



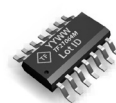
Features

- Floating high-side driver in bootstrap operation to 600V
- Drives two N-channel MOSFETs or IGBTs in a half bridge configuration
- Outputs tolerant to negative transients
- Wide logic and low side gate driver supply voltage: 10V to 20V
- Wide logic supply voltage offset voltage: -5V to 5V
- Logic input (HIN and LIN) 3.3V capability
- Schmitt triggered logic inputs with internal pull down
- Undervoltage lockout for high and low side drivers
- Extended temperature range: -40°C to +125°C

Description

The TF21064M is a high voltage, high speed gate driver capable of driving N-channel MOSFETs and IGBTs in a half bridge configuration. TF Semiconductors's high voltage process enables the TF21064's high side to switch to 600V in a bootstrap operation.

The TF21064M 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 TF21064M is offered in PDIP-14 and SOIC-14(N) packages and operates over an extended -40 °C to +125 °C temperature range.



SOIC-14(N)



PDIP-14

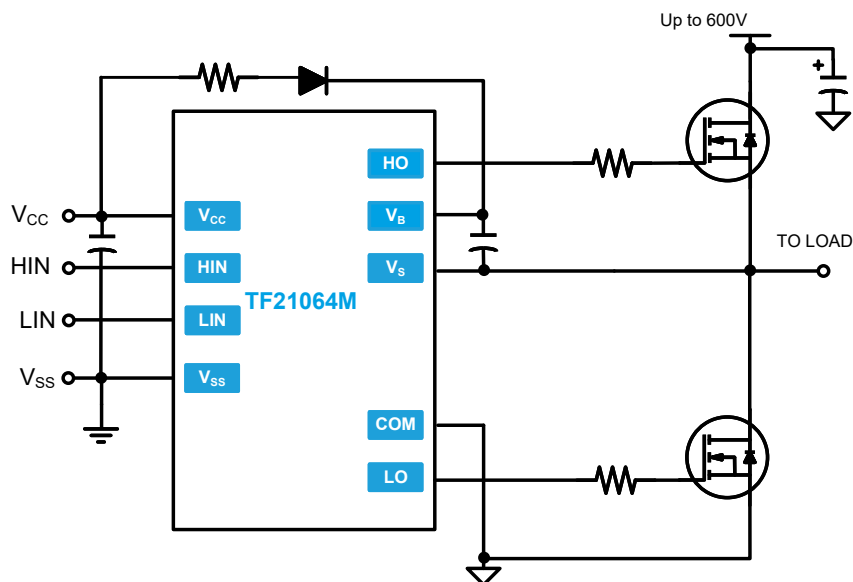
Applications

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

Ordering Information

PART NUMBER	PACKAGE	PACK / Qty	MARK
TF21064M-TUU	SOIC-14(N)	Tube / 50	TF YYWW TF21064M Lot ID
TF21064M-TUH		T&R / 2500	
TF21064M-3BS	PDIP-14	Tube / 25	TF YYWW TF21064M Lot ID

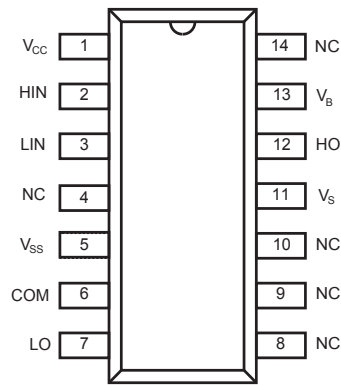
Typical Application



Pin Diagrams

TF21064M

High-Side and Low-Side Gate Driver



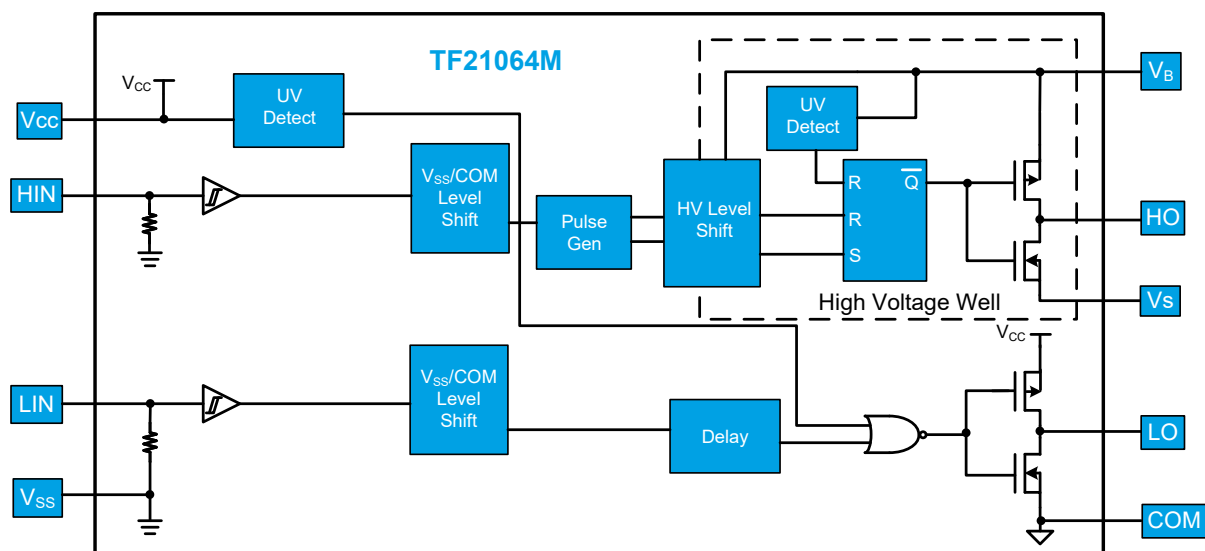
Top View: SOIC-14, PDIP-14

TF21064M

Pin Descriptions

PIN NAME	PIN DESCRIPTION
HIN	Logic input for high-side gate driver output, in phase with HO (referenced to VSS).
LIN	Logic input for low side gate driver output, in phase with LO (referenced to VSS)
VSS	Logic ground
NC	No connect
COM	Low-side return
LO	Low-side gate drive output
V _{CC}	Low-side and logic fixed supply
V _B	High-side floating supply
HO	High-side gate drive output
V _S	High-side floating supply return

Functional Block Diagram



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_{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_{DT} - Programmable dead time pin voltage..... V_{SS} -0.3V to V_B +0.3V

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_{SS} - Logic supply offset voltage..... V_{CC} - 24V to V_{CC} +0.3V
 V_{IN} - Logic input voltage (HIN and LIN)..... V_{SS} - 0.3V to V_{CC} +0.3V

P_D - Package power dissipation at $T_A \leq 25^\circ\text{C}$

SOIC-14.....1.0W
 PDIP-14.....1.6W

SOIC-14 Thermal Resistance (NOTE2)

θ_{JA}120 $^\circ\text{C/W}$

PDIP-14 Thermal Resistance (NOTE2)

θ_{JA}75 $^\circ\text{C/W}$

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.

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.

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	(NOTE 3)	600	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	COM	V_{CC}	V
V_{IN}	Logic input voltage (HIN & LIN)	V_{SS}	5	V
V_{DT}	Programmable deadtime pin voltage	V_{SS}	V_{CC}	V
V_{SS}	Logic ground	-5	5	V
T_A	Ambient temperature	-40	125	$^\circ\text{C}$

NOTE3 Logic operational for V_S of -5 V to +600 V.

DC Electrical Characteristics (NOTE4)

$V_{BIAS} (V_{CC}, V_{BS}) = 15V$, $V_{SS} = COM$, and $T_A = 25\text{ }^{\circ}C$ 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				0.6	
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	$V_B = V_S = 600V$			50	μA
I_{BSQ}	Quiescent V_{BS} supply current	$V_{IN} = 0V \text{ or } 5V$	20	75	130	
I_{CCQ}	Quiescent V_{CC} supply current	$V_{IN} = 0V \text{ or } 5V$	60	120	180	
I_{IN+}	Logic "1" input bias current	$V_{IN} = 5V$		5	20	
I_{IN-}	Logic "0" input bias current	$V_{IN} = 0V$			5	
V_{BSUV+}	V_{BS} supply under-voltage positive going threshold		7.0	8.4	9.8	V
V_{BSUV-}	V_{BS} supply under-voltage negative going threshold		6.4	7.8	9.0	
V_{CCUV+}	V_{CC} supply under-voltage positive going threshold		7.0	8.4	9.8	
V_{CCUV-}	V_{CC} supply under-voltage negative going threshold		6.4	7.8	9.0	
V_{CCUVH}	Hysteresis		0.3	0.7		V
V_{BSUVH}						
I_{O+}	Output high short circuit pulsed current	$V_O = 0V$, $PW \leq 10\text{ }\mu s$	130	290		mA
I_{O-}	Output low short circuit pulsed current	$V_O = 15V$, $PW \leq 10\text{ }\mu s$	270	600		

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

NOTE5 For optimal operation, it is recommended that the input pulse (to HIN and LIN) should have an amplitude of 2.5V minimum with a pulse width of 440 μs minimum.

AC Electrical Characteristics

$V_{BIAS} (V_{CC}, V_{BS}) = 15V$ and $C_L = 100pF$, $V_{SS} = COM$, and $T_A = 25\text{ }^{\circ}C$ unless otherwise specified.

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
t_{ON}	Turn-on propagation delay	$V_S = 0V$		220	300	ns
t_{OFF}	Turn-off propagation delay	$V_S = 0V$ or $600V$		200	280	
t_{DM}	Delay matchng			0	30	
t_r	Turn-on rise time	$V_S = 0V$		100	220	
t_f	Turn-off fall time	$V_S = 0V$		35	80	

Timing Waveforms

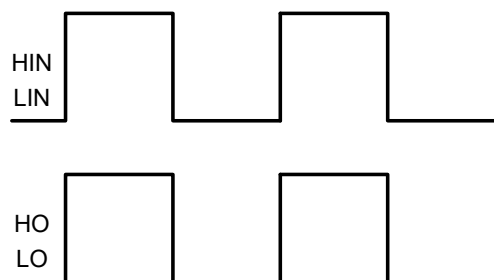


Figure 1. Input / Output Timing Diagram

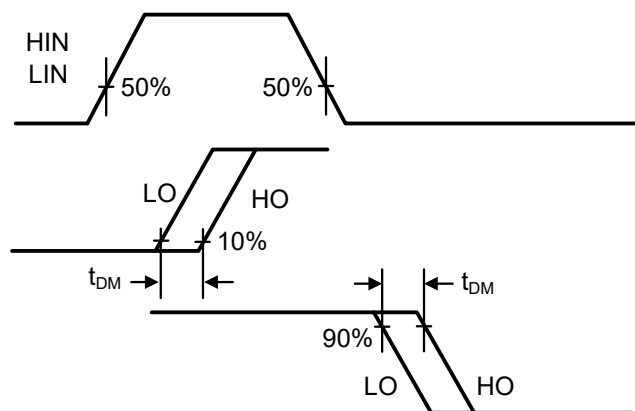


Figure 2. Delay Matching Waveform Definitions

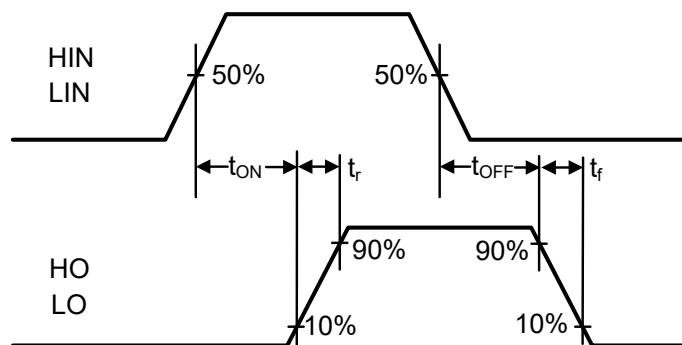


Figure 3. Switching Time Waveform Definitions

Application Information

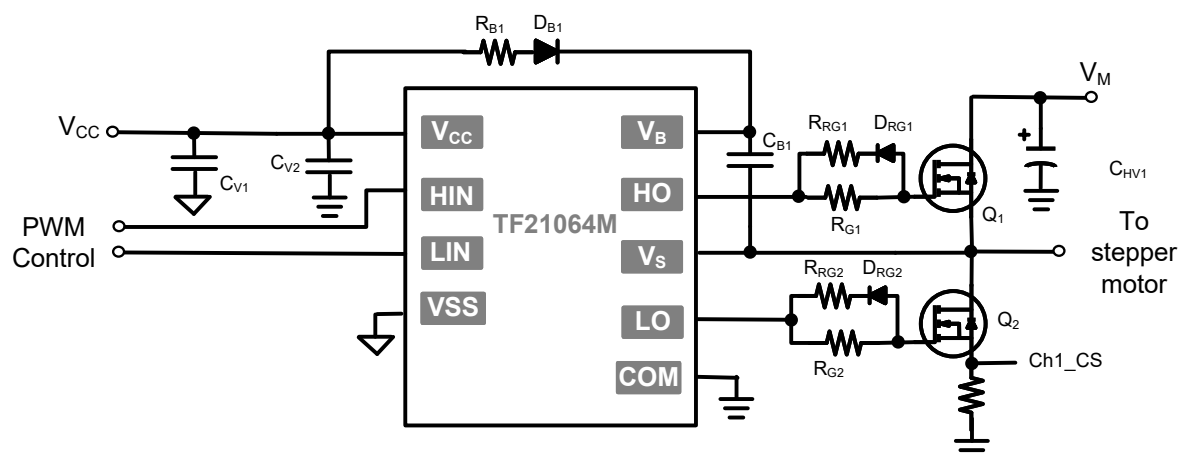


Figure 4. Single phase (of four) for Stepper motor driver application using TF21064M

- RRG1 and RRG2 values are typically between 0Ω and 10Ω , exact value decided by MOSFET junction capacitance and drive current of gate driver; 10Ω is used in this example.
- It is **highly recommended** that the input pulse (to HIN and LIN) should have an amplitude of 2.5V minimum (for VDD=15V) with a minimum pulse width of 440ns
- RG1 and RG2 values are typically between 10Ω and 100Ω , exact value decided by MOSFET junction capacitance and drive current of gate driver; 50Ω is used in this example.
- RB1 value is typically between 3Ω and 20Ω , exact value depending on bootstrap capacitor value and amount of current limiting required for bootstrap capacitor charging; 10Ω is used in this example. Also DB1 should be an ultra fast diode of 1A rating minimum and voltage rating greater than system operating voltage.

Typical Characteristics

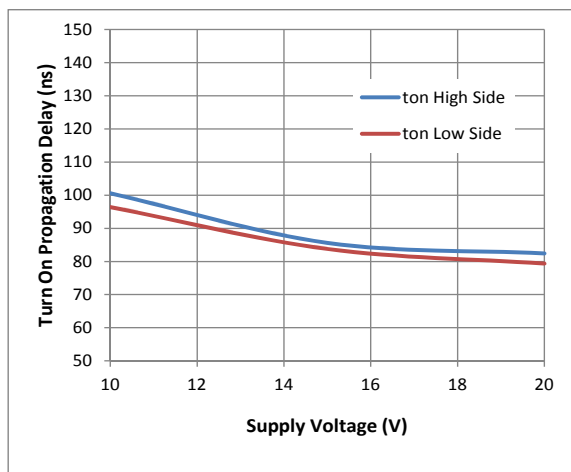


Figure 5. Turn-on Propagation Delay vs. Supply Voltage

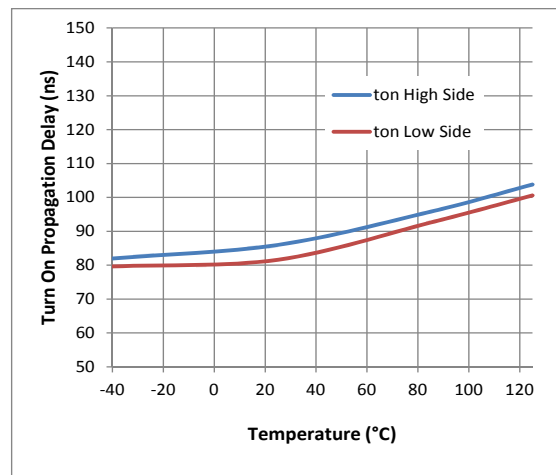


Figure 6. Turn-on Propagation Delay vs. Temperature

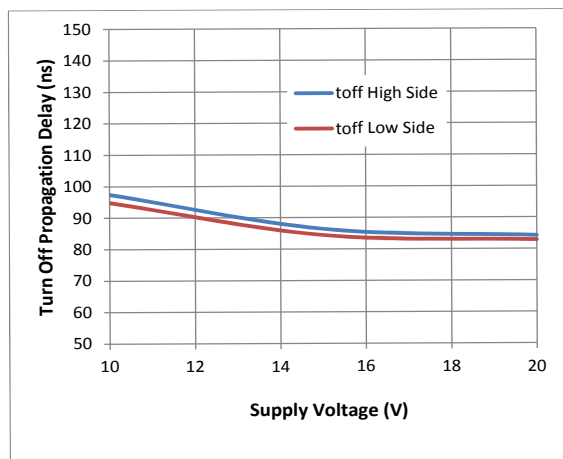


Figure 7. Turn-off Propagation Delay vs. Supply Voltage

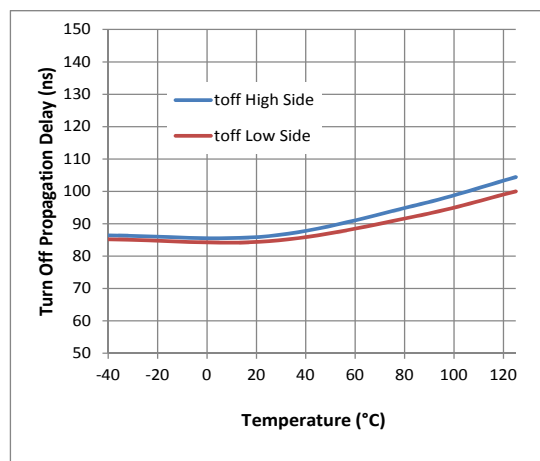


Figure 8. Turn-off Propagation Delay vs. Temperature

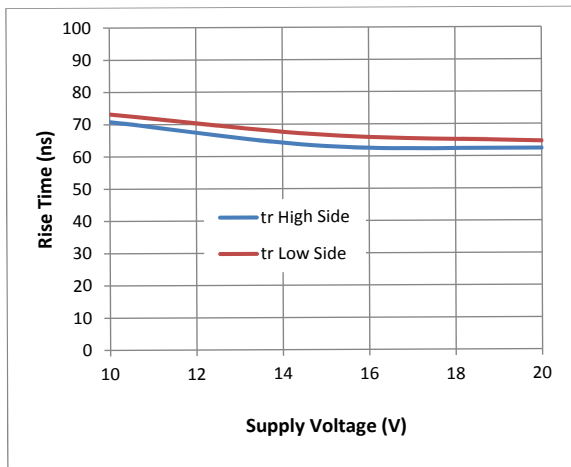


Figure 9. Rise Time vs. Supply Voltage

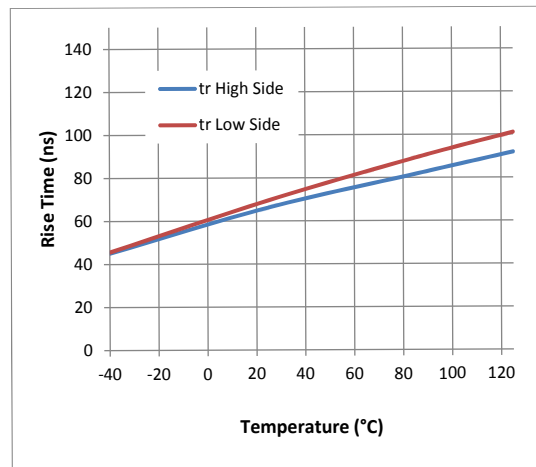


Figure 10. Rise Time vs. Temperature

Typical Characteristics

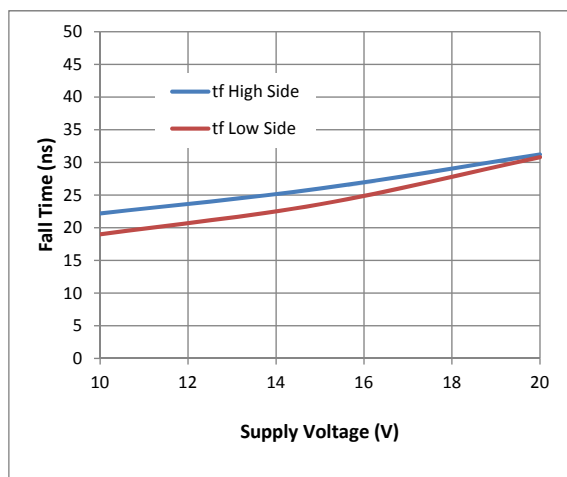


Figure 11. Fall Time vs. Supply Voltage

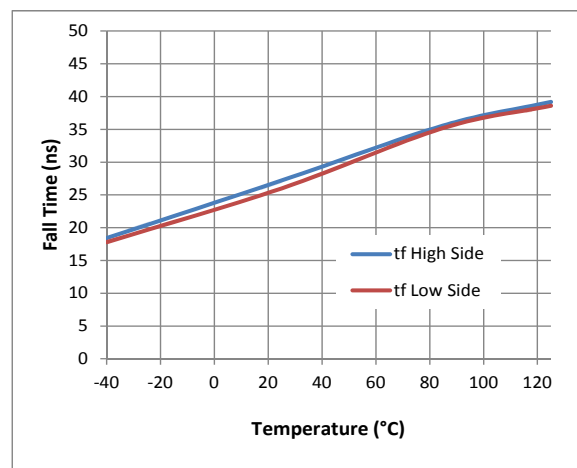


Figure 12. Fall Time vs. Temperature

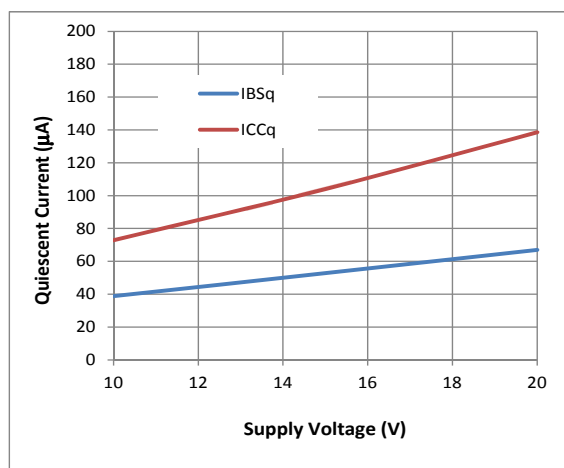


Figure 13. Quiescent Current vs. Supply Voltage

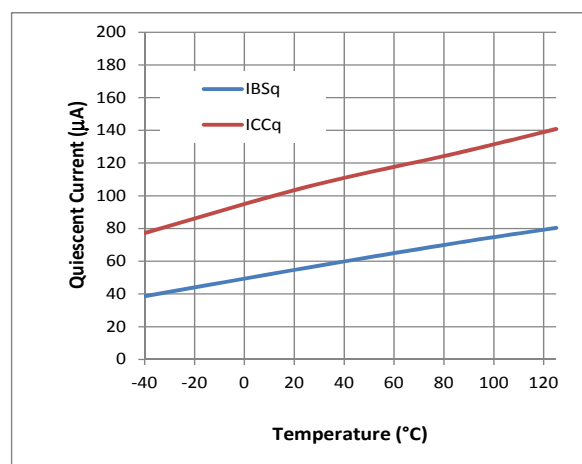


Figure 14. Quiescent Current vs. Temperature

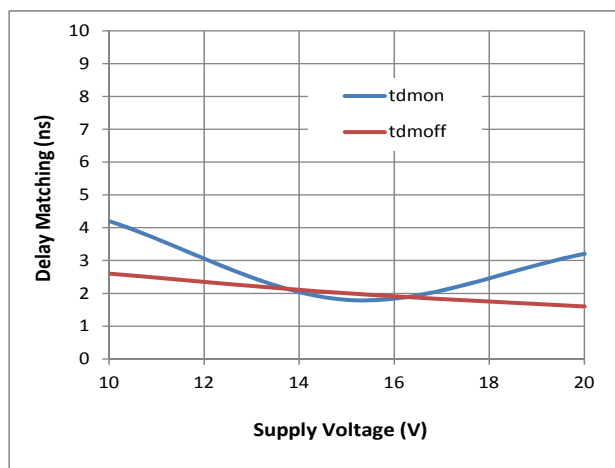


Figure 15. Delay Matching vs. Supply Voltage

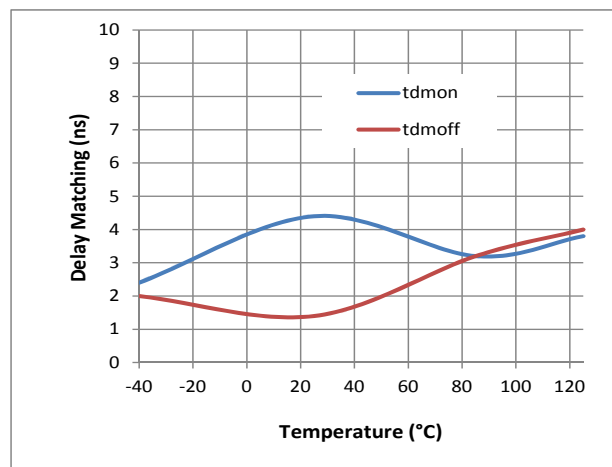


Figure 16. Delay Matching vs. Temperature

Typical Characteristics

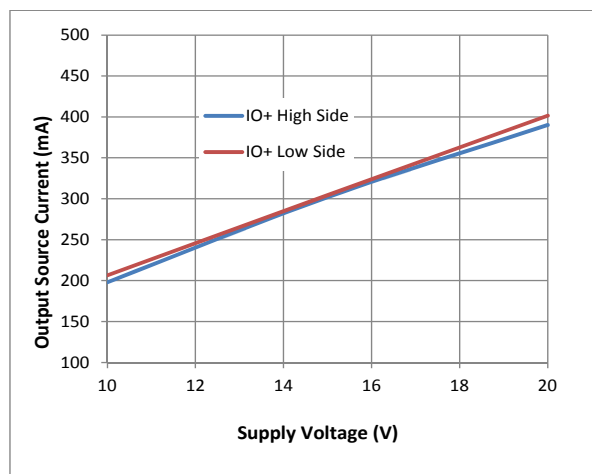


Figure 17. Output Source Current vs. Supply Voltage

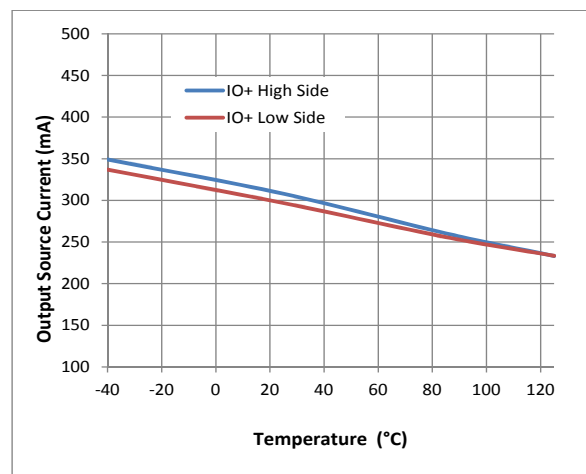


Figure 18. Output Source Current vs. Temperature

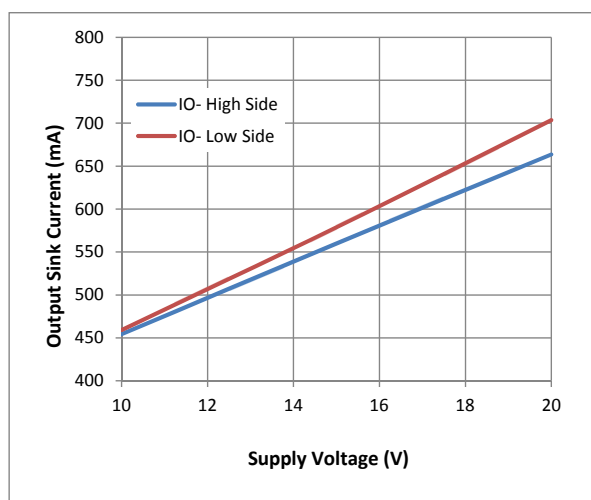


Figure 19. Output Sink Current vs. Supply Voltage

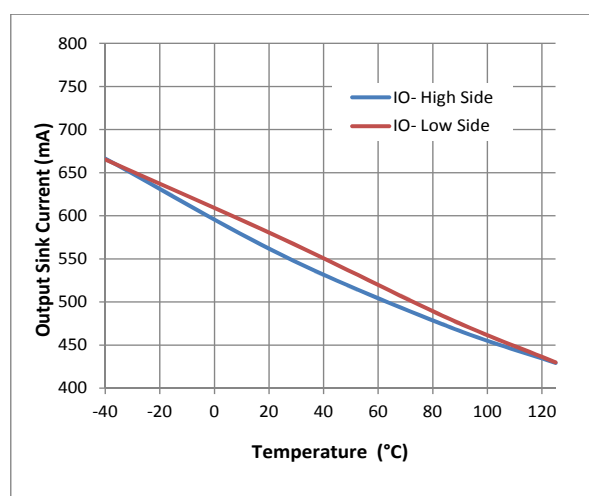


Figure 20. Output Sink Current vs. Temperature

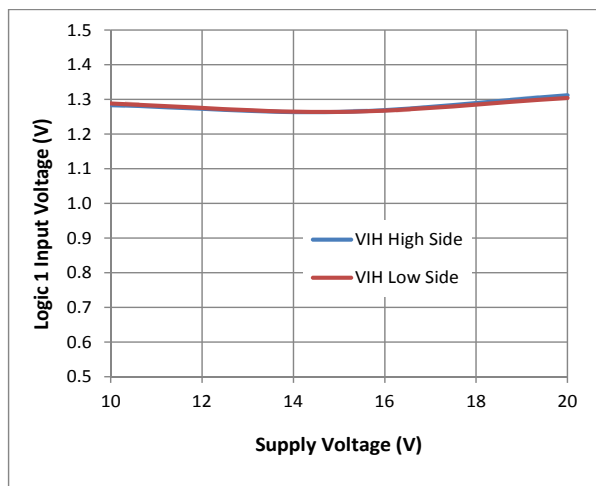


Figure 21. Logic 1 Input Voltage vs. Supply Voltage

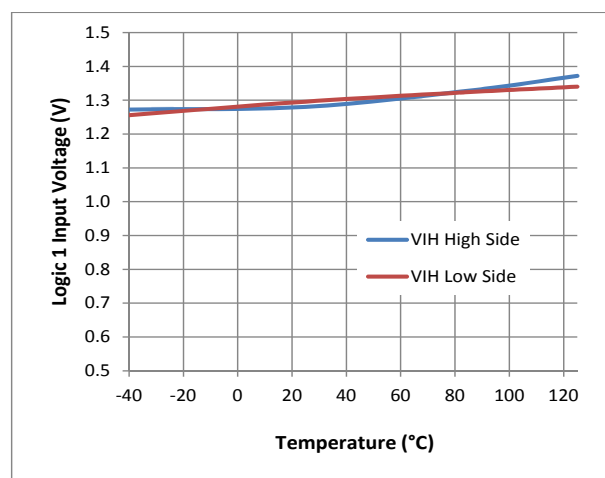


Figure 22. Logic 1 Input Voltage vs. Temperature

Typical Characteristics

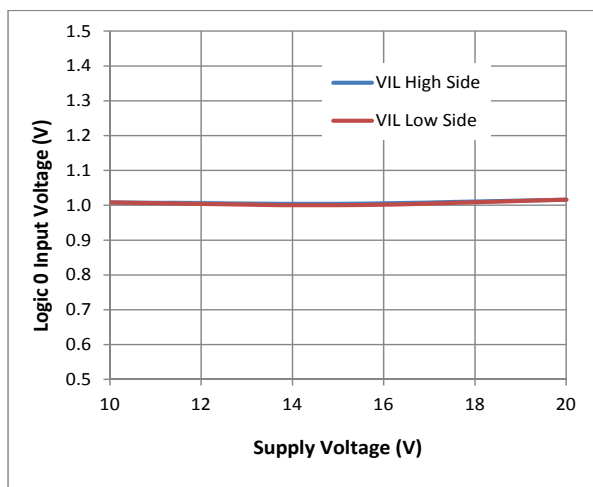


Figure 23. Logic 0 Input Voltage vs. Supply Voltage

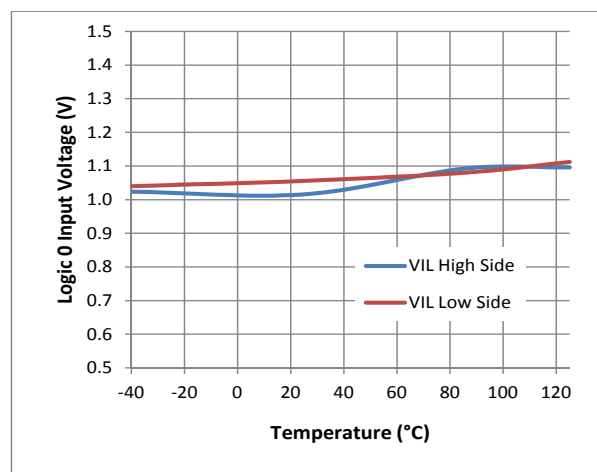


Figure 24. Logic 0 Input Voltage vs. Temperature

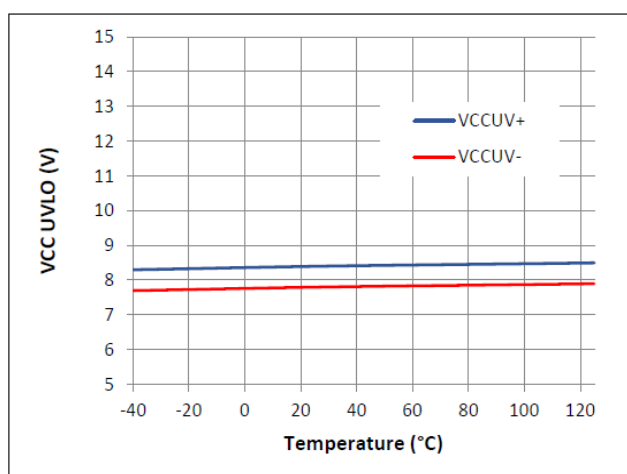


Figure 25. VCC UVLO vs. Temperature

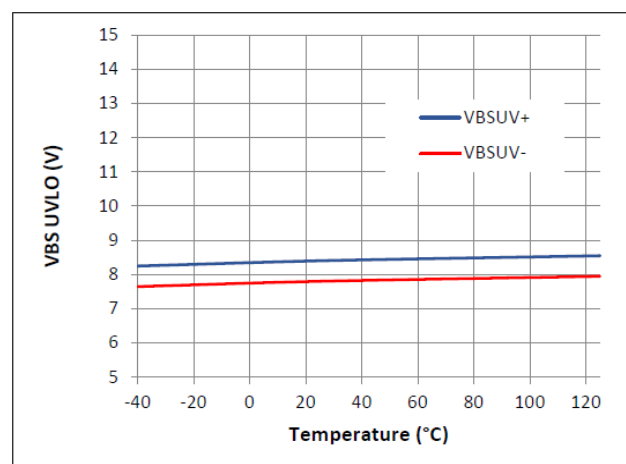


Figure 26. VBS UVLO vs. Temperature

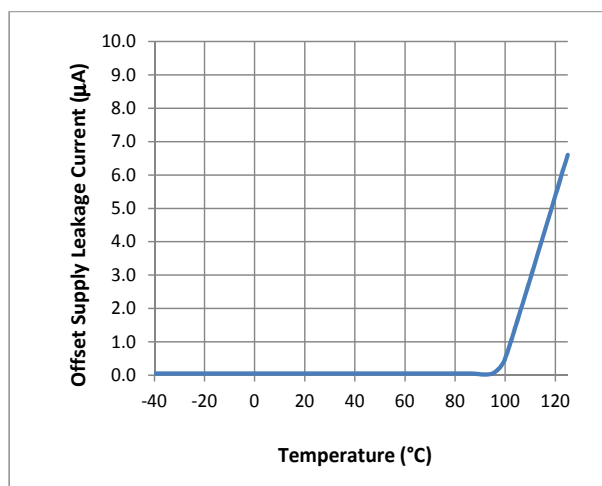


Figure 27. Offset Supply Leakage Current Temperature

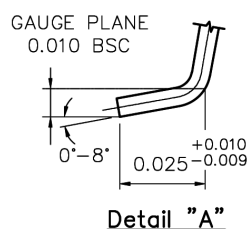
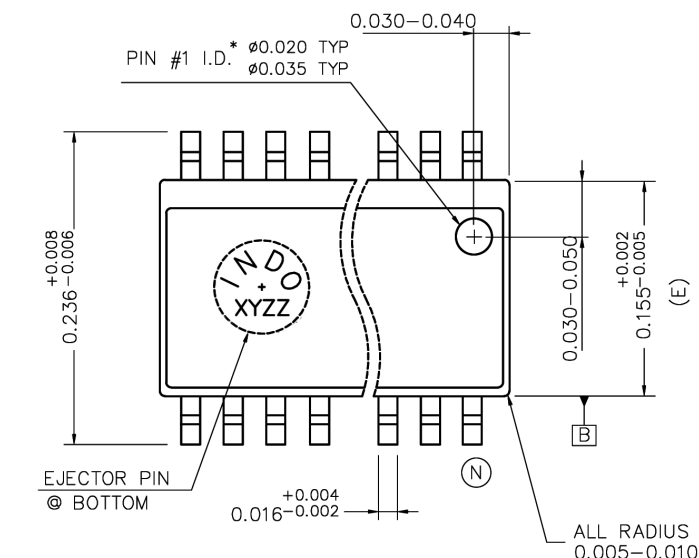
Package Dimensions (SOIC-14N)

Please contact support@tfsemi.com for package availability.

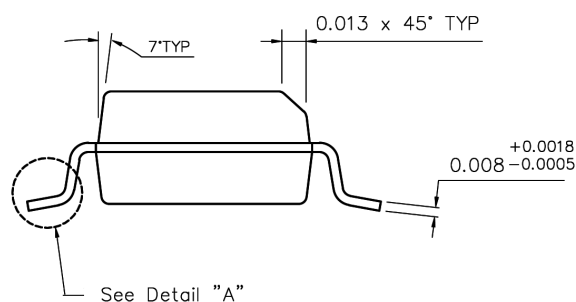
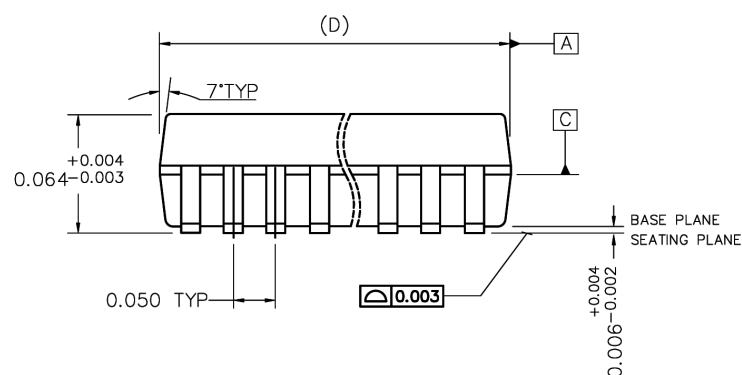
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

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. MS-012 REV. E



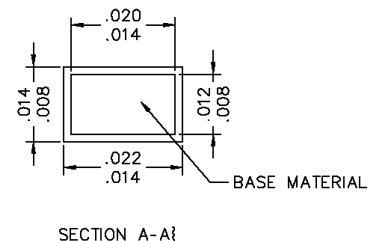
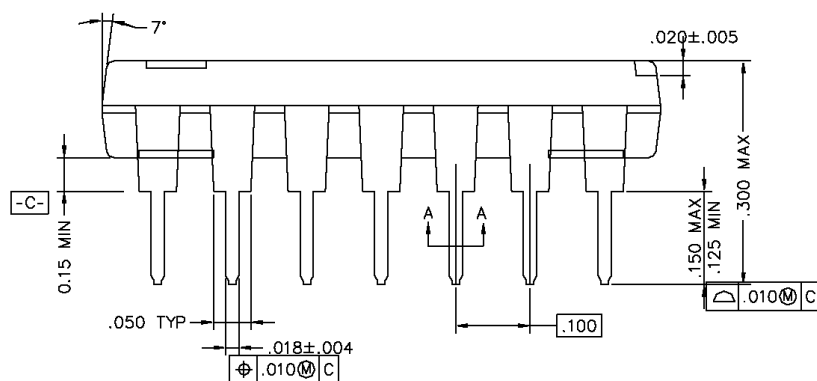
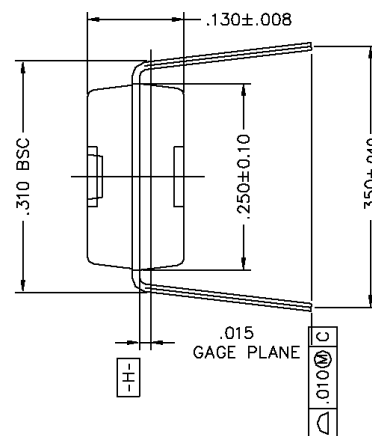
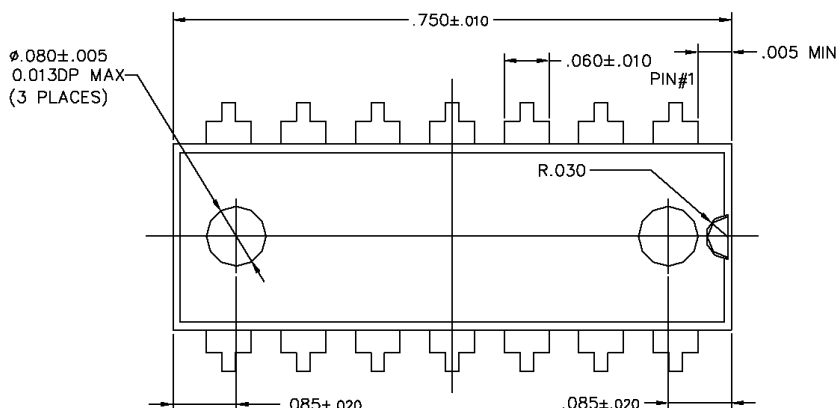
N	D VARIATION			MGP MOLD			
	MIN	NOM	MAX	PIN 1 I.D.	EJECT PIN	PIN 1 I.D.	EJECT PIN
08	0.189	0.193	0.196	N/A	YES	YES	YES
14	0.337	0.339	0.344	YES	NO	YES	YES
16	0.386	0.390	0.393	N/A	YES	YES	YES



Package Dimensions (PDIP-14)

Please contact support@tfsemi.com for package availability.

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED



Note: Drawing conforms to jedec ref. MS-001 rev D

Revision Table

Rev.	Change	Owner	Date
AI 1.0	First release, Advance Info ds	Keith Spaulding	11/24/2017
1.1	Add Note 5	Duke Walton	7/30/2019
1.2	Application Notes	Keith Spaulding	6/15/2021
Final 1.0	Edit to VCC and VBS UVLO electrical specifications	Keith Spaulding	2/18/2022

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[17149P](#) [6131-220-21149P](#) [6131-260-2358P](#)