Replacement of
LM2575 Series

Simple Switcher (1A Step-Down Voltage Regulator)

MIK2575 Series

October 2001 - revised July 2002

Description

The MIK2575 series of regulators are monolithic integrated circuits that provide all the active functions for a step-down (buck) switching regulator, capable of driving 1A load with excellent line and load regulation. Requiring a minimum number of external components, these regulators are simple to use and include internal frequency compensation and a fixed-frequency oscillator. The MIK2575 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. Other features include a guaranteed ± 4% tolerance on output voltage within specified input voltages and output load conditions, and ±10% on the oscillator frequency The output switch includes cycle-by-cycle current limiting, as well as thermal shutdown for full protection under fault conditions.

Features

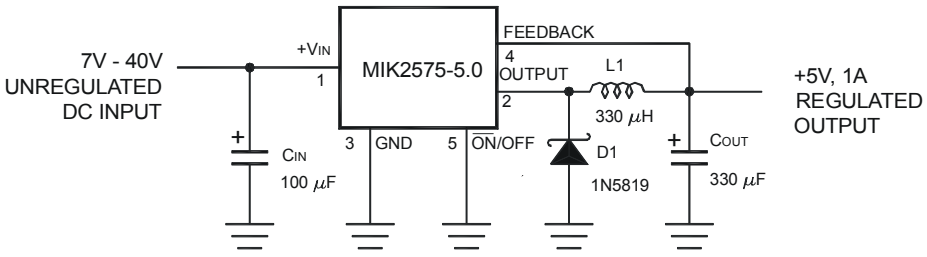
- 3.3V, 5V, 12V, 15V, and adjustable output versions
- Adjustable version output voltage range, 1.23V to 37V ± 4% max over line and load conditions
- Guaranteed 1A output current
- Wide input voltage range
- Requires only 4 external components
- 52 kHz fixed frequency oscillator
- TTL shutdown capability, 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)

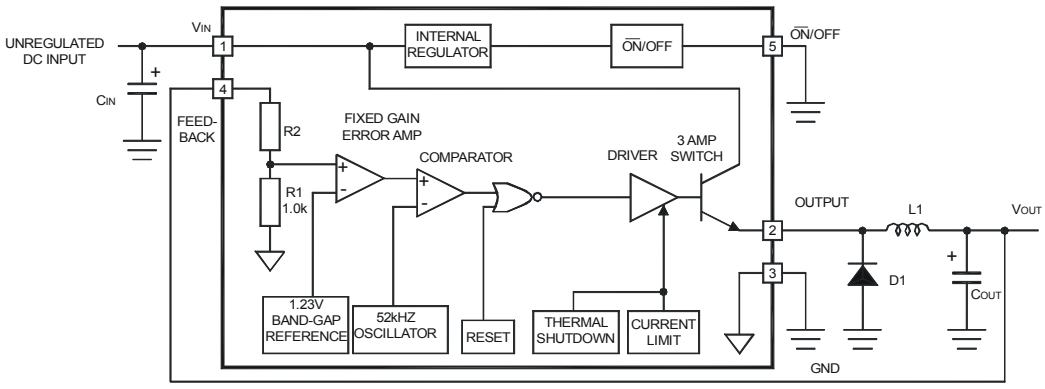
Typical application

(Fixed Output Voltage Versions)



Note: Pin numbers are for the TO-220 package.

Block Diagram



Note: Pin numbers are for the TO-220 package.

Absolute Maximum Ratings (unless otherwise noted)

Parameter	Maximum	Units
Maximum Supply Voltage	45	V
ON/OFF Pin Input Voltage	$-0.3V \le V \le +V_{IN}$	
Input Voltage to Ground	-1	V
Power Dissipation	Internally Limited	W
Storage Temperature Range	-65 to +150	°C
Maximum Junction Temperature	150	°C
Lead Temperature (Soldering, 10 Seconds)	260	°C

Operating Ratings

Parameter	Value	Units
Temperature Range	$-40 \le T_J \le +125$	°C
Supply Voltage	40	V

Electrical Characteristics

(T_J = 25°C, unless otherwise noted) Note 1

Symbol	Parameter	Conditions		Min	Typ	Max	Units
	Output Voltage						V
	MIK2575-3.3	V_{IN} =12V, I_{LOAD} =0.2A Circuit of *Figure 1*		3.234	3.3	3.366	
V_{OUT}		4.75V ≤ V_{IN} ≤ 40V, 0.2A ≤ I_{LOAD} ≤ 1A; Circuit of *Figure 1*	*	3.168 3.135		3.432 3.465	
	MIK2575-5.0	V_{IN} =12V, I_{LOAD} =0.2A Circuit of *Figure 1*		4.900	5.0	5.100	
		8V ≤ V_{IN} ≤ 40V, 0.2A ≤ I_{LOAD} ≤ 1A Circuit of *Figure 1*	*	4.800 4.750		5.200 5.250	
	MIK2575-12	V_{IN} =25 V, I_{LOAD} =0.2A Circuit of *Figure 1*		11.76	12.0	12.24	
		15 V ≤ V_{IN} ≤ 40V, 0.2A ≤ I_{LOAD} ≤ 1A Circuit of *Figure 1*	*	11.52 11.40		12.48 12.60	
	MIK2575-15	V_{IN} =30V, I_{LOAD} =0.2A Circuit of *Figure 1*		14.70	15.0	15.30	
		18V ≤ V_{IN} ≤ 40V, 0.2A ≤ I_{LOAD} ≤ 1A Circuit of *Figure 1*	*	14.40 14.25		15.60 15.75	
	MIK2575-Adj	V_{IN} =12V, I_{LOAD} =0.2A, U_{OUT} =5V Circuit of *Figure 1*		1.217	1.230	1.243	
		8V ≤ V_{IN} ≤ 40V, 0.2A ≤ I_{LOAD} ≤ 1A, U_{OUT} =5V Circuit of *Figure 1*	*	1.193 1.180		1.267 1.280	
η	Efficiency						%
	MIK2575-3.3	V_{IN} =12V, I_{LOAD} =1A			75		
	MIK2575-5.0	V_{IN} =12V, I_{LOAD} =1A			77		
	MIK2575-12	V_{IN} =15V, I_{LOAD} =1A			88		
	MIK2575-15	V_{IN} =18V, I_{LOAD} =1A			88		
	MIK2575-Adj	V_{IN} =12V, I_{LOAD} =1A, U_{OUT} =5			77		

Electrical Characteristics

(T_J = 25°C, unless otherwise noted) Note 1

Symbol	Parameter	Conditions		Min	Typ	Max	Units
I_{FB}	Feedback Bias Current	V_{OUT} =5V (Adjustable Version Only)	*		50	100 500	nA
F_0	Oscillator Frequency	(Note 6)	* *	47 42	52	58 63	kHz
V_{SAT}	Saturation Voltage	I_{OUT} =1A (Note 2)	*		0.9	1.2 1.4	V
T_{DC}	Max Duty Cycle (ON)	(Note 3)		93	98		%
I_{CL}	Current Limit	Peak Current (Notes 2, 6)	*	1.7 1.3	2.2	3.0 3.2	A
I_{OL}	Output Leakage Current	(Notes 4, 5): Output = 0V Output = 0V Output = -1V			7.5	2 30	mA
I_Q	Quiescent Current	(Note 4)			5	10	mA
I_{STBY}	Standby Quiescent Current	$\overline{ON}$/OFF Pin = 5V (OFF)			50	200	μA
$\overline{ON}$/OFF CONTROL							
V_{IH}	$\overline{ON}$/OFF Pin Logic Input Level	V_{OUT} = 0V	* *	2.2 2.4	1.4		V
V_{IL}		V_{OUT} = Nominal Output Voltage	*		1.2	1.0 0.8	V
I_{IH}	$\overline{ON}$/OFF Pin Input Current	$\overline{ON}$/OFF Pin = 5V (OFF)			12	30	μA
I_{IL}		$\overline{ON}$/OFF Pin = 0V (ON)			0	10	μA

The * denotes the specifications which apply over the full operating temperature range.

Note 1: External components such as the catch diode, inductor, input and output capacitors can affect switching regulator system perfomance.

All limits guaranteed at room temperature (standard type face) and at temperature extremes (bold type face).

Note 2: Output (pin 2) sourcing current. No diode, inductor or capacitor connected to output pin.

Note 3: Feedback (pin 4) removed from output and connected to 0V

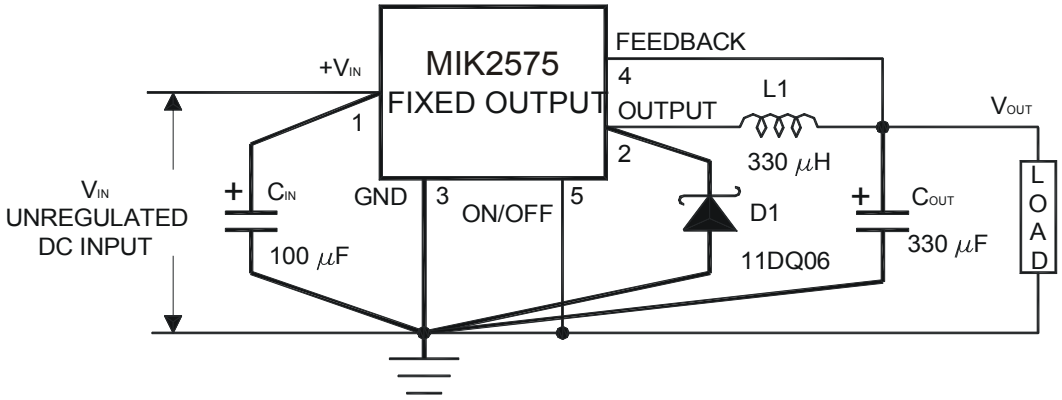
Note 4: Feedback (pin 4) removed from output and connected to +12V for the Adjustable, 3.3V, and 5V, versions, and +25V for the 12V and 15V versions, to force the output transistor OFF.

Note 5: V_{IN} =40V.

Note 6: The oscillator frequency reduces to approximately 18kHz 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%.

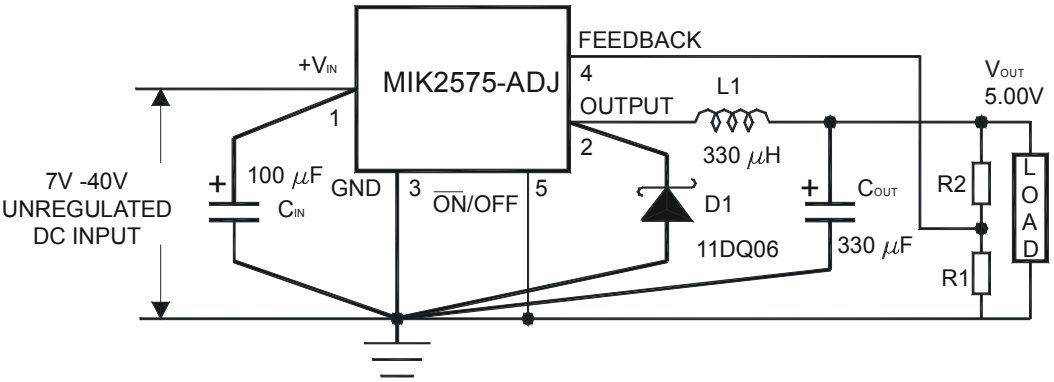
Test Circuit and Layout Guidelines

Fixed Output Voltage Versions (Figure 1a)



C_{IN} — 330μF, 25V, Aluminum Electrolytic
D1 — Schottky, 11DQ06
L1 — 330μH, PE-52627
R1 — 2k, 0.1%
R2 — 6.12k, 0.1%

Adjustable Output Voltage Version (Figure 1a)

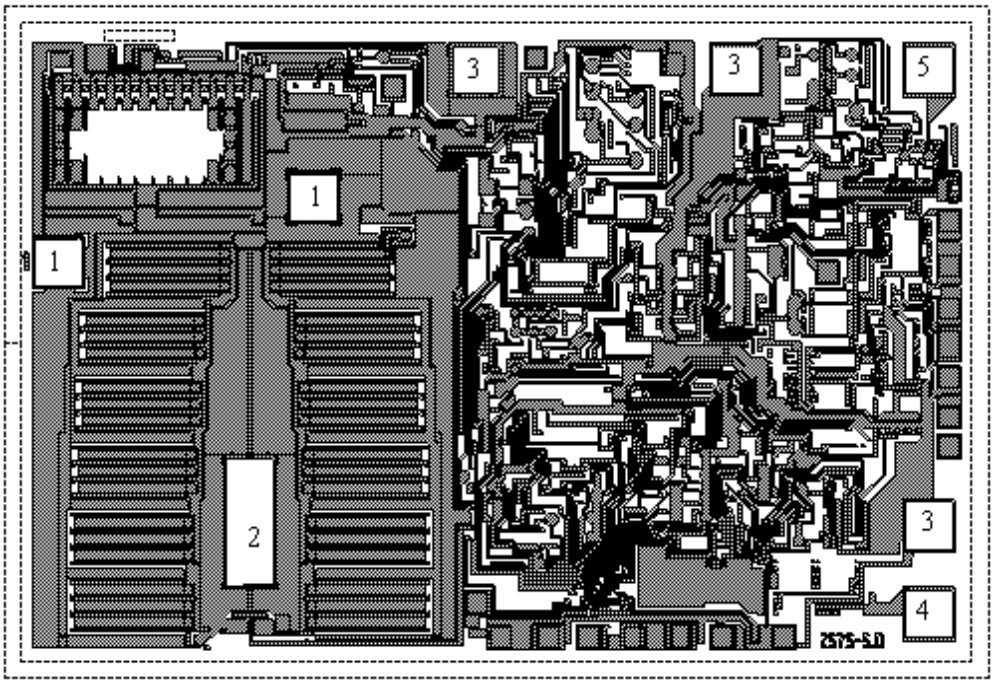


$$V_{OUT} = V_{REF}(1 + \frac{R1}{R2})$$

$$R2 = R1(\frac{V_{OUT}}{V_{REF}} - 1)$$

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

Pad location MIK2575



Chip Size 3.95x2.65mm

Pad Location Coordinates (the center of pads)

N	Pad size (µm)	Coordinates (µm)	
		X	Y
1	190x190	220.5	1640
1	190x190	1244	1900
2	190x500	985.5	619.5
3	190x190	1893.5	2399
3	190x190	2935	2403
3	190x190	3716.5	603.5
4	190x190	3716.5	254
5	190x190	3716.5	2399