

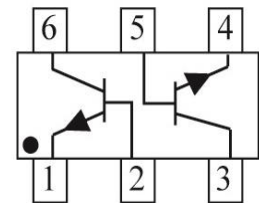
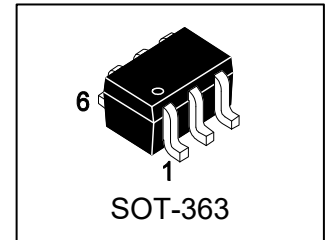
MBT3904D

S-MBT3904D

General Purpose Transistors NPN Silicon

1. FEATURES

- We declare that the material of product compliance with RoHS requirements and Halogen Free.
- S- prefix for automotive and other applications requiring unique site and control change requirements; AEC-Q101 qualified and PPAP capable.
- Low $V_{CE(sat)}$, ≤ 0.4 V
- Simplifies circuit design
- Reduces board space
- Reduces component count
- Available in 8 mm, 7-inch/3,000 unit tape and reel
- h_{FE} , 100–300



2. DEVICE MARKING AND ORDERING INFORMATION

| Device | Marking | Shipping |
|----------|---------|----------------|
| MBT3904D | MA | 3000/Tape&Reel |

3. MAXIMUM RATINGS($T_a = 25^\circ\text{C}$)

| Parameter | Symbol | Limits | Unit |
|--------------------------------|-----------|--------|------|
| Collector–Emitter Voltage | V_{CEO} | 40 | Vdc |
| Collector–Base Voltage | V_{CBO} | 60 | Vdc |
| Emitter–Base Voltage | V_{EBO} | 6 | Vdc |
| Collector Current — Continuous | I_C | 200 | mAdc |

4. THERMAL CHARACTERISTICS

| Parameter | Symbol | Limits | Unit |
|--|-----------------|-----------------|----------------------------|
| Total Device Dissipation, FR-5 Board (Note 1) @ $T_A = 25^\circ\text{C}$ Derate above 25°C | PD | 150 1.2 | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction–to–Ambient(Note 1) | $R_{\theta JA}$ | 833 | $^\circ\text{C}/\text{W}$ |
| Junction and Storage temperature | T_J, T_{stg} | $-55 \sim +150$ | $^\circ\text{C}$ |

1. FR-5 = 1.0×0.75×0.062 in.



5. ELECTRICAL CHARACTERISTICS (Ta= 25°C)

OFF CHARACTERISTICS

| Characteristic | Symbol | Min. | Typ. | Max. | Unit |
|--|----------|------|------|------|------|
| Collector–Emitter Breakdown Voltage (IC = 1.0 mA _{dc} , IB = 0) | VBR(CEO) | 40 | - | - | V |
| Collector–Base Breakdown Voltage (IC = 10 μA _{dc} , IE = 0) | VBR(CBO) | 60 | - | - | V |
| Emitter–Base Breakdown Voltage (IE = 10 μA _{dc} , IC = 0) | VBR(EBO) | 6 | - | - | V |
| Collector Cutoff Current (VCE = 30 V _{dc} , VEB = 3.0V _{dc}) | ICEX | - | - | 50 | nA |
| Base Cutoff Current (VCE = 30 V _{dc} , VEB = 3.0V _{dc}) | IBL | - | - | 50 | nA |

ON CHARACTERISTICS (Note 2.)

| | | | | | |
|---|----------|-----------------------------|-----------------------|-------------------------|---|
| DC Current Gain (IC = 0.1 mA _{dc} , VCE = 1.0 V _{dc}) (IC = 1.0 mA _{dc} , VCE = 1.0 V _{dc}) (IC = 10 mA _{dc} , VCE = 1.0 V _{dc}) (IC = 50 mA _{dc} , VCE = 1.0 V _{dc}) (IC = 100 mA _{dc} , VCE = 1.0 V _{dc}) | HFE | 40 70 100 60 30 | - - - - - | - - 300 - - | |
| Collector–Emitter Saturation Voltage (IC = 10 mA _{dc} , IB = 1.0 mA _{dc}) (IC = 50 mA _{dc} , IB = 5.0 mA _{dc}) | VCE(sat) | - - | - - | 0.2 0.3 | V |
| Base–Emitter Saturation Voltage (IC = 10 mA _{dc} , IB = 1.0 mA _{dc}) (IC = 50 mA _{dc} , IB = 5.0 mA _{dc}) | VBE(sat) | 0.65 - | - - | 0.85 0.95 | V |

SMALL–SIGNAL CHARACTERISTICS

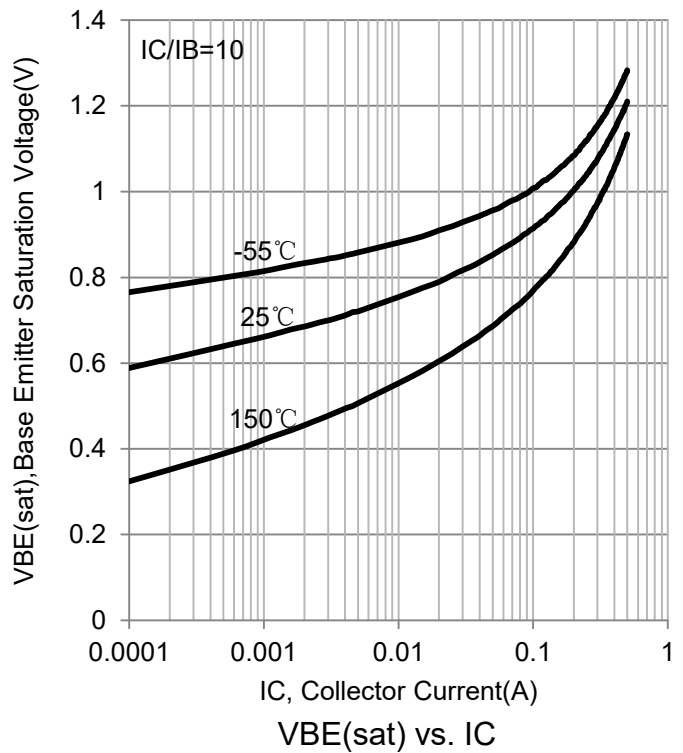
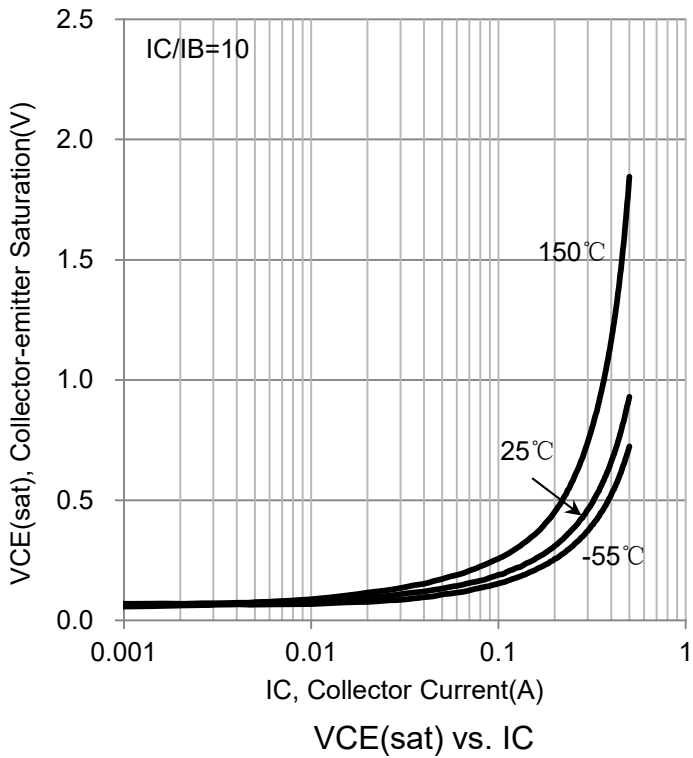
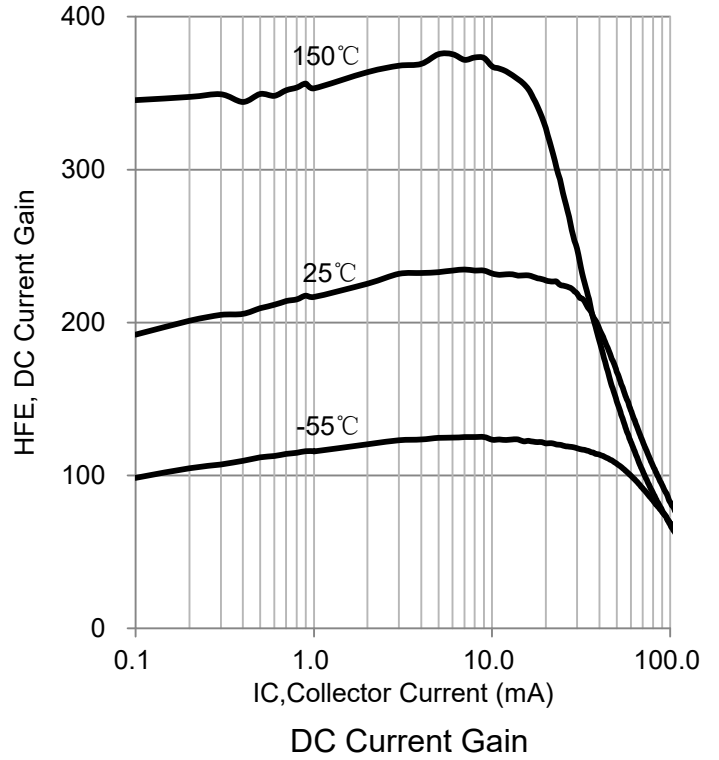
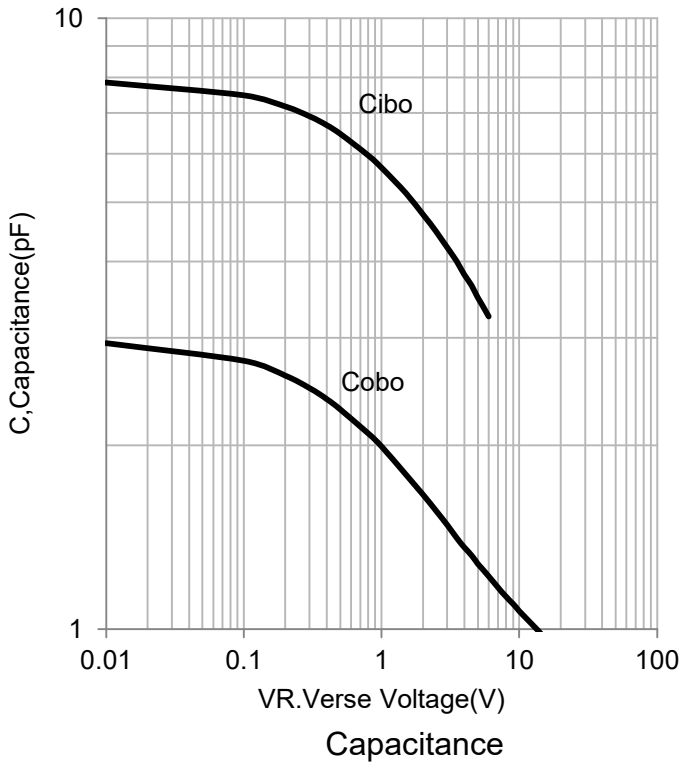
| | | | | | |
|---|------------------|-----|---|-----|--------------------|
| Current–Gain — Bandwidth Product (IC = 10mA _{dc} , VCE= 20V _{dc} , f = 100MHz) | f _T | 300 | - | - | MHz |
| Output Capacitance (VCB = 5.0 V _{dc} , IE = 0, f = 1.0 MHz) | C _{obo} | - | - | 4 | pF |
| Input Capacitance (VEB = 0.5 V _{dc} , IC = 0, f = 1.0 MHz) | C _{ibo} | - | - | 8 | pF |
| Input Impedance (VCE= 10 V _{dc} , IC = 1.0 mA _{dc} , f = 1.0 kHz) | h _{ie} | 1 | - | 10 | k Ω |
| Voltage Feedback Ratio (VCE= 10 V _{dc} , IC = 1.0 mA _{dc} , f = 1.0 kHz) | h _{re} | 0.5 | - | 8 | X 10 ⁻⁴ |
| Small–Signal Current Gain (VCE= 10 V _{dc} , IC = 1.0 mA _{dc} , f = 1.0 kHz) | h _{fe} | 100 | - | 400 | |
| Output Admittance (VCE= 10 V _{dc} , IC = 1.0 mA _{dc} , f = 1.0 kHz) | h _{oe} | 1 | - | 40 | μmhos |
| Noise Figure (VCE = 5V, IC = 100μ ₁ , RS = 1.0kΩ, f = 1.0kHz) | NF | - | - | 5 | dB |

SWITCHING CHARACTERISTICS

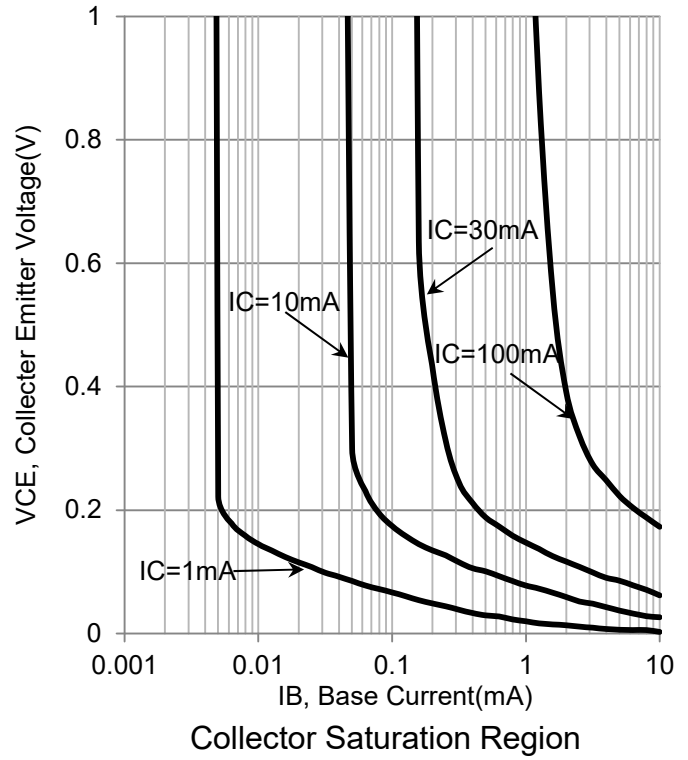
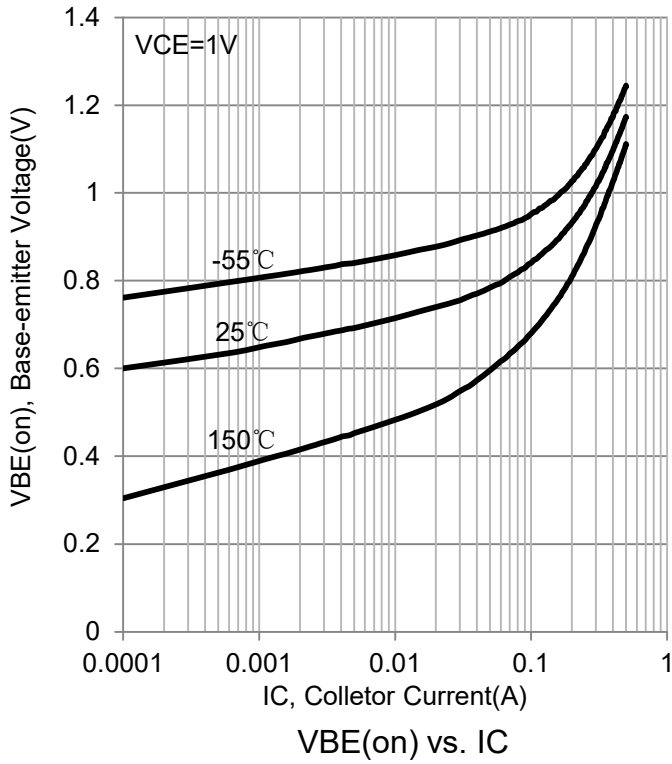
| | | | | | | |
|--------------|--|----------------|---|---|-----|----|
| Delay Time | (VCC = 3.0 V _{dc} , VBE = -0.5V _{dc} , IC = 10mA _{dc} , IB1 = 1.0 mA _{dc}) | t _d | - | - | 35 | ns |
| Rise Time | | t _r | - | - | 35 | |
| Storage Time | (VCC = 3.0 V _{dc} , IC = 10 mA _{dc} , IB1 = IB2 = 1.0 mA _{dc}) | t _s | - | - | 200 | |
| Fall Time | | t _f | - | - | 50 | |



6. ELECTRICAL CHARACTERISTICS CURVES



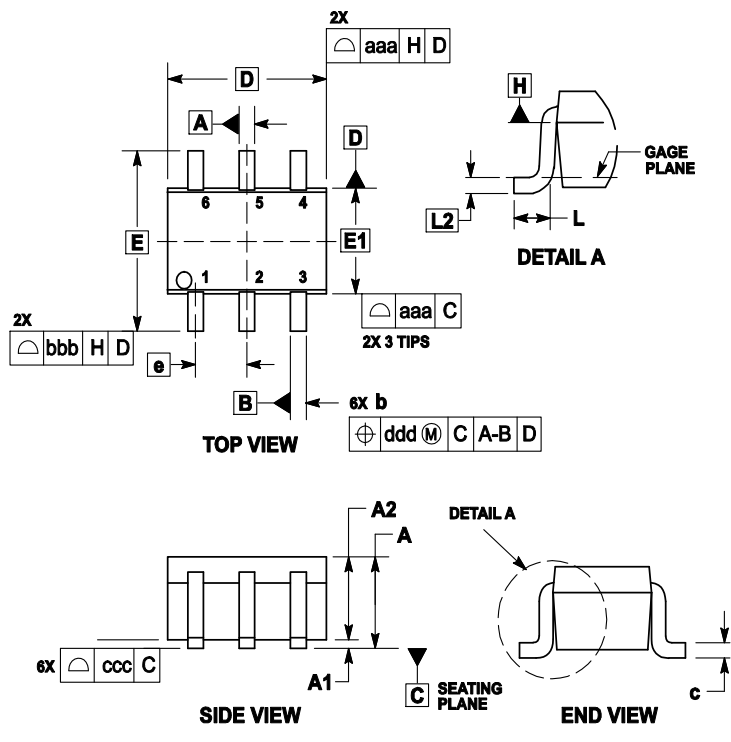
6. ELECTRICAL CHARACTERISTICS CURVES



7.OUTLINE AND DIMENSIONS

Notes:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.



| DIM | MILLIMETERS | | | INCHES | | |
|-----|-------------|------|------|-----------|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | --- | --- | 1.10 | --- | --- | 0.04 |
| A1 | 0.00 | --- | 0.10 | 0 | --- | 0 |
| A2 | 0.70 | 0.90 | 1.00 | 0.03 | 0.04 | 0.04 |
| b | 0.15 | 0.20 | 0.25 | 0.01 | 0.01 | 0.01 |
| C | 0.08 | 0.15 | 0.22 | 0 | 0.01 | 0.01 |
| D | 1.80 | 2.00 | 2.20 | 0.07 | 0.08 | 0.09 |
| E | 2.00 | 2.10 | 2.20 | 0.08 | 0.08 | 0.09 |
| E1 | 1.15 | 1.25 | 1.35 | 0.05 | 0.05 | 0.05 |
| e | 0.65 BSC | | | 0.026 BSC | | |
| L | 0.26 | 0.36 | 0.46 | ##### | 0.01 | 0.02 |
| L2 | 0.15 BSC | | | 0.006 BSC | | |
| aaa | 0.15 | | | 0.01 | | |
| bbb | 0.30 | | | 0.01 | | |
| ccc | 0.10 | | | 0.00 | | |
| ddd | 0.10 | | | 0.00 | | |

8.SOLDERING FOOTPRINT

