- Bidirectional Bus Transceivers in High-Density 20-Pin Packages
- Hysteresis at Bus Inputs Improves Noise Margins
- Choice of True or Inverting Logic
- A Bus Outputs are Open-Collector, B Bus Outputs are 3-State

description

These octal bus transceivers are designed for asynchronous two-way communication between open-collector and 3-state buses. The devices transmit data from the A bus (open-collector) to the B bus (3-state) or from the B bus to the A bus depending upon the level at the direction control (DIR) input. The enable input ($\overline{G}$) can be used to disable the device so the buses are isolated.

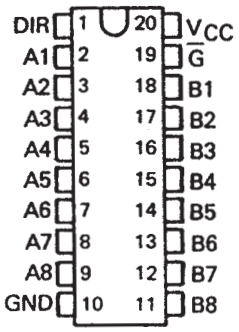
FUNCTION TABLE

CONTROL INPUTS		OPERATION	
$\overline{G}$	DIR	'LS638	'LS639
L	L	$\overline{B}$ data to A bus	B data to A bus
L	H	$\overline{A}$ data to B bus	A data to B bus
H	X	Isolation	Isolation

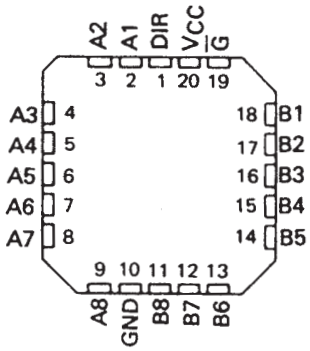
H = high level, L = low level, X = irrelevant

DEVICE	A OUTPUT	B OUTPUT	LOGIC
'LS638	Open-Collector	3-State	Inverting
'LS639	Open-Collector	3-State	True

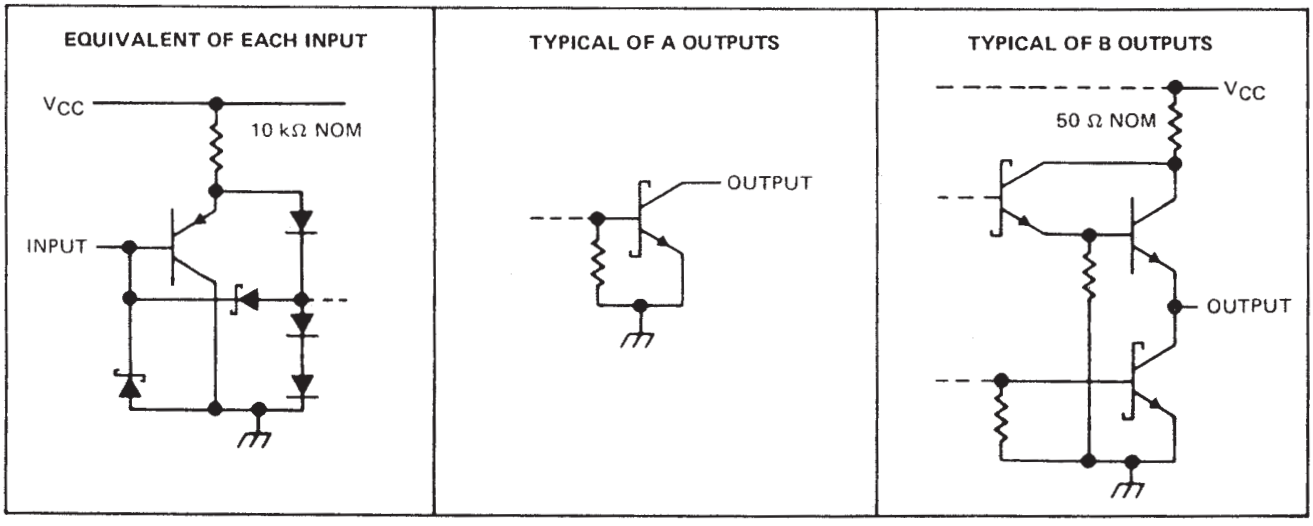
SN54LS638, SN54LS639 . . . J PACKAGE
SN74LS638, SN74LS639 . . . DW OR N PACKAGE
(TOP VIEW)



SN54LS638, SN54LS639 . . . FK PACKAGE
(TOP VIEW)



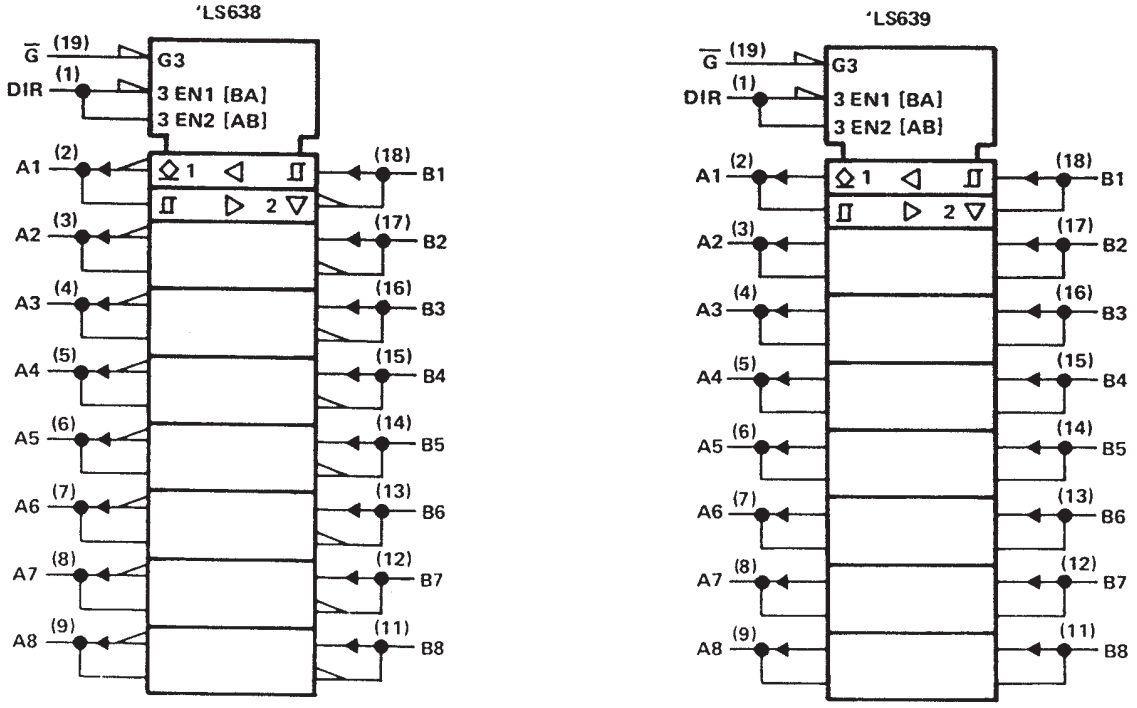
schematics of inputs and outputs



PRODUCTION DATA information is 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.

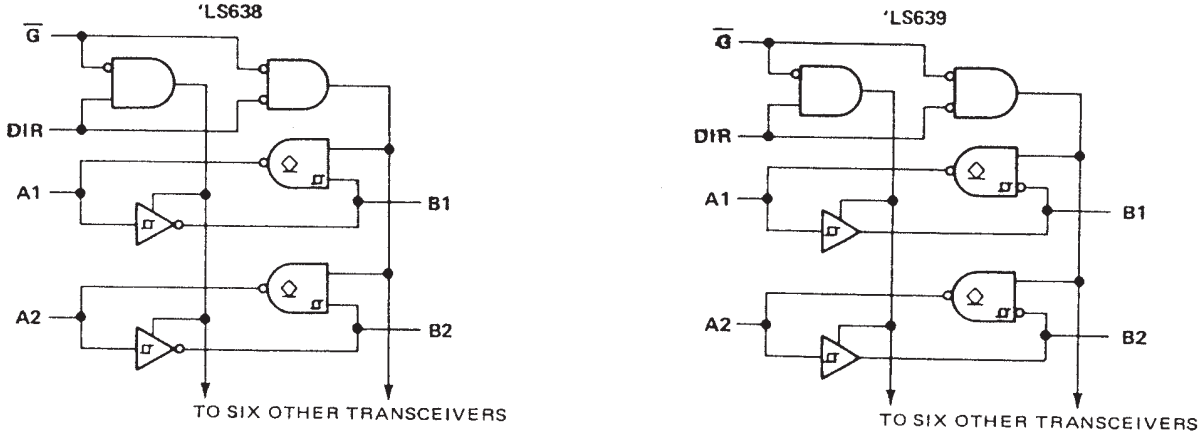
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logic symbols†



† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for DW, J, and N packages.

logic diagrams (positive logic)



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

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage (DIR or $\overline{G}$) . . . . . 7 V
Off-state output voltage (A or B) . . . . . 5.5 V
Operating free-air temperature range: SN54LS638, SN54LS639 . . . . . −55°C to 125°C
SN74LS638, SN74LS639 . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

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

recommended operating conditions

	SN54LS'			SN74LS'			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output voltage, V_{OH} (A bus)			5.5			5.5	V
High-level output current, I_{OH} (B bus)			–12			–15	mA
Low-level output current, I_{OL} (A or B bus)			12			24	mA
Operating free-air temperature, T_A	–55		125	0		70	°C

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

PARAMETER			TEST CONDITIONS†		SN54LS'			SN74LS'			UNIT
					MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage				2			2			V
V_{IL}	Low-level input voltage						0.5			0.6	V
V_{IK}	Input clamp voltage		V_{CC} = MIN, I_I = –18 mA				–1.5			–1.5	V
	Hysteresis (V_{T+}–V_{T-})		V_{CC} = MIN		0.1	0.4		0.2	0.4		V
I_{OH}	High-level output current	A	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX, V_{OH} = 5.5 V				0.1			0.1	mA
V_{OH}	High-level output voltage	B	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX	I_{OH} = –3 mA	2.4			2.4			V
				I_{OH} = MAX	2			2			
V_{OL}	Low-level output voltage	A or B	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX	I_{OL} = 12 mA		0.25	0.4		0.25	0.4	V
				I_{OL} = 24 mA					0.35	0.5	
I_{OZH}	Off-state output current, high-level voltage applied	B	V_{CC} = MAX, $\overline{G}$ at 2 V,	V_O = 2.7 V			20			20	μA
I_{OZL}	Off-state output current low-level voltage applied	A or B	V_{CC} = MAX, $\overline{G}$ at 2 V,	V_O = 0.4 V			– 0.4			– 0.4	mA
I_I	Input current at maximum input voltage	A or B	V_{CC} = MAX	V_I = 5.5 V			0.1			0.1	mA
		DIR or $\overline{G}$		V_I = 7 V			0.1			0.1	
I_{IH}	High-level input current		V_{CC} = MAX, V_I = 2.7 V				20			20	μA
I_{IL}	Low-level input current		V_{CC} = MAX, V_I = 0.4 V				–0.4			–0.4	mA
I_{OS}	Short-circuit output current§	B	V_{CC} = MAX		–40		–225	–40		–225	mA
I_{CCH}	Supply current, outputs high		V_{CC} = MAX, Outputs open			48	70		48	70	mA
I_{CCL}	Supply current, outputs low		V_{CC} = MAX, Outputs open			62	90		62	90	mA
I_{CCZ}	Supply current, outputs off		V_{CC} = MAX, Outputs open			64	95		64	95	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 should not exceed one second.

switching characteristics, V_{CC} = 5 V, T_A = 25°C, see note 2

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS638			'LS639			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH}	A	B	C_L = 45 pF, R_L = 667 Ω		6	10		8	15	ns
	B	A			17	25		19	25	
t_{PHL}	A	B			8	15		11	15	ns
	B	A			14	25		16	25	
t_{PLH}	$\overline{G}$	A			26	40		23	40	ns
t_{PHL}	$\overline{G}$	A			43	60		34	50	ns
t_{PZH}	$\overline{G}$	B			23	40		26	40	ns
t_{PZL}	$\overline{G}$	B			31	40		31	40	ns
t_{PHZ}	$\overline{G}$	B	C_L = 5 pF, R_L = 667 Ω		15	25		15	25	ns
t_{PLZ}	$\overline{G}$	B			15	25		15	25	ns

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

TYPICAL CHARACTERISTICS

SN54LS'
INVERTING OUTPUT VOLTAGE
vs
INPUT VOLTAGE

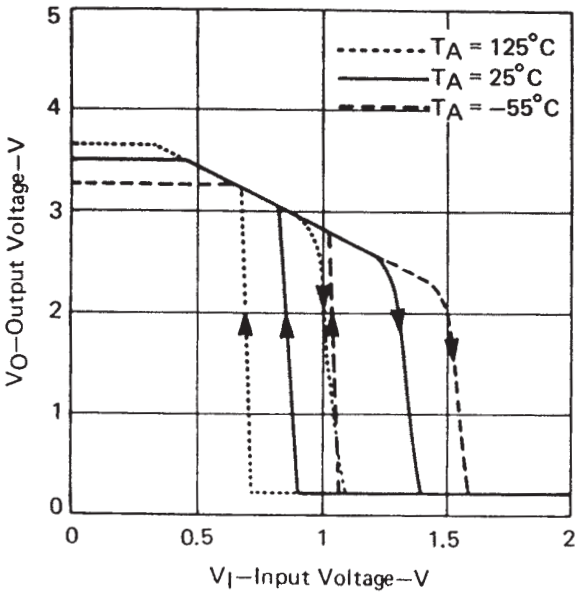


FIGURE 1

SN74LS'
INVERTING OUTPUT VOLTAGE
vs
INPUT VOLTAGE

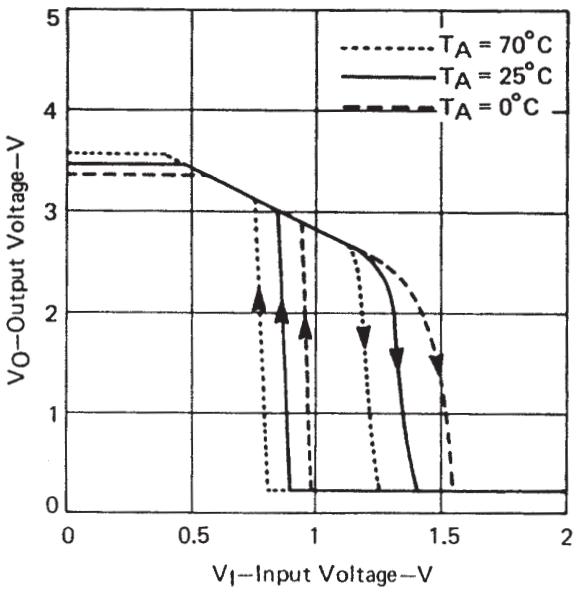


FIGURE 2

SN54LS'
NONINVERTING OUTPUT VOLTAGE
vs
INPUT VOLTAGE

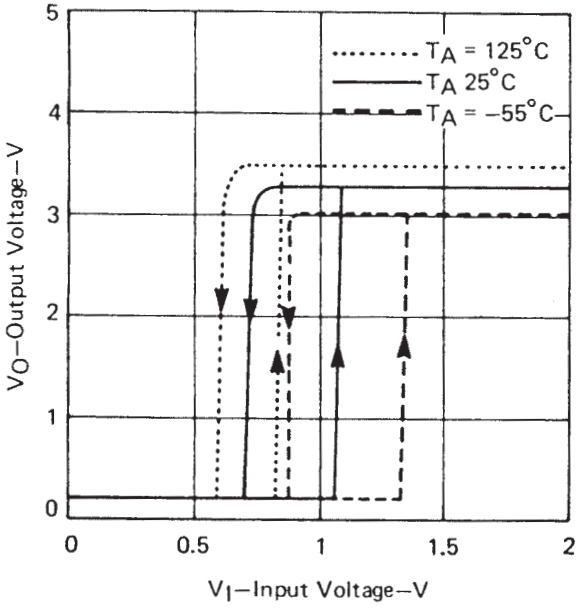


FIGURE 3

SN74LS'
NONINVERTING OUTPUT VOLTAGE
vs
INPUT VOLTAGE

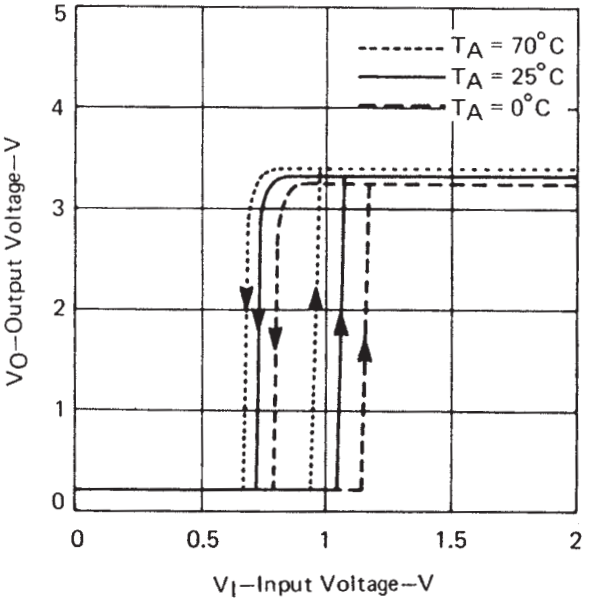


FIGURE 4

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