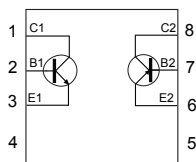
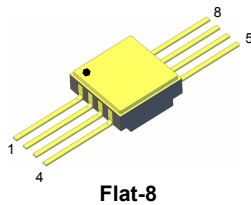


## Rad-Hard 60 V, 0.8 A, NPN and PNP transistors in single package



**Flat-8**  
Pin 4 and pin 5  
are connected together to the seal ring and lid

### Features

Polarity	$V_{(BR)CEO}$	IC (max.)	$h_{FE}$
NPN	60 V	0.8 A	160
PNP	-60 V	-0.8 A	160

1. at  $I_C = 1\text{ A}$  and  $V_{CE} = 2\text{ V}$

- 100 krad
- Linear gain characteristics
- ESCC qualified

### Description

The 2ST3360K is a dual NPN and PNP bipolar transistor developed from ST's Rad-Hard high current density technology and housed in Flat-8 hermetic package.

Both NPN and PNP transistors offer linear and complementary behavior, fast switching and best in class radiation hardness performance.

Specifically designed for aerospace applications and suitable for power MOSFET driver and high peak output current applications, it is qualified in the ESCC system as per 5207/009 specification.

In case of discrepancies between this datasheet and the relevant agency specification, the latter takes precedence.

Product status link

[2ST3360K](#)

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		NPN	PNP	
V <sub>CBO</sub>	Collector-base voltage (I <sub>E</sub> = 0)	60	-60	V
V <sub>CEO</sub>	Collector-emitter voltage (I <sub>B</sub> = 0)	60	-60	V
V <sub>EBO</sub>	Emitter-base voltage (I <sub>C</sub> = 0)	6	-6	V
I <sub>C</sub>	Collector current	0.8	-0.8	A
I <sub>CM</sub>	Collector peak current (t <sub>p</sub> < 5 ms)	4	-4	A
I <sub>B</sub>	Base current	0.2	-0.2	A
I <sub>BM</sub>	Base peak current (t <sub>p</sub> < 5 ms)	0.4	-0.4	A
P <sub>TOT</sub>	Total dissipation at T <sub>amb</sub> ≤ 25 °C	1.4 <sup>(1)</sup>		W
		0.8 <sup>(2)</sup>		
	Total dissipation at T <sub>C</sub> ≤ 25 °C	7 <sup>(1)</sup>		W
		5 <sup>(2)</sup>		
T <sub>STG</sub>	Storage temperature range	-65 to 200		°C
T <sub>J</sub>	Operating junction temperature range			°C

1. Both sections.
2. One section.

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
R <sub>thJA</sub>	Thermal resistance junction-to-ambient max.	125 <sup>(1)</sup>	°C/W
		180 <sup>(2)</sup>	
R <sub>thJC</sub>	Thermal resistance junction-to-case max.	25 <sup>(1)</sup>	
		35 <sup>(2)</sup>	

1. Both sections.
2. One section.

## 2 Electrical characteristics

Note: For PNP transistor voltage and current polarity is reversed.

**Table 3. Electrical characteristics for NPN ( $T_{amb} = 25\text{ °C}$  unless otherwise specified)**

Symbol	Parameter	Test conditions	Min.	Max.	Unit
$I_{CBO}$	Collector-base cut-off current ( $I_E = 0$ )	$V_{CB} = 60\text{ V}$		100	nA
		$V_{CB} = 60\text{ V}, T_a = 150\text{ °C}$		10	$\mu\text{A}$
$I_{EBO}$	Emitter-base cut-off current ( $I_C = 0$ )	$V_{EB} = 6\text{ V}$		100	nA
$V_{(BR)CBO}$	Collector-base breakdown voltage ( $I_E = 0$ )	$I_C = 100\text{ }\mu\text{A}$	60		V
$V_{(BR)CEO}$	Collector-emitter breakdown voltage ( $I_B = 0$ )	$I_C = 1\text{ mA}$	60		V
$V_{(BR)EBO}$	Emitter-base breakdown voltage	$I_E = 10\text{ }\mu\text{A}$	6		V
$V_{BE(on)}$	Base-emitter on voltage	$V_{CE} = 2\text{ V}, I_C = 100\text{ mA}$	600	720	mV
$V_{CE(sat)}^{(1)}$	Collector-emitter saturation voltage	$I_C = 0.8\text{ A}, I_B = 40\text{ mA}$		160	mV
		$I_C = 2\text{ A}, I_B = 100\text{ mA}$		380	mV
$h_{FE}^{(1)}$	DC current gain	$I_C = 100\text{ mA}, V_{CE} = 2\text{ V}$	100		
		$I_C = 100\text{ mA}, V_{CE} = 2\text{ V}, T_a = -55\text{ °C}$	40		
		$I_C = 1\text{ A}, V_{CE} = 2\text{ V}$	160	400	
$t_{on}$	Turn on-time	$V_{CC} = 10\text{ V}, I_C = 0.8\text{ A}, I_{bon} = 80\text{ mA}, I_{boff} = -80\text{ mA}^{(2)}$		175	ns
$t_{off}$	Turn off-time			2.5	$\mu\text{s}$
$C_{OBO}$	Output capacitance	$V_{CB} = 10\text{ V}, I_E = 0\text{ A}, f = 1\text{ MHz}$		45	pF

1. Pulse test: pulse duration  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

2. Resistive load

**Table 4. Electrical characteristics for PNP ( $T_{amb} = 25\text{ °C}$  unless otherwise specified)**

Symbol	Parameter	Test conditions	Min.	Max.	Unit
$I_{CBO}$	Collector-base cut-off current ( $I_E = 0$ )	$V_{CB} = 60\text{ V}$		100	nA
		$V_{CB} = 60\text{ V}, T_a = 150\text{ °C}$		10	$\mu\text{A}$
$I_{EBO}$	Emitter-base cut-off current ( $I_C = 0$ )	$V_{EB} = 6\text{ V}$		100	nA
$V_{(BR)CBO}$	Collector-base breakdown voltage ( $I_E = 0$ )	$I_C = 100\text{ }\mu\text{A}$	60		V
$V_{(BR)CEO}$	Collector-emitter breakdown voltage ( $I_B = 0$ )	$I_C = 1\text{ mA}$	60		V
$V_{(BR)EBO}$	Emitter-base breakdown voltage	$I_E = 10\text{ }\mu\text{A}$	6		V
$V_{BE(on)}$	Base-emitter on voltage	$V_{CE} = 2\text{ V}, I_C = 100\text{ mA}$	600	720	mV
$V_{CE(sat)}^{(1)}$	Collector-emitter saturation voltage	$I_C = 0.8\text{ A}, I_B = 40\text{ mA}$		180	mV
		$I_C = 2\text{ A}, I_B = 100\text{ mA}$		440	mV
$h_{FE}^{(1)}$	DC current gain	$I_C = 100\text{ mA}, V_{CE} = 2\text{ V}$	100		
		$I_C = 100\text{ mA}, V_{CE} = 2\text{ V}, T_a = -55\text{ °C}$	40		
		$I_C = 1\text{ A}, V_{CE} = 2\text{ V}$	160	400	
$t_{on}$	Turn on-time	$V_{CC} = 10\text{ V}, I_C = 0.8\text{ A}, I_{bon} = 80\text{ mA},$		150	ns
$t_{off}$	Turn off-time	$I_{boff} = -80\text{ mA}^{(2)}$		1	$\mu\text{s}$
$C_{OBO}$	Output capacitance	$V_{CB} = 10\text{ V}, I_E = 0\text{ A}, f = 1\text{ MHz}$		60	pF

1. Pulse test: pulse duration  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

2. Resistive load

## 2.1 Test circuits

Figure 1. Resistive load switching for NPN

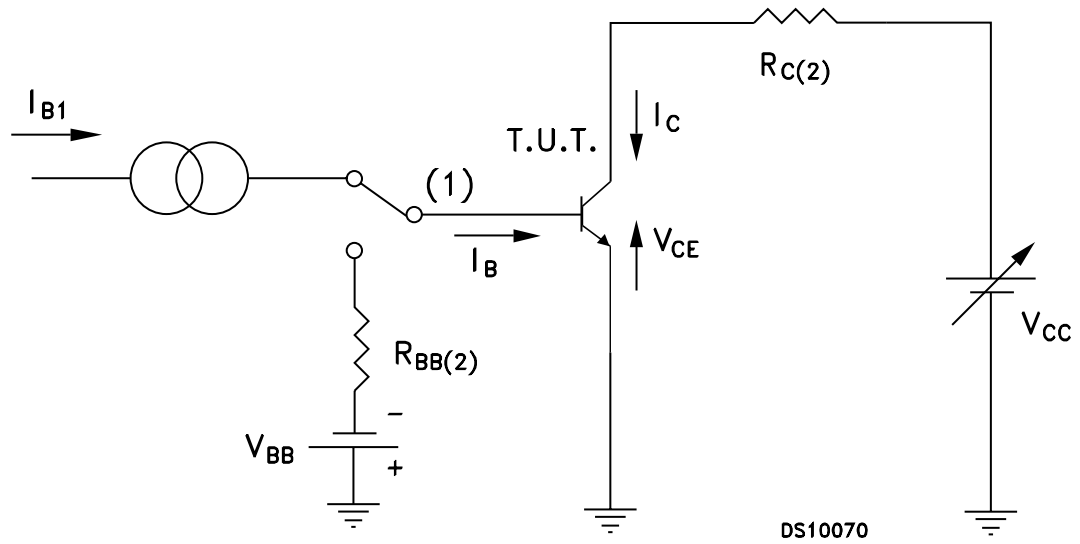
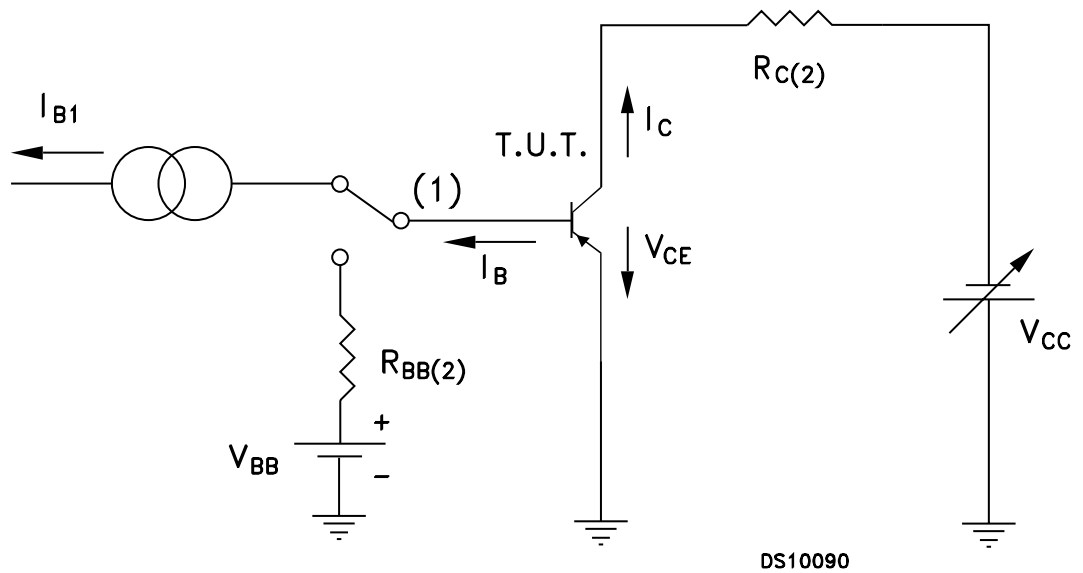


Figure 2. Resistive load switching for PNP



### 3 Radiation hardness assurance

This products is guaranteed in radiation as per ESCC 22900 and in compliance with ESCC 5207/009 specification. Each lot is tested in radiation according to the following procedure:

- Irradiation at 0.1 rad (Si)/s
- Test of 11 samples by wafer, 5 biased at least 80% of  $V_{(BR)CEO}$ , 5 unbiased and for reference.
- Acceptance criteria of each wafer at 100 krad if all 10 samples comply with the post radiation electrical characteristics as per Table 5 and Table 6.

**Table 5. ESCC5207/009 post radiation electrical characteristics for NPN**  
( $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Max	Unit
$I_{CBO}$	Collector cut-off current ( $I_E=0$ )	$V_{CB}= 60\text{ V}$		200	nA
$I_{EBO}$	Emitter cut-off current ( $I_C= 0$ )	$V_{EB} = 6\text{ V}$		200	nA
$V_{BE(on)}$	VBE(on) Base-emitter on voltage	$V_{CE} = 2\text{ V}, I_C = 100\text{ mA}$	600	828	mV
$V_{(BR)CBO}$	Collector-base breakdown voltage ( $I_E= 0$ )	$I_C=100\text{ }\mu\text{A}$	60		V
$V_{(BR)CEO}$	Collector-emitter breakdown voltage ( $I_B = 0$ )	$I_C = 1\text{ mA}$	60		V
$V_{(BR)EBO}$	Emitter-base breakdown voltage ( $I_C= 0$ )	$I_E = 10\text{ }\mu\text{A}$	6		V
$V_{CE(sat)}^{(1)}$	Collector-emitter saturation voltage	$I_C=0.8\text{ A}, I_B = 40\text{ mA}$		184	mV
		$I_C= 2\text{ A}, I_B = 100\text{ mA}$		437	
$h_{FE}^{(1)}$	DC current gain	$I_C= 100\text{ mA}, V_{CE}= 2\text{ V}$	[50] <sup>(2)</sup>		
		$I_C= 1\text{ A}, V_{CE}= 2\text{ V}$	[80] <sup>(2)</sup>	400	

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

2. The post-irradiation gain calculation of  $[h_{FE}]$ , made using  $h_{FE}$  measurements from prior to and on completion of irradiation testing and after each annealing step if any, shall be as specified in MILSTD-750 method 1019

**Note:** For PNP transistor voltage and current polarity is reversed.

**Table 6. ESCC5207/009 post radiation electrical characteristics for PNP**  
 ( $T_{amb} = 25\text{ °C}$  unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Max	Unit
$I_{CBO}$	Collector cut-off current ( $I_E=0$ )	$V_{CB}= 60\text{ V}$		200	nA
$I_{EBO}$	Emitter cut-off current ( $I_C= 0$ )	$V_{EB} = 6\text{ V}$		200	nA
$V_{BE(on)}$	Base-emitter on voltage	$V_{CE} = 2\text{ V}, I_C = 100\text{ mA}$	600	828	mV
$V_{(BR)CBO}$	Collector-base breakdown voltage ( $I_E= 0$ )	$I_C= 100\text{ }\mu\text{A}$	60		V
$V_{(BR)CEO}$	Collector-emitter breakdown voltage ( $I_B = 0$ )	$I_C = 1\text{ mA}$	60		V
$V_{(BR)EBO}$	Emitter-base breakdown voltage ( $I_C= 0$ )	$I_E = 10\text{ }\mu\text{A}$	6		V
$V_{CE(sat)}^{(1)}$	Collector-emitter saturation voltage	$I_C=0.8\text{ A}, I_B = 40\text{ mA}$		207	mV
		$I_C= 2\text{ A}, I_B = 100\text{ mA}$		506	
$h_{FE}^{(1)}$	DC current gain	$I_C= 100\text{ mA}, V_{CE}= 2\text{ V}$	[50] <sup>(2)</sup>		
		$I_C= 1\text{ A}, V_{CE}= 2\text{ V}$	[80] <sup>(2)</sup>	400	

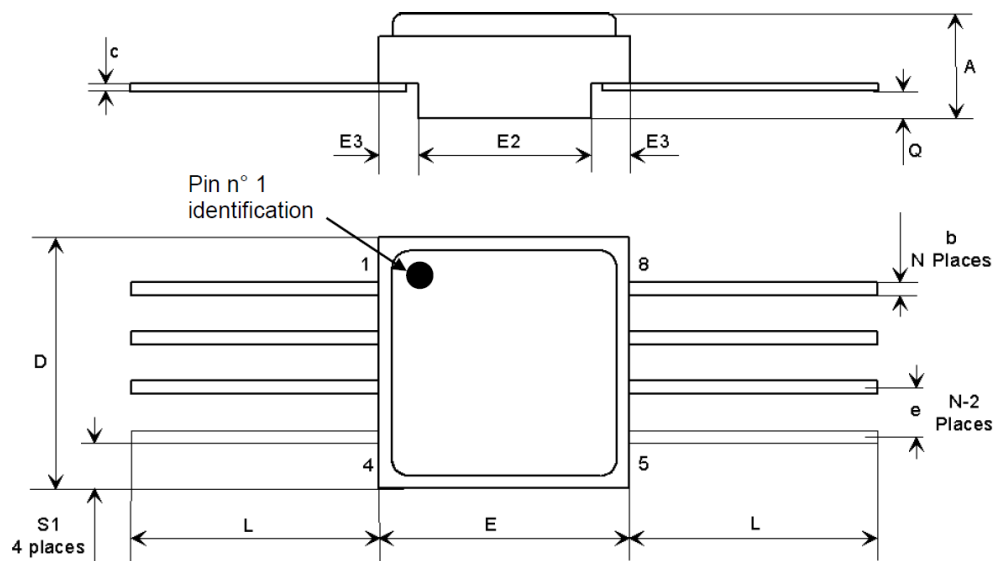
1. Pulsed duration = 300  $\mu\text{s}$ , duty cycle  $\geq 2\%$
2. The post-irradiation gain calculation of  $[h_{FE}]$ , made using  $h_{FE}$  measurements from prior to and on completion of irradiation testing and after each annealing step if any, shall be as specified in MILSTD-750 method 1019

## 4 Package information

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](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 Flat-8 package information

**Figure 3. Flat-8 package outline**



7939278\_6

**Table 7. Flat-8 mechanical data**

Symbol	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.24	2.44	2.64	0.088	0.096	0.104
b	0.38	0.43	0.48	0.015	0.017	0.019
c	0.10	0.13	0.16	0.004	0.005	0.006
D	6.35	6.48	6.61	0.250	0.255	0.260
E	6.35	6.48	6.61	0.250	0.255	0.260
E2	4.32	4.45	4.58	0.170	0.175	0.180
E3	0.88	1.01	1.14	0.035	0.040	0.045
e		1.27			0.050	
L	6.51	-	7.38	0.256	-	0.291
Q	0.66	0.79	0.92	0.026	0.031	0.036
S1	0.92	1.12	1.32	0.036	0.044	0.052
N	08			08		



## 5 Ordering information

**Table 8. Ordering information**

Part number	Agency specification	Quality level	Radiation level	Package	Weight	Lead finish	Marking <sup>(1)</sup>	Packing
2ST3360K1		Engineering model	-	Flat-8	0.4 g	Gold	2ST3360K1	Waffle pack
2ST3360RKG	5207/009/01R	ESCC flight	100 krad				520700901R	
2ST3360RKT	5207/009/02R	ESCC flight	100 krad			Solder dip	520700902R	

1. Specific marking only. The full marking includes in addition: For the Engineering Models: ST logo, date code; country of origin (FR). For ESCC flight parts: STlogo, date code, country of origin (FR), ESA logo, serial number of the part within the assembly lot.

Contact ST sales office for information about specific conditions for products in die form.



## 6 Other information

### 6.1 Date code

Date code information is described in [Table 9](#).

**Table 9. Date codes**

Model	Date code
EM	3yywwN
ECC	yywwN

1. yy = year, ww = week number, N = lot index in the week.

### 6.2 Documentation

Documentation is provided for each product as per below [Table 10](#).

**Table 10. Documentation summary**

Quality level	Radiation level	Documentation
Engineering model	-	Certificate of conformance.
ESCC	100 krad	Certificate of conformance. ESCC qualification maintenance lot reference. Radiation data at 25 / 50 / 70 / 100 krad at 0.1 rad / s.

## Revision history

**Table 11. Document revision history**

Date	Version	Changes
19-May-2021	1	Initial release.

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