



# MCH4015 — NPN Epitaxial Planar Silicon Transistor

## High-Frequency Low-Noise Amplifier

### Features

- Low-noise use : NF=1.2dB typ (f=1GHz)
- High cut-off frequency :  $f_T=10\text{GHz}$  typ ( $V_{CE}=5\text{V}$ )
- High gain :  $|S_{21e}|^2=17\text{dB}$  typ (f=1GHz)
- Halogen free compliance

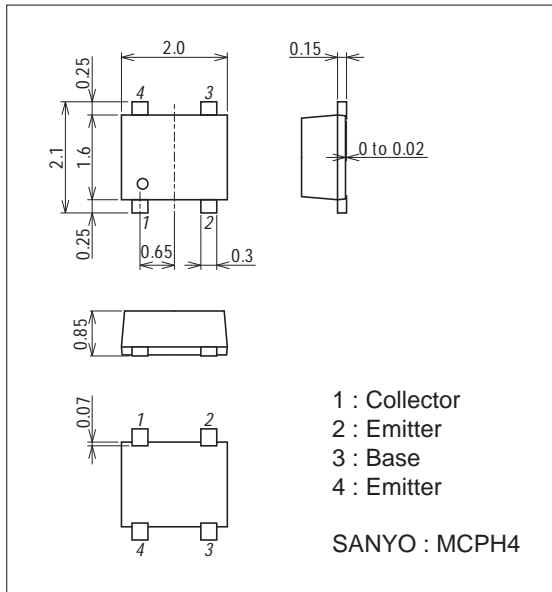
### Specifications

Absolute Maximum Ratings at  $T_a=25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	$V_{CBO}$		20	V
Collector-to-Emitter Voltage	$V_{CEO}$		12	V
Emitter-to-Base Voltage	$V_{EBO}$		2	V
Collector Current	$I_C$		100	mA
Collector Dissipation	$P_C$		450	mW
Junction Temperature	$T_j$		150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$		-55 to +150	$^\circ\text{C}$

### Package Dimensions

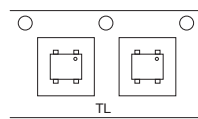
unit : mm (typ)  
7020A-002



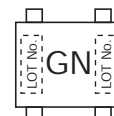
### Product & Package Information

- Package : MCPH4
- JEITA, JEDEC : SC-82AB, SOT-343, SC-82
- Minimum Packing Quantity : 3,000 pcs./reel

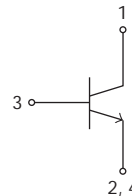
### Packing Type: TL



### Marking



### Electrical Connection

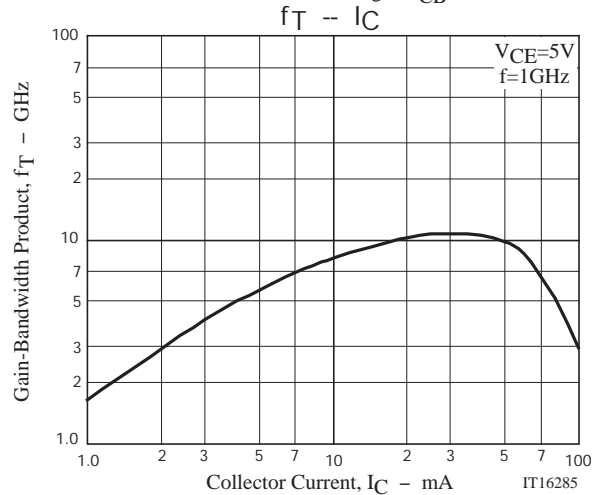
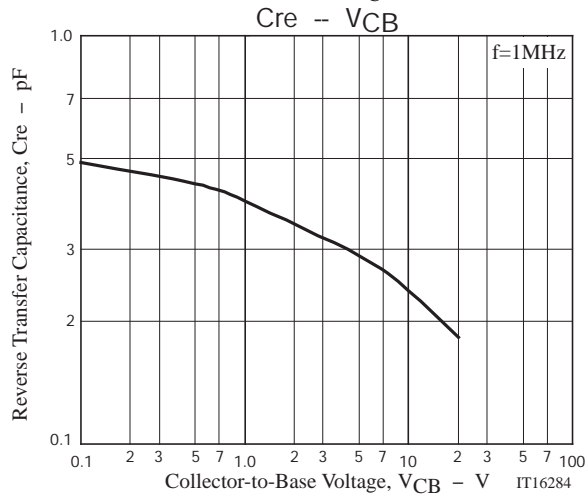
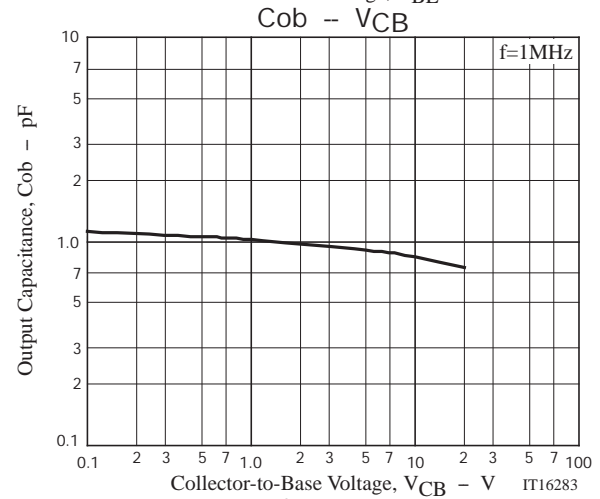
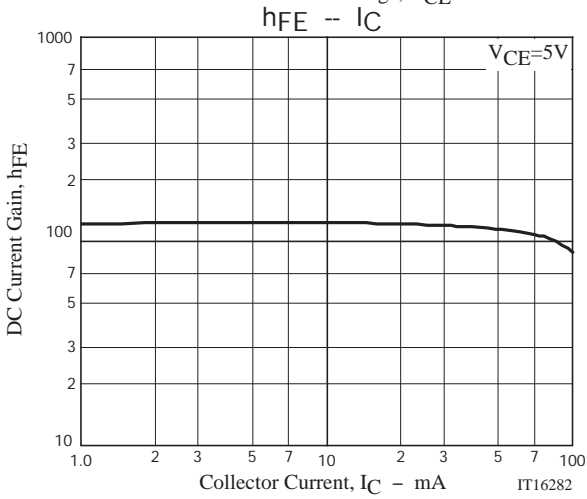
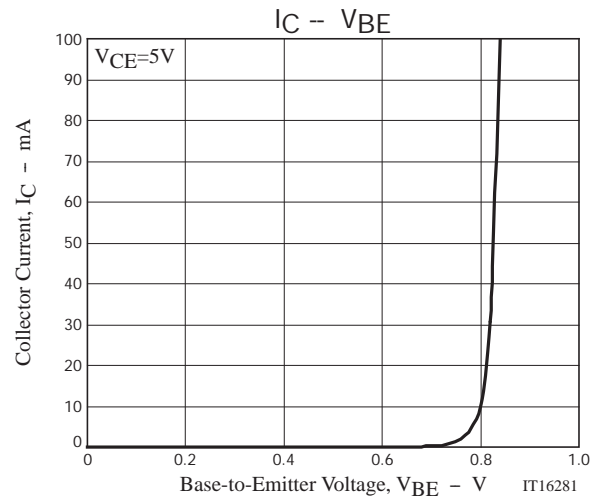
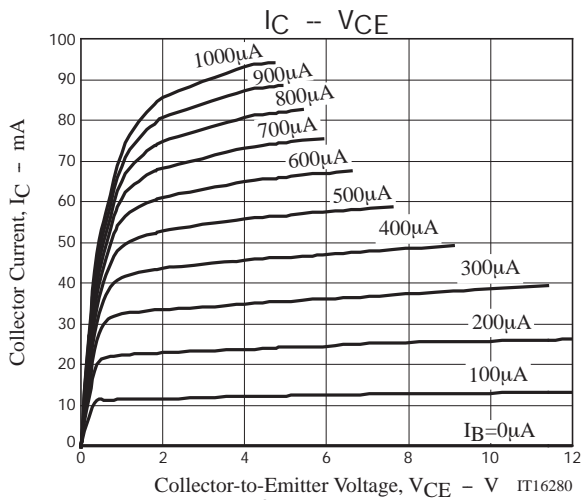


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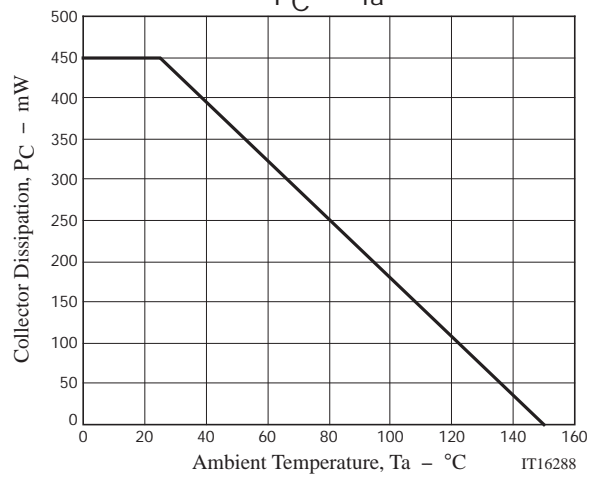
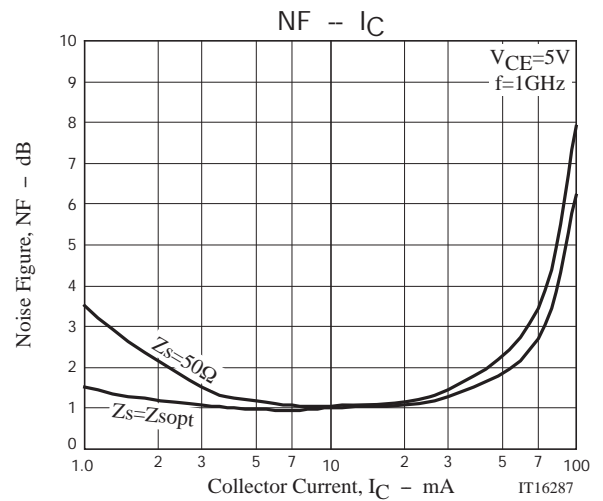
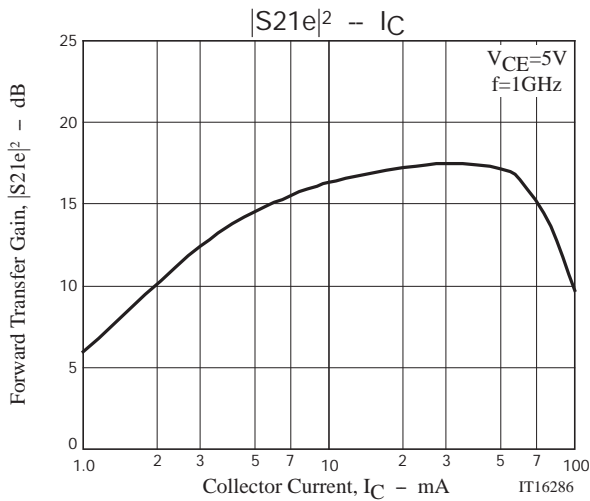
## Electrical Characteristics at $T_a=25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	$I_{CBO}$	$V_{CB}=5\text{V}, I_E=0\text{A}$			1.0	$\mu\text{A}$
Emitter Cutoff Current	$I_{EBO}$	$V_{EB}=1\text{V}, I_C=0\text{A}$			1.0	$\mu\text{A}$
DC Current Gain	$h_{FE}$	$V_{CE}=5\text{V}, I_C=50\text{mA}$	60		150	
Gain-Bandwidth Product	$f_T$	$V_{CE}=5\text{V}, I_C=30\text{mA}$	8	10		GHz
Forward Transfer Gain	$ S_{21e} ^2$	$V_{CE}=5\text{V}, I_C=30\text{mA}, f=1\text{GHz}$	14	17		dB
Noise Figure	NF	$V_{CE}=5\text{V}, I_C=10\text{mA}, f=1\text{GHz}$		1.2	1.8	dB

Pay attention to handling since it is liable to be affected by static electricity due to the high-frequency process adopted.



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## S Parameters (Common emitter)

$V_{CE}=3V, I_C=10mA$

Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠S12	S22	∠S22
100	0.763	-38.0	22.980	155.3	0.018	71.5	0.923	-22.7
200	0.733	-71.8	20.122	135.9	0.031	58.6	0.798	-40.2
300	0.702	-98.5	17.019	121.3	0.038	50.6	0.703	-53.5
400	0.690	-116.5	14.110	110.7	0.043	46.3	0.626	-62.9
500	0.701	-127.2	12.307	103.5	0.048	45.0	0.592	-67.4
600	0.679	-137.1	10.431	97.5	0.050	43.7	0.531	-72.0
700	0.663	-145.1	8.949	92.7	0.052	43.6	0.484	-75.2
800	0.651	-152.1	7.848	88.4	0.054	43.9	0.446	-78.7
900	0.646	-157.6	6.993	84.8	0.057	44.0	0.422	-81.6
1000	0.639	-162.3	6.272	81.9	0.059	45.1	0.404	-84.4
1200	0.635	-170.2	5.211	76.5	0.063	47.1	0.375	-88.7
1400	0.634	-176.5	4.462	71.7	0.068	49.1	0.362	-92.4
1600	0.633	177.9	3.907	67.3	0.073	51.2	0.352	-95.9
1800	0.636	173.2	3.463	63.4	0.079	52.7	0.351	-99.0
2000	0.637	169.1	3.122	59.5	0.085	54.3	0.352	-102.3
2200	0.637	164.9	2.838	55.8	0.091	55.5	0.356	-105.2
2400	0.638	161.0	2.604	52.1	0.098	56.5	0.364	-108.1
2600	0.639	157.3	2.413	48.7	0.105	57.2	0.372	-111.1
2800	0.642	153.7	2.244	45.1	0.112	57.9	0.384	-113.5
3000	0.641	150.0	2.095	41.8	0.120	57.8	0.396	-116.2

## MCH4015

S Parameters (Common emitter)

$V_{CE}=3V$ ,  $I_C=30mA$

Freq(MHz)	S11	$\angle S11$	S21	$\angle S21$	S12	$\angle S12$	S22	$\angle S22$
100	0.542	-76.9	42.437	142.3	0.013	63.9	0.801	-36.2
200	0.588	-118.2	30.735	119.6	0.020	53.9	0.602	-56.8
300	0.614	-138.6	22.677	106.5	0.024	52.3	0.505	-69.3
400	0.626	-150.0	17.506	98.4	0.027	53.8	0.448	-77.9
500	0.635	-155.0	14.522	92.7	0.031	55.6	0.423	-79.8
600	0.630	-161.3	12.035	88.5	0.035	57.8	0.381	-83.6
700	0.627	-166.4	10.249	85.2	0.038	59.8	0.350	-86.9
800	0.626	-170.9	8.902	82.2	0.042	61.3	0.327	-90.4
900	0.627	-174.7	7.888	79.5	0.045	62.3	0.314	-93.2
1000	0.626	-177.8	7.046	77.3	0.049	63.4	0.303	-96.1
1200	0.629	176.7	5.835	73.1	0.057	65.4	0.287	-100.4
1400	0.631	171.9	4.976	69.2	0.065	66.2	0.282	-103.8
1600	0.633	167.7	4.344	65.6	0.073	66.5	0.280	-106.9
1800	0.637	163.9	3.854	62.0	0.082	66.8	0.281	-109.7
2000	0.638	160.5	3.474	58.7	0.090	66.6	0.287	-112.5
2200	0.638	156.8	3.160	55.5	0.099	66.5	0.293	-115.1
2400	0.640	153.5	2.900	52.2	0.108	65.8	0.302	-117.3
2600	0.640	150.2	2.684	49.0	0.117	65.2	0.312	-119.5
2800	0.642	146.9	2.499	45.9	0.125	64.3	0.324	-121.6
3000	0.640	143.6	2.337	42.8	0.134	63.6	0.337	-123.8

$V_{CE}=3V$ ,  $I_C=50mA$

Freq(MHz)	S11	$\angle S11$	S21	$\angle S21$	S12	$\angle S12$	S22	$\angle S22$
100	0.514	-110.3	43.067	133.3	0.011	59.0	0.700	-40.9
200	0.607	-141.4	29.221	112.3	0.016	53.1	0.495	-58.9
300	0.642	-154.9	20.818	101.0	0.019	55.3	0.417	-68.7
400	0.657	-162.5	15.865	94.1	0.023	58.5	0.376	-75.5
500	0.660	-165.8	13.033	88.9	0.027	61.4	0.360	-75.7
600	0.659	-170.3	10.812	85.3	0.030	64.0	0.330	-78.7
700	0.658	-174.3	9.213	82.3	0.034	66.1	0.307	-81.5
800	0.660	-177.8	7.995	79.5	0.038	67.8	0.291	-84.5
900	0.663	179.2	7.097	77.1	0.042	68.6	0.284	-87.1
1000	0.662	176.6	6.333	74.8	0.046	69.6	0.277	-89.7
1200	0.666	172.0	5.247	70.8	0.055	70.9	0.268	-93.7
1400	0.670	167.9	4.475	67.0	0.063	71.3	0.269	-97.1
1600	0.673	164.1	3.897	63.4	0.072	71.5	0.270	-100.2
1800	0.676	160.6	3.469	59.9	0.080	71.4	0.275	-103.3
2000	0.678	157.5	3.113	56.5	0.089	71.0	0.284	-106.5
2200	0.679	154.1	2.836	53.1	0.098	70.4	0.293	-109.3
2400	0.681	150.9	2.598	49.8	0.107	69.8	0.304	-111.9
2600	0.682	147.8	2.404	46.6	0.116	68.9	0.316	-114.4
2800	0.683	144.6	2.241	43.4	0.125	67.8	0.330	-117.0
3000	0.682	141.3	2.094	40.3	0.135	66.8	0.346	-119.6

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S Parameters (Common emitter)

V<sub>CE</sub>=3V, I<sub>C</sub>=80mA

Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠S12	S22	∠S22
100	0.662	-146.8	29.622	120.5	0.011	47.5	0.455	-44.8
200	0.751	-164.0	16.762	102.8	0.014	46.9	0.315	-52.9
300	0.774	-171.2	11.369	94.2	0.017	52.5	0.288	-57.1
400	0.783	-175.6	8.549	88.9	0.019	58.6	0.279	-61.3
500	0.778	-178.0	6.977	84.2	0.023	62.0	0.283	-61.0
600	0.778	179.0	5.801	81.0	0.027	66.0	0.272	-62.9
700	0.778	176.3	4.965	78.3	0.030	68.6	0.265	-65.2
800	0.780	173.9	4.316	75.7	0.034	70.2	0.260	-68.0
900	0.782	171.6	3.846	73.3	0.038	71.9	0.263	-70.7
1000	0.782	169.6	3.439	71.0	0.042	73.0	0.263	-73.7
1200	0.787	166.0	2.860	66.6	0.051	74.5	0.268	-78.5
1400	0.789	162.5	2.454	62.4	0.059	75.3	0.278	-83.1
1600	0.792	159.2	2.139	58.4	0.068	75.7	0.288	-87.5
1800	0.796	156.0	1.912	54.5	0.077	75.7	0.300	-91.7
2000	0.797	153.1	1.721	50.8	0.086	75.4	0.314	-96.1
2200	0.797	149.9	1.569	47.1	0.095	75.0	0.328	-100.0
2400	0.799	146.8	1.436	43.4	0.105	74.1	0.343	-103.8
2600	0.800	143.8	1.331	39.9	0.115	73.4	0.359	-107.4
2800	0.801	140.6	1.238	36.5	0.125	72.2	0.377	-110.9
3000	0.799	137.4	1.157	33.3	0.135	71.1	0.394	-114.4

V<sub>CE</sub>=5V, I<sub>C</sub>=10mA

Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠S12	S22	∠S22
100	0.771	-35.8	23.180	156.3	0.016	72.7	0.933	-20.3
200	0.741	-68.2	20.484	137.3	0.028	60.4	0.820	-36.2
300	0.706	-94.4	17.503	122.8	0.035	53.0	0.722	-48.5
400	0.691	-112.7	14.633	111.9	0.040	48.5	0.656	-57.3
500	0.701	-123.8	12.817	104.7	0.044	47.2	0.622	-61.7
600	0.677	-133.9	10.891	98.4	0.047	46.0	0.560	-66.0
700	0.659	-142.2	9.349	93.5	0.049	45.5	0.513	-68.9
800	0.646	-149.5	8.209	89.1	0.051	45.7	0.474	-72.0
900	0.640	-155.2	7.315	85.3	0.053	46.1	0.449	-74.7
1000	0.633	-160.1	6.557	82.3	0.055	46.9	0.428	-77.4
1200	0.628	-168.2	5.459	76.8	0.060	49.0	0.399	-81.4
1400	0.625	-174.7	4.663	71.9	0.064	51.0	0.385	-84.9
1600	0.625	179.5	4.086	67.5	0.069	53.3	0.373	-88.4
1800	0.627	174.7	3.616	63.5	0.075	54.8	0.372	-91.5
2000	0.628	170.5	3.260	59.5	0.080	56.6	0.372	-94.9
2200	0.628	166.2	2.960	55.7	0.086	57.9	0.376	-98.0
2400	0.630	162.2	2.715	52.0	0.093	58.9	0.383	-101.1
2600	0.631	158.5	2.517	48.5	0.100	59.8	0.391	-104.3
2800	0.634	154.8	2.337	44.9	0.107	60.4	0.402	-107.0
3000	0.633	151.1	2.180	41.5	0.115	60.6	0.416	-109.9

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## S Parameters (Common emitter)

V<sub>CE</sub>=5V, I<sub>C</sub>=30mA

Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠S12	S22	∠S22
100	0.542	-70.6	43.013	144.3	0.012	66.3	0.826	-31.8
200	0.577	-112.5	32.303	121.4	0.018	56.3	0.636	-50.4
300	0.599	-134.2	24.068	107.8	0.022	55.0	0.539	-61.6
400	0.611	-146.5	18.636	99.4	0.025	55.5	0.478	-69.3
500	0.620	-151.9	15.457	93.6	0.029	57.7	0.454	-71.4
600	0.614	-158.6	12.813	89.2	0.033	59.6	0.410	-74.7
700	0.611	-164.1	10.898	85.6	0.036	61.5	0.376	-77.5
800	0.610	-168.7	9.470	82.5	0.039	62.9	0.351	-80.5
900	0.611	-172.7	8.381	79.8	0.043	64.1	0.337	-83.2
1000	0.610	-176.0	7.487	77.5	0.047	65.3	0.324	-85.8
1200	0.612	178.3	6.186	73.2	0.054	66.8	0.306	-89.7
1400	0.615	173.4	5.277	69.2	0.062	67.7	0.299	-93.1
1600	0.617	169.0	4.596	65.6	0.070	68.2	0.296	-96.3
1800	0.620	165.1	4.085	62.0	0.078	68.6	0.297	-99.3
2000	0.622	161.6	3.669	58.7	0.086	68.4	0.301	-102.5
2200	0.622	158.0	3.344	55.5	0.095	68.3	0.307	-105.1
2400	0.625	154.6	3.065	52.1	0.103	67.8	0.316	-107.9
2600	0.625	151.3	2.835	48.8	0.112	67.2	0.326	-110.5
2800	0.628	148.0	2.638	45.7	0.120	66.5	0.339	-113.0
3000	0.626	144.6	2.464	42.6	0.129	65.6	0.352	-115.5

V<sub>CE</sub>=5V, I<sub>C</sub>=50mA

Freq(MHz)	S11	∠S11	S21	∠S21	S12	∠S12	S22	∠S22
100	0.479	-97.2	42.927	137.2	0.010	63.4	0.761	-35.0
200	0.566	-132.9	32.978	115.4	0.015	56.7	0.560	-51.6
300	0.603	-148.8	23.718	103.2	0.018	58.0	0.485	-60.6
400	0.620	-157.8	18.120	95.7	0.021	60.4	0.427	-66.9
500	0.625	-161.4	14.893	90.4	0.025	63.7	0.410	-68.0
600	0.624	-166.7	12.324	86.4	0.029	66.0	0.375	-70.7
700	0.624	-171.0	10.482	83.2	0.032	68.0	0.348	-73.2
800	0.626	-174.8	9.088	80.4	0.036	69.2	0.328	-75.9
900	0.628	-178.1	8.053	77.9	0.040	70.4	0.317	-78.4
1000	0.628	179.1	7.184	75.6	0.044	70.9	0.308	-80.9
1200	0.633	174.2	5.943	71.5	0.052	72.2	0.295	-84.6
1400	0.636	169.8	5.061	67.7	0.060	72.7	0.292	-88.2
1600	0.640	165.9	4.407	64.1	0.069	72.7	0.292	-91.5
1800	0.643	162.3	3.917	60.6	0.077	72.6	0.295	-94.7
2000	0.645	159.1	3.518	57.2	0.086	72.3	0.301	-98.1
2200	0.646	155.6	3.202	54.0	0.094	71.8	0.309	-101.1
2400	0.648	152.4	2.931	50.6	0.103	71.1	0.319	-104.0
2600	0.650	149.3	2.708	47.3	0.112	70.3	0.331	-106.8
2800	0.652	146.0	2.520	44.2	0.121	69.3	0.344	-109.6
3000	0.650	142.7	2.353	41.1	0.130	68.2	0.358	-112.5

## MCH4015

S Parameters (Common emitter)

V<sub>CE</sub>=5V, I<sub>C</sub>=80mA

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
100	0.558	-133.0	39.014	127.8	0.009	54.5	0.618	-33.7
200	0.671	-155.6	23.364	107.6	0.012	52.6	0.457	-41.5
300	0.704	-165.1	16.107	97.6	0.014	57.5	0.415	-45.4
400	0.718	-170.7	12.150	91.5	0.017	62.9	0.395	-49.0
500	0.716	-173.4	9.907	86.7	0.021	66.8	0.385	-50.4
600	0.717	-177.0	8.214	83.3	0.024	69.5	0.378	-52.4
700	0.718	179.9	7.015	80.4	0.028	72.5	0.364	-54.4
800	0.720	177.1	6.091	77.8	0.031	73.9	0.354	-57.0
900	0.723	174.5	5.413	75.3	0.035	75.7	0.351	-59.7
1000	0.723	172.3	4.829	72.9	0.039	76.8	0.346	-62.4
1200	0.728	168.3	4.009	68.8	0.047	78.1	0.343	-67.0
1400	0.731	164.7	3.423	64.7	0.055	78.9	0.347	-71.8
1600	0.735	161.2	2.987	60.8	0.063	78.9	0.352	-76.2
1800	0.738	157.9	2.662	57.1	0.072	79.1	0.359	-80.6
2000	0.740	155.0	2.393	53.5	0.081	78.7	0.369	-85.3
2200	0.741	151.7	2.179	50.0	0.090	78.2	0.379	-89.5
2400	0.743	148.6	1.993	46.4	0.099	77.4	0.391	-93.5
2600	0.744	145.6	1.843	43.0	0.109	76.5	0.404	-97.4
2800	0.746	142.4	1.716	39.6	0.119	75.4	0.418	-101.3
3000	0.744	139.2	1.601	36.3	0.129	74.2	0.433	-105.1

V<sub>CE</sub>=8V, I<sub>C</sub>=10mA

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
100	0.784	-33.9	22.973	157.1	0.014	73.5	0.941	-18.1
200	0.754	-64.8	20.491	138.6	0.025	62.4	0.839	-32.6
300	0.715	-90.5	17.690	124.1	0.032	55.0	0.739	-44.1
400	0.697	-109.0	14.905	113.1	0.037	50.3	0.685	-52.2
500	0.704	-120.4	13.108	105.8	0.041	49.3	0.652	-56.5
600	0.678	-130.9	11.176	99.3	0.044	47.7	0.591	-60.6
700	0.659	-139.5	9.599	94.2	0.046	47.3	0.544	-63.3
800	0.645	-146.9	8.439	89.7	0.048	47.3	0.504	-66.1
900	0.638	-152.9	7.523	85.8	0.050	47.5	0.478	-68.7
1000	0.629	-158.0	6.746	82.7	0.052	48.6	0.457	-71.2
1200	0.623	-166.3	5.618	77.1	0.056	50.5	0.427	-75.0
1400	0.621	-173.1	4.797	72.1	0.060	52.6	0.411	-78.5
1600	0.620	-179.0	4.199	67.5	0.065	55.0	0.399	-81.8
1800	0.622	176.1	3.717	63.4	0.071	56.9	0.398	-85.2
2000	0.623	171.8	3.348	59.4	0.076	58.6	0.397	-88.5
2200	0.623	167.4	3.039	55.5	0.082	60.1	0.401	-91.7
2400	0.625	163.5	2.786	51.8	0.089	61.4	0.407	-95.0
2600	0.626	159.6	2.581	48.2	0.096	62.2	0.415	-98.3
2800	0.629	155.9	2.395	44.6	0.103	62.8	0.426	-101.3
3000	0.629	152.2	2.233	41.1	0.111	63.0	0.439	-104.4

# MCH4015

S Parameters (Common emitter)

$V_{CE}=8V, I_C=30mA$

Freq(MHz)	S11	$\angle S11$	S21	$\angle S21$	S12	$\angle S12$	S22	$\angle S22$
100	0.556	-65.2	43.179	145.8	0.011	67.8	0.846	-28.0
200	0.578	-106.8	32.894	123.0	0.017	57.9	0.669	-44.6
300	0.594	-129.7	24.775	109.1	0.021	56.2	0.584	-54.7
400	0.604	-142.8	19.256	100.3	0.024	57.0	0.512	-61.6
500	0.614	-148.7	15.997	94.4	0.028	59.0	0.488	-63.9
600	0.606	-155.8	13.266	89.8	0.031	60.8	0.443	-66.9
700	0.603	-161.6	11.285	86.1	0.034	62.5	0.409	-69.3
800	0.602	-166.5	9.802	82.9	0.037	64.2	0.382	-72.0
900	0.602	-170.7	8.672	80.0	0.041	65.4	0.366	-74.3
1000	0.600	-174.1	7.739	77.6	0.044	66.3	0.352	-76.7
1200	0.603	179.9	6.401	73.3	0.051	68.1	0.333	-80.3
1400	0.605	174.9	5.453	69.2	0.059	69.2	0.325	-83.7
1600	0.607	170.4	4.753	65.4	0.066	69.8	0.321	-87.0
1800	0.611	166.4	4.215	61.8	0.074	70.0	0.321	-90.2
2000	0.613	162.9	3.791	58.4	0.082	69.9	0.325	-93.4
2200	0.614	159.2	3.445	55.1	0.090	70.1	0.330	-96.5
2400	0.616	155.8	3.155	51.7	0.099	69.6	0.339	-99.4
2600	0.617	152.4	2.916	48.4	0.107	69.1	0.349	-102.4
2800	0.619	149.1	2.711	45.2	0.115	68.5	0.361	-105.3
3000	0.619	145.7	2.531	42.0	0.124	67.5	0.375	-108.2

$V_{CE}=8V, I_C=50mA$

Freq(MHz)	S11	$\angle S11$	S21	$\angle S21$	S12	$\angle S12$	S22	$\angle S22$
100	0.477	-88.8	42.926	139.6	0.009	65.5	0.793	-30.4
200	0.554	-127.0	34.154	117.2	0.014	59.2	0.603	-45.1
300	0.589	-144.5	24.758	104.4	0.017	59.1	0.529	-53.1
400	0.606	-154.4	18.954	96.6	0.020	61.9	0.478	-58.7
500	0.613	-158.4	15.585	91.2	0.024	64.8	0.453	-60.2
600	0.611	-164.1	12.888	87.0	0.027	67.3	0.416	-62.6
700	0.611	-168.8	10.954	83.7	0.031	69.1	0.388	-64.8
800	0.613	-172.8	9.503	80.7	0.034	70.4	0.366	-67.2
900	0.616	-176.3	8.407	78.1	0.038	71.5	0.355	-69.5
1000	0.615	-179.2	7.494	75.7	0.042	72.3	0.343	-71.9
1200	0.619	175.7	6.192	71.6	0.049	73.7	0.329	-75.5
1400	0.623	171.2	5.272	67.7	0.057	74.1	0.324	-79.0
1600	0.626	167.2	4.586	64.0	0.065	74.5	0.323	-82.4
1800	0.631	163.5	4.071	60.4	0.073	74.4	0.325	-85.8
2000	0.633	160.2	3.658	57.0	0.081	74.0	0.331	-89.4
2200	0.634	156.7	3.322	53.7	0.090	73.7	0.337	-92.7
2400	0.637	153.5	3.041	50.3	0.099	73.0	0.347	-95.9
2600	0.638	150.3	2.809	47.0	0.107	72.2	0.358	-99.1
2800	0.641	147.0	2.611	43.8	0.116	71.3	0.371	-102.3
3000	0.640	143.7	2.435	40.7	0.125	70.4	0.386	-105.5



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