TF Semiconductor Solutions

Advance Info

TF0503

Half-Bridge Gate Driver

Features

- **Floating high-side driver in bootstrap operation to 100V**
- **Drives two N-channel MOSFETs or IGBTs in a half bridge configuration**
- **290mA source/600mA sink output current capability**
- **Outputs tolerant to negative transients**
- **Internal dead time of 430ns to protect MOSFETs**
- **Wide low side gate driver supply voltage: 10V to 20V**
- **Logic input (HIN and LIN*) 3.3V capability**
- **Schmitt triggered logic inputs**
- **Undervoltage lockout for V_{CC} (logic and low side supply)**
- **Extended temperature range: -40°C to +125°C**

Description

The TF0503 is a high voltage, high speed gate driver capable of driving N-channel MOSFETs and IGBTs in a half bridge configuration. TF Semiconductor's high voltage process enables the TF0503's high side to switch to 100V in a bootstrap operation.

The TF0503 logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) to interface easily with controlling devices. The driver outputs feature high pulse current buffers designed for minimum driver cross conduction. TF0503 has a fixed internal deadtime of 430ns (typical).

The TF0503 is offered in a TDFN-10 package and operates over an extended -40 °C to +125 °C temperature range.

Applications

- DC-DC Converters
- AC-DC Inverters
- Motor Controls
- Class D Power Amplifiers

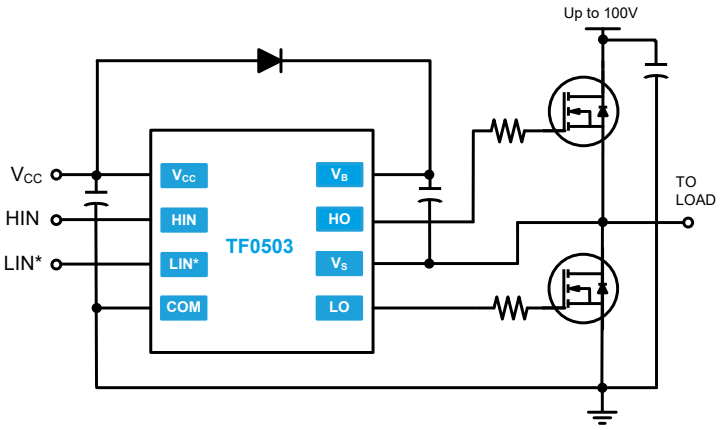
TDFN-10

Ordering Information

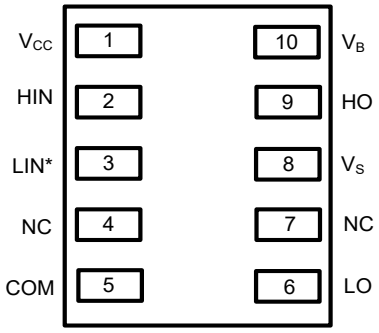
Year Year Week Week

PART NUMBER	PACKAGE	PACK / Qty	MARK
TF0503-NHS	TDFN-10	Tube / 120	YYWW TF0503
TF0503-NHP	TDFN-10	T&R / 3,000	

Typical Application



Pin Diagrams



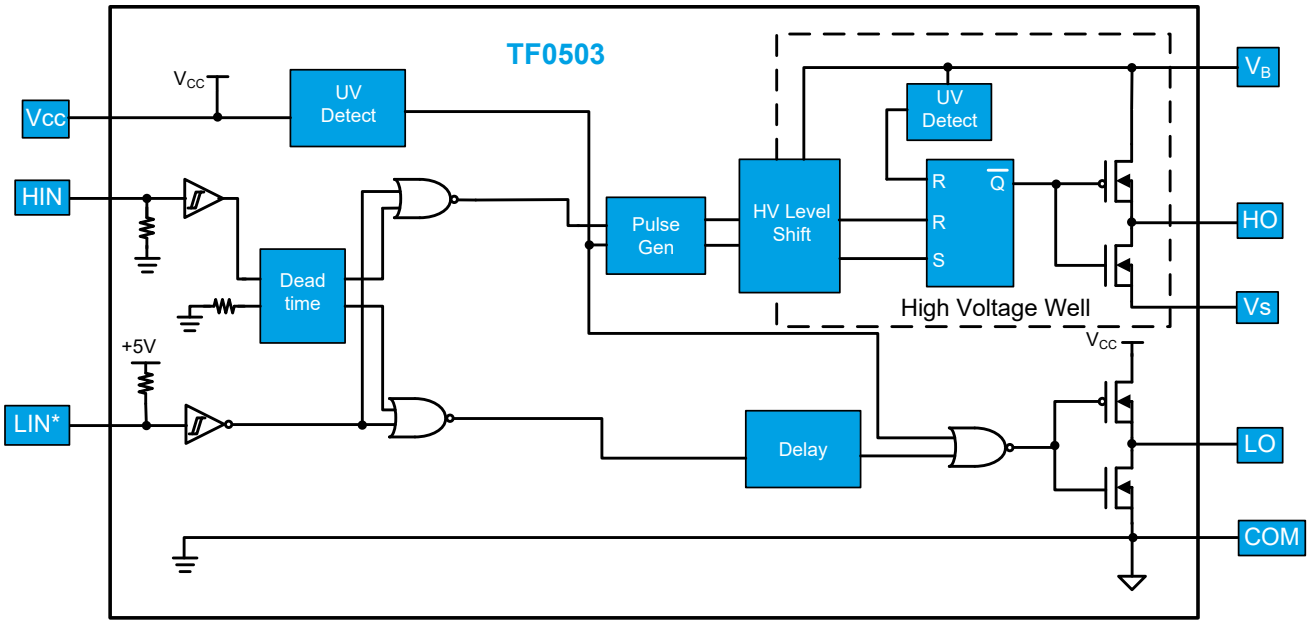
Top View: TDFN-10

TF0503

Pin Descriptions

PIN NAME	PIN NUMBER	PIN DESCRIPTION
V_{CC}	1	Logic and low side supply
HIN	2	Logic input for high-side gate driver output in phase with HO
LIN*	3	Logic input for low-side gate driver output out of phase with LO
NC	4, 7	No Connect
COM	5	Low-side and logic return
LO	6	Low-side gate drive output
V_S	8	High-side floating supply return
HO	9	High-side gate drive output
V_B	10	High-side floating supply

Functional Block Diagram



Absolute Maximum Ratings *(NOTE1)*

V_B - High side floating supply voltage.....-0.3V to +124V
V_S - High side floating supply offset voltage....V_B-24V to V_B+0.3V
V_{HO} - High side floating output voltage.....V_S-0.3V to V_B+0.3V
dV_S/dt - Offset supply voltage transient.....50 V/ns

V_{CC} - Low-side fixed supply voltage.....-0.3V to +24V
V_{LO} - Low-side output voltage.....-0.3V to V_{CC} +0.3V
V_{IN} - Logic input voltage (HIN and LIN*).....-0.3V to V_{CC} +0.3V

NOTE1 *Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and 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 affect device reliability.*

P_D - Package power dissipation at $T_A \leq 25$ °C
TDFN-10.....0.4W

TDFN-10 Thermal Resistance ***(NOTE2)***
θ_{JA}.....64 °C/W
θ_{JC}.....42°C/W

T_J - Junction operating temperature.....+150 °C
T_L - Lead Temperature (soldering, 10 seconds).....+300 °C
T_{stg} - Storage temerature .....-55 to 150 °C

NOTE2 *When mounted on a standard JEDEC 2-layer FR-4 board.*

Recommended Operating Conditions

Symbol	Parameter	MIN	MAX	Unit
V_B	High side floating supply absolute voltage	V_S + 10	V_S + 20	V
V_S	High side floating supply offset voltage	***NOTE3***	100	V
V_{HO}	High side floating output voltage	V_S	V_B	V
V_{CC}	Low side fixed supply voltage	10	20	V
V_{LO}	Low side output voltage	0	V_{CC}	V
V_{IN}	Logic input voltage (HIN and LIN*)	0	5	V
T_A	Ambient temperature	-40	125	°C

NOTE3 *Logic operational for VS of -5V to +100V. Logic state held for VS of -5V to -VBS*

DC Electrical Characteristics *(NOTE4)*

V_{BIAS} (V_{CC}, V_{BS}) = 15V, T_A = 25 °C , unless otherwise specified.

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
V_{IH}	Logic "1" (HIN) & Logic "0" (LIN*) input voltage	V_{CC} = 10V to 20V	2.5			V
V_{IL}	Logic "0" (HIN) & Logic "1" (LIN*) input voltage				0.8	
V_{OH}	High level output voltage, V_{BIAS} - V_O	I_O = 2mA		0.05	0.2	
V_{OL}	Low level output voltage, V_O	I_O = 2mA		0.02	0.1	
I_{LK}	Offset supply leakage current	VB = VS = 100V			50	µA
I_{BSQ}	Quiescent V_{BS} supply current	V_{IN} = 0V or 5V		60	100	
I_{CCQ}	Quiescent V_{CC} supply current	V_{IN} = 0V or 5V		350	500	
I_{IN+}	Logic "1" input bias current	HIN = 5V, LIN* = 0V		3	10	
I_{IN-}	Logic "0" input bias current	HIN = 0V, LIN* = 5V			5	
V_{CCUV+}	V_{CC} supply under-voltage positive going threshold		7.2	8.5	9.8	V
V_{CCUV-}	V_{CC} supply under-voltage negative going threshold		6.8	8.0	9.3	
V_{BSUV+}	V_{BS} supply under-voltage positive going threshold		5.5	6.5	7.5	V
V_{BSUV-}	V_{BS} supply under-voltage negative going threshold		5.3	6.3	7.3	V
I_{O+}	Output high short circuit pulsed current	V_O = 0V, PW ≤ 10 µs	130	290		mA
I_{O-}	Output low short circuit pulsed current	V_O = 15V, PW ≤ 10 µs	270	600		

NOTE4 *The V_{IN} and I_{IN} parameters are applicable to the two logic input pins: HIN and LIN*. The V_O and I_O parameters are applicable to the respective output pins: HO and LO*

AC Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 15V, C_L = 1000pF, and T_A = 25 °C , unless otherwise specified.

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
t_{on}	Turn-on propagation delay	V_S = 0V		680	820	ns
t_{off}	Turn-off propagation delay	V_S = 100V		150	220	
t_{DM}	Delay matching, HS & LS turn-on/turn-off				60	
t_r	Turn-on rise time	V_S = 0V		70	170	
t_f	Turn-off fall time			35	90	
t_{DT}	Deadtime: $t_{DT\ LO\text{-}HO}$ & $t_{DT\ HO\text{-}LO}$		300	430	550	

Timing Waveforms

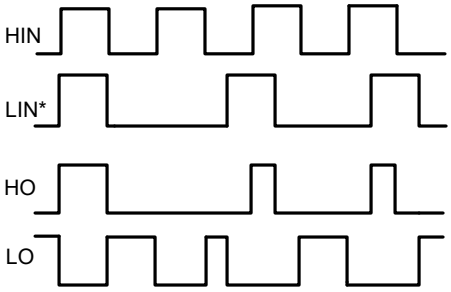


Figure 1. Input / Output Timing Diagram

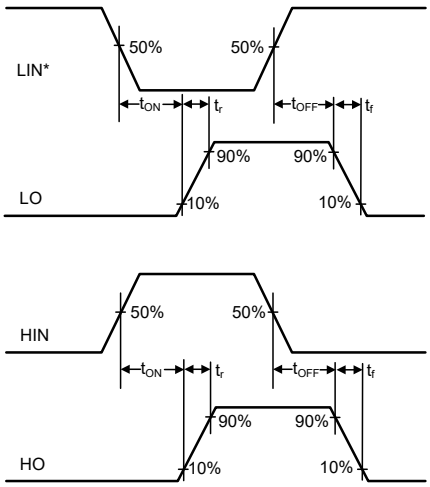


Figure 2. Switching Time Waveform Definitions

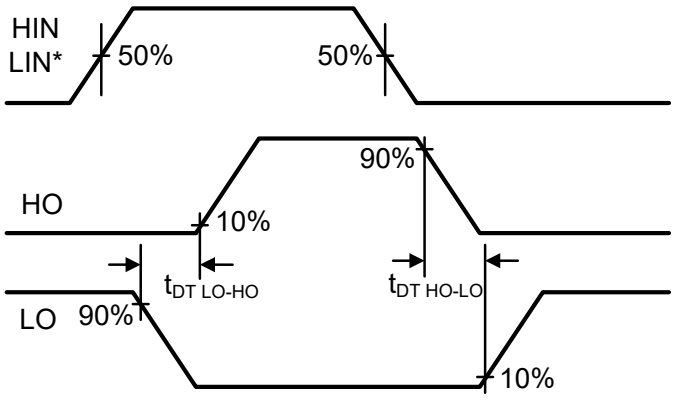
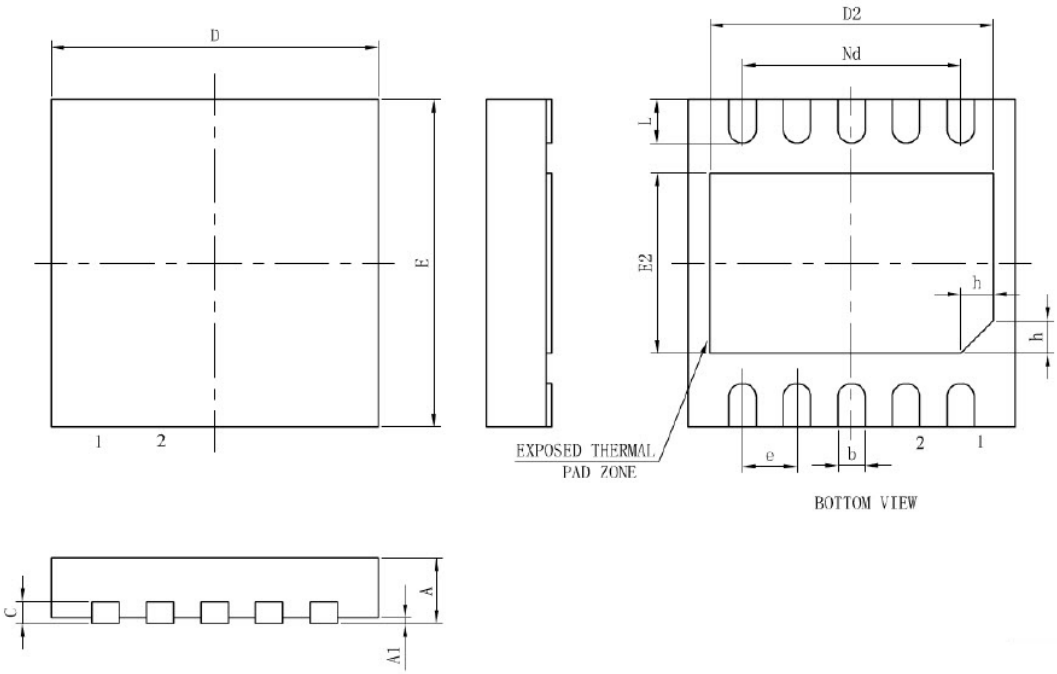


Figure 3. Deadtime Waveform Definitions

Package Dimensions (TDFN-10)

Please contact support@tfsemi.com for package availability.



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.02	0.05
b	0.18	0.25	0.30
c	0.18	0.20	0.25
D	2.90	3.00	3.10
D2	2.40	2.50	2.60
e	0.50BSC		
Nd	2.00BSC		
E	2.90	3.00	3.10
E2	1.45	1.55	1.65
L	0.30	0.40	0.50
h	0.20	0.25	0.30

Revision History

Rev.	Change	Owner	Date
2.0	First release, final datasheet	Keith Spaulding	2/6/2016
2.1	Added VBS UVLO block in Functional Block Diagram and to Electrical Specifications	Keith Spaulding	6/28/2016
2.2	Text edit	Keith Spaulding	1/25/2018

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