

LTM4618EV: 6A Step-Down Power µModule Regulator

DESCRIPTION

Demonstration circuit 1472 features the LTM[®]4618EV µModule[®] regulator, a complete high efficiency synchronous buck regulator. The DC1472 input range is from 4.5V to 26.5V and is capable of delivering up to 6A of output current. However, current derating may be necessary under certain V_{IN} , V_{OUT} , frequency and thermal conditions. The output voltage for the board is jumper programmable from 1.2V to 5V and can be set as low as 0.8V, the reference voltage of the LTM4618EV.

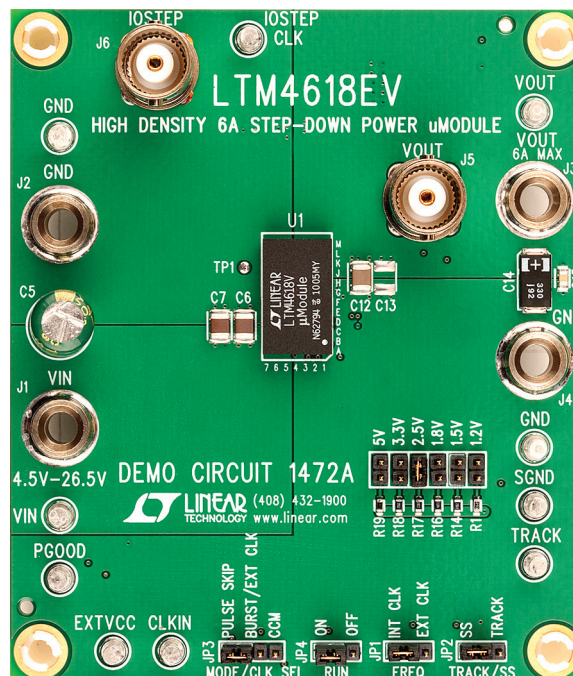
Layout is simple, requiring only a few bulk input and output capacitors externally. The TRACK/SS pin allows the user to program the output voltage ramp-up and ramp-down, as well as coincidentally or ratiometrically track an external voltage. The LTM4618EV may be enabled or disabled by the RUN pin. The MODE jumper (JP3) is available to select

from pulse-skipping or Burst Mode[®] operation for improved efficiency at light load. DC1472 has a default switching frequency of 500 kHz and is synchronizable to an external clock from 250 kHz up to 750 kHz. These features and the availability of the LTM4618EV in a compact 9mm × 15mm × 4.32mm LGA package make the demonstration circuit ideal for use in many high density point-of-load regulation applications. The LTM4618 data sheet must be read in conjunction with this demo manual for working on or modifying the demo circuit 1472A.

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

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BOARD PHOTO



PERFORMANCE SUMMARY

| PARAMETER | CONDITIONS/NOTES | VALUE |
|---|--|--|
| Input Voltage Range | | 4.5V to 26.5V |
| Jumper Selectable Output Voltage, V_{OUT} | $V_{IN} = 4.5V - 26.5V$, $I_{OUT} = 0A - 6A$ | 1.2V, 1.5V, 1.8V, 2.5V, 3.3V or 5V $\pm 2\%$ |
| Maximum Continuous Output Current | Derating is Necessary for Certain Operating Conditions. See Data Sheet for Details | 6A _{DC} |
| Default Operating Frequency | R3 = 10k Ω , R4 = 3.16k Ω | 500kHz |
| External Clock Sync. Frequency Range | | 250kHz to 750kHz |
| Efficiency | $V_{IN} = 12V$, $V_{OUT} = 2.5V$, $I_{OUT} = 6A$ | 88.7% See Figure 2 |

QUICK START PROCEDURE

Demonstration circuit 1472 is easy to set up to evaluate the performance of the LTM4618EV. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

1. With power off, connect the input power supply, load and meters as shown in Figure 1. Preset the load to 0A and V_{IN} supply to be 0V. Place jumpers in the following positions for a typical 1.5V_{OUT} application:

| JP6 | JP3 | JP4 | JP2 |
|------------------------------------|-------------|------------|-----------------|
| V_{OUT} Select | MODE | RUN | TRACK/SS |
| 1.5V | CCM | OFF | SS |

2. Turn on the power at the input. Increase V_{IN} to 12V (Caution: Do not hot plug the input supply or apply more than the rated maximum voltage of 26.5V to the board or the part may be damaged).
3. Set the RUN pin jumper (JP4) to the on position. The output voltage should rise to 1.5V. The output voltage meter should read the selected output voltage $\pm 2\%$.
4. Vary the input voltage from 6V to 24V and adjust the load current from 0A to 6A. The output voltage meter should read the selected output voltage $\pm 2\%$. Set the input voltage to 12V and the load current to 6A.

5. Measure the output voltage ripple at J5 with a BNC cable and oscilloscope.
6. To set the output voltage to 5V, turn off the input supply power, apply the following changes listed below and repeat steps 2 to 5:

| JP10 | JP3 | JP4 | JP2 |
|------------------------------------|-------------|------------|-----------------|
| V_{OUT} Select | MODE | RUN | TRACK/SS |
| 5V | CCM | OFF | SS |

7. Set the load current to 0A. Set the RUN pin jumper (JP4) to the OFF position. Power off the input supply.
8. For load transient tests, apply an adjustable positive pulse signal between IOSTEP CLK and GND test points. The pulse amplitude sets the load step current amplitude. The pulse width should be short (<1ms) and pulse duty cycle should be low (<15%) to limit the thermal stress on the load transient circuit. The load step current can be monitored with a BNC connected to J6 (10mV/A).

QUICK START PROCEDURE

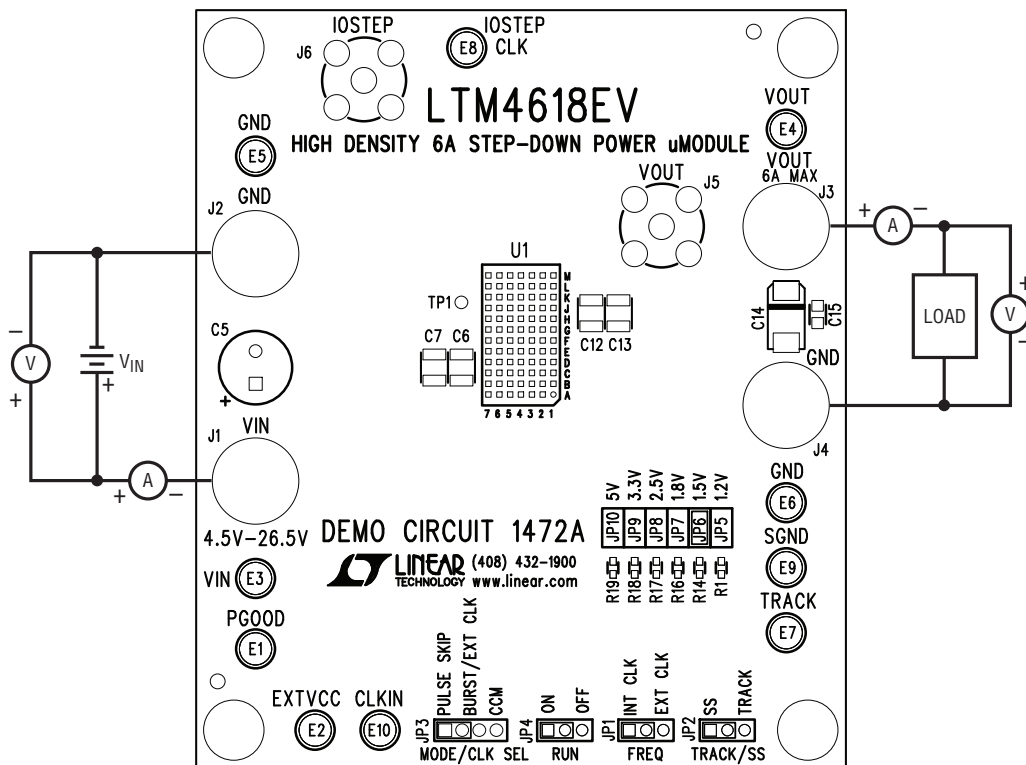


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

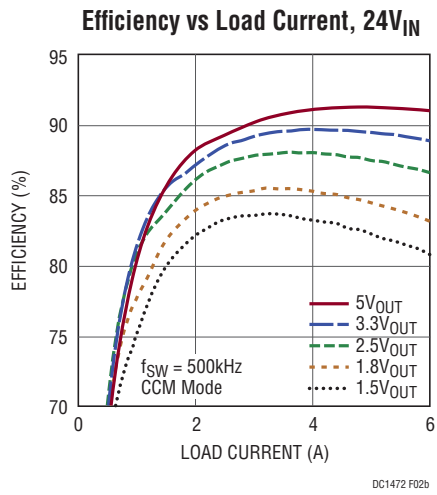
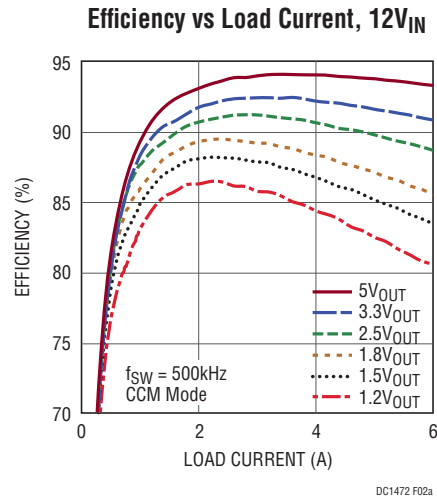
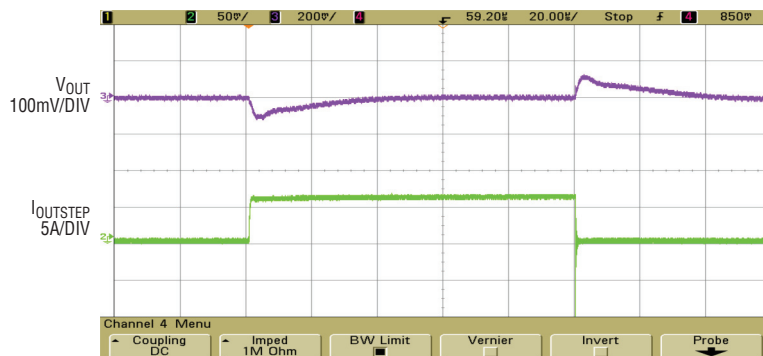


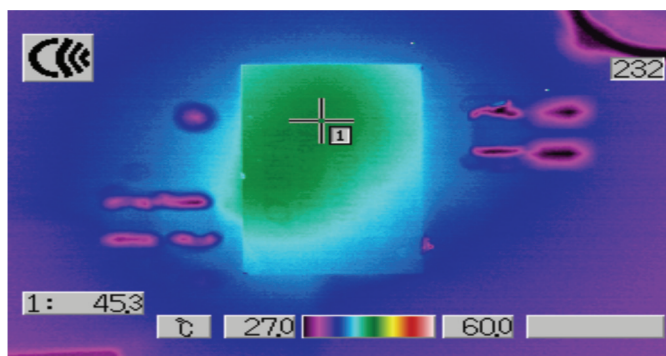
Figure 2. Measured Supply Efficiency at 12V_{IN} and 24V_{IN}

QUICK START PROCEDURE



| V_{IN} (V) | V_{OUT} (V) | C_{OUT} BULK | C_{OUT} CERAMIC |
|--------------|---------------|-------------------------|---------------------------|
| 12 | 1.5 | 330 μ F/6.3V POSCAP | 1 \times 47 μ F 10V |

Figure 3. Measured Load Transient Response (0A to 6A Load Step)



| V_{IN} (V) | V_{OUT} (V) | I_{OUT} (A) | AIRFLOW | AMBIENT ($^{\circ}$ C) |
|--------------|---------------|---------------|--------------------|-------------------------|
| 12 | 1.5 | 6 | Natural Convection | 27 |

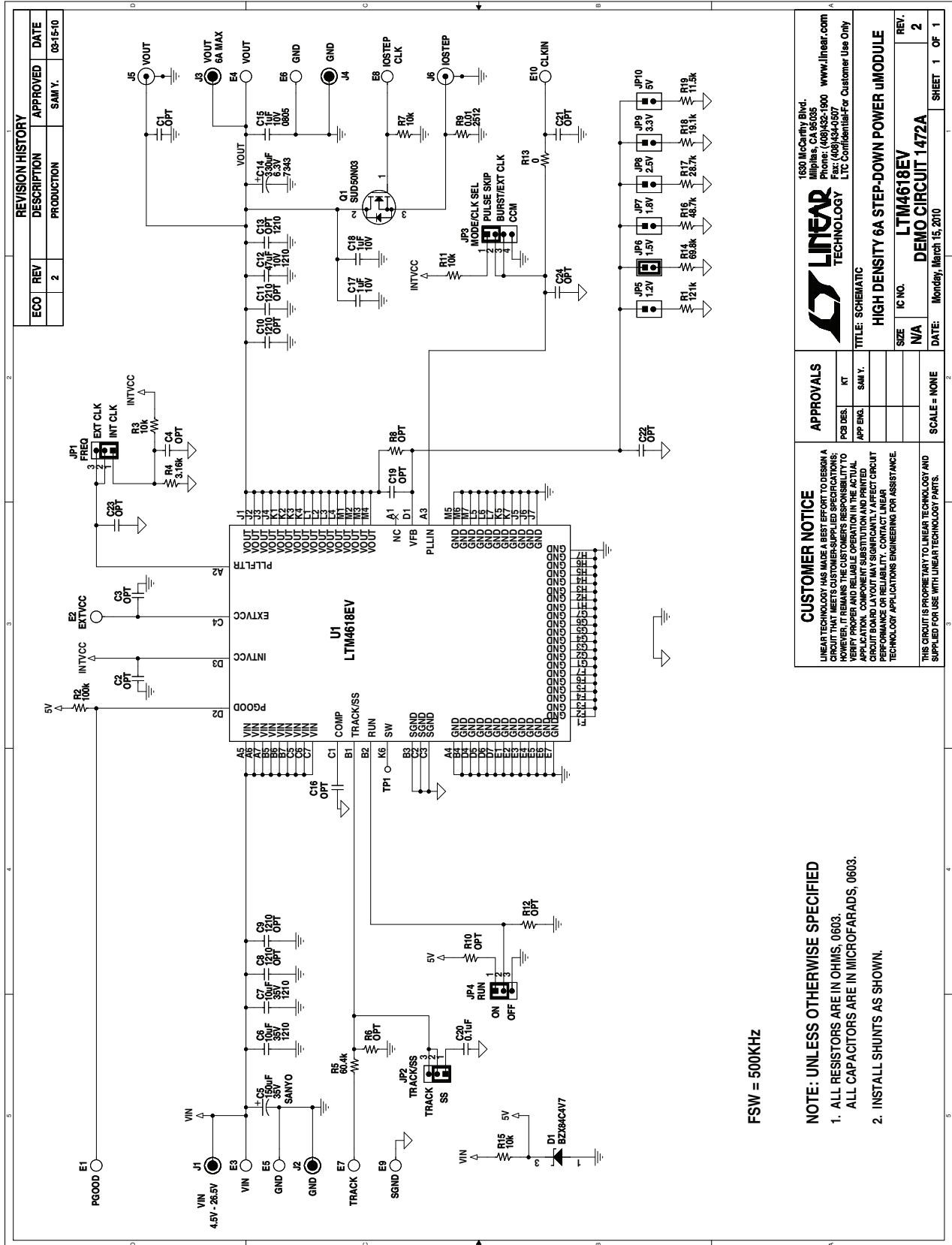
Figure 4. Measured Thermal Capture

DEMO MANUAL DC1472A

PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|-----|-------------------------------|---------------------------------|-----------------------------------|
| Required Circuit Components | | | | |
| 1 | 1 | C5 | CAP, 150µF 35V, ALUM | SANYO, 35ME150WXV+TS |
| 2 | 2 | C6, C7 | CAP, X5R, 10µF 35V, 1210 | TAIYO YUDEN, GMK325BJ106MN-T |
| 3 | 1 | C12 | CAP, X5R, 47µF 10V, 1210 | TDK, C3225X5R1A476M |
| 4 | 1 | C14 | CAP, POSCAP, 330µF 6.3V, 7343 | SANYO, 6TPC330MA |
| 5 | 1 | C15 | CAP, X5R, 1µF 10V, 0805 | AVX, 0805ZD105MAT2A |
| 6 | 1 | C20 | CAP, X7R, 0.1µF 16V, 0603 | AVX, 0603YC104KAT2A |
| 7 | 1 | R1 | RES., 121k 1/16W 1%, 0603 | VISHAY, CRCW0603121KFKEA |
| 8 | 4 | R3, R11 | RES., 10k 1/16W 1%, 0603 | VISHAY, CRCW060310K0FKEA |
| 9 | 1 | R4 | RES., 3.16k 1/16W 1%, 0603 | VISHAY, CRCW06033K16FKEA |
| 10 | 1 | R5 | RES., 60.4k 1/16W 1%, 0603 | VISHAY, CRCW060360K4FKEA |
| 11 | 1 | R14 | RES., 69.8k 1/16W 1%, 0603 | VISHAY, CRCW060369K8FKEA |
| 12 | 1 | R16 | RES., 48.7k 1/16W 1%, 0603 | VISHAY, CRCW060348K7FKEA |
| 13 | 1 | R17 | RES., 28.7k 1/16W 1%, 0603 | VISHAY, CRCW060328K7FKEA |
| 14 | 1 | R18 | RES., 19.1k 1/16W 1%, 0603 | VISHAY, CRCW060319K1FKEA |
| 15 | 1 | R19 | RES., 11.5k 1/16W 1%, 0603 | VISHAY, CRCW060311K5FKEA |
| 16 | 1 | U1 | IC, LTM4618EV | LINEAR TECH., LTM4618EV LGA |
| Additional Demo Board Circuit Components | | | | |
| 1 | 0 | C1-C4, C16, C19, C21-C24 | CAP, 0603 Optional | |
| 2 | 0 | C8, C9, C10, C11, C13 | CAP, 1210 Optional | |
| 3 | 2 | C17, C18 | CAP, X5R, 1µF 10V, 0603 | TAIYO YUDEN, LMK107BJ105MA-T |
| 4 | 0 | R6, R8, R10, R12 | RES, 0603 Optional | |
| 5 | 4 | R7 | RES., 10k 1/16W 1%, 0603 | VISHAY, CRCW060310K0FKEA |
| 6 | 1 | R9 | RES., 0.01Ω 5% 1W, 2512 | IRC, LRC-LRF2512LF-01-R010-J |
| 7 | 1 | R15 | RES., 10k 1/16W 1%, 0603 | VISHAY, CRCW060310K0FKEA |
| 8 | 1 | R2 | RES., 100k 1/16W 1%, 0603 | VISHAY, CRCW0603100KFKEA |
| 9 | 1 | R13 | RES., CHIP, 0, 1/16W, 0603 | VISHAY, CRCW06030000Z0EA |
| 10 | 1 | D1 | DIODE, ZENER 350MW 4.7V, SOT-23 | DIODES INC., BZX84C4V7-7-F |
| 11 | 1 | Q1 | XSTR, SUD50N03-10CP MOSFET | SILICONIX, SUD50N03-10CP |
| Hardware | | | | |
| 1 | 10 | E1-E10 | TP, TURRET, 0.094", PBF | MILL-MAX, 2501-2-00-80-00-00-07-0 |
| 2 | 3 | JP1, JP2, JP4 | JMP, 1X3, 0.079" | SAMTEC, TMM-103-02-L-S |
| 3 | 1 | JP3 | JMP, 1X4, 0.079" | SAMTEC, TMM-104-02-L-S |
| 4 | 6 | JP5, JP6, JP7, JP8, JP9, JP10 | JMP, 1X2, 0.079" | SAMTEC, TMM-102-02-L-S |
| 5 | 4 | J1, J2, J3, J4 | JACK, BANANA | KEYSTONE, 575-4 |
| 6 | 2 | J5, J6 | CONN, BNC, 5 PINS | CONNEX, 112404 |
| 7 | 5 | JP1-JP4, JP6 | SHUNT, 0.079" CENTER | SAMTEC, 2SN-BK-G |
| 8 | 4 | 4 Corners | STANDOFF, SNAP ON, 0.50" | KEYSTONE, 8833 |

SCHEMATIC DIAGRAM



FSW = 500KHz

- NOTE: UNLESS OTHERWISE SPECIFIED**
1. ALL RESISTORS ARE IN OHMS, 0603.
 2. ALL CAPACITORS ARE IN MICROFARADS, 0603.
 3. INSTALL SHUNTS AS SHOWN.

| REVISION HISTORY | | |
|------------------|-----|------------------|
| ECO | REV | DESCRIPTION |
| | 2 | PRODUCTION |
| | | APPROVED DATE |
| | | SAMI Y. 08-15-10 |

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APPROVALS

| | |
|-----------|---------|
| PCB DES. | KT |
| APP ENGR. | SAMI Y. |

TITLE: SCHEMATIC

HIGH DENSITY 6A STEP-DOWN POWER uMODULE

| | | |
|------|-----------|------|
| SIZE | IC NO. | REV. |
| N/A | LTM4618EV | 2 |

DEMO CIRCUIT 1472A

DATE: Monday, March 15, 2010

SCALE = NONE

SHEET 1 OF 1



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DEMO MANUAL DC1472A

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dc1472af



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