

助力家电高效智能 英飞凌产品全景

田斌
英飞凌科技工业功率控制事业部

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英飞凌是您在电气化和数字化方面的合作伙伴



全球十大
半导体公司之一

约50,280名
员工*

电气化

- › CO₂ 节能
- › 能源效率
- › 节约成本

数字化

- › 生产力
- › 舒适度
- › 新的使用案例

9%+ | 19% | 13%

目标运营模式**

* 截至2021年9月30日

** 营收同比增长9%以上；运营利润率19%；投资占销售额的比例13%；随着赛普拉斯整合过程的推进，将逐渐达成目标

工业功率控制事业部对于家电市场持续的投入



工业驱动

- › 通用变频
- › 中压变频
- › 伺服
- › 电梯



家电

- › 冰箱
- › 空调
- › 洗衣机
- › 小家电



可再生能源

- › 风电
- › 太阳能
- › 高压直流输电



牵引

- › 高铁
- › 机车
- › 地铁
- › 轻轨



中国变频大家电市场高速增长,出货数量1.56亿台, 同比年增长 35%.

财年2021预测 (2020/09-2021/10)	家用空调	洗衣机	冰箱
Overall Shipment	147mu +6% YoY	69mu +13% YoY	93mu +16% YoY
Inverter Shipment	101mu +52% YoY	31mu +22% YoY	31mu +36% YoY
Inverterization %	69% 48% FY-1	45% 42% FY-1	36% 29% FY-1
	<ul style="list-style-type: none"> 由于国家家用空调新能效标准的执行, 国内家用空调变频率已经达到97%, 导致中国家用变频空调出货数量(含外销) 预计超过1亿台 	<ul style="list-style-type: none"> 由于更高的变频率, 中国家用变频洗衣机市场稳步成长 	<ul style="list-style-type: none"> 由于宅经济对冰箱升级的需求、疫情导致海外订单回流中国、价值消费升级导致变频率的进一步提高, 中国变频冰箱市场预计成长36%, 出货超过3100万台

Source: China IOL as of June 2021

家电应用趋势-绿色、智能、健康

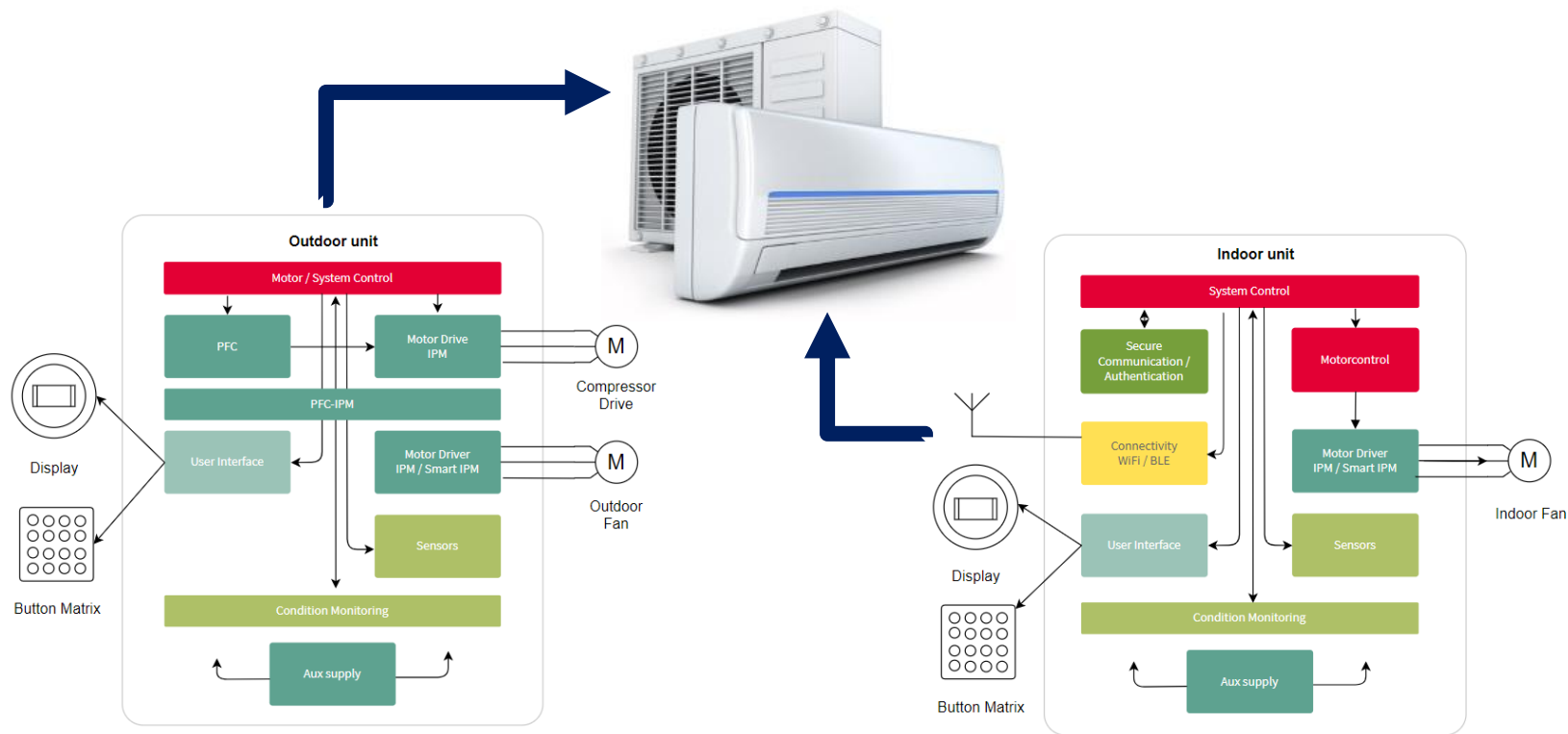


RAC	W/M	Fridge
<ul style="list-style-type: none"> › 高频PFC (~70kHz) › 高反电动势/高效压缩机 › BLDC 风机迅速普及 	<ul style="list-style-type: none"> › 洗烘一体洗衣机 › 双筒洗衣机 	<ul style="list-style-type: none"> › 轻载高效的MOSFET 单管及IPM
互联	感知	大数据

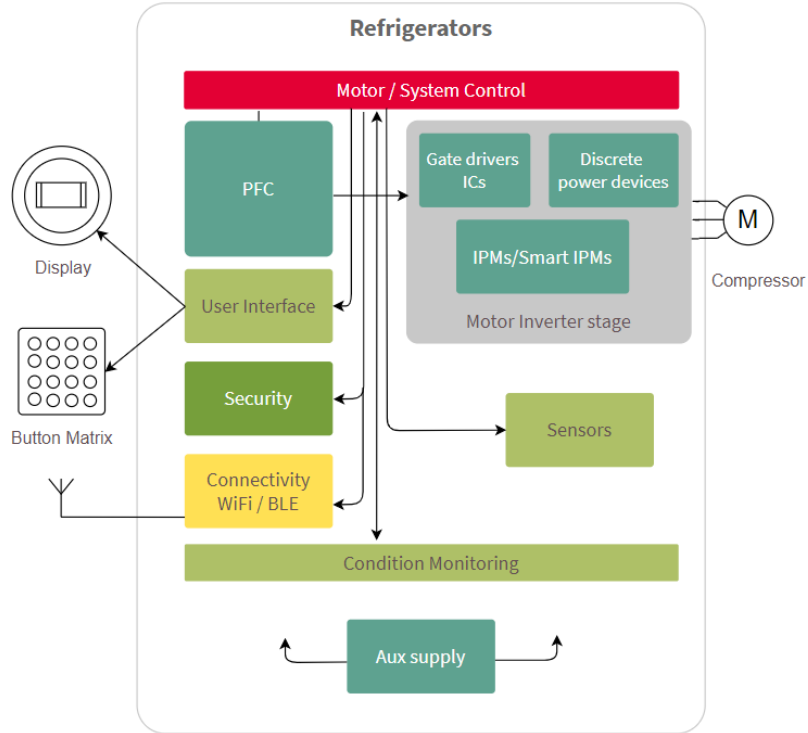
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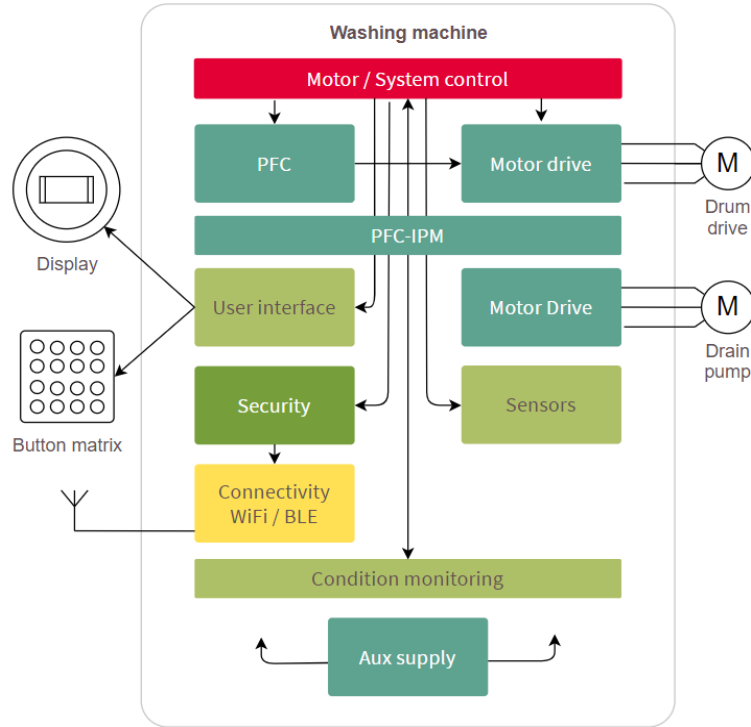
英飞凌家用空调解决方案



英飞凌家用冰箱解决方案



英飞凌洗衣机解决方案



英飞凌可以为中国变频家电提供完整解决方案



系统控制



变频驱动



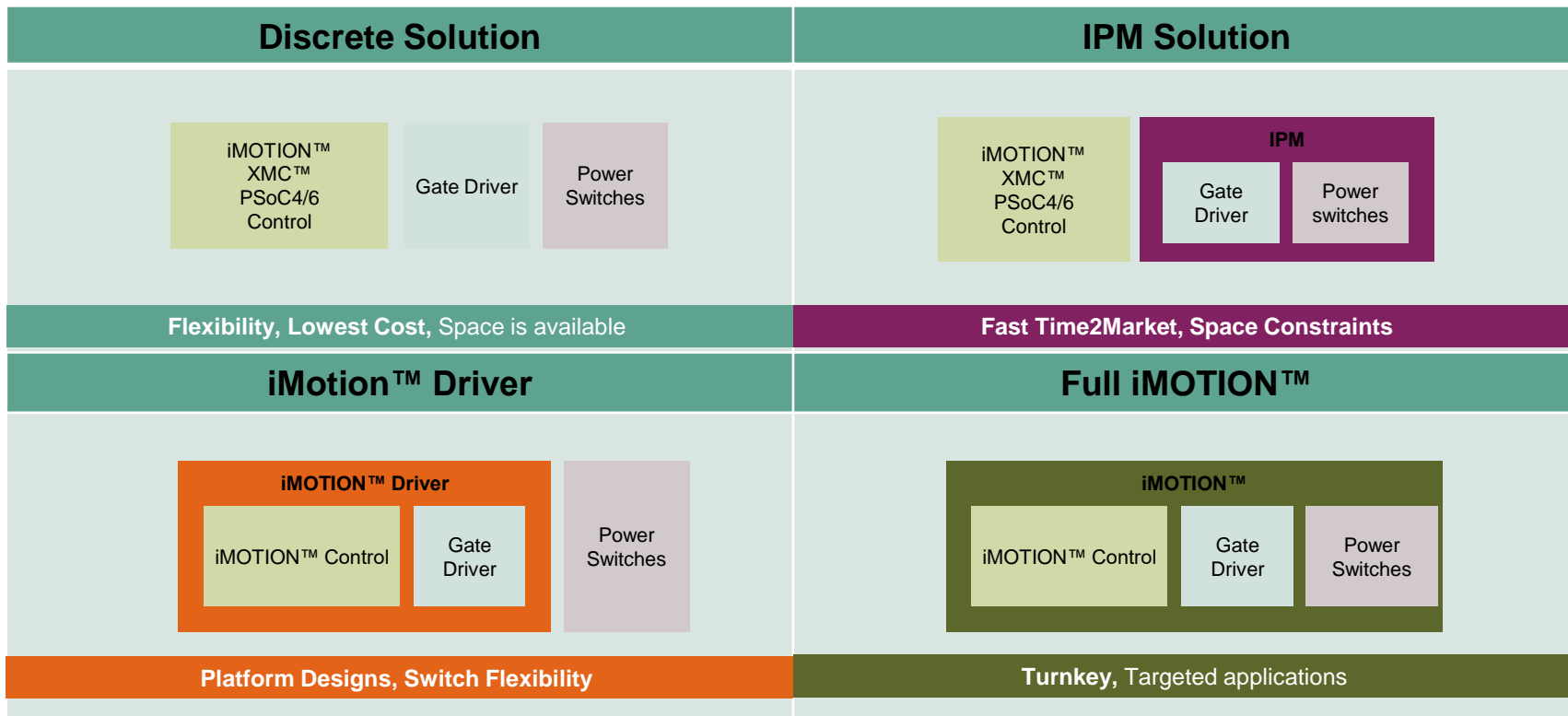
智能家电

Main control	XENSIV™ Sensors	Motor control	Power Stage	Condition monitoring	Connectivity	Security	User interface
<ul style="list-style-type: none"> > PSoC® MCU > XMC™ 	<ul style="list-style-type: none"> > Magnetic hall > Pressure > Gas (CO₂) > Radar > MEMS Microphone > Time of Flight 	<ul style="list-style-type: none"> > iMOTION™ motor controller > PSoC® MCU > XMC™ 	<ul style="list-style-type: none"> > CIPOS™ IPM > CIPOS™ SmartIPM > Trenchstop™ IGBT > Reverse Conducting Drives Series > Rapid diodes > EiceDRIVER™ gate drivers 	<ul style="list-style-type: none"> > Sensor fusion reference solution with cloud connectivity 	<ul style="list-style-type: none"> > AIROC™ Wi-Fi and Bluetooth Combo controller 	<ul style="list-style-type: none"> > Secured communication / secured host firmware update > OPTIGA™ Trust M 	<ul style="list-style-type: none"> > Touch buttons using CapSense™ > Touch display incl. TFT > Voice control

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英飞凌能够为变频家电电机驱动提供丰富的产品组合



MCU产品系列组合

Note: Automotive, Aurix for Industrial, iMotion covered separately

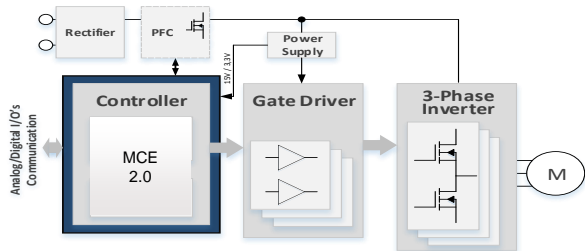
8-Bit	32-Bit Arm® Cortex®-M0/M0+	32-Bit Arm Cortex-M3	32-Bit Arm Cortex-M4 / Arm Cortex-M0+	32-bit Arm Cortex-Mx (next generation)
<p>IoT / Consumer</p> <p>PSoC 6 MCUs for the broad-base of IoT and Consumer applications, bringing best in class low power, connectivity, and security</p> <p>PSoC 4 delivers unique software-defined peripherals and industry leading capacitive sensing designs</p>  <div data-bbox="73 659 382 762"> <p>PSoC 3 8051 CPU 67 MHz, 64KB Flash Up to 19 PAB, 30 PDB, 72 I/Os</p> </div> <div data-bbox="73 773 382 875"> <p>PSoC 1 M8C CPU 24 MHz, 32KB Flash 16 PAB, 16 PDB, 64 I/Os</p> </div> <div data-bbox="73 886 382 989"> <p>8FX 8-bit RISC MCU 16 MHz, 32-50KB Flash</p> </div>	<div data-bbox="450 590 759 693"> <p>PSoC 4 Cortex-M0/M0+ 48 MHz, 384KB Flash Up to 13 PAB, 20 PDB, 98 I/Os</p> </div> <div data-bbox="450 704 759 806"> <p>FM0+ MCUs Cortex®-M0+ 40 MHz, 512KB Flash, 102 I/Os</p> </div> <div data-bbox="450 817 759 920"> <p>XMC1000 MCUs Cortex®-M0 32-48 MHz, 200KB Flash, 55 I/Os</p> </div>	<div data-bbox="813 512 1122 614"> <p>PSoC 5LP Cortex-M3 80 MHz, 256KB Flash 20 PAB, 30 PDB, 72 I/Os</p> </div> <div data-bbox="813 625 1122 728"> <p>FM3 MCUs Cortex-M3 144 MHz, 1.5MB Flash, 154 I/Os</p> </div> <div data-bbox="832 809 1180 979"> <p>Industrial XMC is a family of high-performance Arm Cortex-M-based MCUs for industrial applications, with industrial control peripherals and extended temp range FM is a portfolio of high-performance Arm Cortex-M-based MCUs for industrial and consumer applications</p>  </div>	<div data-bbox="1180 441 1489 543"> <p>PSoC 6 150 MHz Cortex-M4/100 Mhz M0+ 2MB Flash 7 PAB, 56 PDB, 104 I/Os</p> </div> <div data-bbox="1180 554 1489 657"> <p>FM4 MCUs Cortex-M4 200 MHz, 2MB Flash, 190 I/Os</p> </div> <div data-bbox="1180 668 1489 770"> <p>XMC4000 MCUs Cortex®-M4 80-144 MHz, 2MB Flash, 119 I/Os Industrial Comms, Ta 125C</p> </div>	<div data-bbox="1547 285 1856 387"> <p>MCU Next Multi-core Cortex-Mx ML-Ready, HMI Rich</p> </div> <div data-bbox="1547 398 1856 501"> <p>Industrial Evolution Multi-core Cortex-Mx Industrial Quality, ECC Memories</p> </div> <div data-bbox="1547 918 1846 983"> <p>Other Specialized and Legacy</p>  </div>

iMOTION™ 硬件集成产品

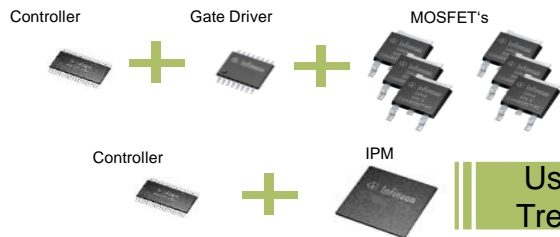
设计灵活性

产品集成度

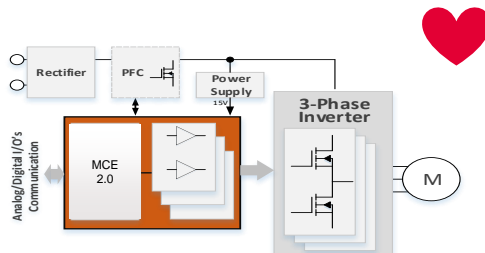
iMOTION™ 2.0 Controller



Digital Controller
MCE 2.0



iMOTION™ 2.0 Smart Driver

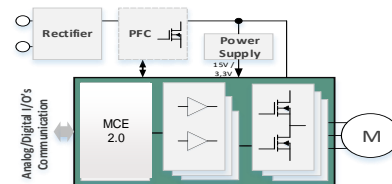


Digital Controller
MCE 2.0

+600V Gate Driver



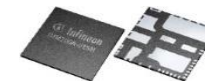
iMOTION™ 2.0 Smart IPM



Digital Controller
MCE 2.0

+600V Gate Driver

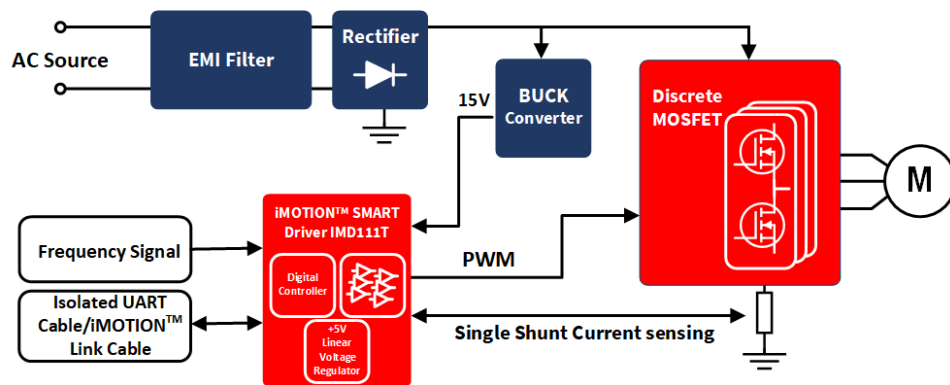
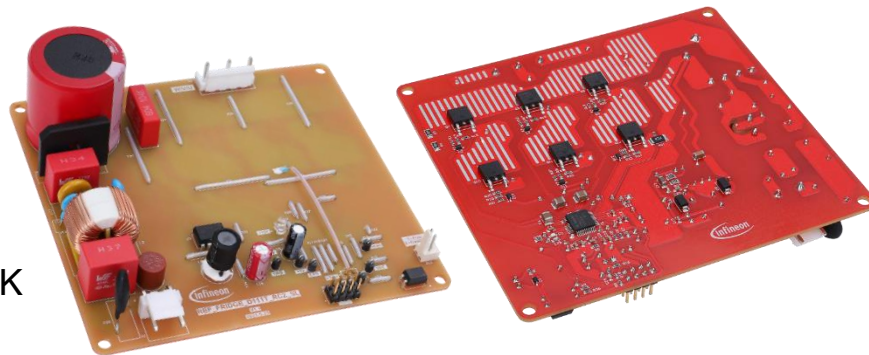
+3ph 600V MOSFET power stage



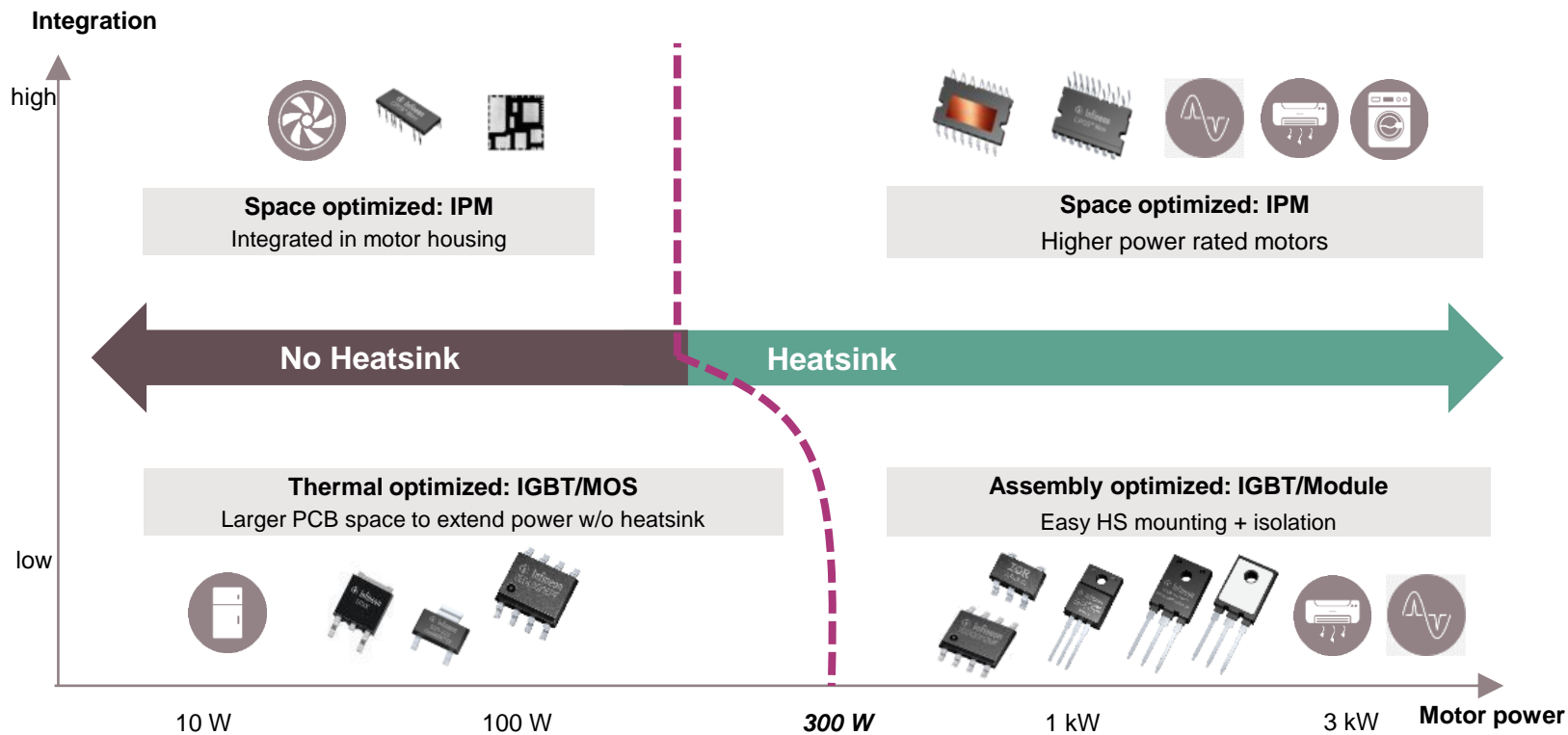
User Trend

用于冰箱压机驱动参考设计

- **REF_Fridge_D111T_CoolMOS SOT223**
 - IMD111T-6F040 + CoolMOS SOT223
- **REF_Fridge_C101T_6ED_IGBT DPAK**
 - IMC101T-T038+6EDL04I06PT+IGBT RCD2 DPAK
- REF_Fridge_C101T_IM231
 - IMC101T-T038+IM231-L6S1B
- Dimension: 78*78 mm
- Application: Fridge, Fans, Motor Drive etc.



电机驱动方案： 灵活的单管方案 vs. 高可靠性易于使用的 IPM 方案



针对于变频家电的高压驱动IC： Low side driver/Junction isolation/SOI

Non-isolated	Level-shift		Galvanic isolation
Low voltage	Junction isolation	Silicon on insulator	Coreless transformer
<p>General purpose markets</p> <p><u>Low-side Families:</u> 1 Ch: 1ED44175/6, IRS44273, 1EDN, 1EDN-TDI 2 Ch: IRS4427, 2ED24427, 2EDN</p> <div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; margin: 5px; text-align: center;"> <p>PFC</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; margin: 5px; text-align: center;"> <p>Aircon</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; margin: 5px; text-align: center;"> <p>Fridge</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; margin: 5px; text-align: center;"> <p>Home Appliance</p> </div> </div>	<p>Markets up to 10 kW</p> <p><u>Jl Product Families:</u> Gen1/2: IR2214, IR2110/13, IR2010/2011, IR2136 Gen5: IRS2005/7/8, IRS2011, IRS2308, IRS2106</p> <p><u>SOI Product Families:</u> 6ED2230, 6EDL04, 6ED003L 2ED2304, 2EDL05, 2EDL23</p> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 10px;"> <p>200 V</p> <div style="display: flex; justify-content: space-between; width: 100%;"> <div style="border-left: 2px solid yellow; border-right: 2px solid yellow; height: 20px; margin: 0 5px;"></div> </div> </div> <div style="display: flex; justify-content: space-around; width: 100%;"> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Power Tools</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Electric toys</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Home & Garden</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>eBike</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>eScooter</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>LSEV</p> </div> </div> <div style="margin-bottom: 10px;"> <p>600 – 1200 V</p> <div style="display: flex; justify-content: space-between; width: 100%;"> <div style="border-left: 2px solid yellow; border-right: 2px solid yellow; height: 20px; margin: 0 5px;"></div> </div> </div> <div style="display: flex; justify-content: space-around; width: 100%;"> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Aircon</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Fans</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Induction</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Home Appliance</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Lighting</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Motor Control</p> </div> </div> <div style="display: flex; justify-content: space-around; width: 100%;"> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Cooling compressors</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Sewing machine</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Pumps</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Solar</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Server</p> </div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> <p>Welding</p> </div> </div> </div>		<p>Markets > 5-100 kW</p> <p><u>Product Families:</u> Compact, Enhanced e.g. 1EDl compact, 1ED-F2, 2ED-F2/F1, 1ED31xx, 1ED34xx, 1ED38xx</p> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 10px;"> <p>Drives</p> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> </div> </div> <div style="margin-bottom: 10px;"> <p>Solar</p> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> </div> </div> <div style="margin-bottom: 10px;"> <p>CAV</p> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> </div> </div> <div style="margin-bottom: 10px;"> <p>Charger</p> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> </div> </div> <div style="margin-bottom: 10px;"> <p>UPS</p> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> </div> </div> <div style="margin-bottom: 10px;"> <p>Telecom</p> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> </div> </div> </div>

英飞凌第五代CoolSET™

什么是CoolSET™?



控制IC

CoolMOS™

CoolSET™

- › 集成控制器和高压MOS管
- › 针对AC-DC
- › 单个封装

应用目标



空调



冰箱



洗衣机



小家电

- › 功率：60W以下
- › 拓扑：Flyback/Buck
- › 作为辅助电源，给MCU、IPM及继电器等供电

第五代CoolSET™ 在家电应用中的优势

- › 低待机高效率，助力更高能效。
- › 集成最高950V带雪崩能量保证CoolMOS™ 及完善的保护功能，增强系统可靠性。
- › 全部保护为自动恢复模式，最大程度减少系统运行中断。
- › 集成度高，设计简单；系列齐全，可覆盖几乎所有家电产品的辅助电源。

传感器应用示例：状态监测和预测性维护

Microphone



Best audio performance

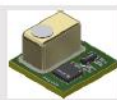


Receive clear audio signals

Sound anomaly detection



Environmental



World smallest form factor

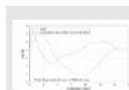


Measure CO2

Indoor air quality



Pressure

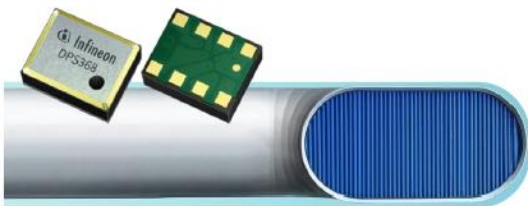


Best-in-class resolution



Measure height and air-flow

Clogged air-filter



Magnetic & current sensors

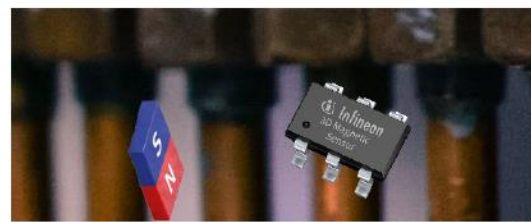


High variety of types and applications



Angle & current sensor, hall switches, 3D magnetics

Vibration & position monitoring



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为什么选择英飞凌家电相关产品?

英飞凌为家电应用提供灵活的完整解决方案

领先的芯片和封装技术实现高效、绿色的家电产品

英飞凌提供广泛的产品帮助实现更智能的家电系统



Part of your life. Part of tomorrow.