HARRIS

HA-2620/22/25

Very Wideband, Uncompensated Operational Amplifiers

T-79-07-10

Features

- Gain Bandwidth Product ($A_V \geq 5$) 100MHz
- High Input Impedance 500MΩ
- Low Input Bias Current 1nA
- Low Input Offset Current 1nA
- Low Input Offset Voltage 0.5mV
- High Gain 150kV/V
- High Slew Rate 35V/μs
- Output Short Circuit Protection

Applications

- Video and R.F. Amplifier
- Pulse Amplifier
- Audio Amplifiers and Filters
- High-Q Active Filters
- High-Speed Comparators
- Low Distortion Oscillators

Description

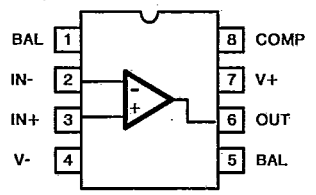
HA-2620/2622/2625 are bipolar operational amplifiers that feature very high input impedance (500MΩ, HA-2620) coupled with wideband AC performance. The high resistance of the input stage is complemented by low offset voltage (0.5mV, HA-2620) and low bias and offset current (1nA, HA-2620) to facilitate accurate signal processing. Input offset can be reduced further by means of an external nulling potentiometer. 100MHz gain-bandwidth product (HA-2620/2622/2625 are stable for closed loop gains greater than 5), 35V/μs slew rate and 150kV/V open-loop gain enables HA-2620/2622/2625 to perform high-gain amplification of very fast, wideband signals. These dynamic characteristics, coupled with fast settling times, make these amplifiers ideally suited to pulse amplification designs as well as high frequency (e.g. video) applications. The frequency response of the amplifier can be tailored to exact design requirements by means of an external bandwidth control capacitor.

In addition to its application in pulse and video amplifier designs, HA-2620/2622/2625 is particularly suited to other high performance designs such as high-gain low distortion audio amplifiers, high-Q and wideband active filters and high-speed comparators. For more information, please refer to Application Notes 509, 519 and 546.

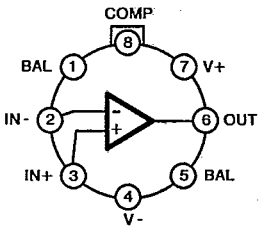
The HA-2620 and HA-2622 have guaranteed operation from -55°C to +125°C and are available in Metal Can and Ceramic Mini-DIP packages. Both are offered as /883 Military Grade with the HA-2622 also available in LCC packages. MIL-STD-883 data sheets are available upon request. The HA-2625 has guaranteed operation from 0°C to +75°C and is available in Plastic and Ceramic Mini-DIP and Metal Can packages.

Pinouts

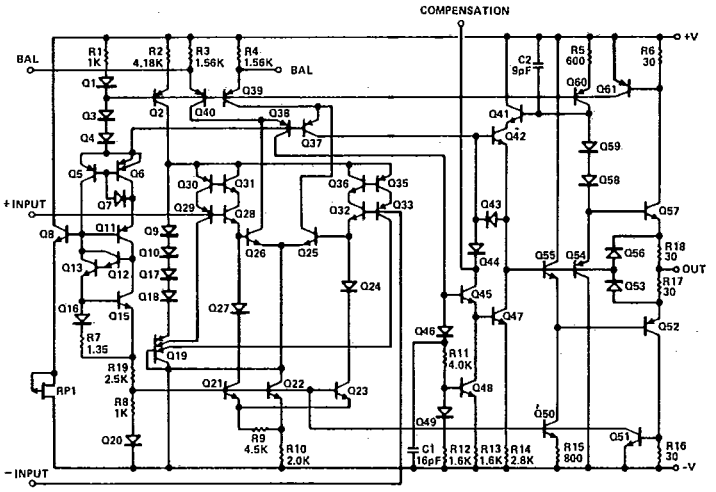
HA7-2620/22/25 (CERAMIC MINI-DIP)
HA3-2625 (PLASTIC MINI-DIP)
TOP VIEW



HA2-2620/22/25 (TO-99 METAL CAN)
TOP VIEW



Schematic



CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.

Absolute Maximum Ratings (Note 13)

Voltage Between V+ and V- Terminals 45.0V
Differential Input Voltage ..... ±12.0V
Peak Output Current ..... Full Short Circuit Protection
Internal Power Dissipation 300mW
Maximum Junction Temperature ..... +175°C

Operating Temperature Ranges

HA-2600/HA-2602 ..... $-55°C \leq T_A \leq +125°C$
HA-2605 ..... $0°C \leq T_A \leq +75°C$
Storage Temperature Range: ..... $-65°C \leq T_A \leq +150°C$
Lead Solder Temperature (10 Seconds) ..... 275°C

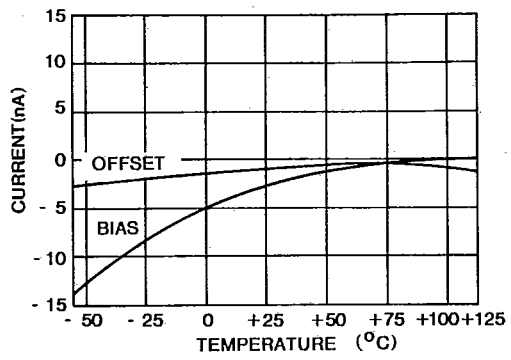
Electrical Specifications $V_S = \pm 15V$ D.C., Unless Otherwise Specified.

PARAMETER	TEMP	HA-2620 -55°C to +125°C			HA-2622 -55°C to +125°C			HA-2625 0°C to +75°C			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
INPUT CHARACTERISTICS											
Offset Voltage (Note 1)	+25°C	-	0.5	4	-	3	5	-	3	5	mV
	Full	-	2	6	-	-	7	-	-	7	mV
Average Offset Voltage Drift	Full	-	5	-	-	5	-	-	5	-	µV/°C
Bias Current	+25°C	-	1	15	-	5	25	-	5	25	nA
	Full	-	10	35	-	-	60	-	-	40	nA
Offset Current	+25°C	-	1	15	-	5	25	-	5	25	nA
	Full	-	5	35	-	-	60	-	-	40	nA
Differential Input Resistance (Note 11)	+25°C	65	500	-	40	300	-	40	300	-	MΩ
Input Noise Voltage Density $f_O = 1kHz$	+25°C	-	11	-	-	11	-	-	11	-	$nV/\sqrt{Hz}$
Input Noise Current Density $f_O = 1kHz$	+25°C	-	0.16	-	-	0.16	-	-	0.16	-	$pA/\sqrt{Hz}$
Common Mode Range	Full	±11	±12	-	±11	±12	-	±11	±12	-	V
TRANSFER CHARACTERISTICS											
Large Signal Voltage Gain (Notes 2 & 3)	+25°C	100K	150K	-	80K	150K	-	80K	150K	-	V/V
	Full	70K	-	-	60K	-	-	70K	-	-	V/V
Common Mode Rejection Ratio (Note 4)	Full	80	100	-	74	100	-	74	100	-	dB
Minimum Stable Gain	+25°C	5	-	-	5	-	-	5	-	-	V/V
Gain Bandwidth Product (Notes 2, 5 & 6)	+25°C	-	100	-	-	100	-	-	100	-	MHz
OUTPUT CHARACTERISTICS											
Output Voltage Swing (Note 2)	Full	±10	±12	-	±10	±12	-	±10	±12	-	V
Output Current (Note 3)	+25°C	±15	±22	-	±10	±18	-	±10	±18	-	mA
Full Power Bandwidth (Notes 2, 3, 7 & 12)	+25°C	400	600	-	320	600	-	320	600	-	kHz
TRANSIENT RESPONSE (Note 8)											
Rise Time (Notes 2, 7 & 8)	+25°C	-	17	45	-	17	45	-	17	45	ns
Slew Rate (Notes 2, 7, 8 & 10)	+25°C	±25	±35	-	±20	±35	-	±20	±35	-	V/µs
POWER SUPPLY CHARACTERISTICS											
Supply Current	+25°C	-	3	3.7	-	3	4	-	3	4	mA
Power Supply Rejection Ratio (Note 9)	Full	80	90	-	74	90	-	74	90	-	dB

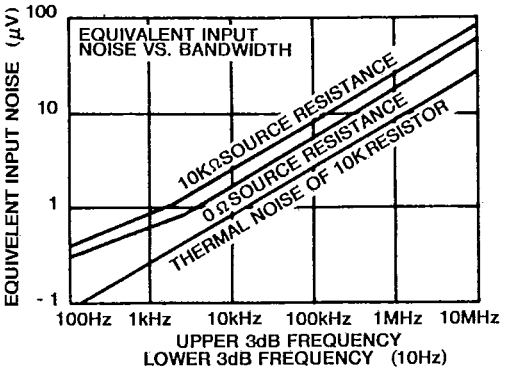
NOTES:
1. Offset may be externally adjusted to zero.
2. $R_L = 2k\Omega$
3. $V_{OUT} = \pm 10.0V$
4. $V_{CM} = \pm 10V$
5. $V_{OUT} < 90mV$
6. 40dB Gain
7. See Transient Response Test Circuits & Waveforms.
8. $A_V = 5$ (The HA-2620 family is not stable at unity gain without external compensation.)
9. $\Delta V_S = \pm 5V$
10. $V_{OUT} = \pm 5V$
11. This parameter value guaranteed by design calculations.
12. Full Power Bandwidth guaranteed by slew rate measurement: $FPBW = S.R./2\pi V_{PEAK}$.
13. Absolute Maximum Ratings are limiting values applied individually beyond which the serviceability of the circuit may be impaired. Functional operation under any of these conditions is not necessarily implied.

Typical Performance Curves $V_S = \pm 15V$ D.C., $T_A = +25^oC$, Unless Otherwise Specified.

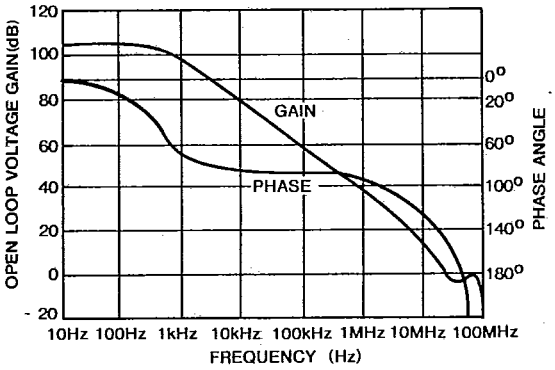
INPUT BIAS CURRENT AND OFFSET CURRENT AS A FUNCTION OF TEMPERATURE



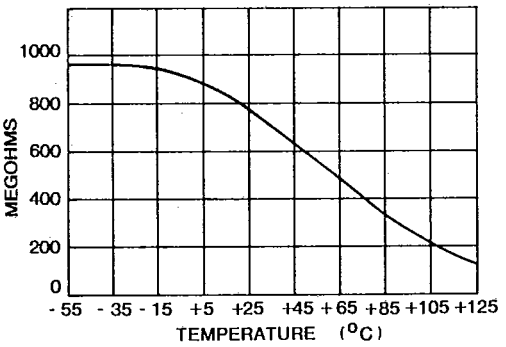
BROADBAND NOISE CHARACTERISTICS



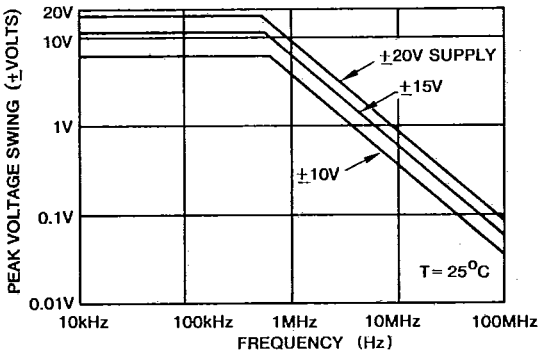
OPEN LOOP FREQUENCY AND PHASE RESPONSE



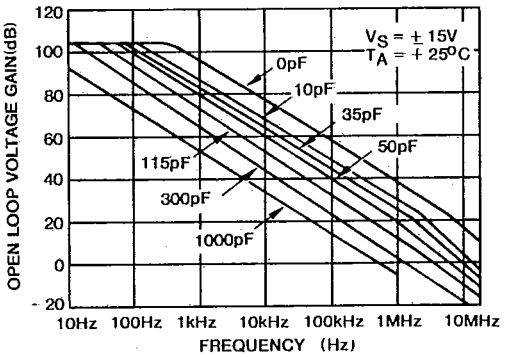
INPUT IMPEDANCE vs. TEMPERATURE, 100Hz



OUTPUT VOLTAGE SWING vs. FREQUENCY



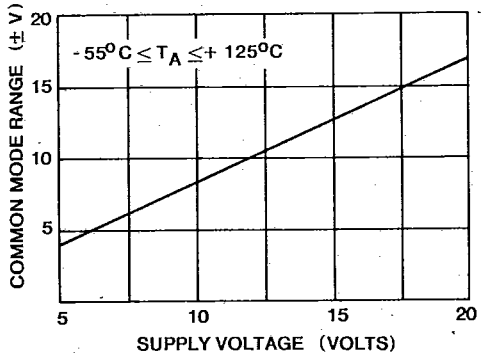
OPEN - LOOP FREQUENCY RESPONSE FOR VARIOUS VALUES OF CAPACITORS FROM COMPENSATION PIN TO GROUND



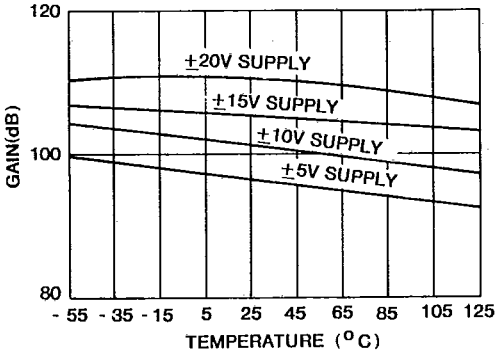
NOTE: External Compensation is required for closed loop gain < 5. If external compensation is used, also connect 100pF capacitor from output to ground.

Typical Performance Curves (Continued)

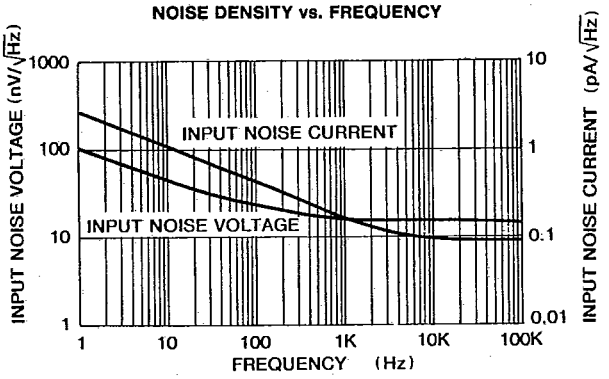
COMMON MODE VOLTAGE RANGE AS A FUNCTION OF SUPPLY VOLTAGE



OPEN - LOOP VOLTAGE GAIN vs. TEMPERATURE

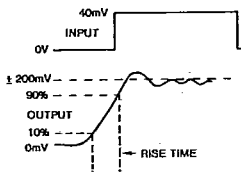


NOISE DENSITY vs. FREQUENCY

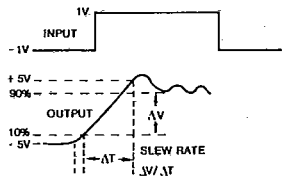


Test Circuits

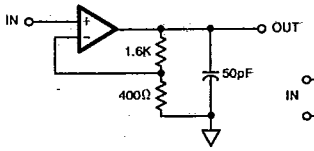
TRANSIENT RESPONSE



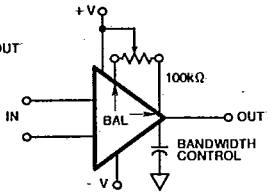
SLEW RATE



SLEW RATE AND TRANSIENT RESPONSE



SUGGESTED V_{OS} ADJUSTMENT AND COMPENSATION HOOK-UP

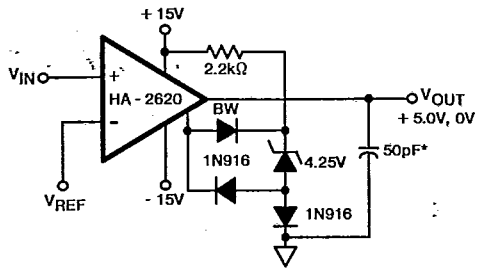


NOTE: Measured on both positive and negative transitions from 0 to +200mV and 0 to -200mV at output.

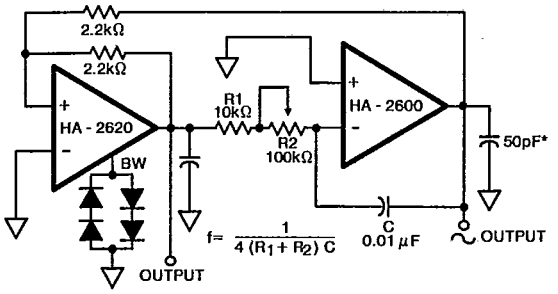
Tested Offset Adjustment is $|V_{OS}| + 1mV|$ minimum referred to output. Typical range is ±10mV with $R_T = 100k\Omega$.

Typical Applications

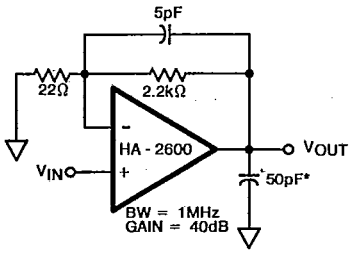
HIGH IMPEDANCE COMPARATOR



FUNCTION GENERATOR



VIDEO AMPLIFIER



* A small load capacitance of at least 30pF (including stray capacitance) is recommended to prevent possible high frequency oscillations.

Die Characteristics

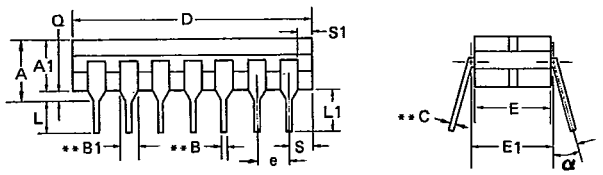
Transistor Count 140
Die Dimensions ..... 73 x 52 x 19 mils
Substrate Potential ..... Unbiased

Thermal Constants (°C/W)	θ_{ja}	θ_{jc}
HA2-Metal Can (-2, -5, -7)	202	55
HA2-Metal Can (-8, /883)	161	48
HA3-Plastic DIP (-5)	83	33
HA4-Ceramic LCC (/883)	96	35
HA7-Ceramic DIP (-2, -5, -7)	204	112
HA7-Ceramic DIP (-8, /883)	81	32

Package Configuration

T-90-20

A B C D E .300 CERAMIC DUAL-IN-LINE



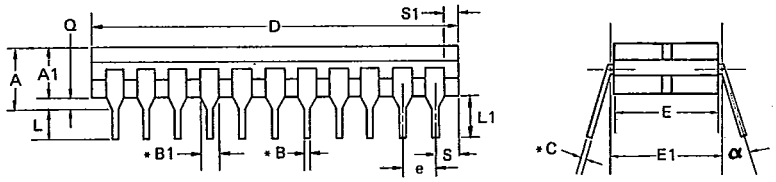
PKG. CODE	LEAD COUNT	DIM. A	DIM. A1	DIM. B	DIM. B1	DIM. C	DIM. D	DIM. E	DIM. E1	DIM. e	DIM. L	DIM. L1	DIM. S	DIM. S1	DIM. Q	DIM. α
A	8 SSI	— .200	.140 .160	.016 .023	.050 .065	.008 .015	.375 .395	.245 .265	.290 .310	.100 BSC	.125 .150	.150 —	— .055	.005 —	.015 .060	0° 15°
B1	14 MSI	— .200	.140 .170	.016 .023	.050 .065	.008 .015	.753 .785	.265 .285	.290 .310	.100 BSC	.125 .180	.150 —	— .098	.005 —	.015 .060	0° 15°
B2	14 LSI	— .200	.140 .170	.016 .023	.050 .065	.008 .015	.753 .785	.285 .305	.300 .320	.100 BSC	.125 .180	.150 —	— .098	.005 —	.015 .060	0° 15°
C1	16* MSI	— .200	.140 .170	.016 .023	.050* .065*	.008 .015	.753 .785	.265 .285	.290 .310	.100 BSC	.125 .180	.150 —	— .080	.005 —	.015 .060	0° 15°
C2	16* LSI	— .200	.140 .170	.016 .023	.050* .065*	.008 .015	.753 .785	.285 .305	.300 .320	.100 BSC	.125 .180	.150 —	— .080	.005 —	.015 .060	0° 15°
D	18 LSI	— .200	.140 .170	.016 .023	.050* .065*	.008 .015	.882 .915	.285 .305	.300 .320	.100 BSC	.125 .180	.150 —	— .098	.005 —	.015 .060	0° 15°
E	20 LSI	— .200	.140 .170	.016 .023	.050* .065*	.008 .015	.940 .970	.285 .305	.300 .320	.100 BSC	.125 .180	.150 —	— .080	.005 —	.015 .060	0° 15°

* End leads are half leads where B remains the same and B1 is $\frac{0.035}{0.045}$

** Solder dip finish add +0.003 inches

F .400 CERAMIC DUAL-IN-LINE

G H .600 CERAMIC DUAL-IN-LINE



PKG. CODE	LEAD COUNT	DIM. A	DIM. A1	DIM. B	DIM. B1	DIM. C	DIM. D	DIM. E	DIM. E1	DIM. e	DIM. L	DIM. L1	DIM. S	DIM. S1	DIM. Q	DIM. α
F .400	22 LSI	— .225	.150 .180	.016 .023	.050 .065	.008 .015	1.055 1.085	.375 .395	.395 .415	.100 BSC	.125 .180	.150 —	— .080	.005 —	.015 .060	0° 15°
G .600	24 LSI	— .225	.150 .180	.016 .023	.050 .065	.008 .015	1.24 1.27	.515 .535	.595 .615	.100 BSC	.125 .180	.150 —	— .098	.005 —	.015 .060	0° 15°
H .600	28 LSI	— .225	.160 .190	.016 .023	.050 .065	.008 .015	1.44 1.47	.515 .535	.595 .615	.100 BSC	.125 .180	.150 —	— .098	.005 —	.015 .060	0° 15°

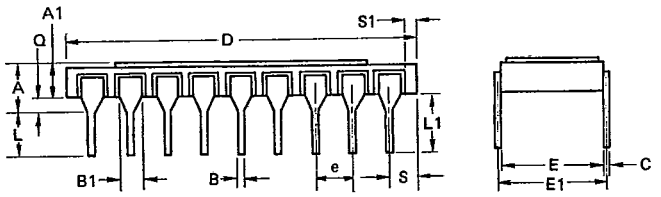
* Solder dip finish add +0.003 inches.

NOTE: Dimensions are $\frac{\text{Min}}{\text{Max}}$. Dimensions are in inches. BSC means basic spacing between centerlines.

Package Configuration

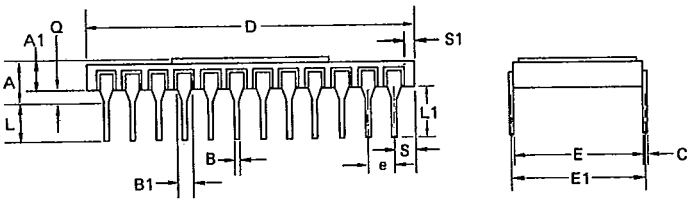
T-90-20

I .300 SIDEBRAZE DUAL-IN-LINE



PKG. CODE	LEAD COUNT	DIM. A	DIM. A1	DIM. B	DIM. B1	DIM. C	DIM. D	DIM. E	DIM. E1	DIM. e	DIM. L	DIM. L1	DIM. S	DIM. S1	DIM. Q
I	18	— .200	.080 .110	.016 .023	.045 .060	.008 .015	.890 .910	.280 .300	.290 .310	.100 BSC	.125 .180	.150 —	— .098	.005 —	.025 .045

J K L .600 SIDEBRAZE DUAL-IN-LINE



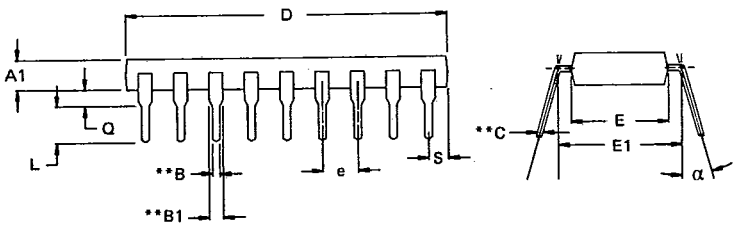
PKG. CODE	LEAD COUNT	DIM. A	DIM. A1	DIM. B	DIM. B1	DIM. C	DIM. D	DIM. E	DIM. E1	DIM. e	DIM. L	DIM. L1	DIM. S	DIM. S1	DIM. Q
J	24	— .225	.080 .110	.016 .023	.040 .054	.008 .015	1.185 1.215	.587 .603	.598 .612	.100 BSC	.125 .180	.150 —	— .080	.005 —	.040 .060
K	28	— .225	.080 .110	.016 .023	.040 .054	.008 .015	1.385 1.415	.587 .603	.598 .612	.100 BSC	.125 .180	.150 —	— .080	.005 —	.030 .060
L	40	— .225	.080 .110	.016 .023	.040 .054	.008 .015	1.980 2.020	.587 .603	.598 .612	.100 BSC	.125 .180	.150 —	— .080	.005 —	.040 .060

NOTE: Dimensions are $\frac{\text{Min}}{\text{Max}}$. Dimensions are in inches.

BSC means basic spacing between centerlines.

Package Configuration

M N O P Q .300 PLASTIC DUAL-IN-LINE

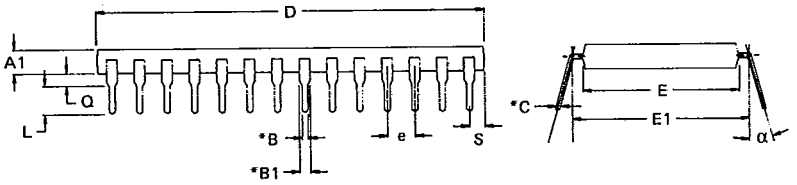


PKG. CODE	LEAD COUNT	DIM. A1	DIM. B	DIM. B1	DIM. C	DIM. D	DIM. E	DIM. E1	DIM. e	DIM. L	DIM. S	DIM. Q	DIM. α
M	8	.125/.140	.016/.023	.050/.070	.008/.015	.370/.390	.245/.265	.290/.310	.090/.110	.110/.150	.030/.050	.020/.040	0°/15°
N	14	.125/.140	.016/.023	.050/.070	.008/.015	.750/.770	.245/.265	.290/.310	.090/.110	.110/.150	.030/.050	.020/.040	0°/15°
O	16*	.125/.140	.016/.023	.050/.070	.008/.015	.750/.770	.245/.265	.290/.310	.090/.110	.110/.150	.025/.035	.020/.040	0°/15°
P	18	.125/.140	.016/.023	.050/.070	.008/.015	.900/.920	.245/.265	.290/.310	.090/.110	.110/.150	.040/.060	.020/.040	0°/15°
Q	20	.130/.145	.016/.023	.050/.070	.008/.015	1.030/1.050	.250/.270	.290/.310	.090/.110	.110/.150	.060/.080	.020/.040	0°/15°

* End leads are half leads where B remains the same and B1 is 0.035/0.045

** Solder dip finish add 0.003 inches.

R S .600 PLASTIC DUAL-IN-LINE



PKG. CODE	LEAD COUNT	DIM. A1	DIM. B	DIM. B1	DIM. C	DIM. D	DIM. E	DIM. E1	DIM. e	DIM. L	DIM. S	DIM. Q	DIM. α
R	24	.145/.155	.016/.023	.050/.070	.008/.015	1.24/1.26	.540/.560	.590/.610	.090/.110	.110/.150	.045/.095	.020/.040	0°/15°
S	28	.145/.155	.016/.023	.050/.070	.008/.015	1.54/1.57	.540/.560	.590/.610	.090/.110	.110/.150	.110/.160	.020/.040	0°/15°

* Solder dip finish add 0.003 inches.

NOTE: Dimensions are Min/Max. Dimensions are in inches.

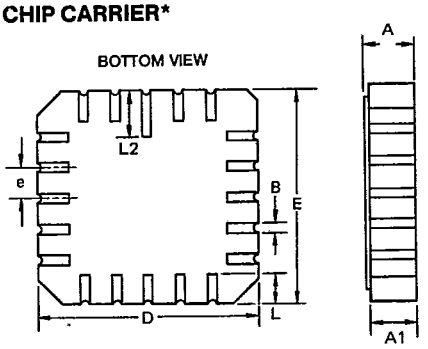
BSC means basic spacing between centerlines.

Package Configuration

T .350 CERAMIC LEADLESS CHIP CARRIER*

U .450 CERAMIC LEADLESS CHIP CARRIER*

V .650 CERAMIC LEADLESS CHIP CARRIER*

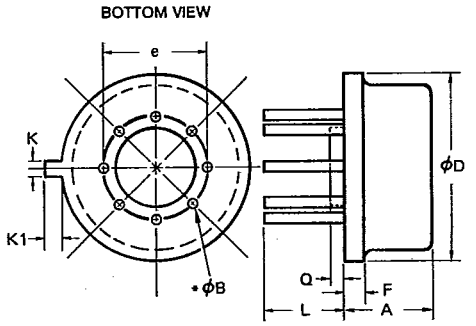


PKG. CODE	LEAD COUNT	DIM. A	DIM. A1	DIM. B	DIM. D	DIM. E	DIM. e	DIM. L	DIM. L2
T	20 .350 SQ	.073 .089	.063 .077	.022 .028	.342 .358	.342 .358	.050 BSC	.045 .055	.075 .095
U	28 .450 SQ	.074 .088	.064 .076	.022 .028	.442 .458	.442 .458	.050 BSC	.045 .055	.075 .095
V	44 .650 SQ	.073 .089	.063 .077	.022 .028	.643 .662	.643 .662	.050 BSC	.045 .055	.075 .095

* Solder dip finish for military parts conform to MIL-M-38510, Type A.

W TO-99 METAL CAN

X TO-100 METAL CAN



PKG. CODE	LEAD COUNT	DIM. A	DIM. ϕB	DIM. ϕD	DIM. e	DIM. F	DIM. K	DIM. K1	DIM. L	DIM. Q
W	8 TO-99	.165 .185	.016 .018	.345 .365	.190 .210	.020 .040	.028 .034	.028 .040	.505 .550	.015 .040
X	10 TO-100	.165 .185	.016 .018	.345 .365	.220 .240	.020 .040	.028 .034	.028 .040	.505 .550	.015 .040

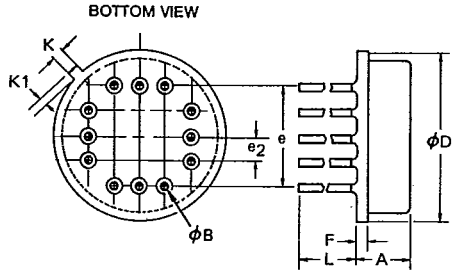
* Solder dip finish add +0.003 inches.

NOTE: Dimensions are Min/Max. Dimensions are in inches.

BSC means basic spacing between centerlines.

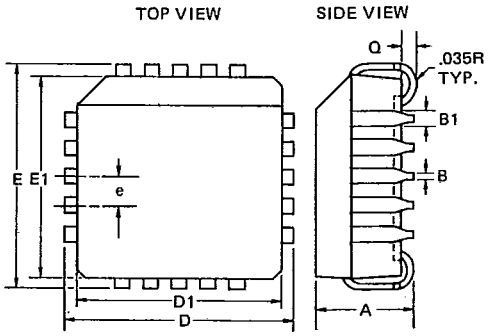
Package Configuration

Y TO-8 METAL CAN



PKG. CODE	LEAD COUNT	DIM. A	DIM. ϕB	DIM. ϕD	DIM. e	DIM. e2	DIM. F	DIM. K	DIM. K1	DIM. L
Y	12 TO-8	.130/.150	.016/.021	.585/.615	.400 BSC	.100 BSC	.020/.040	.027/.034	.027/.045	.500/.550

AA AB AC PLASTIC LEADED CHIP CARRIER



PKG. CODE	LEAD COUNT	DIM. A	DIM. B	DIM. B1	DIM. D/E	DIM. D1/E1	DIM. e	DIM. Q
AA	20	.165/.180	.013/.021	.026/.032	.385/.395	.350/.356	.050 BSC	.020/—
AB	28	.165/.180	.013/.021	.026/.032	.485/.495	.450/.456	.050 BSC	.020/—
AC	44	.165/.180	.013/.021	.026/.032	.685/.695	.650/.656	.050 BSC	.020/—

NOTE: Dimensions are Min/Max. Dimensions are in inches. BSC means basic spacing between centerlines.