

# Offline AC/DC

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# Flyback Controllers and HV Converters

# LPC Portfolio

## Power Supply Controls for every market

\*Automotive Grade Available

### Controllers

#### Products

##### ▪ General Purpose PWM Controllers

- UCC28XX\*, UCC38XX
- UCC28C4X\*, UCC38C4X
- LM5021\*
- UC284X\*, UC384X
- UCC2570X, UCC3570X

##### ▪ Flyback Controllers

###### - SSR Flyback

- UCC28740
- LM5023
- UCC28600/10\*

###### - PSR Flyback

- UCC2870X\*
- UCC2871X/2X
- UCC28730\*
- UCC2863X

### Converters

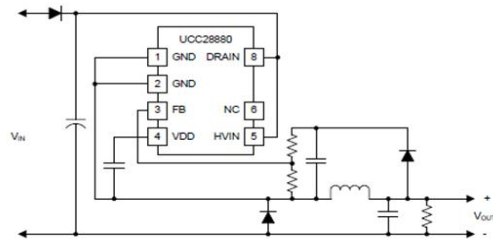
#### Products

##### ▪ HV Buck Converter/Flyback

- UCC25230
- UCC28880
- UCC28881

##### ▪ PSR Flyback Converter

- UCC28910
- UCC28911



### Secondary Side Controllers

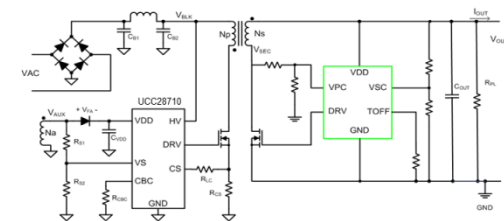
#### Products

##### ▪ Secondary Side SR Controllers

- UCC24610
- UCC24630
- UCC24636

##### ▪ Wakeup Monitor

- UCC24650



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# What is a Flyback Converter?

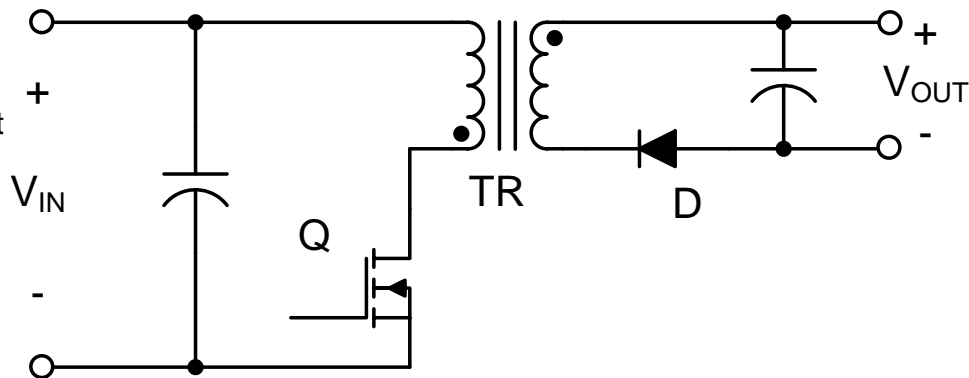
A flyback converter is a simple DC/DC or AC/DC converter that can achieve high efficiency with a high voltage gain ratio

## Benefits

- Coupled inductor (TR), commonly called a transformer, provides isolation and large voltage gain while maintain high efficiency
- Low part count

## Limitations

- High voltage stress on Q, requires clamping circuit
- Typically used in power levels below 150W



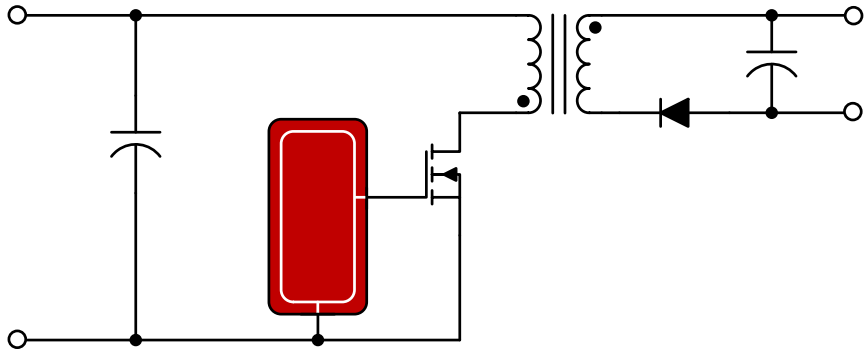
# Difference Between **Controller** and **Converter**

## Controller

Integrated circuit that regulates output

Independent of power stage, more agnostic to operating parameters

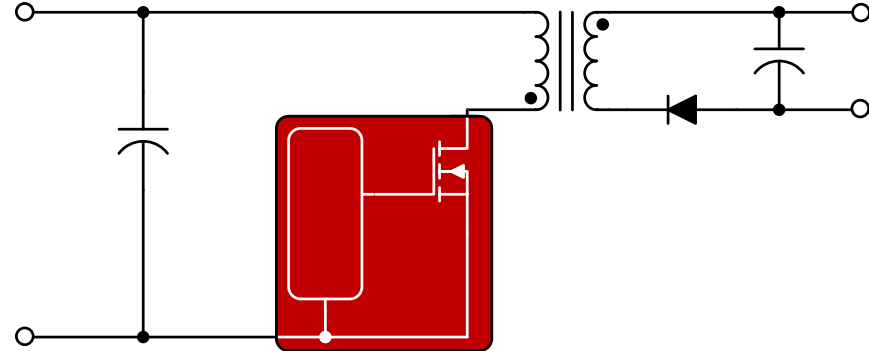
Provides increased **flexibility** for design



## Converter

Integrated circuit that includes power FET

Increased integration allows for greater power **density** and **smaller BOM**

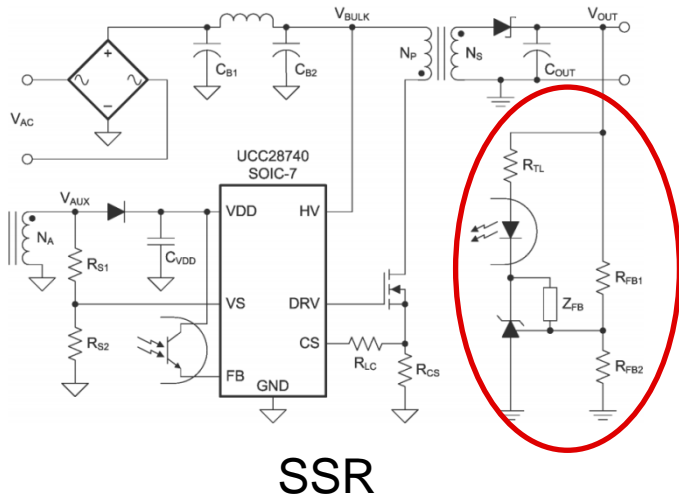


# Secondary Side Regulated vs Primary Side Regulated

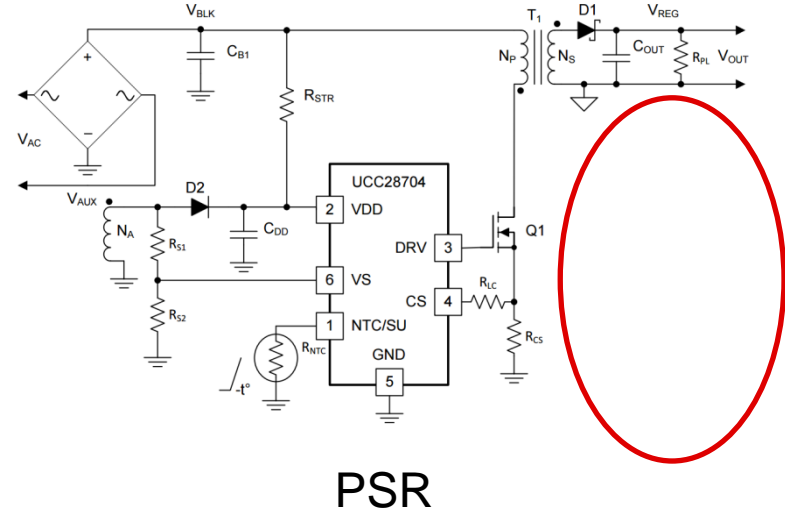
Flyback converter is regulated in one of two ways:

1. Secondary Side Regulated (SSR)
2. Primary Side Regulated (PSR)

**Simplified Application Diagram**



**Simplified Schematic**



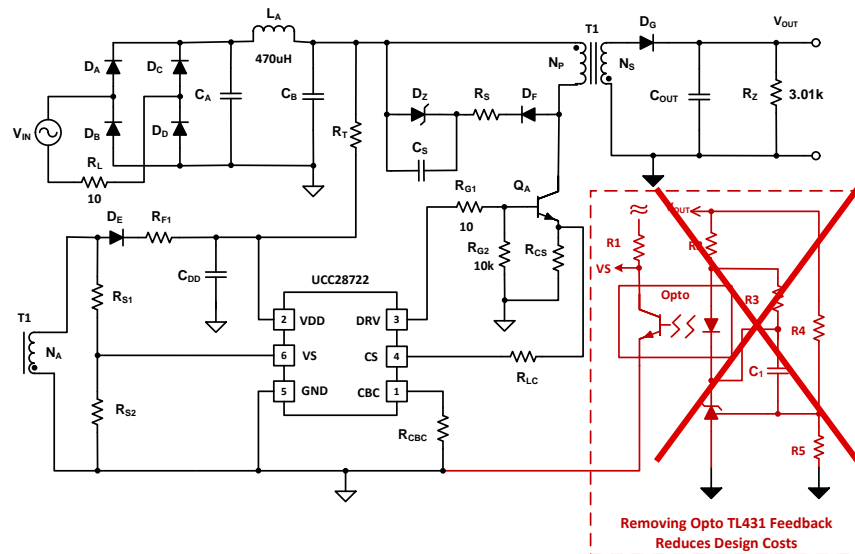
# When to use PSR and SSR

## PSR Benefits

- Eliminates optocoupler, simplifying the feedback network which gives:
  - Less components
  - Smaller system size
  - Lower standby power
  - Better surge test and system reliability

## SSR Benefits

- Tighter voltage regulation
- Faster transient response
- Improved cross regulation of multiple outputs
- Relaxed transformer design requirements



# Additional Features

## Controller/Converter Features

- Operation Modes
  - Discontinuous Conduction Mode (DCM) – Typical for lower power levels, current fully discharged in transformer every switching cycle
  - Quasi-Resonant (QR) or Transition Mode – Typical for higher power levels, special DCM case where switch turns on at first valley to reduce switching losses
  - Continuous Conduction Mode (CCM) – Typical for higher power levels where current is always conducting through the transformer
- Power Device – controlled switch that regulates the output
  - MOSFET – Metal Oxide Semiconductor Field Effect Transistor, most common power switch for flyback converters
  - BJT – Bipolar Junction Transistor, older technology and lower cost switch

## Optional Features – not included in all controllers/converters

- CV/CC Control “Current Limiting” - Controller behaves as a constant current source at maximum output current
- HV Start-up - Internal HV transistor in controller used for startup, reduces no load standby power consumption
- NTC (Thermistor Interface) – Allows NTC resistor to provide external over temperature shutdown protection
- CBC (Cable Compensation) – Adjusts output voltage to compensate for voltage drop across long output cables, maintaining fixed voltage at cable output



# Flyback Controller Selection Table

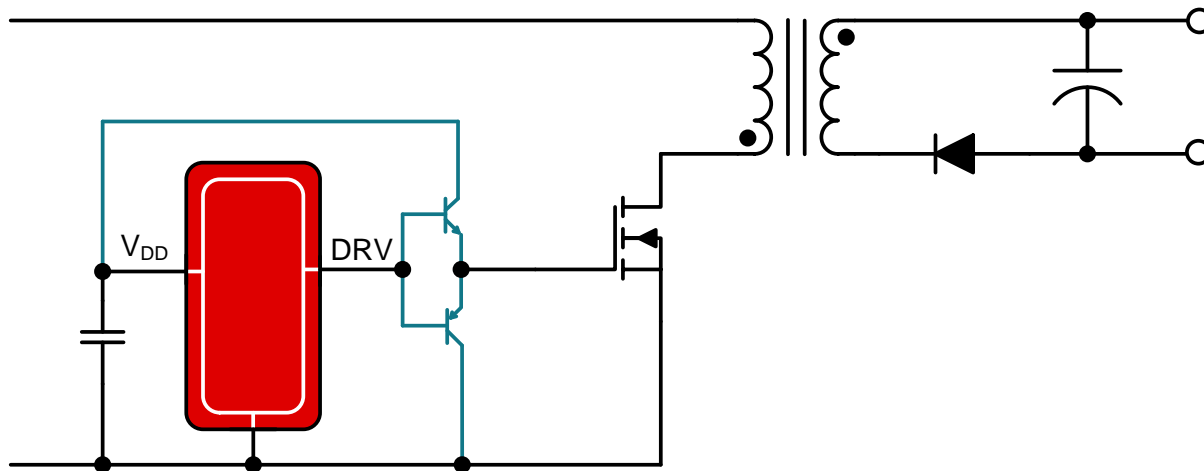
Part	Variants	Typical Max Power* (W)	Regulation PSR/SSR	Operation Mode	CV/CC Control	Power Device	Gate Drive Strength		Switching Frequency		UVLO (on/off V)	Internal HV Startup	No Load Power (mW)	NTC** (Thermistor Interface)	CBC** (Cable Compensation)		Package	Auto Grade	Recommended SR
							Source (A)	Sink (A)	Max (kHz)	Min (kHz)					Fixed	Adj			
UCC28720	-	15	PSR	DCM	□	BJT	0.037	1	80	0.68	21/7.7	□	<10		□	SOIC-7		UCC24636	
UCC28722	-	15	PSR	DCM	□	BJT	0.037	1	80	0.65	21/7.7		<50		□	SOT23-6		UCC24636	
UCC2870x	0-3	30	PSR	DCM	□	MOSFET	0.025	0.4	132	1	21/8.1		<30	1,2,3	2,3	0	SOT23-6	0	UCC24636
UCC28704	-	30	PSR	DCM	□***	MOSFET	0.032	0.4	85	1	21/7.7	External	<30	□	□		SOT23-6		UCC24636
UCC2871x	0-6	30	PSR	DCM	□	MOSFET	0.025	0.4	100	0.68	21/8	□	<10	1,2,3	2,3	0	SOIC-7		UCC24636
UCC28730	-	30	PSR	DCM	□	MOSFET	0.029	0.4	83	0.031	21/7	□	<5		□		SOIC-7	□	UCC24636
UCC28740	-	30	SSR	DCM	□	MOSFET	0.025	0.4	100	0.17	21/7.75	□	<10				SOIC-7		UCC24636
UCC28610	-	65	SSR	QR/DCM		Cascode MOSFET/BJT	-	-	130	29.4	10.2/8		-				SOIC-8 PDIP-8		UCC24636
LM5023	-	100	SSR	QR/DCM		MOSFET	0.3	0.7	130		12.8/7.5	External	-				VSSOP-8		UCC24630
UCC2863x	0-3	150	PSR	CCM/DCM	1,2,3	MOSFET	1	2	120	0.2	14.5/8	□	<30	□			SOIC-7		UCC24610
UCC28600	-	150	SSR	QR/DCM		MOSFET	0.75	1	130	40	10.3/9.3		-				SOIC-8		UCC24630

\* Not limited by part, actual maximum power may vary depending on operating parameters and external components

\*\* Number denotes that only specific variant has feature

\*\*\* Includes enhanced CCUV shutdown protection

# Increase Gate Drive Strength



The gate drive strength is not limited to what's internal to the controller

External gate drive circuit, such as push-pull BJT, can increase drive strength