

SN54LS138, SN54S138, SN74LS138, SN74S138A 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

SDLS014

DECEMBER 1972—REVISED MARCH 1988

- Designed Specifically for High-Speed:
Memory Decoders
Data Transmission Systems
- 3 Enable Inputs to Simplify Cascading
and/or Data Reception
- Schottky-Clamped for High Performance

description

These Schottky-clamped TTL MSI circuits are designed to be used in high-performance memory decoding or data-routing applications requiring very short propagation delay times. In high-performance memory systems, these decoders can be used to minimize the effects of system decoding. When employed with high-speed memories utilizing a fast enable circuit, the delay times of these decoders and the enable time of the memory are usually less than the typical access time of the memory. This means that the effective system delay introduced by the Schottky-clamped system decoder is negligible.

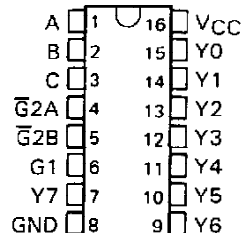
The 'LS138, SN54S138, and SN74S138A decode one of eight lines dependent on the conditions at the three binary select inputs and the three enable inputs. Two active-low and one active-high enable inputs reduce the need for external gates or inverters when expanding. A 24-line decoder can be implemented without external inverters and a 32-line decoder requires only one inverter. An enable input can be used as a data input for demultiplexing applications.

All of these decoder/demultiplexers feature fully buffered inputs, each of which represents only one normalized load to its driving circuit. All inputs are clamped with high-performance Schottky diodes to suppress line-ringing and to simplify system design.

The SN54LS138 and SN54S138 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN74LS138 and SN74S138A are characterized for operation from 0°C to 70°C .

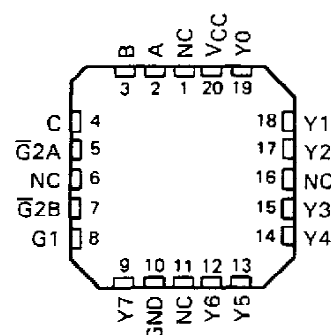
SN54LS138, SN54S138 . . . J OR W PACKAGE
SN74LS138, SN74S138A . . . D OR N PACKAGE

(TOP VIEW)



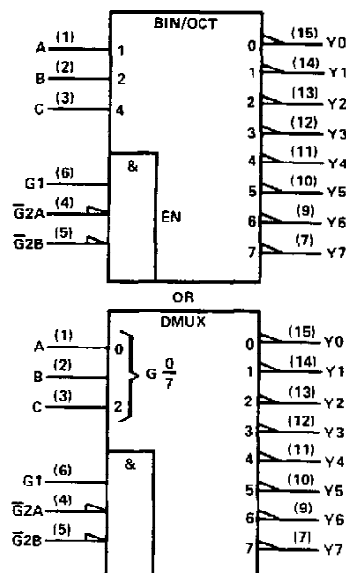
SN54LS138, SN54S138 . . . FK PACKAGE

(TOP VIEW)



NC—No internal connection

logic symbols†



†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

TEXAS
INSTRUMENTS

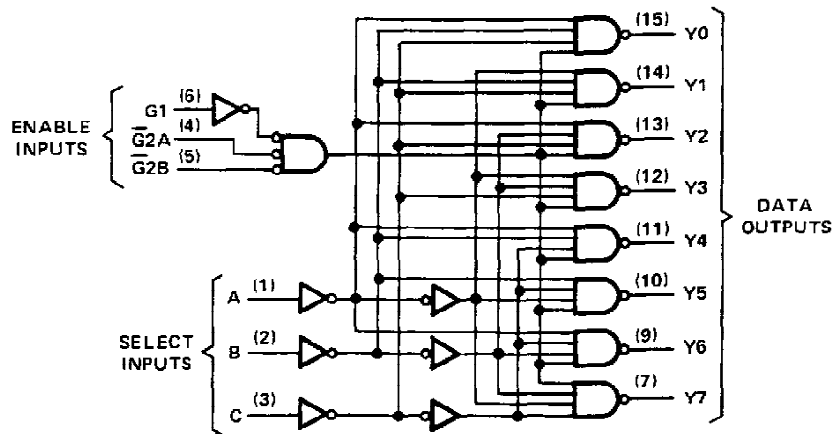
POST OFFICE BOX 655012 • DALLAS, TEXAS 75265

Copyright © 1972, Texas Instruments Incorporated

SN54LS138, SN54S138, SN74LS138, SN74S138A 3-LINE-TO 8-LINE DECODERS/DEMULTIPLEXERS

logic diagram and function table

LS138, SN54S138, SN74S138A



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

LS138, SN54138, SN74S138A

FUNCTION TABLE

INPUTS					OUTPUTS							
ENABLE		SELECT										
G1	G2*	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	L	H	H	H	L	H	H	H	H	H
H	L	L	L	H	H	H	H	L	H	H	H	H
H	L	L	L	H	H	H	H	H	L	H	H	H
H	L	L	L	H	H	H	H	H	H	L	H	H
H	L	L	L	H	H	H	H	H	H	H	L	H
H	L	L	L	H	H	H	H	H	H	H	H	L

*G2 = G2A + G2B

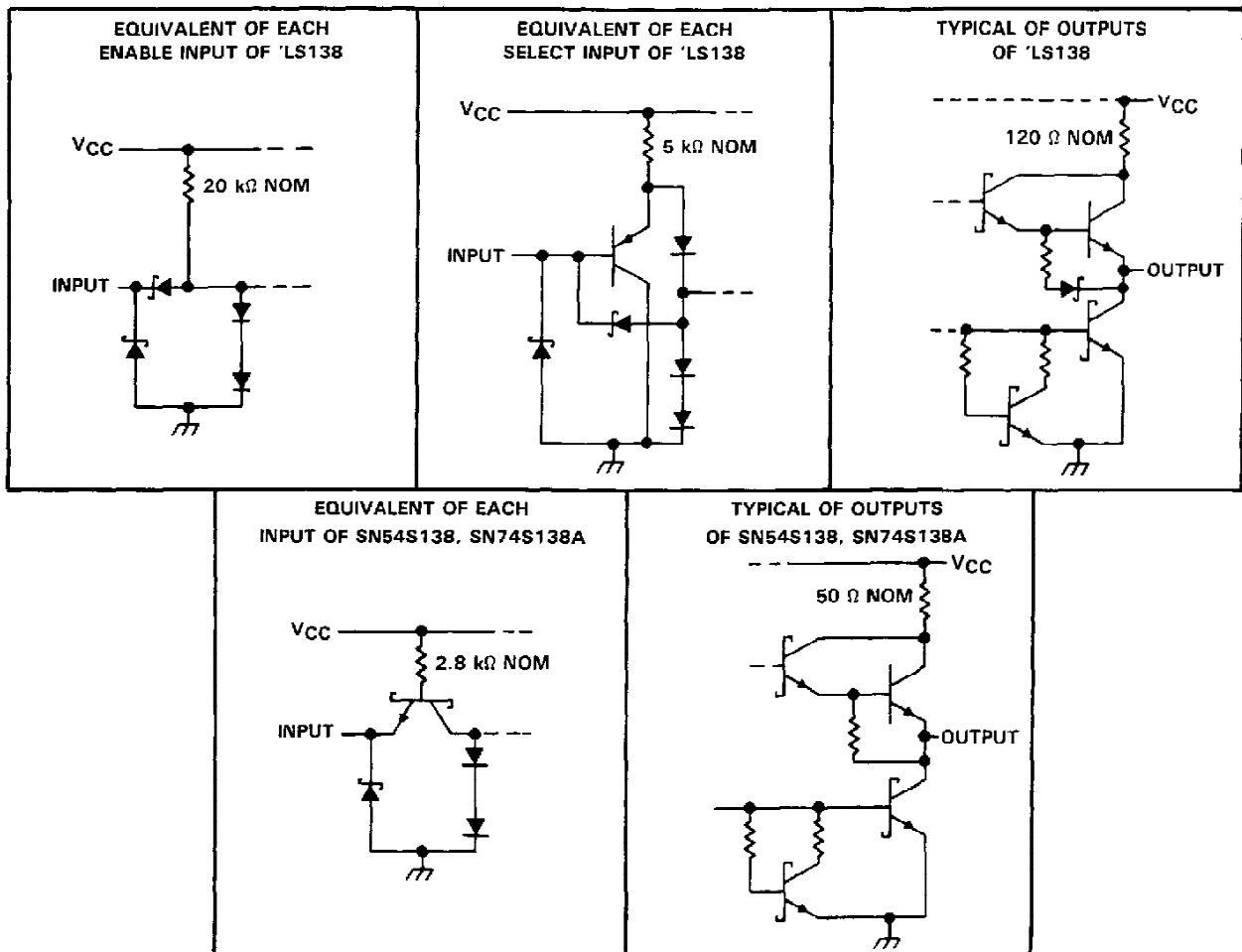
H = high level, L = low level, X = irrelevant

TEXAS
INSTRUMENTS

POST OFFICE BOX 655012 • DALLAS, TEXAS 75265

SN54LS138, SN54S138, SN74LS138, SN74S138A 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

schematics of inputs and outputs



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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	7 V
Operating free-air temperature range: SN54LS138, SN54S138	-55°C to 125°C
SN74LS138, SN74S138A	0°C to 70°C
Storage temperature range	-65°C to 150°C

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

TEXAS
INSTRUMENTS

POST OFFICE BOX 655012 • DALLAS, TEXAS 75285

SN54LS138, SN74LS138

3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

recommended operating conditions

		SN54LS138			SN74LS138			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V _{IH}	High-level input voltage	2			2			V
V _{IL}	Low-level input voltage			0.7			0.8	V
I _{OH}	High-level output current			-0.4			-0.4	mA
I _{OL}	Low-level output current			4			8	mA
T _A	Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†		SN54LS138		SN74LS138		UNIT		
			MIN	TYP‡	MAX	MIN		TYP‡	MAX
V _{IK}	V _{CC} = MIN, I _I = -18 mA				-1.5		-1.5	V	
V _{OH}	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = MAX, I _{OH} = -0.4 mA		2.5	3.4		2.7	3.4	V	
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = MAX	I _{OL} = 4 mA		0.25	0.4		0.25	0.4	V
		I _{OL} = 8 mA					0.35	0.5	
I _I	V _{CC} = MAX, V _I = 7 V				0.1			0.1	mA
I _{IH}	V _{CC} = MAX, V _I = 2.7 V				20		20		μA
I _{IL}	V _{CC} = MAX, V _I = 0.4 V	Enable			-0.4		-0.4		mA
		A, B, C			-0.2		-0.2		
I _{OS} §	V _{CC} = MAX		-20		100	-20		-100	mA
I _{CC}	V _{CC} = MAX, Outputs enabled and open			6.3	10		6.3	10	mA

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

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time, and duration of the short-circuit test should not exceed one second.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	LEVELS OF DELAY	TEST CONDITIONS	SN54LS138 SN74LS138			UNIT
					MIN	TYP	MAX	
t _{PLH}	Binary Select	Any	2	R _L = 2 kΩ, C _L = 15 pF. See Note 2		11	20	ns
t _{PHL}						18	41	ns
t _{PLH}			3			21	27	ns
t _{PHL}						20	39	ns
t _{PLH}	Enable	Any	2			12	18	ns
t _{PHL}						20	32	ns
t _{PLH}			3			14	26	ns
t _{PHL}						13	38	ns

† t_{PLH} = propagation delay time, low-to-high-level output

t_{PHL} = propagation delay time, high-to-low-level output

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

TEXAS
INSTRUMENTS

POST OFFICE BOX 655012 • DALLAS, TEXAS 75265

SN54S138, SN74S138A

3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	5.5 V
Operating free-air temperature range: SN54S138	-55°C to 125°C
SN74S138A	0°C to 70°C
Storage temperature range	-65°C to 150°C

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

recommended operating conditions

		SN54S138			SN74S138A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.8			0.8	V
I_{OH}	High-level output current			-1			-1	mA
I_{OL}	Low-level output current			20			20	mA
T_A	Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	SN54S138 SN74S138A			UNIT
		MIN	TYP‡	MAX	
V_{IK}	$V_{CC} = \text{MIN.}$, $I_I = -18 \text{ mA}$			-1.2	V
V_{OH}	$V_{CC} = \text{MIN.}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OH} = -1 \text{ mA}$	SN54S'	2.5	3.4	V
		SN74S'	2.7	3.4	
V_{OL}	$V_{CC} = \text{MIN.}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = 20 \text{ mA}$			0.5	V
I_I	$V_{CC} = \text{MAX.}$, $V_I = 5.5 \text{ V}$			1	mA
I_{IH}	$V_{CC} = \text{MAX.}$, $V_I = 2.7 \text{ V}$			50	µA
I_{IL}	$V_{CC} = \text{MAX.}$, $V_I = 0.5 \text{ V}$			-2	mA
I_{OS}^{\S}	$V_{CC} = \text{MAX.}$	-40		-100	mA
I_{CC}	$V_{CC} = \text{MAX.}$, Outputs enabled and open		49	74	mA

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

‡ All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$.

§ Not more than one output should be shorted at a time, and duration of the short circuit test should not exceed one second.



POST OFFICE BOX 655012 • DALLAS, TEXAS 75265

SN54S138, SN74S138A
3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	LEVELS OF DELAY	TEST CONDITIONS	SN54S138 SN74S138A			UNIT	
					MIN	TYP	MAX		
tPLH	Binary Select	Any	2	RL = 280 Ω, CL = 15 pF, See Note 2		4.5	7	ns	
tPHL						7	10.5	ns	
tPLH			3			7.5	12	ns	
tPHL						8	12	ns	
tPLH	Enable	Any	2			5	8	ns	
tPHL						7	11	ns	
tPLH			3			7	11	ns	
tPHL						7	11	ns	

† t_{PLH} = propagation delay time, low-to-high-level output

t_{PHL} = propagation delay time, high-to-low-level output

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

TEXAS
INSTRUMENTS

POST OFFICE BOX 655012 • DALLAS, TEXAS 75265

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
76005012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	76005012A SNJ54LS 138FK	Samples
7600501EA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	7600501EA SNJ54LS138J	Samples
7600501FA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	7600501FA SNJ54LS138W	Samples
76041012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	76041012A SNJ54S 138FK	Samples
7604101EA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	7604101EA SNJ54S138J	Samples
7604101FA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	7604101FA SNJ54S138W	Samples
JM38510/07701BEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 07701BEA	Samples
JM38510/07701BFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 07701BFA	Samples
JM38510/30701B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	JM38510/ 30701B2A	Samples
JM38510/30701BEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 30701BEA	Samples
JM38510/30701BFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 30701BFA	Samples
JM38510/30701SEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 30701SEA	Samples
JM38510/30701SFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 30701SFA	Samples
M38510/07701BEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 07701BEA	Samples
M38510/07701BFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 07701BFA	Samples
M38510/30701B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	JM38510/ 30701B2A	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
M38510/30701BEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 30701BEA	Samples
M38510/30701BFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 30701BFA	Samples
M38510/30701SEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 30701SEA	Samples
M38510/30701SFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 30701SFA	Samples
SN54LS138J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN54LS138J	Samples
SN54S138J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN54S138J	Samples
SN74LS138D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS138	Samples
SN74LS138DE4	ACTIVE	SOIC	D	16		TBD	Call TI	Call TI	0 to 70		Samples
SN74LS138DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS138	Samples
SN74LS138DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS138	Samples
SN74LS138DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS138	Samples
SN74LS138DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS138	Samples
SN74LS138N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS138N	Samples
SN74LS138N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	0 to 70		
SN74LS138NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS138N	Samples
SN74LS138NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS138	Samples
SN74LS138NSRE4	ACTIVE	SO	NS	16		TBD	Call TI	Call TI	0 to 70		Samples
SN74LS138NSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS138	Samples
SN74S138AD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	S138A	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74S138AN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74S138AN	Samples
SN74S138AN3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	0 to 70		
SN74S138ANE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74S138AN	Samples
SNJ54LS138FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	76005012A SNJ54LS 138FK	Samples
SNJ54LS138J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	7600501EA SNJ54LS138J	Samples
SNJ54LS138W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	7600501FA SNJ54LS138W	Samples
SNJ54S138FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	76041012A SNJ54S 138FK	Samples
SNJ54S138J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	7604101EA SNJ54S138J	Samples
SNJ54S138W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	7604101FA SNJ54S138W	Samples

(1) 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.

(2) 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)

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

- (4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.
- (5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.
- (6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN54LS138, SN54LS138-SP, SN74LS138 :

- Catalog: [SN74LS138](#), [SN54LS138](#)
- Military: [SN54LS138](#)
- Space: [SN54LS138-SP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

TAPE AND REEL INFORMATION


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS138DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS138DR	SOIC	D	16	2500	333.2	345.9	28.6

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



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

W (R-GDFP-F16)

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 GDFP2-F16

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - Falls within JEDEC MS-004

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



4040049/E 12/2002

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-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - $\triangle C$ Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - $\triangle D$ Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

- 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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com