Fuji's Power Devices for SMPS

August - 2007

Power Supply Application Division
Semiconductor Group
Fuji Electric Device Technology Co., Ltd.

Fuji recommend devices for SMPS

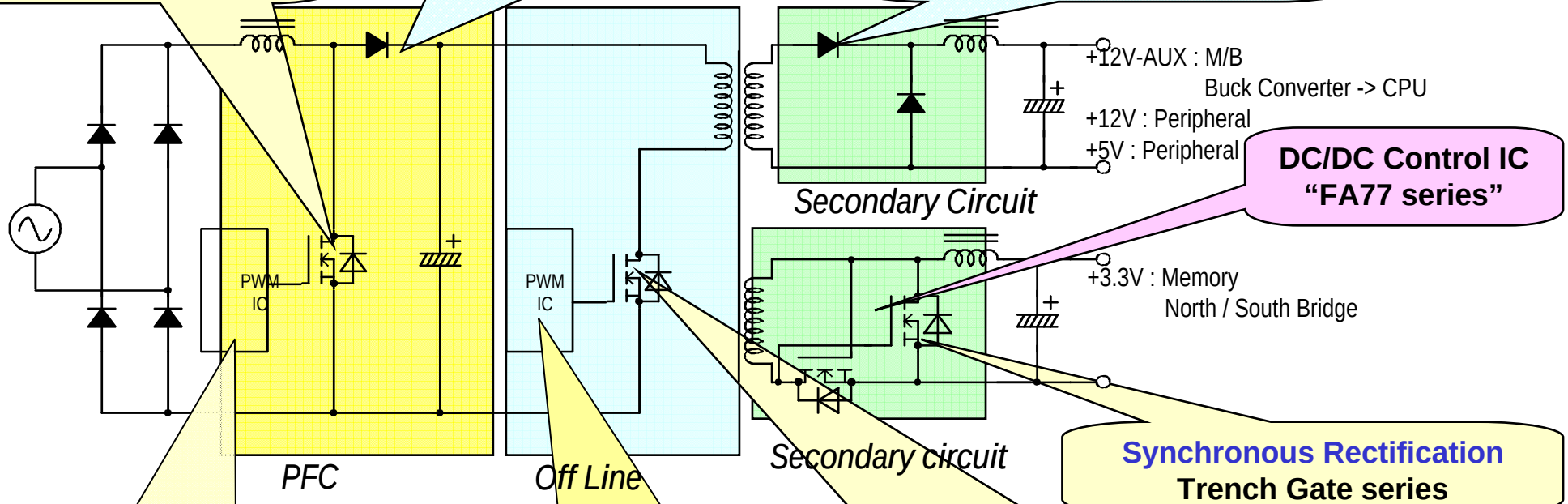
Red : New Products

e-Front runners

500V / 600V MOSFET
Super FAP-E3 series
Super FAP-G series

600V Super LLD for PFC
SuperLLD1, LLD2, LLD3

Low VF, Soft Recovery Diode
100 to 200V High voltage SBD
Low IR SBD, 300V/400V LLD



DC/DC Control IC
"FA77 series"

Synchronous Rectification
Trench Gate series

PFC IC
Critical conduction mode
: FA5500/01
Average current control
: FA5502
: FA5550/51

PWM IC
FA13842/43/44/45
PWM Green Mode IC
FA5526/27/28/36/37/38
FA5546/47/53/54/66/67
Quasi-Resonant IC
FA5530/31/32
FA5540/41/42
FA5571/72/73/74

Smart Power Devise "M-power2"
500V / 600V MOSFET
Super FAP-E3 Series
Super FAP-G series
900V MOSFET
Super FAP-G series

- AC/DC IC series
  - PWM Green Mode Control IC
  - Quasi-Resonant Control IC
  - PFC IC series
- Smart Power Device M-Power2
  - Outline of M-Power2
  - M-Power2A series
- Power MOSFET
  - Next gen. MOSFET
- Diode
  - 80V 200V SBD
  - 300V 400V LLD
  - 600V Super LLD3

Fuji AC-DC IC series

SMPS Trend	FDT technology
Power saving	Built-in Low Standby Functions
	Low Operating Current Low Standby Power
	High Voltage Start-up Circuit
Down-sizing Cost down Low Noise	Wide Vcc range
	Multi function
	Built-in High voltage resistor
	Low EMI Low audible noise
High Reliability	Protection functions (OCP, OVP, OTP, Brown-Out)

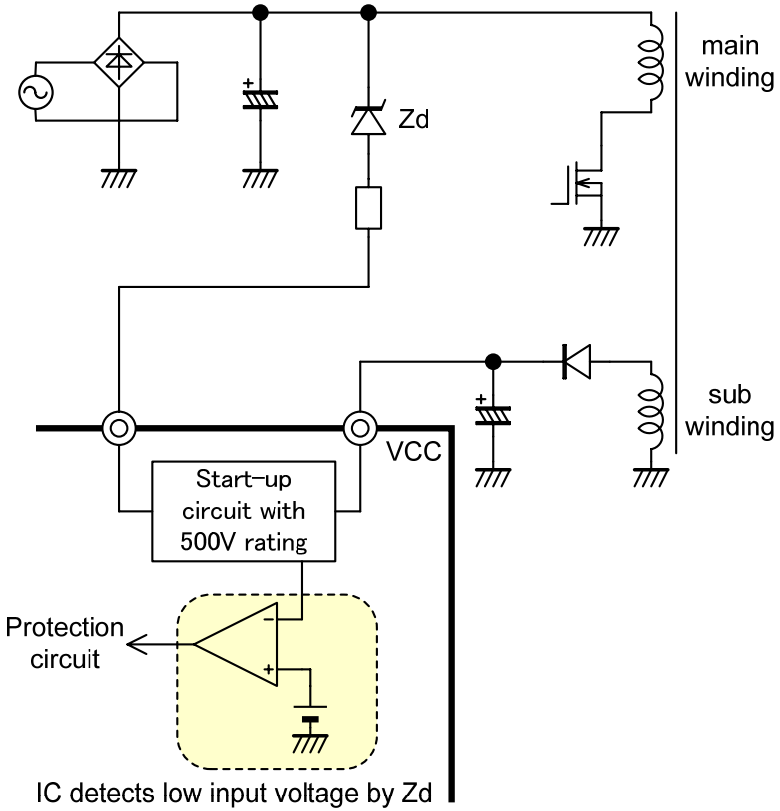
Fuji's Analog CMOS Technology

Lighter Weight, Smaller Size, Smaller Noise and Power saving of Electric Equipments

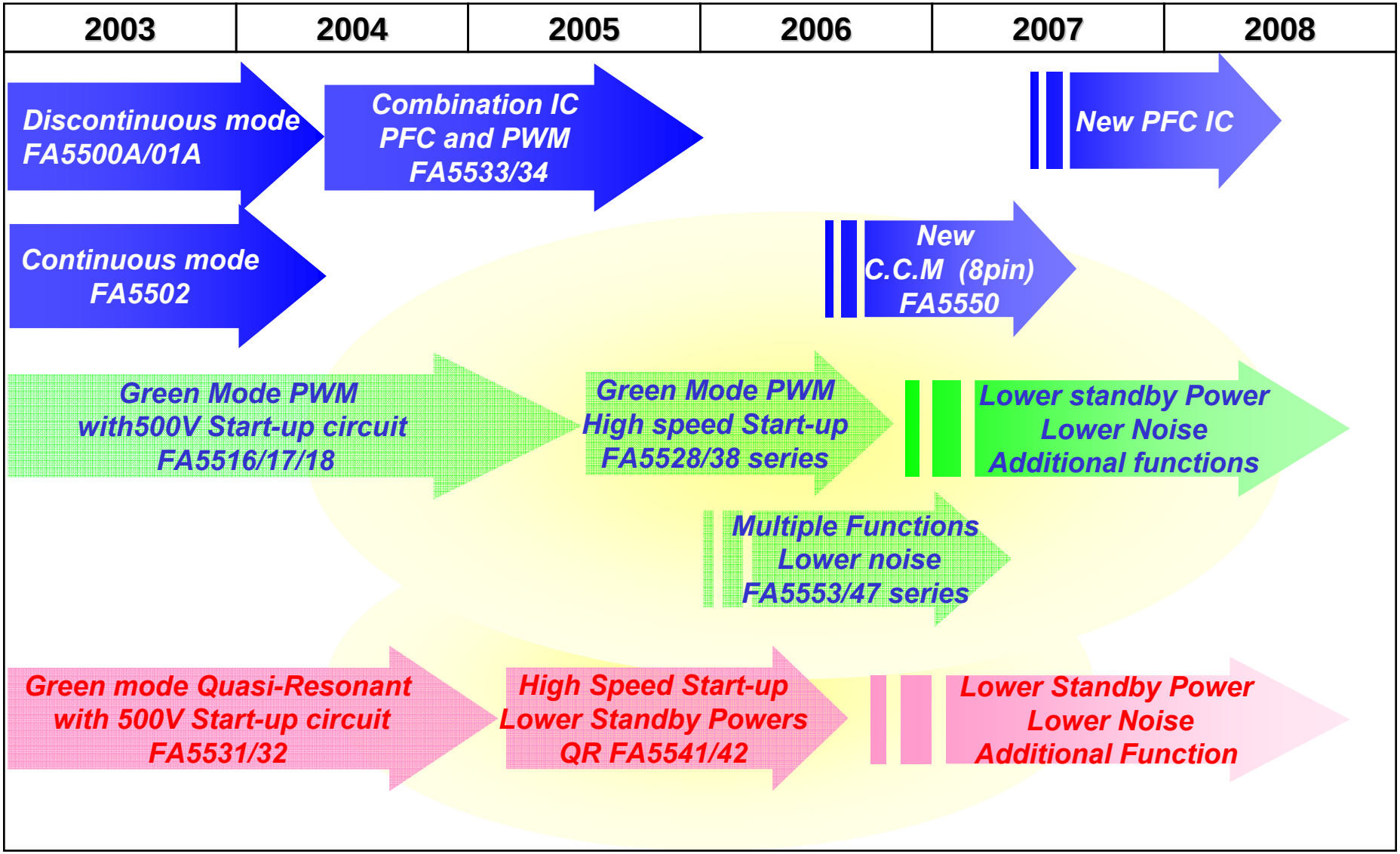
Applied to FA5547(U.D.)

Additional function : Brown out (Low input voltage protection)

IC stops switching when it detects low input voltage by start-up circuit.



Development Road Map of AC-DC Control ICs



Fuji PWM Green Mode Control ICs

Features

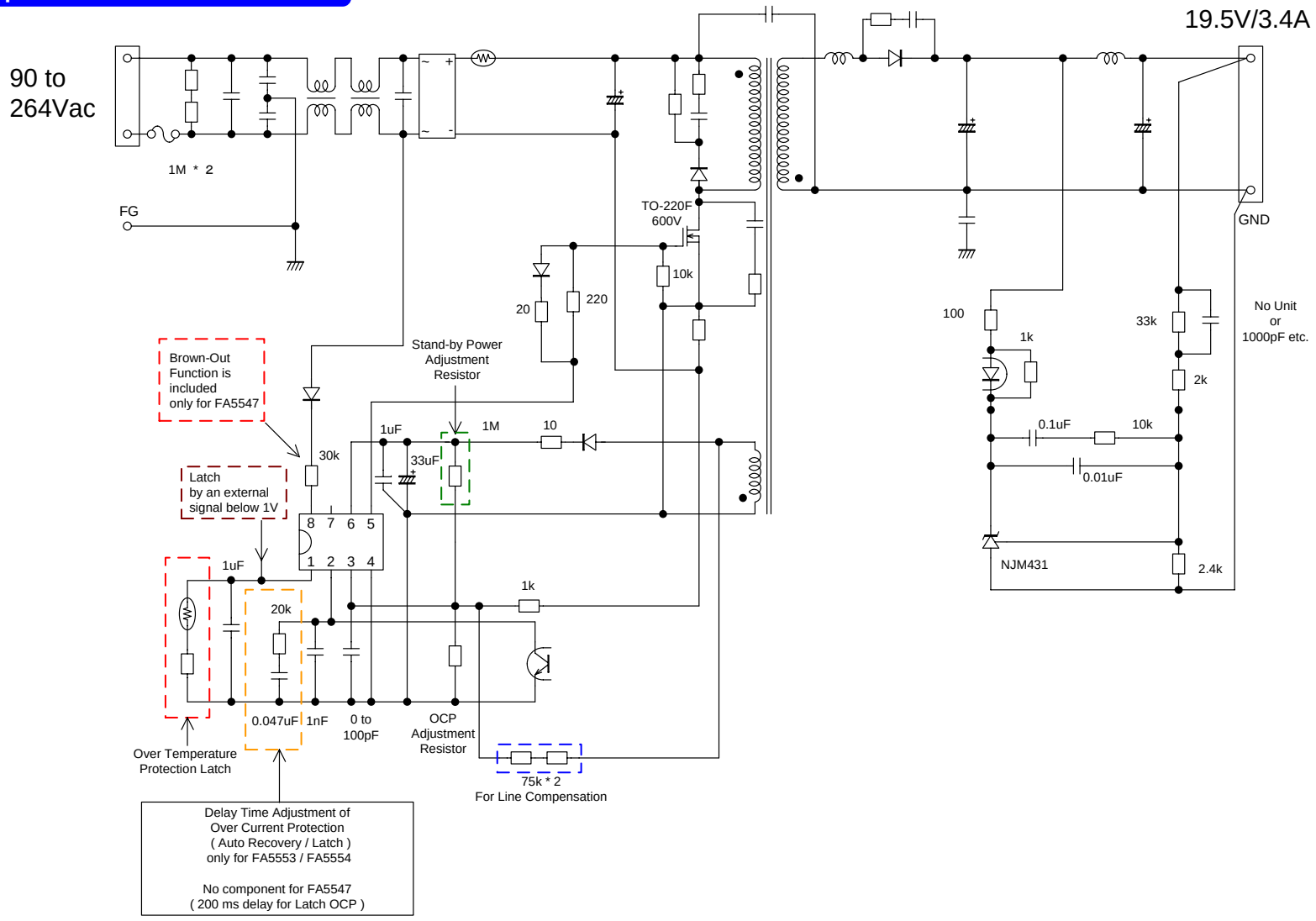
- Internal start-up circuit with 500V rating
- Switching Frequency at heavy load : 60kHz for FA5546/47/53/54 and 100kHz for FA5566/67
- Auto-reducing switching frequency at light load for low standby power

  Minimum frequency is adjustable. --- Small Audible Noise and Low Standby Power around 0.1W
- Loss of OPP Compensation circuit for AC line voltage is very low (below 10mW)
- Auto-recovery over current protection : FA5553 / 5566 (adjustable delay), FA5546 (200ms delay)

  Timer-Latched over current protection : FA5554 / 5567 (adjustable delay), FA5547 (200ms delay)
- 2 stages OPP suitable for Motor drive is include in FA5546 / FA5547
- Over temperature protection (latch)
- VCC over voltage protection (latch, VCC Threshold = 24V or 28V)
- Brown-out function for stopping operation at low AC Input (only for FA5546 / 5547, Adjustable)
- Adjustable Soft Start is available by adding a diode, a resistor and a capacitor.

Usage : Ink Jet Printer, Notebook PC, LCD Monitor, LCD-TV etc.

Application Circuit



Fuji Quasi-Resonant Control IC

Quasi-Resonant (Valley Switching) IC “FA5540/41/42”

Features

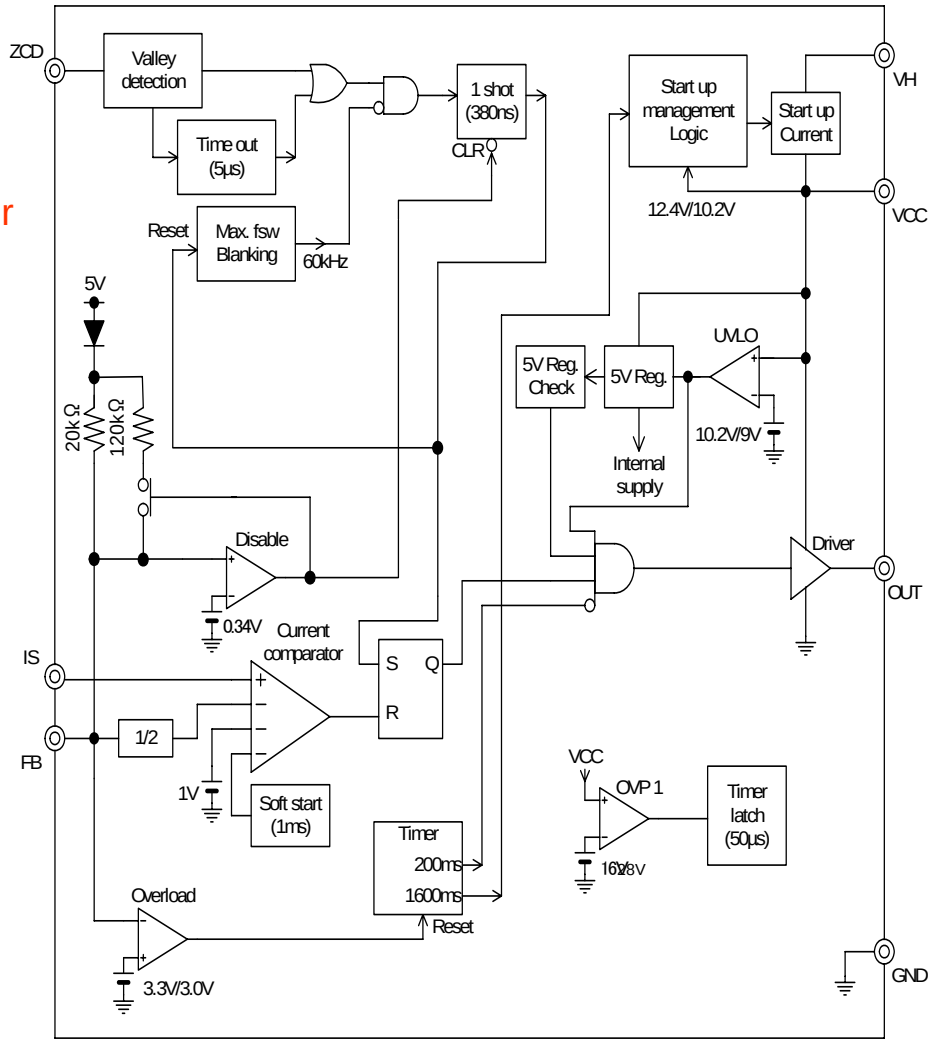
- Built-in start-up circuit with 500V rating : 0.1W input at no load by low frequency operation. 0.2s high speed start-up is available by no Vcc drop to UVLO Level.
- Intermittent switching at light load for low standby power
- Suitable for Low Noise and High Efficiency about 90%
- Line-up of 3 types for maximum frequency and OLP

Type name	Max. frequency	Vcc(max)	OLP
FA5540	65kHz	16V	Auto-Restart
FA5541	130kHz	28V	
FA5542			Timer-Latched

- High ability of driving Power MOSFET for 200W output
- Vcc rating 28V allows no series regulator for auxiliary winding to clamp Vcc voltage for FA5541/42.
- 1ms Fixed Soft Start time
- Timer Latched Over-Voltage Protection of 16V/28V Vcc
- 8 pins package (DIP/SOP)

Usage : Notebook PC, LCD Monitor, LCD-TV etc.

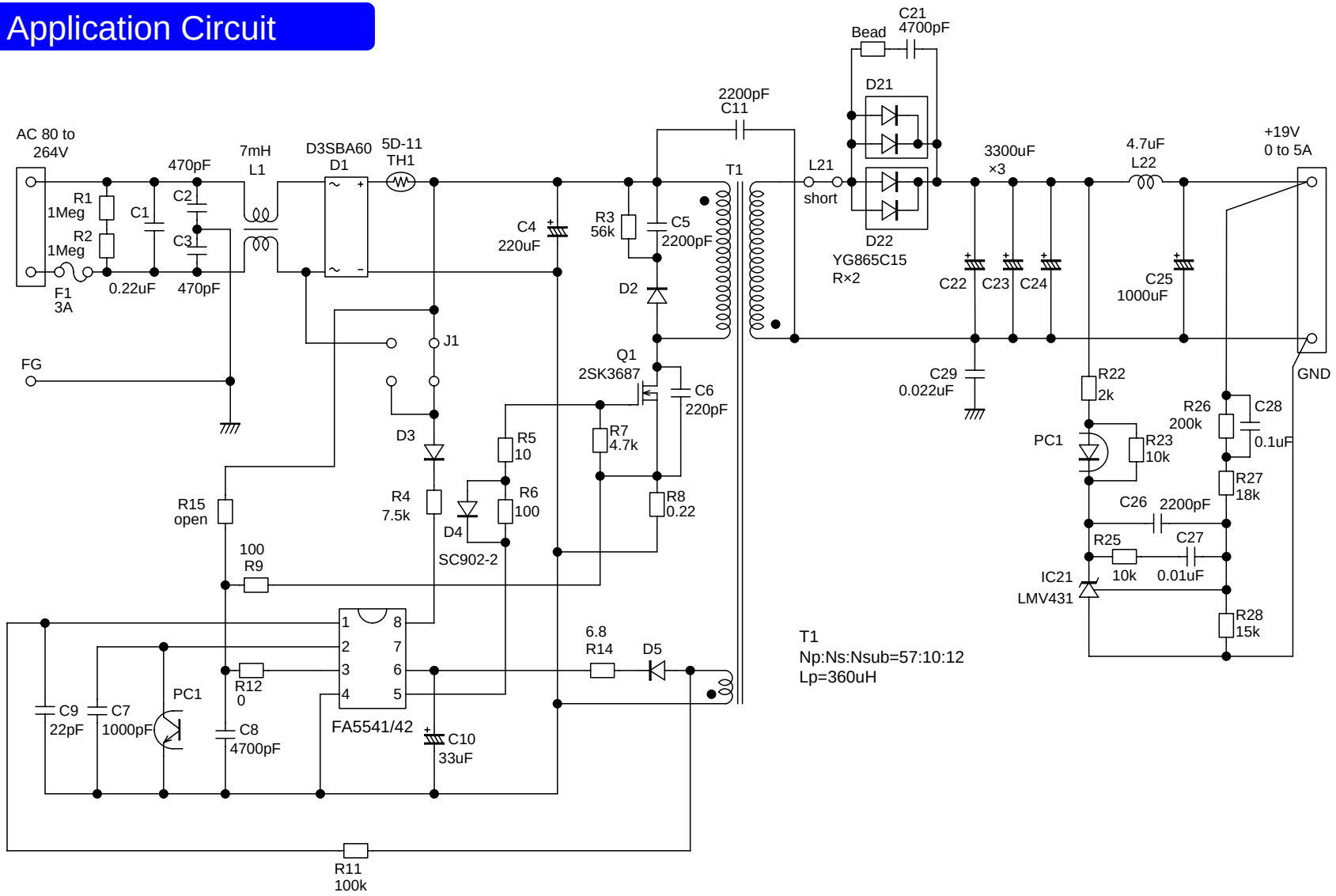
Block Diagram



Fuji Electric Device Technology

Quasi-Resonant (Valley Switching) IC “FA5541”

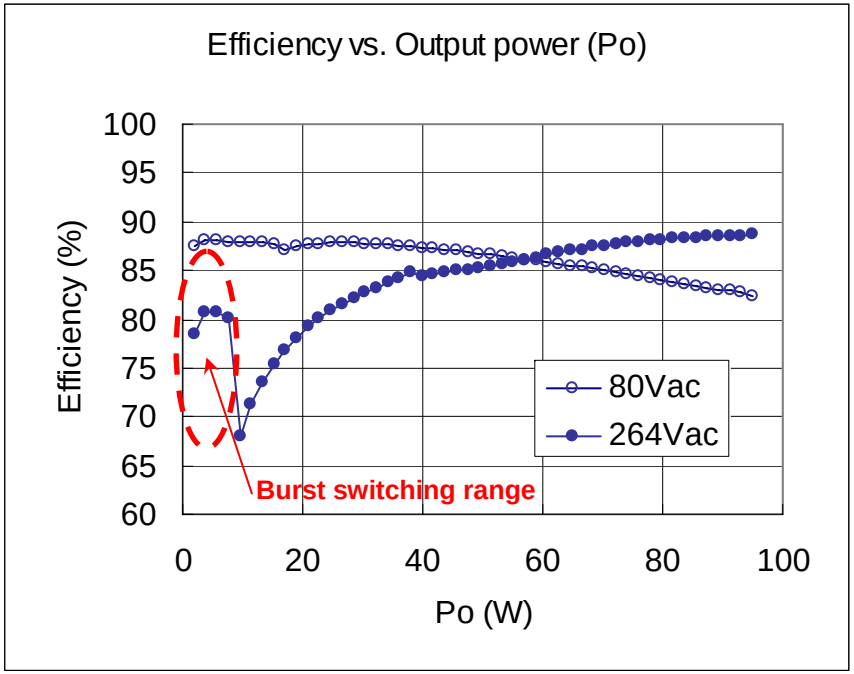
Application Circuit

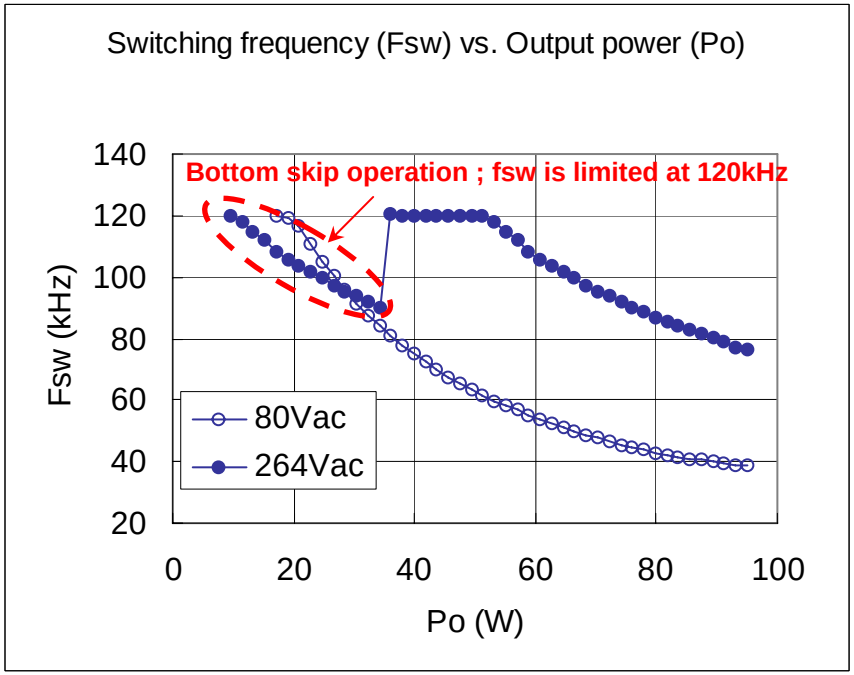


Fuji Electric Device Technology

Demo Board Data

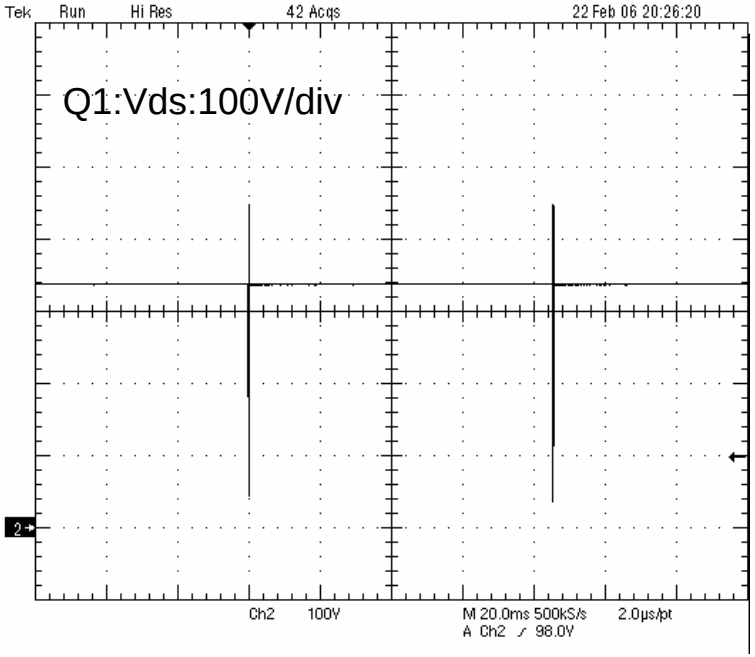
- Demo Board Specification
  Input Range : 80Vac to 264Vac
  Output Rating : 95W (19V / 5A)





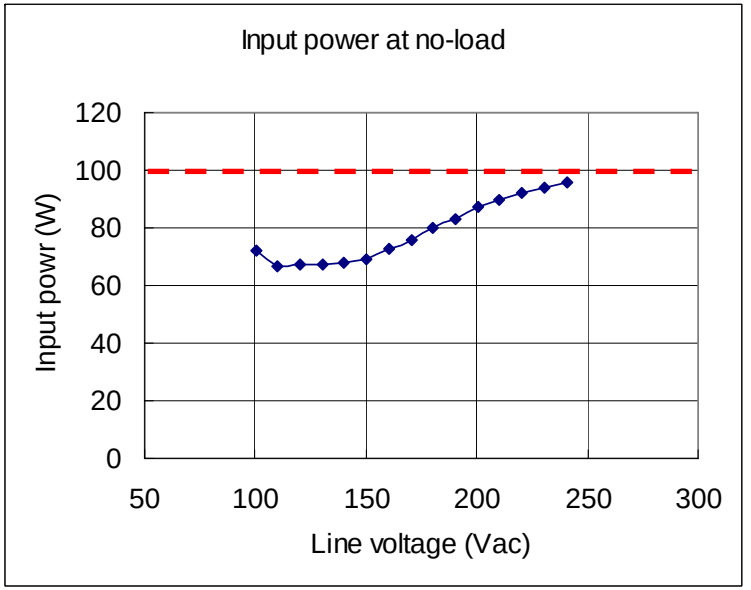
Demo Board Data

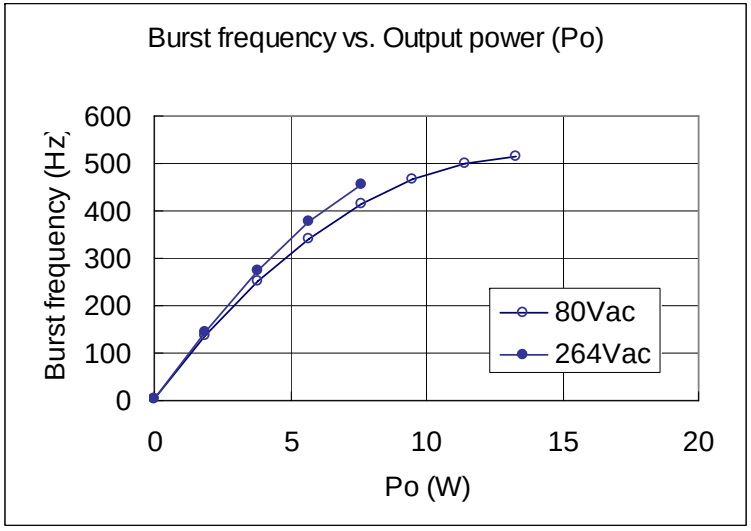
Vin:240Vac Io=0A



20ms/div

Burst switching operation



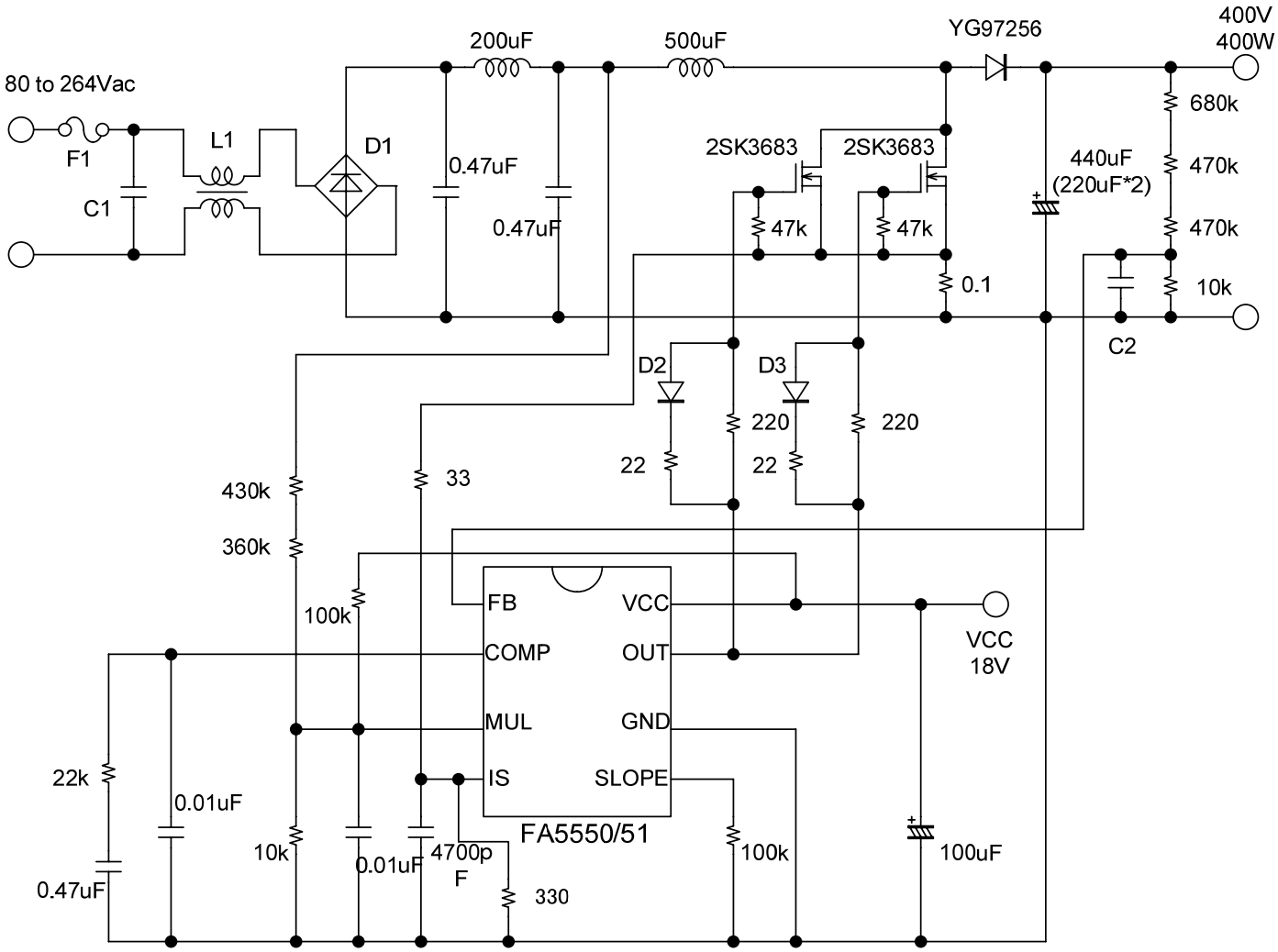


Fuji PFC IC series

Comparison of Critical conduction mode / Average current control mode PFC-ICs

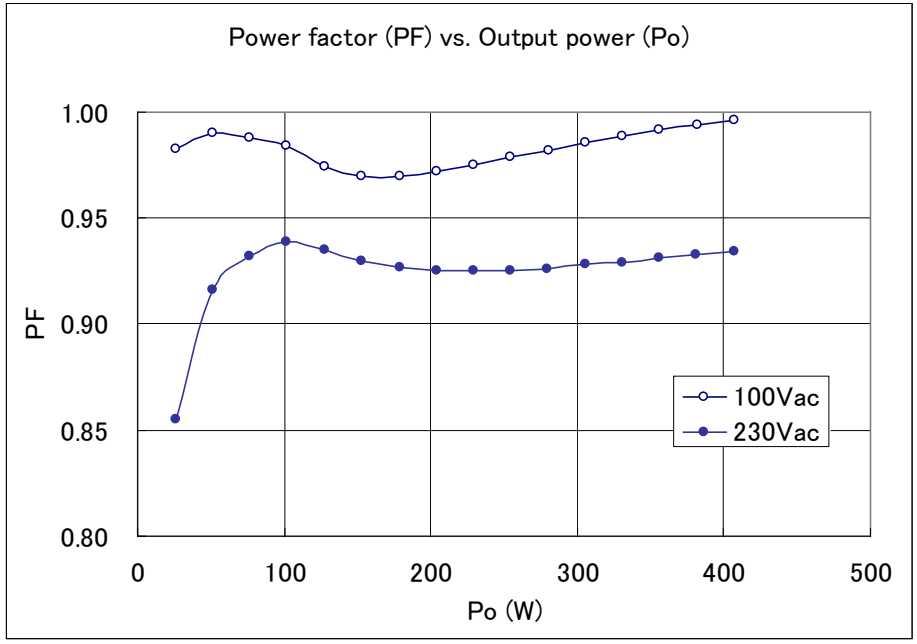
Type Name	FA5500A / FA5501A	FA5550/FA5551(U.D.)	FA5502
Control mode	**Critical conduction mode**	**Average current control**	**Average current control**
Switching Frequency	**Variable**	65kHz fixed(-9.2%/+9.2%)	Fixed (-10%/+10%)
Package	**DIP8/SOP8**	**DIP8/SOP8**	DIP16/SOP16
SMPS Output power range	**75W - 300W**	**75W - 700W**	**300W - 2kW**
Vcc Range (V)	10 to **28**	10 to **28**	10 to **28**
Output current (A)	-0.5/+1.0	**-1A/+2A**	-1.5/+1.5
Startup current (uA)	20 (Max.)	80 (Max.)	30 (Max.)
Operating current (mA)	1.0 (Typ.)	2.0 (Typ.)	4.0 (Typ.)
UVLO ON Threshold (V)	FA5500A : 11.5 (Typ.) FA5501A : 13.0 (Typ.)	FA5550 : 9.6 (Typ.) FA5551 : 13.0 (Typ.)	16.5 (Typ.)
UVLO OFF Threshold (V)	9.0 (Typ.)	9.0(Typ.)	8.9 (Typ.)
UVLO Hysteresis (V)	FA5500A : 2.5 (Typ.) FA5501A : 4.0 (Typ.)	FA5550 : 0.6 (Typ.) FA5551 : 4.0 (Typ.)	7.6 (Typ.)
Error amplifier	Transconductance Amp. Reference Vfb : 2.5V -1.4%/+1.4%	Transconductance Amp. Reference Vfb : 2.5V -1.4%/+1.4%	Voltage Amp. Reference Vr : 1.55V -2%/+2%
Over Voltage Protection	Threshold : Vfb*1.075 to Vfb*1.105 (briefly 2.725V -2.8%/+2.8%)	Threshold : Vfb*1.075 to Vfb*1.105 (briefly 2.725V -2.8%/+2.8%)	Threshold : Vr*1.037 to Vr*1.079 and 1.64V -2%/+2%
Over Current Limit Threshold (V)	1.5 (Typ.)	**1.0(Typ.) (±10%)**	-1.1 (Typ.)
Low AC input voltage protection (Brown out)	none	**OK**	none
Feed back open/short protection	**OK**	**OK**	none
No over voltage at no load	OK	OK	OK

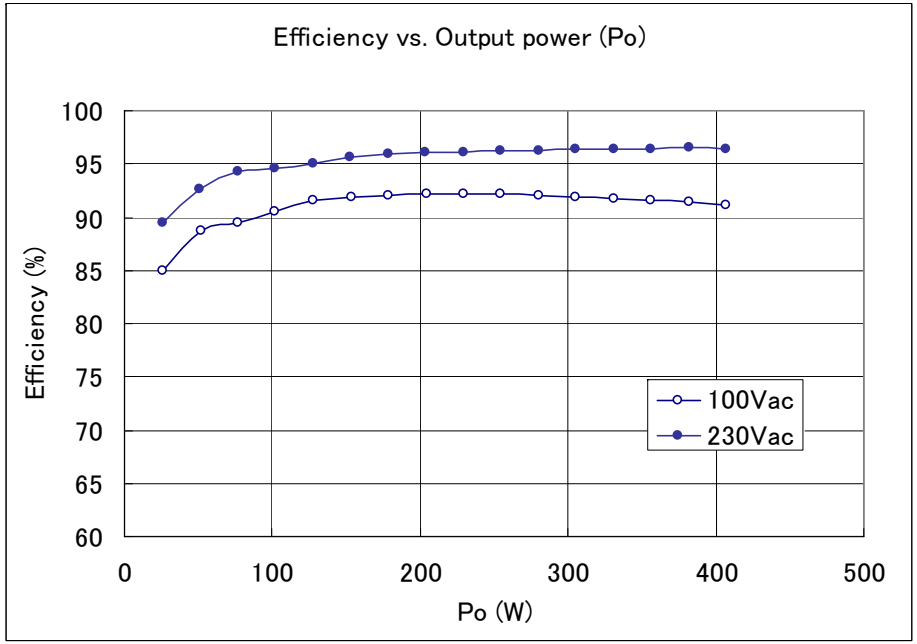
Application Circuit



Demo Board Data

- Demo Board Specification
  Input Range : 80Vac to 264Vac
  Output Rating : 400W (400V / 1A)

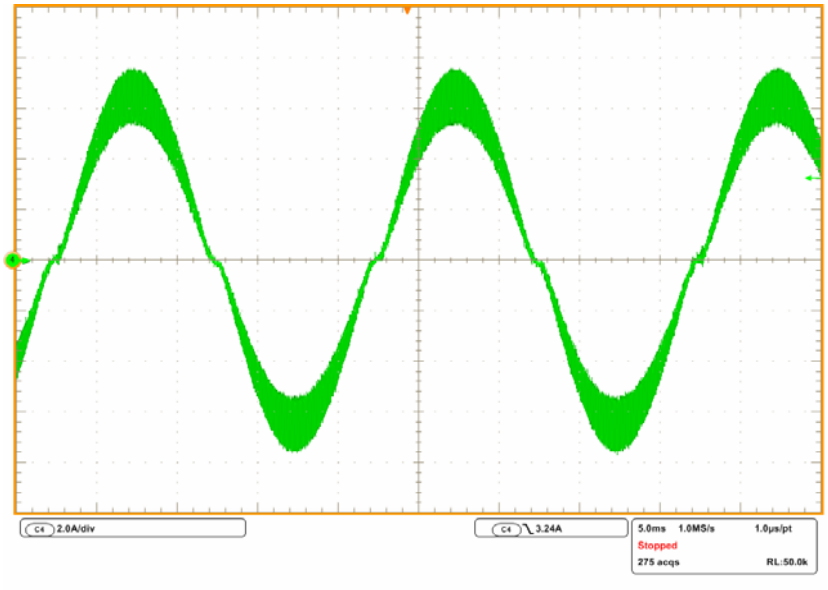




Demo Board Data

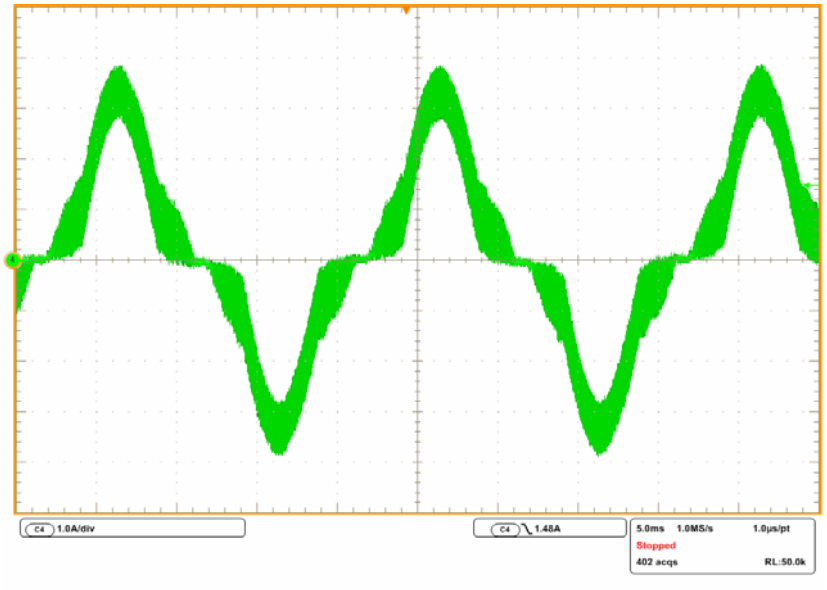
AC input current waveform

Vac=100V, Po=400W



5ms/div

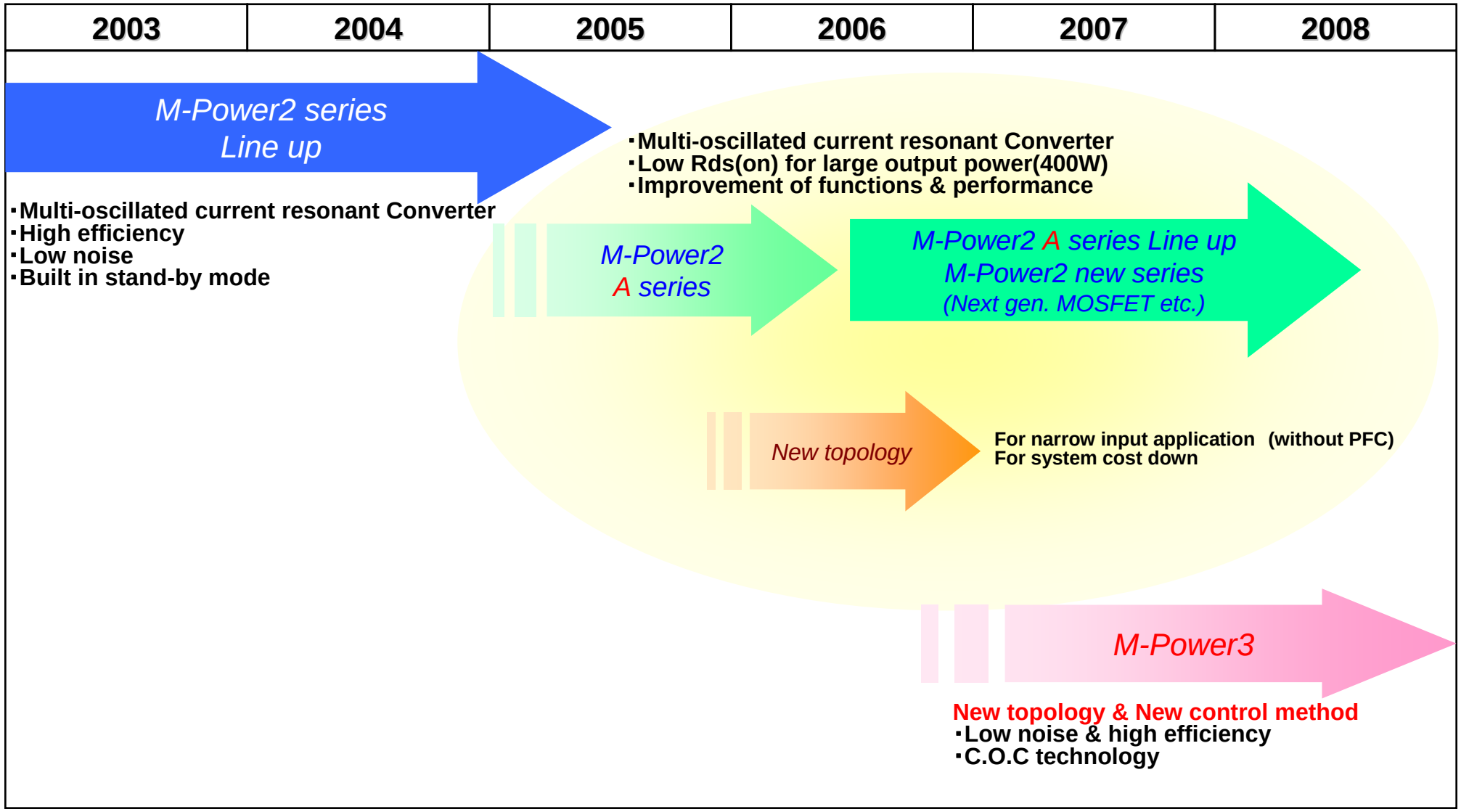
Vac=240V, Po=400W



5ms/div

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**

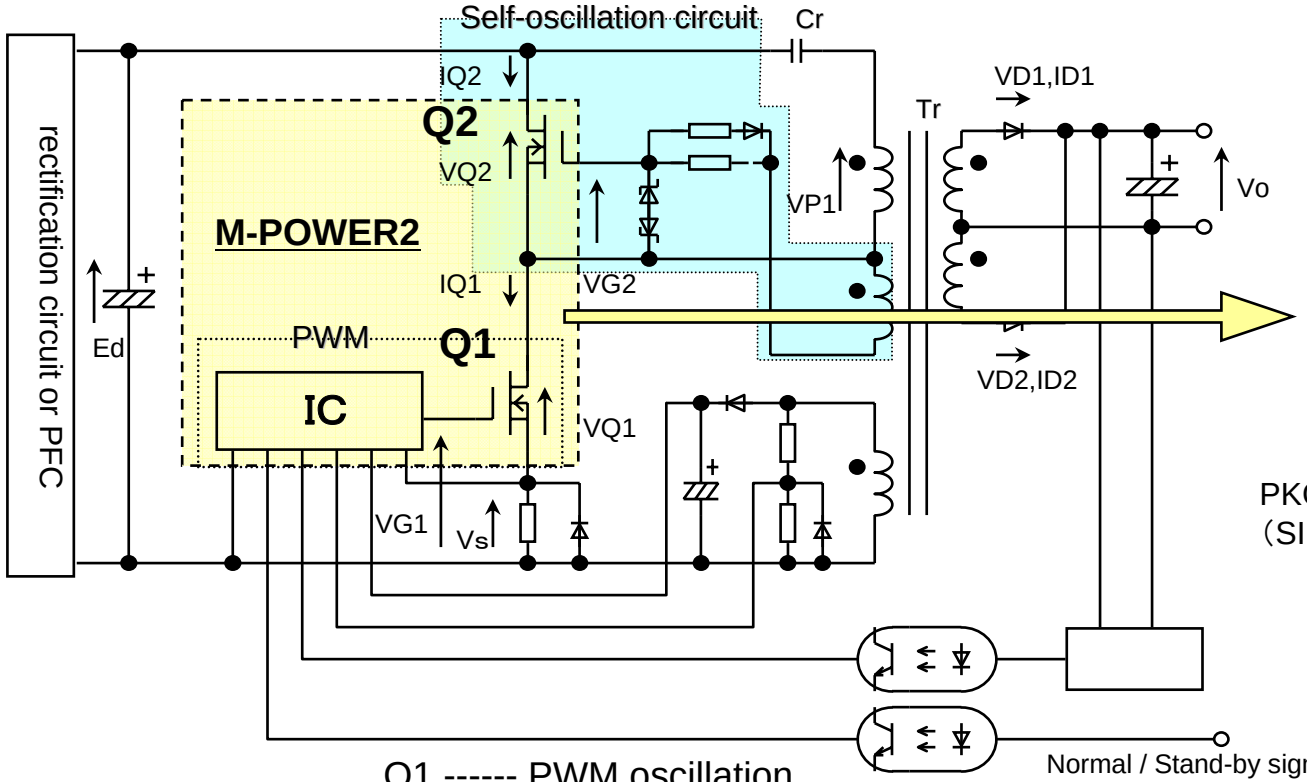
  Diodes (secondary side)
  - **Surge voltage does not occur at reverse recovery.**

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

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

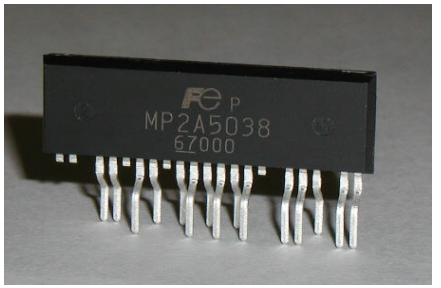
- **Stand-by mode (A series: External, Conventional series: Built in)**
  - **Pin<0.4W at Pout=0.0W**
  - **Pin<1.0W at Pout=0.23W**
  - **Pin<4.0W at Pout=2.0W**

Multi-oscillated current resonant circuit (MOCRC)



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

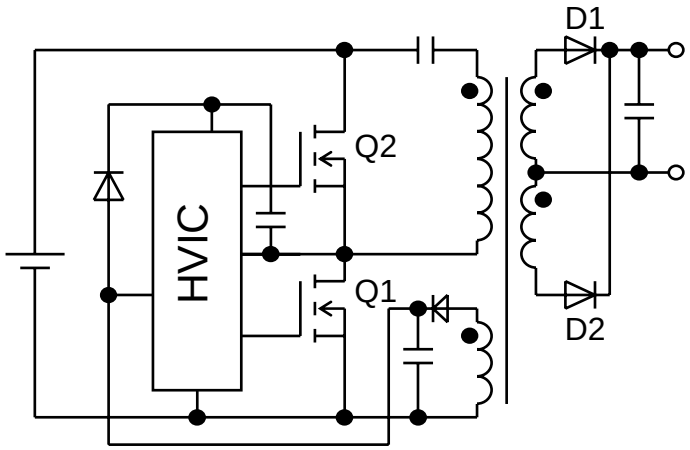
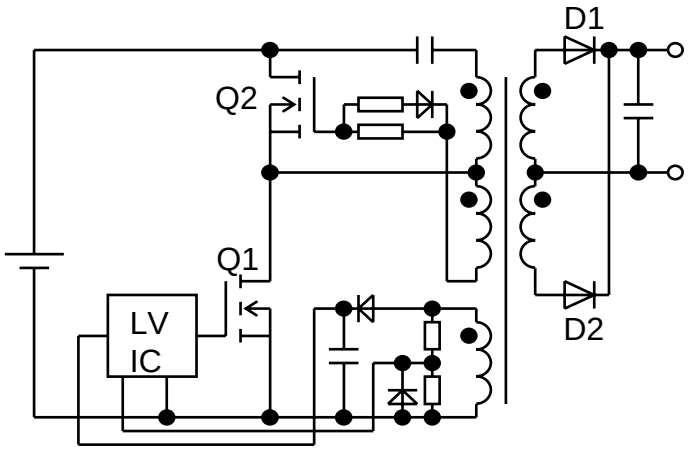
M-Power2 Aseries



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

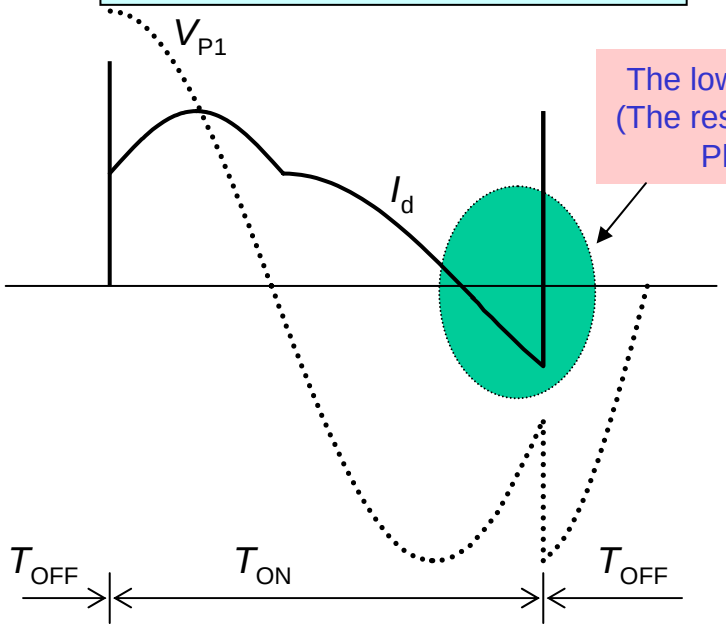
Features of the Multi-oscillated current resonant
1) No arm-short circuit by No lower side operation (No resonant breakaway phenomenon) → Easy to design
2) Low noise & high efficiency (at light load too) → same as conventional PFM type or more

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

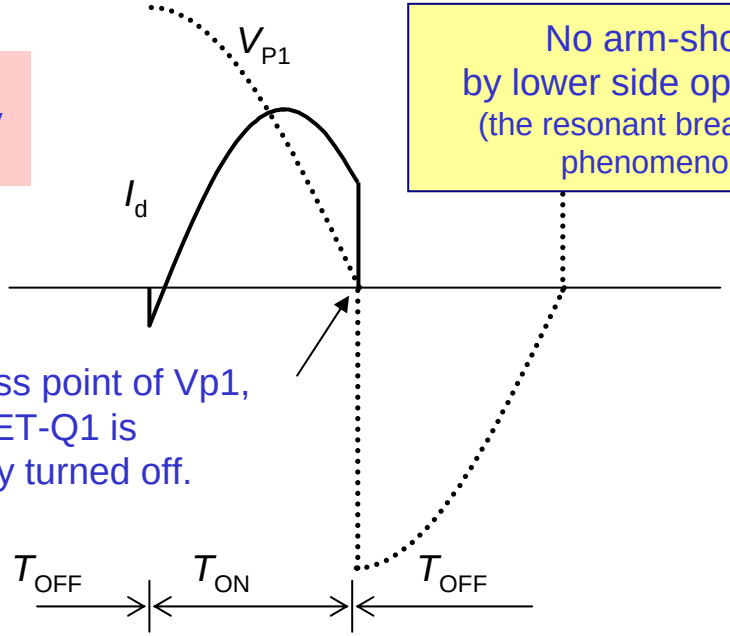
Operation of switching transient

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

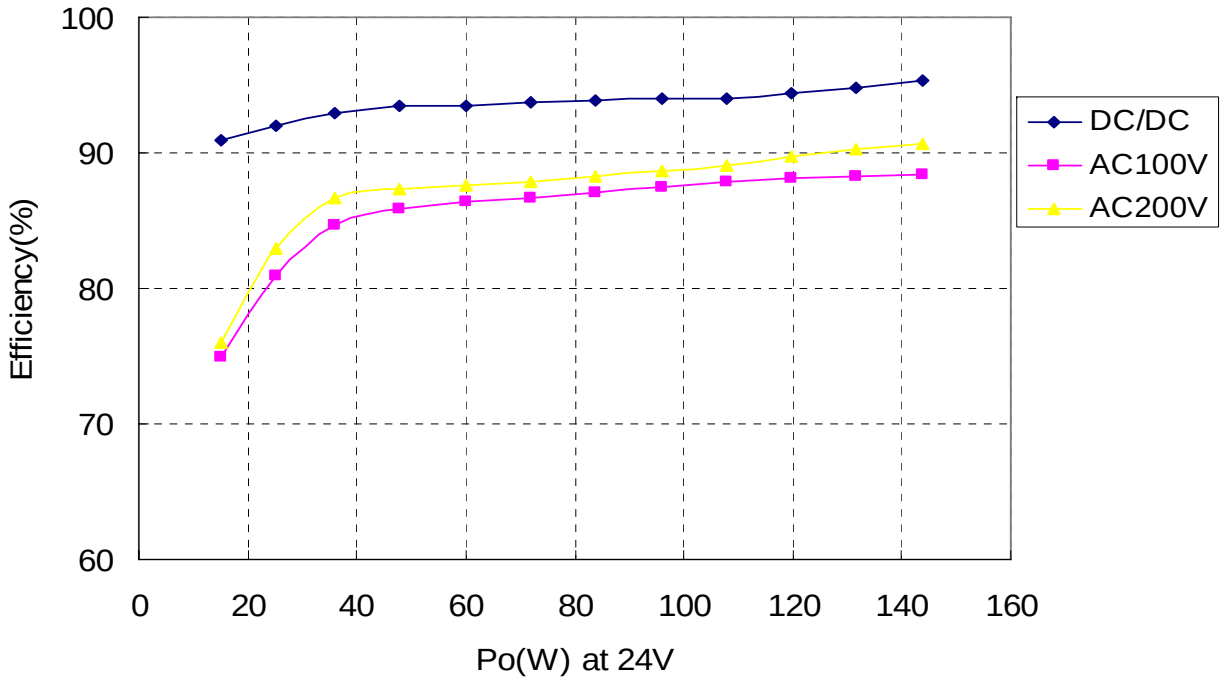
At Zero-cross point of Vp1, The MOSFET-Q1 is compulsorily turned off.

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



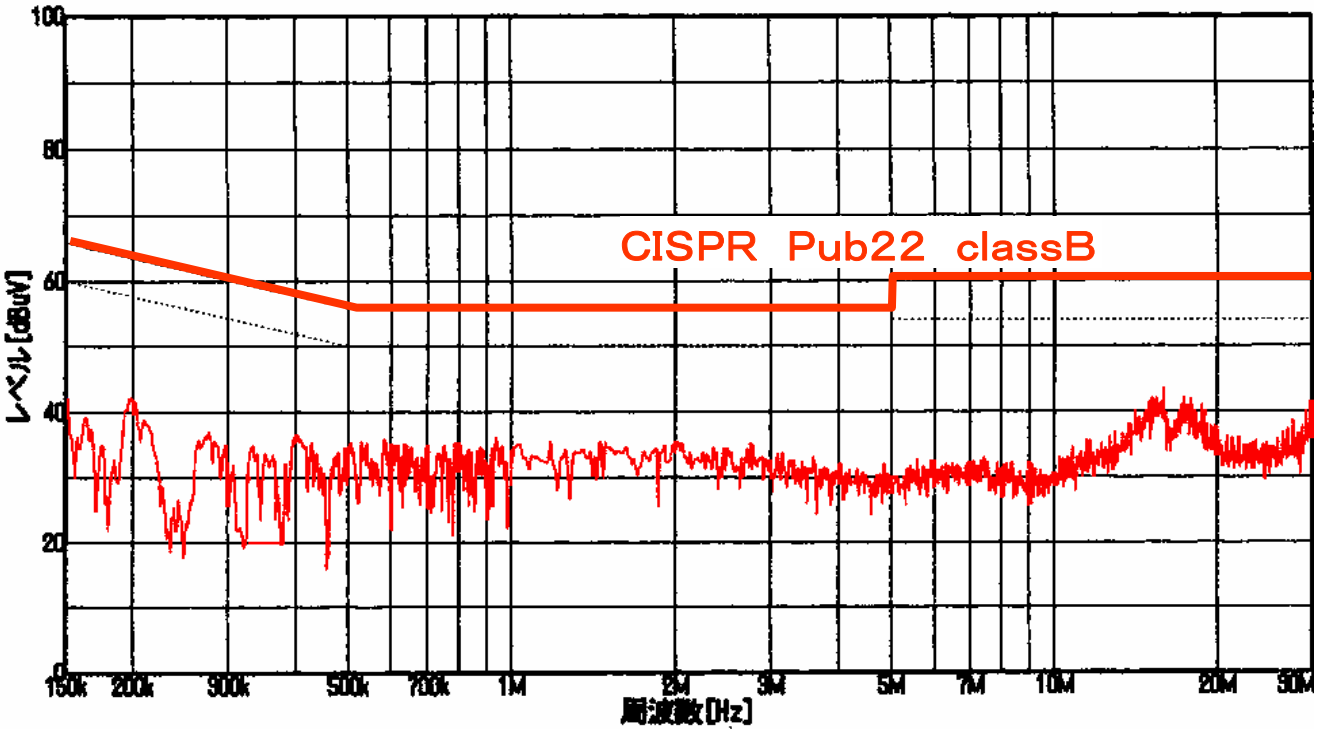
Efficiency - Load characteristic at normal mode

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

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

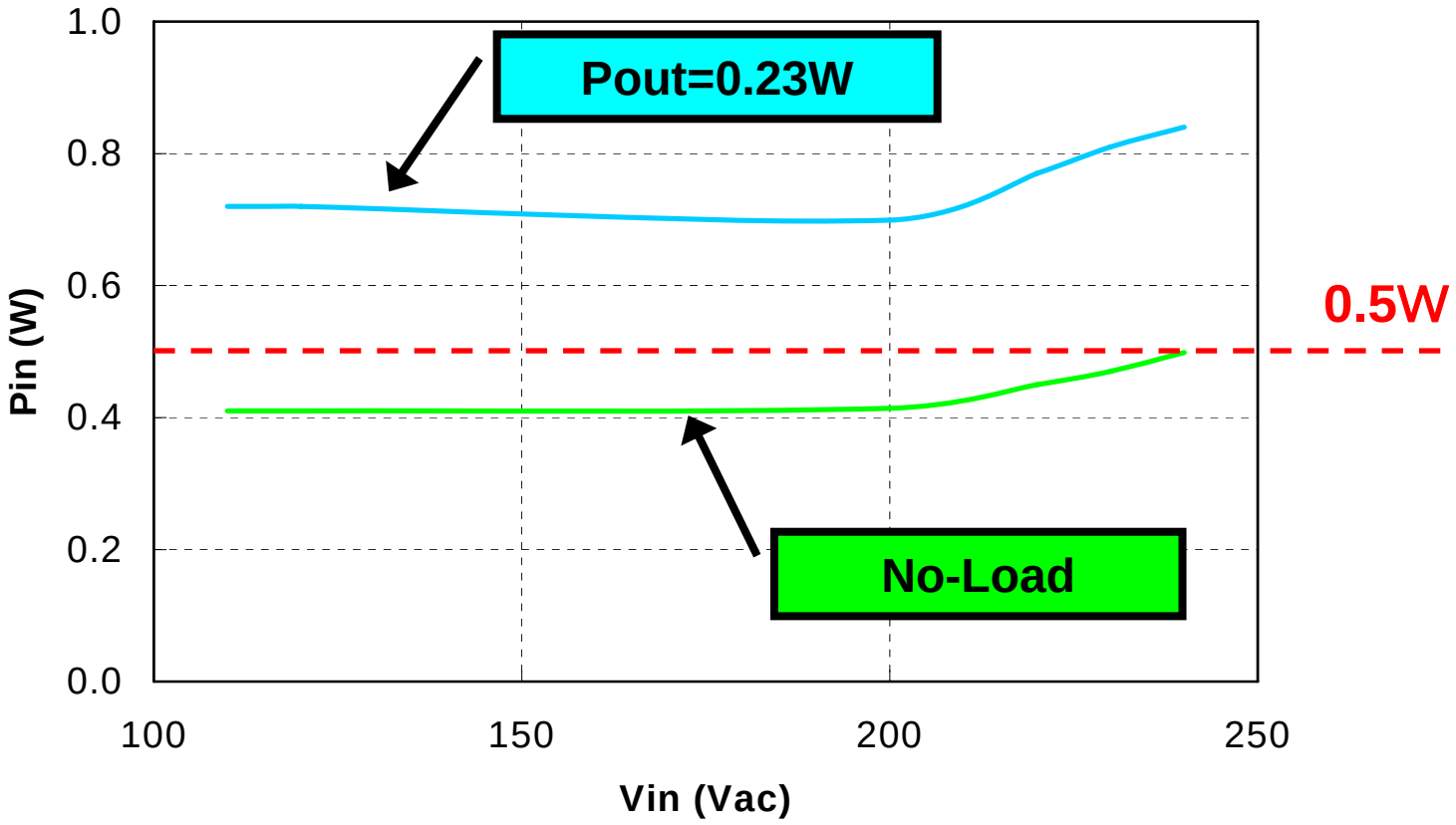
Down size your SMPS

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)

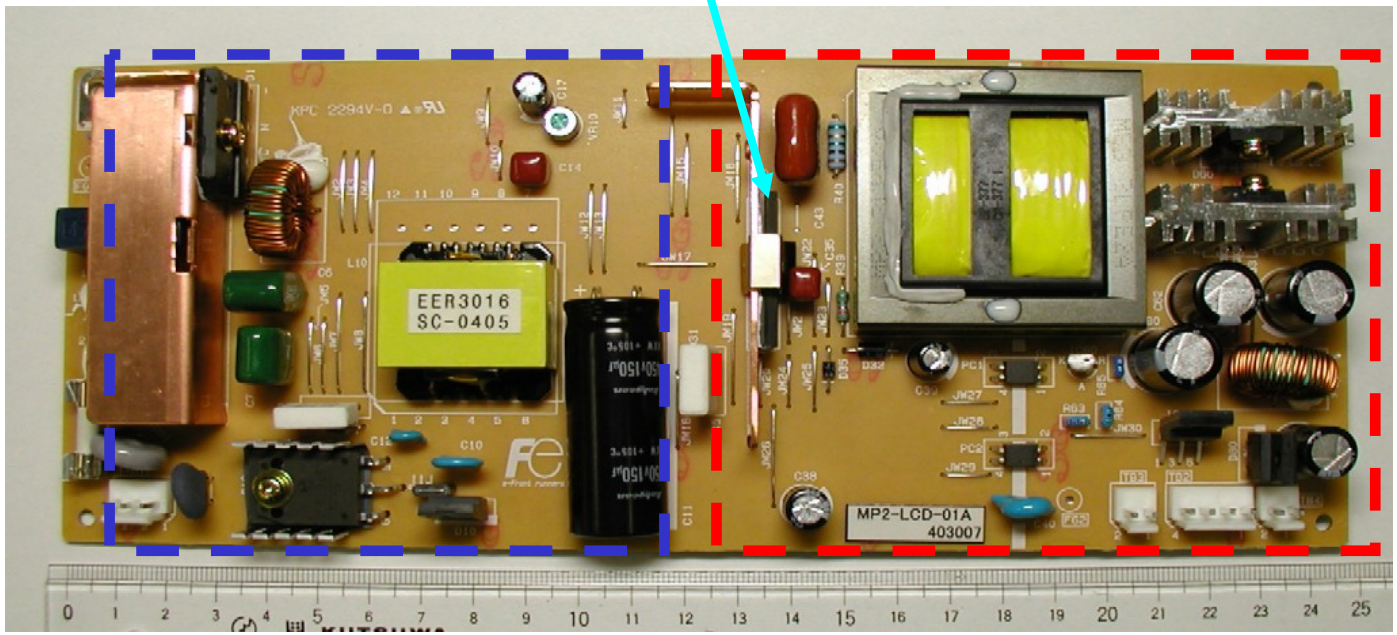
M-Power2

Spec.

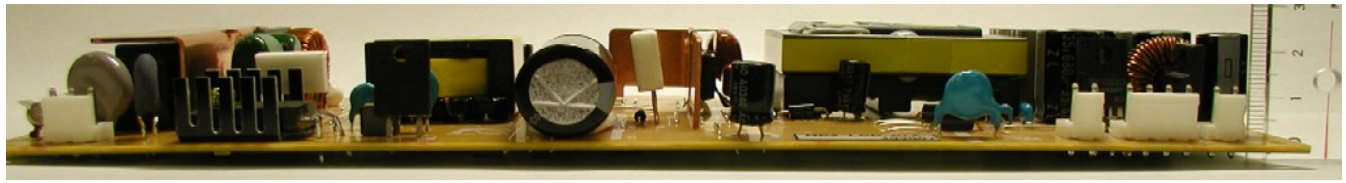
Input:AC90～264V
Output:150W
24V/6A
5V/1.2A

Outline

W：246mm
D：100mm
H：20mm



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

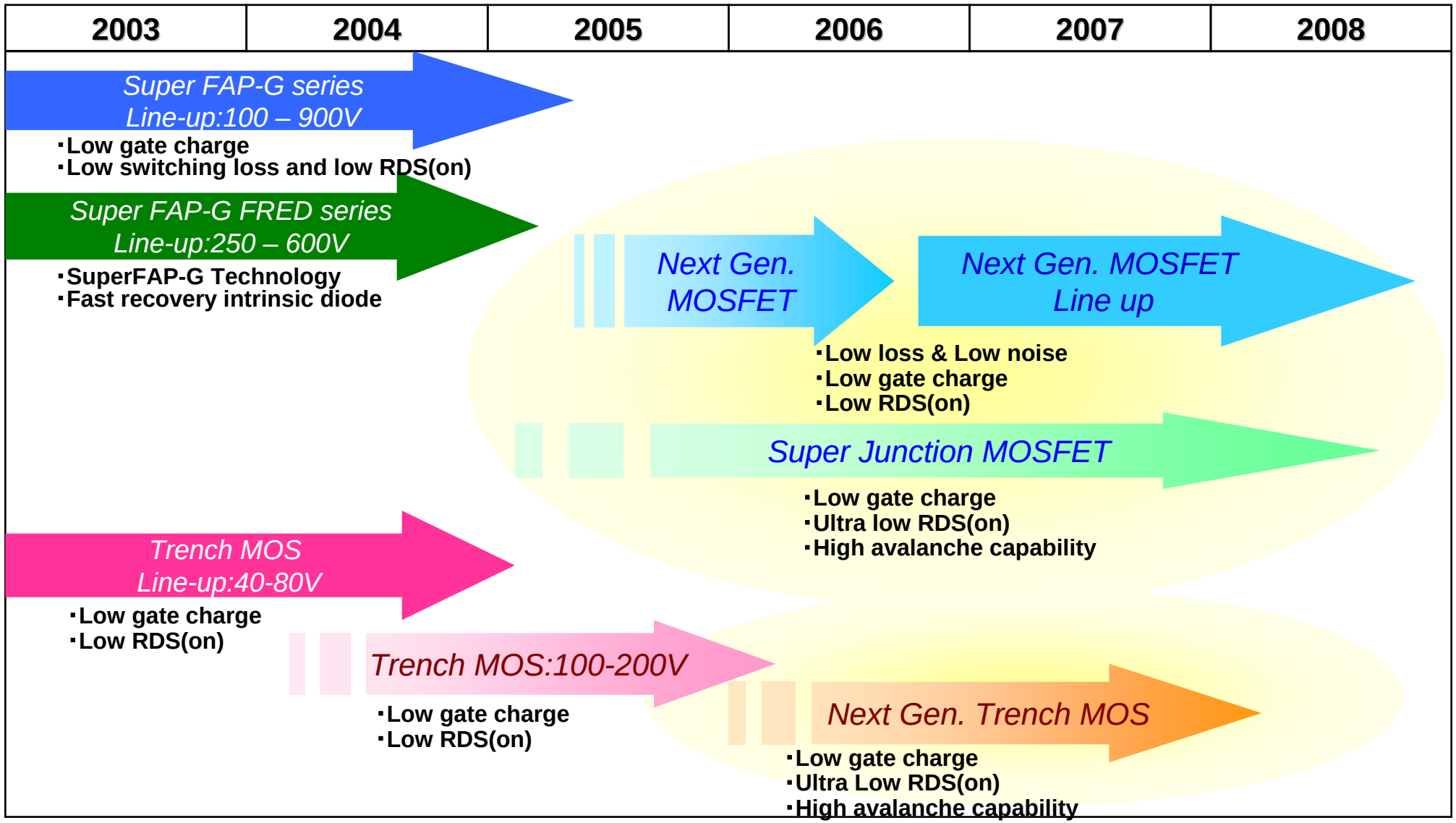


Fuji Electric Device Technology

Power MOSFET

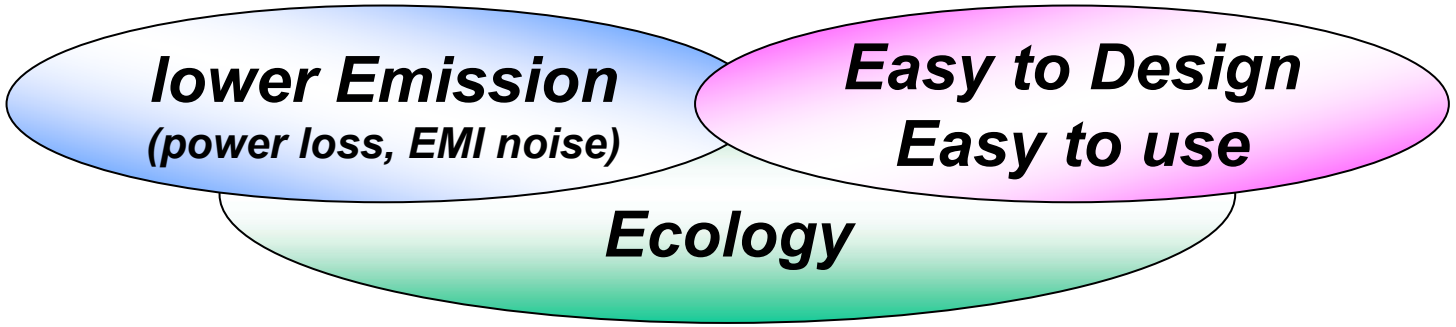
Next gen. MOSFET

Development road map of Fuji Power MOSFET



☐Basic Concept

We offer a higher performance and easy-to-use, easy-to-design planer type power MOSFET all over the world. As a result, We contribute to the ecology electronics by the performance improving and improving efficiency.



☐User Benefit

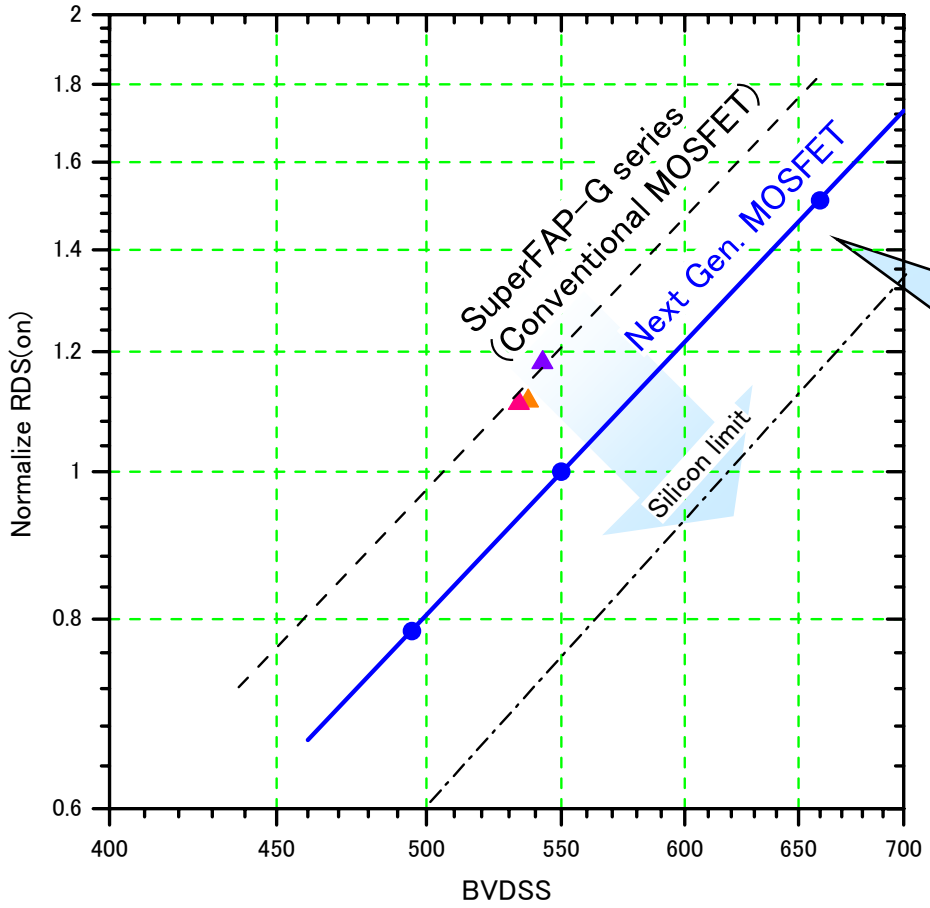
①Higher Performance

- **coping with both low loss and low noise**
- **Lower RDS(on) characteristic**

②Easy-to-Design, Easy-to-use

- **More controllable switching dV/dt by gate resistance**
- **Smaller VGS ringing waveform of switching term**
- **Narrow band of gate threshold voltage (±0.5V)**
- **Higher avalanche ruggedness**

Next Gen. Planar MOSFET : Lowest RDS(on)



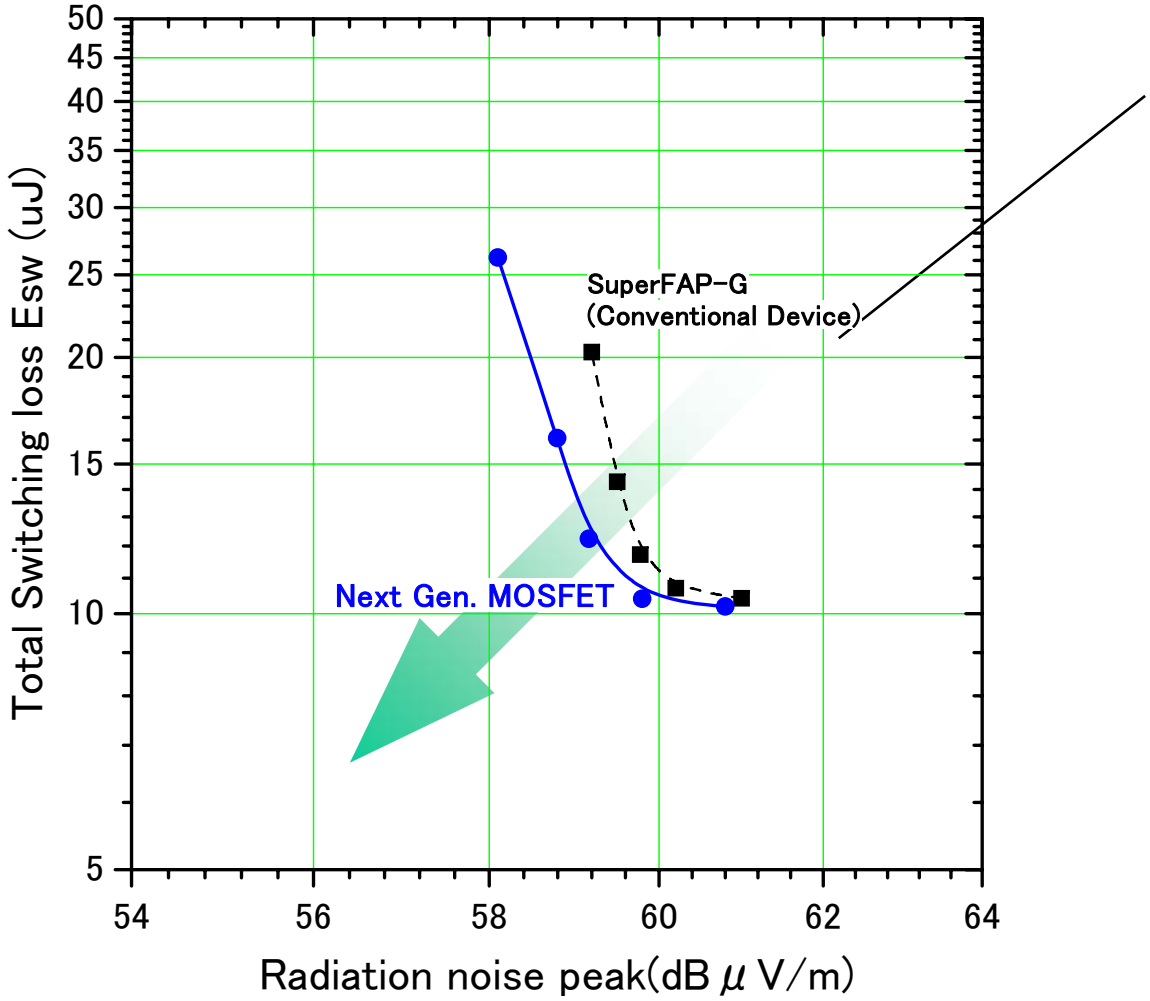
"The Next Gen. MOSFET" was used the second generation QPJ structure.

This product has achieved RDS(on) of 12-17% Decrease for the conventional planar type power MOSFET.

Next Gen. Planar MOSFET : Lower noise and lower loss

Evaluation result of trade-off of the radiated noise characteristic and the switching loss.

Testing object : Standard SMPS of commercial type(150W/AC100V input/DC24V output/FCC type)



"The Next Gen. MOSFET" was used the second generation QPJ structure.

Improvement of trade-off of the radiation noise characteristic and the switching loss.

As a result, an environment-friendly power supply of a low loss and the low noise can be composed compared with the conventional devices.

Next Gen. Planar MOSFET : Characteristics table (500V)

Under Development

	Next Gen. MOSFET	Current Device	Company A	Company B
Package	**TO-220F**	TO-220F	TO-220F	TO-220F
VDS	**500V**	500V	500V	500V
PD	**125W**	70W	50W	40W
ID	**23A**	19A	15A	14A
VGS	**±30V**	±30V	±30V	±30V
Avalanche ruggednessI(AR)	**23A**	19A	15A	14A
VGS(th)	**3.0±0.5V**	3～5V	2～4V	3～4.5V
RDS(on) max.	**0.245Ω**	0.38Ω	0.30Ω	0.34Ω
Qg typ.	**95nC**	34nC	62nC	76nC
Qgs typ.	**21nC**	13nC	40nC	15nC
Qgd typ.	**30nC**	10nC	22nC	40nC

Characteristics rating is no previous notice but there is a possibility of changing.

Next Gen. Planar MOSFET : Line-up (tentative)

Type Name	VDSS	ID	VGS(th)	RDS(on) max.	Avalanche Rating	Package	Application	Sample	Note
FMP20N50E	500V	20A	3±0.5V	0.31Ω	20A	TO-220	Various	ES Available	Under Development
FMA20N50E						TO-220F			
FMI20N50E						T-Pack(L)			
FMC20N50E						T-Pack(S)			
FMP16N50E	500V	16A	3±0.5V	0.38Ω	16A	TO-220		ES sample June/'07	Under Planning
FMA16N50E						TO-220F			
FMI16N50E						T-Pack(L)			
FMC16N50E						T-Pack(S)			
FMH28N50E	500V	28A	3±0.5V	0.19Ω	28A	TO-3P		ES sample Oct./'07	Under Planning
FMW28N50E						TO-247			
FMR28N50E						TO-3PF			
FMA23N50E	500V	23A	3±0.5V	0.245Ω	23A	TO-220F(New)		ES sample Oct./'07	Under Planning
FMH23N50E						TO-3P			
FMW23N50E						TO-247			
FMR23N50E						TO-3PF			

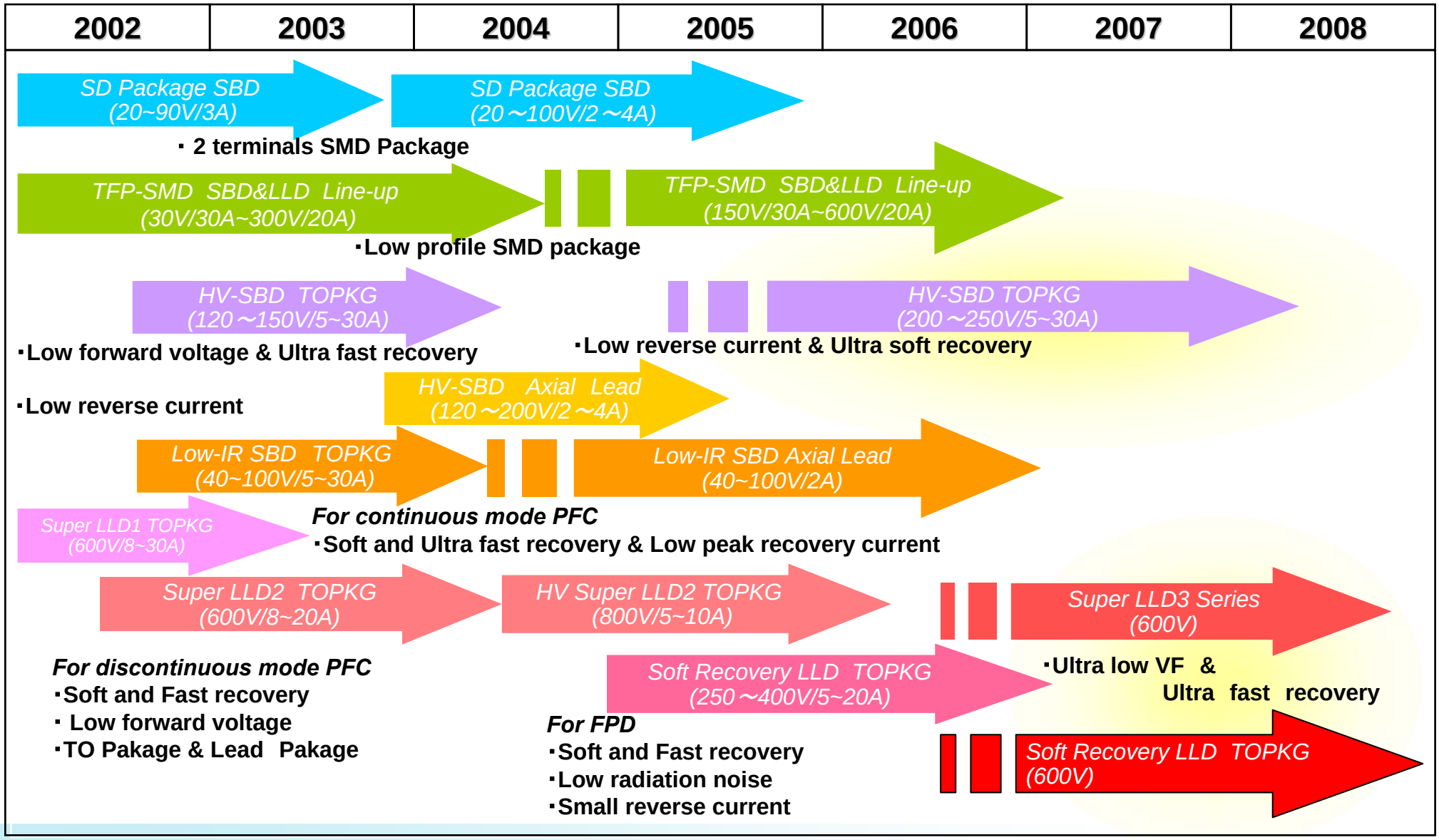
Type Name	VDSS	ID	VGS(th)	RDS(on) max.	Avalanche Rating	Package	Application	Sample	Note
FMP16N60E	600V	16A	3±0.5V	0.47Ω	16A	TO-220	Various	ES Available	Under Development
FMA16N60E						TO-220F			
FMI16N60E						T-Pack(L)			
FMC16N60E						T-Pack(S)			
FMP13N60E	600V	13A	3±0.5V	0.58Ω	13A	TO-220		ES sample June/'07	Under Planning
FMA13N60E						TO-220F			
FMI13N60E						T-Pack(L)			
FMC13N60E						T-Pack(S)			
FMH23N60E	600V	23A	3±0.5V	0.28Ω	23A	TO-3P		ES sample Oct./'07	Under Planning
FMW23N60E						TO-247			
FMR23N60E						TO-3PF			
FMA19N60E	600V	19A	3±0.5V	0.365Ω	19A	TO-220F(New)		ES sample Oct./'07	Under Planning
FMH19N60E						TO-3P			
FMW19N60E						TO-247			
FMR19N60E						TO-3PF			

There are no previous notice but there is a possibility of changing.

Diode

80V 200V SBD
300V 400V LLD
600V Super LLD3

Development road map of Fuji Rectifier Diodes



80V Low-IR SBD Series（under development）

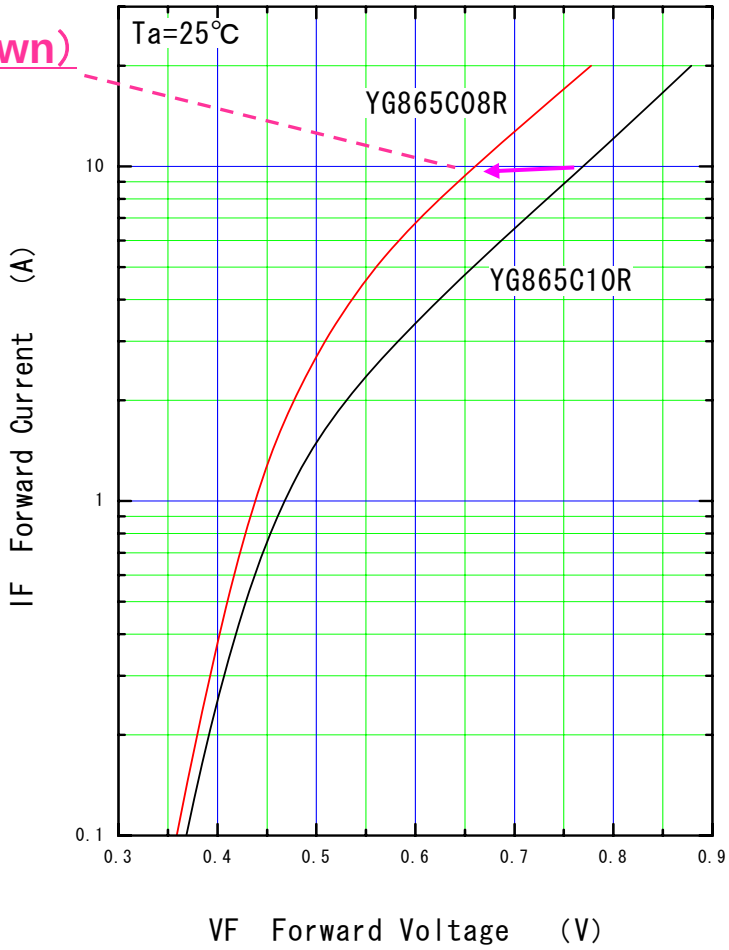
Prototype Sample (YG865C08R) Data

VF 0.66V/IF=10A (Typical)

IR 30uA/VR=80V (Typical)

△0.11V（14%down）

Forward Characteristic (typ.)



Line-up Plan and Ratings & Characteristics（Tentative）

Device type	SMD	Maximum rating			Thermal rating	Characteristics(Ta=25℃)			Package	Sample
		VRRM Volts	Io＊1 Amps.	IFSM＊2 Amps.	Tj and Tstg ℃	VFM Max.Volts	IRRM＊3 Max.mA	Rth(j-c) ℃/W		
YA862C08R		80	10	125	−40 to +150	0.74	0.150	2	TO220AB	Available
YG862C08R		80	10	125	−40 to +150	0.74	0.150	3.5	TO220F	Available
PA862C08R		80	10	125	−40 to +150	0.74	0.150	3.5	TO3P	June/'07
TS862C08R	SMD	80	10	125	−40 to +150	0.74	0.150	2	T-pack(S)	June/'07
YA865C08R		80	20	145	−40 to +150	0.74	0.175	1.75	TO220AB	Available
YG865C08R		80	20	145	−40 to +150	0.74	0.175	2.5	TO220F	Available
PA865C08R		80	20	145	−40 to +150	0.74	0.175	2.5	TO3P	June/'07
TS865C08R	SMD	80	20	145	−40 to +150	0.74	0.175	1.75	T-pack(S)	June/'07
YA868C08R		80	30	160	−40 to +150	0.74	0.200	1.25	TO220AB	Available
YG868C08R		80	30	160	−40 to +150	0.74	0.200	2	TO220F	Available
PA868C08R		80	30	160	−40 to +150	0.74	0.200	1.5	TO3P	June/'07
TS868C08R	SMD	80	30	160	−40 to +150	0.74	0.200	1.25	T-pack(S)	June/'07

＊1 Square wave duty 1/2 (Average forward current of centertap full wave connection)
＊2 Sine wave, 10ms ＊3 VR=VRRM

200V Low-IR SBD Series（under development）

Line-up Plan（Tentative）

Device type	SMD	Maximum rating		Thermal rating	Package	Sample
		V_{RRM} Volts	Io *1 Amps.	Tj and Tstg ℃		
TS862C20R	SMD	200	10	−40 to +150	T−pack（S）	Sep/'07
YA862C20R		200	10	−40 to +150	TO−220AB	Sep/'07
YG862C20R		200	10	−40 to +150	TO−220F	Sep/'07
TS865C20R	SMD	200	20	−40 to +150	T−pack（S）	Sep/'07
YA865C20R		200	20	−40 to +150	TO−220AB	Sep/'07
YG865C20R		200	20	−40 to +150	TO−220F	Sep/'07
PA865C20R		200	20	−40 to +150	TO−3PF	Sep/'07
TS868C20R	SMD	200	30	−40 to +150	T−pack（S）	Sep/'07
YA868C20R		200	30	−40 to +150	TO−220AB	Sep/'07
YG868C20R		200	30	−40 to +150	TO−220F	Sep/'07
PA868C20R		200	30	−40 to +150	TO−3PF	Sep/'07

＊1 50Hz Square wave duty 1/2

（Average forward current of centertap full wave connection）

*Electrical Characteristics is undecided because of the development early stage.

*Feature is Low VF&IR, Low Noise.

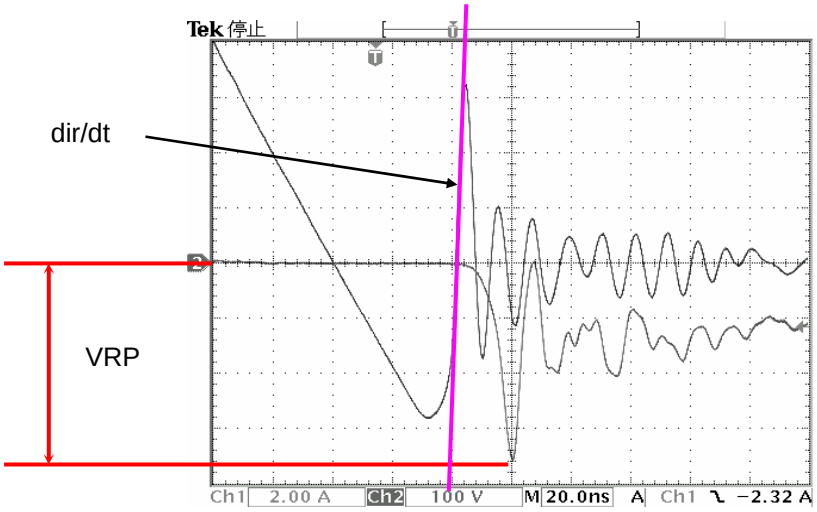
Circuit simplification by low noise and low spike voltage (VRP)

(1).Low dir/dt and low dV/dt : simple snubber circuit, Decrease of number of noise control parts

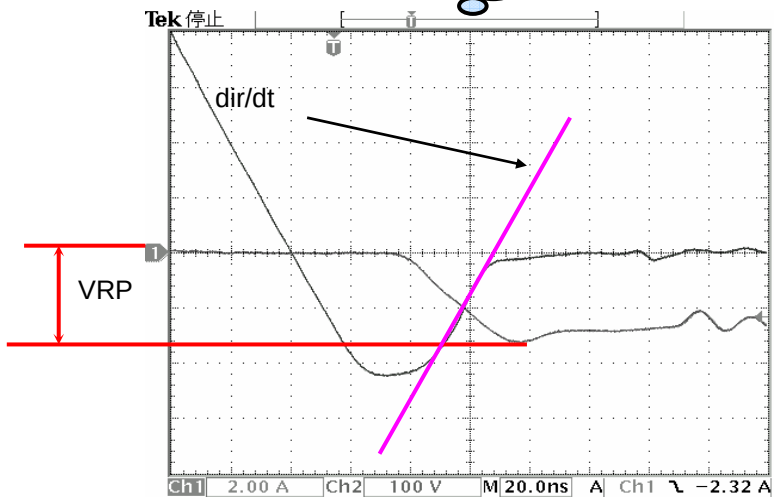
(2) Low spike Voltage (VRP) : There is a possibility that the rated voltage of the diode used is lowered.

Soft Recovery
=Low dir/dt
⇒ Low VRP

IF=10A,dif/dt=-200A/us(VR=160V),Tj=100℃



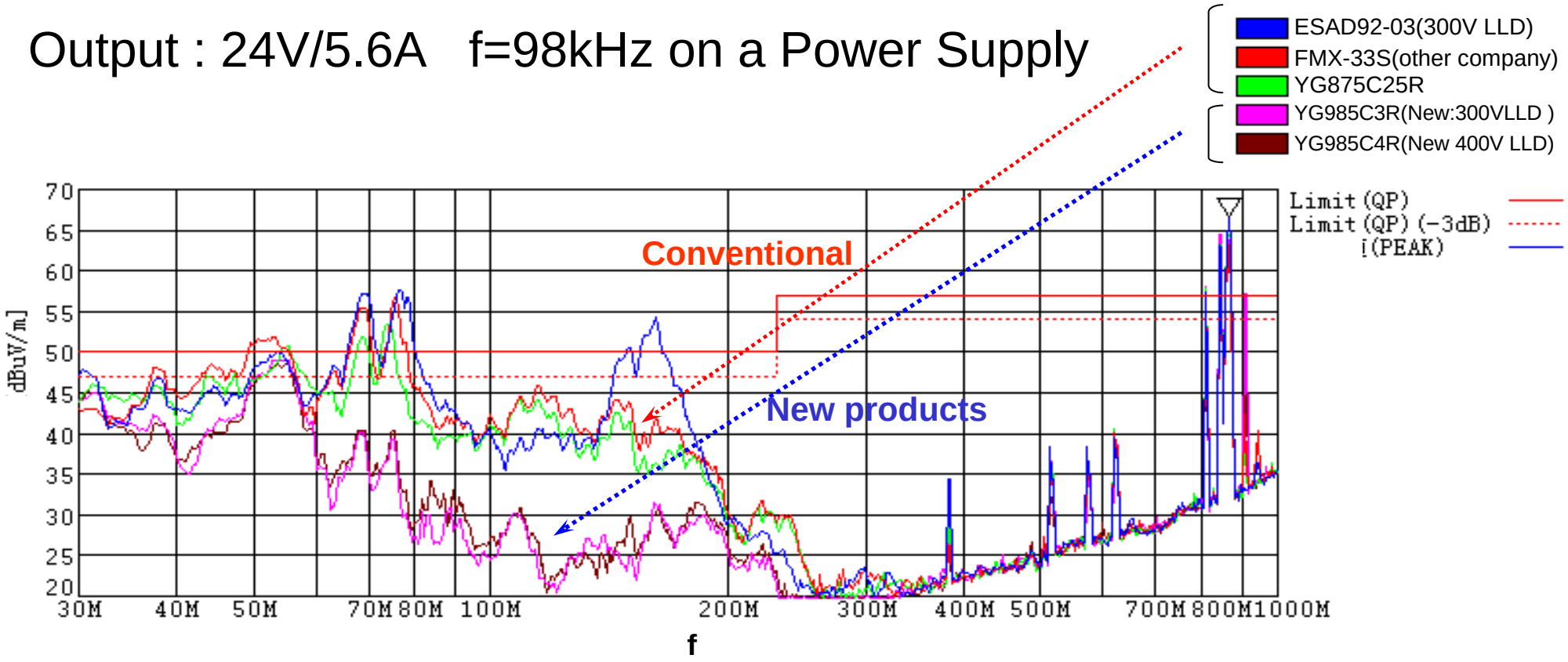
Conventional 400VLLD



Soft-Recovery400VLLD(Proto Sample)

Radiation Noise Data

Output : 24V/5.6A　f=98kHz on a Power Supply



300V,400V Soft-Recovery LLD Line-up

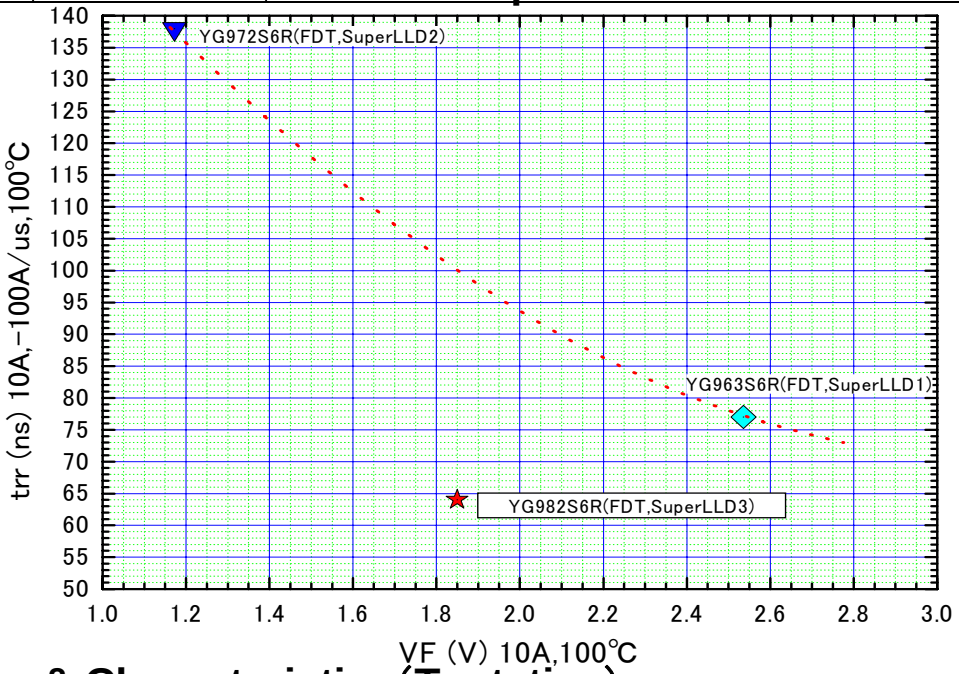
形式 Device type	SMD 対応品	絶対最大定格 Maximum rating			接合、保存温度 Thermal rating	電気的特性(Ta=25℃) Electrical Characteristics				パッケージ Package	質 量 Net mass
		VRRM Volts	Io *1 Amps.	IFSM＊2 Amps.	Tj and Tstg ℃	VFM Max.Volts	IRRM＊3 Max. μA	trr *4 μsec	Rth(j-c) ℃/W		Grams
TS982C3R	●	300	10 (Tc=128℃	90	-40 to +150	1.3 (IF=5A)	20	0.04	1.75	T-pack(S)	1.6
TS982C4R	●	400	10 (Tc=125℃	80	-40 to +150	1.45(IF=5A)	20	0.05	1.75	T-pack(S)	1.6
YA982C3R		300	10 (Tc=128℃	90	-40 to +150	1.3 (IF=5A)	20	0.04	1.75	TO-220AB	2
YA982C4R		400	10 (Tc=125℃	80	-40 to +150	1.45(IF=5A)	20	0.05	1.75	TO-220AB	2
YG982C3R		300	10 (Tc=112℃	90	-40 to +150	1.3 (IF=5A)	20	0.04	3	TO-220F	2
YG982C4R		400	10 (Tc=107℃	80	-40 to +150	1.45(IF=5A)	20	0.05	3	TO-220F	2
TS985C3R	●	300	20 (Tc=118℃	110	-40 to +150	1.3 (IF=10A)	35	0.04	1.25	T-pack(S)	1.6
TS985C4R	●	400	20 (Tc=114℃	100	-40 to +150	1.45(IF=10A)	35	0.05	1.25	T-pack(S)	1.6
YA985C3R		300	20 (Tc=118℃	110	-40 to +150	1.3 (IF=10A)	35	0.04	1.25	TO-220AB	2
YA985C4R		400	20 (Tc=114℃	100	-40 to +150	1.45(IF=10A)	35	0.05	1.25	TO-220AB	2
YG985C3R		300	20 (Tc=105℃	110	-40 to +150	1.3 (IF=10A)	35	0.04	1.75	TO-220F	2
YG985C4R		400	20 (Tc=100℃	100	-40 to +150	1.45(IF=10A)	35	0.05	1.75	TO-220F	2
PG985C3R		300	20 (Tc= ℃	110	-40 to +150	1.3 (IF=10A)	35	0.04	3	TO-3PF	6
PG985C4R		400	20 (Tc= 64℃)	100	-40 to +150	1.45(IF=10A)	35	0.05	3	TO-3PF	6

＊1 50Hz Square wave duty 1/2
(Average forward current of centertap full wave conr
＊2 Sine wave, 10ms

＊3 VR=VRRM
＊4 IF=0.1A, IR=0.2A, Irec.=0.05A

600V Super-LLD3 Series（under development）

S-LLD3 Prototype Sample（YG982S&R）VF-trr compared with conventional S-LLD1&S-LLD2



Line-up Plan and Ratings & Characteristics（Tentative）

Device type	SMD	Maximum rating		Thermal rating	Electrical Characteristics (Ta=25℃)				Package	Sample
		VRRM Volts	Io *1 Amps.	Tj and Tstg ℃	VFM Max.Volts	IRRM *2 Max.μA	trr *3 μsec	Rth(j-c) ℃/W		
YA981S6R		600	5	−40 to +150	2.5 (IF=5A)	35	0.03	2.50	TO-220AB	Jun/'07
YG981S6R		600	5	−40 to +150	2.5 (IF=5A)	35	0.03	4.50	TO-220F	Jun/'07
TS982C6R	SMD	600	10	−40 to +150	2.5 (IF=5A)	35	0.03	1.50	T-pack(S)	Jun/'07
YA982C6R		600	10	−40 to +150	2.5 (IF=5A)	35	0.03	1.50	TO-220AB	Jun/'07
YG982C6R		600	10	−40 to +150	2.5 (IF=5A)	35	0.03	2.00	TO-220F	Aveilable
YA982S6R		600	10	−40 to +150	2.5 (IF=10A)	35	0.03	2.00	TO-220AB	Jun/'07
YG982S6R		600	10	−40 to +150	2.5 (IF=10A)	35	0.03	3.50	TO-220F	Jun/'07
TS985C6R	SMD	600	20	−40 to +150	2.5 (IF=10A)	35	0.03	1.25	T-pack(S)	Jun/'07
YA985C6R		600	20	−40 to +150	2.5 (IF=10A)	35	0.03	1.25	TO-220AB	Jun/'07
YG985C6R		600	20	−40 to +150	2.5 (IF=10A)	35	0.03	1.75	TO-220F	Jun/'07
PA985C6R		600	20	−40 to +150	2.5 (IF=10A)	35	0.03	1.50	TO-3PF	Jun/'07

＊1 50Hz Square wave duty 1/2
(Average forward current of centertap full wave connection)

＊2 VR=VRRM

＊3 IF=0.1A, IR=0.2A, Irec.=0.05A