State-of-the-art process technology for optimal performance and density

Foundry technologies
130-nm CMOS and RF CMOS

Highlights

Standard Features

- ***Twin-well CMOS technology on nonepitaxial p- doped substrate***
- ***Low-resistance cobalt-silicide n+ and p+ doped polysilicon and diffusion regions***
- ***Up to three thick copper wiring levels***
- ***Four to eight levels of global copper metal (CMOS 8SFG)***
- ***Five to eight levels of copper metal with an Al-Cu-Al last metal sequence (CMOS 8RF)***
- ***Wire-bond or C4 solder-bump terminals***

Optional Features

- ***Range of FET devices to optimize power and performance, including an isolated triple-well NFET (CMOS 8RF)***
- ***Vast array of passive analog RF devices, including:***
  - ***Low-tolerance resistors with high and low sheet resistivity***
  - ***High-quality factor (Q) copper and aluminum inductors and inductor models (CMOS 8RF)***
  - ***High-value, low-tolerance capacitors***
  - ***Electrically writable e-fuses***
- ***IBM and third-party logic library design tools***

IBM 130-nm Technology Highlights

Category	Base Technology CMOS 8SFG	Related Technology CMOS 8RF
Process	Industry-standard 130-nm CMOS	CMOS 8SFG additional passive devices
Wiring	Copper	Copper and aluminum with analog metal

IBM Microelectronics offers a comprehensive suite of foundry products and services for its industry-standard 130-nm CMOS-based technology family, which includes a high-speed analog radio frequency (RF) CMOS technology. Customers can choose appropriate devices and design tools to match their application requirements.

Base technology

The IBM **CMOS 8SFG** advanced process technology features 130-nm lithography. The fine lines and high densities characterizing this state-of-the-art silicon process can support leading-edge microprocessors, communications and computer data-processing applications. CMOS 8SFG uses low-resistance copper wiring at all metal levels, enabling high wiring density with minimal timing delays. Up to three thick copper wiring metal options provide design flexibility.

Related technology

IBM **CMOS 8RF** offers several enhancements to CMOS 8SFG including FET structures that support high-frequency RF-compatible models, a broad range of optional passive devices and copper and aluminum wiring with a thick last metal. A high-quality analog design kit ensures close correlation between simulated and measured performance. In addition, the technology maintains compatible design rules with the corresponding levels in CMOS 8SFG.

CMOS 8RF is an ideal semiconductor technology for low-cost, high-performance wireless applications such as Bluetooth™ technologies, local area networks, handsets and global positioning systems.

For more information

For more information, contact IBM at foundry@us.ibm.com

CMOS Specifications (common to 130-nm technology family)	
Lithography	130 nm
Voltage (V_{DD})	1.2 V or 1.5 V
Additional power supply options	2.5 V / 3.3 V I/O
Standard NFET / PFET	
L_{min}	0.24 µm
L_p	0.22 µm
V_t	0.355 V / -0.30 V
I_{Dsat}	530 mA / 210 mA
I_{off}	300 pA/um / 250 pA/µm
T_{ox}	2.2 nm
Thick-oxide NFET / PFET	
L_{min}	0.24 µm
L_p	0.22 µm
V_t	0.41 V / -0.44 V
I_{Dsat}	660 mA / 260 mA
I_{off}	10 pA/µm / 10 pA/µm
T_{ox}	5.2 nm

Note: Specifications given for 1.2 V (nominal) at 25°C.

CMOS Specifications	CMOS 8SFG	CMOS 8RF
Isolation	Shallow trench	Shallow trench
Levels of metal	4–8	5–8
Metallization	Copper	Copper, Aluminum
FET devices (max. voltage)*		
Ultra-thin NFET / PFET (1.2V)	✓	–
Standard NFET / PFET (1.5V)	✓	✓
Zero-V_t NFET (1.5V)	✓	✓
Isolated NFET (1.5V)	–	✓
Low- V_t NFET / PFET (1.5V)	✓	–
High-V_t NFET / PFET (1.5V)	✓	–
Low-power NFET / PFET (1.5V)	✓	✓
Thick-oxide NFET / PFET (2.5V)	✓	✓
Thick-oxide Zero V_t NFET (2.5V)	✓	✓
Thick-oxide Isolated NFET (2.5V)	–	✓
Thick-oxide I/O NFET / PFET (3.3V)	✓	✓

*FET devices can be used in a variety of design options that are defined in the respective technology design manuals.

Passive Devices	CMOS 8SFG	CMOS 8RF
Capacitors		
MIM	1.35 fF/μm² ± 15%	1.35 fF/μm² ± 15%
Single MIM	–	2.0 fF/μm² ± 10%
Dual MIM	–	4.1 fF/μm² ± 10%
Thick-oxide MOS	5.85 fF/μm² ± 10%	5.85 fF/μm² ± 10%
Thin-oxide MOS	11.1 fF/μm² ± 10%	11.1 fF/μm² ± 10%
Fuses	Laser, e-fuse	e-fuse
Inductors*		
Analog metal spiral	–	Q = 10
Stacked dual-metal spiral	–	Q = 24
Resistors		
n+ diffusion	73 Ω/❑ ± 11%	73 Ω/❑ ± 15%
p+ polysilicon	340 Ω/❑ ± 12%	340 Ω/❑ ± 20%
p- polysilicon	–	1450 Ω/❑ ± 25%
Tantalum nitride	–	60 Ω/❑ ± 6%
Varactors		
Hyperabrupt junction	–	✓
MOS	✓	✓

* All inductor measurements were taken at L = 1 nH and f = 2 GHz.

Design Tools	CMOS 8SFG	CMOS 8RF
Models		
BSIM3	✓	✓
Cadence Spectre	✓	–
Cadence SpectreRF	–	✓
IBM digital	✓	–
Synopsys HSPICE	✓	✓
Verification tools		
Avant! Hercules	✓	✓
Cadence Assura	–	✓
Mentor Graphics Calibre	✓	✓
Libraries		
Artisan	✓	✓
IBM	✓	–

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