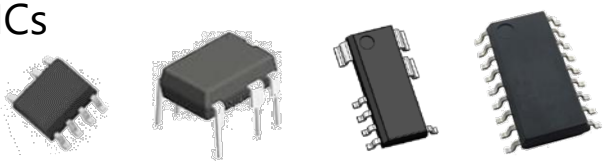
Working Together for
a Greener Society

Future of Power Electronics and the Earth

A Selection Guide to Power Management ICs

- Power ICs for PWM Switching Power Supply Control
- LLC Current-resonant Switching Power Supply Control ICs
- Quasi-resonant (QR) Switching Power Supply Control ICs
- Critical Conduction Mode (CRM) PFC Control ICs



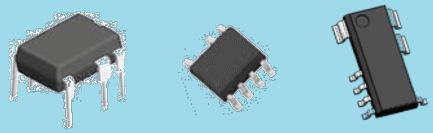
All information in this guide is as of the date of publication. Please make sure that you are using the latest version of the guide.
If you need more product information, please refer to our data sheets.
https://www.sanken-ele.co.jp/en

Contents

Power Management ICs: 4 Product Families

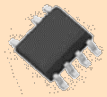
This selection guide covers our power management ICs, including functions and characteristics, by product family.

Power ICs for PWM Switching Power Supply Control

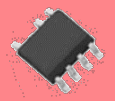


LLC Current-resonant Switching Power Supply Control ICs

Quasi-resonant (QR) Switching Power Supply Control ICs



Critical Conduction Mode (CRM) PFC Control ICs

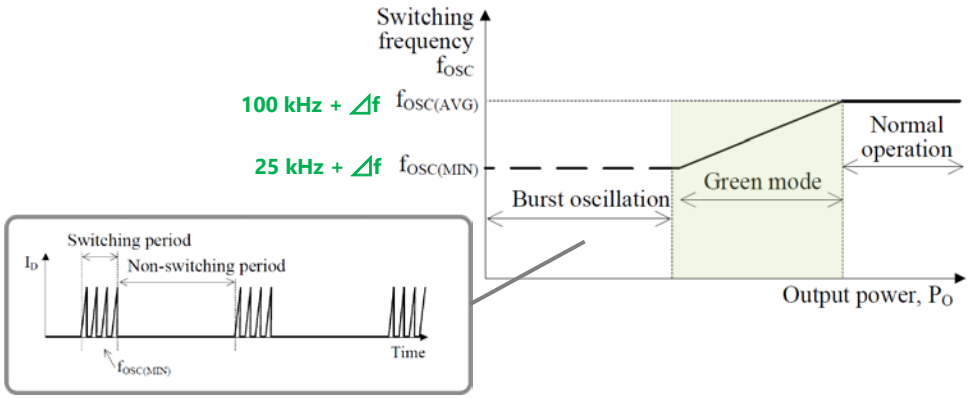


Features: Power ICs for PWM Switching Power Supply Control

1. Green Mode (Reduced Oscillation Frequency)

Lowers standby power by the reduced oscillation frequency at medium load and the burst oscillation operation at light load.

✓ **Increases the efficiency at 25–75% loads**

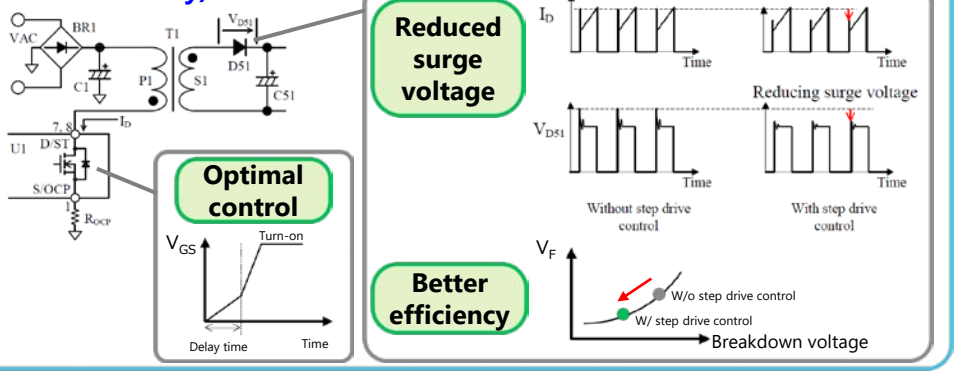


2. Step Drive Control (Reduced Secondary Diode Loss)

Optimizes the power MOSFET gate drive control according to loads.

✓ **Decreases a surge voltage in the secondary rectifier diode at MOSFET turn-off**

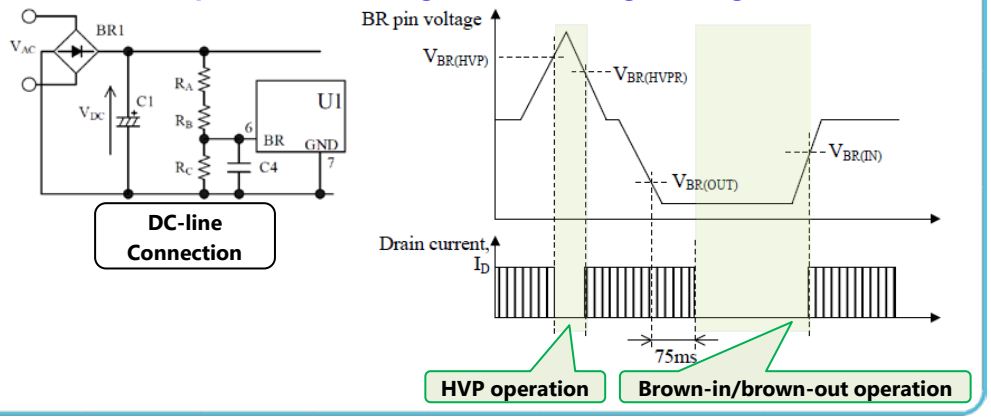
✓ **Decreases the breakdown voltage and V_F loss (higher power supply efficiency)**



3. AC Input High-voltage Protection (HVP)

Stops oscillations on a pulse-by-pulse basis upon overvoltage input to the AC power supply.

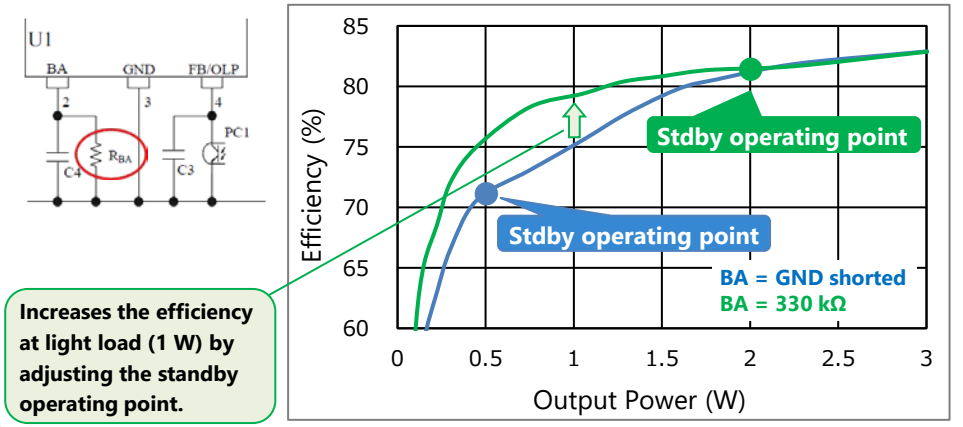
✓ **Protects power MOSFETs against overvoltage damage**



4. Standby Operating Point Adjustment

Adjusts the standby operating point by connecting R_{BA} to the BA pin.

✓ **Decreases the power consumption during standby**

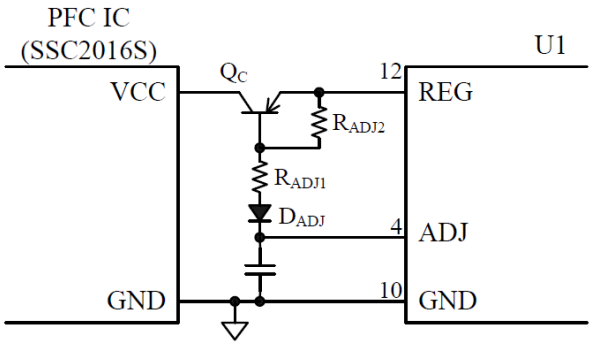


Increases the efficiency at light load (1 W) by adjusting the standby operating point.

Features: LLC Current-resonant Switching Power Supply Control ICs

1. PFC On/Off Function

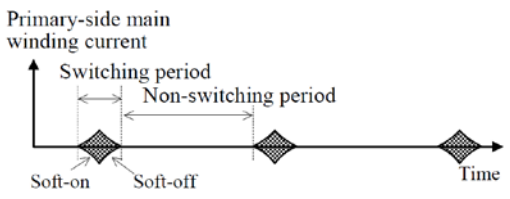
Powers on/off the PFC control IC (recommended: SSC2016S) in synchronization with the standby operation.
Allows circuits to consist of fewer external components.
✓ **Decreases the power consumption at light load or during standby**

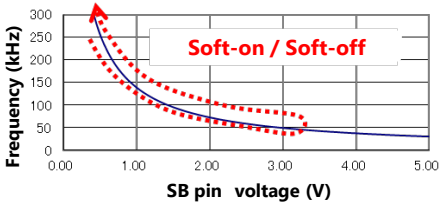


2. Standby Function

Performs the burst oscillation during the standby operation.
✓ **Decreases the switching loss at light load**

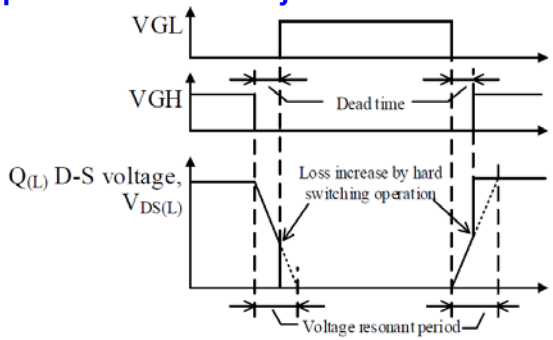
The soft-on/soft-off function prevents drain currents from varying steeply during the burst oscillation.
Controls switching frequencies with the SB pin voltage during the burst oscillation.
✓ **Minimizes audible transformer noise**





3. Automatic Dead Time Adjustment Function

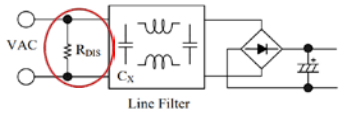
Detects a voltage-resonant period to automatically control the zero voltage switching (ZVS) operations of the high- and low-side power MOSFETs.
✓ **Requires no dead time adjustment**



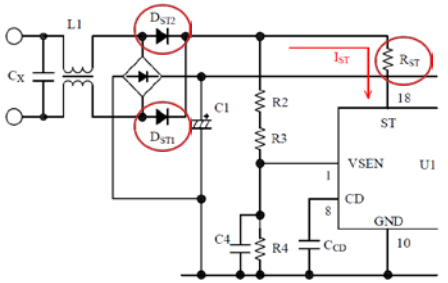
Waveforms at ZVS Failure

4. X-capacitor Discharge Function

Requires no discharge resistor R_{DIS} (IEC60950 compliant).
A typical line filter configuration needs R_{DIS} that is connected to an X-capacitor in parallel and always power consuming.
✓ **Increases circuit efficiencies**



Typical Line Filter Circuit

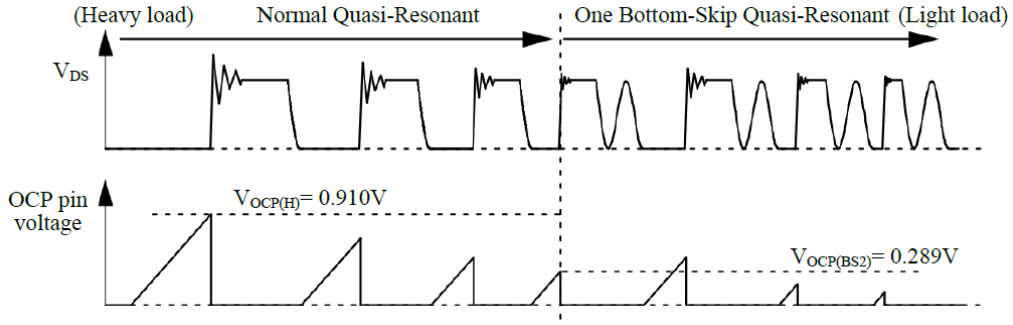


R_{DIS} removed; D_{ST1}, D_{ST2}, R_{ST} connected to the ST pin.

1. Bottom-skip Function

Minimizes an increase in switching frequency to reduce switching loss at light to medium loads.

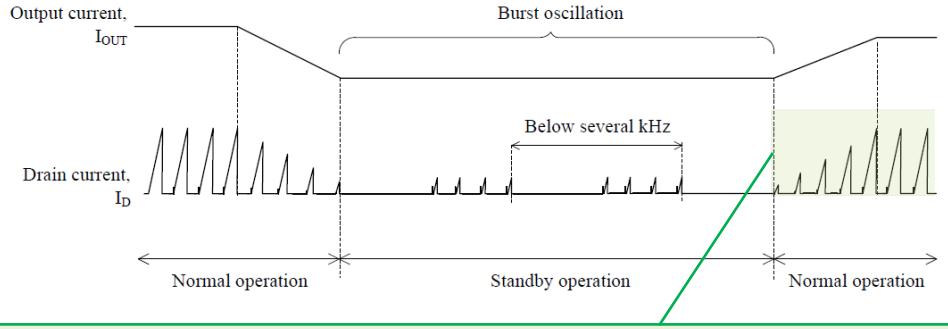
✓ Decreases the power consumption at light to medium loads



2. Automatic Standby Mode Function

Performs the burst oscillation by automatically shifting to the standby mode when the drain current I_D decreases at light load.

✓ Decreases the power consumption at light load or during standby



The step-on burst oscillation function (that gradually expands an on-time) can minimize audible transformer noise.

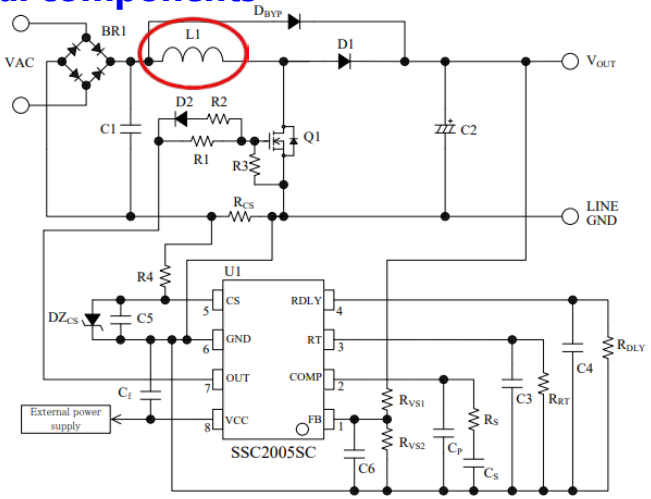
Features: Critical Conduction Mode (CRM) PFC Control ICs

1. Configuration without Auxiliary Winding

Based on the inductor current detection method.

✓ **Allows a circuit design using a single-wound inductor**

✓ **Reduces costs with fewer external components**



2. Maximum Switching Frequency Limitation Function

Limits the oscillation frequency (f_{MAX} = 300 kHz) to suppress switching loss.

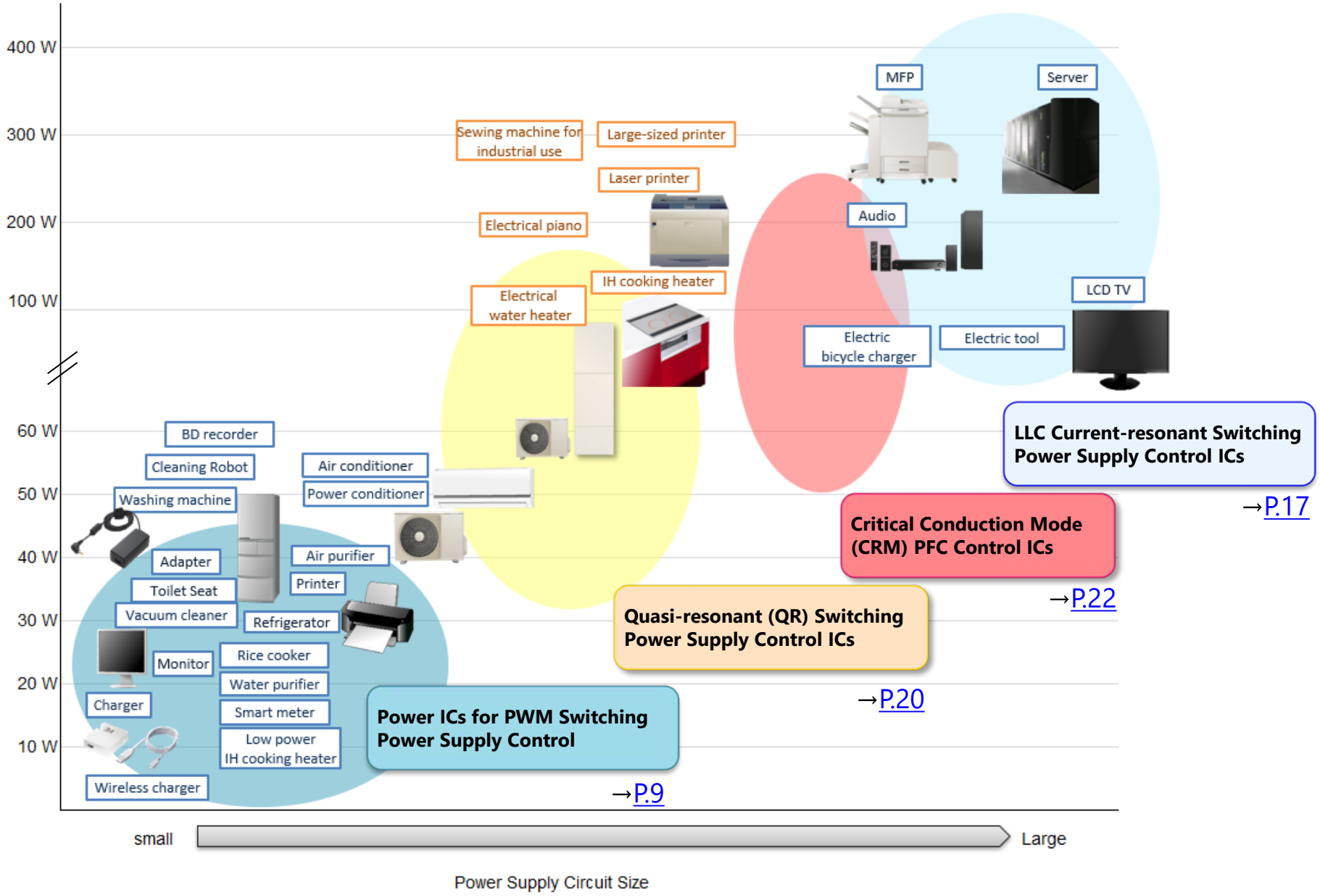
✓ **Decreases the power consumption at light load or during standby**

3. Restart Circuit

Turns on the OUT pin when the OUT pin off-time continues for the restart time (t_{RS} = 220 µs or more).
This restart operation takes the OUT pin on-time, $t_{ON(RS)}$ = 1.7 µs.

✓ **Stabilizes the switching operation at startup or light load**

Selection Guide to Power Supply ICs by Application



Selection Guide: Power ICs for PWM Switching Power Supply Control

Application	Output Power (W) (10 / 20 / 30 / 40 / 50)	Package	Feature	Series Name	Page
• Large Home Appliance • AC/DC Adopter  		DIP8	• Built-in 700 V startup circuit • Ultra-low standby power (standby operating point adj. + green mode)	STR6A100xV STR6A100xVD	P.10
		DIP8	• Built-in 700 V startup circuit • Ultra-low standby power (green mode) • Brown-in/brown-out function	STR6A100HZ	
		SOIC16	• Built-in 700 V startup circuit • Ultra-low standby power (green mode) • AC input high-voltage protection (HVP) • Brown-in/brown-out function	STR6S161HXD	
		DIP8	• Built-in 700 V startup circuit • General-purpose type • Fixed frequency (67 kHz / 100 kHz) • Brown-in/brown-out function	STR-A6000xZ	P.14
		DIP8	• Built-in 800 V (max.) startup circuit • Ultra-low standby power (green mode) • Power DIP8 (Po ≤ 44 W)	STR3A450 STR3A460HL/HDL STR3A475HDL	P.11
		DIP8	• Built-in 650 V startup circuit • General-purpose type • Power DIP8 (Po ≤ 44 W) • Fixed frequency (67 kHz / 100 kHz)	STR3A250	P.12
• Small Home Appliance 		DIP8 SOIC8	• Built-in 730 V startup circuit • Built-in overcurrent detection resistor • Fixed frequency (67 kHz / 100 kHz)	STR4A160	P.13
		DIP8	• Built-in 730 V startup circuit • Primary-side regulation (w/o optocoupler) • Built-in overcurrent detection resistor	STR5A160D	P.15
		DIP8 SOIC8	• Built-in 700 V startup circuit • Ultra-low standby power (green mode) • Built-in error amplifier	STR5A450D STR5A460	P.16

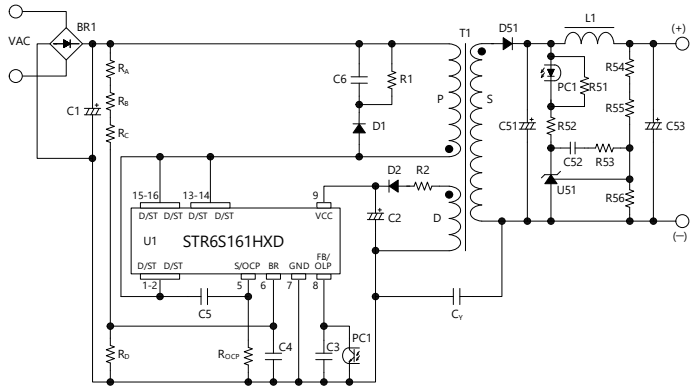
STR6A/STR6S Series

● Package

DIP8

SOIC16

● Typical Application



● Recommended Diode

Category	Part Number	Characteristics
Fast Recovery Diode	SJPX-F2	200 V, 1.5 A
Schottky Diode	SJPE-L15	150 V, 3 A
	SJPE-T15	150 V, 5 A
Snubber Diode	SARS05	800 V, 1 A

● Product List

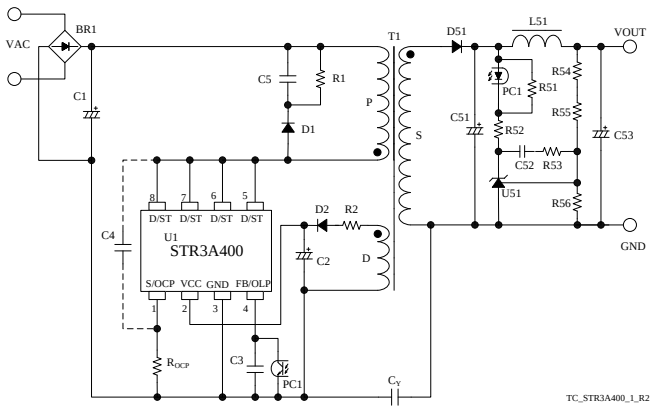
Series Name	Part Number	V_{DSS} (Min.)	$R_{DS(ON)}$ (Max.)	$f_{OSC(AVG)}$ (Typ.)	$f_{OSC(MIN)}$ (Typ.)	Green Mode	Step Drive Control	Standby Operating Point Adj	Brown-in/Brown-out	HVP	OVP TSD	$V_{CC(OVP)}$ (Min.)	OLP	OCP	$V_{OCP(H)}$ (Typ.)	Current Detection Resistor	Package
STR6A100xV STR6A100xVD	STR6A153MV	650 V	1.9 Ω	65 kHz	25 kHz	✓	✓	✓	—	—	Latch	27.0 V	Auto-restart	Pulse-by-pulse	0.888 V	External	DIP8
	STR6A153MVD										Auto-restart						
	STR6A168HV	700 V	10 Ω	100 kHz	25 kHz	✓	✓	✓	—	—	Latch	27.0 V	Auto-restart	Pulse-by-pulse	0.888 V	External	DIP8
	STR6A168HVD		10 Ω								Auto-restart						
	STR6A169HVD		6 Ω								Auto-restart						
	STR6A161HV		3.95 Ω								Latch						
	STR6A161HVD		3.95 Ω								Auto-restart						
	STR6A163HVD		2.3 Ω								Auto-restart						
STR6A100HZ	STR6A169HZ	700 V	6 Ω	100 kHz	25 kHz	✓	✓	—	✓	—	Latch	27.0 V	Auto-restart	Pulse-by-pulse	0.888 V	External	DIP8
	STR6A161HZ		3.95 Ω														
	STR6A163HZ		2.3 Ω														
STR6S161HXD	STR6S161HXD	700 V	3.95 Ω	100 kHz	25 kHz	✓	✓	—	✓	✓	Auto-restart	27.0 V	Auto-restart	Pulse-by-pulse	0.888 V	External	SOIC16

STR3A450 Series

● Package

DIP8

● Typical Application



● Recommended Diode

Category	Part Number	Characteristics
Fast Recovery Diode	SJPX-F2	200 V, 1.5 A
Schottky Diode	SJPE-L15	150 V, 3 A
	SJPE-T15	150 V, 5 A
Snubber Diode	SARS05	800 V, 1 A
	EG01C	1000 V, 0.5 A

● Product List

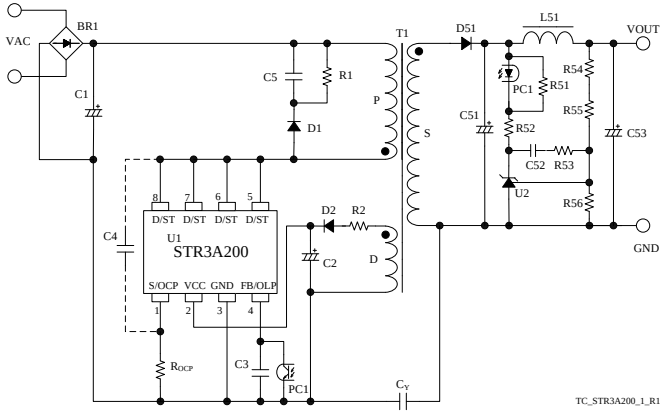
Series Name	Part Number	V_{DSS} (Min.)	$R_{DS(ON)}$ (Max.)	$f_{OSC(AVG)}$ (Typ.)	$f_{OSC(MIN)}$ (Typ.)	Green Mode	Step Drive Control	OVP TSD	$V_{CC(OVP)}$ (Min.)	OLP	OCP	$V_{OCP(H)}$ (Typ.)	$V_{OCP(LEB)}$ (Typ.)	Current Detection Resistor
STR3A450	STR3A451	650 V	4 Ω	65 kHz	30 kHz	✓	✓	Latch	27.0 V	Auto-restart	Pulse-by-pulse	0.888 V	1.69 V	External
	STR3A451D		4 Ω					Auto-restart						
	STR3A453		1.9 Ω					Latch						
	STR3A453D		1.9 Ω					Auto-restart						
	STR3A455		1.1 Ω					Latch						
	STR3A455D		1.1 Ω					Auto-restart						
STR3A460HL/HDL	STR3A461HDL	700 V	4.2 Ω	100 kHz	30 kHz	✓	✓	Auto-restart	27.0 V	Auto-restart	Pulse-by-pulse	0.888 V	1.69 V	External
	STR3A461HL		4.2 Ω					Latch						
	STR3A462HDL		3.2 Ω					Auto-restart						
	STR3A463HDL		2.2 Ω					Auto-restart						
STR3A475HDL	STR3A475HDL	800 V	1.7 Ω	100 kHz	30 kHz	✓	✓	Auto-restart	27.0 V	Auto-restart	Pulse-by-pulse	0.888 V	1.69 V	External

STR3A250 Series

● Package

DIP8

● Typical Application



● Recommended Diode

Category	Part Number	Characteristics
Fast Recovery Diode	SJPX-F2	200 V, 1.5 A
	SJPL-F4	400 V, 1.5 A
	SJPL-L4	400 V, 3 A
Snubber Diode	SARS05	800 V, 1 A

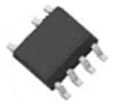
● Product List

Series Name	Part Number	V_{DSS} (Min.)	$R_{DS(ON)}$ (Max.)	$f_{OSC(AVG)}$ (Typ.)	$f_{OSC(MIN)}$ (Typ.)	OVP TSD	$V_{CC(OVP)}$ (Min.)	OLP	OCP	$V_{OCP(H)}$ (Typ.)	$V_{OCP(LEB)}$ (Typ.)	Current Detection Resistor
STR3A250	STR3A251	650 V	4 Ω	67 kHz	—	Latch	27.0 V	Auto-restart	Pulse-by-pulse	0.888 V	1.69 V	External
	STR3A251D		4 Ω			Auto-restart						
	STR3A253		1.9 Ω			Latch						
	STR3A253D		1.9 Ω			Auto-restart						
	STR3A255		1.1 Ω			Latch						
	STR3A255D		1.1 Ω			Auto-restart						

STR4A160 Series

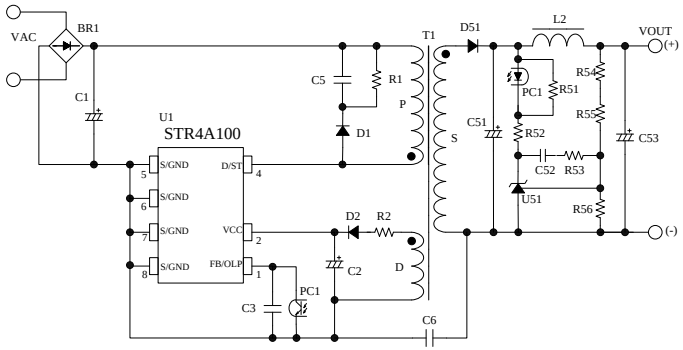
● Package

DIP8



SOIC8

● Typical Application



● Recommended Diode

Category	Part Number	Characteristics
Fast Recovery Diode	SJPX-F2	200 V, 1.5 A
	SJPL-F4	400 V, 1.5 A
Snubber Diode	SARS05	800 V, 1 A

● Product List

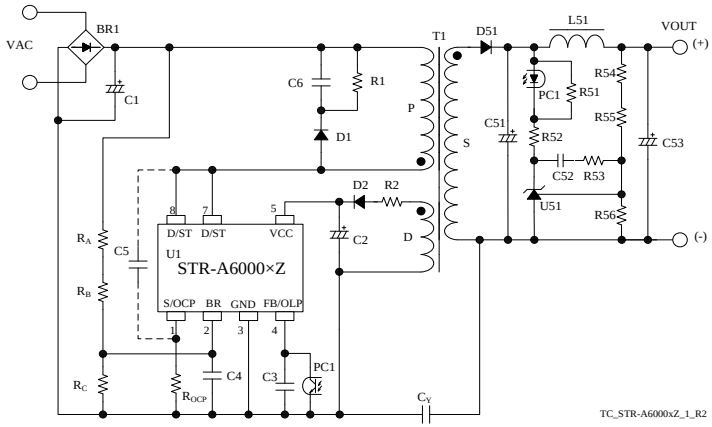
Series Name	Part Number	V_{DSS} (Min.)	$R_{DS(ON)}$ (Max.)	$f_{OSC(AVG)}$ (Typ.)	$f_{OSC(MIN)}$ (Typ.)	OVP TSD	$V_{CC(OVP)}$ (Min.)	OLP	OCP	Current Detection Resistor	Package
STR4A160	STR4A162D	730 V	24.6 Ω	65 kHz	—	Auto-restart	27.5 V	Auto-restart	Pulse-by-pulse	Built-in	DIP8
	STR4A162S		24.6 Ω	65 kHz							SOIC8
	STR4A164D		12.9 Ω	65 kHz							DIP8
	STR4A164HD		12.9 Ω	100 kHz							DIP8

STR-A6000xZ Series

● Package

DIP8

● Typical Application



● Recommended Diode

Category	Part Number	Characteristics
Fast Recovery Diode	SJPX-F2	200 V, 1.5 A
	SJPL-F4	400 V, 1.5 A
	SJPL-L4	400 V, 3 A
Snubber Diode	SARS05	800 V, 1 A

● Product List

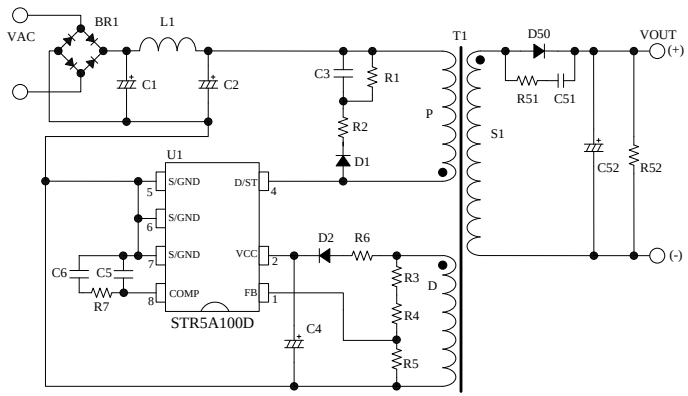
Series Name	Part Number	V_{DSS} (Min.)	$R_{DS(ON)}$ (Max.)	$f_{OSC(AVG)}$ (Typ.)	$f_{OSC(MIN)}$ (Typ.)	OVP TSD	$V_{CC(OVP)}$ (Min.)	OLP	OCP	$V_{OCP(H)}$ (Typ.)	$V_{OCP(LEB)}$ (Typ.)	Current Detection Resistor
STR-A6000xZ	STR-A6069HZ	700 V	6 Ω	100 kHz	—	Auto-restart	27 V	Auto-restart	Pulse-by-pulse	0.888 V	1.69 V	External
	STR-A6069MZ		6 Ω	67 kHz								
	STR-A6061HZ		3.95 Ω	100 kHz								
	STR-A6061MZ		3.95 Ω	67 kHz								
	STR-A6063MZ		2.3 Ω	100 kHz								
	STR-A6063HZ		2.3 Ω	67 kHz								

STR5A160D Series

● Package

DIP8

● Typical Application



● Recommended Diode

Category	Part Number	Characteristics
Fast Recovery Diode	SJPX-F2	200 V, 1.5 A
	SJPL-F4	400 V, 1.5 A
Snubber Diode	SARS05	800 V, 1 A

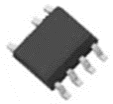
● Product List

Series Name	Part Number	V_{DSS} (Min.)	$R_{DS(ON)}$ (Max.)	$f_{OSC(AVG)}$ (Typ.)	$f_{OSC(MIN)}$ (Typ.)	Green Mode	OVP TSD	$V_{CC(OVP)}$ (Min.)	OLP	OCP	Current Detection Resistor
STR5A160D	STR5A162D	730 V	24.6 Ω	65 kHz	23 kHz	✓	Auto-restart	27.5 V	Auto-restart	Pulse-by-pulse	Built-in
	STR5A164D		13 Ω								

STR5A400 Series

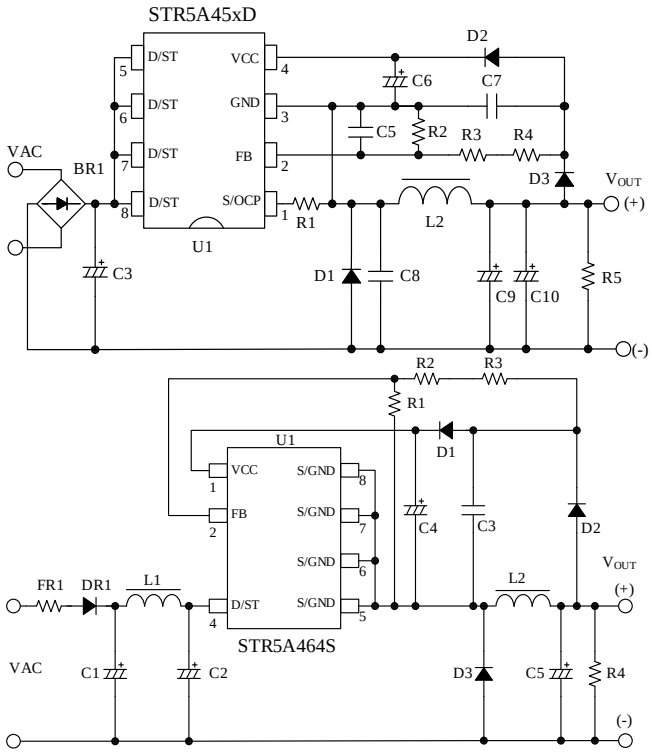
● Package

DIP8



SOIC8

● Typical Application



● Recommended Diode

Category	Part Number	Characteristics
General Rectifier Diode	EM1C	1000 V, 1 A
Fast Recovery Diode	SJPD-L5	500 V, 3 A
	SJPD-D5	500 V, 1 A
Schottky Diode	SJPB-D9	90 V, 1 A

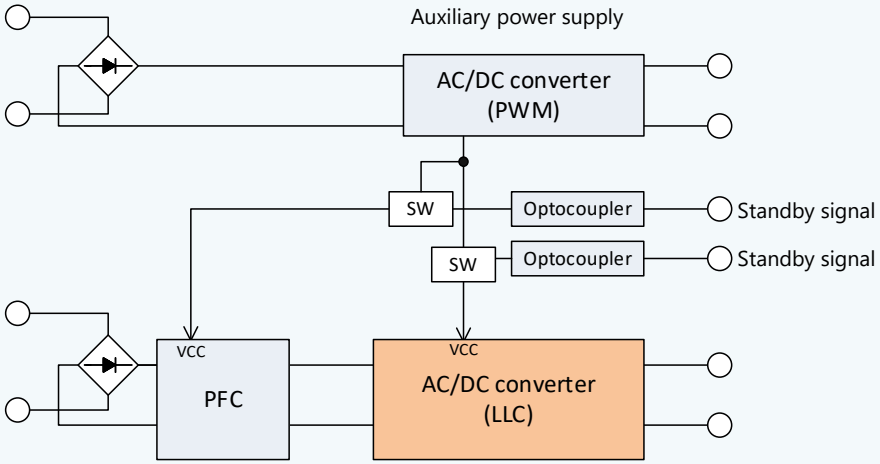
● Product List

Series Name	Part Number	V_{DSS} (Min.)	$R_{DS(ON)}$ (Max.)	$f_{OSC(AVG)}$ (Typ.)	$f_{OSC(MIN)}$ (Typ.)	Green Mode	OVP TSD	$V_{CC(OVP)}$ (Min.)	OLP	OCP	Error Amplifier	Current Detection Resistor	Package
STR5A450D	STR5A451D	650 V	4.0 Ω	60 kHz	23 kHz	✓	Auto-restart	27.5 V	Auto-restart	Pulse-by-pulse	✓	External	DIP8
	STR5A453D		1.9 Ω										DIP8
STR5A460	STR5A464D	700 V	13.6 Ω	60 kHz	23 kHz	✓	Auto-restart	27.5 V	Auto-restart	Pulse-by-pulse	✓	Built-in	DIP8
	STR5A464S												SOIC8

Type 1: External Auxiliary Power Supply

◆To minimize standby power (P_{IN} ≤ 30 mW)

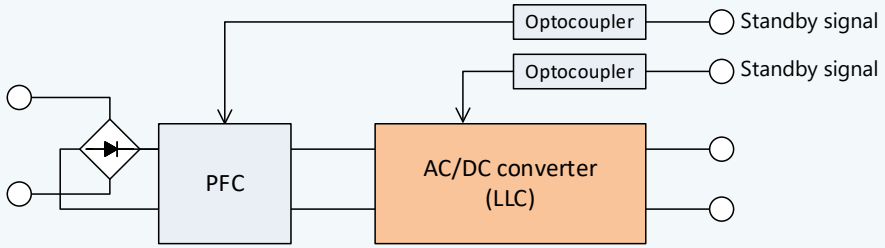
- **SSC3S931** → P.19
- **SSC3S932** → P.19



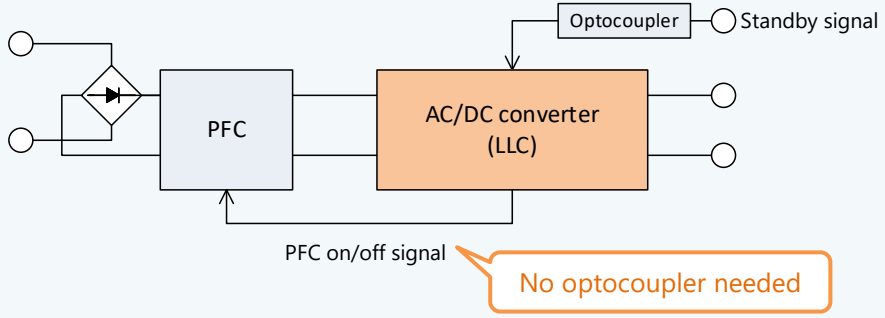
Type 2: Built-in Standby Function

◆To minimize the number of external components

- **SSC3S900** → P.19
- **SSC3S910** → P.19
- **SSC3S927L** → P.19



- **SSC3S921** → P.19
- **SSC3S927** → P.19



Selection Guide: LLC Current-resonant Switching Power Supply Control ICs

Application	Output Power (W)	Package	Feature*	Series Name	Page
	10 30 50 100 250 500				
• Digital Appliance • Office Automation • Industrial • Communication • Audio Visual  		SOP18	• Built-in 600 V startup circuit • Universal input voltage supported (OLP input compensation)	SSC3S900 SSC3S910	P.19
		SOP18	• Built-in 600 V startup circuit • PFC on/off function • Audible transformer noise suppression in standby mode	SSC3S921	
		SOP18	• Built-in 600 V startup circuit • PFC on/off function • X-capacitor discharge function • AC input high-voltage protection (HVP)	SSC3S927 SSC3S927L	
		SOP18	• External auxiliary power supply • AC input high-voltage protection (HVP) • Optocoupler open protection (OOP)	SSC3S931 SSC3S932	

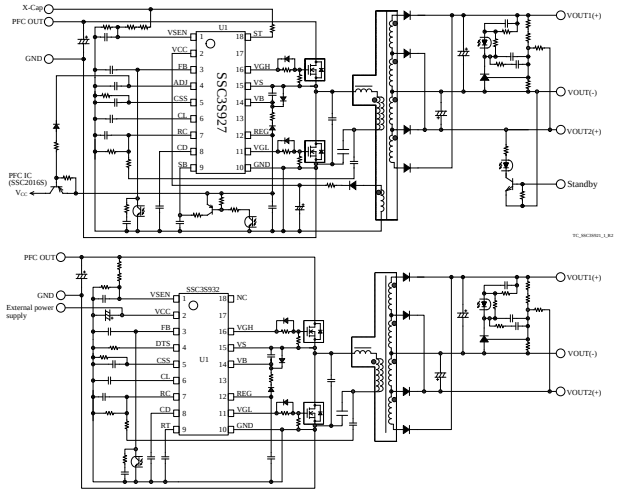
* Control method: Harf-bridge

SSC3S900 Series

● Package

SOP18

● Typical Application



● Recommended Diode

Category	Part Number	Characteristics
Fast Recovery Diode	SJPX-F2	200 V, 1.5 A
Schottky Diode	SJPA-D3	30 V, 1 A
	FMW-4306	60 V, 30 A
	FMEN-230A	100 V, 30 A

● Product List

Series Name	Part Number	V_{ST} (Min.)	f_{MAX} (Min.)	f_{MAX} (Typ.)	$I_{FB(MAX)}$ (Typ.)	PFC On/Off Function	X-capacitor Discharge Function	HVP	OVP TSD	$V_{CC(OVP)}$ (Min.)	OLP	OCP
SSC3S900	SSC3S901	600 V	32 kHz	300 kHz	-195 µA	—	—	—	Auto-restart	29.5 V	Auto-restart*	Pulse-by-pulse
	SSC3S902								Latch		Latch*	
SSC3S910	SSC3S910	600 V	32 kHz	300 kHz	-195 µA	—	—	—	Auto-restart	30.0 V	Auto-restart	Pulse-by-pulse
SSC3S921	SSC3S921	600 V	32 kHz	300 kHz	-195 µA	✓	—	—	Auto-restart	30.0 V	Auto-restart	Pulse-by-pulse
SSC3S927	SSC3S927	600 V	32 kHz	300 kHz	-195 µA	✓	✓	✓	Auto-restart	30.0 V	Auto-restart	Pulse-by-pulse
SSC3S927L	SSC3S927L	600 V	32 kHz	300 kHz	-195 µA	✓	✓	✓	Auto-restart	30.0 V	Auto-restart	Pulse-by-pulse
SSC3S931	SSC3S931	—	32 kHz	300 kHz	-1600 µA	—	—	✓	Latch	30.0 V	Latch	Pulse-by-pulse
SSC3S932	SSC3S932	—	32 kHz	300 kHz	-1600 µA	—	—	✓	Latch/ Auto-restart	30.0 V	Latch/ Auto-restart	Pulse-by-pulse

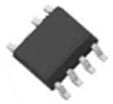
* With input compensation function

Selection Guide: Quasi-resonant (QR) Switching Power Supply Control ICs

Application	Output Power (W)						Package	Feature	Series Name	Page
	10	30	50	100	250	500				
• Digital Appliance • Office Automation • Large Home Appliance • Industrial • Communication							SOIC8	• Built-in 600 V startup circuit • Bottom-skip function (higher efficiency at light to medium loads) • Automatic standby mode function (higher efficiency with burst oscillation at light load)	SSC1S310A	P.21

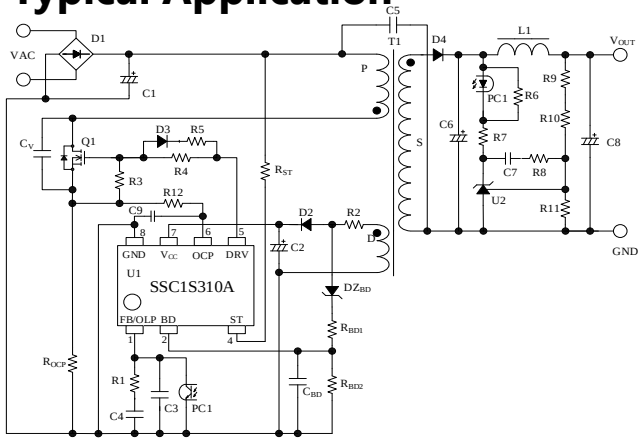
SSC1S310A Series

● Package



SOIC8

● Typical Application



● Recommended Diode

Category	Part Number	Characteristics
Fast Recovery Diode	SJPX-F2	200 V, 1.5 A
	SJPL-L4	400 V, 3 A
	FML-24S	400 V, 10 A
Schottky Diode	SJPA-D3	30 V, 1 A
Snubber Diode	SARS05	800 V, 1 A

● Product List

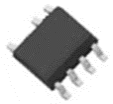
Series Name	Part Number	V_{ST} (Min.)	OVP TSD	$V_{CC(OVP)}$ (Min.)	OLP	OCP
SSC1S310A	SSC1S311A	600 V	Auto-restart	28.5 V	Auto-restart	Pulse-by-pulse
	SSC1S312A	600 V	Latch	28.5 V	Latch	Pulse-by-pulse

Selection Guide: Critical Conduction Mode (CRM) PFC Control ICs

Application	Output Power (W)						Package	Feature	Series Name	Page
	10	30	50	100	250	500				
• Digital Appliance • Office Automation • AC/DC Power Supply • Communication 							SOIC8	• Configuration without auxiliary winding (inductor current detection method) • Low standby power consumption • Minimum off-time limitation function (curbed frequency increases)	SSC2005SC	P.23
							SOIC8	• Low standby power consumption • Maximum oscillation frequency limitation function • Maximum on-time limitation function (reduced audible transformer noise in a transient state)	SSC2016S	

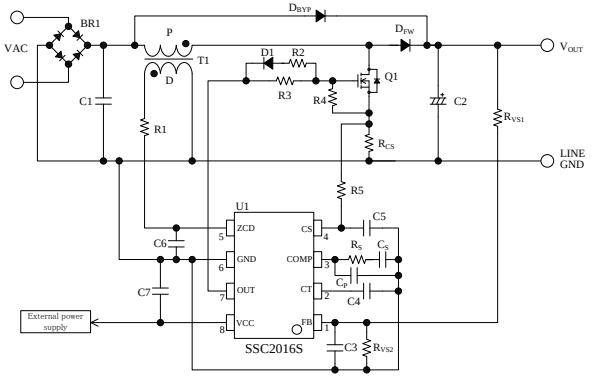
SSC2000 Series

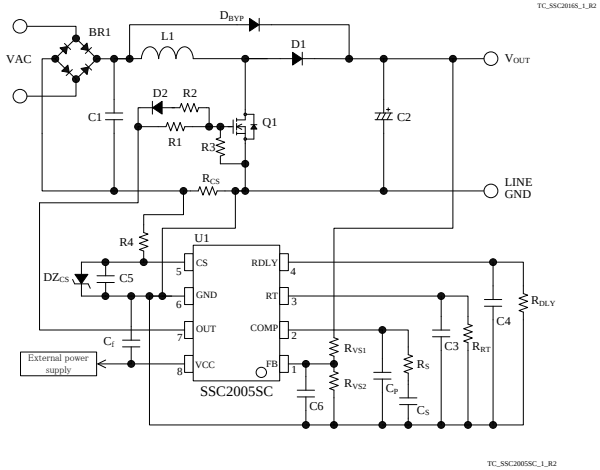
● Package



SOIC8

● Typical Application





● Recommended Diode

Category	Part Number	Characteristics
General Rectifier Diode	EM2A	600 V, 1.2 A
Fast Recovery Diode	FMNS-1106S	600 V, 10 A
	SJPL-H6	600 V, 2 A
Schottky Diode	SJPA-D3	30 V, 1 A

● Product List

Part Number	f_{MAX} (Typ.)	FB_UVP (FB Pin Undervoltage Protection)	OVP TSD	OCP1	$V_{CS(OCP1)}$ (Typ.)
SSC2016S	300 kHz	✓	Auto-restart	Pulse-by-pulse	0.5 V
SSC2005SC	—	✓	Auto-restart	Pulse-by-pulse	-0.6 V

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DSGN-CEZ-16003