

CS3361

Alternator Voltage Regulator FET Driver

The CS3361 integral alternator regulator integrated circuit provides the voltage regulation for automotive, 3-phase alternators.

It drives an external logic level N channel enhancement power FET for control of the alternator field current. In the event of a charge fault, a lamp output pin is provided to drive an external darlington transistor capable of switching on a fault indicator lamp. An overvoltage or no Stator signal condition activates the lamp output.

A STATOR Power Up feature is incorporated for systems which require power up activation by sensing the crank cycle of the starter at the stator. This eliminates unnecessary current drain when the ignition is turned on, but the car is not running. The CS3361 is available in an SO-14 package.

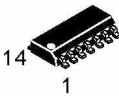
Features

- Drives Logic Level Power NFET
- 80 V Load Dump
- Temperature Compensated Regulation Voltage
- Shorted Field Protection Duty Cycle, Self Clearing
- STATOR Power Up



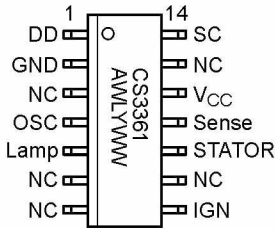
ON Semiconductor™

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**SO-14
D SUFFIX
CASE 751A**

PIN CONNECTIONS AND MARKING DIAGRAM



A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week

ORDERING INFORMATION

Device	Package	Shipping
CS3361YD14	SO-14	55 Units/Rail
CS3361YDR14	SO-14	2500 Tape & Reel

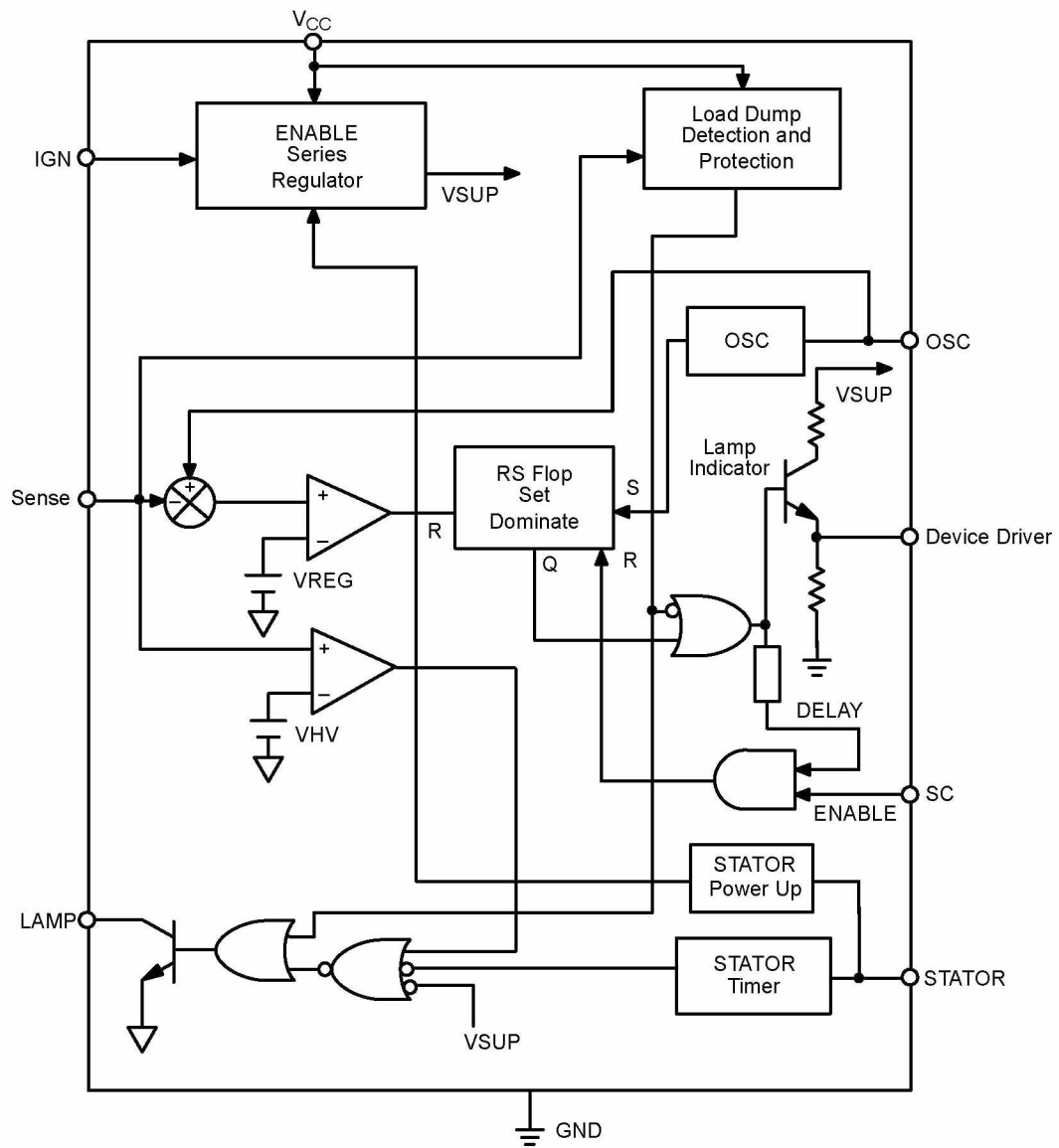


Figure 1. Block Diagram

MAXIMUM RATINGS*

Rating	Value	Unit
Storage Temperature Range, T_S	-55 to +165	°C
Junction Temperature Range	-40 to 150	°C
Continuous Supply	27	V
I_{CC} Load Dump (@ $V_{CC} = 80 V_{peak}$)	400	mA
Lead Temperature Soldering: Reflow: (SMD styles only) (Note 1)	230 peak	°C

1. 60 second maximum above 183°C.

*The maximum package power dissipation must be observed.

ELECTRICAL CHARACTERISTICS ($-40^{\circ}\text{C} < T_A < 125^{\circ}\text{C}$, $-40^{\circ}\text{C} < T_J < 150^{\circ}\text{C}$, $9.0\text{ V} \leq V_{CC} \leq 17\text{ V}$;
unless otherwise specified.)

Characteristic	Test Conditions	Min	Typ	Max	Unit
Supply					
Supply Current Enabled	–	–	–	10	mA
Supply Current Disabled	–	–	–	50	μA
Driver Stage					
Output High Voltage	–	5.5	–	12	V
Output Low Voltage	$I_{OL} = 25\text{ μA}$	–	–	0.35	V
Output High Current	$V_{DD} = 1.2\text{ V}$	–10	–6.0	–4.0	mA
Minimum ON Time	$C_{OSC} = 0.022\text{ μF}$	200	–	–	μs
Minimum Duty Cycle	–	–	6.0	10	%
Short Circuit Duty Cycle	–	1.0	–	5.0	%
Field Switch Turn On Rise Time	–	15	–	75	μs
Field Switch Turn On Fall Time	–	15	–	75	μs
Stator					
Input High Voltage	–	10	–	–	V
Input Low Voltage	–	–	–	6.0	V
Stator Time Out	High to Low	6.0	100	600	ms
Lamp					
Output High Current	$V_{LAMP} @ 3.0\text{ V}$	–	–	50	μA
Output Low Voltage	$I_{LAMP} @ 30\text{ mA}$	–	–	0.35	V
Ignition					
Input High Voltage	$I_{CC} > 1.0\text{ mA}$	1.8	–	–	V
Input Low Voltage	$I_{CC} < 100\text{ μA}$	–	–	0.5	V
Oscillator					
Oscillator Frequency	$C_{OSC} = 0.022\text{ μF}$	90	–	210	Hz
Rise Time/Fall Time	$C_{OSC} = 0.022\text{ μF}$	–	17	–	–
Oscillator High Threshold	$C_{OSC} = 0.022\text{ μF}$	–	–	4.5	V

CS3361

ELECTRICAL CHARACTERISTICS (continued) ($-40^{\circ}\text{C} < T_A < 125^{\circ}\text{C}$, $-40^{\circ}\text{C} < T_J < 150^{\circ}\text{C}$, $9.0\text{ V} \leq V_{CC} \leq 17\text{ V}$; unless otherwise specified.)

Characteristic	Test Conditions	Min	Typ	Max	Unit
Battery Sense					
Input Current	–	–10	–	+10	μA
Regulation Voltage	@25°C, $R_1 = 100\text{ k}\Omega$, $R_2 = 50\text{ k}\Omega$	13.8	–	15.8	V
Proportional Control	–	0.10	–	0.25	V
High Voltage Threshold Ratio	$\frac{V_{\text{High Voltage@LampOn}}}{V_{\text{Regulation@50\%Duty Cycle}}}$	1.083	–	1.190	V/V
High Voltage Hysteresis	–	0.020	–	0.600	V

PACKAGE PIN DESCRIPTION

PACKAGE PIN #	PIN SYMBOL	FUNCTION
SO-14		
1	Driver	Output driver for external power switch.
2	GND	Ground.
3, 6, 7, 9, 13	NC	No Connection.
4	OSC	Timing capacitor for oscillator.
5	Lamp	Base driver for lamp driver indicates no stator signal or overvoltage condition.
8	IGN	Switched ignition power up.
10	Stator	Stator signal input for stator timer.
11	Sense	Battery sense voltage regulator comparator input and protection.
12	V_{CC}	Supply for IC.
14	SC	Short circuit sensing.

TYPICAL PERFORMANCE CHARACTERISTICS

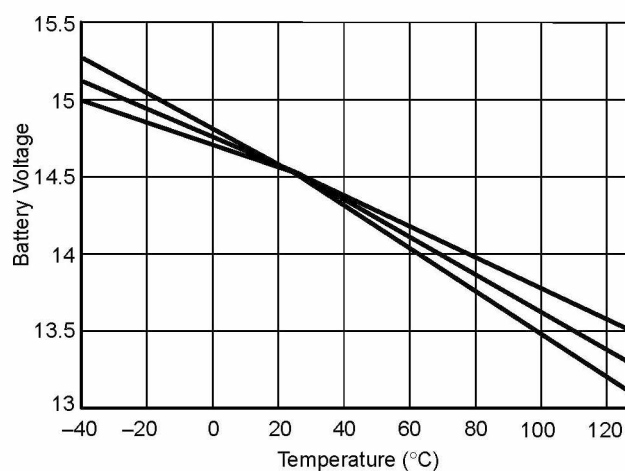


Figure 2. CS3361 Battery Voltage vs. Temperature (°C) Over Process Variation

APPLICATIONS INFORMATION

The CS3361 is designed for use in an alternator charging system.

In a standard alternator design (Figure 3), the rotor carries the field winding. An alternator rotor usually has several N and S poles. The magnetic field for the rotor is produced by forcing current through a field or rotor winding. The stator windings are formed into a number of coils spaced around a cylindrical core. The number of coils equals the number of pairs of N and S poles on the rotor. The alternating current in the stator windings is rectified by the diodes and applied to the regulator. By controlling the amount of field current, the magnetic field strength is controlled and hence the output voltage of the alternator.

Referring to Figure 4, a typical application diagram, the oscillator frequency is set by an external capacitor connected between OSC and ground. The sawtooth waveform ramps between 1.0 V and 3.0 V and provides the timing for the system. For the circuit shown the oscillator frequency is approximately 140 Hz. The alternator voltage is sensed at Terminal A via the resistor divider network R1/R2 on the Sense pin of the IC. The voltage at the sense pin determines the duty cycle for the regulator. The voltage is adjusted by potentiometer R2. A relatively low voltage on the sense pin causes a long duty cycle that increases the field current. A high voltage results in a short duty cycle.

The ignition Terminal (I) switches power to the IC through the V_{CC} pin. The Stator pin monitors the voltage from the stator and senses a stopped engine condition. It drives the Lamp pin high after the stator timeout expires. The Lamp pin also goes high when an overvoltage condition

is detected on the sense pin. This causes the darlington lamp drive transistor to switch on and pull current through the lamp. If the system voltage continues to increase, the field and lamp output turn off as in an overvoltage or load dump condition.

The SC or Short Circuit pin monitors the field voltage. If the drive output and the SC voltage are simultaneously high for a predetermined period, a short circuit condition is assumed and the output is disabled. The regulator is forced to a minimum short circuit duty cycle.

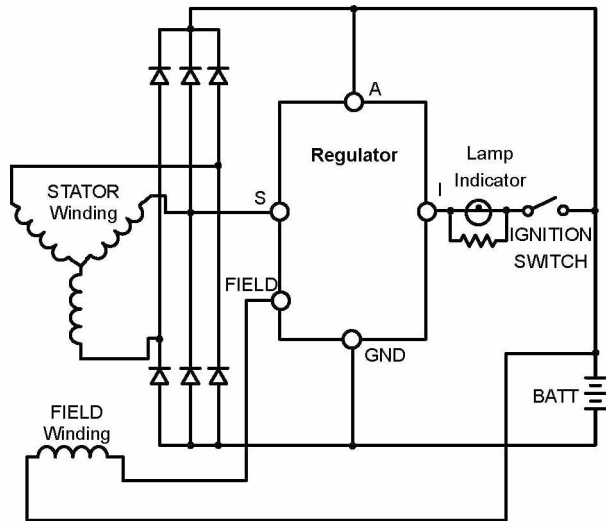


Figure 3. IAR System Block Diagram

CS3361

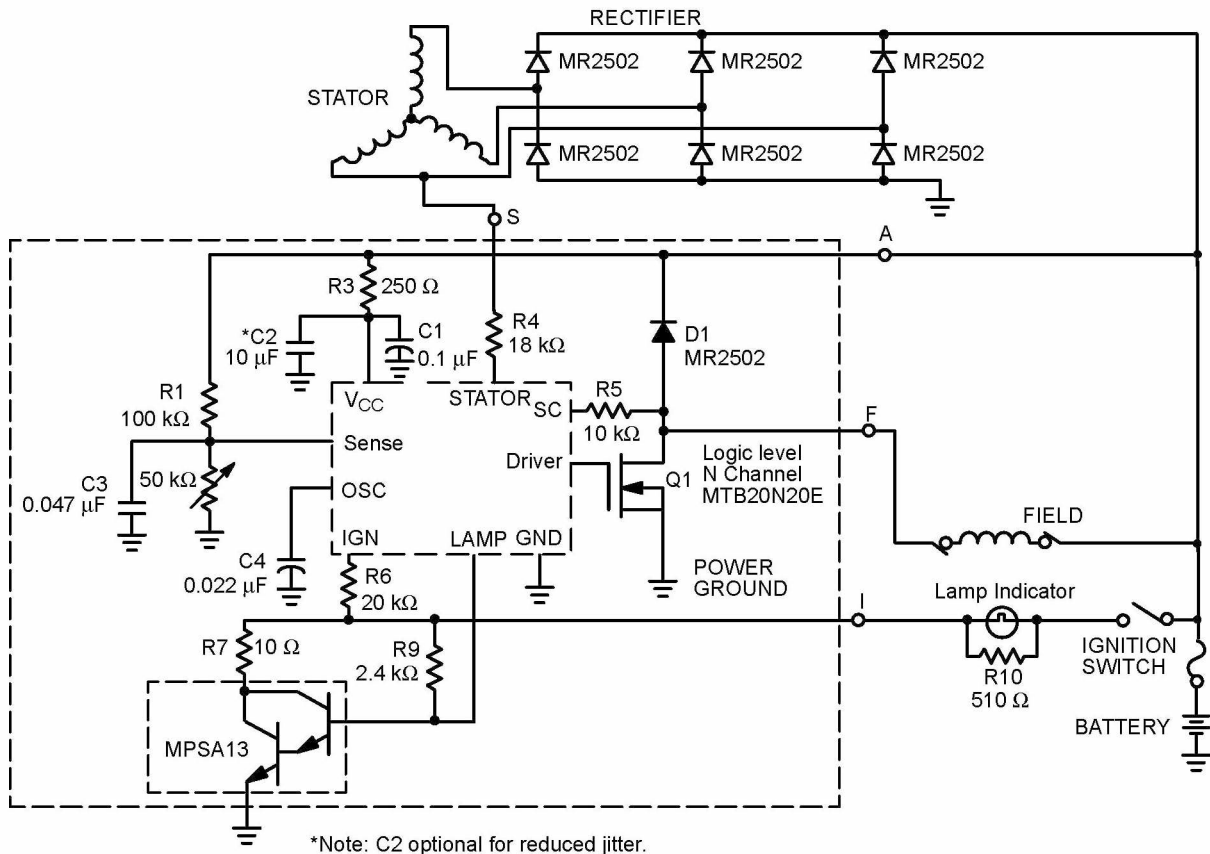


Figure 4. Typical Application Diagram

PACKAGE THERMAL DATA

Parameter		SO-14	Unit
R _{θJC}	Typical	30	°C/W
R _{θJA}	Typical	125	°C/W