



UAC3092

LINEAR INTEGRATED CIRCUIT

ALTERNATOR VOLTAGE REGULATOR

■ DESCRIPTION

The UAC3092 is specifically designed for voltage regulation and Load Response Control (LRC) of diode rectified alternator charging systems, as commonly found in automotive applications.

In maintaining system voltage, the UAC3092 monitors and compares the system battery voltage to an externally programmed set point value and pulse width modulates an N-channel MOSFET transistor to control the average alternator field current.

■ FEATURE

*Forced Load Response Control (LRC) with Heavy Load Transitions at Low RPM

*Capable of Regulating Voltage to ± 0.1 V @ 25

*Operating Frequency Selectable with One External Resistor

* < 0.1 V Variation over Speed Range of 2000 to 10,000 RPM

* < 0.4 V Variation over 10% to 95% of Maximum Alternator Output

*Maintains Regulation with External Loads as Low as 1.0 A

*Load Dump Protection of Lamp, Field Control Devices, and Loads

*Duty Cycle Limit Protection

*Provides High Side MOSFET Control of a Ground Referenced Field Winding

*Controlled MOSFET and Flyback Diode Recovery Characteristics for Minimum RFI

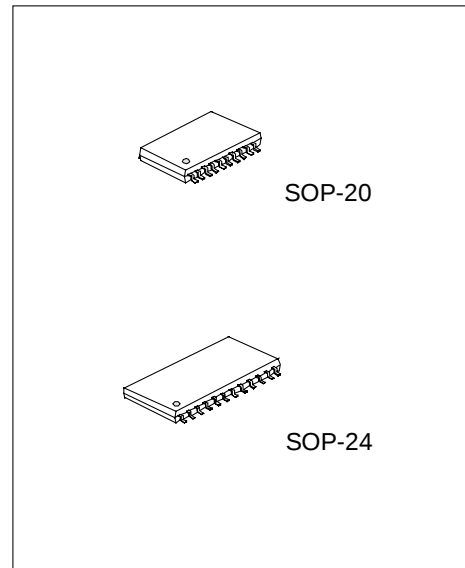
*Optional 2.5 or 10 sec. LRC Rate Control (Osc. Freq. = 280 kHz)

*Undervoltage, Overvoltage and Phase Fault (Broken Belt) Detection

■ ORDERING INFORMATION

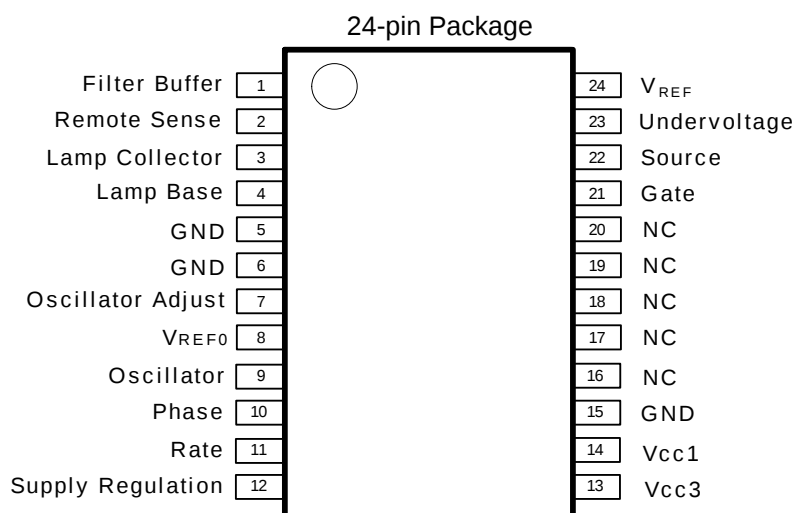
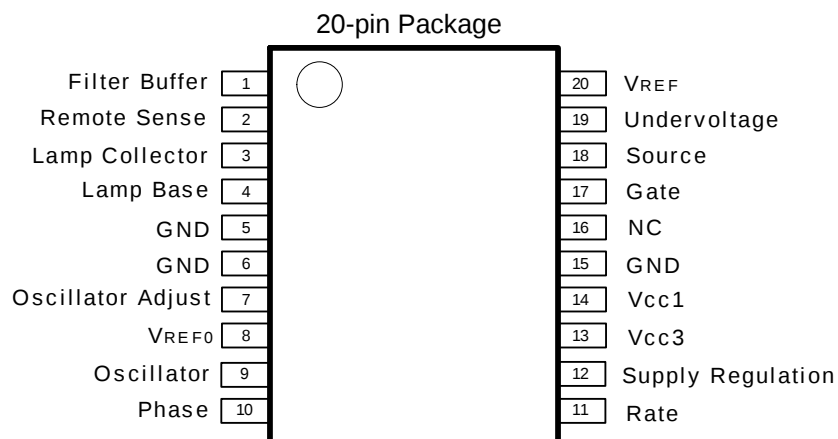
Order Number		Package	Packing
Normal	Lead Free Plating		
UAC3092-S20-R	UAC3092L-S20-R	SOP-20	Tape Reel
UAC3092-S20-T	UAC3092L-S20-T	SOP-20	Tube
UAC3092-S24-R	UAC3092L-S24-R	SOP-24	Tape Reel
UAC3092-S24-T	UAC3092L-S24-T	SOP-24	Tube

UAC3092L-S20-R	
(1) Packing Type	(1) R: Tape Reel, T: Tube
(2) Package Type	(2) S20: SOP-20, S24: SOP-24
(3) Lead Plating	(3) L: Lead Free Plating, Blank: Pb/Sn



*Pb-free plating product number: UAC3092L

■ PIN CONFIGURATIONS

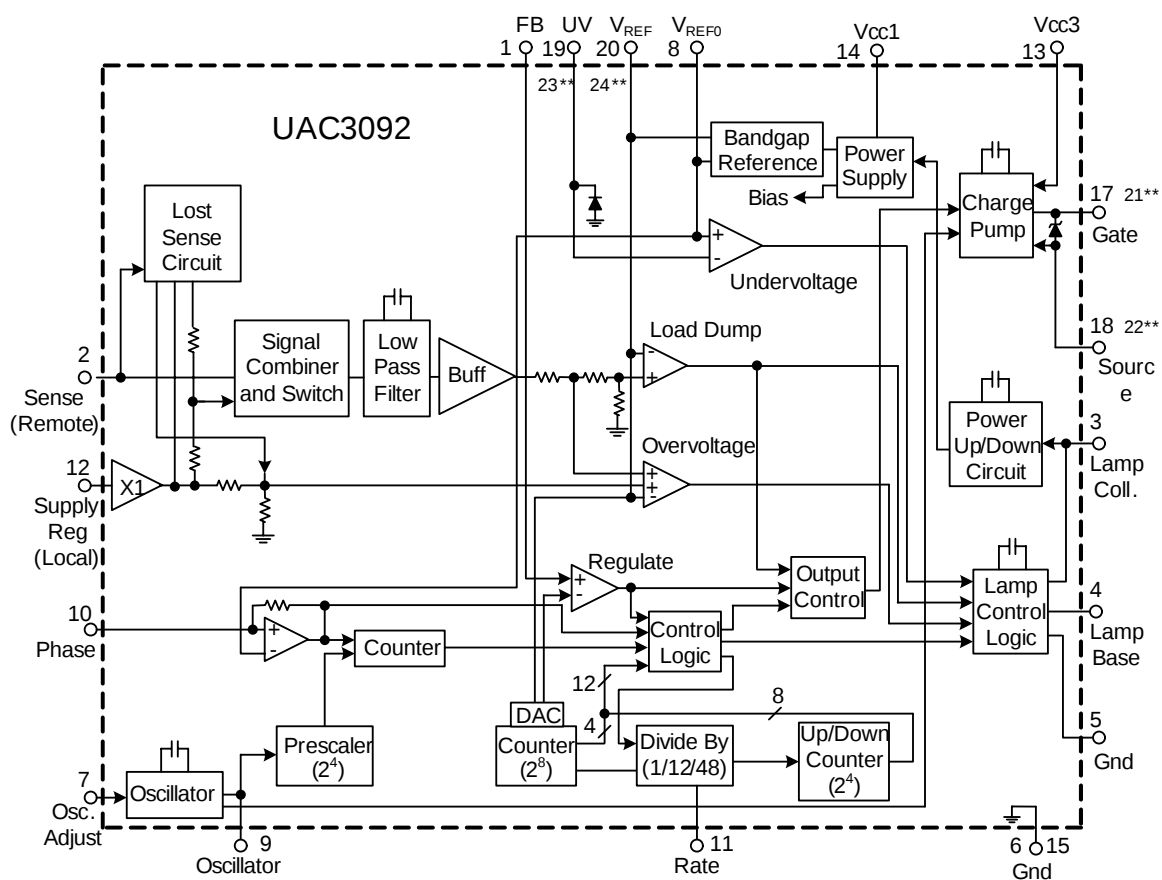


■ PIN DESCRIPTION

20-pin Package	24-pin Package	PIN NAME	DESCRIPTION
PIN No.			
1	1	FB	This pin provides a filtered result of the Sense input (if the Sense input is used) or the Supply Regulation input (if the Sense input is not used).
2	2	Sense	The Sense input is a remote, low current battery voltage reference input used to give an accurate representation of the true battery voltage. This input is also used to monitor overvoltage or load dump conditions.
3	3	Lamp Collector and Power-Up/Do wn	This pin connects to the collector of the transistor (Q2) used to drive the fault lamp. It is also used to sense a closed ignition switch (voltage sense) which then turns power on to the IC.
4	4	Lamp Base	The Lamp Base pin provides base current to the fault lamp drive transistor (Q2).
5	5	Ground	Grounded to provide a ground return for the fault lamp control logic circuit.
6, 15	6,15	Ground	IC ground reference pins.
7	7	Oscillator Adjust	A resistor to ground on this pin adjusts the internal oscillator frequency.
8	8	V _{REF0}	This is a test point for the 1.1V to 1.4V reference voltage. It has a zero temperature coefficient. The reference is used internally for phase signal and undervoltage detection.
9	9	Oscillator	Test point for checking the operation of the internal oscillator.
10	10	Phase	The Phase input detects the existence of a magnetic field rotating within the alternator.
11	11	Rate	The Rate pin is used to select a slow mode (floating) or fast mode (ground) Load Response Control recovery rate.
12	12	Supply Regulation	The voltage on the Supply Regulation pin is used as a representation of the alternator output voltage. This input also used to monitor overvoltage or load dump conditions.
13	13	V _{CC3}	Positive supply for the internal Charge Pump.
14	14	V _{CC1}	Positive supply for the entire IC except for the Charge Pump.
15,6	15,6	Ground	Ground reference for the IC.
16	16,17,18, 19,20	N/C	No connection.
17	21	Gate	Controls the Gate of the MOSFET used to energize the field winding.
18	22	Source	Field winding control MOSFET source reference.
19	23	Undervoltage	If the voltage at this pin goes below 1.0 V, the fault lamp is guaranteed to turn on. The IC will continue to function, but with limited performance.
20	24	V _{REF}	Test point for the 1.7 V to 2.3 V Band gap reference voltage. This voltage has a negative temperature coefficient of approximately -11 mV/

Note: Pins 8, 9, 20(20 Pin Package) and 24(24 Pin Package) are test points only.

■ BLOCK DIAGRAM



Note: ** For 24-pin package

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Power Supply Voltage	Vbat	24	V
Load Dump Transient Voltage (Note 1)	+Vmax	40	
Negative Voltage (Note 2)	-Vmin	-2.5	
Power Dissipation (Ta = 125)	SOP-20	867	mW
	SOP-24	1000	mW
Operating Junction Temperature	T _J	+150	°C
Operating Ambient Temperature	T _{OPR}	-40 ~ +125	°C
Storage Temperature	T _{STG}	-45 ~ +150	°C

Note: 1. 125 ms wide square wave pulse.

2. Maximum time = 2 minutes.

3. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise specified)

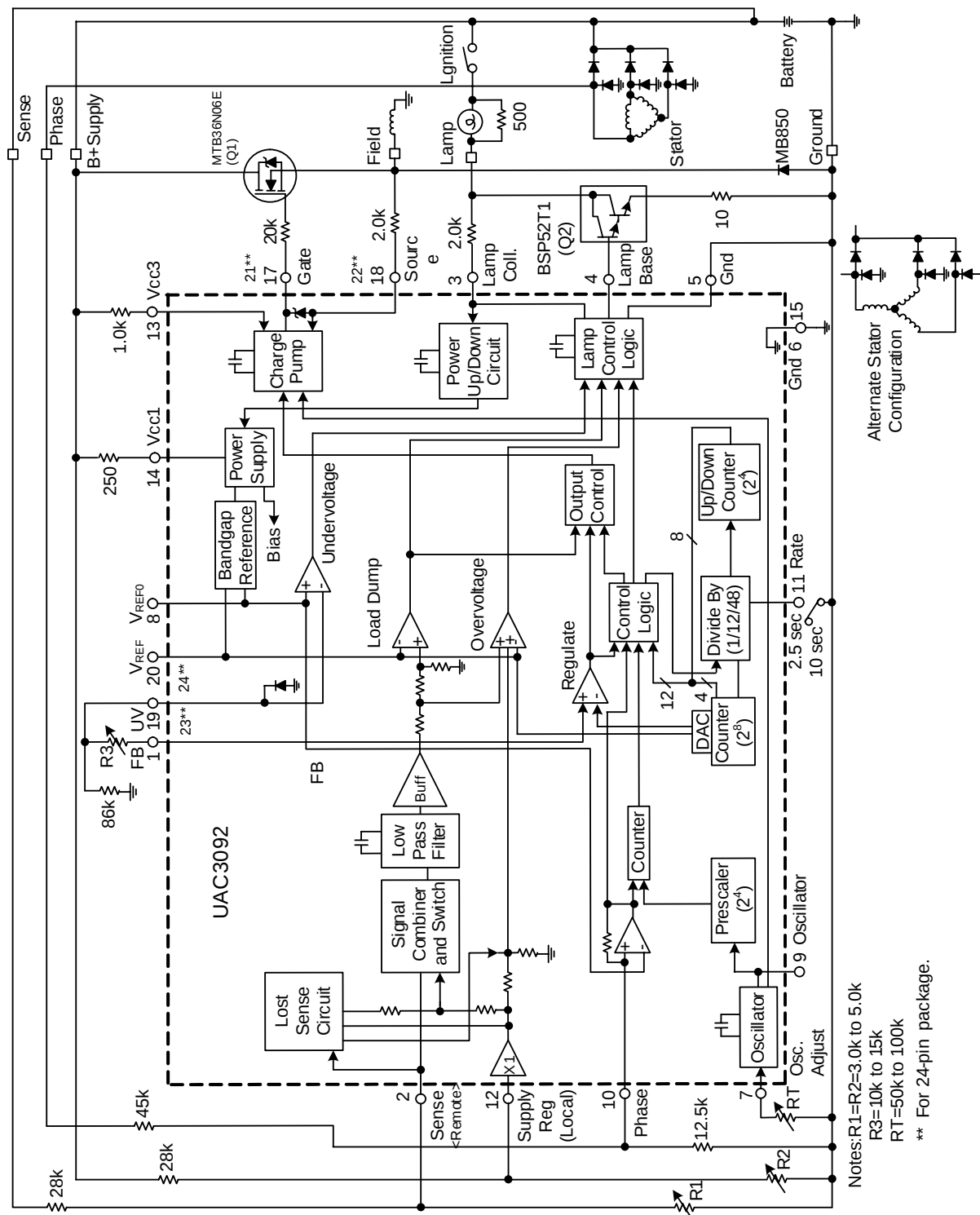
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
DC CHARACTERISTICS						
Regulation Voltage (Determined by external resistor divider)	VReg			14.85		V
Regulation Voltage Temperature Coefficient	Tc		-13	-11	-9.0	mV/°C
Suggested Battery Voltage Operating Range	Vbat		11.5	14.85	16.5	V
Power Up/Down Threshold Voltage (Pin 3)	Vpwr		0.5	1.2	2.0	V
Standby Current	I _{Q1}	Vbat = 12.8 V, Ignition off, Ta = 25		1.3	2.0	mA
	I _{Q2}	Vbat = 12.8 V, Ignition off, -40 ~ 125			3.0	mA
Zero Temperature Coefficient Reference Voltage, (Pin 8)	V _{REF0}		1.1	1.25	1.4	V
Band Gap Reference Voltage [Pin 20 (24**)]	V _{REF}		1.7	2.0	2.3	V
Band Gap Reference Temperature Coefficient	TC		-13	-11	-9.0	mV/°C
Sense Loss Threshold (Pin 2)	S _{LOSS(TH)}			0.6	1.0	V
Phase Detection Threshold Voltage (Pin 10)	P _{TH}		1.0	1.25	1.5	V
Phase Rotation Detection Frequency (Pin 10)	P _{POT}			36		Hz
Undervoltage Threshold [Pin 19 (23**)]	V _{UV}		1.0	1.25	1.5	V
Overvoltage Threshold (Pin 2, or Pin 12 if Pin 2 is not used)	V _{OV}		1.09(V _{REF})	1.12(V _{REF})	1.16(V _{REF})	V
Load Dump Threshold (Pin 2, or Pin 12 if Pin 2 is not used)	V _{LD}		1.33(V _{REF})	1.4(V _{REF})	1.48(V _{REF})	V

■ ELECTRICAL CHARACTERISTICS(Cont.)

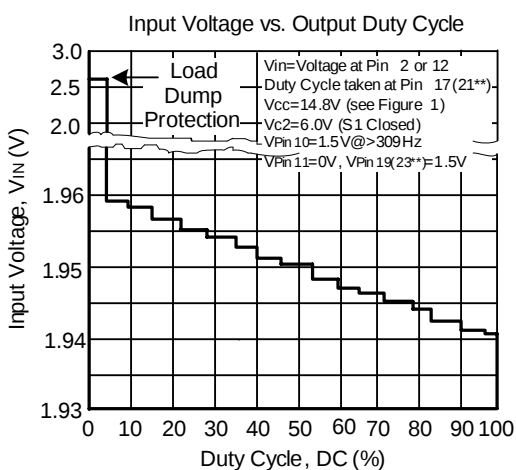
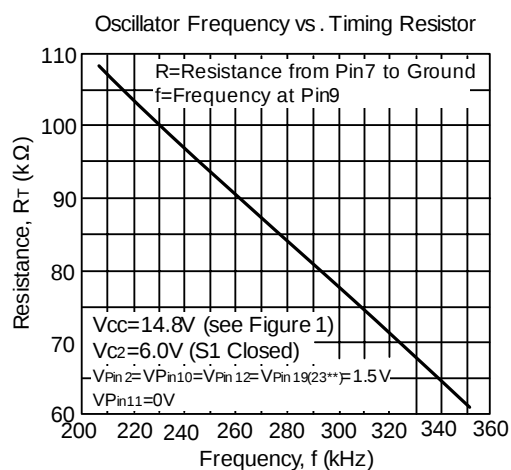
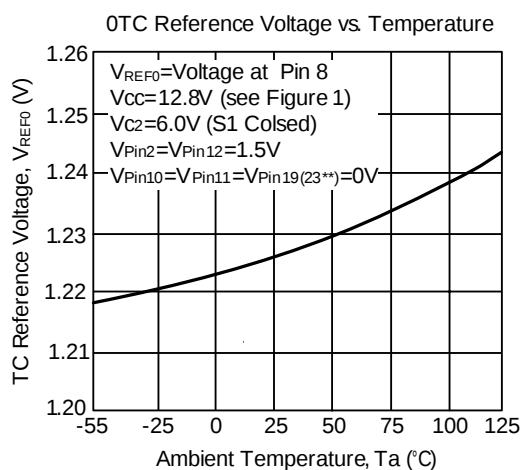
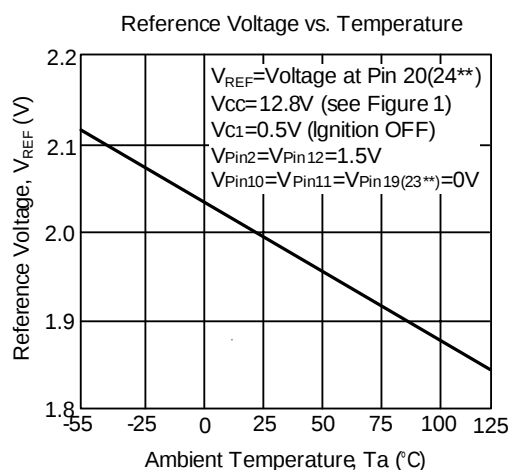
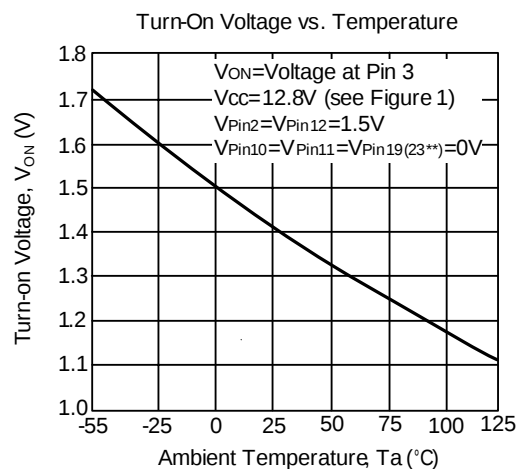
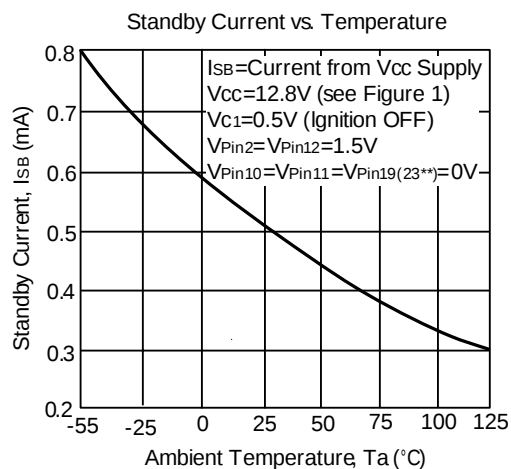
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SWITCHING CHARACTERISTICS						
Fundamental Regulation Output Frequency, [Pin 17 (21**)]	f	Clock oscillator frequency divided by 4096		68		Hz
Suggested Clock Oscillator Frequency Range, (Pin 9)	fosc	Determined by external resistor, R _T	205	280	350	kHz
Duty Cycle [Pin 17 (21**)] At Start-up During Overvoltage Condition	Start _{DC} OV _{DC}		27 3.5	29 4.7	31 5.5	%
Low/High RPM Transition Frequency (Pin 10)	LRCFreq		247	273	309	Hz
LRC Duty Cycle Increase Rate	LRCS	Low RPM Mode (LRCFreq < 247 Hz), Pin 11 = Open (Slow Rat)	8.5	9.5	10.5	%/sec
	LRCF	Low RPM Mode (LRCFreq < 247 Hz), Pin 11 = Grounded (Fast Rate)	34	38	42	
	LRCH	High RPM Mode (LRCFreq > 309 Hz), Pin 11 = Don't Care (LRC Mode is disabled)	409	455	501	

Note: ** For 24-pin package.

APPLICATION CIRCUIT



TYPICAL CHARACTERISTICS



Note: ** For 24-pin package.

The diagram illustrates the internal architecture of the UAC3092 microcontroller, enclosed in a dashed box. Key internal blocks include:

- Bandgap Reference** and **Power Supply** blocks connected to V_{REF} and V_{REF0} pins.
- Undervoltage** and **Overvoltage** comparators monitoring the power supply rails.
- Charge Pump** and **Power Up/Down Circuit** for managing the V_{CC3} supply.
- Signal Combiner and Switch**, **Low Pass Filter**, and **Buf** (buffer) for the Sense (Remote) input.
- Regulate** block for the Supply Reg (Local) input.
- Counter** and **Prescaler (2⁴)** for the Phase input.
- DAC 4 Counter (2⁹)**, **Divide By (1/12/48)**, and **Up/Down Counter (2⁴)** for the Rate input.
- Control Logic** and **Output Control** blocks.
- Lamp Control Logic** for the Lamp Base output.

External connections and components shown include:

- V_{CC}** and **V_{CC3}** supply rails with decoupling capacitors and resistors (250Ω, 1.0kΩ).
- Gate** (pin 21) and **Source** (pin 18) pins with associated capacitors and resistors (2.0kΩ).
- Lamp Coll.** (pin 3) and **Lamp Base** (pin 4) outputs.
- RT** (Resistor Temperature) input (pin 7) connected to a thermistor.
- Oscillator** (pin 9) and **Oscillator Output** (pin 11) connected to an oscillator circuit.
- Supply Reg (Local)** (pin 12) and **Phase** (pin 10) inputs.
- Sense (Remote)** (pin 2) input.
- FB** (pin 19), **UV** (pin 20), **V_{REF}** (pin 23), and **V_{REF0}** (pin 8) pins.
- Rate** (pin 11) input.
- Gnd** (pins 6, 15, 5) connections.

Note: ** For 24-pin package

Figure 1.

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