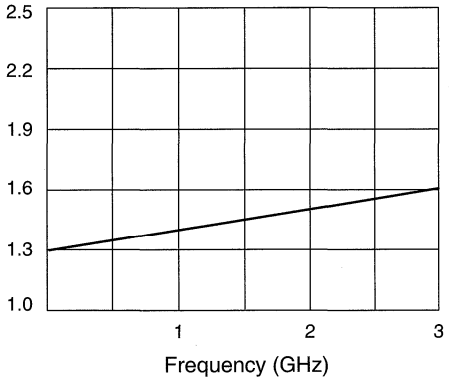
Typical Performance Data (+5, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

Absolute Maximum Ratings

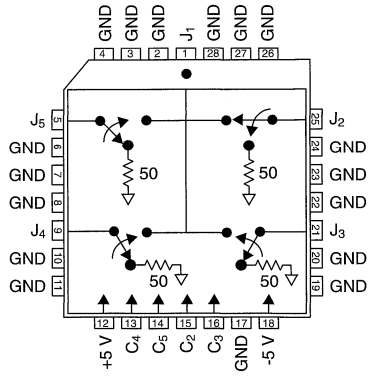
Characteristic	Value
RF Input Power	0.8 W > 500 MHz 0.2 W @ 50 MHz
Supply Voltage	+7.0 V, -7 V
Control Voltage	-0.2 V, +7.0 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	30°C/W

Truth Table

Insertion Loss Path J_1 to:	J_2	J_3	J_4	J_5
	C_2	C_3	C_4	C_5
J_2	0	1	1	1
J_3	1	0	1	1
J_4	1	1	0	1
J_5	1	1	1	0

"0" = 0.0 to 0.5 V, "1" = 4.0 to 5.0 V

Pin Out



GaAs IC SP4T Non-Reflective Switch DC–2 GHz

Alpha

AS115-61

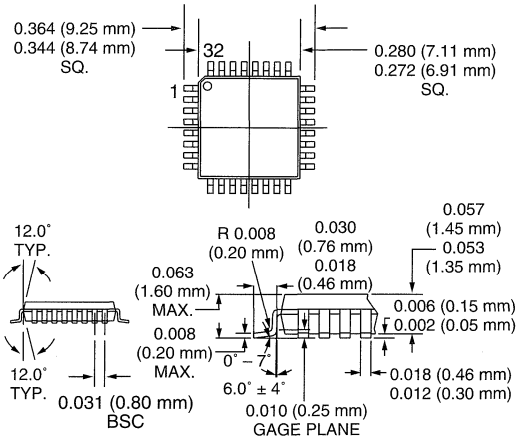
Features

- -3 V to -5 V Operation
- High Isolation (50 dB @ 0.9 GHz)
- Low Insertion Loss (0.7 dB @ 0.9 GHz)
- LQFP-32 Plastic Package
- Non-Reflective All Ports

Description

The AS115-61 is a high isolation SP4T FET IC non-reflective switch. The switch operates with 0 and -3 V or -5 V over the frequency range of DC–2 GHz. The insertion loss is 0.7 dB and isolation is 50 dB at 0.9 GHz. The switch is ideal for cellular base station switch matrices.

LQFP-32



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.5	0.7	dB
	DC–1.0 GHz		0.7	0.9	dB
	DC–2.0 GHz		1.1	1.3	dB
Isolation	DC–0.5 GHz	50	58		dB
	DC–1.0 GHz	45	51		dB
	DC–2.0 GHz	35	39		dB
VSWR[4]	DC–1.0 GHz		1.55:1	1.6:1	
	DC–2.0 GHz		1.65:1	1.8:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			15		ns
	On, Off (50% CTL to 90/10% RF)			30		ns
	Video Feedthru			30		mV
Input Power for 1 dB Compression	0/-3 V	0.50–2.0 GHz		+24		dBm
	0/-5 V	0.50–2.0 GHz		+30		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–2.0 GHz		+40		dBm
		0.05 GHz		+29		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max.					
	V_{High} = -3 V @ 100 µA to -5 V @ 500 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Input/output.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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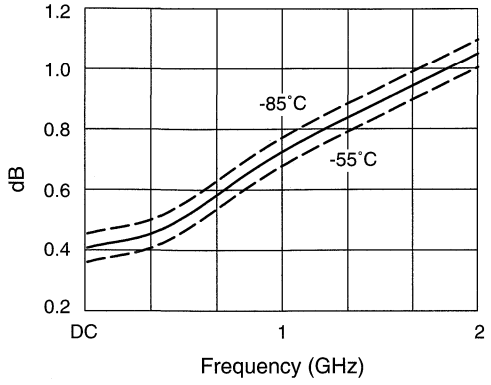
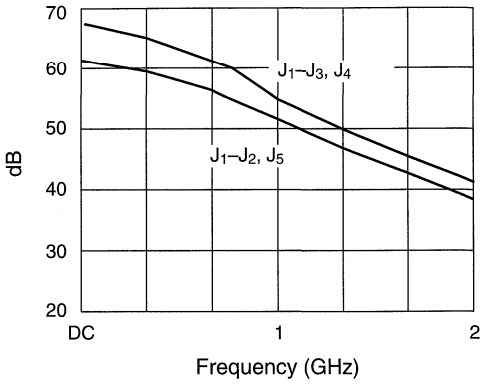
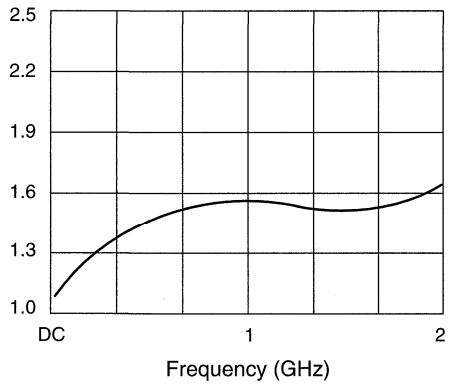
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

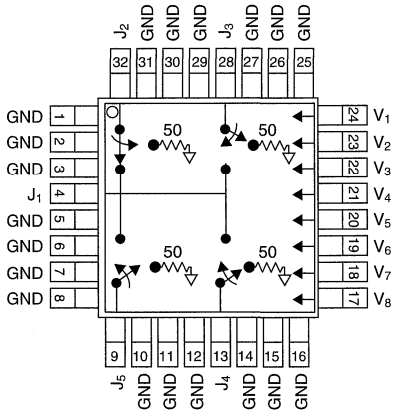
Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-7 V 0.5 W @ 50 MHz 0/-7 V
Control Voltage	+0.2 V, -10 V
Operating Temperature	-55°C to 125°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Truth Table

Insertion Loss Path J_1 to:	J_3		J_2		J_5		J_4	
	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8
J_2	0	-5	-5	0	-5	0	-5	0
J_3	-5	0	0	-5	-5	0	-5	0
J_4	0	-5	0	-5	-5	0	0	-5
J_5	0	-5	0	-5	0	-5	-5	0

Pin Out



GaAs IC SP4T Non-Reflective Switch DC–2.5 GHz

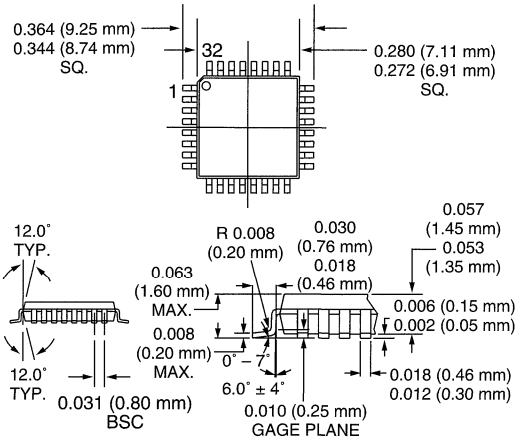
Alpha

AS124-61

Features

- -3 V to -5 V Operation
- High Isolation (38 dB @ 1.9 GHz)
- Low Insertion Loss (0.7 dB @ 1.9 GHz)
- LQFP-32 Plastic Package
- Non-Reflective All Ports

LQFP-32



Description

The AS124-61 is a high isolation SP4T FET IC non-reflective switch. The switch operates with 0 and -3 V or -5 V over the frequency range of DC–2.5 GHz. The insertion loss is 0.7 dB and isolation is 38 dB at 1.9 GHz. The switch is ideal for base station switch matrices. It can also be used as a high isolation SPDT Switch.

Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		0.5	0.7	dB
	DC–1.0 GHz		0.6	0.8	dB
	DC–2.0 GHz		0.7	1.0	dB
	DC–2.5 GHz		1.0	1.3	dB
Isolation	DC–0.5 GHz	50	55		dB
	DC–1.0 GHz	45	50		dB
	DC–2.0 GHz	32	37		dB
	DC–2.5 GHz	28	32		dB
VSWR[4]	DC–1.0 GHz		1.45:1	1.6:1	
	DC–2.5 GHz		1.6:1	1.8:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			15		ns
	On, Off (50% CTL to 90/10% RF)			30		ns
	Video Feedthru			30		mV
Input Power for 1 dB Compression	0/-3 V	0.50–2.0 GHz		+24		dBm
	0/-5 V	0.50–2.0 GHz		+30		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–2.0 GHz		+40		dBm
		0.05 GHz		+29		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max.					
	V_{High} = -3 V @ 100 µA to -5 V @ 500 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Input/output.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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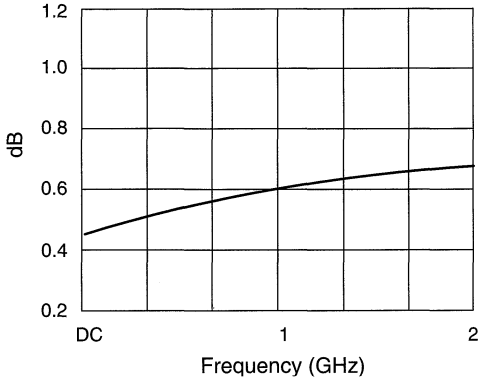
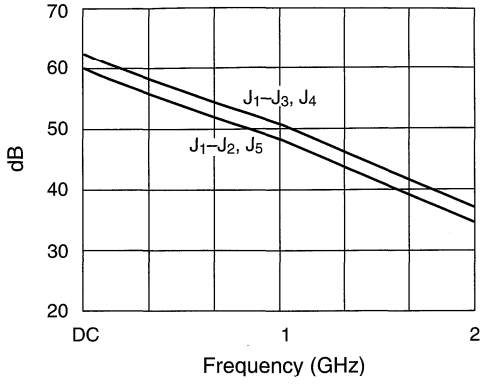
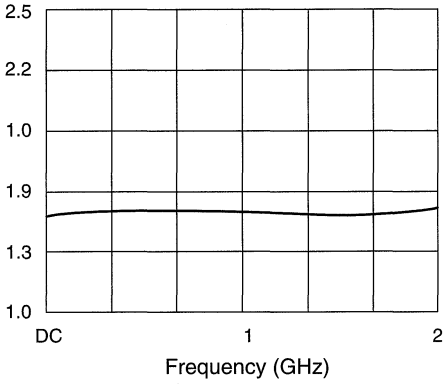
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Isolation vs. Frequency



VSWR vs. Frequency

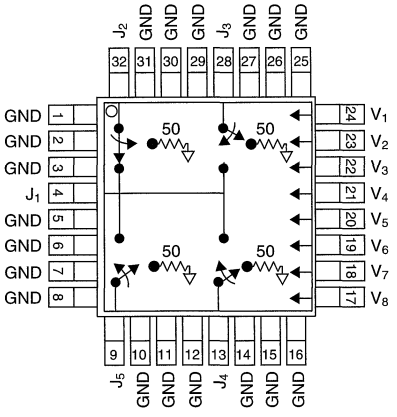
Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-7 V 0.5 W @ 50 MHz 0/-7 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-55°C to 125°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Truth Table

Insertion Loss Path J_1 to:	J_3		J_2		J_5		J_4	
	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8
J_2	0	-5	-5	0	-5	0	-5	0
J_3	-5	0	0	-5	-5	0	-5	0
J_4	0	-5	0	-5	-5	0	0	-5
J_5	0	-5	0	-5	0	-5	-5	0

Pin Out



Digital Attenuators

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
DC–2.0	4 Bit, LSB 1 dB	0.9–2.0	15	48	SOIC-16	▶ AD210-25	1-122
DC–2.0	4 Bit, LSB 2 dB	1.0–2.0	30	48	SOIC-16	▶ AD220-25	1-124
DC–2.0	3 Bit, LSB 4 dB	1.1–1.9	28	48	SOIC-14	▶ AD230-24	1-126
0.75–2.0	3 Bit, LSB 4 dB, Single Pos. CTL	1.4–2.0	28	48	SOIC-8	AD239-12	1-128
DC–2.0	4 Bit, LSB 4 dB	0.9–2.0	15	48	SOIC-16	AD310-25	1-130
DC–2.0	4 Bit, LSB 2 dB	1.0–2.0	30	48	SOIC-16	AD320-25	1-132
DC–2.0	4 Bit, LSB 2 dB w/Driver	1.2–3.2	30	43	SOIC-16	AK100-25	1-134
DC–2.0	2 Bit, LSB 16 dB w/Driver	1.6–2.5	48	37	SOIC-14	▶ AK002D2-24	1-136
DC–2.0	4 Bit, LSB 1 dB w/Driver	1.4–3.8	15	37	SOIC-14	▶ AK002D4-24	1-138
DC–2.0	4 Bit, LSB 1 dB w/Driver	1.2–3.0	15	24	SOIC-14	AK802D4-24	1-140
DC–1.0	3 Bit, LSB 4 dB	1.2–3.2	28	43	SOIC-14	AT001D3-24	1-142
DC–1.0	4 Bit, LSB 2 dB	1.1–1.6	30	43	SOIC-16	AT001D4-25	1-144
DC–1.0	4 Bit, LSB 3 dB	1.5–3.6	45	43	SOIC-16	▶ AT001D6-25	1-146

▶ Available through distribution.

Preferred for new designs.

GaAs IC 4 Bit Digital Attenuator
1 dB LSB DC–2 GHz

Alpha

AD210-25

Features

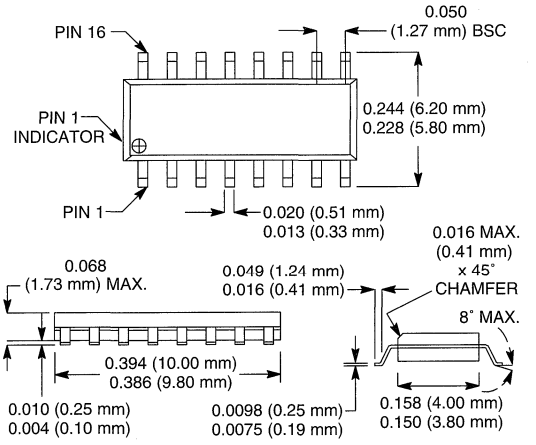
- Attenuation in 1 dB Steps to 15 dB with High Accuracy
- Low Intermodulation Products
- Low Cost SOIC-16 Plastic Package
- Low DC Power Consumption

Description

The AD210-25 is an IC FET digital attenuator consisting of four monolithic attenuators with LSB of 1 dB and a total attenuation of 15 dB with all attenuators connected. Attenuator bits are switched with -5 and 0 V.

The AD210-25 is particularly suited where high attenuation accuracy, low insertion loss and low intermodulation products are required. Typical applications include cellular, radio, wireless data, wireless local loop and other gain/level control circuits.

SOIC-16



Electrical Specifications at 25°C (0, -5 V)

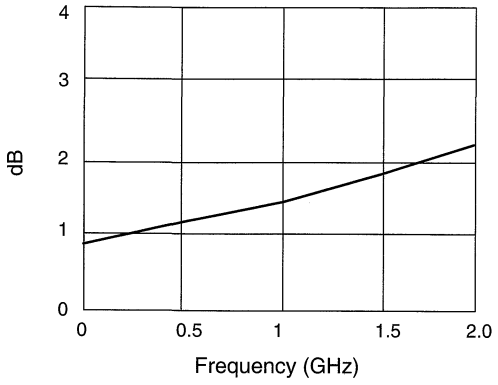
Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.1 GHz		0.9	1.2	dB
	DC–0.5 GHz		1.1	1.5	dB
	DC–1.0 GHz		1.3	1.8	dB
	DC–2.0 GHz		2.1	2.5	dB
Attenuation Range			15		dB
Attenuation Accuracy[4]	DC–1.0 GHz	± (0.25 + 3% of Attenuation Setting in dB)			dB
	DC–2.0 GHz	± (0.4 + 5% of Attenuation Setting in dB)			dB
VSWR (I/O)	DC–1.0 GHz		1.3:1	1.4:1	
	DC–2.0 GHz		1.6:1	1.8:1	

Operating Characteristics at 25°C (0, -5 V)

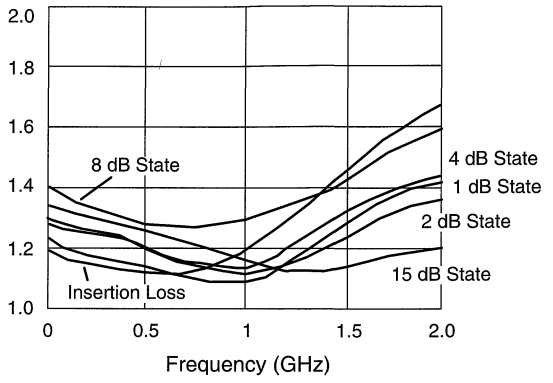
Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			15		ns
	On, Off (50% CTL to 90/10% RF)			25		ns
	Video Feedthru			25		mV
Input Power for 1 dB Compression		0.50–2.0 GHz		+28		dBm
		0.05 GHz		+22		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +5 dBm	0.50–2.0 GHz		+48		dBm
		0.05 GHz		+38		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 10 µA Typ. V_{High} = -5 @ 10 µA Typ. to -8 V @ 200 µA Typ.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Attenuation referenced to insertion loss.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

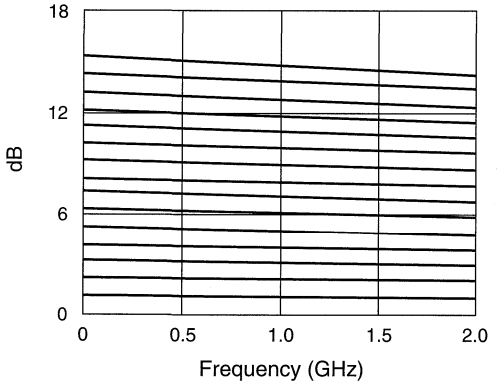
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



VSWR vs. Frequency



Attenuation vs. Frequency (All States)

Absolute Maximum Ratings

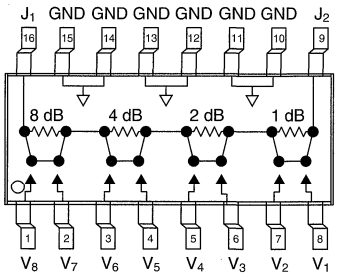
Characteristic	Value
RF Input Power	1.5 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

1 dB		2 dB		4 dB		8 dB		Attenuation
V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	J_1–J_2
-5	0	-5	0	-5	0	-5	0	Reference I. L.
0	-5	-5	0	-5	0	-5	0	1 dB
-5	0	0	-5	-5	0	-5	0	2 dB
-5	0	-5	0	0	-5	-5	0	4 dB
-5	0	-5	0	-5	0	0	-5	8 dB
0	-5	0	-5	0	-5	0	-5	15 dB

Pin Out



GaAs IC 4 Bit Digital Attenuator 2 dB LSB DC–2 GHz

Alpha

AD220-25

Features

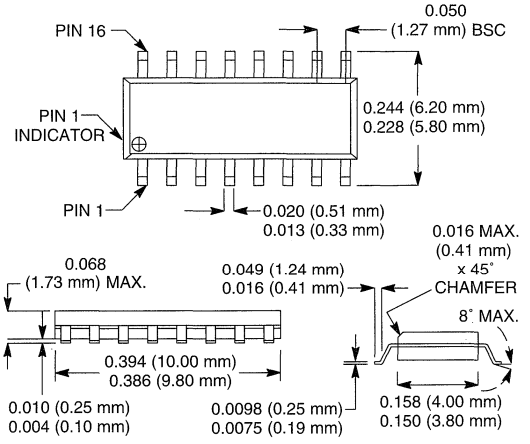
- Attenuation in 2 dB Steps to 30 dB with High Accuracy
- Low Cost SOIC-16 Plastic Package
- Low DC Power Consumption

Description

The AD220-25 is an IC FET digital attenuator consisting of four monolithic attenuators with LSB of 2 dB and a total attenuation of 30 dB with all attenuators connected.

The AD220-25 is particularly well suited where high attenuation accuracy, low insertion loss and low intermodulation products are required. Typical applications include cellular, radio, wireless data, wireless local loop and other gain level control circuits.

SOIC-16



Electrical Specifications at 25°C (0, -5 V)

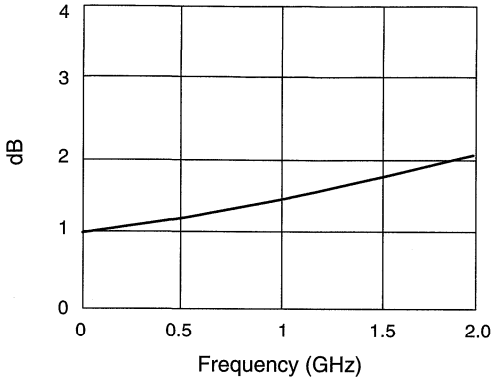
Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.1 GHz		1.2	1.4	dB
	DC–0.5 GHz		1.4	1.7	dB
	DC–1.0 GHz		1.5	1.8	dB
	DC–2.0 GHz		2.0	2.5	dB
Attenuation Range			30		dB
Attenuation Accuracy[4]	DC–1.0 GHz	± (0.2 + 3% of Attenuation Setting in dB)			dB
	DC–2.0 GHz	± (0.3 + 3% of Attenuation Setting in dB)			dB
VSWR (I/O)	DC–1.0 GHz		1.4:1	1.6:1	
	DC–2.0 GHz		1.6:1	2.0:1	

Operating Characteristics at 25°C (0, -5 V)

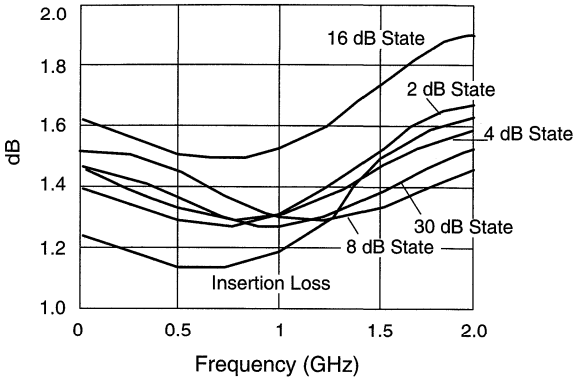
Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			15		ns
	On, Off (50% CTL to 90/10% RF)			25		ns
	Video Feedthru			25		mV
Input Power for 1 dB Compression		0.50–2.0 GHz		+28		dBm
		0.05 GHz		+22		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +5 dBm	0.50–2.0 GHz		+48		dBm
		0.05 GHz		+38		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max.					
	V_{High} = -5 V @ 50 µA Typ. to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Attenuation referenced to insertion loss.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

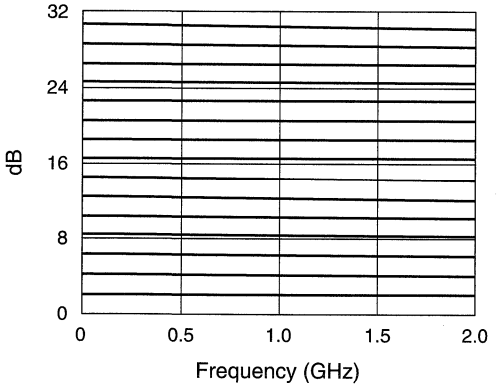
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



VSWR vs. Frequency



Attenuation vs. Frequency

Absolute Maximum Ratings

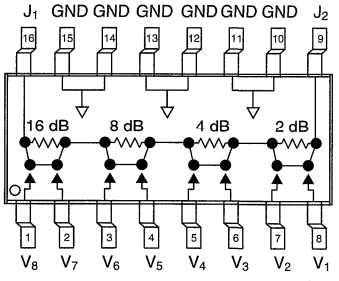
Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	Attenuation
2 dB		4 dB		8 dB		16 dB		J_1–J_2
-5	0	-5	0	-5	0	-5	0	Reference I.L.
0	-5	-5	0	-5	0	-5	0	2 dB
-5	0	0	-5	-5	0	-5	0	4 dB
-5	0	-5	0	0	-5	-5	0	8 dB
-5	0	-5	0	-5	0	0	-5	16 dB
0	-5	0	-5	0	-5	0	-5	30 dB

Pin Out



GaAs IC 3 Bit Digital Attenuator 4 dB LSB DC–2 GHz

Alpha

AD230-24

Features

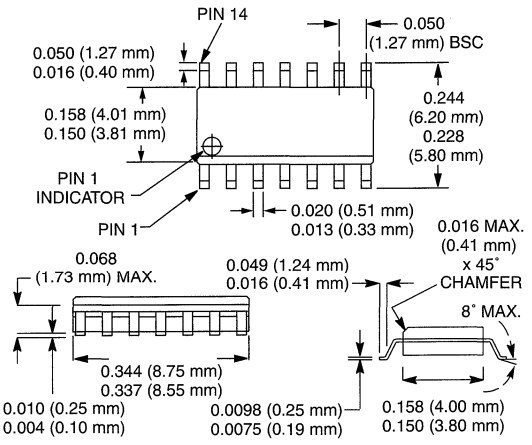
- Attenuation in 4 dB steps to 28 dB with High Accuracy
- Low Cost SOIC-14 Plastic Package
- Low DC Power Consumption

Description

The AD230-24 is an IC FET Digital Attenuator consisting of three monolithic attenuators with LSB of 4 dB and a total attenuation of 28 dB with all attenuators connected. Attenuators are switched with -5 and 0 V.

The AD230-24 is particularly suited where high attenuation accuracy, low insertion loss and low intermodulation products are required. Typical applications include cellular radio, wireless data, wireless local loop and other gain level control circuits.

SOIC-14



Electrical Specifications at 25°C (0, -5 V)

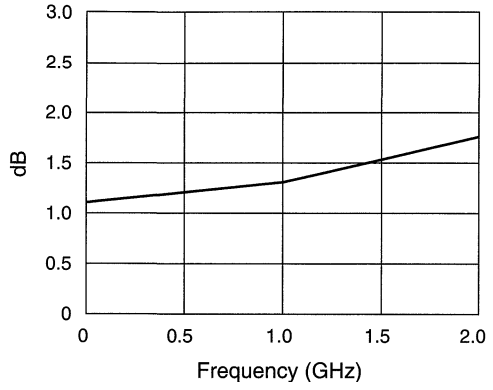
Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.1 GHz DC–0.5 GHz DC–1.0 GHz DC–2.0 GHz		1.1 1.2 1.3 1.9	1.4 1.5 1.7 2.3	dB dB dB dB
Attenuation Range			28		dB
Attenuation Accuracy[4]	DC–1.0 GHz DC–2.0 GHz	± (0.2 + 3% of Attenuation Setting in dB) ± (0.4 + 5% of Attenuation Setting in dB)			dB dB
VSWR (I/O)	DC–2.0 GHz		1.3:1	1.5:1	

Operating Characteristics at 25°C (0, -5 V)

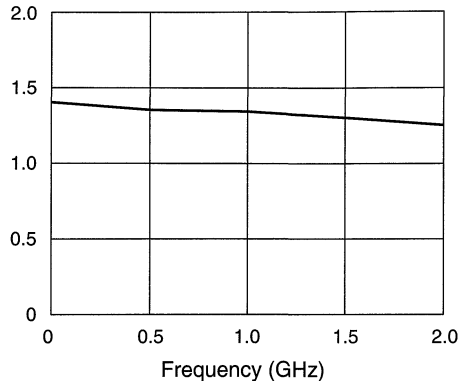
Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru			15 25 25		ns ns mV
Input Power for 1 dB Compression		0.50–2.0 GHz 0.05 GHz		+28 +22		dBm dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +5 dBm	0.50–2.0 GHz 0.05 GHz		+48 +38		dBm dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA Typ. to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Attenuation referenced to insertion loss.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

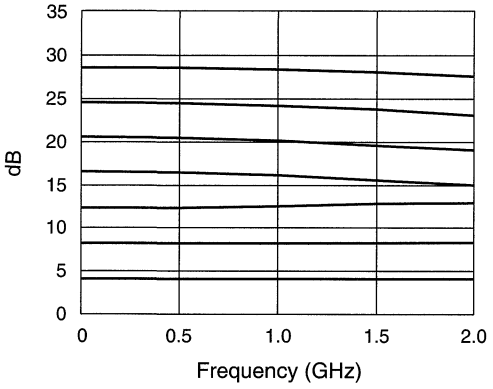
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



VSWR vs. Frequency (All States)



Attenuation vs. Frequency (All States)

Absolute Maximum Ratings

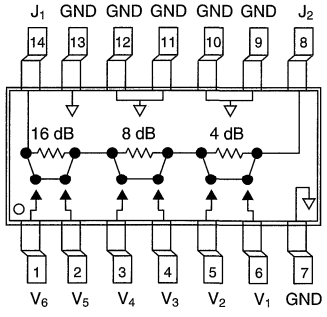
Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

4 dB		8 dB		16 dB		Attenuation
V_1	V_2	V_3	V_4	V_5	V_6	J_1–J_2
-5	0	-5	0	-5	0	Reference I.L.
0	-5	-5	0	-5	0	4 dB
-5	0	0	-5	-5	0	8 dB
-5	0	-5	0	0	-5	16 dB
0	-5	0	-5	0	-5	28 dB

Pin Out



GaAs IC 3 Bit Digital Attenuator
4 dB LSB Positive Control 0.75–2 GHz

Alpha

AD239-12

Features

- Attenuation in 4 dB Steps to 28 dB with High Accuracy
- Single Positive Control Voltage for Each Bit
- +3 V to +5 V Operation
- Small Low Cost SOIC-8 Plastic Package

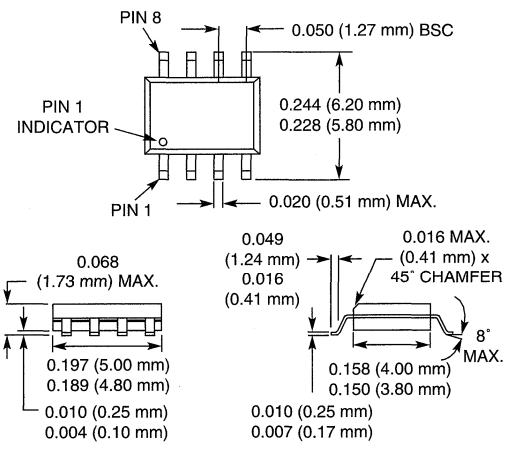
Description

The AD239-12 is a 3 bit, single positive control, 4 dB step GaAs IC FET digital attenuator in a low cost SOIC-8 plastic package. For positive operation external DC blocking capacitors are required on all RF ports.

The AD239-12 is particularly suited where high attenuation accuracy, low insertion loss and low intermodulation products are required.

Typical applications include cellular, radio, wireless data, wireless local loop and other gain level control circuits.

SOIC-8



Electrical Specifications at 25°C (0, +3 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[2]	0.75–2.0 GHz		1.8	2.1	dB
Attenuation Range	0.75–2.0 GHz		28		dB
Attenuation Accuracy[3]	0.75–1.0 GHz	± (0.2 + 3% of Attenuation Setting in dB)			dB
	0.75–2.0 GHz	± (0.3 + 3% of Attenuation Setting in dB)			dB
VSWR (I/O)	0.75–2.0 GHz		1.5:1	2.0:1	

Operating Characteristics at 25°C (0, +3 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[4]	Rise, Fall (10/90% or 90/10% RF)			0.7		µs
	On, Off (50% CTL to 90/10% RF)			1.0		µs
	Video Feedthru			50		mV
Input Power for 1 dB Compression	V_S = +3 V	0.75–2.0 GHz		+20		dBm
	V_S = +5 V	0.75–2.0 GHz		+26		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +10 dBm					
	V_S = +3 V	0.75–2.0 GHz		+32		dBm
	V_S = +5 V	0.75–2.0 GHz		+45		dBm
Control Voltage	V_{Low} = 0 to 0.2 V @ 20 µA Max. V_{High} = +3 V @ 100 µA Max. to +5 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. Insertion loss changes by 0.003 dB/°C.
3. Attenuation referenced to insertion loss.
4. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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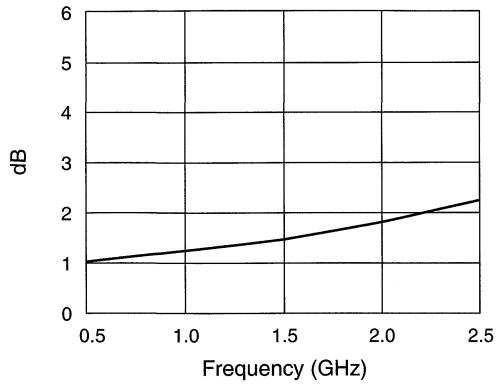
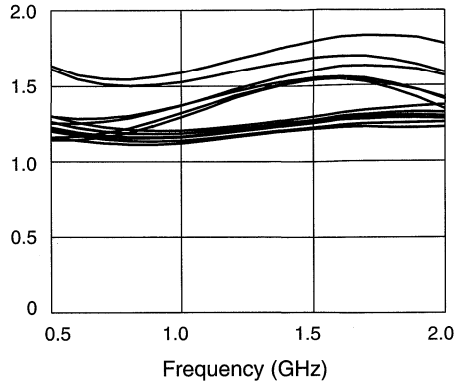
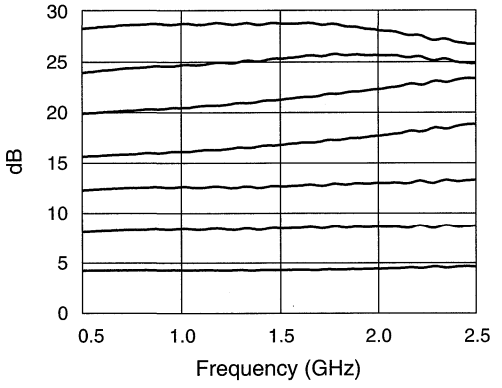
Typical Performance Data (0, +3 V)



Insertion Loss vs. Frequency



VSWR vs. Frequency (All States)



Attenuation vs. Frequency (All States)

Truth Table

16 dB	4 dB	8 dB	Attenuation
V_1	V_2	V_3	J_1–J_2
V_{High}	V_{High}	V_{High}	Ins. Loss
V_{High}	0	V_{High}	4 dB
V_{High}	V_{High}	0	8 dB
V_{High}	0	0	12 dB
0	V_{High}	V_{High}	16 dB
0	0	V_{High}	20 dB
0	V_{High}	0	24 dB
0	0	0	28 dB

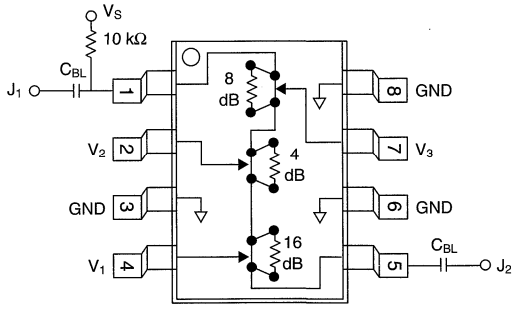
V_{High} = +3 to +5 V (V_S = V_{High} ± 0.2 V)

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	1 W > 500 MHz 0/8 V 0.5 W @ 50 MHz 0/8 V
Supply Voltage	+8 V
Control Voltage	-0.2 V, +8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

Note: Exceeding these parameters may cause irreversible damage.

Pin Out



DC blocking capacitors (C_{BL}) and biasing resistor must be supplied externally for positive operation.
C_{BL} = 100 pF for operation >.75 GHz.

GaAs IC 4 Bit Digital Attenuator
1 dB LSB DC–2 GHz

Alpha

AD310-25

Features

- Attenuation in 1 dB Steps to 15 dB with High Accuracy
- Designed for Cellular Radio Applications
- Low Cost SOIC-16 Plastic Package
- Low DC Power Consumption

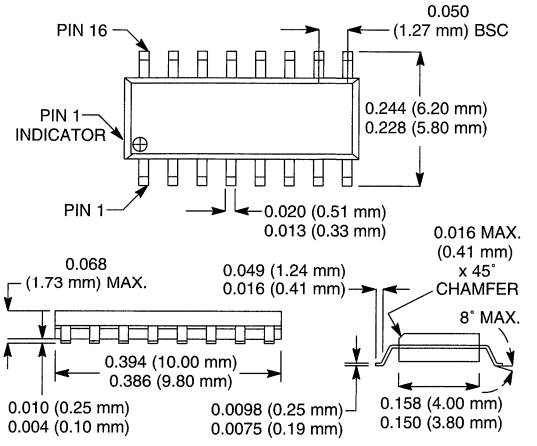
Description

The AD310-25 is an IC FET digital attenuator consisting of four monolithic attenuators with LSB of 1 dB and a total attenuation of 15 dB with all attenuators connected.

This unit is a pin for pin replacement for the AT002D8-25 with improved RF performance extended to 2 GHz.

The AD310-25 is particularly suited where high attenuation accuracy, low insertion loss and low intermodulation products are required. Typical applications include cellular radio, wireless data, wireless local loop and other gain level control circuits.

SOIC-16



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.1 GHz		0.9	1.2	dB
	DC–0.5 GHz		1.1	1.5	dB
	DC–1.0 GHz		1.3	1.8	dB
	DC–2.0 GHz		2.1	2.5	dB
Attenuation Range			15		dB
Attenuation Accuracy[4]	DC–1.0 GHz	± (0.25 + 3% of Attenuation Setting in dB)			dB
	DC–2.0 GHz	± (0.4 + 5% of Attenuation Setting in dB)			dB
VSWR (I/O)	DC–1.0 GHz		1.3:1		
	DC–2.0 GHz		1.6:1		

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			15		ns
	On, Off (50% CTL to 90/10% RF)			25		ns
	Video Feedthru			25		mV
Input Power for 1 dB Compression		0.50–2.0 GHz		+28		dBm
		0.05 GHz		+22		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +5 dBm	0.50–2.0 GHz		+48		dBm
		0.05 GHz		+38		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max.					
	V_{High} = -5 V @ 10 µA Typ. to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Attenuation referenced to insertion loss.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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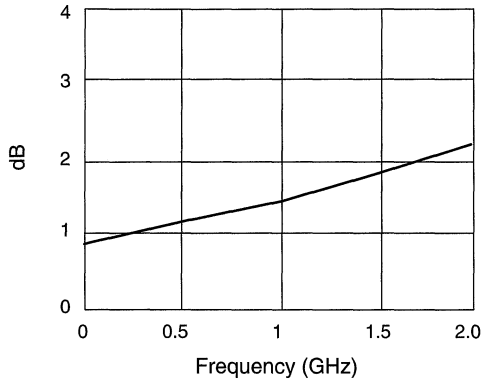
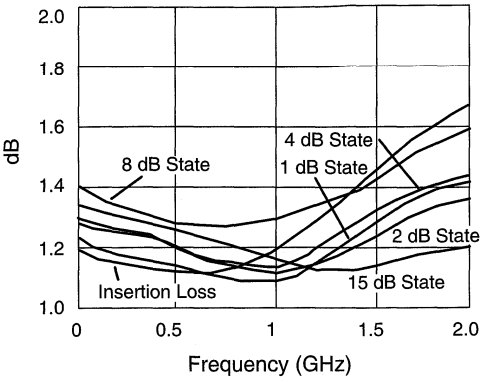
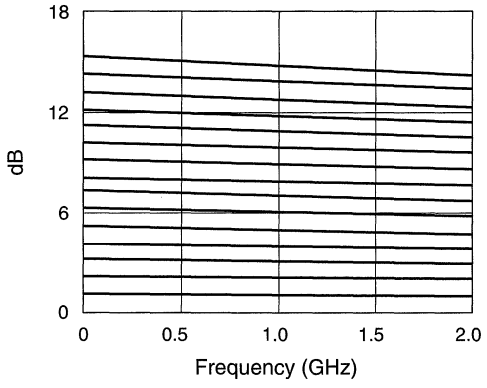
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



VSWR vs. Frequency



Attenuation vs. Frequency (All States)

Absolute Maximum Ratings

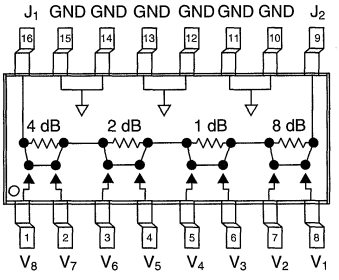
Characteristic	Value
RF Input Power	2 W > 0.5 GHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	Attenuation
8 dB Bit		1 dB Bit		2 dB Bit		4 dB Bit		J_1–J_2
0	-5	0	-5	0	-5	0	-5	Reference I.L.
0	-5	-5	0	0	-5	0	-5	1 dB
0	-5	0	-5	-5	0	0	-5	2 dB
0	-5	0	-5	0	-5	-5	0	4 dB
-5	0	0	-5	0	-5	0	-5	8 dB
-5	0	-5	0	-5	0	-5	0	15 dB Max. Atten.

Pin Out



GaAs IC 4 Bit Digital Attenuator 2 dB LSB DC–2 GHz

Alpha

AD320-25

Features

- Attenuation in 2 dB Steps to 30 dB with High Accuracy
- Low Cost SOIC-16 Plastic Package
- Low DC Power Consumption

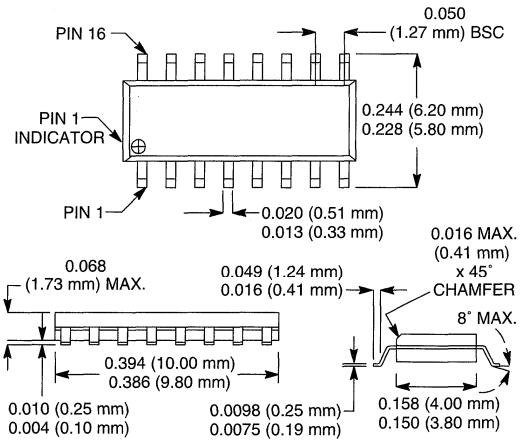
Description

The AD320-25 is an IC FET digital attenuator consisting of four monolithic attenuators with LSB of 2 dB and a total attenuation of 30 dB with all attenuators connected.

This unit is a pin for pin replacement for the AT001D4-25 with improved RF performance extended to 2 GHz.

The AD320-25 is particularly well suited where high attenuation accuracy, low insertion loss and low intermodulation products are required. Typical applications include cellular, radio, wireless data, wireless local loop and other gain level control circuits.

SOIC-16



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.1 GHz		1.2	1.4	dB
	DC–0.5 GHz		1.4	1.7	dB
	DC–1.0 GHz		1.5	1.8	dB
	DC–2.0 GHz		2.0	2.5	dB
Attenuation Range			30		dB
Attenuation Accuracy[4]	DC–1.0 GHz	± (0.2 + 3% of Attenuation Setting in dB)			dB
	DC–2.0 GHz	± (0.3 + 3% of Attenuation Setting in dB)			dB
VSWR (I/O)	DC–1.0 GHz		1.4:1	1.6:1	
	DC–2.0 GHz		1.6:1	2.0:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			15		ns
	On, Off (50% CTL to 90/10% RF)			25		ns
	Video Feedthru			25		mV
Input Power for 1 dB Compression		0.50–2.0 GHz		+28		dBm
		0.05 GHz		+22		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +5 dBm	0.50–2.0 GHz		+48		dBm
		0.05 GHz		+38		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max.					
	V_{High} = -5 V @ 50 µA Typ. to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Attenuation referenced to insertion loss.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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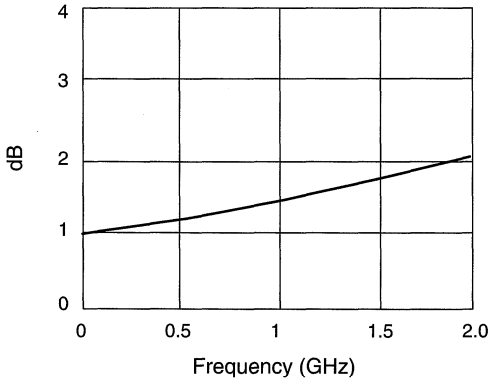
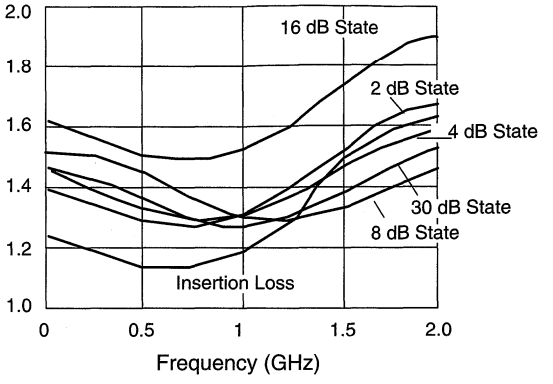
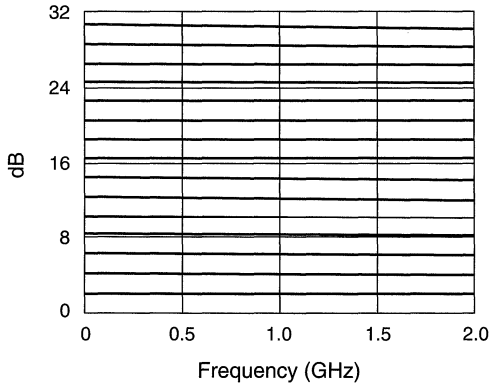
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



VSWR vs. Frequency



Attenuation vs. Frequency

Absolute Maximum Ratings

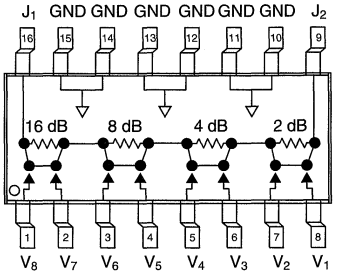
Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	Attenuation
2 dB		4 dB		8 dB		16 dB		J_1–J_2
-5	0	-5	0	0	-5	-5	0	Reference I.L.
0	-5	-5	0	0	-5	-5	0	2 dB
-5	0	0	-5	0	-5	-5	0	4 dB
-5	0	-5	0	-5	0	-5	0	8 dB
-5	0	-5	0	0	-5	0	-5	16 dB
0	-5	0	-5	-5	0	0	-5	30 dB Max. Atten.

Pin Out



GaAs IC 4 Bit Digital Attenuator With Driver 2 dB LSB DC–2.0 GHz

Alpha

AK100-25

Features

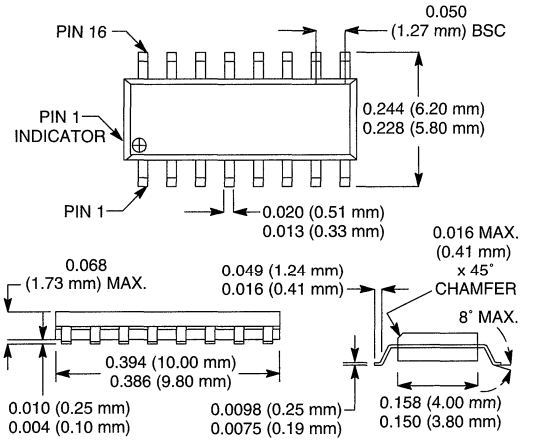
- Attenuation in 2 dB Steps to 30 dB
- Low DC Current Consumption < 10 mA Total
- Integral Driver ±5 V Supply Voltages
- Low Cost SOIC-16 Plastic Package

Description

The AK100-25 is an IC FET digital attenuator consisting of four monolithic attenuators with LSB of 2 dB and a total attenuation of 30 dB with all attenuators connected.

The device has integral drivers for each bit requiring less than 3 mA per bit. DC supply voltages of ±5 V are required. The attenuator is packaged in a 16 lead plastic SOIC.

SOIC-16



Electrical Specifications at 25°C (+5 V, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz DC–1.0 GHz DC–2.0 GHz		1.8 2.0 3.0	2.0 2.5 3.5	dB dB dB
Attenuation Accuracy per Bit[4]	DC–2.0 GHz	+(0.3 dB + 3% of Attenuation Setting)			dB
VSWR (I/O)	DC–2.0 GHz		1.4:1	1.6:1	

Operating Characteristics at 25°C (+5 V, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru			10 20 30		ns ns mV
Input Power for 1 dB Compression		0.50–2.0 GHz 0.05 GHz		+25 +16		dBm dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–2.0 GHz 0.05 GHz		+43 +30		dBm dBm
Control Voltages	V_{Low} V_{High}		0.0 4.0		0.5 5.0	V V
Supply Voltages[6,7]	+5 V ± 0.5 V @ 3 mA Typ. -5 V ± 0.20 V @ 10 mA Typ.		4.5 -4.8		5.5 -5.2	V V

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Attenuation referenced to insertion loss.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.
6. Supply voltage and ground must be connected before control voltage is applied. Use of toggle switches or other similar components may produce voltage spikes which can cause irreversible damage to the device.
7. Current drain @ 85°C = 5 mA Typ. @ +5 V, 14 mA Typ. @ -5 V.

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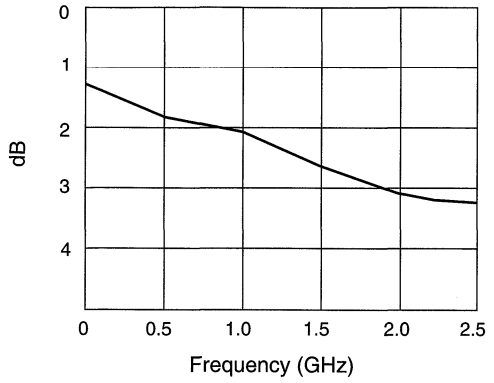
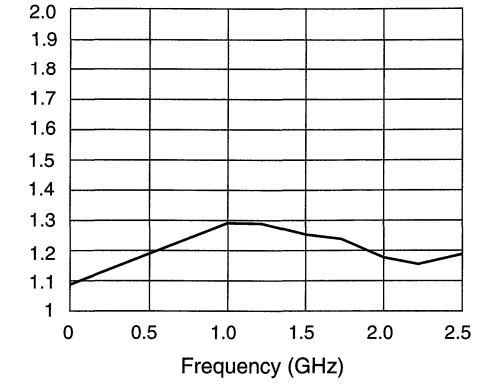
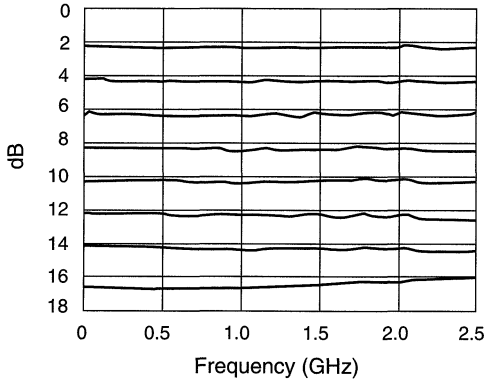
Typical Performance Data (+5 V, -5 V)



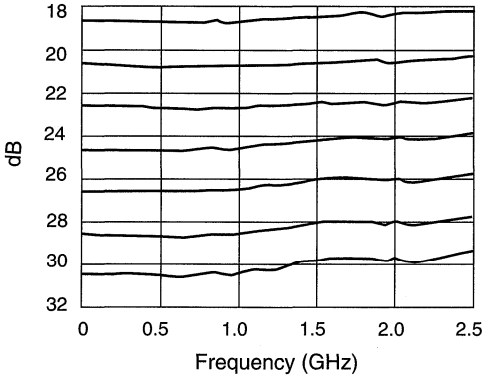
Insertion Loss vs. Frequency



Typical VSWR vs. Frequency (All States)



Attenuation 2 dB to 16 dB

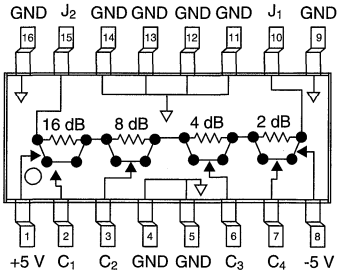


Attenuation 18 dB to 30 dB

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	0.5 W > 500 MHz 0.1 W @ 50 MHz
Supply Voltages	+6 V, -6 V
Control Voltage	-0.2 V, +6 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Θ_{JC}	30°C/W

Pin Out



Truth Table

16 dB	8 dB	4 dB	2 dB	Attenuation
C_1	C_2	C_3	C_4	J_1–J_2
0	0	0	0	Reference I.L.
0	0	0	1	2 dB
0	0	1	0	4 dB
0	1	0	0	8 dB
1	0	0	0	16 dB
1	1	1	1	30 dB

"0" = 0.0 V to 0.5 V, "1" = 4.0 to 5.0 V

GaAs IC 2 Bit Digital Attenuator With Driver 16 dB LSB DC–2 GHz

Alpha

AK002D2-24

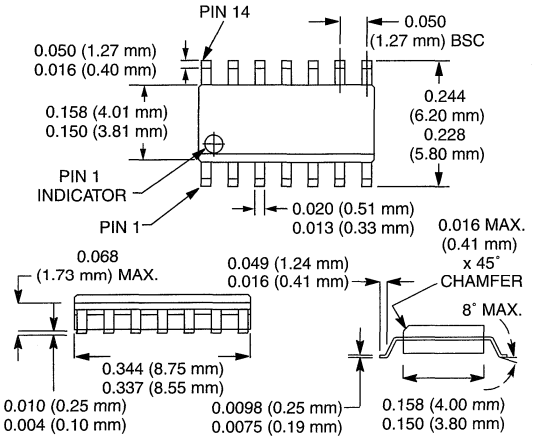
Features

- Attenuation in 16 dB Steps to 48 dB
- Integral Driver ±5 V Supply Voltages
- Low Cost SOIC-14 Plastic Package

Description

The AK002D2-24 is an IC FET digital attenuator consisting of two monolithic attenuators with LSB of 16 dB and a total attenuation of 48 dB with all attenuators connected. The device has integral drivers for each bit requiring < 3 mA per bit. DC supply voltages of ± 5 V are required.

SOIC-14



Electrical Specifications at 25°C (+5 V, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz		1.7	1.8	dB
	DC–1.0 GHz		1.9	2.1	dB
	DC–2.0 GHz		2.2	2.5	dB
Attenuation Accuracy[4]		**16 32 48**		**Bits**	
	DC–1.0 GHz	±6% ±6% ±8%		Max.	dB
	DC–2.0 GHz	±6% ±8% ±10%		Max.	dB
VSWR (I/O)	DC–1.0 GHz		1.4:1	1.5:1	
	DC–2.0 GHz		1.6:1	1.7:1	

Operating Characteristics at 25°C (+5 V, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF)			10		ns
	On, Off (50% CTL to 90/10% RF)			20		ns
	Video Feedthru			30		mV
Input Power for 1 dB Compression		0.50–2.0 GHz		+20		dBm
		0.05 GHz		+12		dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–2.0 GHz		+37		dBm
		0.05 GHz		+26		dBm
Control Voltages	V_{Low}		0.0		0.5	V
	V_{High}		4.0		5.0	V
Supply Voltages[6,7]	+5 V ± 0.5 V @ 3 mA Typ.		4.5	5.0	5.5	V
	-5 V ± 0.20 V @ 8 mA Typ.		-4.8	-5.0	-5.2	V

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Attenuation referenced to insertion loss.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.
6. Supply voltages and ground must be connected before control voltage is applied. Use of toggle switches or other similar components may produce voltage spikes which can cause irreversible damage to the device.
7. Current drain @ 85°C = 5 mA Typ. @ +5 V, 11 mA Typ. @ -5 V.

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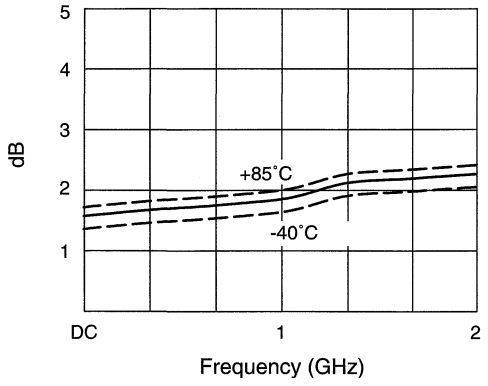
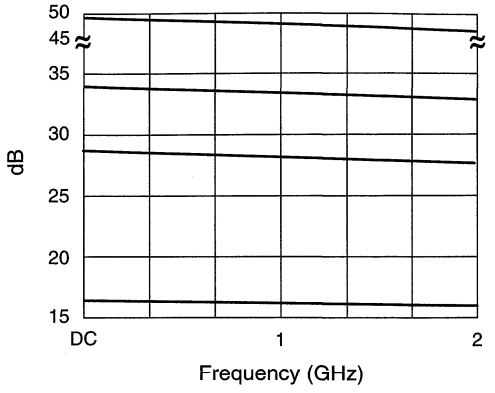
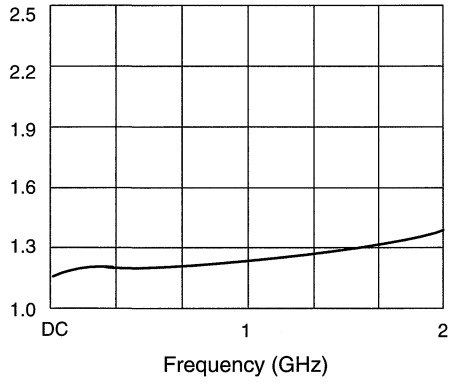
Typical Performance Data (+5 V, -5 V)



Insertion Loss vs. Frequency



16, 32 and 48 dB States vs. Frequency



VSWR vs. Frequency (All States)

Absolute Maximum Ratings

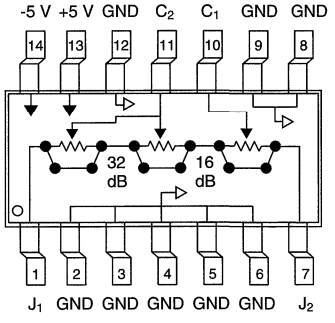
Characteristic	Value
RF Input Power	0.8 W > 500 MHz 0.2 W @ 50 MHz
Supply Voltages	+6 V, -6 V
Control Voltage	-0.2 V, +6 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	30°C/W

Truth Table

16 dB C_1	32 dB C_2	Attenuation J_1–J_2
0	0	Reference I.L.
1	0	16 dB
0	1	32 dB
1	1	48 dB

"0" = 0.0 to 0.5 V, "1" = 4.0 to 5.0 V

Pin Out



GaAs IC 4 Bit Digital Attenuator With Driver 1 dB LSB DC–2 GHz

Alpha

AK002D4-24

Features

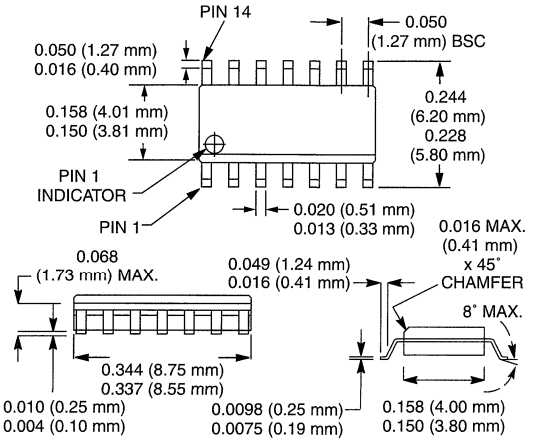
- Attenuation in 1 dB Steps to 15 dB
- Integral Driver ±5 V Supply Voltages
- Low Cost SOIC-14 Plastic Package

Description

The AK002D4-24 is an IC FET digital attenuator consisting of four monolithic attenuators with LSB of 1 dB and a total attenuation of 15 dB with all attenuators connected.

The device has integral drivers for each bit requiring less than 4 mA per bit. DC supply voltages of ±5 V are required. The attenuator is packaged in a 14 lead plastic SOIC.

SOIC-14



Electrical Specifications at 25°C (+5 V, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz DC–1.0 GHz DC–2.0 GHz		2.0 2.5 3.7	2.5 3.0 4.0	dB dB dB
Attenuation Accuracy Per Bit[4]	DC–2.0 GHz	10% or ±0.5 dB Whichever is Greater			dB
VSWR (I/O)	DC–0.5 GHz DC–2.0 GHz		1.3:1 1.6:1	1.5:1 1.8:1	

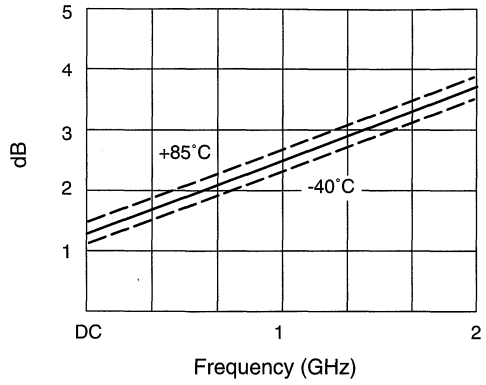
Operating Characteristics at 25°C (+5 V, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru			20 40 30		ns ns mV
Input Power for 1 dB Compression		0.50–2.0 GHz 0.05 GHz		+24 +16		dBm dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–2.0 GHz 0.05 GHz		+37 +26		dBm dBm
Control Voltages	V_{Low} V_{High}		0.0 4.0		0.5 5.0	V V
Supply Voltages	+5 V ± 0.5 V @ 4 mA Typ. -5 V ± 0.20 V @ 16 mA Typ.		4.5 -4.8		5.5 -5.2	V V

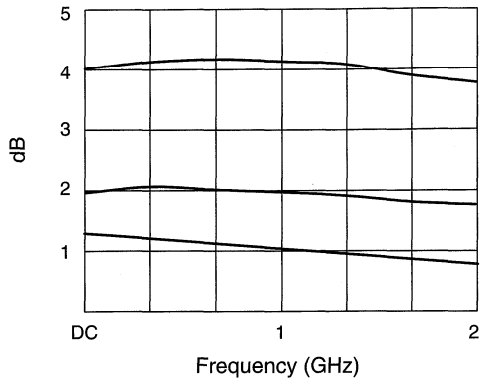
1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Attenuation referenced to insertion loss.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.
6. Supply voltage and ground must be connected before control voltage is applied. Use of toggle switches or other similar components may produce voltage spikes which can cause irreversible damage to the device.
7. Current drain @ 85°C = 6 mA Typ. @ +5 V, 20 mA Typ. @ -5 V.

1

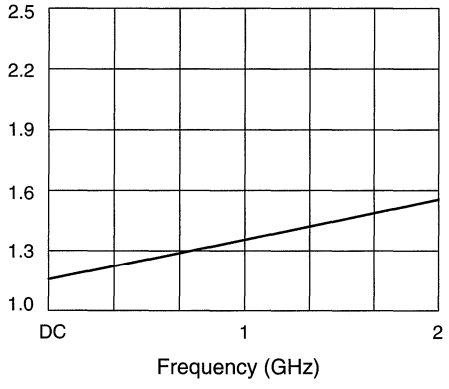
Typical Performance Data (+5 V, -5 V)



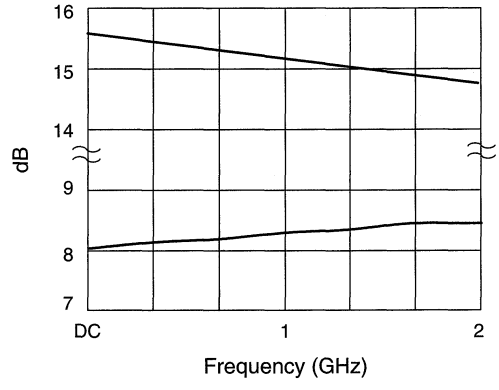
Insertion Loss vs. Frequency



1, 2, 4 dB Bits vs. Frequency



VSWR vs. Frequency (All States)

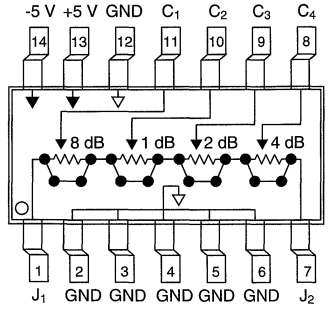


8, 15 dB Bits vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	0.5 W > 500 MHz 0.1 W @ 50 MHz
Supply Voltages	+6 V, -6 V
Control Voltage	+6 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	30°C/W

Pin Out



Truth Table

8 dB	1 dB	2 dB	4 dB	Attenuation
C_1	C_2	C_3	C_4	J_1–J_2
0	0	0	1	Reference I.L.
0	1	0	1	1 dB
0	0	1	1	2 dB
0	0	0	0	4 dB
1	0	0	1	8 dB
1	1	1	0	15 dB

"0" = 0.0 to 0.5 V, "1" = 4.0 to 5.0 V

GaAs IC 4 Bit Digital Attenuator With Driver 1 dB LSB DC–2.0 GHz

Alpha

AK802D4-24

Features

- Attenuation in 1 dB Steps to 15 dB
- Low Cost SOIC-14 Plastic Package
- Low DC Current < 16 mA Total
- Integral Driver +5 V, -5.6 V Supply Voltages

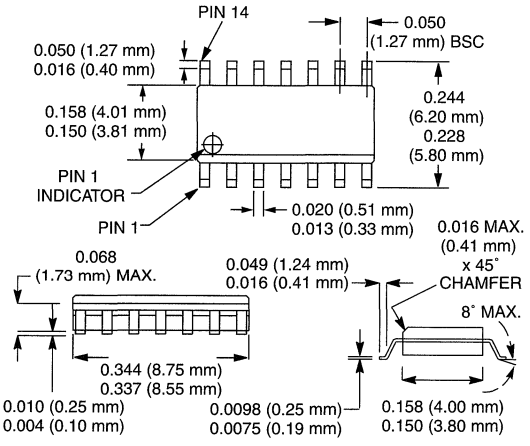
Description

The AK802D4-24 is an IC FET digital attenuator consisting of four monolithic attenuators with a LSB of 1 dB and a total attenuation of 15 dB with all attenuators connected.

The device has integral drivers for each bit requiring less than 4 mA per bit. DC supply voltages of +5 and -5.6 V are required.

The attenuator is packaged in a 14 lead plastic SOIC.

SOIC-14



Electrical Specifications at 25°C (+5 V, -5.6 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz DC–1.0 GHz DC–2.0 GHz		1.7 2.2 3.1	2.0 2.5 3.5	dB dB dB
Attenuation Accuracy Per Bit[4]	DC–1.0 GHz DC–2.0 GHz	(7% or 0.25 dB Whichever is Greater) (10% or 0.5 dB Whichever is Greater)			dB dB
VSWR (I/O)	DC–1.0 GHz DC–2.0 GHz		1.2:1 1.4:1	1.3:1 1.5:1	

Operating Characteristics at 25°C (+5 V, -5.6 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru			15 30 30		ns ns mV
Input Power for 1 dB Compression		0.5–1.0 GHz 0.05 GHz		+24 +16		dBm dBm
Control Voltages	V_{Low} V_{High}		0.0 4.0		0.2 5.0	V V
Supply Voltages[6,7]	+5.0 V ± 0.5 V @ 4 mA Typ. -5.6 V ± 0.20 V @ 12 mA Typ.		4.5 -5.4		5.5 -5.8	V V

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Attenuation referenced to insertion loss.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.
6. Protection circuit for driver included in package.
7. Current drain @ 85°C = 6 mA Typ. @ +5 V, 16 mA Typ. @ -5 V.

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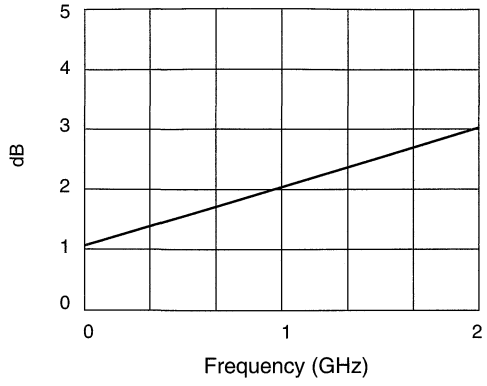
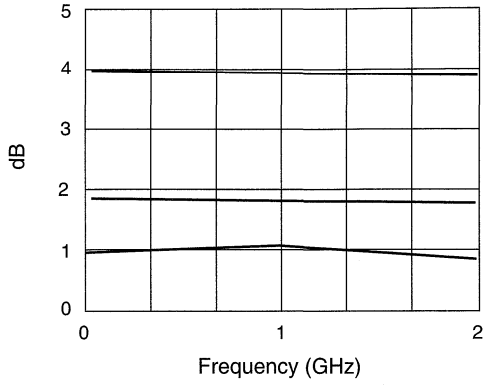
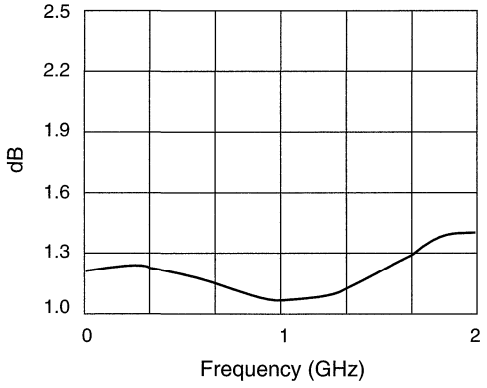
Typical Performance Data (+5 V, -5.6 V)



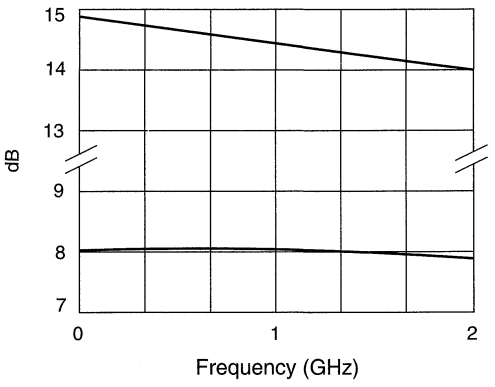
Insertion Loss vs. Frequency



1, 2, 4 dB Bits vs. Frequency



VSWR vs. Frequency (All States)

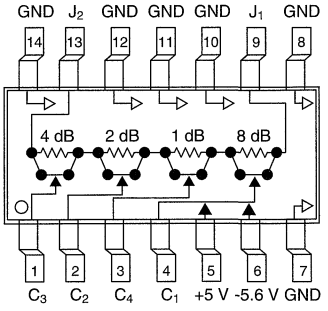


8, 15 dB Bits vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	0.5 W > 500 MHz 0.1 W @ 50 MHz
Supply Voltages	+6 V, -6 V
Control Voltage	-0.2 V, +6 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	30°C/W

Pin Out



Truth Table

C_1 (8 dB)	C_2 (2 dB)	C_3 (4 dB)	C_4 (1 dB)	Attenuation J_1–J_2
0	0	0	0	Reference I.L.
0	0	0	1	1 dB
0	1	0	0	2 dB
0	0	1	0	4 dB
1	0	0	0	8 dB
1	1	1	1	15 dB

"0" = 0.0 to 0.2 V, "1" = 4.0 to 5.0 V

GaAs IC 3 Bit Digital Attenuator
4 dB LSB DC–1 GHz

Alpha

AT001D3-24

Features

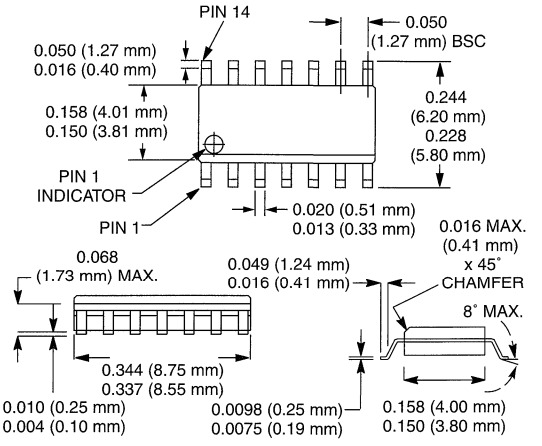
- Attenuation in 4 dB Steps to 28 dB
- Low Cost SOIC-14 Plastic Package
- Low DC Power Consumption

Description

The AT001D3-24 is an IC FET digital attenuator consisting of three monolithic attenuators with LSB of 4 dB and a total attenuation of 28 dB with all attenuators connected. Attenuator bits are switched with -5 and 0 V.

The attenuator is packaged in the plastic 14 lead surface mount package for low cost commercial cellular radio applications.

SOIC-14



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz DC–1.0 GHz		2.2 3.0	2.5 3.2	dB dB
Attenuation Range	DC–1.0 GHz		28		dB
Attenuation Accuracy Per Bit[4]	DC–1.0 GHz	±5%, 16 dB Bit ±10%, 4, 8 dB Bits			dB dB
VSWR (I/O)	DC–1.0 GHz		1.4:1	1.6:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru			10 20 20		ns ns mV
Input Power for 1 dB Compression		0.50–1.0 GHz 0.05 GHz		+24 +14		dBm dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–1.0 GHz 0.05 GHz		+43 +32		dBm dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA to -8 V at 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Attenuation referenced to insertion loss.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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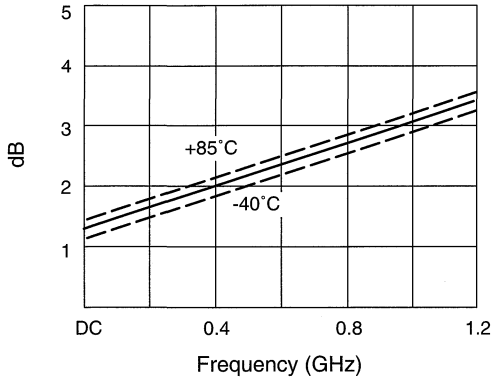
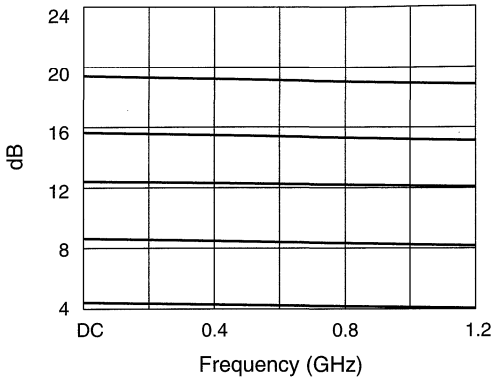
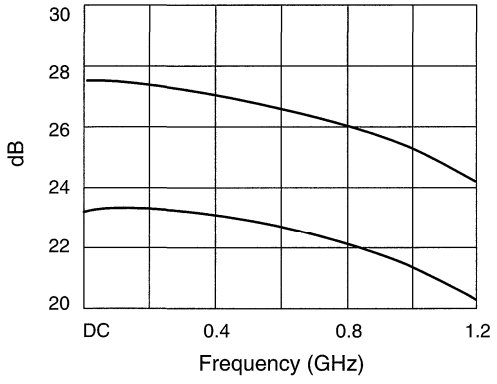
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



4, 8, 12, 16, 20 dB States vs. Frequency



24, 28 dB States vs. Frequency

Absolute Maximum Ratings

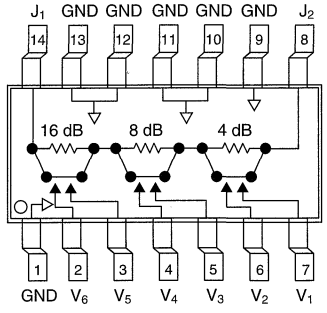
Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

V_1	V_2	V_3	V_4	V_5	V_6	Attenuation
4 dB		8 dB		16 dB		J_1–J_2
-5	0	0	-5	-5	0	Reference I.L.
0	-5	0	-5	-5	0	4 dB
-5	0	-5	0	-5	0	8 dB
-5	0	0	-5	0	-5	16 dB
0	-5	-5	0	0	-5	28 dB

Pin Out



GaAs IC 4 Bit Digital Attenuator
2 dB LSB DC–1 GHz

Alpha

AT001D4-25

Features

- 2, 4, 8, 16 dB Bits
- Designed for Cellular Radio Applications
- Low Cost Plastic Package
- For Extended Frequency Performance to 2 GHz Use the AD320-25
- Low DC Power Consumption

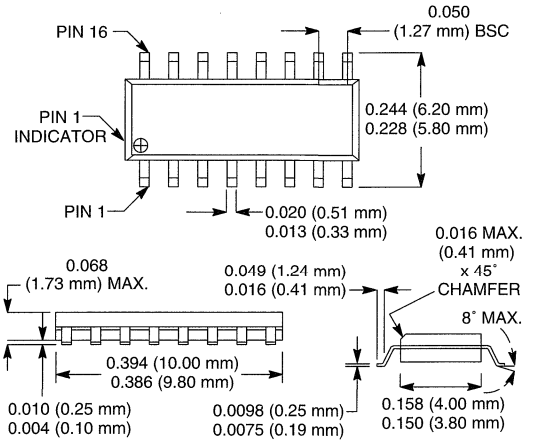
Description

The AT001D4-25 is an IC FET digital attenuator consisting of four monolithic attenuators with LSB of 2 dB and a total attenuation of 30 dB with all attenuators connected.

The attenuator is packaged in the plastic 16 lead surface mount package for low cost commercial cellular radio applications.

Bias required is -5, 0 V. By "floating" the device, a bias of + 5 and 0 is required. Refer to the application note, "Switch and Attenuator Mounting for Positive Voltage Operation," in the Application Notes section.

SOIC-16



Electrical Specifications at 25°C (0, -5 V)

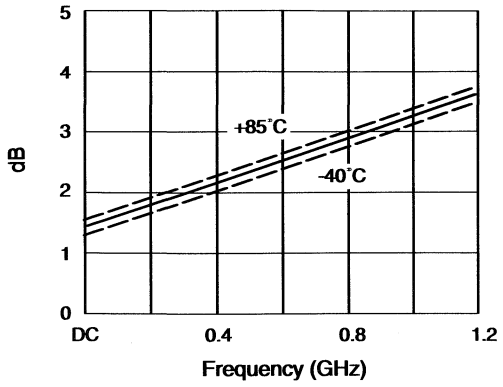
Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz DC–1.0 GHz		1.3 1.5	1.8 1.9	dB dB
Attenuation Range[4]	DC–1.0 GHz	± 0.25 + 3% of Attenuation Setting in dB or ± 0.5 dB, Whichever is Greater			dB
VSWR (I/O)	DC–0.5 GHz DC–1.0 GHz		1.45 1.5	1.8:1 1.6:1	

Operating Characteristics at 25°C (0, -5 V)

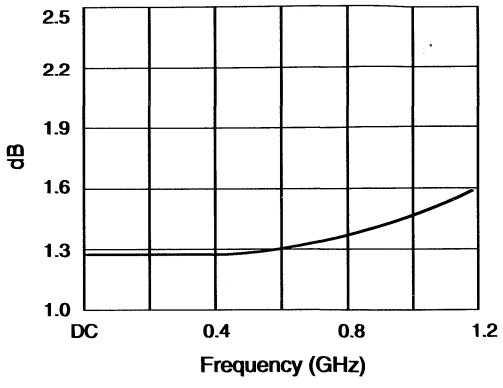
Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru			10 20 20		ns ns mV
Input Power for 1 dB Compression		0.5–1.0 GHz 0.001 GHz		+24 +14		dBm dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.5–1.0 GHz 0.001 GHz		+43 +32		dBm dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 @ 50 µA to -8 V @ 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Attenuation referenced to insertion loss.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

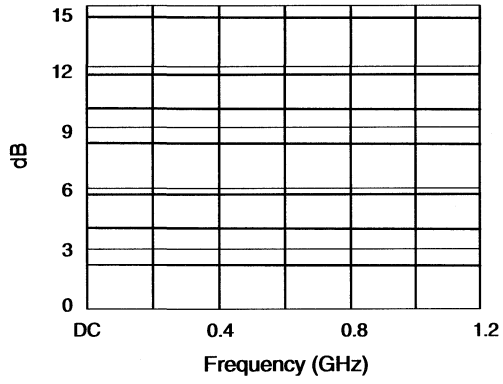
Typical Performance Data (0, -5 V)



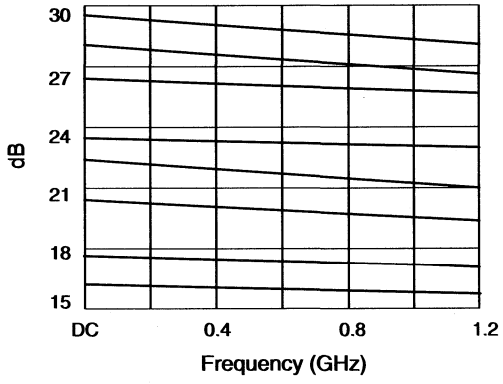
Insertion Loss vs. Frequency



VSWR vs. Frequency (All States)



2 Through 14 dB States vs. Frequency



16 Through 30 dB States vs. Frequency

Truth Table

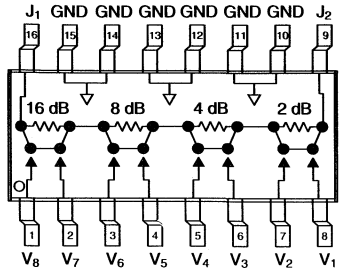
2 dB		4 dB		8 dB		16 dB		Attenuation
V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	J_1–J_2
-5	0	-5	0	0	-5	-5	0	Reference I.L.
0	-5	-5	0	0	-5	-5	0	2 dB
-5	0	0	-5	0	-5	-5	0	4 dB
-5	0	-5	0	-5	0	-5	0	8 dB
-5	0	-5	0	0	-5	0	-5	16 dB
0	-5	0	-5	-5	0	0	-5	30 dB Max.

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Pin Out



GaAs IC 4 Bit Digital Attenuator 3 dB LSB DC–1 GHz

Alpha

AT001D6-25

Features

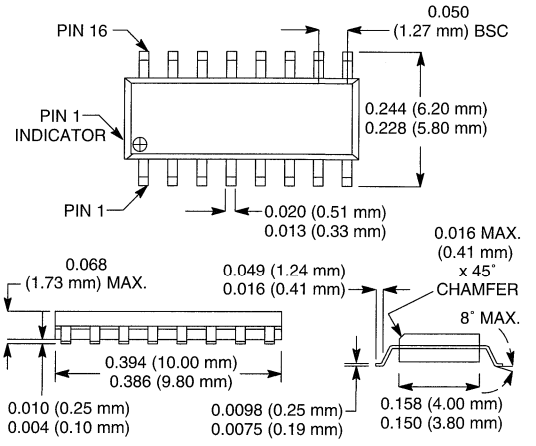
- Attenuation in 3 dB Steps to 45 dB
- Low DC Power Consumption
- Low Cost SOIC-16 Plastic Package

Description

The AT001D6-25 is an IC FET digital attenuator consisting of four monolithic attenuators with LSB of 3 dB and a total attenuation of 45 dB with all attenuators connected.

The attenuator is packaged in the plastic 16 lead surface mount package for low cost commercial cellular radio applications.

SOIC-16



Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–0.5 GHz DC–1.0 GHz		2.5 3.5	3.2 4.0	dB dB
Attenuation Range[4]	DC–1.0 GHz	10% or ± 0.5 dB Whichever is Greater 12% for 45 dB Attenuation			
VSWR (I/O)	DC–0.5 GHz DC–1.0 GHz		1.4:1 1.6:1	1.6:1 1.8:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[5]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru			10 20 20		ns ns mV
Input Power for 1 dB Compression		0.50–1.0 GHz 0.05 GHz		+24 +14		dBm dBm
Intermodulation Intercept Point (IP3)	For Two-tone Input Power +13 dBm	0.50–1.0 GHz 0.05 GHz		+43 +32		dBm dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA to -8 V at 200 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Attenuation referenced to insertion loss.
5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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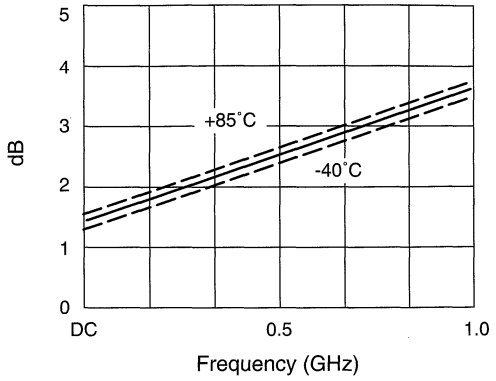
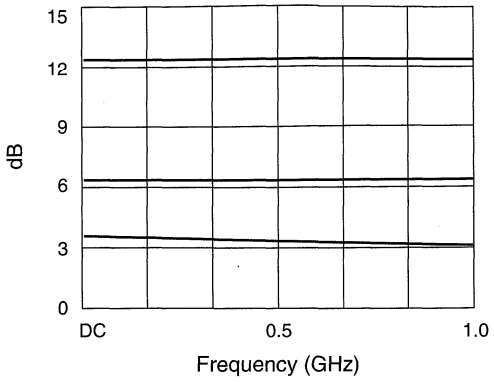
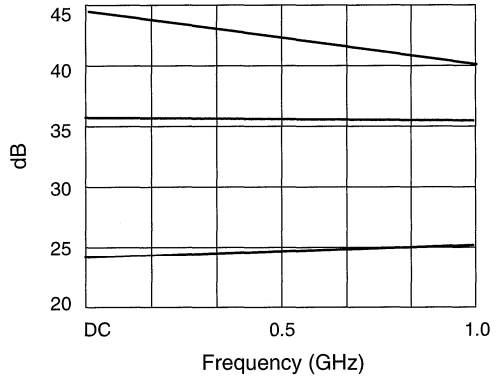
Typical Performance Data (0, -5 V)



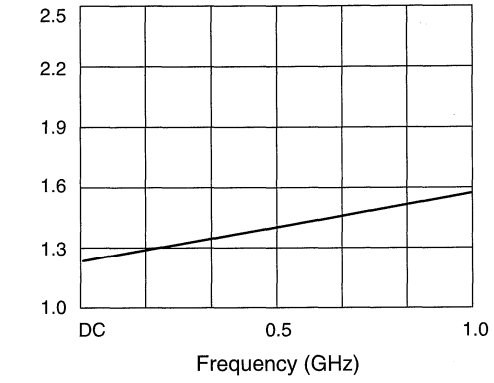
Insertion Loss vs. Frequency



3, 6, 12 dB States



24, 36, 45 dB States



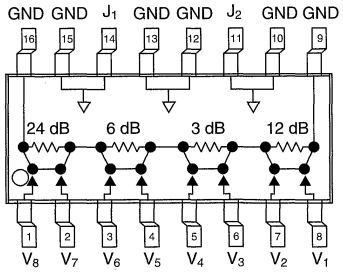
VSWR vs. Frequency (All States)

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	2 W > 500 MHz 0/-8 V 0.5 W @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Pin Out



Truth Table

V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	Attenuation
12 dB		3 dB		6 dB		24 dB		J_1–J_2
-5	0	-5	0	0	-5	0	-5	Reference I.L.
-5	0	0	-5	0	-5	0	-5	3 dB
-5	0	-5	0	-5	0	0	-5	6 dB
0	-5	-5	0	0	-5	0	-5	12 dB
-5	0	-5	0	0	-5	-5	0	24 dB
0	-5	0	-5	-5	0	-5	0	45 dB

VVA

Frequency (GHz)	Description	Insertion Loss Range (dB) Typ.	Isolation Range (dB) Typ.	IP3 >0.5 GHz (dBm) Typ.	Package	Part Number	Page Number
DC–2.0	15 dB, Single CTL	3.1–3.8	15–7	18	SOT-143	▶ AF002N2-32	1-150
DC–2.5	Dual Control	1.0–1.2	30–25	12	SOIC-8	AT002N3-12	1-152
0.4–2.5	30 dB, Single Pos. CTL	1.7–2.5	30–34	12	SOIC-8	▶ AT002S3-12	1-154
DC–2.0	15 dB, Single CTL	3.1–3.8	15–7	18	SOT-143	▶ AV259-32	1-156

▶ Available through distribution.

Preferred for new designs.

GaAs IC 15 dB Voltage Variable Attenuator Single Control DC–2 GHz

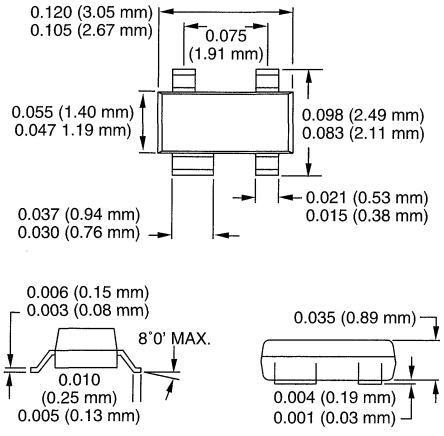
Alpha

AF002N2-32

Features

- Single Voltage Control, Positive or Negative Voltage
- Low Cost SOT-143 Package
- 15 dB Attenuation Range
- Non-Reflective

SOT-143



Description

The AF002N2-32 is a single control non-reflective IC FET VVA ideal for AGC applications. Its low DC drain characteristic and size make it suitable for PCS and portable cellular markets. A positive control voltage may be used by adding 2 DC blocking capacitors (C_{BL}) and 1 bypass capacitor (C_{BP}).

Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss (V_1 = -5 V)[3]	DC–0.5 GHz		3.1	3.3	dB
	DC–1.0 GHz		3.3	3.5	dB
	DC–2.0 GHz		3.5	3.8	dB
Attenuation (V_1 = 0 V)	DC–0.5 GHz	15	17		dB
	DC–1.0 GHz	11	13		dB
	DC–2.0 GHz	7	9		dB
VSWR (V_1 = 0 to -5 V)	DC–2.0 GHz		2.0:1	2.2:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[4]	Rise, Fall (10/90% or 90/10% RF)			7		ns
	On, Off (50% CTL to 90/10% RF)			10		ns
	Video Feedthru			20		mV
Input Power for 1 dB Compression	For All Attenuation Levels	0.05 GHz		-3		dBm
		0.90 GHz		0		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA Max. to -8 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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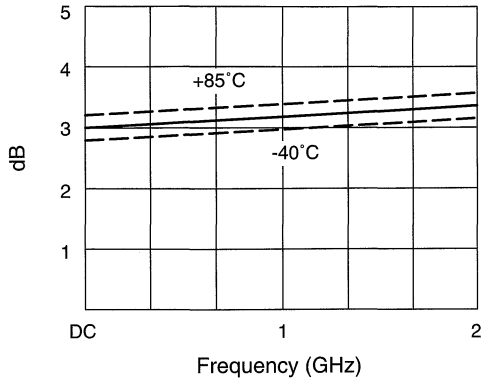
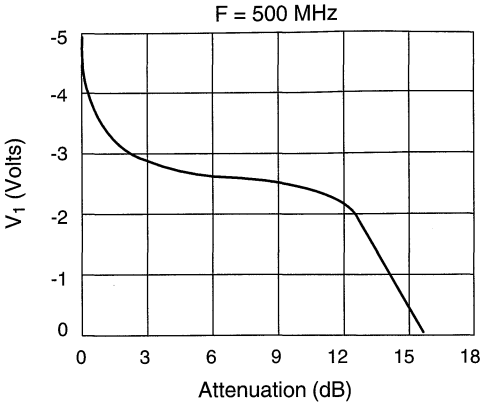
1

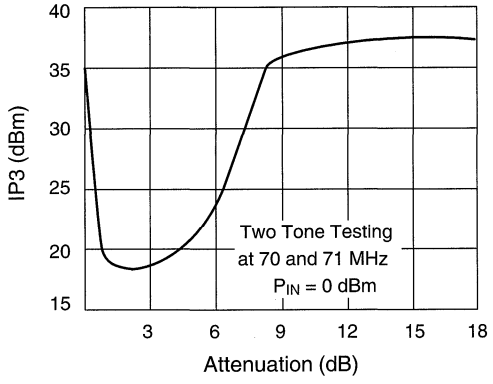
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



Attenuation vs. Control Voltage



Attenuation vs. IP3

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	10 mW > 500 MHz 0/-8 V 4 mW @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -10 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Operating this device above any of these parameters may cause irreversible damage.

Truth Table

Negative Voltage Operation

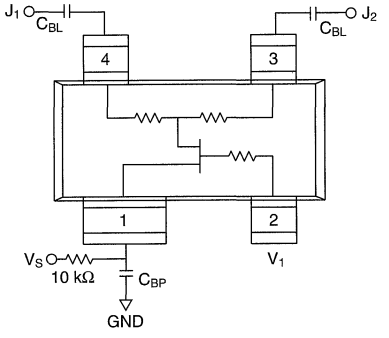
V_1	Attenuation J_1–J_2
-5	Insertion Loss
0	Full Attenuation

Positive Voltage Operation

V_1	Attenuation J_1–J_2
V_{High}	Full Attenuation
0	Insertion Loss

V_{High} = +5 V to +8 V (V_S = V_{High} ± 0.2 V)

Pin Out



External components for positive voltage operation only.
C_{BL} = 100 pF, C_{BP} = 1000 pF for operation >500 MHz.

GaAs IC 30 dB Voltage Variable Attenuator Dual Bias DC–2.5 GHz

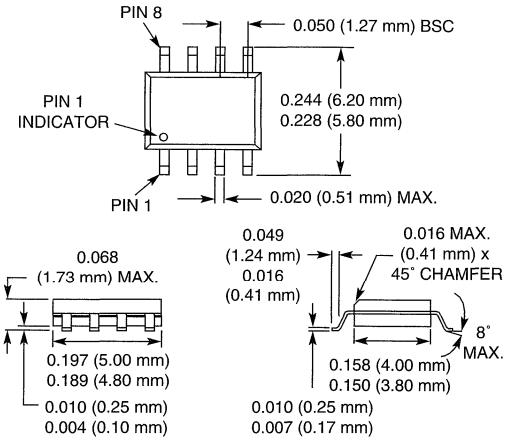
Alpha

AT002N3-12

Features

- Dual Voltage Control
- Low Insertion Loss < (1.2 dB)
- Bridged "T" Design, Non-Reflective
- Low Cost SOIC-8 Plastic Package

SOIC-8



Description

The AT002N3-12 DC–2 GHz GaAs FET IC non-reflective bridged "T" attenuator provides up to 30 dB of "non-reflective" attenuation. The control voltage requirements are 0 to -5 V.

This attenuator has two independent voltage controls, which must be adjusted in a prescribed manner to obtain the desired attenuation under non-reflective conditions. Refer to the Application Notes section, "Dual Voltage Controlled VVA."

Applications for these fast attenuators are AGC circuits and variable level control in various military and telecommunications systems.

Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss[3]	DC–1.0 GHz		0.9	1.0	dB
	DC–2.0 GHz		1.1	1.2	dB
	DC–2.5 GHz		1.2	1.3	dB
Attenuation	DC–1.0 GHz	30	31		dB
	DC–2.0 GHz	27	29		dB
	DC–2.5 GHz	23	27		dB
VSWR (I/O)	DC–2.5 GHz		1.6:1	1.8:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[4]	Rise, Fall (10/90% or 90/10% RF)			7		ns
	On, Off (50% CTL to 90/10% RF)			10		ns
	Video Feedthru			20		mV
Input Power for 1 dB Compression	For All Attenuation Levels	0.5–3 GHz		0		dBm
		0.05 GHz		-3		dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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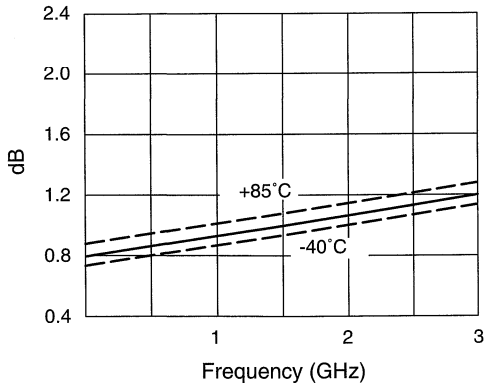
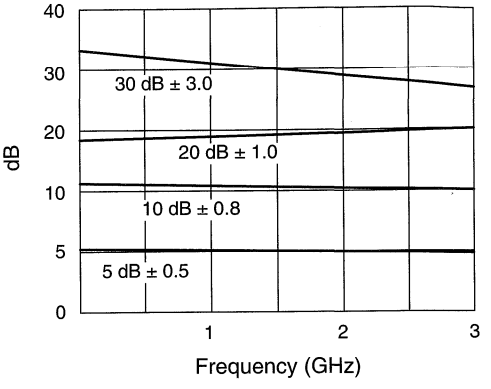
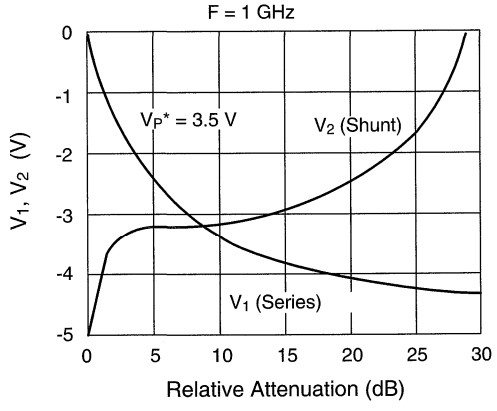
Typical Performance Data (0, -5 V)



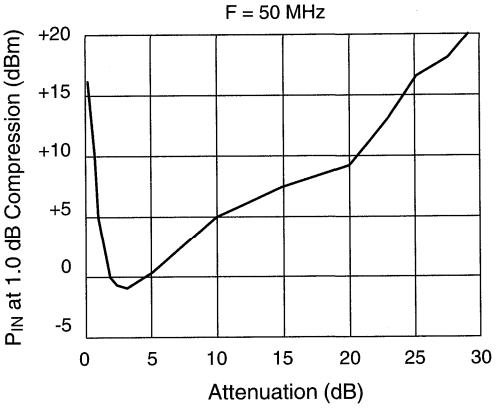
Insertion Loss vs. Frequency



Attenuation (By State) vs. Frequency



Relative Attenuation vs. Control Voltage



Attenuation vs. 1.0 dB Compression Point

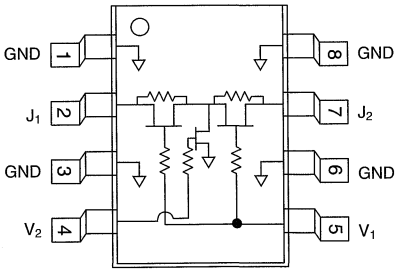
*"Pinch-off" voltage (V_P) varies from unit to unit in the approximate range of -3.2 to -3.8 V. Bias voltages V_1 and V_2 would shift up or down.

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	10 mW > 500 MHz 0/-8 V 4 mW 50 MHz 0/-8 V
Control Voltage	+0.2 V, -8 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Operating this device above any of these parameters may cause irreversible damage.

Pin Out



Truth Table

V_1	V_2	Attenuation J_1–J_2
0	-5	Insertion Loss
-5	0	Full Attenuation

GaAs IC 35 dB Voltage Variable Attenuator Single Positive Control 0.4–2.5 GHz

Alpha

AT002S3-12

Features

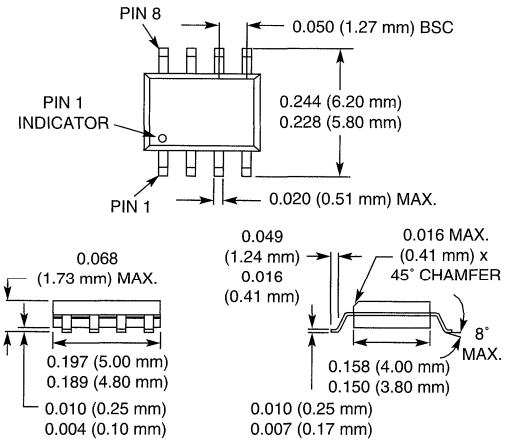
- +5 V Operation
- Single Positive Voltage Control
- 35 dB Attenuation Range
- Low Insertion Loss (1.7 dB @ 0.9 GHz)

Description

The AT002S3-12 GaAs IC FET bridge "T" attenuator provides 35 dB minimum absolute attenuation at 900 MHz.

The key feature of this attenuator is the requirement of only one "positive" control voltage. Blocking capacitors are required on the RF ports.

SOIC-8



Electrical Specifications at 25°C (V_S = 5 V)

Parameter[1]	Frequency	Min.	Typ.	Max.	Unit
Insertion Loss (V_1 = 5 V)[2]	0.4–1.0 GHz		1.5	1.7	dB
	1.0–2.0 GHz		2.0	2.4	dB
	2.0–2.5 GHz		2.5	2.9	dB
Absolute Attenuation (V_1 = 0 V)	0.4–0.6 GHz	30	32		dB
	0.6–1.0 GHz	35	37		dB
	1.0–1.5 GHz	30	33		dB
	1.5–2.0 GHz	27	30		dB
	2.0–2.5 GHz	25	27		dB
VSWR (I/O)[3]	0.4–2.5 GHz		2.5:1		

Operating Characteristics at 25°C (V_S = 5 V)

Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[4]	Rise, Fall (10/90% or 90/10% RF)			1.0		µs
	On, Off (50% CTL to 90/10% RF)			1.5		µs
	Video Feedthru			20		mV
Attenuation Flatness	0–10 dB	0.8–2.0 GHz		±1.0		dB
	11–20 dB	0.8–2.0 GHz		±1.5		dB
	21–30 dB	0.8–2.0 GHz		±3.5		dB
	31–Max.	0.8–2.0 GHz		±4.5		dB
Input Power for 1 dB Compression	Worst Case For All Attenuation States	0.9 GHz		-3		dBm
Control Voltage	V_{Low} = 0 to 0.2 V @ 50 µA Max. V_{High} = +5 V @ 100 µA Max.					
Supply Voltage (V_S)	+5 V @ 100 µA Max.					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. Insertion loss changes by 0.003 dB/°C.
3. For all states.
4. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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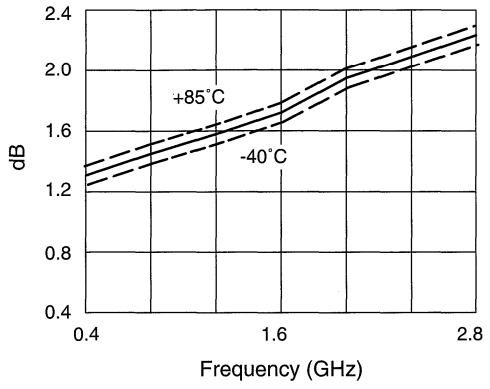
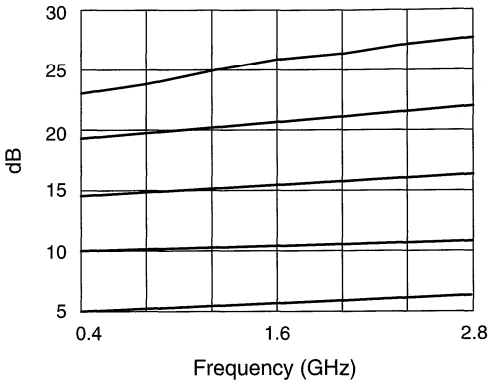
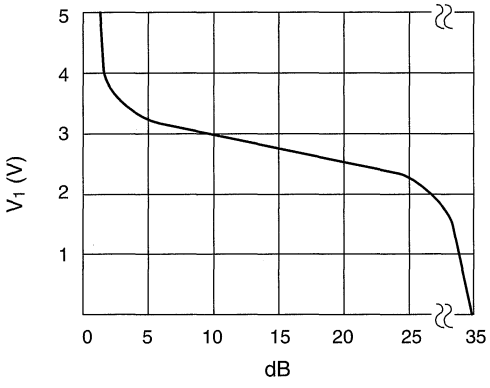
Typical Performance Data



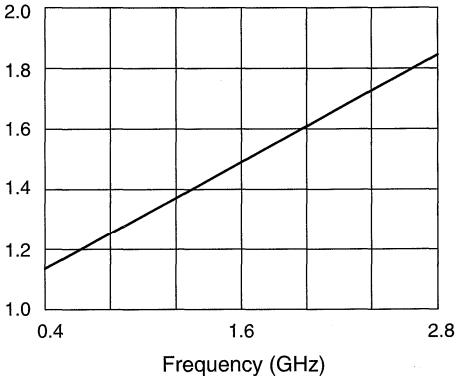
Insertion Loss vs. Frequency



Attenuation Flatness vs. Frequency



Relative Attenuation vs. Control Voltage at 1.0 GHz



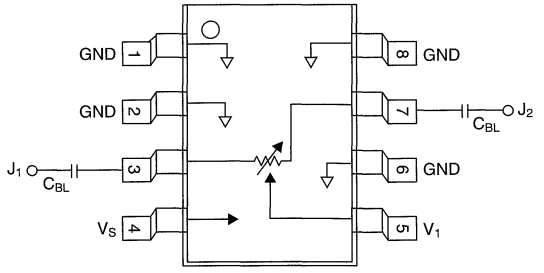
VSWR vs. Frequency (Insertion Loss)

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	5 mW > 500 MHz
Supply Voltage	+8 V
Control Voltage	-0.2 V, +8 V (Do not allow control voltage to exceed V_S voltage.)
Operating Temperature	-55°C to +125°C
Storage Temperature	-65°C to +150°C
Thermal Resistance	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Pin Out



DB blocking capacitors (C_{BL}) supplied externally.
C_{BL} = 100 pF for operation >500 MHz.

GaAs IC 15 dB Single Voltage Control Variable Attenuator DC–2 GHz

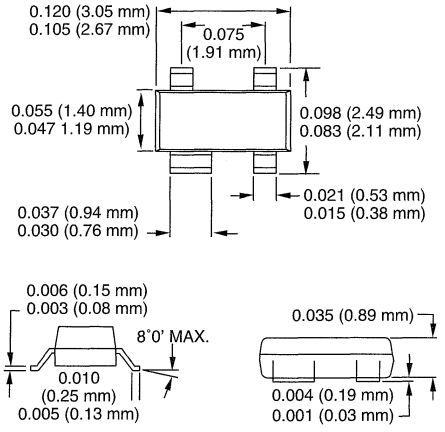
Alpha

AV259-32

Features

- Single Voltage Control, Positive or Negative
- 15 dB Attenuation Range
- Low Cost SOT-143 Package
- Non-Reflective

SOT-143



Description

The AV259-32 is a single control non-reflective IC FET VVA ideal for AGC applications. Its low DC drain characteristic and size make it suitable for the PCS and portable cellular markets. A positive control voltage may be used by adding 2 DC blocking capacitors (C_{BL}) and 1 bypass capacitor (C_{BP}).

Electrical Specifications at 25°C (0, -5 V)

Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion Loss (V_1 = -5 V)[3]	DC–0.5 GHz DC–1.0 GHz DC–2.0 GHz		3.0 3.2 3.4	3.2 3.5 3.8	dB dB dB
Attenuation (V_1 = 0 V)	DC–0.5 GHz DC–1.0 GHz DC–2.0 GHz	15 11 7	18 15 8		dB dB dB
VSWR (V_1 = 0 to -5 V)	DC–2.0 GHz		2.0:1	2.2:1	

Operating Characteristics at 25°C (0, -5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[4]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru			10 20 20		ns ns mV
Input Power for 1 dB Compression	For All Attenuation Levels	0.05 GHz 0.50 GHz		-3 0		dBm dBm
Control Voltages	V_{Low} = 0 to -0.2 V @ 20 µA Max. V_{High} = -5 V @ 50 µA Max. to -8 V @ 200 µA Max. $V_S = V_{High} \pm 0.2$ V					

1. All measurements made in a 50 ohm system, unless otherwise specified.
2. DC = 300 kHz.
3. Insertion loss changes by 0.003 dB/°C.
4. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

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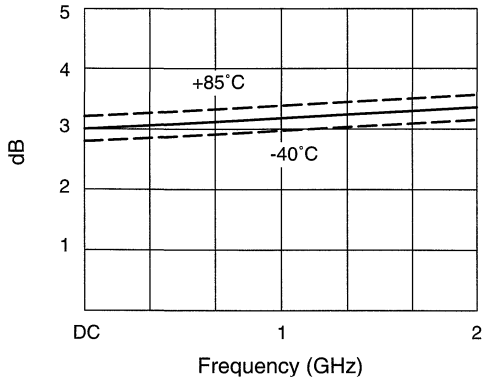
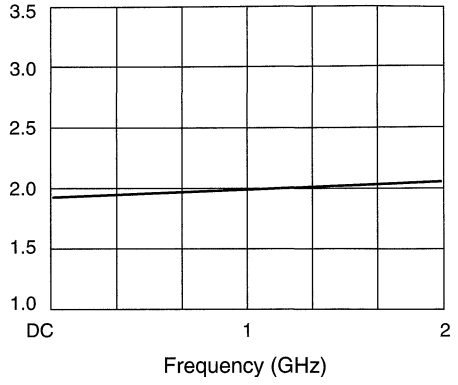
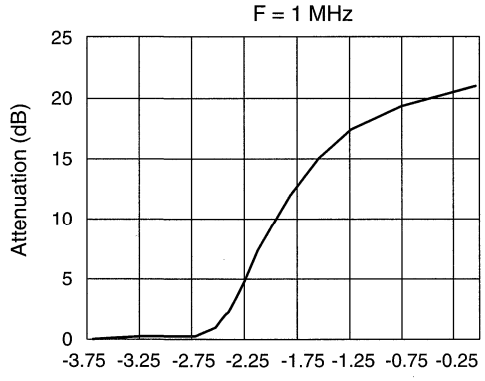
Typical Performance Data (0, -5 V)



Insertion Loss vs. Frequency



VSWR vs. Frequency



Attenuation vs. Bias

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	10 mW > 500 MHz 0/-8 V 4 mW @ 50 MHz 0/-8 V
Control Voltage	+0.2 V, -10 V
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Θ_{JC}	25°C/W

Note: Exceeding these parameters may cause irreversible damage.

Truth Table

Negative Voltage Operation

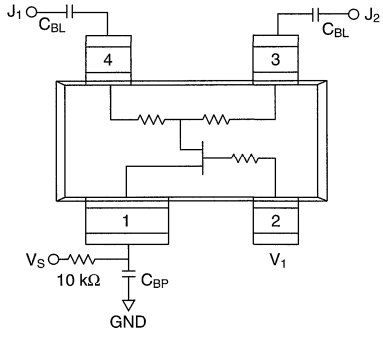
V_1	State
-5	Insertion Loss
0	Full Attenuation

Positive Voltage Operation

V_1	State
V_{High}	Full Attenuation
0	Insertion Loss

V_{High} = +5 V to +8 V ($V_S = V_{High} \pm 0.2$ V)

Pin Out



External components for positive voltage operation only.
C_{BL} = 100 pF, C_{BP} = 1000 pF for operation >500 MHz.

Section 2

Plastic Packaged Power Amplifiers

Linear

Frequency (MHz)	Description	Typical Output Power (dBm)	Typical PAE (%)	Typical Gain (dB)	Supply Voltage (V)	Package	Part Number	Page Number
824-849	AMPS, DAMPS, Dual Mode, Single Pos. Supply	31.0 (PEP)	37	26.0	5.80	SSOP-28 Batwing Slug	AP105-69	2-2
1850-1910	PCS, TDMA	31.0 (PEP)	35	28.0	5.80, -4.70	SOIC-16 Slug	AP107-81	2-6

GaAs IC Linear Power Amplifier

Alpha

AP105-69

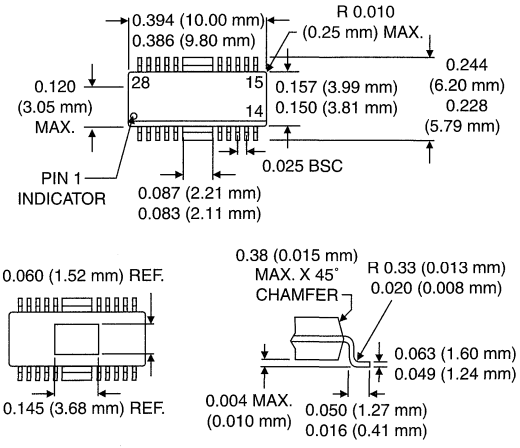
Features

- IS-136/54 TDMA
- IS-95 CDMA
- Linear Power up to 28 dBm Nominal
- Nominal 6 V Operation, Single Supply Operation
- Efficiency Greater Than 35%
- High Power SSOP-28 Batwing Package with Slug

Description

The AP105-69 is a low cost IC power amplifier designed for the 824–849 MHz frequency band. It features 5 cell battery operation and operates from 5 V to 7.5 V with excellent linearity, and high efficiency. An integrated DC/DC converter supplies -4 V to the power amplifier and can supply 1.5 mA to an external circuit. The amplifier is designed to be stable over a temperature range of -30 to 100°C and over 3:1 VSWR loads.

SSOP-28 Slug



Electrical Specifications at 25°C

Characteristic	Condition	Frequency	Min.	Typ.	Max.	Unit
Digital Mode						
P_{OUT} (Reference at Output Pin Leads)	$0<P_{IN}<5$	824–849 MHz		28		dBm
Efficiency	P_{OUT} = 28 dBm			37		%
Large Signal Gain	P_{IN} = -20 dBm			26		dB
Idle Current	P_{IN} = -60 dBm			150	200	mA
Noise in the Receive Band	P_{OUT} = 28 dBm R_X Band = 869–894 MHz R_X Bandwidth = 30 kHz			-100	-95	dBm
Reference Current	P_{OUT} = 28 dBm			1	5	mA
Input VSWR	P_{IN} = -30 to +7 dBm			2.5:1		
Analog Mode						
P_{OUT}	$0<P_{IN}<5$	824–849 MHz		28		dBm
Efficiency	P_{OUT} = 28 dBm			40		%
Large Signal Gain	P_{IN} = -20 dBm			24		dB
Idle Current	P_{IN} = -60 dBm			50	90	mA

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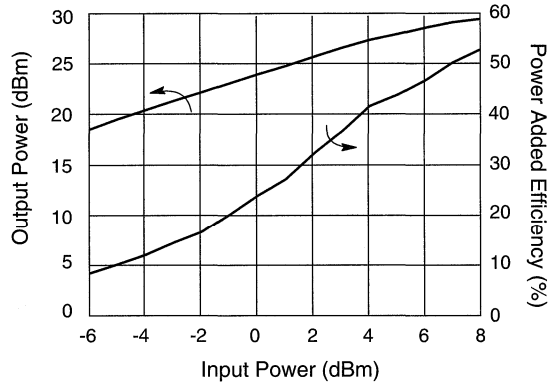
Operating Characteristics at 25°C

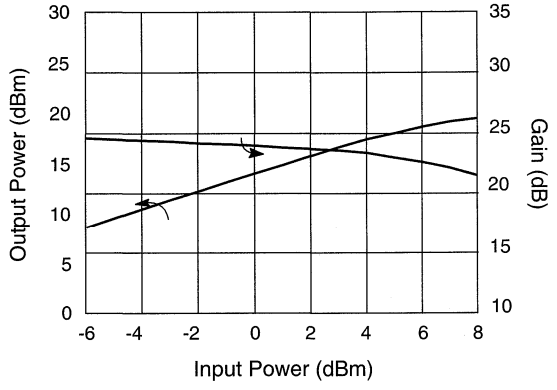
Characteristic	Condition	Frequency	Min.	Typ.	Max.	Unit
Voltage			5	6	7.5	V
IM3@ Rated P_{OUT}	P_{OUT} = 31 dBm PEP			-24		dBc
IM5@ Rated P_{OUT}	P_{OUT} = 31 dBm PEP			-34		dBc
IM7@ Rated P_{OUT}	P_{OUT} = 31 dBm PEP			-38		dBc
Harmonic Power	2fo 3fo			-30 -45		dBc
Modulation	Channel Spacing = 30 kHz, 832 Channels, Pi/4 QPSK					
P_{ADJ}	30 kHz 60 kHz 90 kHz			-28 -49 -60		dBc
Input Impedance				50		Ω

2

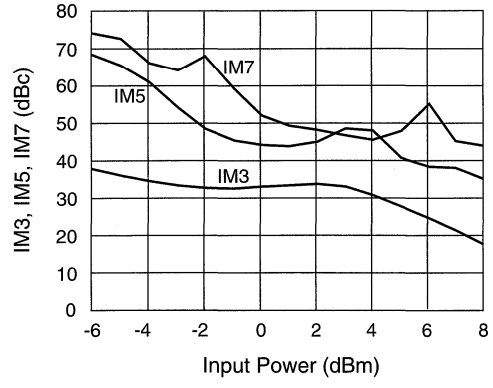
Typical Performance Data (824–849 MHz)



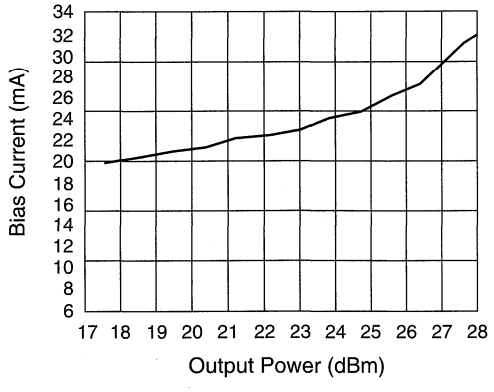
P_{OUT}, P.A.E. vs. P_{IN}



P_{OUT}, Gain vs. P_{IN}

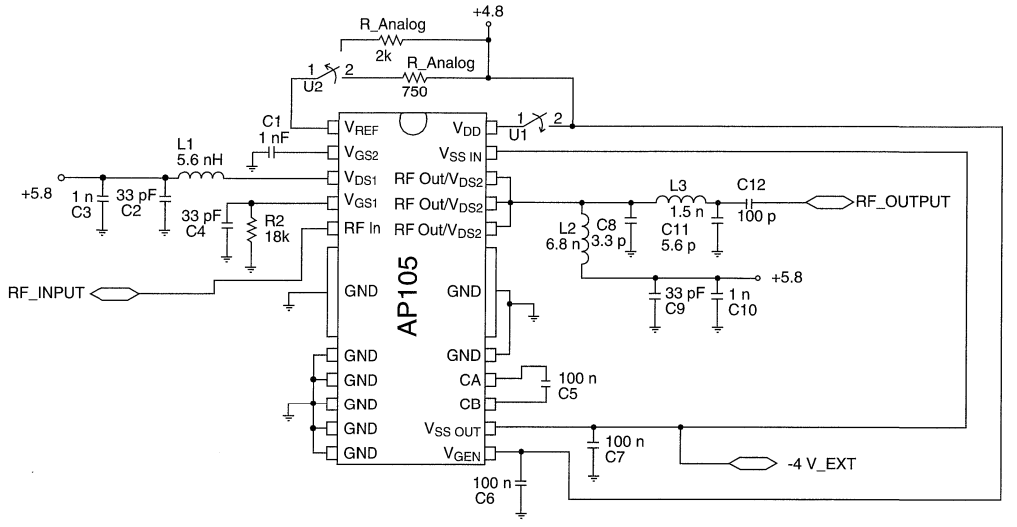


Distortion. vs. P_{IN}



Bias Current vs. P_{OUT}

Power Amplifier Typical Configuration



Output Matching Circuit

The output match for the AP105 is provided externally in order to improve performance, reduce cost, and add flexibility. By making use of ceramic surface mount components with better Qs than GaAs matching elements, a lower loss matching network can be made. This lower loss results in higher power and efficiency for the amplifier. Also, by keeping these elements external the GaAs die size is reduced and the overall cost is less. This approach also permits the flexibility to tweak the amplifier for optimum performance at different powers, and/or frequencies.

The board schematic demonstrates one way to present the optimum load match while providing a path for the DC bias.

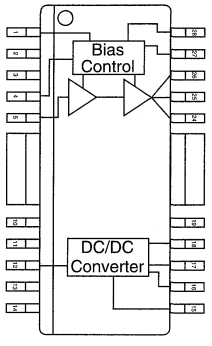
Bias Controller Circuit

An on-chip bias controller circuit eliminates the need to individually adjust the gate bias voltages. This circuit uses +4.8 V and the negative voltage from the DC converter (-3.5 V to -4.5 V) to set the gate voltages on each stage for the proper bias current. Pin 1 can be used to adjust the bias current between a linear and a saturated mode of operation. By switching resistors between this pin and +4.8 V, different quiescent currents can be selected. A current of 100-200 mA for good linearity in the digital mode, and a lower current, less than 100 mA, for better power consumption in the analog mode is optimum.

Standby Mode

The power amplifier should be turned off whenever possible in order to reduce the overall power consumption. The AP105 can be turned off in several ways. The simplest is to switch the bias controller supply voltage (Pin 1) open. This, in effect, switches the gate voltages to V_{SS}. The bias current of the PA in this condition will drop to less than 1 mA. By adding PMOS switches to the drain lines bias-off currents on the order of a few µA can be achieved.

Pin Out Assignments



Pin 1: V_{REF}

Sets the quiescent bias current. Nominally +3.5 V for a bias of 120-200 mA with best gain and linearity. Lower voltages in the range of +1 to +3.5 V will set the amplifier for less quiescent bias current. This is useful for analog or saturated operation where linearity is not critical. A resistor

divider network can be used with the +4.8 V regulated supply to achieve the nominal voltage. The input impedance of this pin is 2 kΩ. A switch can be used to change the resistance and toggle the amp between digital and analog mode.

Pin 2: V_{GS2}
Second stage gate voltage tap. Should be bypassed with a 1nF capacitor. This value is not critical.

Pin 3: V_{DS1}
First stage drain bias feed. Requires a matching inductor with good RF bypassing and the +5.8 V nominal supply voltage.

Pin 4: V_{GS1}
First stage gate voltage. Requires RF bypassing and an 18K resistor to properly bias the first stage.

Pin 5: RF In
50 Ω RF input.

Pin 6-14: GND
Connect to ground.

Pin 15: V_{GEN}
Supply voltage to DC/DC converter. Requires +4.8 V with a 100 nF bypassing capacitor.

Pin 16: $V_{SS\ OUT}$
Negative output voltage from the DC/DC converter. A 100 nF capacitor is required. This voltage should be supplied to the bias controller network at Pin 27. External circuitry (LCD display, driver amplifiers, etc.) can tap off the negative voltage at this point. Maximum current 2 mA.

Pin 17: CB
Switched capacitor for DC/DC converter. 100 nF capacitor should be connected between Pin 17 and Pin 18 with minimal distance between the capacitor and the chip.

Pin 18: CA
Switch capacitor for DC/DC converter, shared with Pin 17.

Pin 19-23: GND
Connect to ground.

Pin 24-26: RF Out/V_{DS2}
RF output and bias feed for the second stage drain. Output matching circuitry is required to transform the optimum load impedance to 50 Ω. The circuit must also provide a path for the +5.8 V nominal DC bias and have good RF bypassing.

Pin 27: $V_{SS\ IN}$
Negative voltage for the bias controller circuit. The negative voltage from the DC/DC converter (Pin 16) should be fed to this pin.

Pin 28: V_{DD}
Bias controller supply voltage. The regulated 4.8 V supply must be connected to this pin. Disconnecting this voltage will turn the PA bias off. A switch at this pin can turn the PA on or off while leaving V_{GEN} connected and the negative supply unchanged.

Pin Configuration

Terminal	Symbol	Function
1	V_{REF}	Reference Voltage
2	V_{GS2}	Gate Voltage 2
3	V_{DS1}	Supply Voltage 1
4	V_{GS1}	Gate Voltage 1
5	RF In	RF Input
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	GND	Ground
11	GND	Ground
12	GND	Ground
13	GND	Ground
14	V_{NGND}	Voltage Generator Ground
15	V_{GEN}	Generator Voltage
16	$V_{SS\ OUT}$	Bias Voltage Out
17	CB	Generator Flying Cap
18	CA	Generator Flying Cap
19	GND	Ground
20	GND	Ground
21	GND	Ground
22	GND	Ground
23	GND	Ground
24	RF Out/V_{DS2}	RF Output/Supply Voltage 2
25	RF Out/V_{DS2}	RF Output/Supply Voltage 2
26	RF Out/V_{DS2}	RF Output/Supply Voltage 2
27	$V_{SS\ IN}$	Negative Bias Voltage Input
28	V_{DD}	Positive Bias Voltage Input

Absolute Maximum Ratings

Characteristics	Symbol	Value	Units
Drain Voltage	V_{DD}	10	V
Bias Voltage	V_{SS}	-6	V
Reference Voltage	V_{REF}	6	V
Power Input	P_{IN}	12	dBm
Operating Temperature	T_{OPT}	-30 to 100°	C
Storage Temperature	T_{STG}	-35 to 120°	C

GaAs IC 1.9 GHz Power Amplifier

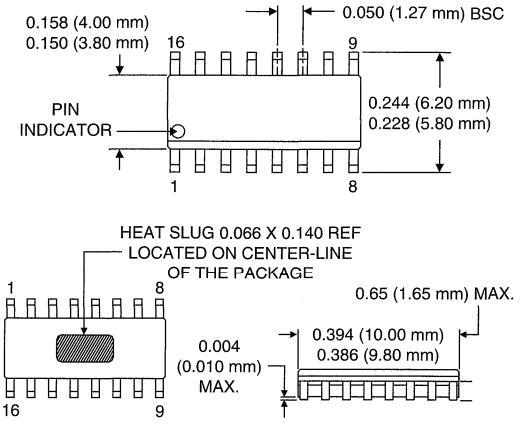
Alpha

AP107-81

Features

- PCS TDMA IS136
- PCS CDMA IS95
- Linear Power up to 31 dBm (PEP)
- 6 V Operation
- Efficiency Greater Than 30%
- High Power 16 Lead SOIC Package with Slug

SOIC-16 Slug



Description

The AP107-81 is a low cost IC power amplifier designed for the 1.85–1.91 GHz frequency band. It features 5 cell battery operation and operates with excellent linearity and high efficiency. The amplifier is designed to be stable over a temperature range of -30 to 100°C and over 3:1 VSWR loads.

Electrical Specifications at 25°C[1,2]

Characteristic	Condition	Frequency	Min.	Typ.	Max.	Unit
Output Power (PEP)	$P_{IN} \leq 2$ dBm (Avg.)	1.85–1.91 GHz	31			dBm
Efficiency	P_{OUT} (PEP) = 31 dBm		30	35		%
Gain (Small Signal)	P_{IN} = -20 dBm		27	30	33	dB
Gain (Large Signal)	P_{OUT} (PEP) = 31 dBm		25	28	31	dB
Noise in the Receive Band	P_{OUT} (PEP) = 31 dBm R_X Band = 1930–1990 MHz R_X Bandwidth = 30 kHz			-100	-95	dBm
Negative Bias Current	P_{OUT} (PEP) = 31 dBm			6	8	mA
Input VSWR	P_{IN} = -30 to +2 (Avg.)				2:1	
IM3@ Rated P_{OUT}	P_{OUT} = 31 dBm (PEP)			-26		dBc
IM5@ Rated P_{OUT}	P_{OUT} = 31 dBm (PEP)			-35		dBc
Harmonic Power	P_{OUT} = 31 dBm (PEP) 2fo 3fo			 -30 -45		 dBc dBc
Modulation	Channel Spacing = 30 kHz, 832 Channels, Pi/4 QPSK					
P_{ADJ}	30 kHz 60 kHz 90 kHz			-30 -50 -55		dBc dBc dBc
Input Impedance				50		Ω
Load Impedance (Measured at Pins 12 & 13)	9-j5.4					Ω

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Typical Performance Data (1.85–1.91 GHz)

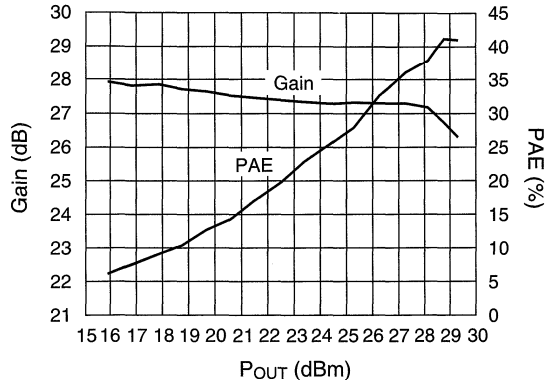


Figure 1. Gain, P.A.E. vs. Output Power

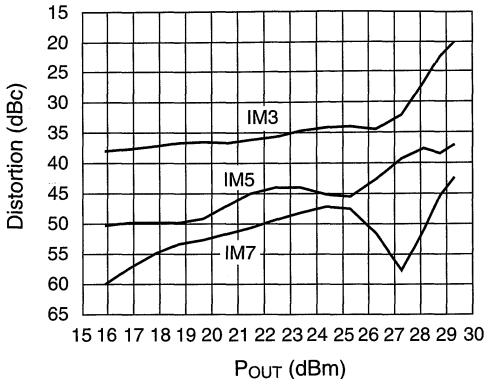


Figure 2. Intermodulation Distortion vs. Output Power

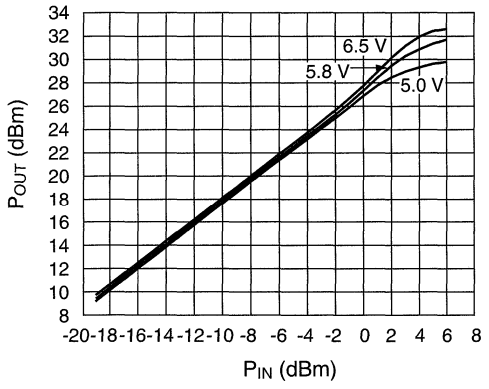


Figure 3. P_{OUT} vs. P_{IN} Over Drain Voltage

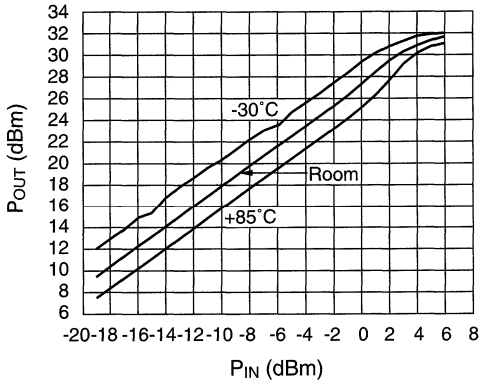


Figure 4. P_{OUT} vs. P_{IN} Over Temperature

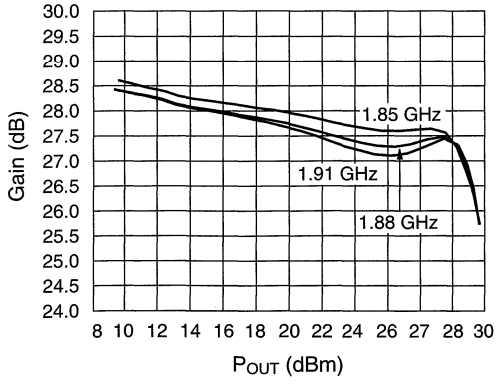


Figure 5. Gain vs. P_{OUT} Over Frequency

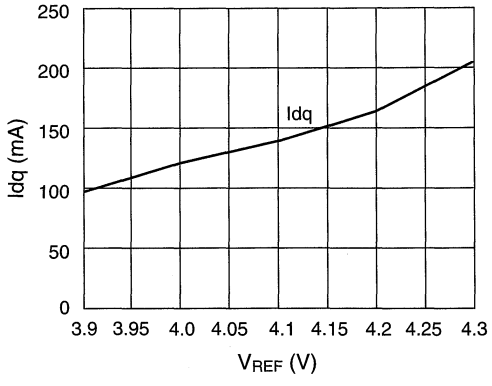


Figure 6. Quiescent Current vs. Reference Voltage

1. Performance in Figures 1, 2, 3, 4 and 5 is with V_{REF} set to 4.1 V through resistive voltage divider as shown in schematic.
2. Performance shown in Figures 1 and 2 is with a two-tone input signal at 1.88 GHz and 1.88001 GHz.
3. Performance in Figures 3, 4 and 7 is with a 1.88 GHz CW input signal.
4. For Figures 6 and 7, V_{REF} was varied using a DC supply connected directly to the V_{REF} pin.

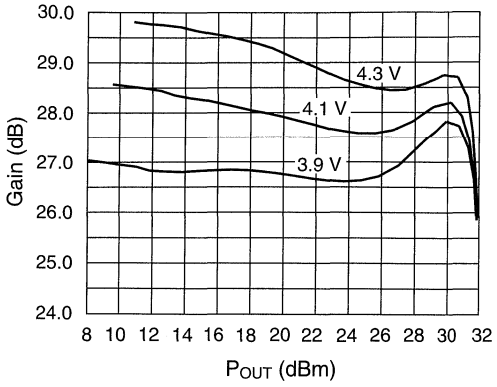


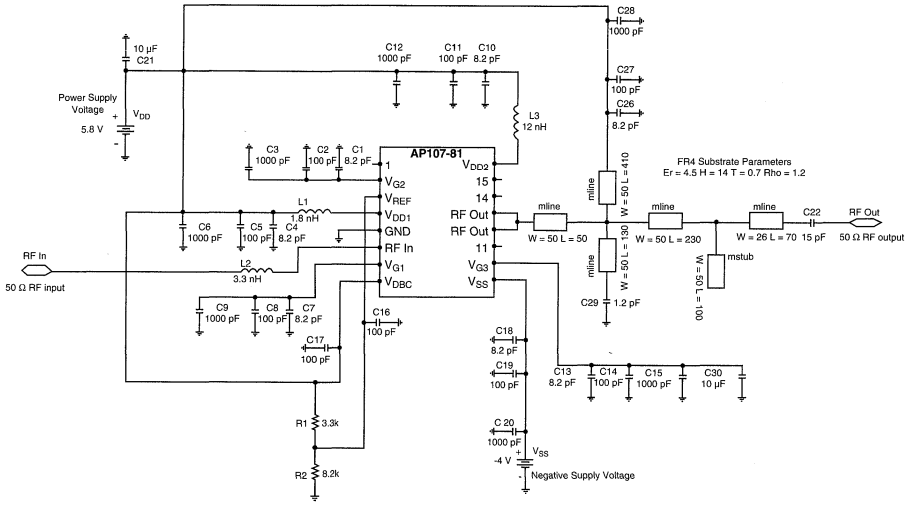
Figure 7. Gain vs. P_{OUT} vs. Reference Voltage

Output Matching Circuit

The output match for the AP107 is provided externally in order to improve performance, reduce cost and add flexibility. By making use of either ceramic surface mount components or a distributed microstrip network, a much lower loss match is achievable than could be obtained using integrated elements on GaAs. This lower loss results in better linearity and efficiency at rated output power for the amplifier. Also, by keeping these elements external to the GaAs IC, die size is smaller and the overall cost is thus reduced. This off-chip approach also permits the flexibility to tweak the amplifier for optimum performance at different powers, and/or frequencies.

The board schematic demonstrates a distributed load matching network on FR4 substrate, which presents the optimum load match while also providing a path for DC bias to the output stage.

Power Amplifier Typical Configuration



Bias Controller Circuit

An on-chip bias controller eliminates the need to individually adjust the gate bias voltages. This circuit uses +5.8 V and an externally supplied negative voltage (-4 V) to set the gate voltages on each stage for the proper bias current. The voltage on Pin 3 (V_{REG}), which can be adjusted using the off-chip resistors R1 and R2, can be used to vary the quiescent current thus providing some gain control and also allowing higher efficiency operation at lower output power levels. However, to obtain the specified linearity at rated power, the amplifier should be biased with 150-200 mA of quiescent current.

Standby Mode

The power amplifier should be turned off whenever possible to reduce overall power consumption. The AP107 can be turned off in a number of ways. The simplest method is to switch the bias controller voltage (Pin 8) open, which has the effect of setting the gate voltages to approximately V_{SS} (-4 V). The bias current of the amplifier in this condition will drop to less than 1 mA. By adding PMOS switches to the drain lines, bias-off currents of the order of <10 µA can be obtained.

Pin Out Assignments

Pin 2: V_{G2}
Second stage gate voltage tap. Should be RF bypassed.

Pin 3: V_{REF}
Sets quiescent current of amplifier. Nominal value of ~4.1 V can be set, by voltage dividing from V_{DBC} (5.8 V) using resistors R1 and R2 as shown in the schematic.

Pin 4: V_{DD1}
Drain of stage 1. Requires matching inductor, good RF bypassing and the +5.8 V nominal supply voltage.

Pin 5: GND
DC and RF ground.

Pin 6: RF In
50 Ω RF input. Series inductor on input line improves input match.

Pin 7: V_{G1}
First stage gate voltage tap. Requires good RF bypassing.

Pin 8: V_{DBC}
Bias controller supply voltage. Connect to +5.8 V nominal supply voltage.

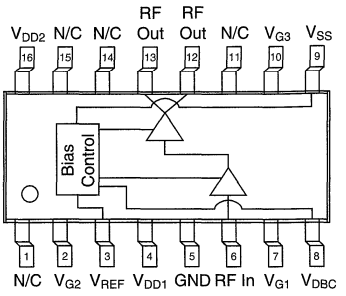
Pin 9: V_{SS}
Negative voltage for bias controller circuit. Nominally -4 V.

Pin 10: V_{G3}
Third stage gate voltage tap. Requires good RF bypassing.

Pin 12, 13: RF Out/V_{DD3}
RF output and bias feed for third stage drain. Output matching is required to transform the optimum load impedance to 50 Ω. The circuit must also provide a path for the +5.8 V nominal DC bias and have good RF bypassing.

Pin 16: V_{DD2}
Second stage drain voltage. Requires matching inductor, good RF bypassing and connection to the +5.8 V nominal supply voltage.

Pin Out



Pin Configuration

Terminal	Symbol	Function
1	N/C	Not Connected
2	V_{G2}	Gate Voltage 2
3	V_{REF}	Reference Voltage
4	V_{DD1}	Drain Voltage 1
5	GND	Ground
6	RF In	RF Input
7	V_{G1}	Gate Voltage 1
8	V_{DBC}	Positive Bias Controller Supply Voltage
9	V_{SS}	Negative Bias Controller Supply Voltage
10	V_{G3}	Gate Voltage 3
11	N/C	Not Connected
12	RF Out/V_{DD3}	RF Output/Drain Voltage 3
13	RF Out/V_{DD3}	RF Output/Drain Voltage 3
14	N/C	Not Connected
15	N/C	Not Connected
16	V_{DD2}	Drain Voltage 2

Absolute Maximum Ratings

Characteristic	Symbol	Value
Drain Voltage	V_{DD}	10 V
Bias Voltage	V_{SS}	-6 V
Reference Voltage	V_{REF}	6 V
Power Input	P_{IN}	12 dBm
Operating Temperature	T_{OPT}	-30 to 100°C
Storage Temperature	T_{STG}	-35 to 120°C

Saturated

Frequency (MHz)	Description	Typical Output Power (dBm)	Typical PAE (%)	Typical Gain (dB)	Supply Voltage (V)	Package	Part Number	Page Number
824-849	AMPS, Single Pos. Supply	30.0	60	25.0	4.80	SSOP-28 Batwing Slug	AP104-69	2-12
824-849	AMPS, High Efficiency	30.5	55	25.0	4.80, -2.75	SSOP-16 Slug	AP110-79	2-16
880-915	GSM, High Efficiency	34.5	55	22.5	3.50, -1.70	SSOP-16 Slug	AP112-79	2-18

GaAs IC Saturated Power Amplifier 824–849 MHz

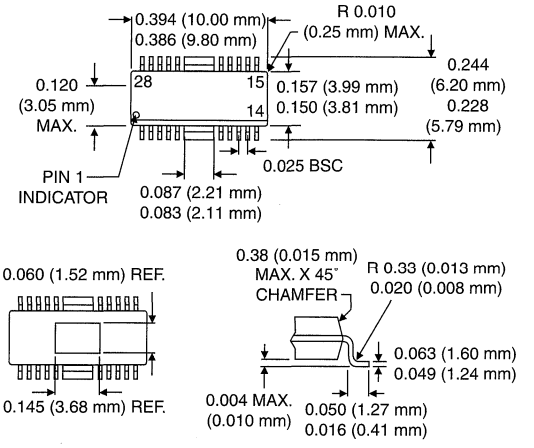
Alpha

AP104-69

Features

- Output Power up to 30 dBm
- +4.8 V Operation, Single Supply
- Efficiency Greater Than 55%
- High Power SSOP-28 Batwing Package with Slug
- DC/DC Converter

SSOP-28 Slug



Description

The AP104-69 is a low cost IC power amplifier designed for the 824–849 MHz frequency band. It features 4 cell battery operation, and high efficiency. A DC/DC converter supplies -3 V to the power amplifier and can supply 1.5 mA to an external circuit. The amplifier is designed to be stable over a temperature range of -30 to 100°C and over 7:1 VSWR loads.

Output Matching Circuit

The output match for the AP104-69 is provided externally in order to improve performance, reduce cost, and add flexibility. By making use of ceramic surface mount components with better Qs than GaAs matching elements, a lower loss matching network can be made. This lower loss results in higher power and efficiency for the amplifier. Also, by keeping these elements external the GaAs die size is reduced and the overall cost is less. This approach also permits the flexibility to tweak the amplifier for optimum performance at different powers, and/or frequencies.

The board schematic demonstrates one way to present the optimum load match while providing a path for the DC bias.

Electrical Specifications at 25°C

Characteristic	Condition	Frequency	Min.	Typ.	Max.	Unit
Output Power (Referenced at Output Pin)	$0<P_{IN}<7$	824–849 MHz		30		dBm
Efficiency	P_{OUT} = 29.5 dBm			60		%
Small Signal Gain	P_{IN} = -20 dBm			25		dB
Idle Current	P_{IN} = -60 dBm			75		mA
Noise in the Receive Band	P_{OUT} = 29.5 dBm R_X Band = 869–894 MHz R_X Bandwidth = 30 kHz			-100	-95	dBm
Reference Current	P_{OUT} = 29.5 dBm			1.0	5.0	mA
Input VSWR	P_{IN} = -30 to +7 dBm				2.5:1	
Harmonic Power	2fo 3fo			-25 -35		dBc
Input Impedance				50		Ω

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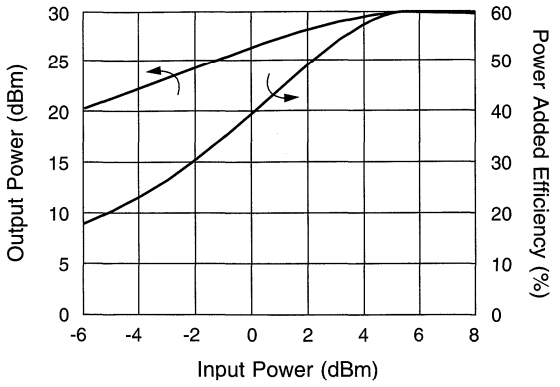
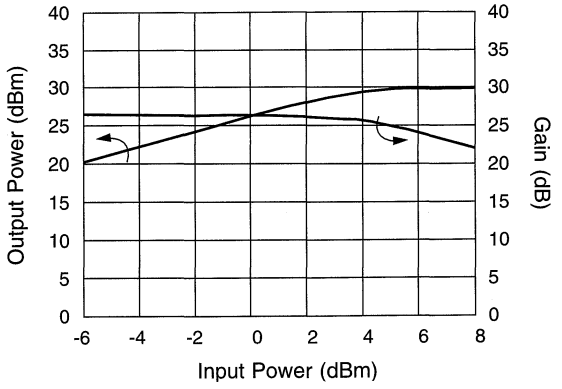
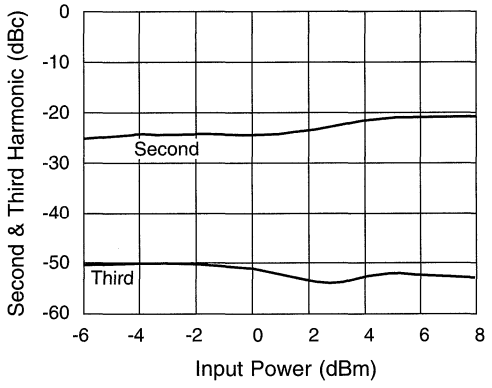
Typical Performance Data (824–849 MHz)



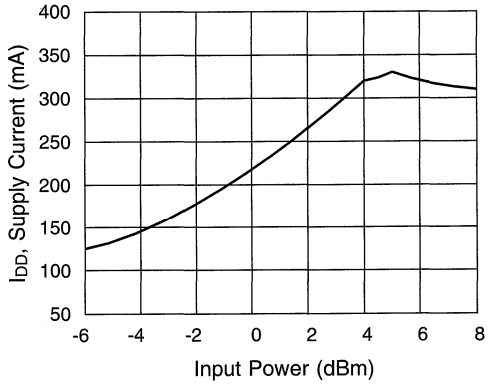
P_{OUT}, P.A.E. vs. P_{IN}



P_{OUT}, Gain vs. P_{IN}

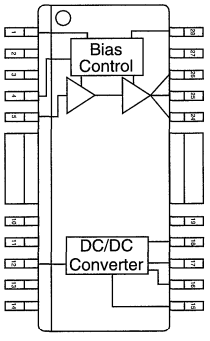


Second & Third Harmonic vs. P_{IN}



I_{DD} vs. P_{IN}

Pin Out



Pin Out Assignments

Pin 1: V_{REF}
Reference voltage for bias control circuitry. 1.2K resistor between this pin and Pin 28 needed to set nominal drain currents.

Pin 2: V_{GS2}
Second stage gate voltage tap. Should be bypassed as shown.

Pin 3: V_{DS1}
First stage drain bias feed. Requires a matching inductor with good RF bypassing and the +4.8 V nominal supply voltage.

Pin 4: V_{GS1}
First stage gate voltage tap. Requires similar RF bypassing as Pin 2 and a 22K resistor to properly bias the first stage.

Pin 5: RF In
RF input with a 33 pF series input matching capacitor.

Pin 6-14: GND
Connect to ground.

Pin 15: V_{GEN}
Supply voltage to DC/DC converter. Requires 3.75 V with 100 nF of bypassing.

Pin 16: $V_{SS\ OUT}$
Negative output voltage from DC/DC converter. Two bypassing capacitors, a 100 nF and a 33 pF capacitor, are required. This voltage should be supplied to the bias controller network at Pin 27. External circuitry (LCD display, driver amplifiers, etc.) can tap off the negative voltage at this point. A maximum of 2 mA can be supplied.

Pin 17: CB
Switched capacitor for DC/DC converter. A 100 nF capacitor must be connected between Pin 17 and Pin 18 with a minimal distance between the capacitor and the chip.

Pin 18: CA
Switched capacitor for DC/DC converter, shared with Pin 17.

Pin 19–23: GND
Connect to ground.

Pin 24–26: RF Out/V_{DD2}
RF output and bias injection for the second stage drain. Output matching circuitry is required to transform the optimum load impedance to 50 Ω. The circuit must also provide a path for the +4.8 V DC bias and have good RF bypassing.

Pin 27: $V_{SS\ IN}$
Negative voltage for the bias controller circuit. The negative voltage from the DC/DC converter, Pin 16, should be fed to this pin.

Pin 28: V_{DD}
Bias controller supply voltage. The regulated +3.75 V supply must be connected to this pin. Disconnecting this voltage will turn the PA bias off. A switch at this pin can turn the PA on or off while leaving V_{GEN} connected and the negative supply unchanged. A 1.2K resistor must be connected between this pin and Pin 1.

Pin Out Table

Terminal	Symbol	Function
1	V_{REF}	Reference Voltage
2	V_{GS2}	Gate Voltage 2
3	V_{DS1}	Drain Supply Voltage 1
4	V_{GS1}	Gate Voltage 1
5	RF In	RF Input
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	GND	Ground
11	GND	Ground
12	GND	Ground
13	GND	Ground
14	V_{REF}	Voltage Generator Ground
15	V_{GEN}	Generator Voltage
16	$V_{SS\ OUT}$	Negative Bias Voltage Out
17	CB	Generator Flying Cap
18	CA	Generator Flying Cap
19	GND	Ground
20	GND	Ground
21	GND	Ground
22	GND	Ground
23	GND	Ground
24	RF Out/V_{DS2}	RF Output/Supply Voltage 2
25	RF Out/V_{DS2}	RF Output/Supply Voltage 2
26	RF Out/V_{DS2}	RF Output/Supply Voltage 2
27	$V_{SS\ IN}$	Negative Bias Voltage In
28	V_{DD}	Positive Bias Voltage

Bias Controller Circuit

An on-chip bias controller circuit eliminates the need to individually adjust the gate bias voltages. This circuit uses 3.75 V and the negative voltage from the DC converter (-2.7 V to -3.75 V) to set the gate voltages on each stage for the proper bias current.

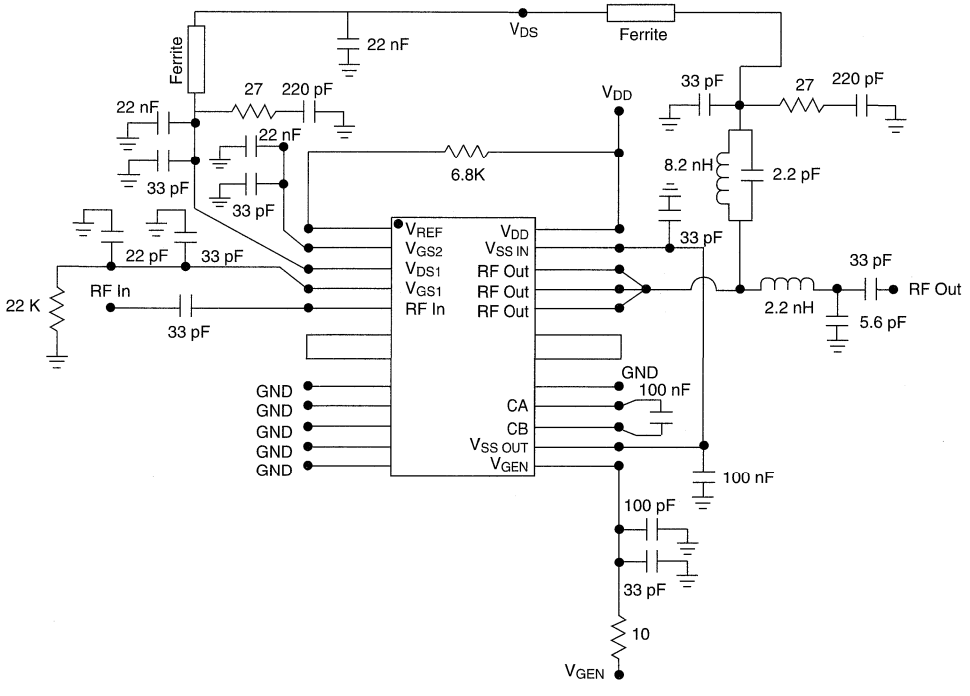
Standby Mode

The power amplifier should be turned off whenever possible in order to reduce the overall power consumption. The AP104 can be turned off in several ways. The simplest is to switch the bias controller supply voltage (Pin 28) open. The gate bias voltages are in turn reduced from their nominal voltages to V_{SS}, resulting in a PA bias current of less than 1 mA. Additional PMOS switches in the drain lines drop the bias-off currents to <10 µA.

Absolute Maximum Ratings

Characteristic	Symbol	Value
Drain Voltage	V_{DD}	10 V
Bias Voltage	V_{SS}	-6 V
Reference Voltage	V_{REF}	6 V
Power Input	P_{IN}	12 dBm
Operating Temperature	T_{OPT}	-30°C to 100°C
Storage Temperature	T_{STG}	-35°C to 120°C

Circuit Layout



GaAs IC AMPS/ETACS Power Amplifier

Alpha

AP110-79

Features

- Output Power Up to 31 dBm
- 4.8 V Operation
- Efficiency Greater Than 55%
- High Power SSOP-16 Package with Slug

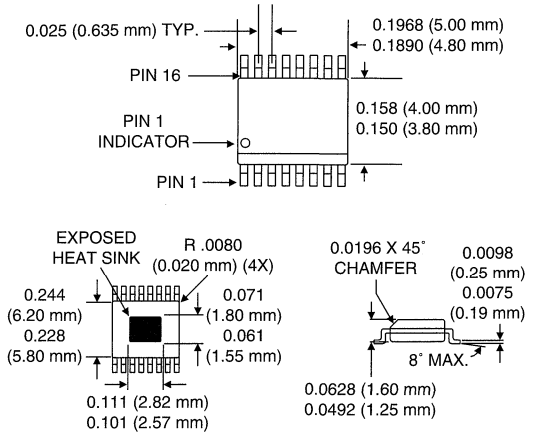
Description

The AP110-79 is a low cost IC power amplifier designed for the 824–849 MHz frequency band. It features 4 cell battery operation and high efficiency. The amplifier is designed to be stable over a temperature range of -30 to 100°C and over 7:1 VSWR loads.

Output Matching Circuit

The output match for the AP110-79 is provided externally in order to improve performance, reduce cost, and add flexibility. By making use of ceramic surface mount components with better Qs than GaAs matching elements, a lower loss matching network can be made. This lower loss results in higher power and efficiency for the amplifier. Also, by keeping these elements external the GaAs die size is reduced and the overall cost is less. This approach also permits the flexibility to tweak the amplifier for optimum performance at different powers, and/or frequencies.

SSOP-16 Slug



Electrical Specifications at 25°C

Characteristic	Condition	Frequency	Min.	Typ.	Max.	Unit
Output Power	$0<P_{IN}<7$	824–849 MHz		30.5		dBm
Efficiency	P_{OUT} = 30.5 dBm			55		%
Small Signal Gain	P_{IN} = -20 dBm			25		dB
Idle Current	P_{IN} = -60 dBm			75		mA
Noise in the Receive Band	P_{OUT} = 29.5 dBm R_X Band = 869–894 MHz R_X Bandwidth = 30 kHz			-100	-95	dBm
Input VSWR	P_{IN} = -30 to +7 dBm				2.5:1	
Harmonic Power	2fo 3fo			-25 -35		dBc
Input Impedance				50		Ω

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Pin Out Assignments

Pin 1: V_{DD}
Bias controller supply voltage. The regulated +3.75 V supply must be connected to this pin. Disconnecting this voltage will turn the PA bias off. A switch at this pin can turn the PA on or off while leaving V_{SS} applied. A 6.8K resistor must be connected between this pin and Pin 2.

Pin 2: V_{REF}
Reference voltage for bias control circuitry. A 6.8K resistor between this pin and Pin 1 is needed to set nominal drain currents.

Pin 3: V_{GS2}
Second stage gate voltage tap.

Pin 4: V_{DS1}
First stage drain bias feed. Requires a matching inductor with good RF bypassing and the +4.8 V nominal supply voltage.

Pin 5: V_{GS1}
First stage gate voltage tap. Requires a 22K resistor to properly bias the first stage.

Pin 6: RF In
RF input with a 33 pF series input matching capacitor.

Pin 7-11: GND
Connect to ground.

Pin 12-13: RF Out/V_{DS2}
RF output and bias injection for the second stage drain. Output matching circuitry is required to transform the optimum load impedance to 50 Ω. The circuit must also provide a path for the +4.8 V DC bias and have good RF bypassing.

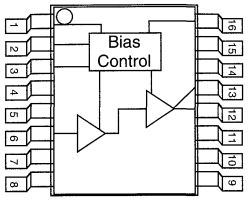
Pin 14-15: GND
Connect to ground.

Pin 16: V_{SS}
Negative bias supply voltage is -2.75 V. Two bypassing capacitors, a 100 nF and a 33 pF capacitor, are required.

Absolute Maximum Ratings

Characteristic	Symbol	Value
Drain Voltage	V_{DS}	10 V
Positive Bias Voltage	V_{DD}	6 V
Negative Bias Voltage	V_{SS}	-6 V
Power Input	P_{IN}	12 dBm
Operating Temperature	T_{OPT}	-30 to 100°C
Storage Temperature	T_{STG}	-35 to 120°C

Pin Out



Pin Configuration

Terminal	Symbol	Function
1	V_{DD}	Positive Bias Voltage In
2	V_{REF}	Reference Voltage
3	V_{GS2}	Gate Voltage 2
4	V_{DS1}	Drain Supply Voltage 1
5	V_{GS1}	Gate Voltage 1
6	RF In	RF Input
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	GND	Ground
11	GND	Ground
12	RF Out/V_{DS2}	RF Out/Drain Supply Voltage 2
13	RF Out/V_{DS2}	RF Out/Drain Supply Voltage 2
14	GND	Ground
15	GND	Ground
16	V_{SS}	Negative Bias Voltage In

Standby Mode

The power amplifier should be turned off whenever possible in order to reduce the overall power consumption. The AP110 can be turned off in several ways. The simplest is to switch the bias controller supply voltage (Pin 1) open. The gate bias voltages are in turn reduced from their nominal voltages to V_{SS}, resulting in a PA bias current of less than 1 mA. Additional PMOS switches in the drain lines drop the bias-off currents to <10 µA.

Bias Controller Circuit

An on-chip bias controller circuit eliminates the need to individually adjust the gate bias voltages. This circuit uses +3.75 V and the negative voltage (-2.75 V) to set the gate voltages on each stage for the proper bias current.

GaAs IC GSM Power Amplifier

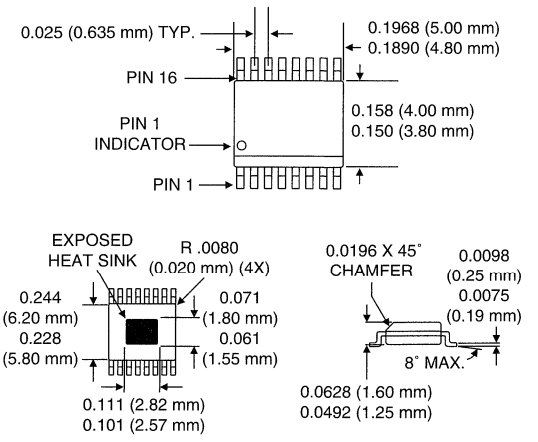
Alpha

AP112-79

Features

- Output Power up to 35 dBm
- 3.5 V Operation
- Efficiency Typically 55%
- High Power SSOP-16 Package with Slug
- Wide Power Control Range (50 dB)

SSOP-16 Slug



Description

The AP112-79 is a low cost IC power amplifier designed for the 880–915 MHz frequency band. It features 3 cell battery operation and high efficiency. The AP112 has external matching for improved performance and flexibility.

Output Matching Circuit

The output match for the AP112-79 is provided externally in order to improve performance, reduce cost, and add flexibility. By making use of ceramic surface mount components with better Qs than GaAs matching elements, a lower loss matching network can be made. This lower loss results in higher power and efficiency for the amplifier. Also, by keeping these elements external the GaAs die size is reduced and the overall cost is less. This approach also permits the flexibility to tweak the amplifier for optimum performance at different powers, and/or frequencies.

Electrical Specifications at 25°C

Characteristic	Condition	Frequency	Min.	Typ.	Max.	Unit
Output Power	P_{IN} = +12 dBm V_{DS} = 3.5 V	880–915 MHz	34.5	35		dBm
Efficiency	P_{OUT} = 34.5 dBm			55		%
Noise in the Receive Band	P_{OUT} = 33.0 dBm R_X Band = 925–960 MHz R_X Bandwidth = 100 kHz			-90	-85	dBm
Input VSWR				2:1	2.5:1	
Harmonic Power	2fo, 3fo, 4fo			-30	-28	dBc
Power Control Range V_{GG}	P_{OUT} < -10 dBm P_{IN} = +12 dBm			-2.5		V
	P_{OUT} > 34.5 dBm P_{IN} = +12 dBm			<-1.2		V

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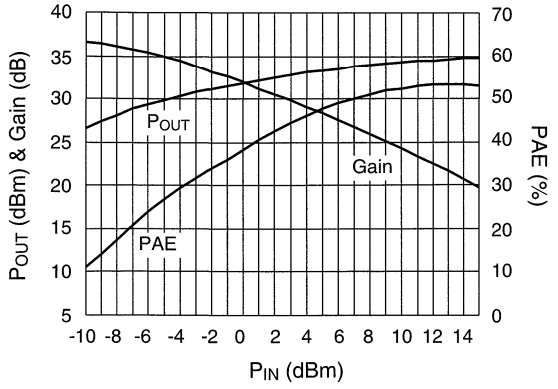
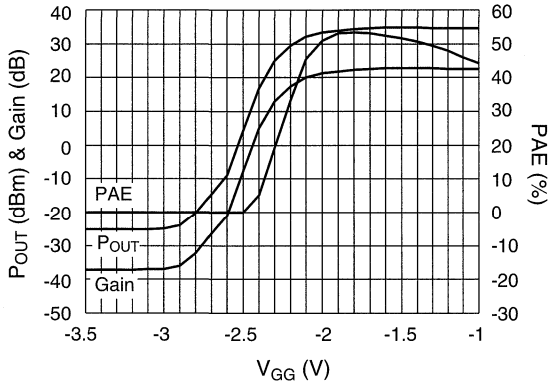
Typical Performance Data

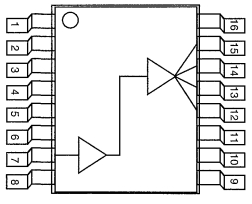


GSM 3.5 V Power Performance
V_G = -1.7, V_{DD} = 3.5, Frequency = 902 MHz



GSM 3.5 V Gate Sweep
P_{IN} = 12 dBm, V_{DD} = 3.5, Frequency = 902 MHz

Pin Out



Pin Out Assignments

Pin 1: Ground
Connect to ground.

Pin 2: V_{GS2}
Gate bias for stage two FET. Tuning and bypassing components required.

Pin 3: No Connect

Pin 4: V_{DS1}
Drain bias for stage one FET. Tuning and bypassing components required.

Pin 5: No Connect

Pin 6: Ground
Connect to ground.

Pin 7: RF In
RF input. Tuning and DC blocking components required.

Pin 8: V_{GS1}
Gate bias for stage one FET. Tuning and bypassing components required.

Pin 9: Ground
Connect to ground.

Pin 10: Ground
Connect to ground.

Pin 11: No Connect

Pin 12: RF Out
RF output and drain bias for stage two FET. Tuning and DC blocking components required.

Pin 13: RF Out
RF output and drain bias for stage two FET.

Pin 14: RF Out
RF output and drain bias for stage two FET.

Pin 15: RF Out/V_{DS2}
RF output and drain bias for stage two FET.

Pin 16: Ground
Connect to ground.

Pin Configuration

Terminal	Symbol	Function
1	GND	Ground
2	V_{GS2}	Gate Voltage 2
3	N/C	Not Connected
4	V_{DS1}	Drain Voltage 1
5	N/C	Not Connected
6	GND	Ground
7	RF In	RF Input
8	V_{GS1}	Gate Voltage 1
9	GND	Ground
10	GND	Ground
11	N/C	Not Connected
12	RF Out	RF Output
13	RF Out	RF Output
14	RF Out	RF Output
15	RF Out/V_{DS2}	RF Output/Drain Voltage 2
16	GND	Ground

Section 3
Passive Products

Plastic Packaged Directional Couplers

Frequency (GHz)	Insertion Loss (db) Typ.	Isolation (db) Typ.	Input VSWR Typ.	Output VSWR Typ.	Coupling (db) Typ.	Coupled Port VSWR Typ.	Package	Part Number	Page Number
0.81–0.96	0.20	30	1.1:1	1.1:1	19.8	1.1:1	SOT-6	DC09-73	3-2
1.42–1.66	0.20	34	1.1:1	1.1:1	18.4	1.1:1	SOT-6	DC15-73	3-5
1.71–1.99	0.20	38	1.1:1	1.1:1	18.8	1.2:1	SOT-6	DC18-73	3-8
2.30–2.60	0.20	33	1.1:1	1.1:1	17.2	1.3:1	SOT-6	DC25-73	3-11

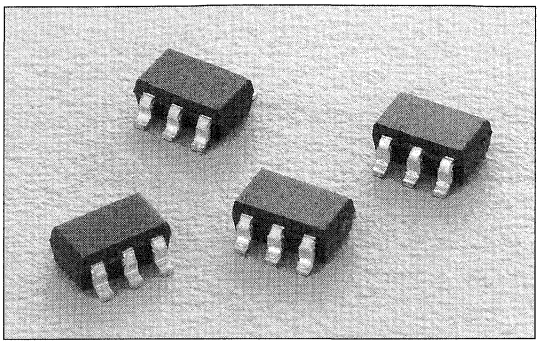
Directional Coupler 0.81–0.96 GHz

Alpha

DC09-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



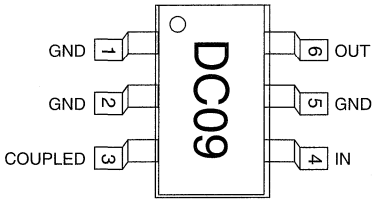
Description

The DC09-73 is a monolithic directional coupler tailored to the 0.81–0.96 GHz band. It offers low loss, good isolation, good input/output matching and exceptional coupling repeatability. It is available in the SOT-6 lead surface mount package.

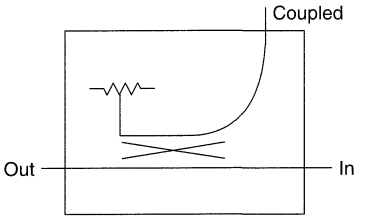
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	0.81		0.96	GHz
Insertion Loss		0.2	0.3	dB
Isolation	27	30		dB
Input VSWR		1.1:1	1.3:1	
Output VSWR		1.1:1	1.3:1	
Coupling	20.8	19.8	18.8	dB
Coupled Port VSWR		1.1:1	1.3:1	

Pin Out



Block Diagram



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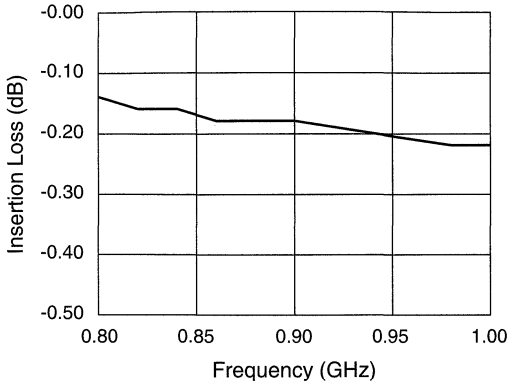
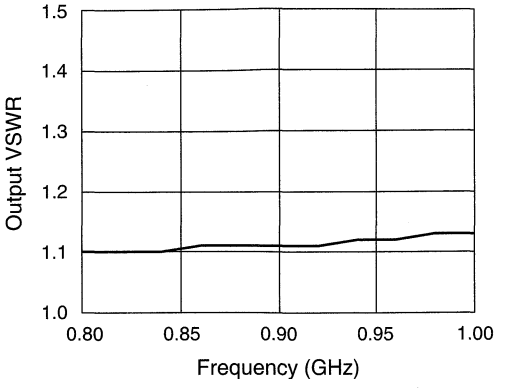
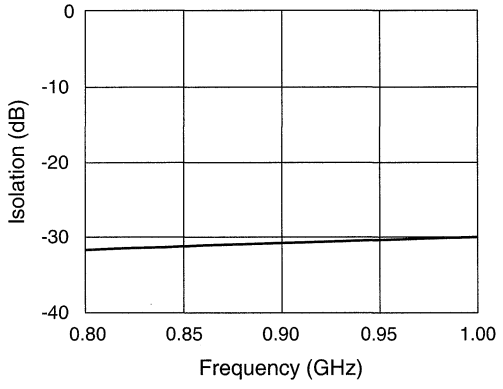
Typical Performance Data



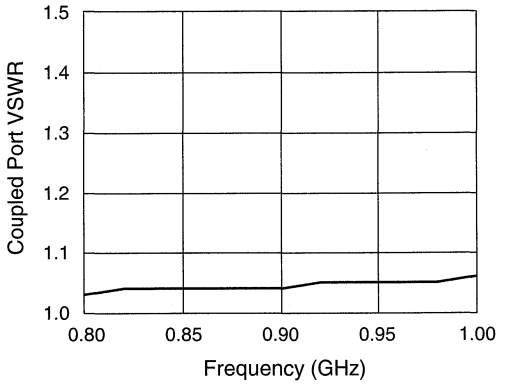
Insertion Loss vs. Frequency



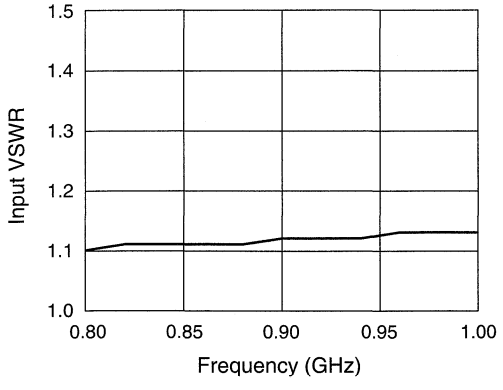
Output VSWR vs. Frequency



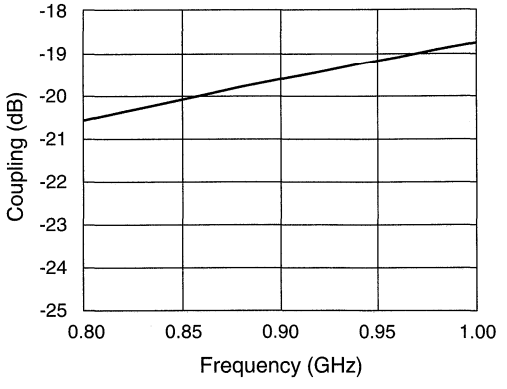
Isolation vs. Frequency



Coupled Port VSWR vs. Frequency



Input VSWR vs. Frequency



Coupling vs. Frequency

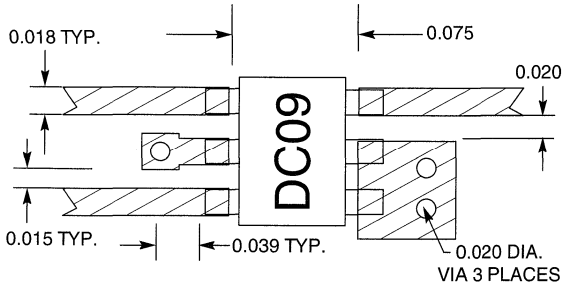
3

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	4.0 W CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

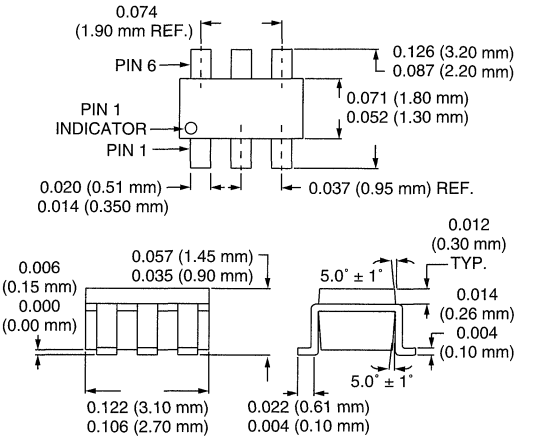
1. When operating with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



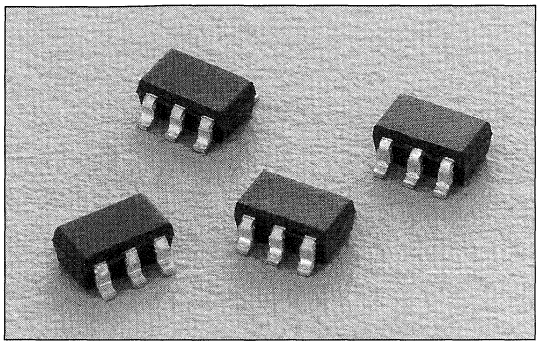
Directional Coupler 1.42–1.66 GHz

Alpha

DC15-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



Description

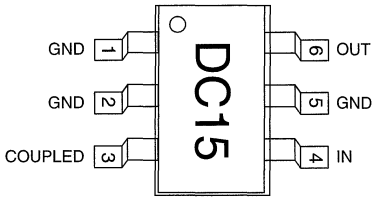
The DC15-73 is a monolithic directional coupler tailored to the 1.42–1.66 GHz band. It offers low loss, good isolation, good input/output matching and exceptional coupling repeatability. It is available in the SOT-6 lead surface mount package.

3

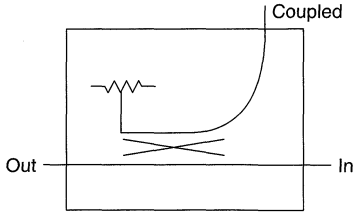
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.42		1.66	GHz
Insertion Loss		0.2	0.3	dB
Isolation	30	34		dB
Input VSWR		1.1:1	1.3:1	
Output VSWR		1.1:1	1.3:1	
Coupling	19.4	18.4	17.4	dB
Coupled Port VSWR		1.1:1	1.3:1	

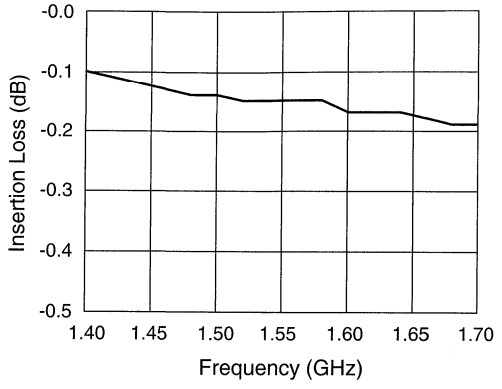
Pin Out



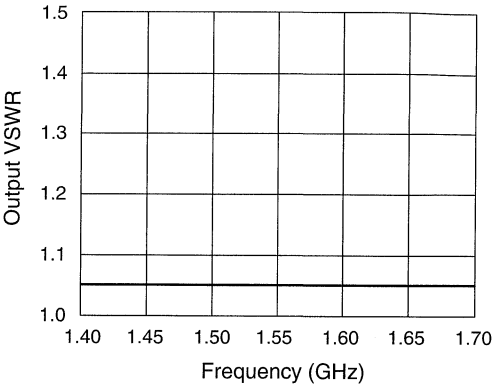
Block Diagram



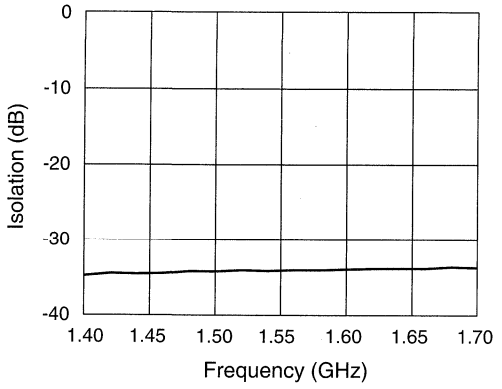
Typical Performance Data



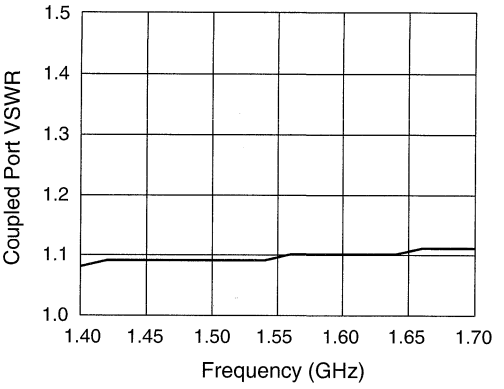
Insertion Loss vs. Frequency



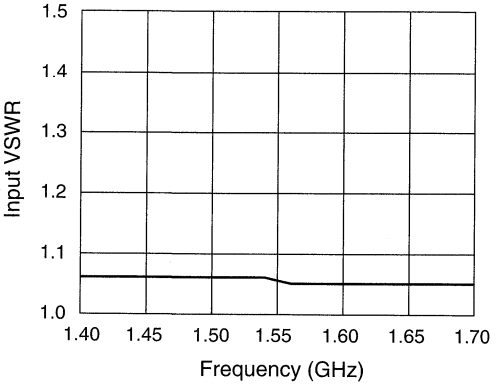
Output VSWR vs. Frequency



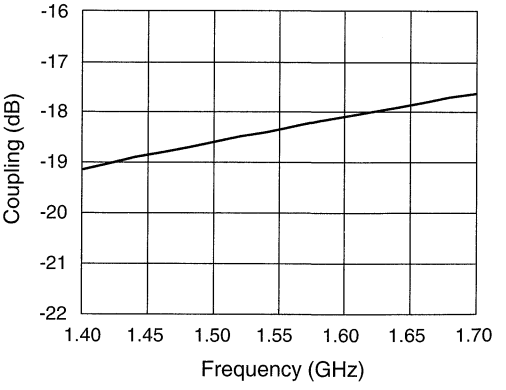
Isolation vs. Frequency



Coupled Port VSWR vs. Frequency



Input VSWR vs. Frequency



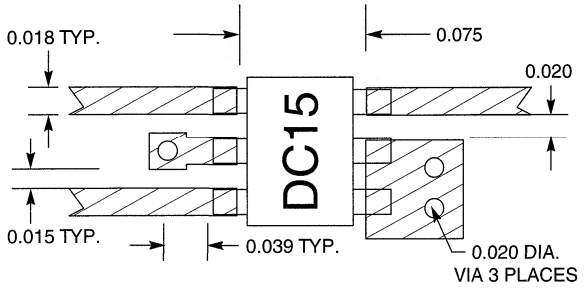
Coupling vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	4.0 W CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

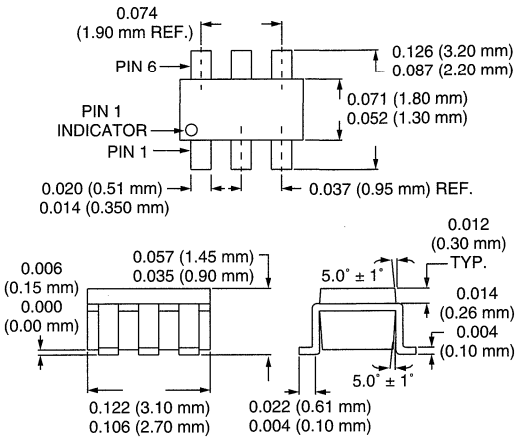
1. When operating with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



3

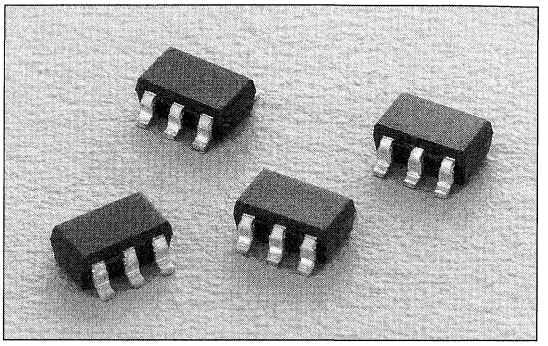
Directional Coupler 1.71–1.99 GHz

Alpha

DC18-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



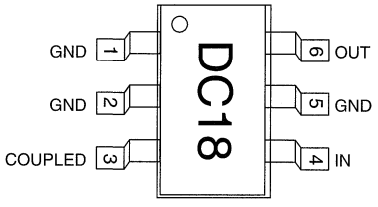
Description

The DC18-73 is a monolithic directional coupler tailored to the 1.71–1.99 GHz band. It offers low loss, good isolation, good input/output matching and exceptional coupling repeatability. It is available in the SOT-6 lead surface mount package.

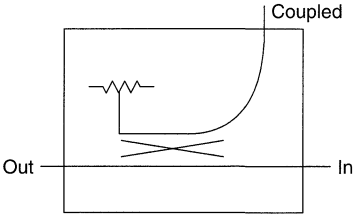
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.71		1.99	GHz
Insertion Loss		0.2	0.3	dB
Isolation	30	38		dB
Input VSWR		1.1:1	1.3:1	
Output VSWR		1.1:1	1.3:1	
Coupling	19.8	18.8	17.8	dB
Coupled Port VSWR		1.2:1	1.4:1	

Pin Out



Block Diagram



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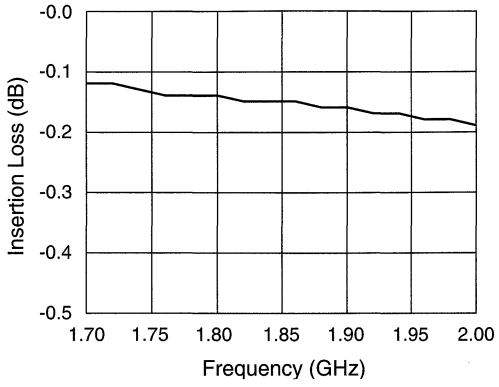
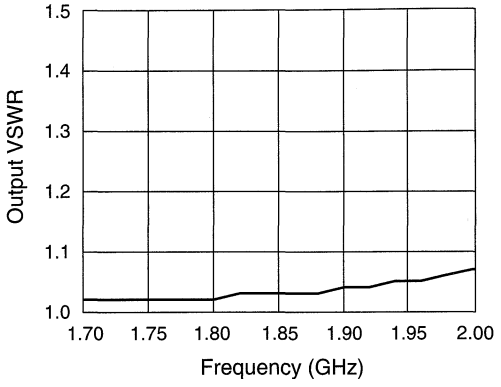
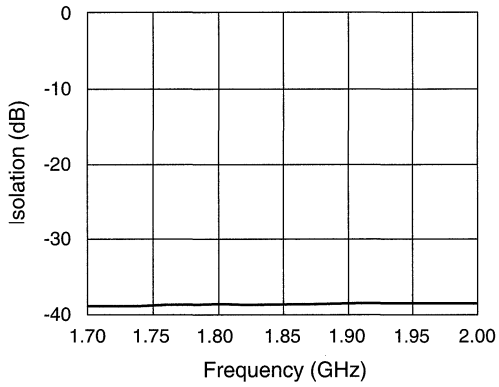
Typical Performance Data



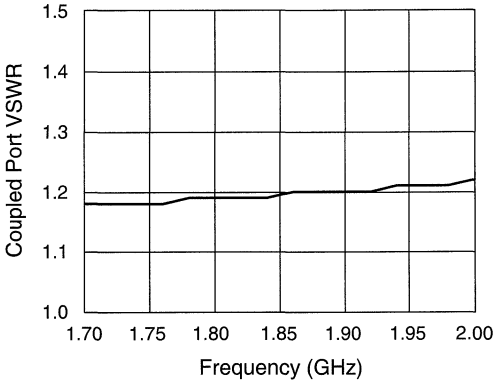
Insertion Loss vs. Frequency



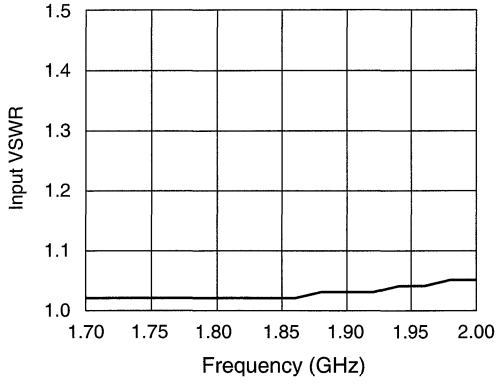
Output VSWR vs. Frequency



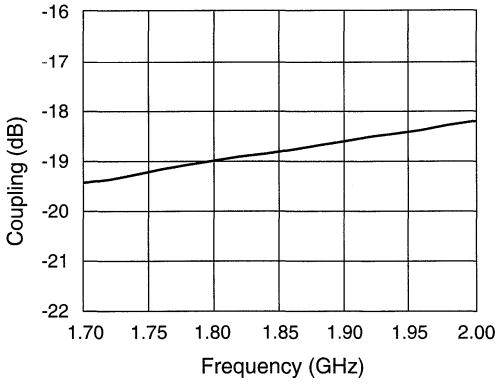
Isolation vs. Frequency



Coupled Port VSWR vs. Frequency



Input VSWR vs. Frequency



Coupling vs. Frequency

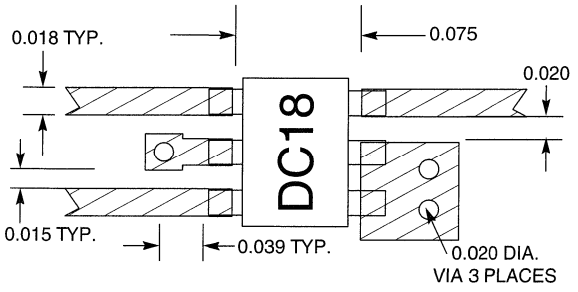
3

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	4.0 W CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

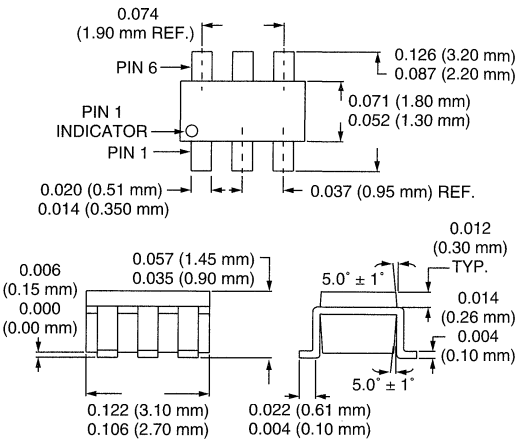
1. When operating with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



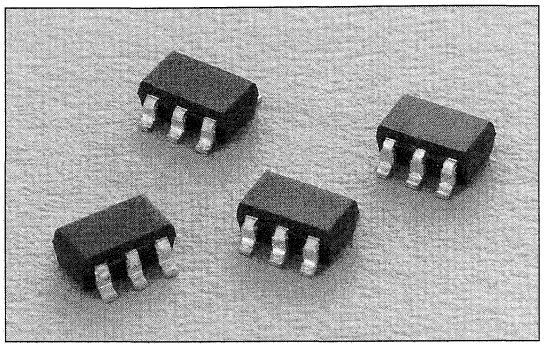
Directional Coupler 2.30–2.60 GHz

Alpha

DC25-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



Description

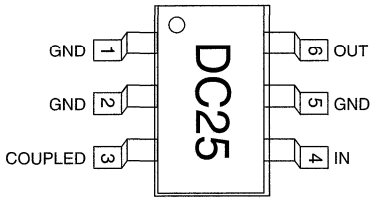
The DC25-73 is a monolithic directional coupler tailored to the 2.30–2.60 GHz band. It offers low loss, good isolation, good input/output matching and exceptional coupling repeatability. It is available in the SOT-6 lead surface mount package.

3

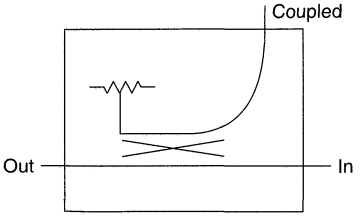
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	2.30		2.60	GHz
Insertion Loss		0.2	0.3	dB
Isolation	30	33		dB
Input VSWR		1.1:1	1.3:1	
Output VSWR		1.1:1	1.3:1	
Coupling	18.2	17.2	16.2	dB
Coupled Port VSWR		1.3:1	1.5:1	

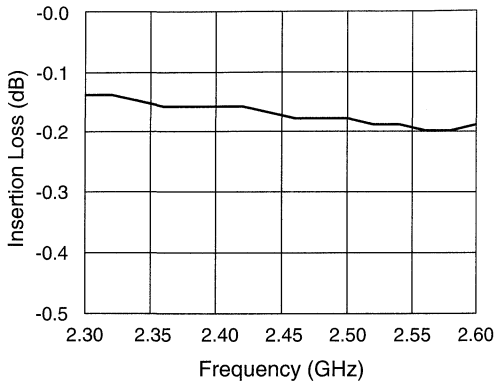
Pin Out



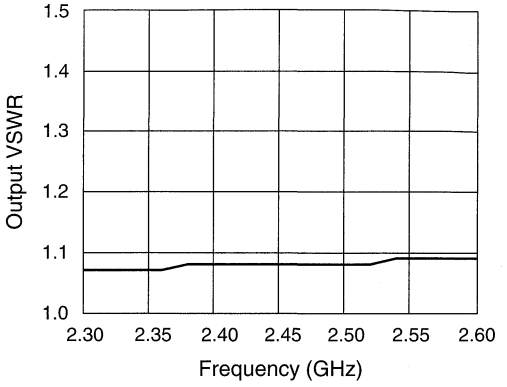
Block Diagram



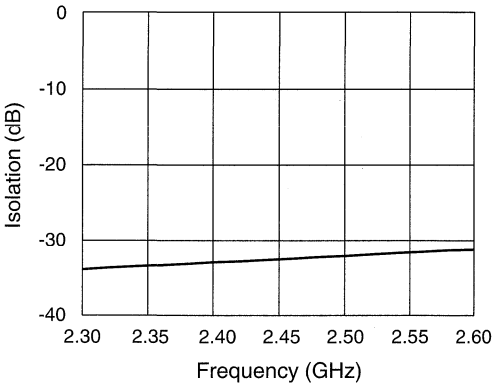
Typical Performance Data



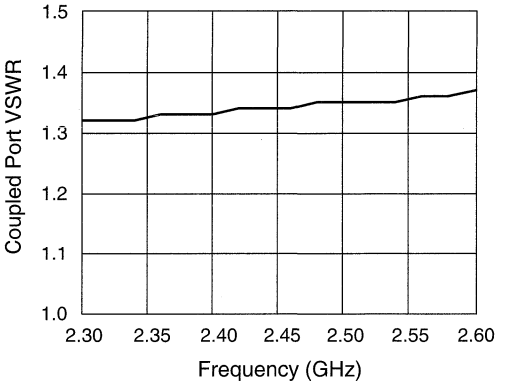
Insertion Loss vs. Frequency



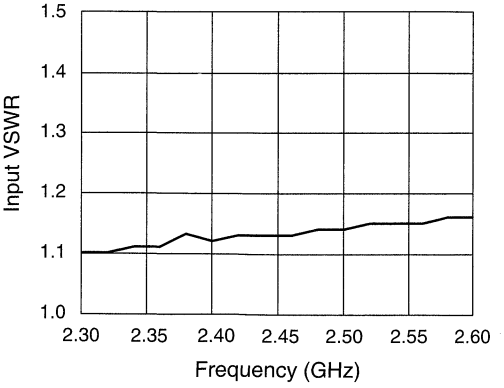
Output VSWR vs. Frequency



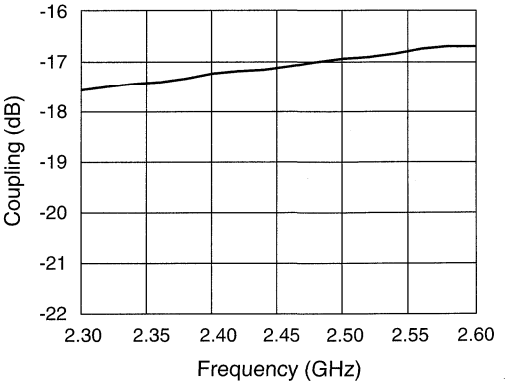
Isolation vs. Frequency



Coupled Port VSWR vs. Frequency



input VSWR vs. Frequency



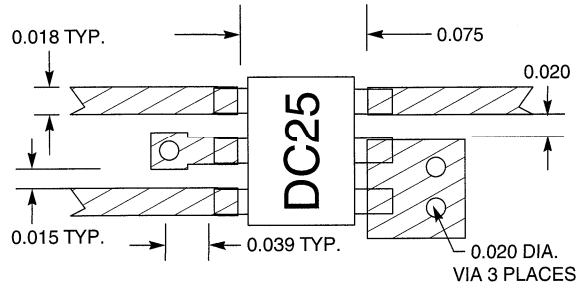
Coupling vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	4.0 W CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

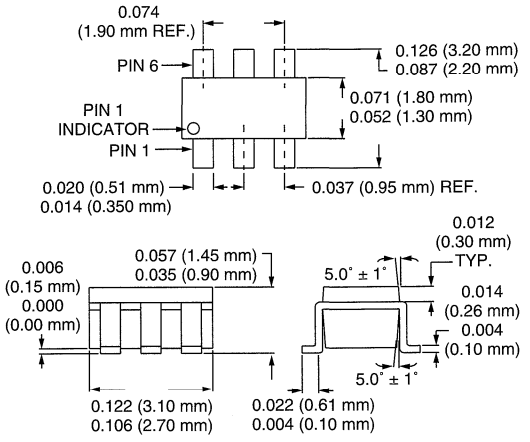
1. When operating with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



3

Plastic Packaged Power Dividers – 2 Way

Frequency (GHz)	Insertion Loss Less 3 dB Split Typ.	Isolation (db) Typ.	Input VSWR Typ.	Output VSWR Typ.	AMP Balance (db)	Phase Balance (Deg.) Typ.	Total Max. Power w/2.0:1 All Ports	Package	Part Number	Page Number
0.81–0.96	0.40	25	1.2:1	1.3:1	± 0.1	±1.0	1.5 W	SOIC-8	PD09-12	3-16
1.42–1.66	0.40	23	1.2:1	1.2:1	±0.1	±1.0	1.5 W	SOIC-8	PD15-12	3-19
1.71–1.99	0.40	23	1.3:1	1.2:1	±0.1	±1.0	1.5 W	SOIC-8	PD18-12	3-22
0.81–0.96	0.40	25	1.2:1	1.3:1	±0.1	±1.0	1.5 W	SOT-6	PD09-73	3-25
1.42–1.66	0.40	23	1.2:1	1.2:1	±0.1	±1.0	1.5 W	SOT-6	PD15-73	3-28
1.71–1.99	0.40	23	1.3:1	1.2:1	±0.1	±1.0	1.5 W	SOT-6	PD18-73	3-31

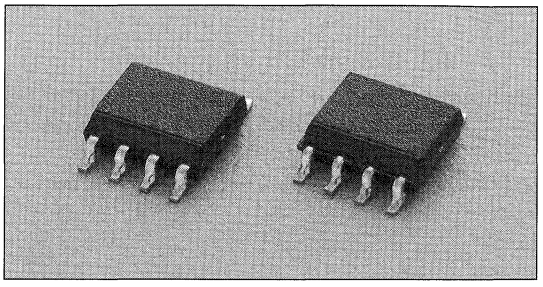
Two-Way 0° Power Splitter Combiner 0.81–0.96 GHz

Alpha

PD09-12

Features

- Low Cost
- Low Profile
- Available in Small SOIC-8 Package
- Tape & Reel



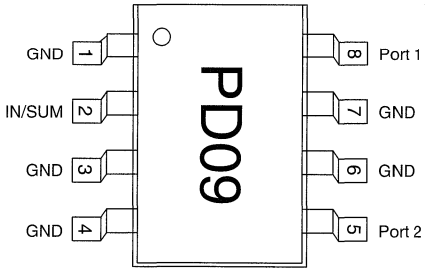
Description

The PD09-12 is a monolithic two-way in-phase hybrid junction tuned for the 0.81–0.96 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

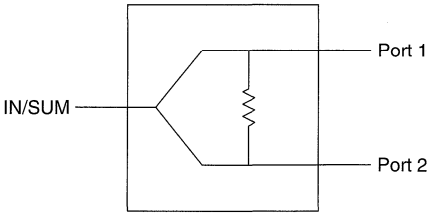
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	0.81		0.96	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	20	25		dB
Input VSWR		1.2:1	1.4:1	
Output VSWR		1.3:1	1.5:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

Pin Out



Block Diagram



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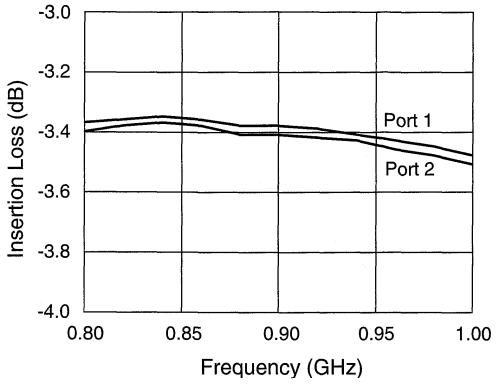
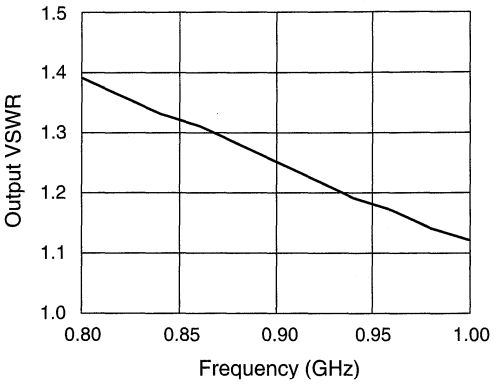
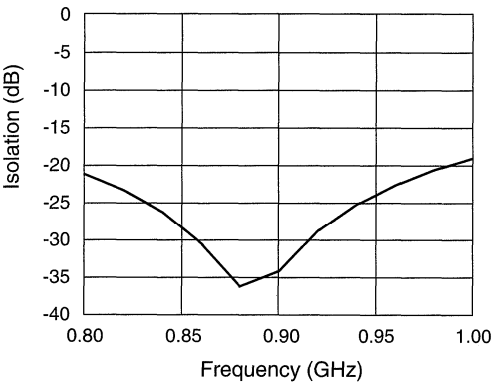
Typical Performance Data



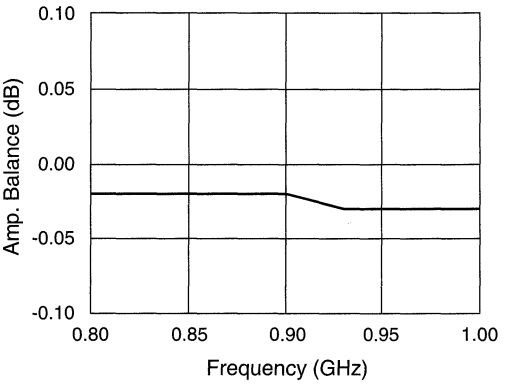
Insertion Loss vs. Frequency



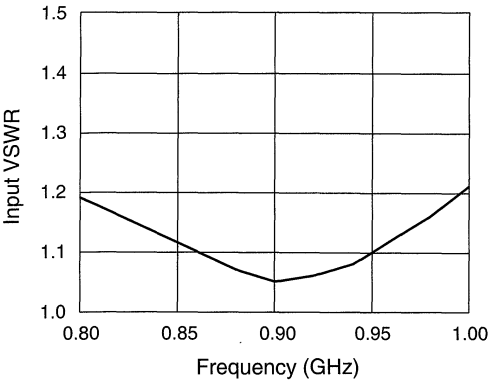
Output VSWR vs. Frequency



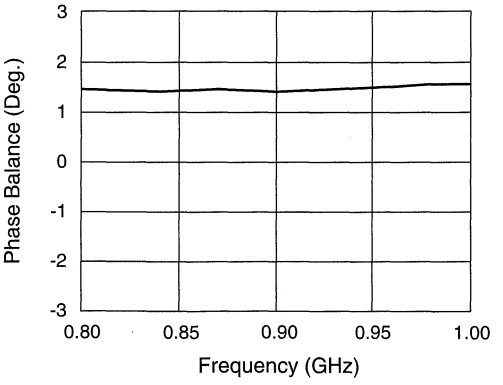
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



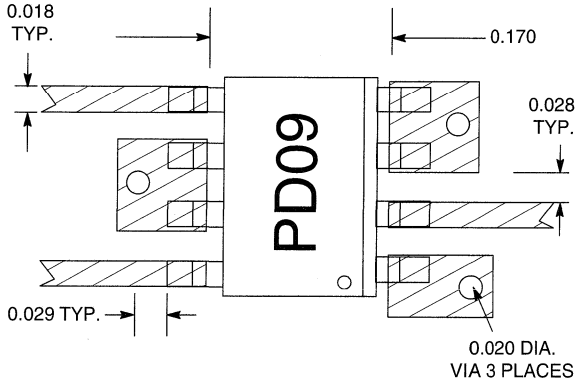
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.75 CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

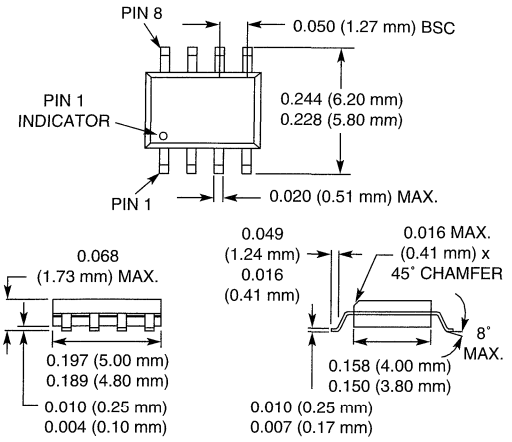
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOIC-8



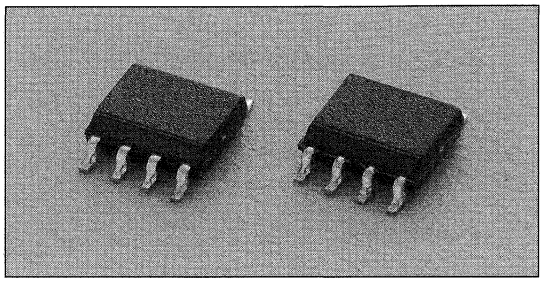
Two-Way 0° Power Splitter Combiner 1.42–1.66 GHz

Alpha

PD15-12

Features

- Low Cost
- Low Profile
- Available in Small SOIC-8 Package
- Tape & Reel



Description

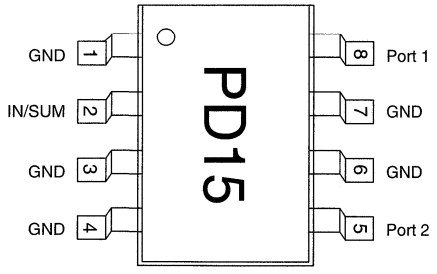
The PD15-12 is a monolithic two-way in-phase hybrid junction tuned for the 1.42–1.66 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

3

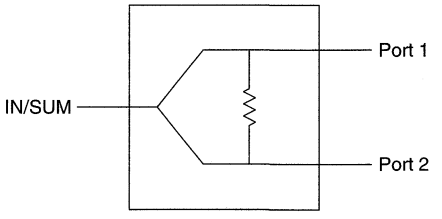
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.42		1.66	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	20	23		dB
Input VSWR		1.2:1	1.5:1	
Output VSWR		1.2:1	1.4:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

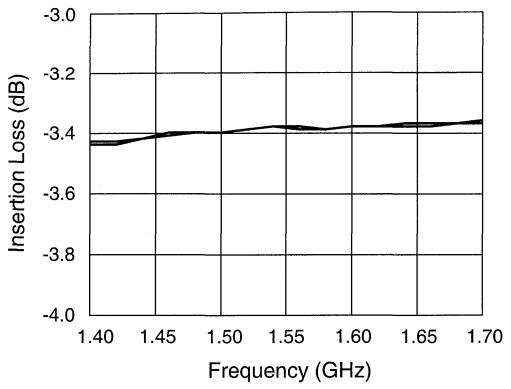
Pin Out



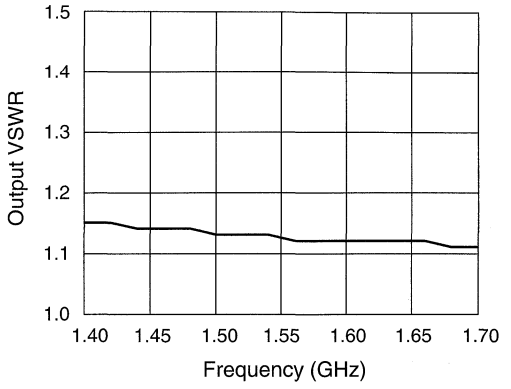
Block Diagram



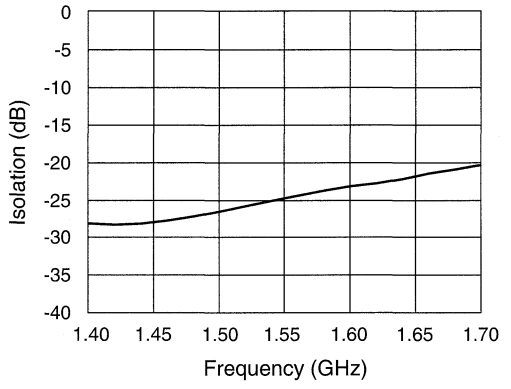
Typical Performance Data



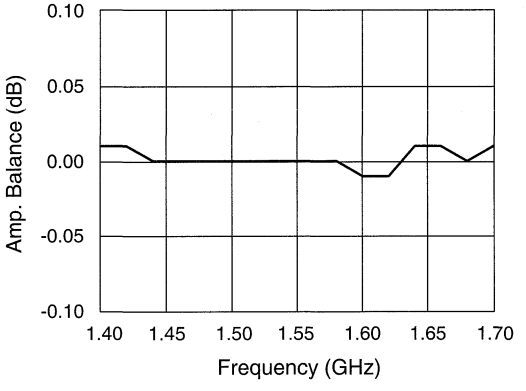
Insertion Loss vs. Frequency



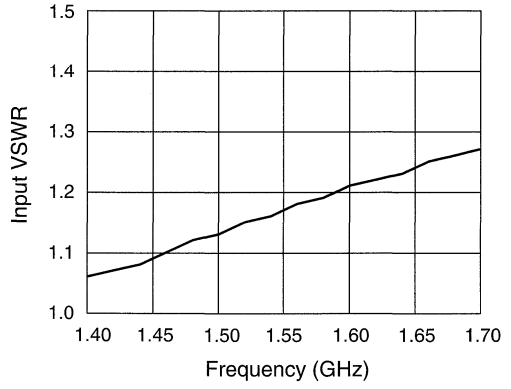
Output VSWR vs. Frequency



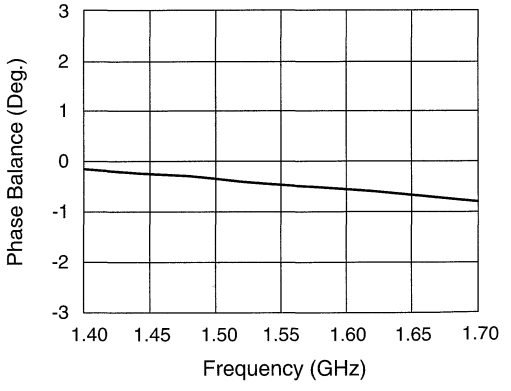
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



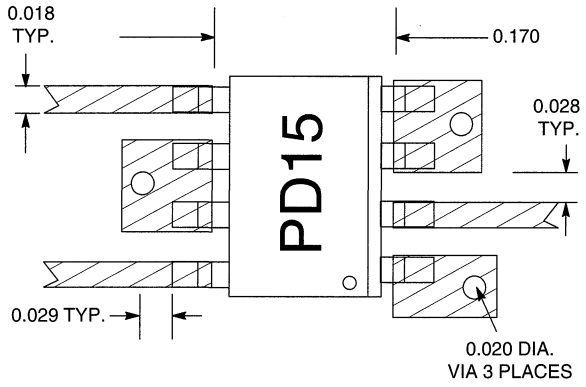
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.75 CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

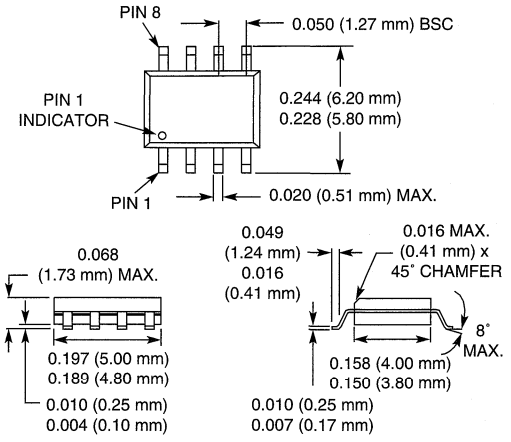
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOIC-8



3

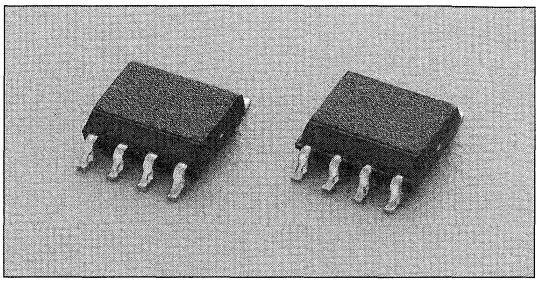
Two-Way 0° Power Splitter Combiner 1.71–1.99 GHz

Alpha

PD18-12

Features

- Low Cost
- Low Profile
- Available in Small SOIC-8 Package
- Tape & Reel



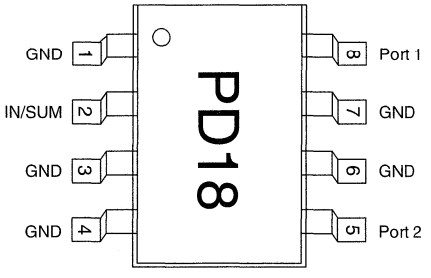
Description

The PD18-12 is a monolithic two-way in-phase hybrid junction tuned for the 1.71–1.99 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

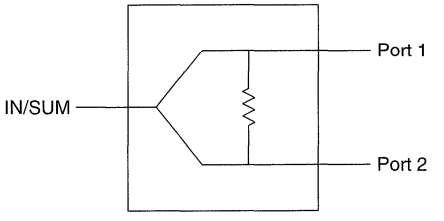
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.71		1.99	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	20	23		dB
Input VSWR		1.3:1	1.5:1	
Output VSWR		1.2:1	1.4:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

Pin Out



Block Diagram



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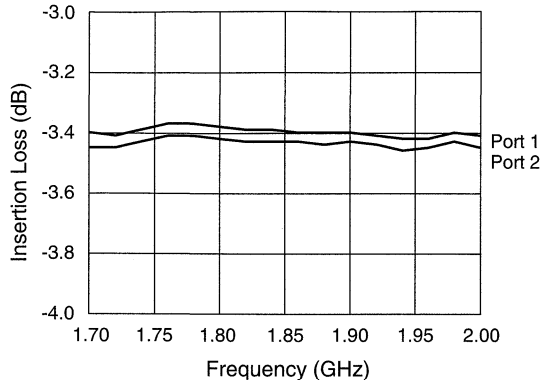
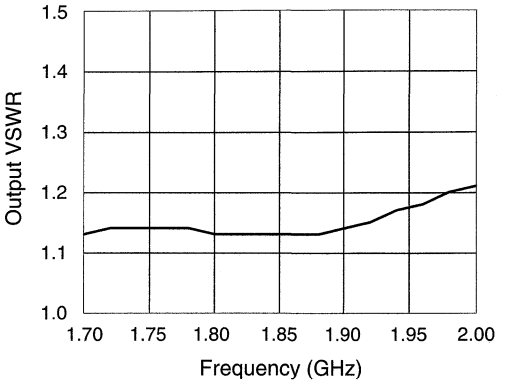
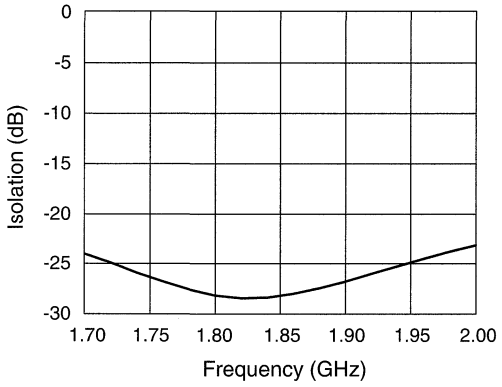
Typical Performance Data



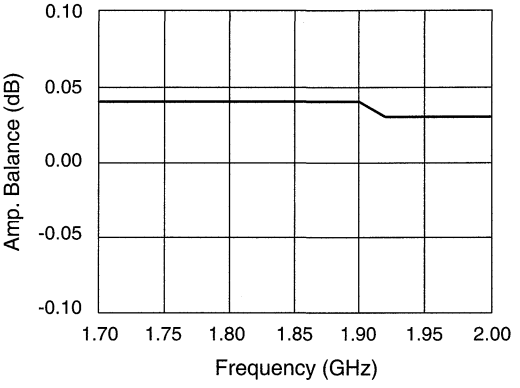
Insertion Loss vs. Frequency



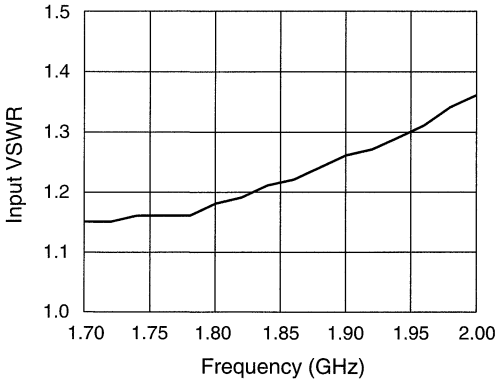
Output VSWR vs. Frequency



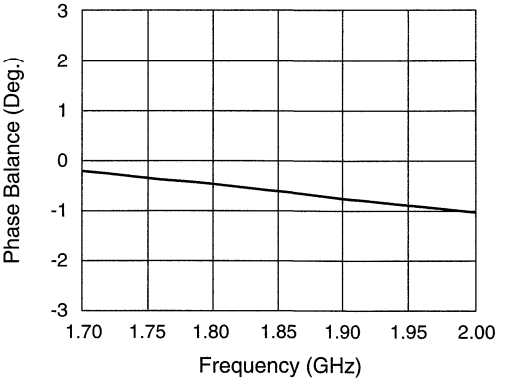
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



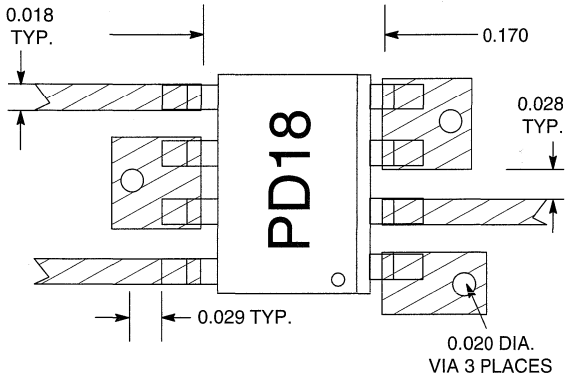
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.75 CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

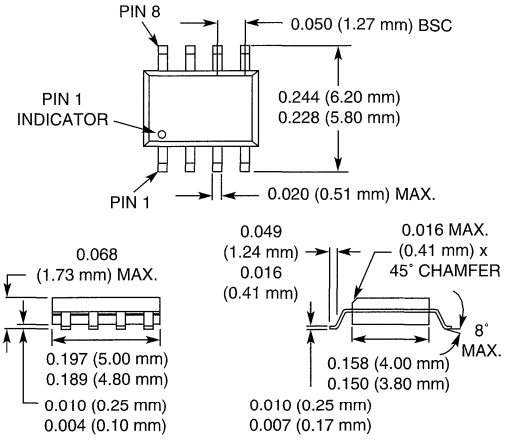
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOIC-8



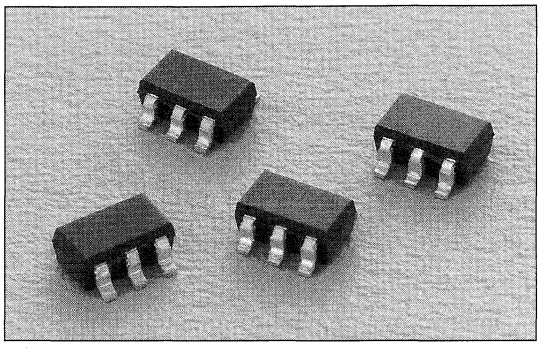
Two-Way 0° Power Splitter Combiner 0.81–0.96 GHz

Alpha

PD09-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



Description

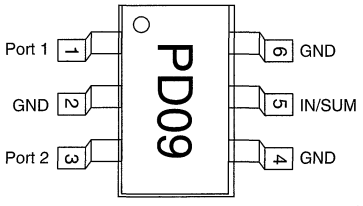
The PD09-73 is a monolithic two-way in-phase hybrid junction tuned for the 0.81–0.96 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOT-6 lead surface mount package.

3

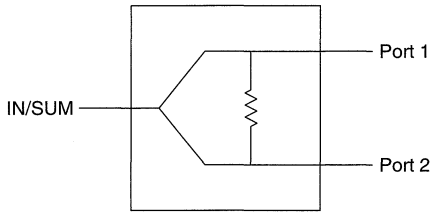
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	0.81		0.96	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	18	25		dB
Input VSWR		1.2:1	1.4:1	
Output VSWR		1.3:1	1.5:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

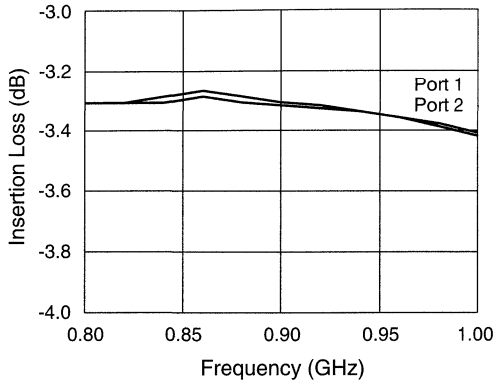
Pin Out



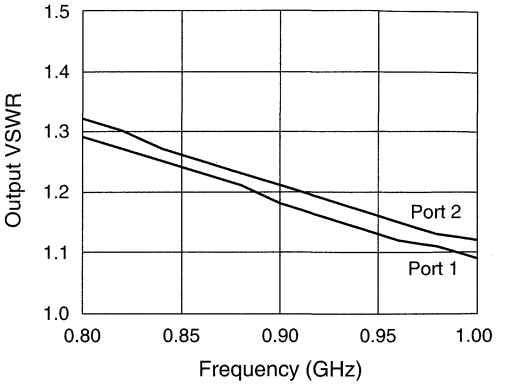
Block Diagram



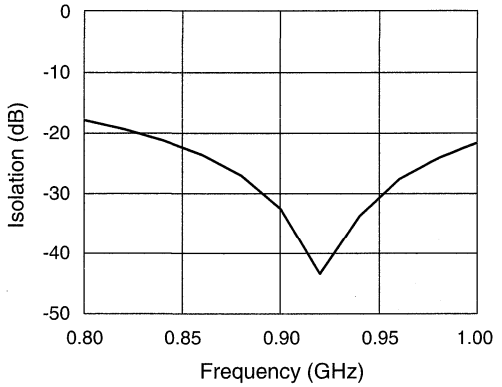
Typical Performance Data



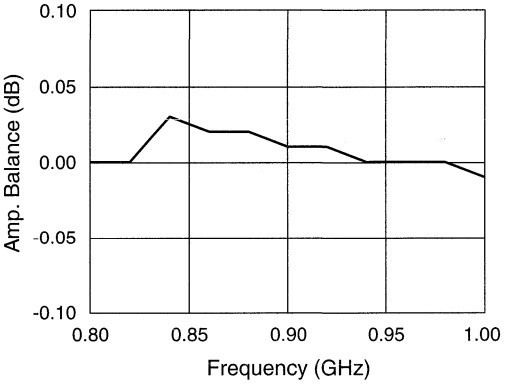
Insertion Loss vs. Frequency



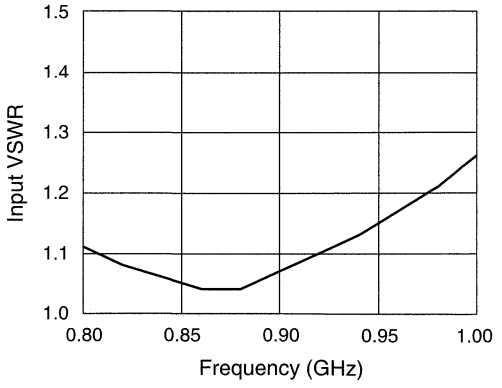
Output VSWR vs. Frequency



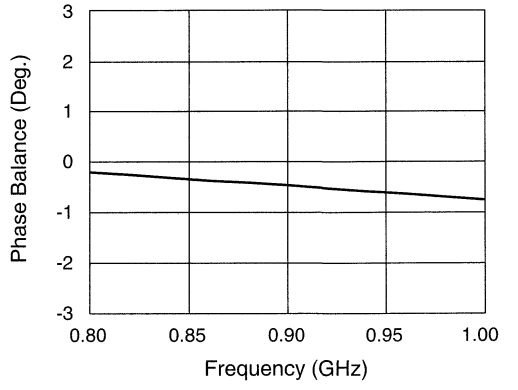
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



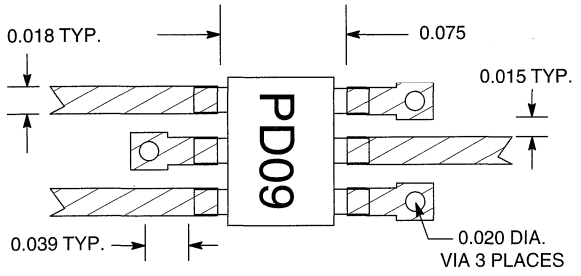
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.75 CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

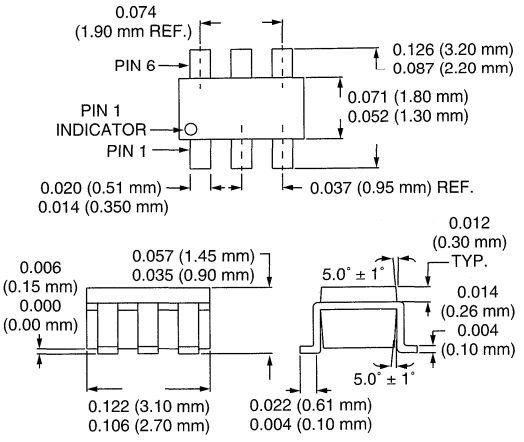
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



3

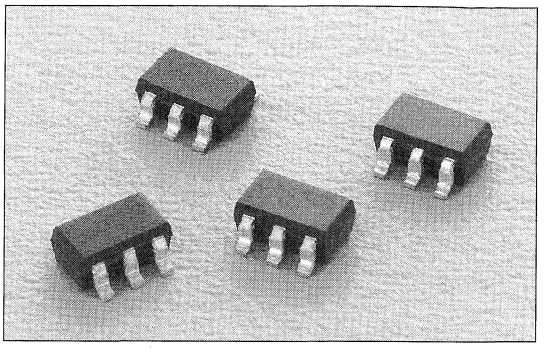
Two-Way 0° Power Splitter Combiner 1.42–1.66 GHz

Alpha

PD15-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



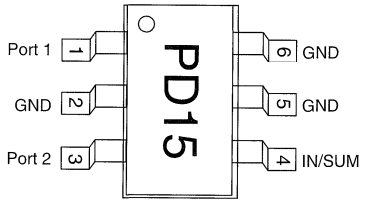
Description

The PD15-73 is a monolithic two-way in-phase hybrid junction tuned for the 1.42–1.66 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOT-6 lead surface mount package.

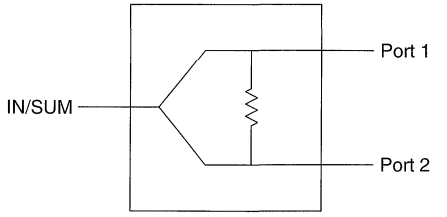
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.42		1.66	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	18	23		dB
Input VSWR		1.2:1	1.5:1	
Output VSWR		1.2:1	1.4:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

Pin Out



Block Diagram



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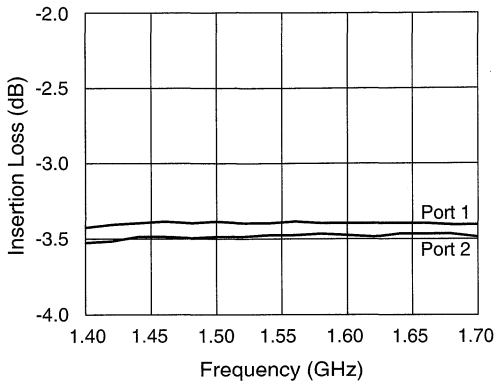
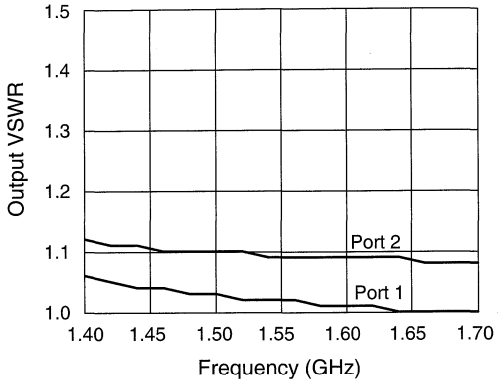
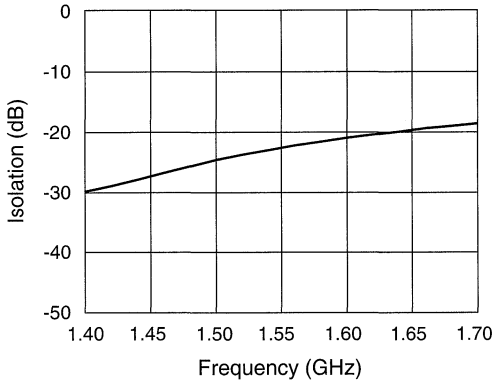
Typical Performance Data



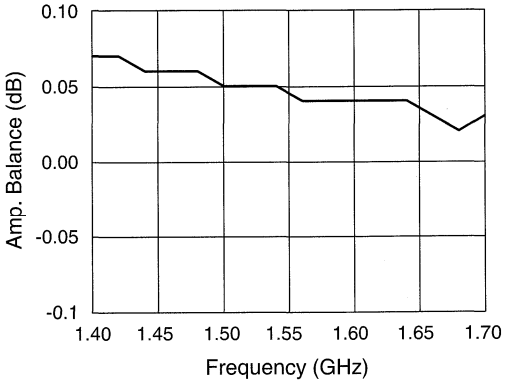
Insertion Loss vs. Frequency



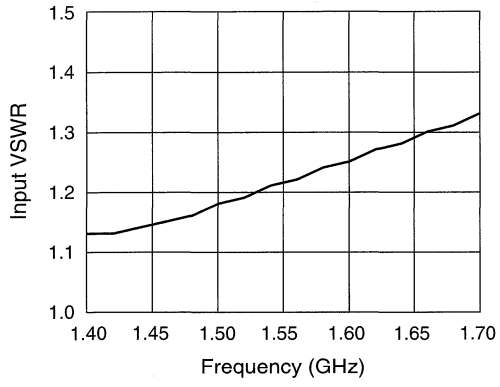
Output VSWR vs. Frequency



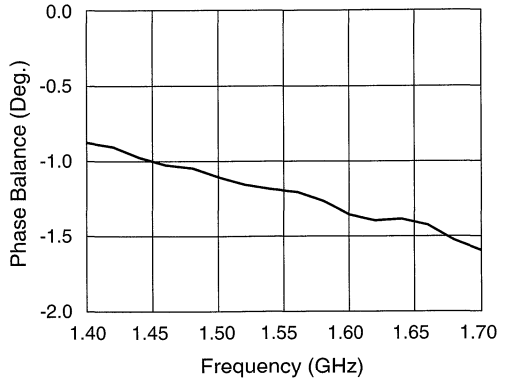
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



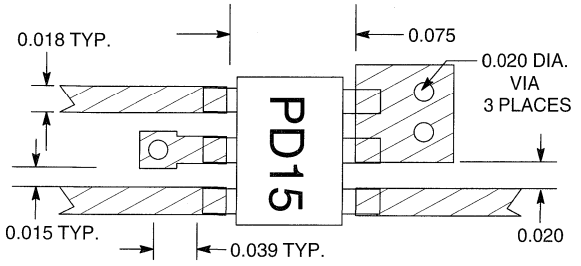
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.75 CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

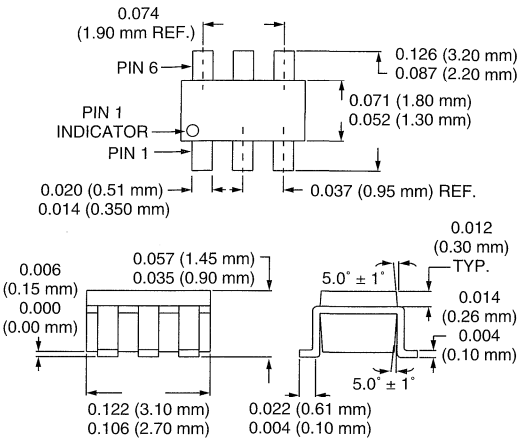
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



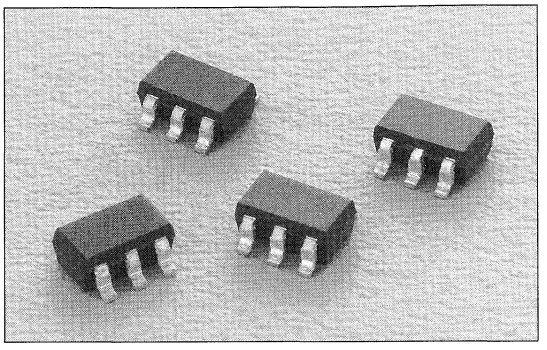
Two-Way 0° Power Splitter Combiner 1.71–1.99 GHz

Alpha

PD18-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



Description

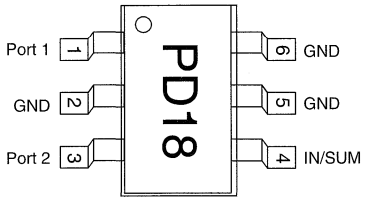
The PD18-73 is a monolithic two-way in-phase hybrid junction tuned for the 1.71–1.99 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOT-6 lead surface mount package.

3

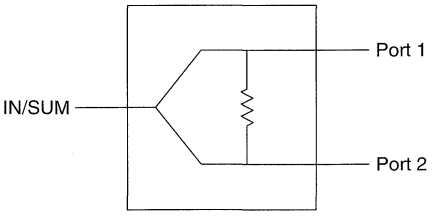
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.71		1.99	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	18	23		dB
Input VSWR		1.3:1	1.5:1	
Output VSWR		1.2:1	1.4:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

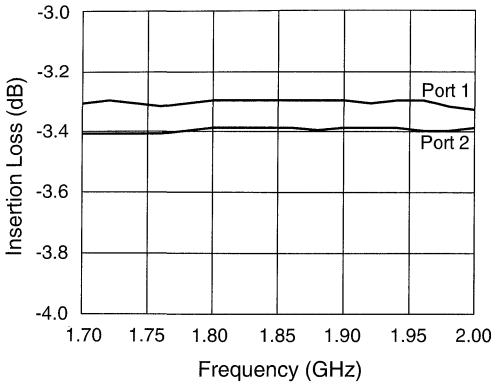
Pin Out



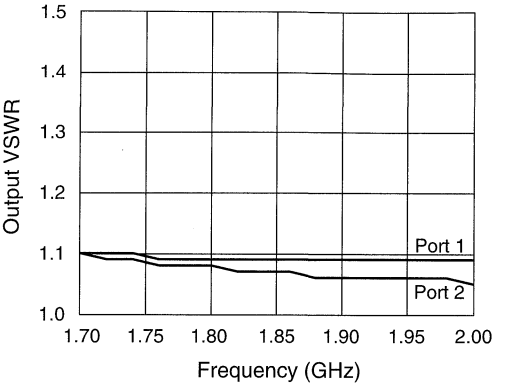
Block Diagram



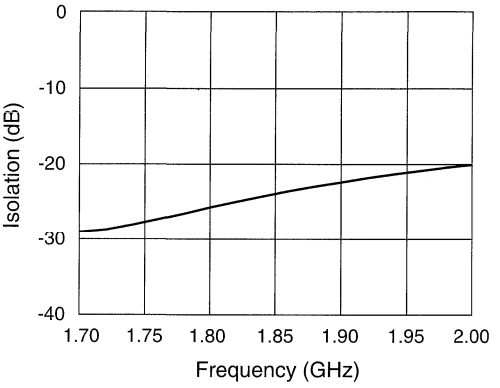
Typical Performance Data



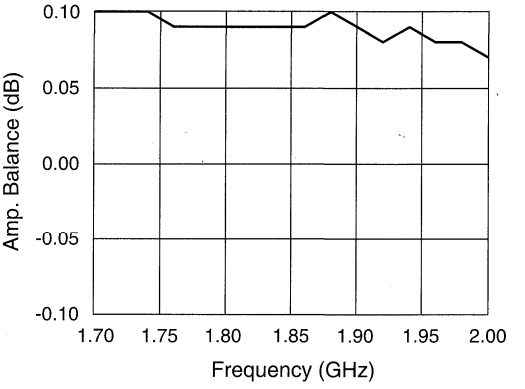
Insertion Loss vs. Frequency



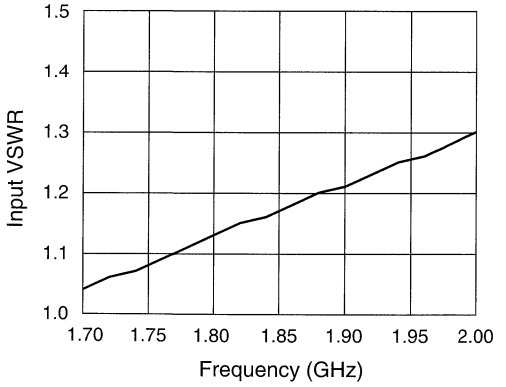
Output VSWR vs. Frequency



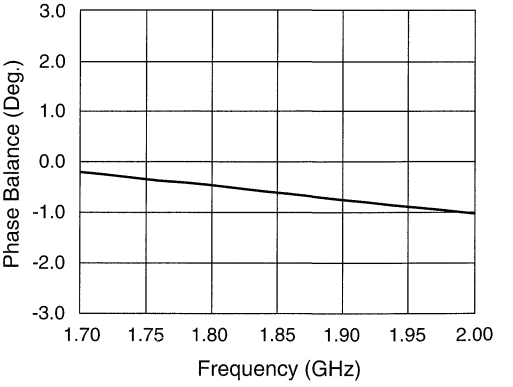
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



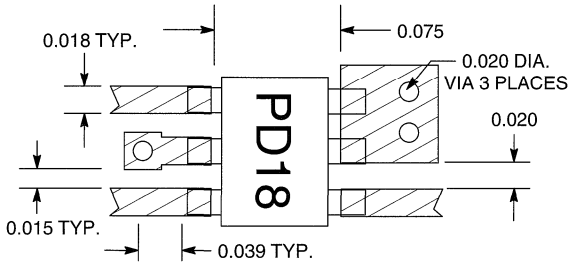
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.75 CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

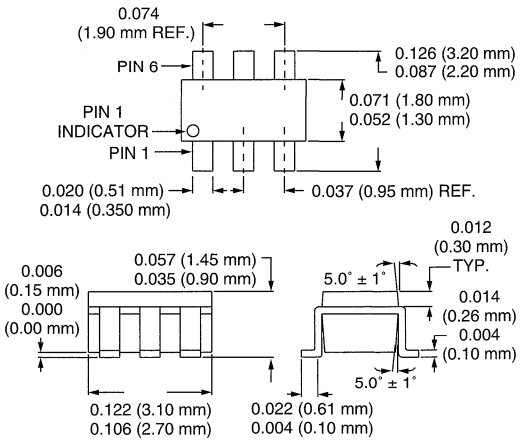
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



3

Plastic Packaged Power Dividers – 4 Way

Frequency (GHz)	Insertion Loss Less 6 dB Split Typ.	Isolation (db) Typ.	Input VSWR Typ.	Output VSWR Typ.	AMP Balance (db)	Phase Balance (Deg.) Typ.	Total Max. Power w/2.0:1 All Ports	Package	Part Number	Page Number
0.81–0.96	1.30	23	1.2:1	1.2:1	±0.4	±6	1.5 W	SOIC-8	PD4W09-12	3-36
1.71–1.99	0.70	25	1.6:1	1.2:1	±0.3	±5	1.5 W	SOIC-8	PD4W18-12	3-39
0.81–0.96	1.30	23	1.2:1	1.2:1	±0.4	±6	1.5 W	MSOP-8	PD4W09-59	3-42
1.71–1.99	0.70	25	1.3:1	1.3:1	±0.3	±5	1.5 W	MSOP-8	PD4W18-59	3-45

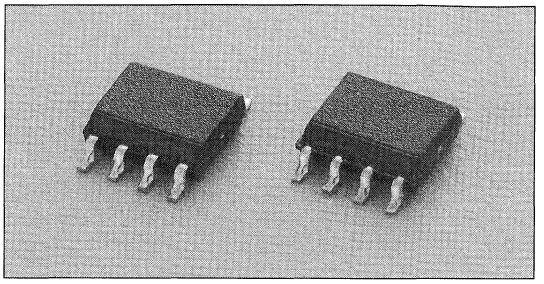
Four-Way 0° Power Splitter Combiner 0.81–0.96 GHz

Alpha

PD4W09-12

Features

- Low Cost
- Low Profile
- Available in Small SOIC-8 Package
- Tape & Reel



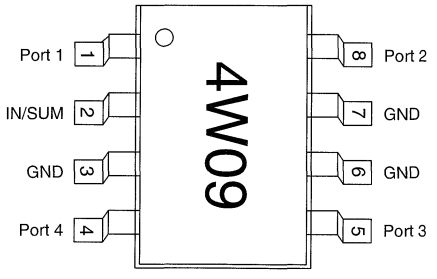
Description

The PD4W09-12 is a monolithic four-way in-phase hybrid junction tuned for the 0.81–0.96 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

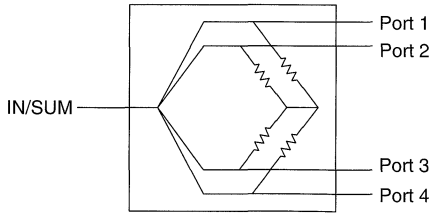
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	0.81		0.96	GHz
Insertion Loss Less 6 dB Split		1.3	1.5	dB
Isolation	20	23		dB
Input VSWR		1.2:1	1.5:1	
Output VSWR		1.2:1	1.5:1	
Amplitude Balance		±0.4	±0.6	dB
Phase Balance		±6	±8	Deg.

Pin Out



Block Diagram



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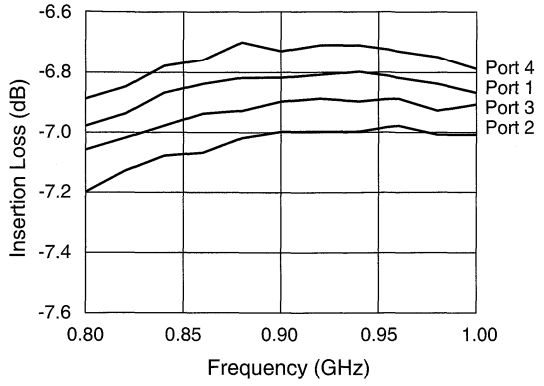
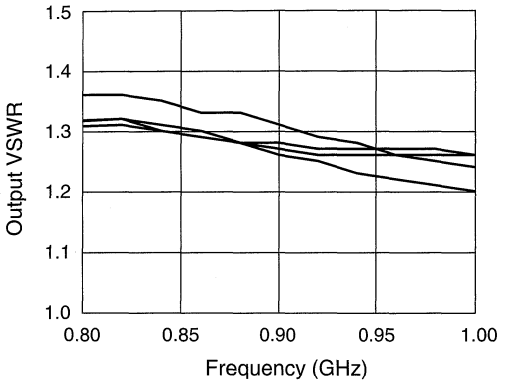
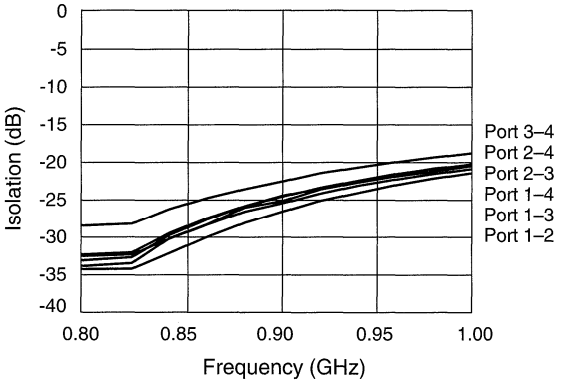
Performance Data



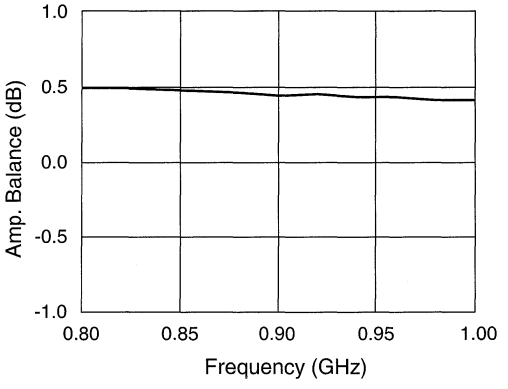
Insertion Loss vs. Frequency



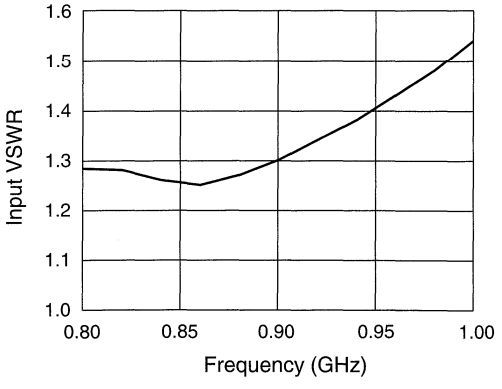
Output VSWR vs. Frequency



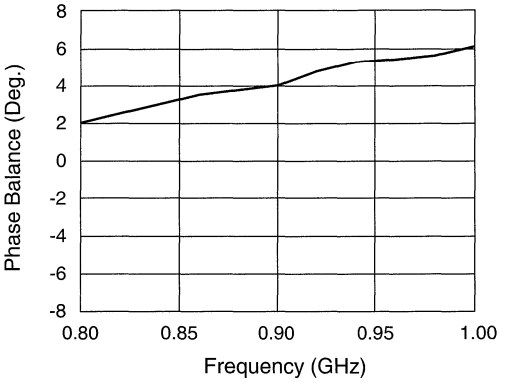
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



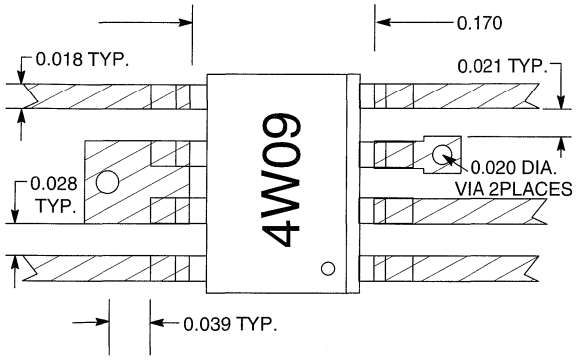
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.375 CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

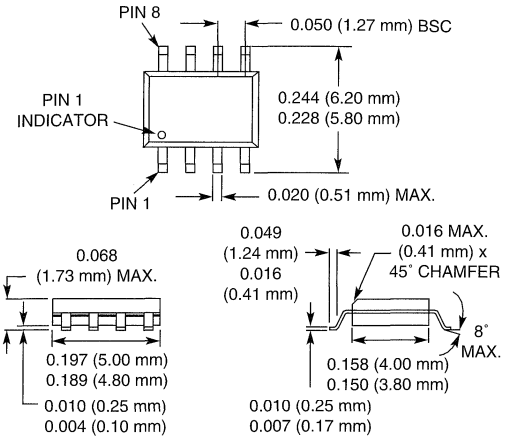
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOIC-8



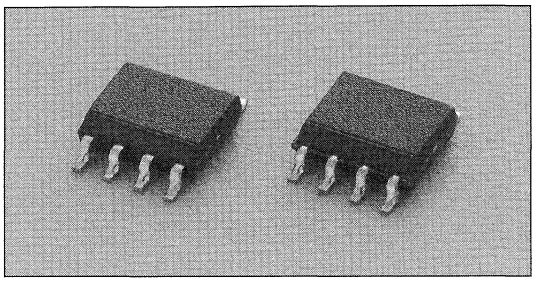
Four-Way 0° Power Splitter Combiner 1.71–1.99 GHz

Alpha

PD4W18-12

Features

- Low Cost
- Low Profile
- Available in Small SOIC-8 Package
- Tape & Reel



Description

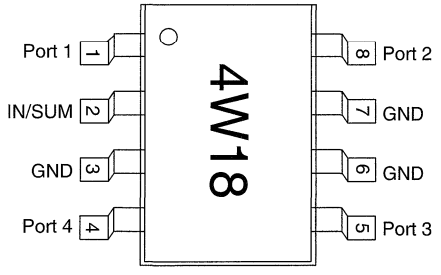
The PD4W18-12 is a monolithic four-way in-phase hybrid junction tuned for the 1.71–1.99 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

3

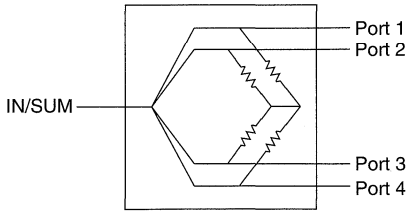
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.71		1.99	GHz
Insertion Loss Less 6 dB Split		0.7	1.0	dB
Isolation	18	25		dB
Input VSWR		1.6:1	1.8:1	
Output VSWR		1.2:1	1.5:1	
Amplitude Balance		±.3	±.4	dB
Phase Balance		±5.0	±9.0	Deg.

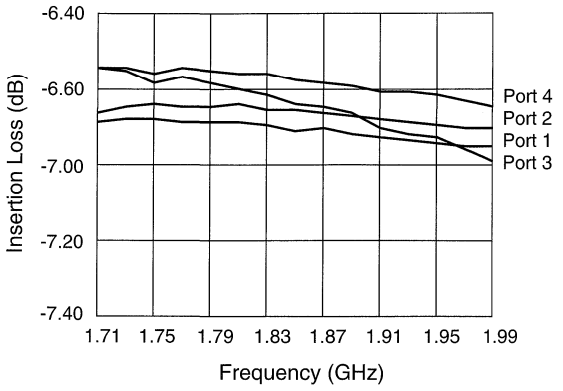
Pin Out



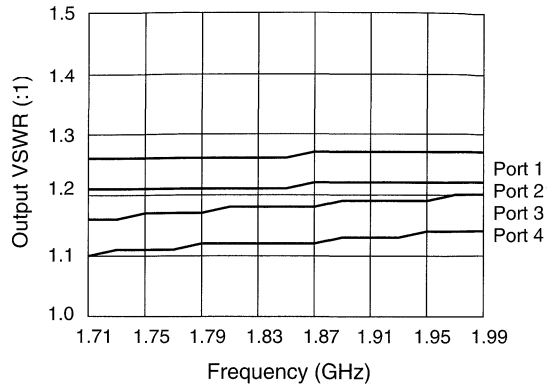
Block Diagram



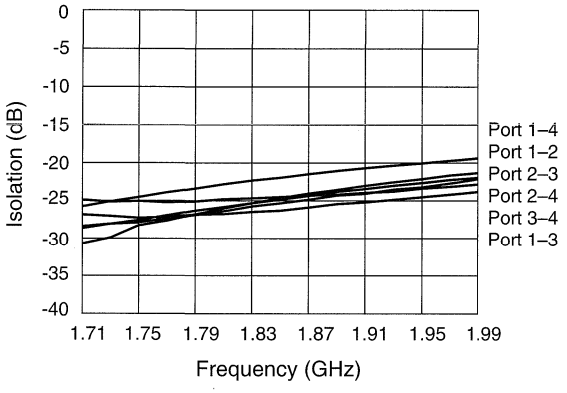
Typical Performance Data



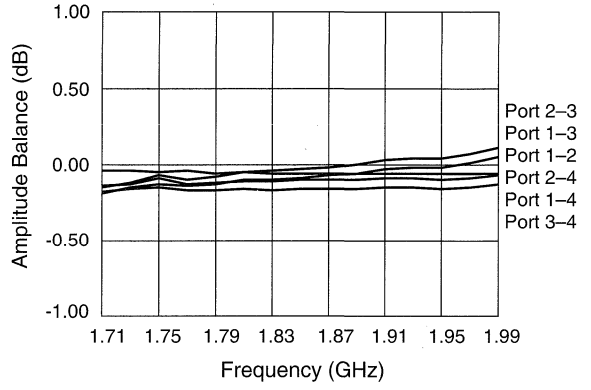
Insertion Loss vs. Frequency



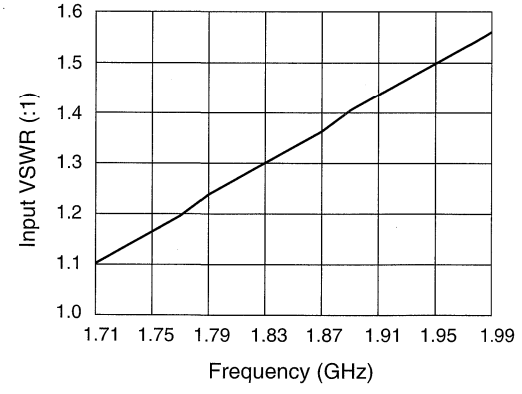
Output VSWR vs. Frequency



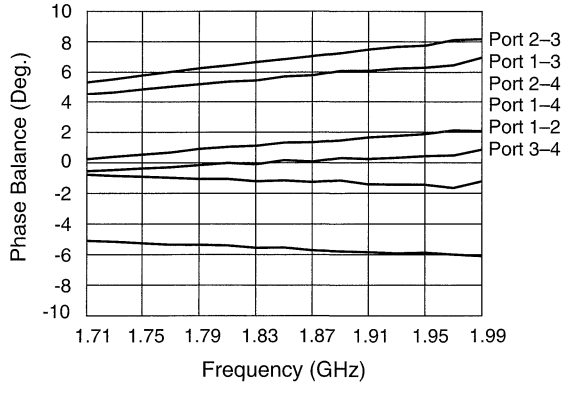
Isolation vs. Frequency



Amplitude Balance vs. Frequency



Input VSWR vs. Frequency



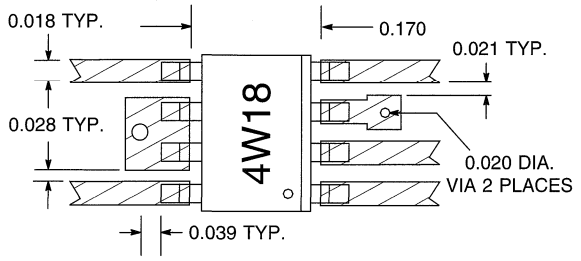
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.375 CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-60°C to 150°C

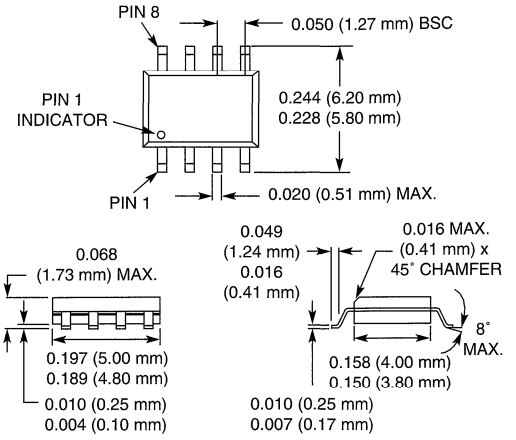
1. When used as a power divider with a 2.0:1 Max. VSWR on all ports.
2. When used as a power combiner with 2.0:1 Max. VSWR on all ports.

Board Layout



Material is 10 mil FR4

SOIC-8



3

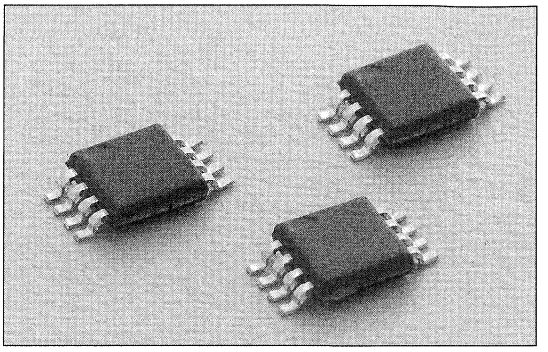
Four-Way 0° Power Splitter Combiner 0.81–0.96 GHz

Alpha

PD4W09-59

Features

- Low Cost
- Low Profile
- Available in Small MSOP-8 Package
- Tape & Reel



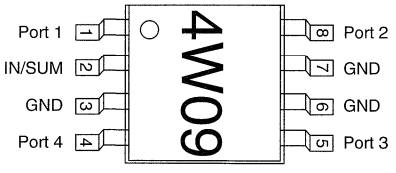
Description

The PD4W09-59 is a monolithic four-way in-phase hybrid junction tuned for the 0.81–0.96 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the MSOP-8 leaded surface mount package.

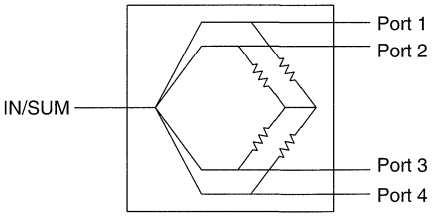
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	0.81		0.96	GHz
Insertion Loss Less 6 dB Split		1.3	1.5	dB
Isolation	20	23		dB
Input VSWR		1.2:1	1.5:1	
Output VSWR		1.2:1	1.5:1	
Amplitude Balance		±0.4	±0.6	dB
Phase Balance		±6	±8	Deg.

Pin Out



Block Diagram



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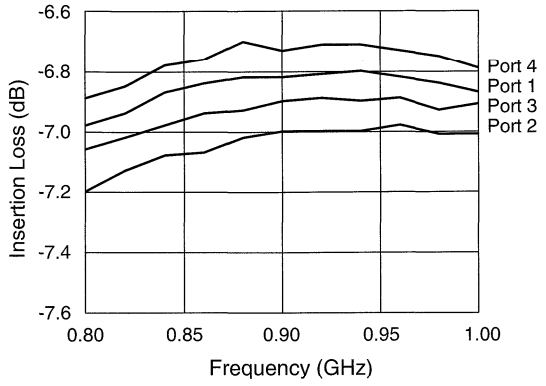
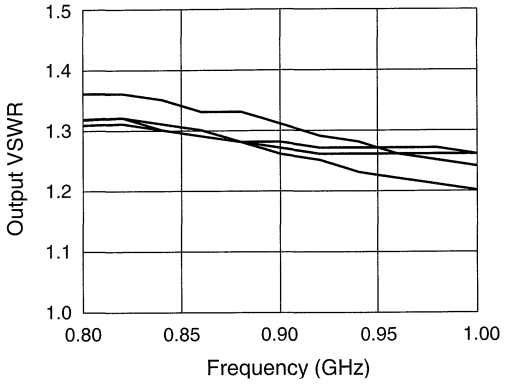
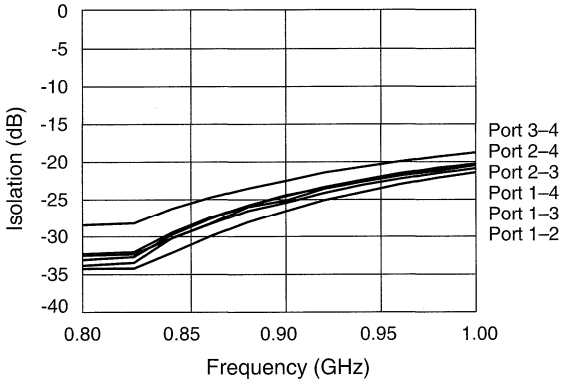
Typical Performance Data



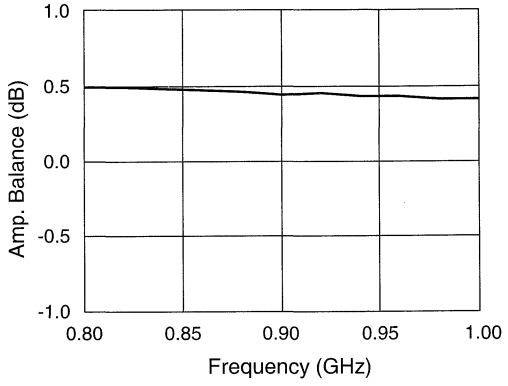
Insertion Loss vs. Frequency



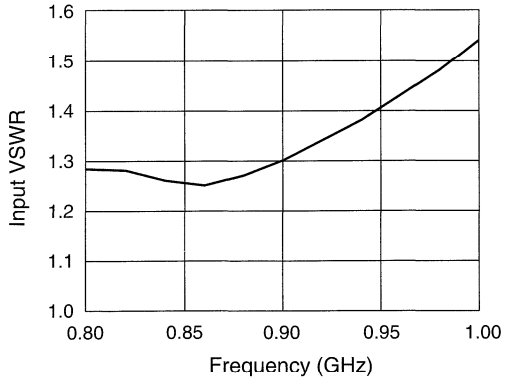
Output VSWR vs. Frequency



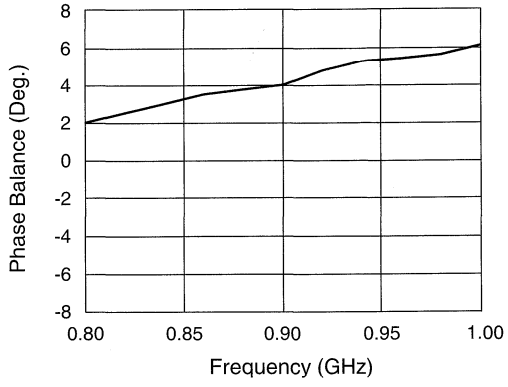
Isolation vs. Frequency



Amp. Balance vs. Frequency

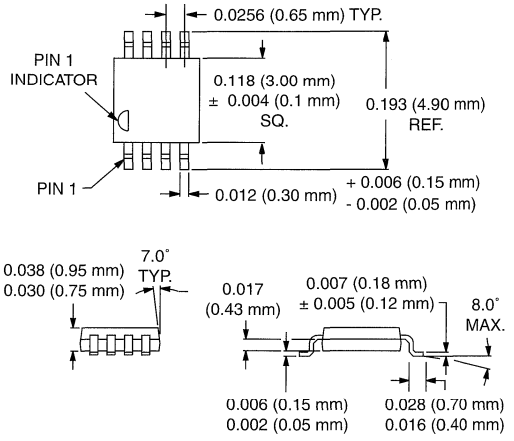


Input VSWR vs. Frequency

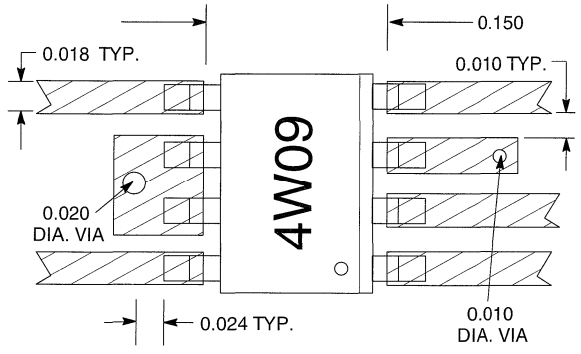


Phase Balance vs. Frequency

MSOP-8



Recommended Board Layout



Material is 10 mil FR4

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.375 CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C

1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

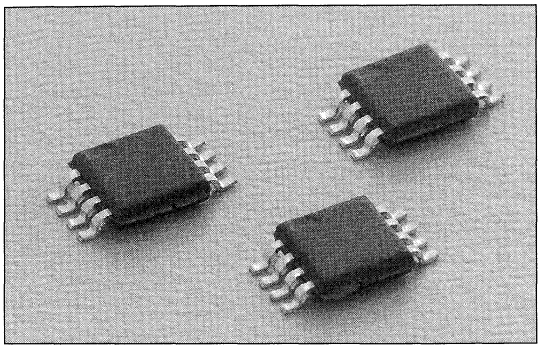
Four-Way 0° Power Splitter Combiner 1.71–1.99 GHz

Alpha

PD4W18-59

Features

- Low Cost
- Low Profile
- Available in Small MSOP-8 Package
- Tape & Reel



Description

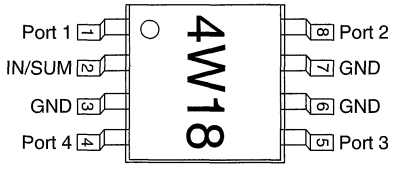
The PD4W18-59 is a monolithic four-way in-phase hybrid junction tuned for the 1.71–1.99 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the MSOP-8 leaded surface mount package.

3

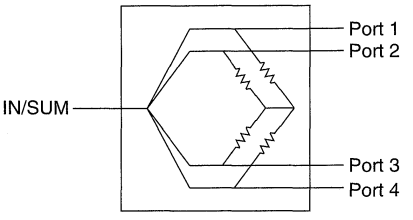
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.71		1.99	GHz
Insertion Loss Less 6 dB Split		0.7	1.2	dB
Isolation	20	25		dB
Input VSWR		1.3:1	1.6:1	
Output VSWR		1.3:1	1.6:1	
Amplitude Balance		±.3	±.4	dB
Phase Balance		±5.0	±8.0	Deg.

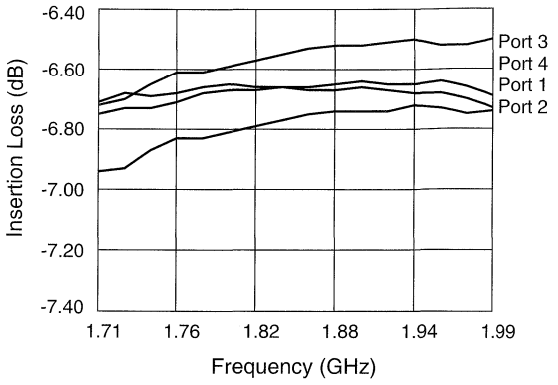
Pin Out



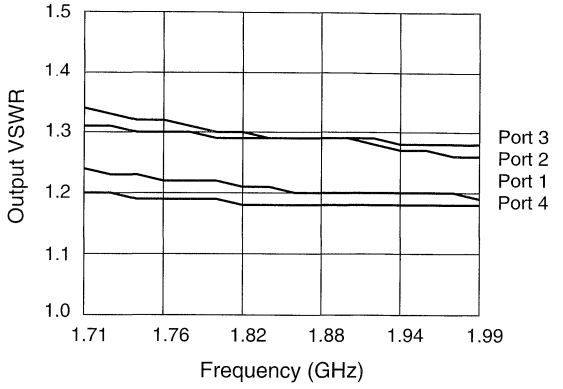
Block Diagram



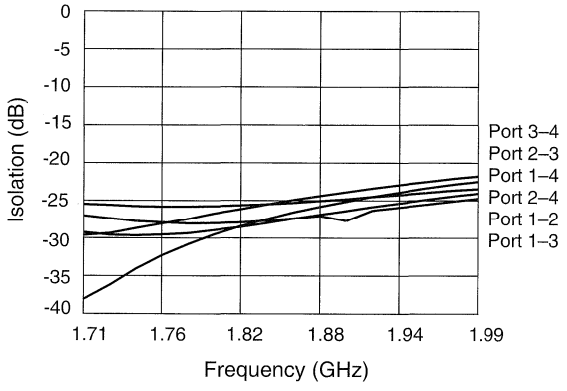
Typical Performance Data



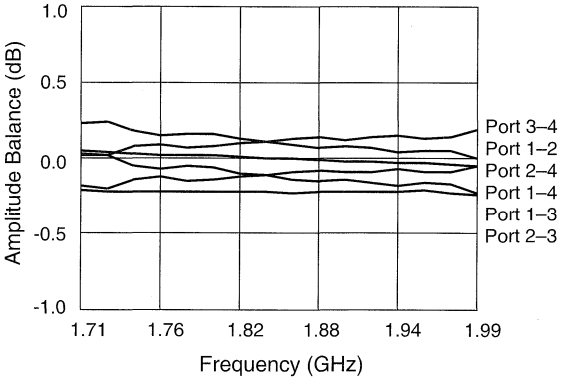
Insertion Loss vs. Frequency



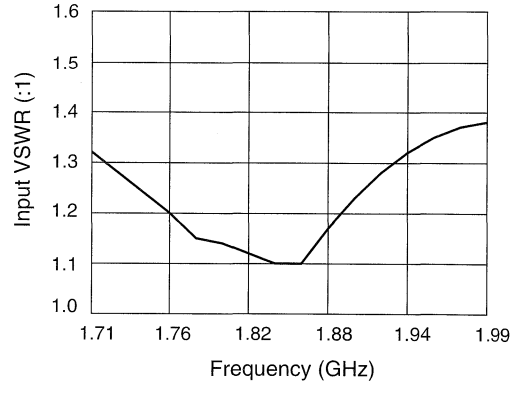
Output VSWR vs. Frequency



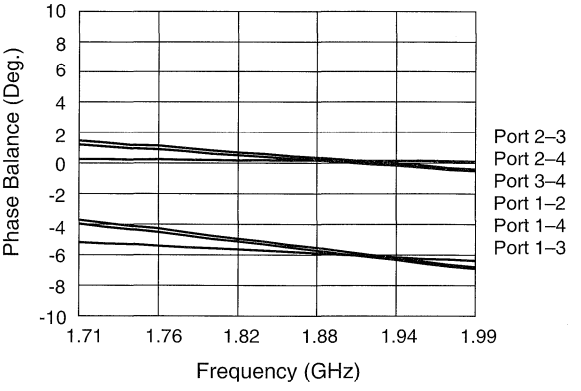
Isolation vs. Frequency



Amplitude Balance vs. Frequency



Input VSWR vs. Frequency



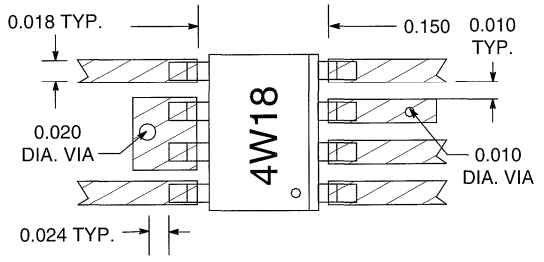
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.375 CW
Operating Temperature	-40°C to 85°C
Storage Temperature	-60°C to 150°C

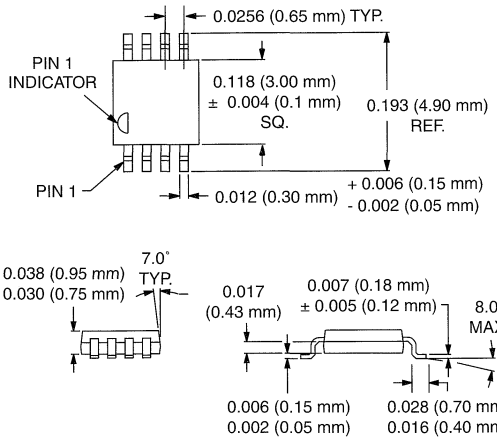
1. When used as a power divider with a 2.0:1 Max. VSWR on all ports.
2. When used as a power combiner with 2.0:1 Max. VSWR on all ports.

Board Layout



Material is 10 mil FR4

MSOP-8



3

Mixers

RF/LO Frequency (GHz)	IF Frequency (GHz)	LO Power (dBm) Typ.	Conversion Loss (dB) Typ.	LO to RF Isolation (dB)	RF to IF Isolation (dB)	RF VSWR Typ.	IP3 (dBm) Typ.	Package	Part Number	Page Number
1.7–2.0	DC–0.3	7	6.5	28	22	1.5:1	11	Ceramic-10L	M18L	3-50
2.3–2.6	DC–0.4	7	5.0	30	23	1.3:1	11	Ceramic-10L	M25L	3-53
3.3–4.3	DC–0.6	7	5.0	30	25	1.5:1	11	Ceramic-10L	M38L	3-56

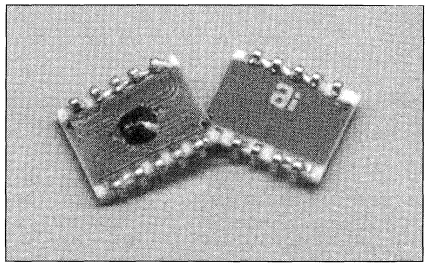
Lead Surface Mount Mixer

Alpha

M18L

Features

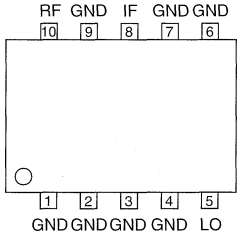
- Low Conversion Loss 6.5 dB (Typ.)
- High Isolation 28 dB (Typ.)
- Low Profile 0.085 (Max.)
- Stress Relieved Leaded Package
- High Performance Diode Ring Mixer



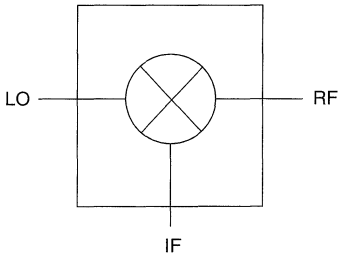
Description

The M18L is designed to be used in wireless systems that are targeted for low-cost/high volume applications. It is a hybrid mixer utilizing the best of Alpha's semiconductor, circuit design and manufacturing capabilities. A custom silicon MMIC is complimented by a rugged thick-film ceramic circuit which doubles as the surface mount package. Wrap-around stress relieving leads ease installation and inspection as well as solve thermal expansion mismatch problems.

Pin Out



Block Diagram



Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
RF Frequency Range	1.7		2.0	GHz
LO Frequency Range	1.7		2.0	GHz
IF Frequency Range	DC		0.3	GHz
LO Power		+7		dBm
Conversion Loss		6.5	8.0	dB
LO to RF Isolation	22	28		dB
LO to IF Isolation	18	22		dB
RF to IF Isolation	17	20		dB
RF VSWR		1.5:1	2.0:1	
LO VSWR		1.5:1	2.0:1	
IF VSWR		1.5:1	2.0:1	
Input Compression Pt.	0	+2		dBm
IP3	+10	11		dBm

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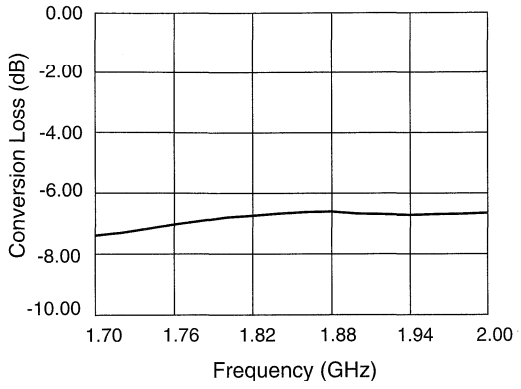
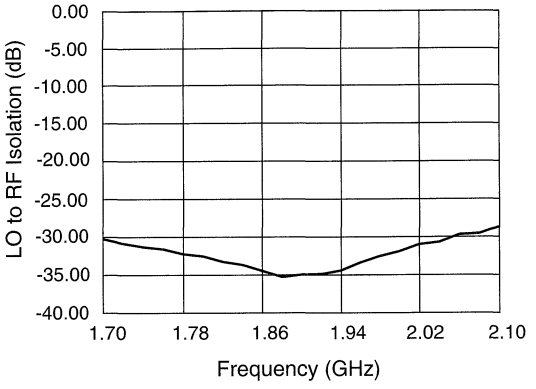
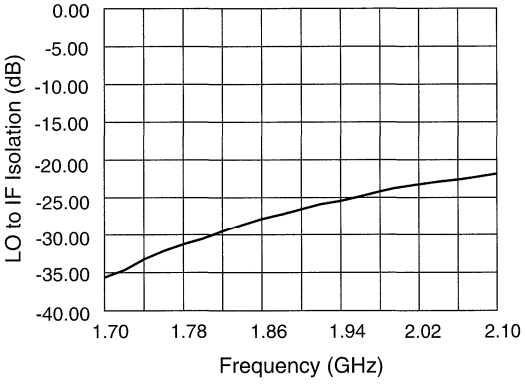
Typical Performance Data



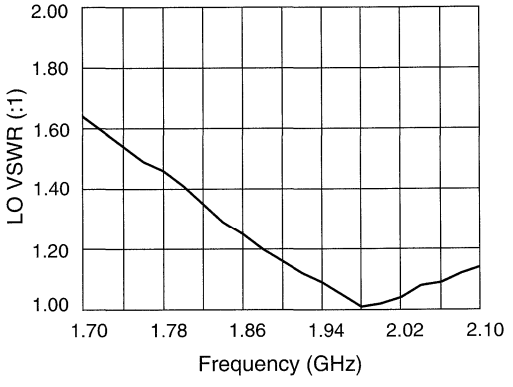
Conversion Loss vs. Frequency



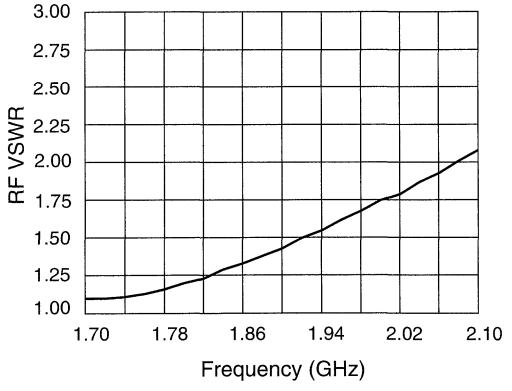
LO to RF Isolation vs. Frequency



LO to IF Isolation vs. Frequency

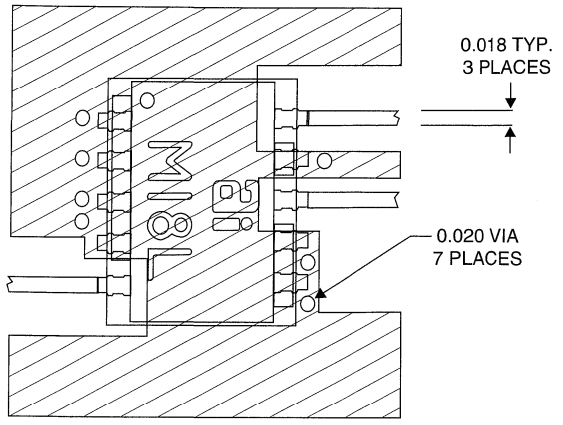


LO VSWR vs. Frequency



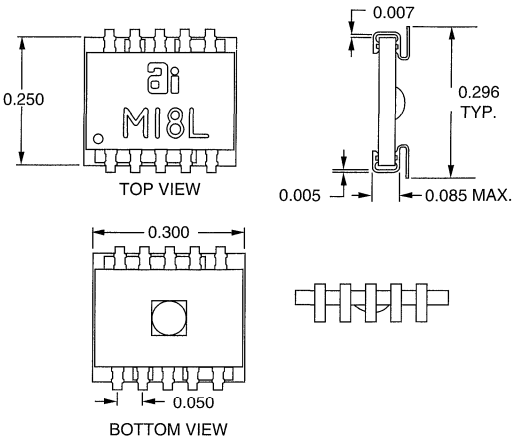
RF VSWR vs. Frequency

Board Layout



Ckt. Material is 10 mil FR4

M18L



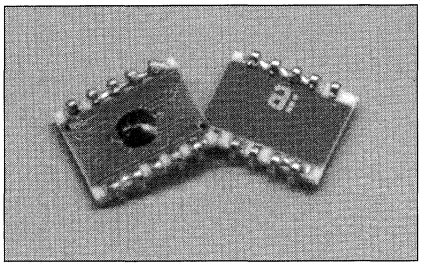
Leaded Surface Mount Mixer

Alpha

M25L

Features

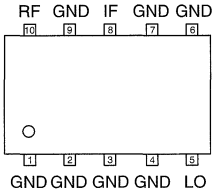
- Low Conversion Loss 5.0 dB (Typ.)
- High Isolation 25 dB (Typ.)
- Low Profile 0.085 (Max.)
- Stress Relieved Leaded Package
- High Performance Diode Ring Mixer



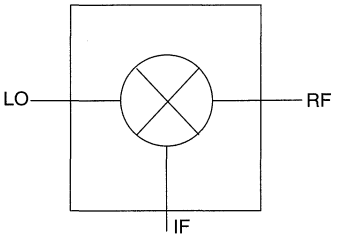
Description

The M25L is designed to be used in wireless systems that are targeted for low-cost/high volume applications. It is a hybrid mixer utilizing the best of Alpha's semiconductor, circuit design and manufacturing capabilities. A custom silicon MMIC is complimented by a rugged thick-film ceramic circuit which doubles as the surface mount package. Wrap-around stress relieving leads ease installation and inspection as well as solve thermal expansion mismatch problems.

Pin Out



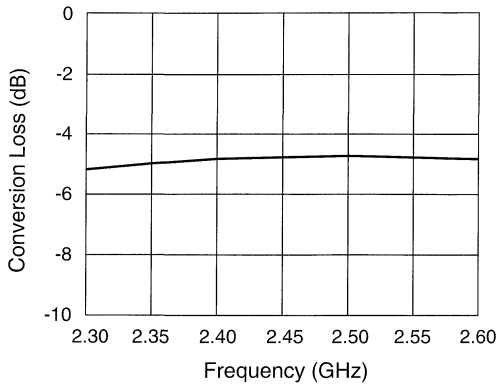
Block Diagram



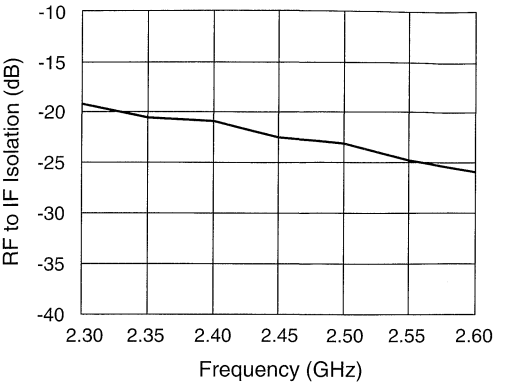
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
RF Frequency Range	2.3		2.6	GHz
LO Frequency Range	2.3		2.6	GHz
IF Frequency Range	DC		0.4	GHz
LO Power		+7		dBm
Conversion Loss		5.0	7.0	dB
LO to RF Isolation	25	30		dB
LO to IF Isolation	12	15		dB
RF to IF Isolation	18	23		dB
RF VSWR		1.3:1	2.5:1	
LO VSWR		1.5:1	2.5:1	
IF VSWR		1.5:1	2.0:1	
Input Compression Pt.	+0	+2		dBm
IP3	+9	+11		dBm

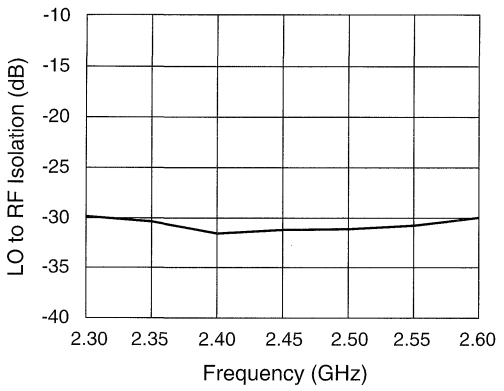
Typical Performance Data



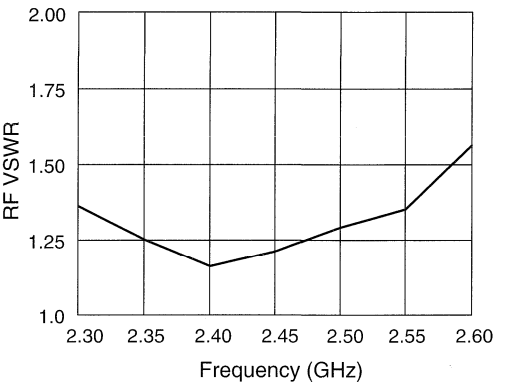
Conversion Loss vs. Frequency



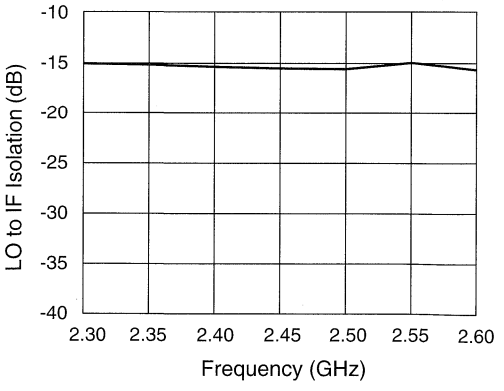
RF to IF Isolation vs. Frequency



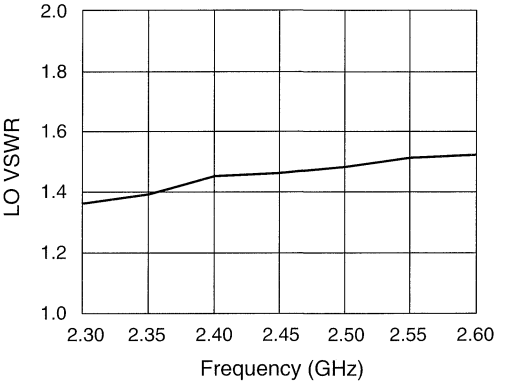
LO to RF Isolation vs. Frequency



RF VSWR vs. Frequency

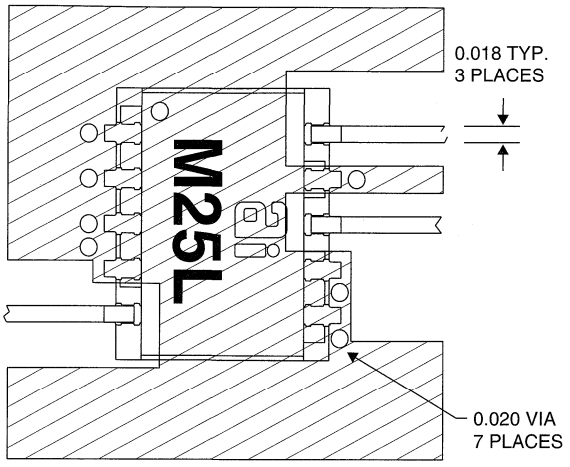


LO to IF Isolation vs. Frequency



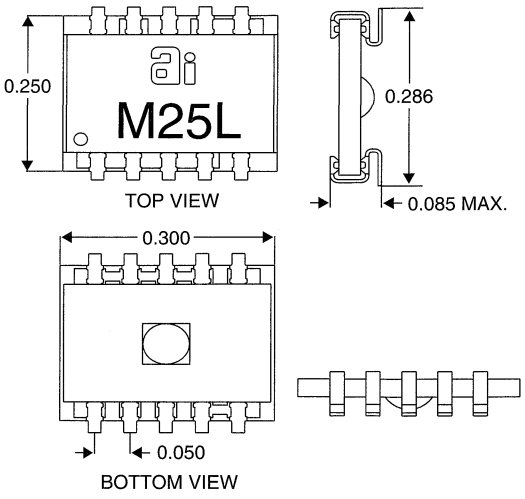
LO VSWR vs. Frequency

Recommended Board Layout



Ckt. Material is 10 mil FR4

M25L



3

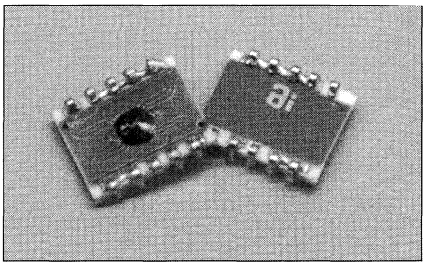
Leaded Surface Mount Mixer

Alpha

M38L

Features

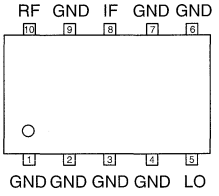
- Low Conversion Loss 5.0 dB (Typ.)
- High Isolation 25 dB (Typ.)
- Low Profile 0.085 (Max.)
- Stress Relieved Leaded Package
- High Performance Diode Ring Mixer



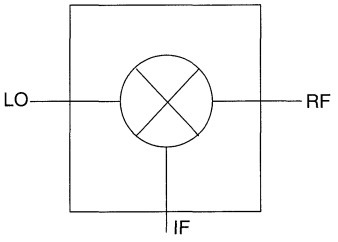
Description

The M38L is designed to be used in wireless/VSAT systems that are targeted for low-cost/high volume applications. It is a hybrid mixer utilizing the best of Alpha's semiconductor, circuit design and manufacturing capabilities. A custom silicon MMIC is complimented by a rugged thick-film ceramic circuit which doubles as the surface mount package. Wrap-around stress relieving leads ease installation and inspection as well as solve thermal expansion mismatch problems.

Pin Out



Block Diagram



Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
RF Frequency Range	3.3		4.3	GHz
LO Frequency Range	3.3		4.3	GHz
IF Frequency Range	DC		0.6	GHz
LO Power		+7		dBm
Conversion Loss		5.0	8.0	dB
LO to RF Isolation	25	30		dB
LO to IF Isolation	18	15		dB
RF to IF Isolation	20	25		dB
RF VSWR		1.5:1	2.5:1	
LO VSWR		1.5:1	2.5:1	
IF VSWR		1.5:1	2.5:1	
Input Compression Pt.	+1	+2		dBm
IP3	+9	+11		dBm

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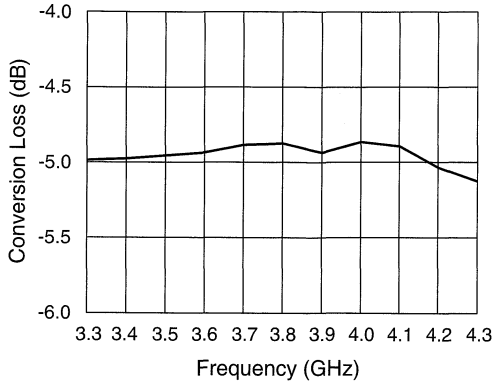
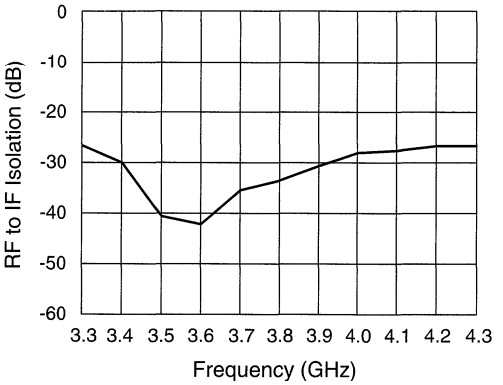
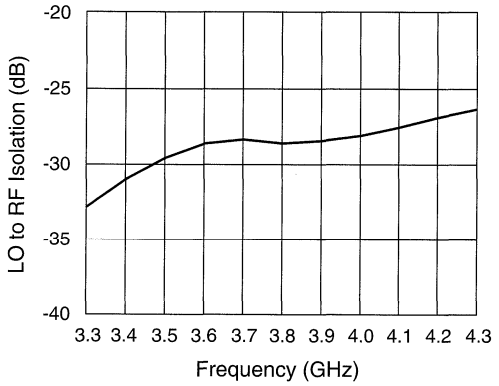
Typical Performance Data



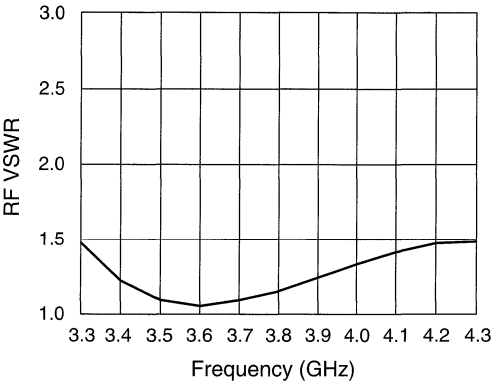
Conversion Loss vs. Frequency



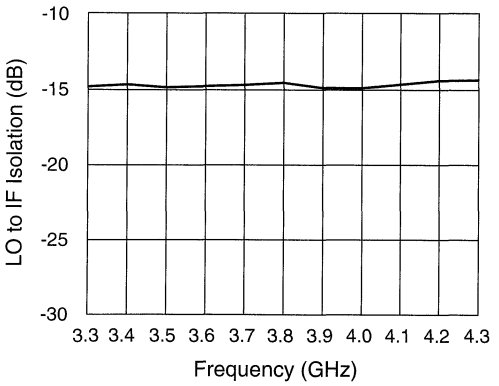
RF to IF Isolation vs. Frequency



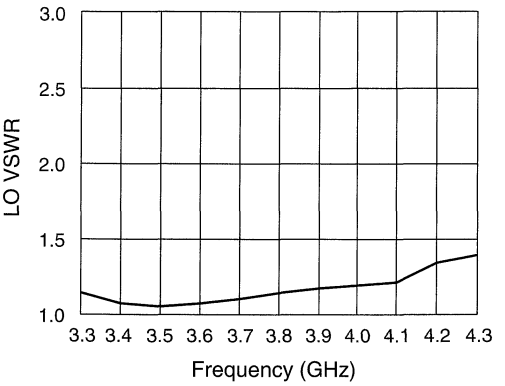
LO to RF Isolation vs. Frequency



RF VSWR vs. Frequency



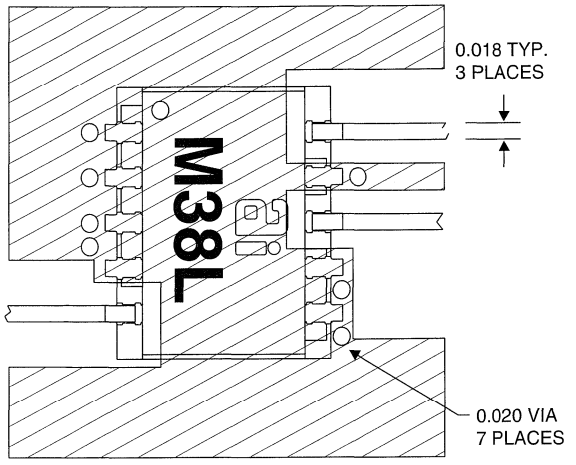
LO to IF Isolation vs. Frequency



LO VSWR vs. Frequency

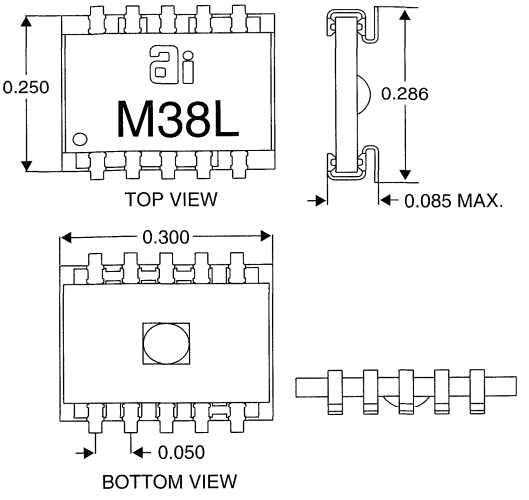
3

Recommended Board Layout



Ckt. Material is 10 mil FR4

M38L



Section 4
Application Notes

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4

Gallium arsenide MESFETs are being used in RF control device applications as switches and attenuators. They are very easily adapted to monolithic circuit form, dissipate essentially no power and can easily be designed into broadband circuits.

The RF signal flows from source to drain, while the RF isolated gate is the voltage control. The high impedance "off state" is attained by applying a DC voltage on the gate more negative than the "pinch-off" voltage (V_P). In this condition the source-drain channel is "pinched off." The capacitance is typically 0.25 pF per mm of gate periphery (see Figure 1A). The "on" state occurs when zero DC bias is applied to the gate (see Figure 1B). The channel from source to drain is "open" and represents a 2.5–3.5 Ω resistance per mm of gate periphery.

A configuration of FETs used in series and shunt normally produce the optimum switch or attenuator performance in monolithic circuits (see Figure 2). The only DC current that flows is the leakage of the gate-source and gate-drain reverse biased junctions (when negative voltage is applied to gate). Typical current drain is < 25 µA @ -5 V. This leakage is a function of the wafer fabrication process, the device periphery, and magnitude of applied voltage. For isolation of gate voltage control, 2.5–5 kΩ resistor is incorporated monolithically in the gate. Since no further external bias circuitry is required, the switch is inherently broadband.

The power handling of the switches is primarily limited by the current handling capability, which is related to the IDSS of the FET. The IDSS is a function of the gate periphery which then determines the source-drain capacitance. The input series FET in switches have a nominal 1 dB compression of 1 W/mm.

Digital attenuators use FETs configured as "T" or "PI" pads to achieve a given attenuation value (Figure 3). For the low loss state V_2 is set to 0 V and V_1 is set to -5 V. For the attenuation state V_2 is set to -5 V and V_1 is set to 0 V.

Typically digital attenuators are composed of multiple bit values (e.g. 2, 4, 8, 16 dB AD220-25).

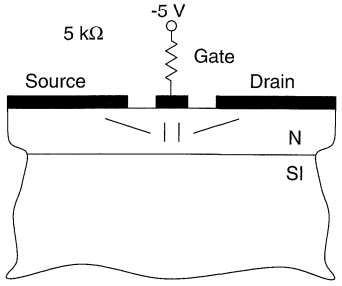


Figure 1A. MESFET Control Device in High Impedance State ("Off" State)

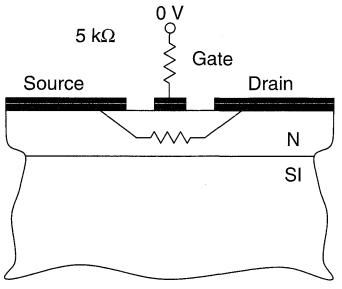
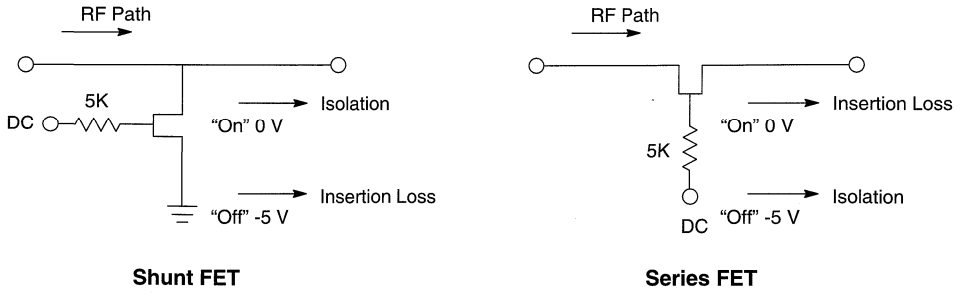


Figure 1B. MESFET Control Device in Low Impedance State ("On" State)

Voltage variable attenuators (VVAs) use the channel resistance of the FET as the actual resistance of the circuit components. The resistance is a nonlinear relationship with control voltage as shown in Figure 4 (FET with a "pinch-off" voltage of 3.5 V). Figure 5 shows a TEE VVA that uses two series FETs and one shunt FET. The attenuator requires two independent control voltages for operation. Alpha also offers a single positive voltage control VVA (AT002S3-12). See "Single Control VVA" application note for more information.

Power handling of VVAs is significantly less than switches since the FET is not normally fully biased 'on' or fully biased 'off'. See "Dual Voltage Controlled VVA" application note for more information.



Shunt FET **Series FET**

Figure 2. Shunt/Series FET

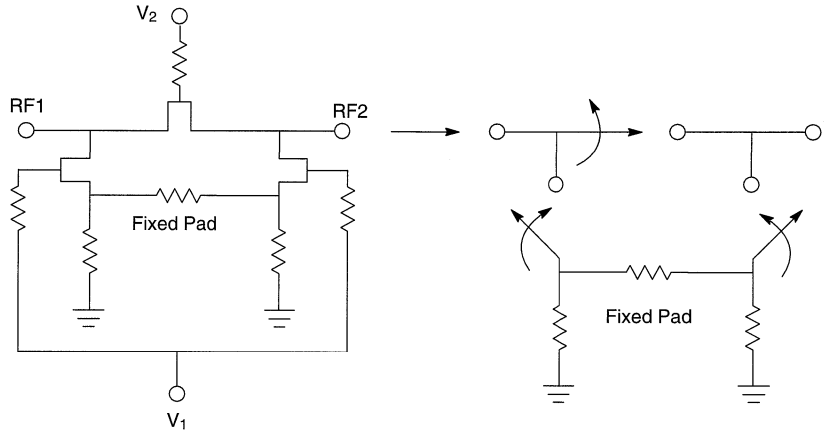


Figure 3. Single Bit Configuration for Digital Attenuator

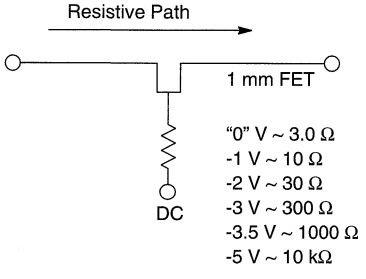


Figure 4. FET as a Variable Resistor

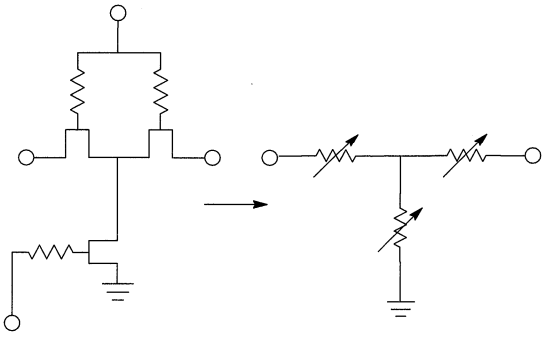


Figure 5. Voltage Variable Attenuator (VVA) in Tee Configuration

Positive Voltage Operation of GaAs Control ICs

Alpha

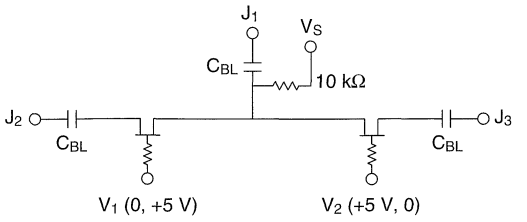
Most GaAs IC control products can be "floated" or "level shifted" to operate using 0/+3 to +5 V control voltages. This is a great advantage since the majority of high volume wireless designs have only a positive voltage supply available.

Switches

GaAs IC switches can easily be made to operate from a positive voltage supply (V_S) by "floating" the source/drain to the V_S voltage and controlling the gates with 0 and V_S voltages. This satisfies the requirement that the gate must be negative with respect to source/drain. Typical schematics implementing this technique are shown in Figures 1 and 2 for an all series FET switch design and Figures 3 and 4 for a series/shunt FET switch design.

To float the series design in Figure 1, a V_S voltage (+5 V) is connected through a 10 kΩ resistor, to the J_1 port. The resistor will limit the supply current and decouple the DC supply from the RF line. DC blocking capacitors (C_{BL}) are needed on the RF ports to keep the V_S voltage from leaking into other portions of the circuit. The control voltages V_1, V_2 can now be operated between 0/+5 V as shown in the truth table. Since there are no shunt FETs all pins labeled as ground can be connected directly to the PCB ground pads.

Floating the series/shunt design is essentially the same as the series only design. The only difference is that the shunt FETs are AC coupled to ground by the use of bypass capacitors (C_{BP}). (See Figure 3.) It is essential that the PCB ground plane be a minimal distance from the switch ground pins. The C_{BP} capacitor can then be soldered directly to ground minimizing the inductive path and maximizing the switch performance. (See Figure 4.)



C_{BL} = 100 pF @ 900 MHz.

Truth Table

Negative Operation (V_S = Open)

V_1	V_2	J_1–J_2	J_1–J_3
-5	0	Isolation	Insertion Loss
0	-5	Insertion Loss	Isolation

Positive Operation (V_S = +5 V)

V_1	V_2	J_1–J_2	J_1–J_3
0	+5	Isolation	Insertion Loss
+5	0	Insertion Loss	Isolation

Figure 1. Schematic Diagram and Truth Table for SPDT Series Switch (AS125-73)

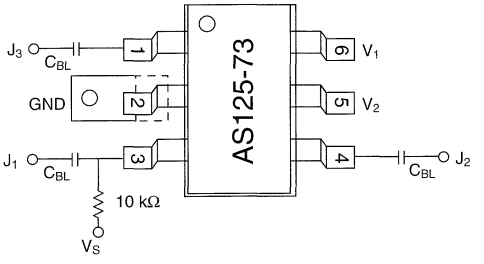


Figure 2. Positive Voltage Control of AS125-73

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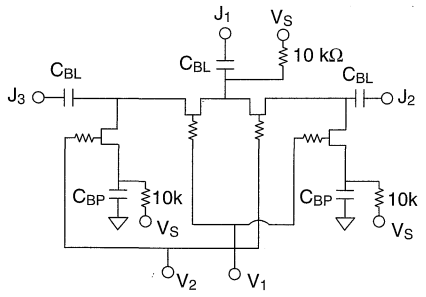


C_{BL} = 100 pF @ 900 MHz.
C_{BP} = .001 to 0.1 µF depending on lowest operating frequency.

Truth Table

Negative Operation (V_S = Open)

V_1	V_2	J_1–J_2	J_1–J_3
0	-5	Isolation	Insertion Loss
-5	0	Insertion Loss	Isolation

Positive Operation (V_S = +5 V)

V_1	V_2	J_1–J_2	J_1–J_3
+5	0	Isolation	Insertion Loss
0	+5	Insertion Loss	Isolation

Figure 3. Schematic Diagram and Truth Table for SPDT Series/Shunt Switch (AS239-12)

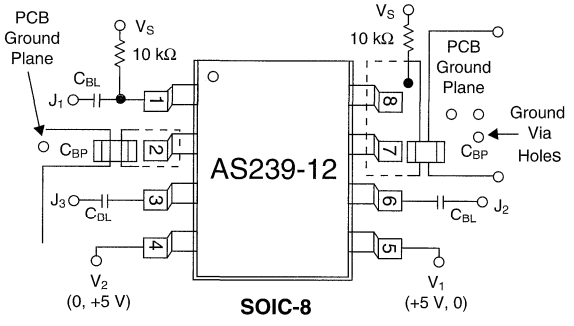
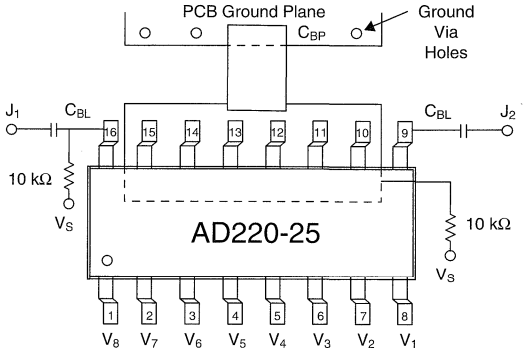


Figure 4. Positive Voltage Control Configuration of AS239-12

Digital Attenuators (DA) and Voltage Variable Attenuators (VVA)

The floating technique discussed for switches can be applied to other GaAs IC control devices. DAs and VVAs utilize the same floating scheme to achieve positive voltage operation. The AD220-25 is shown as an example of a digital attenuator that is floated. (See Figure 5.) The AV259-32 is shown as an example of a VVA that is floated. (See Figure 6.) All ground pins are AC coupled to the PCB ground through a single bypass capacitor. Inductance to ground must be minimized to achieve the best possible RF performance of the device. In this case maximum attenuation.



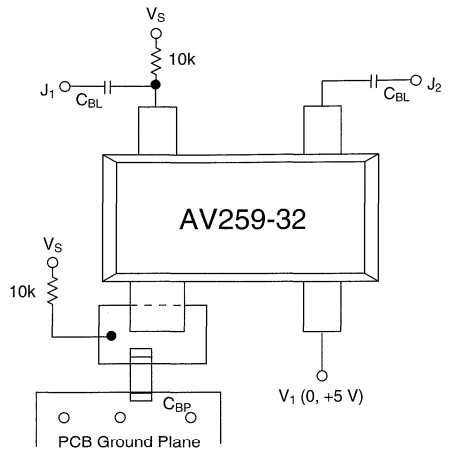
C_{BL} = 100 pF.
C_{BP} = 1000 pF.

Truth Table

Positive Operation (V_S = +5 V)

V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	Attenuation (dB)
0	+5	0	+5	0	+5	0	+5	Reference
+5	0	0	+5	0	+5	0	+5	2 dB
0	+5	+5	0	0	+5	0	+5	4 dB
0	+5	0	+5	+5	0	0	+5	8 dB
0	+5	0	+5	0	+5	+5	0	16 dB
+5	0	+5	0	+5	0	+5	0	30 dB

Figure 5. Positive Voltage Configuration of AD220-25 and Truth Table



C_{BL} = 100 pF.
C_{BP} = 1000 pF.
F = 900 MHz.

Truth Table

Positive Operation (V_S = +5 V)

V_1	J_1–J_2
0	Insertion Loss
+5 V	Full Attenuation

Figure 6. Positive Voltage Control Configuration of AV259-32 and Truth Table

Differential Voltage Operation of High Linearity IC Switches

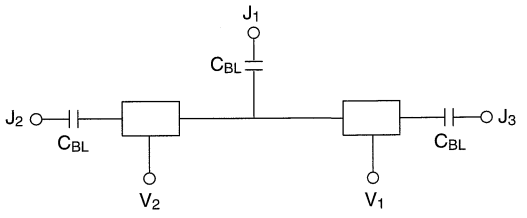
Alpha

Power handling and linearity performance of IC switches can be improved by increasing the differential between the control voltages. Due to system design constraints sufficient positive or negative control voltages are not always available to achieve maximum device performance. In this case a combination of positive and negative voltage may be used to attain a higher differential thus optimizing the switch performance.

The AW002R2-12, 10 W T/R switch can be operated with positive and negative voltages. Figure 1 shows the required schematic, control voltages and truth table. The differential of the control voltages must not exceed the maximum voltage rating of the device.

Since the design utilizes "all series FETs" there is no need to bypass the ground pins. They may be connected directly to ground (See Figure 2, pins 2, 6, 8). All RF ports (J_1, J_2, J_3) must be DC blocked.

It is recommended that the ground leads (2, 6, 8) be connected to PCB grounds that are "good" heat sinks whenever the part is operated at an RF power level of 3 W or higher.



Truth Table

V_1	V_2	J_1–J_2	J_1–J_3
V_{Low}	V_{High}	Insertion Loss	Isolation
V_{High}	V_{Low}	Isolation	Insertion Loss

Control Voltages (V_1, V_2)
V_{Low} $-12\ V \le V_{Low} \le 0\ V$
V_{High} $0\ V \le V_{High} \le +12\ V$
Differential $+5\ V \le (V_{High} - V_{Low}) < +12\ V$

Figure 1. Schematic, Truth Table, and Control Voltages

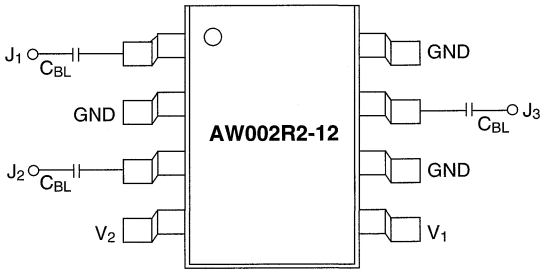


Figure 2. Direct Connection to Ground Pins

4

GaAs IC Switch Power Handling Characteristics

Power handling is defined as the amount of input power that causes the insertion loss to increase by 1 dB ($P_{-1\ dB}$). Alpha's general purpose switches are nominally 0.5–1 W capability that satisfies the receiver market. These products range from single throws to four throws in various package configurations. Alpha's high power, or high linearity switches are nominally 2.0–10 W capability. They are designed for the hand-held radio market such as T/R, antenna diversity and antenna changeover applications.

General Purpose Switches (<1.0 W)

Control Voltage vs. $P_{-1\ dB}$

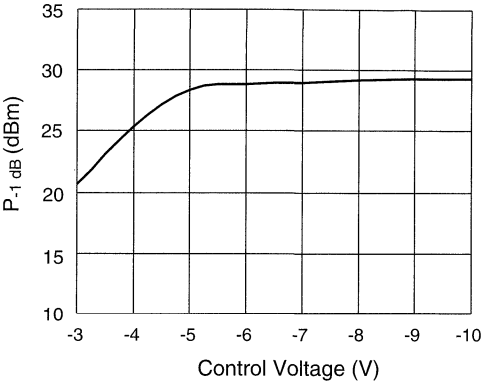
Power handling of a GaAs IC switch is determined primarily by the current handling (IDSS) and voltage breakdown (V_{GS}, V_{GD}) of the MESFET device. For a given design, the user must consider the frequency of operation and the voltage available for biasing the MESFET. Increased power handling occurs up to approximately -10 V. Beyond this voltage, increasing control voltage eventually results in reverse breakdown of the FET junction due to the RF voltage swing at high powers.

GaAs IC switches that operate at -5 V have a "pinch-off" voltage (V_P) of typically -3 to -4 V. As the control voltage becomes more negative the 1 dB compression point increases dramatically as shown in Figure 1.

Frequency of Operation vs. $P_{-1\ dB}$

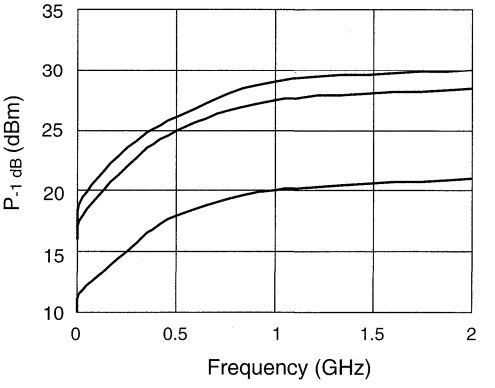
Figure 2 shows the power handling degradation as a function of frequency and control voltage. At a frequency when the gate-to-channel capacitive impedance approximates the gate bias resistance, a significant fall off in power handling occurs in a MESFET switch. At this point the RF voltage in the channel tends to put the device into forward bias or premature saturation. Below 0.5 GHz the $P_{-1\ dB}$ decreases by 2–3 dB and at 0.1 GHz decreases by 5–7 dB at a given control voltage.

As the control voltage is decreased, the "off" path of the switch starts to conduct RF power (turn "on" slightly). This causes non linearities, or distortion to appear in the "on" or T_X path. This must be avoided for proper signal transmission in commercial radios. For these designs high power switches must be used.



Control Voltage vs. $P_{-1\ dB}$ <1.0 W
Switches F = 900 MHz

Figure 1. Control Voltage vs. $P_{-1\ dB}$



Frequency vs. $P_{-1\ dB}$ <1.0 W
Switches V_{CTL} = -3, -5, -7 V

Figure 2. Frequency vs. $P_{-1\ dB}$

High Power Switches (2–10 W)

By splitting RF voltage across many FETs or using multi-gated FETs RF power handling can be increased up to 10 W. Alpha offers many switches that combine high power handling, low insertion loss and good isolation. Please refer to the Commercial IC Products Selection Guide for individual datasheets.

Introduction

GaAs FETs have been used as building blocks in the design of VVAs using the channel resistance of the FET as the actual resistance of the circuit components. In a tee attenuator design, two equal series FETs and one shunt FET are utilized to form a resistive network. For matched conditions, unique resistive values for the series and shunt elements are required. This resistive value is obtained by de-biasing the gate of the FET thereby pinching off the channel which in turn increases the resistance. These designs require two DC independent biases, one for the series FETs and one for the shunt FETs. The resulting control voltage transfer curve is nonlinear.

To partially alleviate this dual biasing requirement, Alpha has designed two novel "single bias" attenuators.

Single Bias 0–35 dB Dynamic Range VVA

The AT002S3-12 is a bridged tee attenuator that operates with a single control voltage of 0 to +5 V. This VVA also requires a fixed bias supply of +5 V for operation. The insertion loss is 1.6 dB @ 1 GHz.

The voltage attenuation characteristics are shown in Figure 1. The attenuator can be considered linear between the relative attenuation range of 5 to 30 dB.

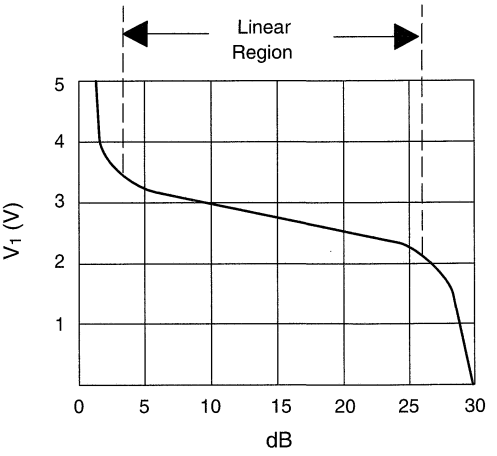


Figure 1. Control Voltage vs. Relative Attenuation for the AT002S3-12

4

Voltage Variable Attenuators

Characteristics	Single Voltage Control		Dual Voltage Control
	AT002S3-12	AV259-32	AT002N3-12
Control Voltage	0–+5 V	0–-5 V	0–-5 V; -5–0 V
Attenuation Range (Relative)	0–35 dB	0–12 dB	0–30 dB
Frequency Range	400 MHz–2.5 GHz	DC–1 GHz	DC–2 GHz
Return Loss[1]	~ 10 dB	~ 10 dB	~ 15 dB
Insertion Loss	~ 2.0 dB	~ 3.2 dB	~ 1.5 dB
Fixed Bias	+5 V	+5 V	–
0.1 dB Compression Pt.[1]	-10 dBm	-10 dBm	-4 dBm
1.0 dB Compression Pt.[1]	-3 dBm	-3 dBm	0 dBm

1. F = 0.9 GHz.

Circuit Implementation

The recommended mounting for the AT002S3-12 is shown in Figure 2. All "GND" leads should be grounded so there is a minimal distance from the lead to the grounding surface. This will allow for as low an inductance to ground as is physically possible and will not degrade the attenuators dynamic range significantly. C_{BL} should be chosen to accommodate the lowest frequency of operation.

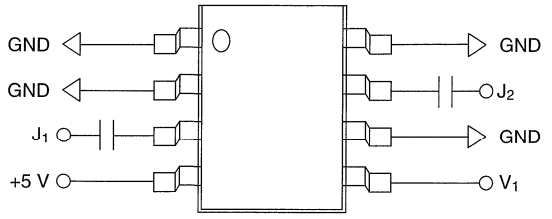
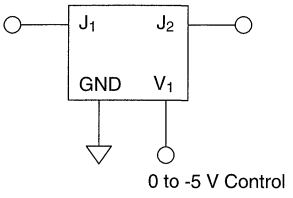


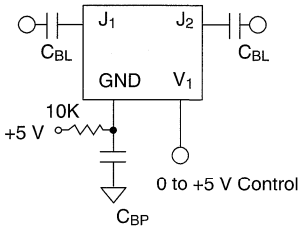
Figure 2. Circuit Implementation of the AT002S3-12 VVA

Single Bias 0–15 dB Dynamic Range AGC VVA

For applications where loss is not critical, such as AGC control circuits, and <15 dB dynamic range is necessary; the AV259-32 is a low cost option. This device is available in the plastic surface mount SOT-143. The device requires single plus or minus voltage. See data sheet for details of specification for the AV259-32. Shown in Figure 3 are mounting configurations.



Negative Voltage Operation



C_{BL} = 100 pF.
C_{BP} = 1000 pF.
F = 900 MHz.

Positive Voltage Operation

Figure 3. Mounting Configurations

Theory of Operation

A dual controlled voltage variable attenuator requires two bias voltages, one applied to the series FETs (V_1) and one applied to the shunt FETs (V_2). The standard "T" pad configuration for the Alpha dual control series VVAs is shown schematically in Figure 1.

As voltages V_1 and V_2 are varied between 0 and -5 V the FETs "on" resistance changes. At 0 V control, the FET is turned fully "on" resulting in a low resistance state (2.5–3.5 Ω). At -5 V control, the FET is in a fully "pinched-off" state resulting in a high resistance state (>5 kΩ). When the control voltages are between 0 and -5 V, the FETs are neither fully "on" nor fully "off" but are in a variable resistance state which is a function of control voltage. The control voltage vs. attenuation curve is shown in Figure 2 and is typical for the AT002N3-12. As can be seen from the curves, they are not a linear function. This occurs because the FET's resistance is a non-linear relationship with respect to control voltage and increases very quickly as the control voltage approaches "pinch-off" (approximately -3.5 V). Also, as the "pinch-off" voltage changes, the curves will shift up or down depending on the direction of "pinch-off" voltage change. A less negative (approaching 0 V) V_P requires less control voltage to achieve a given attenuation. A more negative (approaching -5 V) V_P requires more control voltage to achieve a given attenuation.

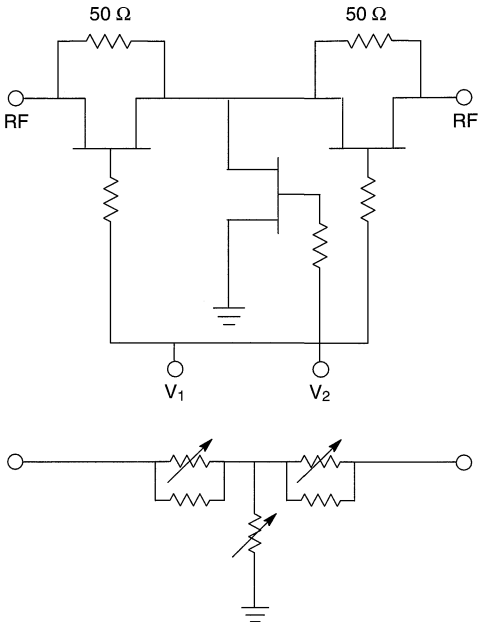


Figure 1. VVA Schematic AT002N3-12

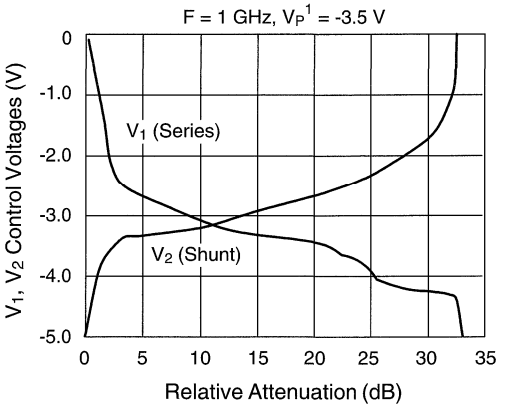


Figure 2. Control Voltages vs. Relative Attenuation (AT002N3-12)

Dual VVA Power Handling Characteristics

The curve shown in Figure 3 relates 1 dB compression point to attenuation at a single frequency (50 MHz). As can be seen in the graph, the compression point changes significantly depending on attenuation value. When the VVA is in its insertion loss state, it has the greatest power handling capability because the series FETs are fully on and the shunt FETs are fully off. The power handling degrades to approximately 0 dBm from just above insertion loss to about the 5 dB attenuation state then gradually increases at higher attenuation values. The reason for this behavior is that the FETs are biased in their most non-linear condition, which is approximately 80% of their "pinch-off" voltage. Since all the FETs are "on" to some extent there exists both a series and shunt leakage path for RF power to flow.

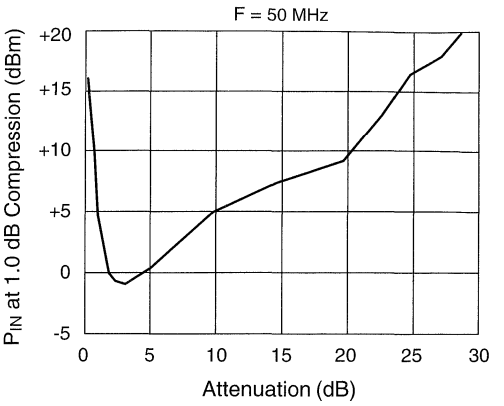


Figure 3. Relative Attenuation vs. 1 dB Compression (AT002N3-12)

Commercial IC Products with GaAs Integral Drivers (On-Chip)

Alpha

Introduction

Alpha's AK series of Commercial IC products have on-chip translators (Integral Driver) that allow the switching functions to be controlled by CMOS or TTL* logic directly. The GaAs FET translators are fabricated by a proven reliable MSAG® process incorporating E/D logic coupled with the analog RF-microwave circuit. Including the translator or "driver" on-chip, can simplify the user's insertion task in a cost effective manner.

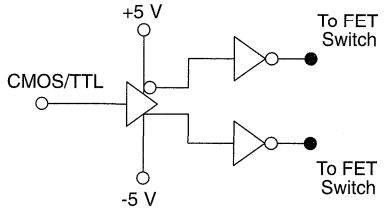


Figure 1. On-Chip Translator Incorporated in the AK Series of Control Products

*Logic Drives (V)	Min.	Max.
Low (0)	0	0.5
High (1)	4	5

Driver Voltage Requirement

The AK series requires DC supply voltages of +5 ± 0.5 V and -5 V ± 0.20 V.

Switching transients are typically less than 25 mV.

Power Consumption

A key feature of Alpha's translators is the very small current drain requirement. Total power needed for a SP2T switch is approximately 15 mW. Shown below is the typical current drain from the TTL, +5 and -5 V supplies for the AK002M2-12.

Typical Drive Current Drains

	Current @ 25°C		
	TTL	+5 V Supply	-5 V Supply
TTL "0"	0.1 µA	100 µA	2.5 mA
TTL "1"	1.2 µA	700 µA	2.7 mA

Power Handling

The power handling characteristics of these switches are less than general purpose driverless switches. This is because the on-chip driver supplies the RF switching FETs with a lower gate voltage than the manually biased standard switch. The 1 dB compression point is typically 1 W for a general purpose switch but only 100–200 mW for a switch with integral driver. Therefore it is recommended that these products be used in low power (<100 mW) applications.

The 1 dB compression of GaAs FET switches is a function of "pinch-off" voltage (V_P) and bias voltage (V_B) for a given FET periphery. Alpha's series of RF switches without drivers has a V_P of 3.5 V and is typically biased at -7 V. Above 800 MHz, this results in a 1 dB compression of 30 dBm. The Alpha series of RF switches with on-chip drivers has a V_P of 1.5 V, which is consistent with the translator output V_0 = 3.0 V. This results in a 1 dB compression of 20 dBm above 800 MHz.

Switching Performance

The data shows that change in switching speed and bias current is minimal over the temperature range of 0°C to +85°C (see applicable data sheet on switching characteristics).

User Precautions

A specific sequence of powering up the control device with on-chip translators is absolutely necessary to avoid damage to the translators E/D FETs. The supply voltage (+5, -5 V) and ground, must be connected and powered before the TTL control voltage is applied.

Power Up Sequence	Power Down Sequence
1. +5 V Supply, Ground	1. TTL Control Voltage
2. -5 V Supply	2. -5 V Supply
3. TTL Control Voltage	3. +5 V Supply, Ground

The microwave circuit FETs on all Alpha control products have ≥2.5K resistors in the gate bias path. This high value of resistor makes the control FETs very insensitive to ESD or random voltage spikes. However, the E/D logic FETs of the translator have no such gate resistor protection. The translator is sensitive to damage similar to CMOS devices and should be so treated. All handling and normal ESD procedures must be followed.

4

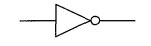
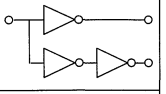
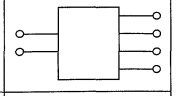
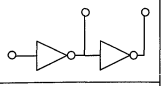
Silicon Driver Chips for the GaAs IC Switch and Digital Attenuator

A very important feature of the GaAs IC switch is the low current flow during either the "on" or "off" state. The current that flows when a FET is reversed biased at -5 V (series FET in the "off" state and shunt FET in the "on" state) is the leakage across the FET (gate to source and gate to drain). This current is typically < 25 µA.

Therefore, taking advantage of this feature, it is desirable to use drivers that are primarily voltage devices with very little current consumption for their operation. Consequently CMOS logic devices are ideal for this application.

In the table below are listed a few of the many CMOS chips that may be utilized with the GaAs IC switches and digital attenuators. These chips are moderately fast, 15–100 ns switching time and can satisfy a large percent of the control device applications. To fully obtain the very fast FET response, 3–10 ns, discrete hybrid silicon or GaAs drivers are required.

Commerical GaAs IC Driver Chips

Driver Chips	Transition Time 10/90% or 90/10% RF	Switching Speed 50% CTL to 90/10% RF	Current Draw (Static)	TTL Compatibility	Power Supply[1]	Logic Function
	Typ.	Typ.	Typ.			
Hex Inverters[2]						
54S04	5 ns	15 ns	25 mA	Yes	+5 V	
54LS04	10 ns	30 ns	8 mA	Yes	+5 V	
54F04	5 ns	15 ns	10 mA	Yes	+5 V	
54HCT04	10 ns	25 ns	50 µA	Yes (CMOS)	+5 V	
54ACT11004	8 ns	20 ns	100 µA	Yes (CMOS)	+5 V	
Quad Complementary Inverter[2]						
CD4041UB	10 ns	50 ns	50 µA	No (CMOS)	+5 V	
Two to Four Line Decoder						
54HCT139	10 ns	25 ns	25 µA	Yes	+5 V	
Zener/Hex[3]	5 ns	20 ns	2 mA	Yes	±5 V or +5 V, -12 V	
DG403 Analog Switch	10 ns	100 ns	4 mA	Yes	+5 to +15, -5 to -15	

1. Refer to the "Positive Voltage Operation" application note.
2. Both the 54 series inverters and the quad complementary inverter can be driven by -5 V by tying V_{CC} to GND and GND to -5 V; however, the input pulse must be negative going. Single chip is capable of driving an SP4T switch or 4 bit digital attenuator.
3. Refer to the "A Fast TTL Input Compatible Driver Circuit for Commercial IC Switches" application note.

High Isolation Synthesizer Selection Circuit for GSM, DCS1800, PCS1900

Alpha

The ability to switch between two synthesizers is a standard requirement in GSM and PCS digital base stations. Typically the isolation required between synthesizers exceeds 90 dB. The most common design solution is to use five commercial GaAs IC switches [(1) SPDT, (4) SPST]. The benefit is that the isolation specification can be met without elaborate circuit manipulation. The downside is higher insertion loss, large PCB area and increased cost. Alpha has developed a three switch solution utilizing high isolation SPDT and SPST GaAs IC switches. Isolation values are >90 dB @ 900, 1800 and 1900 MHz. The key is to lay out the PCB so that DC to RF coupling, radiation and leakage effects are minimized. The circuit is composed of one AS148-24 SPDT and two AS123-12 SPST positive control switches. It is non-reflective at the J_2, J_3 ports (Figure 1).

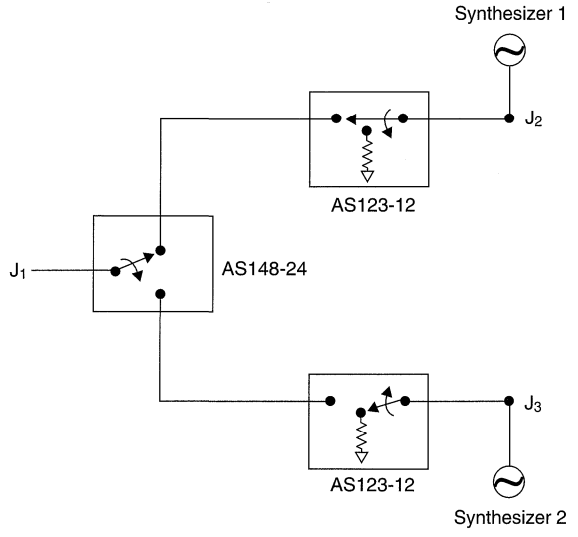


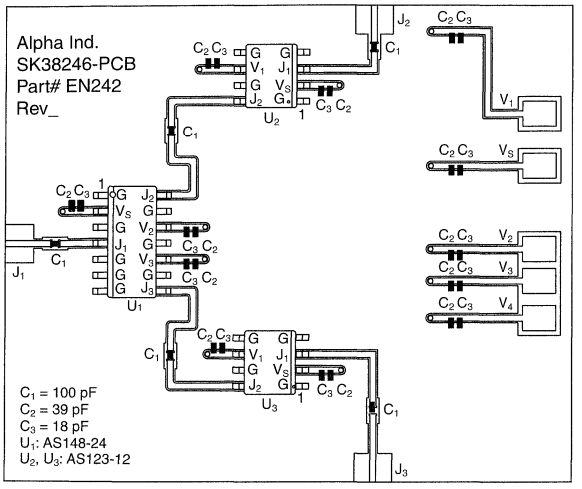
Figure 1. Block Diagram Synthesizer Selection Circuit

The PCB material is low cost FR4, 0.028" thick, $E_R = 4.5$. The circuit was designed using two-layer grounded-coplanar-waveguide (CPW) as the transmission medium. CPW has many advantages over microstrip when high isolation is required.

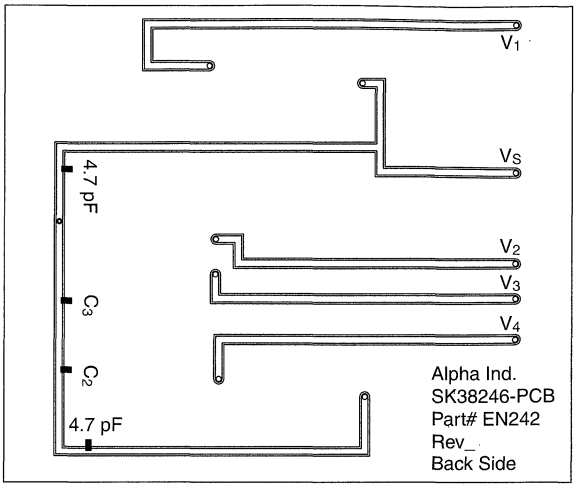
- CPW transmission lines and gaps are narrower thus saving PCB area. For this design 0.019" line width 0.005" gap yielded the best simulated and measured results. The PCB could also be fabricated easily using these values.
- Radiation and DC to RF coupling effects are minimized because of the top ground layer. It acts as a termination point for stray fields.
- Grounding under the GaAs IC and along the RF lines is provided by plated thru-holes. This helps to further isolate the individual switch paths.
- The voltage supply and control lines can be capacitively bypassed due to the close proximity of the ground plane. Hi Q 0402 multilayer capacitors worked well. Two values of capacitor were chosen, 39 pF for 900 MHz and 18 pF for 1800, 1900 MHz. See Figure 2.
- Two layer PCB keeps RF and DC lines separated and results in a further isolation improvement.

The assembly requires a fixed +5 V supply voltage (V_S) and four lines of voltage control (V_1–V_4) 0/+5 V. Figure 2 shows the PCB layout, top and bottom, with associated bypass and blocking capacitors. Figure 3 shows isolation, return loss and insertion loss measurements. The isolation measurements were made without shielding the individual switches. An improvement of ≈20 dB (>105 dB) can be achieved with proper shielding.

4

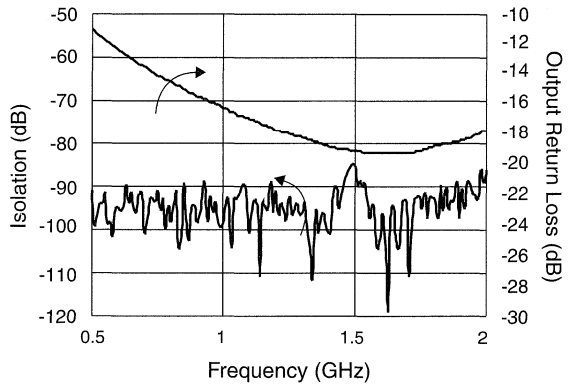


PCB Top

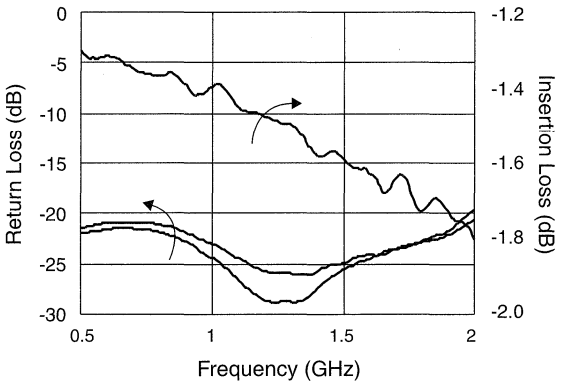


PCB Bottom

Figure 2. Synthesizer Selection Circuit PCB and Truth Table



Synthesizer Switch
Isolation & Return Loss



Synthesizer Switch
Insertion Loss & Return Loss

Figure 3. Isolation, Return Loss, Insertion Loss Measurements

A Fast TTL Input Compatible Driver Circuit for Commercial IC Switches

Alpha

A driver technique presently used for Alpha's GaAs switch product line is called the "Floating Channel" technique (refer to the section of the latest Alpha catalog for a discussion of this driver circuit). Because of the complexity of this driver technique a new driver circuit was developed. The goals of the new design were to preserve the TTL input compatibility and fast switching characteristics of the present design, while limiting current consumption to under 2 mA and providing output voltages compatible with the GaAs IC switch complementary control voltages of 0/-5 V_{DC}.

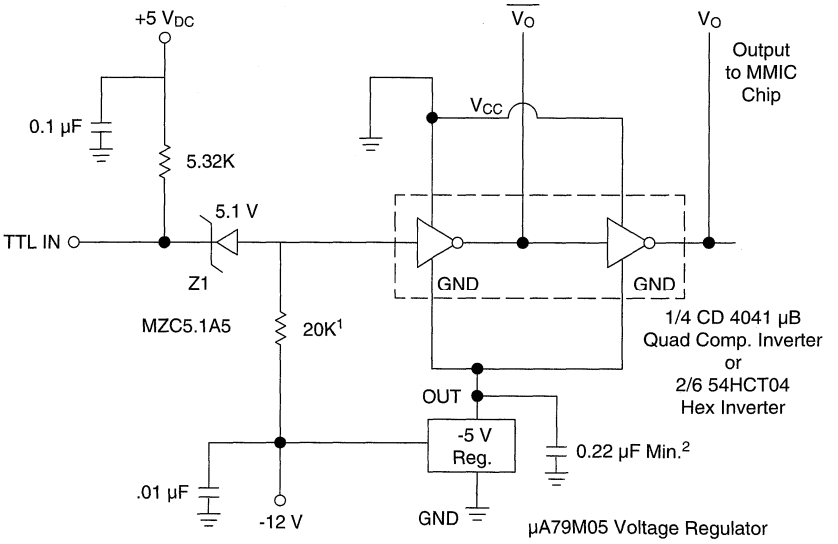
As shown in Figure 1 the new driver circuit consists of three main components:

- The MZC5.1A5 5.1 V Zener diode
- The 54HCT04 hex inverter
- The µA79M05 -5.0 voltage regulator

Other components are: .01 µF decoupling capacitors, a 5.32 kΩ resistor for open collector TTL, and a 20K bias resistor to keep the Zener diode in its reverse breakdown mode.

In comparison, the "floating channel" technique requires all drain to source channels of the IC switch to be floated above ground. This is achieved through the use of pull-up resistors, bypass, DC block, and decoupling capacitors. As a result, the components used in this driver circuit limit the RF performance of the IC switches.

The QMOS inverter was chosen to satisfy the output control voltage magnitude requirement of 5/0 V_{DC}. QMOS (Quick CMOS) devices have the low power consumption of CMOS and the high speed of LSTTL. This LSTTL input compatible logic gate is designed to have its output high voltages pull to the supply voltage (V_{CC}) of +5 V_{DC} ± 10%. Since IC switches are controlled by negative complementary voltages of 0/-5 V_{DC} the QMOS inverter bias was reversed with its ground connected to -5 V_{DC} and V_{CC} connected to 0 V_{DC} (ground). The inverter outputs will now pull to -5 or 0 V_{DC}. Under this bias condition the maximum TTL input low voltage (V_{IL}) changes from +.8 V_{DC} to -5 (+.8) = -4.2 V_{DC}. The minimum TTL input high voltage (V_{IH}) changes from +2.0 V_{DC} to -5 - (+2.0) = -3.0 V_{DC}.



1. Choose resistor to allow for optimum Zener current.
2. 1.0 µF recommended however this is usually a very large capacitor. A 0.22 µF cap is sufficient to prevent oscillations.
CD4041UB will yield approximately 40 ns T_{ON}.
54HCT04 will yield approximately 20 ns T_{ON} (50% CTL to 90/10% RF).

Figure 1. Zener/Inverter Driver for GaAs IC Switches

With the -5/0 V_{DC} complementary output taken care of, a circuit is required to interface positive logic TTL to the modified negative input of the QMOS inverter. A 5.1 V (±5%) Zener diode is used to provide a voltage drop between the TTL input and the inverter input. The diode is reverse biased to ensure that it is always operating well above its typical Zener knee current of .10 mA. At TTL = 0 the inverter receives 0–5.1 = -5.1 V_{DC}. At TTL = +5.0 V_{DC} the inverter receives +5.0–5.1 = -0.1 V_{DC} TTL maximum and minimum threshold voltage drops are as follows:

TTL input V_{IL} = +0.8 V_{DC}
+0.8 -5.1 = -4.3 V_{DC}

TTL input V_{IH} = +2.0 V_{DC}
+2.0 -5.1 = -3.1 V_{DC}

Figure 2 shows the Zener diode interface circuit under the five significant TTL input conditions. The bias voltage of -12 V_{DC} was chosen because of its common appearance in system design. The +5 V_{DC} bias was chosen because of its use as an open collector TTL pull-up. The value of R_2 = 20K was chosen to limit the current to under 1 mA in the TTL condition of Figure 2E and to provide a reliable source of current to keep the diode in its Zener mode under the TTL condition of Figure 2A. The resistance of R_1 was calculated by examining the TTL input open circuit condition of Figure 2D where the TTL V_{OH} minimum voltage is +2.5 V_{DC}. At this point the TTL input should not source or sink any current (below +2.5 V_{DC} the input sinks current). Therefore from Figure 2D:

-12 V - (-2.6 V) = -9.4 V
-9.4 V/20K = .470 mA
+5 V - (+2.5 V) = +2.5 V
R_1 = 2.5 V/.470 mA = 5.32K

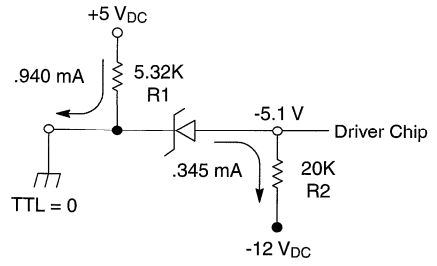
The value of 5.32K satisfies the previous open circuit condition and also limits the current to under 1 mA for the TTL = 0 condition of Figure 2A. Other resistor values may be chosen as long as the TTL open circuit condition is satisfied. For V_{OH} Min. = +2.5 V_{DC} the TTL input should neither source or sink current for the R_1 and R_2 resistor values chosen. When selecting R_1 and R_2 also keep in mind the Zener current requirements and that for designs where the customer is using open collector TTL an increase in R_1 will slow the circuit down.

A -5 V regulator was employed since the QMOS inverter requires a -5 V_{DC} supply and the Zener bias supply was determined to be -12 V_{DC}. The regulator, a Motorola µA79M05, with the help of a 0.22 µF compensation capacitor at its output, provides a stable -5 V_{DC} supply to the inverter. The .01 µF capacitors are used at the positive and negative supply inputs to filter any RF and microwave energy on the bias lines, thus helping to minimize crosstalk.

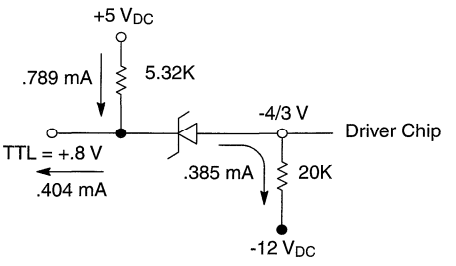
The switching performance of the Zener/QMOS driver circuit is no different than the performance of the floating bias circuit. Since the Zener diode is always well into the reverse breakdown region of its I-V curve and the voltage drop across it is always 5.1 V there is no delay in switching speed.

Typically at 25°C the 10 to 90% (90 to 10%) rise, fall times of the RF envelope are 3 ns and the 50% control to 90% (10%) on, off times are 20 ns. Typical worst case on/off video transients are 60 mV. The maximum control pulse repetition frequency (PRF) used without distortion to the RF envelope was 20 MHz with the same switching characteristics as above.

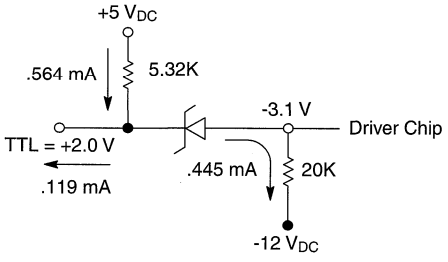
Measured data demonstrates that the Zener/QMOS GaAs switch driver circuit is reliable and fast from -55°C to +125°C and is easier to implement than the "floating channel" circuit. The RF and microwave performance of the GaAs IC switch is not degraded with the Zener/QMOS driver technique because it does not have the pull-up resistors, bypass and DC blocking capacitors that the older driver uses. With the Zener/QMOS driver technique any GaAs IC switch with the negative complementary control can be driven with TTL logic.



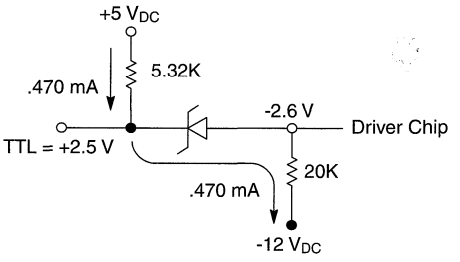
A. Worst Case +V Current
Minimum Zener Current



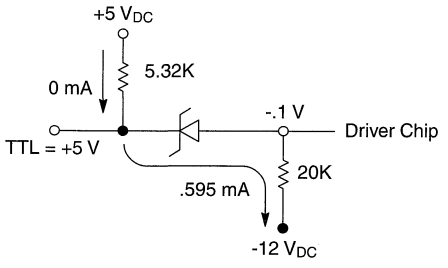
B. TTL V_{IL} Max. = +.8 V



C. TTL V_{IH} Max. = +2.0 V



D. TTL V_{OH} Min = +2.5 V
(This is the Min. Output High from Another TTL Device)
Open Circuit TTL Input Condition

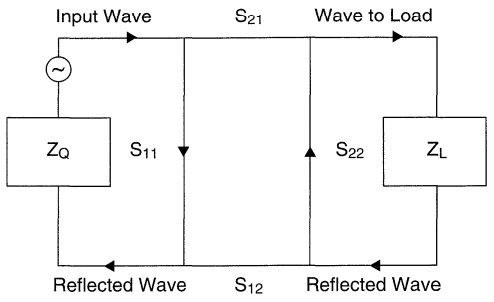


E. TTL V_{OH} Min. = +5.0 V
Worst Case -V Current
(Add 1 mA Typ. for -5 V Regulator)

Figure 2. TTL Condition and Current Paths for the Zener/QMOS GaAs IC Switch Driver

Section 5
Reference Material

Reference Material 5-2
Plastic Packaging 5-3
Footprints 5-4
Tape and Reel Orientation 5-6
Power Conversion dBm to Watts 5-7
VSWR, Return Loss and Transmission Loss vs. Transmission Power 5-8



Linear Two-Port Network

$$S_{11} = \frac{\text{Voltage wave reflected from Port 1}}{\text{Voltage wave incident on Port 1}}$$

$$S_{22} = \frac{\text{Voltage wave reflected from Port 2}}{\text{Voltage wave incident on Port 2}}$$

$$S_{21} = \frac{\text{Voltage wave reflected or leaving Port 2}}{\text{Voltage wave incident or entering Port 1}}$$

$$S_{21} = \left[\frac{\text{Power leaving Port 2}}{\text{Power entering Port 1}}\right]^{1/2}$$

$$S_{21} = \text{Forward Transmission Loss}$$

$$S_{12} = \frac{\text{Voltage wave reflected or leaving Port 1}}{\text{Voltage wave incident or entering Port 2}}$$

$$S_{12} = \left[\frac{\text{Power leaving Port 1}}{\text{Power entering Port 2}}\right]^{1/2}$$

$$S_{12} = \text{Forward Transmission Loss}$$

Radio Frequency Designations

HF	High Frequency	3 MHz–30 MHz
VHF	Very High Frequency	30 MHz–300 MHz
UHF	Ultra-High Frequency	300 MHz–3 GHz
SHF	Super-High Frequency	3 GHz–30 GHz
EHF	Extremely-High Frequency	30 GHz–300 GHz

Frequency Band Designations

Band Designation	Frequency (GHz)
P	.5–1
L	1–2
S	2–4
C	4–8
X	8–12.4
Ku	12.4–18
K	18–26.5
Ka	26.5–40
Q	33–50
U	40–60
V	50–75
E	60–90
W	75–110
F	90–140
D	110–170
G	140–220

Switching Equations for Shunt and Series Elements

Insertion Loss (IL) and Isolation (ISO) for shunt and series switching impedances are represented by the following equations:

Shunt:
$$IL = 10 \log [1 + (R_R/Z_0)]$$
$$ISO = 10 \log [1 + Z_0/2R_S)]^2$$

Series:
$$IL = 10 \log [1 + (R_S/2Z_0)]^2$$
$$ISO = 10 \log [1 + (X_C/2Z_0)]^2$$

Shunt:
$$R_R = Z_0 ([\text{Antilog } (IL/10)] - 1)$$
$$R_s = \frac{Z_0}{2} [\{\text{Antilog } (ISO/20)\} - 1]^{-1}$$

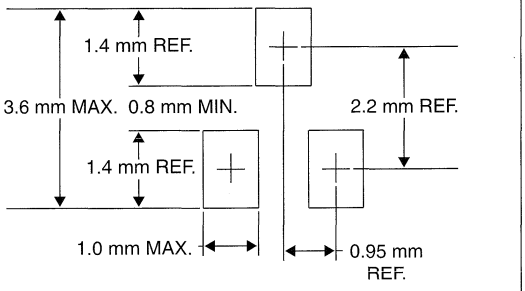
Series:
$$R_s = 2Z_0 [\{\text{Antilog } (IL/20)] - 1\}]$$
$$X_C = 2Z_0 [\{\text{Antilog } (ISO/20) - 1\}]$$

Package Style	Packaging Part Number Suffix
SOT-23	-39
SOT-143	-32
SOT-6	-73
MSOP-8	-59
SSOP-8	-62
SOIC-8	-12
SOIC-14	-24
SOIC-16	-25
SOIC-16 Batwing	-64
SSOP-28 Batwing with Slug	-69
LQFP-32 (7 x 7 mm)	-61
SOIC-16 Wide Body (.300")	-45
PLCC-28	-47
SOIC-24 Wide Body (.300")	-49
PFP-16 with Slug	-75
SSOP-16 with Slug	-79
SOIC-16 with Slug	-81
SSOP-28 with Slug	-83
SSOP-20	-85

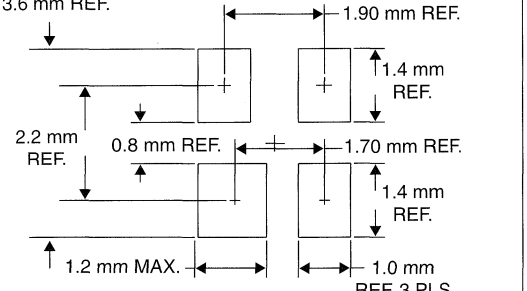
Surface Mount Land Patterns

Below are sample printed circuit board land pattern dimensions. These are based on the IPC (Institute for Interconnecting and Packaging Electronic Circuits) surface mount design and land pattern standard: IPC-SM-782.

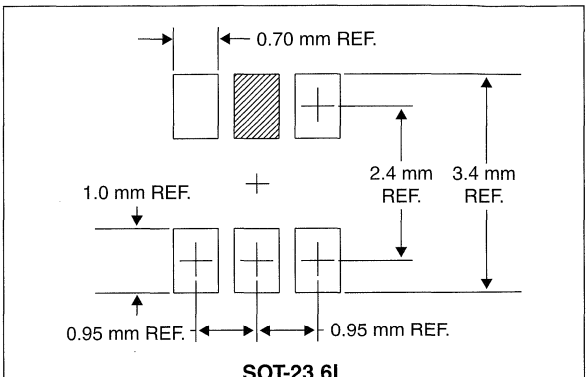
These drawings are for reference only. It is recommended that you consult with the company doing the component mounting and soldering to the printed circuit board. These companies have more information on options (various possible dimensions) of actual land patterns.



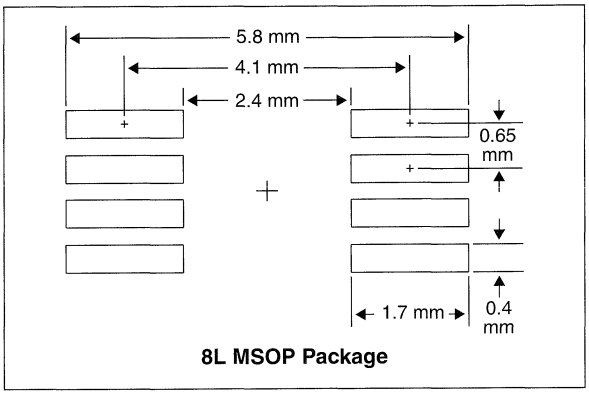
SOT-23 3L



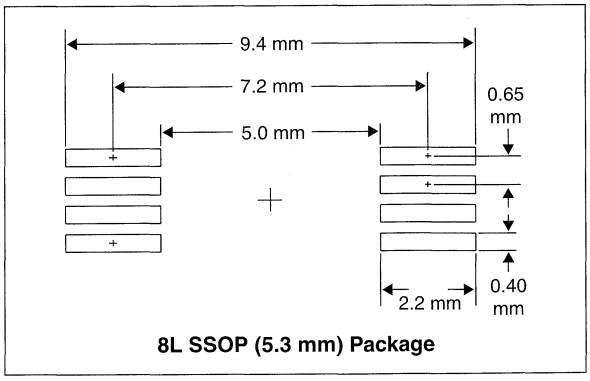
SOT-143 4L



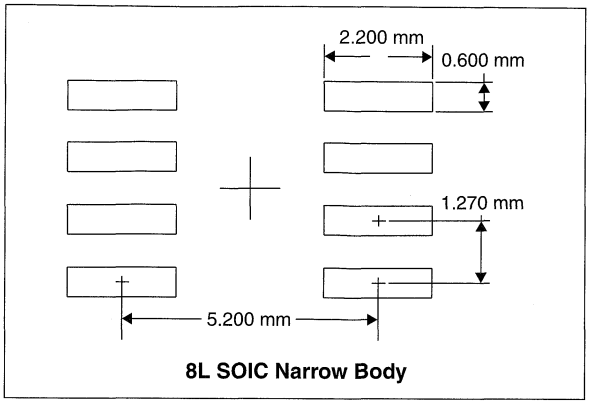
SOT-23 6L



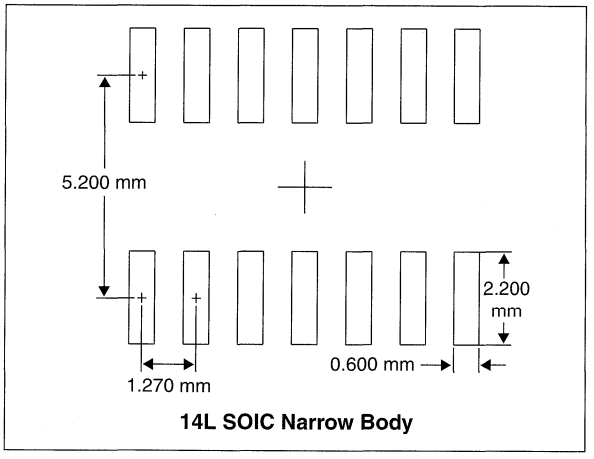
8L MSOP Package



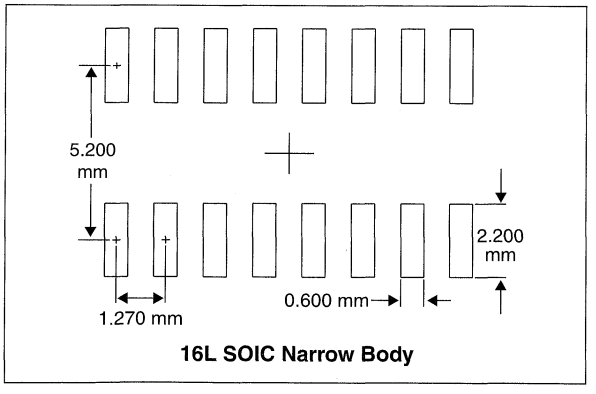
8L SSOP (5.3 mm) Package



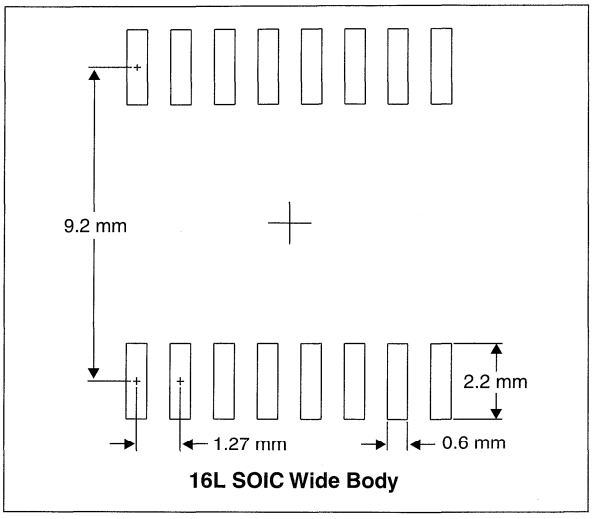
8L SOIC Narrow Body



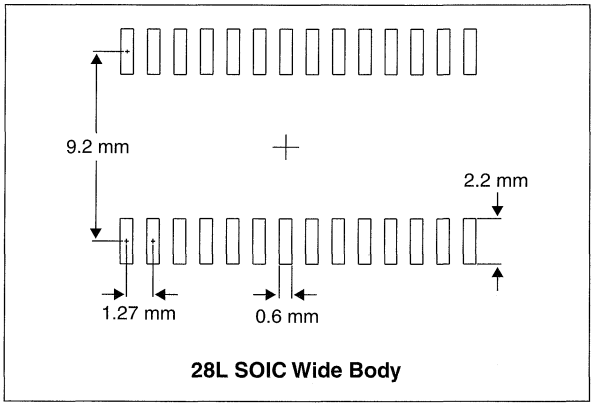
14L SOIC Narrow Body



16L SOIC Narrow Body



16L SOIC Wide Body



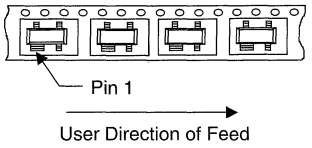
28L SOIC Wide Body

5

Tape & Reel Package Orientation

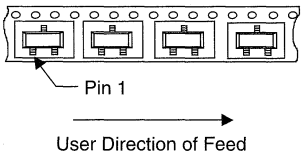
Alpha

SOT-143



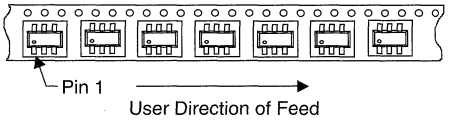
Standard Reel Size	7"	13"
Standard Reel Quantity	3,000	12,000

SOT-23



Standard Reel Size	7"	13"
Standard Reel Quantity	3,000	12,000

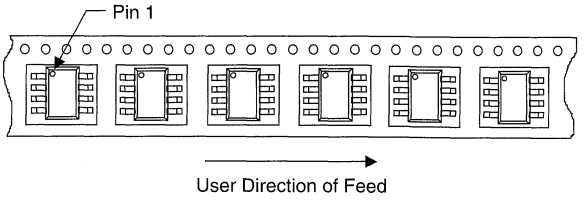
6LD SOT



Standard Reel Size	7"	13"
Standard Reel Quantity	3,000	12,000

All SOIC and MSOP Devices

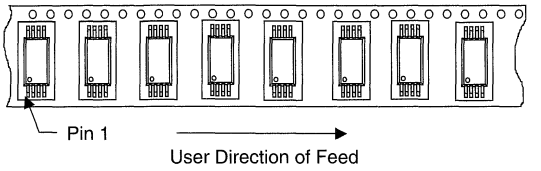
8, 14, 16, Batwing Paddle



Standard Reel Size	7"	13"
Standard Reel Quantity	1,000	3,000

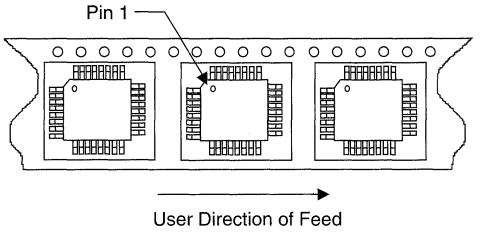
All SSOP Devices

8, 16, 28, Batwing



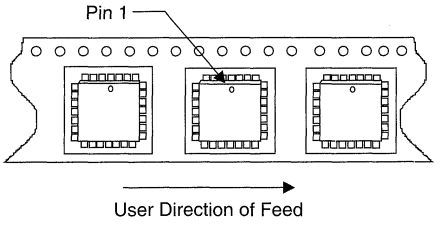
Standard Reel Size	7"	13"
Standard Reel Quantity	1,000	3,000

32 Lead TQFP



Standard Reel Size	7"	13"
Standard Reel Quantity	N/A	2,000

28 Lead PLCC



Standard Reel Size	7"	13"
Standard Reel Quantity	N/A	1,500

Alpha Industries, Inc. **[781] 935-5150** • Fax **[617] 824-4579** • Email **sales@alphaind.com** • **www.alphaind.com**

Power Conversion dBm to Watts

Alpha

dBm	mW	dBm	mW	dBm	mW	dBm	mW	dBm	mW	dBm	mW	dBm	W	dBm	W
0.0	1.00	5.0	3.16	10.0	10.0	15.0	31.6	20.0	100	25.0	316	30.1	1.02	35.1	3.24
0.1	1.02	5.1	3.24	10.1	10.2	15.1	32.4	20.1	102	25.1	324	30.2	1.05	35.2	3.31
0.2	1.05	5.2	3.31	10.2	10.5	15.2	33.1	20.2	105	25.2	331	30.3	1.07	35.3	3.39
0.3	1.07	5.3	3.39	10.3	10.7	15.3	33.9	20.3	107	25.3	339	30.4	1.10	35.4	3.47
0.4	1.10	5.4	3.47	10.4	11.0	15.4	34.7	20.4	110	25.4	347	30.5	1.12	35.5	3.55
0.5	1.12	5.5	3.55	10.5	11.2	15.5	35.5	20.5	112	25.5	355	30.6	1.15	35.6	3.63
0.6	1.15	5.6	3.63	10.6	11.5	15.6	36.3	20.6	115	25.6	363	30.7	1.17	35.7	3.72
0.7	1.17	5.7	3.72	10.7	11.7	15.7	37.2	20.7	117	25.7	372	30.8	1.20	35.8	3.80
0.8	1.20	5.8	3.80	10.8	12.0	15.8	38.0	20.8	120	25.8	380	30.9	1.23	35.9	3.89
0.9	1.23	5.9	3.89	10.9	12.3	15.9	38.9	20.9	123	25.9	389	31.0	1.26	36.0	3.98
1.0	1.26	6.0	3.98	11.0	12.6	16.0	39.8	21.0	126	26.0	398	31.1	1.29	36.1	4.07
1.1	1.29	6.1	4.07	11.1	12.9	16.1	40.7	21.1	129	26.1	407	31.2	1.32	36.2	4.17
1.2	1.32	6.2	4.17	11.2	13.2	16.2	41.7	21.2	132	26.2	417	31.3	1.35	36.3	4.27
1.3	1.35	6.3	4.27	11.3	13.5	16.3	42.7	21.3	135	26.3	427	31.4	1.38	36.4	4.37
1.4	1.38	6.4	4.37	11.4	13.8	16.4	43.7	21.4	138	26.4	437	31.5	1.41	36.5	4.47
1.5	1.41	6.5	4.47	11.5	14.1	16.5	44.7	21.5	141	26.5	447	31.6	1.45	36.6	4.57
1.6	1.45	6.6	4.57	11.6	14.5	16.6	45.7	21.6	145	26.6	457	31.7	1.48	36.7	4.68
1.7	1.48	6.7	4.68	11.7	14.8	16.7	46.8	21.7	148	26.7	468	31.8	1.51	36.8	4.79
1.8	1.51	6.8	4.79	11.8	15.1	16.8	47.9	21.8	151	26.8	479	31.9	1.55	36.9	4.90
1.9	1.55	6.9	4.90	11.9	15.5	16.9	49.0	21.9	155	26.9	490	32.0	1.58	37.0	5.01
2.0	1.58	7.0	5.01	12.0	15.8	17.0	50.1	22.0	158	27.0	501	32.1	1.62	37.1	5.13
2.1	1.62	7.1	5.13	12.1	16.2	17.1	51.3	22.1	162	27.1	513	32.2	1.66	37.2	5.25
2.2	1.66	7.2	5.25	12.2	16.6	17.2	52.5	22.2	166	27.2	525	32.3	1.70	37.3	5.37
2.3	1.70	7.3	5.37	12.3	17.0	17.3	53.7	22.3	170	27.3	537	32.4	1.74	37.4	5.50
2.4	1.74	7.4	5.50	12.4	17.4	17.4	55.0	22.4	174	27.4	550	32.5	1.78	37.5	5.62
2.5	1.78	7.5	5.62	12.5	17.8	17.5	56.2	22.5	178	27.5	562	32.6	1.82	37.6	5.75
2.6	1.82	7.6	5.75	12.6	18.2	17.6	57.5	22.6	182	27.6	575	32.7	1.86	37.7	5.89
2.7	1.86	7.7	5.89	12.7	18.6	17.7	58.9	22.7	186	27.7	589	32.8	1.91	37.8	6.03
2.8	1.91	7.8	6.03	12.8	19.1	17.8	60.3	22.8	191	27.8	603	32.9	1.95	37.9	6.17
2.9	1.95	7.9	6.17	12.9	19.5	17.9	61.7	22.9	195	27.9	617	33.0	2.00	38.0	6.31
3.0	2.00	8.0	6.31	13.0	20.0	18.0	63.1	23.0	200	28.0	631	33.1	2.04	38.1	6.46
3.1	2.04	8.1	6.46	13.1	20.4	18.1	64.6	23.1	204	28.1	646	33.2	2.09	38.2	6.61
3.2	2.09	8.2	6.61	13.2	20.9	18.2	66.1	23.2	209	28.2	661	33.3	2.14	38.3	6.76
3.3	2.14	8.3	6.76	13.3	21.4	18.3	67.6	23.3	214	28.3	676	33.4	2.19	38.4	6.92
3.4	2.19	8.4	6.92	13.4	21.9	18.4	69.2	23.4	219	28.4	692	33.5	2.24	38.5	7.08
3.5	2.24	8.5	7.08	13.5	22.4	18.5	70.8	23.5	224	28.5	708	33.6	2.29	38.6	7.24
3.6	2.29	8.6	7.24	13.6	22.9	18.6	72.4	23.6	229	28.6	724	33.7	2.34	38.7	7.41
3.7	2.34	8.7	7.41	13.7	23.4	18.7	74.1	23.7	234	28.7	741	33.8	2.40	38.8	7.59
3.8	2.40	8.8	7.59	13.8	24.0	18.8	75.9	23.8	240	28.8	759	33.9	2.45	38.9	7.76
3.9	2.45	8.9	7.76	13.9	24.5	18.9	77.6	23.9	245	28.9	776	34.0	2.51	39.0	7.94
4.0	2.51	9.0	7.94	14.0	25.1	19.0	79.4	24.0	251	29.0	794	34.1	2.57	39.1	8.13
4.1	2.57	9.1	8.13	14.1	25.7	19.1	81.3	24.1	257	29.1	813	34.2	2.63	39.2	8.32
4.2	2.63	9.2	8.32	14.2	28.3	19.2	83.2	24.2	263	29.2	832	34.3	2.69	39.3	8.51
4.3	2.69	9.3	8.51	14.3	26.9	19.3	85.1	24.3	269	29.3	851	34.4	2.75	39.4	8.71
4.4	2.75	9.4	8.71	14.4	27.5	19.4	87.1	24.4	275	29.4	871	34.5	2.82	39.5	8.91
4.5	2.82	9.5	8.91	14.5	28.2	19.5	89.1	24.5	282	29.5	891	34.6	2.88	39.6	9.12
4.6	2.88	9.6	9.12	14.6	28.8	19.6	91.2	24.6	288	29.6	912	34.7	2.95	39.7	9.33
4.7	2.95	9.7	9.33	14.7	29.5	19.7	93.3	24.7	295	29.7	933	34.8	3.02	39.8	9.55
4.8	3.02	9.8	9.55	14.8	30.2	19.8	95.5	24.8	302	29.8	955	34.9	3.09	39.9	9.77
4.9	3.09	9.9	9.77	14.9	30.9	19.9	97.7	24.9	309	29.9	977	35.0	3.16	40.0	10.00
										30.0	1000				

5

VSWR, Return Loss and Transmission Loss vs. Transmitted Power

Alpha

VSWR	Return Loss (dB)	Trans. Loss (dB)	Volt. Refl Coeff	Power Trans (%)	Power Refl (%)	VSWR	Return Loss (dB)	Trans. Loss (dB)	Volt. Refl Coeff	Power Trans (%)	Power Refl (%)
1.00	—	.000	.00	100.0	.0	1.64	12.3	.263	.24	94.1	5.9
1.01	46.1	.000	.00	100.0	.0	1.66	12.1	.276	.25	93.8	6.2
1.02	40.1	.000	.01	100.0	.0	1.68	11.9	.289	.25	93.6	6.4
1.03	36.6	.001	.01	100.0	.0	1.70	11.7	.302	.26	93.3	6.7
1.04	34.2	.002	.02	100.0	.0	1.72	11.5	.315	.26	93.0	7.0
1.05	32.3	.003	.02	99.9	.1	1.74	11.4	.329	.27	92.7	7.3
1.06	30.7	.004	.03	99.9	.1	1.76	11.2	.342	.28	92.4	7.6
1.07	29.4	.005	.03	99.9	.1	1.78	11.0	.356	.28	92.1	7.9
1.08	28.3	.006	.04	99.9	.1	1.80	10.9	.370	.29	91.8	8.2
1.09	27.3	.008	.04	99.8	.2	1.82	10.7	.384	.29	91.5	8.5
1.10	26.4	.010	.05	99.8	.2	1.84	10.6	.398	.30	91.3	8.7
1.11	25.7	.012	.05	99.7	.3	1.86	10.4	.412	.30	91.0	9.0
1.12	24.9	.014	.06	99.7	.3	1.88	10.3	.426	.31	90.7	9.3
1.13	24.3	.016	.06	99.6	.4	1.90	10.2	.440	.31	90.4	9.6
1.14	23.7	.019	.07	99.6	.4	1.92	10.0	.454	.32	90.1	9.9
1.15	23.1	.021	.07	99.5	.5	1.94	9.9	.468	.32	89.8	10.2
1.16	22.6	.024	.07	99.5	.5	1.96	9.8	.483	.32	89.5	10.5
1.17	22.1	.027	.08	99.4	.6	1.98	9.7	.497	.33	89.2	10.8
1.18	21.7	.030	.08	99.3	.7	2.00	9.5	.512	.33	88.9	11.1
1.19	21.2	.033	.09	99.2	.8	2.50	7.4	.881	.43	81.6	18.4
1.20	20.8	.036	.09	99.2	.8	3.00	6.0	1.249	.50	75.0	25.0
1.21	20.4	.039	.10	99.1	.9	3.50	5.1	1.603	.56	69.1	30.9
1.22	20.1	.043	.10	99.0	1.0	4.00	4.4	1.938	.60	64.0	36.0
1.23	19.7	.046	.10	98.9	1.1	4.50	3.9	2.255	.64	59.5	40.5
1.24	19.4	.050	.11	98.9	1.1	5.00	3.5	2.553	.67	55.6	44.4
1.25	19.1	.054	.11	98.8	1.2	5.50	3.2	2.834	.69	52.1	47.9
1.26	18.8	.058	.12	98.7	1.3	6.00	2.9	3.100	.71	49.0	51.0
1.27	18.5	.062	.12	98.6	1.4	6.50	2.7	3.351	.73	46.2	53.8
1.28	18.2	.066	.12	98.5	1.5	7.00	2.5	3.590	.75	43.7	56.2
1.29	17.9	.070	.13	98.4	1.6	7.50	2.3	3.817	.76	41.5	58.5
1.30	17.7	.075	.13	98.3	1.7	8.00	2.2	4.033	.78	39.5	60.5
1.32	17.2	.083	.14	98.1	1.9	8.50	2.1	4.240	.79	37.7	62.3
1.34	16.8	.093	.15	97.9	2.1	9.00	1.9	4.437	.80	36.0	64.0
1.36	16.3	.102	.15	97.7	2.3	9.50	1.8	4.626	.81	34.5	65.5
1.38	15.9	.112	.16	97.5	2.5	10.00	1.7	4.807	.82	33.1	66.9
1.40	15.8	.122	.17	97.2	2.8	11.00	1.6	5.149	.83	30.6	69.4
1.42	15.2	.133	.17	97.0	3.0	12.00	1.5	5.466	.85	28.4	71.6
1.44	14.9	.144	.18	96.7	3.3	13.00	1.3	5.762	.86	26.5	73.5
1.46	14.6	.155	.19	96.5	3.5	14.00	1.2	6.040	.87	24.9	75.1
1.48	14.3	.166	.19	96.3	3.7	15.00	1.2	6.301	.88	23.4	76.6
1.50	14.0	.177	.20	96.0	4.0	16.00	1.1	6.547	.88	22.1	77.9
1.52	13.7	.189	.21	95.7	4.3	17.00	1.0	6.780	.89	21.0	79.0
1.54	13.4	.201	.21	95.5	4.5	18.00	1.0	7.002	.89	19.9	80.1
1.56	13.2	.213	.22	95.2	4.8	19.00	.9	7.212	.90	19.0	81.0
1.58	13.0	.225	.22	94.9	5.1	20.00	.9	7.413	.90	18.1	81.9
1.60	12.7	.238	.23	94.7	5.3	25.00	.7	8.299	.92	14.8	85.2
1.62	12.5	.250	.24	94.4	5.6	30.00	.6	9.035	.94	12.5	87.5

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Section 7

Warranty / Order Information

How to Order

To order products from this catalogue or if you need additional information, please contact your local representative, distributor or contact us directly.

A worldwide list of Sales Offices / Representatives and Distributors appears on the inside back cover of this catalogue. Please provide part numbers, quantities and any additional information that will help us expedite your order.

Warranty

As an expression of confidence in the quality of our products, and in order to continue to meet the high standard of reliability and performance that you can expect from Alpha Industries Inc., our GaAs and silicon products carry the following warranty:

> Alpha Industries Inc. products are warranted against any defect in material and workmanship for a period of one year from date of shipment. If Alpha Industries receives notice of such defects during the warranty period, Alpha Industries will replace the defective parts. A full statement of Terms and Conditions of Sales is included with the order acknowledgment, and those Terms and Conditions take precedence over the brief statement of the terms in this catalogue.

Customer Satisfaction

As an integral part of our total quality management, Alpha's primary focus is customer satisfaction. Our reputation with customers for impeccable quality is the result of an aggressive, ongoing Total Quality Management Program in which each employee accepts responsibility for continuously improving the company's products, processes, and procedures.

To our customers, Alpha is a trusted partner. We work closely with you to provide product solutions that best achieve your design and manufacturing objectives.

Alpha has a worldwide network of sales representatives, distributors, and experienced application engineers ready to work with you towards your specific product requirements.

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For minimum order requirements, fees, or charges, please contact your local sales representatives or contact us directly. A complete set of Alpha Industries Inc. General Terms and Conditions of Sales is available upon request.

Returns

Alpha requires a Returned Material Authorization (RMA) number prior to returning any product. Please contact your sales representative or contact us directly so that we may help you with your request in the quickest and most efficient manner.

Notice

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- ❑ GaAs FETs and PHEMTs
- ❑ Ceramic Packaged Diodes
- ❑ Diode Chips

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  - ❑ Power Dividers
  - ❑ Quadratures
  - ❑ Mixers
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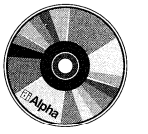

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Alabama/Mississippi/ Western Tennessee
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Fax: (205) 883-9516

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USA Headquarters/Cain-Sweet, Co.
Cain-Sweet, Co.
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Brazil/South America
Vermont Representatives
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Rua Dom Paulo Pedrosa 400
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Mexico
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Denmark
Tech Partner A/S
Tomsagervej 18
8230 Aabyhoj
Denmark
Tel: (45) 874-61600
Fax: (45) 874-61616

England/Ireland/Scotland/Wales
Alpha Industries, Ltd.
19/21 Chapel St.
Marlow Bucks, SL73HN
England
Tel: (44) 1628-475562
Fax: (44) 1628-474078

Finland/Russia
Integrated Electronics Oy Ab
Laurinmaenkuja 3A
P.O. Box 31, FIN-00441
Helsinki, Finland
Tel: (358) 9-586-1770
Fax: (358) 9-586-1771

France/Belgium
Millimondes S.A.
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Greece
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GR 142 35 Nea Ionia
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USA Office for India
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Israel
Ormic Components
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P.O. Box 58029
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Tel: (972) 3-6491118
Fax: (972) 3-6471942

Italy
Microelit S.P.A.
Via Sardegna, 1
20146 Milan, Italy
Tel: (39) 2-481-7900
Fax: (39) 2-481-3594

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Via Nicola Marchese, 10
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Tel: (39) 6-86894323
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Netherlands/Belgium/ Luxembourg
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Middel 6, 1551SP Westzaan
P.O. Box 303
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The Netherlands
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Norway
Datamatik as
Jerikoveien 16, P.O. Box 12
Lindeberg Gaard
1007 Oslo Norway
Tel: (47) 22-301730
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South Africa
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Woodmead Park
Woodmead Extn. 22 Sandton
P.O. Box 6690
Westgate, South Africa
Tel: (27) 11-802-7808
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Spain
Iberica de Componentes, S.A.
Avda Somosierra, 112, 1 of A
28709 San Sebastian de los Reyes
Madrid, Spain
Tel: (34) 91-6541856
Fax: (34) 91-6531019

Sweden
Nordimar
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S-182 05 Djursholm Sweden
Tel: (46) 8-753-3760
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Farabi Sokak No. 44/4
06690 Cankaya
Ankara, Turkey
Tel: (90) 312-467-9952
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Pangaea (Hong Kong) Ltd.
Room 1810 Tai Yau Building
181 Johnston Road
Wanchai, Hong Kong
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Fax: (852) 2834-7340

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S-TEC Intl. Co., Ltd.
P.O. Box 577 Yoido-Dong
Yeung-Deung-Po
Seoul, Korea
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Fax: (82) 2-784-8600

Japan
M-RF Co., Ltd.
1-7-9 Izumi-cho
Kanda, Chiyoda-ku
Tokyo 101 Japan
Tel: (81) 3-5821-3623
Fax: (81) 3-5821-3625

Osaka Branch
M-RF K.K.
2-4-5 Minami-Morimachi
Kita-Ku
Osaka 530 Japan
Tel: (81) 6-313-7180
Fax: (81) 6-313-7182

Philippines
Pangaea International
Trading Corporation
Unit 703 Alabang Business Tower
Blk. 1, Lot 6, Acacia Ave.
Madrigal Business Park
Ayala Alabang
1780 Muntinlupa City, Philippines
Tel: (632) 807-8430
Fax: (632) 809-1355

Singapore/Thailand/Malaysia
Pangaea Corporation
20 MacTaggart Rd. #07-02
Khong Guan Industrial Bldg.
368078 Singapore
Tel: (65) 282-1870
Fax: (65) 282-9879

USA Office for Pangaea
Pangaea Associates
3 Uplands Dr.
Littleton, MA 01460 USA
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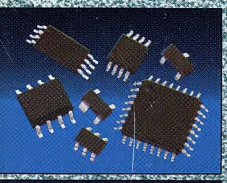

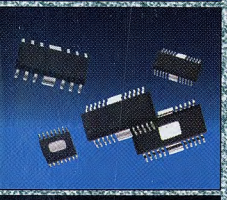

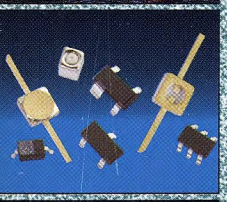

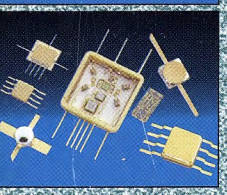

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