MOTOROLA

SN54LS/74LS640 thru SN54LS/74LS645

OCTAL BUS TRANSCEIVERS

LOW POWER SCHOTTKY

DESCRIPTION — These octal bus transceivers are designed for asynchronous two-way communication between data buses. Control function implementation minimizes external timing requirements. These circuits allow data transmission from the A bus to B or from the B bus to A bus depending upon the logic level of the direction control (DIR) input. Enable input ($\overline{G}$) can disable the device so that the buses are effectively isolated.

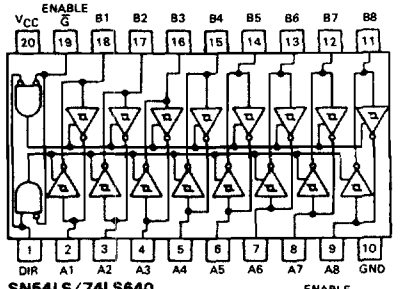
DEVICE	OUTPUT	LOGIC
LS640	3-State	Inverting
LS641	Open-Collector	True
LS642	Open-Collector	Inverting
LS643	3-State	True and Inverting
LS644	Open-Collector	True and Inverting
LS645	3-State	True

FUNCTION TABLE

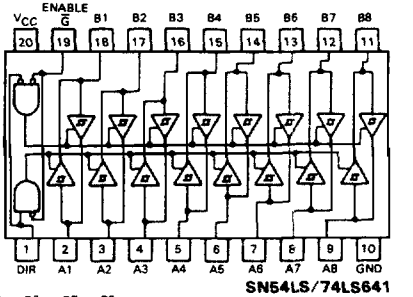
CONTROL INPUTS		OPERATION		
$\overline{G}$	DIR	LS640 LS642	LS641 LS645	LS643 LS644
L	L	$\overline{B}$ data to A bus	B data to A bus	B data to A bus
L	H	$\overline{A}$ data to B bus	A data to B bus	$\overline{A}$ data to B bus
H	X	Isolation	Isolation	Isolation

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

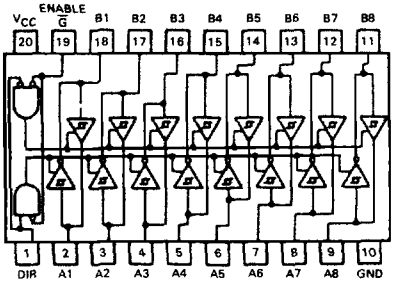
CONNECTION DIAGRAMS
(TOP VIEW)



SN54LS/74LS640
SN54LS/74LS642



SN54LS/74LS641
SN54LS/74LS645



SN54LS/74LS643
SN54LS/74LS644

J Suffix — Case 732-03 (Ceramic)
N Suffix — Case 738-01 (Plastic)

GUARANTEED OPERATING RANGES

SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	54 74	4.5 4.75	5.0 5.0	5.5 5.25	V
T_A	Operating Ambient Temperature Range	54 74	−55 0	25 25	125 70	°C
I_{OH}	Output Current — High	54,74			−3.0	mA
		54 74			−12 −15	mA
I_{OL}	Output Current — Low	54 74			12 24	mA

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

SYMBOL	PARAMETER		LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS	TEST CONDITIONS	
V_{IH}	Input HIGH Voltage		2.0			V	Guaranteed Input HIGH Voltage for All Inputs	
V_{IL}	Input LOW Voltage	54			0.5	V	Guaranteed Input LOW Voltage for All Inputs	
		74			0.6			
V_{IK}	Input Clamp Diode Voltage			−0.65	−1.5	V	V_{CC} = MIN, I_{IN} = −18 mA	
V_{OH}	Output HIGH Voltage	54,74	2.4	3.4		V	V_{CC} = MIN, I_{OH} = −3.0 mA	
		54,74	2.0			V	V_{CC} = MIN, I_{OH} = MAX	
V_{OL}	Output LOW Voltage	54,74		0.25	0.4	V	I_{OL} = 12 mA	V_{CC} = V_{CC} MIN, V_{IN} = V_{IL} or V_{IH} per Truth Table
		74		0.35	0.5	V	I_{OL} = 24 mA	
I_{OZH}	Output Off-Current HIGH				20	μA	V_{CC} = MAX, V_{OUT} = 2.4 V	
I_{OZL}	Output Off Current LOW				−400	μA	V_{CC} = MAX, V_{OUT} = 0.4 V	
I_{IH}	Input HIGH Current	A or B, DIR or $\overline{G}$			20	μA	V_{CC} = MAX, V_{IN} = 2.7 V	
		DIR or $\overline{G}$			0.1	mA	V_{CC} = MAX, V_{IN} = 7.0 V	
		A or B			0.1	mA	V_{CC} = MAX, V_{IN} = 5.5 V	
I_{IL}	Input LOW Current				−0.4	mA	V_{CC} = MAX, V_{IN} = 0.4 V	
I_{OS}	Output Short Circuit Current		−40		−225	mA	V_{CC} = MAX	
I_{CC}	Power Supply Current Total Output HIGH				70	mA	V_{CC} = MAX	
	Total Output LOW				90			
	Total at HIGH Z				95			

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AC CHARACTERISTICS: $T_A = 25°C$, $V_{CC} = 5.0$ V

SYMBOL	PARAMETER	LIMITS									UNITS	TEST CONDITIONS
		LS640			LS643			LS645				
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX		
t_{PLH} t_{PHL}	Propagation Delay, A to B		6.0 8.0	10 15		6.0 9.0	10 15		8.0 11	15 15	ns	$C_L = 45$ pF, $R_L = 667\ \Omega$
t_{PLH} t_{PHL}	Propagation Delay, B to A		6.0 8.0	10 15		8.0 11	15 15		8.0 11	15 15	ns	
t_{PZL} t_{PZH}	Output Enable Time $\overline{G}$, DIR to A		31 23	40 40		32 27	45 40		31 26	40 40	ns	
t_{PZL} t_{PZH}	Output Enable Time $\overline{G}$, DIR to B		31 23	40 40		32 23	45 40		31 26	40 40	ns	
t_{PLZ} t_{PHZ}	Output Disable Time $\overline{G}$, DIR to A		15 15	25 25		15 15	25 25		15 15	25 25	ns	$C_L = 5.0$ pF
t_{PLZ} t_{PHZ}	Output Disable Time $\overline{G}$, DIR to B		15 15	25 25		15 15	25 25		15 15	25 25	ns	

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GUARANTEED OPERATING RANGES

SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	54 74	4.5 4.75	5.0 5.0	5.5 5.25	V
T_A	Operating Ambient Temperature Range	54 74	−55 0	25 25	125 70	°C
V_{OH}	Output Voltage — High	54,74			5.5	V
I_{OL}	Output Current — Low	54 74			12 24	mA

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

SYMBOL	PARAMETER		LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS	TEST CONDITIONS	
V_{IH}	Input HIGH Voltage		2.0			V	Guaranteed Input HIGH Voltage for All Inputs	
V_{IL}	Input LOW Voltage	54			0.5	V	Guaranteed Input LOW Voltage for All Inputs	
		74			0.6			
V_{IK}	Input Clamp Diode Voltage			−0.65	−1.5	V	V_{CC} = MIN, I_{IN} = −18 mA	
I_{OH}	Output HIGH Current	54,74			100	μA	V_{CC} = MIN, V_{OH} = MAX	
V_{OL}	Output LOW Voltage	54,74		0.25	0.4	V	I_{OL} = 12 mA	V_{CC} = V_{CC} MIN, V_{IN} = V_{IL} or V_{IH} per Truth Table
		74		0.35	0.5	V	I_{OL} = 24 mA	
I_{IH}	Input HIGH Current				20	μA	V_{CC} = MAX, V_{IN} = 2.7 V	
					−0.1	mA	V_{CC} = MAX, V_{IN} = 7.0 V	
I_{IL}	Input LOW Current				−0.4	mA	V_{CC} = MAX, V_{IN} = 0.4 V	
I_{CC}	Power Supply Current Total, Output HIGH				70	mA	V_{CC} = MAX	
	Total, Output LOW				90	mA	V_{CC} = MAX	
	Total at HIGH Z				95	mA	V_{CC} = MAX	

AC CHARACTERISTICS: T_A = 25°C, V_{CC} = 5.0 V

SYMBOL	PARAMETER	LIMITS LS641 MIN	LS641 TYP	LS641 MAX	LS642 MIN	LS642 TYP	LS642 MAX	LS644 MIN	LS644 TYP	LS644 MAX	UNITS	TEST CONDITIONS
t_{PLH} t_{PHL}	Propagation Delay, A to B		17 16	25 25		19 14	25 25		17 14	25 25	ns	C_L = 45 pF, R_L = 667 Ω
t_{PLH} t_{PHL}	Propagation Delay, B to A		17 16	25 25		19 14	25 25		19 16	25 25	ns	
t_{PLH} t_{PHL}	Propagation Delay, $\overline{G}$, DIR to A		23 34	40 50		26 43	40 60		26 43	40 60	ns	
t_{PLH} t_{PHL}	Propagation Delay, $\overline{G}$, DIR to B		25 37	40 50		28 39	40 60		25 37	40 50	ns	

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