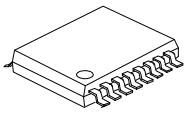
CMOS, 1.8V to 5.5V/±2.5V, 3Ω LOW VOLTAGE 4-CHANNEL MULTIPLEXERS



TSSOP-16

■ DESCRIPTION

The UTC **UDG709** is low voltage, CMOS analog multiplexers comprising four differential channels. The UTC **UDG709** switches one of four differential inputs to a common differential output as determined by the 2-bit binary address lines A0 and A1. An EN input on both devices is used to enable or disable the device. When disabled, all channels are switched off.

The switch provides low power dissipation yet gives high switching speed, very low on resistance, and leakage currents. Low power consumption and an operating supply range of 1.8V to 5.5V make the UTC **UDG709** ideal for battery-powered, portable instruments. All channels exhibit break-before-make switching action preventing momentary shorting when switching channels.

On resistance is in the region of a few ohms and is closely matched between switches and very flat over the full signal range. These parts can operate equally well as either multiplexers or demultiplexers and have an input signal range that extends to the supplies.

■ FEATURES

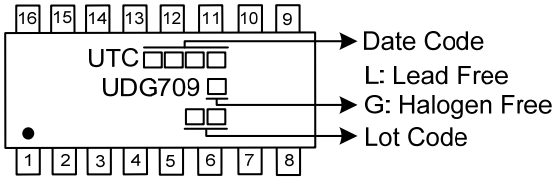
* Differential 4-to-1 multiplexer
* 1.8V to 5.5V single supply
* ±2.5V dual supply
* TTL-/CMOS-compatible inputs
* 20ns switching times

■ ORDERING INFORMATION

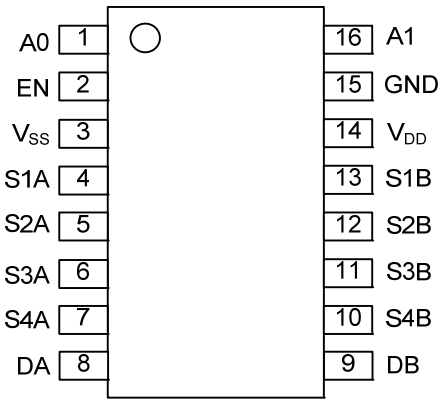
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UDG709L-P16-R	UDG709G-P16-R	TSSOP-16	Tape Reel

UDG709G-P16-R (1)Packing Type (2)Package Type (3)Green Package	(1) R: Tape Reel (2) P16: TSSOP-16 (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



■ PIN CONFIGURATION



■ PIN DESCRIPTION

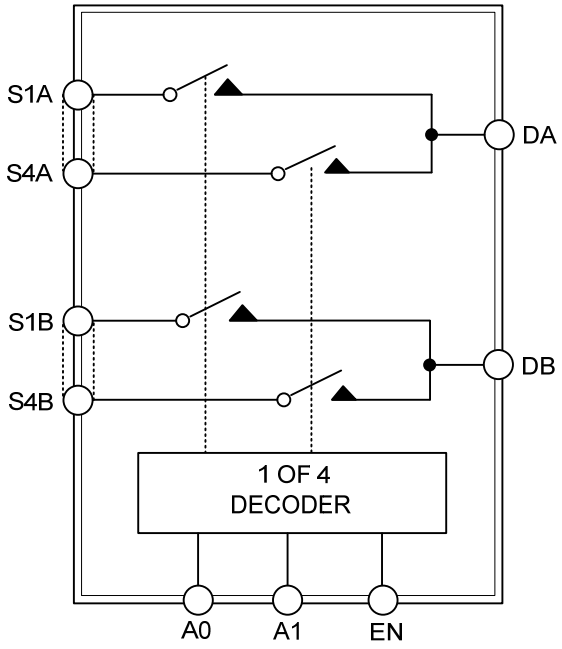
PIN NO.	PIN NAME	DESCRIPTION
1	A0	Digital Input. Controls the configuration of the switch, as shown in the truth table.
2	EN	Digital Input. Controls the configuration of the switch, as shown in the truth table.
3	V_{SS}	Most Negative Power Supply Pin in Dual-Supply Applications. For single-supply applications, it should be tied to GND
4	S1A	Source Terminal. Can be an input or output
5	S2A	Source Terminal. Can be an input or output
6	S3A	Source Terminal. Can be an input or output
7	S4A	Source Terminal. Can be an input or output
8	DA	Drain Terminal. Can be an input or output
9	DB	Drain Terminal. Can be an input or output
10	S4B	Source Terminal. Can be an input or output
11	S3B	Source Terminal. Can be an input or output
12	S2B	Source Terminal. Can be an input or output
13	S1B	Source Terminal. Can be an input or output
14	V_{DD}	Most Positive Power Supply Pin
15	GND	Ground (0 V) Reference
16	A1	Digital Input. Controls the configuration of the switch, as shown in the truth table.

■ TRUTH TABLE

A1	A0	EN	On Switch Pair
X	X	0	None
0	0	1	1
0	1	1	2
1	0	1	3
1	1	1	4

Note: X = Don't care.

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
V_{DD} to V_{SS}		7	V
V_{DD} to GND		-0.3 ~ +7	V
V_{SS} to GND		+0.3 ~ -3.5	V
Analog Inputs (Note 1)		V_{SS} - 0.3 to V_{DD} + 0.3 or 30mA, whichever occurs first	V
Digital Inputs		-0.3 to V_{DD} + 0.3 or 30mA, whichever occurs first	V
Continuous Current, S or D		30	mA
Power Dissipation		450	mW
Junction Temperature	T_J	+150	°C
Storage Temperature	T_{STG}	-65 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Overvoltages at A, EN, S, or D are clamped by internal codes. Current should be limited to the maximum ratings given.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Positive Power Supply Voltage	V_{DD}	1.8		5.5	V
Signal Path Input/Output Voltage (Source or Drain Pin) (Sx, D)	V_S or V_D	0		V_{DD}	V
Ambient Temperature	T_A	-40		+125	°C

■ ELECTRICAL CHARACTERISTICS

(V_{DD}=5V±10%, V_{SS}=0V, GND=0V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
ANALOG SWITCH							
Analog Signal Range	V_S	T_A=-40°C~+125°C		0		V_{DD}	V
On-Resistance	R_{ON}	V_S=0V ~ V_{DD}, I_{DS}=10mA	T_A=25°C		6	9.2	Ω
			T_A=-40°C ~ +125°C			11.7	Ω
On-Resistance Matching Between Channels	ΔR_{ON}	V_S=0V ~ V_{DD}, I_{DS}=10mA	T_A=25°C		0.4		Ω
			T_A=-40°C ~ +125°C			1.5	Ω
On-Resistance Flatness	$R_{FLAT (ON)}$	V_S=0V ~ V_{DD}, I_{DS}=10mA	T_A=25°C		1.5		Ω
			T_A=-40°C ~ +125°C		2		Ω
LEAKAGE CURRENTS							
Source Off Leakage Current	$I_{S(OFF)}$	V_{DD}=5.5V, V_D=4.5V / 1V, V_S=1V / 4.5V	T_A=25°C		±0.01		nA
			T_A=-40°C ~ +125°C			±200	nA
Drain Off Leakage Current	$I_{D(OFF)}$	V_D=4.5V / 1V, V_S=1V / 4.5V	T_A=25°C		±0.01		nA
			T_A=-40°C ~ +125°C			±200	nA
Channel On Leakage Current	$I_{D(ON)}$, $I_{S(ON)}$	V_D =V_S=1V or 4.5V	T_A=25°C		±0.01		nA
			T_A=-40°C ~ +125°C			±500	nA
DIGITAL INPUTS							
Input High Voltage	V_{INH}	T_A=-40°C ~ +125°C		2.4			V
Input Low Voltage	V_{INL}	T_A=-40°C ~ +125°C				0.8	V
Input Current	I_{INL} or I_{INH}	V_{IN}=V_{INL} or V_{INH}, T_A=25°C			0.05		μA
Input Current	I_{INL} or I_{INH}	T_A=-40°C ~ +125°C				±0.1	μA
Digital Input Capacitance	C_{IN}	T_A=25°C			2		pF
DYNAMIC CHARACTERISTICS (Note 1)							
Transition Time between Channels	$t_{TRANSITION}$	R_L=300Ω, C_L=35pF, V_{S1}=3V/0V, V_{S4}= 0V/3V	T_A=25°C		20		ns
			T_A=-40°C ~ +125°C			30	ns
Break-Before-Make Time Delay	t_{OPEN}	R_L=300Ω, C_L=35pF, V_S=3V	T_A=25°C		8		ns
			T_A=-40°C ~ +125°C	1			ns
Turn-On Time	$t_{ON (EN)}$	R_L=300Ω, C_L=35pF, V_S=3V	T_A=25°C		18		ns
			T_A=-40°C ~ +125°C			30	ns
Turn-Off Time	$t_{OFF (EN)}$	R_L=300Ω, C_L=35pF, V_S=3V	T_A=25°C		7		ns
			T_A=-40°C ~ +125°C			15	ns
Charge Injection	Q_C	V_S=2.5V, R_S=0Ω, C_L=1nF, T_A=25°C			±3		pC
Off Isolation	O_{ISO}	R_L=50Ω, C_L=5pF, f=10MHz, T_A=25°C			-55		dB
		R_L=50Ω, C_L=5pF, f=1MHz, T_A=25°C			-70		dB
DYNAMIC CHARACTERISTICS							
Channel-to-Channel Crosstalk	X_{TALK}	R_L=50Ω, C_L=5pF, f=10MHz, T_A=25°C			-55		dB
		R_L=50Ω, C_L=5pF, f=1MHz, T_A=25°C			-70		dB
-3dB Bandwidth	BW	R_L=50Ω, C_L=5pF, T_A=25°C			50		MHz
Source Off Capacitance	C_{SOFF}	f=1MHz, T_A=25°C			13		pF
Drain Off Capacitance	C_{DOFF}	f=1MHz, T_A=25°C			42		pF
On Capacitance	C_{SON}, C_{DON}	f=1MHz, T_A=25°C			48		pF
POWER REQUIREMENTS							
V_{DD} Supply Current	I_{DD}	V_{DD}=5.5V, Digital Inputs=0V or 5.5V	T_A=25°C		0.03		μA
			T_A=-40°C ~ +125°C			1.0	μA

Note: Guaranteed by design, not subject to production test.

■ ELECTRICAL CHARACTERISTICS

(V_{DD}=3V±10%, V_{SS}=0V, GND=0V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
ANALOG SWITCH							
Analog Signal Range	V_S	T_A=-40°C~+125°C		0		V_{DD}	V
On-Resistance	R_{ON}	V_S=0V ~ V_{DD}, I_{DS} =10mA	T_A =25°C		8	11.5	Ω
			T_A=-40°C ~ +125°C			14.5	Ω
On-Resistance Matching Between Channels	ΔR_{ON}	V_S=0V ~ V_{DD}, I_{DS}=10mA	T_A =25°C		0.4		Ω
			T_A=-40°C ~ +125°C			2	Ω
LEAKAGE CURRENTS							
Source Off Leakage Current	$I_{S(OFF)}$	V_{DD}=3.3V, V_S=3V / 1V, V_D=1V / 3V	T_A =25°C		±0.01		nA
			T_A=-40°C ~ +125°C			±200	nA
Drain Off Leakage Current	$I_{D(OFF)}$	V_S=3V / 1V, V_D=1V / 3V	T_A =25°C		±0.01		nA
			T_A=-40°C ~ +125°C			±200	nA
Channel On Leakage Current	$I_{D(ON)}$, $I_{S(ON)}$	V_D =V_S=1V or 3V	T_A =25°C		±0.01		nA
			T_A=-40°C ~ +125°C			±500	nA
DIGITAL INPUTS							
Input High Voltage	V_{INH}	T_A=-40°C ~ +125°C		2.0			V
Input Low Voltage	V_{INL}	T_A=-40°C ~ +125°C				0.66	V
Input Current	I_{INL} or I_{INH}	V_{IN}=V_{INL} or V_{INH}, T_A =25°C			0.05		μA
Input Current	I_{INL} or I_{INH}	T_A=-40°C ~ +125°C				±0.1	μA
Digital Input Capacitance	C_{IN}	T_A =25°C			2		pF
DYNAMIC CHARACTERISTICS (Note 1)							
Transition Time between Channels	$t_{TRANSITION}$	R_L=300Ω, C_L=35pF, V_{S1}=2V/0V, V_{S2}= 0V/2V	T_A =25°C		25		ns
			T_A=-40°C ~ +125°C			35	ns
Break-Before-Make Time Delay	t_{OPEN}	R_L=300Ω, C_L=35pF, V_S=2V	T_A =25°C		8		ns
			T_A=-40°C ~ +125°C	1			ns
Turn-On Time	$t_{ON\ (EN)}$	R_L=300Ω, C_L=35pF, V_S=2V	T_A =25°C		20		ns
			T_A=-40°C ~ +125°C			33	ns
Turn-Off Time	$t_{OFF\ (EN)}$	R_L=300Ω, C_L=35pF, V_S=2V	T_A =25°C		9		ns
			T_A=-40°C ~ +125°C			18	ns
Charge Injection	Q_C	V_S=1.5V, R_S=0Ω, C_L=1nF, T_A=25°C			±3		pC
Off Isolation	O_{ISO}	R_L=50Ω, C_L=5pF, f=10MHz, T_A=25°C			-55		dB
		R_L=50Ω, C_L=5pF, f=1MHz, T_A=25°C			-70		dB
DYNAMIC CHARACTERISTICS							
Channel-to-Channel Crosstalk	X_{TALK}	R_L=50Ω, C_L=5pF, f=10MHz, T_A =25°C			-55		dB
		R_L=50Ω, C_L=5pF, f=1MHz, T_A =25°C			-70		dB
-3dB Bandwidth	BW	R_L=50Ω, C_L=5pF, T_A =25°C			50		MHz
Source Off Capacitance	C_{SOFF}	f=1MHz, T_A =25°C			13		pF
Drain Off Capacitance	C_{DOFF}	f=1MHz, T_A =25°C			42		pF
On Capacitance	C_{SON}, C_{DON}	f=1MHz, T_A =25°C			48		pF
POWER REQUIREMENTS							
V_{DD} Supply Current	I_{DD}	V_{DD}=3.3V, Digital Inputs=0V or 3.3V	T_A =25°C		0.01		μA
			T_A=-40°C ~ +125°C			1.0	μA

Note: Guaranteed by design, not subject to production test.

■ ELECTRICAL CHARACTERISTICS

(V_{DD}=2.5V±10%, V_{SS}=-2.5V±10%, GND=0V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
ANALOG SWITCH							
Analog Signal Range	V_S	T_A=-40°C~+125°C		V_{SS}		V_{DD}	V
On-Resistance	R_{ON}	V_S=V_{SS} ~ V_{DD}, I_{DS}=10mA	T_A=25°C		6.0	9.2	Ω
			T_A=-40°C ~ +125°C			11.7	Ω
On-Resistance Matching Between Channels	ΔR_{ON}	V_S=V_{SS} ~ V_{DD}, I_{DS}=10mA	T_A=25°C		0.4		Ω
			T_A=-40°C ~ +125°C			1.5	Ω
On-Resistance Flatness	$R_{FLAT (ON)}$	V_S=V_{SS} ~ V_{DD}, I_{DS}=10mA	T_A=25°C		2.5		Ω
			T_A=-40°C ~ +125°C		3		Ω
LEAKAGE CURRENTS							
Source Off Leakage Current	$I_{S(OFF)}$	V_{DD}=+2.75V, V_{SS}=-2.75V, V_S=+2.25V/-1.25V, V_D=−1.25V/+2.25V	T_A=25°C		±0.01		nA
			T_A=-40°C ~ +125°C			±200	nA
Drain Off Leakage Current	$I_{D(OFF)}$	V_S=+2.25V/-1.25V, V_D=-1.25V/+2.25V	T_A=25°C		±0.01		nA
			T_A=-40°C ~ +125°C			±200	nA
Channel On Leakage Current	$I_{D(ON)}$ $I_{S(ON)}$	V_S=V_D=+2.25V/-1.25V	T_A=25°C		±0.01		nA
			T_A=-40°C ~ +125°C			±500	nA
DIGITAL INPUTS							
Input High Voltage	V_{INH}	T_A=-40°C~+125°C		1.7			V
Input Low Voltage	V_{INL}	T_A=-40°C~+125°C				0.7	V
Input Current	I_{INL} or I_{INH}	V_{IN}=V_{INL} or V_{INH}, T_A=25°C			0.03		μA
Input Current	I_{INL} or I_{INH}	T_A=-40°C~+125°C				±0.1	μA
Digital Input Capacitance	C_{IN}	T_A=25°C			2		pF
DYNAMIC CHARACTERISTICS (Note 1)							
Transition Time between Channels	$t_{TRANSITION}$	R_L=300Ω, C_L=35pF, V_S=1.5V/0V	T_A=25°C		20		ns
			T_A=-40°C ~ +125°C			30	ns
Break-Before-Make Time Delay	t_{OPEN}	R_L=300Ω, C_L=35pF, V_S=1.5V	T_A=25°C		8		ns
			T_A=-40°C ~ +125°C	1			ns
Turn-On Time	$t_{ON (EN)}$	R_L=300Ω, C_L=35pF, V_S =1.5V	T_A=25°C		20		ns
			T_A=-40°C ~ +125°C			30	ns
Turn-Off Time	$t_{OFF (EN)}$	R_L=300Ω, C_L=35pF, V_S=1.5V	T_A=25°C		9		ns
			T_A=-40°C ~ +125°C			18	ns
Charge Injection	Q_C	V_S=0V, R_S=0Ω, C_L=1nF, T_A=25°C			±3		pC
Off Isolation	O_{ISO}	R_L=50Ω, C_L=5pF, f=10MHz, T_A=25°C			-55		dB
		R_L=50Ω, C_L=5pF, f=1MHz, T_A=25°C			-70		dB
DYNAMIC CHARACTERISTICS							
Channel-to-Channel Crosstalk	X_{TALK}	R_L=50Ω, C_L=5pF, f=10MHz, T_A=25°C			-55		dB
		R_L=50Ω, C_L=5pF, f=1MHz, T_A=25°C			-70		dB
-3dB Bandwidth	BW	R_L=50Ω, C_L=5pF, T_A=25°C			50		MHz
Source Off Capacitance	C_{SOFF}	f=1MHz, T_A=25°C			13		pF
Drain Off Capacitance	C_{DOFF}	f=1MHz, T_A=25°C			42		pF
On Capacitance	C_{SON} C_{DON}	f=1MHz, T_A=25°C			48		pF
POWER REQUIREMENTS							
V_{DD} Supply Current	I_{DD}	V_{DD}=2.75V, Digital Inputs=0V or 2.75V	T_A=25°C		0.03		μA
			T_A=-40°C ~ +125°C			1.0	μA
V_{SS} Supply Current	I_{SS}	V_{SS}=-2.75V, Digital Inputs=0V or 2.75V	T_A=25°C		0.03		μA
			T_A=-40°C ~ +125°C			1.0	μA

Note: Guaranteed by design, not subject to production test.

■ TYPICAL CHARACTERISTICS