SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N silicon transistors, in a microminiature plastic envelope intended for switching and linear applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BSR13	BSR14	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	75	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	6	V
Collector current (d.c.)	I_C	max.	800		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain					
I_C = 150 mA; V_{CE} = 10 V	h_{FE}		100 to 300		
I_C = 500 mA; V_{CE} = 10 V	h_{FE}	>	30	40	
Transition frequency at f = 100 MHz					
I_C = 20 mA; V_{CE} = 20 V	f_T	>	250	300	MHz

MECHANICAL DATA

Dimensions in mm

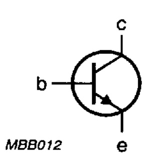
Marking code

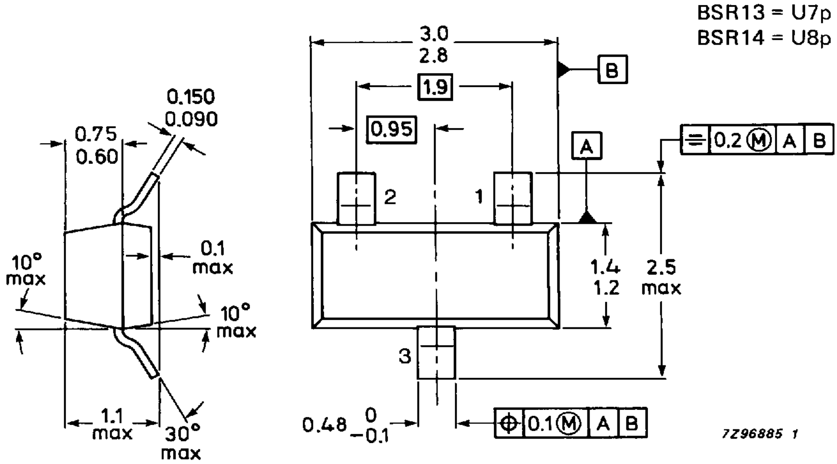
BSR13 = U7p
BSR14 = U8p

Fig. 1 SOT-23.

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

Reverse pinning types are available on request.

See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSR13	BSR14	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	75	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	6	V
Collector current (d.c.)	I_C	max.	800		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BSR13	BSR14	
Collector cut-off current					
$I_E = 0$; V_{CB} = 50 V	I_{CBO}	<	30	—	nA
$I_E = 0$; V_{CB} = 60 V	I_{CBO}	<	—	10	nA
$I_E = 0$; V_{CB} = 50 V; T_j = 150 °C	I_{CBO}	<	10	—	μA
$I_E = 0$; V_{CB} = 60 V; T_j = 150 °C	I_{CBO}	<	—	10	μA
V_{EB} = 3 V; V_{CE} = 60 V	I_{CEX}	<	—	10	nA
Base current with reverse biased emitter junction					
V_{EB} = 3 V; V_{CE} = 60 V	I_{BEX}	<	—	20	nA
Emitter cut-off current					
$I_C = 0$; V_{EB} = 3 V	I_{EBO}	<	30	15	nA
Saturation voltages					
I_C = 150 mA; I_B = 15 mA	V_{CEsat}	<	400	300	mV
	V_{BEsat}	<	1300	—	mV
	V_{BEsat}		—	0,6 to 1,2	V
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	1600	1000	mV
	V_{BEsat}	<	2600	2000	mV

* Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

D.C. current gain *				
$I_C = 0{,}1$ mA; $V_{CE} = 10$ V		h_{FE}	> 35	
$I_C = 1$ mA; $V_{CE} = 10$ V		h_{FE}	> 50	
$I_C = 10$ mA; $V_{CE} = 10$ V		h_{FE}	> 75	
$I_C = 150$ mA; $V_{CE} = 10$ V		h_{FE}	100 to 300	
$I_C = 150$ mA; $V_{CE} = 1$ V		h_{FE}	> 50	
$I_C = 500$ mA; $V_{CE} = 10$ V	BSR13; R	h_{FE}	> 30	
$I_C = 500$ mA; $V_{CE} = 10$ V	BSR14; R	h_{FE}	> 40	
Transition frequency at f = 100 MHz				
$I_C = 20$ mA; $V_{CE} = 20$ V	BSR13; R	f_T	> 250	MHz
$I_C = 20$ mA; $V_{CE} = 20$ V	BSR14; R	f_T	> 300	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V		C_c	< 8	pF
h parameters (common emitter) at f = 1 kHz				
$I_C = 1$ mA; $V_{CE} = 10$ V			BSR14	
input impedance		h_{ie}	2 to 8	kΩ
reverse voltage transfer ratio		h_{re}	< 8.10^{-4}	
small signal current gain		h_{fe}	50 to 300	
output admittance		h_{oe}	5 to 35	μS
$I_C = 10$ mA; $V_{CE} = 10$ V			BSR13	
input impedance		h_{ie}	0,25 to 1,25	kΩ
reverse voltage transfer ratio		h_{re}	< 4.10^{-4}	
small signal current gain		h_{fe}	75 to 375	
output admittance		h_{oe}	25 to 200	μS

* Measured under pulsed conditions to avoid excessive dissipation; pulse duration $t_p \leqslant 300\ \mu s$; duty factor $\delta \leqslant 0{,}02$.

Switching times (between 10% and 90% levels)

		BSR14		
Turn-on time switched to I_C = 150 mA (see Fig. 2)				
delay time	t_d	<	10	ns
rise time	t_r	<	25	ns
Turn-off time switched from I_C = 150 mA (see Fig. 3)				
storage time	t_s	<	225	ns
fall time	t_f	<	60	ns

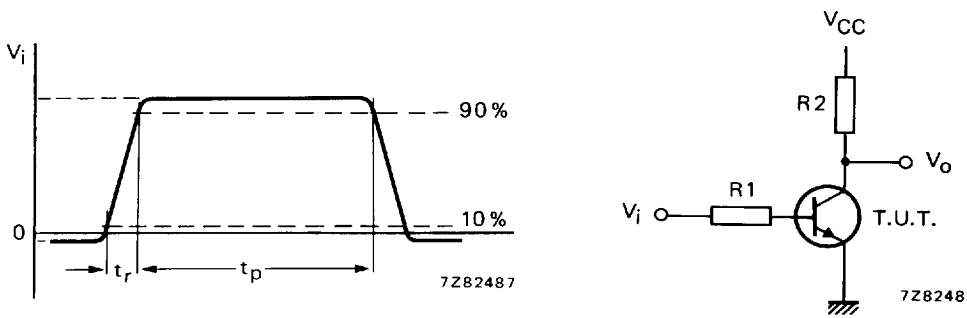


Fig. 2 Waveform and test circuit delay and rise time.

V_i = –0,5 to + 9,9 V; V_{CC} = 30 V; R1 = 619 Ω; R2 = 200 Ω.

Pulse generator:				Oscilloscope:			
pulse duration	t_p	⩽	200 ns	input impedance	Z_i	>	100 kΩ
rise time	t_r	⩽	2 ns	input capacitance	C_i	<	12 pF
duty factor	δ	=	2 %	rise time	t_r	<	5 ns

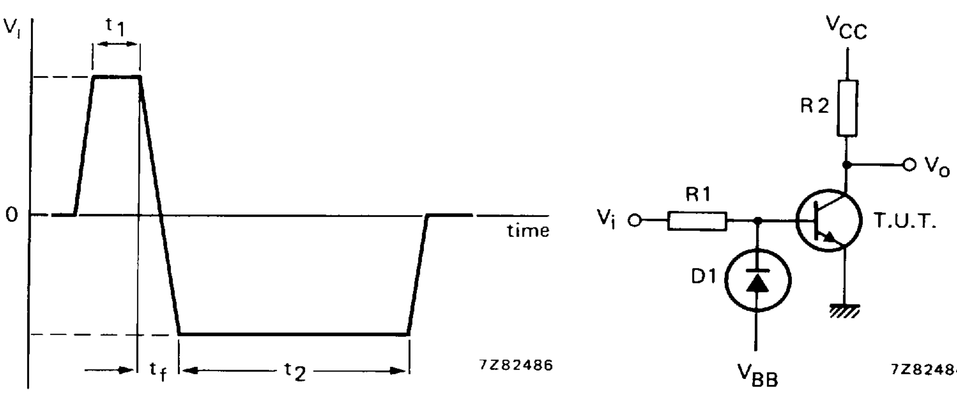


Fig. 3 Waveform and test circuit storage and fall time.

V_i = –13,8 to + 16,2 V; V_{CC} = 30 V; $-V_{BB}$ = 3 V; R1 = 1 kΩ; R2 = 200 Ω.

Pulse generator:				Oscilloscope:			
fall time	t_f	<	5 ns	input impedance	Z_i	>	100 kΩ
pulse time	t_1	=	100 μs	input capacitance	C_i	<	12 pF
	t_2	=	500 μs	rise time	t_r	<	5 ns