# Process C1206
## BiCMOS 1.2µm
## 6.4GHz

## Electrical Characteristics

T=25°C Unless otherwise noted

| N-Channel Transistor | Symbol | Minimum | Typical | Maximum | Unit | Comments |
|---|---|---|---|---|---|---|
| Threshold Voltage | $VT_N$ | 0.55 | 0.75 | 0.95 | V | 100x1.2µm |
| Body Factor | $\gamma_N$ | | 0.34 | | $V^{1/2}$ | 100x1.2µm |
| Conduction Factor | $\beta_N$ | 64 | 75 | 86 | $\mu A/V^2$ | 100x100µm |
| Effective Channel Length | $Leff_N$ | 0.8 | 1.0 | 1.2 | µm | 100x1.2µm |
| Width Encroachment | $\Delta W_N$ | | 0.6 | | µm | Per side |
| Punch Through Voltage | $BVDSS_N$ | 9 | | | V | |
| Poly Field Threshold Voltage | $VTF_{P(N)}$ | 10 | | | V | |

| P-Channel Transistor | Symbol | Minimum | Typical | Maximum | Unit | Comments |
|---|---|---|---|---|---|---|
| Threshold Voltage | $VT_P$ | –0.7 | –0.9 | –1.1 | V | 100x1.2µm |
| Body Factor | $\gamma_P$ | | 0.38 | | $V^{1/2}$ | 100x1.2µm |
| Conduction Factor | $\beta_P$ | 21 | 25 | 29 | $\mu A/V^2$ | 100x100µm |
| Effective Channel Length | $Leff_P$ | 0.9 | 1.1 | 1.3 | µm | 100x1.2µm |
| Width Encroachment | $\Delta W_P$ | | 0.8 | | µm | Per side |
| Punch Through Voltage | $BVDSS_P$ | –9 | | | V | |
| Poly Field Threshold Voltage | $VTF_{P(P)}$ | –10 | | | V | |

| Diffusion & Thin Films | Symbol | Minimum | Typical | Maximum | Unit | Comments |
|---|---|---|---|---|---|---|
| Base Resistor Sheet Resist. | $\rho_{RB}$ | 1.33 | 1.66 | 2.00 | KΩ/□ | |
| Base Resistor Effective Width Change | $\Delta W_{RB}$ | –0.2 | –0.6 | –1.0 | µm | |
| Base Resistor Voltage Coefficient, Narrow Size | $V_{OLTCO\_N}$ | | 11297 | | ppm/V | 250x5µm |
| Base Resistor Voltage Coefficient, Wide Size | $V_{OLTCO\_W}$ | | 15468 | | ppm/V | 250x25µm |
| Base Resistor Voltage Coefficient, Narrow Size | $T_{EMPCO\_N}$ | | 2761 | | ppm/C | 250x5µm |
| High Resistance Poly | $\rho_{HI\text{-}POLY}$ | 1.5 | 2.0 | 2.5 | KΩ/□ | |
| Voltage Coefficient - High Resistance Poly | $V_{OLTCO\ HIPOLY}$ | –200 | | 0.0 | ppm/V | For < 2V, 4σ 100µm |
| Temperature Coefficient - High Resistance Poly | $T_{EMPCO\ HIPOLY}$ | | –1969 | | ppm/C | |
| Base to Emitter Capacitance | $C_{BEO}$ | | 33.8 | | $fF/\mu m^2$ | |
| Base to Collector Cap. | $C_{BCO}$ | | 56.9 | | $fF/\mu m^2$ | |
| Base to Substrate Cap. | $C_{CS}$ | | 35.1 | | $fF/\mu m^2$ | |
| Collector to Substrate Junction Capacitance | $C_{JS}$ | | 0.1 | | $fF/\mu m^2$ | |

| Capacitance | Symbol | Minimum | Typical | Maximum | Unit | Comments |
|---|---|---|---|---|---|---|
| Gate Oxide | $C_{OX}$ | 1.28 | 1.38 | 1.58 | $fF/\mu m^2$ | |
| Metal-1 to Poly-1 | $C_{M1P}$ | | 0.057 | | $fF/\mu m^2$ | |
| Metal-1 to Silicon | $C_{M1S}$ | | 0.028 | | $fF/\mu m^2$ | |
| Metal-2 to Metal-1 | $C_{MM}$ | | 0.035 | | $fF/\mu m^2$ | |
| Poly-1 to Poly-2 | $C_{P1P2}$ | 0.69 | 0.86 | 1.03 | $fF/\mu m^2$ | |

# Electrical Characteristics

**NPN Bipolar Transistor Characteristics (Emitter size 4.5 x 4.5μm)**

| | Sym | Min | Typ | Max | Unit | Comments |
|---|---|---|---|---|---|---|
| Current Gain | $h_{FE}$ | | 102 | | | @100μA |
| Early Voltage | $V_A$ | | 22 | | V | |
| Cut - Off Frequency | $f_\tau$ | | 6.2 | | GHz | |
| Collector-Emitter Saturation Voltage | $V_{CESAT}$ | | 0.25 | | V | |
| Collector to Emitter Breakdown Voltage | $BV_{CEO}$ | 5 | | | V | |
| Collector to Base Breakdown Voltage | $BV_{CBO}$ | 15 | | | V | |
| Emitter to Base Breakdown Voltage | $BV_{EBO}$ | 5 | | | V | |
| Emitter Resistance | $R_E$ | | 14 | | Ω | |
| Base Spreading Resistance | $R_B$ | | 1500 | | Ω | |
| Collector Saturation Resistance | $R_C$ | | 60 | | Ω | |
| Base to Emitter Capacitance | $C_{BEO}$ | | 0.10 | | pF | |
| Base to Collector Capacitance | $C_{BCO}$ | | 0.04 | | pF | |
| Base to Substrate Capacitance | $C_{CS}$ | | 0.125 | | pF | |

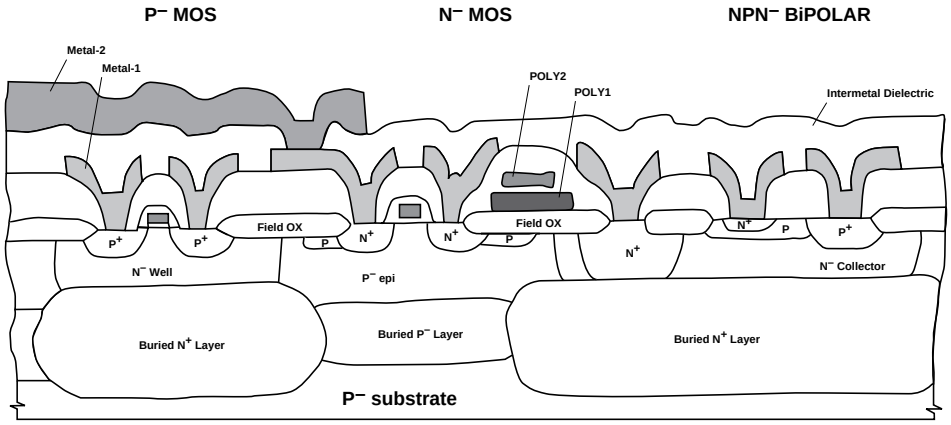
**NPN Bipolar Transistor Characteristics (Emitter size 31.5 x 4.5μm)**

| | Sym | Min | Typ | Max | Unit | Comments |
|---|---|---|---|---|---|---|
| Current Gain | $h_{FE}$ | | 93 | | | @100μA |
| Early Voltage | $V_A$ | | 22 | | V | |
| Cut - Off Frequency | $f_\tau$ | | 6.4 | | GHz | |
| Collector-Emitter Saturation Voltage | $V_{CESAT}$ | | 0.25 | | V | |
| Collector to Emitter Breakdown Voltage | $BV_{CEO}$ | 5 | | | V | |
| Collector to Base Breakdown Voltage | $BV_{CBO}$ | 15 | | | V | |
| Emitter to Base Breakdown Voltage | $BV_{EBO}$ | 5 | | | V | |
| Emitter Resistance | $R_E$ | | 2.0 | | Ω | |
| Base Spreading Resistance | $R_B$ | | 200 | | Ω | |
| Collector Saturation Resistance | $R_C$ | | 10 | | Ω | |
| Base to Emitter Capacitance | $C_{BEO}$ | | 0.50 | | pF | |
| Base to Collector Capacitance | $C_{BCO}$ | | 0.21 | | pF | |
| Base to Substrate Capacitance | $C_{CS}$ | | 0.41 | | pF | |

## Physical Characteristics

| | | | |
|---|---|---|---|
| Starting Material | p <100> | N+/P+ Width/Space | 2.5/1.2µm |
| Starting Mat. Resistivity | 25 - 50 Ω-cm | N+ to P+ Space | 9.0µm |
| Typ. Operating Voltage | 5V | Contact to Poly Space | 1.5µm |
| Well Type | N-well | Contact Overlap of Diffusion | 1.0µm |
| Metal Layers | 2 | Contact Overlap of Poly | 1.0µm |
| Poly Layers | 2 | Metal-1 Overlap of Contact | 1.0µm |
| Contact Size | 1.5x1.5µm | Metal-1 Overlap of Via | 1.0µm |
| Via Size | 1.5x1.5µm | Metal-2 Overlap of Via | 1.0µm |
| Metal-1 Width/Space | 2.5 / 1.5µm | Minimum Pad Opening | 65x65µm |
| Metal-2 Width/space | 2.5 / 1.5µm | Minimum Pad-to-Pad Spacing | 5.0µm |
| Gate Poly Width/Space | 1.5 / 2.0µm | Minimum Pad Pitch | 80.0µm |

Special feature of C1206 Process: BiCMOS 1.2-µm technology with a cutoff frequency of 6.4GHz.




Cross-sectional view of the BiCMOS 1.2 C1206 process