8283

LNB SUPPLY AND CONTROL-VOLTAGE REGULATOR

A8283SLB

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 V**
Output Current, I_O .... **1.0 A**
Logic Input Voltage Range,
   V_I .... **-0.5 V to +7 V**
Bypass Switch Current,
   I_{SW} .... **Internally Limited**
Flag Output Voltage, V_{OLF} .... **7 V**
Operating Temperature Range,
   T_A .... **-20°C to +85°C**
Storage Temperature Range,
   T_S .... **-40°C to +150°C**

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 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 (V_{SEL0}, V_{SEL1}, 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.

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 DiSEqC™ (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.

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FUNCTIONAL BLOCK DIAGRAM
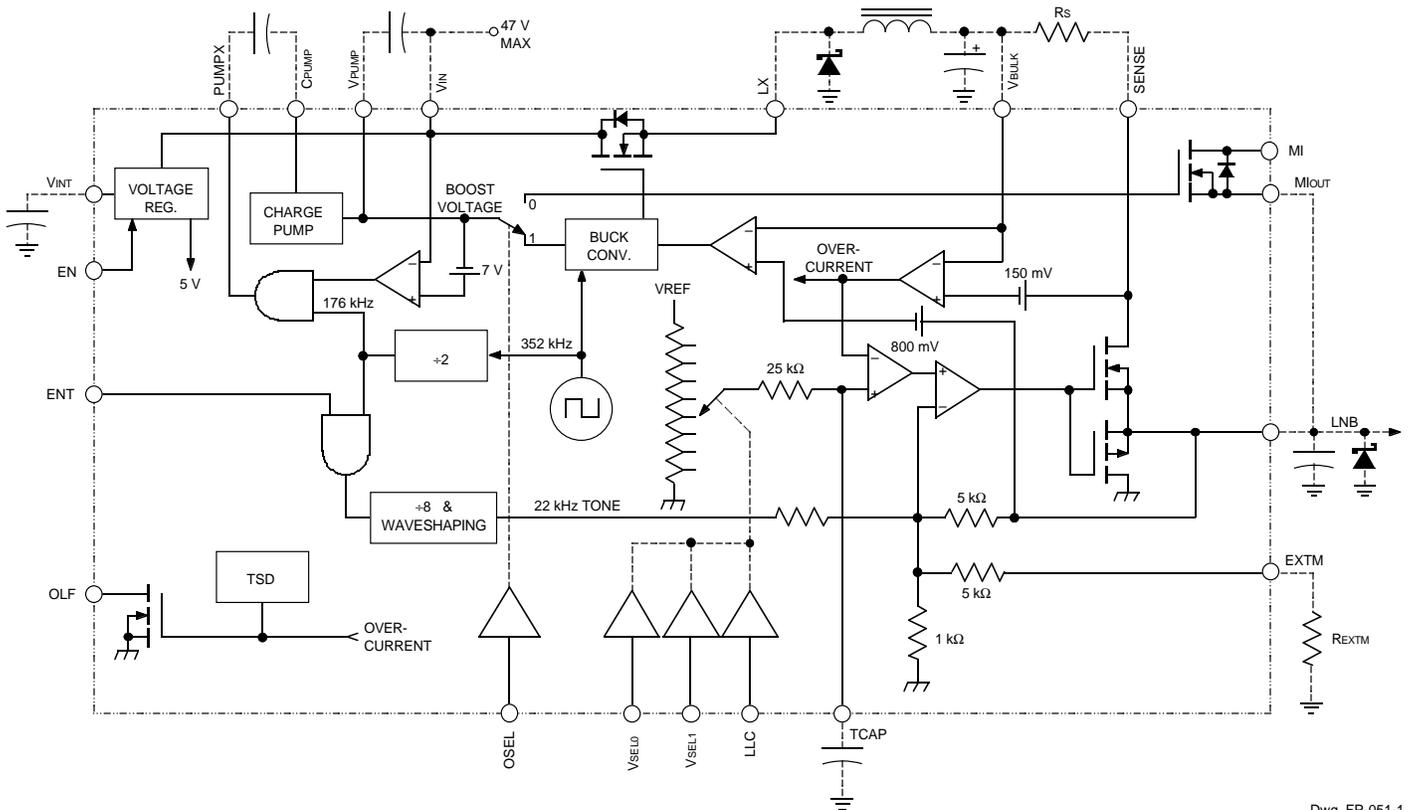
Dwg. FP-051-1

Output Voltage Select Table

VSEL0	VSEL1	LLC	$V_{LNB(typ)}$
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

ELECTRICAL CHARACTERISTICS at T_A = 70°C, ENT = L, EN = H, OSEL = H, LLC = L, I_O = 50 mA (unless otherwise noted).

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
			Limits			
Supply Voltage	V_{IN}	I_O = 500 mA, VSEL0 = L, VSEL1 = L, LLC = L	5.5 + V_O	—	47	V
Output Voltage	V_O	I_O = 500 mA, VSEL0 = L, VSEL1 = L, LLC = L	12.5	13	13.8	V
		I_O = 500 mA, VSEL0 = L, VSEL1 = L, LLC = H	13.4	14	14.9	V
		I_O = 500 mA, VSEL0 = L, VSEL1 = H, LLC = L	17.3	18	18.7	V
		I_O = 500 mA, VSEL0 = L, VSEL1 = H, LLC = H	18.2	19	19.8	V
		I_O = 500 mA, VSEL0 = H, VSEL1 = L, LLC = L	11.5	12	12.8	V
		I_O = 500 mA, VSEL0 = H, VSEL1 = L, LLC = H	12.5	13	13.8	V
		I_O = 500 mA, VSEL0 = H, VSEL1 = H, LLC = L	19.2	20	20.8	V
		I_O = 500 mA, VSEL0 = H, VSEL1 = H, LLC = H	20.2	21	21.8	V
Load Regulation	ΔV_O	V_O = 13 or 18 V, I_O = 50 to 500 mA	—	80	220	mV
Current-Limiting Threshold	$V_{OM(th)}$		125	145	160	mV
Tone Frequency	f_{tone}	ENT = H	20	22	24	kHz
Tone Amplitude	$V_{tone(PP)}$	ENT = H, V_O = 13 or 18 V, I_O = 500 mA	400	680	800	mV
External Modulation Output	$V_{mod(out)}$	ENT = L, I_O = 500 mA, R_{EXTM} = 200 kΩ, $V_{mod(PP)}$ = 130 mV, f = 22 kHz	400	500	800	mV
Tone Duty Cycle	dc_{tone}	ENT = H	—	50	—	%
Tone Rise or Fall Time	t_r, t_f	ENT = H	—	10	—	µs
External Modulation Gain	A_{mod}	R_{EXTM} = 200 kΩ, $V_{mod(PP)}$ = 130 mV, f = 22 kHz	—	4.6	—	V/V
External Modulation Input Voltage	$V_{mod(PP)}$	AC coupling	—	—	160	mV
External Modulation Input Impedance	Z_{mod}	f = 22 kHz	4.0	7.0	10	kΩ

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ELECTRICAL CHARACTERISTICS at T_A = 25°C, ENT = L, EN = H, OSEL = H, LLC = L, V_{IN} = 24 V, V_O = 13 V or 18 V, I_O = 50 mA, R_{EXTM} = open (unless otherwise noted).

Characteristic	Symbol	Test Conditions	Limits			Units
			Min.	Typ.	Max.	
Overload Flag Logic Low	V_{OL}	I_{OL} = 8 mA	—	0.28	0.8	V
Overload Flag Leakage Current	I_{OZ}	V_{OH} = 6 V	—	<1.0	10	µA
Logic Input Voltage	V_{IL}		—	—	0.8	V
	V_{IH}		2.0	—	—	V
Logic Input Current	I_{IL}	V_{IL} = 0 V	—	<-1.0	-10	µA
	I_{IH}	V_{IH} = 5 V	—	<1.0	10	µA
Supply Current	I_{IN}	Output disabled (EN = L)	—	0.2	1.0	mA
		Output enabled, ENT = H, I_O = 0, V_O = 13 V	—	7.5	15	mA
Thermal Shutdown Temp.	T_J		—	165	—	°C
Linear Regulator Voltage Drop	ΔV_{BUCK}	$V_{BULK} - V_O$	—	0.8	—	V
Switching Frequency	f_O	16 x f_{tone}	320	352	384	kHz
Bypass Switch Current Limit	I_{swM}	OSEL = L	400	900	—	mA
Bypass Switch Voltage Drop (MI to LNB)	V_{sw}	OSEL = L, I_{sw} = 300 mA	—	0.15	—	V

FUNCTIONAL DESCRIPTION

The ENT (Tone Enable) terminal activates the internal tone signal, modulating the dc output with a ±0.3 V, 22 kHz symmetrical waveform. The internal oscillator is factory-trimmed to provide a tone of 22 kHz ±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 should be decoupled with a 0.1 µF capacitor.

Applications that are required to deliver more than 400 mA and use the external modulation terminal should be rebiased to increase the voltage drop across the linear regulator. This will allow full modulation under all conditions.

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FUNCTIONAL DESCRIPTION (cont'd)

This can be accomplished by connecting a 200 kΩ resistor from the external modulation terminal (24) to ground. This will reduce the LNB output voltage by typically 300 mV without effecting the V_{BULK} voltage. The output voltage can be restored to the programmed value by connecting a 1 MΩ resistor from the V_{INT} terminal (23) to the T_{CAP} terminal (12). This raises both V_{BULK} and V_O by typically 300 mV.

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

The programmed output voltage rise and fall times can be set by an internal 25 kΩ resistor and an external capacitor located on the TCAP terminal. Typical values are 0.0047 µF to 0.047 µF. This feature only affects the turn on and programmed voltage rise and fall times. Modulation is unaffected by the choice of TCAP.

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 0.15 Ω.

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} x 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 — $R_{\theta JA} = 40°C/W$, $R_{\theta JT} = 6°C/W$, or
SOIC — $R_{\theta JA} = 77°C/W$, $R_{\theta JT} = 6°C/W$.
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.

$R_{\theta JA}$ is measured on typical two-sided PCB with minimal copper ground area. For the SOIC, adding 3.57[2] in copper ground area will reduce the thermal resistance to 49°C/W. See Application Note 29501.5, *Improving Batwing Power Dissipation*.

TerminalConfiguration

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 $T_J > 165°C$, high when $I_O < I_{OM}$ and $I_O < I_{SWM}$ and $T_J < 130°C$
V_{BULK}	3	Tracking supply voltage to linear regulators
MI_{OUT}	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 (V_O) to LNB (connect to terminal 4)
LX	10	Inductor drive point
V_{IN}	11	Supply input voltage (minimum, V_{LNB} + 2.5 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
V_{SEL1}	14	Logic input: output voltage select
V_{SEL0}	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
C_{PUMP}	20	High side of charge-pump capacitor
V_{PUMP}	21	Gate supply voltage for high-side drivers
PUMPX	22	Charge-pump drive
V_{INT}	23	Bypass capacitor for internal voltage reference
EXTM	24	External modulation input

A8283SB

Dimensions in Inches
(controlling dimensions)

Dwg. MA-001-25A in
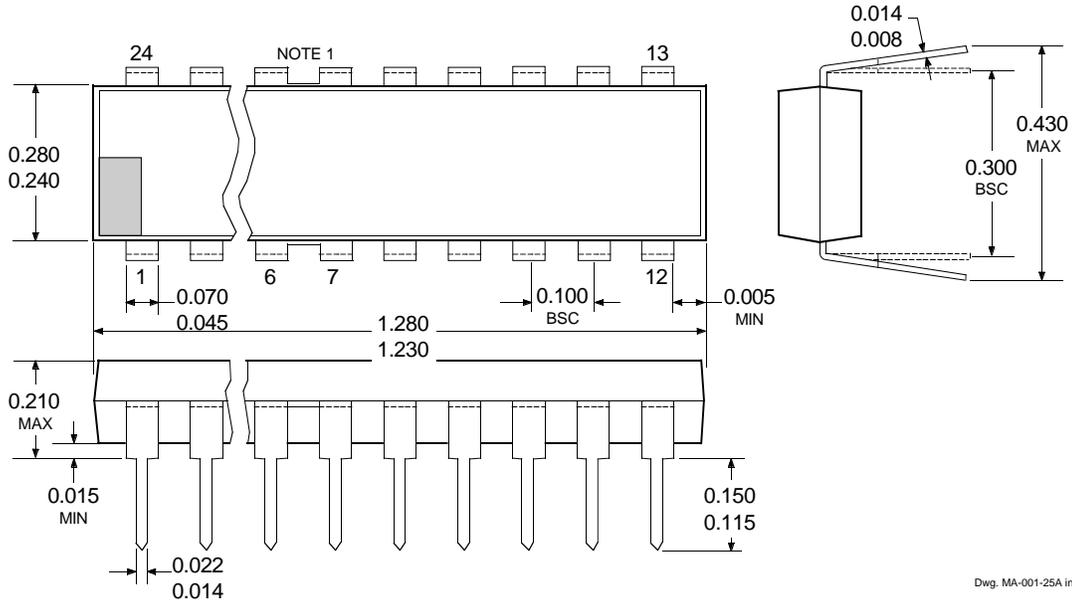
Dimensions in Millimeters
(for reference only)

Dwg. MA-001-25A mm
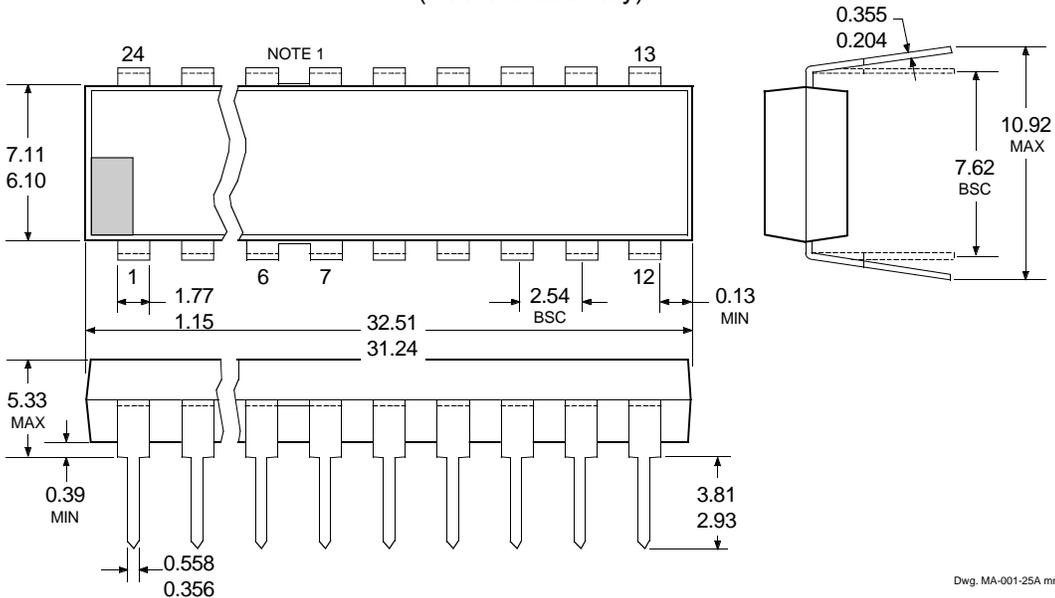
NOTES: 1. Webbed lead frame. Leads 6, 7, 18, and 19 are internally one piece.
2. Exact body and lead configuration at vendor's option within limits shown.
3. Lead spacing tolerance is non-cumulative.
4. Lead thickness is measured at seating plane or below.
5. Supplied in standard sticks/tubes of 15 devices.

A8283SLB
Dimensions in Inches
(for reference only)

24   13

0.2992
0.2914

0.020   1 2 3   0.6141   0.050
0.013   0.5985   BSC

NOTE 1
NOTE 3

0.419
0.394

0.0125
0.0091

0.050
0.016

0° TO 8°

0.0926
0.1043

0.0040 MIN.
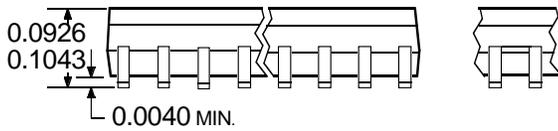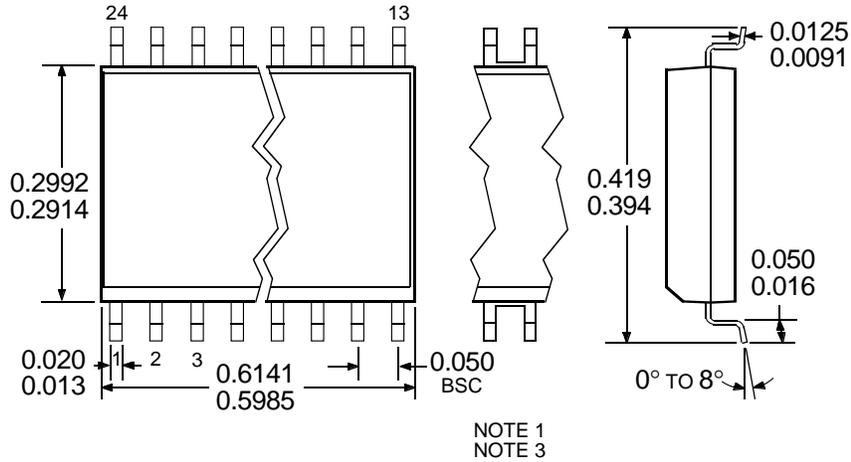
Dwg. MA-008-25A in

Dimensions in Millimeters
(controlling dimensions)

24   13

7.60
7.40

0.51   1 2 3   15.60   1.27
0.33   15.20   BSC

NOTE 1
NOTE 3

10.65
10.00

0.32
0.23

1.27
0.40

0° TO 8°

2.65
2.35

0.10 MIN.
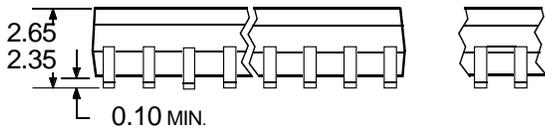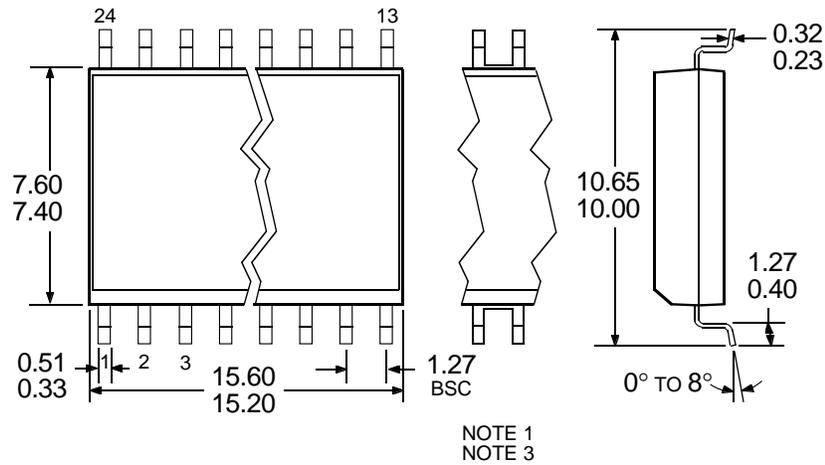
Dwg. MA-008-25A mm

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.
        4. Supplied in standard sticks/tubes of 31 devices or add "TR" to part numbr for tape and reel.