Preliminary – LD6715

3A Step-Down Voltage Regulator & Operational Amplifier

Features

- 3.3V, 5V, 12V, 15V and adjustable output versions
- Adjustable version output voltage range,
- 1.23~37V±3% max over line and load conditions
- Guaranteed 3A output current
- Wide input voltage range
- Requires only 4 external components
- 150 KHz fixed frequency oscillator
- TTL shutdown capability, low power standby mode
- Uses readily available standard inductors
- Thermal shutdown and current limit protection

Applications

- Simple high-efficiency step-down (buck) regulator
- Efficient pre-regulator for linear regulators
- On-card switching regulators
- Positive-to-negative converter (buck-boost)

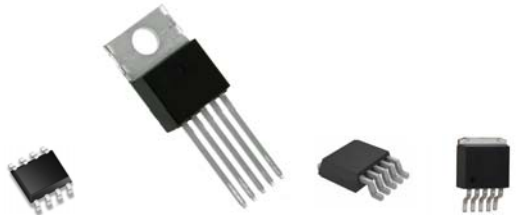
General Description

The LD6715 series of regulators are monolithic integrated circuits that provide all the active functions for a step-down (buck) switching regulator, capable of driving 3A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3V, 5V, 12V, 15V and adjustable output versions. Requiring a minimum number of external components, these regulators are simple to use and include internal frequency compensation and a fixed-frequency oscillator.

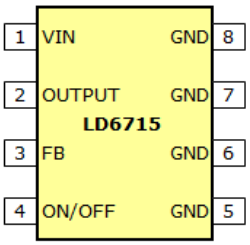
The LD6715 series offers a high-efficiency replacement for popular three-terminal linear regulators. It substantially reduces the size of the heat sink, and in some cases no heat sink is required. A standard series of inductors optimized for use with the LD6715 are available from several different manufacturers. This feature greatly simplifies the design of switch-mode power supplies.

Other features include a guaranteed ± 4% tolerance on output voltage within specified input voltages and output load conditions, and ±15% on the oscillator frequency. External shutdown is included, featuring 50μA (typical) standby current. The output switch includes cycle-by-cycle current limiting, as well as thermal shutdown for full protection under fault conditions.

Package Pin Out



SOP8 TO220-5L TO252-5L TO263-5L



Pin Assignment of TO220, TO252, and TO263

Pin	Name
1	VIN
2	OUTPUT
3	GND
4	FB
5	ON/OFF

Ordering Information

		Packing Options	
Part No.	Package	Tube (TU)	Tape & Reel (TR)
LD6715	SOP-8	LD6715S1-000-TU	LD6715S1-000-TR
	TO220-5L	LD6715T4-000-TU	LD6715T4-000-TR
	TO252-5L	LD6715T7-000-TU	LD6715T7-000-TR
	TO263-5L	LD6715T9-000-TU	LD6715T9-000-TR

- Package material default is “Green” package.

Output Voltage Selection

Part No.	V_{OUT}
LD6715S1-000-XX	Adjustable
LD6715S1-033-XX	3.3V
LD6715S1-050-XX	5.0V
LD6715S1-120-XX	12V
LD6715S1-150-XX	15V

Product Marking

LD8888
SSSSS…
●

- Line 1 – “LD” is a fixed character
  8888: product name
- Line 2 – SSSSS…: lot number

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Absolute Maximum Ratings

Parameter	Maximum	Unit
V_{IN} supply voltage	45	V
Operating V_{IN} supply voltage	5.1 to 40	V
ON/OFF pin voltage	$-0.3 \leqq V \leqq V_{IN}$	V
FB pin voltage	$-0.3 \leqq V \leqq V_{IN}$	V
OUTPUT pin to GND	-0.8	V
Operating current load	3.0	A
Junction temperature	150	°C
Operating temperature range	-40 to +125	°C
Storage temperature range	-65 to +150	°C
Power dissipation	Internal limited	

The values beyond the boundaries of absolute maximum rating may cause the damage to the device. Functional operation in this context is not implied. Continuous use of the device at the absolute rating level might influence device reliability. All voltages have their reference to device ground.

Electrical Characteristics[*1]

V_{IN}=12V for 3.3V, 5V; V_{IN}=25V for 12V, 15V and adjustable version, I_{LOAD}=0.5A, T_A=25°C unless specified

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
System Parameters						
Output voltage range LD6715-033	V_{OUT}	$5.5V \leqq V_{IN} \leqq 40V$, $0.2A \leqq I_{LOAD} \leqq 3A$, V_{OUT}=>3.3V	3.168	3.300	3.432	V
		$5.5V \leqq V_{IN} \leqq 40V$, $0.2A \leqq I_{LOAD} \leqq 3A$, V_{OUT}=>3.3V[*7]	3.135	3.300	3.465	
Output voltage range LD6715-050		$8V \leqq V_{IN} \leqq 40V$, $0.2A \leqq I_{LOAD} \leqq 3A$, V_{OUT}=>5V	4.800	5.000	5.200	
		$8V \leqq V_{IN} \leqq 40V$, $0.2A \leqq I_{LOAD} \leqq 3A$, V_{OUT}=>5V[*7]	4.750	5.000	5.250	
Output voltage range LD6715-120		$15V \leqq V_{IN} \leqq 40V$, $0.2A \leqq I_{LOAD} \leqq 3A$, V_{OUT}=>12V	11.52	12.00	12.48	
		$15V \leqq V_{IN} \leqq 40V$, $0.2A \leqq I_{LOAD} \leqq 3A$, V_{OUT}=>12V[*7]	11.40	12.00	12.60	
Output voltage range LD6715-150		$18V \leqq V_{IN} \leqq 40V$, $0.2A \leqq I_{LOAD} \leqq 3A$, V_{OUT}=>15V	14.40	15.00	15.60	
		$18V \leqq V_{IN} \leqq 40V$, $0.2A \leqq I_{LOAD} \leqq 3A$, V_{OUT}=>15V[*7]	14.25	15.00	15.75	
Output voltage range LD6715-000		$8V \leqq V_{IN} \leqq 40V$, $0.2A \leqq I_{LOAD} \leqq 3A$, V_{OUT}=>1.23V	1.193	1.230	1.267	
		$8V \leqq V_{IN} \leqq 40V$, $0.2A \leqq I_{LOAD} \leqq 3A$, V_{OUT}=>1.23V[*7]	1.180	1.230	1.280	
Efficiency of LD6715-033	η	V_{IN}=12V, I_{LOAD}=3A, V_{OUT}=>3.3V	–	75	–	%
Efficiency of LD6715-050		V_{IN}=12V, I_{LOAD}=3A, V_{OUT}=>5V	–	77	–	
Efficiency of LD6715-120		V_{IN}=12V, I_{LOAD}=3A, V_{OUT}=>12V	–	88	–	
Efficiency of LD6715-150		V_{IN}=18V, I_{LOAD}=3A, V_{OUT}=>15V	–	88	–	
Efficiency of LD6715-000		V_{IN}=12V, I_{LOAD}=3A, V_{OUT}=>1.23V	–	77	–	
Device Parameters						
Feedback bias current	I_{FB}	V_{OUT}=5V	–	50	100	nA
		V_{OUT}=5V[*7]	–	–	500	
Oscillator frequency	F_{OSC}	*6	130	150	170	KHz
		*6*7	120	–	180	
Saturation voltage	V_{SAT}	V_{FB}=0V, I_{LOAD}=3A[*2]	–	1.4	1.6	V
		V_{FB}=0V, I_{LOAD}=3A[*2*7]	–	–	1.8	
Maximum duty cycle	DC_{MAX}	V_{FB}=0V (driver on)[*3*7]	93	98	–	%
Current limit	I_{CL}	V_{FB}=0V, peak current	4.0	5.7	6.9	A
		V_{FB}=0V, peak current[*7]	3.5	–	7.5	
Output leakage current	I_L	V_{OUT}=-0.8V[*4*5]	–	10	30	mA
		V_{OUT}=0V[*4*5]	–	0.4	2	
Quiescent current	I_Q	*4	–	5	10	μA
Standby current	I_{STB}	$V_{ON/OFF}$=5V, V_{IN}=40V	–	60	200	μA
		$V_{ON/OFF}$=5V, V_{IN}=40V[*7]	–	–	250	
ON/OFF Control						
ON/OFF pin input level	V_{IH}	V_{OUT}=0V	2.2	1.4	–	V
		V_{OUT}=0V[*7]	2.4	–	–	
	V_{IL}	V_{OUT}=normal output	–	1.2	1.0	V
		V_{OUT}=normal output[*7]	–	–	0.8	
ON/OFF pin input current	I_{IH}	$V_{ON/OFF}$=5V(off)	–	12	30	μA
	I_{IL}	$V_{ON/OFF}$ =0V(on)	–	0	10	μA

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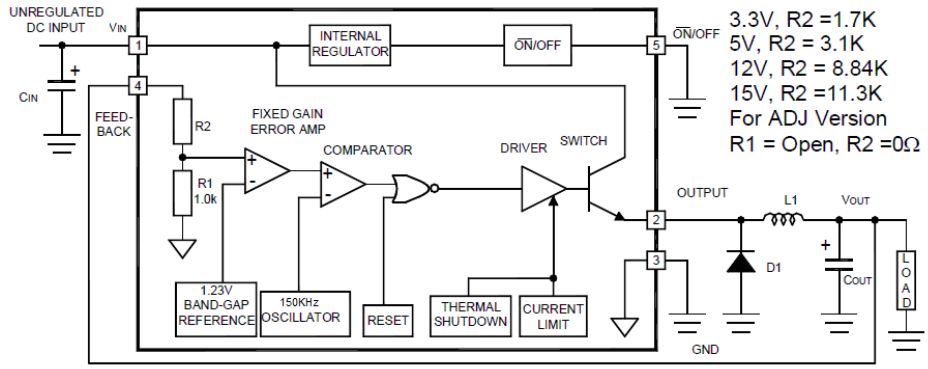
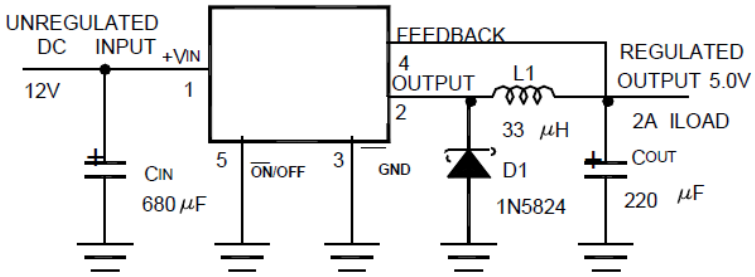
Notes:

1. External components such as the catch diode, inductor, input and output capacitors can affect switching regulator system performance.
2. Output pin sourcing current. No diode, inductor or capacitor connected to output.
3. Feedback pin removed from output and connected to 0V.
4. Feedback pin removed from output and connected to +12V for the Adjustable, 3.3V, and 5V, versions, and +25V for the 12V and 15V versions, to force the output transistor OFF.
5. VIN =40V.
6. The oscillator frequency reduces to approximately 36 kHz in the event of an output short or an overload which causes the regulated output voltage to drop approximately 40% from the nominal output voltage. This self protections feature lowers the average power dissipation of the IC by lowering the minimum duty cycle from 5% down to approximately 2%.
7. This applied over full operation temperature range.

Block Diagram

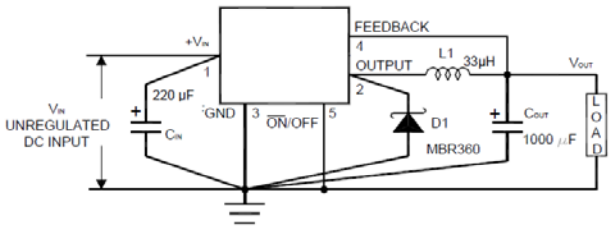


Typical Application Circuit



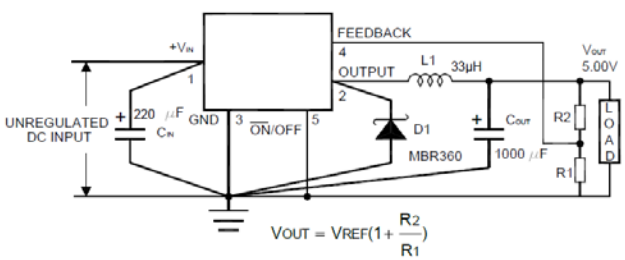
Test Circuit and Layout Guidelines

Fixed Output Voltage Versions



CIN — 220uF, 75V, Aluminum Electrolytic
COUT —1000µF, 25V, Aluminum Electrolytic
D1 — Schottky, MBR360
L1 — 33uH, Pulse Eng. PE-92108
R1 — 2k, 0.1%
R2 — 6.12k, 0.1%

Adjustable Output Voltage Version



$V_{OUT} = V_{REF}(1+\frac{R_2}{R_1})$

$R_2 = R_1(\frac{V_{OUT}}{V_{REF}} - 1)$

where V_{REF} = 1.23V, R1 between 1k and 5k

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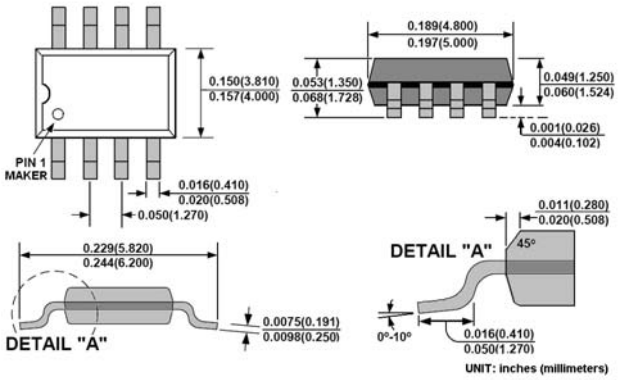
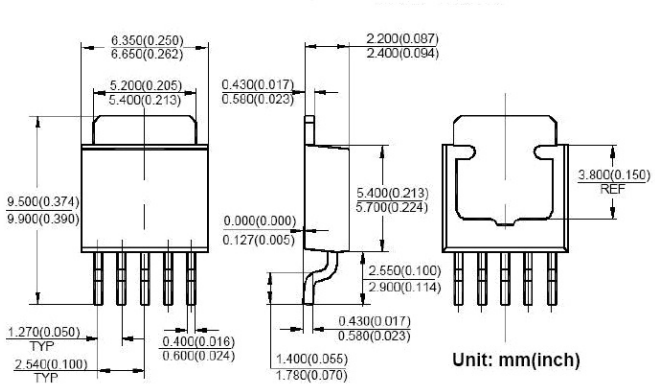
Package Outline

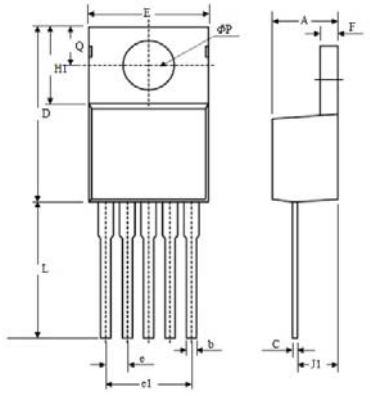
SOP8:



TO252-5L:

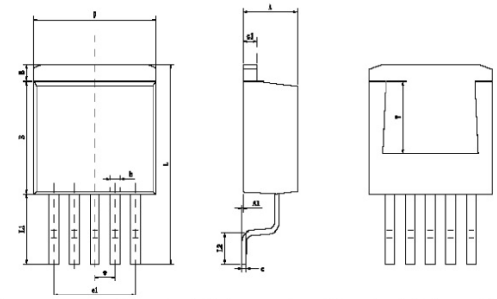


TO220-5L:



Symbols	Dimensions in Millimeters		
	Minimum	Normal	Maximum
A	4.07	4.45	4.82
b	0.76	0.89	1.02
C	0.36	0.5	0.64
D	14.22	14.86	15.5
E	9.78	10.16	10.54
e	1.57	1.71	1.85
e1	6.68	6.81	6.93
F	1.14	1.27	1.4
H1	5.46	6.16	6.86
J1	2.29	2.74	3.18
L	13.21	13.97	14.73
ΦP	3.68	3.81	3.94
Q	2.54	2.73	2.92

TO263-5L:



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.470	4.670	0.176	0.184
A1	0.000	0.150	0.000	0.006
B	1.560	1.760	0.061	0.069
b	0.710	0.910	0.028	0.036
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	9.880	10.180	0.389	0.401
E	8.200	8.600	0.323	0.339
e	1.700TYP		0.067TYP	
e1	6.700	6.900	0.264	0.272
L	15.140	15.540	0.596	0.612
L1	5.080	5.480	0.200	0.216
L2	2.340	2.740	0.092	0.108

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