Rochester Electronics

REI Datasheet

HI-516

16-Channel/Differential 8-Channel, CMOS High Speed Analog Multiplexer

The HI-516 is a monolithic, dielectrically isolated, high-speed, high-performance CMOS analog multiplexer. It offers unique built-in channel selection decoding plus an inhibit for disabling all channels. The dual function of address input A_3 enables the HI-516 to be user programmed either as a single ended 16-Channel multiplexer by connecting 'out A' to 'out B' and using A_3 as a digital address input, or as an 8-Channel differential multiplexer by connecting A3 to the V- supply. The substrate leakages and parasitic capacitances are reduced substantially by using the Harris Dielectric Isolation process to achieve optimum performance in both high and low level signal applications. The low output leakage current ($I_{D(OFF)}$ < 100pA at 25C) and fast settling (t_{SETTLE} = 800ns to 0.01%) characteristics of the device make it an ideal choice for high speed data acquisition systems, precision instrumentation, and industrial process control.

Rochester Electronics Manufactured Components

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All recreations are done with the approval of the OCM.

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

Quality Overview

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-38535
    - Class Q Military
    - Class V Space Level
- Qualified Suppliers List of Distributors (QSLD)
    - Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OEM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

16-Channel/Differential 8-Channel, CMOS High Speed Analog Multiplexer

The HI-516 is a monolithic, dielectrically isolated, high-speed, high-performance CMOS analog multiplexer. It offers unique built-in channel selection decoding plus an inhibit input for disabling all channels. The dual function of address input A_3 enables the HI-516 to be user programmed either as a single ended 16-Channel multiplexer by connecting 'out A' to 'out B' and using A_3 as a digital address input, or as an 8-Channel differential multiplexer by connecting A_3 to the V- supply. The substrate leakages and parasitic capacitances are reduced substantially by using the Harris Dielectric Isolation process to achieve optimum performance in both high and low level signal applications. The low output leakage current ($I_{D(OFF)}$ < 100pA at 25°C) and fast settling (t_{SETTLE} = 800ns to 0.01%) characteristics of the device make it an ideal choice for high speed data acquisition systems, precision instrumentation, and industrial process control.

For MIL-STD-883 compliant parts, request the HI-516/883 data sheet.

Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
HI3-0516-5	0 to 75	28 Ld PDIP	E28.6
HI1-0516-2	-55 to 125	28 Ld CERDIP	F28.6

Features

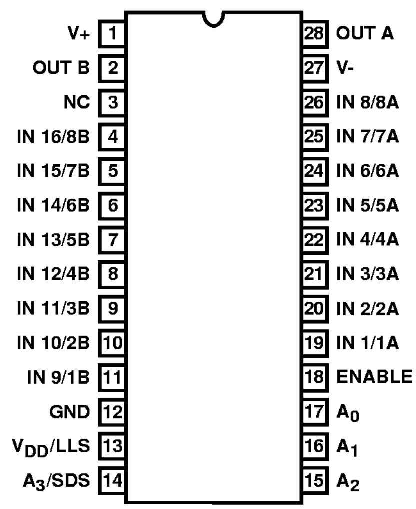
- Access Time (Typical) 130ns
- Settling Time 250ns (0.1%)
- Low Leakage (Typical)
  - $I_{S(OFF)}$ 10pA
  - $I_{D(OFF)}$ 30pA
- Low Capacitance (Max)
  - $C_{S(OFF)}$ 10pF
  - $C_{D(OFF)}$ 25pF
- Off Isolation at 500kHz . . . . 55dB (Min)
- Low Charge Injection Error 20mV
- Single Ended to Differential Selectable (SDS)
- Logic Level Selectable (LLS)

Applications

- Data Acquisition Systems
- Precision Instrumentation
- Industrial Control

Pinout

HI-516 (CERDIP, PDIP)
TOP VIEW



Truth Tables

HI-516 USED AS A 16-CHANNEL MULTIPLEXER OR DUAL 8-CHANNEL MULTIPLEXER (NOTE 1)

USE A_3 AS DIGITAL ADDRESS INPUT					ON CHANNEL TO	
ENABLE	A_3	A_2	A_1	A_0	OUT A	OUT B
L	X	X	X	X	None	None
H	L	L	L	L	1A	None
H	L	L	L	H	2A	None
H	L	L	H	L	3A	None
H	L	L	H	H	4A	None
H	L	H	L	L	5A	None
H	L	H	L	H	6A	None
H	L	H	H	L	7A	None
H	L	H	H	H	8A	None
H	H	L	L	L	None	1B
H	H	L	L	H	None	2B
H	H	L	H	L	None	3B
H	H	L	H	H	None	4B
H	H	H	L	L	None	5B
H	H	H	L	H	None	6B
H	H	H	H	L	None	7B
H	H	H	H	H	None	8B

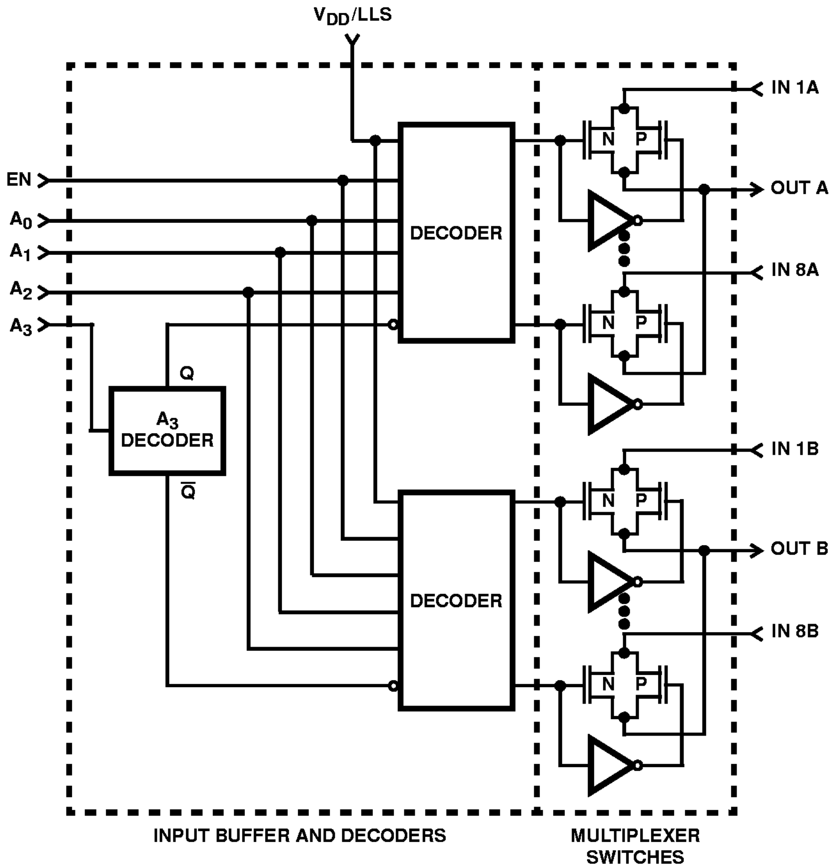
NOTE:

1. For 16-channel single-ended function, tie 'out A' to 'out B'; for dual 8-channel function use the A_3 address pin to select between MUX A and MUX B, where MUX A is selected with A_3 low.

HI-516 USED AS A DIFFERENTIAL 8-CHANNEL MULTIPLEXER

A_3 CONNECTED TO V- SUPPLY				ON CHANNEL TO	
ENABLE	A_2	A_1	A_0	OUT A	OUT B
L	X	X	X	None	None
H	L	L	L	1A	1B
H	L	L	H	2A	2B
H	L	H	L	3A	3B
H	L	H	H	4A	4B
H	H	L	L	5A	5B
H	H	L	H	6A	6B
H	H	H	L	7A	7B
H	H	H	H	8A	8B

Functional Block Diagram



A_3 DECODE		
A_3	Q	$\overline{Q}$
H	H	L
L	L	H
V-	L	L

Absolute Maximum Ratings

V+ to V- 33V
Analog Signal. . . . . (V_{IN}, V_{OUT})
. . . . (V-) -2V to (V+) +2V
Digital Input Voltage:
TTL Levels Selected (V_{DD}/LLS Pin = GND or Open)
V_{A0-2} . . . . -6V to +6V
$V_{A3/SDS}$ . . . . (V-) -2V to (V+) +2V
CMOS Levels Selected (V_{DD}/LLS Pin = V_{DD})
V_{A0-3} . . . . -2V to (V+) +2V

Operating Conditions

Temperature Ranges
HI-516-2 . . . . -55°C to 125°C
HI-516-5 . . . . 0°C to 75°C

Thermal Information

Thermal Resistance (Typical, Note 2)	θ_{JA} (°C/W)	θ_{JC} (°C/W)
PDIP Package	60	N/A
CERDIP Package	55	18

Maximum Junction Temperature
Ceramic Package . . . . 175°C
Plastic Package . . . . 150°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:

2. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications

Supplies = +15V, -15V; V_{AH} (Logic Level High) = 2.4V, V_{AL} (Logic Level Low) = 0.8V; V_{DD}/LLS = GND. (Note 3) Unless Otherwise Specified

PARAMETER	TEST CONDITIONS	TEMP (°C)	-2			-5			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
DYNAMIC CHARACTERISTICS									
Access Time, t_A		25	-	130	175	-	130	175	ns
		Full	-	-	225	-	-	225	ns
Break-Before-Make Delay, t_{OPEN}		25	10	20	-	10	20	-	ns
Enable Delay (ON), $t_{ON(EN)}$		25	-	120	175	-	120	175	ns
Enable Delay (OFF), $t_{OFF(EN)}$		25	-	140	175	-	140	175	ns
Settling Time	To 0.1%	25	-	250	-	-	250	-	ns
	To 0.01%	25	-	800	-	-	800	-	ns
Charge Injection Error	Note 6	25	-	-	20	-	-	20	mV
Off Isolation	Note 7	25	55	-	-	55	-	-	dB
Channel Input Capacitance, $C_{S(OFF)}$		25	-	-	10	-	-	10	pF
Channel Output Capacitance, $C_{D(OFF)}$		25	-	-	25	-	-	25	pF
Digital Input Capacitance, C_A		25	-	-	10	-	-	10	pF
Input to Output Capacitance, $C_{DS(OFF)}$		25	-	0.02	-	-	0.02	-	pF
DIGITAL INPUT CHARACTERISTICS									
Input Low Threshold, V_{AL} (TTL)	Note 3	Full	-	-	0.8	-	-	0.8	V
Input High Threshold, V_{AH} (TTL)	Note 3	Full	2.4	-	-	2.4	-	-	V
Input Low Threshold, V_{AL} (CMOS)	Note 3	Full		-	$0.3V_{DD}$	-	-	$0.3V_{DD}$	V
Input High Threshold, V_{AH} (CMOS)	Note 3	Full	$0.7V_{DD}$	-	-	$0.7V_{DD}$	-	-	V

Electrical Specifications

Supplies = +15V, -15V; V_{AH} (Logic Level High) = 2.4V, V_{AL} (Logic Level Low) = 0.8V; V_{DD}/LLS = GND. (Note 3) Unless Otherwise Specified **(Continued)**

PARAMETER	TEST CONDITIONS	TEMP (°C)	-2			-5			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Leakage Current, I_{AH} (High)		Full	-	-	1	-	-	1	µA
Input Leakage Current, I_{AL} (Low)		Full	-	-	25	-	-	25	µA
ANALOG CHANNEL CHARACTERISTICS									
Analog Signal Range, V_{IN}	Note 4	Full	-14	-	+14	-15	-	+15	V
On Resistance, r_{ON}	Note 5	25	-	620	750	-	620	750	Ω
		Full	-	-	1,000	-	-	1,000	Ω
Off Input Leakage Current, $I_{S(OFF)}$		25	-	0.01	-	-	0.01	-	nA
		Full	-	-	50	-	-	50	nA
Off Output Leakage Current, $I_{D(OFF)}$		25	-	0.03	-	-	0.03	-	nA
		Full	-	-	100	-	-	100	nA
On Channel Leakage Current, $I_{D(ON)}$		25	-	0.04	-	-	0.04	-	nA
POWER SUPPLY CHARACTERISTICS									
Power Dissipation, P_D		Full	-	-	750	-	-	900	mW
I+, Current	V_{EN} = 2.4V	Full	-	-	25	-	-	30	mA
I-, Current		Full	-	-	25	-	-	30	mA

NOTES:

3. V_{DD}/LLS pin = open or grounded for TTL compatibility. V_{DD}/LLS pin = V_{DD} for CMOS compatibility.
4. At temperatures above 90°C, care must be taken to assure V_{IN} remains at least 1V below the V_{SUPPLY} for proper operation.
5. V_{IN} = ±10V, I_{OUT} = -100µA.
6. V_{IN} = 0V, C_L = 100pF, enable input pulse = 3V, f = 500kHz.
7. V_{EN} = 0.8V, V_{IN} = 3V_{RMS}, f = 500kHz, C_L = 40pF, R_L = 1K, Pin 3 grounded.

Test Circuits and Waveforms V_{DD}/LLS = GND, Unless Otherwise Specified.

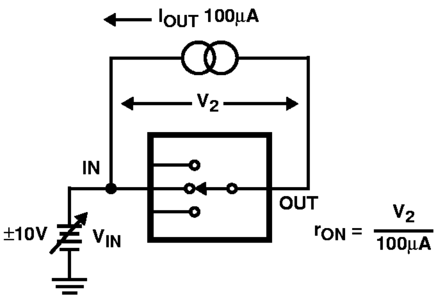


FIGURE 1. ON RESISTANCE TEST CIRCUIT

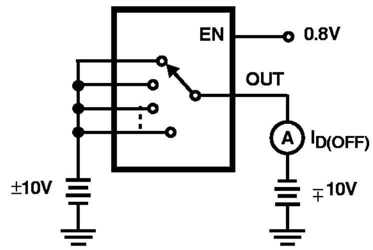


FIGURE 2. $I_{D(OFF)}$ TEST CIRCUIT (NOTE 8)

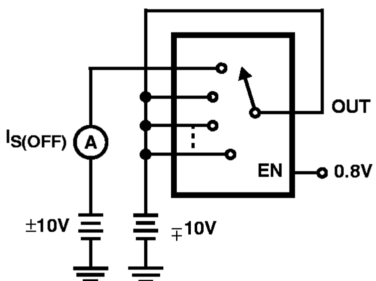


FIGURE 3. $I_{S(OFF)}$ TEST CIRCUIT (NOTE 8)

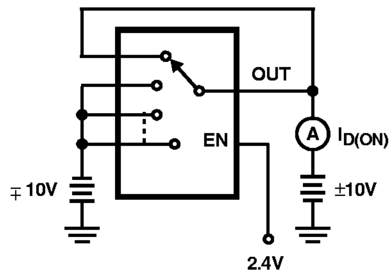


FIGURE 4. $I_{D(ON)}$ TEST CIRCUIT (NOTE 8)

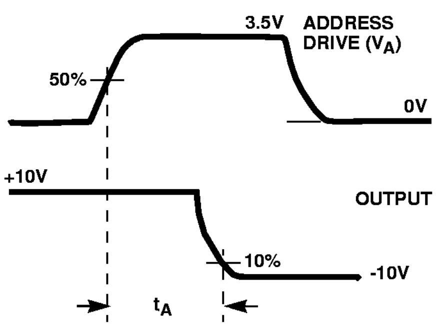


FIGURE 5A. MEASUREMENT POINTS

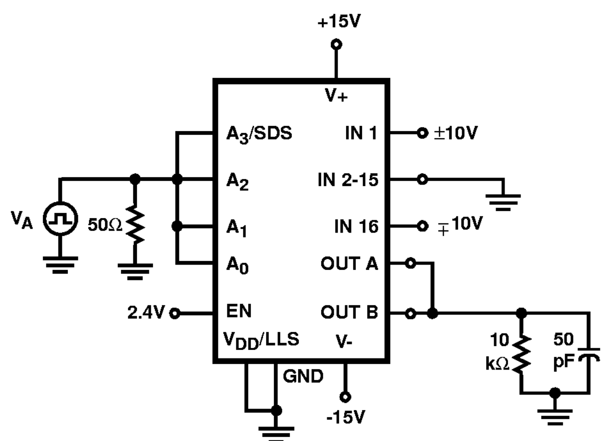


FIGURE 5B. TEST CIRCUIT

FIGURE 5. ACCESS TIME

NOTE:

8. Two measurements per channel: ±10V and ∓10V. (Two measurements per device for $I_{D(OFF)}$ ±10V and ∓10V).

Test Circuits and Waveforms V_{DD}/LLS = GND, Unless Otherwise Specified. **(Continued)**

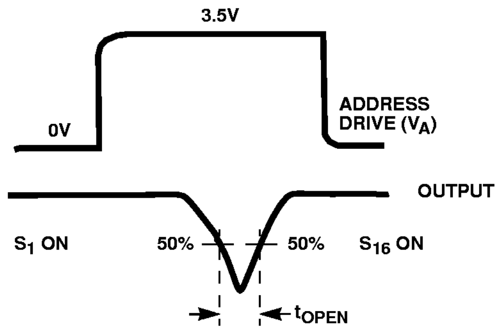


FIGURE 6A. MEASUREMENT POINTS

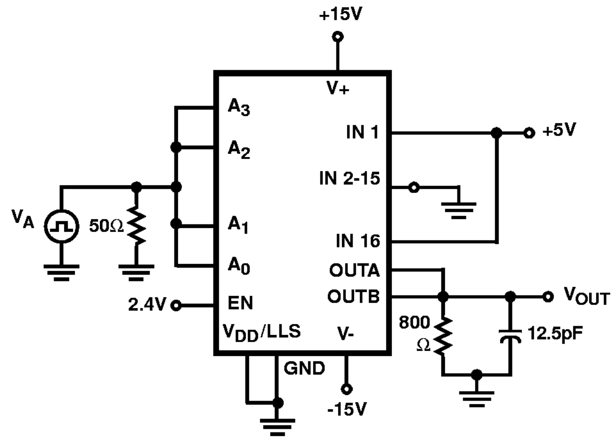


FIGURE 6B. TEST CIRCUIT

FIGURE 6. BREAK-BEFORE-MAKE DELAY

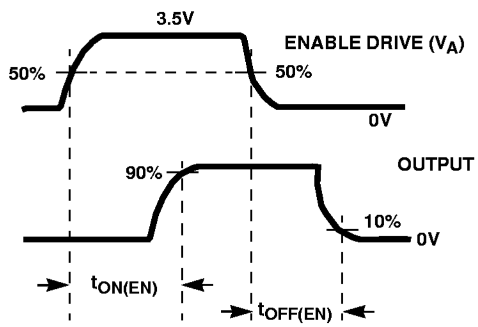


FIGURE 7A. MEASUREMENT POINTS

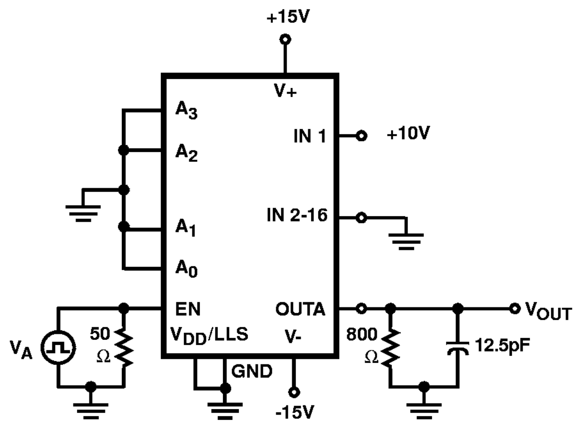


FIGURE 7B. TEST CIRCUIT

FIGURE 7. ENABLE DELAYS

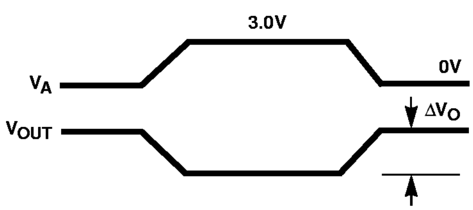


FIGURE 8A. MEASUREMENT POINTS

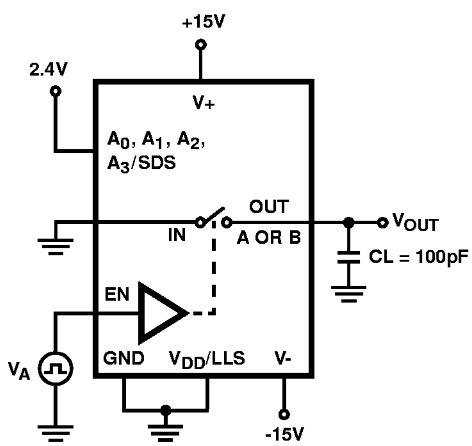


FIGURE 8B. TEST CIRCUIT

ΔV_O is the measured voltage error due to charge injection. The error in coulombs is $Q = C_L \times \Delta V_O$.

FIGURE 8. CHARGE INJECTION

Die Characteristics

DIE DIMENSIONS:

2250µm x 3720µm x 485µm

METALLIZATION:

Type: CuAl
Thickness: 16kÅ ±2kÅ

PASSIVATION:

Type: Nitride Over Silox
Nitride Thickness: 3.5kÅ ±1kÅ
Silox Thickness: 12kÅ ±2kÅ

WORST CASE CURRENT DENSITY:

1.64 x 10^5 A/cm^2

Metallization Mask Layout

HI-516