

GaAs DPDT Diversity Switch
0.5 - 3.0 GHz

MASWSS0040
V3

Features

- Low Insertion Loss 0.7 dB at 2.4 GHz
- Low Cost 3 mm 12-Lead PQFN Package
- Ideal for WLAN IEEE 802.11b
- 0.5 micron GaAs PHEMT Process

Description

M/A-COM's MASWSS0040 is a GaAs PHEMT MMIC DPDT diversity switch in a low cost miniature 3 mm 12-lead PQFN Package. The MASWSS0040 is ideally suited for applications where very small size and low cost are required.

Typical applications are for WLAN IEEE 802.11b/g systems that employ two antennas for transmit and receive diversity. This part is designed for low insertion loss and allows for independent control and selection of each switch path. This part can be used in all systems operating up to 3.0 GHz requiring moderate power and diversity switching.

The MASWSS0040 is fabricated using a 0.5 micron gate length GaAs pHEMT process. The process features full passivation for performance and reliability.

Ordering Information ¹

Part Number	Package
MASWSS0040	Bulk Packaging
MASWSS0040TR	1000 piece reel
MASWSS0040TR-3000	3000 piece reel
MASWSS0040SMB	Sample Test Board (Includes 5 Samples)

1. Reference Application Note M513 for reel size information.

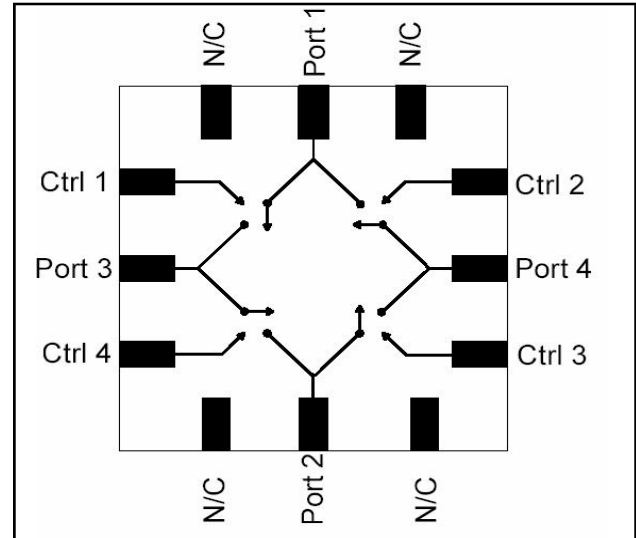
Absolute Maximum Ratings ^{2,3}

Parameter	Absolute Maximum
Input Power 3V Control	+32 dBm
Input Power 5V Control	+34 dBm
Operating Voltage	+8.5 volts
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

2. Exceeding any one or combination of these limits may cause permanent damage to this device.

3. M/A-COM does not recommend sustained operation near these survivability limits.

Functional Schematic



Pin Configuration

Pin No.	Pin Name	Description
1	Ctrl 1	Control 1
2	Port 3	RF Port 3
3	Ctrl 4	Control 4
4	N/C	No Connection
5	Port 2	RF Port 2
6	N/C	No Connection
7	Ctrl 3	Control 3
8	Port 4	RF Port 4
9	Ctrl 2	Control 2
10	N/C	No Connection
11	Port 1	RF Port 1
12	N/C	No Connection

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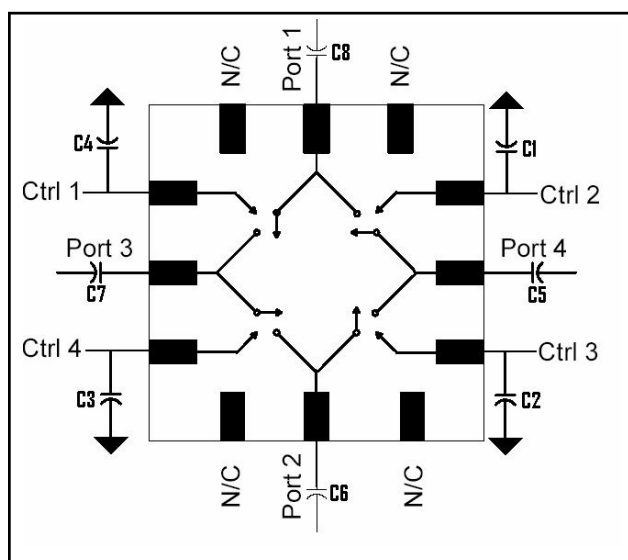
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Electrical Specifications: $T_A = 25^\circ\text{C}$, $Z_0 = 50 \Omega$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss ⁴	0.5 - 1.0 GHz	dB	—	0.5	1.2
	1.0 - 2.0 GHz	dB	—	0.6	1.2
	2.0 - 2.5 GHz	dB	—	0.7	1.2
	2.5 - 3.0 GHz	dB	—	0.8	1.2
Isolation ⁵	0.5 - 1.0 GHz	dB	17.0	28.0	—
	1.0 - 2.0 GHz	dB	17.0	21.0	—
	2.0 - 2.5 GHz	dB	17.0	19.0	—
	2.5 - 3.0 GHz	dB	17.0	18.0	—
Return Loss	0.5 - 3.0 GHz	dB	—	20	—
IP3	Two Tone +5 dBm, 5 MHz Spacing, > 50 MHz	dBm	—	47	—
	$V_C = 0.2 \text{ V} / 2.3 \text{ V}$ $V_C = 0.2 \text{ V} / 3.0 \text{ V}$	dBm	—	52	—
P1dB	$V_C = 0.2 \text{ V} / 2.3 \text{ V}$	dBm	—	26	—
	$V_C = 0.2 \text{ V} / 3.0 \text{ V}$	dBm	—	31	—
2 nd Harmonic	2.4 GHz, $P_{IN} = 20 \text{ dBm}$, $V_C = 0.2 \text{ V} / 2.5 \text{ V}$	dBc	—	70	—
3 rd Harmonic	2.4 GHz, $P_{IN} = 20 \text{ dBm}$, $V_C = 0.2 \text{ V} / 2.5 \text{ V}$	dBc	—	60	—
Trise, Tfall	10% to 90% RF and 90% to 10% RF	nS	—	12/20	—
Ton, Toff	50% Control to 90% RF	nS	—	35	—
	50% Control to 10% RF	nS	—	40	—
Gate Leakage	$ V_C = 5 \text{ V}$	μA	—	5	50

4. Insertion Loss can be optimized by varying the DC Blocking Capacitor value, i.e. 1000 pF for 100 MHz - 1.0 GHz, 27 pF for 0.5 - 3.0 GHz.
5. Isolation of two paths on either side of the selected path.

Circuit Block Diagram



Parts List

Part	Description
C1 – C4	27 pF Decoupling Capacitor
C5 – C8	27 pF DC Blocking Capacitor
RF1 – RF4	RF connector
Item 3	10-pin solder connector

Handling Procedures

Please observe the following precautions to avoid damage:

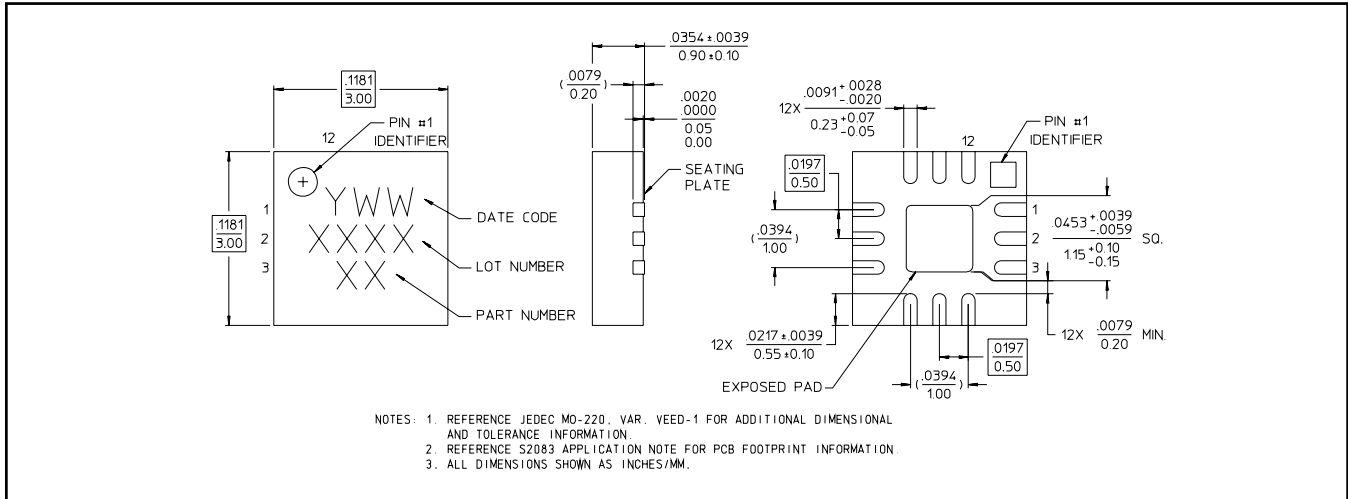
Static Sensitivity

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

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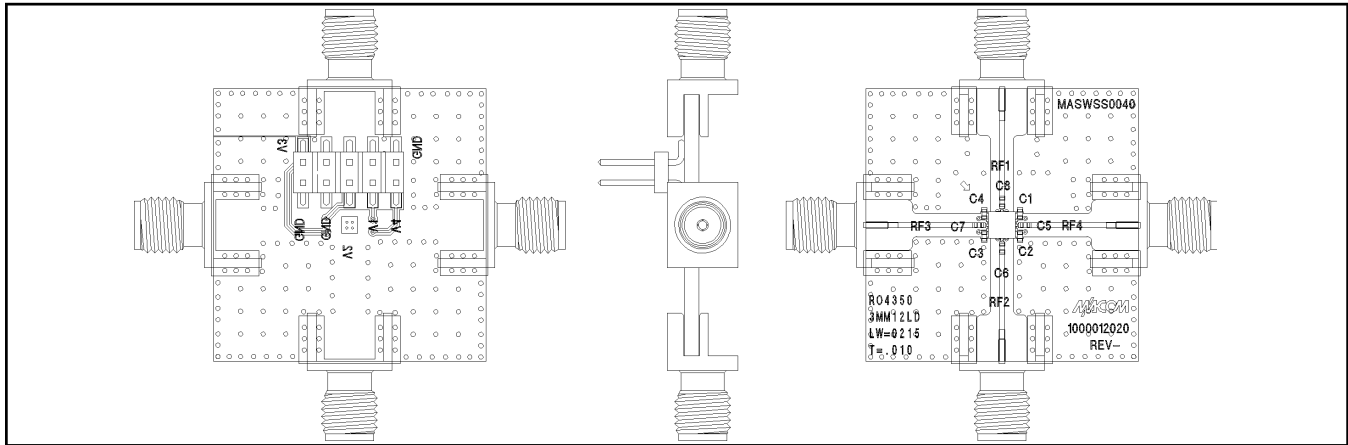
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3 mm 12-Lead PQFN†



† Meets JEDEC moisture sensitivity level 1 requirements

Evaluation Board MASWSS0040



Truth Table 6,7

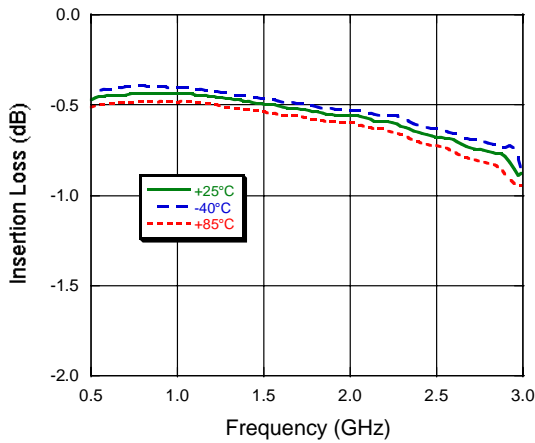
Control V1	Control V2	Control V3	Control V4	Port 1 - Port 3	Port 1 - Port 4	Port 2 - Port 4	Port 2 - Port 3
1	0	0	0	On	Off	Off	Off
0	1	0	0	Off	On	Off	Off
0	0	1	0	Off	Off	On	Off
0	0	0	1	Off	Off	Off	On
1	0	1	0	On	Off	On	Off
0	1	0	1	Off	On	Off	On

6. External DC blocking capacitors are required on all RF ports.

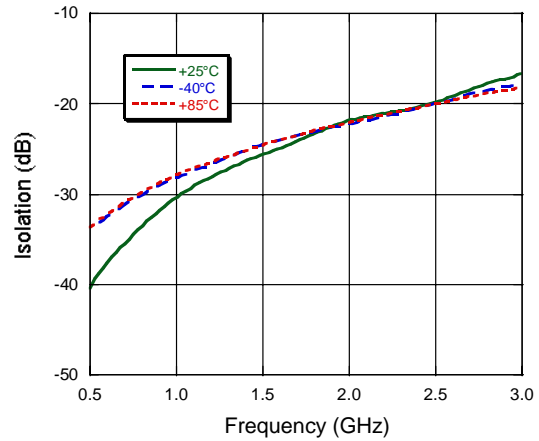
7. 0 = 0 V ± 0.2 V, 1 = +2.3 V to 5.0 V

Typical Performance Curves

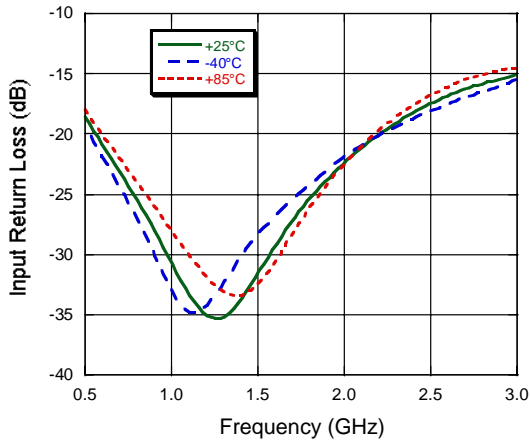
Insertion Loss, 27 pF



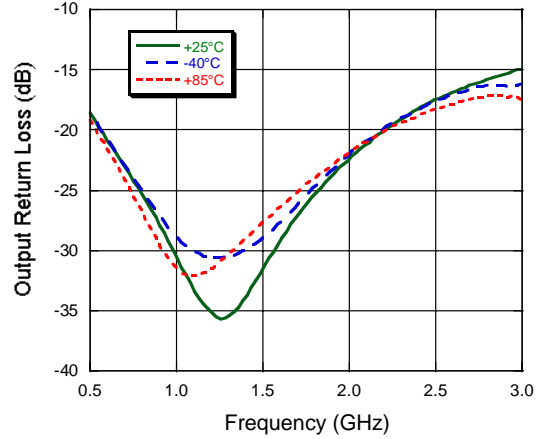
Isolation, 27 pF



Input Return Loss



Output Return Loss



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S-Parameters - Insertion Loss State, RF Port 1 to RF Port 3

Temp: Freq GHz)	+25 C S11 (dB)	+25 C S21 (dB)	+25 C S22 (dB)	-40 C S11 (dB)	-40 C S21 (dB)	-40 C S22 (dB)	+85 C S11 (dB)	+85 C S21 (dB)	+85 C S22 (dB)
0.50	-18.6027	-0.4654	-18.5213	-19.3613	-0.4339	-19.1541	-18.0085	-0.5123	-17.9488
0.60	-20.8494	-0.4416	-20.8067	-21.8376	-0.4069	-21.5515	-20.0388	-0.4891	-20.0041
0.70	-23.0914	-0.4450	-23.0463	-24.2872	-0.4045	-24.1074	-22.0202	-0.4913	-21.9549
0.80	-25.3732	-0.4330	-25.2263	-26.9306	-0.3923	-26.9988	-23.9682	-0.4790	-23.7412
0.90	-27.7353	-0.4377	-27.2666	-29.6162	-0.3995	-29.9640	-25.8897	-0.4831	-25.3424
1.00	-30.7638	-0.4448	-29.0320	-33.5275	-0.4100	-32.0794	-28.1240	-0.4859	-26.7539
1.10	-33.5635	-0.2980	-30.1795	-36.4314	-0.3327	-32.5867	-30.0768	-0.4240	-27.8247
1.20	-35.9160	-0.4558	-31.1605	-34.9625	-0.4284	-31.9804	-31.9773	-0.4995	-29.1024
1.30	-36.3211	-0.4731	-30.9829	-32.4300	-0.4460	-30.5651	-33.5190	-0.5198	-29.6264
1.40	-34.0465	-0.4786	-29.9664	-29.9757	-0.4476	-28.7205	-34.2573	-0.5231	-29.5132
1.50	-31.5467	-0.4934	-28.9178	-28.1694	-0.4627	-27.4684	-32.9181	-0.5374	-28.8812
1.60	-29.3299	-0.5189	-27.8802	-26.8191	-0.4860	-26.5125	-30.9659	-0.5619	-28.0103
1.70	-26.8650	-0.5167	-26.0353	-25.2041	-0.4891	-24.9500	-27.9354	-0.5552	-26.2555
1.80	-25.2959	-0.5396	-24.6714	-24.1522	-0.5116	-23.9778	-26.0420	-0.5827	-24.7702
1.90	-23.7871	-0.5606	-23.4366	-23.0146	-0.5222	-22.9759	-24.1191	-0.6016	-23.4124
2.00	-22.2287	-0.5534	-21.7257	-21.7321	-0.5317	-21.6541	-22.3026	-0.5787	-21.5110
2.10	-21.2390	-0.5763	-20.8956	-21.0057	-0.5310	-21.0528	-21.0415	-0.6227	-20.5431
2.20	-19.8473	-0.5803	-19.6707	-19.8795	-0.5582	-19.9287	-19.4731	-0.6076	-19.2367
2.30	-19.1325	-0.6175	-18.9507	-19.4372	-0.5703	-19.3577	-18.5966	-0.6715	-18.4240
2.40	-18.1417	-0.6681	-18.2421	-18.6325	-0.6282	-18.7855	-17.5284	-0.7171	-17.6214
2.50	-17.3713	-0.6695	-17.3284	-17.9975	-0.6322	-17.9655	-16.6874	-0.7170	-16.6287
2.60	-16.8832	-0.6625	-17.1056	-17.6555	-0.6529	-17.9103	-16.1114	-0.7607	-16.2958
2.70	-16.0634	-0.7731	-16.4745	-16.7757	-0.7208	-17.3043	-15.3337	-0.8210	-15.6184
2.80	-15.8346	-0.7433	-16.1385	-16.5488	-0.7080	-17.0290	-15.0872	-0.8058	-15.3366
2.90	-15.4466	-0.7294	-16.4468	-16.0958	-0.7457	-17.2754	-14.6606	-0.9072	-15.6625
3.00	-15.0199	-0.8677	-16.1135	-15.3471	-0.8900	-17.6242	-14.5580	-0.9451	-15.5308

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S-Parameters - Isolation State, RF Port 1 to RF Port 3

Temp:	+25 C	+25 C	+25 C	-40 C	-40 C	-40 C	+85 C	+85 C	+85 C
Freq (GHz)	S11 (dB)	S21 (dB)	S22 (dB)	S11 (dB)	S21 (dB)	S22 (dB)	S11 (dB)	S21 (dB)	S22 (dB)
0.50	-0.2387	-40.3798	-17.7871	-0.2152	-34.1017	-18.3789	-0.2663	-33.6911	-16.9063
0.55	-0.2800	-38.6075	-20.2236	-0.2315	-33.2663	-21.2041	-0.2990	-32.9165	-19.4707
0.60	-0.3033	-37.8366	-20.0361	-0.2530	-32.3662	-20.8447	-0.3329	-32.1037	-18.4824
0.65	-0.3288	-36.1271	-21.9219	-0.2765	-31.8787	-23.1748	-0.3570	-31.6315	-22.2236
0.70	-0.3458	-35.5570	-22.7520	-0.3015	-30.9632	-23.9482	-0.3958	-30.7441	-20.9590
0.75	-0.3699	-34.1188	-23.3535	-0.3129	-30.7054	-24.8857	-0.4027	-30.4427	-24.1357
0.80	-0.3992	-33.6711	-24.9219	-0.3473	-29.9284	-26.4863	-0.4397	-29.5393	-22.1973
0.85	-0.4242	-32.4027	-24.4404	-0.3683	-29.5035	-25.9434	-0.4669	-29.3653	-24.7471
0.90	-0.4424	-31.8488	-28.3438	-0.3849	-28.9525	-30.0996	-0.4931	-28.6355	-25.8428
0.95	-0.4709	-30.9988	-25.7813	-0.4060	-28.5103	-27.2520	-0.5034	-28.3662	-26.2412
1.00	-0.5064	-30.2467	-32.0176	-0.4289	-28.2122	-36.0078	-0.5291	-27.8092	-28.5147
1.10	-0.5387	-29.0098	-41.0254	-0.4724	-27.3494	-46.4727	-0.5826	-26.9278	-32.7441
1.20	-0.5820	-28.0480	-36.3633	-0.5003	-26.7386	-48.4902	-0.6150	-26.4994	-38.3535
1.30	-0.5913	-27.1969	-39.8516	-0.5073	-25.8648	-36.0879	-0.6279	-25.8930	-39.4004
1.40	-0.6143	-26.2585	-33.0508	-0.5439	-25.0932	-31.3506	-0.6680	-25.1077	-33.9746
1.50	-0.6225	-25.5753	-28.3721	-0.5428	-24.4977	-26.8906	-0.6723	-24.6341	-34.2148
1.60	-0.6517	-24.9628	-27.1650	-0.5815	-23.8834	-26.3447	-0.7105	-23.9054	-29.3721
1.70	-0.6097	-24.1436	-25.7988	-0.5652	-23.4561	-24.8975	-0.6976	-23.4766	-27.4951
1.80	-0.6376	-23.2844	-25.0801	-0.5806	-23.1137	-24.3320	-0.6954	-22.8071	-24.2686
1.90	-0.6901	-22.3777	-23.5430	-0.5976	-22.5081	-23.2480	-0.7298	-22.5175	-22.2676
2.00	-0.6900	-21.6555	-23.0645	-0.6031	-22.2552	-22.6582	-0.7099	-21.9908	-19.6436
2.10	-0.7131	-21.4391	-20.4551	-0.6269	-21.8977	-19.9346	-0.7445	-21.7545	-18.6436
2.20	-0.7304	-20.9731	-18.9287	-0.6598	-21.2974	-18.6641	-0.7727	-21.1197	-18.1172
2.30	-0.7379	-20.9154	-17.3799	-0.6549	-21.0886	-17.2998	-0.7723	-20.8756	-17.5635
2.40	-0.7639	-20.3135	-16.7227	-0.7179	-20.3845	-16.7998	-0.8387	-20.4132	-17.7207
2.50	-0.8042	-19.8248	-16.7979	-0.7549	-19.9612	-17.1514	-0.8884	-19.9776	-16.8115
2.60	-0.8694	-19.2154	-16.6455	-0.8163	-19.5861	-17.3291	-0.9644	-19.5877	-16.4570
2.70	-0.9435	-18.3638	-15.5996	-0.8816	-18.8297	-16.5332	-1.0624	-19.2242	-15.0513
2.80	-1.0205	-17.6340	-15.2612	-0.9363	-18.4579	-16.1777	-1.1379	-18.6811	-15.0679
2.90	-1.1882	-17.3241	-14.5591	-1.0298	-18.0998	-15.2344	-1.2657	-18.6548	-14.0005
3.00	-1.3138	-16.4654	-14.1133	-1.1093	-17.9439	-14.6489	-1.3771	-17.8609	-13.6182