High-Side and Low-Side Gate Driver

MCP14LH2181, MCP14LH21814

Description

The MCP14LH2181 and the MCP14LH21814 are high-voltage, high-speed gate drivers capable of driving N-channel MOSFETs and IGBTs in a half-bridge configuration. Microchips high voltage process enables the MCP14LH2181(4) high-side to switch to 600V in a bootstrap operation.

The MCP14LH2181(4) 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 MCP14LH2181 is offered in space-saving 8-pin SOIC and the MCP14LH21814 in the 14-pin SOIC and operates over an extended -40°C to +125°C temperature range.

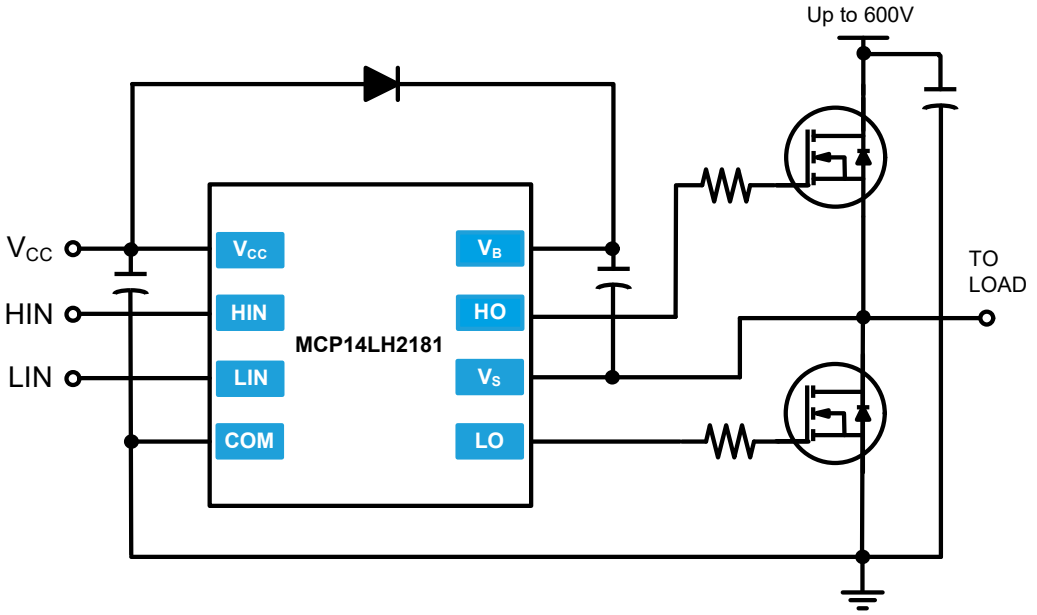
Features

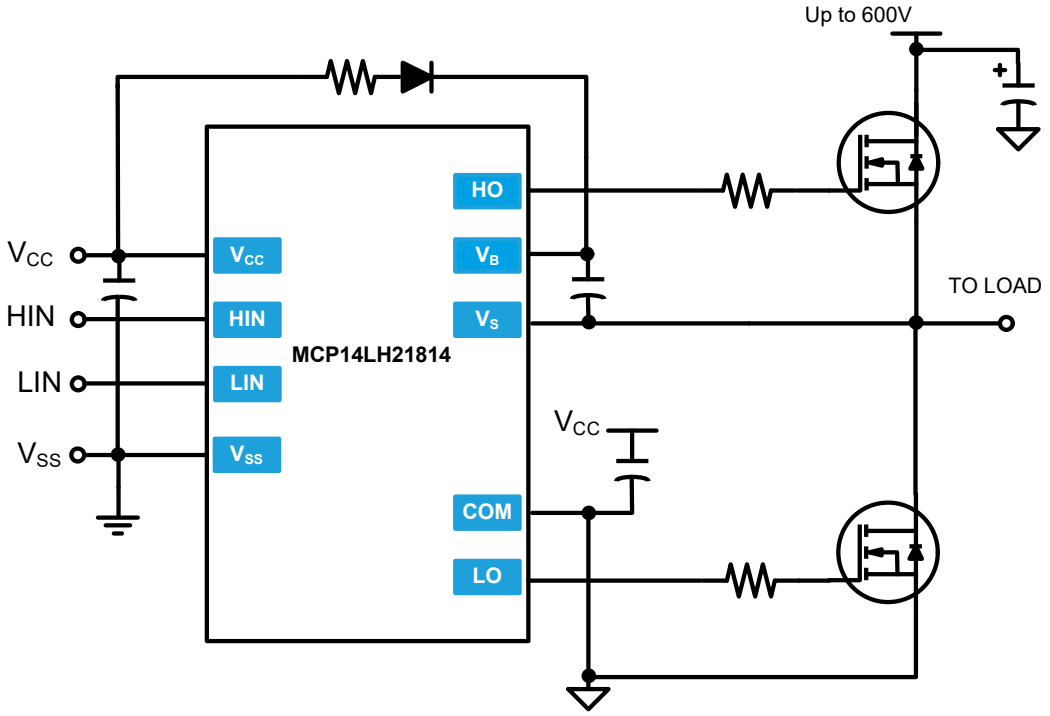
- Floating High-side Driver in Bootstrap Operation to 600V
- Drives Two N-Channel MOSFETs or IGBTs in a Half-bridge Configuration
- 1.9A Source/2.3A Sink Output Current Capability
- Outputs Tolerant to Negative Transients
- Wide Low-side Gate Driver Supply Voltage: 10V to 20V
- Logic Input (HIN and LIN) 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

Applications

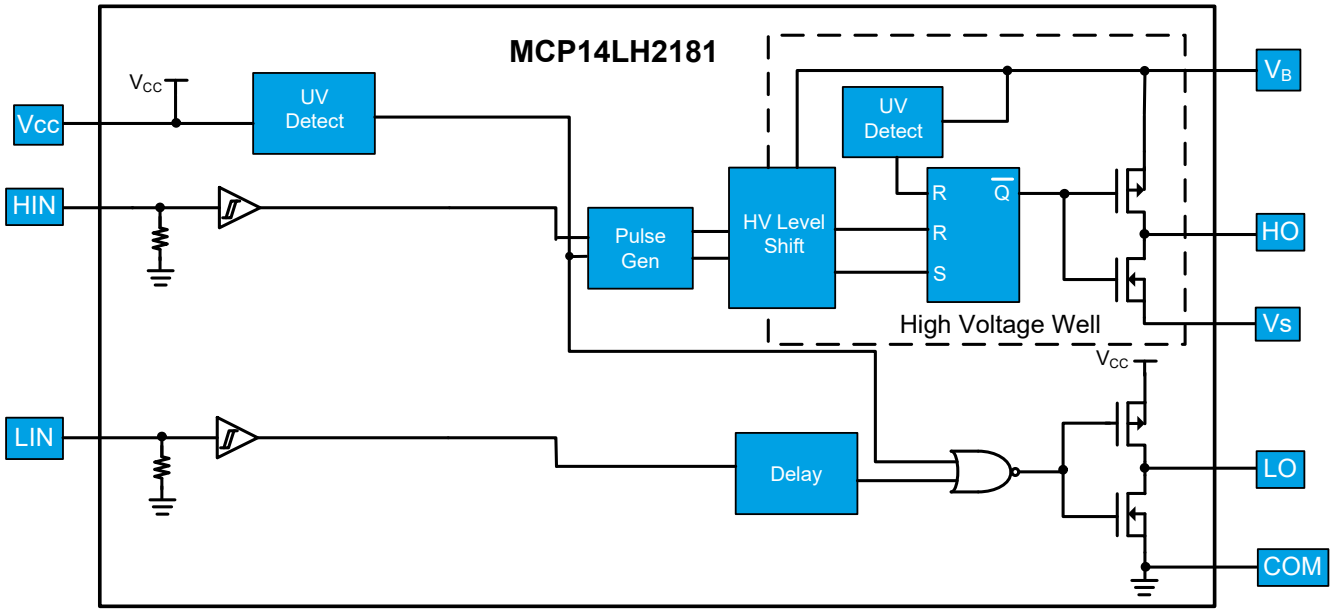
- DC-DC Converters
- AC-DC Inverters
- Motor Controls
- Motor Drivers
- Class D Power Amplifiers

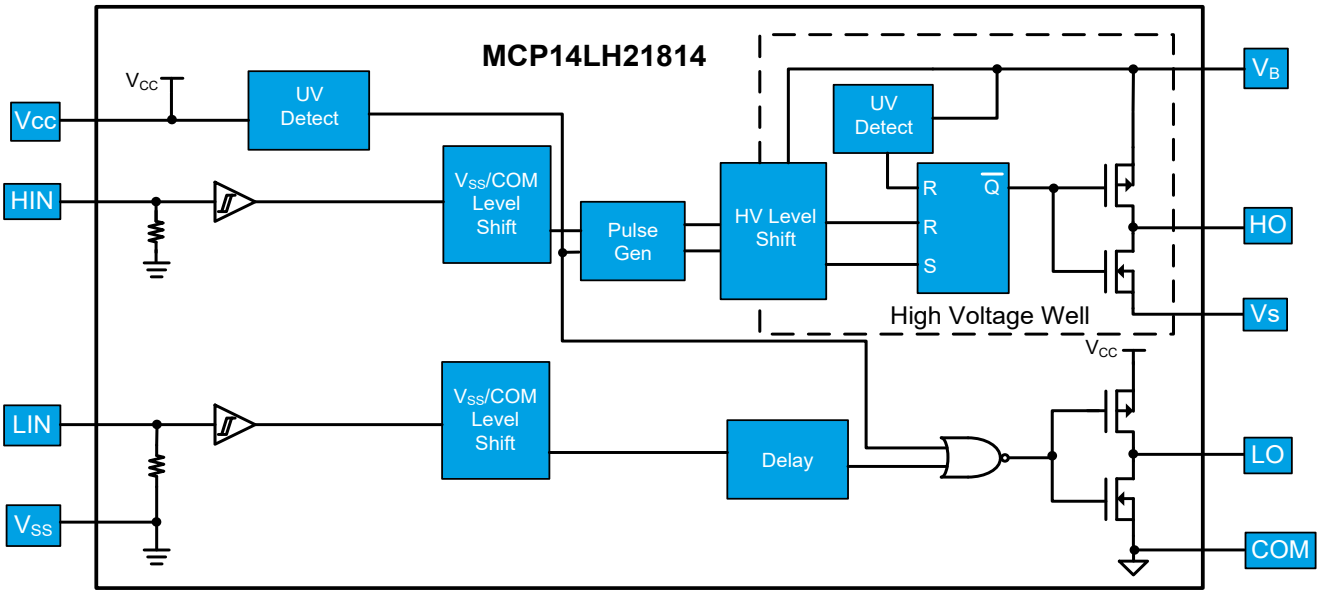
Typical Application





Block Diagrams





1. Pin Configuration

Pin No.	Pin Name MCP14LH2181	Pin Name MCP14LH21814	Pin Description
1	HIN	HIN	Logic input for high-side gate driver output, in phase with HO
2	LIN	LIN	Logic input for low-side gate driver output, in phase with LO
3	COM	—	Low-side and logic return
3	—	V_{SS}	Logic Return
4	LO	—	Low-side gate drive output
4	—	NC	Not connected
5	V_{CC}	—	Low-side and logic fixed supply
5	—	COM	Low-side return
6	V_S	—	High-side floating supply return
6	—	LO	Low-side gate drive output
7	HO	—	High-side gate driver output
7	—	V_{CC}	Low-side and logic fixed supply
8	V_B	—	High-side floating supply
8, 9, 10, 14	—	NC	Not connected
11	—	V_S	High-side floating supply return
12	—	HO	High-side gate driver output
13	—	V_B	High-side floating supply

1.1. Package Types

Figure 1-1. SOIC-8 Package (MCP14LH2181 - Top View)

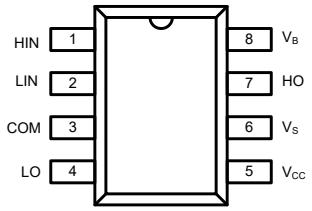
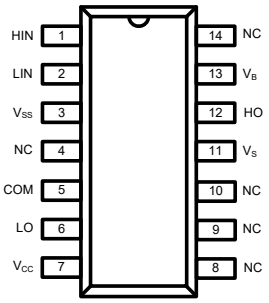


Figure 1-2. SOIC-14 Package (MCP14LH21814 - Top View)



2. Electrical Characteristics

2.1. Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
High-side Floating Supply Voltage	V_B	−0.3V	+624	V
High-side Floating Supply Offset Voltage	V_S	V_B − 24	V_B + 0.3	V
High-side Floating Output Voltage	V_{HO}	V_S − 0.3	V_B + 0.3	V
Offset Supply Voltage Transient	dV_S/dt	—	50	V/ns
Low-side Fixed Supply Voltage	V_{CC}	−0.3V	24	V
Low-side Output Voltage	V_{LO}	−0.3V	V_{CC} + 0.3	V
Logic Supply Offset Voltage (MCP14LH21814 only)	V_{SS}	V_{CC} − 24	V_{CC} + 0.3	V
Logic Input Voltage (HIN and LIN)	V_{IN}	−0.3V	V_{CC} + 0.3	V
SOIC-8 Package Power Dissipation at $T_A \leq 25°C$ (MCP14LH2181)	P_D	—	0.625	W
SOIC-14 Package Power Dissipation at $T_A \leq 25°C$ (MCP14LH21814)		—	1.0	W
SOIC-8 Thermal Resistance (MCP14LH2181, see Note)	θ_{JA}	—	200	°C/W
SOIC-14 Thermal Resistance (MCP14LH21814, see Note)	θ_{JA}	—	120	°C/W
Junction Operating Temperature	T_J	—	+150	°C
Lead Temperature (soldering, 10 seconds)	T_L	—	+300	°C
Storage Temperature Range	T_{stg}	−55	+150	°C

⚠ WARNING Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

Note: When mounted on a standard JEDEC 2-layer FR-4 board.

2.2. Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Unit
High-side Floating Supply Absolute Voltage	V_B	V_S + 10	V_S + 20	V
High-side Floating Supply Offset Voltage	V_S	See Note	600	V
High-side Floating Output Voltage	V_{HO}	V_S	V_B	V
Low-side Fixed Supply Voltage	V_{CC}	10	20	V
Low-side Output Voltage	V_{LO}	COM	V_{CC}	V
Logic Input Voltage (HIN and LIN, MCP14LH2181)	V_{IN}	COM	5	V
Logic Input Voltage (HIN and LIN, MCP14LH21814)	V_{IN}	V_{SS}	5	V
Logic Ground (MCP14LH21814 only)	V_{SS}	−5	5	V
Ambient Temperature	T_A	−40	125	°C

Note: Logic operational for VS of −5V to +600V.

2.3. DC Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 15V, T_A = 25°C , unless otherwise specified.						
Parameter (Note 1)	Symbol	Min.	Typ.	Max.	Unit	Conditions
Logic "1" Input Voltage	V_{IH}	2.5	—	—	V	V_{CC} = 10V to 20V (Note 2)
Logic "0" Input Voltage	V_{IL}	—	—	0.8	V	V_{CC} = 10V to 20V (Note 2)
High Level Output Voltage, V_{BIAS} – V_O	V_{OH}	—	—	1.4	V	I_O = 0 mA
Low Level Output Voltage, V_O	V_{OL}	—	—	0.2	V	I_O = 20 mA
Offset Supply Leakage Current	I_{LK}	—	—	50	µA	VB = VS = 600V
Quiescent V_{BS} Supply Current	I_{BSQ}	20	60	150	µA	V_{IN} = 0V or 5V
Quiescent V_{CC} Supply Current	I_{CCQ}	50	120	240	µA	V_{IN} = 0V or 5V
Logic "1" Input Bias Current	I_{IN+}	—	25	60	µA	V_{IN} = 5V
Logic "0" Input Bias Current	I_{IN-}	—	—	5.0	µA	V_{IN} = 0V
V_{BS} Supply Undervoltage Positive Going Threshold	V_{BSUV+}	8.0	8.9	9.8	V	
V_{BS} Supply Undervoltage Negative Going Threshold	V_{BSUV-}	7.4	8.2	9.0	V	
V_{CC} Supply Undervoltage Positive Going Threshold	V_{CCUV+}	8.0	8.9	9.8	V	
V_{CC} Supply Undervoltage Negative Going Threshold	V_{CCUV-}	7.4	8.2	9.0	V	
Output High Short Circuit Pulsed Current	I_{O+}	1.4	1.9	—	A	V_O = 0V, PW ≤ 10 µs
Output Low Short Circuit Pulsed Current (MCP14LH2181)	I_{O-}	1.7	2.3	—	A	V_O = 15V, PW ≤ 10 µs
Output Low Short Circuit Pulsed Current (MCP14LH21814)		1.8	2.3	—	A	

Notes:

1. The V_{IN}, V_{TH} 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.
2. 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 (PW) of 360 ns, minimum for MCP14LH2181 or 440 ns, minimum for MCP14LH21814.

2.4. AC Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 15V, C_L = 1000 pF and T_A = 25°C , unless otherwise specified.						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Turn-on Propagation Delay	t_{on}	—	180	270	ns	V_S = 0V, seeFigure 3-3.
Turn-off Propagation Delay	t_{off}	—	220	330	ns	V_S = 0V or 600V, see Figure 3-3.
Delay Matching, HS and LS Turn-on/Turn-off	t_{DM}	—	—	35	ns	See Figure 3-2.
Turn-on Rise Time	t_r	—	40	60	ns	V_S = 0V, see Figure 3-3.
Turn-off Fall Time	t_f	—	20	35	ns	V_S = 0V, see Figure 3-3.

3. Timing Waveforms

Figure 3-1. Input/Output Timing Diagram

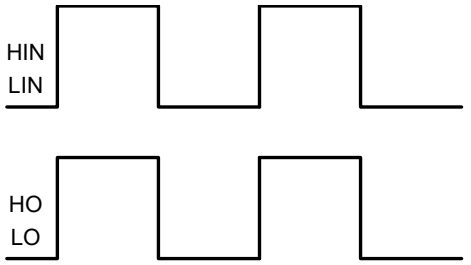


Figure 3-2. Delay Matching Waveform Definitions

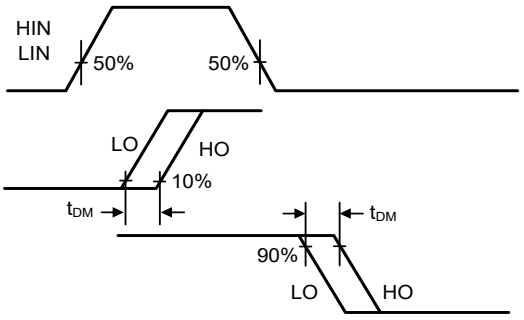
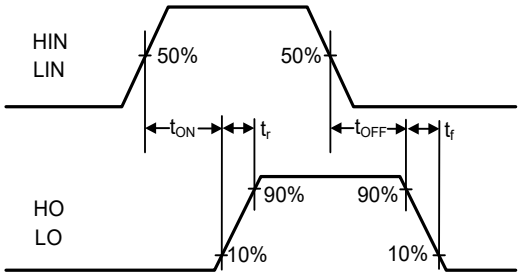


Figure 3-3. Switching Time Waveform Definitions



4. Typical Performance Curves

Figure 4-1. Output Source Current vs. Supply Voltage

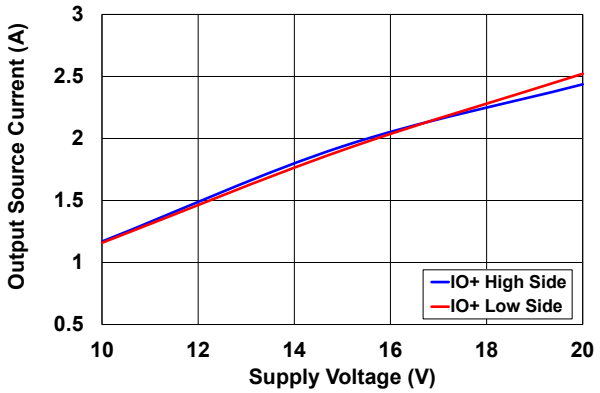


Figure 4-2. Output Source Current vs. Temperature

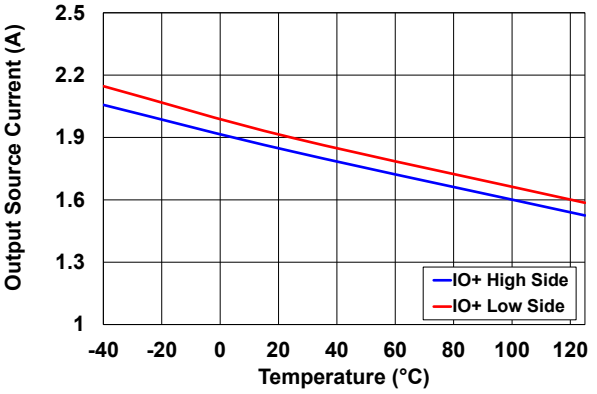


Figure 4-3. Output Sink Current vs. Supply Voltage

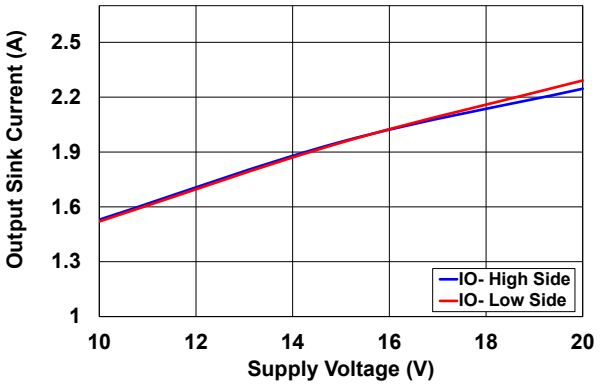


Figure 4-4. Output Sink Current vs. Temperature

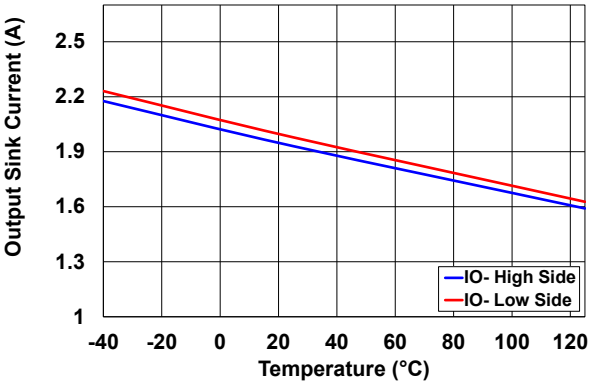


Figure 4-5. Logic 1 Input Voltage vs. Supply Voltage

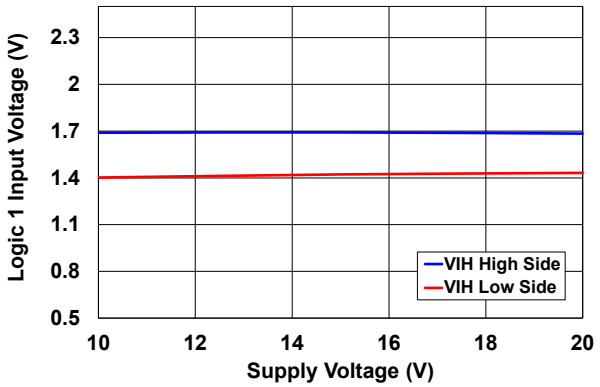


Figure 4-6. Logic 1 Input Voltage vs. Temperature

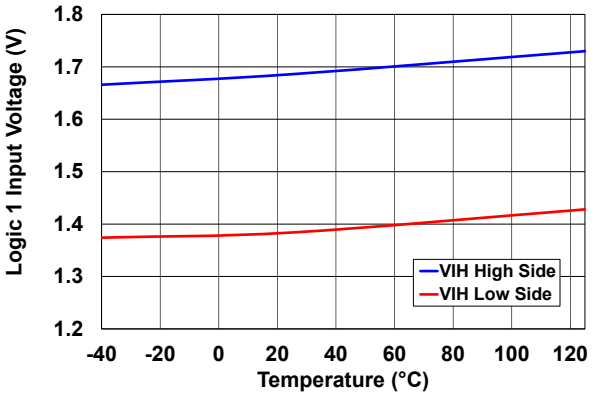


Figure 4-7. Logic 0 Input Voltage vs. Supply Voltage

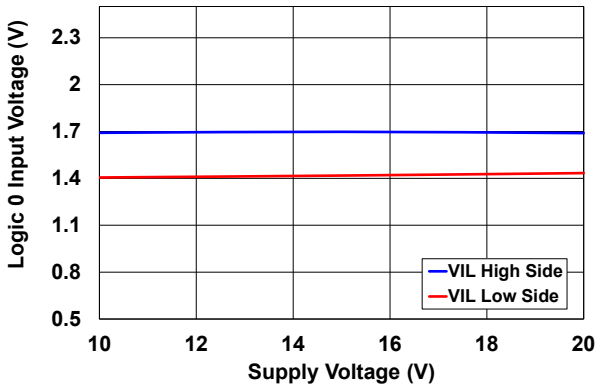


Figure 4-8. Logic 0 Input Voltage vs. Temperature

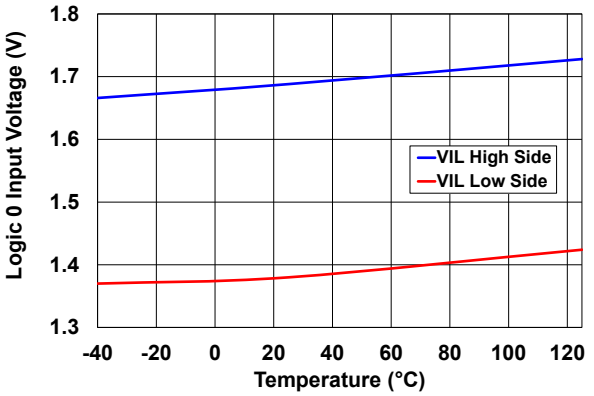


Figure 4-9. Quiescent Current vs. Supply Voltage

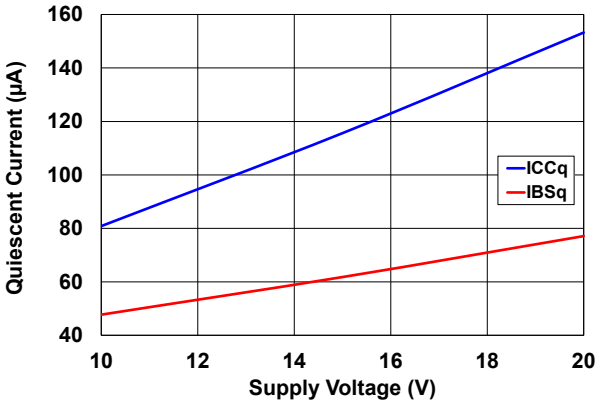


Figure 4-10. Quiescent Current vs. Temperature

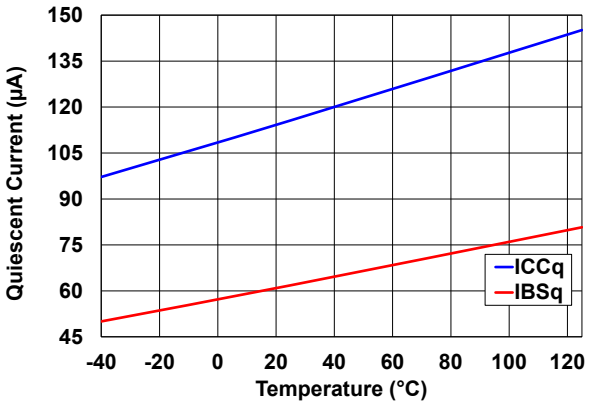


Figure 4-11. Turn-on Propagation Delay vs. Supply Voltage

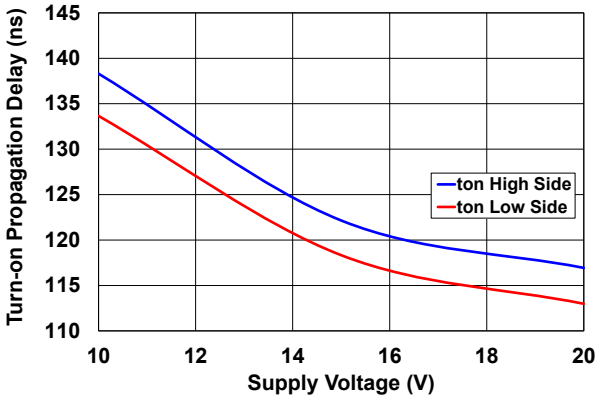


Figure 4-12. Turn-on Propagation Delay vs. Temperature

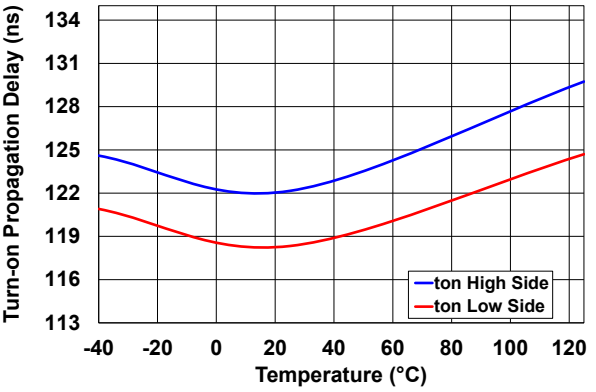


Figure 4-13. Turn-off Propagation Delay vs. Supply Voltage

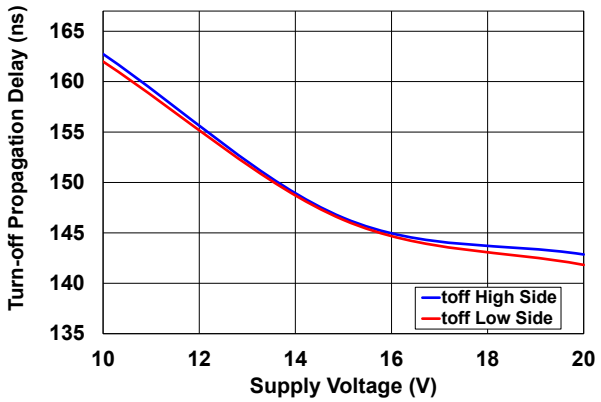


Figure 4-14. Turn-off Propagation Delay vs. Temperature

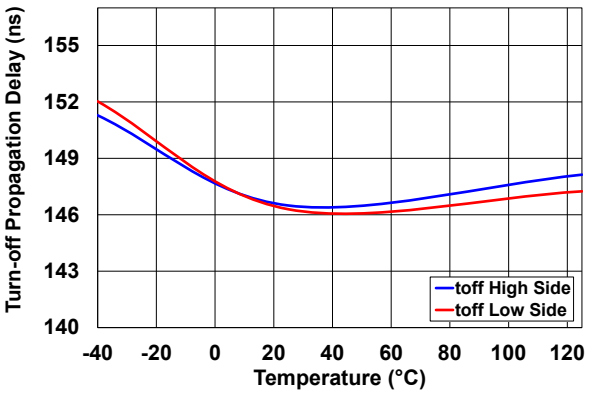


Figure 4-15. Rise Time vs. Supply Voltage

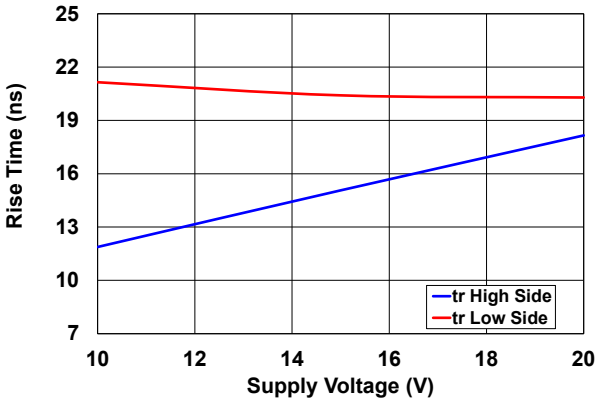


Figure 4-16. Rise Time vs. Temperature

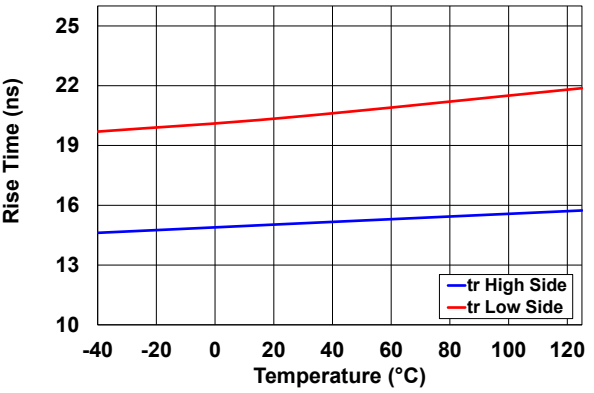


Figure 4-17. Fall Time vs. Supply Voltage

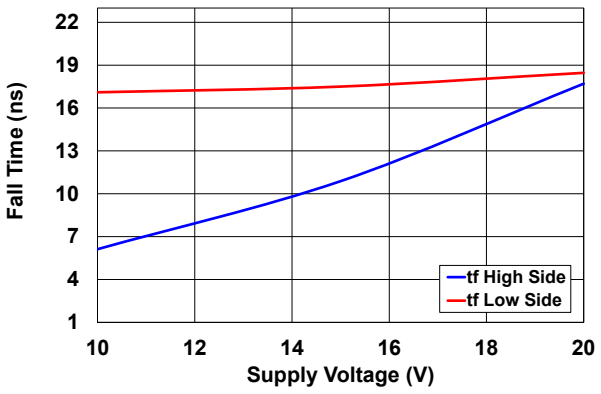


Figure 4-18. Fall Time vs. Temperature

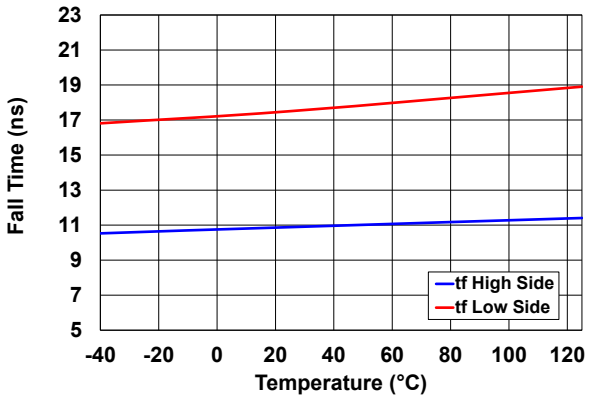


Figure 4-19. Delay Matching vs. Supply Voltage

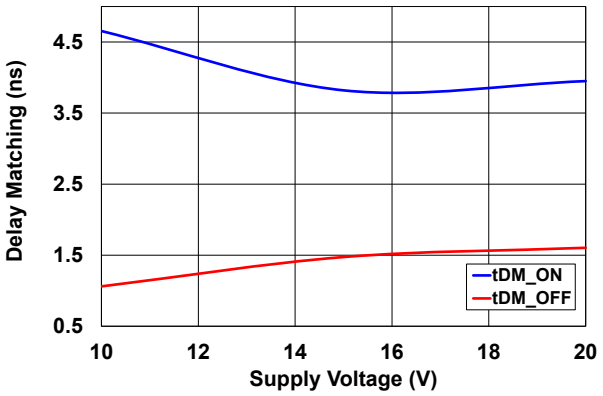


Figure 4-20. Delay Matching vs. Temperature

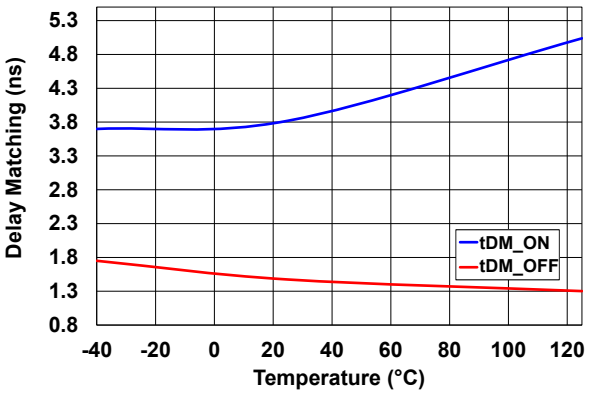


Figure 4-21. V_{CC} UVLO vs. Temperature

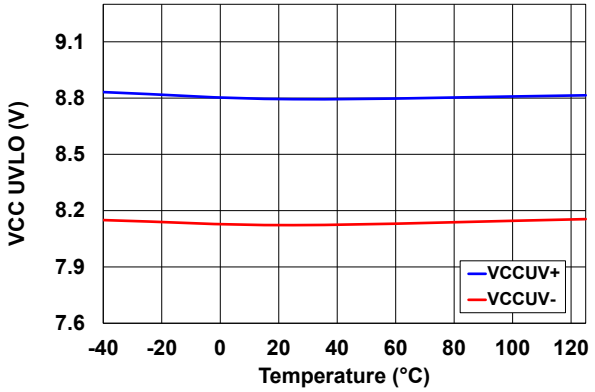


Figure 4-22. V_{BS} UVLO vs. Temperature

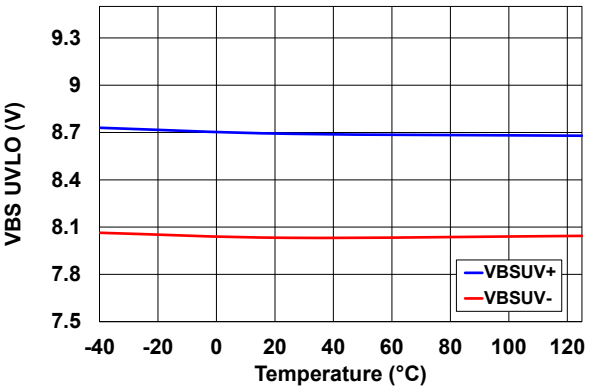
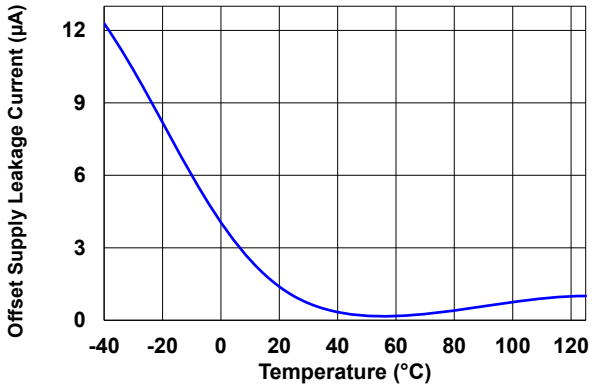
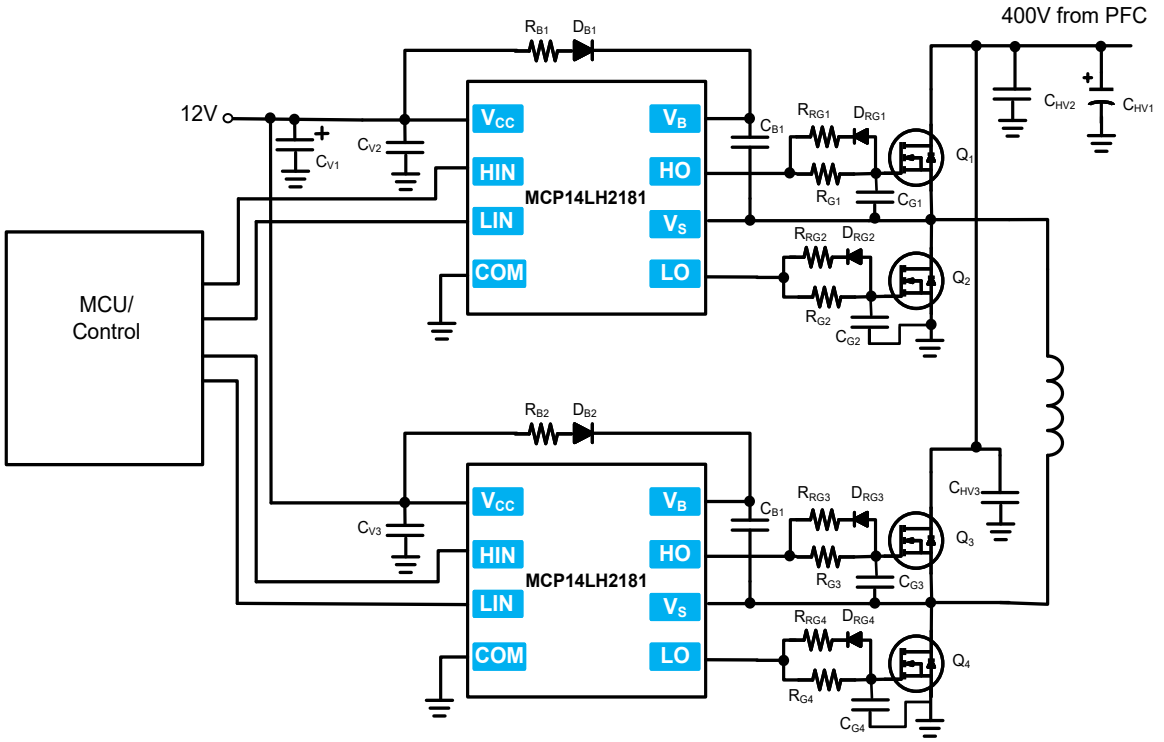


Figure 4-23. Offset Supply Leakage Current Temperature



5. Application Information MCP14LH2181

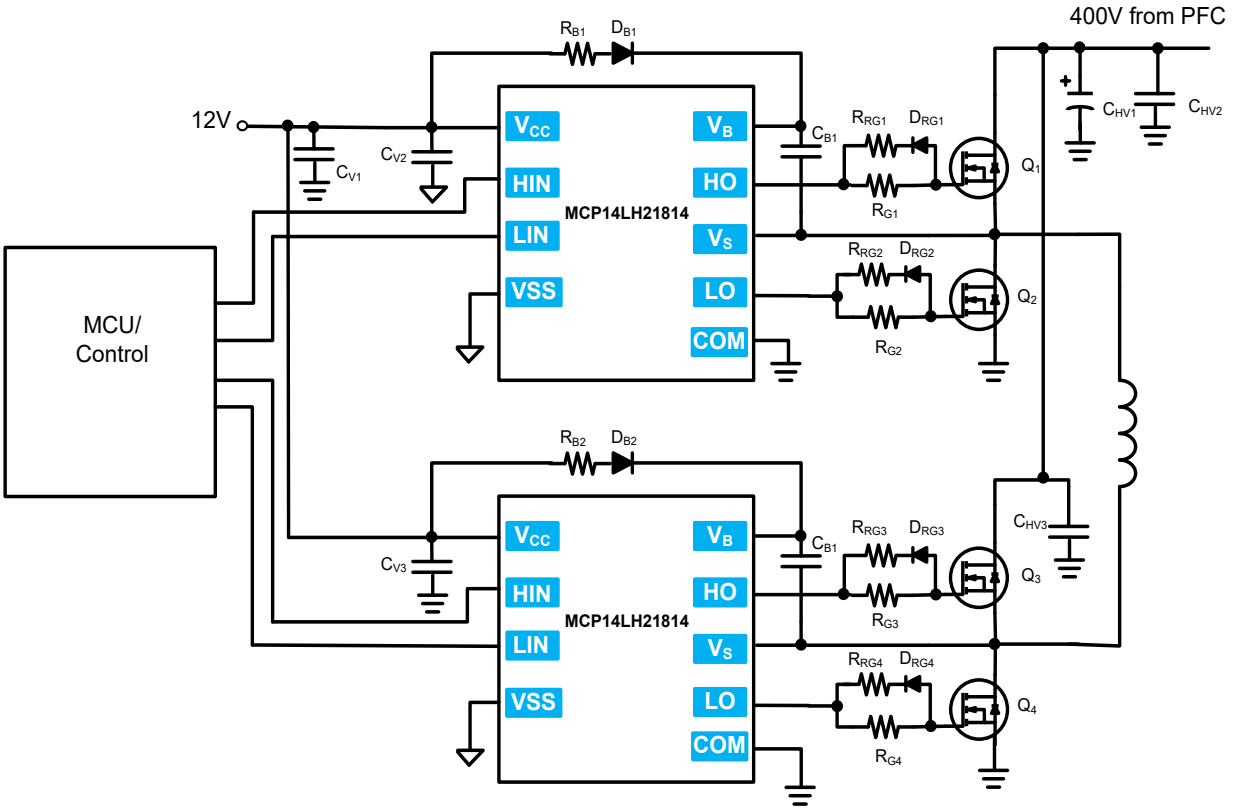
Figure 5-1. Primary Side of Full Bridge Converter Using the MCP14LH2181



- R_{RG1}, R_{RG2}, R_{RG3}, and R_{RG4} values are typically between 0Ω and 10Ω. The exact value is decided based on the MOSFET junction capacitance and the drive current of gate driver. A value of 10Ω is used in this example.
- It is 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 360 ns.
- R_{G1}, R_{G2}, R_{G3}, and R_{G4} values are typically between 20Ω and 100Ω. The exact value is decide based on the MOSFET junction capacitance and drive current of the gate driver. A value of 50Ω is used in this example.
- R_{B1} and R_{B2} value is typically between 3Ω and 20Ω. The exact value is calculated based on the bootstrap capacitor value and the amount of current limiting required for bootstrap capacitor charging. A value of 10Ω is used in this example. Also, D_{B1} and D_{B2} should be an ultra fast diode with a minimum rating of 1A and a voltage rating greater than the system operating voltage.

6. Application Information MCP14LH21814

Figure 6-1. Primary Side of Full Bridge Converter Using the MCP14LH21814

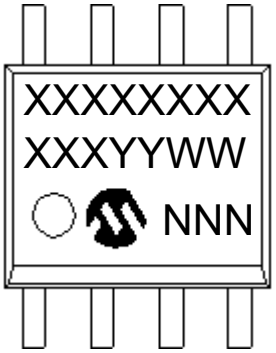


- R_{RG1}, R_{RG2}, R_{RG3}, and R_{RG4} values are typically between 0Ω and 10Ω. The exact value is decided based on the MOSFET junction capacitance and the drive current of gate driver. A value of 10Ω is used in this example.
- It is **highly recommended** that the input pulse (to HIN and LIN) should have an amplitude of 2.5V minimum (for VDD = 15V) with a minimum pulse width of 440 ns.
- R_{G1}, R_{G2}, R_{G3}, and R_{G4} values are typically between 20Ω and 100Ω. The exact value is decide based on the MOSFET junction capacitance and drive current of the gate driver. A value of 50Ω is used in this example.
- R_{B1} and R_{B2} value is typically between 3Ω and 20Ω. The exact value is calculated based on the bootstrap capacitor value and the amount of current limiting required for bootstrap capacitor charging. A value of 10Ω is used in this example. Also, D_{B1} and D_{B2} should be an ultra fast diode with a minimum rating of 1A and a voltage rating greater than the system operating voltage.

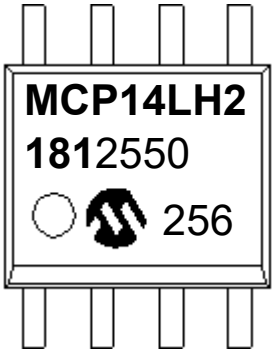
7. Packaging Information

Package Marking Information

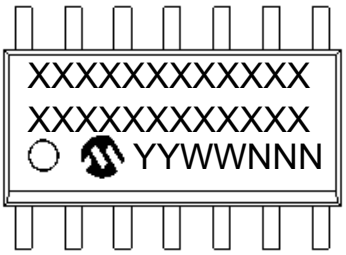
8-Pin SOIC (MCP14LH2181):



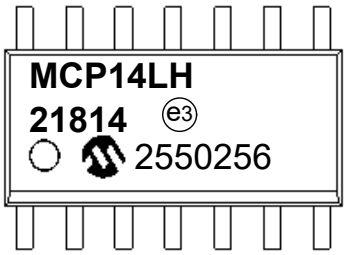
Example:



14-Pin SOIC (MCP14LH21814):



Example:

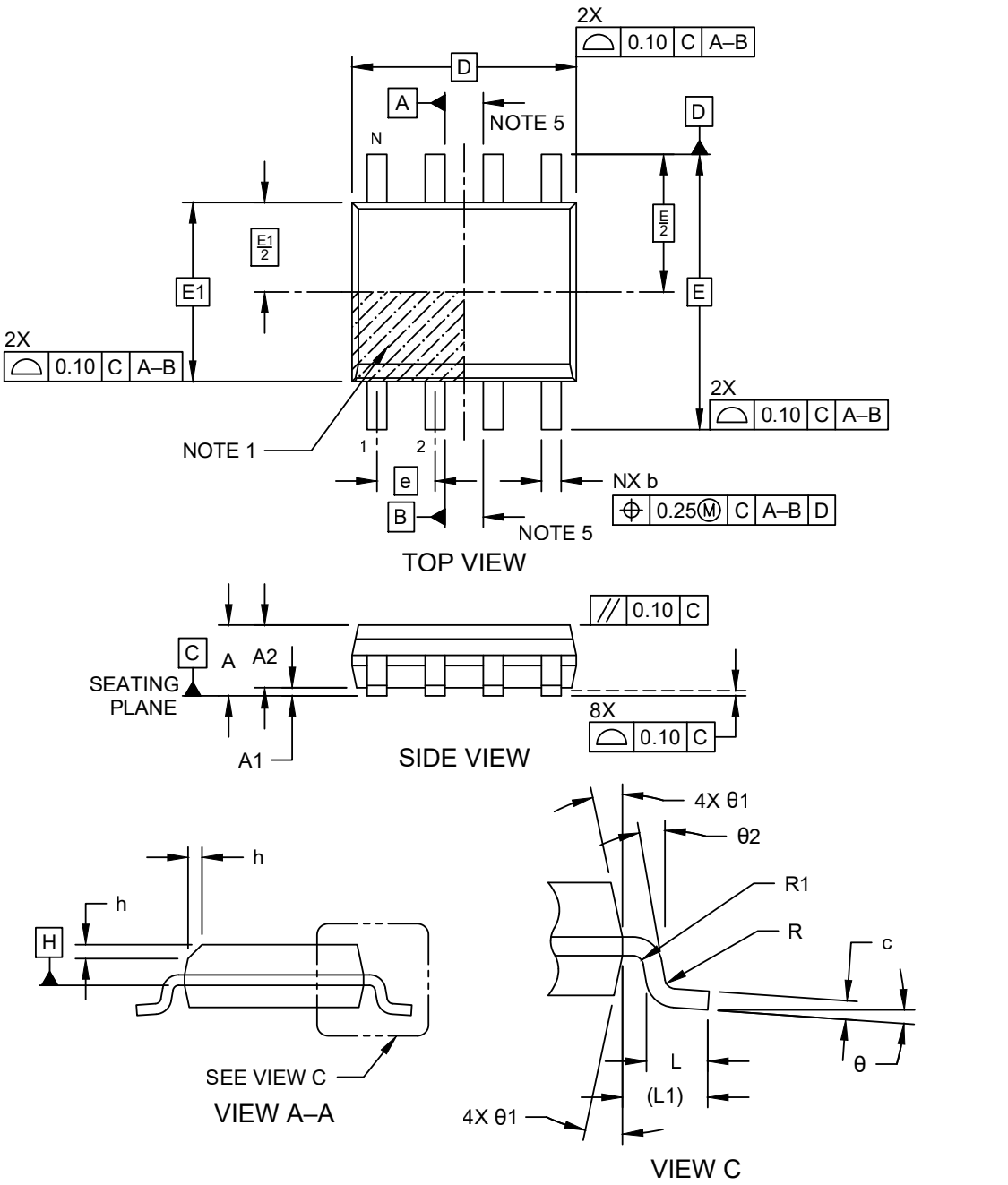


Legend:	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.
Note:	In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or not include the corporate logo.	

Package Outline Drawings

8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm (.150 In.) Body [SOIC]

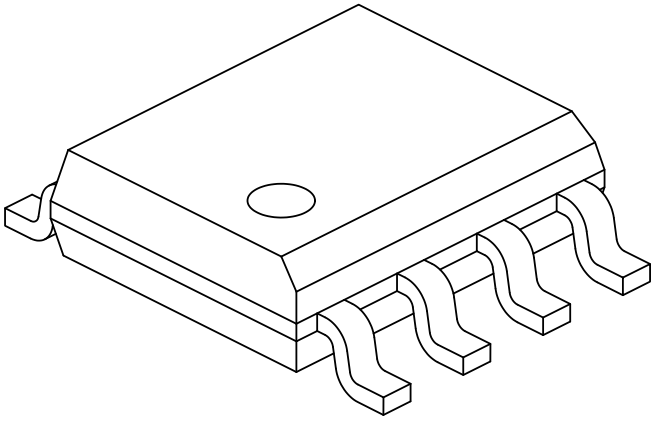
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing No. C04-00057-SN Rev L Sheet 1 of 2

8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm (.150 In.) Body [SOIC]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		1.27 BSC	
Overall Height	A	–	–	1.75
Molded Package Thickness	A2	1.25	–	-
Standoff §	A1	0.10	–	0.25
Overall Width	E		6.00 BSC	
Molded Package Width	E1		3.90 BSC	
Overall Length	D		4.90 BSC	
Chamfer (Optional)	h	0.25	–	0.50
Foot Length	L	0.40	–	1.27
Footprint	L1		1.04 REF	
Lead Thickness	c	0.17	–	0.25
Lead Width	b	0.31	–	0.51
Lead Bend Radius	R	0.07	–	–
Lead Bend Radius	R1	0.07	–	–
Foot Angle	θ	0°	–	8°
Mold Draft Angle	θ1	5°	–	15°
Lead Angle	θ2	0°	–	–

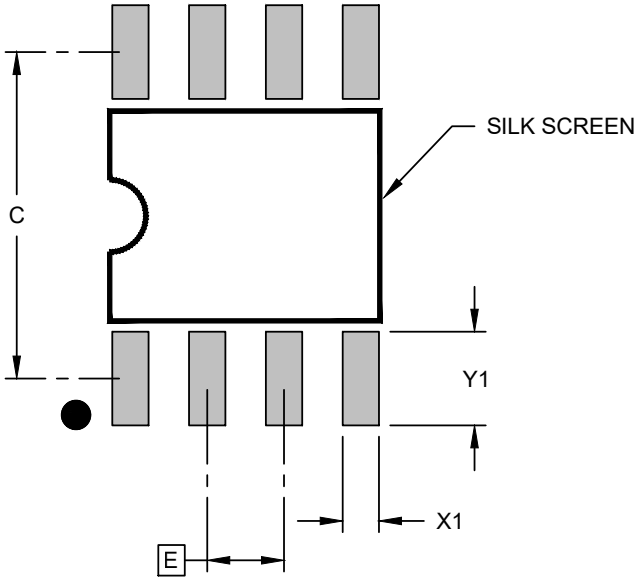
Notes:

1. The Pin 1 visual index feature may vary, but it must be located within the hatched area.
2. § Significant Characteristic
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
4. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
   REF: Reference Dimension, usually without tolerance, for information purposes only.
5. Datums A & B to be determined at Datum H.

Microchip Technology Drawing No. C04-00057-SN Rev L Sheet 2 of 2

8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm (.150 In.) Body [SOIC]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		1.27 BSC	
Contact Pad Spacing	C		5.40	
Contact Pad Width (X8)	X1			0.60
Contact Pad Length (X8)	Y1			1.55

Notes:

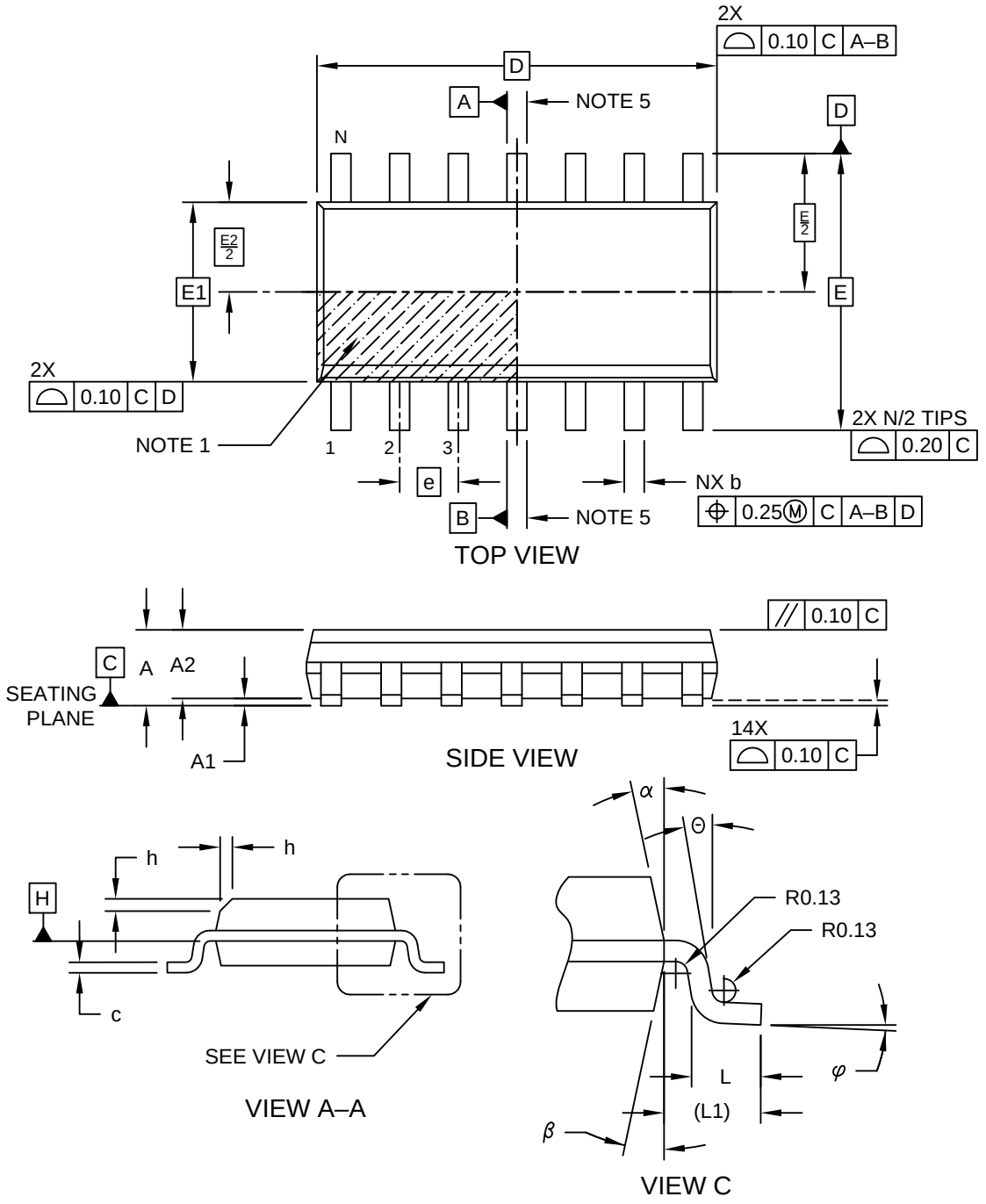
1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-02057-SN Rev L

14-Lead Plastic Small Outline (SL) - Narrow, 3.90 mm Body [SOIC]

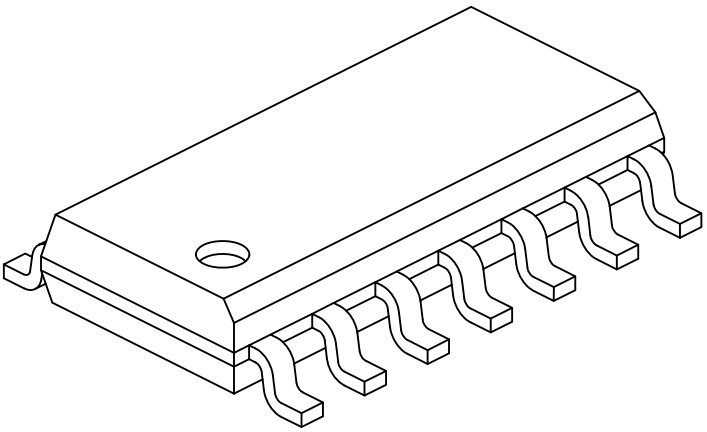
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing No. C04-065-SL Rev D Sheet 1 of 2

14-Lead Plastic Small Outline (SL) - Narrow, 3.90 mm Body [SOIC]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		14	
Pitch	e		1.27 BSC	
Overall Height	A	-	-	1.75
Molded Package Thickness	A2	1.25	-	-
Standoff §	A1	0.10	-	0.25
Overall Width	E		6.00 BSC	
Molded Package Width	E1		3.90 BSC	
Overall Length	D		8.65 BSC	
Chamfer (Optional)	h	0.25	-	0.50
Foot Length	L	0.40	-	1.27
Footprint	L1		1.04 REF	
Lead Angle	Θ	0°	-	-
Foot Angle	φ	0°	-	8°
Lead Thickness	c	0.10	-	0.25
Lead Width	b	0.31	-	0.51
Mold Draft Angle Top	α	5°	-	15°
Mold Draft Angle Bottom	β	5°	-	15°

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic
3. Dimension D does not include mold flash, protrusions or gate burrs, which shall not exceed 0.15 mm per end. Dimension E1 does not include interlead flash or protrusion, which shall not exceed 0.25 mm per side.
4. Dimensioning and tolerancing per ASME Y14.5M

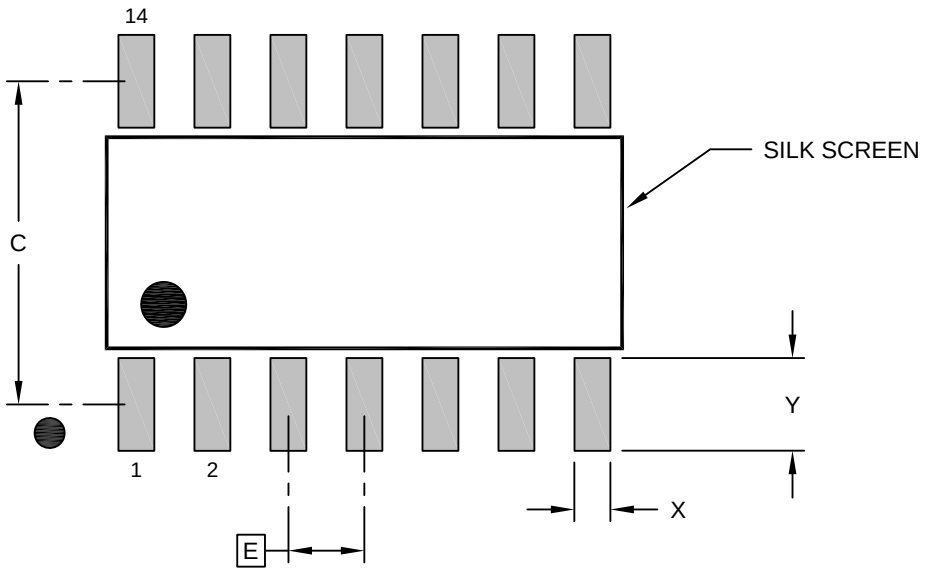
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

   REF: Reference Dimension, usually without tolerance, for information purposes only.
5. Datums A & B to be determined at Datum H.

Microchip Technology Drawing No. C04-065-SL Rev D Sheet 2 of 2

14-Lead Plastic Small Outline (SL) - Narrow, 3.90 mm Body [SOIC]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		1.27 BSC	
Contact Pad Spacing	C		5.40	
Contact Pad Width (X14)	X			0.60
Contact Pad Length (X14)	Y			1.55

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2065-SL Rev D

8. Revision History

Doc. Rev.	Date	Section	Comments
A	November 2025		Initial release of this document.

Product Identification System

To order or obtain information, for example, on pricing or delivery, contact Microchip: https://www.microchip.com/en-us/about/contact-us.

Device:	MCP14LH2181(4): High-Side and Low-Side Gate Driver	
Tape and Reel Option(1):	Blank	= Tube
	T	= Tape and Reel
Temperature Range:	E	= −40°C to +125°C (Extended)
Package:	SN	= Plastic Small Outline IC, 3.90 mm, SOIC, 8-Pin (Package Code: SN)
	SL	= Plastic Small Outline IC, 3.90 mm, SOIC, 14-Pin (Package Code: SL)

Examples:

- MCP14LH2181T-E/SN: Half-Bridge Gate Driver, Tape and Reel, Extended Temperature Range, SOIC-8 Package
- MCP14LH21814T-E/SL: Half-Bridge Gate Driver, Tape and Reel, Extended Temperature Range, SOIC-14 Package

Notes:

1. Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.
2. Small form-factor packaging options may be available. Please check www.microchip.com/packaging for small-form factor package availability, or contact your local Sales Office.

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