4.5 OHM LOW VOLTAGE, HIGH BANDWIDTH, DUAL SPDT ANALOG SWITCH IDTUS4717

Description

The IDTUS4717 low on-resistance (R_{ON}), low voltage, dual single-pole/double-throw (SPDT) analog switch operates from a single +2.7 V to +3.6 V supply. The IDTUS4717 features a 4.5Ω (max) R_{ON} for its NC switch and a 4.5Ω (max) R_{ON} for its NO switch at a +3.0 V supply. It also features break-before-make switching action (1ns) with t_{ON} <80ns and t_{OFF} <40ns at +2.7 V. Available in 3x3 DFN, or 10-bump CSP package.

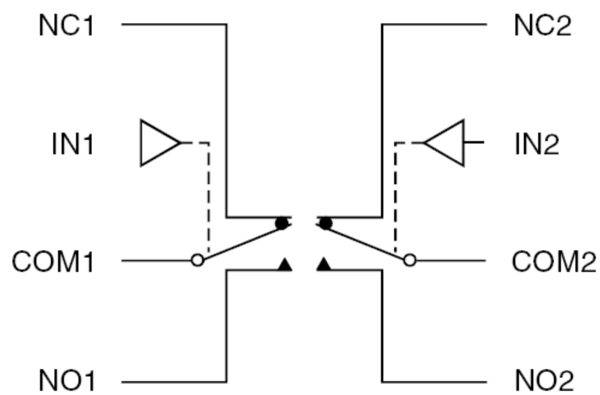
Applications

- USB 1.1 signal switching circuits
- Speaker headset switching
- MP3 players
- Battery-operated equipment
- Audio and video signal routing
- PCMCIA cards
- Cellular phones
- Modems
- PDAs

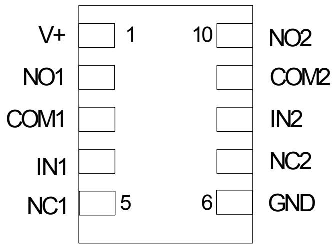
Features

- USB 1.1 signal switching compliant
- 2ns (max) differential skew
- -3dB bandwidth > 90 MHz
- Low 15 pF on-channel capacitance
- 2.7 V to 3.6 V single-supply operation
- Rail-to-rail signal handling
- R_{ON} match between channels: 0.3Ω (max)
- R_{ON} flatness over signal range: 1.2Ω (max)
- NCx switch R_{ON}: 4.5Ω max (3 V supply)
- NOx switch R_{ON}: 4.5Ω max (3 V supply)
- Low crosstalk: -80dB (10 MHz)
- High off-oscillation: -55dB (10 MHz)
- THD: 0.02%
- 1 mA (max) supply current
- Low leakage currents: <0.5nA at T_A = +25°C
- 10-bump, 0.5 mm pitch UCSP or 10-lead, 0.5 mm pitch 3x3 mm DFN packages

Block Diagram

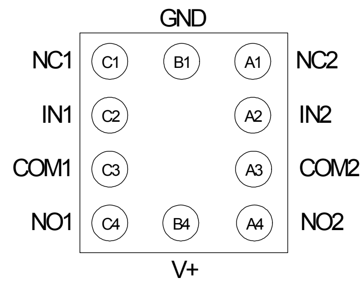


Pin Assignment (DFN)



10-pin DFN

Pin Assignment (CSP)



CSP (top view)

Truth Table

IN	NO	NC
0	OFF	ON
1	ON	OFF

Pin Descriptions

Pin Numbers		Pin Name	Pin Description
DFN	CSP		
1	B4	V+	Positive supply voltage input.
2	C4	NO1	Analog switch. Normally open terminal 1.
3	C3	COM1	Analog switch. Common terminal 1.
4	C2	IN1	Digital control input 1.
5	C1	NC1	Analog switch. Normally closed terminal 1.
6	B1	GND	Ground.
7	A1	NC2	Analog switch. Normally closed terminal 2.
8	A2	IN2	Digital control input 2.
9	A3	COM2	Analog switch. Common terminal 2.
10	A4	NO2	Analog switch. Normally open terminal 2.

Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the IDTUS4717. 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	Rating	Min	Max	Unit
V+, IN		-0.3	+4.6	V
COM, NO, NC		-0.3	(V+ 0.3)	V
NO, NC, COM	Continuous current		±300	mA
	Peak current (pulsed at 1ms, 50% duty cycle)		±400	
	Peak current (pulsed at 1ms, 10% duty cycle)		±500	
	Continuous power dissipation (TA = +70°C) and 12-bump UCSP (derate 11.4mW/°C above +70°C)		+909	mW
	Operating temperature range	-40	+85	°C
TSTG	Storage temperature range	-65	+150	°C
	Lead temperature (soldering, 10s)		+300	°C
	Bump temperature (soldering, infrared, 15s)		+200	°C
	Vapor phase (60s)		+215	°C

Electrical Characteristics

Unless stated otherwise, **V+ = 2.7 V to 3.6 V, V_{IH} = 2 V, V_{IL} = 0.5 V, T_A = T_{MIN} to T_{MAX}.** Typical values are at +3 V and 25°C

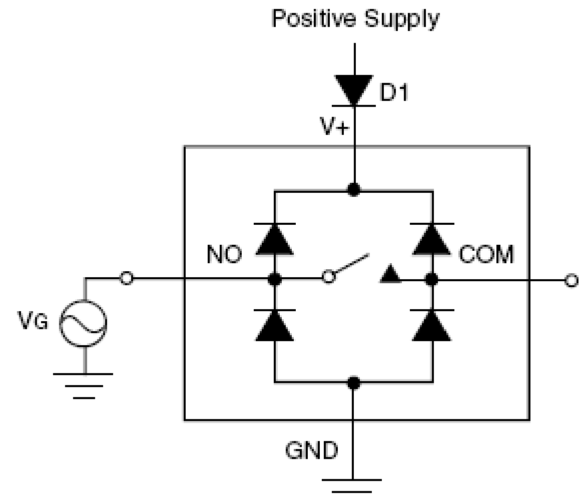
Parameter	Symbol	Conditions	T_A	Min.	Typ.	Max.	Units
Analog Switch							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}		T_{MIN} to T_{MAX}	0		V+	V
NC On-Resistance	$R_{ON(NC)}$	V+ = 3.0 V, I_{COM} = 10 mA, V_{NC} = 0 to V+; Note 3	+25°C		3.0	4.5	Ω
			T_{MIN} to T_{MAX}			5	
NO On-Resistance	$R_{ON(NO)}$	V+ = 3.0 V, I_{COM} = 10 mA, V_{NO} = 0 to V+; Note 3	+25°C		3.0	4.5	Ω
			T_{MIN} to T_{MAX}			5	
On-Resistance Match between channels	$\triangle R_{ON(NO)}$	V+ = 3.0 V, I_{COM} = 10 mA, V_{NO} or V_{NC} = 1.5 V; Notes 3, 4	+25°C		0.1	0.3	Ω
			T_{MIN} to T_{MAX}			0.4	
NC On-Resistance Flatness	$R_{FLAT(NC)}$	V+ = 3.0 V, I_{COM} = 10 mA, V_{NC} = 0 to V+; Note 5	T_{MIN} to T_{MAX}			1.5	Ω
NO On-Resistance Flatness	$R_{FLAT(NO)}$	V+ = 3.0 V, I_{COM} = 10 mA, V_{NO} = 0 to V+; Note 5	T_{MIN} to T_{MAX}			1.5	Ω
NO or NC Off-leakage Current	I_{NO}(OFF) or I_{NC}(OFF)	V+ = 3.3 V, V_{NO} or V_{NC} = 3 V, 0.3 V V_{COM} = 0.3 V, 3 V	+25°C	-0.5	+0.01	+0.5	nA
			T_{MIN} to T_{MAX}	-1		+1	
COM On-leakage Current	I_{COM}(ON)	V+ = 3.3 V, V_{NO} or V_{NC} = 3 V, 0.3 V, or floating V_{COM} = 0.3 V, 3 V, or floating	+25°C	-1	+0.01	+1	nA
			T_{MIN} to T_{MAX}	-2		+2	
Dynamic Characteristics							
Turn-on Time	t_{ON}	V+ = 2.7 to 3.6 V, V_{NO} or V_{NC} = 1.5 V, R_L = 300Ω, C_L = 35 pF	T_{MIN} to T_{MAX}			30	ns
Turn-off Time	t_{OFF}	V+ = 2.7 to 3.6 V, V_{NO} or V_{NC} = 1.5 V, R_L = 300Ω, C_L = 35 pF	T_{MIN} to T_{MAX}			40	ns
Break-Before-Make-Delay	t_{BBM}	V+ = 3.0 V, V_{NO} or V_{NC} = 1.5 V, R_L = 300Ω, C_L = 35 pF	T_{MIN} to T_{MAX}		8		ns
Charge Injection	Q	COM = 0, RS = 0, C_L = 1 nF	+25°C		5		pC
Skew	t_{SKEW}	Note 3			0.15	2.0	ns
Off-Isolation	V_{ISO}	C_L = 5 pF; R_L = 50Ω, f = 10 MHz, V_{COM} = 1 V_{RMS}	+25°C		-55		dB
Crosstalk	V_{CT}	f = 10 MHz, V_{NO} or V_{NC} = 1 V p-p, R_L = 50Ω, C_L = 5 pF	+25°C		-80		dB
		f = 1 MHz, V_{NO} or V_{NC} = 1 V p-p, R_L = 50Ω, C_L = 5 pF	+25°C		-110		
Total Harmonic Distortion	THD	R_L = 600Ω, IN = 2 V p-p, f = 20Hz to 20 kHz	+25°C		0.02		%
NO_, NC_ Off-Capacitance	C_{NC}(OFF)	f = 1 MHz	+25°C		9		pF
NC On-Capacitance	C_{NC}(ON)	f = 1 MHz	+25°C		15		pF
NC On-Capacitance	C_{NO}(ON)	f = 1 MHz	+25°C		15		pF
On-channel -3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, C_L = 5 pF	+25°C		>90		MHz

Parameter	Symbol	Conditions	T_A	Min.	Typ.	Max.	Units
Digital I/O							
Input Logic HIGH	V_{IH}		T_{MIN} to T_{MAX}	V+ x0.5			V
Input Logic LOW	V_{IL}		T_{MIN} to T_{MAX}			V+ x0.2	V
IN Input Leakage Current	I_{IN}	V+ = 3.6 V, V_{IN} = 0 or V+	T_{MIN} to T_{MAX}	-100		100	nA
Power Supply							
Power Supply Range	V+		T_{MIN} to T_{MAX}	2.7		3.6	V
Supply Current	I+	V+ = 3.6 V, V_{IN} = 0 or V+, Note 3	+25°C		+0.04	+50	nA
			T_{MIN} to T_{MAX}			+200	

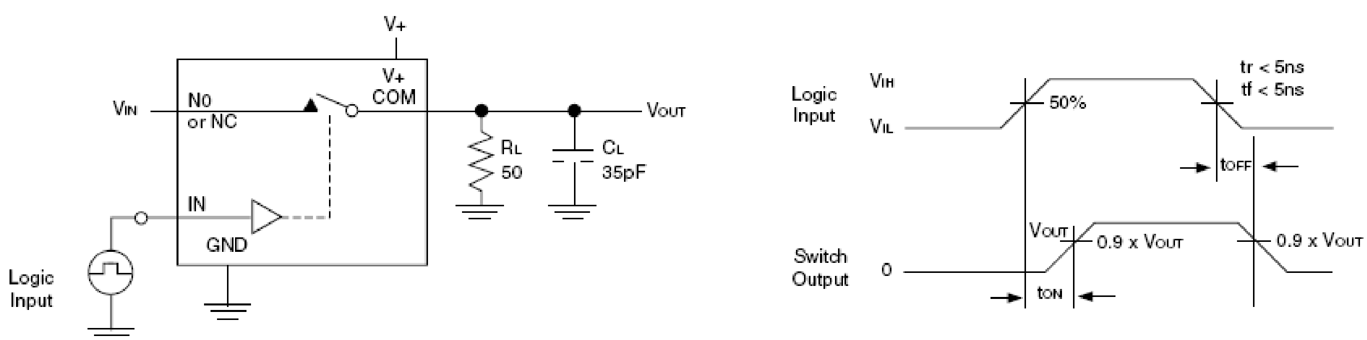
Notes:

1. The algebraic convention used in this data sheet is where the most negative value is a minimum and the most positive value a maximum.
2. UCSP parts are 100% tested at +25°C only and guaranteed by design and correlation at the full hot-rated temperature.
3. Guaranteed by design.
4. $\triangle R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$, between NC1 and NC2 or between NO1 and NO2.
5. Flatness is defined as the difference between the maximum and minimum value of on resistance as measured over the specified analog signal ranges.
6. Off-isolation = 20log10 (V_{COM} / V_{CO}), V_{COM} = output, V_{CO} = input to off switch.

Test Circuits and Timing Diagrams



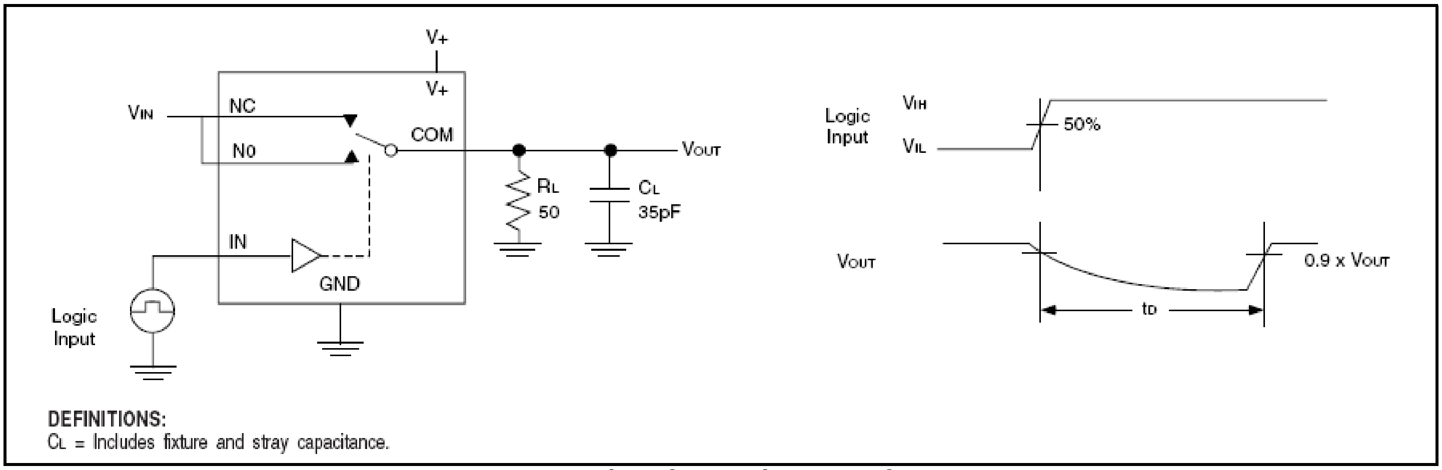
Overvoltage Protection Using an External Blocking Diode



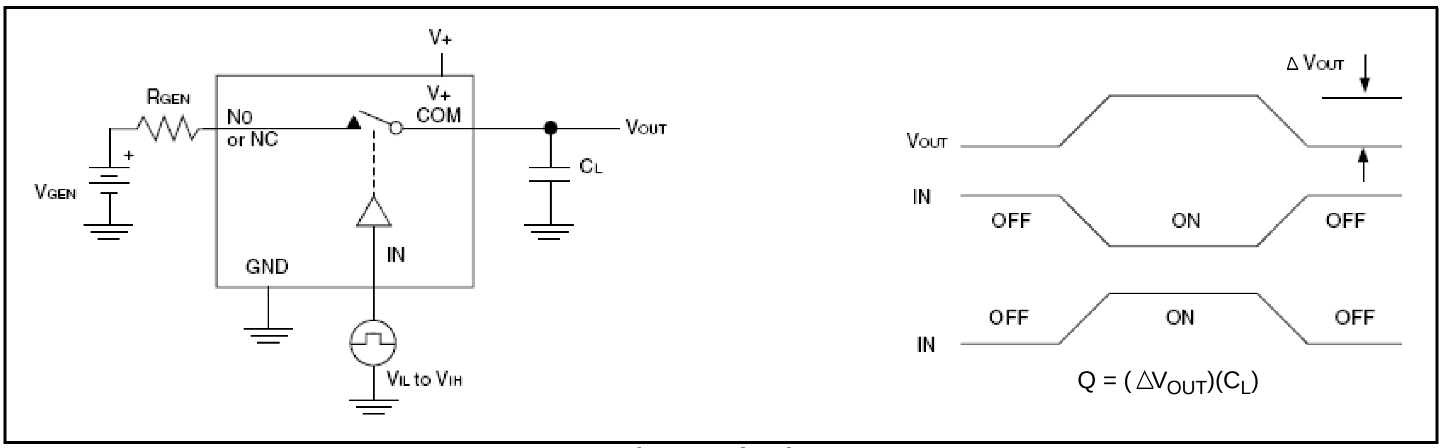
DEFINITIONS:
C_L = Includes fixture and stray capacitance.
$V_{OUT} = V_N \left(\frac{R_L}{R_L + R_{ON}}\right)$

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

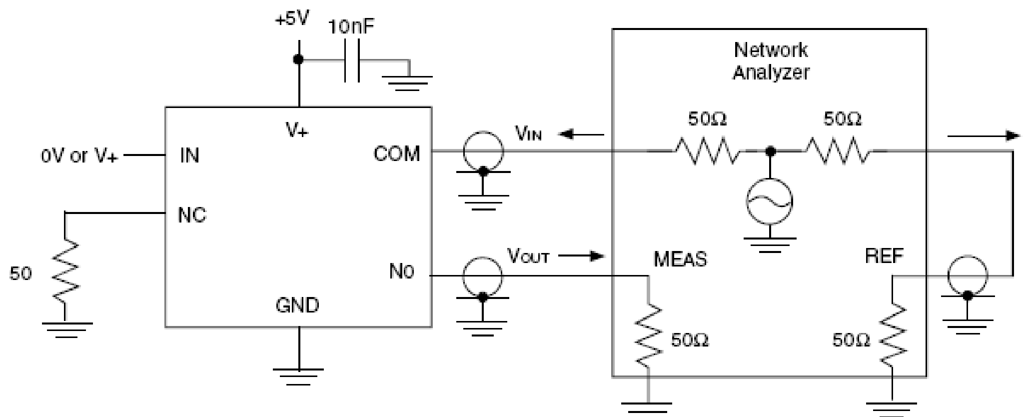
Switching Time



Break-Before-Make Interval



Charge Injection



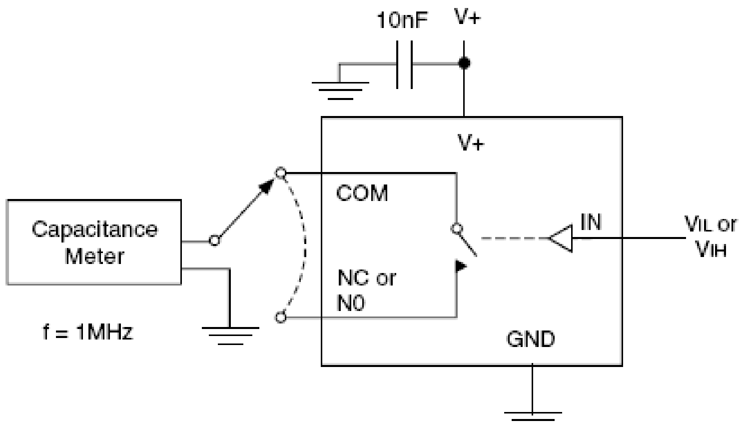
NOTE:

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

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

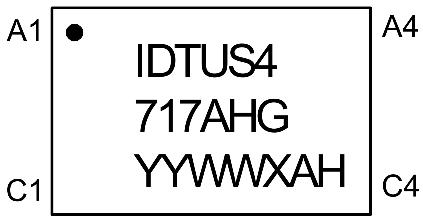
$$\text{CROSSTALK} = 20\log \frac{V_{OUT}}{V_{IN}}$$

On-Loss, Off-Isolation, and Crosstalk

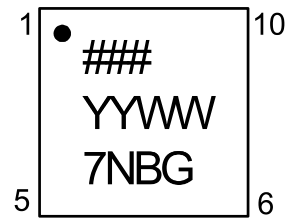


Channel Off/On Capacitance

Marking Diagram (CSP package)



Marking Diagram (DFN package)

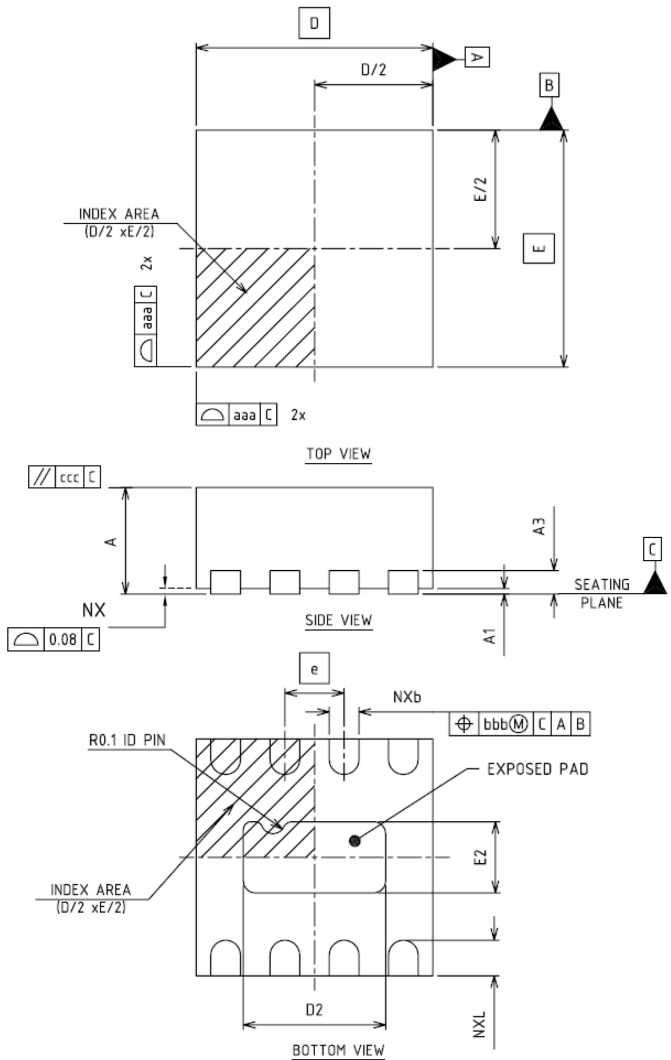


Notes:

1. “G” after the two-letter package code designates RoHS compliant package.
2. YYWW is the last two digits of the year and week that the part was assembled.
3. ### is the last three digits of the lot number.
4. “X” is the sequential code.
5. “A” is for the first assembly lot for the “WW”.
6. “H” is the assembly code.
7. Bottom marking (if applicable): country of origin if not USA.

Package Outline and Package Dimensions (10-pin DFN 3x3mm, 0.5 mm pitch))

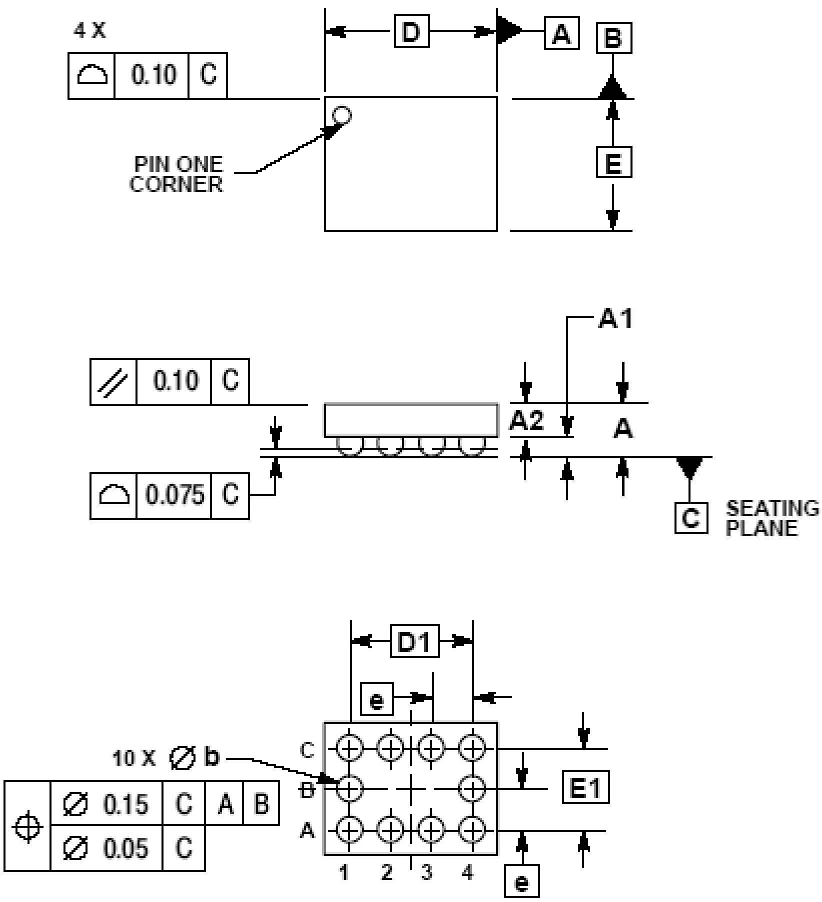
Package dimensions are per ASME Y14.5M - 1994,



	Millimeters	
Symbol	**Min**	**Max**
A	0.80	1.00
A1	0	0.05
A3	0.20 Reference	
b	0.18	0.30
N	10	
N_D	5	
N_E	–	
D	3.00 BASIC	
E	3.00 BASIC	
e	0.50 BASIC	
D2	2.20	2.70
E2	1.40	1.70
L	0.30	0.50
aaa	0.15	
bbb	0.10	
ccc	0.10	

Package Outline and Package Dimensions (10-bump CSP, 0.5 mm pitch))

Package dimensions are per ASME Y14.5M - 1994,



	Millimeters	
Symbol	**Min**	**Max**
A	–	0.650
A1	0.210	0.270
A2	0.280	0.380
b	0.250	0.350
D	1.965 BASIC	
E	1.465 BASIC	
e	0.500 BASIC	
D1	1.500 BASIC	
E1	1.000 BASIC	

Ordering Information

IDT XXXXXX XXX X X

Device Type | Package | Temp. Range | Shipping Carrier

8	Tape and Reel
Blank	Tray
Blank	Commercial (0 to +70°C)
I	Industrial (-40 to +85°C)
AHG	Chip Scale Package
NBG	10-lead 3mm x 3mm DFN
US4717	4.5Ω Low Voltage, High Bandwidth, Dual SPDT Analog Switch

Revision History

Rev.	Originator	Date	Description of Change
A		09/04/06	New device/datasheet. Preliminary release.
B		09/26/06	Changed supply voltage from 1.8 to 1.65 V; added industrial temp range; changed NC switch voltage from 2.7 to 3.0 V; added Skew spec; numerous min/max updates to Electrical Characteristics.
C		09/28/06	Changed the bandwidth spec from 300 MHz to 90 MHz; changed title of doc to reflect “High Bandwidth”.
D		01/24/07	Changed operating supply voltage from 1.8 - 5.5 V to 2.7 - 3.6 V; added marking diagram for CSP/DFN packages; added package drawings.

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