

## 2N3904

### NPN General Purpose Amplifier

#### Features

- Lead Free Finish/RoHS Compliant ("P" Suffix designates RoHS Compliant. See ordering information)
- ≠ Capable of 625mW of Power Dissipation and 200mA  $I_C$
- ≠ Epoxy meets UL 94 V-0 flammability rating
- ≠ Moisture Sensitivity Level 1
- ≠ Through Hole Package
- ≠ Marking: Type number
- Operating Temperature: -55°C to +150°C
- Storage Temperature: -55°C to +150°C

#### Electrical Characteristics @ 25°C Unless Otherwise Specified

| Symbol | Parameter | Min | Max | Units |
|--------|-----------|-----|-----|-------|
|--------|-----------|-----|-----|-------|

##### OFF CHARACTERISTICS

|               |                                                                   |     |    |      |
|---------------|-------------------------------------------------------------------|-----|----|------|
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage*<br>( $I_C=1.0mA$ , $I_B=0$ ) | 40  |    | Vdc  |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage<br>( $I_C=10\mu A$ , $I_E=0$ )   | 60  |    | Vdc  |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage<br>( $I_E=10\mu A$ , $I_C=0$ )     | 6.0 |    | Vdc  |
| $I_{BL}$      | Base Cutoff Current<br>( $V_{CE}=30V$ , $V_{BE}=3.0V$ )           |     | 50 | nAdc |
| $I_{CEX}$     | Collector Cutoff Current<br>( $V_{CE}=30V$ , $V_{BE}=3.0V$ )      |     | 50 | nAdc |

##### ON CHARACTERISTICS

|               |                                                                                                                                                                                               |                             |              |     |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------|-----|
| $h_{FE}$      | DC Current Gain*<br>( $I_C=0.1mA$ , $V_{CE}=1.0V$ )<br>( $I_C=1.0mA$ , $V_{CE}=1.0V$ )<br>( $I_C=10mA$ , $V_{CE}=1.0V$ )<br>( $I_C=50mA$ , $V_{CE}=1.0V$ )<br>( $I_C=100mA$ , $V_{CE}=1.0V$ ) | 40<br>70<br>100<br>60<br>30 | 300          |     |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage<br>( $I_C=10mA$ , $I_B=1.0mA$ )<br>( $I_C=50mA$ , $I_B=5.0mA$ )                                                                                          |                             | 0.2<br>0.4   | Vdc |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage<br>( $I_C=10mA$ , $I_B=1.0mA$ )<br>( $I_C=50mA$ , $I_B=5.0mA$ )                                                                                               | 0.65                        | 0.85<br>0.95 | Vdc |

##### SMALL-SIGNAL CHARACTERISTICS

|           |                                                                                                |     |     |     |
|-----------|------------------------------------------------------------------------------------------------|-----|-----|-----|
| $f_T$     | Current Gain-Bandwidth Product<br>( $I_C=10mA$ , $V_{CE}=20V$ , $f=100MHz$ )                   | 250 |     | MHz |
| $C_{obo}$ | Output Capacitance<br>( $V_{CB}=5.0V$ , $I_E=0$ , $f=1.0MHz$ )                                 |     | 4.0 | pF  |
| $C_{ibo}$ | Input Capacitance<br>( $V_{BE}=0.5V$ , $I_C=0$ , $f=1.0MHz$ )                                  |     | 8.0 | pF  |
| NF        | Noise Figure<br>( $I_C=100\mu A$ , $V_{CE}=5.0V$ , $R_S=1.0k\Omega$<br>$f=10Hz$ to $15.7kHz$ ) |     | 5.0 | dB  |

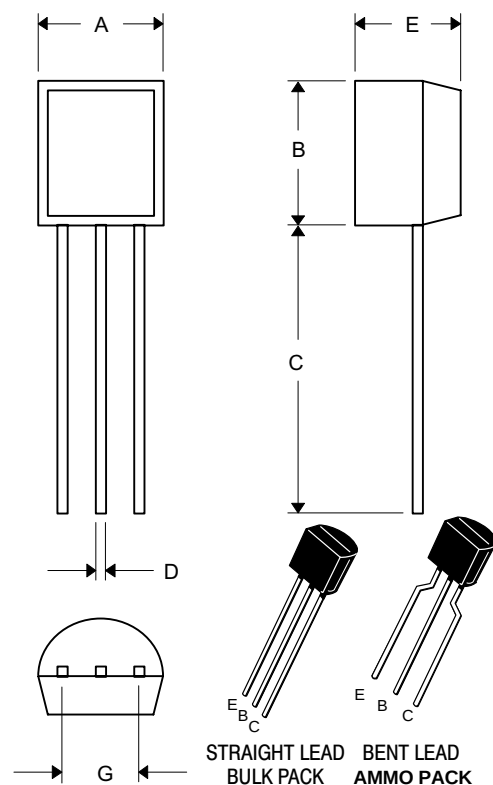
##### SWITCHING CHARACTERISTICS

|       |              |                                   |     |    |
|-------|--------------|-----------------------------------|-----|----|
| $t_d$ | Delay Time   | ( $V_{CC}=3.0V$ , $V_{BE}=0.5V$ ) | 35  | ns |
| $t_r$ | Rise Time    | ( $I_C=10mA$ , $I_B=1.0mA$ )      | 35  | ns |
| $t_s$ | Storage Time | ( $V_{CC}=3.0V$ , $I_C=10mA$ )    | 200 | ns |
| $t_f$ | Fall Time    | ( $I_B=I_{B2}=1.0mA$ )            | 50  | ns |

\*Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2.0\%$

| Symbol          | Characteristic                          | Max | Unit |
|-----------------|-----------------------------------------|-----|------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 200 | °C/W |

#### TO-92

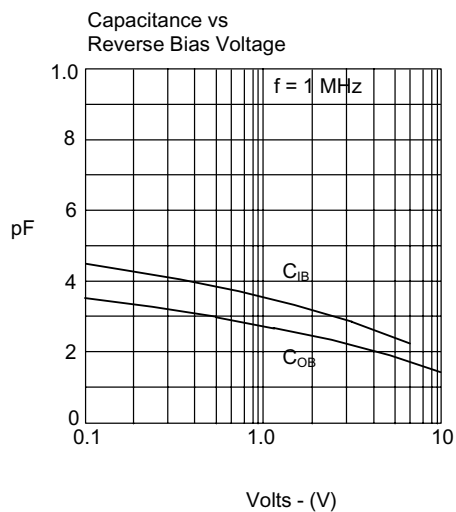
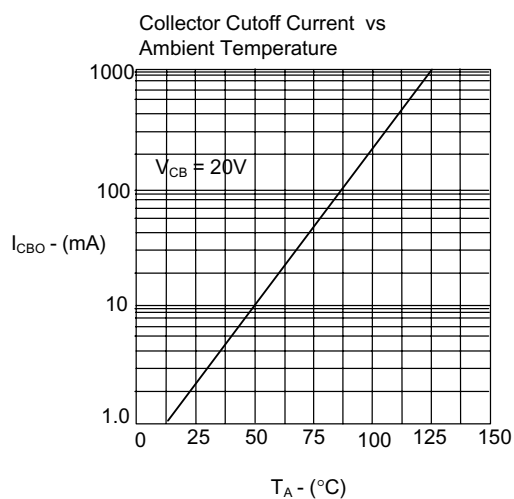
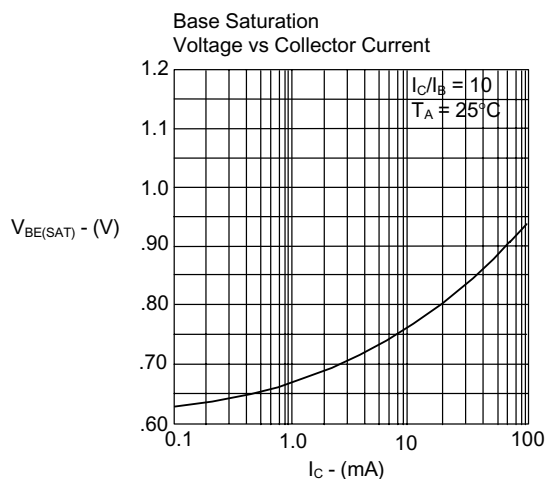
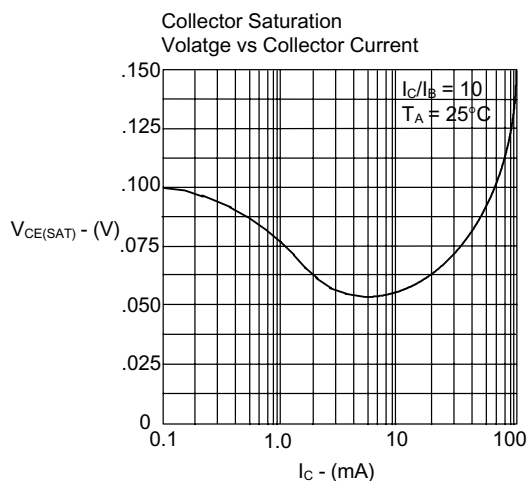
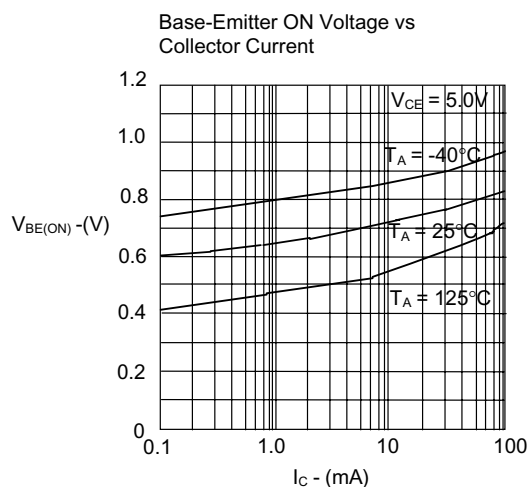
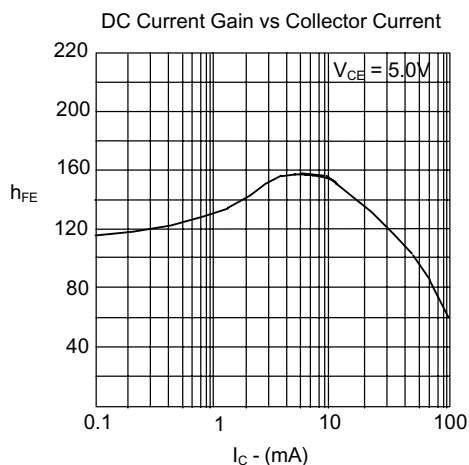


#### DIMENSIONS

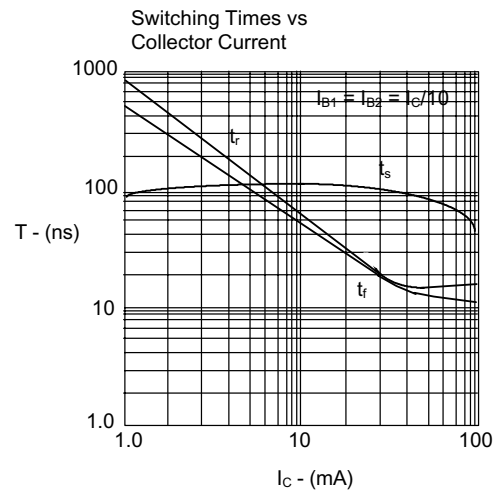
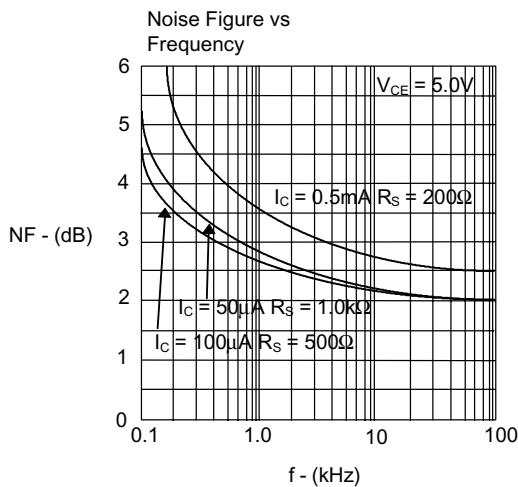
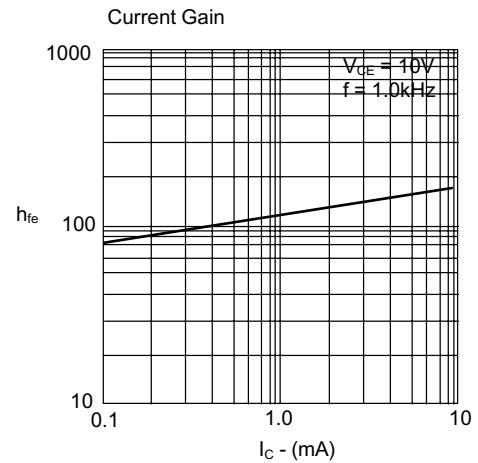
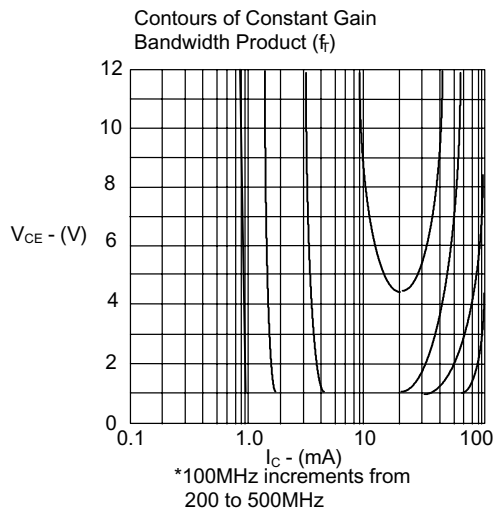
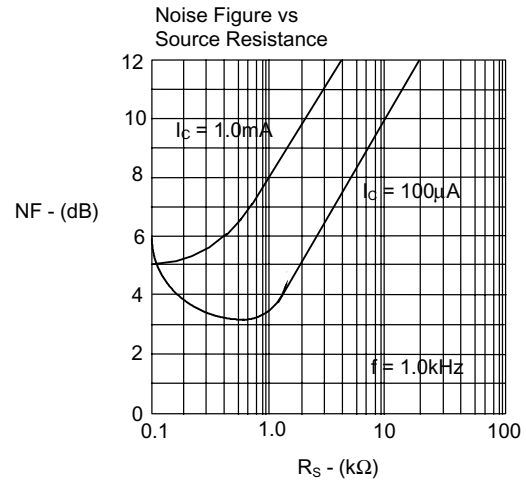
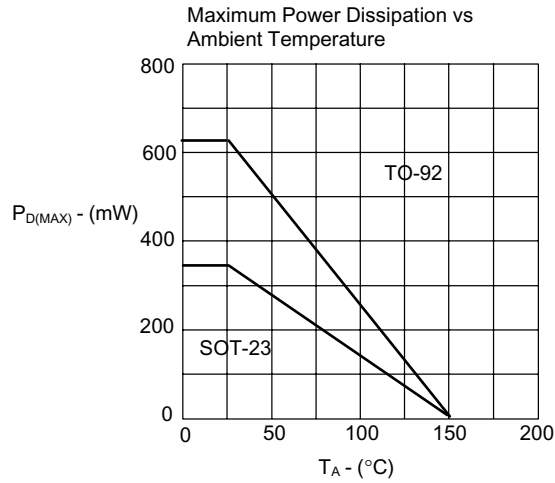
| DIM | INCHES |      | MM    |      | NOTE          |
|-----|--------|------|-------|------|---------------|
|     | MIN    | MAX  | MIN   | MAX  |               |
| A   | .175   | .185 | 4.45  | 4.70 |               |
| B   | .175   | .185 | 4.45  | 4.70 |               |
| C   | .500   | ---  | 12.70 | ---  |               |
| D   | .016   | .020 | 0.41  | 0.63 |               |
| E   | .135   | .145 | 3.43  | 3.68 |               |
| G   | .095   | .105 | 2.42  | 2.67 | Straight Lead |
|     | .173   | .220 | 4.40  | 5.60 | Bent Lead     |

\* For ammo packing detailed specification, click here to visit our website of product packaging for details.

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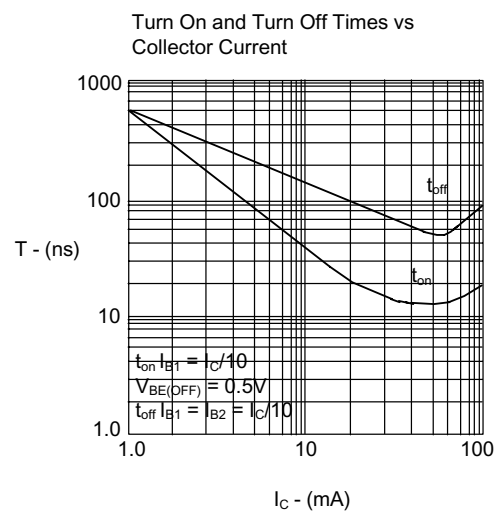
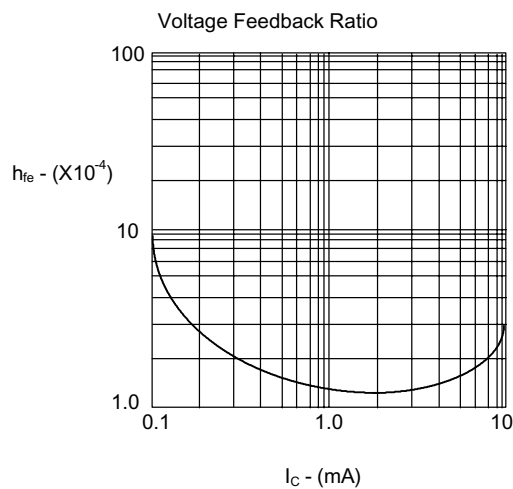
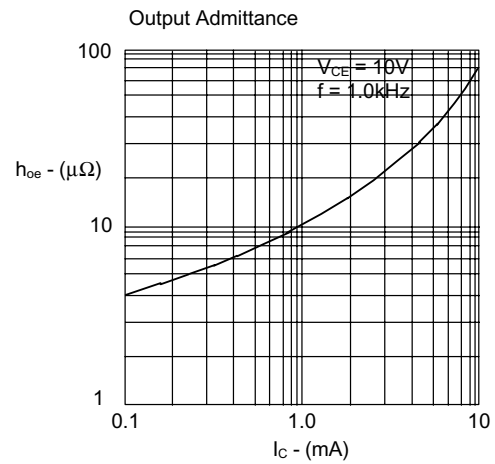
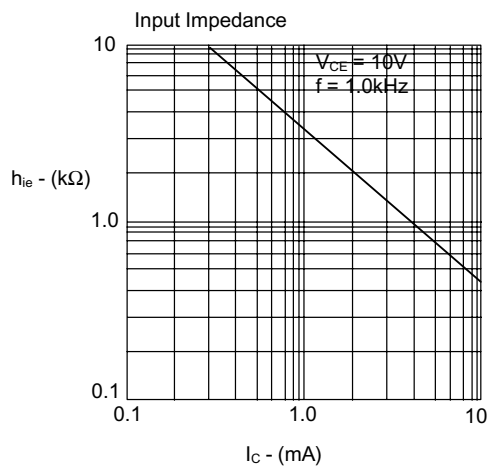
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## Ordering Information :

| Device         | Packing                     |
|----------------|-----------------------------|
| Part Number-AP | Ammo Packing: 20Kpcs/Carton |
| Part Number-BP | Bulk: 100Kpcs/Carton        |

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