

## DESCRIPTION

Demonstration circuit 1684A-A features the **LTC®2758A** 18-bit SoftSpan™ I<sub>OUT</sub> DAC. DC1684A-B features the pin-compatible 16-bit **LTC2752A**. The digital interface is a simple, 4-wire Serial Peripheral Interface (SPI), augmented with separate **CLEAR** and **LDAC** pins that reset the output to zero and load the DAC code, respectively. These devices feature six output ranges: 0V to 5V, 0V to 10V, ±5V, ±10V, ±2.5V, and -2.5V to 7.5V. These ranges are programmable through the SPI interface or through separate span control pins if SoftSpan operation is not needed. Voltage input offset and gain adjustment pins

facilitate trimming of residual DC errors without impacting the excellent temperature stability of this device.

The DC1684A-B uses LT®1468 amplifiers recommended for 16-bit applications. The DC1684A-A uses low noise, low offset LT1012A amplifiers for reference inversion, and a composite amplifier for I-V conversion that provides 18-bit accuracy and fast settling. Amplifier selection is detailed in the LTC2758 and LTC2752 data sheets.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC1684A>**

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## BOARD PHOTO

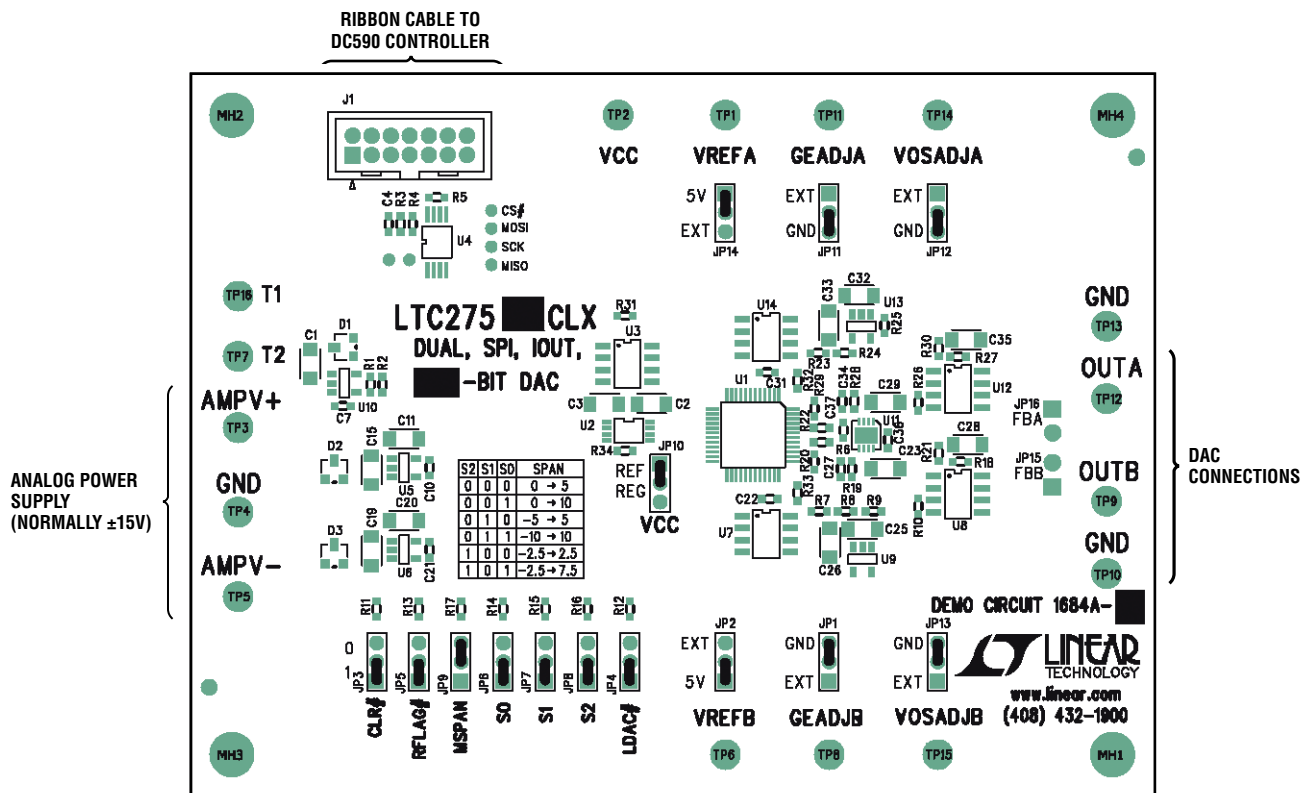


Figure 1. Connection Diagram

dc1684aa/ab F01

dc1684aabfb

### QUICK START PROCEDURE

Connect a low noise  $\pm 15V$  power supply to the AMPV+, GND, and AMPV- turret posts on the DC1684A board. Connect J1 to a DC590 USB serial controller using the supplied 14-conductor ribbon cable. Connect DC590 to a host PC with a standard USB A/B cable. Run the evaluation software supplied with the DC590, or download it from [www.linear.com/software](http://www.linear.com/software). The correct control panel will be loaded automatically (shown in Figure 2). The software automatically sets the LTC2758A / LTC2752A outputs ac-

ording to the entries in the control panel. A square wave option is available to test the settling time. The MSPAN jumper should be set to 0 if software span control is desired. Setting MSPAN high (1) causes the S2, S1 and S0 pins to set the span according to the table printed on the board. The corresponding span should be selected in the software to ensure that the calculated DAC code is correct.

Additional software documentation may be available from the Help menu item, as features may be added periodically.

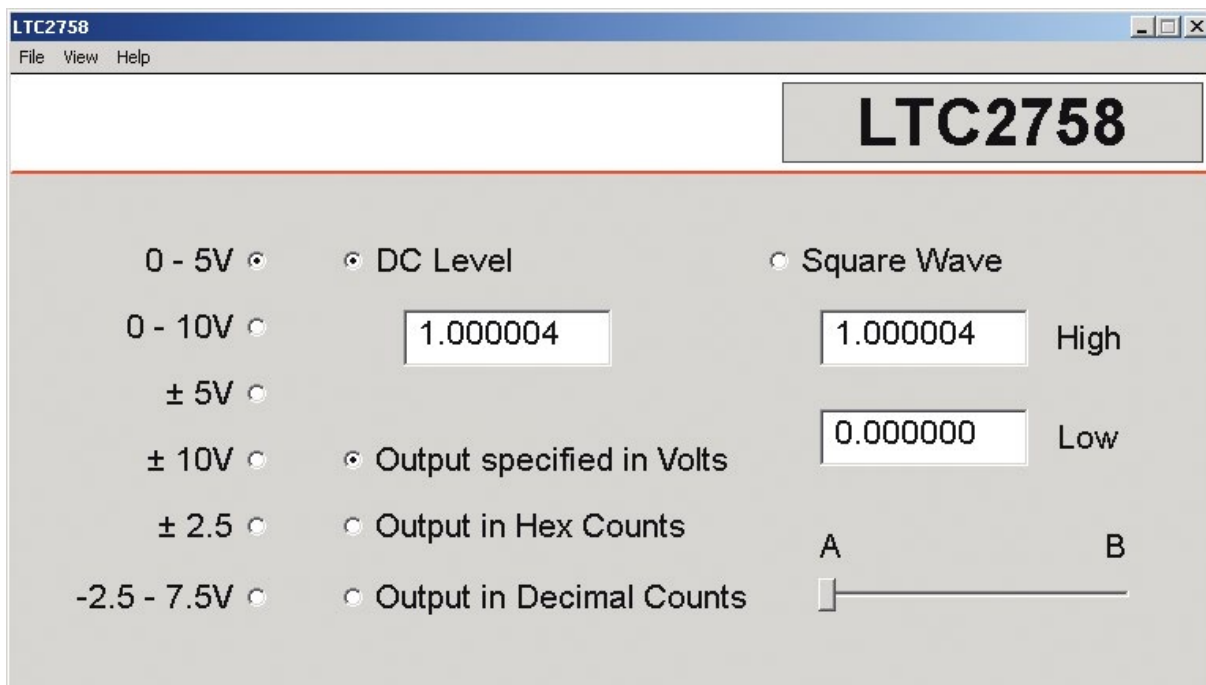


Figure 2. Software Screenshot

## HARDWARE SETUP

### JUMPERS

**MSPAN:** Manual Span Control Pin. MSPAN is used to configure the LTC2758/LTC2752 for operation in a single, fixed output range. If MSPAN is 1, it will be configured for single span use. If MSPAN is 0, it will be set through the QuikEval™ software. Default position is 0 (low).

**S0, S1, S2:** Used to set the fixed output range if MSPAN is 1.

**Table 1. MSPAN Configuration**

S2	S1	S0	SPAN
0	0	0	0V to 5V
0	0	1	0V to 10V
0	1	0	±5V
0	1	1	±10V
1	0	0	±2.5V
1	0	1	-2.5V to 7.5V

**GEADJA, GEADJB:** Gain Adjust Pins. If no adjustments are required, select GND. Selecting EXT connects the pin to the turret, allowing external adjustment to null gain error or compensate for reference errors.

**VOSADJA, VOSADJB:** Offset Adjustment Selection for DACA or DACB. If no offset adjustment is required, select GND. Selecting EXT connects the offset pin to the turret, allowing external adjustment of offset.

**VREFA, VREFB:** Select Source for  $V_{REF}$  on Either DACA or DACB. 5V connects to onboard LTC6655 5V reference; EXT connects to the turret, allowing an external reference to be used.

**VCC:** Select Source for 5V VCC Supply. Set to 5V for supply by on-board LTC6655 reference (recommended). Set to REG to be supplied by regulated supply from DC590 controller and remove the jumper to supply externally.

**CLR:** Asynchronous Clear Input. Tie to 0 to set all DAC outputs to 0V.

**LDAC:** Asynchronous DAC Load Input. Tie to 0 to update all DACs if CS is high.

**RFLAG:** Reset Flag Output. Remove jumper and probe middle pin for  $\overline{RFLAG}$  status.

### ANALOG CONNECTIONS (TURRET POSTS)

**OUTA/B:** DAC Voltage Outputs.

**VREFA/B:** DAC Reference Voltages. If the on-board LTC6655 references are selected, the voltage may be measured at these points. If a remote reference is selected, then an external reference must be applied to these points.

**VOSADJA/B:** DAC Offset Adjust Inputs. Use only if the VOSA jumper is set to EXT. The nominal range of these pins is ±5V, which will provide ±2048LSB of offset adjustment.

**GEADJA/B:** Gain Adjust Pins. These voltage-control pins can be used to null gain error or to compensate for reference errors. The nominal range of these pins is ±5V, which will provide ±2048LSB of gain adjustment.

### POWER AND GROUND CONNECTIONS

**Analog Power:** The AMPV+, AMPV–, and GND turret posts are the analog supplies for the on-board DAC amplifiers. These should be connected to a well regulated, low noise ±15V power supply.

**VCC:** Connection to VCC. See the Schematic Diagrams and the description for the VCC jumper.

**Grounding:** Separate power and signal grounds are provided. Signal grounds are the turrets closest to OUTA and OUTB. Use these for measurement ground and output return. Power GND is between the AMPV+ and AMPV– turrets.

# DEMO MANUAL

## DC1684A-A/DC1684A-B

### PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	15	C1, C2, C3, C5, C6, C11-C20	CAP, X5R, 10µF, 10V, 20%, 1206	TDK, C3216X5R1A106M
2	8	C4, C7, C36, C37, C38, C39, C40, C41	CAP, X7R, 0.1µF, 10V, 10%, 0603	AVX, 0603ZC104KAT2A
3	2	C10, C21	CAP, X7R, 0.01µF, 10V, 10%, 0603	AVX, 0603ZC103KAT2A
4	2	C22, C31	CAP, COG, 100pF, 50V, 10%, 0603	AVX, 06035A101KAT2A
5	0	C23, C29 (OPT.)		
6	0	C27, C34 (OPT.)	CAP, 0603	
7	3	D1, D2, D3	DIODE, BAT54C, SOT23	DIODE, ZETEX, BAT54C-7-F
8	1	J1	CONNECTOR, HD2X7-079	MOLEX, 87831-1420
9	14	JP1-JP14	3-PIN, 0.079", SINGLE ROW HEADER	SAMTEC, TMM103-02-L-S
10	14	XJP1-XJP14	SHUNT, 0.079", CENTER	SAMTEC, 2SN-BK-G
11	2	JP15, JP16	0.01" JUMPER, SHUNT, SOLDER DOWN	SAMTEC, JL-100-25-T
12	1	R1	RES., CHIP, 88.7k, 1/16W, 1%, 0603	VISHAY, CRCW060388K7FKEA
13	5	R2, R31-R34	RES., CHIP, 10k, 1/16W, 1%, 0603	NIC, NRC06F1002TRF
14	3	R3, R4, R5	RES., CHIP, 4.99k, 1/16W, 1%, 0603	NIC, NRC06F4991TRF
15	7	R11-R17	RES., CHIP, 10k, 1/16W, 5%, 0603	NIC, NRC06J103TRF
16	16	TP1-TP16	TURRET, TEST POINT	MILL-MAX, 2308-2-00-80-00-00-07-0
17	1	U2	I.C., LTC6655CHMS8-5, MSOP-8	LINEAR TECHNOLOGY, LTC6655CHMS8-5#TRPBF
18	0	U3 (OPT.)	I.C., LT1236ACS8-5, SO-8	
19	1	U4	I.C., 24LC025, TSSOP-8	MICROCHIP, 24LC025 I/ST
20	1	U5	I.C., LT1761ES5-5, SOT23-5	LINEAR TECHNOLOGY, LT1761ES5-5#TR
21	1	U6	I.C., LT1964ES5-5, SOT23-5	LINEAR TECHNOLOGY, LT1964ES5-5#TRPBF
22	1	U10	I.C., LT1761ES5-BYP, SOT23-5	LINEAR TECHNOLOGY, LT1761ES5-BYP#TRPBF

## PARTS LIST—1684A-A

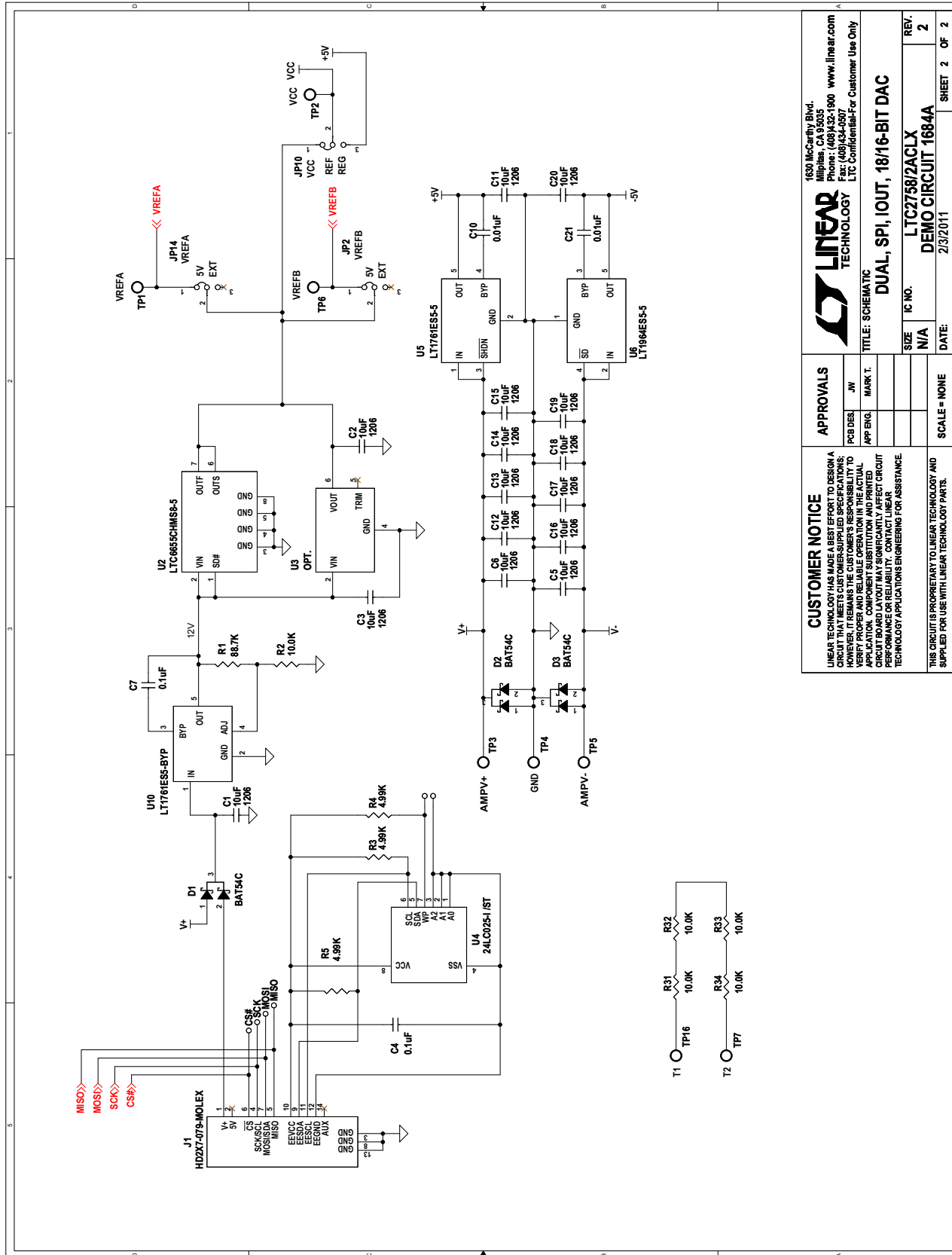
ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	1	1684A GENERAL BOM		
2	2	C24, C30	CAP, COG, 100pF, 50V, 5%, 1206	AVX, 12065A101JAT2A
3	4	C25, C26, C32, C33	CAP, X7R, 1µF, 16V, 10%, 1206	AVX, 1206YC105KAT2A
4	0	C28, C35 (OPT.)	CAP, 1206	
5	6	R6, R9, R21, R22, R25, R30	RES., CHIP, 1k, 1/16W, 5%, 0603	VISHAY, CRCW06031K00JNEA
6	4	R7, R8, R23, R24	RES., CHIP, 10k, 1/16W, 5%, 0603	NIC, NRC06J103TRF
7	0	R10, R20, R26, R29 (OPT.)	RES., CHIP, 0603	
8	2	R18, R27	RES., CHIP, 4.02k, 1/16W, 1%, 0603	YAGEO, RC0603FR-074K02L
9	2	R19, R28	RES., CHIP, 10, 1/16W, 5%, 0603	NIC, NRC06J100TRF
10	1	U1	I.C., LTC2758ACLX, 48-LX	LINEAR TECHNOLOGY, LTC2758ACLX#TRPBF
11	2	U7, U14	I.C., LT1012ACS8, SO-8	LINEAR TECHNOLOGY, LT1012ACS8#TRPBF
12	2	U8, U12	I.C., LT1360CS8, SO-8	LINEAR TECHNOLOGY, LT1360CS8#TRPBF
13	2	U9, U13	I.C., LTC2054HVCS5, TSOT23-5	LINEAR TECHNOLOGY, LTC2054HVCS5#TRPBF
14	1	U11	I.C., LTC6244HVCDD, 8-PIN-3x3, DD	LINEAR TECHNOLOGY, LTC6244HVCDD#TRPBF

## PARTS LIST—1684A-B

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	1	1684A GENERAL BOM		
2	0	C24, C25, C26, C30, C32, C33 (OPT.)	CAP, 1206	
3	2	C28, C35	CAP, COG, 33pF, 50V, 5%, 1206	AVX, 12065A330JAT2A
4	0	R6-R9, R18, R19, R21-R25, R27, R28	RES., 0603	
5	0	R30 (OPT.)		
6	4	R10, R20, R26, R29	RES., CHIP, 0, 1/16W, 0603	VISHAY, CRCW06030000Z0EA
7	1	U1	I.C., LTC2752ACLX, 48-LX	LINEAR TECHNOLOGY, LTC2752ACLX#TRPBF
8	4	U7, U8, U12, U14	I.C., LT1468CS8, SO-8	LINEAR TECHNOLOGY, LT1468CS8#TRPBF
9	0	U9, U13 (OPT.)	I.C., TSOT23-5	
10	0	U11 (OPT.)	I.C., 8-PIN-3x3, DD	



### SCHEMATIC DIAGRAMS



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<b>TITLE: SCHEMATIC</b>			
<b>DUAL, SPI, IOUT, 18/16-BIT DAC</b>		<b>REV. 2</b>	
<b>DEMO CIRCUIT 1684A</b>		<b>DATE: 2/3/2011</b>	
SCALE = NONE		SHEET 2 OF 2	
<b>CUSTOMER NOTICE</b>			
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<b>APPROVALS</b>			
PCB DES.	JW	MARK T.	
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Figure 4. DC1684A Dual, SPI, IOUT, 18-/16-Bit DAC

# DEMO MANUAL

## DC1684A-A/DC1684A-B

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