TEXAS INSTRUMENTS

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4Q 2002

2.5V - 5V Standard Logic IC

SN74LV-A Series

Overview

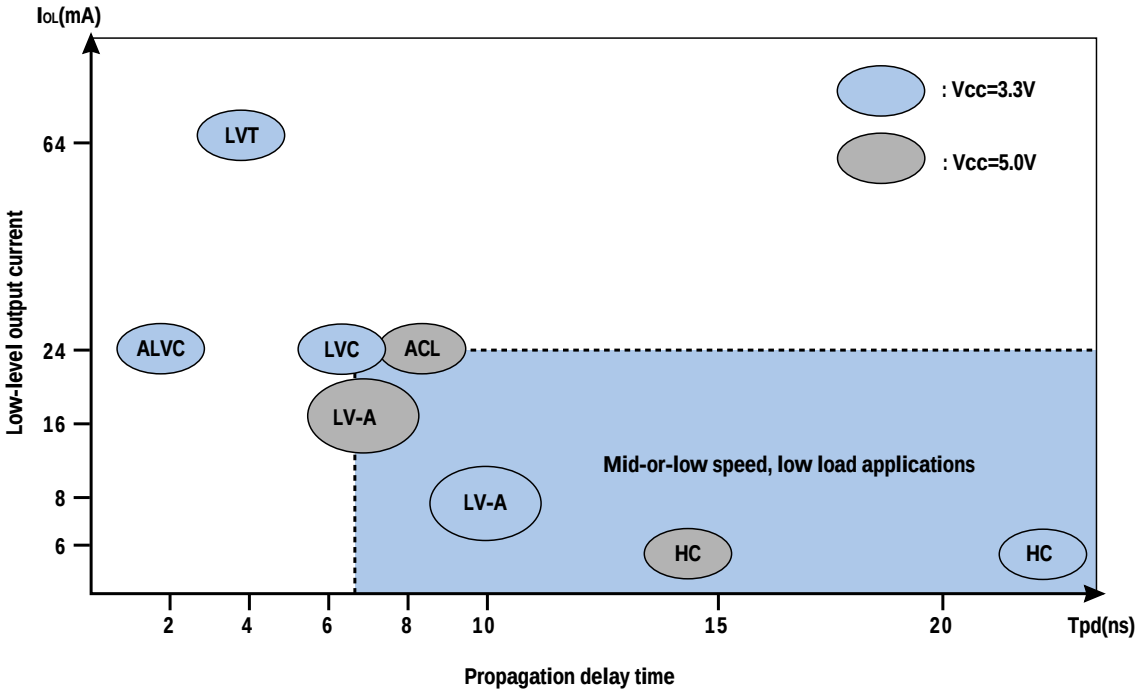
The SN74LV-A Series is a group of low-voltage standard logic products best suited for mid-or-low speed applications. This series has been developed by adding the tolerant features and the 2.5V power supply specifications to the conventional SN74LV Series.

The specifications for the conventional logic were all within the range of 5.0V±10%, 3.3V±10%, or 3.0V±10%. The new SN74LV-A, however, now supports all types of power supply systems by adding a 2.5V specification.

The addition of the I/O tolerant features has enabled the interface between 5.0V and 3.3V and between 3.3V and 2.5V. Also, the specification of leakage current when power is turned off (Vcc = 0V) has been provided, so this series lends itself to partial power down or similar applications.

The product lineup consists of 51 types, and includes SOIC, SSOP, TSSOP, PDIP and QFN packages, as well as the new 0.4 mm pitch TVSOP for a wider range of selection. The LV-A Series is expected to be the mainstream logic for mid-and low-speed ranges in the future.

Relationship of the SN74LV-A Series and Other Series



Features

Wide range of source voltages available

Not only 5.0V and 3.3V specifications but also 2.5V (next-generation source voltage) specifications have been supported. AC specifications for all three source voltages have been added.
(See the section of LV-A specifications.)
Operation-available source voltage (Vcc) = 2.0 to 5.5V

High-speed operation

When a 5V power supply is used, the speed equal to that for 74F or 74AC is obtained; when a 3.3V power supply is used, the speed equal to or greater than that for 74HC or 74ALS on 5V is obtained.
Propagation delay time for SN74LV244A:tpd (TYP) = 3.9 ns (on 5.0V)
5.4 ns (on 3.3V)
7.5 ns (on 2.5V)

Optimization of drive current

The drive capability equivalent to that for HC is implemented on 3.3V so that this series is best suited for medium-or-low load applications.
Output current for the gate system: I_{OH}/I_{OL} = ±12 mA (on 5V); ±6.0 mA (on 3.3V); ±2 mA (on 2.5V)
Output current for the buffer system: I_{OH}/I_{OL} = ±16 mA (on 5V); ±8.0 mA (on 3.3V); ±2 mA (on 2.5V)

Low power consumption

The adoption of 1.2µ CMOS process technology has implemented low power consumption current characteristics. Therefore, this series is suited for portable equipment.
Static power consumption I_{CC} (max) = 20µA

Low noise characteristic

The output edge control circuit implements smooth leading/falling edge characteristics, resulting in greatly reduced switching noise.

5.0V- and 3.3V-tolerant feature

Tolerance between different voltages for use on low voltage, not supported in the conventional LV Series, has been supported. As a result, interfacing between 5.0V and 3.3V and between 3.3V and 2.5V has been enabled.

Power down HI-Z feature

The specification of leakage current when source voltage is turned off enables partial power down and similar applications to be used.
I_{off} = 5µA (Vcc = 0V)

Hysteresis characteristic

Input hysteresis Vth = 0.4V (on 5.0V) is obtained. Although this value is not included in the specification, this characteristic lends itself to resistance to noise (such as prevention of malfunction due to noise).

Output skew available

For bus system models, skew between output pins is available.
Skew between output pins TSK(O) ≤ 1.0 ns (on 5V); 1.5 ns (on 3.3V); 2.0 ns (on 2.5V)

Abundant package types

Available package types include SOIC, SSOP, TSSOP, PDIP, TVSOP (0.4 mm pitch), and QFN (0.5 mm pitch).

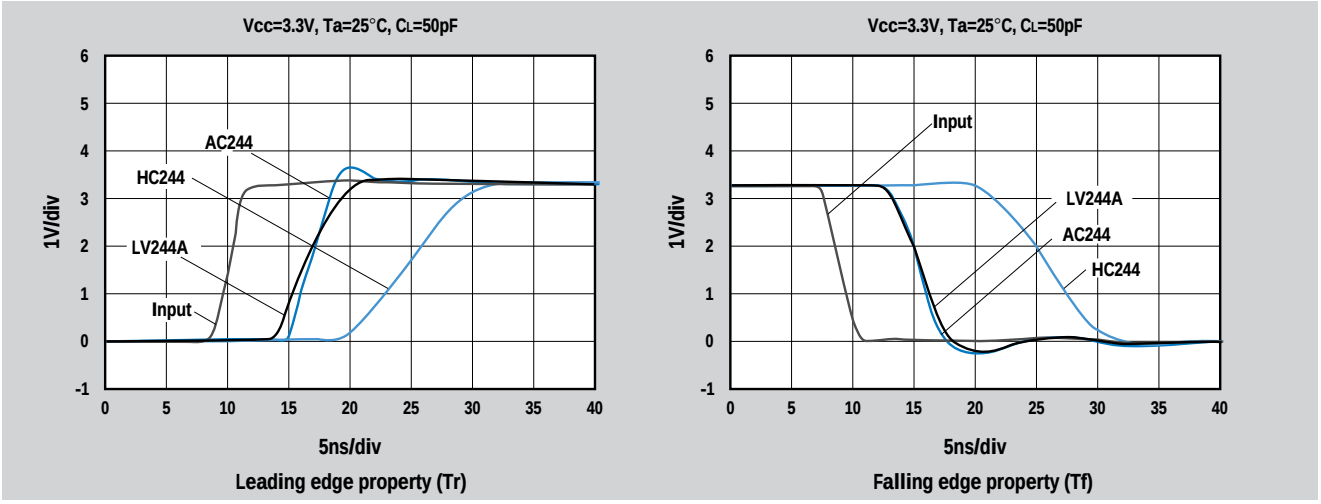
Rich lineup

A total of 51 types are provided through a lineup of main functions.

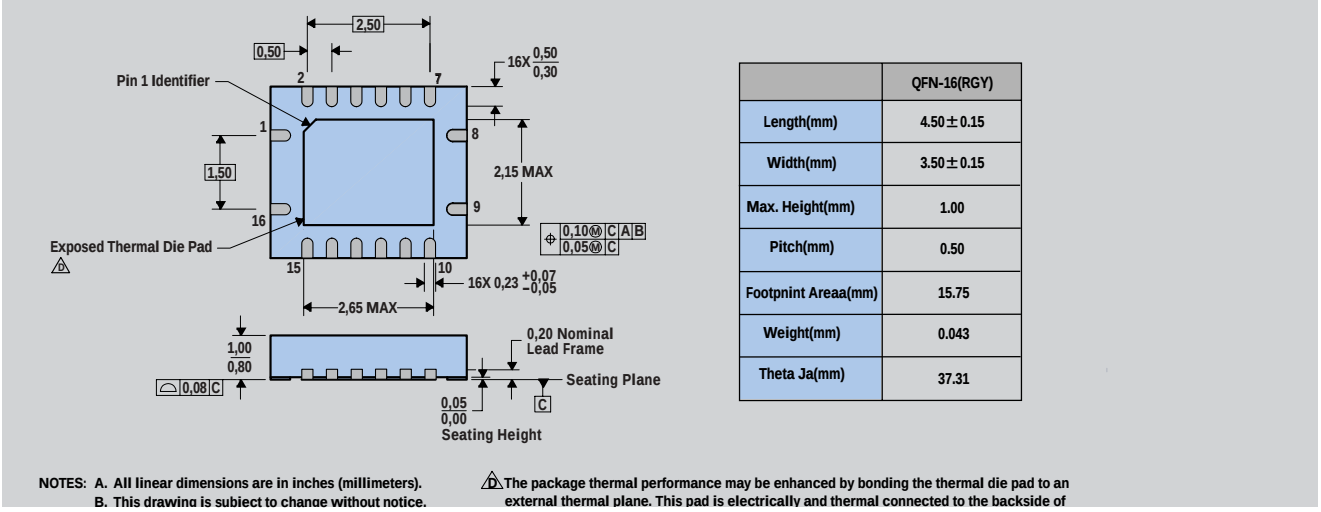
Properties

Output Waveform for SN74LV244A (with load capacity C_L = 50pF and ambient temperature Ta = 25°C)

When Vcc = 3.3V



When Vcc = 5.0V



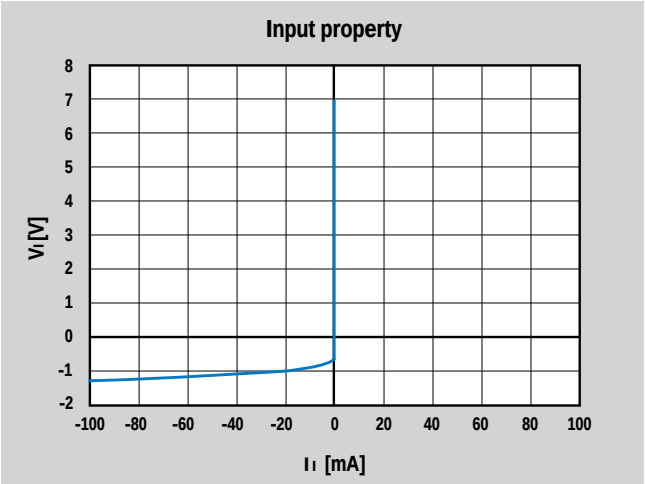
	QFN-16(RGY)
Length(mm)	4.50±0.15
Width(mm)	3.50±0.15
Max. Height(mm)	1.00
Pitch(mm)	0.50
Footpnint Areaa(mm)	15.75
Weight(mm)	0.043
Theta Ja(mm)	37.31

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
D. The package thermal performance may be enhanced by bonding the thermal die pad to an external thermal plane. This pad is electrically and thermal connected to the backside of

Properties

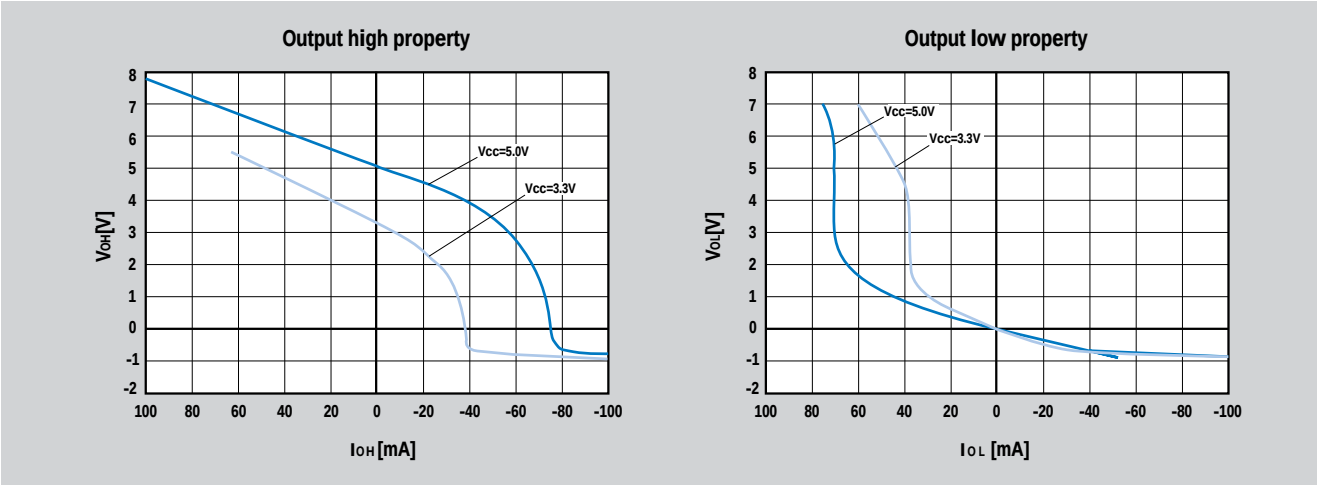
Input/Output Property for SN74LV-A (with ambient temperature Ta = 25°C)

Input Property

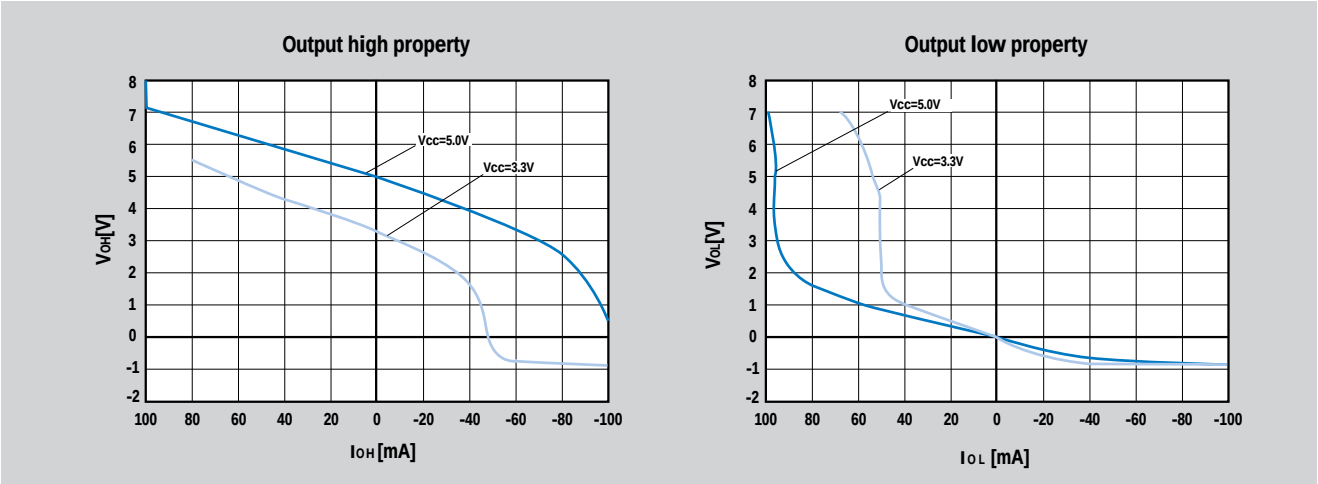


Output Property

SN74LV00A (I_{OH}/I_{OL} = ±4 mA (on 3.3V); ±8.0 mA (on 5.0V))

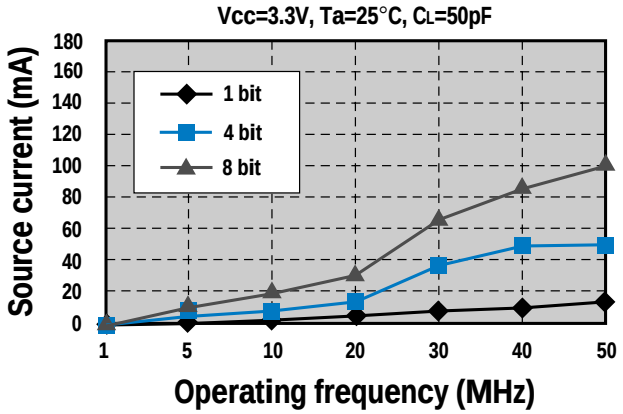


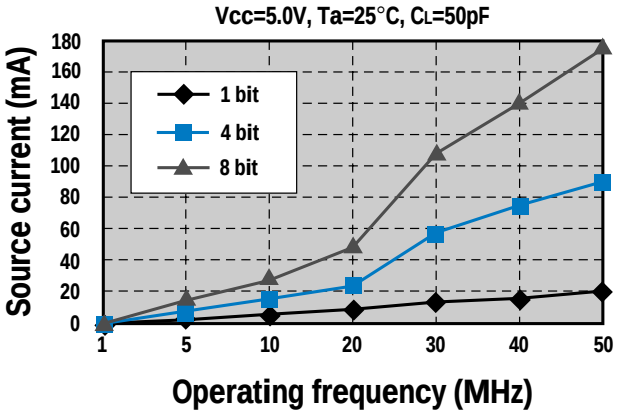
SN74LV244A (I_{OH}/I_{OL} = ±8.0 mA (on 3.3V); ±16.0 mA (on 5.0V))



Current Consumption

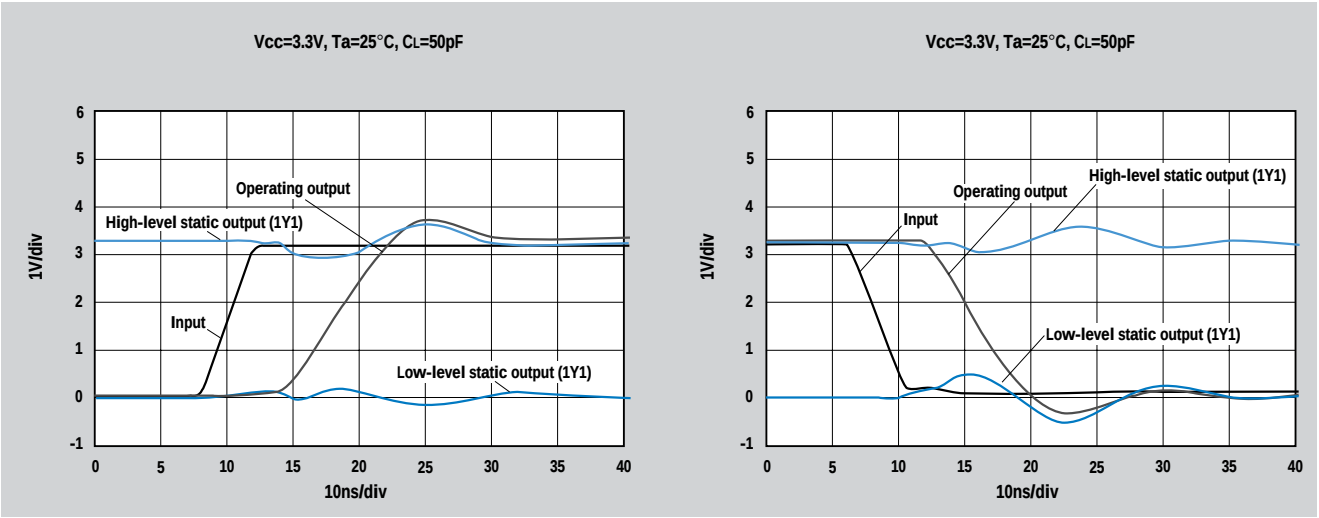
Operating current consumption for SN74LV244A (with load capacity C_L = 50pF and ambient temperature Ta = 25°C)





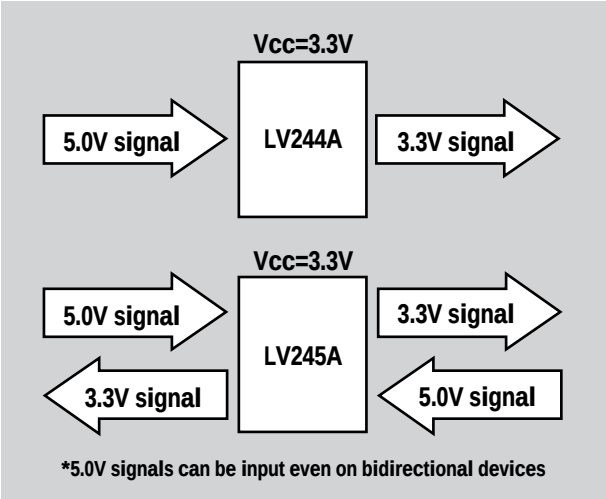
Low Noise Property

Simultaneous switching waveform for SN74LV244A (7-circuit switching)

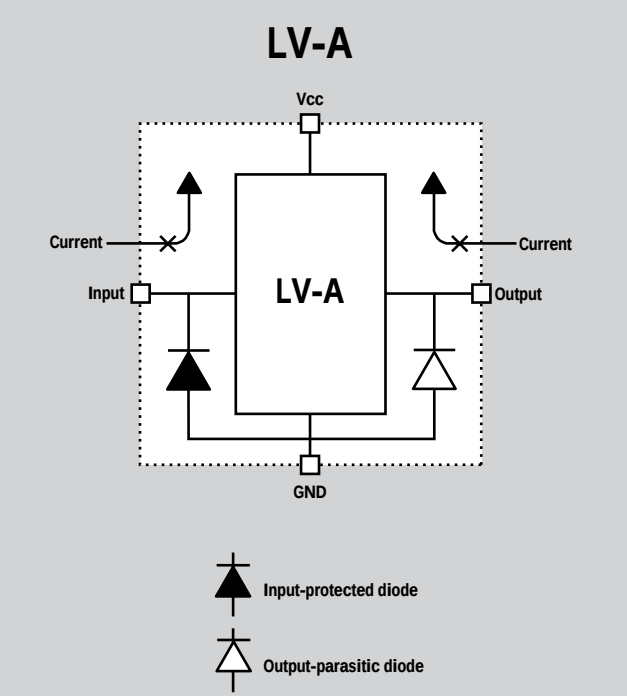


Tolerant Feature

Because input and output for the SN74LV-A Series do not involve electric paths to the Vcc side, voltages higher than Vcc can be applied even for use on low voltage, thus interfacing between differente power sources is enabled (only when output is Hi-Z).



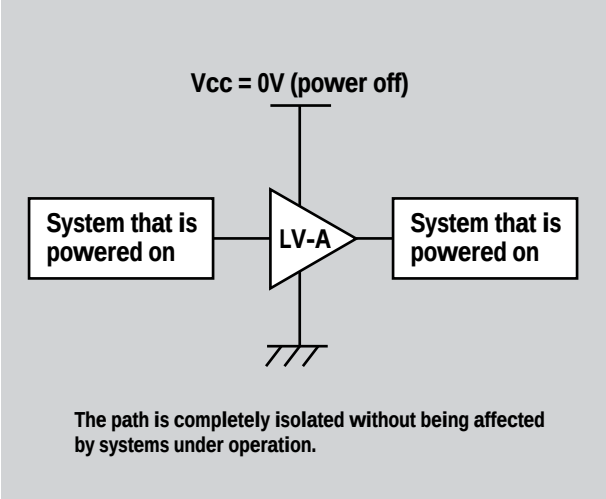
Interface Example for the LV-A Series



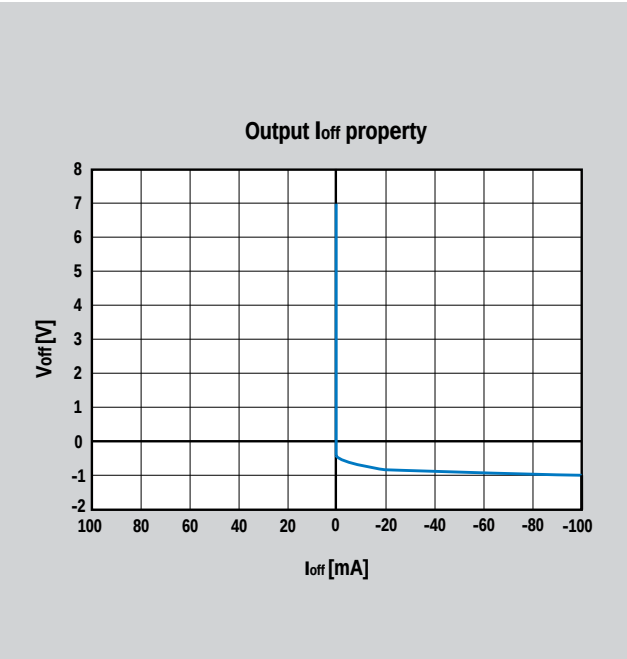
I/O Equivalent Circuit for the LV-A Series

Power Down Property

The SN74LV-A Series specifications provide output leakage current for source voltage Vcc = 0V to cope with applications requiring partial drop of system power, such as suspended mode or partial power down.



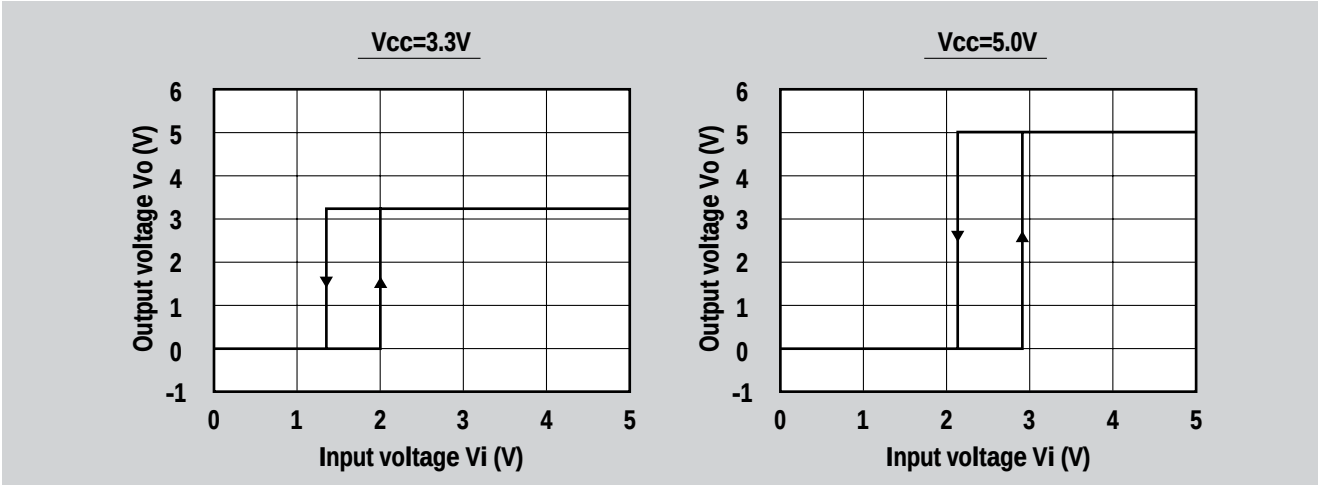
Partial-power-down application



Output I_{off} property (when Vcc = 0V)

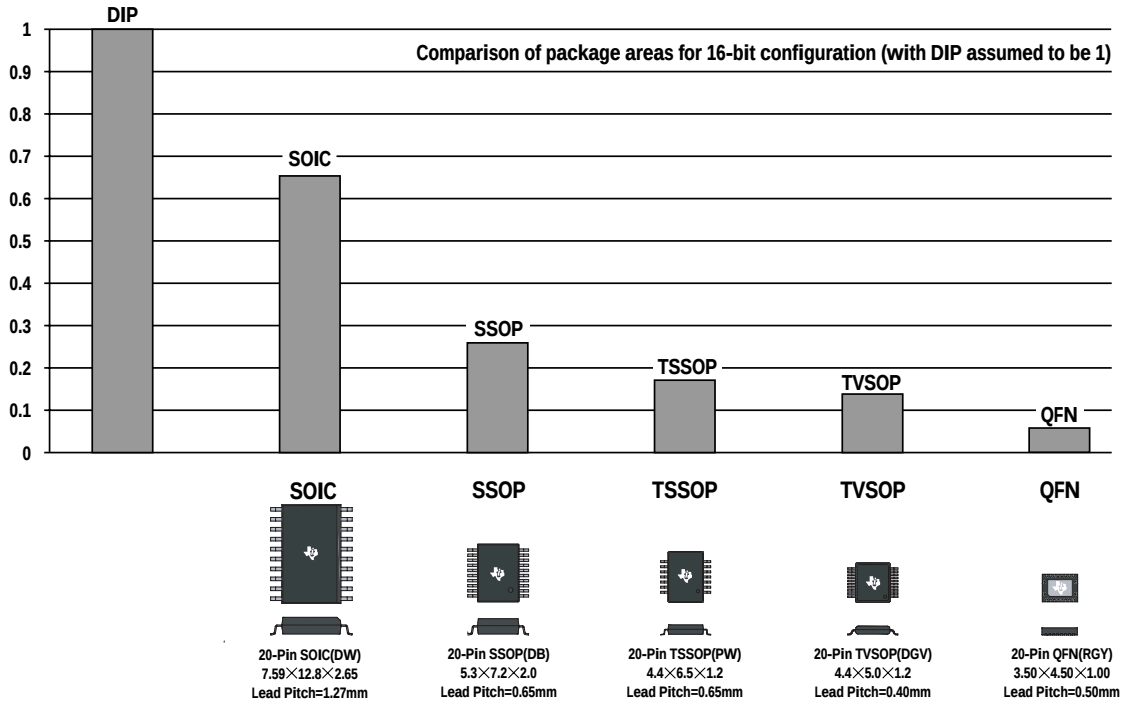
Hysteresis Property

Input hysteresis property for SN74LV244A (with ambient temperature Ta = 25°C)



Packages

Comparison of package areas



Specifications of the LV-A Series

Absolute Maximum Ratings

Symbol	Item			Rating
V_{CC}	Source voltage			-0.5V to 7.0V
V_I	Input voltage			-0.5V to 7.0V
V_O	Output voltage	When output is "H" or "L"		-0.5V to Vcc+0.5V
		When output is Hi-Z or when power is turned off		-0.5V to 7.0V
I_{IK}	Input diode current	VI<0		-20mA
I_{OK}	Output diode current	Vo<0 or Vo>Vcc		±50mA
I_O	Output current	Vo=0 to Vcc	Gate system	±25mA
			Bus system	±35mA
I_{CC}/I_{GND}	Vcc/GND current		Gate system	±50mA
			Bus system	±70mA
Tstg	Storage temperature			-65°C to 150°C

Recommended Operating Conditions

Symbol	Item			Min.	Max.	Unit
V_{CC}	Source voltage			2	5.5	V
V_{IH}	"H" level input voltage	Vcc=2V		1.5		V
		Vcc=2.3V to 2.7V		Vcc×0.7		
		Vcc=3V to 3.6V		Vcc×0.7		
		Vcc=4.5V to 5.5V		Vcc×0.7		
V_{IL}	"L" level input voltage	Vcc=2V			0.5	V
		Vcc=2.3V to 2.7V			Vcc×0.3	
		Vcc=3V to 3.6V			Vcc×0.3	
		Vcc=4.5V to 5.5V			Vcc×0.3	
V_I	Input voltage			0	5.5	V
V_O	Output voltage	When output is "H" or "L"		0	Vcc	V
		When output is Hi-Z (for the bus system)		0	5.5	
I_{OH}	"H" level output current	Vcc=2V			-50	μA
		Vcc=2.3V to 2.7V			-2	mA
		Vcc=3V to 3.6V	Gate system		-6	
			Bus system		-8	
		Vcc=4.5V to 5.5V	Gate system		-12	
			Bus system		-16	
I_{OL}	"L" level output current	Vcc=2V			50	μA
		Vcc=2.3V to 2.7V			2	mA
		Vcc=3V to 3.6V	Gate system		6	
			Bus system		8	
		Vcc=4.5V to 5.5V	Gate system		12	
			Bus system	0	16	
$\Delta t/\Delta v$	Input leading/ falling edge rate	Vcc=2.3V to 2.7V		0	200	ns/V
		Vcc=3V to 3.6V		0	100	
		Vcc=4.5V to 5.5V		0	20	
Ta	Operation-guarantee temperature			-40	85	°C

Specifications of the LV-A Series

DC Properties

Symbol	Source voltage	Measuring condition		Min.	Max.	Unit
V_{OH}	2V to 5.5V	I_{OH}=-50μA		Vcc-0.1		V
	2.3V	I_{OH}=-2mA		2		
	3V	I_{OH}=-6mA	Gate system	2.48		
		I_{OH}=-8mA	Bus system	2.48		
	4.5V	I_{OH}=-12mA	Gate system	3.8		
		I_{OH}=-16mA	Bus system	3.8		
V_{OL}	2V to 5.5V	I_{OL}=50μA			0.1	V
	2.3V	I_{OL}=2mA			0.4	
	3V	I_{OL}=6mA	Gate system		0.44	
		I_{OL}=8mA	Bus system		0.44	
	4.5V	I_{OL}=12mA	Gate system		0.55	
		I_{OL}=16mA	Bus system		0.55	
I_I	5.5V	V_I=Vcc or GND			±1	μA
I_{CC}	5.5V	V_I=Vcc or GND	I_O=0		20	μA
I_{off}	0V	V_O=5.5V			5	μA

AC Properties

SN74LV00A

Vcc=2.5V±0.2V

Symbol	Item	FROM (Input)	TO (Output)	Load capacity	Ta=25°C			Ta=-40~85°C		Unit
					Min.	Std.	Max.	Min.	Max.	
tpd	Propagation delay time	A or B	Y	C_L=15pF		7.1	12.9	1	15	ns
tpd	Output enable time	A or B	Y	C_L=50pF		9.6	16.9	1	20	ns

Vcc=3.3V±0.3V

Symbol	Item	FROM (Input)	TO (Output)	Load capacity	Ta=25°C			Ta=-40~85°C		Unit
					Min.	Std.	Max.	Min.	Max.	
tpd	Propagation delay time	A or B	Y	C_L=15pF		5	7.9	1	9.5	ns
tpd	Output enable time	A or B	Y	C_L=50pF		6.9	11.4	1	13	ns

Vcc=5V±0.5V

Symbol	Item	FROM (Input)	TO (Output)	Load capacity	Ta=25°C			Ta=-40~85°C		Unit
					Min.	Std.	Max.	Min.	Max.	
tpd	Propagation delay time	A or B	Y	C_L=15pF		3.6	5.5	1	6.5	ns
tpd	Output enable time	A or B	Y	C_L=50pF		4.9	7.5	1	8.5	ns

Specifications of the LV-A Series

SN74LV244A

Vcc=2.5V±0.2V

Symbol	Item	FROM (Input)	TO (Output)	Load capacity	Ta=25°C			Ta=-40~85°C		Unit
					Min.	Std.	Max.	Min.	Max.	
tpd	Propagation delay time	A	Y	CL=15pF		7.5	12.5	1	15	ns
				CL=50pF		9.5	15.3	1	18	
ten	Output enable time	$\overline{OE}$	Y	CL=15pF		8.9	14.6	1	17	ns
				CL=50pF		10.8	17.8	1	21	
tdis	Output disable time	$\overline{OE}$	Y	CL=15pF		9.1	14.1	1	16	ns
				CL=50pF		13.4	19.2	1	21	
tsk(o)	Skew between output pins			CL=50pF			2		2	ns

Vcc=3.3V±0.3V

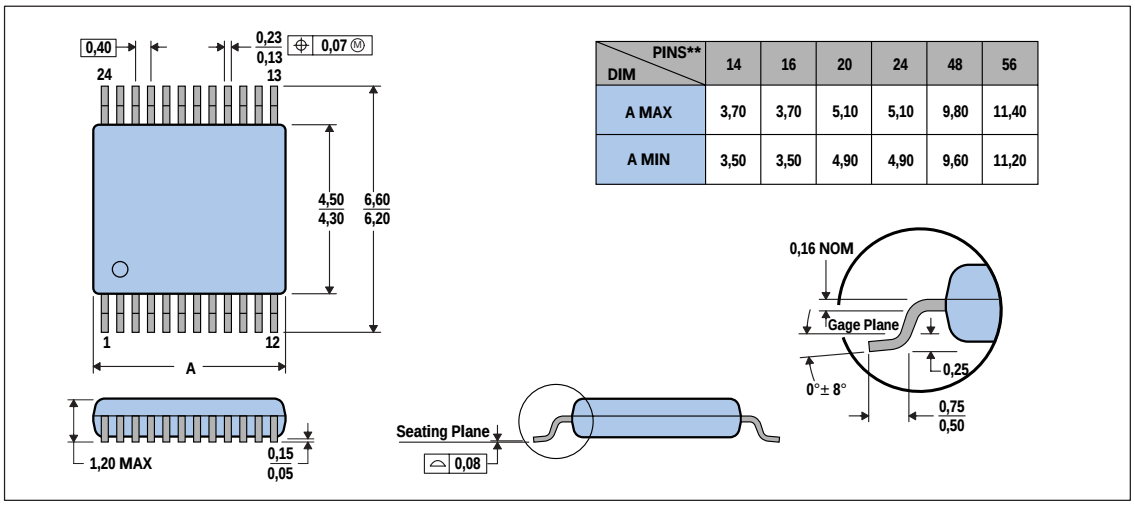
Symbol	Item	FROM (Input)	TO (Output)	Load capacity	Ta=25°C			Ta=-40~85°C		Unit
					Min.	Std.	Max.	Min.	Max.	
tpd	Propagation delay time	A	Y	CL=15pF		5.4	8.4	1	10	ns
				CL=50pF		6.8	11.9	1	13.5	
ten	Output enable time	$\overline{OE}$	Y	CL=15pF		6.3	10.6	1	12.5	ns
				CL=50pF		7.8	14.1	1	16	
tdis	Output disable time	$\overline{OE}$	Y	CL=15pF		7.6	11.7	1	13	ns
				CL=50pF		11	16	1	18	
tsk(o)	Skew between output pins			CL=50pF			1.5		1.5	ns

Vcc=5.0V±0.5V

Symbol	Item	FROM (Input)	TO (Output)	Load capacity	Ta=25°C			Ta=-40~85°C		Unit
					Min.	Std.	Max.	Min.	Max.	
tpd	Propagation delay time	A	Y	CL=15pF		3.9	5.5	1	6.5	ns
				CL=50pF		4.9	7.5	1	8.5	
ten	Output enable time	$\overline{OE}$	Y	CL=15pF		4.5	7.3	1	8.5	ns
				CL=50pF		5.6	9.3	1	10.5	
tdis	Output disable time	$\overline{OE}$	Y	CL=15pF		6.5	12.2	1	13.5	ns
				CL=50pF		8.8	14.2	1	15.5	
tsk(o)	Skew between output pins			CL=50pF			1		1	ns

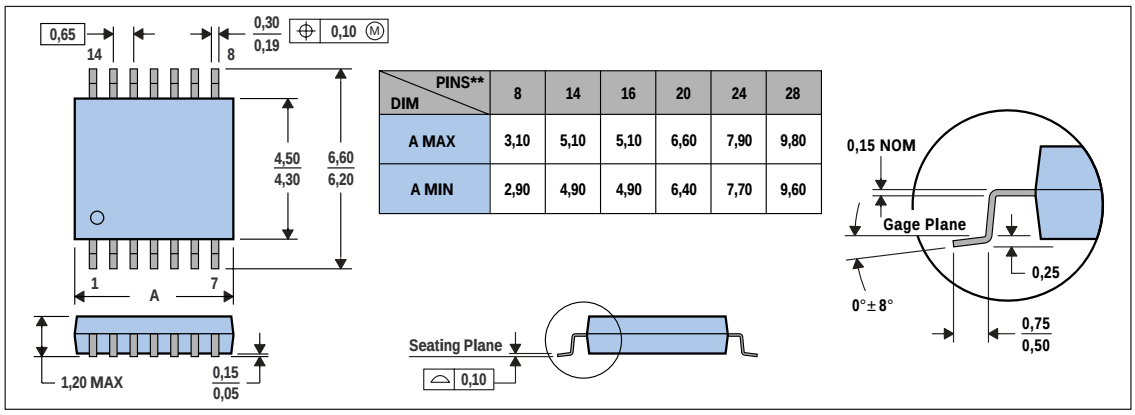
Package Dimension Diagram

TVSOP (14/16/20/24/48/56-pin) - DGV



DIM \ PINS**	14	16	20	24	48	56
A MAX	3,70	3,70	5,10	5,10	9,80	11,40
A MIN	3,50	3,50	4,90	4,90	9,60	11,20

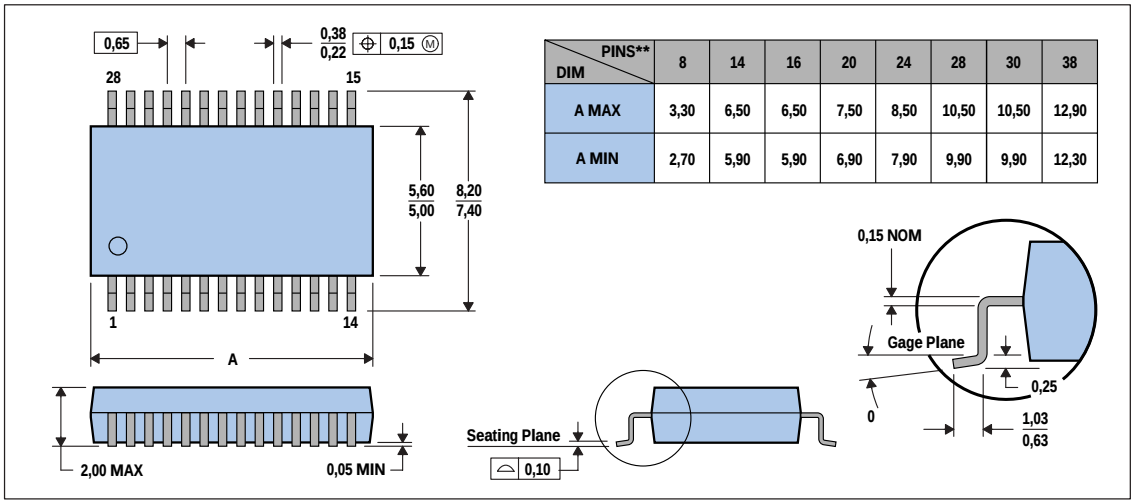
TSSOP (8/14/16/20/24/28-pin) - PW



DIM \ PINS**	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

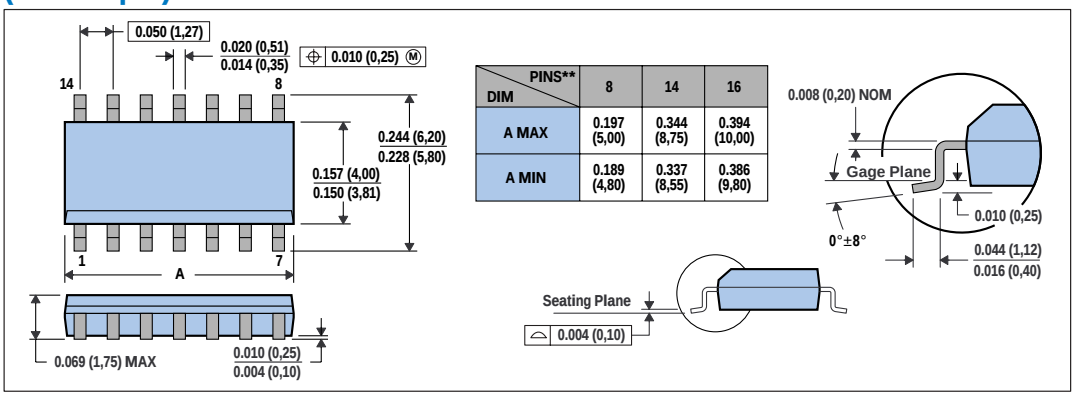
SSOP (14/16/20/24/28/30/38-pin) - DB



DIM \ PINS**	8	14	16	20	24	28	30	38
A MAX	3,30	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	2,70	5,90	5,90	6,90	7,90	9,90	9,90	12,30

Package Dimension Diagram

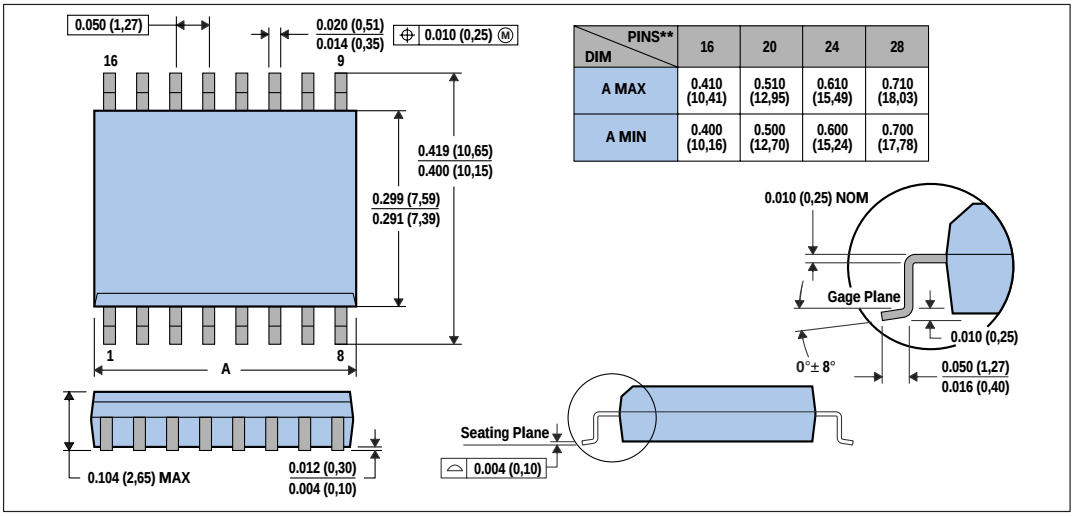
SOIC (8/14/16-pin) - D



DIM \ PINS**	8	14	16
A MAX	0.197 (5,00)	0.344 (8,75)	0.394 (10,00)
A MIN	0.189 (4,80)	0.337 (8,55)	0.386 (9,80)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-012

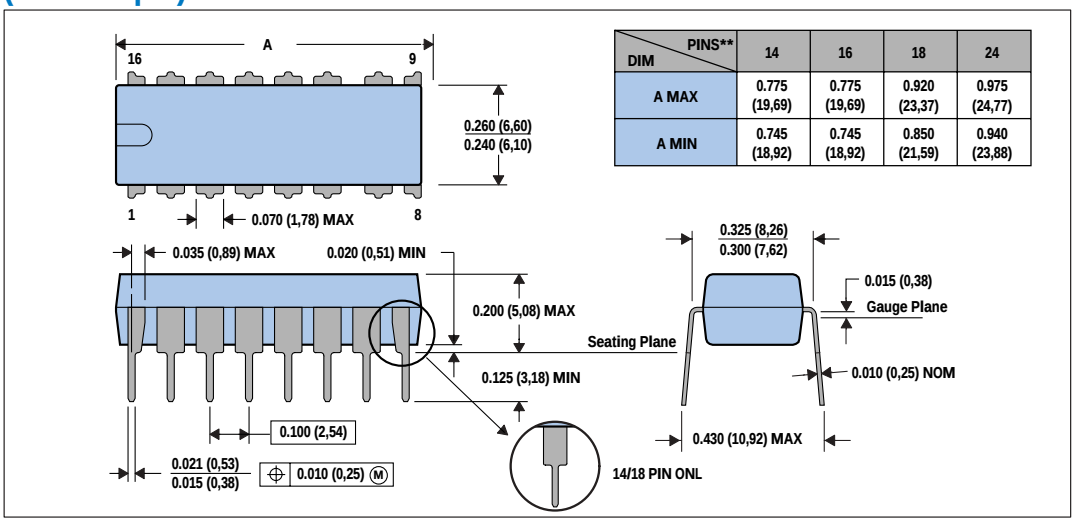
SOIC (16/20/24/28-pin) - DW



DIM \ PINS**	16	20	24	28
A MAX	0.410 (10,41)	0.510 (12,95)	0.610 (15,49)	0.710 (18,03)
A MIN	0.400 (10,16)	0.500 (12,70)	0.600 (15,24)	0.700 (17,78)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-013

PDIP (14/16/20-pin) - N

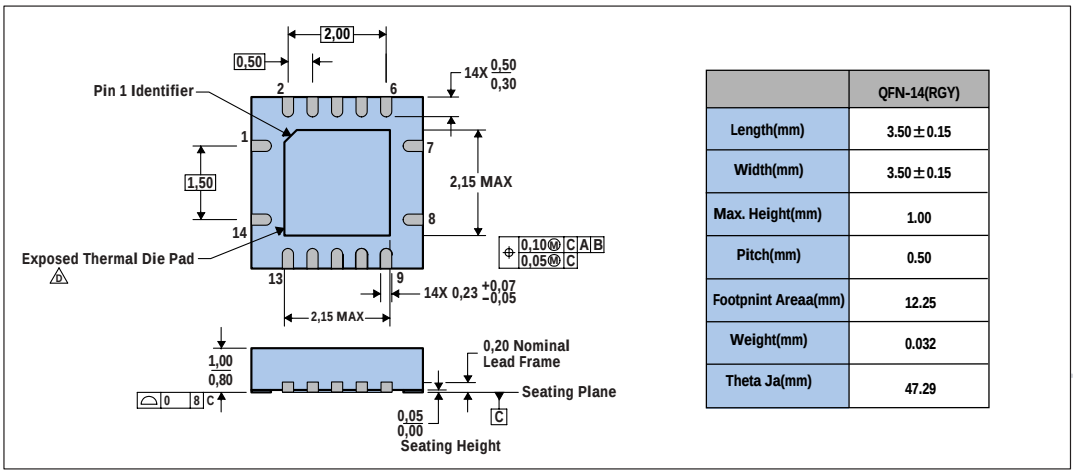


DIM \ PINS**	14	16	18	24
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	0.975 (24,77)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001 (20-pin package is shorter than MS-001).

Package Dimension Diagram

QFN (14-pin) - RGY

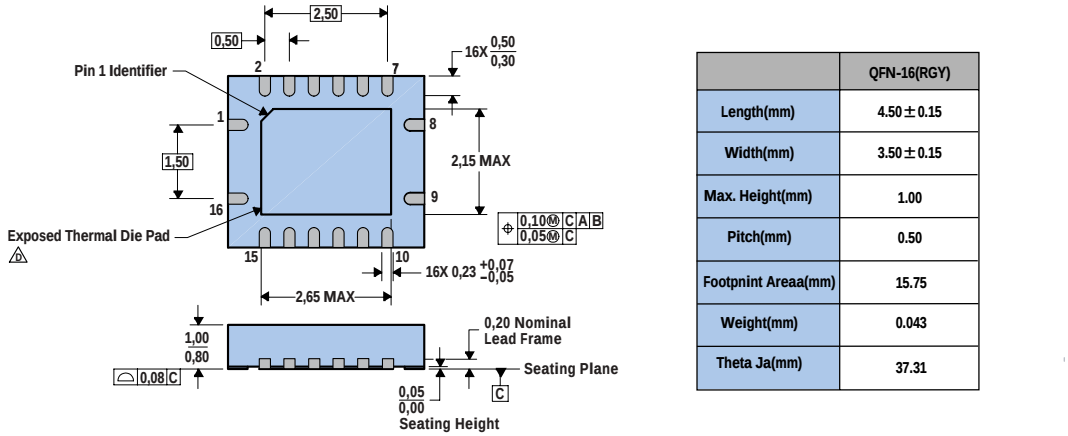


	QFN-14(RGY)
Length(mm)	3.50±0.15
Width(mm)	3.50±0.15
Max. Height(mm)	1.00
Pitch(mm)	0.50
Footpnint Areaa(mm)	12.25
Weight(mm)	0.032
Theta Ja(mm)	47.29

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. QFN (Quad Flatpack No-Lead) package configuaration.

D. The package thermal performance may be enhanced by bonding the thermal die pad to an external thermal plane. This pad is electrically and thermal connected to the backside of the die and possibly selected ground leads.

QFN (16-pin) - RGY

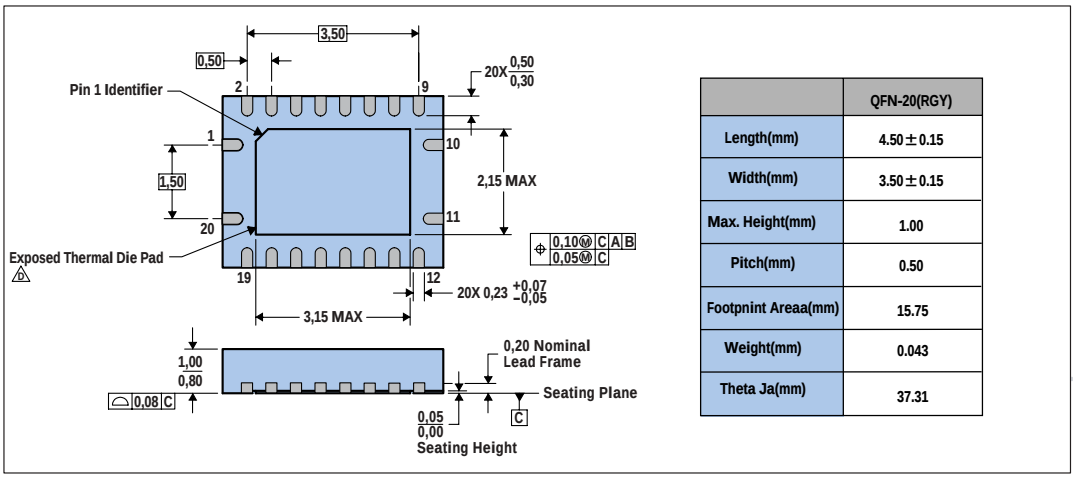


	QFN-16(RGY)
Length(mm)	4.50±0.15
Width(mm)	3.50±0.15
Max. Height(mm)	1.00
Pitch(mm)	0.50
Footpnint Areaa(mm)	15.75
Weight(mm)	0.043
Theta Ja(mm)	37.31

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. QFN (Quad Flatpack No-Lead) package configuaration.

D. The package thermal performance may be enhanced by bonding the thermal die pad to an external thermal plane. This pad is electrically and thermal connected to the backside of the die and possibly selected ground leads.

QFN (20-pin) - RGY

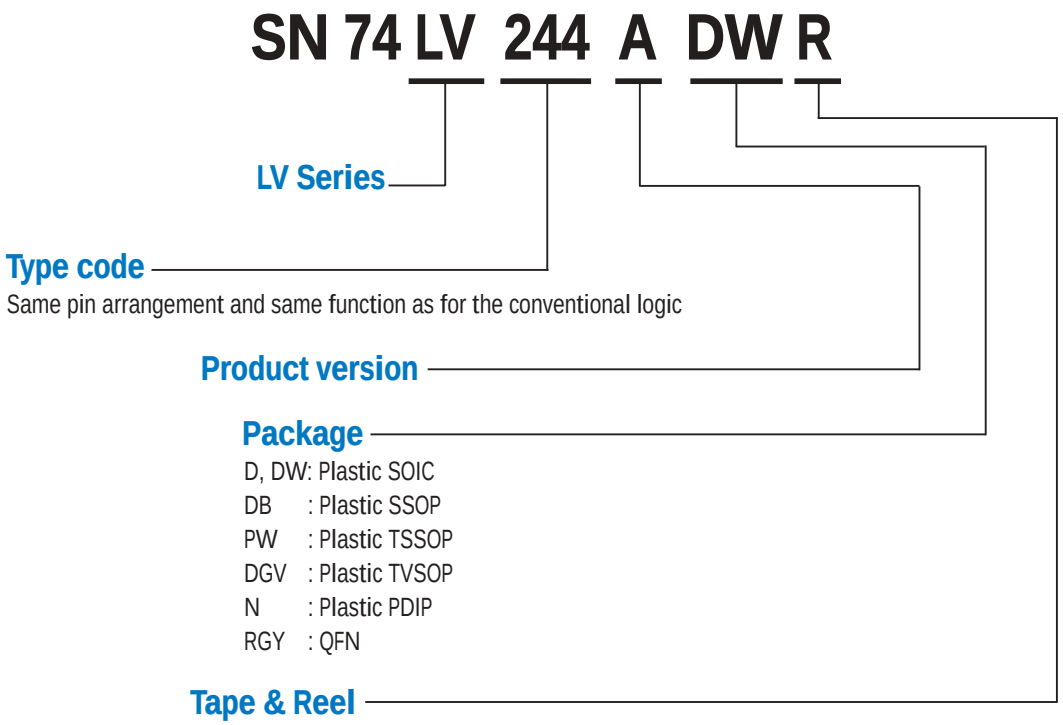


	QFN-20(RGY)
Length(mm)	4.50±0.15
Width(mm)	3.50±0.15
Max. Height(mm)	1.00
Pitch(mm)	0.50
Footpnint Areaa(mm)	15.75
Weight(mm)	0.043
Theta Ja(mm)	37.31

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. QFN (Quad Flatpack No-Lead) package configuaration.

D. The package thermal performance may be enhanced by bonding the thermal die pad to an external thermal plane. This pad is electrically and thermal connected to the backside of the die and possibly selected ground leads.

Product Name



Abundant package types

Available package types include SOIC, SSOP, TSSOP, PDIP and the new 0.4mm pitch TVSOP micro-package

Function List

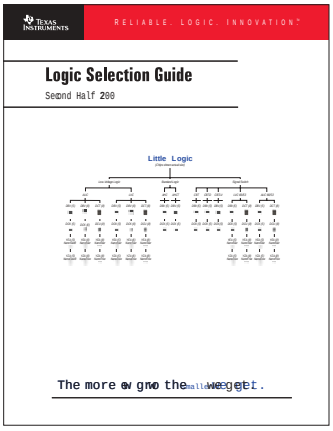
GATE	NAND	00A, 10A, 20A
	NOR	02A, 27A
	INVERTER	04A, U04A, 05A, 06A, 07A
	AND	08A, 11A, 21A
	OR	32A
	EXCLUSIVE-OR	86A
	SCHMITT TRIGGER	14A, 132A
MULTIVIBRATOR		123A, 221A
DECODER/DEMULTIPLEXER		138A, 139A
DATA SELECTOR		157A
COUNTER		161A, 163A, 393A, 4040A
SHIFT REGISTER		164A, 165A, 166A, 594A, 595A
FLIP-FLOP		74A, 174A, 175A, 273A, 374A, 574A
LATCH		373A, 573A
BUFFER	BUS DRIVER	125A, 126A, 240A, 244A, 367A, 540A, 541A
	BUS TRANSCEIVER	245A
ANALOG SWITCH		4051A, 4052A, 4053A, 4066A

Product Lineup

Model name (SN74)	Number of pins	SOIC (D, DW)	SSOP (DB)	TSSOP (PW)	TVSOP (DGV)	PDIF	QFN	Function
		Production status	Production status	Production status	Production status	Production status	Production status	
LV00A	14	○	○	○	○	—	○	Quad 2-Input NAND Gate
LV02A	14	○	○	○	○	—	○	Quad 2-Input NOR Gate
LV04A	14	○	○	○	○	—	○	Hex Inverter
LVU04A	14	○	○	○	○	—	○	Unbuffered Hex Inverter
LV05A	14	○	○	○	○	○	○	Hex Inverters Open Collector Outputs
LV06A	14	○	○	○	○	—	○	Hex Inverters with Open Collector Outputs
LV07A	14	○	○	○	○	—	○	Hex Buffers with Open Collector Outputs
LV08A	14	○	○	○	○	—	○	Quad 2-Input AND Gate
LV10A	14	○	○	○	○	—	○	Quad 3-Input NAND Gate
LV11A	14	○	○	○	○	—	○	Quad 3-Input AND Gate
LV14A	14	○	○	○	○	—	○	Hex Inverter With Schmitt Trigger
LV20A	14	○	○	○	○	—	○	Quad 4-Input NAND Gate
LV21A	14	○	○	○	○	—	○	Quad 4-Input AND Gate
LV27A	14	○	○	○	○	—	○	Triple 3-Input NOR Gate
LV32A	14	○	○	○	○	—	○	Quad 2-Input OR Gate
LV74A	14	○	○	○	○	—	○	Dual D-Type Flip-Flop With Preset and Clear
LV86A	14	○	○	○	○	—	○	Quad Exclusive-OR Gate
LV123A	16	○	○	○	○	—	○	Dual Retriggerable Monostable Multivibrator
LV125A	14	○	○	○	○	—	○	Quad Bus Buffer Gate with 3-State Outputs
LV126A	14	○	○	○	○	—	○	Quad Bus Buffer Gate with 3-State Outputs
LV132A	14	○	○	○	○	—	○	Quad 2-Input NAND With Schmitt Trigger
LV138A	16	○	○	○	○	—	○	3-to-8 Decoder/Demultiplexer
LV139A	16	○	○	○	○	—	○	Dual 2-to-4 Line Decoder/Demultiplexer
LV157A	16	○	○	○	○	—	○	Quad 2-to-1 Data Selector/Multiplexer
LV161A	16	○	○	○	○	—	○	Sync. Binary Counter With Async. Clear
LV163A	16	○	○	○	○	—	○	Sync. Binary Counter With Sync. Clear
LV164A	14	○	○	○	○	—	○	8-Bit Parallel Output Serial Shift Registers
LV165A	16	○	○	○	○	—	○	Parallel Load 8-Bit Shift Registers
LV166A	16	○	○	○	○	—	○	8-Bit Shift Registers
LV174A	16	○	○	○	○	—	○	Hex D-Type Flip-Flop
LV175A	16	○	○	○	○	—	○	Quad D-Type Flip-Flop with Clear
LV221A	16	○	○	○	○	—	○	Dual Monostable Multivibrators
LV240A	20	○	○	○	○	—	○	Octal Buffer/Driver
LV244A	20	○	○	○	○	—	○	Octal Buffer/Driver
LV245A	20	○	○	○	○	○	○	Octal Bus Transceiver
LV273A	20	○	○	○	○	—	○	Octal D-Type Flip-Flop With Clear
LV367A	16	○	○	○	○	—	○	Hex Bus Drivers with 3-State Outputs
LV373A	20	○	○	○	○	—	○	Octal D-Type Transparent Latch
LV374A	20	○	○	○	○	—	○	Octal D-Type Flip-Flop
LV393A	14	○	○	○	○	—	○	Dual 4-Bit Binary Counters
LV540A	20	○	○	○	○	—	○	Inverting Octal Buffer/Driver
LV541A	20	○	○	○	○	—	○	Octal Buffer/Driver
LV573A	20	○	○	○	○	—	○	Octal D-Type Transparent Latch
LV574A	20	○	○	○	○	—	○	Octal D-Type Flip-Flop
LV594A	16	○	○	○	○	—	○	8-Bit Shift Register With Output Latches
LV595A	16	○	○	○	○	—	○	8-Bit Shift Register With 3-State Output Registers
LV4040A	16	○	○	○	○	○	○	12-Stage Binary Counter
LV4051A	16	○	○	○	○	○	○	Single 8-Channel Analog
LV4052A	16	○	○	○	○	○	○	Dual 4-Channel Analog Multiplexer/Demultiplexer
LV4053A	16	○	○	○	○	○	○	Triple 2-Channel Analog Multiplexer/Demultiplexer
LV4066A	14	○	○	○	○	○	○	Quad Bilateral Switch

○ : Active

Logic Literature



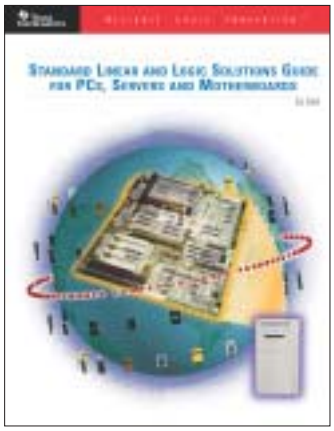
SDYU001R

SLYT017

SCYT129

SCEB011A

SCLA013D



SCYB005

SCYM001

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