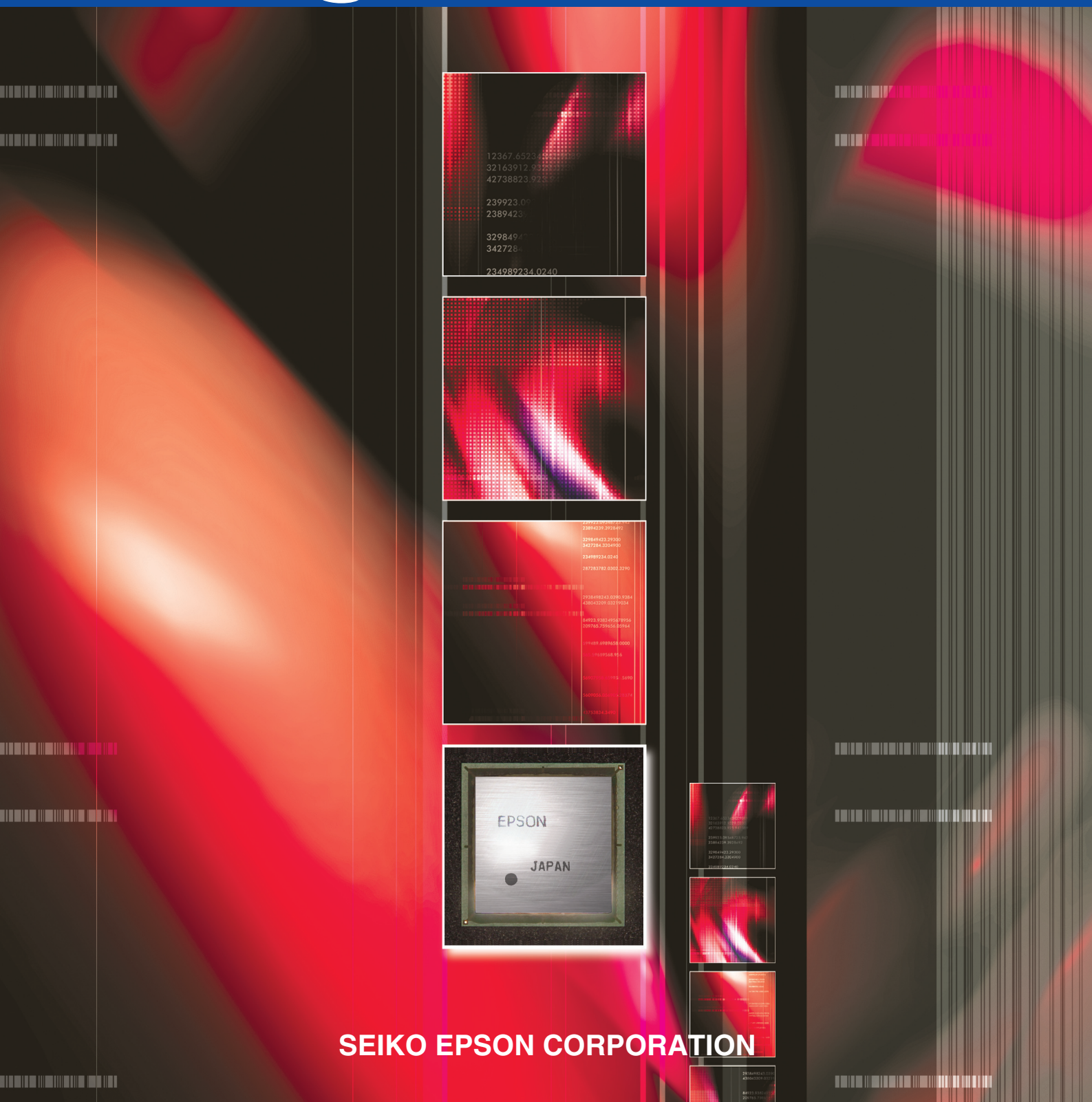
EPSON
EXCEED YOUR VISION

Power Management IC

2007/4-



SEIKO EPSON CORPORATION

Our goal is to be a true partner that strategically contributes to your product development through our concept of "saving technologies" that save power, time, and space.

Power Management IC

The market for semiconductors is expanding quickly as communications devices become increasingly ubiquitous in society.

Demand is growing for semiconductors for products ranging from mobile phones and other mobile devices and information terminals, automobile devices, and home appliances.

There is growing demand for more functions and better performance, namely, battery-operated devices, long-term operation with limited power, thinner and lighter devices, a shorter product cycle, and quicker development.

Never before has development of new products been more challenging.

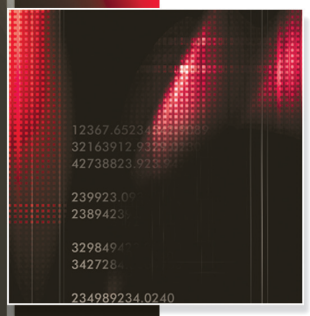
We have been focusing on the creation of compact and low power semiconductors since we began development of a CMOS LSI for watches in 1969.

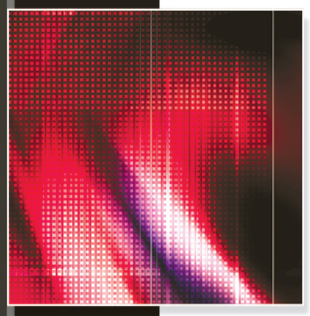
Through this process we have acquired expertise in power saving, space saving, and time saving.

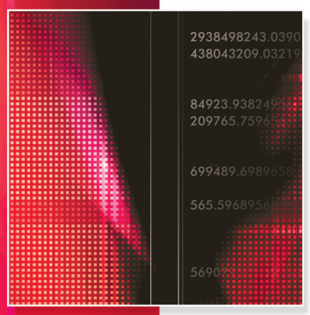
The result was that we quickly obtained the semiconductor development technology that is required by a society with ubiquitous communications.

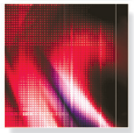
Our unique range of technologies and passion for excellence enables us to provide high value added solutions that fully meet your demands.

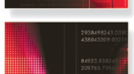
Our goal is to be a true partner that strategically contributes to your product development through our concept of "saving technologies" that save power, time, and space.











Power Management IC

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Real-time auto luminace control LED driver
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Real-time auto luminace control LED driver
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Power ICs that can extend the battery life of portable devices

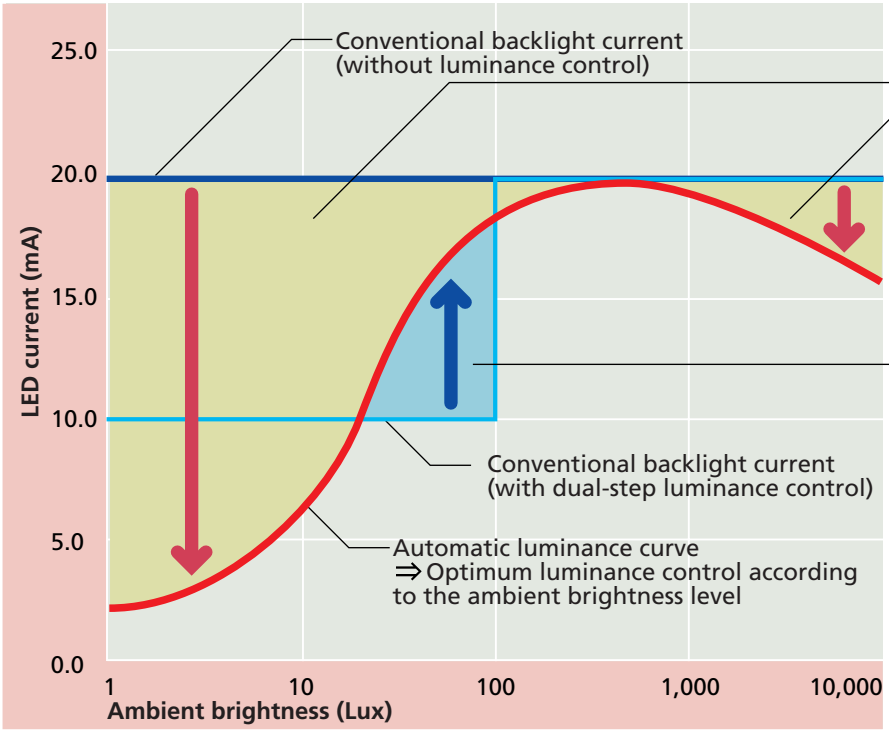
Introduction of auto luminance control LED drivers that can realize "real-time auto luminance control" of the backlight of portable devices

New Product

Auto luminance control LED drivers/controllers S1F76680/87110

As Epson's original luminance control data is stored, the LED driver can realize **real-time auto luminance control** according to the ambient brightness just when a photosensor is connected to it. This automatic luminance control function can reduce the LED current consumption by 20 to 30% and also realize a highly viewable display. As the LED driver has a built-in I2C interface, the customer can set up customized luminance control data in the driver and control the luminance of any type of display appropriately.
Our product lineup, consisting of the S1F76680 primarily used for luminance control of main displays, and the S1F87110 for control of auto luminance by PWM when connected to the existing LED driver, will be extended.

■ Can realize the low power consumption but high viewable display by automatic luminance control.



The luminance area where the user feels it is "dazzling"

Reduces backlight intensity, cuts power consumption, and makes the display easily viewable.

The luminance area where the user feels it is "too dark"

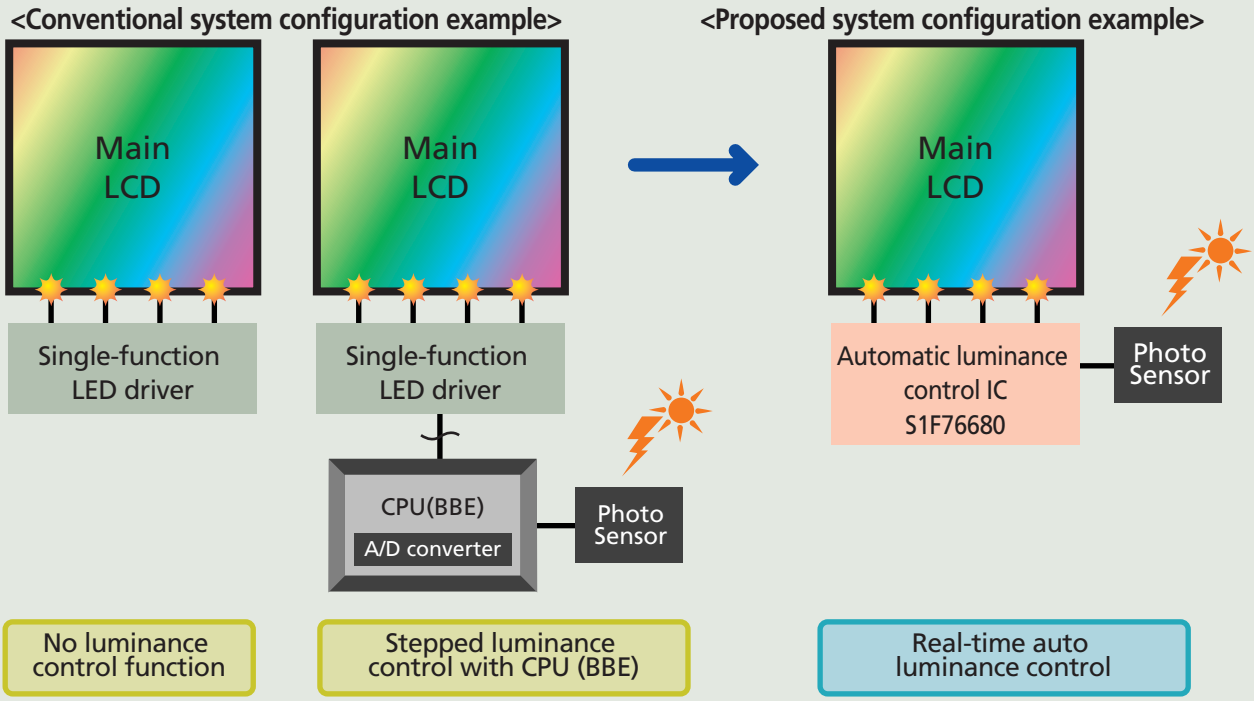
Increases the intensity to make the display easily viewable.

Can reduce the backlight current consumption by 20 to 30%. (*1)

*1: Simulated current consumption if 4 LEDs are used.

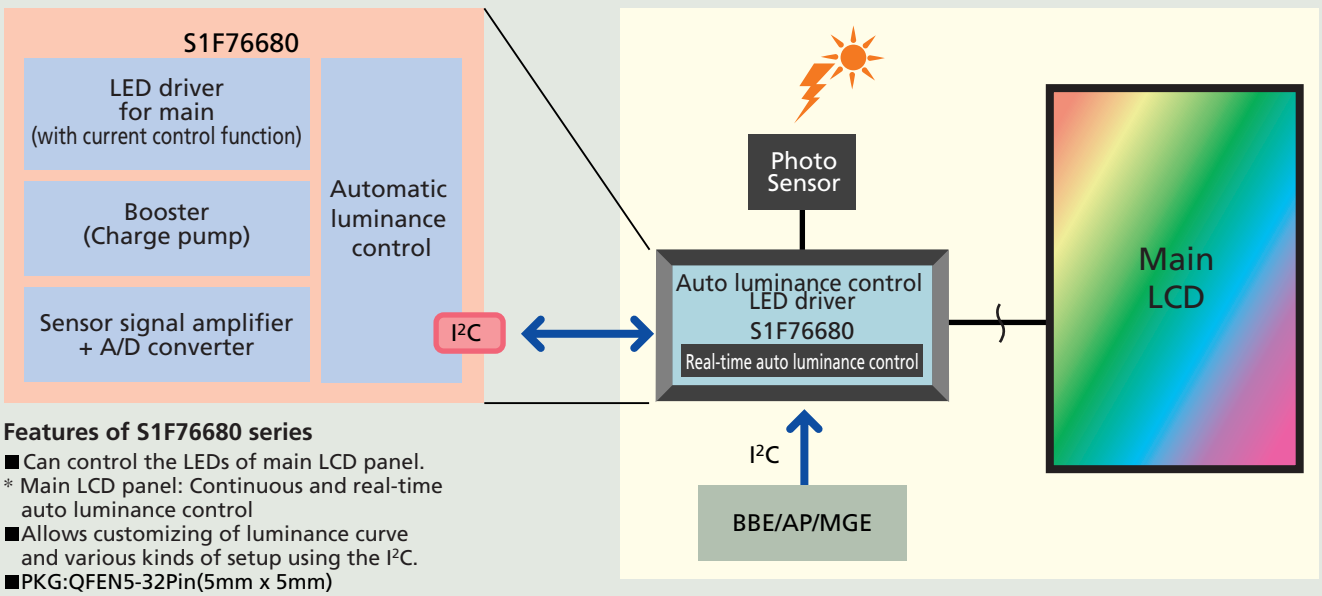
Proposal for real-time auto luminance control ICs (1)
S1F76680

Configuration of backlight LED drivers (1)



S1F76680 Auto Luminance Control LED Driver

- Can automatically control the backlight luminance of handset LCD and keys in real time mode!
- A combination of the S1F76680 and photosensors can readily realize real-time and automatic luminance control of LCD panels!

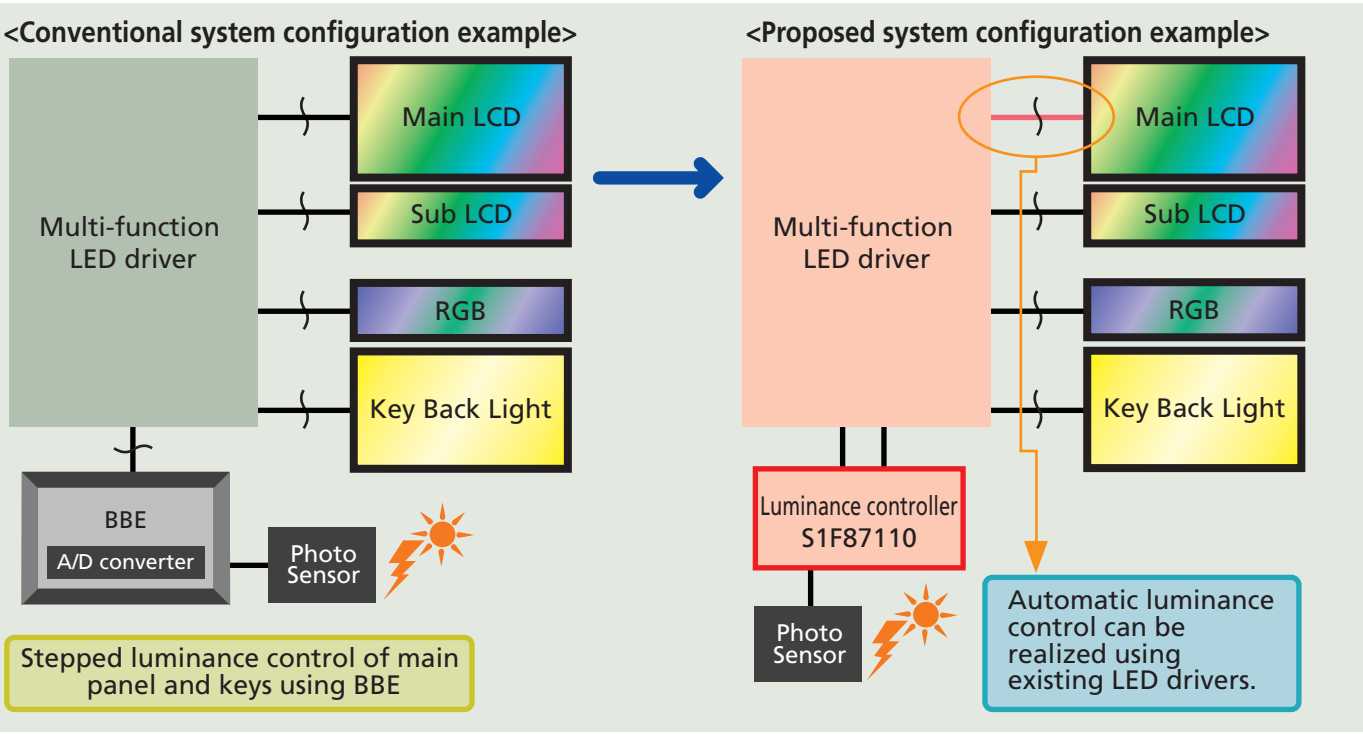


Features of S1F76680 series

- Can control the LEDs of main LCD panel.
  * Main LCD panel: Continuous and real-time auto luminance control
- Allows customizing of luminance curve and various kinds of setup using the I²C.
- PKG:QFEN5-32Pin(5mm x 5mm)

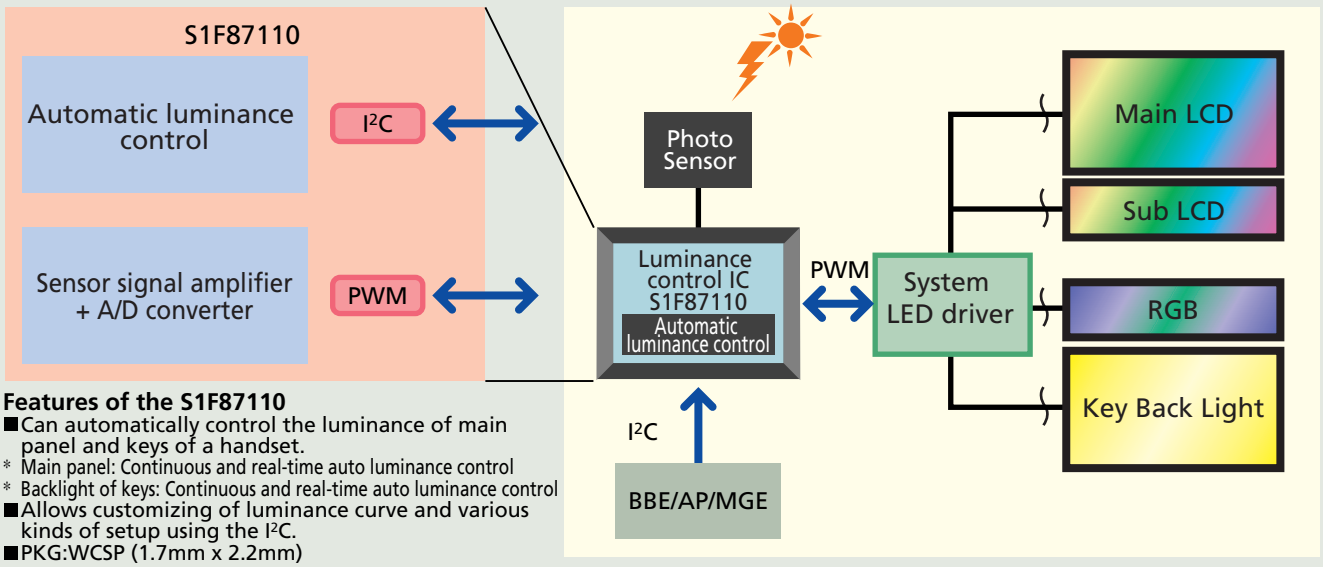
Proposal for real-time auto luminance control ICs (2)
S1F87110

Configuration of backlight LED drivers



S1F87100 Automatic Luminance Controller ICs

- Real-time auto luminance control functionality can be realized by simply adding the S1F87100 and a photosensor to the LED driver currently being used!
- Luminance control information can be entered in the system LED driver using the PMW. The luminance curve can be customized using the I²C.



Features of the S1F87110

- Can automatically control the luminance of main panel and keys of a handset.
  - * Main panel: Continuous and real-time auto luminance control
  - * Backlight of keys: Continuous and real-time auto luminance control
- Allows customizing of luminance curve and various kinds of setup using the I²C.
- PKG:WCSP (1.7mm x 2.2mm)

Ultra Low current Consumption

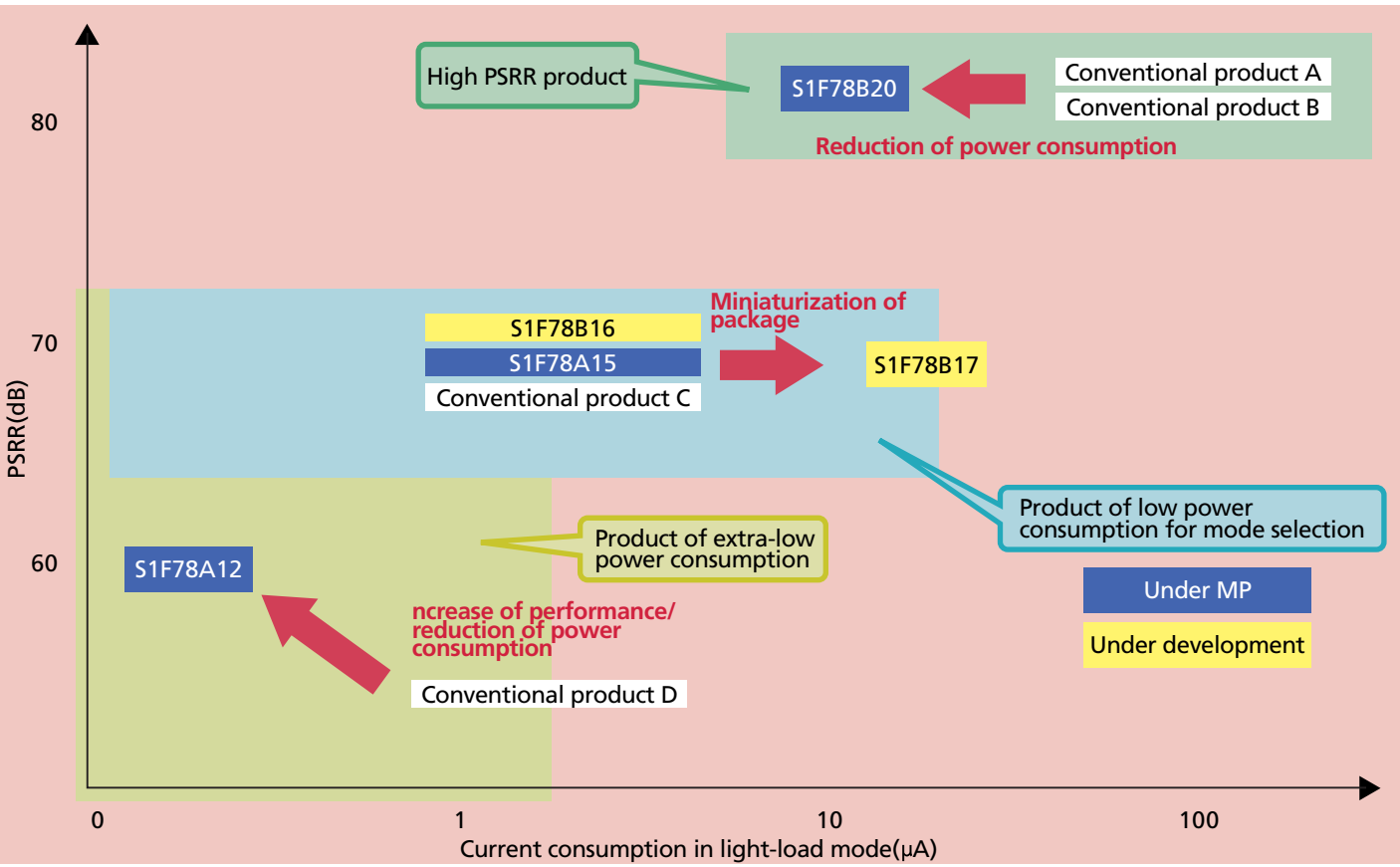
A regulator reducing power consumption by automatically switching between high-speed response and low power consumption modes has appeared on the market.

New Product

Regulator of extra-low current consumption S1F78A12/15 S1F78B20/17

This is a LDO which has achieved a **high ripple removal rate, high load response,** and **high precision** while substantially reducing current consumption using EPSON's unique circuit technique. It is provided with a built-in **automatic mode selector function,** which makes self-determination of output current and automatically switches to low current consumption mode when no load is applied. Therefore, external mode switching is not required and low current consumption is achieved. It adopts the ultra-compact package of VSON-6Pin (1.6mm x 1.6mm) to contribute to space savings. In addition to "S1F78A12" of the min. self-current consumption and "S1F78A15" providing low power consumption and high-speed response, we will provide a lineup of products such as "S1F78B20" of a high ripple removal rate, "S1F78B17" **in which packages should be applied to WCSP (Wafer level CSP)** and "S1F78B16: **VOUT 0.9V or less**" which supports the low voltage.

■ A lineup of regulators of extra-low current consumption

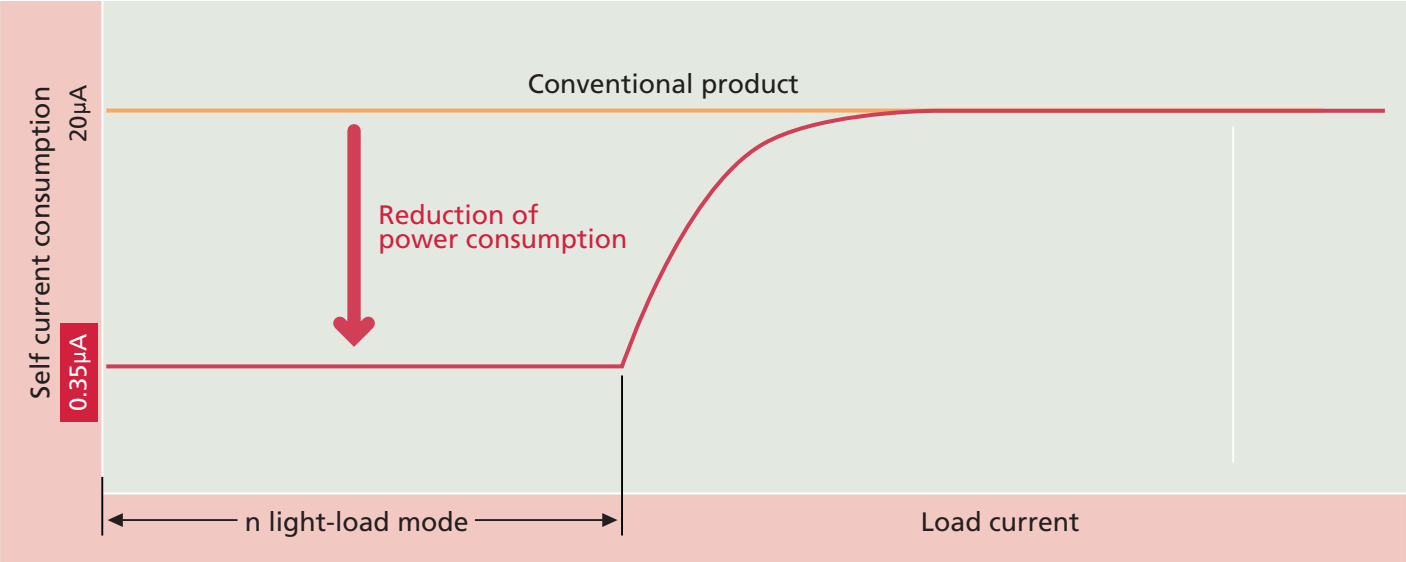


S1F78A12 Series

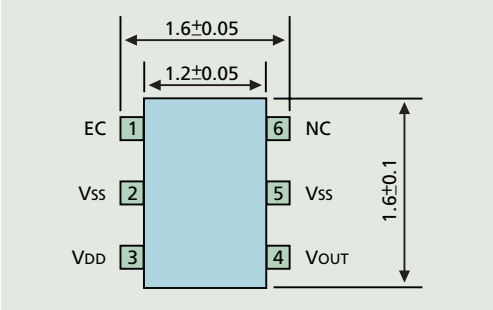
Industry leading extra-low power consumption Automatic switching regulator (Control pin is not required)

Control pin not required

■ Self current consumption of 0.35μA achieved in light-load mode by automatic load detection/mode selector function



■ Compact PKG-based high density package VSON-6Pin (1.6mm x 1.6mm)
■ Built-in discharge function
Discharges the capacitor connected to VOUT by CE pin setting.
■ Stable built-in overcurrent protection circuit



■ General specification

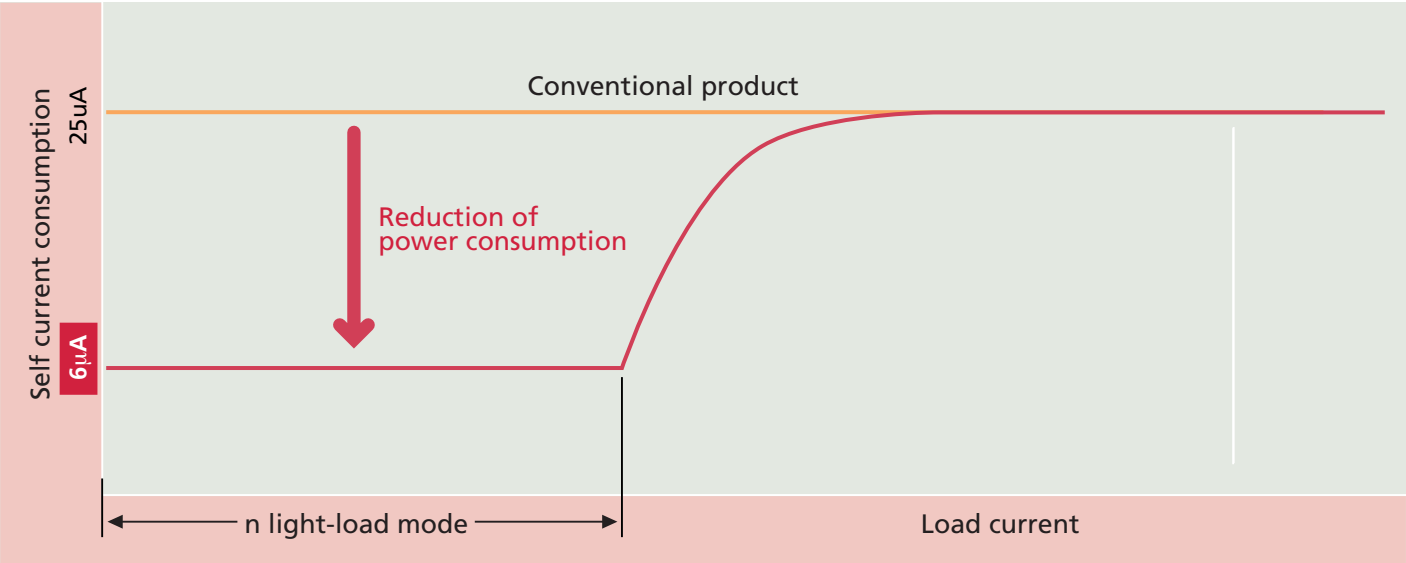
Input voltage range (V)	Operating temperature range (°C)	Output voltage (V)	Output current (mA)	Current consumption (μA)		Ripple removal rate (dB)	PKG
				In light-load mode	In standby mode		
(Max.) 5.5	–40 to 85	1.5 to 4.0 (In 0.1V interval)	75	0.35	(Max.) 0.05	55	VSON-6pin SOT23-5

S1F78A15 Series

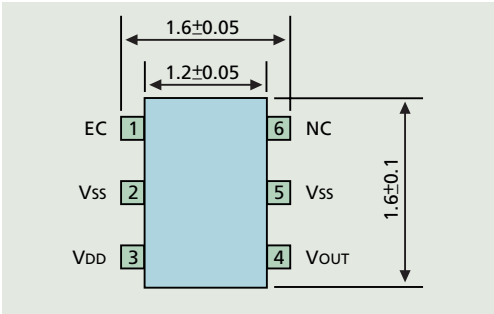
Automatic low power consumption/ high-speed response switching regulator (Control pin is not required)

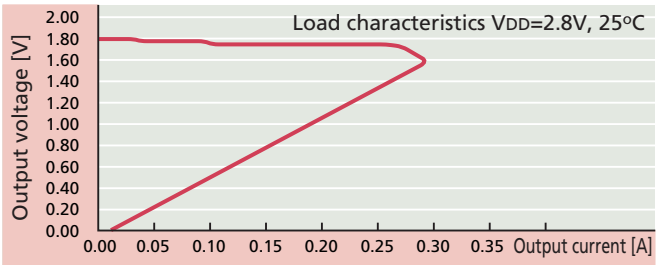
- **Self current consumption of 6μA achieved in light-load mode by automatic high-speed response/ low power consumption mode selector function**

Control pin not required



- **Ripple removal rate (PSRR) of 70dB achieved with low power consumption**
- **Compact PKG-based high density package VSON-6Pin (1.6mm x 1.6mm)**
- **Built-in discharge function Discharges the capacitor connected to VOUT by CE pin setting.**
- **Stable built-in overcurrent protection circuit**





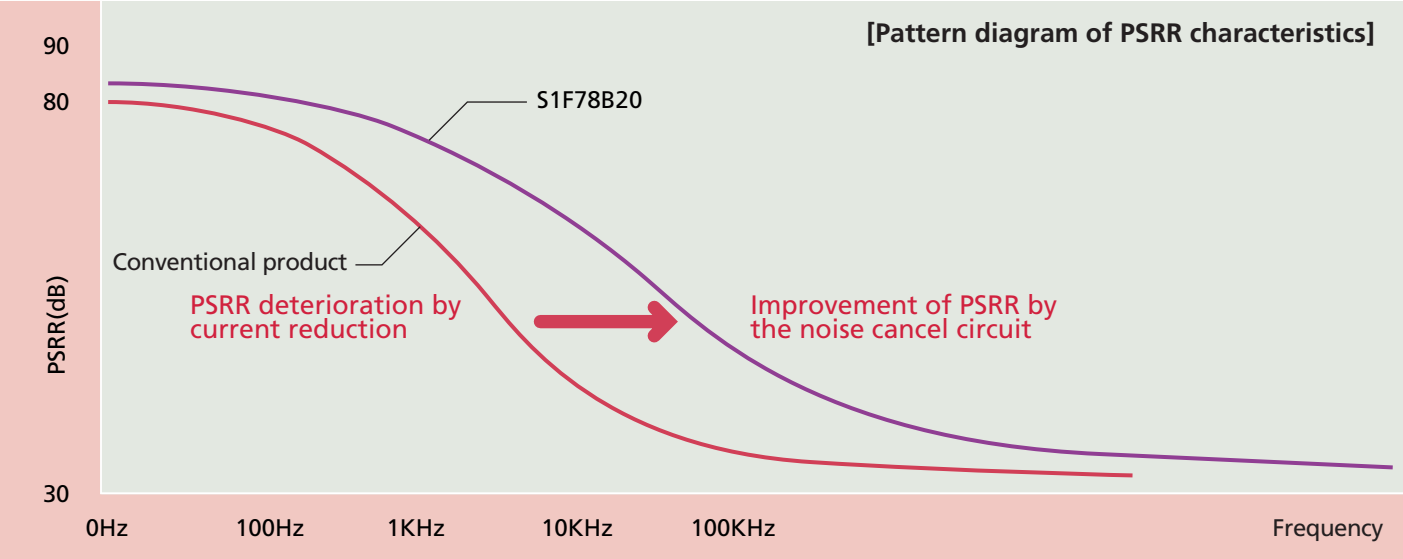
General specification

Input voltage range (V)	Operating temperature range (°C)	Output voltage (V)	Output current (mA)	Current consumption (μA)		Ripple removal rate (dB)	PKG
				In light-load mode	In standby mode		
(Max.) 5.5	–40 to 85	1.5 to 4.0 (In 0.1V interval)	200	6	(Max.) 0.05	70	VSON-6pin SOT23-5

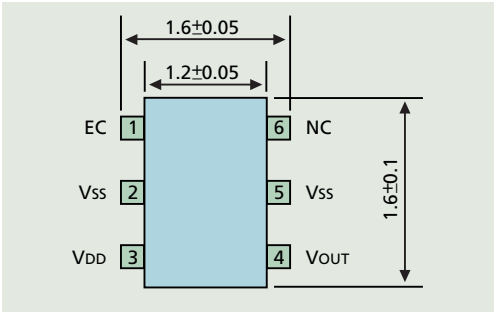
S1F78B20 Series

A regulator of low power consumption, low output noise, and high PSRR

■ Ripple removal rate (PSRR) of 80dB and low output noise voltage of 30μV/rms achieved with low power consumption based on the noise cancel circuit technique



■ Self current consumption: 50μA (During operation)
■ Compact PKG-based high density package VSON-6Pin (1.6mm x 1.6mm)
■ Built-in discharge functionDischarges the capacitor connected to VOUT by CE pin setting.
■ Stable built-in overcurrent protection circuit



■ General specification

Input voltage range (V)	Operating temperature range (°C)	Output voltage (V)	Output current (mA)	Current consumption (μA)		Low output noise voltage (μVrms)	Ripple removal rate (dB)	PKG
				In light-load mode	In standby mode			
(Max.) 5.5	–40 to 85	1.8 to 4.0 (In 0.1V interval)	150	0.35	(Max.) 0.1	30	80	VSON-6pin SOT23-5

Product lineup

Power supply ICs for logic

Products	Supply voltage(V)	Output voltage(V)	Output current(mA)	Power-off current(mA)	Package
S1F78520M0A0	2.8 to 5.5	3.3 or 2.9 or 2.5/2.5 or 2.0 or 1.8	100/80	2 power outputs(Charge pump and LOD)	SSOP3-24pin

Products	Supply voltage(V)	Output voltage(V)	Output current(mA)	Features	Package
S1F81100F0E1	3.3 to 5.5	Ch-1: 0.8 to 1.5(Selectable by I²C) Ch-2: 3.3 Ch-3: 3.3 Ch-4: same voltage as Ch-1.	Ch-1: 500mA Ch-2: 1A Ch-3: 1A Ch-4: 20mA	・Most suitable for Intel® PXA255/210 application processors based on Intel® XScale™ micro-architecture.	QFP12-48pin
S1F81100F0R2	3.3 to 5.5	Ch-1: 0.9 to 1.5(Selectable by GPIO) Ch-2: 3.3 Ch-3: 2.5 Ch-4: same voltage as Ch-1.	Ch-1: 500mA Ch-2: 1A Ch-3: 1A Ch-4: 5mA		QFP12-48pin

Power supply ICs for liquid crystal

Products	Supply voltage(V)	Output voltage(V)	Consumption current(mA)	Features	Package
S1F75510M0A0	2.7 to 3.6	Double/triple in the positive direction	200mA	Conversion efficiency 95% Built-in Blank mode	SSOP3-24pin
S1F75540F5B0	2.4 to 3.6	Triple in the negative direction V_{SCE}–V_{SS}: +3.0 to +6.0 V_{GON}–V_{SS}: +3.0 to +16.5 V_{GOFFL}–V_{SS}:–1.0 to –16.5 V_{COM} amplitude: +3.0 to +5.5 V_{COM} center: +1.0 to +3.6 V_{OUT2}–V_{SS}: +3.0 to +6.0 V_{LG}–V_{SS}: +1.8 V_H–V_{SS}: +2.0 to VGON V_L–V_{SS}: VN2+1.0 to –1.0	2.4mA	Supports V_{COM} and V_{GOFF}. Allows the setting of the pressurizing scale factor appropriate for output voltage.	QFN9-64pin

White LED driver ICs

Products	Supply voltage(V)	Application	Features	Package
S1F76680F5A1	3.0 to 4.6	LED driver for LED backlight ofcell phones	・Real-time auto luminance control ・The luminance control curve can be customized. ・Parallel 4 LED drive ・Luminance sensor amplification and brightness evaluation ・7bit automatic tone light control ・Automatic variable pressurize output by magnification	QFN5-32
S1F87110B0A0	2.7 to 3.6	Automatic luminance control of LED backlight	・Automatic luminance control of LED driver in real-time mode ・The luminance control curve can be customized.	WCSP

____ : Under development

Battery management IC (with lithium cell recharging control)

Products	Supply voltage(V)	Application	Features	Package
S1F77500M0A0	4.3 to 6.3	Changer controller for 1 cell lithium ion battery	●Constant voltage and constant current charging ●Timer function ●Temperature detection ●Constant voltage circuit (4.2V) ●Charging and discharging current detection (Option)	SSOP3-24pin

Product lineup

Battery liquid leak prevention and protection circuit IC

Products	Supplyvoltage(V)	Application	Features	Package
S1F77600Y0A0	0.0 to 5.5	Liquid leak prevention for two batteries in series	● Low voltage operation ● High precision detection, low current consumption ● Built-in output secure circuit (forced output Hi-Z)	SOT89-3pin
S1F77600M0A0				SON-6pin

3-Input power switching IC

Products	Supply voltage[V]	Built-in power monitoring circuit (Detection voltage)(V)			Application	Features	Package
		V_{CC}	V_{BUS}	V_{BAT}			
S1F76980F0A0	0.0 to 6.5	5.0	4.0	2.8	The USB, battery, and AC adapter powers can be switched.	Supply voltage monitoring circuit (VCC/VBUS/VBAT) Over-discharge protection circuit Power-on detect circuit, voltage limiter for overvoltage protection Power input control logic	QFN4-24pin
S1F76980F0B0		2.3	3.8	1.6			QFN4-24pin
S1F76980F0C0		2.3	3.8	1.6			QFN4-24pin

DC to DC converters

Products	Feature	Package
S1F76600M1E0	● Power supply voltage conversion IC ● Easy voltage conversions from input voltage to positive/negative potential (two conversion types; one-fold for reverse polarity and two-fold for the same polarity) ● Power conversion efficiency: 95% typical	SOP3A-8pin
S1F76620M0C0	● Possible to double pressure rise to positive potential ● Power conversion efficiency: 95% typical	SOP3B-8pin

DC to DC converters and voltage regulators

Products	Feature	Package
S1F76610M2E0	● Power supply voltage conversion IC ● Easy voltage conversions from input voltage to positive negative potential (two conversion types; one- and two-fold for reverse polarity and two- and three-fold for the same polarity) ● Power conversion efficiency: 95% typical ● Built-in circuit for voltage stabilization ● Four temperature coefficients suitable for LCD power supplies	SSOP2-16pin
S1F76540M0C0	● Power supply voltage conversion IC ● Generation of 4/3/2 times output voltage in the negative direction ● Power conversion efficiency: 95% (Typ.) ● Built-in voltage stabilization circuit ● Possible to select temperature gradient for LCD power supply	SSOP2-16pin
S1F76640M0C0	● Power supply voltage conversion IC ● Possible to 2/3/4 times pressure rise output to the positive potential ● Built-in voltage stabilization circuit ● Possible to select temperature gradient for LCD power supply	SSOP2-16pin

: Under development

Step-down DC/DC converter (PWM switching regulator)

Products	Supply voltage(V)	Output voltage(V)	Output current(mA)	Features	Package
S1F72B01	2.5 to 5.5	0.9 to 3.3 (Voltage can be set by 0.1V)	600mA	● Buck type Synchronous Rectifier Switching Regulator Built-in PFM/PWM Automatic function ● LDO mode selection during limited load (by pin switching) ● Low power consumption:(during standby) 500nA ● Switching frequency: 2.2MHz ● High efficiency: 95%	PLP-8pin

: Under development

Product lineup

High precision voltage regulators

Products	Input voltage (V-max.)	Output voltage (V)	Output current (μA-Typ.)	Current consumption(mA-Typ.)	Package
S1F78101Y3C0	15	3.2	10(V_I=5V)	3.0	SOT89-3pin
S1F78101Y3T0		3.3	10(V_I=5V)		
S1F78101Y3K0		3.9	10(V_I=6V)		
S1F78101Y3B0		5.0	10(V_I=7V)		
S1F78A12M	5.5	1.5 to 4.0 (Voltage can be set by 0.1V)	75(V_{DD}=V_{OUT}+1.0V)	0.35 (Unloaded) (During standby: 50nA Max.)	VSON-6pin
S1F78A12Y					SOT23-5
S1F78A15M	5.5	1.5 to 4.0 (Voltage can be set by 0.1V)	200(V_{DD}=V_{OUT}+1.0V)	6.0 (Unloaded) (During standby: 50nA Max.)	VSON-6pin
S1F78A15Y					SOT23-5
S1F78B20M	5.5	1.8 to 4.0 (Voltage can be set by 0.1V)	150(V_{DD}=V_{OUT}+1.0V)	50 (Unloaded) (During standby: 100nA Max.)	VSON-6pin
S1F78B20Y					SOT23-5
S1F78B17B	5.5	1.8 to 4.0 (Voltage can be set by 0.1V)	150(V_{DD}=V_{OUT}+1.0V)	35 (Unloaded) (During standby: 100nA Max.)	WCSP-4pin
S1F78B17Y					SOT23-5

Note) Temperatures during reflow soldering must remain within the limits set out under LSI Device Precautions in this catalog. Do not immerse QFP and SOT89 packages during soldering, as the rapid temperature gradient during dipping can cause damage.

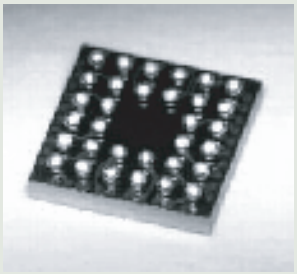
High precision voltage detectors

Products	Output level (V)	Detection voltage level (V)			Operating voltagerange (V)	Operating current(μA-Typ.)	Package
		Min.	Typ.	Max.			
S1F77201Y1C0	N-channel open drain	2.1	2.15	2.2	1.5 to 12.0	4.0 (V_{DD}=3.0V)	SOT89-3pin
S1F77201Y1F0		2.6	2.65	2.7			
S1F77201Y1T0		3.9	4	4.1		4.0 (V_{DD}=5.0V)	
S1F77211Y1R0	CMOS	2.73	2.8	2.87		4.0 (V_{DD}=3.0V)	
S1F77211Y1G0		2.93	3	3.07		4.0 (V_{DD}=4.0V)	
S1F77211Y1T0		3.9	4	4.1		4.0 (V_{DD}=5.0V)	
S1F77B01B	N-channel open drain/CMOS	1.5 to 4.6 (Voltage can be set by 0.1V)			0.7 to 6.0	0.35 (V_{DD}=3.0V)	WCSP-4pin
S1F77B01Y							SOT23-5pin

Note) Temperatures during reflow soldering must remain within the limits set out under LSI Device Precautions in this catalog. Do not immerse QFP and SOT89 packages during soldering, as the rapid temperature gradient during dipping can cause damage.

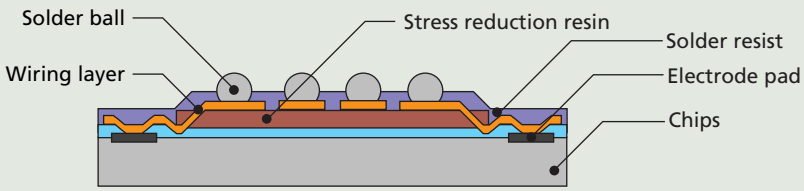
Package lineup

WCSP



WCSP (Wafer Level Chip Size Package) is a package that satisfies lightweight, compact, and thin conditions required for high-density assembly such as a small-sized portable device. Small-to-medium-sized pin devices such as EEPROM, RTC, PLL, and power supply are targeted for applications.

- Space saving package with full real chip size
- Ball pitch: 0.65/0.5/0.4mm pitch
- Under-filling is not required because this package provides a stress reduction structure at secondary mounting.
- This package facilitates changing from a conventional interposer-type package; so, it enables you to replace bare-chip mounting (wire bonding or face-down bonding) with SMT mounting.



Quad Flat Non-leaded Package

Unit: mm

Number of pins	PKG code	Body size Nom.	Height Max.	Lead pitch	Lead shape
24	QFN 4	4 x 4	1.0	0.5	STD
32	QFN 5	5 x 5	1.0	0.5	STD
48	QFN 7	7 x 7	1.0	0.5	STD
52	QFN 8	8 x 8	1.0	0.5	STD
64	QFN 9	9 x 9	1.0	0.5	STD

Small Outline Non-leaded Package

Unit: mm

Number of pins	PKG code	Body size Nom.	Height Max.	Lead pitch	Lead shape
8	SON 1	3 x 3.8	1.0	0.65	STD
6	SON	1.6 x 2.6	0.8	0.5	STD
16	SON 2	5.3 x 4.4	1.0	0.65	STD

Small Outline Package

Unit: mm

Number of pins	PKG code	Body size Nom.	Height Max.	Lead pitch	Lead shape
8	SOP 3B	4.9 x 3.9	1.75	1.27	STD
8	SOP 3A	5 x 4.4	1.7	1.27	STD
16	SOP 3A	10 x 4.4	1.7	1.27	STD

Shrink Small Outline Package

Unit: mm

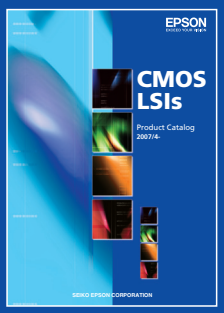
Number of pins	PKG code	Body size Nom.	Height Max.	Lead pitch	Lead shape
16	SSOP 2	6.6 x 4.4	1.7	0.8	STD
24	SSOP 3	7.8 x 5.6	1.45	0.65	STD

Small Outline Transistor Package

Unit: mm

Number of pins	PKG code	Body size Nom.	Height Max.	Lead pitch	Lead shape
3	SOT 89	4.5 x 2.5	1.6	1.5	STD

Power Management IC 2007/4-



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