



SANYO Semiconductors

# DATA SHEET

## 15GN03MA — NPN Epitaxial Planar Silicon Transistor

### VHF High-frequency Amplifier Applications

#### Applications

- VHF, RF, MIXER, OSC, IF amplifier.

#### Features

- High cut-off frequency :  $f_T=1.5\text{GHz}$  typ.
- High gain :  $|S_{21e}|^2=13\text{dB}$  typ ( $f=0.4\text{GHz}$ ).
- Ultrasmall package permitting applied sets to be small and slim.

#### Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	$V_{CB0}$		20	V
Collector-to-Emitter Voltage	$V_{CE0}$		10	V
Emitter-to-Base Voltage	$V_{EB0}$		3	V
Collector Current	$I_C$		70	mA
Collector Dissipation	$P_C$	When mounted on ceramic substrate (250mm <sup>2</sup> X0.8mm)	400	mW
Junction Temperature	$T_j$		150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$		-55 to +150	$^\circ\text{C}$

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

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	$I_{CB0}$	$V_{CB}=10\text{V}, I_E=0\text{A}$			0.1	$\mu\text{A}$
Emitter Cutoff Current	$I_{EB0}$	$V_{EB}=2\text{V}, I_C=0\text{A}$			1	$\mu\text{A}$
DC Current Gain	$h_{FE}$	$V_{CE}=5\text{V}, I_C=10\text{mA}$	100		180	
Gain-Bandwidth Product	$f_T$	$V_{CE}=5\text{V}, I_C=20\text{mA}$	1.0	1.5		GHz

Marking : ZC

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# 15GN03MA

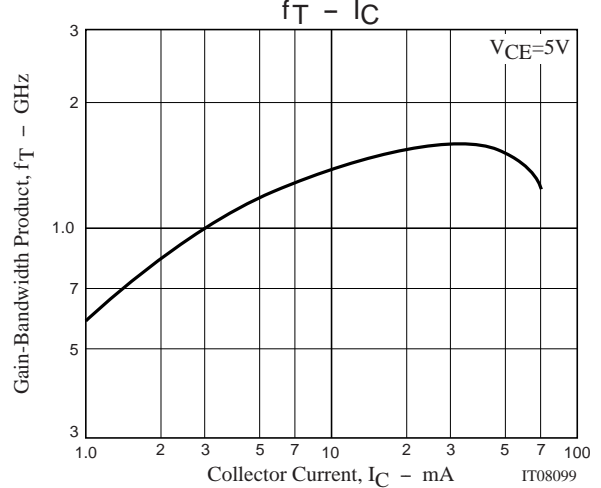
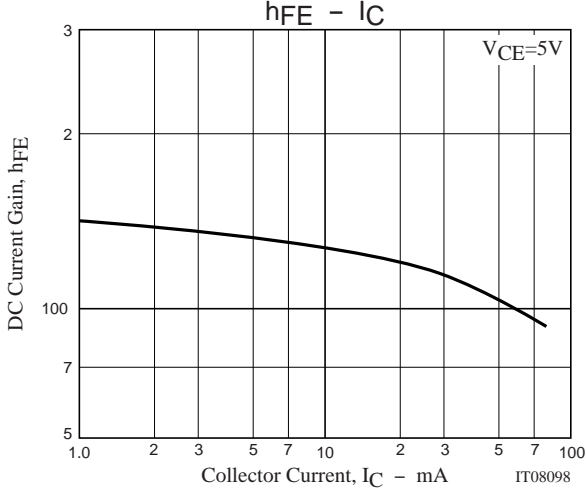
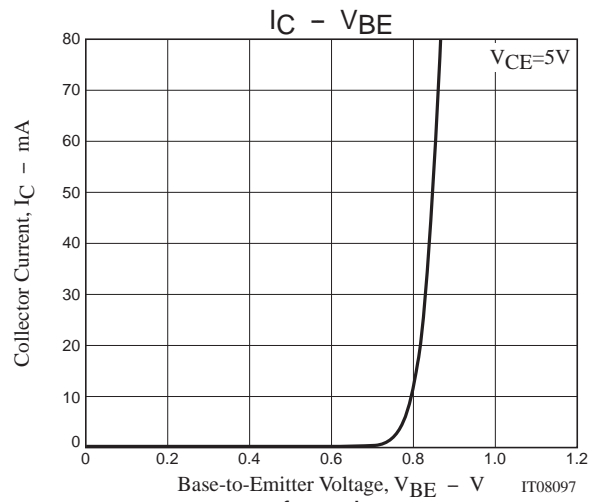
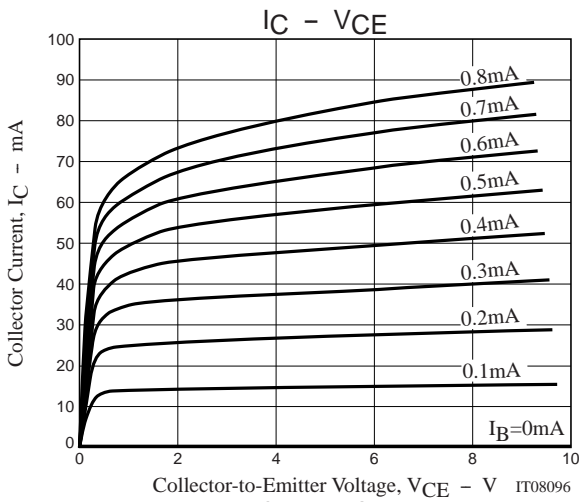
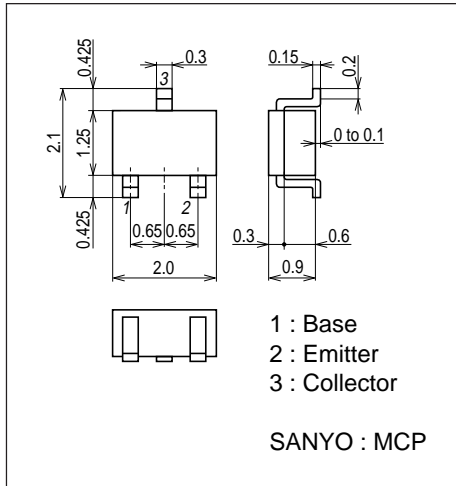
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output Capacitance	Cob	V <sub>CB</sub> =10V, f=1MHz		0.95	1.25	pF
Reverse Transfer Capacitance	Cre	V <sub>CB</sub> =10V, f=1MHz		0.65		pF
Forward Transfer Gain	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> =5V, I <sub>C</sub> =20mA, f=0.4GHz	10	13		dB
Noise Figure	NF	V <sub>CE</sub> =3V, I <sub>C</sub> =2mA, f=0.4GHz		1.6		dB

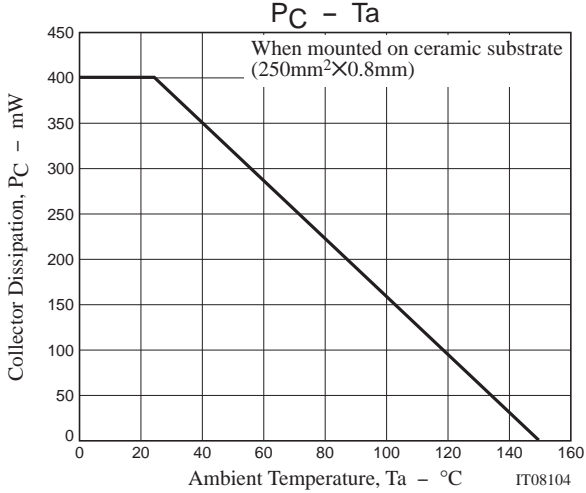
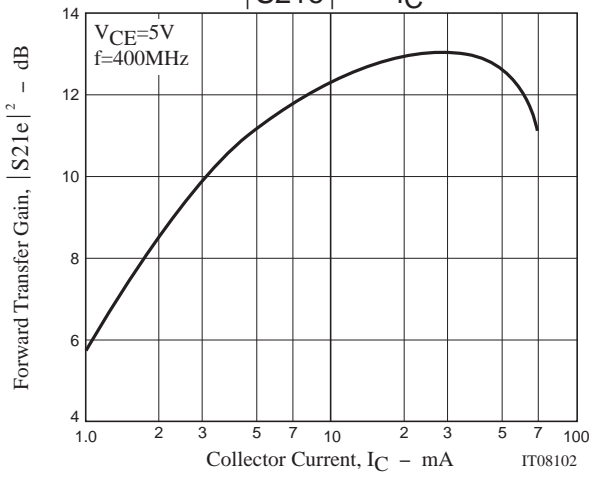
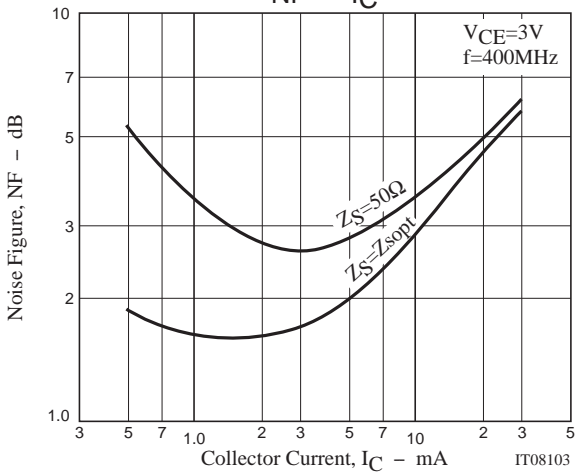
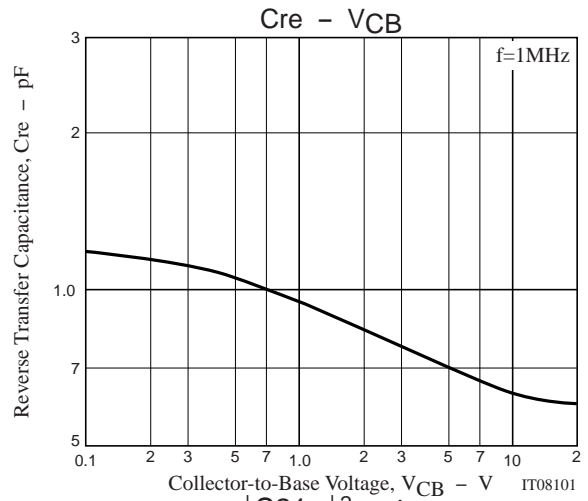
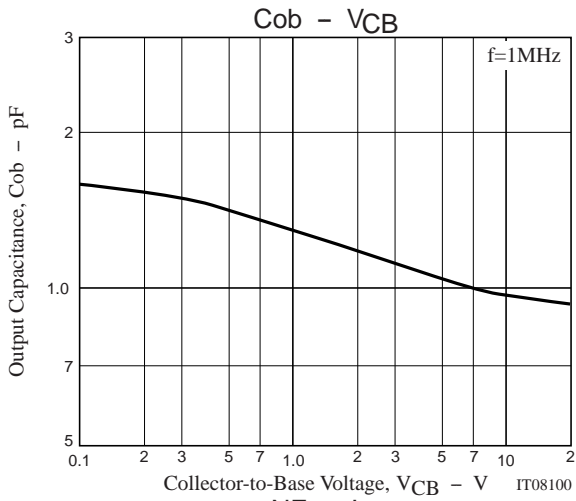
## Package Dimensions

unit : mm (typ)

7023-009



# 15GN03MA



# 15GN03MA

## S Parameters (Common emitter)

$V_{CE}=5V, I_C=1mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.927	-39.48	3.051	153.95	0.045	66.57	0.938	-5.28
200	0.877	-72.13	2.643	134.85	0.072	53.42	0.879	-10.12
300	0.831	-97.09	2.258	118.70	0.090	41.89	0.834	-15.17
400	0.796	-115.43	1.925	105.65	0.093	33.66	0.806	-20.70
500	0.772	-128.51	1.645	95.12	0.090	29.42	0.796	-25.57
600	0.759	-139.76	1.420	86.92	0.085	28.20	0.796	-28.96
700	0.754	-148.33	1.255	80.31	0.080	30.19	0.792	-31.48
800	0.750	-155.54	1.132	74.68	0.072	36.45	0.790	-34.42
900	0.746	-162.07	1.033	69.44	0.067	44.81	0.793	-37.89
1000	0.743	-167.59	0.948	65.05	0.065	55.74	0.796	-41.83

$V_{CE}=5V, I_C=3mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.819	-66.73	7.544	137.99	0.036	55.23	0.862	-14.15
200	0.733	-107.53	5.274	115.44	0.050	43.07	0.730	-17.07
300	0.698	-130.44	3.901	102.51	0.055	40.37	0.691	-20.60
400	0.682	-144.75	3.111	93.53	0.056	41.56	0.673	-22.18
500	0.674	-154.20	2.563	85.87	0.056	46.54	0.680	-25.14
600	0.669	-161.91	2.175	79.64	0.057	53.71	0.686	-28.23
700	0.669	-167.44	1.884	74.61	0.061	62.91	0.686	-30.58
800	0.671	-172.33	1.680	70.09	0.067	70.67	0.690	-33.35
900	0.672	-176.77	1.520	65.76	0.075	78.25	0.695	-36.65
1000	0.672	179.40	1.386	61.98	0.086	83.86	0.700	-40.53

$V_{CE}=5V, I_C=5mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.745	-85.56	10.487	129.32	0.031	52.32	0.808	-17.13
200	0.673	-125.68	6.596	107.46	0.041	43.79	0.695	-19.72
300	0.650	-144.45	4.641	95.99	0.044	45.46	0.655	-20.94
400	0.643	-155.93	3.583	88.14	0.046	51.02	0.641	-22.34
500	0.641	-163.08	2.926	81.98	0.051	57.47	0.638	-24.48
600	0.641	-169.17	2.468	76.86	0.055	65.57	0.640	-27.05
700	0.642	-173.85	2.139	72.14	0.064	72.10	0.640	-29.96
800	0.645	-177.59	1.898	68.01	0.072	78.01	0.643	-32.86
900	0.648	179.02	1.708	64.03	0.082	84.74	0.654	-36.05
1000	0.649	175.69	1.565	60.67	0.096	88.35	0.663	-39.64

$V_{CE}=5V, I_C=10mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.648	-111.11	13.755	118.07	0.025	49.17	0.710	-18.60
200	0.617	-144.00	7.787	99.84	0.031	50.50	0.618	-18.94
300	0.610	-157.84	5.322	90.62	0.035	55.71	0.593	-19.18
400	0.611	-165.84	4.071	84.05	0.042	63.53	0.585	-20.81
500	0.612	-171.10	3.295	78.75	0.049	72.26	0.585	-23.14
600	0.616	-175.51	2.770	74.15	0.059	76.93	0.591	-25.68
700	0.620	-179.00	2.401	69.78	0.068	81.33	0.595	-28.62
800	0.622	178.16	2.122	65.84	0.080	85.49	0.598	-31.66
900	0.629	175.42	1.906	62.06	0.091	88.11	0.610	-34.80
1000	0.632	172.79	1.741	58.71	0.104	90.16	0.619	-38.30

# 15GN03MA

## S Parameters (Common emitter)

$V_{CE}=5V, I_C=15mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.608	-124.26	15.141	112.79	0.021	49.66	0.661	-18.68
200	0.596	-152.05	8.271	96.59	0.028	56.25	0.584	-17.69
300	0.594	-163.33	5.613	88.34	0.034	63.87	0.566	-18.43
400	0.600	-169.82	4.267	82.26	0.042	71.61	0.561	-19.87
500	0.601	-173.91	3.457	77.23	0.052	77.39	0.564	-22.13
600	0.606	-177.77	2.902	72.65	0.061	81.90	0.570	-24.90
700	0.613	179.41	2.501	68.50	0.071	84.02	0.573	-27.96
800	0.617	176.72	2.210	64.59	0.083	86.75	0.579	-30.98
900	0.624	174.31	1.988	60.86	0.094	88.46	0.592	-34.26
1000	0.628	171.96	1.808	57.39	0.108	90.57	0.599	-37.51

$V_{CE}=5V, I_C=20mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.587	-132.33	15.887	109.73	0.018	50.98	0.630	-18.23
200	0.589	-156.83	8.517	94.77	0.026	60.57	0.563	-17.10
300	0.590	-166.31	5.751	86.97	0.034	66.88	0.549	-17.73
400	0.593	-171.88	4.373	80.95	0.043	73.76	0.547	-19.30
500	0.598	-175.61	3.529	76.08	0.052	79.21	0.552	-21.55
600	0.604	-178.89	2.958	71.70	0.063	82.86	0.558	-24.41
700	0.611	178.36	2.550	67.43	0.073	85.71	0.560	-27.19
800	0.616	176.07	2.257	63.56	0.085	87.76	0.569	-30.31
900	0.624	173.75	2.026	59.99	0.097	89.02	0.581	-33.63
1000	0.628	171.39	1.838	56.47	0.109	90.88	0.590	-36.92

$V_{CE}=5V, I_C=30mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.574	-141.90	16.518	106.28	0.017	56.75	0.594	-17.60
200	0.584	-161.69	8.702	92.68	0.024	65.21	0.541	-16.13
300	0.587	-169.42	5.851	85.19	0.033	71.56	0.531	-16.69
400	0.596	-174.12	4.433	79.42	0.042	77.01	0.532	-18.41
500	0.599	-177.29	3.570	74.54	0.053	82.34	0.536	-20.78
600	0.609	179.93	2.987	70.07	0.063	84.47	0.545	-23.60
700	0.616	177.48	2.574	65.88	0.073	86.83	0.550	-26.54
800	0.621	175.27	2.268	61.99	0.085	88.18	0.559	-29.78
900	0.631	173.12	2.033	58.20	0.096	90.72	0.571	-33.08
1000	0.638	170.96	1.845	54.81	0.111	91.80	0.582	-36.46

$V_{CE}=5V, I_C=50mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.578	-151.54	16.222	102.78	0.015	58.15	0.564	-16.24
200	0.596	-166.79	8.428	90.13	0.023	71.59	0.524	-14.78
300	0.603	-172.63	5.641	82.89	0.033	76.27	0.520	-15.94
400	0.611	-176.28	4.254	77.21	0.043	79.95	0.521	-17.71
500	0.618	-178.98	3.421	72.11	0.052	83.78	0.530	-20.31
600	0.629	178.44	2.851	67.60	0.064	86.83	0.538	-23.39
700	0.639	176.23	2.452	63.15	0.074	88.24	0.546	-26.40
800	0.647	174.01	2.155	59.33	0.087	89.54	0.555	-29.74
900	0.657	171.87	1.921	55.44	0.099	92.59	0.568	-33.37
1000	0.664	169.65	1.740	51.95	0.113	94.10	0.581	-36.94

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