SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N silicon transistors, in a microminiature plastic package 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

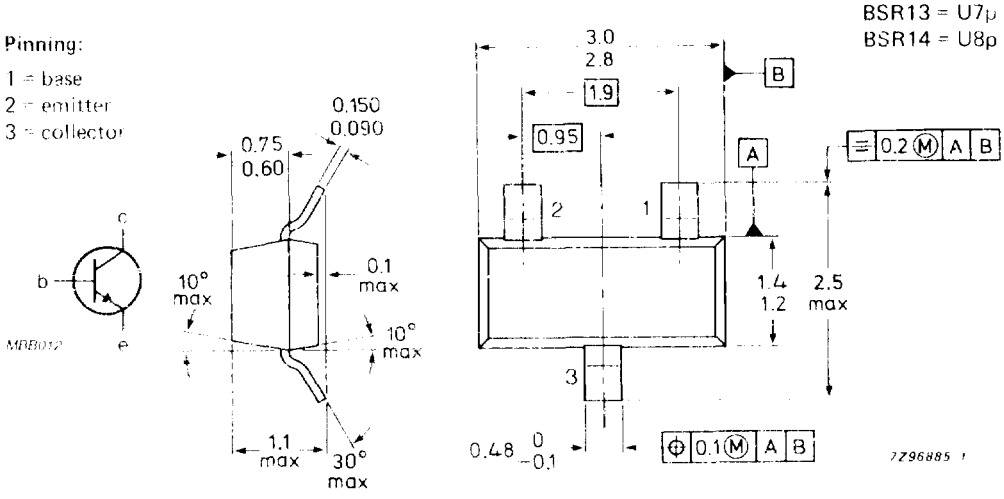
Fig. 1 SOT-23.

Pinning:

1 = base
2 = emitter
3 = collector

Marking code

BSR13 = U7p
BSR14 = U8p



TOP VIEW

Reverse pinning types are available on request.

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

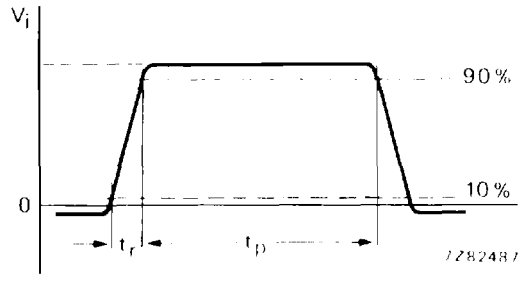
* Mounted on an FR4 printed-circuit board 8 mm x 10 mm x 0.7 mm.

D.C. current gent *			
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 $t_p \leq 300$ μs; duty factor $\delta \leq 0{,}02$.

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



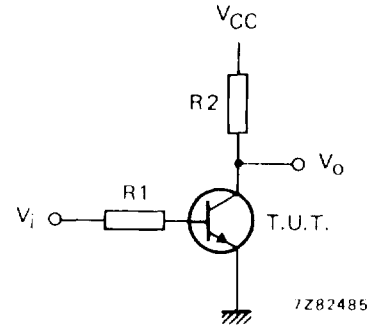
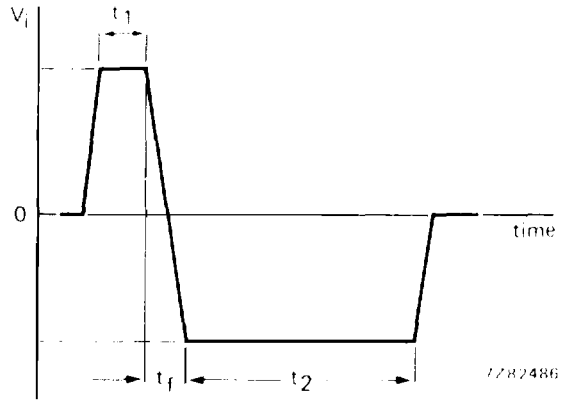


Fig. 2 Waveform and test circuit delay and rise time.

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



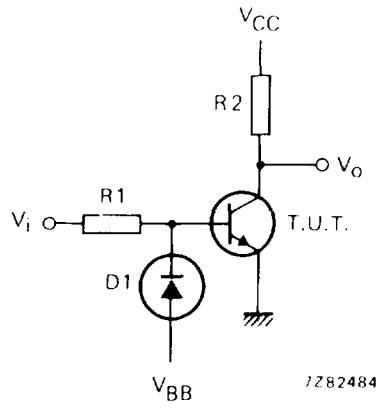


Fig. 3 Waveform and test circuit storage and fall time.

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