

8283

Data Sheet  
27448

## PRELIMINARY INFORMATION

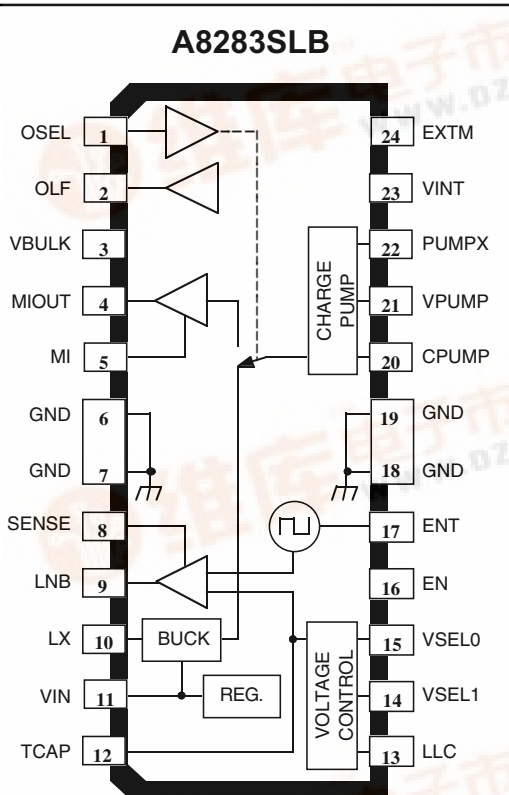
(Subject to change without notice)  
November 21, 2000LNB SUPPLY AND  
CONTROL-VOLTAGE REGULATOR

Intended for analog and digital satellite receivers, the low-noise block converter regulator (LNBR) is a monolithic linear and switching voltage regulator designed to provide power and interface signals to the LNB down converter via the coaxial cable. If the device is in stand-by mode (EN terminal LOW), the regulator output is disabled, allowing the antenna downconverters to be supplied or controlled by other satellite receivers sharing the same coaxial cable. Similar two-output LNB supply and control voltage regulators are the A8284SB/SLB.

For slave operation in single-dish dual-receiver systems, the bypass function is implemented by an electronic switch between the master input terminal (MI) and the LNB terminal, leaving all LNB power and control functions to the master receiver. This electronic switch is closed if the device is powered, EN is HIGH, and OSEL is LOW.

The regulator outputs are set to 12, 13, 18, or 20 V by the VSEL terminals. Additionally, it is possible to increase the selected voltage by 1 V to compensate for the voltage drop in the coaxial cable (LLC terminal HIGH). The LNBR combines a tracking switching regulator and low-noise linear regulator. Logic inputs (VSEL0, VSEL1, and LLC) select the desired output voltage. A tracking current-mode buck converter provides the linear regulator with an input voltage that is set to the output voltage plus typically 0.8 V. This maintains constant voltage drop across the linear regulator while permitting adequate voltage range for tone injection.

The device is supplied in a 24-pin plastic DIP with batwing tabs (A8283SB), or a 24-lead SOIC power-tab package (A8283SLB). In both cases, the power tab is at ground potential and needs no electrical isolation.



Dwg. PP-072A

Note that the A8283SB (dual in-line package) and A8283SLB (small-outline IC package) are electrically identical and share a common terminal number assignment.

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage,  $V_{IN}$  ..... 47 VOutput Current,  $I_O$  .... Internally Limited

Logic Input Voltage Range,

 $V_I$  ..... -0.5 V to +7 V

Bypass Switch Current,

 $I_{SW}$  ..... Internally LimitedFlag Output Voltage,  $V_{OLF}$  ..... 7 V

Operating Temperature Range,

 $T_A$  ..... -20°C to +85°C

Storage Temperature Range,

..... -40°C to +150°C

## FEATURES

- Short-Circuit Protected Bypass Function for Slave Operation
- LNB Selection and Stand-By Function
- Built-In Tone Oscillator Factory Trimmed to 22 kHz, Facilitates DiSeQ™ (a trademark of EUTELSAT) Encoding
- Full Modulation With No Load
- Tracking Switch-Mode Power Converter for Lowest Dissipation
- Externally Adjustable Short-Circuit Protection
- LNB Short-Circuit Protection and Diagnostics
- Auxiliary Modulation Input
- Cable Length Compensation
- Internal Over-Temperature Protection

*This device incorporates features that have patents pending.*

Always order by complete part number, e.g., **A8283SLB**.



# FUNCTIONAL BLOCK DIAGRAM

The diagram illustrates the internal architecture of the FP-051 power management IC. Key components and connections include:

- Inputs:** VINT (input voltage), EN (enable), ENT (enable threshold), OLF (output load fault), VSEL0, VSEL1, LLC (load regulation control), TCAP (temperature compensation), MI (microcontroller interface), MIOUT (microcontroller interface output), LNB (load noise bypass), and EXTM (external temperature measurement).
- Internal Blocks:**
  - Voltage Reg.:** A 5V regulator block.
  - Charge Pump:** A 176 kHz charge pump block.
  - Boost Voltage:** A 7V boost voltage block.
  - Buck Conv.:** A buck converter block.
  - Comparators:** Two comparators with thresholds of 150 mV and 800 mV.
  - Logic:** A 352 kHz oscillator, a 22 kHz tone generator, and a +8 & Waveshaping block.
  - Transistors:** MOSFETs for the buck converter and output stage.
  - Resistors:** Various resistors for feedback and sensing, including 25 kΩ, 5 kΩ, and 1 kΩ.
  - Capacitors:** Various capacitors for filtering and timing, including 176 kHz, 352 kHz, and 22 kHz.
- Outputs:** The main output is connected to a load (LX) through an inductor and capacitor, with a sense resistor (RS) for current sensing.

VSEL0	VSEL1	LLC	V <sub>LNB(typ)</sub>
L	L	L	13 V
L	L	H	14 V
L	H	L	18 V
L	H	H	19 V
H	L	L	12 V
H	L	H	13 V
H	H	L	20 V
H	H	H	21 V

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**LNB SUPPLY AND**  
**CONTROL-VOLTAGE REGULATOR**

**ELECTRICAL CHARACTERISTICS** at  $T_A = 25^\circ\text{C}$ , ENT = L, EN = H, OSEL = H, LLC = L,  $V_{IN} = 24\text{ V}$ ,  $I_O = 50\text{ mA}$  (unless otherwise noted).

Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units
Supply Voltage	$V_{IN}$	$I_O = 600\text{ mA}$ , VSEL0 = L, VSEL1 = L, LLC = L	—	$3.3 + \Delta V_{BUCK}$	47	V
Output Voltage	$V_O$	$I_O = 600\text{ mA}$ , VSEL0 = L, VSEL1 = L, LLC = L	12.5	13	13.5	V
		$I_O = 600\text{ mA}$ , VSEL0 = L, VSEL1 = L, LLC = H	13.4	14	14.6	V
		$I_O = 600\text{ mA}$ , VSEL0 = L, VSEL1 = H, LLC = L	17.3	18	18.7	V
		$I_O = 600\text{ mA}$ , VSEL0 = L, VSEL1 = H, LLC = H	18.2	19	19.8	V
		$I_O = 600\text{ mA}$ , VSEL0 = H, VSEL1 = L, LLC = L	11.5	12	12.5	V
		$I_O = 600\text{ mA}$ , VSEL0 = H, VSEL1 = L, LLC = H	12.5	13	13.5	V
		$I_O = 600\text{ mA}$ , VSEL0 = H, VSEL1 = H, LLC = L	19.2	20	20.8	V
		$I_O = 600\text{ mA}$ , VSEL0 = H, VSEL1 = H, LLC = H	20.2	21	21.8	V
Line Regulation	$\Delta V_O$	$V_O = 13\text{ V}$ , $V_I = 16\text{ to }40\text{ V}$	—	4.0	40	mV
		$V_O = 18\text{ V}$ , $V_I = 21\text{ to }40\text{ V}$	—	4.0	40	mV
Load Regulation	$\Delta V_O$	$V_O = 13\text{ or }18\text{ V}$ , $I_O = 50\text{ to }600\text{ mA}$	—	80	180	mV
Current-Limiting Threshold	$V_{OM(th)}$		125	135	145	mV
Tone Frequency	$f_{tone}$	ENT = H	20	22	24	kHz
Tone Amplitude	$V_{tone(PP)}$	ENT = H	550	680	800	mV
Tone Duty Cycle	$dc_{tone}$	ENT = H	40	50	60	%
Tone Rise or Fall Time	$t_r, t_f$	ENT = H	5.0	10	15	$\mu\text{s}$
External Modulation Gain	$G_{mod}$	$\Delta V_O / \Delta V_{mod}$ , $f = 10\text{ Hz to }40\text{ kHz}$	—	5.0	—	V/V
External Modulation Input Voltage	$V_{mod(PP)}$	AC coupling	—	—	160	mV
External Modulation Impedance	$Z_{mod}$	$f = 10\text{ Hz to }40\text{ kHz}$	—	5.0	—	k $\Omega$

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## LNB SUPPLY AND CONTROL-VOLTAGE REGULATOR

**ELECTRICAL CHARACTERISTICS** at  $T_A = 25^\circ\text{C}$ , ENT = L, EN = H, OSEL = H, LLC = L,  $V_{IN} = 24\text{ V}$ ,  $I_{OUT} = 50\text{ mA}$  (unless otherwise noted).

Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units
Overload Flag Logic Low	$V_{OL}$	$I_{OL} = 8\text{ mA}$	—	0.28	—	V
Overload Flag Leakage Current	$I_{OZ}$	$V_{OH} = 5.5\text{ V}$	—	<1.0	—	$\mu\text{A}$
Logic Input Voltage	$V_{IL}$		—	—	0.8	V
	$V_{IH}$		2.0	—	—	V
Logic Input Current	$I_{IH}$	$V_{IH} = 5\text{ V}$	—	<1.0	—	$\mu\text{A}$
Supply Current	$I_{IN}$	Outputs disabled (EN = L)	—	0.5	—	mA
		ENT = H, $I_O = 600\text{ mA}$ , $V_O = 13\text{ V}$	—	382	—	mA
Thermal Shutdown Temp.	$T_J$		—	165	—	$^\circ\text{C}$
Linear Regulator Voltage Drop	$\Delta V_{BUCK}$	$V_{BULK} - V_O$	—	0.8	—	V
Switching Frequency	$f_O$	$16 \cdot f_{tone}$	320	352	384	kHz
Bypass Switch Current Limit	$I_{swM}$	OSEL = L	630	900	—	mA
Bypass Switch Voltage Drop (MI to LNB)	$V_{sw}$	OSEL = L, $I_{sw} = 300\text{ mA}$	—	0.15	—	V

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**LNB SUPPLY AND**  
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## FUNCTIONAL DESCRIPTION

The ENT (Tone Enable) terminal activates the internal tone signal, modulating the dc output with a  $\pm 0.3$  V, 22 kHz symmetrical waveform. The internal oscillator is factory-trimmed to provide a tone of 22 kHz  $\pm 2$  kHz. No further adjustment is required. The internal oscillator operates the buck converter at 16 times the tone frequency.

Burst coding of the 22 kHz tone can be accomplished due to the fast response of the ENT input and rapid tone response. This allows implementation of the DiSEqC™ protocols.

To improve design flexibility and to allow implementation of proposed LNB remote control standards, an analog modulation input terminal is available (EXTM). An appropriate dc-blocking capacitor must be used to couple the modulating signal source to the EXTM terminal. If external modulation is not used, the EXTM terminal can be left open.

The output linear regulator will sink and source current. This feature allows full modulation capability into capacitive loads as high as 0.25  $\mu$ F.

The programmed output voltage rise and fall times can be set by an internal 25 k $\Omega$  resistor and an external capacitor located on the TCAP terminal. Although any value of capacitor is permitted, practical values are typically 0.001  $\mu$ F to 0.02  $\mu$ F. This feature only affects the turn on and programmed voltage rise and fall times. Modulation is unaffected by the choice of TCAP. This terminal can be left open if voltage rise and fall time control is not required.

Two terminals are dedicated to the over-current protection/monitoring: SENSE and OLF. The LNB output is current limited. The short-circuit protection threshold is set by the value of an external resistor,  $R_S$ , between terminals 3 and 8.  $R_S = V_{OM(th)}/I_{OM}$  where  $V_{OM(th)}$  is the current-limiting threshold voltage and  $I_{OM}$  is the desired current limit value. The minimum recommended value for  $R_S$  is 0.17  $\Omega$ .

In operation, the short-circuit protection produces current fold-back at the input due to the tracking converter. If the output is shorted, the linear regulator will limit the output current to  $I_{OM}$ . The tracking converter will maintain a constant voltage drop of 0.8 V across the linear regulator. This condition results in typically 550 mW dissipation ( $I_{OM} \cdot 0.8$  V). Short-circuit or thermal-shutdown activation will cause the OLF terminal, an open-drain diagnostic output flag, to go LOW.

Thermal resistance:

DIP —  $R_{\theta JA} = 40^\circ\text{C/W}$ ,  $R_{\theta JT} = 6^\circ\text{C/W}$ ,

SOIC —  $R_{\theta JA} = 55^\circ\text{C/W}$ ,  $R_{\theta JT} = 6^\circ\text{C/W}$ .

The device junction temperature should be kept below 150°C. Thermal shut-down circuitry turns off the device if junction temperature exceeds +165°C typically.

*The products described here are manufactured under one or more U.S. patents or U.S. patents pending.*

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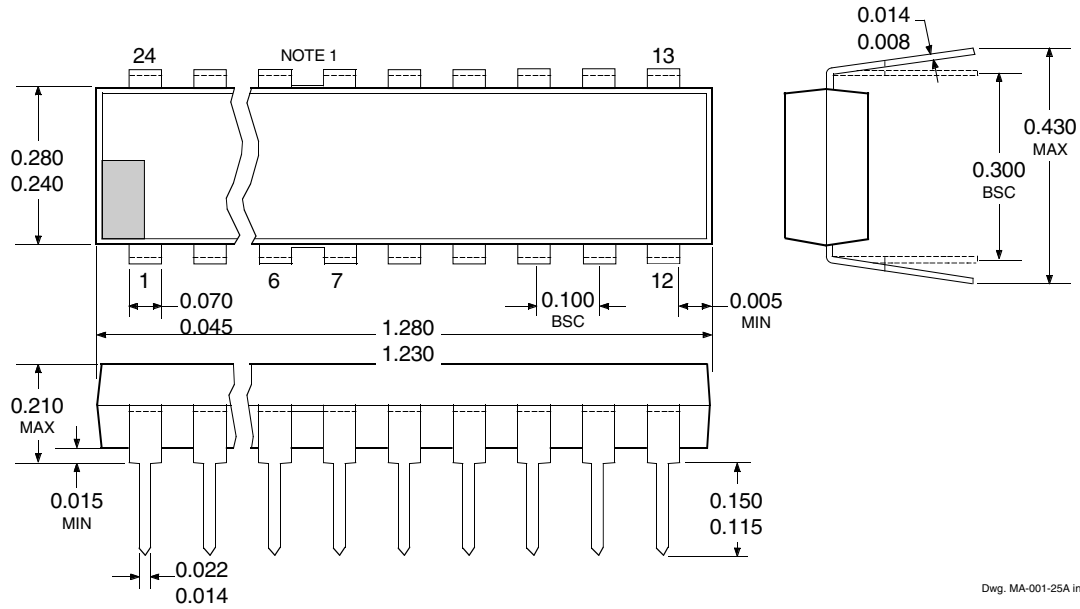
## LNB SUPPLY AND CONTROL-VOLTAGE REGULATOR

### Terminal Configuration

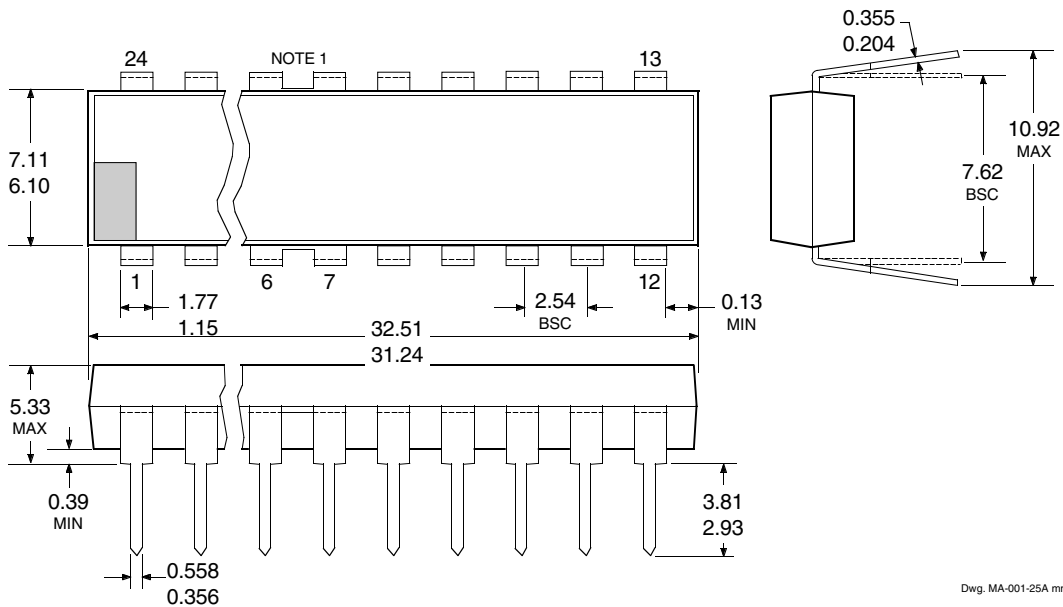
Symbol	Terminal	Function
OSEL	1	Logic input: selects between LNB on (when high) and bypass switch closed (when low)
OLF	2	Overload flag output: low when $I_O > I_{OM}$ or $I_O > I_{SWM}$ or $T_J > 165^\circ\text{C}$ , high when $I_O < I_{OM}$ and $I_O < I_{SWM}$ and $T_J < 130^\circ\text{C}$
VBULK	3	Tracking supply voltage to linear regulators
MIOUT	4	Output voltage from MI (connect to terminal 9)
MI	5	Master input
GND	6, 7	Ground
SENSE	8	Current limit setup resistor
LNB	9	Output voltage to LNB (connect to terminal 4)
LX	10	Inductor drive point
VIN	11	Supply input voltage (minimum, $V_{LNB} + 2.5\text{ V}$ )
TCAP	12	Capacitor for setting the rise and fall time of the outputs
LLC	13	Logic input: when high, increases output voltage by 1 V for line length compensation
VSEL1	14	Logic input: output voltage select
VSEL0	15	Logic input: output voltage select
EN	16	Logic input: when high, enables device
ENT	17	Logic input: when high, enables internal 22 kHz modulation
GND	18, 19	Ground
CPUMP	20	High side of charge-pump capacitor
VPUMP	21	Gate supply voltage for high-side drivers
PUMPX	22	Charge-pump drive
VINT	23	Bypass capacitor for internal voltage reference
EXTM	24	External modulation input

# 8283 LNB SUPPLY AND CONTROL-VOLTAGE REGULATOR

## A8283SB Dimensions in Inches (controlling dimensions)



## Dimensions in Millimeters (for reference only)



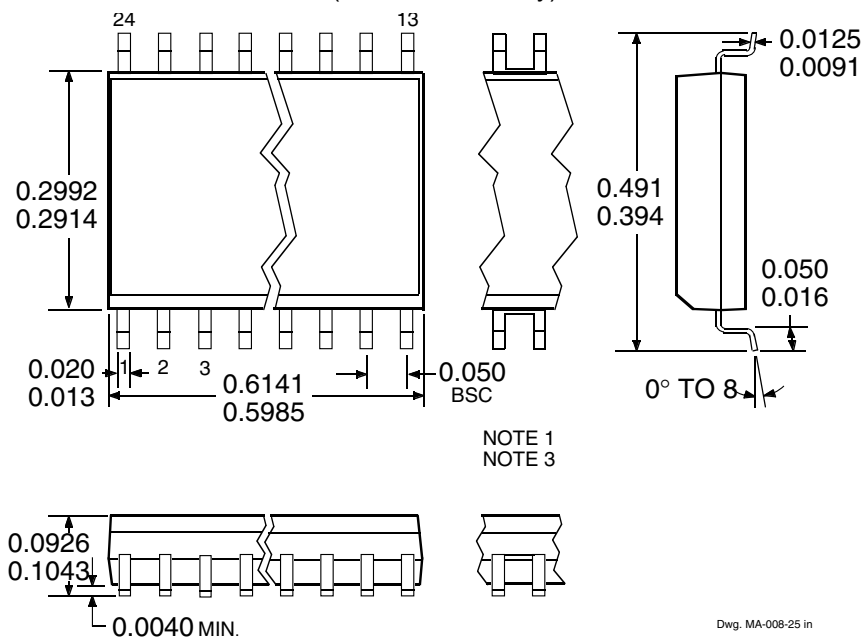
- NOTES: 1. Webbed lead frame. Leads 6, 7, 18, and 19 are internally one piece.  
2. Exact body and lead configuration at vendor's option within limits shown.  
3. Lead spacing tolerance is non-cumulative  
4. Lead thickness is measured at seating plane or below.

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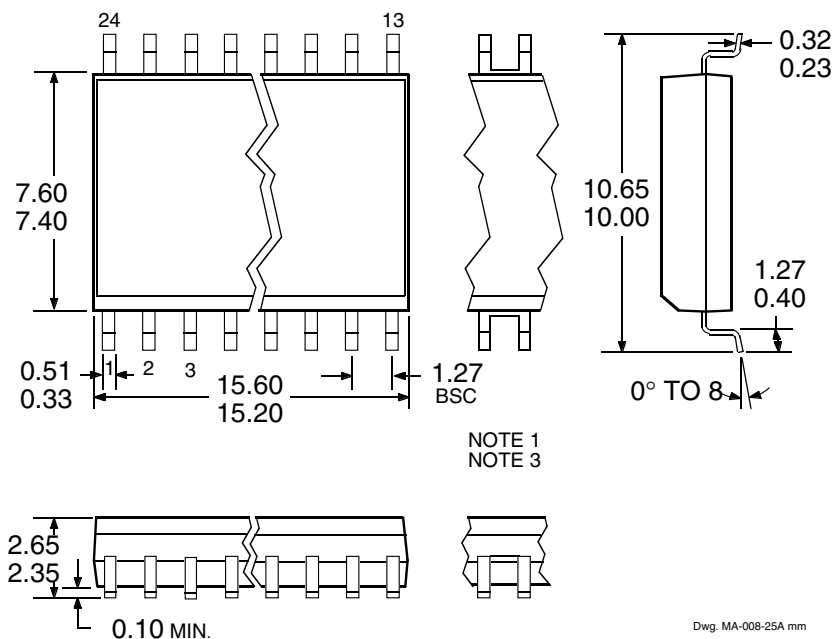
## LNB SUPPLY AND CONTROL-VOLTAGE REGULATOR

### A8283SLB

Dimensions in Inches  
(for reference only)



Dimensions in Millimeters  
(controlling dimensions)



- NOTES: 1. Exact body and lead configuration at vendor's option within limits shown.  
2. Lead spacing tolerance is non-cumulative  
3. Webbed lead frame. Leads 6, 7, 18, and 19 are internally one piece.