
2SC4196

Silicon NPN Epitaxial

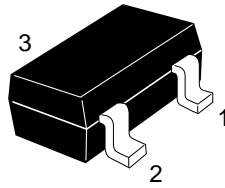
HITACHI

Application

UHF Local oscillator

Outline

MPAK



- 1. Emitter
- 2. Base
- 3. Collector

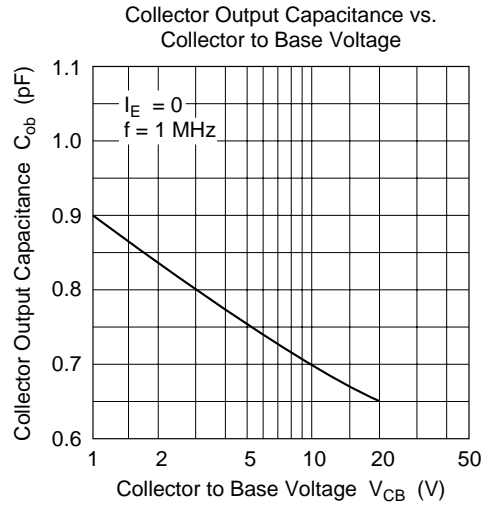
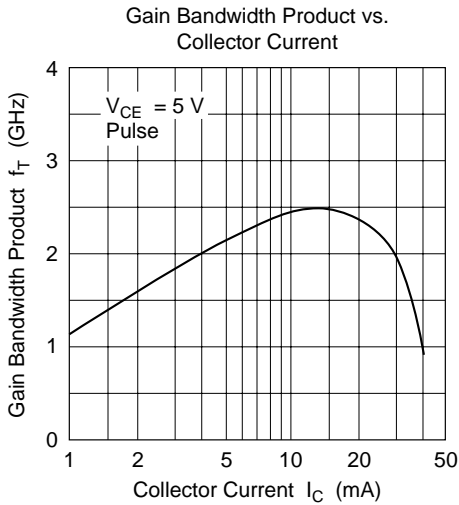
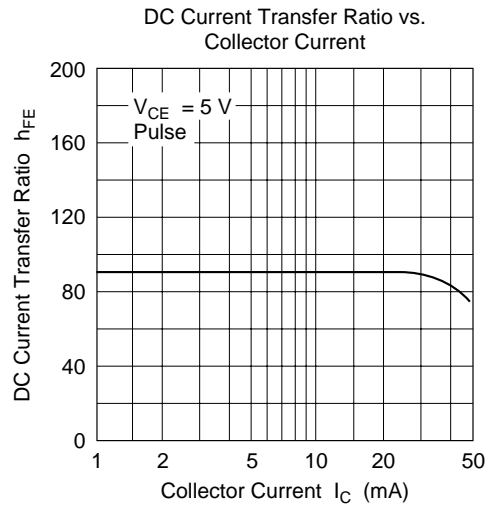
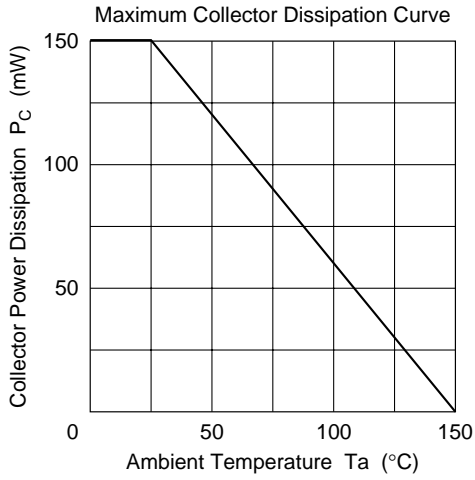
Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

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	T_{j}	150	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to +150	$^\circ\text{C}$

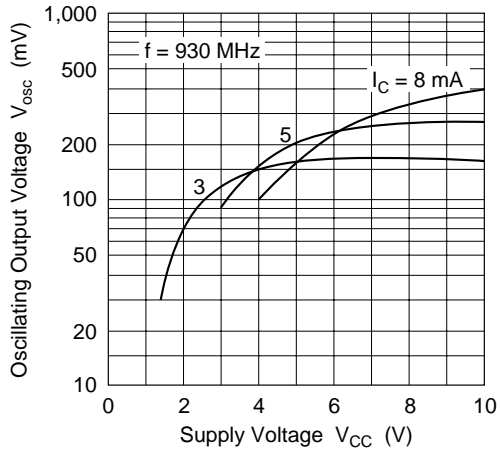
Electrical Characteristics ($T_a = 25^\circ\text{C}$)

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

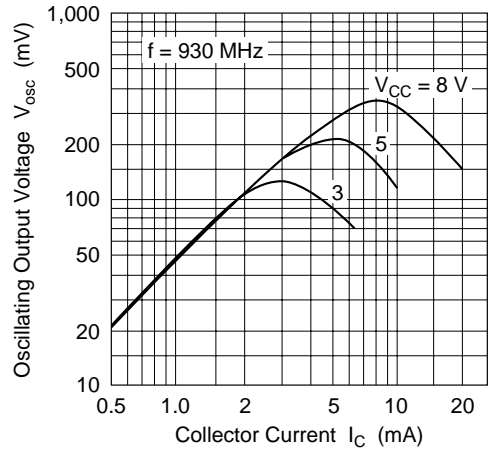
Note: Marking is "QI—".



Oscillating Output Voltage vs. Supply Voltage



Oscillating Output Voltage vs. Collector Current

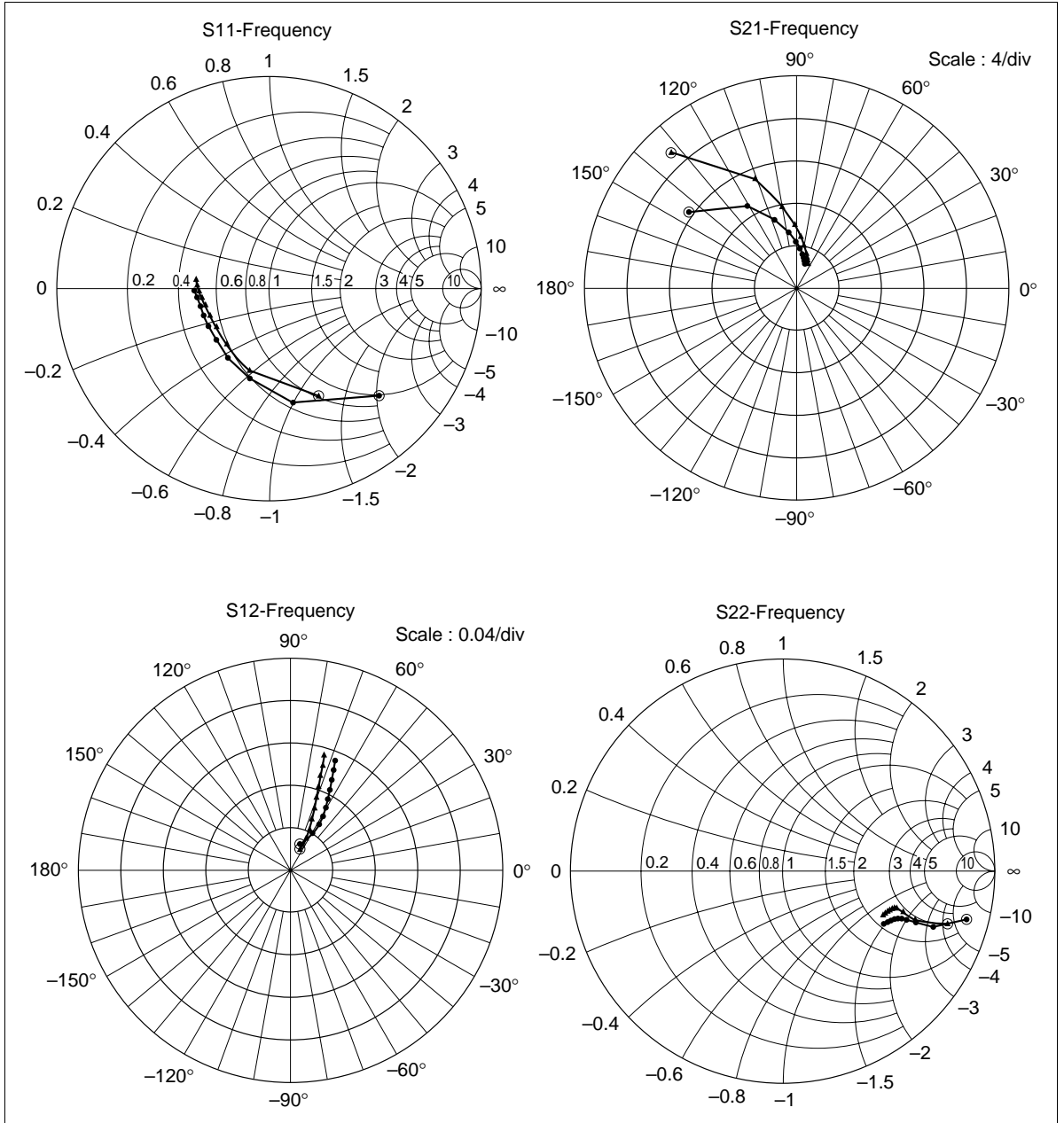


S Parameters (Emitter Common)

Test condition $V_{CE} = 5\text{ V}$, 100 MHz to 1000 MHz (100 MHz STEP), $Z_O = 50\ \Omega$

$I_C = 5\text{ mA}$ ● ——— ●

$I_C = 10\text{ mA}$ ▲ ——— ▲



S Parameters (Emitter Common)**Test Condition** $V_{CE} = 5 \text{ V}$, $I_C = 5 \text{ mA}$, $Z_O = 50 \Omega$

Freq. (MHz)	S11		S21		S12		S22	
	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 $V_{CE} = 5 \text{ V}$, $I_C = 10 \text{ mA}$, $Z_O = 50 \Omega$

Freq. (MHz)	S11		S21		S12		S22	
	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)

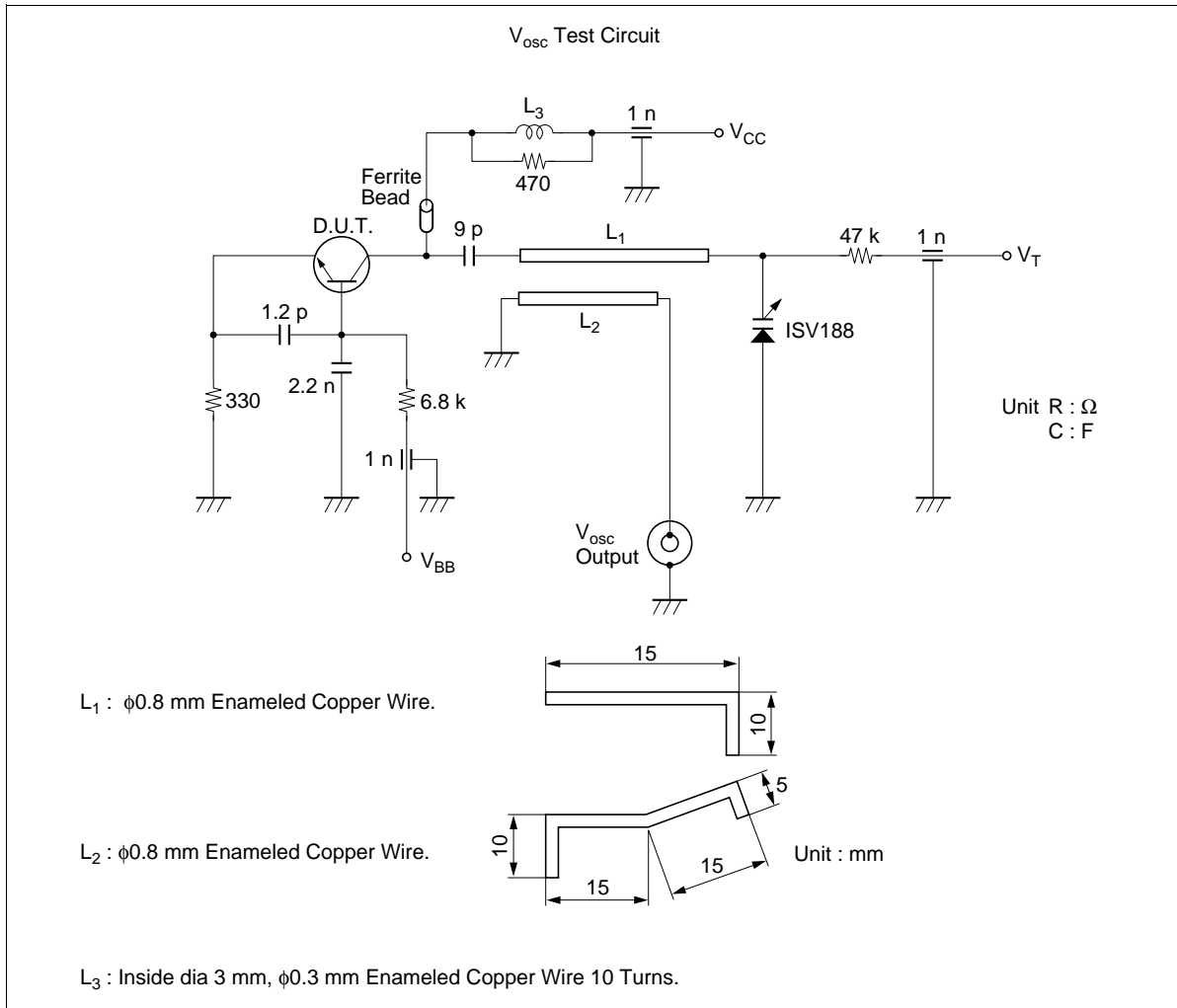
Test Condition $V_{CE} = 5\text{ V}$, $I_C = 5\text{ mA}$

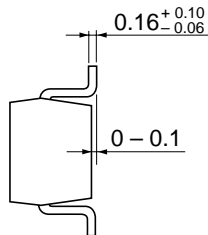
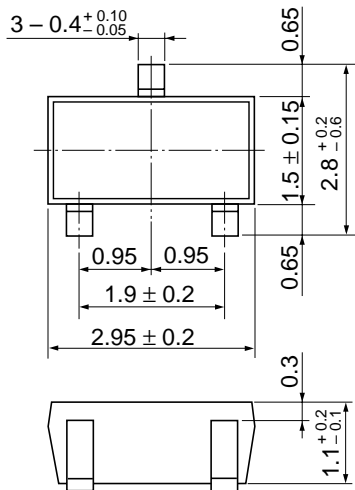
Freq. (MHz)	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	3.035	5.491	152.256	-40.168	-0.005	-0.334	0.048	0.613
200	6.463	10.003	131.145	-71.318	-0.015	-0.679	0.100	1.238
300	10.768	12.356	103.025	-90.187	-0.036	-1.034	0.191	1.804
400	15.089	13.186	77.334	-98.666	-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 $V_{CE} = 5\text{ V}$, $I_C = 10\text{ mA}$

Freq. (MHz)	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
	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





Hitachi Code	MPAK
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.011 g

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