14 IVR-11, 14 IVR-12, 14IVR-21, 14IVR-22

MONOCHIP CAR ALTERNATOR REGULATOR

Description

Alternator regulator 14IVR-XX, made under the integrated technology is essentially a monochip voltage regulator for the car alternators with the rectifier nodes on the Zener diodes. The single chip combines the control functions and the powerful output cascade with I_{Field}=5 A to control the generator excitation circuit. The alternator regulator 14 IVR-XX does not require application of other external components, which considerably reduces the system cost as a whole and enhances its reliability.

- NO EXTERNAL COMPONENTS
- PRECISE TEMPERATURE COEFFICIENT
- PRECISE REGULATED VOLTAGE
- HIGH OUTPUT CURRENT
- LOW OUTPUT SATURATION VOLTAGE
- OVERVOLTAGE PROTECTION
- VERY LOW START UP VOLTAGE

Device	**Nominal regulation voltage**	**Nominal temperature coefficient of the regulation voltage**
14IVR-11	14,1V	-7,0 mV/°C
14IVR-12	14,1V	-10,0 mV/°C
14IVR-21	14,5V	-7,0 mV/°C
14IVR-22	14,5V	-10,0 mV/°C

Absolute maximum ratings

Parameter	Symbol	Value	Unit
Maximum field current	I_{Field}	6,0	A
Overvoltage pulse of ≤100 ms with 5 ms ≤ Trise ≤ 10 ms	Vs	40	V
Junction and storage temperature range	Tj, Tstg	-60 to +150	°C
Operation ambient temperature range *	T_A	-45 to +100	°C

*- mounting of regulator must provide thermal resistance case-ambient R_{TC-A} not more then 6°C/W

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Termal data

Parameter	Symbol	Value	Unit
Thermal resistance junction-ambient	R_{TJA}	2,5	°C/W
Thermal resistance junction-case	R_{TJC}	1	°C/W

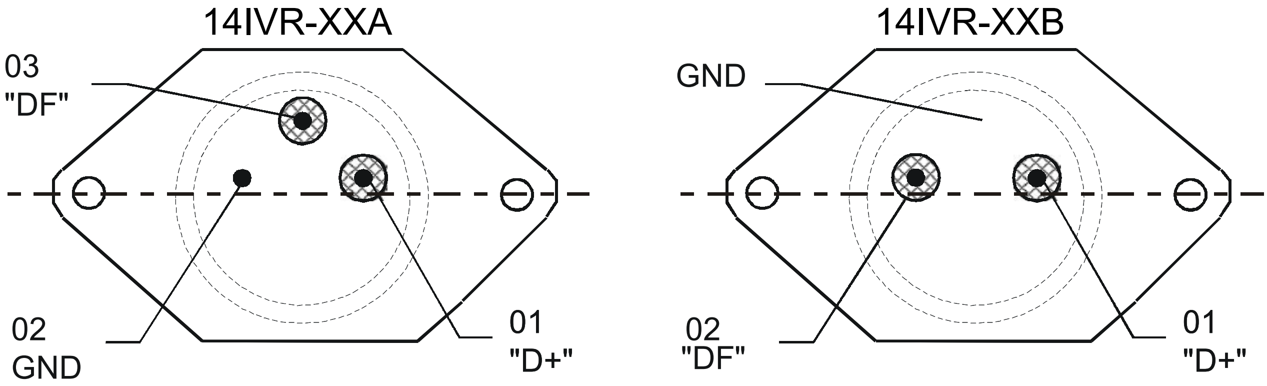
Electrical Characteristics
-45°C ≤ Ta ≤ 100°C Unless Otherwise Noted

Parameter	Sym-bol	Test condition	Value			Unit	Note
			Min	Typ	Max		
Regulation voltage							
14IVR-11	U_{REG}	T_J=-45°C	14,39	14,59	14,80	V	1
		T_J=25°C	14,00	14,10	14,20		
		T_J=100°C	13,36	13,58	13,79		
14IVR-12		T_J=-45°C	14,56	14,80	15,04		
		T_J=25°C	14,00	14,10	14,20		
		T_J=100°C	13,10	13,35	13,60		
14IVR-21	U_{REG}	T_J=-45°C	14,74	14,99	15,25	V	1
		T_J=25°C	14,35	14,50	14,65		
		T_J=100°C	13,71	13,98	14,24		
14IVR-22		T_J=-45°C	14,91	15,20	15,49		
		T_J=25°C	14,35	14,50	14,65		
		T_J=100°C	13,45	13,75	14,05		
Range of the regulation voltage	ΔU_{REG}	T_J=-45÷100°C		250	350	mV	2
Voltage of output transistor transition into close state	U_{CL}	T_J=-45°C	19,0		23,0	V	
		T_J=25°C	16,5		20,5		
		T_J=100°C	15,0		19,0		
Output saturation voltage	U_{SAT}	I_{Field}=5 A T_J=-45÷100°C			0,75	V	
		T_J=25°C			0,6		
Voltage on shunt diode	U_D	I_D=5 A			1,7	V	
Quiescent current	I_Q	Field off			80	mA	
Supply current	I_S	Field on			220	mA	
Field pin sink current	I_{FS}	Field off field pin 15V			1,0	mA	
		field pin 24V			1,0		
Temperature coefficient of the regulation voltage							
for 14IVR-11 14IVR-21	C_T	T_J=-45÷100°C	-5,5	-7,0	-8,5	mV/°C	
for 14IVR-12 14IVR-22			-8	-10	-12		
Control circuit minimum start up voltage	U_{SU}	Measured at supply pin I_{Field}=300 mA			2,5	V	
Switching frequency	Fsw		40	180	250	Hz	
Shunt diode reverse current	I_R	U_D=24 V			1,0	mA	

Note 1 — Measurements processed after thermostabilization of regulator t_{thst}=300sec.

Note 2 — ΔU_{REG} determines both the range of the input voltage, at which porosity of the output current pulses varies from the value of Q=21 to the value of Q=1,0.

Versions of Package TO-3 (Jumbo) Pins (View from Side of Pins)



Purpose and numbers of pins

14IVR-XXA (Suffix A)

Pin	Symbol	Purpose
01	«D+»	Input + Ucc
02	«GND»	Common output (“Masse”)
03	«DF»	Output to the excitation winding

14IVR-XXB(Suffix B)

Pin	Identification	Purpose
01	«D+»	Input + Ucc
02	«DF»	Output to the excitation winding

Note — the package base is power supplied with the potential GND.

Operation of Device

Principle of operation of the voltage regulator is essentially in the porosity alteration of the output pulses under influence of the voltage fluctuations, generated by the car alternator, from which the microcircuit is voltage supplied.

Voltage regulator incorporates the powerful output transistor stage, ensuring the direct connection of the microcircuit output to the excitation winding of the alternator.

Voltage, generated by the alternator, is rectified on the external diodes and compared with the internal reference voltage of the voltage regulator. In dependence on the value of difference a signal is generated with the width-pulse modulation, which forms current in the alternator excitation circuit.

Application of the width-pulse modulation makes it possible to make the switching frequency in the regulator constant and, consequently, to exclude influence of the different kind of interferences, in particular, of the pulsations of the rectified voltage on its operation.

During voltage reduction under the influence of the external factors, generated by the alternator, the porosity of the Q output current pulses is reduced, which results in the current increase in the alternator excitation circuit for restoration of the upset balance.

At the rise of voltage, generated by the alternator, porosity of the Q current pulses at the microcircuit output increases, appropriately, the current is reduced, which is applied to the alternator excitation winding.

Interval of the voltages, within which range the microcircuit ensures the voltage regulation of the car-borne mains, is the regulation range.

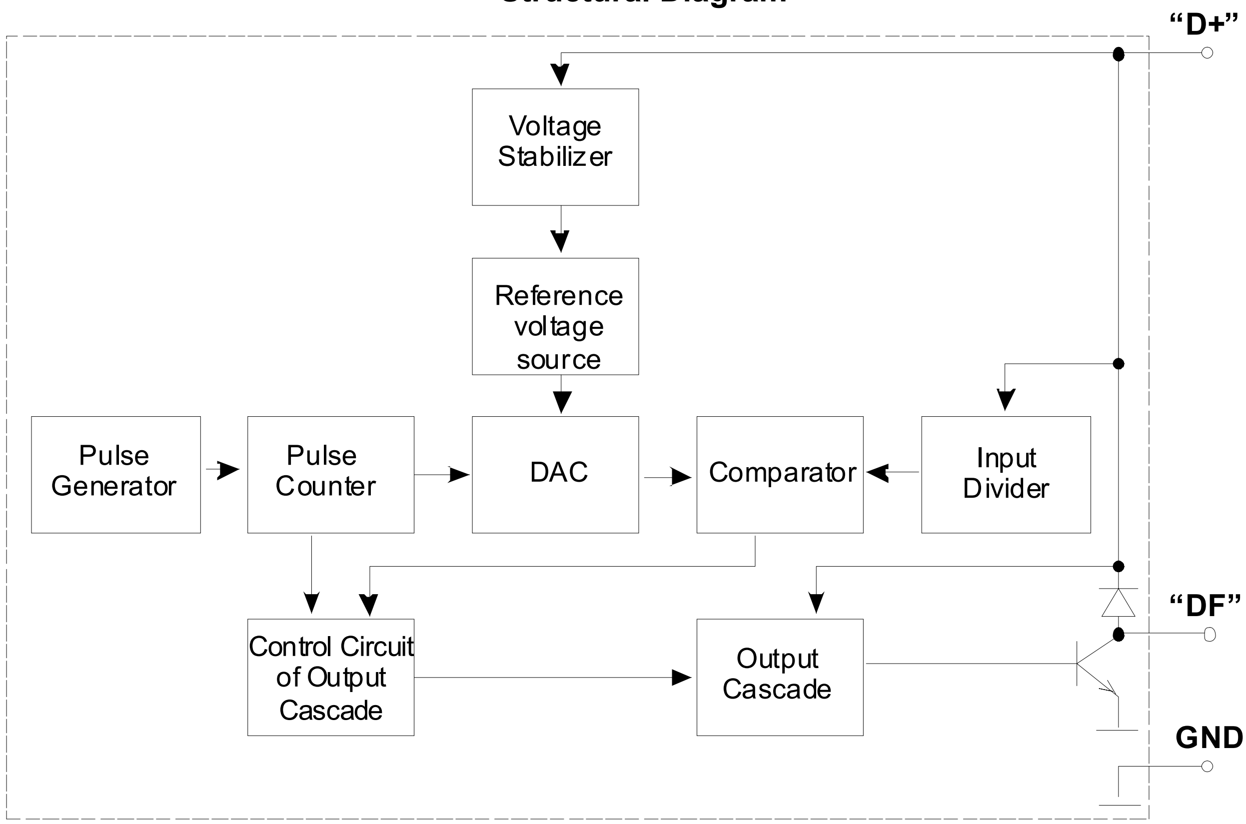
When reducing the regulated voltage to the bottom margin of the regulation range the generation rupture occurs, i. e. the pulses disappear. At the microcircuit output the low level status is set appropriately (the direct current is applied to the excitation coil of the alternator).

When increasing the regulated voltage to the regulation range upper margin, the generation stabilization occurs, i. e. the pulses appear with porosity of Q ≈ 21. The further increase of the regulated voltage within the rated norm limits on the regulated voltage (at the temperature of $T=(25 \pm 3)^{o}C$ $U_{CC} \approx 18V$) does not result in alteration of the output voltage pulses porosity.

In the middle of the regulation range porosity of the output pulses Q=2±0.1, which is taken for the regulator adjustment voltage U_{REG}.

The tune-up characteristic of the voltage regulator has a non-linear dependence on the regulation voltage, which makes it possible to enhance the efficiency of the alternator current output during the voltage reduction.

Microcircuit Structural Diagram



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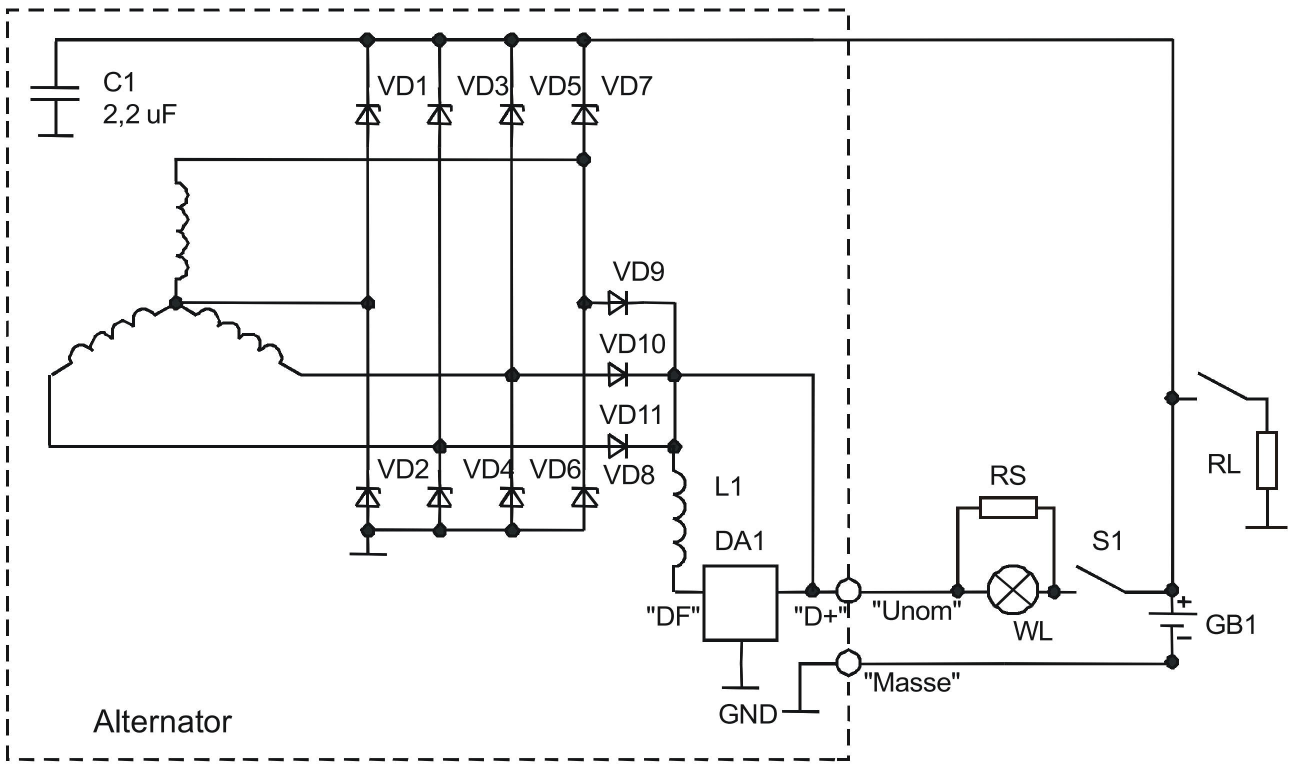
Structural Application Circuit



DA1 – voltage regulator 14IVR;

GB1 - storage battery;

L1 - generator’s excitation winding;

S1 - ignition start-up;

VD1 – VD8 – rectifier Zener diodes;

VD9 –VD11 – additional diodes

WL – control lamp

RS – shunt resistor

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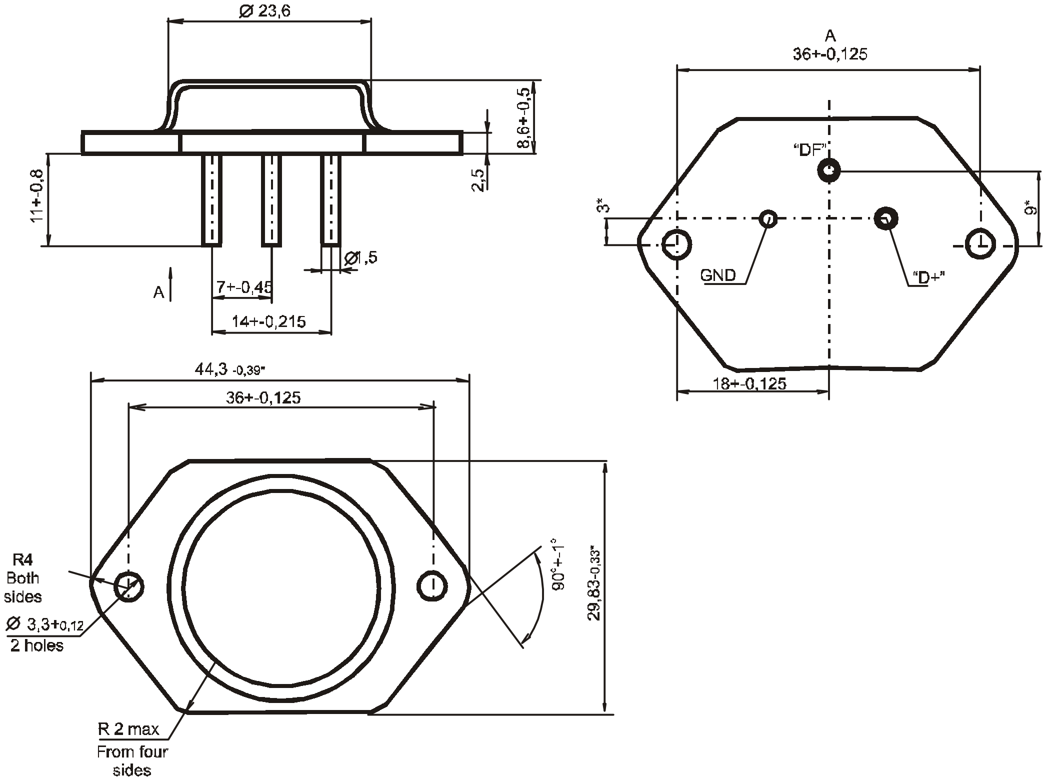
Assembly and Attachment Package Dimensions of the Regulator

14IVR-XXA



14IVR-XXB