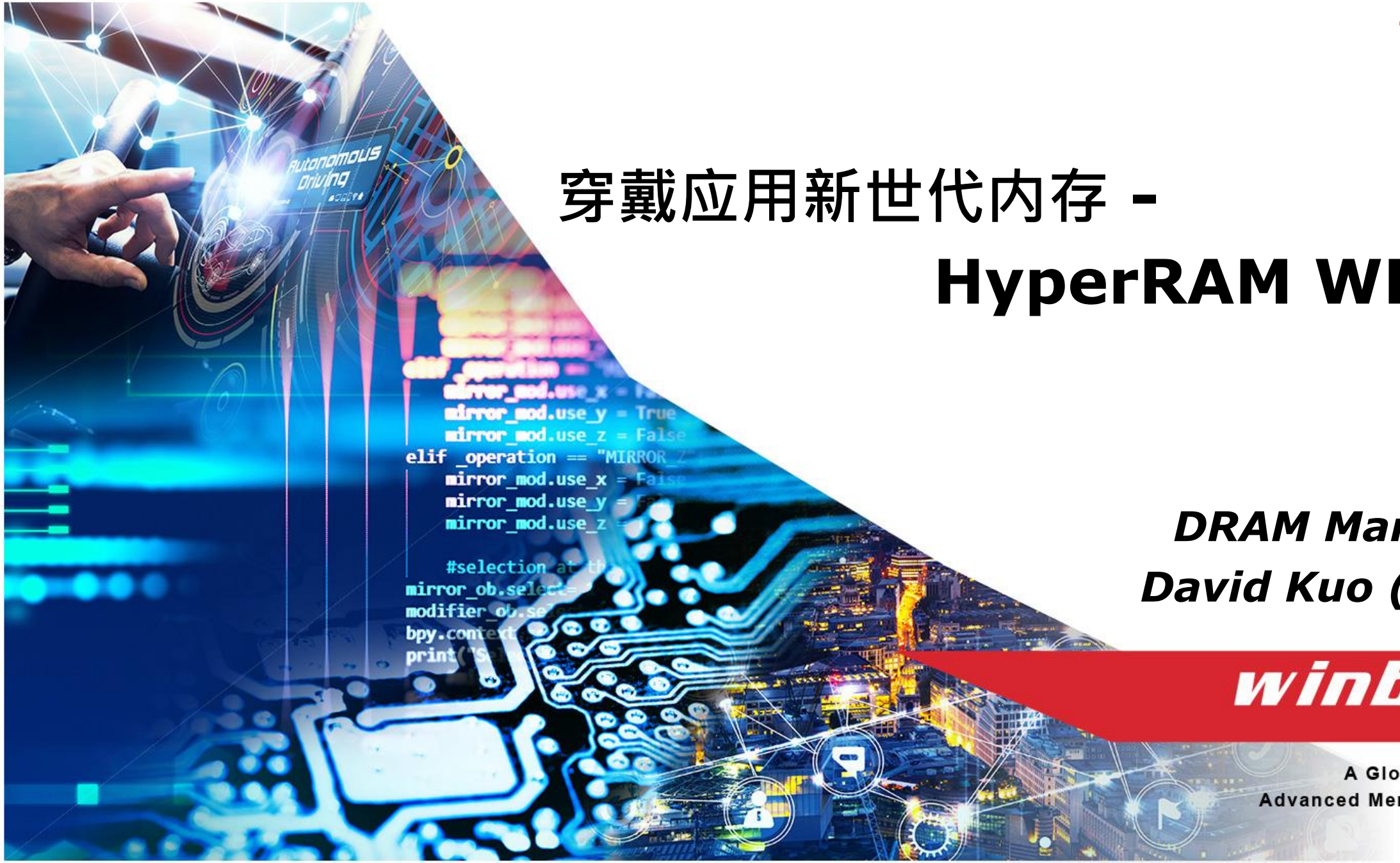
2022

穿戴应用新世代内存 -
HyperRAM WLCSP



DRAM Marketing
David Kuo (郭仲祺)

winbond
We Deliver

A Global Supplier of
Advanced Memory Solutions

穿戴应用市场概述

◆2021市场

- ◆全球出貨量 - 533.6 million.
- ◆年成长 - 20%.

Top 5 Wearable Device Companies (shipments in millions)

Company	2021 Shipments	2021 Market Share	2020 Shipments	2020 Market Share	Year-Over-Year Growth
Apple	161.8	30.3%	151.5	34.1%	6.8%
Xiaomi	54.4	10.2%	50.8	11.4%	7.1%
Samsung	48.1	9.0%	40.1	9.0%	20.1%
Huawei	42.7	8.0%	34.0	7.6%	25.6%
Imagine Marketing	26.8	5.0%	10.2	2.3%	163.4%
Others	199.9	37.5%	158.2	35.6%	26.3%
Total	533.6	100%	444.7	100%	20%

资料来源: IDC 国际数据资讯

◆市场主流

- ◆产品型态:



- ◆前五大市占 > 60%
- ◆智能手机延伸应用

◆市场新应用

- ◆快速成长: 2021 Q4季成长率 94.1%
- ◆产品型态:

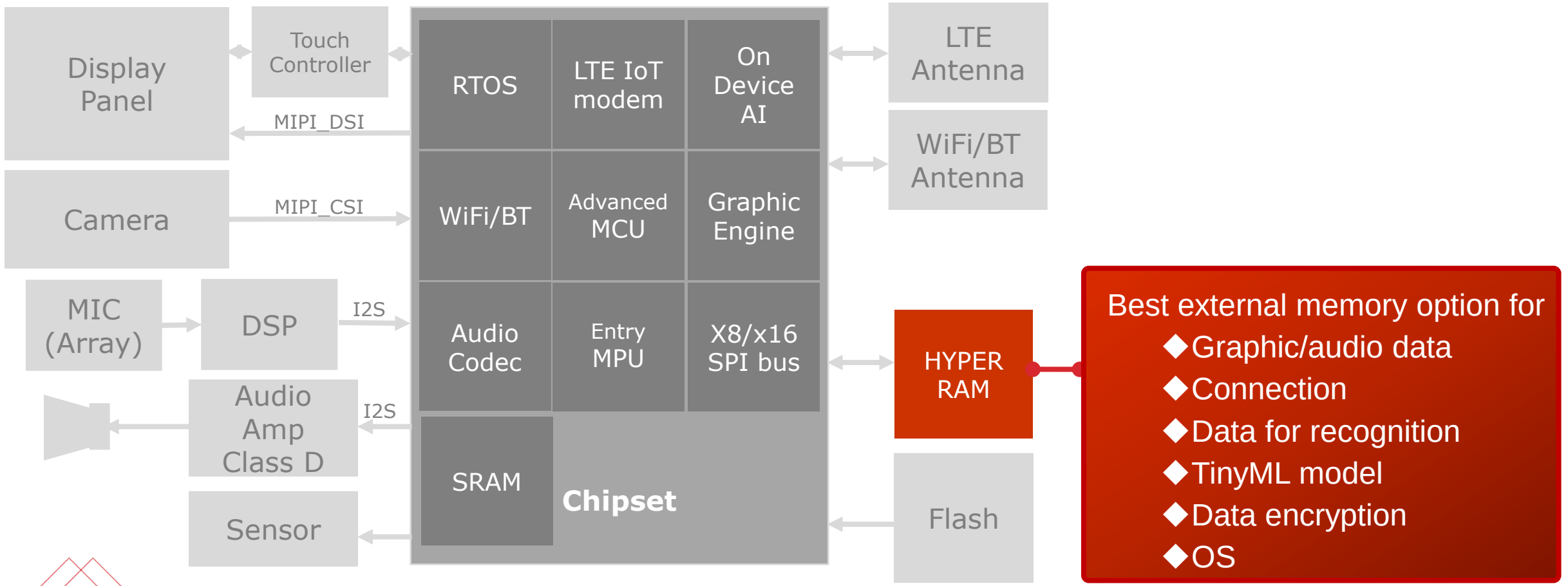


穿戴产品应用趋势

应用	卫生保健	健身	医疗	工业	应用场景多元化 用户体验直觉化
产品	手表	手环	耳機	眼镜	主流延续市智能手机 新产品爆发成长
	服饰	珠宝			
功能	心跳	血压	血氧	体温	长效，串联功能，装置互联形成直觉应用场景
	海拔高度	速度	定位	湿度	
	语音控制	语音辨识	物体侦测	图像控制	
	加密	认证	无线传输	支付	
零件組成	芯片	传感器	内存	电池	微处理器功能增强 内存需求增大
	天线	显示屏	麦克风		

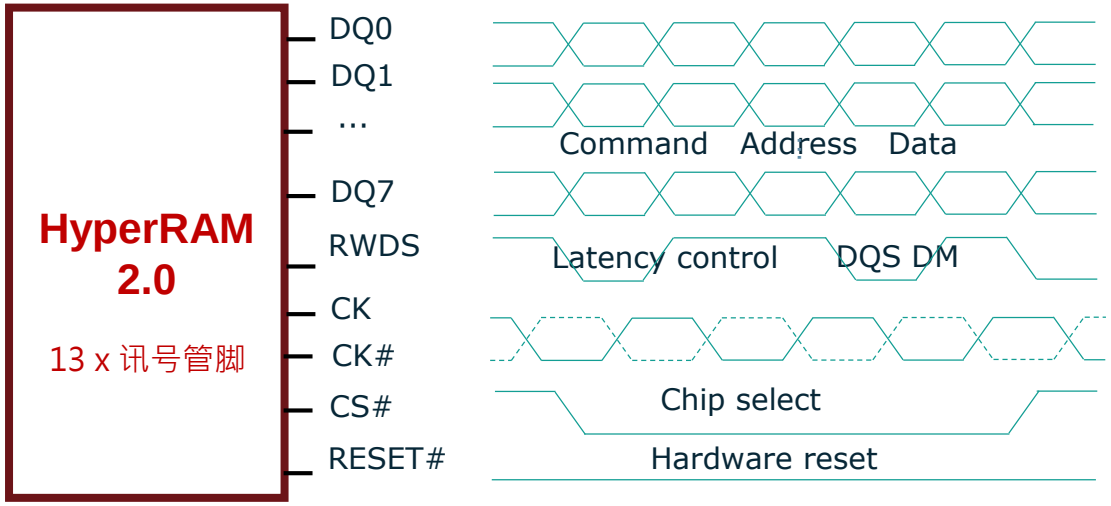
穿戴应用的动态存储器新選項

- 因应穿戴装置演进, 外接缓存器数据带宽与容量需求也持续成长
- 穿戴装置的外接随机存储器的考虑:低功耗, 小型封装, 适用于新世代高效能微处理器



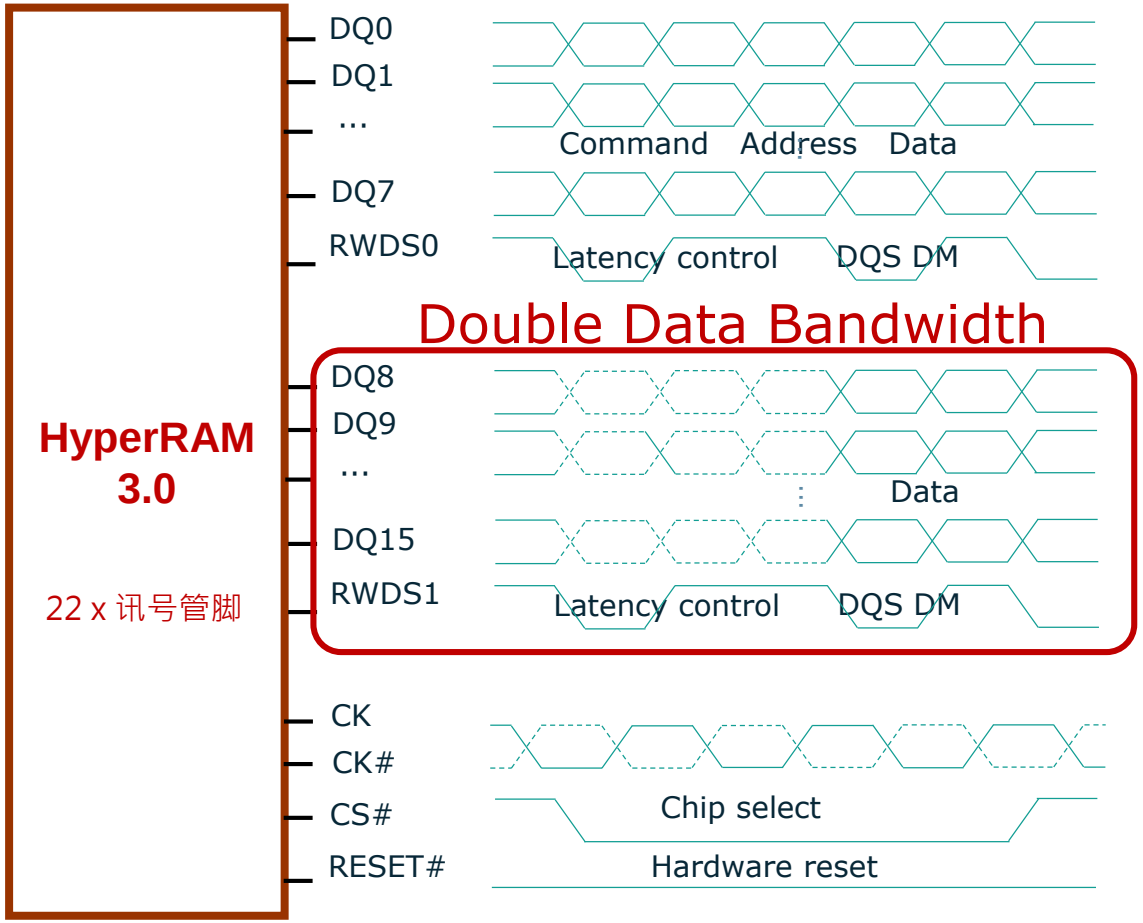
HyperRAM Function Brief

HyperRAM 2.0



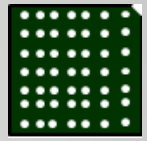
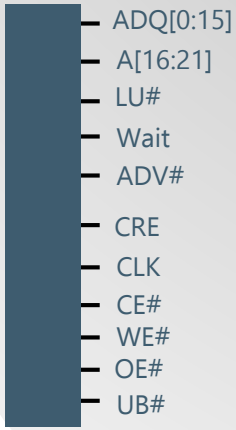
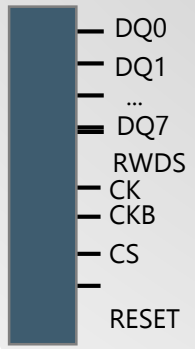
- Octal IO bus for address/command/data.
- Data read/write for memory access, register read/write for setting/control via SPI interface.

HyperRAM 3.0



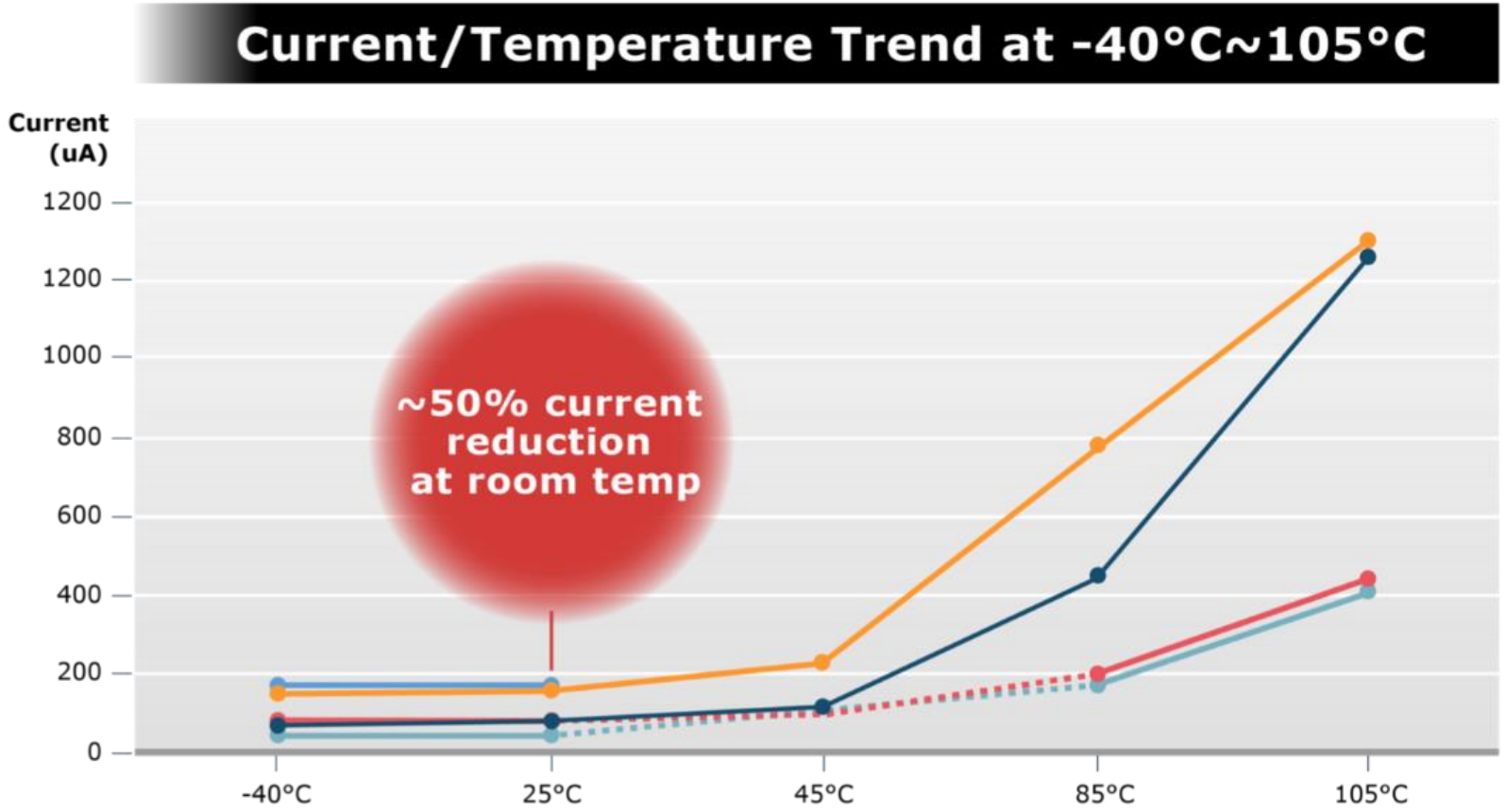
- Hex IO bus for data with double bandwidth; Octal IO bus for address/command/data
- Same command/address signal with HyperRAM 2.0

CellularRAM vs HyperRAM Comparison

	CellularRAM	HyperRAM
Form Factor	 64Mb WFBGA49: • 4mm * 4mm • Ball pitch 0.5mm	 WLCSP: Die/device level dimension • 256Mb: 30 ball <3mm*2.5mm • 64Mb: 15 ball <2mm*1.5mm
Power @ Room Temp.	Operation power: 45mW@1.8V Standby power: 170uW@1.8V	Operation power: 27mW@1.8V Standby power: 145uW@1.8V **Hybrid Sleep Mode: 45uW@1.8V**
Signal Pin Counts	 31 signal pads for address, data, command 16 bits data bus Up to 166Mbps per IO SDR	 HyperRAM 2.0: 13 signal pads with 8 bits data bus HyperRAM 3.0: 22 signal pads with 16 bits data bus Up to 400Mbps per IO DDR Hybrid sleep mode

HyperRAM Standby / HSM Current

- **Standby power reduction**
  - Up to 50% current reduction with HSM
  - Save more at room temp.
  - DRAM refresh rate change by temperature. A change point is set at 45C, so the current at high temp will be bigger, but will still have at least 16% current reduction at 85C.



	-40°C	25°C	45°C	85°C	105°C
64Mb pSRAM-stand by	76	77	—	—	—
64Mb HyperRAM-stand by	33	35	—	92	221
64Mb HyperRAM-HSM	14	15	—	77	197
256Mb HyperRAM-stand by	67	72	108	382	650
256Mb HyperRAM-HSM	27	31	50	217	632

HyperRAM WLCSP – Design & Process

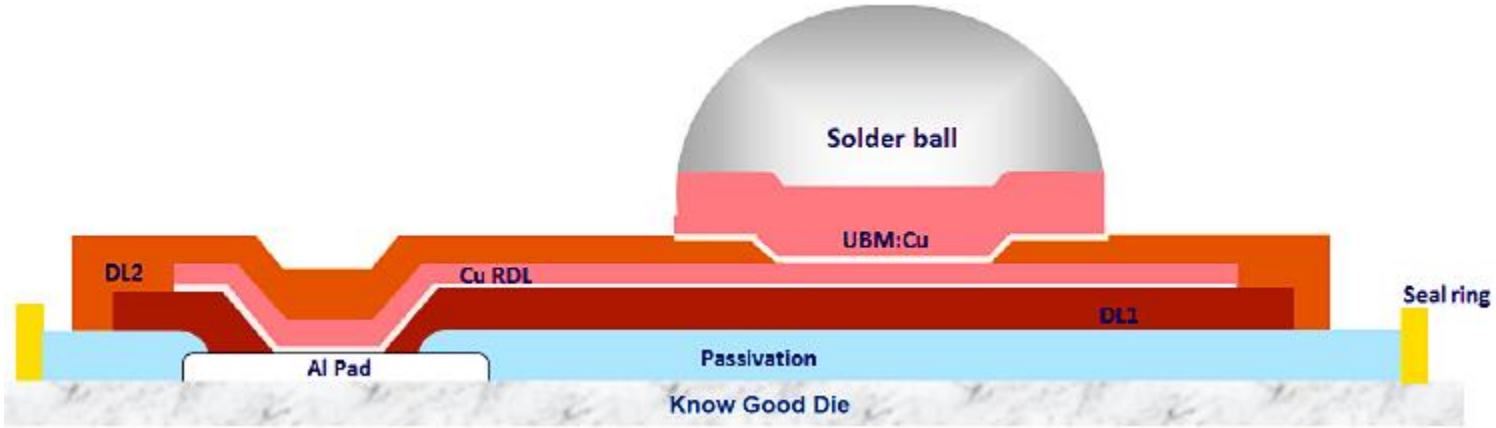
- HyperRAM WLCSP is the package type based on the extension of the wafer fab process.



- Characteristics:
  - Minimum package dimension: Device/die level
  - Good signal integrity: limited trace length from device/die to solder ball.
  - Cost effective: keep process/material simple.



WLCSP Bottom View



WLCSP Cross-section

HyperRAM Success Story in Wearable

	2021	2022
ambiq	Apollo4	Apollo4 plus
winbond We Deliver	HyperRAM 2.0 WLCSP 256Mb	HyperRAM 3.0 WLCSP 256Mb
	Mass Production	Validation Done

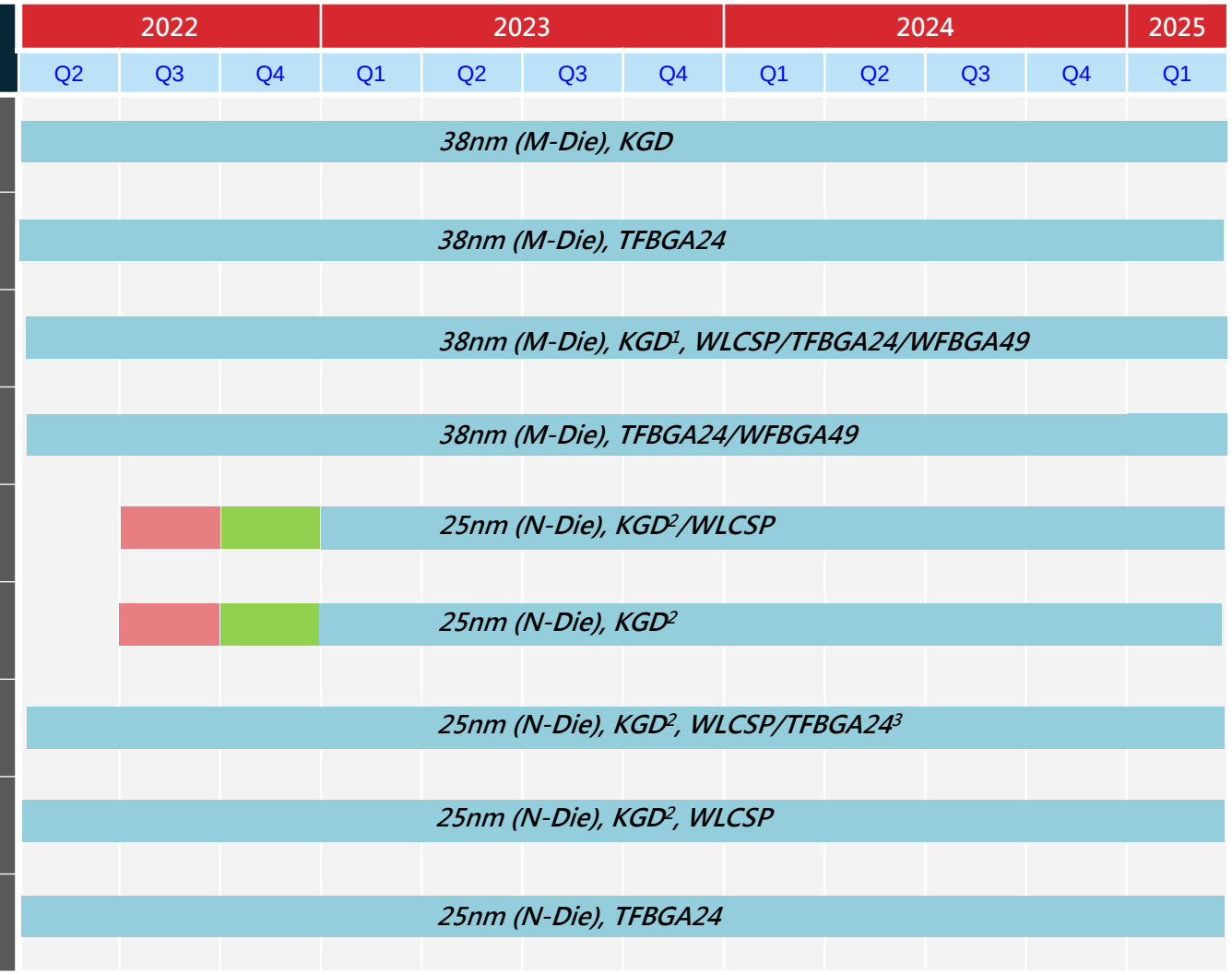


Winbond HyperRAM



Winbond HyperRAM™ Roadmap

Density	Product	Description
32 Mb	W955D8MK	x8 1.8V 333Mbps(DDR)
32Mb	W955K8MB W955N8MB	x8 1.8V or 3V 400Mbps, DDR
64 Mb	W956D8MB W956A8MB	x8 1.8V or 3V 400Mbps, DDR
128 Mb	W957D8MF W957A8MF	x8, DDP 1.8V or 3V 400Mbps, DDR
128Mb	W957D8NK W957D8NW	X8 1.8V [4] 400Mbps(DDR)
128Mb	W957D6NK	X16 1.8V [4] 400Mbps(DDR)
256 Mb	W958D8NB	x8 1.8V 400Mbps(DDR)
256Mb	W958D6NW	x16 1.8V 400Mbps(DDR)
512 Mb	W959D8NF	x8, DDP 1.8V 400Mbps(DDR)



Note

1: Up to 500Mbps for KGD
2: Up to 500Mbps for KGD
3: Up to 500Mbps for TFBGA24
4. For lower VDD, contact marketing

ES CS MP

Winbond Confidential

2022

穿戴应用新世代内存 -
Flash for Wearable



China Marketing
Forest(朱迪)

winbond
We Deliver

A Global Supplier of
Advanced Memory Solutions

Winbond Flash Portfolio

Product	Serial NOR Flash			QspiNAND Flash		SLC NAND Flash		Octal Flash
Voltage /Density	3V	1.8V	1.2V	3V	1.8V	3V	1.8V	1.8V
8Gb						W29N08GV	W29N08GZ/W	
4Gb				W25N04KV	**W25N04KW**	W29N04GV	W29N04GZ/W W29N04KZ	W35N04JW(Q4'22)
2Gb	W25Q02JV	W25Q02NW		W25N02KV	**W25N02KW**	W29N02GV W29N02KV	W29N02GZ/W W29N02KZ	W35T02NW(Q2'23) W35N02JW(Q3'22)
1Gb	W25Q01JV	W25Q01NW		W25N01KV W25N01GV	**W25N01GW**	W29N01HV	W29N01HZ/W	W35T01NW(Q1'23) W35N01JW(Q3'22)
512Mb	W25Q/R512JV	W25Q512NW		W25N512GV	**W25N512GW**			W35T512NW(Q4'22)
256Mb	W25Q/R256JV	**W25Q256JW**	W25Q256NE(Q2'23)					
128Mb	W25Q/R128JV	**W25Q128JW**	W25Q128NE(Q1'23)					
64Mb	W25Q/R64JV	**W25Q64JW**	**W25Q64NE**					
32Mb	W25Q32JV	**W25Q32JW**	W25Q32NE(Q3'23)					
16Mb	W25Q16JV	25Q16JW	W25Q16NE(Q4'23)					
8Mb	W25Q80JV W25Q80DV	25Q80EW	W25Q81NE(Q1'24)					
4Mb	W25X40CL W25Q40CL	25Q40EW						
2Mb	W25X20CL W25Q20CL	25Q20EW						

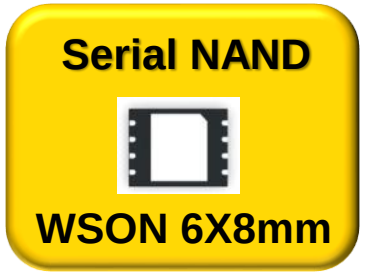
Ideal for Wearable

Note: Roadmaps are subject to change.

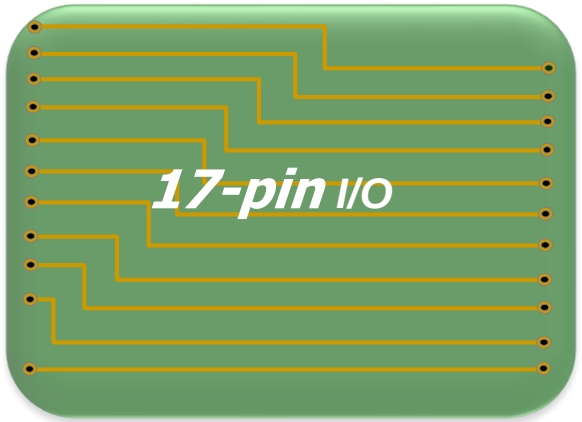
QSPI NAND for Smart Watch 更大容量







Reduce 80% Package Size







Reduce 65% Routing Area





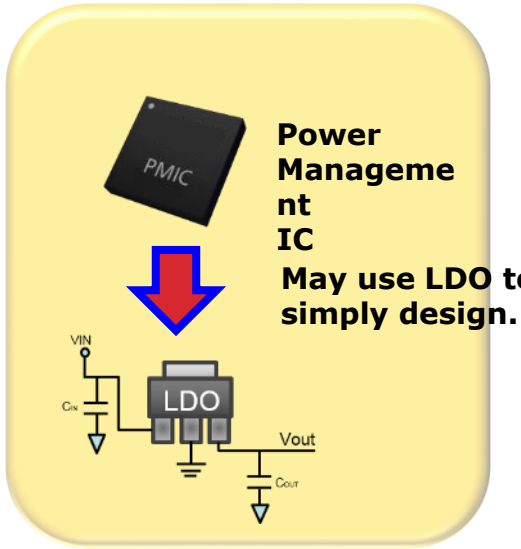


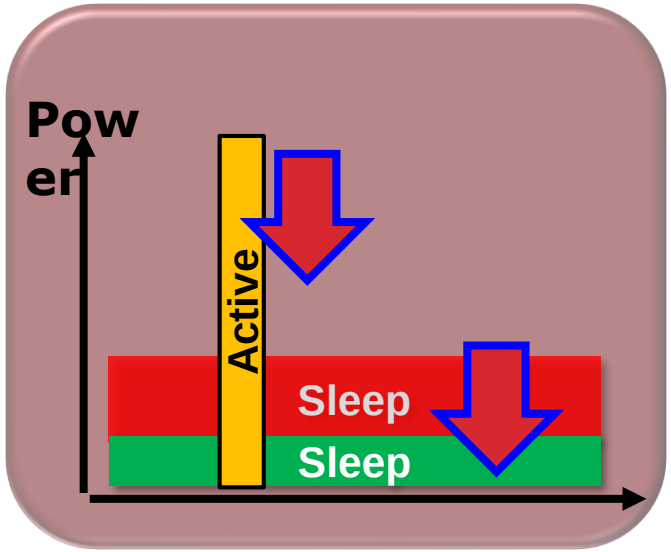
Simplify I/O interface

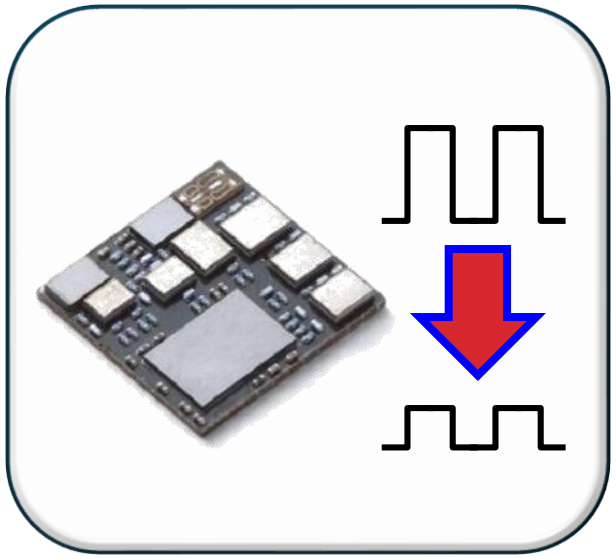


- 容量:
  - 1/ 2/ 4Gbit
  - 512Mbit
- 封装
  - WSON8*6
  - WLCSP (512Mb)

1.2V Serial NOR Flash 更低功耗

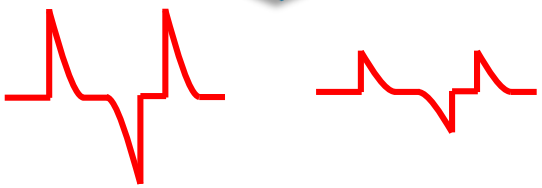










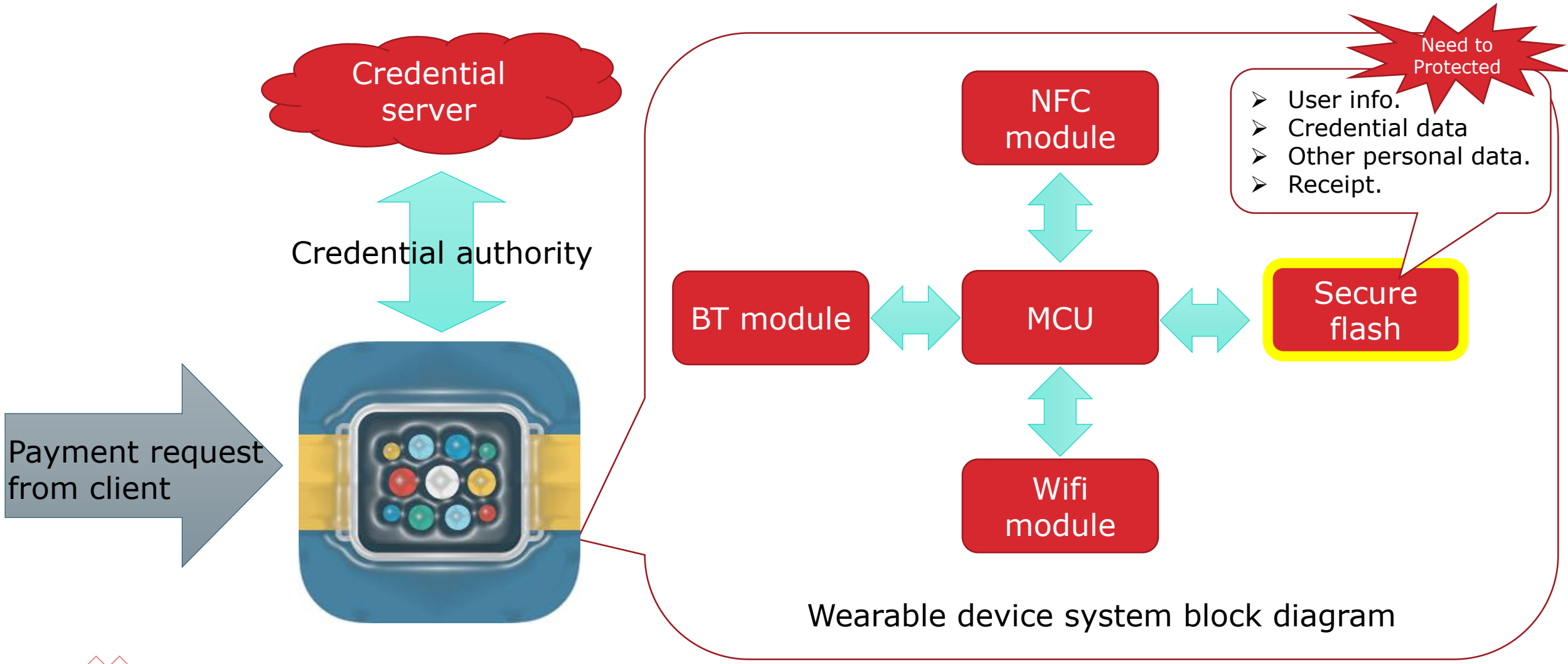


Reduce BOM Cost

Reduce Power Consumption

Reduce Noise Coupling

W77Q Secure Flash for Mobile Payment 更安全





Thank You

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