

QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS

SDLS105 - DECEMBER 1983 - REVISED MARCH 1988

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

description

These devices contain four independent 2-input NAND buffer gates with open-collector outputs. The open-collector outputs require pull-up resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate high  $V_{OH}$  levels.

The SN5438, SN54LS38, and SN54S38 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7438, SN74LS38, and SN74S38 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE (each gate)

INPUTS		OUTPUT
A	B	Y
H	H	L
L	X	H
X	L	H

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

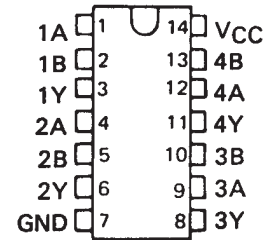
Pin numbers shown are for D, J, N, and W packages.

SN5438, SN54LS38, SN54S38 . . . J OR W PACKAGE

SN7438 . . . N PACKAGE

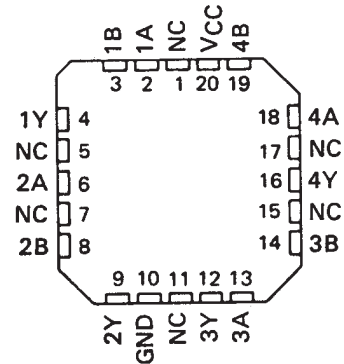
SN74LS38, SN74S38 . . . D OR N PACKAGE

(TOP VIEW)



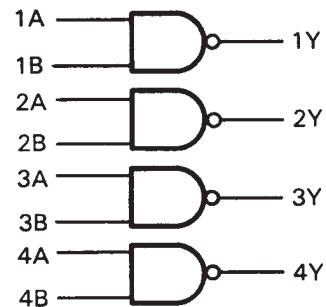
SN54LS38, SN54S38 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

logic diagram



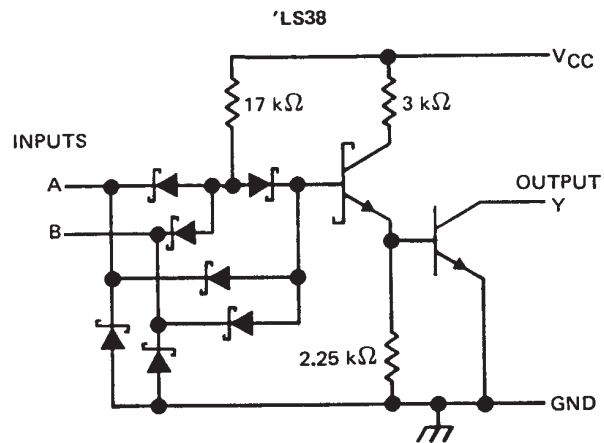
positive logic

$$Y = \overline{A \cdot B} \text{ or } Y = \overline{\overline{A} + \overline{B}}$$

QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS

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schematics (each gate)



Resistor values shown are nominal.

absolute maximum ratings over operating free-air temperature (unless otherwise noted)

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage: '38	5.5 V
LS38	7 V
Off-state output voltage	7 V
Operating free-air temperature range: SN54'	$-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$
SN74'	$0^{\circ}\text{C}$ to $70^{\circ}\text{C}$
Storage temperature range	$-65^{\circ}\text{C}$ to $150^{\circ}\text{C}$

NOTE 1: Voltage values are with respect to network ground terminal.

QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS

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recommended operating conditions

	SN5438			SN7438			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage	0.8			0.8			V
V <sub>OH</sub> High-level output voltage	5.5			5.5			V
I <sub>OL</sub> Low-level output current	48			48			mA
T <sub>A</sub> Operating free-air temperature	-55		125	0		70	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	SN5438			SN7438			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -12 mA	-1.5			-1.5			V
I <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.8 V, V <sub>OH</sub> = 5.5 V				0.25			mA
	V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.7 V, V <sub>OH</sub> = 5.5 V	0.25						
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 16 mA	0.4			0.4			V
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V	1			1			mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V	40			40			μA
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V	-1.6			-1.6			mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0	5	8.5		5	8.5	mA	
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V	34	54		34	54	mA	

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	A or B	Y	R <sub>L</sub> = 133 Ω, C <sub>L</sub> = 45 pF		14	22	ns
t <sub>PHL</sub>					11	18	ns

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS

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recommended operating conditions

	SN54LS38			SN74LS38			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage	0.7			0.8			V
V <sub>OH</sub> High-level output voltage	5.5			5.5			V
I <sub>OL</sub> Low-level output current	12			24			mA
T <sub>A</sub> Operating free-air temperature	- 55 125			0 70			°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS †	SN54LS38			SN74LS38			UNIT
		MIN	TYP ‡	MAX	MIN	TYP ‡	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = - 18 mA	- 1.5			- 1.5			V
I <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>OH</sub> = 5.5 V	0.25			0.25			mA
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 12 mA	0.25 0.4			0.25 0.4			V
	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 24 mA				0.35 0.5			
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V	0.1			0.1			mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V	20			20			µA
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V	- 0.4			- 0.4			mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0	0.9 2			0.9 2			mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V	6 12			6 12			mA

† For conditons shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	A or B	Y	R <sub>L</sub> = 667 Ω, C <sub>L</sub> = 45 pF	20		32	ns
t <sub>PHL</sub>				18		28	ns

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.



QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS

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recommended operating conditions

	SN54S38			SN74S38			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage			0.8			0.8	V
V <sub>OH</sub> High-level output voltage			5.5			5.5	V
I <sub>OL</sub> Low-level output current			60			60	mA
T <sub>A</sub> Operating free-air temperature	-55		125	0		70	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	SN54S38		SN74S38		UNIT		
		MIN	TYP‡	MAX	MIN		TYP‡	MAX
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA			-1.2		-1.2	V	
I <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.8 V, V <sub>OH</sub> = 5.5 V					0.25	mA	
	V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.7 V, V <sub>OH</sub> = 5.5 V			0.25				
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 60 mA			0.5		0.5	V	
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V			1		1	mA	
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V			0.1		0.1	mA	
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5 V			-4		-4	mA	
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0			20	36	20	36	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V			46	80	46	80	mA

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS		MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	A or B	Y	R <sub>L</sub> = 93 Ω,	C <sub>L</sub> = 50 pF	6.5	10	ns	
t <sub>PHL</sub>					6.5	10	ns	
t <sub>PLH</sub>			R <sub>L</sub> = 93 Ω,	C <sub>L</sub> = 150 pF	9		ns	
t <sub>PHL</sub>					8.5		ns	

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
JM38510/00303BCA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
JM38510/30203B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
JM38510/30203B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
JM38510/30203BCA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
JM38510/30203BCA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
JM38510/30203BDA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
JM38510/30203BDA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
SN5438J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN5438J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN54LS38J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN54LS38J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN54S38J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN54S38J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN7438D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN7438D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN7438DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN7438DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN7438DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN7438DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN7438DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN7438DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN7438J	OBSOLETE	CDIP	J	14		TBD	Call TI	Call TI
SN7438J	OBSOLETE	CDIP	J	14		TBD	Call TI	Call TI
SN7438N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN7438N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN7438N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN7438N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN7438NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN7438NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN7438NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN7438NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN7438NSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
						no Sb/Br)		
SN7438NSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS38D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS38D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS38DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS38DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS38DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS38DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS38DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS38DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS38N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS38N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS38N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74LS38N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74LS38NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS38NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS38NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS38NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS38NSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS38NSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S38D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S38D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S38DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S38DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S38DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S38DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S38DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74S38DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S38N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74S38N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74S38N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74S38N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74S38NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74S38NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74S38NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S38NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S38NSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S38NSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ5438J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ5438J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ5438W	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
SNJ5438W	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
SNJ54LS38FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54LS38FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54LS38J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54LS38J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54LS38W	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
SNJ54LS38W	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
SNJ54S38FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54S38FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54S38J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54S38J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54S38W	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
SNJ54S38W	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered



at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package is hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within MIL STD 1835 GDFP1-F14 and JEDEC MO-092AB

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a metal lid.
  - D. The terminals are gold plated.
  - E. Falls within JEDEC MS-004

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AB.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- 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.

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