Ultra-low Resistance with Quick Rising Time Load Switch

General Description

The EM5201D is a small, ultra-low RON, single channel load switch with controlled turn on. The device contains an N-channel MOSFET that can operate over an input voltage range of 0.6V to 5V and can support a maximum continuous current of 8A.

The combination of ultra-low RON and high current capability of the device makes it ideal for driving processor rails with very tight voltage dropout tolerances.

The EM5201D is available in a small, space-saving DFN3.0X3.0-08 with integrated thermal pad allowing for high power dissipation.

Ordering Information

Part Number	Package	Ron
EM5201DV	DFN3.0X3.0-08	6.5m

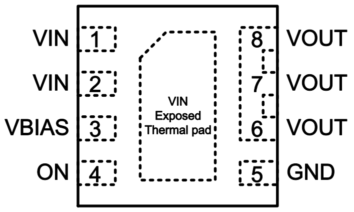
Features

- VBIAS Voltage Range : 3V to 5.5V
- VIN Voltage Range : 0.8V to 5.5V
- Low Ron Internal NMOS: Ron=6.5mohm for 8A at Vin=1.05V(VBIAS=3V to 5.5V)
- 8A Continuous Current
- Low Quiescent Current (20uA at VBIAS=5V)
- Low Shutdown Current (1uA at VBIAS=5V)
- Quick Output Discharge
- DFN3.0X3.0-08 with Thermal PAD

Applications

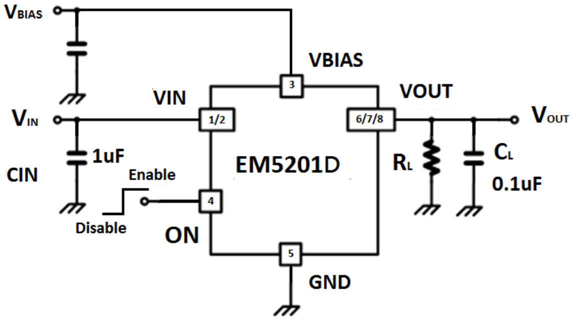
- Notebook & Netbook & MB
- Desktops
- Tablet PC

Pin Configuration



TOP VIEW
DFN3.0X3.0-08

Typical Application Circuit

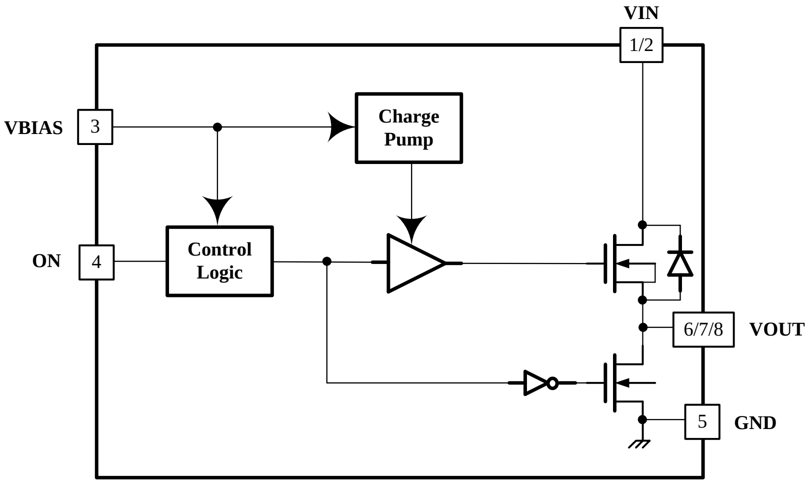


CIN>10＊CL is recommended.

Pin Assignment

Pin Name	Pin No.	Pin Function
VIN	1,2 Exposed Pad	Switch input. Place ceramic bypass capacitor(s) between this terminal and GND.
VBIAS	3	Bias voltage. Power supply to the device.
ON	4	Chip Enable Input
GND	5	GND
VOUT	6,7,8	Output Voltage.

Function Block Diagram



Absolute Maximum Ratings (Note1)

- V_{IN} -- 0.8V to 5.5 V
- Other Pins--5.5V
- Power Dissipation, P_D @ $T_A = 25°C$, DFN3.0X3.0-08 -- 2.08 W
- Package Thermal Resistance, θ_{JA}, DFN3.0X3.0-08 (Note 2)---60°C/W
- Junction Temperature-- 150°C
- Lead Temperature (Soldering, 10 sec.)-- 260°C
- Storage Temperature -- –65°C to 150°C
- ESD susceptibility (Note3)
  - HBM (Human Body Mode)--- 2KV
  - MM (Machine Mode)--- 200V

Recommended Operating Conditions (Note4)

- Supply Input Voltage, V_{IN} -- 0.8V to VBIAS-2V
- Bias Input Voltage, VBIAS -- 3V to 5.5V
- Junction Temperature -- –40°C to 125°C
- Ambient Temperature --- -40°C to 85°C

Electrical Characteristics

V_{BIAS}= V_{ON} =3V to 5.5V, VIN=VBIAS-2V, T_A=25℃, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Power Supplies and Currents Section						
Input supply voltage	V_{IN}	V_{ON} = 5V	0.8		V_{BIAS}-2	V
V_{BIAS} Supply Voltage	V_{BIAS}		3		5.5	V
Maximum continuous current	I_D	V_{ON} = 5V		8		A
V_{BIAS} quiescent current	$I_{Q-BAIAS}$	I_{OUT} = 0, V_{IN} = 3V		20		uA
V_{BIAS} shutdown current	$I_{SD-BAIAS}$	V_{ON} = 0V；V_{OUT} = 0V		1		uA
V_{IN} shutdown current	I_{SD-IN}	V_{ON} = 0V；V_{OUT} = 0V		1		uA
High-level input voltage	v_{ON-H}		1.2			V
Low-level input voltage	v_{ON-L}				0.6	V
ON pin leakage current	I_{ON}	V_{ON} = 5.5V		1		uA
Resistance Section						
ON-state Resistance	R_{ON}	Io=1A, VBIAS = 3V to 5.5V VIN=VBIAS-1.5V		6.5	7.8	mΩ
Output Pull-down Resistance	R_{PD}	V_{IN} = 5.0V, V_{ON} = 0V, I_{OUT} = 5mA		250	350	Ω

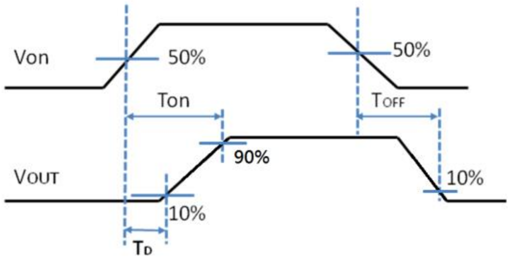
Note 1. Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

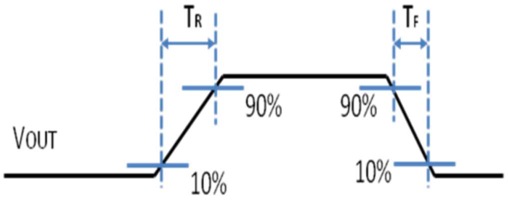
Note 2. θ_{JA} is measured in the natural convection at T_A=25°C on a low effective thermal conductivity test board (Single layout, 1S) of JEDEC 51-3 thermal measurement standard.

Note 3. Devices are ESD sensitive. Handling precaution is recommended.

Note 4. The device is not guaranteed to function outside its operating conditions.

Switching Timing Diagrams



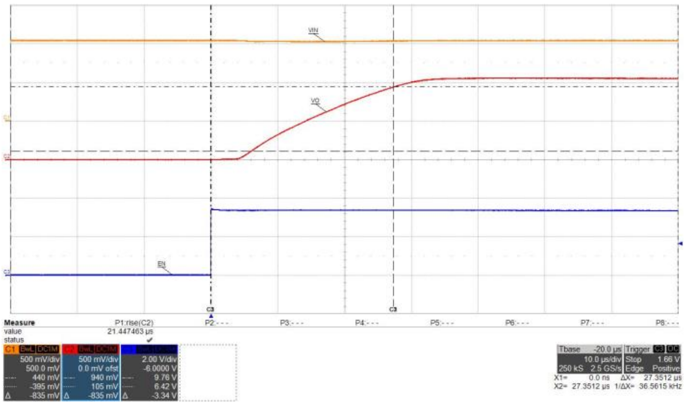


Switching characteristics

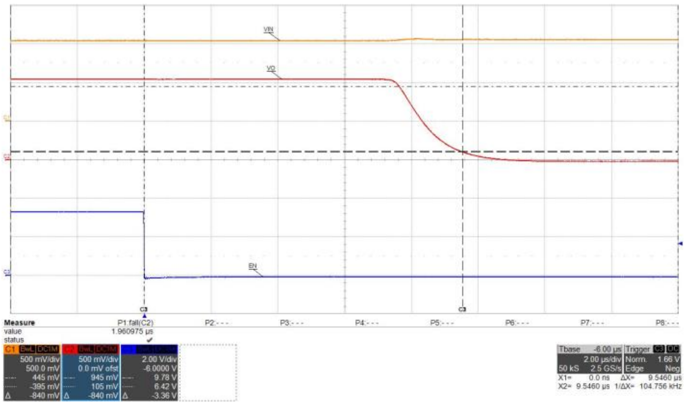
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
V_{IN}=1.05V；V_{ON}=V_{BIAS}=5V； T_A=25℃						
Turn-on time	T_{ON}	R_L=10Ω；C_L=0.1uF		25	40	uS
Turn-off time	T_{OFF}			9		uS
Vout Rising time	T_R		11	20	30	uS
Vout falling time	T_F			2		uS
ON Delay time	T_D			7		uS

Typical Operating Characteristics

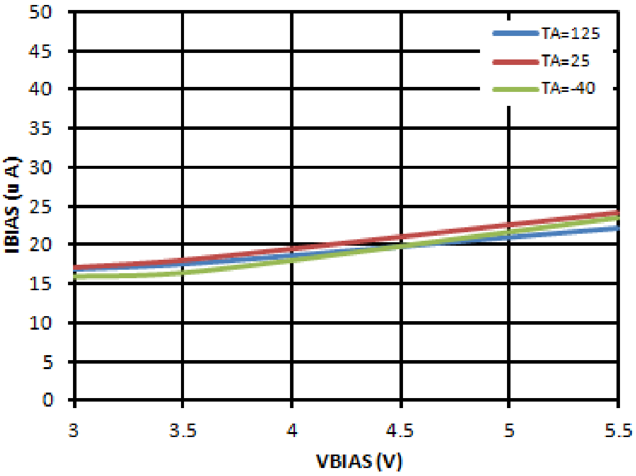
Turn on from EN
VIN=1.05V, VBIAS=5V, RL=10Ohm
CH1: VIN, CH2:Vo, CH3:EN



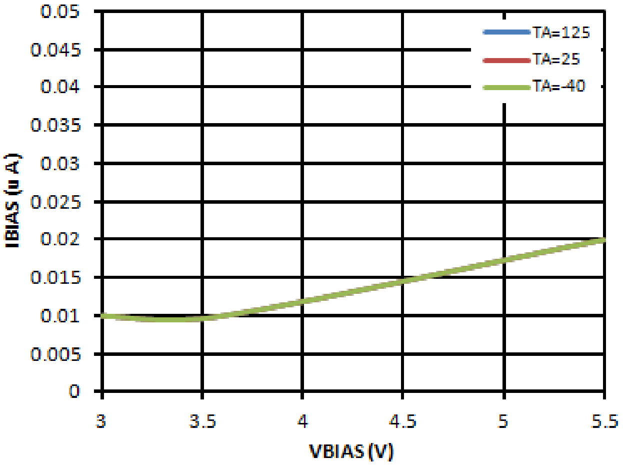
Turn off from EN
VIN=1.05V, VBIAS=5V, RL=10Ohm
CH1: VIN, CH2:Vo, CH3:EN



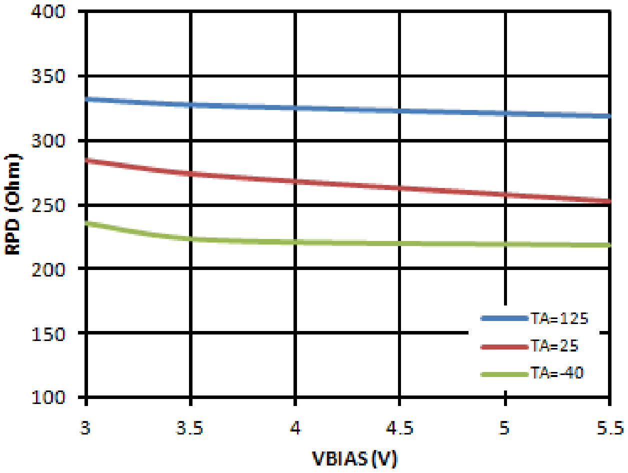
BIAS Supply Current VS. Temperature
VIN=1V, VBIAS=3V to 5.5V



BIAS Shunt down Current VS. Temperature
VIN=1V, VBIAS=3V to 5.5V



RPD Performance VS. Temperature
VIN=1V, VBIAS=3V to 5.5V



Functional Description

VIN and VBIAS Voltage Range

The MOSFET gate voltage in the EM5201D is driven by an internal charge pump. The output voltage of the charge pump is dependent on the voltage on VBIAS pin. Care must be taken to ensure a sufficient VBIAS is used to keep the desired output rising time when given the anticipated input voltage. For quickly output rising requirement that may be under 60usec, make sure VIN ≤ (VBIAS – 2V) is highly recommended. For example, in order to have VIN=3V, VBIAS must be 5V. The Ron of EM5201D will still be keep constant if VIN > (VBIAS – 2V) but it will exhibit slowly output rising time.

ON/OFF Control

EM5201D is enabled if the voltage of the Von pin is greater than logic high level and the VBIAS voltage has an adequate applied. If the voltage of the EN pin is less than logic low level, the device will be disabled.

Input Capacitor

The EM5201D do not require an input capacitor. In order to limit the voltage drop on the input supply caused by transient inrush current, an input bypass capacitor is recommended. A 1uF ceramic capacitor should be placed as closed as possible to the VIN pin. Higher values capacitor can help to further reduce the voltage drop.

Output Capacitor

Due to the integrated body diode in the NMOS switch, the CIN greater than Co is highly recommended. A CIN to Co ratio of 10 to 1 is recommended for minimizing VIN drop caused by inrush during startup. It also helps to prevent parasitic inductance forces Vo below GND when switching off.

Thermal and Layout Consideration

EM5201D is designed to maintain a constant output load current. Due to physical limitations of the chip layout and assembly of the device the continuous current is 8A. All copper traces for the VIN and Vo pin should be widely and short to carry the maximum continuous current and obtain the best effect. The input and output capacitor should be close to the device as possible to minimize the parasitic trace inductances and prevents the voltage drop when load transient.

The maximum IC junction temperature should be restricted to 125 ℃ under normal operating conditions. To calculate the maximum allowable dissipation, $P_{D(MAX)}$ for a given output current and ambient temperature, used the following equation:

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_A}{\theta_{JA}}$$

Where:

$P_{D(MAX)}$=Maximum allowable power dissipation

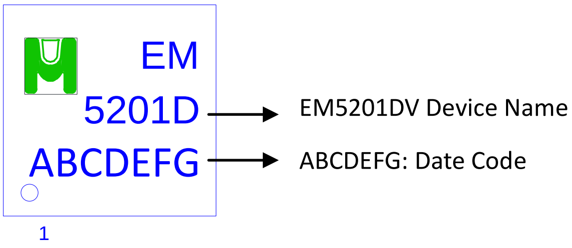
$T_{J(MAX)}$=Maximum allowable junction temperature (125 ℃ for the EM5201D)

T_A=Ambient Temperature of the device

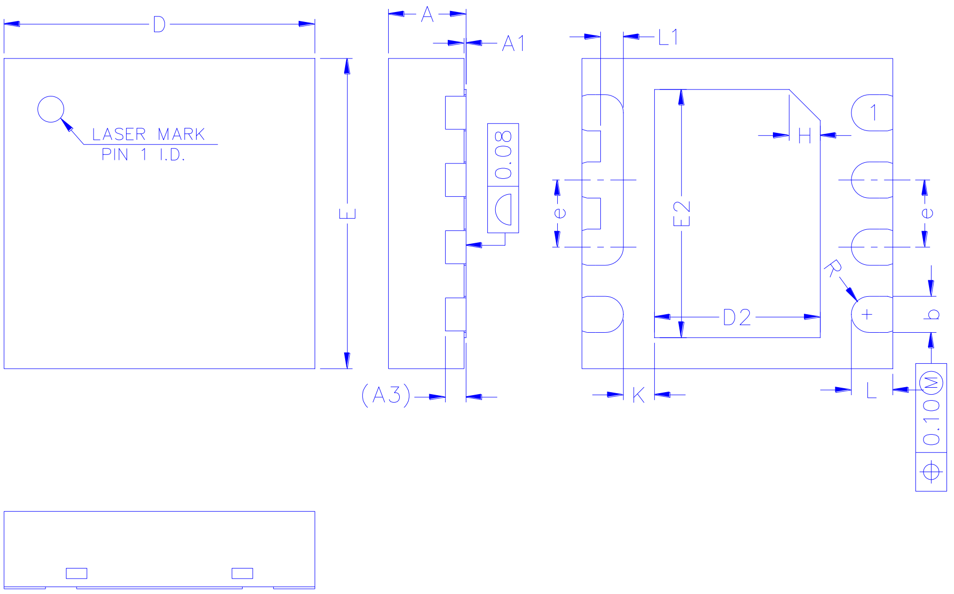
Θ_{JA}= Junction to air thermal impedance. This parameter is also dependent upon PCB layput.

Ordering & Marking Information

Device Name: EM5201DV for DFN3.0X3.0-08



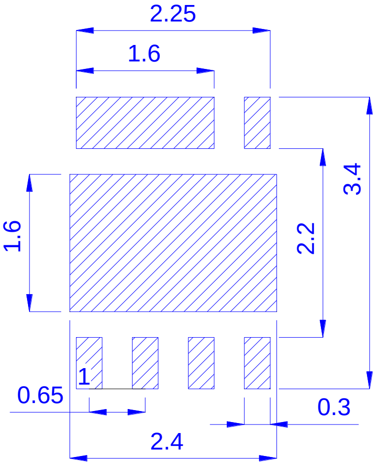
Outline Drawing



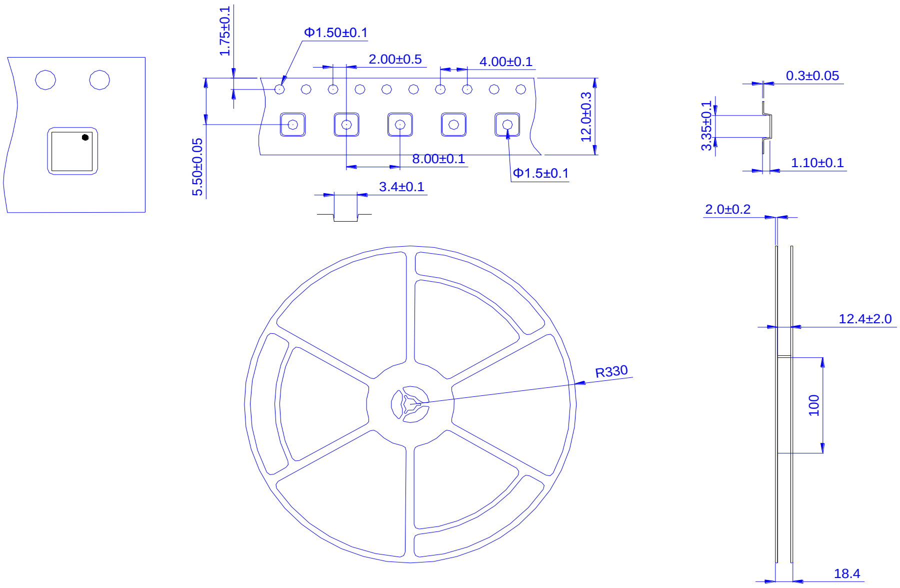
Dimension in mm

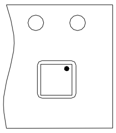
Dimension	A	A1	A3	b	D	E	D2	E2	e	H	K	L	L1	R
Min.	0.7	0.00	0.2 REF	0.3	2.9	2.9	1.5	2.3	0.55	0.3REF	0.2	0.3	0.12	0.16
Typ.	0.75	0.02		0.35	3.0	3.0	1.6	2.4	0.65		0.3	0.4	0.22	
Max.	0.8	0.05		0.4	3.1	3.1	1.7	2.5	0.75		0.4	0.5	0.32	

Recommended minimum pads



Tape&Reel Information: 5000pcs/Reel



產品別	DFN3.0X3.0-08
Reel 尺寸	13”
編帶方式	
前空格	50
後空格	50
裝箱數	
滿捲數量	5K
捲/內盒比	1 : 1
內盒滿箱數	5K
內/外箱比	10 : 1
外箱滿箱數	50K
包裝材料規格	
導電袋(mm)	500 * 375 * 0.1
保護帶(mm)	108 ± 1* 1.6 ± 0.05 * 0.1 ± 0.01
內盒尺寸(mm)	351 * 339 * 31
外箱尺寸(mm)	384 * 360 * 360