富士电机
Fuji Electric

"Step Forward, Raise Value"

开关电源用富士新型智能功率器件

Fuji New Smart power device for switching power supply

M-Power 2A, 3A series

概要 Summary （M-Power 2A）

系统：富士原创之完美系统
包含多项功能(软开关,待机)

器件：多芯片功率器件：M-Power 2A
在SIP-13封装里包含IC及2颗MOSFET
及多项保护功能

System : The ideal and Fuji's original system
It includes many functions (Soft-switching, stand-by)

Device : Multiple-chip Power Device : M-Power2A contains and two MOSFET's in SIP-13pin package.
M-Power2A has various types of protection function.

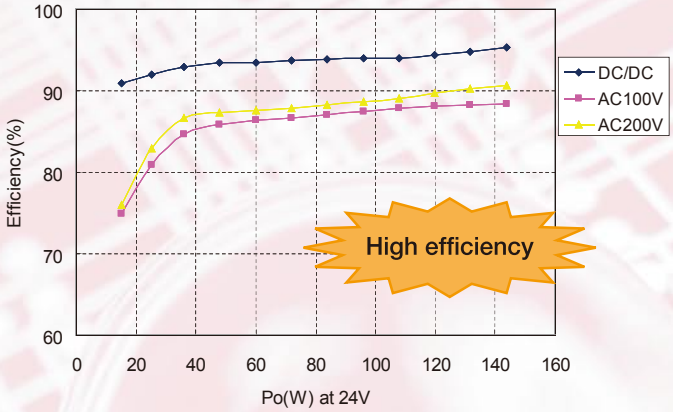
特性 Features

- 高效能 (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)
- 内藏待机制式 (An auxiliary power supply is unnecessary.)
- 低噪音 (a reduction in the noise suppression parts is possible.)
  MOSFET's Turn-on: ZVS+ZCS, Turn-off: ZVS
  Diodes (secondary side)
  Surge voltage does not occur at reverse recovery
- 保护功能 (Built-in protection functions: OC, SC, OV, Tj (OH))
- 简化设计 (Reduction of design time)

- High efficiency (a reduction in SMPC size possible.)
  DC/DC : 95.3% (DC input:385V, output:24V)
  PFC+DC/DC : 88.4% (AC100V), 90.7%(AC200V)
- Stand-by mode
  (A series : External, Conventional series : Built in)
- Low noise
  (a reduction the noise suppression part 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)

特征 Characteristic

DC/DC : 95.3% (DC input:385V, output:24V)
PFC+DC/DC : 88.4%(AC100V), 90.7%(200V)



Efficiency-Load characteristic at normal mode

Line up of M-Power 2A, 3A series

M-Power 2A series

Type Name	MOSFET(Q1)		MOSFET(Q2)		Control IC	
	VDS [V]	RDS(on) [Ω]	VDS [V]	RDS(on) [Ω]	VCC(on) [V]	Tj(on) [℃]
MP2A5038	500	0.38	500	0.38	16.5	125to 150
MP2A5060		0.68		0.68		
MP2A5077		0.77		0.77		
MP2A5100		1		1		
MP2A5135		1.35		1.35		
MP2A2010	250	0.1	250	0.1		
MP2A2013		0.125		0.125		

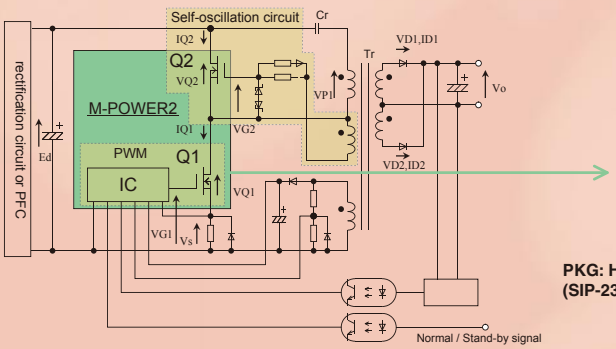
Package : SIP-23

M-Power 3A series

Type Name	MOSFET(Q1)		MOSFET(Q2)		Control IC	
	VDS [V]	RDS(on) [Ω]	VDS [V]	RDS(on) [Ω]	VCC(on) [V]	Tj(on) [℃]
MP3A5060	500	1	500	0.6	16.5	125to 150
MP3A5038	500	0.77	500	0.38	16.5	125to 150

Package : SIP-23

电路结构 Circuit configuration



PKG: H:10.2mm x W:31.0mm x T:3.5mm
(SIP-23pin)

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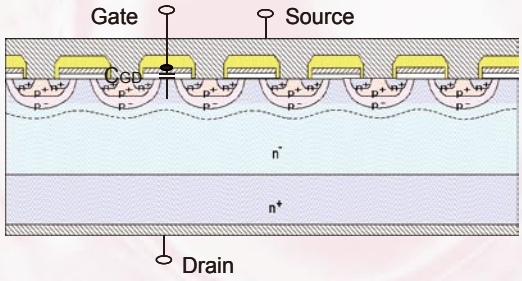
超级FAP-G系列 下一代MOSFET FAP-E³ 系列

Super FAP-G series and Next Generation MOSFET FAP-E³ series

超级FAP-G系列 SuperFAP-G series (VDS=100～900V)

准平面结合件 Quasi-Plane-Junction



采用准平面结合实现RDS(on)和闸电荷特性，
FOM:RonQgd减少到以往产品的1/2

特性 Features

- 减少关机损失 Lower turn-off loss
  →比以往产品降低75%(600V规格)
  →75% lower Eoff against conventional type
- 减少闸电荷(Qg) Lower gate charge (Qg)
  →比以往产品降低60%(600V规格)
  →60% lower Qg against conventional type
- 高雪崩耐量 Higher avalanche ruggedness
  →改善在高温度下的雪崩耐量
  →Improved avalanche ruggedness at high temp.
- RDS(on)相同的情况下,封装更小.
  Smaller package with same RDS(on)
  →600V/0.75ohm/TO-3P ⇒ 600V/0.65ohm/TO-220

下一代MOSFET的基本概念 Basic Concept

向全球推出实现“高性能（低损失、低噪音特性）”和提高“易用性”的 平面型功率场效应管,通过提高从设计到成品的综合性能和功率,对环境保护技术做出贡献

We would offer a higher performance, easy-to-use and easy-to-design Power MOSFET all over the world. As a result, it contributes to a ecology by improvement of the performance and efficiency.

特性 Features

- 同时具有低损失和低噪音特性
- 低导通电阻特性
- 开关时 DV/DT 的门极电阻控制性较好
- 开关时 VGS 的激震较小
- 门极域值电压为 ±0.5V
- 峰值容量高，不易损坏

- Low loss and low noise
- Low on resistance characteristic
- During switching, DV/DT gate resistance and control function is good.
- During switching, VGS rinking is small.
- Gate threshold voltage: ±0.5V
- High avalanche capacity, hard to be damaged.

计划实现平面型下一代场效应管的系列化 Next Generation MOSFET (Plan)

Type Name	VDSS [V]	ID [A]	VGS(th) [V]	RDS(on) max. [Ω]	Package	Note
FM[ ]05N50E	500	5	3±0.5V	1.5	TO-220AB, TO-220F, T-Pack(L), T-Pack(S)	Under Development
FM[ ]07N50E		6.5		0.85	TO-220AB, TO-220F, T-Pack(L), T-Pack(S)	Under Development
FM[ ]08N50E		7.5		0.79	TO-220AB, TO-220F	Under Development
FM[ ]12N50E		12		0.52	TO-220AB, TO-220F, T-Pack(L), T-Pack(S)	Under Development
FM[ ]16N50E		16		0.38	TO-220AB, TO-220F, T-Pack(L), T-Pack(S)	
FM[ ]20N50E		20		0.31	TO-220AB, TO-220F, T-Pack(L), T-Pack(S)	
FM[ ]23N50E		23		0.245	TO-220F, TO-3P(Q), TO-3PF	Under Development
FM[ ]28N50E		28		0.19	TO-3P(Q), TO-3PF	Under Development
FM[ ]03N60E	600	3	3±0.5V	2.3	TO-220AB, TO-220F, T-Pack(L), T-Pack(S)	Under Development
FM[ ]05N60E		5.5		1.3	TO-220AB, TO-220F, T-Pack(L), T-Pack(S)	Under Development
FM[ ]06N60E		6		1.2	TO-220AB, TO-220F	Under Development
FM[ ]10N60E		10		0.79	TO-220AB, TO-220F, T-Pack(L), T-Pack(S)	Under Development
FM[ ]11N60E		11		0.75	TO-220AB, TO-220F, T-Pack(L), T-Pack(S)	Under Development
FM[ ]13N60E		13		0.58	TO-220AB, TO-220F, T-Pack(L), T-Pack(S)	
FM[ ]16N60E		16		0.47	TO-220AB, TO-220F, T-Pack(L), T-Pack(S)	
FM[ ]19N60E		19		0.36	TO-220F, TO-3P(Q), TO-3PF	Under Development
FM[ ]23N60E		23		0.28	TO-3P(Q), TO-3PF	Under Development

[ ] : Package type
P : TO-220AB
A : TO-220F
I : T-Pack(L)
C : T-Pack(S)
H : TO-3P(Q)
R : TO-3PF

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富士低待机能耗PWM IC

PWM IC for low standby power

FA5526/27/28, FA5536/37/38

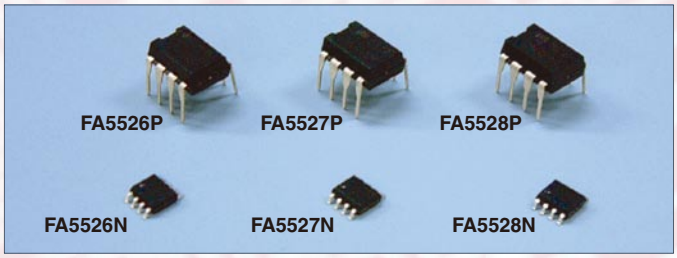
特性 Features

- 内置 500V 耐压启动元件，轻负荷时，通过减低 PWM 频率，实现无负荷时，输入功率约为 0.1W
- 下列三种型号的 PWM 频率
  FA5526/27/28 : 130/100/60kHz 过负荷锁定
  FA5536/37/38 : 130/100/60kHz 过负荷自动恢复
- MOSFET 驱动能力强（输出段高侧 16Ω，低侧 5Ω）可在 200W 回扫电源中使用
- VCC 工作电压范围是 10~26V，允许辅助线圈上不使用串联调节器
- MOSFET 的电流限制为 0.5V，快门抵抗损失低
- 具有软启动功能（设顶时间可调整）
- 过负荷保护（以上两种方式，也可做延迟时间的调整）
- VCC 额定 28V 具有定时过电压保护功能
- 具有 8PIN 封装 (DIP/SOP)

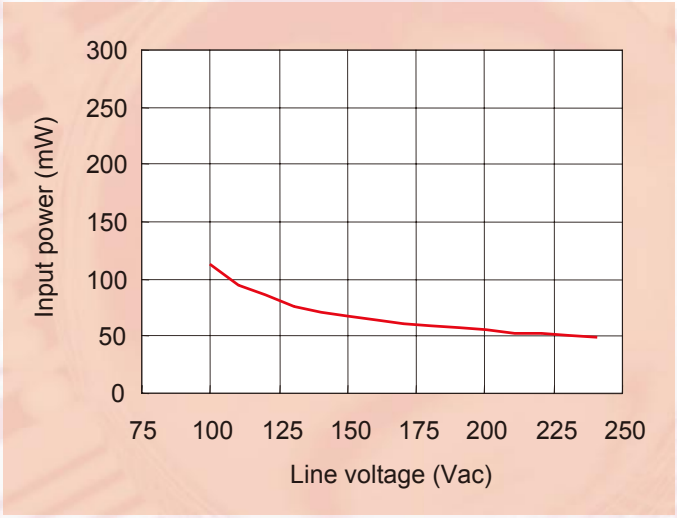
- 应用
  个人电脑电源适配器，液晶显示器 / TV 用 AC-DC 电源

- Internal start-up circuit with 500V. Linearly reduced frequency for lighter load achieves small output capacitance and 0.1W input at no load
- Line-up of 3types for frequency at full load
  FA5526/27/28 : 130/100/60kHz Latch OCP
  FA5536/37/38 : 130/100/60kHz Auto-Recovery OCP
- MOSFET drives ability is high (output 16Ω of a HIGH side, 5Ω of LOW side) can be used in 200W flyback
- VCC operating range is 10 to 26V, VCC allows no series regulator for auxiliary winding to clamp Vcc voltage.
- 0.5V threshold for MOSFET drain current limit
  The shutter resists lose is low
- Soft start function (time can be adjusted)
- Over-voltage protection
  (Above two kinds of methods, also can do the adjustment of delay time)
- VCC terminal 28V over-voltage protection function
  (Timer Latched)
- 8 pin package (DIP/SOP)

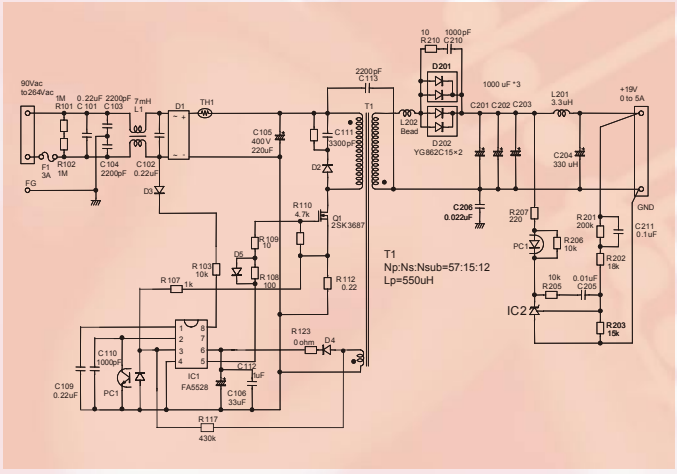
- Applications
  PC adapter, LCD Monitor / AC-DC Power Supply for TV



特征 Low wait electricity



应用电路 Application circuit



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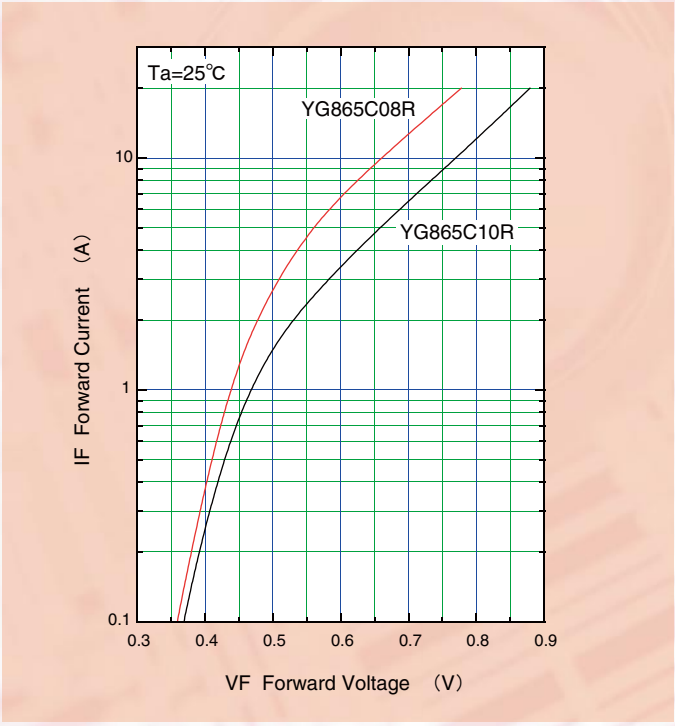
高压SBD和软恢复LLD

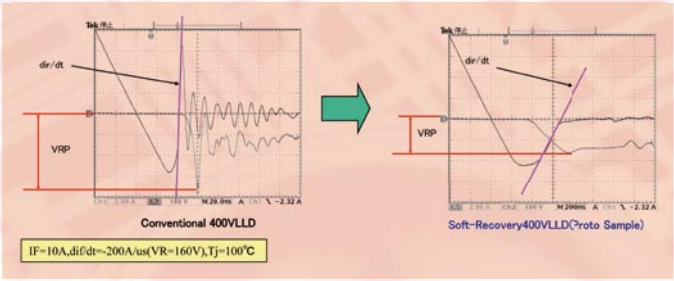
High voltage SBD and Soft recovery LLD

正向特性 Forward Characteristic (typ.)



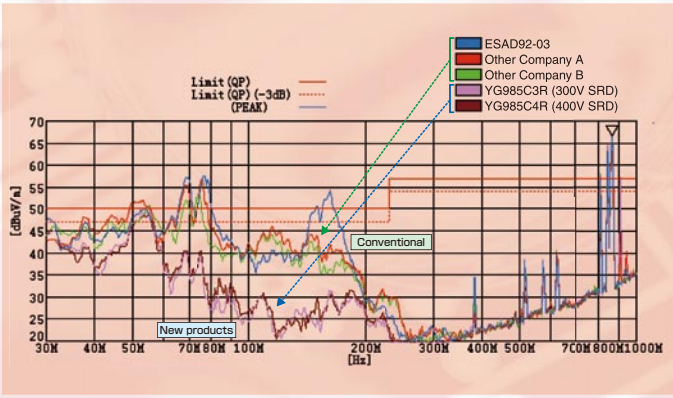
软恢复LLD Soft recovery LLD (300, 400V LLD)

通过低噪音和低峰值电压,实现电路简化
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.

放射噪音评价



产品系列 Line up

Line up Plan (Tentative)

Device type	SMD	Maximum rating VRRM Volts	Maximum rating IO *1 Amps.	Thermal rating Tj and Tstg ℃	Package
YG862C20R		200	10	-40 to +150	TO-220F
YA862C20R		200	10	-40 to +150	TO-220AB
TS862C20R	SMD	200	10	-40 to +150	T-Pack(S)
YG865C20R		200	20	-40 to +150	TO-220F
YA865C20R		200	20	-40 to +150	TO-220AB
TS865C20R	SMD	200	20	-40 to +150	T-Pack(S)
PA865C20R		200	20	-40 to +150	TO-3P
YG868C20R		200	30	-40 to +150	TO-220F
YA868C20R		200	30	-40 to +150	TO-220AB
TS868C20R	SMD	200	30	-40 to +150	T-Pack(S)
PA868C20R		200	30	-40 to +150	TO-3P

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

Line up

Device type	SMD	Maximum rating VRRM Volts	Maximum rating IO *1 Amps.	Maximum rating IFSM*2 Amps.	Thermal rating Tj and Tstg ℃	Characteristics VFM Max. Volts	Characteristics IRRM*3 Max.μA	Characteristics Rth(j-c) ℃/W	Package
YG862C08R		80	10(Tc=109℃)	125	-40 to +150	0.76	0.15	3.5	TO-220F
YA862C08R		80	10(Tc=126℃)	125	-40 to +150	0.76	0.15	2.0	TO-220AB
TS862C08R	SMD	80	10(Tc=126℃)	125	-40 to +150	0.76	0.15	2.0	T-pack(S)
YG865C08R		80	20(Tc=89℃)	145	-40 to +150	0.76	0.175	2.5	TO-220F
YA865C08R		80	20(Tc=107℃)	145	-40 to +150	0.76	0.175	1.75	TO-220AB
TS865C08R	SMD	80	20(Tc=107℃)	145	-40 to +150	0.76	0.175	1.75	T-pack(S)
YG868C08R		80	30(Tc=72℃)	160	-40 to +150	0.76	0.20	2.0	TO-220F
YA868C08R		80	30(Tc=105℃)	160	-40 to +150	0.76	0.20	1.25	TO-220AB
TS868C08R	SMD	80	30(Tc=105℃)	160	-40 to +150	0.76	0.20	1.25	T-pack(S)
YG869C08R		80	40(Tc=86℃)	190	-40 to +150	0.71	0.20	1.2	TO220F
YA869C08R		80	40(Tc=98℃)	190	-40 to +150	0.71	0.20	1.0	TO220AB

( ) Conditions
*1 50Hz Square wave duty=1/2 (Average forward current of centertap full wave connection)
*2 Sine wave, 10ms per element *3 IF=0.5Io per element
*3 VR=VRRM per element

300V, 400V软恢复LLD系列

Device type	SMD	Maximum rating VRRM Volts	Maximum rating Io *1 Amps.	Maximum rating IFSM *2 Amps.	Thermal rating Tj and Tstg ℃	Electrical Characteristics (Ta=25℃) VFM Max.Volts	Electrical Characteristics IRRM *3 Max. μA	Electrical Characteristics trr *4 μsec	Electrical Characteristics Rth(j-c) ℃/W	Package	Net mass 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

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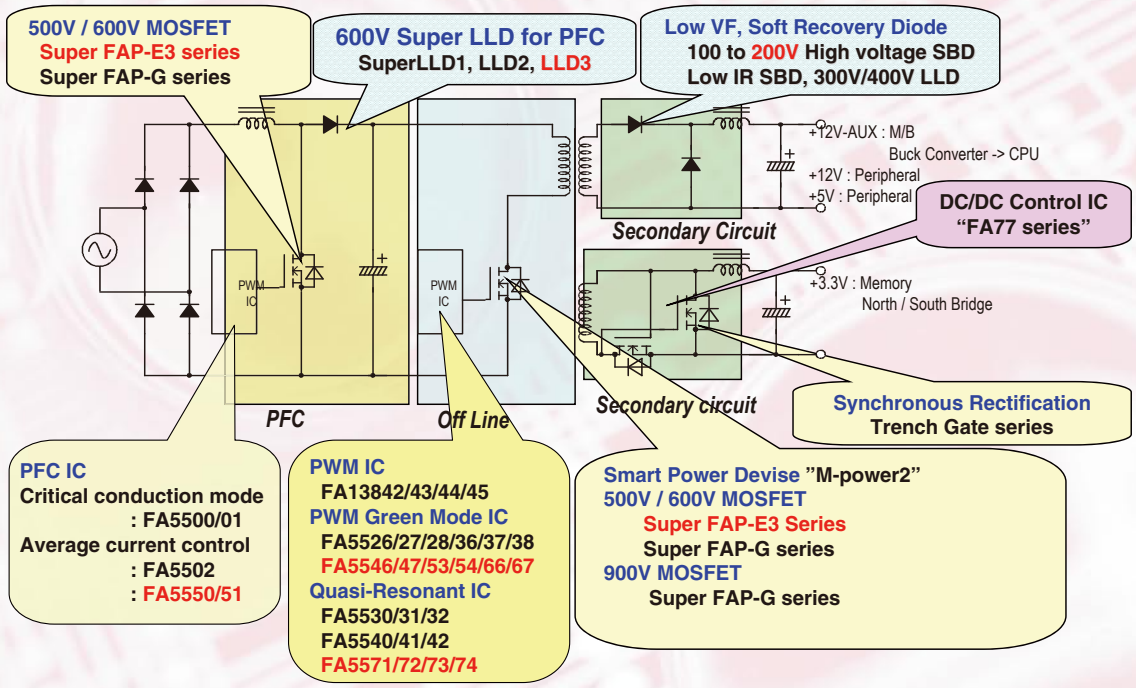
电源解决方案
Power Supply Solutions

应用于开关电源的富士推荐器件 FDT Recommended Devices for Switching Power Supply application



应用于液晶电视的富士推荐器件 FDT Recommended Devices for LCD-TV application

Inch size	Output power	PFC circuit			Converter			DC/DC for intermediate bus
		IC	MOSFET	Diode	IC	MOSFET	Diode	
50"	400W	FA5502M C.C.M.	E3-MOS *FMA23N60E 2pcs 600V/0.28Ω	Super LLD3 *YG985C6R 600V/20A	M-Power2 Current Resonant MP2A5038 500V/0.38Ω		24V&19V rail YG868C10R 100V/30A	12V input, External MOSFET FA7701V 5V/3A
40"	300W	FA5550 C.C.M. 8pin	*FMA19N60E 3pcs 600V/0.365Ω	Super LLD2 YG972S6R 600V/10A	MP2A5050 500V0.5Ω		12V rail YG865C04R 45V/20A	12V&24V input, Built-in MOSFET FA7738N 5V/1A
37"	200W		FMA20N50E *2pcs 500V/0.31Ω		MP2A5060 500V/0.6Ω		24V&19V rail YG865C10R 100V/20A	
32" 26"	150W	FA5500AN/ 01AN D.C.M.	FMA20N50E	Super LLD2 YG971S6R 600V/8A	MP2A5077 500V/0.77Ω	* MP3B5038 500V/ 0.38Ω,0.77Ω	24V&19V rail YG865C12R 120V/20A	FA7735F 5V/1.2A Dual Synchronous 24V input, External MOSFET FA7703V 3.3-19V/3A Dual FA7711V 3.3-19V/3A Triple
23"							12V rail YG862C04R 45V/10A	
20"	100W		FMA16N50E 500V/0.38Ω		* MP3B5060 500V/0.60Ω,1.00Ω		12V rail YG862C08R 80V/10A	
					Quasi-Resonant FA5571N FA5572N	2SK3677-01M 700V/0.93Ω 2SK3673-01M 700V/1.18Ω	24V rail YG865C15R 150V/20A 15V rail YG862C10R 100V/10A	

*=under development