

# Step Down DC - DC Converter Power IC

## MD3221R

Small footprint

Output adjustable

Remote On/Off

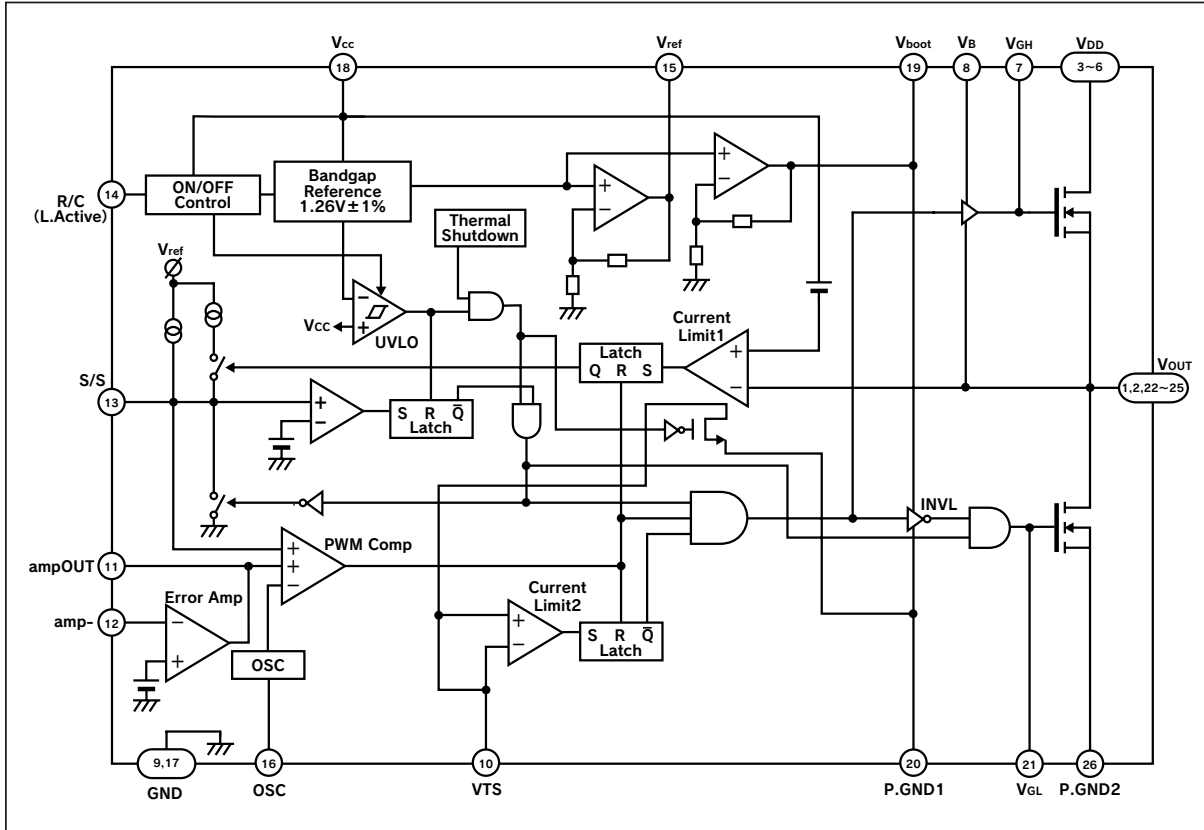
Synchronous Rectification

5V Input

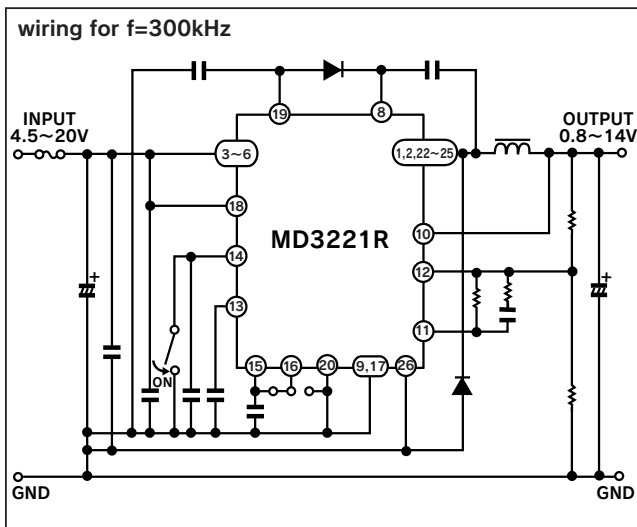
### Feature

- Input Voltage range 4.5V to 20V
  - Maximum Output Current 3A
  - Built\_in MOSFETs for main switch and synchronous rectification
  - Adjustable output from 0.8V to 14V with external resistors
  - High Efficiency typ. 96% (at: Vin=5V, Vout=3.3V, Iout=1A, f=100kHz)
  - 100kHz / 300kHz selectable switching frequency
  - Over Current Protection
  - Under Voltage Lockout
  - Thermal Shut Down
  - Remote On / Off
- Supply current at remote off 25μA typ.

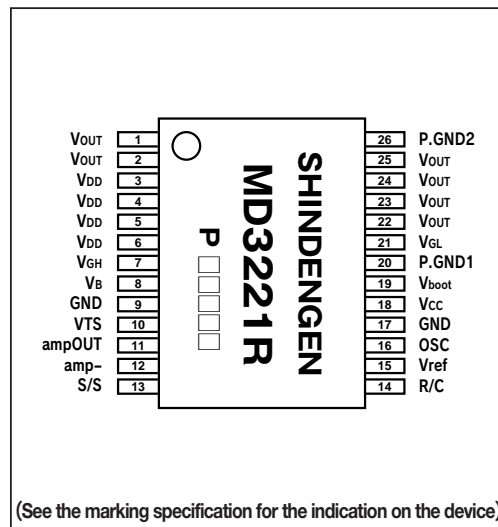
### Block Diagram



### Standard Connection Diagram



### Pin Assignment (LSSOP26)



## Absolute Maximum Ratings

Unless otherwise specified : Ta=25°C

Item	Symbol	Ratings	Units
Input/Output Ratings			
Input voltage	V <sub>CC</sub>	22	V
Main MOSFET input voltage	V <sub>DD</sub>	22	V
Output current (ave)	I <sub>OUTAVE</sub>	3	A
Output current (peak)	I <sub>OUTPEAK</sub>	4	A
Input voltage between V <sub>B</sub> and V <sub>OUT</sub>	V <sub>B</sub>	5.5	V
Vboot sink current	I <sub>boot</sub>	-30	mA
Remote control voltage	V <sub>RC</sub>	V <sub>CC</sub>	V
OSC input voltage	V <sub>OSC</sub>	V <sub>ref</sub>	V
Amp- input voltage	V <sub>amp-</sub>	V <sub>ref</sub>	V
V <sub>ref</sub> sink current	I <sub>ref</sub>	-3	mA
Thermal Ratings			
Power dissipation max *1	PD1 *3	1.1	W
	PD2 *3	1.5	W
Operating temperature	Ta-ope	-30 to 85	°C
Storage temperature	Tstg	-40 to 150	°C
Junction temperature	Tj	150	°C
Thermal resistance *1	θja1 *3	110	°C/W
	θja2 *3	87	°C/W
	θjc1 *2, *3	55	°C/W
	θjc2 *2, *3	30	°C/W

\*1 CEM-3 Board : 50.8×50.8mm<sup>2</sup>, Thickness : 1mm, Copper Pattern : 300mm<sup>2</sup> (Top Side). There is no through-hole.

\*2 The measurement result in the center of case.

\*3 PD1, θja1, θjc1 are the values of the power dissipation and thermal resistance when electifying to a single internal element.

PD2, θja2, θjc2 are the values of the power dissipation and thermal resistance when electifying to two internal element.

## Recommended Operating Conditions

Item	Symbol	Recommendation	Units
Junction temperature	Tj	-30 to 125	°C
Input voltage	V <sub>i</sub> *4	4.5 to 20	V
Output voltage setting range	V <sub>o</sub> *5	0.8 to 14	V

\*4 Input voltage at the time of power supply operation.

\*5 Output voltage at the time of power supply operation.

## Electrical Characteristics

Unless otherwise specified : Ta=25°C

Item	Symbol	Condition	MIN	TYP	MAX	Units
High Side MOSFET						
Drain-source breakdown voltage	V <sub>DSS_H</sub>	ID=1mA, V <sub>GS</sub> =0V	22	-	-	V
Zero gate voltage drain current	IDSS_H	V <sub>DS</sub> =22V, V <sub>GS</sub> =0V	-	-	10	μA
Static drain-source on-state resistance	RON_H	ID=1.2A, V <sub>GS</sub> =4.5V	-	22	55	mΩ
Source-drain diode forward voltage	V <sub>SD_H</sub>	IS=1.2A, V <sub>GS</sub> =0V	-	-	1.5	V
Low Side MOSFET						
Drain-source breakdown voltage	V <sub>DSS_L</sub>	ID=1mA, V <sub>GS</sub> =0V	22	-	-	V
Zero gate voltage drain current	IDSS_L	V <sub>DS</sub> =22V, V <sub>GS</sub> =0V	-	-	10	μA
Static drain-source on-state resistance	RON_L	ID=1.2A, V <sub>GS</sub> =4.5V	-	22	55	mΩ
Source-drain diode forward voltage	V <sub>SD_L</sub>	IS=1.2A, V <sub>GS</sub> =0V	-	-	1.5	V
Control IC						
Supply current (f=100kHz)	I <sub>cc_L</sub>	V <sub>CC</sub> =4.5V to 20V	-	3.3	3.9	mA
Supply current (f=300kHz)	I <sub>cc_H</sub>	V <sub>CC</sub> =4.5V to 20V	-	5	5.9	mA
Supply current at remote OFF	I <sub>cc_off</sub>	V <sub>CC</sub> =4.5V to 20V	-	25	50	μA
Undervoltage lockout threshold (start)	V <sub>cc_start</sub>	-	4.1	4.3	4.5	V
Undervoltage lockout hysteresis	V <sub>cc_hys</sub>	-	0.4	0.5	0.6	V
Bootstrap voltage	V <sub>boot</sub>	V <sub>CC</sub> =5V	3.84	4	4.16	V
Line regulation	V <sub>B-IN</sub>	V <sub>CC</sub> =4.5V to 20V	-	-	30	mV
Load regulation	V <sub>B-L</sub>	V <sub>CC</sub> =5V	-	-	30	mV
Reference voltage	V <sub>ref</sub>	V <sub>CC</sub> =5V	3.84	4	4.16	V
Line regulation	REG-IN	V <sub>CC</sub> =4.5V to 20V	-	-	30	mV
Load regulation	REG-L	V <sub>CC</sub> =5V	-	-	30	mV
Initial frequency1 accuracy	fosc_1	V <sub>CC</sub> =5V	85	100	115	kHz
Initial frequency2 accuracy	fosc_2	V <sub>CC</sub> =5V	255	300	345	kHz
Maximum duty cycle	Dty_max	V <sub>CC</sub> =5V	85	90	95	%
Remote control ON input voltage	V <sub>R/C_ON</sub>	V <sub>CC</sub> =5V	-0.2	-	0.7	V
Remote control OFF input voltage	V <sub>R/C_OFF</sub>	V <sub>CC</sub> =5V	2	-	V <sub>CC</sub>	V
Remote control source current	I <sub>RC</sub>	V <sub>CC</sub> =5V	-	2	10	μA
Soft-start source current	I <sub>s/s</sub>	V <sub>CC</sub> =5V	-3	-2.5	-2	μA
Error amplifier reference voltage	V <sub>amp</sub>	V <sub>CC</sub> =5V	0.784	0.8	0.816	V
Threshold of over current limit at Ron detection	I <sub>th_OCL1</sub>	V <sub>CC</sub> =5V	3	-	-	A
Timer current	I <sub>timer</sub>	V <sub>CC</sub> =5V	-40	-33	-26	μA
Soft-start input voltage before timer starting	V <sub>s/s</sub>	V <sub>CC</sub> =5V	2.75	2.9	3.05	V
Threshold of latch	V <sub>th_lat</sub>	V <sub>CC</sub> =5V	3.3	3.45	3.6	V
Output voltage accuracy (Vo=0.8V)	V <sub>F/B_1</sub>	V <sub>CC</sub> =4.5V to 20V	0.784	0.800	0.816	V
Thermal shutdown temperature	T <sub>TSD</sub>	-	-	140	-	°C