Ferranti

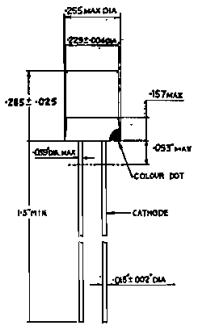
SILICON ZENER DIODES

Voltage Reference Diodes

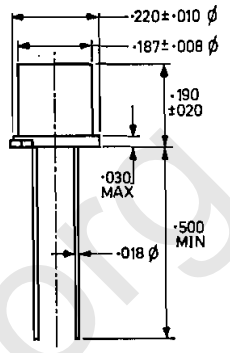
Single-ended series of diodes for voltage reference or voltage stabiliser applications. The diodes are available with Reference Voltage to 5% tolerance, (KS30A,30AF series) and to 10% tolerance (KS30B,30BF series).

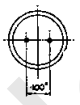
KS30A—KS44A
KS30AF—KS44AF
KS30B—KS44B
KS30BF—KS44BF

KS30A,30B Series



KS30AF,30BF Series





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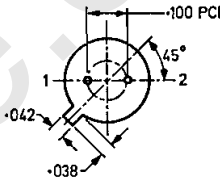

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Dimensions in inches

PHYSICAL DATA

	KS30A,30B Series	KS30AF,30BF Series
Max. Overall Length ...	0·325" (8·5 mm.)	0·210" (5·0 mm.)
Max. Diameter	0·252" (6·25 mm.)	0·230" (5·4 mm.)
Length of Flexible Leads	1·5" (38 mm.)	1·5" (38 mm.)
Outline	VASCA SO-1	VASCA SO-12A IEC C7
Base...	VASCA SB2-1 IEC B1	VASCA SB2-3 IEC B10

POLARITY

KS30A.30B Series:

The reference voltage is developed when the lead nearest to the red dot is made positive.

KS30AF.30BF Series:

The reference voltage is developed when lead 2 is made positive.

RATINGS AND CHARACTERISTICS (At 25°C unless otherwise specified)

Type No.	KS30A KS30AF	KS30B KS30BF	KS31A KS31AF	KS32A KS32AF	KS32B KS32BF	KS33A KS33AF	KS34A KS34AF	KS34B KS34BF	KS35A KS35AF	KS36A KS36AF	KS36B KS36BF	
Nominal Voltage at 5 mA	3·3	3·3	3·6	3·9	3·9	4·3	4·7	4·7	5·1	5·6	5·6	volts
Tolerance on Nom. Voltage	5	10	5	5	10	5	5	10	5	5	10	%
Max. Slope Resistance at 5mA	130	130	100	90	90	80	75	75	70	40	65	ohms
*Max. Mean Dissipation up to 50°C ...	300	300	300	300	300	300	300	300	300	300	300	mW
Dissipation derating above 50°C ...	3	3	3	3	3	3	3	3	3	3	3	mW/°C
Max. Pre-reference current at:—												
0·5V and 25°C	1·0	1·0	1·0	—	—	—	—	—	—	—	—	µA
1V and 25°C	—	—	—	1·0	1·0	1·0	1·0	1·0	1·0	1·0	1·0	µA
1V and 150°C	20	20	20	20	20	20	20	20	20	20	20	µA
Temperature Coefficient at 5 mA:—												
Upper Limit	−·03	−·02	−·02	−·02	−·01	−·01	·00	+·01	+·02	+·03	+·04	%/°C
Lower Limit	−·08	−·08	−·06	−·06	−·06	−·05	−·04	−·05	−·03	−·02	−·03	%/°C
Max. Peak Reference Current:—												
at 25°C	110	110	110	90	90	80	75	75	65	60	60	mA
at 125°C	44	44	40	36	36	32	30	30	28	25	25	mA
Max. Voltage for 100 mA with reversed polarity	1·2	1·2	1·2	1·2	1·2	1·2	1·2	1·2	1·2	1·2	1·2	volts
Ambient temperature range operation or storage (all types)	—— −40 to +150 ——											°C

Type No.	KS37A KS37AF	KS38A KS38AF	KS38B KS38BF	KS39A KS39AF	KS40A KS40AF	KS40B KS40BF	KS41A KS41AF	KS42A KS42AF	KS42B KS42BF	KS43A KS43AF	KS44A KS44AF	KS44B KS44BF	
Nominal Voltage at 5mA ...	6·2	6·8	6·8	7·5	8·2	8·2	9·1	10·0	10·0	11·0	12·0	12·0	volts
Tolerance on Nom. Voltage ...	5	5	10	5	5	10	5	5	10	5	5	10	%
Max. Slope Resistance at 5 mA	15	10	10	10	15	15	18	25	30	40	45	45	ohms
*Max. Mean Dissipation up to 50°C	300	300	300	300	300	300	300	300	300	300	300	300	mW
Dissipation derating above 50°C	3	3	3	3	3	3	3	3	3	3	3	3	mW/°C
Max. Pre-reference current at:—													
1V and 25°C	1·0	1·0	1·0	—	—	—	—	—	—	—	—	—	µA
1V and 150°C	20	20	20	—	—	—	—	—	—	—	—	—	µA
3V and 25°C	—	—	—	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	µA
3V and 150°C	—	—	—	20	20	20	20	20	20	20	20	20	µA
Temperature Coefficient at 5mA:—													
Upper Limit	+·05	+·07	+·07	+·07	+·08	+·08	+·08	+·08	+·08	+·08	+·09	+·09	%/°C
Lower Limit ...	·00	+·02	+·01	+·03	+·04	+·04	+·05	+·05	+·05	+·05	+·05	+·05	%/°C
Max. Peak Reference Current at 25°C	50	45	45	42	40	40	35	30	30	27	25	25	mA
at 125°C	20	18	18	17	16	16	15	14	14	11	10	10	mA
Max. Voltage for 100mA with reversed polarity... ...	1·2	1·2	1·1	1·2	1·2	1·2	1·2	1·2	1·2	1·2	1·2	1·2	volts
Ambient temperature range operation or storage (all types)	—— −40 to +150 ——												°C

*Averaged over any 20 millisecond period

SERVICES TYPE NOS.

Ferranti Type No.	Services Type Nos.
KS30A	CV5794. CV7536
KS31A	CV5795. CV7537
KS32A	CV5796. CV7538
KS33A	CV5862. CV7539
KS34A	CV7067. CV7540
KS35A	CV5928. CV7068. CV7541
KS36A	CV7069. CV7542
KS37A	CV7070. CV7543
KS38A	CV5283. CV7071. CV7544
KS39A	CV7072. CV7545
KS40A	CV7073. CV7546
KS41A	CV5081. CV7547
KS42A	CV5361. CV7548
KS43A	CV5802. CV7549
KS44A	CV5803. CV7550. CV8014

FERRANTI SILICON SEMICONDUCTOR DEVICES.

Ferranti Ltd., Gem Mill, Chadderton, Oldham, Lancs.
Telephone: MAln 6661

Issue 5, January, 1966.

KS30A, AF Series
KS30B, BF Series

Ferranti

TYPICAL CHARACTERISTICS.

Reference Region. For diodes with reference voltage below 5 volts (KS30—35) the slope resistance decreases gradually with increasing current being inversely proportional to the current.
For diodes with reference voltage above 7 volts (KS39—44) the slope resistance decreases abruptly at a very low current and then decreases only slightly at higher currents.
For diodes with reference voltage between 5 and 7 volts (KS36, KS37, KS38,) the slope resistance will follow a pattern intermediate between those of the above two groups.

Pre-Reference Region. For diodes with reference voltages below 7 volts the current in the pre-reference region increases rapidly at voltages above approximately 0·5 volts.
For diodes with reference voltages greater than 7 volts there is little variation of current with voltage up to a point within 2 volts of the reference region.

Slope Resistance. Typical Slope resistance figures are:—

TYPE	ohms at 1 mA	ohms at 5 mA	ohms at 20 mA	TYPE	ohms at 1 mA	ohms at 5 mA	ohms at 20 mA	TYPE	ohms at 1 mA	ohms at 5 mA	ohms at 20 mA
KS30A	350	75	20	KS35A	300	55	10	KS40B	14	6	4
KS30B	350	75	20	KS36A	300	35	4	KS41A	20	8	6
KS31A	350	75	18	KS36B	300	50	4	KS42A	30	15	8
KS32A	350	70	17	KS37A	200	12	4	KS42B	30	15	8
KS32B	350	70	17	KS38A	30	7	3	KS43A	45	20	10
KS33A	350	65	17	KS38B	50	8	4	KS44A	50	25	15
KS34A	350	60	12	KS39A	14	6	4	KS44B	50	25	15
K534B	350	60	12	K540A	14	6	4				

OPERATION

As Reference Source. When the diode is run as a reference source and not as a regulator or coupling element, it is desirable, for maximum long term stability of reference voltage to operate at the minimum current consistent with obtaining the desired slope resistance. This minimising of the dissipation also means that the change in junction temperature during the warming-up period after switching on will be minimised, as will also the resultant change in reference voltage. For example the optimum reference current at 25°C for a KS38 would be approximately 5 mA.

Temperature Coefficient. The temperature coefficients of the lower voltage diodes (KS30—KS36) are very dependent on the precise reference voltages. The figures given are for the typical temperature coefficient at the normal reference voltage, i.e. the centre of the voltage range specified for the diode. The temperature coefficient of the diodes with reference voltage below approximately 7 volts is also dependent on current.

Typical temperature coefficients (% per °C) are:—

TYPE	1 mA	5 mA	20 mA	TYPE	1 mA	5 mA	20 mA	TYPE	1 mA	5 mA	20 mA
KS30A	−·08	−·06	−·04	KS35A	−·03	−·01	·00	KS40B	+·05	+·05	—
KS30B	−·08	−·06	−·04	KS34A	−·02	·00	+·01	KS41A	+·06	+·06	—
KS31A	−·07	−·05	−·03	KS36B	−·02	·00	+·01	KS42A	+·06	+·06	—
KS32A	−·05	−·04	−·02	KS37A	+·02	+·03	+·04	KS42B	+·06	+·06	—
KS32B	−·05	−·04	−·02	KS38A	+·04	+·04	+·04	KS43A	+·07	+·07	—
KS33A	−·05	−·03	−·02	KS38B	+·04	+·04	+·04	KS44A	+·07	+·07	—
KS34A	−·04	−·02	−·01	KS39A	+·05	+·05	+·05	KS44B	+·07	+·07	—
KS34B	−·04	−·02	−·01	KS40A	+·05	+·05	—				

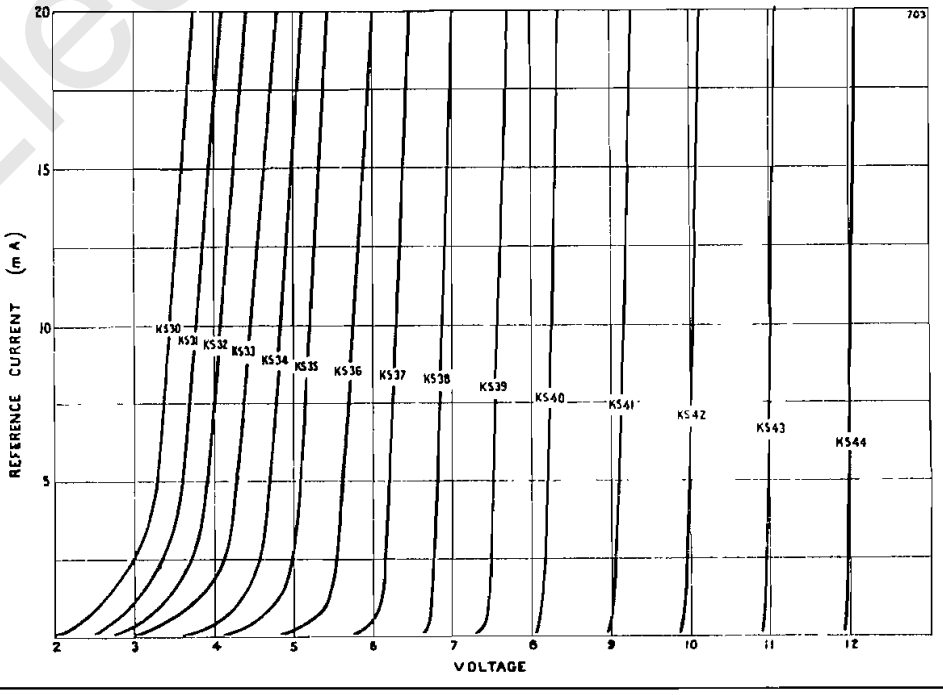
Capacitance. The capacitance of the diode decreases with increasing applied voltage (V). In the pre-reference region the capacitance (C) is approximately proportional to $(V+1\cdot0)^{-\frac{1}{2}}$.

Reversed Polarity. The characteristic obtained when a voltage of opposite polarity is applied to the diode is similar to that of the ZS10 series diodes, i.e. a current of 100 mA will pass at a voltage not greater than 1·2 volts. (See Data Sheet ZS10A for characteristics.)

As a Voltage Limiter. Diodes in the higher voltage group may be used in this application where use is made of the rapid increase of current from a few microamperes to several milliamperes to prevent the voltage rising beyond the reference voltage.

Series Operation. Diodes may be used in series provided that the dissipation in each diode is within the rated dissipation.

TYPICAL REFERENCE CURRENT/VOLTAGE CHARACTERISTICS



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