

SEMI-CONDUCTOR DEVICES



PHILIPS ELECTRONIC TUBE DIVISION

SYMBOLS FOR SEMI-CONDUCTORS

I. BASIC SYMBOLS

	Current	I or i
	Voltage	V or v
	Power	P or p
	Peak value	M or m
	R.M.S. value	eff
	Average or D.C. value	— ¹⁾
	Input	subscript i
	Output	subscript o
<u>Crystal Diodes</u>	Cathode	K or k
	Anode	D or d
<u>Transistors</u>	Base	B or b
	Emitter	E or e
	Collector	C or c

The way in which these symbols are used is shown in fig.1 In this figure a varying collector current is shown with its constant (D.C.) component ²⁾ and its varying (A.C.) component. The same can be done with other currents and with voltages and powers

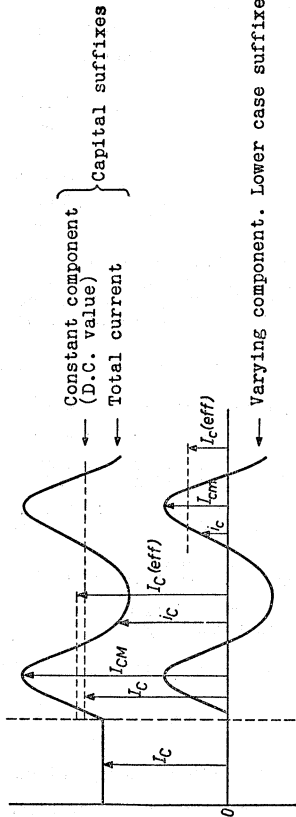
The following tabel may be used for indicating the various quantities:

Instantaneous values	lower case letters	i, v or p
Average (D.C.) values	capitals	I, V or P
R.M.S. values	{	capitals I, V or P
		with the addition eff
Peak values	{	capitals I, V or P ₃
		with the subscript M or m ³⁾
Total currents, voltages or powers or their constant components	}	are used with capital subscripts K, D, B, E, C
		are used with lower case subscripts k, d, b, e, c

¹⁾ The average value is understood when no symbol is used for R.M.S. or peak value

²⁾ The constant component is the same as the average value of the concerning quantity

³⁾ The capital subscript M is used after the capital subscripts K, D, B, E, C
The lower case subscript m is used after the lower case subscripts k, d, b, e, c



Constant component
(D.C. value)
Total current

Capital suffixes

Varying component. Lower case suffixes

I_C	D.C. value	} of total current
I_{CM}	peak value	
$I_C(eff)$	R.M.S. value	
i_C	instantaneous value	} of varying component
I_{cm}	peak value	
$i_C(eff)$	R.M.S. value	
i_C	instantaneous value	

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II. VOLTAGES

Voltages are indicated by the symbols V or v with two subscripts, the first of which indicates the electrode at which the voltage is measured and the second one the electrode with respect to which the voltage is measured (usually the common electrode in the case of transistors) When no confusion has to be feared, the second subscript may be omitted.

Supply voltages are indicated by repeating the first index. The electrode with respect to which the voltage is measured is then indicated by the third subscript. Where difficulties might arise, the supply voltage may be indicated by subscript S .

Base voltage in common emitter circuits.	V_{BE} or V_{be}
Collector voltage in common base circuits.	V_{CB} or V_{cb}
Collector supply voltage in common base circuits.	V_{CCB}
Collector supply voltage in common emitter circuits.	V_{CCE}
Collector voltage in common emitter circuits.	V_{CE} or V_{ce}
Collector knee voltage in common emitter circuits.	V_{CEK}
HF voltage.	V_{hf}
AC input voltage.	V_i
AC output voltage.	V_o
Oscillator voltage.	V_{osc}
Supply voltage.	V_S

III. CURRENTS

A current flowing in the conventional direction from the external circuit into the electrode is called positive

Base current.	I_B or I_b
Collector current.	I_C or I_c
Collector current in common base circuit when $I_E = 0$	I_{CBO}
Collector current in common emitter circuit when $I_B = 0$	I_{CEO}
Diode current.	I_D or I_d
Emitter current.	I_E or I_e
Emitter current in common base circuit when $I_C = 0$	I_{EBO}
AC input current.	I_i
AC output voltage.	I_o
Current of supply voltage source.	I_S
Surge current.	I_{surge}

IV. POWERS

Collector dissipation.	PC	
A.C. power supplied by collector. .		Rc
A.C. input power of a circuit . . .		Pi
A.C. output power of a circuit. . .		Po
Power supplied by voltage source. .	Ps	

V. CAPACITANCES

Shunt capacitance of a diode. . . .		Cdk
Load capacitance.		C _l

VI. RESISTANCES

External resistance in the base lead	RB	or Rb
Equivalent internal base resistance		rb
External resistance between base and emitter.	RBE	or Rbe
External resistance in the collector lead.	Rc	or Rc
Equivalent internal collector resistance		rc
Matching resistance of a push-pull amplifier (collector to collector)		Rcc
R.F. damping resistance of a diode circuit.		rd
External resistance in the emitter lead.	RE	or Re
Equivalent internal emitter resistance		re
Load resistance.		R _l
Equivalent internal transfer resistance of a transistor		rm

VII. ADMITTANCES

Input admittance of a circuit. . .	Si
Output admittance of a circuit . .	So

VIII. FREQUENCIES

Cut-off frequency of α_{fb} (= frequency at which the value of α_{fb} is 3dB below its D.C. value α_{FB}). . .	f _{ab}
Cut-off frequency of α_{fe} (= frequency at which the value of α_{fe} is 3dB below its D.C. value α_{FE}).	f _{ae}
Resonant frequency.	f _o

SYMBOLS FOR SEMI-CONDUCTORS

IX. TEMPERATURES

Ambient temperature	T _{amb}
Junction temperature	T _j
Variation of the junction temperature	ΔT _j

X. h-PARAMETERS

Common base circuit

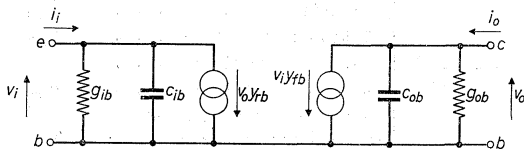
Input impedance, output short-circuited	h _{11b} or h _{ib}
Reverse voltage ratio, input open.	h _{12b} or h _{rb}
Current transfer ratio, output short-circuited.	-h _{21b} or -h _{fb}
Output admittance, input open.	h _{22b} or h _{ob}

Common emitter circuit

Input impedance, output short-circuited	h _{11e} or h _{ie}
Reverse voltage ratio, input open.	h _{12e} or h _{re}
Current transfer ratio, output short-circuited.	h _{21e} or h _{fe}
Output admittance, input open.	h _{22e} or h _{oe}

XI. y-PARAMETERS

Common base circuit

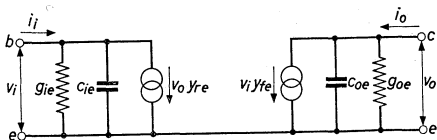


Output short-circuited	{	Input admittance . . .	Y _{ib}
	{	Input conductance . .	ξ _{ib}
	{	Input capacitance . . .	C _{ib}
	{	Phase angle of input admittance.	φ _{ib}
Input short-circuited	{	Output admittance . . .	Y _{ob}
	{	Output conductance. . .	ξ _{ob}
	{	Output capacitance. . .	C _{ob}
	{	Phase angle of output admittance.	φ _{ob}

XI. y-PARAMETERS (continued)

Input short-circuited	}	Feedback admittance	Y_{rb}
		Feedback conductance	ξ_{rb}
		Feedback capacitance	C_{rb}
		Phase angle of feedback admittance	ϕ_{rb}
Output short-circuited	}	Transfer admittance	Y_{fb}
		Transfer conductance	ξ_{fb}
		Transfer capacitance	C_{fb}
		Phase angle of transfer admittance	ϕ_{fb}

Common emitter circuit



Output short-circuited	}	Input admittance	Y_{ie}
		Input conductance	ξ_{ie}
		Input capacitance	C_{ie}
		Phase angle of input admittance	ϕ_{ie}
Input short-circuited	}	Output admittance	Y_{oe}
		Output conductance	ξ_{oe}
		Output capacitance	C_{oe}
		Phase angle of output admittance	ϕ_{oe}
Input short-circuited	}	Feedback admittance	Y_{re}
		Feedback conductance	ξ_{re}
		Feedback capacitance	C_{re}
		Phase angle of feedback admittance	ϕ_{re}
Output short-circuited	}	Transfer admittance	Y_{fe}
		Transfer conductance	ξ_{fe}
		Transfer capacitance	C_{fe}
		Phase angle of transfer admittance	ϕ_{fe}

SYMBOLS FOR SEMI-CONDUCTORS

XII. VARIOUS SYMBOLS

Bandwidth	B
Distortion factor	d
Noise factor.	F
Heat resistance	K
Averaging time of voltages and currents	t_{av}
Current gain factor of a transistor in common base circuits	a_{FB} or a_{fb}
Current gain factor of a transistor in common emitter circuits.	a_{FE} or a_{fe}
Duty factor	δ
Efficiency.	η
Wave length	λ

PREFERRED TYPES

GERMANIUM DIODES

Type number	Main application
OA 70	Video detection
2-OA 72	Ratio detection
OA 73	Non domestic purposes
OA 79	Low level A.M. detection
OA 81	General purpose Medium forward current
OA 85	General purpose High forward current
OA 86	Data processing equipment

TRANSISTORS

Type number	Main application
OC 70	Input stage hearing aids and low frequency amplifiers
OC 71	Driver and output stage hearing aids Driver stage low frequency amplifiers
2-OC 72	Matched pair for class B power stage
OC 73	Data processing equipment
OC 76	For switching and oscillating purposes (e.g. D.C. converters)

