VICOR

Modular Solutions for Your Power System

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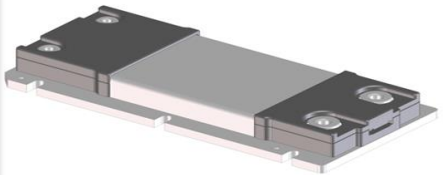
BCM – 最强大的板上母线电压转换解决方案

大功率母线转换器的发展

“低电压” BCM/NBMs: VIN = 36-60V	“高电压” BCMs: VIN = 260–410V	“超高电压“ BCMs: VIN = 400–800V

ChiP 插脚	**VIA** 板上安装和机壳安装	**SM ChiP** 贴片	**Super-Brick** 机壳安装
			
• 800W to 2.4kW (已经量产)	• 1.4kW -2.4W (已经量产，在逐步完善型号)	• 1.5kW to 2.4kW (开发中)	• 3kW+ (开发中)

BCM - ChiP 和 SM ChiP 封装

大功率和 PMBus™ 接口

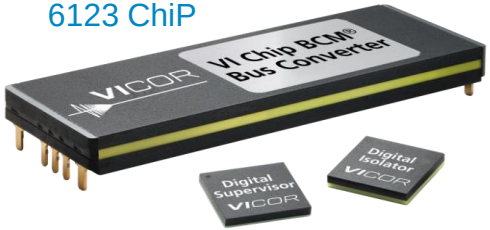
Vicor 新的 BCM ChiPs 提供了新的功率范围

› 输入: 36-60V, 200-400V, 260-410V, 400-700V, 500-800V

› 功率: 最高到 2.4kW

› 功率密度: 最高到 333W/立方厘米

6123 ChiP



Digital Supervisor + Isolator

› PMBus 提供了实时的监控和控制

- 目前的 PMBus Chip 的整套方案包含了 Vicor 的数字监控和隔离组合的芯片
- 新的 PLI 将会整合监控和隔离的功能
- 可以支持ChiP和SM ChiP的BCM
- 提供2次侧控制接口

6123 SM ChiP

PLI

BCM - VIA 和 超级砖封装

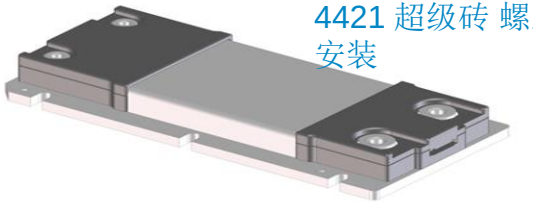
增强散热和更高集成度

封装提供以下的性能

- 热处理简单，高效。
- 集成了滤波器，简化了客户对传导辐射的处理
- PMBus 接口提供实时的控制和监控
- 瞬态电压抑制，浪涌保护
- 提供插脚和螺丝安装

4414 VIA
插脚安装

4414 VIA
螺丝安装



4421 超级砖 螺丝
安装

高压母线转换器模块

Model Number	Input (V)	Output (V)	Output Power (W)	Output Current (A)	Package	Control Interface
BCM352x110y300B00	352V (330 – 365V)	11V (10.3 – 11.4V)	300	28.0	VIChip Full	Analog
BCM6123TD1E1368Tzz	384V (260 – 410V)	12V (8.1 – 12.8V)	800	68	6123 ChiP	Digital/Analog
BCM384x120y300Azz	384V (360 – 400V)	12V (11.3 – 12.5V)	300	27.7	VIChip Full	Analog
BCM6123TD1E13A3Tzz	384V (260 – 410V)	12V (8.1 – 12.8V)	1500	125.0	6123 ChiP	Digital/Analog
BCM4414xD1E13A3yzz	384V(260 – 410V)	12V (8.1 – 12.8V)	1500	125.0	4414 Chassis/PCB VIA	Digital
BCM352x125y300A00	352V (330 – 365V)	12.5V (11.79 – 13.04V)	300	26.0	VIChip Full	Analog
BCM6123TD1E2663Tzz	384V (260 – 410V)	24V (16.3 – 25.6V)	1500	62.5	6123 ChiP	Digital/Analog
BCM4414xD1E2663yzz	384V (260 – 410V)	24V (16.3 – 25.6V)	1500	62.5	4414 Chassis/PCB VIA	Digital
BCM352x440T330A00	352V (330 – 365V)	44V (41.25 – 45.63V)	325	7.7	VIChip Full	Analog
BCM384x480y325A00	384V (360 – 400V)	48V (45 – 50V)	325	7.0	VIChip Full	Analog
BCM6123TD1E5117Tzz	384V (260 – 410V)	48V(32.5 – 51.3V)	800	16.9	6123 ChiP	Digital/Analog
BCM6123TD1E5126Tzz	384V (260 – 410V)	48V(32.5 – 51.3V)	1200	25.7	6123 ChiP	Digital/Analog
BCM6123TD1E5135Tzz	384V (260 – 410V)	48V (32.5 – 51.3V)	1750	35.0	6123 ChiP	Digital/Analog
BCM4414xD1E5135yzz	384V (260 – 410V)	48V (32.5 – 51.3V)	1750	35.0	4414 Chassis/PCB VIA	Digital

低压母线转换器模块

Model Number	Input (V)	Output (V)	Output Power (W)	Output Current (A)	Package	Control Interface
BCM6123T60E10A5Txx	36 – 60	6 – 10	1500	150	6123 ChiP	Analog or Digital
BCM6123T60E15A3Txx	36 – 60	9 – 15	1950	130	6123 ChiP	Analog or Digital
BCM3814x60E10A5yzz	36 – 60	6 – 10	1500	150	3814 VIA	Digital
BCM3814x60E15A3yzz	36 – 60	9 – 15	1950	130	3814 VIA	Digital
BCM48Bx030x210A00	38 – 55	2.4 – 3.4	210	70	Full	Analog
BCM48Bx040x200B00	38 – 55	3.2 – 4.6	200	50	Full	Analog
BCM48Bx060x240A00	38 – 55	4.75 – 6.87	240	40	Full	Analog
BCM48Bx080x240A00	38 – 55	6.34 – 9.16	240	30	Full	Analog
BCM48Bx096x240A00	38 – 55	7.6 – 11.0	240	25	Full	Analog
BCM48Bx120x300A00	38 – 55	9.5 – 13.8	300	25	Full	Analog
BCM48Bx160x240A00	38 – 55	12.7 – 18.3	240	15	Full	Analog
BCM48Bx240x300A00	38 – 55	19 – 27.5	300	12	Full	Analog
BCM48Bx320x300A00	38 – 55	25.3 – 36.7	300	9	Full	Analog
BCM48Bx480x300A00	38 – 55	38.0 – 55	300	6	Full	Analog
BCM48BH120x120B00	38 – 55	9.5 – 13.75	120	11.3	Half	Analog

中间母线线转换器模块

型号	封装	转换比例	输出电压 (标称)	输出电流	最高输出功率 (55 Vin)
IB050E096T40N1-00	Eighth Brick	5:1	9.6 V	40 A	300 W
IB050E096T48N1-00	Eighth Brick	5:1	9.6 V	48 A	500 W
IB050Q096T64N1-00	Quarter Brick	5:1	9.6 V	64 A	650 W
IB050Q096T70N1-00	Quarter Brick	5:1	9.6 V	70 A	750 W
IB050Q096T80N1-00	Quarter Brick	5:1	9.6 V	80 A	850 W
IB050E120T32N1-00	Eighth Brick	4:1	12 V	32 A	300 W
IB050E120T40N1-00	Eighth Brick	4:1	12 V	40 A	500 W
IB050Q120T53N1-00	Quarter Brick	4:1	12 V	53 A	650 W
IB050Q120T60N1-00	Quarter Brick	4:1	12	60 A	750 W

低功率的BCM 路标：SM ChiP BCM

隔离和变压

更新低功率的 BCM产品系列

- 输入：36V-60V
- 输出：3V, 6V, 8V, 12V, 16V, 24V
- 功率: 2308的封装最高提供200W
- 峰值效率：97%

经典的 VI Chip

Full VI Chip
300W
96%

Half VI Chip
120W
95%

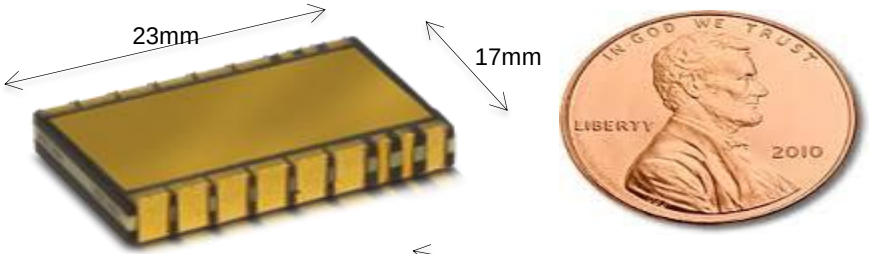
最新的SM Chip

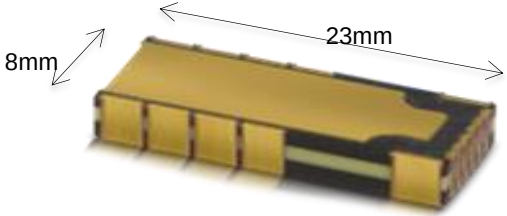
2317 SM
400W
97%

2308
200W, 97%

- 尺寸减小
- 功率提升
- 效率提升

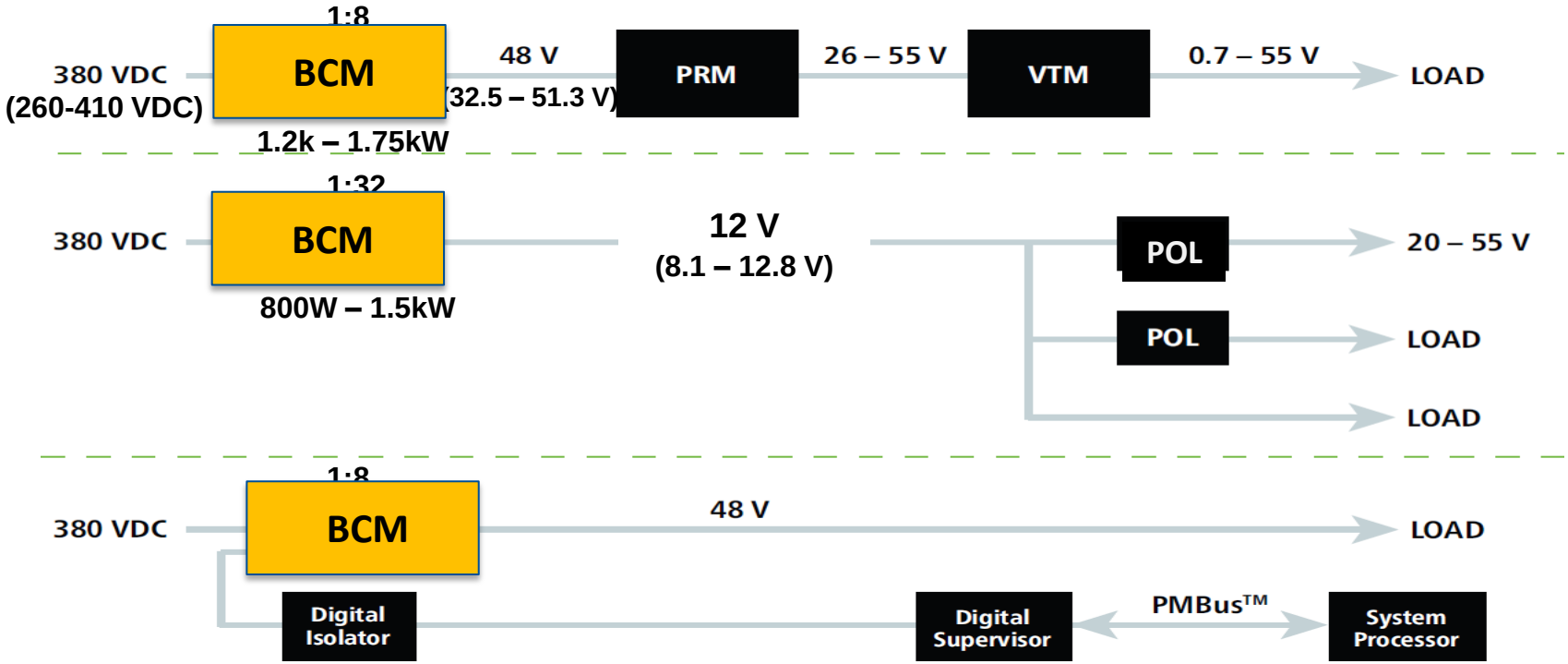
2317 BCM SM ChiP





2308 BCM SM ChiP

从高压直流 到 负载点的解决方案总览



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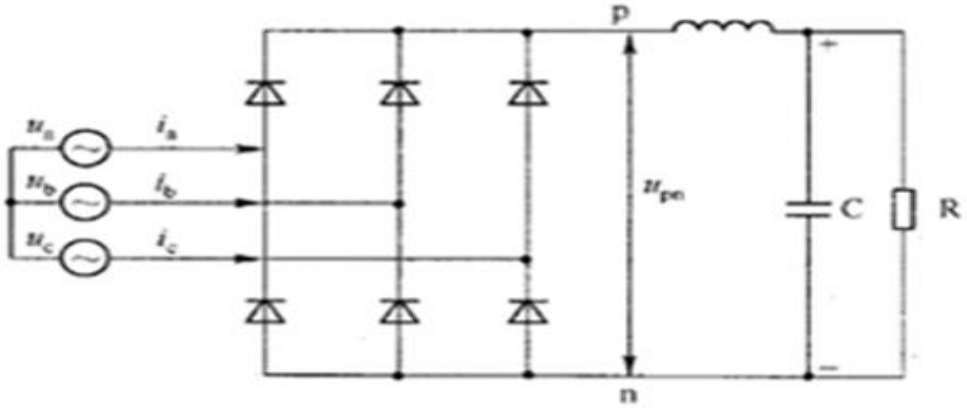
超高压 UHVBCM 介绍

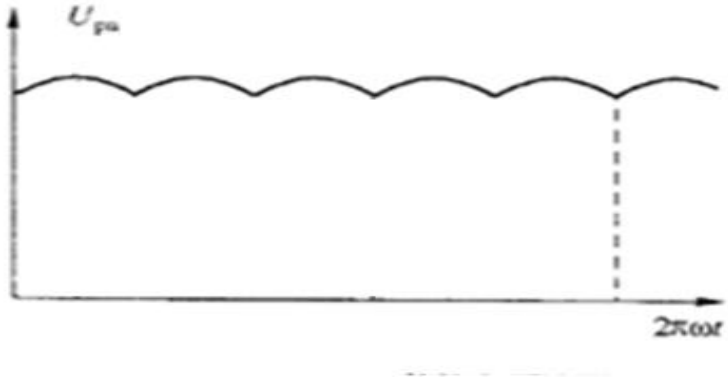
380V 三相输入整流的介绍

› 三相整流后的直流电压： $380*1.35=510V$

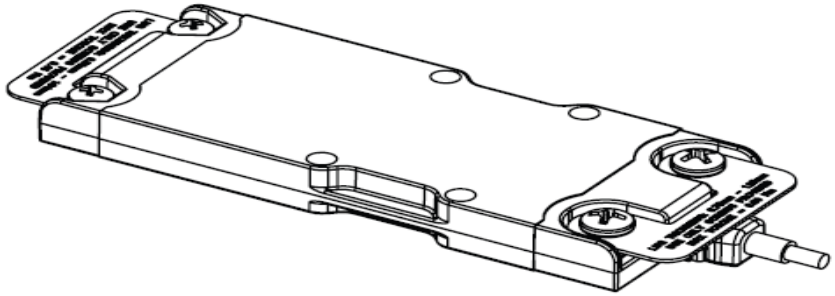
› 更低的纹波，更高的纹波频率

› 对比220VAC 高的输入电压可以支撑更高功率的应用.

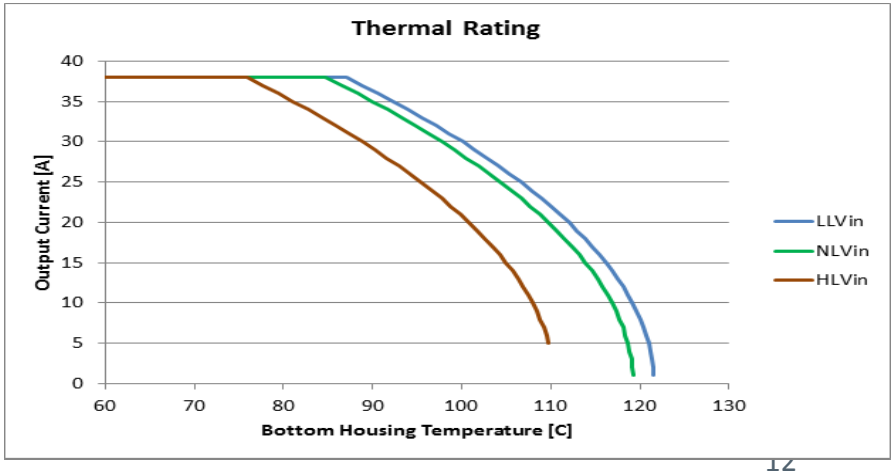




VIA封装 超高压 UHVBCM 规格



- 输入电压：540 V(400 - 700 V)
- 输出电压：34 V (25 - 43.8 V)
- 单片最大功率1750W
- 峰值效率：97.4%
- 高MTBF和可靠性
- 集成EMI 滤波器 和瞬态保护
- 插脚安装和螺丝安装方式
- 尺寸：110.55 x 35.54 x 9.30 mm

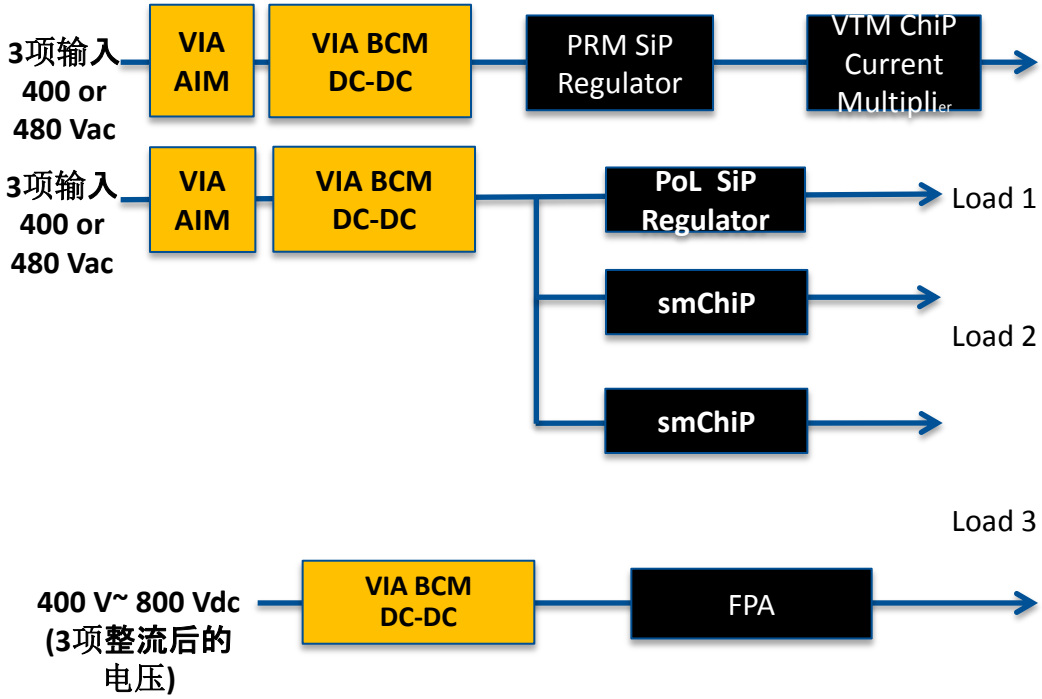


超高电压的BCM 和 3Φ AIM的配合

- 超高压 BCMs
  - 400-700 输入
    - 540 V to 34 V (K= 1/16)
  - 500-800 输入
    - 650 V to 41 V (K= 1/16)
  - BCM ChiP 和 VIA 4414
  - 螺丝安转和插脚安装
  - 模拟和数字控制
  - 通信/工业 和军用等级
  - 固定变比
- AIM 整流模块
  - 3 项整流桥，滤波器，瞬态保护

超高压 BCM 和 3ϕ AIM 的应用图解

- AC 到 低压大电流负载 ： 3Φ AC ->AIM->UHV BCM
  -> PRM+VTM -> 负载.
- AC 到 高压负载:
  3Φ AC ->AIM->UHV BCM
  -> SiP/smChiP PRM-> 负载.



超高压 BCM 应用举例

- 国防
  - 相控阵雷达
  - 潜水机器人
- 工业
  - 高功率的三相电源
  - 系留无人机
- 高电压电池系统
  - 电动车
  - 能量存储

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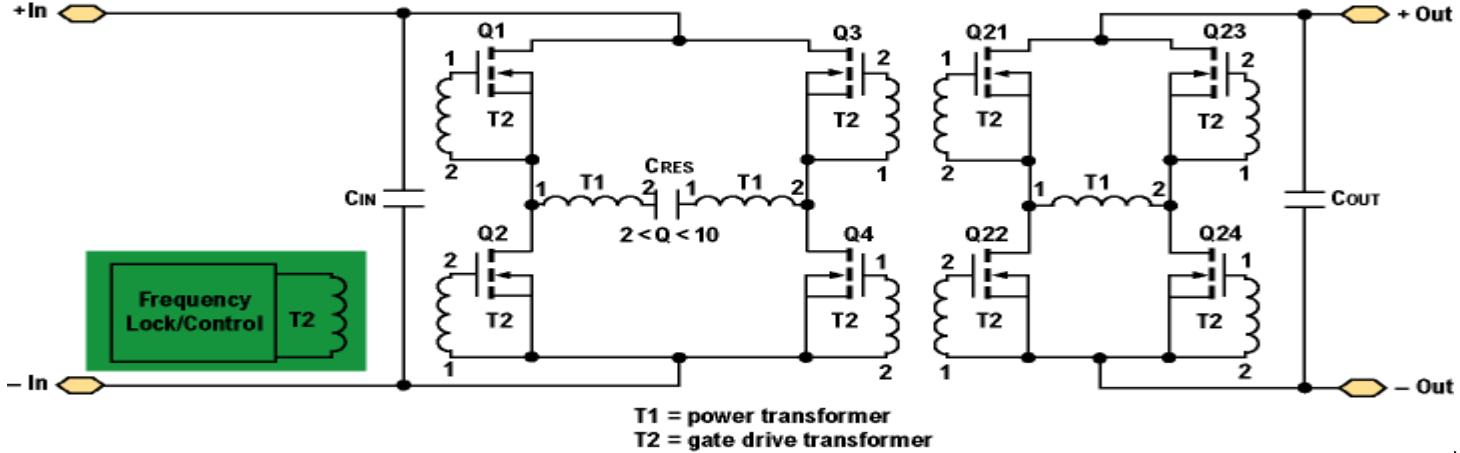
正弦振幅转换器

What is SAC

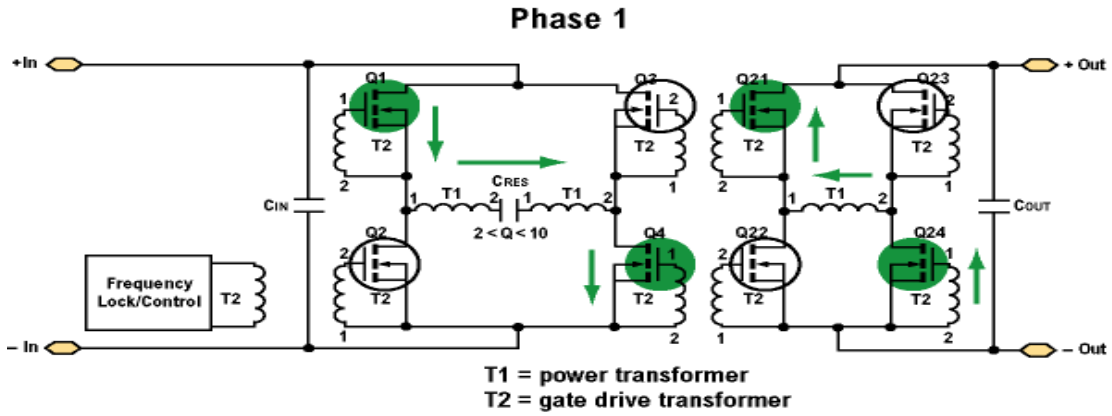
- Sine Amplitude Converter (SAC)
- Achieve ZVS and ZCS.
- Input voltage: 0-800 V (up to 2:1 input range)
- Output voltage: 0-55 V
- Transformation ratio (K): 1:1-48:1
- Output current or power: up to 160 A or 2.4KW
- Conversion efficiency: up to 98%
- Conversion frequency: up to 4 MHz, fixed
- VTM, LVBCM, HVBCM,UHVBCM,NBM and IBC are all use SAC.

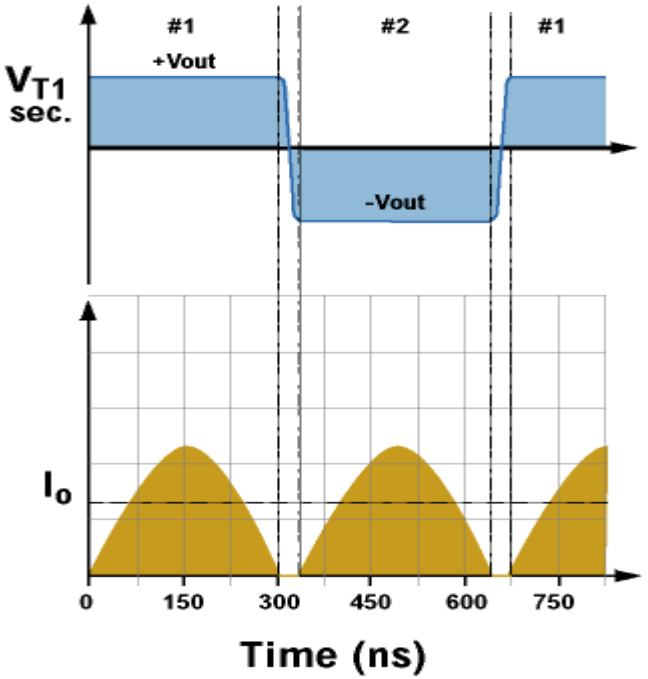
VTM / BCM SAC Control



- The controller locks to the natural frequency of the Low Q oscillator and turns all switches ON and OFF under ZCS/ZVS conditions
- Conduction states result in a 100% effective duty cycle
- Control circuitry recycles the gate drive energy from each pair of switches
- Control Servo locks to Sine Amplitude Converter resonant frequency and phase, compensating for power train parametric variabilities
- Soft start, inrush control and Adaptive Loop Compensation of Rout

VTM Operation Phases

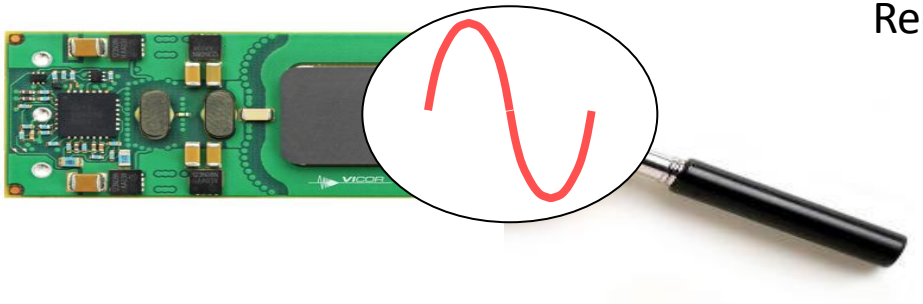




Always Sinusoidal Current

Zero Voltage, Zero Current Switching:
All transitions, every cycle

Optimal Filtering:
No harmonics below switching frequency, and very few above



Enables Components with Higher Figure of Merit:
Reduced de-rating guidelines

Reduced EMI:
Very narrow spectrum

Low Peak to Average Current and Voltage Ratios:
Most efficient use of silicon switches

No Switching Losses:
Switching frequency not limited by power switches ‘losses

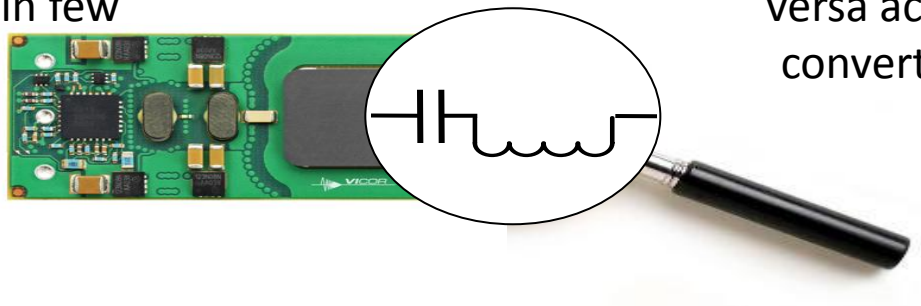
Converter Switching AT Resonant Frequency

Fast Transient Response:

Resonant tank will naturally let current flow and output voltage settle within few switching cycl

Bidirectional:

Power can be processed from input to output or vice versa across the entire converter bandwidth



Low-resistive Output Characteristic:

Typical output voltage droop is only few percentage points of the no load output voltage

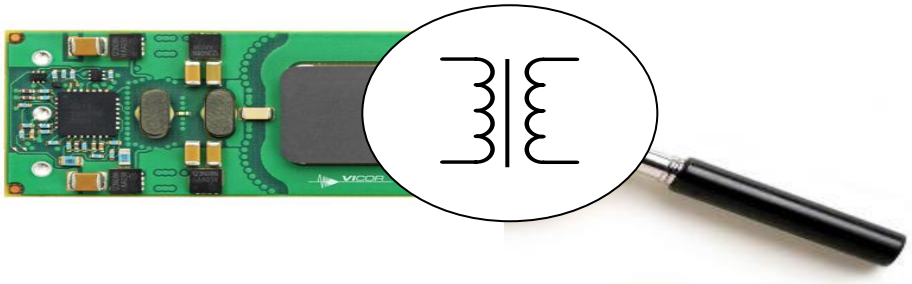
Negligible Energy Storage:

No need to store energy in magnetic components or bulk capacitance

Transformer Based

Broadband AC Characteristic:
Flat gain up to 2/3 of the switching frequency

Open Loop, not PWM Based:
Not affected by narrow pulse and regulation issues

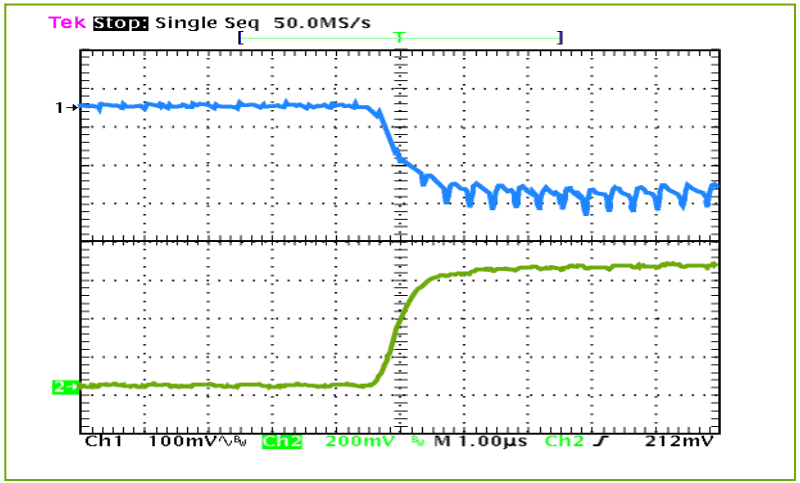


Capacitance Multiplication:
Primary capacitance is effectively applied to the load on the secondary multiplied by the square of the transformer ratio (K^2)

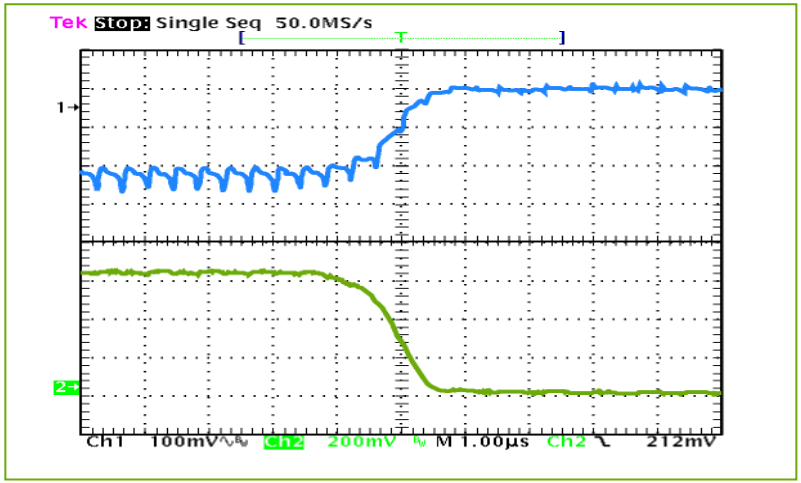
Extreme High Frequency Output Voltage Ripple:
Center tap output

Dynamic Response

K = 1/32 VTM @ Vout = 1 V



0 – 100 A load step with 100 µF input capacitance and NO output capacitance



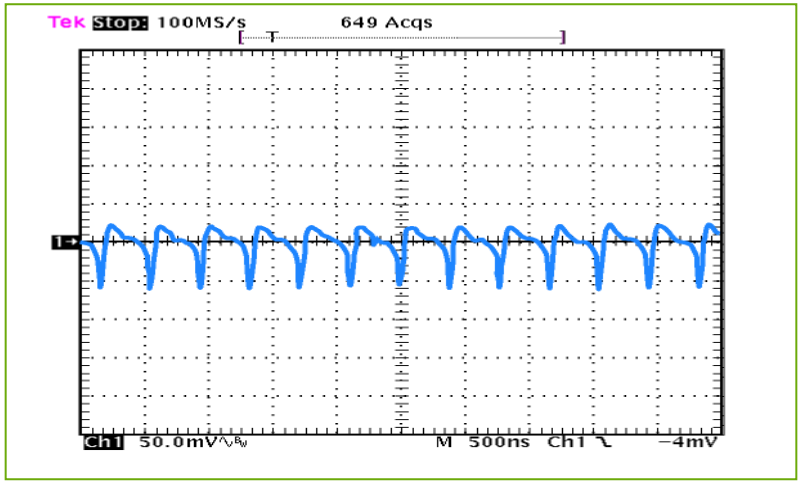
100 – 0 A load step with 100 µF input capacitance and NO output capacitance

SAC: Lowest Noise

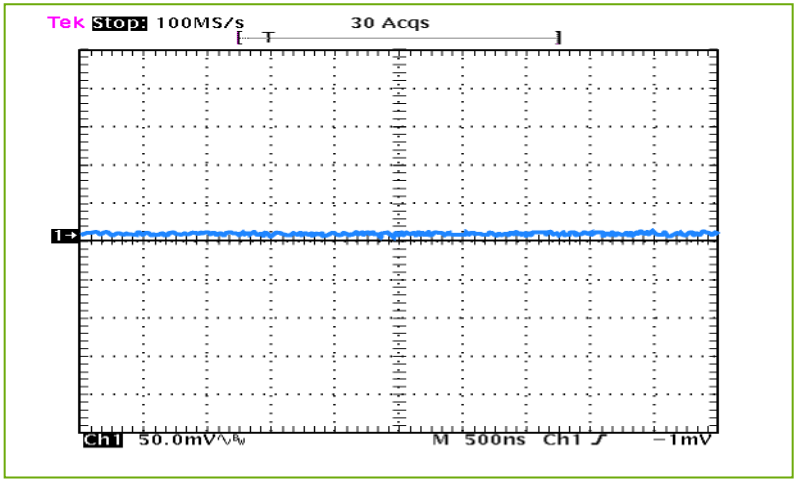
- **ZCS/ZVS**
  - Order of magnitude reduction in *dI/dt*
  - Significant reduction in *dV/dt*
- **Symmetric power train**
  - Cancellation of common-mode noise
- **High fixed switching frequency (up to 4 MHz)**
  - Easy to filter

Output Noise

K = 1/32 VTM @ 1.0 V & 100 A



Output voltage ripple @ 100 A
with NO bypass capacitance



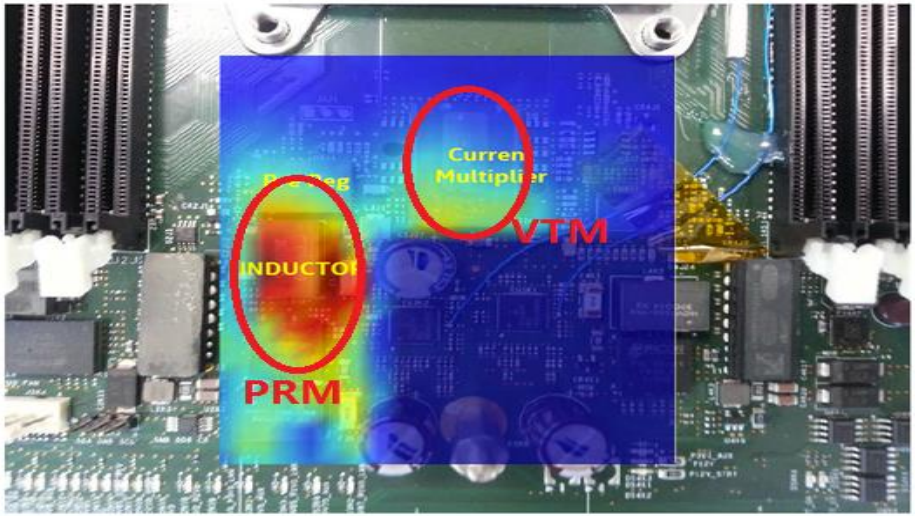
Output voltage ripple @ 100 A
with 200 µF ceramic bypass capacitance and
20 nH distribution inductance

Output noise comparison with multi-phase hard switching

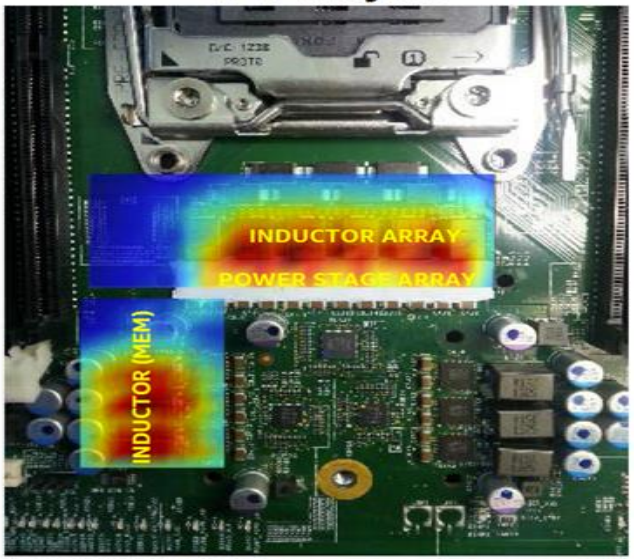
› Very good for signal integrity, easy for layout, small area for keep out.

Total Noise

48V Mayan



12V Mayan



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Thank You