

# BCX70

# SOT23 NPN SILICON PLANAR SMALL SIGNAL TRANSISTOR

ISSUE 2 – FEBRUARY 95

# BCX70

## ELECTRICAL CHARACTERISTICS (at $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated).

| PARAMETER                             | SYMBOL  | MIN. | TYP. | MAX. | UNIT          | CONDITIONS.  |
|---------------------------------------|---|------|------|------|---------------|--|
| Collector-Emitter Breakdown Voltage   | $V_{(BR)CEO}$   | 45   |      |      | V             | $I_C=2\text{mA}$   |
| Emitter-Base Breakdown Voltage        | $V_{(BR)EBO}$   | 5    |      |      | V             | $I_{EBO}=1\mu\text{A}$   |
| Collector-Emitter Cut-off Current     | $I_{CES}$   | 20   |      |      | nA            | $V_{CES}=45\text{V}$   |
|                                       |   | 20   |      |      | $\mu\text{A}$ | $V_{CES}=45\text{V}$ ,<br>$T_{amb}=150^{\circ}\text{C}$  |
| Emitter-Base Cut-Off Current          | $I_{EBO}$   | 20   |      |      | nA            | $V_{EBO}=4\text{V}$  |
| Collector-Emitter Saturation Voltage  | $V_{CE(sat)}$   | 0.12 | 0.12 | 0.35 | V             | $I_C=10\text{mA}$ , $I_B=0.25\text{mA}$  |
|                                       |   | 0.20 | 0.20 | 0.55 | V             | $I_C=50\text{mA}$ , $I_B=1.25\text{mA}$  |
| Base-Emitter Saturation Voltage       | $V_{BE(sat)}$   | 0.60 | 0.70 | 0.85 | V             | $I_C=10\text{mA}$ , $I_B=0.25\text{mA}$  |
|                                       |   | 0.70 | 0.83 | 1.05 | V             | $I_C=50\text{mA}$ , $I_B=1.25\text{mA}$  |
| Base - Emitter Voltage                | $V_{BE}$  | 0.52 | 0.65 | 0.75 | V             | $I_C=10\mu\text{A}$ , $V_{CE}=5\text{V}$   |
|                                       |   | 0.55 | 0.65 | 0.78 | V             | $I_C=2\text{mA}$ , $V_{CE}=5\text{V}$  |
| Static Forward Current Transfer Ratio | $h_{FE}$  | 78   | 170  | 220  |               | $I_C=10\mu\text{A}$ , $V_{CE}=5\text{V}$   |
|                                       |   | 120  | 170  | 220  |               | $I_C=2\text{mA}$ , $V_{CE}=5\text{V}$  |
| BCX70H                                | $h_{FE}$  | 20   | 145  | 310  |               | $I_C=10\mu\text{A}$ , $V_{CE}=5\text{V}$   |
|                                       |   | 180  | 250  | 310  |               | $I_C=2\text{mA}$ , $V_{CE}=5\text{V}$  |
| BCX70J                                | $h_{FE}$  | 40   | 220  | 460  |               | $I_C=10\mu\text{A}$ , $V_{CE}=5\text{V}$   |
|                                       |   | 250  | 350  | 460  |               | $I_C=2\text{mA}$ , $V_{CE}=5\text{V}$  |
| BCX70K                                | $h_{FE}$  | 100  | 300  | 630  |               | $I_C=10\mu\text{A}$ , $V_{CE}=5\text{V}$   |
|                                       |   | 380  | 500  | 630  |               | $I_C=2\text{mA}$ , $V_{CE}=5\text{V}$  |
| Transition Frequency                  | $f_T$   | 125  | 250  |      | MHz           | $I_C=10\text{mA}$ , $V_{CE}=5\text{V}$ ,<br>$f=100\text{MHz}$  |
|                                       |   |      |      |      |               | $V_{EBO}=0.5\text{V}$ , $f=1\text{MHz}$  |
| Emitter-Base Capacitance              | $C_{ebo}$   |      | 8    |      | pF            | $V_{CBO}=10\text{V}$ , $f=1\text{MHz}$   |
| Collector-Base Capacitance            | $C_{cbo}$   |      | 2    | 4.5  | pF            | $I_C=0.2\text{mA}$ , $V_{CE}=5\text{V}$ ,<br>$R_G=2\text{K}\Omega$ , $f=1\text{KH}$  |
| Noise Figure                          | N   |      | 6    |      | dB            | $\Delta f=200\text{Hz}$  |
| Switching times:                      | $t_d$<br>$t_r$<br>$t_{on}$<br>$t_s$<br>$t_f$<br>$t_{off}$ | 35   |      |      | ns            | $I_C=I_B$ , $I_B=10:1:1\text{mA}$ ,<br>$R_1=5\text{K}\Omega$ , $R_2=5\text{K}\Omega$ ,<br>$V_{BB}=3.6\text{V}$ , $R_L=990\Omega$ |
|                                       |   | 50   |      |      | ns            |  |
|                                       |   | 85   | 150  |      | ns            |  |
|                                       |   | 400  |      |      | ns            |  |
|                                       |   | 400  |      |      | ns            |  |
|                                       |   | 80   | 800  |      | ns            |  |

\*Measured under pulsed conditions. Pulse width=300 $\mu\text{s}$ . Duty cycle  
Spice parameter data is available upon request for this device

PARTMARKING DETAIL – BCX70G – AG

- BCX70H – AH
- BCX70J – AJ
- BCX70K – AK
- BCX70GR – AW
- BCX70HR – 9P
- BCX70JR – AX
- BCX70KR – P9

COMPLEMENTARY TYPE – BCX71

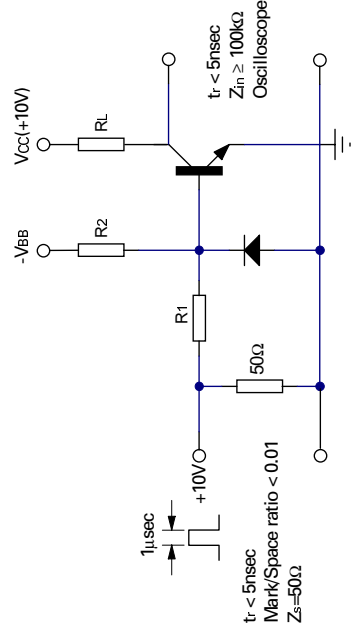
## ABSOLUTE MAXIMUM RATINGS.

| PARAMETER   | SYMBOL    | VALUE       | UNIT               |
|---|-----------|-------------|--------------------|
| Collector-Emitter Voltage                         | $V_{CES}$ | 45          | V                  |
| Collector-Emitter Voltage                         | $V_{CEO}$ | 45          | V                  |
| Emitter-Base Voltage                              | $V_{EBO}$ | 5           | V                  |
| Continuous Collector Current                      | $I_C$     | 200         | mA                 |
| Base Current                                      | $I_B$     | 50          | mA                 |
| Power Dissipation at $T_{amb}=25^{\circ}\text{C}$ | $P_{TOT}$ | 330         | mW                 |
| Operating and Storage Temperature Range           | tj:stg    | -55 to +150 | $^{\circ}\text{C}$ |

## FOUR TERMINAL NETWORK DATA ( $I_C=2\text{mA}$ , $V_{CE}=5\text{V}$ , $f=1\text{kHz}$ )

|           | $h_{FE}$ Group G |      | $h_{FE}$ Group H |      | $h_{FE}$ Group J |      | $h_{FE}$ Group K |           |
|-----------|------------------|------|------------------|------|------------------|------|------------------|-----------|
|           | Min.             | Typ. | Min.             | Typ. | Min.             | Typ. | Min.             | Max.      |
| $h_{11e}$ | 1.6              | 2.7  | 2.5              | 3.6  | 4.5              | 8.5  | 4.5              | 12        |
| $h_{12e}$ | 1.5              |      | 2                |      | 2                |      | 3                | $10^{-4}$ |
| $h_{21e}$ | 200              |      | 260              |      | 330              |      | 520              |           |
| $h_{22e}$ | 18               | 30   | 24               | 50   | 30               | 60   | 50               | 100       |

## SWITCHING CIRCUIT



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## ELECTRICAL CHARACTERISTICS (at $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated).

| PARAMETER                             | SYMBOL  | MIN. | TYP. | MAX. | UNIT          | CONDITIONS.  |
|---------------------------------------|---|------|------|------|---------------|--|
| Collector-Emitter Breakdown Voltage   | $V_{(BR)CEO}$   | 45   |      |      | V             | $I_C=2\text{mA}$   |
| Emitter-Base Breakdown Voltage        | $V_{(BR)EBO}$   | 5    |      |      | V             | $I_{EBO}=1\mu\text{A}$   |
| Collector-Emitter Cut-off Current     | $I_{CES}$   | 20   |      |      | nA            | $V_{CES}=45\text{V}$   |
|                                       |   | 20   |      |      | $\mu\text{A}$ | $V_{CES}=45\text{V}$ ,<br>$T_{amb}=150^{\circ}\text{C}$  |
| Emitter-Base Cut-Off Current          | $I_{EBO}$   | 20   |      |      | nA            | $V_{EBO}=4\text{V}$  |
| Collector-Emitter Saturation Voltage  | $V_{CE(sat)}$   | 0.12 | 0.12 | 0.35 | V             | $I_C=10\text{mA}$ , $I_B=0.25\text{mA}$  |
|                                       |   | 0.20 | 0.20 | 0.55 | V             | $I_C=50\text{mA}$ , $I_B=1.25\text{mA}$  |
| Base-Emitter Saturation Voltage       | $V_{BE(sat)}$   | 0.60 | 0.70 | 0.85 | V             | $I_C=10\text{mA}$ , $I_B=0.25\text{mA}$  |
|                                       |   | 0.70 | 0.83 | 1.05 | V             | $I_C=50\text{mA}$ , $I_B=1.25\text{mA}$  |
| Base - Emitter Voltage                | $V_{BE}$  | 0.52 | 0.65 | 0.75 | V             | $I_C=10\mu\text{A}$ , $V_{CE}=5\text{V}$   |
|                                       |   | 0.55 | 0.65 | 0.78 | V             | $I_C=2\text{mA}$ , $V_{CE}=5\text{V}$  |
| Static Forward Current Transfer Ratio | $h_{FE}$  | 120  | 170  | 220  |               | $I_C=10\mu\text{A}$ , $V_{CE}=5\text{V}$   |
|                                       |   | 50   | 170  | 220  |               | $I_C=2\text{mA}$ , $V_{CE}=5\text{V}$  |
| BCX70H                                | $h_{FE}$  | 20   | 145  | 310  |               | $I_C=10\mu\text{A}$ , $V_{CE}=5\text{V}$   |
|                                       |   | 180  | 250  | 310  |               | $I_C=2\text{mA}$ , $V_{CE}=5\text{V}$  |
| BCX70J                                | $h_{FE}$  | 40   | 220  | 460  |               | $I_C=10\mu\text{A}$ , $V_{CE}=5\text{V}$   |
|                                       |   | 250  | 350  | 460  |               | $I_C=2\text{mA}$ , $V_{CE}=5\text{V}$  |
| BCX70K                                | $h_{FE}$  | 100  | 300  | 630  |               | $I_C=10\mu\text{A}$ , $V_{CE}=5\text{V}$   |
|                                       |   | 380  | 500  | 630  |               | $I_C=2\text{mA}$ , $V_{CE}=5\text{V}$  |
| Transition Frequency                  | $f_T$   | 125  | 250  |      | MHz           | $I_C=10\text{mA}$ , $V_{CE}=5\text{V}$ ,<br>$f=100\text{MHz}$  |
|                                       |   |      |      |      |               | $V_{EBO}=0.5\text{V}$ , $f=1\text{MHz}$  |
| Emitter-Base Capacitance              | $C_{ebo}$   |      | 8    |      | pF            | $V_{CBO}=10\text{V}$ , $f=1\text{MHz}$   |
| Collector-Base Capacitance            | $C_{cbo}$   |      | 2    | 4.5  | pF            | $I_C=0.2\text{mA}$ , $V_{CE}=5\text{V}$ ,<br>$R_G=2\text{K}\Omega$ , $f=1\text{KH}$  |
| Noise Figure                          | N   |      | 2    | 6    | dB            | $\Delta f=200\text{Hz}$  |
| Switching times:                      | $t_d$<br>$t_r$<br>$t_{on}$<br>$t_s$<br>$t_f$<br>$t_{off}$ | 35   |      |      | ns            | $I_C=I_B$ , $I_B=10:1:1\text{mA}$<br>$R_1=5\text{K}\Omega$ , $R_2=5\text{K}\Omega$ ,<br>$V_{BB}=3.6\text{V}$ , $R_L=990\Omega$ |
|                                       |   | 50   |      |      | ns            |  |
|                                       |   | 85   | 150  |      | ns            |  |
|                                       |   | 400  |      |      | ns            |  |
|                                       |   | 400  |      |      | ns            |  |
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|           | Min.             | Typ. | Min.             | Typ. | Min.             | Typ. | Min.             | Max.          |
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| $h_{12e}$ | 1.5              |      | 2                |      | 2                |      | 3                | $10^{-4}$     |
| $h_{21e}$ | 200              | 260  | 24               | 260  | 30               | 520  |                  |               |
| $h_{22e}$ | 18               | 30   | 50               | 30   | 60               | 100  |                  | $\mu\text{S}$ |

## SWITCHING CIRCUIT

