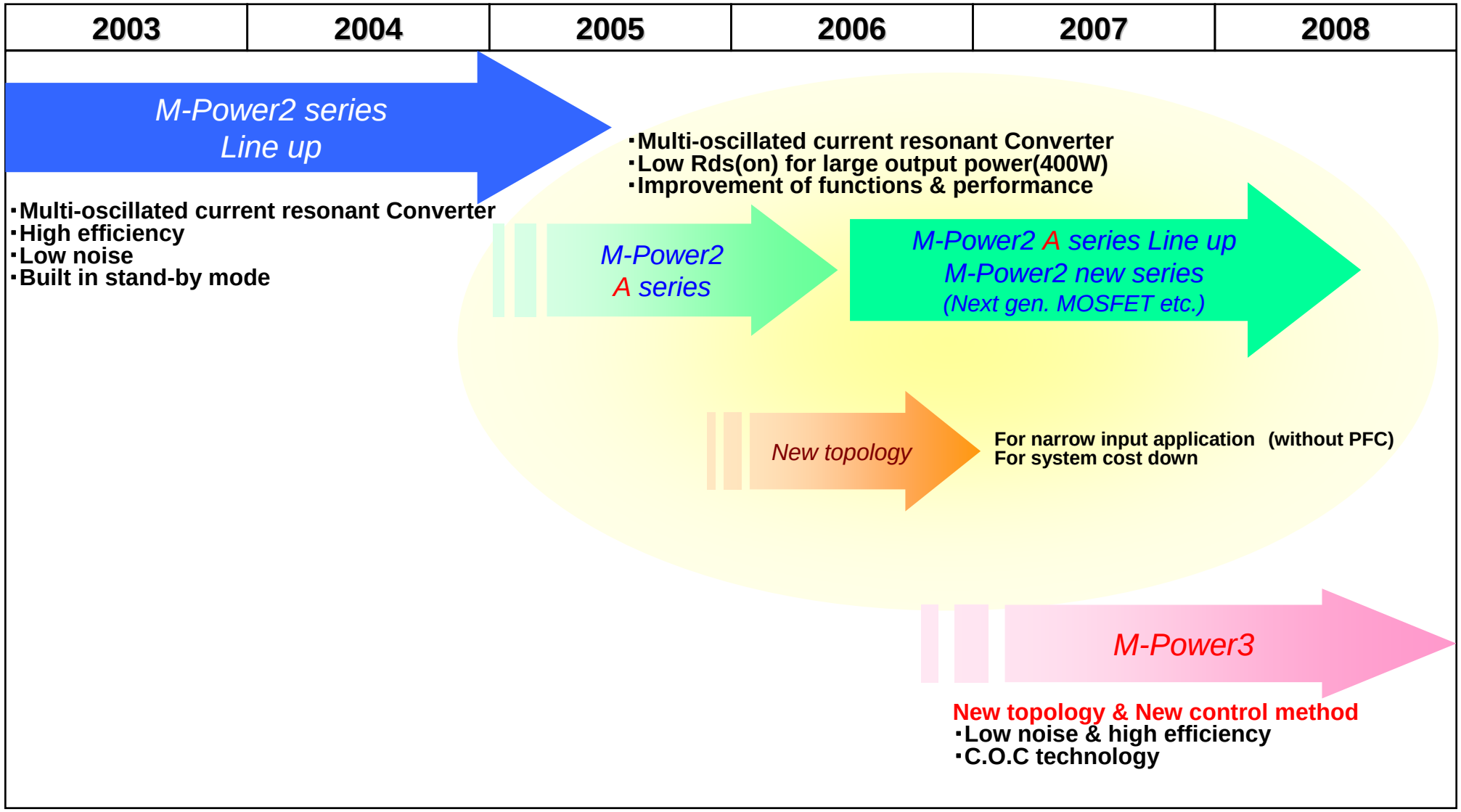
Smart power device
M-Power2

Development road map of Fuji M-Power



- **High efficiency (a reduction in SMPS size is possible.)**
  - **DC/DC : 95.3%(DC input:385V,output:24V**
  - **PFC+DC/DC : 88.4%(AC100V),90.7%(AC200V)**

- **Low noise (a reduction in the noise suppression parts is possible.)**

  MOSFETs:
  - **Turn-on : ZVS+ZCS**
  - **Turn-off : ZVS**

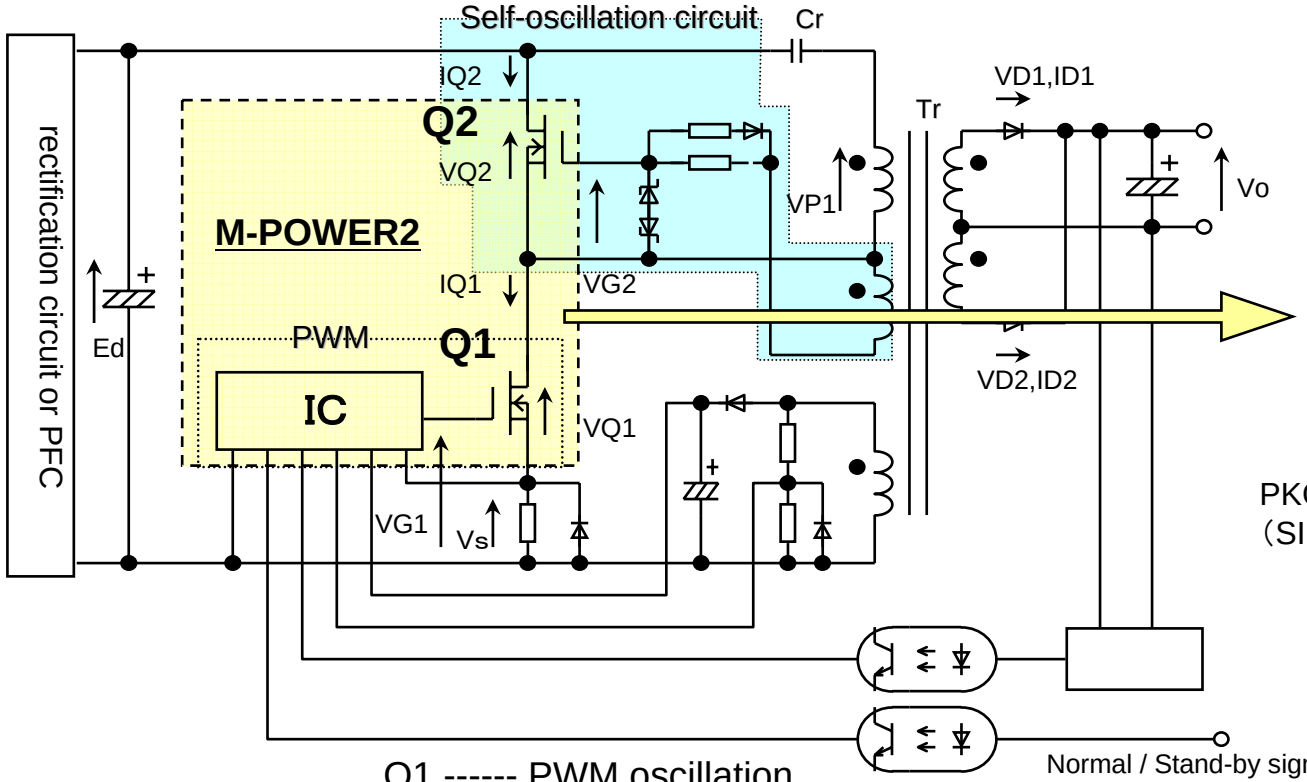
  Diodes (secondary side)
  - **Surge voltage does not occur at reverse recovery.**

- **Fail-safety (Built in protection functions : OC, SC, OV, Tj(OH))**

- **Easy design power supply (Reduction of design time)**

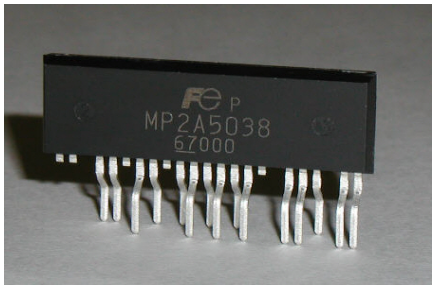
- **Stand-by mode (A series: External, Conventional series: Built in)**
  - **Pin<0.4W at Pout=0.0W**
  - **Pin<1.0W at Pout=0.23W**
  - **Pin<4.0W at Pout=2.0W**

Multi-oscillated current resonant circuit (MOCRC)



Q1 ------ PWM oscillation
Q2 ------ self-oscillation (driven by winding voltage).

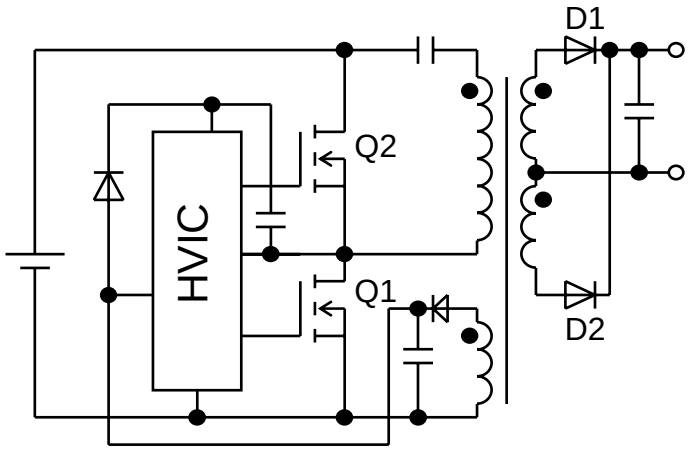
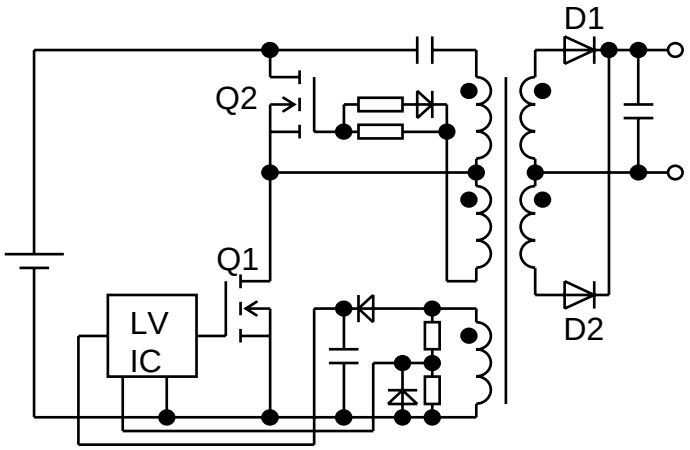
M-Power2 Aseries



PKG：H:10.2mm × W:31.0mm × T:3.5mm
（SIL-7Pin）

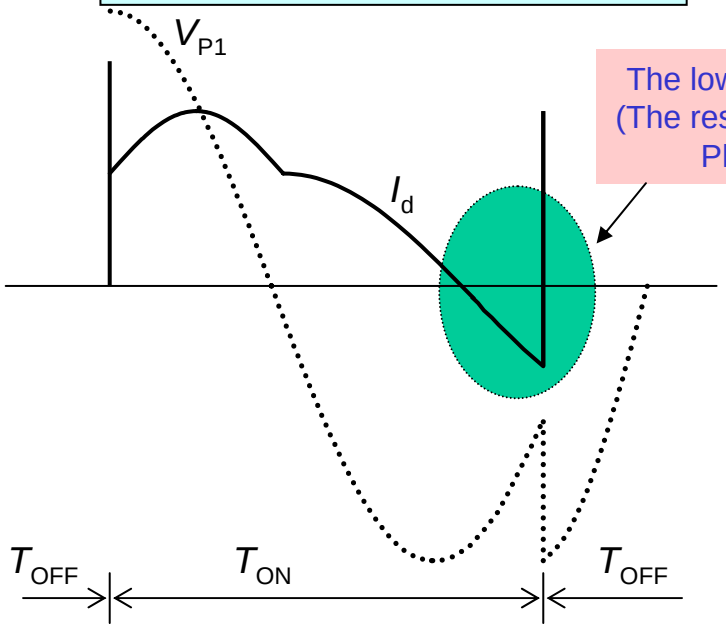
Features of the Multi-oscillated current resonant
1) No arm-short circuit by No lower side operation (No resonant breakaway phenomenon) → Easy to design
2) Low noise & high efficiency (at light load too) → same as conventional PFM type or more

Comparison of conventional PFM type and multi-oscillated type(M-Power2)

	Conventional PFM type	Multi-oscillated type（M-Power2）
Circuit configuration		
Gate Driving	HVIC	LVIC＋ Trans. winding (high side)
Control method	PFM（Fixed Duty:50%)	PWM＋PFM（variable Duty）
MOSFET Vds	＞500V	＞500V
Efficiency (DC/DC)	＞92-93%	＞93-95%
Noise	Low	Low
Loss at no load	>3W	< 0.4W
Size	○	◎（ Built-in standby mode ）
Design	Difficult	Easy to do fail-safety design

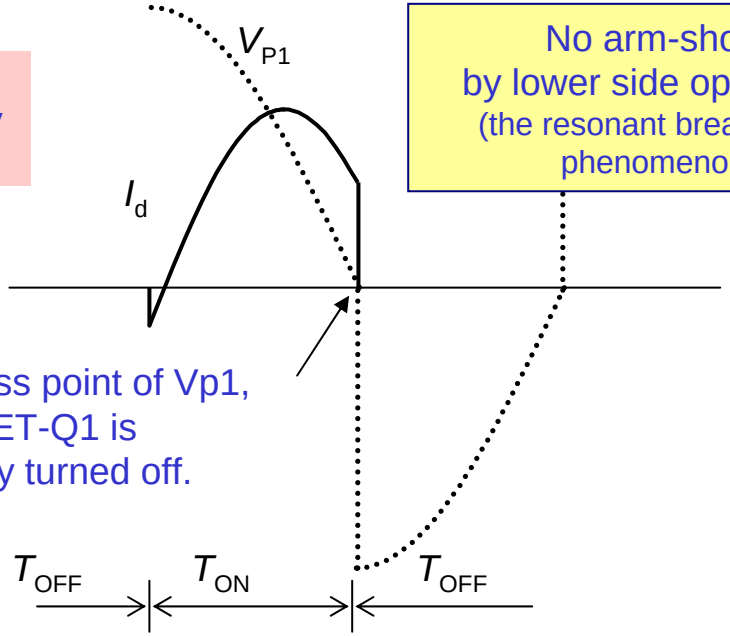
Operation of switching transient

Conventional PFM type current resonant converter



The lower side operation (The resonant breakaway Phenomenon)

M-Power2(Multi-oscillated type)



No arm-short by lower side operation (the resonant breakaway phenomenon

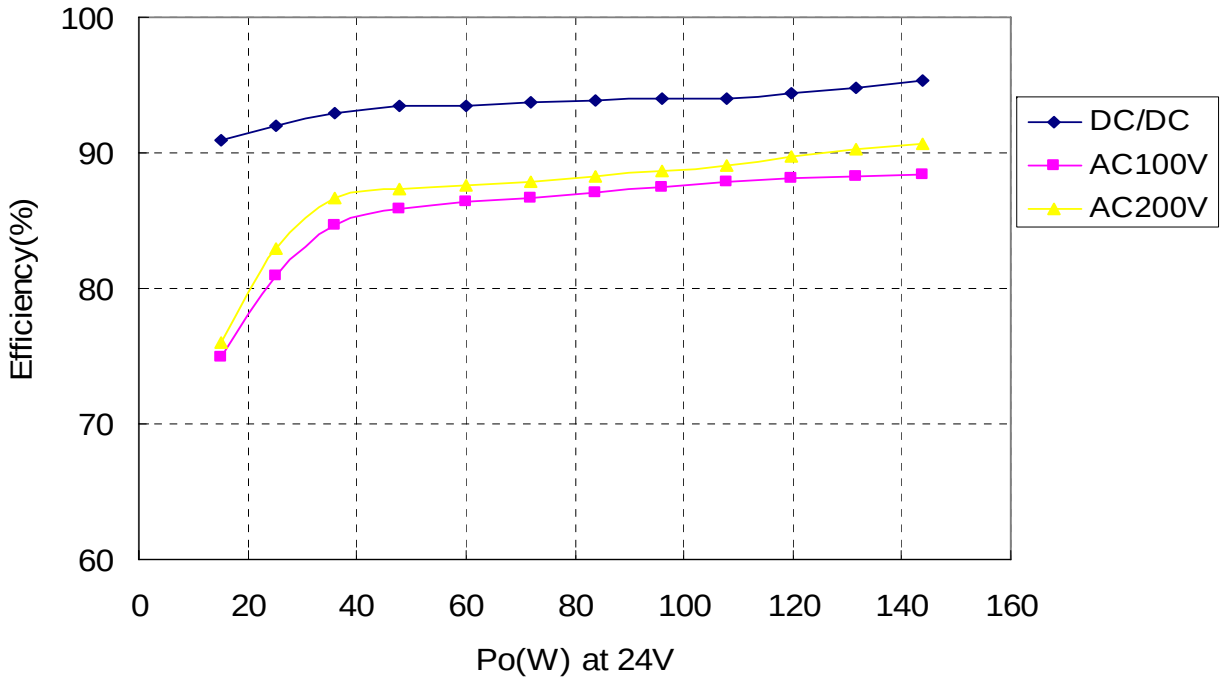
At Zero-cross point of Vp1, The MOSFET-Q1 is compulsorily turned off.

There is a possibility that the lower side operation **(the resonant breakaway phenomenon)** happens.
In the condition of a low input voltage and the overload, when the drain current of Low side MOSFET(Q1) becomes minus, Upper-side MOSFET(Q2) turn on and body diode of Q1 operates high – di/dt reverse recovery and the arm-short happens. In the worst case, **MOSFET(Q1) is destroyed.**

M-Power2 always detects winding voltage(Vp3) and has the function of turning off MOSFET(Q1) at Zero-cross point of Vp3(Vp1).
The phase of the voltage is later for that of the current (about 90deg.).
So the drain current of Low side MOSFET(Q1) is always plus and **the lower side operation (resonant breakaway phenomenon) never happen.**

It is easy to do fail-safety design.

High efficiency



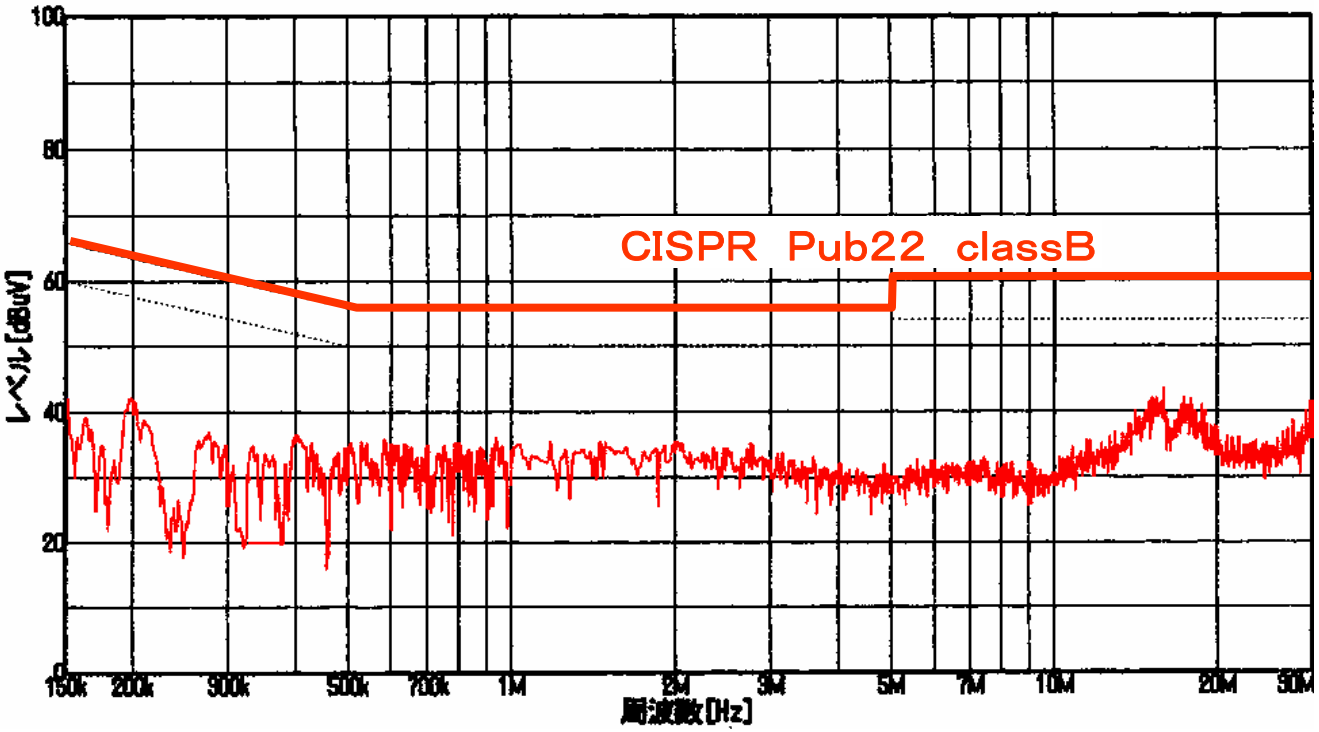
Efficiency - Load characteristic at normal mode

DC/DC : 95.3%
(DC input:385V,output:24V)

PFC+DC/DC:88.4%(AC100V)
90.7%(AC200V)

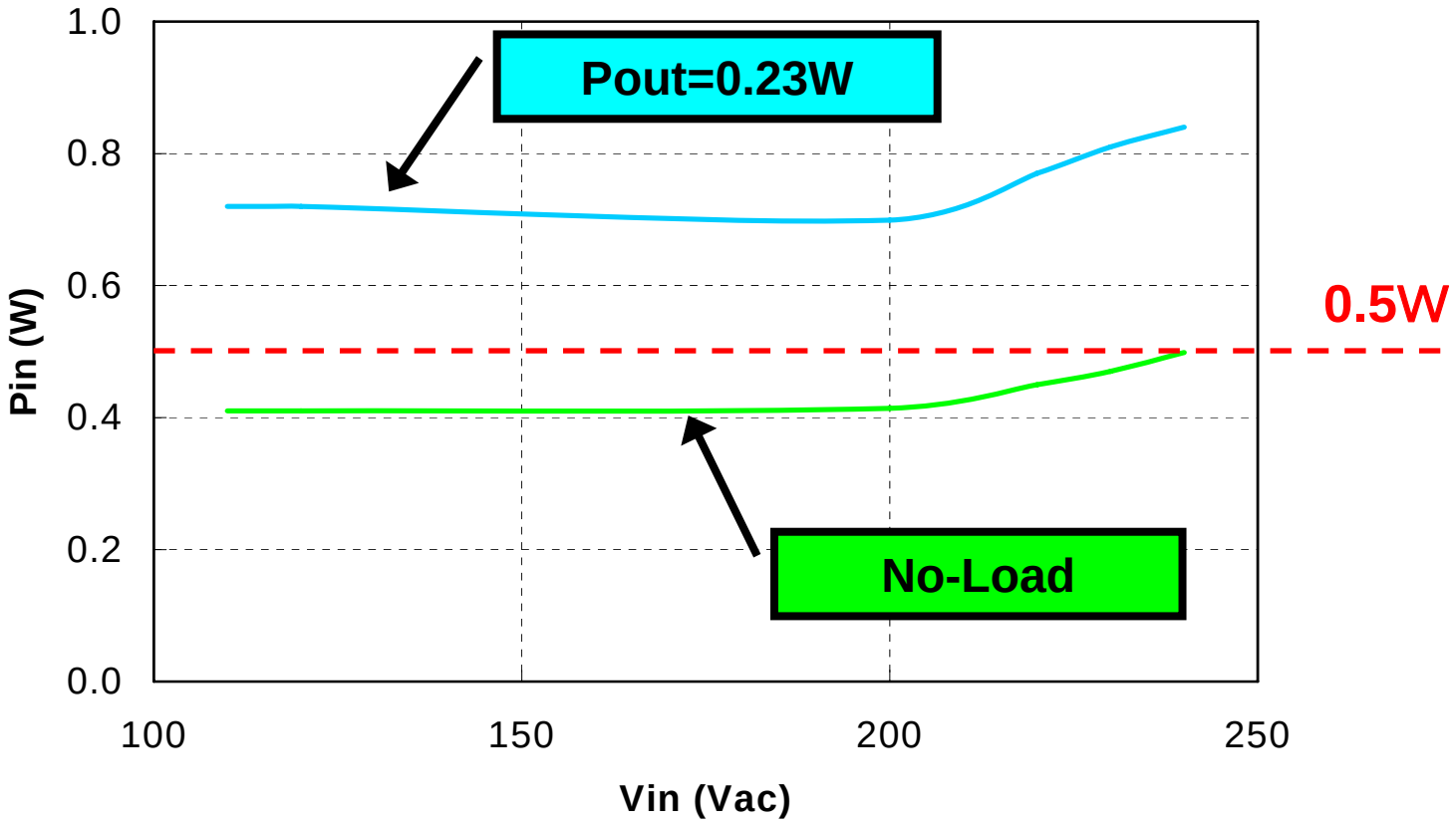
Down size your SMPS

Conducted Emission



Input Power at Stand-by (with PFC)

- Input power is less than 0.9W at the output power is 0.23W (5V/46mA).
- Input power is less than 0.5W at the No-load.



- Line up of M-Power2 A series

Type name	MOSFET(Q1)		MOSFET(Q2)		Control IC		Sample
	V_{DS}	$R_{DS(ON)}$	V_{DS}	$R_{DS(ON)}$	$V_{CC(ON)}$	$T_{j(OH)}$	
MP2A5038	500V	0.38Ω	500V	0.38Ω	16.5V	125 ～ 150 ℃	M/P
MP2A5060	500V	0.6Ω	500V	0.6Ω			M/P
MP2A5077	500V	0.77Ω	500V	0.77Ω			Apr.-2007
MP2A5100	500V	1Ω	500V	1Ω			May-07
MP2A5135	500V	1.35Ω	500V	1.35Ω			May-07
MP2A2010	250V	0.1Ω	250V	0.1Ω			Apr.-2007
MP2A2013	250V	0.125Ω	250V	0.125Ω			Apr.-2007

- Line up of M-Power2 (Conventional series)

Type name	MOSFET(Q1)		MOSFET(Q2)		Control IC		Sample
	V_{DS}	$R_{DS(ON)}$	V_{DS}	$R_{DS(ON)}$	$V_{CC(ON)}$	$T_{j(OH)}$	
F9220L	500V	0.93Ω	500V	0.93Ω	16.5V	125 ～ 150 ℃	M/P
F9222L	500V	0.6Ω	500V	0.6Ω			M/P
F9223L	500V	0.5Ω	500V	0.5Ω			M/P
F9231L	250	0.125Ω	250V	0.125Ω			M/P

Application (Fuji demo board)

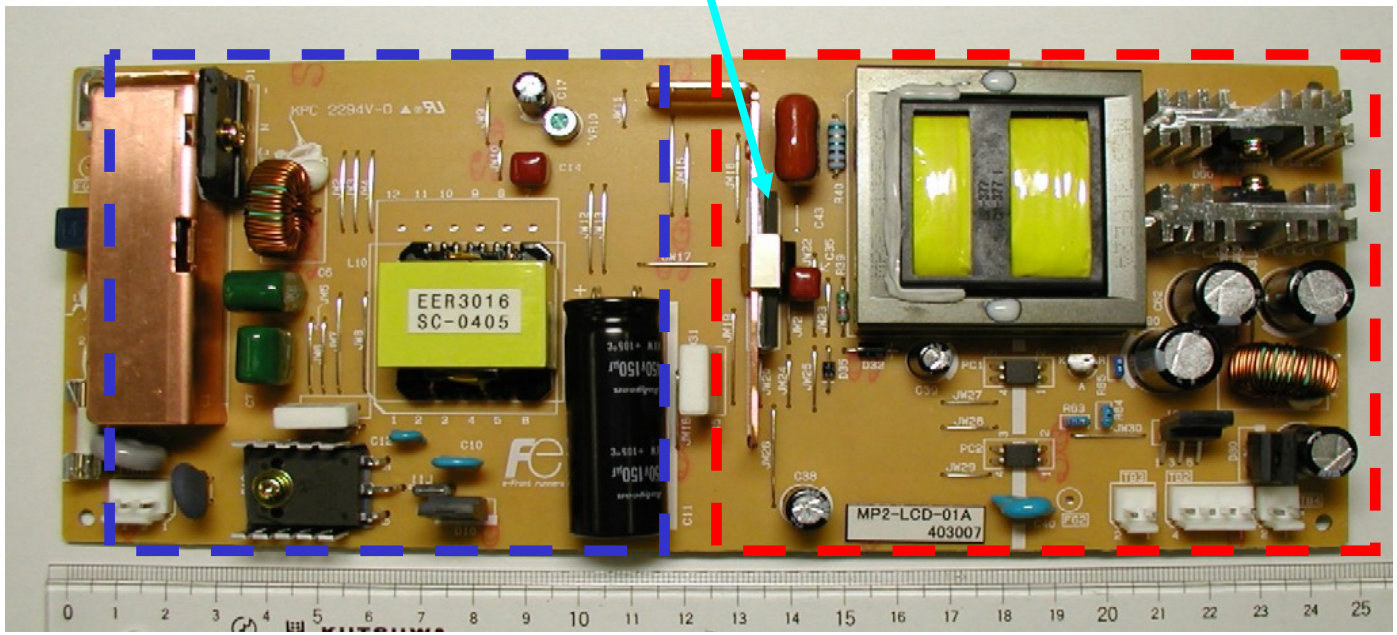
M-Power2

Spec.

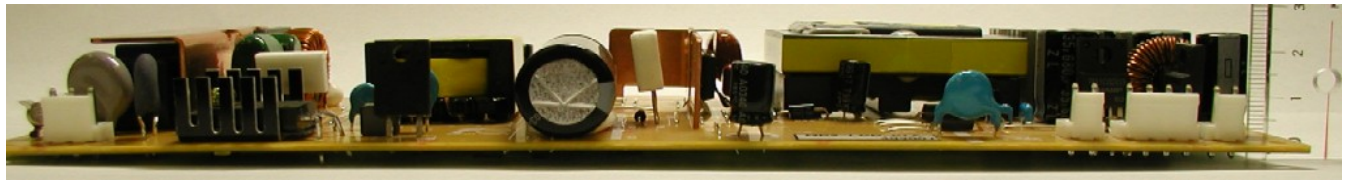
Input:AC90～264V
Output:150W
24V/6A
5V/1.2A

Outline

W：246mm
D：100mm
H：20mm



PFC circuit (CDM) **Multi-oscillated current resonant converter**



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