HI-200, HI-201

August 1996

Dual/Quad SPST CMOS Analog Switches

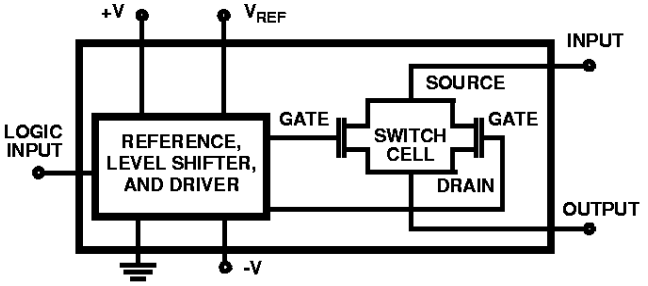
Features

- Analog Voltage Range . . . . . ±15V
- Analog Current Range. 80mA
- Turn-On Time 240ns
- Low R_{ON} 55Ω
- Low Power Dissipation 15mW
- TTL/CMOS Compatible

Applications

- High Frequency Analog Switching
- Sample and Hold Circuits
- Digital Filters
- Operational Amplifier Gain Switching Networks

Functional Diagram



Description

HI-200/HI-201 are monolithic devices comprising independently selectable SPST switches which feature fast switching speeds (HI-200 240ns, and HI-201 185ns) combined with low power dissipation (15mW at +25°C). Each switch provides low "ON" resistance operation for input signal voltage up to the supply rails and for signal current up to 80mA. Rugged DI construction eliminates latch-up and substrate SCR failure modes.

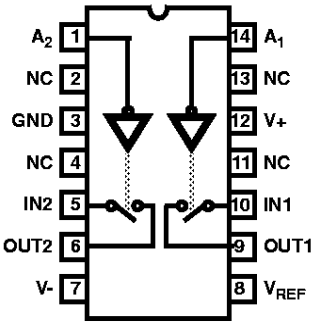
All devices provide break-before-make switching and are TTL and CMOS compatible for maximum application versatility. HI-200/HI-201 are ideal components for use in high frequency analog switching. Typical applications include signal path switching, sample and hold circuit, digital filters, and operational amplifier gain switching networks.

HI-200 is a dual SPST CMOS analog switch available in DIP and (TO-99) metal cans and is pin compatible with other available "200 series" switches. For MIL-STD-883 compliant parts, request the HI-200/883 data sheet.

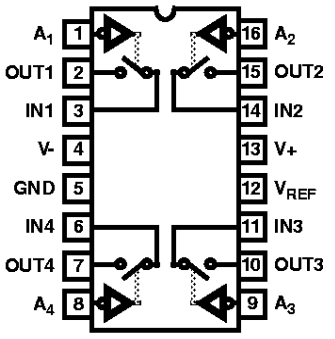
HI-201 is a quad SPST CMOS analog switch available in DIP and SOIC package and pin compatible with other available "200 series" switches. For MIL-STD-883 compliant parts, request the HI-201/883 datasheet.

Pinouts

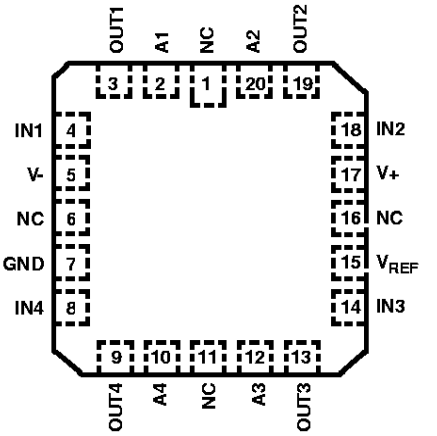
HI-200 (CERDIP, PDIP, SOIC)
TOP VIEW



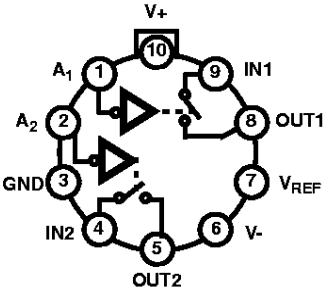
HI-201 (CERDIP, PDIP, SOIC)
TOP VIEW



HI-201 (PLCC, CLCC)
TOP VIEW



HI-200 (METAL CAN)
TOP VIEW



CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper IC Handling Procedures.

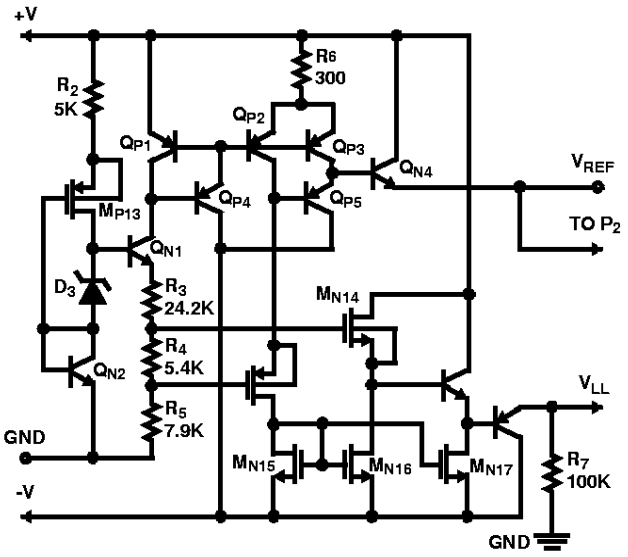
File Number **3121.1**

Ordering Information

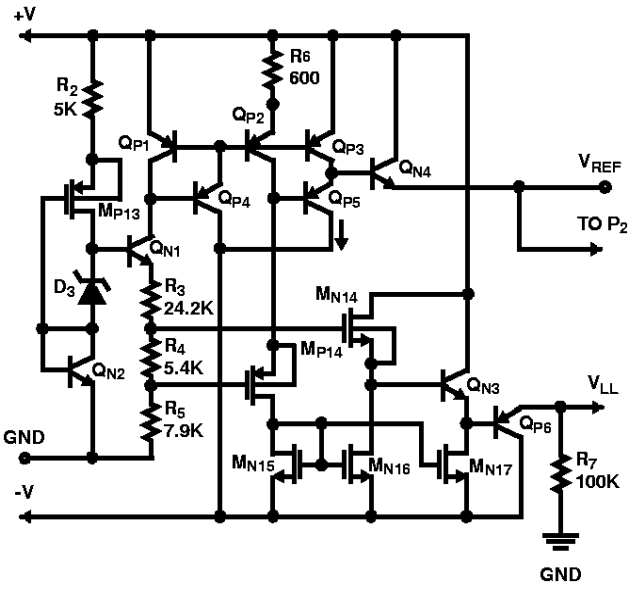
PART NUMBER	TEMPERATURE RANGE	PACKAGE	PKG. NO.
HI2-0200-5	0°C to +75°C	10 Pin Metal Can	T10.B
HI1-0200-5	0°C to +75°C	14 Lead CERDIP	F14.3
HI2-0200-4	-25°C to +85°C	10 Pin Metal Can	T10.B
HI3-0200-5	0°C to +75°C	14 Lead PDIP	E14.3
HI2-0200-7	0°C to +75°C +96 Hr. Burn-In	10 Pin Metal Can	T10.B
HI1-0200-7	0°C to +75°C +96 Hr. Burn-In	14 Lead CERDIP	F14.3
HI1-0200-2	-55°C to +125°C	14 Lead CERDIP	F14.3
HI1-0200-4	-25°C to +85°C	14 Lead CERDIP	F14.3
HI2-0200-2	-55°C to +125°C	10 Pin Metal Can	T10.B
HI9P0200-5	0°C to +75°C	14 Lead Plastic SOIC	M14.15
HI9P0200-9	-40°C to +85°C	14 Lead Plastic SOIC	M14.15
HI1-0200/883	-55°C to +125°C	14 Lead CERDIP	F14.3
HI2-0200/883	-55°C to +125°C	10 Pin Metal Can	T10.B
HI1-0201-7	0°C to +75°C +96 Hr. Burn-In	16 Lead CERDIP	F16.3
HI1-0201-5	0°C to +75°C	16 Lead CERDIP	F16.3
HI1-0201-4	-25°C to +85°C	16 Lead CERDIP	F16.3
HI4P0201-5	0°C to +75°C	20 Lead PLCC	N20.35
HI9P0201-5	0°C to +75°C	16 Lead Plastic SOIC (N)	M16.15
HI9P0201-9	-40°C to +85°C	16 Lead Plastic SOIC (N)	M16.15
HI1-0201-2	-55°C to +125°C	16 Lead CERDIP	F16.3
HI3-0201-5	0°C to +75°C	16 Lead PDIP	E16.3
HI1-0201/883	-55°C to +125°C	16 Lead CERDIP	F16.3
HI4-0201/883	-55°C to +125°C	20 Lead CLCC	J20.A

Schematic Diagrams

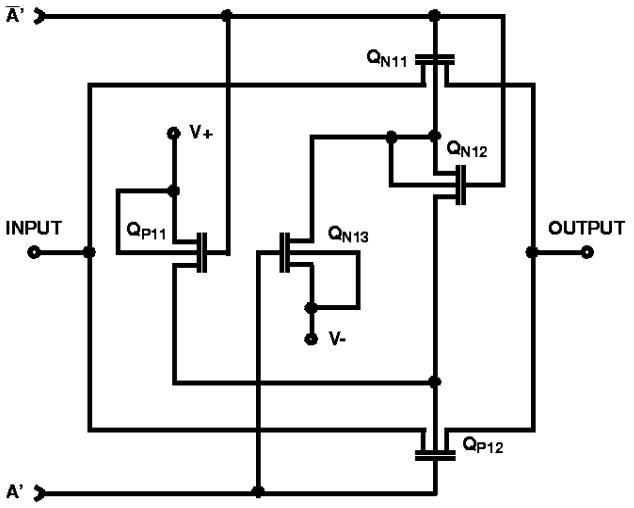
TTL/CMOS REFERENCE CIRCUIT V_{REF} CELL
HI-200



TTL/CMOS REFERENCE CIRCUIT V_{REF} CELL
HI-201

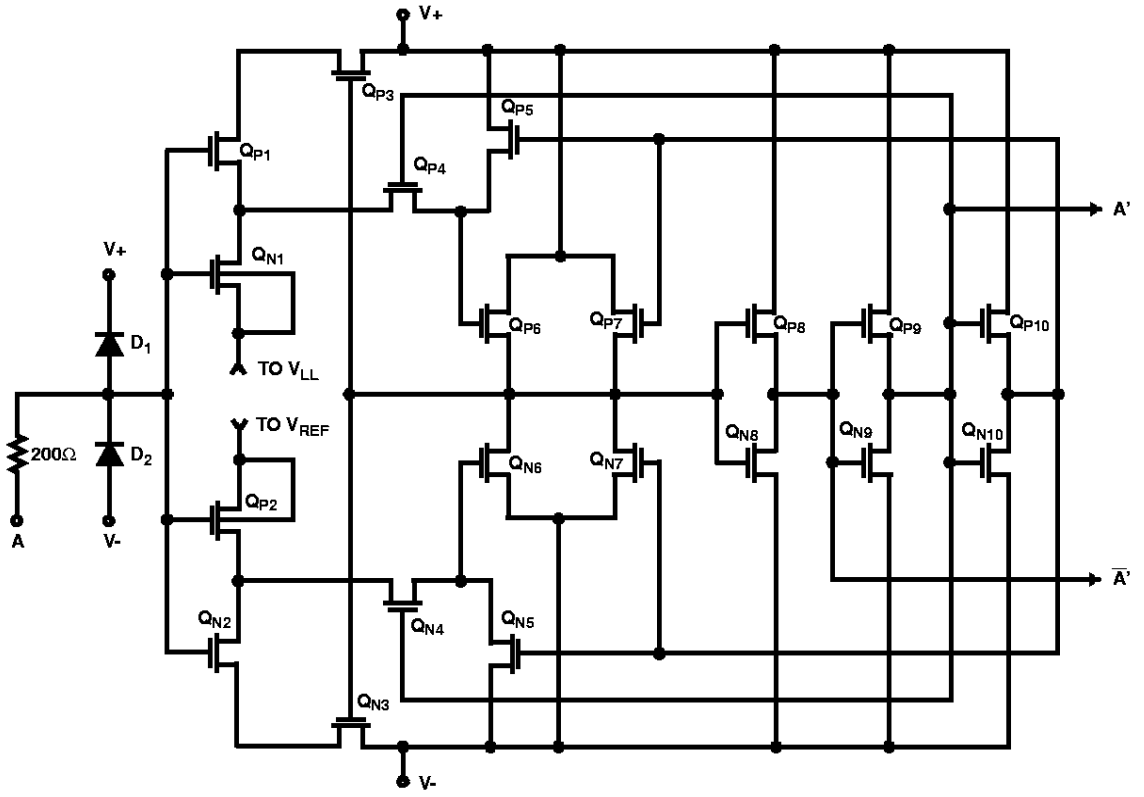


SWITCH CELL



Schematic Diagrams (Continued)

DIGITAL INPUT BUFFER AND LEVEL SHIFTER



Absolute Maximum Ratings

Supply Voltage . . . . . .44V (±22)
V_{REF} to Ground . . . . . .20V, -5V
Digital Input Voltage . . . . . $+V_{SUPPLY}$ 4V
$-V_{SUPPLY}$ -4V
Analog Input Voltage (One Switch) . . . . . $+V_{SUPPLY}$ 2.0V
$-V_{SUPPLY}$ -2.0V

Operating Temperature Range

HI-200-2, HI-201-2 . . . . . -55°C to 125°C
HI-200-4, HI-201-4 . . . . . -25°C to 85°C
HI-200-5, HI-201-5 . . . . . 0°C to 75°C
HI200-9, HI201-9 . . . . . -40°C to 85°C

Thermal Information

Thermal Resistance (Typical, Note 1)	θ_{JA} (°C/W)	θ_{JC} (°C/W)
CERDIP Package (/883 Versions)	80	24
CERDIP Package (Non /883 Versions)	95	40
Plastic LCC Package	80	-
Plastic DIP Package	100	-
Plastic SOP Package (14 Lead)	120	-
Plastic SOP Package (16 Lead)	100	-
Metal Can Package	160	75
Ceramic LCC Package	65	13

Maximum Storage Temperature . . . . . -65°C to 150°C
Maximum Junction Temperature (Hermetic) . . . . . +175°C
Maximum Junction Temperature (Plastic) . . . . . +150°C
Maximum Lead Temperature (Soldering, 10s) . . . . . 300°C
(For Surface Mount Packages - Lead Tips Only)

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 Characteristics

Supplies = +15V, -15V; V_{REF} = Open; V_{AH} (Logic Level High) = 2.4V, V_{AL} (Logic Level Low) = +0.8V

PARAMETER	TEST CONDITIONS	TEMP	HI-200, HI-201-2			HI-200, HI201 -4, -5, -7, -9			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
SWITCHING CHARACTERISTICS									
Switch On Time, t_{ON}									
HI-200		+25°C	-	240	500	-	240	-	ns
HI-201		+25°C	-	185	500	-	185	-	ns
		Full	-	1000	-	-	1000	-	ns
Switch Off Time, t_{OFF}									
HI-200		+25°C	-	330	500	-	500	-	ns
HI-201		+25°C	-	220	500	-	220	-	ns
		Full	-	1000	-	-	1000	-	ns
"Off Isolation"	(Note 4)								
HI-200		+25°C	-	70	-	-	70	-	dB
HI-201		+25°C	-	80	-	-	80	-	dB
Input Switch Capacitance, $C_{S(OFF)}$		+25°C	-	5.5	-	-	5.5	-	pF
Output Switch Capacitance, $C_{D(OFF)}$		+25°C	-	5.5	-	-	5.5	-	pF
Output Switch Capacitance, $C_{D(ON)}$		+25°C	-	11	-	-	11	-	pF
Digital Input Capacitance, C_A		+25°C	-	5	-	-	5	-	pF
Drain-to-Source Capacitance, $C_{DS(OFF)}$		+25°C	-	0.5	-	-	0.5	-	pF
DIGITAL INPUT CHARACTERISTICS									
Input Low Threshold, V_{AL}		Full	-	-	0.8	-	-	0.8	V
Input High Threshold, V_{AH}		Full	2.4	-	-	2.4	-	-	V
Input Leakage Current (High or Low), I_A	(Note 2)	Full	-	-	1.0	-	-	1.0	µA
ANALOG SWITCH CHARACTERISTICS									
Analog Signal Range, V_S		Full	-15	-	+15	-15	-	+15	V

Electrical Characteristics Supplies = +15V, -15V; V_{REF} = Open; V_{AH} (Logic Level High) = 2.4V, V_{AL} (Logic Level Low) = +0.8V **(Continued)**

PARAMETER	TEST CONDITIONS	TEMP	HI-200, HI-201-2			HI-200, HI201 -4, -5, -7, -9			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
On Resistance, R_{ON}	(Note 1)	+25°C	-	55	70	-	55	80	Ω
		Full	-	80	100	-	72	100	Ω
Off Input Leakage Current, $I_{S(OFF)}$	(Note 6)	+25°C	-	1	5	-	1	50	nA
HI-200		Full	-	100	500	-	10	500	nA
Off Output Leakage Current, $I_{D(OFF)}$	(Note 6)	+25°C	-	1	5	-	1	50	nA
HI-200		Full	-	100	500	-	10	500	nA
On Leakage Current, $I_{D(ON)}$	(Note 6)	+25°C	-	1	5	-	1	50	nA
HI-200		Full	-	100	500	-	10	500	nA
$I_{S(OFF)}$		+25°C	-	2	5	-	2	50	nA
HI-201		Full	-	-	500	-	-	250	nA
$I_{D(OFF)}$		+25°C	-	2	5	-	2	50	nA
HI-201		Full	-	35	500	-	35	250	nA
$I_{D(ON)}$		+25°C	-	2	5	-	2	50	nA
HI-201		Full	-	-	500	-	-	250	nA
POWER REQUIREMENTS (Note 5)									
Power Dissipation, P_D		+25°C	-	15	-	-	15	-	mW
		Full	-	-	60	-	-	60	mW
Current, I+		+25°C	-	0.5	-	-	0.5	-	mA
		Full	-	-	2.0	-	-	2.0	mA
Current, I-		+25°C	-	0.5	-	-	0.5	-	mA
		Full	-	-	2.0	-	-	2.0	mA

NOTES:

2. $V_{OUT} = \pm 10V$, $I_{OUT} = 1mA$.
3. Digital Inputs are MOS gates: typical leakage is < 1nA.
4. $V_{AH} = 4.0V$.
5. $V_A = 5V$, $R_L = 1k\Omega$, $C_L = 10pF$, $V_S = 3V_{RMS}$, f = 100kHz.
6. $V_A = +3V$ or $V_A = 0V$ for Both Switches.
7. Refer to Leakage Current Measurements (Figure 4).

Performance Curves and Test Circuits $T_A = +25°C$, $V_{SUPPLY} = 15V$, $V_{AH} = 2.4V$, $V_{AL} = 0.8V$ and V_{REF} = Open

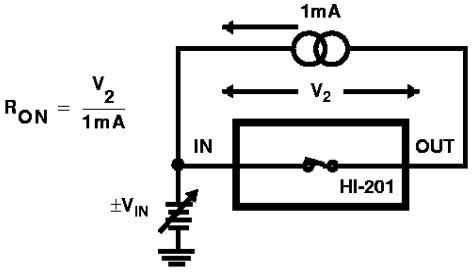


FIGURE 1. ON RESISTANCE vs ANALOG SIGNAL LEVEL, SUPPLY VOLTAGE AND TEMPERATURE

Performance Curves and Test Circuits $T_A = +25^oC$, $V_{SUPPLY} = 15V$, $V_{AH} = 2.4V$, $V_{AL} = 0.8V$ and V_{REF} = Open

(Continued)

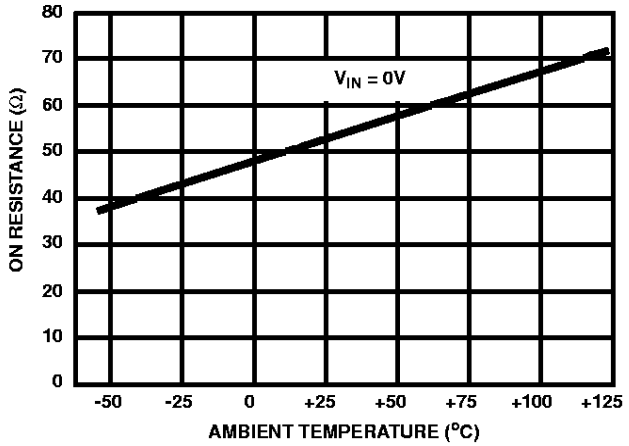


FIGURE 2. ON RESISTANCE vs TEMPERATURE

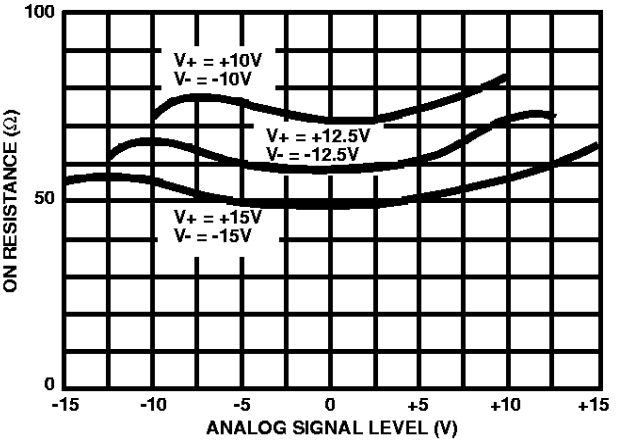


FIGURE 3. HI-201 ON RESISTANCE vs ANALOG SIGNAL LEVEL AND POWER SUPPLY VOLTAGE

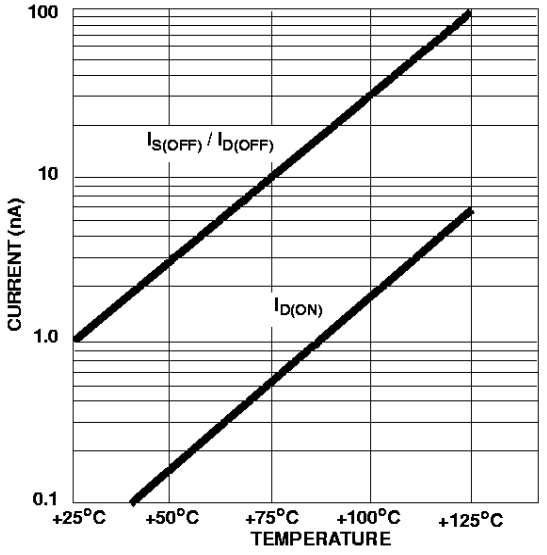


FIGURE 4A. HI-201 SWITCH LEAKAGE CURRENT vs TEMPERATURE

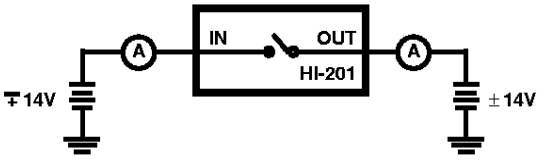


FIGURE 4B. OFF LEAKAGE CURRENT vs TEMPERATURE

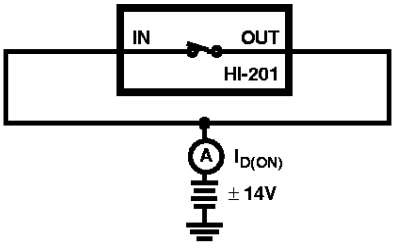


FIGURE 4C. ON LEAKAGE CURRENT vs TEMPERATURE

FIGURE 4.

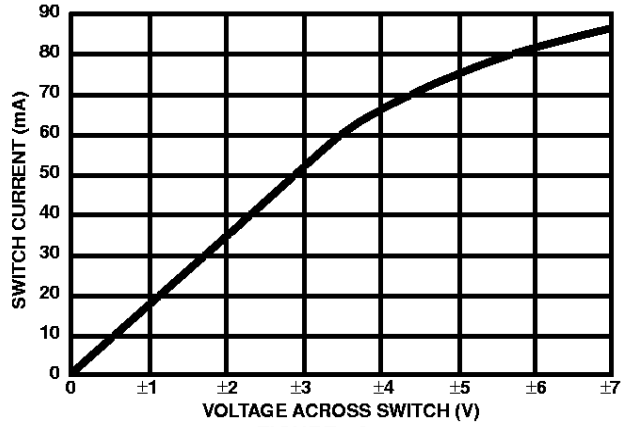


FIGURE 5A.

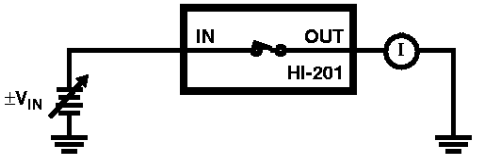


FIGURE 5B.

FIGURE 5. SWITCH CURRENT vs VOLTAGE

Switching Waveforms

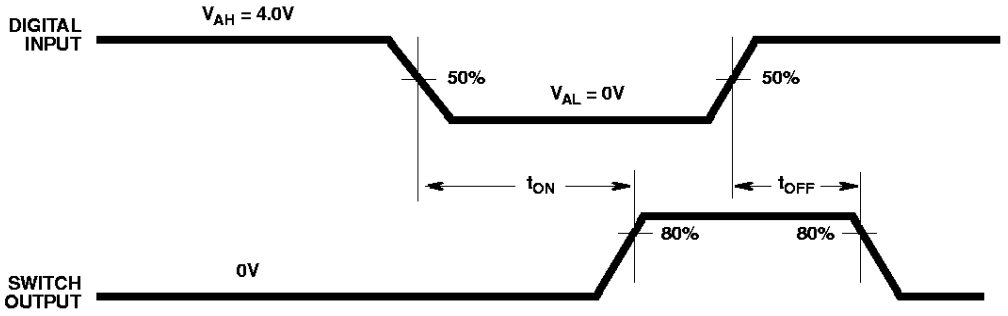


FIGURE 6. LOGIC "0" = SWITCH ON

t_{ON}, t_{OFF} (TTL INPUT), V_{IN} = +4.0V
Vertical: 2V/Div.
Horizontal: 100ns/Div.

t_{ON}, t_{OFF} (TTL INPUT), V_{IN} = +15.0V
Vertical: 5V/Div.
Horizontal: 100ns/Div.

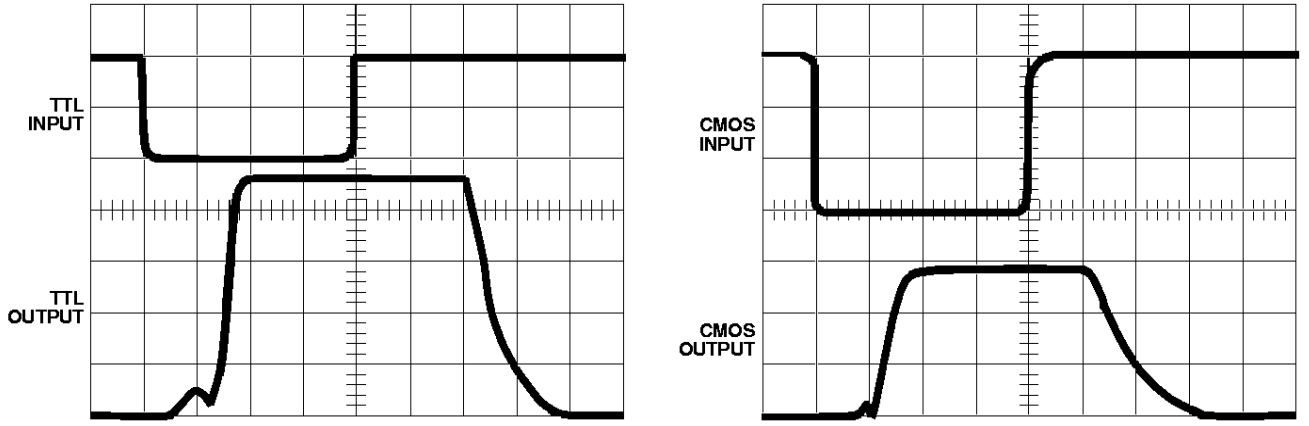


FIGURE 7. TTL INPUT

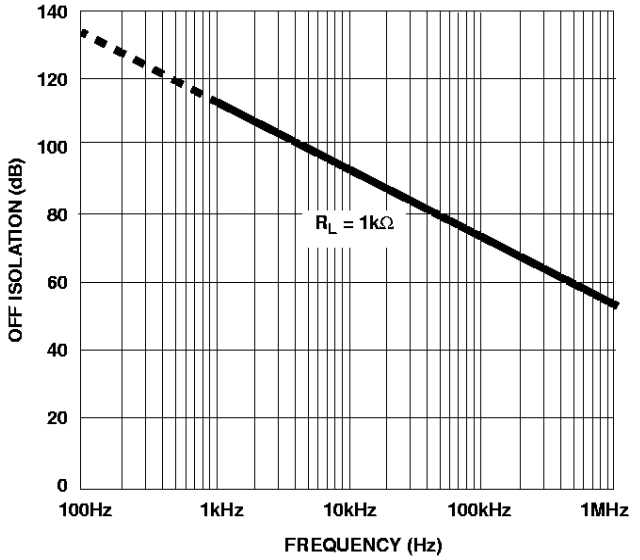


FIGURE 8. OFF ISOLATION vs FREQUENCY

For more information see Application Notes 520, 521, 531, 532 and 557.

Die Characteristics

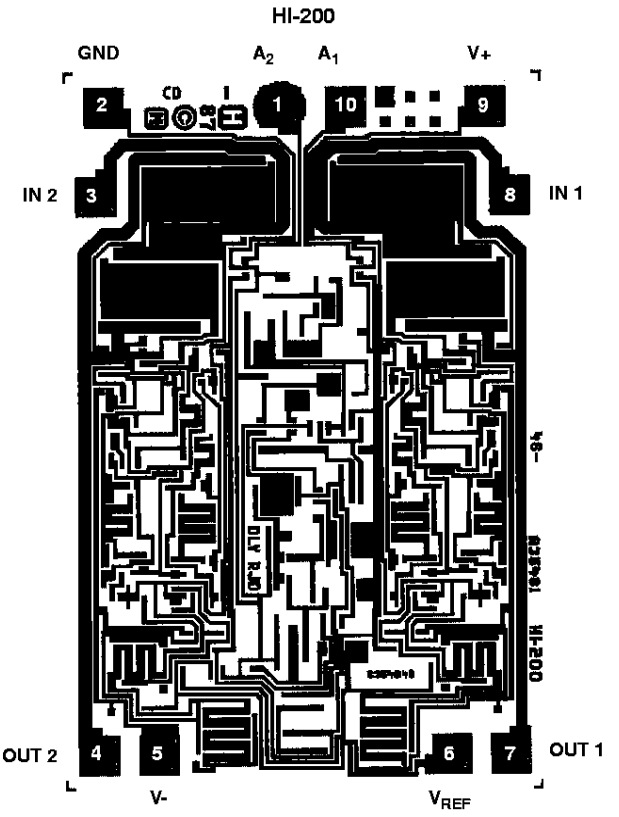
DIE DIMENSIONS:
54 mils x 79 mils x 19 mils

METALLIZATION:
Type: CuAL
Thickness: 16kÅ ±2kÅ

GLASSIVATION:
Type: Nitride over Silox
Nitride Thickness: 3.5kÅ ±1kÅ
Silox Thickness: 12kÅ ±2kÅ

WORST CASE CURRENT DENSITY:
2 x 10^5 A/cm^2 at 25mA

Metallization Mask Layout



Die Characteristics

DIE DIMENSIONS:
81 mils x 85 mils x 19 mils

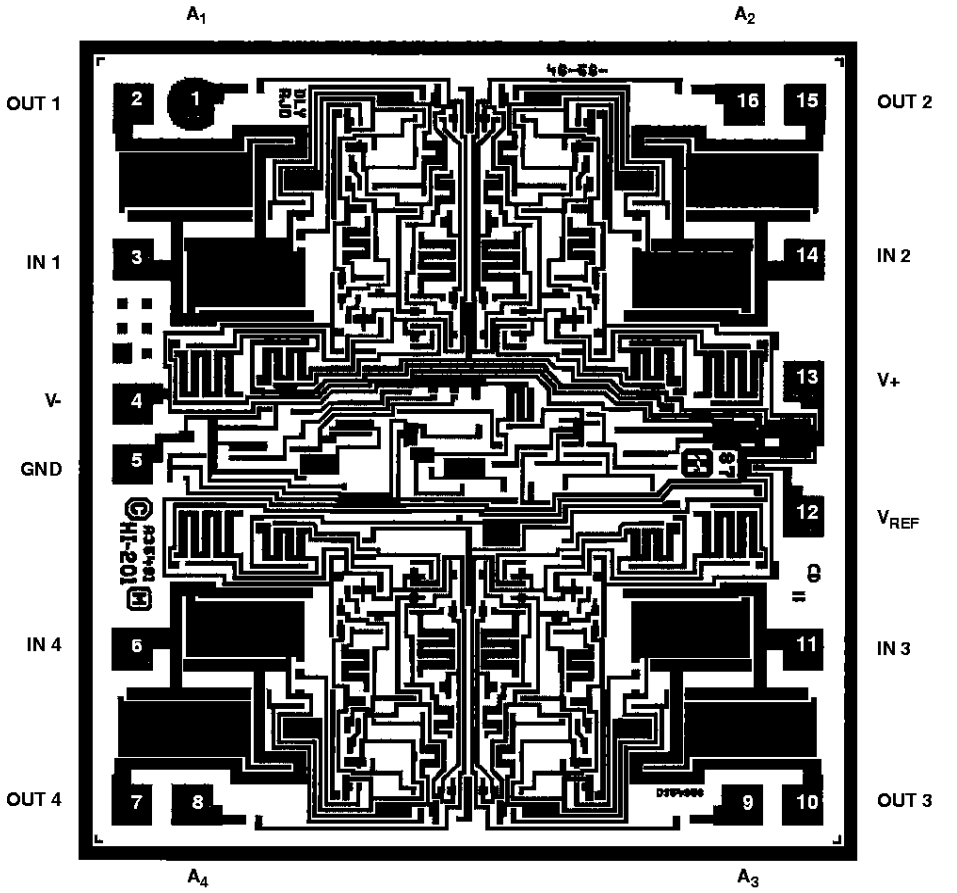
METALLIZATION:
Type: CuAl
Thickness: 16kÅ ±2kÅ

GLASSIVATION:
Type: Nitride over Silox
Nitride Thickness: 3.5kÅ ±1kÅ
Silox Thickness: 12kÅ ±2kÅ

WORST CASE CURRENT DENSITY:
2 x 10^5 A/cm^2 at 25mA

Metallization Mask Layout

HI-201



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