

0.18 μm Process Family:

> XP018



0.18 Micron CMOS Analog Mixed-Signal Process Technology

DESCRIPTION

The XP018 series is X-FAB's 0.18 micron Modular CMOS High Performance Analog Mixed-Signal Technology. Based upon the industrial standard single poly with up to six metal layers 0.18-micron drawn gate length N-well process, integrated with high voltage and Non-Volatile-Memory modules, the platform is engineered for applications needing an integrated solution and cost efficient process for

high performance analog ICs. Targeted applications are switching applications, lighting, display, etc; operating in temperature range of -40 to 175 $^{\circ}\text{C}$.

Comprehensive design rules, precise SPICE models, analog and digital libraries, IPs and development kits support the process for major EDA vendors.

KEY FEATURES OVERVIEW

- 0.18-micron single poly, up to six-metal N-well CMOS basic process
- Modular concept
- 1.8V & 5V Low Power or **5V only core module**
- Integrated digital, analog, HV and NVM in a single process
- High-reliability NVM using SONOS technology
- Isolation well for all 1.8V, 5V MOS devices
- Integrated high-ohmic poly resistor in core module (zero mask penalty)
- 15V~45V HVMOS module
- 15V~60V DMOS module
- Depletion transistors
- Single, double, triple MIM and Sandwich MIM Capacitors
- Vertical NPN BJT
- Excellent Ron in HVMOS module with multiple resurf technology
- Very low mask count for an integrated analog process with HV and NVM
- Very low cost-per-function
- Thick top metal
- High density up to 125000 gates per mm^2
- Typical and worst-case models - BSIM3v3.24 (MOS, BJT, RES, CAP)
- MOS 1/f noise characterized & included in model
- Assura verification deck
- Common-Timing-Engine in Cadence P&R encounter platform
- Cadence PDK
- **NEW Primitive Devices:**
 - Low Vt Transistors
 - 30V~40V Asymmetrical HVMOS transistors
 - ESD protected HV PNP for reverse polarity protection (e.g. for LIN pins)

APPLICATIONS

- Sensor Interface
- Lighting
- Audio, Display
- Power management IC
- Switching applications, Portable analog applications
- Communications, Consumer and Industrial markets

QUALITY ASSURANCE

X-FAB spends a lot of effort to improve the product quality and reliability and to provide comprehensive support to the customers. This is maintained by the direct and flexible customer interface, the reliable manufacturing process and complex test and evaluation conceptions, all of them guided by

strict quality improvement procedures developed by X-FAB. This comprehensive, proprietary quality improvement system has been certified to fulfill the requirements of the ISO 9001, ISO TS 16949 and other standards.

DELIVERABLES

- PCM tested wafers
- Optional engineering services: Multi Project Wafer (MPW) and Multi Layer Mask Service (MLM)
- Optional design services: feasibility studies, Place & Route, synthesis, custom block development

DIGITAL LIBRARIES

- Foundry-specific optimized libraries
- Low power, low leakage library for energy efficient and small size digital blocks
- Junction isolated library for low noise applications
- Multi-voltage library for multi-voltage and power cut-off applications
- Liberty™ synthesis models
- IEEE 1364 Verilog simulation models
- IEEE 1076.4 VHDL-VITAL simulation models

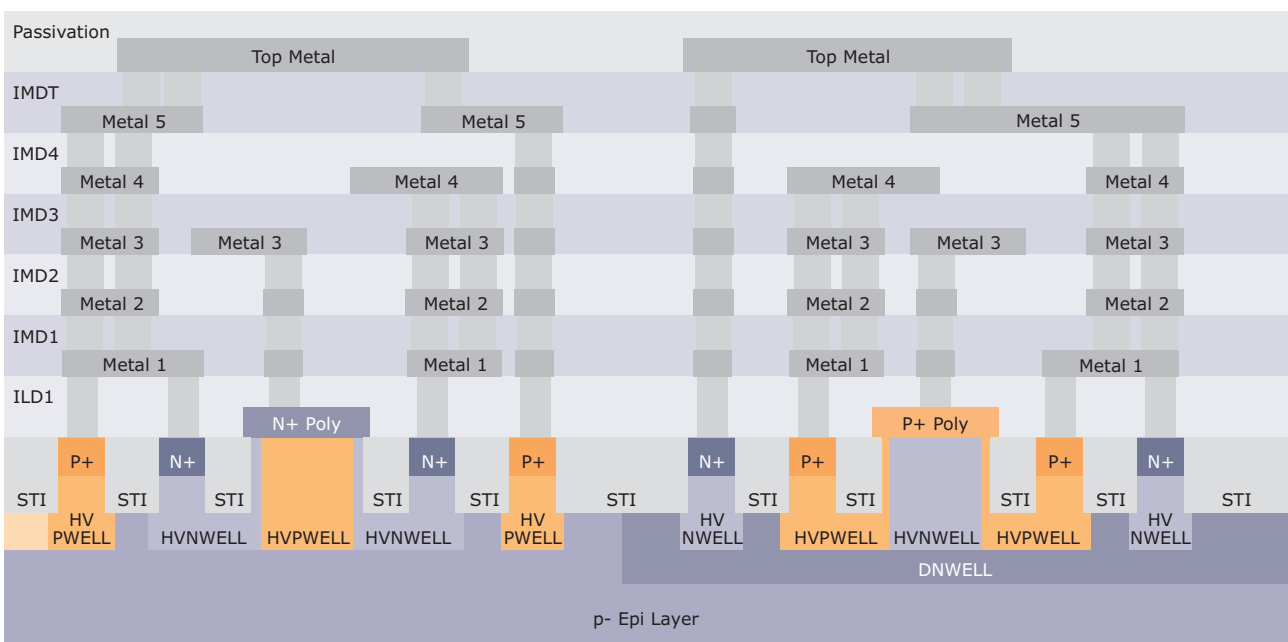
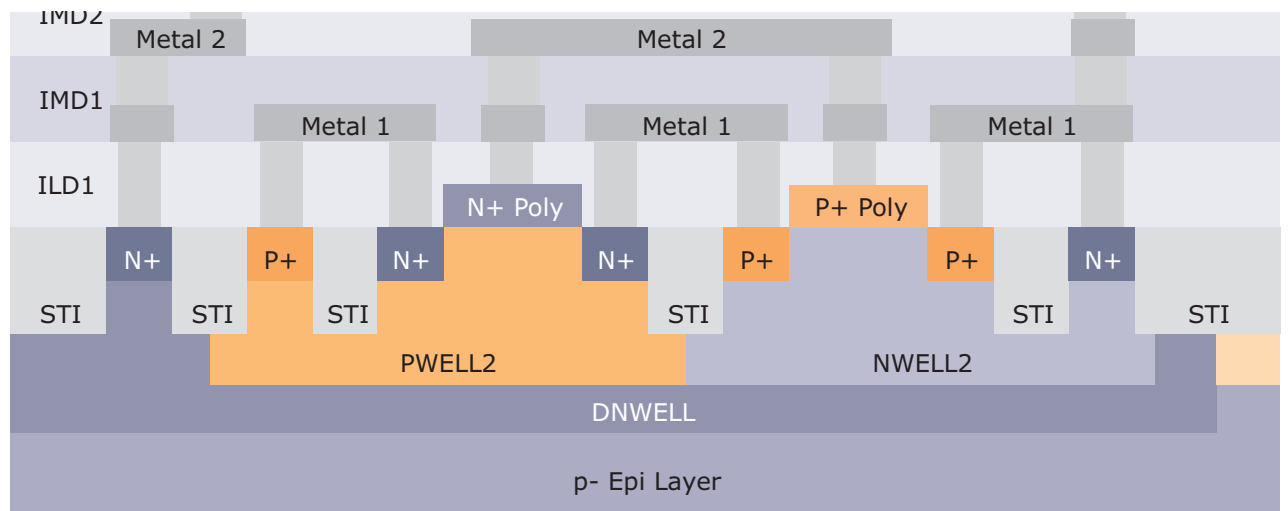
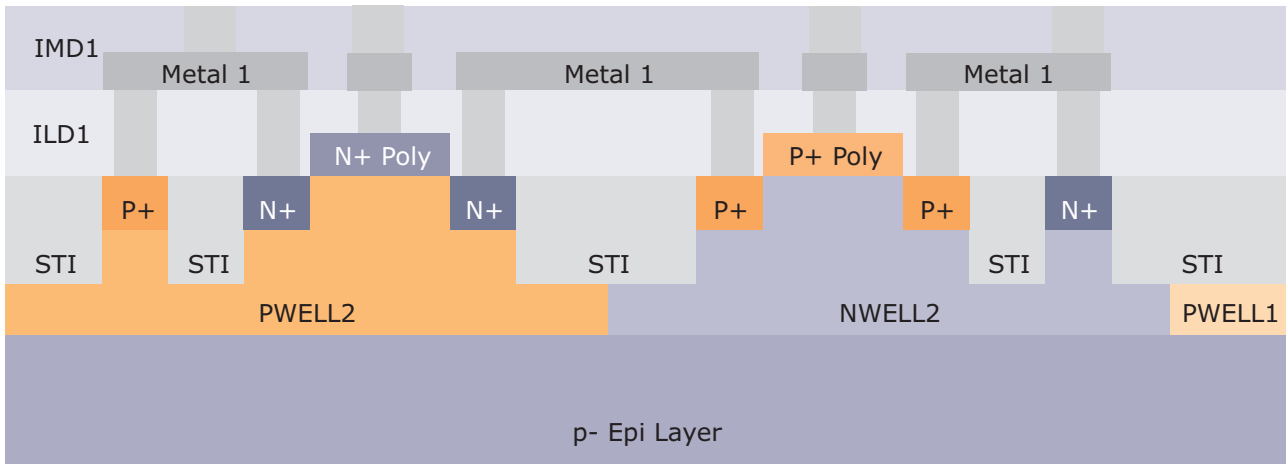
PRIMITIVE DEVICES

- MOS transistors
- (Isolated) 1.8V, 5.0V LP NMOS/PMOS
- 15V, 30V, 40V HV NMOS/PMOS
- 12V, 15V, 25V, 40V, 60V lateral nDMOS/pDMOS
- Depletion NMOS
- Vertical PNP/NPN Bipolar transistors
- MIM, Sandwich, Fringe Capacitors
- Poly, Metal, Diffusion Resistors
- Schottky, Protection, Diffusion, Diodes

XP018 BASIC DESIGN RULES

Mask	width [μm]	Spacing [μm]
N-well	0.86	1.4
Active Area	0.22	0.28
Poly-silicon Gate	0.18	0.25
Poly-silicon Resistor	0.44	0.44
Contact	0.22	0.25
Metal 1	0.23	0.23
Via 1, 2, 3, 4	0.26	0.26
Metal 2, 3, 4, 5	0.28	0.28
Top Via	0.36	0.35
Top Metal	0.44	0.46
Thick Metal	3.0	2.5

XP018 DEVICES SCHEMATIC CROSS SECTION



XP018 PROCESS FLOW

LP5MOS/MOS5 Module	Additional Modules	
Wafer Start		
Active area	Very deep N-well	HVC/HVD/BIPESD
	Deep N-well	ISOMOS/BJTA/ HV(A/AN/AP/C/D/EN/EP) /DIODEB/BIPESD
	N-drain extension implant	HV(EN/EP)
	Deep P-barrier	HVC
	N-drain extension implant	HV(B/C)
	P-drain extension implant	HV(A/AN/AP/D) /BJTA/BIPESD
	P-drain extension implant	HVEP
	Non volatile memory	NVM/FLASH
5V wells		
1.8V wells		
1.8V low Vt wells		LVT (LP5MOS only)
	Additional wells (MOS5 only)	HVAN/HVAP/HVC/HVD/ HVEP/DIODEA/DIODEB
	Depletion implant	DEPL
Gate oxide		
Poly silicon gate		
Source/Drain implants		
	HRPOLY implant	HRPOLY
	MRPOLY implant	MRPOLY
Salicidation		
Contact		
Metal 1		
Via 1		
Metal 2		
	M2/M3 MIM capacitor	MIM23/MIMH23
	Double MIM capacitor	DMIM/DMIMH
	Triple MIM capacitor	TMIM/TMIMH
	Via 2	
	Metal 3	MET3
	M3/M4 MIM capacitor	MIM34/MIMH34
	Double MIM capacitor	DMIM/DMIMH
	Triple MIM capacitor	TMIM/TMIMH
	Via 3	
	Metal 4	MET4
	Triple MIM capacitor	TMIM/TMIMH
	Via 4	
	Metal 5	MET5
	MIM capacitor	MIM/MIMH
	Top Via	
	Top metal	METMID
	Thick Via	
	Thick Metal	METTHK
PAD		
	Polyimide deposition	PIMIDE

mask steps

XP018 MODULE		
Module Name	Descriptions	Masks No.
LP5MOS	1.8V/5.0V low power CMOS module	19
MOSS	5.0V low power CMOS module	14

XP018 ADDITIONAL MODULES		
Module Name	Descriptions	Masks No.
ISOMOS	Triple well isolated CMOS module	1
LVT	1.8V low Vt module	2
DEPL	Depletion module	1
NVM	Non volatile memory module	4
FLASH	Flash module	0
HVA *	High voltage module (15V nDMOS, symmetrical HV PMOS)	2
HVAN *	High voltage module (15V - 60V nDMOS)	3
HVAP *	High voltage module (15V - 60V pDMOS)	3
HVB	High voltage module (symmetrical HV NMOS)	1
HVC *	High voltage module (vertical NPN BJT)	6
HVD *	High voltage module (HV PNP)	4
HVEN *	High voltage module (low RDSon 12V nDMOS)	2
HVEP *	High voltage module (low RDSon 12V pDMOS)	4
BJTA *	Bipolar module	3
DIODEA *	Diode module (N-type protection diode)	1
DIODEB *	Diode module (Schottky & P-type protection diode)	2
MRPOLY	Medium resistance polysilicon module	1
HRPOLY *	High resistance polysilicon module	1
OTP5	One-Time Programmable memory module	0
MIM	MIM capacitor module	1
MIM23	MIM capacitor module	1
MIM34	MIM capacitor module	1
MIMH	High capacitance MIM capacitor module	1
MIMH23	High capacitance MIM capacitor module	1
MIMH34	High capacitance MIM capacitor module	1
DMIM	Double MIM capacitor module	1
DMIMH	High capacitance double MIM capacitor module	1
TMIM	Triple MIM capacitor module	1
TMIMH	High capacitance triple MIM capacitor module	1
MET3	3 metal module	2
MET4	4 metal module	2
MET5	5 metal module	2
BIPESD	ESD module	4

* The final mask count of this module will be less than the sum of the masks per single module when in combination with certain modules. Please refer to the Process Overview at X-TIC for the final mask count in case of such module combinations.

XP018 ADDITIONAL MODULES		
Module Name	Descriptions	Masks No.
METTHIN	Thin top metal module	0
METMID	Top metal module	2
METTHK	Thick metal module	2
PIMIDE	Polyimide module	1

XP018 RESTRICTION FOR MODULE COMBINATIONS		
Module name	Use of the module also requires use of the following module(s)	Use of the module is not available with the use of the following module(s)
LP5MOS	METTHIN, METMID, METTHK	MOSS5
MOSS5	METTHIN, METMID, METTHK	LP5MOS
LVT		MOSS5
NVM	ISOMOS	MOSS5
FLASH	NVM	MOSS5
BJTA		MOSS5
MIM	METMID	MIM23, MIM34, DMIM, TMIM, MIMH, MIMH23, MIMH34, DMIMH, TMIMH
MIM23	MET3	MIM, MIM34, DMIM, TMIM, MIMH, MIMH23, MIMH34, DMIMH, TMIMH
MIM34	MET3	MIM, MIM23, DMIM, TMIM, MIMH, MIMH23, MIMH34, DMIMH, TMIMH
MIMH	METMID	MIM, MIM23, MIM34, DMIM, TMIM, MIMH23, MIMH34, DMIMH, TMIMH
MIMH23	MET3	MIM, MIM23, MIM34, DMIM, TMIM, MIMH, MIMH34, DMIMH, TMIMH
MIMH34	MET4	MIM, MIM23, MIM34, DMIM, TMIM, MIMH, MIMH23, DMIMH, TMIMH
DMIM	MET4, MET3+METMID	MIM, MIM23, MIM34, TMIM, MIMH, MIMH23, MIMH34, DMIMH, TMIMH
TMIM	MET5, MET4+METMID	MIM, MIM23, MIM34, DMIM, MIMH, MIMH23, MIMH34, DMIMH, TMIMH
DMIMH	MET4, MET3+METMID	MIM, MIM23, MIM34, DMIM, TMIM, MIMH, MIMH23, MIMH34, TMIMH
TMIMH	MET5, MET4+METMID	MIM, MIM23, MIM34, DMIM, TMIM, MIMH, MIMH23, MIMH34, DMIMH
MET4	MET3	METTHIN
MET5	MET4	METTHIN, METTHK
METTHIN	MET3	MET4, MET5, METMID, METTHK
METMID		METTHIN
METTHK		MET5, METTHIN

XP018 METAL OPTIONS		
Metal Layers	Available Metal Layer Combinations	Module names (CORE = LP5MOS or MOSS5)
3	MET1-MET2-MET3 MET1-MET2-METTP MET1-MET2-METTPL	CORE+MET3+METTHIN CORE+METMID CORE+METTHK
4	MET1-MET2-MET3-METTP MET1-MET2-MET3-METTPL MET1-MET2-METTP-METTPL	CORE+MET3+METMID CORE+MET3+METTHK CORE+METMID+METTHK
5	MET1-MET2-MET3-MET4-METTP MET1-MET2-MET3-MET4-METTPL MET1-MET2-MET3-METTP-METTPL	CORE+MET3+MET4+METMID CORE+MET3+MET4+METTHK CORE+MET3+METMID+METTHK
6	MET1-MET2-MET3-MET4-MET5-METTP MET1-MET2-MET3-MET4-MET5-METTPL MET1-MET2-MET3-MET4-METTP-METTPL	CORE+MET3+MET4+MET5+METMID CORE+MET3+MET4+MET5+METTHK CORE+MET3+MET4+METMID+METTHK

Active Devices

XP018 MOS CORE TRANSISTORS								
Device	Name	Available with module	VT [V]	IDS [$\mu\text{A}/\mu\text{m}$]	IOFF [$\text{pA}/\mu\text{m}$]	BVDS [V]	Max. VDS [V]	Max. VGS [V]
1.8V LP NMOS	ne	LP5MOS	0.60	480	< 3	> 3.6	1.98	1.98
1.8V LP PMOS	pe, pe_5	LP5MOS	0.65	170	< 3	> 3.6	1.98	1.98
1.8V native Vt NMOS	nn	LP5MOS	0.02	360			1.98	1.98
5.0V native Vt NMOS	nn5	LP5MOS, MOSS	0.20	610			5.5	5.5
5.0V LP PMOS	ne5	LP5MOS, MOSS	0.78	550	< 5	> 8.0	5.5	5.5
5.0V LP PMOS	pe5, pe5_5	LP5MOS, MOSS	0.86	250	< 10	> 7.5	5.5	5.5
1.8V low Vt NMOS	nel	LVT	0.33	605	< 5K	> 3.6	1.98	1.98
1.8V low Vt PMOS	pel, pel_5	LVT	0.34	310	< 10K	> 3.6	1.98	1.98

XP018 ISOMOS TRANSISTORS								
Device	Name	Available with module	VT [V]	IDS [$\mu\text{A}/\mu\text{m}$]	IOFF [$\text{pA}/\mu\text{m}$]	BVDS [V]	max. VDS [V]	max. VGS [V]
Iso. 1.8V LP NMOS	nei, nei_m_6, nei_a_6, nei_b_6, nei_d_6	ISOMOS	0.60	480	< 3	> 3.6	1.98	1.98
Iso. 1.8V LP PMOS	pei, pei_m_5, pei_a_5, pei_b_5, pei_d_5	ISOMOS	0.65	170	< 3	> 3.6	1.98	1.98
Iso. 5.0V LP NMOS	ne5i, ne5i_m_6, ne5i_a_6, ne5i_b_6, ne5i_d_6	ISOMOS	0.78	550	< 5	> 8.0	5.5	5.5
Iso. 5.0V LP PMOS	pe5i, pe5i_m_5, pe5i_a_5, pe5i_b_5, pe5i_d_5	ISOMOS	0.86	250	< 10	> 7.5	5.5	5.5
Iso. 1.8V low Vt NMOS	neli, neli_m_6, neli_a_6, neli_b_6, neli_d_6	LVT+ISOMOS	0.33	605	< 5K	> 3.6	1.98	1.98
Iso. 1.8V low Vt PMOS	pe5i, pe5i_m_5, pe5i_a_5, pe5i_b_5, pe5i_d_5	LVT+ISOMOS	0.34	310	< 10K	> 3.6	1.98	1.98

XP018 MEDIUM VOLTAGE TRANSISTORS									
Device	Name	Available with module	VT [V]	IDS [$\mu\text{A}/\mu\text{m}$]	RON [$\text{k}\Omega\cdot\mu\text{m}$]	RON*A [$\text{m}\Omega\cdot\text{mm}^2$]	BVDSS [V]	Max. VDS [V]	Max. VGS [V]
15V HV NMOS	nmma	HVB	0.87	117	18	80	> 25	15	5.5
30V HV NMOS	nmmb	HVB	0.88	102	26	195	> 40	30	5.5
15V HV PMOS	pmma	HVA	0.91	40	60	300	> 25	15	5.5
30V HV PMOS	pmmb	HVA	0.90	25	100	860	> 35	30	5.5
30V Asy. HV NMOS	nmb	HVB	0.83	197	17	95	> 40	30	5.5
30V Asy. HV PMOS	pmb	HVA	0.87	80	61	310	> 35	30	5.5

Active Devices (Continued)

XP018 HIGH VOLTAGE TRANSISTORS

Device	Name	Available with module	VT [V]	IDS [μ A/ μ m]	RON [k Ω . μ m]	RON*A [m Ω .mm ²]	BVDSS [V]	Max. VDS [V]	Max. VGS [V]
40V/45V HV NMOS	nmmc	HVB	0.88	95	30	265	> 55	40 / 45 *	5.5
35V/40V HV PMOS	pmmc	HVA	0.90	18	150	1850	> 50	35 / 40 *	5.5
40V Asy. HV NMOS	nmc	HVB	0.83	184	20	130	> 55	40	5.5
35V Asy. HV PMOS	pmc	HVA	0.88	61	86	617	> 50	35	5.5

* Value @ Tj = -40°C ... +175°C / Tj = 0°C ... +175°C

XP018 DMOS TRANSISTORS

Device	Name	Available with module	VT [V]	IDS [μ A/ μ m]	RON [k Ω . μ m]	RON*A [m Ω .mm ²]	BVDSS [V]	Max. VDS [V]	Max. VGS [V]
Iso. drain 13V LDMOS	nhia *	HVC	0.91	140	7	23	> 37	13	5.5
12V nLDMOS	nede	HVEN	0.95	139	4.65	11.9	> 16	12	5.5
15V nLDMOS	neda	ISOMOS, HVA	0.92	100	6.5	19	> 19	15	5.5
23V/25V nLDMOS	nedb	HVAN	0.91	100	12	39	> 28	23/25 **	5.5
35V/40V nLDMOS	nedc	HVAN	0.91	90	18	75	> 43	35/40 **	5.5
50V/60V nLDMOS	nedd	HVAN	0.91	90	19.5	110	> 62	50/60 **	5.5
12V pLDMOS	pede	HVEP	1.05	42.7	14.1	33.1	> 16	12	5.5
15V pLDMOS	peda	HVAP	0.95	31	20.5	52	> 24	15	5.5
25V pLDMOS	pedb	HVAP	0.97	30	27	95	> 35	25	5.5
35V/40V pLDMOS	pedc	HVAP	0.97	28	35	154	> 45	35/40 **	5.5
50V/60V pLDMOS	pedd	HVAP	0.97	27	43	230	> 61	50/60 **	5.5

* The device nhia is still in development. All values quoted in the specification are preliminary.
 ** Value @ Tj = -40°C ... +175°C / Tj = 0°C ... +175°C

XP018 BIPOLAR TRANSISTORS

Device	Name	Available	BETA	VA [V]	BVCEO [V]	VBE [mV]	max. VCE [V]	VEB [V]
1.8V vPNP	qpva	LP5MOS	2.5	250	> 6	710	1.98	1.98
	qpvb		2.6	150		669		
	qpvc		2.8	100		636		
5.0V vPNP	qpva5	LP5MOS, MOSS	1.7	100	> 6	710	5.5	5.5
	qpvb5		2.0	100		670		
	qpvc5		2.2	100		637		
vNPN	qnva	BJTA	55	15	> 6	695	3.6	5.5
vNPN	qnva5	HVAP	43	15	> 6	695	3.6	5.5
vNPN	qnvb	HVC	108	30	> 13	615	10	10
HV PNP	qpvh	HVD	74	155		610	60	25

Active Devices (Continued)

XP018 DEPLETION TRANSISTORS							
Device	Name	Available with module	VT [V]	IDS [$\mu\text{A}/\mu\text{m}$]	BVDSS [V]	Max. VDS [V]	Max. VGS [V]
5.0V Depl. NMOS	nd5	DEPL	0.52	730	> 8	5.5	5.5
Iso. 5.0V Depl. NMOS	nd5i, nd5i_m_6, nd5i_a_6, nd5i_b_6, nd5i_d_6	DEPL+ISOMOS	0.52	730	> 8	5.5	5.5

Passive Devices

XP018 DIFFUSION RESISTORS						
Device	Name	Available with module	RS [Ω/\square]	Thickness/junc. depth [μm]	Temp. Coeff. [$10^{-3}/\text{K}$]	Max VTB [V]
1.8V N+ diffusion	rdn	LP5MOS	62	0.2	1.4	1.98
1.8V P+ diffusion	rdp	LP5MOS	135	0.2	1.3	1.98
1.8V N-well	rnw	LP5MOS	1000	1.5	3.0	5.5
5.0V N+ diffusion	rdn5	LP5MOS, MOSS	62	0.2	1.4	5.5
5.0V P+ diffusion	rdp5	LP5MOS, MOSS	135	0.2	1.3	5.5
5.0V N-well	rnw5	LP5MOS, MOSS	1200	1.5	3.0	5.5
5V Deep N-well	rdnwmv	ISOMOS	1750	2.8	5.6	5.5

XP018 POLY RESISTORS					
Device	Name	Available with module	RS [Ω/\square]	Temp. Coeff. [$10^{-3}/\text{K}$]	Max VTB [V]
N+ Poly	rnp1, rnp1_3*	LP5MOS, MOSS	330	-1.4	60
P+ Poly	rpp1, rpp1_3*	LP5MOS, MOSS	280	-0.04	60
P+ Poly salicided	rpp1s, rpp1s_3*	LP5MOS, MOSS	7.0	2.90	60
High-Ohmic N+ Poly1	rnp1h, rnp1h_3*	HRPOLY	6700	-5.7	60
Lightly dope P+ Poly1	rpp1k, rpp1k_3*	MRPOLY	1000	-0.9	60

* These devices are variants of the corresponding basic device with an underlying well, but not crossing a well boundary. The models realize an improved description of bulk voltage dependency.

XP018 METAL RESISTORS							
Device	Name	Available with module	RS [Ω/\square]	Thickness/junc. depth [μm]	Max J/W [$\text{mA}/\mu\text{m}$]	Temp. Coeff. [$10^{-3}/\text{K}$]	Max VTB [V]
Metal 1	rm1	LP5MOS, MOSS	0.095	0.555	1.0*	3.2	60
Metal 2	rm2	LP5MOS, MOSS	0.085	0.555	1.0*	3.2	60
Metal 3	rm3	MET3	0.085	0.555	1.0*	3.2	60
Metal 4	rm4	MET4	0.085	0.555	1.0*	3.2	60
Metal 5	rm5	MET5	0.085	0.555	1.0*	3.2	60
Top Metal	rmtpl	METMID	0.043	0.975	1.6*	3.2	60
Thick Metal	rmtpl	METTHK	0.0095	3.00	6*	3.5	60

* value @ Tj = -40°C ... +175°C, wide track (width > 0.44 μm)

Passive Devices (Continued)

XP018 SANDWICH CAPACITORS				
Device	Name	Available with module	Area Cap [fF]	Max. VTB [V]
Poly1/M1/M2/M3	csandwt3	MET3	0.13	60
Poly1/M1/M2/M3/M4	csandwt4	MET4	0.16	60
Poly1/M1/M2/M3/M4/M5	csandwt5	MET5	0.20	60

XP018 FRINGE CAPACITORS					
Device	Name	Available with module	Cap [fF]	BV [V]	Max. VTB [V]
Poly1/M1/M2 fringe	csf2p	LP5MOS, MOSS	22.9	> 15	60
Poly1/M1/M2/M3 fringe	csf3p	MET3	33.8	> 15	60
M1/M2/M3 fringe	csf3	MET3	29.9	> 35	60
60V M1/M2/M3 fringe	csf3a	MET3	21.7	> 70	60
M1/M2/M3/M4 fringe	csf4	MET4	40.9	> 35	60
60V M1/M2/M3/M4 fringe	csf4a	MET4	29.9	> 70	60
M1/M2/M3/M4/M5 fringe	csf5	MET5	52.8	> 35	60
60V M1/M2/M3/M4/M5 fringe	csf5a	MET5	38.0	> 70	60
M1/M2/M3/MTP fringe	csft4	MET3+METMID	33.8	> 35	60
60V M1/M2/M3/MTP fringe	csft4a	MET3+METMID	26.1	> 70	60
M1/M2/M3/M4/MTP fringe	csft5	MET4+METMID	44.9	> 35	60
60V M1/M2/M3/M4/MTP fringe	csft5a	MET4+METMID	34.3	> 70	60
M1/M2/M3/M4/M5/MTP fringe	csft6	MET5+METMID	56.9	> 35	60
60V M1/M2/M3/M4/M5/MTP fringe	csft6a	MET5+METMID	42.4	> 70	60

XP018 MOS VARACTOR						
Device	Name	Available with module	Tuning range [%]	Cap @+V [fF/μm ²]	Cap. @-V [fF/μm ²]	Max VGB [V]
1.8V N-type	mosvc	LP5MOS	80	8.3	1.7	1.98
5V N-type	mosvc5	LP5MOS, MOSS	63	2.7	1	5.5
1.8V P-type /DNWELLMV	mosvc _i _m	LP5MOS+ISOMOS	75	2.1	8.3	1.98
1.8V P-type /DNWELL15	mosvc _i _a	LP5MOS+ISOMOS	75	2.1	8.3	1.98
1.8V P-type /DNWELL25	mosvc _i _b	LP5MOS+ISOMOS	75	2.1	8.3	1.98
1.8V P-type /DNWELL60	mosvc _i _d	LP5MOS+ISOMOS	75	2.1	8.3	1.98
5V P-type /DNWELLMV	mosvc _{5i} _m	(LP5MOS, MOSS)+ISOMOS	67	0.9	2.7	5.5
5V P-type /DNWELL15	mosvc _{5i} _a	(LP5MOS, MOSS)+ISOMOS	67	0.9	2.7	5.5
5V P-type /DNWELL25	mosvc _{5i} _b	(LP5MOS, MOSS)+ISOMOS	67	0.9	2.7	5.5
5V P-type /DNWELL60	mosvc _{5i} _d	(LP5MOS, MOSS)+ISOMOS	67	0.9	2.7	5.5

Passive Devices (Continued)

XP018 MIM CAPACITOR						
Device	Name	Available with module	Area Cap [fF/ μm^2]	V Coeff. [1/V]	BV [V]	max. VTB [V]
Single MIM, M2/M3 Single MIM, M2/MTP Single MIM, M3/MTP Single MIM, M4/MTP Single MIM, M5/MTP	cmm3 cmm3t cmm4t cmm5t cmm6t	MIM23 METMID+MIM (MET3+METMID)+MIM (MET4+METMID)+MIM (MET5+METMID)+MIM	1.00	15	> 20	60
Single MIM, M3/M4	cmm4	MIM34	1.00	15	> 20	60
High cap. MIM, M2/M3 High cap. MIM, M2/MTP High cap. MIM, M3/MTP High cap. MIM, M4/MTP High cap. MIM, M5/MTP	cmmh3 cmmh3t cmmh4t cmmh5t cmmh6t	MIMH23 METMID+MIM (MET3+METMID)+MIM (MET4+METMID)+MIM (MET5+METMID)+MIM	2.20	-120	> 10	60
High cap. MIM, M3/M4	cmmh4	MIMH34	2.20	-120	> 10	60
Double MIM, M2/M3/M4 Double MIM, M2/M3/MTP	cdmm4 cdmm4t	MET4+DMIM (MET3+METMID)+DMIM	2.00	3	> 20	60
High cap. double MIM, M2/M3/M4 High cap. double MIM, M2/M3/MTP	cdmmh4 cdmmh4t	MET4+DMIMH (MET3+METMID)+DMIMH	4.40	-20	> 10	60
Triple MIM, M2/M3/M4/M5 Triple MIM, M2/M3/M4/MTP	ctmm5 ctmm5t	(MET5+METMID)+TMIM (MET4+ METMID)+ TMIM	3.00	15	> 20	60
High cap. triple MIM, M2/M3/M4/M5 High cap. triple MIM, M2/M3/M4/MTP	ctmmh5 ctmmh5t	MET5+TMIMH (MET4+METMID)+TMIMH	6.60	-120	> 10	60

XP018 DIFFUSION DIODE						
Device	Name	Available with module	Area Cap [fF/ μm^2]	BV [V]	Leakage Current [fA/ μm^2]	Max VCC [V]
1.8V N+ diff. /PW	dn	LP5MOS	1.12	> 6	5.0×10^{-4}	1.98
1.8V P+ diff. /NW	dp	LP5MOS	0.98	> 6	5.0×10^{-4}	1.98
1.8V NW /Psub	dnw	LP5MOS	0.29	> 9	1.0×10^{-3}	5.5
5.0V N+ diff. /PW2	dn5	LP5MOS, MOSS	1.07	> 7	7.0×10^{-4}	5.5
5.0V P+ diff. /NW2	dp5	LP5MOS, MOSS	0.96	> 7	7.0×10^{-4}	5.5
5.0V NW /Psub	dnw5	LP5MOS, MOSS	0.29	> 9	1.0×10^{-3}	5.5
DNWMV /Psub	ddnwmv	ISOMOS	0.08	> 15	5.0×10^{-4}	5..5
DNW15 /Psub	ddnw15	ISOMOS, HVA, HVAN, HVAP, HVEN, HVEP	0.08	> 22	5.0×10^{-4}	15
DNW25 /Psub	ddnw25	ISOMOS, HVA, HVAN, HVAP	0.08	> 34	5.0×10^{-4}	25
DNW60 /Psub	ddnw60	ISOMOS, HVA, HVAN, HVAP, DIODEB, BJTA	0.08	> 70	5.0×10^{-4}	60
P+ diff. /DNWMV	dpdnwmv	ISOMOS	0.98	> 10	6.0×10^{-4}	5.5
P+ diff. /DNW15	dpdnw15	ISOMOS, HVA, HVAN, HVAP, HVEN, HVEP	0.98	> 10	6.0×10^{-4}	5.5
P+ diff. /DNW25	dpdnw25	ISOMOS, HVA, HVAN, HVAP	0.98	> 10	6.0×10^{-4}	5.5
P+ diff. /DNW60	dpdnw60	ISOMOS, HVA, HVAN, HVAP	0.98	> 10	6.0×10^{-4}	5.5
Iso. PW /DNWMV	dipdnwmv	ISOMOS	0.33	> 15	6.0×10^{-4}	5.5
Iso. PW /DNW15	dipdnw15	ISOMOS, HVA, HVAN, HVEN	0.33	> 15	6.0×10^{-4}	5.5
Iso. PW /DNW25	dipdnw25	ISOMOS, HVA, HVAN	0.33	> 15	6.0×10^{-4}	5.5
Iso. PW /DNW60	dipdnw60	ISOMOS, HVA, HVAN	0.33	> 15	6.0×10^{-4}	5.5

Passive Devices (Continued)

XP018 PROTECTION DIODES						
Device	Name	Available with module	Leakage Current [pA/μm]	BV [V]	BV Temp. Coef. [mV/K]	Max Vcc [V]
5.5V N-type Protection	dnp	DIODEA	2.5	7.70	5	9.6
5.5V P-type Protection	dpp	DIODEB	3.0	7.60	5	9.4

XP018 SCHOTTKY DIODE						
Device	Name	Available with module	Vforward [V]	ILeakage [nA]	BV [V]	Max. VTB [V]
5.5V Schottky	dsa	LP5MOS, MOSS	0.34	< 10	> 7.3	5.5
12V Schottky	dsb	DIODEB	0.41	< 10	> 14	45

XP018 ESD DEVICES							
Device	Name	Available with module	BETA	VBE [V]	BVCEO [V]	VEB [V]	Max. VCE [V]
1.8V LV NMOS triggered SCR	rnw_scr	LP5MOS	-	-	-	-	-
5V LV NMOS triggered SCR	rnw5_scr	LP5MOS, MOSS	-	-	-	-	-
Diode PDD /DNWELL	dpdddnw_esd	BJTA, HVA, HVAN, HVAP, BIPESD	-	-	-	-	-
Diode PDD&ISOPWELL / DNWELL	dpddipdnw_esd	BIPESD	-	-	-	-	-
Diode PDD&ISOWELL / VDNWELL	dpddvdnw_esd	HVD, BIPESD	-	-	-	-	-
Diode VDNWELL /PSUB	dvdnw_esd	HVC, HVD, BIPESD	-	-	-	-	-
ESD HV PNP	qpvhascr	BIPESD	5	568	70	35	45

These devices are only allowed to be used for ESD protection. Please refer to ESD documentation on XTIC.

Non-Volatile-Memory

XP018 NVM			
Parameter	EEPROM	Flash *	TrimOTP Compiler
Available with module	NVM	FLASH	OTP5
Memory Size	1k bits	312k bits	8 to 16k bits
Operating voltage	1.8 / 5.0V	1.8 V	5.0V
Operating temperature	-40 to +175°C	-40 to +175°C read -40 to +125°C NV write/erase	-40 to +175°C
Endurance	20k cycles @25°C 5k cycles @125°C	1k cycles @125°C	
Data retention	Min. 20 years @ 125°C	Min. 10 years @125°C Min. 3 years @150°C Min. 1 years @175°C	Min. 20 years @ 125°C
Access time / programming time	73ns read, < 12ms write	60ns read, 5ms page write 20ms page erase	25ns read (typ.) 10ms Byte program

* in development

XP018 POLY FUSE						
Device	Name	Available with module	Unprog. Res. [Ω]	Prog. Res. [kΩ]	Prog. Max VT1-T2 [V]	Unprog. Max VT1-T2 [V]
Poly fuse	pfuse	LP5MOS, MOS5	32	> 100	3.6	0.1

STANDARD CELLS LIBRARIES

XP018 LOGIC LIBRARY			
Device	Library feature	Voltage range	Application benefits
D_CELLS	Low power	1.8V, 1.2V	High speed, P&R compatible with D_CELLSL
D_CELLS_LL	Low power, low leakage	1.8V, 1.2V	Low power consumption, low leakage, P&R compatible with D_CELLS
D_CELLS_MV	Multivoltage, power shut off	1.8 / 1.2V ... 5.0V	High speed, multivoltage
D_CELLS_HD	Low power, HD	1.8V, 1.2V	High speed, high density routing pitch, low power cells available, P&R compatible with D_CELLS_HDMV
D_CELLS_HDMV	Multivoltage, power shut off, HD	1.8 / 1.2V ... 5.0V	Multi-supply voltage, power shut off, high density metal pitch
D_CELLS_M5V	Multivoltage, power shut off, HD	5.0V / 2.5V ... 5.0V	High speed, 5V supply, multivoltage
D_CELLS_5V	Low power, HD	5.0V, 4.0V, 3.3V, 2.5V	High speed, 5V supply
D_CELLS_JI	Junction isolated, low power	1.8V, 1.2V	High speed, junction isolated, low noise, voltage shifting, P&R compatible with D_CELLSL_JI
D_CELLS_JILL	Junction isolated, low leakage, low power	1.8V, 1.2V	Low leakage, 0.21µm channel length, availability of low power cells, noise protection, voltage shifting, P&R compatible with D_CELLS_JI
D_CELLS_JIMV	Junction isolated, multivoltage, power shut off, HD	1.8V / 1.2V ... 5.0V	High speed, junction isolated, Multi-supply voltage
D_CELLS_JIM5V	Junction isolated, multivoltage, power shut off, HD	5.0V / 2.5V ... 5.0V	High speed, multivoltage, 5V supply, junction isolated, low noise, voltage shifting
D_CELLS_JIHD	Junction isolated, low power, HD	1.8V, 1.2V	High speed, high density routing pitch, low power cells available, noise protection, voltage shifting, P&R compatible with D_CELLS_JIHDMV
D_CELLS_JIHDLL	Junction isolated, low leakage, low power, HD	1.8V, 1.2V	Low leakage, low power cells available, noise protection, voltage shifting, P&R compatible with D_CELLS_JIHD, D_CELLS_JIHDMV
D_CELLS_JIHDMV	Junction isolated, multivoltage, power shut off, HD	1.8V / 1.2V ... 5.0V	Multi-supply voltage, power shut off, high density metal pitch, noise protection, voltage shifting
D_CELLS_JISV	Junction isolated, low power, high density	5.0V, 3.3V, 2.5V	High speed, 5V supply, junction isolated, low noise, voltage shifting

I/O LIBRARIES

XP018 I/O CELLS LIBRARY						
Device	Library Feature	V _{CORE} *	V _{IO} *	ESD Level	Application benefits	
IO_CELLS_5V	Standard, 1.8V/5.0V multi supply voltage	1.8V	5.0V	4kV HBM	Pad limited	
IO_CELLS_F5V	Standard, 1.8V/5.0V multi supply voltage	1.8V	5.0V	2kV HBM	Core limited	
IO_CELLS_C1V8	Standard, V _{CORE} =V _{IO} single supply voltage	1.8V (1.2V)	1.8V (1.2V)	4kV HBM	Pad limited	
IO_CELLS_FC1V8	Standard, V _{CORE} =V _{IO} single supply voltage	1.8V (1.2V)	1.8V (1.2V)	2kV HBM	Core limited	
IO_CELLS_C5V	Standard, V _{CORE} =V _{IO} single supply voltage	5.0V (3.3V)	5.0V (3.3V)	4kV HBM	Pad limited	
IO_CELLS_FC5V	Standard, V _{CORE} =V _{IO} single supply voltage	5.0V (3.3V)	5.0V (3.3V)	2kV HBM	Core limited	
IO_CELLS_I15V	Junction isolated, 1.8V/5.V multi supply voltage	1.8V	5.0V	4kV HBM	Pad limited	

* Please refer to the library databook for details about available PVT ranges

XP018 HV CELLS LIBRARY				
Device	Library Feature	Voltage Range	ESD Level	Application benefits
HV_CELLS	Special LV I/O, operating voltage specific HV ESD protection cells	LV, 8.5V-61V	2kV-8kV HBM	Customized I/O Design

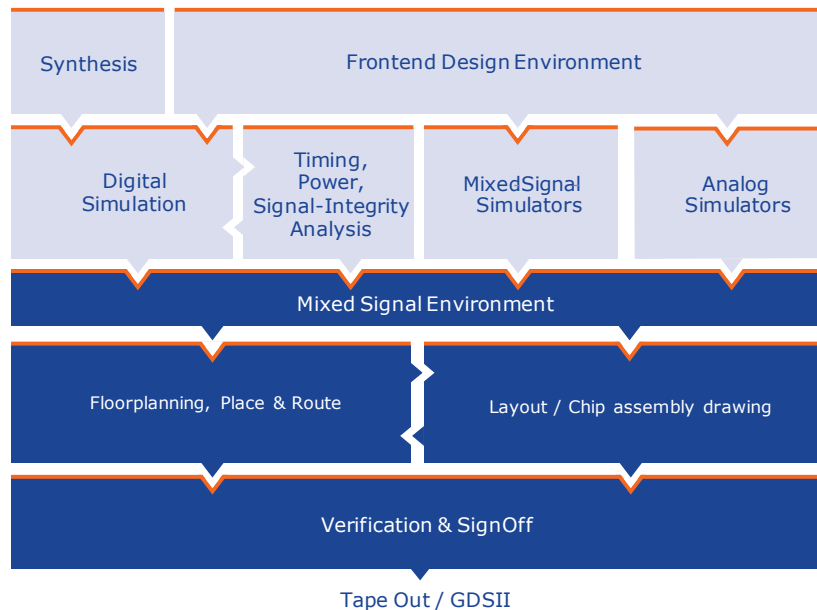
ANALOG LIBRARIES

XP018 5V A_CELLS ANALOG LIBRARY			
Library	Cell Name	Operating conditions	Required module
Bias Cells	abiac01_5v abiac02_5v	VDD: 3.5V to 5.5V; T: -40...175°C	LP5MOS/MOSS, MET3
Bias Cells	acsoc01_5v acsoc02_5v	VDD: 3.5V to 5.5V; T: -40...175°C	LP5MOS/MOSS, MET3
Bandgap	abgpc01_5v abgpc02_5v abgpc03_5v abgpc04_5v abgpc05_5v abgpc06_5v	VDD: 3V, (2.5)V to 5.5V; T: -40...150°C	LP5MOS/MOSS, MET3
Operational Amplifier	aopac01_5v aopac02_5v aopac03_5v aopac04_5v	VDD: 3.5V to 5.5V; T: -40...125°C	LP5MOS/MOSS, MET3
Comparators	acmpc01_5v acmpc02_5v	VDD: 3.5V to 5.5V; T: -40...125°C	LP5MOS/MOSS, MET3
RC Oscillators	arcoc01_5V arcoc02_5V arcoc03_5V arcoc04_5V	VDD: 3.5V to 5.5V; T: -40...175°C	LP5MOS/MOSS, MET3
ADC	aadcc01_5v	VDDA: 3.5V to 5.5V; T: -40...125°C	LP5MOS, MET3, METMID, MIM
DAC	adacc01_5v	VDDA: 3.5V to 5.5V; T: -40...125°C	LP5MOS, MET3
Power-On-Reset	aporc01_5v aporc02_5v aporc03_5v	VDD: 3.5V to 5.5V; T: -40...125°C	LP5MOS/MOSS, MET3
Voltage Regulator	aregc01_5v	T: -40...125°C	LP5MOS/MOSS, MET3, METMID
Over-Temperature Detector	atmpc01_5v	VDD: 3.0V to 5.5V; T: -40...175°C	LP5MOS/MOSS, MET3

ANALOG LIBRARIES (Continued)

XP018 1.8V A_CELLS ANALOG LIBRARY			
Library	Cell Name	Operating conditions	Required module
Bandgap	abgpc01_1v8 abgpc03_1v8 abgpc04_1v8 abgpc07_1v8	VDD: 1.5V to 1.98V; T: -40...125°C	LP5MOS, BJTA, MET3 LP5MOS, MET3 LP5MOS, MET3 LP5MOS, BJTA, MET3
Current Sources	acsoc01_1v8 acsoc02_1v8 acsoc03_1v8 acsoc04_1v8 acsoc05_1v8 acsoc06_1v8 acsoc07_1v8 acsoc08_1v8 acsoc09_1v8 acsoc10_1v8	VDD: 1.5V, (1.2)V to 1.98V; T: -40...150, (175)°C	LP5MOS, MET3 LP5MOS, MRPOLY, MET3
ADC	aadcc01_1v8	VDD: 1.62V to 1.98V; T: -40...150°C	LP5MOS, MRPOLY, MET3, METMID, MIM
DAC	adacc01_1v8	VDD: 1.62V to 1.98V; T: -40...125°C	LP5MOS, ISOMOS, MET3
Operational Amplifiers	aopac01_1v8 aopac03_1v8 aopac05_1v8 aopac06_1v8 aopac07_1v8 aopac08_1v8 aopac09_1v8	VDD: 1.5V to 1.98V; T: -40...150°C	LP5MOS, MET3
Comparators	acmpc01_1v8 acmpc02_1v8 acmpc03_1v8 acmpc04_1v8 acmpc05_1v8 acmpc06_1v8 acmpc07_1v8	VDD: 1.5V to 1.98V; T: -40...150°C	LP5MOS, MET3
Power-On/Off-Resets	aporc02_1v8	VDD: 1.62V to 1.98V; T: -40...125°C	LP5MOS, MET3
RC Oscillators	arcoc01_1v8 arcoc02_1v8 arcoc03_1v8 arcoc05_1v8 arcoc06_1v8 arcoc07_1v8 arcoc08_1v8 arcoc10_1v8	VDD: 1.5V to 1.98V; T: -40...175°C	LP5MOS, MET3

XP018 SUPPORTED EDA TOOLS



Note: Diagram shows overview of reference flow at X-FAB. Detailed information of supported EDA tools for major vendors like Cadence, Mentor and Synopsys can be found on X-FAB's online technical information center X-TIC.

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which contain full front-end and back-end information for the development of digital, analog and mixed signal circuits. Tutorials and application notes are included as well. The Master Kit Plus additionally provides a set of general purpose analog functions mentioned in section "Analog Library Cells" and is subject to a particular license.

CONTACT

Marketing & Sales Headquarters
 X-FAB Semiconductor Foundries AG
 Haarbergstr. 67, 99097 Erfurt, Germany
 Tel.: 49-361-427 6160
 Fax: 49-361-427 6161
 Email: info@xfab.com
 Web: http://www.xfab.com

Technology & Design Support
 hotline@xfab.com
 Silicon Foundry Services
 sifo@xfab.com

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