STRUCTURE Silicon Monolithic Integrated Circuit

TYPE Power switch for ExpressCard™

PRODUCT SERIES **BD4153FV**

FEATURES
- High Side Switch for ExpressCard™
- Soft Start Circuit
- Meets the ExpressCard™ Standard

○ ABSOLUTE MAXIMUM RATINGS (Ta=100℃)

Parameter	Symbol	Limit	Unit
Power Supply Voltage	VCC	5.0 *1	V
Logic Input Voltage	EN,CPPE#,CPUSB#,SYSR,PERST_IN#	5.0 *1	V
Logic Output Voltage 1	OC	5.0 *1	V
Logic Output Voltage 2	PERST#	VCC *1	V
Input Voltage 1	V3_IN, V15_IN	5.0 *1	V
Input Voltage 2	V3AUX_IN	VCC *1	V
Output Voltage	V3,V3AUX,V15	5.0 *1	V
Output current 1	IOV3, IOV15	2.0	A
Output current 2	IOV3AUX	1.0	A
Power Dissipation 1	Pd1	787 *2	mW
Power Dissipation 2	Pd2	1025 *3	mW
Operating Temperature Range	Topr	-40～+100	℃
Storage Temperature Range	Tstg	-55～+150	℃
Maximum Junction Temperature	Tjmax	+150	℃

*1 Not to exceed Pd.

*2 Reduced by 6.3mW for each increase in Ta of 1℃ over 25℃

*3 Reduced by 8.2mW for each increase in Ta of 1℃ over 25℃ (When mounted on a board 70mm × 70mm × 1.6mm Glass-epoxy PCB).

○ RECOMMENDED OPERATING CONDITIONS (Ta=25℃)

Parameter	Symbol	MIN	MAX	Unit
Power Supply Voltage	VCC	3.0	3.6	V
Logic Input Voltage 1	EN	-0.2	3.6	V
Logic Input Voltage 2	CPPE#,CPUSB#,SYSR,PERST_IN#	-0.2	VCC	V
Logic Output Voltage 1	OC	-	3.6	V
Logic Output Voltage 2	PERST#	-	VCC	V
Input Voltage 1	V3_IN	3.0	3.6	V
Input Voltage 2	V3AUX_IN	3.0	VCC	V
Input Voltage 3	V15_IN	1.35	1.65	V
Soft Start Setup Capacitor 1	CSS_V3, CSS_V15	0.001	1.0	μF
Soft Start Setup Capacitor 2	CSS_V3AUX	0.001	0.1	μF

★ This product is not designed for protection against radioactive rays.

∗ ExpressCard™ is a trademark of PCMCIA(Personal Computer Memory Card International Association)

Status of this document

The Japanese version of this document is the official specification.

This translated version is intended only as a reference, to aid in understanding the official version.

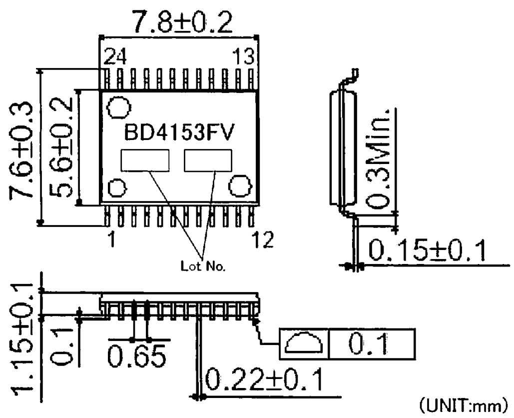
If there are any differences between the original and translated versions of this document, the official Japanese language version takes priority.

○ ELECTRICAL CHARACTERISTICS (unless otherwise noted, Ta=25℃ VCC=3.3V VEN=3.3V V3_IN=V3AUX_IN=3.3V,V15_IN=1.5V)

Parameter	Symbol	Standard Value MIN	Standard Value TYP	Standard Value MAX	Unit	Condition
Standby current	IST	-	35	70	μA	VEN=0V
Bias current 1	Icc1	-	0.25	0.50	mA	VSYSR=0V
Bias current 2	Icc2	-	1.0	2.0	mA	VSYSR=3.3V
[Enable]						
High Level Enable Input Voltage	VENHI	2.3	-	5.5	V	
Low Level Enable Input Voltage	VENLOW	-0.2	-	0.8	V	
Enable Pin Input current	IEN	-	3	10	μA	VEN=3V
[Logic (CPPE#, CPUSB#)]						
High Level Logic Input Voltage	VLHI	2.3	-	VCC	V	
Low Level Logic Input Voltage	VLLOW	-0.2	-	0.8	V	
Logic Pin Input current	IL	-1	0	1	μA	$V_{CPPE\#}$=3.3V or $V_{CPUSB\#}$=3.3V
[Logic (SYSR)]						
High Level Logic Input Voltage	VSYSRHI	2.3	-	VCC	V	
Low Level Logic Input Voltage	VSYSRLOW	-0.2	-	0.8	V	
Logic Pin Input current	ISYSR	6	11	18	μA	V_{SYSR}=3.3V
[Logic (PERST_IN#)]						
High Level Logic Input Voltage	VPSTHI	2.3	-	VCC	V	
Low Level Logic Input Voltage	VPSTLOW	-0.2	-	0.8	V	
Logic Pin Input current	IPST	-18	-11	-6	μA	$V_{PERST\_IN\#}$=0V
[Switch V3]						
On Resistance	R_{V3}	-	35	73	mΩ	Tj=-10～100℃ *
Discharge On Resistance	R_{V3}Dis	-	60	150	Ω	
[Switch V3AUX]						
On Resistance	R_{V3AUX}	-	100	210	mΩ	Tj=-10～100℃ *
Discharge On Resistance	R_{V3AUX}Dis	-	60	150	Ω	
[Switch V15]						
On Resistance	R_{V15}	-	42	85	mΩ	Tj=-10～100℃ *
Discharge On Resistance	R_{V15}Dis	-	60	150	Ω	
[Soft Start]						
Charge current	Ichr	1.0	2.0	3.0	μA	
SS_V3 High Voltage	SS_V3high	V3+4	V3+5	V3+6	V	
SS_V15 High Voltage	SS_V15high	V15+4	V15+5	V15+6	V	
SS_V3AUX High Voltage	SS_AUXhigh	1.5	1.8	2.1	V	
Discharge current	IDis	0.3	1.0	-	mA	Vss=1V
Low Voltage	SSLOW	-	-	50	mV	
[Over Current Protection]						
OC Flag V3	OCPV3_S	1.0	-	-	A	
V3 Over current	OCPV3	2.0	-	-	A	
OC Flag V3AUX	OCPV3AUX_S	0.25	-	-	A	
V3AUX Over current	OCPV3AUX	0.50	-	-	A	
OC Flag V15	OCPV15_S	0.50	-	-	A	
V15 Over current	OCPV15	1.20	-	-	A	
OC_Delay Charge current	$I_{OCP\_Delaych}$	1.0	2.0	3.0	μA	
OC_Delay Discharge current	$I_{OCP\_Delaydis}$	1.0	2.0	-	mA	VOC_DELAY=1V
OC_Delay Standby Voltage	VOCP_Delayst	-	-	50	mV	
OC_Delay Threshold Voltage	VOCP_Delayth	0.6	0.7	0.8	V	
OC Low Voltage	VOCP	-	0.1	0.2	V	IOC=0.5mA
OC Leak current	IOCP	-	-	1	μA	VOC=3.65V
[Under Voltage Lockout]						
V3_IN UVLO OFF Voltage	VUVLOV3_IN	2.80	2.90	3.00	V	sweep up
V3_IN Hysteresis Voltage	⊿VUVLOV3_IN	80	160	240	mV	sweep down
V3AUX_IN UVLO OFF Voltage	VUVLOV3AUX_IN	2.80	2.90	3.00	V	sweep up
V3AUX_IN Hysteresis Voltage	⊿VUVLOV3AUX_IN	80	160	240	mV	sweep down
V15 UVLO OFF Voltage	VUVLOV15	1.25	1.30	1.35	V	sweep up
V15 Hysteresis Voltage	⊿VUVLO15	50	100	150	mV	sweep down
VCC UVLO OFF Voltage	VUVLOVCC	2.80	2.90	3.00	V	sweep up
VCC Hysteresis Voltage	⊿VUVLOVCC	80	160	240	mV	sweep down
[POWER GOOD]						
V3 POWER GOOD Low Voltage	$V3_{PGL}$	2.500	2.750	3.000	V	
V3 POWER GOOD High Voltage	$V3_{PGH}$	V3_IN ×1.03	V3_IN ×1.05	V3_IN ×1.07	V	
V3AUX POWER GOOD Low Voltage	$V3AUX_{PGL}$	2.500	2.750	3.000	V	
V3AUX POWER GOOD High Voltage	$V3AUX_{PGH}$	V3AUX_IN ×1.03	V3AUX_IN ×1.05	V3AUX_IN ×1.07	V	
V15 POWER GOOD Low Voltage	$V15_{PGL}$	1.200	1.275	1.350	V	
V15 POWER GOOD High Voltage	$V15_{PGH}$	V15_IN ×1.03	V15_IN ×1.05	V15_IN ×1.07	V	
PERST#_DELAY Charge current	Idelaych	1.0	2.0	3.0	μA	
PERST#_DELAY Discharge current	Idelaydis	1.0	2.0	-	mA	VPERST_DELAY=1V
PERST#_DELAY Standby current	VdelayST	-	-	50	mV	
PERST#_DELAY Threshold Voltage	Vdelayth	0.6	0.7	0.8	V	
PERST# LOW Voltage	VPERST#Low	-	0.1	0.3	V	
PERST# HIGH Voltage	VPERST#HIGH	3.0	-	-	V	

* Design Guarantee

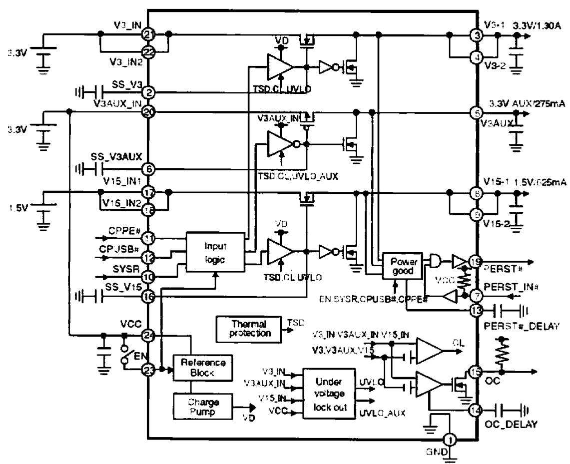
○ PHYSICAL DIMENSIONS



(UNIT:mm)

SSOP-B24

○ BLOCK DIAGRAM



○ Pin number Pin name

Pin number	Pin name
1	GND
2	SS_V3
3	V3_1
4	V3_2
5	V3AUX
6	SS_V3AUX
7	PERST_IN#
8	V15_1
9	V15_2
10	SYSR
11	CPPE#
12	CPUSB#
13	PERST_DELAY
14	OC_DELAY
15	OC
16	SS_V15
17	V15_IN1
18	V15_IN2
19	PERST#
20	V3AUX_IN
21	V3_IN1
22	V3_IN2
23	EN
24	VCC

○NOTES FOR USE

(1) Absolute maximum range
Although the quality of this product is rigorously controlled, and circuit operation is guaranteed within the operation ambient temperature range, the device may be destroyed when applied voltage or operating temperature exceeds its absolute maximum rating. Because the failure mode (such as short mode or open mode) cannot be identified in this instance, it is important to take physical safety measures such as fusing if a specific mode in excess of absolute rating limits is considered for implementation.

(2) Ground potential
Make sure the potential for the GND pin is always kept lower than the potentials of all other pins, regardless of the operating mode, including transient conditions.

(3) Thermal Design
Provide sufficient margin in the thermal design to account for the allowable power dissipation (Pd) expected in actual use.

(4) Using in the strong electromagnetic field
Use in strong electromagnetic fields may cause malfunctions.

(5) ASO
Be sure that the output transistor for this IC does not exceed the absolute maximum ratings or ASO value.

(6) Thermal shutdown circuit
The IC is provided with a built-in thermal shutdown (TSD) circuit. When chip temperature reaches the threshold temperature shown below, output goes to a cut-off (open) state. Note that the TSD circuit is designed exclusively to shut down the IC in abnormal thermal conditions. It is not intended to protect the IC per se or guarantee performance when extreme heat occurs. Therefore, the TSD circuit should not be employed with the expectation of continued use or subsequent operation once TSD is operated.

TSD ON temperature [°C] (typ.)	Hysteresis temperature [°C] (typ.)
175	15

(7) GND pattern
When both a small-signal GND and high current GND are present, single-point grounding (at the set standard point) is recommended, in order to separate the small-signal and high current patterns, and to be sure the voltage change stemming from the wiring resistance and high current does not cause any voltage change in the small-signal GND. In the same way, care must be taken to avoid wiring pattern fluctuations in any connected external component GND.

(8) Electrical Characteristics
Be sure to check the electrical characteristics, such as transient characteristics in the present specification, since these can be changed by temperature, supply voltage, and external circuits.

(9) Input Capacitor
The input capacitor reduces the output impedence of the voltage supply source. If the output impedence of this power supply increases, the input voltage (V3_IN,V3AUX_IN,V15_IN) may become unstable. A 0.1uF capacitor for the VCC and V3AUX_IN pin, and a 1uF capacitor for V3_IN and V15_IN pin are recommended. A low ESR capacitor with minimal susceptibility to temperature is preferable, but stability depends on power supply characteristics and the substrate wiring pattern. Please confirm operation across a variety of temperature and load conditions.

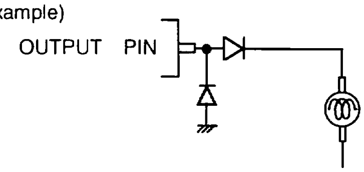
(10) Output Capacitor
Mount an output capacitor between output pin (V3,V3AUX,V15)and GND for stability purposes. A 10uF capacitor for the V3 and V15 pin, and a 1uF capacitor for the V3AUX pin are recommended. A low ESR capacitor with minimal susceptibility to temperature is preferable, but stability depends on power supply characteristics and the substrate wiring pattern. Please confirm operation across a variety of temperature and load conditions.

(11) Short-circuits between pins and and mounting errors
When mounting the IC onto a set substrate or circuit board, be careful to avoid incorrect orientation or mis-positioning of the IC, as such mounting errors may cause device malfunctions. Similar damage may occur when the power supply connection is reversed. Also, note that the introduction of foreign material between pins and the GND, or between the pins themselves may cause shorts and destroy the IC.

(12) This product is not designed for protection against radioactive rays.

(13) Please add a protection diode when a large inductance component is connected to the output terminal, and reverse-polarity power is possible at startup or in output OFF condition.

(Example)



(14) Operating Conditions
The circuit functionality is guaranteed within the operating ambient temperature range. The standard electrical characteristics cannot be guaranteed, except at Ta=25°C. However, any variation will be small.

(15) Operating stability depends on the layout pattern. Make sure the wiring pattern for the input (V3_IN, V3AUX_IN, V15_IN) and the output (V3, V3AUX, V15) on the application board is designed wide and short , in order to minimize layout impedance.

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