



## Features

- Floating high-side driver in bootstrap operation to 600V
- Drives two N-channel MOSFETs or IGBTs in a half-bridge configuration
- Output drivers capable of 4.5A/4.5A typ sink/source
- Logic input (HIN and LIN) 3.3V capability
- Schmitt triggered logic inputs with internal pulldown
- Undervoltage lockout for high and low-side drivers
- Extended temperature range: -40°C to +125°C

## Description

The TC2190 is a high voltage, high speed gate driver capable of driving N-channel MOSFET's and IGBTs in a half-bridge configuration. TF Semi's high voltage process enables the TC2190's high side to switch to 600V in a bootstrap operation under high dV/dt conditions.

The TC2190 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.

The TC2190 is offered in space saving 8-pin SOIC and the TC21904 in the 14-pin SOIC and operates over an extended -40°C to +125°C temperature range.

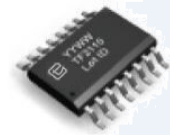
## Applications

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

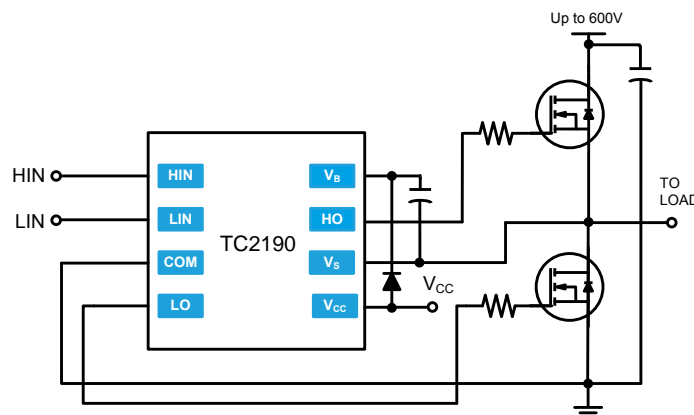
SOIC-8(N)



SOIC-14(N)

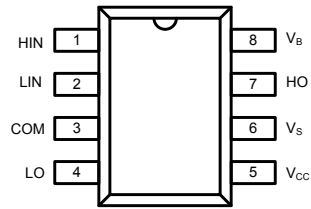


## Typical Application

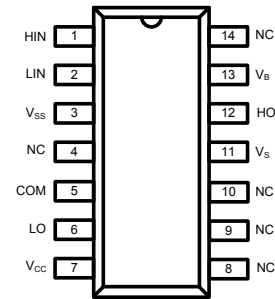




## Pin Diagrams



**Top View: SOIC-8(N), TC2190**



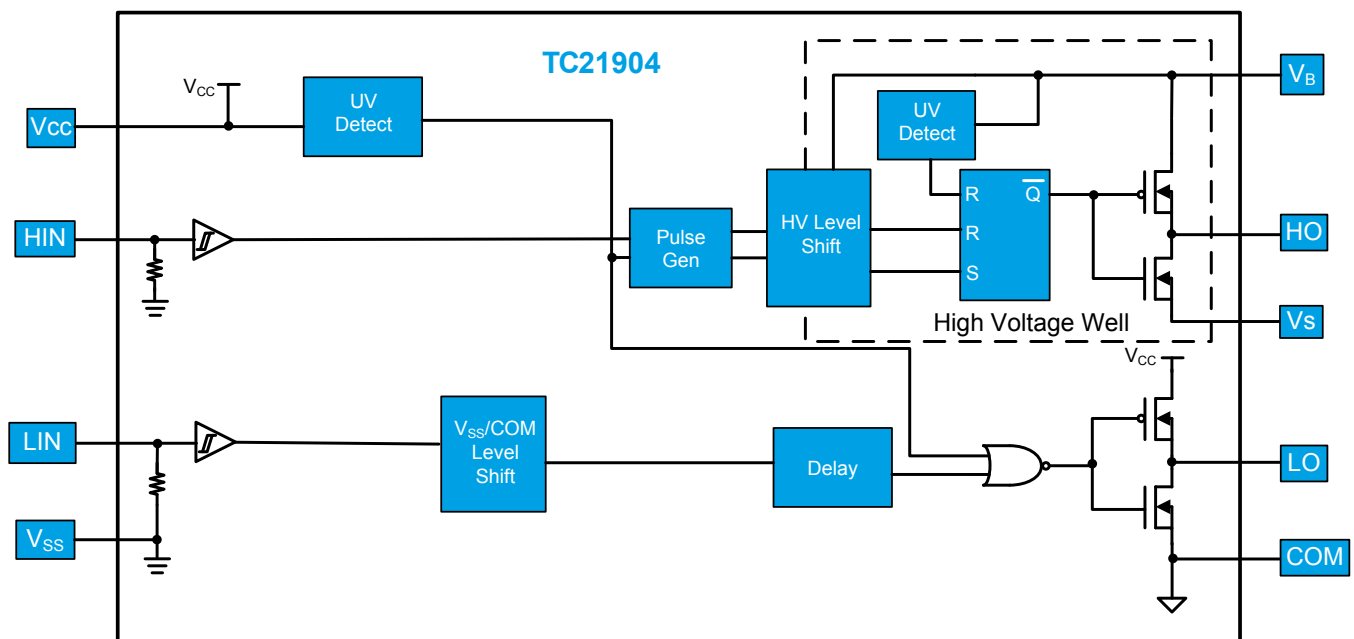
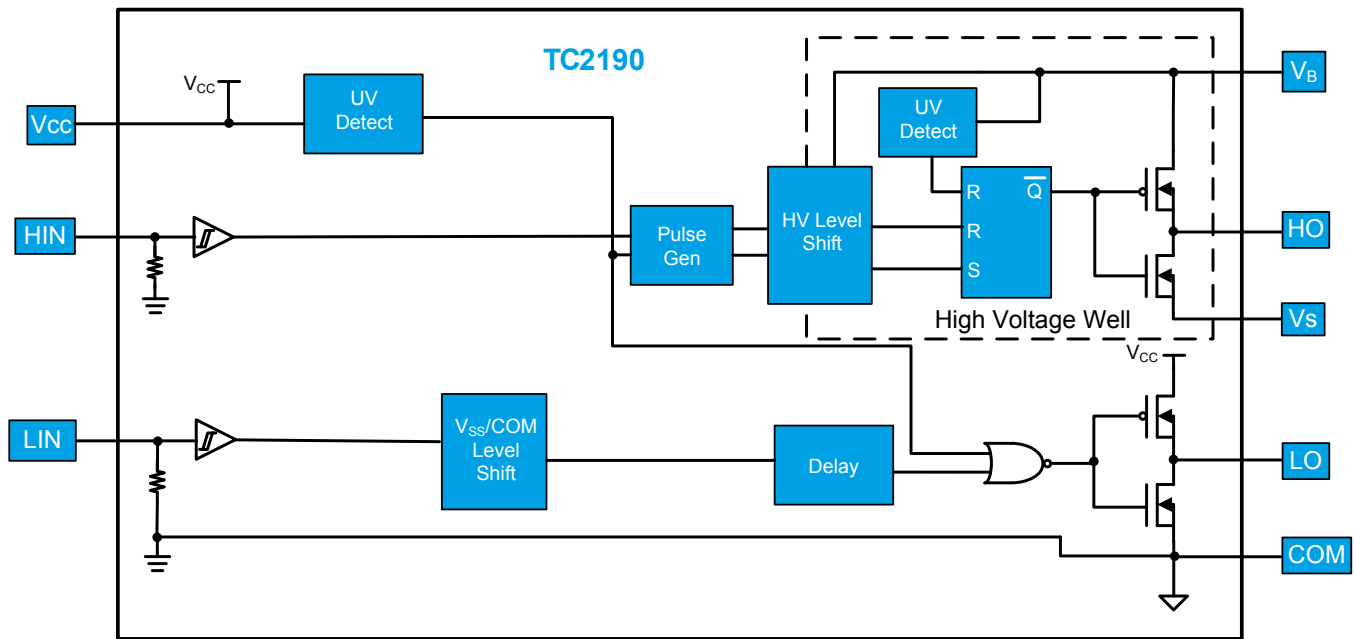
**Top View: SOIC-14(N), TC21904**

## Pin Descriptions

PIN NAME	PIN DESCRIPTION
HIN	Logic input for high-side gate driver output, in phase with HO
LIN	Logic input for low-side gate driver output, in phase with LO
COM	Low-side and logic return
LO	Low-side gate drive output
V <sub>CC</sub>	Low-side and logic fixed supply
V <sub>S</sub>	High-side floating supply return
HO	High-side gate driver output
V <sub>B</sub>	High-side floating supply
V <sub>SS</sub>	Logic Ground (TC21904 only)



### Functional Block Diagrams





## Absolute Maximum Ratings (NOTE1)

$V_B$  - High side floating supply voltage.....-0.3V to +624V  
 $V_S$  - High side floating supply offset voltage... $V_B$ -24V to  $V_B$ +0.3V  
 $V_{SS}$  - Logic Supply offset voltage..... $V_{CC}$  -24V to  $V_{CC}$  + 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 and logic 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  $T_A \leq 25^\circ\text{C}$   
 SOIC-8.....0.625W  
 SOIC-14.....0.862W

### SOIC-8 Thermal Resistance (NOTE2)

$\theta_{JC}$ .....45  $^\circ\text{C}/\text{W}$   
 $\theta_{JA}$ .....200  $^\circ\text{C}/\text{W}$

### SOIC-14 Thermal Resistance (NOTE2)

$\theta_{JA}$ .....145  $^\circ\text{C}/\text{W}$

$T_J$  - Junction operating temperature .....+150  $^\circ\text{C}$

$T_L$  - Lead temperature (soldering, 10s) ..... +300  $^\circ\text{C}$

$T_{stg}$  - Storage temperature range .....-55  $^\circ\text{C}$  to +150  $^\circ\text{C}$

**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	<b>NOTE3</b>	600	
$V_{SS}$	Logic ground (TC21904 only)	-5	5	
$V_{HO}$	High side floating output voltage	$V_S$	$V_B$	
$V_{CC}$	Low side fixed supply voltage	10	20	
$V_{LO}$	Low side output voltage	0	$V_{CC}$	
$V_{IN}$	Logic input voltage (HIN and LIN)	0	$V_{CC}$	
$T_A$	Ambient temperature	-40	125	$^\circ\text{C}$

**NOTE3** Logic operational for  $V_S$  of -5V to +600V. Logic state held for  $V_S$  of -5V to -VBS

**DC Electrical Characteristics** (NOTE4)

$V_{BIAS} (V_{CC}, V_{BS}) = 15V, T_A = 25^\circ C$ , unless otherwise specified.

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
$V_{IH}$	Logic "1" input voltage	$V_{CC} = 10V \text{ to } 20V$	2.5			V
$V_{IL}$	Logic "0" input voltage					
$V_{OH}$	High level output voltage, $V_{BIAS} - V_O$	$I_O = 0mA$			1.0	
$V_{OL}$	Low level output voltage, $V_O$	$I_O = 0mA$			0.035	
$I_{LK}$	Offset supply leakage current	$V_B = V_S = 600V$			50	$\mu A$
$I_{BSQ}$	Quiescent $V_{BS}$ supply current	$V_{IN} = 0V \text{ or } 5V$		45	80	
$I_{CCQ}$	Quiescent $V_{CC}$ supply current	$V_{IN} = 0V \text{ or } 5V$		75	110	
$I_{IN+}$	Logic "1" input bias current	$V_{IN} = 5V$		25	50	
$I_{IN-}$	Logic "0" input bias current	$V_{IN} = 0V$		1.0	2.0	
$V_{BSUV+}$	$V_{BS}$ supply under-voltage positive going threshold		8.0	8.8	9.8	V
$V_{BSUV-}$	$V_{BS}$ supply under-voltage negative going threshold		7.4	8.3	9.0	
$V_{CCUV+}$	$V_{CC}$ supply under-voltage positive going threshold		8.0	8.8	9.8	
$V_{BSUV-}$	$V_{CC}$ supply under-voltage negative going threshold		7.4	8.3	9.8	
$V_{CCUVH}$	$V_{CC}$ and $V_{BS}$ under-voltage hysteresis			0.5		
$V_{BSUVH}$						
$I_{O+}$	Output high short circuit pulsed current	$V_O = 0V, PW \leq 10 \text{ ms}$	3.5	4.5		A
$I_{O-}$	Output low short circuit pulsed current	$V_O = 15V, PW \leq 10 \text{ ms}$	3.5	4.5		

**NOTE4** The  $V_{IH}$ ,  $V_{IL}$ , 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  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified.

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
$t_{on}$	Turn-on propagation delay	$V_s = 0V$		140	200	ns
$t_{off}$	Turn-off propagation delay	$V_s = 0V$		140	200	
$t_{DM}$	Delay matching, HS & LS turn on/off			0	50	
$t_r$	Turn-on rise time	$V_s = 0V$		25	500	
$t_f$	Turn-off fall time			20	45	

### Timing Waveforms

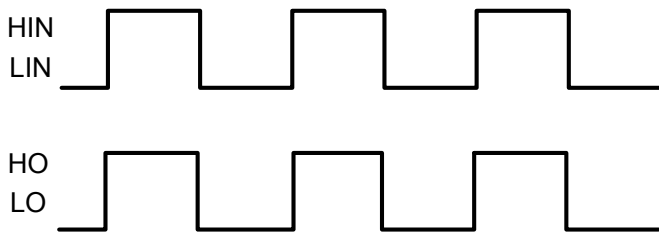


Figure 1. Input / Output Timing Diagram

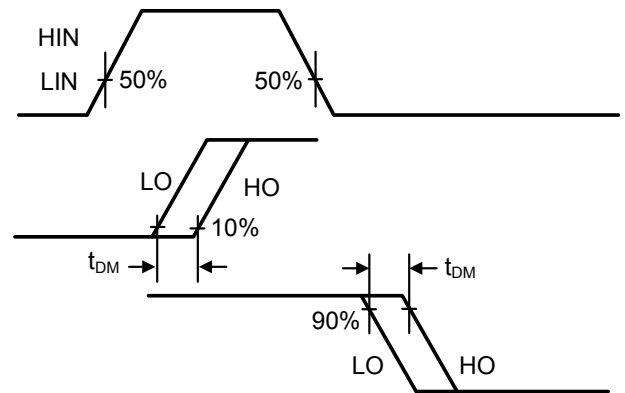


Figure 2. Delay Matching Waveform Definitions

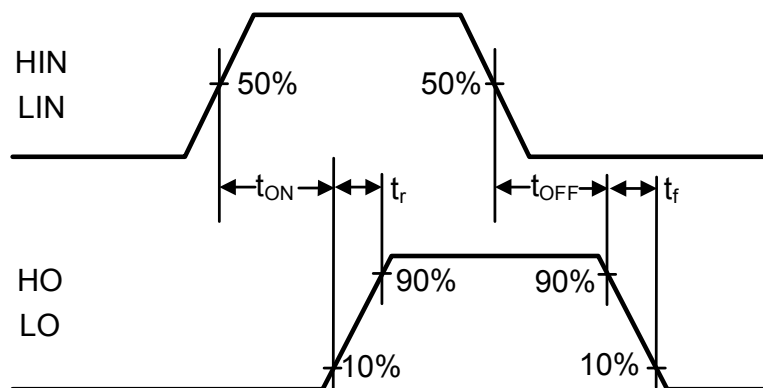


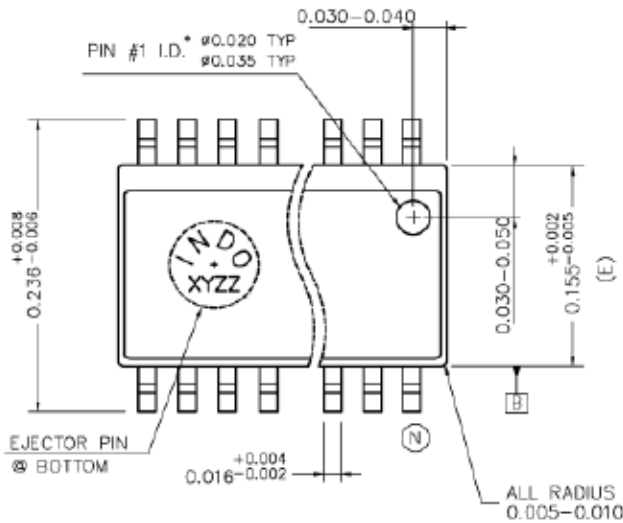
Figure 3. Switching Time Waveform Definitions





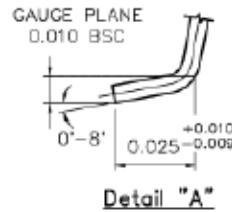
## Package Dimensions (SOIC-14)

Please contact support@tfproducts.com for package availability.

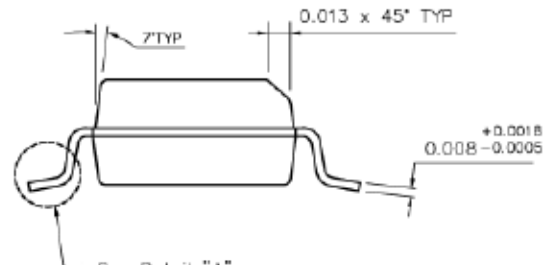
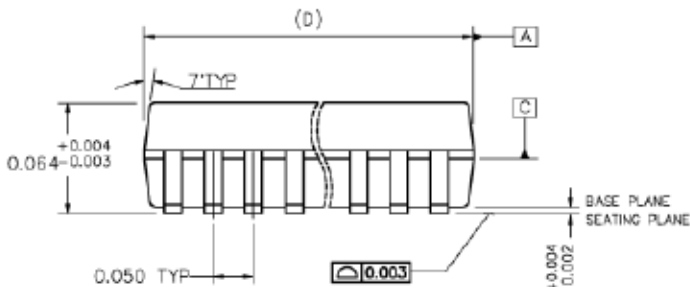


ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED  
NOTES:

1. "D" & "E" ARE REFERENCE DATUMS AND DO NOT INCLUDE MOLD FLASH OR PROTRUSION. MOLD FLASH OR PROTRUSION SHALL NOT EXCEED 6 MILS PER SIDE.
2. "N" IS THE NUMBER OF TERMINAL POSITIONS.
3. FORMED LEADS SHALL BE PLANAR WITH RESPECT TO ONE ANOTHER WITHIN 3 MILS (SEATING PLANE) OUTGOING ASSEMBLY & 4 MILS AFTER TEST.
4. THE BOTTOM PACKAGE LEAD SIDE MAY BE BIGGER THAN THE TOP PACKAGE LEAD SIDE BY 4 MILS (2 MILS PER SIDE). BOTTOM PACKAGE DIMENSION SHALL FOLLOW DIMENSION STATED IN THIS DRAWING.
5. THE BOTTOM EJECTOR PIN CONTAINS COUNTRY OF ORIGIN "INDO" AND MOLD ID. (REFER TO TABLE FOR OPTION).
6. THIS DRAWING CONFORMS TO JEDEC REF. M5-012 REV. E



N	D VARIATION			MCP MOLD			
	MIN	NOM	MAX	PIN 1 I.D.	EJECT PIN	PIN 1 I.D.	EJECT PIN
08	0.189	0.193	0.196	N/A	YES	YES	YES
14	0.337	0.339	0.344	YES	NO	YES	YES
16	0.386	0.390	0.393	N/A	YES	YES	YES







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