

FEATURES

- **HIGH GAIN BANDWIDTH PRODUCT**
 $f_T = 1.0 \text{ GHz}$
- **LOW OUTPUT CAPACITANCE**
 $C_{CB} = 2.5 \text{ pF}$
- **HIGH SPEED SWITCHING**
 $t_{STG} = 90 \text{ ns}$
- **HIGH VOLTAGE**
 $V_{CEO} = -40 \text{ V}$

DESCRIPTION AND APPLICATIONS

The NE711 series of PNP silicon transistors is designed for HF and VHF amplifier and switching applications. The series has a very high voltage and current handling capability providing good dynamic range. The part is available either in the 11 package (TO-18) or as an aluminum metallized chip for hybrid circuits. The NE71111 is a good PNP complement to several NPN transistors, including the NE66912, for amplifier and switching applications.

PERFORMANCE SPECIFICATIONS ($T_A = 25^\circ\text{C}$)

| PART NUMBER EIAJ ¹ REGISTERED NUMBER PACKAGE OUTLINE | | | NE71111 2SA711 11 (TO-18) | | |
|---|--|----------|---------------------------------|---------|-----|
| SYMBOLS | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX |
| f_T | Gain Bandwidth Product at $V_{CE} = -10 \text{ V}$, $I_C = 10 \text{ mA}$ | GHz | 0.8 | 1 | |
| $ S_{21E} ^2$ | Insertion Power Gain at $V_{CE} = -10 \text{ V}$, $I_C = 20 \text{ mA}$ $f = 200 \text{ MHz}$ $f = 500 \text{ MHz}$ | dB dB | | 13 6 | |
| MAG | Maximum Available Gain at $V_{CE} = -10 \text{ V}$, $I_C = 10 \text{ mA}$ $f = 200 \text{ MHz}$ $f = 500 \text{ MHz}$ | dB dB | | 15 9 | |
| Rise Time | See Test Circuit | ns | | 45 | 70 |
| Storage Time | | ns | | 90 | 130 |
| Fall Time | | ns | | 130 | 170 |

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

| PART NUMBER EIAJ ¹ REGISTERED NUMBER PACKAGE OUTLINE | | | NE71111 2SA711 11 (TO-18) | | |
|---|--|--------------------|---------------------------------|------------|-----|
| SYMBOLS | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX |
| I_{CBO} | Collector Cutoff Current at $V_{CB} = -30 \text{ V}$, $I_E = 0$ | μA | | | 0.1 |
| I_{EBO} | Emitter Cutoff Current at $V_{EB} = -3 \text{ V}$, $I_C = 0$ | μA | | | 0.1 |
| $V_{CE(sat)}$ | Collector Saturation Voltage at $I_C = 10 \text{ mA}$, $I_B = 1 \text{ mA}$ | V | | 0.12 | 0.2 |
| $V_{BE(sat)}$ | Base Saturation Voltage at $I_C = 10 \text{ mA}$, $I_B = 1 \text{ mA}$ | V | | 0.79 | 0.9 |
| h_{FE} | DC Current Gain at $V_{CE} = -1 \text{ V}$, $I_C = 1 \text{ mA}$ $V_{CE} = -1 \text{ V}$, $I_C = 10 \text{ mA}$ | | 60 70 | 105 120 | 240 |
| C_{CB} | Collector to Base Capacitance ² at $V_{CB} = -10 \text{ V}$, $I_E = 0 \text{ mA}$, $f = 1.0 \text{ MHz}$ | pF | | 2.5 | 4 |
| R_{TH} | Thermal Resistance (Junction-to-Case) | $^\circ\text{C/W}$ | | | 150 |
| P_t | Total Device Dissipation | mW | | | 300 |

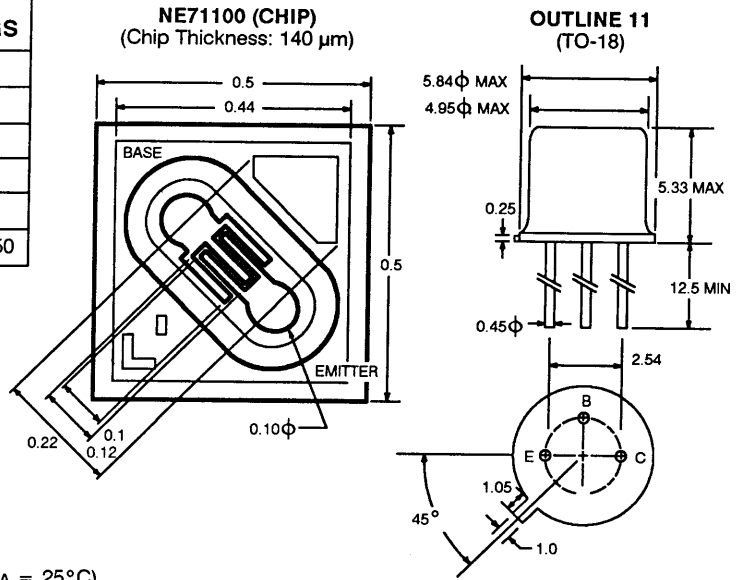
Notes:

1. Electronic Industrial Association of Japan.
2. C_{CB} measurement employs a three terminal bridge incorporating a guard circuit.

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$)

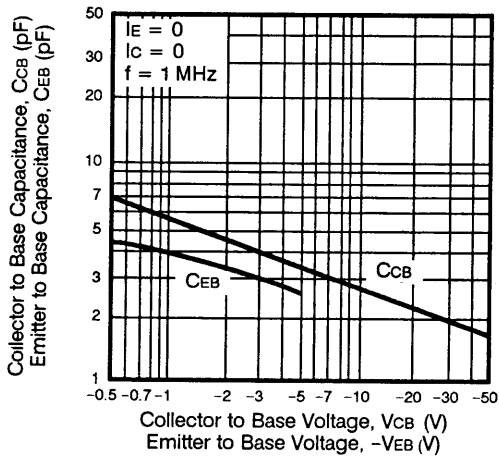
| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|------------------|------------------------------|-------|-------------|
| V _{CB0} | Collector to Base Voltage | V | -50 |
| V _{CE0} | Collector to Emitter Voltage | V | -40 |
| V _{EB0} | Emitter to Base Voltage | V | -5.0 |
| I _c | Collector Current | mA | 100 |
| T _J | Junction Temperature | °C | 150 |
| T _{STG} | Storage Temperature | °C | -65 to +150 |

OUTLINE DIMENSIONS (Units in mm)

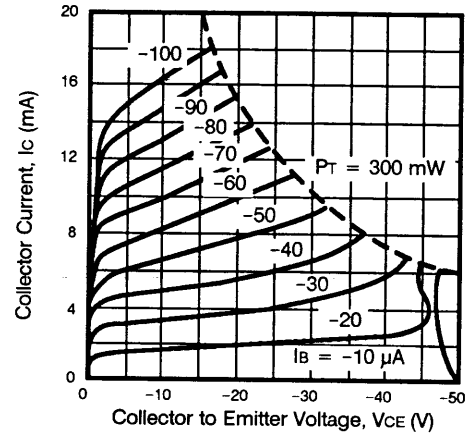


TYPICAL DEVICE CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

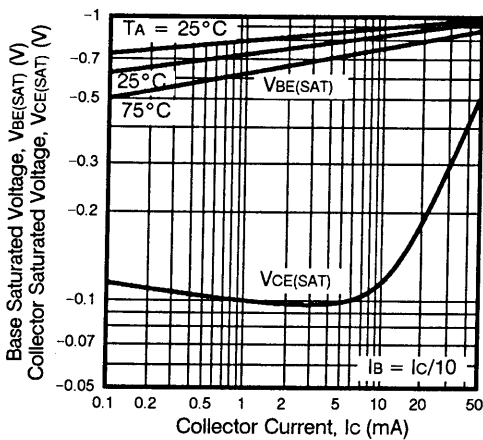
DEVICE CAPACITANCE



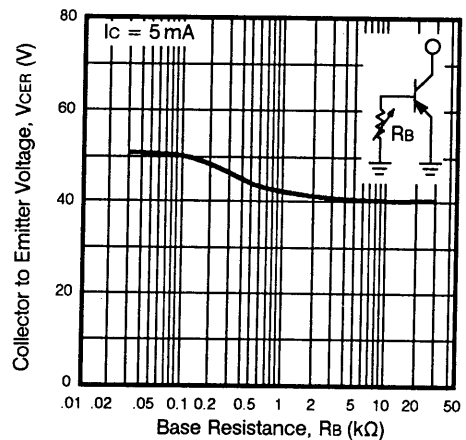
CHARACTERISTIC CURVES



SATURATED VOLTAGE vs. COLLECTOR CURRENT AND TEMPERATURE



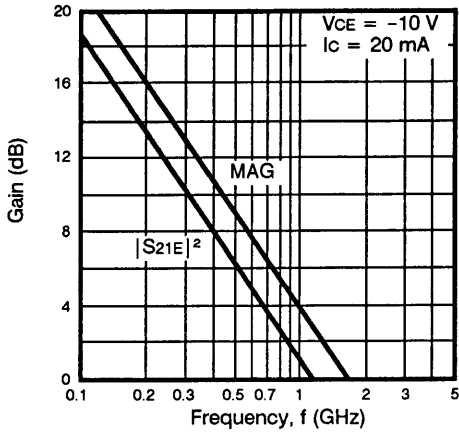
COLLECTOR TO EMITTER VOLTAGE vs. BASE RESISTANCE



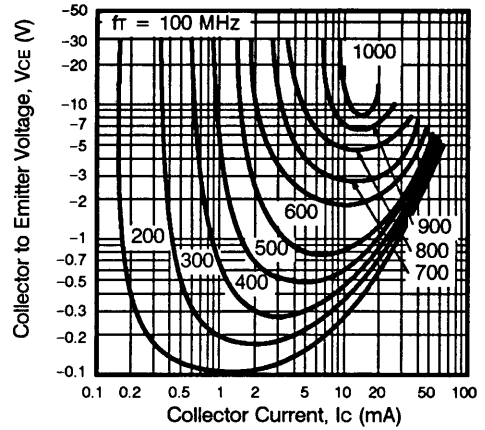
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TYPICAL PERFORMANCE CHARACTERISTICS (TA = 25°C)

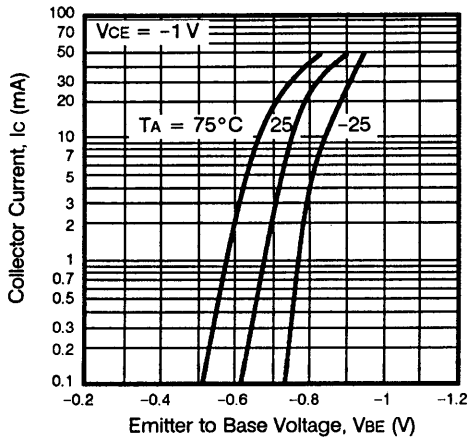
GAIN CHARACTERISTICS



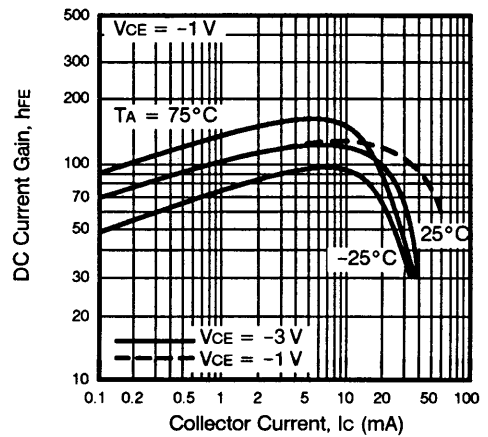
MAP OF THE GAIN BANDWIDTH PRODUCT



COLLECTOR CURRENT vs. BASE VOLTAGE AND TEMPERATURE

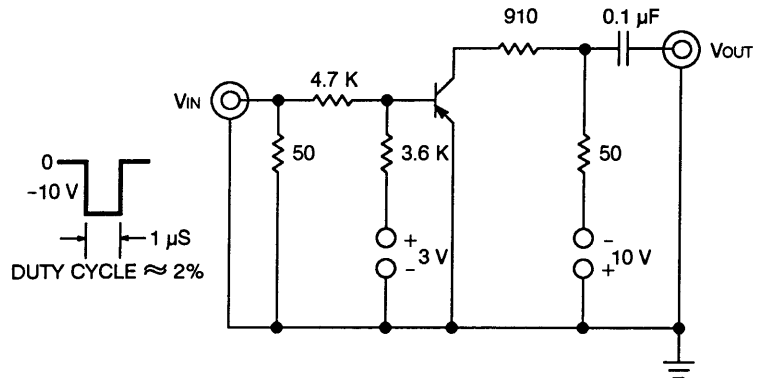
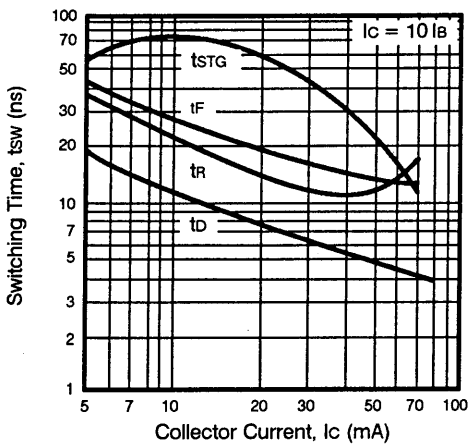


DC CURRENT GAIN vs. COLLECTOR CURRENT AND TEMPERATURE

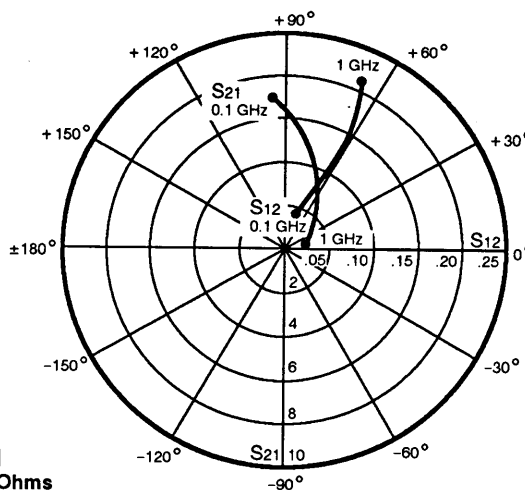
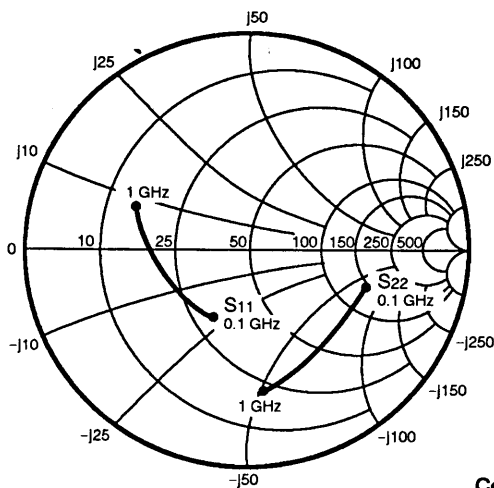


TYPICAL SWITCHING CHARACTERISTICS

SWITCHING TIME vs. COLLECTOR CURRENT



TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE71111
Coordinates in Ohms
Frequency in GHz
(VCE = -10 V, IC = 20 mA)

S-MAGN AND ANGLES:

VCE = -10 V, IC = 5 mA

FREQUENCY (MHz)

| | S11 | | S21 | | S12 | | S22 | |
|------|-----|------|------|-----|-----|----|-----|-----|
| 100 | .46 | -89 | 6.15 | 106 | .05 | 56 | .67 | -24 |
| 200 | .35 | -117 | 3.44 | 86 | .08 | 59 | .61 | -32 |
| 400 | .34 | -146 | 1.83 | 66 | .12 | 55 | .61 | -46 |
| 600 | .37 | 165 | 1.28 | 50 | .15 | 52 | .63 | -62 |
| 800 | .39 | 180 | .99 | 38 | .17 | 56 | .66 | -77 |
| 1000 | .42 | 167 | .80 | 28 | .20 | 60 | .69 | -90 |

VCE = -10 V, IC = 10 mA

| | | | | | | | | |
|------|-----|------|------|----|-----|----|-----|-----|
| 100 | .36 | -104 | 7.09 | 98 | .05 | 62 | .59 | -22 |
| 200 | .32 | -130 | 3.84 | 83 | .07 | 64 | .54 | -29 |
| 400 | .35 | -157 | 2.06 | 66 | .11 | 61 | .55 | -42 |
| 600 | .38 | -174 | 1.42 | 51 | .15 | 59 | .58 | -58 |
| 800 | .41 | 171 | 1.12 | 39 | .18 | 62 | .61 | -73 |
| 1000 | .44 | 160 | .92 | 29 | .22 | 64 | .64 | -86 |

VCE = -10 V, IC = 20 mA

| | | | | | | | | |
|------|-----|------|------|----|-----|----|-----|-----|
| 100 | .32 | -118 | 7.43 | 94 | .04 | 64 | .55 | -20 |
| 200 | .34 | -142 | 3.97 | 81 | .07 | 66 | .52 | -29 |
| 400 | .38 | -166 | 2.10 | 64 | .11 | 65 | .53 | -43 |
| 600 | .42 | 179 | 1.43 | 50 | .14 | 63 | .56 | -60 |
| 800 | .44 | 166 | 1.11 | 37 | .18 | 65 | .60 | -75 |
| 1000 | .46 | 155 | .90 | 27 | .21 | 66 | .64 | -88 |

VCE = -10 V, IC = 30 mA

| | | | | | | | | |
|------|-----|------|------|----|-----|----|-----|-----|
| 100 | .33 | -126 | 6.98 | 93 | .04 | 66 | .54 | -19 |
| 200 | .37 | -149 | 3.75 | 80 | .06 | 65 | .52 | -28 |
| 400 | .41 | -172 | 1.97 | 62 | .10 | 67 | .54 | -43 |
| 600 | .44 | 175 | 1.35 | 48 | .14 | 65 | .57 | -59 |
| 800 | .46 | 163 | 1.03 | 36 | .17 | 67 | .61 | -75 |
| 1000 | .49 | 152 | .84 | 26 | .21 | 69 | .64 | -88 |

2

FEATURES

- **LOW NOISE FIGURE:** < 3 dB at 500 MHz
- **HIGH GAIN:** 15 dB at 500 MHz
- **HIGH GAIN BANDWIDTH PRODUCT:** 2 GHz (3 GHz for the NE73435)
- **SMALL COLLECTOR CAPACITANCE:** 1 pF
- **DUAL CHIP CONFIGURATIONS**
- **HIGH RELIABILITY METALLIZATION**

DESCRIPTION AND APPLICATIONS

The NE734 series of NPN silicon general purpose UHF transistors provide the designer with a wide selection of reliable transistors for high speed logic and wide-band low noise amplifier applications. The series uses NEC's highly reliable platinum-silicide, titanium, platinum, and gold metallization system to assure uniform performance and reliability. Besides the chip form (NE73400), several package styles are available in both single and dual chip configurations. While the series is designed for industrial applications, the NE734 is also available in Grade C (JANTXV equivalent) and Grade CX (JANTX equivalent). The NE73432 is packaged in the popular TO-92 plastic package and is available in two lead configurations. The NE73433 is in the plastic Mini-Mold package designed for high-speed automated assembly operations for large volume hybrid IC's. The NE73436 and NE73437 are packaged in the plastic Disk-Mold stripline package. For hybrid MIC applications requiring more performance, the NE73435 is recommended. This device is packaged in the economical metal-ceramic, hermetic Micro-X package.

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|------------------|------------------------------|-------|--------------|
| V _{CB0} | Collector to Base Voltage | V | 30 |
| V _{CE0} | Collector to Emitter Voltage | V | 14 |
| V _{EB0} | Emitter to Base Voltage | V | 3 |
| I _C | Collector Current | mA | 50 |
| T _J | Junction Temperature | °C | 200 |
| T _{STG} | Storage Temperature | °C | -65 to +200* |

*Maximum Case Temperature for the
 NE73432: T_{STG} = -55° to 150°C
 NE73433: T_{STG} = -55° to 150°C
 NE73435 Grade D: T_{STG} = -65° to 150°C
 NE73435 Grade C: T_{STG} = -65° to 200°C
 NE73437: T_{STG} = -65° to 150°C

NE73435 TYPICAL NOISE PARAMETERS

V_{CE} = 10 V, I_C = 3 mA

| FREQUENCY (MHz) | NF min (dB) | G _a (dB) | OPT SOURCE | R _n /50 Ω |
|-----------------|-------------|---------------------|------------|----------------------|
| 500 | 2.0 | 16.1 | .30 ∠ 80° | .63 |
| 1000 | 3.1 | 11.2 | .43 ∠ 126° | .33 |
| 1500 | 4.2 | 9.2 | .54 ∠ 168° | .19 |
| 2000 | 5.1 | 7.1 | .56 ∠ 178° | .20 |

V_{CE} = 10 V, I_C = 15 mA

| | | | | |
|------|-----|------|-------------|-----|
| 500 | 3.3 | 17.5 | .34 ∠ 120° | .36 |
| 1000 | 4.7 | 13.5 | .47 ∠ 168° | .27 |
| 1500 | 6.5 | 10.8 | .67 ∠ -174° | .13 |
| 2000 | 7.4 | 9.2 | .64 ∠ -163° | .46 |

*Input tuned for minimum Noise Figure, output tuned for Maximum Gain.

PERFORMANCE SPECIFICATIONS (TA = 25°C)

| SYMBOLS | PART NUMBER EIAJ 1 REGISTERED NUMBER PACKAGE OUTLINE | NE73412 2SC1275(Grd CX) 2SC1424(Grd D) 12 | | | NE73416 2SC1733(Grd C) 16 | | | NE73432E 2SC2026 32E | | | NE73432B 2SC2037 32B | | | NE73433 2SC2759 33 | | | NE73435 2SC2148 35 | | | NE73437 2SC2368 37 | | | NE73440A, B 2SC1926 2SC1927 40 | | |
|--------------------|--|--|-------|-----|---------------------------------|-----|-----|----------------------------|-----|-----|----------------------------|-----|-----|--------------------------|-----|-----|--------------------------|-----|-----|--------------------------|-----|------|---|-----|--|
| | | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| fT | Gain Bandwidth Product at VCE = 10 V, IC = 10 mA | GHZ | 1.5 | 2 | | 1.5 | 2 | | 1.5 | 2 | | 1.5 | 2 | | 1.5 | 2 | | 1.5 | 3 | | 2.8 | | | | |
| S21E ² | Insertion Power Gain at VCE = 10 V, IC = 10 mA, f = 0.5 GHz | dB | 5 | 12 | 6 | | | | | | | 12 | 7 | | | | | 13 | 16 | | 13 | 14.5 | | | |
| NFMIN | Minimum Noise Figure ² at VCE = 10 V, IC = 3 mA, f = 0.5 GHz | dB | | 3 | 4 | | | | | | | 3 | 4 | | | | | | 2.1 | 3.5 | | 2.3 | 3.5 | | |
| MAG | Maximum Available Gain ³ at VCE = 10 V, IC = 10 mA, f = 1 GHz | dB | 13 | 15 | 8 | | | | 13 | 15 | 9 | | | | | | | | | | | 17 | 11 | | |

Notes:

1. Electronic Industrial Association of Japan.
2. Input and output are tuned for optimum noise figures.
3. Maximum Available Gain (MAG) is calculated for the device S-Parameters using the equation, $MAG = |S21E|^2 \cdot \frac{1}{1 - |S11E|^2} \cdot \frac{1}{1 - |S22E|^2}$

ELECTRICAL CHARACTERISTICS (TA = 25°C)

| SYMBOLS | PART NUMBER EIAJ 1 REGISTERED NUMBER PACKAGE OUTLINE | NE73412 2SC1275(Grd CX) 2SC1424(Grd D) 12 | | | NE73416 2SC1733(Grd C) 16 | | | NE73432E 2SC2026 32E | | | NE73432B 2SC2037 32B | | | NE73433 2SC2759 33 | | | NE73435 2SC2148 35 | | | NE73437 2SC2368 37 | | | NE73440A, B 2SC1926 2SC1927 40 | | |
|---------|--|--|-------|-----|---------------------------------|-----|-----|----------------------------|-----|-----|----------------------------|-----|-----|--------------------------|-----|-----|--------------------------|-----|-----|--------------------------|-----|-----|---|-----|-----|
| | | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| ICBO | Collector Cutoff Current at VCB = 15 V, IE = 0 | µA | | | .05 | | | | | | .01 | | | | | | | | | | | | | | |
| ICES | Collector Cutoff Current at VCE = 15 V, RBE = 0 | µA | | | .05 | | | | | | | | | | | | | | | | | | | | |
| IEBO | Emitter Cutoff Current at VEB = 2 V, IC = 0 | µA | | | | | | | | | 0.1 | | | | | | | | | | | | | | |
| hFE | Forward Current Gain Ratio at VCE = 10 V, IC = 10 mA | | 25 | 100 | 200 | | | | 25 | 100 | 200 | 25 | 100 | 200 | 25 | 100 | 200 | 25 | 100 | 200 | 25 | 100 | 200 | 25 | 100 |
| ΔfFE1 | Forward Current Gain Ratio at VCE = 10 V, IC = 10 mA | | | | | | | | | | | | | | | | | | | | | | | | |
| ΔVBE | Base to Emitter Voltage at VCE = 10 V, IC = 10 mA | mV | | | | 0.8 | | | | | | | | | | | | | | | | | | 0.8 | |
| CCB | Collector to Base Capacitance ² at VCB = 10 V, IC = 0 mA, f = 1 MHz | pF | | 1.1 | 1.5 | | | | | | | 0.9 | 1.3 | | | | | | .55 | 1.5 | | 0.7 | 1 | | 1.1 |
| RTH | Thermal Resistance (J-C) ³ | °C/W | | 190 | 300 | | 95 | 150 | | 130 | | | 130 | | | | | | | | | | | | |
| PC | Collector Dissipation | mW/Chip | | | | | 200 | | | | | | | | | | | | | | | | | | |
| PT | Total Power Dissipation | mW | | | 250 | | 300 | | | | | 250 | | | | | | | | | | | 250 | | |

Notes:

1. Electronic Industrial Association of Japan.
2. CCB measurement employs a three-terminal capacitance bridge incorporating a guard circuit. The emitter terminal shall be connected to the guard terminal.
3. RTH for dual chip devices (°C/W); Per Chip

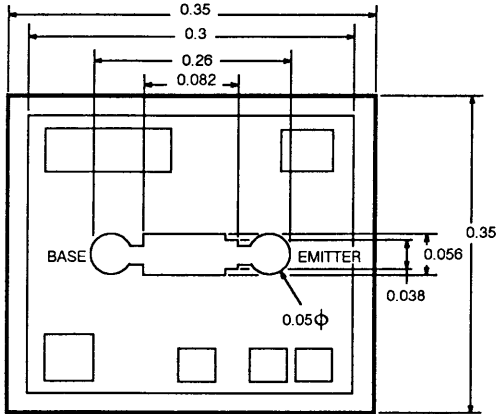
| NE73416: | | NE73437: | |
|-----------|-----|-----------|-----|
| RTH (J-A) | 583 | RTH (J-A) | 875 |
| RTH (J-C) | 300 | RTH (J-C) | 150 |
| NE73440: | | NE73440: | |
| RTH (J-A) | 500 | RTH (J-A) | 445 |
| RTH (J-C) | 110 | RTH (J-C) | 55 |



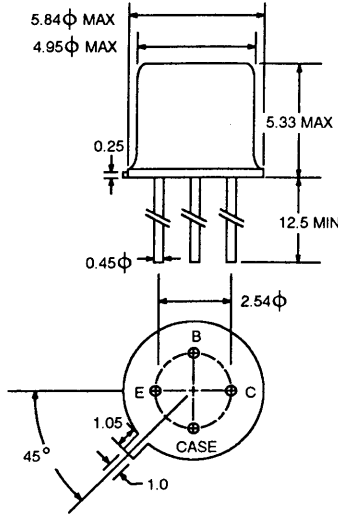
NE734 SERIES

OUTLINE DIMENSIONS (Units in mm)

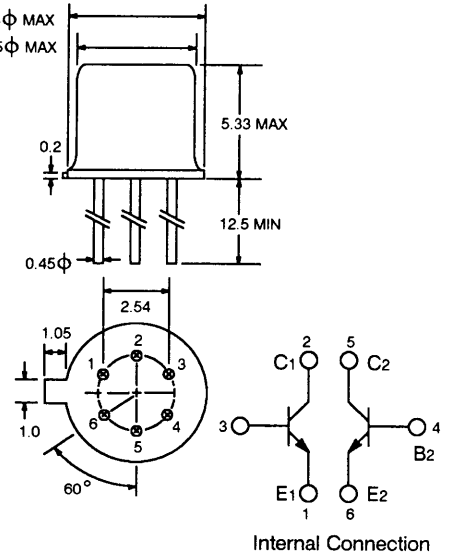
NE73400 (CHIP)
Chip Thickness: 160 μm TYP



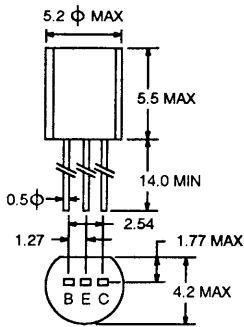
OUTLINE 12 (TO-72)



OUTLINE 16

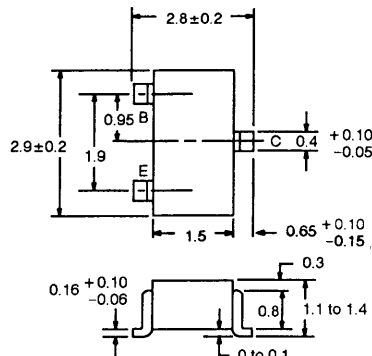


OUTLINE 32 (TO-92)

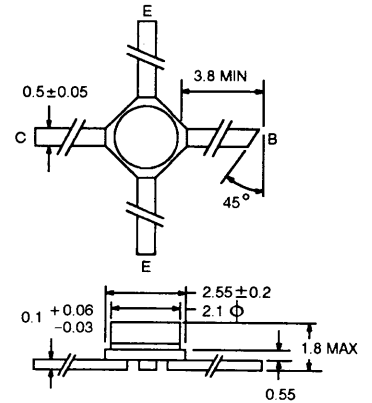


*32B has emitter base reversed.

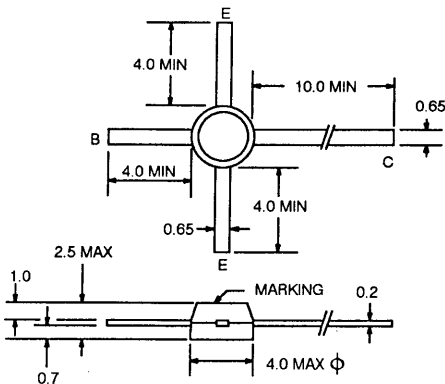
OUTLINE 33 (SOT-23)



OUTLINE 35 (MICRO-X)

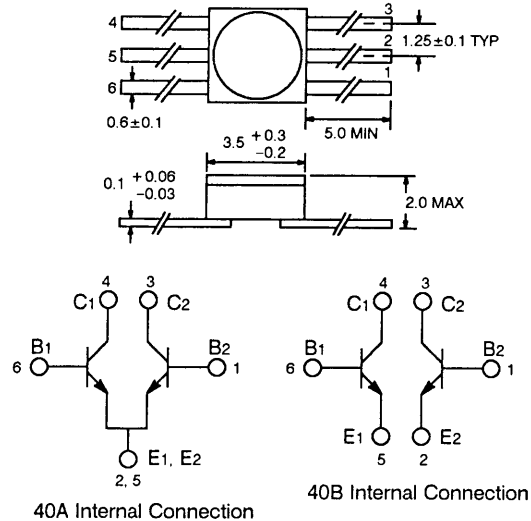


OUTLINE 37

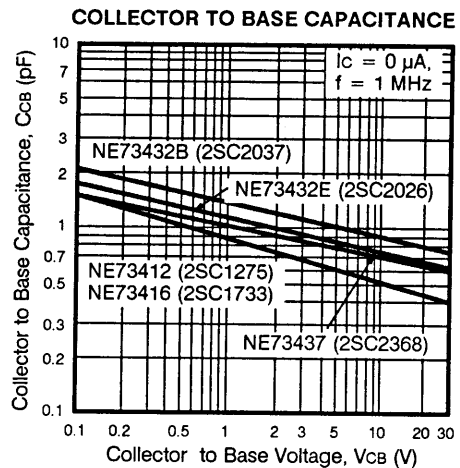
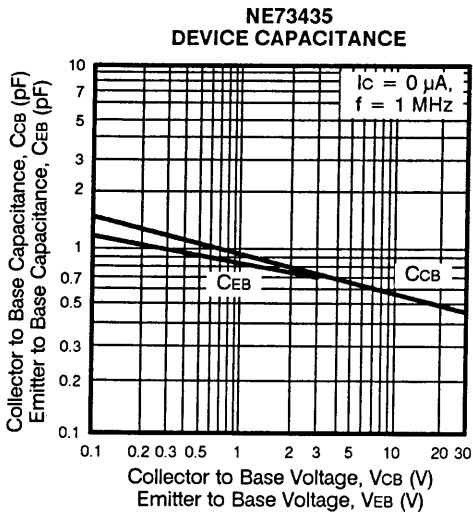
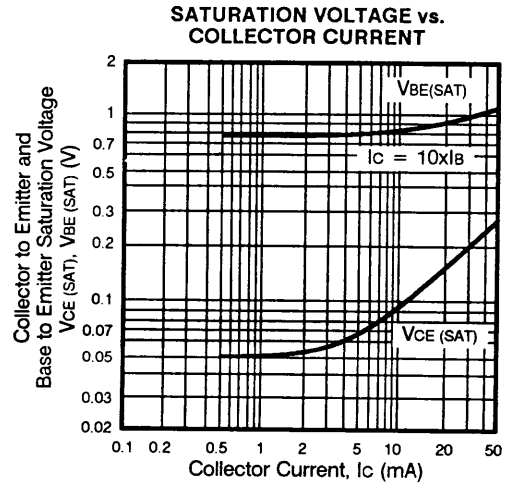
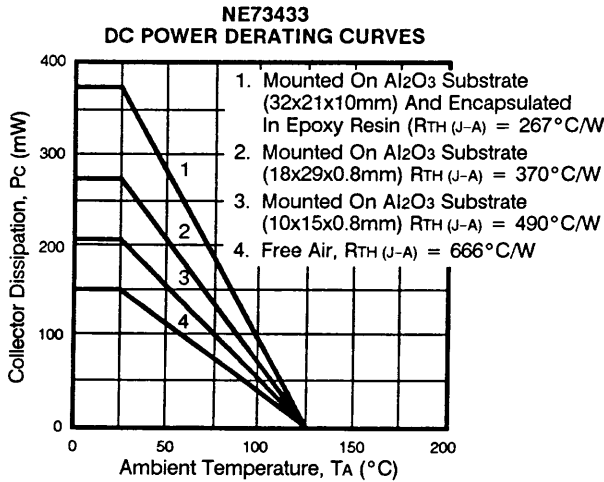
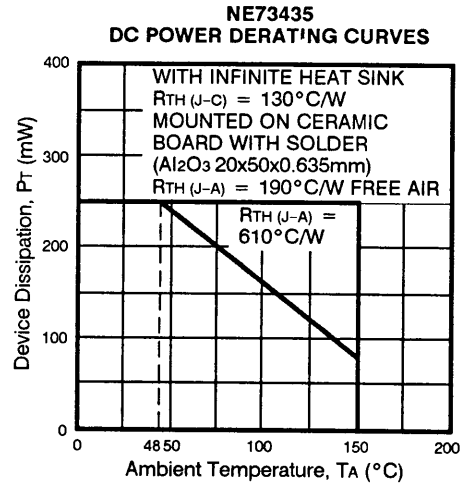
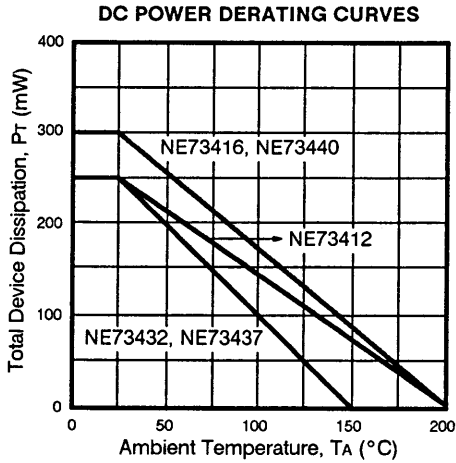


*36 package is available with only the bottom emitter lead.

OUTLINE 40



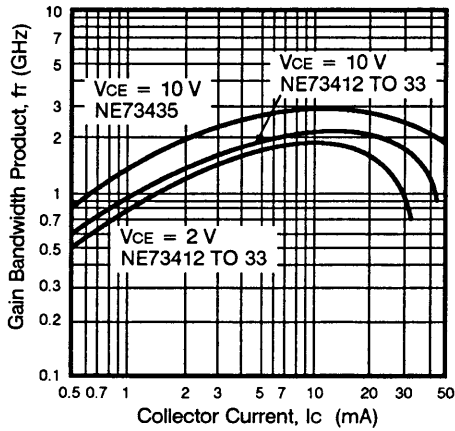
TYPICAL DEVICE CHARACTERISTICS (TA = 25°C)



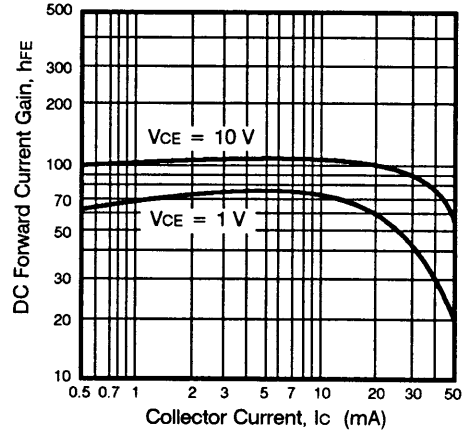
NE734 SERIES

TYPICAL PERFORMANCE CHARACTERISTICS (T_A = 25°C)

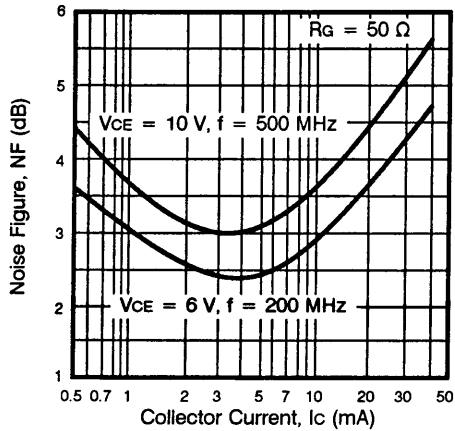
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



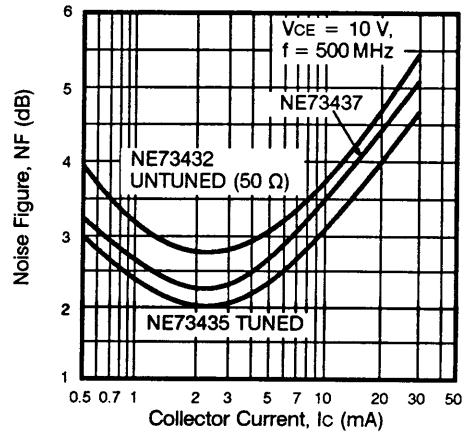
DC CURRENT GAIN vs. COLLECTOR CURRENT



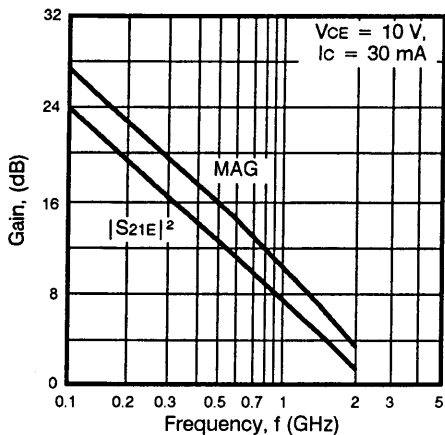
NE73412, NE73433 NOISE FIGURE vs. COLLECTOR CURRENT



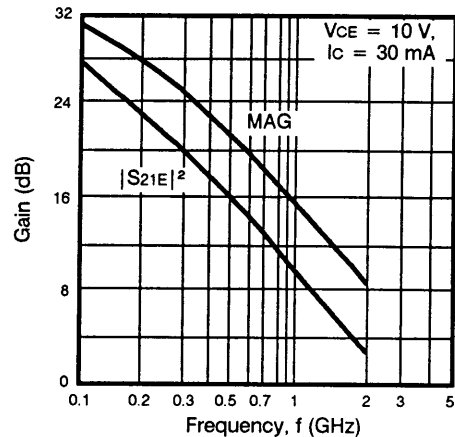
NE73432, NE73435, NE73437 NOISE FIGURE vs. COLLECTOR CURRENT



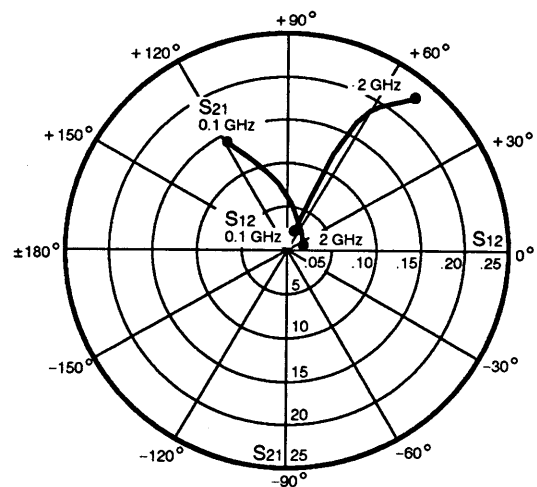
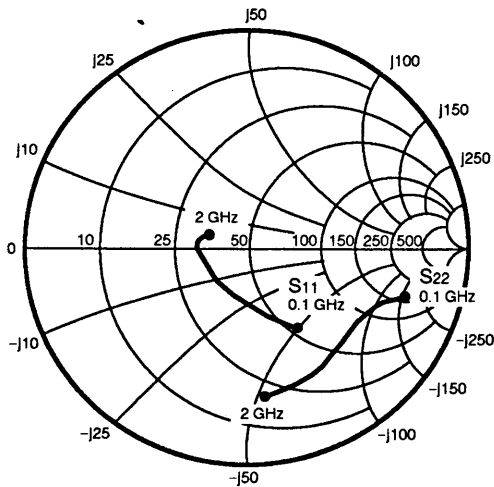
NE73412, NE73432E GAIN vs. FREQUENCY



NE73435 GAIN vs. FREQUENCY



TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE73412
Coordinates in Ohms
Frequency in GHz
(VCE = 10 V, IC = 20 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 5 mA

| FREQUENCY (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|-----------------|-----------------|------|-----------------|-----|-----------------|----|-----------------|-----|
| 100 | .71 | -41 | 10.28 | 138 | .02 | 66 | .87 | -15 |
| 200 | .53 | -66 | 7.51 | 116 | .04 | 60 | .77 | -22 |
| 500 | .30 | -105 | 3.74 | 85 | .08 | 61 | .66 | -30 |
| 1000 | .21 | -146 | 2.08 | 58 | .13 | 62 | .63 | -45 |
| 1500 | .19 | -171 | 1.52 | 36 | .18 | 57 | .67 | -64 |
| 2000 | .15 | 174 | 1.16 | 14 | .22 | 51 | .73 | -84 |

VCE = 10 V, IC = 10 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .56 | -50 | 13.44 | 128 | .02 | 67 | .81 | -17 |
| 200 | .39 | -73 | 8.71 | 108 | .04 | 67 | .70 | -21 |
| 500 | .23 | -112 | 4.03 | 80 | .08 | 66 | .63 | -29 |
| 1000 | .19 | -151 | 2.21 | 56 | .14 | 63 | .61 | -43 |
| 1500 | .18 | -175 | 1.59 | 34 | .19 | 58 | .65 | -63 |
| 2000 | .14 | 170 | 1.22 | 13 | .22 | 50 | .71 | -84 |

VCE = 10 V, IC = 20 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .42 | -60 | 14.98 | 119 | .02 | 71 | .75 | -17 |
| 200 | .29 | -82 | 9.07 | 102 | .03 | 69 | .67 | -19 |
| 500 | .19 | -121 | 4.03 | 77 | .08 | 70 | .63 | -26 |
| 1000 | .19 | -164 | 2.18 | 54 | .14 | 66 | .61 | -42 |
| 1500 | .19 | 170 | 1.57 | 33 | .19 | 60 | .66 | -62 |
| 2000 | .13 | 153 | 1.20 | 11 | .23 | 50 | .71 | -84 |

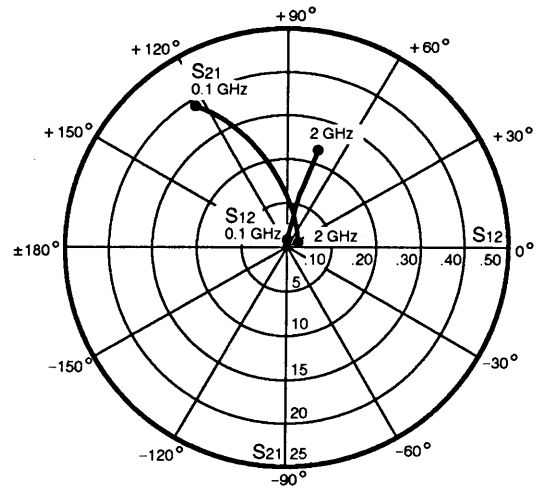
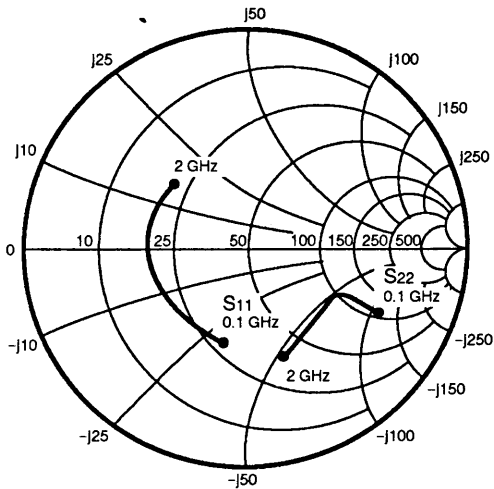
VCE = 10 V, IC = 30 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .36 | -68 | 14.51 | 115 | .02 | 71 | .74 | -15 |
| 200 | .26 | -95 | 8.52 | 98 | .03 | 69 | .67 | -17 |
| 500 | .20 | -137 | 3.71 | 76 | .08 | 69 | .64 | -25 |
| 1000 | .22 | -178 | 2.01 | 52 | .13 | 67 | .63 | -43 |
| 1500 | .22 | 156 | 1.45 | 31 | .19 | 63 | .67 | -63 |
| 2000 | .16 | 130 | 1.11 | 9 | .23 | 53 | .72 | -85 |

2

NE734 SERIES

TYPICAL COMMON EMITTER SCATTERING PARAMETERS (Cont'd.)



NE73432E
Coordinates in Ohms
Frequency in GHz
(VCE = 10 V, IC = 20 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 5 mA

| FREQUENCY (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|-----------------|-----------------|------|-----------------|-----|-----------------|----|-----------------|-----|
| 100 | .73 | -51 | 12.00 | 143 | .03 | 71 | .86 | -20 |
| 200 | .57 | -87 | 8.36 | 119 | .04 | 56 | .69 | -29 |
| 500 | .41 | -141 | 4.13 | 89 | .09 | 58 | .51 | -36 |
| 1000 | .37 | -178 | 2.20 | 61 | .13 | 59 | .50 | -48 |
| 1500 | .36 | 157 | 1.56 | 42 | .19 | 65 | .49 | -63 |
| 2000 | .36 | 133 | 1.21 | 26 | .25 | 61 | .51 | -77 |

VCE = 10 V, IC = 10 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .58 | -75 | 16.56 | 132 | .03 | 71 | .74 | -25 |
| 200 | .46 | -112 | 10.15 | 109 | .03 | 54 | .57 | -30 |
| 500 | .40 | -157 | 4.57 | 84 | .07 | 67 | .45 | -32 |
| 1000 | .38 | 179 | 2.37 | 60 | .13 | 66 | .47 | -43 |
| 1500 | .38 | 161 | 1.68 | 43 | .18 | 73 | .48 | -57 |
| 2000 | .36 | 140 | 1.28 | 28 | .25 | 67 | .52 | -72 |

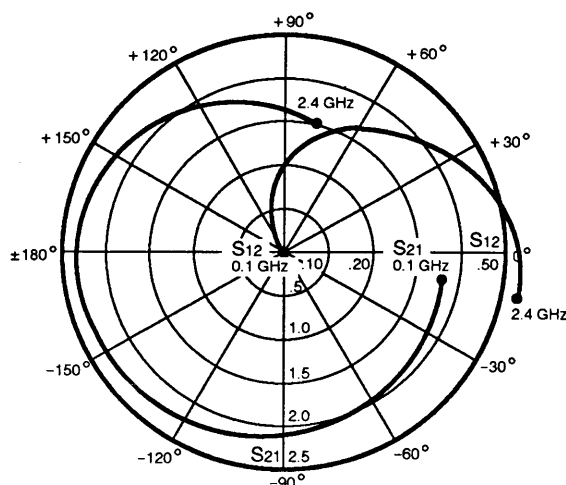
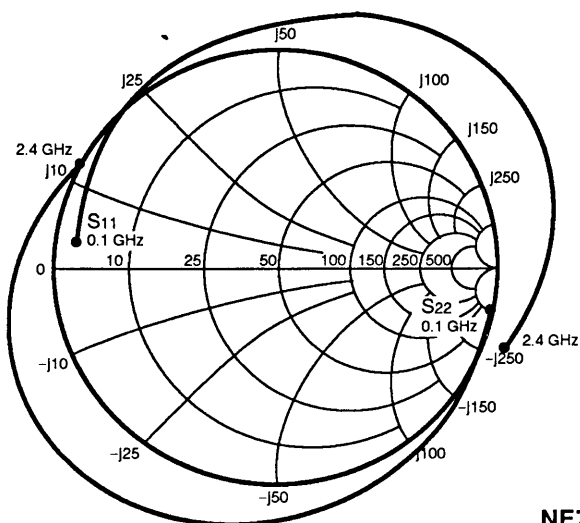
VCE = 10 V, IC = 20 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .44 | -101 | 19.27 | 122 | .03 | 65 | .66 | -26 |
| 200 | .39 | -136 | 10.79 | 102 | .03 | 64 | .52 | -26 |
| 500 | .40 | -169 | 4.62 | 81 | .07 | 72 | .44 | -27 |
| 1000 | .40 | 172 | 2.36 | 57 | .13 | 72 | .47 | -40 |
| 1500 | .41 | 153 | 1.65 | 41 | .19 | 75 | .49 | -57 |
| 2000 | .40 | 134 | 1.25 | 26 | .25 | 71 | .53 | -71 |

VCE = 10 V, IC = 30 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .42 | -120 | 19.34 | 117 | .03 | 69 | .62 | -24 |
| 200 | .40 | -150 | 10.48 | 99 | .03 | 68 | .51 | -23 |
| 500 | .42 | -174 | 4.41 | 78 | .06 | 77 | .46 | -25 |
| 1000 | .43 | 167 | 2.25 | 55 | .12 | 75 | .49 | -40 |
| 1500 | .44 | 150 | 1.54 | 39 | .18 | 79 | .52 | -56 |
| 2000 | .44 | 129 | 1.17 | 25 | .26 | 75 | .54 | -72 |

TYPICAL COMMON BASE SCATTERING PARAMETERS (Cont'd.)



NE73432B
Coordinates in Ohms
Frequency in GHz
(VCE = 10 V, IC = 20 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 5 mA

| FREQUENCY (MHz) | S11 | | S21 | | S12 | | S22 | |
|-----------------|------|-----|------|------|------|-----|------|------|
| 100 | .78 | 174 | 1.73 | -10 | .001 | 70 | 1.00 | -7 |
| 200 | .78 | 169 | 1.77 | -17 | .002 | 115 | 1.01 | -14 |
| 500 | .82 | 150 | 1.79 | -43 | .028 | 110 | 1.04 | -36 |
| 1000 | .88 | 114 | 1.90 | -91 | .105 | 97 | 1.14 | -73 |
| 1500 | 1.05 | 67 | 1.89 | -153 | .261 | 64 | 1.26 | -116 |
| 2000 | 1.14 | 16 | 1.72 | 136 | .425 | 18 | 1.22 | -166 |
| 2400 | .99 | -17 | 1.36 | 81 | .511 | -17 | 1.01 | 151 |

VCE = 10 V, IC = 10 mA

| | | | | | | | | |
|------|------|-----|------|------|------|-----|------|------|
| 100 | .87 | 174 | 1.82 | -9 | .001 | 73 | 1.00 | -7 |
| 200 | .87 | 169 | 1.86 | -17 | .002 | 130 | 1.01 | -14 |
| 500 | .92 | 150 | 1.90 | -42 | .026 | 121 | 1.04 | -36 |
| 1000 | .99 | 114 | 2.06 | -89 | .108 | 103 | 1.15 | -72 |
| 1500 | 1.20 | 69 | 2.14 | -150 | .278 | 67 | 1.30 | -115 |
| 2000 | 1.30 | 15 | 1.98 | 137 | .455 | 19 | 1.26 | -168 |
| 2400 | 1.09 | -19 | 1.52 | 82 | .535 | -18 | 1.02 | 149 |

VCE = 10 V, IC = 20 mA

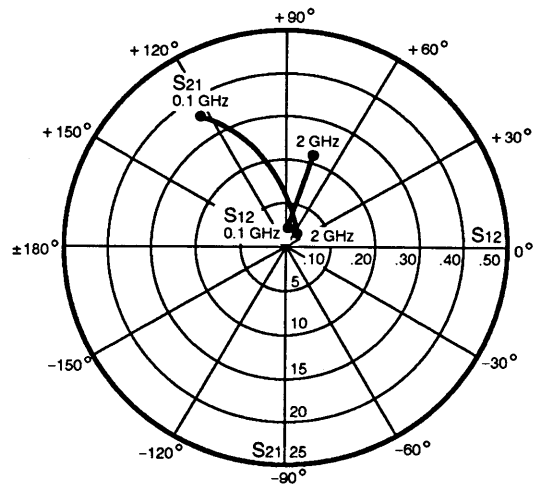
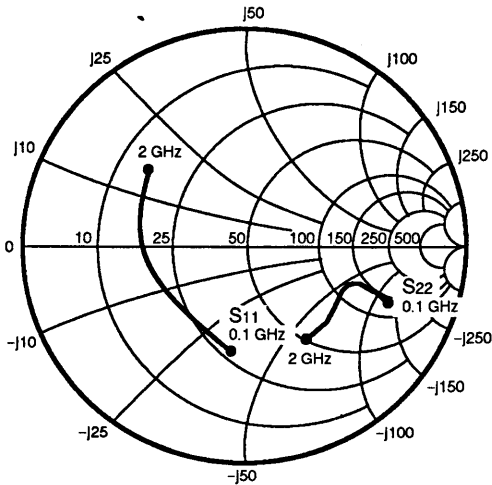
| | | | | | | | | |
|------|------|-----|------|------|------|-----|------|------|
| 100 | .91 | 174 | 1.85 | -9 | .001 | 77 | 1.00 | -7 |
| 200 | .91 | 169 | 1.91 | -17 | .001 | 143 | 1.01 | -14 |
| 500 | .97 | 151 | 1.94 | -41 | .026 | 126 | 1.04 | -36 |
| 1000 | 1.06 | 115 | 2.16 | -89 | .111 | 106 | 1.16 | -72 |
| 1500 | 1.30 | 69 | 2.27 | -152 | .292 | 69 | 1.32 | -116 |
| 2000 | 1.37 | 13 | 2.06 | 133 | .471 | 18 | 1.25 | -170 |
| 2400 | 1.12 | -21 | 1.54 | 78 | .541 | -19 | .99 | 147 |

VCE = 10 V, IC = 30 mA

| | | | | | | | | |
|------|------|-----|------|------|------|-----|------|------|
| 100 | .93 | 174 | 1.87 | -10 | .001 | 79 | 1.00 | -7 |
| 200 | .93 | 169 | 1.92 | -17 | .001 | 149 | 1.01 | -14 |
| 500 | .98 | 150 | 1.97 | -42 | .026 | 127 | 1.04 | -36 |
| 1000 | 1.08 | 114 | 2.19 | -92 | .114 | 107 | 1.17 | -73 |
| 1500 | 1.32 | 67 | 2.27 | -158 | .301 | 68 | 1.31 | -118 |
| 2000 | 1.34 | 11 | 1.96 | 126 | .467 | 16 | 1.19 | -172 |
| 2400 | 1.08 | -21 | 1.45 | 72 | .530 | -20 | .93 | 146 |

NE734 SERIES

TYPICAL COMMON EMITTER SCATTERING PARAMETERS (Cont'd.)



NE73433
Coordinates in Ohms
Frequency in GHz
(VCE = 10 V, IC = 20 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 5 mA

| FREQUENCY (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|-----------------|-----------------|------|-----------------|-----|-----------------|----|-----------------|-----|
| 100 | .72 | -53 | 11.71 | 143 | .02 | 68 | .89 | -17 |
| 200 | .57 | -88 | 8.26 | 120 | .03 | 57 | .72 | -22 |
| 500 | .43 | -144 | 4.04 | 90 | .07 | 59 | .57 | -25 |
| 1000 | .42 | -178 | 2.17 | 65 | .11 | 62 | .55 | -33 |
| 1500 | .44 | 159 | 1.55 | 50 | .17 | 67 | .52 | -45 |
| 2000 | .49 | 142 | 1.23 | 35 | .22 | 67 | .51 | -60 |

VCE = 10 V, IC = 10 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .57 | -71 | 15.95 | 132 | .02 | 66 | .80 | -20 |
| 200 | .44 | -109 | 9.93 | 110 | .02 | 57 | .62 | -21 |
| 500 | .39 | -157 | 4.42 | 86 | .07 | 68 | .53 | -23 |
| 1000 | .40 | 175 | 2.31 | 63 | .11 | 67 | .52 | -31 |
| 1500 | .44 | 156 | 1.65 | 48 | .17 | 70 | .49 | -43 |
| 2000 | .49 | 138 | 1.30 | 33 | .22 | 69 | .49 | -59 |

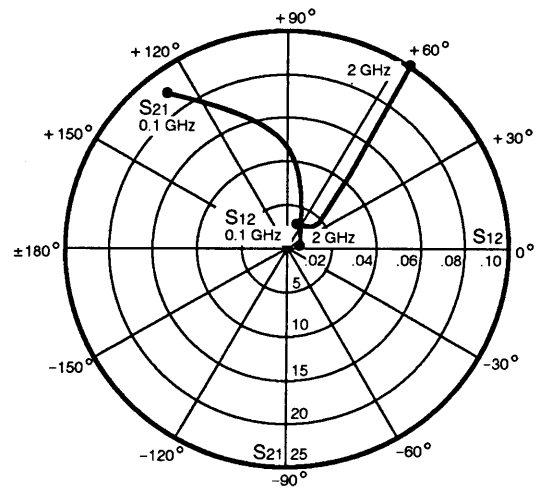
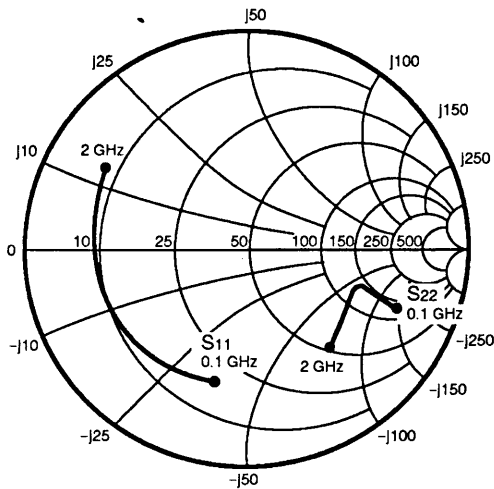
VCE = 10 V, IC = 20 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .47 | -93 | 18.06 | 122 | .02 | 69 | .72 | -20 |
| 200 | .38 | -130 | 10.35 | 103 | .02 | 56 | .58 | -19 |
| 500 | .38 | -167 | 4.39 | 82 | .06 | 75 | .51 | -18 |
| 1000 | .42 | 171 | 2.27 | 60 | .12 | 69 | .52 | -28 |
| 1500 | .46 | 153 | 1.61 | 46 | .17 | 72 | .51 | -41 |
| 2000 | .52 | 137 | 1.26 | 31 | .23 | 70 | .49 | -58 |

VCE = 10 V, IC = 30 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .43 | -111 | 16.72 | 116 | .02 | 82 | .70 | -19 |
| 200 | .39 | -144 | 9.20 | 99 | .02 | 54 | .60 | -16 |
| 500 | .41 | -173 | 3.85 | 79 | .06 | 73 | .56 | -17 |
| 1000 | .46 | 167 | 1.99 | 58 | .11 | 72 | .57 | -28 |
| 1500 | .51 | 149 | 1.41 | 43 | .17 | 77 | .55 | -42 |
| 2000 | .57 | 133 | 1.10 | 29 | .23 | 73 | .53 | -60 |

TYPICAL COMMON EMITTER SCATTERING PARAMETERS (Cont'd.)



NE73435
Coordinates in Ohms
Frequency in GHz
(V_{CE} = 10 V, I_c = 20 mA)

S-MAGN AND ANGLES:

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

| FREQUENCY (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|-----------------|-----------------|------|-----------------|-----|-----------------|----|-----------------|-----|
| 100 | .80 | -48 | 12.50 | 148 | .02 | 73 | .93 | -15 |
| 200 | .73 | -85 | 9.76 | 128 | .03 | 46 | .77 | -24 |
| 500 | .65 | -142 | 5.17 | 94 | .06 | 37 | .59 | -31 |
| 1000 | .64 | -175 | 2.78 | 68 | .07 | 35 | .53 | -38 |
| 1500 | .63 | 169 | 1.83 | 49 | .09 | 36 | .54 | -50 |
| 2000 | .66 | 156 | 1.39 | 36 | .10 | 40 | .56 | -61 |

V_{CE} = 10 V, I_C = 10 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .67 | -72 | 18.41 | 138 | .01 | 65 | .85 | -20 |
| 200 | .64 | -114 | 12.50 | 116 | .01 | 45 | .65 | -26 |
| 500 | .64 | -159 | 5.78 | 87 | .04 | 43 | .51 | -28 |
| 1000 | .65 | 175 | 3.00 | 64 | .06 | 45 | .49 | -35 |
| 1500 | .65 | 165 | 1.97 | 47 | .08 | 44 | .50 | -47 |
| 2000 | .68 | 153 | 1.47 | 33 | .10 | 48 | .54 | -59 |

V_{CE} = 10 V, I_C = 20 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .58 | -101 | 22.55 | 127 | .01 | 63 | .75 | -22 |
| 200 | .62 | -139 | 13.67 | 107 | .01 | 31 | .57 | -23 |
| 500 | .65 | -171 | 5.88 | 83 | .03 | 51 | .49 | -23 |
| 1000 | .68 | 170 | 2.98 | 60 | .05 | 54 | .49 | -30 |
| 1500 | .68 | 160 | 1.93 | 43 | .07 | 52 | .52 | -44 |
| 2000 | .72 | 148 | 1.42 | 30 | .10 | 57 | .56 | -56 |

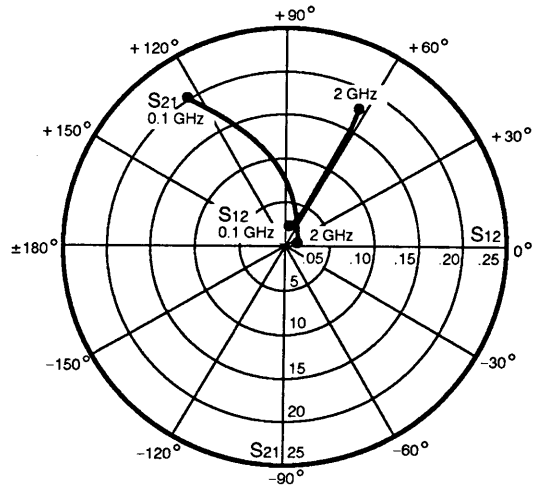
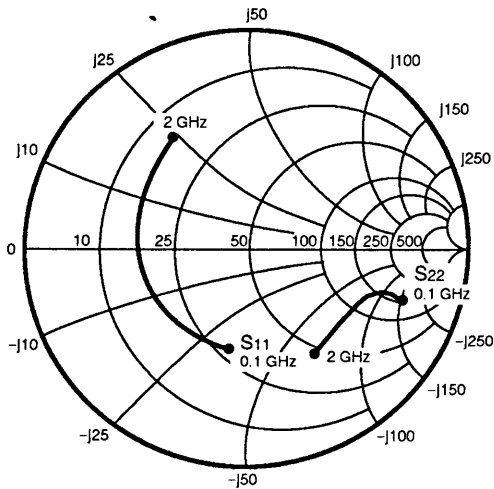
V_{CE} = 10 V, I_C = 30 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .56 | -120 | 22.89 | 122 | .01 | 55 | .71 | -21 |
| 200 | .62 | -151 | 13.21 | 102 | .01 | 42 | .56 | -20 |
| 500 | .67 | -176 | 5.52 | 80 | .02 | 54 | .51 | -20 |
| 1000 | .70 | 168 | 2.78 | 58 | .04 | 59 | .52 | -29 |
| 1500 | .70 | 158 | 1.78 | 41 | .06 | 55 | .56 | -43 |
| 2000 | .74 | 146 | 1.31 | 28 | .09 | 63 | .59 | -57 |

2

NE734 SERIES

TYPICAL COMMON EMITTER SCATTERING PARAMETERS (Cont'd.)



NE73437
Coordinates in Ohms
Frequency in GHz
(VCE = 10 V, IC = 20 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 5 mA

| FREQUENCY (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|-----------------|-----------------|------|-----------------|-----|-----------------|----|-----------------|-----|
| 100 | .75 | -48 | 12.09 | 147 | .03 | 68 | .91 | -14 |
| 200 | .63 | -84 | 9.19 | 129 | .03 | 52 | .77 | -22 |
| 500 | .48 | -146 | 4.66 | 89 | .06 | 48 | .61 | -27 |
| 1000 | .47 | 171 | 2.51 | 62 | .09 | 54 | .56 | -34 |
| 1500 | .52 | 148 | 1.69 | 42 | .13 | 54 | .55 | -45 |
| 2000 | .56 | 126 | 1.33 | 26 | .17 | 56 | .55 | -62 |

VCE = 10 V, IC = 10 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .58 | -70 | 17.20 | 135 | .02 | 72 | .84 | -18 |
| 200 | .50 | -111 | 11.27 | 113 | .02 | 51 | .67 | -22 |
| 500 | .45 | -165 | 5.12 | 83 | .05 | 56 | .55 | -24 |
| 1000 | .47 | 162 | 2.68 | 59 | .09 | 63 | .53 | -31 |
| 1500 | .54 | 143 | 1.80 | 39 | .13 | 58 | .53 | -43 |
| 2000 | .58 | 124 | 1.39 | 24 | .17 | 58 | .53 | -59 |

VCE = 10 V, IC = 20 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .47 | -96 | 20.34 | 125 | .02 | 68 | .75 | -19 |
| 200 | .44 | -137 | 12.01 | 104 | .02 | 51 | .61 | -19 |
| 500 | .46 | -176 | 5.14 | 79 | .04 | 65 | .54 | -20 |
| 1000 | .49 | 157 | 2.66 | 56 | .09 | 68 | .54 | -29 |
| 1500 | .56 | 141 | 1.75 | 36 | .12 | 62 | .54 | -41 |
| 2000 | .60 | 122 | 1.34 | 21 | .17 | 62 | .55 | -58 |

VCE = 10 V, IC = 30 mA

| | | | | | | | | |
|------|-----|------|-------|-----|-----|----|-----|-----|
| 100 | .45 | -117 | 20.05 | 119 | .02 | 75 | .72 | -17 |
| 200 | .45 | -150 | 11.32 | 100 | .02 | 52 | .62 | -17 |
| 500 | .49 | 179 | 4.72 | 77 | .04 | 67 | .57 | -18 |
| 1000 | .53 | 155 | 2.42 | 53 | .08 | 71 | .57 | -28 |
| 1500 | .61 | 139 | 1.59 | 34 | .12 | 66 | .58 | -41 |
| 2000 | .64 | 120 | 1.20 | 19 | .17 | 66 | .58 | -58 |

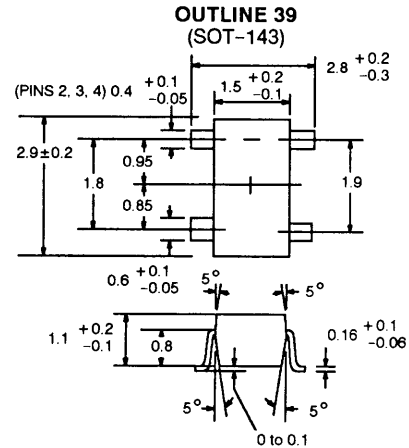
FEATURES

- **HIGH GAIN BANDWIDTH PRODUCT:**
2.0 GHz (TYP)
- **SURFACE MOUNT COMMON BASE OR COMMON EMITTER PACKAGE**
- **AVAILABLE IN TAPE & REEL AND BULK**
- **HIGH RELIABILITY METALLIZATION**
- **LOW COST**

DESCRIPTION AND APPLICATIONS

The NE73439 and NE73439B are NPN silicon transistors designed for high speed logic and wide-band low noise amplifier applications. These devices use NEC's highly reliable platinum-silicide, titanium, platinum and gold metallization system on the chip to assure uniform performance and reliability, and employ surface mount packaging technology. The 4-leaded mini mold package provides superior mechanical stability and is available either individually or in two configurations of tape and reel. The NE73439 has two emitter leads to help reduce emitter inductance and the NE73439B has two base leads making it a superior choice for oscillator applications.

OUTLINE DIMENSIONS (Units in mm)



PIN CONNECTIONS

- | | |
|--------------|--------------|
| NE73439 | NE73439B |
| 1. Collector | 1. Collector |
| 2. Emitter | 2. Base |
| 3. Base | 3. Emitter |
| 4. Emitter | 4. Base |

ABSOLUTE MAXIMUM RATINGS (TA = 25°C)

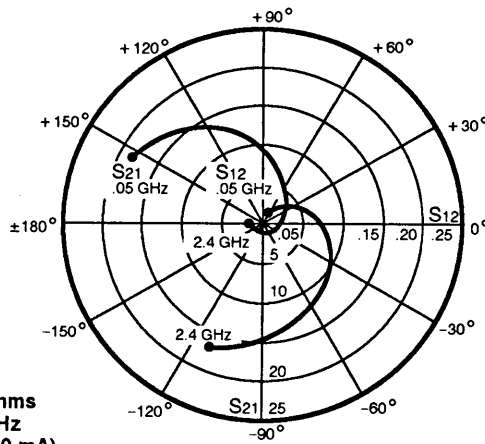
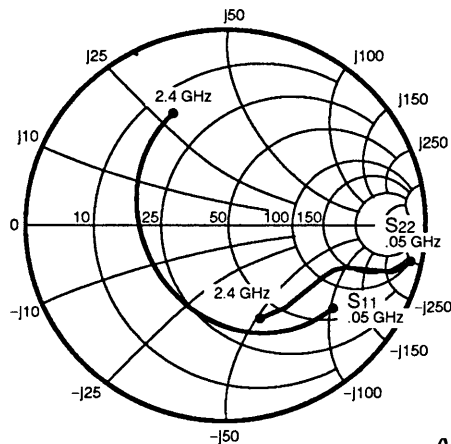
| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|------------------|------------------------------|-------|-------------|
| V _{cb0} | Collector to Base Voltage | V | 30 |
| V _{ce0} | Collector to Emitter Voltage | V | 14 |
| V _{eb0} | Emitter to Base Voltage | V | 3 |
| I _c | Collector Current | mA | 50 |
| P _T | Total Power Dissipation | mW | 150 |
| T _J | Junction Temperature | °C | 150 |
| T _{STG} | Storage Temperature | °C | -55 to +150 |

ELECTRICAL CHARACTERISTICS (TA = 25°C)

| SYMBOLS | PARAMETERS AND CONDITIONS | UNITS | NE73439 2SC4090 39 | | | NE73439B 2SC4087 39B | | |
|-------------------|---|-------|--------------------------|-----|-----|----------------------------|-----|-----|
| | | | MIN | TYP | MAX | MIN | TYP | MAX |
| I _{cb0} | Collector Cutoff Current at V _{cb} = 5 V, I _E = 0 | μA | | | 0.1 | | | 0.1 |
| h _{FE} | Forward Current Gain at V _{CE} = 10 V, I _c = 5 mA | | 40 | 100 | 180 | 40 | 100 | 180 |
| f _T | Gain Bandwidth Product at V _{CE} = 10 V, I _c = 5 mA | GHz | 1.5 | 2 | | 2 | | |
| N _{FMIN} | Minimum Noise Figure at V _{CE} = 10 V, I _c = 3 mA, f = 0.5 GHz | dB | | 3 | | | | |
| C _{OB} | Output Capacitance at V _{cb} = 10 V, I _E = 0, f = 1 MHz | pF | | | | | 1.1 | |
| MAG | Maximum Available Gain at V _{CE} = 10 V, I _c = 10 mA, f = 0.5 GHz | dB | | 17 | | | | |

*Electronic Industrial Association of Japan.

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE73439
Coordinates in Ohms
Frequency in GHz
(V_{CE} = 10 V, I_c = 10 mA)

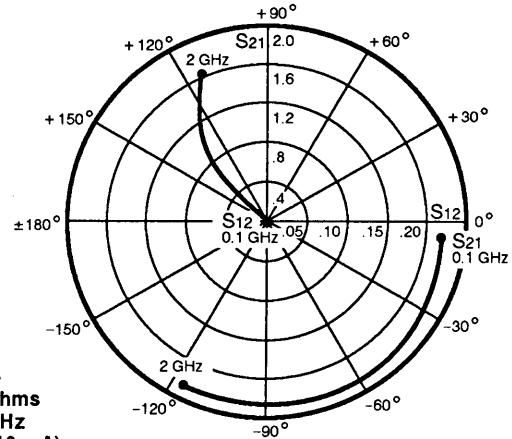
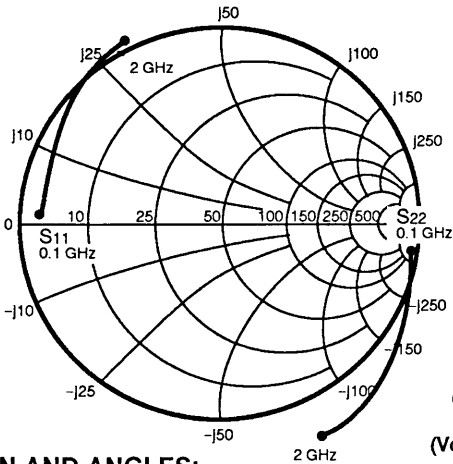
S-MAGN AND ANGLES:
V_{CE} = 10 V, I_C = 5 mA

| FREQUENCY (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|-----------------|-----------------|------|-----------------|------|-----------------|------|-----------------|-----|
| 50 | .81 | -23 | 10.89 | 158 | .014 | 73 | .96 | -8 |
| 100 | .75 | -44 | 10.08 | 140 | .025 | 59 | .91 | -14 |
| 200 | .63 | -83 | 8.36 | 111 | .038 | 40 | .78 | -20 |
| 300 | .55 | -111 | 6.51 | 88 | .046 | 28 | .70 | -21 |
| 400 | .50 | -132 | 5.35 | 71 | .052 | 20 | .66 | -22 |
| 500 | .48 | -147 | 4.44 | 56 | .057 | 13 | .63 | -23 |
| 600 | .47 | -158 | 3.77 | 42 | .062 | 7 | .62 | -24 |
| 700 | .47 | -167 | 3.29 | 29 | .067 | 1 | .61 | -26 |
| 800 | .47 | -176 | 2.90 | 17 | .072 | -5 | .60 | -27 |
| 900 | .47 | -177 | 2.60 | 5 | .078 | -11 | .59 | -29 |
| 1000 | .48 | -171 | 2.35 | -6 | .083 | -18 | .59 | -31 |
| 1100 | .48 | -165 | 2.15 | -17 | .088 | -24 | .58 | -33 |
| 1200 | .50 | -160 | 1.99 | -29 | .094 | -31 | .58 | -35 |
| 1300 | .50 | -155 | 1.84 | -39 | .100 | -37 | .57 | -38 |
| 1400 | .51 | -151 | 1.72 | -50 | .105 | -44 | .57 | -40 |
| 1500 | .52 | -147 | 1.61 | -61 | .112 | -51 | .57 | -43 |
| 1600 | .54 | -143 | 1.51 | -71 | .117 | -58 | .56 | -46 |
| 1700 | .55 | -139 | 1.43 | -82 | .123 | -65 | .56 | -46 |
| 1800 | .56 | -136 | 1.35 | -92 | .130 | -71 | .55 | -52 |
| 1900 | .57 | -132 | 1.29 | -102 | .136 | -79 | .55 | -55 |
| 2000 | .58 | -129 | 1.22 | -112 | .143 | -86 | .55 | -58 |
| 2100 | .59 | -126 | 1.16 | -122 | .150 | -93 | .54 | -62 |
| 2200 | .60 | -123 | 1.11 | -132 | .157 | -100 | .54 | -66 |
| 2300 | .61 | -120 | 1.06 | -142 | .164 | -107 | .54 | -69 |
| 2400 | .62 | -118 | 1.02 | -152 | .172 | -115 | .53 | -73 |

V_{CE} = 10 V, I_C = 10 mA

| | | | | | | | | |
|------|-----|------|-------|------|------|------|-----|-----|
| 50 | .68 | -35 | 17.95 | 152 | .012 | 69 | .93 | -12 |
| 100 | .61 | -66 | 15.51 | 130 | .021 | 54 | .83 | -18 |
| 200 | .50 | -112 | 10.91 | 99 | .030 | 40 | .68 | -20 |
| 300 | .46 | -137 | 7.91 | 79 | .037 | 33 | .62 | -20 |
| 400 | .45 | -152 | 6.14 | 63 | .043 | 28 | .59 | -20 |
| 500 | .44 | -164 | 4.99 | 50 | .049 | 22 | .58 | -21 |
| 600 | .45 | -172 | 4.20 | 37 | .056 | 22 | .58 | -22 |
| 700 | .45 | -180 | 3.63 | 25 | .062 | 10 | .56 | -23 |
| 800 | .46 | -174 | 3.19 | 14 | .068 | 3 | .56 | -25 |
| 900 | .47 | -169 | 2.85 | 2 | .075 | -4 | .55 | -27 |
| 1000 | .48 | -164 | 2.57 | -9 | .081 | -11 | .55 | -29 |
| 1100 | .49 | -159 | 2.34 | -20 | .088 | -18 | .54 | -31 |
| 1200 | .50 | -155 | 2.16 | -31 | .094 | -25 | .54 | -33 |
| 1300 | .51 | -151 | 1.99 | -42 | .100 | -32 | .54 | -36 |
| 1400 | .52 | -147 | 1.85 | -52 | .106 | -39 | .54 | -38 |
| 1500 | .53 | -143 | 1.73 | -63 | .113 | -46 | .53 | -41 |
| 1600 | .54 | -140 | 1.63 | -73 | .119 | -53 | .53 | -44 |
| 1700 | .56 | -136 | 1.54 | -83 | .125 | -61 | .52 | -47 |
| 1800 | .57 | -133 | 1.45 | -94 | .132 | -68 | .52 | -50 |
| 1900 | .58 | -130 | 1.38 | -104 | .139 | -75 | .52 | -53 |
| 2000 | .59 | -127 | 1.31 | -114 | .145 | -82 | .51 | -56 |
| 2100 | .60 | -124 | 1.24 | -124 | .153 | -90 | .51 | -60 |
| 2200 | .61 | -121 | 1.19 | -134 | .160 | -97 | .51 | -64 |
| 2300 | .62 | -119 | 1.13 | -143 | .168 | -105 | .51 | -68 |
| 2400 | .64 | -116 | 1.08 | -153 | .176 | -112 | .50 | -72 |

TYPICAL COMMON BASE SCATTERING PARAMETERS



NE73439B
Coordinates in Ohms
Frequency in GHz
(V_{cb} = 10 V, I_c = 10 mA)

S-MAGN AND ANGLES:
VCE = 10 V, IC = 3 mA

| FREQUENCY (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|-----------------|-----------------|-----|-----------------|------|-----------------|-----|-----------------|------|
| 0.1 | .67 | 177 | 1.64 | -5 | .00 | 20 | 1.00 | -3 |
| 0.2 | .67 | 174 | 1.65 | -11 | .00 | 76 | 1.01 | -5 |
| 0.4 | .67 | 168 | 1.61 | -21 | .01 | 110 | 1.01 | -9 |
| 0.6 | .69 | 162 | 1.63 | -31 | .02 | 116 | 1.02 | -14 |
| 0.8 | .72 | 155 | 1.61 | -43 | .04 | 119 | 1.02 | -19 |
| 1.0 | .74 | 150 | 1.56 | -54 | .05 | 122 | 1.04 | -24 |
| 1.2 | .78 | 143 | 1.59 | -66 | .07 | 123 | 1.07 | -29 |
| 1.4 | .80 | 136 | 1.55 | -79 | .10 | 120 | 1.10 | -35 |
| 1.6 | .82 | 130 | 1.51 | -94 | .13 | 119 | 1.13 | -44 |
| 1.8 | .84 | 123 | 1.46 | -106 | .16 | 113 | 1.16 | -53 |
| 2.0 | .84 | 117 | 1.38 | -124 | .20 | 109 | 1.16 | -62 |
| 2.2 | .85 | 109 | 1.28 | -143 | .24 | 100 | 1.13 | -76 |
| 2.4 | .84 | 103 | 1.17 | -158 | .27 | 94 | 1.09 | -87 |
| 2.6 | .82 | 99 | 1.06 | -173 | .31 | 86 | 1.04 | -96 |
| 2.8 | .80 | 94 | 0.95 | -172 | .34 | 82 | 0.99 | -106 |
| 3.0 | .78 | 91 | 0.89 | -157 | .36 | 76 | 0.95 | -115 |
| 3.2 | .76 | 89 | 0.84 | -144 | .38 | 72 | 0.90 | -123 |
| 3.4 | .74 | 87 | 0.78 | -131 | .40 | 65 | 0.87 | -131 |
| 3.6 | .72 | 86 | 0.74 | -120 | .42 | 61 | 0.84 | -139 |
| 3.8 | .70 | 85 | 0.71 | -107 | .44 | 56 | 0.82 | -147 |
| 4.0 | .69 | 84 | 0.70 | -97 | .45 | 54 | 0.80 | -153 |

VCE = 10 V, IC = 5 mA

| | | | | | | | | |
|-----|-----|-----|------|------|-----|-----|------|-----|
| 0.1 | .77 | 176 | 1.72 | -6 | .00 | 63 | 1.00 | -2 |
| 0.2 | .77 | 174 | 1.74 | -10 | .00 | 121 | 1.01 | -5 |
| 0.4 | .77 | 167 | 1.72 | -21 | .01 | 116 | 1.01 | -10 |
| 0.6 | .78 | 161 | 1.75 | -28 | .02 | 121 | 1.01 | -13 |
| 0.8 | .80 | 153 | 1.73 | -39 | .03 | 126 | 1.04 | -18 |
| 1.0 | .81 | 148 | 1.73 | -48 | .05 | 126 | 1.06 | -23 |
| 1.2 | .84 | 142 | 1.75 | -64 | .07 | 126 | 1.07 | -29 |
| 1.4 | .86 | 136 | 1.73 | -73 | .10 | 122 | 1.11 | -34 |
| 1.6 | .88 | 129 | 1.74 | -85 | .12 | 120 | 1.15 | -43 |
| 1.8 | .89 | 123 | 1.66 | -99 | .16 | 115 | 1.18 | -51 |
| 2.0 | .90 | 117 | 1.63 | -116 | .19 | 111 | 1.20 | -61 |

VCE = 10 V, IC = 10 mA

| | | | | | | | | |
|-----|------|-----|------|------|-----|-----|------|------|
| 0.1 | .86 | 177 | 1.82 | -5 | .00 | 16 | 1.00 | -3 |
| 0.2 | .87 | 174 | 1.84 | -9 | .00 | 57 | 1.00 | -4 |
| 0.4 | .87 | 167 | 1.82 | -19 | .01 | 126 | 1.01 | -9 |
| 0.6 | .89 | 161 | 1.86 | -29 | .02 | 134 | 1.02 | -14 |
| 0.8 | .91 | 154 | 1.85 | -39 | .03 | 135 | 1.02 | -19 |
| 1.0 | .94 | 149 | 1.84 | -50 | .06 | 135 | 1.04 | -24 |
| 1.2 | .98 | 141 | 1.91 | -62 | .08 | 134 | 1.08 | -29 |
| 1.4 | .99 | 135 | 1.89 | -74 | .11 | 129 | 1.12 | -35 |
| 1.6 | 1.03 | 128 | 1.87 | -90 | .14 | 126 | 1.17 | -43 |
| 1.8 | 1.04 | 121 | 1.85 | -101 | .18 | 118 | 1.20 | -53 |
| 2.0 | 1.03 | 114 | 1.77 | -120 | .23 | 112 | 1.22 | -63 |
| 2.2 | 1.04 | 105 | 1.67 | -138 | .27 | 102 | 1.18 | -78 |
| 2.4 | 1.01 | 98 | 1.53 | -154 | .30 | 95 | 1.13 | -89 |
| 2.6 | .97 | 93 | 1.36 | -169 | .34 | 86 | 1.08 | -99 |
| 2.8 | .93 | 88 | 1.21 | -175 | .37 | 80 | 1.02 | -109 |
| 3.0 | .88 | 85 | 1.11 | -160 | .39 | 74 | 0.96 | -118 |
| 3.2 | .84 | 83 | 1.02 | -147 | .40 | 70 | 0.91 | -127 |
| 3.4 | .81 | 81 | 0.94 | -136 | .42 | 63 | 0.87 | -135 |
| 3.6 | .76 | 80 | 0.87 | -123 | .43 | 59 | 0.84 | -143 |
| 3.8 | .74 | 79 | 0.81 | -111 | .45 | 54 | 0.81 | -150 |
| 4.0 | .73 | 79 | 0.78 | -100 | .47 | 52 | 0.79 | -157 |