



首次评级 汇顶科技 (603160.SS)

中性

证券研究报告

指纹识别芯片领军企业，但面临替代风险；首次覆盖评为中性 (摘要)

投资观点

2017 年年中，汇顶科技成为全球指纹识别芯片的领军企业。这是中国首家取得如此地位的半导体设计上市公司。我们预计汇顶科技将维持在电容式指纹识别触控芯片方面的领先地位，并实现其人机交互领域龙头企业的长期目标，但我们对来自人脸识别技术和屏下超声波指纹识别技术的替代风险感到担忧。我们预计汇顶科技的每股盈利增速将从 2018 年的同比 31% 降至 2019 年的 10%。如果汇顶的屏下光学/超声波指纹识别芯片取得积极的进展或普及，则我们对公司的看法将更加积极。鉴于其增长前景已基本被计入，我们首次覆盖该股并评为中性。

主要增长动力

我们预计 2018 年指纹传感器在安卓手机中的渗透率将触顶于 66%，随后在 2021 年降至 45%，其中假设(1) 500 美元以上、配备 3D 摄像头的手机将采用 3D 人脸识别或屏下指纹传感器；(2) 100-500 美元的手机仍将主要采用指纹传感器；(3) 100 美元以下的手机将仅采用 2D 人脸识别技术。我们预计汇顶科技在安卓手机中的市场份额将从 2017 年的 35% 扩大到 2021 年的 50%。在新产品中，我们预计 2018 年下半年汇顶科技将推出高端手机适用的屏下光学指纹识别芯片，同时因可预见性目前还有限，我们的预测未计入汇顶在超声波指纹识别芯片的市场潜力。

风险

风险包括高端智能手机对屏下光学指纹识别芯片的采用、来自本土品牌和超声波指纹识别芯片的竞争加剧。而下一代 iPhone 采用屏下指纹识别将令我们的观点更加积极。

估值

我们预计 2017/18 年汇顶科技的每股盈利同比增速将为 23%/31%，但 2019-21 年将放缓至 10%-13%。12 个月目标价格为人民币 125 元，基于 40 倍的长期市盈率乘以 2021 年每股盈利，并以 11.3% 的股权成本贴现回 2018 年。该目标价格对应 40 倍的 2018 年预期市盈率和 9% 的上行空间。

行业背景

汇顶科技是中国最大的 A 股上市半导体设计公司。

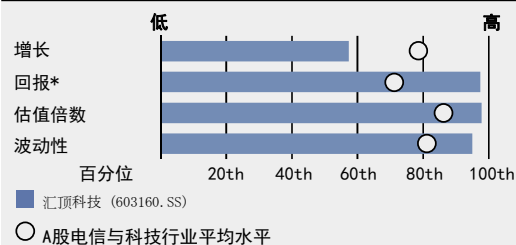
所属投资名单

中性

行业评级：中性

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投资摘要



投资摘要指标的全面描述请参见本报告的信息披露部分。

主要数据

股价 (Rmb)	110.57
12个月目标价格 (Rmb)	125.00
市值(Rmb mn / US\$ mn)	50,227.3 / 7,564.8
外资持股比例 (%)	--

	12/16	12/17E	12/18E	12/19E
每股盈利 (Rmb)	1.93	2.36	3.10	3.40
每股盈利增长 (%)	103.6	22.8	31.1	9.8
每股摊薄盈利 (Rmb)	1.93	2.34	3.10	3.40
每股基本盈利 (Rmb)	1.93	2.36	3.10	3.40
市盈率 (X)	55.5	46.8	35.7	32.5
市净率 (X)	17.4	14.0	10.7	8.4
EV/EBITDA (X)	49.8	46.8	39.0	34.1
股息收益率 (%)	0.2	0.4	0.6	0.6
净资产回报率 (%)	43.9	33.6	33.9	29.0
CROCI (%)	81.5	57.6	59.3	53.2

股价走势图



股价表现 (%)	3个月	6个月	12个月
绝对	24.0	20.2	(28.9)
相对于沪深300指数	12.0	(2.4)	(41.3)

资料来源：公司数据、高盛研究预测、FactSet (股价为11/10/2017收盘价)

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汇顶科技： 财务数据概要

损益表(Rmb mn)	12/16	12/17E	12/18E	12/19E	资产负债表(Rmb mn)	12/16	12/17E	12/18E	12/19E
主营业务收入	3,079.3	3,989.1	5,483.6	6,225.9	现金及等价物	1,103.6	1,603.3	2,066.2	2,961.7
主营业务成本	(1,627.6)	(2,105.6)	(2,945.2)	(3,260.2)	应收账款	1,236.4	1,601.7	2,201.8	2,499.8
销售、一般及管理费用	(537.6)	(875.8)	(1,327.2)	(1,606.3)	存货	550.4	712.1	996.0	1,102.6
研发费用	--	--	--	--	其它流动资产	33.0	33.0	33.0	33.0
其它营业收入/（支出）	0.0	0.0	0.0	0.0	流动资产	2,923.4	3,950.1	5,297.0	6,597.1
员工股票期权费用	--	--	--	--	固定资产净额	161.1	182.7	215.2	251.5
EBITDA	933.0	1,027.3	1,234.8	1,385.4	无形资产净额	58.5	73.9	67.4	61.5
折旧和摊销	(18.9)	(19.7)	(23.7)	(26.0)	长期投资	62.2	62.2	62.2	62.2
EBIT	914.2	1,007.6	1,211.2	1,359.4	其它长期资产	9.9	9.9	9.9	9.9
利息收入	0.0	11.0	16.0	20.7	资产合计	3,215.2	4,278.9	5,651.8	6,982.3
财务费用	(5.5)	(1.2)	0.0	0.0	应付账款	344.1	445.2	622.7	689.3
联营公司	0.0	0.0	0.0	0.0	短期贷款	0.0	0.0	0.0	0.0
其它	78.0	174.7	337.1	337.1	其它流动负债	120.8	233.4	302.4	330.0
税前利润	986.7	1,192.1	1,564.3	1,717.2	流动负债	464.9	678.6	925.2	1,019.3
所得税	(130.0)	(129.5)	(156.4)	(171.7)	长期贷款	0.0	0.0	0.0	0.0
少数股东损益	0.1	0.2	0.2	0.2	其它长期负债	13.8	13.8	13.8	13.8
优先股股息前净利润	856.8	1,062.8	1,408.1	1,545.7	长期负债	13.8	13.8	13.8	13.8
优先股息	0.0	0.0	0.0	0.0	负债合计	478.7	692.4	939.0	1,033.1
非经常性项目前净利润	856.8	1,062.8	1,408.1	1,545.7	优先股	0.0	0.0	0.0	0.0
税后非经常性损益	0.0	0.0	0.0	0.0	普通股权益	2,734.6	3,584.8	4,711.3	5,947.9
净利润	856.8	1,062.8	1,408.1	1,545.7	少数股东权益	1.9	1.7	1.5	1.3
每股基本盈利（非经常性项目前）(Rmb)	1.93	2.36	3.10	3.40	负债及股东权益合计	3,215.2	4,278.9	5,651.8	6,982.3
每股基本盈利（非经常性项目后）(Rmb)	1.93	2.36	3.10	3.40	每股净资产(Rmb)	6.15	7.89	10.37	13.09
每股摊薄盈利（非经常性项目后）(Rmb)	1.93	2.34	3.10	3.40					
不含员工股票期权费用的每股盈利（基本）	--	--	--	--					
不含员工股票期权费用的每股盈利（摊薄）	--	--	--	--					
每股股息(Rmb)	0.22	0.47	0.62	0.68					
股息支付率(%)	11.7	19.8	20.0	20.0					
自由现金流收益率(%)	(0.4)	1.2	1.3	2.3					
增长率和利润率(%)	12/16	12/17E	12/18E	12/19E	比率	12/16	12/17E	12/18E	12/19E
主营业务收入增长率	175.0	29.5	37.5	13.5	CROCI(%)	81.5	57.6	59.3	53.2
EBITDA增长率	134.5	10.1	20.2	12.2	净资产回报率(%)	43.9	33.6	33.9	29.0
EBIT增长率	137.1	10.2	20.2	12.2	总资产回报率(%)	37.2	28.4	28.4	24.5
净利润增长率	126.5	24.0	32.5	9.8	平均运用资本回报率(%)	78.3	58.3	60.2	54.2
每股盈利增长	103.6	22.8	31.1	9.8	存货周转天数	77.7	109.4	105.8	117.5
毛利率	47.1	47.2	46.3	47.6	应收账款周转天数	94.6	129.8	126.6	137.8
EBITDA利润率	30.3	25.8	22.5	22.3	应付账款周转天数	56.3	68.4	66.2	73.4
EBIT利润率	29.7	25.3	22.1	21.8	净负债/股东权益(%)	(40.3)	(44.7)	(43.8)	(49.8)
					EBIT利息保障倍数(X)	167.1	NM	NM	NM
现金流量表(Rmb mn)	12/16	12/17E	12/18E	12/19E	估值	12/16	12/17E	12/18E	12/19E
优先股股息前净利润	856.8	1,062.8	1,408.1	1,545.7	基本市盈率(X)	55.5	46.8	35.7	32.5
折旧及摊销	18.9	19.7	23.7	26.0	市净率(X)	17.4	14.0	10.7	8.4
少数股东权益	(0.1)	(0.2)	(0.2)	(0.2)	EV/EBITDA(X)	49.8	46.8	39.0	34.1
运营资本增减	(1,098.7)	(425.9)	(706.5)	(338.0)	企业价值/总投资现金(X)	27.7	23.5	17.6	15.2
其它	40.7	0.0	0.0	0.0	股息收益率(%)	0.2	0.4	0.6	0.6
经营活动产生的现金流	(182.5)	656.4	725.1	1,233.5					
资本开支	(27.9)	(36.1)	(49.7)	(56.4)					
收购	0.0	(20.5)	0.0	0.0					
剥离	0.0	0.0	0.0	0.0					
其它	6.9	0.0	0.0	0.0					
投资活动产生的现金流	(21.0)	(56.7)	(49.7)	(56.4)					
支付股息的现金（普通股和优先股）	(99.0)	(100.0)	(212.6)	(281.6)					
借款增减	0.0	0.0	0.0	0.0					
普通股发行（回购）	809.7	0.0	0.0	0.0					
其它	(9.8)	0.0	0.0	0.0					
筹资活动产生的现金流	701.0	(100.0)	(212.6)	(281.6)					
总现金流	497.5	499.8	462.8	895.5					

注：最后一个实际年度数据可能包括已公布和预测数据。
资料来源：公司数据、高盛研究预测

对此报告有贡献的人员

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Prices in this report are as of the November 9, 2017 close, unless indicated otherwise.

Exhibit 1: Greater China semiconductor sector coverage comp table

GS semiconductor	Ticker	Ratings	Market Price	Target Price	Market cap US\$ mn	Trading P/E		PEG	Trading P/B		ROE	
						2017E	2018E		2017E	2018E	2017E	2018E
SG Micro (Rmb)	300661.SZ	Buy	94	116	867	60.6	46.5	1.5	7.5	6.5	18.2%	14.9%
Goodix (Rmb)	603160.SS	Neutral	115	125	7,910	48.6	37.1	1.1	14.6	11.1	33.6%	33.9%
Hua Hong (HK\$)	1347.HK	Buy	14.88	16.90	1,980	14.6	12.7	0.8	1.3	1.2	8.9%	9.6%
MediaTek (NT\$)	2454.TW	Buy	331.00	356.00	17,222	27.5	16.5	0.2	2.0	1.9	7.5%	11.5%
Silergy (NT\$)	6415.TW	Buy	678.00	636.00	1,723	28.5	22.5	0.9	5.6	4.7	22.0%	22.8%
TSMC (NT\$)	2330.TW	Neutral	241.00	213.00	206,811	18.3	17.0	2.3	4.1	3.7	23.5%	22.9%
TSMC-ADR (US\$)	TSM	Neutral	41.64	35.10	215,730	19.1	17.8	2.5	4.3	4.3	23.5%	22.9%
UMC (NT\$)	2303.TW	Neutral	15.70	14.10	6,747	20.2	18.0	1.5	0.9	0.9	4.4%	4.9%
UMC-ADR(US\$)	UMC	Neutral	2.58	2.30	6,694	20.1	18.0	1.5	0.9	0.9	4.4%	4.9%
SMIC (US\$)	SMI	Sell	8.76	4.60	7,400	37.0	25	0.6	1.7	1.6	4.9%	6.5%
SMIC-H shares (HK\$)	0981.HK	Sell	14.16	7.20	8,463	38.3	26.3	0.6	1.7	1.6	4.9%	6.5%
Parade (NT\$)	4966.TWO	Neutral	557.00	515.00	1,408	21.3	19.8	2.6	4.9	4.4	25.5%	24.4%
Average						29.5	23.1	1.3	4.1	3.6	15.1%	15.5%
Median						24.4	18.9	1.3	3.0	2.8	13.5%	13.2%
STD						14.1	9.7	0.8	3.9	3.0	10.4%	9.6%

Note: Target prices are on a 12-month timeframe.

Source: Datastream, Gao Hua Securities Research.

Global leader facing near-term substitution threat

Founded in 2002 and based in Shenzhen, Goodix is the largest listed Chinese semiconductor design company in terms of both revenue and market cap (as of 3Q17). Goodix generated 83% and 17% of its total 1H17 revenues from **fingerprint sensors** and **touch controllers**, respectively. In 3Q17, Goodix surpassed Sweden's Fingerprint Cards (Not Covered) to become the global leader in fingerprint sensors by revenue. Goodix is the only Chinese publically traded semiconductor design company to become a global leader in a major segment and the supplier to premium smartphones such as Huawei's P9/ P10 series/Mate 10, and the Vivo X20/X20 Plus. Goodix aims to become a global leader in human and machine physical interfaces within the realm of fingerprint sensing, blood pressure, and pulse/temperature measurement. We are confident that Goodix will achieve its long-term target for the following reasons.

- Goodix has a strong local customer base in China, especially near the greater Shenzhen area. Furthermore, Goodix has established a reputation as an innovator and global leader for premium products;
- It has articulated a long-term vision to investors for the next 20 years;
- It has strong financial and technical resources, partially due to rich valuations in the A-share market;
- We believe the trend toward human and machine physical interfaces has tremendous potential in the IoT era.

Looking into 2018-2019, however, the fingerprint sensor market faces substitution risk from facial recognition, as demonstrated by the iPhoneX, Vivo X20, and Xiaomi Note 3 phones. Facial recognition can perform the same biometric identification as a fingerprint sensor, for example to verify the user and unlock the phone. There are also two solutions: 2D facial recognition and 3D facial recognition. 2D can be achieved via software support, like in the Vivo X20, but 3D facial recognition requires a 3D camera such as the one built into the iPhone X. 3D is much more powerful than 2D in terms of accuracy, speed and reliability, but it is also much more expensive. Generally speaking, a 3D camera module costs US\$10-15, around \$5-9 more than a 2D module.

According to Face++, the IP supplier of facial recognition for Alipay, Meitu, and Lenovo, almost all major Chinese smartphone makers are developing 2D facial recognition technologies for new products in 2018. **One of the key factors behind our Neutral rating on Goodix is** that we expect fingerprint sensor penetration to decline from 2019 and the company's earnings growth to stagnate in 2019E-21E. We make the following assumptions.

- 2D facial recognition will replace fingerprint sensors (mostly capacitive sensors) in the low-end smartphone segment for cost reasons from 2019 (2D facial recognition only requires software support, while fingerprint module cost a few dollars);
- Mid-range smartphones with a 2D camera will continue to use fingerprint sensors and the mix of under-display (UD) ultrasound optical sensors will increase (vs. capacitive sensors) from 2H18E, when we expect Goodix to launch its first UD optical sensor;
- 3D facial recognition will continue to replace fingerprint sensors in the premium phone segment from 2018.
- Fingerprint sensor ASP will maintain a declining trend overall, but rebound in 2019-2020E due to the ramp-up of higher-ASP UD sensors.

Exhibit 2: Our assumptions for the fingerprint sensor market

FP sensor	2017E	2018E	2019E	2020E	2021E
Penetration					
ASP					

Source: Gao Hua Securities Research.

The main risks to our base case scenario are the development and adoption of UD optical sensors and facial recognition.

UD sensors can turn certain areas of the OLED display into a fingerprint sensor. We therefore see them as the best fit for full-screen smartphones, which we believe will be the trend for mid- to high-end smartphones going forward. Currently, only smartphones with OLED displays can use UD sensors, because LCDs are too thick for the signal to penetrate. UD sensors offer two kinds of solution: optical and ultrasonic. Goodix and Qualcomm lead in optical and ultrasonic solutions, respectively.

We see three UD uncertainties for Goodix:

- 1) **Technology development:** We currently forecast that Goodix will launch its UD optical sensor as planned in 2H18E; the market was expecting UD to be launched this year but it was delayed given difficulties with the technology, so there is a risk of the timing being pushed back again.
- 2) **Competition between ultrasonic and optical sensors:** Goodix unveiled a prototype smartphone with its UD optical sensor in March 2017, while Qualcomm (jointly with Vivo) also displayed a prototype with a UD ultrasonic sensor this June. In addition, FPC unveiled its in-display ultrasonic sensor technology in November 2017. We expect competition between the two solutions to intensify and we believe this will depend on the timing of launches and user experience.
- 3) **Adoption of UD sensors after 3D facial recognition:** The iPhone X has replaced the fingerprint sensor with 3D facial recognition. However, if the user experience with 3D facial recognition is lacking, we think Apple could potentially add a UD sensor back to the next generation of the iPhone. Our earnings model for Goodix assumes that smartphones with 3D cameras will no longer use fingerprint sensors.

Our 12-month target price of Rmb125 is based on a long-term discounted P/E of 40X, derived from Goodix's A share peers' average 2018E P/E consensus, applied to 2021E EPS and discounted back to 2018E using a peer average cost of equity of 11.3%, implying a 2018E P/E of 40X and 9% upside.

Product overview: Substitution risk and under-display visibility

Fingerprint sensors are Goodix's key growth driver...

Fingerprint (FP) sensors contributed **83%** of Goodix's total revenues in 1H17. Goodix has four mature FP technologies for customers, including **live finger detection**, **IFS (invisible fingerprint sensors)**, ceramic/glass/sapphire **covered fingerprint sensors**, and fingerprint sensors with **hard coating**. We highlight that Goodix was the world's first company to launch mobile devices with live finger detection technology, which can reject fake fingerprints through the detection of fingerprint, blood flow and infrared signals. IFS is also the world's first fingerprint sensor and touch panel integrated solution that enables the manufacturer to embed a fingerprint sensor without cutting the front glass or back cover.

The company is also actively engaged in the development of a next-generation FP solution known as the **under-display (UD) optical fingerprint sensor**, which turns a certain area of the OLED display into a fingerprint sensor and is thus well suited to full-screen displays/borderless design smartphones. Goodix showcased a prototype at Mobile World Congress Barcelona in March 2017 and expects to launch mass production in 2H18 (we make the same assumption).

Exhibit 3: Comparison between different types of fingerprint sensor solutions

FP solution for Smartphone	Capacitive	Optical	Ultrasonic
Description	The capacitive solution is the most commonly used fingerprint sensor in mobile devices. It uses tiny capacitor circuits to collect fingerprint data based on the changes of charge stored in the capacitor when a finger's ridge is placed/moving over a conductive plate.	The optical fingerprint sensor solution has an image sensor to capture the reflected light cast on the finger area from a light source, and form an optical image. It then uses algorithms to detect unique patterns of the surface image like ridges, by analysing the lightest and darkest areas of the image to identify the fingerprint.	The ultrasonic solution relies on a pulse that is transmitted against the finger over the scanner. The pulse is absorbed or bounced back, depending upon the ridges, pores and other details that are unique to each fingerprint, and collected by the sensor to profile the fingerprint.
Integration Position and Solutions	Coating, Cover and Invisible	Under Glass, Under Display and In Display	Under Metal, Under Glass, Under Display, In Display
Technology Maturity	Coating and Cover based solutions are very mature with further development in biometric recognition. They are the current mainstreams and should remain the top choice before the Under Display solution enters mass production. The invisible solution does not require the front glass or back cover to be cut, and is thus better for design. There are three types: In Glass (very difficult, not suitable for mass production yet); Under Glass (relatively low yield); Under Cover Glass (poor experience); Goodix's IFS technology is an invisible solution.	Under Display only has a prototype at present. In Display is still at an early stage, and Apple is leading the research. Goodix displayed a prototype of UD optical sensor on a refitted Samsung S7 at MWC in Mar 2017. It also has a live finger detection function.	- Under Display only has a prototype. - In Display is at an early stage, but FPC has just unveiled its solution on Nov 1, 2017. No prototype yet. - Under Metal and Under Glass are in mass production. Qualcomm & Vivo displayed a prototype UD ultrasonic sensor at MWC in Jun 2017. Qualcomm & Leshi launched Le Max Pro with UM (mass production) in Jan 2016. Qualcomm & Xiaomi launched XiaoMi 5S with UG (mass production) in Sep 2016.
Advantages	Mature and cheap	It can penetrate relatively thick glass/display, thus it can be integrated into displays for full screen designs.	1) It can penetrate various materials; thus it can be integrated into displays for full-screen designs. 2) It is water/oil proof and unacted on strong light.
Bottlenecks	1) Can only be placed on the back cover for full screen displays; 2) Doesn't work with wet fingers.	1) Can only be used in smartphones with OLED displays. 2) Accuracy undermined by strong light and wet fingers.	Cannot penetrate air layer which limits the penetration capability (weaker than Optical).

Source: Gao Hua Securities Research, Company data.

We believe that full-screen OLED display designs are becoming the trend for mid-high end smartphones in the future, as demonstrated by the iPhone X and Samsung S8, and that UD fingerprint sensors could be the next peak of the FP market before other biometric technologies (e.g. facial recognition) start taking share. While Qualcomm is leading in UD ultrasonic sensors, we think the poor signal penetration capability will be a bottleneck to improving user experience. Goodix is the leader in UD optical sensors, whose sensing signal penetration capability is better

but faces more environmental interference; for example, strong light or a dry finger will undermine recognition accuracy. Meanwhile, on November 1, 2017, Sweden-based FPC unveiled its in-display ultrasonic technology which can turn the whole screen into a sensor and is compatible with both LCD and OLED displays. While a potential threat going forward, we believe this technology is at a very early stage at present.

Touch controllers and **fixed line telephone chips** contributed **16.9%** and **0.1%** of Goodix's revenue in 1H17. These are mature and stable businesses, and both we and the company expect flat growth over the next few years.

Earnings/financials analysis: Revenue growth to stagnate in '19-'21E

To gauge the market potential of the fingerprint sensor business, we project the total addressable market (TAM) by different applications, namely Android smartphones, PCs, smart cards and IoT/vehicles. Note that our TAM forecast assumes Apple will continue to use AuthenTec's sensors, thus we have not included the Apple market.

Total addressable market (TAM) forecast – penetration and ASP

In the **Android smartphone segment**, we estimate that annual shipments will increase to nearly 1.7bn units in 2021E from 1.4bn in 2017E and the fingerprint sensor penetration rate will continue to increase from 53% in 2017E to 66% in 2018E mainly due to further expansion into low-end smartphones. However, we estimate the penetration rate will decline to 58%/51%/45% in 2019E-2021E due to 1) 3D facial recognition starting to gain high-end market share from fingerprint sensors as the technology matures, and 2) low-end smartphones starting to replace fingerprint sensors with 2D facial recognition to save cost.

We also estimate that capacitive sensor ASP will continue its declining trend as the technology reaches its limitations and competition intensifies, and that UD sensor ASP will follow a similar pattern once introduced (we assume in 2H18). Consequently, we see the blended ASP declining in 2018E and 2021E but increasing in 2019E/2020E due to UD sensor ramp-up (with UD replacing capacitive in mid- to high-end smartphones).

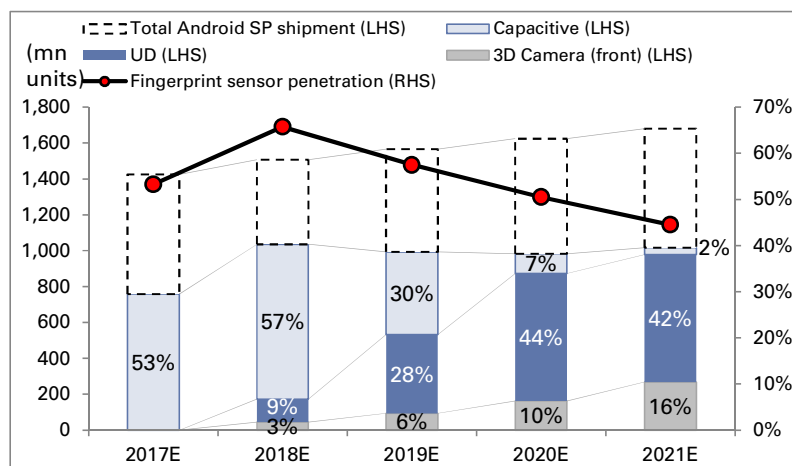
Exhibit 4: We estimate the fingerprint sensor penetration rate will peak in 2018E...
Android smartphone (SP) fingerprint sensor penetration and ASP forecast model

SP mix (types)	Android	2017E	2018E	2019E	2020E	2021E
Low-end		35%	35%	35%	35%	35%
Mid-end		45%	45%	45%	45%	45%
High-end		20%	20%	20%	20%	20%
Total units (mn units)	Android	2017E	2018E	2019E	2020E	2021E
Low-end		499	527	548	568	588
Mid-end		641	678	704	731	756
High-end		285	301	313	325	336
Capacitive Penetration	Android	2017E	2018E	2019E	2020E	2021E
Low-end		5%	30%	15%	0%	0%
Mid-end		70%	75%	45%	15%	5%
High-end		100%	65%	20%	0%	0%
UD Penetration	Android	2017E	2018E	2019E	2020E	2021E
Low-end		0%	0%	0%	0%	0%
Mid-end		0%	10%	40%	75%	85%
High-end		0%	20%	50%	50%	20%
3D camera Penetration	Android	2017E	2018E	2019E	2020E	2021E
Low-end		0%	0%	0%	0%	0%
Mid-end		0%	0%	0%	0%	0%
High-end		0%	15%	30%	50%	80%
ASP	Android	2017E	2018E	2019E	2020E	2021E
Capacitive		1.80	1.00	0.80	0.70	0.60
UD			4.20	2.80	2.00	1.75
3D camera (front)		13.00	11.05	9.39	7.98	6.79
Blended	Android	2017E	2018E	2019E	2020E	2021E
FP Penetration		53%	66%	58%	51%	45%
FP sensor ASP		1.80	1.41	1.77	1.83	1.69

Note: "Low-end" refers to smartphones with ASP below US\$100; "Mid-end" refers to smartphones with ASP between US\$100 and US\$500; "High-end" refers to smartphones with ASP above US\$500.

Source: Gao Hua Securities Research.

Exhibit 5: ...while UD and 3D cameras will take market share from capacitive sensors
Android smartphone (SP) shipment and sensor penetration forecasts



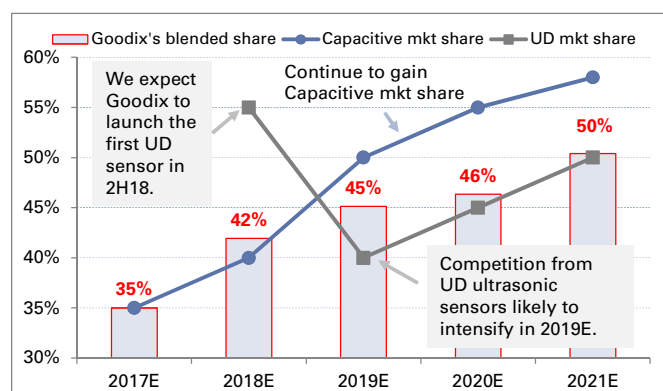
Source: Gao Hua Securities Research.

Goodix market share forecast

Between the current two major players, Goodix and FPC, we believe that Goodix will continue to gain market share from FPC due to its leading technology, lower cost and improving brand name recognition among customers. Considering the severer competition from local brands, uncertainty over the development and adoption of UD optical sensors, and potential competition from ultrasonic sensors, we estimate that Goodix's market share will only increase by 15ppt to 50% by 2021E.

Goodix's fingerprint sensor ASP will depend on the mix of high-price UD sensors (for 2018 we assume a starting price of US\$4.20, referencing capacitive sensor ASP 2 years ago) and low-price capacitive sensors (assuming a decline to US\$1.00 on rising competition/ technology limitations). We believe both sensors' prices will maintain a downward trend over our forecast period. We currently forecast Goodix's ASP to decrease 14% yoy in 2018 led by capacitive sensors, and increase 8% yoy in 2019 on greater UD sensor penetration even as UD ASP falls.

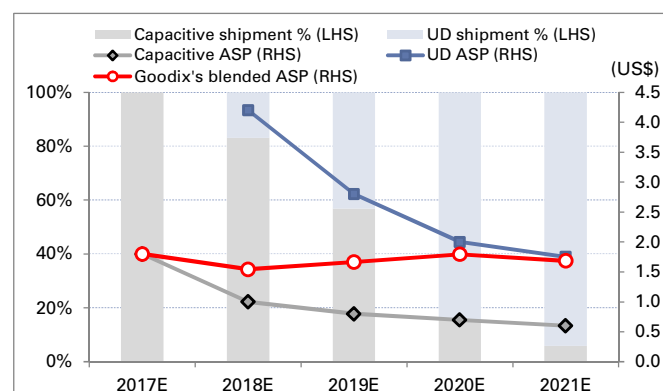
Exhibit 6: Goodix leads in capacitive and UD optical sensor markets but competition is likely to intensify
Capacitive, UD, and overall market share of Goodix



Source: Gao Hua Securities Research.

Exhibit 7: High UD sensor ASP to offset capacitive ASP erosion in 2018 and 2019

Capacitive, UD, and overall ASP of Goodix



Source: Gao Hua Securities Research.

For other segments, we believe fingerprint sensors adopted in emerging applications, i.e. **smart cards and IoT/vehicles**, will see fast growth starting from 2018, while those for **PCs** will be more stable. Based on our industry TAM analysis, we estimate potential fingerprint sensor demand from close to 600mn units of emerging applications in 2021E. Within that number, we estimate Goodix will take a 50% market share as of 2021E, the same as that in the Android smartphone market. The below table shows more details.

Exhibit 8: GS fingerprint sensor (excl. Apple) TAM forecast

All devices (excl. Apple)	2015	2016	2017E	2018E	2019E	2020E	2021E
Goodix Fingerprint (FP) revenue (US\$ mn)			494	691	797	957	1,143
Android Smartphone	2015	2016	2017E	2018E	2019E	2020E	2021E
Total Android SP shipments (mn units, GHe)	1,232	1,416	1,425	1,507	1,565	1,624	1,680
FP Penetration in SP (%)	17%	42%	53%	66%	58%	51%	45%
SP FP TAM - Android (mn units)	214	600	759	991	900	820	748
SP FP market share							
Goodix	5%	23%	35%	42%	45%	46%	50%
SP FP shipments (mn units)							
Goodix	11	137	266	416	405	377	377
SP FP sales (US\$ mn)							
Goodix	40	280	478	642	674	677	634
FP ASP (US\$)							
Goodix	3.60	2.05	1.80	1.54	1.66	1.79	1.68
PC	2015	2016	2017E	2018E	2019E	2020E	2021E
PC FP TAM (mn units, GHe)	10	40	60	75	90	100	110
PC FP market share							
Goodix	0%	0%	15%	23%	36%	46%	50%
PC FP shipments (mn units)							
Goodix	-	-	9	18	32	46	55
PC FP sales (US\$ mn)							
Goodix	-	-	16	27	53	83	93
Smart Cards	2015	2016	2017E	2018E	2019E	2020E	2021E
Smart Cards FP TAM (mn units, GHe)	0	0	0	30	60	120	240
Smart Cards FP market share							
Goodix				23%	36%	46%	50%
Smart Cards FP shipments (mn units)							
Goodix	-	-	-	7	21	55	121
Smart Cards FP sales (US\$ mn)							
Goodix	-	-	-	11	35	99	204
IoT/Vehicle	2015	2016	2017E	2018E	2019E	2020E	2021E
IoT/Vehicles FP TAM (mn units, GHe)	0	0	0	30	60	120	250
IoT/Vehicles FP market share							
Goodix				23%	36%	46%	50%
IoT/Vehicles FP shipments (mn units)							
Goodix	-	-	-	7	21	55	126
IoT/Vehicles FP sales (US\$ mn)							
Goodix	-	-	-	11	35	99	212

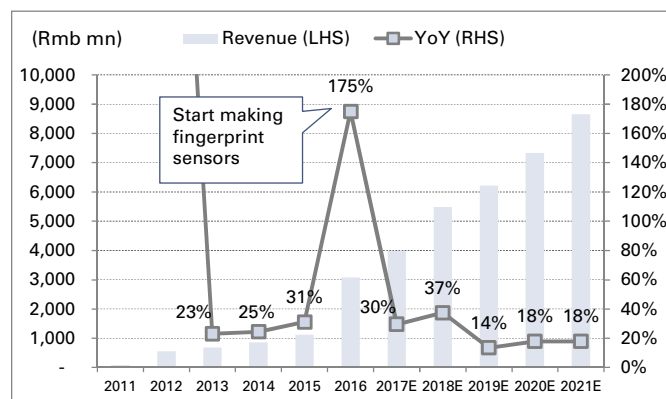
Source: Company data, SunRise Big Data, Gao Hua Securities Research.

Goodix operating forecast

Revenue and profitability: We believe that Goodix will continue investing in its fingerprint sensor segment while maintaining the revenue size of its touch controller segment at the current level. Based on the above TAM and market share analysis, we estimate Goodix's topline to grow at 30%/37%yoy in 2017E-2018E and then a slower 14%-18% in 2019E-2021E, with fingerprint sensors contributing 92% of revenue in 2021E vs. 83% in 2017E. We also expect its GPM to decline by 1ppt yoy to 46.3% in 2018E due to further expansion in its low-ASP capacitive sensor market, but to improve to 47.6% in 2019E on the back of its UD sensor ramp-up.

Exhibit 9: We expect Goodix to quickly expand revenue before 2019E and then slow down

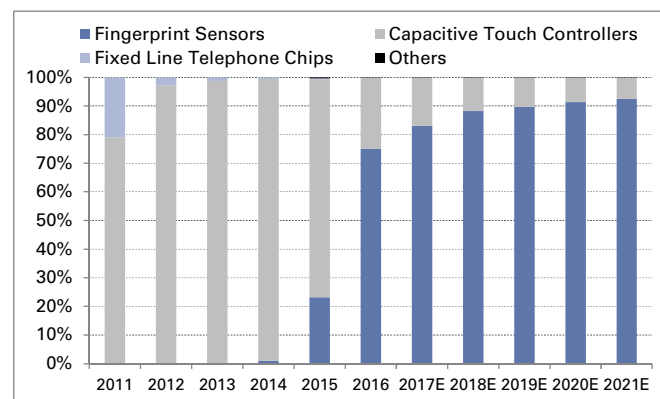
Goodix's revenue and yoy growth



Source: Company data, Gao Hua Securities Research.

Exhibit 10: Fingerprint sensors have become Goodix's key growth driver since 2016

Goodix's revenue mix



Source: Company data, Gao Hua Securities Research.

Given its goal of maintaining a leading technology advantage and continuing to gain market share, we expect Goodix's OPEX as a percentage of revenue to stay high between 24% and 26% in 2017E-2021E, and its net margin to decline to 23% in 2021E from 27% in 2017E on GPM erosion in 2018E/20E/21E and a high OPEX weighting.

Balance sheet: Goodix has a strong balance sheet. Although our earnings model does not factor in any potential M&A in the future, we believe that the strong net cash position of over 4bn Rmb by 2021E could potentially provide solid support for Goodix to continuously invest in R&D, make acquisitions, and potentially raise dividend payout.

Capex: We believe Goodix will maintain its capex at a low level as a fabless company. It has also not indicated any plans to expand capex. We forecast its capex to sales ratio to stay at around 1% and free cash flow to grow at a CAGR of 15% in 2017E-2021E as earnings increase.

Dividends: We currently assume a dividend payout ratio of 20% across our forecast period, reflecting company guidance. The company was listed in October 2016, and it paid out 12% of its net income for FY16.

Leverage/debt: Goodix has zero debt as of 3Q17. Although we do not rule out the possibility, we believe the company has limited need of raising funding in the next few years given its abundant cash at hand.

Exhibit 11: Revenue to grow by 30%-37% in 2017E-18E but only 14% in 2019E
 Goodix's income statement, 2014-2019E

Income statement (Rmb mn)	2014	2015	2016	2017E	2018E	2019E
Total sales/revenues	854	1,120	3,079	3,989	5,484	6,226
yoy %	25%	31%	175%	30%	37%	14%
COGS	(294)	(472)	(1,628)	(2,106)	(2,945)	(3,260)
Gross profit	559	648	1,452	1,883	2,538	2,966
yoy %	24%	16%	124%	30%	35%	17%
gross margin %	65.5%	57.9%	47.1%	47.2%	46.3%	47.6%
Total operating expense	(150)	(262)	(538)	(876)	(1,327)	(1,606)
EBITDA	417	398	933	1,027	1,235	1,385
EBITDA margin %	48.8%	35.5%	30.3%	25.8%	22.5%	22.3%
EBIT (operating profit)	409	386	914	1,008	1,211	1,359
EBIT margin %	48.0%	34.4%	29.7%	25.3%	22.1%	21.8%
Pre-tax profit (income before tax)	445	436	987	1,192	1,564	1,717
Pre-tax margin %	52.1%	38.9%	32.0%	29.9%	28.5%	27.6%
Net income	384	378	857	1,063	1,408	1,546
yoy %	49%	(1%)	126%	24%	32%	10%
Net margin %	44.9%	33.8%	27.8%	26.6%	25.7%	24.8%
EPS - basic (Rmb)	0.96	0.95	1.93	2.36	3.10	3.40
EPS - fully diluted (Rmb)	0.96	0.95	1.93	2.34	3.10	3.40
Common dividends declared	(83)	(99)	(100)	(213)	(282)	(309)
Dividends per share (Rmb)	0.21	0.25	0.22	0.47	0.62	0.68
Fully diluted shares outstanding (mn)	400	400	445	454	454	454

Source: Company data, Gao Hua Securities Research.

Exhibit 12: Goodix has a strong balance sheet
 Goodix's balance sheet, 2014-2019E

Balance sheet (Rmb mn)	2014	2015	2016	2017E	2018E	2019E
Cash and equivalents	498	606	1,104	1,603	2,066	2,962
Net receivables	185	360	1,236	1,602	2,202	2,500
Inventory/stocks	104	142	550	712	996	1,103
Other current assets	4	6	33	33	33	33
Current assets	791	1,114	2,923	3,950	5,297	6,597
Gross PP&E/Fixed assets	149	164	192	228	278	334
Less accumulated depreciation	(8)	(18)	(31)	(46)	(63)	(83)
Net PP&E/Fixed assets	141	146	161	183	215	251
Gross intangibles	6	59	68	89	89	89
Accumulated amortization	(2)	(4)	(10)	(15)	(22)	(28)
Net intangibles	4	55	59	74	67	62
Total investments	65	64	62	62	62	62
Other long-term assets	4	14	10	10	10	10
Total assets	1,005	1,393	3,215	4,279	5,652	6,982
Accounts payable	80	158	344	445	623	689
Short-term debt	-	-	-	-	-	-
Other current liabilities	31	55	121	233	302	330
Current liabilities	112	213	465	679	925	1,019
Long-term debt	-	-	-	-	-	-
Other long-term liabilities/creditors	1	6	14	14	14	14
Total long-term liabilities	1	6	14	14	14	14
Total liabilities	113	219	479	693	939	1,033
Common stock	300	554	1,445	1,445	1,445	1,445
Retained earnings	592	618	1,289	2,139	3,265	4,502
Other common equity	-	0	1	1	1	1
Total common equity	892	1,172	2,735	3,585	4,711	5,948
Minority interest (balance sheet)	-	2	2	2	2	1
Total shareholders funds/equity	892	1,174	2,737	3,587	4,713	5,949
Total liabilities and equity	1,005	1,393	3,215	4,279	5,652	6,982
Other balance sheet items	2014	2015	2016	2017E	2018E	2019E
Net receivable days	79	117	147	147	147	147
Inventory days	129	110	123	123	123	123
Net payable days	99	122	77	77	77	77
Cash conversion days	109	105	193	193	193	193
Book value per share (Rmb)	2	3	6	8	10	13
Net working capital (Rmb mn)	680	901	2,458	3,272	4,372	5,578
Net debt (RMB mn)	(498)	(606)	(1,104)	(1,603)	(2,066)	(2,962)
Cash dividend payout	22%	26%	20%	20%	20%	20%
ROE	51.7%	36.7%	43.9%	33.6%	33.9%	29.0%

Source: Company data, Gao Hua Securities Research.

Exhibit 13: We expect Goodix's free cash flow to grow at 10%-20% in 2017E-2019E
 Goodix's cash flow statement, 2014-2019E

Cash flow statement (Rmb mn)	2014	2015	2016	2017E	2018E	2019E
Income pre-preferred share dividends	384	378	857	1,063	1,408	1,546
Minority interest add-back	-	(0)	(0)	(0)	(0)	(0)
Depreciation and amortization add-back	7	12	19	20	24	26
(Increase)/decrease in working capital :	(63)	(135)	(1,099)	(426)	(707)	(338)
Accounts receivable	(70)	(175)	(876)	(365)	(600)	(298)
Inventory	(40)	(38)	(408)	(162)	(284)	(107)
Accounts payable	48	78	186	101	178	67
Other operating cash flow items	7	(27)	41	-	-	-
Cash flow from operations	335	228	(182)	656	725	1,234
Capital expenditure	(73)	(34)	(28)	(36)	(50)	(56)
(Acquisitions)/divestitures	-	-	-	(21)	-	-
Investments	-	(14)	(1)	-	-	-
Other investment cash flow items	-	19	8	-	-	-
Cash flow from investing	(73)	(29)	(21)	(57)	(50)	(56)
Dividends paid (common and preferred)	(16)	(83)	(99)	(100)	(213)	(282)
Share repurchase/issue (change in common stock)	-	-	810	-	-	-
Increase/(decrease) in short-term debt	-	-	-	-	-	-
Increase/(decrease) in long-term debt	-	-	-	-	-	-
Increase/(decrease) in preferred shares	-	-	-	-	-	-
Change in minority interest	-	-	-	-	-	-
Other financing cash flow items	(67)	(19)	(19)	-	-	-
Cash flow from financing	(83)	(102)	692	(100)	(213)	(282)
Total cash flow	179	108	497	500	463	896
Free cash flow	344	364	905	991	1,185	1,329
yoy %	83%	6%	149%	10%	20%	12%

Source: Company data, Gao Hua Securities Research.

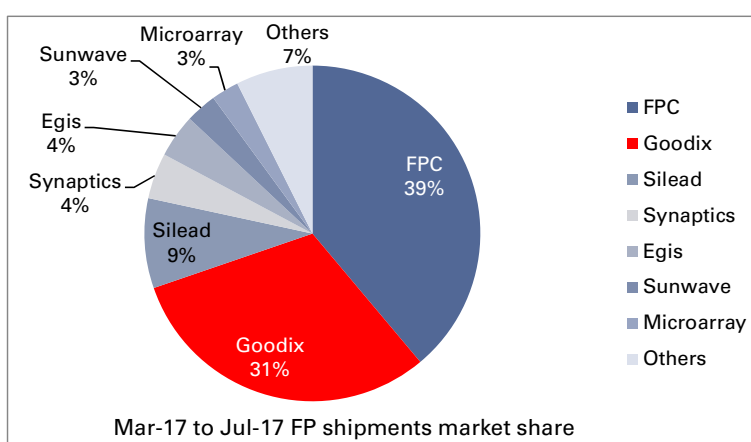
Strong customer base and premium supply chain

Fingerprint sensors

Since it entered the fingerprint sensor market in 2015, Goodix has been a significant share gainer: its global market share (excl. Apple) rose from around 5% in 2015 to 23% in 2016 and 31% in 1H17, and in 3Q17 it overtook FPC to become **the world's biggest fingerprint sensor maker** for mobile devices by revenue. As noted earlier, we believe its market share will reach 50% by 2021E. Goodix competes mostly with overseas names such as FPC, Synaptics and Egis Technology (Taiwan) and domestic players like Silead, Sunwave and Microarray, as shown in Exhibits 14 and 15.

Exhibit 14: Goodix had around 1/3 market share in 1H17 and surpassed FPC to become the global leader in 3Q17

Mar-17 to Jul-17 (1H17) Android smartphone fingerprint sensor shipment market shares



Source: SunRise Big Data, Gao Hua Securities Research.

Goodix sources wafers from TSMC, X-FAB and Dongbu Hitec and relies on Amkor/JCET (Jiangsu Changjiang Electronics Technology) and others for packaging and testing. It works with module makers like O-Film and also sells directly to a broad range of domestic and overseas customers.

Exhibit 15: Goodix's fingerprint sensors are widely used by many well-known domestic and overseas smartphone makers

Main fingerprint sensor suppliers' supply chain comparison

Operating System	FP Sensor Designer	Foundry	Packaging/Testing and Modularization	Customers
iOS	AuthenTec	TSMC	WLCSP, XinTec, ASE	Apple (iPhone/iPad)
Android	FPC	SMIC	CrucialTech, O-Film	Huawei, Vivo, Oppo etc.
	Goodix	TSMC, X-FAB, Dongbu Hitec	Amkor, Huatian, JCET, O-Film, Speed Wireless	Meizu, Leshi, Huawei, Xiaomi, Vivo, ZTE, Lenovo, Gionee, TCL, Nokia, LG, ASUS etc.
	Synaptics (Validity)	TSMC, Samsung	Chipmos, ThaiLin	Samsung, HTC, etc.
	Silead	SMIC	WLCSP	Local brands

Note: Apple only uses AuthenTec's (Apple's subsidiary) products and Samsung mainly uses Synaptics' and Egis' sensors.

Source: Company data, Gao Hua Securities Research.

Exhibit 16: Goodix has a track record of delivering strong revenue growth with a stable margin and ROE

Global peer comparison for Goodix

Revenue (mn US\$)	2011	2012	2013	2014	2015	2016	Revenue growth	2011	2012	2013	2014	2015	2016
Goodix	13.3	87.2	110.1	136.9	176.4	459.9	Goodix		556.3%	26.3%	24.3%	28.9%	160.7%
FPC	10.6	1.5	14.6	34.1	344.1	776.6	FPC	24.8%	-85.7%	864.9%	133.0%	908.1%	125.7%
Synaptics	598.5	548.2	663.6	947.5	1,703.0	1,666.9	Synaptics	16.2%	-8.4%	21.0%	42.8%	79.7%	-2.1%
EgisTec	7.0	4.7	2.8	1.5	16.8	51.9	EgisTec		-32.8%	-40.2%	-46.8%	1022.2%	208.4%
Gross Margin	2011	2012	2013	2014	2015	2016	R&D % of revenue	2011	2012	2013	2014	2015	2016
Goodix	48.9%	66.0%	65.4%	65.1%	57.4%	46.7%	Goodix			6.4%	9.6%	14.3%	10.0%
FPC	56.4%	-55.3%	41.0%	30.7%	43.3%	47.7%	FPC	14.1%	86.9%	27.2%	60.0%	6.1%	4.6%
Synaptics	41.1%	46.6%	49.1%	46.0%	34.0%	34.9%	Synaptics	17.5%	21.5%	21.8%	20.3%	17.2%	18.7%
EgisTec	39.7%	79.4%	67.7%	30.3%	74.3%	45.2%	EgisTec	39.7%	39.7%	68.6%	329.4%	50.2%	23.2%
OP Margin	2011	2012	2013	2014	2015	2016	SG&A % of revenue	2011	2012	2013	2014	2015	2016
Goodix	32.4%	48.8%	47.9%	48.6%	34.8%	29.1%	Goodix	15.9%	16.2%	17.5%	16.6%	22.7%	16.8%
FPC	6.3%	-361.7%	-35.4%	-64.8%	31.5%	39.4%	FPC	36.1%	219.5%	49.2%	35.7%	5.7%	4.4%
Synaptics	12.1%	12.3%	15.2%	7.6%	9.5%	4.5%	Synaptics	11.5%	12.8%	12.0%	10.6%	7.5%	9.7%
EgisTec	-44.2%	-11.6%	-98.7%	-587.5%	-11.8%	8.1%	EgisTec	83.9%	905.0%	1662.2%	617.9%	86.1%	13.8%
ROE	2011	2012	2013	2014	2015	2016	Net Margin	2011	2012	2013	2014	2015	2016
Goodix		111.4%	56.9%	51.7%	36.7%	43.9%	Goodix	30.9%	40.8%	37.9%	45.5%	34.1%	28.1%
FPC	3.6%	-36.7%	-16.8%	-48.8%	110.3%	120.6%	FPC	4.9%	-371.6%	-34.5%	-61.7%	27.5%	30.7%
Synaptics	20.4%	14.7%	21.5%	7.6%	14.8%	9.6%	Synaptics	10.7%	9.9%	14.9%	4.9%	6.5%	4.3%
EgisTec		-53.3%	-28.3%	-51.3%	-8.9%	7.8%	EgisTec	-45.3%	-146.1%	-86.4%	-506.1%	-16.8%	6.8%

Source: Bloomberg.

Touch controllers

In the **touch controller** market, Goodix ranks no. 2 in China and top 5 in the world as of 2015 based on volume. It mainly competes with Synaptics and FocalTech, while other players include Cypress, Atmel and Broadcom (for Apple only). Goodix's touch controllers are commonly used by ZTE, Huawei, Coolpad, Lenovo, Gionee, Toshiba, TCL, Dell, Panasonic, and Acer, among others.

Sales channels

Goodix sell its products to customers directly (c.40% as of 2016) and through distributors (c.60%). The distributors include Silicon Application, ATM Electronic, DigiPro/Yilai, and Hiways/Desida.

Solid leadership and execution

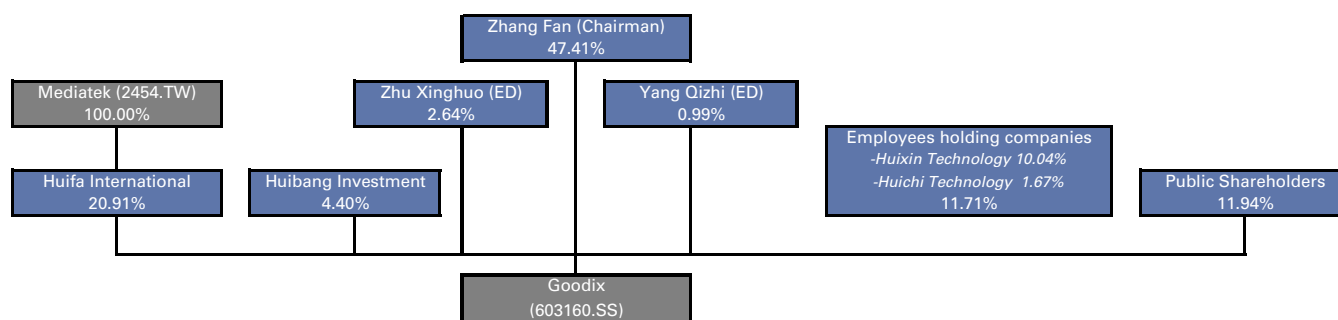
In the past, many Chinese and Taiwanese design companies have ended up being a “one-hit-wonder” that succeeds in only one product category. Since its founding in 2002, Goodix has successfully migrated from wireline telephone ICs to touch controller ICs and then to fingerprint sensors, where it has now become the global leader. We believe that Goodix’s successful progress demonstrates its strong leadership under Chairman Fan Zhang and the executive team.

We believe this strong leadership and execution are the product of Goodix’s shareholder structure (Exhibit 17). As of end-3Q17 total shares outstanding, Chairman Zhang owns 47.4%, other executives and employees own 15.3%, and Mediatek was an early VC investor and owns 20.9%. Goodix announced on November 5, 2017, that Mediatek intends to sell 6.27% of its holding over a 6-month period from November 9, 2017. Additionally, it announced another 2.73% share sell-down by other employees/EDs in October 2017. While these share sales could present a near-term overhang, they should not affect Goodix’s business performance because Goodix has already expanded far beyond Mediatek’s customer base.

Goodix distributed 20% of its net income to common shareholders during 2014-2016 on average, and the company will maintain a minimum cash dividend payout ratio of 20% going forward, as stated in its filings.

Exhibit 17: Goodix’s management has an absolute controlling stake

Goodix’s shareholder structure (as of 3Q17)



Source: Company data.

Valuation: Largely priced in light of decelerating growth in '19-21E

We initiate Goodix with a Neutral rating and 12-m TP of Rmb125. We value A-share China design companies in our coverage using long-term discounted P/E in order to capture their longer-term growth potential. For Goodix, we apply its A share peers' average 2018E P/E of 40X to 2021E EPS and discount back to 2018E using the peer-average cost of equity of 11.3%, as shown in Exhibits 18 and 19.

Goodix is currently trading at 38X consensus NTM P/E, slightly below its average NTM P/E of 41X since listing on October 17, 2016. Our 12-m target price of Rmb125 implies a 2018E P/E of 40X and 9% return potential offering more limited upside than Buy-rated SG Micro (+23%).

We believe that a NTM P/E of around 40X is likely to be maintained over the next 12 months as 1) Goodix is continuing to gain market share in the fingerprint sensor market globally, but 2) also faces margin pressure, new product launch uncertainty, and intensified competition.

Exhibit 18: A-share Chinese design companies average 2018E consensus P/E is c.40X
Goodix's peers P/E consensus comparison (pricing as of Nov 9, 2017)

Company	Ticker	MV	P/E				ROE	COE delevered
		(US\$ mn)	2016	2017E	2018E	2019E	2018E	(YTD)
Fabless								
Allwinners	300458.SZ	1,560	69	51	41	28	11%	12.6%
Goodix	603160.SS	7,910	61	44	36	31	27%	11.7%
Goke Microelectronics	300672.SZ	1,202	155	89	45	38	13%	n.a.
SinoWealth	300327.SZ	1,137	70	51	36	24	20%	9.5%
SG Micro	300661.SZ	867	71	60	46	37	24%	10.4%
GigaDevice	603986.SS	5,010	187	70	43	33	30%	12.6%
Average		2,948	102	61	40	32	21%	11.3%
St. dev.		2,880	55	16	4	5	8%	1.4%

Source: Wind.

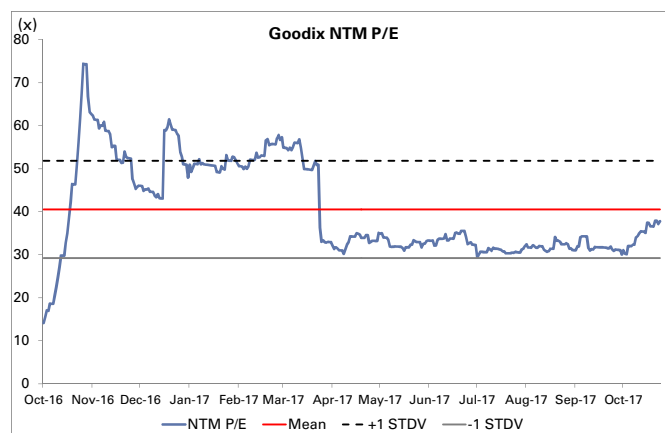
Exhibit 19: Our 12m-TP of Rmb125 implies a 40X 2018E P/E and 9% upside

Long-term discounted P/E methodology for Goodix

Company	Ticker	Rating	Target Price	Market Price	Potential +/-side	2021E EPS	COE	Peers avg. 2018E P/E	TP implied 2018E P/E
Goodix	603160.SS	Neutral	125	115	9%	4.32	11.30%	40.0	40.3

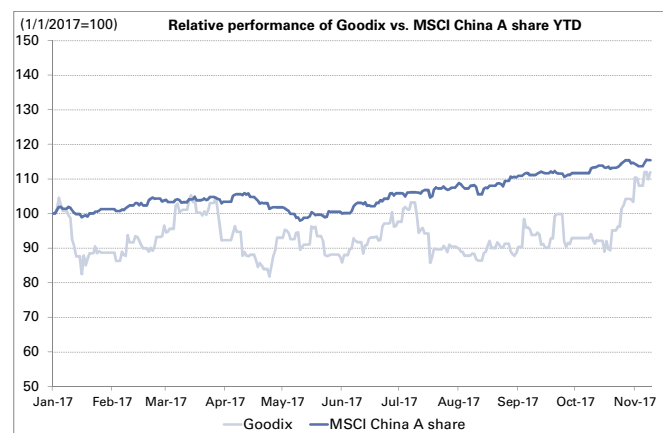
Source: Wind, Gao Hua Securities Research.

Exhibit 20: Goodix's average NTM consensus P/E is 41X
Goodix NTM consensus P/E



Source: Wind.

Exhibit 21: Goodix has underperformed most of 2017
YTD Goodix relative performance vs. MSCI China A share



Source: Wind.

Key risks to our investment thesis

- **Downside risks:**

- 1) **Development delay with UD optical sensors:** UD sensors are required for a full-screen display design to incorporate a fingerprint sensor. The company that launches UD sensors first for mass production will have the first mover advantage and in our view take a lead in the high-end smartphone market. As such, any delay in the launch of Goodix's UD sensors in 2H18 (our current expected timeframe), or any launch by a competitor ahead of Goodix (e.g. if Qualcomm were to launch a UD ultrasonic sensor before Goodix's optical sensor), could weaken Goodix's earnings visibility, especially given that margins on older products are narrowing.
- 2) **Faster-than-expected substitution of fingerprint sensors by 2D/3D facial recognition:** Currently we expect fingerprint sensors' penetration rate to decline from 2019E. If the substitution starts earlier than we expect, it could limit Goodix's potential market share upside.
- 3) **Intensified competition from ultrasonic sensors and local brands:** FPC and Qualcomm are developing UD ultrasonic sensors, which we view as a threat to Goodix UD optical sensors as both have similar functionality, although no maker has a mass production solution yet. In addition, domestic players including Silead and Microarray are also gaining share in the more mature capacitive sensor market, which could pose some risk if faster than expected.
- 4) **Poorer-than-expected user experience of UD optical sensor after launch:** If the user experience does meet customers' expectations, phone makers could turn back to capacitive sensors until UD is a more mature technology.
- 5) **Weaker-than-expected smartcards/IoT/vehicle demand in the next few years:** We have yet to see meaningful volume of fingerprint sensors in these emerging applications, although our TAM analysis points to 600mn unit demand by 2021E given fast pace of development and potential needs. If demand were weaker than we expect, there could be downside risk to our outlook.

- **Upside risks:**

- 1) **Adoption of UD sensor by smartphones with 3D camera (e.g. next generation of iPhoneTM):** If full-screen smartphones with 3D cameras were to continue to adopt UD sensors in order to achieve a better user experience, it could push up UD fingerprint sensor demand especially in the high-end market, leading to higher-than-expected ASP and volume for Goodix.
- 2) **Low-end smartphones continue to adopt fingerprint sensors:** Similar to risk 1), if low-end smartphones keep using fingerprint sensors (mostly capacitive sensors, in our view), the penetration rate may not come down as much as we forecast and could help Goodix's business further scale up as leader in the capacitive fingerprint sensor market.
- 3) **Faster-than-expected market share gain:** Currently we forecast Goodix's market share to increase only 15pp to 50% by 2021E, but share gains could be stronger if the above upside risks were to materialize.

Exhibit 22: Greater China semiconductor sector coverage comparison table

GS semiconductor	Ticker	Ratings	Market Price	Target Price	Market cap US\$ mn	Trading P/E		PEG	Trading P/B		ROE	
						2017E	2018E		2017E	2018E	2017E	2018E
SG Micro (Rmb)	300661.SZ	Buy	94	116	867	60.6	46.5	1.5	7.5	6.5	18.2%	14.9%
Goodix (Rmb)	603160.SS	Neutral	115	125	7,910	48.6	37.1	1.1	14.6	11.1	33.6%	33.9%
Hua Hong (HK\$)	1347.HK	Buy	14.88	16.90	1,980	14.6	12.7	0.8	1.3	1.2	8.9%	9.6%
MediaTek (NT\$)	2454.TW	Buy	331.00	356.00	17,222	27.5	16.5	0.2	2.0	1.9	7.5%	11.5%
Silergy (NT\$)	6415.TW	Buy	678.00	636.00	1,723	28.5	22.5	0.9	5.6	4.7	22.0%	22.8%
TSMC (NT\$)	2330.TW	Neutral	241.00	213.00	206,811	18.3	17.0	2.3	4.1	3.7	23.5%	22.9%
TSMC-ADR (US\$)	TSM	Neutral	41.64	35.10	215,730	19.1	17.8	2.5	4.3	4.3	23.5%	22.9%
UMC (NT\$)	2303.TW	Neutral	15.70	14.10	6,747	20.2	18.0	1.5	0.9	0.9	4.4%	4.9%
UMC-ADR(US\$)	UMC	Neutral	2.58	2.30	6,694	20.1	18.0	1.5	0.9	0.9	4.4%	4.9%
SMIC (US\$)	SMI	Sell	8.76	4.60	7,400	37.0	25	0.6	1.7	1.6	4.9%	6.5%
SMIC-H shares (HK\$)	0981.HK	Sell	14.16	7.20	8,463	38.3	26.3	0.6	1.7	1.6	4.9%	6.5%
Parade (NT\$)	4966.TWO	Neutral	557.00	515.00	1,408	21.3	19.8	2.6	4.9	4.4	25.5%	24.4%
Average						29.5	23.1	1.3	4.1	3.6	15.1%	15.5%
Median						24.4	18.9	1.3	3.0	2.8	13.5%	13.2%
STD						14.1	9.7	0.8	3.9	3.0	10.4%	9.6%

Note: Target prices are on a 12-month timeframe.

Source: Gao Hua Securities Research, Datastream.

Introducing M&A framework for Goodix

Across our global coverage, we examine stocks using an M&A framework, considering both qualitative factors and quantitative factors (which may vary across sectors and regions) to incorporate the potential that certain companies could be acquired. We then assign a M&A rank as a means of scoring companies under our rated coverage from 1 to 3, with 1 representing high (30%-50%) probability of the company becoming an acquisition target, 2 representing medium (15%-30%) probability and 3 representing low (0%-15%) probability. For companies ranked 1 or 2, in line with our standard departmental guidelines we incorporate an M&A component into our target price. M&A rank of 3 is considered immaterial and therefore does not factor into our price target, and may or may not be discussed in research.

In the Asia technology sector, we examine companies' potential as M&A targets based on the assessment of **(1) impediments**, such as shareholder structure/preferences, industry regulations/government policies, and takeover defense that could prevent a transaction from occurring, **(2) qualitative factors**, including: (i) attractiveness of technology, (ii) attractiveness of customers, (iii) cost synergy potential, (iv) other/intangible value; and **(3) quantitative factors**, including (i) market cap, and (ii) valuations. For details of our Asia technology M&A framework, see our report *Pan Asia: Technology: Navigating the noise (6): Introduce M&A framework, update roadmap*, dated July 4, 2016.

Shareholder structure and potential impediments

We gauge whether there are any impediments to M&A, because if there are, a company is unlikely to become an M&A target even if it ranks 1 or 2 on qualitative/quantitative criteria.

When assessing potential impediments we take into consideration:

(1) Major shareholder preferences: We assume that shareholders with a 20% or greater stake have a significant influence, or a blocking stake, and take into account any potential actions by major shareholders in the event of a possible acquisition by a third party (hostile or otherwise), or if they have announced a preference to raise their stake in the company;

(2) Regulatory and or government policy impediments; and

(3) Possible takeover defense measures such as a poison pill.

We assign a "No" qualification if one or more of the three considerations above are applicable and a "Yes" qualification if these considerations do not apply.

Qualitative assessment criteria

1) Technology: We look at whether or not a company has attractive technology capable of generating future value, as well as its technological capabilities and intellectual property rights. We assign a rank of "3" if its technology is unattractive or moderately attractive, "2" if it is attractive and "1" if it is very attractive.

2) Customer base: We look at whether or not a company has an attractive customer base and product applications. We also take customer retention and end-market exposure (including sales channels) into account. We assign a rank of "3" if its customer base and product applications are unattractive or moderately attractive, "2" if they are attractive and "1" if they are very attractive.

3) Cost synergies: We look at prospects for growth in business scale and scope for profit margin/ yield improvement via acquisition of an M&A target company. We assign a rank of "3" if there is low or some possibility of synergies, "2" if there is high possibility, and "1" if there is very high possibility.

4) Other: We look at whether or not a target company possesses attractive assets, including brand strength, outstanding management/employees, and intangible assets. We assign a rank of “3” if they are unattractive or moderately attractive, “2” if they are attractive, and “1” if they are very attractive.

Quantitative assessment criteria

1) Market cap: We rank the companies in four tiers based on the assumption that the smaller a company is, the easier it is to acquire. We also take regional qualities (such as differing market cap ranges between regions) into account.

2) Valuation: We look at whether a target company’s three-year average P/E and EV/DACF are below the industry/peer average for the same period, as we believe companies trading at a discount to peers are more likely to be acquired.

We assign a rank of “3” if the company appears overvalued relative to its respective industry peer group or largely in line with the peer average, “2” if its valuation is discounted, and “1” if its valuation is significantly discounted. We take into account differing valuation multiple ranges between the companies depending on their region and their peers.

Within this framework, we assign an M&A rank of ‘3’ to Goodix

This is mainly due to its relatively large market cap of US\$7.9bn as of Nov 9, 2017 and shareholding structure (47.41% held by Chairman Mr. Zhang Fan, another 3.63% by the other two co-founders, and c.11.7% by employees). Moreover, as Mr. Zhang has a long-term vision for the company, we believe he is likely to retain a controlling stake as long as possible.

Exhibit 23: We assign an M&A rank of ‘3’ to Goodix

Goodix’s M&A score summary

Company name	Shareholders' structure				Qualitative score (1-3)				Quantitative score (1-3)		Total score	M&A Rank
	% of free float	Shareholders' intention	No regulatory barrier	No anti-takeover measure	Technology	Customer base	Cost synergy	Other intangible asset	Market cap	Valuation unlocking		
Goodix	12%	No	Yes	Yes	1	3	2	3	3	3	3	3

Source: Company data, Gao Hua Securities Research

信息披露附录

申明

我们，吕东风, PhD、侯雪婷，在此申明，本报告所表述的所有观点准确反映了我们对上述公司或其证券的个人看法。此外，我们的薪金的任何部分不曾与，不与，也将不会与本报告中的具体推荐意见或观点直接或间接相关。

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投资摘要部分通过将一只股票的主要指标与其行业和市场相比较来评价该股的投资环境。所描述的四个主要指标包括增长、回报、估值倍数和波动性。增长、回报和估值倍数都是运用数种方法综合计算而成，以确定该股在地区研究行业内所处的百分位排名。

每项指标的准确计算方式可能随着财务年度、行业和所属地区的不同而有所变化，但标准方法如下：

增长是下一年预测与当前年度预测的综合比较，如每股盈利、EBITDA 和收入等。**回报**是各项资本回报指标一年预测的加总，如 CROCI、平均运用资本回报率和净资产回报率。**估值倍数**根据一年预期估值比率综合计算，如市盈率、股息收益率、EV/FCF、EV/EBITDA、EV/DACF、市净率。**波动性**根据 12 个月的历史波动性计算并经股息调整。

并购评分

在我们的全球覆盖范围中，我们使用并购框架来分析股票，综合考虑定性和定量因素（各行业和地区可能会有所不同）以计入某些公司被收购的可能性。然后我们按照从 1 到 3 对公司进行并购评分，其中 1 分代表公司成为并购标的的概率较高(30%-50%)，2 分代表概率为中等(15%-30%)，3 分代表概率较低(0%-15%)。对于评分为 1 或 2 的公司，我们按照研究部统一标准将并购因素体现在我们的目标价格当中。并购评分为 3 被认为意义不大，因此不予体现在我们的目标价格当中，分析师在研究报告中可以予以讨论或不予讨论。

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GS SUSTAIN 是一项侧重于通过发现优质行业领先企业而实现长期超额收益的全球投资策略。GS SUSTAIN 50 关注名单列出了我们认为凭借出色的资本回报、具有可持续性的竞争优势和对 ESG（环境、社会和企业治理）风险的有效管理而有望在长期内相对于全球同业表现出色的行业领军企业。候选企业主要基于对企业在这三方面表现的综合量化分析筛选而出。

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