Quad High Side Micropower MOSFET Driver with Internal Charge Pump

FEATURES

- No External Charge Pump Components
- Fully Enhances N-Channel Power MOSFETs
- 16 Microamps Standby Current
- 95 Microamps ON Current
- Wide Power Supply Range 4.5V to 18V
- Controlled Switching ON and OFF Times
- Replaces P-Channel High Side Switches
- Compatible with Standard Logic Families
- Available in 16-pin SOL Package

APPLICATIONS

- Laptop Computer Power Switching
- SCSI Termination Power Switching
- Cellular Telephone Power Management
- P-Channel Switch Replacement
- Battery Charging and Management
- Low Frequency H-Bridge Driver
- Stepper Motor and DC Motor Control

DESCRIPTION

The LTC1156 quad High side gate driver allows using low cost N-channel FETs for high side switching applications. An internal charge pump boosts the gate drive voltage above the positive rail, fully enhancing an N-channel MOS switch with no external components. Micropower operation, with 16μA standby current and 95μA operating current, allows use in virtually all systems with maximum efficiency.

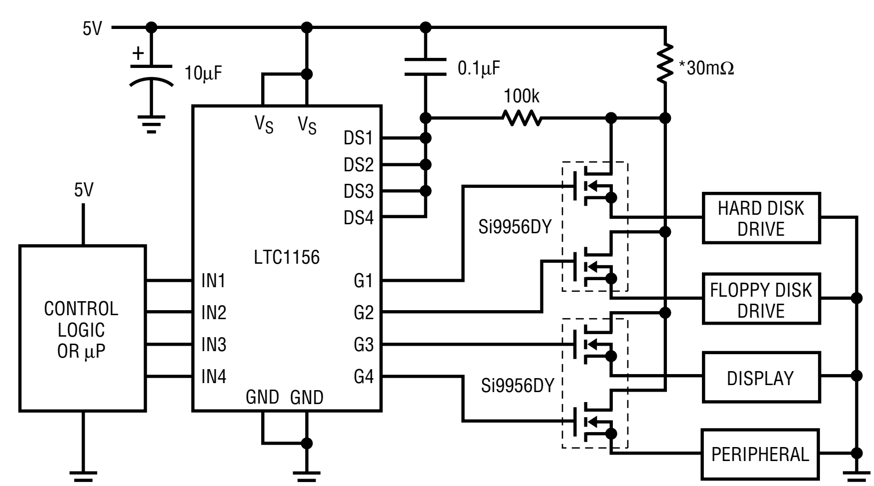
Included on chip is independent over-current sensing to provide automatic shutdown in case of short circuits. A time delay can be added to the current sense to prevent false triggering on high in-rush current loads.

The LTC1156 operates off of a 4.5V to 18V supply and is well suited for battery-powered applications, particularly where micropower "sleep" operation is required.

The LTC1156 is available in both 16-pin DIP and 16-pin SOL packages.

TYPICAL APPLICATION

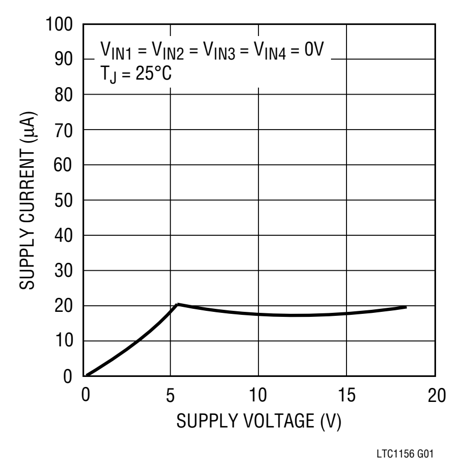
Laptop Computer Power Management



ALL COMPONENTS SHOWN ARE SURFACE MOUNT. MINIMUM PARTS COUNT SHOWN. CURRENT LIMITS CAN BE SET SEPARATELY AND TAILORED TO INDIVIDUAL LOAD CHARACTERISTICS.
* IMS026 INTERNATIONAL MANUFACTURING SERVICES, INC. (401) 683-9700

1156 TA01

Standby Supply Current

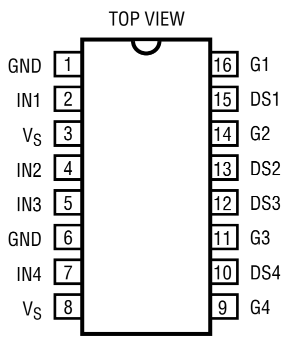


ABSOLUTE MAXIMUM RATINGS

Supply Voltage 22V
Input Voltage .... (V_S + 0.3V) to (GND – 0.3V)
Gate Voltage .... (V_S + 24V) to (GND – 0.3V)
Current (Any Pin) 50mA

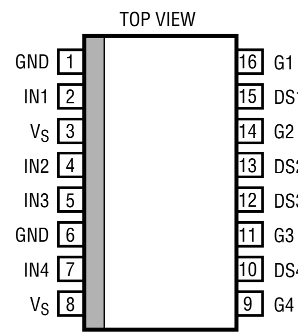
Operating Temperature Range
LTC1156C .... 0°C to 70°C
Storage Temperature Range .... –65°C to 150°C
Lead Temperature (Soldering, 10 sec.) .... 300°C

PACKAGE/ORDER INFORMATION



N PACKAGE
16-LEAD PLASTIC DIP
T_{JMAX} = 110°C, θ_{JA} = 120°C/W

ORDER PART NUMBER
LTC1156CN



S PACKAGE
16-LEAD PLASTIC SOL
T_{JMAX} = 110°C, θ_{JA} = 130°C/W

ORDER PART NUMBER
LTC1156CS

Consult factory for Industrial and Military grade parts.

ELECTRICAL CHARACTERISTICS **V_S = 4.5V to 18V, T_A = 25°C, unless otherwise noted.**

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
V_S	Supply Voltage	(Note 1)	●	4.5		18	V
I_Q	Quiescent Current OFF	V_S = 5V, V_{IN} = 0V (Note 2)			16	40	µA
I_Q	Quiescent Current ON	V_S = 5V, V_{IN} = 5V (Note 3)			95	125	µA
I_Q	Quiescent Current ON	V_S = 12V, V_{IN} = 5V (Note 3)			180	400	µA
V_{INH}	Input High Voltage		●	2.0			V
V_{INL}	Input Low Voltage		●			0.8	V
I_{IN}	Input Current	0V < V_{IN} < V_S	●			±1.0	µA
C_{IN}	Input Capacitance				5		pF
V_{SEN}	Drain Sense Threshold Voltage		 ●	80 75	100 100	120 125	mV mV
I_{SEN}	Drain Sense Input Current	0V < V_{SEN} < V_S	●			±0.1	µA
$V_{GATE} – V_S$	Gate Voltage Above Supply	V_S = 5V V_S = 6V V_S = 12V	● ● ●	6.0 7.5 15	7.0 8.3 18	9.0 15.0 25	V V V
t_{ON}	Turn-ON Time	V_S = 5V, C_{GATE} = 1000pF Time for V_{GATE} > V_S + 2V Time for V_{GATE} > V_S + 5V		 50 200	 250 1100	 750 2000	 µs µs
		V_S = 12V, C_{GATE} = 1000pF Time for V_{GATE} > V_S + 5V Time for V_{GATE} > V_S + 10V		 50 120	 180 450	 500 1200	 µs µs

ELECTRICAL CHARACTERISTICS V_S = 4.5V to 18V, T_A = 25°C, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
t_{OFF}	Turn-OFF Time	V_S = 5V, C_{GATE} = 1000pF Time for V_{GATE} < 1V	10	36	60	µs
		V_S = 12V, C_{GATE} = 1000pF Time for V_{GATE} < 1V	10	26	60	µs
t_{SC}	Short Circuit Turn-OFF Time	V_S = 5V, C_{GATE} = 1000pF Time for V_{GATE} < 1V	5	16	30	µs
		V_S = 12V, C_{GATE} = 1000pF Time for V_{GATE} < 1V	5	16	30	µs

The ● denotes specifications which apply over the full operating temperature range.

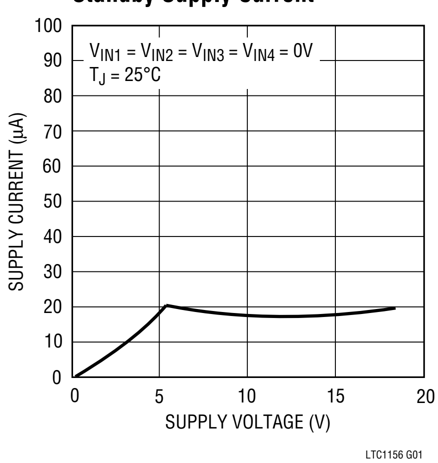
Note 1: Both V_S pins (3 and 8) must be connected together, and both ground pins (1 and 6) must be connected together.

Note 2: Quiescent current OFF is for all channels in OFF condition.

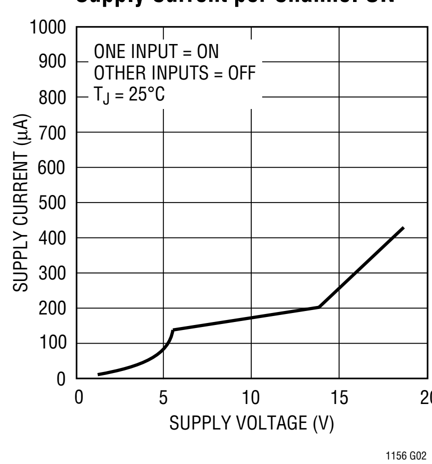
Note 3: Quiescent current ON is per driver and is measured independently.

TYPICAL PERFORMANCE CHARACTERISTICS

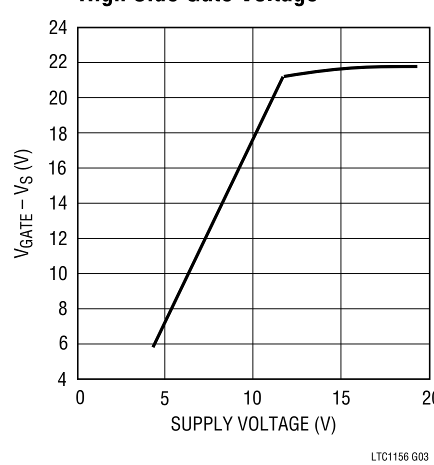
Standby Supply Current



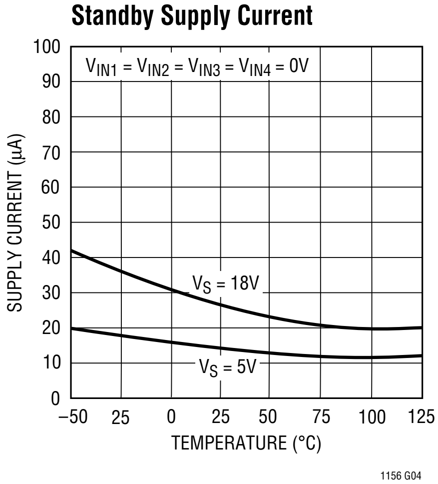
Supply Current per Channel ON



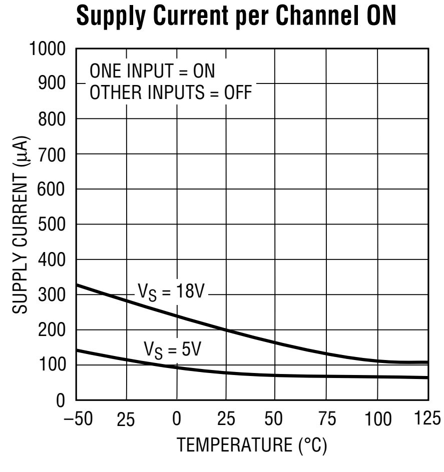
High Side Gate Voltage



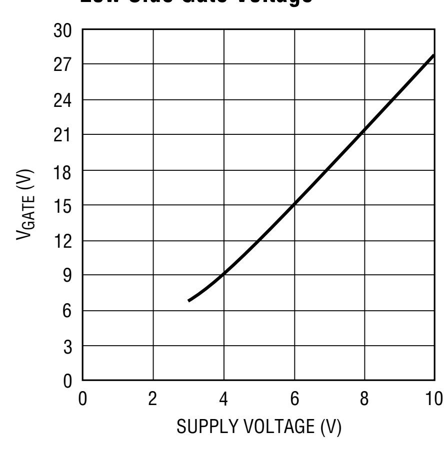
Standby Supply Current



Supply Current per Channel ON

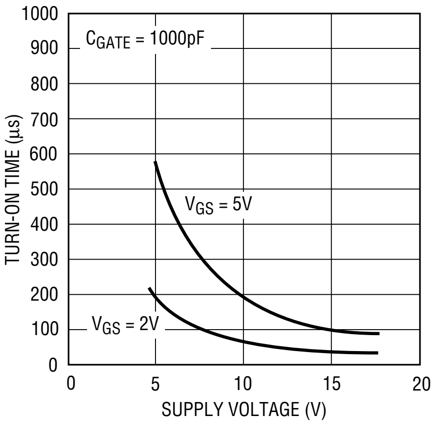


Low Side Gate Voltage

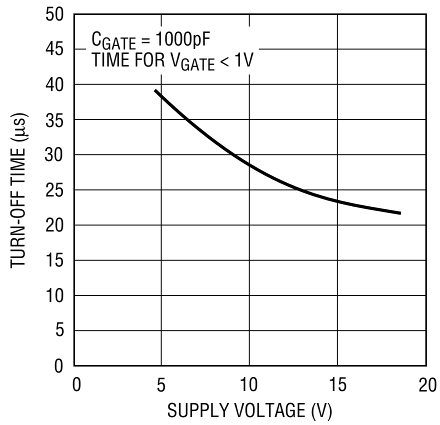


TYPICAL PERFORMANCE CHARACTERISTICS

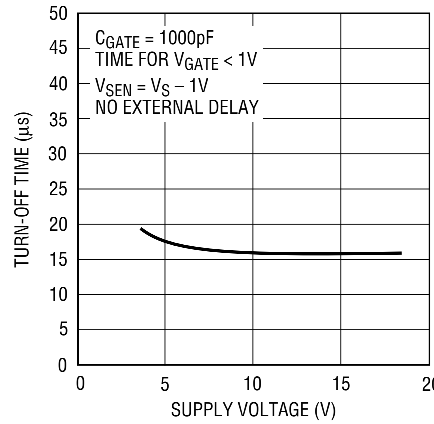
Turn-ON Time



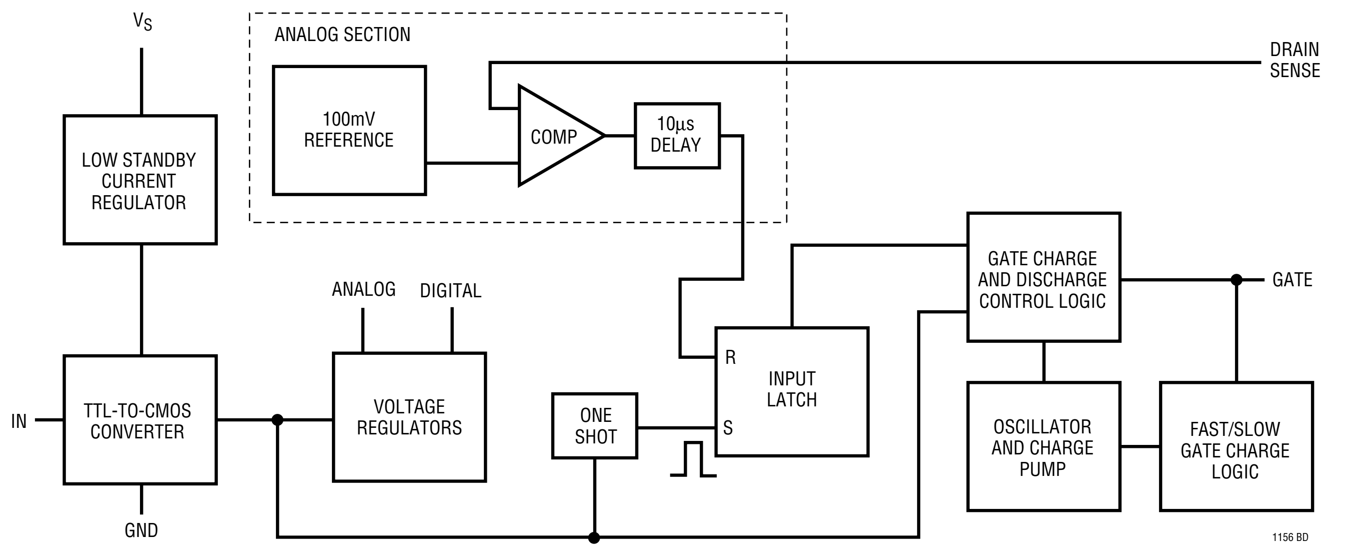
Turn-OFF Time



Short Circuit Turn-OFF Delay Time



BLOCK DIAGRAM



OPERATION

The LTC1156 contains four independent power MOSFET gate drivers and protection circuits (refer to the Block Diagram for detail). Each section of LTC1156 consists of the following functional blocks:

TTL and CMOS Compatible Inputs

Each driver input has been designed to accommodate a wide range of logic families. The input threshold is set at 1.3V with approximately 100mV of hysteresis.

OPERATION

A voltage regulator with low standby current provides continuous bias for the TTL to CMOS converters. The TTL to CMOS converter output enables the rest of the circuitry. In this way the power consumption is kept to a minimum in the standby mode.

Internal Voltage Regulation

The output of the TTL to CMOS converter drives two regulated supplies which power the low voltage CMOS logic and analog blocks. The regulator outputs are isolated from each other so that the noise generated by the charge pump logic is not coupled into the 100mV reference or the analog comparator.

Gate Charge Pump

Gate drive for the power MOSFET is produced by an adaptive charge pump circuit which generates a gate voltage substantially higher than the power supply voltage. The charge pump capacitors are included on chip and therefore no external components are required to generate the gate drive.

Drain Current Sense

The LTC1156 is configured to sense the drain current of the power MOSFET in high side applications. An internal 100mV reference is compared to the drop across a sense resistor (typically 0.002Ω to 0.1Ω) in series with the drain lead. If the drop across this resistor exceeds the internal 100mV threshold, the input latch is reset and the gate is quickly discharged by a large N-channel transistor. A simple RC network can be added to delay the over-current protection so that large in-rush current loads such as lamps or capacitors can be started.

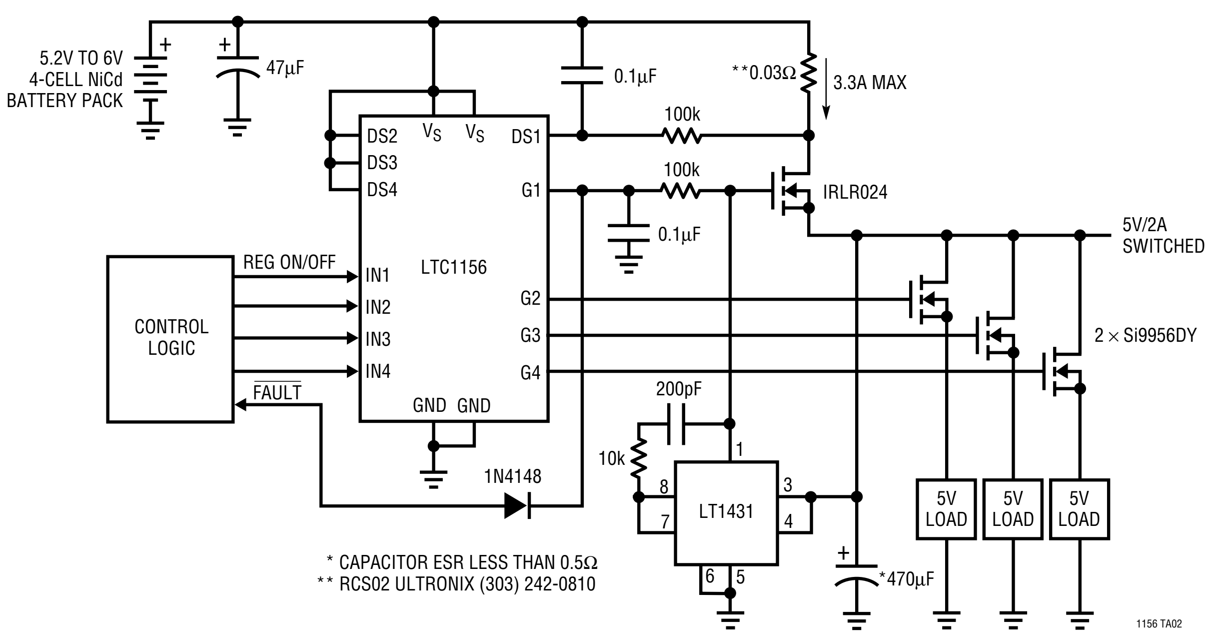
Supply and Ground Pins

The two supply pins (3 and 8) of the LTC1156 must be connected together at all times and the two ground pins (1 and 6) must be connected together at all times. The two supply pins should be connected to the "top" of the drain current sense resistor/s to ensure accurate sensing.

For further applications information, see the LTC1155 Dual High Side Micropower MOSFET Driver data sheet.

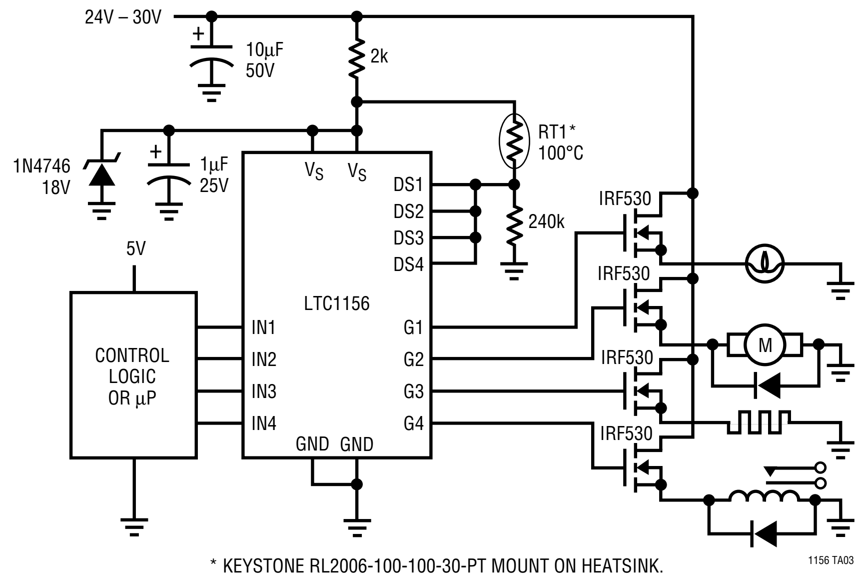
TYPICAL APPLICATIONS

4-Cell Extremely Low Voltage Drop Regulator and Three Load Switches with Short-Circuit Protection and 20μA Standby Current

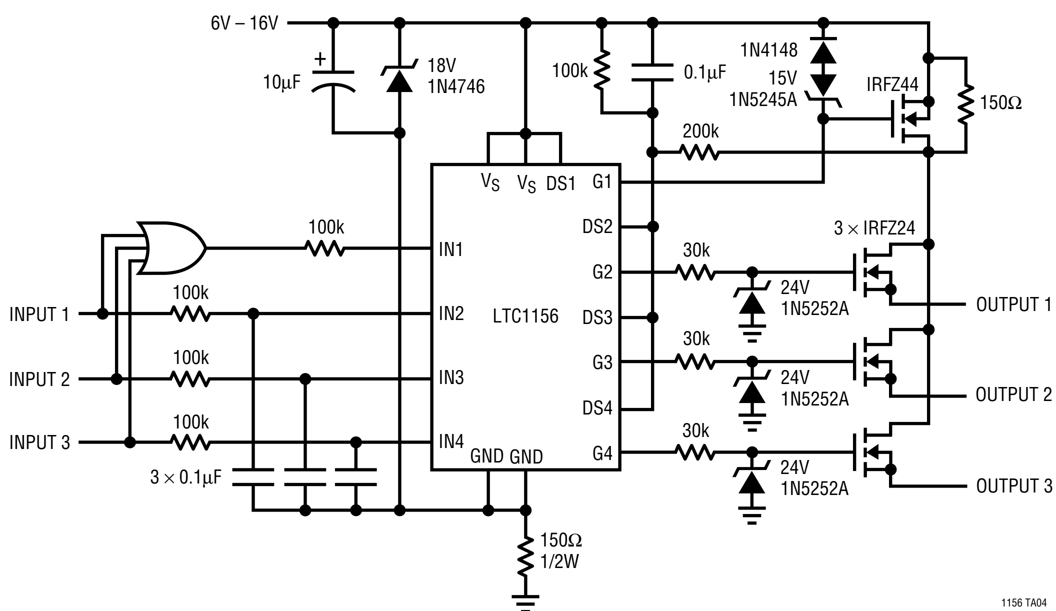


TYPICAL APPLICATIONS

24V to 30V Quad Industrial Switch with Thermal Shutdown

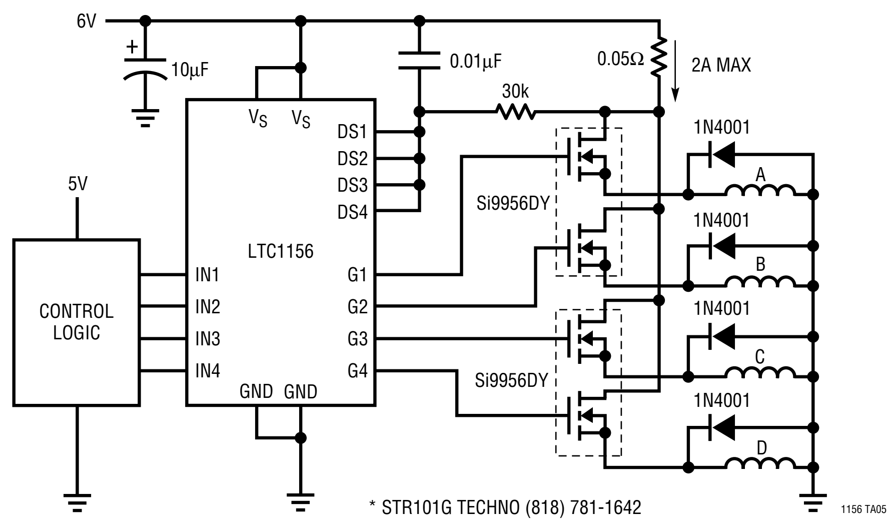


Automotive Triple High Side Switch with Reverse Battery Interrupt, Short-Circuit and High-Voltage Transient Protection (20μA Standby Current)

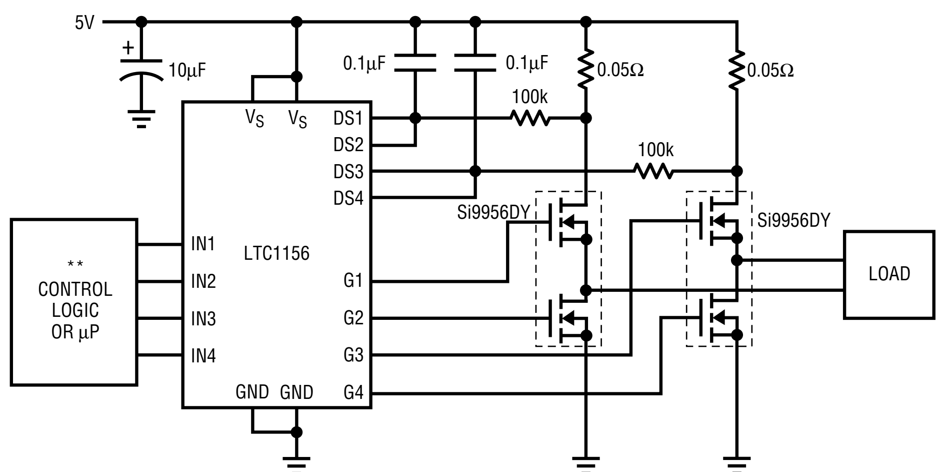


TYPICAL APPLICATIONS

4-Phase Stepper Motor Driver with Short-Circuit Protection



Full H-Bridge Driver with Short-Circuit Protection and 16µA Standby Current
Low Frequency Operation (<100Hz)

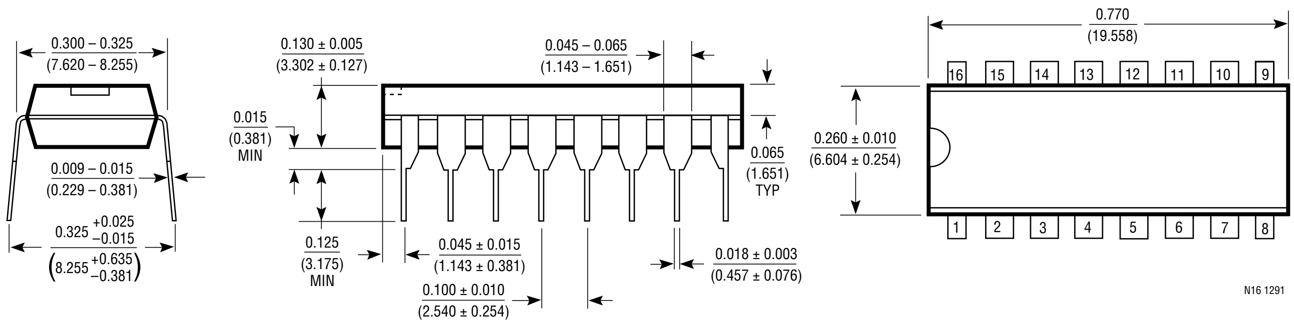


* STR101G TECHNO (818) 781-1642
** SOFTWARE (OR HARDWARE) DELAYS SHOULD BE PROVIDED TO AVOID CROSS-CONDUCTION. ALL COMPONENTS SHOWN ARE SURFACE MOUNT.

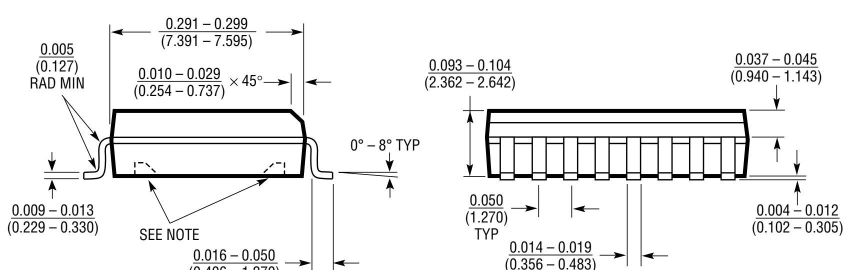
For more Typical Applications, see LTC1155 data sheet.

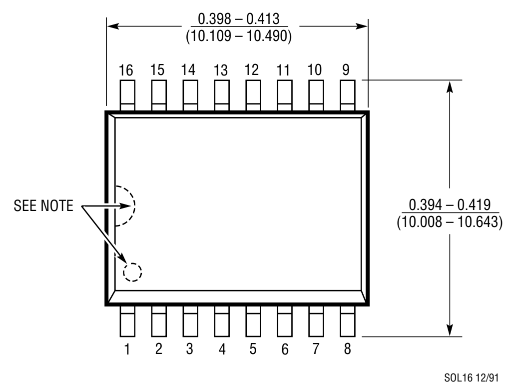
PACKAGE DESCRIPTION **Dimesions in inches (millimeters) unless otherwise noted.**

N Package
16-Lead Plastic DIP



S Package
16-Lead Plastic SOL





NOTE:
PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS.
THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS.

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