LM2984 Microprocessor Power Supply System

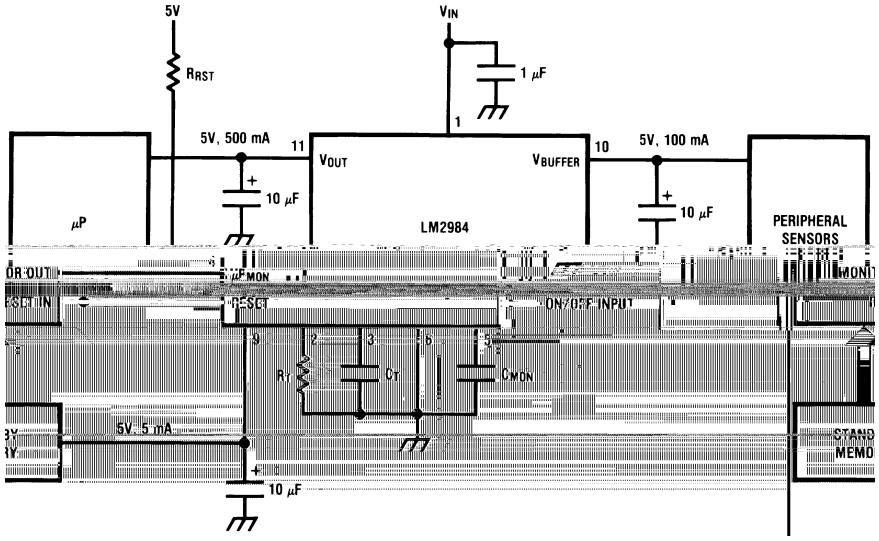
Check for Samples: LM2984

FEATURES

- **Three Low Dropout Tracking Regulators**
- **Output Current in Excess of 500 mA**
- **Fully Specified for −40°C to +125°C Operation**
- **Low Quiescent Current Standby Regulator**
- **Microprocessor Malfunction RESET Flag**
- **Delayed RESET on Power-Up**
- **Accurate pretrimmed 5V outputs**
- **Reverse Battery Protection**
- **Overvoltage Protection**
- **Reverse**

DESCRIPTION

The LM2984 positive voltage regulator features three independent and tracking outputs capable of delivering the power for logic circuits, peripheral sensors and standby memory in a typical microprocessor system. The LM2984 includes circuitry which monitors both its own high-current output and also an external µP. If any error conditions are sensed in either, a reset error flag is set and maintained until the malfunction terminates. Since these functions are included in the same package with the three regulators, a great saving in board space can be realized in the typical microprocessor system. The LM2984 also features very low dropout



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings (1)(2)

Input Voltage	
Survival Voltage (<100 ms)	60V
Operational Voltage	26V
Internal Power Dissipation	Internally Limited
Operating Temperature Range (T_A)	−40°C to +125°C
Maximum Junction Temperature	
(3)	150°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature	
(Soldering, 10 sec.)	230°C
ESD Susceptability (4)	2000V

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. DC and AC electrical specifications do not apply when operating the device beyond its specified operating ratings.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and and

thermi 21.52 Tv
Mo Wo Td 26o 72 479.275 0 Td (Voltage)TipF.88 0 Tv

Electrical Characteristics (continued)

V_{IN} = 14V, I_{OUT} = 5 mA, C_{OUT} = 10 µF, unless otherwise indicated. **Boldface** type refers to limits over the entire operating temperature range, −40°C ≤ T_A ≤ +125°C, all other limits are for T_A = T_j = 25°C (1) .

Parameter	Conditions	Typical	Limit (2)	Units
Reverse Polarity Input Voltage Transient	T ≤ 100 ms, R_{stby} = 1000Ω	−55	−35/**−35**	V_{min}
Tracking and Isolation				
Tracking V_{OUT}–V_{stby}	I_{OUT} ≤ 500 mA, I_{buf} = 5 mA, I_{stby} ≤ 7.5 mA	±30	±100/**±100**	mV_{max}
Tracking V_{buf}–V_{stby}	I_{OUT} = 5 mA, I_{buf} ≤ 100 mA, I_{stby} ≤ 7.5 mA	±30	±100/**±100**	mV_{max}
Tracking V_{OUT}–V_{buf}	I_{OUT} ≤ 500 mA, I_{buf} ≤ 100 mA, I_{stby} = 1 mA	±30	±100/**±100**	mV_{max}
Isolation (3) V_{buf} from V_{OUT}	R_{OUT} = 1Ω, I_{buf} ≤ 100 mA	5.00	4.50/**4.50** 5.50/**5.50**	V_{min} V_{max}
Isolation (3) V_{stby} from V_{OUT}	R_{OUT} = 1Ω, I_{stby} ≤ 7.5 mA	5.00	4.50/**4.50** 5.50/**5.50**	V_{min} V_{max}
Isolation (3) V_{OUT} from V_{buf}	R_{buf} = 1Ω, I_{OUT} ≤ 500 mA	5.00	4.50/**4.50** 5.50/**5.50**	V_{min} V_{max}
Isolation (3) V_{stby} from V_{buf}	R_{buf} = 1Ω, I_{stby} ≤ 7.5 mA	5.00	4.50/**4.50** 5.50/**5.50**	V_{min} V_{max}
Computer Monitor/Reset Functions				
I_{reset} Low	V_{IN} = 4V, V_{rst} = 0.4V	5	2/**0.50**	mA_{min}
V_{reset} Low	V_{IN} = 4V, I_{rst} = 1 mA	0.10	0.40/**0.40**	V_{max}
R_t voltage	(Pin 2)	1.22	1.15/**0.75**	V_{min}
		1.22	1.30/**2.00**	V_{max}
Power On Reset Delay	VµP$_{mon}$ = 5V (T_{dly} = 1.2 R_t C_t)	50	45/**17.0**	ms_{min}
		50	55/**80.0**	ms_{max}
ΔV_{OUT} Low Reset Threshold	(4)	−350	−225/**−175**	mV_{min}
			−500/**−550**	mV_{max}
ΔV_{OUT} High Reset Threshold	(4)	600	225/**175**	mV_{min}
			750/**800**	mV_{max}
Reset Output Leakage	VµP$_{mon}$ = 5V, V_{rst} = 12V	0.01	1/**5.0**	$µA_{max}$
µP$_{mon}$ Input Current (Pin 4)	VµP$_{mon}$ = 2.4V	7.5	25/**25**	$µA_{max}$
	VµP$_{mon}$ = 0.4V	0.01	10/**15**	$µA_{max}$
µP$_{mon}$ Input Threshold Voltage		1.22	0.80/**0.80**	V_{min}
		1.22	2.00/**2.00**	V_{max}
µP Monitor Reset Oscillator Period	VµP$_{mon}$ = 0V (T_{window} = 0.82 R_tC_{mon})	50	45/**30**	ms_{min}
		50	55/**70**	ms_{max}
µP Monitor Reset Oscillator Pulse Width	VµP$_{mon}$ = 0V ($RESET_{pw}$ = 2000 C_{mon})	1.0	0.7/**0.4**	ms_{min}
		1.0	1.3/**2.10**	ms_{max}
Minimum µP Monitor	(5.97 0 Td (R)Tj /F2 6 Tf 5.76 -1.6 Td (10.3 168.6 Td (ms)Tj /F2 6 Tfrg 186.4 145.4 Td ((5.97 0 Td rg 509arg 181.7 155.4 Td ((RESET)Tj /F2 6 Tf iTd (all)Tj 11.7			

(RESET
resetT BT.07 0 TdaesetTf 17.7 0 Td

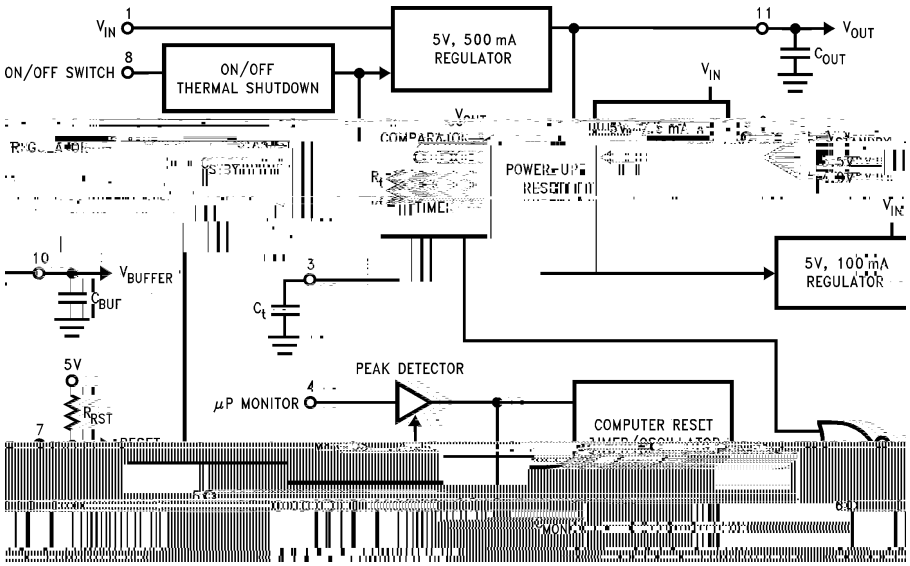
Electrical Characteristics (continued)

V_{IN} = 14V, I_{OUT} = 5 mA, C_{OUT} = 10 µF, unless otherwise indicated. **Boldface** type refers to limits over the entire operating temperature range, −40°C ≤ T_A ≤ +125°C, all other limits are for T_A = T_j = 25°C (1) .

Parameter	Conditions	Typical	Limit (2)	Units
Reset Fall Time	R_{rst} = 10k, V_{rst} = 5V, C_{rst} ≤ 10 pF	0.20	1.00/**1.00** 1.00/	μs_{max}
Reset Rise Time	R_{rst} = 10k, V_{rst} = 5V, C_{rst} ≤ 10 pF	0.60	1.00/**1.50** =	μs_{max}
On/Off Switch Input Current (Pin 8)	V_{ON} = 2.4V	7.5	25/**25**	μA_{max}
	V_{ON} = 0.4V	0.01	10/**10**	μA_{max}
On/Off Switch Input Threshold Voltage		1.22	0.80/**0.80**	V_{min}
		1.22	2.00/**2.00**	V_{max}

BLOCK DIAGRAM

V



Pin Descriptions

Pin No.	Pin Name	Comments
1	V_{IN}	Positive supply input 0 8 T f (1 0) T j T e 1 a 0 0 0 1 B J 3 7 5 5 5 8 7 . 8 z 0 T T (1 / 2 2 2 7 6 2 6 8 1 6 T d [(E) T j B F 2 6 1 T f 1 5 3 1 0 6 2 7 0 F 2 0 2 . 1 g 0

Connection Diagram

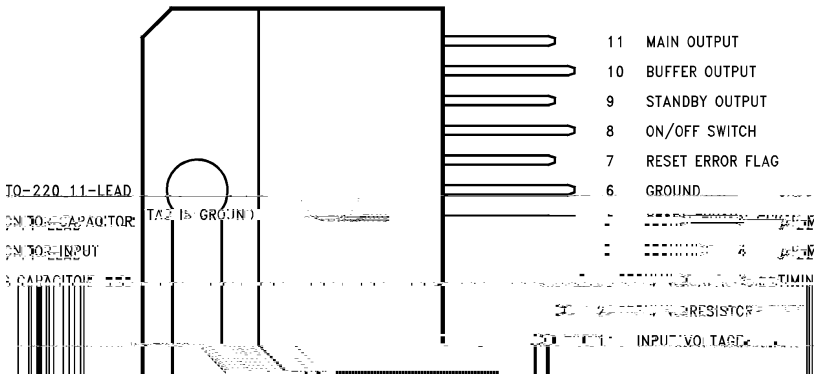


Figure 2. Package Number NDJ0011B

Typical Performance Characteristics

Dropout Voltage (V_{OUT})

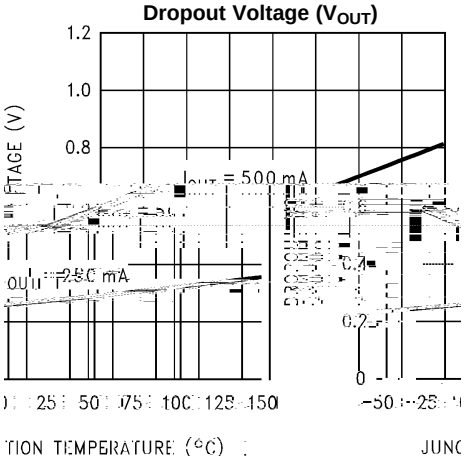


Figure 3.

Dropout Voltage (V_{buf})

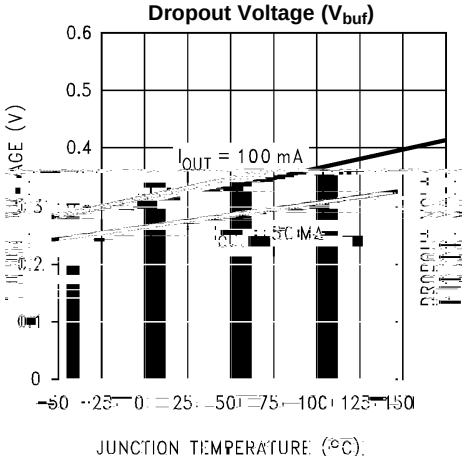


Figure 4.

Dropout Voltage (V_{stby})

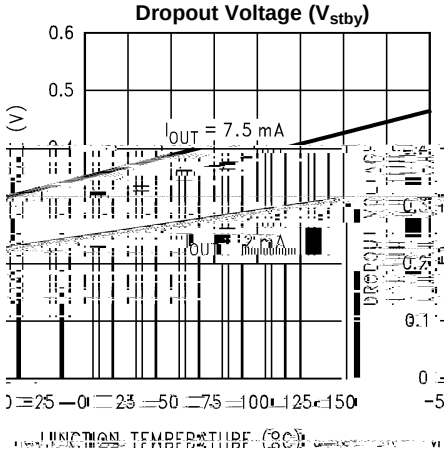


Figure 5.

Dropout Voltage (V_{OUT})

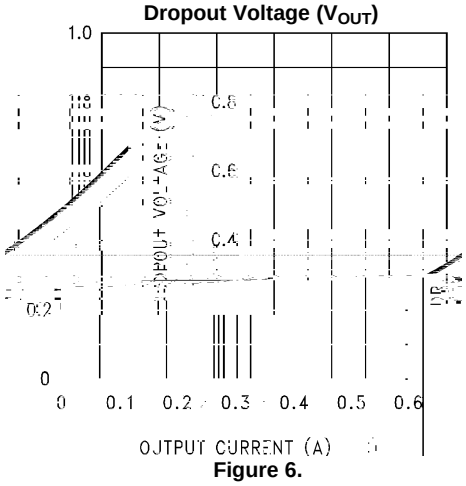


Figure 6.

Dropout Voltage (V_{buf})

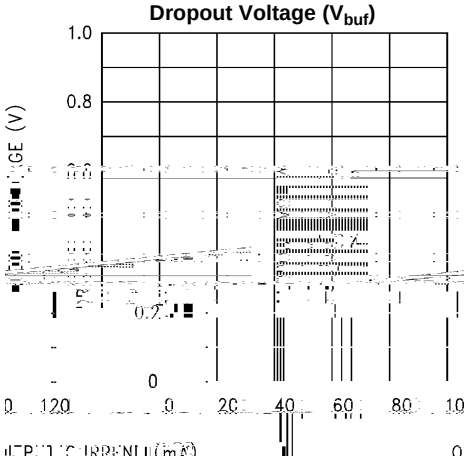


Figure 7.

Dropout Voltage (V_{stby})

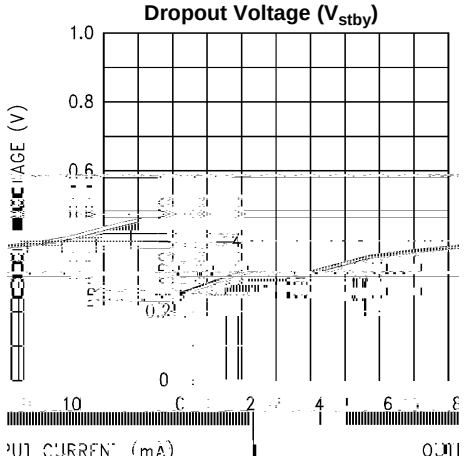


Figure 8.

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Typical Performance Characteristics (continued)

Peak Output Current (V_{OUT})

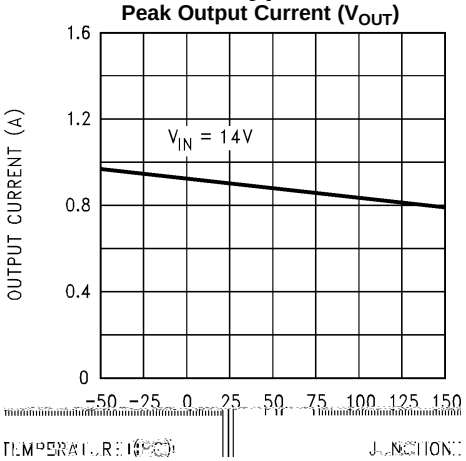

Figure 9.

Peak Output Current (V_{buf})

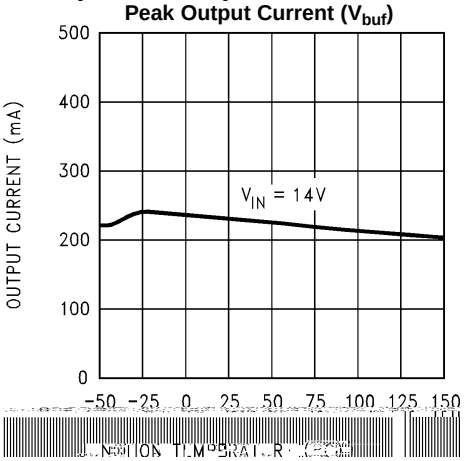

Figure 10.

Peak Output Current (V_{stby})

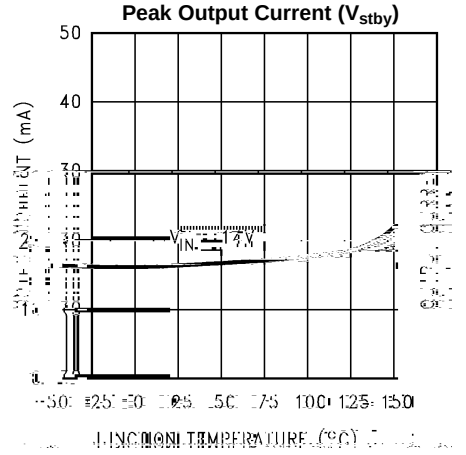

Figure 11.

Quiescent Current (V_{OUT})

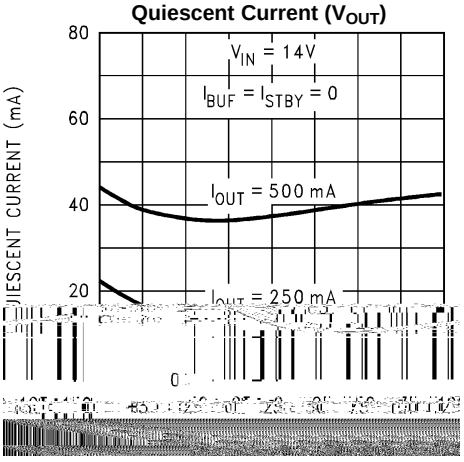

Figure 12.

Quiescent Current (V_{buf})

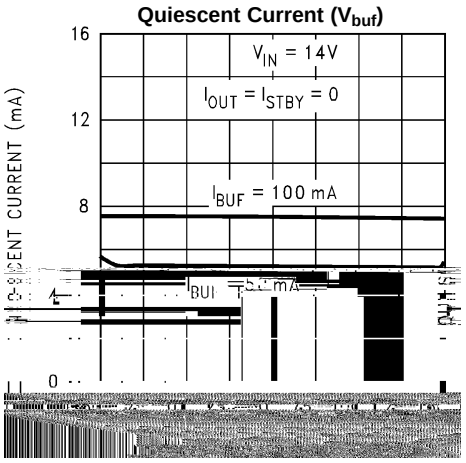

Figure 13.

Quiescent Current (V_{stby})

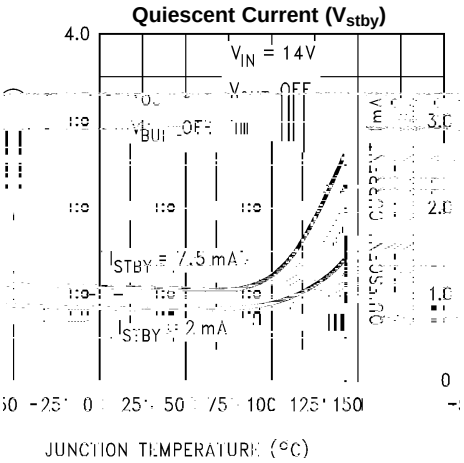

Figure 14.

Typical Performance Characteristics (continued)

Quiescent Current (V_{OUT})

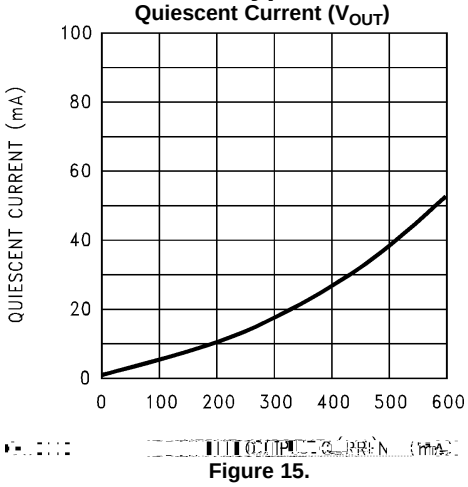

Figure 15.

Quiescent Current (V_{buf})

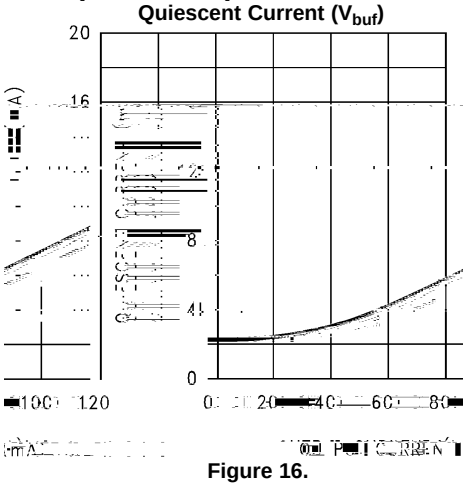

Figure 16.

Quiescent Current (V_{stby})

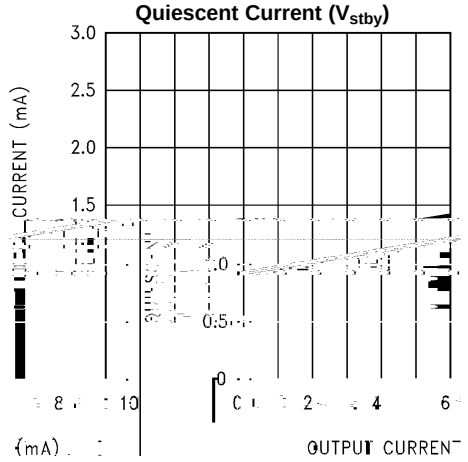

Figure 17.

Quiescent Current (V_{OUT})

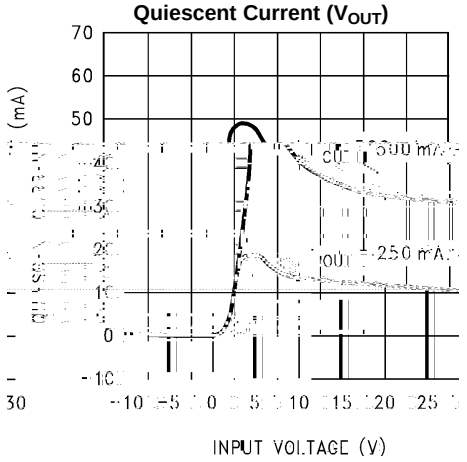

Figure 18.

Quiescent Current (V_{buf})

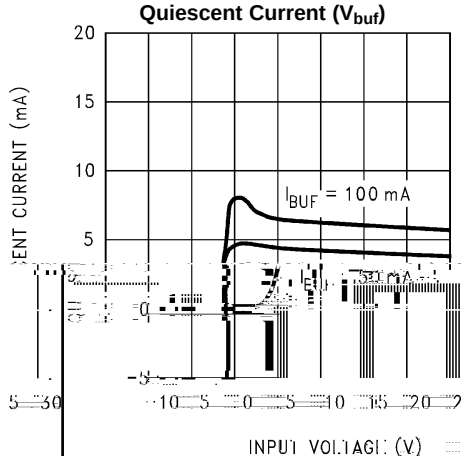

Figure 19.

Quiescent Current (V_{stby})

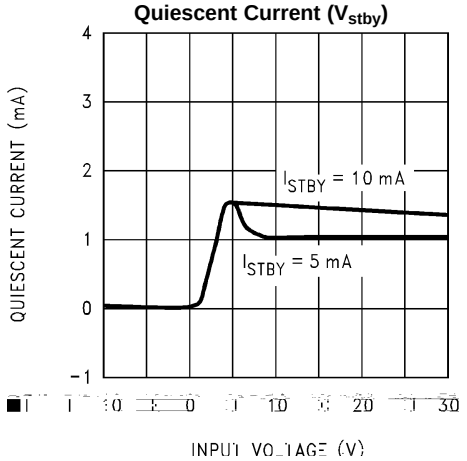

Figure 20.

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Typical Performance Characteristics (continued)

Output Voltage (V_{OUT})

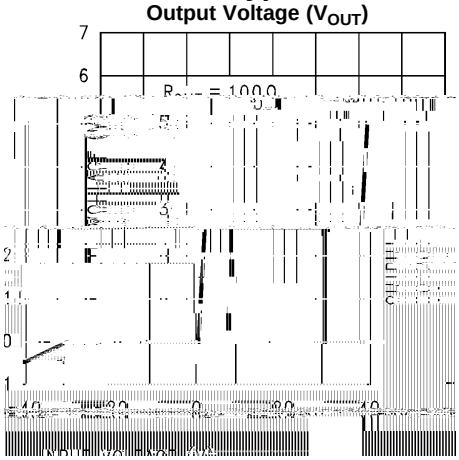

Figure 21.

Output Voltage (V_{buf})

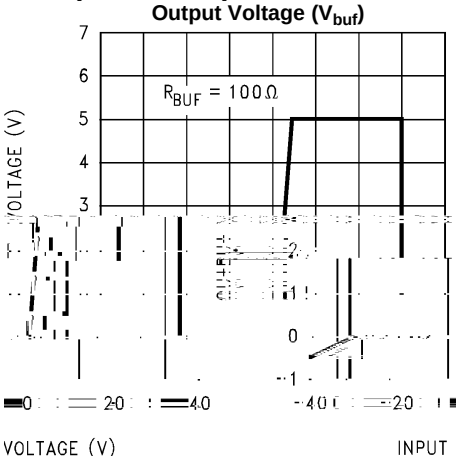

Figure 22.

Output Voltage (V_{stby})

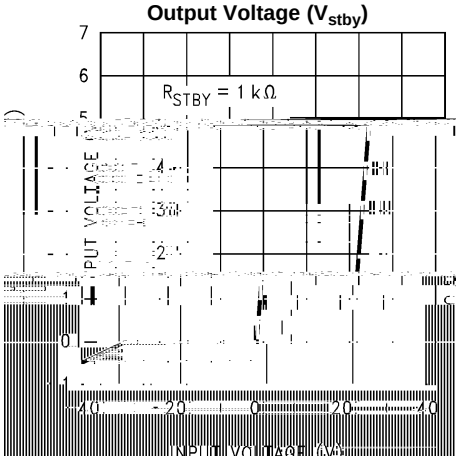

Figure 23.

Low Voltage Behavior (V_{OUT})

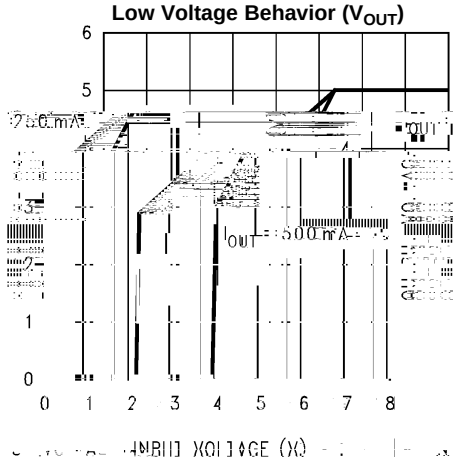

Figure 24.

Low Voltage Behavior (V_{buf})

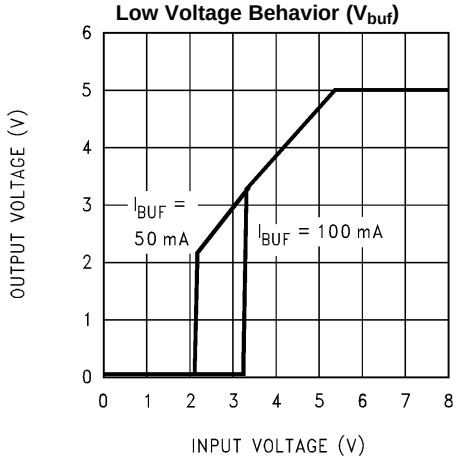

Figure 25.

Low Voltage Behavior (V_{stby})

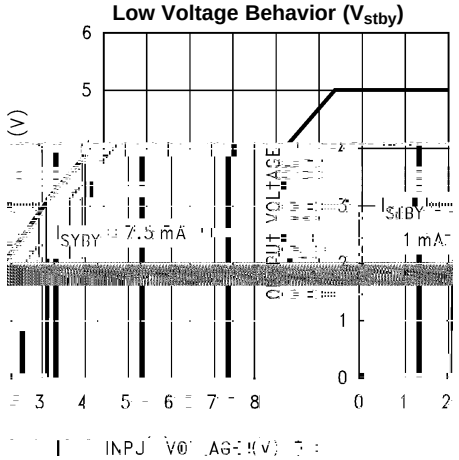

Figure 26.

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Typical Performance Characteristics (continued)

Line Transient Response (V_{OUT})

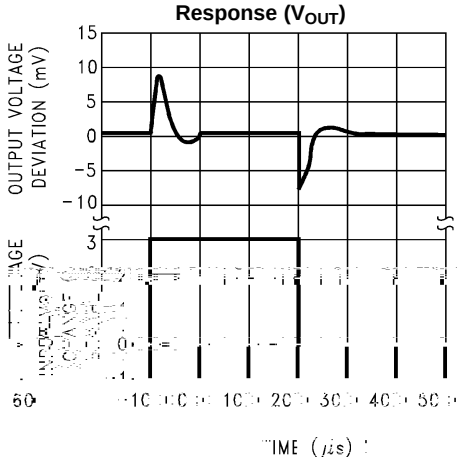

Figure 27.

Line Transient Response (V_{buf})

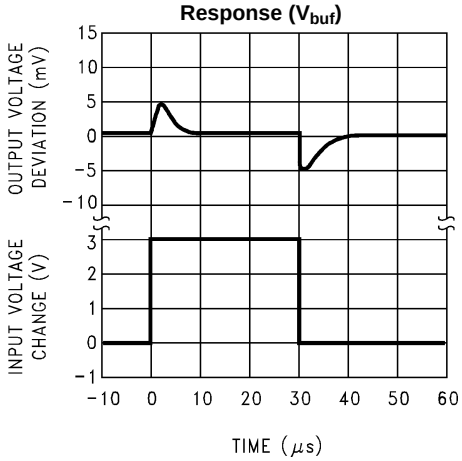

Figure 28.

Line Transient Response (V_{stby})

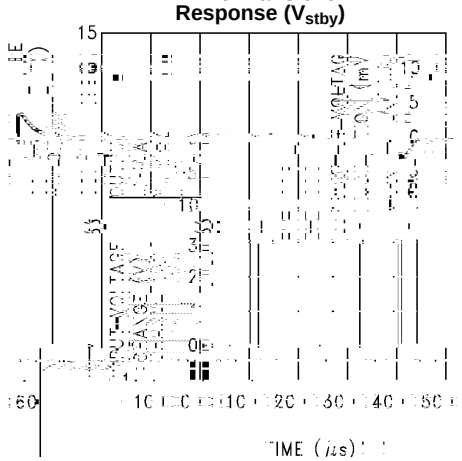

Figure 29.

Load Transient Response (V_{OUT})

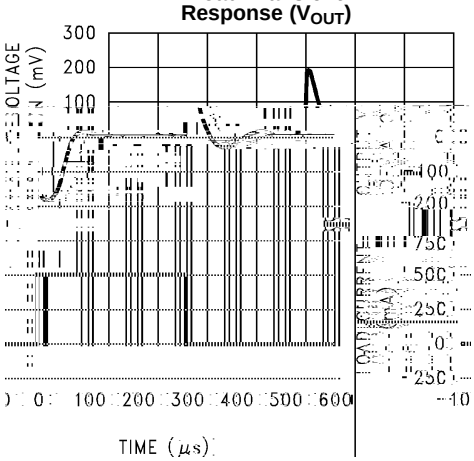

Figure 30.

Load Transient Response (V_{buf})

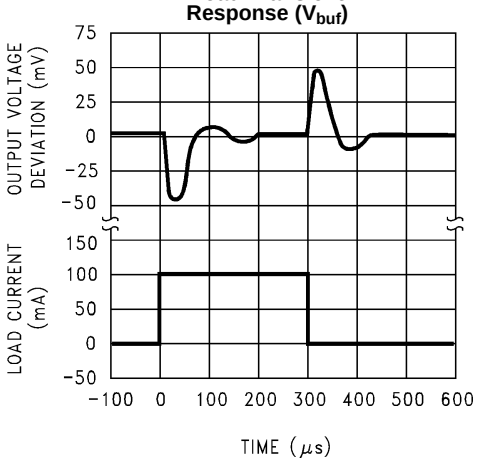

Figure 31.

Load Transient Response (V_{stby})

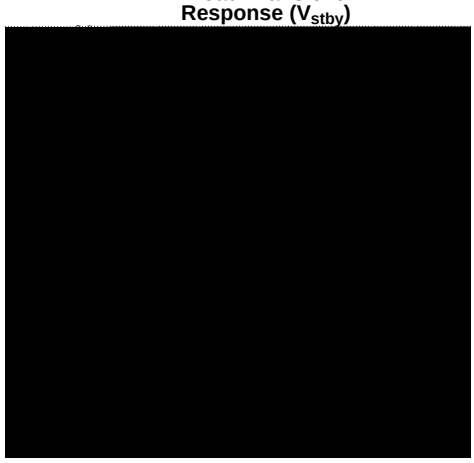

Figure 32.

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Typical Performance Characteristics (continued)

Output Voltage

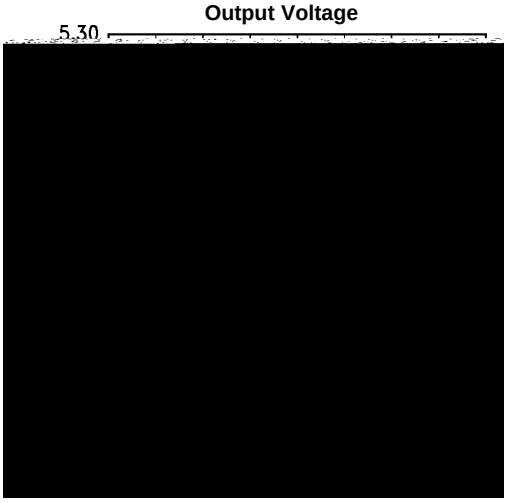

Figure 39.

Device Dissipation vs Ambient Temperature

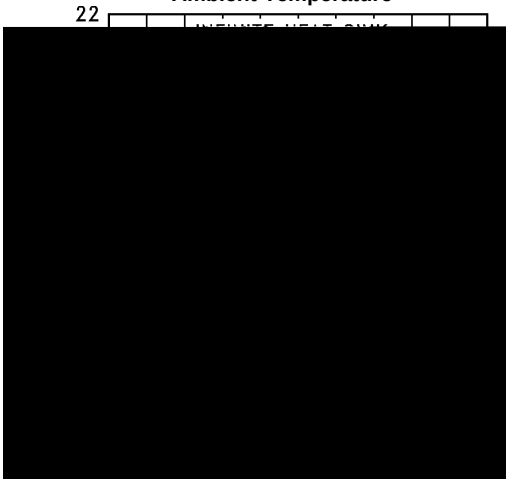

Figure 40.

Output Capacitor ESR (Standby Output, Pin 9)

Figure 41.

Output Capacitor ESR (Buffer Output, Pin 10)

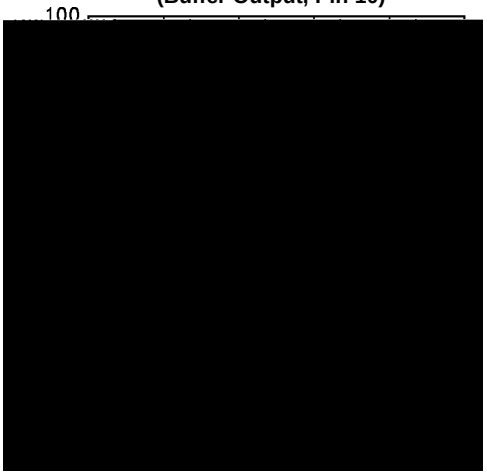

Figure 42.

Output Capacitor ESR (Main Output, Pin 11)

Figure 43.

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APPLICATION HINTS

OUTPUT CAPACITORS

The LM2984 output capacitors are required for stability. Without them, the regulator outputs will oscillate, sometimes by many volts. Though the 10 µF shown are the minimum recommended values, actual size and type may vary depending upon the application load and temperature range. Capacitor effective series resistance (ESR) also affects the IC stability. Since ESR varies from one brand to the next, some bench work may be required to determine the minimum capacitor value to use in production. Worst case is usually determined at the minimum ambient temperature and the maximum load expected.

Output capacitors can be increased in size to any desired value above the minimum. One possible purpose of this would be to maintain the output voltages during brief conditions of negative input transients that might be characteristic of a particular system.

Capacitors must also be rated at all ambient temperatures expected in the system. Many aluminum type electrolytics will freeze at temperatures less than −30°C, reducing their effective capacitance to zero. To maintain regulator stability down to −40°C, capacitors rated at that temperature (such as tantalums) must be used.

Each output **must** be terminated by a capacitor, even if it is not used.

STANDBY OUTPUT

The standby output is intended for use in systems requiring standby memory circuits. While the high current regulator outputs are controlled with the ON/OFF pin described later, the standby output remains on under all conditions as long as sufficient input voltage is supplied to the IC. Thus, memory and other circuits powered by this output remain unaffected by positive line transients, thermal shutdown, etc.

The standby regulator circuit is designed so that the quiescent Td (outputets)Tji38.00Td (s0odcte20.73 0 Td 0 Td 36.9 0 Td d)

ON/OFF SWITCH

The ON/OFF switch controls the main output and the buffer output. The threshold voltage is compatible with most logic families and has about 20 mV of hysteresis to insure “clean” switching from the standby mode to the active mode and vice versa. This pin can be tied to the input voltage through a 10 kΩ resistor if the regulator is to be powered continuously.

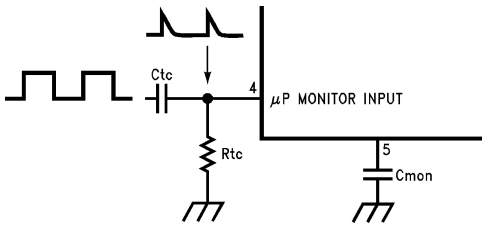
POWER DOWN OVERRIDE

Another possible approach is to use a diode in series with the ON/OFF signal and another in series with the main output in order to maintain power for some period of time after the ON/OFF signal has been removed (see Figure 44). When the ON/OFF switch is initially pulled high through diode D1, the main output will turn on and supply power through diode D2 to the ON/OFF switch effectively latching the main output. An open collector transistor Q1 is connected to the ON/OFF pin along with the two diodes and forces the regulators off after a period of time determined by the µP. In this way, the µP can override a power down command and store data, do housekeeping, etc. before reverting back to the standby mode.

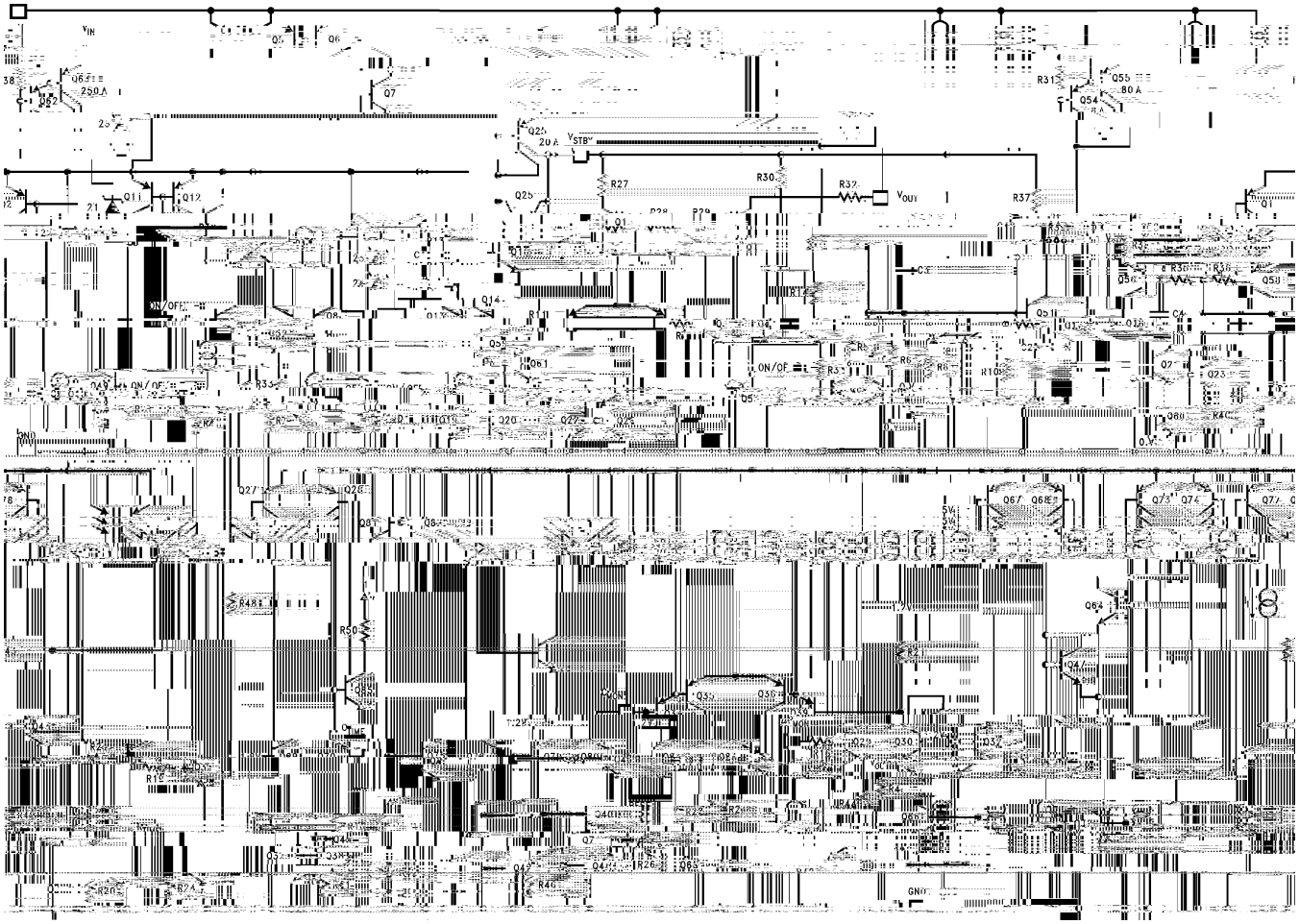
Figure 44. Power Down Override

RESET OUTPUT

This output is an open collector


Ctc
4
μP MONITOR INPUT
Rtc
5
Cmon

Equivalent Schematic Diagram



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REVISION HISTORY

Changes from Revision B (March 2013) to Revision C	Page
• Changed layout of National Data Sheet to TI format	18

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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM2984T	ACTIVE	TO-220	NDJ	11	20	TBD	Call TI	Call TI	-40 to 125	LM2984T	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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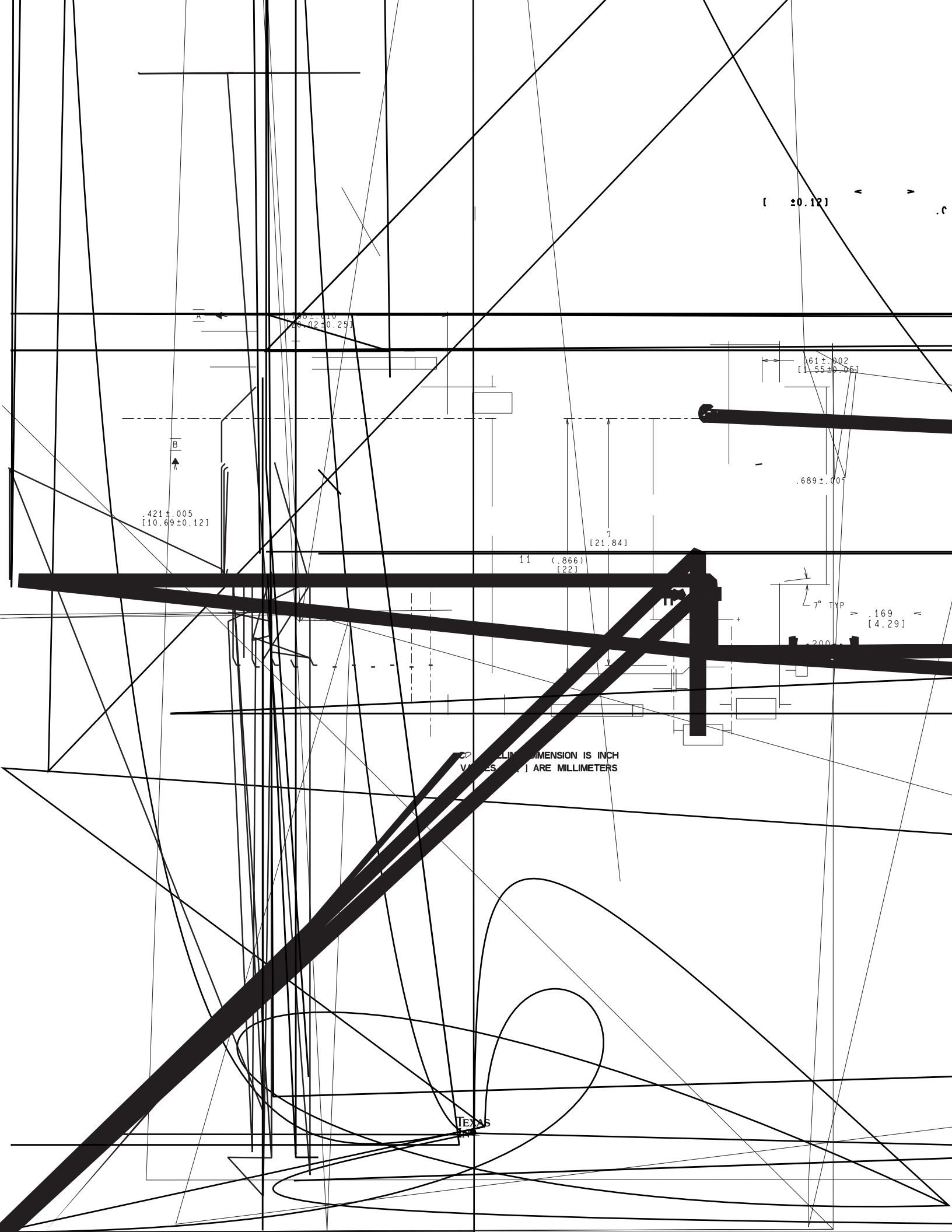
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[21.84]
(.866)
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7° TYP
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.161±.002
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DIMENSION IS INCH
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