杰力科技股份有限公司
Excelliance MOS Corporation

EM5207

Fast Turn on Dual Load Switch

General Description

The EM5207 is a small, ultra-low RON, dual channel load switch with controlled turn on. The device contains two N-channel MOSFETs that can operate over an input voltage range of 0.8V to 2.5V and can support a maximum continuous current of 6A per channel. Each switch is independently controlled by an on/off input (ON1 and ON2), which is capable of interfacing directly with low-voltage control signals. In EM5207, a 220-Ω on-chip load resistor is added for quick output discharge when switch is turned off. The EM5207 is available in a small, space-saving DFN3X2 package with integrated thermal pad allowing for high power dissipation.

Ordering Information

Part Number	Package	Remark
EM5207VF	DFN3X2-14L	

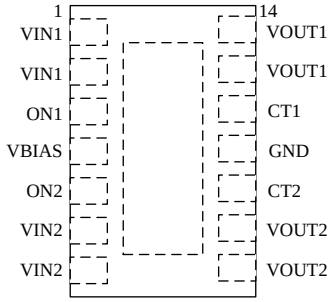
Features

- Integrated dual channel load switch
- Input voltage range : 0.8V to 2.5V
- Ultra- low R_{ON} resistance 20mΩ per channel
- Fast Turn-ON≦65uS at VIN=1.05V, VBIAS=5V
- 6A maximum continuous switch current per channel
- Low quiescent current 60uA (CH1 ON or CH2 ON)
- Adjustable output rising time
- Quick Output Discharge (QOD)
- DFN3X2 14-pin package with Thermal Pad
- Bias voltage supports : 4.5V and 5.5V
- Over Temperature Protection

Applications

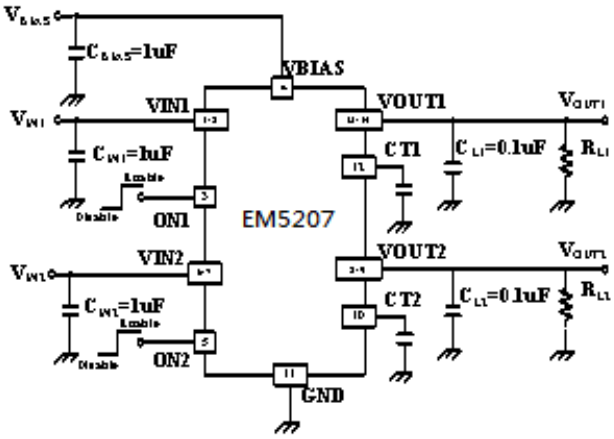
- Ultrabook
- Notebooks & Netbooks
- Tablet PC
- Consumer electronics
- Set-top boxes
- Telecom systems
- Solid State Drives (SSD)

Pin Configuration



DFN3X2 14L
TOP VIEW

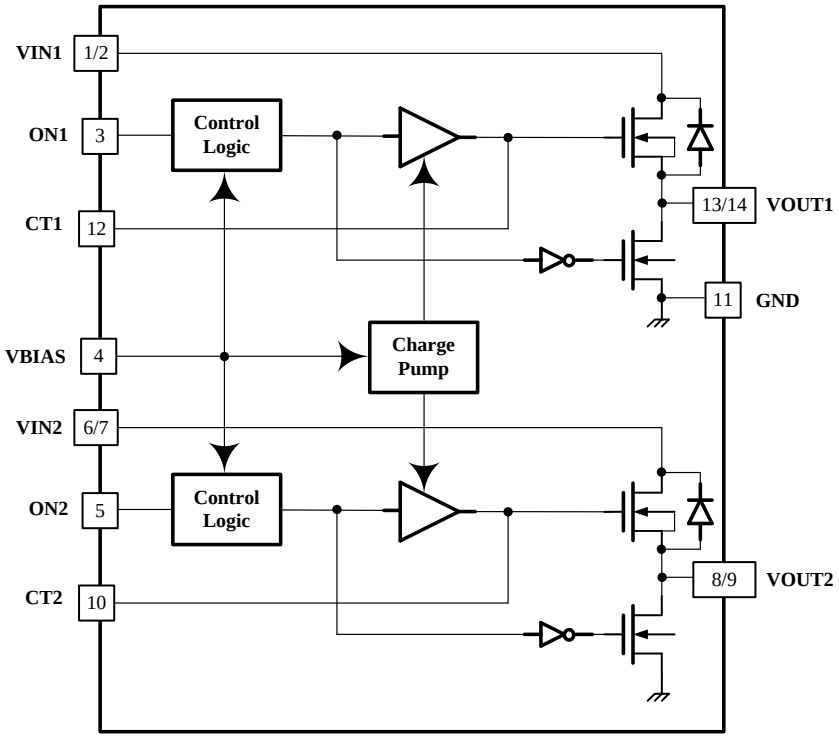
Typical Application Circuit



Pin Assignment

Pin Name	Pin No.	Pin Function
VIN1	1 / 2	Switch #1 input. Bypass this input with a ceramic capacitor to GND.
ON1	3	Active high switch #1 control input. Do not leave floating.
VBIAS	4	Bias voltage. Power supply to the device. Recommended voltage range for this pin is 2.5V to 5.5V.
ON2	5	Active high switch #2 control input. Do not leave floating.
VIN2	6 / 7	Switch #2 input. Bypass this input with a ceramic capacitor to GND.
VOUT2	8 / 9	Switch #2 output.
CT2	10	Switch #2 slew rate control. Can be left floating.
GND	11	Ground
CT1	12	Switch #1 slew rate control. Can be left floating.
VOUT1	13 / 14	Switch #1 output.
Thermal PAD	15	Thermal pad (exposed center pad) to alleviate thermal stress. Tie to GND.

Function Block Diagram



Absolute Maximum Ratings (Note1)

- $V_{IN1,2}$ ---------- -0.3V to +6.0V
- $V_{OUT1,2}$ ---------- -0.3V to +6.0V
- V_{BIAS} ---------- -0.3V to +6.0V
- $V_{ON1,2}$ ---------- -0.3V to +6.0V
- Maximum Continuous Switch Current Per Channel, I_{MAX} ---------- 6A
- Power Dissipation, P_D @ T_A = 25°C, DFN3X2 ---------- 1.53W
- Package Thermal Resistance, Θ_{JA}, DFN3X2 (Note 2)---------- 65°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
  CDM (Charged-Device Model) ---------- 1KV

Recommended Operating Conditions (Note4)

- Bias Voltage, V_{BIAS} ---------- +4.5V to +5.5V
- Supply Input Voltage, $V_{IN1,2}$ ---------- +0.8V to +2.5V
- ON Voltage $V_{ON1,2}$ High-level input voltage ---------- +1.2V to +5.5V
  $V_{ON1,2}$ Low-level input voltage ---------- +0V to +0.6V
- Junction Temperature ---------- –40°C to 125°C
- Ambient Temperature ---------- –40°C to 85°C
- Input capacitor $C_{IN1,2}$ ---------- ≧0.1uF

Electrical Characteristics

V_{BIAS}= 5V, T_A=25℃, unless otherwise specified

Parameter	Symbol	Test Conditions		Min	Typ	Max	Units
Power Supplies and Currents Section							
VBIAS Quiescent current	$I_{BIAS-ON}$	V_{IN1} or V_{IN2} =1.05V, V_{BIAS} = 5V No Load			60		uA
VBIAS Shutdown current	$I_{BIAS-OFF}$	$V_{OUT1,2}$ = 0V, $V_{ON1,2}$ = 0V $V_{IN1,2}$ = V_{BIAS} = 5V				2	uA
$V_{IN1,2}$ Off state supply current (per channel)	$I_{VIN-OFF}$	$V_{OUT1,2}$ = 0V, $V_{ON1,2}$ = 0V	$V_{IN1,2}$ = 5.0V			2	uA
ON pin leakage current	I_{ON}	V_{ON} = 5.5V				1	uA
High Level Input Voltage of ON pin	V_{ONH}			1.2			V
Low Level Input Voltage of ON pin	V_{ONL}					0.6	V
Resistance Section							
ON-state Resistance		I_{OUT}=200mA, V_{BAIS}=5.0V	V_{IN} = 2.5V		20	25	mΩ
			V_{IN} = 0.8V		20	25	
Output Pull-down Resistance	R_{PD}	V_{IN} = 5.0V, V_{ON} = 0V, I_{OUT} = 15mA			220	300	Ω
Switch ON/OFF Timing							
Turn-on Delay Time	T_D	R_L=10Ω ; C_L=0.1uF; CT=Open; V_{IN}=1.05V, V_{BIAS}=5V			20	30	uS
Turn-on Rising Time	T_R			11	20	30	uS
Turn-off Delay Time	T_{OFF}				2	10	uS
Turn-off Falling Time	T_F				2	10	uS
Turn-on time	T_{ON}				30		uS

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.

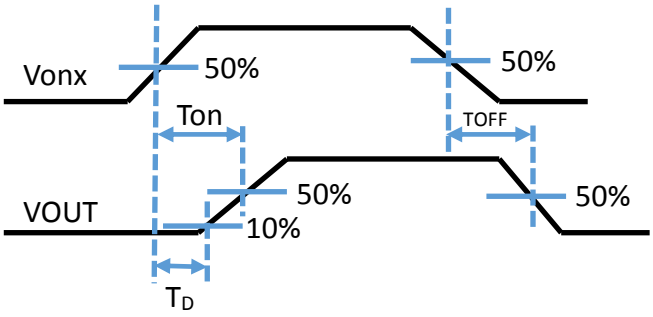
Note 2. θ_{JA} is measured in the natural convection at T_A=25°C on a 4-layers high effective thermal conductivity test board with minimum copper area of JEDEC 51-7 thermal measurement standard.

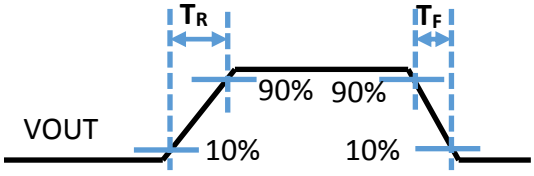
Note 3. Devices are ESD sensitive. Handling precaution is recommended.

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

Note 5. EMC will review datasheet by quarter, and update new version.

Switch ON/OFF Timing Diagrams





Output Rising Time Control

The table as below contains rise time values measured on a typical device. Rise time shown below are only valid for the power-on sequence where VIN and VBIAS are already in steady state condition, and the VON is high. Or use below formula to determine rise times

Tr = (200 x CT + 19) x VIN x 0.8

Where,

CT = the capacitance on the CT pin (in nF)

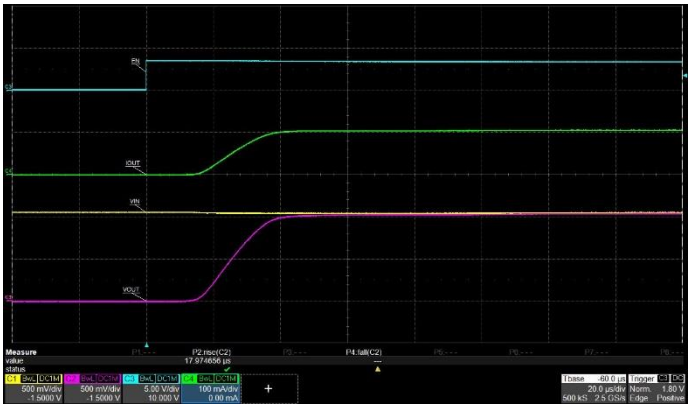
Rise Time (us)		10%-90% Vo Rising Time, V_{ON}=V_{BIAS}=5V,R_L=10Ω, C_{IN}=1uF, C_L=0.1uF, T_A=25℃							
	CT (nF)	0.8V	1.1V	1.2V	1.5V	1.8V	2.5V	3.3V	5.0V
EM5207VF	0	14.9	17.8	20.1	24.2	27.9	36.6	45.8	65.9
	0.22	40	51	58	72	87	122	164	257
	0.47	67	87	98	124	150	215	290	462
	1	133	174	200	253	311	449	612	984
	2.2	266	350	403	514	630	916	1257	2035
	4.7	614	811	927	1189	1471	2143	2933	4779
	10	1120	1477	1699	2178	2671	3891	5352	8707

Table1

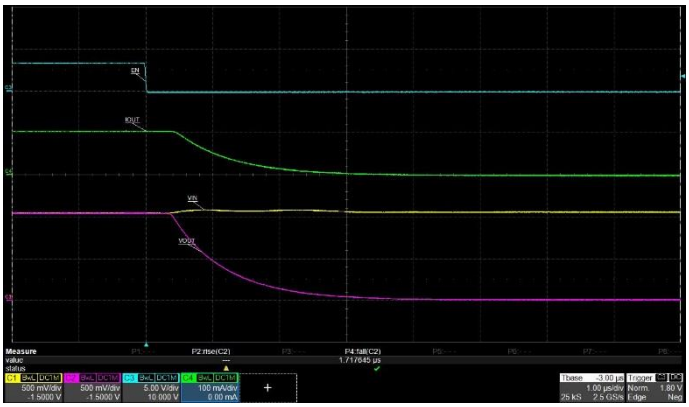
Typical Operating Characteristics

V_{BIAS} = 5V ； $V_{IN1,2}$ = 1.05V ； C_{IN} = 1uF ； C_L = 0.1uF ； C_T = OPEN ； R_L = 10Ω ； T_A=25℃

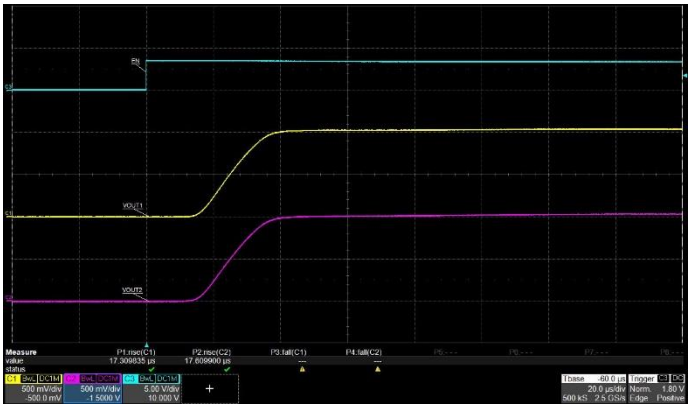
Turn-On by V_{ON1}
(Single Channel)
CH1:VIN CH2: VOUT CH3:ON1 CH4:IOUT



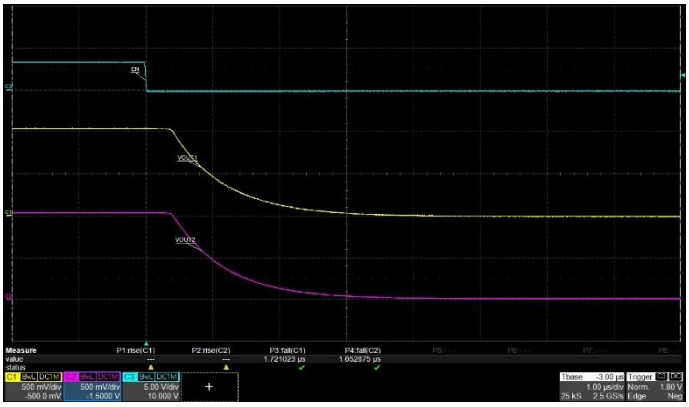
Turn-Off by V_{ON1}
(Single Channel)
CH1:VIN CH2: VOUT CH3:ON1 CH4:IOUT



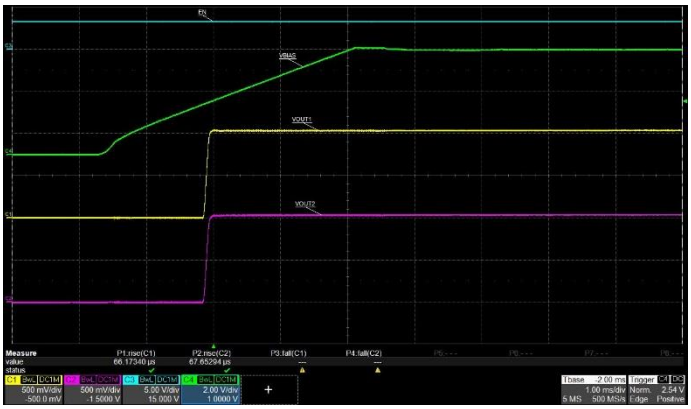
Turn-On by V_{ON1} & V_{ON2}
(Both Channel)
CH1:VOUT1 CH2: VOUT2 CH3:ON1 / ON2 CH4:--



Turn-Off by V_{ON1} & V_{ON2}
(Both Channel)
CH1:VOUT1 CH2: VOUT2 CH3:ON1 / ON2 CH4:--



Turn-On from V_{BIAS}
(Both Channel)
CH1:VOUT1 CH2: VOUT2 CH3:ON1 / ON2
CH4:VBIAS



Functional Description

On-Resistance

The MOSFET gate voltage in the EM5207 is driven by an internal charge pump. The output voltage of the charge pump is dependent on the voltage on V_{BIAS} pin. Care must be taken to ensure a sufficient V_{BIAS} is used to keep the desired R_{ON} when given the anticipated input voltage.

ON/OFF Control

EM5207 is enabled if the voltage of the Von pin is greater than logic high level and the V_{BIAS} voltage has an adequate applied. If the voltage of the ON pin is less than logic low level, the device will be disabled.

Input Capacitor

The EM5207 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 V_{IN} 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 C_{IN} greater than C_L is highly recommended. A C_{IN} to C_L ratio of 10 to 1 is recommended for minimizing V_{IN} drop caused by inrush during startup. It also helps to prevent parasitic inductance forces V_{OUT} below GND when switching off. Output capacitor has minimal affect on device's turn on slew rate time.

Slew Rate Control

The slew rate of each channel output voltage can be controlled by the capacitor on the CT pin to GND which provides soft start functionality. This limits the inrush current caused by capacitor charging.

Thermal and Layout Consideration

EM5207 is designed to maintain a constant output load current. Due to physical limitations of the chip layout and assembly of the device the maximum switch current is 6A for each channel, the figure below show an example of typical PCB layout. All copper traces for the V_{IN} and V_{OUT} pin should be widely and short to carry the maximum continuous current and obtain the best effect. The input and output capacitor (option) 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:

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

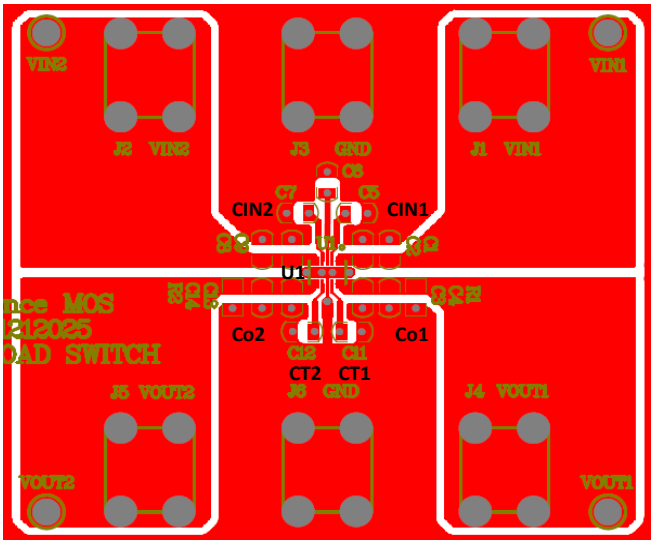
Where:

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

$T_{J(MAX)}$=Maximum allowable junction temperature (125 ℃ for the EM5207)

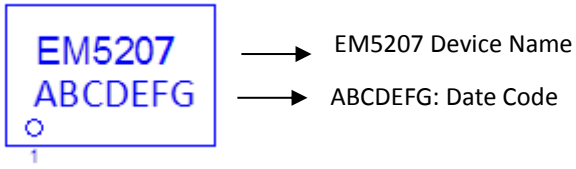
T_A=Ambient Temperature of the device

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

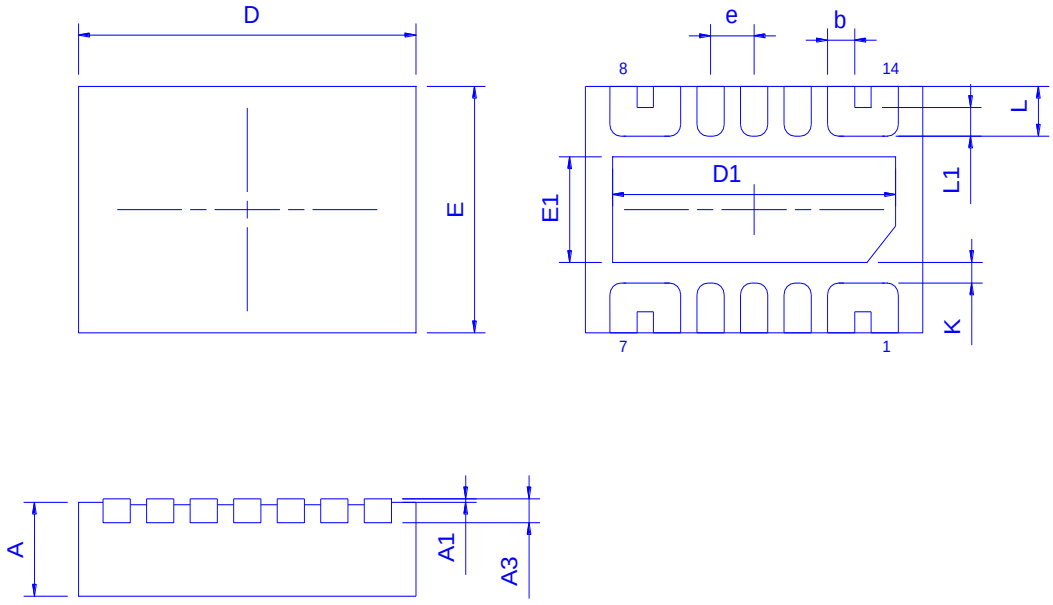


Marking Information

Device Name: EM5207VF for DFN3X2-14L



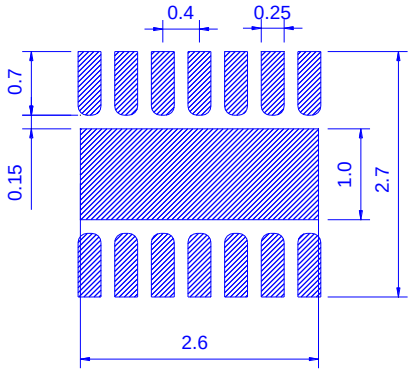
Outline Drawing



Dimension in mm

Dimension	A	A1	A3	b	D	E	D1	E1	e	L	K
Min.	0.7	0.00		0.13	2.9	1.9	2.4	0.7	0.3	0.200	0.15
Typ.			0.203		3.0	2.0					
Max.	0.8	0.05		0.25	3.1	2.1	2.6	1.0	0.5	0.426	0.35

Recommended minimum pads



Tape & Reel Information：3000pcs/Reel (Dimension in millimeter)