Q

High Speed CMOS
Dual 4 Input
Mulitplexers

QS54/74FCT153T

QS54/74FCT253T

QS54/74FCT2153T

QS54/74FCT2253T

FEATURES/BENEFITS

- Pin and function compatible to the 74F153/253 74FCT153/253 and 74FCT153T/253T
- CMOS power levels: <7.5 mW static
- Available in PDIP, ZIP, SOIC, QSOP, HQSOP
- Undershoot clamp diodes on all inputs

- TTL-compatible input and output levels
- Ground bounce controlled outputs
- Reduced output swing of 0-3.5V
- Military product compliant to MIL-STD-883

FCT-T 153T, 253T

- JEDEC-FCT spec compatible
- Fastest CMOS logic family available
- Std. and A speed grades with 4.5 ns t_{PD} for C
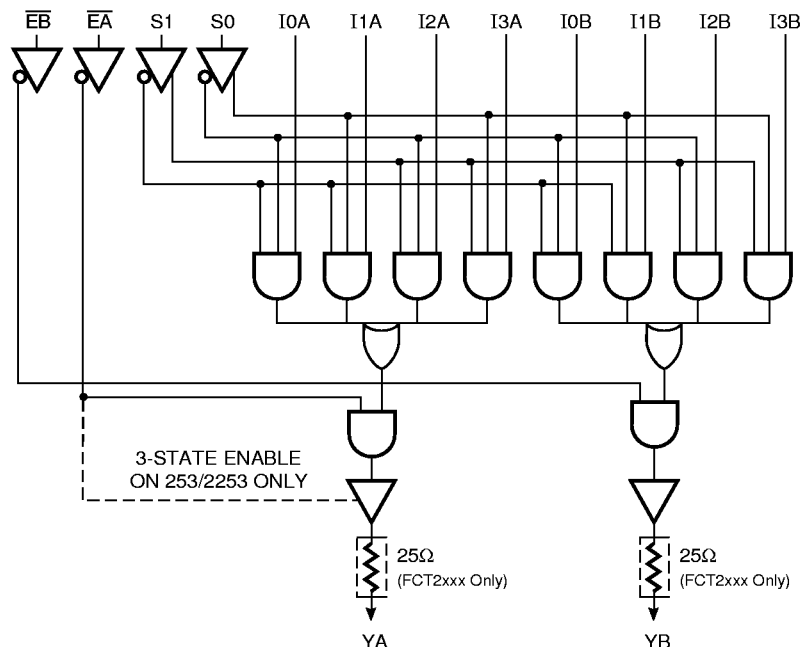- I_{OL} = 48 mA Com., 32 mA Mil.

FCT-T 2153T, 2253T

- Built-in 25Ω series resistor outputs reduce reflection and other system noise
- Std and A speed grades with 5.2 ns t_{PD} for A
- I_{OL} = 12 mA Com.

DESCRIPTION
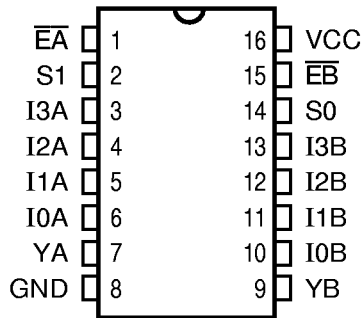
The QSFCT153T and QSFCT253T are high-speed CMOS TTL-compatible dual 4-input multiplexers. The 153 TTL ouputs; the 253 has 3-state outputs. The QSFCT2153T and QSFCT2253T are 25Ω resistor output versions useful for driving transmission lines and reducing system noise. All inputs have clamp diodes for undershoot noise suppression. All outputs have ground bounce suppression (see QSI Application Note AN-001). Ouputs will not load an active bus when Vcc is removed from the device.
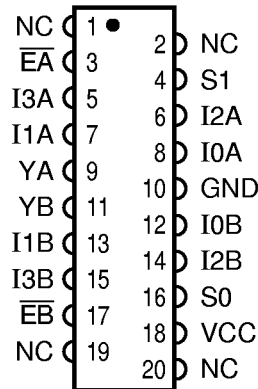
FUNCTIONAL BLOCK DIAGRAM
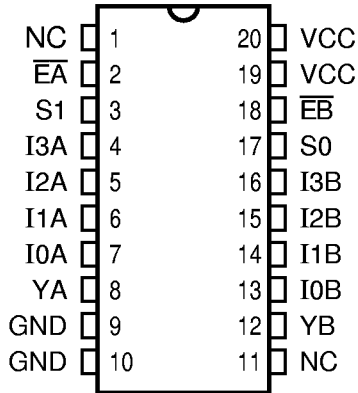
PIN CONFIGURATIONS (All Pins Top View)

PDIP, SOIC, QSOP

```
 EA  [ 1      16 ] VCC
 S1  [ 2      15 ] EB
I3A  [ 3      14 ] S0
I2A  [ 4      13 ] I3B
I1A  [ 5      12 ] I2B
I0A  [ 6      11 ] I1B
 YA  [ 7      10 ] I0B
GND  [ 8       9 ] YB
```

ZIP

```
 NC ( 1 •   2 ) NC
 EA ( 3     4 ) S1
I3A ( 5     6 ) I2A
I1A ( 7     8 ) I0A
 YA ( 9    10 ) GND
 YB ( 11   12 ) I0B
I1B ( 13   14 ) I2B
I3B ( 15   16 ) S0
 EB ( 17   18 ) VCC
 NC ( 19   20 ) NC
```

HQSOP

```
 NC  [ 1      20 ] VCC
 EA  [ 2      19 ] VCC
 S1  [ 3      18 ] EB
I3A  [ 4      17 ] S0
I2A  [ 5      16 ] I3B
I1A  [ 6      15 ] I2B
I0A  [ 7      14 ] I1B
 YA  [ 8      13 ] I0B
GND  [ 9      12 ] YB
GND  [ 10     11 ] NC
```

Note:
Available in both 150 mil wide SOIC (package code S1)
and 300 mil wide SOIC (package code SO).

PIN DESCRIPTION

Name	I/O	Description
I7-I0	I	Data In
S1-S0	I	Select
EA, EB	I	Enable
YA, YB	O	Data Out

FUNCTION TABLE

Enable		Select		153, 2153		253, 2253		
EA	EB	S1	S0	YA	YB	YA	YB	Function
H	X	X	X	L	X	HI-Z	Z	Disable A
X	H	X	X	X	L	X	HI-Z	Disable B
L	L	L	L	I0A	I0B	I0A	I0B	S1-0 = 0
L	L	L	H	I1A	I1B	I1A	I1B	S1-0 = 1
L	L	H	L	I2A	I2B	I2A	I2B	S1-0 = 2
L	L	H	H	I3A	I3B	I3A	I3B	S1-0 = 3

ABSOLUTE MAXIMUM RATINGS

Supply Voltage to Ground .... −0.5V to +7.0V
DC Output Voltage V$_{OUT}$ .... −0.5V to +7.0V
DC Input Voltage V$_{IN}$ .... −0.5V to +7.0V
AC Input Voltage (for a pulse width ≤ 20 ns) .... −3.0V
DC Input Diode Current with V$_{IN}$ < 0 .... −20 mA
DC Output Diode Current with V$_{OUT}$ < 0 .... −50 mA
DC Output Current Max. Sink Current/Pin .... 120 mA
Maximum Power Dissipation .... 0.5 watts
T$_{STG}$ Storage Temperature .... −65° to +150°C

Note: Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to this device resulting in functional or reliability type failures.

CAPACITANCE

T$_A$ = 25°C, f = 1 MHz, V$_{IN}$ = 0V, V$_{OUT}$ = 0V

Pins	SOIC	QSOP	PDIP	ZIP	Unit
1-6, 10-15	4	4	5	7	pF
7, 9	6	6	7	9	pF
—	8	8	9	10	pF

Note: Capacitance is characterized but not tested.

POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions(1)	Min	Max	Unit
Icc	Quiescent Power Supply Current	Vcc = Max., freq = 0 0V ≤ V$_{IN}$ ≤ 0.2V or Vcc-0.2V ≤ V$_{IN}$ ≤ Vcc	—	1.5	mA
ΔIcc	Supply Current per Input @ TTL HIGH	Vcc = Max., V$_{IN}$ = 3.4V, freq = 0(2)	—	2.0	mA
Qccd	Supply Current per Input per MHz	Vcc = Max., Outputs Open and Enabled One Bit Toggling @ 50% Duty Cycle Other Inputs at GND or Vcc(3,4)	—	0.25	mA/MHz

Notes:

1. For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
2. Per TTL driven input (V$_{IN}$ = 3.4V).
3. For flip-flops, Qccd is measured by switching one of the data input pins so that the output changes every clock cycle. This is a measurement of device power consumption only and does not include power to drive load capacitance or tester capacitance. This parameter is guaranteed by design but not tested.
4. Ic can be computed using the above parameters as explained in the Technical Overview section.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Commercial T_A = 0°C to 70°C, V_{CC} = 5.0V ± 5%   Military T_A = −55°C to 125°C, V_{CC} = 5.0V ± 10%

Symbol	Parameter	Test Conditions	Min	Typ[1]	Max	Unit
V_{IH}	Input HIGH Voltage	Logic HIGH for All Inputs	2.0	—	—	V
V_{IL}	Input LOW Voltage	Logic LOW for All Inputs	—	—	0.8	V
ΔV_T	Input Hysteresis	V_{TLH} − V_{THL} for All Inputs	—	0.2	—	V
| I_{IH} | | I_{IL} |	Input Current Input HIGH or LOW	V_{CC} = Max., 0 ≤ V_{IN} < V_{CC}	—	—	5	μA
| I_{OZ} |	Off-State Output Current (Hi-Z)(253, 2253)	V_{CC} = Max., 0 ≤ V_{IN} ≤ V_{CC}	—	—	5	μA
I_{OS}	Short Circuit Current FCTXXX	V_{CC} = Max., V_{OUT} = GND[2,3]	−60	—	—	mA
I_{OR}	Current Drive FCT2XXX	V_{CC} = Max., V_{OUT} = 2.0V[3]	50	—	—	mA
V_{IC}	Input Clamp Voltage	V_{CC} = Min., I_{IN} = −18 mA, T_A = 25°C[3]	—	−0.7	−1.2	V
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = −12 mA (MIL) I_{OH} = −15 mA (COM)	2.4 2.4	— —	— —	V
V_{OL}	Output LOW Voltage FCTXXX	V_{CC} = Min., I_{OL} = 32 mA (MIL) I_{OL} = 48 mA (COM)	— —	— —	0.50 0.50	V
V_{OL}	Output LOW Voltage FCT2XXX (25Ω)	V_{CC} = Min., I_{OL} = 12 mA (MIL) I_{OL} = 12 mA (COM)	— —	— —	0.50 0.50	V
R_{OUT}	Output Resistance FCT2XXX (25Ω)	V_{CC} = Min., I_{OL} = 12 mA (MIL) I_{OL} = 12 mA (COM)	— 20	25 28	— 40	Ω

Notes:
1. Typical values indicate V_{CC} = 5.0V and T_A = 25°C.
2. Not more than one output should be shorted and the duration is ≤1 second.
3. These parameters are guaranteed by design but not tested.

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Commercial T$_A$ = 0°C to 70°C, Vcc = 5.0V ± 5%   Military T$_A$ = −55°C to 125°C, Vcc = 5.0V ± 10%
C$_{LOAD}$ = 50 pF, R$_{LOAD}$ = 500Ω unless otherwise noted.

Symbol	Description[1]		153 253 2153 2253		153A 253A 2153A 2253A		153C 253C 2153C 2253C		Unit
			Min	Max	Min	Max	Min	Max	
t$_{IY}$	Propagation Delay In to Y, 153/253	Com	1.5	7	1.5	5.2	1.5	4.5	ns
		Mil	1.5	8	1.5	5.8			
t$_{IY}$	Propagation Delay In to Y, 2153/2253	Com	1.5	7	1.5	5.2	1.5	4.5	ns
		Mil	1.5	8	1.5	5.8			
t$_{SY}$	Propagation Delay Sn to Y, 153/253	Com	1.5	9	1.5	6.6	1.5	5.6	ns
		Mil	1.5	9.5	1.5	7.4			
t$_{SY}$	Propagation Delay Sn to Y, 2153/2253	Com	1.5	9	1.5	6.6	1.5	5.6	ns
		Mil	1.5	9.5	1.5	7.4			
t$_{OEH}$ t$_{OEL}$	Output Enable Time Ē to Yi, 153	Com	1.5	7	1.5	5.2	1.5	4.8	ns
		Mil	1.5	8	1.5	5.8			
t$_{OEH}$ t$_{OEL}$	Output Enable Time Ē to Yi, 2153	Com	1.5	7	1.5	5.2	1.5	4.8	ns
		Mil	1.5	8	1.5	5.8			
t$_{PZH}$ t$_{PZL}$	Ouput Enable Time Ē to Yi, 253	Com	1.5	9	1.5	6.0	1.5	5.0	ns
		Mil	1.5	10	1.5	6.4			
t$_{PZH}$ t$_{PZL}$	Output Enable Time Ē to Yi, 2253	Com	1.5	9	1.5	6.0	1.5	5.0	ns
		Mil	1.5	10	1.5	6.4			
t$_{PHZ}$ t$_{PLZ}$	Output Disable Time[2] Ē to Yi, 253/2253	Com	1.5	7	1.5	6	1.5	5.0	ns
		Mil	1.5	7	1.5	6.3			

Notes:
1. Minimums guaranteed but not tested.
2. This parameter is guaranteed by design but not tested.
3. See Test Circuit and Waveforms.

QUALITY
SEMICONDUCTOR, INC.

300-MIL SOIC - Package Code SO
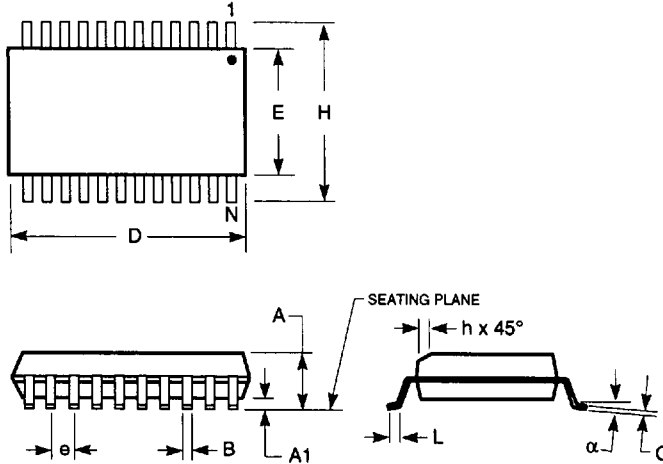## Plastic Small Outline Gull-Wing
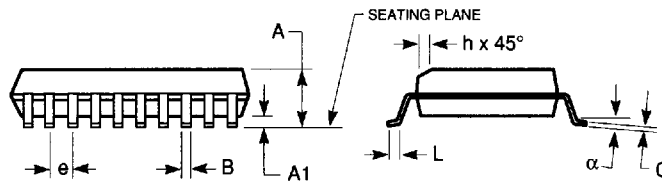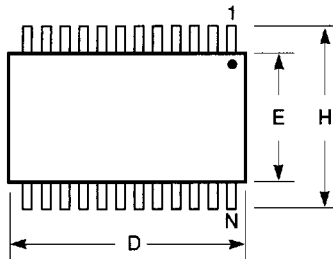
Notes:
1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006in. per side.
5. Lead coplanarity is 0.004in. maximum.

JEDEC#	MS-013AA		MS-013AC		MS-013AD		MS-013AE	
DWG#	PS16A		PS20A		PS24A		PS28A	
Symbol	Min	Max	Min	Max	Min	Max	Min	Max
A	0.096	0.104	0.096	0.104	0.096	0.104	0.096	0.104
A1	0.005	0.011	0.005	0.011	0.005	0.011	0.005	0.011
B	0.014	0.019	0.014	0.019	0.014	0.019	0.014	0.019
C	0.009	0.012	0.009	0.012	0.009	0.012	0.009	0.012
D	0.402	0.412	0.500	0.510	0.602	0.612	0.701	0.711
E	0.292	0.299	0.292	0.299	0.292	0.299	0.292	0.299
e	0.044	0.056	0.044	0.056	0.044	0.056	0.044	0.056
H	0.396	0.416	0.396	0.416	0.396	0.416	0.396	0.416
h	0.010	0.016	0.010	0.016	0.010	0.016	0.010	0.016
L	0.020	0.040	0.020	0.040	0.020	0.040	0.020	0.040
N	16		20		24		28	
α	0°	8°	0°	8°	0°	8°	0°	8°

■ 7466803 0003749 900 ■

150-MIL SOIC - Package Code S1
Plastic Small Outline Gull-Wing

Notes:
1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006 in. per side.
5. Lead coplanarity is 0.004 in. maximum.

JEDEC#	MS-012AB			MS-012AC		
DWG#	PS-14B			PS-16B		
Symbol	Min	Nom	Max	Min	Nom	Max
A	0.060	0.064	0.068	0.060	0.064	0.068
A1	0.004	0.006	0.008	0.004	0.006	0.008
B	0.014	0.016	0.019	0.014	0.016	0.019
C	0.0075	0.008	0.0098	0.0075	0.008	0.0098
D	0.337	0.341	0.346	0.386	0.390	0.394
E	0.150	0.154	0.157	0.150	0.154	0.157
e	0.050 BSC			0.050 BSC		
H	0.230	0.236	0.244	0.230	0.236	0.244
h	0.010	0.013	0.016	0.010	0.013	0.016
L	0.016	0.025	0.035	0.016	0.025	0.035
N	14			16		
α	0°	5°	8°	0°	5°	8°

Ⓠ QUALITY
SEMICONDUCTOR, INC.

150-MIL QSOP - Package Code Q
Quarter-Size Outline Package
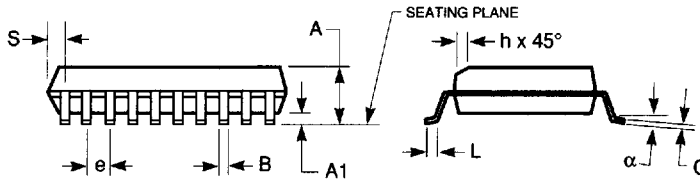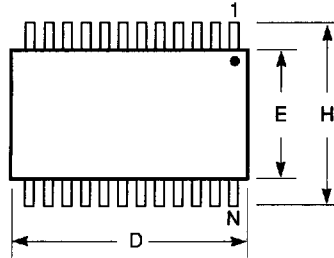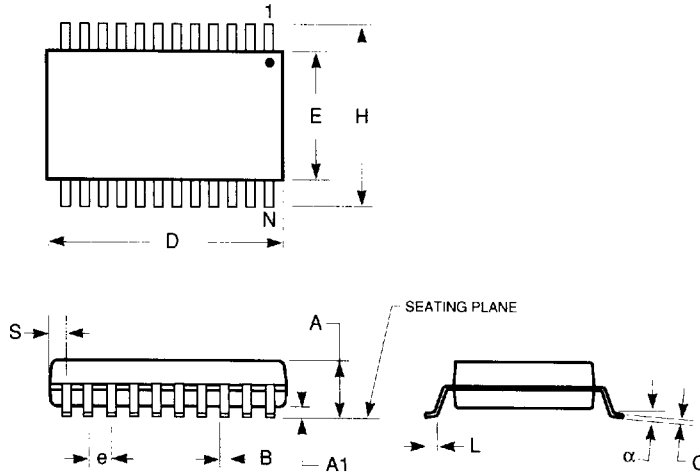**Plastic Small Outline Gull-Wing**

Notes:
1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006in. per side.
5. Lead coplanarity is 0.004in. maximum.

JEDEC#	MO-137AB			MO-137AD			MO-137AE			MO-137AF		
DWG#	PSS-16A			PSS-20A			PSS-24A			PSS-28A		
Symbol	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
A	0.060	0.064	0.068	0.060	0.064	0.068	0.060	0.064	0.068	0.060	0.064	0.068
A1	0.004	0.006	0.008	0.004	0.006	0.008	0.004	0.006	0.008	0.004	0.006	0.008
B	0.009	0.010	0.012	0.009	0.010	0.012	0.009	0.010	0.012	0.009	0.010	0.012
C	0.007	0.008	0.010	0.007	0.008	0.010	0.007	0.008	0.010	0.007	0.008	0.010
D	0.189	0.193	0.197	0.337	0.341	0.344	0.337	0.341	0.344	0.386	0.390	0.394
E	0.150	0.154	0.157	0.150	0.154	0.157	0.150	0.154	0.157	0.150	0.154	0.157
e	0.025 BSC			0.025 BSC			0.025 BSC			0.025 BSC		
H	0.230	0.236	0.244	0.230	0.236	0.244	0.230	0.236	0.244	0.230	0.236	0.244
h	0.010	0.013	0.016	0.010	0.013	0.016	0.010	0.013	0.016	0.010	0.013	0.016
L	0.016	0.025	0.035	0.016	0.025	0.035	0.016	0.025	0.035	0.016	0.025	0.035
N	16			20			24			28		
α	0°	5°	8°	0°	5°	8°	0°	5°	8°	0°	5°	8°
S	0.006	0.009	0.010	0.056	0.058	0.060	0.031	0.033	0.035	0.031	0.033	0.035

QUALITY
SEMICONDUCTOR, INC.

150-MIL HQSOP - Package Code H
**Hermetic Quarter-Size Outline Package
Ceramic Small Outline Gull-Wing**

Notes:
1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition.
5. Lead coplanarity is 0.004in. maximum.

JEDEC#	TBD			TBD		
DWG#	HSS-20A			HSS-24A		
Symbol	Min	Nom	Max	Min	Nom	Max
A	0.070	0.074	0.078	0.070	0.074	0.078
A1	0.008	0.012	0.016	0.008	0.012	0.016
B	0.009	0.010	0.012	0.009	0.010	0.012
C	0.007	0.008	0.010	0.007	0.008	0.010
D	0.337	0.342	0.350	0.337	0.342	0.350
E	0.150	0.155	0.158	0.150	0.155	0.158
e	0.025 BSC			0.025 BSC		
H	0.230	0.236	0.244	0.230	0.236	0.244
L	0.016	0.025	0.035	0.016	0.025	0.035
N	20			24		
α	0°	5°	8°	0°	5°	8°
S	0.056	0.058	0.062	0.031	0.033	0.037

300-MIL PDIP - Package Code P
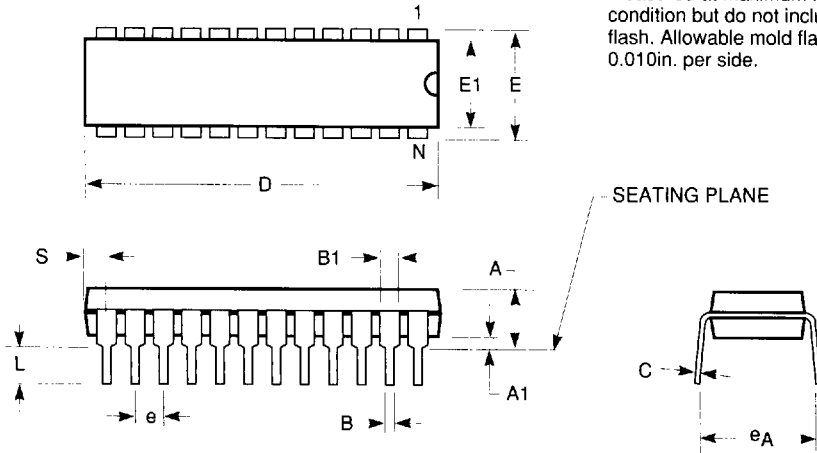## Plastic Dual In-line Package

Notes:
1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E1 are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.010in. per side.

JEDEC#	MS-001AC		MS001AA		MS-001AE		N/A		MS-001AF		MO-095AH	
DWG#	PD14A		PD16A		PD20A		PT22B		PT24A		PT28A	
Symbol	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
A	0.130	0.170	0.130	0.170	0.130	0.170	0.130	0.170	0.130	0.170	0.130	0.180
A1	0.015	0.040	0.015	0.040	0.015	0.040	0.015	0.040	0.015	0.040	0.015	0.040
B	0.016	0.020	0.016	0.020	0.016	0.020	0.016	0.020	0.016	0.020	0.016	0.020
B1	0.045	0.070	0.045	0.070	0.045	0.070	0.045	0.070	0.045	0.070	0.045	0.060
C	0.009	0.012	0.009	0.012	0.009	0.012	0.009	0.012	0.009	0.012	0.009	0.012
D	0.745	0.765	0.745	0.765	1.020	1.040	1.020	1.040	1.150	1.260	1.345	1.385
E	0.300	0.325	0.300	0.325	0.300	0.325	0.300	0.325	0.300	0.325	0.300	0.325
E1	0.240	0.270	0.240	0.270	0.240	0.270	0.240	0.270	0.250	0.280	0.275	0.295
e	0.090	0.110	0.090	0.110	0.090	0.110	0.090	0.110	0.090	0.110	0.090	0.110
e_A	0.310	0.380	0.310	0.380	0.310	0.380	0.310	0.380	0.310	0.380	0.310	0.380
L	0.120	0.140	0.120	0.140	0.120	0.140	0.120	0.140	0.120	0.140	0.120	0.140
S	0.070	0.080	0.020	0.035	0.060	0.070	0.010	0.020	0.025	0.080	0.020	0.040
N	14		16		20		22		24		28	

300-MIL ZIP - Package Code Z
Zig-zag In-line Packages
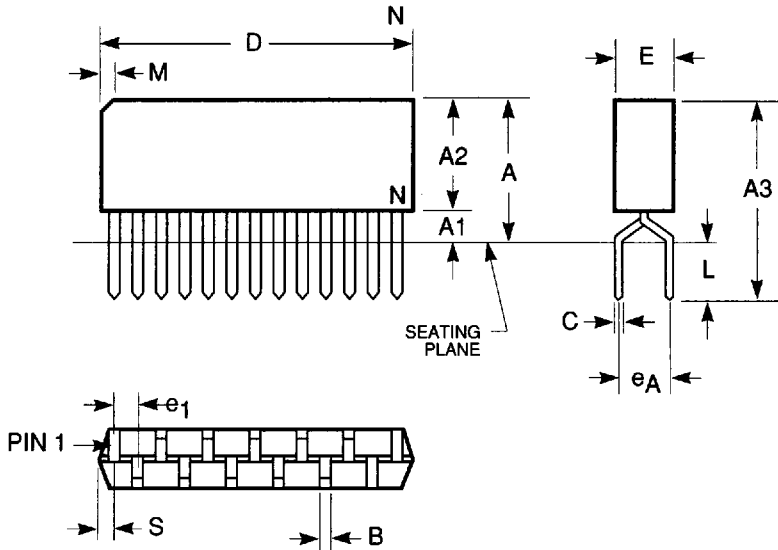
JEDEC#	MO-072AB		MO-072AC		MO-072AD	
DWG#	**PZ20A**		**PZ24A**		**PZ28A**	
Symbol	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
A	0.350	0.400	0.350	0.400	0.350	0.400
A1	0.030	0.070	0.030	0.070	0.032	0.055
A2	0.280	0.340	0.320	0.350	0.335	0.345
A3	0.450	0.550	0.450	0.550	0.460	0.550
B	0.015	0.024	0.015	0.024	0.015	0.024
C	0.008	0.012	0.008	0.012	0.008	0.012
D	1.008	1.030	1.200	1.250	1.409	1.424
E	0.100	0.120	0.100	0.120	0.110	0.120
e1	0.050 BSC		0.050 BSC		0.050 BSC	
eA	0.100 BSC		0.100 BSC		0.100 BSC	
L	0.100	0.150	0.100	0.150	0.110	0.150
M	0.035	0.085	0.035	0.085	0.035	0.085
N	20		24		28	
S	0.018	0.032	0.018	0.032	0.025	0.038

Notes:
1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.010in. per side.