TRANSHIELD*
SILICON SURGE SUPPRESSOR DIODES
9-275V
BREAKDOWN VOLTAGES

Transhield FP1000 and FP1000A surge suppressors are silicon diffused junction devices having bidirectional foldback characteristics. Devices are available having tolerances on the nominal breakdown voltages of ± 10% (FP1000 series) and ± 5% (FP1000A series).

The foldback characteristic provides the suppressors with an increased surge current handling capability coupled with lower clamping voltages compared with industrial standard devices. Each device is 100% tested. In the event of an abnormal surge causing the ratings of the Transhield suppressor to be exceeded, the device will initially fail safe to a short-circuit state tripping the series protective device.

The suppressors are intended for telecommunication, data transmission and general applications where permanent damage could otherwise be caused to integrated circuits, m.o.s. devices, hybrids and other voltage sensitive semiconductors and components by surges deriving from lightning, electrostatic discharges, NEMP, inductive switching, etc.

Transhield suppressors can be supplied bandoliered (tape and reel).

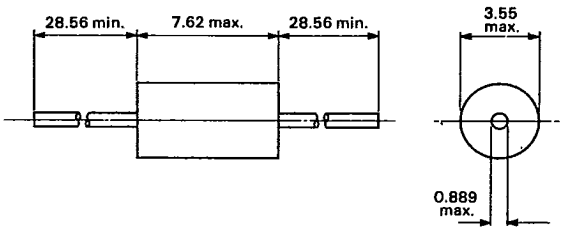
*Trademark of Lucas Industries plc.

QUICK REFERENCE DATA

	FP1000	FP1000A
V_{SO}	7.37 – 223V	7.78 – 235V
V_{CL} max. (10/1000μs waveform)	13.50 – 340V	12.9 – 324V

Outline and Dimensions

All dimensions in millimetres. For detail dimensions see Page 10.



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The ratings quoted are limiting values of operating and environmental conditions and are in accordance with the absolute maximum rating system defined in BS3494 (Part 1) and IEC Publication 134.

Voltage Ratings

V_{so}	Stand-off voltage	See pages 4 and 6
V_{SM}	Maximum non-repetitive peak pulse voltage (1.2/50μs and 10/700μs waveforms)	See pages 5 and 7

Current Rating

I_{SM}	Maximum non-repetitive peak pulse current (10/1000μs and 8/20μs waveforms)	See pages 4, 5, 6, 7

Power Ratings

P_{tot}	Total continuous power dissipation at T_{lead} = 87.5°C	1.5W
P_{SM}	Maximum non-repetitive peak pulse power dissipation	See page 8

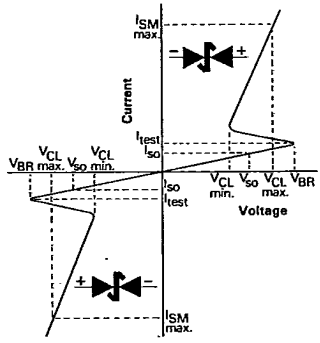
Thermal Ratings

T_j	Maximum junction temperature	125°C
T_{stg}	Storage temperature range	−55°C to +125°C

CHARACTERISTICS

V_{BR}	Breakdown voltage at T_{amb} = 25°C	See pages 4 and 6
S_{BR}	Temperature coefficient of breakdown voltage	See note below
V_{CL}	Clamping voltage at T_{amb} = 25°C	See pages 4, 5, 6, 7
I_{so}	Leakage current at V_{so} and T_{amb} = 25°C	See pages 4 and 6
C_{tot}	Total diode capacitance	See page 9
t_{on}	Turn on time (theoretical) to	
	− breakdown voltage	1×10^{-12}s
	− sustaining voltage	1×10^{-6}s
$R_{th\ (j\text{-}lead)}$	Thermal resistance (junction to lead)	25 deg C/W max.

Note: Temperature coefficient of breakdown voltage. For low voltage devices (<45V) the temperature coefficient of V_{BR} is the same as the zener temperature coefficient. For higher voltage devices the temperature coefficient is virtually zero between room temperature and −55°C. At temperatures up to 125°C the temperature coefficient is negative and has a typical value of −0.2%/deg C. Further information is available from the address on page 10.

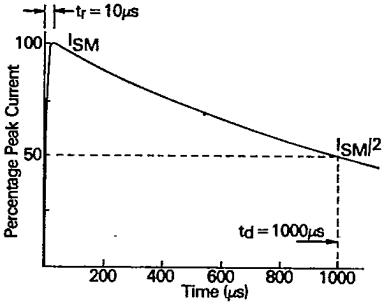


Voltage/current characteristic.

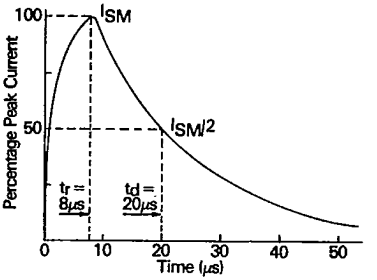
V_{so} Stand-off voltage is the maximum rated continuous or repetitive peak voltage at which the device should be operated, and should be equal to or greater than the normal operating voltage of the circuit to be protected.

V_{CL}max. Maximum clamping voltage is the peak voltage across the device when subjected to the maximum rated peak surge current of a specified waveshape.

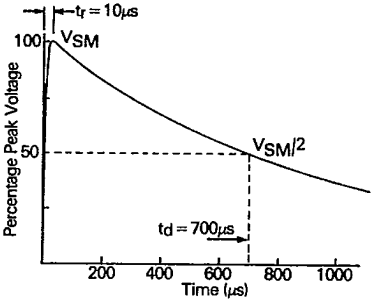
Test Waveforms and Circuits



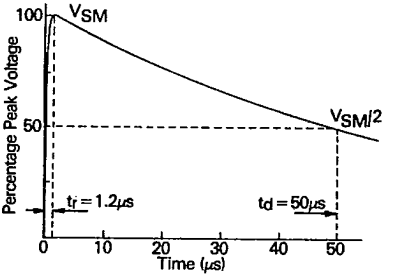
10/1000μs short-circuit waveform
(Keytek Model 424 generator)



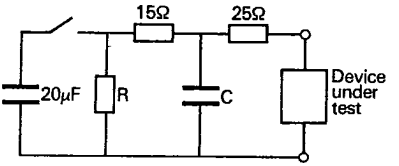
8/20μs short-circuit waveform
(Keytek Model 424 generator)



10/700μs open-circuit waveform
(Haefley Model P6T generator)



1.2/50μs open-circuit waveform
(Haefley Model P6T generator)



10/700μs R = 50Ω C = 0.2μF

1.2/50μs R = 3Ω C = 15nF

Haefley Model P6T generator internal drive circuits for 10/700μs and 1.2/50μs open-circuit voltage waveforms. The 20μF capacitor is charged to the required voltage level (see tables pages 5 and 7) and then discharged into the network to which the device under test is attached.

Type number	V_{so}	Breakdown voltage at $T_{amb}=25°C$			V_{CL} min.	I_{so} max. at V_{so} & $T_{amb}=25°C$	10/1000μs s.c. waveform	
		V_{BR} min.	V_{BR} max.	I_{test}			V_{CL} max. at I_{SM} max. & $T_{amb}=25°C$	I_{SM} max.
	V	V	V	μA	V	μA	V	A
FP1009	7.37	8.19	10.00	1000	7.78	50	13.50	44.40
FP1009A	7.78	8.65	9.55	1000	8.22	50	12.90	46.50
FP1010	8.10	9.00	11.00	1000	8.60	10	14.90	40.30
FP1010A	8.55	9.50	10.50	1000	9.03	10	14.20	42.30
FP1011	8.92	9.90	12.10	1000	9.41	5	16.30	36.80
FP1011A	9.40	10.50	11.60	1000	9.98	5	15.70	38.20
FP1012	9.72	10.80	13.20	1000	10.26	5	17.80	33.70
FP1012A	10.20	11.40	12.60	1000	10.83	5	17.00	35.30
FP1013	10.50	11.70	14.30	1000	11.11	5	19.30	31.10
FP1013A	11.10	12.40	13.70	1000	11.78	5	18.50	32.40
FP1015	12.10	13.50	16.50	1000	12.83	5	22.30	26.90
FP1015A	12.80	14.30	15.80	1000	13.59	5	21.30	28.20
FP1016	12.90	14.40	17.60	1000	13.68	5	23.80	25.20
FP1016A	13.60	15.20	16.80	1000	14.44	5	22.70	26.40
FP1018	14.50	16.20	19.80	1000	14.58	5	26.70	22.50
FP1018A	15.30	17.10	18.90	1000	15.39	5	25.50	23.50
FP1020	16.20	18.00	22.00	1000	14.85	5	29.70	20.20
FP1020A	17.10	19.00	21.00	1000	15.68	5	28.40	21.10
FP1022	17.80	19.80	24.20	1000	14.85	5	32.70	18.30
FP1022A	18.80	20.90	23.10	1000	15.68	5	31.20	19.20
FP1024	19.40	21.60	26.40	1000	16.20	5	35.60	16.90
FP1024A	20.50	22.80	25.20	1000	17.10	5	34.00	17.60
FP1027	21.80	24.30	29.70	<100	17.00	5	35.60	20.20
FP1027A	23.10	25.70	28.40	<100	18.00	5	34.10	21.10
FP1030	24.33	27.00	33.00	<100	18.90	5	39.60	18.20
FP1030A	25.60	28.50	31.50	<100	20.00	5	38.00	19.00
FP1033	26.80	29.70	36.30	<100	20.00	5	43.50	16.50
FP1033A	28.20	31.40	34.70	<100	21.20	5	41.60	17.30
FP1036	29.10	32.40	39.60	<100	21.10	5	45.50	17.80
FP1036A	30.80	34.20	37.80	<100	22.20	5	43.50	18.70
FP1039	31.60	35.10	42.90	<100	22.00	5	49.30	16.50
FP1039A	33.30	37.10	41.00	<100	23.20	5	47.20	17.20
FP1043	34.80	38.70	47.30	<100	23.20	5	54.40	14.90
FP1043A	36.80	40.90	45.20	<100	24.50	5	52.00	15.60
FP1047	38.10	42.30	51.70	<100	25.40	5	58.20	15.50
FP1047A	40.20	44.70	49.40	<100	26.80	5	55.60	16.20

All stand-off voltages (V_{SO}) are valid from d.c. to 100Hz. Breakdown voltages (V_{BR}) are measured at 5Hz. Clamp voltages (V_{CL}) are valid for the waveforms stated. For operation outside these limits contact the address on page 10.

TRANSHIELD SILICON SURGE SUPPRESSOR DIODES
9 – 275V BREAKDOWN VOLTAGES

FP1000 & FP1000A SERIES

81C 00206 D

7-11-23

Type number	1.2/50μs o.c. waveform		10/700μs o.c. waveform		8/20μs s.c. waveform	
	V_{CL} max. at V_{SM} max. & T_{amb} = 25°C	V_{SM} max.	V_{CL} max. at V_{SM} max. & T_{amb} = 25°C	V_{SM} max.	V_{CL} max. at I_{SM} max. & T_{amb} = 25°C	I_{SM} max.
	V	kV	V	kV	V	A
FP1009	15.0	6.95	14.0	3.01	16.5	267
FP1009A	14.3	7.29	13.4	3.15	15.8	278
FP1010	16.5	6.32	15.4	2.74	18.2	242
FP1010A	15.8	6.60	14.7	2.87	17.3	254
FP1011	18.2	5.73	16.9	2.50	20.0	220
FP1011A	17.4	5.99	16.2	2.61	19.1	230
FP1012	19.8	5.27	18.5	2.29	21.8	202
FP1012A	18.9	5.52	17.6	2.40	20.8	212
FP1013	21.5	4.86	20.0	2.12	23.6	186
FP1013A	20.6	5.07	19.2	2.21	22.6	195
FP1015	24.8	4.22	23.1	1.84	27.2	162
FP1015A	23.7	4.41	22.1	1.92	26.1	169
FP1016	26.4	3.97	24.6	1.73	29.0	152
FP1016A	25.2	4.15	23.5	1.81	27.7	159
FP1018	29.7	3.53	27.7	1.54	32.7	135
FP1018A	28.4	3.69	26.5	1.61	31.2	141
FP1020	33.0	3.18	30.8	1.39	36.3	121
FP1020A	31.5	3.33	29.4	1.46	34.7	127
FP1022	36.3	2.90	33.9	1.27	40.0	110
FP1022A	34.7	3.03	32.3	1.33	38.1	115
FP1024	39.6	2.67	37.0	1.17	43.6	101
FP1024A	37.8	2.79	35.3	1.23	41.6	106
FP1027	35.6	3.53	35.6	1.44	35.6	148
FP1027A	34.1	3.69	34.1	1.51	34.1	155
FP1030	39.6	3.18	39.6	1.31	39.6	133
FP1030A	38.0	3.33	38.0	1.36	38.0	140
FP1033	43.5	2.90	43.5	1.19	43.5	121
FP1033A	41.6	3.03	41.6	1.25	41.6	127
FP1036	45.5	3.12	45.5	1.28	45.5	123
FP1036A	43.5	3.27	43.5	1.34	43.5	129
FP1039	49.3	2.89	49.3	1.19	49.3	114
FP1039A	47.2	3.02	47.2	1.24	47.2	119
FP1043	54.4	2.63	54.4	1.08	54.4	103
FP1043A	52.0	2.75	52.0	1.13	52.0	108
FP1047	58.2	2.72	58.2	1.12	58.2	106
FP1047A	55.6	2.84	55.6	1.17	55.6	111

LEDEX®

Type number	V_{so}	Breakdown voltage at $T_{amb}=25°C$			V_{CL} min.	I_{so} max. at V_{so} & $T_{amb}=25°C$	10/1000μs s.c. waveform	
		V_{BR} min.	V_{BR} max.	I_{test}			V_{CL} max. at I_{SM} max. & $T_{amb}=25°C$	I_{SM} max.
	V	V	V	μA	V	μA	V	A
FP1051	41.30	45.90	56.10	<100	26.40	5	63.10	14.30
FP1051A	43.60	48.50	53.60	<100	27.90	5	60.30	14.90
FP1056	45.50	50.40	61.60	<100	29.00	5	69.30	13.00
FP1056A	47.80	53.20	58.80	<100	30.60	5	66.20	13.60
FP1062	50.20	55.80	68.20	<100	30.70	5	76.00	11.70
FP1062A	53.00	58.90	65.10	<100	32.40	5	73.00	12.30
FP1068	55.10	61.20	74.80	<100	33.70	5	84.00	10.70
FP1068A	58.10	64.60	71.40	<100	33.50	5	80.00	11.20
FP1075	60.70	67.50	82.50	<100	35.50	5	92.00	9.70
FP1075A	64.10	71.30	78.80	<100	37.40	5	88.00	10.20
FP1082	66.40	73.80	90.20	<100	38.50	5	103.00	7.80
FP1082A	70.10	77.90	86.10	<100	40.90	5	99.00	8.20
FP1091	73.70	81.90	100.00	<100	49.10	5	115.00	8.50
FP1091A	77.80	86.50	95.50	<100	51.90	5	109.00	8.90
FP1100	81.00	90.00	110.00	<100	51.80	5	123.00	7.80
FP1100A	85.50	95.00	105.80	<100	54.60	5	118.00	8.10
FP1110	89.00	99.00	121.00	<100	56.90	5	136.00	8.00
FP1110A	94.00	105.00	116.00	<100	60.40	5	130.00	8.30
FP1120	97.00	108.00	132.00	<100	59.40	5	148.00	7.30
FP1120A	102.00	114.00	126.00	<100	62.70	5	141.00	7.70
FP1130	105.00	117.00	143.00	<100	64.40	5	160.00	6.80
FP1130A	111.00	124.00	137.00	<100	68.20	5	154.00	7.10
FP1150	121.00	135.00	165.00	<100	70.90	5	185.00	5.90
FP1150A	128.00	143.00	158.00	<100	75.10	5	177.00	6.10
FP1160	130.00	144.00	176.00	<100	75.60	5	198.00	5.50
FP1160A	136.00	152.00	168.00	<100	79.80	5	189.00	5.80
FP1170	138.00	153.00	187.00	<100	76.50	5	210.00	5.20
FP1170A	145.00	162.00	179.00	<100	81.00	5	201.00	5.40
FP1180	146.00	162.00	198.00	<100	81.00	5	222.00	4.90
FP1180A	154.00	171.00	189.00	<100	85.50	5	212.00	5.10
FP1200	162.00	180.00	220.00	<100	90.00	5	247.00	4.40
FP1200A	171.00	190.00	210.00	<100	95.00	5	236.00	4.60
FP1220	175.00	198.00	242.00	<100	89.10	5	272.00	4.00
FP1220A	185.00	209.00	231.00	<100	94.50	5	259.00	4.20
FP1250	202.00	225.00	275.00	<100	90.00	5	309.00	3.50
FP1250A	214.00	237.00	263.00	<100	94.80	5	295.00	3.70
FP1275	223.00	247.50	302.50	<100	93.80	5	340.00	3.20
FP1275A	235.00	261.30	288.80	<100	92.00	5	324.00	3.30

All stand-off voltages (V_{SO}) are valid from d.c. to 100Hz. Breakdown voltages (V_{BR}) are measured at 5Hz. Clamp voltages (V_{CL}) are valid for the waveforms stated. For operation outside these limits contact the address on page 10.

TRANSHIELD SILICON SURGE SUPPRESSOR DIODES
9 – 275V BREAKDOWN VOLTAGES

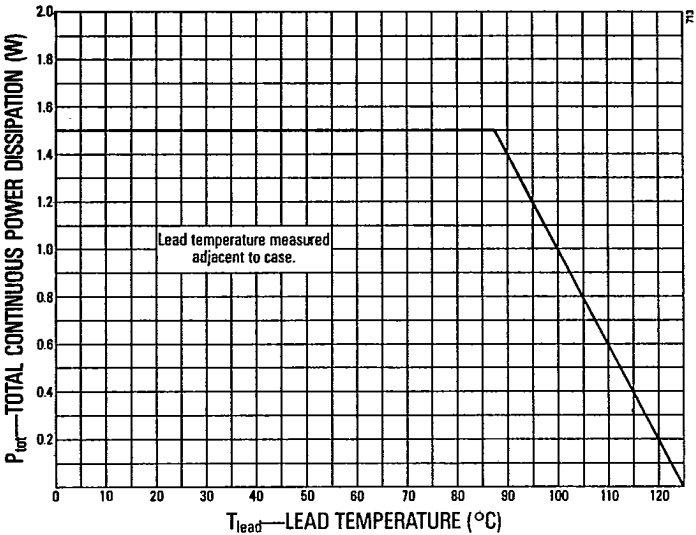
81C 00208 D

T-11-23

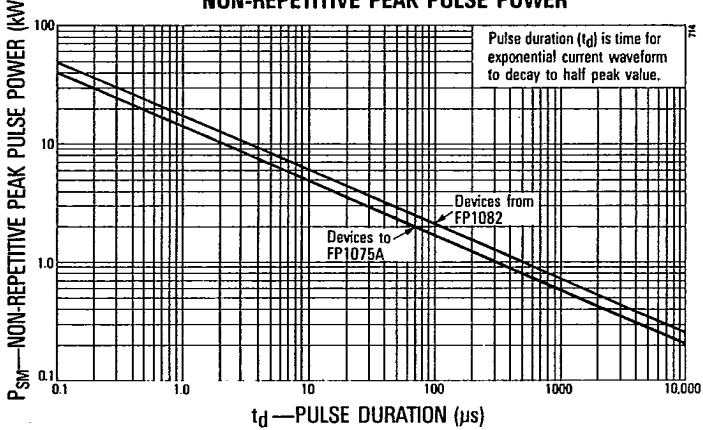
Type number	1.2/50μs o.c. waveform		10/700μs o.c. waveform		8/20μs s.c. waveform	
	V_{CL} max. at V_{SM} max. & T_{amb} = 25°C	V_{SM} max.	V_{CL} max. at V_{SM} max. & T_{amb} = 25°C	V_{SM} max.	V_{CL} max. at I_{SM} max. & T_{amb} = 25°C	I_{SM} max.
	V	kV	V	kV	V	A
FP1051	63.1	2.51	63.1	1.04	63.1	98
FP1051A	60.3	2.63	60.3	1.08	60.3	103
FP1056	69.3	2.30	69.3	0.96	69.3	89
FP1056A	66.2	2.40	66.2	1.00	66.2	94
FP1062	76.0	2.08	76.0	0.87	76.0	81
FP1062A	73.0	2.18	73.0	0.91	73.0	84
FP1068	84.0	1.91	84.0	0.80	84.0	74
FP1068A	80.0	2.00	80.0	0.84	80.0	77
FP1075	92.0	1.74	92.0	0.74	92.0	67
FP1075A	88.0	1.82	88.0	0.77	88.0	70
FP1082	103.0	1.43	103.0	0.62	103.0	54
FP1082A	99.0	1.49	99.0	0.65	99.0	57
FP1091	115.0	1.64	115.0	0.67	115.0	60
FP1091A	109.0	1.71	109.0	0.70	109.0	63
FP1100	123.0	1.51	123.0	0.63	123.0	55
FP1100A	118.0	1.57	118.0	0.65	118.0	57
FP1110	136.0	1.55	136.0	0.64	136.0	60
FP1110A	130.0	1.60	130.0	0.66	130.0	62
FP1120	148.0	1.43	148.0	0.60	148.0	55
FP1120A	141.0	1.49	141.0	0.62	141.0	57
FP1130	160.0	1.34	160.0	0.57	160.0	50
FP1130A	154.0	1.39	154.0	0.59	154.0	53
FP1150	185.0	1.19	185.0	0.53	185.0	44
FP1150A	177.0	1.23	177.0	0.54	177.0	46
FP1160	198.0	1.13	198.0	0.51	198.0	41
FP1160A	189.0	1.17	189.0	0.52	189.0	43
FP1170	210.0	1.08	210.0	0.50	210.0	39
FP1170A	201.0	1.12	201.0	0.51	201.0	40
FP1180	222.0	1.04	222.0	0.49	222.0	36
FP1180A	212.0	1.07	212.0	0.49	212.0	38
FP1200	247.0	0.97	247.0	0.47	247.0	33
FP1200A	236.0	1.00	236.0	0.47	236.0	34
FP1220	272.0	0.91	272.0	0.46	272.0	30
FP1220A	259.0	0.94	259.0	0.46	259.0	31
FP1250	309.0	0.85	309.0	0.45	309.0	26
FP1250A	295.0	0.87	295.0	0.45	295.0	27
FP1275	340.0	0.81	340.0	0.45	340.0	24
FP1275A	324.0	0.83	324.0	0.45	324.0	25

LEDEX

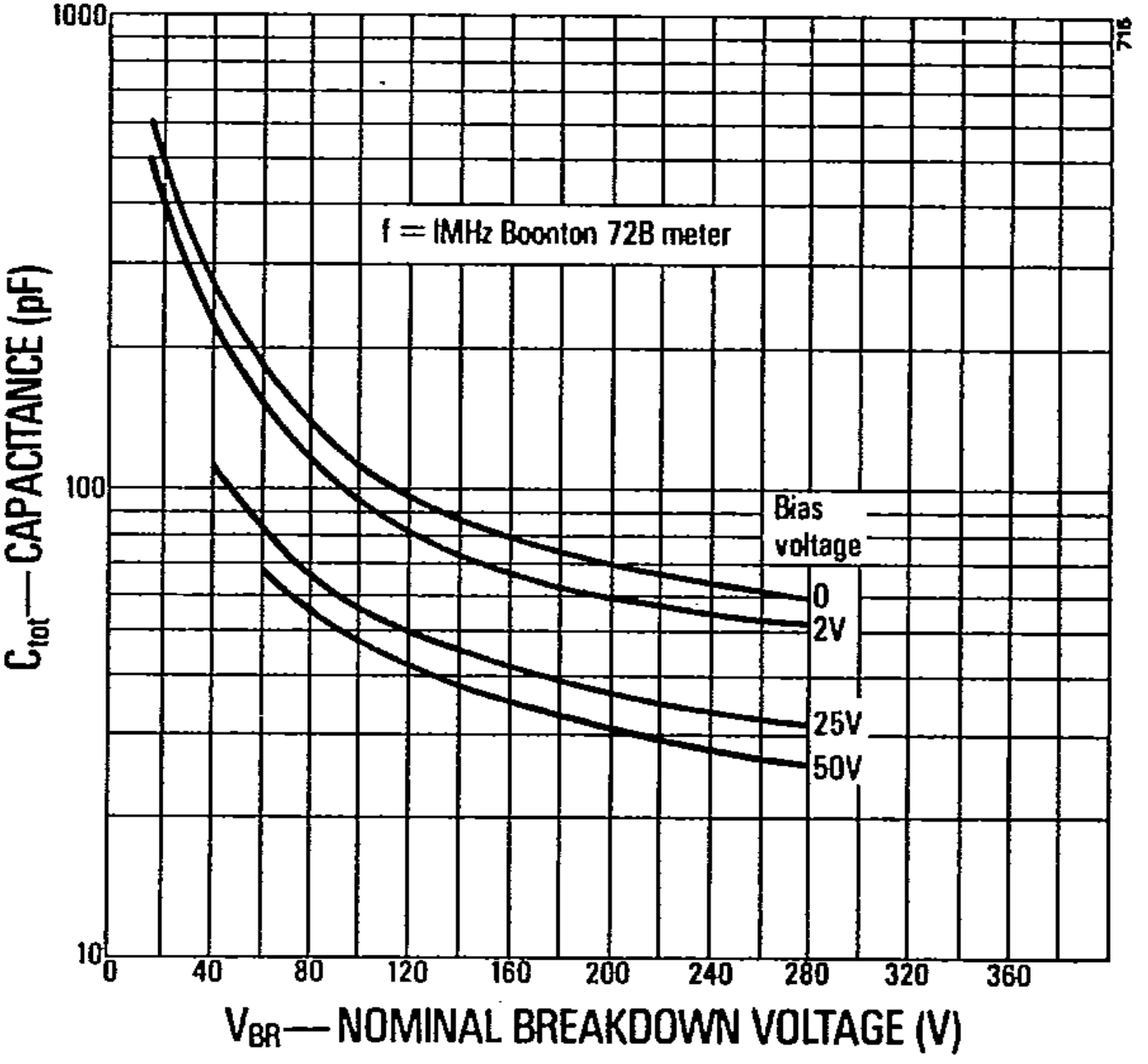
POWER DERATING

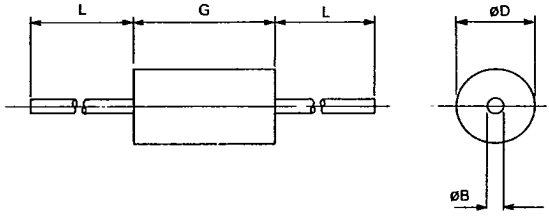


NON-REPETITIVE PEAK PULSE POWER



TYPICAL SUPPRESSOR CAPACITANCE AGAINST NOMINAL BREAKDOWN VOLTAGE





Ref.	Millimetres		Inches		Notes
	Min.	Max.	Min.	Max.	
ØB2	0.686	0.889	0.027	0.035	
ØD	2.64	3.55	0.104	0.140	
G	5.84	7.62	0.230	0.300	
L	28.56		1.125		

Notes:

1. The suppressors comply with JEDEC D0-15 outline.
2. The millimetre dimensions are derived from the inch dimensions.

Weight 0.5 gramme.

INSTALLATION NOTES

The suppressors have insulated bodies which permits high density component mounting. The minimum axial length within which these suppressors may be placed with their leads bent at right angles is 0.5 in (12.7mm). The suppressors may be dip-soldered at a temperature of 220°C for a maximum of 10 seconds up to a point 0.2 in (5mm) from their bodies.

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Transhield surge suppressors are manufactured in the UK by Lucas Electrical Electronics & Systems Limited a subsidiary company of Lucas Industries plc.

In the interest of improved product design, changes to this specification may be made at any time. Please contact the address above for any recent changes to this specification and advice on specific applications. Lucas does not assume any liability arising out of the use of any product described in this specification.