英飞凌家电生态圈
<赋能课堂>

适用于洗碗机的英飞凌智能功率模块介绍

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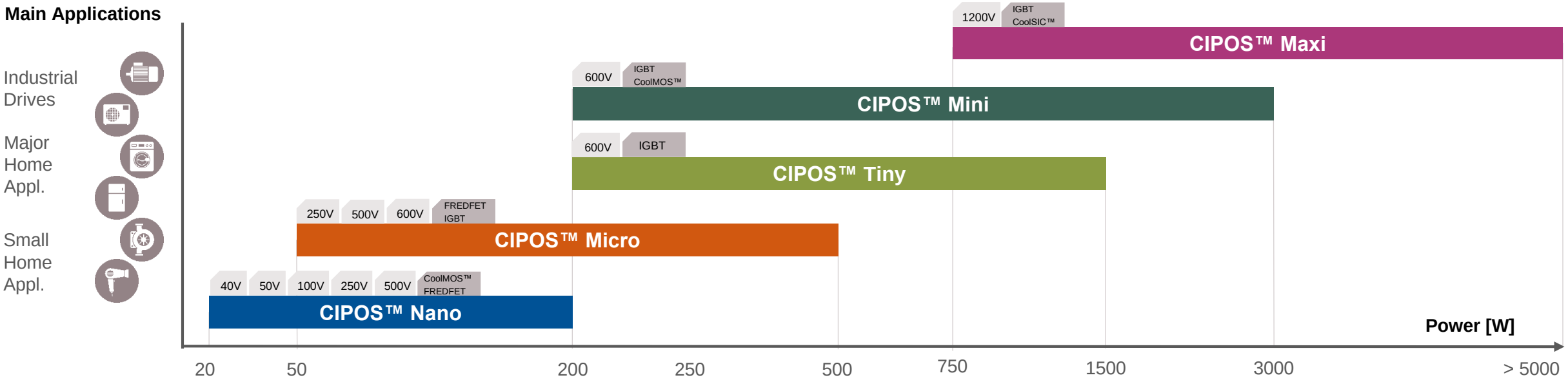
2004年毕业于华中科技大学并获得电力电子专业硕士学位，具有丰富的开关电源和电机驱动系统设计经验。2011年加入英飞凌，目前负责中国地区家电应用的技术支持工作。

Broad intelligent power module portfolio serving power ranges from 20 W to 5 kW plus



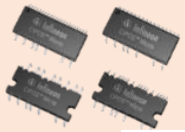
CIPOS™ Nano

7x8x0.9 mm
8x9x0.9 mm
12x12x0.9 mm

For space constrained applications

Powering millions of personal cares and low power application

CIPOS™ Micro



29x12x2.9 mm

Compact solution

Optimized solution for low power fan & pump

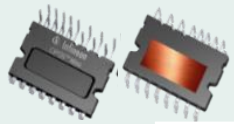
CIPOS™ Tiny

33x19x3.6 mm

New solution for better design flexibility

Optimized solution for RAC and motor drives up to 1.5hp

CIPOS™ Mini

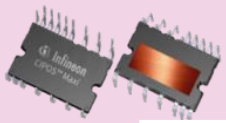


36x21x3.1 mm

Broad range portfolio

Proven solution for MHA/Industrial drives

CIPOS™ Maxi



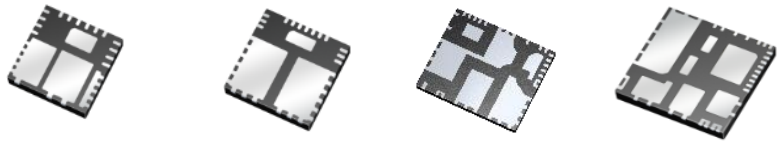
36x23x3.1 mm

Highest power density

Ruggedized Industrial drives and CAC solution

CIPOS™ Nano IPM product family

Product overview



Dimension [mm]	7x8	8x9	12x10	12x12
Configuration	Half-bridge	Half-bridge	H-bridge	3-phase
Voltage rating	40 V, 100 V	250 V, 500 V	250 V, 600 V	250 V, 500 V
RdsOn [max]	0.005 - 0.21 Ω	0.15 – 1.7 Ω	0.073 – 0.31 Ω	0.45 – 6.0 Ω

Key features

- Various topology solutions; Half-bridge, H-bridge, 3-phase
- Broad product coverage in same footprint; 40 V - 500 V
- Power capability from 20 W to 200 W
- Optimized dv/dt for loss and EMI trade-off
- Built-in NTC thermistor, Bootstrap function
- Multiple protection; Overcurrent, Shoot-through, Over temperature, UVLO, Fault reporting

Typical applications

- Hair dryer
- Fan motor
- Pump
- Air conditioner Indoor Unit
- Air purifiers
- Small kitchen appliances
- CPAP machine

Value proposition

- Smallest modules in the market
- Cost savings from smaller footprint and PCB size reduce
- Half-bridge enables more PCB design flexibility, better heat dissipation
- Same package/PCB design for multiple markets (Battery powered, AC plugged)

CIPOS™ Micro IPM product family

Product overview

DIP 29x12(F)
SOP 29x12 (F)

Dimension [mm]	29x12x2.9		
Configuration	3-phase		
Voltage rating	250 V	500 V	600 V
MOSFET Rds(on) max	0.45 Ω	1.3, 1.7, 2.2, 4.0, 6.0 Ω	IGBT (2/4/6 A)

Key features

- Wide range of product coverage with various switch technologies
- Various application optimized options available
- Pin-comparable solution to one of the main solution in the market

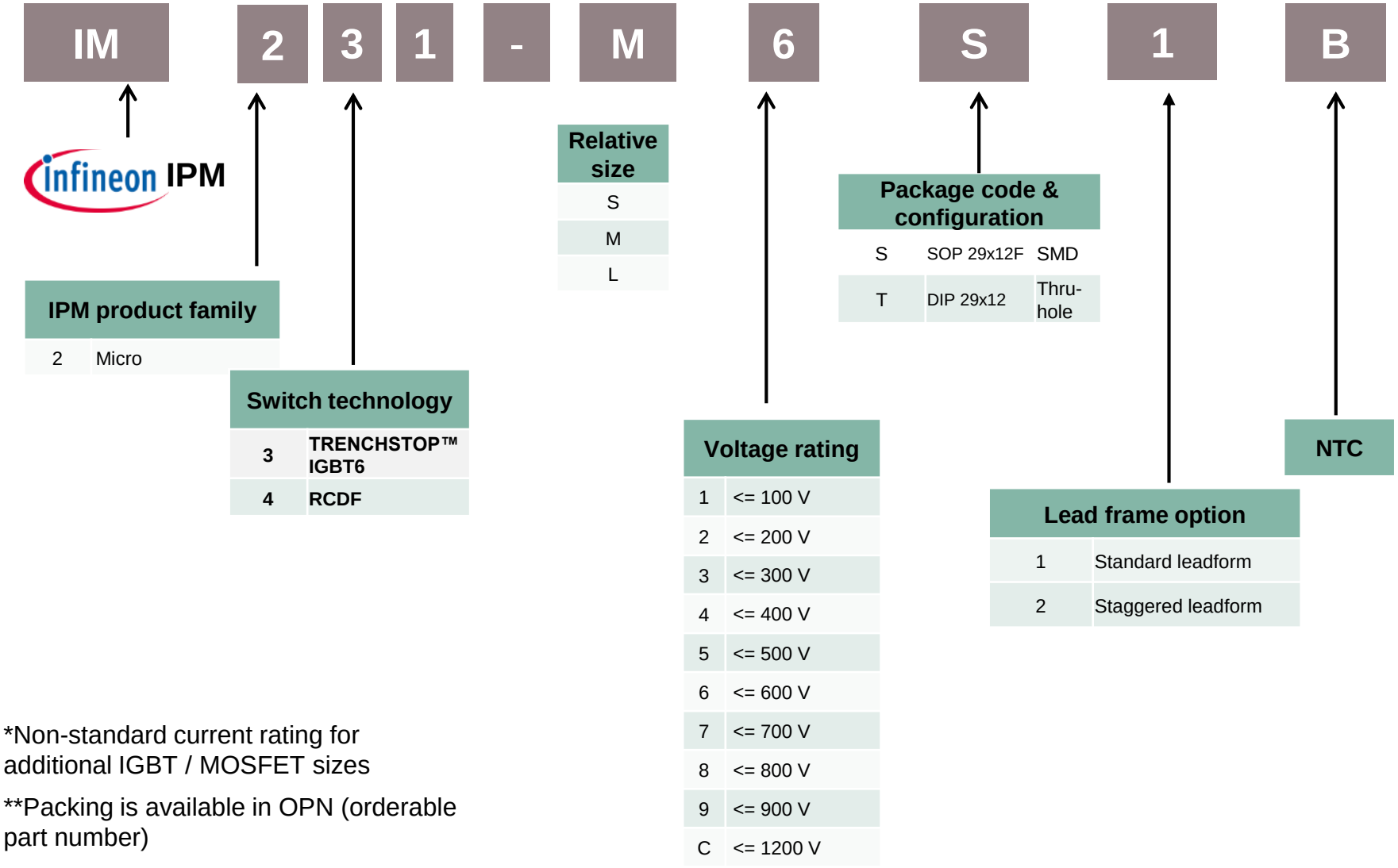
Typical applications

- Split air conditioning systems:
- Indoor & outdoor fan drive
- Circulation pumps
- Ceiling & floor fans
- Air purifiers
- Small compressors
- 10-200 W motor drives

Value proposition

- Reduce system costs and fast time to market
- Provide wide switching speed range
- High power density and high efficiency and high output power in one small package
- Offer very low loss by using the advanced MOSFET technology

CIPOS™ Micro nomenclature



*Non-standard current rating for additional IGBT / MOSFET sizes

**Packing is available in OPN (orderable part number)

Ruggedness & reliability: Proven reliability

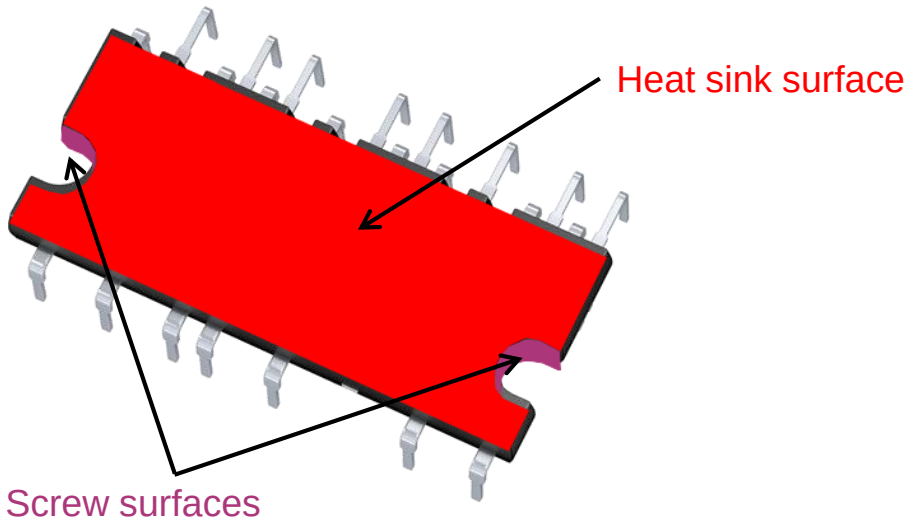
In addition to Infineon's world-class industrial qualification standards:

1. **High voltage H3TRB** (480 V per switch, 85% RH, 85°C, 1000 hrs)
   - Pre-conditioning:
     - 125°C bake for 24 hrs
     - 30 C/60% RH soak for 192 hrs
     - 3x reflow at 245°C
2. **Extended temperature cycling** to 1500 cycles (500 more than standard)
   - Evaluates package reliability including bond-wires, die attach.
3. **Extended intermittent operating life** to 15000 cycles
   - Simulates thermal and power stresses during drastic load changes
   - IGBT junction temperature changes by 90 C within each cycle
   - Runs for 10000 cycles.

Higher reliability testing levels for harsh environmental conditions.

Ruggedness & reliability:
2 kV Isolation rating

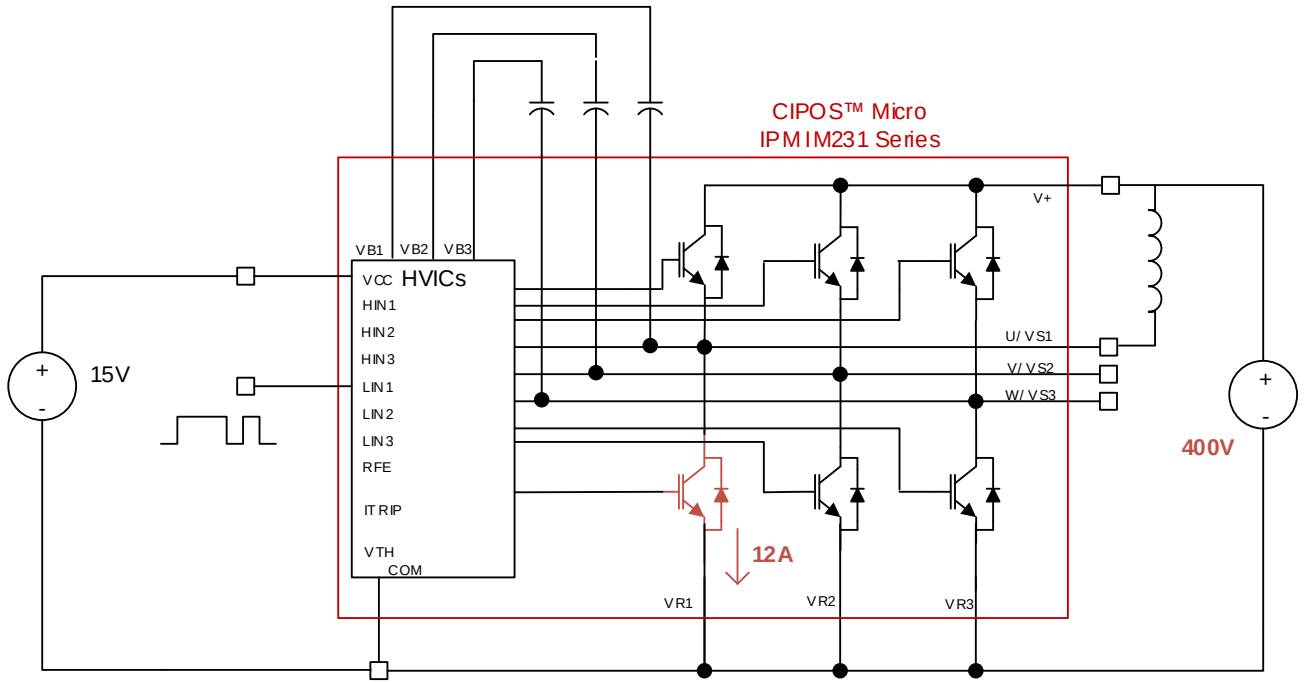
- 100% tested at 2.4 kV_{AC}, 1 s (equivalent to 2 kV_{AC}, 1 min)
- Done with full overlap including the screw surface



Providing system isolation with higher safety margins.

Ruggedness & reliability:
High voltage, high current (HV/HI) test

- 100% high voltage, high current (HV / HI) test at production.
- Subjects every IGBT switching at 12 A (2x rated), 400 V

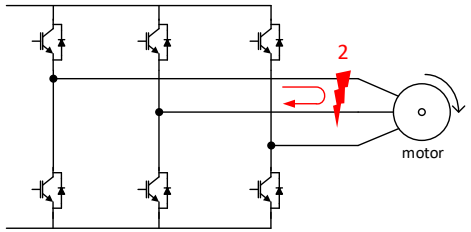


Low side U-phase IGBT being tested at 12A, 400V

Similar screen as avalanche test for MOSFETs.

Protection:
Overcurrent protection (OCP)

- What is short circuit?
  - Broken insulation in motor windings
  - Can be prevented by comparing the shunt voltage to an internal reference



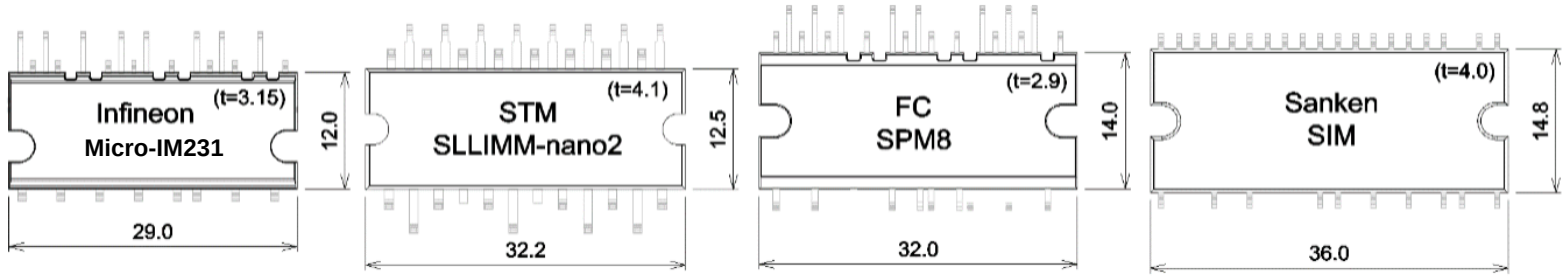
- With long internal delays for OCP competitors needs noise filter to minimize susceptibility to noise trips

SIM6822M	+/- 10%
STGIPQ5C60T	+ 11 / - 5.5%
FNB80560T	+/- 6%
STGIPQ8C60T	+ 3.5 / - 5.5%
IM231 Series	+/- 5%

Increasing OCP accuracy

Most accurate OCP, avoiding false tripping and stopping of the motor.

Ease of use:
Creepage and clearance



		Infineon Micro-IM231	STM SLLIMM-nano2	FC SPM8	Sanken SIM
Creepage	Pin to HS	1.85	1.8	1.25	1.7
	Pin to Pin	3.3	1.48	3.3	2.94**
	PCB Pin to Pin	3.3	3.1	2.1	2.94
Clearance	Pin to HS	1.85	1.8	1.25	1.7
	Pin to Pin	1.84*	1.48	1.8	2.94
	PCB Pin to Pin	3.3	3.1	2.1	2.94

* Meets IEC 61800-5-1 standard which requires 1.5 mm in the worst case.

** Is the nominal value. With tolerances & CTI considered, creepage of SIM6822 is 2.73 mm which is below the IEC 61800-5-1 standard of 2.8 mm

IFX Micro IPM overall offers the best overall creepage & clearance.

CIPOS™ Micro IPM:IM231 Series

IM231-**L**6 (600V, 6A)
IM231-**M**6 (600V, 4A)

Overcurrent Protection (±5% Accuracy)

Fault Reporting + Auto Fault Clear

Accurate UL Certified NTC

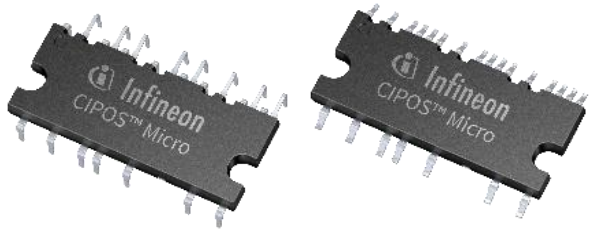
Shoot-Through Protection

Surface Mount & Through Hole Options

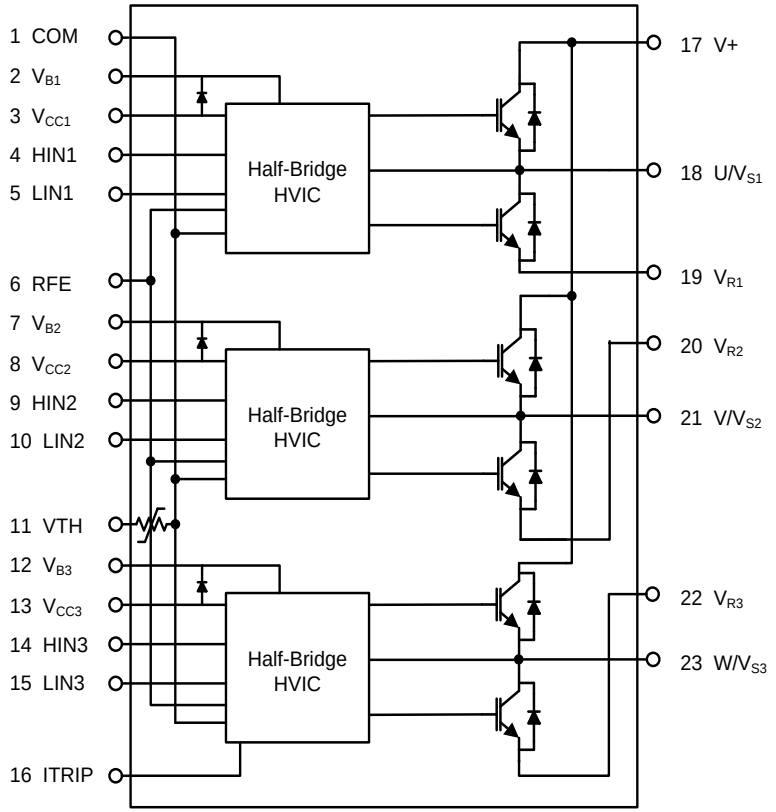
Mounting Holes

Target Power: Up to ~450W

12 x 29 x 3.2mm



12x29x3.2mm



CIPOS™ Micro IPM: IM241-S6/M6/L6 series

600V / 2, 4, 6 A
50 - 500 W

Leveraging new Micro package

Rugged gate driver for
IEC 61000-4-4/5 system (6kV EFT) tests

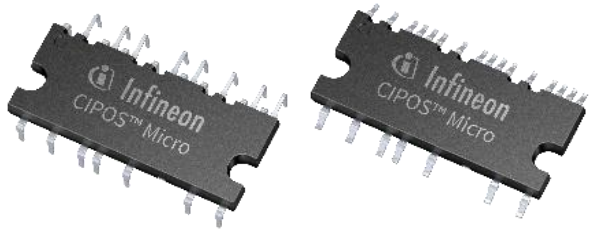
HV H3TRB qualified

2kV Isolation voltage

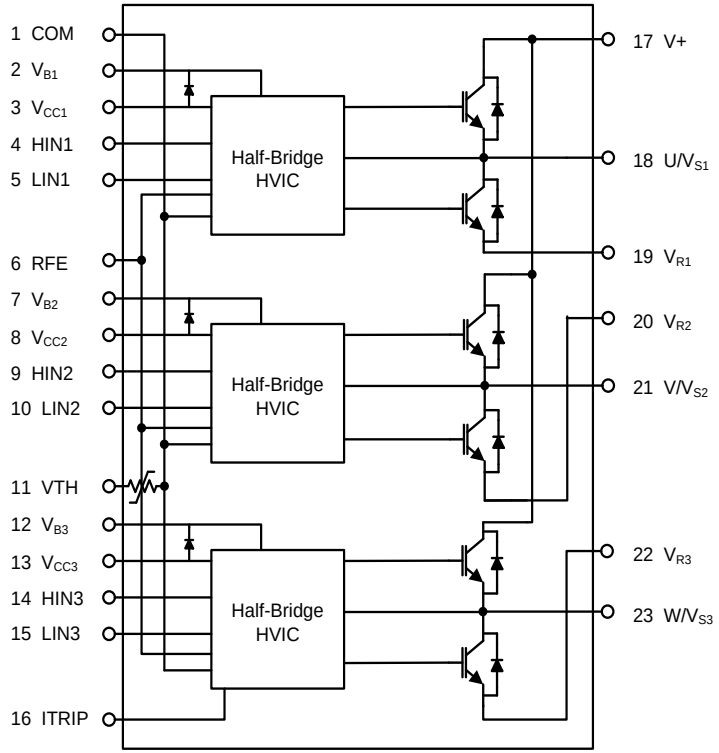
2 speed (J-(2V/ns)/Lower EMI or B
(5V/ns)/Better Thermal) options

SOP 29x12, DIP 29x12, DIP 29x12 LL

Accurate OCP, temp sense & fault reporting



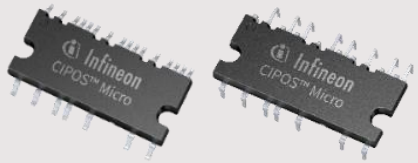
12x29x3.2mm



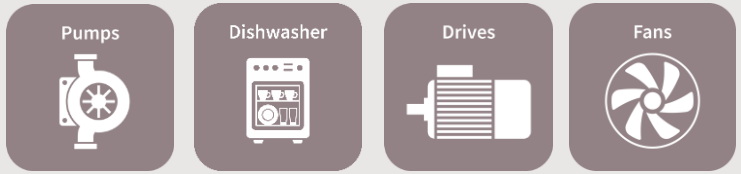
CIPOS™ Micro IPM: IM241-series 600 V 2-6 A IPM

Key features

- 600 V 3-phase inverter with open emitters
- **Based on the latest RCD IGBT technology optimized for motor drives**
- **Enhanced power capability**
- Accurate overcurrent protection (±5%)
- **Optimized dv/dt for loss and EMI trade offs**
- Built-in temperature sensor
- Power capability up to 450 W at Isolation 2000 VRMS, 1 min



Typical applications



Product line-up

Product name	Related Current [A]	Package	Speed [V/ns]	Remark
IM241-x6S1J	2 / 4	SOP 29x12	2	SMD, Low EMI
IM241-x6S1B	2 / 4 / 6		5	SMD, Low loss
IM241-x6T2J	2 / 4	DIP 29x12 (2.9 mm)	2	Low EMI
IM241-x6T2B	2 / 4 / 6		5	Low loss
IM241-xT2J2	2 / 4	DIP 29x12 (LL) (5.5 mm)	2	Low EMI
IM241-x6T2B2	2 / 4 / 6		5	Low loss

Value proposition

- Easy to design and fast time to market compared to mass market TO-2xx
- Application optimized solution for both low loss and low EMI version
- Improved system ruggedness thru enhanced protection features & isolation voltage

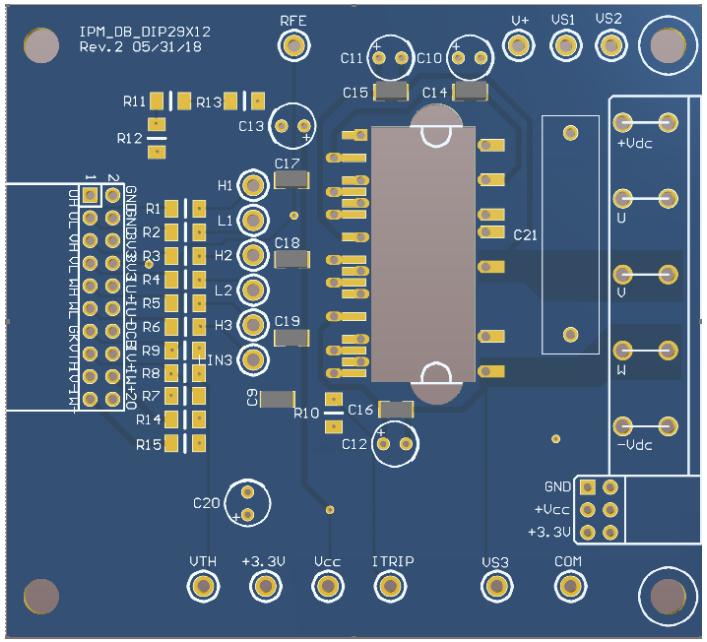
4 Key advantages of CIPOS™ Micro IPM series

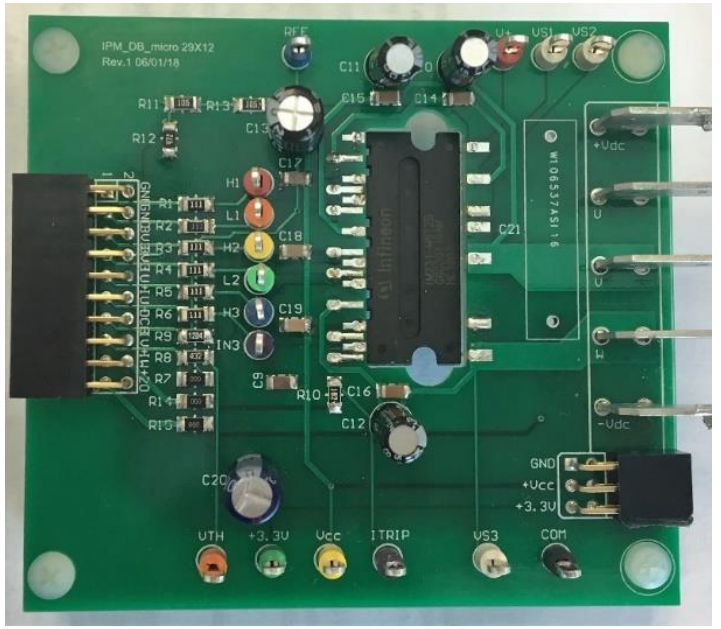
	Optimized feature set:	Application benefit
Ruggedness & reliability	1. HV H3TRB qualified 2. Surge ruggedness 3. Highest isolation voltage in its class 4. 100% high current/high voltage tested	1. Higher lifetime & reliability in humid environments 2. Faster EN61000-4-4/5 qualification 3. Better protection 4. Lower ppms
Protection	1. Anti shoot-through & accurate current protection 2. UL certified temp sense 3. Accurate OCP, fault clear, fault and enable functions	1. Protection from system faults 2. Easier system qualification 3. Smarter system design
Ease of use	1. Surface Mount (SMD) option 2. Optimal creepage and clearance	1. Compatible with modern assembly lines 2. Easier PCB design
Performance	1. Latest generation TRENCHSTOP™ IGBT6 and RCD2 tech 2. Optimized switching	1. Up to 450 W in a small package and higher efficiency 2. Low EMI

IFX Micro IPM offer Clear benefit in harsh environment applications.

CIPOS™ Micro Boards

Single daughter boards (DB)

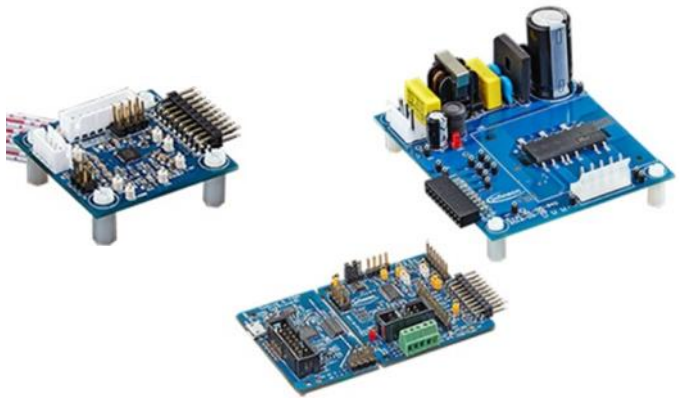




Reference Designs and Modular Evaluation Boards

CIPOS™ Nano, Micro

Control Boards **Power Stage**

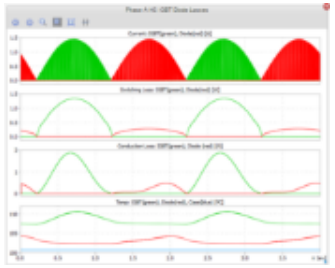


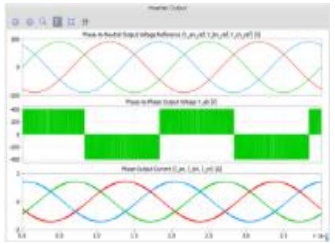
The Modular Application Design Kit (MADK) is available from:

- www.infineon.com/MADK

Software Tools

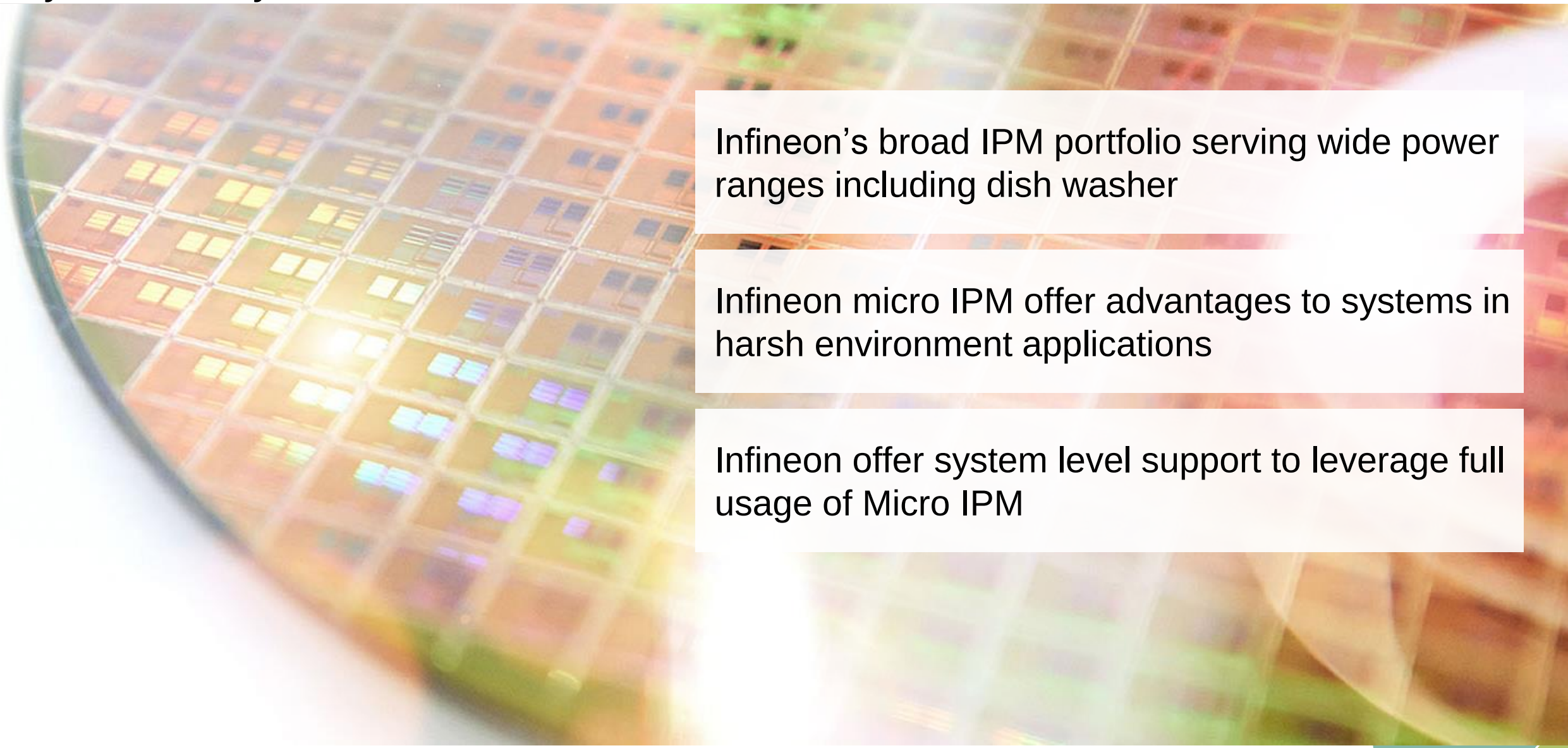
Simulators





- https://plex.infineon.com/plexim/ipmmotor.html

Key Take-away



Infineon’s broad IPM portfolio serving wide power ranges including dish washer

Infineon micro IPM offer advantages to systems in harsh environment applications

Infineon offer system level support to leverage full usage of Micro IPM

Part of your life. Part of tomorrow.