

**Markets at a Glance**

Indices	Closing	DoD%
Hang Seng Index	28855.1	(0.1)
HSCEI	10922.4	(0.5)
Shanghai COMP	3015.3	(0.9)
Shenzhen COMP	1600.0	(1.2)
Gold	1418.7	0.0
BDIY	1446.0	4.7
Crude Oil, WTI (US\$/BBL)	57.3	1.9
Crude Oil, BRENT (US\$/BBL)	63.8	2.3
HIBOR, 3-M	2.5	4.3
SHIBOR, 3-M	2.6	(0.6)
RMB/USD	6.9	0.1

*Source: Bloomberg***Upcoming Key Data Releases**

Date	Key Data
------	----------

*Source: Bloomberg*

# CGIS Yum Cha Daily

**RESEARCH NOTES**

**CRSC [3969.HK; HK\$6.19; UPGRADE TO ADD]** - CRSC has received approval from CSRC for its A-share listing on the SSE STAR Market, with trading likely to start in late July. Since its listing, CRSC has traded at a significant discount to its A-share peers. We think its A-share listing should help it gain market traction and improve its trading liquidity, given its market leader position. Benefiting from accelerating rail and urban transit investment, CRSC's core railway and urban transit business growth should continue beyond the 13th FYP. We upgrade the stock from HOLD to ADD and raise our target price (TP), as we expect value to emerge from its A-share listing. (Analyst: Kelly Zou)

**TMT SECTOR UPDATE** - Samsung will officially launch the Galaxy Note 10 on 7 Aug 2019 and based on current news flow. The Note 10 has Time of Flight (TOF) 3D sensing on both sides. Apple (structured light), Huawei, Samsung (S10), Oppo, LG and Xiaomi have adopted 3D sensing on one side. The Note 10 is likely to be the first phone with 3D sensing on both sides. Given the popularity of the under-display fingerprint design, there is concern about the development of the VCSEL supply chain. However, given the latest news flow, VCSEL will remain one of key trends in hardware development. The VCSEL supply chain will be a key beneficiary of the industry trend. For details, please refer to our previous updates on 02 Mar 2018 and 31 May 2018. We believe that Pentamaster [1665.HK] will be one of the HK-listed beneficiaries of development of the VCSEL supply chain. (Analyst: Mark Po)

**Research Contact****Wong Chi Man, Head of Research**

T: (852) 3698 6317

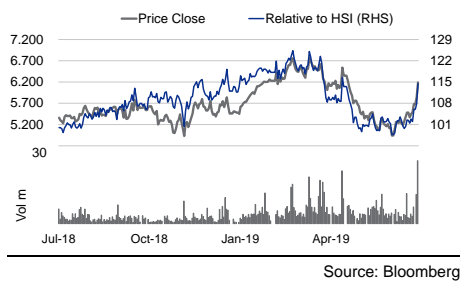
E: [cmwong@chinastock.com.hk](mailto:cmwong@chinastock.com.hk)

**Hong Kong**
**ADD (upgrade from HOLD)**

Consensus ratings\*: Buy 16 Hold 4 Sell 0

Current price:	HK\$6.19
Target price:	HK\$7.20
Previous target:	HK\$6.70
Up/downside:	16.3%
CGS-CIMB / Consensus:	N/A
Reuters:	
Bloomberg:	3969 HK
Market cap:	US\$6,971m
	HK\$54,409m
Average daily turnover:	US\$3.36m
	HK\$28.47m
Current shares o/s:	8,790m
Free float:	24.9%

\*Source: Bloomberg



Price performance	1M	3M	12M
Absolute (%)	18.8	0.3	15.5
Relative (%)	11.5	4.1	14.4

Major shareholders	% held
CRSC Corporation	75.1

**Analysts**
**Kelly Zou**

 T (852) 3698 6319  
 E kellyzou@chinastock.com.hk

**Wong Chi Man, CFA**

 T (852) 3698 6317  
 E cmwong@chinastock.com.hk

**CRSC**
**Value to emerge from SSE STAR Market listing**

- CRSC has received approval from CSRC for its A-share listing on the SSE STAR Market, with trading likely to start in late July.
- Since its listing, CRSC has traded at a significant discount to its A-share peers. We think its A-share listing should help it gain market traction and improve its trading liquidity, given its market leader position.
- Benefiting from accelerating rail and urban transit investment, CRSC's core railway and urban transit business growth should continue beyond the 13<sup>th</sup> FYP. We upgrade the stock from **HOLD** to **ADD** and raise our target price (TP), as we expect value to emerge from its A-share listing.

**A-share listing on the SSE STAR Market to gain market traction**

CRSC has received approval from CSRC for its A-share offering. The Company will issue 1.8bn in new A-shares on the SSE STAR Market, which represents 17% of the total share capital of CRSC after the issue. The A-share issuance will help the Company raise >Rmb10.5bn for investment in 1) R&D of advanced intelligent technology related to rail transportation, smart city, and chips for use in smart rail transportation; 2) the development of an advanced intelligent manufacturing base in Changsha; 3) the development of IT projects; and 4) the replenishment of working capital. Since its H-share listing in 2015, the Company has traded at a significant discount to its A-share peers. We think the A-share listing should help it gain market traction and improve trading liquidity, given its market leader position.

**Strong position in the smart rail transportation industry value chain**

CRSC has a 60% share of China's railway control system market. The railway business (46% of revenue in 2018) should benefit from 1) an increase in new rail line additions, and 2) further railway reforms. Although overall railway investment will remain only stable, investment growth will shift to railway equipment for operations. In the urban transit control system market, CRSC has a 40% share in terms of contract value of urban transit control system projects it has won. With the central government promoting the development of urban transit networks to support economic growth and facilitate the development of a few city clusters, investment in urban transit network development started to reaccelerate in 2018. CRSC is better positioned to enjoy accelerating investment growth in both early- and late-cycle urban transit investment, so its urban transit business (23% of total revenue growth in 2018) should have sustainable earnings growth beyond the 13<sup>th</sup> FYP. Moreover, the Company will keep investing in advanced intelligent technology in railway and urban transit control and communication systems, which will help it expand into smart rail transportation and the smart city market for more sustainable long-term growth.

**Core railway business growth reacceleration from 2019 onwards**

CRSC's new contract wins in 2018 show that its core railway business growth should pick up from 2019 onwards. New contract wins for its railway business grew 44.8% YoY in 2018 and 22.5% YoY in Q1 2019. We maintain our earnings forecast for the Company in 2019–2020E. We expect its core railway business revenue to grow 18–20% p.a. in 2019–2020E. We expect its urban transit business revenue growth to remain at 30% p.a. in 2019–2020E. Overall, we expect total revenue to grow 16.9% in 2019E and 18.5% YoY in 2020E. With the improving revenue mix, we expect its gross profit margin to expand in 2019–2020E. We expect its net profit to grow 17.4% YoY in 2019E and 26.1% YoY in 2020E. With its A-share listing, we forecast that its EPS will grow 6.5% YoY in 2019E and 15.4% YoY in 2020E. We think its earnings growth is subject to upside risk, depending on its product and business development with the proceeds of its A-share listing.

**Attractive valuation**

We upgrade CRSC from **HOLD** to **ADD** and raise our TP from HK\$6.70 to HK\$7.20. Our TP reflects our 1) lowered EPS forecast due to earnings dilution from the new share issuance, and 2) raised target PER multiple from potential improvement in trading liquidity after the A-share issuance. Our TP is derived from a target PER multiple of 14x vs. its historical trading average forward PER of 12.5x.

Financial Summary	Dec-16A	Dec-17A	Dec-18A	Dec-19F	Dec-20F
Revenue (Rmbm)	29,402	34,434	39,844	46,565	55,187
Operating EBITDA (Rmbm)	4,133	4,666	4,977	6,062	7,315
Net Profit (Rmbm)	3,049	3,310	3,429	4,028	5,078
Normalised EPS (Rmb)	0.35	0.38	0.39	0.42	0.48
Normalised EPS Growth	9.7%	8.5%	3.6%	6.5%	15.4%
FD Normalised P/E (x)	15.72	14.48	13.97	13.12	11.37
DPS (Rmb)	0.10	0.15	0.20	0.17	0.19
Dividend Yield	1.83%	2.75%	3.67%	3.10%	3.52%
EV/EBITDA (x)	8.31	8.03	7.89	5.71	5.50
P/FCFE (x)	11.94	NA	35.18	34.76	30.06
Net Gearing	(63.3%)	(43.6%)	(30.6%)	(43.9%)	(39.9%)
P/BV (x)	2.21	2.00	1.66	1.38	1.28
ROE	15.1%	14.5%	13.0%	11.4%	11.7%
% Change In Normalised EPS Estimates					
Normalised EPS/consensus EPS (x)				0.88	0.87

SOURCES: CGIS RESEARCH, BLOOMBERG

**Figure 1: CRSC key revenue segment forecast**

Rmb m	2015	2016	2017	2018	2019E	2020E
Railway	15,703	16,762	16,606	18,373	21,680	26,016
Urban transit	3,930	5,920	7,208	9,360	12,168	15,818
Construction contracting	3,440	5,770	9,635	11,517	12,093	12,697
Other business	362	234	201	60	63	66
Overseas business	517	716	783	534	561	589
<b>Total</b>	<b>23,952</b>	<b>29,402</b>	<b>34,434</b>	<b>39,844</b>	<b>46,565</b>	<b>55,187</b>
<b>% of total</b>						
Railway	66%	57%	48%	46%	47%	47%
Urban transit	16%	20%	21%	23%	26%	29%
Construction contracting	14%	20%	28%	29%	26%	23%
Other business	2%	1%	1%	0%	0%	0%
Overseas business	2%	2%	2%	1%	1%	1%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
<b>% YoY chg</b>						
Railway	15.1%	6.7%	-0.9%	10.6%	18.0%	20.0%
Urban transit	103.7%	50.7%	21.7%	29.9%	30.0%	30.0%
Construction contracting	na	67.7%	67.0%	19.5%	5.0%	5.0%
Other business	-69.4%	-35.4%	-13.7%	-70.3%	5.0%	5.0%
Overseas business	-10.3%	38.3%	9.4%	-31.8%	5.0%	5.0%
<b>Total</b>	<b>38.2%</b>	<b>22.8%</b>	<b>17.1%</b>	<b>15.7%</b>	<b>16.9%</b>	<b>18.5%</b>

SOURCES: CGIS RESEARCH, COMPANY DATA

**Figure 2: CRSC new contract wins**

Rmb m	2014	2015	2016	2017	2018	1Q19
Railway	13,670	14,600	15,775	17,320	25,080	3,978
Urban transit	3,209	9,920	7,764	10,910	11,610	1,857
Overseas	717	1,130	2,768	2,700	950	130
Construction contracting	12,816	12,170	23,173	29,800	29,850	1,515
Smart city	0	0	0	0	800	0
<b>Total</b>	<b>30,413</b>	<b>37,820</b>	<b>49,480</b>	<b>60,730</b>	<b>68,290</b>	<b>7,480</b>
<b>% of total</b>						
Railway	45%	39%	32%	29%	37%	53%
Urban transit	11%	26%	16%	18%	17%	25%
Overseas	2%	3%	6%	4%	1%	2%
Construction contracting	42%	32%	47%	49%	44%	20%
Smart city	0%	0%	0%	0%	1%	0%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
<b>% YoY</b>						
Railway		6.8%	8.1%	9.8%	44.8%	22.5%
Urban transit		209.1%	-21.7%	40.5%	6.4%	14.4%
Overseas		57.6%	145.0%	-2.5%	-64.8%	282.4%
Construction contracting		-5.0%	90.4%	28.6%	0.2%	-1.4%
Smart city						
<b>Total</b>	<b>31.1%</b>	<b>24.4%</b>	<b>30.8%</b>	<b>22.7%</b>	<b>12.4%</b>	<b>16.1%</b>

SOURCES: CGIS RESEARCH, COMPANY DATA

**Figure 3: Earnings estimates: CGIS new vs. old and consensus**

2019E (Rmb m, Rmb)	Sales	EBIT	EBITDA	Net profit	EPS Adj	EPS GAAP
CGIS old	46,565	5,481	6,058	4,028	0.46	0.46
CGIS new	46,565	5,481	6,062	4,028	0.42	0.42
Consensus	46,675	5,175	5,903	4,233	0.47	0.48
<i>Diff%</i>						
CGIS new vs. consensus	-0.2%	5.9%	2.7%	-4.8%	-10.2%	-12.0%
CGIS new vs. old	0.0%	0.0%	0.1%	0.0%	-7.9%	-7.9%
2020E (Rmb m, Rmb)	Sales	EBIT	EBITDA	Net profit	EPS Adj	EPS GAAP
CGIS old	55,187	6,709	7,297	4,942	0.56	0.56
CGIS new	55,187	6,709	7,315	5,078	0.48	0.48
Consensus	53,910	6,070	6,887	4,974	0.55	0.53
<i>Diff%</i>						
CGIS new vs. consensus	2.4%	10.5%	6.2%	2.1%	-12.6%	-10.2%
CGIS new vs. old	0.0%	0.0%	0.3%	2.8%	-14.7%	-14.7%

SOURCES: CGIS RESEARCH, COMPANY DATA, BLOOMBERG

**Figure 4: CRSC's key shareholder structure before and after A-share listing**

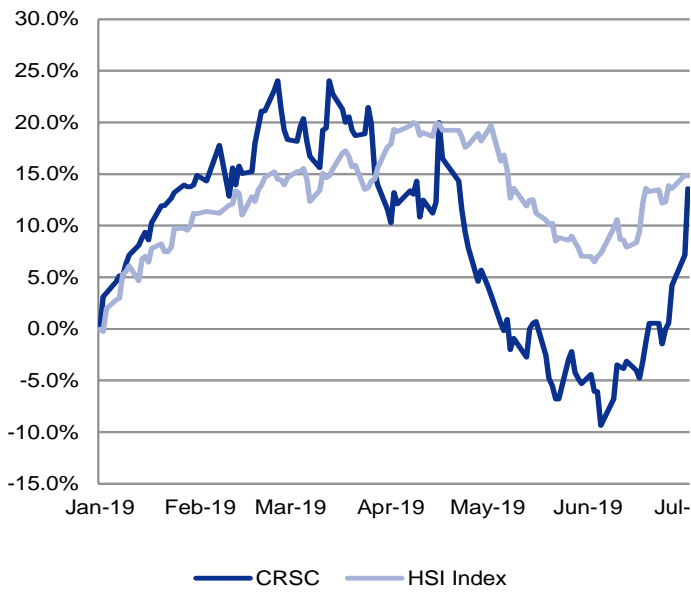
	Before	After
Parent company	75.14%	62.37%
China Chengtong	0.72%	0.60%
China Reform	0.72%	0.60%
Sinomach	0.72%	0.60%
CICC Jiacheng	0.30%	0.25%
A-share shareholders	0.00%	17.00%
Other H-share holders	22.40%	18.59%

SOURCES: CGIS RESEARCH, COMPANY DATA

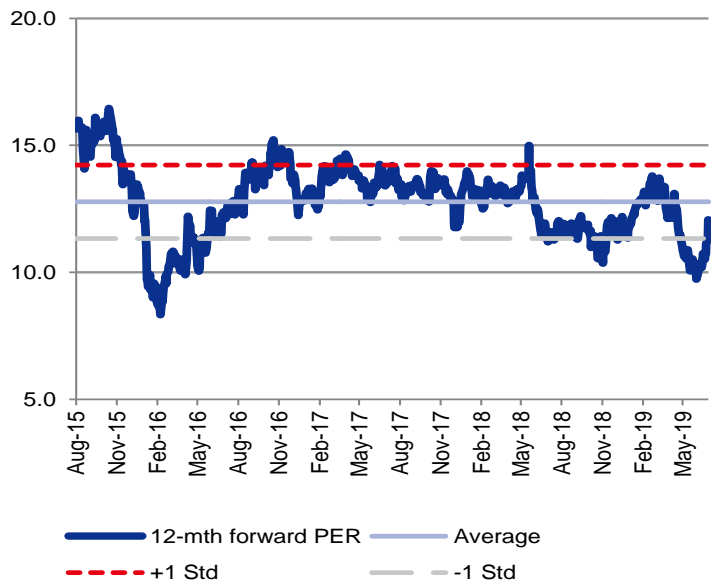
**Figure 5: Planned usage of proceeds from A-share listing**

	Total investment (Rmb m)	% of total
R&D of advanced and intelligent technology related to rail transportation, smart city and chips for uses in rail transportation etc	4,600	44%
Intelligent manufacturing base in Changsha	2,500	24%
IT	300	3%
Working capital	3,100	30%
<b>Total</b>	<b>10,500</b>	<b>100%</b>

SOURCES: CGIS RESEARCH, COMPANY DATA

**Figure 6: CRSC share price performance CYTD**


SOURCES: CGIS RESEARCH, BLOOMBERG

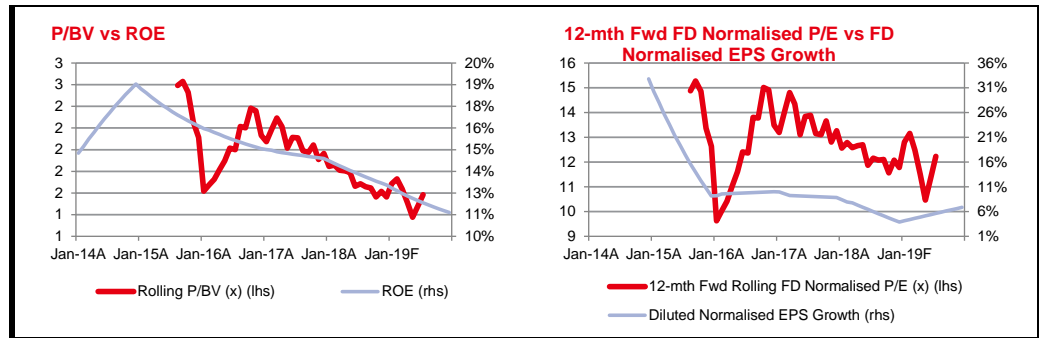
**Figure 7: CRSC 12-mth forward PER band**


SOURCES: CGIS RESEARCH, COMPANY DATA, BLOOMBERG

**Figure 8: Peer comparison**

Ticker	Mkt cap US\$ m	Price (tc)	PER			EPS growth			PEG		P/Bk		Dividend yield			ROE			
			2018	2019E	2020E	2018	2019E	2020E	2019E	2018	2019E	2020E	2018	2019E	2020E	2018	2019E	2020E	
<b>H-share rail transportation control system companies</b>																			
CRSC	3969 HK	6,971	6.19	14.0	13.1	11.4	3.6%	6.5%	15.4%	2.0	1.7	1.4	1.3	3.7%	3.1%	3.5%	13.0%	11.4%	11.7%
Bil Trans Tech	1522 HK	180	0.67	29.7	13.9	9.6	23.1%	114.0%	45.4%	0.1	0.6	0.6	0.6	1.5%	2.2%	3.1%	2.2%	4.5%	6.3%
<b>A-share railway control system and smart transportation system companies</b>																			
Henan Thinker Automatic Equipment	603508 CH	1,808	63.89	54.6	33.0	25.2	42.7%	65.4%	31.3%	0.5	3.8	4.1	3.7	0.6%	1.0%	1.2%	7.0%	12.4%	14.5%
China Transinfo Technology	002373 CH	3,755	17.38	32.2	25.4	20.4	63.6%	26.5%	24.6%	1.0	3.2	2.9	2.6	0.3%	0.6%	0.7%	10.0%	11.4%	12.6%
PCI-Suntek Technology	600728 CH	2,388	10.03	61.2	37.6	27.5	23.3%	62.8%	36.7%	0.6	4.5	4.1	3.6	0.6%	0.6%	0.4%	7.3%	11.0%	13.0%

SOURCES: CGIS RESEARCH, COMPANY DATA, BLOOMBER, Note: based on closing prices on 3 July 2019

**BY THE NUMBERS**

**Profit & Loss**

(Rmbm)	Dec-16A	Dec-17A	Dec-18A	Dec-19F	Dec-20F
<b>Total Net Revenues</b>	<b>29,402</b>	<b>34,434</b>	<b>39,844</b>	<b>46,565</b>	<b>55,187</b>
<b>Gross Profit</b>	<b>7,428</b>	<b>8,390</b>	<b>8,912</b>	<b>10,684</b>	<b>12,874</b>
<b>Operating EBITDA</b>	<b>4,133</b>	<b>4,666</b>	<b>4,977</b>	<b>6,062</b>	<b>7,315</b>
Depreciation And Amortisation	(510)	(513)	(519)	(581)	(607)
<b>Operating EBIT</b>	<b>3,624</b>	<b>4,153</b>	<b>4,458</b>	<b>5,481</b>	<b>6,709</b>
Financial Income/(Expense)	156	99	83	33	184
Pretax Income/(Loss) from Assoc.	36	34	57	59	61
Non-Operating Income/(Expense)	0	0	0	0	0
<b>Profit Before Tax (pre-EI)</b>	<b>3,816</b>	<b>4,286</b>	<b>4,599</b>	<b>5,574</b>	<b>6,954</b>
Exceptional Items					
<b>Pre-tax Profit</b>	<b>3,816</b>	<b>4,286</b>	<b>4,599</b>	<b>5,574</b>	<b>6,954</b>
Taxation	(625)	(773)	(803)	(973)	(1,214)
Exceptional Income - post-tax					
<b>Profit After Tax</b>	<b>3,191</b>	<b>3,513</b>	<b>3,796</b>	<b>4,601</b>	<b>5,740</b>
Minority Interests	(142)	(203)	(294)	(357)	(445)
Preferred Dividends			(72)	(216)	(216)
FX Gain/(Loss) - post tax					
Other Adjustments - post-tax					
Preference Dividends (Australia)					
<b>Net Profit</b>	<b>3,049</b>	<b>3,310</b>	<b>3,429</b>	<b>4,028</b>	<b>5,078</b>
Normalised Net Profit	3,191	3,513	3,796	4,601	5,740
<b>Fully Diluted Normalised Profit</b>	<b>3,049</b>	<b>3,310</b>	<b>3,429</b>	<b>4,028</b>	<b>5,078</b>

**Cash Flow**

(Rmbm)	Dec-16A	Dec-17A	Dec-18A	Dec-19F	Dec-20F
<b>EBITDA</b>	<b>4,133</b>	<b>4,666</b>	<b>4,977</b>	<b>6,062</b>	<b>7,315</b>
Cash Flow from Inv. & Assoc.					
Change In Working Capital	(1,497)	(5,065)	(5,652)	(3,166)	(3,728)
(Incr)/Decr in Total Provisions					
Other Non-Cash (Income)/Expense					
Other Operating Cashflow	804	149	2,912	0	0
Net Interest (Paid)/Received	156	99	83	33	184
Tax Paid	(662)	(735)	(734)	(973)	(1,214)
<b>Cashflow From Operations</b>	<b>2,935</b>	<b>(886)</b>	<b>1,586</b>	<b>1,956</b>	<b>2,557</b>
Capex	(926)	(1,252)	(759)	(837)	(1,037)
Disposals Of FAs/subsidiaries	20	62	0	0	0
Acq. Of Subsidiaries/investments	(384)	(490)	0	0	0
Other Investing Cashflow	1,713	(49)	117	0	0
<b>Cash Flow From Investing</b>	<b>422</b>	<b>(1,729)</b>	<b>(642)</b>	<b>(837)</b>	<b>(1,037)</b>
Debt Raised/(repaid)	657	821	418	400	400
Proceeds From Issue Of Shares	(188)	0	0	10,500	0
Shares Repurchased					
Dividends Paid	(943)	(879)	(1,318)	(1,758)	(1,788)
Preferred Dividends					
Other Financing Cashflow	(167)	(82)	2,522	0	0
<b>Cash Flow From Financing</b>	<b>(641)</b>	<b>(140)</b>	<b>1,622</b>	<b>9,142</b>	<b>(1,388)</b>
Total Cash Generated	2,716	(2,755)	2,566	10,262	132
<b>Free Cashflow To Equity</b>	<b>4,014</b>	<b>(1,794)</b>	<b>1,362</b>	<b>1,520</b>	<b>1,921</b>
<b>Free Cashflow To Firm</b>	<b>3,387</b>	<b>(2,563)</b>	<b>1,083</b>	<b>1,286</b>	<b>1,714</b>

SOURCES: CGIS RESEARCH, COMPANY DATA, BLOOMBERG

**BY THE NUMBERS... cont'd**

**Balance Sheet**

(Rmbm)	Dec-16A	Dec-17A	Dec-18A	Dec-19F	Dec-20F
Total Cash And Equivalents	15,521	12,879	11,552	21,814	21,946
Total Debtors	13,171	14,980	18,565	21,388	25,348
Inventories	3,243	3,330	4,087	4,740	5,590
Total Other Current Assets	9,658	17,938	31,171	36,083	42,169
<b>Total Current Assets</b>	<b>41,593</b>	<b>49,127</b>	<b>65,374</b>	<b>84,025</b>	<b>95,053</b>
Fixed Assets	3,755	4,335	4,616	4,938	5,427
Total Investments	632	1,003	1,006	1,065	1,127
Intangible Assets	738	635	682	666	656
Total Other Non-Current Assets	3,577	6,145	8,001	8,614	9,492
<b>Total Non-current Assets</b>	<b>8,702</b>	<b>12,118</b>	<b>14,304</b>	<b>15,283</b>	<b>16,702</b>
Short-term Debt	931	1,329	1,438	1,538	1,638
Current Portion of Long-Term Debt	0	0	0	0	0
Total Creditors	21,293	29,432	38,581	43,307	50,119
Other Current Liabilities	4,175	3,713	7,613	8,799	10,321
<b>Total Current Liabilities</b>	<b>26,399</b>	<b>34,474</b>	<b>47,632</b>	<b>53,644</b>	<b>62,078</b>
Total Long-term Debt	220	547	856	1,156	1,456
Hybrid Debt - Debt Component					
Total Other Non-Current Liabilities	0	0	0	0	0
<b>Total Non-current Liabilities</b>	<b>220</b>	<b>547</b>	<b>856</b>	<b>1,156</b>	<b>1,456</b>
Total Provisions	985	999	919	923	929
<b>Total Liabilities</b>	<b>27,605</b>	<b>36,020</b>	<b>49,406</b>	<b>55,723</b>	<b>64,462</b>
Shareholders' Equity	21,657	24,019	28,908	41,864	45,127
Minority Interests	1,034	1,206	1,364	1,721	2,166
<b>Total Equity</b>	<b>22,690</b>	<b>25,225</b>	<b>30,272</b>	<b>43,584</b>	<b>47,293</b>

**Key Ratios**

	Dec-16A	Dec-17A	Dec-18A	Dec-19F	Dec-20F
Revenue Growth	22.8%	17.1%	15.7%	16.9%	18.5%
Operating EBITDA Growth	15.8%	12.9%	6.7%	21.8%	20.7%
Operating EBITDA Margin	14.1%	13.6%	12.5%	13.0%	13.3%
Net Cash Per Share (Rmb)	1.63	1.25	1.05	1.81	1.78
BVPS (Rmb)	2.46	2.73	3.29	3.95	4.26
Gross Interest Cover	120.7	80.1	32.1	33.0	34.8
Effective Tax Rate	16.4%	18.0%	17.5%	17.5%	17.5%
Net Dividend Payout Ratio	28.8%	39.8%	51.3%	44.4%	40.0%
Accounts Receivables Days	120.2	124.3	128.1	130.9	129.4
Inventory Days	49.40	46.06	43.76	44.90	44.68
Accounts Payables Days	221.5	279.4	355.5	388.2	374.9
ROIC (%)	42.0%	35.9%	23.5%	19.6%	20.7%
ROCE (%)	16.7%	16.4%	15.3%	14.2%	14.4%
Return On Average Assets	6.66%	6.17%	5.30%	5.11%	5.31%

SOURCES: CGIS RESEARCH, COMPANY DATA, BLOOMBERG

## Technology - Others

### 3D sensing: A push by a leading player.

- Samsung will officially launch the Galaxy Note 10 on 7 Aug 2019 and based on current news flow. The Note 10 has Time of Flight (TOF) 3D sensing on both sides.
- Apple (structured light), Huawei, Samsung (S10), Oppo, LG and Xiaomi have adopted 3D sensing on one side. The Note 10 is likely to be the first phone with 3D sensing on both sides.
- Given the popularity of the under-display fingerprint design, there is concern about the development of the VCSEL supply chain. However, given the latest news flow, VCSEL will remain one of key trends in hardware development.
- The VCSEL supply chain will be a key beneficiary of the industry trend. For details, please refer to our previous updates on 02 Mar 2018 and 31 May 2018.
- We believe that Pentamaster [1665.HK] will be one of the HK-listed beneficiaries of development of the VCSEL supply chain.

### First handset with 3D sensing on both front and rear

According to industry news flow, Samsung will officially launch the Galaxy Note 10 (its flagship model) in New York on 7 Aug 2019. Samsung has recently filed a trademark for the name "DepthVision Lens" under Class 9, which covers things such as smartphone cameras, 3D scanning and smartphone camera software. The market is speculating that the Galaxy Note 10 will adopt the DepthVision Lens for implementation of ToF 3D sensing. News reports also suggest that the Galaxy Note 10 will adopt ToF 3D sensing on both front and rear. Recall that Apple (structured light), Huawei P30 Pro, Samsung S10 5G, Oppo RX17 Pro, Honor View 20 and LG G8 ThinQ adopted 3D sensing on one side. The Galaxy Note 10 is likely to be the first model with 3D sensing on both front and back. Samsung has also applied for a trademark for "Make and Play 3D", which specifically mentions the ToF sensor, which leads us to believe that Samsung is likely to launch the app (3D crafting) during the launch of the Galaxy Note 10.

Apart from ToF 3D sensing, the Galaxy Note 10 series is expected to adopt the Exynos 9825 processor with 12G RAM and feature a 25w fast-charging port, UFS 3.0 storage, 12MP primary, 12MP telephoto and a 16MP ultra wide-angle lens in the Pro model, a fingerprint reader, and a 4,170mAh battery. The Galaxy Note 10 camera is expected to feature a three-step variable aperture setting, which enables it to churn out better pictures in low light conditions and also crank out better portrait shots. Two screen sizes will be available: a 6.8" Dynamic AMOLED for the Pro model, and a 6.4" display and no 3.5mm headphone jack for the regular Galaxy Note 10, which is also expected to feature super-thin bezels and Sound on Display technology. The Galaxy Note is expected to support 5G transmission.

### What is ToF?

ToF measures the distance between a sensor and an object by calculating the time it takes IR light to travel from the sensor to an object and reflect back to the sensor. ToF technique has several advantages: for example, it has a high frame rate, it is good at capturing moving objects, and it does not need diffraction optical elements (DOE) or a collimator. However, there are some major limitations to ToF: a) ToF cameras have low spatial resolution due to extra processing at the sensor level; b) since ToF is an active optical measurement technique, it consumes more power than stereo vision; and c) the image resolution of a ToF camera is relatively low. The TrueDepth camera set-up on iPhones uses 30,000 points to develop the 3D face matrix, while ToF cameras use a sensor and auxiliary light kit that can detect and map up to 300,000 points at a distance of about 10 feet. There is limited information on Samsung's Galaxy Note 10 ToF module. Based on our understanding, Vixar (acquired by Osram in 2018) is the VCSEL solution supplier. VPEC will be the Epiwafer supplier for Vixar. Market rumours suggest that MCNEX and Patron are ToF module suppliers for the Samsung Note 10.

### Long-term development trend

Given popularity of the under-display fingerprint design, there is concern about the development of the VCSEL supply chain. However, given latest news flow, VCSEL will remain one of key trends in hardware development (increasing adoption by handset brands and breakthroughs in other areas such as industrial and auto). The VCSEL supply chain, including Epiwafers, foundries, IDM, fabless and equipment makers, will be the key beneficiaries of this industry trend. We believe that names such as ams, Osram, VPEC, WINS and Lumentum will be treated as key beneficiaries of the development of the VCSEL supply chain. The market might also treat optical names such as Sunny Optical [2382.HK] as beneficiaries. We maintain the view that Pentamaster [1665.HK] will be one of the HK-listed beneficiaries of the development of the VCSEL supply chain

#### Analysts

**Mark Po**

T (852) 3698 6318

E markpo@chinastock.com.hk

**Wong Chi Man**

T (852) 3698 6317

E cmwong@chinastock.com.hk



Figure 1: VCSEL Structure and VCSEL vs LED and EEL.

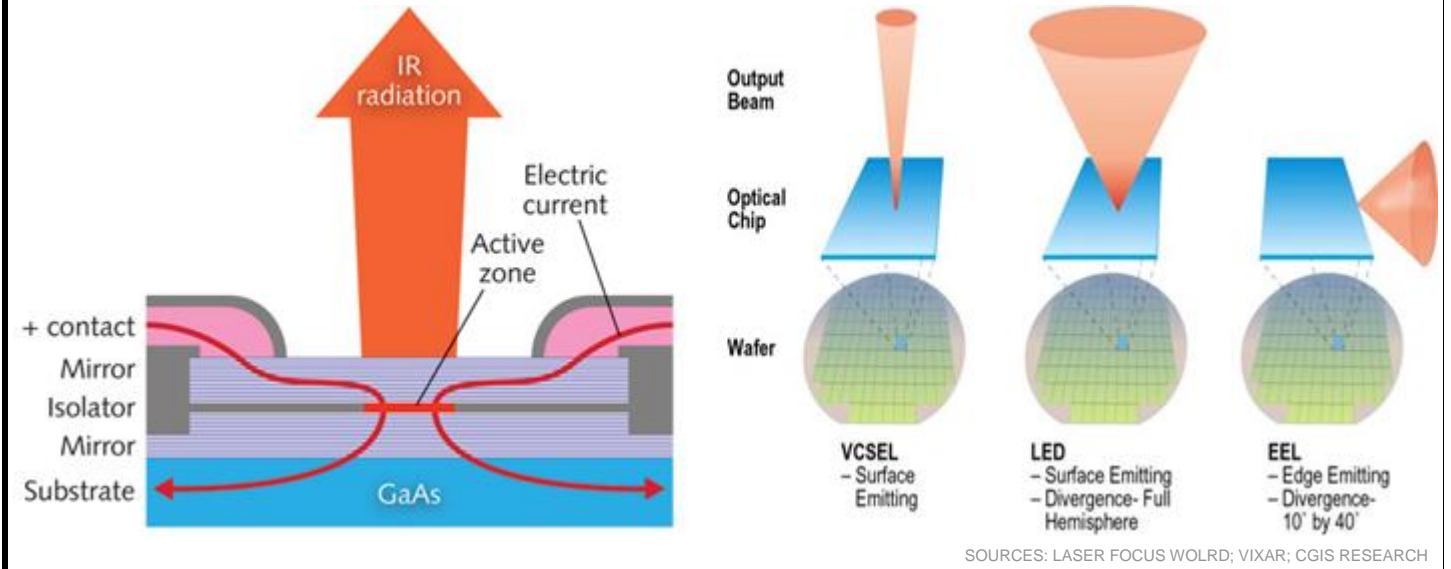
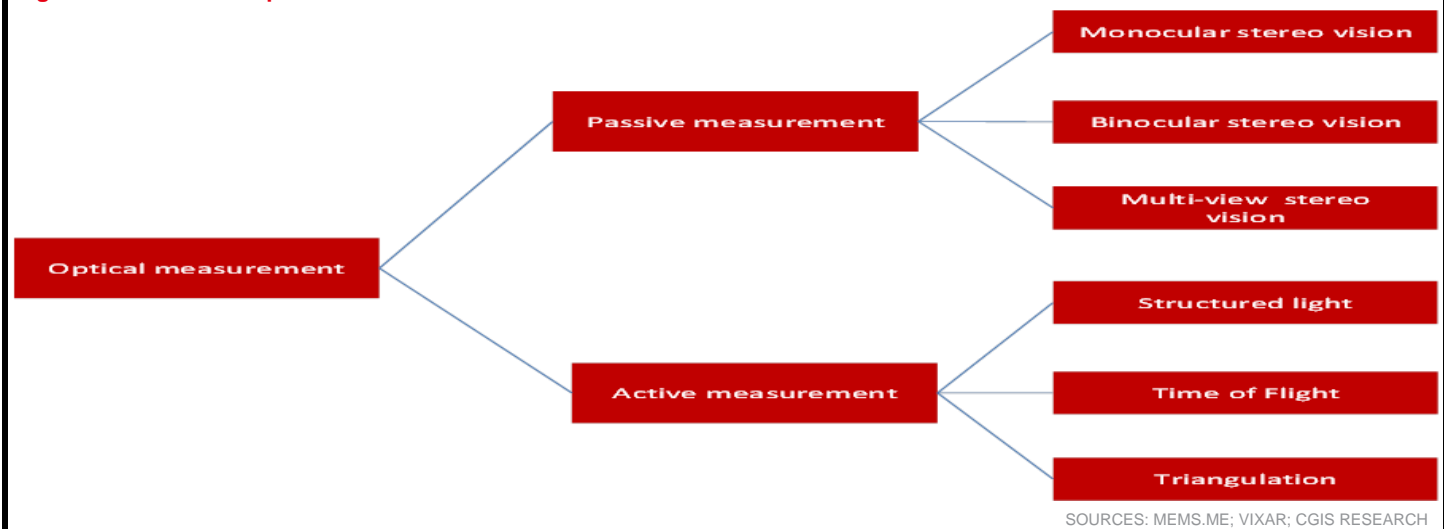


Figure 2: Comparison of stereo vision, structured light and ToF

Considerations	Stereo Vision	Structured Light	Time of Flight
Algorithm complexity	High	Mid	Low
Depth Accuracy	Low	High	Mid
Material costs	Low	High	Mid
Responding speed	Mid	Slow	Fast
Performance at low-light environment	Weak	Good	Good
Performance at bright-light environment	Good	Weak	Good
Power Consumption	Low	Mid	Scalable
Range	Limited	Scalable	Scalable
Applications			
Game		Yes	Yes
3D Movies	Yes		
3D Scanning		Yes	Yes
User Interface Control			Yes
AR	Yes		Yes

SOURCES: TEXAS INSTRUMENT; CGIS RESEARCH

Figure 3: Structure of optical measurement methods



**Disclaimer**

This research report is not directed at, or intended for distribution to or used by, any person or entity who is a citizen or resident of or located in any jurisdiction where such distribution, publication, availability or use would be contrary to applicable law or regulation or which would subject China Galaxy International Securities (Hong Kong) Co., Limited ("Galaxy International Securities") and/or its group companies to any registration or licensing requirement within such jurisdiction.

This report (including any information attached) is issued by Galaxy International Securities, one of the subsidiaries of the China Galaxy International Financial Holdings Limited, to the institutional clients from the information sources believed to be reliable, but no representation or warranty (expressly or implied) is made as to their accuracy, correctness and/or completeness.

This report shall not be construed as an offer, invitation or solicitation to buy or sell any securities of the company(ies) referred to herein. Past performance should not be taken as an indication or guarantee of future performance, and no representation or warranty, express or implied, is made regarding future performance. The recipient of this report should understand and comprehend the investment objectives and its related risks, and where necessary consult their own independent financial advisers prior to any investment decision.

Where any part of the information, opinions or estimates contained herein reflects the personal views and opinions of the analyst who prepared this report, such views and opinions may not correspond to the published views or investment decisions of China Galaxy International Financial Holdings Limited, its subsidiaries and associate companies ("China Galaxy International"), directors, officers, agents and employees ("the Relevant Parties").

All opinions and estimates reflect the judgment of the analyst on the date of this report and are subject to change without notice. China Galaxy International and/or the Relevant Parties hereby disclaim any of their liabilities arising from the inaccuracy, incorrectness and incompleteness of this report and its attachment/s and/or any action or omission made in reliance thereof. Accordingly, this report must be read in conjunction with this disclaimer.

**Disclosure of Interests**

China Galaxy Securities Co., Ltd. (6881.HK; 601881.CH) is the direct and/or indirect holding company of the group of companies under China Galaxy International Financial Holdings Limited. China Galaxy International may have financial interests in relation to the subjected company(ies)' securities in respect of which are reviewed in this report, and such interests aggregate to an amount may equal to or less than 1% of the subjected company(ies)' market capitalization unless specified otherwise.

One or more directors, officers and/or employees of China Galaxy International may be a director or officer of the securities of the company(ies) mentioned in this report.

China Galaxy International and the Relevant Parties may, to the extent permitted by law, from time to time participate or invest in financing transactions with the securities of the company(ies) mentioned in this report, perform services for or solicit business from such company(ies), and/or have a position or holding, or other material interest, or effect transactions, in such securities or options thereon, or other investments related thereto.

Galaxy International Securities may have served as manager or co-manager of a public offering of securities for, or currently may make a primary market in issues of, any or all of the entities mentioned in this report or may be providing, or have provided within the last 12 months, significant advice or investment services in relation to the investment concerned or a related investment or investment banking services to the company(ies) mentioned in this report.

Furthermore, Galaxy International Securities may have received compensation for investment banking services from the company(ies) mentioned in this report within the preceding 12 months and may currently seeking investment banking mandate from the subject company(ies).

China Galaxy International has procedures in place to eliminate, avoid and manage any potential conflicts of interests that may arise in connection with the production of research reports. The research analyst(s) responsible for this report operates as part of a separate and independent team to the investment banking function of Galaxy International Securities and procedures are in place to ensure that confidential information held by either the research or investment banking function is handled appropriately.

**Analyst Certification**

The analyst who is primarily responsible for the content of this report, in whole or in part, certifies that with respect to the securities or issuer covered in this report: (1) all of the views expressed accurately reflect his or her personal views about the subject, securities or issuer; and (2) no part of his or her compensation was, is, or will be, directly or indirectly, related to the specific views expressed by the analyst in this report.

Besides, the analyst confirms that neither the analyst nor his/her associates (as defined in the code of conduct issued by The Hong Kong Securities and Futures Commission) (1) have dealt in or traded in the securities covered in this research report within 30 calendar days prior to the date of issue of this report; (2) will deal in or trade in the securities covered in this research report three business days after the date of issue of this report; (3) serve as an officer of any of the Hong Kong-listed companies covered in this report; and (4) have any financial interests in the Hong Kong-listed companies covered in this report.

We are transferring the rating mechanism from "BUY, SELL, HOLD" to "ADD, REDUCE, HOLD". Please refer to the definitions below.

**Explanation on Equity Ratings (Existing mechanism (will be replaced by new mechanism by 01/09/19))**

- BUY : share price will increase by >20% within 12 months in absolute terms  
SELL : share price will decrease by >20% within 12 months in absolute terms  
HOLD : no clear catalyst, and downgraded from BUY pending clearer signal to reinstate BUY or further downgrade to outright SELL

**Explanation on Equity Ratings (New mechanism)**

- ADD : The stock's total return is expected to exceed 10% over the next 12 months.  
REDUCE : The stock's total return is expected to fall below 0% or more over the next 12 months.  
HOLD : The stock's total return is expected to be between 0% and positive 10% over the next 12 months.

**Copyright Reserved**

No part of this material may be reproduced or redistributed without the prior written consent of China Galaxy International Securities (Hong Kong) Co., Limited.

China Galaxy International Securities (Hong Kong) Co. Limited, CE No.AXM459

20/F, Wing On Centre, 111 Connaught Road Central, Sheung Wan, Hong Kong. General line: 3698-6888.