



# Patent

## 3A LOW-NOISE PWM STEP-DOWN REGULATOR

**CM3708**

### GENERAL DESCRIPTION

The CM3708 is a low-noise, pulse-width-modulated (PWM), DC-DC step-down converter. It powers logic and transmitters in small wireless systems such as cellular phones, communicating PDAs, and handy-terminals. The device features an internal synchronous rectifier for high efficiency; it requires no external Schottky diode. Excellent noise characteristics and fixed-frequency operation provide easy post-filtering. The CM3708 is ideally suited for Li-Ion battery applications. It is also useful for +3V or +5V fixed input applications.

The device operates in one of four modes. Forced PWM mode operates at a fixed frequency regardless of the load. Shutdown mode places the device in standby, reducing quiescent supply current to under 0.1µA.

The CM3708 can deliver over 3.0A. The output voltage can be adjusted from VREF to VIN. The input range is from 2.0V to 5.0V. Other features of the CM3708 include high efficiency, low dropout voltage. It is available in a space-saving 16-pin SOP & TSSOP package.

### FEATURES

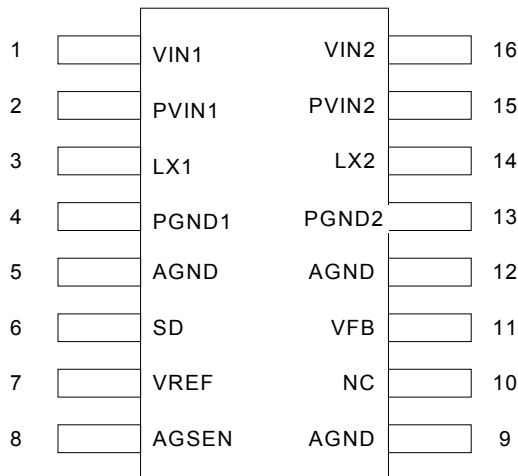
- ◆ Patent Filed #6,452,366
- ◆ 600KHz switching and synchronization
- ◆ Dynamic output-voltage adjustment from VREF to VIN
- ◆ 3A Guaranteed Output Current
- ◆ 95% Efficiency
- ◆ No Schottky Diode Required
- ◆ External Soft start
- ◆ 16-pin PSOP/PTSSOP power packages

### APPLICATIONS

- ◆ Cellular Phone
- ◆ Cordless Phone
- ◆ PDAs and Handy-Terminals
- ◆ AGP Chipset Supplies
- ◆ CPU I/O Supplies
- ◆ Notebook Chipset Supplies
- ◆ Battery Operated Devices

### PIN CONFIGURATION

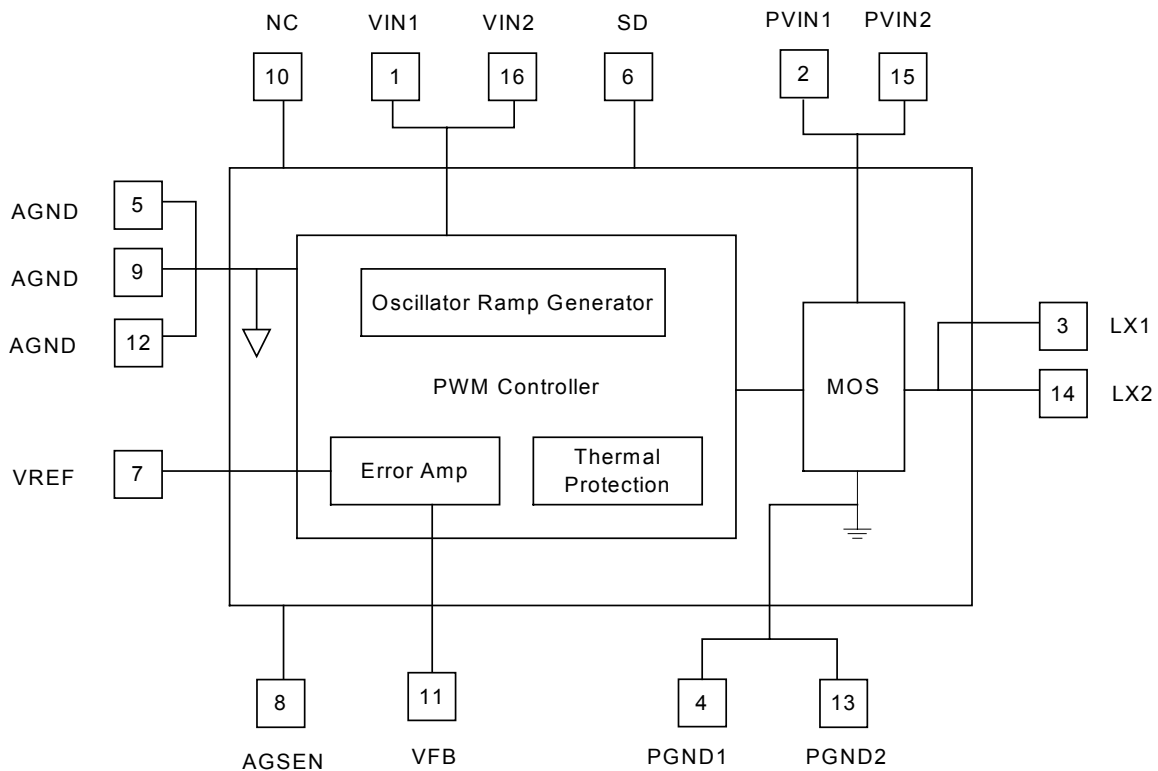
PSOP-16 (PS16) / PTSSOP-16 (PT16)  
Top View



### PIN DESCRIPTION

Pin No.	Symbol	Description	Operating Rating			
			Min.	Typ.	Max.	Unit
1,16	VIN1, VIN2	Voltage supply for internal circuits	2	2.5	5	V
2,15	PVIN1, PVIN2	Voltage supply for output power transistors	2	2.5	5	V
3,14	LX1, LX2	Inductor connection to the Drains of the internal power MOSFETs			5	V
4,13	PGND1, PGND2	Ground for output power transistors				
5,9,12	AGND	Ground for internal reference voltage divider				
8	AGSEN	Ground for remote sensing				
6	SD	Shutdown active high. CMOS input level	0.75 x VIN		VIN + 0.3V	V
7	VREF	V <sub>OUT</sub> Set Voltage	1.1		VIN	V
10	NC	No Connection				
11	VFB	Feedback node for the V <sub>OUT</sub>			5	V

### BLOCK DIAGRAM





# Patent

## 3A LOW-NOISE PWM STEP-DOWN REGULATOR

**CM3708**

### ORDERING INFORMATION

Part Number	Temperature Range	Package
CM3708IT	-40 to 85	16-Pin PTSSOP (PT16)
CM3708GIT*	-40 to 85	16-Pin PTSSOP (PT16)
CM3708IS	-40 to 85	16-Pin PSOP (PS16)
CM3708GIS*	-40 to 85	16-Pin PSOP (PS16)

\*Note: G : Suffix for Pb Free Product

### ABSOLUTE MAXIMUM RATINGS

Absolute maximum ratings are those values beyond which the device could be permanently damaged.

PVIN/VIN .....-0.3V to 5.0V  
 Voltage on Any Other Pin ..... GND – 0.3V to VIN + 0.3V  
 Output Current, Source or Sink .....3.0A

Junction Temperature .....150°C  
 Storage Temperature ..... -65°C to 125°C  
 Lead Temperature (Soldering, 5 sec)..... 260°C  
 Thermal Dissipation(  $\theta_{JC}$  )..... .50°C/W

### OPERATING CONDITIONS

Temperature Range ..... -40°C to 85°C  
 PVIN Operating Range .....2.0V to 5.0V

**ELECTRICAL CHARACTERISTICS** (Unless otherwise stated, these specifications apply  $T_A=25^\circ\text{C}$ ;  $V_{IN}=+3.3\text{V}$  and  $PV_{IN}=+3.3\text{V}$ ) maximum ratings are stress ratings only and functional device operation is not implied.  
 (Note 1)

Symbol	Parameter	Test Conditions	CM3708			Unit
			Min.	Typ.	Max.	
<b>SWITCHING REGULATOR</b>						
$V_{REF}$	Adjustable Output Voltage		$V_{REF}$		$V_{IN}$	V
fsw	Switching Frequency	CM3708	480		660	KHz
$I_{OUT(RMS)}$	Maximum Output RMS Current	CM3708			3.0	A
$I_{OUT(PEAK)}$	Maximum Output Peak Current	CM3708			6.0	A
<b>MOSFETs</b>						
$R_{DS(ON)}$	Drain to Source on-State Resistance	$PV_{IN}=5\text{V}$		150	180	m
<b>SUPPLY</b>						
$I_{VIN}$	Quiescent Current	VFB = 1.4V LC unconnected		200		$\mu\text{A}$
$I_{PVIN}$		VFB = 1.4V LC unconnected		500		$\mu\text{A}$

**Note 1:** Limits are guaranteed by 100% testing, sampling, or correlation with worst case test conditions

**Note 2:**  $V_{IN}$ ,  $PV_{IN}$  = 3.3V  $\pm 10\%$

**Note 3:** It's not 100% test

## FUNCTIONAL DESCRIPTION

The CM3708 step-down, pulse-width-modulated (PWM), DC-DC converter has an adjustable output range from VREF to the input voltage (VIN). An internal synchronous rectifier improves efficiency and eliminates an external Schottky diode. Fixed-frequency operation enables easy post-filtering, thereby providing excellent noise characteristics. As a result, the CM3708 is an ideal choice for many small wireless systems.

### VREF

The reference voltage could be ranged from 1.1V to VIN.

### OUTPUTS

The output voltage pins (LX1, LX2) are tied to the RF power amp, via an external inductor. Output voltage is determined by the VREF inputs.

### INPUTS

The input voltage reference pin, VREF determine the output voltages (LX1, LX2). If a specific voltage is forced at the VREF pin, the output voltage follows the voltage at the VREF pin.

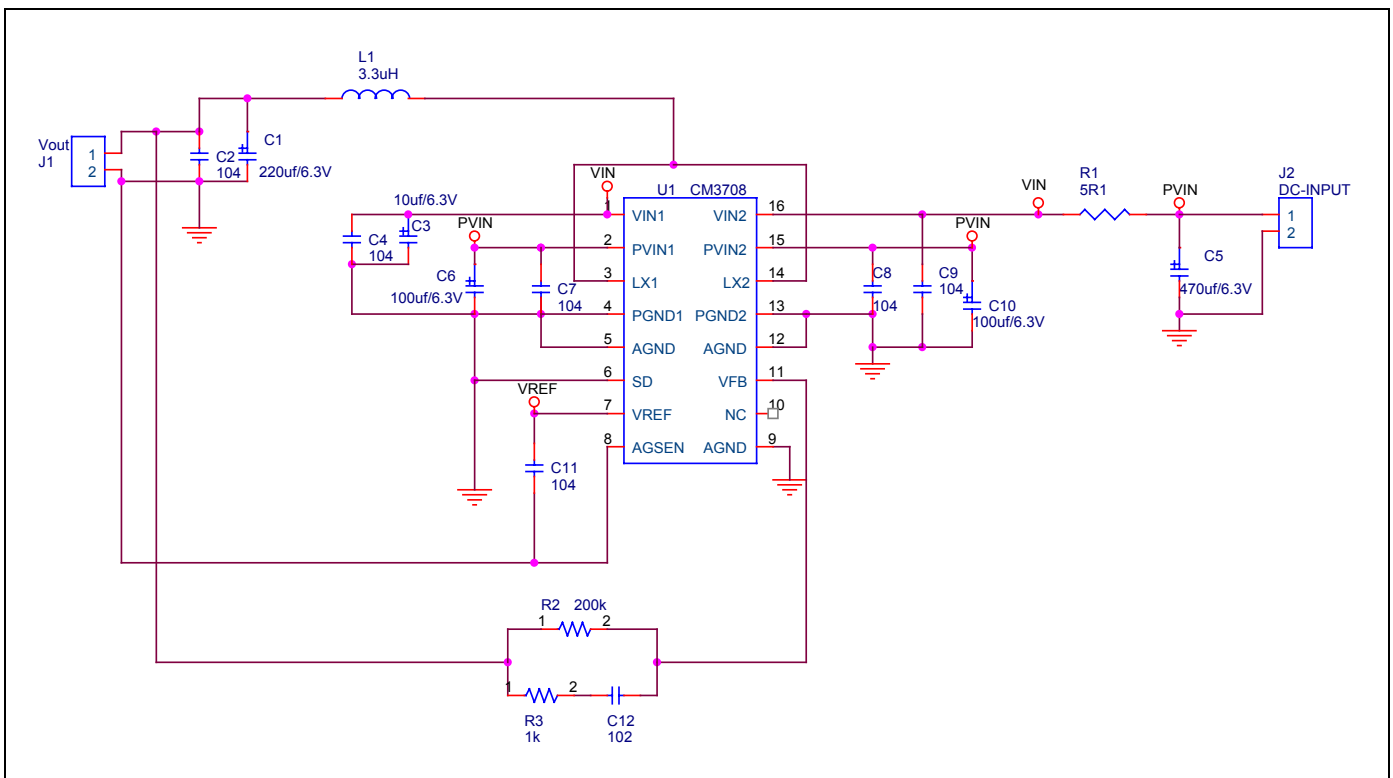
### OTHER SUPPLY VOLTAGES

Several inputs are provided for the supply voltages: PVIN and VIN. The PVIN provide the power supply to the power MOSFETs. VIN provides the voltage supply to the logic section and internal error amplifiers.

### FEEDBACK

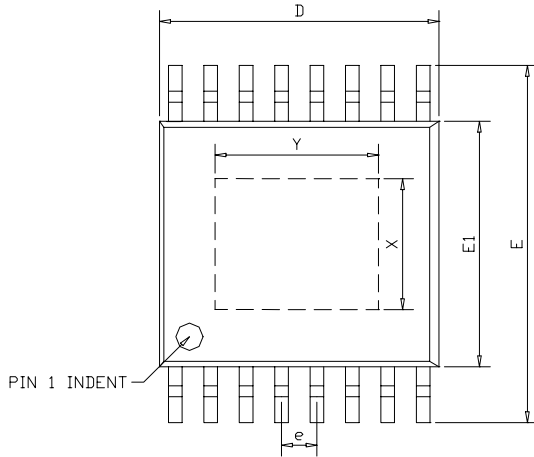
The VFB pin is an input that can be used for closed loop compensation. This input is derived from the voltage output. AGND pin is a contact node of internal resistor divider for remote sense.

## APPLICATION CIRCUIT



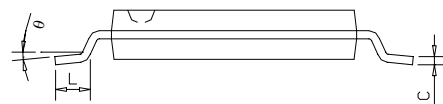
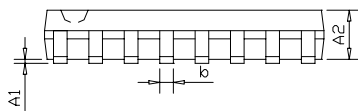
## PACKAGE DIMENSION

### 16-PIN PTSSOP (PT16)

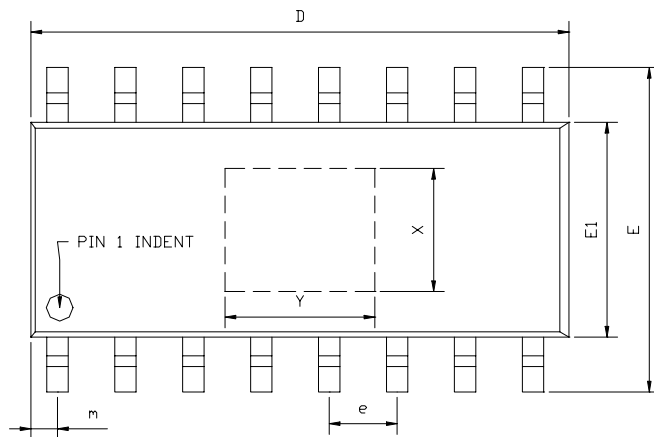


SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHS		
	MIN	NOM	MAX	MIN	NOM	MAX
A1	0.05	---	0.15	0.002	---	0.006
A2	0.84	---	0.94	0.033	---	0.037
b	0.20	---	0.30	0.008	---	0.012
c	0.10	---	0.20	0.004	---	0.008
D	4.88	---	5.13	0.192	---	0.202
E	6.25	---	6.55	0.246	---	0.258
E1	4.29	---	4.50	0.169	---	0.177
e	---	0.65	---	---	0.026	---
L	0.51	---	0.71	0.020	---	0.028
θ	0°	---	8°	0°	---	8°

EXPOSED PAD DIMENSION : (mm)  
PAD SIZE: X=2.4; Y=3.0

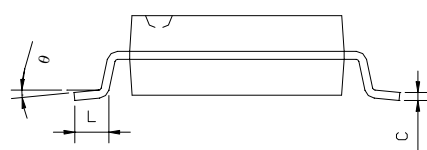
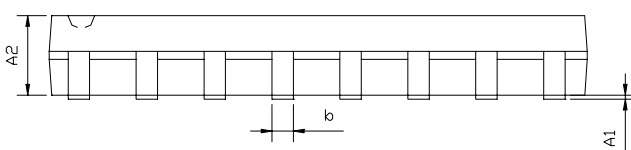


### 16-PIN PSOP (PS16)



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHS		
	MIN	NOM	MAX	MIN	NOM	MAX
A1	0.05	---	0.15	0.002	---	0.006
A2	1.40	---	1.55	0.055	---	0.061
b	0.30	---	0.51	0.012	---	0.020
C	0.15	---	0.26	0.006	---	0.010
D	9.80	---	10.06	0.386	---	0.396
E	5.79	---	6.20	0.228	---	0.244
E1	3.76	---	4.01	0.148	---	0.158
e	---	1.27	---	---	0.050	---
L	0.38	---	0.69	0.015	---	0.035
m	0.43	---	0.69	0.017	---	0.027
θ	0°	---	8°	0°	---	8°

EXPOSED PAD DIMENSION : (mm)  
PAD SIZE: X=2.3 ; Y=2.8





### IMPORTANT NOTICE

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