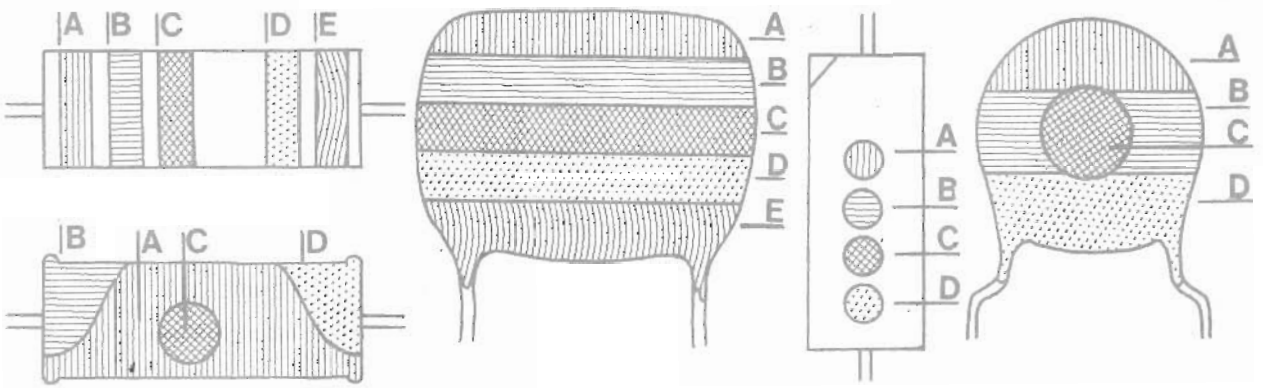
Electronic Reference Data

PRESENTED FREE WITH ELECTRONICS TODAY
NOVEMBER 1975

Common Abbrieviations

A	Ampere or Anode
AC	Alternating Current
Ae	Aerial
AF	Audio Frequency
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
AM	Amplitude Modulation
ATU	Aerial Tuning Unit
AVC	Automatic Volume Control
b	Base of Transistor
B&S	Wire Gauge (U.S.)
BCD	Binary Coded Decimal
C	Capacitor, Cathode, Centigrade.
c	Collector
CCTV	Closed Circuit Television
c.g.s.	Centimetre-gramme-second
Ck	Clock
CMOS	Complementary Metal Oxide Semiconductor
CW	Continuous Wave
D	Diode
d	Drain (of FET)
dB	Decibel
DC	Direct Current
DCC	Double Cotton Covered
DF	Direction Finding
DIL	Dual-in-line
DIN	Audio Standard of German Standards Institute
DPDT	Double-pole double-throw
DPST	Double-pole single-throw
DSC	Double Silk Covered
DTL	Diode Transistor Logic
DX	Long Distance Reception
E	Sometimes used for Voltage
e	Emitter
EHT	Extra High Voltage
EMF	Electromotive Force
ERP	Effective Radiated Power
F	Farad or Fahrenheit
f	Frequency
FET	Field Effect Transistor
fhfb	Frequency at which current gain in common-base transistor mode is reduced by $3dB^{-1}$.
FM	Frequency Modulation
f_T	Frequency at which current gain is unity in common-emitter mode
G	Giga (10^9)
g	Grid
H	Henry
HF	High Frequency
h_{fe}	Transistor small signal current gain
h_{FE}	Transistor large signal current gain
HT	High Tension
Hz	Hertz
I	Current
Ib	Base Current of Transistor
Ic	Collector Current of Transistor
IC	Integrated Circuit
Icbo	Collector-base current with emitter open circuit
IF	Intermediate Frequency
Igt	Gate Current to Trigger Thyristor
IIL	Integrated Injection Logic (also I^2L)
i/p	Input
i.p.s.	Inches per Second
K	Kilo (10^3) or Cathode
L	Inductance
LED	Light Emitting Diode
LF	Low Frequency
Lin	Linear
Log	Logarithimic
LS	Loudspeaker
LSI	Large Scale Integration
M	Mega (10^6)
m	Milli (10^{-3})
mA	Milliamp
mH	MilliHenry
mHz	Megahertz
mmF	Alternative to Picofarad
MOSFET	Metal Oxide Semiconductor FET
MSI	Medium Scale Integration
MOST	Metal Oxide Semiconductor Transistor
MPX	Multiplex
mV	Millivolt
mW	Milliwatt
n	Nano (10^{-9})
Ni-Cad	Nickel Cadmium
o/c	Open Circuit
o/p	Output
Op.Amp	Operational Amplifier
p	Pico (10^{-12})
PA	Public Address
PCB	Printed Circuit Board
p.d.	Potential Difference
PIV	Peak Inverse Working Voltage
PLL	Phase Locked Loop
P_{tot}	Maximum Total Power Dissipation
PU	Pickup
PUJT	Programmable Unijunction Transistor
Q	Transistor,'Goodness' factor of tuned circuit
R	Resistance
RAM	Random Access Memory
RF	Radio Frequency
RFC	Radio Frequency Choke
R_L	Load Resistor
r.m.s.	Root-mean-square
RTL	Resistor Transistor Logic
RV	Variable Resistor
Rx	Receiver
SCC	Single Cotton Covered
SCR	Silicon Controlled Rectifier
SPDT	Single-pole double-throw
SPST	Single-pole single-throw
SSC	Single Silk Covered
SSI	Small Scale Integration
SWG	Standard Wire Gauge
TRF	Timed Radio Frequency
TTL	Transistor Transistor Logic
TVI	TV Interference
Tx	Transmitter
uF	accepted alternative to μF
UHF	Ultra High Frequency
UJT	Unijunction Transistor
V	Volts
VA	Collector-emitter voltage with base open-circuit
V	Volts
V_{CEO}	Collector-emitter with base open - circuit
VA	Volt Amps
VCO	Voltage Controlled Oscillator
Veb	Base-emitter reverse voltage
Vf	Forward Voltage of Diode
Vgs	Gate - source Voltage of FET
Vgt	Gate Voltage necessary to trigger thyristor
VHF	Very High Frequency
VLF	Very Low Frequency
VR	Variable Resistor
W	Watts
X	Reactance
Xtal	Crystal
Z	Impedance
ZD	Zener Diode

Component Colour Codes



COLOUR	BAND A	BAND B	BAND C Multiplier		BAND D				BAND E	
			resistors	capacitors	resistors	capacitors up tp 10pF	capacitors over 10pF	tantalum working voltage	resistors	capacitors
BLACK	–	0	1	1	–	2pF	± 20%	10V	–	–
BROWN	1	1	10	10	± 1%	0.1pF	± 1%	–	–	–
RED	2	2	10^2	10^2	± 2%	–	± 2%	–	–	250V
ORANGE	3	3	10^3	10^3	–	–	± 2.5%	–	–	–
YELLOW	4	4	10^4	10^4	–	–	–	6.3V	–	400V
GREEN	5	5	10^5	–	–	0.5pF	± 5%	16V	–	–
BLUE	6	6	10^6	–	–	–	–	20V	–	630V
VIOLET	7	7	10^7	–	–	–	–	–	–	–
GREY	8	8	10^8	0.01	–	0.25pF	–	25V	–	–
WHITE	9	9	10^9	0.1	–	–	–	2V	–	–
SILVER	–	–	0.01	–	± 10%	–	–	–	–	–
GOLD	–	–	0.1	–	± 5%	–	–	–	–	–
PINK	–	–	–	–	–	–	–	35V	High Stability	–

NOTE: Adjacent bands, if the same colour are not always separated.

Preferred Values of Resistors

E12 Series (10%)

1.0 1.2 1.5 1.8 2.2 2.7 3.3 3.9 4.7
5.6 6.8 8.2 and their decades

E24 Series (5%)

1.0 1.1 1.2 1.3 1.5 1.6 1.8 2.0 2.2
2.4 2.7 3.0 3.3 3.6 3.9 4.3 4.7 5.1
5.6 6.2 6.8 7.5 8.2 9.1 and their decades

Decibel Table

The voltage and current figures are given on the assumption that there is no change in impedance.

Voltage or current ratio	Power ratio	− dB +	Voltage or current ratio	Power ratio
1.000	1.000	0	1.000	1.000
0.989	0.977	0.1	1.012	1.023
0.977	0.955	0.2	1.023	1.047
0.966	0.933	0.3	1.035	1.072
0.955	0.912	0.4	1.047	1.096
0.944	0.891	0.5	1.059	1.122
0.933	0.871	0.6	1.072	1.148
0.912	0.832	0.8	1.096	1.202
0.891	0.794	1.0	1.122	1.259
0.841	0.708	1.5	1.189	1.413
0.794	0.631	2.0	1.259	1.585
0.750	0.562	2.5	1.334	1.778
0.708	0.501	3.0	1.413	1.995
0.668	0.447	3.5	1.496	2.239
0.631	0.398	4.0	1.585	2.512
0.596	0.355	4.5	1.679	2.818
0.562	0.316	5.0	1.778	3.162
0.501	0.251	6.0	1.995	3.981
0.447	0.200	7.0	2.239	5.012
0.398	0.159	8.0	2.512	6.310
0.355	0.126	9.0	2.818	7.942
0.316	0.100	10	3.162	10.00
0.282	0.0794	11	3.55	12.6
0.251	0.0631	12	3.98	15.9
0.224	0.0501	13	4.47	20.0
0.200	0.0398	14	5.01	25.1
0.178	0.0316	15	5.62	31.6
0.159	0.0251	16	6.31	39.8
0.126	0.0159	18	7.94	63.1
1.100	0.0100	20	10.00	100.0
3.16×10^{-2}	10^{-3}	30	3.16×10	10^{3}
10^{-2}	10^{-4}	40	10^{2}	10^{4}
3.16×10^{-3}	10^{-5}	50	3.16×10^{2}	10^{5}
10^{-3}	10^{-6}	60	10^{3}	10^{6}
3.16×10^{-4}	10^{-7}	70	3.16×10^{3}	10^{7}
10^{-4}	10^{-6}	80	10^{4}	10^{8}
3.16×10^{-5}	10^{-9}	90	3.16×10^{4}	10^{9}
10^{-5}	10^{-10}	100	10^{5}	10^{10}
3.16×10^{-6}	10^{-11}	110	3.16×10^{5}	10^{11}
10^{-6}	10^{-12}	120	10^{6}	10^{12}

Dielectric Constants and Power Factor

	Dielectric Constant at 50Hz	Power Factor at 50Hz	Power Factor at 1MHz	Power Factor at 100MHz
Air (normal pressure)	1	–	–	–
Glass, Crown	6.2	–	1	–
Glass, Pyrex	4.5	–	0.5	–
Mica	2.5 – 8.0	0.2	0.2 – 6	–
Paper	2 – 2.6	–	–	–
PTFE	2	–	–	0.001
Polystyrene	2.5	0.02	0.02	0.03
Polythene	2.25	0.03	0.02	0.03
PVC	2.9 – 3.2	1.2	1.6	0.8
Vinyl resins	4	–	4.2	–

Mail Order Companies

with catalogues

ARROW ELECTRONICS LTD.
7 Coptfold Road,
Brentwood,
Essex, CM14 4BN

B.H. COMPONENT FACTORS LTD.
59 North Street,
Leighton Buzzard,
Beds. LU7 7EG

BI-PAK,
P.O. Box 6,
Ware,
Herts.

BI-PRE-PAK LTD.
222-224 West Road,
Westcliff- on- Sea,
Essex SS0 9DF

DORAM ELECTRONICS LTD.
P.O. Box TR8,
Wellington Road Industrial Estate,
Wellington Bridge,
Leeds, LS12 2UF

ELECTROVALUE LTD.
28 St Judes Road,
Englefield Green,
Egham,
Surrey TW20 0HB

HENRY'S RADIO LTD.
303 Edgware Road,
London W2 1BW

HOME RADIO (COMPONENTS) LTD.
240 London Road,
Mitcham,
Surrey CR4 3HD

MAPLIN ELECTRONIC SUPPLIES.
P.O. Box 3,
Rayleigh,
Essex SS6 8LR

A. MARSHALL (LONDON) LTD.
42 Cricklewood Broadway,
London NW2 3ET

S.C.S. COMPONENTS.
Northfield Industrial Estate,
Beresford Avenue,
Wembley,
Middlesex HA0 1YY

Wire Gauge Comparisons

Metric mm. (preferred sizes)	2.00	1.80	1.60	1.40	1.25	1.00	0.90	0.71	0.56	0.45	0.355	0.315	0.280	0.250	0.224	0.200	0.160	0.125	0.100	0.080
S.W.G. (nearest)	14	15	16	17	18	19	20	22	24	26	28	30	32	33	34	36	38	40	42	44
B&S (nearest)	12	13	14	15	16	18	19	21	23	25	27	28	29	30	31	32	34	36	38	40

Formulae

Capacitance

$$C = \frac{0.0885\ KA}{d}$$

C in pF
K is dielectric constant (air = 1)
A is area of plates in cm^2
d is thickness of dielectric

Frequency-Wavelength

$$f = \frac{300{,}000\ \text{kHz}}{\lambda}$$

$$\lambda = \frac{300{,}000\ \text{metres}}{f}$$

f is frequency in kHz
λ is wavelength in metres

Ohms Law

$$I = \frac{V}{R} \text{ or } V = IR \text{ or } R = \frac{V}{R}$$

I is current in amps.
V is volts
R is resistance in ohms.

Power

$$W = VI = I^2R$$

W is watts

Reactance

$$X_L = 2\pi fL$$

X_L is reactance of inductor.
f is specific frequency.
L is inductance in Henries.

$$X_C = \frac{1}{2\pi fC}$$

X_C is reactance of capacitor.
C is capacitance in Farads.

Resonance

$$f = \frac{10^6}{2\pi\sqrt{LC}}$$

L is inductance in microhenries.
C is capacitance in picofarads.
f is frequency in kilohertz.

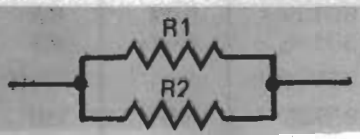
Time Constant

For a combination of capacitance and resistance in series, the time constant (defined as the time necessary for voltage to reach 63% of final value) is:

$t = CR$

t is time in seconds.
C is capacitance in Farads.
R is resistance in ohms.

Resistors in Parallel



R2 \ R1	10	12	15	18	22	27	33	39	47	56	68	82	100
10	5.00	5.45	6.00	6.43	6.88	7.30	7.67	7.96	8.25	8.48	8.72	8.91	9.09
12	5.45	6.00	6.67	7.20	7.76	8.31	8.80	9.18	9.56	9.88	10.20	10.47	10.71
15	6.00	6.67	7.50	8.18	8.92	9.64	10.31	10.83	11.37	11.83	12.29	12.68	13.04
18	6.43	7.20	8.18	9.00	9.90	10.80	11.65	12.32	13.02	13.62	14.23	14.76	15.25
22	6.88	7.76	8.92	9.90	11.00	12.12	13.20	14.07	14.99	15.79	16.62	17.35	18.03
27	7.30	8.31	9.64	10.80	12.12	13.50	14.85	15.95	17.15	18.22	19.33	20.31	21.26
33	7.67	8.80	10.31	11.65	13.20	14.85	16.50	17.88	19.39	20.76	22.22	23.53	24.81
39	7.96	9.18	10.83	12.32	14.07	15.95	17.88	19.50	21.31	22.99	24.79	26.43	28.06
47	8.25	9.56	11.37	13.02	14.99	17.15	19.39	21.31	23.50	25.55	27.79	29.88	31.97
56	8.48	9.88	11.83	13.62	15.79	18.22	20.76	22.99	25.55	28.00	30.71	33.28	35.90
68	8.72	10.20	12.29	14.23	16.62	19.33	22.22	24.79	27.79	30.71	34.00	37.17	40.48
82	8.91	10.47	12.68	14.76	17.35	20.31	23.53	26.43	29.88	33.28	37.17	41.00	45.05
100	9.09	10.71	13.04	15.25	18.03	21.26	24.81	28.06	31.97	35.90	40.48	45.05	50.00
120	9.23	10.91	13.33	15.65	18.59	22.04	25.88	29.43	33.77	38.18	43.40	48.71	54.55
150	9.38	11.11	13.64	16.07	19.19	22.88	27.05	30.95	35.79	40.78	46.79	53.02	60.00
180	9.47	11.25	13.85	16.36	19.60	23.48	27.89	32.05	37.27	42.71	49.35	56.34	64.29
220	9.57	11.38	14.04	16.64	20.00	24.05	28.70	33.13	38.73	44.64	51.94	59.74	68.75
270	9.64	11.49	14.21	16.88	20.34	24.55	29.41	34.08	40.03	46.38	54.32	62.90	72.97
330	9.71	11.58	14.35	17.07	20.63	24.96	30.00	34.88	41.14	47.88	56.38	65.68	76.74
390	9.75	11.64	14.44	17.21	20.83	25.25	30.43	35.45	41.95	48.97	57.90	67.75	79.59
470	9.79	11.70	14.54	17.34	21.02	25.53	30.83	36.01	42.73	50.04	59.41	69.82	82.46
560	9.82	11.75	14.61	17.44	21.17	25.76	31.16	36.46	43.36	50.91	60.64	71.53	84.85
680	9.86	11.79	14.68	17.54	21.31	25.97	31.47	36.88	43.96	51.74	61.82	73.18	87.18
820	9.88	11.83	14.73	17.61	21.43	26.14	31.72	37.23	44.45	52.42	62.79	74.55	89.13
1000	9.90	11.86	14.78	17.68	21.53	26.29	31.95	37.54	44.89	53.03	63.67	75.79	90.91

Popular Transistors

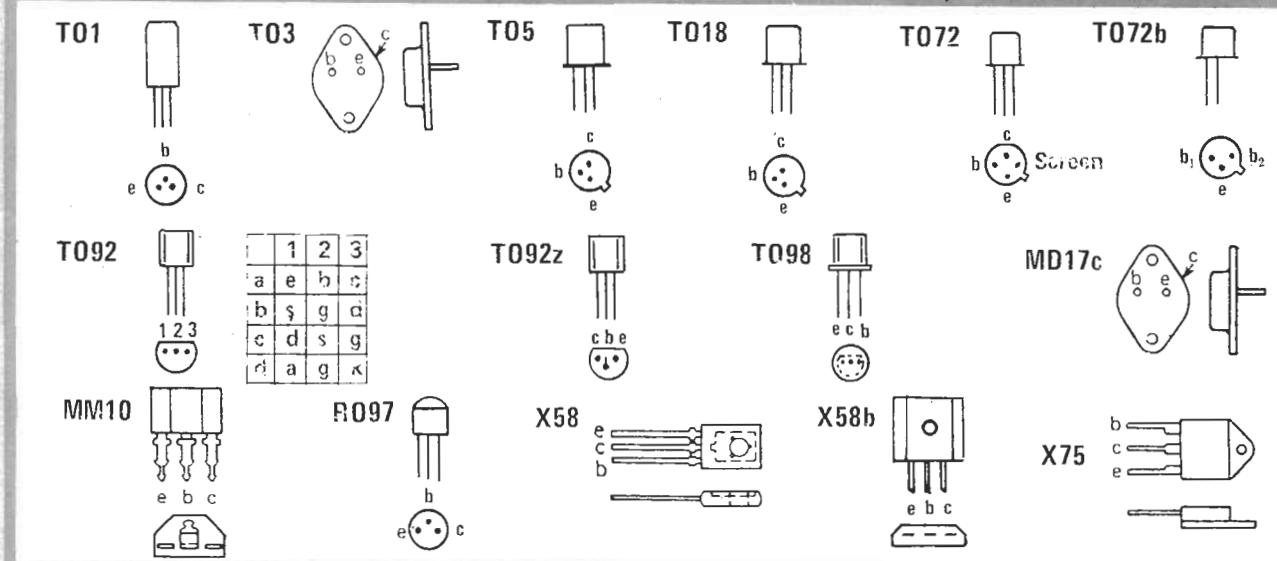
TYPE	PNP or NPN	P_t max Power mW	GAIN HFE @ mA		fT (MHz)	VCEO (V)	OUTLINE	USUAL APPLICATION
2N2219	NPN	800	100	150	250	30	TO5	Medium power
2N706	NPN	300	50	10	200	20	TO18	G.P. Switching
2N2926G	NPN	200	470	2	120	18	TO98a	G.P. Audio
2N3702	PNP	200	60	50	100	25	TO92a	G.P.
2N3704	NPN	300	90	50	100	30	TO92	G.P.
2N3638	PNP	300	30	50	100	25	RO97	G.P.
2N3643	NPN	300	100	150	250	30	RO97	G.P.
AC127	NPN/G	200	25	500	1.5	32	TO1	
AC128	PNP/G	220	60	300	1.5	32	TO1	
AD161	NPN/G	4W	50	500	1	20	MD17c	} Complementary Power
AD162	PNP/G	6W	50	500	1	20	MD17c	} Germanium
AF239	PNP/G	60	50	2	800	15	TO72	UHF
BC107	NPN	300	125	2	150	45	TO18	G.P.
BC108	NPN	300	125	2	150	20	TO18	G.P.
BC109	NPN	300	240	2	300	20	TO18	Low Noise, High Gain
BC147	NPN	220	125	2	300	45	MM10	G.P.
BC148	NPN	220	125	2	300	20	MM10	G.P.
BC149	NPN	220	240	2	300	30	MM10	Low Noise, High Gain
BC157	PNP	220	125	2	300	45	MM10	G.P.
BC158	PNP	220	125	2	300	20	MM10	G.P.
BC159	PNP	200	240	2	200	20	MM10	Low Noise
BC177	PNP	300	125	2	300	45	TO18	G.P.
BC178	PNP	300	125	2	300	20	TO18	G.P.
BC179	PNP	300	240	2	200	20	TO18	G.P.
BC328	PNP	360	100	100	100	25	TO92zb	} Low power
BC338	NPN	360	100	100	100	25	TO92zb	} Complementary pair
BD131	NPN	11W	30	500	60	45	X58	} High power
BD132	PNP	11W	30	500	60	45	X58	} Complementary pair
BD139	NPN	8W	40	150	250	80	X58	} High power
BD140	PNP	8W	40	150	75	80	X58	} Complementary pair
BDY20	NPN	115W	20	4A	1	60	TO3	V. High power
BF180	NPN	150	50	2	675	25	TO72	UHF
BFR40	NPN	800	75	100	100	60	TO92	} Complementary
BFR80	PNP	800	75	100	100	60	TO92	} pair
BFX30	PNP	500	50	10	100	45	TO5	Medium power G.P.
BFX85	NPN	800	50	10	50	60	TO5	Medium power G.P.
BFX88	PNP	600	125	10	100	40	TO5	Medium power G.P.
BFY50	NPN	800	30	150	60	35	TO5	Medium power G.P.
BFY51	NPN	800	40	150	50	30	TO5	Medium power G.P.
2N3055	NPN	115W	20	4A	0.4	60	TO3	High power
MJ2955	PNP	115W	20	4A	0.4	60	TO3	High power
MJE3055	NPN	90W	20	4A	2	60	X58c	High power
MJE2955	PNP	90W	20	4A	2	60	X58c	High power
TIP31A	NPN	40W	20	1A	3	60	X75b	High power
TIP32A	PNP	40W	20	1A	3	60	X75b	High power
OC44	PNP/G	75	40	2	7.5	15	TO1	R.F. Low power
OC45	PNP/G	72	25	2	9	15	TO1	R.F. Low power
OC71	PNP/G	125	30	3	0.3	20	TO1	A.F. Low power
OC72	PNP/G	125	30	80	1	32	TO1	A.F. Low power
OC81	PNP/G	240	50	50	1	32	TO1	A.F. G.P.

P.U.T.'s	ANODE-CATHODE VOLTAGE (V)	VALLEY CURRENT Rg=1MHz (μA)	VALLEY CURRENT Rg=10kHz (μA)	MAX PEAK – POINT CURRENT Rg=1MHz (μA)	MAX PEAK – POINT CURRENT Rg=10kHz (μA)	OFF-SET VOLTAGE (V)		OUTLINE
2N6027 (D13TI)	40	50	70	2	5	0.2	1.6	TO92d

UNIJUNCTION TRANSISTORS	INTERBASE VOLTAGE (V)	VALLEY POINT CURRENT (mA) Min	VALLEY POINT CURRENT (mA) Max	PEAK POINT EMITTER CURRENT (μA)	INTRINSIC STAND-OFF RATIO Min	INTRINSIC STAND-OFF RATIO Max	INTERBASE RESISTANCE (Ω) Min	INTERBASE RESISTANCE (Ω) Max	OUTLINE
2N2646	35	4	18	5	0.56	0.75	4.7k	9.1k	TO72b
2N2647	35	8	18	2	0.68	0.82	4.7k	9.1k	TO72b
2N2160	30	8		25	0.47	0.8	4k	12k	TO72b

FETS TYPE	N or P	Vds Max (V)	Drain to Source Current when Vgs=O (mA) Min	Drain to Source Current when Vgs=O (mA) Max	Pt max Power (mW)	Gate-Source Cut-off Voltage (Vgs) (V) Min	Gate-Source Cut-off Voltage (Vgs) (V) Max	OUTLINE
2N3819	N	25	2	20	200	0.2	15	TO92b
2N3820	P	20	18 typical		200	4 typical		TO92b
2N5457	N	25	1	5	310	0.5	6	TO92c
2N5458	N	25	2	99	310	1	7	TO92c
2N5459	N	25	4	16	310	2	8	TO92c

Transistor Outlines

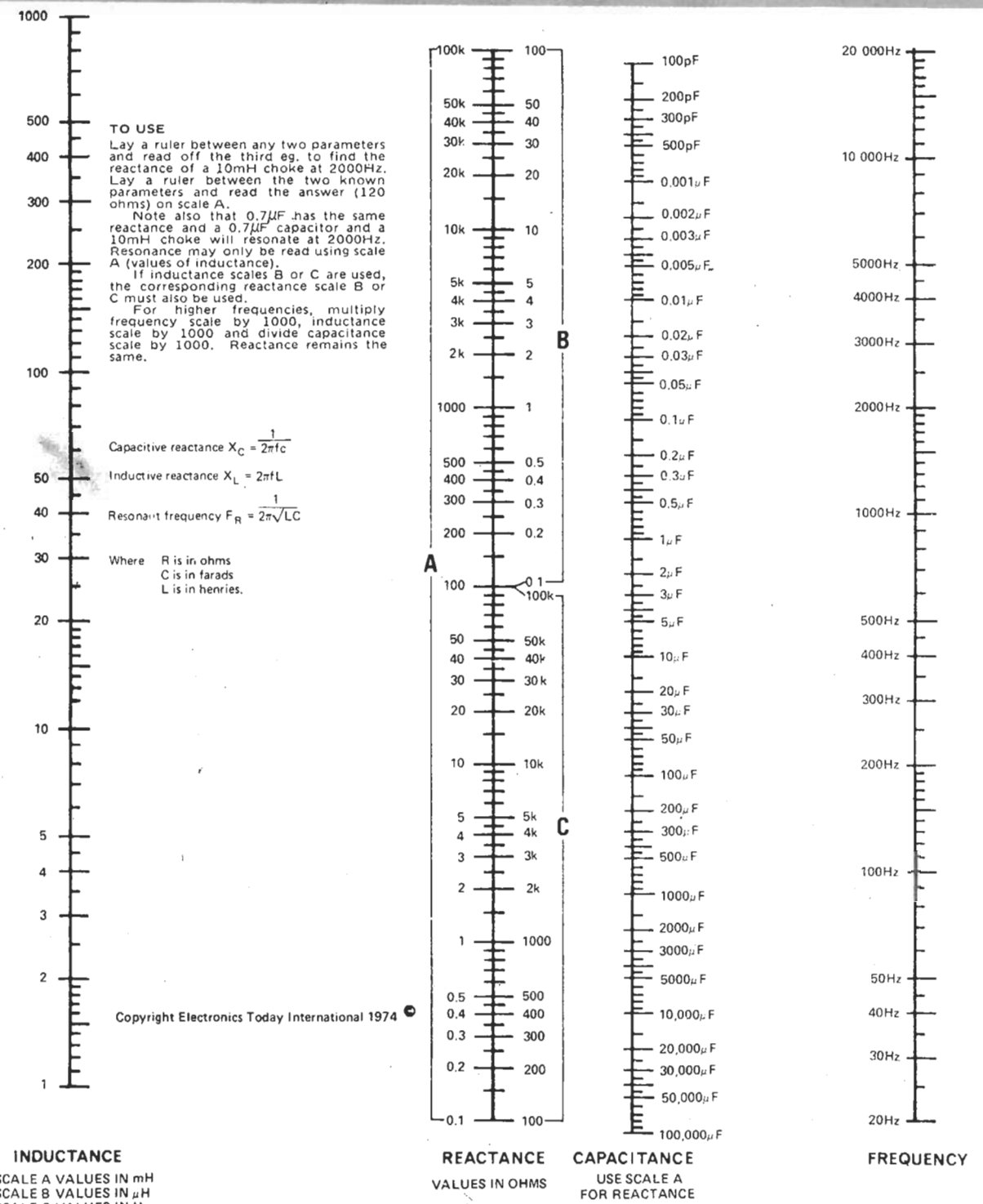


Transistor Codings

The preferred applications of many British and European semiconductors can be derived from their letter code. The first letter A describes a germanium device, a first letter B is for silicon devices. The second letter describes the following:–

A Diode low power
C AF low power
D AF low power
E Tunnel Diode
F RF low power
L RF power
P Photo type
S Switching low power
V Switching power
Y Diode power
Z Zener Diode

Reactance Chart



TO USE

Lay a ruler between any two parameters and read off the third eg. to find the reactance of a 10mH choke at 2000Hz. Lay a ruler between the two known parameters and read the answer (120 ohms) on scale A.

Note also that 0.7μF has the same reactance and a 0.7μF capacitor and a 10mH choke will resonate at 2000Hz. Resonance may only be read using scale A (values of inductance).

If inductance scales B or C are used, the corresponding reactance scale B or C must also be used.

For higher frequencies, multiply frequency scale by 1000, inductance scale by 1000 and divide capacitance scale by 1000. Reactance remains the same.

Capacitive reactance $X_C = \frac{1}{2\pi fc}$

Inductive reactance $X_L = 2\pi fL$

Resonant frequency $F_R = \frac{1}{2\pi\sqrt{LC}}$

Where R is in ohms
C is in farads
L is in henries.

INDUCTANCE
SCALE A VALUES IN mH
SCALE B VALUES IN μH
SCALE C VALUES IN H

REACTANCE
VALUES IN OHMS

CAPACITANCE
USE SCALE A
FOR REACTANCE

FREQUENCY