



GaAs DP2T Diversity Switch

0.5 - 3.0 GHz

V2
MASWSS0040

MASWSS0040

Features

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

Description

M/A-COM's MASWSS0040 is a GaAs pHEMT MMIC DP2T diversity switch in a low cost miniature 3 mm FQFP-N 12 Lead 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 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 GHz requiring moderate power and diversity switching.

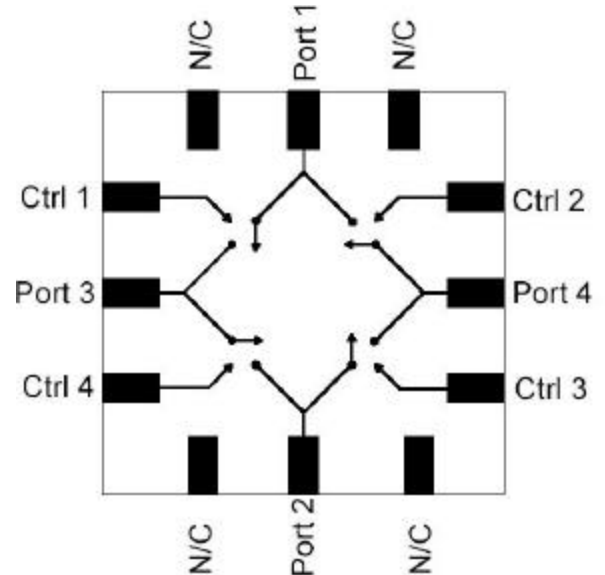
The MASWSS0040 is fabricated using a 0.5 micron gate length GaAs pHEMT process. The process features full passivation for performance and reliability.

Ordering Information ¹

Part Number	Package
MASWSS0040	3 mm FQFP-N 12 Lead Package
MASWSS0040TR	7 inch, 1000 piece reel ¹
MASWSS0040TR-3000	13 inch, 3000 piece reel ¹
MASWSS0040SMB	Sample Test Board (Includes 5 Samples)

1. If specific reel size is required, consult factory for part number assignment.

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 Connect
5	Port 2	RF Port 2
6	N/C	No Connect
7	Ctrl 3	Control 3
8	Port 4	RF Port 4
9	Ctrl 2	Control 2
10	N/C	No Connect
11	Port 1	RF Port 1
12	N/C	No Connect

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Electrical Specifications: $T_A = 25^\circ\text{C}$, $Z_0 = 50\Omega$ ^{1,2}

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss ¹	0.5 – 1 GHz	dB		0.5	1.2
	1 – 2 GHz	dB		0.6	1.2
	2 - 2.5 GHz	dB		0.7	1.2
	2.5 – 3 GHz	dB		0.8	1.2
Isolation ²	0.5 – 1 GHz	dB	17.0	28.0	
	1 – 2 GHz	dB	17.0	21.0	
	2 - 2.5 GHz	dB	17.0	19.0	
	2.5 – 3 GHz	dB	17.0	18.0	
Return Loss	0.5 – 3 GHz	dB		20	
IP3	Two Tone +5 dBm, 5 MHz Spacing, > 50 MHz $V_c = 0.2\text{V}/2.3\text{V}$ $V_c = 0.2\text{V}/3.0\text{V}$	dBm		47	
		dBm		52	
P1dB	$V_c = 0.2\text{V}/2.3\text{V}$ $V_c = 0.2\text{V}/3.0\text{V}$	dBm		26	
				31	
2 nd Harmonic	2.4 GHz, $P_{IN} = 20$ dBm, $V_c = 0.2\text{V}/2.5\text{V}$	dBc		70	
3 rd Harmonic	2.4 GHz, $P_{IN} = 20$ 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 50% Control to 10% RF	nS		35	
		nS		40	
Gate Leakage	$ V_c = 5\text{V}$	uA		5	50

1. Insertion Loss can be optimized by varying the DC Blocking Capacitor value, i.e. 1000 pF for 100 MHz - 1 GHz, 27 pF for 0.5 GHz - 3 GHz.
2. Isolation of two paths on either side of the selected path.

Absolute Maximum Ratings ¹

Parameter	Absolute Maximum
Max Input Power 3V Control	+32 dBm
Max 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

1. Exceeding any one or combination of these limits may cause permanent damage.

Handling Procedures

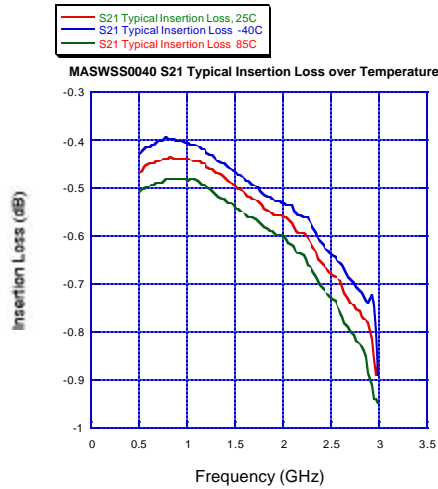
The following precautions should be observed to avoid damage:

Static Sensitivity

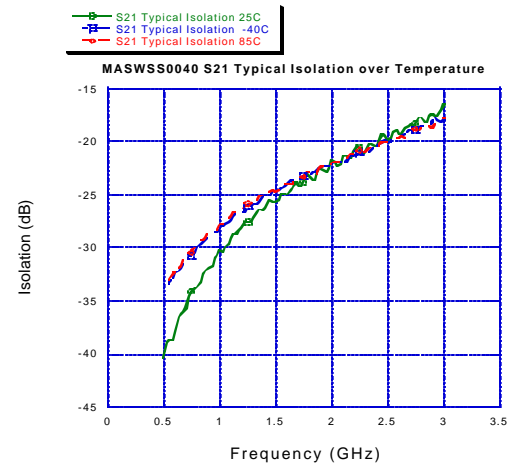
Gallium Arsenide Integrated Circuits are ESD sensitive and can be damaged by static electricity. Proper ESD techniques should be used when handling these devices.

Typical Performance Curves

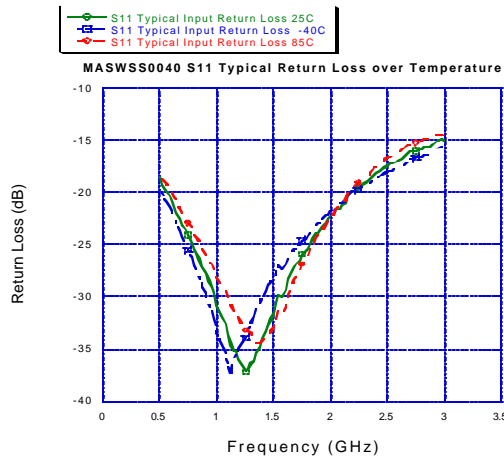
Insertion Loss vs. Frequency, 27 pF



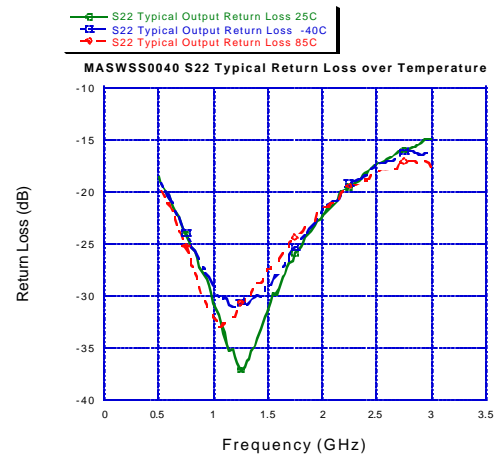
Isolation vs. Frequency, 27 pF



Input Return Loss vs. Frequency



Output Return Loss vs. Frequency

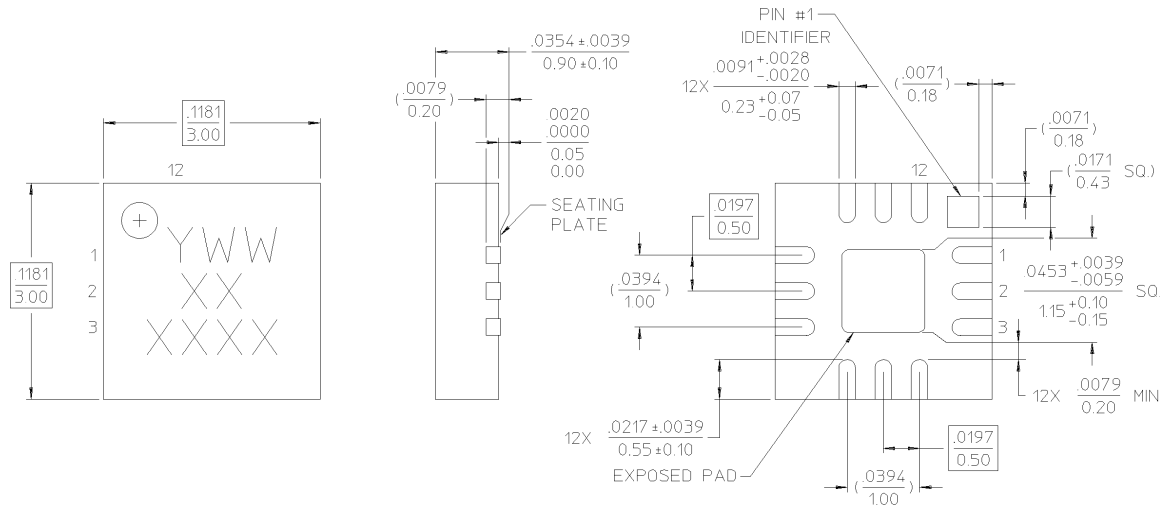


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3 mm FQFP-N 12 Lead



Truth Table¹

Control V1	Control V2	Control V3	Control V4	Port 1 - Port 3	Port 1 - Port 4	Port 2 - Port 4	Port 2 - Port 3
+2.3 to +5V	0 ± 0.2V	0 ± 0.2V	0 ± 0.2V	On	Off	Off	Off
0 ± 0.2V	+2.3 to +5V	0 ± 0.2V	0 ± 0.2V	Off	On	Off	Off
0 ± 0.2V	0 ± 0.2V	+2.3 to +5V	0 ± 0.2V	Off	Off	On	Off
0 ± 0.2V	0 ± 0.2V	0 ± 0.2V	+2.3 to +5V	Off	Off	Off	On
+2.3 to +5V	0 ± 0.2V	+2.3 to +5V	0 ± 0.2V	On	Off	On	Off
0 ± 0.2V	+2.3 to +5V	0 ± 0.2V	+2.3 to +5V	Off	On	Off	On

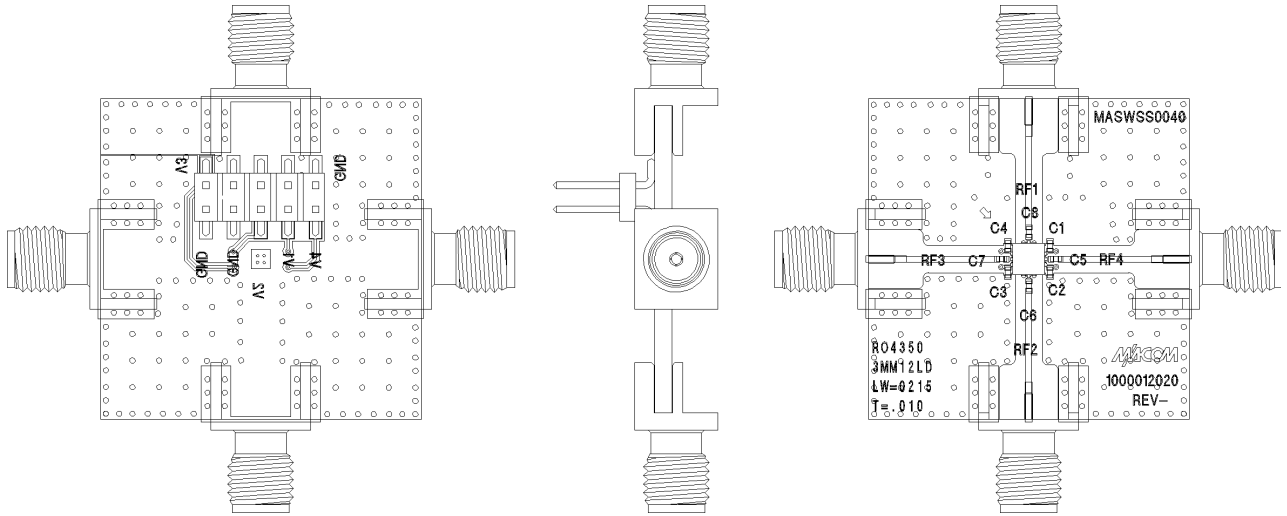
1. External DC blocking capacitors are required on all RF ports.

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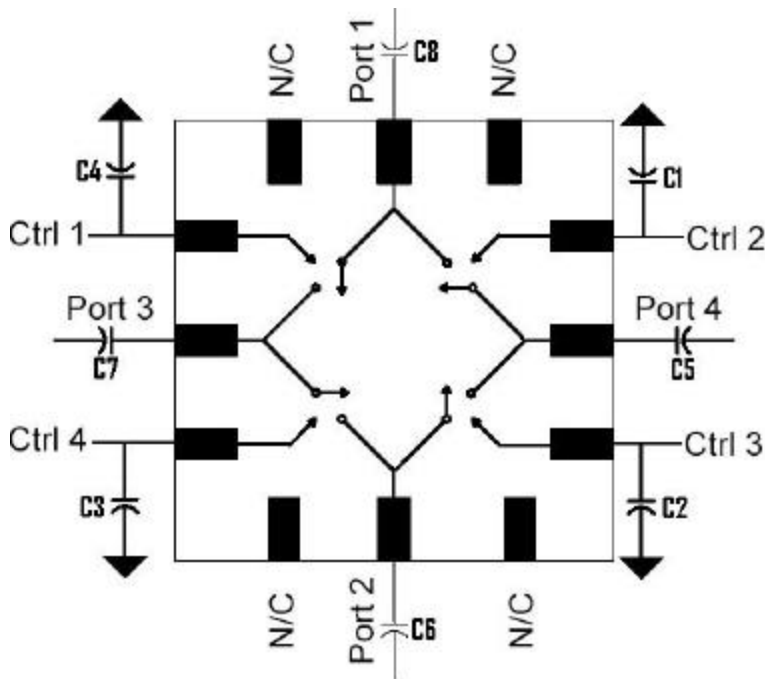
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Evaluation Board MASWSS0040



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

Circuit Block Diagram



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S-Parameters

Insertion Loss 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	-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 (continued)

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

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