DATASHEET

0.5Ω LOW VOLTAGE, QUAD SPDT ANALOG SWITCH

IDTAS3699A

Description

The IDTAS3699A quad single-pole/double-throw (SPDT) analog switch operates from a single +1.65 V to +4.3 V supply and responds to TTL control input levels. Additional features include fast switching speed and break-before-make delay time. This product is available in 3x3mm and 2.5x2.5mm 16-pin QFN packages.

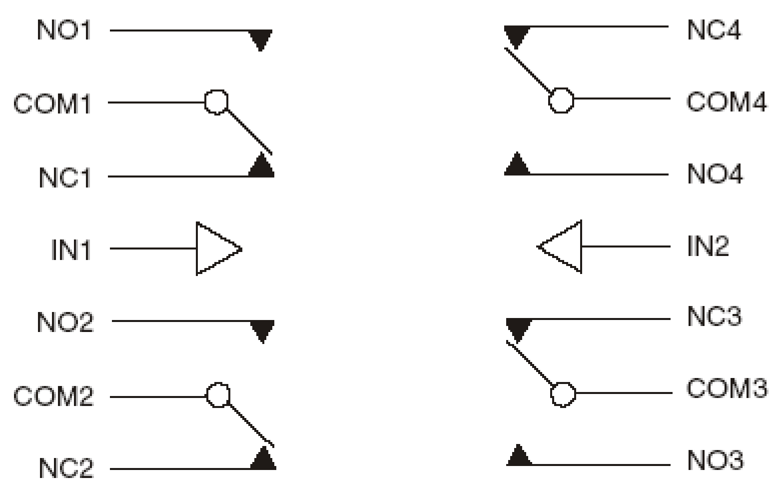
Applications

- Speaker headset switching
- MP3 players
- Battery-operated equipment
- Audio and video signal routing
- PCMCIA cards
- Cellular phones
- Modems

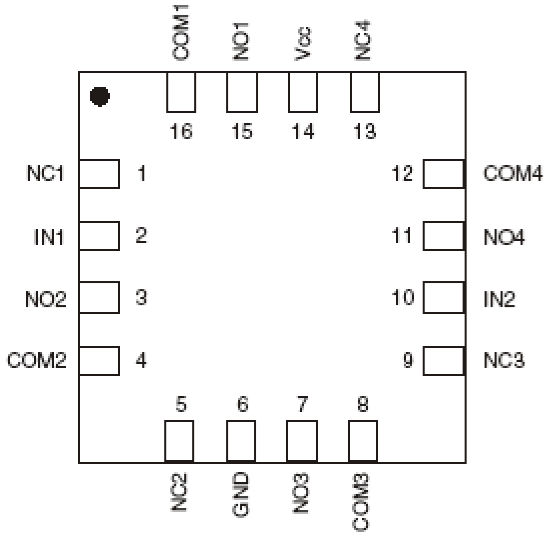
Features

- High Speed:
  - t_{PD} = 0.3 ns (typ.) at V_{CC} = 3 V
  - t_{PD} = 0.4 ns (typ.) at V_{CC} = 2.3 V
- Low “ON” resistance VIN = 0V:
  - R_{ON} = 0.5Ω (max. T_A = 25°C) at V_{CC} = 2.7 V
  - R_{ON} = 0.7Ω (max. T_A = 25°C) at V_{CC} = 2.3 V
  - R_{ON} = 1.5Ω (max. T_A = 25°C) at V_{CC} = 1.8 V
- Wide operating voltage range:
  - V_{CC} (OPR) = 1.65 V to 4.3 V single supply
- 4.3 V tolerant and 1.8 V compatible threshold on digital control input at V_{CC} = 2.3 to 3 V
- Latch-up performance exceeds 300 mA (JESD 17)
- Available in 3x3mm and 2.5x2.5mm 16-pin QFN packages

Block Diagram



Pin Assignment



QFN
TOP VIEW

Truth Table

IN1	IN2	ON Switches
L	—	NC1-COM1, NC2-COM2
H	—	NO1-COM1, NO2-COM2
—	L	NC3-COM3, NC4-COM4
—	H	NO3-COM3, NO4-COM4

Pin Descriptions

Pin Numbers	Pin Names	Pin Description
3, 7, 11, 15	NO1 - NO4	Analog switch normally open.
1, 5, 9, 13	NC1 - NC4	Analog switch normally closed.
4, 8, 12, 16	COM1 - COM4	Analog switch common to terminal.
2, 10	IN1, IN2	Digital control input.
14	VCC	Positive supply voltage input.
6	GND	Ground.

Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the IDTAS3699A. These ratings, which are standard values for IDT commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range. All voltages referenced to ground.

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.5 to 4.6	V
V_I	DC Input Voltage	-0.5 to V_{CC} +0.5	V
V_{IC}	DC Control Input Voltage	-0.5 to 4.6	mA
V_O	DC Output Voltage	-0.5 to V_{CC} +0.5	
I_{IKC}	DC Input Diode Current on control pin (V_{IN} < 0V)	-50	mA
I_{IK}	DC Input Diode Current (V_{IN} < 0V)	±50	mA
I_{OK}	DC Output Diode Current	±20	mA
I_O	DC Output Current	±300	mA
I_{OP}	DC Output Current Peak (pulse at 1 ms, 10% duty cycle)	±500	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	±100	mA
P_D	Power Dissipation at T_A = 70°C (Note 1)	1120	mW
T_{STG}	Storage temperature range	-65 to 150	°C
T_L	Lead Temperature (10 sec)	300	°C

Note 1: Derate above 70°C: by 18.5 mW/°C

Recommended Operating Conditions

Symbol	Parameter		Value	Unit
V_{CC}	Supply Voltage		1.65 to 4.3	V
V_I	Input Voltage		0 to V_{CC}	V
V_{IC}	Control Input Voltage		0 to 4.3	V
V_O	Output Voltage		0 to V_{CC}	V
T_{OP}	Operating Temperature		-55 to 125	°C
dt/dv	Input Rise and Fall Time Control Input	V_{CC} = 1.65 V to 2.7 V	0 to 20	ns/V
		V_{CC} = 3 V to 4.3 V	0 to 10	

DC Electrical Characteristics

Unless stated otherwise, **C_L = 35 pF, R_L = 50Ω, tr = tf ≤ 5ns, T_A = 25°C**

Parameter	Symbol	Conditions		Value					Unit
				T_A			0 to 70°C		
		V_{CC} (V)		Min.	Typ.	Max.	Min	Max	
HIGH Level Input Voltage	V_{IH}	1.65 - 1.95		0.65V_{CC}			0.65V_{CC}		V
		2.3 - 2.5		1.0			1.2		
		2.7 - 3		1.1			1.3		
		3.3		1.1			1.4		
		3.6		1.2			1.5		
		4.3		1.2			1.6		
LOW Level Input Voltage	V_{IL}	1.65 - 1.95				0.25		0.25	V
		2.3 - 2.5				0.25		0.25	
		2.7 - 3				0.25		0.25	
		3.3				0.3		0.3	
		3.6				0.3		0.3	
		4.3				0.4		0.4	
Switch ON Resistance	R_{ON}	4.3	$V_{NC} = V_{NO}$ = 0V to V_{CC} $I_{NC} = I_{NO}$ = 100mA		0.35	0.45		0.5	Ω
		3			0.4	0.5		0.6	
		2.7			0.4	0.5		0.6	
		2.3			0.45	0.7		0.8	
		1.8			0.55	1.5		2	
		1.65			0.65	1.5		2	
On-Resistance Match between channels (1)	$\triangle R_{ON}$		$V_{NC} = V_{NO}$ @ R_{ON} Max $I_{NC} = I_{NO}$ = 100mA		0.06				Ω
On Resistance Flatness (2)	R_{FLAT}	4.3	$V_{NC} = V_{NO}$ = 0V to V_{CC} $I_{NC} = I_{NO}$ = 100mA		0.15	0.2		0.2	Ω
		3			0.15	0.2		0.2	
		2.7			0.15	0.2		0.2	
		2.3			0.2	0.25		0.25	
		0.65			0.3	0.35		0.35	
OFF State Leakage Current (COM, NO, NR)	I_{OFF}	4.3	$V_{NC} = V_{NO}$ = 0.3 V to 4 V			±20		±100	nA
Input Leakage Current	I_{IN}	0 - 4.3	V_{IN} = 0V to 4.3 V			±0.1		±1	µA
Quiescent Supply Current	I_{CC}	1.65 - 4.3	$V_{IN} = V_{CC}$ or GND			±0.05		±0.2	µA

Notes:

1. $\triangle R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$.
2. Flatness is defined as the difference between the maximum and minimum value of on resistance as measured over the specified analog signal ranges.

AC Electrical Characteristics

Unless stated otherwise, **C_L = 35 pF, R_L = 50Ω, tr = tf ≤ 5ns, T_A = 25°C**

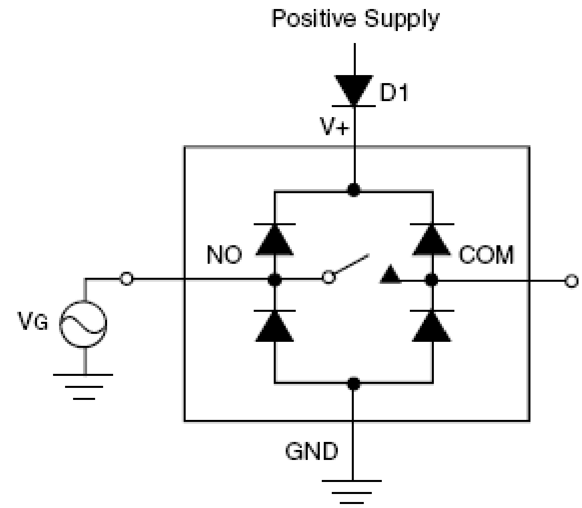
Parameter	Symbol	Conditions		Value					Unit
				T_A			0 to 70°C		
		V_{CC} (V)		Min.	Typ.	Max.	Min	Max	
Propagation Delay	t_{PLH}, t_{PHL}	1.65 - 1.95			0.45				ns
		2.3 - 2.7			0.4				
		3 - 3.3			0.3				
		3.6 - 4.3			0.3				
Turn-ON Time	t_{ON}	1.65 - 1.95	$V_{NC} = V_{NO}$ = 0.8 V		120				ns
		2.3 - 2.7	$V_{NC} = V_{NO}$ = 1.5 V		45	55		65	
		3 - 3.3			42	55		65	
		3.6 - 4.3			40	55		65	
Turn-OFF Time	t_{OFF}	1.65 - 1.95	$V_{NC} = V_{NO}$ = 0.8 V		22				ns
		2.3 - 2.7	$V_{NC} = V_{NO}$ = 1.5 V		18	30		40	
		3 - 3.3			16	30		40	
		3.6 - 4.3			15	30		40	
Break-Before-Make Delay	t_D	1.65 - 1.95	C_L = 35pF R_L = 50Ω $V_{NC} = V_{NO}$ = 1.5 V	10	80				ns
		2.3 - 2.7		10	60				
		3 - 3.3		10	55				
		3.6 - 4.3		10	50				
Charge Injection	Q	1.65 - 1.95	C_L = 100pF R_L = 1MΩ V_{GEN} = 0V R_{GEN} = 0Ω		50				ns
		2.3 - 2.7			40				
		3 - 3.3			35				
		3.6 - 4.3			35				

Analog Switch Characteristics

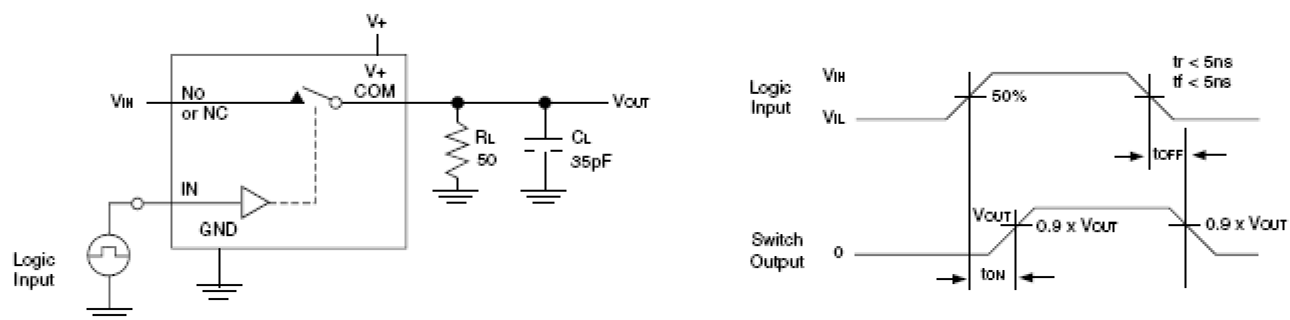
Unless stated otherwise, **C_L = 5 pF, R_L = 50Ω, T_A = 25°C**

Parameter	Symbol	Conditions		Value					Unit
				T_A			0 to 70°C		
		V_{CC} (V)		Min.	Typ.	Max.	Min	Max	
OFF Isolation	OIRR	1.65 - 4.3	V_{NC} = V_{NO} = 1 V_{RMS} f = 100 kHZ		-64				dB
Crosstalk	X_{TALK}	1.65 - 4.3	V_{NC} = V_{NO} = 1 V_{RMS} f = 100 kHZ		-54				dB
Total Harmonic Distortion	THD	2.3 - 4.3	R_L = 600Ω V_{IN} = $2V_{PP}$ f = 20 Hz to 20 kHz		0.03				%
-3dB Bandwidth	BW	1.65 - 4.3	R_L = 50Ω		50				MHz
Control Pin Input Capacitance	C_{IN}				5				pF
Sn Port Capacitance	C_{NC}, C_{NO}	3.3	f = 1 MHz		30				pF
D Port Capacitance (when switch is enabled)	C_{COM}	3.3			84				

Test Circuits and Timing Diagrams



Overvoltage Protection Using Two External Blocking Diodes

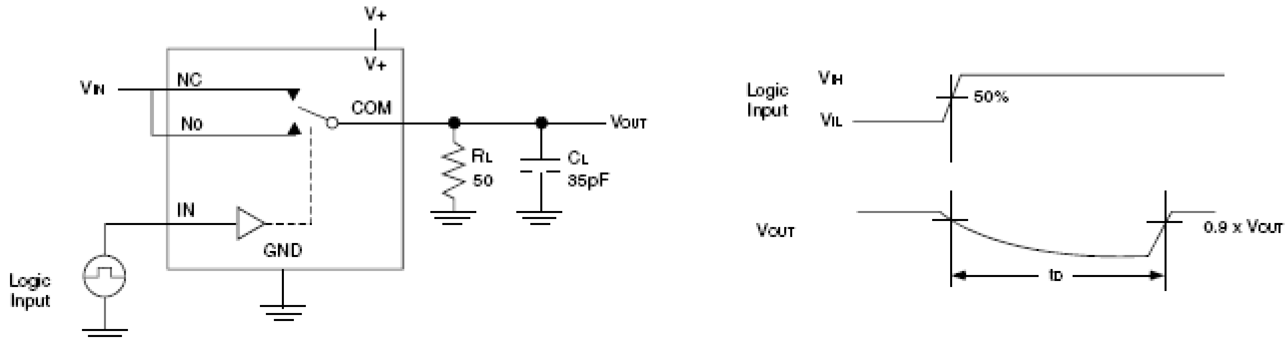


DEFINITIONS:
C_L = Includes fixture and stray capacitance.

$V_{OUT} = V_{IN}\left(\frac{R_L}{R_L + R_{ON}}\right)$

NOTE:
1. Logic input waveforms inverted for switches that have the opposite logic sense

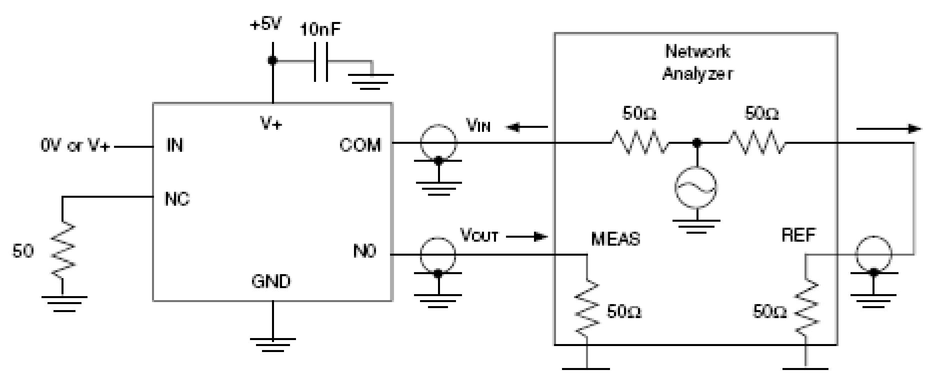
Switching Time



DEFINITIONS:
C_L = Includes fixture and stray capacitance.

Break-Before-Make Interval

Charge Injection



NOTE:

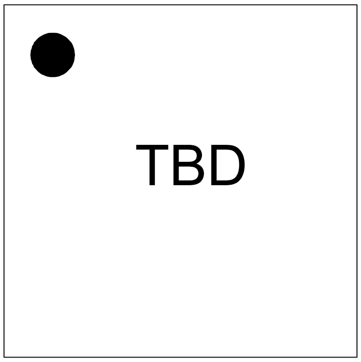
OFF-ISOLATION = $20\log \frac{V_{OUT}}{V_{IN}}$

ON-LOSS = $20\log \frac{V_{OUT}}{V_{IN}}$

CROSSTALK = $20\log \frac{V_{OUT}}{V_{IN}}$

On-Loss, Off-Isolation, and Crosstalk

Marking Diagram

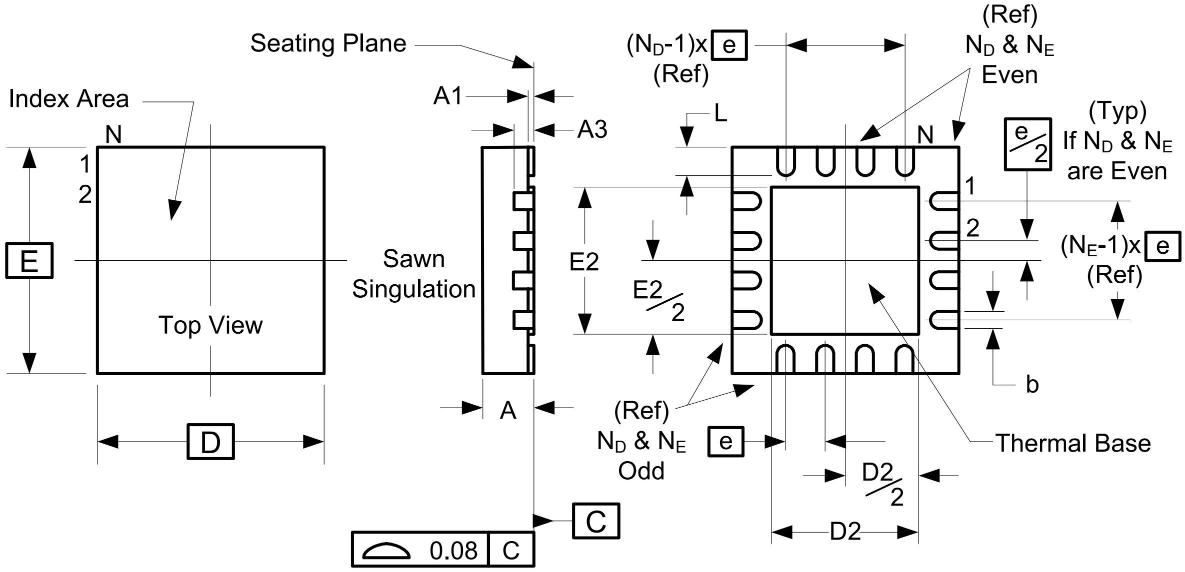


Notes:

1. YYWW is the last two digits of the year and week that the part was assembled.
2. “G” after the two-letter package code designates RoHS compliant package.
3. Bottom marking: country of origin if not USA.

Package Outline and Package Dimensions (16-pin 2.5x2.5mm QFN)

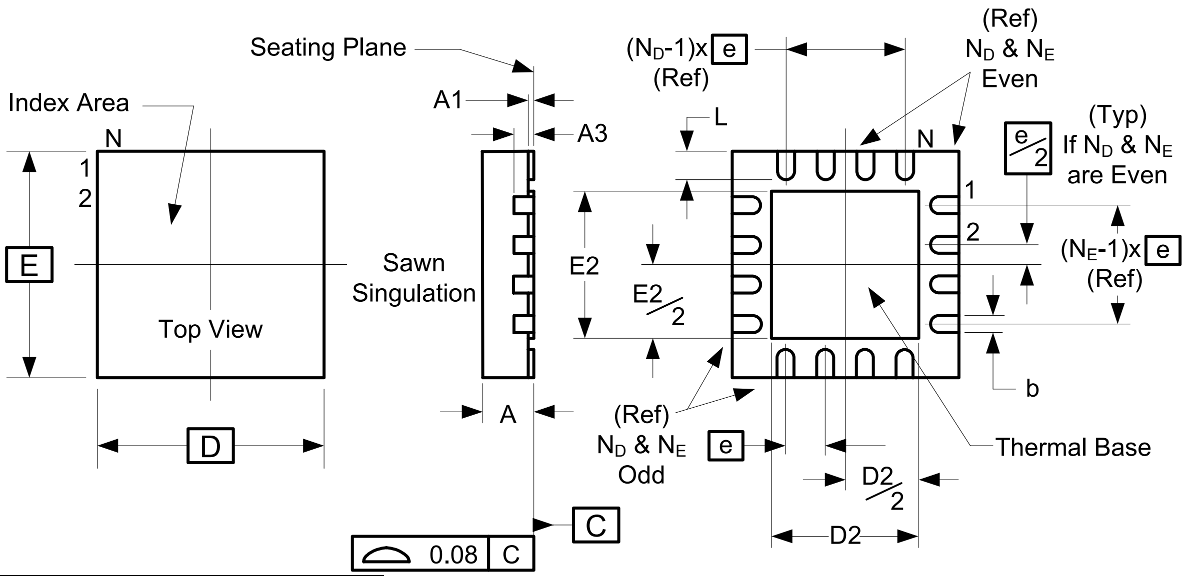
Package dimensions are kept current with JEDEC Publication No. 95



	Millimeters	
Symbol	**Min**	**Max**
A	0.50	0.60
A1	0	0.05
A3	0.25 Reference	
b	0.15	0.25
e	0.40 BASIC	
N	16	
N_D	4	
N_E	4	
D x E BASIC	2.50 x 2.50	
D2	1.00	1.25
E2	1.00	1.25
L	0.255	0.425

Package Outline and Package Dimensions (16-pin 3x3mm QFN)

Package dimensions are kept current with JEDEC Publication No. 95



	Millimeters	
Symbol	**Min**	**Max**
A	0.80	1.00
A1	0	0.05
A3	0.25 Reference	
b	0.18	0.30
e	0.50 BASIC	
N	16	
N_D	4	
N_E	4	
D x E BASIC	3.00 x 3.00	
D2	1.55	1.80
E2	1.55	1.80
L	0.30	0.50

Ordering Information

Part / Order Number	Marking	Shipping Packaging	Package	Temperature
IDTAS3699ANDG	see page 9	Tubes	2.5x2.5mm 16-pin QFN	0 to +70° C
IDTAS3699ANDG8		Tape and Reel	2.5x2.5mm 16-pin QFN	0 to +70° C
IDTAS3699ANLG		Tubes	3x3mm 16-pin QFN	0 to +70° C
IDTAS3699ANLG8		Tape and Reel	3x3mm 16-pin QFN	0 to +70° C

Parts ordered with a “G” after the two-letter package code are the Pb-Free configuration and are RoHS compliant.

Revision History

Rev.	Originator	Date	Description of Change
A		12/13/07	redesign of the AS3699 to accommodate TTL input Levels to reduce operating power.

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