

**System Power Supply for TV Series**

# Built-in 1ch FET Synchronous Rectification Type DC/DC converters

**BD8627EFV**

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**●Description**

BD8627EFV has realized the high performance and reliability required as a power supply for thin-screen TV.

With built-in FET 1ch current mode control, the DC/DC Converter series has the advantage of high-speed load response and wide phase margin.

Due to the high-speed load response, it is most suitable for TV-purpose processors with increasingly high performance, and due to the wide phase margin it leaves a good margin for board pattern & constant setting and so facilitates its application design.

As a high-reliability design, it has various built-in protection circuits (overcurrent protection, output voltage abnormal protection, thermal protection, and off-latch function at the time of abnormality etc.), therefore as an advantage it does not easily damage in every possible abnormal condition such as all-pin short circuit test etc. and hence most suitable for thin-screen TV which requires the high reliability.

**●Features**

- 1) High efficiency in all load area
- 2) 3.0A output current
- 3) Low RDS(ON) internal switches (PchMOS:85mΩ, NchMOS:65mΩ)
- 4) ±1% reference voltage accuracy
- 5) Programmable frequency : 250kHz-1MHz
- 6) Terminal RT OPEN/SHORT detecting function
- 7) Over current protection function
- 8) Output over voltage/low voltage protection function (over : FB > VREF +60mV , low : FB < VREF -60mV)
- 9) Timer off latch function in abnormal circumstances
- 10) Thermal shutdown function
- 11) Under voltage protection
- 12) Soft start/start delay circuit
- 13) Soft start time out function
- 14) HTSSOP-B20 package

Aug. 2008

●ABSOLUTE MAXIMUM RATING (Ta=25°C)

Parameter	Symbol	Limits	Unit
Input supply voltage	$V_{IN}$	7	V
Input terminal voltage	$V_{INP}^{*1}$	$V_{IN}$	V
Output terminal voltage	$V_{OUT}^{*2}$	$V_{IN}$	V
Output current	$I_{OUT}$	4	A
Power dissipation	$P_d$	3.2 <sup>*3</sup>	W
Operating temperature	$T_{opr}$	-10 ~ 85	°C
Storage temperature	$T_{stg}$	-55 ~ 150	°C

\* 1  $V_{INP}$  Application terminal : EN, SS/DELAY, TEST, FB

\* 2  $V_{OUT}$  Application terminal : SW, PDET, FC, RT, REG

\* 3 (70mm×70mm, thickness 1.6mm, and four layer glass epoxy substrates)

When mounting substrate and the package back exposure part are connected with solder.

Operating at higher than Ta=25°C, 25.6mW shall be reduced per 1

Operation condition

Parameter	Symbol	MIN	TYP	MAX	Unit
Input supply voltage	$V_{IN}$	4.5	-	6.0	V
Output current	$I_{OUT}$	-	-	3.0	A

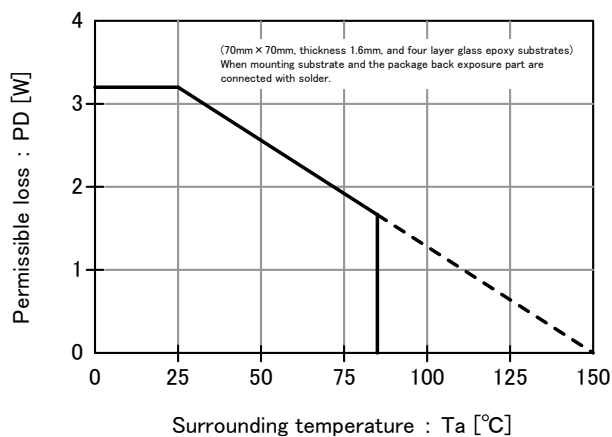
● Electrical characteristic

(Unless otherwise noted  $T_a=25^{\circ}\text{C}$ ,  $V_{IN}=5.6\text{V}$ )

Parameter	Symbol	Specification value			UNIT	Condition
		MIN	TYP	MAX		
VIN supply current (operating)	$I_{Q\_active}$	-	1.3	2.0	mA	$V_{FB} = 0.83\text{V}$ , $V_{FC} = 1\text{V}$
VIN supply current (standby)	$I_{Q\_stby}$	-	350	700	$\mu\text{A}$	$V_{EN} = 0\text{V}$
Reference voltage (VREF)	$V_{REF}$	0.792	0.8	0.808	V	
Output rise detection voltage	$V_{OVP}$	30	60	90	mV	Monitoring FB terminal
Output decrease detection voltage	$V_{LVP}$	-90	-60	-30	mV	Monitoring FB terminal
Terminal PDET output current	$I_{PDET}$	1	-	-	mA	$V_{PDET} < 0.5\text{V}$
Oscillation frequency	$f_{OSC}$	500	550	600	kHz	$R_{OSC} = 220\text{k}\Omega$
Pch FET ON resistance	$R_{PFET}$	-	85	120	$\text{m}\Omega$	$I_{SW} = 1\text{A}$
Nch FET ON resistance	$R_{NFET}$	-	65	100	$\text{m}\Omega$	$I_{SW} = -1\text{A}$
UVLO voltage	$V_{UVLO}$	3.8	4.0	4.2	V	
SW leak current	$I_{LSW}$	-	0	1	$\mu\text{A}$	$V_{EN} = 0\text{V}$ , $V_{IN} = 6\text{V}$
EN terminal H threshold voltage	$V_{ENH}$	2.0	-	-	V	
EN terminal L threshold voltage	$V_{ENL}$	-	-	0.5	V	
SS/DELAY terminal source current	$I_{SSSO}$	2	4	6	$\mu\text{A}$	

$V_{FB}$ :FB terminal voltage,  $V_{EN}$ :EN terminal voltage,  $V_{FC}$ :FC terminal voltage,  $V_{PDET}$ : PDET terminal voltage  
 Current capability should not exceed Pd.

**Permissible loss**



**Fig. 1 heat decrease curve**

● Block Diagram

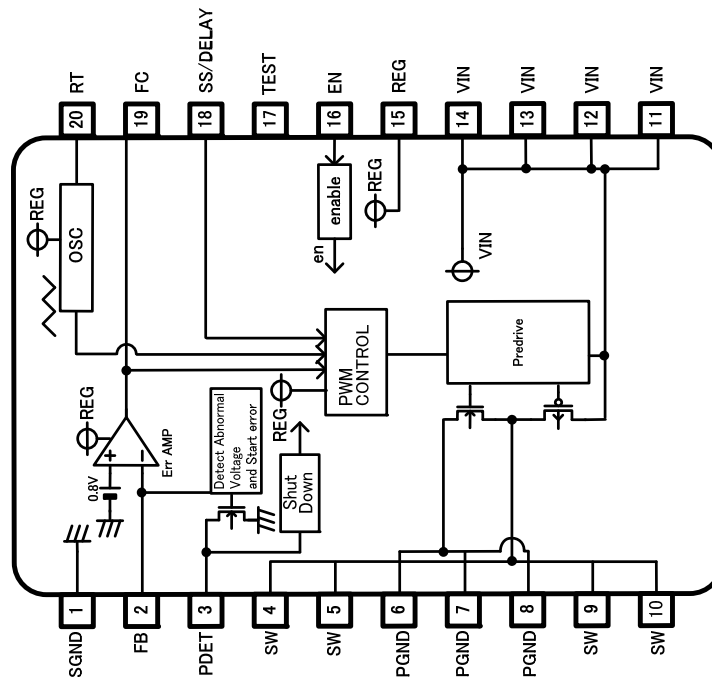


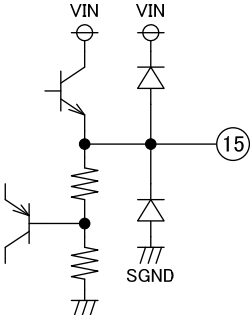
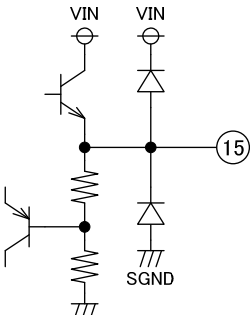
Fig.2 Block diagram

● Pin description

No.	Symbol	Description	Explanation
1	SGND	Signal GND terminal	Small signal system GND
2	FB	Feed back terminal	Output voltage detection
3	PDET	Off latch signal output	Reset output
4	SW	Output terminal	Switching output
5	SW		
6	PGND	Power GND terminal	GND for power MOSFET
7	PGND		
8	PGND		
9	SW	Output terminal	Power Mos output
10	SW		
11	VIN	Power supply input terminal	Power supply input. The decoupling is done to PGND
12	VIN		
13	VIN		
14	VIN		
15	REG	Internal regulator	Internal regulator
16	EN	Enable input	ON/OFF control for device operation
17	TEST	TEST terminal	GND short in application set
18	SS/DELAY	Soft start adjustment capacity connection terminal	The soft start time is adjusted with the connected capacitor
19	FC	Error amplifier output	Error amplifier phase compensation point
20	RT	Frequency adjustment resistance connection terminal	The switching frequency is set by the connected resistance

● Pin equivalence circuit diagram

No.	Symbol	Explanation	Terminal equivalent circuit diagram
1	SGND	GND (connected 0V)	
2	FB	Output voltage detection terminal	
3	PDET	Off latch signal output terminal	
4,5,9,10	SW	Output terminal	
6,7,8	PGND	Power GND (Same voltage as SGND)	
11,12,13,14	VIN	Power supply input terminal	

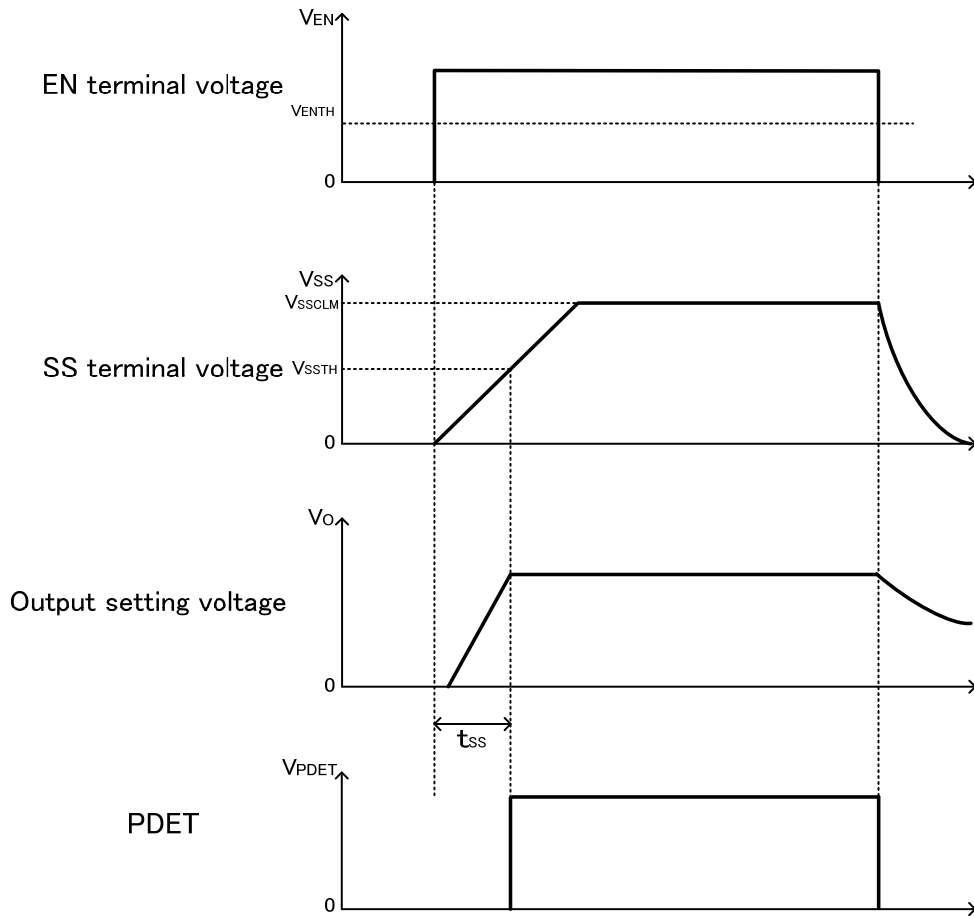
No.	Symbol	Explanation	Terminal equivalent circuit diagram
15	REG	Internal regulator output terminal	 <p>The diagram shows a differential pair of transistors. The top node is connected to VIN through a diode. The bottom node is connected to SGND through a diode. A resistor is connected between the two nodes. The output terminal (15) is connected to the top node.</p>
16	EN	Enable terminal	 <p>The diagram shows a differential pair of transistors. The top node is connected to VIN through a diode. The bottom node is connected to SGND through a diode. A resistor is connected between the two nodes. The output terminal (15) is connected to the top node.</p>

No.	Symbol	Explanation	Terminal equivalent circuit diagram
18	SS	Soft start time adjustment terminal	
19	FC	Error amplifier compensation terminal	
20	RT	Oscillator frequency adjustment terminal	

- Operation description

- **Enable control**

- The device can be controlled ON/OFF by EN terminal (16 pin) voltage.  
An internal circuit starts when  $V_{EN}$  reaches 0.65V.



**Fig. 3 ON/OFF transition wave form in EN controlling**

- **Soft start time set function**

- As for BD8627EFV, output can do soft start without overshoot by charging soft start capacity (CSS) connected between SS and SGND terminal.

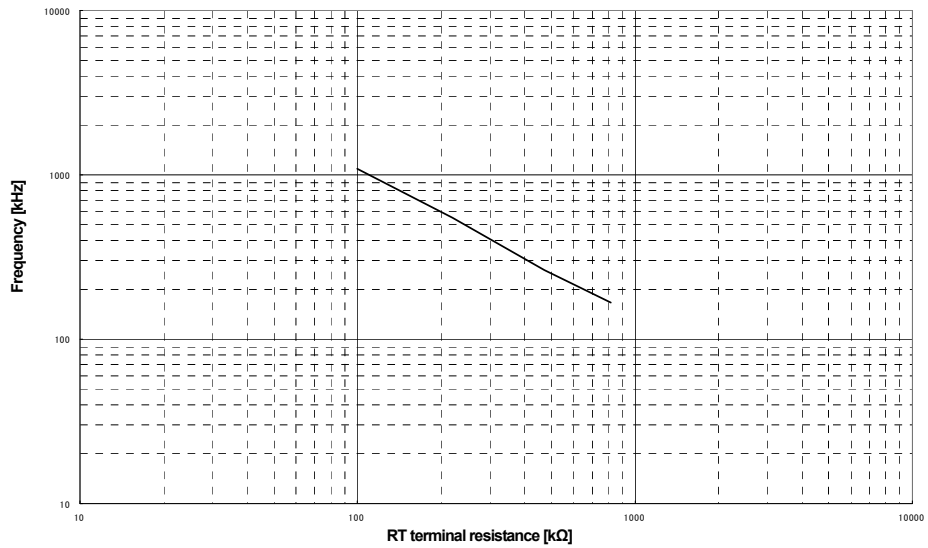
- Also, soft start time ( $t_{SS}$ ) can be set by setting soft start capacity (CSS) arbitrarily.



**OSC oscillation frequency setting function**

The output oscillation frequency can be set by connecting resistance between terminal RT (20 pins) and SGND (range = 250kHz - 1MHz)

The relation between RT terminal resistance and the oscillation frequency follows Fig.4.



**Fig. 4 RT resistance-oscillation frequency**

● **Protection function**

Protection circuit is effective for destruction prevention due to accident so that avoid using under continuous protection operation.

**Low voltage protection function (LVP)**

The voltage of the terminal FB (2 pins) is compared with internal reference voltage VREF.

If FB terminal voltage falls below  $V_{LVP}(= VREF -60mV)$  and the state continues for 500us, output changes to low voltage and the state is fixed. In that case , PDET (3pin) output changes to L.

Table 4-1 output low voltage protection function

EN terminal	SS terminal	FB terminal	Low voltage protection function	Low voltage protection operation
$>V_{IHEN}$	$>1.4V(\text{typ})$	$<V_{LVP}$	Effective	ON
		$>V_{LVP}$		OFF
	$<1.4V(\text{typ})$	-	Invalidity	OFF
$<V_{ILEN}$	-	-	Invalidity	OFF

\* Low voltage protection function is available when SS terminal voltage becomes more than 1.4V (typ) in the transition to ON control (during soft start).

**Over voltage protection function(OVP)**

The voltage of the terminal FB is compared with internal reference voltage VREF.

If FB terminal voltage is over  $V_{ovp}(=VREF +60mV)$  and the state is continues for 500usec, output changes to low voltage and the state is fixed.

Table 4-2 output over voltage protection function

EN terminal	SS terminal	FB terminal	Over voltage protection function	Over voltage protection operation
$>V_{IHEN}$	$>1.4V(\text{typ})$	$>V_{OVP}$	Effective	ON
		$<V_{OVP}$		OFF
	$<1.4V(\text{typ})$	-	Invalidity	OFF
$<V_{ILEN}$	-	-	Invalidity	OFF

\* Over voltage protection function is available when SS terminal voltage becomes more than 1.4V (typ) in the transition to ON control (during soft start).

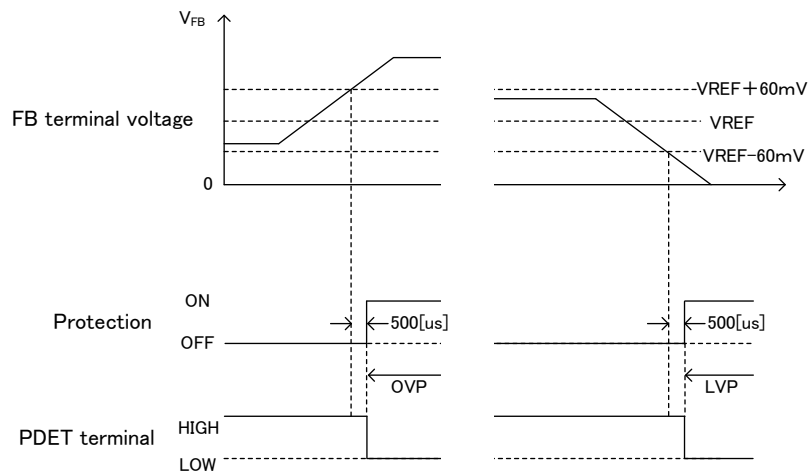


Fig. 5 Output voltage error detection range

### **Under voltage lock out protection (UVLO)**

As for BD8627EFV, the power-supply voltage decrease detection protection circuit is built in.

If the input voltage decrease below the UVLO voltage (4.0V typ), the device state changes to the standby mode (Moreover, to prevent the chattering of the output) hysteresis width of 300mV(typ) has been installed in the UVLO cancel voltage.

### **RT terminal open/short protection function (RTO/RTS)**

RT terminal opening/short protection function prevent the clock from abnormal oscillation.

If RT terminal open/short protection function is detected, output voltage changes to low level and is fixed.

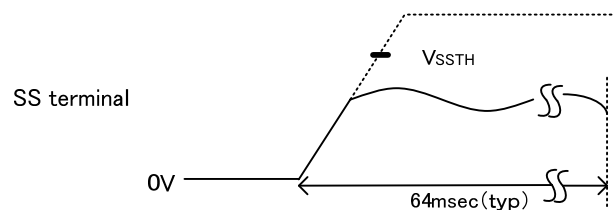
Terminal RT opening/short protection function is always effective after the power supply start-up.

Terminal RT opening/short protection function is available if the state continue for 500usec, abnormal detection operates when the state continues about 500μsec(typ).

### **Soft start time-out function**

If VSS doesn't exceed VSSTH within 64msec (typ) since a soft start began, BD8627EFV controls an off latch.

Vo is fixed in a low level.



**Fig. 6 Soft start time-out**

### **Error detection (off latch) release method**

BD8627EFV enters the state of an off latch when the protection function operates.

To release the off latch state, EN terminal voltage should be changed to low level once time.

### **Thermal shut down function**

Thermal shut down circuit (TSD circuit) is built into BD8627EFV. When the temperature of the chip exceeds  $T_{jmax}=175$ , the DC/DC converter is fixed in a low voltage.

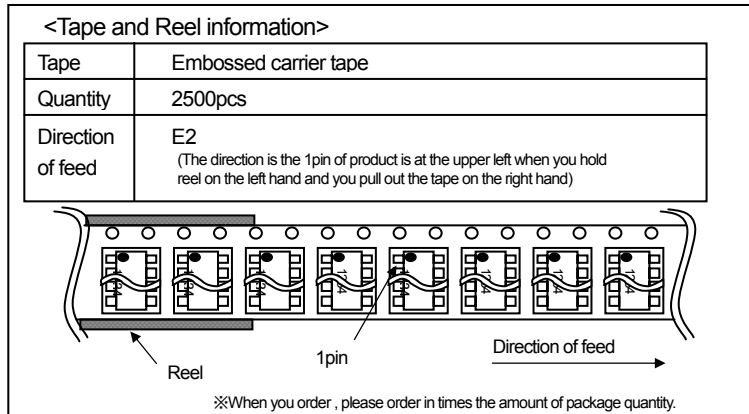
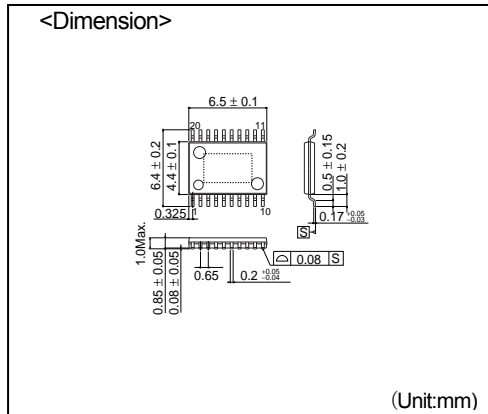
TSD function is aimed to shut down IC from thermal reckless driving under an abnormal state to exceed  $T_{jmax}=175$ . It aims at neither protection nor the guarantee of the set. Therefore, please do not use this function to protect the set.

### **Over current protection function**

The over current protection function has been achieved by limiting the current that flows on high side MOSFET.

The current is controlled in every one cycle of the switching frequency. When an abnormal state continues for about 500μsec(typ), the output is fixed in a low level.

# HTSSOP-B20



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