

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

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.

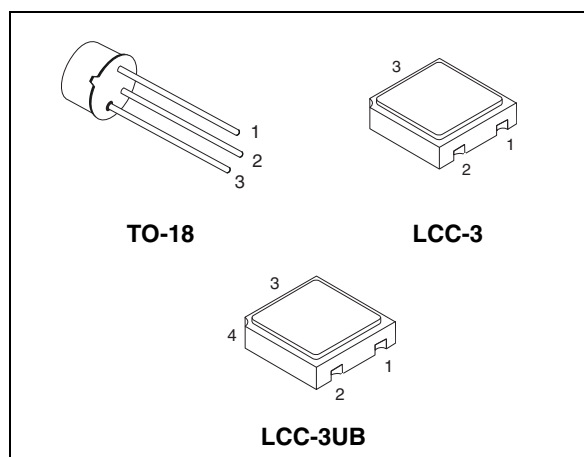


Figure 1. Internal schematic diagram

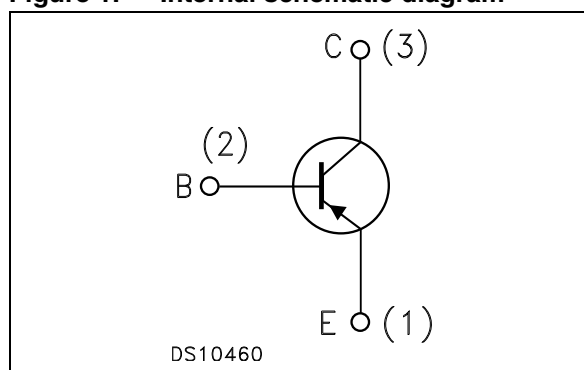


Table 1. Device summary

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.

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 for 2N5401HR for SOC5401HRB	-0.6 -0.5	A A
P_{TOT}	Total dissipation at $T_{amb} \leq 25\text{ °C}$ for 2N5401HR	0.36	W
	for SOC5401HRB	0.36	W
	for SOC5401HRB ⁽¹⁾	0.58	W
	Total dissipation at $T_c \leq 25\text{ °C}$ for 2N5401HR	1.2	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

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

Table 5. Electrical characteristics

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

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

2.1 Electrical characteristics (curves)

Figure 2. h_{FE} @ $V_{CE} = 5\text{ V}$

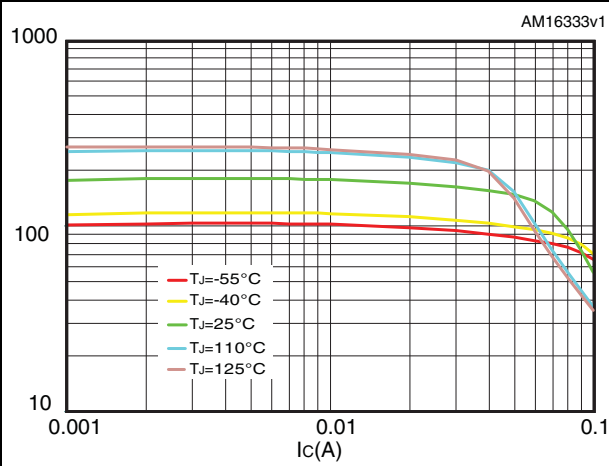


Figure 3. $V_{CE(sat)}$ @ $h_{FE} = 10$

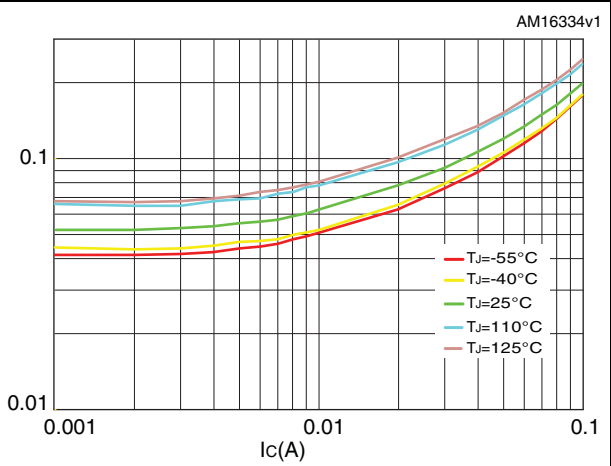
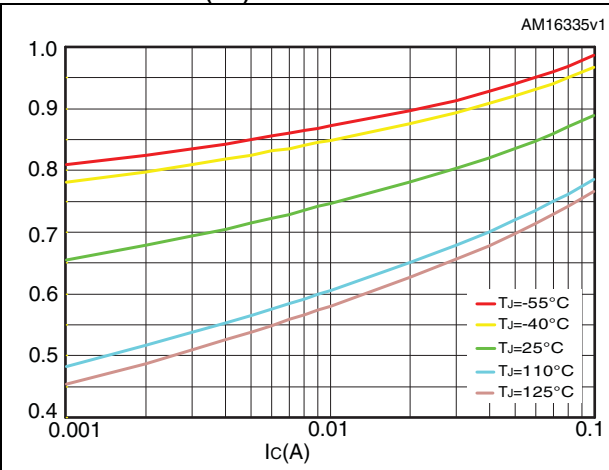


Figure 4. $V_{BE(sat)}$ @ $h_{FE} = 10$



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 5. LCC-3 drawings

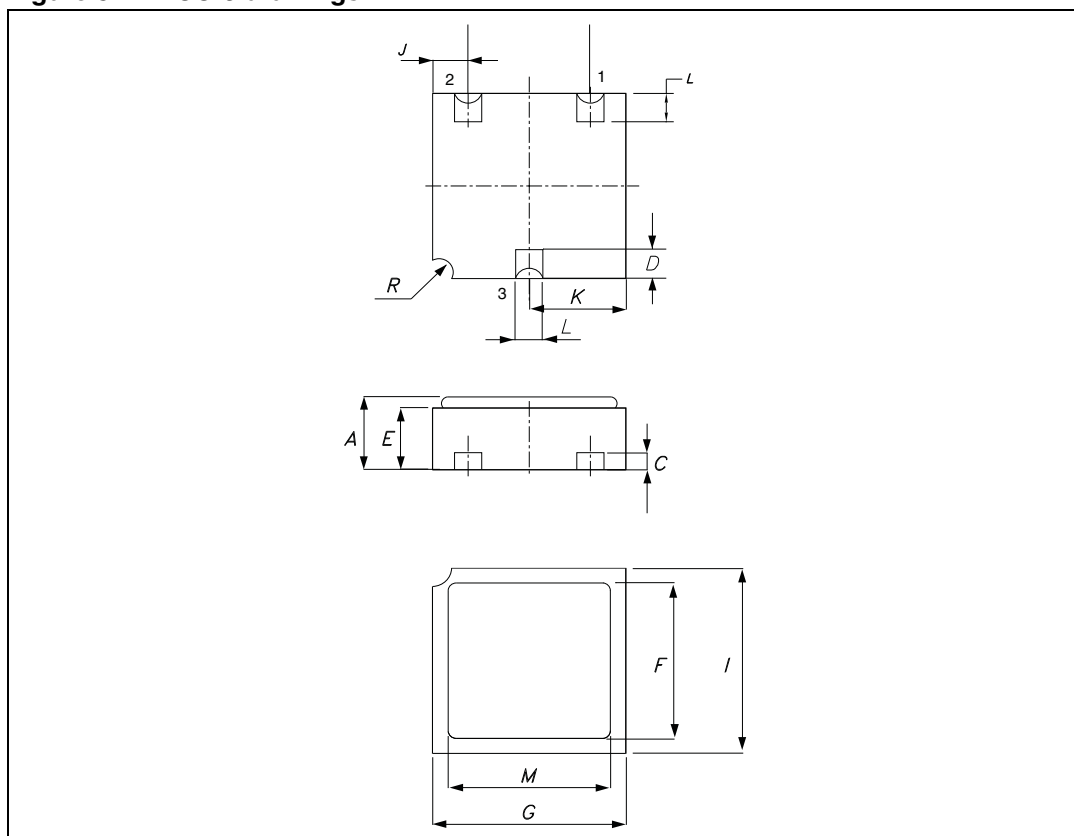


Table 7. LCC-3UB mechanical data

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 6. LCC-3UB drawings

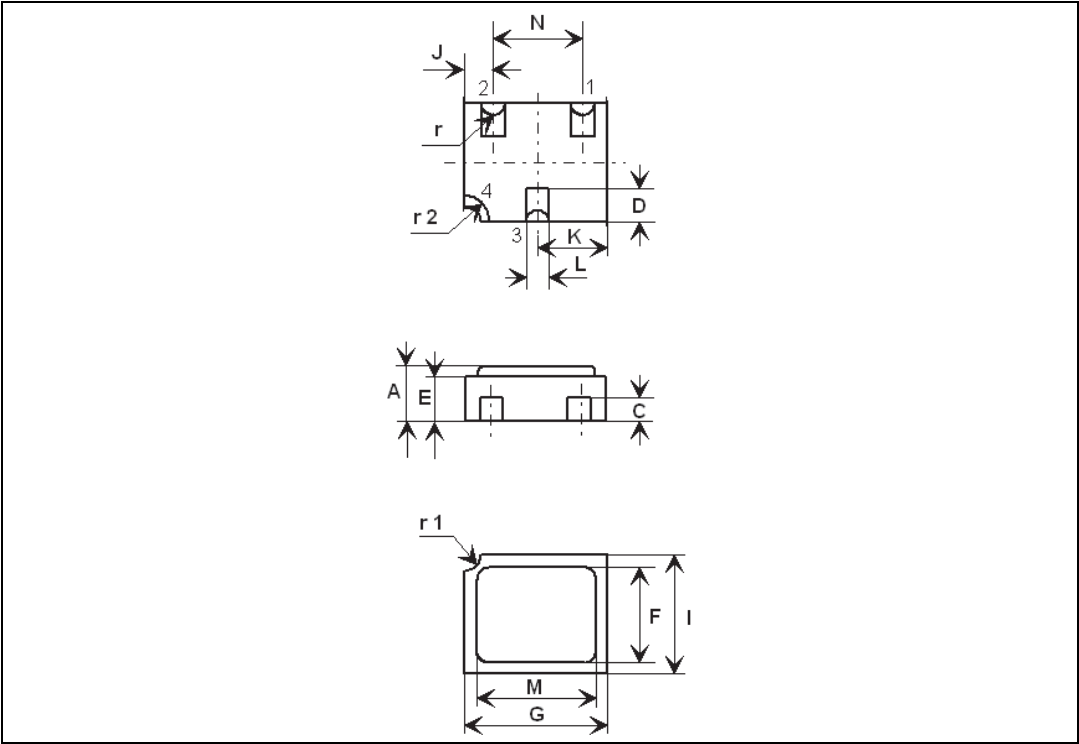
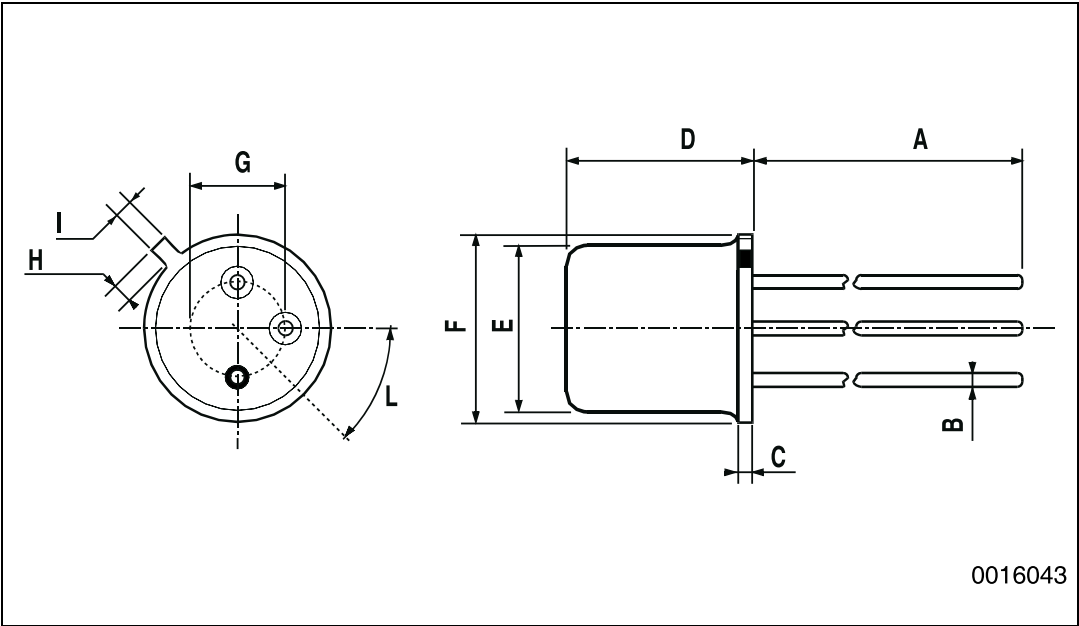


Table 8. TO-18 mechanical data

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 7. 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 9
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.
12-Nov-2012	4	Added: Section 2.1: Electrical characteristics (curves)

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY TWO AUTHORIZED ST REPRESENTATIVES, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2012 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com

