



# STMUX1000L

## GIGABIT LAN ANALOG SWITCH 16-BIT TO 8-BIT MULTIPLEXER

- LOW  $R_{ON}$ : 5.5  $\Omega$  TYPICAL
- $V_{CC}$  OPERATING RANGE: 3.0 TO 3.6 V
- LOW CURRENT CONSUMPTION: 20  $\mu$ A
- ESD HBM MODEL: > 2 KV
- CHANNEL ON CAPACITANCE: 7.5 pF TYPICAL
- SWITCHING TIME SPEED: 9 ns
- NEAR TO ZERO PROPAGATION DELAY: 250 ps
- VERY LOW CROSS TALK: -40 dB AT 250MHz
- BIT TO BIT SKEW: 200 ps
- > 450 MHZ -3db TYPICAL BANDWIDTH
- THREE SWITCH S.P.D.T FOR LED SUPPORTING
- PACKAGE: QFN56
- Pb FREE

### DESCRIPTION

The STMUX1000L is a 16 to 8 Bit multiplexer/demultiplexer low  $R_{ON}$  bidirectional LAN Switch designed for various standard, such as 10/100/1000 Ethernet.



Table 1: Order Codes

PACKAGE	T & R
QFN	STMUX1000LQTR

It is designed for very low Cross Talk, low bit to bit skew and low I/O capacitance.

The differential signal from the Gigabit Ethernet Transceiver is multiplexed in one of two selected output while the unselected switch go to Hi-Z status.

The device integrates three 16 $\Omega$  switches, S.P.D.T. (Single Pole Dual Throw Channel), for LED supporting.

Figure 1: Pin Connection (Top Through View)

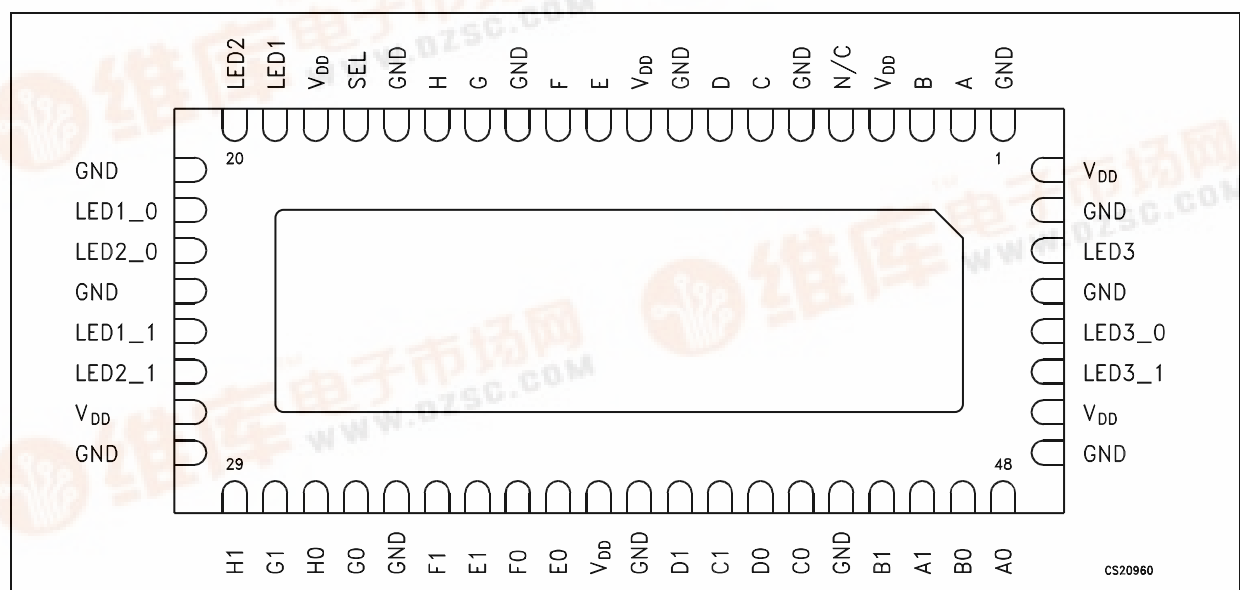


Figure 2: Input Equivalent Circuit

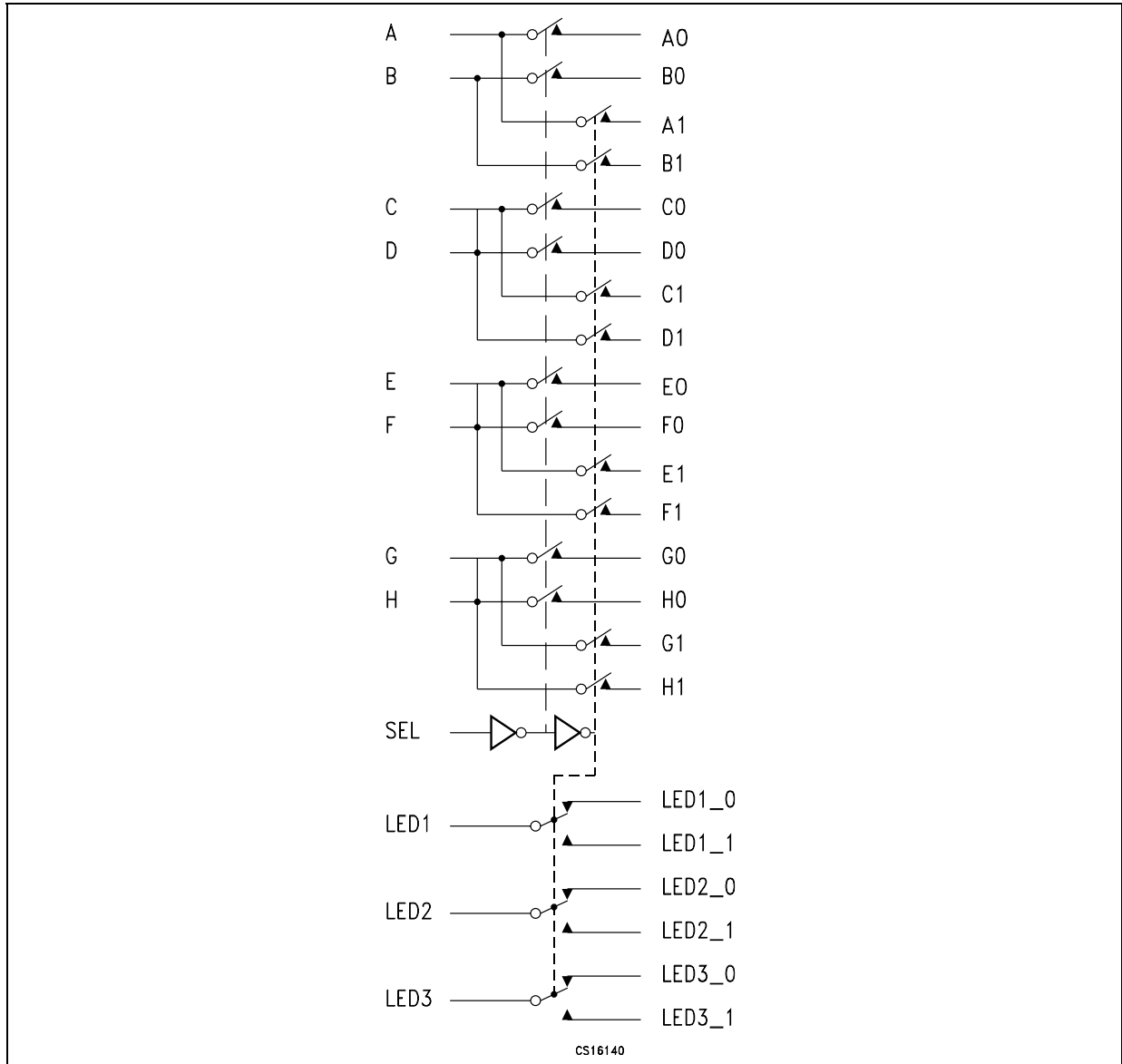


Table 2: Pin Description

PIN N°	SYMBOL	NAME AND FUNCTION
2, 3, 7, 8, 11, 12, 14, 15	A, B, C, D, E, F, G, H	8 Bit Bus
48, 47, 43, 42, 37, 36, 32, 31	A0, B0, C0, D0, E0, F0, G0, H0	8 Bit Multiplexed to Bus 0
46, 45, 41, 40, 35, 34, 30, 29	A1, B1, C1, D1, E1, F1, G1, H1	8 Bit Multiplexed to Bus 1
5	N/C	Not Connected
17	SEL	BUS and LED Switch Selection
19, 20, 54	LED1, LED2, LED3	LED Switch Input
22, 23, 25, 26, 51, 52	LED1_0, LED2_0, LED1_1, LED2_1, LED3_0, LED3_1	LED Switch Output
4, 10, 18, 27, 38, 50, 56	V <sub>DD</sub>	Supply Voltage
1, 6, 9, 13, 16, 21, 24, 28, 33, 39, 44, 49, 53, 55	GND	Ground

**Table 3: Lan Switch Function Table**

SE	FUNCTION
L	8 Bit Bus to 8 Bit Multiplexed Bus 0
H	8 Bit Bus to 8 Bit Multiplexed Bus 1

**Table 4: Led Switch Function Table**

SE	FUNCTION
L	Led Switch Input connected to Led Switch Output X_0
H	Led Switch Input connected to Led Switch Output X_1

**Table 5: Absolute Maximum Ratings**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage to Ground	-0.5 to 4	V
$V_I$	DC Input Voltage	-0.5 to 4	V
$V_{IC}$	DC Control Input Voltage	-0.5 to 4	V
$I_O$	DC Output Current (*)	120	mA
$P_D$	Power Dissipation	0.5	W
$T_{stg}$	Storage Temperature	-65 to 150	°C
$T_L$	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

(\*) If not exceed the max limit of  $P_D$ .

**Table 6: DC Electrical Characteristics For Gigabit Ethernet LAN8/16MUX/DEMUX**

( $T_A = -40$  to  $85^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 10\%$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{IH}$	Voltage Input High	High Level Guaranteed	2			V
$V_{IL}$	Voltage Input Low	Low Level Guaranteed	-0.5		0.8	V
$V_{IK}$	Clamp Diode Voltage	$V_{CC} = 3.6\text{V}$ , $I_{IN} = -18\text{mA}$		-0.8	-1.2	V
$I_{IH}$	Input High Current	$V_{CC} = 3.6\text{V}$ , $V_{IN} = V_{CC}$			$\pm 5$	$\mu\text{A}$
$I_{IL}$	Input Low Current	$V_{CC} = 3.6\text{V}$ , $V_{IN} = \text{GND}$			$\pm 5$	$\mu\text{A}$
$I_{OFF}$	Power Down Leakage Current	$V_{CC} = 0\text{V}$ , A to H $V = 0\text{V}$ , A0 to H0 and A1 to H1 $\leq 3.6\text{V}$			$\pm 5$	$\mu\text{A}$
$R_{ON}$	Switch ON Resistance (1)	$V_{CC} = 3.0\text{V}$ , $V_{IN} = 1.5$ to $V_{CC}$ $I_{IN} = -40\text{mA}$		5.5	7.5	$\Omega$
$R_{FLAT}$	ON Resistance FLATNESS (1, 2)	$V_{CC} = 3.0\text{V}$ , $V_{IN}$ @ 1.5 and $V_{CC}$ $I_{IN} = -40\text{mA}$		0.8		$\Omega$
$\Delta R_{ON}$	ON Resistance Match between channel $\Delta R_{ON} = R_{ONMAX} - R_{ONMIN}$ (1,3)	$V_{CC} = 3.0\text{V}$ , $V_{IN} = 1.5$ to $V_{CC}$ $I_{IN} = -40\text{mA}$		0.5	1	$\Omega$

Note 1: Measured by voltage drop between Channels @ indicated current through the switch. On-Resistance is determined by the lower the voltage on the two.

Note 2: Flatness is defined as the difference the  $R_{ONMAX}$  and  $R_{ONMIN}$  of On-Resistance over the specified range condition.

Note 3:  $\Delta R_{ON}$  measured @ same  $V_{CC}$ , temperature and voltage level.

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**Table 7: DC Electrical Characteristics For 10/100 Ethernet LAN8/16MUX/DEMUX**  
( $T_A = -40$  to  $85^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 10\%$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{IH}$	Voltage Input High	High Level Guaranteed	2			V
$V_{IL}$	Voltage Input Low	Low Level Guaranteed	-0.5		0.8	V
$V_{IK}$	Clamp Diode Voltage	$V_{CC} = 3.6\text{V}$ , $I_{IN} = -18\text{mA}$		-0.7	-1.2	V
$I_{IH}$	Input High Current	$V_{CC} = 3.6\text{V}$ , $V_{IN} = V_{CC}$			$\pm 5$	$\mu\text{A}$
$I_{IL}$	Input Low Current	$V_{CC} = 3.6\text{V}$ , $V_{IN} = \text{GND}$			$\pm 5$	$\mu\text{A}$
$I_{OFF}$	Power Down Leakage Current	$V_{CC} = 0\text{V}$ , A to H $V = 0\text{V}$ , A0 to H0 and A1 to H1 $\leq 3.6\text{V}$			$\pm 5$	$\mu\text{A}$
$R_{ON}$	Switch ON Resistance (1)	$V_{CC} = 3.0\text{V}$ , $V_{IN} = 1.25$ to $V_{CC}$ $I_{IN} = -40\text{mA}$		5.5	7.5	$\Omega$
$R_{FLAT}$	ON Resistance FLATNESS (1, 2)	$V_{CC} = 3.0\text{V}$ , $V_{IN}$ @ 1.25 and $V_{CC}$ $I_{IN} = -40\text{mA}$		0.9		$\Omega$
$\Delta R_{ON}$	ON Resistance Match between channel $\Delta R_{ON} = R_{ONMAX} - R_{ONMIN}$ (1, 3)	$V_{CC} = 3.0\text{V}$ , $V_{IN} = 1.25$ to $V_{CC}$ $I_{IN} = -40\text{mA}$		0.5	1	$\Omega$

Note 1: Measured by voltage drop between Channels @ indicated current through the switch. On-Resistance is determined by the lower the voltage on the two.

Note 2: Flatness is defined as the difference the  $R_{ONMAX}$  and  $R_{ONMIN}$  of On-Resistance over the specified range condition.

Note 3:  $\Delta R_{ON}$  measured @ same  $V_{CC}$ , temperature and voltage level.

**Table 8: Led Switches DC Electrical Characteristics**  
( $T_A = -40$  to  $85^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 10\%$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{IH}$	Voltage Input High	High Level Guaranteed	2			V
$V_{IL}$	Voltage Input Low	Low Level Guaranteed	-0.5		0.8	V
$V_{IK}$	Clamp Diode Voltage	$V_{CC} = 3.6\text{V}$ , $I_{IN} = -18\text{mA}$		-0.7	-1.2	V
$I_{IH}$	Input High Current	$V_{CC} = 3.6\text{V}$ , $V_{IN} = V_{CC}$			$\pm 5$	$\mu\text{A}$
$I_{IL}$	Input Low Current	$V_{CC} = 3.6\text{V}$ , $V_{IN} = \text{GND}$			$\pm 5$	$\mu\text{A}$
$R_{ON}$	Switch ON Resistance (1)	$V_{CC} = 3.0\text{V}$ , $V_{IN} = 1.25$ to $V_{CC}$ $I_{IN} = -40\text{mA}$		16	25	$\Omega$
$R_{FLAT}$	ON Resistance FLATNESS (1, 2)	$V_{CC} = 3.0\text{V}$ , $V_{IN}$ @ 1.25 and $V_{CC}$ $I_{IN} = -40\text{mA}$		8		$\Omega$
$\Delta R_{ON}$	ON Resistance Match between channel $\Delta R_{ON} = R_{ONMAX} - R_{ONMIN}$ (1, 3)	$V_{CC} = 3.0\text{V}$ , $V_{IN} = 1.25$ to $V_{CC}$ $I_{IN} = -40\text{mA}$		1	2	$\Omega$

Note 1: Measured by voltage drop between Channels @ indicated current through the switch. On-Resistance is determined by the lower the voltage on the two.

Note 2: Flatness is defined as the difference the  $R_{ONMAX}$  and  $R_{ONMIN}$  of On-Resistance over the specified range condition.

Note 3:  $\Delta R_{ON}$  measured @ same  $V_{CC}$ , temperature and voltage level.

**Table 9: Capacitance Lan 8/16 MUX/DEMUX** ( $T_A = 25^\circ\text{C}$ ,  $f = 1\text{ MHz}$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$C_{IN}$	Input Capacitance (Note 4)	$V_{IN} = 0\text{ V}$		2	3	pF
$C_{OFF}$	Port x0 to Port x1, Switch Off (Note 4)	$V_{IN} = 0\text{ V}$		4	6	pF
$C_{ON}$	Capacitance Switch On (x to x0 or x to x1) (Note 4)	$V_{IN} = 0\text{ V}$		7.5	11	pF

Note 4: x = A to H, x0 = A0 to H0, x1 = A1 to H1.

**Table 10: Capacitance Led Switches** ( $T_A = 25^\circ\text{C}$ ,  $f = 1\text{ MHz}$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$C_{IN}$	Input Capacitance	$V_{IN} = 0\text{ V}$			10	pF
$C_{OFF}$	Port x0 to Port x1, Switch Off	$V_{IN} = 0\text{ V}$		4	10	pF
$C_{ON}$	Capacitance Switch On	$V_{IN} = 0\text{ V}$		11	20	pF

**Table 11: Power Supply Characteristics** ( $T_A = -40\text{ to }85^\circ\text{C}$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{CC}$	Quiescent Power Supply	$V_{CC} = 3.6\text{ V}$ , $V_{IN} = V_{CC}$ or GND		150	500	$\mu\text{A}$

**Table 12: LAN 8/16 MUX/DEMUX Dynamic Electrical Characteristics**  
( $T_A = -40\text{ to }85^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 10\%$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Xtalk	Cross-Talk	$R_L = 100\ \Omega$ , $f = 250\text{ MHz}$		-40		dB
OIRR	Off Isolation	$R_L = 100\ \Omega$ , $f = 250\text{ MHz}$		-36		dB
BW	-3dB Bandwidth	$R_L = 100\ \Omega$		450		MHz

**Table 13: LAN 8/16 MUX/DEMUX Switching Characteristics**  
( $T_A = -40\text{ to }85^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 10\%$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{PD}$	Propagation Delay	$V_{CC} = 3\text{ V to }3.6\text{ V}$		0.25		ns
$t_{PZH}$ , $t_{PZL}$	Line Enable Time, SE to x to x0 or x to x1	$V_{CC} = 3\text{ V to }3.6\text{ V}$	0.5	6.5	9	ns
$t_{PHZ}$ , $t_{PLZ}$	Line Disable Time, SE to x to x0 or x to x1	$V_{CC} = 3\text{ V to }3.6\text{ V}$	0.5	6.5	8.5	ns
$t_{SK(O)}$	Output Skew between center port to any other port	$V_{CC} = 3\text{ V to }3.6\text{ V}$		0.1	0.2	ns
$t_{SK(P)}$	Skew between opposite transition of the same output ( $t_{PHL}$ , $t_{PLH}$ )	$V_{CC} = 3\text{ V to }3.6\text{ V}$		0.1	0.2	ns

Note 4: x = A to H, x0 = A0 to H0, x1 = A1 to H1.

**Table 14: Three Channel Switches Switching Characteristics**  
( $T_A = -40\text{ to }85^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 10\%$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{ON}$	Propagation Delay	$V_{CC} = 3\text{ V to }3.6\text{ V}$			50	ns
$t_{OFF}$	Propagation Delay	$V_{CC} = 3\text{ V to }3.6\text{ V}$			30	ns

Figure 3: Bandwidth

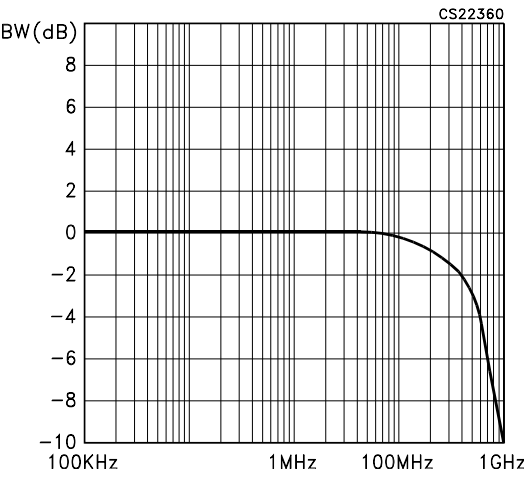
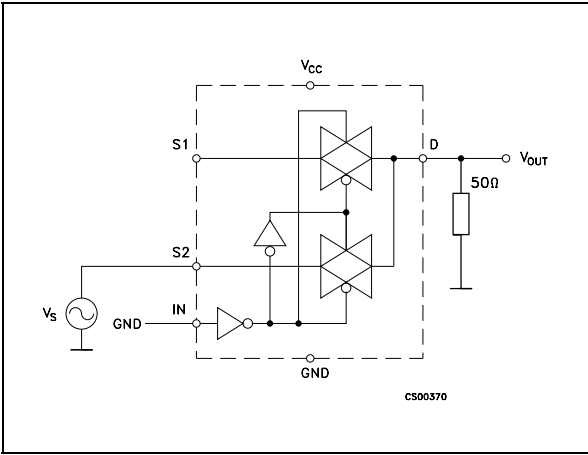
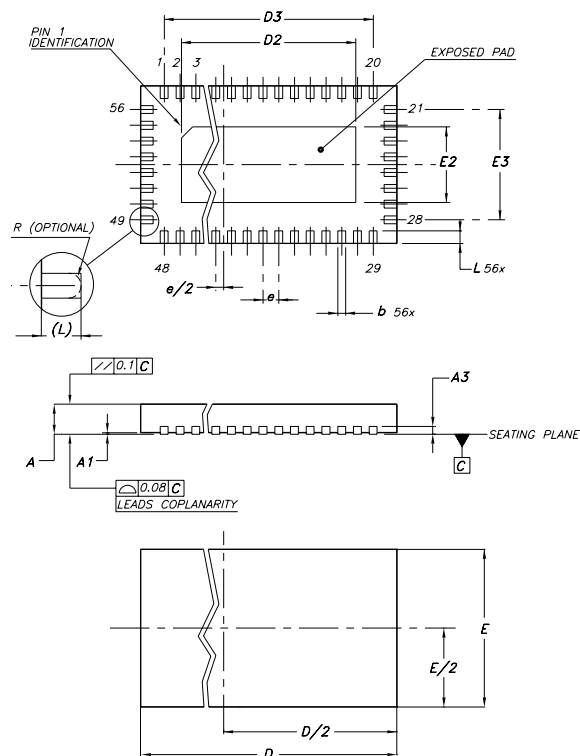


Figure 4: Schematic Bandwidth



## QFN56 (11x5) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	0.70	0.75	0.80	0.028	0.030	0.031
A1			0.05			0.002
A3		0.20			0.008	
b	0.20	0.25	0.30	0.008	0.010	0.012
D	10.90	11.00	11.10	0.429	0.433	0.437
D2	8.30	8.40	8.50	0.327	0.331	0.335
D3		9.50			0.374	
E	4.90	5.00	5.10	0.193	0.197	0.201
E2	2.30	2.40	2.50	0.091	0.094	0.098
E3		3.50			0.138	
e		0.50			0.020	
L	0.30	0.40	0.50	0.012	0.016	0.020



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**Table 15: Revision History**

Date	Revision	Description of Changes
08-Apr-2005	1	First Release.
03-May-2005	2	Maturity Code.



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