HA-2640, HA-2645

4MHz, High Supply Voltage Operational Amplifiers

FN2904
Rev 6.00
August 7, 2015

HA-2640 and HA-2645 are monolithic operational amplifiers which are designed to deliver unprecedented dynamic specifications for a high voltage internally compensated device. These dielectrically isolated devices offer very low values for offset voltage and offset current coupled with large output voltage swing and common mode input voltage.

For maximum reliability, these amplifiers offer unconditional output overload protection through current limiting and a chip temperature sensing circuit. This sensing device turns the amplifier “off”, when the chip reaches a certain temperature level.

These amplifiers deliver ±35V common mode input voltage range, ±35V output voltage swing, and up to ±40V supply range for use in such designs as regulators, power supplies, and industrial control systems. 4MHz gain bandwidth and 5V/µs slew rate make these devices excellent components for high performance signal conditioning applications. Outstanding input and output voltage swings coupled with a low 5nA offset current make these amplifiers excitation designs.

Features

- Output Voltage Swing . . . . ±35V
- Supply Voltage. . . . . ±10V to ±40V
- Offset Current. 5nA
- Bandwidth 4MHz
- Slew Rate. 5V/µs
- Common Mode Input Voltage Range. . . . . ±35V
- Output Overload Protection

Applications

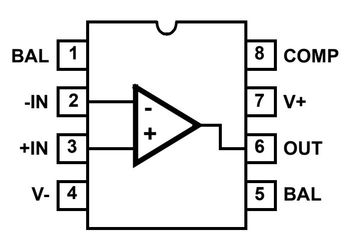
- Industrial Control Systems
- Power Supplies
- High Voltage Regulators
- Resolver Excitation
- Signal Conditioning

Ordering Information

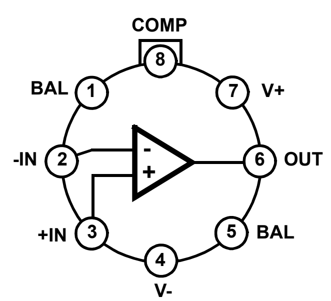
PART NUMBER	PART MARKING	TEMP. RANGE (^{o}C)	PACKAGE	PKG. DWG. #
HA2-2640-2	HA2-2640-2	-55 to 125	8 Pin Metal Can	T8.C
HA7-2640-2	HA7-2640-2	-55 to 125	8 Ld CERDIP	F8.3A
HA2-2645-5 (No longer available or supported)	HA2-2645-5	0 to 75	8 Pin Metal Can	T8.C
HA7-2645-5 (No longer available or supported)	HA7-2645-5	0 to 75	8 Ld CERDIP	F8.3A

Pinouts

HA-2640/2645
(CERDIP)
TOP VIEW



HA-2640/2645
(METAL CAN)
TOP VIEW



(TO-99 CASE VOLTAGE = FLOATING)

Absolute Maximum Ratings

Voltage Between V+ and V- Terminals 100V
Differential Input Voltage Range 37V
Output Current . . . . Full Short Circuit Protection

Operating Conditions

Temperature Range
HA-2640-2 . . . . -55°C to 125°C
HA-2645-5 . . . . 0°C to 75°C

Thermal Information

Thermal Resistance (Typical, Note 1)	θ_{JA} (°C/W)	θ_{JC} (°C/W)
CERDIP Package.	135	50
Metal Can Package	165	80

Maximum Junction Temperature . . . . .175°C
Maximum Storage Temperature Range . . . . -65°C to 150°C
Maximum Lead Temperature (Soldering 10s) . . . . 300°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 an evaluation PC board in free air.

Electrical Specifications

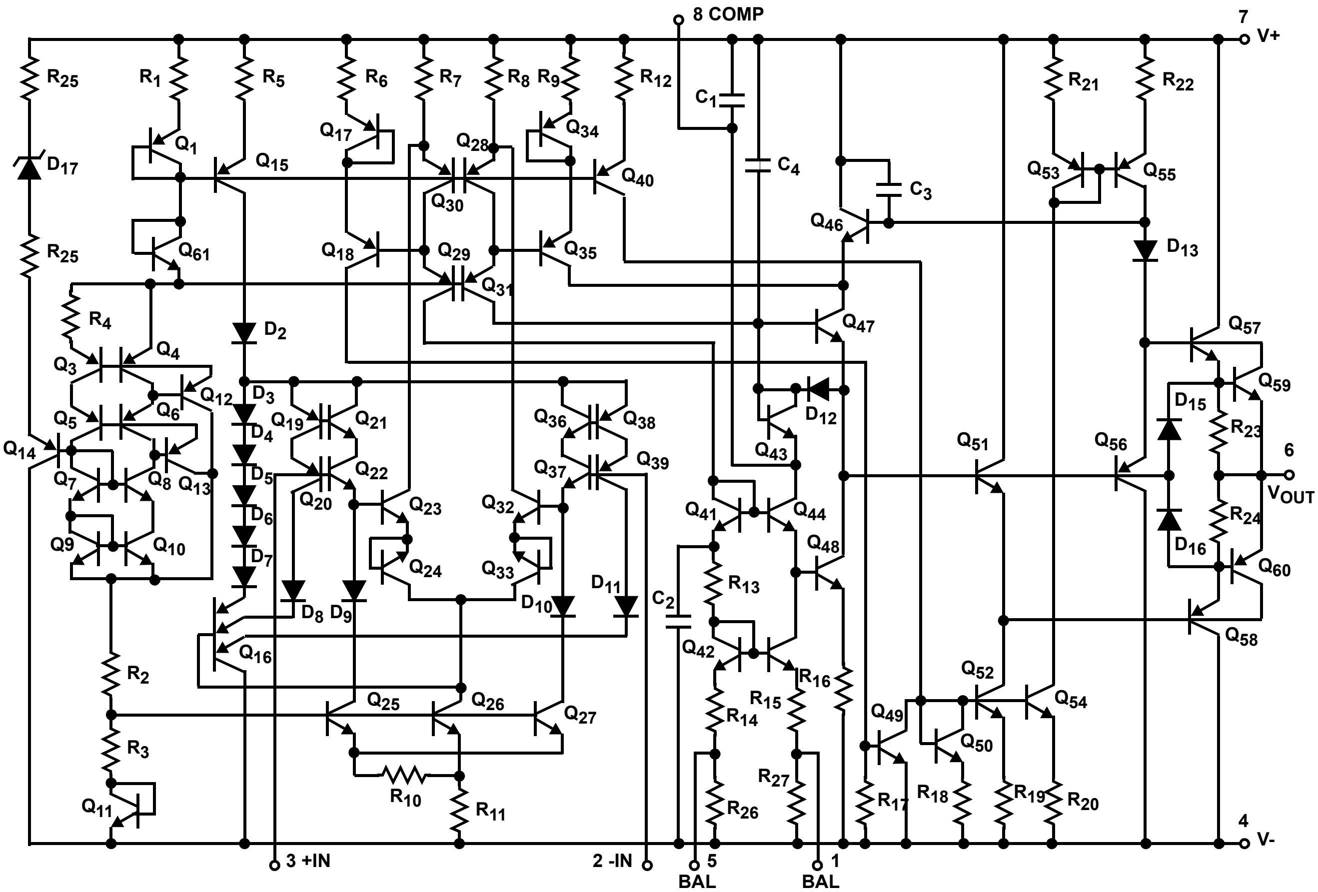
V_{SUPPLY} = ±40V, R_L = 5kΩ, Unless Otherwise Specified

PARAMETER	TEST CONDITIONS	TEMP (°C)	HA-2640-2 MIN	HA-2640-2 TYP	HA-2640-2 MAX	HA-2645-5 MIN	HA-2645-5 TYP	HA-2645-5 MAX	UNITS
INPUT CHARACTERISTICS									
Offset Voltage		25	-	2	4	-	2	6	mV
		Full		-	6	-	-	7	mV
Average Offset Voltage Drift		Full	-	15	-	-	15	-	µV/°C
Bias Current		25	-	10	25	-	12	30	nA
		Full	-	-	50	-	-	50	nA
Offset Current		25	-	5	12	-	15	30	nA
		Full	-	-	35	-	-	50	nA
Input Resistance (Note 2)		25	50	250	-	40	200	-	MΩ
Common Mode Range		Full	±35	-	-	±35	-	-	V
TRANSFER CHARACTERISTICS									
Large Signal Voltage Gain	V_{OUT} = ±30V	25	100	200	-	100	200	-	kV/V
		Full	75	-	-	75	-	-	kV/V
Common Mode Rejection Ratio	V_{CM} = ±20V	Full	80	100	-	74	100	-	dB
Minimum Stable Gain		25	1	-	-	1	-	-	V/V
Unity Gain Bandwidth	V_{OUT} = 90mV	25	-	4	-	-	4	-	MHz
OUTPUT CHARACTERISTICS									
Output Voltage Swing		Full	±35	-	-	±35	-	-	V
Output Current	R_L = 1kΩ	25	±12	±15	-	±10	±12	-	mA
Output Resistance	Open Loop	25	-	500	-	-	500	-	Ω
Full Power Bandwidth (Note 3)	V_{OUT} = ±35V	25	-	23	-	-	23	-	kHz
TRANSIENT RESPONSE A_V = +1, C_L = 50pF, R_L = 5kΩ									
Rise Time	V_{OUT} = ±200mV	25	-	60	135	-	60	135	ns
Overshoot	V_{OUT} = ±200mV	25	-	15	30		15	40	%
Slew Rate		25	±3	±5	-	±2.5	±5	-	V/µs
POWER SUPPLY CHARACTERISTICS									
Supply Current		25	-	3.2	3.8	-	3.2	4.5	mA
Supply Voltage Range		Full	±10	-	±40	±10	-	±40	V
Power Supply Rejection Ratio	V_S = ±10V to ±40V	Full	80	90	-	74	90	-	dB

NOTES:

2. This parameter is based upon design calculations.
3. Full Power Bandwidth guaranteed based upon slew rate measurement: FPBW = S.R./$2\pi V_{PEAK}$; V_{PEAK} = 35V.

Schematic Diagram



Test Circuits and Waveform

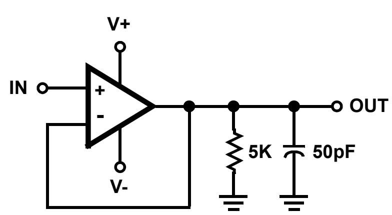
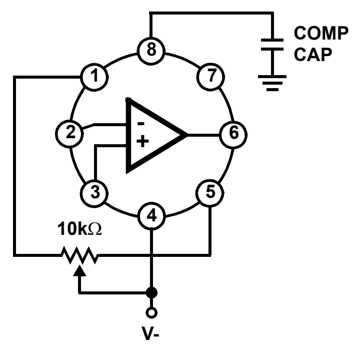


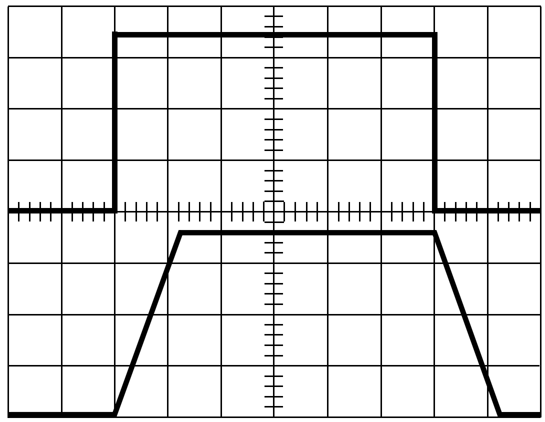
FIGURE 1. SLEW RATE AND TRANSIENT RESPONSE TEST CIRCUIT



NOTE: Tested offset adjustment range is $|V_{OS} + 1mV|$ minimum referred to output. Typical range is ±20mV with $R_T = 10k\Omega$.

FIGURE 2. SUGGESTED V_{OS} ADJUSTMENT AND COMPENSATION HOOK UP

Test Circuits and Waveform (Continued)



Vertical = 10V/Div., Horizontal = 5µs/Div.

NOTE: $R_L = 5k\Omega$, $C_L = 50pF$, $T_A = 25^oC$, $V_S = \pm40V$

FIGURE 3. VOLTAGE FOLLOWER PULSE RESPONSE

Typical Performance Curves $V_S = \pm40V$, $T_A = 25^oC$, Unless Otherwise Specified

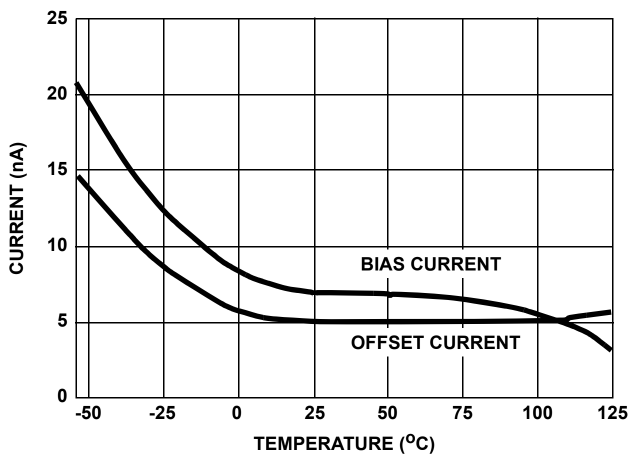


FIGURE 4. INPUT BIAS AND OFFSET CURRENT vs TEMPERATURE

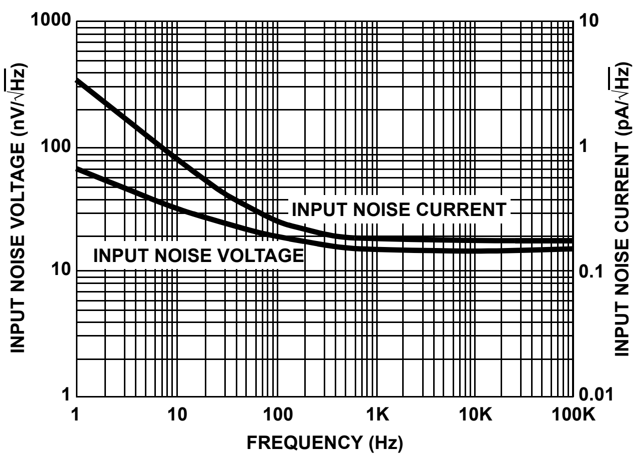


FIGURE 5. INPUT NOISE CHARACTERISTICS

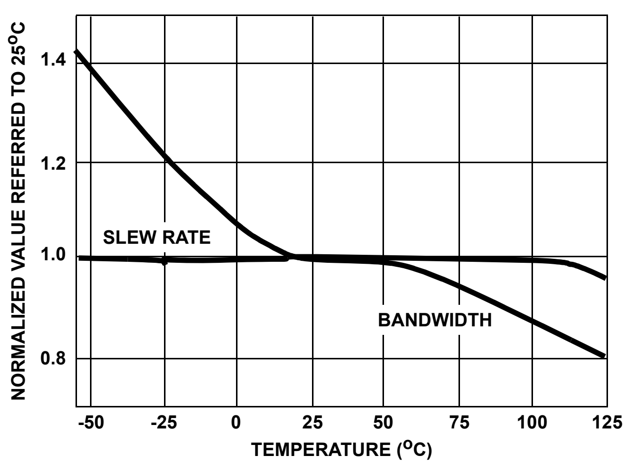


FIGURE 6. NORMALIZED AC PARAMETERS vs TEMPERATURE

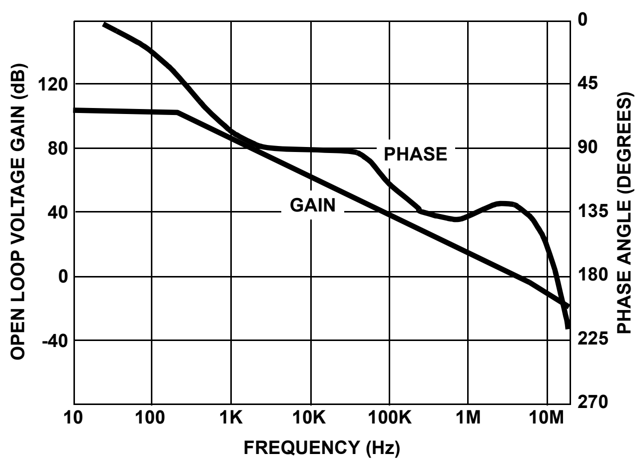


FIGURE 7. OPEN LOOP FREQUENCY RESPONSE

Typical Performance Curves $V_S = \pm 40V$, $T_A = 25^oC$, Unless Otherwise Specified **(Continued)**

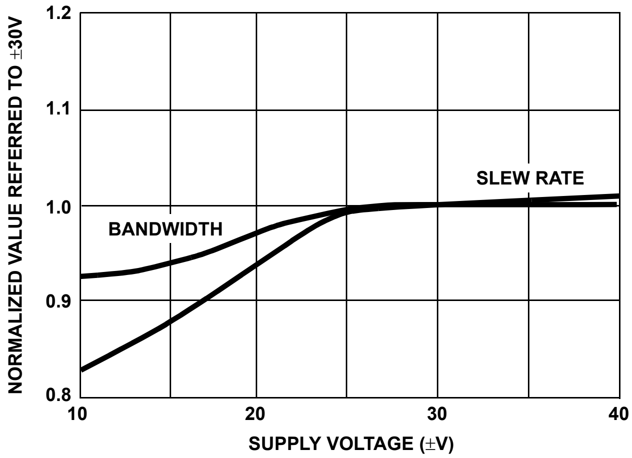


FIGURE 8. NORMALIZED AC PARAMETERS vs SUPPLY VOLTAGE AT 25°C

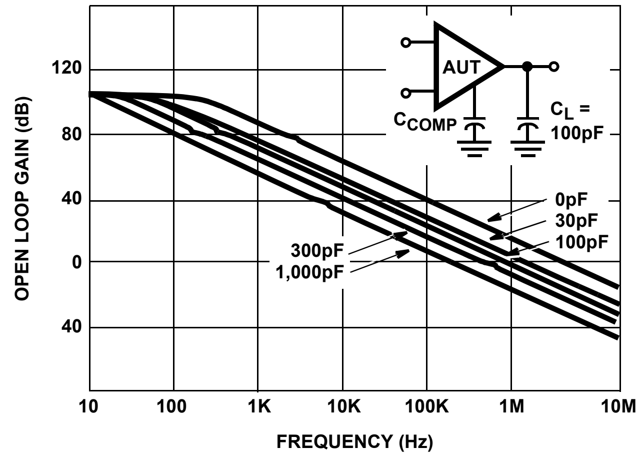


FIGURE 9. OPEN LOOP FREQUENCY RESPONSE FOR VARIOUS VALUES OF CAPACITORS FROM COMPENSATION PIN TO GROUND

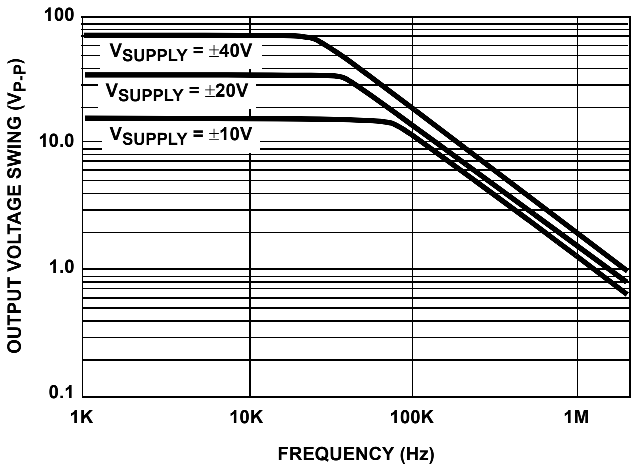


FIGURE 10. OUTPUT VOLTAGE SWING vs FREQUENCY

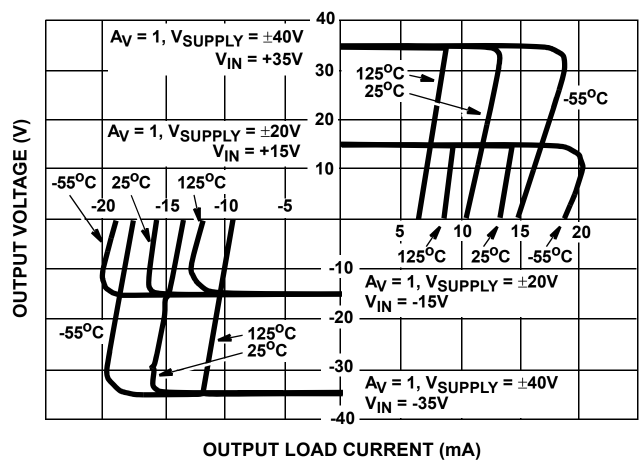


FIGURE 11. OUTPUT CURRENT CHARACTERISTIC

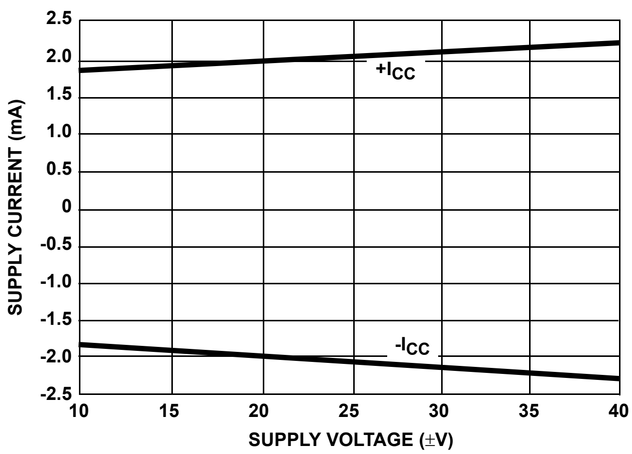


FIGURE 12. SUPPLY CURRENT vs SUPPLY VOLTAGE

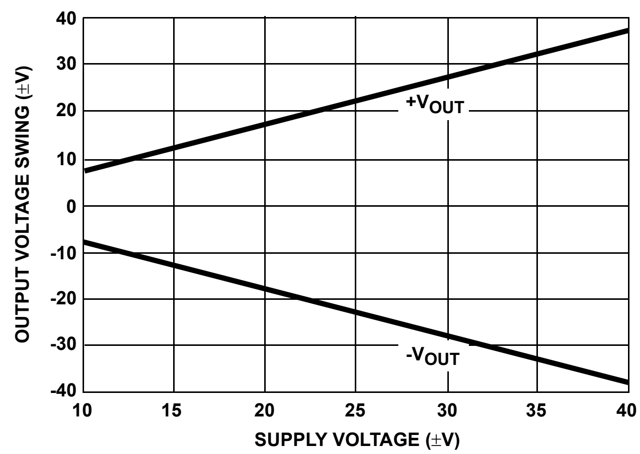


FIGURE 13. OUTPUT VOLTAGE SWING vs SUPPLY VOLTAGE

Die Characteristics

SUBSTRATE POTENTIAL (Powered Up):

Unbiased

TRANSISTOR COUNT:

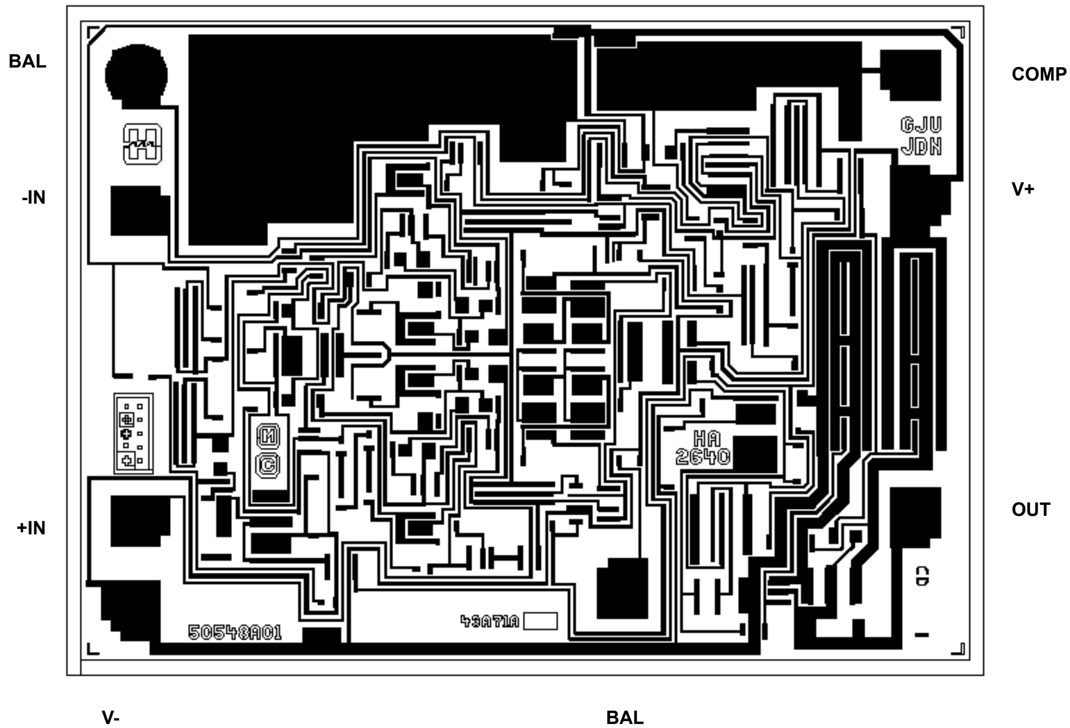
76

PROCESS:

HV200 Bipolar Dielectric Isolation

Metallization Mask Layout

HA-2640, HA-2645



Revision History

The revision history provided is for informational purposes only and is believed to be accurate, but not warranted. Please go to the web to make sure that you have the latest revision.

DATE	REVISION	CHANGE
August 7, 2015	FN2904.6	Page 1, Ordering Information table: HA2-2645-5 and HA7-2645-5 no longer available or supported. Added Revision History and About Intersil.

About Intersil

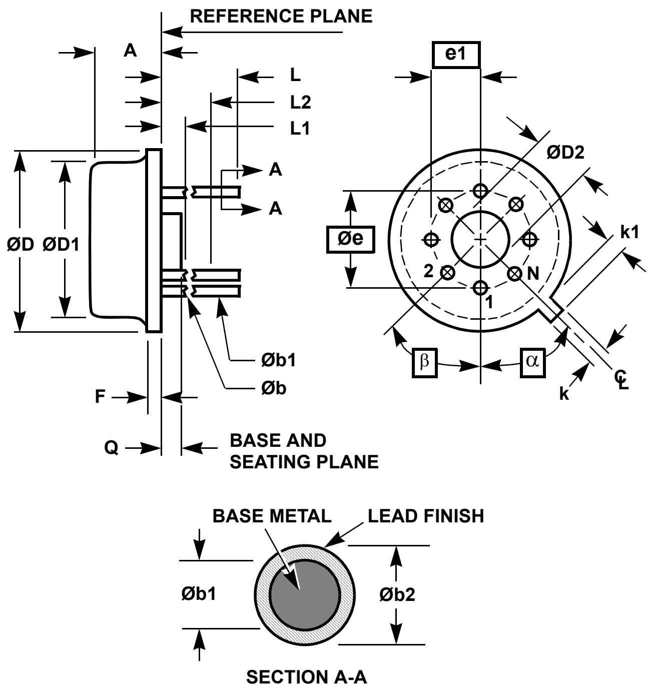
Intersil Corporation is a leading provider of innovative power management and precision analog solutions. The company's products address some of the largest markets within the industrial and infrastructure, mobile computing and high-end consumer markets.

For the most updated datasheet, application notes, related documentation and related parts, please see the respective product information page found at www.intersil.com.

You may report errors or suggestions for improving this datasheet by visiting www.intersil.com/ask.

Reliability reports are also available from our website at www.intersil.com/support

Metal Can Packages (Can)



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

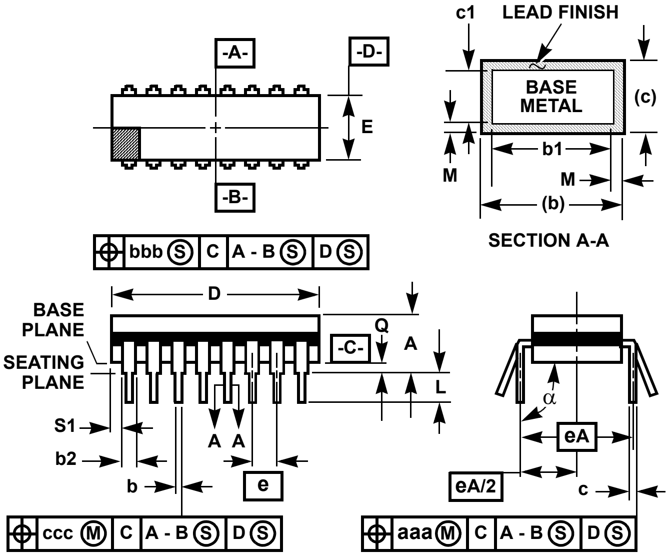
SYMBOL	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX	NOTES
A	0.165	0.185	4.19	4.70	-
Øb	0.016	0.019	0.41	0.48	1
Øb1	0.016	0.021	0.41	0.53	1
Øb2	0.016	0.024	0.41	0.61	-
ØD	0.335	0.375	8.51	9.40	-
ØD1	0.305	0.335	7.75	8.51	-
ØD2	0.110	0.160	2.79	4.06	-
e	0.200 BSC		5.08 BSC		-
e1	0.100 BSC		2.54 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

Rev. 0 5/18/94

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.

Ceramic Dual-In-Line Frit Seal Packages (CERDIP)



F8.3A MIL-STD-1835 GDIP1-T8 (D-4, CONFIGURATION A)
8 LEAD CERAMIC DUAL-IN-LINE FRIT SEAL PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	-	0.200	-	5.08	-
b	0.014	0.026	0.36	0.66	2
b1	0.014	0.023	0.36	0.58	3
b2	0.045	0.065	1.14	1.65	-
b3	0.023	0.045	0.58	1.14	4
c	0.008	0.018	0.20	0.46	2
c1	0.008	0.015	0.20	0.38	3
D	-	0.405	-	10.29	5
E	0.220	0.310	5.59	7.87	5
e	0.100 BSC		2.54 BSC		-
eA	0.300 BSC		7.62 BSC		-
eA/2	0.150 BSC		3.81 BSC		-
L	0.125	0.200	3.18	5.08	-
Q	0.015	0.060	0.38	1.52	6
S1	0.005	-	0.13	-	7
α	90^o	105^o	90^o	105^o	-
aaa	-	0.015	-	0.38	-
bbb	-	0.030	-	0.76	-
ccc	-	0.010	-	0.25	-
M	-	0.0015	-	0.038	2, 3
N	8		8		8

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NOTES:

1. Index area: A notch or a pin one identification mark shall be located adjacent to pin one and shall be located within the shaded area shown. The manufacturer's identification shall not be used as a pin one identification mark.
2. The maximum limits of lead dimensions b and c or M shall be measured at the centroid of the finished lead surfaces, when solder dip or tin plate lead finish is applied.
3. Dimensions b1 and c1 apply to lead base metal only. Dimension M applies to lead plating and finish thickness.
4. Corner leads (1, N, N/2, and N/2+1) may be configured with a partial lead paddle. For this configuration dimension b3 replaces dimension b2.
5. This dimension allows for off-center lid, meniscus, and glass overrun.
6. Dimension Q shall be measured from the seating plane to the base plane.
7. Measure dimension S1 at all four corners.
8. N is the maximum number of terminal positions.
9. Dimensioning and tolerancing per ANSI Y14.5M - 1982.
10. Controlling dimension: INCH