

NPN SILICON PLANAR TRANSISTORS

MA-42000 SERIES AND 2N6665

This series of NPN silicon planar bipolar NPN transistors is designed to provide the lowest possible noise figure at frequencies from 10 to 700 MHz. These transistors exhibit excellent noise figure versus current characteristics which results in extremely low noise and wide dynamic range performance. This series is recommended such applications as IF, VHF, UHF, TV and RF amplifiers.

MODEL NUMBER	CASE STYLE ²	TEST FREQ. (MHz)	MAX. NOISE FIGURE @ COLLECT. CURRENT ³ (dB @ mA)	MAX. UNI-LATERAL GAIN ⁴ (dB)	MAX. COLLECT. BASE LEAK. CURRENT ⁵ I _{CBO} (nA)	MIN. COLLECT. BASE BREAK-DOWN VOLT. W/OPEN EMIT. BV _{CBO} ⁶ (VOLTS)	MIN. EMIT. BASE BREAK-DOWN VOLT. BV _{EBO} ⁷ (VOLTS)
MA-42001	509	60	1.0 @ 5.0	28	10	20	2.5
2N6665 ¹	509	60	1.0 @ 5.0	28	10	20	2.5
MA-42014	509	60	1.3 @ 5.0	28	10	20	2.5
MA-42002	509	60	1.5 @ 5.0	28	10	20	2.5
MA-42004	509	60	1.5 @ 15.0	30	10	20	2.5
MA-42003	509	60	2.0 @ 5.0	30	10	20	2.5
MA-42005	509	60	2.0 @ 20.0	30	10	20	2.5
MA-42006	510	60	4.0 @ 40.0	35	10	20	2.5
MA-42008	511	450	2.0 @ 5.0	18	10	20	2.5
MA-42009	509	450	2.5 @ 5.0	14	10	20	2.5
MA-42010	509	450	3.0 @ 20.0	15	10	20	2.5
MA-42011	509	450	3.5 @ 20.0	15	10	20	2.5
MA-42010	510	450	3.5 @ 40.0	20	10	20	2.5
MA-42011	510	450	4.0 @ 40.0	20	10	20	2.5
MA-42015	510	450	4.0 @ 60.0	20	10	20	2.5
MA-42016	510	450	4.5 @ 60.0	20	10	20	2.5
MA-42012	510	450	5.0 @ 60.0	20	10	20	2.5

NOTES:

1. The 2N6665 is a fully screened and tested version of the MA-42001.

2. The desired case style must be added to the part number as a suffix.

3. V_{CE} = 10 volts.

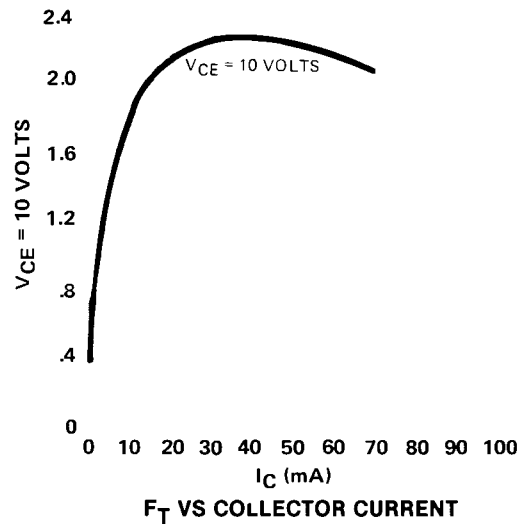
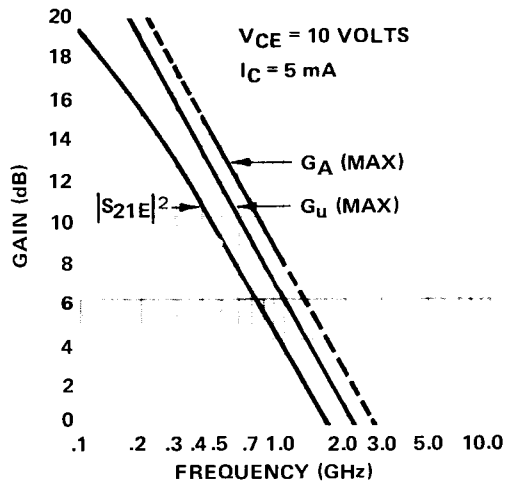
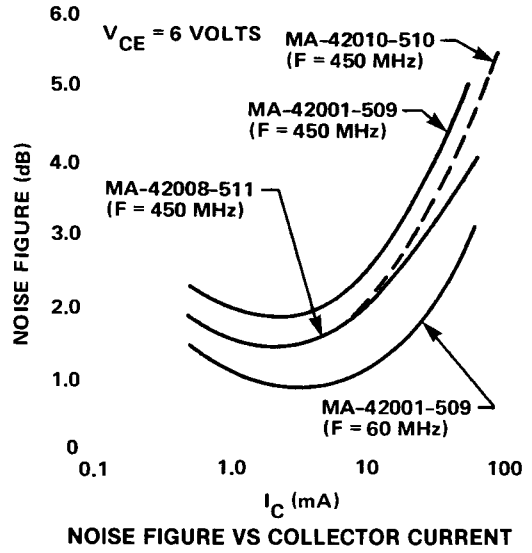
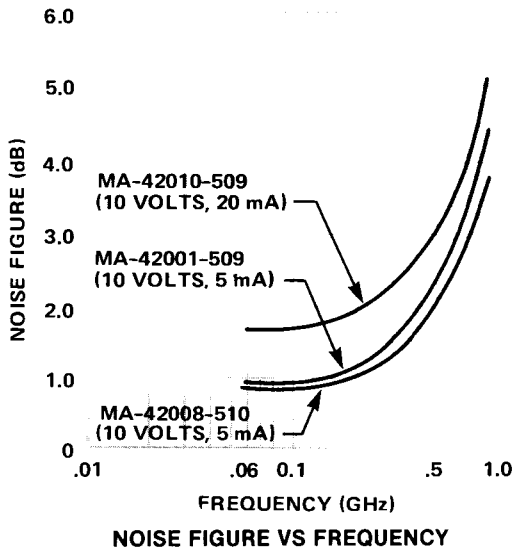
4. G_U (Max.)(dB) = 10 log $\frac{|S_{21E}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$

5. V_{CB} = 10 volts.

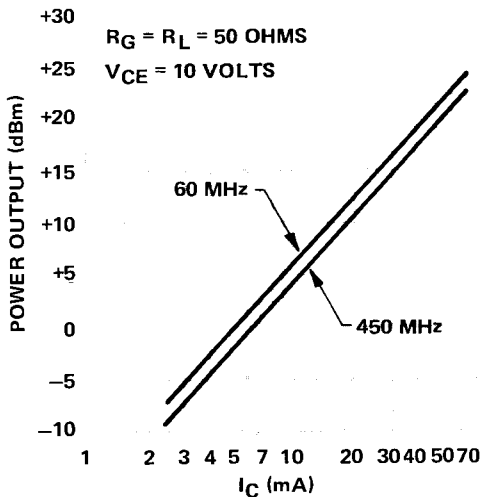
6. Collector current = 10 μA.

7. Emitter current = 10 μA.

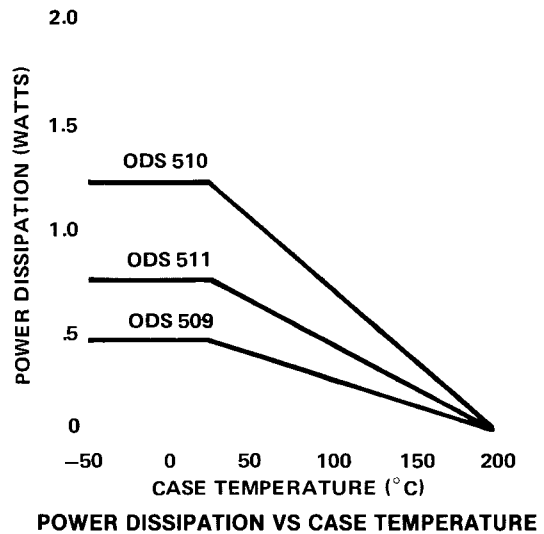
MA-42000 SERIES AND 2N6665 (CONT'D)
TYPICAL PERFORMANCE



MA-42001-509 GAIN PARAMETERS VS FREQUENCY



MA-42001-509 GAIN PARAMETERS VS FREQUENCY



MA-42020 SERIES AND JAN 2N2857

This series of NPN silicon planar transistors, packaged in the 509 case style, is designed especially for low cost applications demanding low noise, high gain performance in IF, VHF, UHF, TV and RF amplifiers. Gold metallization employed in the construction of the device results in a rugged, highly reliable transistor.

MODEL NUMBER	TEST FREQ. (MHz)	MAX. NOISE FIGURE @ COLLECT. CURRENT ¹ (dB @ mA)	MAX. UNI-LATERAL GAIN ² (dB)	MIN. COLLECT. TO BASE BREAK-DOWN VOLT. ³ BV _{CB0} (VOLTS)	MIN. EMIT. TO BASE BREAK-DOWN VOLT. ⁴ BV _{EB0} (VOLTS)	MAX. COLLECT. CUTOFF CURRENT ⁵ (μA)	TYP. CURRENT TRANSFER RATIO ⁶
MA-42020	60	1.6 @ 1.5	23	30	2.5	0.01	120
MA-42021	60	2.0 @ 1.5	23	30	2.5	0.01	120
MA-42022	60	2.5 @ 1.5	23	30	2.5	0.01	120
MA-42023	60	2.0 @ 1.5	23	30	2.5	0.01	120
MA-42024	60	3.0 @ 1.5	23	30	2.5	0.01	120
MA-42025	450	2.5 @ 1.0	13	30	2.5	0.01	120
MA-42026	450	3.0 @ 1.0	10	30	2.5	0.01	120
MA-42027	450	3.5 @ 1.0	10	30	2.5	0.01	120
MA-42028	450	4.0 @ 1.5	10	30	2.5	0.01	120
2N5031	450	2.5 @ 1.0	10	30	2.5	0.01	120
2N3570	450	2.5 @ 1.5	10	30	2.5	0.01	120
2N3953	450	3.0 @ 1.0	10	30	2.5	0.01	120
2N5032	450	3.0 @ 1.0	10	30	2.5	0.01	120
2N3880	450	3.5 @ 1.5	10	30	2.5	0.01	120
2N3839	450	3.9 @ 1.5	10	30	2.5	0.01	120
2N3571	450	4.0 @ 2.0	10	30	2.5	0.01	120
2N5054	450	4.0 @ 2.0	10	30	2.5	0.01	120
2N3683	450	4.5 @ 1.5	10	30	2.5	0.01	120
2N5179	450	4.5 @ 2.0	10	30	2.5	0.01	120
2N5053	450	5.0 @ 2.0	10	30	2.5	0.01	120
2N3572	450	6.0 @ 2.0	10	30	2.5	0.01	120

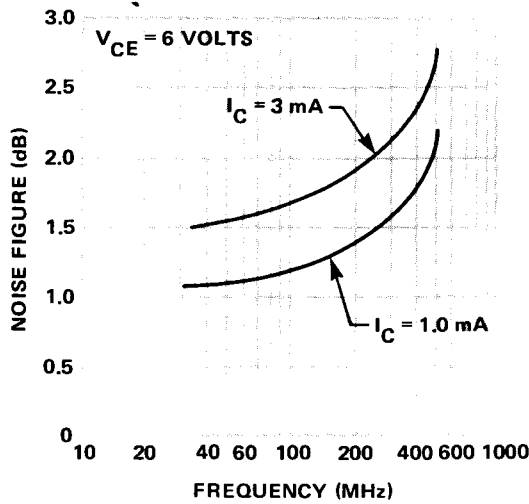
NOTES:

1. V_{CE} = 6 volts.5. V_{CB} = 15 Volts.

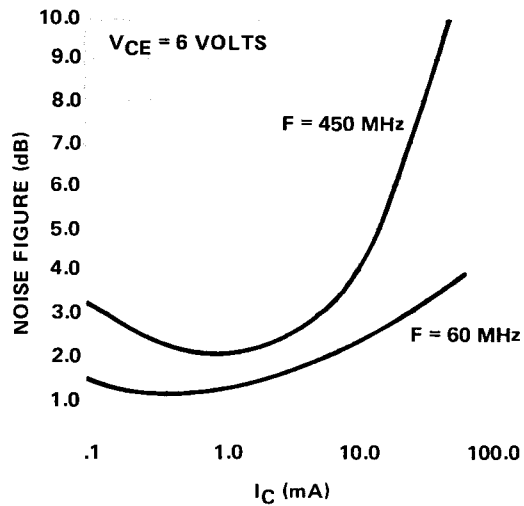
2. G_U (Max.) can be derived from S-Parameter data; G_U (Max.) (dB) = 10 log $\frac{|S_{21E}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$

6. V_{CE} = 1V; I_C = 3 mA.3. I_C = 1 μA4. I_E = 10 μA

MA-42020 SERIES AND JAN-2N2857 (CONT'D)
TYPICAL PERFORMANCE



NOISE FIGURE VS FREQUENCY FOR AN MA-42020 TRANSISTOR



NOISE FIGURE VS COLLECTOR CURRENT FOR AN MA-42020 TRANSISTOR

MA-42050 SERIES

The MA-42050 series of NPN silicon planar transistors is designed to give high gain and low noise figure characteristics in amplifier applications. The refractory gold metallization techniques employed in the construction of these devices results in rugged, highly reliable transistors. This series is recommended for applications such as VHF, UHF, TV and RF amplifiers and oscillators.

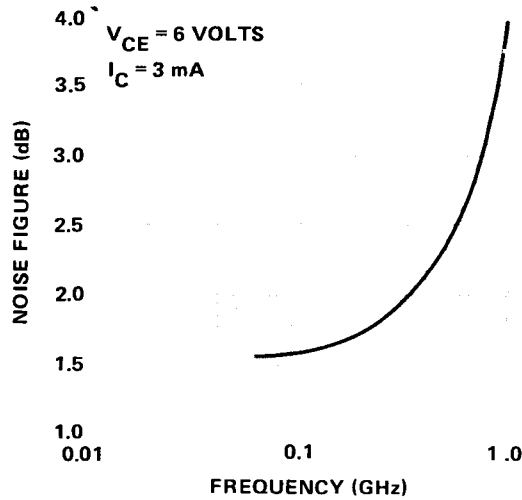
MODEL NUMBER ¹	TEST FREQ. (MHz)	MAX. NOISE FIGURE @ COLLECT. CURRENT (dB @ mA)	MAX. UNI-LATERAL GAIN ² (dB)	MIN. COLLECT. TO BASE BREAK-DOWN VOLT. ³ BV _{CBO} (VOLTS)	MIN. EMIT. TO BASE BREAK-DOWN VOLT. ⁴ BV _{EBO} (VOLTS)	TYP. CURRENT TRANSFER RATIO ⁵	MAX. COLLECT. CUTOFF CURRENT ⁶ (μA)
MA-42051	450	2.2 @ 3.0	18	20	2.5	75	0.05
MA-42052	450	2.5 @ 3.0	18	20	2.5	75	0.05
MA-42056	1000	4.5 @ 3.0	11	20	2.5	75	0.05

NOTES:

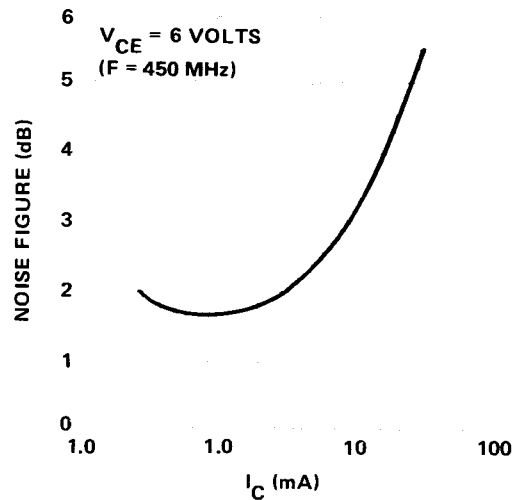
- The MA-42051 and MA-42052 are available in the 509, 510, 511 case styles. The MA-42056 is available in the 510 and 511 case styles. When ordering, please specify desired case style as a suffix to the basic model number.
- The 1 dB compression point is measured at +1 dBm except for the MA-42056, which has a 1 dB compression point measured at 0 dBm.

- $I_C = 10 \mu A$
- $I_E = 10 \mu A$
- $V_{CE} = 1 V; I_C = 3 mA.$
- $V_{CB} = 10 volts.$

**MA-42050 SERIES (CONT'D)
TYPICAL PERFORMANCE**



OPTIMUM NOISE FIGURE VS FREQUENCY FOR AN MA-42050 SERIES SILICON PLANAR TRANSISTOR



OPTIMUM NOISE FIGURE VS COLLECTOR CURRENT FOR AN MA-42050 SERIES SILICON PLANAR TRANSISTOR

MA-42110 SERIES

The MA-42110 series of silicon NPN bipolar transistors is designed to give very low noise figure and wide dynamic range up to approximately 4 GHz. Gold metallization is employed in the construction of the device resulting in a rugged, highly reliable transistor.

MODEL NUMBER ¹	CASE STYLE	MAX. NOISE FIGURE ² (dB)	MAX. UNI-LATERAL GAIN ³ (dB)	MIN. S _{21E} ²⁵	TYP. GAIN @OPT. NOISE FIGURE ² (dB)	MIN. COLLECT. TO BASE BREAK-DOWN VOLT. ⁶ BV _{CB0} (VOLTS)	MIN. EMIT. TO BASE BREAK-DOWN VOLT. ⁷ BV _{EBO} (VOLTS)	MAX. COLLECT. CUTOFF CURRENT ⁸ (μA)	TYP. CURRENT TRANSFER RATIO ⁹
MA-42111	509	1.5	14	13	13	20	1.5	10	125
MA-42111	510	1.5	17	15.5	15	20	1.5	10	125
MA-42111	511	1.5	19	16	15	20	1.5	10	125
MA-42112	509	1.8	14	13	13	20	1.5	10	125
MA-42112	510	1.8	17	15.5	15	20	1.5	10	125
MA-42112	511	1.8	19	16	15	20	1.5	10	125
MA-42113	509	2.1	14	13	13	20	1.5	10	125
MA-42113	510	2.1	17	15.5	15	20	1.5	10	125
MA-42113	511	2.1	19	16	15	20	1.5	10	125

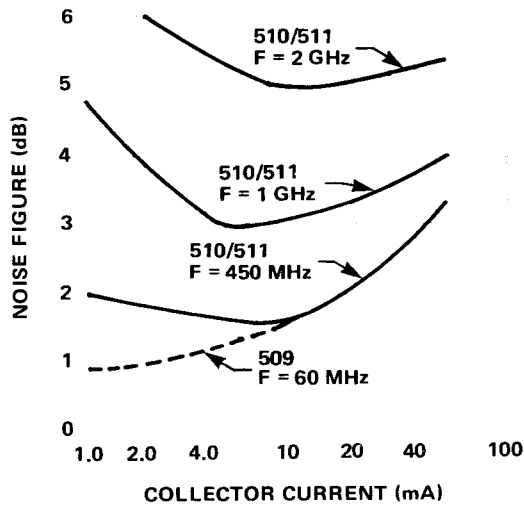
NOTES:

- The test frequency is 450 MHz.
- V_{CE} = 10 Volts, I_C = 5 mA, frequency = 450 MHz.
- 1 dB compression point = 0 dBm:
- $G_U(\text{Max.})(\text{dB}) = 10 \log \frac{|S_{21E}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$
- V_{CE} = 10 Volts, I_C = 20 mA, frequency = 450 MHz.
- I_C = 10 μA
- I_E = 10 μA
- V_{CB} = 10 Volts
- V_{CE} = 10 Volts, I_C = 5 mA

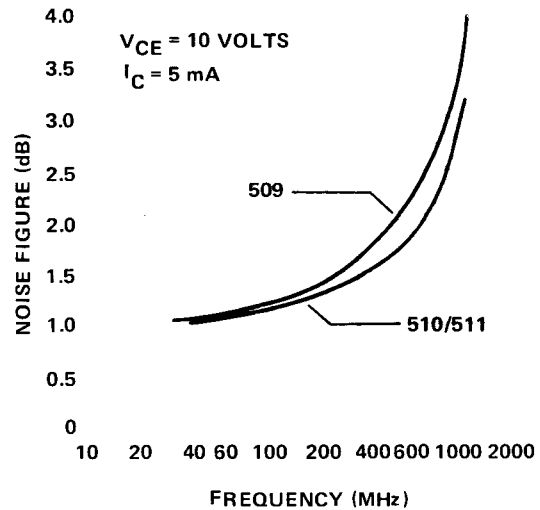
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MA-42110 SERIES (CONT'D)

TYPICAL PERFORMANCE



NOISE FIGURE VS COLLECTOR CURRENT FOR AN MA-42110 SERIES SILICON PLANAR TRANSISTOR



NOISE FIGURE VS FREQUENCY FOR AN MA-42110 SERIES SILICON PLANAR TRANSISTOR

MA-42120 SERIES

This series of NPN epitaxial silicon planar transistors is designed for VHF/UHF service. The performance of this series is directly interchangeable with the Fairchild FMT-1060 series. The high gain bandwidth products make the MA-42122 and MA-42123 useful to 1.0 GHz

while the MA-42121 has a maximum frequency of oscillation of 4.2 GHz. Two packages are offered: the TO-46 (case style 508) for low power oscillator applications and the TO-72 (case style 509) for small signal IF and RF amplifiers.

MODEL NUMBER ¹	CASE STYLE	MAX. NOISE FIGURE ² (dB)	MAX. UNI-LATERAL GAIN (dB)	FAIRCHILD EQUIV.	MIN. GAIN BANDWIDTH PROD. ³ (GHz)	MAX. AVAIL. GAIN ⁴ (dB)	TYP. NEUTRAL PWR. GAIN G _{pE} (dB)	MAX. FREQ. OSCIL. ⁵ (GHz)	MIN. COLLECT. TO BASE BREAK-DOWN VOLT ⁶ V_{CBO} (VOLTS)
MA-42120	508	—	13	FMT-1060	1.0	—	—	3.8	30
MA-42121	508	—	13	FMT-1060A	1.3	12.8	—	4.2	30
MA-42122 ²	509	3.5	14	FMT-1061	1.0	—	—	—	30
MA-42123 ²	509	3.0	14	FMT-1061A	1.3	13.8	17.0	—	30

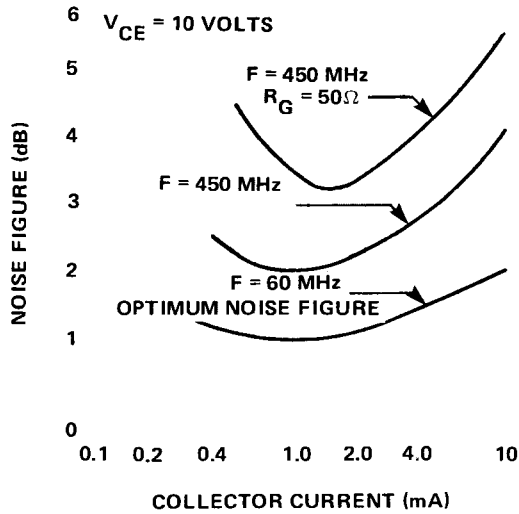
NOTES:

1. Test frequency for all above devices is 450 MHz.
2. Collector current for the MA-42122 and MA-42123 is 1.5 mA.
3. $V_{CE} = 10$ volts, $I_C = 20$ mA, Frequency = 500 MHz.
4. $V_{CE} = 10$ volts, $I_C = 20$ mA, Frequency = 1 GHz.

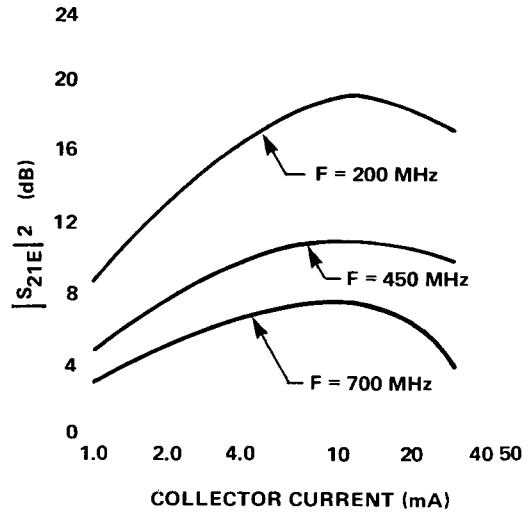
5. The maximum frequency of oscillation is calculated from S-Parameters. F_{max} is the frequency at which the extrapolated GA_{max} is 0 dB.

6. $I_C = 10 \mu A$, $I_E = 0$.

MA-42120 SERIES (CONT'D)
TYPICAL PERFORMANCE



OPTIMUM NOISE FIGURE VS COLLECTOR CURRENT FOR AN MA-42123-509 TRANSISTOR



$|S_{21E}|^2$ VS COLLECTOR CURRENT FOR AN MA-42123-509 TRANSISTOR

MA-42140 SERIES

The MA-42140 series of NPN silicon planar transistors features good high frequency current gain at medium current levels. The MA-42141 exhibits an excellent noise figure characteristic over the frequency range of 0.5 to 2 GHz. These transistors may be used in RF amplifiers and low level oscillators.

MODEL NUMBER ¹	TEST FREQ. (GHz)	MAX. NOISE FIGURE ² (dB)	MAX. UNI-LATERAL GAIN (dB)	TYP. COLLECT. TO BASE BREAK-DOWN VOLT. ³ BV _{CB0} (VOLTS)	TYP. EMIT. TO BASE BREAK-DOWN VOLT. ⁴ BV _{EB0} (VOLTS)	TYP. COLLECT. TO EMIT. BREAK-DOWN VOLT. ⁵ BV _{CE0} (VOLTS)	MAX. COLLECT. CUTOFF CURRENT ⁶ (nA)	TYP. CURRENT TRANSFER RATIO ⁷
MA-42141	1.00	2.5	17	35	1.5	25	100	100
MA-42142	1.00	3.0	17	35	1.5	25	100	100
MA-42143	0.45	1.7	18	35	1.5	25	100	100
2N5651	0.45	2.0	21	35	3.5	25	100	100
2N5652	0.45	2.5	21	35	3.5	25	100	100

NOTES:

1. The standard case style for all these devices is 509. The MA-42141, MA-42142 and MA-42143 are also available in case styles 510 and 511. To order, please add the case style as a suffix to the basic model number (ie: MA-42142-510).

2. Collector current = 15 mA.

3. $I_C = 10 \mu A$

4. $I_E = 10 \mu A$

5. $I_C = 500 \mu A$

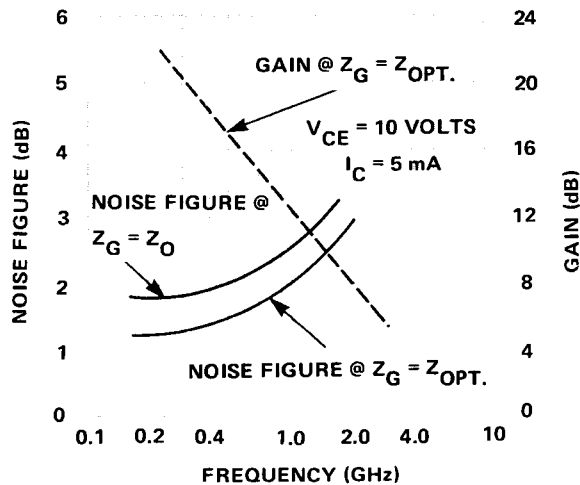
6. $V_{CB} = 10$ Volts

7. $I_C = 5$ mA, $V_{CE} = 10$ Volts

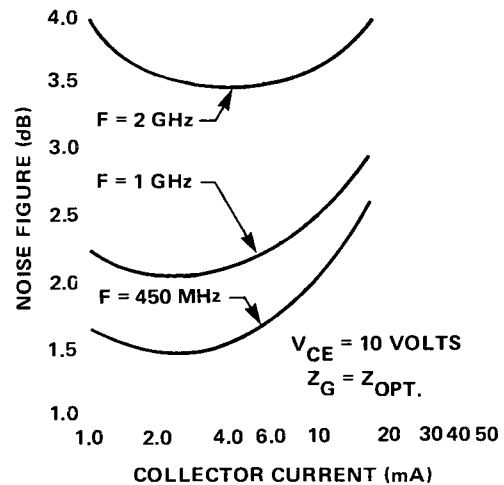
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MA-42140 SERIES (CONT'D)

TYPICAL PERFORMANCE



NOISE FIGURE AND ASSOCIATED GAIN VS FREQUENCY FOR AN MA-42140 TRANSISTOR



NOISE FIGURE VS COLLECTOR CURRENT FOR AN MA-42140 TRANSISTOR

MA-42151 AND MA-42191 TRANSISTORS

These NPN planar transistors are characterized for local oscillator use in the 1.0 to 3.0 GHz range. The MA-42151, when mounted in a common-base package exhibits a typical f_{max} of 9.5 GHz at 20 mA collector current and at 3.0 GHz has a guaranteed power output. The MA-42191, when mounted in a common base

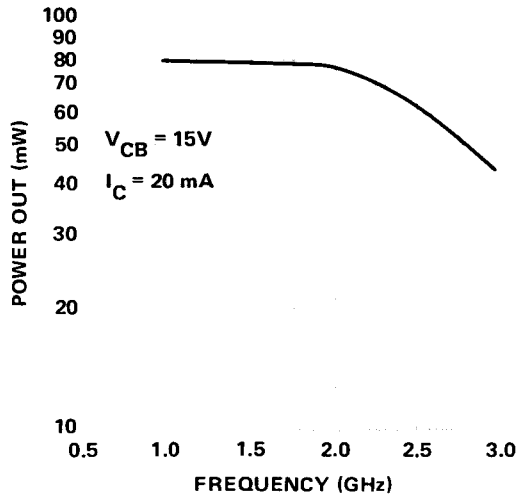
package exhibits a typical f_{max} of 6.0 GHz at 50 mA collector current and has a guaranteed power output at 2.0 GHz. This transistor is available in the hermetically sealed case style 510 stripline package and meets the MIL-S-19500 environmental ratings and test requirements of MIL-STD-750/883.

MODEL NUMBER	CASE STYLE	MIN. COLLECT. TO BASE BREAK-DOWN VOLT. BV _{CB0} (VOLTS)	MIN. EMIT. TO BASE BREAK-DOWN VOLT. ⁴ BV _{EB0} (VOLTS)	MIN. COLLECT. TO EMIT BREAK-DOWN VOLT. BV _{CE0} (VOLTS)	TYP. CURRENT TRANSFER RATIO	MIN. OSCIL. OUT-PUT PWR. mW	COLLECT. CURRENT (mA)
MA-42151	510 ¹	27 ²	1.5	20 ⁵	60 ⁷	20 ⁹	50
MA-42191	510	30 ³	3.5	25 ⁶	40 ⁸	350 ¹⁰	300

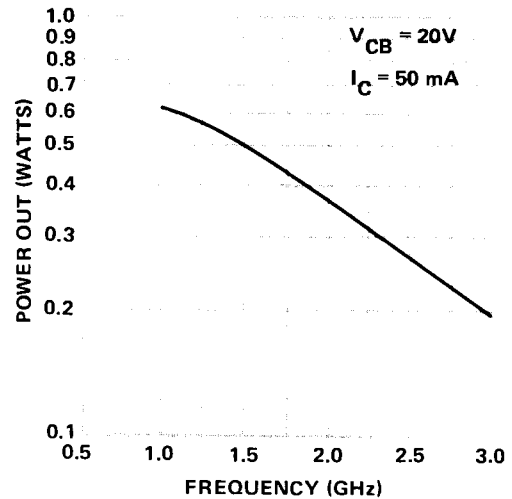
NOTES:

- The MA-42151 is also available in the hermetically sealed 511 stripline package and meets the MIL-S-19500 environmental ratings and test requirements of MIL-STD-750/883.
- $I_C = 10 \mu A$
- $I_C = 100 \mu A$
- $I_E = \mu A$
- $I_C = 500 \mu A$
- $I_C = 100 \mu A$
- $V_{CE} = 10$ Volts; $I_C = 5$ mA
- $V_{CE} = 5$ Volts; $I_C = 100$ mA
- $V_{CB} = 10$ Volts; $I_C = 20$ mA
Frequency = 3 GHz.
- $V_{CB} = 20$ Volts; $I_C = 50$ mA
Frequency = 2 GHz.

MA-42151 AND MA-42191 (CONT'D)
TYPICAL PERFORMANCE



MA-42151-511 OUTPUT POWER VS FREQUENCY



MA-42191-510 OUTPUT POWER VS FREQUENCY

MA-42160 SERIES

The MA-42161 is a low noise silicon planar epitaxial transistor intended for use in microwave amplifier applications in the 0.5 to 4 GHz frequency range. The performance of this transistor is comparable to the Fairchild FMT-4005. These units feature high power gain, typically 14.0 dB at 2.0 GHz and a low intrinsic noise figure of typically 2.3 dB at 2.0 GHz. These devices, housed in case style 511, may also be used in low level oscillators.

MODEL NUMBER ^{1,2}	TEST FREQ. (GHz)	MAX. NOISE FIGURE ² (dB)	MAX. UNI-LATERAL GAIN (dB)	TYP. $ S_{21E} ^2$ (dB)	TYP. GAIN @ OPT. NOISE FIGURE (dB)	TYP. CURRENT TRANSFER RATIO ³	MIN. COLLECT. TO BASE BREAK-DOWN VOLT. ³ (VOLTS)	TYP. COLLECT. TO EMIT. SUSTAIN. VOLT. ⁴ (VOLTS)
MA-42161	2.0	2.5	12	8.0	11.0	80	20	12
MA-42161	1.0	1.5	18	12.5	15.0	80	20	12
MA-42162	2.0	3.0	12	8.0	11.0	80	20	12
MA-42162	1.0	1.9	18	12.5	15.0	80	20	12
2N6618	2.0	2.2	12	8.0	11.0 min.	50 min.	20	12

NOTES:

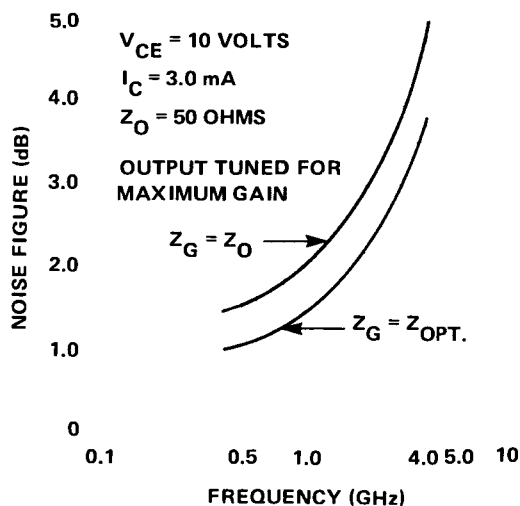
- 1 dB compression point is -5 dBm.
2. Test conditions: $I_C = 3$ mA, $V_{CE} = 10$ volts.
3. $I_C = 10$ μ A.
4. $I_C = 1.0$ mA.

POWER GENERATION AND ATTENUATION DEVICES

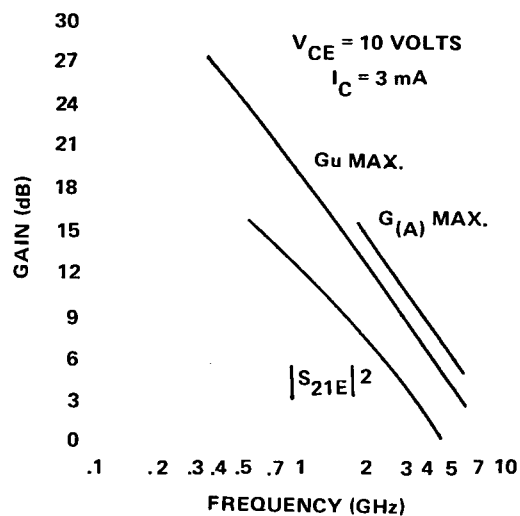
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MA-42160 SERIES (CONT'D)

TYPICAL PERFORMANCE



NOISE FIGURE VS FREQUENCY



GAIN PARAMETERS VS FREQUENCY

MA-42181 TRANSISTOR

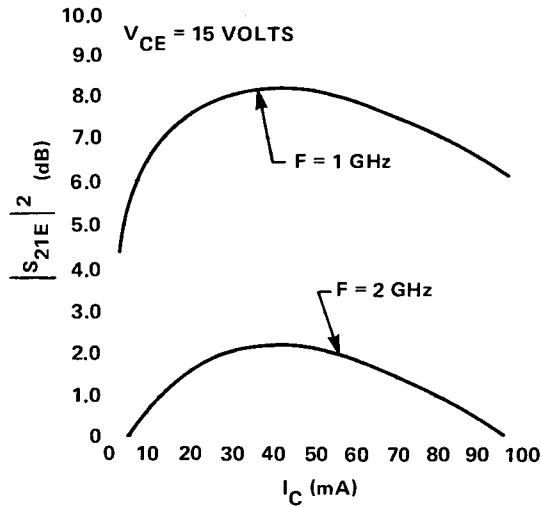
The MA-42181 transistor is designed for wide dynamic range amplifier applications over the 100 MHz to 3 GHz frequency range. Other applications include second stage amplifiers and low level oscillators.

MODEL NUMBER	CASE STYLE	MIN. COLLECT TO BASE BREAK-DOWN VOLT. ¹	MIN. EMIT. TO BASE BREAK-DOWN VOLT. ²	MIN. COLLECT. TO EMIT. BREAK-DOWN VOLT. ³	TYP. CURRENT TRANSFER RATIO ⁴	1 dB COMPRESS. POINT ⁵ (dBm)	MAX. UNI-LATERAL GAIN ⁶ (dB)	TYP. $ S_{21E} ^{26}$ (dB)	TYP. GAIN @ OPT. NOISE FIGURE ⁷ (dB)
MA-42181	510	30	3.5	25	60	+25	8.4	2.0	14.5

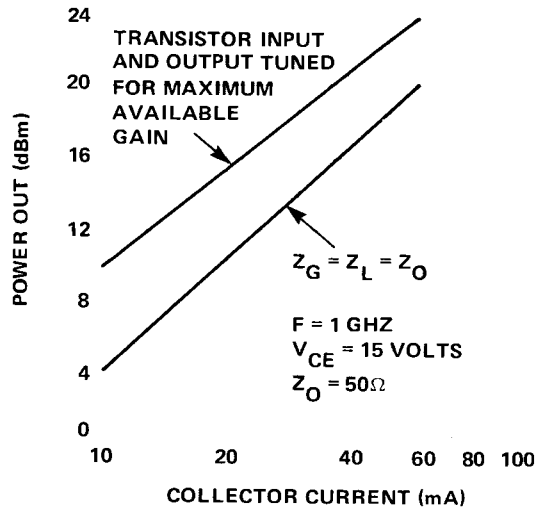
NOTES:

- $I_C = 100 \mu\text{A}$
- $I_E = 10 \mu\text{A}$
- $I_C = 100 \mu\text{A}$
- $V_{CE} = 5 \text{ Volts}, I_C = 100 \text{ mA}$
- $V_{CE} = 15 \text{ Volts}, I_C = 60 \text{ mA}$
 $Z_G = Z_L = 500 \text{ ohms}$
Frequency = 1 GHz.
- $V_{CE} = 15 \text{ Volts}, I_C = 60 \text{ mA}$,
Frequency = 2 GHz
- $V_{CE} = 15 \text{ Volts}, I_C = 60 \text{ mA}$,
Frequency = 1 GHz.

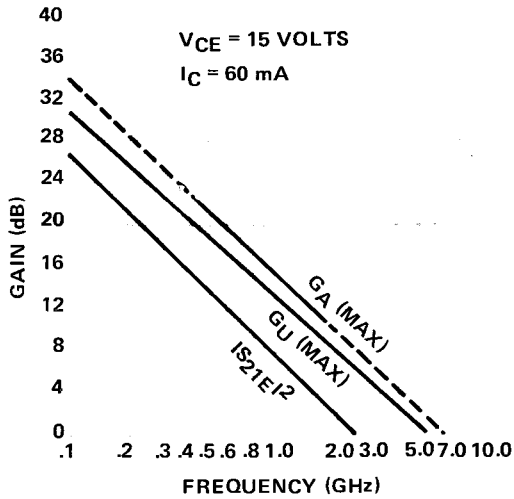
MA-42181 TRANSISTOR (CONT'D)
TYPICAL PERFORMANCE



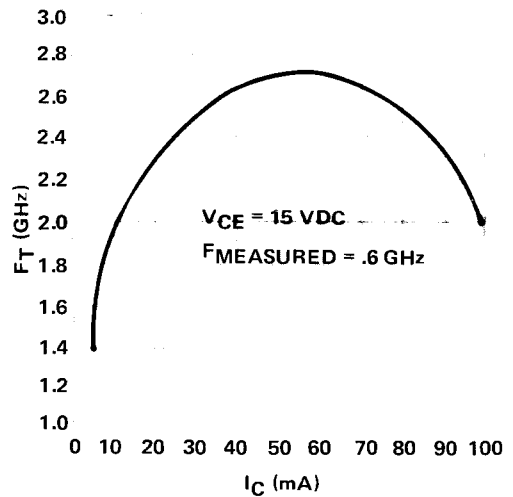
$|S_{21E}|^2$ VS COLLECTOR CURRENT



OUTPUT POWER AT THE 1 dB COMPRESSION POINT VS COLLECTOR CURRENT



TYPICAL GAIN PARAMETERS VS FREQUENCY



TYPICAL F_T VS COLLECTOR CURRENT

LOW COST 106 SILICON BIPOLAR TRANSISTORS

MA-42217 AND MA-42218 TRANSISTORS

The MA-42217 and MA-42218 NPN silicon planar bipolar transistors are designed to provide low noise figure and high gain at low cost. The high gain is due, in part, to the low lead inductance of the standard Jedec TO-92 package (case style 524). These devices exhibit excellent noise figure versus current characteristics which results in extremely low noise performance and wide dynamic range.

The chips used for these devices are of planar interdigitated geometry and are thermocompression bonded and encapsulated in the rugged TO-72 package.

Applications for these devices include CATV, UHF and VHF low noise amplifiers.

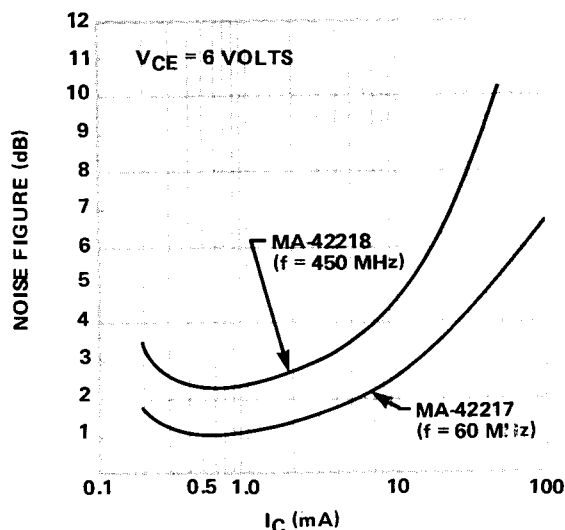
SYMBOL	PARAMETER	TEST CONDITIONS	VALUE
BV_{CBO}	Collector-base breakdown voltage	$I_C = 10 \mu A$	30 V min.
BV_{EBO}	Emitter-base breakdown voltage	$I_E = 10 \mu A$	2.5 V min.
I_{CBO}	Collector cutoff current	$V_{CB} = 15 V$	0.01 μA max.
h_{FE}	Current transfer ratio	$V_{CE} = 1 V$ $I_C = 3 mA$	30 min. 400 max.

MODEL NUMBER	TEST FREQUENCY (MHz)	TYPICAL NOISE FIGURE (dB)	COLLECTOR CURRENT, I_C^1 (mA)
MA-42217	60	1.0	1
MA-42217	60	1.7	3
MA-42217	100	1.0	1
MA-42217	100	1.7	3
MA-42218	450	2.3	1
MA-42218	450	2.9	3

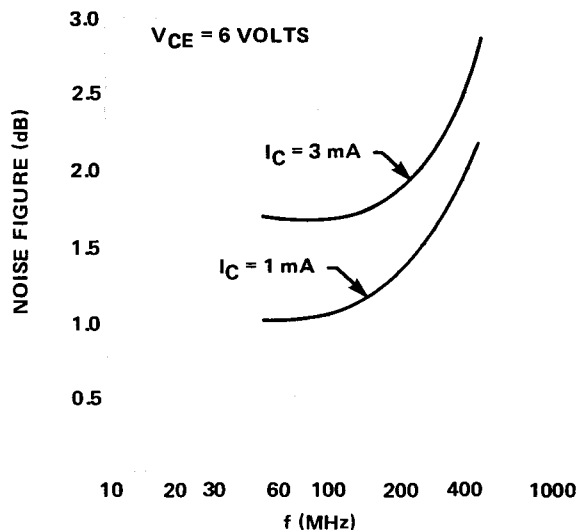
NOTE:

1. $V_{CE} = 10V$

TYPICAL PERFORMANCE



OPTIMUM NOISE FIGURE VS COLLECTOR CURRENT



OPTIMUM NOISE FIGURE VS FREQUENCY

MA-42197 TRANSISTOR

The MA-42197 NPN silicon planar bipolar transistor is designed to provide low noise figure and high gain at low cost. The high gain is due, in part, to the low lead inductance of the standard Jedec TO-92 package (case style 524). This device exhibits excellent noise figure versus current characteristics which result in extremely low noise performance and wide dynamic range.

The chip used for this device is of planar interdigitated geometry, thermocompression bonded and encapsulated in this rugged package.

Applications for the MA-42197 include CATV, UHF and VHF low noise amplifiers.

MODEL NUMBER	TEST FREQUENCY (MHz)	TYPICAL NOISE FIGURE (dB)	COLLECTOR CURRENT, I_C^1 (mA)	MAX. UNI-LATERAL PWR. GAIN, G_U^2 (dB)
MA-42197	60	0.8	5.0	28
MA-42197	100	0.95	5.0	26
MA-42197	450	1.7	5.0	13

NOTES:

1. $V_{CE} = 10$ Volts

2. G_U MAX. (dB) = $10 \text{ LOG} \frac{|S_{21}E|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$

SYMBOL	PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.
BV_{CBO}	Collector-base breakdown voltage	$I_C = 10 \mu A$	20 V	25 V	
BV_{EBO}	Emitter-base breakdown voltage	$I_E = 10 \mu A$	2.5 V	3.0 V	
I_{CBO}	Collector cutoff current	$V_{CB} = 10$ V			10 nA
h_{FE}	Current transfer ratio	$V_{CE} = 10$ V, $I_C = 5$ mA	20 V		400 V
C_{CB}	Output capacitance	$V_{CB} = 15$ V			

TYPICAL PERFORMANCE

