



ZXGD3101T8

Synchronous rectifier controller for flyback converters.

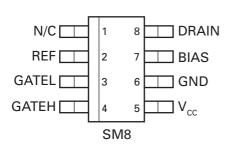
Description

The ZXGD3101 is intended to drive MOSFETS configured as ideal diode replacements. The device is comprised of a differential amplifier detector stage and high current driver. The detector monitors the reverse voltage of the MOSFET such that if body diode conduction occurs a positive voltage is applied to the MOSFET's Gate pin.

Features

- Turn-off propagation delay 15ns and turnoff time 20ns
- Suitable for Discontinuous Mode (DCM), Critical Conduction Mode (CrCM) and Continuous conduction mode (CCM) operation
- Compliant with Energy Star V2.0 and European Code of Conduct V3
- Low component count
- · Halogen free
- 5-15V V_{CC} range

Pin out detail



Once the positive voltage is applied to the Gate the MOSFET switches on allowing reverse current flow. The detectors' output voltage is then proportional to the MOSFET Drain-Source reverse voltage drop and this is applied to the Gate via the driver. This action provides a rapid turn off as current decays.

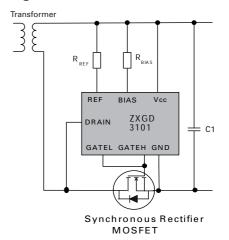
Applications

Flyback converters in:

- Adaptors
- LCD monitors
- Server PSU's
- · Set top boxes

Refer to documents; AN54, DN90, DN91 and DN94 available from the website

Typical configuration



Ordering information

Device	Status	Package	Part Mark	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXGD3101T8TA	Active	SM8	ZXGD3101	7	12	1000

Absolute maximum ratings

Parameter	Symbol	Limit	Unit
Supply voltage ¹	V _{CC}	15	V
Continuous Drain pin voltage ¹	V _D	-3 to180	V
GATEH and GATEL output Voltage ¹	V _G	-3 to V _{CC} + 3	V
Driver peak source current	I _{SOURCE}	4	Α
Driver peak sink current	I _{SINK}	7	Α
Reference current	I _{REF}	25	mA
Bias voltage	V _{BIAS}	V _{CC}	V
Bias current	I _{BIAS}	100	mA
Power dissipation at T _A =25°C	P _D	500	mW
Operating junction temperature	T _j	-40 to +150	°C
Storage temperature	T _{stg}	-50 to +150	°C

NOTES:

Thermal resistance

Parameter	Symbol	Value	Unit
Junction to ambient (*)	$R_{ heta JA}$	250	°C/W
Junction to lead ^(†)	R _{OIA}	54	°C/W

NOTES:

(*) Mounted on minimum 1oz copper on FR4 PCB in still air conditions

ESD Rating

Model	Rating	Unit	
Human body	4,000	V	
Machine	400	V	

^{1.} All voltages are relative to GND pin

^(†) Output Drivers - Junction to solder point at end of the lead 5 and 6

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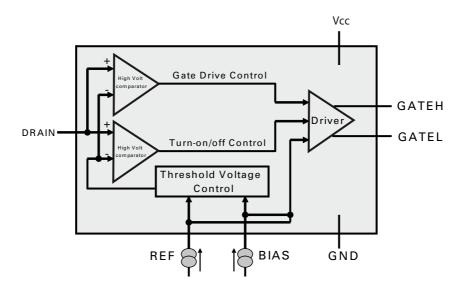
Electrical characteristics at T_A = 25°C; V_{CC} = 10V; R_{BIAS} = 1.8k Ω ; R_{REF} =3k Ω

Parameter	Symbol	Conditions	Min.	Тур.	Max.	Unit	
Input and supply characteristics							
Operating aurent	1	V _{DRAIN} ≤ -200m V		3	-	A	
Operating current	I _{OP}	V _{DRAIN} ≥ 0V	-	8	-	mA	
Gate Driver							
Turn-off Threshold Voltage ^(**)	V _T	V _G = 1V, (*)	-45	-16	0	mV	
	$V_{G(off)}$	V _{DRAIN} ≥ 0V, (*)	-	0.6	1		
		V _{DRAIN} = -60mV, ^(†)	5.0	7.5	-	V	
GATE output voltage (**)		V _{DRAIN} = -80mV, ^(†)	7.0	8.5	-		
	V _G	V _{DRAIN} = -100mV, ^(†)	8.4	9	-		
		V _{DRAIN} ≤ -140mV, (†)	9.2	9.4	_		
		V _{DRAIN} ≤ -200mV, (†)	9.3	9.5	-		
GATEH peak source current	I _{SOURCE}	V _{GH} = 1V		2.5	-	Α	
GATEL peak sink current	I _{SINK}	V _{GL} = 5V		2.5	-	Α	
Turn on Propagation delay	t _{d1}			525		ns	
Turn off Propagation delay	t _{d2}	C 2.25 (t)(a)		15		ns	
Gate rise time	t _r	C _L = 2.2nF, ^{(†) (a)}		305		ns	
Gate fall time	t _f			20		ns	

(**) GATEH connected to GATEL

(*) $R_H = 100K\Omega$, $R_L = 0/C$ (†) $R_L = 100K\Omega$, $R_H = 0/C$ (a) (Refer to Fig 4; Test circuit and Fig 5; Timing diagram on page 11

Schematic symbol and pin description



Pin No.	Symbol	Description and function
1	NC	No connection This pin can be connected to GND
2	REF	Reference This pin is connected to V_{CC} via resistor, R_{REF} R_{REF} should be selected to source ~3mA into this pin. See note 1
3	GATEL	Gate turn off This pin sinks current, I _{SINK} , from the synchronous MOSFET Gate.
4	GATEH	Gate turn on This pin sources current, I _{SOURCE} , to the synchronous MOSFET Gate.
5	V _{CC}	Power Supply This is the supply pin. It is recommended to decouple this point to ground closely with a ceramic capacitor.
6	GND	Ground This is the ground reference point. Connect to the synchronous MOSFET Source terminal.
7	BIAS	Bias This pin is connected to V_{CC} via resistor, R_{BIAS} . R_{BIAS} should be selected to source 1.6 times I_{REF} into this pin. See note 1
8	DRAIN	Drain connection This pin connects directly to the synchronous MOSFET Drain terminal.

NOTES:

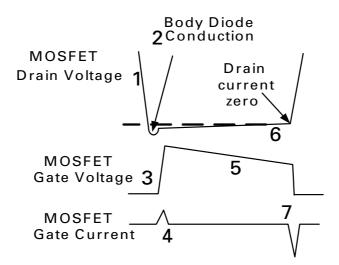
1. BIAS and REF pins should be assumed to be at GND+0.7V

Operation

Normal Operation

The operation of the device is described step-by-step with reference to the timing diagram below.

- 1. The detector monitors the MOSFET Drain-Source voltage.
- 2. When, due to transformer action, the MOSFET body diode is forced to conduct there is approximately -0.6V on the Drain pin.
- 3. The detector outputs a positive voltage with respect to ground, this voltage is then fed to the MOSFET driver stage and current is sourced out of the GATEH pin.
- 4. The current out of the GATEH pin is sourced into the synchronous MOSFET Gate to turn the device on.
- 5. The GATEH output voltage is now proportional to the Drain-Source voltage drop across the MOSFET due to the current flowing through the MOSFET.
- 6. MOSFET conduction continues until the drain current reaches zero.
- 7. At zero current the detector output voltage is zero and the synchronous MOSFET Gate voltage is pulled low by the GATEL, turning the device off.



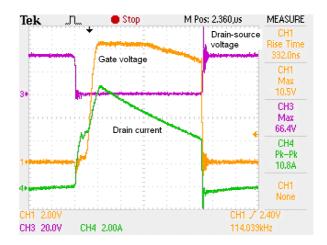


Fig 1a: Continuous Conduction Mode (CCM)

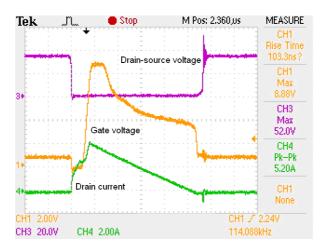


Fig 1b: Critical Conduction Mode (CrCM)

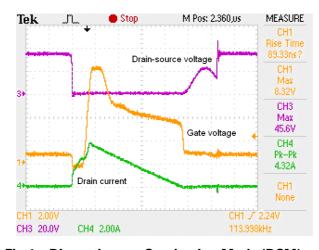
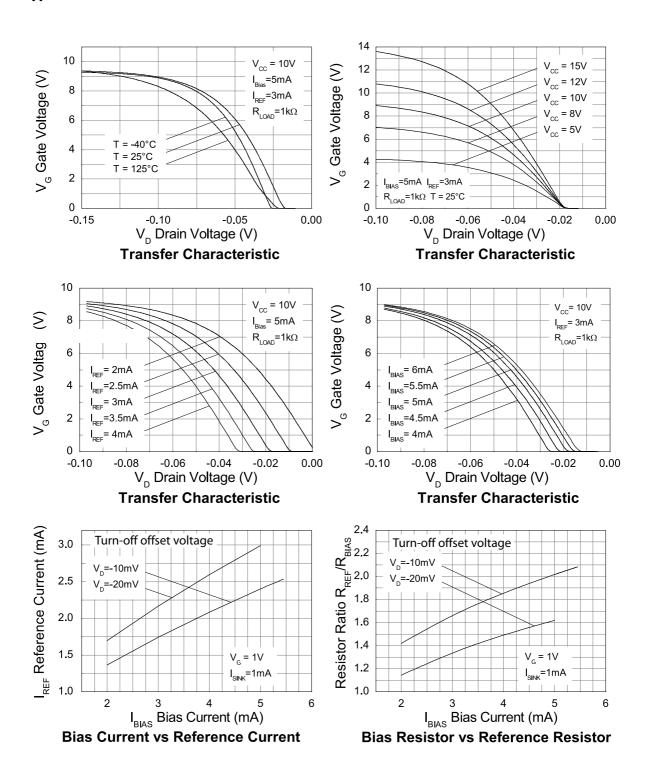


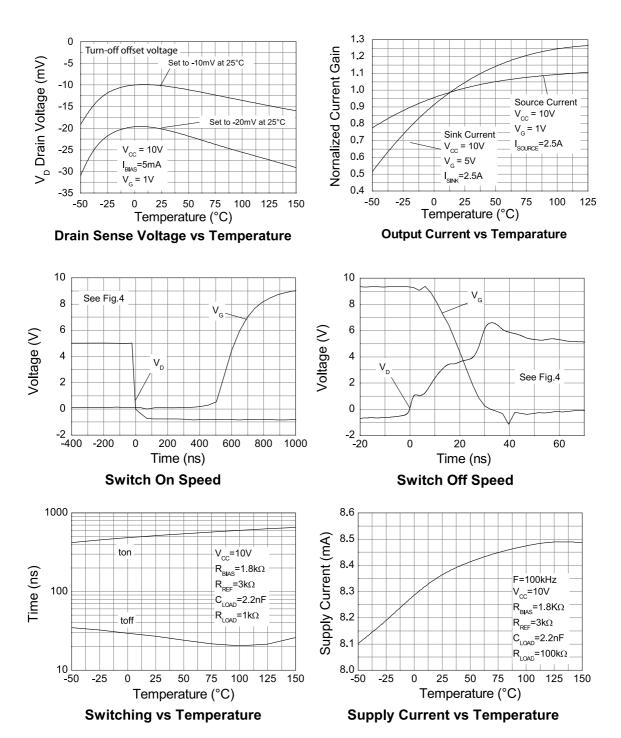
Fig 1c: Discontinuous Conduction Mode (DCM)

Figure 1. Typical waveforms

Typical characteristics

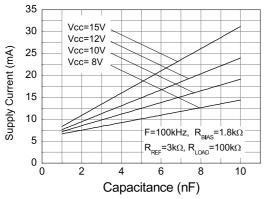


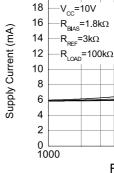
Typical characteristics



100000

Typical characteristics





20

Supply Current vs Capacitive Load

Frequency (Hz)

Supply Current vs Frequency

10000

C_{LOAD}=10nF

C_{LOAD}=4.7nF

C_{LOAD}=2.2nF

C_{LOAD}=1nF

Component selection

It is advisable to decouple the ZXGD3101 closely to V_{CC} and ground due to the possibility of high peak gate currents with C1 in Figure 2.

The proper selection of external resistors R_{REF} and R_{BIAS} is important to the optimum device operation. Select a value for resistor R_{REF} to give a reference current, I_{REF} of ~3mA. The value of R_{BIAS} must then be 0.6 times the value of R_{REF} to give a bias current, I_{BIAS} , of 1.6 times I_{REF} . This provides a recommended typical offset voltage of -20mV.

External gate resistors are optional. They can be inserted to control the rise times which may help with EMI issues, power supply consumption issues or dissipation within the part.

 $R_{REF} = (V_{CC} - 0.7V) / 0.003$

 $R_{BIAS} = (V_{CC} - 0.7V) / 0.005$

Layout considerations

The Gate pins should be as close to the MOSFET Gate as possible. Also the ground return loop should be as short as possible. The decoupling capacitor should be close to the V_{CC} and Ground pin, and should be a X7R type.

For more detailed information refer to application note AN54.

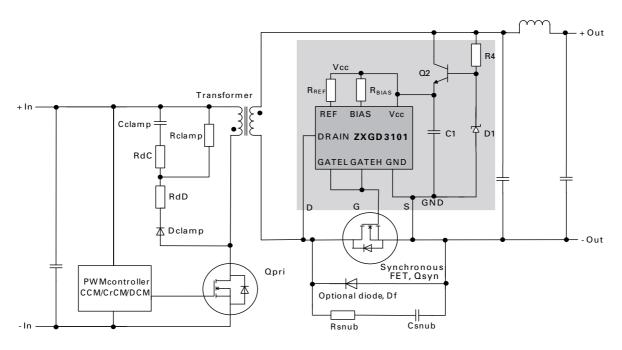


Figure 2 - Example connection for low side synchronous rectification

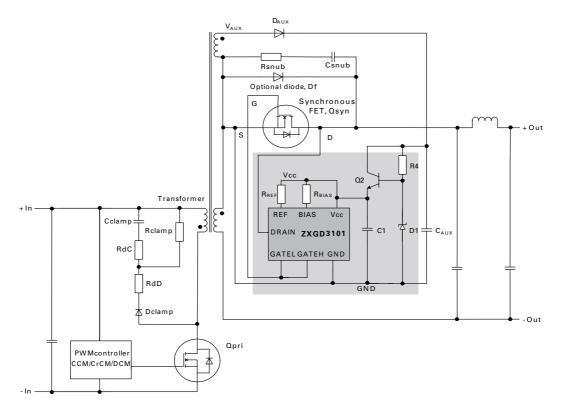


Figure 3 - Example connection for high side synchronous rectification

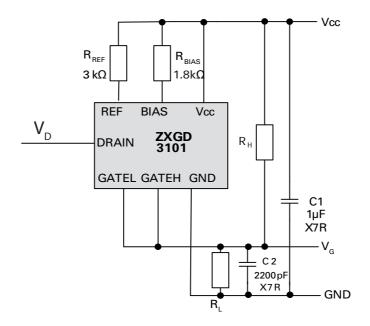
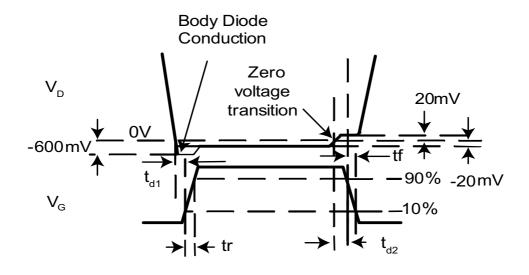


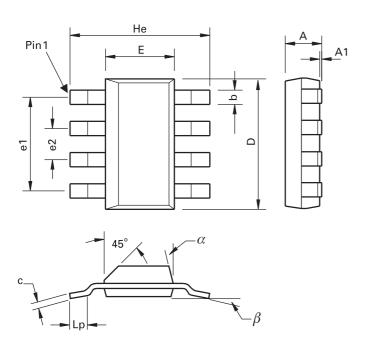
Figure 4: Test circuit



NOTE: GATE H AND GATE L ARE CONNECTED

Figure 5: Timing diagram

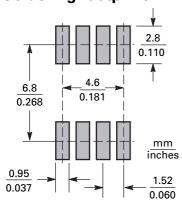
Package information - SM8 (Surface mounted, 8 pin package)



DIM	N	Millimeters Inches		DIM	Millimeters		Inches						
	Min.	Max.	Тур.	Min.	Max.	Тур.		Min.	Max.	Тур.	Min.	Max.	Тур.
Α	-	1.7	-	-	0.067	-	e1	-	-	4.59	-	-	0.1807
A1	0.02	0.1	-	0.0008	0.004	-	e2	-	-	1.53	-	-	0.0602
b	-	-	0.7	-	-	0.0275	He	6.7	7.3	-	0.264	0.287	-
С	0.24	0.32	-	0.009	0.013	-	Lp	0.9	-	-	0.035	-	-
D	6.3	6.7	-	0.248	0.264	-	α	-	15°	-	-	15°	-
Е	3.3	3.7	i	0.130	0.145	-	β	-	-	10°	-	-	10°

Note: Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

Soldering footprint



ZXGD3101T8

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