



5.5V, 10A, Ultra Low Ron Single Load Switch

General Description

The EM5202D is a small, ultra-low R_{ON} , single channel load switch with controlled turn on. The device contains an N-channel MOSFET that can operate over an input voltage range of 0.8V to 5V and can support a maximum continuous current of 10A.

The combination of ultra-low R_{ON} and high current capability of the device makes it ideal for driving processor rails with very tight voltage dropout tolerances. The EM5202D is available in a small, space-saving DFN 3mm x 3mm 8- with integrated thermal pad allowing for high power dissipation.

Ordering Information

Part Number	Package	Remark
EM5202DV	DFN3X3-8L	

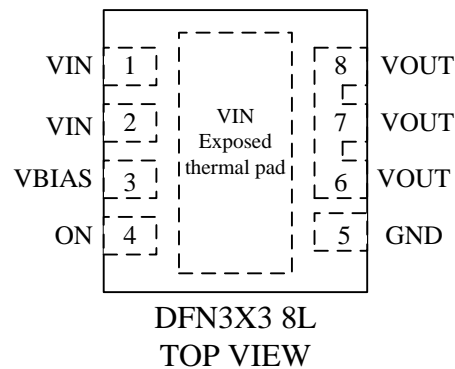
Features

- VBIAS Voltage Range : 2.5V to 5.5V
- VIN Voltage Range : 0.8V to 5.5V
- Low Ron Internal NMOS: $R_{on}=3.5m\Omega$ at $V_{in}=1.05V(V_{BIAS}=2.5V \text{ to } 5.5V)$
- 10A Maximum Continuous Switch Current
- Low Quiescent Current (20uA at $V_{BIAS}=5V$)
- Low Shutdown Current (1uA at $V_{BIAS}=5V$)
- Quick Output Discharge
- DFN3X3 8L with Thermal PAD

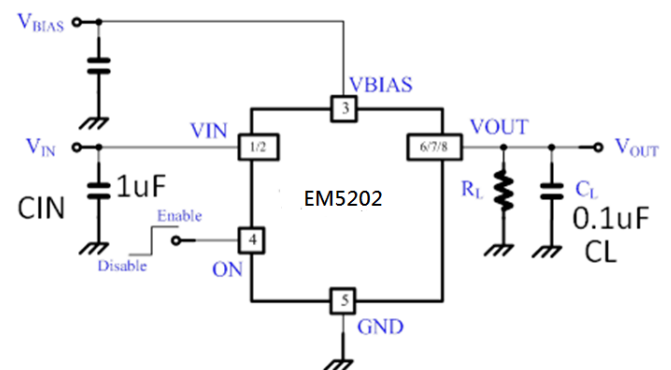
Applications

- Notebook & Netbook & MB
- Desktops
- Tablet PC

Pin Configuration



Typical Application Circuit

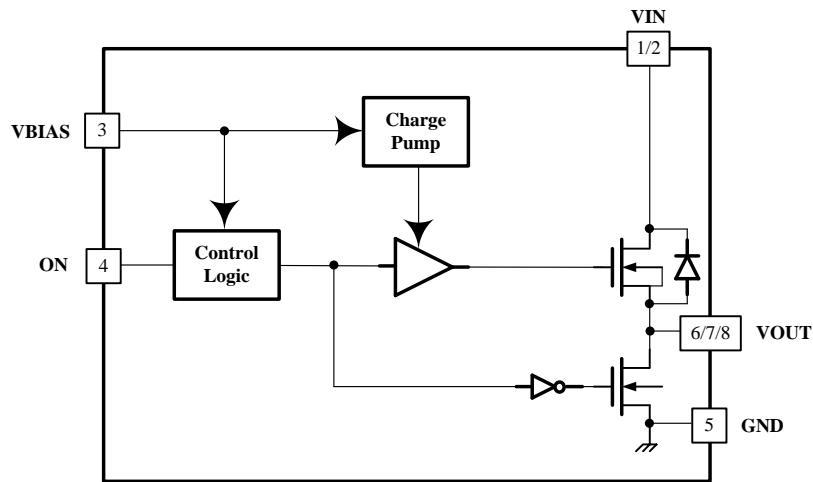


* $C_{IN} > 10 C_L$ is recommended.

Pin Assignment

Pin Name	Pin No.	Pin Function
VIN	1,2	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 @ $T_A = 25^\circ C$, DFN3X3-8L ----- 1.67 W
- Package Thermal Resistance, θ_{JA} , DFN3X3-8 (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
 - CDM (Charge Device Mode)----- 1KV

Recommended Operating Conditions (Note4)

- Supply Input Voltage, V_{IN} ----- 0.8V to VBIAS
- Bias Input Voltage, VBIAS ----- 2.5V to 5.5V
- Junction Temperature ----- -40°C to 125°C
- Ambient Temperature ----- 0°C to 85°C

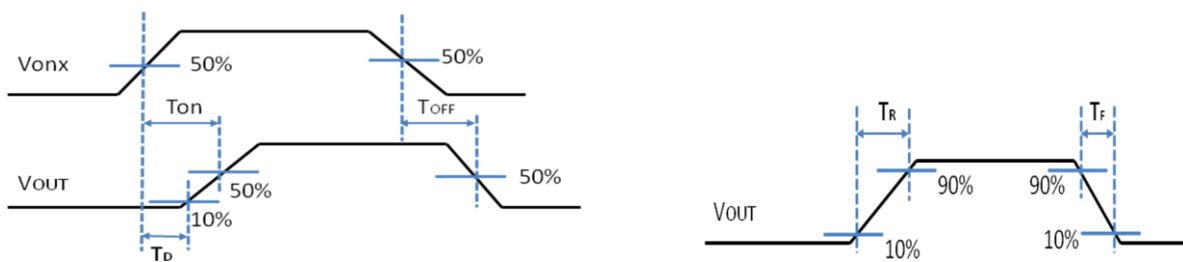
Electrical Characteristics

$V_{BIAS} = V_{ON} = 2.5V$ to $5.5V$, $V_{IN} \leq V_{BIAS}$, $T_A = 25^\circ C$, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Power Supplies and Currents Section						
V_{BIAS} Supply Voltage	V_{BIAS}		2.5		5.5	V
V_{BIAS} quiescent current	I_{Q-BIAS}	$I_{OUT} = 0, V_{IN} = 3V$		20		μA
V_{BIAS} shutdown current	$I_{SD-BIAS}$	$V_{ON} = 0V ; V_{OUT} = 0V$		1		μA
V_{IN} shutdown current	I_{SD-IN}	$V_{ON} = 0V ; V_{OUT} = 0V$		1		μA
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		μA
Resistance Section						
ON-state Resistance	R_{ON}	$I_o = 1A,$ $V_{BIAS} = 3V$ to $5.5V$ $V_{IN} = V_{BIAS}$		3.5	5.5	$m\Omega$
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 $T_A = 25^\circ C$ 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
$V_{IN}=1.05V$; $V_{ON}=V_{BIAS}=5V$; $T_A=25^{\circ}C$						
Turn-on time	T_{ON}	$R_L=10\Omega$; $C_L=0.1\mu F$		900		μS
Turn-off time	T_{OFF}			3		μS
Vout Rising time	T_R			600		μS
Vout falling time	T_F			2		μS
ON Delay time	T_D			650		μS
$V_{IN}=3.3V$; $V_{ON}=V_{BIAS}=5V$; $T_A=25^{\circ}C$						
Turn-on time	T_{ON}	$R_L=10\Omega$; $C_L=0.1\mu F$		1100		μS
Turn-off time	T_{OFF}			5		μS
Vout Rising time	T_R			1400		μS
Vout falling time	T_F			3		μS
ON Delay time	T_D			650		μS
$V_{IN}=0.8V$; $V_{ON}=V_{BIAS}=5V$; $T_A=25^{\circ}C$						
Turn-on time	T_{ON}	$R_L=10\Omega$; $C_L=0.1\mu F$		900		μS
Turn-off time	T_{OFF}			5		μS
Vout Rising time	T_R			500		μS
Vout falling time	T_F			3		μS
ON Delay time	T_D			650		μS
$V_{IN}=2.5V$; $V_{ON}=V_{BIAS}=2.5V$; $T_A=25^{\circ}C$						
Turn-on time	T_{ON}	$R_L=10\Omega$; $C_L=0.1\mu F$		1900		μS
Turn-off time	T_{OFF}			3		μS
Vout Rising time	T_R			1350		μS
Vout falling time	T_F			3		μS
ON Delay time	T_D			1330		μS
$V_{IN}=1.8V$; $V_{ON}=V_{BIAS}=2.5V$; $T_A=25^{\circ}C$						
Turn-on time	T_{ON}	$R_L=10\Omega$; $C_L=0.1\mu F$		1850		μS
Turn-off time	T_{OFF}			3		μS
Vout Rising time	T_R			1100		μS
Vout falling time	T_F			3		μS
ON Delay time	T_D			1380		μS
$V_{IN}=0.8V$; $V_{ON}=V_{BIAS}=2.5V$; $T_A=25^{\circ}C$						
Turn-on time	T_{ON}	$R_L=10\Omega$; $C_L=0.1\mu F$		1750		μS
Turn-off time	T_{OFF}			3		μS
Vout Rising time	T_R			750		μS
Vout falling time	T_F			3		μS
ON Delay time	T_D			1380		μS

Typical Operating Characteristics

CIN=1 μ , Co=0.1 μ , CL=10 Ω , VBIAS=2.5V~5V.

Von to Vo Ready, VIN=5V, VBIAS=5V.

CH1:VON, CH2:VO, CH3:IIN

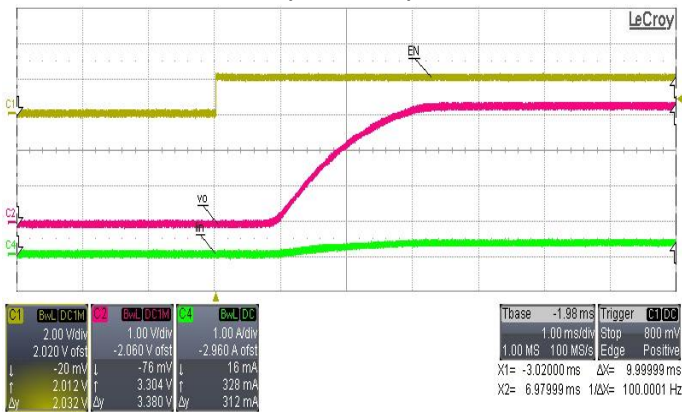


Turn off TOFF from VON, VIN=5V, VBIAS=5V
CH1:VON, CH2:VO, CH3:IIN



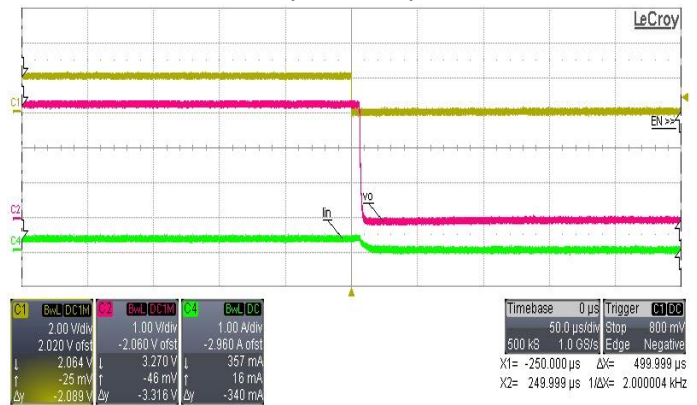
Von to Vo Ready, VIN=3.3V, VBIAS=5V.

CH1:VON, CH2:VO, CH3:IIN



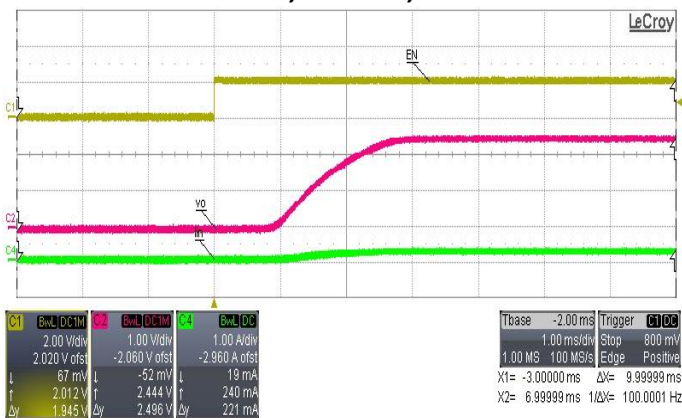
Turn off TOFF from VON, VIN=3.3V, VBIAS=5V

CH1:VON, CH2:VO, CH3:IIN



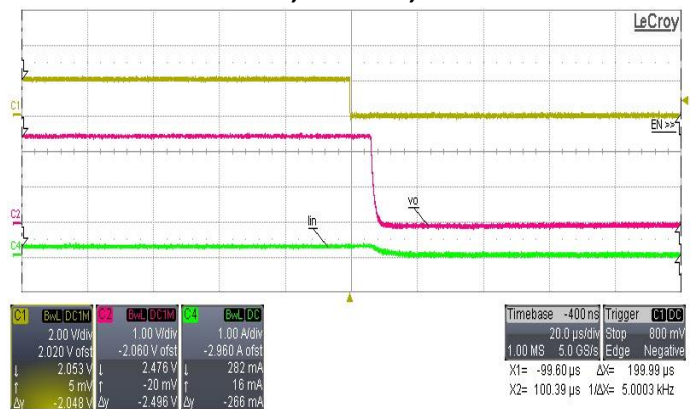
Von to Vo Ready, VIN=2.5V, VBIAS=5V.

CH1:VON, CH2:VO, CH3:IIN

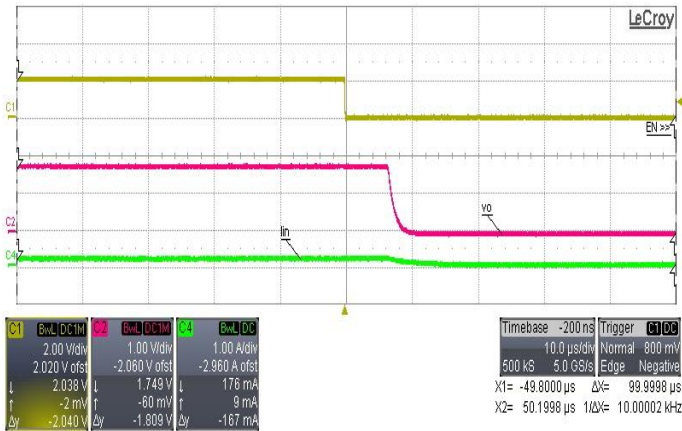


Turn off TOFF from VON, VIN=2.5V, VBIAS=5V

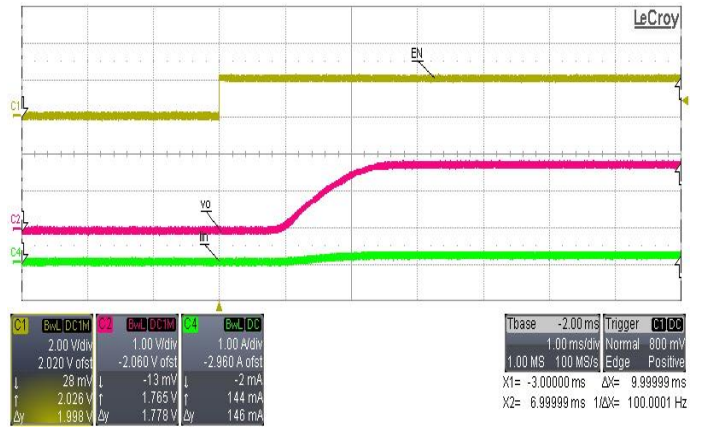
CH1:VON, CH2:VO, CH3:IIN



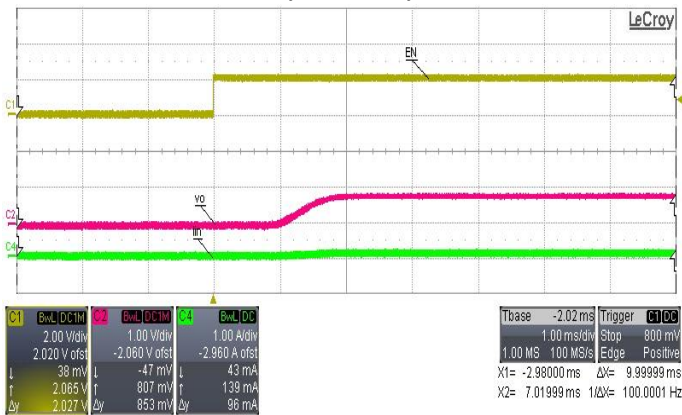
Turn off TOFF from VON, VIN=1.8V, VBIAS=5V
CH1:VON, CH2:VO, CH3:IIN



Von to Vo Ready, VIN=1.8V, VBIAS=5V
CH1:VON, CH2:VO, CH3:IIN



Von to Vo Ready, VIN=0.8V, VBIAS=5V
CH1:VON, CH2:VO, CH3:IIN



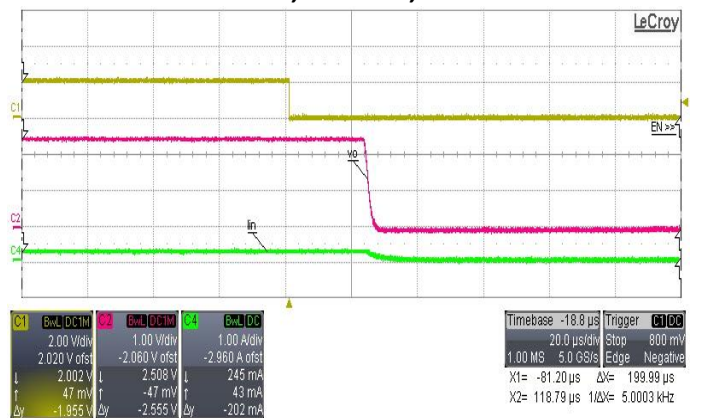
Turn off TOFF from VON, VIN=0.8V, VBIAS=5V
CH1:VON, CH2:VO, CH3:IIN



Von to Vo Ready, VIN=2.5V, VBIAS=2.5V.
CH1:VON, CH2:VO, CH3:IIN



Turn off TOFF from VON, VIN=2.5V, VBIAS=2.5V
CH1:VON, CH2:VO, CH3:IIN



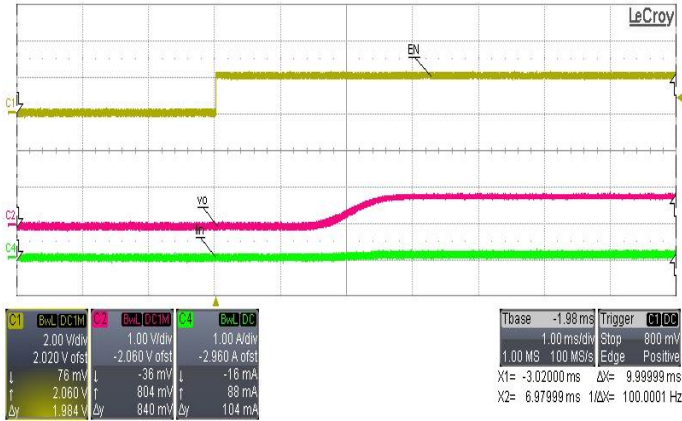


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Von to Vo Ready, VIN=0.8V, VBIAS=2.5V.

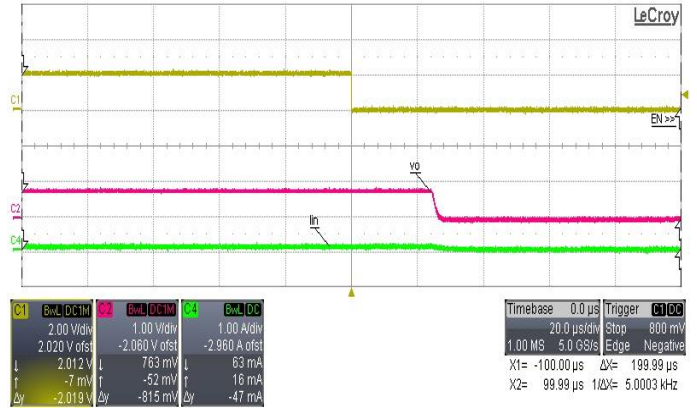
CH1:VON, CH2:VO, CH3:IIN



EM5202D

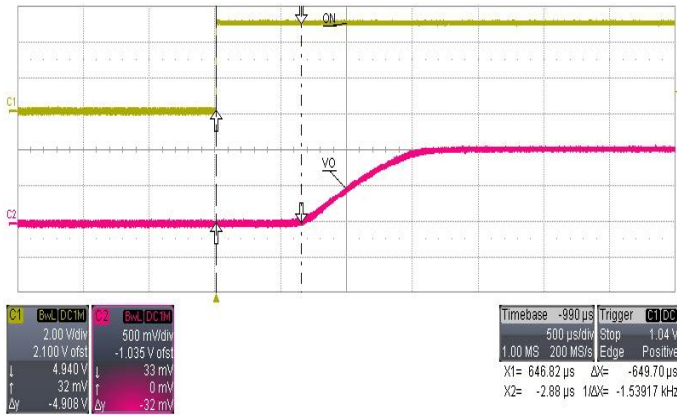
Turn off TOFF from VON, VIN=0.8V, VBIAS=2.5V

CH1:VON, CH2:VO, CH3:IIN



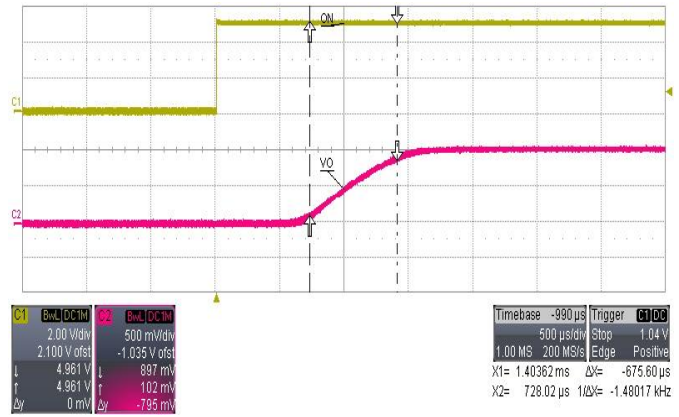
Von to Vo T_D, VIN=1.05V, VBIAS=5V

CH1:VON, CH2:VO



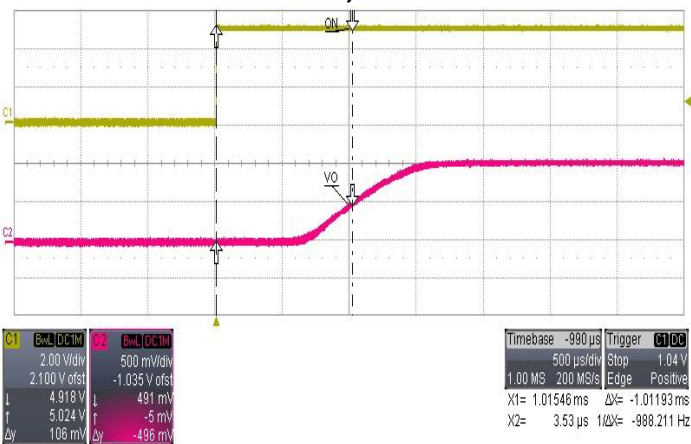
Von to Vo T_R, VIN=1.05V, VBIAS=5V

CH1:VON, CH2:VO



Von to Vo T_{ON}, VIN=1.05V, VBIAS=5V

CH1:VON, CH2:VO



Von to Vo T_{OFF}, VIN=1.05V, VBIAS=5V

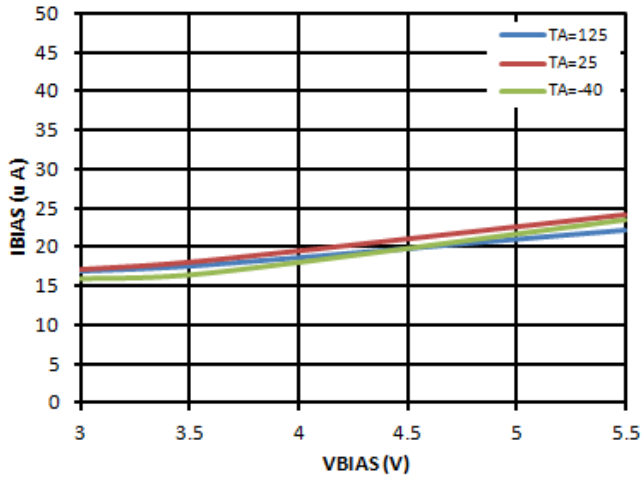
CH1:VON, CH2:VO



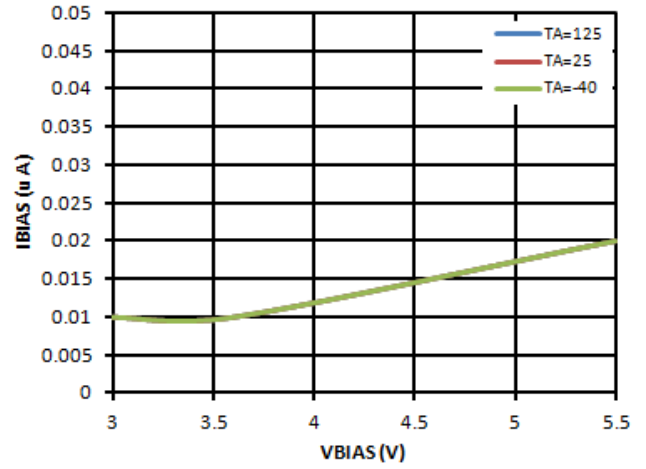


EM5202D

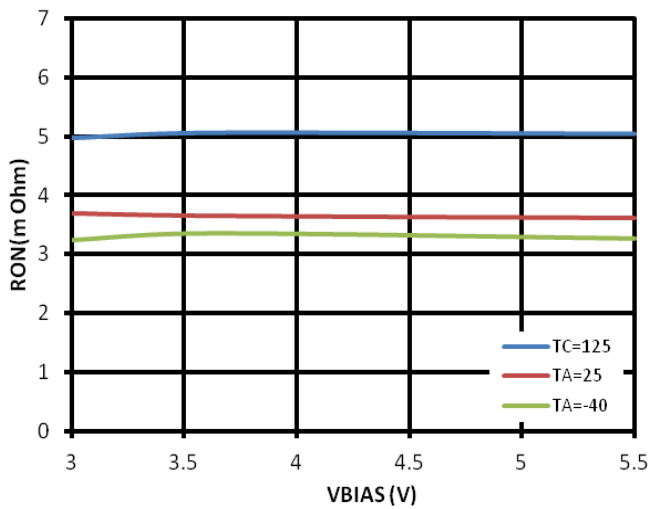
BIAS Supply Current VS. Temperature
VIN=1V, VBIAS=3V to 5.5V



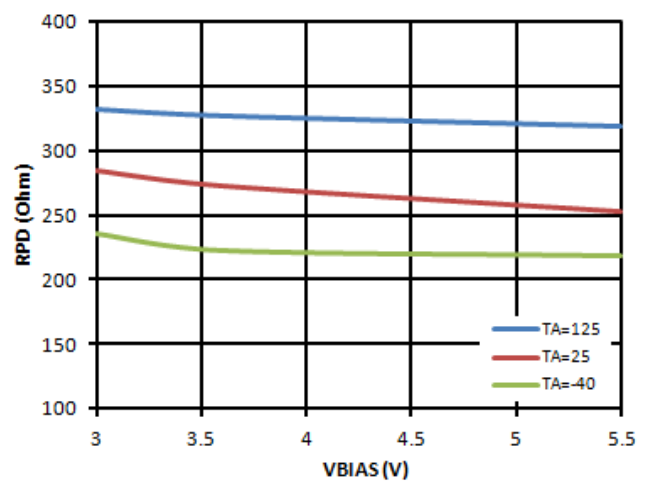
BIAS Shunt down Current VS. Temperature
VIN=1V, VBIAS=3V to 5.5V



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



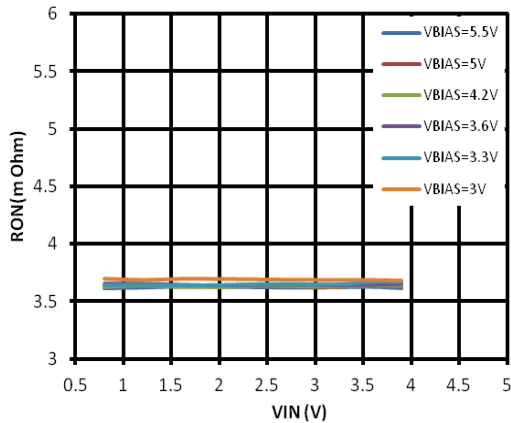
RPD Performance VS. Temperature
VIN=1V, VBIAS=3V to 5.5V



Functional Description

VIN and VBIAS Voltage Range

The MOSFET gate voltage in the EM5202D is driven by an internal charge pump. The output voltage of the charge pump is dependent on the voltage on VBIAS pin. The Ron of EM5202D will still be keep constant if $V_{IN} = V_{BIAS}$. See figure as below.



ON/OFF Control

EM5202D 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 CIN

The EM5202D 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 Co

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. A 0.1uF ceramic capacitor should be placed as closed as possible to the Vo pin.

Thermal and Layout Consideration

EM5202D 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 10A. 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 °C under normal operating conditions. To calculate the maximum allowable dissipation, PD(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:

PD(MAX)=Maximum allowable power dissipation

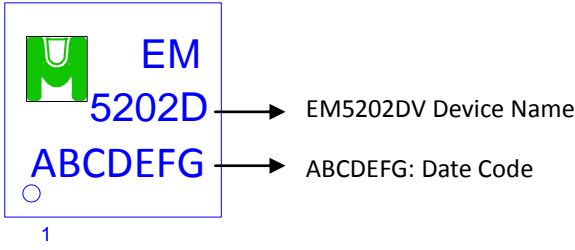
TJ(MAX)=Maximum allowable junction temperature (125 °C for the EM5202)

TA=Ambient Temperature of the device

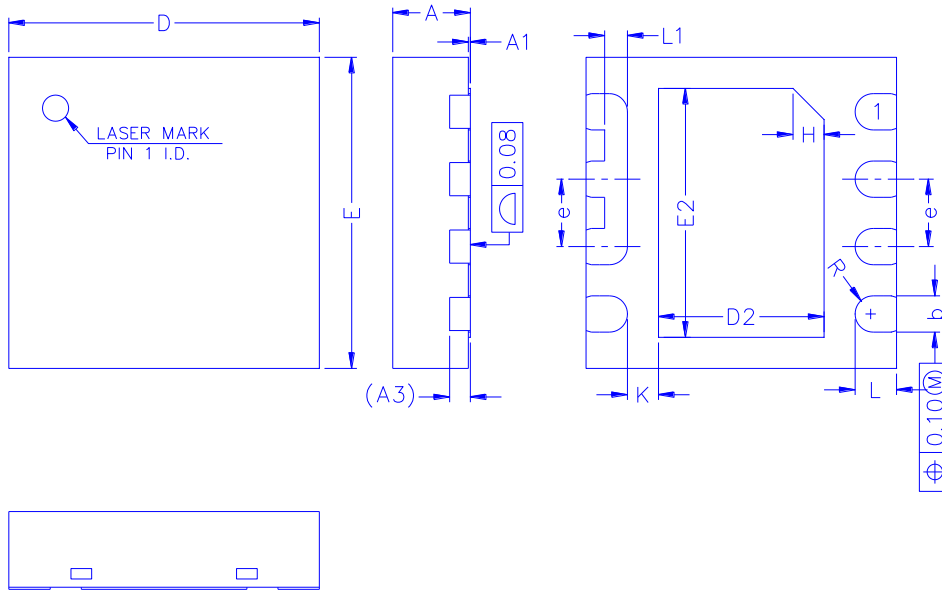
θJA= Junction to air thermal impedance. This parameter is also dependent upon PCB layout.

Ordering & Marking Information

Device Name: EM5202DV for DFN3308



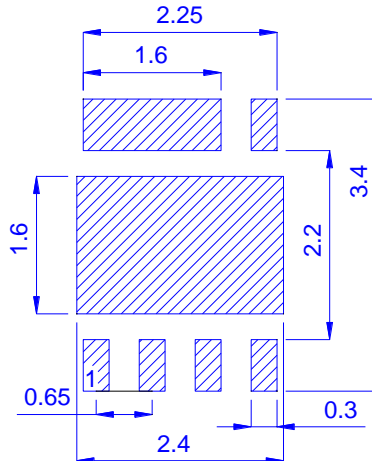
Outline Drawing

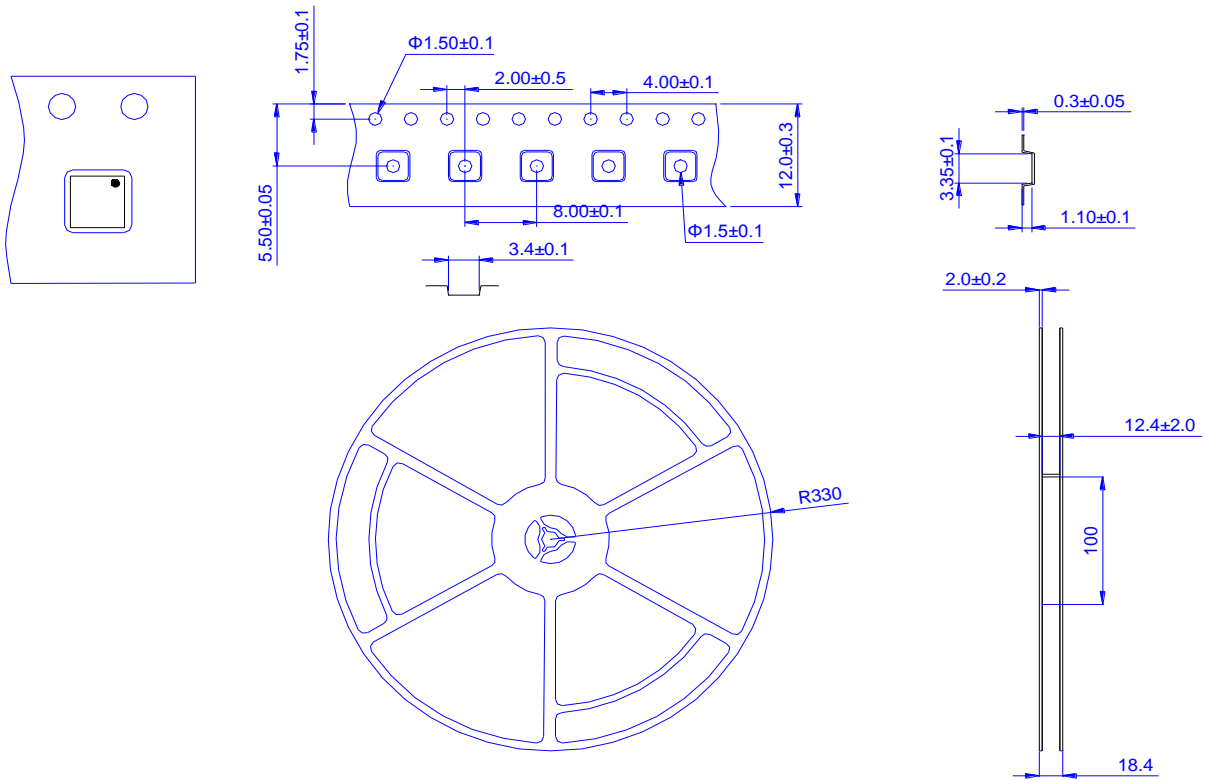


Dimension in mm

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





產品別	DFN 3*3-8L
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