

SCD8502

48-Channel Analog Multiplexer Module Radiation Tolerant & ESD Protected

ACT8502

Features

- 48 Channels provided by six 16-channel multiplexers
- Radiation performance
 - Total dose: 300 krads(Si), Dose rate = 50 - 300 rads(Si)/s
 - SEU: Immune up to 120 MeV-cm²/mg
 - SEL: Immune by process design
- Full military temperature range
- Low power consumption < 90mW
- One address bus (A0-3) and three enable lines afford flexible organization
- All channel inputs protected by ±20V nominal Transorbs
- Fast access time 1500ns typical
- Break-Before-Make switching
- High analog input impedance (power on or off)
- Designed for aerospace and high reliability space applications
- Packaging – Hermetic ceramic
 - 96 leads, 1.32"Sq x 0.20"Ht quad flat pack
 - Typical Weight 15 grams
- **CAES Radiation Hardness Assurance Plan is DLA Certified to MIL-PRF-38534, Appendix G.**

General Description

CAES ACT8502 is a radiation tolerant, 48 channel multiplexer MCM (multi-chip module) with electrostatic discharge (ESD) protection on all channel inputs.

The ACT8502 has been specifically designed to meet exposure to radiation environments. The multiplexer is available in a 96 lead High Temperature Co-Fired Ceramic (HTCC) Quad Flatpack (CQFP). It is guaranteed operational from -55°C to +125°C. Available screened in accordance with MIL-PRF-38534, the ACT8502 is ideal for demanding military and space applications.

Organization and Application

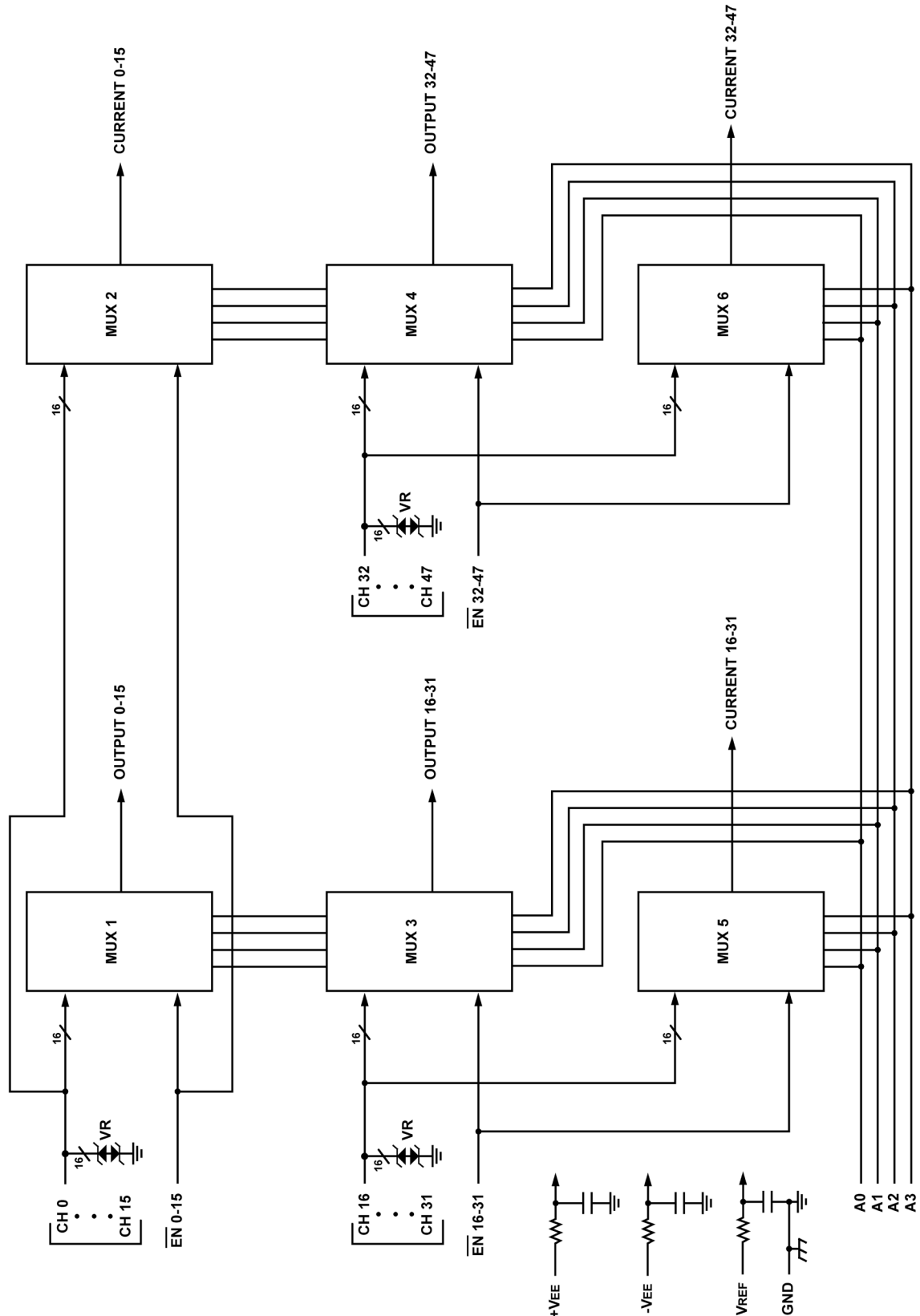
The ACT8502 consists of six 16 channel multiplexers arranged as shown in the Block Diagram. The ACT8502 design is inherently radiation tolerant.

The ACT8502 consists of forty-eight (48) channels addressable by bus A₀~A₃ in three 16 channel blocks, each block enabled separately. Each block connects the addressed channel to two outputs, "Output" and "Current". This technique enables selecting and reading a remote resistive sensor without the MUX resistance being part of the measurement. For grounded sensors, this is done by passing current to the sensor by means of the "Current" pin and reading the resultant voltage (proportional to the sensor resistance) at the "Output" pin.

SCD8502

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ACT8502



ACT8502 48 - Channel Analog Mux Block Diagram

ACT8502

Absolute Maximum Ratings 1/

Parameter	Range	Units
Case Operating Temperature Range	-55 to +125	°C
Storage Temperature Range	-55 to +150	°C
Supply Voltage		
+V _{EE} (Pin 44)	+16.5	V
-V _{EE} (Pin 46)	-16.5	V
V _{REF} (Pin 48)	+16.5	V
Digital Input Overvoltage	<V _R +4	V
V _{EN} (Pins 5, 91, 92), V _A (Pins 1, 3, 93, 95)	>GND -4	V
Analog Input Over Voltage	±18	V
V _S		

Note:

- 1) All measurements are made with respect to ground.

Notice: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress rating only; functional operation beyond the "Operation Conditions" is not recommended and extended exposure beyond the "Operation Conditions" may affect device reliability.

Recommended Operating Conditions 1/

Symbol	Parameter	Typical	Units
+V _{EE}	+15V Power Supply Voltage	+15.0	V
-V _{EE}	-15V Power Supply Voltage	-15.0	V
V _{REF}	Reference Voltage	+5.00	V
V _{AL}	Logic Low Level	+0.8	V
V _{AH}	Logic High Level	+4.0	V

Notes:

- 1) Power Supply turn-on sequence shall be as follows: +V_{EE}, -V_{EE}, followed by V_{REF}.

DC Electrical Performance Characteristics 1/

(T_c = -55°C to +125°C, +V_{EE} = -15V, -V_{EE} = -15V, V_{REF} = +5.0V - Unless otherwise specified)

Parameter	Symbol	Conditions	MIN	MAX	Units
Supply Current	+I _{EE}	V _{EN} (0-47) = V _A (0-3) = 0	0.3	3	mA
	-I _{EE}		-3	-0.3	mA
	+I _{SBY}	V _{EN} (0-47) = 4V, V _A (0-3) = 0 <u>6/</u>	0.3	3	mA
	-I _{SBY}		-3	-0.3	mA
Address Input Current	I _{AL} (0-3)	V _A = 0V <u>1/</u> , <u>2/</u>	-6	6	μA
	I _{AH} (0-3)	V _A = 5V <u>1/</u> , <u>2/</u>	-6	6	μA
Enable Input Current	I _{ENL} (0-15)	V _{EN} (0-15) = 0V <u>2/</u>	-2	2	μA
	I _{ENH} (0-15)	V _{EN} (0-15) = 5V <u>2/</u>	-2	2	μA
	I _{ENL} (16-31)	V _{EN} (16-31) = 0V <u>2/</u>	-2	2	μA
	I _{ENH} (16-31)	V _{EN} (16-31) = 5V <u>2/</u>	-2	2	μA
	I _{ENL} (32-47)	V _{EN} (32-47) = 0V <u>2/</u>	-2	2	μA
	I _{ENH} (32-47)	V _{EN} (32-47) = 5V <u>2/</u>	-2	2	μA

DC Electrical Performance Characteristics 1/ (continued)(T_c = -55°C to +125°C, +V_{EE} = -15V, -V_{EE} = -15V, V_{REF} = +5.0V - Unless otherwise specified)

Parameter	Symbol	Conditions	MIN	MAX	Units	
Positive Input Leakage Current CH0-CH47	I _{SOFFOUTPUT}	V _{IN} = +10V, V _{EN} = 4V, output and all unused MUX inputs under test = -10V <u>2/</u> , <u>3/</u> , <u>5/</u>	-100	+700	nA	
	+I _{SOFFCURRENT}		-100	+700	nA	
Negative Input Leakage Current CH0-CH47	-I _{SOFFOUTPUT}	V _{IN} = -10V, V _{EN} = 4V, output and all unused MUX inputs under test = +10V <u>2/</u> , <u>3/</u> , <u>5/</u>	-100	+700	nA	
	-I _{SOFFCURRENT}		-100	+700	nA	
Output Leakage Current OUTPUTS (pins 25, 70 & 68) CURRENTS (pins 67 & 69)	+I _{DOFFOUTPUT}	V _{OUT} = +10V, V _{EN} = 4V, output and all unused MUX inputs under test = -10V <u>3/</u> , <u>4/</u> , <u>5/</u>	-100	+100	nA	
	+I _{DOFFCURRENT}		-100	+100	nA	
Output Leakage Current OUTPUTS (pins 25, 70 & 68) CURRENTS (pins 67 & 69)	-I _{DOFFOUTPUT}	V _{OUT} = -10V, V _{EN} = 4V, output and all unused MUX inputs under test = +10V <u>3/</u> , <u>4/</u> , <u>5/</u>	-100	+100	nA	
	-I _{DOFFCURRENT}		-100	+100	nA	
Input Clamped Voltage CH0 – CH47	+V _{CLMP} (0-47)	V _{EN} = 4V, all unused MUX inputs under test are open. <u>3/</u>	+25°C	18.0	23.0	V
			+125°C	18.0	23.5	V
			-55°C	17.5	22.5	V
Input Clamped Voltage CH0 – CH47	-V _{CLMP} (0-47)	V _{EN} = 4V, all unused MUX inputs under test are open. <u>3/</u>	+25°C	-23.0	-18.0	V
			+125°C	-23.5	-18.0	V
			-55°C	-22.5	-17.5	V
Switch ON Resistance OUTPUTS (pins 25, 70, & 68)	R _{DS(ON)} (0-47) _A	V _{IN} = +15V, V _{EN} = 0.8V, I _{OUT} = -1mA <u>2/</u> , <u>3/</u> , <u>5/</u>	500	3000	Ω	
	R _{DS(ON)} (0-47) _B	V _{IN} = +5V, V _{EN} = 0.8V, I _{OUT} = -1mA <u>2/</u> , <u>3/</u> , <u>5/</u>	500	3000	Ω	
	R _{DS(ON)} (0-47) _C	V _{IN} = -5V, V _{EN} = 0.8V, I _{OUT} = +1mA <u>2/</u> , <u>3/</u> , <u>5/</u>	500	3000	Ω	
Switch ON Resistance CURRENTS (pins 26, 67 & 69)	R _{DS(ON)} (0-47) _A	V _{IN} = +15V, V _{EN} = 0.8V, I _{OUT} = -1mA <u>2/</u> , <u>3/</u> , <u>5/</u>	500	3000	Ω	
	R _{DS(ON)} (0-47) _B	V _{IN} = +5V, V _{EN} = 0.8V, I _{OUT} = -1mA <u>2/</u> , <u>3/</u> , <u>5/</u>	500	3000	Ω	
	R _{DS(ON)} (0-47) _C	V _{IN} = -5V, V _{EN} = 0.8V, I _{OUT} = +1mA <u>2/</u> , <u>3/</u> , <u>5/</u>	500	3000	Ω	

ACT8502

Notes:

- 1) Measure inputs sequentially. Ground all unused inputs of the device under test. V_A is the applied input voltage to the address lines A(0-3).
- 2) V_{IN} is the applied input voltage to the input channels CH0-CH47.
- 3) V_{EN} is the applied input voltage to the enable lines EN (0-15), EN (16-31) and EN (32-47).
- 4) V_{OUT} is the applied input voltage to the output lines OUTPUT(0-15), OUTPUT(16-31), OUTPUT(32-47), CURRENT(0-15), CURRENT(16-31) and CURRENT(32-47).
- 5) Negative current is the current flowing out of each of the MUX pins. Positive current is the current flowing into each MUX Pin.
- 6) If not tested, shall be guaranteed to the specified limits.
- 7) These parameters for $T_c = -55^\circ\text{C}$ are guaranteed by design, characterization, or correlation to other test parameters but not production tested.

Switching Characteristics

($T_c = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $+V_{EE} = +15\text{V}$, $-V_{EE} = -15\text{V}$, $V_{REF} = +5.0\text{V}$ -- Unless otherwise specified)

Parameter	Symbol	Conditions	MIN	MAX	Units
Switching Test MUX	t_{aHL}	$R_L = 10\text{K}\Omega$, $C_L = 50\text{pF}$	10	1500	ns
	t_{aLH}	$R_L = 10\text{K}\Omega$, $C_L = 50\text{pF}$ $T_c = +25^\circ\text{C}$, $+125^\circ\text{C}$ $T_c = -55^\circ\text{C}$	10	2000	ns
			10	5000	ns
	t_{onEN}	$R_L = 1\text{K}\Omega$, $C_L = 50\text{pF}$	10	1500	ns
t_{offEN}	10		1000	ns	

Truth Table (CH0 – CH15)

A3	A2	A1	A0	EN(0-15)	"ON" Channel <u>1</u> /
X	X	X	X	H	NONE
L	L	L	L	L	CH0
L	L	L	H	L	CH1
L	L	H	L	L	CH2
L	L	H	H	L	CH3
L	H	L	L	L	CH4
L	H	L	H	L	CH5
L	H	H	L	L	CH6
L	H	H	H	L	CH7
H	L	L	L	L	CH8
H	L	L	H	L	CH9
H	L	H	L	L	CH10
H	L	H	H	L	CH11
H	H	L	L	L	CH12
H	H	L	H	L	CH13
H	H	H	L	L	CH14
H	H	H	H	L	CH15

1/ Between CH0-15 and OUTPUT (0-15) and CURRENT (0-15).

ACT8502

Truth Table (CH16 – CH31)

A3	A2	A1	A0	EN(16-31)	"ON" Channel <u>1</u> /
X	X	X	X	H	NONE
L	L	L	L	L	CH16
L	L	L	H	L	CH17
L	L	H	L	L	CH18
L	L	H	H	L	CH19
L	H	L	L	L	CH20
L	H	L	H	L	CH21
L	H	H	L	L	CH22
L	H	H	H	L	CH23
H	L	L	L	L	CH24
H	L	L	H	L	CH25
H	L	H	L	L	CH26
H	L	H	H	L	CH27
H	H	L	L	L	CH28
H	H	L	H	L	CH29
H	H	H	L	L	CH30
H	H	H	H	L	CH31

1/ Between CH16-31 and OUTPUT (16-31) and CURRENT (16-31).

Truth Table (CH32 – CH47)

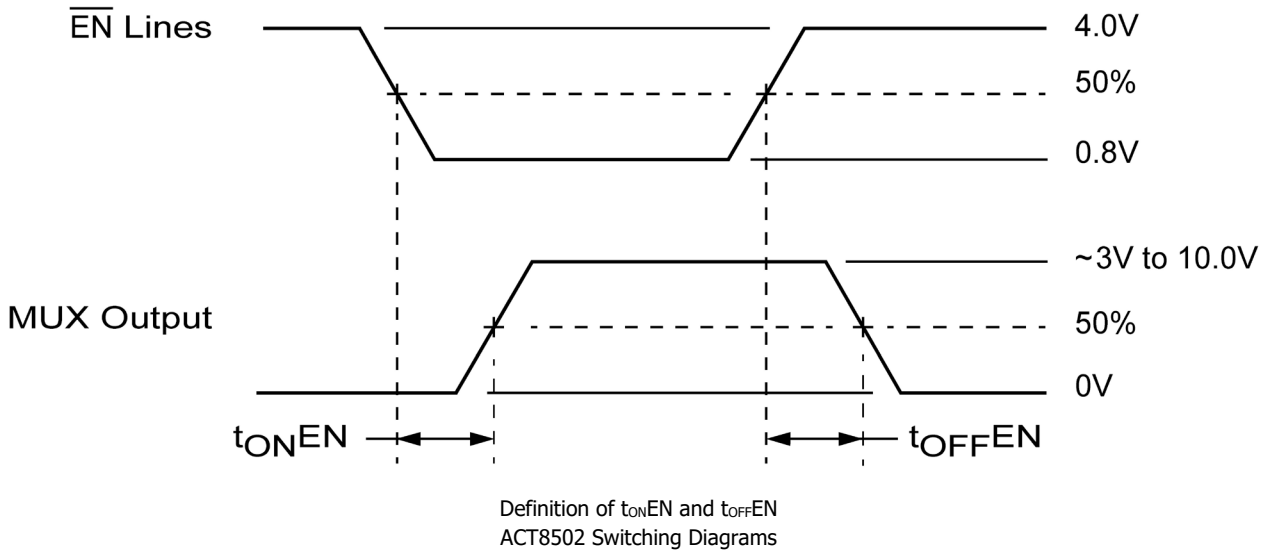
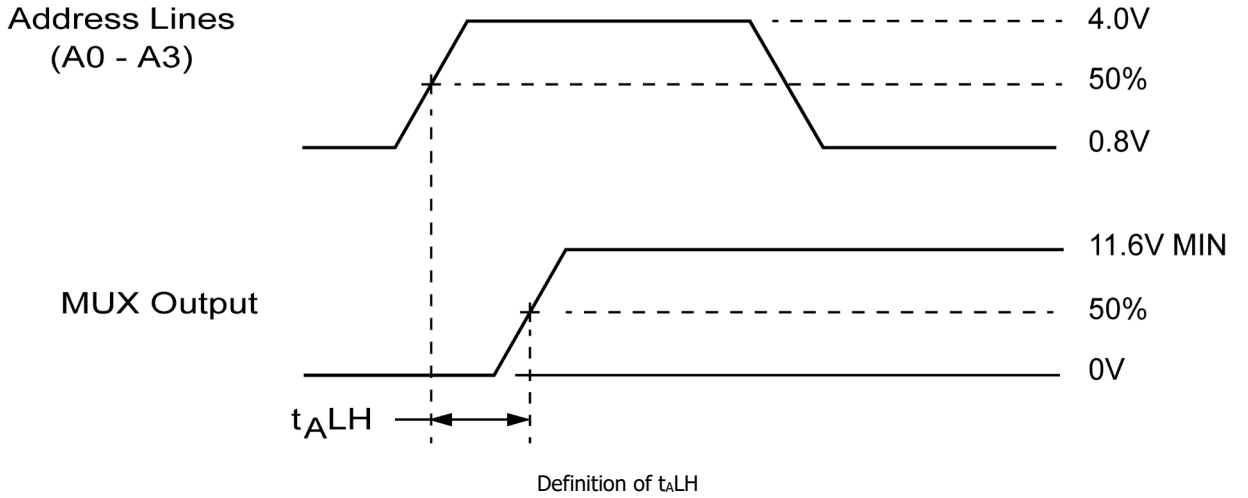
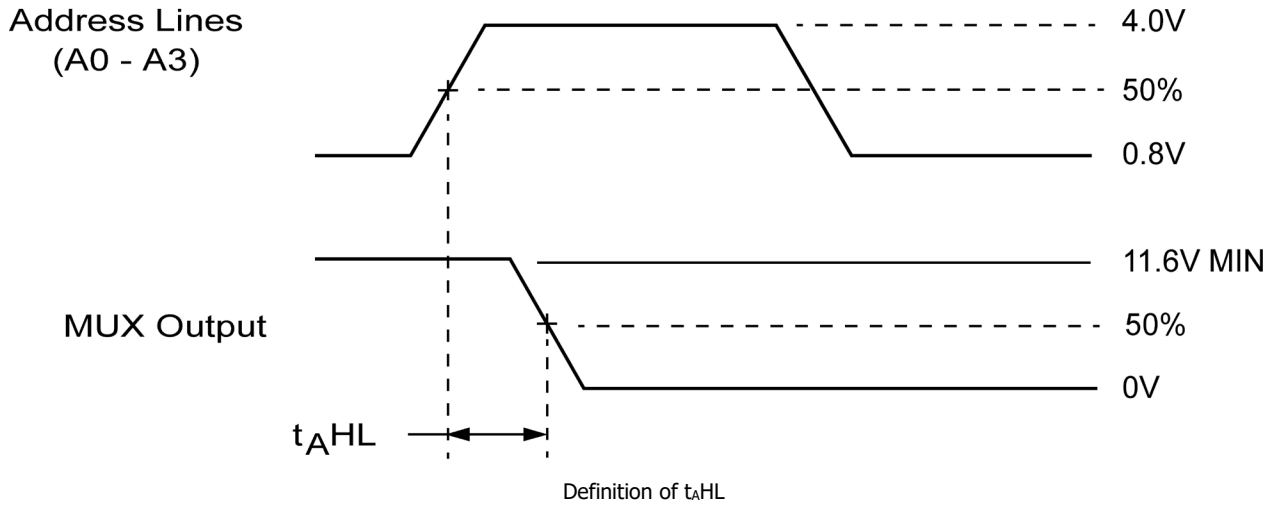
A3	A2	A1	A0	EN(32-47)	"ON" Channel <u>1</u> /
X	X	X	X	H	NONE
L	L	L	L	L	CH32
L	L	L	H	L	CH33
L	L	H	L	L	CH34
L	L	H	H	L	CH35
L	H	L	L	L	CH36
L	H	L	H	L	CH37
L	H	H	L	L	CH38
L	H	H	H	L	CH39
H	L	L	L	L	CH40
H	L	L	H	L	CH41
H	L	H	L	L	CH42
H	L	H	H	L	CH43
H	H	L	L	L	CH44
H	H	L	H	L	CH45
H	H	H	L	L	CH46
H	H	H	H	L	CH47

1/ Between CH32-47 and OUTPUT (32-47) and CURRENT (32-47)

SCD8502

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ACT8502



NOTE: $f = 10\text{KHz}$, Duty cycle = 50%.

SCD8502

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ACT8502

Pin Numbers & Functions

ACT8502 – 96 Leads Ceramic QUAD Flat Pack					
Pin #	Function	Pin #	Function	Pin #	Function
1	A2	33	CH11	65	CH33
2	NC	34	NC	66	CH32
3	A3	35	CH12	67	Output I(32-476)
4	NC	36	NC	68	Output V(32-47)
5	\overline{EN} 0-15	37	CH13	69	Output I(16-31)
6	NC	38	NC	70	Output V(16-31)
7	CH0	39	CH14	71	GND
8	NC	40	NC	72	GND
9	CH1	41	CH15	73	CH31
10	NC	42	NC	74	CH30
11	CH2	43	NC	75	CH29
12	NC	44	+V _{EE}	76	CH28
13	CH3	45	NC	77	CH27
14	NC	46	-V _{EE}	78	CH26
15	CH4	47	NC	79	CH25
16	NC	48	V _{REF}	80	CH24
17	CH5	49	NC	81	CH23
18	NC	50	CASE GND	82	CH22
19	CH6	51	CH47	83	CH21
20	NC	52	CH46	84	CH20
21	CH7	53	CH45	85	CH19
22	NC	54	CH44	86	CH18
23	GND	55	CH43	87	CH17
24	GND	56	CH42	88	CH16
25	Output V(0-15)	57	CH41	89	GND
26	Output I(0-15)	58	CH40	90	GND
27	CH8	59	CH39	91	\overline{EN} 32-47
28	NC	60	CH38	92	\overline{EN} 16-31
29	CH9	61	CH37	93	A0
30	NC	62	CH36	94	NC
31	CH10	63	CH35	95	A1
32	NC	64	CH34	96	NC

Note:

- 1) It is recommended that all "NC or "no connect pin" be grounded. This eliminates or minimizes any ESD or static buildup.

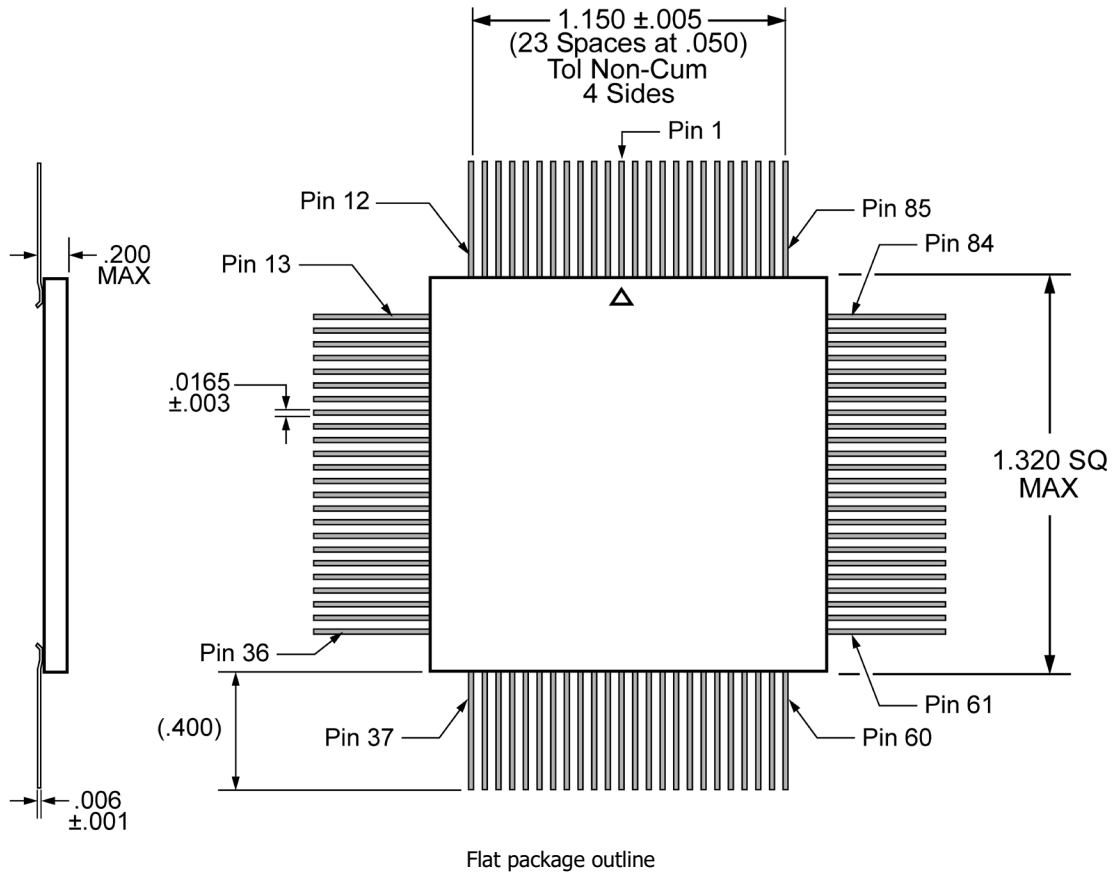
SCD8502

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ACT8502

Ordering Information

Model Number	DLA SMD #	Screening	Package
ACT8502-7	-	Commercial Flow, +25°C testing only	QUAD Flat Pack
ACT8502-S	5962-0323401KXC	In accordance with DLA SMD	
ACT8502-901-1S	5962F0323401KXC	In accordance with DLA Certified RHA Program Plan to RHA Level "F", 300krads(Si)	



Note:

- 1) Outside ceramic tie bars not shown for clarity. Contact factory for details.

REVISION HISTORY

Date	Rev. #	Change Description	Initials
12/8/08	G	REVISED PER ECN 8502-11	KAM
5/15/14	H	REVISED PER ECN 8502-15	KM
3/4/21	J	REVISED PER ECN 23534	

Datasheet Definitions

	DEFINITION
Advanced Datasheet	CAES reserves the right to make changes to any products and services described herein at any time without notice. The product is still in the development stage and the datasheet is subject to change . Specifications can be TBD and the part package and pinout are not final .
Preliminary Datasheet	CAES reserves the right to make changes to any products and services described herein at any time without notice. The product is in the characterization stage and prototypes are available.
Datasheet	Product is in production and any changes to the product and services described herein will follow a formal customer notification process for form, fit or function changes.

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