SILICON PLANAR VOLTAGE REGULATOR DIODES

Low power general purpose voltage regulator diodes in a micro miniature plastic envelope. They are available in three series; one to the international standardized E24 (± 5%) range, one in a tolerance of ± 2% and the other in a tolerance of ± 1%. The C5V1 is CECC approved to 50 005-21.
Each series consists of 37 types with nominal working voltages from 2.4 V to 75 V.

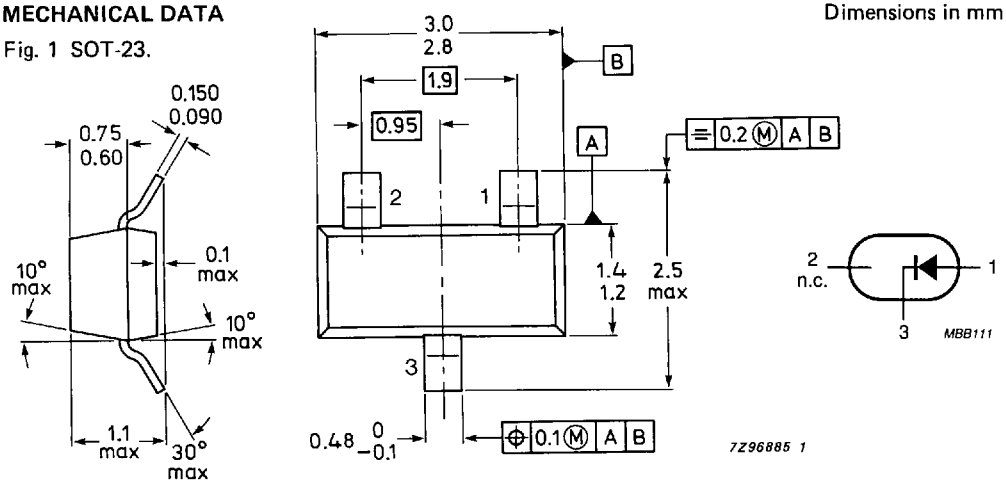
QUICK REFERENCE DATA

Working voltage range	V_Z	nom.	2.4 to 75 V
Working voltage tolerance			± 5 %
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



TOP VIEW

See also *Soldering recommendations.*

Marking code

BZX84-C2V4 = Z11	BZX84-C5V6 = Z3p	BZX84-C13 = Y3p	BZX84-C33 = Y12
C2V7 = Z12	C6V2 = Z4p	C15 = Y4p	C36 = Y13
C3V0 = Z13	C6V8 = Z5p	C16 = Y5p	C39 = Y14
C3V3 = Z14	C7V5 = Z6p	C18 = Y6p	C43 = Y15
C3V6 = Z15	C8V2 = Z7p	C20 = Y7p	C47 = Y16
C3V9 = Z16	C9V1 = Z8p	C22 = Y8p	C51 = Y17
C4V3 = Z17	C10 = Z9p	C24 = Y9p	C56 = Y18
C4V7 = Z1p	C11 = Y1p	C27 = Y10	C62 = Y19
C5V1 = Z2p	C12 = Y2p	C30 = Y11	C68 = Y20
			C75 = Y21

Marking for B and A types available on request.

RATINGS

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

Repetitive peak forward current	I_{FRM}	max.	250 mA
Repetitive peak working current	I_{ZRM}	max.	250 mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300 mW
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*	$R_{th\ j\text{-}a}$	=	430 K/W
From junction to ambient**	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage				
I_F = 10 mA		V_F	<	0.9 V
Reverse current				
BZX84–.2V4	V_R = 1 V	I_R	<	50 μA
2V7	V_R = 1 V	I_R	<	20 μA
3V0	V_R = 1 V	I_R	<	10 μA
3V3	V_R = 1 V	I_R	<	5 μA
3V6	V_R = 1 V	I_R	<	5 μA
3V9	V_R = 1 V	I_R	<	3 μA
4V3	V_R = 1 V	I_R	<	3 μA
4V7	V_R = 2 V	I_R	<	3 μA
5V1	V_R = 2 V	I_R	<	2 μA
5V6	V_R = 2 V	I_R	<	1 μA
6V2	V_R = 4 V	I_R	<	3 μA
6V8	V_R = 4 V	I_R	<	2 μA
7V5	V_R = 5 V	I_R	<	1 μA
8V2	V_R = 5 V	I_R	<	700 nA
9V1	V_R = 6 V	I_R	<	500 nA
10	V_R = 7 V	I_R	<	200 nA
11	V_R = 8 V	I_R	<	100 nA
12	V_R = 8 V	I_R	<	100 nA
13	V_R = 8 V	I_R	<	100 nA
15 to 75	V_R = 0.7 V_{Znom}	I_R	<	50 nA

. = A for 1%
. = B for 2%
.. = C for (E24), 5%

* Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.
** Device mounted on an FR4 printed-circuit board.

T_j = 25 °C
± 5% tolerance range

BZX84	working voltage V_Z (V) at I_{Ztest} = 5 mA		differential resistance r_{diff} (Ω) at I_{Ztest} = 5 mA		temperature coefficient S_Z (mV/K) at I_{Ztest} = 5 mA			differential resistance r_{diff} (Ω) at I_Z = 1 mA	
	min.	max.	typ.	max.	min.	typ.	max.	typ.	max.
C2V4	2.20	2.60	70	100	−3.5	−1.6	0	275	600
C2V7	2.50	2.90	75	100	−3.5	−2.0	0	300	600
C3V0	2.80	3.20	80	95	−3.5	−2.1	0	325	600
C3V3	3.10	3.50	85	95	−3.5	−2.4	0	350	600
C3V6	3.40	3.80	85	90	−3.5	−2.4	0	375	600
C3V9	3.70	4.10	85	90	−3.5	−2.5	0	400	600
C4V3	4.00	4.60	80	90	−3.5	−2.5	0	410	600
C4V7	4.40	5.00	50	80	−3.5	−1.4	0.2	425	500
C5V1	4.80	5.40	40	60	−2.7	−0.8	1.2	400	480
C5V6	5.20	6.00	15	40	−2.0	1.2	2.5	80	400
C6V2	5.80	6.60	6	10	0.4	2.3	3.7	40	150
C6V8	6.40	7.20	6	15	1.2	3.0	4.5	30	80
C7V5	7.00	7.90	6	15	2.5	4.0	5.3	30	80
C8V2	7.70	8.70	6	15	3.2	4.6	6.2	40	80
C9V1	8.50	9.60	6	15	3.8	5.5	7.0	40	100
C10	9.40	10.60	8	20	4.5	6.4	8.0	50	150
C11	10.40	11.60	10	20	5.4	7.4	9.0	50	150
C12	11.40	12.70	10	25	6.0	8.4	10.0	50	150
C13	12.40	14.10	10	30	7.0	9.4	11.0	50	170
C15	13.80	15.60	10	30	9.2	11.4	13.0	50	200
C16	15.30	17.10	10	40	10.4	12.4	14.0	50	200
C18	16.80	19.10	10	45	12.4	14.4	16.0	50	225
C20	18.80	21.20	15	55	14.4	16.4	18.0	60	225
C22	20.80	23.30	20	55	16.4	18.4	20.0	60	250
C24	22.80	25.60	25	70	18.4	20.4	22.0	60	250
	at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA			at I_Z = 0.5 mA	
C27	25.10	28.90	25	80	21.4	23.4	25.3	65	300
C30	28.00	32.00	30	80	24.4	26.6	29.4	70	300
C33	31.00	35.00	35	80	27.4	29.7	33.4	75	325
C36	34.00	38.00	35	90	30.4	33.0	37.4	80	350
C39	37.00	41.00	40	130	33.4	36.4	41.2	80	350
C43	40.00	46.00	45	150	37.6	41.2	46.6	85	375
C47	44.00	50.00	50	170	42.0	46.1	51.8	85	375
C51	48.00	54.00	60	180	46.6	51.0	57.2	90	400
C56	52.00	60.00	70	200	52.2	57.0	63.8	100	425
C62	58.00	66.00	80	215	58.8	64.4	71.6	120	450
C68	64.00	72.00	90	240	65.6	71.7	79.8	150	475
C75	70.00	79.00	95	255	73.4	80.02	88.6	170	500

± 2% tolerance range

BZX84	working voltage V_Z (V) at I_{Ztest} = 5 mA		differential resistance r_{diff} (Ω) at I_{Ztest} = 5 mA		temperature coefficient S_Z (mV/K) at I_{Ztest} = 5 mA			differential resistance r_{diff} (Ω) at I_Z = 1 mA	
	min.	max.	typ.	max.	min.	typ.	max.	typ.	max.
B2V4	2.35	2.45	70	100	−3.5	−1.6	0	275	600
B2V7	2.65	2.75	75	100	−3.5	−2.0	0	300	600
B3V0	2.94	3.06	80	95	−3.5	−2.1	0	325	600
B3V3	3.23	3.37	85	95	−3.5	−2.4	0	350	600
B3V6	3.53	3.67	85	90	−3.5	−2.4	0	375	600
B3V9	3.82	3.98	85	90	−3.5	−2.5	0	400	600
B4V3	4.21	4.39	80	90	−3.5	−2.5	0	410	600
B4V7	4.61	4.79	50	80	−3.5	−1.4	0.2	425	500
B5V1	5.00	5.20	40	60	−2.7	−0.8	1.2	400	480
B5V6	5.49	5.71	15	40	−2.0	1.2	2.5	80	400
B6V2	6.08	6.32	6	10	0.4	2.3	3.7	40	150
B6V8	6.66	6.94	6	15	1.2	3.0	4.5	30	80
B7V5	7.35	7.65	6	15	2.5	4.0	5.3	30	80
B8V2	8.04	8.36	6	15	3.2	4.6	6.2	40	80
B9V1	8.92	9.28	6	15	3.8	5.5	7.0	40	100
B10	9.80	10.20	8	20	4.5	6.4	8.0	50	150
B11	10.80	11.20	10	20	5.4	7.4	9.0	50	150
B12	11.80	12.20	10	25	6.0	8.4	10.0	50	150
B13	12.70	13.30	10	30	7.0	9.4	11.0	50	170
B15	14.70	15.30	10	30	9.2	11.4	13.0	50	200
B16	15.70	16.30	10	40	10.4	12.4	14.0	50	200
B18	17.60	18.40	10	45	12.4	14.4	16.0	50	225
B20	19.60	20.40	15	55	14.4	16.4	18.0	60	225
B22	21.60	22.40	20	55	16.4	18.4	20.0	60	250
B24	23.50	24.50	25	70	18.4	20.4	22.0	60	250
	at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA			at I_Z = 0.5 mA	
B27	26.50	27.50	25	80	21.4	23.4	25.3	65	300
B30	29.40	30.60	30	80	24.4	26.6	29.4	70	300
B33	32.30	33.70	35	80	27.4	29.7	33.4	75	325
B36	35.30	36.70	35	90	30.4	33.0	37.4	80	350
B39	38.20	39.80	40	130	33.4	36.4	41.2	80	350
B43	42.10	43.90	45	150	37.6	41.2	46.6	85	375
B47	46.10	47.90	50	170	42.0	46.1	51.8	85	375
B51	50.00	52.00	60	180	46.6	51.0	57.2	90	400
B56	54.90	57.10	70	200	52.2	57.0	63.8	100	425
B62	60.80	63.20	80	215	58.8	64.4	71.6	120	450
B68	66.60	69.40	90	240	65.6	71.7	79.8	150	475
B75	73.50	76.50	95	255	73.4	80.02	88.6	170	500

T_j = 25 °C
± 1% tolerance range

BZX84	working voltage V_Z (V) at I_{Ztest} = 5 mA		differential resistance r_{diff} (Ω) at I_{Ztest} = 5 mA		temperature coefficient S_Z (mV/K) at I_{Ztest} = 5 mA			differential resistance r_{diff} (Ω) at I_Z = 1 mA	
	min.	max.	typ.	max.	min.	typ.	max.	typ.	max.
A2V4	2.37	2.43	70	100	−3.5	−1.6	0	275	600
A2V7	2.67	2.73	75	100	−3.5	−2.0	0	300	600
A3V0	2.97	3.03	80	95	−3.5	−2.1	0	325	600
A3V3	3.26	3.34	85	95	−3.5	−2.4	0	350	600
A3V6	3.56	3.64	85	90	−3.5	−2.4	0	375	600
A3V9	3.86	3.94	85	90	−3.5	−2.5	0	400	600
A4V3	4.25	4.35	80	90	−3.5	−2.5	0	410	600
A4V7	4.65	4.75	50	80	−3.5	−1.4	0.2	425	500
A5V1	5.04	5.16	40	60	−2.7	−0.8	1.2	400	480
A5V6	5.54	5.66	15	40	−2.0	1.2	2.5	80	400
A6V2	6.13	6.27	6	10	0.4	2.3	3.7	40	150
A6V8	6.73	6.87	6	15	1.2	3.0	4.5	30	80
A7V5	7.42	7.58	6	15	2.5	4.0	5.3	30	80
A8V2	8.11	8.29	6	15	3.2	4.6	6.2	40	80
A9V1	9.0	9.2	6	15	3.8	5.5	7.0	40	100
A10	9.9	10.10	8	20	4.5	6.4	8.0	50	150
A11	10.8	11.11	10	20	5.4	7.4	9.0	50	150
A12	11.88	12.12	10	25	6.0	8.4	10.0	50	150
A13	12.87	13.13	10	30	7.0	9.4	11.0	50	170
A15	14.85	15.15	10	30	9.2	11.4	13.0	50	200
A16	15.84	16.16	10	40	10.4	12.4	14.0	50	200
A18	17.82	18.18	10	45	12.4	14.4	16.0	50	225
A20	19.80	20.20	15	55	14.4	16.4	18.0	60	225
A22	21.78	22.22	20	55	16.4	18.4	20.0	60	250
A24	23.76	24.24	25	70	18.4	20.4	22.0	60	250
	at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA			at I_Z = 0.5 mA	
A27	26.73	27.27	25	80	21.4	23.4	25.3	65	300
A30	29.70	30.30	30	80	24.4	26.6	29.4	70	300
A33	32.67	33.33	35	80	27.4	29.7	33.4	75	325
A36	35.64	36.36	35	90	30.4	33.0	37.4	80	350
A39	38.61	39.39	40	130	33.4	36.4	41.2	80	350
A43	42.57	43.43	45	150	37.6	41.2	46.6	85	375
A47	46.53	47.47	50	170	42.0	46.1	51.8	85	375
A51	50.49	51.51	60	180	46.6	51.0	57.2	90	400
A56	55.44	56.56	70	200	52.2	57.0	63.8	100	425
A62	61.38	62.62	80	215	58.8	64.4	71.6	120	450
A68	67.32	68.68	90	240	65.6	71.7	79.8	150	475
A75	74.25	75.75	95	255	73.4	80.02	88.6	170	500

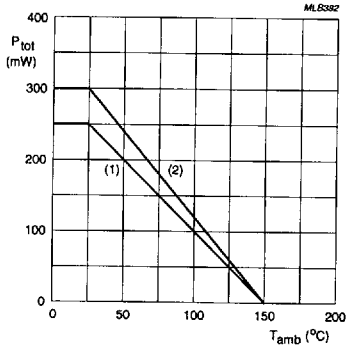


Fig. 2 Power derating curve.

(1) Mounted on an FR4 printed-circuit board.
(2) Mounted on a ceramic substrate 8 x 10 x 0.7 mm.

Model for calculating the static working voltage ($V_{Z\ stat}$).

This model can be derived from $V_{Z\ stat} = V_{Z\ dyn} + \Delta V_Z$ of which $V_{Z\ dyn}$ is given in the preceding tables and can be derived from the typical dynamic characteristic curves in Figs 3 to 6.
$\Delta V_Z = \Delta T \times S_Z$. For S_Z see tables and graphs S_Z versus T_j.
$\Delta T = P_{tot} \times R_{th\ j\text{-}a} = I_Z \times V_{Z\ dyn} \times R_{th\ j\text{-}a}$.
Following $\Delta V_Z = I_Z \times V_{Z\ dyn} \times R_{th\ j\text{-}a} \times S_Z$ and the model will be:

$$V_{Z\ stat} = V_{Z\ dyn} + I_Z \times V_{Z\ dyn} \times R_{th\ j\text{-}a} \times S_Z$$

Calculating example

BZX84-C24 mounted on a ceramic substrate of 8 x 10 x 0.7 mm; at I_Z = 7 mA.

$$V_{Z\ stat} = 24 + \left(\frac{7}{1000} \times 24 \times \frac{430}{1000} \times 20.4\right)$$

$$= 24 + 1.47 = 25.47\ V.$$

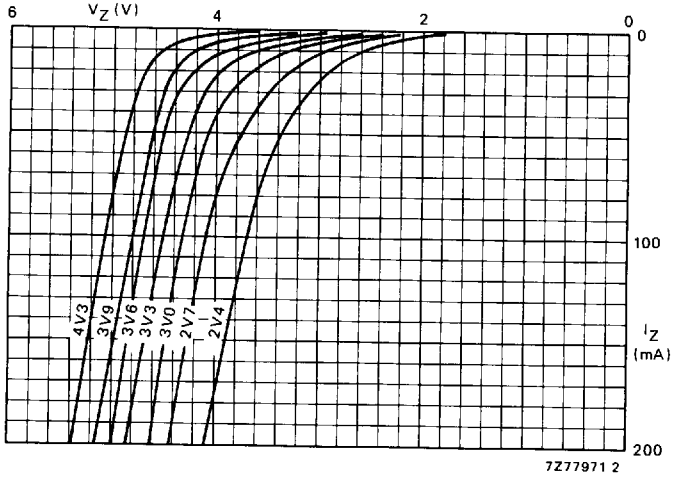


Fig. 3 Dynamic characteristics; typical values; T_j = 25 °C.

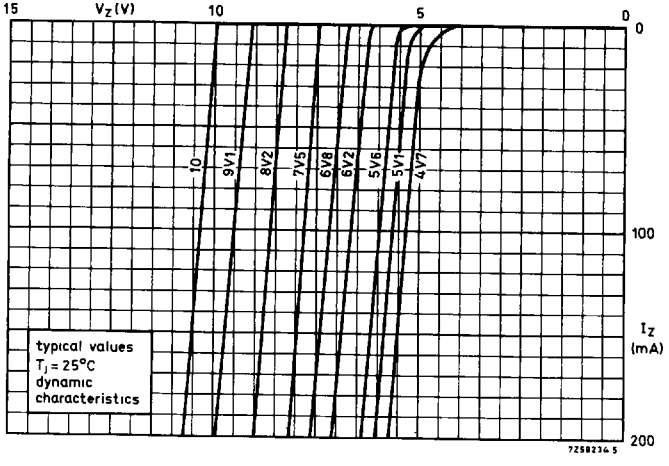


Fig. 4 Dynamic characteristics; typical values; T_j = 25 °C.

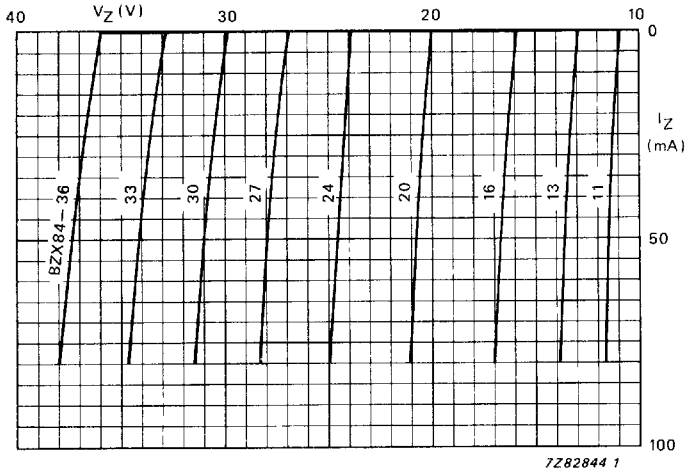


Fig. 5 Dynamic characteristics; typical values; T_j = 25 °C.

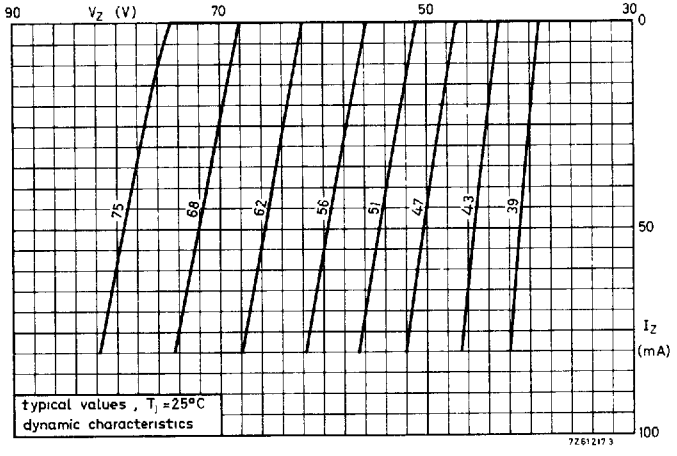


Fig. 6 Dynamic characteristics; typical values; T_j = 25 °C.

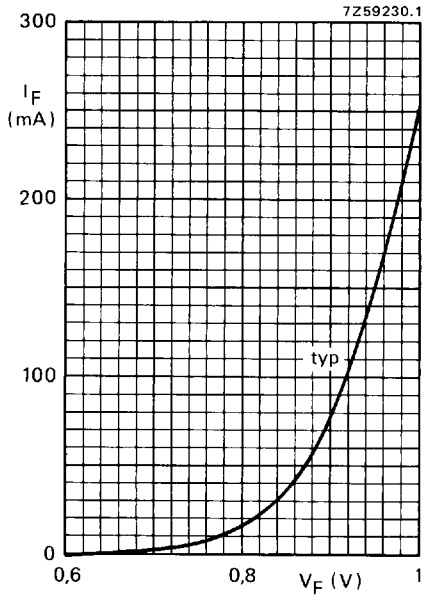


Fig. 7 Typical values at T_j = 25 °C.

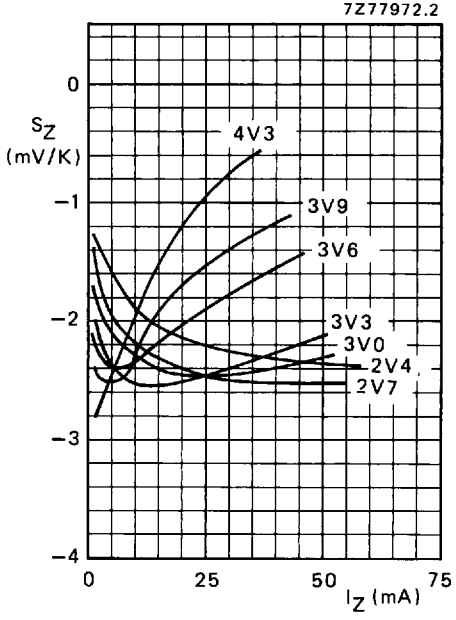


Fig. 8 Typical values; T_j = 25 to 175 °C.

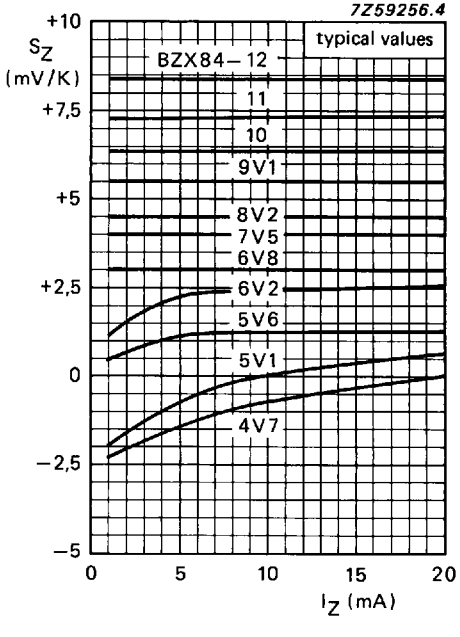


Fig. 9 Typical values; T_j = 25 to 175 °C.

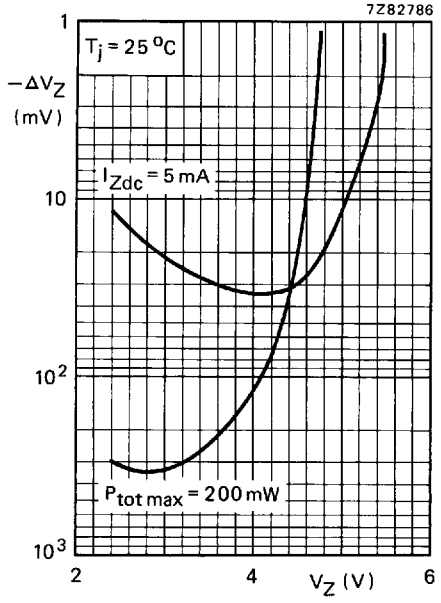


Fig. 10 Typical values; T_j = 25 °C.

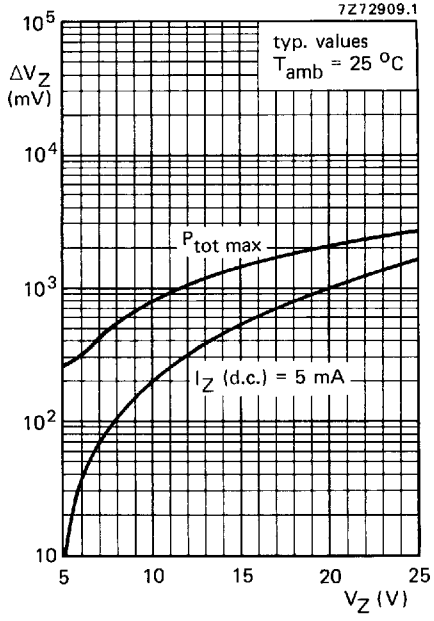


Fig. 11 Typical values; T_{amb} = 25 °C.

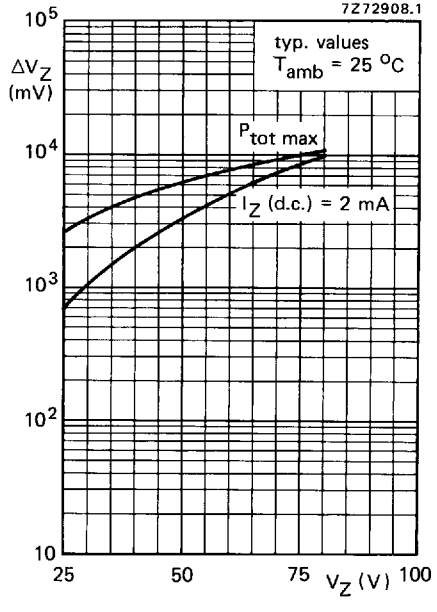


Fig. 12 Typical values; T_{amb} = 25 °C.

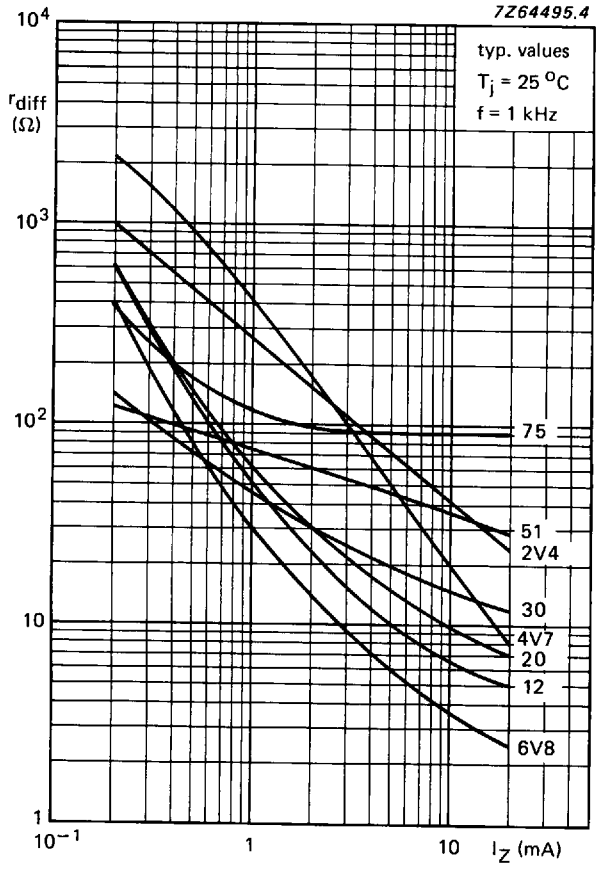

7Z64495.4
typ. values
T_j = 25 °C
f = 1 kHz
r_{diff} (Ω)
10^4
10^3
10^2
10
1
10^{-1}
1
10
I_Z (mA)
75
51
2V4
30
4V7
20
12
6V8

Fig. 13.