

System Power Supply for TV Series

FET Controller Type 3ch System Power Supply ICs



BD8621EFV

No.09034EAT03

●Description

BD8621EFV 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) 3A output current
- 2) Low RDS(ON) internal switches (PchMOS:75mΩ, NchMOS:55mΩ)
- 3) ±1% reference voltage accuracy
- 4) Programmable frequency : 250kHz-1MHz
- 5) (Frequency in programmable by adjusting RT resistance or synchronizing with SYNCLK terminal.)
- 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) Protecting BUS function with terminal PDET
- 15) HTSSOP-B20 package

●Electrical characteristics

(Unless otherwise noted Ta=25°C, VIN=3.3V, GND=0V)

| Parameter | Symbol | Specification value | | | UNIT | Condition |
|-----------------------------------|-----------------|---------------------|------|-------|------------|-------------------------------|
| | | MIN | TYP | MAX | | |
| VIN supply current (operating) | I_{Q_active} | - | 220 | 350 | μA | $V_{FB} = 0.83V, V_{FC} = 1V$ |
| VIN supply current (standby) | I_{Q_stby} | - | 0 | 1 | μA | $V_{EN} = 0V$ |
| 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} | 0.4 | - | - | mA | $V_{PDET} < 0.3V$ |
| Oscillation frequency | f_{OSC} | 500 | 550 | 600 | kHz | $R_{RT} = 220k\Omega$ |
| Pch FET ON resistance | R_{PFET} | - | 75 | 110 | m Ω | $I_{SW} = 1A$ |
| Nch FET ON resistance | R_{NFET} | - | 55 | 90 | m Ω | $I_{SW} = 1A$ |
| UVLO voltage | V_{UVLO} | 2.35 | 2.50 | 2.65 | V | |
| SW leak current | I_{LSW} | - | 0 | 1 | μA | $V_{EN} = 0V, V_{IN} = 5.5V$ |
| EN terminal H threshold voltage | V_{ENH} | 1.1 | - | - | V | |
| EN terminal L threshold voltage | V_{ENL} | - | - | 0.4 | V | |
| FC sink current | I_{FCSI} | 10 | 20 | - | μA | |
| FC source current | I_{FCSO} | - | -20 | -10 | μA | |
| SS/DELAY terminal source current | I_{SSSO} | 2 | 4 | 6 | μA | |
| Terminal PDET pull-up resistor | R_{PDET} | 100 | 170 | 250 | k Ω | |

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.

●Block Diagram

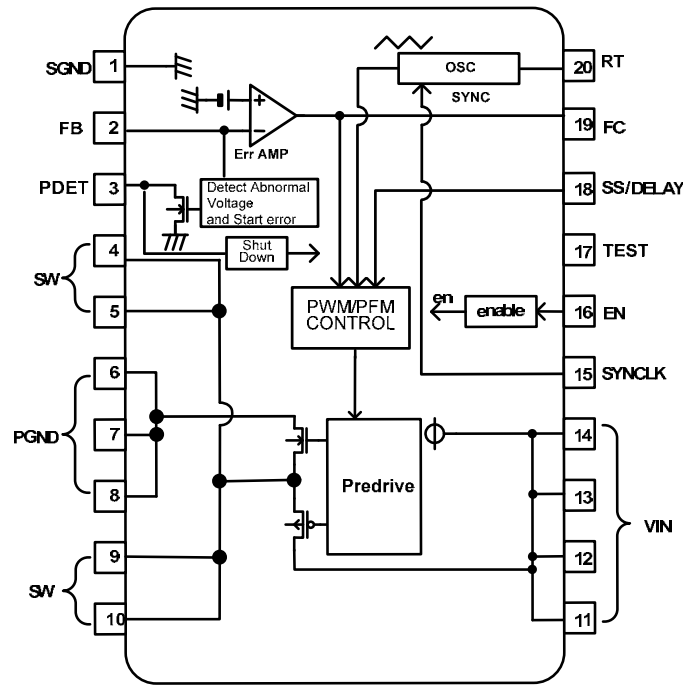


Fig1 Block diagram

●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 | Protecting BUS communication terminal |
| 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 | Synchronizable switching output terminal frequency with external clock |
| 16 | EN | Enable input | ON/OFF control for device operation |
| 17 | TEST | Terminal for test | SGND short in the 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 | Protecting BUS I/O 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 voltage | |
| 16 | EN | Enable terminal | |
| 17 | TEST | Using at test mode | |

| No. | Symbol | Explanation | Terminal equivalent circuit diagram |
|-----|--------------|--|-------------------------------------|
| 18 | SS /DELAY | 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 VEN reaches 1.1V.

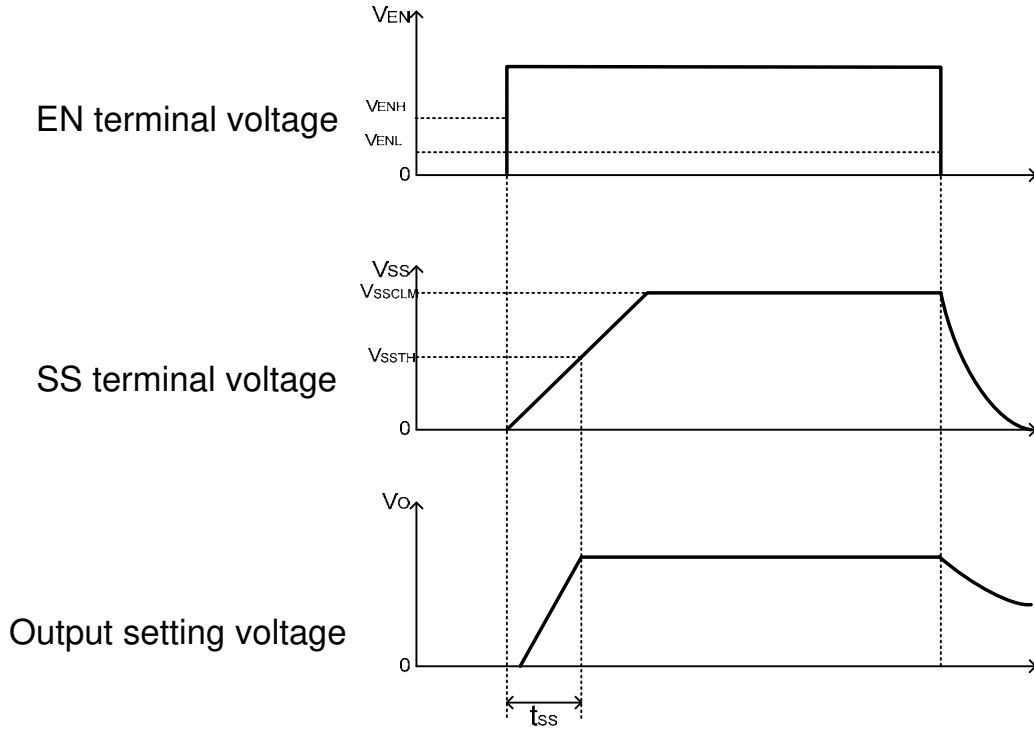


Fig.2 ON/OFF transition wave form in EN controlling

Soft start time set function

As for BD8621EFV, output can do soft start without overshoot by charging soft start capacity (CSS) connected between SS and SGND terminal.

Also, soft start time (tss) 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.3.

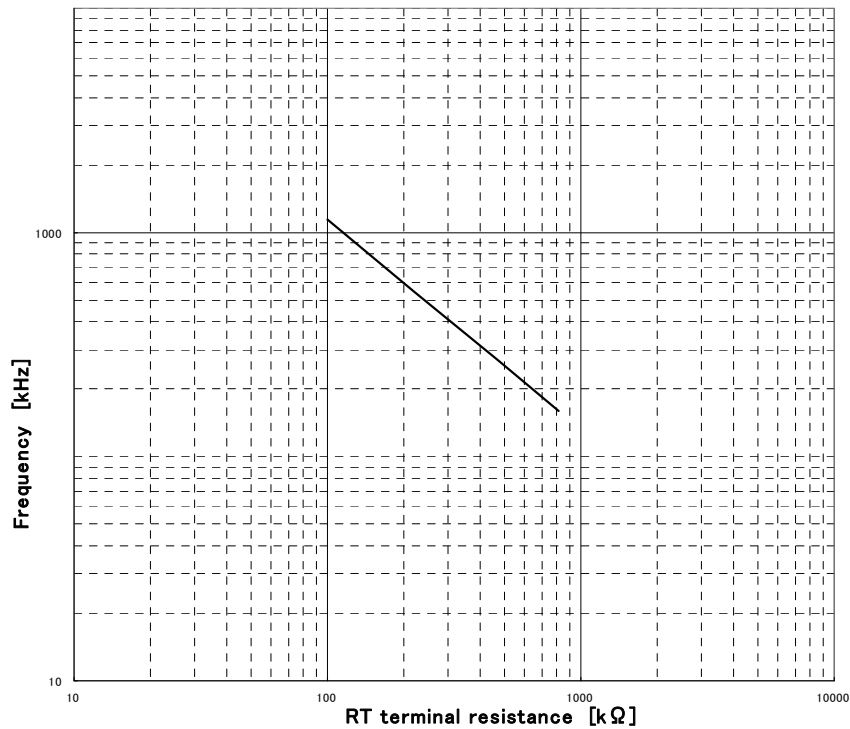


Fig.3 RT resistance-oscillation frequency

Switching frequency synchronization

An internal transmitter of BD8621EFV can be synchronized with the external clock signal connected with the terminal SYNCLK (15 pins).

The frequency of external clock can be set within the range of 250kHz-1MHz. In this case, please set the RT resistance that may become about -20% value of the external clock frequency.

* Be short-circuited SYNCLK terminal to SGND when a frequency synchronous function is not used.

●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 1 output low voltage protection function

| EN terminal | SS terminal | FB terminal | Low voltage protection function | Low voltage protection operation |
|-------------|---------------------|-------------|---------------------------------|----------------------------------|
| $>V_{ENH}$ | $>1.4V(\text{typ})$ | $<V_{LVP}$ | Effective | ON |
| | | $>V_{LVP}$ | | OFF |
| $<V_{ENL}$ | $<1.4V(\text{typ})$ | - | Invalidity | OFF |
| | - | - | 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 2 output overvoltage protection function

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

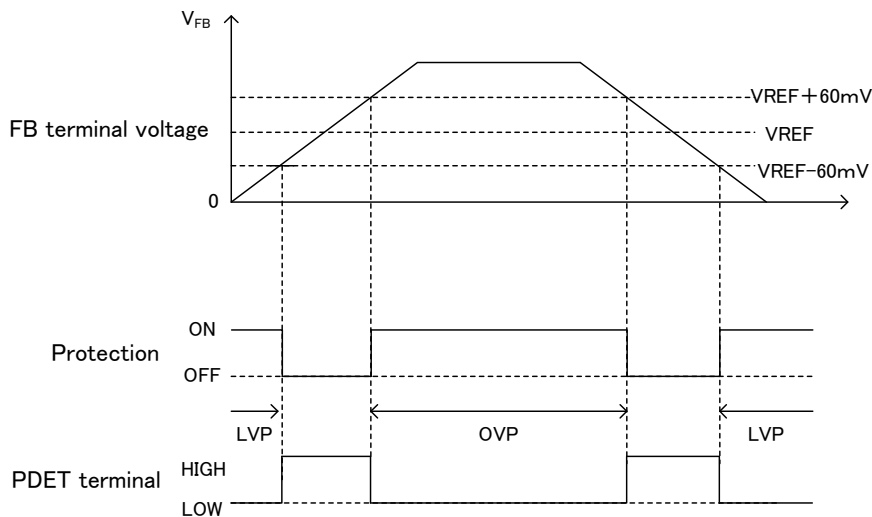


Fig.4 Output voltage error detection range

Under voltage lock out protection (UVLO)

As for BD8621EFV, the power-supply voltage decrease detection protection circuit is built in.

If the input voltage decrease below the UVLO voltage (2.5V typ), the device state changes to the standby mode (Moreover, to prevent the chattering of the output) hysteresis width of 100mV(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 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, BD8621EFV controls an off latch.

Vo is fixed in a low level.

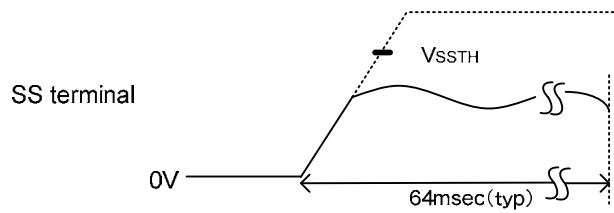


Fig.5 Soft start time-out

Thermal shut down function

Thermal shut down circuit (TSD circuit) is built into BD8621EFV. 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.

Protecting BUS function with terminal PDET

The terminal PDET (3 pins) monitors whether IC is normal or not. When IC becomes abnormal, the PDET output is reduced at "L" level with the output voltage fixed "L" level at the same time. Moreover, it is possible to make the output fix in a low level by compulsorily reducing the terminal PDET at "L" level from the outside.

When two or more BD8621EFV is used in the application, this function prevents the IC from destroying, because one IC error transmits all other ICs by PDET line in the condition that PDET terminals are connected each other.

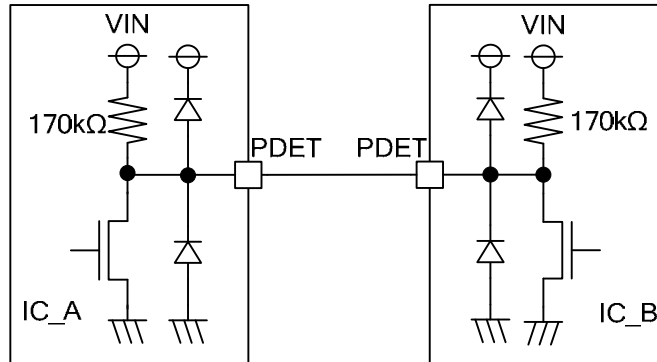


Fig.6 Protecting BUS communication

※Please give the terminal PDET as OPEN when you do not use protecting BUS function.

Error detection (off latch) release method

BD8621EFV 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.

● Each characteristic reference data

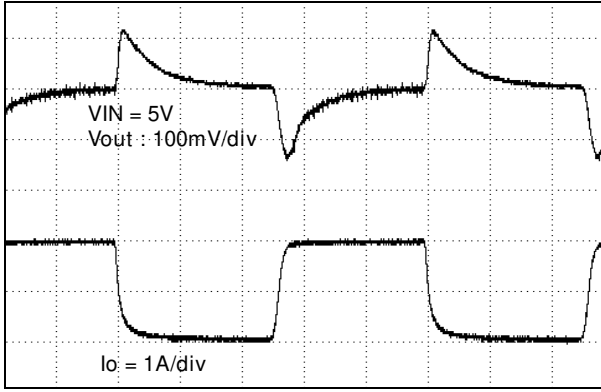


Fig.7 Output load response

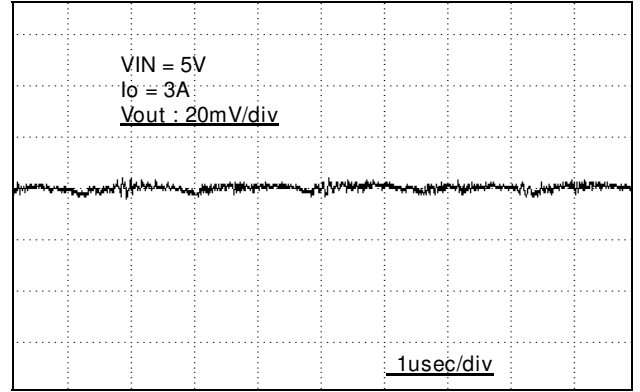


Fig.8 Output ripple

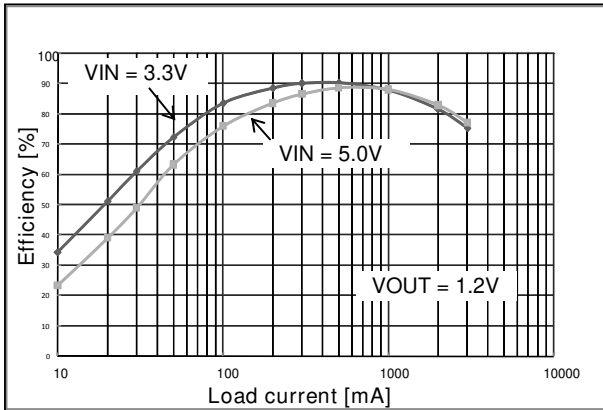


Fig.9 Efficiency

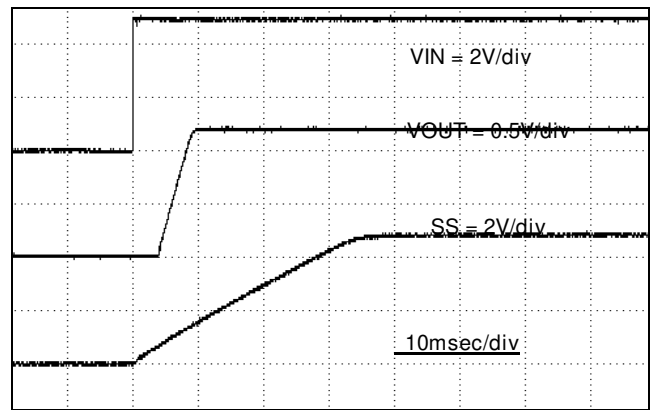


Fig.10 Soft start

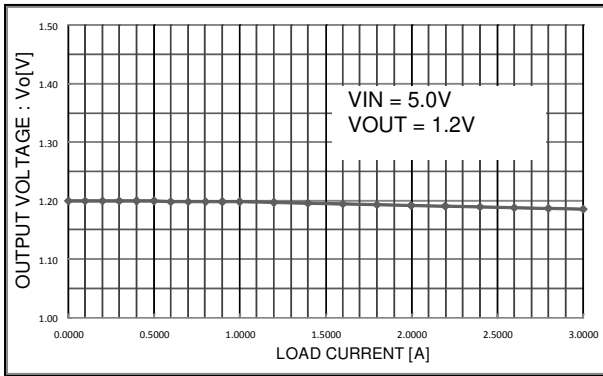


Fig.11 Regulation

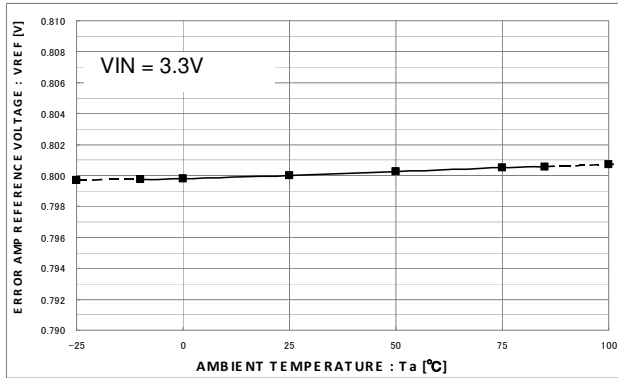


Fig.12 Reference voltage - Temperature characteristic

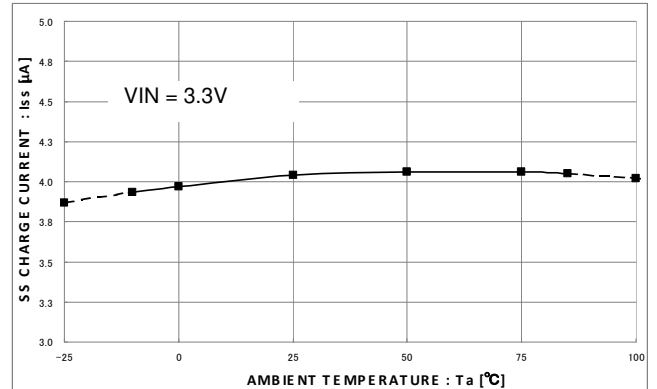


Fig.13 SS Charging current - Temperature characteristic

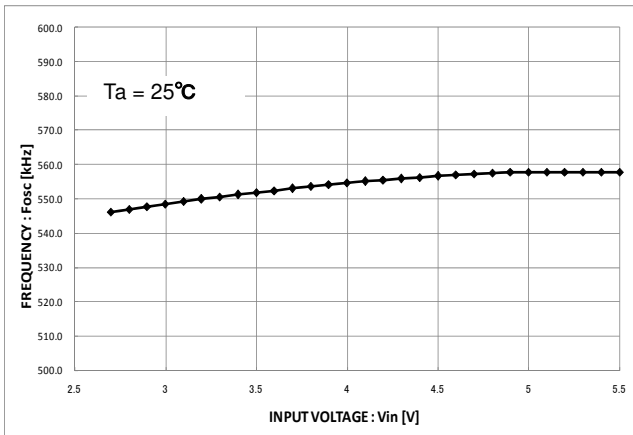


Fig.14 Switching frequency-power-supply voltage

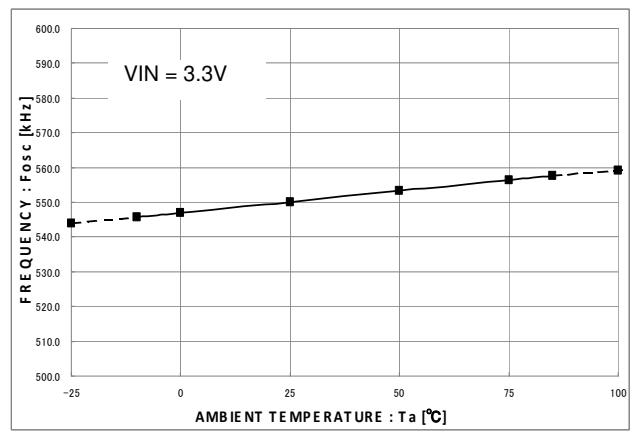


Fig.15 Switching frequency-temperature characteristic

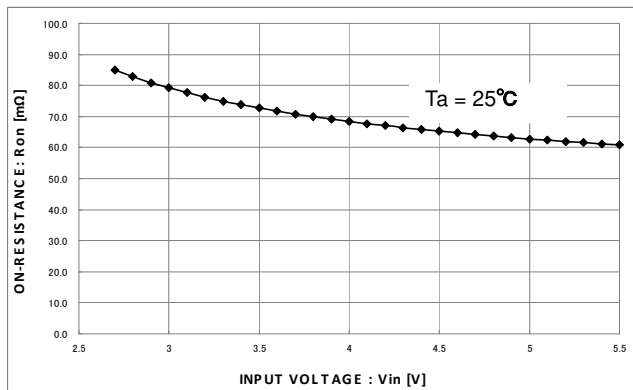


Fig.16 PMOS on resistance-power-supply voltage

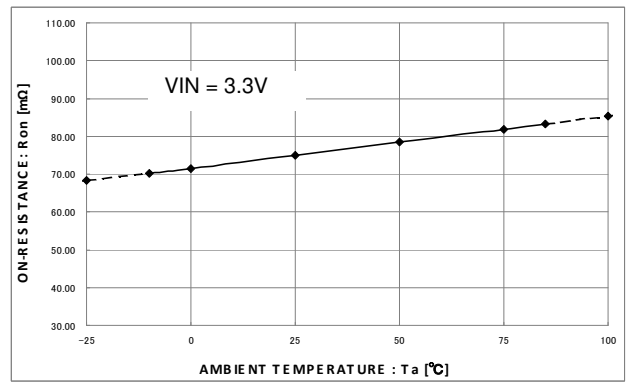


Fig.17 PMOS on resistance-temperature characteristic

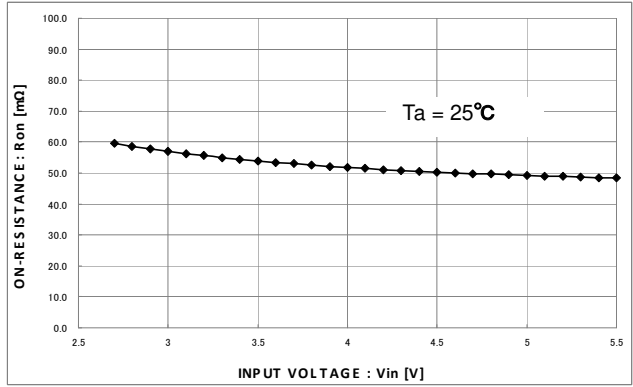


Fig.18 NMOS on resistance-power-supply voltage

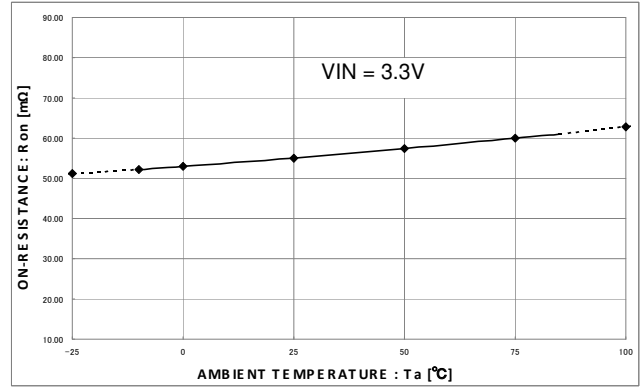


Fig.19 NMOS on resistance-temperature characteristic

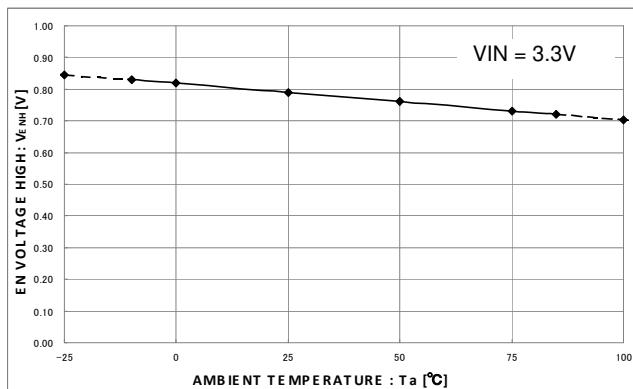


Fig.20 Terminal EN H voltage-temperature characteristic

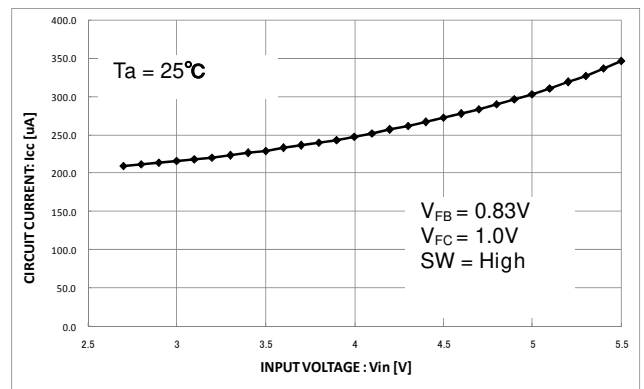


Fig.21 Circuit current-power-supply voltage characteristic

●Ordering part number

| | |
|---|---|
| B | D |
|---|---|

Part No

| | | | |
|---|---|---|---|
| 8 | 6 | 2 | 1 |
|---|---|---|---|

Part No.

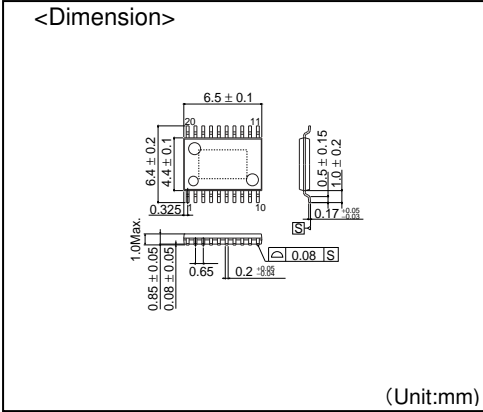
| | | |
|---|---|---|
| E | F | V |
|---|---|---|

Package
EFV: HTSSOP-B20

| | |
|---|---|
| E | 2 |
|---|---|

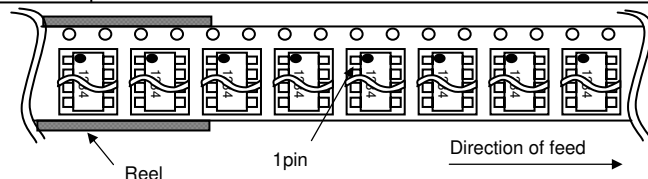
Packaging and forming specification
E2: Embossed tape and reel

HTSSOP-B20



<Tape and Reel information>

| | |
|-------------------|--|
| Tape | Embossed carrier tape |
| Quantity | 2500pcs |
| Direction of feed | E2 (The direction is the 1 pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand) |



※When you order , please order in times the amount of package quantity.

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|-----------|-----------|------------|-----------|
| CLASS III | CLASS III | CLASS II b | CLASS III |
| CLASS IV | | CLASS III | |

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 - Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
 - Sealing or coating our Products with resin or other coating materials
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 - Use of the Products in places subject to dew condensation
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- Please verify and confirm characteristics of the final or mounted products in using the Products.
- In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
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