

# 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 16 $\mu$ A standby current and 95 $\mu$ A operating current, allows use in virtually all systems with maximum efficiency.

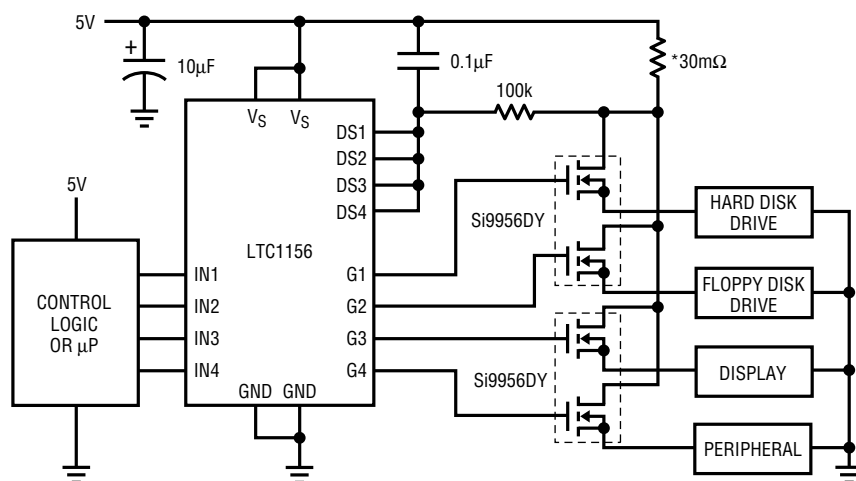
Included on chip is independent over-current sensing to provide automatic shutdown in case of short circuits. A time delay can be added to the current sense to prevent false triggering on high in-rush current loads.

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.

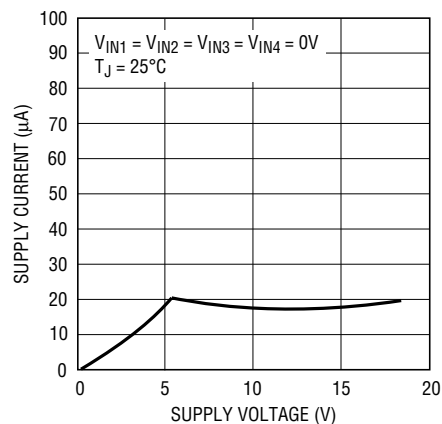
The LTC1156 is available in both 16-pin DIP and 16-pin SOL packages.

## TYPICAL APPLICATION

**Laptop Computer Power Management**



**Standby Supply Current**



ALL COMPONENTS SHOWN ARE SURFACE MOUNT. MINIMUM PARTS COUNT SHOWN. CURRENT LIMITS CAN BE SET SEPARATELY AND TAILORED TO INDIVIDUAL LOAD CHARACTERISTICS.

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# LTC1156

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage .....	22V	Operating Temperature Range	
Input Voltage .....	( $V_S + 0.3V$ ) to ( $GND - 0.3V$ )	LTC1156C .....	0°C to 70°C
Gate Voltage .....	( $V_S + 24V$ ) to ( $GND - 0.3V$ )	Storage Temperature Range .....	-65°C to 150°C
Current (Any Pin) .....	50mA	Lead Temperature (Soldering, 10 sec.) .....	300°C

## PACKAGE/ORDER INFORMATION

<p>N PACKAGE 16-LEAD PLASTIC DIP <math>T_{JMAX} = 110^{\circ}C</math>, <math>\theta_{JA} = 120^{\circ}C/W</math></p>	<p>ORDER PART NUMBER</p> <p>LTC1156CN</p>	<p>S PACKAGE 16-LEAD PLASTIC SOL <math>T_{JMAX} = 110^{\circ}C</math>, <math>\theta_{JA} = 130^{\circ}C/W</math></p>	<p>ORDER PART NUMBER</p> <p>LTC1156CS</p>
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Consult factory for Industrial and Military grade parts.

## ELECTRICAL CHARACTERISTICS $V_S = 4.5V$ to $18V$ , $T_A = 25^{\circ}C$ , 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	$\mu A$	
$I_Q$	Quiescent Current ON	$V_S = 5V$ , $V_{IN} = 5V$ (Note 3)		95	125	$\mu A$	
$I_Q$	Quiescent Current ON	$V_S = 12V$ , $V_{IN} = 5V$ (Note 3)		180	400	$\mu A$	
$V_{INH}$	Input High Voltage		●	2.0		V	
$V_{INL}$	Input Low Voltage		●		0.8	V	
$I_{IN}$	Input Current	$0V < V_{IN} < V_S$	●		$\pm 1.0$	$\mu A$	
$C_{IN}$	Input Capacitance			5		pF	
$V_{SEN}$	Drain Sense Threshold Voltage		●	80 75	100 100	120 125	mV mV
$I_{SEN}$	Drain Sense Input Current	$0V < V_{SEN} < V_S$	●		$\pm 0.1$	$\mu A$	
$V_{GATE} - V_S$	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	$\mu s$ $\mu s$
		$V_S = 12V$ , $C_{GATE} = 1000pF$ Time for $V_{GATE} > V_S + 5V$ Time for $V_{GATE} > V_S + 10V$		50 120	180 450	500 1200	$\mu s$ $\mu s$

**ELECTRICAL CHARACTERISTICS**  $V_S = 4.5V$  to  $18V$ ,  $T_A = 25^\circ C$ , 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	$\mu s$
		$V_S = 12V, C_{GATE} = 1000pF$ Time for $V_{GATE} < 1V$	10	26	60	$\mu s$
$t_{SC}$	Short Circuit Turn-OFF Time	$V_S = 5V, C_{GATE} = 1000pF$ Time for $V_{GATE} < 1V$	5	16	30	$\mu s$
		$V_S = 12V, C_{GATE} = 1000pF$ Time for $V_{GATE} < 1V$	5	16	30	$\mu s$

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

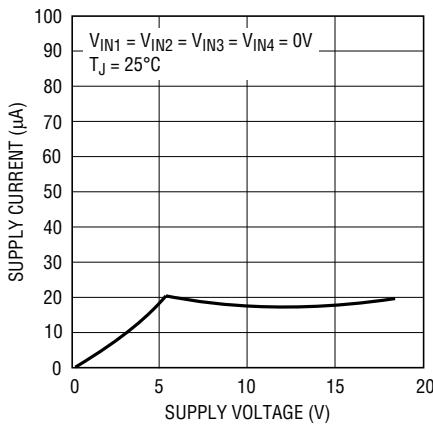
**Note 1:** Both  $V_S$  pins (3 and 8) must be connected together, and both ground pins (1 and 6) must be connected together.

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

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

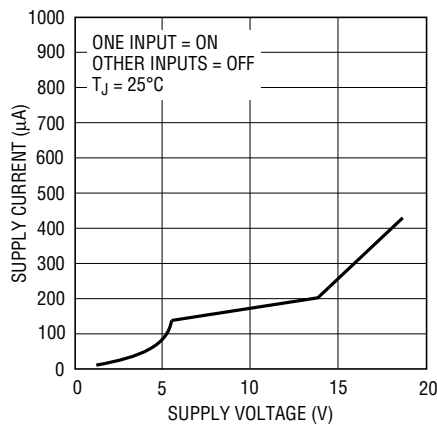
**TYPICAL PERFORMANCE CHARACTERISTICS**

**Standby Supply Current**



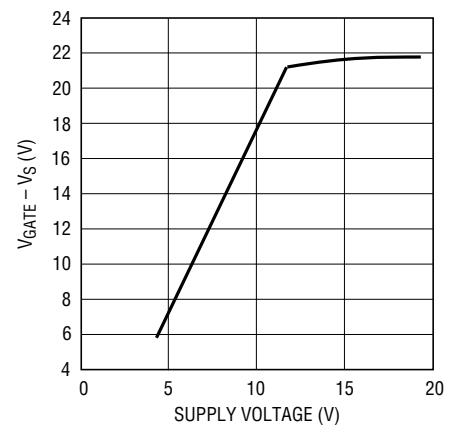
LTC1156 G01

**Supply Current per Channel ON**



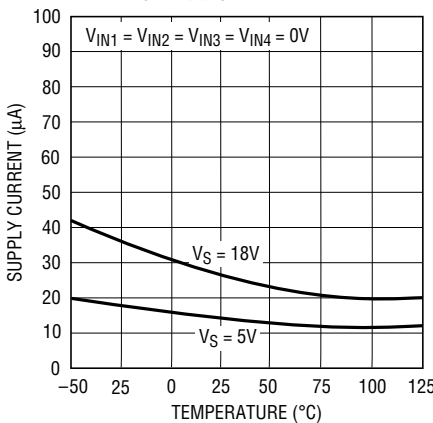
1156 G02

**High Side Gate Voltage**



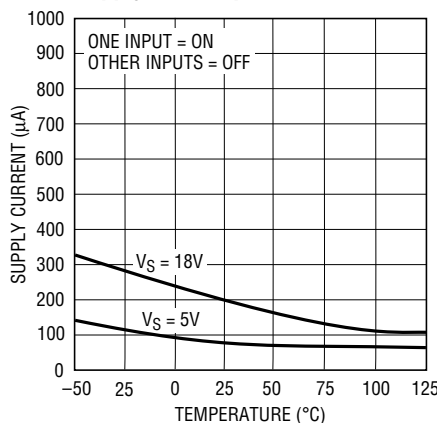
LTC1156 G03

**Standby Supply Current**



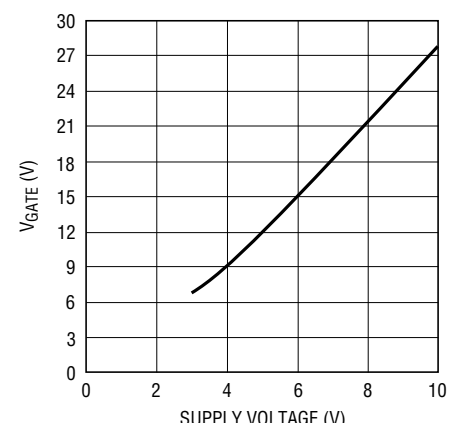
1156 G04

**Supply Current per Channel ON**



1156 G05

**Low Side Gate Voltage**



1156 G06