National **S**emiconductor

54LS245/DM54LS245/DM74LS245
TRI-STATE® Octal Bus Transceiver

General Description

These octal bus transceivers are designed for asynchronous two-way communication between data buses. The control function implementation minimizes external timing requirements.

The device allows data transmission from the A bus to the B bus or from the B bus to the A bus depending upon the logic level at the direction control (DIR) input. The enable input ($\overline{G}$) can be used to disable the device so that the buses are effectively isolated.

Features

■ Bi-Directional bus transceiver in a high-density 20-pin package
■ TRI-STATE outputs drive bus lines directly

■ PNP inputs reduce DC loading on bus lines
■ Hysteresis at bus inputs improve noise margins
■ Typical propagation delay times, port-to-port 8 ns
■ Typical enable/disable times 17 ns
■ I_{OL} (sink current)
    54LS   12 mA
    74LS   24 mA
■ I_{OH} (source current)
    54LS   −12 mA
    74LS   −15 mA
■ Alternate Military/Aerospace device (54LS245) is available. Contact a National Semiconductor Sales Office/Distributor for specifications.

Connection Diagram

Dual-In-Line Package
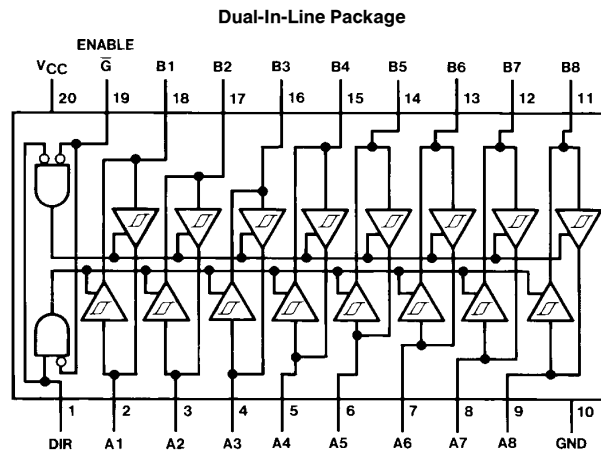
TL/F/6413–1

Order Number 54LS245DMQB, 54LS245FMQB, 54LS245LMQB, DM54LS245J, DM54LS245W, DM74LS245WM or DM74LS245N
See NS Package Number E20A, J20A, M20B, N20A or W20A

Function Table

Enable $\overline{G}$	Direction Control DIR	Operation
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

H = High Level, L = Low Level, X = Irrelevant

RRD-B30M105/Printed in U. S. A.

Absolute Maximum Ratings (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Note: *The ''Absolute Maximum Ratings'' are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the ''Electrical Characteristics'' table are not guaranteed at the absolute maximum ratings. The ''Recommended Operating Conditions'' table will define the conditions for actual device operation.*

Supply Voltage	7V
Input Voltage	
DIR or $\overline{G}$	7V
A or B	5.5V
Operating Free Air Temperature Range	
DM54LS and 54LS	$-55°C$ to $+125°C$
DM74LS	$0°C$ to $+70°C$
Storage Temperature Range	$-65°C$ to $+150°C$

Recommended Operating Conditions

Symbol	Parameter	DM54LS245			DM74LS245			Units
		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			-12			-15	mA
I_{OL}	Low Level Output Current			12			24	mA
T_A	Free Air Operating Temperature	-55		125	0		70	°C

Electrical Characteristics over recommended operating free air temperature range (unless otherwise noted)

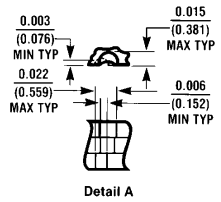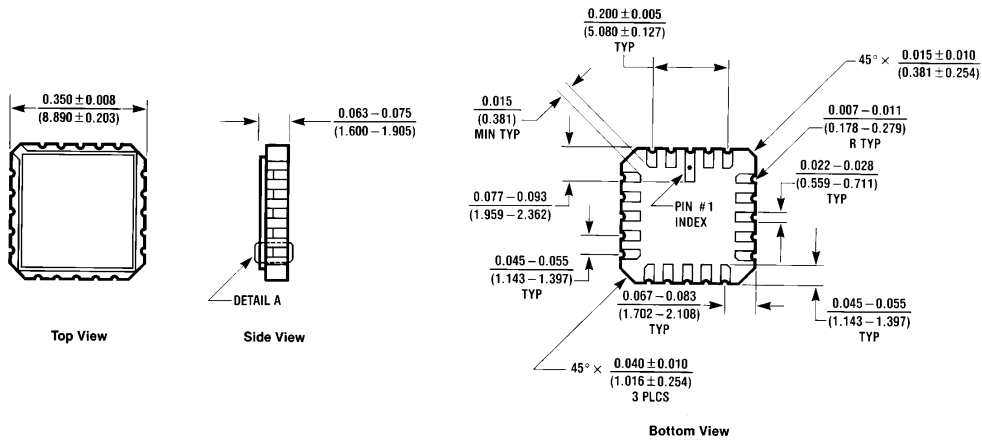| Symbol	Parameter	Conditions			Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	$V_{CC} = $ Min, $I_I = -18$ mA					-1.5	V
HYS	Hysteresis $(V_{T+} - V_{T-})$	$V_{CC} = $ Min			0.2	0.4		V
V_{OH}	High Level Output Voltage	$V_{CC} = $ Min, $V_{IH} = $ Min $V_{IL} = $ Max, $I_{OH} = -1$ mA	DM74		2.7			V
		$V_{CC} = $ Min, $V_{IL} = $ Min $V_{IL} = $ Max, $I_{OH} = -3$ mA	DM54/DM74		2.4	3.4		
		$V_{CC} = $ Min, $V_{IH} = $ Min $V_{IL} = 0.5V$, $I_{OH} = $ Max	DM54/DM74		2			
V_{OL}	Low Level Output Voltage	$V_{CC} = $ Min $V_{IL} = $ Max $V_{IH} = $ Min	$I_{OL} = 12$ mA	DM74			0.4	V
			$I_{OL} = $ Max	DM54			0.4	
				DM74			0.5	
I_{OZH}	Off-State Output Current, High Level Voltage Applied	$V_{CC} = $ Max $V_{IL} = $ Max $V_{IH} = $ Min	$V_O = 2.7V$				20	μA
I_{OZL}	Off-State Output Current, Low Level Voltage Applied		$V_O = 0.4V$				-200	μA
I_I	Input Current at Maximum Input Voltage	$V_{CC} = $ Max	A or B	$V_I = 5.5V$			0.1	mA
			DIR or $\overline{G}$	$V_I = 7V$			0.1	
I_{IH}	High Level Input Current	$V_{CC} = $ Max, $V_I = 2.7V$					20	μA
I_{IL}	Low Level Input Current	$V_{CC} = $ Max, $V_I = 0.4V$					-0.2	mA
I_{OS}	Short Circuit Output Current	$V_{CC} = $ Max (Note 2)			-40		-225	mA
I_{CC}	Supply Current	Outputs High	$V_{CC} = $ Max			48	70	mA
		Outputs Low				62	90	
		Outputs at Hi-Z				64	95	

Note 1: All typicals are at $V_{CC} = 5V$, $T_A = 25°C$.

Note 2: Not more than one output should be shorted at a time, not to exceed one second duration

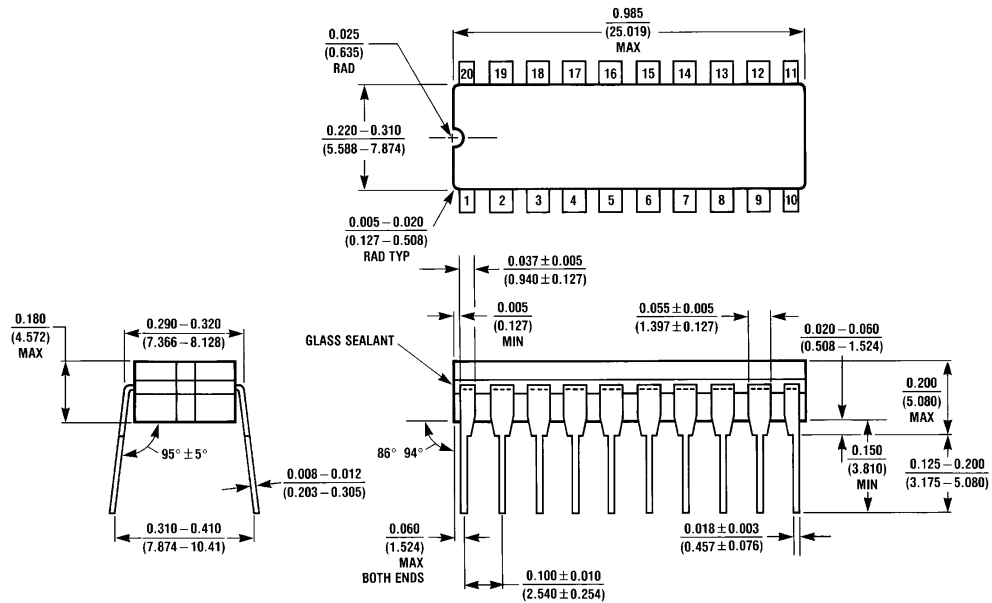**Switching Characteristics** $V_{CC} = 5V$, $T_A = 25°C$ (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	Conditions	DM54/74 LS245		Units
			Min	Max	
t_{PLH}	Propagation Delay Time, Low-to-High-Level Output	$C_L = 45$ pF $R_L = 667\Omega$		12	ns
t_{PHL}	Propagation Delay Time, High-to-Low-Level Output			12	ns
t_{PZL}	Output Enable Time to Low Level			40	ns
t_{PZH}	Output Enable Time to High Level			40	ns
t_{PLZ}	Output Disable Time from Low Level	$C_L = 5$ pF $R_L = 667\Omega$		25	ns
t_{PHZ}	Output Disable Time from High Level			25	ns
t_{PLH}	Propagation Delay Time, Low-to-High-Level Output	$C_L = 150$ pF $R_L = 667\Omega$		16	ns
t_{PHL}	Propagation Delay Time, High-to-Low-Level Output			17	ns
t_{PZL}	Output Enable Time to Low Level			45	ns
t_{PZH}	Output Enable Time to High Level			45	ns

Physical Dimensions inches (millimeters)

Top View

Side View

DETAIL A

0.350 ± 0.008
(8.890 ± 0.203)

0.063 − 0.075
(1.600 − 1.905)

0.200 ± 0.005
(5.080 ± 0.127)
TYP

45° × 0.015 ± 0.010
(0.381 ± 0.254)

0.015
(0.381)
MIN TYP

0.007 − 0.011
(0.178 − 0.279)
R TYP

0.077 − 0.093
(1.959 − 2.362)

PIN # 1
INDEX

0.022 − 0.028
(0.559 − 0.711)
TYP

0.045 − 0.055
(1.143 − 1.397)
TYP

0.067 − 0.083
(1.702 − 2.108)
TYP

0.045 − 0.055
(1.143 − 1.397)
TYP

45° × 0.040 ± 0.010
(1.016 ± 0.254)
3 PLCS

Bottom View

0.003
(0.076)
MIN TYP

0.015
(0.381)
MAX TYP

0.022
(0.559)
MAX TYP

0.006
(0.152)
MIN TYP

Detail A

E20A (REV D)

Ceramic Leadless Chip Carrier Package (E)
Order Number 54LS245LMQB
NS Package Number E20A

0.985
(25.019)
MAX

0.025
(0.635)
RAD

20 19 18 17 16 15 14 13 12 11

0.220 − 0.310
(5.588 − 7.874)

1 2 3 4 5 6 7 8 9 10

0.005 − 0.020
(0.127 − 0.508)
RAD TYP

0.037 ± 0.005
(0.940 ± 0.127)

0.005
(0.127)
MIN

0.055 ± 0.005
(1.397 ± 0.127)

0.020 − 0.060
(0.508 − 1.524)

0.180
(4.572)
MAX

0.290 − 0.320
(7.366 − 8.128)

GLASS SEALANT

0.200
(5.080)
MAX

95° ± 5°

86°   94°

0.150
(3.810)
MIN

0.125 − 0.200
(3.175 − 5.080)

0.008 − 0.012
(0.203 − 0.305)

0.310 − 0.410
(7.874 − 10.41)

0.060
(1.524)
MAX
BOTH ENDS

0.018 ± 0.003
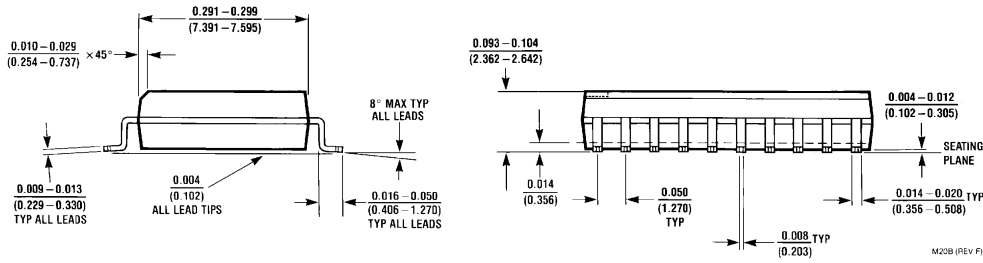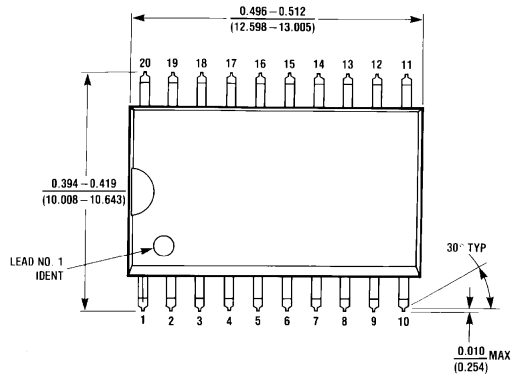(0.457 ± 0.076)

0.100 ± 0.010
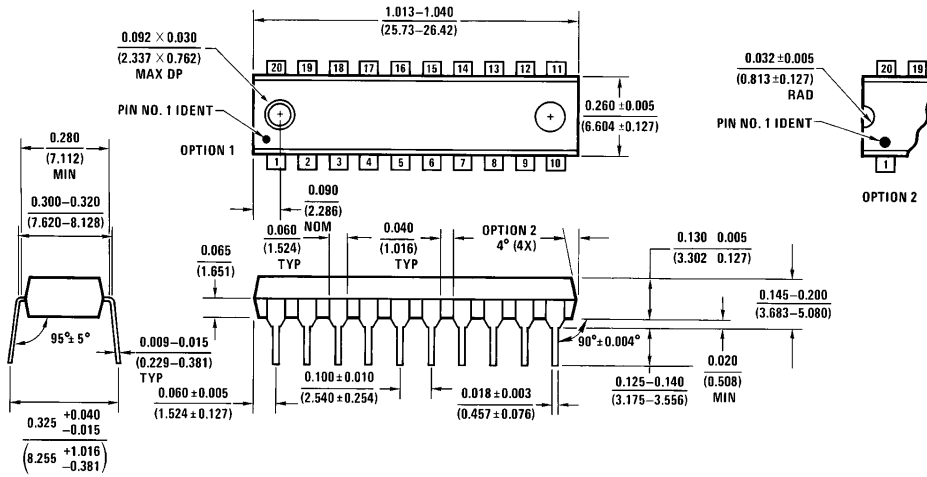(2.540 ± 0.254)

J20A (REV M)

20-Lead Ceramic Dual-In-Line Package (J)
Order Number 54LS245DMQB or DM54LS245J
NS Package Number J20A

4

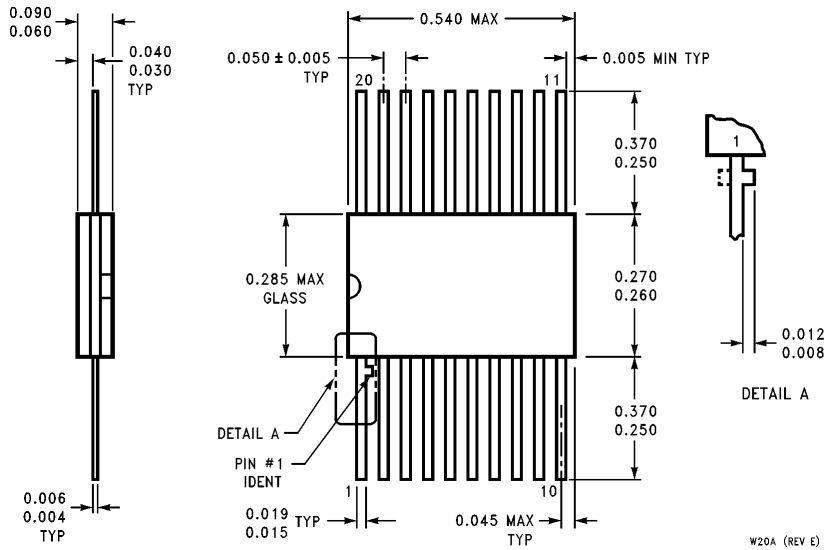## Physical Dimensions inches (millimeters) (Continued)

0.496 − 0.512
(12.598 − 13.005)

20 19 18 17 16 15 14 13 12 11

0.394 − 0.419
(10.008 − 10.643)

LEAD NO. 1
IDENT

30° TYP

0.010 MAX
(0.254)

1 2 3 4 5 6 7 8 9 10

0.291 − 0.299
(7.391 − 7.595)

0.010 − 0.029
(0.254 − 0.737) × 45°

8° MAX TYP
ALL LEADS

0.093 − 0.104
(2.362 − 2.642)

0.004 − 0.012
(0.102 − 0.305)

SEATING
PLANE

0.009 − 0.013
(0.229 − 0.330)
TYP ALL LEADS

0.004
(0.102)
ALL LEAD TIPS

0.016 − 0.050
(0.406 − 1.270)
TYP ALL LEADS

0.014
(0.356)

0.050
(1.270)
TYP

0.014 − 0.020 TYP
(0.356 − 0.508)

0.008 TYP
(0.203)

M20B (REV F)

20-Lead Small Outline Molded Package (M)
Order Number DM74LS245WM
NS Package Number M20B

1.013 − 1.040
(25.73 − 26.42)

0.092 × 0.030
(2.337 × 0.762)
MAX DP

20 19 18 17 16 15 14 13 12 11

PIN NO. 1 IDENT

OPTION 1

0.260 ±0.005
(6.604 ±0.127)

1 2 3 4 5 6 7 8 9 10

0.032 ±0.005
(0.813 ±0.127)
RAD

20 19

PIN NO. 1 IDENT

1

OPTION 2

0.280
(7.112)
MIN

0.300 − 0.320
(7.620 − 8.128)

0.090
(2.286)

0.060 NOM
(1.524)
TYP

0.065
(1.651)

0.040
(1.016)
TYP

OPTION 2
4° (4X)

0.130   0.005
(3.302   0.127)

0.145 − 0.200
(3.683 − 5.080)

95° ± 5°

0.009 − 0.015
(0.229 − 0.381)
TYP

0.100 ± 0.010
(2.540 ± 0.254)

0.018 ± 0.003
(0.457 ± 0.076)

90° ± 0.004°

0.125 − 0.140
(3.175 − 3.556)

0.020
(0.508)

0.325 +0.040
−0.015

(8.255 +1.016
−0.381)

0.060 ± 0.005
(1.524 ± 0.127)

N20A (REV G)

20-Lead Molded Dual-In-Line Package (N)
Order Number DM74LS245N
NS Package Number N20A

5

Physical Dimensions inches (millimeters) (Continued)

0.090 / 0.060

0.040 / 0.030 TYP

0.540 MAX

0.050 ± 0.005 TYP

0.005 MIN TYP

20   11

0.370 / 0.250

0.285 MAX GLASS

0.270 / 0.260

DETAIL A

PIN #1 IDENT

0.370 / 0.250

1   10

0.006 / 0.004 TYP

0.019 / 0.015 TYP

0.045 MAX TYP

0.012 / 0.008

DETAIL A

W20A (REV E)

20-Lead Ceramic Flat Package (W)
Order Number 54LS245FMQB or DM54LS245W
NS Package Number W20A

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.