DEMO CIRCUIT 1672A
QUICK START GUIDE

LTC3816EUHF
HIGH EFFICIENCY SINGLE PHASE BUCK CONVERTER FOR INTEL IMVP-6/IMVP-6.5 CPUs

DESCRIPTION

Demonstration circuit 1672A is a high efficiency, single phase, synchronous buck converter for Intel IMVP-6/IMVP-6.5 CPUs. It can supply 25A maximum load current at up to 1.5V output with 4.5V to 28V input range. The demo board features the LTC®3816EUHF controller. The LTC3816 is a single-phase synchronous buck controller in a constant-frequency voltage mode architecture. The controller's leading edge modulation topology allows extremely low output voltages and supports a phase-lockable switching frequency up to 550kHz. The output voltage is programmed using a 7-bit VID code. The default VID jumpers (VID6 to VID0) are set to be 0110000 for 0.9V output. The LTC3816 features all of the IMVP-6/IMVP-6.5 requirements, including start-up to a preset boot voltage, differential remote output voltage sensing with programmable active voltage positioning, Imon output current reporting, power optimization during sleep state, and slow slew rate sleep state exit. Fault protection features include input undervoltage lockout, cycle-by-cycle current limit, output overvoltage protection, and power-good (PWRGD) and overtemperature flags. The LTC3816 supports wide input range (4.5V to 36V) with optional line feedforward compensation, temperature compensated inductor DCR or sense resistor output current monitoring. The LTC3816 can provide high efficiency, high power density and versatile power solutions for embedded computing, mobile computers, internet devices and navigation displays. The controller is available in 38-pin thermally enhanced eTSSOP and 5mm × 7mm QFN packages.

The VRON pin (JP15) provides enable feature. To shut down the converter, one simple way is to force the VRON pin below 0.65V (JP15: OFF). Use JP19 jumper to select pulse-skipping or forced continuous mode operation. Switching frequency is pre-set at about 400KHz, and it can be easily modified from 150KHz to 550KHz. JP20~JP26 (VID0~VID7) are used to set the output voltage based on the IMVP-6/IMVP-6.5 VID code, as shown in table 2. JP1 and JP18 are used to select either IMVP6 or IMVP6.5 specification. For detailed information, please see LTC3816 data sheet and Intel IMVP-6/IMVP-6.5 specification.

Design files for this circuit board are available. Call the LTC factory.

Table 1. Performance Summary (T_A = 25°C)

PARAMETER	CONDITION	VALUE
Input Voltage Range		4.5V to 28V
Output Voltage, V_{OUT}	V_{IN} = 4.5-28V, I_{OUT} = 0A to 23A, VID6-0=0110000	0.9V ±1.5%
Maximum Output Current, I_{OUT}	V_{IN} = 4.5-28V, V_{OUTMAX} = 1.5V	25A
Typical Efficiency	V_{IN} = 12V, V_{OUT} = 1.5V, I_{OUT} = 23A	86.7%
Typical Switching Frequency		400kHz

Table 2. IMVP-6/IMVP-6.5 VID Output Voltage Programming

VID6	VID5	VID4	VID3	VID2	VID1	VID0	$V_{CC(CORE)}$
0	0	0	0	0	0	0	1.5000
0	0	0	0	0	0	1	1.4875
0	0	0	0	0	1	0	1.4750
0	0	0	0	0	1	1	1.4625
0	0	0	0	1	0	0	1.4500
0	0	0	0	1	0	1	1.4375
0	0	0	0	1	1	0	1.4250
0	0	0	0	1	1	1	1.4125
0	0	0	1	0	0	0	1.4000
0	0	0	1	0	0	1	1.3875
0	0	0	1	0	1	0	1.3750
0	0	0	1	0	1	1	1.3625
0	0	0	1	1	0	0	1.3500
0	0	0	1	1	0	1	1.3375
0	0	0	1	1	1	0	1.3250
0	0	0	1	1	1	1	1.3125
0	0	1	0	0	0	0	1.3000
0	0	1	0	0	0	1	1.2875
0	0	1	0	0	1	0	1.2750
0	0	1	0	0	1	1	1.2625
0	0	1	0	1	0	0	1.2500
0	0	1	0	1	0	1	1.2375
0	0	1	0	1	1	0	1.2250
0	0	1	0	1	1	1	1.2125
0	0	1	1	0	0	0	1.2000
0	0	1	1	0	0	1	1.1875
0	0	1	1	0	1	0	1.1750
0	0	1	1	0	1	1	1.1625
0	0	1	1	1	0	0	1.1500
0	0	1	1	1	0	1	1.1375
0	0	1	1	1	1	0	1.1250
0	0	1	1	1	1	1	1.1125
0	1	0	0	0	0	0	1.1000
0	1	0	0	0	0	1	1.0875
0	1	0	0	0	1	0	1.0750
0	1	0	0	0	1	1	1.0625
0	1	0	0	1	0	0	1.0500
0	1	0	0	1	0	1	1.0375
0	1	0	0	1	1	0	1.0250
0	1	0	0	1	1	1	1.0125
0	1	0	1	0	0	0	1.0000
0	1	0	1	0	0	1	0.9875
0	1	0	1	0	1	0	0.9750
0	1	0	1	0	1	1	0.9625
0	1	0	1	1	0	0	0.9500
0	1	0	1	1	0	1	0.9375
0	1	0	1	1	1	0	0.9250
0	1	0	1	1	1	1	0.9125
0	1	1	0	0	0	0	0.9000
0	1	1	0	0	0	1	0.8875
0	1	1	0	0	1	0	0.8750
0	1	1	0	0	1	1	0.8625
0	1	1	0	1	0	0	0.8500
0	1	1	0	1	0	1	0.8375
0	1	1	0	1	1	0	0.8250
0	1	1	0	1	1	1	0.8125
0	1	1	1	0	0	0	0.8000
0	1	1	1	0	0	1	0.7875
0	1	1	1	0	1	0	0.7750
0	1	1	1	0	1	1	0.7625
0	1	1	1	1	0	0	0.7500
0	1	1	1	1	0	1	0.7375
0	1	1	1	1	1	0	0.7250
0	1	1	1	1	1	1	0.7125

VID6	VID5	VID4	VID3	VID2	VID1	VID0	$V_{CC(CORE)}$
1	0	0	0	0	0	0	0.7000
1	0	0	0	0	0	1	0.6875
1	0	0	0	0	1	0	0.6750
1	0	0	0	0	1	1	0.6625
1	0	0	0	1	0	0	0.6500
1	0	0	0	1	0	1	0.6375
1	0	0	0	1	1	0	0.6250
1	0	0	0	1	1	1	0.6125
1	0	0	1	0	0	0	0.6000
1	0	0	1	0	0	1	0.5875
1	0	0	1	0	1	0	0.5750
1	0	0	1	0	1	1	0.5625
1	0	0	1	1	0	0	0.5500
1	0	0	1	1	0	1	0.5375
1	0	0	1	1	1	0	0.5250
1	0	0	1	1	1	1	0.5125
1	0	1	0	0	0	0	0.5000
1	0	1	0	0	0	1	0.4875
1	0	1	0	0	1	0	0.4750
1	0	1	0	0	1	1	0.4625
1	0	1	0	1	0	0	0.4500
1	0	1	0	1	0	1	0.4375
1	0	1	0	1	1	0	0.4250
1	0	1	0	1	1	1	0.4125
1	0	1	1	0	0	0	0.4000
1	0	1	1	0	0	1	0.3875
1	0	1	1	0	1	0	0.3750
1	0	1	1	0	1	1	0.3625
1	0	1	1	1	0	0	0.3500
1	0	1	1	1	0	1	0.3375
1	0	1	1	1	1	0	0.3250
1	0	1	1	1	1	1	0.3125
1	1	0	0	0	0	0	0.3000
1	1	0	0	0	0	1	0.2875
1	1	0	0	0	1	0	0.2750
1	1	0	0	0	1	1	0.2625
1	1	0	0	1	0	0	0.2500
1	1	0	0	1	0	1	0.2375
1	1	0	0	1	1	0	0.2250
1	1	0	0	1	1	1	0.2125
1	1	0	1	0	0	0	0.2000
1	1	0	1	0	0	1	0.1875
1	1	0	1	0	1	0	0.1750
1	1	0	1	0	1	1	0.1625
1	1	0	1	1	0	0	0.1500
1	1	0	1	1	0	1	0.1375
1	1	0	1	1	1	0	0.1250
1	1	0	1	1	1	1	0.1125
1	1	1	0	0	0	0	0.1000
1	1	1	0	0	0	1	0.0875
1	1	1	0	0	1	0	0.0750
1	1	1	0	0	1	1	0.0625
1	1	1	0	1	0	0	0.0500
1	1	1	0	1	0	1	0.0375
1	1	1	0	1	1	0	0.0250
1	1	1	0	1	1	1	0.0125
1	1	1	1	0	0	0	0.0000
1	1	1	1	0	0	1	0.0000
1	1	1	1	0	1	0	0.0000
1	1	1	1	0	1	1	0.0000
1	1	1	1	1	0	0	0.0000
1	1	1	1	1	0	1	0.0000
1	1	1	1	1	1	0	0.0000
1	1	1	1	1	1	1	0.0000

QUICK START PROCEDURE

Demonstration circuit 1672A is easy to set up to evaluate the performance of the LTC3816EUHF. Refer to Figure 1 for the proper measurement equipment setup and jumpers' location, and follow the procedure below:

1. With power off, connect the input power supply to Vin (4.5V-28V) and GND (input return).
2. Set VID jumpers VID6-0: 0110000 for 0.9V ouput.
3. Connect the output load between Vout and GND (Initial load: no load).
4. Connect the DVMs to the input and outputs.
5. Turn on the input power supply and check for the proper output voltages. Vout should be within 0.885 V to 0.915V.
6. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage and other parameters.

Note: When measuring the output or input voltage ripple, do not use the long ground lead on the oscilloscope probe. See Figure 2 for the proper scope probe technique. Short, stiff leads need to be soldered to the (+) and (-) terminals of an output capacitor. The probe's ground ring needs to touch the (-) lead and the probe tip needs to touch the (+) lead.

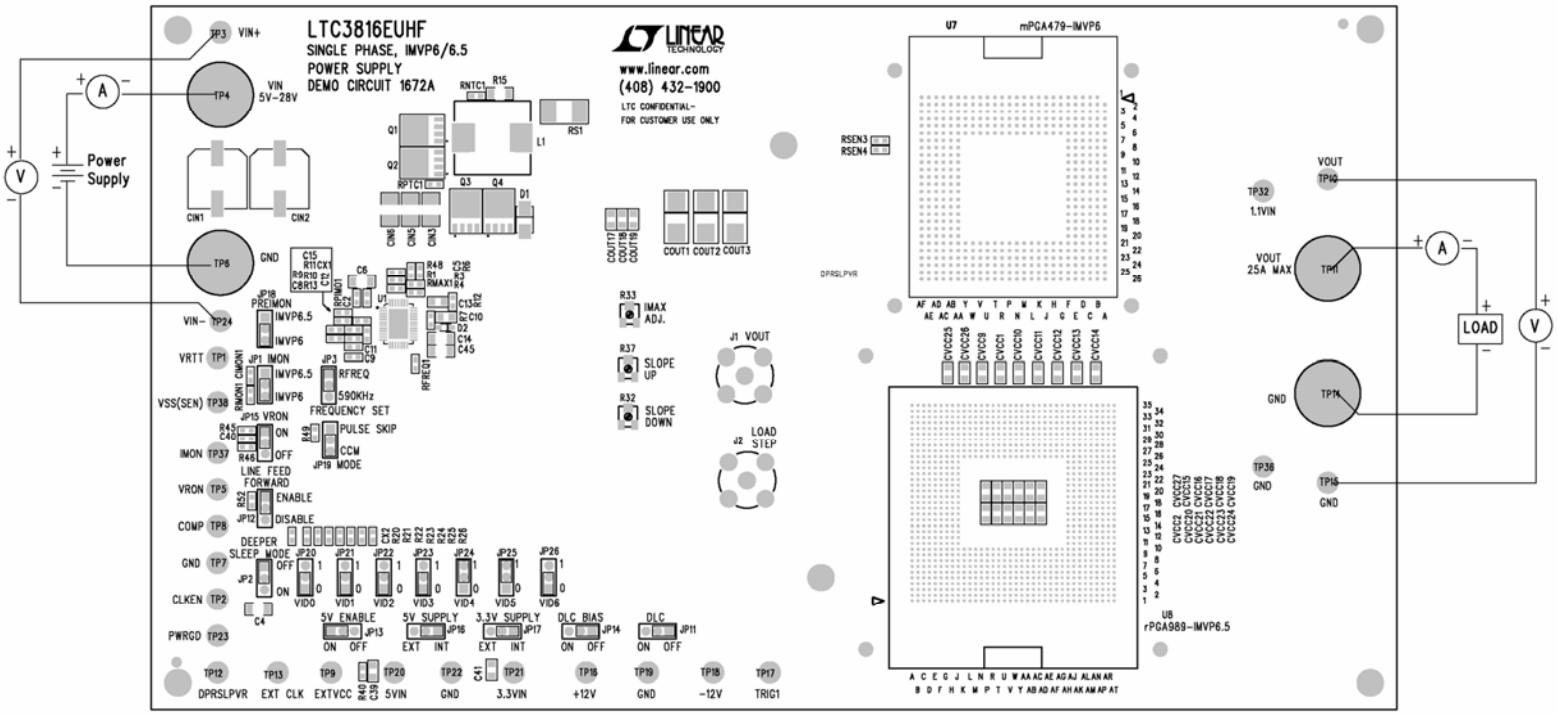


Figure 1. Proper Measurement Equipment Setup

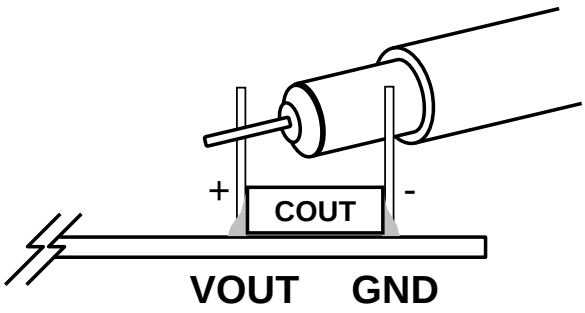


Figure 2. Measuring Output Voltage Ripple

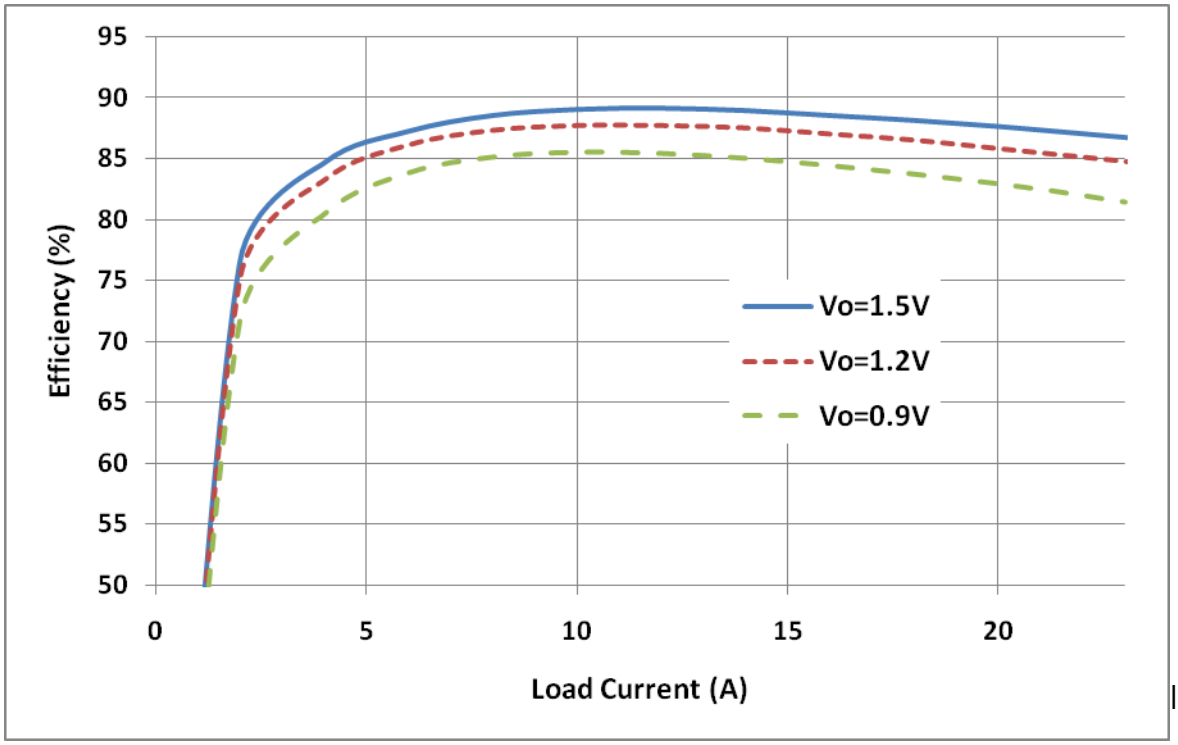
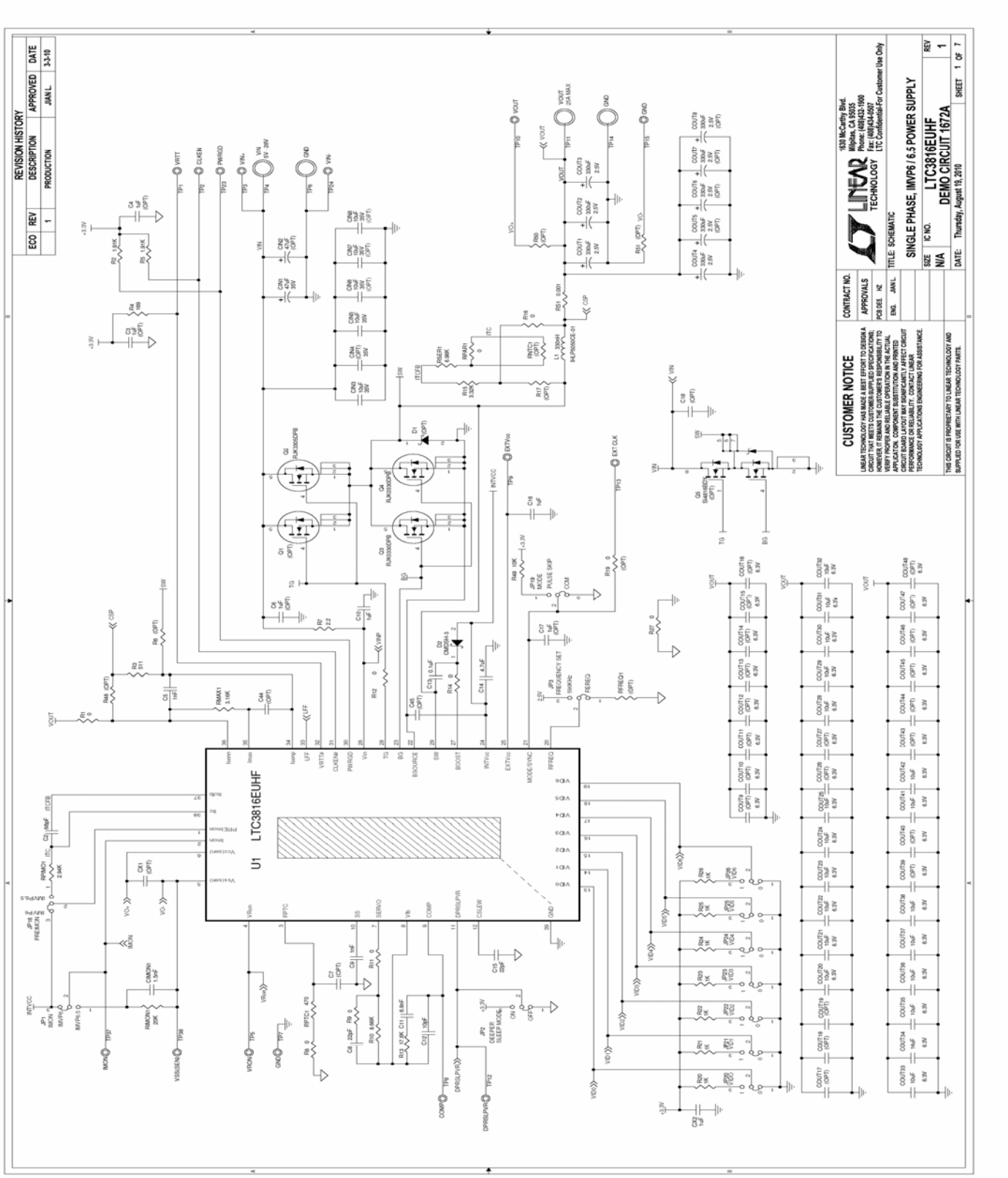


Figure 3. Efficiency vs load current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ECO REV DESCRIPTION APPROVED DATE
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U1 LTC3816EUHF
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PCB DES. HZ
ENG. JIAN L.
TITLE: SCHEMATIC
SINGLE PHASE, IMVP6 / 6.5 POWER SUPPLY
SIZE IC NO. LTC3816EUHF REV 1
N/A DEMO CIRCUIT 1672A
DATE: Thursday, August 19, 2010
SHEET 1 OF 7
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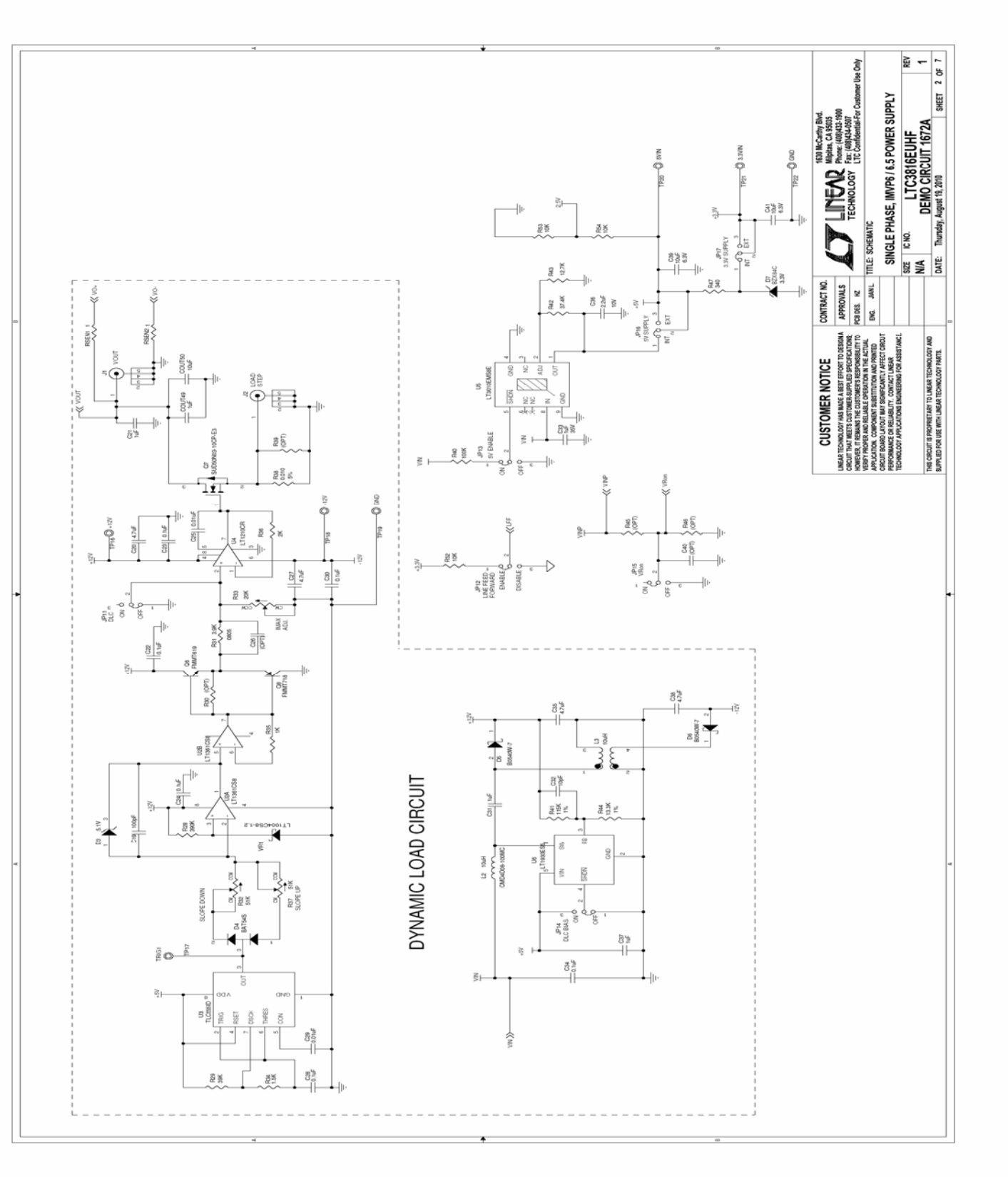
DYNAMIC LOAD CIRCUIT
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SLOPE UP
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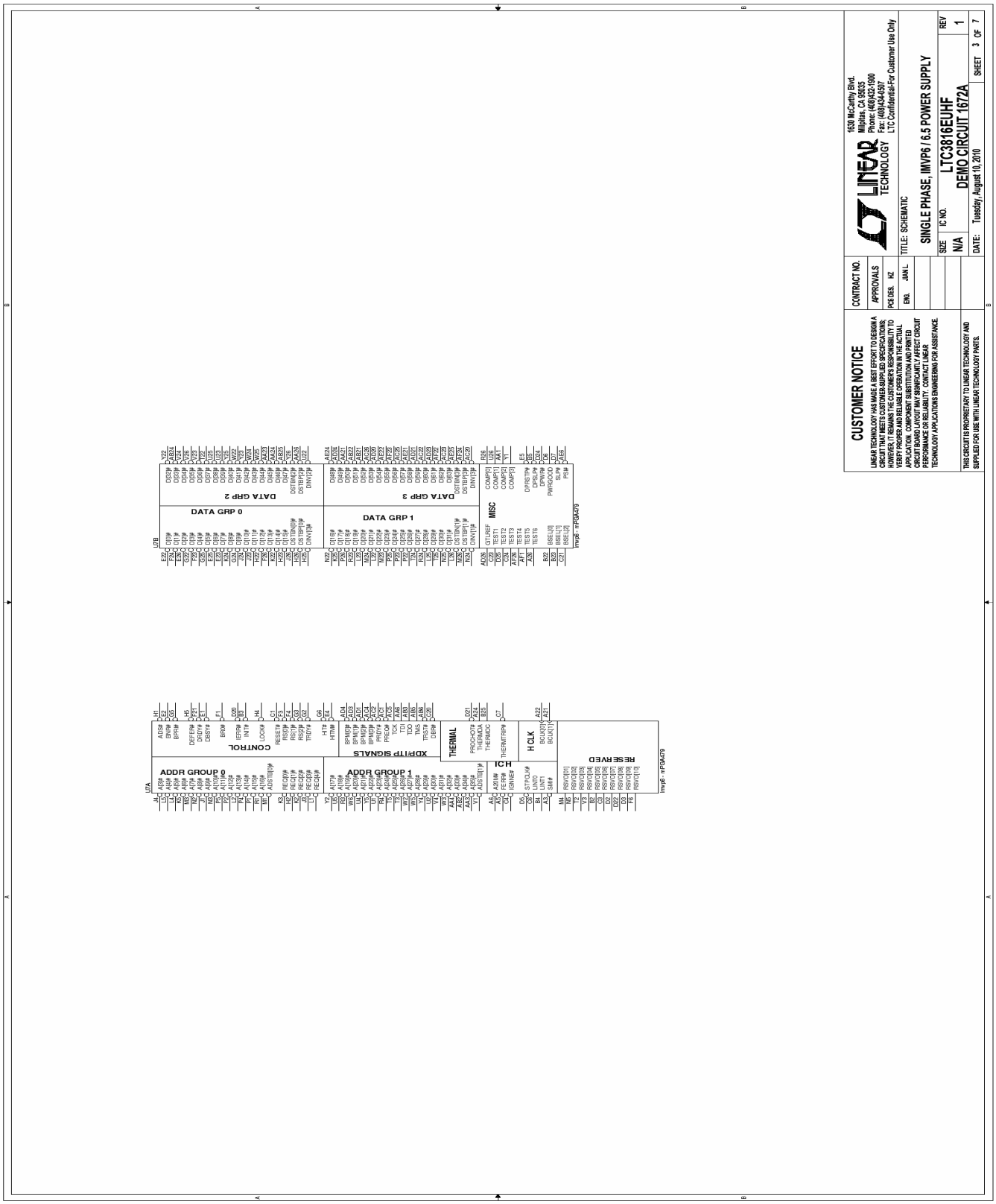
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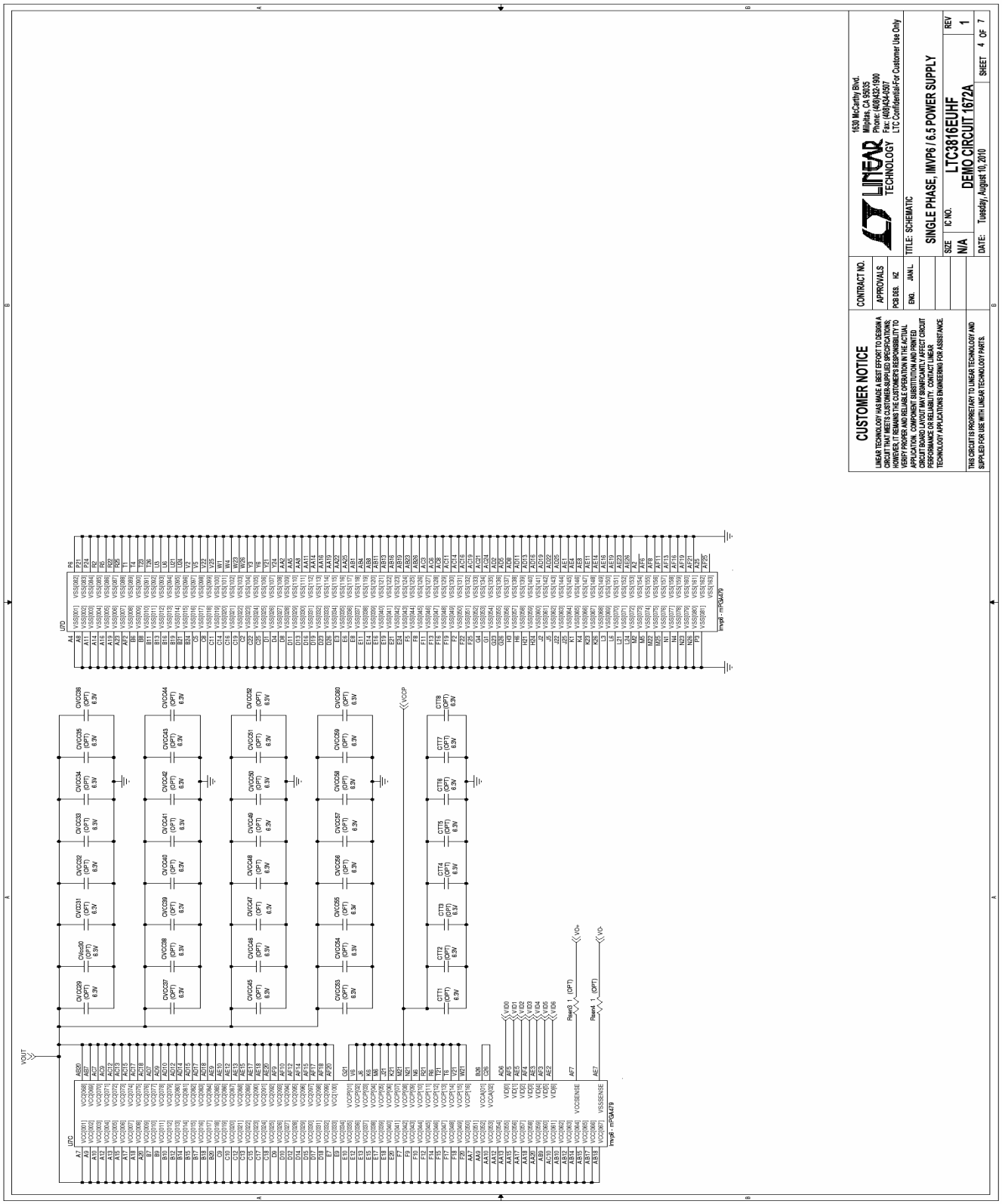
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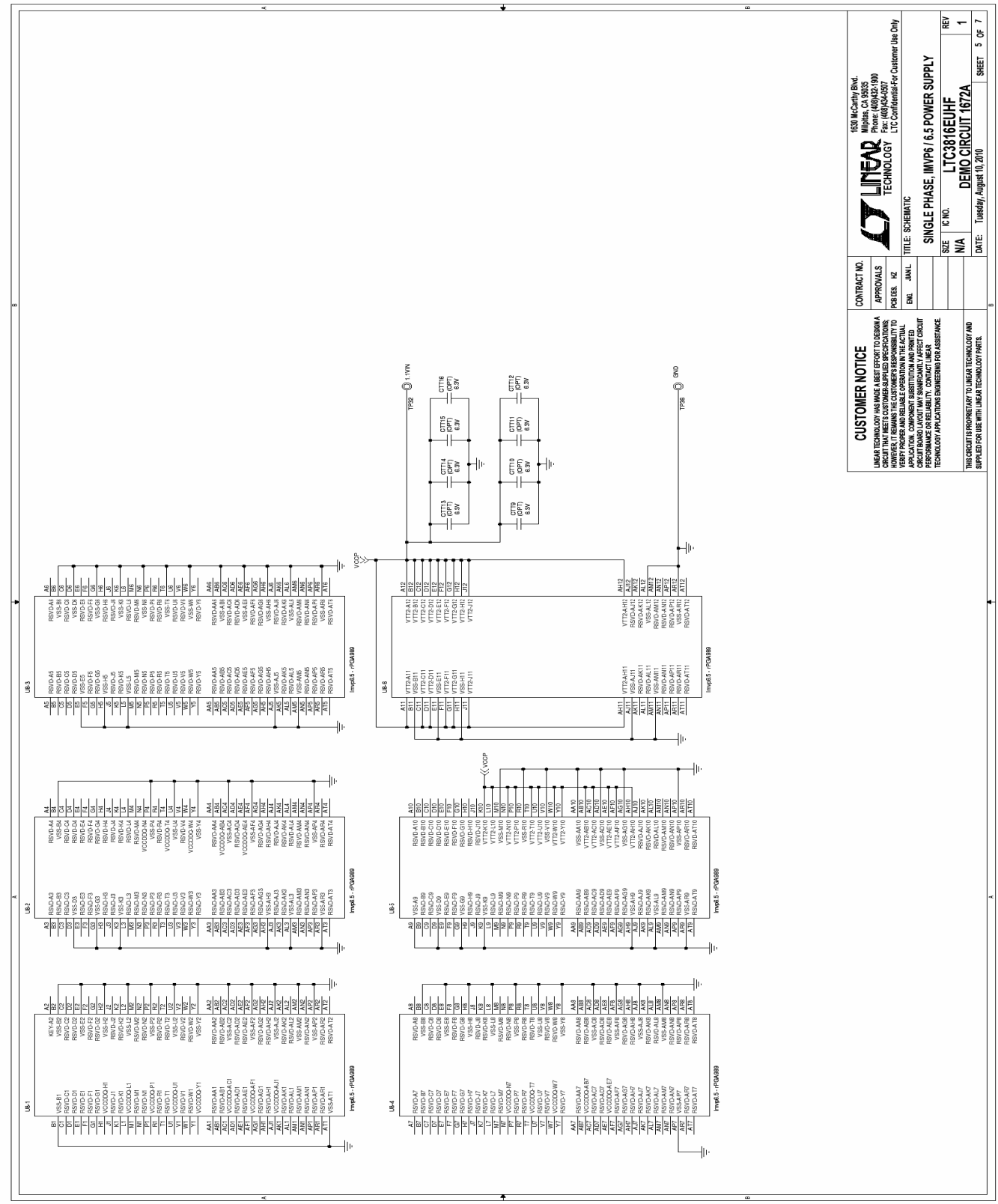
SHEET 4 OF 7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DEMO CIRCUIT 1672A
REV 1
DATE: Tuesday, August 10, 2010
SHEET 5 OF 7
U8-1
U8-2
U8-3
U8-4
U8-5
U8-6
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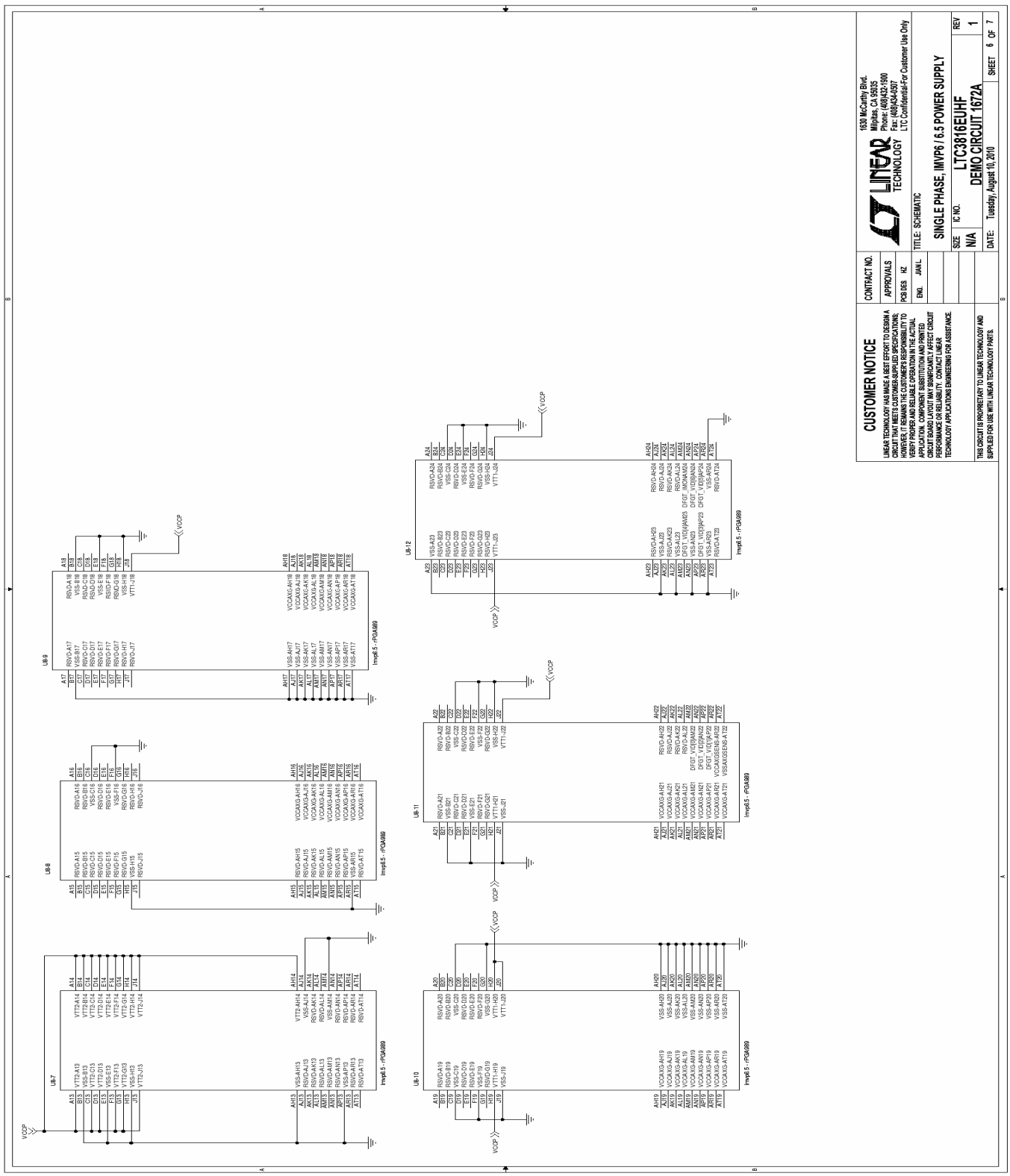
VCCP
1.1VIN
GND
TP32
TP38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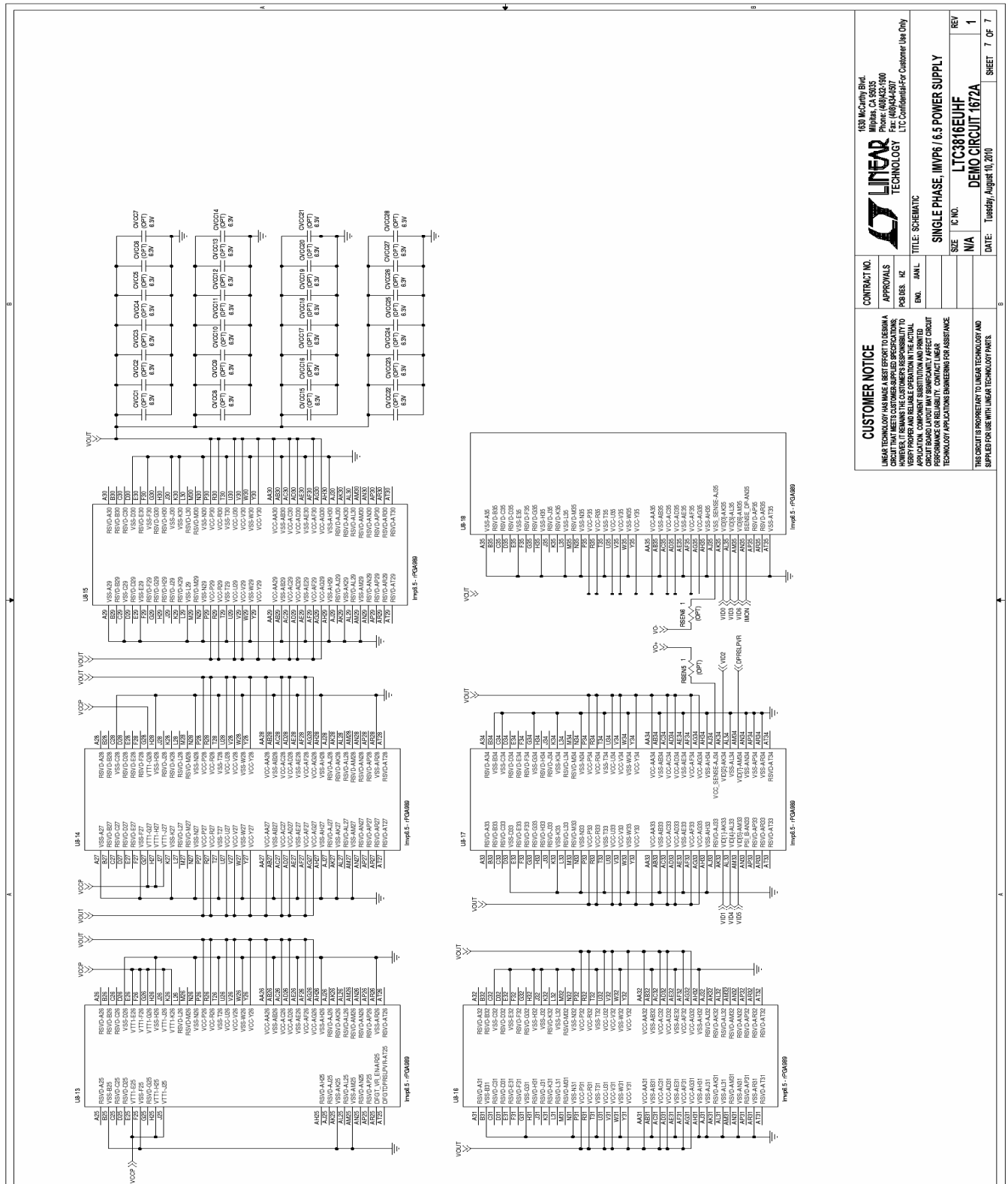
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U8-13
U8-14
U8-15
U8-16
U8-17
U8-18
Imvp6.5 - rPGA989
VOUT
VCCP
VCC_SENSE+_A
VCC_SENSE-_A
VID0
VID1
VID2
VID3
VID4
VID5
VID6
IMON
DPRSLPVR
RSENS 1
(OPT)