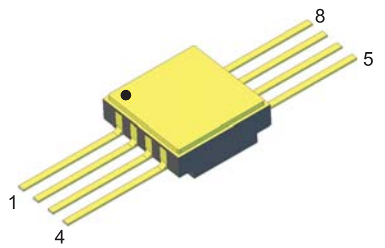
JANS2ST3360K

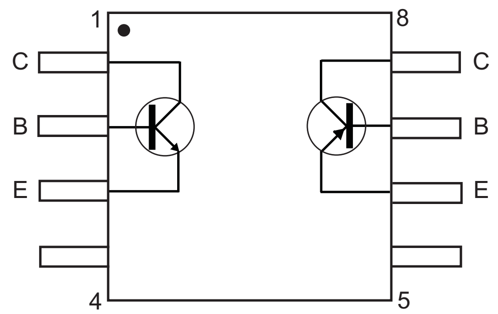
Hi-Rel NPN and PNP complementary transistors 60 V, 0.8 A

Datasheet - production data



Flat-8

Figure 1. Internal schematic diagram



Pin 4 and 5 are connected to the seal ring and lid

Features

Polarity	$V_{(BR)CEO}$	I_C (max.)	h_{FE} (1)
NPN	60 V	0.8 A	160
PNP	-60 V	-0.8 A	160

1. @ I_C = 1 A and V_{CE} = 2 V.

- Very low collector-emitter saturation voltage
- High current gain characteristic
- Fast-switching speed: ft= 130 MHz
- Hermetic package
- JANS qualified

Application

- Power MOSFET drivers

Description

The JANS2ST3360K power bipolar transistor is a fast, dual complementary matched device (NPN and PNP) housed in a single Flat-8 hermetic package, intended for aerospace Hi-Rel and Rad-hard applications. ST's high current density technology ensures high levels of electrical and switching performance. Due to its radiation hardness specific design, the post radiation performance makes it the best in its class. The high switching performance allows this device to be particularly suitable for power MOSFET driver applications. It is qualified in the JANS system as per MIL-PRF19500. In case of mismatches between this datasheet and the specification of the agency, the latter takes precedence.

Table 1. Device summary

Order code	Qualification system	Agency specification	Package	Lead finish	Radiation level	Mass
J2ST3360K1	-	-	Flat-8	Gold	-	0.4 g
JANS2ST3360KG	JANS	MIL-PRF-M19500/773	Flat-8	Gold	-	
JANS2ST3360KT	JANS	MIL-PRF-M19500/773	Flat-8	Solder dip	-	
JANSR2ST3360KG	JANSR	MIL-PRF-M19500/773	Flat-8	Gold	100 krad	
JANSR2ST3360KT	JANSR	MIL-PRF-M19500/773	Flat-8	Solder dip	100 krad	

Contents

1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		NPN	PNP	
V_{CBO}	Collector-base voltage ($I_E = 0$)	60	-60	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60	-60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	-6	V
I_C	Collector current	0.8	-0.8	A
I_{CM}	Collector peak current ($t_P < 5$ ms)	4	-4	A
I_B	Base current	0.2	-0.2	A
I_{BM}	Base peak current ($t_P < 5$ ms)	0.4	-0.4	A
P_{TOT}	Total dissipation at $T_{amb} = 25$ °C	1.4(1)		W
		0.8(2)		W
P_{TOT}	Total dissipation at $T_C = 25$ °C	7 (1)		W
		5 (2)		W
T_{STG}	Storage temperature range	-65 to 200		°C
T_J	Operating junction temperature range			°C

1. Both sections.
2. One section.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}amb}$	Thermal resistance junction-amb	125 (1)	°C/W
		180 (2)	°C/W
$R_{thj\text{-}case}$	Thermal resistance junction-case	25 (1)	°C/W
		35 (2)	°C/W

1. Both sections.
2. One section.

2 Electrical characteristics

T_{CASE} = 25 °C; unless otherwise specified.

Table 4. Electrical characteristics for NPN

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

1. Pulse test: pulse duration ≤ 300 µs, duty cycle ≤ 2%.

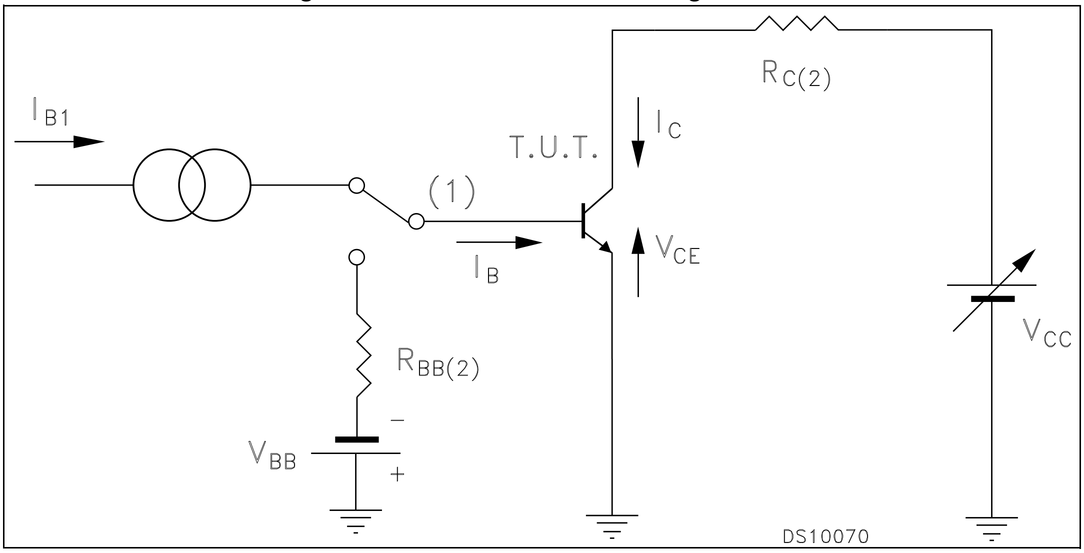
Table 5. Electrical characteristics for PNP[(1)]

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

1. For PNP type, voltage and current values are negative.
2. Pulse test: pulse duration ≤ 300 µs, duty cycle ≤ 2%.

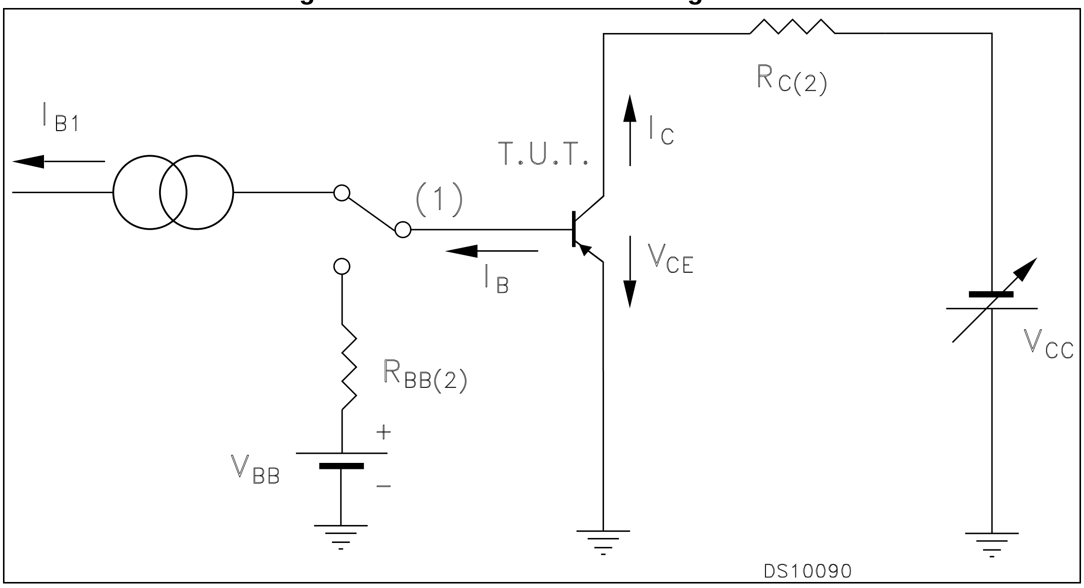
2.1 Test circuits

Figure 2. Resistive load switching for NPN



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

Figure 3. Resistive load switching for PNP



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

3 Radiation hardness assurance

The product guaranteed in radiation within the JANS system fully complies with the MIL-PRF-M19500/773 specifications.

3.1 JANS radiation assurance

ST's JANS parts are guaranteed at 100 krad (Si), tested as defined in MIL-PRF-19500 specifications, specifically the group D, subgroup 2 inspection, between 50 and 300 rad/s.

On top of the standard JANSR high dose rate by wafer lot guarantee, this device includes an additional wafer by wafer 100 krad low dose rate guarantee at 0.1 rad/s.

A summary of the standard high dose rate by wafer lot JANSR guarantee is provided below:

- All tests are performed in accordance with MIL-PRF-19500 and test method 1019 of MIL-STD-750 for total ionizing dose.
- The table below provides for each monitored parameter, the test conditions and the acceptance criteria.

Table 6. MIL-PRF-19500 (test method 1019) post radiation electrical characteristics for NPN

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

1. Pulse test: pulse duration ≤ 300 µs, duty cycle ≤ 2%.
2. See method 1019 of MIL-STD-750 about how to determine [h_{FE}] by first calculating the delta (1/h_{FE}) from the pre- and post-radiation h_{FE}. Note that the [h_{FE}] is not the same as h_{FE} and cannot be measured directly. The [h_{FE}] value can never exceed the pre-radiation minimum h_{FE}, which is based upon.

Table 7. MIL-PRF-19500 (test method 1019) post radiation electrical characteristics for PNP[(1)]

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cut-off current ($I_E = 0$)	$V_{CB} = 60$ V		-	200	nA
I_{EBO}	Emitter cut-off current ($I_C = 0$)	$V_{EB} = 6$ V		-	200	nA
$V_{BE(on)}$	Base-emitter on voltage	$V_{CE} = 2$ V $I_C = 100$ mA	600	-	828	mV
$V_{(BR)CBO}$	Collector-base breakdown voltage ($I_E = 0$)	$I_C = 100$ µA	60	-		V
$V_{(BR)CEO}$	Collector-emitter breakdown voltage ($I_B = 0$)	$I_C = 1$ mA	60	-		V
$V_{(BR)EBO}$	Emitter-base breakdown voltage	$I_E = 10$ µA	6	-		V
$V_{CE(sat)}$[(2)]	Collector-emitter saturation voltage	$I_C = 0.8$ A $I_B = 40$ mA $I_C = 2$ A $I_B = 100$ mA		-	207 506	mV mV
h_{FE}[(1)]	DC current gain	$I_C = 100$ mA $V_{CE} = 2$ V $I_C = 1$ A $V_{CE} = 2$ V	[50][(3)] [80][(3)]	-	 [400]	

1. For PNP type, voltage and current values are negative.
2. Pulse test: pulse duration ≤ 300 µs, duty cycle ≤ 2%.
3. See method 1019 of MIL-STD-750 about how to determine [h_{FE}] by first calculating the delta ($1/h_{FE}$) from the pre- and post-radiation h_{FE}. Note that the [h_{FE}] is not the same as h_{FE} and cannot be measured directly. The [h_{FE}] value can never exceed the pre-radiation minimum h_{FE}, which is based upon.

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*. ECOPACK® is an ST trademark.

4.1 Flat-8 package information

Figure 4. Flat-8 package outline

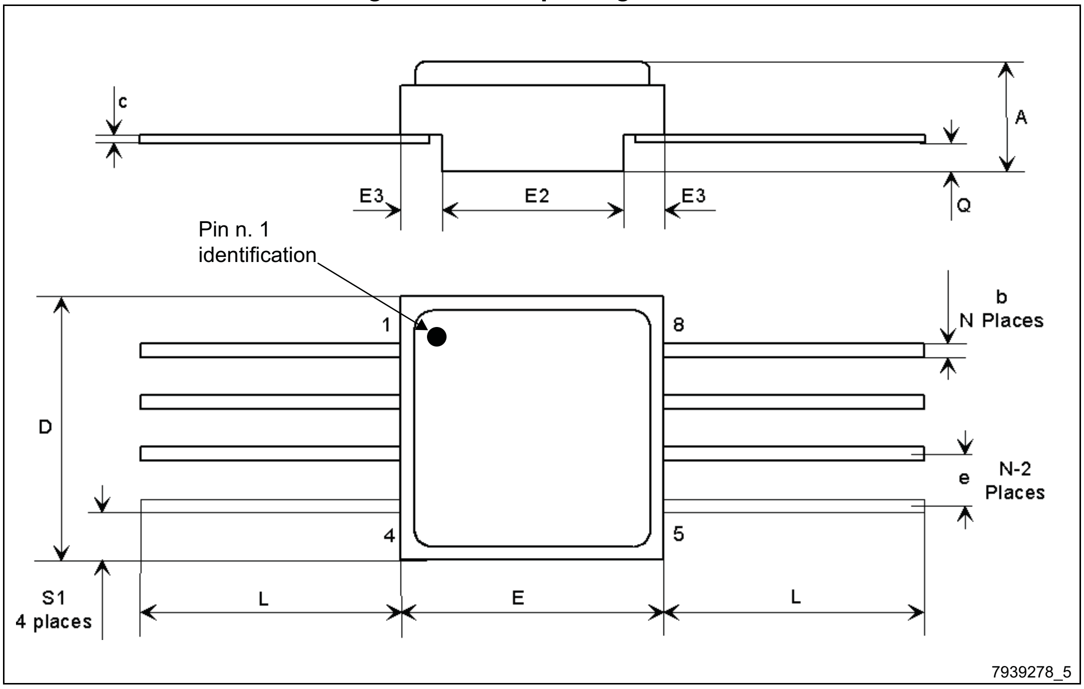


Table 8. Flat-8 package mechanical data

Dim.	mm			inch		
	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 Order code

Table 9. Ordering information

Device	Agency specification	Quality level	Radiation level	Package	Lead finish	Marking	Packing
J2ST3360K1	-	Eng. model	-	Flat-8	Gold	J2ST3360K1	Strip pack
JANS2ST3360KG	MIL-PRF-M19500/773	Flight model	-	Flat-8	Gold	JANSM19500/773-01	
JANS2ST3360KT	MIL-PRF-M19500/773	Flight model	-	Flat-8	Solder dip	JANSM19500/773-01	
JANSR2ST3360KG	MIL-PRF-M19500/773	Flight model	100 krad	Flat-8	Gold	JANSRM19500/773-01	
JANSR2ST3360KT	MIL-PRF-M19500/773	Flight model	100 krad	Flat-8	Solder dip	JANSRM19500/773-01	

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

– Products in die form

– Other JANS quality levels

6 Shipping details

6.1 Date code

Date code xyywwz is explained below:

Table 10. Date code

	x	xx	ww	z
EM JANS	3	Last two digits of the year	Week digits	Lot index in the week
Flight JANS (in Singapore)	w			

6.2 Documentation

Table 11. Document provided for each type of product

Quality level	Radiation level	Documentation
Engineering model	-	Certificate of conformance
JANS flight	-	Certificate of conformance
JANSR flight	MIL-STD 100 krad and ST 100 krad LDR	Certificate of conformance. 50 rad/s and 0.1 rad/s radiation verification test report

7 Revision history

Table 12. Document revision history

Date	Revision	Changes
30-Sep-2015	1	Initial release.
14-Sep-2016	2	Updated *Table 1: Device summary*, *Table 2: Absolute maximum ratings*, *Table 3: Thermal data*, *Table 4: Electrical characteristics for NPN*, *Table 5: Electrical characteristics for PNP*, *Table 9: Ordering information* and *Figure 4: Flat-8 package outline*. Minor text changes.