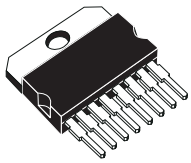
L9484

Alternator voltage regulator

Features

- For air and liquid cooled applications
- Ambient air temperature (thermistor) compensated
- Special default compensation curve with TS-terminal open
- Compensation curve with application specific resistor on TS
- Thermal protection
- Field driver, lamp driver, relay driver, and df (field monitor) short circuit protected
- Load response control
- Single phase autostart



Multiiwatt8

L9484 regulates the output of an automotive generator by controlling the field winding current by means of a variable frequency PWM high side driver.

Description

The L9484 is a monolithic multifunction alternator voltage regulator intended for use in automotive charging applications.

Table 1. Device summary

Order code	Package	Packing
L9484	Multiwatt8	Tube

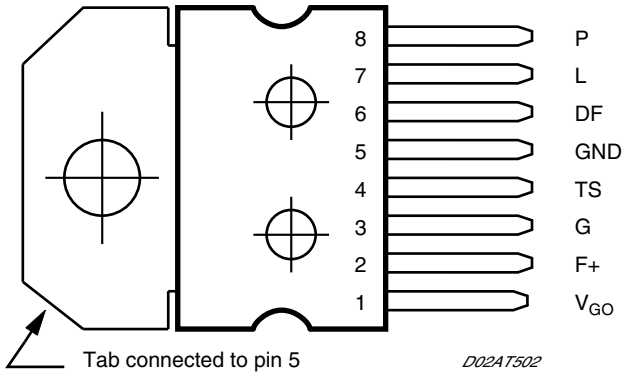
Contents

1 Pin description

Table 2. Pin description

N #	Pin	Description
1	V_{GO}	Generator output – voltage sense and power supply to ASVR
2	F+	Field driver - high side drive output
3	G	Ground for ASVR (must be connected for ground for ASVR)
4	TS	Thermistor sense terminal
5	Gnd	Internally connected to the tab or slug in MW-8. Shall not be used for ASVR ground, nor voltage applied to pin 5 to cause ≥ 50mV pin 5 to pin 3. May be unconnected or externally connected to pin 3.
6	DF	Inverted field monitor output
7	L	Lamp - low side driver; relay - high side driver
8	P	Phase sense input

Figure 1. Pin connection (top view)



2 Electrical specification

2.1 Absolute maximum ratings

Table 3. Absolute maximum ratings

Symbol	Parameter	Value	Unit
I_o	Output current capability	Internally limited	A
P_{tot}	Power dissipation	6	W
	Short circuit protected	All terminal, to VGO and ground	

2.2 Thermal data

Table 4. Thermal data

Symbol	Parameter	Value	Unit
T_j	Junction temperature	-40 to +150	°C
T_{stg}	Storage temperature	-50 to +150	°C
T_{sd}	Thermal shut-down	175 ± 15	°C
$R_{th\ j\text{-}case}$	Thermal resistance junction to case	1.5	°C/W

2.3 Electrical characteristcs

Table 5. Electrical characteristcs
(T_{case} = -35°C to +150°C continuous unless otherwise specified)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{OS}	Operating supply voltage	T_{case} = +25°C to =150°C	8		Vov	V
V_{OS}	Operating supply voltage	T_{case} = -40°C to +25°C	10		Vov	V
I_{SB}	Stand-by current	V_{GO} = 12.6V; T_{case} = 25°C; 10kΩ V_{GO} to TS; F+, G & tab (slug) grounded; L, DF, & P unconnected; regulator not activated.			300	µA
V_{SP}	Regulator set-point	10kΩ between V_{GO} and TS	Curve shown in *Figure 3*			
V_{SP}	Regulator set-point	NTC thermistor with $R_{25°C}$ = 10kΩ; T_j = 90°C	Curves shown in *Figure 4* (with MURATA NTC NTH4G39A1)			
V_{NB}	Generator output, no battery	No battery, I_{OUT} = 2A to 50% max. load	V_{SP} - 2		V_{SP} + 2	V
T_C	Thermal compensation	voltage @ V_{GO}	Curves shown in *Figure 3* and *Figure 4*			

Table 5. Electrical characteristcs (continued)
(T_{case} = -35°C to +150°C continuous unless otherwise specified)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{LR}	Load regulation	6500 grpm, 10% to 95% load			300	mV
V_{SR}	Speed regulation	15A load, 2000 to 20,000 grpm			100	mV
V_{F-ON}	Output saturation voltage	I_F = 6A, V_{GO} = 14.0V, T_{case} = 25°C			750	mV
V_{F-ON}	Output saturation voltage	I_F = 5A, V_{GO} = 13.5V, T_{case} = 125°C			850	mV
I_{F-LIM}	Field limit current(1)	Current F+ Terminal to Gnd. @ $T_{case} \leq$ 25°C	9.0			A
I_{F-LIM}	Field limit current(1)	Current F+ Terminal to Gnd. @ T_{case} = +150°C	6.0			A
I_{G-MIN}	Min. generator current load	Current measured @ generator output	0.5			A
V_{D-F}	Field discharge diode	I_F = 6A, T_{case} = 25°C			1.85	V
I_{D-R}	Diode reverse current	V_R = 20V			1	mA
F_{OSC}	oscillation frequency	During LRC operation	340	400	460	Hz
V_{DF}	DF saturation voltage	$I_{DF} \leq$ 10mA			0.8	V
I_{DF-LK}	DF output leakage current	V_{DF} < 25V			10	µA
F_{TURBO}	Internal clock frequency	V_{DF} = 32 - 35V; thru 2.2kΩ		4X		Hz
F_{TURBO}	IRD, SS, LRC rate	V_{DF} = 32 - 35V; thru 2.2kΩ		÷ 16		

1. The Field Drive capability shall not decrease as a function of temperature between 25°C and 150°C, at a rate faster than -0.024A/°C (for example, Field Drive shall be capable of ≥7.2A at 100°C).

Figure 2. Typical application schematic

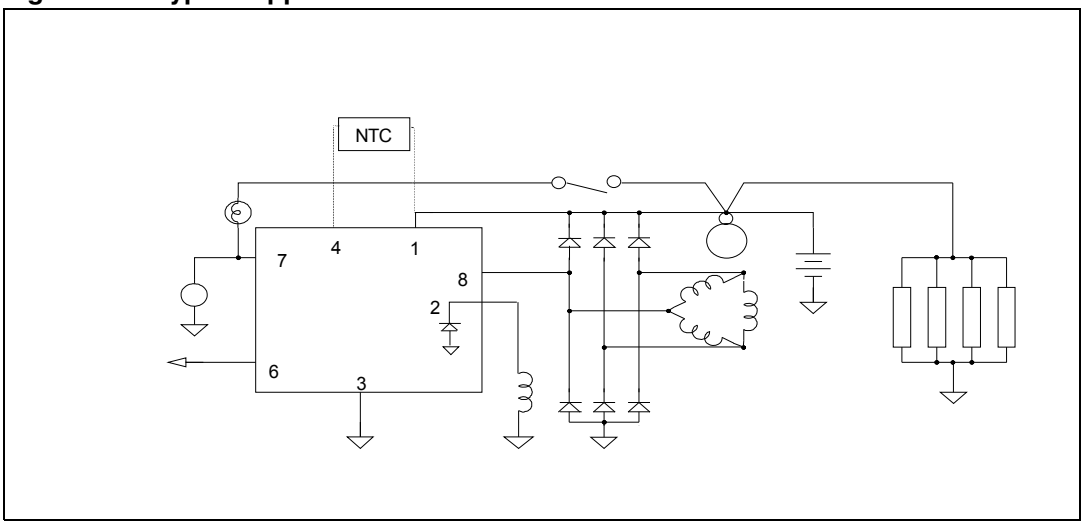


Figure 3. Set-point voltage vs. mounting tab temperature (10kΩ between V_{GO} & TS)

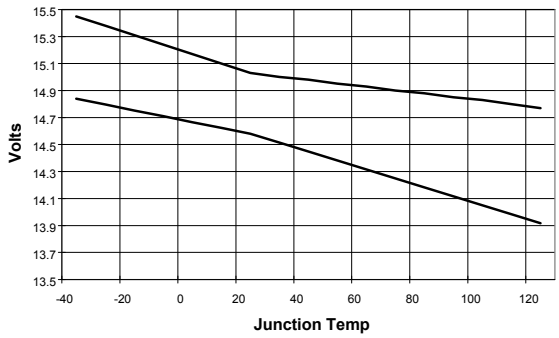


Figure 4. Set-point voltage vs. thermistor temperature, T_j = 90°C (not guaranteed by testing, depending on NTC characteristics)

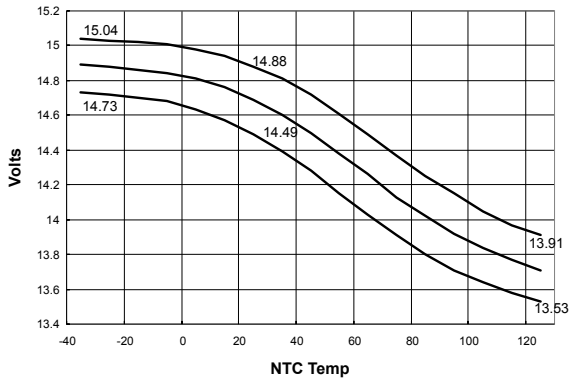
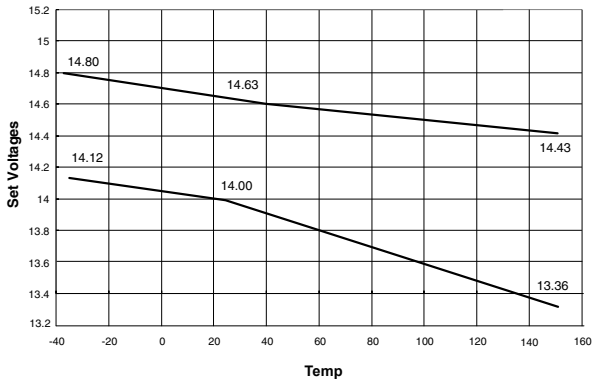


Figure 5. Set-point voltages vs. mounting tab temperature (TS-open)



2.4 Diagnostic

Table 6. Diagnostic
(T_{case} = -35°C to +150°C unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{OV}	Over-voltage		V_{SP} + 1	V_{SP} + 1.3	V_{SP} + 2	V
V_{L-SAT}	Lamp ON saturation voltage	I_L = 0.5A (sinked by ASVR)	>V_{L-ACT}	1.33	1.45	V
$V_{L-SAT-BO}$	Lamp ON voltage (1)	I_L < 0.5A, VGO = open; T_{case} = -35°C to 85°C		3.8	5	V
V_{L-RLY}	Lamp OFF (relay drive) saturation voltage (vs. B+)	I_L = 750mA (sourced by ASVR)(2) Tcase < 125C			1.85	V
T_{DELAY}	Fault indication delay time	Delay before lamp ON	0.9	1.1	1.3	s

1. This condition can happen when the connection between the battery and VGO or the output terminal of the generator is broken. The 1.1 second delay is not required, and current is sinked by ASVR.
2. When no fault is detected the Lamp terminal is pulled up by ASVR.

2.5 Fault indication

Table 7. Fault indication table

Conditions	T_{Delay}?
Initial KEY-ON Bulb and wiring check (lamp ON for 1 sec ± 15% after initial KEY-ON)	No
$V_{GO} > V_{OV}$	Yes
$V_P < V_{P-F}$ AND $V_{GO} < V_{SP}$	Yes
$F_P < F_{P-TR}$ @ V_{P-TR}	Yes
No connection between battery and V_{GO}	No
At start: lamp ON until $F_P > F_{P-IR}$ AND $V_P > V_{P-F}$ i.e. until V_P reaches 8V.	No

2.6 Regulation features

Table 8. Regulation features

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{L-PD}	L terminal regulator activate threshold	VGO=12.6V	0.8	1	1.15	V
I_{L-PD}	L terminal pull down current	$V_L = V_{L-ACT}$ VGO=12.6V	0.09		0.78	mA
V_{P-IR}	Initiate regulation phase voltage threshold	Regulator activated	1.1	1.3	1.5	V
V_{P-TR}	Terminate regulation phase voltage threshold	Regulator activated	1.1	1.3	1.5	V

Table 8. Regulation features (continued)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{P-F}	Phase input voltage low fault threshold		7.0	8	9.0	V
I_P	Phase terminal current sink	V_P > 1.5V and < 12.6V VGO = 12.6V	0.3		3.5	mA
F_{P-IR}	Initiate regulation phase frequency		123	145	167	Hz
F_{P-TR}	Terminate regulation phase frequency		59	72	86	Hz
IRD	Initiate regulation delay	Regulator activated, V_{P-IR} AND F_{P-IR} conditions met first time.	1.7	2	2.3	s
FSDC	Field strobe duty cycle	Regulator activated and (regulation terminated or regulation not initiated)	16	18.75	22	%
LRC	Load response control rate	Field drive duty cycle increase	34	40	46	%/s
F_{P-LRC}	LRC transition frequency	LRC enabled if $F_P < F_{P-LRC}$	255	300	345	Hz
SS	Soft-start	LRC enabled until V_{SP} reached regardless other conditions	34	40	46	%/s

3 Package information

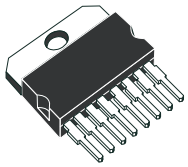
In order to meet environmental requirements, ST (also) offers these devices in ECOPACK® packages. ECOPACK® packages are lead-free. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label.

ECOPACK is an ST trademark. ECOPACK specifications are available at: *www.st.com*.

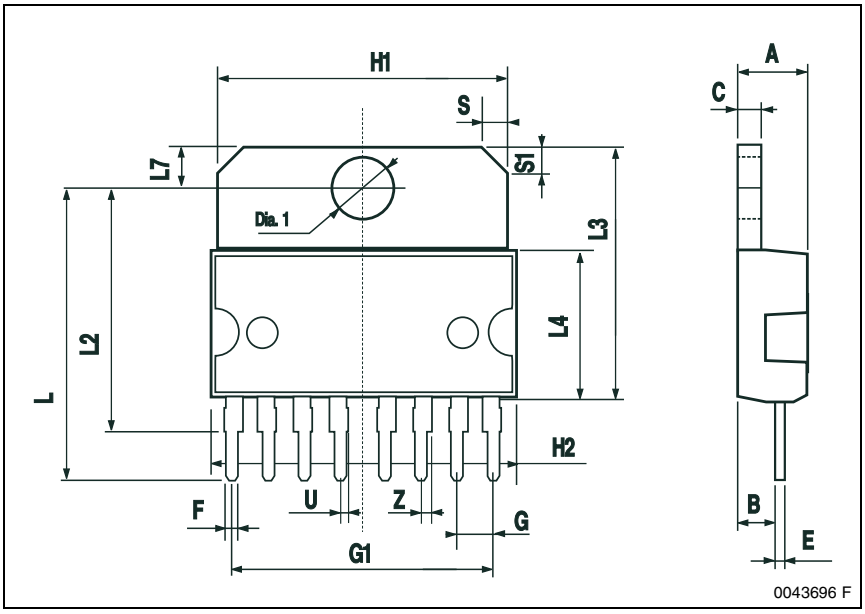
Figure 6. Multiwatt8 mechanical data and package dimensions

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5			0.197
B			2.65			0.104
C			1.6			0.063
E	0.49		0.55	0.019		0.022
F	0.78		0.85	0.030		0.033
G	2.40	2.54	2.68	0.094	0.10	0.105
G1	17.64	17.78	17.92	0.69	0.70	0.71
H1	19.6			0.772		
H2			20.2			0.795
L	20.35		20.65	0.80		0.81
L2	17.05	17.20	17.35	0.67	0.68	0.68
L3	17.25	17.5	17.75	0.679	0.689	0.699
L4	10.3	10.7	10.9	0.406	0.421	0.429
L7	2.65		2.9	0.104		0.114
S	1.9		2.6	0.075		0.102
S1	1.9		2.6	0.075		0.102
U	0.40		0.55	0.015		0.022
Z	0.70		0.85	0.028		0.034
Dia1	3.65		3.85	0.144		0.152

OUTLINE AND MECHANICAL DATA



Multiwatt8 (Pin 5 GND)



4 Revision history

Table 9. Document revision history

Date	Revision	Changes
15-Feb-2003	1	Initial release.
09-Sept-2004	2	Update
18-Nov-2008	3	Document reformatted. Document promoted from “product preview” to “datasheet“. Added *Table 1: Device summary on page 1*. Added ECOPACK text in *Section 3: Package information*.
19-Sep-2013	4	Updated Disclaimer.

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