

# LTC7001 Fast High Voltage High Side NMOS Static Switch Driver

## DESCRIPTION

Demonstration circuit 2708A is a 135V, high side switch featuring the [LTC<sup>®</sup>7001](#). The demo board is designed to switch a 5A output load from 0V up to 135V. This board offers a low 50ns (typical) propagation delay, fast switching times (<10ns) and 100% duty cycle operation.

The LTC7001 is a fast high voltage high side N-channel MOSFET driver. An internal charge pump fully enhances an external N-channel MOSFET switch, allowing it to remain on indefinitely. A powerful gate driver can drive large gate capacitance MOSFETs with very short transition times, ideal for both high frequency switching and static switch applications. The LTC7001 operates over a 0V to 135V input supply range.

The demo board includes input capacitors and an output diode to accommodate input and output supply inductance when switching loads. The switch can be controlled by providing an external signal on INPUT turret. The  $V_{CC}$

input must be powered with an external power supply to provide power to the controller. Positions for RC delay network to control inrush current are also included.

The LTC7001 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this demo manual for demo circuit 2708A. Proper board layout is essential for maximum thermal and electrical performance. See the data sheet sections for details. The LTC7001 is available in 10-lead MSOP package and three operating junction temperature grades, extended and industrial from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ , a high temp automotive version from  $-40^{\circ}\text{C}$  to  $150^{\circ}\text{C}$  and a military grade version from  $-55^{\circ}\text{C}$  to  $150^{\circ}\text{C}$ .

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2708A>**

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## PERFORMANCE SUMMARY Specifications are at $T_A = 25^{\circ}\text{C}$

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
$V_{IN}$	Input Voltage		0		135	V
$I_{OUT}$	Output Current		5			A
	Insertion Drop	$V_{IN} - V_{OUT}$ , 5A Load, Input to Output Terminals		115		mV
$V_{CC}$	Main Supply		7		12	V
$V_{CCUV}$	$V_{CC}$ Undervoltage Lockout	$V_{CC}$ Rising	6.5	7.0	7.5	V
		$V_{CC}$ Falling	5.8	6.4	6.9	V
		Hysteresis		0.6		V
	Input to Output Propagation Delay	$V_{IN} = 135\text{V}$ , 50 $\Omega$ Load, INP = 2.2V to $V_{OUT} = 13.5\text{V}$		50		ns
	Output Rise Time	$V_{IN} = 135\text{V}$ , 50 $\Omega$ Load, 10% to 90%		6.5		ns

### QUICK START PROCEDURE

Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

NOTE: When measuring the output voltage during switching transitions, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip and ground ring directly across the output capacitor as shown in Figure 2.

1. With input power supply set to zero volt and power off, connect the input power supply to  $+V_{IN}$  and GND.
2. With power off, connect load from  $+V_{OUT}$  to GND.
3. Set  $V_{CC}$  supply to zero volt and power off, connect  $V_{CC}$  supply to  $V_{CC}$  and GND.
4. Turn on  $V_{CC}$  supply and increase the voltage slowly to 10V.
5. Turn on the input power supply and increase the input voltage slowly to 9V. The input range is up to 135V but hot-plugging with long leads may result in input voltages in excess of 135V.
6. Connect a signal source across INPUT and GND. Apply a signal with 2.2V or higher will turn-on the high side switch.
7. Check for the proper output voltage using a voltmeter. Output voltage should be close to input voltage.
8. Once the proper output voltage is established, adjust the load.

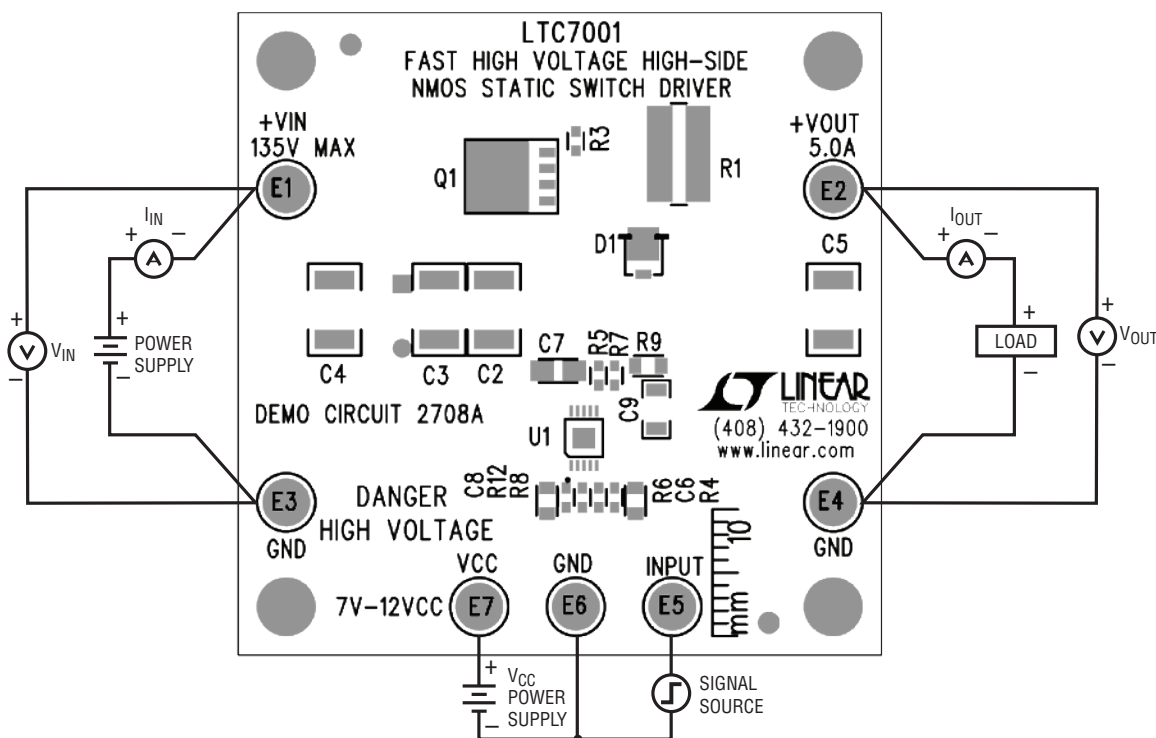


Figure 1. Proper Measurement Equipment Setup

## QUICK START PROCEDURE

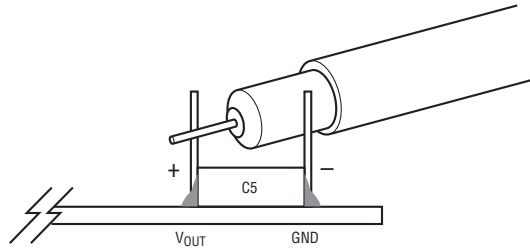
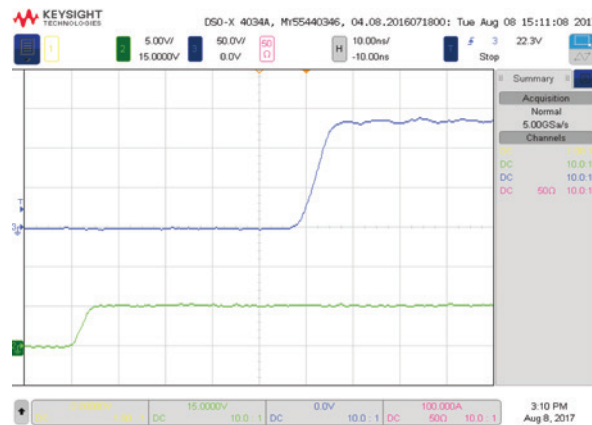


Figure 2. Measuring Output Voltage During Switching across C5. Note that C5 May Not Be Installed

## TYPICAL PERFORMANCE CHARACTERISTICS



CHANNEL 2: INP  
CHANNEL 3: V<sub>OUT</sub>  
50Ω RESISTIVE LOAD

Figure 3. Rise Time into 50Ω Load ( $V_{IN} = 135V$ , CH2  $V_{INP}$  5V/DIV, CH3  $V_{OUT}$  50V/DIV, 10ns/DIV)

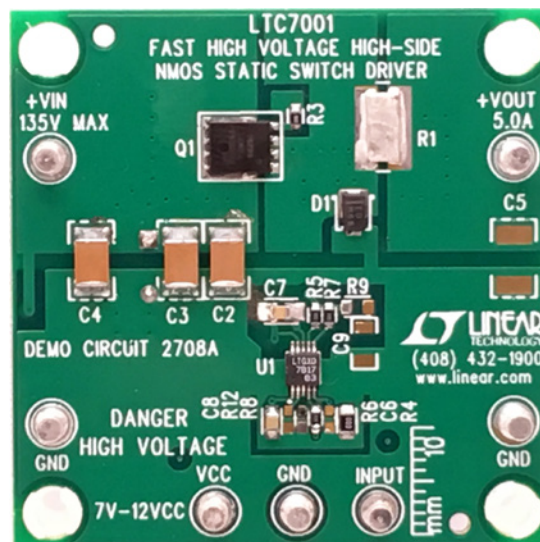


Figure 4. Board Photo

# DEMO MANUAL

## DC2708A

### PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	3	C2, C3, C4	CAP, 1 $\mu$ F, X7T, 250V, 1812	TDK, C4532X7T2E105K250KA
2	1	C7	CAP, 0.1 $\mu$ F, X7R, 25V, 10%, 0805	AVX, 08053C104KAT2A
3	1	C8	CAP, 1 $\mu$ F, X7R, 25V,10%, 0805	AVX, 08053C105KAT2A
4	1	D1	DIODE, ES1PD, 200V, 1A, DO-220AA	VISHAY, ES1PD-M3/84A
5	1	Q1	MOSFET, N-CH, 150V, POWERPAK-SO-8	FAIRCHILD, FDMS86250
6	1	R3	RES., 10 $\Omega$ , 1/10W, 1%, 0603	VISHAY, CRCW060310R0FKEA
7	1	R4	RES., 0 $\Omega$ , 1/10W, 0805	VISHAY CRCW08050000Z0EA
8	1	U1	IC, LTC7001EMSE, MSE-10	LINEAR TECH., LTC7001EMSE#PBF
<b>Additional Demo Board Circuit Components</b>				
1	1	C1	CAP., 22 $\mu$ F, ALUM, 160V, 20%,10mm x 12.5mm	SUN ELECT., 160ME22HPC
2	0	C5	CAP., OPTIONAL, 1812	OPTIONAL
3	0	C6	CAP., OPTIONAL, 0603	OPTIONAL
4	0	C9	CAP., OPTIONAL, 1206	OPTIONAL
5	0	D2	DIODE OPTIONAL, POWERDI5	OPTIONAL
6	1	D3	DIODE, OPTIONAL, SOT23	OPTIONAL
7	0	D4	DIODE, OPTIONAL, SOT23	OPTIONAL
8	0	Q2	MOSFET, OPTIONAL, D2-PAK	OPTIONAL
9	0	Q3	MOSFET, OPTIONAL, POWERPAK-SO-8	OPTIONAL
10	1	R1	RES., SENSE, 0 $\Omega$ , 1/2W, 1%, 1225	TEPRO, RN5326
11	0	R2, R9	RES., OPTIONAL, 0805	OPTIONAL
12	3	R5, R6, R7	RES., 0 $\Omega$ , 1/10W, 0603	VISHAY CRCW06030000Z0EA
13	0	R8, R10, R11, R12	RES., OPTIONAL, 0603	OPTIONAL
<b>Hardware: For Demo Board Only</b>				
1	7	E1-E7	TESTPOINT, TURRET 0.094"	MILL MAX 2501-2-00-80-00-00-07-0
2	4	MTGS. @ 4 CORNERS	STAND-OFF, NYLON 0.559" TALL	WURTH ELEKTRONIK, 702935500
3	1		PCB, DC2708A	DEMO CIRCUIT 2708A



# DEMO MANUAL

## DC2708A

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**Please read the DEMO BOARD manual prior to handling the product.** Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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