

Features

| | |
|----------------------------------|-----------------|
| BV _{CEO} | 80 V |
| I _C (max) | 1 A |
| H _{FE} at 10 V - 150 mA | > 100 |
| Operating temperature range | -65°C to +200°C |

- Hi-Rel NPN bipolar transistor
- Linear gain characteristics
- ESCC qualified
- European preferred part list - EPPL
- Radiation level: lot specific total dose contact marketing for specified level

Description

The 2N3019HR is a silicon planar epitaxial NPN transistor in a TO-39 package. It is specifically designed for aerospace Hi-Rel applications, and ESCC qualified in accordance with the 5201-003 specification. In case of discrepancies between this datasheet and ESCC detailed specification, the latter prevails.

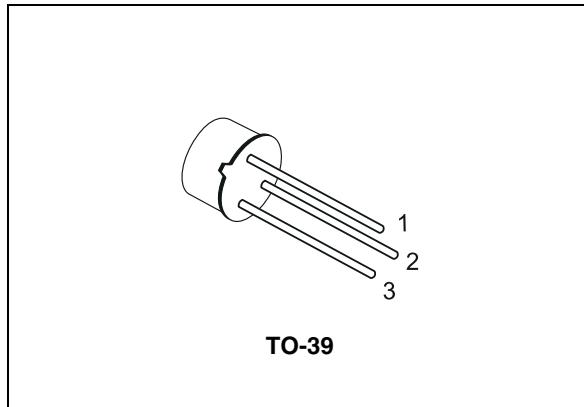


Figure 1. Internal schematic diagram

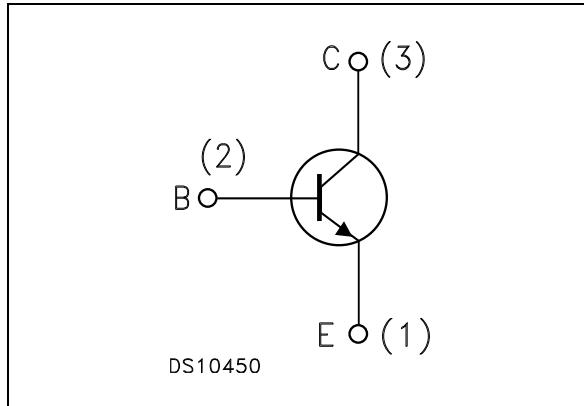


Table 1. Device summary

| Order codes | Package | Lead finish | Marking | Type | EPPL | Packaging |
|-------------|---------|-----------------|------------------------|-------------|------|------------|
| 2N3019HR | TO-39 | Gold Solder Dip | 520101103 520101104 | ESCC Flight | Yes | Strip pack |

1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|-----------|------------------------------------------------------|------------|------------------|
| V_{CBO} | Collector-base voltage ($I_E = 0$) | 140 | V |
| V_{CEO} | Collector-emitter voltage ($I_B = 0$) | 80 | V |
| V_{EBO} | Emitter-base voltage ($I_C = 0$) | 7 | V |
| I_C | Collector current | 1 | A |
| P_{TOT} | Total dissipation at $T_{amb} \leq 25^\circ\text{C}$ | 0.8 | W |
| | Total dissipation at $T_c \leq 25^\circ\text{C}$ | 5 | W |
| T_{STG} | Storage temperature | -65 to 200 | $^\circ\text{C}$ |
| T_J | Max. operating junction temperature | 200 | $^\circ\text{C}$ |

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|------------|-------------------------------------|-------|---------------------------|
| R_{thJC} | Thermal resistance junction-case | 35 | $^\circ\text{C}/\text{W}$ |
| R_{thJA} | Thermal resistance junction-ambient | 218 | $^\circ\text{C}/\text{W}$ |

2 Electrical characteristics

$T_{case} = 25^\circ\text{C}$ unless otherwise specified

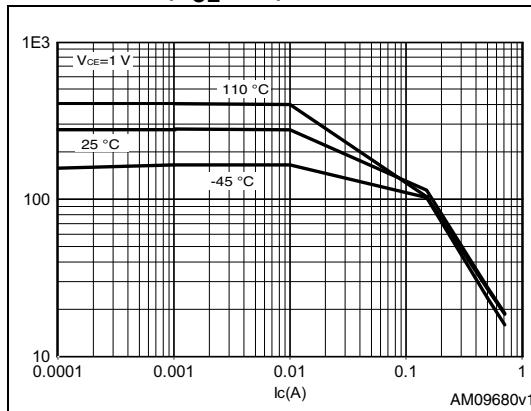
Table 4. Electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------|-------------------|---------------------|
| I_{CES} | Collector cut-off current ($I_E = 0$) | $V_{CB} = 90\text{ V}$ $V_{CB} = 90\text{ V}, T_{amb} = 150^\circ\text{C}$ | | - | 10 10 | nA μA |
| I_{EBO} | Emitter cut-off current ($I_C = 0$) | $V_{EB} = 5\text{ V}$ | | - | 10 | nA |
| $V_{(BR)CBO}$ | Collector-base breakdown voltage ($I_E = 0$) | $I_C = 100\text{ }\mu\text{A}$ | 140 | - | | V |
| $V_{(BR)CEO}^{(1)}$ | Collector-emitter breakdown voltage ($I_B = 0$) | $I_C = 30\text{ mA}$ | 80 | - | | V |
| $V_{(BR)EBO}$ | Emitter-base breakdown voltage ($I_C = 0$) | $I_E = 100\text{ }\mu\text{A}$ | 7 | - | | V |
| $V_{CE(sat)}^{(1)}$ | Collector-emitter saturation voltage | $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ $I_C = 500\text{ mA}, I_B = 50\text{ mA}$ | | - | 0.2 0.5 | V V |
| $V_{BE(sat)}^{(1)}$ | Base-emitter saturation voltage | $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ | | - | 1.1 | V |
| $h_{FE}^{(1)}$ | DC current gain | $I_C = 0.1\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 500\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 1\text{ A}, V_{CE} = 10\text{ V}$ $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}$ $T_{amb} = -65^\circ\text{C}$ | 50 90 100 50 15 40 | - | 200 300 200 | |
| h_{fe} | Small signal current gain | $V_{CE} = 10\text{ V}, I_C = 50\text{ mA}$ $f = 20\text{ MHz}$ | 5 | - | 20 | |
| h_{fe} | Small signal short circuit forward current transfer ratio | $V_{CE} = 5\text{ V}, I_C = 1\text{ mA}$ | 80 | - | 400 | |
| C_{CBO} | Output capacitance ($I_E = 0$) | $V_{CB} = 10\text{ V}, f = 1\text{ MHz}$ | | - | 12 | pF |
| C_{IBO} | Input capacitance ($I_C = 0$) | $V_{EB} = 0.5\text{ V}, f = 1\text{ MHz}$ | | - | 60 | pF |
| NF | Noise figure | $V_{CE} = 10\text{ V}, I_C = 100\text{ }\mu\text{A}$ $R_G = 1\text{ k}\Omega$ Bandwidth = 200 Hz | | - | 4 | dB |
| $t_{C(CB)}$ | Collector-base constant time | $V_{CE} = 10\text{ V}, I_C = 10\text{ mA}$ $f = 79.8\text{ MHz}$ | | - | 400 | ps |
| $t_{on} + t_{off}$ | Pulse response | $V_{CC} = 20\text{ V}$, see <i>Figure 8</i> | | - | 30 | ns |

1. Pulsed duration = 300 μs , duty cycle $\leq 2\%$

2.1 Electrical characteristics (curves)

**Figure 2. DC current gain
($V_{CE}=1$ V)**



**Figure 3. DC current gain
($V_{CE}=10$ V)**

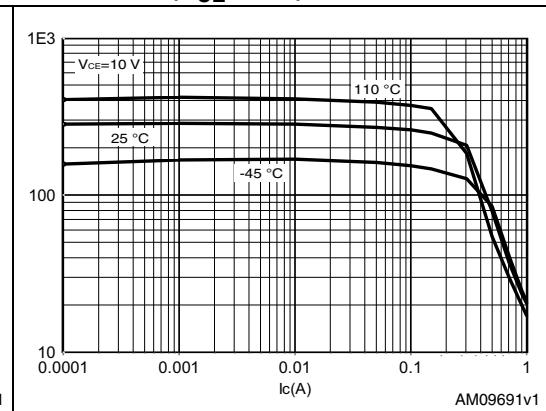


Figure 4. Collector emitter saturation voltage

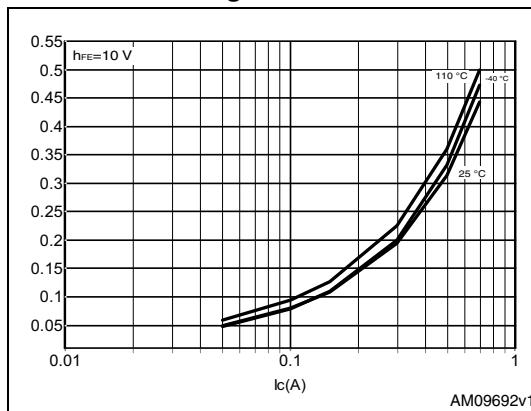
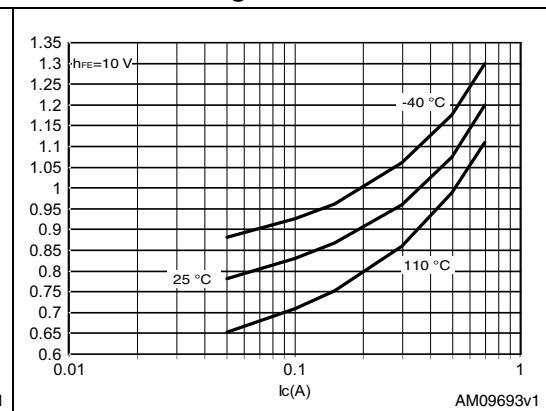
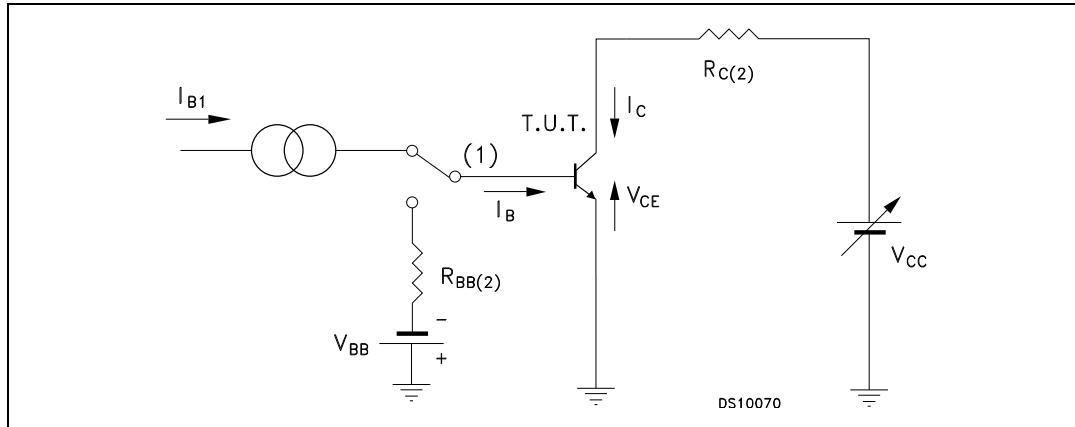


Figure 5. Base emitter saturation voltage



2.2 Test circuits

Figure 6. Resistive load switching test circuit



1. Fast electronic switch
2. Non-inductive resistor

Figure 7. Circuit for electrical measurement

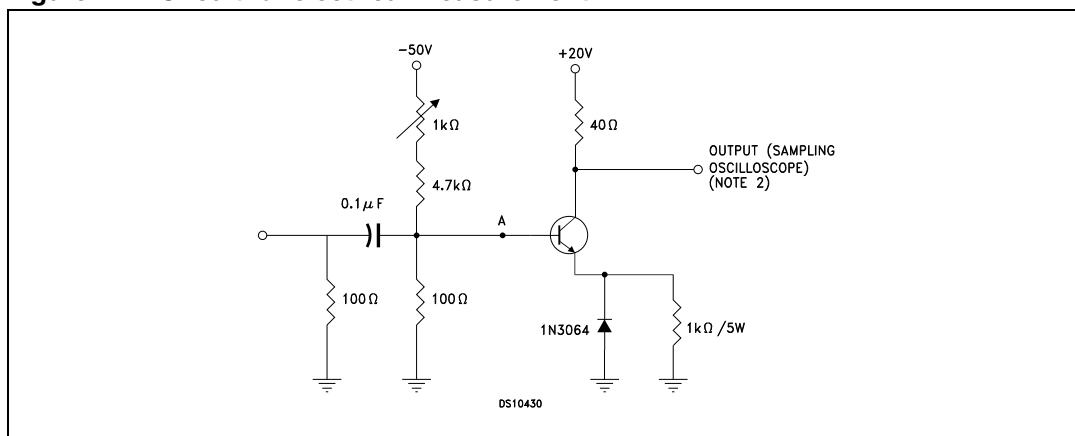
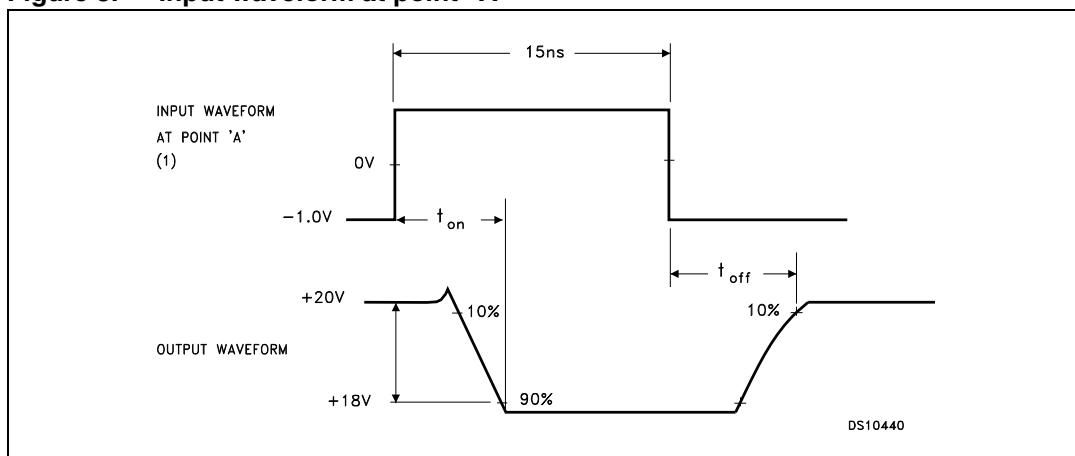


Figure 8. Input waveform at point "A"



1. $t_r \leq 5$ ns, duty cycle $\leq 2\%$, $Z_{IN} = 50 \Omega$
2. Sampling oscilloscope: $Z_{IN} \geq 100 \text{ k}\Omega$, $C_{IN} \leq 12 \text{ pF}$, $t_r \leq 5 \text{ ns}$

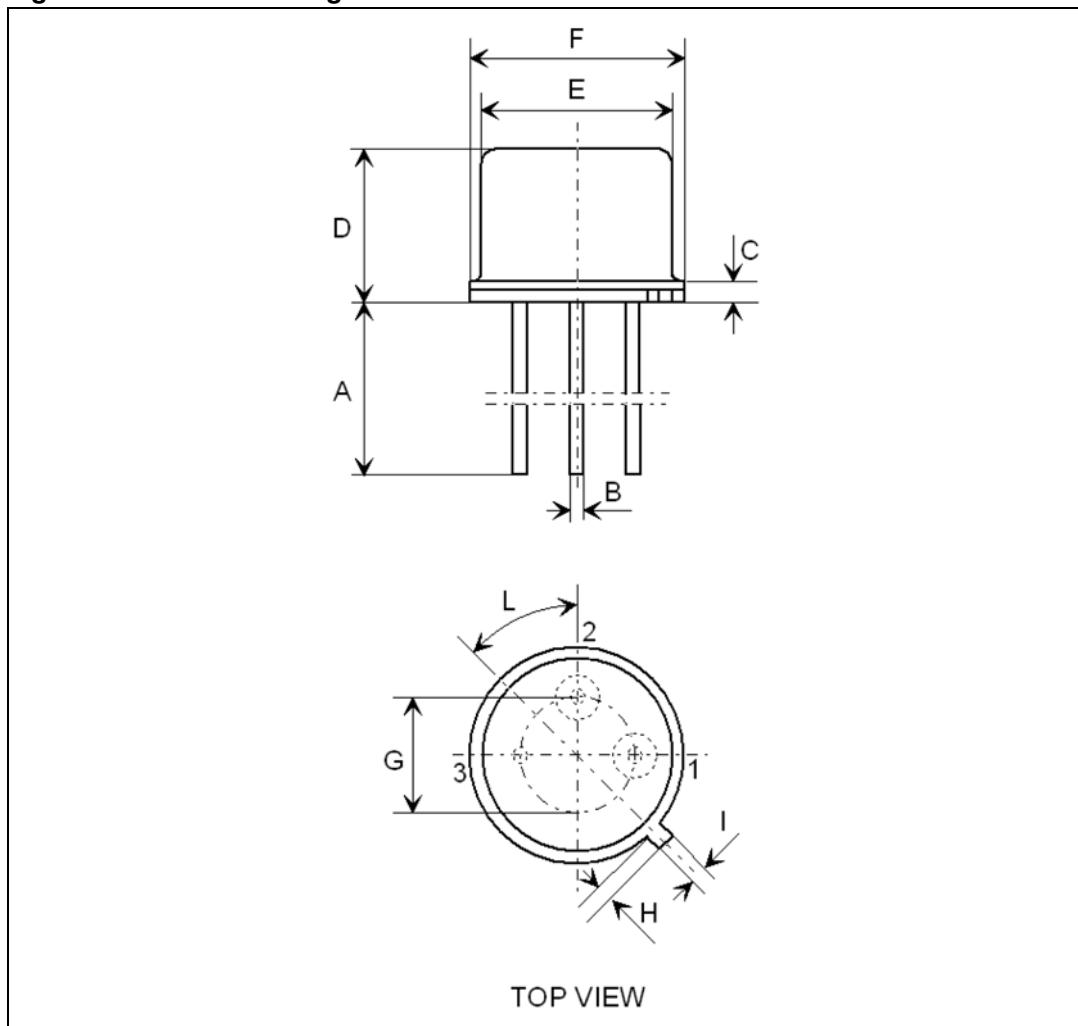
3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com.
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Table 5. TO-39 mechanical data

| Dim. | mm | | |
|------|------|-------|-------|
| | Min. | Typ. | Max. |
| A | | 12.70 | 14.20 |
| B | | 0.40 | 0.49 |
| C | | 0.58 | 0.74 |
| D | | 6.00 | 6.40 |
| E | | 8.15 | 8.25 |
| F | | 9.10 | 9.20 |
| G | | 4.93 | 5.23 |
| H | | 0.85 | 0.95 |
| I | | 0.75 | 0.85 |
| L | | 42° | 48° |

Figure 9. TO-39 drawing



4 Revision history

Table 6. Document revision history

| Date | Revision | Changes |
|-------------|----------|---------------------------------------------------------------------------------------------------------|
| 09-Feb-2009 | 1 | Initial release |
| 07-Jan-2010 | 2 | Modified Table 1 on page 1 |
| 05-Oct-2012 | 3 | Minor text changes. Section 2.1: Electrical characteristics (curves) has been added. |

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