LINEAR TECHNOLOGY

LT1584/LT1585/LT1587

7A, 4.6A, 3A Low Dropout Fast Response Positive Regulators Adjustable and Fixed

FEATURES

- **Fast Transient Response**
- **Guaranteed Dropout Voltage at Multiple Currents**
- Load Regulation: 0.05% Typ
- Trimmed Current Limit
- On-Chip Thermal Limiting
- Standard 3-Pin Power Package

APPLICATIONS

- Pentium™ Processor Supplies
- PowerPC™ Supplies
- Other 2.5V to 3.6V Microprocessor Supplies
- Low Voltage Logic Supplies
- Battery-Powered Circuitry
- Post Regulator for Switching Supply

LT1585/7CM, LT1584/5/7CT	Adjustable
LT1585/7CM-3.3, LT1584/5/7CT-3.3	3.3V Fixed
LT1585CM-3.38, LT1584/5CT-3.38	3.38V Fixed
LT1585/7CM-3.45, LT1584/5/7CT-3.45	3.45V Fixed
LT1585/7CM-3.6, LT1584/5/7CT-3.6	3.6V Fixed

DESCRIPTION

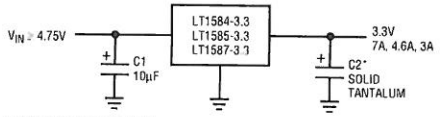
The LT®1584/LT1585/LT1587 are low dropout three-terminal regulators with 7A, 4.6A and 3A output current capability, respectively. Design has been optimized for low voltage applications where transient response and minimum input voltage are critical. Similar to the LT1083/4/5 family, it has lower dropout voltage and faster transient response. These improvements make it ideal for low voltage microprocessor applications requiring a regulated 2.5V to 3.6V output with an input supply below 7V.

Current limit is trimmed to ensure specified output current and controlled short-circuit current. On-chip thermal limiting provides protection against any combination of overload that would create excessive junction temperatures.

The LT1585/LT1587 are available in both the through-hole and surface mount versions of the industry standard 3-pin TO-220 power package. The LT1584 is available in the through-hole 3-pin TO-220 power package.

TYPICAL APPLICATION

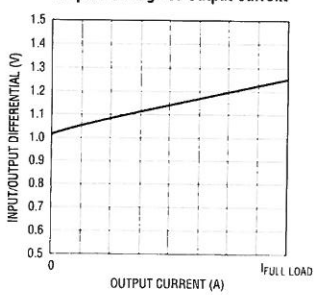
3.3V, 7A, 4.6A, 3A Regulator



* REQUIRED FOR STABILITY
LT1584: C2 = 22µF,
LT1585/LT1587: C2 = 10µF

NOTE: MICROPROCESSOR APPLICATIONS WITH LOAD TRANSIENTS OF 3.8A REQUIRE OUTPUT DECOUPLING CAPACITANCE > 1300µF ON FIXED VOLTAGE PARTS TO ACHIEVE < 50mV OF DEVIATION FROM NOMINAL OUTPUT. CONSULT FACTORY FOR DETAILS

Dropout Voltage vs Output Current



ABSOLUTE MAXIMUM RATINGS

V_{IN} 7V
Operating Junction Temperature Range
Control Section ..... 0°C to 125°C
Power Transistor ..... 0°C to 150°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

PRECONDITIONING

100% Thermal Limit Functional Test

PACKAGE/ORDER INFORMATION

	ORDER PART NUMBER		ORDER PART NUMBER
FRONT VIEW 3 VIN 2 VOUT 1 ADJ M PACKAGE 3-LEAD PLASTIC DD PAK θ_{JA} = 30°C/W*	LT1585CM LT1587CM	FRONT VIEW 3 VIN 2 VOUT 1 ADJ T PACKAGE 3-LEAD PLASTIC TO-220 θ_{JA} = 50°C/W	LT1584CT LT1585CT LT1587CT
FRONT VIEW 3 VIN 2 VOUT 1 GND M PACKAGE 3-LEAD PLASTIC DD PAK θ_{JA} = 30°C/W*	LT1585CM-3.3 LT1585CM-3.38 LT1585CM-3.45 LT1585CM-3.6 LT1587CM-3.3 LT1587CM-3.45 LT1587CM-3.6	FRONT VIEW 3 VIN 2 VOUT 1 GND T PACKAGE 3-LEAD PLASTIC TO-220 θ_{JA} = 50°C/W	LT1584CT-3.3 LT1585CT-3.3 LT1587CT-3.3 LT1584CT-3.38 LT1585CT-3.38 LT1584CT-3.45 LT1585CT-3.45 LT1587CT-3.45 LT1584CT-3.6 LT1585CT-3.6 LT1587CT-3.6

* With package soldered to 0.5 square inch copper area over backside ground plane or internal power plane. θ_{JA} can vary from 20°C/W to >40°C/W with other mounting techniques.

Consult factory for Industrial and Military grade parts.

ELECTRICAL CHARACTERISTICS

PARAMETER		CONDITIONS		MIN	TYP	MAX	UNITS
Reference Voltage	LT1584 LT1585 LT1587	1.5V ≤ (VIN – VOUT) ≤ 3V, 10mA ≤ IOUT ≤ 7A 1.5V ≤ (VIN – VOUT) ≤ 5.75V, 10mA ≤ IOUT ≤ 4.6A, TJ ≥ 25°C 1.5V ≤ (VIN – VOUT) ≤ 5.75V, 10mA ≤ IOUT ≤ 4A, TJ < 25°C 1.5V ≤ (VIN – VOUT) ≤ 5.75V, 10mA ≤ IOUT ≤ 3A	●	1.225 (– 2%)	1.250	1.275 (+2%)	V
Output Voltage	LT1584-3.3 LT1585-3.3 LT1587-3.3	4.75V ≤ VIN ≤ 6.3V, 0mA ≤ IOUT ≤ 7A 4.75V ≤ VIN ≤ 7V, 0mA ≤ IOUT ≤ 4.6A, TJ ≥ 25°C 4.75V ≤ VIN ≤ 7V, 0mA ≤ IOUT ≤ 4A, TJ < 25°C 4.75V ≤ VIN ≤ 7V, 0mA ≤ IOUT ≤ 3A	●	3.235 (– 2%)	3.300	3.365 (+2%)	V
	LT1584-3.38 LT1585-3.38	4.75V ≤ VIN ≤ 6.38V, 0mA ≤ IOUT ≤ 7A 4.75V ≤ VIN ≤ 7V, 0mA ≤ IOUT ≤ 4A	●	3.313 (– 2%)	3.380	3.465 (+2.5%)	V
	LT1584-3.45 LT1585-3.45 LT1587-3.45	4.75V ≤ VIN ≤ 6.45V, 0mA ≤ IOUT ≤ 7A 4.75V ≤ VIN ≤ 7V, 0mA ≤ IOUT ≤ 4A 4.75V ≤ VIN ≤ 7V, 0mA ≤ IOUT ≤ 3A	●	3.381 (– 2%)	3.450	3.519 (+2%)	V
	LT1584-3.6 LT1584-3.6 LT1584-3.6 LT1584-3.6	4.75V ≤ VIN ≤ 7V, 0mA ≤ IOUT ≤ 6A 4.80V ≤ VIN ≤ 7V, 0mA ≤ IOUT ≤ 6A 4.80V ≤ VIN ≤ 6.6V, 0mA ≤ IOUT ≤ 7A 4.85V ≤ VIN ≤ 6.6V, 0mA ≤ IOUT ≤ 7A	● ● ● ●	3.400 (– 5.5%) 3.450 (– 4%) 3.431 (– 4.7%) 3.481 (– 3.3%)	3.600 3.600 3.600 3.600	3.672 (+2%) 3.672 (+2%) 3.672 (+2%) 3.672 (+2%)	V V V V

ELECTRICAL CHARACTERISTICS

PARAMETER		CONDITIONS		MIN	TYP	MAX	UNITS
Output Voltage	LT1585/7-3.6	$4.75V \le V_{IN} \le 7V$, $0mA \le I_{OUT} \le 3A$	●	3.474 (–3.5%)	3.600	3.672 (+2%)	V
	LT1585/7-3.6	$4.80V \le V_{IN} \le 7V$, $0mA \le I_{OUT} \le 3A$	●	3.528 (–2%)	3.600	3.672 (+2%)	V
	LT1585-3.6	$4.80V \le V_{IN} \le 7V$, $0mA \le I_{OUT} \le 4A$	●	3.450 (–4%)	3.600	3.672 (+2%)	V
	LT1585-3.6	$4.85V \le V_{IN} \le 7V$, $0mA \le I_{OUT} \le 4A$	●	3.492 (–3%)	3.600	3.672 (+2%)	V
Line Regulation (Notes 1, 2)	LT1584/5/7	$2.75V \le V_{IN} \le 7V$, $I_{OUT} = 10mA$					
	LT1584/5/7-3.3	$4.75V \le V_{IN} \le 7V$, $I_{OUT} = 0mA$					
	LT1584/5-3.38	$4.75V \le V_{IN} \le 7V$, $I_{OUT} = 0mA$					
	LT1584/5/7-3.45	$4.75V \le V_{IN} \le 7V$, $I_{OUT} = 0mA$					
	LT1584/5/7-3.6	$4.75V \le V_{IN} \le 7V$, $I_{OUT} = 0mA$	●		0.005	0.2	%
Load Regulation (Notes 1, 2, 3)	LT1584/5/7	$(V_{IN} - V_{OUT}) = 3V$, $T_J = 25°C$, $10mA \le I_{OUT} \le I_{FULL\ LOAD}$					
	LT1584/5/7-3.3	$V_{IN} = 5V$, $T_J = 25°C$, $0mA \le I_{OUT} \le I_{FULL\ LOAD}$					
	LT1584/5-3.38	$V_{IN} = 5V$, $T_J = 25°C$, $0mA \le I_{OUT} \le I_{FULL\ LOAD}$					
	LT1584/5/7-3.45	$V_{IN} = 5V$, $T_J = 25°C$, $0mA \le I_{OUT} \le I_{FULL\ LOAD}$					
	LT1584/5/7-3.6	$V_{IN} = 5.25V$, $T_J = 25°C$, $0mA \le I_{OUT} \le I_{FULL\ LOAD}$			0.05	0.3	%
			●		0.05	0.5	%
Dropout Voltage	LT1585/7	$\Delta V_{REF} = 1\%$, $I_{OUT} = 3A$					
	LT1585/7-3.3	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 3A$					
	LT1585-3.38	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 3A$					
	LT1585/7-3.45	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 3A$					
	LT1585/7-3.6	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 3A$	●		1.150	1.300	V
	LT1585	$\Delta V_{REF} = 1\%$, $I_{OUT} = 4.6A$, $T_J \ge 25°C$					
		$\Delta V_{REF} = 1\%$, $I_{OUT} = 4A$, $T_J < 25°C$					
	LT1585-3.3	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 4.6A$, $T_J \ge 25°C$					
		$\Delta V_{OUT} = 1\%$, $I_{OUT} = 4A$, $T_J < 25°C$					
	LT1585-3.38	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 4A$					
	LT1585-3.45	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 4A$					
	LT1585-3.6	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 4A$	●		1.200	1.400	V
	LT1584	$\Delta V_{REF} = 1\%$, $I_{OUT} = 6A$					
	LT1584-3.3	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 6A$					
	LT1584-3.38	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 6A$					
	LT1584-3.45	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 6A$					
	LT1584-3.6	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 6A$					
		$T_J \ge 25°C$	●		1.200	1.300	V
		$T_J < 25°C$	●		1.200	1.350	V
	LT1584	$\Delta V_{REF} = 1\%$, $I_{OUT} = 7A$					
	LT1584-3.3	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 7A$					
	LT1584-3.38	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 7A$					
	LT1584-3.45	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 7A$					
	LT1584-3.6	$\Delta V_{OUT} = 1\%$, $I_{OUT} = 7A$	●		1.250	1.400	V
Current Limit (Note 3)	LT1584	$(V_{IN} - V_{OUT}) = 3V$					
	LT1584-3.3	$(V_{IN} - V_{OUT}) = 3V$					
	LT1584-3.38	$(V_{IN} - V_{OUT}) = 3V$					
	LT1584-3.45	$(V_{IN} - V_{OUT}) = 3V$					
	LT1584-3.6	$(V_{IN} - V_{OUT}) = 3V$	●	7.100	8.250		A
	LT1585	$(V_{IN} - V_{OUT}) = 5.5V$					
	LT1585-3.3	$(V_{IN} - V_{OUT}) = 5.5V$					
		$T_J > 25°C$	●	4.600	5.25		A
		$T_J < 25°C$	●	4.100	5.25		A
	LT1585-3.38	$(V_{IN} - V_{OUT}) = 5.5V$					
	LT1585-3.45	$(V_{IN} - V_{OUT}) = 5.5V$					
	LT1585-3.6	$(V_{IN} - V_{OUT}) = 5.5V$	●	4.100	4.750		A
	LT1587	$(V_{IN} - V_{OUT}) = 5.5V$					
	LT1587-3.3	$(V_{IN} - V_{OUT}) = 5.5V$					
	LT1587-3.45	$(V_{IN} - V_{OUT}) = 5.5V$					
	LT1587-3.6	$(V_{IN} - V_{OUT}) = 5.5V$	●	3.100	3.750		A

ELECTRICAL CHARACTERISTICS

PARAMETER		CONDITIONS		MIN	TYP	MAX	UNITS
Adjust Pin Current	LT1584/5/7		●		55	120	µA
Adjust Pin Current Change (Note 3)	LT1584	$1.5V \le (V_{IN} - V_{OUT}) \le 3V$, $10mA \le I_{OUT} \le I_{FULL\ LOAD}$					
	LT1585/7	$1.5V \le (V_{IN} - V_{OUT}) \le 5.75V$, $10mA \le I_{OUT} \le I_{FULL\ LOAD}$	●		0.2	5	µA
Minimum Load Current	LT1584/5/7	$1.5V \le (V_{IN} - V_{OUT}) \le 5.75V$	●		2	10	mA
Quiescent Current	LT1584/5/7-3.3	$V_{IN} = 5V$					
	LT1584/5-3.38	$V_{IN} = 5V$					
	LT1584/5/7-3.45	$V_{IN} = 5V$					
	LT1584/5/7-3.6	$V_{IN} = 5V$	●		8	13	mA
Ripple Rejection	LT1584	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $(V_{IN} - V_{OUT}) = 2.5V$, $I_{OUT} = 7A$					
	LT1584-3.3	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $V_{IN} = 5.8V$, $I_{OUT} = 7A$					
	LT1584-3.38	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $V_{IN} = 5.88V$, $I_{OUT} = 7A$					
	LT1584-3.45	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $V_{IN} = 5.95V$, $I_{OUT} = 7A$					
	LT1584-3.6	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $V_{IN} = 6.1V$, $I_{OUT} = 7A$					
	LT1585	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $(V_{IN} - V_{OUT}) = 3V$, $I_{OUT} = 4.6A$, $T_J \ge 25°C$					
		$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $(V_{IN} - V_{OUT}) = 3V$, $I_{OUT} = 4A$, $T_J < 25°C$					
	LT1585-3.3	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $V_{IN} = 6.3V$, $I_{OUT} = 4.6A$, $T_J \ge 25°C$					
		$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $V_{IN} = 6.3V$, $I_{OUT} = 4A$, $T_J < 25°C$					
	LT1585-3.38	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $V_{IN} = 6.38V$, $I_{OUT} = 4A$					
	LT1585-3.45	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $V_{IN} = 6.45V$, $I_{OUT} = 4A$					
	LT1585-3.6	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $V_{IN} = 6.6V$, $I_{OUT} = 4A$					
	LT1587	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $(V_{IN} - V_{OUT}) = 3V$, $I_{OUT} = 3A$					
	LT1587-3.3	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $V_{IN} = 6.3V$, $I_{OUT} = 3A$					
	LT1587-3.45	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $V_{IN} = 6.45V$, $I_{OUT} = 3A$					
	LT1587-3.6	$f = 120Hz$, $C_{OUT} = 25µF$ Tant., $V_{IN} = 6.6V$, $I_{OUT} = 3A$	●	60	72		dB
Thermal Regulation	LT1584/5/7	$T_A = 25°C$, 30ms pulse					
	LT1584/5/7-3.3	$T_A = 25°C$, 30ms pulse					
	LT1584/5-3.38	$T_A = 25°C$, 30ms pulse					
	LT1584/5/7-3.45	$T_A = 25°C$, 30ms pulse					
	LT1584/5/7-3.6	$T_A = 25°C$, 30ms pulse			0.004	0.02	%/W
Temperature Stability			●		0.5		%
Long-Term Stability		$T_A = 125°C$, 1000 Hrs.			0.03	1.0	%
RMS Output Noise (% of V_{OUT})		$T_A = 25°C$, $10Hz \le f \le 10kHz$			0.003		%
Thermal Resistance Junction to Case	LT1584	T Package: Control Circuitry/Power Transistor				0.65/2.7	°C/W
	LT1585	T Package: Control Circuitry/Power Transistor				0.7/3.0	°C/W
	LT1585	M Package: Control Circuitry/Power Transistor				0.7/3.0	°C/W
	LT1587	T Package: Control Circuitry/Power Transistor				0.7/3.0	°C/W
	LT1587	M Package: Control Circuitry/Power Transistor				0.7/3.0	°C/W

The ● denotes specifications which apply over the specified operating temperature range.

Note 1: See thermal regulation specifications for changes in output voltage due to heating effects. Load and line regulation are measured at a constant junction temperature by low duty cycle pulse testing.

Note 2: Line and load regulation are guaranteed up to the maximum power dissipation (25W for the LT1584 in T package, 26.5W for the LT1585 in T package, 18W for the LT1587 in T package). Power dissipation is determined by input/output differential and the output current. Guaranteed maximum output power will not be available over the full input/output voltage range.

Note 3: $I_{FULL\ LOAD}$ is defined as the maximum value of output load current as a function of input-to-output voltage. $I_{FULL\ LOAD}$ is equal to 7A for the LT1584, 4.6A at $T_J \ge 25°C$ and 4A at $T_J < 25°C$ for the LT1585/LT1585-3.3 and 3A for the LT1587. The remaining LT1585 fixed voltage versions are 4A. The LT1585 and LT1587 have constant current limit with changes in input-to-output voltage. The LT1584 has variable current limit which decreases about 4A as input-to-output voltage increases from 3V to 7V.