



YOUSHANG SEMICONDUCTOR

设计研发新型功率器件

各类小信号开关

中低压及高压大电流等场效应管

0755-83047638

ysbdt@szyoushang.cn

www.szyoushang.cn



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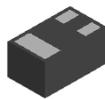
Features

- $BV_{CEO} > -40V$
- $I_C = -200mA$ High Collector Current
- $P_D = 1000mW$ Power Dissipation
- $0.60mm^2$ Package Footprint, 13 Times Smaller than SOT23
- 0.5mm Height Package Minimizing Off-Board Profile
- Complementary NPN Type DIODES™ NK-MMBT3904LP

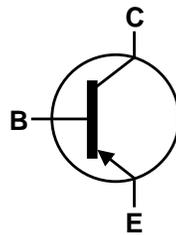
Mechanical Data

- Package: X1-DFN1006-3
- Package Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – NiPdAu, Solderable per MIL-STD-202, Method 208 
- Weight: 0.0008 grams (Approximate)

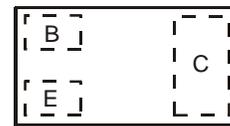
X1-DFN1006-3



Bottom View



Device Symbol



Top View
Device Schematic

Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---------------------------|------------------|-------|------|
| Collector-Base Voltage | V _{CB0} | -40 | V |
| Collector-Emitter Voltage | V _{CEO} | -40 | V |
| Emitter-Base Voltage | V _{EB0} | -6 | V |
| Collector Current | I _C | -200 | mA |
| Peak Collector Current | I _{CM} | -200 | mA |

Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|-----------------------------------|------------------|------|
| Power Dissipation | P _D | (Note 5) 400 | mW |
| | | (Note 6) 1000 | |
| Thermal Resistance, Junction to Ambient | R _{θJA} | (Note 5) 310 | °C/W |
| | | (Note 6) 120 | |
| Thermal Resistance, Junction to Case | R _{θJC} | 60 | °C/W |
| Operating and Storage Temperature Range | T _J , T _{STG} | -55 to +150 | °C |

ESD Ratings (Note 7)

| Characteristic | Symbol | Value | Unit | JEDEC Class |
|--|---------|-------|------|-------------|
| Electrostatic Discharge - Human Body Model | ESD HBM | 4,000 | V | 3A |
| Electrostatic Discharge - Machine Model | ESD MM | 200 | V | B |

- Notes:
5. For the device mounted on minimum recommended pad layout 2oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in steady state condition.
 6. Same as Note 5, except the exposed collector pad is mounted on 25mm x 25mm 2oz copper.
 7. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

Thermal Characteristics

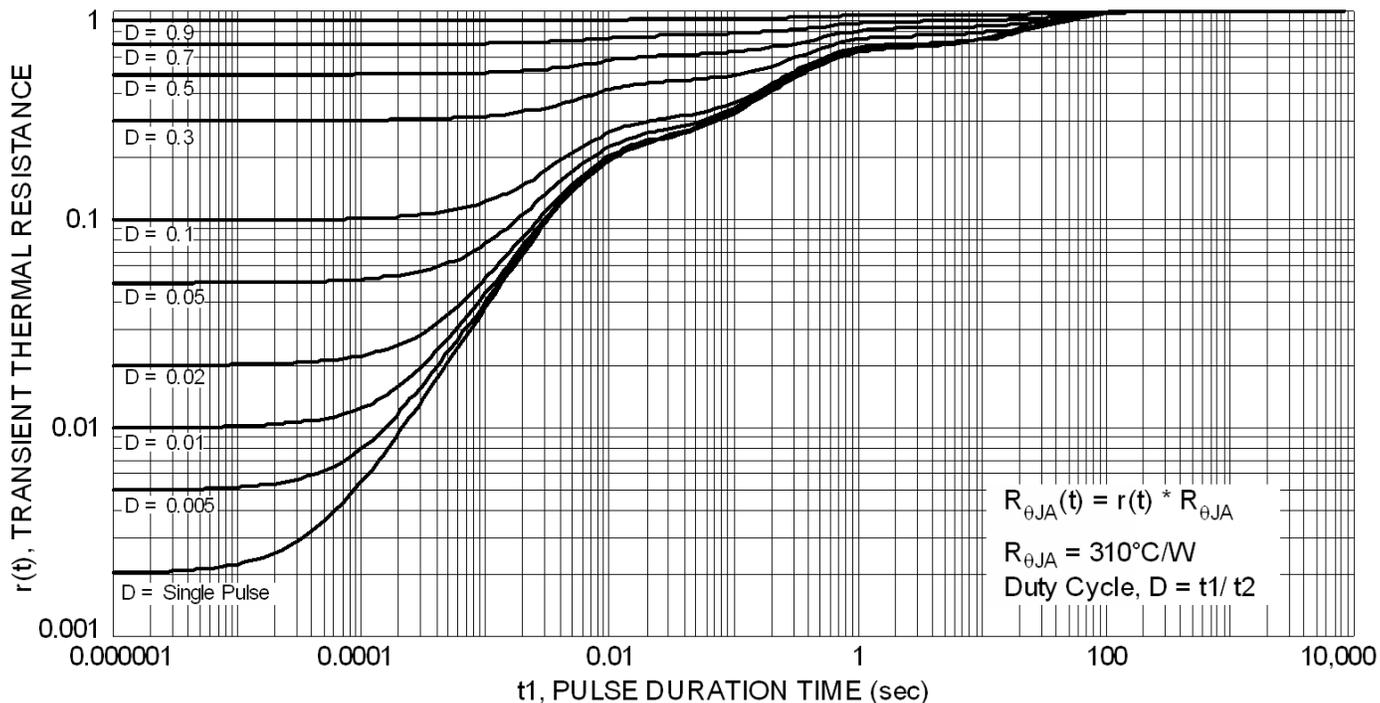


Fig. 1 Transient Thermal Resistance

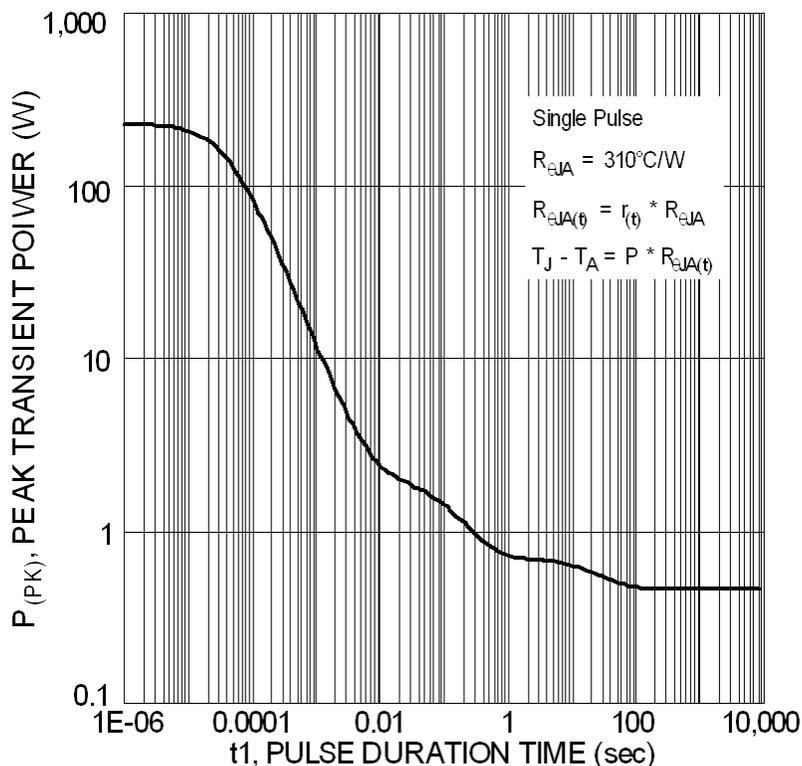


Fig. 2 Single Pulse Maximum Power Dissipation

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Max | Unit | Test Condition |
|--|----------------------|-------|-------|--------------------|--|
| OFF CHARACTERISTICS | | | | | |
| Collector-Base Breakdown Voltage | BV _{CBO} | -40 | — | V | I _C = -100μA |
| Collector-Emitter Breakdown Voltage (Note 8) | BV _{CEO} | -40 | — | V | I _C = -10.0mA |
| Emitter-Base Breakdown Voltage | BV _{EBO} | -6 | — | V | I _E = -100μA |
| Collector Cutoff Current | I _{CEX} | — | -50 | nA | V _{CE} = -30V, V _{EB(off)} = -3.0V |
| | I _{CBO} | — | -50 | nA | V _{CB} = -30V |
| Base Cutoff Current | I _{BL} | — | -50 | nA | V _{CE} = -30V, V _{EB(off)} = -3.0V |
| ON CHARACTERISTICS (Note 8) | | | | | |
| DC Current Gain | h _{FE} | 60 | — | — | I _C = -100μA, V _{CE} = -1.0V |
| | | 80 | — | | I _C = -1.0mA, V _{CE} = -1.0V |
| | | 100 | 300 | | I _C = -10mA, V _{CE} = -1.0V |
| | | 60 | — | | I _C = -50mA, V _{CE} = -1.0V |
| | | 30 | — | | I _C = -100mA, V _{CE} = -1.0V |
| Collector-Emitter Saturation Voltage | V _{CE(sat)} | — | -0.25 | V | I _C = -10mA, I _B = -1.0mA |
| | | — | -0.40 | | I _C = -50mA, I _B = -5.0mA |
| Base-Emitter Saturation Voltage | V _{BE(sat)} | -0.65 | -0.85 | V | I _C = -10mA, I _B = -1.0mA |
| | | — | -0.95 | | I _C = -50mA, I _B = -5.0mA |
| SMALL SIGNAL CHARACTERISTICS | | | | | |
| Output Capacitance | C _{obo} | — | 4.5 | pF | V _{CB} = -5.0V, f = 1.0MHz |
| Input Capacitance | C _{ibo} | — | 10 | pF | V _{EB} = -0.5V, f = 1.0MHz |
| Input Impedance | h _{ie} | 2 | 12 | kΩ | V _{CE} = -10V, I _C = -1.0mA f = 1.0kHz |
| Voltage Feedback Ratio | h _{re} | 0.1 | 10 | x 10 ⁻⁴ | |
| Small Signal Current Gain | h _{fe} | 100 | 400 | — | |
| Output Admittance | h _{oe} | 3 | 60 | μS | |
| Current Gain-Bandwidth Product | f _T | 300 | — | MHz | |
| SWITCHING CHARACTERISTICS | | | | | |
| Delay Time | t _d | — | 35 | ns | V _{CC} = -3.0V, I _C = -10mA I _{B1} = -I _{B2} = -1.0mA |
| Rise Time | t _r | — | 35 | ns | |
| Storage Time | t _s | — | 225 | ns | |
| Fall Time | t _f | — | 75 | ns | |

Note: 8. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

Typical Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

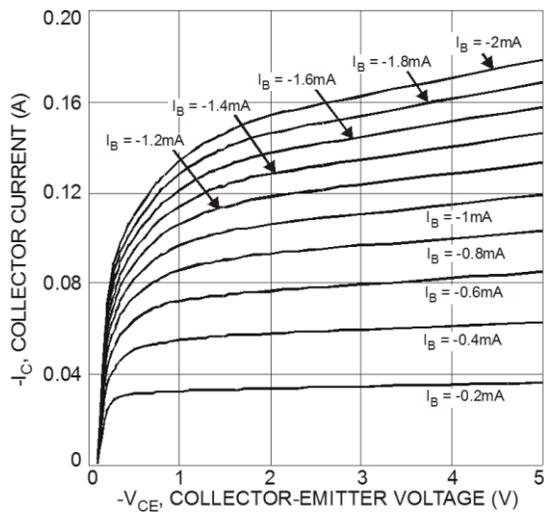


Fig. 3 Typical Collector Current vs. Collector-Emitter Voltage

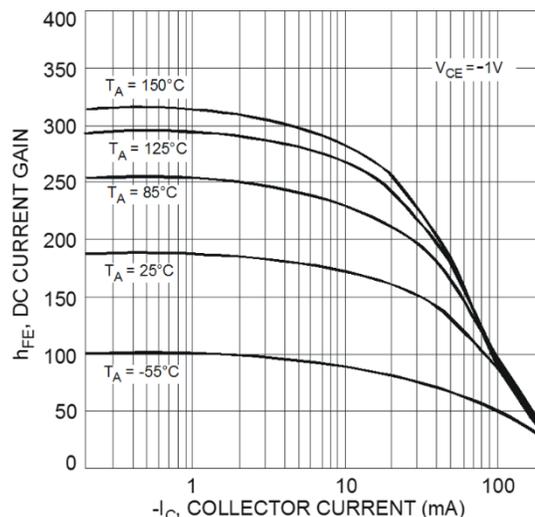


Fig. 4 Typical DC Current vs. Collector Current

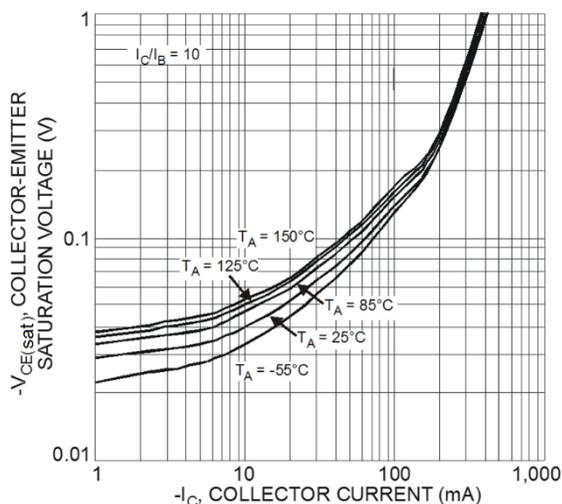


Fig. 5 Typical Collector-Emitter Saturation Voltage vs. Collector Current

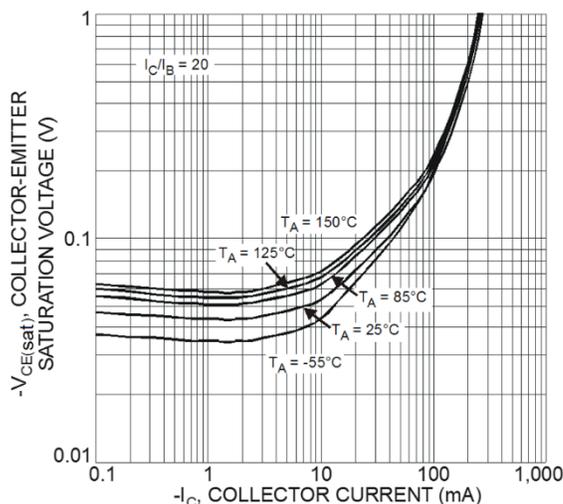


Fig. 6 Typical Collector-Emitter Saturation Voltage vs. Collector Current

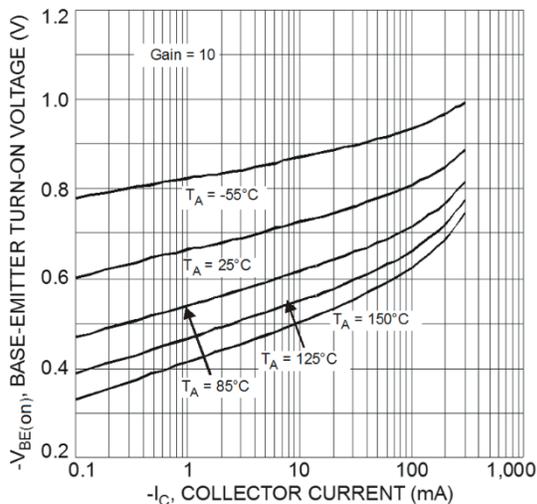


Fig. 7 Typical Base-Emitter Turn-On Voltage vs. Collector Current

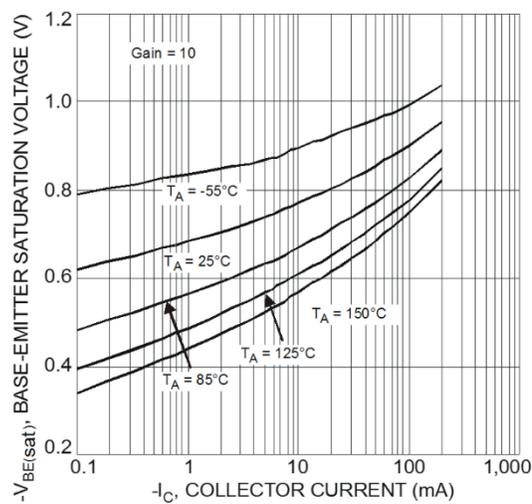
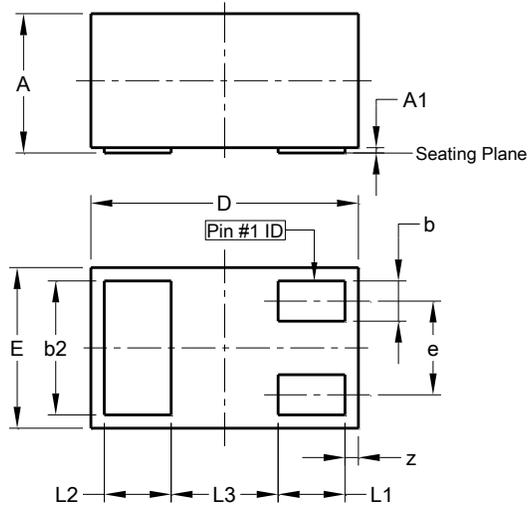


Fig. 8 Typical Base-Emitter Saturation Voltage vs. Collector Current

Package Outline Dimensions

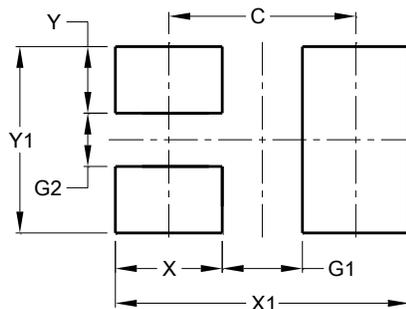
X1-DFN1006-3



| X1-DFN1006-3 | | | |
|----------------------|------|-------|------|
| Dim | Min | Max | Typ |
| A | 0.47 | 0.53 | 0.50 |
| A1 | 0.00 | 0.05 | 0.03 |
| b | 0.10 | 0.20 | 0.15 |
| b2 | 0.45 | 0.55 | 0.50 |
| D | 0.95 | 1.075 | 1.00 |
| E | 0.55 | 0.675 | 0.60 |
| e | - | - | 0.35 |
| L1 | 0.20 | 0.30 | 0.25 |
| L2 | 0.20 | 0.30 | 0.25 |
| L3 | - | - | 0.40 |
| z | 0.02 | 0.08 | 0.05 |
| All Dimensions in mm | | | |

Suggested Pad Layout

X1-DFN1006-3



| Dimensions | Value (in mm) |
|------------|---------------|
| C | 0.70 |
| G1 | 0.30 |
| G2 | 0.20 |
| X | 0.40 |
| X1 | 1.10 |
| Y | 0.25 |
| Y1 | 0.70 |