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STRUCTURE Silicon Monolithic Integrated Circuit

NAME OF PRODUCT DC-AC Inverter Control IC

TYPE **BD9887FS**

FUNCTION
- 36V High voltage process
- 1ch control with Full-Bridge
- Lamp current and voltage sense feed back control
- Sequencing easily achieved with Soft Start Control
- Short circuit protection with Timer Latch
- Under Voltage Lock Out
- Mode-selectable the operating or stand-by mode by stand-by pin
- Synchronous operating the other BD9887FS IC's
- BURST mode controlled by PWM and DC input
- Output liner Control by external DC voltage

○Absolute Maximum Ratings (Ta = 25℃)

Parameter	Symbol	Limits	Unit
Supply Voltage	Vcc	36	V
BST pin	BST	40	V
SW pin	SW	36	V
BST-SW voltage difference	BST-SW	7	V
Operating Temperature Range	Topr	-40～+85	℃
Storage Temperature Range	Tstg	-55～+125	℃
Maximum Junction Temperature	Tjmax	+150	℃
Power Dissipation	Pd	760*	mW

*Pd derate at 6.08mW/℃ for temperature above Ta = 25℃ (When mounted on a PCB 70.0mm×70.0mm×1.6mm)

○Operating condition

Parameter	Symbol	Limits	Unit
Supply voltage	VCC	6.5～30.0	V
BST voltage	BST	4.0～36.0	V
BST-SW voltage difference	BST-SW	4.0～6.0	V
CT oscillation frequency	fCT	60～180	kHz
BCT oscillation frequency	fBCT	0.05～1.00	kHz

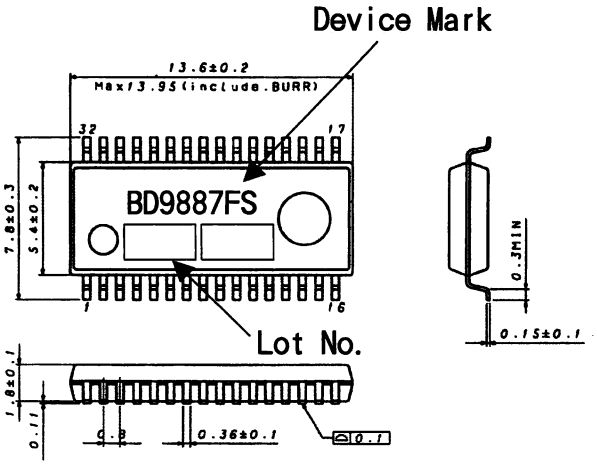
Status of this document
The Japanese version of this document is the official specification.
Please use the translation version of this document as a reference to expedite understanding of the official version.
If these are any uncertainty in translation version of this document, official version takes priority.

○Electric Characteristics (Ta=25℃, VCC=24V)

Parameter	Symbol	Limits			Unit	Conditions
		MIN.	TYP.	MAX.		
((WHOLE DEVICE))						
Operating current	Icc1	—	10.0	18.0	mA	VCT=0.5V
Stand-by current	Icc2	—	13.0	30.0	μA	
((STAND BY CONTROL))						
Stand-by voltage H	VstH	1.4	—	VCC	V	System O N
Stand-by voltage L	VstL	-0.3	—	0.8	V	System O F F
((UVLO BLOCK)))						
Operating voltage (VCC)	VuvloH	5.7	6.0	6.3	V	
Shut down voltage (VCC)	VuvloL	5.4	5.7	6.0	V	
Hesteresis width (VCC)	⊿VCC_Vuvlo	0.22	0.29	0.36	V	
Operating voltage (UVLO)	Vuvlo1	2.10	2.16	2.22	V	
Shut down voltage (UVLO)	Vuvlo2	2.179	2.25	2.321	V	
Hesteresis width (UVLO)	⊿Vuvlo	0.074	0.098	0.122	V	
((REG BLOCK))						
REG output voltage	VREG	5.68	5.80	5.92	V	VCC>7.0V
REG source current	IREG	20.0	—	—	mA	
VREF input voltage range	VREFIN	0.60	—	1.60	V	No effect at VREF>1.25V
((OSC BLOCK))						
Active edge setting current	Iact	1.35/RT	1.5/RT	1.65/RT	V	
Negative edge setting current	Ineg	Iact×8	Iact×10	Iact×12	V	
OSC Max voltage	VoscH	1.8	2.0	2.2	V	fCT=120kHz
OSC Min voltage ①	VoscL1	0.32	0.63	0.94	V	fCT=50kHz
OSC Min voltage ②	VoscL2	0.22	0.44	0.66	V	fCT=120kHz
Soft start current	ISS	0.7	1.4	2.1	μA	
SRT ON resistance	RSRT	-	150	300	Ω	
((BOSC BLOCK))						
BOSC Max voltage	VBCTH	1.94	2.00	2.06	V	fBCT=0.3kHz
BOSC Min voltage	VBCTL	0.40	0.50	0.60	V	fBCT=0.3kHz
BOSC constant current	IBCT	1.35/BRT	1.5/BRT	1.65/BRT	A	VBCT=0.2V
BOSC frequency	fBCT	291	300	309	Hz	BRT=33kΩ BCT=0.048μF
((FEED BACK BLOCK))						
IS threshold voltage 1	VIS①	1.225	1.250	1.275	V	
IS threshold voltage 2	VIS②	—	VREFIN	VIS①	V	VREF applying voltage
VS threshold voltage	Vvs	1.225	1.250	1.275	V	
IS source current 1	IIS1	—	—	0.9	μA	DUTY=2.0V
IS source current 2	IIS2	35.6	57.0	78.4	μA	DUTY=0V IS=0.5V
VS source current	IVS	—	—	0.9	μA	
FB over voltage detect voltage	Vovf	2.2	2.5	2.8	V	
IS COMP detect voltage ①	VISCOMP①	0.893	0.92	0.947	V	VREFIN≧1.25V
IS COMP detect voltage ②	VISCOMP②	-	VREFIN×0.74	-	V	VREFIN<1.25V
((DUTY BLOCK))						
High voltage	VDUTY-OUTH	2.8	3.1	3.4	V	
Low voltage	VDUTY-OUTL	-	-	0.5	V	
DUTY-OUT sink resistance	RDUTY-OUTSink	-	150	300	Ω	
DUTY-OUT source resistance	RDUTY-OUTSource	-	200	400	Ω	
((OUTPUT BLOCK))						
LN output sink resistance	RsinkLN	-	1.5	3.0	Ω	
LN output source resistance	RsourceLN	-	5.0	10.0	Ω	
HN output sink resistance	RsinkHN	-	2.5	5.0	Ω	VBST-VSW=5.0V
HN output source resistance	RsourceHN	-	5.0	10.0	Ω	VBST-VSW=5.0V
MAX DUTY	MAX DUTY	44	46.5	49	%	FOUT=60kHz
OFF period ①	TOFF①	-	120	200	ns	SW>4.0V
OFF period ②	TOFF②	150	230	310	ns	SW<2.0V
Drive output frequency	fCT	58.5	60.0	61.5	kHz	RT=15kΩ、CT=430pF
((TIMER LATCH BLOCK))						
Timer Latch setting voltage	VCP	1.94	2.0	2.06	V	
Timer Latch setting current ①	ICP1	0.53	0.66	0.79	μA	except for under voltage detecting
Timer Latch setting current ②	ICP2	4.98	6.22	7.46	μA	only under voltage detecting
((COMP CLOCK))						
COMP1 over voltage detect voltage	VCOMPH	2.460	2.485	2.510	V	VSS>2.2V
COMP2 over voltage detect voltage	VCMOP2_H	2.460	2.485	2.510	V	VSS>2.2V
COMP2 under voltage detect voltage ①	VCOMP_L_1	1.225	1.25	1.275	V	VSS>2.2V
COMP2 under voltage detect voltage ②	VCOMP_L_2	0.606	0.625	0.644	V	VSS<2.2V
((Synchronous Block))						
High voltage	VCT_SYNCH	2.8	3.1	3.4	V	
Low voltage	VCT_SYNCL	-	-	0.5	V	
CT_SYNC sink resistance	RCT_SYNC_SYNC	-	150	300	Ω	
CT_SYNC source resistance	RCT_SYNC_SOURCE	-	370	740	Ω	
Master IC setting voltage	VM_CT	5.5	-	7.0	V	CT_SYNC_IN pulled up to REG
High voltage input range	VCT_SYNC_IN_H	2.0	-	3.3	V	
Low voltage input range	VCT_SYNC_IN_L	-0.3	-	0.6	V	

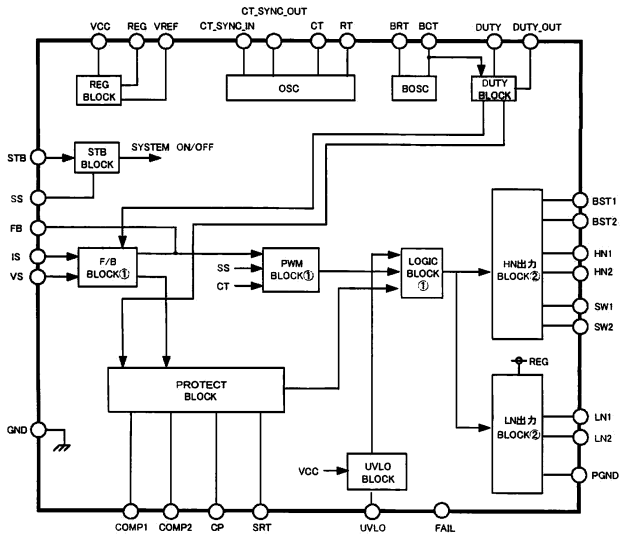
(This product is not designed to be radiation-resistant.)

○Package Dimensions



SSOP-A32 (unit:mm)

○Block Diagram



○Pin Description

PIN No.	PIN NAME	FUNCTION
1	PGND	Ground for FET drivers
2	LN2	NMOS FET driver
3	HN2	NMOS FET driver
4	SW2	Lower rail voltage for HN2 output
5	BST2	Boot-Strap input for HN2 output
6	CT_SYNC_IN	CT synchronous signal input pin
7	CT_SYNC_OUT	CT synchronous signal output pin
8	SRT	External resistor from SRT to RT for adjusting the triangle oscillator
9	RT	External resistor from SRT to RT for adjusting the triangle oscillator
10	CT	External capacitor from CT to GND for adjusting the triangle oscillator
11	GND	GROUND
12	BCT	External capacitor from BCT to GND for adjusting the BURST triangle oscillator
13	BRT	External resistor from BRT to GND for adjusting the BURST triangle oscillator
14	DUTY	Control PWM mode and BURST mode
15	DUTY_OUT	BURST signal output pin
16	STB	Stand-by switch
17	CP	External capacitor from CP to GND for Timer Latch
18	FAIL	COMP2 under voltage protect clock output
19	VREF	Reference voltage input pin for Error amplifier ①
20	VS	Error amplifier input ②
21	IS	Error amplifier input ①
22	FB	Error amplifier output
23	SS	External capacitor from SS to GND for Soft Start Control
24	COMP2	Under, over voltage detect pin
25	COMP1	Over voltage detect pin
26	VCC	Supply voltage input
27	UVLO	External Under Voltage Lock Out
28	REG	Internal regulator output
29	BST1	Boot-Strap input for HN1 output
30	SW1	Lower rail voltage for HN1 output
31	HN1	NMOS FET driver
32	LN1	NMOS FET driver

○NOTE FOR USE

1. When designing the external circuit, including adequate margins for variation between external devices and IC. Use adequate margins for steady state and transient characteristics.
2. The circuit functionality is guaranteed within of ambient temperature operation range as long as it is within recommended operating range. The standard electrical characteristic values cannot be guaranteed at other voltages in the operating ranges, however the variation will be small.
3. Mounting failures, such as misdirection or miscounts, may harm the device.
4. A strong electromagnetic field may cause the IC to malfunction.
5. The GND pin should be the location within ±0.3V compared with the PGND pin.
6. BD9887FS incorporate a built-in thermal shutdown circuit (TSD circuit). The thermal shutdown circuit (TSD circuit) is designed only to shut the IC off to prevent runaway thermal operation. It is not designed to protect the IC or guarantee its operation of the thermal shutdown circuit is assumed.
7. Absolute maximum ratings are those values that, if exceeded, may cause the life of a device to become significantly shortened. Moreover, the exact failure mode caused by short or open is not defined. Physical countermeasures, such as a fuse, need to be considered when using a device beyond its maximum ratings.
8. About the external FET, the parasitic Capacitor may cause the gate voltage to change, when the drain voltage is switching. Make sure to leave adequate margin for this IC variation.
9. On operating Slow Start Control (SS is less than 2.2V), It does not operate Timer Latch.
10. By STB voltage, BD9887FS are changed to 2 states. Therefore, do not input STB pin voltage between one state and the other state (0.8~1.4V).
11. The pin connected a connector need to connect to the resistor for electrical surge destruction.
    This IC is a monolithic IC which (as shown is Fig-1) has P^+ substrate and between the various pins. A P-N junction is formed from this P layer of each pin. For example, the relation between each potential is as follows,
    ○(When GND > PinB and GND > PinA, the P-N junction operates as a parasitic diode.)
    ○(When PinB > GND > PinA, the P-N junction operates as a parasitic transistor.)
    Parasitic diodes can occur inevitably in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits as well as operation faults and physical damage. Accordingly you must not use methods by which parasitic diodes operate, such as applying a voltage that is lower than the GND (P substrate) voltage to an input pin.
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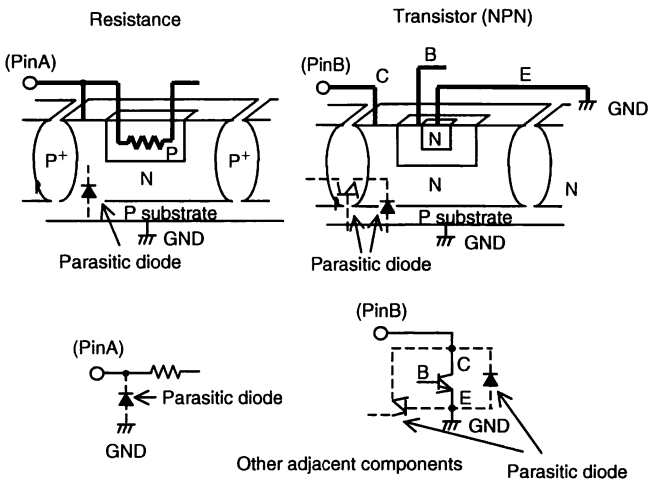

Fig-1 Simplified structure of a Bipolar IC

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As of 18th. April 2005