

## Hi-Rel NPN bipolar transistor 160 V, 0.5 A

Datasheet — production data

### Features

$BV_{CEO}$	160 V
$I_C$ (max)	0.5 A
$H_{FE}$ at 5 V - 10 mA	> 80
Operating temperature range	-65 °C to +200 °C

- Linear gain characteristics
- ESCC qualified
- European preferred part list - EPPL
- 100 krad low dose rate
- Hermetic packages

### Description

The 2N5551HR is a silicon planar epitaxial NPN transistor in TO-18, TO-39 and LCC-3 packages. It is specifically designed for aerospace Hi-Rel applications and ESCC qualified according to the 5201-019 specification. In case of conflict between this datasheet and ESCC detailed specification, the latter prevails.

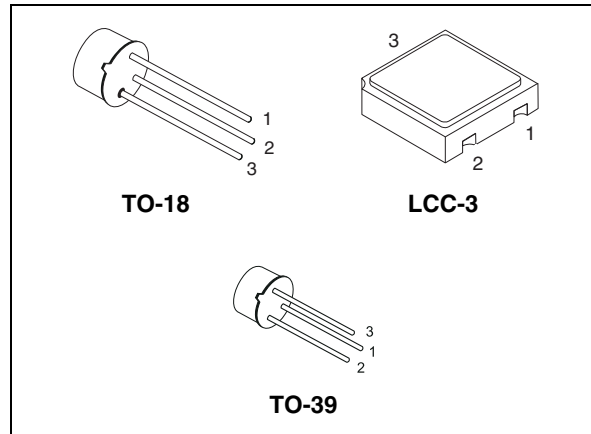


Figure 1. Internal schematic diagram

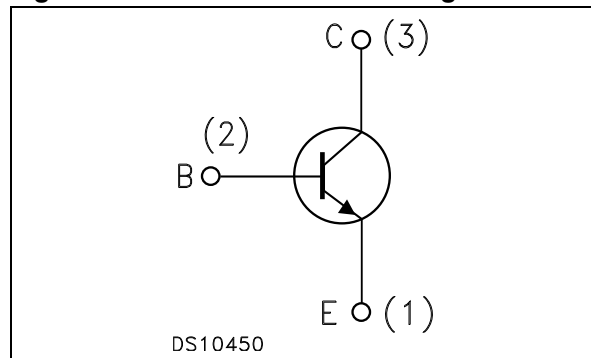


Table 1. Device summary

Order codes	ESCC Part number	Qual. Level	Rad. level	Packages	Lead Finish	Mass (g)	EPPL
2N5551UB1	-	Eng. Model		LCC-3UB	Gold	0.06	-
2N5551UB	5201/019/08 or 09	ESCC Flight		LCC-3UB	Gold / Solder Dip <sup>(1)</sup>	0.06	-
SOC5551	-	Eng. Model		LCC-3	Gold	0.06	-
SOC5551HRB	5201/019/04 or 05	ESCC Flight		LCC-3	Gold / Solder Dip <sup>(1)</sup>	0.06	Y
SOC5551SW	5201/019/05	ESCC Flight	100 krad	LCC-3	Solder Dip	0.06	Y
2N5551/T1	-	Eng. Model		TO-18	Gold	0.40	-
2N5551HR	5201/019/01 or 02	ESCC Flight		TO-18	Gold / Solder Dip <sup>(1)</sup>	0.40	-
2N5551SHR	5201/019/06 or 07	ESCC Flight		TO-39	Gold / Solder Dip <sup>(1)</sup>	1.20	-

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 ( $I_E = 0$ )	180	V
$V_{CEO}$	Collector-emitter voltage ( $I_B = 0$ )	160	V
$V_{EBO}$	Emitter-base voltage ( $I_C = 0$ )	6	V
$I_C$	Collector current for 2N5551HR	0.6	A
	for SOC5551HRB	0.5	A
$P_{TOT}$	Total dissipation at $T_{amb} \leq 25\text{ °C}$ for 2N5551HR	0.36	W
	for SOC5551HRB	0.36	W
	for SOC5551HRB <sup>(1)</sup>	0.58	W
	Total dissipation at $T_c \leq 25\text{ °C}$ for 2N5551HR	1.2	W
$T_{STG}$	Storage temperature	-65 to 200	°C
$T_J$	Max. operating junction temperature	200	°C

1. When mounted on a 8 x 10 x 0.6 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 <sup>(1)</sup> max	302	°C/W

1. When mounted on a 8 x 10 x 0.6 mm ceramic substrate.

## 2 Electrical characteristics

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

**Table 5. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{CBO}}$	Collector-base cut-off current ( $I_{\text{E}} = 0$ )	$V_{\text{CB}} = 120\text{ V}$ $V_{\text{CB}} = 120\text{ V}$ $T_{\text{C}} = 150\text{ °C}$		-	50 50	nA $\mu\text{A}$
$I_{\text{EBO}}$	Emitter-base cut-off current ( $I_{\text{C}} = 0$ )	$V_{\text{EB}} = 4\text{ V}$		-	50	nA
$V_{(\text{BR})\text{CBO}}$	Collector-base breakdown voltage ( $I_{\text{E}} = 0$ )	$I_{\text{C}} = 100\text{ }\mu\text{A}$	180	-		V
$V_{(\text{BR})\text{CEO}}^{(1)}$	Collector-emitter breakdown voltage ( $I_{\text{B}} = 0$ )	$I_{\text{C}} = 1\text{ mA}$	160	-		V
$V_{(\text{BR})\text{EBO}}$	Emitter-base breakdown voltage ( $I_{\text{C}} = 0$ )	$I_{\text{E}} = 10\text{ }\mu\text{A}$	6	-		V
$V_{\text{CE}(\text{sat})}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 10\text{ mA}$ $I_{\text{B}} = 1\text{ mA}$ $I_{\text{C}} = 50\text{ mA}$ $I_{\text{B}} = 5\text{ mA}$		-	0.15 0.2	V V
$V_{\text{BE}(\text{sat})}^{(1)}$	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	$I_{\text{C}} = 1\text{ mA}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 10\text{ mA}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 50\text{ mA}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 10\text{ mA}$ $V_{\text{CE}} = 5\text{ V}$ $T_{\text{amb}} = -55\text{ °C}$	80 80 30 20	-	250	
$h_{\text{fe}}$	Small signal current gain	$V_{\text{CE}} = 10\text{ V}$ $I_{\text{C}} = 1\text{ mA}$ $f = 1\text{ kHz}$	50	-	200	
$h_{\text{fe}}$	Small signal current gain	$V_{\text{CE}} = 10\text{ V}$ $I_{\text{C}} = 10\text{ mA}$ $f > 100\text{ MHz}$	1	-		
$C_{\text{obo}}$	Output capacitance ( $I_{\text{E}} = 0$ )	$V_{\text{CB}} = 10\text{ V}$ $f = 1\text{ MHz}$		-	6	pF
$C_{\text{ebo}}$	Emitter-base capacitance ( $I_{\text{C}} = 0$ )	$V_{\text{EB}} = 5\text{ V}$ $f = 1\text{ MHz}$		-	20	pF

1. Pulsed duration = 300  $\mu\text{s}$ , duty cycle  $\leq 1.5\%$

## 2.1 Electrical characteristics (curves)

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

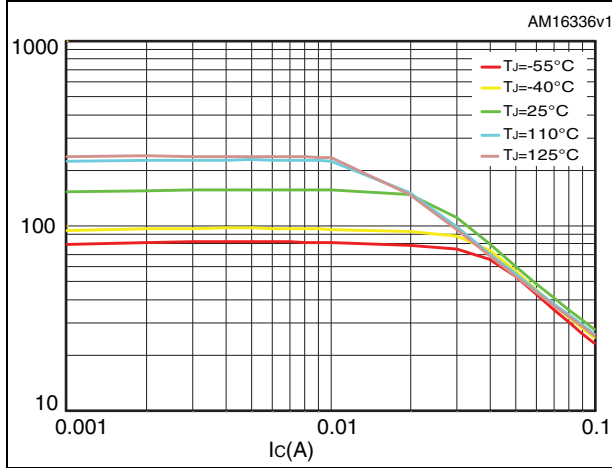


Figure 3.  $V_{CE(sat)}$  @  $h_{FE} = 10$

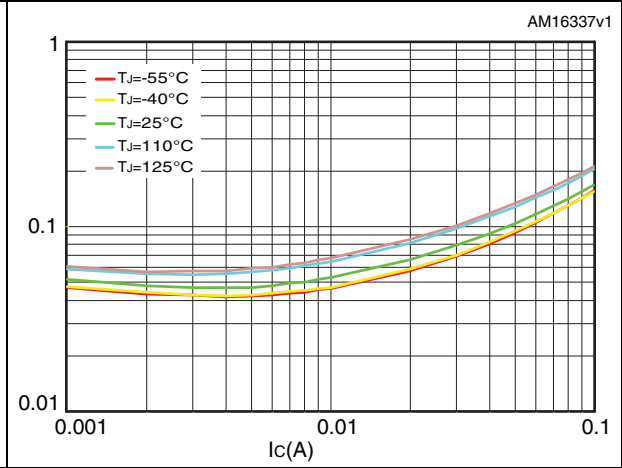
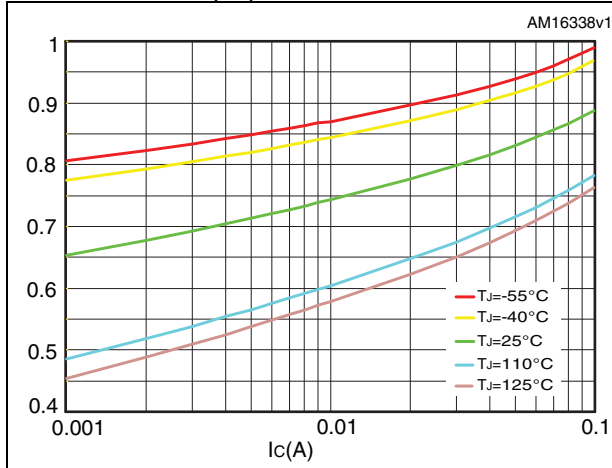


Figure 4.  $V_{BE(sat)}$  @  $h_{FE} = 10$



### 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<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.

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

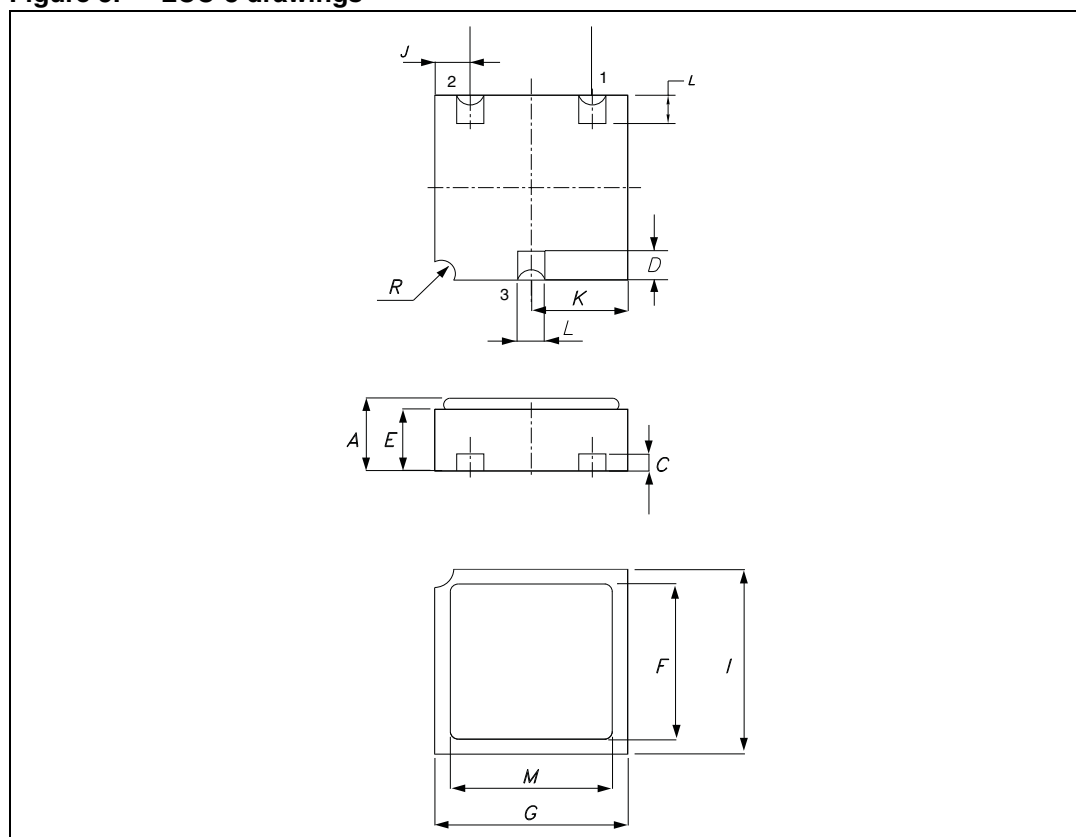


Table 7. TO-18 mechanical data

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 6. TO-18 drawings

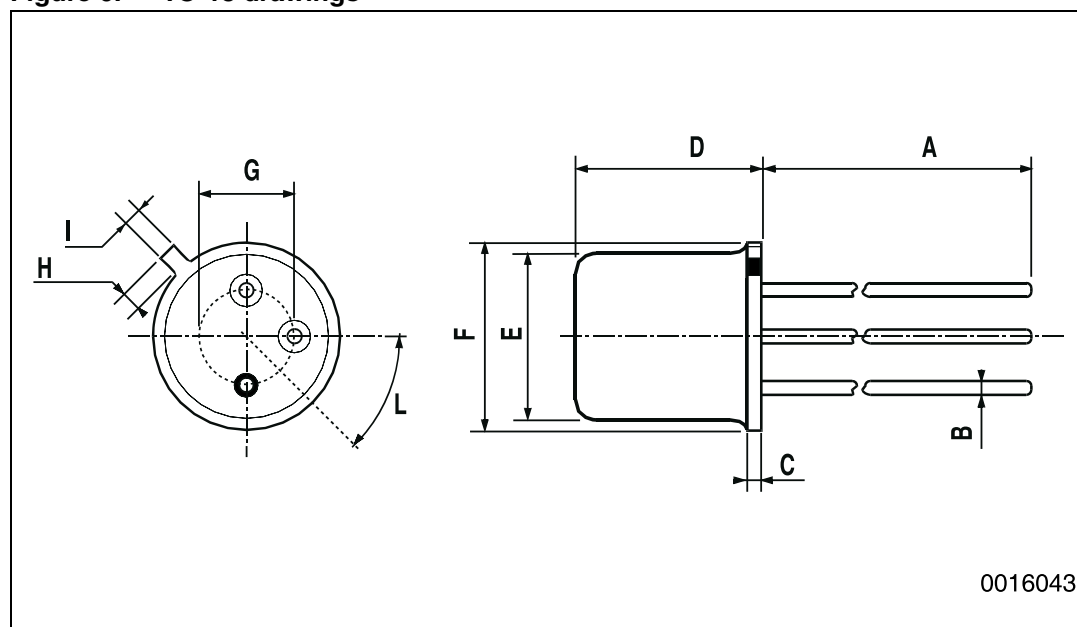
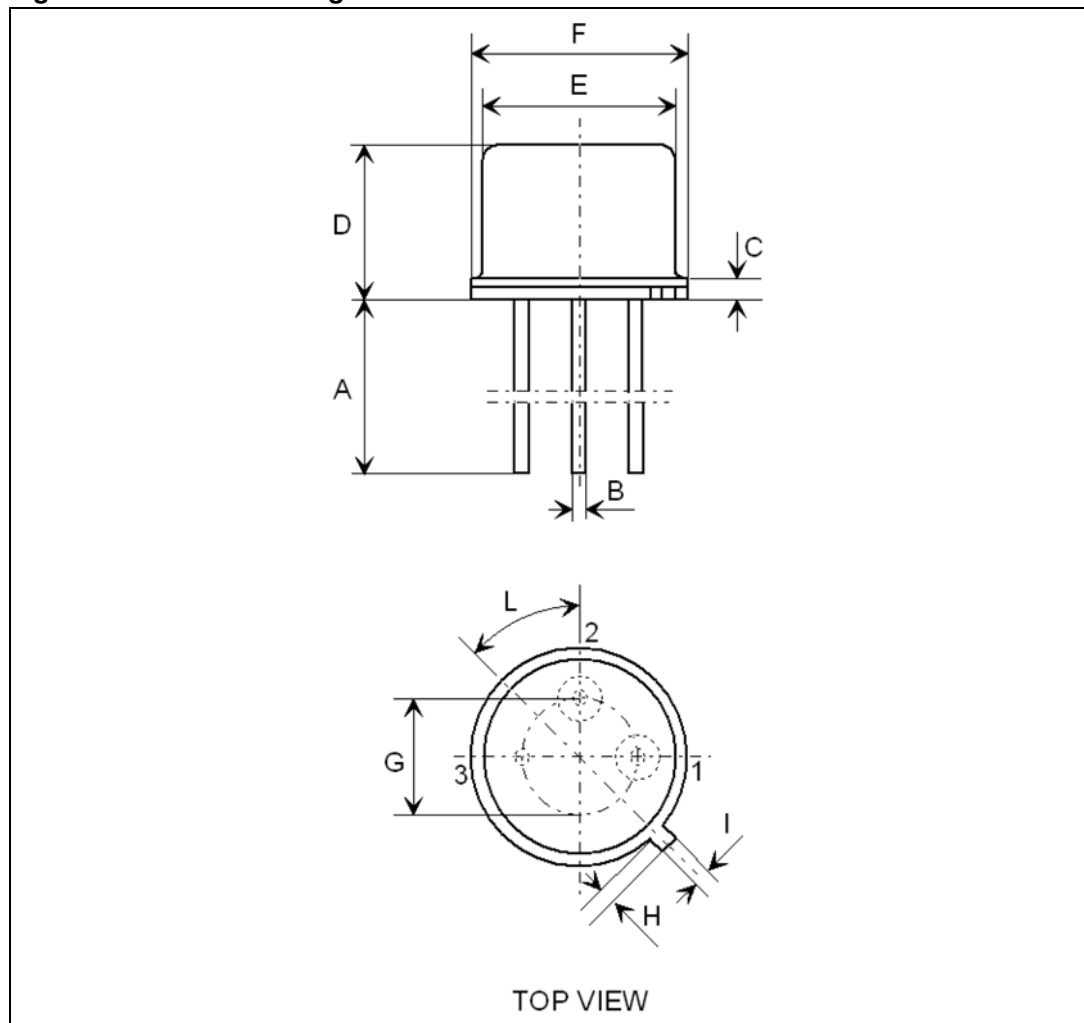


Table 8. TO-39 mechanical data

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 7. TO-39 drawing





## 4 Order codes

**Table 9. Order codes**

Order codes	ESCC Part number	Radiation level	Packages	Lead Finish	Marking	EPPL	Packing
2N5551UB1	-		LCC-3UB	Gold	2N5401UB1	-	Waffle Pack
2N5551UB	5201/019/08 or 09		LCC-3UB	Gold / Solder Dip <sup>(1)</sup>	520101908 or 09	-	Waffle Pack
SOC5551	-		LCC-3	Gold	SOC5551	-	Waffle Pack
SOC5551HRB	5201/019/04 or 05		LCC-3	Gold / Solder Dip <sup>(1)</sup>	520101904 or 05	Y	Waffle Pack
SOC5551SW	5201/019/05	100 krad	LCC-3	Solder Dip	520101904 or 05	Y	Waffle Pack
2N5551/T1	-		TO-18	Gold	2N5551/T1	-	Strip Pack
2N5551HR	5201/019/01 or 02		TO-18	Gold / Solder Dip <sup>(1)</sup>	520101901 or 02	-	Strip Pack
2N5551SHR	5201/019/06 or 07		TO-39	Gold / Solder Dip <sup>(1)</sup>	520101906 or 07	-	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
17-May-2010	2	Modified: <a href="#">Table 1 on page 1</a> and <a href="#">Table 9 on page 9</a>
12-Jul-2010	3	Modified: <a href="#">Table 1 on page 1</a> and <a href="#">Table 9 on page 9</a>
13-Nov-2012	4	Added: <a href="#">Section 2.1: Electrical characteristics (curves)</a>

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