2SC4196

Silicon NPN Epitaxial

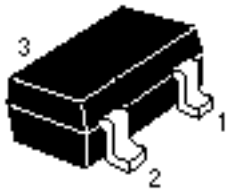
HITACHI

Application

UHF Local oscillator

Outline

MPAK



1. Emitter
2. Base
3. Collector

Hitachi semiconductor

Absolute Maximum Ratings (Ta = 25°C)

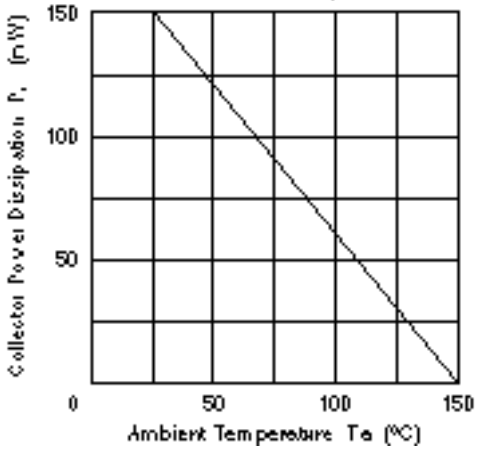
Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	25	V
Collector to emitter voltage	V_{CEO}	15	V
Emitter to base voltage	V_{EBO}	3	V
Collector current	I_C	50	mA
Collector power dissipation	P_C	150	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	–55 to +150	°C

Electrical Characteristics (Ta = 25°C)

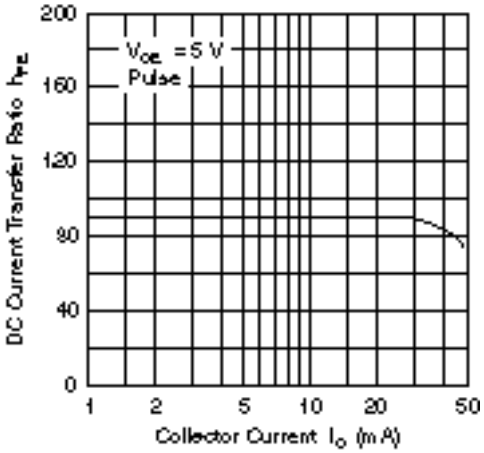
Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	25	—	—	V	I_C = 10 µA, I_E = 0
Collector cutoff current	I_{CBO}	—	—	0.3	µA	V_{CB} = 15 V, I_E = 0
	I_{CEO}	—	—	10	µA	V_{CE} = 15 V, R_{BE} = ∞
Emitter cutoff current	I_{EBO}	—	—	1.0	µA	V_{EB} = 3 V, I_C = 0
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	0.3	V	I_C = 20 mA, I_B = 4 mA
DC current transfer ratio	h_{FE}	50	—	180		V_{CE} = 5 V, I_C = 5 mA
Collector output capacitance	Cob	—	0.7	1.0	pF	V_{CB} = 10 V, I_E = 0, f = 1MHz
Gain bandwidth product	f_T	1.8	2.4	—	GHz	V_{CE} = 5 V, I_C = 20 mA
Oscillating output voltage	V_{OSC}	—	200	—	mV	V_{CC} = 5 V, I_C = 5 mA, f = 930 MHz

Note: Marking is “QI–”.

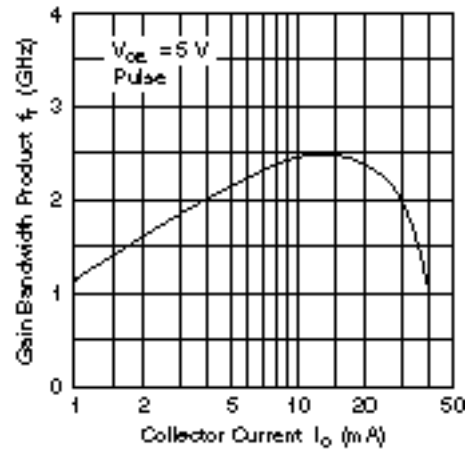
Maximum Collector Dissipation Curve



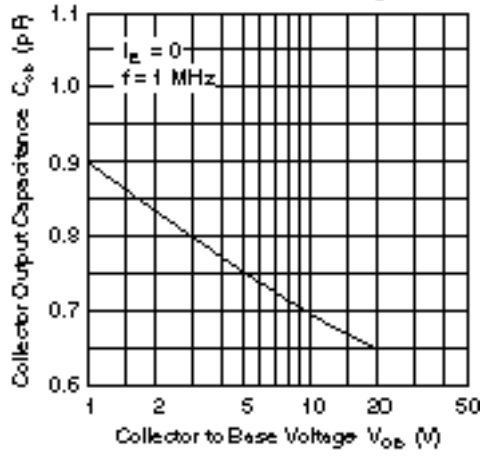
DC Current Transfer Ratio vs. Collector Current

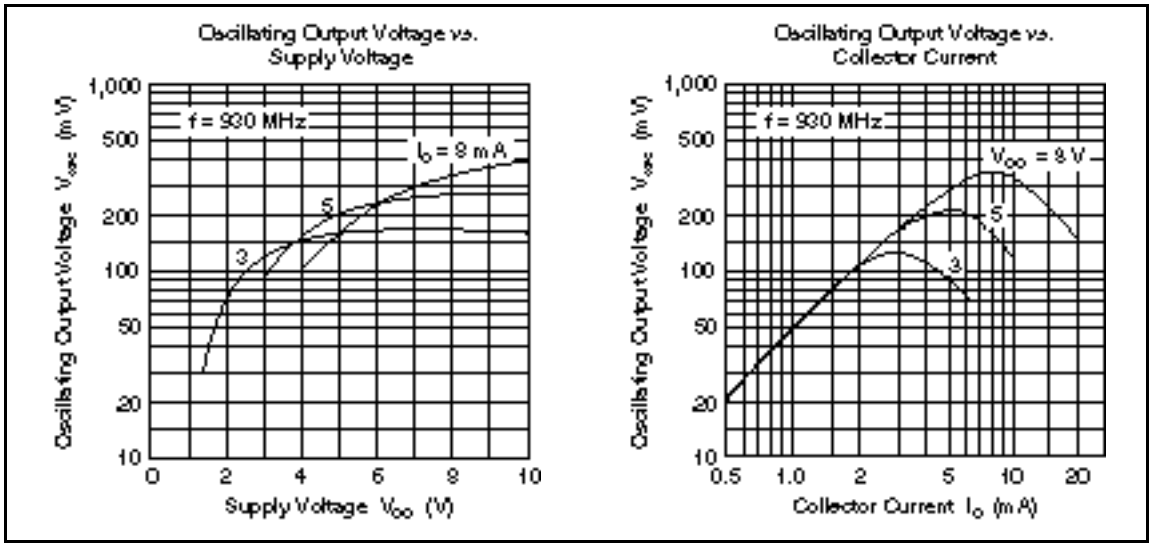


Gain Bandwidth Product vs. Collector Current



Collector Output Capacitance vs. Collector to Base Voltage



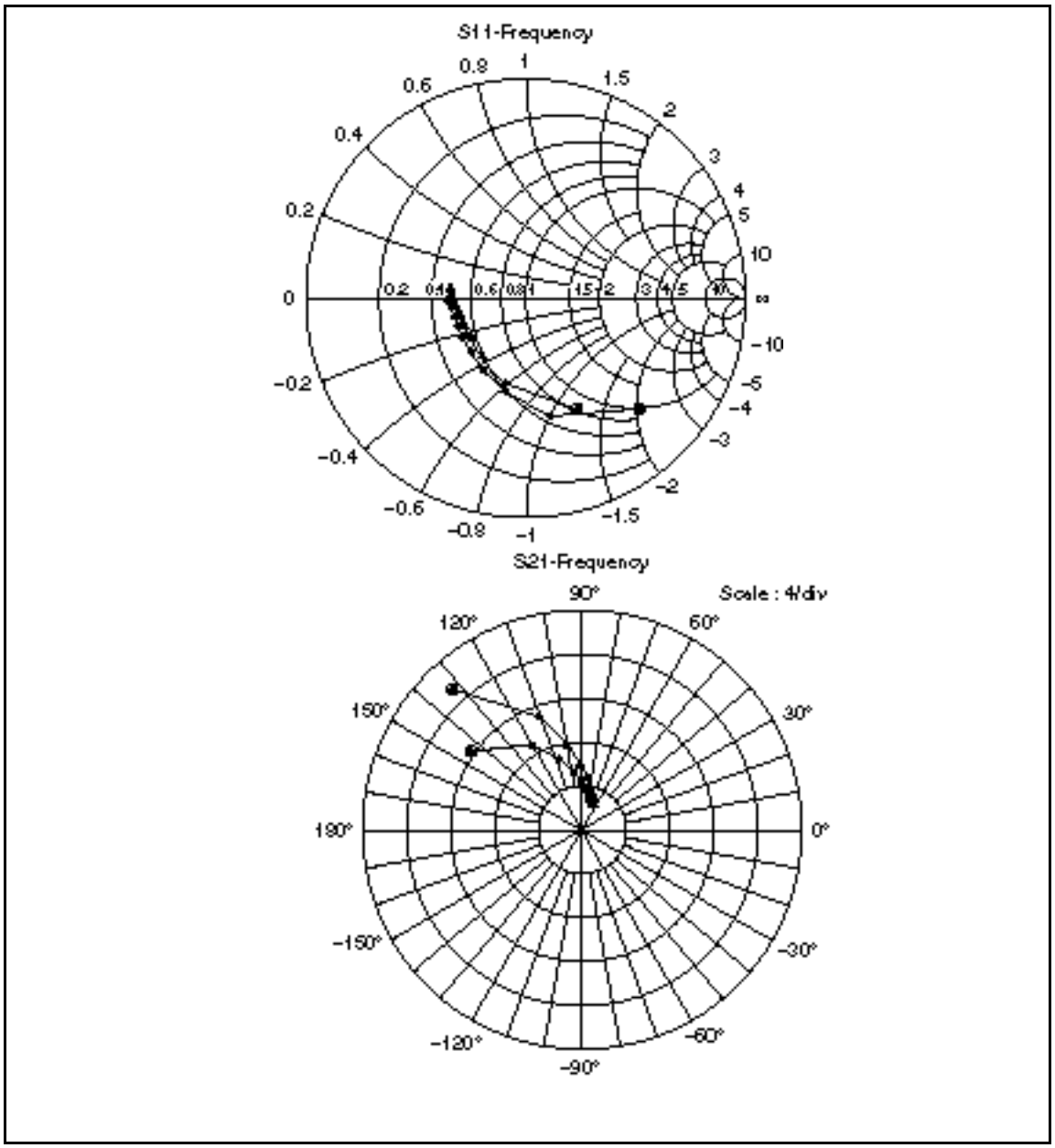

Oscillating Output Voltage vs. Supply Voltage
f = 930 MHz
I_C = 9 mA
5
3
Oscillating Output Voltage V_{osc} (mV)
1,000
500
200
100
50
20
10
0
2
4
6
8
10
Supply Voltage V_{CC} (V)
Oscillating Output Voltage vs. Collector Current
f = 930 MHz
V_{CC} = 9 V
5
3
Oscillating Output Voltage V_{osc} (mV)
1,000
500
200
100
50
20
10
0.5
1.0
2
5
10
20
Collector Current I_C (mA)

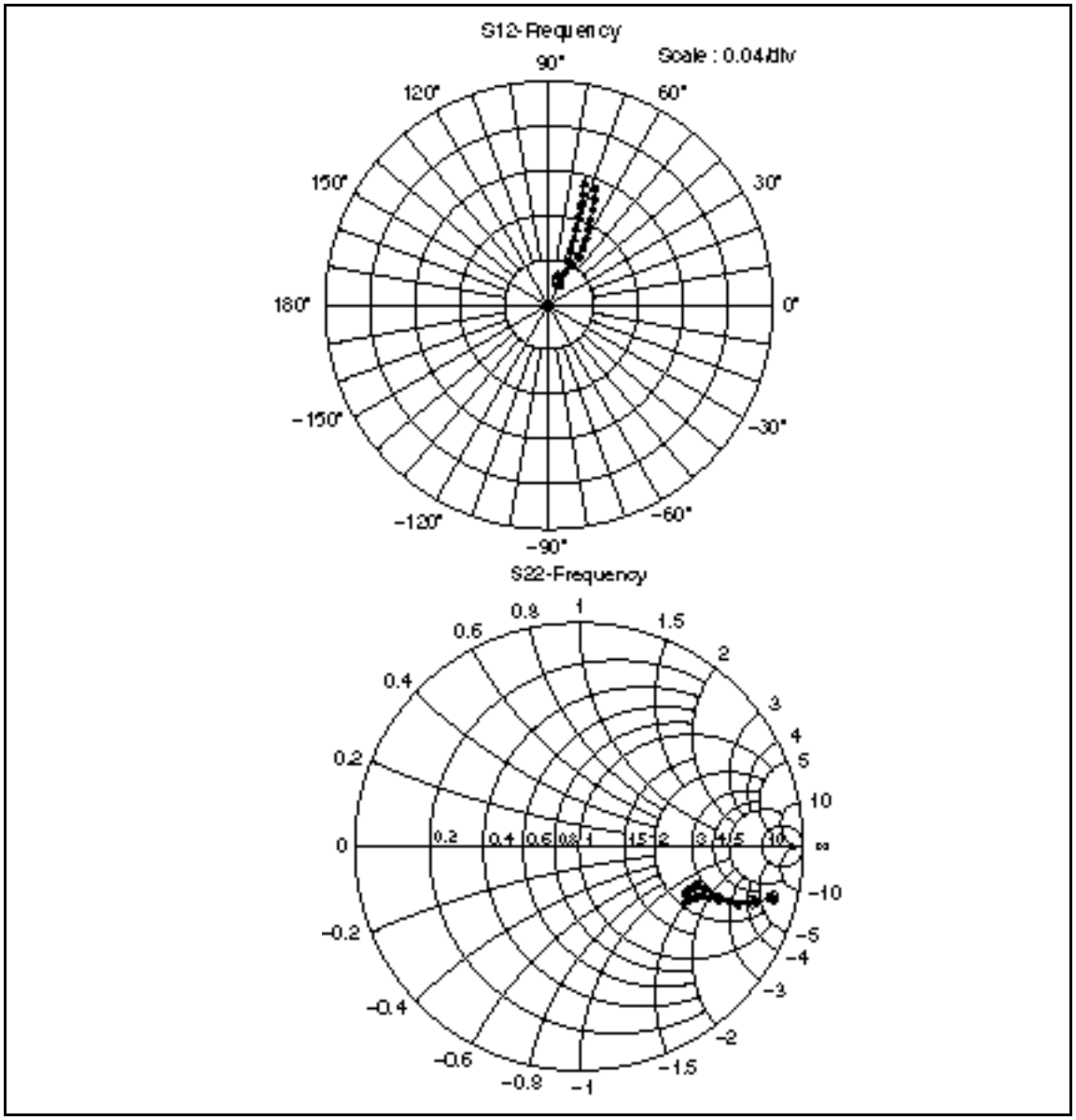
S Parameters (Emitter Common)

Test condition V_{CE} = 5 V, 100 MHz to 1000 MHz (100 MHz STEP), Z_O = 50 Ω

I_C = 5 mA

I_C = 10 mA




S12-Frequency
Scale : 0.04/div
90°
120°
60°
150°
30°
180°
0°
-150°
-30°
-120°
-60°
-90°
S22-Frequency
0.8
1
0.6
1.5
2
0.4
3
4
5
0.2
10
0
0.2
0.4
0.6
0.8
1
1.5
2
3
4
5
10
∞
-10
-0.2
-5
-4
-0.4
-3
-2
-0.6
-0.8
-1
-1.5

S Parameters (Emitter Common)

Test Condition V_{CE} = 5 V, I_C = 5 mA, Z_O = 50 Ω

Freq.	S11		S21		S12		S22	
(MHz)	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.718	–44.8	12.498	144.9	0.026	68.8	0.895	–14.6
200	0.549	–78.8	9.123	122.0	0.042	59.3	0.756	–20.3
300	0.439	–102.0	6.788	108.4	0.051	57.6	0.671	–21.3
400	0.381	–120.8	5.348	99.3	0.060	58.5	0.626	–21.5
500	0.351	–135.5	4.396	92.4	0.068	60.6	0.600	–21.8
600	0.340	–148.2	3.732	86.7	0.076	62.5	0.582	–22.5
700	0.337	–157.8	3.240	81.7	0.085	64.3	0.569	–23.3
800	0.337	–165.2	2.875	77.3	0.094	66.0	0.558	–24.4
900	0.343	–173.1	2.575	73.4	0.103	67.3	0.547	–25.8
1000	0.359	–177.9	2.355	70.0	0.112	68.4	0.538	–27.2

Test Condition V_{CE} = 5 V, I_C = 10 mA, Z_O = 50 Ω

Freq.	S11		S21		S12		S22	
(MHz)	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.553	–65.2	17.540	133.2	0.022	64.8	0.809	–18.0
200	0.401	–103.4	11.066	111.3	0.033	61.3	0.659	–20.0
300	0.337	–127.4	7.723	99.9	0.043	63.9	0.598	–18.6
400	0.314	–143.9	5.939	92.5	0.052	66.3	0.570	–18.1
500	0.313	–155.7	4.816	86.7	0.063	68.6	0.555	–18.2
600	0.314	–165.5	4.052	81.8	0.073	70.1	0.545	–18.9
700	0.327	–172.2	3.496	77.6	0.083	71.4	0.536	–19.9
800	0.335	–177.7	3.090	73.8	0.093	72.4	0.530	–21.0
900	0.349	176.8	2.753	70.1	0.103	73.0	0.523	–22.4
1000	0.354	172.8	2.515	67.0	0.113	74.0	0.516	–24.0

Y Parameters (Emitter Common)

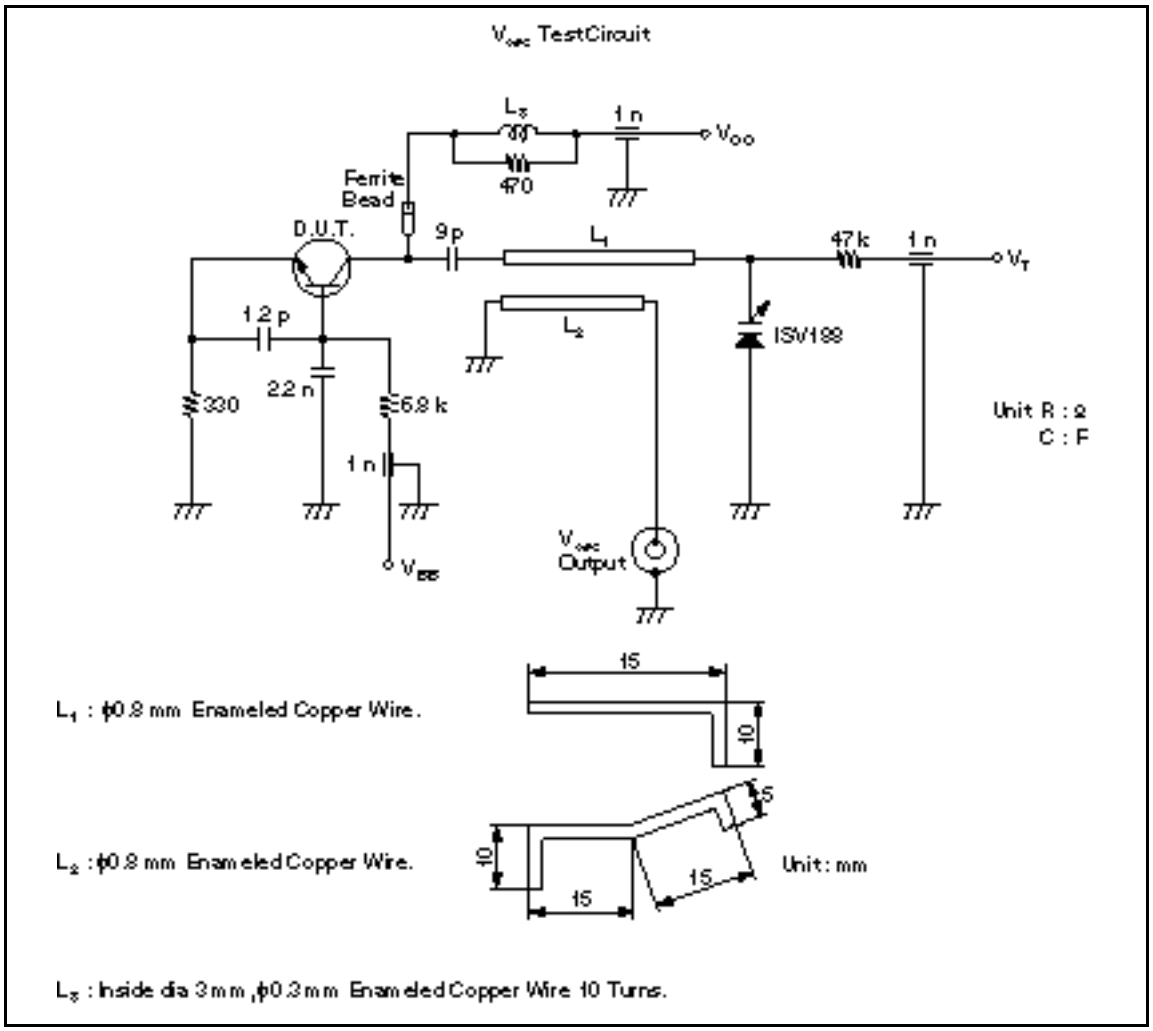
Test Condition V_{CE} = 5 V, I_C = 5 mA

Freq.	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
(MHz)	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	3.035	5.491	152.256	–40.168	–0.005	–0.334	0.048	0.613
200	6.463	10.003	131.145	–71.318	–0.015	–0.679	0.100	1.238
300	10.768	12.356	103.025	–90.187	–0.036	–1.034	0.191	1.804
400	15.089	13.186	77.334	–98.666	–0.065	–1.397	0.232	2.386
500	18.776	12.837	55.039	–99.977	–0.090	–1.767	0.270	2.947
600	22.098	11.913	37.290	–98.247	–0.128	–2.134	0.347	3.555
700	24.568	10.731	22.802	–93.799	–0.163	–2.515	0.417	4.133
800	26.291	9.416	11.686	–88.266	–0.193	–2.890	0.516	4.703
900	28.112	7.683	2.225	–82.972	–0.260	–3.305	0.614	5.354
1000	29.685	6.751	–3.931	–78.720	–0.291	–3.746	0.629	5.908

Test Condition V_{CE} = 5 V, I_C = 10 mA

Freq.	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
(MHz)	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	5.903	7.347	243.307	–103.091	–0.008	–0.338	0.026	0.591
200	11.583	10.820	168.225	–150.806	–0.022	–0.682	0.128	1.254
300	16.546	10.993	103.210	–155.623	–0.045	–1.041	0.216	1.797
400	20.055	10.038	61.965	–145.393	–0.074	–1.387	0.320	2.394
500	22.491	8.943	35.421	–131.365	–0.093	–1.766	0.316	2.917
600	24.417	7.556	16.762	–118.513	–0.133	–2.138	0.378	3.544
700	26.086	6.620	5.096	–107.291	–0.155	–2.531	0.424	4.086
800	27.193	5.569	–3.874	–97.359	–0.185	–2.923	0.469	4.659
900	28.543	4.340	–11.095	–88.952	–0.248	–3.349	0.563	5.307
1000	28.955	3.253	–15.953	–81.466	–0.270	–3.737	0.650	5.861

V_{OSC} Test Circuit



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HITACHI

Hitachi, Ltd.
Semiconductor & IC Div.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100, Japan
Tel: Tokyo (03) 3270-2111
Fax: (03) 3270-5109

For further information write to:

Hitachi America, Ltd.
Semiconductor & IC Div.
2000 Sierra Point Parkway
Brisbane, CA. 94005-1835
U.S.A.
Tel: 415-589-8300
Fax: 415-583-4207

Hitachi Europe GmbH
Electronic Components Group
Continental Europe
Dornacher Straße 3
D-85622 Feldkirchen
München
Tel: 089-9 91 80-0
Fax: 089-9 29 30 00

Hitachi Europe Ltd.
Electronic Components Div.
Northern Europe Headquarters
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA
United Kingdom
Tel: 0628-585000
Fax: 0628-778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 0104
Tel: 535-2100
Fax: 535-1533

Hitachi Asia (Hong Kong) Ltd.
Unit 706, North Tower,
World Finance Centre,
Harbour City, Canton Road
Tsim Sha Tsui, Kowloon
Hong Kong
Tel: 27359218
Fax: 27306071