# 2N5401HR

## Hi-Rel PNP bipolar transistor 150 V, 0.5 A

**Datasheet — production data**

## Features

| | |
|---|---|
| $BV_{CEO}$ | 150 V |
| $I_C$ (max) | 0.5 A |
| $H_{FE}$ at 10 V - 150 mA | > 60 |
| Operating temperature range | -65°C to +200°C |

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

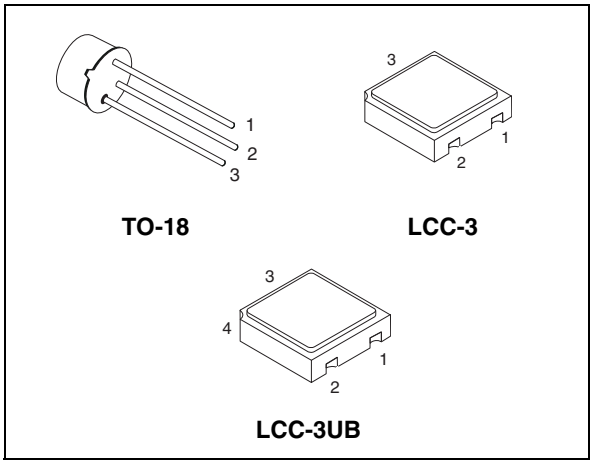
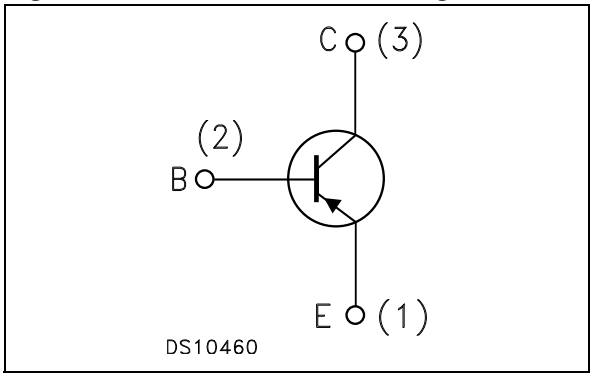



**Figure 1. Internal schematic diagram**




## Description

The 2N5401HR is a silicon planar epitaxial PNP transistor available in TO-18 and LCC-3 packages. It is specifically designed for aerospace Hi-Rel applications and ESCC qualified according to the 5202-014 specification. In case of conflict between this datasheet and ESCC detailed specification, the latter prevails.

**Table 1. Device summary**

| Order codes | ESCC part num. | Quality level | Rad level | Packages | Lead finish | Mass (g) | EPPL |
|---|---|---|---|---|---|---|---|
| 2N5401UB1 | - | Eng. Model | | LCC-3UB | Gold | 0.06 | - |
| 2N5401SW | 5202/014/05 | ESCC Flight | 100 krad | LCC-3 | Solder Dip | 0.06 | Y |
| 2N5401UB06 | 5202/014/06 | ESCC Flight | | LCC-3UB | Gold | 0.06 | - |
| 2N5401UB07 | 5202/014/07 | ESCC Flight | | LCC-3UB | Solder Dip | 0.06 | - |
| SOC5401 | - | Eng. Model | | LCC-3 | Gold | 0.06 | - |
| SOC5401HRB | 5202/014/04 or 05 | ESCC Flight | | LCC-3 | Gold/Solder Dip(1) | 0.06 | Y |
| 2N5401/T1 | - | Eng. Model | | TO-18 | Gold | 0.40 | - |
| 2N5401HR | 5202/014/01 or 02 | ESCC Flight | | TO-18 | Gold/Solder Dip (1) | 0.40 | - |

1. Depending ESCC part number mentioned on the purchase order.



This is information on a product in full production. www.st.com

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CBO}$ | Collector-base voltage ($I_E$ = 0) | -160 | V |
| $V_{CEO}$ | Collector-emitter voltage ($I_B$ = 0) | -150 | V |
| $V_{EBO}$ | Emitter-base voltage ($I_C$ = 0) | -5 | V |
| $I_C$ | Collector current<br>for 2N5401HR<br>for SOC5401HRB | <br>-0.6<br>-0.5 | <br>A<br>A |
| $P_{TOT}$ | Total dissipation at $T_{amb} \leq 25$ °C<br>for 2N5401HR<br>for SOC5401HRB<br>for SOC5401HRB (1)<br>Total dissipation at $T_c \leq 25$ °C<br>for 2N5401HR | <br>0.36<br>0.36<br>0.58<br><br>1.2 | <br>W<br>W<br>W<br><br>W |
| $T_{STG}$ | Storage temperature | -65 to 200 | °C |
| $T_J$ | Max. operating junction temperature | 200 | °C |

1. When mounted on a 8x10x0.6 mm ceramic substrate.

**Table 3. Thermal data for through-hole package**

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $R_{thJC}$ | Thermal resistance junction-case | max | 146 | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient | max | 486 | °C/W |

**Table 4. Thermal data for SMD package**

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $R_{thJA}$ | Thermal resistance junction-ambient | max | 486 | °C/W |
| | Thermal resistance junction-ambient (1) | max | 302 | °C/W |

1. When mounted on a 8x10x0.6 mm ceramic substrate.

# 2 Electrical characteristics

$T_{case}$ = 25 °C unless otherwise specified.

**Table 5. Electrical characteristics**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CBO}$ | Collector-base cut-off current ($I_E$ = 0) | $V_{CB}$ = -120 V<br>$V_{CB}$ = -120 V $T_C$ = 150 °C | | | -50<br>-50 | nA<br>µA |
| $I_{EBO}$ | Emitter-base cut-off current ($I_C$ = 0) | $V_{EB}$ = -3 V | | | -50 | nA |
| $V_{(BR)CBO}$ | Collector-base breakdown voltage ($I_E$ = 0) | $I_C$ = -100 µA | -160 | | | V |
| $V_{(BR)CEO}$ (1) | Collector-emitter breakdown voltage ($I_B$ = 0) | $I_C$ = -1 mA | -150 | | | V |
| $V_{(BR)EBO}$ | Emitter-base breakdown voltage ($I_C$ = 0) | $I_E$ = -10 µA | -5 | | | V |
| $V_{CE(sat)}$ (1) | Collector-emitter saturation voltage | $I_C$ = -10 mA $I_B$ = -1 mA<br>$I_C$ = -50 mA $I_B$ = -5 mA | | | -0.2<br>-0.5 | V<br>V |
| $V_{BE(sat)}$ (1) | Base-emitter saturation voltage | $I_C$ = -10 mA $I_B$ = -1 mA<br>$I_C$ = -50 mA $I_B$ = -5 mA | | | -1<br>-1 | V<br>V |
| $h_{FE}$ (1) | DC current gain | $I_C$ = -1 mA $V_{CE}$ = -5 V<br>$I_C$ = -10 mA $V_{CE}$ = -5 V<br>$I_C$ = -50 mA $V_{CE}$ = -5 V<br>$I_C$ = -10 mA $V_{CE}$ = -5 V<br>$T_{amb}$ = -55 °C | 50<br>60<br>60<br>20 | | 240 | |
| $h_{fe}$ | Small signal current gain | $V_{CE}$ = -10 V $I_C$ = -10 mA<br>f = 10 kHz | 5 | | | |
| $C_{obo}$ | Output capacitance ($I_E$ = 0) | $V_{CB}$ = -10 V f = 1 MHz | | | 6 | pF |

1. Pulsed duration = 300 µs, duty cycle ≤ 2 %

# 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*. ECOPACK® is an ST trademark.

**Table 6. LCC-3 mechanical data**

| Dim. | mm. | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 1.16 | | 1.42 |
| C | 0.45 | 0.50 | 0.56 |
| D | 0.60 | 0.76 | 0.91 |
| E | 0.91 | 1.01 | 1.12 |
| F | 1.95 | 2.03 | 2.11 |
| G | 2.92 | 3.05 | 3.17 |
| I | 2.41 | 2.54 | 2.66 |
| J | 0.42 | 0.57 | 0.72 |
| K | 1.37 | 1.52 | 1.67 |
| L | 0.40 | 0.50 | 0.60 |
| M | 2.46 | 2.54 | 2.62 |
| N | 1.80 | 1.90 | 2.00 |
| R | | 0.30 | |

**Figure 2. LCC-3 drawings**

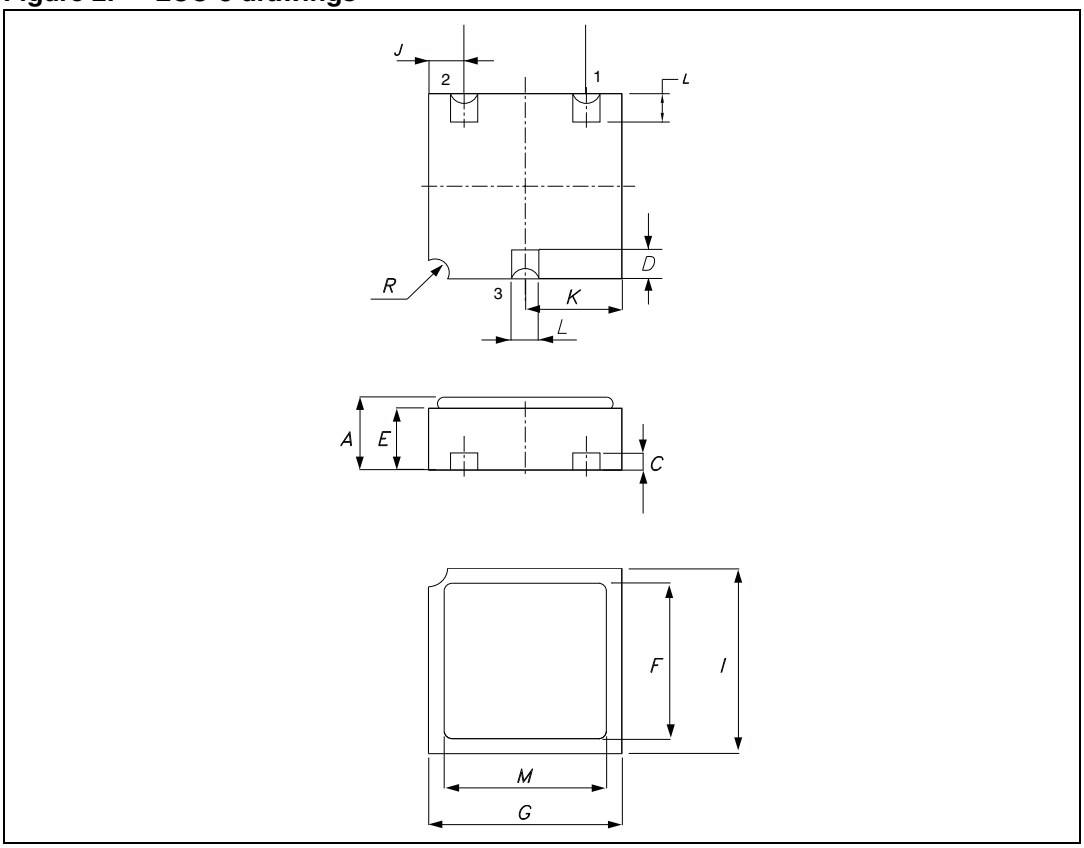


**Table 7. LCC-3UB mechanical data**

| Dim. | mm. | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 1.16 | | 1.42 |
| C | 0.46 | 0.51 | 0.56 |
| D | 0.56 | 0.76 | 0.96 |
| E | 0.92 | 1.02 | 1.12 |
| F | 1.95 | 2.03 | 2.11 |
| G | 2.92 | 3.05 | 3.18 |
| I | 2.41 | 2.54 | 2.67 |
| J | 0.42 | 0.57 | 0.72 |
| K | 1.37 | 1.52 | 1.67 |
| L | 0.41 | 0.51 | 0.61 |
| M | 2.46 | 2.54 | 2.62 |
| N | 1.81 | 1.91 | 2.01 |
| r | | 0.20 | |
| r1 | | 0.30 | |
| r2 | | 0.56 | |

**Figure 3. LCC-3UB drawings**

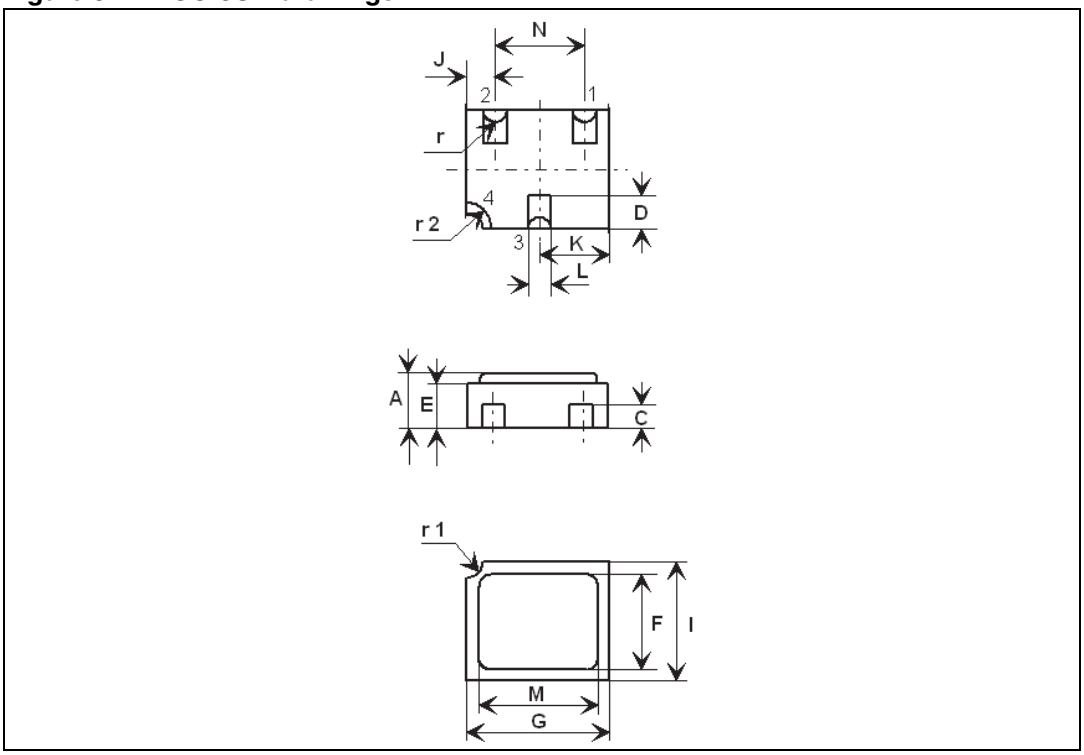
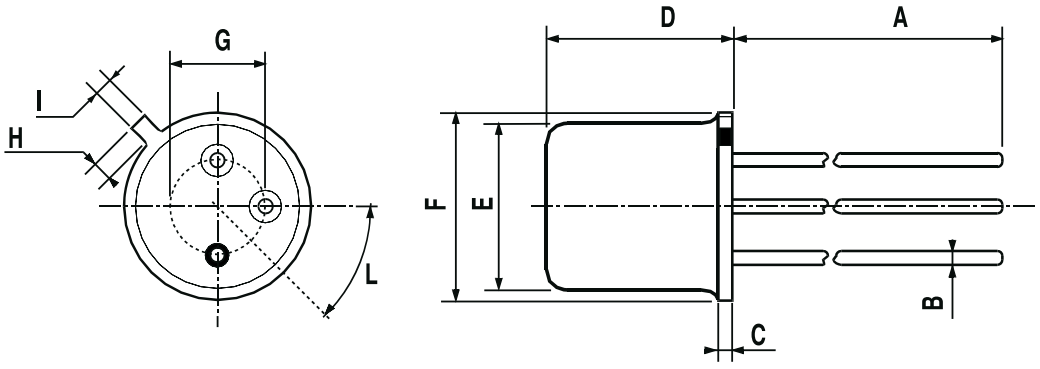


**Table 8. TO-18 mechanical data**

| Dim. | mm. | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | | 12.7 | |
| B | | | 0.49 |
| D | | | 5.3 |
| E | | | 4.9 |
| F | | | 5.8 |
| G | 2.54 | | |
| H | | | 1.2 |
| I | | | 1.16 |
| L | 45° | | |

**Figure 4. TO-18 drawings**



# 4 Order codes

**Table 9. Order codes**

| Order codes | ESCC part number | Radiation level | Packages | Lead finish | Marking | EPPL | Packing |
|---|---|---|---|---|---|---|---|
| 2N5401UB1 | - | | LCC-3UB | Gold | 2N5401UB1 | - | Waffle pack |
| 2N5401SW | 5202/014/05 | 100 krad | LCC-3 | Solder Dip | 520201407 | Y | Waffle pack |
| 2N5401UB06 | 5202/014/06 | | LCC-3UB | Gold | 520201406 | - | Waffle pack |
| 2N5401UB07 | 5202/014/07 | | LCC-3UB | Solder Dip | 520201407 | - | Waffle pack |
| SOC5401 | - | | LCC-3 | Gold | SOC5401 | - | Waffle pack |
| SOC5401HRB | 5202/014/04 or 05 | | LCC-3 | Gold/Solder Dip(1) | 520201404 or 05 | Y | Waffle pack |
| 2N5401/T1 | - | | TO-18 | Gold | 2N5401/T1 | - | Strip pack |
| 2N5401HR | 5202/014/01 or 02 | | TO-18 | Gold/Solder Dip(1) | 520201401 or 02 | - | Strip pack |

1. Depending ESCC part number mentioned on the purchase order.

Contact ST sales office for information about the specific conditions for:

- Products in die form
- Tape and reel packing

# 5 Revision history

**Table 10. Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 04-Jan-2010 | 1 | Initial release |
| 13-Jul-2010 | 2 | Modified *Table 1 on page 1*, added *Table 9 on page 8* |
| 10-Oct-2012 | 3 | *Table 1 on page 1* and *Section 4: Order codes* have been updated. *Section 3: Package mechanical data* has been updated. |

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