HARRIS

HMR-11000

GaAs MMIC Attenuator
DC-18 GHz

PRODUCT DATA

Features

- **Low VSWR**
- **Ultra Low Power Consumption**
- **Voltage Controlled Impedence**
- **Directly Cascadable for Higher Attenuation/Isolation**

Applications

- **Gain Control**
- **Temperature Compensation**
- **SPST Switching**
- **Amplitude/Pulse Modulation**

Description

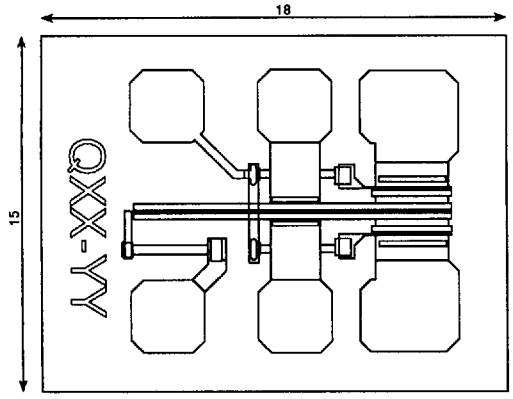
The HMR-11000 is a voltage variable GaAs MMIC attenuator. Directly cascadable, without interstage matching, it provides flexible gain control over a wide bandwidth. The HMR-11000 needs just two analog control voltages with a range of –3.0 to 0.0 V at less than 30 µA each. Direct cascadability offers wider attenuation ranges, while low VSWR offers greater flexibility in your circut lineups.

Its small size and rugged Ti/Pt/Au metallization make it ideal for multi-chip hybrids and demanding military applications as well as a wide variety of instrument and telecommunications applications from DC to 18 GHz.

The HMR product family is based on a 1 µm gate length planar process, with the active layer formed by selective ion implantation. Dielectric and scratch protection protects the channel and the first layer metal. Large gold bonding pads allow easy bonding with 1 mil wire.

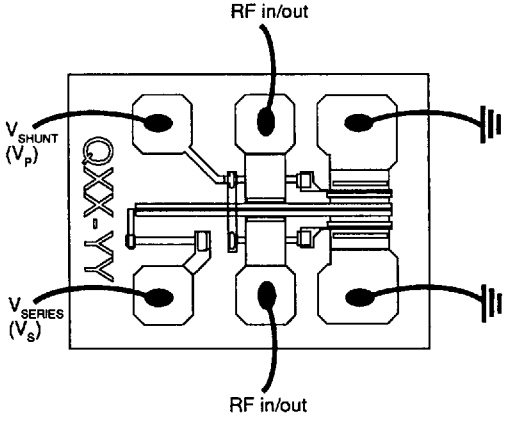
Standard wafer qualification includes 100% DC probe test and visual inspection as well as RF evaluation on a sample basis. Special selection, to customer-specified limits, is available through the use of unique quadrant/row/column serialization which is a feature of all Harris Microwave Semiconductor standard products.

Device Outline



DIMENSIONS IN MILS

Bonding Diagram



CHIP THICKNESS 5 MILS
Au BACKSIDE METALLIZATION

Electrical Specifications at T_A = 25°C

SYMBOL	PARAMETER[1]	FREQ	UNITS	MIN	TYP	MAX
	Maximum Linear Attenuation	DC-2 GHz 2-4 GHz 4-8 GHz 8-12 GHz 12-18 GHz	dB		35 30 22 20 15	
IL	Insertion Loss State	DC-4 GHz 4-8 GHz 8-12 GHz	dB		1.2 1.4 1.7	
VSWR	Input/Output VSWR[2]	DC-8 GHz 8-18 GHz			1.2:1 1.3:1	
P_{IN}	Input Power for 1 dB Change in Attenuation (@ 8 GHz with midrange attenuation)		dBm		16	
IP3	Third Order Input Intercept Point		dBm		40	
τ_S	Attenuation Switching Time, 10% to 90%		ns		3	
	Control Voltage (min to max Attenuation)[3]		V	–5.0		0.5
	Typical "Pivot Point" Attenuation[4] (V_{SERIES} and V_{SHUNT} = –1.3V)		dB		6.5	

NOTES:
1. Typical RF performance and minimum limits are based on testing of sample units from each wafer on 50 Ω test carriers, and do not include correction for tuner/fixture losses. DC min/max limits are guaranteed by 100% on-wafer probe test.
2. For any attenuation setting VSWR can be controlled by adjusting of the shunt voltage
3. Two control voltages required, V_{SHUNT} and V_{SERIES}, at 30 µA max each. Typical operation is achieved by varying V_{SERIES} from 0.0 to -3.0 V and V_{SHUNT} from –3.0 to 0.0 V.
4. "Pivot Point" is attenuation level with $V_{SERIES} = V_{SHUNT}$ at which Z_0 = 50 Ω.

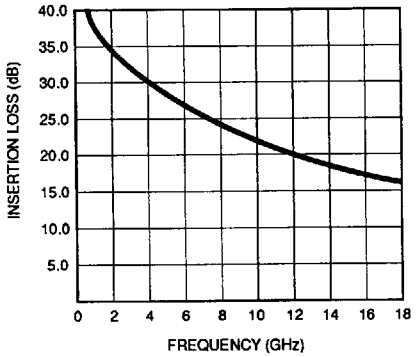
Product Ratings

SYMBOL	PARAMETER	MAXIMUM OPERATING CONDITIONS	
		RECOMMENDED	ABSOLUTE
V_S, V_P	Control Voltage	–5.0 to +0.5 V	–6.0 to +1.0 V
T_{CH}	Channel Temperature, Operating	+180°C	+250°C
T_{STG}	Storage Temperature	–65°C to +180°C	–65°C to +250°C

NOTE: Permanent damage may result from operation at conditions beyond absolute maximum ratings.

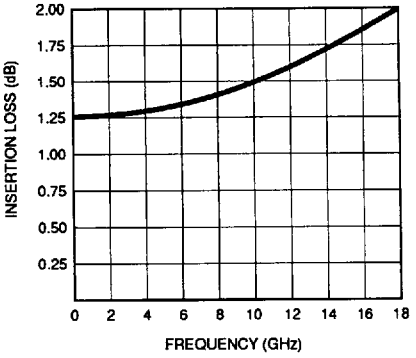
Refer to Application Note 201 for die attachment and wire-bonding recommendations.

Maximum Insertion Loss



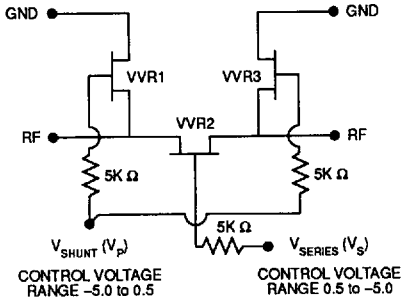
Typical Maximum Insertion Loss vs. Frequency.
V_S = –5.0 V, V_P = 0.0 V, Z_0 = 50 Ω.

Minimum Insertion Loss



Typical Minimum Insertion Loss vs. Frequency.
V_S = 0.0 V, V_P = –5.0 V, Z_0 = 50 Ω.

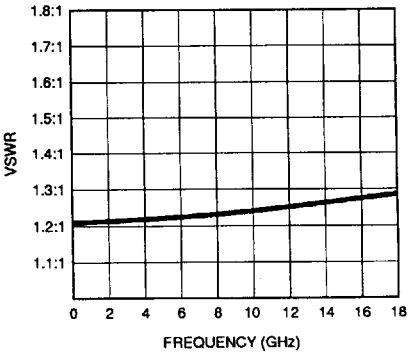
Device Schematic



VVR1, VVR2, VVR3 are FETs used as Voltage Variable Resistors.
Resistor values are nominal.

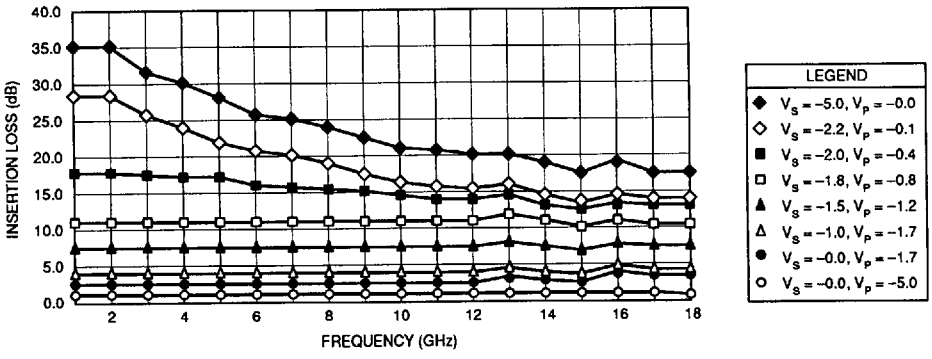
Input/Output VSWR

All Attenuation States



Input/Output VSWR vs. Frequency
(achieved through V_P adjustment.)

Typical Attenuation vs Frequency



Typical Attenuation vs. Frequency in a 50 Ω System.