Triple-Band GaAs IC Antenna Switch Module

AM124

Applications

- Tri Band Antenna Switch for GSM Handsets 5.4 x 4.0 x 1.7 mm

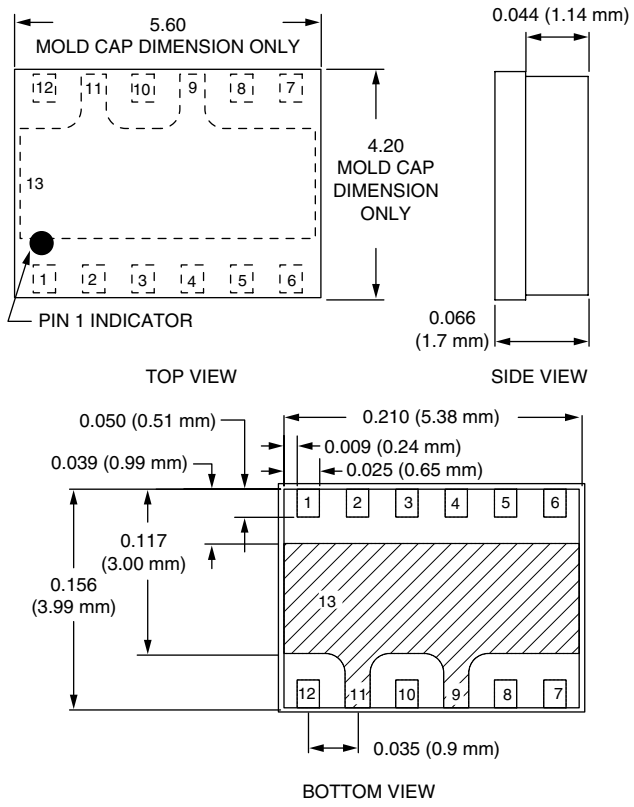
Features

- Integrated Diplexer, T_X LPFs, GaAs Switches and Decoder
- Low Current Drain, < 10 µA Typ.
- Low T_X Insertion Loss (1.0 dB @ EGSM, 1.3 dB @ DCS/PCS)
- ESD Robust (>8 kV Contact, >15 kV Air)
- Capable of All Off Conditions for DCS/PCS Bands
- Combines GaAs PHEMT, CMOS and LTCC Process Technologies

Description

The AM124 is an EGSM/DCS/PCS antenna switch module with integrated SP2T/SP3T GaAs switches, decoder for 3 line control, T_X low pass filters and diplexer. It is housed in a 13 pin 5.4 x 4.0 x 1.7 mm LTCC multilayer ceramic package. The module has internal ESD protection to 2000 V. For protection to 8 kV and higher, contact factory for application note.

Outline Drawing



Dimensions in inches (mm).
Tolerance ± 0.2 mm unless otherwise specified.

T_X Specification

Mode	Parameter	Min.	Typ.	Max.	Unit
EGSM_T_X to Ant	Passband	880	897.5	915	MHz
	Insertion Loss		1	1.2	dB
	Attenuation 1760–1830 MHz (2*F_O)	30	35		dB
	Attenuation 2640–2745 MHz (3*F_O)	30	35		dB
	Attenuation 3520–3660 MHz (4*F_O)	30	40		dB
	Return Loss (I/O)	12	14		dB
	Isolation EGSM_T_X - EGSM_R_X	28	35		dB
	Isolation EGSM_T_X - DCS_R_X	30	40		dB
	Isolation EGSM_T_X - PCS_R_X	30	40		dB
	Harmonic Generation 1760–1830 MHz (2*F_O)		80		dBc
	Harmonic Generation 2640–2745 MHz (3*F_O)		80		dBc
	Input Power		34.5	35	dBm
	Current Consumption		10	100	µA
DCS/PCS_T_X to Ant	Passband - DCS_T_X	1710	1747.5	1785	MHz
	Passband - PCS_T_X	1850	1880	1910	MHz
	Insertion Loss - DCS_T_X		1.5	1.7	dB
	Insertion Loss - PCS_T_X		1.3	1.5	dB
	Attenuation 3420–3820 MHz (2*F_O)	25	35		dB
	Attenuation 5130–5730 MHz (3*F_O)	30	40		dB
	Return Loss DCS_T_X (I/O)	12	15		dB
	Return Loss PCS_T_X (I/O)	14	18		dB
	Isolation DCS/PCS_T_X - EGSM_R_X	25	30		dB
	Isolation DCS/PCS_T_X - DCS_R_X	23	28		dB
	Isolation DCS/PCS_T_X - PCS_R_X	25	30		dB
	Harmonic Generation 3420–3820 MHz (2*F_O)		70		dBc
	Harmonic Generation 5130–5730 MHz (3*F_O)		75		dBc
	Input Power		32.5	33	dBm
	Current Consumption		10	100	µA

R_X Specification

Mode	Parameter	Min.	Typ.	Max.	Unit
Ant to EGSM_R_X	Passband	925	942.5	960	MHz
	Insertion Loss		0.9	1.1	dB
	Return Loss (I/O)	14	18		dB
	Isolation EGSM_T_X - Ant	17	21		dB
	Input Power		10		dBm
	Current Consumption		5	15	µA
Ant to DCS_R_X	Passband	1805	1842.5	1880	MHz
	Insertion Loss		1.2	1.4	dB
	Return Loss (I/O)	14	17		dB
	Isolation DCS_T_X - Ant	15	18		dB
	Isolation PCS_R_X - Ant	23	26		
	Input Power		10		dBm
	Current Consumption		5	15	µA
Ant to PCS_R_X	Passband	1930	1960	1990	MHz
	Insertion Loss		1.2	1.4	dB
	Return Loss (I/O)	12	15		dB
	Isolation PCS_T_X - Ant	14	17		dB
	Isolation DCS_R_X - Ant	23	26		
	Input Power		10		dBm
	Current Consumption		5	15	µA
Control Voltage	V_{C1}, V_{C2}, V_{C3} High “1”	V_{CC}-0.6		V_{CC}	V
	V_{C1}, V_{C2}, V_{C3} Low “0”	0		0.5	V
Supply Voltage	V_{CC}	2.6	3.0	5.0	V

Absolute Maximum Ratings

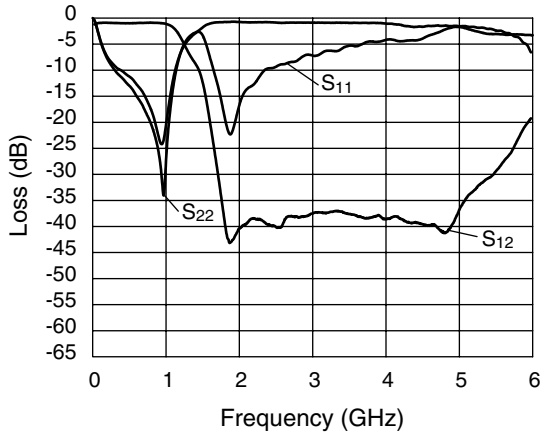
Characteristic	Value
Operating Temp Range (T_{OP})	-30 to +85°C
Storage Temp Range (T_{STG})	-40 to +85°C
Input Power, EGSM_T_X (P_{IN} EGSM_T_X)	36 dBm
Input Power, DCS_T_X (P_{IN} DCS_T_X)	34 dBm
Control Voltage Logic 0 (V_{C1}, V_{C2}, V_{C3})	-0.1 to +0.8 V
Control Voltage Logic 1 (V_{C1}, V_{C2}, V_{C3})	V_{CC} + 0.1 V
Supply Voltage (V_{CC})	6 V
Nominal I/O Impedances (T_X, R_X, Ant)	50 Ω

Truth Table

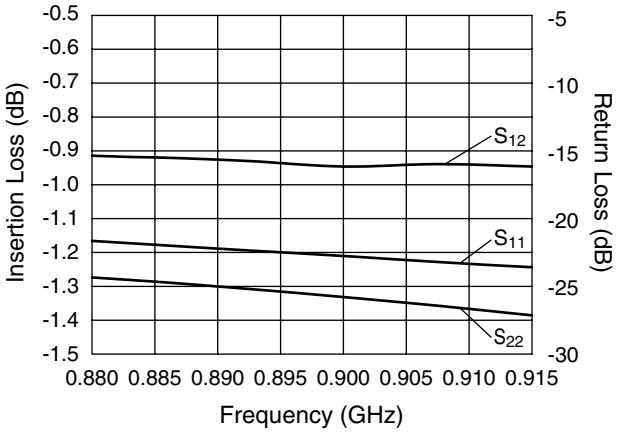
Switch Mode	V_{C1}	V_{C2}	V_{C3}
EGSM_R_X, DCS_R_X	0	0	0
PCS_R_X, EGSM_R_X	0	0	1
EGSM_T_X, DCS_R_X	1	0	0
DCS/PCS_T_X, EGSM_R_X	0	1	0
EGSM_T_X, DCS/PCS_Off[1, 2]	1	1	1

1. DCS/PCS_T_X, DCS_R_X and PCS_R_X paths can be turned off simultaneously. Apply a V_{CC} voltage to the DCS/PCS_T_X path. Set control voltages as shown in the truth table. Chosen path is EGSM_T_X. All other paths are in the off condition.
2. V_{CC} voltage must be applied 10 ns (min.) before application of control voltages (V_{C1}, V_{C2}).

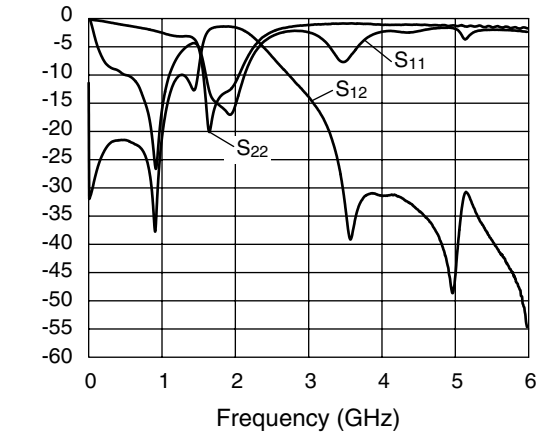
Typical Performance Data (0, +3 V)



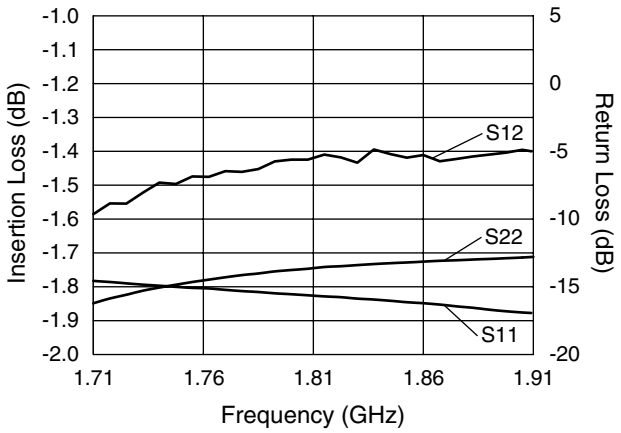
EGSM T_X



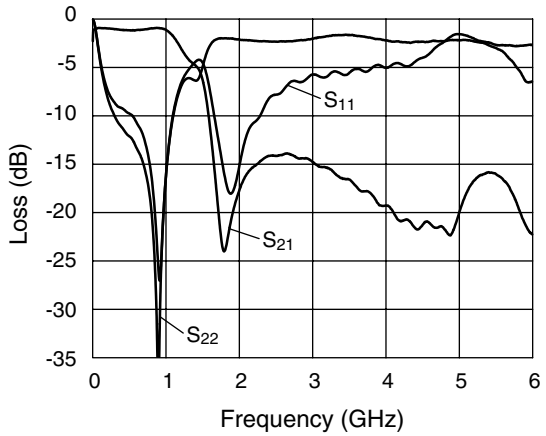
EGSM T_X In Band



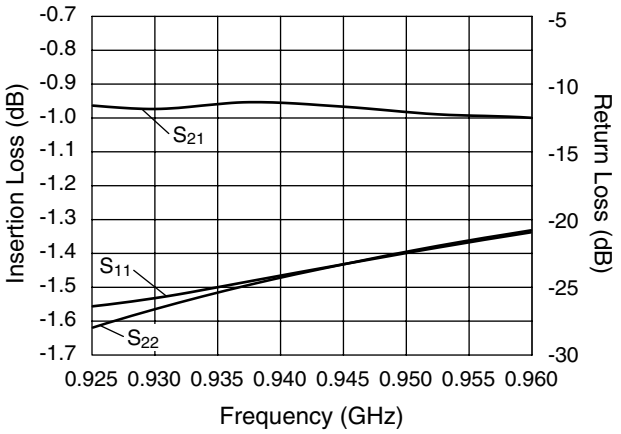
DCS/PCS T_X



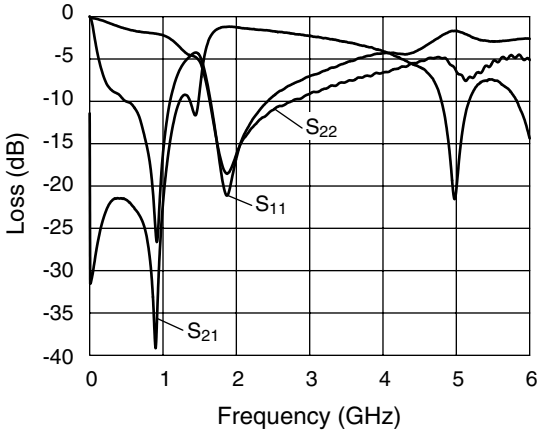
DCS/PCS T_X In Band



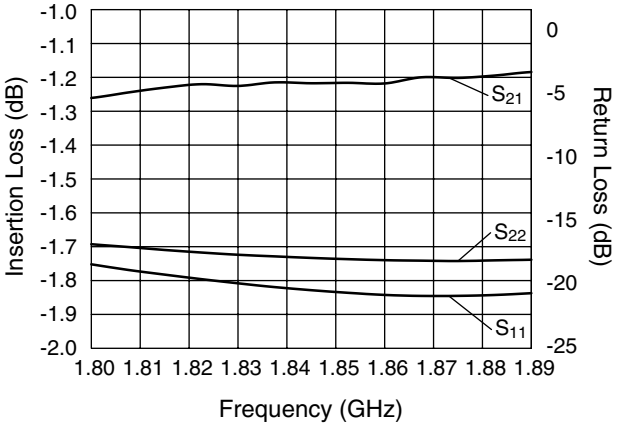
EGSM R_X



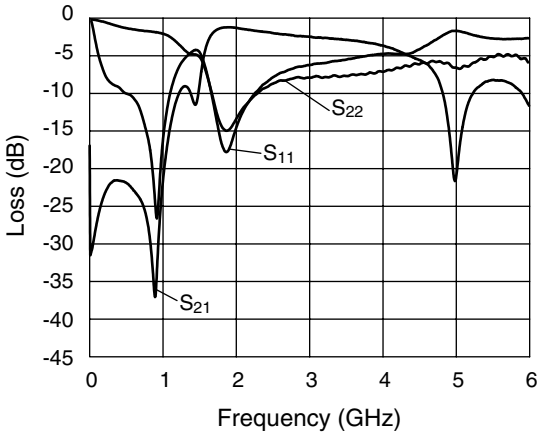
EGSM R_X In Band



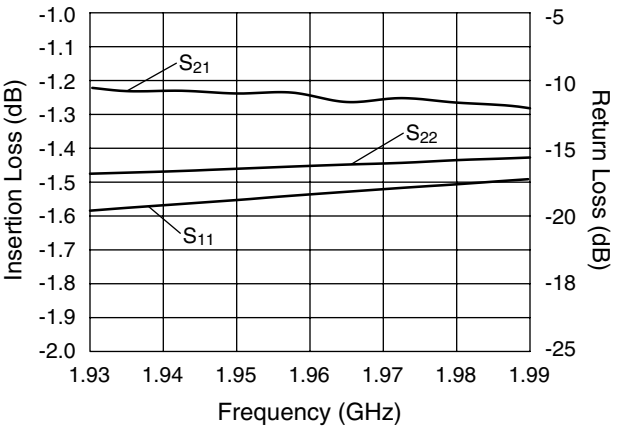
DCS R_X



DCS R_X In Band

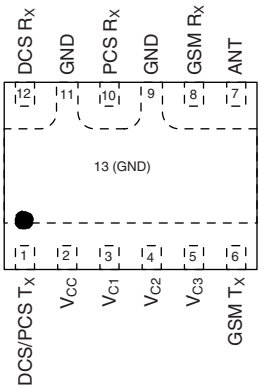


PCS R_X



PCS R_X In Band

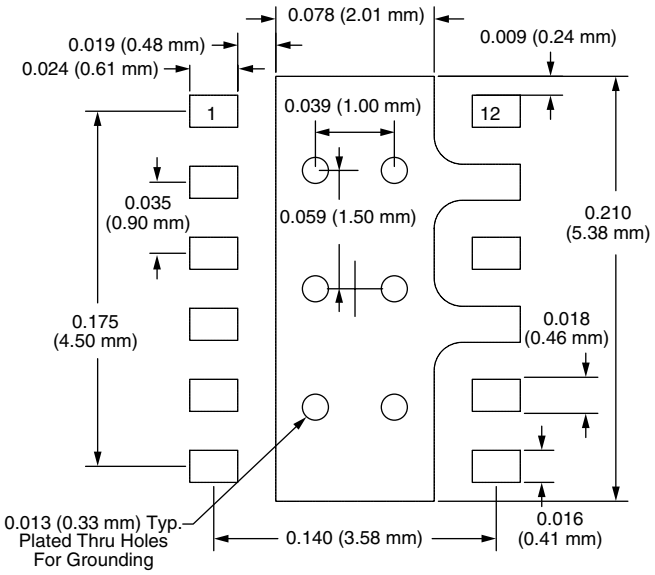
Pin Out (Top View)



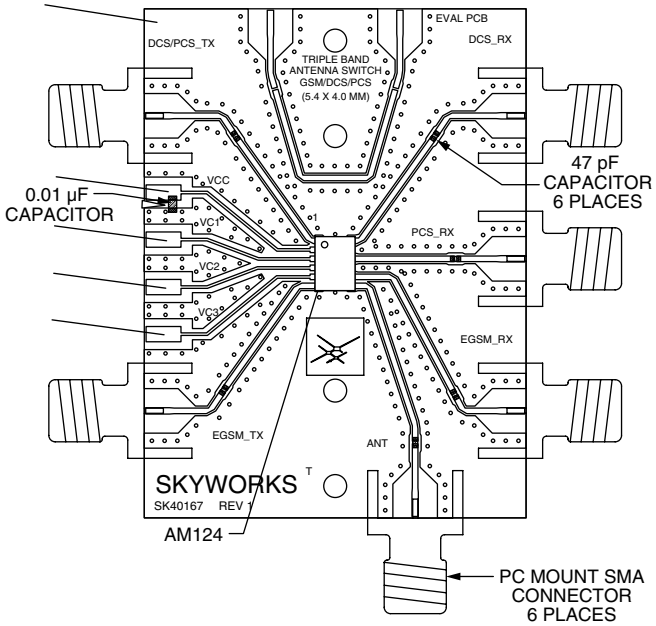
Pin Out Description

Pin Number	Description	Remarks
1	DCS/PCS_T_X	50 Ω Terminating Impedance
2	V_{CC}	Power Supply
3	V_{C1}	Control Voltage Input
4	V_{C2}	Control Voltage Input
5	V_{C3}	Control Voltage Input
6	GSM_T_X	50 Ω Terminating Impedance
7	ANT	50 Ω Terminating Impedance
8	GSM_R_X	50 Ω Terminating Impedance
9, 11, 13	GND	Ground
10	PCS_R_X	50 Ω Terminating Impedance
12	DCS_R_X	50 Ω Terminating Impedance

Suggested Land Pattern



Evaluation PCB



Material: FR4
The circuit board used in the final application should employ RF circuit design techniques. RF signal lines should have 50 Ω impedance. The package bottom ground plane should be connected directly to PCB ground plane. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown is available upon request.

Block Diagram