

Appendix A

Explanatory notes to tabulations

The general layout plan of the information in the tables of this compendium should be immediately evident from the data tabulation explanatory chart set out overleaf.

Supporting Appendices with additional information are:

- App. B Glossary of *Opamp Terms*
- App. C Tabulation *Codes for Manufacturers*
- App. D IC Manufacturers' *House Numbers*
- App. E Tabulation *Codes for Applications*
- App. F *Case Outline and Leadout Diagrams*
- App. G Codes for *Leadout Connections*

Unit symbols used in the tables are:

- A = amperes
- C = °centigrade
- dB = decibels
- G = gigaohms (megohms $\times 10^3$)
- GHZ = gigahertz (megahertz $\times 10^3$)
- K = kilohms
- KHZ = kilohertz
- M = megohms
- MA = milliamperes, mA
- MAX = maximum
- MHZ = megahertz
- MIN = minimum
- MV = millivolts
- MWC = milliwatts, case at 25C
- MWF = milliwatts, free air at 25C
- MWH = milliwatts, heat sink, 25C
- NA = nanoamps (microamps $\times 10^{-3}$)
- NV = nanovolts (microvolts $\times 10^{-3}$)
- PA = picoamps (microamps $\times 10^{-12}$)
- R = ohms
- T = teraohms (megohms $\times 10^6$)
- V = volts
- WC = watts, case at 25C
- WF = watts, free air at 25C
- WH = watts, heatsink, 25C
- μ A = microamps
- μ S = microseconds
- μ V = microvolts
- μ W = microwatts
- μ WF = microwatts, free air at 25C

Where a unit symbol appears in the middle of a value, it indicates the position of the decimal point, e.g. 3K3 = 3.3K.

Appendix A

TYPE NUMBER	MFR	APP	CMP	GBP MIN	SLEW RATE MIN	V _{S+} MAX	V _{S-} MAX	T _{OP} MAX	A _{VOL} MIN	V _{IO} MAX	I _B MAX	I _{IO} MAX	P _{TOT} MAX	I _{OUT} MIN	V _{OUT} MIN	V _{ICM} MAX	V _{IDF} MAX	dV _{IO} /dT MAX	P _O MAX	I _O MAX	CMRR MIN	PSRR MIN	R _{IN} MIN
(EXAMPLE) LH0022CH	NAU	FET	INT	.3MHZ	1V/US	+22V	-22V	85C	97dB	6MV	25pA	5pA	500MWF	10MA	10V	15V	30V	15uV/C	85MW	3MA	70dB	70dB	0.1T
<p>TYPE No. NUMERO-ALPHABETIC LISTING</p> <p>MFR = MANUFACTURER CODED AS APP. C</p> <p>APP = APPLICATION CODED AS APP. E</p> <p>CMP = FREQUENCY COMPENSATION WITH INT = INTERNAL EXT = EXTERNAL</p> <p>GBP MIN = UNITY GAIN BANDWIDTH PRODUCT, MIN; IN KHZ, MHZ, or GHZ</p> <p>SLEW RATE, MIN. IN VOLTS PER MICROSECOND. V/μS</p> <p>V_{S+} MAX = MAX. PERMISSIBLE +VE DC SUPPLY VOLTAGE IN VOLTS, V</p> <p>V_{S-} MAX = MAX. PERMISSIBLE -VE DC SUPPLY VOLTAGE IN VOLTS, V</p> <p>T_{OP} MAX = MAX. PERMISSIBLE OPERATIONAL AMBIENT TEMPERATURE IN °C.</p> <p>A_{VOL} MIN = MIN. OPEN-LOOP VOLTAGE GAIN IN DB</p> <p>V_{IO} MAX = MAX INPUT OFFSET VOLTAGE AT 25°C IN MV or μV.</p> <p>I_B MAX = MAX. INPUT BIAS CURRENT AT 25°C IN MA, μA, nA or pA</p>	<p>I_O MAX = MAX. QUIESCENT (NO SIGNAL, NO LOAD) CURRENT CONSUMPTION IN MA</p> <p>P_O MAX = MAX. QUIESCENT (NO SIGNAL, NO LOAD) POWER CONSUMPTION IN MW</p> <p>dV_{IO}/dT MAX = MAX. INPUT OFFSET VOLTAGE TEMPERATURE DRIFT IN μV/C OR MV/C</p> <p>V_{IDF} MAX = MAX. PERMISSIBLE DIFFERENTIAL INPUT VOLTAGE IN V.</p> <p>V_{ICM} MAX = MAX. PERMISSIBLE COMMON-MODE INPUT VOLTAGE IN VOLTS, V</p> <p>V_{OUT} MIN = GUARANTEED MIN. OUTPUT VOLTAGE, PEAK VALUE, IN VOLTS, V</p> <p>I_{OUT} MIN = GUARANTEED MINIMUM OUTPUT CURRENT, PEAK VALUE, IN MA OR μA.</p> <p>P_{TOT} MAX = MAX. PERMISSIBLE POWER DISSIPATION IN W, mW, μW WITH F = FREE AIR 25°C, C = CASE 25°C, H = HEATSINK 25°C.</p> <p>I_{IO} MAX = MAX. INPUT OFFSET CURRENT AT 25°C IN MA, μA, nA, OR pA</p>	<p>R_{IN} MIN = MIN IN-PUT RESISTANCE</p> <p>PSRR MIN = MIN. POWER SUPPLY REJECTION RATIO IN DB</p> <p>CMRR MIN = MIN. COMMON MODE REJECTION RATIO IN DB</p>																					
<p>[NOTE: FOR FURTHER EXPLANATION OF SPECIAL TERMS SEE APP. B]</p>	<p>* R_{IN} EXPRESSED AS OHMS (R), KILOHMS (K), MEGOHMS (M), GIGAOHMS (G) OR TERAHMS (T)</p>																						

Appendix A

LEFT HAND PAGE

For detailed explanations of column heading notations, see App. A.

Also for ready references the more important abbreviations used in the column headings are listed below:

- APP = application
(codes at APP.E.)
- CMRR = common mode rejection ratio
- CMP = compensation
(frequency)
- dV_{io}/dT = input offset voltage temperature drift
- GBP = gain bandwidth product
- I_b = input bias current
- I_{io} = input bias offset current
- I_Q = quiescent supply current
- MFR = manufacturer
(codes at App.C.)
- P_Q = quiescent power consumer
- PSRR = power supply rejection ratio
- V_{icm} = common mode input voltage rating
- V_{idc} = differential input voltage rating
- V_{io} = input offset voltage
- V_S = dc supply voltage

RIGHT HAND PAGE

Lead out coding summary (details at APP.G.) for different cases (APP.F.)

- A = gain adjust
- B = bias adjust
- C = case
- E- = inverting input
- E+ = non-inverting input
- F,F* = input frequency compensation
- G = ground
- J = high level input
- K = output, open collector
- L = output, open emitter
- M = metal case
- N = not connected
- Q = special terminal
- R,R* = outputs
- S = strobe
- T,T* = offset balance
- V+ = +ve dc supply
- V- = -ve dc supply
- W = guard ring
- X = blank position, no lead
- + + = +ve supplementary dc supply
- - = -ve supplementary dc supply
- ϕ, ϕ^* = output frequency compensation

CASE (APP. F.)	LD 1	LD 2	LD 3	LD 4	LD 5	LD 6	LD 7	LD 8	LD 9	LD 10	LD 11	LD 12	LD 13	LD 14	LD 15	LD 16	EUROPE SUBSTITUTION	USA SUBSTITUTION	ISS	TYPE NUMBER	
T05-8/1M	T	E-	E+	V-	T*	R	V+	N	LH0022H	0	LH0022CH

CASE = PACKAGE OF DIFFERENT TYPES CODED ACCORDING TO APP. F - FIRST NUMBER INDICATES NUMBER OF LEAD POSITIONS EG DIL-14 = 14 LEAD DUAL-IN-LINE PACKAGE

LD1, LD2, ETC = LEAD NUMBERS WITH CONNECTIONS ACCORDING TO PAGE FOOTNOTE OR APP. G.

EURO SUBSTITUTION = PROELECTRON STANDARD OR OTHER TYPE AVAILABLE IN EUROPE

TYPE No. REPEATED ON R.H. MARGIN

ISS = ISSUE NUMBER OF DATA ENTRY

USA SUBSTITUTION = SUGGESTED ALTERNATIVE AVAILABLE IN USA.

Appendix C

Tabulation Codes for Manufacturers

ADU	Advanced Micro Devices Inc., 901 Thompson Pl., Sunnyvale, CA 94086, USA	ITU	DA14 5HT, UK ITT Semiconductors 74 Commerce Way, Woburn, MA, 01801, USA
ANG	Analog Devices Ltd, Central Ave., East Molesey, KT8 9BR, Surrey, UK	MNG	Mitsubishi Shoji Kaisha Ltd, Bow Bells House, Bread St., London, EC4, UK
ANU	Analog Devices Inc., P.O. Box 280, Norwood, Mass., 02062	MNJ	Mitsubishi Electric Corp., 2-12 Marunouchi, Chiyoda-ku, Tokyo, Japan
BLG	Bell & Howell Ltd, Lennox Road, Basingstoke, Hants, UK	MTG	Motorola Ltd (Semiconductor Products Div.), York House, Empire Way, Wembley, Middlesex, HA9 0PR, UK
BLU	Bell & Howell (Control Products Divison), 706 Bostwick Ave, Bridgeport, Conn. 06605, USA	MTU	Motorola Semiconductor Products Inc., 5005 E. McDowell Road, Phoenix, AZ, 85008, USA
BUG	Burr-Brown International Ltd, 17 Exchange Rd, Watford, WQD1 7EB, Herts., UK	MUG	Mullard Ltd, Mullard House, Torrington Place, London, WC1E 7HD, UK
BUU	Burr-Brown Research Corp., P.O. Box 11400, Tucson, AZ, 85734, USA	NAG	National Semiconductor (UK) Ltd, Harpur Centre, Bedford, MK40 3LF, UK
CMG	Computing Techniques Ltd, Brookers Rd, Billingshurst, Sussex, RH14 9RZ, UK	NAU	National Semiconductor Corp., 2900 Semiconductor Drive, Santa Clara, CA, 95051, USA
DAG	Datel UK Ltd, Stephenson Close, Portway Ind. Estate, Andover, Hants, UK	NIJ	Nippon Electric Co. Ltd, 1753 Shimonumabe, Nakahara-ku, Kawasaki, Japan
DAU	Datel Systems Inc., 1020 Turnpike St., Canton, MA 02021, USA	OAU	Opamp Labs Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038, USA
FAG	Fairchild Camera & Instrument (UK) Ltd, 230 High St., Potters Bar, Herts., UK	OBS	Obsolete – no longer commercially available.
FAU	Fairchild Semiconductor 464 Ellis St., Mountain View, CA 94042, USA	OTU	Optical Electronics Inc., P.O. Box 11140, Tucson, AZ, 85734, USA
FEG	Ferranti Ltd, (Electronic Department), Gem Mill, Chadderton, Oldham, Lancs., OL9 8NP, UK	PLG	Plessey Semiconductors, Cheney Manor, Swindon, Wilts., SN2 2QW, UK
FUJ	Fujitsu Ltd, 1015 Kamikodanaka, Kawasaki, Japan	PRG	Precision Monolithics (Bourns Trimpot Ltd) 17/27 High St., Hounslow, Middlesex, UK
HAG	Harris Semiconductor (Memec) Ltd, The Firs, Whitchurch, Nr. Aylesbury, Bucks., HP22 4JU, UK	PRU	Precision Monolithics (Bourns) Inc., 1500 Space Park Drive, Santa Clara, CA, 95050, USA
HAU	Harris Semiconductor P.O. Box 883, Melbourne, FL, 32901, USA	RAG	Raytheon Semiconductor The Pinnacles, Harlow, Essex, CM19 5BB, UK
HIJ	Hitachi Ltd (Semiconductor and IC Div.), 1450 Josuihonimachi, Kodaira City, Tokyo, Japan	RAU	Raytheon Semiconductor, 350 Ellis Street, Mountain View, CA, 94042, USA
ING	Intersil Inc., 8 Tessa Rd, Richfield Trading Estate, Reading, Berks., UK	RCG	RCA (Great Britain) Ltd, Lincoln Way, Windmill Road, Sunbury-on- Thames, Middlesex, UK
INU	Intersil Inc., 10900 N. Tantau Ave, Cupertino, CA, 95014, USA	RCU	RCA Solid State Division Route 202, Somerville, NJ, 08876, USA
ITG	ITT Semiconductors Maidstone Rd, Fooks Cray, Sidcup, Kent,	SAJ	Sanken Electric Co. Ltd, 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan

Appendix C

SGG	SGS-ATES (UK) Ltd, Planar House, Walton Street, Aylesbury, Bucks., UK	SPU	Sprague Electric Company (Semiconductor Div.), 115 Northeast Cutoff, Worcester, MA, 01606, USA
SGI	SGS-ATES Componenti Spa, Via Olivetti, 2 Agrate Brianza, 20041, Milan, Italy	TDG	Teledyne Semiconductor, Heathrow House, Bath Road, Cranford, Hounslow, Middlesex, TW5 9QP, UK
SHG	Shindengen Hyokuto Boeki Haisha Ltd, St. Alphage House, Fore St., London, EC2Y 5DA, UK	TDU	Teledyne (Amelco) Semiconductor, 1300 Terra Bella Ave, Mountain View, CA, 94032, USA
SHJ	Shindengen Electric Mfg Co., Ltd, New Ohtemachi Bldng, 2-1, 2-chome, Ohtemachi, Chiyoda-ku, Tokyo, Japan	TEB	Teledyne-Philbrick, Heathrow House, Bath Road, Cranford, Hounslow, Middlesex, TW5 9QP, UK
SIG	Siemens Ltd, Great West Road, Brentford, Middlesex, TW8 9DG, UK	TEU	Teledyne-Philbrick, Allied Drive at Route 128, Dedham, MA, 02026, USA
SIW	Siemens Aktiengesellschaft, Richard-Strauss-Strasse 76, D-8000 Munchen 2, Postfach 202109, W. Germany	TGG	Texas Instruments Ltd, Manton Lane, Bedford, UK
SJG	Signetics International Corporation Yeoman House, 63 Croydon Rd, London, SE20, UK	TGU	Texas Instruments Inc. (Components Group), P.O. Box 5012, Dallas, Texas, 75222, USA
SJU	Signetics Corp., 811 East Arques Ave, Sunnydale, CA. 94086, USA	THF	Thomson-CSF (Sescosem), 50 Rue Jean Pierre Timbaud, BP 120, 92403, Courbevoie, France
SKU	Silicon General Inc., 7382 Bolsa Avenue, Westminster, CA, 92683, USA	THG	Thomson-CSF (UK) Ltd, Ringway House, Bell Rd, Daneshill, Basingstoke, Hants., RG24 0QG, UK.
SLG	Siliconix Ltd, 30A High St., Thatcham, Newbury, Berks., RG13 4JG, UK	TKJ	Tokyo Sanyo Electric Co. Ltd (Semiconductor Div.), Oizumachi, Oragun, Gumma, Japan
SLU	Siliconix Incorporated, 2201 Laurelwood Road, Santa Clara, CA, 95054, USA	TOG	Toshiba (UK) Ltd, Toshiba House, Great South West Rd, Feltham, Middlesex, UK
SOJ	Sony Semiconductor Corp., 14-1, Asa hi-sho 4, Atsuigi-shi, Kanagawa-ken, 243, Japan	TOJ	Toshiba (Tokyo Shibaura) Electric Co., 2-1, 5-chome, Ginza Chuo-ku, Tokyo, Japan
SPG	Sprague Electric (UK) Ltd, 159 High St., Yiewsley, W. Drayton, Middlesex, UB7 7RY, UK	TRU	Transitron Electronic Corp., 168 Albion St., Wakefield, MA, 01881, USA
		ZEU	Zeltex Inc., 940 Detroit Ave, Concord, CA, 94518, USA

Appendix D

IC Manufacturers'

House Numbers

(General Note: Manufacturers often adopt their own 'in-house' serial numbering for their ICs. Listed below are the initial letters of numerical series used by different manufacturers.)

AD	Analog Devices	OP	Precision Monolithics
ADO	Analog Devices	P	Teledyne-Philbrick
AM	Advanced Micro Devices; Datel	PF	Teledyne-Philbrick
AMD	Advanced Micro Devices	PG	General Instruments (obs.)
AMLM	Advanced Micro Devices	PP	Teledyne-Philbrick
AMSSS	Advanced Micro Devices	RA	Radiation (now Harris)
AMU	Advanced Micro Devices	RC	Raytheon
C	Bell & Howell	RL	Raytheon
CA	RCA	RM	Raytheon
CIA	Teledyne-Philbrick	RSN	Raytheon
CMP	Precision Monolithics	RV	Raytheon
CN	Ferranti	S	Signetics
DA	Teledyne-Philbrick	SA	Teledyne-Philbrick
EP	Teledyne-Philbrick	SE	Signetics; Mullard
ESL	Teledyne-Philbrick	SFC	Thomson-CSF
FSL	Teledyne-Philbrick	SG	Silicon General
FSS	Ferranti	SH	Fairchild
HA	Harris	SK	RCA
HEPC	Motorola	SL	Plessey; Teledyne-Philbrick
ICH	Intersil	SN	Texas Instruments
ICL	Intersil	SP	Teledyne-Philbrick
JM	Fairchild	SQ	Teledyne-Philbrick
JSF	Thomson-CSF	SSS	Precision Monolithics
L	Analog Devices; SGS-ATES	SU	Signetics; Mullard
LA	Teledyne-Philbrick	T	Teledyne-Philbrick Transitron
LF	National Semiconductor	TA	AEG-Telefunken
LH	National Semiconductor	TAA	Proelectron Standard
LM	National Semiconductor	TBA	Proelectron Standard
M	Mitsubishi	TBB	Proelectron Standard
MC	Motorola Semiconductors	TBC	Proelectron Standard
MCC	Motorola Semiconductors	TBE	Proelectron Standard
MCCF	Motorola Semiconductors	TCA	Proelectron Standard
MCE	Motorola Semiconductors	TDA	Proelectron Standard
MCH	Motorola Semiconductors	TDB	Proelectron Standard
MIC	ITT Semiconductors	TDC	Proelectron Standard
MLF	Motorola; Teledyne-Philbrick	TDE	Proelectron Standard
MLM	Motorola Semiconductors	TL	AEG-Telefunken
MLMC	Motorola Semiconductors	TOA	Transitron
MONO-OP	Precision Monolithics	TSC	Transitron
N	Signetics; Mullard	U	Fairchild
NC	General Instruments (obs.)	ULN	Sprague
NE	Signetics; Mullard	ULS	Sprague
NH	National Semiconductor	USL	Teledyne-Philbrick
		ZA	Zeltex
		ZEL	Zeltex
		ZLD	Ferranti
		ZN	Ferranti
		μA	Fairchild

Appendix E

Tabulation Codes for Applications

BDO	Balanced differential-output amplifier	PAA	Parametric amplifier
CDA	Current-difference amplifier	PIA	Precision instrumentation amplifier
CHP	Chopper-stabilized amplifier	PRA	Programmable opamp
CPR	DC comparator	QCD	Quad current-difference amplifier
DBD	Dual balanced differential-output amplifier	QCP	Quad comparator
DCP	Dual Comparator	QFE	Quad fet-input opamp
DFE	Dual fet-input opamp	Q GK	Quad general-purpose, internally-compensated, opamp
DGK	Dual general purpose opamp	QGU	Quad general-purpose, uncompensated, opamp
DGU	Dual general-purpose uncompensated opamp	QLQ	Quad low-quiescent-power opamp
DHS	Dual high-slew-rate opamp	QPI	Quad precision instrumentation amplifier
DLN	Dual low-noise opamp	QPR	Quad programmable opamp
DPI	Dual precision instrumentation amplifier	QSB	Quad super-beta opamp
DPR	Dual programmable opamp	SBA	Super-beta opamp
DSB	Dual super-beta opamp	TCP	Triple comparator
FET	Fet-input opamp	TFE	Triple fet-input opamp
GPK	General-purpose, internally-compensated, opamp	TGK	Triple general-purpose, internally compensated, opamp
GPU	General-purpose, uncompensated, opamp	TGU	Triple general-purpose, uncompensated, opamp
HCO	High current output opamp	TLN	Triple low-noise opamp
HIR	High input resistance opamp	TLP	Triple low-quiescent-power opamp
HPO	High power output opamp	TOT	Triple operational transconductance amplifier
HSR	High slew rate opamp	TPI	Triple precision instrumentation amplifier
HVO	High voltage output opamp	TPR	Triple programmable opamp
LBC	Low input bias current opamp	TSB	Triple super-beta opamp
LCD	Low input offset current drift opamp	VFA	Voltage-follower amplifier
LNA	Low noise opamp	WBA	Wide-band opamp
LOC	Low input offset current opamp	XHG	Extra-high-gain opamp
LOV	Low input offset voltage opamp	XLP	Extra-low quiescent power opamp
LQP	Low quiescent power opamp	XSR	Extra-high slew rate opamp
LVD	Low input offset voltage drift opamp	XWB	Extra-wide-band opamp
MWB	Medium-wideband opamp		
OTA	Operational transconductance amplifier		

Appendix G

Codes for Leadout Connections

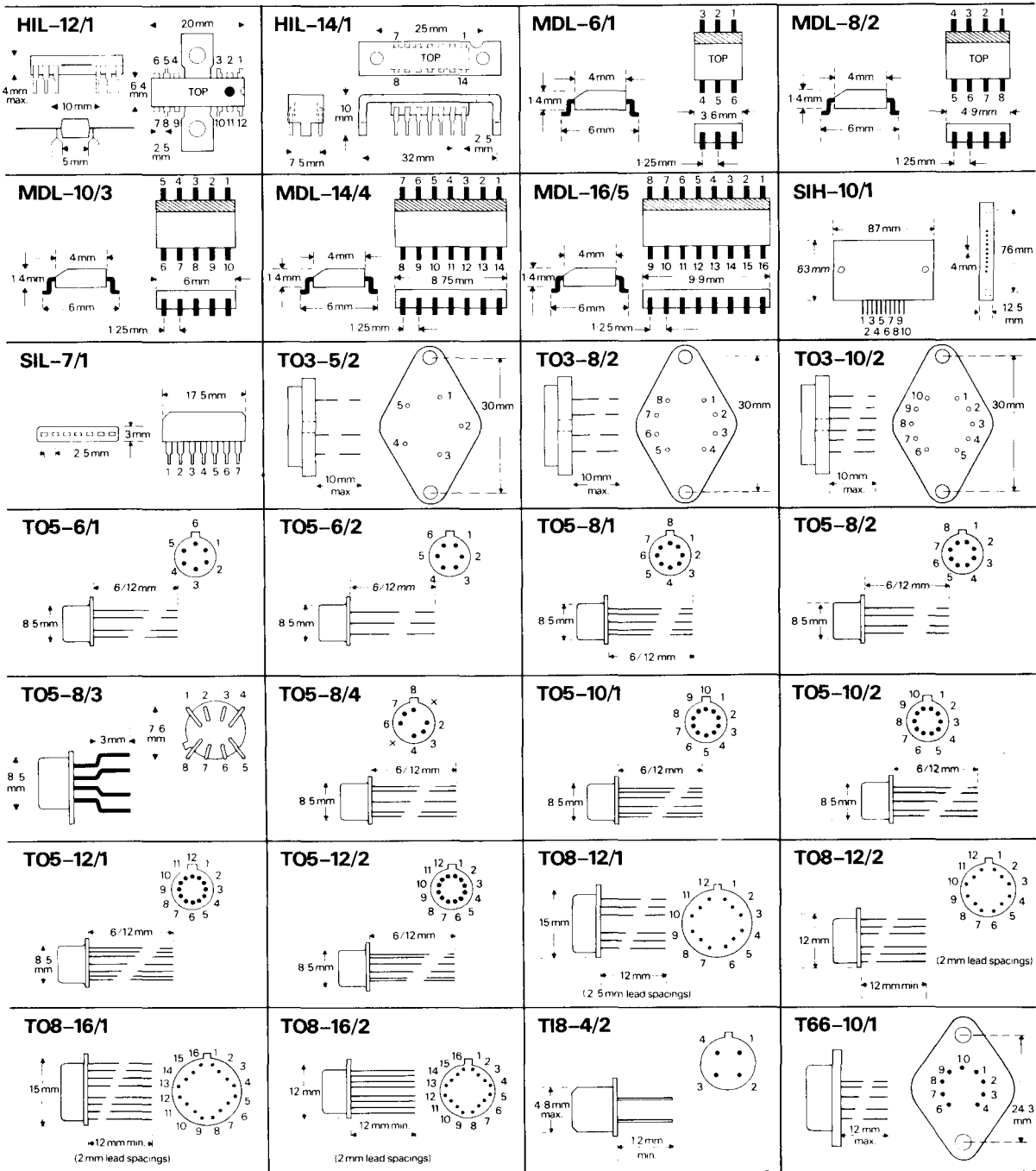
I: Connection Codes in Serial Order

A	= Gain adjust, 1
A*	= Gain adjust, 2
B	= Bias adjust or set
C	= Case, package, screen
E+	= Input, non-inverting, low-level
E-	= Input, inverting, low-level
F	= Input frequency compensation, 1
F*	= Input frequency compensation, 2
G	= Ground, common, earth, zero volts
J+	= Input, non-inverting, high-level
J-	= Input, inverting, high-level
K	= Output, open collector
L	= Output, open emitter
M	= Metal casing
N	= Not connected, i.e. isolated lead
Q	= Special terminal (consult manufacturer's data)
R	= Output, 1
R*	= Output, 2
S	= Strobe
T	= Offset balance, trim or null, 1
T*	= Offset balance, trim or null, 2
V+	= +ve dc supply
V-	= -ve dc supply
W	= Guard ring
X	= Blank position, lead omitted
++	= +ve supplementary dc supply
--	= -ve supplementary dc supply
φ	= Output frequency compensation, 1
φ*	= Output frequency compensation, 2

II: Lead Assignments in Alphabetical Order

Balance, offset, 1 = T
Balance, offset, 2 = T*
Bias adjust = B
Blank position, without lead = X
Case = C
Compensation, input, 1 = F
Compensation, input, 2 = F*
Compensation, output, 1 = φ
Compensation, output, 2 = φ*
DC supply, +ve = V+
DC supply, -ve = V-
Frequency compensation, input, 1 = F
Frequency compensation, input, 2 = F*
Frequency compensation, output, 1 = φ
Frequency compensation, output, 2 = φ*
Gain adjust, 1 = A
Gain adjust, 2 = A*
Ground = G
Guard ring = W
Input, inverting, high-level = J-
Input, non-inverting, high-level = J+
Input, inverting, low-level = E-
Input, non-inverting, low-level = E+
Input offset voltage, adjust, 1 = T
Input offset voltage, adjust, 2 = T*
Lead omitted, blank position = X
Lead in position but not connected = N
Metal case = M
Not connected, but lead in position = N
Null, offset, 1 = T
Null, offset, 2 = T*
Offset voltage adjust, 1 = T
Offset voltage adjust, 2 = T*
Output, 1 = R
Output, 2 = R*
Output, open-collector = K
Output, open-emitter = L
Package = C
Special purpose terminal (data sheet to be consulted) = Q
Strobe = S
Supply, dc, +ve = V+
Supply, dc, -ve = V-
Supply, dc, supplementary, +ve = ++
Supply, dc, supplementary, -ve = --
Trim (offset voltage), 1 = T
Trim (offset voltage), 2 = T*

Appendix F



Appendix F

