STRUCTURE : Silicon Monolithic Integrated Circuit
PRODUCT NAME : DC/DC converter IC for camera module for car navigation system
MODEL NAME : B D 8 6 7 1 K N
BLOCK DIAGRAM : Fig. - 2

◎FEATURES :

- +3.3V output Step down DC/DC converter for asynchronous rectification system
- +12V output Boost DC/DC converter for asynchronous rectification system
- -5V output Voltage control charge pump for reversing type for negative voltage
- Soft start function
- Building in low voltage and over voltage protection function
- Building in terminal RT OPEN/Short protection
- The frequency can be set by external resistance
- Concentrated protection control with built-in sequencer
- VQFN-28 package

◎ABSOLUTE MAXIMUM RATING: (Ta=25℃)

Parameter	Symbol	Limits			Unit
VIN supply voltage	VIN	-0.3	～	+18.0	V
PVIN supply voltage	PVIN	-0.3	～	VIN	V
Input terminal voltage 1*1	VIN1	-0.3	～	VIN	V
Input terminal voltage 2*2	VIN2	-0.3	～	+20.0	V
Input terminal voltage 3*3	VIN3	-0.3	～	+20.0	V
Input terminal voltage 4*4	VIN4	-10.0	～	+0.3	V
Output terminal voltage 1*5	VOUT1	-0.3	～	VIN	V
Output terminal voltage 2*6	VOUT2	-0.3	～	PVIN	V
Output terminal voltage 3*7	VOUT3	-0.3	～	+20.0	V
Output terminal voltage 4*8	VOUT4	-0.3	～	VIN3*10	V
Output terminal voltage 5*9	VOUT5	VIN4	～	+0.3	V
Power dissipation	Pd	0.725*11			W
Operating temperature	Topr	-40	～	+85	℃
Storage temperature	Tstg	-55	～	+150	℃

*1 FB12、SS12、TEST1、TEST2、TEST3、RT、CTL1、CTL2、CTL3、SS33、V33 terminal voltage *2 V12 terminal voltage *3 V12IN terminal voltage
*4 MV8 terminal voltage *5 FC12 terminal voltage *6 SW33 terminal voltage *7 SW12 terminal voltage
*8 V8、CP terminal voltage *9 MV5、CM terminal voltage
*10 V8 terminal voltage ABSOLUTE MAXIMUM RATING is VIN3 or 10V is low. Between V8 terminal voltage and MV5 terminal voltage ABSOLUTE MAXIMUM RATING is 15V.
*11 70mm×70mm, thickness1.6mm, less than 3% share of copper foil when implementing glass epoxy board.
Operating at higher than Ta=25℃, 5.8mW shall be reduced per 1

◎OPERATION CONDITION (Please set the power-supply voltage in consideration of a power dissipation.)

Parameter	Symbol	MIN	TYP	MAX	Unit
VIN supply voltage	VIN	4.5	6.0	9.0	V

This product is not designed for protection against radioactive rays.

◎ELECTRICAL CHARACTERISTICS

(Unless otherwise noted Ta=25℃, VIN=6.0V,PVIN=6.0V,CTL1,2,3=6.0V,GND=0V)

Parameter	Symbol	specification value			UNIT	Condition
		MIN	TYP	MAX		
VIN,PVIN Circuit current 1	I_{Q1}	-	0	50	μA	CTL1,2,3=0V
VIN,PVIN Circuit current 2	I_{Q2}	-	4.1	6.1	mA	CTL1,2,3=VIN、 V_{V33}=3.5V V_{V12}=13.0V 、V_{V12IN}=12.0V
V12IN Circuit current	I_{Q3}	-	2.3	3.3	mA	CTL1,2,3=VIN、 V_{V33}=3.5V V_{V12}=13.0V 、V_{V12IN}=12.0V
Range of DC/DC converter oscillation frequency setting	F_{OSC}	500	1000	1200	kHz	It is possible to set it with the terminal RT.
<Step-down DC/DC converter of 3.3V output part>						
3.3V output voltage	V_{033}	3.234	3.300	3.366	V	
Terminal SS Discharge resistance	R_{V33DIS}	270	390	500	Ω	CTL1,2,3=0V
Terminal SS Charging current	I_{SS33}	-4.0	-2.5	-1.0	μA	V_{SS33}=1.0V
Terminal SS Threshold voltage	V_{SS33TH}	1.0	1.1	1.2	V	V_{SS33}voltage、V_{V33}=3.3V
Terminal SS Clamping voltage	$V_{SS33CLM}$	1.6	1.9	2.2	V	
Terminal SS Standby voltage	$V_{SS33STB}$	0.11	0.15	0.19	V	V_{SS33} voltage (L→H)
Terminal SS Standby voltage Maximum hysteresis error	$V_{SS33STB\_HYS}$	5	50	100	mV	
Terminal SS Discharge resistance	$R_{SS33DIS}$	4.9	7.0	9.1	kΩ	CTL1,2,3=6.0→0.0V
Terminal SS Protection circuit start voltage	$V_{SS33PON}$	1.0	1.1	1.2	V	V_{SS33} voltage (L→H)
Terminal SS Protection circuit start voltage Maximum hysteresis error	$V_{SS33PON\_HYS}$	10	100	200	mV	V_{SS33} voltage
Terminal V33 Low voltage detection voltage	V_{V33LVP}	1.11	1.32	1.53	V	V_{V33} voltage (H→L)
Terminal V33 Low voltage detection Maximum hysteresis error	V_{V33LVP_HYS}	41.2	412	824	mV	V_{V33} voltage
Terminal V33 Overvoltage detection voltage	V_{V33OVP}	4.45	4.95	5.45	V	V_{V33} voltage (L→H)
< Boost DC/DC converter of 12V output part >						
12V output voltage	V_{012}	11.76	12.00	12.24	V	
Terminal V12 Discharge resistance	R_{V12DIS}	270	390	500	Ω	CTL1,2,3=0V
Terminal FC12 Clamping voltage H	V_{FC12H}	1.2	-	-	V	V_{V12}=10.5V
Terminal FC12 Clamping voltage L	V_{FC12L}	-	-	0.2	V	V_{V12}=13.5V
Terminal FC12 Sink current	$I_{FC12SINK}$	0.3	-	-	mA	V_{V12}=13.5V、V_{FC12}=0.4V
Terminal FC12 Source current	$I_{FC12SOURCE}$	-	-	-14	μA	V_{V12}=10.5V、V_{FC12}=1.4V
Terminal SS12 Charging current	I_{SS12}	-4.0	-2.5	-1.0	μA	V_{SS12}=1.0V
Terminal SS12 Threshold voltage	V_{SS12TH}	1.0	1.1	1.2	V	V_{SS12} voltage、V_{FB12}=0.8V
Terminal SS12 Clamping voltage	$V_{SS12CLM}$	1.6	1.9	2.2	V	
Terminal SS12 Standby voltage	$V_{SS12STB}$	0.11	0.15	0.19	V	V_{SS12} voltage (L→H)
Terminal SS12 Standby voltage Maximum hysteresis error	$V_{SS12STB\_HYS}$	5	50	100	mV	
Terminal SS12 Discharge resistance	$R_{SS12DIS}$	4.9	7.0	9.1	kΩ	CTL1,2,3=6.0→0.0V
Terminal SS12 Protection circuit start voltage	$V_{SS12PON}$	1.0	1.1	1.2	V	V_{SS12} voltage (L→H)
Terminal SS12 Protection circuit start voltage Maximum hysteresis error	$V_{SS12PON\_HYS}$	10	100	200	mV	V_{SS12} voltage
Terminal V12Low voltage detection voltage	V_{V12LVP}	4.0	4.8	5.6	V	V_{V12} voltage (H→L)
Terminal V12 Low voltage detection Maximum hysteresis error	V_{V12LVP_HYS}	0.15	1.5	3.0	V	V_{V12} voltage
Terminal V12 Overvoltage detection voltage	V_{V12OVP}	16.2	18.0	19.8	V	V_{V12} voltage (L→H)
< -5V output reversing charge pump part >						
Terminal MV5 output voltage	V_{MV5}	-5.10	-5.00	-4.90	V	MV8= −8.0V
Terminal MV5 Discharge resistance	R_{MV5DIS}	200	320	430	Ω	CTL3=0V、V_{V8}=8.0V
Terminal MV5 Overvoltage detection voltage	V_{MV5OVP}	-8.25	-7.50	-6.75	V	V_{MV5} voltage、V_{V33}=3.3V
Terminal MV5 Protection circuit start voltage	V_{MV5PON}	-4.5	-3.5	-2.5	V	V_{MV5} voltage (H→L)、V_{V33}=3.3V
Terminal MV5 Low voltage detection voltage	V_{MV5LVP}	-2.5	-2.0	-1.5	V	V_{MV5} voltage (L→H)、V_{V33}=3.3V
Terminal MV5 Low voltage detection Maximum hysteresis error	V_{MV5LVP_HYS}	62.5	625	1250	mV	V_{MV5} voltage、V33=3.3V

●V_{V33} : V33 voltage、V_{VSS33} : SS33 voltage、V_{V12} : V12 voltage、V_{FC12} : FC12 voltage、

V_{SS12} : SS12 voltage、 V_{MV5} : MV5 voltage 、V_{MV8} : MV8 voltage、V_{V8} : V8 voltage、V_{V12IN} : V12IN voltage

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

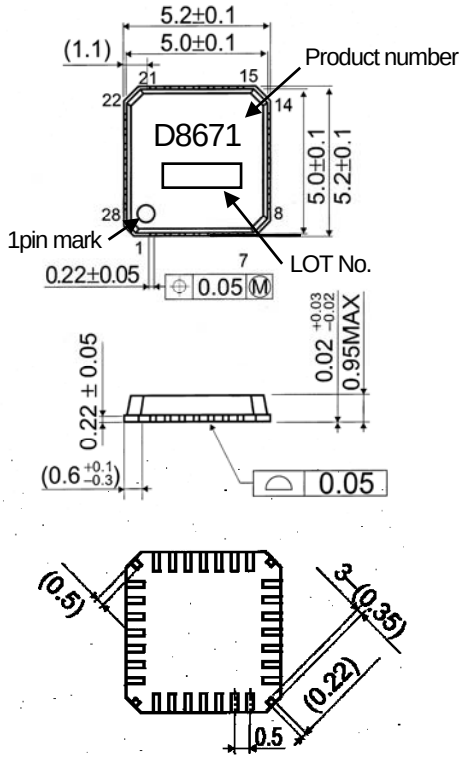
●The current ability must not exceed Pd.

◎PIN ASSIGNMENT

No.	Symbol	Description	No.	Symbol	Description
1	V12	12V output voltage detection terminal	15	TEST1	Test terminal 2(0V is connected and use it usually).
2	FB12	Error amplifier input terminal	16	SW33	3.3V coil connection terminal
3	FC12	Error amplifier output terminal	17	PGND33	Power GND (the same potential as terminal GND)
4	SS12	12V soft start adjustment capacity connection terminal	18	SS33	3.3V soft start adjustment capacity connection terminal
5	PGND12	GND(0V connection)	19	V33	3.3V output voltage detection terminal
6	SW12	12V coil connection terminal	20	TEST3	Test terminal 3 (It uses it by the open usually.)
7	TEST2	Test terminal 2(0V is connected and use it usually).	21	SGND	Sense GND(the same potential as terminal GND)
8	CTL1	3.3V output control terminal	22	MV5	-5V regulator output terminal
9	VIN	Power supply input terminal	23	MV8	-8V charge pump output terminal
10	GND	GND(0V connection)	24	CM	Capacity connection terminal for charge pump (−)
11	RT	Frequency adjustment resistance connection terminal	25	PGNDV8	Power GND (the same potential as terminal GND)
12	PVIN	Power supply input terminal for PowerTr (=VIN)	26	CP	Capacity connection terminal for charge pump (+)
13	CTL3	-5V output control terminal	27	V8	8V regulator output terminal
14	CTL2	12V output control terminal (*12)	28	V12IN	LDO12V voltage input terminal

*12 **H->L (ON->OFF) control, When CTL3=L. (Refer to NOTE ON USE-13)**

◎PACKAGE OUTLINE



VQFN-28 (UNIT : mm)

Fig.- 1 PACKAGE OUTLINE

◎BLOCK DIAGRAM

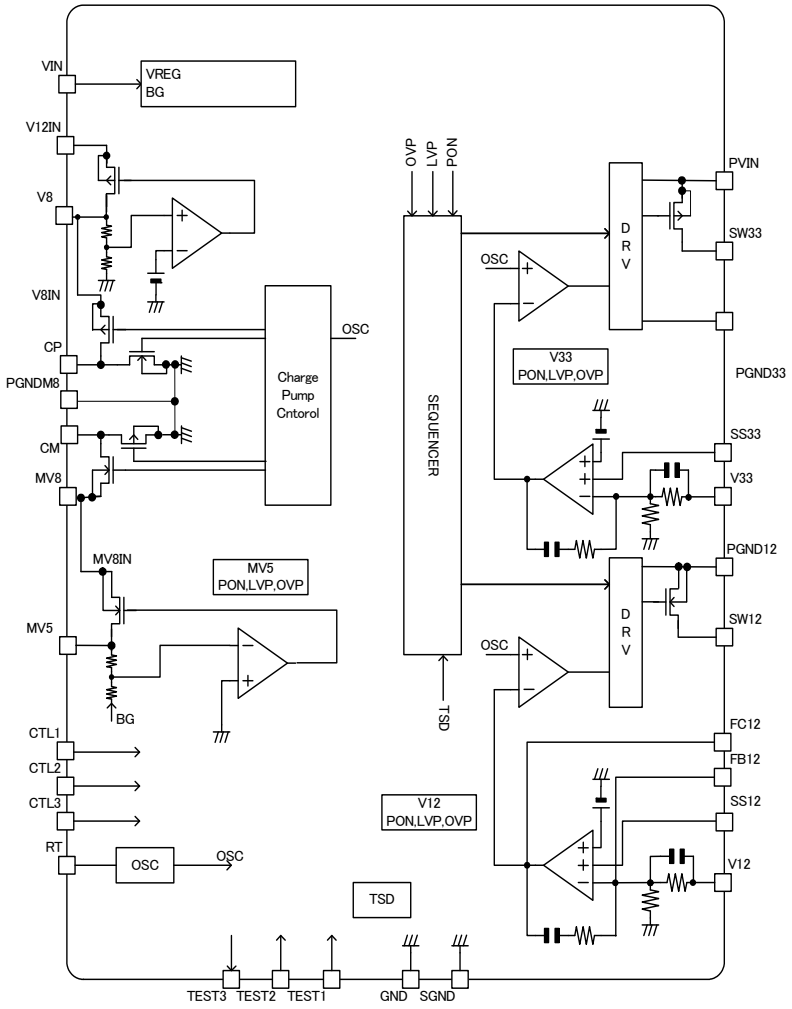


Fig.-2.BLOCK DIAGRAM

◎NOTE ON USE

1. About the absolute maximum rating

   Attention is brushed off enough to the quality control, it is likely to destroy when the absolute maximum rating such as impressed voltages (VCC_IN,DCIN) and ranges (Topr) of the operating temperature as it is exceeded, the mode of breakings of the short or the opening, etc. cannot be specified, and examine it in this IC to give physical measures for safety such as fuses when a special mode that exceeds the absolute maximum rating is assumed.
2. About the reverse-connection of the power supply connector

   IC might destroy it by reversely connecting the power supply connector. Give measures such as putting the diode between power supply terminals of power supply and IC outside for the reverse-touching destruction protection.
3. Power supply line

   Please do measures such as putting the bypass capacitor in power supply-GND nearest pin of this IC as the route of the resurrection current to cause the return of the current in which it resurrected it by the counter electromotive force of the coil.
   Please confirm the characteristic of the electrolytic capacitor enough as the capacity omission etc. at the low temperature never happen, and decide it.
4. About grand potential

   Any state of operation must become the lowest potential about the potential of the terminal GND. Moreover, confirm whether there is terminal that is actually the voltage of GND or less including transients.
5. About the heat design

   Think about permissible loss (Pd) in an actual state of use, and do the heat design with the margin enough.
6. About the short and the miss-installation between terminals

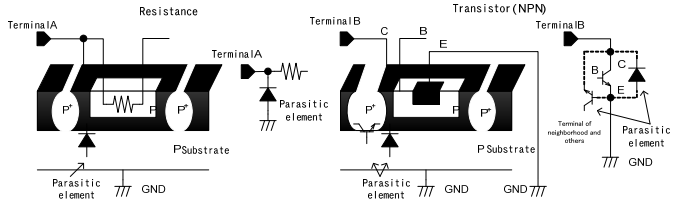
   Note the direction and the miss-registration of IC enough when you install it in the set substrate. IC might destroy it as well as reversely connecting the power supply connector when installing it by mistake. Moreover, there is fear of destruction when the foreign body enters between terminals, the terminal, the power supply, and grandeur and it is short-circuited.
7. About operation in strong electromagnetic field

   In use in strong electromagnetic field, note that there is a possibility of malfunctioning.
8. About the capacitor during output-GND

   The current charged the capacitor with when VCC is 0V or is GND and is short-circuited when a big capacitor is connected between GND output by some factors flows into the output and it is likely to destroy it. Give the capacitor between GND output to 0.1μF or less.
9. About the inspection by the set substrate

   It is likely to suffer stress to IC and discharge electricity every one process when you connect the capacitor with the pin with low impedance when inspecting it in the set substrate. Moreover, detach it after connecting after the power supply is turned off without fail when detaching it to G in the inspection process, inspecting, and turning off the power supply. n addition, be give the earth to the assembly process as a static electricity measures, and careful enough when it transports and you preserve it.
10. About each input terminal

    This IC is a monolithic IC which has a P^+ isolations and P substrate to isolate elements each other.
    This P layer and an N layer in each element form a PN junction to construct various parasitic elements.
    For instance, the potential difference operates in resistance as shown in the figure below when resistance and the transistor connect it with the terminal and the playground (GND) >(terminal B) joint of PN operates as a parasitic diode in playground (GND) >(terminal A) transistor (NPN). In addition, the NPN transistor of parasitism works with N layer of the element of the above-mentioned parasitic diode and the neighborhood and others in transistor (NPN). A parasitic element in IC composition is inevitably formed because of the potential relation.
    A parasitic element can operate, the interference with the circuit operation be caused, it malfunction, and, consequently, it cause destruction. Therefore, do not do the usage that a parasitic element operates as a voltage that is lower than the playground (GND;P substrate) is impressed to the input terminal enough. Moreover, do not impress the voltage to the input terminal when you do not impress the power-supply voltage to IC. Give each input terminal to me the voltage below the power-supply voltage or in the guarantee value of an electric characteristic when you similarly impress the power-supply voltage.



Example of IC of simple structure

11. Earth wiring pattern

    If small signal GND and large current GND exist, disperse their pattern. In addition, for voltage change by pattern wiring impedance and large current not to change voltage of small signal GND, each ground terminal of IC must be connected at the one point on the set circuit board. As for GND of external parts, it is similar to the above-mentioned.

12. Thermal Shut-Down

    When a thermal shutdown operates, the DC/DC converter controller of all Ch is turned off. When a thermal shutdown is released, the DC/DC converter controller of all Ch becomes an operation beginning from turning off.
13. DC/DC converter control terminal (CTL1,2,3)

    This IC has 3 output voltage (3.3V,12.0V,-5.0V). When you turning off control 12.0V output from all output ON(CTL1,2,3=H) time with the terminal CTL2, please control 12.0V output turning off with the terminal CTL2 after 200μs or more has passed by the terminal CTL3 since -5.0 the V output was turning off controlled.

Notes

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