

2N5338 AND 2N5339

5 AMP

HIGH SPEED NPN TRANSISTOR

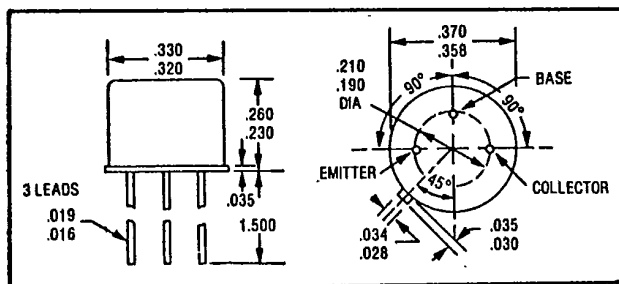
100 VOLTS



14830 Valley View Avenue
La Mirada, California 90638
(213) 921-9660
TWX 910-583-4807
FAX 213-921-2396

CASE STYLE W

JEDEC TO-5



FEATURES

- RADIATION TOLERANT
- FAST SWITCHING, 100 NSEC MAX t_d
- HIGH FREQUENCY, TYPICAL f_T 100 MHZ
- V_{CE0} 100 VOLTS MIN
- HIGH LINEAR GAIN, LOW SATURATION VOLTAGE
- 200°C OPERATING, GOLD EUTECTIC DIE ATTACH
- DESIGNED FOR COMPLEMENTARY USE WITH 2N6192 AND 2N6193
- 2N5334 THRU 2N5337 ALSO AVAILABLE

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|----------------|-------------|-------|
| Collector - Emitter Voltage | V_{CE0} | 100 | Volts |
| Collector - Base Voltage | V_{CB0} | 100 | Volts |
| Emitter - Base Voltage | V_{EB0} | 6 | Volts |
| Collector Current | I_C | 5 | Amps |
| Base Current | I_B | 1 | Amps |
| Total Device Dissipation @ $T_C = 25^\circ C$ | P_D | 6 | Watts |
| Derate above $25^\circ C$ | | 34.3 | mW/°C |
| Operating and Storage Temperature | T_j, T_{stg} | -65 to +200 | °C |

THERMAL CHARACTERISTICS

| Characteristics | Symbol | Value | Unit |
|--------------------------------------|-----------------|-------|------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 29.2 | °C/W |

ELECTRICAL CHARACTERISTICS

| Characteristics | Symbol | Min. | Max. | Unit |
|---|--------------|------|------|------|
| Collector - Emitter Breakdown Voltage* ($I_C = 50$ mA dc) | BV_{CE0} * | 100 | | Vdc |
| Collector - Base Breakdown Voltage ($I_C = 200$ μ A dc) | BV_{CB0} | 100 | | Vdc |
| Emitter - Base Breakdown Voltage ($I_E = 200$ μ A dc) | BV_{EB0} | 6 | | Vdc |

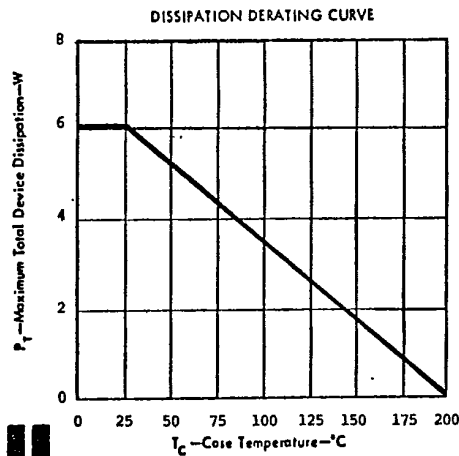
NOTE: All specifications subject to change without notice.

ELECTRICAL CHARACTERISTICS

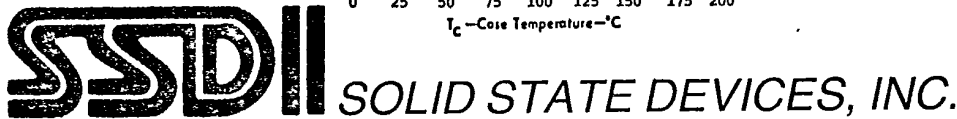
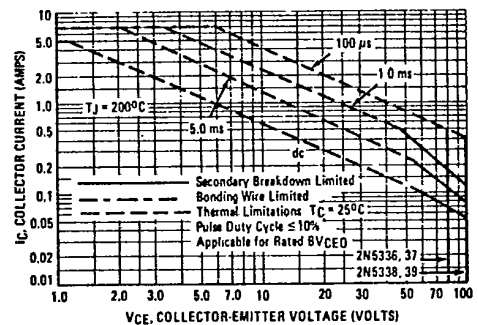
| Characteristics | Symbol | Min. | Max. | Unit |
|---|---------------|----------------------------------|------------------|--|
| Collector Cutoff Current ($V_{CE} = 90 \text{ Vdc}$) ($V_{CE} = 90 \text{ Vdc}, V_{EB} = 1.5 \text{ Vdc}$) ($V_{CE} = 90 \text{ Vdc}, V_{EB} = 1.5 \text{ Vdc}, T_C = 150^\circ\text{C}$) | | | 100 10 1.0 | $\mu\text{A dc}$ $\mu\text{A dc}$ mA dc |
| Collector Cutoff Current ($V_{CB} = 100 \text{ Vdc}$) | I_{CBO} | | 10 | $\mu\text{A dc}$ |
| Emitter Cutoff Current ($V_{EB} = 6 \text{ Vdc}$) | I_{EBO} | | 100 | $\mu\text{A dc}$ |
| DC Current Gain* ($I_C = 500 \text{ mA dc}, V_{CE} = 2 \text{ Vdc}$) ($I_C = 2 \text{ A dc}, V_{CE} = 2 \text{ Vdc}$) ($I_C = 5 \text{ A dc}, V_{CE} = 2 \text{ Vdc}$) | h_{FE} | 30 60 30 60 20 40 | 120 240 | |
| Collector - Emitter Saturation Voltage* ($I_C = 2 \text{ A dc}, I_B = 200 \text{ mA dc}$) ($I_C = 5 \text{ A dc}, I_B = 500 \text{ mA dc}$) | $V_{CE(SAT)}$ | | 0.7 1.2 | Vdc |
| Base - Emitter Saturation Voltage* ($I_C = 2 \text{ A dc}, I_B = 200 \text{ mA dc}$) ($I_C = 5 \text{ A dc}, I_B = 500 \text{ mA dc}$) | $V_{BE(SAT)}$ | | 1.2 1.8 | Vdc |
| Current - Gain - Bandwidth Product ($I_C = 500 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}, f = 10 \text{ MHz}$) | f_T | 30 | | M Hz |
| Output Capacitance ($V_{CB} = 10 \text{ Vdc}, I_E = 0, f = 100 \text{ KHz}$) | C_{ob} | | 250 | pf |
| Input Capacitance ($V_{BE} = 2 \text{ Vdc}, I_C = 0, f = 100 \text{ KHz}$) | C_{ib} | | 1000 | pf |
| Delay Time ($V_{CC} = 40 \text{ Vdc}$) | t_d | | 100 | ns |
| Rise Time ($I_C = 2.0 \text{ A dc}$) | t_r | | 100 | ns |
| Storage Time ($V_{EB(Off)} = 3.0 \text{ Vdc}$) | t_s | | 2.0 | μs |
| Fall Time ($I_{B1} = I_{B2} = 200 \text{ mA dc}$) | t_f | | 200 | ns |

*Pulse Test: Pulse width = 300 μs , DutyCycle = 2%

TYPICAL OPERATING CURVES



FORWARD BIAS DC SAFE OPERATION AREA (S.O.A. CURVE)
CURVES APPLY BELOW RATED V_{CEO} $T_C = 25^\circ\text{C}$



2N3996 AND 2N3997

5 AMP

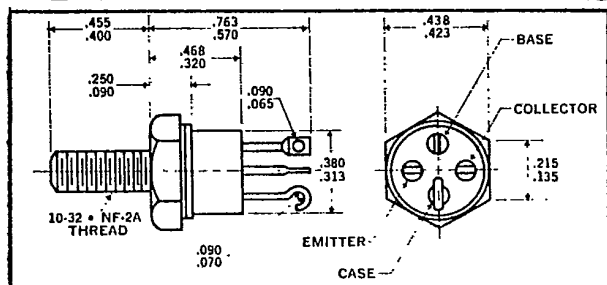
HIGH SPEED NPN TRANSISTOR

100 VOLTS

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CASE STYLE Z**JEDEC TO-111****ALL TERMINALS ISOLATED FROM CASE****FEATURES**

- RADIATION TOLERANT
- FAST SWITCHING, 300 NSEC MAX t_{on}
- HIGH FREQUENCY, TYPICAL f_T 100 MHZ
- V_{CEO} 80 VOLTS MIN
- HIGH LINEAR GAIN, LOW SATURATION VOLTAGE
- 200°C OPERATING, GOLD EUTECTIC DIE ATTACH
- DESIGNED FOR COMPLEMENTARY USE WITH 2N4999 AND 2N5001

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|--|----------------|-------------|-------|
| Collector - Emitter Voltage | V_{CEO} | 80 | Volts |
| Collector - Base Voltage | V_{CBO} | 100 | Volts |
| Emitter - Base Voltage | V_{EBO} | 8 | Volts |
| Collector Current | I_C | 5 | Amps |
| Base Current | I_B | 1 | Amps |
| Total Device Dissipation @ $T_C = 100^\circ\text{C}$ | P_D | 30 | Watts |
| Derate above 100 °C | | 300 | mW/°C |
| Operating and Storage Temperature | T_j, T_{stg} | -65 to +200 | °C |

THERMAL CHARACTERISTICS

| Characteristics | Symbol | Value | Unit |
|--------------------------------------|-----------------|-------|------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.33 | °C/W |

ELECTRICAL CHARACTERISTICS

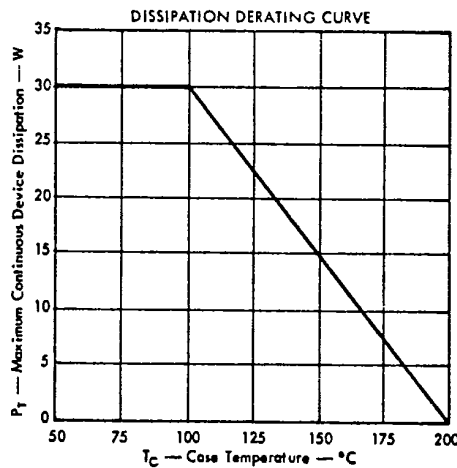
| Characteristics | Symbol | Min. | Max. | Unit |
|---|--------------|------|------|------|
| Collector - Emitter Breakdown Voltage* ($I_C = 50$ mA dc) | BV_{CEO}^* | 80 | | Vdc |
| Collector - Base Breakdown Voltage ($I_C = 200$ uA dc) | BV_{CBO} | 100 | | Vdc |
| Emitter - Base Breakdown Voltage ($I_E = 200$ uA dc) | BV_{EBO} | 8 | | Vdc |

ELECTRICAL CHARACTERISTICS

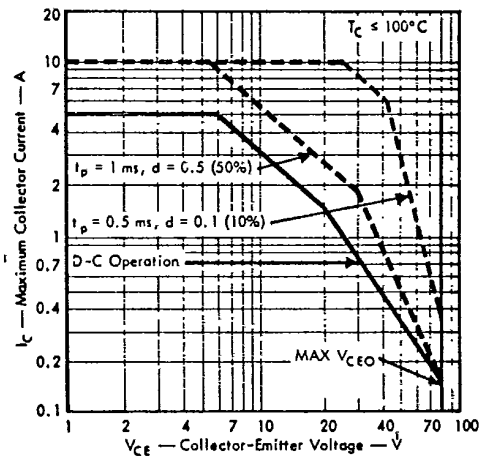
| Characteristics | Symbol | Min. | Max. | Unit |
|---|----------------------------------|----------------------------------|-------------|------------------------------------|
| Collector Cutoff Current ($V_{CE} = 60 \text{ Vdc}$) | I_{CEO} | | 10 | μAdc |
| Collector Cutoff Current ($V_{CE} = 90 \text{ Vdc}$) ($V_{CE} = 90 \text{ Vdc}, T_C = 150^\circ\text{C}$) | I_{CES} | | 5 50 | μAdc μAdc |
| Emitter Cutoff Current ($V_{EB} = 5 \text{ Vdc}$) ($V_{EB} = 8 \text{ Vdc}$) | I_{EBO} | | 500 10 | nAdc μAdc |
| DC Current Gain* ($I_C = 50 \text{ mAdc}, V_{CE} = 2 \text{ Vdc}$) ($I_C = 1 \text{ Adc}, V_{CE} = 2 \text{ Vdc}$) ($I_C = 5 \text{ Adc}, V_{CE} = 2 \text{ Vdc}$) | h_{FE} | 30 60 40 80 15 20 | 120 240 | |
| Collector - Emitter Saturation Voltage* ($I_C = 1 \text{ Adc}, I_B = 100 \text{ mAdc}$) ($I_C = 5 \text{ Adc}, I_B = 500 \text{ mAdc}$) | $V_{CE(SAT)}$ | | 0.25 2.0 | Vdc |
| Base - Emitter Saturation Voltage* ($I_C = 1 \text{ Adc}, I_B = 100 \text{ mAdc}$) ($I_C = 5 \text{ Adc}, I_B = 500 \text{ mAdc}$) | $V_{BE(SAT)}$ | 0.6 | 1.2 1.6 | Vdc |
| Current - Gain - Bandwidth Product ($I_C = 1 \text{ Adc}, V_{CE} = 5 \text{ Vdc}, f = 10 \text{ MHz}$) | f_T | 40 | | MHz |
| Output Capacitance ($V_{CB} = 10 \text{ Vdc}, I_E = 0.1 = 1 \text{ MHz}$) | C_{ob} | | 150 | pf |
| Delay Time Rise Time Storage Time Fall Time | t_d t_r t_s t_f | | 300 | n s u s |

*Pulse Test: Pulse width = 300 μs , DutyCycle = 2%

TYPICAL OPERATING CURVES



FORWARD BIAS DC SAFE OPERATION AREA (S.O.A.) CURVE
CURVES APPLY BELOW RATED V_{CE0} $T_C = 25^\circ\text{C}$



2N5002 AND 2N5004

5 AMP

HIGH SPEED NPN TRANSISTOR

100 VOLTS

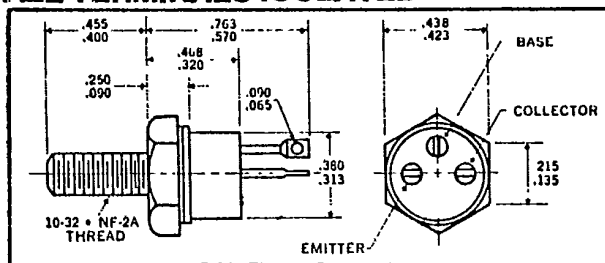


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CASE STYLE X

JEDEC TO-59

ALL TERMINALS ISOLATED FROM CASE



FEATURES

- RADIATION TOLERANT
- FAST SWITCHING, TYPICAL 200 NSEC t_{on}
- HIGH FREQUENCY, TYPICAL f_T 100 MHZ
- V_{CE0} 80 VOLTS MIN
- HIGH LINEAR GAIN, LOW SATURATION VOLTAGE
- 200°C OPERATING, GOLD EUTECTIC DIE ATTACH
- DESIGNED FOR COMPLEMENTARY USE WITH 2N5003 AND 2N5005

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|----------------|-------------|-------|
| Collector - Emitter Voltage | V_{CE0} | 80 | Volts |
| Collector - Base Voltage | V_{CBO} | 100 | Volts |
| Emitter - Base Voltage | V_{EBO} | 6 | Volts |
| Collector Current | I_C | 5 | Amps |
| Base Current | I_B | 2 | Amps |
| Total Device Dissipation @ $T_C = 50^\circ C$ | P_D | 50 | Watts |
| Derate above 50 °C | | 333 | mW/°C |
| Operating and Storage Temperature | T_j, T_{stg} | -65 to +200 | °C |

THERMAL CHARACTERISTICS

| Characteristics | Symbol | Value | Unit |
|--------------------------------------|-----------------|-------|------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.0 | °C/W |

ELECTRICAL CHARACTERISTICS

| Characteristics | Symbol | Min. | Max. | Unit |
|--|------------|------|------|------|
| Collector - Emitter Breakdown Voltage* ($I_C = 100$ mA) | BV_{CE0} | 80 | | Vdc |
| Collector - Base Breakdown Voltage ($I_C = 200$ μ A) | BV_{CBO} | 100 | | Vdc |
| Emitter - Base Breakdown Voltage ($I_E = 200$ μ A) | BV_{EBO} | 6 | | Vdc |

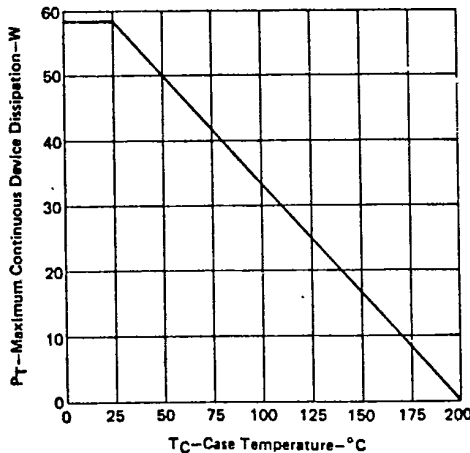
ELECTRICAL CHARACTERISTICS

| Characteristics | Symbol | Min. | Max. | Unit |
|--|------------------------|----------------------------------|-------------|-------------------|
| Collector Cutoff Current (VCE = 60 Vdc, VBE = 2 Vdc, TC = 150°C) (VCE = 40 Vdc) | I_{CEV} I_{CEO} | | 500 50 | μ Adc uAdc |
| Collector Cutoff Current (VCE = 60 Vdc) (VCE = 100 Vdc) | I_{CES} | | 1.0 1.0 | μ Adc mAcd |
| Emitter Cutoff Current (VEB = 5 Vdc) (VEB = 6 Vdc) | I_{EBO} | | 1.0 1.0 | μ Adc mAcd |
| DC Current Gain* ($I_C = 50$ mAcd, $V_{CE} = 5$ Vdc) ($I_C = 2.5$ Acd, $V_{CE} = 5$ Vdc) ($I_C = 5$ Acd, $V_{CE} = 5$ Vdc) | h_{FE} | 20 50 30 70 20 40 | 90 200 | |
| Collector - Emitter Saturation Voltage* ($I_C = 2.5$ Acd, $I_B = 250$ mAcd) ($I_C = 5$ Acd, $I_B = 500$ mAcd) | $V_{CE(SAT)}$ | | 0.75 1.5 | Vdc |
| Base - Emitter Saturation Voltage* ($I_C = 2.5$ Acd, $I_B = 250$ mAcd) ($I_C = 5$ Acd, $I_B = 500$ mAcd) | $V_{BE(SAT)}$ | | 1.45 2.2 | Vdc |
| Current - Gain - Bandwidth Product ($I_C = 500$ mAcd, $V_{CE} = 5$ Vdc, $f = 20$ MHz) | f_T | 60 70 | | M Hz |
| Output Capacitance ($V_{CB} = 10$ Vdc, $f = 0.1 = 1$ MHz) | C_{ob} | | 250 | pf |
| Base - Emitter Voltage* ($V_{CE} = 5$ Vdc, $I_C = 2.5$ Acd) | $V_{BE(ON)}$ * | | 1.45 | Vdc |
| Delay Time ($V_{CC} = 30$ Vdc, $I_C = 5$ Acd, $V_{EB(Off)} = 3.7$ Vdc, $I_{B1} = I_{B2} = 500$ mAcd, $R_L = 6$ Ohms) | $t_d + t_r$ | | 500 | ns |
| Rise Time | t_r | | | |
| Storage Time | $t_s + t_f$ | | 1.3 | us |
| Fall Time | t_f | | | |

*Pulse Test: Pulse width = 300 us, DutyCycle = 2%

TYPICAL OPERATING CURVES

DISSIPATION DERATING CURVE



FORWARD BIAS DC SAFE OPERATION AREA (S.O.A. CURVE)

CURVES APPLY BELOW RATED V_{CEO} $T_C = 25^\circ C$

