# General Purpose Low Noise Bipolar Transistors

V 2.00

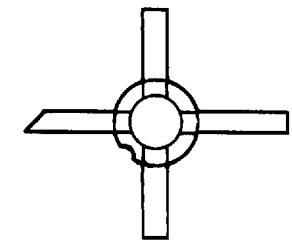
## Features

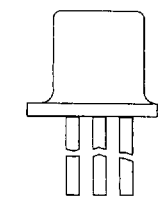
- Low Noise Through 1.5 GHz
- Hermetic Package
- Can Be Screened to JAN, JANTX, JANTXV Levels

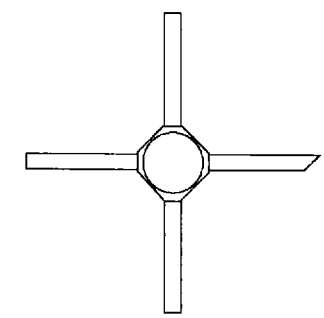
## Description

The series of Silicon NPN bipolar transistors are designed for low noise amplifiers in the frequency range of 60 MHz through 2 GHz. These devices are offered in several different families with different $f_T$, gain and dynamic range characteristics. They are offered in hermetic, RF packages and as chips. Also offered are a family of low power, high $f_T$ oscillator transistors useful in applications up to 3 GHz.

## Case Styles



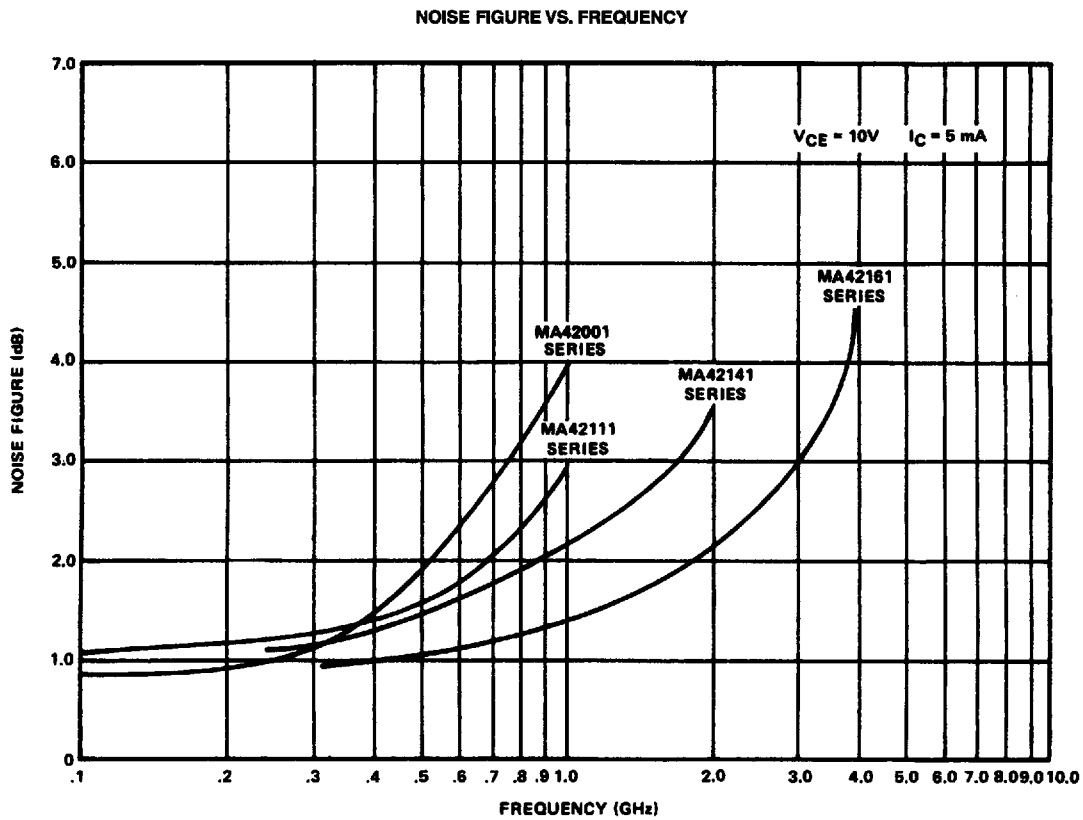




## Selection Guide

| Model No. Series | Geometry | Nominal $f_T$ (GHz) | Nominal Optimum Noise Figure at Current (mA) | Nominal Current Range | $I_C$ (Max.) (mA) | Useful Frequency Range (MHz) |
|---|---|---|---|---|---|---|
| MA42161 | 72 | 7.0 | 3 | 0.5 - 7.0 | 20 | 500 - 2500 |
| MA42111 | 60 | 5.5 | 5 | 3.0 - 20.0 | 125 | 100 - 1500 |
| MA42141 | 63 | 4.5 | 3 | 1.0 - 10.0 | 50 | 300 - 2000 |
| MA42151 | 63 | 4.5 | 3 | 1.0 - 10.0 | 50 | 300 - 2000 |
| MA42001 | 60 | 2.5 | 5 | 5.0 - 40.0 | 125 | 10 - 750 |
| MA42021 | 20 | 1.8 | 1 | 1.0 - 3.0 | 40 | 10 - 600 |
| MA42051 | 55 | 1.8 | 2 | 1.0 - 5.0 | 50 | 10 - 600 |
| MA42121 | 70 | 1.5 | 1 | 0.9 - 3.0 | 80 | 10 - 600 |
| MA42181 | 02 | 2.8 | 20 | 10.0 - 60.0 | 300 | 10 - 1600 |

## Typical Performance Curves



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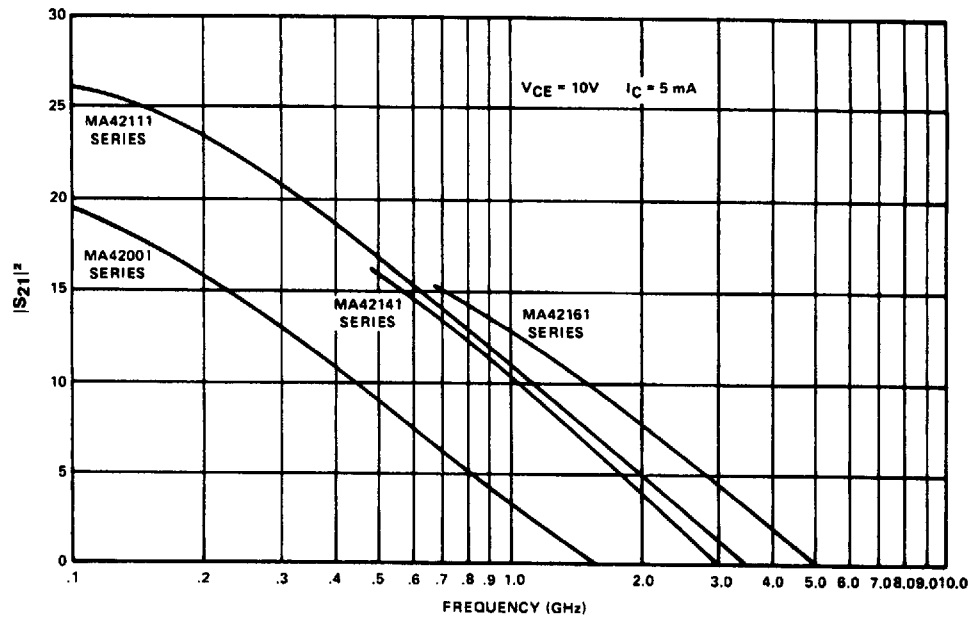
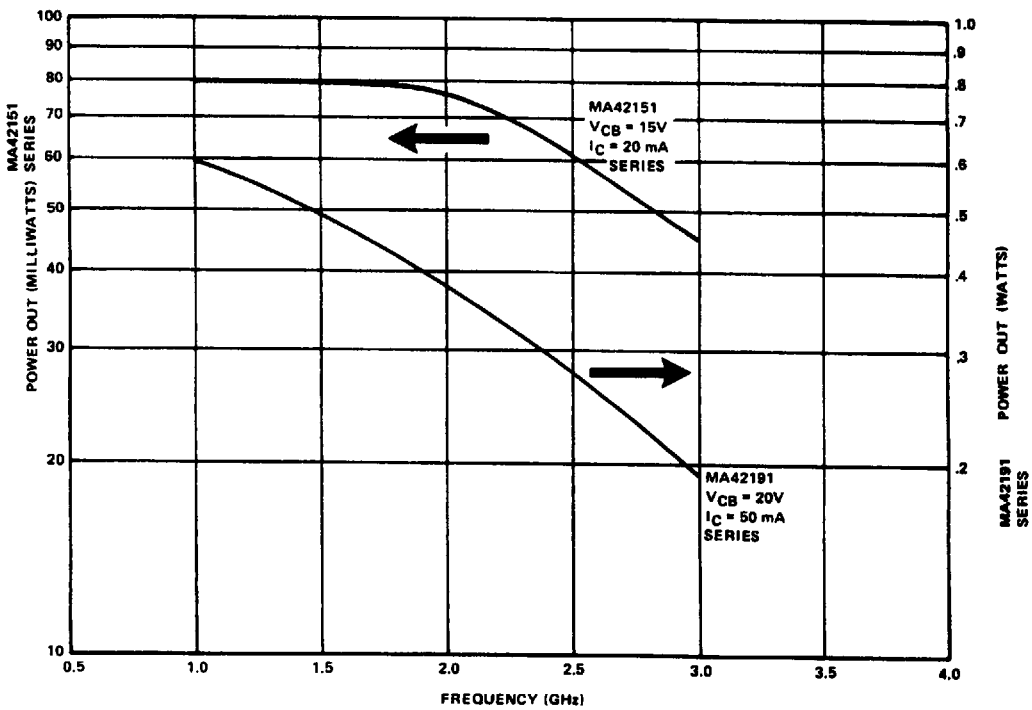
## Typical Performance Curves (Cont'd)

$|S_{21}|^2$ VS. FREQUENCY




COMMON-BASE POWER OUT VS. FREQUENCY



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## MA42161 Series

### Description

- Nominal $f_T$ = 7 GHz
- Nominal Current Range = 0.5 to 7 mA
- $I_C$ Max. = 20 mA
- Frequency Range = 500 MHz to 2 GHz

The MA42161 is a low noise silicon planar epitaxial transistor for 0.5 to 2.0 GHz amplifiers. These transistors have typically 14.0 dB gain at 2.0 GHz and nominal noise figure of 2.3 dB at 2.0 GHz. These transistors when housed in case style 511, are useful in low level oscillators from 1-5 GHz.

## Maximum Ratings @ 25° C

### MA42161 Series

| Parameter | Symbol | Unit | MA42161 |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | Volts | 20 |
| Collector-Emitter Voltage | $V_{CEO}$ | Volts | 12 |
| Emitter-Base Voltage | $V_{EBO}$ | Volts | 1.5 |
| Collector Current | $I_C$ | mA | 20 |
| Junction Operating Temperature | $T_j$ | °C | -65 to +150 |
| Storage Temperature | $T_S$ | °C | -65 to +200 |
| Power Dissipation (Case Style 511) | $P_D$ | mW | 250 |

## Specifications @ $T_A$ =25°C

| Model[1,4] Number | Test Frequency (GHz) | Maximum[2] Noise Figure (dB) | Maximum[2] Unilateral Gain (dB) | Nominal[2] $\|S_{21E}\|^2$ (dB) | Nominal[2] Gain @ Optimum Noise Figure (dB) |
|---|---|---|---|---|---|
| MA42161 | 2.0 | 2.5 | 12 | 8.0 | 11.0 |
| MA42161 | 1.0 | 1.5 | 18 | 12.5 | 15.0 |

**Notes:**
1. 1 dB compression point is -5 dBM.
2. Test conditions $I_C$ = 3 mA, $V_{CE}$ = 10 volts.
3. The nominal collector to emitter sustaining voltage is 12 volts; $I_C$ = 1.0 mA.
4. Available in case styles 511 and Micro-X. To order, add package as suffix to the model number i.e., MA42161-511.

## Electrical Specifications @ 25° C

### MA42161 Series

| Parameter | Condition | Symbol | Min. | Typical | Max. | Unit |
|---|---|---|---|---|---|---|
| Collector Cut-off Current | $V_{CB}$ = 10 V<br>$I_E$ = 0 µA | $I_{CBO}$ | — | — | 200 | nA |
| Emitter Cut-off Current | $V_{EB}$ = 1 V<br>$I_C$ = 0 µA | $I_{EBO}$ | — | — | 1.0 | µA |
| Forward Current Gain | $V_{CE}$ = 10 V<br>$I_C$ = 5 mA | $H_{FE}$ | 50 | 80 | 250 | — |
| Collector-Base Junction Capacitance | $V_{CB}$ = 5 V<br>f = 1 MHz | $C_{OB}$ | — | 1.0 | 1.2 | pF |



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## MA42141 Series

### Description

- Nominal $f_T$ = 4.5 GHz
- Nominal Current Range = 1 to 10 mA
- $I_C$ Max. = 50 mA
- Frequency Range = 300 MHz to 2.0 GHz
- Geometry = 63

The MA42141 NPN silicon planar transistor features excellent high frequency current gain at medium current levels.

The MA42141 series has low noise figures from the frequency range of 0.5 to 2 GHz. These transistors are useful in RF amplifiers and low level oscillators from 100 MHz to 2 GHz.

## Maximum Ratings @ 25° C

### MA42141 Series

| Parameter | Symbol | Unit | MA42141 |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | Volts | 27 |
| Collector-Emitter Voltage | $V_{CEO}$ | Volts | 20 |
| Emitter-Base Voltage | $V_{EBO}$ | Volts | 3 |
| Collector Current | $I_C$ | mA | 50 |
| Junction Operating Temperature | $T_j$ | °C | -65 to +150 |
| Storage Temperature | $T_S$ | °C | -65 to +200 |
| Power Dissipation | $P_D$ | mW | |
| Case Style 509 | | | 400 |
| Case Style 510 | | | 700 |
| Case Style 511 | | | 700 |

## Specifications @ $T_A$ = 25°C

| Model[1] Number | Test Frequency (GHz) | Maximum[2] Noise Figure (dB) | Maximum Unilateral Gain (dB) | Nominal $BV_{ebo}$ (Volts) |
|---|---|---|---|---|
| MA42141 | 1.00 | 2.5 | 17 | 1.5 |

**Notes:**
1. MA42141 is available in case styles 509, 510 and 511. To order, add the case style as a suffix to the basic model number, i.e.: MA42141-510.
2. The collector current = 5 mA.

## Electrical Specifications @ 25° C

| Parameter | Condition | Symbol | Min. | Typical | Max. | Unit |
|---|---|---|---|---|---|---|
| Collector Cut-off Current | $V_{CB}$ = 10 V<br>$I_E$ = 0 µA | $I_{CBO}$ | — | — | 200 | nA |
| Emitter Cut-off Current | $V_{EB}$ = 1 V<br>$I_C$ = 0 µA | $I_{EBO}$ | — | — | 1.0 | µA |
| Forward Current Gain | $V_{CE}$ = 10 V<br>$I_C$ = 5 mA | $H_{FE}$ | 20 | 80 | 200 | — |
| Collector-Base Junction Capacitance | $V_{CB}$ = 5 V<br>f = 1 MHz | $C_{OB}$ | — | 0.8 | 1.0 | pF |



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## MA42111 Series

### Description

- Nominal $f_T$ = 5.5 GHz
- Nominal Current Range = 3 to 20 mA
- $I_C$ Max. = 125 mA
- Frequency Range = 100 MHz to 1.5 GHz

The MA42111 series of silicon NPN bipolar transistors is designed to give low noise figure and wide dynamic range. They can be used as low power oscillators to 4 GHz.

## Maximum Ratings @ 25° C

### MA42111 Series

| Parameter | Symbol | Unit | MA42111 |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | Volts | 20 |
| Collector-Emitter Voltage | $V_{CEO}$ | Volts | 15 |
| Emitter-Base Voltage | $V_{EBO}$ | Volts | 2.5 |
| Collector Current | $I_C$ | mA | 125 |
| Junction Operating Temperature | $T_j$ | °C | -65 to +150 |
| Storage Temperature | $T_S$ | °C | -65 to +200 |
| Power Dissipation | $P_D$ | mW | |
| Case Style 509 | | | 450 |
| Case Style 510 | | | 1200 |
| Case Style 511 | | | 750 |

## Specifications @ $T_A$ = 25°C

| Model Number | Case Style | Test Frequency (MHz) | Maximum[1] Noise Figure (dB @ mA) | Maximum[2] Unilateral Gain (dB) | Minimum[3] $\|S_{21E}\|^2$ | Nominal Gain @ Opt. NF (dB) |
|---|---|---|---|---|---|---|
| MA42111-509 | 509 | 450 | 1.5 | 14 | 13.0 | 13 |
| MA42111-510 | 510 | 450 | 1.5 | 17 | 15.5 | 15 |
| MA42111-511 | 511 | 450 | 1.5 | 19 | 16.0 | 15 |

**Notes:**

1. The maximum noise figure is measured as follows:
   $V_{CE}$ = 10 volts
   $I_C$ = 5 mA
   Frequency = 450 MHz.
2. For the maximum unilateral gain, 1 dB compression point is equal to 0 dBm.
3. Minimum $|S_{21}E|^2$ is: $V_{CE}$ = 10 volts, $I_C$ = 20 mA, and the frequency = 450 MHz.
4. The maximum collector cutoff current is 10 µA, where $V_{CB}$ = 10 volts.

## Electrical Specifications @ 25° C

### MA42111 Series

| Parameter | Condition | Symbol | Min. | Typical | Max. | Unit |
|---|---|---|---|---|---|---|
| Collector Cut-off Current | $V_{CB}$ = 10 V<br>$I_E$ = 0 µA | $I_{CBO}$ | — | 10 | 100 | nA |
| Emitter Cut-off Current | $V_{EB}$ = 1 V<br>$I_C$ = 0 µA | $I_{EBO}$ | — | — | 1.0 | µA |
| Forward Current Gain | $V_{CE}$ = 15 V<br>$I_C$ = 5 mA | $H_{FE}$ | 20 | 120 | 300 | — |
| Collector-Base Junction Capacitance | $V_{CB}$ = 5 V<br>f = 1 MHz | $C_{OB}$ | — | 1.0 | 1.2 | pF |



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## MA42001-509 and 2N6665-509

### Description

- Nominal $f_T$ = 2.5 GHz
- Nominal Current Range = 5 to 40 mA
- $I_C$ Max. = 125 mA
- Frequency Range = 10 MHz to 750 GHz

This series of NPN silicon bipolar transistors is designed to provide low noise figures at frequencies from 10 to 750 MHz. These transistors have flat noise figures from ~2 to 20 mA collector current. This series is recommended for applications such as IF and RF amplifiers from 10 to 750 MHz where wider dynamic range is required.

## Maximum Ratings @ 25° C
## MA42001 Series

| Parameter | Symbol | Unit | MA42001 |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | Volts | 20 |
| Collector-Emitter Voltage | $V_{CEO}$ | Volts | 15 |
| Emitter-Base Voltage | $V_{EBO}$ | Volts | 2.5 |
| Collector Current | $I_C$ | mA | 125 |
| Junction Operating Temperature | $T_j$ | °C | -65 to +150 |
| Storage Temperature | $T_S$ | °C | -65 to +200 |
| Power Dissipation | $P_D$ | mW | |
| Case Style 509 | | | 450 |
| Case Style 510 | | | 1200 |
| Case Style 511 | | | 750 |

## Specifications @ $T_A$ = 25°C

| Model Number | Case Style | Test Frequency (MHz) | Maximum[1] Noise Figure (dB @ mA) | Maximum[2] Unilateral Gain (dB) | Maximum[4] cbo (nA) | Minimum[2] $BV_{cbo}$ (Volts) | Minimum[3] $BV_{ebo}$ (Volts) |
|---|---|---|---|---|---|---|---|
| 2N6665-509 | 509 | 60 | 1.0 @ 5.0 | 28 | 10 | 20 | 2.5 |
| MA42001-509 | 509 | 60 | 1.0 @ 5.0 | 28 | 10 | 20 | 2.5 |

**Notes:**
1. $V_{CE}$ = 10 Volts.
2. Collector current = 10 µA.
3. Emitter current = 10 A.



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## MA42021 and 2N Series

### Description

- Nominal $f_T$ = 1.8 GHz
- Nominal Current Range = 1 to 5 mA
- $I_C$ Max = 50 mA
- Frequency = 10 MHz to 600 MHz

This series of NPN silicon planar transistors, packaged in the 509 case style are useful for low noise, high gain amplifiers from 10 to 600 MHz. All these transistors have gold metallization resulting in a rugged, highly reliable transistor.

## Specifications @ $T_A$ = 25°C

| Model[1] Number | Test Frequency (MHz) | Maximum[4] Noise Figure (dB @ mA) | Maximum Unilateral Gain (dB) | Minimum[5] $BV_{cbo}$ (Volts) | Minimum[6] $BV_{ebo}$ (Volts) |
|---|---|---|---|---|---|
| MA42021 | 60 | 1.6 @ 1.5 | 23 | 30 | 2.5 |
| 2N5031 | 450 | 2.5 @ 1.0 | 10 | 30 | 2.5 |
| 2N3570 | 450 | 2.5 @ 1.5 | 10 | 30 | 2.5 |
| 2N3953 | 450 | 3.0 @ 1.0 | 10 | 30 | 2.5 |
| 2N5032 | 450 | 3.0 @ 1.0 | 10 | 30 | 2.5 |
| 2N3880 | 450 | 3.5 @ 1.5 | 10 | 30 | 2.5 |
| 2N3839 | 450 | 3.9 @ 1.5 | 10 | 30 | 2.5 |
| 2N3571 | 450 | 4.0 @ 2.0 | 10 | 30 | 2.5 |
| 2N5054 | 450 | 4.0 @ 2.0 | 10 | 30 | 2.5 |
| 2N3683 | 450 | 4.5 @ 1.5 | 10 | 30 | 2.5 |
| 2N2857* | 450 | 4.5 @ 1.5 | 10 | 30 | 2.5 |
| 2N5179 | 450 | 4.5 @ 2.0 | 10 | 30 | 2.5 |
| 2N5053 | 450 | 5.0 @ 2.0 | 10 | 30 | 2.5 |
| 2N3572 | 450 | 6.0 @ 2.0 | 10 | 30 | 2.5 |

* This transistor can be screened to JAN level screening.

**Notes:**

1. This series of NPN silicon planar transistors is packaged in case style 509.
2. Maximum collector cutoff current is 10 µA, where $V_{CB}$ = 15 volts.
3. The nominal current transfer ratio is 120 where $V_{CE}$ = 1 volt, and $I_C$ = 3 mA.
4. $V_{CE}$ = 6 volts.
5. $I_C$ = 1 µA.
6. $I_E$ = 10 µA.



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## MA42051 Series

### Description

- Nominal $f_T$ = 1.8 GHz
- Nominal Current Range = 1 to 5 mA
- $I_C$ Max. = 40 mA
- Frequency Range = 10 MHz to 600 GHz

The MA42051 series of NPN silicon planar transistors will give high gain and low noise figure characteristics in VHF amplifier applications. This transistor is recommended for low power oscillators from 100 MHz to 1 GHz.

## Maximum Ratings @ 25° C

### MA42051 Series

| Parameter | Symbol | Unit | MA42051 |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | Volts | 20 |
| Collector-Emitter Voltage | $V_{CEO}$ | Volts | 15 |
| Emitter-Base Voltage | $V_{EBO}$ | Volts | 2.5 |
| Collector Current | $I_C$ | mA | 40 |
| Junction Operating Temperature | $T_j$ | °C | -65 to +150 |
| Storage Temperature | $T_S$ | °C | -65 to +200 |
| Power Dissipation | $P_D$ | mW | |
| Case Style 509 | | | 300 |
| Case Style 510 | | | 450 |
| Case Style 511 | | | 350 |

## Specifications @ $T_A$ = 25°C

| Model[1] Number | Test Frequency (MHz) | Maximum[3] Noise Figure (dB @ mA) | Maximum[4] Unilateral Gain (dB) | Minimum[5] $BV_{cbo}$ (Volts) | Minimum $BV_{ebo}$ (Volts) |
|---|---|---|---|---|---|
| MA42051 | 450 | 2.2 @ 3.0 | 18 | 20 | 2.5 |

**Notes:**
1. MA42051 is available in the 509, 510, 511 case styles. When ordering, specify the desired case style as a suffix to the basic mode number, i.e., MA42051-510.
2. $I_C$ = 10 µA.
3. $I_E$ = 10 µA.
4. $V_{CE}$ = 1 Volt; $I_C$ = 3 mA; Nominal current transfer ratio = 75.
5. $V_{CB}$ = 10 Volts; Maximum collector current = 40 mA.



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## MA42121 Series

### Description

- Nominal $f_T$ = 1.5 GHz
- Nominal Current Range = 0.4 to 3 mA
- $I_C$ Max. = 80 mA
- Frequency = 100 to 600 MHz

This series of NPN epitaxial silicon planar transistors is designed for 100 MHz to 1 GHz amplifiers and low power oscillators up to 4 GHz. The MA42121 has the maximum frequency of oscillation of 4.2 GHz. Two case styles are offered, case style 508 for low power oscillator applications and case style 509 for small signal IF and RF amplifiers.

## Maximum Ratings @ 25° C

### MA42121 Series

| Parameter | Symbol | Unit | MA42121 |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | Volts | 30 |
| Collector-Emitter Voltage | $V_{CEO}$ | Volts | 30 |
| Emitter-Base Voltage | $V_{EBO}$ | Volts | 4.0 |
| Collector Current | $I_C$ | mA | 80 |
| Junction Operating Temperature | $T_J$ | °C | -65 to +150 |
| Storage Temperature | $T_S$ | °C | -65 to +200 |
| Power Dissipation | $P_D$ | W | |
| Case Style 508 | | | 1.0 |
| Case Style 509 | | | 0.5 |

## Specifications @ TA = 25°C

| Model[1] Number | Case[1] Style | Maximum[2] Unilateral Gain Gu(dB) | Minimum[4] Gain Bandwidth $f_T$ (GHz) | Maximum[4] Available Gain GA(dB) | Maximum[3,5] Frequency Oscillation (GHz) |
|---|---|---|---|---|---|
| MA42121 | 508 | 13 | 1.3 | 12.8 | 4.2 |

**Notes:**

1. Available in case styles 508 and 509. When ordering, specify the package, by adding the case style as a suffix to the basic model number, i.e MA42121-508.
2. The test frequency is 450 MHz.
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, Fmax is the frequency at which the extrapolated Ga (max) is 0 dB.
6. $I_C$ = 10 µA, $I_E$ = 0.



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## MA42151 and MA42191 Series

### Description

- Nominal $f_T$ = 4.5 GHz
- Nominal Current Range = 1 to 10 mA
- $I_C$ Max. = 100 mA
- Frequency = 300 MHz to 2.0 GHz

These NPN planar transistors are characterized for local oscillator use in to 1.0 to 3.0 GHz range. The MA42151 when mounted in a common base package (case style 510) exhibits a typical Fmax of 9.5 GHz at 20 mA collector current. The MA42191 in case style 510 exhibits a typical Fmax of 6.0 GHz at 50 mA collector current. This transistor is also available in the hermetically sealed case style 511 stripline package.

## Maximum Ratings @ 25° C
## MA42151 and MA42191 Series

| Parameter | Symbol | Unit | MA42151 | MA42191 |
|---|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | Volts | 27 | 30 |
| Collector-Emitter Voltage | $V_{CEO}$ | Volts | 25 | 20 |
| Emitter-Base Voltage | $V_{EBO}$ | Volts | 1.5 | 3.5 |
| Collector Current | $I_C$ | mA | 50 | 300 |
| Junction Operating Temperature | $T_j$ | °C | -65 to +150 | -65 to +150 |
| Storage Temperature | $T_S$ | °C | -65 to +200 | -65 to +200 |
| Power Dissipation (Case Style 510) | $P_D$ | mW | 700 | 30 |

## Specifications @ $T_A$ = 25°C

| Model[1] Number | Minimum[2] $BV_{cbo}$ (Volts) | Minimum[3] $BV_{ebo}$ (Volts) | Minimum[4] $BV_{ceo}$ (Volts) | Minimum[5] Oscillator Power (mW) | Collector Current (mA) | Nominal Current Transfer Ratio (hFe) |
|---|---|---|---|---|---|---|
| MA42151 | 27 | 1.5 | 20 | 20 | 50 | 60 |
| MA42191 | 30 | 3.5 | 25 | 350 | 300 | 40 |

**Notes:**
1. The standard case style for the MA42151 and MA42191 is case style 510. The MA42151 is also available in the hermetically sealed 511 stripline package; to order, add the case style as a suffix to the basic model number, i.e. MA42151-511.
2. $I_C$ = 10 µA for MA42151; $I_C$ = 100 µA for MA42191.
3. $I_E$ = 10 µA.
4. $I_C$ = 500 µA.
5. $I_C$ = 100 µA.

## Maximum Ratings @ 25° C
### MA42151 and MA42191 Series

| Parameter | Symbol | Unit | MA42151 | MA42191 |
|---|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | Volts | 27 | 30 |
| Collector-Emitter Voltage | $V_{CEO}$ | Volts | 25 | 20 |
| Emitter-Base Voltage | $V_{EBO}$ | Volts | 1.5 | 3.5 |
| Collector Current | $I_C$ | mA | 50 | 300 |
| Junction Operating Temperature | $T_j$ | °C | -65 to +150 | -65 to +150 |
| Storage Temperature | $T_S$ | °C | -65 to +200 | -65 to +200 |
| Power Dissipation (Case Style 510) | $P_D$ | mW | 700 | 30 |

## MA42181-510

### Description

- Nominal fT = 2.8 GHz
- Nominal Current Range = 10 to 60 mA
- IC Max. = 300 mA
- Frequency Range = 10 MHz to 1 GHz

The MA42181 transistor is designed for wide dynamic range amplifier applications from 100 MHz to 1 GHz. Other applications include second stage high dynamic range amplifiers and low level oscillators.

## Maximum Ratings @ 25° C

### MA42181-510

| Parameter | Symbol | Unit | MA42181 |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | Volts | 30 |
| Collector-Emitter Voltage | $V_{CEO}$ | Volts | 25 |
| Emitter-Base Voltage | $V_{EBO}$ | Volts | 35 |
| Collector Current | $I_C$ | mA | 300 |
| Junction Operating Temperature | $T_j$ | °C | -65 to +150 |
| Storage Temperature | $T_S$ | °C | -65 to +200 |
| Power Dissipation<br>Case Style 510 | $P_D$ | W | <br>3.0 |

## Specifications @ $T_A$ = 25°C

| Model Number | Case Style | Minimum[1] $BV_{cbo}$ (Volts) | Minimum[2] $BV_{EBO}$ (Volts) | Minimum[3] $BV_{CEO}$ (Volts) | 1dB[5] Compression Point ($P_{1dB}$) | Maximum[8] Unilateral Gain(dB) (GHz) |
|---|---|---|---|---|---|---|
| MA42181-510 | 510 | 30 | 3.5 | 25 | +25 | 8.4 |

**Notes:**

1. $I_C$ = 100 µA
2. $I_E$ = 10 µA.
3. $I_C$ = 100 µA.
4. Nominal current transfer ratio is 60; $V_{CE}$ = 15 Volts; $I_C$ = 100 mA.
5. $V_{CE}$ = 15 Volts; $I_C$ = 60 mA; ZG = ZL = 500 Ohms; Frequency = 1 GHz.
6. The nominal $|S_{21E}|^2$ is 2.0 dB; $V_{CE}$ = 15 Volts; $I_C$ = 60 mA; Frequency = 2 GHz.
7. The nominal gain at optimum noise figure is 14.5 dB; $V_{CE}$ = 15 Volts; $I_C$ = 60 mA; Frequency = 1 GHz.
8. $V_{CE}$ = 15 Volts; $I_C$ = 60 mA; Frequency = 1 GHz.



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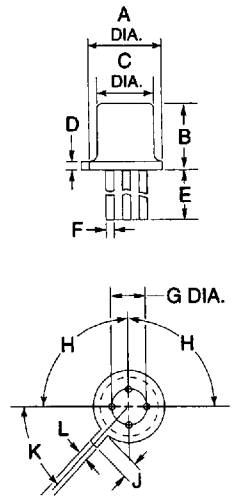
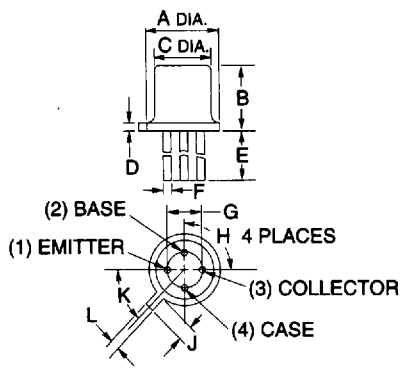
5642205 0001808 362

## Case Style 508




| DIM. | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX |
| A | 0.209 | 0.230 | 5,31 | 5,84 |
| B | 0.065 | 0.085 | 1,65 | 2,16 |
| C | 0.178 | 0.195 | 4,52 | 4,95 |
| D | — | 0.030 | — | 0,76 |
| E | 0.500 | — | 12,70 | — |
| F | 0.016 | 0.021 | 0,41 | 0,53 |
| G | 0.090 | 0.110 | 2,29 | 2,75 |
| H | 89° | 91° | 89° | 91° |
| J | 0.028 | 0.048 | 0,71 | 1,22 |
| K | 43° | 47° | 43° | 47° |
| L | 0.036 | 0.046 | 0,91 | 1,17 |

## Case Style 509




| DIM. | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX |
| A | 0.209 | 0.230 | 5.31 | 5,84 |
| B | 0.170 | 0.210 | 4,32 | 5.33 |
| C | 0.178 | 0.195 | 4,52 | 4,95 |
| D | — | 0.020 | — | 0,51 |
| E | 0.500 | — | 12,70 | — |
| F | 0.016 | 0.019 | 0,41 | 0,48 |
| G | 0.090 | 0.110 | 2,29 | 2,79 |
| H | 89° | 91° | 89° | 91° |
| J | 0.028 | 0.048 | 0,71 | 1,22 |
| K | 43° | 47° | 43° | 47° |
| L | 0.036 | 0.046 | 0,91 | 1,17 |



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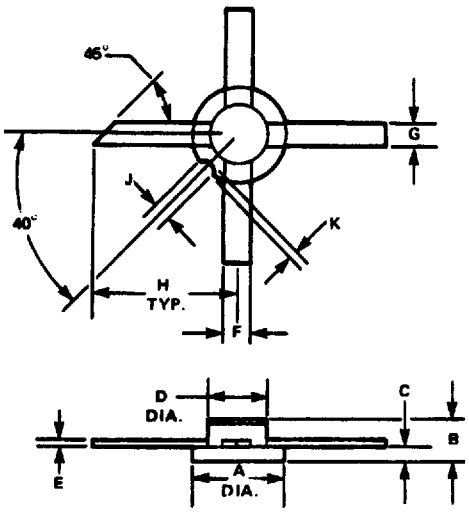
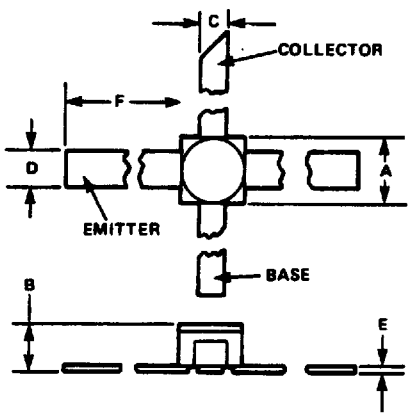
## Case Style 510




| DIM. | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX |
| A | 0.195 | 0.215 | 4 95 | 5 46 |
| B | 0.043 | 0.063 | 1,09 | 1,60 |
| C | 0.016 | 0.024 | 0,41 | 0,61 |
| D | 0.129 | 0.141 | 3,28 | 3,58 |
| E | 0.0015 | 0.0045 | 0,04 | 0,11 |
| F | 0.054 | 0.066 | 1,37 | 1,68 |
| G | 0.024 | 0.036 | 0,61 | 0,91 |
| H | 0.279 | 0.321 | 7,09 | 8,15 |
| J | 0.030 REF. | | 0,76 REF. | |
| K | 0.150 REF. | | 0,38 REF. | |

## Case Style 511




| DIM. | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX |
| A | 0.095 | 0.105 | 2,41 | 2,68 |
| B | — | 0.050 | — | 1,27 |
| C | 0.016 | 0.024 | 0,41 | 0,61 |
| D | 0.036 | 0.044 | 0,91 | 1,12 |
| E | 0.002 | 0.006 | 0,05 | 0,15 |
| F | 0 190 | 0.260 | 4,83 | 6,60 |



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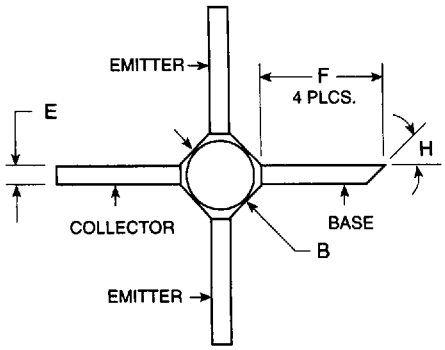
## Micro-X




| DIM. | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX |
| A | 0.092 | 0.108 | 2,34 | 2,74 |
| B | 0.079 | 0.087 | 2,01 | 2,21 |
| C | — | 0.070 | — | 1,78 |
| D | 0.019 | 0.025 | 0.48 | 0,64 |
| E | 0.018 | 0.022 | 0,46 | 0,56 |
| F | 0.150 | — | 3,81 | — |
| G | 0.003 | 0.006 | 0,08 | 0,15 |
| H | 45° | | 45° | |