DALLAS SEMICONDUCTOR

DS1245Y/AB
1024K Nonvolatile SRAM

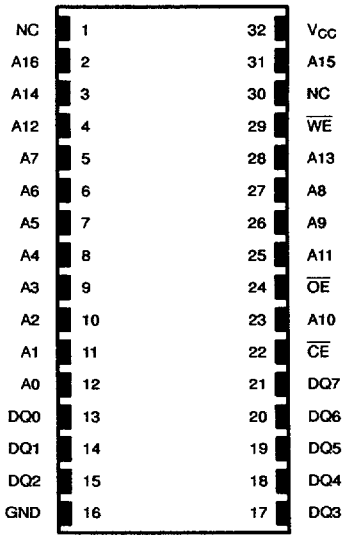
FEATURES

- 10 years minimum data retention in the absence of external power
- Data is automatically protected during power loss
- DIP–package devices directly replace 128K x 8 volatile static RAM
- Unlimited write cycles
- Low-power CMOS
- Read and write access times as fast as 70 ns
- Lithium energy source is electrically disconnected to retain freshness until power is applied for the first time.
- Full ±10% V_{CC} operating range (DS1245Y)
- Optional ±5% V_{CC} operating range (DS1245AB)
- Optional industrial temperature range of -40°C to +85°C, designated IND
- JEDEC standard 32–pin DIP package
- Low Profile Module (LPM) package
  - Fits into standard 68–pin PLCC surface–mountable sockets
  - 250 mil package height

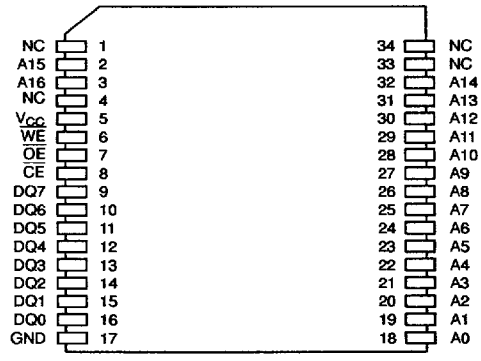
PIN DESCRIPTION

A0 - A16	-	Address Inputs
DQ0 - DQ7	-	Data In/Data Out
$\overline{CE}$	-	Chip Enable
$\overline{WE}$	-	Write Enable
$\overline{OE}$	-	Output Enable
V_{CC}	-	Power (+5V)
GND	-	Ground
NC	-	No Connect

PIN ASSIGNMENT



32-PIN ENCAPSULATED PACKAGE
740 MIL EXTENDED



34-PIN LOW PROFILE MODULE (LPM)

DESCRIPTION

The DS1245 1024K Nonvolatile SRAMs are 1,048,576-bit, fully static, nonvolatile SRAMs organized as 131,072 words by 8 bits. Each NV SRAM has a self-contained lithium energy source and control circuitry which constantly monitors V_{CC} for an out-of-tolerance condition. When such a condition occurs, the lithium energy source is automatically switched on and write protection is unconditionally enabled to prevent data corruption. DIP-package DS1245 devices can be used in place of existing 128K x 8 static RAM directly conforming to the popular bytewide 32-pin DIP standard. DS1245 devices in the Low Profile Module package are specifically designed for surface mount applications. There is no limit on the number of write cycles which can be executed and no additional support circuitry is required for microprocessor interfacing.

READ MODE

The DS1245 devices execute a read cycle whenever $\overline{WE}$ (Write Enable) is inactive (high) and $\overline{CE}$ (Chip Enable) and $\overline{OE}$ (Output Enable) are active (low). The unique address specified by the 17 address inputs (A_0 - A_{16}) defines which of the 131,072 bytes of data is accessed. Valid data will be available to the eight data output drivers within t_{ACC} (Access Time) after the last address input signal is stable, providing that $\overline{CE}$ and $\overline{OE}$ access times are also satisfied. If $\overline{OE}$ and $\overline{CE}$ access times are not satisfied, then data access must be measured from the later occurring signal ($\overline{CE}$ or $\overline{OE}$) and the limiting parameter is either t_{CO} for $\overline{CE}$ or t_{OE} for $\overline{OE}$ rather than address access.

WRITE MODE

The DS1245 devices excute a write cycle whenever the $\overline{WE}$ and $\overline{CE}$ signals are active (low) after address inputs are stable. The later occurring falling edge of $\overline{CE}$ or $\overline{WE}$ will determine the start of the write cycle. The write cycle is terminated by the earlier rising edge of $\overline{CE}$ or $\overline{WE}$. All address inputs must be kept valid throughout the write cycle. $\overline{WE}$ must return to the high state for a minimum recovery time (t_{WR}) before another cycle can be initiated. The $\overline{OE}$ control signal should be kept inactive (high) during write cycles to avoid bus contention. However, if the output drivers are enabled ($\overline{CE}$ and $\overline{OE}$ active) then $\overline{WE}$ will disable the outputs in t_{ODW} from its falling edge.

DATA RETENTION MODE

The DS1245AB provides full functional capability for V_{CC} greater than 4.75 volts and write protects by 4.5 volts. The DS1245Y provides full functional capability for V_{CC} greater than 4.5V and write protects by 4.25 volts. Data is maintained in the absence of V_{CC} without any additional support circuitry. The nonvolatile static RAMs constantly monitor V_{CC}. Should the supply voltage decay, the NV SRAMs automatically write protect themselves, all inputs become "don't care," and all outputs become high impedance. As V_{CC} falls below approximately 3.0 volts, a power switching circuit connects the lithium energy source to RAM to retain data. During power-up, when V_{CC} rises above approximately 3.0 volts, the power switching circuit connects external V_{CC} to RAM and disconnects the lithium energy source. Normal RAM operation can resume after V_{CC} exceeds 4.75 volts for the DS1245AB and 4.5 volts for the DS1245Y.

FRESHNESS SEAL

Each DS1245 device is shipped from Dallas Semiconductor with its lithium energy source disconnected, guaranteeing full energy capacity. When V_{CC} is first applied at a level greater than V_{TP}, the lithium energy source is enabled for battery backup operation.

ABSOLUTE MAXIMUM RATINGS*

Voltage on Any Pin Relative to Ground	−0.3V to +7.0V
Operating Temperature	0°C to 70°C, −40°C to +85°C for Ind parts
Storage Temperature	−40°C to +70°C, −40°C to +85°C for Ind parts
Soldering Temperature	260°C for 10 seconds

* This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

RECOMMENDED DC OPERATING CONDITIONS

(t_A: See Note 10)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
DS1245Y Power Supply Voltage	V_{CC}	4.5	5.0	5.5	V	
DS1245AB Power Supply Voltage	V_{CC}	4.75	5.0	5.25	V	
Logic 1	V_{IH}	2.2		V_{CC}	V	
Logic 0	V_{IL}	0.0		+0.8	V	

DC ELECTRICAL CHARACTERISTICS

(V_{CC}=5V ± 5% for DS1245AB)
(t_A: See Note 10) (V_{CC}=5V ± 10% for DS1245Y)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Input Leakage Current	I_{IL}	−1.0		+1.0	µA	
I/O Leakage Current $\overline{CE} \geq V_{IH} \leq V_{CC}$	I_{IO}	−1.0		+1.0	µA	
Output Current @ 2.4V	I_{OH}	−1.0			mA	
Output Current @ 0.4V	I_{OL}	2.0			mA	
Standby Current $\overline{CE}$=2.2V	I_{CCS1}		5.0	10.0	mA	
Standby Current $\overline{CE}=V_{CC}-0.5V$	I_{CCS2}		3.0	5.0	mA	
Operating Current	I_{CCO1}			85	mA	
Write Protection Voltage (DS1245Y)	V_{TP}	4.25	4.37	4.5	V	
Write Protection Voltage (DS1245AB)	V_{TP}	4.50	4.62	4.75	V	

CAPACITANCE

(t_A = 25°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Input Capacitance	C_{IN}		5	10	pF	
Input/Output Capacitance	$C_{I/O}$		5	10	pF	

AC ELECTRICAL CHARACTERISTICS

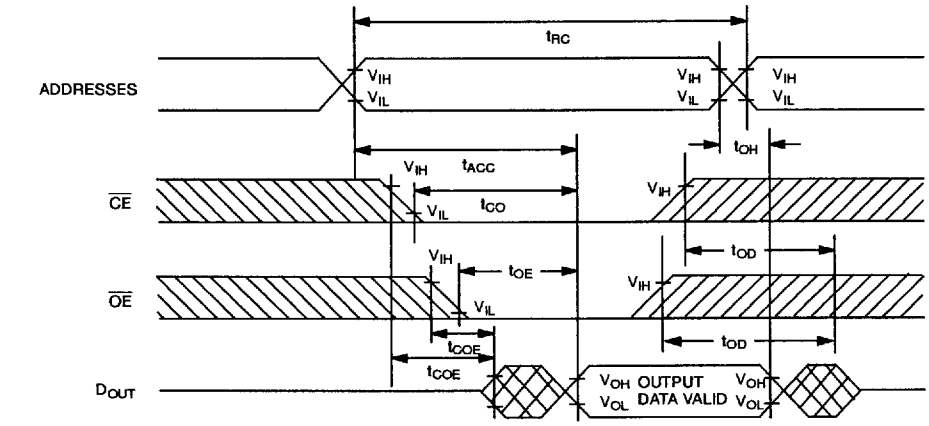
(V_{CC}=5V ± 5% for DS1245AB)
(t_A: See Note 10) (V_{CC}=5V ± 10% for DS1245Y)

PARAMETER	SYMBOL	DS1245Y-70 DS1245AB-70		DS1245Y-85 DS1245AB-85		UNITS	NOTES
		MIN	MAX	MIN	MAX		
Read Cycle Time	t_{RC}	70		85		ns	
Access Time	t_{ACC}		70		85	ns	
$\overline{OE}$ to Output Valid	t_{OE}		35		45	ns	
$\overline{CE}$ to Output Valid	t_{CO}		70		85	ns	
$\overline{OE}$ or $\overline{CE}$ to Output Active	t_{COE}	5		5		ns	5
Output High Z from Deselection	t_{OD}		25		30	ns	5
Output Hold from Address Change	t_{OH}	5		5		ns	
Write Cycle Time	t_{WC}	70		85		ns	
Write Pulse Width	t_{WP}	55		65		ns	3
Address Setup time	t_{AW}	0		0		ns	
Write Recovery Time	t_{WR1} t_{WR2}	5 15		5 15		ns ns	12 13
Output High Z from $\overline{WE}$	t_{ODW}		25		30	ns	5
Output Active from $\overline{WE}$	t_{OEW}	5		5		ns	5
Data Setup Time	t_{DS}	30		35		ns	4
Data Hold Time	t_{DH1} t_{DH2}	0 10		0 10		ns ns	12 13

AC ELECTRICAL CHARACTERISTICS – (cont'd)

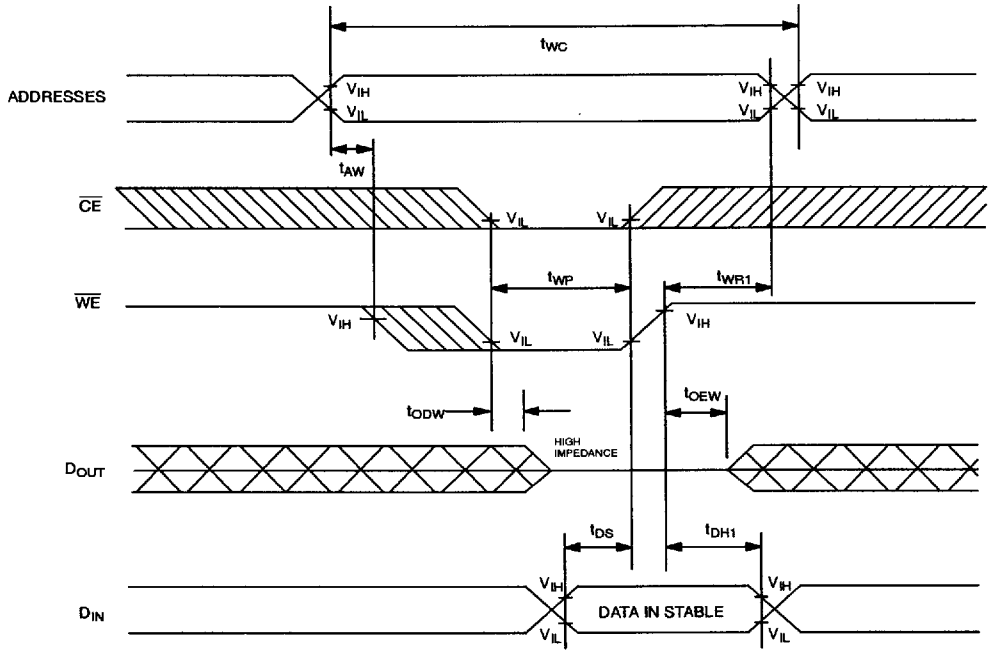
PARAMETER	SYMBOL	DS1245Y-100 DS1245AB-100		DS1245Y-120 DS1245AB-120		UNITS	NOTES
		MIN	MAX	MIN	MAX		
Read Cycle Time	t_{RC}	100		120		ns	
Access Time	t_{ACC}		100		120	ns	
$\overline{OE}$ to Output Valid	t_{OE}		50		60	ns	
$\overline{CE}$ to Output Valid	t_{CO}		100		120	ns	
$\overline{OE}$ or $\overline{CE}$ to Output Active	t_{COE}	5		5		ns	5
Output High Z from Deselection	t_{OD}		35		35	ns	5
Output Hold from Address Change	t_{OH}	5		5		ns	
Write Cycle Time	t_{WC}	100		120		ns	
Write Pulse Width	t_{WP}	75		90		ns	3
Address Setup time	t_{AW}	0		0		ns	
Write Recovery Time	t_{WR1} t_{WR2}	5 15		5 15		ns ns	12 13
Output High Z from $\overline{WE}$	t_{ODW}		35		35	ns	5
Output Active from $\overline{WE}$	t_{OEW}	5		5		ns	5
Data Setup Time	t_{DS}	40		50		ns	4
Data Hold Time	t_{DH1} t_{DH2}	0 10		0 10		ns ns	12 13

READ CYCLE



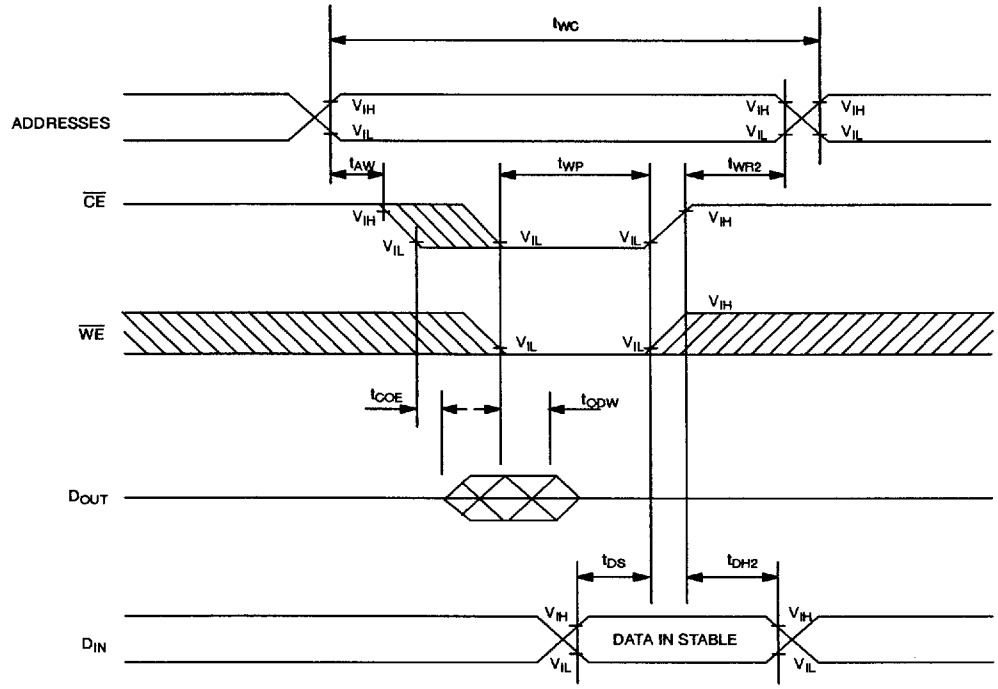
SEE NOTE 1

WRITE CYCLE 1



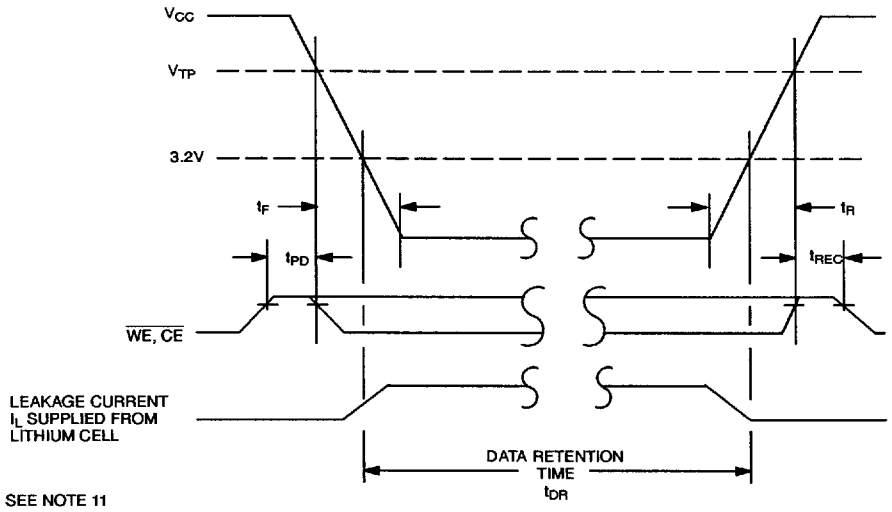
SEE NOTES 2, 3, 4, 6, 7, 8, and 12

WRITE CYCLE 2



SEE NOTES 2, 3, 4, 6, 7, 8, and 13

POWER-DOWN/POWER-UP CONDITION



SEE NOTE 11

POWER-DOWN/POWER-UP TIMING

(t_A: See Note 10)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
$\overline{CE}$, $\overline{WE}$ at V_{IH} before Power-Down	t_{PD}	0			µs	11
V_{CC} slew from V_{TP} to 0V ($\overline{CE}$ at V_{IH})	t_F	300			µs	
V_{CC} slew from 0V to V_{TP} ($\overline{CE}$ at V_{IH})	t_R	300			µs	
$\overline{CE}$, $\overline{WE}$ at V_{IH} after Power-Up	t_{REC}	2		125	ms	

(t_A = 25°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Expected Data Retention Time	t_{DR}	10			years	9

WARNING:

Under no circumstance are negative undershoots, of any amplitude, allowed when device is in battery backup mode.

NOTES:

1. $\overline{WE}$ is high for a Read Cycle.
2. $\overline{OE}$ = V_{IH} or V_{IL}. If $\overline{OE}$ = V_{IH} during write cycle, the output buffers remain in a high impedance state.
3. t_{WP} is specified as the logical AND of $\overline{CE}$ and $\overline{WE}$. t_{WP} is measured from the latter of $\overline{CE}$ or $\overline{WE}$ going low to the earlier of $\overline{CE}$ or $\overline{WE}$ going high.
4. t_{DS} is measured from the earlier of $\overline{CE}$ or $\overline{WE}$ going high.
5. These parameters are sampled with a 5 pF load and are not 100% tested.
6. If the $\overline{CE}$ low transition occurs simultaneously with or latter than the $\overline{WE}$ low transition in Write Cycle 1, the output buffers remain in a high impedance state during this period.
7. If the $\overline{CE}$ high transition occurs prior to or simultaneously with the $\overline{WE}$ high transition, the output buffers remain in high impedance state during this period.
8. If $\overline{WE}$ is low or the $\overline{WE}$ low transition occurs prior to or simultaneously with the $\overline{CE}$ low transition, the output buffers remain in a high impedance state during this period.
9. Each DS1245 has a built-in switch that disconnects the lithium source until V_{CC} is first applied by the user. The expected t_{DR} is defined as accumulative time in the absence of V_{CC} starting from the time power is first applied by the user.
10. All AC and DC electrical characteristics are valid over the full operating temperature range. For commercial products, this range is 0°C to 70°C. For industrial products (IND), this range is −40°C to +85°C.
11. In a power down condition the voltage on any pin may not exceed the voltage on V_{CC}.
12. t_{WR1}, t_{DH1} are measured from $\overline{WE}$ going high.
13. t_{WR2}, t_{DH2} are measured from $\overline{CE}$ going high.
14. DS1245 modules are recognized by Underwriters Laboratory (U.L.®) under file E99151.

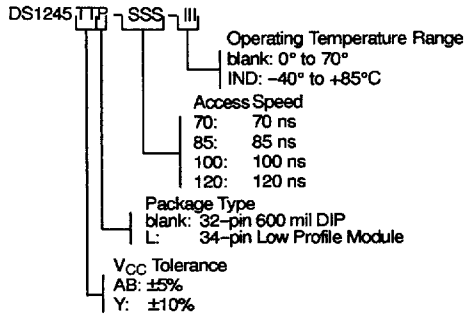
DC TEST CONDITIONS

Outputs Open
Cycle = 200 ns for operating current
All voltages are referenced to ground

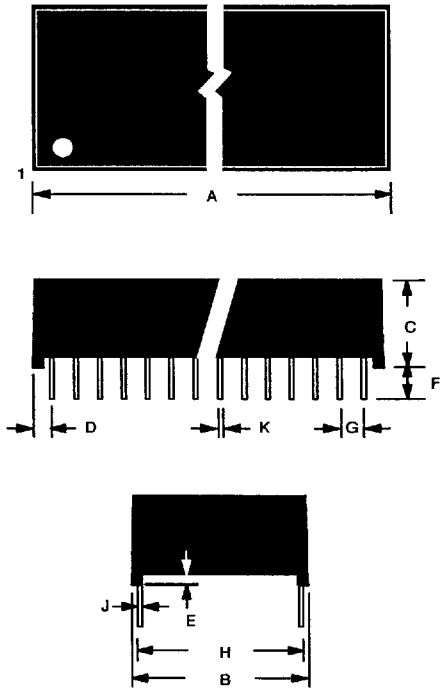
AC TEST CONDITIONS

Output Load: 100 pF + 1TTL Gate
Input Pulse Levels: 0 - 3.0V
Timing Measurement Reference Levels
Input: 1.5V
Output: 1.5V
Input pulse Rise and Fall Times: 5 ns

ORDERING INFORMATION

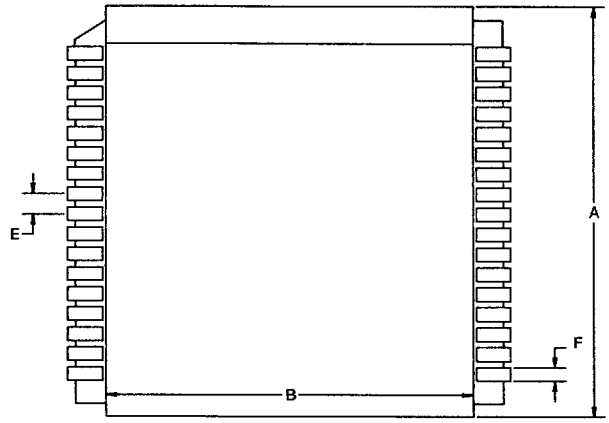


DS1245Y/AB NONVOLATILE SRAM, 32-PIN 740 MIL EXTENDED MODULE

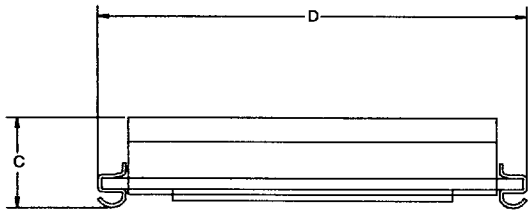


PKG	32-PIN	
DIM	MIN	MAX
A IN.	1.680	1.700
MM	42.67	43.18
B IN.	0.720	0.740
MM	18.29	18.80
C IN.	0.355	0.375
MM	9.02	9.52
D IN.	0.080	0.110
MM	2.03	2.79
E IN.	0.015	0.025
MM	0.38	0.63
F IN.	0.120	0.160
MM	3.05	4.06
G IN.	0.090	0.110
MM	2.29	2.79
H IN.	0.590	0.630
MM	14.99	16.00
J IN.	0.008	0.012
MM	0.20	0.30
K IN.	0.015	0.021
MM	0.38	0.53

DS1245YL/ABL 34-PIN LOW PROFILE MOFULE (LPM)



PKG	INCHES	
DIM	MIN	MAX
A	0.955	0.980
B	0.840	0.855
C	0.230	0.250
D	0.975	0.995
E	0.050 BSC	
F	0.015	0.025



Suggested 68-pin PLCC surface mountable sockets with leads on two sides only are:

McKenzie	34P-SMT-3
Harwin	HIS-40001-04
Robinson Nugent	PLCC-34-SMT
Dallas Semiconductor	DS34PIN-PLC

For recommended prototype/breadboard sockets, contact the Dallas Semiconductor factory.