

## Hi-Rel NPN bipolar transistor 80 V - 5 A

Datasheet – production data

### Features

$BV_{CEO}$	80 V
$I_C$ (max)	5 A
$H_{FE}$ at 10 V - 150 mA	> 70
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 2N5154HR is a silicon planar epitaxial NPN transistor in TO-39, TO-257 and SMD.5 packages. It is specifically designed for aerospace Hi-Rel applications and ESCC qualified according to the 5203-010 specification. In case of conflict between this datasheet and ESCC detailed specification, the latter prevails.

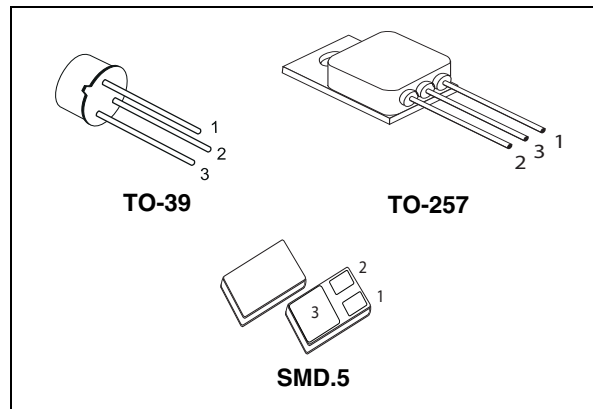


Figure 1. Internal schematic diagram

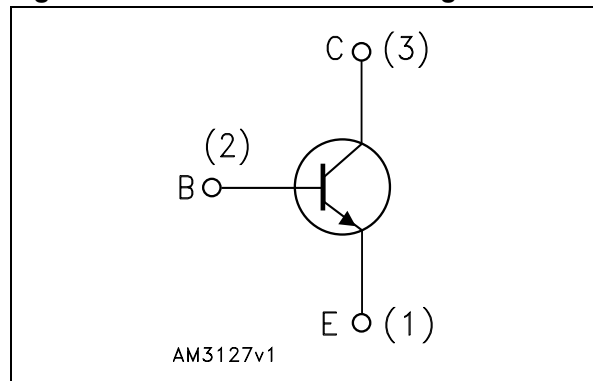


Table 1. Device summary

Order codes	Packages	Lead finish	Marking	Type	EPPL	Packaging
2N5154HR	TO-39	Gold Solder Dip	520301001 520301002	ESCC Flight		Strip pack
2N5154SHR	SMD.5	Gold	520301006	ESCC Flight	Yes	Strip pack
2N5154ESYHRB	TO-257	Gold Solder Dip	520301004 520301005	ESCC Flight		Strip pack
2N5154T1	TO-39	Gold	2N5154T1	Engineering model		Strip pack
2N5154S1	SMD.5	Gold	2N5154S1	Engineering model		Strip pack
2N5154ESY	TO-257	Gold	2N5154ESY	Engineering model		Strip pack

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CBO}$	Collector-base voltage ( $I_E = 0$ )	100	V
$V_{CEO}$	Collector-emitter voltage ( $I_B = 0$ )	80	V
$V_{EBO}$	Emitter-base voltage ( $I_C = 0$ )	6	V
$I_C$	Collector current	5	A
$P_{TOT}$	Total dissipation at $T_{amb} \leq 25\text{ °C}$		
	for 2N5154HR	1	W
	for 2N5154ESYHRB	3.3	W
	for 2N5154SHR	3.3	W
	$T_C \leq 25\text{ °C}$		
	for 2N5154HR	8.75	W
	for 2N5154ESYHRB	35	W
	for 2N5154SHR	35	W
$T_{STG}$	Storage temperature	- 65 to 200	°C
$T_J$	Max. operating junction temperature	200	°C

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

Symbol	Parameter	TO-39	TO-257	Unit
$R_{thJC}$	Thermal resistance junction-case max	20	5	°C/W
$R_{thJA}$	Thermal resistance junction-ambient max	175	53	

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

Symbol	Parameter	SMD.5	Unit
$R_{thJC}$	Thermal resistance junction-case max	5	°C/W

## 2 Electrical characteristics

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

**Table 5. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{CES}}$	Collector cut-off current ( $I_{\text{E}} = 0$ )	$V_{\text{CB}} = 60\text{ V}$ $V_{\text{CB}} = 60\text{ V}$ $T_{\text{amb}} = 150\text{ °C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{\text{EBO}}$	Emitter cut-off current ( $I_{\text{C}} = 0$ )	$V_{\text{EB}} = 5\text{ V}$ $V_{\text{EB}} = 6\text{ V}$			1 1	$\mu\text{A}$ $\text{mA}$
$I_{\text{CEO}}$	Collector cut-off current ( $I_{\text{B}} = 0$ )	$V_{\text{CE}} = 40\text{ V}$			50	$\mu\text{A}$
$V_{(\text{BR})\text{CEO}}^{(1)}$	Collector-emitter breakdown voltage ( $I_{\text{B}} = 0$ )	$I_{\text{C}} = 100\text{ mA}$	80			V
$V_{\text{CE}(\text{sat})}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 5\text{ A}$ $I_{\text{B}} = 0.5\text{ A}$ $I_{\text{C}} = 2.5\text{ A}$ $I_{\text{B}} = 250\text{ mA}$			1.5 1.45	V V
$V_{\text{BE}(\text{sat})}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 2.5\text{ A}$ $I_{\text{B}} = 0.25\text{ A}$ $I_{\text{C}} = 5\text{ A}$ $I_{\text{B}} = 0.5\text{ A}$			1.45 2.2	V V
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 50\text{ mA}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 2.5\text{ A}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 5\text{ A}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 2.5\text{ A}$ $V_{\text{CE}} = 5\text{ V}$ $T_{\text{amb}} = -55\text{ °C}$	50 70 40 35		200	
$h_{\text{fe}}$	AC forward current transfer ratio	$V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 500\text{ mA}$ $f = 20\text{ MHz}$	3.5			
$C_{\text{OBO}}$	Output capacitance	$I_{\text{E}} = 0$ $V_{\text{CB}} = 10\text{ V}$ $f = 1\text{ MHz}$			250	pF
$t_{\text{on}}$	Turn-on time	$V_{\text{CC}} = 30\text{ V}$ $V_{\text{BB}} = 4\text{ V}$ $V_{\text{in}} \cong 51\text{ V}$ $I_{\text{C}} = 5\text{ A}$ $I_{\text{B}1} = -I_{\text{B}2} = 0.5\text{ A}$			0.5	$\mu\text{s}$
$t_{\text{off}}$	Turn-off time	$V_{\text{CC}} = 30\text{ V}$ $V_{\text{BB}} = 4\text{ V}$ $V_{\text{in}} \cong 51\text{ V}$ $I_{\text{C}} = 5\text{ A}$ $I_{\text{B}1} = -I_{\text{B}2} = 0.5\text{ A}$			1.3	$\mu\text{s}$

1. Pulsed duration = 300  $\mu\text{s}$ , duty cycle  $\leq 2\%$

## 2.1 Electrical characteristics (curves)

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

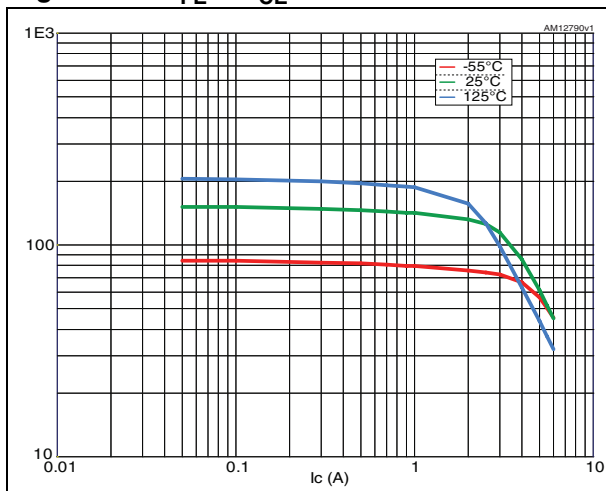


Figure 3.  $V_{CEsat} @ h_{FE} = 10$

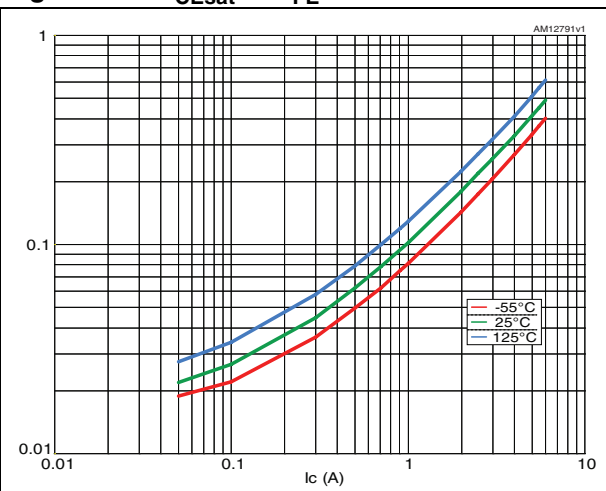


Figure 4.  $V_{BEsat} @ h_{FE} = 10$

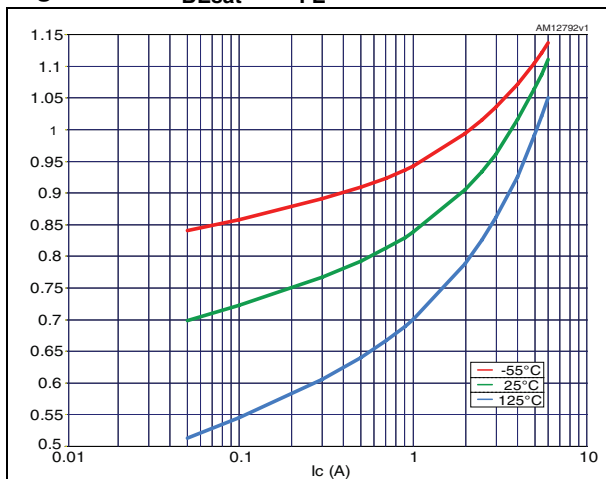
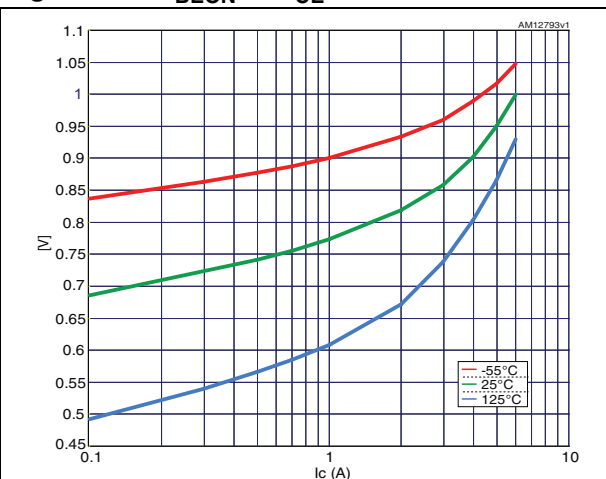
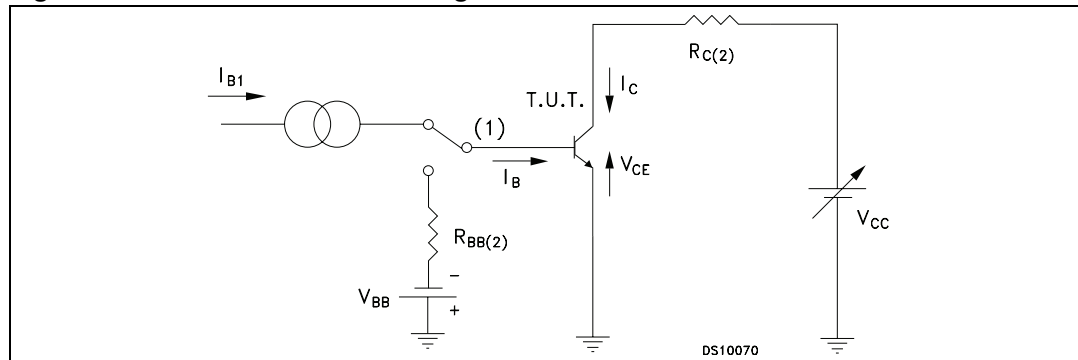


Figure 5.  $V_{BEON} @ V_{CE} = 5 V$



## 2.2 Test circuit

Figure 6. Resistive load switching test circuit



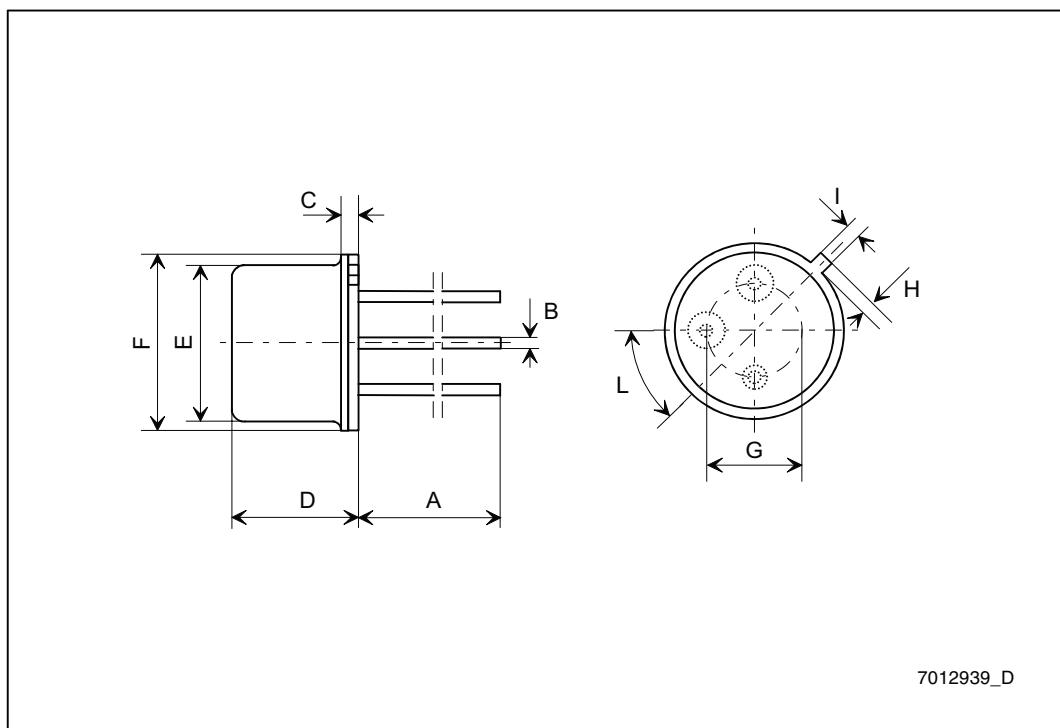
- 1. Fast electronic switch
- 2. Non-inductive resistor

### 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

**TO-39 mechanical data**

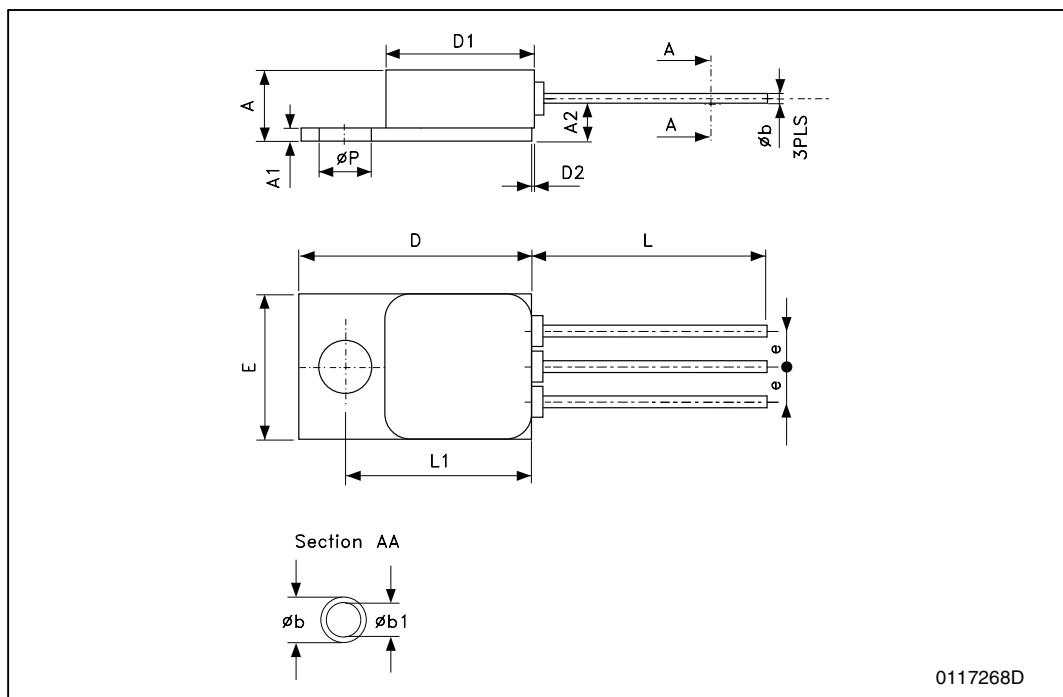
DIM.	mm.		
	Min.	Typ.	Max.
A	12.70		
B			0.49
D			6.60
E			8.51
F			9.40
G		5.08	
H			1.02
I			0.86
L		45°	



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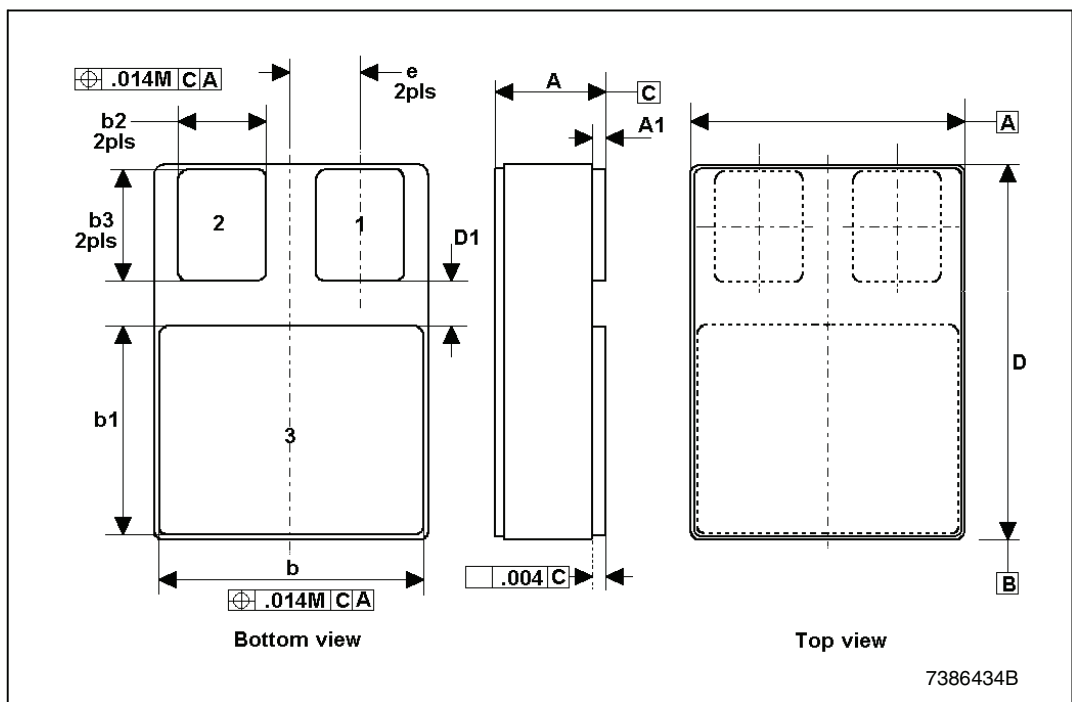
**TO-257 mechanical data**

DIM.	mm.		
	Min.	Typ.	Max.
A	4.83		5.08
A1	0.89		1.14
A2		3.05	
b	0.64		1.02
b1	0.64	0.76	0.89
D	16.38		16.89
D1	10.41		10.92
D2			0.97
e		2.54	
E	10.41		10.67
L	12.70		19.05
L1	13.39		13.64
P	3.56		3.81



**SMD.5 mechanical data**

Dim.	mm.		
	Min.	Typ.	Max.
A	2.84	3.00	3.15
A1	0.25	0.38	0.51
b	7.13	7.26	7.39
b1	5.58	5.72	5.84
b2	2.28	2.41	2.54
b3	2.92	3.05	3.18
D	10.03	10.16	10.28
D1		0.76	
E	7.39	7.52	7.64
e		1.91	





## 4 Revision history

**Table 6. Document revision history**

Date	Revision	Changes
08-Jan-2009	1	Initial release
08-Jan-2010	2	Modified <a href="#">Table 1 on page 1</a>
22-Jul-2011	3	Updated marking for the order code 2N5154ESYHRB in <a href="#">Table 1 on page 1</a>
12-Sep-2012	4	Added: <a href="#">Section 2.1: Electrical characteristics (curves) on page 4</a>

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