BICMON
Product Highlights

Full Featured Built-in CMOS I_{DDQ} Monitor Core

FEATURES

- Small Chip Area: 0.2 mm² (0.7µm CMOS)
- Wide measurement range: I_{DDQ} = 0 – 1.0mA
- Maximum measurement rate: 2 MHz
- High capacitive driving capability: up to 1µF
- High resolution: 500 pA
- Low Power: I_{DD} Typ = 300µA @ 5V Supply
- CCII+ based design
- Easily transferable to other CMOS processes

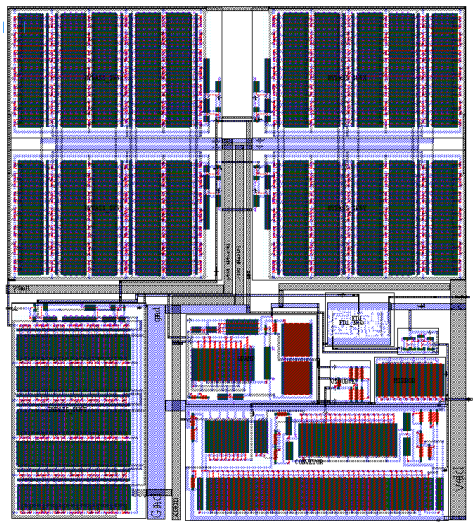
APPLICATIONS

- On-chip I_{DDQ} Monitor Applications
- Off-chip I_{DDQ} Monitor Applications
- High Speed I_{DDQ} Measurements
- I_{DDQ} Pass/Fail Measurements
- I_{DDQ} Comparative Measurements

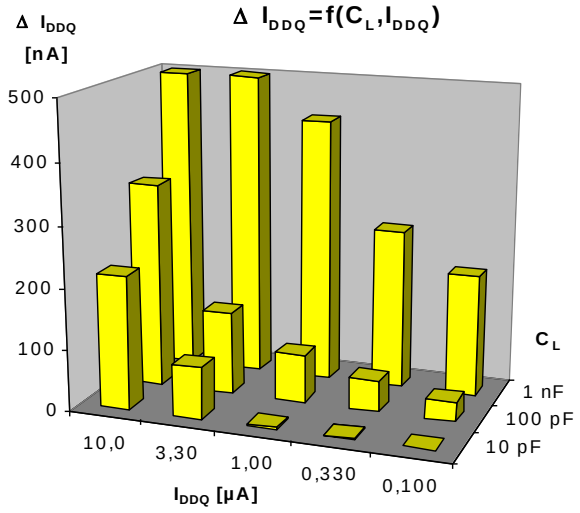
DESCRIPTION

The BICMON is a complete I_{DDQ} monitor for on-chip applications. It is the first of a series of current conveyor based I_{DDQ} monitors. To characterise and validate the design concept an implementation was done using the Alcatel Microelectronics 0.7µm CMOS technology. The parameters listed in this document refer to that implementation, targeted for use in combination with 3.3V devices. The monitor is in principle an on-chip monitor, but could also be used as an off-chip monitor considering its high capacitive driving capability.

The BICMON monitor is basically a sensitive ampmeter with a low internal resistance. It is designed to be inserted between the internal V_{DD} connection of the functional part of the IC to test and the supply pad. As an off-chip monitor, it needs to be inserted between the supply pin of the DUT and the ATE DUT supply.



BICMON Core



The current sensor is based on a second generation current conveyor CCII+ architecture. This unique approach enables fast and highly sensitive I_{DDQ} measurements. The BICMON offers a measurement resolution of 0.5nA when running at 5kHz with 10pF loading.

The bypass switch unit is modular and consists of a compensated MOSFET. The compensation decreases the switch's on/off time and reduces the switching peaks significantly resulting in faster settling times. The modularity allows controlling the R_{ON}.

The BICMON can drive high capacitive loading and hence only 1 monitor per design is needed.

A measurement speed of 2MHz @ I_{DDQ} = 300µA and 100pF loading capacitance can be obtained.

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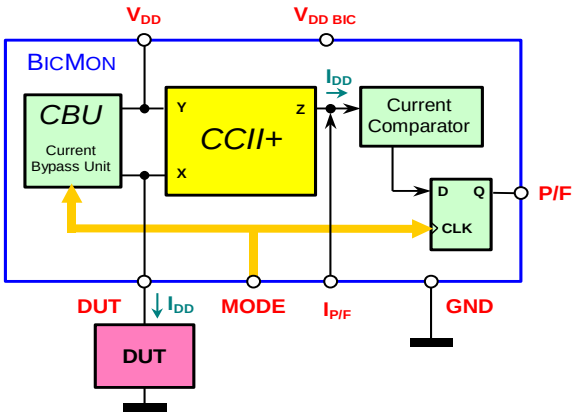
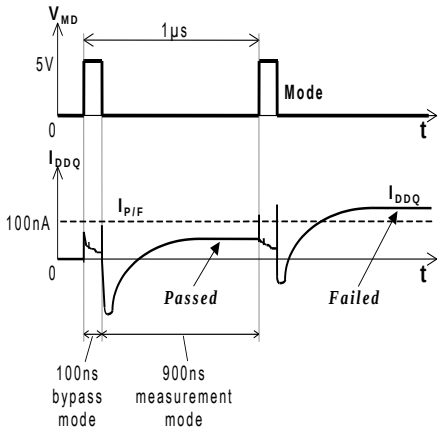
CIRCUIT DESCRIPTION

The BICMON consists of a bypass switch, a current conveyor, a current comparator and an output register. The I_{DDQ}, which is drawn by the unit under test or DUT, is mirrored by the conveyor to the Z output. The Z output current is compared to the $I_{P/F}$ current (I_{DDQ} limit) using a current comparator. The input current mirror, which sinks the $I_{P/F}$ reference, has an attenuation factor of 10. Therefore, there is no problem to generate low I_{DDQ} limits. The comparator generates the pass/fail flag, which is registered by the D flip-flop. The figures show a basic block diagram as well as a typical measurement cycle.





Typical measurement cycle

OPERATING MODES

The monitor can operate in 2 modes, i.e. measurement and bypass mode. A measurement cycle is initiated by placing the monitor in bypass mode and holding the MODE pin 'high' while a new test vector is applied to the DUT. During this mode the internal bypass switch is turned on to bypass the (high) transient current drawn by DUT. The bypass switch has a low on resistance, therefore the operation of the DUT is not affected during this critical period.

When the MODE signal is 'low', the monitor is placed in measurement mode and the bypass switch is turned off. At the end of the measurement cycle, the measured current settles and the rising edge of the MODE signal loads the valid pass/fail flag in the output register. The I/O pin is 'low' (fail), if the measured I_{DDQ} exceeds the I_{DDQ} limit $I_{P/F}$/10. The I/O pin is 'high' (pass), if the measured I_{DDQ} is below the I_{DDQ} limit.

ELECTRICAL SPECIFICATIONS

For Alcatel Microelectronics 0.7µm CMOS technology; V_{DDBIC}=+5.00V, V_{DUT}= 3.30V, T=25°C

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
Power Supply					
V_{DDBIC}	BIC Positive Supply Voltage	+4.8	+5.0	+5.2	V
I_{DDBIC}	BIC Supply Current		0.3	0.5	µA
Measurement Characteristics					
I_{DDQ}	Measurement Range	0.05		1000	µA
V_{DUT}	DUT Supply Voltage	+3.2	+3.3	+3.4	V
	Resolution @ C_L = 10pF, f_{TEST}= 5kHz	0.5			nA
	Measurement Speed @ CL < 100pF			2	MHz
C_L	Loading Capacitance	0.01		1000	nF
	Linearity error @ C_L > 100pF			5	%
	Measurement Offset		2	5	nA
	Gain Error			5	%
Modular Bypass Characteristics *					
I_{DDT}	Transient Current			100	mA
R_{ON}	On Resistance @ I_{DD}=100µA		1	2	Ω
R_{OFF}	Off Resistance @ I_{DD}=10mA		5	7	MΩ
	Bypass Switch On Time			200	ns

* The bypass unit characteristics can be improved at expense of silicon area.

 Covered by U.S. Patent No 6,118,293
Due to continuous pursuit of innovation, the technical specifications listed are subject to change without notice.