

General Information

1

Data Sheets

2

Product Previews

3

Design Considerations

4

Mechanical Data

5



Product Previews

LT1036M, LT1036C LOGIC-CONTROLLED POSITIVE REGULATORS

D3219, JULY 1988—REVISED JANUARY 1989

- Two Regulated Outputs
+ 12 V at 3 A
+ 5 V at 75 mA
- 2% Output Voltage Tolerance
- 60-dB Ripple Rejection
- 0.7% Output Regulation
- 100% Thermal-Limit Burn-In
- TTL and CMOS Compatible Logic Control

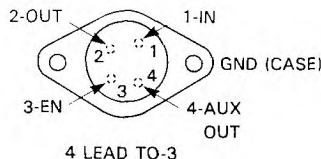
description

The LT1036 contains two positive regulators in the same package. The 12-V main regulator supplies current up to 3 A and the auxiliary 5-V regulator supplies up to 75 mA. The 12-V main regulator has an additional feature that allows a logic signal to control its operation. When the enable input is taken to a low logic level, the main regulator shuts down and its output voltage goes to near 0 V. The auxiliary regulator at this time is unaffected and continues to provide a 5-V output.

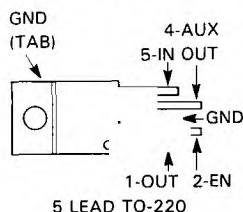
The 12-V main output has current and power limiting combined with thermal shutdown to make it very reliable. The 5-V auxiliary output is not affected by the thermal shutdown circuits or the state of the 12-V main output. This allows it to be used as a back-up in case of overloads on the main supply. The logic enable input of the LT1036 has a 1.6-V threshold and can be driven by most logic families including TTL and CMOS.

Typical applications include power supply sequencing, remote on/off power control, selective system power during emergency power operation, and power supply with back-up.

KJ PACKAGE
(TOP VIEW)



KV PACKAGE
(TOP VIEW)



AVAILABLE OPTIONS

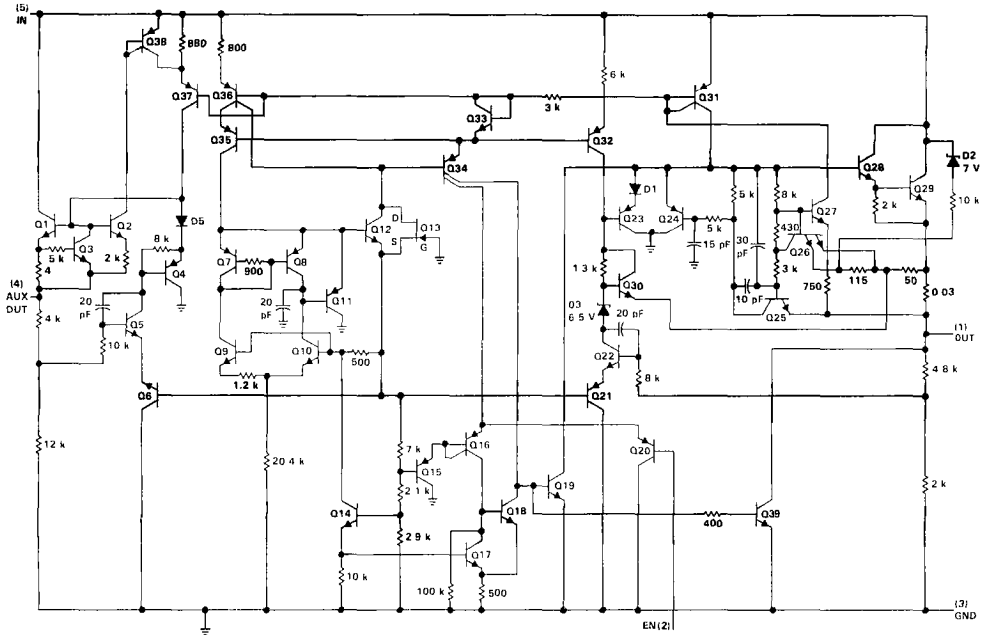
T _J	PACKAGE	
	4 LEAD TO-3 KJ	5 LEAD TO-220 KV
0°C to 125°C	LT1036CKJ	LT1036CKV
-55°C to 150°C	LT1036MKJ	

3

Product Previews

LT1036M, LT1036C LOGIC-CONTROLLED POSITIVE REGULATORS

schematic diagram



All resistor values are nominal and in ohms.

absolute maximum ratings over operating virtual-junction temperature (unless otherwise noted)

Input voltage, V_I	30 V
Enable voltage, V_{EN}	30 V
Continuous power dissipation, P_D	24 W
Power dissipation under fault conditions	Internally self-limited
Operating virtual junction temperature range: LT1036M	-55°C to 150°C
LT1036C	0°C to 125°C
Storage temperature range	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: KJ package	300°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: KV package	260°C

recommended operating conditions

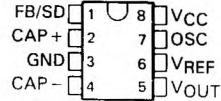
	MIN	MAX	UNIT	
Output current, I_O		3	A	
Operating junction temperature, T_J	LT ^{***}	-55	150	°C
	LT [*]	0		°C

LT1054 SWITCHED-CAPACITOR VOLTAGE CONVERTER WITH REGULATOR

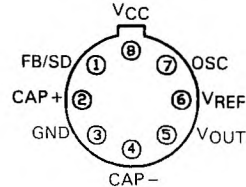
D3202, JANUARY 1989

- Output Current . . . 100 mA
- Low Loss . . . 1.1 V at 100 mA
- Operating Range . . . 3.5 V to 15 V
- Reference and Error Amplifier for Regulation
- External Shutdown
- External Oscillator Synchronization
- Devices Can Be Paralleled
- Pin Compatible with the LTC1044/7660

JG AND P PACKAGE
(TOP VIEW)



L PACKAGE
(TOP VIEW)



AVAILABLE OPTIONS

T _A	PACKAGE		
	CERAMIC DIP (JG)	METAL CAN (L)	PLASTIC DIP (P)
0°C to 70°C	LT1054CJG	LT1054CL	LT1054CP
-55°C to 125°C	LT1054MJG	LT1054ML	N/A

description

The LT1054 is a monolithic, bipolar, switched capacitor voltage converter and regulator. It provides higher output current and significantly lower voltage losses than previously available converters. An adaptive switch drive scheme optimizes efficiency over a wide range of output currents. Total voltage drop at 100 mA output current is typically 1.1 V. This holds true over the full supply voltage range of 3.5 V to 15 V. Quiescent current is typically 2.5 mA.

The LT1054 also provides regulation, a feature not previously available in switched capacitor voltage converters. By adding an external resistive divider, a regulated output can be obtained. This output is regulated against changes in both input voltage and output current. The LT1054 can also be shut down by grounding the feedback pin. Supply current in shut down is less than 100 μ A.

The internal oscillator of the LT1054 runs at a nominal frequency of 25 kHz. The oscillator pin can be used to adjust the switching frequency, or to externally synchronize the LT1054.

The LT1054 is pin compatible with previous converters such as the LTC1044/7660.

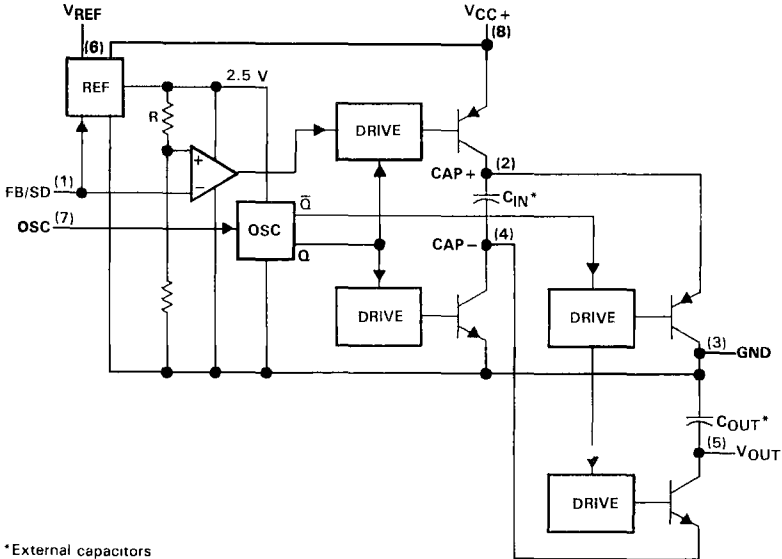
3

Product Previews

PREVIEW documents contain information on products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.

LT1054 SWITCHED-CAPACITOR VOLTAGE CONVERTER WITH REGULATOR

functional block diagram



*External capacitors

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1)	16 V
Input voltage, FB/SD terminal	0 V to V_{CC+}
Input voltage, OSC terminal	0 V to V_{ref}
Junction temperature (see Note 2): LT1054C	125°C
LT1054M	150°C
Storage temperature range	-55°C to 150°C
Lead temperature, 1,6 mm (1/16 inch) from case for 10 seconds: JG or L package	300°C
Lead temperature, 1,6 mm (1/16 inch) from case for 10 seconds: P package	260°C

- NOTES: 1. The absolute maximum supply voltage rating of 16 V is for unregulated circuits. For regulation mode circuits with $V_O \leq 15$ V, this rating may be increased to 20 V.
2. The devices are functional up to the absolute maximum junction temperature.

3

Product Previews

LT1054 SWITCHED-CAPACITOR VOLTAGE CONVERTER WITH REGULATOR

recommended operating conditions

		MIN	MAX	UNIT	
V _{CC}	Supply voltage	3.5	15	V	
T _A	Operating free-air temperature	LT1054C	0	70	°C
		LT1054M	-55	125	

electrical characteristics

PARAMETER	TEST CONDITIONS	T _A [†]	MIN	TYP	MAX	UNIT
Regulated output voltage, V _O	V _{CC} = 7 V, T _J = 25°C, See Note 3	25°C	-4.7	-5	-5.2	V
Input regulation	V _{CC} = 7 V to 12 V, See Note 3	Full range		5	25	mV
Output regulation	V _{CC} = 7 V, R _L = 100 Ω to 500 Ω, See Note 3	Full range		10	50	mV
Voltage loss, V _{CC} - V _O (see Note 4)	C ₁ = C _O = μF tantalum	I _O = 10 mA	Full range	0.35	0.55	V
		I _O = 100 mA	Full range	1.1	1.6	
Output resistance	ΔI _O = 10 mA to 100 mA, See Note 5	Full range		10	15	Ω
Oscillator frequency	V _{CC} = 3.5 V to 15 V	Full range	15	25	35	kHz
Reference voltage, V _{ref}	I _{ref} = 60 μA, T _J = 25°C		2.35	2.5	2.65	V
		Full range	2.25		2.75	
Maximum switch current		25°C		300		mA
Supply current, I _{CC}	I _O = 0	V _I = 3.5 V	Full range	2.5	3.5	mA
		V _I = 15 V	Full range	3	4.5	
Supply current in shutdown	V _{FBS/SD} = 0 V	Full range		100	150	μV

[†]Full range is -55°C to 125°C for the LT1054M and 0°C to 70°C for the LT1054C. For the LT1054C, the specifications apply up to a junction temperature of 100°C.

NOTES: 3. All regulation specifications are for a device connected as a positive to negative converter/regulator with R₁ = 20 kΩ, R₂ = 102.5 kΩ, C₁ = 10 μF (tantalum), and C_O = 100 μF (tantalum).

4. For voltage-loss tests, the device is connected as a voltage inverter, with pins 1, 6, and 7 unconnected. The voltage losses may be higher in other configurations.
5. Output resistance is defined as the slope of the curve (ΔV_O vs ΔI_O) for output currents of 10 mA to 100 mA. This represents the linear portion of the curve. The incremental slope of the curve will be higher at currents of less than 10 mA due to the characteristics of the switch transistors.

Product Previews

3 Product Previews

LT1070, LT1070HV 5-A HIGH-EFFICIENCY SWITCHING REGULATOR

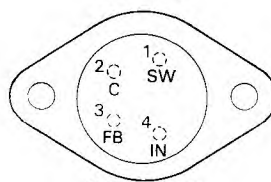
D3222, OCTOBER 1988

- **Wide Supply Voltage Range:**
LT1070HV . . . 3 V to 60 V
LT1070 . . . 3 V to 40 V
- **Low Quiescent Current . . . 6 mA Typ**
- **Internal 5-A Switch**
- **Very Few External Parts Required**
- **Self-Protected Against Overloads**
- **Operates in Nearly All Switching Topologies**
- **Low Shutdown-Mode Supply Current**
- **Fully Floating Outputs in Flyback-Regulated Mode**
- **Available in Standard KV and KJ Packages**
- **Can be Externally Synchronized**

AVAILABLE OPTIONS

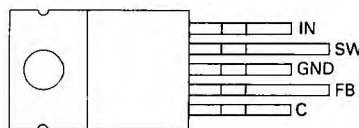
T _J	MAX INPUT VOLTAGE	KJ PACKAGE	KV PACKAGE
0°C to 100°C	60 V	LT1070HVCKJ	LT1070HVCKV
	40 V	LT1070CKJ	LT1070CKV
-55°C to 150°C	60 V	LT1070HVMKJ	
	40 V	LT1070MKJ	

KJ PACKAGE
(TOP VIEW)



CASE IS GND

KV PACKAGE
(TOP VIEW)



description

The LT1070 is a monolithic, high-power switching regulator. It can be operated in all standard switching configurations including: buck, boost, flyback, forward, inverting, and Cuk†. A high-current, high-efficiency switch is included in the package along with all oscillator, control, and protection circuitry. Integration of all functions allows the LT1070 to be built in a standard 5-pin KV package and the 4-pin case-ground KJ power package. This makes it extremely easy to use and provides bust-proof operation similar to that obtained with 3-pin linear regulators.

The LT1070 operates with supply voltages from 3 V to 40 V. The LT1070HV, a high-voltage version of the LT1070, operates with supply voltages from 3 V to 60 V. These devices draw only 6-mA quiescent current, deliver load power up to 100 W with no external power devices, and by utilizing current-mode switching techniques, they provide excellent ac and dc input and output regulation.

The LT1070 is much easier to use than the low-power control chips that are presently available and has many unique features that are not found on these chips. It uses an adaptive saturation-preventing switch drive to allow very-wide-ranging load currents with no loss in efficiency. An externally activated shutdown mode reduces total supply current to 50 μA typical for standby operation. Totally isolated and regulated outputs can be generated by using the optional "flyback regulation mode" built into the LT1070, without the need for optocouplers or extra transformer windings.

† Boost-buck-derived regulator circuit patented by Slobodan Ćuk.

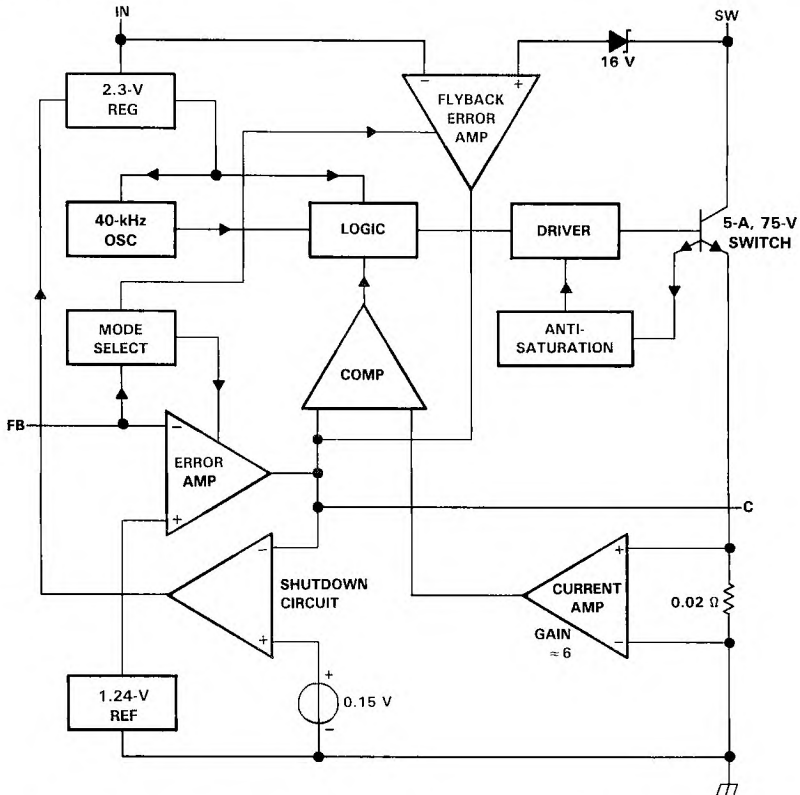
PRODUCT PREVIEW documents contain information on the characteristics of the formative or prototype phase of development. Characteristic values and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.

TEXAS
INSTRUMENTS
POST OFFICE BOX 655012 • DALLAS, TEXAS 75265

Copyright © 1989, Texas Instruments Incorporated

LT1070, LT1070HV 5-A HIGH-EFFICIENCY SWITCHING REGULATOR

functional block diagram



absolute maximum ratings over operating virtual junction temperature range (unless otherwise noted)

Input voltage, V_I (see Note 1): LT1070	40 V
LT1070HV	60 V
Switch output voltage: LT1070	65 V
LT1070HV	75 V
Feedback pin voltage, V_{FB} (transient, 1 ms)	± 15 V
Operating virtual junction temperature range:	
LT1070C, LT1070HVC (normal operation)	0°C to 100°C
LT1070C, LT1070HVC (short-circuit operation)	0°C to 125°C
LT1070M, LT1070HVM	-55°C to 150°C
Storage temperature range	-65°C to 150°C
Lead temperature, 1,6 mm (1/16 inch) from case for 10 seconds:	300°C

NOTE 1: Minimum switch-on time for the LT1070 in current limit is $\approx 1 \mu\text{s}$. This limits the maximum input voltage during short-circuit conditions, in the buck and inverting modes only, to ≈ 35 V. Normal (unshorted) conditions are not affected. If the LT1070 is being operated in the buck or inverting mode at high input voltages and short-circuit conditions are expected, a resistor must be placed in series with the inductor.

LT1084M, LT1084C

5-AMP, LOW-DROPOUT, ADJUSTABLE POSITIVE REGULATORS

D3118, JULY 1988 — REVISED JANUARY 1989

- Adjustable Output . . . 1 V to 35 V
- 5-A Output Capability
- Dropout Voltage . . . 5 V Max
- Input Regulation . . . 0.015% Typ
- Output Regulation . . . 0.01% Typ
- 100% Thermal Limit Burn-In

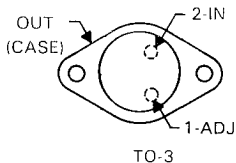
description

The LT1084 is a 3-terminal adjustable positive regulator that operates with higher efficiency than currently available devices with output loads up to 5 A. Internal circuitry is designed to operate with a small input-to-output differential voltage of 1.3 V (typical) and all dropout voltages are specified as a function of output current. Dropout voltage reaches a maximum of 1.5 V at maximum output currents. On-chip circuitry holds the reference voltage constant to within 1%. Current limiting is used to minimize the stress on both the regulator and power source circuits under overload conditions.

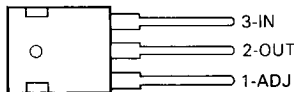
The LT1084 is pin compatible with older 3-terminal regulators. A 10- μ F output capacitor is required, as in most regulator designs. In P-N-P regulators, up to 10% of the output current is lost as bias (quiescent) current, but LT1084 bias current flows into the load, which improves power efficiency.

Typical applications include high-efficiency linear regulators, post regulators for switching power supplies, constant-current regulators, and battery chargers.

KA PACKAGE
(TOP VIEW)



KK PACKAGE
(TOP VIEW)



AVAILABLE OPTIONS

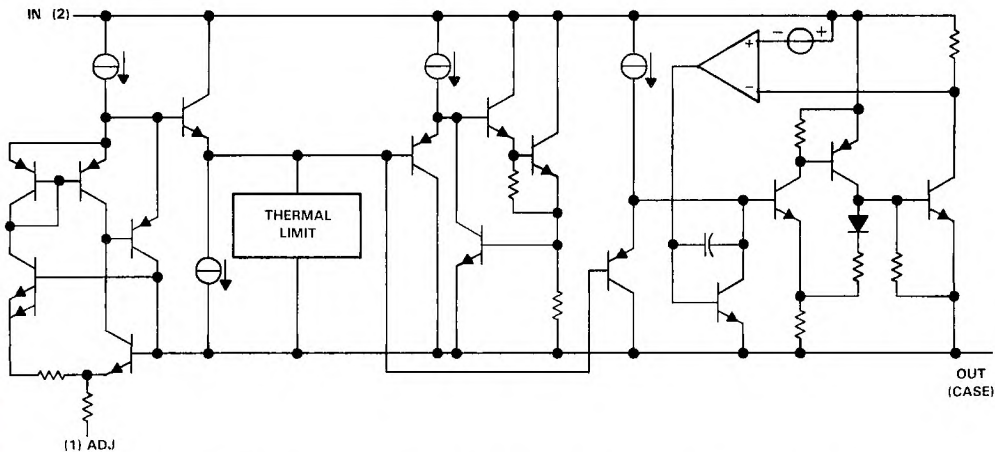
T _J	PACKAGE	
	METAL TO-3 KA	PLASTIC KK
0°C to 125°C	LT1084CKA	LT1084CKK
-55°C to 150°C	LT1084MKA	

3

Product Previews

LT1084M, LT1084C 5-AMP, LOW-DROPOUT, ADJUSTABLE POSITIVE REGULATORS

functional block diagram



Product Previews

absolute maximum ratings over operating temperature range (unless otherwise noted)

- Input-to-output differential voltage: LT1084M 35 V
- LT1084C 30 V
- Power dissipation Internally self-limited
- Operating virtual-junction temperature range: LT1084M Control section -55°C to 150°C
- LT1084M Power transistor -55°C to 200°C
- LT1084C Control section 0°C to 125°C
- LT1084C Power transistor 0°C to 150°C
- Storage temperature range -65°C to 150°C
- Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: KA package 300°C
- Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: KK package 260°C

recommended operating conditions

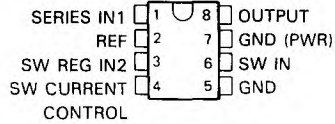
		MIN	MAX	UNIT
Output current, I _O			5	A
Operating virtual-junction temperature, T _J	LT1084M Control section	0	125	°C
	LT1084M Power transistor	0	150	
	LT1084C Control section	0	125	
	LT1084C Power transistor	0	150	

TL499AC WIDE-RANGE POWER SUPPLY CONTROLLER

D2762, JANUARY 1984—REVISED FEBRUARY 1989

- Internal Series-Pass and Step-Up Switching Regulator
- Output Adjustable from 2.9 V to 30 V
- 1-V to 10-V Input for Switching Regulator
- 4.5-V to 32-V Input for Series Regulator
- Externally Controlled Switching Current
- No External Rectifier Required

D OR P PACKAGE
(TOP VIEW)



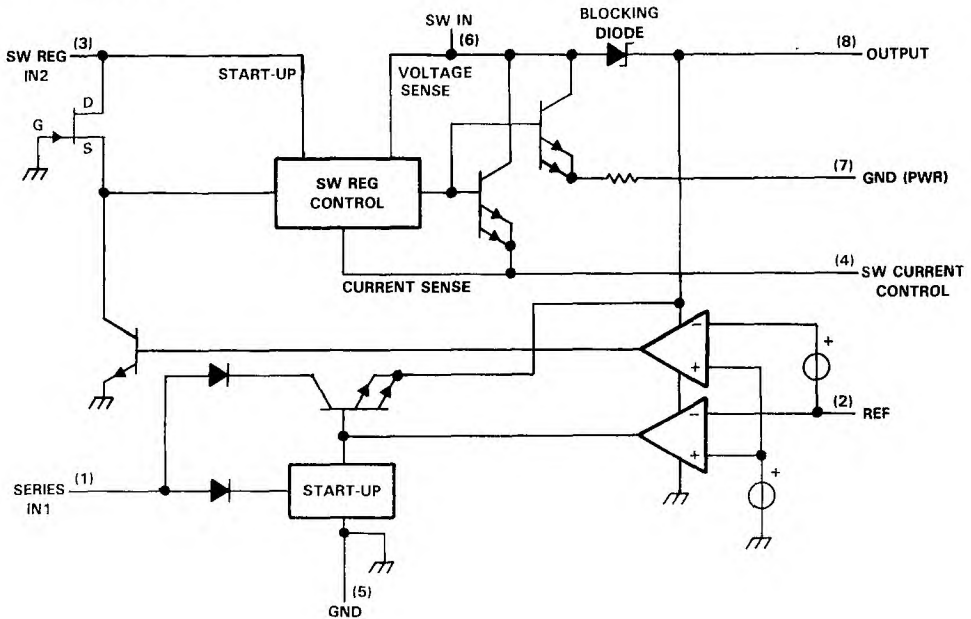
description

The TL499A is a monolithic integrated circuit designed to provide a wide range of adjustable regulated supply voltages. The regulated output voltage is adjustable from 2.9 V to 30 V by adjusting two external resistors. When the TL499A is ac coupled to line power through a step-down transformer, it operates as a series dc voltage regulator to maintain the regulated output voltage. With the addition of a backup battery of from 1.1 V to 10 V, an inductor, a filter capacitor, and two resistors, the TL499A will operate as a step-up switching regulator during an ac-line failure.

The adjustable regulated output voltage makes the TL499A useful for a wide range of applications. Providing backup power during an ac-line failure makes the TL499A extremely useful as backup power in microprocessor memory applications.

The TL499A is characterized for operation from -20°C to 85°C .

functional block diagram



3
Product Previews

PREVIEW documents contain information on products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these specifications without notice.

TL499AC

WIDE-RANGE POWER SUPPLY CONTROLLER

absolute maximum ratings over operating free-air temperature range (unless otherwise noted) (see Note 1)

Output voltage, V_O	35 V
Input voltage, series regulator, V_{I1}	35 V
Input voltage, switching regulator, V_{I2}	10 V
Diode (blocking) reverse voltage	35 V
Diode (blocking) forward current	1 A
Power switch current (at SW IN, pin 6)	1 A
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range	-20°C to 85°C
Storage temperature range	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

NOTE 1. All voltage values are with respect to network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$	DERATING FACTOR	$T_A = 85^\circ\text{C}$
	POWER RATING	ABOVE $T_A = 25^\circ\text{C}$	POWER RATING
D	825 mW	6.6 mW/°C	429 mW
P	1000 mW	8 mW/°C	520 mW

recommended operating conditions

	MIN	NOM	MAX	UNIT
Output voltage, V_O	2.9		30	V
Input voltage, series regulator, V_{I1}	4.5		32	V
Input voltage, switching regulator, V_{I2}	1.1		10	V
Input-to-output differential voltage, switching regulator, $V_O - V_{I2}$ (see Note 2)	1.2			V
Continuous output current, I_O				mA
Power switch current (at SW IN, pin 6)				mA
Current limiting resistor, R_{CL}				Ω
Capacitor, filter				μF
Capacitor, pass		0.1		μF
Inductor, L ($r_{iL} \leq 0.1 \Omega$)	50		150	μH
Operating free-air temperature, T_A	-20		85	°C

NOTE 2. When operating temperature range is $T_A \leq 70^\circ\text{C}$, $\Delta V \geq 1.2\text{V}$. When operating temperature range is $T_A \leq 85^\circ\text{C}$, $\Delta V \geq 1.9\text{V}$.
 $\Delta V = V_O - V_{I2}$.

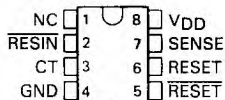
Product Previews

TLC77011, TL77051, TL77211, TL77251 LinCMOS™ SUPPLY VOLTAGE SUPERVISORS

D3221, JANUARY 1989

- Power-On and Supply Drop-Out Reset Generator
- Low Supply Current . . . Maximum 80 μ A
- Reset Outputs Defined from 1-V Supply Voltage
- Wide Supply Voltage Range . . . 3 V to 16 V
- Precision Temperature-Compensated Threshold Voltage
- True and Complement Open-Drain or Push-Pull Outputs
- Externally Adjustable Pulse Duration
- Pin-Compatible Improved Low-Power Versions of TL7702A and TL7705A

D, JG, OR P PACKAGE
(TOP VIEW)



NC—No internal connection

description

The LinCMOS™ TLC77__ series of supply voltage supervisors (SVS) are low-power integrated circuits designed for use as reset controllers in microprocessor and logic systems. During system power-up, the SVS tests the supply voltage level via the SENSE input. If it is below the nominal value, the RESET and RESET outputs are held high and low, respectively. The reset outputs reach their active reset levels when the power supply voltage to the SVS has increased to 1 V.

To ensure a full reset period, the monitored supply voltage reaches its nominal value, the SVS delays the return of the RESET and RESET outputs to their low and high levels, respectively, by an internal time delay t_d . This time delay is determined by an external capacitor connected from the CT input to GND and is of duration $t_d = 275 \times C_T \mu s$, where C_T is in nF.

If at any time the supply voltage drops below its nominal value, the reset outputs will immediately become, and remain, in the reset active state until the supply voltage has returned to its nominal value and the reset period has elapsed.

Holding the RESIN input low keeps the reset outputs in their active (reset) states. The RESIN input can be used to provide a debounced input for a reset switch or a cascade input for the wired-OR reset outputs of several SVSs in multiple supply systems.

To prevent functional failures, these devices have internal electrostatic discharge (ESD) protection circuits rated at 2 kV. However, care should be exercised in handling these devices as exposure to ESD may result in a degradation of the device parametric performance.

These devices are characterized for operation from -40°C to 85°C .

DEVICE FEATURES

Threshold voltage	1.3 V	4.55 V
Open-drain outputs	TLC7701	TLC7705
Push-pull outputs	TLC7721	TLC7725

LinCMOS is a trademark of Texas Instruments Incorporated.

PRELIMINARY PREVIEW documents contain information on devices in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.

TEXAS
INSTRUMENTS

POST OFFICE BOX 655012 • DALLAS, TEXAS 75265

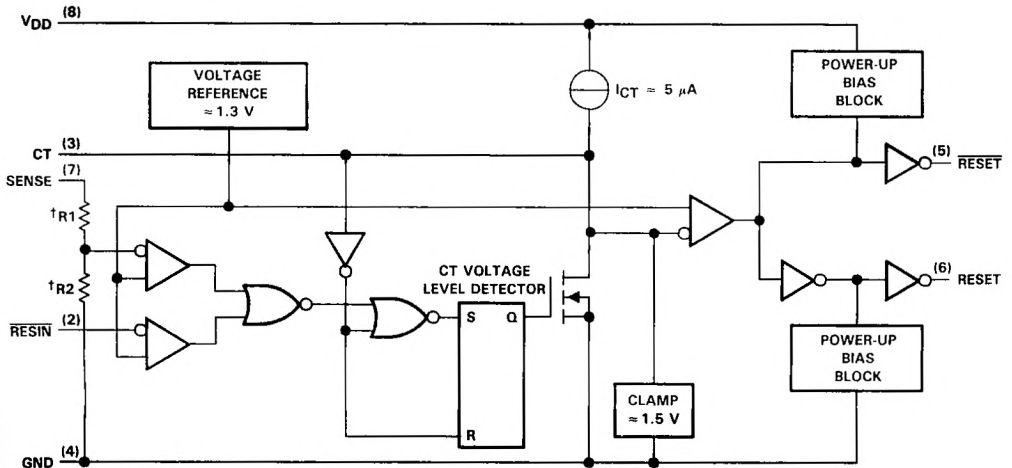
Copyright © 1989, Texas Instruments Incorporated

3

Product Previews

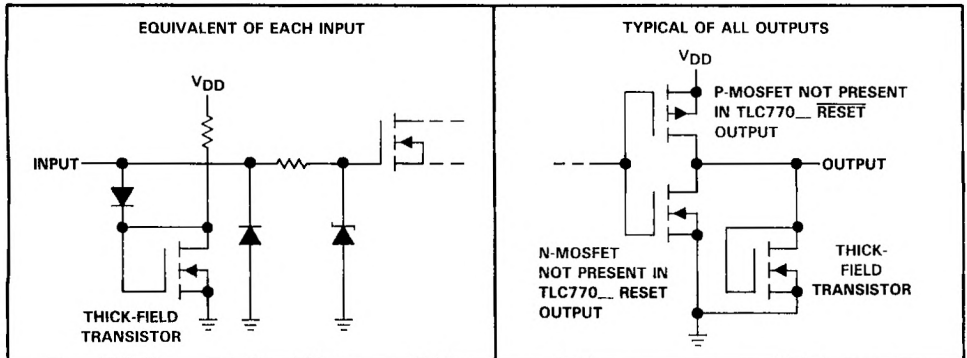
TLC7701I, TLC7705I, TLC7721I, TLC7725I LinCMOS™ SUPPLY VOLTAGE SUPERVISORS

functional block diagram

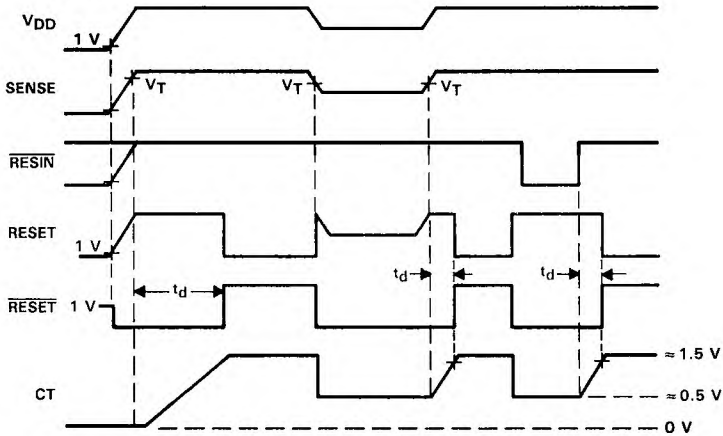


†TLC7701, TLC7721: R1 = 0 Ω NOM, R2 = Open.
TLC7705, TLC7725: R1 = 1.37 MΩ NOM, R2 = 545 kΩ NOM.

schematics of inputs and outputs



typical operating sequence



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{DD} (see Note 1)	18 V
Input voltage range at RESIN and SENSE	-0.3 V to V_{DD}
High-level output current at RESET	-5 mA
Low-level output current at RESET	5 mA
Continuous total dissipation	see Dissipation Rating Table
Operating free-air temperature range	-40°C to 85°C
Storage temperature range	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or P package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: JG package	300°C

NOTE 1: All voltage values are with respect to the network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$	DERATING FACTOR	$T_A = 85^\circ\text{C}$
	POWER RATING	ABOVE $T_A = 25^\circ\text{C}$	PO. RATING
D	725 mW	5.8 mW/°C	nW
JG	825 mW	6.6 mW/°C	429 mW
P	1000 mW	8.0 mW/°C	520 mW

recommended operating conditions

	MIN	MAX	UNIT
Supply voltage, V_{DD} † (see Note 2)	3	16	V
High-level input voltage at SENSE, V_{IH} ‡	2		V
Low-level input voltage at SENSE, V_{IL} ‡		0.6	V
Input voltage at RESIN, V_{I}	0	V_{DD}	V
High-level output current at RESET, I_{OH}		-2	mA
Low-level output current at RESET, I_{OL}		4	mA
Operating free-air temperature range, T_A	-40	85	°C

†Outputs are in a reset state above a V_{DD} of 1 V.

‡An unused RESIN input should be tied to V_{DD} .

NOTE 2: The minimum operating supply voltage will be equal to the voltage at the SENSE input for the TLC77__5.

3
Product Previews

TLC7701I, TLC7705I, TLC7721I, TLC7725I LinCMOS™ SUPPLY VOLTAGE SUPERVISORS

electrical characteristics over ranges of recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
VOH	High-level output voltage RESET	IOH = 2 mA	VDD - 1.5			V
		IOH = 20 µA	VDD - 0.1			
VOL	Low-level output voltage RESET	IOH = 4 mA			0.4	V
		IOH = 20 µA			0.1	
VOH(ST)	High-level output voltage at RESET defined at start-up	VDD = 1 V to 3 V, RL = 500 kΩ to GND§	VDD - 0.1			V
VOL(ST)	Low-level output voltage at RESET defined at start-up	VDD = 1 V to 3 V, RL = 4.7 kΩ to VDD§			0.8	V
VT	Threshold voltage at SENSE input	TLC77_1 VDD = 3 V to 16 V, TA = 25 °C	1	1	1	V
		TLC77_5 VDD = 5 V to 16 V, TA = 25 °C	4			
		TLC77_1 VDD = 3 V to 16 V	1.277	1	1	
		TLC77_5 VDD = 5 V to 16 V	4.46	4.55	4.64	
Vhys	Hysteresis at SENSE input (see Note 3)	VDD = 3V to 16 V, TA = 25 °C	5			mV
			15			
II	Input current at ..	VI = 0 to VDD		0.5	2	µA
II	Input current at SENSE	TLC77_1 VI = 0 to VDD		0.5	2	µA
		TLC77_5 VI = 5 V			5	
IOH	High-level output current at RESET	TLC77_5 VDD = 16 V, VO = 16 V, VI = VDD			1	µA
IOL	Low-level output current at RESET	TLC77_5 VDD = 16 V, VO = 0, VI = VDD			-1	µA
IDDP	Supply current	All inputs at VDD, No load		25	80	µA

switching characteristics over full range of recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	TYP‡	MAX	UNIT
tW1 Pulse duration, SENSE	VIH = VTtyp × 1.08, VIL = VTtyp × 0.92			ns
tW2 Pulse duration, RESIN	VIH = 4.8 V, VIL = 0.4 V	400		ns
td Time delay, SENSE high to reset outputs inactive	CT = 1 nF, TA = 25 °C, See Note 4	0.35		ns
tpd1 Propagation delay, SENSE to reset active	VDD = 5 V, RL = 4.7 kΩ, CL = 100 pF		0.6	µs
tpd2 Propagation delay, RESIN to reset active	CT = 1 nF, TA = 25 °C		0.4	µs
tr1 Rise time, RESET and RESET	TLC7721, TL7725			ns
tf1 Fall time, .. and ..	TLC7721, TL7725			ns
tr2 Rise time, ..	TLC7701, TL7705		200	ns
tf2 Fall time, ..	TLC7701, TL7705		1 2	µs
tr3 Rise time, RESET	TLC7701, TL7705		1 2	µs
tf3 Fall time, ..	TLC7701, TL7705		200	ns

†All characteristics are at 10 nF between CT and GND.

‡All typical values are at TA = 25 °C.

§Supply voltage slew rate should not exceed 30 V/µs.

NOTES: 3. Hysteresis is the difference between the positive-going input threshold voltage (VT+) and the negative-going input threshold voltage (VT-).

4. This parameter is measured in normal operation after the initial power-up reset. See typical operating sequence.

3

Product Previews

PARAMETER MEASUREMENT INFORMATION

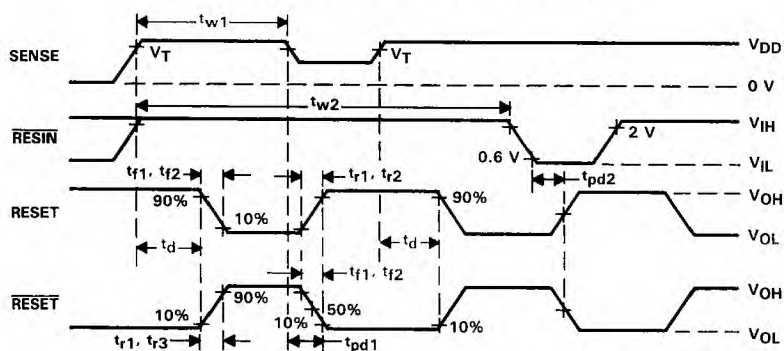


FIGURE 1. SWITCHING VOLTAGE WAVEFORMS

PRINCIPLES OF OPERATION

The internal configuration, shown in the functional block diagram, comprises a precision SENSE input comparator, a precision voltage reference, a current source, a discharge NMOS transistor, an RS latch, and an output comparator that drives the reset outputs. Logic input RESIN feeds the input of another comparator.

The SENSE input comparator is used to monitor a chosen supply voltage. The reset outputs of TLC77__5 trip at an input voltage threshold level, preset by an internal high-impedance potential divider, equalling a 10% drop in a 5-V supply. The reset outputs of TLC77__1 trip at any user-defined supply voltage threshold level set by an external potential divider connected directly to the input of the SENSE comparator. The TLC77__1 SENSE comparator has a threshold level at its input set by the internal reference voltage of nominally 1.3 V (see electrical characteristics table values).

The current source, discharge NMOS transistor, and RS latch provide the retriggerable reset timing function with an external capacitor connected between CT and GND. The internal output comparator monitors the capacitor voltage and controls the state of the reset outputs.

The TLC770__ RESET and RESETE outputs are open drain and require resistors to define the non-reset condition by pulling-up to V_{DD} or pulling-down to GND, respectively. Open-drain reset outputs allow the TLC770__ to be used in applications where wired-AND/OR is required. An example is microprocessors with reset inputs that also act as system reset outputs under software control. When this is not required, the push-pull outputs of TLC772__ are more appropriate. These use internal PMOS and NMOS transistors, respectively, on RESET and RESETE outputs to define an active non-reset condition, saving an external pull-up resistor.

In operation, when the monitored supply voltage has reached the SVS threshold level V_T , an internal 5- μ A current source starts to charge the external capacitor C_T . The reset outputs remain in their active reset state until the voltage across C_T reaches an internal 1.3-V reference voltage. The output comparator then returns the reset outputs to their non-reset states. The internal current source continues to charge C_T until a clamp level of 1.5 V is reached. Supply voltage drop-outs that make the SENSE input fall below V_T cause capacitor C_T to be discharged via the NMOS transistor. The input of the output comparator then falls below its reference level and the reset outputs are switched to an active reset state. A full reset timing pulse duration is ensured by discharging C_T to the same voltage level irrespective of the input SENSE



PRINCIPLES OF OPERATION

pulse duration above the minimum specified. This is achieved by detecting the C_T capacitor voltage level and only releasing the RS latch when the capacitor has reached 0.5 V. A feedback action maintains this value. At power-up, when C_T is fully discharged, the reset pulse duration (t_W) is approximately twice the duration of a reset pulse duration obtained when V_{DD} is established and TLC77__ is in normal operation.

Setting the $\overline{\text{RESIN}}$ input low has the same effect as the SENSE input falling below V_T . If the $\overline{\text{RESIN}}$ input is unused, it should be tied to V_{DD} . The $\overline{\text{RESIN}}$ input uses a comparator with a nominal threshold voltage of 1.3 V, and can be used to monitor supply voltages with an external potential divider in the manner of the TLC77__1 SENSE input but with less accuracy. For greater precision, the wired-OR $\overline{\text{RESET}}$ outputs of several TLC770__ devices used to monitor a systems multiple supply voltages can be fed into the $\overline{\text{RESIN}}$ input of a master SVS whose output provides the overall system reset function.

When their supply voltage approaches the nominal TTL threshold of 1.4 V during power-up, most logic devices start to become internally biased. Special bias circuits have been added to the TLC77__ $\overline{\text{RESET}}$ and $\overline{\text{RESET}}$ output transistor to ensure that these outputs are reset active when V_{DD} reaches 1 V. The $\overline{\text{RESET}}$ output will not exceed the lower TTL input threshold of 0.8 V. The only limitation is the initial rate of rise of supply voltage, which if greater than 30 V/ μs may not allow sufficient time for the $\overline{\text{RESET}}$ and $\overline{\text{RESET}}$ MOS output transistors to be fully turned on. This is caused by their gate circuit time-constants being initially higher at very low supply voltages. The effect is for the $\overline{\text{RESET}}$ output to follow the supply voltage increase for several ns. This is not a problem in practice because power supplies usually assume a current sourcing mode at start-up that, when feeding into an output smoothing capacitor, limits the rate of rise of output voltage.

When using the TLC77__1, low-power applications require high-value external resistors to provide a user-defined external threshold level. To achieve minimum propagation delay, it may be necessary to provide compensation by means of a capacitor across the series resistor (the input capacitance of the SENSE comparator is typically 8 pF). Care should be taken that over compensation, which would cause triggering on noise, does not occur. Conversely, if it is desired to reduce susceptibility to noise, a capacitor can be placed across the input. For the TLC77__5, a low-value resistor in series with the SENSE input is required to achieve this function.

Capacitor C_T should have a leakage current substantially below the 5- μA charge current. This may rule out the use of electrolytic capacitors.

TLC77__ internal parameter values referred to in this description are nominal design values.

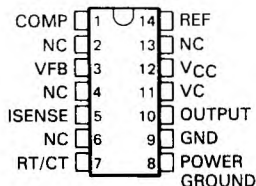


UC2842, UC2843, UC2844, UC2845 UC3842, UC3843, UC3844, UC3845 CURRENT-MODE PWM CONTROLLERS

D3175, REV. 11, 1989

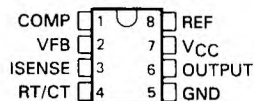
- Optimized for Off-Line and DC-to-DC Converters
- Low Start-Up Current (<1 mA)
- Automatic Feed-Forward Compensation
- Pulse-by-Pulse Current Limiting
- Enhanced Load-Response Characteristics
- Undervoltage Lockout with Hysteresis
- Double Pulse Suppression
- High-Current Totem-Pole Output
- Internally Trimmed Bandgap Reference
- 500-kHz Operation
- Error Amplifier with Low Output Resistance
- Designed to be Interchangeable with Unitrode UC2842 and UC3842 Series

D PACKAGE
(TOP VIEW)



NC—No internal connection

P PACKAGE
(TOP VIEW)



description

The UC2842 and UC3842 series of control integrated circuits provide the features that are necessary to implement off-line or dc-to-dc fixed-frequency current-mode control schemes with a minimum number of external components. Internally implemented circuits include: undervoltage lockout (UVLO) featuring a start-up current of less than 1 mA, a precision reference trimmed for accuracy at the error amplifier input, logic to ensure latched operation, a pulse-width modulation (PWM) comparator (which also provides current-limit control), and a totem-pole output stage designed to source or sink high peak current. The output stage, suitable for driving N-channel MOSFETs, is low when it is in the off state.

The primary difference between the UC2842-series devices and the UC3842-series devices is the ambient operating temperature range. The UC2842-series devices operate between -25°C and 85°C ; the UC3842-series devices operate between 0°C and 70°C . Major differences between members of these series are the undervoltage lockout (UVLO) thresholds and maximum duty cycle ranges. Typical UVLO thresholds of 16 V (on) and 10 V (off) on the UC__842 and UC__844 devices make them ideally suited to off-line applications. The corresponding typical thresholds for the UC__843 and UC__845 devices are 8.4 V on and 7.6 V off. The UC__842 and UC__843 devices can operate to duty cycles approaching 100%. A duty cycle range of 0 to 50% is obtained by the UC__844 and UC__845 by the addition of an internal toggle flip-flop, which blanks the output off every other clock cycle.

3

Product Previews

PRODUCT INFORMATION information concerns products in the formative or design phase of development. Characteristics, callouts and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.

TEXAS
INSTRUMENTS

Copyright © 1989, Texas Instruments Incorporated

POST OFFICE BOX 655012 • DALLAS, TEXAS 75265

3-21

**UC2842, UC2843, UC2844, UC2845
UC3842, UC3843, UC3844, UC3845
CURRENT-MODE PWM CONTROLLERS**

absolute maximum ratings over operating free-air temperature (unless otherwise noted)

Supply voltage (see Note 1) ($I_{CC} < 30$ mA)	Self Limiting
Analog input voltage (VFB and ISENSE terminals)	-0.3 V to 6.3 V
Voltage on output pin	35 V
Voltage on VC pin (14-pin package)	35 V
Supply current, I_{CC}	30 mA
Output current	± 1 A
Error amplifier output sink current	10 mA
Continuous power dissipation	see Dissipation Rating Table
Output energy (capacitive load)	5 μ J
Storage temperature range	-65°C to 150°C
Lead temperature, 1,6 mm (1/16 inch) from case for 10 seconds	260°C

NOTE 1: All voltages are with respect to the device GND terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$	DERATING FACTOR	$T_A = 70^\circ\text{C}$	$T_A = 85^\circ\text{C}$
	POWER RATING	ABOVE $T_A = 25^\circ\text{C}$	POWER RATING	POWER RATING
D	950 mW	7.6 mW/°C	608 mW	494 mW
P	1000 mW	8.0 mW/°C	640 mW	520 mW

recommended operating conditions

	UC284__			UC384__			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC} and VC			30			30	V
Average output current, I_O			1			1	mA
Reference output current			-25			-25	mA
Frequency range			500			500	kHz
Operating free-air temperature, T_A	-25		85	0		70	°C

electrical characteristics, $V_{CC} = 15$ V (see Note 2), $R_T = 10$ k Ω , $C_T = 3.3$ nF, $T_A =$ full range (unless otherwise specified)

reference section

PARAMETER	TEST CONDITIONS	UC284__			UC384__			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage	$I_O = 1$ mA, $T_J = 25^\circ\text{C}$	4.95	5	5.05	4.9	5	5.1	V
Line regulation	$V_{CC} = 12$ V to 25 V		6	20		6	20	mV
Load regulation	$I_O = 1$ mA to 20 mA		6	25		6	25	mV
Temperature coefficient of output voltage			0.2	0.4		0.2	0.4	mV/°C
Output voltage with worst-case variation	$V_{CC} = 12$ V to 25 V, $I_O = 1$ mA to 20 mA	4.9		5.1	4.82		5.18	V
Output noise voltage	$f = 10$ Hz to 10 kHz, $T_J = 25^\circ\text{C}$		50			50		μ V
Output voltage long-term drift	After 1000 h at $T_A = 125^\circ\text{C}$		5	25		5	25	mV
Short-circuit output current		-30	-100	-180	-30	-100	-180	mA

NOTE 2: Adjust V_{CC} above the start threshold before setting it to 15 V.