LTC7004
Fast 60V High Side NMOS Static Switch Driver

DESCRIPTION

Demonstration circuit 2750A is a 60V, high side switch featuring the LTC®7004. This demo board is designed to switch a 14.5A output load from 0V up to 60V, and offers a low 50ns (typical) propagation delay, fast switching times (<10ns) and 100% duty cycle operation.

The LTC7004 is a fast 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 LTC7004 operates over a 0V to 60V 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 LTC7004 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this DC2750A demo manual. Proper board layout is essential for maximum thermal and electrical performance. See the data sheet sections for details. The LTC7004 is available in 10-lead MSOP package and three operating junction temperature grades, extended and industrial from –40°C to 125°C, a high temp automotive version from –40°C to 150°C and a military grade version from –55°C to 150°C.

Design files for this circuit board are available at http://www.linear.com/demo/DC2750A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Voltage		0		60	V
I_{OUT}	Output Current				14.5	A
	Insertion Drop	$V_{IN} – V_{OUT}$, 14.5A Load, Input to Output Terminals		50		mV
V_{CC}	Main Supply		6		12	V
V_{CCUV}	V_{CC} Undervoltage Lockout	V_{CC} Rising V_{CC} Falling Hysteresis		5.0 4.4 0.6		V V V
	Input to Output Propagation Delay	V_{IN} = 60V, 50Ω Load, INP = 2.2V to V_{OUT} = 6V		50		ns
	Output Rise Time	V_{IN} = 60V, 50Ω Load, 10% to 90%		9		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 60V but hot-plugging with long leads may result in input voltages in excess of 60V.
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.

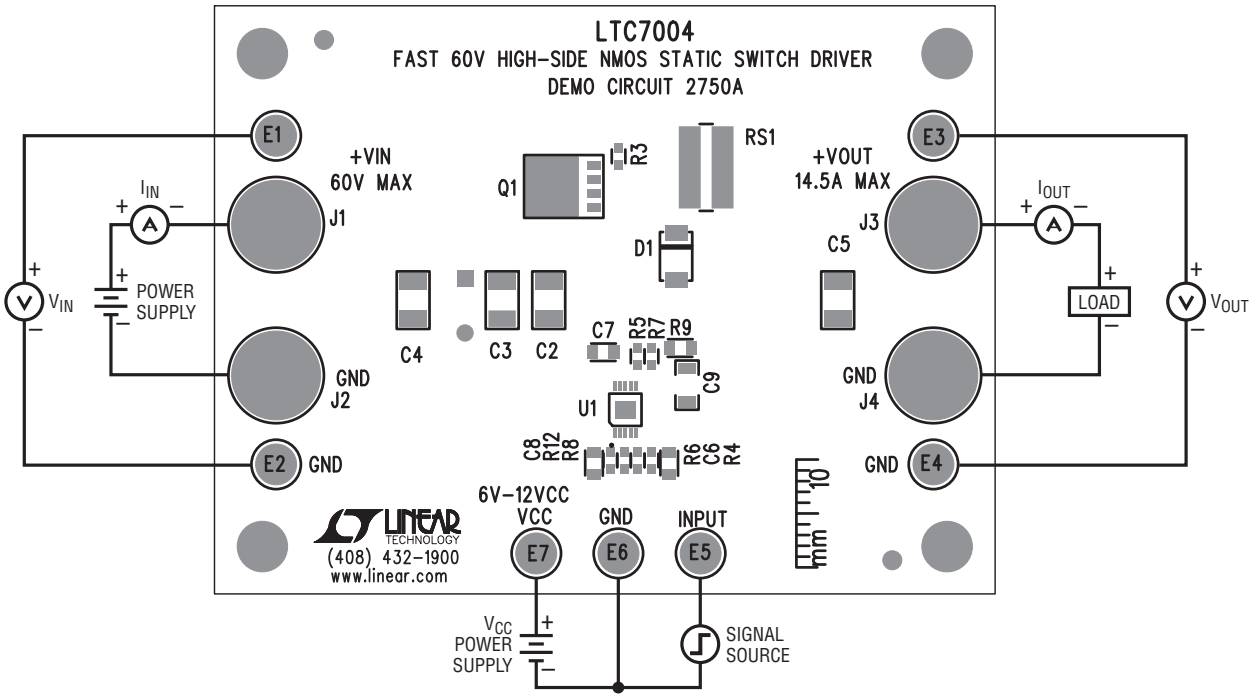


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

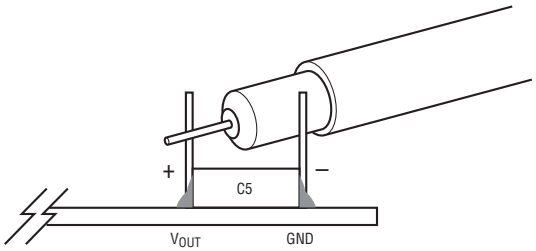
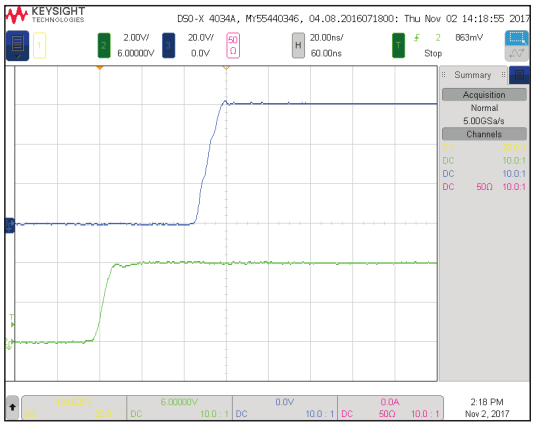


Figure 2. Measuring Output Voltage During Switching across C5. Note that C5 May Not Be Installed

TYPICAL PERFORMANCE CHARATERISTICS



CHANNEL 2: INP
CHANNEL 3: V_{OUT}
50Ω RESISTIVE LOAD

Figure 3. Rise Time into 50Ω Load (V_{IN} = 60V, CH2 V_{INP} 2V/DIV, CH3 V_{OUT} 20V/DIV, 20ns/DIV)

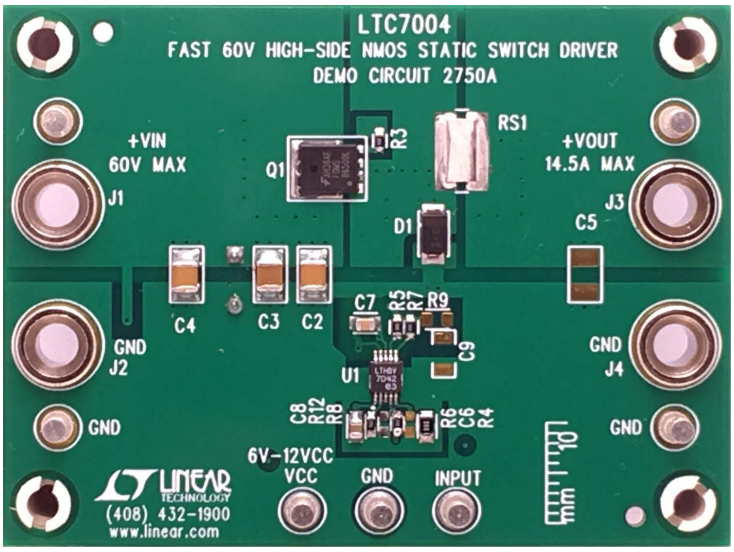
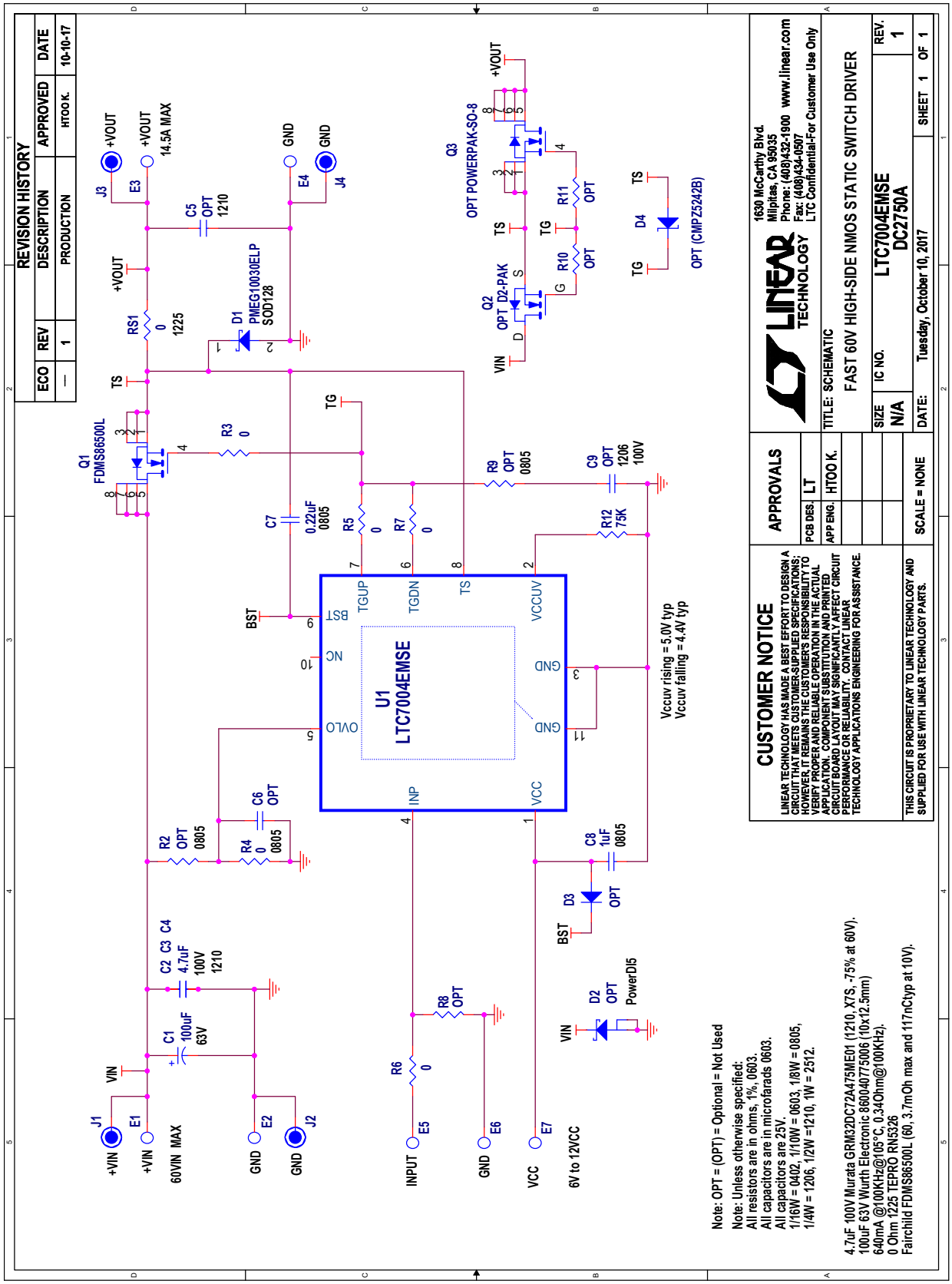


Figure 4. Board Photo

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	3	C2, C3, C4	CAP., 4.7µF, X7S, 100V, 20%, 1210	MURATA, GRM32DC72A475ME01
2	1	C7	CAP., 0.22µF, X7R, 25V, 10%, 0805	AVX, 08053C224KAT2A
3	1	C8	CAP., 1µF, X7R, 25V, 10%, 0805	AVX, 08053C105KAT2A
4	1	D1	DIODE, SCHOTTKY, 100V, 3A, SOD128	NEXPERIA, PMEG10030ELP
5	1	Q1	MOSFET, N-CH, 60V, POWERPAK-SO-8	ON SEMI., FDMS86500L
6	1	R3	RES., 0Ω, 1/10W, 0603	VISHAY CRCW06030000Z0EA
7	1	R4	RES., 0Ω, 1/10W, 0805	VISHAY CRCW08050000Z0EA
8	1	R12	RES., 75k, 1/10W, 0603	VISHAY CRCW060375KFKEA
9	1	U1	IC, LTC7004EMSE, MSE-10	LINEAR TECH., LTC7004EMSE#PBF
Additional Demo Board Circuit Components				
1	1	C1	CAP., 100µF, ELECT., 63V, 20%, TH C-10X12.5	WURTH ELECTRONIC, 860040775006
2	0	C5	CAP., OPTIONAL, 1210	OPTIONAL
3	0	C6	CAP., OPTIONAL, 0603	OPTIONAL
4	0	C9	CAP., OPTIONAL, 1206	OPTIONAL
5	0	D2	DIODE OPTION, PDS4150, POWERDI5	OPTIONAL
6	0	D3	DIODE, OPTION, CMPD3003, SOT23	CENTRAL SEMI., CMPD3003TR
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	RS1	RES., SENSE, 0Ω, 1/2W, 1%, 1225	TEPRO, RN5326
11	0	R2, R9	RES., OPTIONAL, 0805	OPTIONAL
12	3	R5, R6, R7	RES., 0Ω, 1/10W, 0603	VISHAY CRCW06030000Z0EA
13	0	R8, R10, R11	RES., OPTIONAL, 0603	OPTIONAL
Hardware: For Demo Board Only				
1	7	E1-E7	TESTPOINT, TURRET 0.094"	MILL MAX 2501-2-00-80-00-00-07-0
2	4	J1, J2, J3, J4	CONN, BANANA JACK	KEYSTONE, 575-4
3	4	MTGS. AT 4 CORNERS	STAND-OFF, NYLON 0.625" TALL	WURTH ELEKTRONIK, 702936000
4	1		PCB, DC2750A	DEMO CIRCUIT 2750A

SCHEMATIC DIAGRAM



ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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