Semicustom Products

UT0.25µHBD Hardened-by-Design Standard Cell

Data Sheet
March 2008
www.aeroflex.com/RadHardASIC

FEATURES

- ❑ Up to 3,500,000 usable equivalent gates for 2.5V Core and 3,000,000 for 3.3V core using standard cell architecture
- ❑ Toggle rates up to 1.6 GHz
- ❑ Advanced 0.25µ silicon gate CMOS processed in a commercial fab
- ❑ Operating voltage of 100% 3.3V or 3.3V I/O and 2.5V cor
- ❑ Input buffers are 5-volt compliant
- ❑ Multiple product assurance levels available, QML Q and V, military, industrial
- ❑ Radiation hardened from 100Krads(Si) to 1 Megarad total dose available using Aeroflex Colorado Springs's (Aeroflex) RadHard techniques
- ❑ SEU-immune to less than 1.0E-10 errors/bits-day available using special library cells
- ❑ Robust Aeroflex Design Library of cells and macros
- ❑ Design support for Mentor Graphics®, Synopsys™, in Verilog and VHDL design languages on Sun and Linux workstations
- ❑ Full complement of industry standard IP cores
- ❑ Configurable RAM compilers
- ❑ Supports cold sparing for power down applications
- ❑ Power dissipation of 0.04µW/MHz/gate at V_{DDCORE} 2.5V and 20% duty cycle and 0.06µW/MHz/gate at V_{DDCORE} 3.3V and 20% duty cycle
- ❑ External chip capacitor attachment option available to space quality levels (for improved SSO response)

PRODUCT DESCRIPTION

The high-performance UT0.25µ Hardened-by-Design ASIC standard cell family features densities up to 3,500,000 equivalent gates and is available in multiple quality assurance levels such as MIL-PRF-38535, QML Q and V, military and industrial grades and non-RadHard versions.

For those designs requiring stringent radiation hardness, Aeroflex's 0.25µ deep sub-micron process employs a special technique that enhances the total dose radiation hardness from 100Krads(Si) to 1 Megarad while maintaining circuit density and reliability. In addition, for both greater transient radiation hardness and latch-up immunity, the deep submicron process is built on epitaxial wafers.

Developed from Aeroflex's patented architectures, the deep submicron ASIC family uses a highly efficient standard cell architecture for the internal cell instantiation. Combined with state-of-the-art placement and routing tools, the area utilization and signal interconnect of transistors is maximized using five levels of metal interconnect.

The UT0.25µHBD ASIC family is supported by an extensive cell library that includes SSI, MSI, and 54XX equivalent functions, as well as configurable RAM and cores. Aeroflex's core library includes the following functions:

- Intel 80C31® equivalent
- Intel 80C196® equivalent
- MIL-STD-1553 functions (BRCTM, RTI, RTMP)
- MIL-STD-1750 microprocessor
- RISC microcontroller
- Configurable RAM

Table 1. Gate Densities

DIE SIZE (Mils estimate)	EQUIVALENT USABLE GATES[1]	SIGNAL I/O[2]	POWER & GROUND PADS
245	276,890	160	48
313	501,760	216	64
374	757,350	265	79
426	1,024,000	308	92
510	1,524,122	376	112
578	2,007,040	431	129
642	2,524,058	484	144
699	3,029,402	530	158

Notes:
1. Based on NAND2 equivalents plus 20% routing overhead. Actual usable gate count is design-dependent.
2. Includes five pins that may or may not be reserved for JTAG boundary-scan, depending on user requirements.

Low-noise Device and Package Solutions

Separate on-chip power and ground buses are provided for internal cells and output drivers which further isolate internal design circuitry from switching noise.

In addition, Aeroflex offers advanced low-noise package technology with multi-layer, co-fired ceramic construction featuring built-in isolated power and ground planes (see Table 2). These planes provide lower overall resistance/inductance through power and ground paths which minimize voltage drops during periods of heavy switching. These isolated planes also help sustain supply voltage during dose rate events, thus preventing rail span collapse.

Flatpacks are available with up to 352 leads; PGAs are available with up to 299 pins and LGAs/CCGAs to 472 pins. Aeroflex's flatpacks feature a non-conductive tie bar that helps maintain lead integrity through test and handling operations. In addition to the packages listed in Table 2, Aeroflex offers custom package development and package tooling modification services for individual requirements.

Table 2. Packages

Type	Package
Flatpack	68, 84, 132, 172, 196, 256, 304, 340, 352
PGA	281, 299
LGA/CCGA	472

Notes:
1. The number of device I/O pads available may be restricted by the selected package.
2. PGA packages have one additional non-connected index pin (i.e., 84 + 1 index pin = 85 total package pins for the 85 PGA). Contact Aeroflex for specific package drawings.
3. External chip capacitor attachment option available to space quality levels (for improved SSO response).

Extensive Cell Library

The UT0.25µHBD family of gate arrays is supported by an extensive cell library that includes SSI, MSI, and 54XX-equivalent functions, as well as RAM and other library functions. User-selectable options for cell configurations include scan for all register elements, as well as output drive strength. Aeroflex's core library includes the following functions:

- Intel® 80C31 equivalent
- Intel® 80C196 equivalent
- MIL-STD-1553 functions (BCRTM, RTI, RTMP)
- MIL-STD-1750 microprocessor
- Standard microprocessor peripheral functions
- Configurable RAM (SRAM, DPsRAM)
- RISC Microcontroller
- USART (82C51)
- EDAC

Refer to Aeroflex's UT0.25µHBD Design Manual for complete cell listing and details.

I/O Buffers

The UT0.25µHBD gate array family offers up to 530 signal I/O locations (note: device signal I/O availability is affected by package selection and pinout.) The I/O cells can be configured by the user to serve as input, output, bidirectional, three-state, or additional power and ground pads. Output drive options range from 2 to 24mA. To drive larger off-chip loads, output drivers may be combined in parallel to provide additional drive up to 48mA.

Other I/O buffer features and options include:

- Pull-up and pull-down resistors
- Schmitt trigger
- LVDS
- PCI
- Cold Sparing

JTAG Boundary-Scan

The UT0.25µHBD arrays provide for a test access port and boundary-scan that conforms to the IEEE Standard 1149.1 (JTAG). Some of the benefits of this capability are:

- Easy test of complex assembled printed circuit boards
- Gain access to and control of internal scan paths
- Initiation of Built-In Self Test

Clock Driver Distribution

Aeroflex design tools provide methods for balanced clock distribution that maximize drive capability and minimize relative clock skew between clocked devices.

Speed and Performance

Aeroflex specializes in high-performance circuits designed to operate in harsh military and radiation environments. Table 3 presents a sampling of typical cell delays.

Note that the propagation delay for a CMOS device is a function of its fanout loading, input slew, supply voltage, operating temperature, and processing radiation tolerance. In a radiation environment, additional performance variances must be considered. The UT0.25µHBD array family simulation models account for all of these effects to accurately determine circuit performance for its particular set of use conditions.

Power Dissipation

Each internal gate or I/O driver has an average power consumption based on its switching frequency and capacitive loading. Radiation-tolerant processes exhibit power dissipation that is typical of CMOS processes. For a rigorous power estimating methodology, refer to the Aeroflex UT0.25µHBD Design Manual or consult with a Aeroflex Applications Engineer.

Typical Power Dissipation

0.04µW/Gate-MHz@2.5V	20% duty cycle
0.06µW/Gate-MHz@3.3V	20% duty cycle

Table 3. Typical Cell Delays

CELL	OUTPUT TRANSITION	PROPAGATION DELAY [1]	PROPAGATION DELAY [1]
Internal Gates		**V_{DD} = 2.5V**	**V_{DD} = 3.3V**
INV1, Inverter	HL	.126	.172
	LH	.123	.195
INV4, Inverter 4X	HL	.074	.114
	LH	.081	.144
NAND2, 2-Input NAND	HL	.162	.218
	LH	.124	.193
NOR2, 2-Input NOR	HL	.128	.173
	LH	.178	.257
DFF - CLK to Q	HL	.473	.681
	LH	.474	.648
LDL - CLK to Q	HL	.542	.725
	LH	.416	.630
Output Buffers			
OC3325N4_C, CMOS	HL	4.302	4.263
	LH	6.080	5.790
OC3325N12_C, CMOS	HL	3.025	2.961
	LH	3.726	3.425
Input Buffers			
IC3325_C, CMOS	HL	.605	.512
	LH	.455	.601

Note:
1. All specifications in ns (typical). Output load capacitance is 50pF. Fanout loading for input buffers and gates is the equivalent of two gate input loads. For core cells and output buffers input slew is ~.2ns. For input buffer, input slew is 0.4ns (slew is measured from 30% - 70% of V_{DD}).

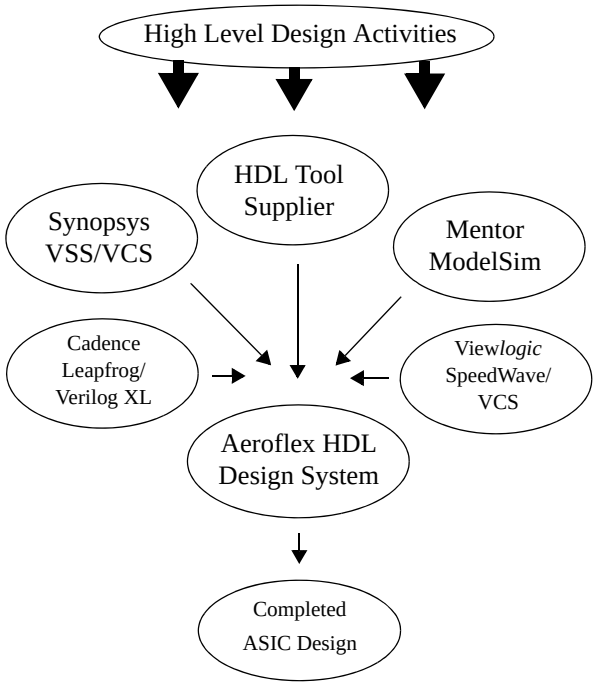
ASIC DESIGN SOFTWARE

Using a combination of state-of-the-art third-party and proprietary design tools, Aeroflex delivers the CAE support and capability to handle complex, high-performance ASIC designs from design concept through design verification and test.

Aeroflex's flexible circuit creation methodology supports high level design by providing UT0.25µHBD libraries for Mentor Graphics and Synopsys synthesis tools. Design verification is performed in any VHDL or Verilog simulator or the Mentor Graphics environment, using Aeroflex's robust libraries. Aeroflex also supports Automatic Test Program Generation to improve design testing.

Aeroflex HDL DESIGN SYSTEMS

Aeroflex offers a Hardware Description Language (HDL) design system supporting VHDL and Verilog. Both the VHDL and Verilog libraries provide sign-off quality models and robust tools.



Aeroflex Springs HDL Design Flow

The VHDL libraries are VITAL 3.0 compliant, and the Verilog libraries are OVI 1.0 compliant.With the library capabilities Aeroflex provides, you can use High Level Design methods to synthesize your design for simulation. Aeroflex also provides tools to verify that your HDL design will result in working ASIC devices.

Either of Aeroflex's HDL design system lets you easily access Aeroflex's RadHard capabilities.

ADVANTAGES OF THE AEROFLEX HDL DESIGN SYSTEMS

- The Aeroflex HDL Design System gives you the freedom to use tools from Synopsys, Mentor Graphics, Cadence, Viewlogic, and other vendors to help you synthesize and verify a design.
- Aeroflex's Logic Rules Checker and Tester Rules Checker allow you to verify partial or complete designs for compliance with Aeroflex design rules.
- Aeroflex HDL Design System accepts back-annotation of timing information through SDF.
- Your design stays entirely within the language in which you started (VHDL or Verilog) preventing conversion headaches.

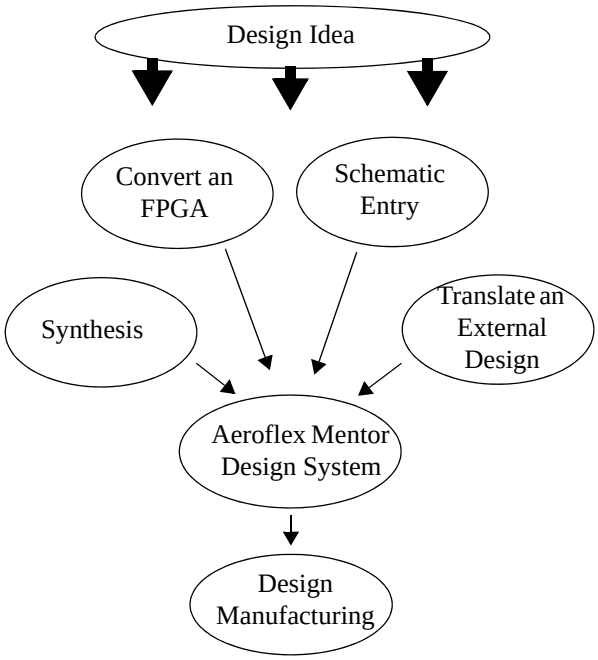
XDT^{sm} (eXternal Design Translation)

Through Aeroflex's XDT services, customers can convert an existing non-Aeroflex design to Aeroflex's processes. The XDT tool is particularly useful for converting an FPGA to an Aeroflex radiation-tolerant gate array. The XDT translation tools convert industry standard netlist formats and vendor libraries to Aeroflex formats and libraries. Industry standard netlist formats supported by Aeroflex include:

- VHDL
- Verilog HDL^{TM}
- FPGA source files (Actel, Altera, Xilinx)
- EDIF
- Third-party netlists supported by Synopsys

AEROFLEX MENTOR GRAPHICS DESIGN SYSTEM

The Aeroflex Mentor Graphics Design System software is fully integrated into the Mentor Graphics design environment, making it familiar and easy to use. Aeroflex tools support Mentor functions such as cross-highlighting, graphical menus, and design navigation.



Aeroflex Mentor Graphics Design Flow

After creating a design in the Mentor Graphics environment, you can easily verify the design for electrical rules compliance with the Aeroflex Logic Rules Checker. Testability can be verified with the Aeroflex Tester Rules Checker. Both of these tools are fully integrated into the Mentor Graphics Environment.

When you have completed all design activities, Aeroflex's Design Transfer tool captures all the required files and prepares them for easy transfer to Aeroflex. Aeroflex uses this data to convert your design into a packaged and tested device.

ADVANTAGES OF THE AEROFLEX MENTOR DESIGN SYSTEM

- Aeroflex customers have successfully used the Aeroflex Mentor Graphics Design System for over a decade.
- Aeroflex's Logic and Tester Rules Checker tools allow you to verify partial or complete designs for compliance with Aeroflex manufacturing practices and procedures.
- The Design System accepts pre-and post-layout timing information to ensure your design results in devices that meet your specifications.
- The Design System supports Leonardo, and database transfer between Synopsys and Mentor.
- The Design System supports powerful Mentor Graphics ATPG capabilities.

TOOLS SUPPORTED BY AEROFLEX

Aeroflex supports libraries for:

- Mentor Graphics
  - ModelSim
- Synopsys
  - Design Compiler
  - PrimeTime
  - Formality
  - TetraMax
- VITAL-compliant VHDL Tools
- OVI-compliant Verilog Tools

TRAINING AND SUPPORT

Aeroflex personnel conduct training classes tailored to meet individual needs. These classes can address a wide mix of engineering backgrounds and specific customer concerns. Applications assistance is also available through all phases of ASIC Design.

PHYSICAL DESIGN

Using five layers of metal interconnect, Aeroflex achieves optimized layouts that maximize speed of critical nets, overall chip performance, and design density up to 3,500,000 equivalent gates.

Test Capability

Aeroflex supports all phases of test development from test stimulus generation through high-speed production test. This support includes ATPG, fault simulation, and fault grading. Scan design options are available on all UT0.25µHBD storage elements. Automatic test program development capabilities handle large vector sets for use with Aeroflex's LTX/Trillium MicroMasters, supporting high-speed testing (up to 80MHz with pin multiplexing), or Teradyne Tiger (up to 1.2GHz).

Unparalleled Quality and Reliability

Aeroflex is dedicated to meeting the stringent performance requirements of aerospace and defense systems suppliers. Aeroflex maintains the highest level of quality and reliability through our Quality Management Program under MIL-PRF-38535 and ISO-9001. In 1988, we were the first gate array manufacturer to achieve QPL certification and qualification of our technology families. Our product assurance program has kept pace with the demands of certification and qualification.

Our quality management plan includes the following activities and initiatives.

- Quality improvement plan
- Failure analysis program
- SPC plan
- Corrective action plan
- Change control program
- Standard Evaluation Circuit (SEC) and Technology Characterization Vehicle (TCV) assessment program
- Certification and qualification program

Because of numerous product variations permitted with customer specific designs, much of the reliability testing is performed using a Standard Evaluation Circuit (SEC) and Technology Characterization Vehicle (TCV). Aeroflex utilizes the wafer foundry's data from TCV test structures to evaluate hot carrier aging, electromigration, and time dependent test samples for reliability testing. Data from the wafer-level testing can provide rapid feedback to the fabrication process, as well as establish the reliability performance of the product before it is packaged and shipped.

Radiation Tolerance

Aeroflex incorporates radiation-tolerance techniques in process design, design rules, array design, power distribution, and library element design. All key radiation-tolerance process parameters are controlled and monitored using statistical methods and in-line testing.

PARAMETER	RADIATION HARDNESS ASSURANCE	NOTES
Total Ionizing Dose (TID)	3.0E5 rad(SiO_2) 1.0E6 rad(SiO_2)	1,2 1,3
Dose Rate Upset (DRU)	>6.6E9 rad(Si)/sec	4
Dose Rate Survivability (DRS)	No latchup observed to maximum dose rate of equipment configuration >5.0E11 rad(Si)/sec	5
Single Event Upset (SEU)	<2.0E-12 errors per cell-day	6,7
Single Event Latchup (SEL)	Latchup-immune over worst case 125°C, 2.75V or 3.6V core, 3.6V I/O V_{DD}, LET >110MeV/cm^2/mg	
Projected neutron fluence	1.0E14 n/sq cm	

Notes:

1. Total dose Co-60 testing is in accordance with MIL-STD-883, Method 1019.
2. Data sheet electrical characteristics guaranteed to 3.0E5 rads(SiO_2). All post-radiation values measured at 25°C.
3. Datasheet electrical characteristics guaranteed to 1.0E6 rad (SiO_2). All post-radiation values measured at 25°C.
4. Short pulse 20ns FWHM (full width, half maximum) 25°C, 2.25V core/3.0V I/O V_{DD}.
5 Short pulse 35ns FWHM (full width, half maximum) 125°C, 2.75V core/3.6V I/O V_{DD}.
6. SEU limit based on standard evaluation circuit at 2.25V or 3.6V core/3.0V I/O V_{DD} 25°C condition.
7. SEU-hard flip-flop cell. Non-hard flip-flop typical is 8E-9.

ABSOLUTE MAXIMUM RATINGS [1]
(Referenced to V_{SS})

SYMBOL	PARAMETER	LIMITS
V_{DD} 2/	I/O DC Supply Voltage	-0.3V to 4.0V
V_{DDCORE} 2/	Core DC Supply Voltage	-0.3 to 2.8V or -0.3 to 4.0V
V_{DD} - V_{DDCORE}	Max Voltage Difference (2.5V core)	1.35V
T_{STG}	Storage temperature	-65 to +150°C
T_J	Maximum junction temperature	+150°C
I_{LU}	Latchup immunity	$\pm$150mA
I_I	DC input current	$\pm$10mA
T_{LS}	Lead temperature (solder 5 sec)	+300°C

Note:
1. Stresses outside the listed absolute maximum ratings may cause permanent damage to the device. This is a stress rating only, and functional operation of the device at these or any other conditions beyond limits indicated in the operational sections of this specification is not recommended. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
2. The recommended "power-on" sequence is V_{DDCORE} voltage supply applied first, followed by the V_{DD} voltage supply. The recommended "power-off" sequence is the reverse. Remove V_{DD} voltage supply, followed by removing V_{DDCORE} voltage supply.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS
V_{DD}	I/O DC Supply Voltage	3.3 $\pm$ 0.3V
V_{DDCORE}	Core DC Supply Voltage	2.5 $\pm$ 0.25V or 3.3 $\pm$ 0.3V

Note:
3. V_{DD} must be maintained at a voltage greater than V_{DDCORE} by 0.25V for 2.5V core option.

DC ELECTRICAL CHARACTERISTICS

(V_{DD} = 3.3V ±0.3; V_{DDCORE} = 2.5V ±0.25 or 3.3V ±0.3V; -55°C < T_C < +125°C)

SYMBOL	PARAMETER	CONDITION	MIN	MAX	UNIT
V_{IL}	Low-level input voltage [1] CMOS, PC1 inputs LVTLL	-55°C ≤ Tc ≤ +125°C V_{DD} = 3.3V ± 0.3V V_{DDCORE} = 2.5V ± 0.25V		0.3V_{DD} 0.8	V
V_{IH}	High-level input voltage [1] CMOS inputs PCI inputs LVTLL	-55°C ≤ Tc ≤ +125°C V_{DD} = 3.3V ± 0.3 V_{DDCORE} = 2.5V ± 0.25	0.7V_{DD} 0.5V_{DD} 2.0		V
V_T+	Schmitt Trigger, positive going threshold[1]	-55°C ≤ Tc ≤ +125°C V_{DD} = 3.3V ± 0.3 V_{DDCORE} = 2.5V ± 0.25		0.7V_{DD}	V
V_T-	Schmitt Trigger, negative going threshold[1]	-55°C ≤ Tc ≤ +125°C V_{DD} = 3.3V ± 0.3 V_{DDCORE} = 2.5V ± 0.25	0.3V_{DD}		V
V_H	Schmitt Trigger, typical range of hysterisis[2]		0.4		V
I_{IN}	Input leakage current Inputs with pull-down resistors Inputs with pull-down resistors Inputs with pull-up resistors Inputs with pull-up resistors Cold Spare Inputs - Off Cold Spare Inputs - On	V_{DD} = Operating Mode V_{IN} = V_{DD} V_{IN} = V_{SS} V_{IN} = V_{DD} V_{IN} = V_{SS} V_{IN} = V_{DD} or V_{SS} V_{DDC} = V_{DD} = V_{SS} = 0 V V_{IN} = 0 V or 3.6V V_{IN} = 5.5V	 10 -5 -5 -120 -5 -5 -10	 120 5 5 -10 5 5 10	µA
V_{OL}	Low-level output voltage [3] LVTTL buffer LVTTL buffer LVTTL buffer LVTTL buffer LVTTL buffer CMOS outputs CMOS outputs PCI outputs	V_{DD} = 3.0V I_{OL} = 4.0mA I_{OL} = 5.0mA I_{OL} = 8.0mA I_{OL} = 12.0mA I_{OL} = 24.0mA I_{OL} = 1.0µA I_{OL} = 100.0µA I_{OL} = 1500.0µA		 0.4 0.4 0.4 0.4 0.4 0.05 0.05 0.1 V_{DD}	V

SYMBOL	PARAMETER	CONDITION	MIN	MAX	UNIT
V_{OH}	High-level output voltage[3]	V_{DD} = 3.0V			V
	LVTTL buffer	I_{OH} = -4.0mA	2.4		
	LVTTL buffer	I_{OH} = -5.0mA	2.4		
	LVTTL buffer	I_{OH} = -8.0mA	2.4		
	LVTTL buffer	I_{OH} = -12.0mA	2.4		
	LVTTL buffer	I_{OH} = -24.0mA	2.4		
	CMOS outputs	I_{OH} = -1.0µA	V_{DD}-0.05		
	CMOS outputs	I_{OH} = -100.0µA	V_{DD}-0.35		
	PCI outputs	I_{OH} = -500.0µA	0.9 V_{DD}		
I_{OZ}	Three-state output leakage current	V_{DD} = Operating mode			µA
	Bidirect with pull-up resistor	V_O = V_{DD}	-10	10	
	Bidirect with pull-up resistor	V_O = V_{SS}	-120	-10	
	Bidirect with pull-down resistor	V_O = V_{DD}	20	150	
	Bidirect with pull-down resistor	V_O = V_{SS}	-10	10	
	Cold Spare bidirect - On	V_{IN} = 0V and 3.6V	-10	10	
		V_{DDC} = V_{DD} = V_{SS} = 0V			
	Cold Spare bidirect - Off	V_{IN} = V_{DD} = V_{SS}	-10		
I_{OS}	Short-circuit output current [2,4]				mA
	CMOS, 4mA buffer	V_O = V_{DD} = V_{SS}	-40	70	
	CMOS, 8mA buffer	V_O = V_{DD} = V_{SS}	-50	100	
	CMOS, 12 mA buffer	V_O = V_{DD} = V_{SS}	-65	130	
	PCI	V_O = V_{DD} = V_{SS}	-130	270	
C_{IN}	Input capacitance [5]	f = 1MHz @ 0V	4	12	pF
C_{OUT}	CMOS and LVTTL output capacitance [5]	f = 1MHz @ 0V			pF
	3.0mA buffer			10	
	5.0mA buffer			12	
	9.0mA buffer			20	
	12.0mA buffer			25	
C_{IO}	CMOS output capacitance [5]	f = 1MHz @ 0V			pF
	3.0mA buffer			15	
	5.0mA buffer			18	
	9.0mA buffer			20	
	12.0mA buffer			25	

I_{DDQ}	Quiescent Supply Current[6]	V_{DD} = 3.6V				µA
	Group A, subgroups 1,3	200K gates			50	
		400K gates			100	
		600K gates			150	
		800K gates			200	
		1000K gates			250	
		1500K gates			375	
		2000K gates			500	
		2500K gates			625	
		3000K gates			750	
	Group A, subgroup 2	V_{DD} = 3.6V				mA
		200K gates			1	
		400K gates			2	
		600K gates			3	
		800K gates			4	
		1000K gates			5	
		1500K gates			7.5	
		2000K gates			10	
		2500K gates			12.5	
		3000K gates			15	
	Group A, subgroup 1 RHA Designator: M, D, P, L, R	V_{DD} = 3.6V				mA
		200K gates			4	
		400K gates			6	
		600K gates			8	
		800K gates			10	
		1000K gates			12	
		1500K gates			18	
		2000K gates			24	
		2500K gates			30	
		3000K gates			36	

Notes:

* Contact Aeroflex and refer to SMD prior to usage.

1. Functional tests are conducted in accordance with MIL-STD-883 with the following input test conditions: $V_{IH} = V_{IH}(min) + 20\%, - 0\%$; $V_{IL} = V_{IL}(max) + 0\%, - 50\%$, as specified herein, for TTL, CMOS, or Schmitt compatible inputs. Devices may be tested using any input voltage within the above specified range, but are guaranteed to $V_{IH}(min)$ and $V_{IL}(max)$.
2. Supplied as a design limit but not guaranteed or tested.
3. Per MIL-PRF-38535, for current density $\leq$ 5.0E5 amps/cm^2, the maximum product of load capacitance (per output buffer) times frequency should not exceed 3,765pF*MHz.
4. Aeroflex IOS specification - maximum of 1 second for any output to be shorted to ground or the maximum output voltage supply - exceeding this specification will reduce the DC current lifetime because of potential joule heating.
5. Capacitance measured for initial qualification and when design changes may affect the value. Capacitance is measured between the designated terminal and V_{SS} at frequency of 1MHz @0V and a signal amplitude of $\leq$50mV RMS.
6. All inputs with internal pull-ups should be left floating. All other inputs should be tied high or low.

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AEROFLEX
A passion for performance.

Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused