

ANTREX Electronics

Electronic Components Sourcing Information

Product Reference Information

Part Number:	23N60E
Manufacturer:	Fuji Electric Co., Ltd.
Package:	Please confirm with sales
Availability:	Please confirm with sales

Product Page:

<https://antrexco.com/product/details/fuji-electric-co-ltd/23n60e.html>

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Note:

This PDF includes an ANTREX product reference cover page.

The original manufacturer datasheet follows from the next page.

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)
- 内藏待机机制 (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)

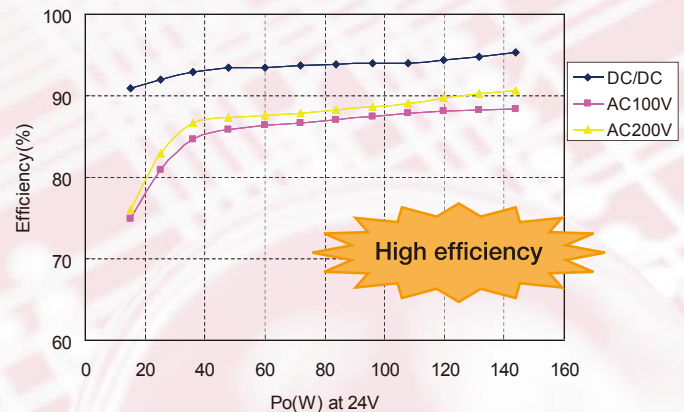
- Stand-by mode
(A series : External, Conventional series : Built in)

- 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) [$^{\circ}$ C]
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	250	1.35	250	1.35		
MP2A2010		0.1		0.1		
MP2A2013		0.125		0.125		

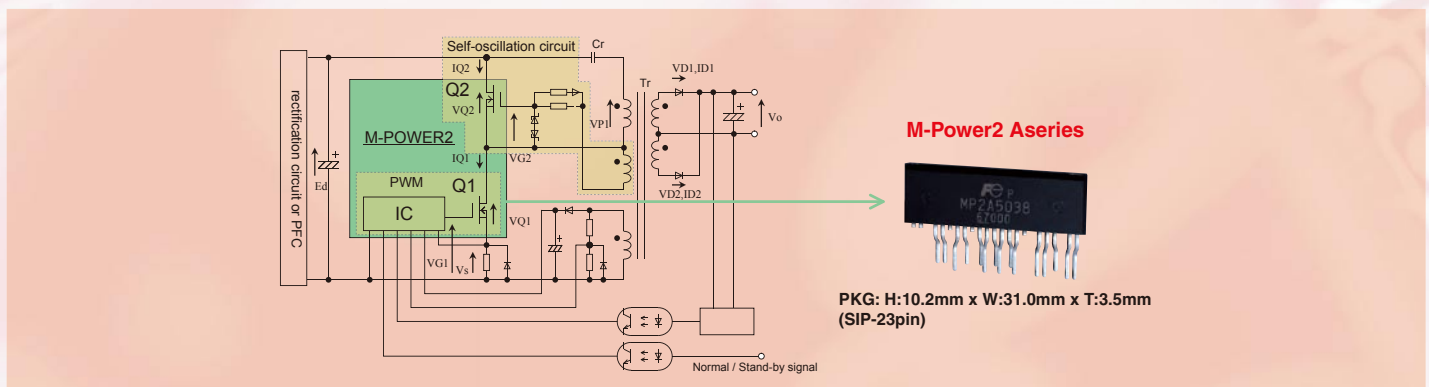
Package : SIP-23

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) [$^{\circ}$ C]
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

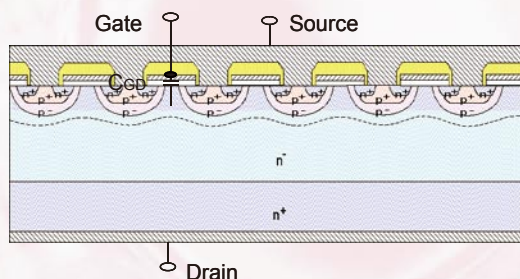


超级FAP-G系列 下一代MOSFET FAP-E³ 系列

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

● 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 $\pm 0.5V$
- 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: $\pm 0.5V$
- High avalanche capacity, hard to be damaged.

● 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

低损失、低噪音
Higher Performance

易用性
Easy to design
Easy to use

环境保护
Ecology

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

Type Name	VDS [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

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)

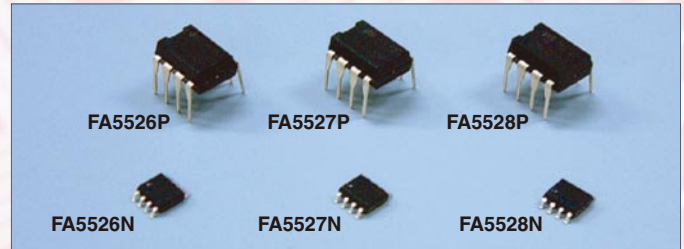
● 应用

个人电脑电源适配器, 液晶显示器 / TV 用 AC-DC 电源

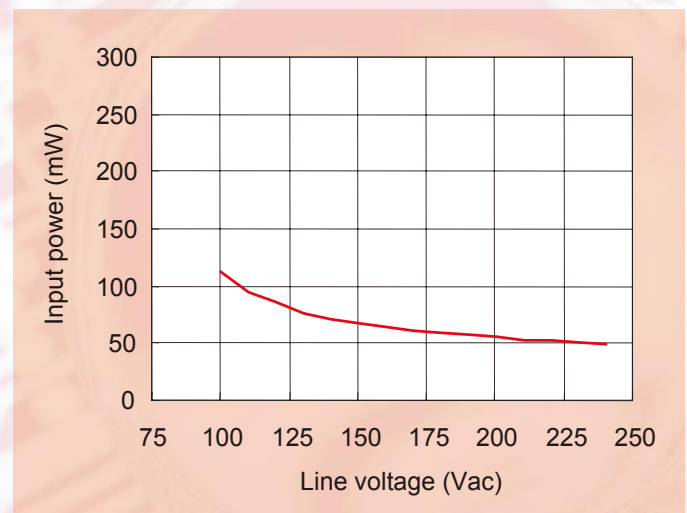
- Internal start-up circuit with 500V. Linearly reduced frequency for lighter load achieves small output capacitance and 0.1W input at no load
- Line-up of 3types for frequency at full load
FA5526/27/28 : 130/100/60kHz Latch OCP
FA5536/37/38 : 130/100/60kHz Auto-Recovery OCP
- MOSFET drives ability is 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

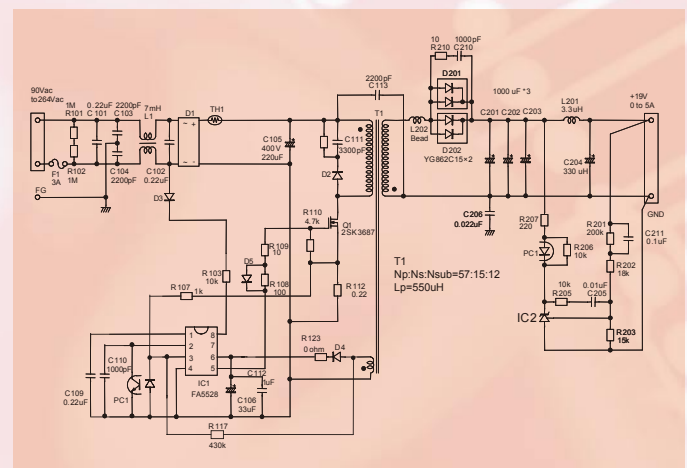
PC adapter, LCD Monitor / AC-DC Power Supply for TV



● 特征 Low wait electricity



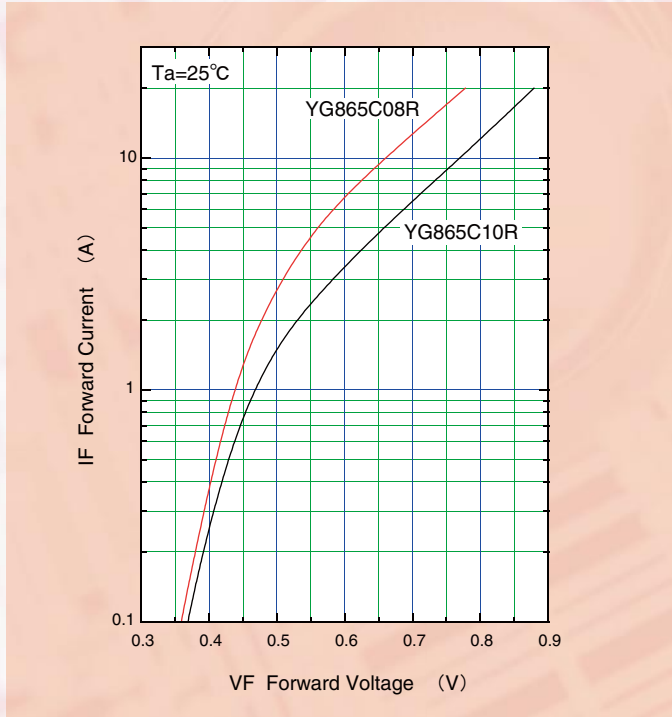
● 应用电路 Application circuit



高压SBD和软恢复LLD

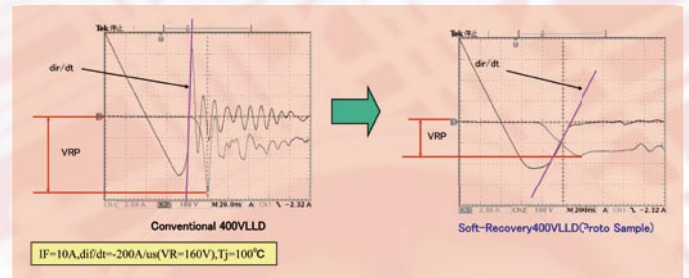
High voltage SBD and Soft recovery LLD

● 正向特性 Forward Characteristic (typ.)



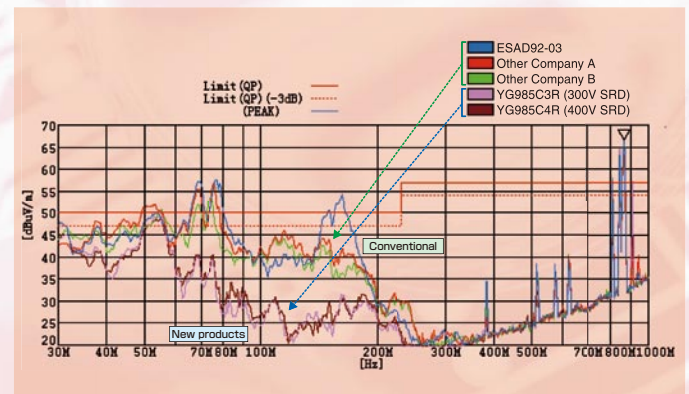
● 软恢复LLD Soft recovery LLD (300, 400V LLD)

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 di/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



● 300V, 400V软恢复LLD系列

Device type	SMD	Maximum rating			Thermal rating Tj and Tstg °C	Electrical Characteristics (Ta=25°C)				Package	Net mass Grams
		VRRM Volts	Io *1 Amps	IFSM*2 Amps		VFM Max.Volts	IRRM*3 Max. μA	trr*4 μsec	Rth(j-c) °C/W		
TS982C3R	●	300	10 (Tc=128°C)	90	-40 to +150	1.3 (IF=5A)	20	0.04	1.75	T-pack(S)	1.6
TS982C4R	●	400	10 (Tc=125°C)	80	-40 to +150	1.45 (IF=5A)	20	0.05	1.75	T-pack(S)	1.6
YA982C3R	●	300	10 (Tc=128°C)	90	-40 to +150	1.3 (IF=5A)	20	0.04	1.75	TO-220AB	2
YA982C4R	●	400	10 (Tc=125°C)	80	-40 to +150	1.45 (IF=5A)	20	0.05	1.75	TO-220AB	2
YG982C3R	●	300	10 (Tc=112°C)	90	-40 to +150	1.3 (IF=5A)	20	0.04	3	TO-220F	2
TS985C3R	●	300	20 (Tc=118°C)	110	-40 to +150	1.3 (IF=10A)	35	0.04	1.25	T-pack(S)	1.6
TS985C4R	●	400	20 (Tc=114°C)	100	-40 to +150	1.45 (IF=10A)	35	0.05	1.25	T-pack(S)	1.6
YA985C3R	●	300	20 (Tc=118°C)	110	-40 to +150	1.3 (IF=10A)	35	0.04	1.25	TO-220AB	2
YA985C4R	●	400	20 (Tc=114°C)	100	-40 to +150	1.45 (IF=10A)	35	0.05	1.25	TO-220AB	2
YG985C3R	●	300	20 (Tc=105°C)	110	-40 to +150	1.3 (IF=10A)	35	0.04	1.75	TO-220F	2
YG985C4R	●	400	20 (Tc=100°C)	100	-40 to +150	1.45 (IF=10A)	35	0.05	1.75	TO-220F	2
PG985C3R	●	300	20 (Tc=85°C)	110	-40 to +150	1.3 (IF=10A)	35	0.04	3	TO-3PF	6
PG985C4R	●	400	20 (Tc=84°C)	100	-40 to +150	1.45 (IF=10A)	35	0.05	3	TO-3PF	6

● 产品系列 Line up

Line up Plan (Tentative)

Device type	SMD	Maximum rating		Thermal rating Tj and Tstg °C	Package
		VRRM Volts	IO *1 Amps		
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

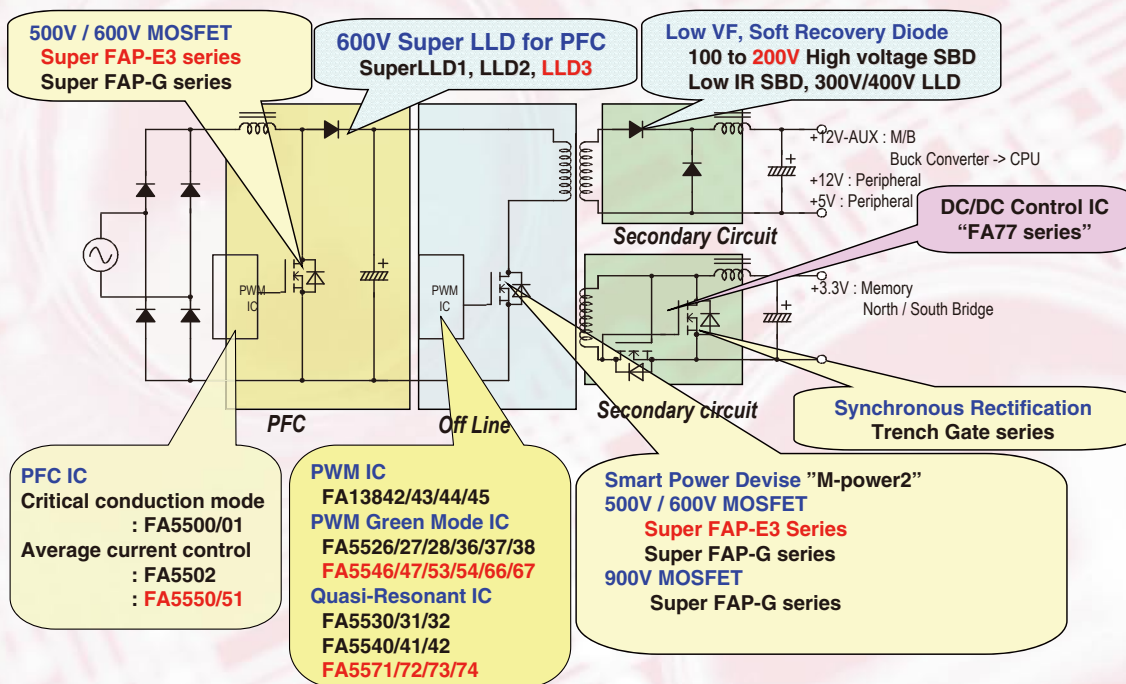
Device type	SMD	Maximum rating			Thermal rating Tj and Tstg °C	Characteristics			Package
		VRRM Volts	Io *1 Amps	IFSM*2 Amps		VFM Max. Volts	IRRM*3 Max. μA	Rth(j-c) °C/W	
YG862C08R		80	10 (Tc=109°C)	125	-40 to +150	0.76	0.15	3.5	TO-220F
YA862C08R		80	10 (Tc=126°C)	125	-40 to +150	0.76	0.15	2.0	TO-220AB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

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
40"	300W	FA5550 C.C.M. 8pin	*FMA19N60E 3pcs 600V/0.365Ω	Super LLD2 YG972S6R 600V/10A	MP2A5050 500V/0.5Ω		12V rail YG865C04R 45V/20A	FA7701V 5V/3A
37"	200W		FMA20N50E *2pcs 500V/0.31Ω		MP2A5060 500V/0.6Ω		24V&19V rail YG865C10R 100V/20A	12V&24V input, Built-in MOSFET
32"	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 12V rail YG862C04R 45V/10A	FA7738N 5V/1A FA7735F 5V/1.2A Dual Synchronous
26"			FMA16N50E 500V/0.38Ω		* MP3B5060 500V/0.60Ω, 1.00Ω		12V rail YG862C08R 80V/10A	FA7703V 3.3-19V/3A Dual
23"	100W				Quasi-Resonant	2SK3677-01M 700V/0.93Ω	24V rail YG865C15R 150V/20A	FA7711V 3.3-19V/3A Triple
20"					FA5571N FA5572N	2SK3673-01M 700V/1.18Ω	15V rail YG862C10R 100V/10A	

*=under development