HA-5002/883

Monolithic, Wideband, High Slew Rate, High Output Current Buffer

FN3705
Rev.4.00
January 5, 2006

The HA-5002/883 is a monolithic, wideband, high slew rate, high output current, buffer amplifier.

Utilizing the advantages of the Intersil Dielectric Isolation technologies, the HA-5002/883 current buffer offers 1300V/µs slew rate typically and 1000V/µs minimum with 110MHz of bandwidth. The ±100mA minimum output current capability is enhanced by a 3Ω output impedance.

The monolithic HA-5002/883 will replace the hybrid LH0002 with corresponding performance increases. These characteristics range from the 3MΩ (typ) input impedance to the increased output voltage swing. Monolithic design technologies have allowed a more precise buffer to be developed with more than an order of magnitude smaller gain error. The voltage gain is 0.98 guaranteed minimum with a 1kΩ load and 0.96 minimum with a 100Ω load.

The HA-5002/883 will provide many present hybrid users with a higher degree of reliability and at the same time increase overall circuit performance.

Ordering Information

PART NUMBER	PART MARKING	TEMP RANGE (°C)	PACKAGE
HA2-5002/883	HA2-5002/883	-55 to +125	8 Pin Can
HA4-5002/883	HA4-5002/883	-55 to +125	20 Ld Ceramic LCC

Features

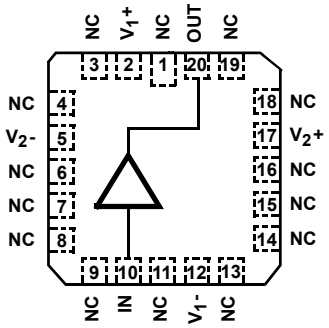
- This Circuit is Processed in Accordance to MIL-STD-883 and is Fully Conformant Under the Provisions of Paragraph 1.2.1.
- Voltage Gain (R_L = 1kΩ) . . . . . 0.98 (Min)
  0.995 (Typ)
  (R_L = 100Ω) . . . . . 0.96 (Min)
  0.971 (Typ)
- High Input Impedance . . . . . 1.5MΩ (Min)
  3MΩ (Typ)
- Low Output Impedance . . . . . 5Ω (Max)
  3Ω (Typ)
- Very High Slew Rate . . . . . 1000V/µs (Min)
  1300V/µs (Typ)
- Wide Small Signal Bandwidth . . . . . 110MHz (Typ)
- High Output Current . . . . . 100mA (Min)
- High Pulsed Output Current . . . . . 400mA (Max)
- Monolithic Dielectric Isolation Construction
- Replaces Hybrid LH0002

Applications

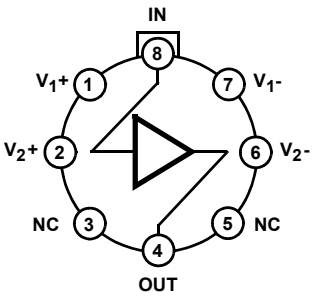
- Line Driver
- Data Acquisition
- 110MHz Buffer
- High Power Current Booster
- High Power Current Source
- Sample and Holds
- Radar Cable Driver
- Video Products

Pinouts

HA-5002/883 (CLCC)
TOP VIEW



HA-5002/883
(METAL CAN)
TOP VIEW



Absolute Maximum Ratings

Voltage Between V+ and V- Terminals 44V
Input Voltage . . . . . .Equal to Supplies
Peak Output Current (50ms On, 1s Off) . . . . . .±400mA
Junction Temperature (T_J) . . . . . .+175°C
Storage Temperature Range . . . . . .-65°C to +150°C
ESD Rating . . . . . .<4000V
Lead Temperature (Soldering 10s) . . . . . .+300°C

Operating Conditions

Operating Temperature Range . . . . . .-55°C to +125°C
Operating Supply Voltage . . . . . .±12V to ±15V
$R_L \geq 100\Omega$

Thermal Information

Thermal Resistance	θ_{JA} (°C/W)	θ_{JC} (°C/W)
Metal Can Package	160	70
Ceramic LCC Package	80	30

Package Power Dissipation Limit at +75°C for $T_J \leq +175°C$
Metal Can Package 625mW
Ceramic LCC Package 1.25W
Package Power Dissipation Derating Factor Above +75°C
Metal Can Package . . . . . .6.3mW/°C
Ceramic LCC Package . . . . . .12.5mW/°C

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

1. θ_{JA} is measured with the component mounted on a low effective thermal conductivity test board in free air. See Tech Brief TB379 for details.

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: V_{SUPPLY} = ±12V and ±15V, R_{SOURCE} = 50Ω, $C_{LOAD} \leq$ 10pF, V_{IN} = 0V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE (°C)	MIN	MAX	UNITS
Input Offset Voltage	V_{IO1}	V_{SUP} = ±15V	1	+25	-20	20	mV
			2, 3	+125, -55	-30	30	mV
	V_{IO2}	V_{SUP} = ±12V	1	+25	-20	20	mV
			2, 3	+125, -55	-30	30	mV
Input Bias Current	I_{B1}	V_{SUP} = ±15V, R_S = 1kΩ	1	+25	-7	7	µA
			2, 3	+125, -55	-10	10	µA
	I_{B2}	V_{SUP} = ±12V, R_S = 1kΩ	1	+25	-7	7	µA
			2, 3	+125, -55	-10	10	µA
Voltage Gain 1	$+AV_1$	V_{SUP} = ±12V, R_L = 1kΩ, V_{IN} = 10V	1	+25	0.98	-	V/V
			2, 3	+125, -55	0.98	-	V/V
	$-AV_1$	V_{SUP} = ±12V, R_L = 1kΩ, V_{IN} = -10V	1	+25	0.98	-	V/V
			2, 3	+125, -55	0.98	-	V/V
Voltage Gain 2	$+AV_2$	V_{SUP} = ±12V, R_L = 100Ω, V_{IN} = 10V	1	+25	0.96	-	V/V
	$-AV_2$	V_{SUP} = ±12V, R_L = 100Ω, V_{IN} = -10V	1	+25	0.96	-	V/V
Voltage Gain 3	$+AV_3$	V_{SUP} = ±15V, R_L = 100Ω, V_{IN} = 10V	1	+25	0.96	-	V/V
	$-AV_3$	V_{SUP} = ±15V, R_L = 100Ω, V_{IN} = -10V	1	+25	0.96	-	V/V
Voltage Gain 4	$+AV_4$	V_{SUP} = ±15V, R_L = 1kΩ, V_{IN} = +10V	1	+25	0.99	-	V/V
			2, 3	+125, -55	0.99	-	V/V
	$-AV_4$	V_{SUP} = ±15V, R_L = 1kΩ, V_{IN} = -10V	1	+25	0.99	-	V/V
			2, 3	+125, -55	0.99	-	V/V

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Tested at: V_{SUPPLY} = ±12V and ±15V, R_{SOURCE} = 50Ω, C_{LOAD} ≤ 10pF, V_{IN} = 0V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE (°C)	MIN	MAX	UNITS
Output Voltage Swing	$+V_{OUT1}$	V_{SUP} = ±15V, R_L = 100Ω, V_{IN} = +15V	1	+25	10	-	V
			2, 3	+125, -55	10	-	V
	$-V_{OUT1}$	V_{SUP} = ±15V, R_L = 100Ω, V_{IN} = -15V	1	+25	-	-10	V
			2, 3	+125, -55	-	-10	V
	$+V_{OUT2}$	V_{SUP} = ±15V, R_L = 1kΩ, V_{IN} = +15V	1	+25	10	-	V
			2, 3	+125, -55	10	-	V
	$-V_{OUT2}$	V_{SUP} = ±15V, R_L = 1kΩ, V_{IN} = -15V	1	+25	-	-10	V
			2, 3	+125, -55	-	-10	V
	$+V_{OUT3}$	V_{SUP} = ±12V, R_L = 1kΩ, V_{IN} = +12V	1	+25	10	-	V
			2, 3	+125, -55	10	-	V
	$-V_{OUT3}$	V_{SUP} = ±12V, R_L = 1kΩ, V_{IN} = -12V	1	+25	-	-10	V
			2, 3	+125, -55	-	-10	V
Output Current	$+I_{OUT1}$	V_{SUP} = ±15V, V_{OUT} = +10V	1	+25	100	-	mA
			2, 3	+125, -55	100	-	mA
	$-I_{OUT1}$	V_{SUP} = ±15V, V_{OUT} = -10V	1	+25	-	-100	mA
			2, 3	+125, -55	-	-100	mA
	$+I_{OUT2}$	V_{SUP} = ±12V, V_{OUT} = +10V	1	+25	100	-	mA
			2, 3	+125, -55	100	-	mA
	$-I_{OUT2}$	V_{SUP} = ±12V, V_{OUT} = -10V	1	+25	-	-100	mA
			2, 3	+125, -55	-	-100	mA
Power Supply Rejection Ratio	$+PSRR_1$	ΔV_{SUP} = ±5V, V+ = +20V, V- = -15V, V+ = +10V, V- = -15V	1	+25	54	-	dB
			2, 3	+125, -55	54	-	dB
	$-PSRR_1$	ΔV_{SUP} = ±5V, V+ = +15V, V- = -20V, V+ = +15V, V- = -10V	1	+25	54	-	dB
			2, 3	+125, -55	54	-	dB
	$+PSRR_2$	ΔV_{SUP} = ±5V, V+ = +17V, V- = -12V, V+ = +7V, V- = -12V	1	+25	54	-	dB
			2, 3	+125, -55	54	-	dB
	$-PSRR_2$	ΔV_{SUP} = ±5V, V+ = +12V, V- = -17V, V+ = +12V, V- = -7V	1	+25	54	-	dB
			2, 3	+125, -55	54	-	dB
Power Supply Current	$+ICC_1$	V_{SUP} = ±15V, V_{OUT} = 0V	1	+25	-	10	mA
			2, 3	+125, -55	-	10	mA
	$-ICC_1$	V_{SUP} = ±15V, V_{OUT} = 0V	1	+25	-10	-	mA
			2, 3	+125, -55	-10	-	mA
	$+ICC_2$	V_{SUP} = ±12V, V_{OUT} = 0V	1	+25	-	10	mA
			2, 3	+125, -55	-	10	mA
	$-ICC_2$	V_{SUP} = ±12V, V_{OUT} = 0V	1	+25	-10	-	mA
			2, 3	+125, -55	-10	-	mA

TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS

Table 2 Intentionally Left Blank. See AC Specifications in Table 3

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Characterized at: V_{SUPPLY} = ±15V or ±12V, R_{LOAD} = 1kΩ, C_{LOAD} ≤ 10pF, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE (°C)	MIN	MAX	UNITS
Input Resistance	R_{IN1}	V_{SUP} = ±15V	1	+25	1.5	-	MΩ
	R_{IN2}	V_{SUP} = ±12V	1	+25	1.5	-	MΩ
Slew Rate	$+SR_1$	V_{SUP} = ±15V, V_{OUT} = -5V to +5V	1	+25	1000	-	V/µs
				+125, -55	1000	-	V/µs
	$-SR_1$	V_{SUP} = ±15V, V_{OUT} = +5V to -5V	1	+25	1000	-	V/µs
				+125, -55	1000	-	V/µs
	$+SR_2$	V_{SUP} = ±12V, V_{OUT} = -5V to +5V	1	+25	1000	-	V/µs
				+125, -55	1000	-	V/µs
	$-SR_2$	V_{SUP} = ±12V, V_{OUT} = +5V to -5V	1	+25	1000	-	V/µs
				+125, -55	1000	-	V/µs
Rise and Fall Time	T_R	V_{SUP} = ±15V or ±12V, V_{OUT} = 0 to +500mV	1, 2	+25	-	10	ns
			1, 2	+125, -55	-	10	ns
	T_F	V_{SUP} = ±15V or ±12V, V_{OUT} = 0 to -500mV	1, 2	+25	-	10	ns
			1, 2	+125, -55	-	10	ns
Overshoot	+OS	V_{SUP} = ±12V or ±15V, V_{OUT} = 0 to +500mV	1	+25	-	30	%
				+125, -55	-	30	%
	-OS	V_{SUP} = ±12V or ±15V, V_{OUT} = 0 to -500mV	1	+25	-	30	%
				+125, -55	-	30	%
Quiescent Power Consumption	PC_1	V_{SUP} = ±15V, V_{IN} = 0V, I_{OUT} = 0mA	1, 3	+25	-	300	mW
				+125, -55	-	300	mW
	PC_2	V_{SUP} = ±12V, V_{IN} = 0V, I_{OUT} = 0mA	1, 3	+25	-	240	mW
				+125, -55	-	240	mW
Output Resistance	R_{OUT1}	V_{SUP} = ±12V	1	+25	-	5	Ω
	R_{OUT2}	V_{SUP} = ±12V	1	+25	-	5	Ω

NOTES:

1. Parameters listed in Table 3 are controlled via design or process parameters and are not directly tested at final production. These parameters are lab characterized upon initial design release, or upon design changes. These parameters are guaranteed by characterization based upon data from multiple production runs which reflect lot to lot and within lot variation.
2. Measured between 10% and 90% points.
3. Quiescent Power Consumption based upon Quiescent Supply Current test maximum. (No load on outputs.)

TABLE 4. ELECTRICAL TEST REQUIREMENTS

MIL-STD-883 TEST REQUIREMENTS	SUBGROUPS (SEE TABLE 1)
Interim Electrical Parameters (Pre Burn-In)	1
Final Electrical Test Parameters	1 (Note 1), 2, 3
Group A Test Requirements	1, 2, 3
Groups C and D Endpoints	1

NOTE:

1. PDA applies to Subgroup 1 only.

Die Characteristics

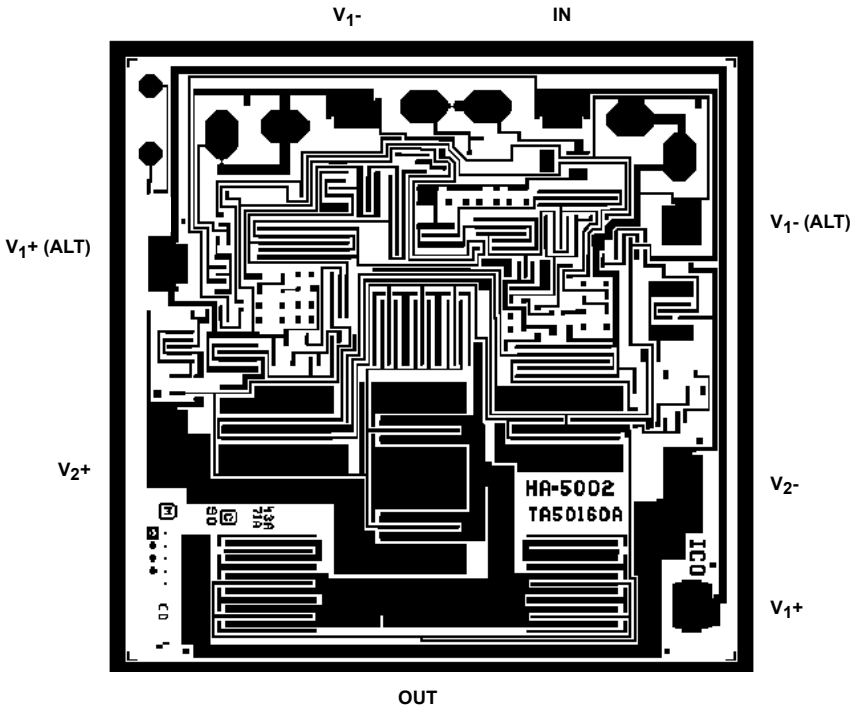
SUBSTRATE POTENTIAL (POWERED UP): V1-

TRANSISTOR COUNT: 27

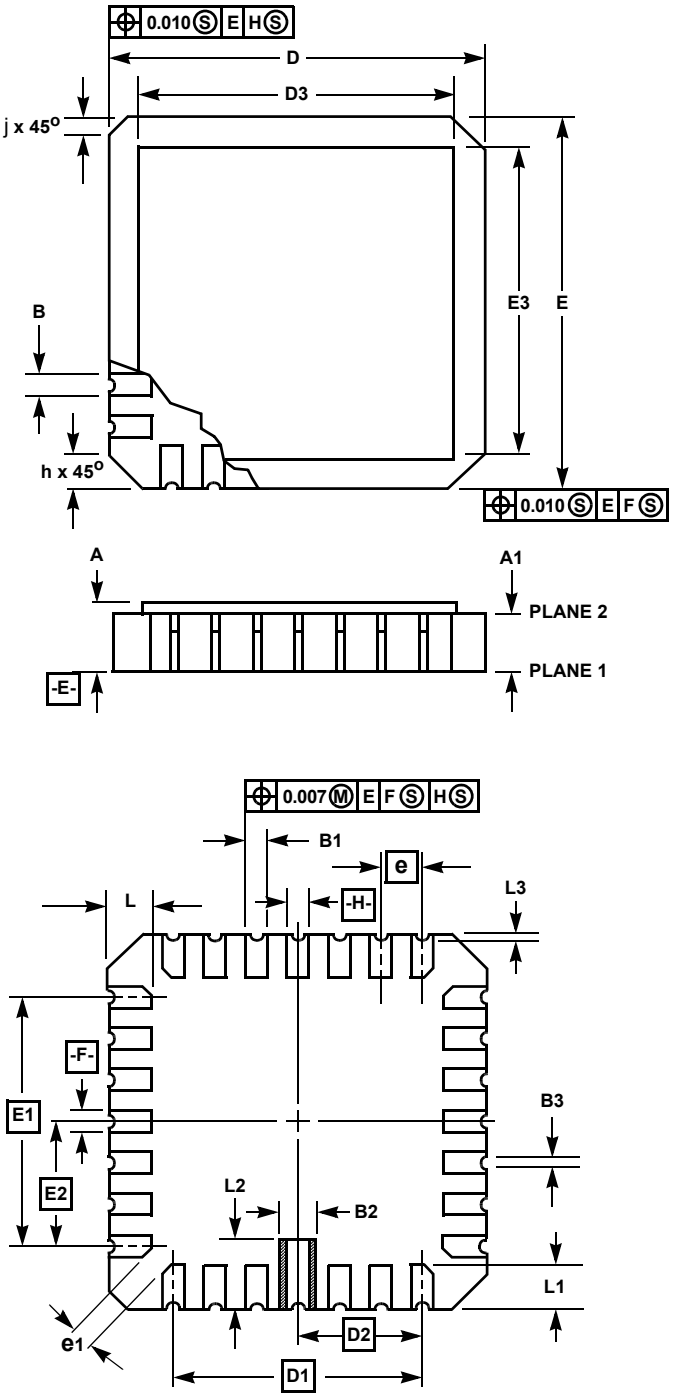
PROCESS: Bipolar Dielectric Isolation

Metallization Mask Layout

HA-5002/883



Ceramic Leadless Chip Carrier Packages (CLCC)



J20.A **MIL-STD-1835 CQCC1-N20 (C-2)**
20 PAD CERAMIC LEADLESS CHIP CARRIER PACKAGE

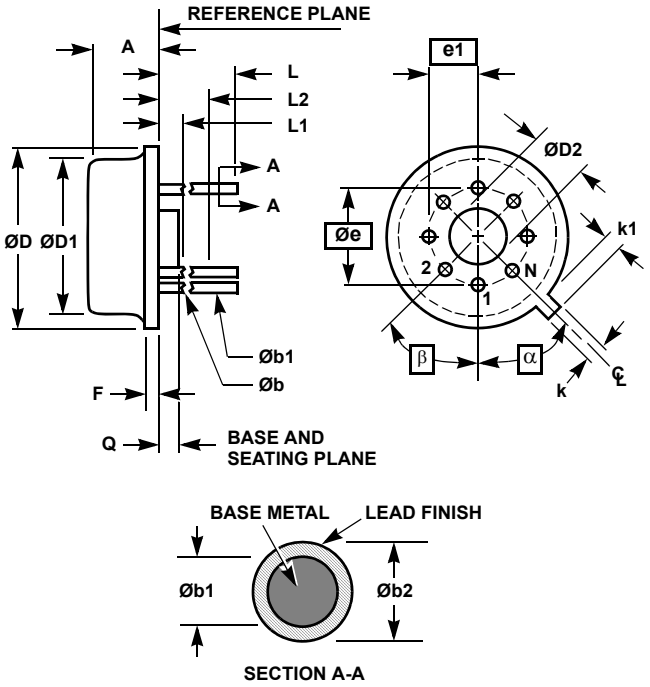
SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.060	0.100	1.52	2.54	6, 7
A1	0.050	0.088	1.27	2.23	-
B	-	-	-	-	-
B1	0.022	0.028	0.56	0.71	2, 4
B2	0.072 REF		1.83 REF		-
B3	0.006	0.022	0.15	0.56	-
D	0.342	0.358	8.69	9.09	-
D1	0.200 BSC		5.08 BSC		-
D2	0.100 BSC		2.54 BSC		-
D3	-	0.358	-	9.09	2
E	0.342	0.358	8.69	9.09	-
E1	0.200 BSC		5.08 BSC		-
E2	0.100 BSC		2.54 BSC		-
E3	-	0.358	-	9.09	2
e	0.050 BSC		1.27 BSC		-
e1	0.015	-	0.38	-	2
h	0.040 REF		1.02 REF		5
j	0.020 REF		0.51 REF		5
L	0.045	0.055	1.14	1.40	-
L1	0.045	0.055	1.14	1.40	-
L2	0.075	0.095	1.91	2.41	-
L3	0.003	0.015	0.08	0.38	-
ND	5		5		3
NE	5		5		3
N	20		20		3

Rev. 0 5/18/94

NOTES:

1. Metallized castellations shall be connected to plane 1 terminals and extend toward plane 2 across at least two layers of ceramic or completely across all of the ceramic layers to make electrical connection with the optional plane 2 terminals.
2. Unless otherwise specified, a minimum clearance of 0.015 inch (0.38mm) shall be maintained between all metallized features (e.g., lid, castellations, terminals, thermal pads, etc.)
3. Symbol “N” is the maximum number of terminals. Symbols “ND” and “NE” are the number of terminals along the sides of length “D” and “E”, respectively.
4. The required plane 1 terminals and optional plane 2 terminals (if used) shall be electrically connected.
5. The corner shape (square, notch, radius, etc.) may vary at the manufacturer’s option, from that shown on the drawing.
6. Chip carriers shall be constructed of a minimum of two ceramic layers.
7. Dimension “A” controls the overall package thickness. The maximum “A” dimension is package height before being solder dipped.
8. Dimensioning and tolerancing per ANSI Y14.5M-1982.
9. Controlling dimension: INCH.

Metal Can Packages (Can)



T8.C MIL-STD-1835 MACY1-X8 (A1)
8 LEAD METAL CAN PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.165	0.185	4.19	4.70	-
Øb	0.016	0.019	0.41	0.48	1
Øb1	0.016	0.021	0.41	0.53	1
Øb2	0.016	0.024	0.41	0.61	-
ØD	0.335	0.375	8.51	9.40	-
ØD1	0.305	0.335	7.75	8.51	-
ØD2	0.110	0.160	2.79	4.06	-
e	0.200 BSC		5.08 BSC		-
e1	0.100 BSC		2.54 BSC		-
F	-	0.040	-	1.02	-
k	0.027	0.034	0.69	0.86	-
k1	0.027	0.045	0.69	1.14	2
L	0.500	0.750	12.70	19.05	1
L1	-	0.050	-	1.27	1
L2	0.250	-	6.35	-	1
Q	0.010	0.045	0.25	1.14	-
α	45^o BSC		45^o BSC		3
β	45^o BSC		45^o BSC		3
N	8		8		4

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NOTES:

1. (All leads) Øb applies between L1 and L2. Øb1 applies between L2 and 0.500 from the reference plane. Diameter is uncontrolled in L1 and beyond 0.500 from the reference plane.
2. Measured from maximum diameter of the product.
3. α is the basic spacing from the centerline of the tab to terminal 1 and β is the basic spacing of each lead or lead position (N -1 places) from α, looking at the bottom of the package.
4. N is the maximum number of terminal positions.
5. Dimensioning and tolerancing per ANSI Y14.5M - 1982.
6. Controlling dimension: INCH.

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