LTC3118EUFD
18V, 2A Buck-Boost DC/DC Converter with Low-Loss Dual Power Path

DESCRIPTION

Demonstration Circuit 2045A featuring the LTC3118 is a dual input fixed frequency synchronous buck-boost converter with an intelligent integrated low-loss Power-Path™. The unique all N-Channel architecture provides efficient operation from either input source to a programmable output voltage above, below or equal to the input. Voltage capability of up to 18V provides flexibility and voltage margin for a variety of applications and power sources.

The LTC3118 uses a low noise, current mode architecture with a fixed 1.2MHz PWM mode frequency that minimizes the solution footprint. For high efficiency at light loads, automatic Burst Mode™ operation can be selected consuming only 50µA of quiescent current in sleep.

Typical efficiencies for both Burst Mode and fixed frequency are shown in Figure 1. JP2 in the FIXED FREQ position results in low output ripple but also lower efficiency at light loads. Moving the JP2 position to AUTOBURST enables Burst Mode operation which improves efficiency at light load.

System level features include selectable IDEAL DIODE Mode (shown in Figure 2) or PRIORITY mode operation (shown in Figure 3)

The system can be monitored through $\overline{\text{V1GD}}$, $\overline{\text{V2GD}}$ and $\overline{\text{PGD}}$ (power good) indicators There are accurate RUN comparators to program independent UVLO thresholds, and output disconnect in shutdown. Other features include 2µA shutdown current, short-circuit protection, soft-start, inductor current limit and thermal overload protection.

The DC2045A circuit has excellent transient load response in both fixed frequency and automatic Burst Mode operation as shown in Figures 4 and 5.

The LTC3118 data sheet has detailed information about the operation, specifications, and applications of the part. The data sheet should be read in conjunction with this Quick Start Guide.

Design files for this circuit board are available at http://www.linear.com/demo/DC2045A

PERFORMANCE SUMMARY Specifications are at T_A = 25°C

Input Voltage Range:	2.5V to 18.0V
V_{OUT}	5.0V
I_{OUT}	2.0A for V_{IN} > 5.0V

QUICK START PROCEDURE

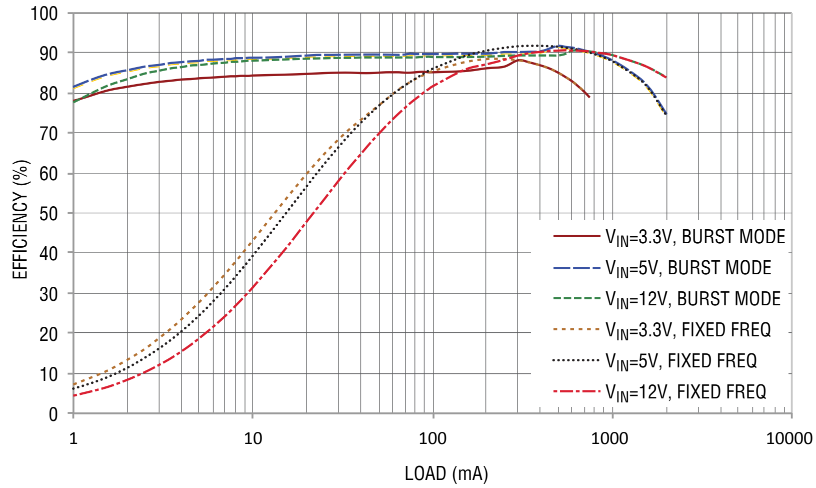


Figure 1. Typical Efficiency as a Function of Input Voltage and Load Current

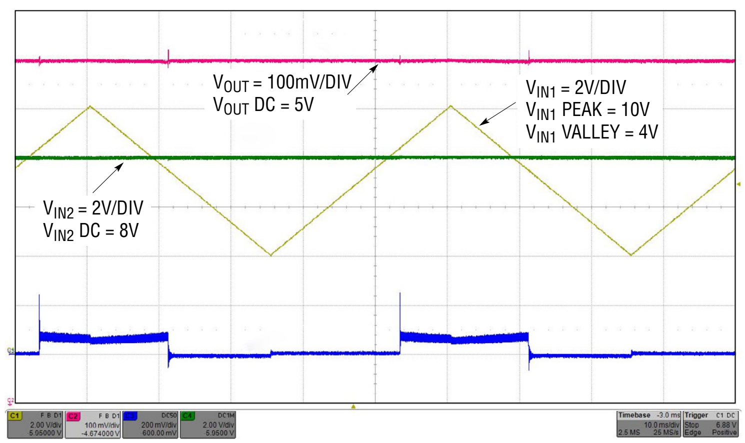


Figure 2. Ideal Diode Mode Operation

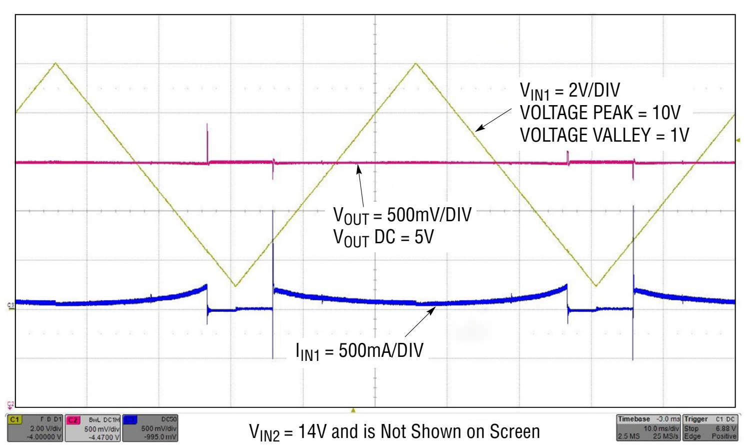


Figure 3. Transitioning from V_{IN1} to V_{IN2} and Back in PRIORITY Mode Operation with V_{IN2} at 14V

QUICK START PROCEDURE

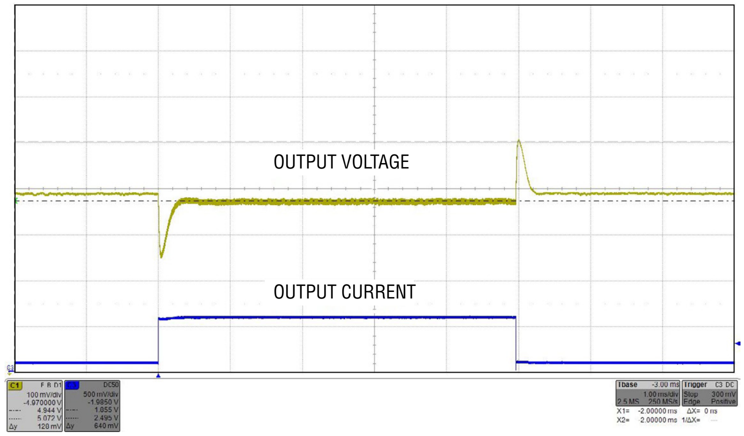


Figure 4. 100mA to 600mA Load Transient with V_{IN1} = 3.5V in Fixed Frequency Mode

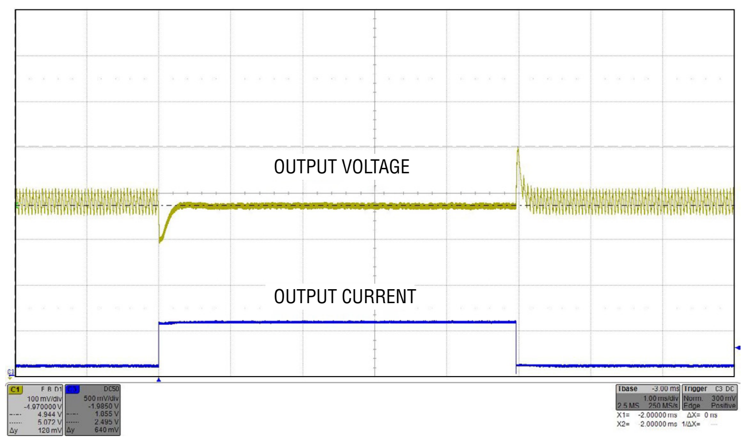


Figure 5. 50mA to 600mA Load Transient with V_{IN1} = 3.5V in Burst Mode

QUICK START PROCEDURE

Using short twisted pair leads for any power connections and with all loads and power supplies off, refer to Figure 6 for the proper measurement and equipment setup. The Power Supplies should not be connected to the circuit until told to do so in the procedure below.

When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe.

The indicators for $\overline{PGD}$, $\overline{V1GD}$ and $\overline{V2GD}$ are negative logic. $\overline{PGD}$ indicates the output voltage is good if it is pulled to ground and $\overline{V1GD}$ and $\overline{V2GD}$ indicate that the input voltage on the respective sources are good if the pins are pulled to ground.

1. JP1 and JP2 settings to start:

   JP1 SELECT = IDEAL DIODE (V_{CC})

   JP2 MODE = FIXED FREQ (V_{CC})

2. With power OFF connect the power supplies (PS1, PS2) as shown in Figure 6. If accurate current measurements are desired (for efficiency calculations for example) then connect the ammeters in series with the supplies as shown. The ammeters however, are not required.
3. Connect the load, set at 50Ω, to V_{OUT} as shown in Figure 6. Again, connect an ammeter if accurate current measurement or monitoring is desired.
4. Turn on the Power Supply, PS1, and slowly increase the voltage. The converter will start at approximately 2.9V.
5. Verify V_{OUT} is ~5.0V, and that $\overline{V2GD}$ is pulled high by V_{CC} and $\overline{PGD}$ and $\overline{V1GD}$ are pulled low.
6. PS1 can now be varied between 2.5V and 18.0V. V_{OUT} will remain in regulation for load currents up to 2 amps with V_{IN} greater than V_{OUT}. As V_{IN1} falls below V_{OUT} the input current may increase to the maximum average inductor current, depending on the load, which will then limit the load current and the output voltage.
7. Turn off PS1 and repeat steps 3 to 6 with PS2. The part will turn on with PS2 at approximately 4.5V. Once on, PS2 can be varied between 3.8V and 18V. The voltage measurements of step 5 will change where $\overline{V1GD}$ will be at V_{CC} and $\overline{V2GD}$ will be pulled low. Set the load to 50Ω.
8. Set PS2 to 7V and turn on PS1 slowly increasing the voltage from 0V to 8V. Note that PS1 starts to supply the power as the voltage of PS1 exceeds the voltage on PS2 by at least 400mV.
9. Now decrease the voltage on PS1 and observe that when the voltage on V_{IN1} falls below the voltage on PS2, PS1 stops supplying the power and PS2 takes over. See Figure 2 for typical performance for steps 8 and 9.
10. Turn off PS1 and PS2. Change the SELECT jumper (JP1) to V_{CC} (the PRIORITY position). Turn on PS2 and adjust it to 14V.
11. By cycling the voltage on PS1 from 1V to 10V you can observe the transition of power from PS2 to PS1 and back as the voltage on V_{IN1} goes through its startup (approximately 2.9V) and shutdown (approximately 2.5V) thresholds. Typical response is shown in Figure 3. Turn off PS1 and PS2.

    Steps 12 and 13 are optional for looking at load step response if desired.

12. With JP2 in the FIXED FREQ position and PS1 at 3.5V switch the load from 100mA to 600mA and back. Note the output voltage response. (Figure 4).
13. With JP2 in AUTOBURST and PS1 at 12V switch the load from 50 mA to 600 mA and back. Note the output voltage ripple. (Figure 5). See the data sheet for more information.

Note: Remove D1 for V_{OUT} > 5V to prevent damage to the converter.

QUICK START PROCEDURE

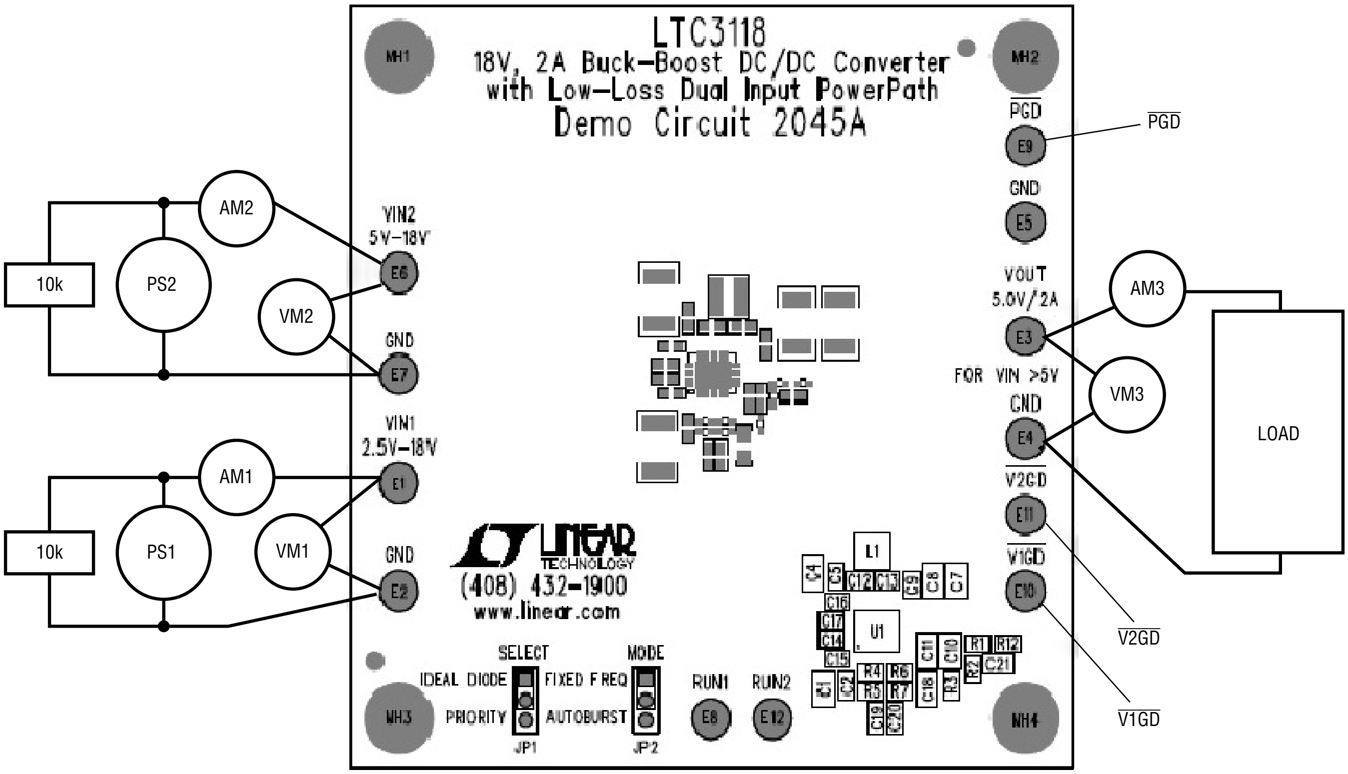
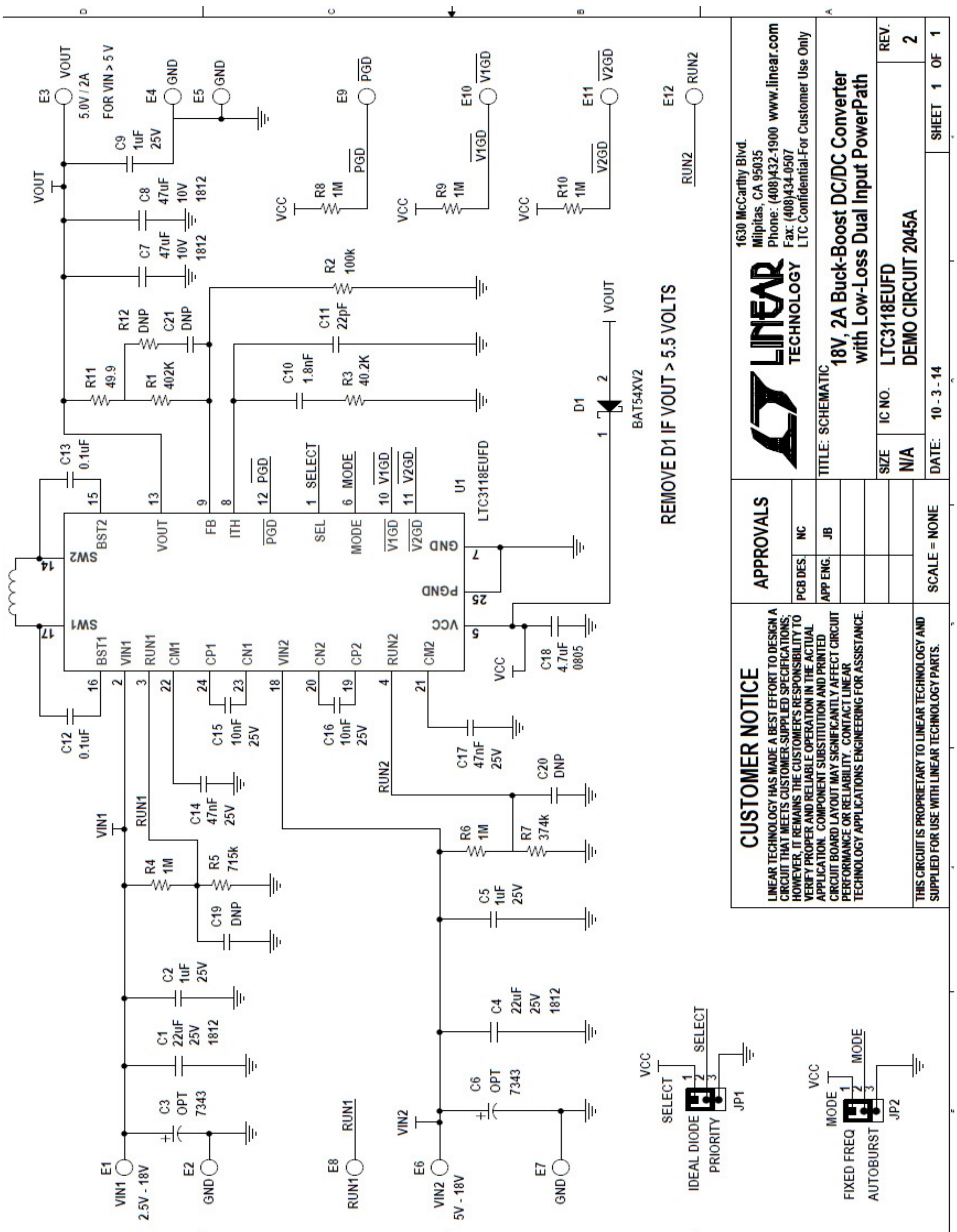


Figure 6. Measurement Setup

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C1, C4	CAP., 22µF, X7R, 25V, 20%, 1812	TDK, C4532X7R1E226M250KC
2	3	C2, C5, C9	CAP., 1µF, X7R, 25V, 10%, 0603	TDK, C1608X7R1E105K080AB
3	0	C3, C6 (OPT)	CAP., ALUM., RADIAL, 150µF, 50V, 20%	PANASONIC, EEU-FM1H151
4	2	C7, C8	CAP., 47µF, X5R, 10V, 20%, 1812	TDK, C4532X5R1A476M280KA
5	1	C10	CAP., 1800pF, C0G, 50V, 5%, 0603	TDK, CGJ3E2C0G1H182J080AA
6	1	C11	CAP., 22PF, NPO, 25V, 10%, 0603	KEMET, C0603C220K3GACTU
7	2	C12, C13	CAP., CER 0.1µF, 25V, 10%, X7R, 0603	TDK, C1608X7R1E104K
8	2	C14, C17	CAP., CER 0.047µF, 50V, 10%, X7R, 0603	TDK, C1608X7R1H473K080AA
9	2	C15, C16	CAP., 0.01µF, X7R, 25V, 10%, 0603	TDK, C1608X7R1E103K080AA
10	1	C18	CAP., 4.7µF, X5R, 6.3V, 20%, 0603	TDK, C1608X5R0J475M080AB
11	0	C19, C20, C21 (OPT)	CAP., OPTION, 0603	
12	1	D1	DIODE, SCHOTTKY, 30V, 0.2A, SOD-523F	FAIRCHILD SEMI., BAT54XV2
13	1	L1	INDUCTOR, PWR., SHIELED, 3.3µH. XAL 40xx Series	COILCRAFT, XAL4030-332MEC
14	1	R1	RES., 402k, 1/16W, 1%, 0402	VISHAY, CRCW0402402KFKED
15	1	R2	RES., 100k, 1/16W, 1%, 0402	VISHAY, CRCW0402100KFKED
16	1	R3	RES., 40.2k, 1/16W, 1%, 0402	VISHAY, CRCW040240K2FKED
17	5	R4, R6, R8, R9, R10	RES., 1M, 1/16W, 1%, 0402	VISHAY, CRCW04021M00FKED
18	1	R5	RES., 715k, 1/16W, 1%, 0402	VISHAY, CRCW0402715KFKED
19	1	R7	RES., 374k, 1/16W, 1%, 0402	VISHAY, CRCW0402374KFKED
20	1	R11	RES., 49.9Ω, 1/16W, 1%, 0402	VISHAY, CRCW040249R9FKED
21	0	R12	RES., OPTION, 0402	
22	1	U1	I.C.,18V, 2A BUCK-BOOST DC/DC CONVERTER WITH LOW-LOSS DUAL INPUT POWERPATH	LINEAR TECHNOLOGY, LTC3118EUFD*PBF
23	12	E1-E12	TP, TURRET, 0.094", MTG. HOLE	MILL-MAX, 2501-2-00-80-00-00-07-0
24	2	JP1, JP2	CONN., HEADER, 1×3, 2mm	SAMTEC, TMM-103-02-L-S
25	2	XJP1-XJP2	SHUNT, 2mm	SAMTEC, 2SN-BK-G
26	4	STAND OFF	STANDOFF, NYLON, SNAP-ON, 0.625"	KEYSTONE, 8834 (SNAP ON)
27	1		PCB, DC2045A	DEMO CIRCUIT 2045A-2
28	2		STENCILS, DC2045A (TOP & BOTTOM)	STENCILS, DC2045A-2 - TOP & BOTTOM

SCHEMATIC DIAGRAM



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

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