Suitable for use with memory card slot

Power Switch for Memory Card Slot
BD6524HFV

● Description
Power switch for memory card Slot (BD6524HFV) is a high side switch IC having one circuit of N-channel Power MOS FET. The switch realizes 200mΩ (Typ.) ON resistance. Operations from low input voltage (VIN ≥ 3.0V) can be made for use for various switch applications.
The switch turns on slowly by the built-in charge pump, therefore, it is possible to reduce inrush current at switch on. There is no parasitic diode between the drain and the source, reverse current flow at switch off is prevented. Further, it has a discharge circuit that discharges electric charge from capacitive load at switch off.

The BD6524HFV is available in a space-saving HVSOF6 package.

● Features
1) Low on resistance (200mΩ, Typ.) N-MOS switch built in
2) Maximum output current : 500mA
3) Soft start circuit
4) Under voltage lockout (UVLO) circuit
5) Discharge circuit built in : operations at switch off, UVLO
6) Reverse current flow blocking at switch off

● Applications
Memory card slots of notebook PC, digital still camera, portable music player, compact portable devices such as PDA and so forth

● Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>VIN</td>
<td>-0.3 to 6.0</td>
<td>V</td>
</tr>
<tr>
<td>Control input voltage</td>
<td>VEN</td>
<td>-0.3 to VIN+0.3</td>
<td>V</td>
</tr>
<tr>
<td>Switch output voltage</td>
<td>VOUT</td>
<td>-0.3 to 6.0</td>
<td>V</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>TSTG</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>Pd</td>
<td>510 *1</td>
<td>mW</td>
</tr>
</tbody>
</table>

*1 Derating : 4.08mW/°C for operation above Ta = 25°C.
* This product is not designed for protection against radioactive rays.
* Operation is not guaranteed.

● Operation conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Limit</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>VIN</td>
<td>3.0 to 5.5</td>
<td>V</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>TOPR</td>
<td>-25 to 75</td>
<td>°C</td>
</tr>
<tr>
<td>Switch current</td>
<td>IOUT</td>
<td>500</td>
<td>mA</td>
</tr>
</tbody>
</table>

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Electrical characteristics

Unless otherwise specified, Ta = 25°C, VIN = 5V.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Limit</th>
<th>Unit</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min.</td>
<td>Typ.</td>
<td>Max.</td>
</tr>
<tr>
<td>Operating current</td>
<td>I_DD</td>
<td>-</td>
<td>50</td>
<td>75 uA V_EN = 5V, VOUT = Open</td>
</tr>
<tr>
<td>Standby current</td>
<td>I_STB</td>
<td>-</td>
<td>0.1</td>
<td>1 uA V_EN = 0V, VOUT = Open</td>
</tr>
<tr>
<td>EN input voltage</td>
<td>V_ENH</td>
<td>-</td>
<td>-</td>
<td>2.5 V High level input voltage</td>
</tr>
<tr>
<td></td>
<td>V_ENL</td>
<td>0.7</td>
<td>-</td>
<td>- Low level input voltage</td>
</tr>
<tr>
<td>EN input leak current</td>
<td>I_EN</td>
<td>-1</td>
<td>0.01</td>
<td>1 uA</td>
</tr>
<tr>
<td>Switch on resistance</td>
<td>R_ON</td>
<td>-</td>
<td>200</td>
<td>255 mΩ VIN = 5V</td>
</tr>
<tr>
<td>Switch leak current</td>
<td>I_LEAK</td>
<td>-</td>
<td>250</td>
<td>335 mΩ VIN = 3.3V</td>
</tr>
<tr>
<td>Switch rise time</td>
<td>T_ON1</td>
<td>-</td>
<td>0.4</td>
<td>0.8 ms RL=10 Ω . Refer to the timing diagram in Fig. 2.</td>
</tr>
<tr>
<td>Switch rise delay time</td>
<td>T_OFFSET</td>
<td>-</td>
<td>0.5</td>
<td>1.0 ms RL=10 Ω . Refer to the timing diagram in Fig. 2.</td>
</tr>
<tr>
<td>Switch fall time</td>
<td>T_OFF1</td>
<td>-</td>
<td>1</td>
<td>2 us RL=10 Ω . Refer to the timing diagram in Fig. 2.</td>
</tr>
<tr>
<td>Switch fall delay time</td>
<td>T_OFF2</td>
<td>-</td>
<td>2</td>
<td>4 us RL=10 Ω . Refer to the timing diagram in Fig. 2.</td>
</tr>
<tr>
<td>UVLO threshold voltage</td>
<td>V_UVLO</td>
<td>1.9</td>
<td>2.2</td>
<td>2.5 V VIN increasing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.8</td>
<td>2.1</td>
<td>2.4 V VIN decreasing</td>
</tr>
<tr>
<td>Discharge resistance</td>
<td>R_DISC</td>
<td>-</td>
<td>200</td>
<td>350 Ω V_EN = 0V, I_L = 1mA</td>
</tr>
<tr>
<td>Discharge current</td>
<td>I_DISC</td>
<td>0.8</td>
<td>1.8</td>
<td>- mA V_EN = 0V, V_IN = V_OUT = 1.8V</td>
</tr>
</tbody>
</table>

Measurement circuit

![Fig.1 Measurement circuit](image1.png)

Timing diagram

![Fig.2 Timing diagram](image2.png)
Typical characteristics

- **Ambient Temperature:** $T_a$ [°C]
- **Operating Current:** $I_{op}(mA)$
- **Standby Current:** $I_{sb}(mA)$
- **EN Input Voltage:** $V_{ENH}(V)$
- **ON Resistance:** $R_{ON}(mΩ)$
- **UVLO Threshold:** $V_{UVLO}(V)$
- **Turn Off Time1:** $T_{OFF1}(μs)$
- **Turn Off Time2:** $T_{OFF2}(μs)$
- **Turn On Time1:** $T_{ON1}(ms)$
- **Turn On Time2:** $T_{ON2}(ms)$
- **Standby Current:** $I_{SB}(μA)$
- **Discharge Resistance:** $R_{DISC}(Ω)$

Fig.3 Operating current
Fig.4 Standby current
Fig.5 EN threshold voltage (High level input voltage)
Fig.6 EN threshold voltage (Low level input voltage)
Fig.7 Switch on resistance
Fig.8 Switch rise time
Fig.9 Switch rise delay time
Fig.10 Switch fall time
Fig.11 Switch fall delay time
Fig.12 UVLO threshold voltage
Fig.13 Discharge resistance
● Waveform data
**Pin description**

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>Pin Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VIN</td>
<td>Switch input pin. At use, connect each pin outside.</td>
</tr>
<tr>
<td>2</td>
<td>VIN</td>
<td>Switch control input pin (hysteresis input) Switch ON at High.</td>
</tr>
<tr>
<td>3</td>
<td>EN</td>
<td>Ground</td>
</tr>
<tr>
<td>4</td>
<td>VOUT</td>
<td>Switch output pin At use, connect each pin outside.</td>
</tr>
</tbody>
</table>

**I/O circuit**

Fig.28 Pin configuration

Fig.29 Block diagram

Fig.30 I/O circuit
1. Input / output
VIN pin and VOUT pin are connected to the drain and the source of N-MOS switch respectively. And the VIN pin is used also as power source input to internal control circuit.

When EN input is set to High level and the switch is turned on, VIN pin and VOUT pin are connected by a 200mΩ switch. In a normal condition, current flows from VIN to VOUT. If voltage of VOUT is higher than VIN, current flows from VOUT to VIN, since the switch is bidirectional. There is not a parasitic diode between the drain and the source, it is possible to prevent current from flowing reversely from VOUT pin to VIN pin when the switch is disabled.

2. Discharge circuit
When the switch between the VIN and the VOUT is OFF, the 200Ω(Typ.) discharge switch between VOUT and GND turns on. By turning on this switch, electric charge at capacitive load is discharged.

3. Under voltage lockout (UVLO)
The UVLO circuit monitors the voltage of the VIN pin, when the EN input is active. UVLO circuit prevents the switch from turning on until the VIN exceeds 2.2V(Typ.). If the VIN drops below 2.1V(Typ.) while the switch turns on, then UVLO shuts off the switch.

While the switch between the VIN pin and VOUT pin is OFF owing to UVLO operations, the switch of the discharge circuit turns on. However, when the voltage of VIN declines extremely, then the VOUT pin becomes Hi-Z.

![Operation timing diagram](image1)

![Typical application circuit](image2)
Cautions on use

(1) Absolute Maximum Ratings
An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down devices, thus making impossible to identify breaking mode such as a short circuit or an open circuit. If any special mode exceeding the absolute maximum ratings is assumed, consideration should be given to take physical safety measures including the use of fuses, etc.

(2) Operating conditions
These conditions represent a range within which characteristics can be provided approximately as expected. The electrical characteristics are guaranteed under the conditions of each parameter.

(3) Reverse connection of power supply connector
The reverse connection of power supply connector can break down ICs. Take protective measures against the breakdown due to the reverse connection, such as mounting an external diode between the power supply and the IC’s power supply terminal.

(4) Power supply line
Design PCB pattern to provide low impedance for the wiring between the power supply and the GND lines. In this regard, for the digital block power supply and the analog block power supply, even though these power supplies has the same level of potential, separate the power supply pattern for the digital block from that for the analog block, thus suppressing the diffraction of digital noises to the analog block power supply resulting from impedance common to the wiring patterns. For the GND line, give consideration to design the patterns in a similar manner. Furthermore, for all power supply terminals to ICs, mount a capacitor between the power supply and the GND terminal. At the same time, in order to use an electrolytic capacitor, thoroughly check to be sure the characteristics of the capacitor to be used present no problem including the occurrence of capacity dropout at a low temperature, thus determining the constant.

(5) GND voltage
Make setting of the potential of the GND terminal so that it will be maintained at the minimum in any operating state. Furthermore, check to be sure no terminals are at a potential lower than the GND voltage including an actual electric transient.

(6) Short circuit between terminals and erroneous mounting
In order to mount ICs on a set PCB, pay thorough attention to the direction and offset of the ICs. Erroneous mounting can break down the ICs. Furthermore, if a short circuit occurs due to foreign matters entering between terminals or between the terminal and the power supply or the GND terminal, the ICs can break down.

(7) Operation in strong electromagnetic field
Be noted that using ICs in the strong electromagnetic field can malfunction them.

(8) Inspection with set PCB
On the inspection with the set PCB, if a capacitor is connected to a low-impedance IC terminal, the IC can suffer stress. Therefore, be sure to discharge from the set PCB by each process. Furthermore, in order to mount or dismount the set PCB to/from the jig for the inspection process, be sure to turn OFF the power supply and then mount the set PCB to the jig. After the completion of the inspection, be sure to turn OFF the power supply and then dismount it from the jig. In addition, for protection against static electricity, establish a ground for the assembly process and pay thorough attention to the transportation and the storage of the set PCB.

(9) Input terminals
In terms of the construction of IC, parasitic elements are inevitably formed in relation to potential. The operation of the parasitic element can cause interference with circuit operation, thus resulting in a malfunction and then breakdown of the input terminal. Therefore, pay thorough attention not to handle the input terminals, such as to apply to the input terminals a voltage lower than the GND respectively, so that any parasitic element will operate. Furthermore, do not apply a voltage to the input terminals when no power supply voltage is applied to the IC. In addition, even if the power supply voltage is applied, apply to the input terminals a voltage lower than the power supply voltage or within the guaranteed value of electrical characteristics.

(10) Ground wiring pattern
If small-signal GND and large-current GND are provided, It will be recommended to separate the large-current GND pattern from the small-signal GND pattern and establish a single ground at the reference point of the set PCB so that resistance to the wiring pattern and voltage fluctuations due to a large current will cause no fluctuations in voltages of the small-signal GND. Pay attention not to cause fluctuations in the GND wiring pattern of external parts as well.
(11) External capacitor

In order to use a ceramic capacitor as the external capacitor, determine the constant with consideration given to a degradation in the nominal capacitance due to DC bias and changes in the capacitance due to temperature, etc.

(12) Thermal design

Perform thermal design in which there are adequate margins by taking into account the power dissipation (Pd) in actual states of use.

● Product Designation

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Package type</th>
<th>Packaging and forming specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD6524</td>
<td>HF: HVSOF</td>
<td>TR: Embossed tape and reel</td>
</tr>
</tbody>
</table>

HVSOF6

<!-- Dimension Information -->

Tape: Embossed carrier tape
Quantity: 3000pcs
Direction of feed: TR (The direction is the top 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)

The products described herein are not designed to be X-ray proof.

The products listed in this catalog are designed to be used with ordinary electronic equipment or devices (such as audio visual equipment, office automation equipment, communications devices, electrical appliances and electronic toys). Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.

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Appendix

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