Highly Integrated LNB Supply and Control Voltage Regulator

For details, check for samples: INN8186

Features

- Low noise output to avoid sensitivity of Can Tuner and DISH's LNA dropping down
    Noise <+/-40mV@300MHz BWL
    Noise <+/-20mV@20MHz BWL
- Single chip power solution with 650mV Vpp 22KHz tone control signal transferred to output
- LNB Voltages (2 levels: 14.3V and 19.3V) compatible with common standards
- External 22KHz tone input
- Integrated DC DC boost converter and high efficiency (typ. 93%) with integrated Power Mosfet
- Integrated low Noise Linear Regulator
- Integrated power switches and current sensing
- Internal overcurrent and over temperature protection
- Provides up to 450mA continuous load current
- Output current limit of 500mA typical, with 48ms timer
- Push-pull output stage minimizes 14 → 19V and 19V →14V output transition times
- Internal Short Protection
- Meet DiSEqC1.x protocol
- 5.0V, 3.3V, 2.5V, 1.8V, 1.2 and 1.05V logic compatible
- 1.0MHz Switch Frequency BOOST
- Highly Integrated with **fewer** external components

Applications

- LNB Power supply and control for Satellite Set-Top Box
- Digital STB
- Satellite TV cards

Descriptions

Intended for analog and digital satellite receivers/sat-TV, sat-OC cards, the INN8186 is a monolithic voltage regulator and interface IC, packaged in SOP8EP, specifically designed to provide the 14/19V power supply with high efficiency and the 22kHz tone signaling to the LNB down-converter in the antenna dish or to the multi-switch box.

INN8186 consists of a boost converter and a low-noise linear regulator along with the circuitry required for tone injection and pin controllable interface. The device makes the total LNB supply design simple, efficient and compact with low external component count

The external modulation input (TONE pin) can accept a tome modulated DiSEqC command and transfer it symmetrically to the output to meet DiSEqC 1.x protocol.

Typical Application
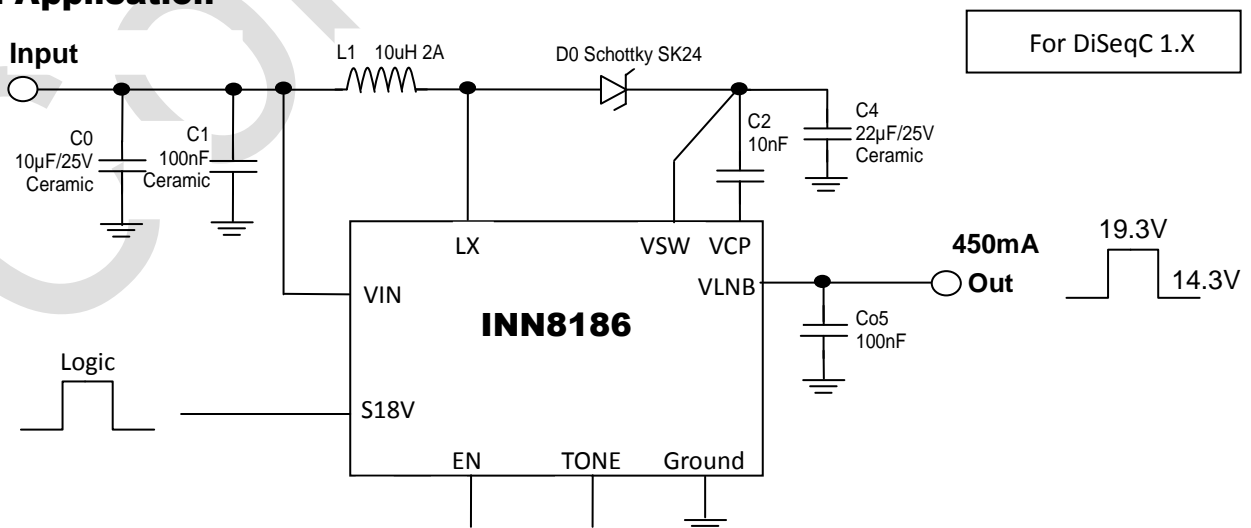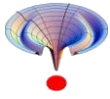
ORDERING INFORMATION

TA	PACKAGE	ORDERING PART NUMBER	PIN	TRANSPORT MEDIA, QUANTITY	ECO PLAN
-20℃ to 85℃	SOP8EP	INN8186 SCCTM	9	Tape and Reel 2500	Green (RoHS & no Sb/Br)

ABOSOLUTE MAXIMUM RATINGS

Over operating free-air temperature range (unless otherwise noted)

ITEMS	NAME	VALUE	UNIT
Voltage Range	VIN, VSW	-0.3 to 27	V
	VCP	-0.3 to 30	V
	LX (10ns transient)	-2 to 40	V
	VLNB (10ns transient)	-2 to 27	V
	S18V	-0.3 to 5.5	V
	EN	-0.3 to 8	V
TJ	Operation Junction	-40 to +150	℃
Tstg	Storage temperature	-55 to +150	℃

DISSIPATION RATINGS

(2oz. trace and copper pad)

PACKAGE	θJA	θJC	UNIT
SOP8EP	60	40	℃/W

RECOMMENDED OPERATING CONDITIONS

Over operating free-air temperature range(unless otherwise noted)

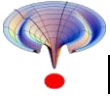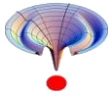|		MIN	MAX	UNIT
Voltage	Supply input voltage range, VIN	9	14	V
	LX	-0.1	30	V
	VSW, VLNB	-0.1	23	V
	S18V	-0.1	5	V
	EN	-0.1	7.0	V
	Ground (Exposed Pad)	-0.1	+0.1	V
T_A	Operating free-air temperature	-20	85	℃
T_J	Operating junction temperature	-40	125	℃

ELECTRICAL CHARACTERISTICS

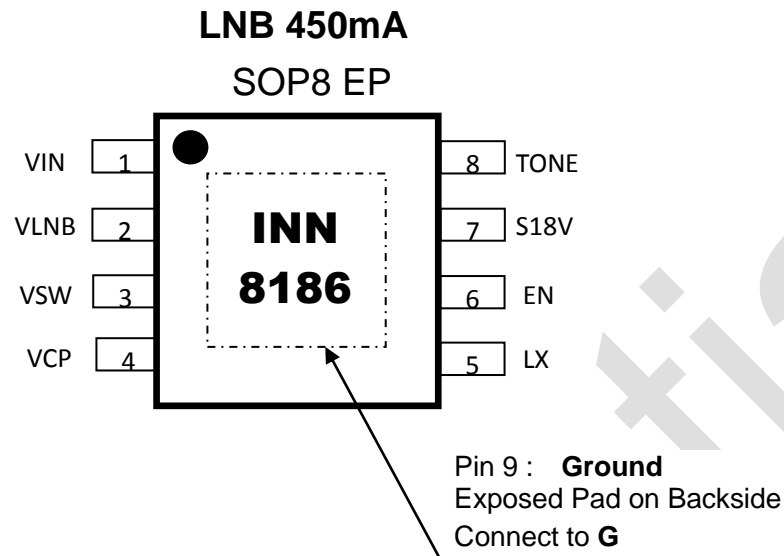Over operating free-air temperature range(unless otherwise noted)

VIN=12V, T$_A$ =25℃

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply Current						
VIN	Operating supply voltage range		9.0	12.0	14.0	V
V$_{UVLO}$	Input Under Voltage Lockout Threshold	VIN Rising	5.5	6.5	7.5	V
V$_{UVLO\_Hys}$	Input Under Voltage Lockout Threshold Hysteresis			0.1		V
I$_{VIN}$	Operating supply current	VIN current, T$_A$=25℃, EN=3.3V, VLNB=19V, TONE=0V		5	9.0	mA
		VIN current, T$_A$=25℃, EN=3.3V, VLNB=19V, 22KHz Tone Input		20	30.0	mA
I$_{SDN}$	Disable Supply Current	V$_{EN}$=0V		2	3.5	mA
Output Voltage						
V$_{OUT}$	Output Voltage	VEN=1, S18V="0"	13.9	14.3	14.7	V
		VEN=1, S18V="1"	18.8	19.3	20.2	V
Line Regulation	VIN Line Regulation	VIN=9V to 14V, VLNB=18.3V		4	40	mV
Load Regulation	VLNB output load regulation	I$_{LOAD}$=0mA to 450mA, Vout=18.3V Slow rate 255mA/us, Cout=0.2μF		120		mV
Drop Voltage	Linear Regulator Drop Voltage	VEN=3.0V, I$_{LOAD}$=450mA		1.2		V
V$_{ripple}$	Ripple and noise on VLNB output	20MHz BWL close to LNB chip		+/-20		mV
		300MHz BWL through 100cm co-axial cable.		+/-40		mV
I$_{LIMIT}$	Output Current limit	VLNB=14.3V		500	550	mA
		VLNB output short		125	200	mA
		VLNB=19.3V		500	550	mA
Short and Overload Protection						
T$_{ON\_OVERLOAD}$	Dynamic Overload ON time	Output shorted to GND		45		ms
T$_{OFF\_OVERLOAD}$	Dynamic Overload OFF time	Output shorted to GND		1800		ms
T$_{SDN}$	Thermal Shutdown Threshold			160		℃
T$_{SDN\_HYS}$	Thermal Shutdown Hysteresis			25		℃
Tone						
F$_{TONE}$	Input Tone Frequency Range		20	22		KHz
V$_{PP\_TONE}$	VLNB Output Tone Amplitude, peak to peak	I$_{LOAD}$=50mA to 450mA, C$_{LOAD}$=200nF	620	650	680	mV

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$Duty_{TONE}$	VLNB output Tone Duty	I_{LOAD}=0mA to 450mA, C_{LOAD}=570nF		50		%
T_{RISE_TONE}	VLNB output Tone Rising Time	I_{LOAD}=0mA to 450mA, C_{LOAD}=570nF	5	7.5	10	µs
T_{FALL_TONE}	VLNB output Tone Rising Time	I_{LOAD}=0mA to 450mA, C_{LOAD}=570nF	5	7.5	10	µs
$V_{TONE(H)}$	TONE High Logic Input		0.95			V
$V_{TONE(L)}$	TONE Low Logic Input				0.55	V
$I_{EMTMLKG}$	TONE Pin Input Leakage Current		-1		1	µA
S18V						
$V_{S18V(H)}$	Logic High Input		0.95			V
$V_{S18V(L)}$	Logic Low Input				0.55	V
I_{S18V_LKG}	Pin Input Leakage Current	Input=1.2V	-10		10	µA
ENABLE						
$V_{EN\_CLAMP\_1}$	Internal Zener Diode Voltage	20µA< EN pin Sink Current <100µA		6.2	7.2	V
$V_{EN\_CLAMP\_2}$	Internal Voltage Clamp	EN pin Sink Current < 5uA		1.3	1.6	V
I_{EN_PIN}	EN PIN Maximum Input Current	Input =6.3V			100	µA
$V_{EN(H)}$	EN Logic High Input		0.95			V
$V_{EN(L)}$	EN Logic Low Input				0.55	V
Boost DC/DC						
$Freq_{PWM}$	Bost DC/DC Switching Frequency	VEN=3.3V	0.8	1.0	1.2	MHz
Max $Duty_{PMW}$	Boost Maximum Duty			93		%
$T_{ON\_MIN\_PWM}$	Boost Minimum On time		0			ns
I_{LIM_PWM}	Boost Current Limit			1.8		A

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PIN ARRANGEMENT

LNB 450mA

SOP8 EP

VIN — 1

VLNB — 2

VSW — 3

VCP — 4

INN
8186

8 — TONE

7 — S18V

6 — EN

5 — LX

Pin 9 :   **Ground**
Exposed Pad on Backside
Connect to **G**

PIN FUNCTIONS

	PIN No.	Description
	INN8186	
NAME	**SOP8EP**	Details
VIN	1	Power Supply input
VLNB	2	Output voltage for the LNB
VSW	3	Boost converter output voltage sense, and internal LDO's input terminal
VCP	4	Charge Pump for LDO supply
LX	5	DC-DC converter switch node connection, connects to inductor
EN	6	When this pin is low, the output is disabled. Setting EN = 1 enables the output voltage
S18V	7	Output voltage selection pins. High for 19.3V output; Low for 14.3V output
TONE	8	Externally modulated DiSEqC tone signal input, like 22KHz signal, which is transferred symmetrically onto LNB pin.
Ground	9 (**Exposed pad**)	Whole chip power ground
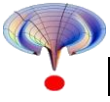
APPLICATION SCHEMATIC

1) Low Noise (Standard) Application (Noise< +/-40mV@300MHz BWL)
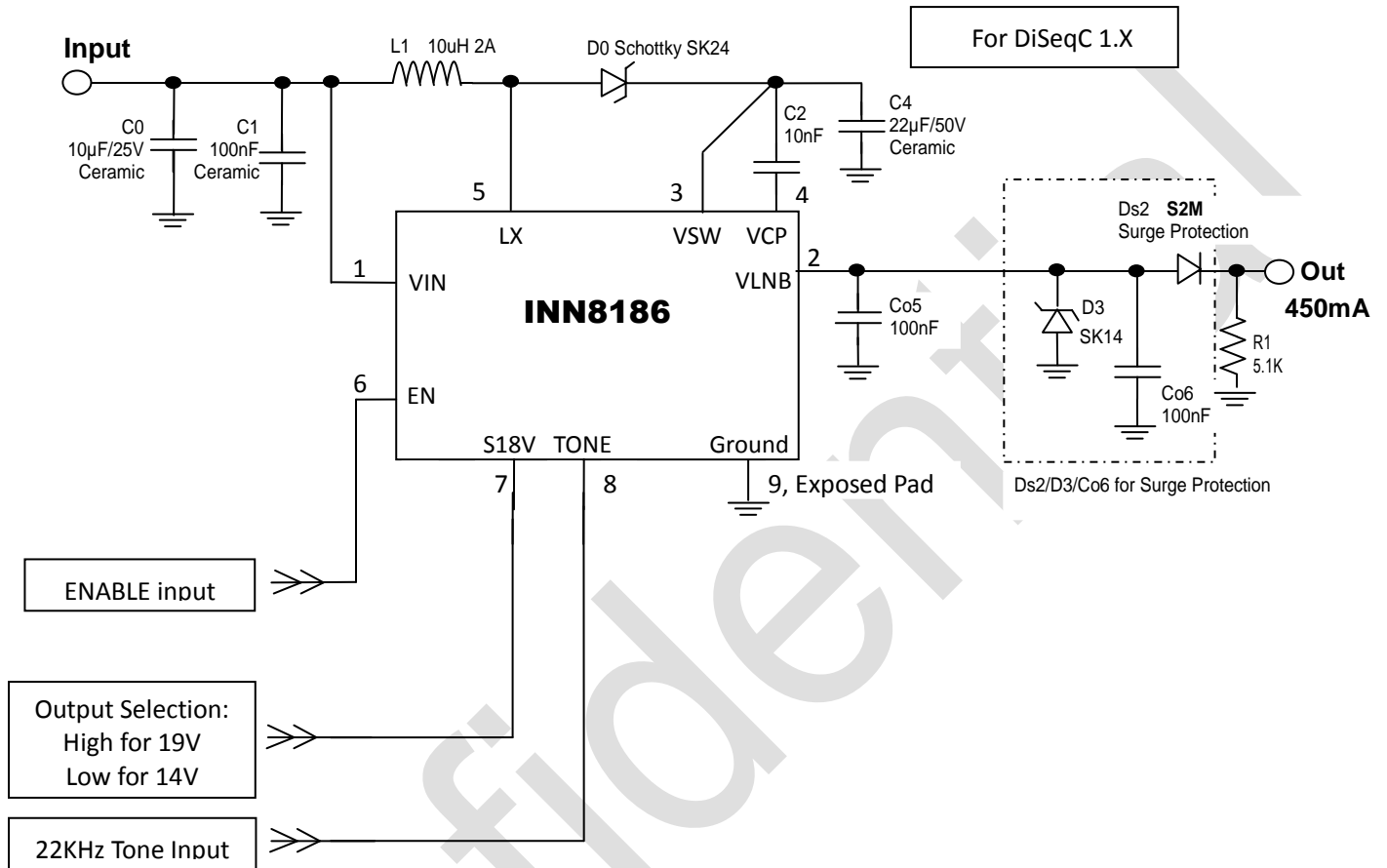
Notes:

1) Exposed pad has to be connected to GA and GP ground shortly;
2) C4 should be very close to VSW pin and GP pin, which can reduce noise largely
3) C1 should be very close to VIN pin
4) Co5 should be very close to VLNB pin
5) R1 (5.1Kohm, 1206) is only for no loading's 22KHz Tone waveform due to that Ds2 diode switches off sinking current into VLNB pin.
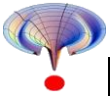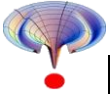
2) Optional Application with Less Drop Voltage
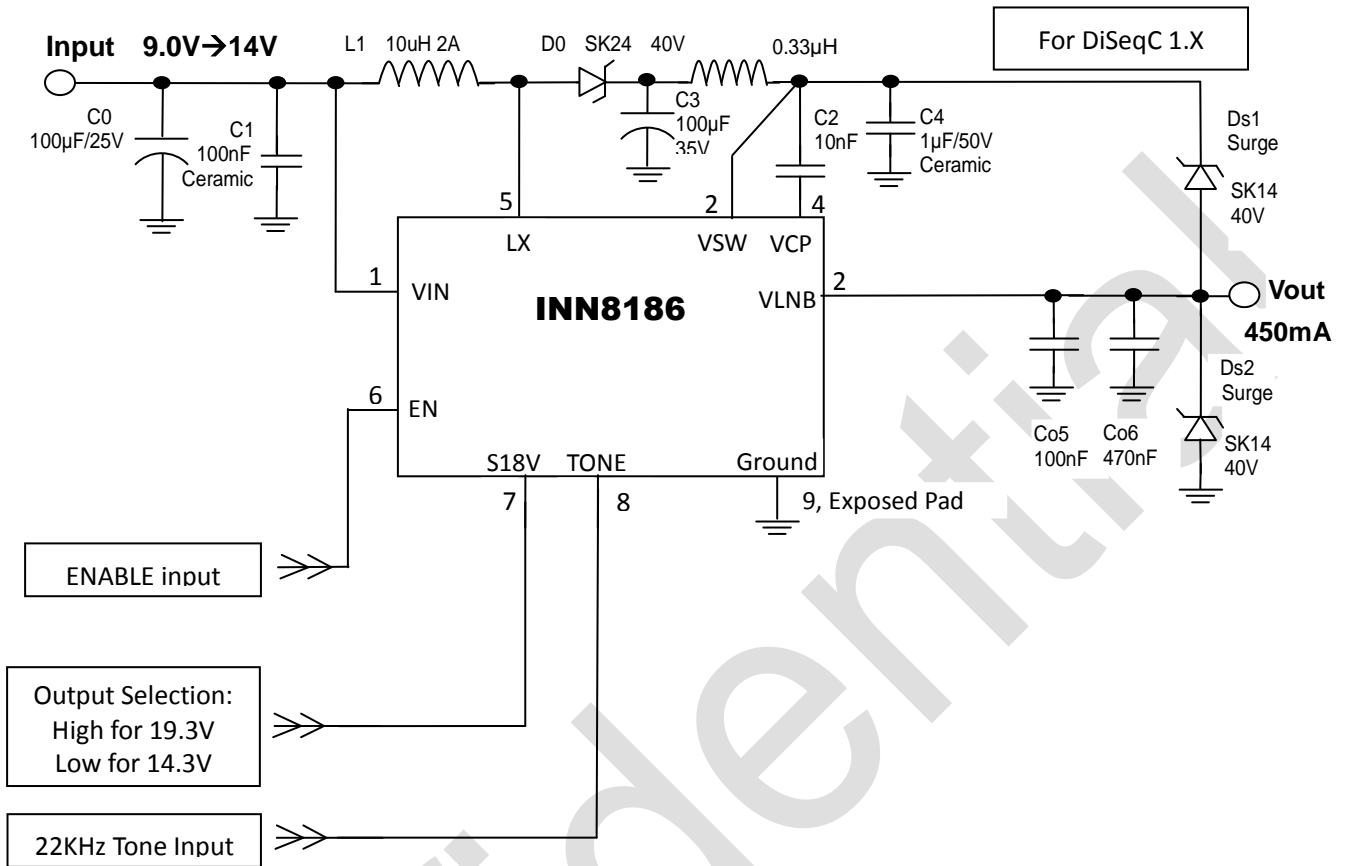
Notes:

1) **Exposed pad has to be connected to GA and GP ground shortly;**
2) **C4 should be very close to VSW pin and GP pin, which can reduce noise largely**
3) **C1 should be very close to VIN pin**
4) **Co5 should be very close to VLNB pin**

FUNCTION DESCRIPTION

The INN8186 single output LNB supply utilizes built-in DC/DC step-up converters, which operate from 9V to 14V and outputs the low noise voltage set by S18V pin, and accepts a tome modulated DiSEqC command and transfers it symmetrically to the output to meet DiSEqC 1.x protocol.

DiSEqC Encoding

The TONE accepts an externally modulated tone command and in turn modulates the VLNB symmetrically to meet the DiSEqC 1.x and with few more external components to meet DiSEqC 2.0 transmit protocol. Burst coding of the tone can be accomplished due to the fast response of the TONE pin.

Linear Regulator

The output linear regulator is designed to source 450mA continuous current and 500mA peak.

In order to minimize the power dissipation, the output voltage of the internal step-up converter is adjusted to allow the linear regulator to work at a minimum dropout of 1.2V typical (Load current =450mA) between the VSW and VOUT pin. The VSEN pin is capable of withstanding a back voltage of 24V.

When the device is put in the shutdown mode (EN = LOW), the PWM power block is disabled, a back diode need to be inserted to VLNB output to block reverse current if parallel with other LNB output.

When the regulator blocks are active (EN = HIGH), the output can be controlled by S18V pin to be 14.3V or 19.3V   for remote controlling
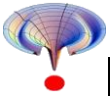
Short and Over Load Protection

When the LDO current exceeds the preset overcurrent threshold set by means of a resistor from the ILIM pin to GND for a period of 45ms, the device enters a   TON = 45ms/TOFF = 1800ms routine. The device returns to normal operation after a successful soft-start cycle
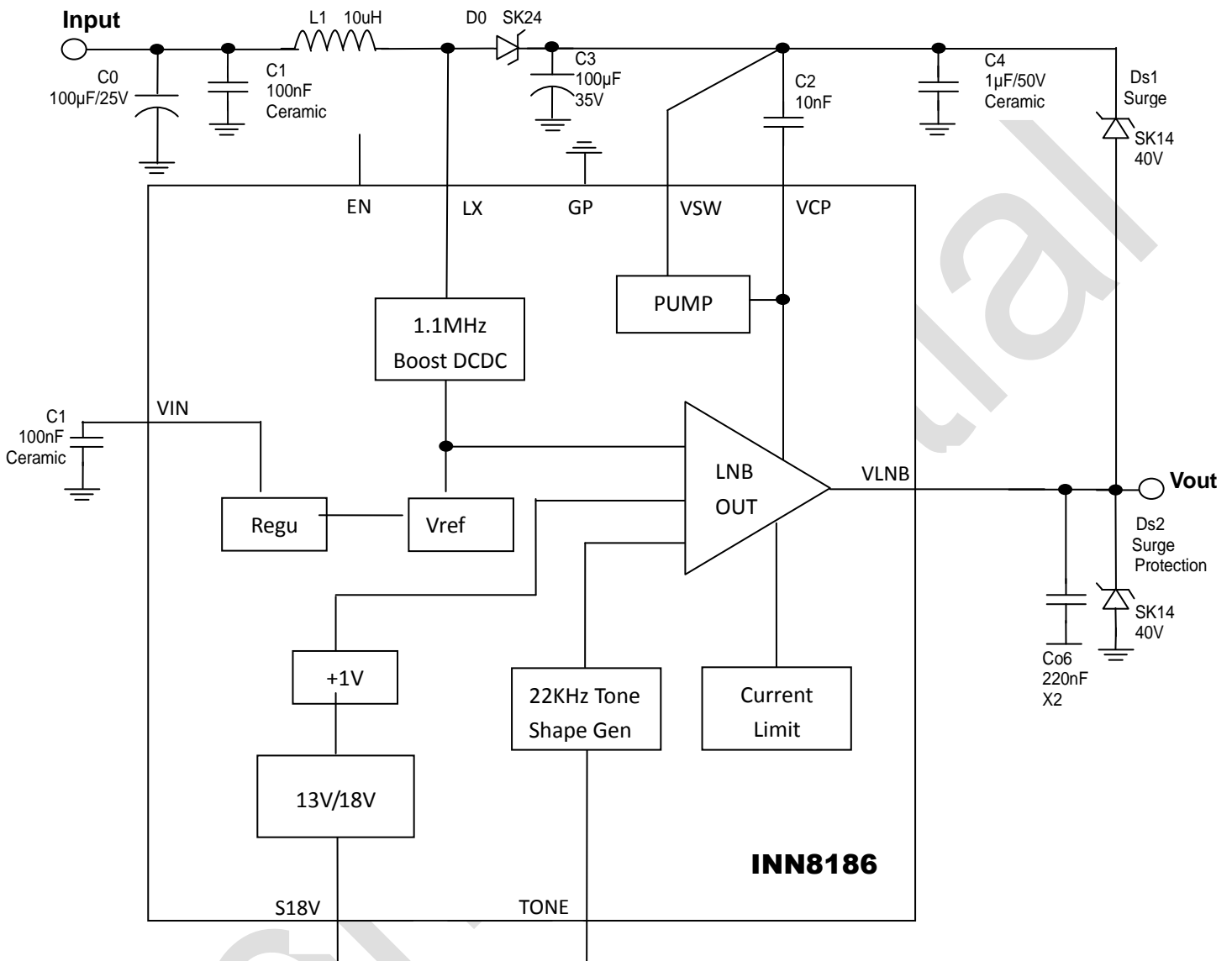
This IC is protected against overheating. When the junction temperature exceeds +160°C (typical), the step-up converter and the linear regulator are shut-off. When the junction is cooled down to +135°C (typical), normal operation is resumed.
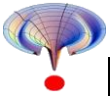
Tone input (TONE pin)

Once EN is pulled high, after a 50ms delay before applying 22kHz/44kHz, 50% square pulse on TONE pin generates the DISEQ tone (+/-320mV) on the output VLNB.
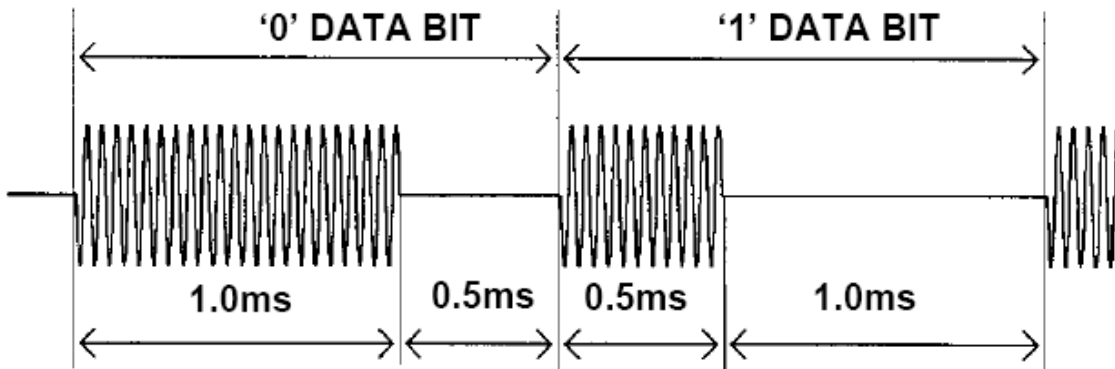
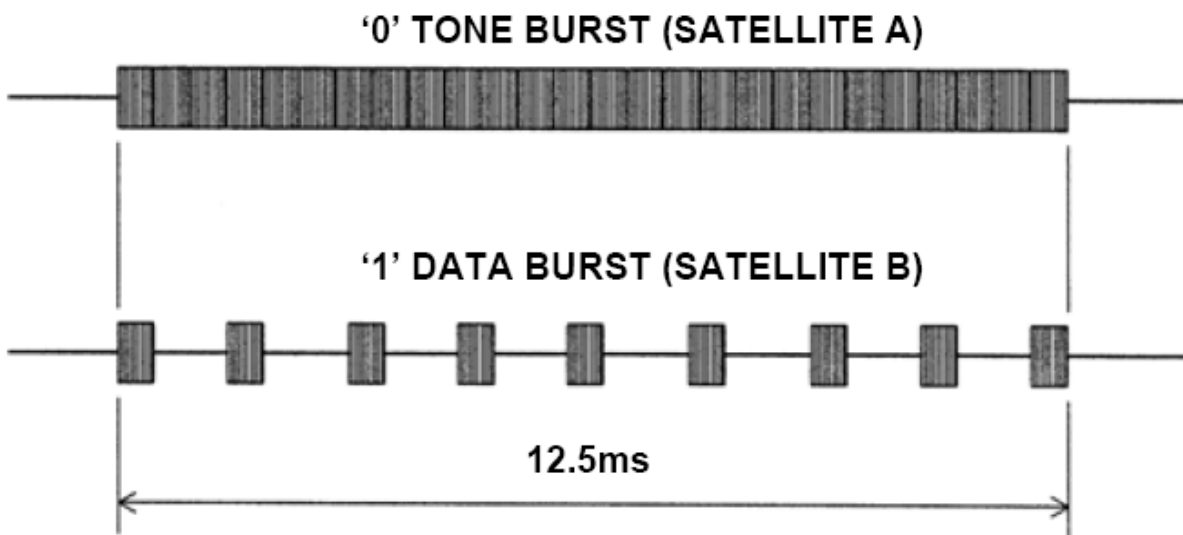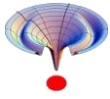Confidential   INNOTECH Proprietary Information. Unauthorized Photocopy and Duplication Prohibited

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LNB INTERNAL BLOCK DIAGRAM

DiSeqC Modulation Scheme

Timing Diagram for 22KHz Tone Burst Control Signal

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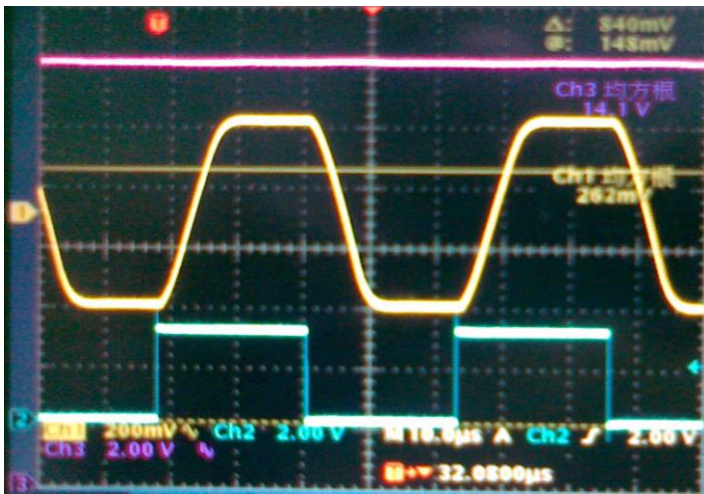
TYPICAL PERFORMANCE CURVES

Figure.1   22KHz Tone ON 13.3Vout with 100mA Loading

Figure.2   22KHz Tone ON 13.3Vout with Transient Loading
(100mA → 400mA → 100mA, slew rate 255mA/7.5us)

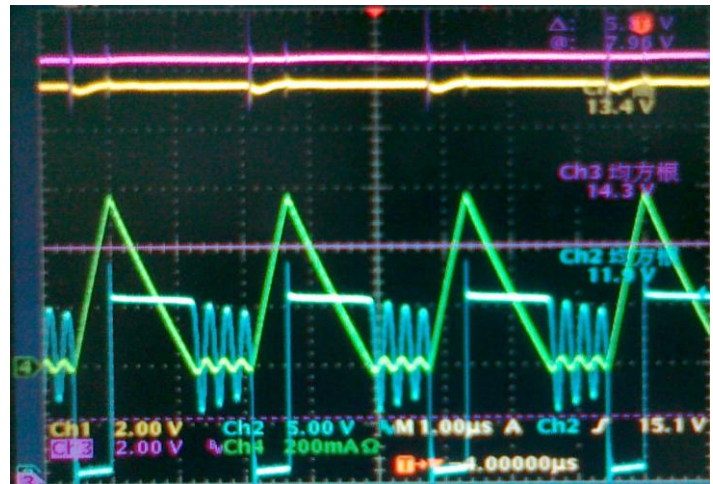Figure.3   22KHz Tone Rising (7.5us) /Falling (7.5us) Edge

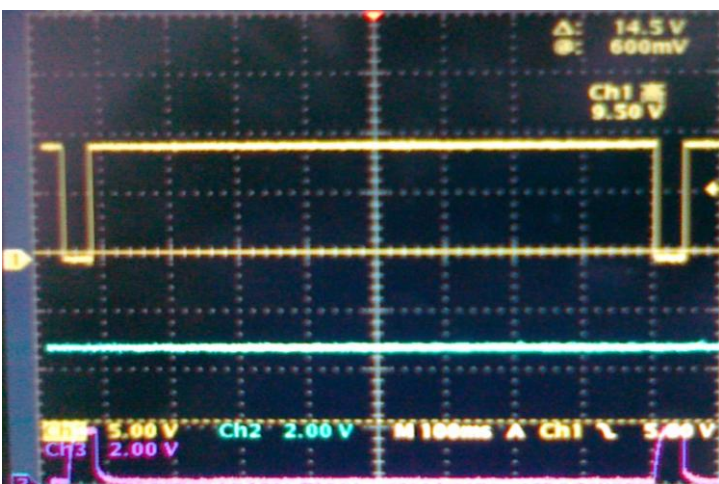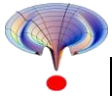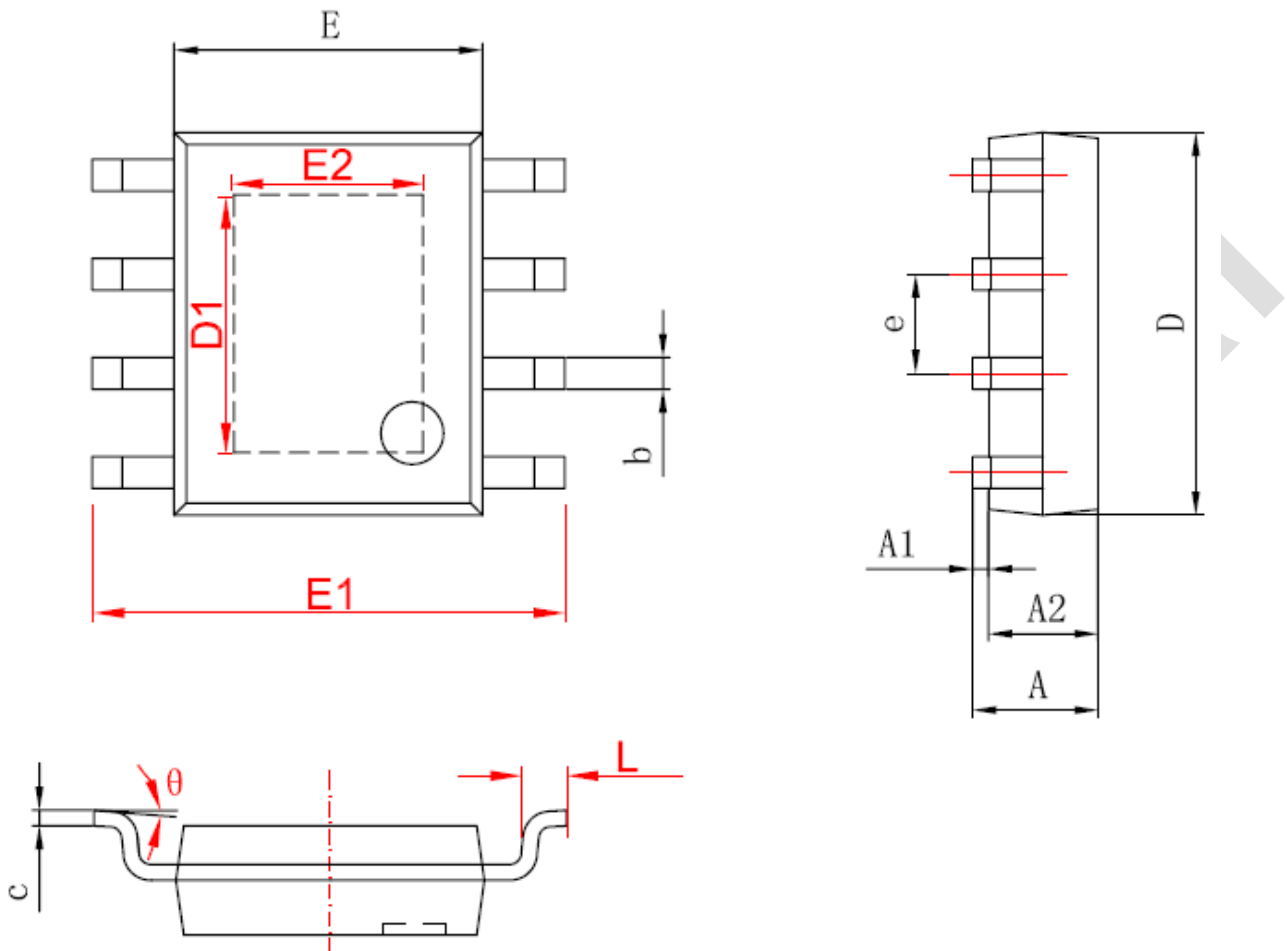Figure.4   PWM Wave (DCM) with light loading

Figure.5   800ms Off/ 45ms ON when Output Shorted

PACKAGE INFORMATION

字符	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.150	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°