



# Switching Power Supply Control ICs Products

April, 2003  
Multi Purpose Semiconductor Device Div.  
Analog & Discrete Semiconductor BU  
Renesas Technology Corp.

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## Classified of Switching Regulator

### Isolated

Used  
transformer

AC/DC converter

48 V input (brick, d2d)

UPS

redundant

### Non isolated

DC/DC converter for battery

Single phase

Multi phase

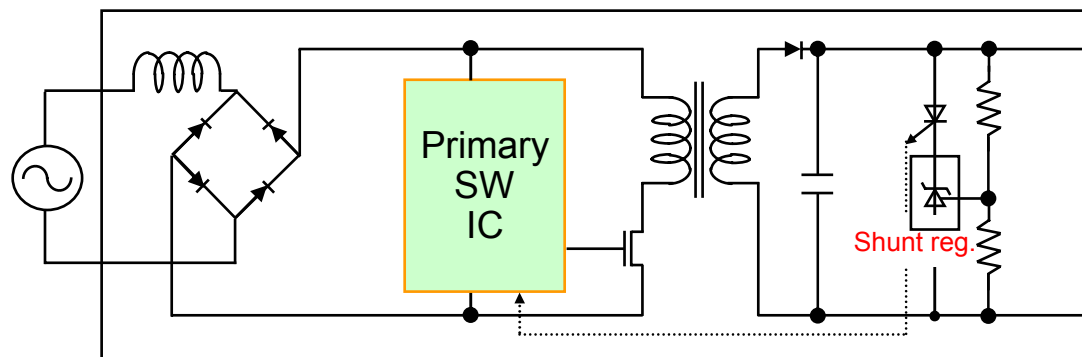
### Other

Shunt regulator

# AC/DC Power Supply ICs

# AC/DC Power Supply ICs

| Type    | SW mode |   | f       | Package | Main SW   | Note        |
|---------|---------|---|---------|---------|-----------|-------------|
| V       | C       |   |         |         |           |             |
| HA17384 | —       | ✓ | 500 kHz | DIP-8   | Power MOS | C-Mode      |
| HA17385 | —       | ✓ | 500 kHz | SOP-8   | Power MOS | UC3842      |
| HA16107 | ✓       | — | 600 kHz | DIP-16  | Power MOS | Timer latch |
| HA16108 | ✓       | — | 600 kHz | SOP-16  | Power MOS | Timer latch |



Notes)

#V: Voltage mode

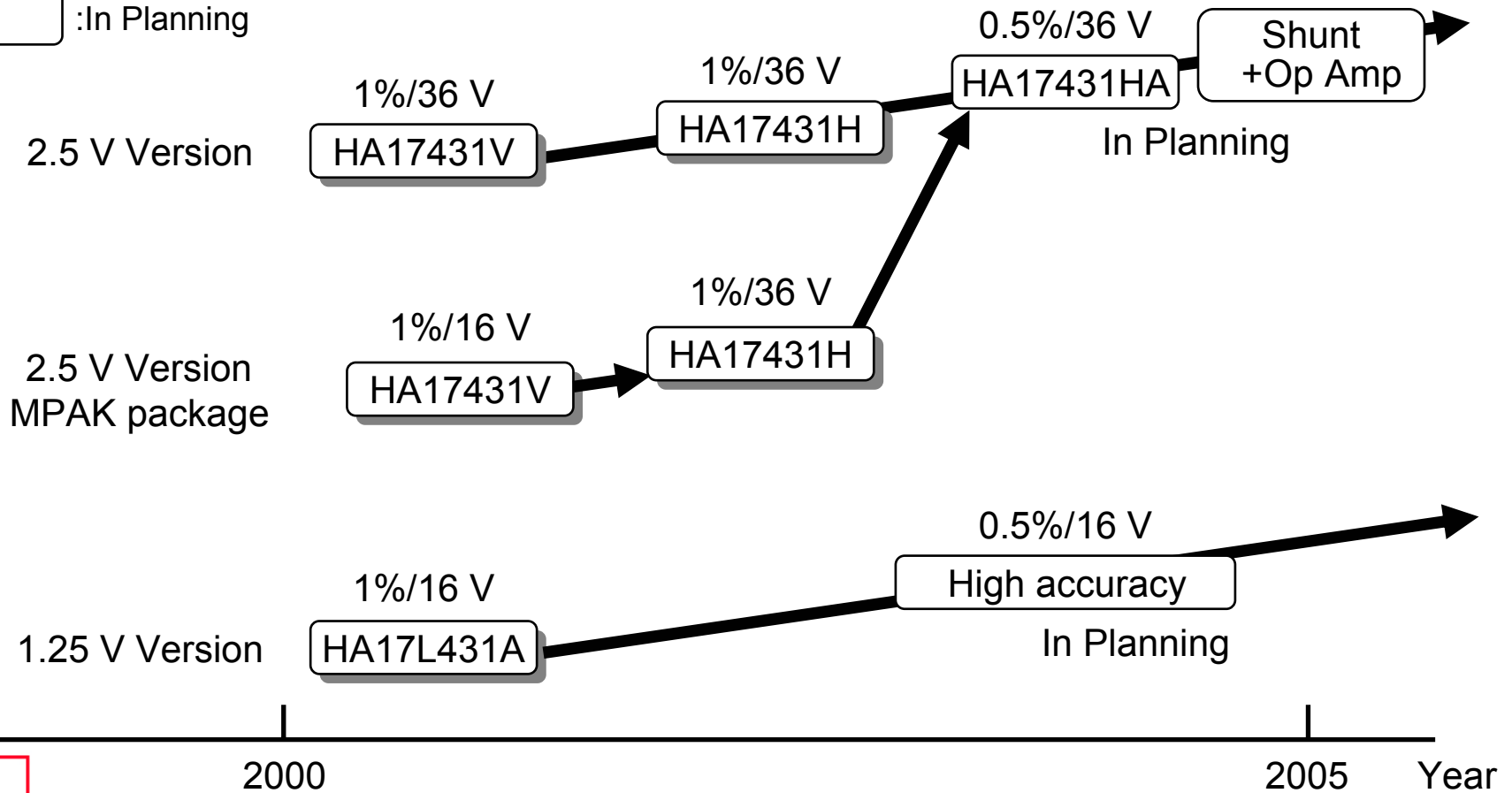
#C: Current mode

# Shunt Regulator

# Shunt Regulator IC Road Map

 : Mass Production

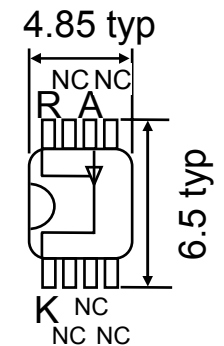
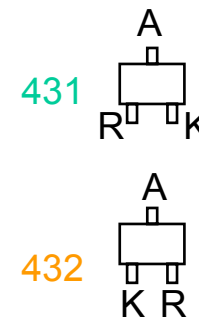
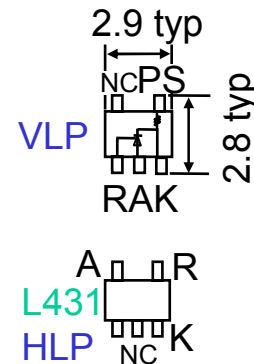
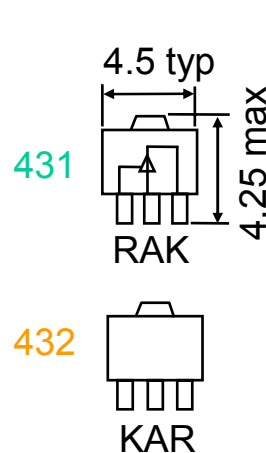
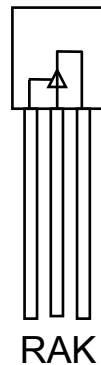
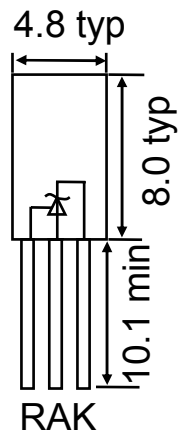
 : In Planning



# Shunt Regulator ICs

HA17LXXX: 1.24 V HA17XXX: 2.50 V

| TO-92MOD  | TO-92                                                           | UPAK                                                                           | MPAK-5                                  | MPAK                                                                                     | SOP-8      |
|-----------|-----------------------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------|------------------------------------------------------------------------------------------|------------|
| HA17431PA | HA17L431AP<br>HA17431VP<br>HA17431PNA<br>HA17431AP<br>HA17431HP | HA17L431UP<br>HA17L432UP<br>HA17431UA<br>HA17431HUP<br>HA17432UA<br>HA17432HUP | HA17L431ALP<br>HA17431VLP<br>HA17431HLP | HA17L431ALTP<br>HA17L432ALTP<br>HA17431HLTP<br>HA17431VLTP<br>HA17432HLTP<br>HA17432VLTP | HA17431FPA |



SMD

Note: Top of View

Many kind of packages.

## Shunt Regulator ICs

| V <sub>x</sub> max<br>(V) | V <sub>ref</sub> and Accuracy | I <sub>k</sub> max<br>(V) | Parts name           | Package  |
|---------------------------|-------------------------------|---------------------------|----------------------|----------|
| 16                        | 1.24 V $\pm$ 1.0%             | -30 to 50                 | HA17L431AP           | TO-92    |
|                           |                               |                           | HA17L431ALP          | MPAK-5   |
|                           |                               |                           | HA17L431ALTP/432ALTP | MPAK     |
|                           | 1.24 V $\pm$ 1.5%             | -30 to 50                 | HA17L431UP/432UP     | UPAK     |
|                           | 2.5 V $\pm$ 1.0%              | -50 to 50                 | HA17431VP            | TO-92    |
|                           |                               |                           | HA17431VLP           | MPAK-5   |
|                           |                               |                           | HA17431VUP/432VUP    | UPAK     |
|                           |                               |                           | HA17431VLTP/432VLTP  | MPAK     |
| 36                        | 2.5 V $\pm$ 1.0%              | -50 to 50                 | HA17431HP            | TO-92    |
|                           |                               |                           | HA17431HLP           | MPAK-5   |
|                           |                               |                           | HA17431HUP/432HUP    | UPAK     |
|                           |                               |                           | HA17431HLTP/432HLTP  | MPAK     |
| 40                        | 2.5 V $\pm$ 2.2%              | -100 to 150               | HA17431PA            | TO-92MOD |
|                           |                               |                           | HA17431PNA           | TO-92    |
|                           |                               |                           | HA17431UA/UPA        | UPAK     |
|                           |                               |                           | HA17432UA/UPA        | UPAK     |
|                           |                               |                           | HA17431FPA           | SOP-8    |

# Shunt Regulator IC Cross Reference (1)

| Package | Standard Type<br>Maker/Vref/Accuracy |                             |                         |                                                |                                                  |                             |                                                |
|---------|--------------------------------------|-----------------------------|-------------------------|------------------------------------------------|--------------------------------------------------|-----------------------------|------------------------------------------------|
|         | Renesas<br>2.500 V<br>±1%            | Toshiba<br>2.495 V<br>±2.2% | NEC<br>2.495 V<br>±2.2% | TI<br>2.495 V<br>±2.2%, ±1%                    | NS<br>2.495 V<br>±2.2%, 1%                       | ST<br>2.495 V<br>±2.2%, ±1% | ON<br>2.495 V<br>±2.2%, ±1%                    |
| TO-92   | HA17431HP                            | TA76431S*1                  | μPC1093J                | TL431CLP<br>TL431ACLP<br>TL431ILP<br>TL431AILP | LM431ACZ<br>LM431BCZ<br>LM431AIZ<br>LM431BIZ     | TL431CZ<br>TL431ACZ         | TL431CLP<br>TL431ILP<br>TL431ACLP<br>TL431AILP |
| UPAK    | HA17431HUP                           | TA76431FR                   |                         | TL431CPK<br>TL431IPK                           |                                                  |                             |                                                |
|         | HA17432HUP                           | TA76431F                    | μPC1093T                |                                                |                                                  |                             |                                                |
| MPAK    | HA17431HLTP                          |                             |                         |                                                |                                                  |                             |                                                |
|         | HA17432HLTP                          |                             |                         |                                                | LM431ACM3<br>LM431BCM3<br>LM431AIM3<br>LM431BIM3 | TS2431ILT*2<br>TS2431AILT*3 |                                                |
| MPAK-5  | HA17431HLP                           |                             | μPC1093TA               | TL431CDBV*4<br>TL431IDBV*4                     |                                                  |                             |                                                |

This cross reference is especially about the Voltage Reference and package.

\*1: TO-92MOD

\*2: TS2431ILT: 2.500 V±2%

\*3: TS2431AILT: 2.500 V±1%

\*4: Pin arrangement is different.

# Shunt Regulator IC Cross Reference (2)

Low Voltage Type.  
Maker/Vref/Accuracy

| Package | Renesas<br>1.24 V<br>±1% | Toshiba<br>1.26 V<br>±1.4% | NEC<br>1.26 V<br>±2.4% | TI<br>1.24 V<br>±1.5%, ±1%                                                                                     | NS<br>1.24 V<br>±1.5%, 1%                                                                                  | ST<br>1.24 V<br>±2%, ±1%                          | ON<br>1.24 V<br>±1%     |
|---------|--------------------------|----------------------------|------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-------------------------|
| TO-92   | HA17L431AP               | TA76432S <sup>*1</sup>     | μPC1944J               | TLV431CLP<br>TLV431ACLP<br>TLV431ILP<br>TLV431AILP                                                             | LMV431CZ<br>LMV431ACZ<br>LMV431AIZ<br>LMV431AIZ                                                            | TS431CZ<br>TS431ACZ                               | TLV431ALP               |
| UPAK    | HA17L431UP <sup>*2</sup> | TA76432FR                  | μPC1943T               |                                                                                                                |                                                                                                            |                                                   |                         |
|         | HA17L432UP <sup>*2</sup> | TA76432F                   | μPC1944T               |                                                                                                                |                                                                                                            |                                                   |                         |
| MPAK    | HA17L431ALTP             |                            |                        |                                                                                                                |                                                                                                            |                                                   |                         |
|         | HA17L432ALTP             |                            |                        |                                                                                                                |                                                                                                            |                                                   |                         |
| MPAK-5  | HA17L431ALP              | TA76432FC <sup>*3</sup>    |                        | TLV431CDBV <sup>*3</sup><br>TLV431IDBV <sup>*3</sup><br>TLV431ACDBV <sup>*3</sup><br>TLV431AIDBV <sup>*3</sup> | LMV431CM5 <sup>*3</sup><br>LMV431ACM5 <sup>*3</sup><br>LMV431IM5 <sup>*3</sup><br>LMV431AIM5 <sup>*3</sup> | TS431ILT <sup>*3</sup><br>TS431AILT <sup>*3</sup> | TLV431ASN <sup>*3</sup> |

This cross reference is especially about the Voltage Reference and package.

\*1: TO-92MOD

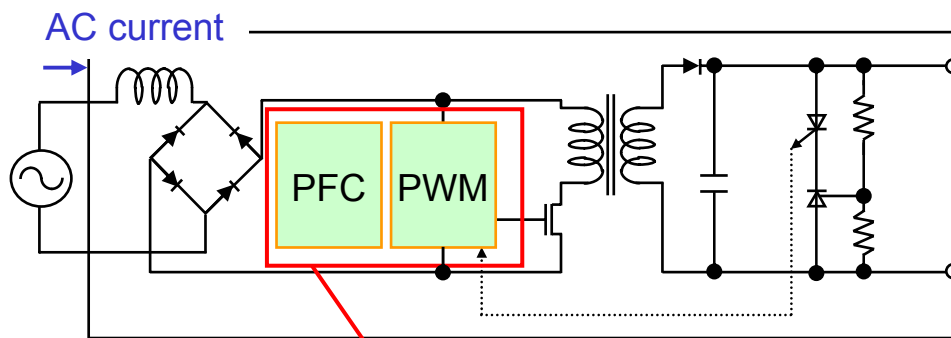
\*2: HA17L431UP, HA17L432UP: 1.24 V±1.5%

\*3: Pin arrangement is different.

## PFC + PWM ICs

# Power Factor (PFC) + SW Reg. (PWM) ICs

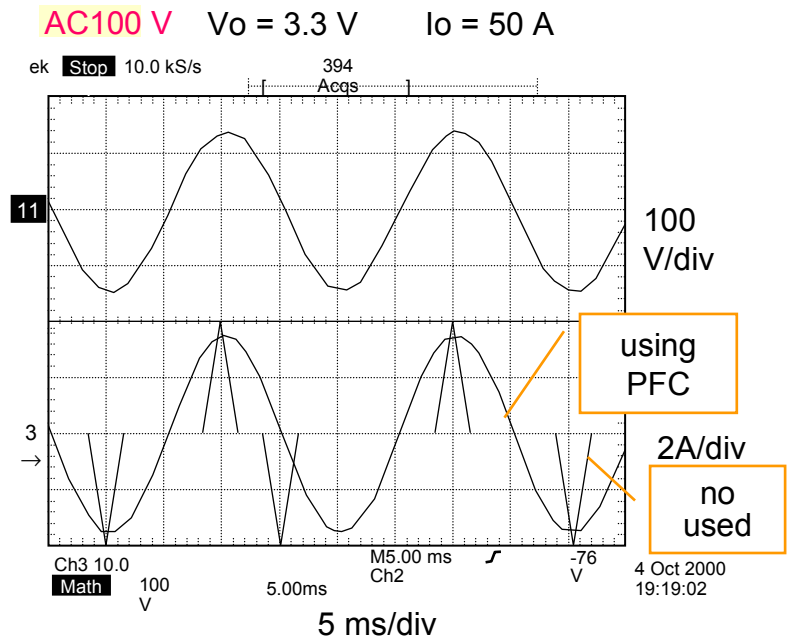
| Type    | SW mode |   | f            | Package | Main SW   | Note                  |
|---------|---------|---|--------------|---------|-----------|-----------------------|
|         | V       | C |              |         |           |                       |
| HA16141 | —       | ✓ | PFC: 100 kHz | DIP-16  | Power MOS | Primary IC of HA16341 |
| HA16142 |         |   | PWM: 200 kHz | SOP-16  |           |                       |
| HA16158 | —       | ✓ | PFC: 65 kHz  | DIP-16  | Power MOS | f adj., f-down        |
|         |         |   | PWM: 130 kHz | SOP-16  |           |                       |



1-chip solution

note) Input ac current becomes fine Sin-curve by PFC.

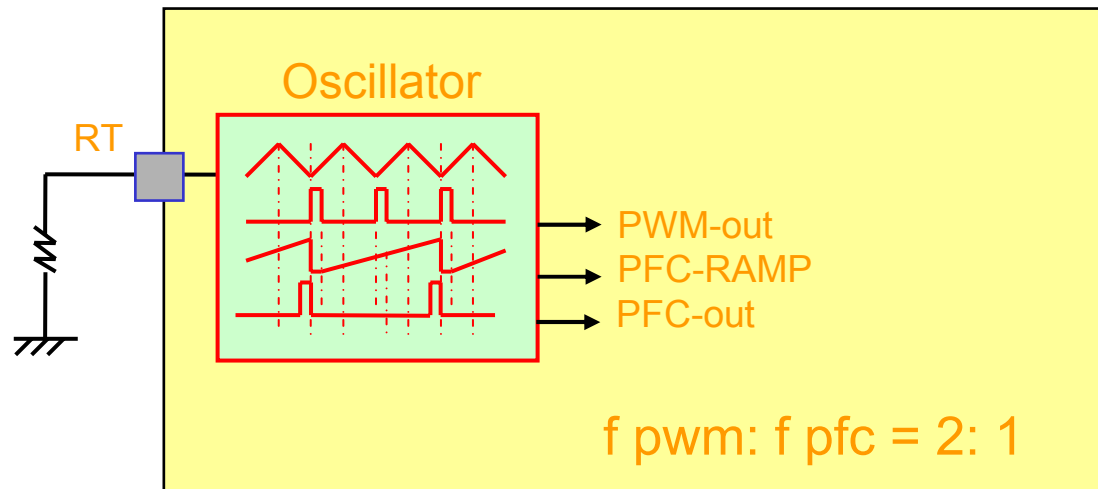
Note) HA16158 WS: 2Q/2002



## PFC+PWM IC, HA16158 (1)

- Features
  - Can adjust frequency
  - f-down at light load
  - Soft start function
  - OVP for PWM

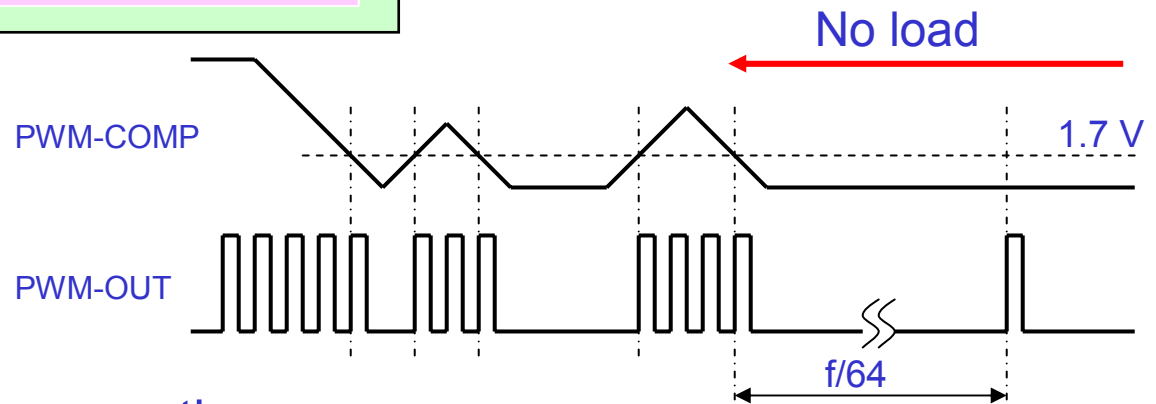
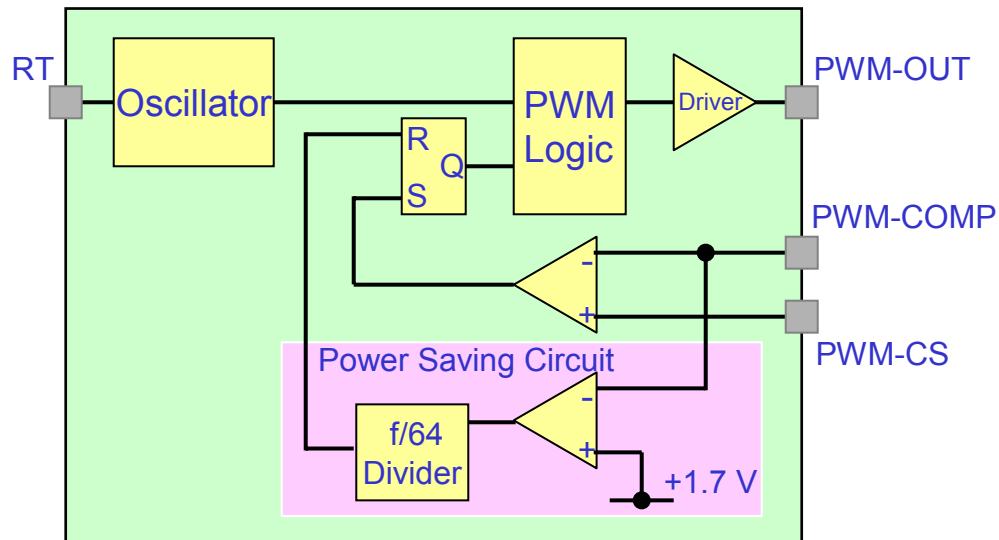
## PFC+PWM IC, HA16158 (2)



- High noise immunity by synchronized between PFC and PWM
- Smaller capacitor on PFC out by PWM turn on when PFC turn off.

## PFC+PWM IC, HA16158 (3)

### Power saving at light load

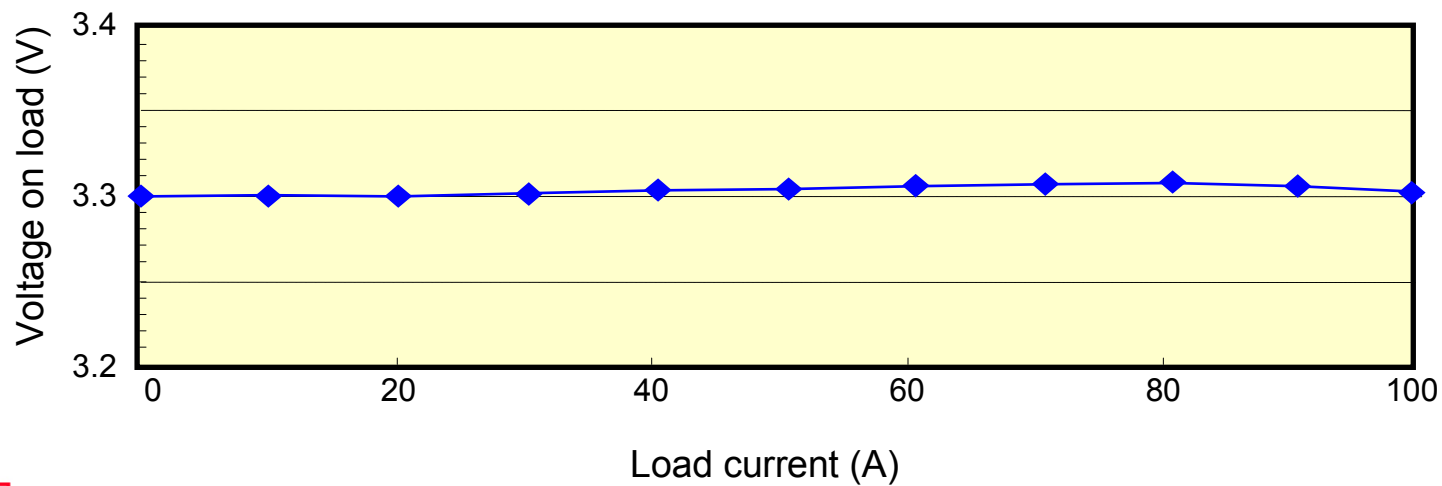
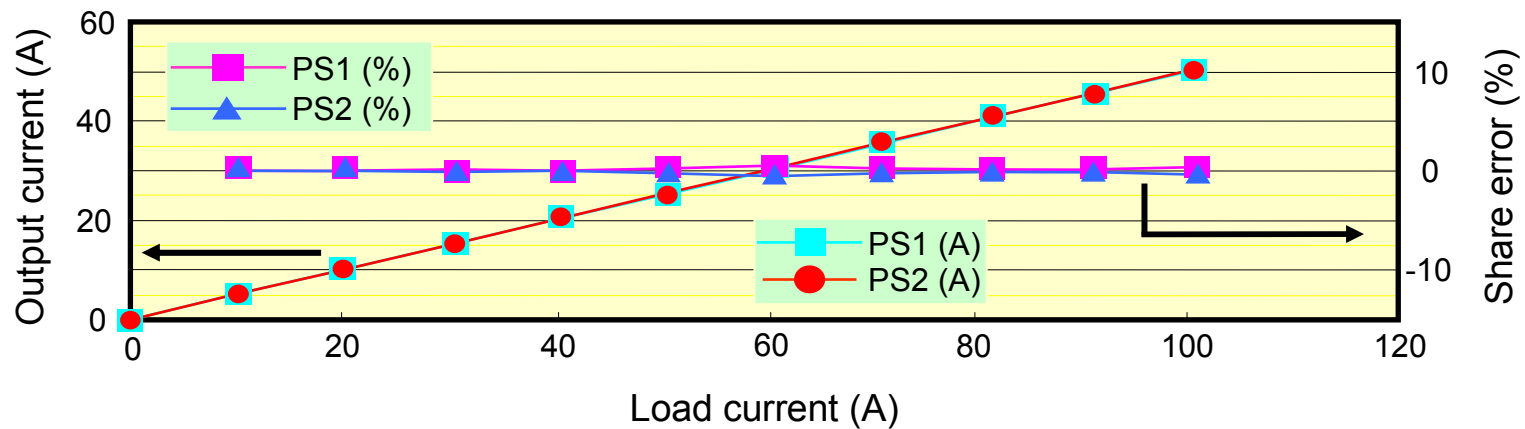


Low Power Consumption.

# Redundant Power Supply ICs.



# Current Share and Load Regulation

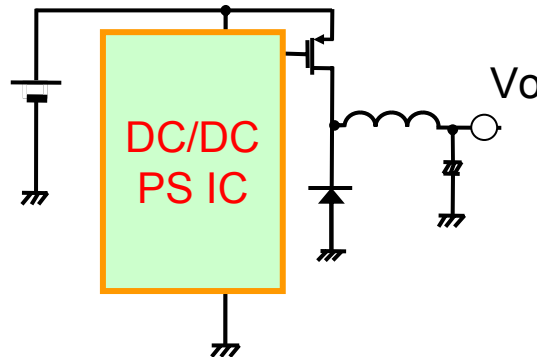


## DC/DC ICs

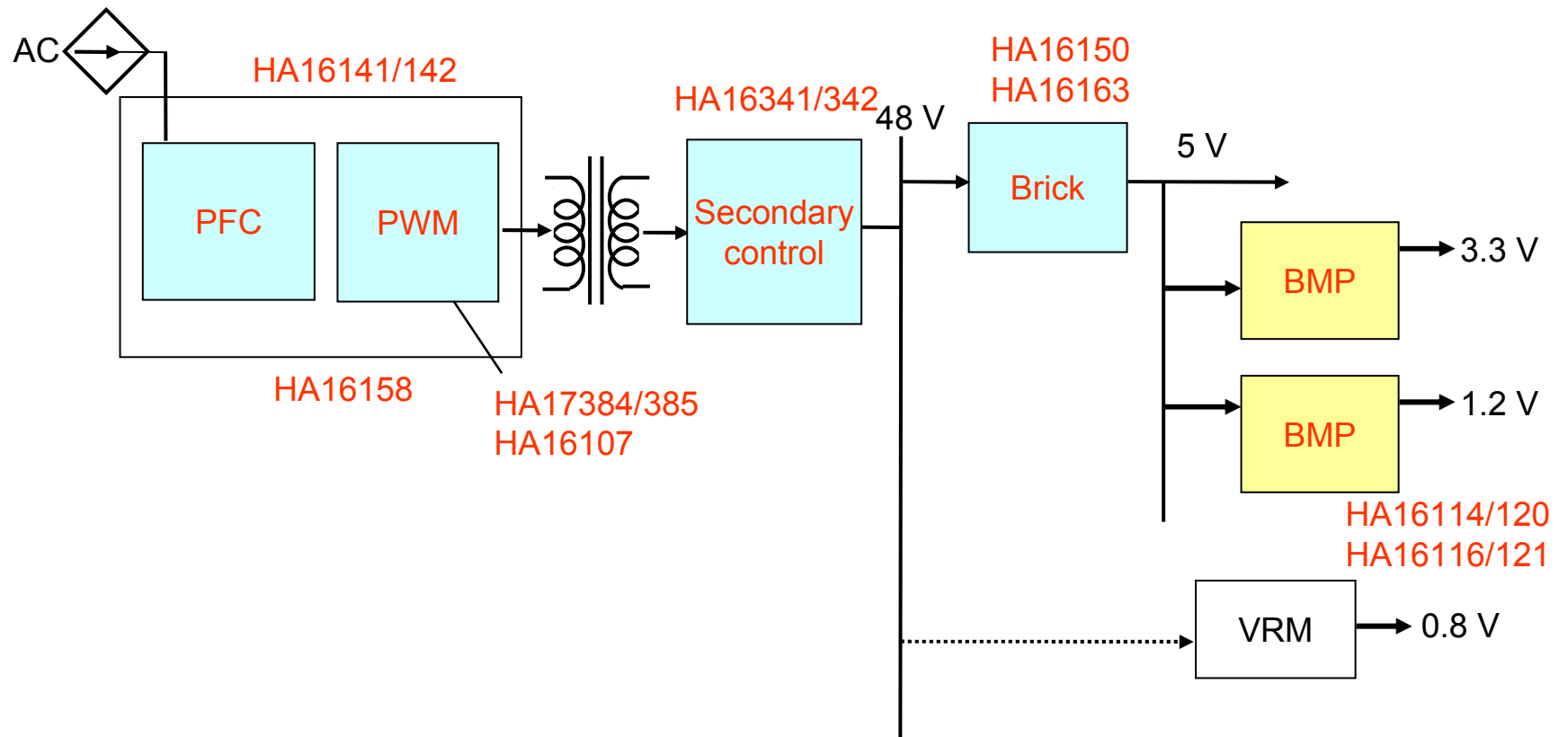
## DC/DC Switching Regulator ICs

| Type     | SW mode |   | f       | Package          | Main SW   | Note                   |
|----------|---------|---|---------|------------------|-----------|------------------------|
|          | V       | C |         |                  |           |                        |
| HA16114  | ✓       | — | 600 kHz | DIP-16<br>SOP-16 | Bip. Trs  | Step down              |
| HA16120  | ✓       | — | 600 kHz | DIP-16<br>SOP-16 | Bip. Trs  | Boost                  |
| HA17451A | ✓       | — | 500 kHz | DIP-16<br>SOP-16 | Bip power | TL451<br>Step down     |
| HA16116  | ✓       | — | 600 kHz | DIP-16<br>SOP-16 | Power MOS | Step down              |
| HA16121  | ✓       | — | 600 kHz | DIP-16<br>SOP-16 | Power MOS | Step down<br>and boost |

< Single ch >  
< Dual ch >



# Distributed Power Supply System



Note )

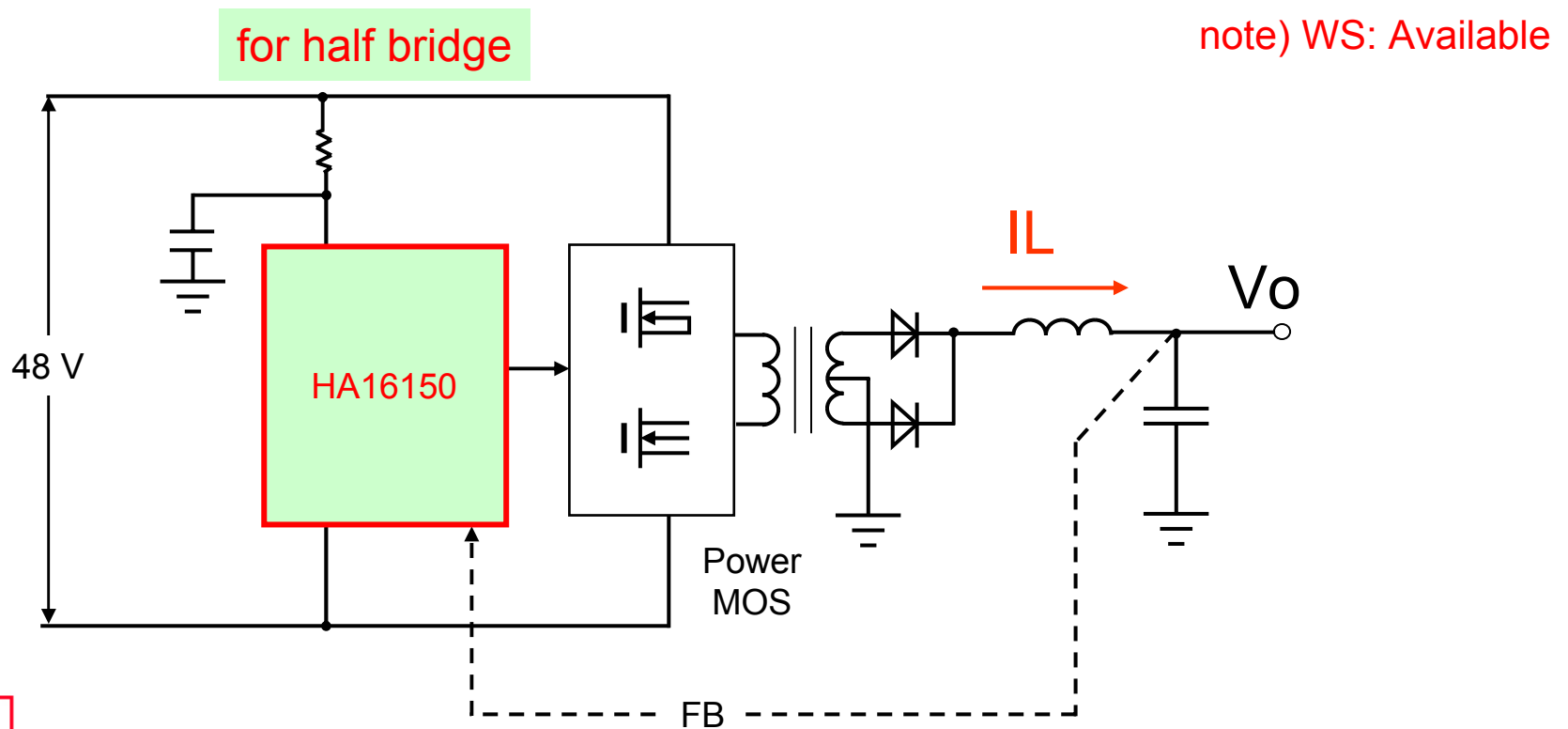
# BMP: Board mounted Power Supply (DC/DC power supply)

# VRM: Voltage Regulated Module

# Half Bridge Power Supply IC

# 48 V Input DC/DC Power Supply IC

| Type    | SW mode |   | f     | Package            | Main SW   | Note       |
|---------|---------|---|-------|--------------------|-----------|------------|
|         | V       | C |       |                    |           |            |
| HA16150 | —       | ✓ | 1 MHz | DIP-16<br>TSSOP-16 | Power MOS | 48 V DC/DC |



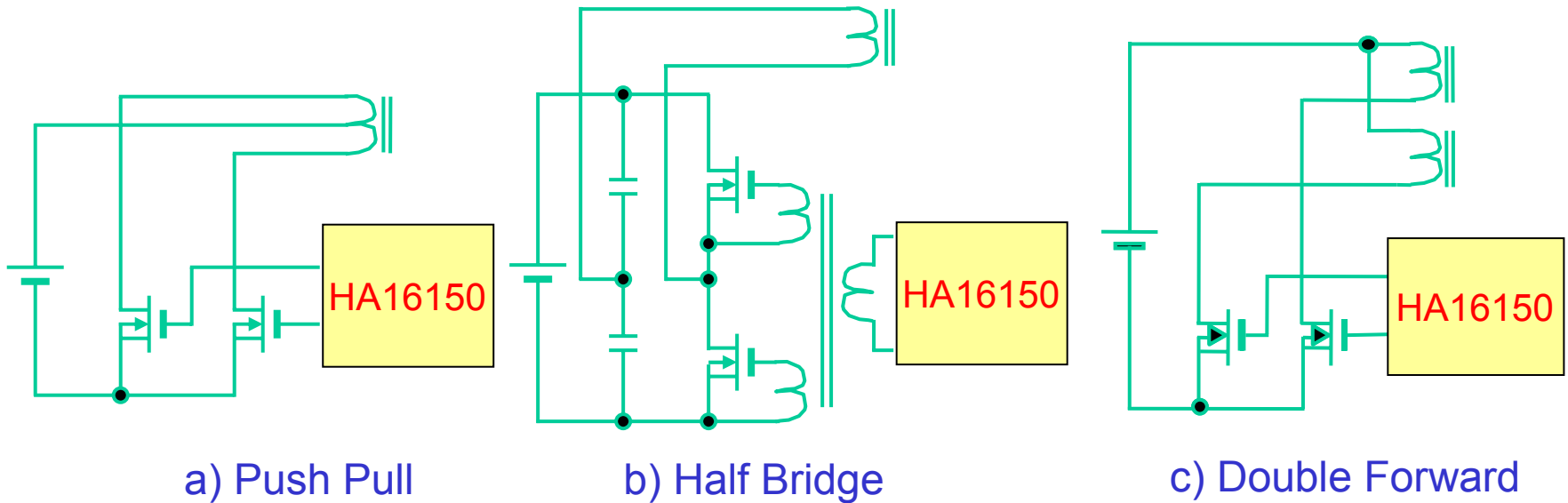
## 48 V Input DC/DC HA16150 (1)

- Features

- PWM Current mode
- FET driver
- 1 MHz max.
- Can adjust dead time
- Small and thin package: TSSOP-16

## 48 V Input DC/DC HA16150 (2)

Dual high current outputs for FET drive



for Wide Applications

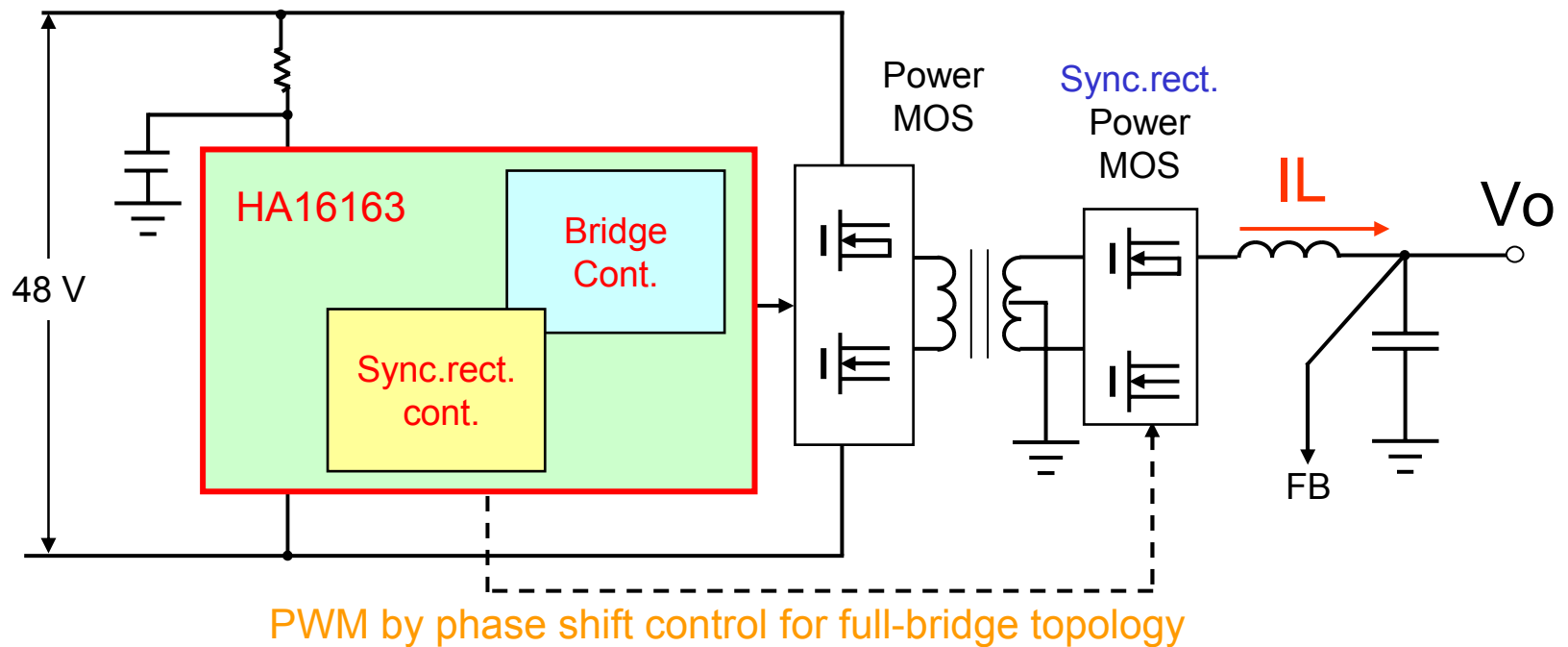
# Full Bridge Power Supply IC

# 48 V Input DC/DC Power Supply IC

| Type    | SW mode |   | f     | Package | Main SW   | Note                       |
|---------|---------|---|-------|---------|-----------|----------------------------|
|         | V       | C |       |         |           |                            |
| HA16163 | —       | ✓ | 2 MHz | TSSOP20 | Power MOS | Bridge cont.<br>Sync.rect. |

Note) WS: Available

for full bridge



## 48 V Input DC/DC HA16163 (1)

Preliminary

- Features

- 2 MHz max.



Miniaturized

- Phase-shift switching

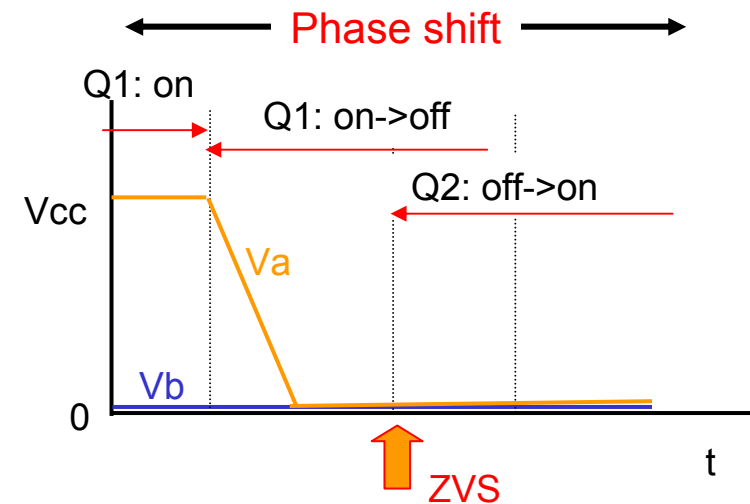
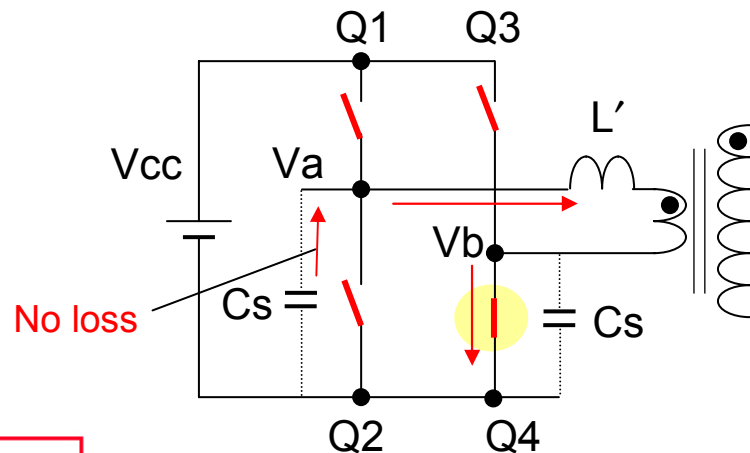
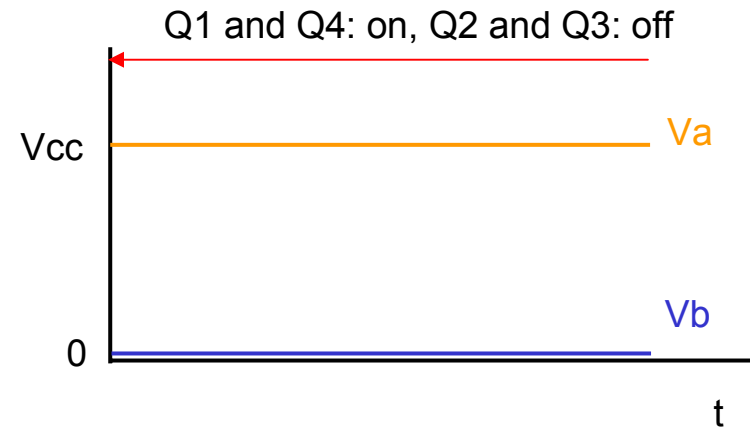
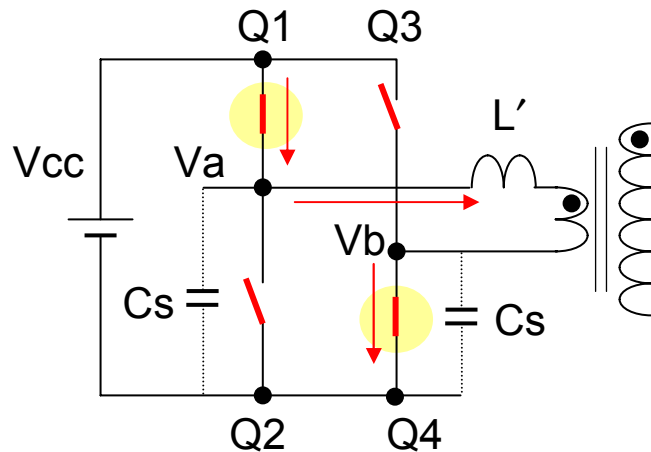
- Synchronous rectification  
with adjustable delay



High  
Efficiency

## 48 V Input DC/DC HA16163 (2)

Phase shift switching → ZVS → low loss



## Switching Power Supply Control ICs Products

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