

LTM4625 Tiny 3A DC/DC Inverting Buck-Boost μModule Regulator

DESCRIPTION

Demonstration circuit 2721A-B features the **LTM®4625EY** μModule® regulator, a tiny high performance high efficiency step-down regulator configured as an inverting buck-boost regulator. DC2721A-B has an operating input voltage range of 4V to 15V and is able to provide an output current of up to 3A. The output voltage can be programmed from $-0.6V$ and $-5.5V$. The LTM4625EY is a complete DC/DC point of load regulator in a thermally

enhanced $6.25mm \times 6.25mm \times 5.01mm$ BGA package requiring only a few input and output capacitors. The LTM4625 data sheet must be read in conjunction with this demo manual for working on or modifying demo circuit 2721A-B.

Design files for this circuit board are available .

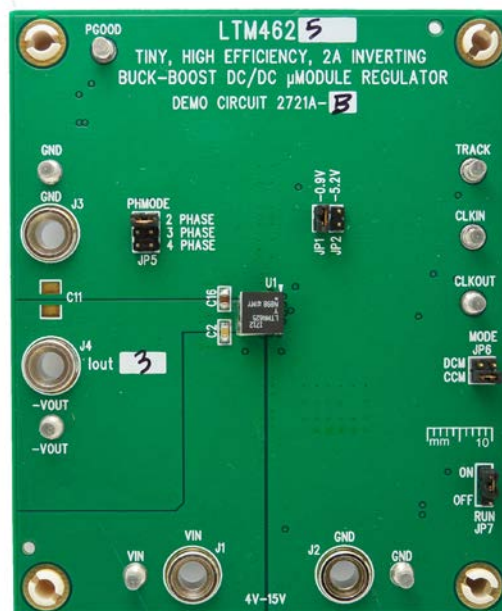
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PERFORMANCE SUMMARY

Specifications are at $T_A = 25^\circ C$

PARAMETER	CONDITIONS/NOTES	VALUE
Input Voltage Range		4V to 15V
Output Voltage V_{OUT}	Jumper Selectable	$-0.9V_{DC}$, $-5.2V_{DC}$
Maximum Continuous Output Current	Derating is Necessary for Certain Operating Conditions. See Data Sheet for Details	$3A_{DC}$
Default Operating Frequency		1MHz
Efficiency	$V_{IN} = 12V$, $V_{OUT} = -2.5V$, $I_{OUT} = 3A$	84% See Figure 2

BOARD PHOTO



QUICK START PROCEDURE

Demonstration circuit 2721A-B is an easy way to evaluate the performance of the LTM4625EY. Please refer to Figure 1 for test setup connections and follow the procedure below.

1. With power off, place the jumpers in the following positions for a typical $-0.9V_{OUT}$ application:

JP7	JP5	JP1
RUN	MODE	V_{OUT} Select
ON	CCM	$-0.9V$

2. Before connecting input supply, load and meters, preset the input voltage supply to be between 4V to 15V. Preset the load current to 0A.
3. With power off, connect the load, input voltage supply and meters as shown in Figure 1.
4. Turn on input power supply. The output voltage meter should display the selected output voltage $\pm 2\%$.

5. Once the proper output voltage is established, adjust the load current within the 0A to 3A range and observe the load regulation, efficiency, and other parameters. Output voltage ripple should be measured across C12 with a BNC cable terminated into 50Ω and an oscilloscope.
6. To observe increased light load efficiency place the mode pin jumper (JP5) in the DCM position.
7. Level shifting circuits are provided for PGOOD, CLKIN and RUN signals. The CLKIN turret E6 can be connected to a ground referenced clock with amplitude up to 3.3V for optional external clock synchronization. The PGOOD turret E8 provides a ground referenced 3.3V PGOOD signal.
8. Note that CLKOUT and TRACK signals are not level shifted and are referenced to $-V_{OUT}$. If ground referenced CLKOUT output and TRACK input signals are desired, external level shifting circuits for these pins are necessary.

QUICK START PROCEDURE

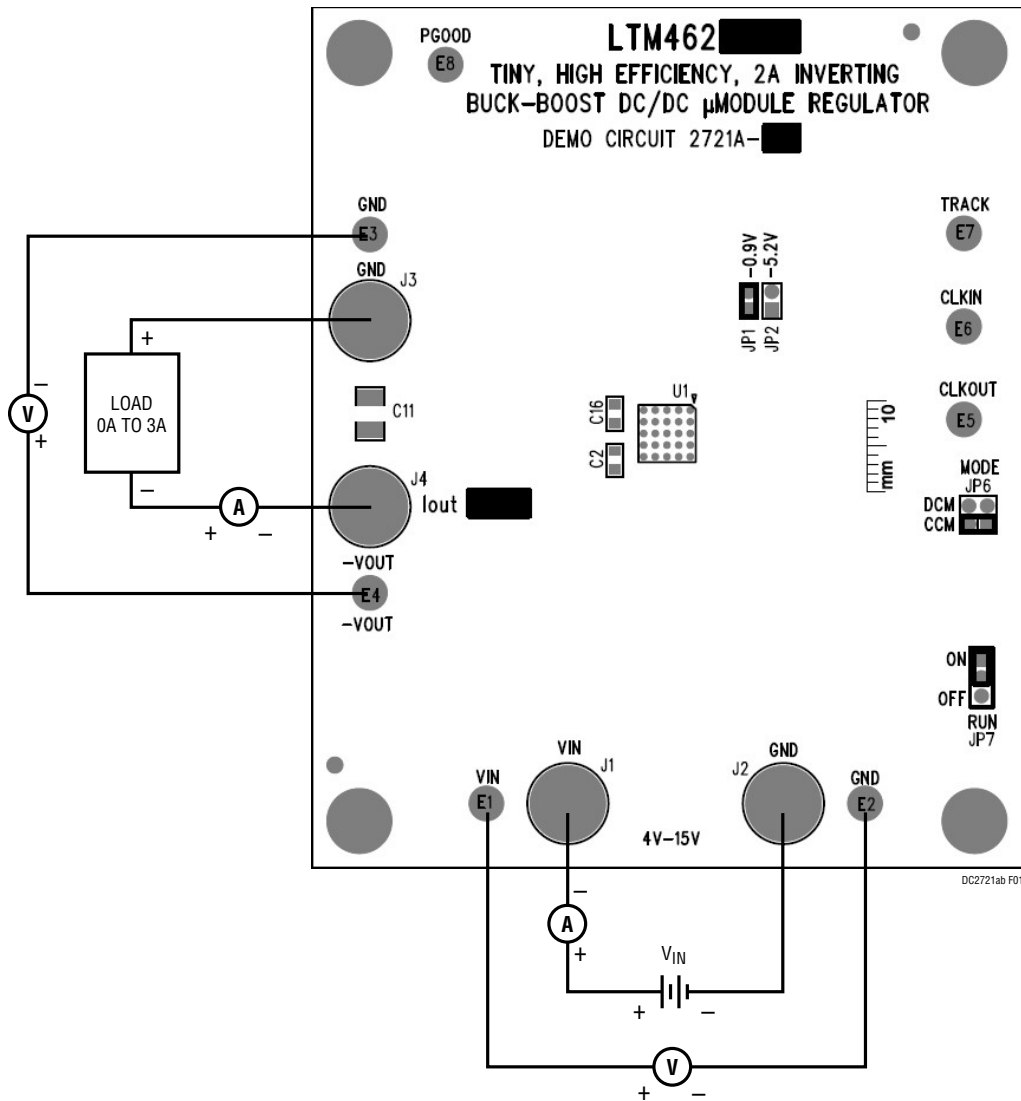


Figure 1. Test Setup

QUICK START PROCEDURE

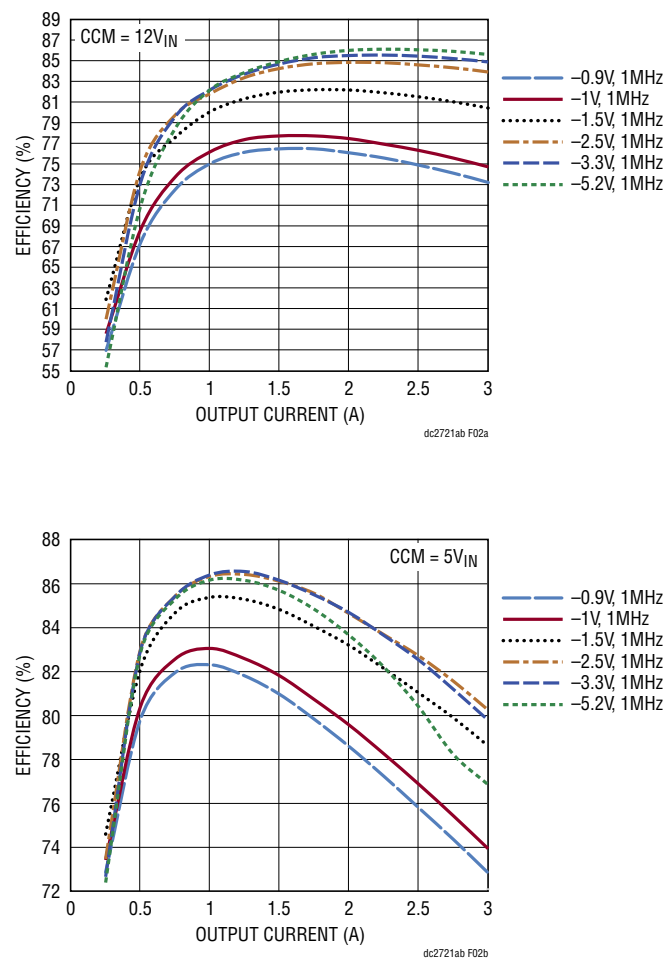
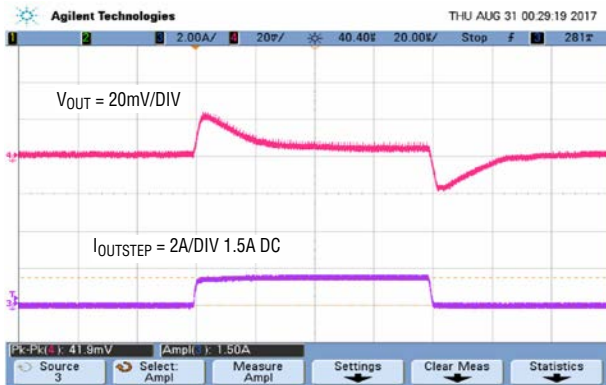


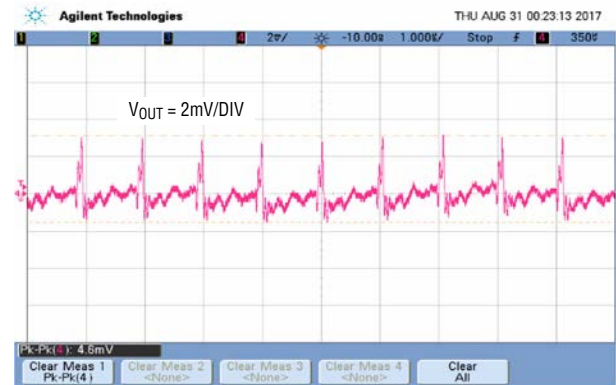
Figure 2. Measured Supply Efficiency at 12V_{IN} and 5V_{IN}

QUICK START PROCEDURE



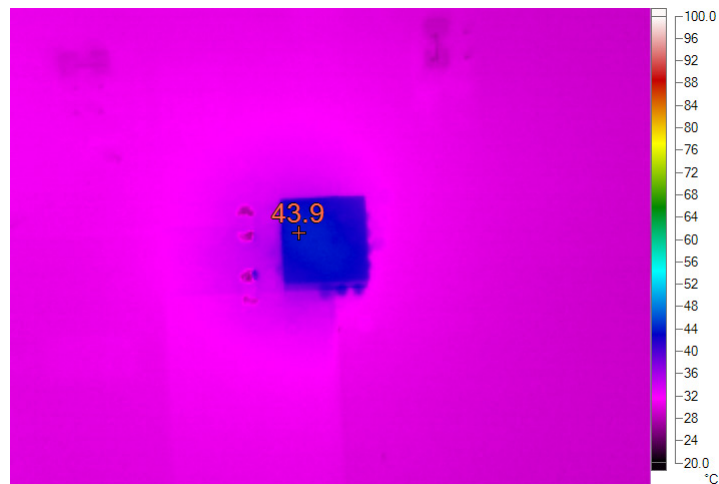
V_{IN} (V)	V_{OUT} (V)	C_{OUT}
12	-0.9	$1 \times 100\mu\text{F}/6.3\text{V} +$ $1 \times 22\mu\text{F}/6.3\text{V} +$ $1 \times 47\mu\text{F}/6.3\text{V}$

Figure 3. Measured Load Transient Response (0A to 1.5A Load Step)



V_{IN} (V)	V_{OUT} (V)	I_{OUT} (A)	C_{OUT}
12	-0.9	3	$1 \times 100\mu\text{F}/6.3\text{V} +$ $1 \times 22\mu\text{F}/6.3\text{V} +$ $1 \times 47\mu\text{F}/6.3\text{V}$

Figure 4. Measured V_{OUT} Ripple



V_{IN} (V)	V_{OUT} (V)	I_{LOAD} (A)	f_{SW} (MHz)	$T_{AMBIENT}$ (C)	FORCED AIRFLOW (LFM)
12	-0.9	3	1	25	0

Figure 5. Measured Case Temperature

DEMO MANUAL

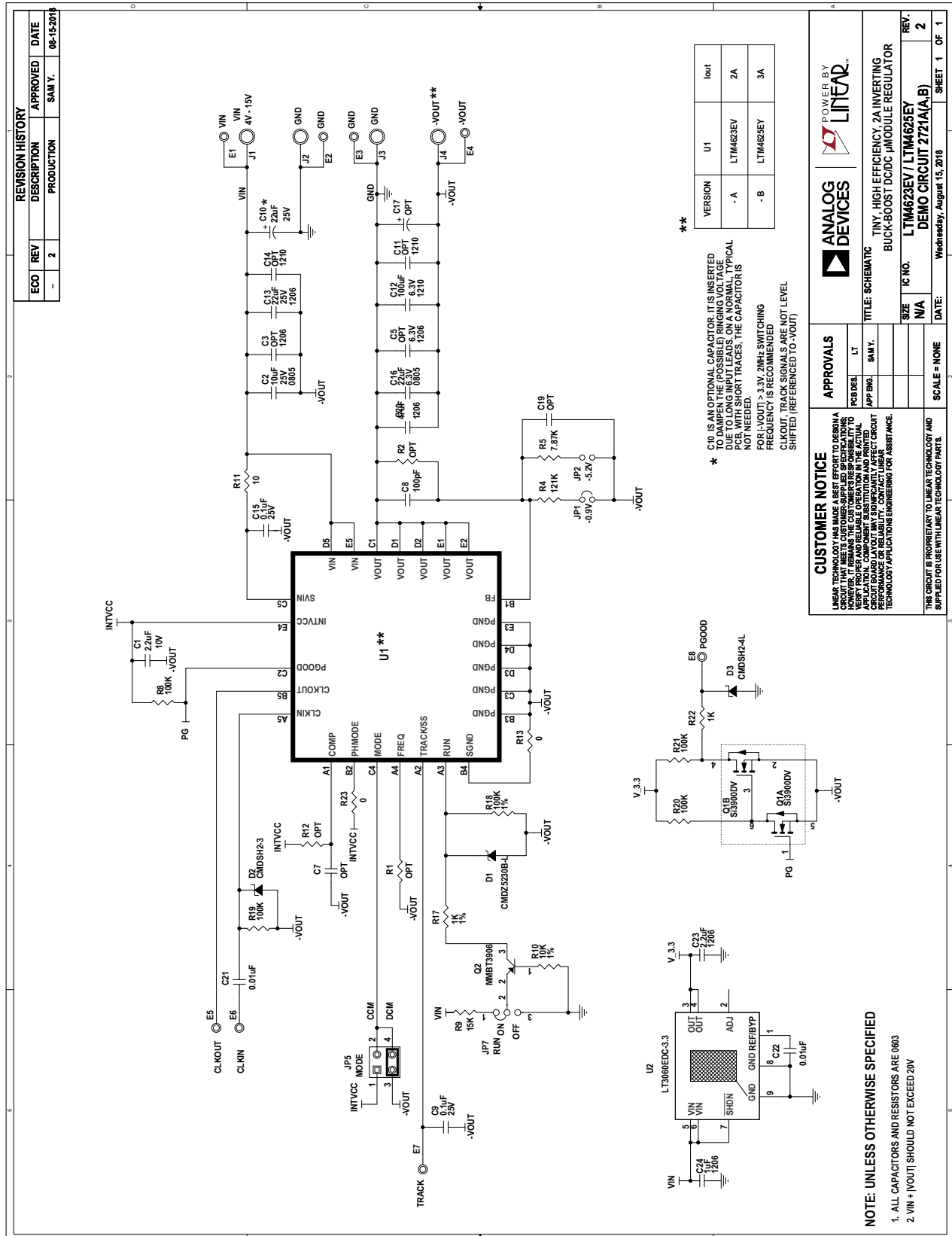
DC2721A-B

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP, 2.2uF, X5R, 10V, 10%, 0603	MURATA, GRM188R61A225KE34D
2	1	C2	CAP, 10uF, X5R, 25V, 10%, 0805	AVX, 08053D106KAT2A
3	1	C12	CAP, 100uF, X5R, 6.3V, 20%, 1210	MURATA, GRM32ER60J107ME20L
4	1	C16	CAP, 22uF, X5R, 6.3V, 20%, 0805	TDK, C2012X5R0J226M125AC
5	1	C20	CAP, 47uF, X5R, 6.3V, 20%, 1206	TDK, C3216X5R0J476M160AC
6	1	R4	RES., 121k, 1/10W, 1%, 0603	VISHAY, CRCW0603121KFKEA
7	1	U1	I.C., STEP-DOWN μ MODULE REGULATOR, BGA-25	ANALOG DEVICES, LTM4625EY#PBF
Additional Demo Board Circuit Components				
1	0	C3,C5 (OPT)	CAP, OPTION, 1206	OPT
2	0	C7,C19 (OPT)	CAP, OPTION, 0603	OPT
3	1	C8	CAP, 100pF, X7R, 50V, 10%, 0603	AVX, 06035C101KAT2A
4	2	C9,C15	CAP, 0.1uF, X5R, 25V, 10%, 0603	AVX, 06033D104KAT2A
5	1	C10	CAP, 22uF, TANT. POLY., 25V, 20%, 7343	PANSONIC, 25TQC22MV
6	0	C11,C14 (OPT)	CAP, OPTION, 1210	OPT
7	1	C13	CAP, 22uF, X5R, 16V, 10%, 1206	MURATA, GRM31CR61C226ME15L
7	1	C23	CAP, 2.2uF, X5R, 10V, 10%, 1206	AVX, 1206ZD225KAT2A
7	1	C24	CAP, 1uF, X7R, 25V, 10%, 1206	AVX, 12063C105KAT2A
8	0	C17 (OPT)	CAP, OPTION, 7343	OPT
9	2	C21,C22	CAP, 0.01uF, X7R, 16V, 10%, 0603	AVX, 0603YC103KAT2A
10	1	D1	DIODE, ZENER, SOD323	CENTRAL SEMI., CMDZ5230B-L
11	1	D2	DIODE, SCHOTTKY, SOD323	CENTRAL SEMI., CMDSH2-3
12	1	D3	DIODE, SCHOTTKY, SOD323	CENTRAL SEMI., CMDSH2-4L
13	1	Q1	XSTR., MOSFET, N-CHAN., 20V, TSOP-6	VISHAY, Si3900DV-T1-GE3
14	1	Q2	XSTR., PNP 40V 0.2A SOT-23	ON SEMI., MMBT3906LT1G
15	0	R1,R2,R12 (OPT)	CAP, OPTION, 0603	OPT
16	1	R5	RES., 7.87k, 1/10W, 1%, 0603	VISHAY, CRCW06037K87FKEA
17	5	R8,R18,R19,R20,R21	RES., 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
18	1	R9	RES., 15k, 1/10W, 1%, 0603	VISHAY, CRCW060315KF0KEA
19	1	R10	RES., 10k, 1/10W, 1%, 0603	VISHAY, CRCW060310K0FKEA
20	1	R11	RES., 10 OHMS, 1/10W, 1%, 0603	VISHAY, CRCW060310R0FKEA
21	2	R13,R23	RES., 0 OHM, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
22	2	R17,R22	RES., 1k, 1/10W, 1%, 0603	VISHAY, CRCW06031K0FKEA
23	1	U2	IC, REG LDO 3.3V 0.1A DFN8	ANALOG DEVICES, LT3060EDC-3.3#TRPBF
Hardware: For Demo Board Only				
1	8	E1,E2,E3,E4,E5,E6,E7,E8	TEST POINT, TURRET, 0.094", MTG. HOLE	MILL MAX 2501-2-00-80-00-00-07-0
2	2	JP1,JP2	CONN., HEADER, 1X2, 2mm	WURTH ELEKTRONIK, 62000211121
3	1	JP5	CONN., HEADER, 2X2, 2mm	WURTH ELEKTRONIK, 62000421121
4	1	JP7	CONN., HEADER, 1X3, 2mm	WURTH ELEKTRONIK, 62000311121
5	4	XJP1,XJP5,XJP6,XJP7	CONN., SHUNT, FEMALE, 2 POS, 2mm	WURTH ELEKTRONIK, 60800213421
6	4	J1,J2,J3,J4	CONN., BANANA JACK, FEMALE, THT, NON-INSULATED, SWAGE, 0.218"	KEYSTONE, 575-4
7	4	MH1,MH2,MH3,MH4	STANDOFF, NYLON, SNAP-ON , 0.375"	KEYSTONE, 8832

Rev.A

SCHEMATIC DIAGRAM



DEMO MANUAL

DC2721A-B



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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Rev.A