



TF0506A

High Frequency Half-Bridge Gate Driver with Programmable Deadtime

Features

- Drives two N-channel MOSFETs in a half bridge configuration
- Floating high-side driver in bootstrap operation to 50V
- 1.5A source / 2.0A sink output current capability
- Internal bootstrap diode included
- Undervoltage lockout for high and low side drivers
- Programmable deadtime to protect MOSFETs
- Ultra low standby current (<math><1\mu\text{A}</math>)
- Logic input (IN and EN) 3.3V capability
- Extended temperature range: -40°C to +125°C

Applications

- eCig devices
- Battery Powered Hand Tools
- DC/DC converters
- BLDC Motor Drivers



TDFN-10



MSOP-10

Description

The TF0506A is a high frequency halfbridge gate driver capable of driving N-channel MOSFETs in a halfbridge configuration.

The TF0506A logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) to interface easily with MCUs. UVLO for high side and low side will protect MOSFET with loss of supply. Also to protect MOSFETs, cross conduction prevention logic prevents the HO and LO to be on at the same time.

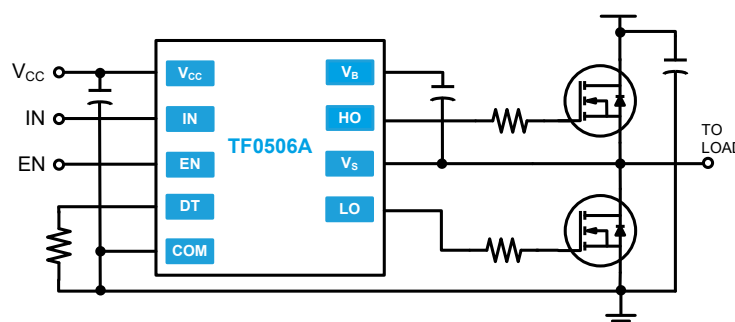
Fast and well matched propagation delays allow a higher switching frequency, enabling a smaller, more compact power switching design using smaller associated components. To further minimize space an internal bootstrap diode is included, also the TF0506A comes in space-saving TDFN-10 and MSOP-10 packages. It operates over an extended -40 °C to +125 °C temperature range.

Ordering Information

Year Year Week Week

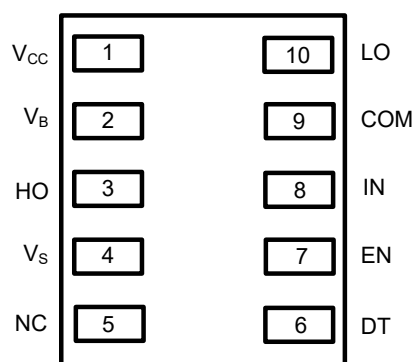
PART NUMBER	PACKAGE	PACK / Qty	MARK
TF0506A-NHS	TDFN-10	Tube / 120	YYWW TF0506A
TF0506A-NHP	TDFN-10	T&R / 3,000	

Typical Application



Pin Diagrams

High Frequency Half-Bridge Gate Driver with Programmable Deadtime

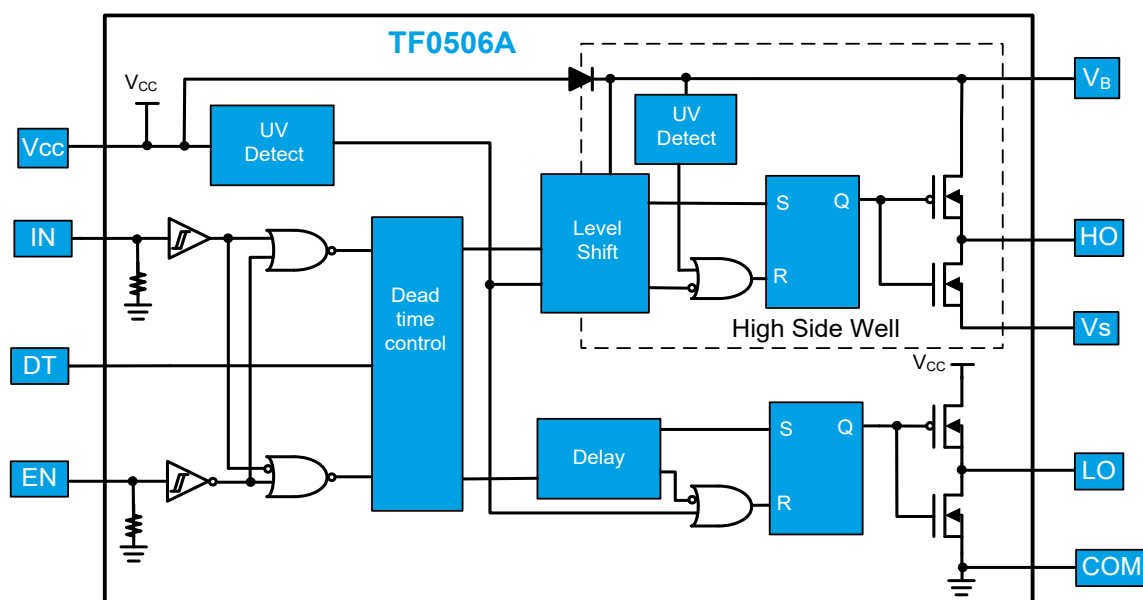


Top View: TDFN-10

Pin Descriptions

PIN NAME	PIN NUMBER	PIN DESCRIPTION
V_{CC}	1	Low-side and logic fixed supply
V_B	2	High-side floating supply
HO	3	High-side gate driver output
V_S	4	High-side floating supply return
NC	5	No Connect
DT	6	Deadtime Control
EN	7	Logic input enable, a logic low turns off gate drivers
IN	8	Logic input for high-side and low-side gate driver outputs (HO and LO), in phase with HO
COM	9	Low-side and logic return
LO	10	Low-side gate drive output
COM	PAD	Low-side and logic return

Functional Block Diagram





High Frequency Half-Bridge Gate Driver with Programmable Deadtime

Absolute Maximum Ratings (NOTE1)

V_B - High side floating positive supply voltage.....0.3V to 60V
 V_S - High side floating negative supply voltage.. V_B -14V to V_B +0.3V
 V_{HO} - Highside floating output voltage..... V_S -0.3V to V_B +0.3V
 dV_S/dt - Offset supply voltage transient.....50V/ns

V_{CC} - Logic and Low-side fixed supply voltage.....-0.3V to +14V
 V_{LO} - Low-side output voltage.....-0.3V to V_{CC} +0.3V
 V_{IN} - Logic input voltage (IN and EN).....-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 $T_A \leq 25^\circ\text{C}$
 TDFN-10.....0.4W

TDFN-10 Thermal Resistance (NOTE2)

θ_{JA}64°C/W
 θ_{JC}42°C/W

T_J - Junction operating temperature.....-40°C to +150°C
 T_L - Lead Temperature (soldering, 10 seconds).....+300°C
 T_{stg} - Storage temperature-55°C 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	$V_S + 8$	$V_S + 14$	V
V_S	High side floating supply offset voltage	NOTE3	50	V
V_{HO}	High side floating output voltage	V_S	V_B	V
V_{CC}	Logic and Low side fixed supply voltage	8	14	V
V_{LO}	Low side output voltage	0	V_{CC}	V
V_{IN}	Logic input voltage (IN and EN)	0	5	V
T_A	Ambient temperature	-40	125	°C

NOTE3 Logic operational for V_S of -5V to +50V.



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DC Electrical Characteristics (NOTE4)

$V_{CC} = V_{BS} = 12V$, $COM = V_S = 0V$, $T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified.

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
V_{IH}	Logic "1" input voltage		2.4			V
V_{IL}	Logic "0" input voltage				0.8	
V_{INHYS}	Input voltage hysteresis			0.6		
V_{OH}	High level output voltage, $V_{BIAS} - V_O$	$I_{O+} = 100\text{mA}$		0.45	0.6	
V_{OL}	Low level output voltage, V_O	$I_{O-} = 100\text{mA}$		0.15	0.22	
I_{LK}	Offset supply leakage current	$V_B = V_S = 60V$		10	50	μA
I_{CCSD}	V_{CC} shutdown supply current	$V_{IN} = 0V$ or $5V$, $V_{EN} = 0V$		0	1	
I_{CCQ}	V_{CC} quiescent supply current	$V_{IN} = 0V$ or $5V$, RDT = $100\text{k}\Omega$		280	500	μA
I_{CCOP}	V_{CC} operating supply current	$f_s = 500\text{kHz}$, $C_L = 1000\text{pF}$		7.6		mA
I_{BSQ}	V_{BS} quiescent supply current	$V_{IN} = 0V$ or $5V$		32	100	μA
I_{BSOP}	V_{BS} operating supply current	$f_s = 500\text{kHz}$, $C_L = 1000\text{pF}$		7.6		mA
I_{IN+}	Logic "1" input bias current	$V_{IN} = 5V$		25	60	μA
I_{IN-}	Logic "0" input bias current	$V_{IN} = 0V$		0	1	
V_{BSUV+}	V_{BS} supply under-voltage positive going threshold		6.0	7.0	8.0	V
V_{BSUV-}	V_{BS} supply under-voltage negative going threshold		5.6	6.6	7.6	
V_{CCUV+}	V_{CC} supply under-voltage positive going threshold		6.0	7.0	8.0	
V_{CCUV-}	V_{CC} supply under-voltage negative going threshold		5.6	6.6	7.6	
I_{O+}	Output high short circuit pulsed current	$V_O = 0V$, $PW \leq 10\text{ }\mu\text{s}$	0.9	1.5		A
I_{O-}	Output low short circuit pulsed current	$V_O = 15V$, $PW \leq 10\text{ }\mu\text{s}$	1.5	2.0		
V_{F1}	Forward voltage of bootstrap diode	$I_F = 100\mu\text{A}$		0.67		V
V_{F2}	Forward voltage of bootstrap diode	$I_F = 100\text{mA}$		1.7		V

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



High Frequency Half-Bridge Gate Driver with Programmable Deadtime

AC Electrical Characteristics

$V_{CC} = V_{BS} = 12V$, $COM = V_S = 0V$, $C_L = 1000pF$, $T_A = 25^\circ C$, unless otherwise specified.

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
t_{on}	Turn-on propagation delay HS and LS	RDT = 10k Ω	65	96	125	ns
		RDT = 100k Ω	350	463	580	
t_{off}	Turn-off propagation delay HS and LS			22	56	
t_r	Turn-on rise time			17	35	
t_f	Turn-off fall time			12	25	
t_{DM}	Delay matching				50	
t_{DT}	Deadtime: $t_{DT\ LO-HO}$ & $t_{DT\ HO-LO}$	RDT = 10k Ω	40	70	100	
		RDT = 100k Ω	300	430	560	
t_{MDT}	Deadtime Matching	RDT = 100k Ω			50	

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Timing Waveforms

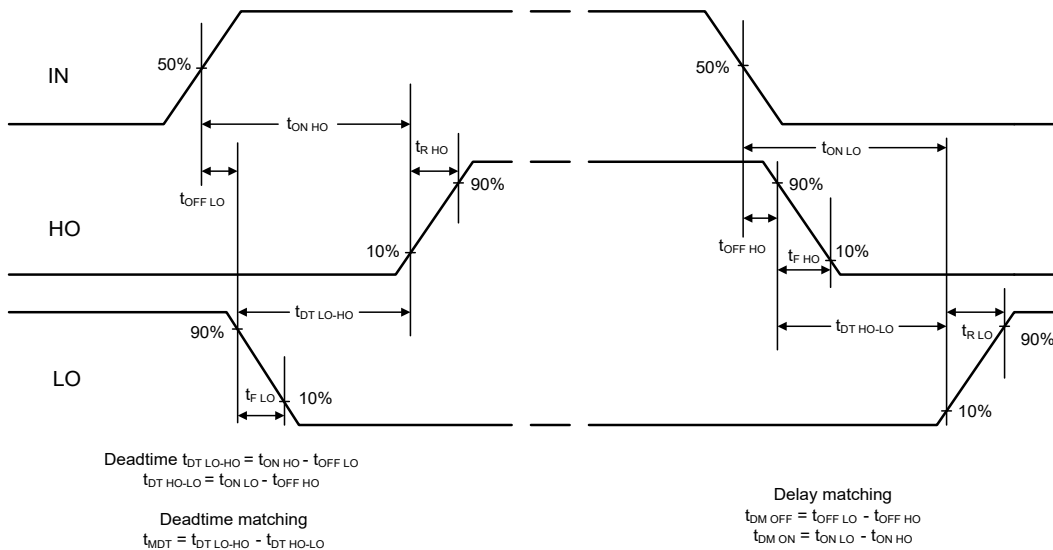


Figure 1. Switching Time Waveform Definitions

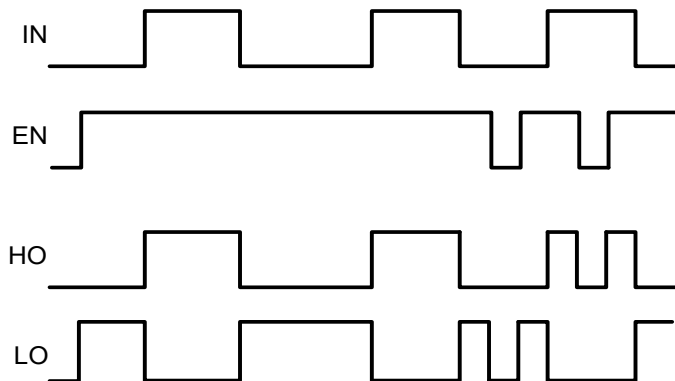


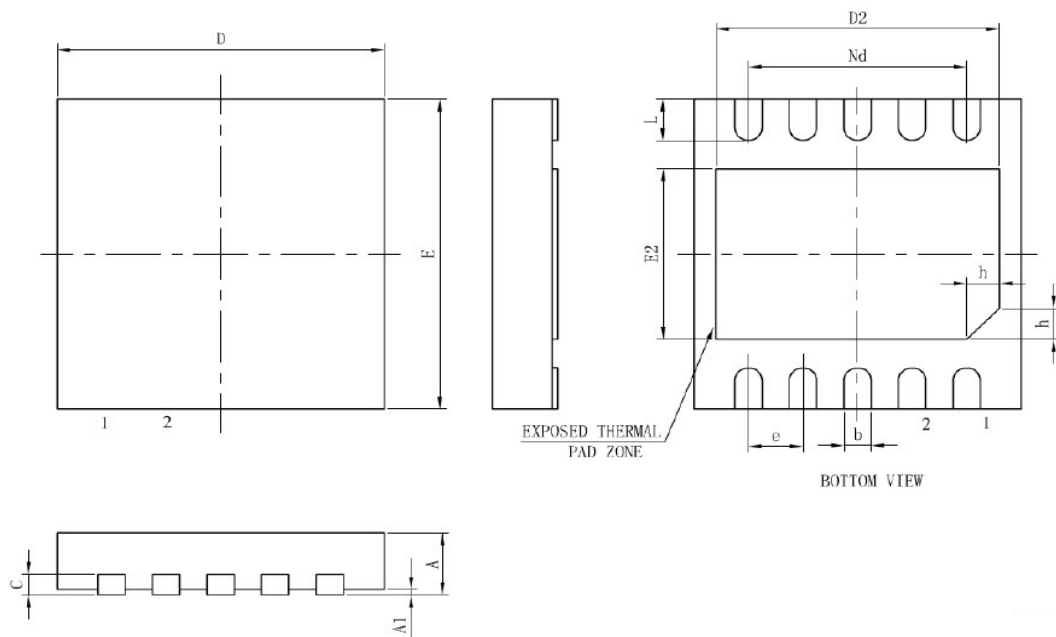
Figure 2. Input / Output Timing Diagram



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Package Dimensions (TDFN-10)

Please contact support@tfsemi.com for package availability.



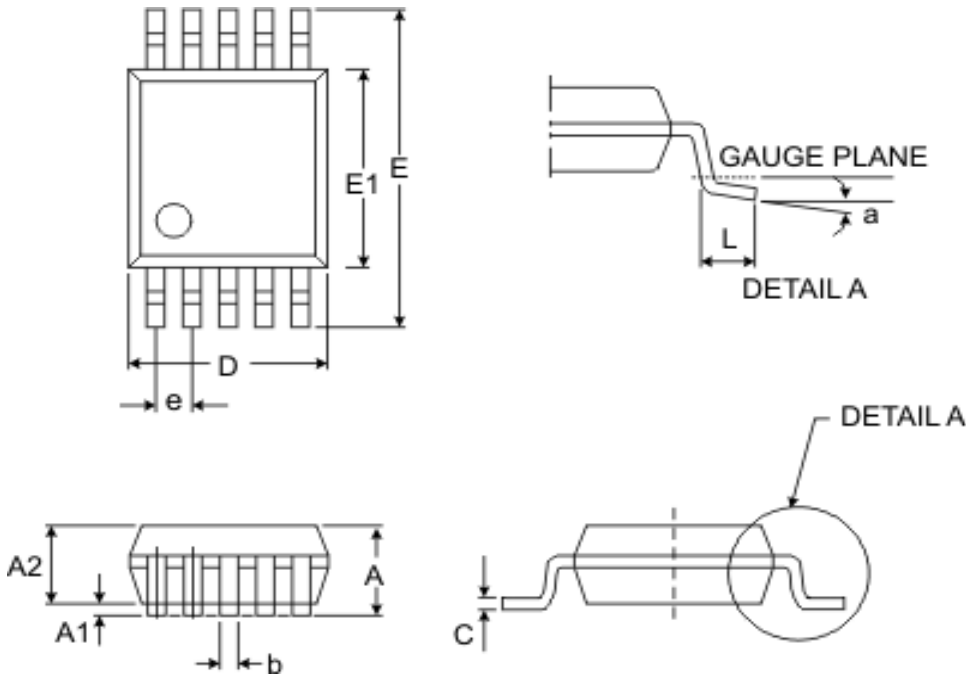
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.02	0.05
b	0.18	0.25	0.30
c	0.18	0.20	0.25
D	2.90	3.00	3.10
D2	2.40	2.50	2.60
c	0.50BSC		
Nd	2.00BSC		
E	2.90	3.00	3.10
E2	1.45	1.55	1.65
L	0.30	0.40	0.50
h	0.20	0.25	0.30



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Package Dimensions (MSOP-10)

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MSOP-10			
Dim	Min	Max	Typ
a	0°	8°	4°
A	-	1.10	-
A1	0.05	0.15	0.10
A2	0.75	0.95	0.86
b	0.17	0.27	0.20
c	0.08	0.23	0.15
D	2.95	3.05	3.00
e	-	-	0.50
E	4.80	5.00	4.90
E1	2.95	3.05	3.00
L	0.40	0.80	0.60
All Dimensions in mm			



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Revision History

Rev.	Change	Owner	Date
1.0	First release	Keith Spaulding	10/2/17

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