DG406/407

Siliconix incorporated

T-51-12

16-Channel/Dual 8-Channel High Performance CMOS Analog Multiplexers

FEATURES

- Low $r_{DS(ON)}$ (100 Ω max)
- Low Charge Injection (Q <20 pC typ.)
- Fast Transition Time (250 ns max)
- Low Power (I_{SUPPLY} <75 µA)
- Single Supply Capability
- ESD Protection > ±4000 V

BENEFITS

- Reduced Switching Errors
- Reduced Glitching
- Improved Data Throughput
- Reduced Power Consumption
- Increased Ruggedness

APPLICATIONS

- Data Acquisition Systems
- Audio Signal Routing and Multiplexing/Demultiplexing
- ATE Systems
- Battery Operated Systems
- High Rel Systems
- Single Supply Systems

DESCRIPTION

The DG406 is a 16-channel single-ended analog multiplexer designed to connect 1 of 16 inputs to a common output as determined by a 4-bit binary address. The DG407 is an 8-channel differential analog multiplexer designed to connect 1 of 8 differential inputs to a common dual output as determined by its 3-bit binary address. Break-before-make switching action protects against momentary shorting of inputs.

An ON channel conducts current equally well in both directions. In the OFF state each channel blocks voltages up to the power supply rails. An enable (EN) function allows the user to reset the multiplexer/demultiplexer to all switches OFF for stacking several devices. All control inputs, address (A_X) and enable (EN) are TTL compatible over the full specified operating temperature range.

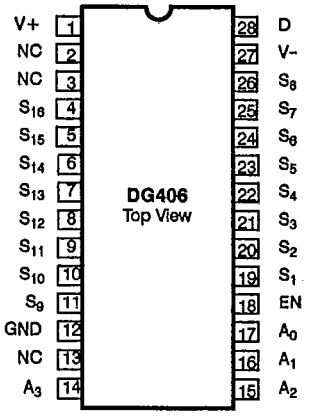
Applications for the DG406/407 include high speed data acquisition, audio signal switching and routing, ATE systems, and avionics. High performance and low power dissipation make them ideal for battery operated and remote instrumentation applications.

Designed in the 44 V silicon-gate CMOS process, the absolute maximum voltage rating is extended to 44 volts, allowing operation with ±20-Volt supplies. Additionally single (12 V) supply operation is allowed. An epitaxial layer prevents latchup.

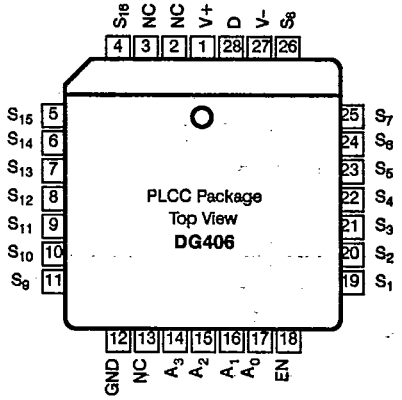
Both DG406 and DG407 are available in dual-in-line ceramic and plastic packages and are specified for operation over the military, A suffix (-55 to 125°C) and industrial, D suffix (-40 to 85°C) temperature ranges.

PIN CONFIGURATION

Dual-In-Line Package

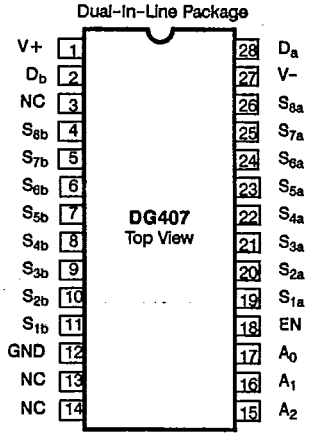


Order Numbers:
CerDIP: DG406AK
Plastic: DG406DJ



Order Number:
DG406DN

Dual-In-Line Package



Order Numbers:
CerDIP: DG407AK
Plastic: DG407DJ

Preliminary

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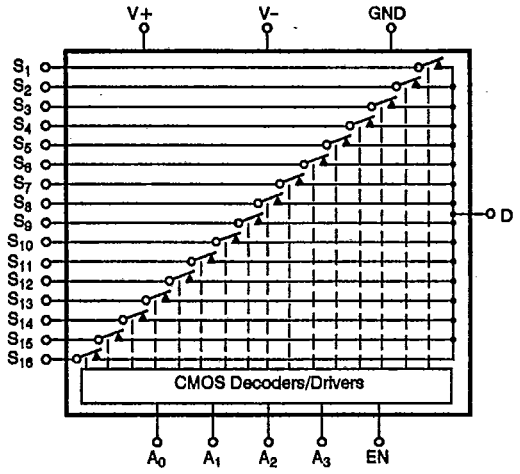
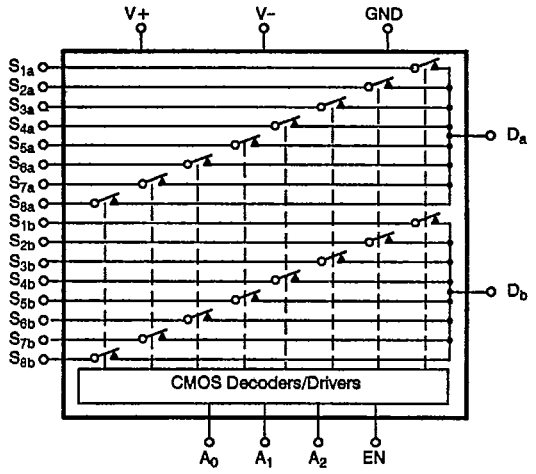
FUNCTIONAL BLOCK DIAGRAM



DG406
16-Channel Single Ended Multiplexer



DG407
Differential 8-Channel Multiplexer

A_3	A_2	A_1	A_0	EN	ON Switch
X	X	X	X	0	None
0	0	0	0	1	1
0	0	0	1	1	2
0	0	1	0	1	3
0	0	1	1	1	4
0	1	0	0	1	5
0	1	0	1	1	6
0	1	1	0	1	7
0	1	1	1	1	8
1	0	0	0	1	9
1	0	0	1	1	10
1	0	1	0	1	11
1	0	1	1	1	12
1	1	0	0	1	13
1	1	0	1	1	14
1	1	1	0	1	15
1	1	1	1	1	16

A_2	A_1	A_0	EN	ON Switch
X	X	X	0	None
0	0	0	1	1
0	0	1	1	2
0	1	0	1	3
0	1	1	1	4
1	0	0	1	5
1	0	1	1	6
1	1	0	1	7
1	1	1	1	8

Logic "0" = $V_{AL} \leq 0.8$ V, Logic "1" = $V_{AH} \geq 2.4$ V

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ABSOLUTE MAXIMUM RATINGS

Voltage Referenced to V–

V+ ..... 44 V

GND ..... 25 V

Digital Inputs [h], V_S, V_D ..... (V–) –2 V to (V+) +2 V or 20 mA, whichever occurs first.

Current (Any Terminal, Except S or D) ..... 30 mA

Continuous Current, S or D ..... 20 mA

Peak Current, S or D
(Pulsed at 1 ms, 10% Duty Cycle Max) ..... 40 mA

Operating Temperature (A Suffix) ..... –55 to 125°C
(D Suffix) ..... –40 to 85°C

Storage Temperature (A Suffix) ..... –65 to 150°C
(D Suffix) ..... –65 to 125°C

Power Dissipation (Package)*
28-Pin Ceramic DIP** ..... 1200 mW
28-Pin Plastic DIP*** ..... 625 mW

*All leads soldered or welded to PC board.
**Derate 12 mW/°C above 75°C.
***Derate 6 mW/°C above 75°C.

Preliminary

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SPECIFICATIONS[a]

PARAMETER		SYMBOL	TEST CONDITIONS Unless Otherwise Specified V+ = 15 V, V− = −15 V, V_{AL} = 0.8 V, V_{AH} = 2.4 V		TEMP[i]	TYP[d]	A SUFFIX −55 to 125°C MIN[b]	A SUFFIX −55 to 125°C MAX[b]	D SUFFIX −40 to 85°C MIN[b]	D SUFFIX −40 to 85°C MAX[b]	UNIT
ANALOG SWITCH											
Analog Signal Range[c]		V_{ANALOG}			Full		−15	15	−15	15	V
Drain-Source ON-Resistance[e]		$r_{DS(ON)}$	V_D = ±10 V, I_S = −1 mA		Room Full	50		100 125		100 125	Ω
$r_{DS(ON)}$ Matching Between Channels[f]		$\Delta r_{DS(ON)}$	V_D = 10 V, −10 V		Room			15		15	
Source OFF Leakage Current		$I_{S(OFF)}$	V_{EN} = 0 V	V_S = ±10 V, V_D = ∓10 V	Room Full		−0.5 −50	0.5 50	−0.5 −50	0.5 50	nA
Drain OFF Leakage Current	DG406	$I_{D(OFF)}$		V_D = ±10 V, V_S = ∓10 V	Room Full		−2 −200	2 200	−2 −200	2 200	
	DG407			V_D = ±10 V, V_S = ∓10 V	Room Full		−2 −100	2 100	−2 −100	2 100	
Drain ON Leakage Current	DG406	$I_{D(ON)}$	V_S = V_D = ±10 V, Sequence Each Switch ON		Room Full		−2 −200	2 200	−2 −200	2 200	
	DG407				Room Full		−2 −100	2 100	−2 −100	2 100	
DIGITAL CONTROL											
Logic High Input Current		I_{AH}	V_A = 2.4 V, 15 V		Full		−10	10	−10	10	µA
Logic Low Input Current		I_{AL}	V_{EN} = 0 V, 2.4 V, V_A = 0 V		Full		−10	10	−10	10	
DYNAMIC CHARACTERISTICS											
Transition Time		t_{TRANS}	See Figure 1		Room			250		250	ns
Break-Before-Make Interval		t_{OPEN}	See Figure 3		Room		10		10		
Enable Turn-ON Time		$t_{ON(EN)}$	See Figure 2		Room			200		200	
Enable Turn-OFF Time		$t_{OFF(EN)}$			Room			150		150	
Charge Injection		Q	C_L = 1 nF, V_S = 0 V, R_s = 0 Ω		Room	20					pC
OFF Isolation[g]			V_{EN} = 0 V, R_L = 1 kΩ, f = 100 kHz		Room	−65					dB
Logic Input Capacitance		C_{in}	f = 1 MHz		Room	8					pF
Source OFF Capacitance		$C_{S(OFF)}$	V_{EN} = 0 V, f = 1 MHz	V_S = 0 V	Room	11					
Drain OFF Capacitance	DG406	$C_{D(OFF)}$		V_D = 0 V	Room	70					
	DG407				Room	35					
Drain ON Capacitance	DG406	$C_{D(ON)}$			Room	100					
	DG407				Room	50					

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SPECIFICATIONS[a]

PARAMETER	SYMBOL	TEST CONDITIONS Unless Otherwise Specified V+ = 15 V, V- = -15 V, V_{AL} = 0.8 V, V_{AH} = 2.4 V	TEMP[l]	TYP[d]	A SUFFIX -55 to 125°C MIN[b]	A SUFFIX -55 to 125°C MAX[b]	D SUFFIX -40 to 85°C MIN[b]	D SUFFIX -40 to 85°C MAX[b]	UNIT
POWER SUPPLIES									
Positive Supply Current	I+	V_{EN} = 0 V, V_A = 0 V	Full			75		75	µA
Negative Supply Current	I-		Full		-5		-5		
Positive Supply Current	I+	V_{EN} = 2.4 V, V_A = 0 V	Room Full			0.5 2		0.5 2	mA
Negative Supply Current	I-		Full		-500		-500		µA

SPECIFICATIONS[a] (Single Supply)

PARAMETER	SYMBOL	TEST CONDITIONS Unless Otherwise Specified V+ = 12 V, V- = 0 V, V_{AL} = 0.8 V, V_{AH} = 2.4 V	TEMP[l]	TYP[d]	A SUFFIX -55 to 125°C MIN[b]	A SUFFIX -55 to 125°C MAX[b]	D SUFFIX -40 to 85°C MIN[b]	D SUFFIX -40 to 85°C MAX[b]	UNIT
ANALOG SWITCH									
Drain-Source ON Resistance[e]	$r_{DS(ON)}$	V_D = 3 V, 10 V I_S = - 1 mA	Room	90					Ω
DYNAMIC CHARACTERISTICS									
Switching Time of Multiplexer	t_{TRANS}	V_{S1} = 8 V, V_{S8} = 0 V V_{IN} = 2.4 V	Room	300					ns
Enable Turn ON Time	$t_{ON(EN)}$	V_{INH} = 2.4 V, V_{INL} = 0 V	Room	250					
Enable Turn OFF Time	$t_{OFF(EN)}$	V_{S1} = 5 V	Room	150					
Charge Injection	Q	C_L = 1 nF, V_S = 6 V, R_S = 0 Ω	Room	5					pC

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NOTES:
a. Refer to PROCESS OPTION FLOWCHART for additional information.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Guaranteed by design, not subject to production test.
d. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
e. Sequence each switch ON.
f. $\Delta r_{DS(ON)} = r_{DS(ON)}$ MAX - $r_{DS(ON)}$ MIN
g. Worst case isolation occurs on channel 4 due to proximity to the drain pin.
h. Signals on S_X, D_X, on IN_X exceeding V+ or V- will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
i. Room = 25°C, Full = as determined by the operating temperature suffix.