

## DESCRIPTION

Demonstration circuit 1789A is an isolated USB transceiver with isolated power featuring the LTM<sup>®</sup>2884. The demo circuit features an EMI optimized circuit configuration and printed circuit board layout. All components are integrated into the  $\mu$ Module<sup>®</sup> isolator. The demo circuit operates from a supply on  $V_{CC}$  and/or  $V_{BUS}$ . The part generates an isolated output voltage on  $V_{CC2}$  and communicates all

necessary signaling across the isolation barrier through LTC's isolator  $\mu$ Module technology.

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

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## PERFORMANCE SUMMARY (T<sub>A</sub> = 25°C)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
$V_{CC}$	Operating Supply Range (Isolated Power Input)		4.4	12	16.5	V
$V_{BUS}$	Operating Supply Range (USB Bus Power Input)		4.4	5	16.5	V
$V_{CC2}$	Regulated Output Voltage	$V_{CC} = V_{BUS} = 4.4V, I_{CC2} = 200mA$ $V_{CC} = 8.1V, I_{CC2} = 500mA$	4.75 4.75	5 5	5.25 5.25	V V
$t_{LDR}$	Low Speed Data Rate			1.5		Mbps
$t_{FDR}$	Full Speed Data Rate			12		Mbps
$V_{IORM}$	Maximum Working Insulation Voltage	GND to GND2	560 400			$V_{DC}$ $V_{RMS}$
	Common Mode Transient Immunity		30			kV/ $\mu$ s

## OPERATING PRINCIPLES

The LTM2884 contains an isolated DC/DC converter delivering power to  $V_{CC2}$  at 5V from the input supply  $V_{CC}$  and/or  $V_{BUS}$ . Isolation is maintained by the separation of GND and GND2 where significant operating voltages and transients can exist without affecting the operation of the LTM2884. The logic side ON pin enables or shuts down the LTM2884. All logic side signals are referenced to the logic supply pin  $V_{LO}$ . The LTM2884 has two power supply inputs,  $V_{CC}$  and  $V_{BUS}$ . For applications requiring more than 200mA from  $V_{CC2}$ ,  $V_{CC}$  must be connected to an external supply of 8.1V to 16.5V.  $V_{BUS}$  may be connected

to USB bus power or to the external supply. For applications requiring 200mA or less connect  $V_{CC}$  and  $V_{BUS}$  to USB bus power.

Upstream USB signaling is controlled by the bidirectional pins D1<sup>+</sup> and D1<sup>-</sup>. A 1.5k pull-up resistor is automatically configured dependent upon the connected downstream peripheral device. For full speed and low speed devices the pull-up is asserted on D1<sup>+</sup> and D1<sup>-</sup>, respectively. The downstream USB data pins, D2<sup>+</sup> and D2<sup>-</sup>, each have integrated 15k pull-down resistors.

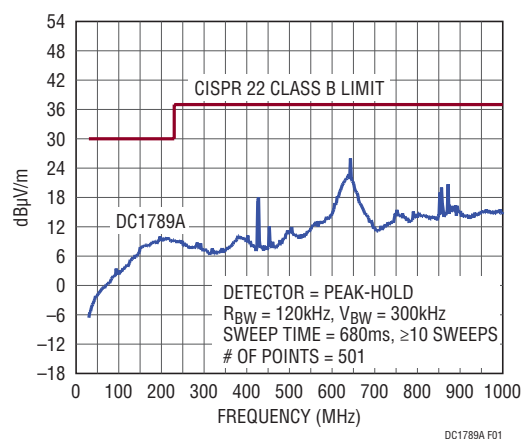
## OPERATING PRINCIPLES

The LTM2884 includes a suspend power feature that when enabled (high) reduces the supply current on  $V_{CC}$  and  $V_{BUS}$  when the upstream USB bus is idle. However, in this mode, if a downstream device is connected or disconnected from the bus or remote wake-up functionality is configured, it will not be recognized by the LTM2884 and relayed to the host. A resume command at the upstream side will wake up the LTM2884 and a re-numeration by the host will be required. If suspend power is configured low the LTM2884 operates in a low power mode but will respond to disconnects, reconnects, downstream wake-up commands, or host resume commands.

The demo circuit has been designed and optimized for low RF emissions. EMI mitigation techniques used include the following:

1. Board/ground plane size has been minimized. This reduces the dipole antenna formed between the logic side and isolated side ground planes.
2. Top signal routing and ground floods have been optimized to reduce signal loops, minimizing differential mode radiation.

EMI performance is shown in Figure 1, measured using a gigahertz transverse electromagnetic (GTEM) cell and method detailed in IEC 61000-4-20, "Testing and Measurement Techniques – Emission and Immunity Testing in Transverse Electromagnetic Waveguides."



**Figure 1. DC1789A Radiated Emissions, Normalized to 10m per IEC 61000-4-20**

## QUICK START PROCEDURE

Demonstration circuit 1789A makes it easy to set up and evaluate the performance of the LTM2884. Refer to Figure 2 for proper measurement equipment setup and follow the procedure below.

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

1. Place jumpers in their default positions:

**JP1** V<sub>CC</sub> supply in the V<sub>BUS</sub> position

**JP2** V<sub>BUS</sub> supply in the V<sub>BUS</sub> position

**JP3** SUSPEND POWER in the OFF position

**JP4** C2 in the OUT position

NOTE: To simulate a hub/splitter output, C2 can be jumpered IN. The additional capacitance reduces V<sub>BUS</sub> droop on downstream device plug-in.

2. Connect USB cable from computer to input side (J1) of the demo board.
3. Connect computer mouse, low speed device, or USB memory stick, typically high speed device, to output side (J2) of demo board.
4. Verify proper operation of mouse or memory stick.

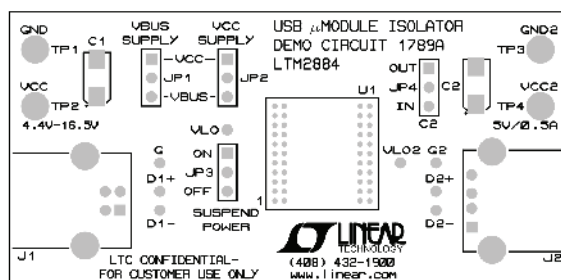
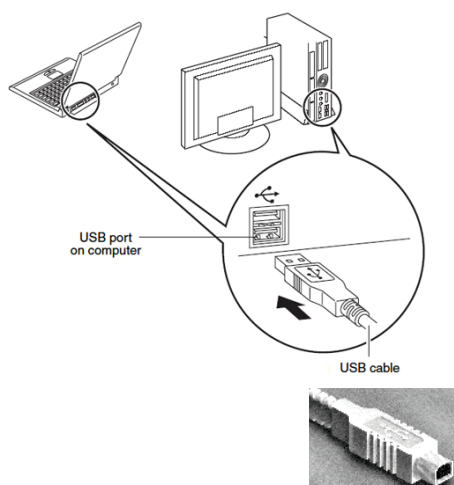
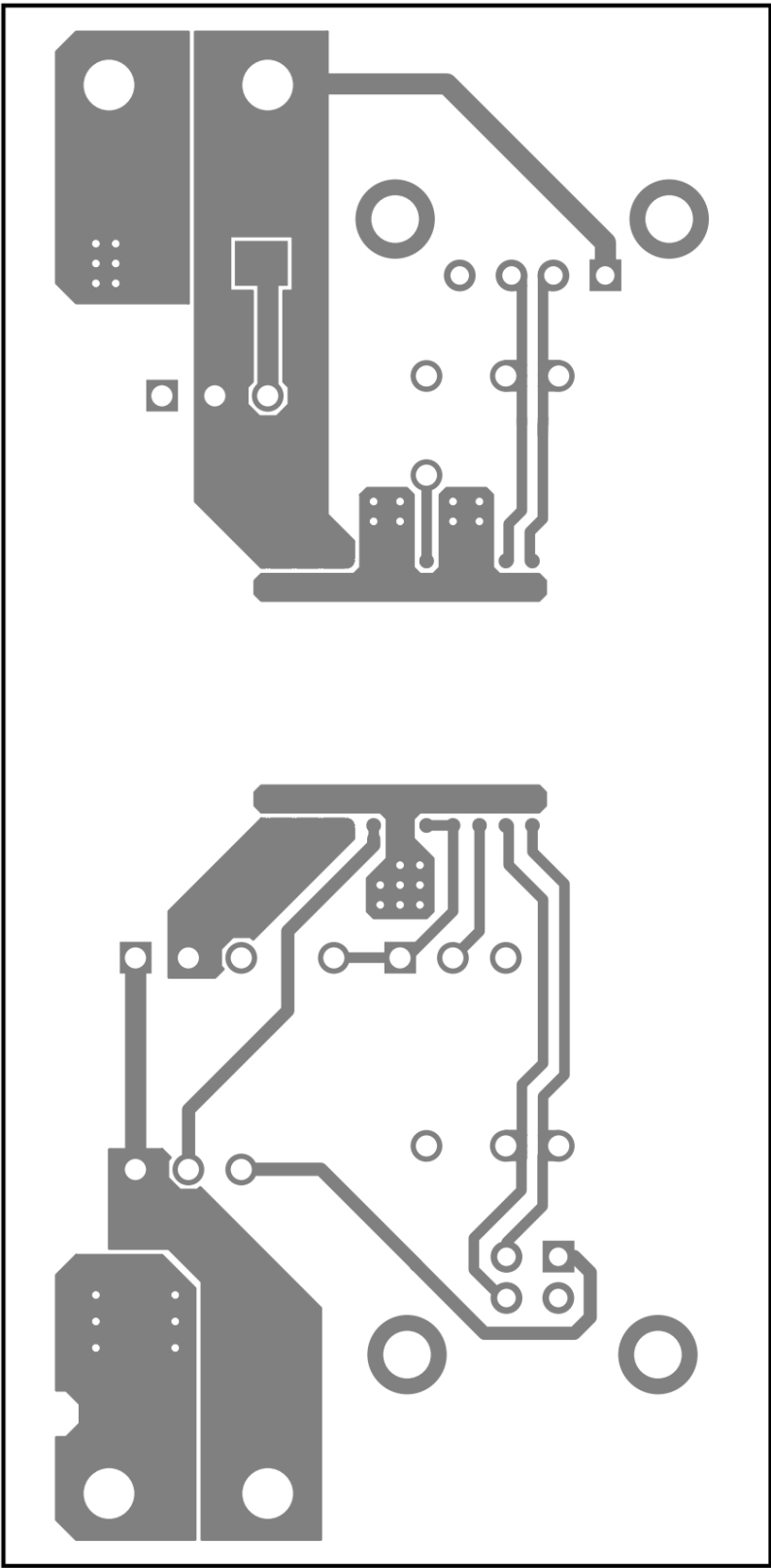


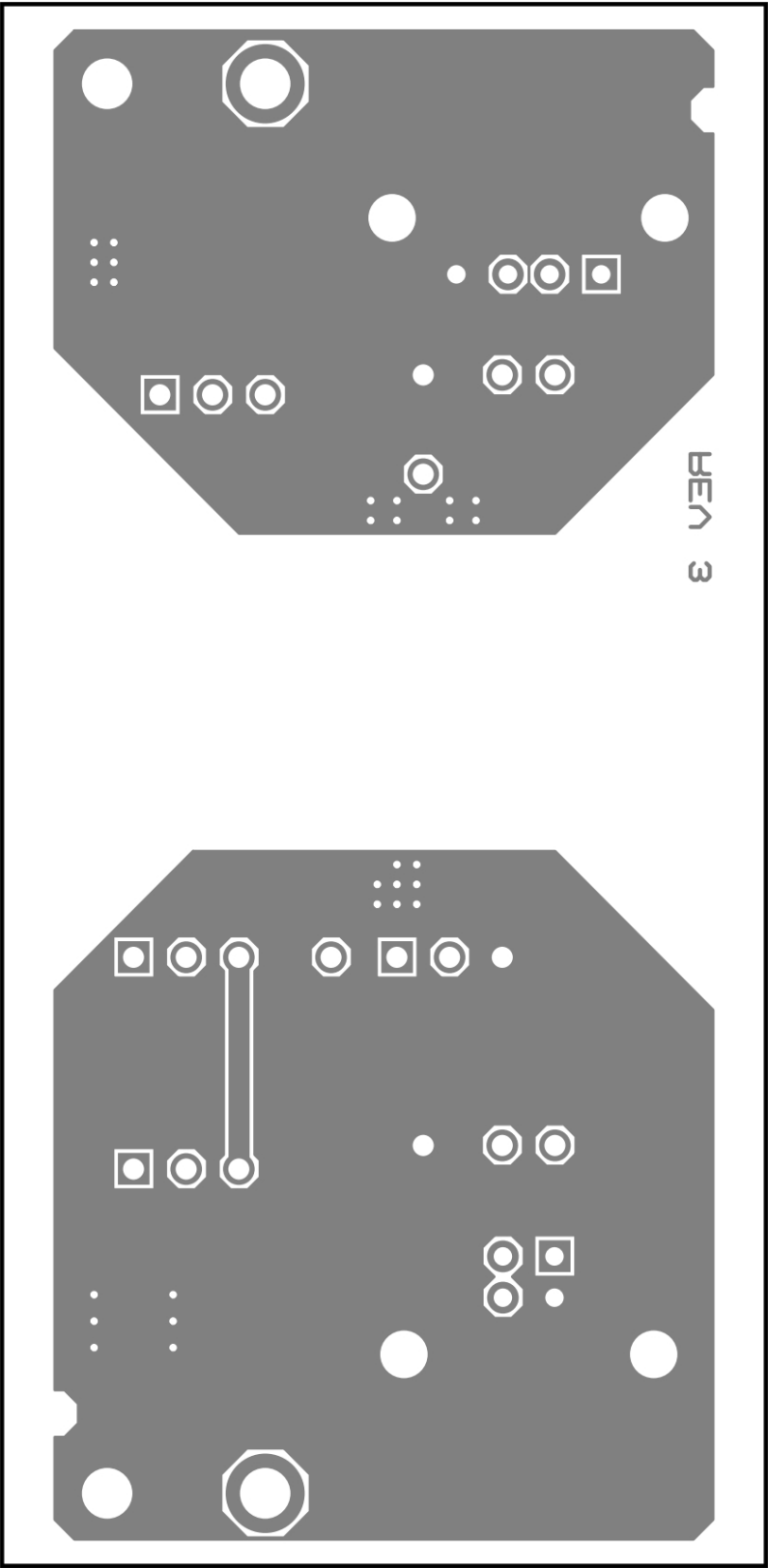
Figure 2. Demo Board Setup

PCB LAYOUT



Layer 1. Top Layer

PCB LAYOUT



# DEMO MANUAL DC1789A

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	1	U1	I.C., LTM2884CY	LINEAR LTM2884CY#PBF
<b>Hardware/Components (For Demo Board Only)</b>				
2	1	C1	CAP., TANT 22F 25V 20% 'C'	AVX TAJC226M025R
3	1	C2	CAP., TANT 100F 10V 20% 'C'	AVX TPSC107M010R0150
4	1	J1	USB RECEPTACLE TYPE B	MILL-MAX 897-43-004-90-00000
5	1	J2	USB RECEPTACLE TYPE A	MILL-MAX 896-43-004-90-00000
6	3	JP1-4	0.1" SINGLE ROW HEADER, 3-PIN	SAMTEC TSW-103-26-L-S
7	3	JP1-4	SHUNT	SAMTEC SNT-100-BK-G
8	4	TP1-4	TESTPOINT, TURRET, 0.095	MILL-MAX 2501-2-00-80-00-00-07-0



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

Mailing Address:

Linear Technology  
1630 McCarthy Blvd.  
Milpitas, CA 95035

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**Наши контакты:**

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331