



Is Now Part of



**ON Semiconductor®**

To learn more about ON Semiconductor, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

# FAN73933

## Half-Bridge Gate Drive IC

### Features

- Floating Channel for Bootstrap Operation to +600V
- Typically 2.5A/2.5A Sourcing/Sinking Current Driving Capability
- Extended Allowable Negative  $V_S$  Swing to -9.8V for Signal Propagation at  $V_{BS}=15V$
- Output in Phase with Input Signal
- 3.3V and 5V Input Logic Compatible
- Matched Propagation Delay for Both Channels
- Built-in UVLO Functions for Both Channels
- Built-in Common-Mode dv/dt Noise Cancelling Circuit
- Programmable Dead-Time Control Function
- Internal 220ns Minimum Dead Time at  $R_{DT}=0\Omega$

### Applications

- High-Speed Power MOSFET and IGBT Gate Driver
- Induction Heating
- High-Power DC-DC Converter
- Synchronous Step-Down Converter
- Motor Drive Inverter

### Description

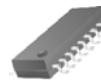
The FAN73933 is a half-bridge, gate-drive IC with programmable dead-time control functions that can drive high-speed MOSFETs and IGBTs operating up to +600V. It has a buffered output stage with all NMOS transistors designed for high-pulse-current driving capability and minimum cross-conduction.

Fairchild's high-voltage process and common-mode noise canceling techniques provide stable operation of the high-side driver under high dv/dt noise circumstances. An advanced level-shift circuit offers high-side gate driver operation up to  $V_S=-9.8V$  (typical) for  $V_{BS}=15V$ .

The UVLO circuit prevents malfunction when  $V_{DD}$  and  $V_{BS}$  are lower than the specified threshold voltage.

The high-current and low-output voltage drop feature makes this device suitable for diverse half- and full-bridge inverters; motor drive inverters, switching mode power supplies, induction heating, and high-power DC-DC converter applications.

14-SOP



### Ordering Information

Part Number	Package	Operating Temperature Range	Eco Status	Packing Method
FAN73933M	14-Lead, Small Outline Integrated Circuit (SOIC), Non-JEDEC, .150 Inch Narrow Body, 225SOP	-40°C to +125°C	RoHS	Tube
FAN73933MX				Tape & Reel



For Fairchild's definition of Eco Status, please visit: [http://www.fairchildsemi.com/company/green/rohs\\_green.html](http://www.fairchildsemi.com/company/green/rohs_green.html).

### Typical Application Diagrams

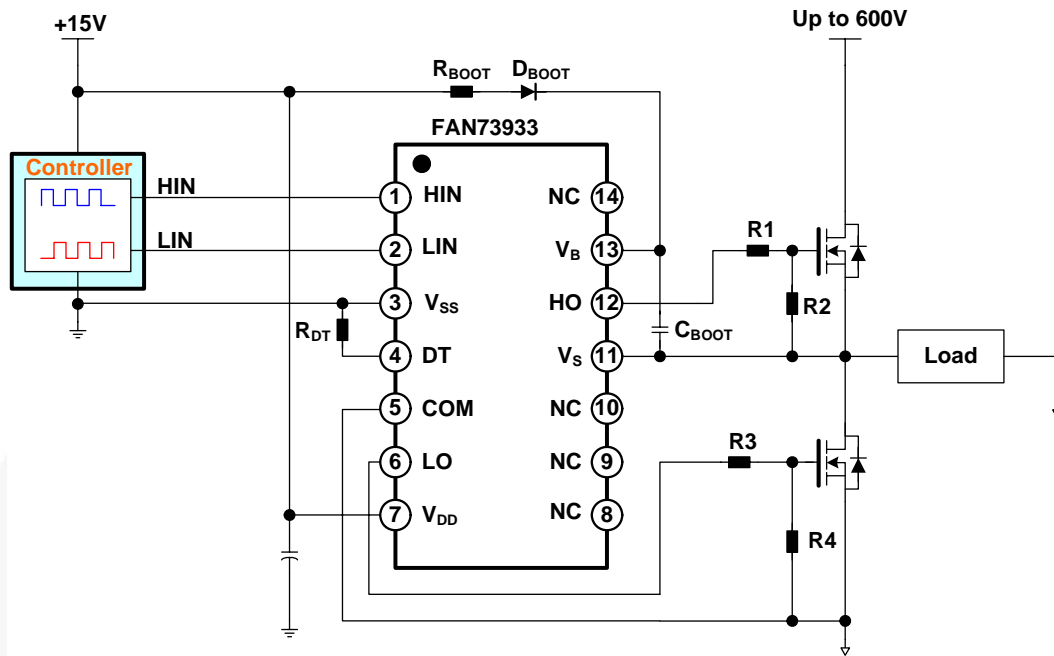


Figure 1. Typical Application Circuit

### Internal Block Diagram

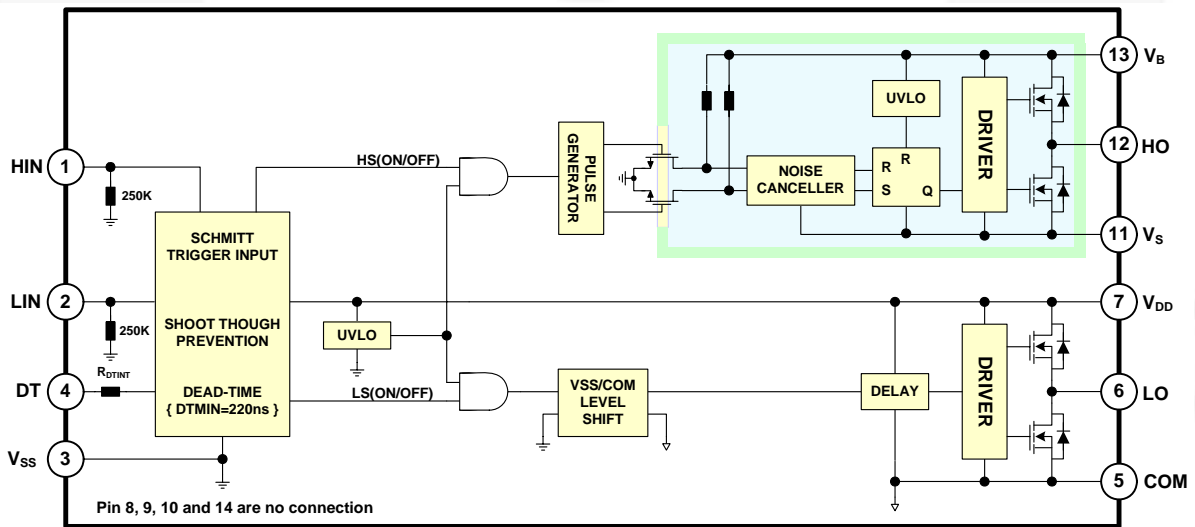


Figure 2. Functional Block Diagram

## Pin Configuration

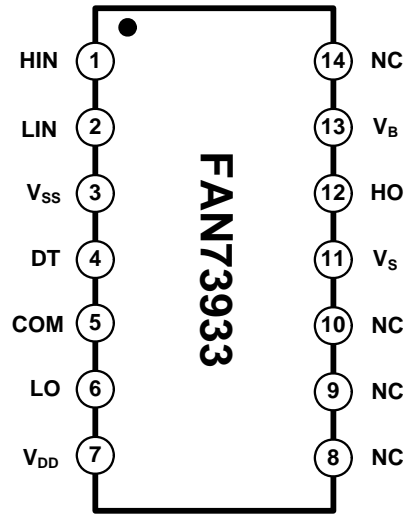


Figure 3. Pin Configurations (Top View)

## Pin Definitions

Pin #	Name	Description
1	HIN	Logic Input for High-Side Gate Driver Output
2	LIN	Logic Input for Low-Side Gate Driver Output
3	$V_{SS}$	Logic Ground
4	DT	Dead-Time Control with External Resistor (Referenced to $V_{SS}$ )
5	COM	Ground
6	LO	Low-Side Driver Return
7	$V_{DD}$	Supply Voltage
8	NC	No Connection
9	NC	No Connection
10	NC	No Connection
11	$V_S$	High-Voltage Floating Supply Return
12	HO	High-Side Driver Output
13	$V_B$	High-Side Floating Supply
14	NC	No Connection

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.  $T_A=25^{\circ}\text{C}$  unless otherwise specified.

Symbol	Characteristics	Min.	Max.	Unit
$V_B$	High-Side Floating Supply Voltage	-0.3	625.0	V
$V_S$	High-Side Floating Offset Voltage	$V_B-25.0$	$V_B+0.3$	V
$V_{HO}$	High-Side Floating Output Voltage	$V_S-0.3$	$V_B+0.3$	V
$V_{LO}$	Low-Side Output Voltage	-0.3	$V_{DD}+0.3$	V
$V_{DD}$	Low-Side and Logic Fixed Supply Voltage	-0.3	25.0	V
$V_{IN}$	Logic Input Voltage (HIN and LIN)	-0.3	$V_{DD}+0.3$	V
DT	Programmable Dead-Time Pin Voltage	-0.3	$V_{DD}+0.3$	V
$V_{SS}$	Logic Ground	$V_{DD}-25$	$V_{DD}+0.3$	V
$dV_S/dt$	Allowable Offset Voltage Slew Rate		$\pm 50$	V/ns
$P_D$	Power Dissipation <sup>(1, 2, 3)</sup>		1	W
$\theta_{JA}$	Thermal Resistance		110	$^{\circ}\text{C/W}$
$T_J$	Junction Temperature		+150	$^{\circ}\text{C}$
$T_{STG}$	Storage Temperature	-55	+150	$^{\circ}\text{C}$

### Notes:

- 1 Mounted on 76.2 x 114.3 x 1.6mm PCB (FR-4 glass epoxy material).
- 2 Refer to the following standards:  
JESD51-2: Integral circuits thermal test method environmental conditions - natural convection, and  
JESD51-3: Low effective thermal conductivity test board for leaded surface mount packages.
- 3 Do not exceed maximum  $P_D$  under any circumstances.

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Min.	Max.	Unit
$V_B$	High-Side Floating Supply Voltage	$V_S+10$	$V_S+20$	V
$V_S$	High-Side Floating Supply Offset Voltage	$6-V_{DD}$	600	V
$V_{HO}$	High-Side Output Voltage	$V_S$	$V_B$	V
$V_{DD}$	Low-Side and Logic Fixed Supply Voltage	10	20	V
$V_{LO}$	Low-Side Output Voltage	COM	$V_{DD}$	V
$V_{IN}$	Logic Input Voltage (HIN and LIN)	$V_{SS}$	$V_{DD}$	V
DT	Programmable Dead-Time Pin Voltage	$V_{SS}$	$V_{DD}$	V
$V_{SS}$	Logic Ground	-5	+5	V
$T_A$	Operating Ambient Temperature	-40	+125	$^{\circ}\text{C}$

## Electrical Characteristics

$V_{BIAS}(V_{DD}, V_{BS})=15.0V$ ,  $V_{SS}=COM=0V$ ,  $DT=V_{SS}$  and  $T_A = 25^\circ C$ , unless otherwise specified. The  $V_{IN}$  and  $I_{IN}$  parameters are referenced to  $V_{SS}/COM$  and are applicable to the respective input leads: HIN and LIN. The  $V_O$  and  $I_O$  parameters are referenced to COM and are applicable to the respective output leads: HO and LO.

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
<b>POWER SUPPLY SECTION</b>						
$I_{QDD}$	Quiescent $V_{DD}$ Supply Current	$V_{IN}=0V$ or $5V$		0.9	1.5	mA
$I_{QBS}$	Quiescent $V_{BS}$ Supply Current	$V_{IN}=0V$ or $5V$		50	100	$\mu A$
$I_{PDD}$	Operating $V_{DD}$ Supply Current	$f_{IN}=20KHz$ , No Load		1.3	1.9	mA
$I_{PBS}$	Operating $V_{BS}$ Supply Current	$C_L=1nF$ , $f_{IN}=20KHz$ , rms		450	800	$\mu A$
$I_{LK}$	Offset Supply Leakage Current	$V_B=V_S=600V$			10	$\mu A$
<b>BOOTSTRAPPED SUPPLY SECTION</b>						
$V_{DDUV+}$ $V_{BSUV+}$	$V_{DD}$ and $V_{BS}$ Supply Under-Voltage Positive-Going Threshold Voltage	$V_{IN}=0V$ , $V_{DD}=V_{BS}=Sweep$	8.0	9.0	10	V
$V_{DDUV-}$ $V_{BSUV-}$	$V_{DD}$ and $V_{BS}$ Supply Under-Voltage Negative-Going Threshold Voltage	$V_{IN}=0V$ , $V_{DD}=V_{BS}=Sweep$	7.4	8.4	9.4	V
$V_{DDUVH-}$ $V_{BSUVH}$	$V_{DD}$ and $V_{BS}$ Supply Under-Voltage Lockout Hysteresis Voltage	$V_{IN}=0V$ , $V_{DD}=V_{BS}=Sweep$		0.6		V
<b>INPUT LOGIC SECTION</b>						
$V_{IH}$	Logic "1" Input Voltage for HO & Logic "0" for LO		2.5			V
$V_{IL}$	Logic "0" Input Voltage for HO & Logic "1" for LO				0.8	V
$I_{IN+}$	Logic Input High Bias Current	$V_{IN}=5V$		20	50	$\mu A$
$I_{IN-}$	Logic Input Low Bias Current	$V_{IN}=0V$			2	$\mu A$
$R_{IN}$	Logic Input Pull-Down Resistance		100	250		$K\Omega$
<b>GATE DRIVER OUTPUT SECTION</b>						
$V_{OH}$	High-Level Output Voltage ( $V_{BIAS} - V_O$ )	No Load			1.5	V
$V_{OL}$	Low-Level Output Voltage	No Load			100	mV
$I_{O+}$	Output High, Short-Circuit Pulsed Current <sup>(4)</sup>	$V_{HO}=0V$ , $V_{IN}=5V$ , $PW \leq 10\mu s$	2.0	2.5		A
$I_{O-}$	Output Low, Short-Circuit Pulsed Current <sup>(4)</sup>	$V_{HO}=15V$ , $V_{IN}=0V$ , $PW \leq 10\mu s$	2.0	2.5		A
$V_S$	Allowable Negative $V_S$ Pin Voltage for IN Signal Propagation to HO			-9.8	-7.0	V

### Note:

- These parameters guaranteed by design.

## Dynamic Electrical Characteristics

$V_{BIAS}(V_{DD}, V_{BS})=15.0V$ ,  $V_{SS}=COM=0V$ ,  $C_L=1000pF$ ,  $DT=V_{SS}$  and  $T_A=25^\circ C$ , unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$t_{ON}$	Turn-On Propagation Delay Time <sup>(5)</sup>	$V_S=0V$ , $R_{DT}=0\Omega$		160	230	ns
$t_{OFF}$	Turn-Off Propagation Delay Time	$V_S=0V$		160	230	ns
$Mt_{ON}$	Delay Matching, HO & LO Turn-On			0	50	ns
$Mt_{OFF}$	Delay Matching, HO & LO Turn-Off			0	50	ns
$t_R$	Turn-On Rise Time	$V_S=0V$		40	60	ns
$t_F$	Turn-Off Fall Time	$V_S=0V$		20	35	ns
DT	Dead Time: LO Turn-Off to HO Turn-On & HO Turn-Off to LO Turn-On	$R_{DT}=0\Omega$	170	220	270	ns
		$R_{DT}=300K\Omega$	400	500	600	ns
MDT	Dead-Time Matching= $ DT_{LO-HO} - DT_{HO-LO} $	$R_{DT}=0\Omega$		0	50	ns
		$R_{DT}=300K\Omega$		0	100	ns

### Note:

5 The turn-on propagation display does not include dead time.

## Typical Characteristics

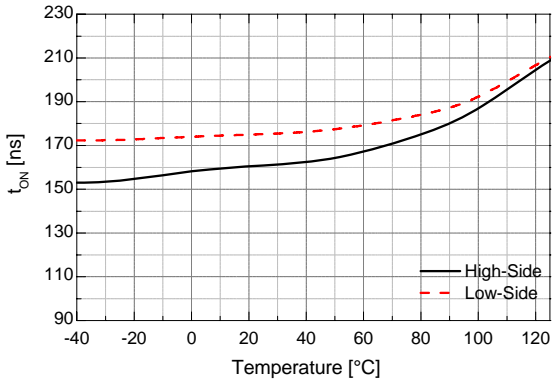


Figure 4. Turn-On Propagation Delay vs. Temperature

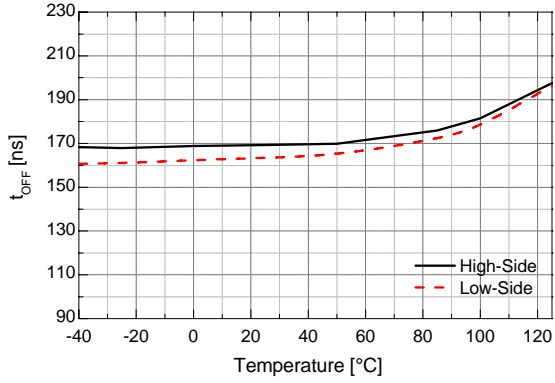


Figure 5. Turn-Off Propagation Delay vs. Temperature

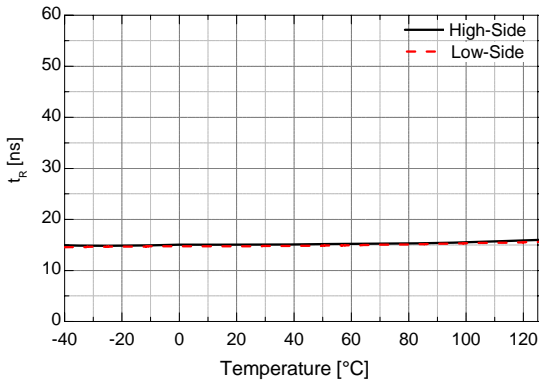


Figure 6. Turn-On Rise Time vs. Temperature

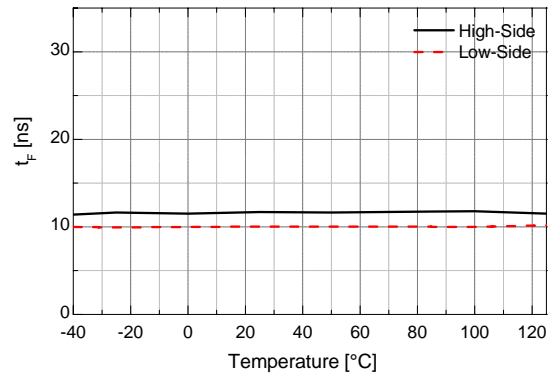


Figure 7. Turn-Off Fall Time vs. Temperature

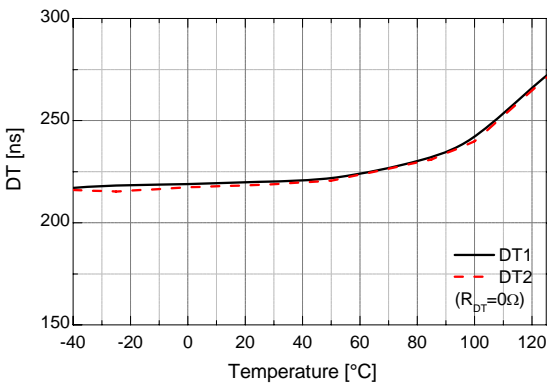


Figure 8. Dead Time ( $R_{DT}=0\Omega$ ) vs. Temperature

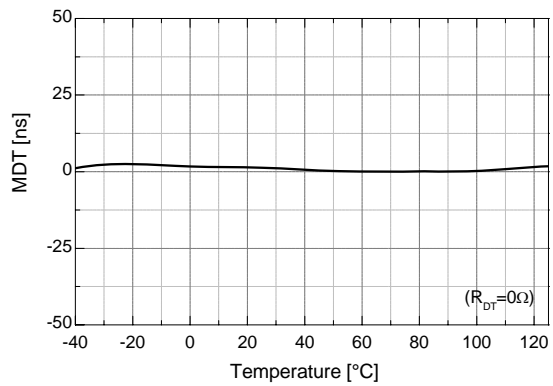


Figure 9. Dead Time Matching ( $R_{DT}=0\Omega$ ) vs. Temperature



Typical Characteristics (Continued)

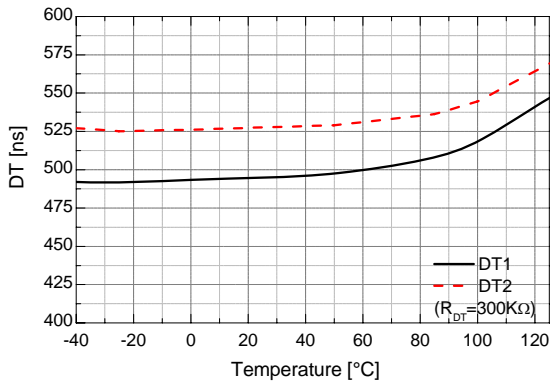


Figure 10. Dead Time ( $R_{DT}=300K\Omega$ ) vs. Temperature

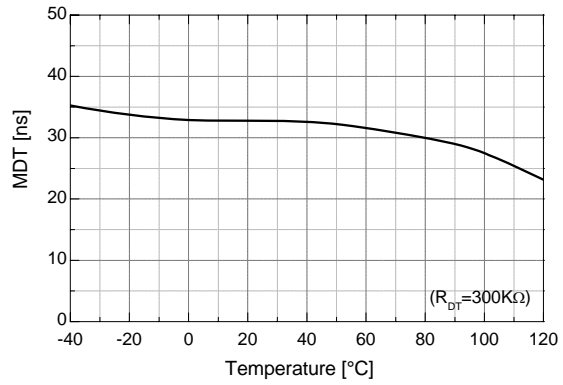


Figure 11. Dead Time Matching ( $R_{DT}=300K\Omega$ ) vs. Temperature

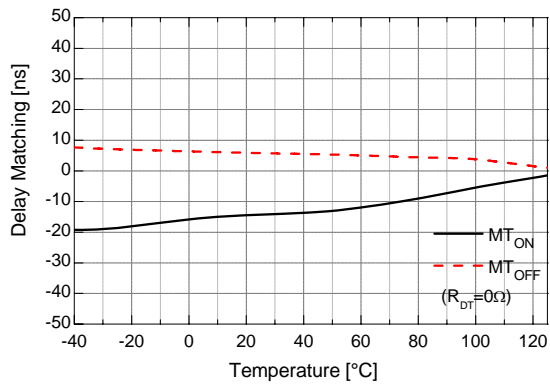


Figure 12. Delay Matching vs. Temperature

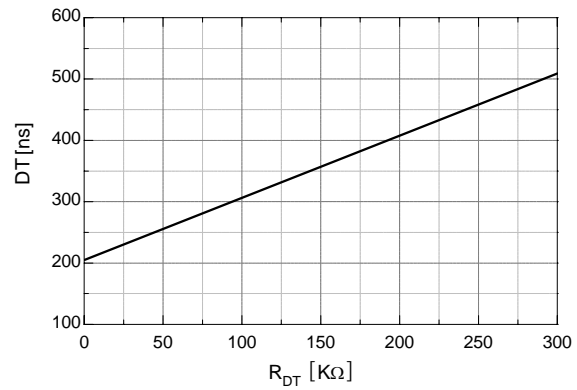


Figure 13. Dead Time vs.  $R_{DT}$

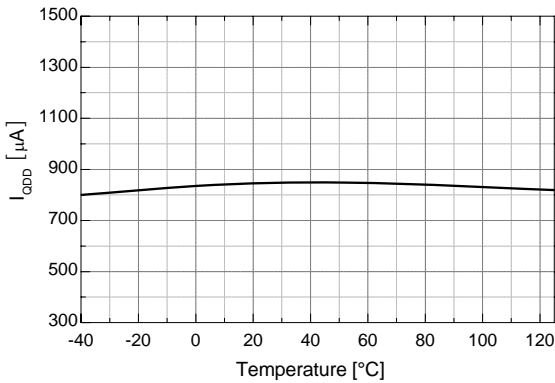


Figure 14. Quiescent  $V_{DD}$  Supply Current vs. Temperature

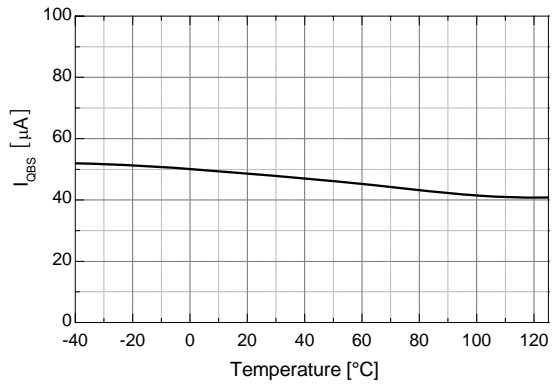


Figure 15. Quiescent  $V_{BS}$  Supply Current vs. Temperature

Typical Characteristics (Continued)

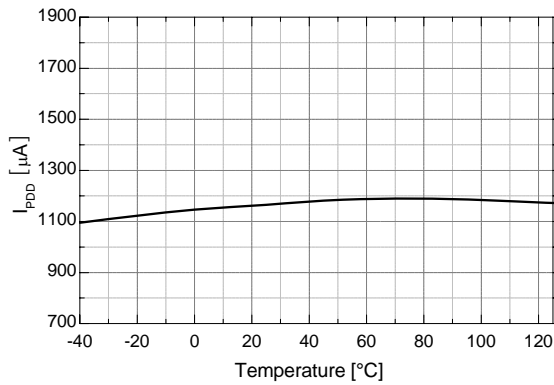


Figure 16. Operating V<sub>CC</sub> Supply Current vs. Temperature

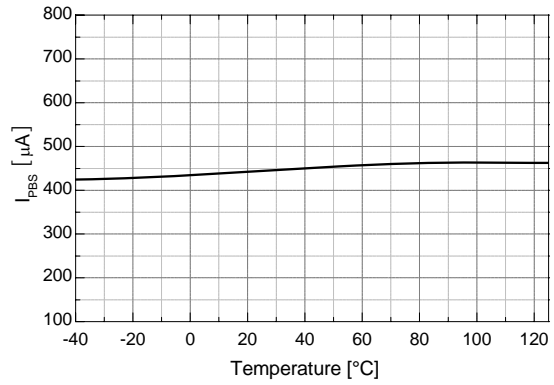


Figure 17. Operating V<sub>BS</sub> Supply Current vs. Temperature

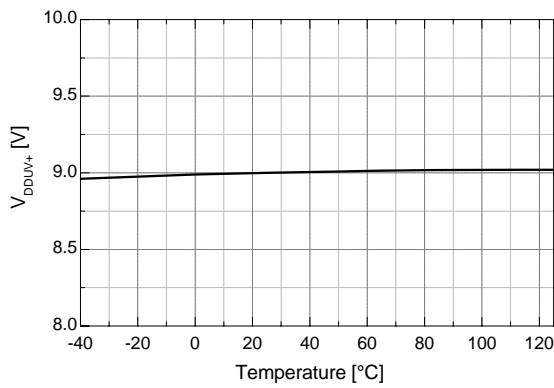


Figure 18. V<sub>DD</sub> UVLO+ vs. Temperature

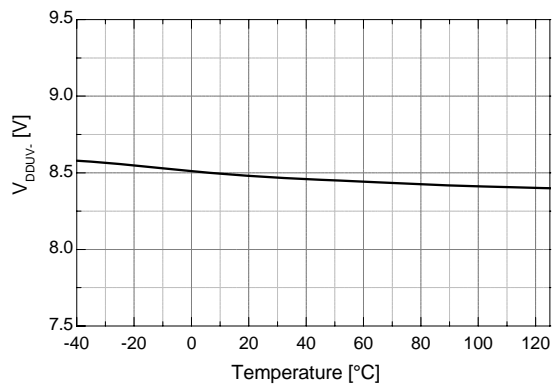


Figure 19. V<sub>DD</sub> UVLO- vs. Temperature

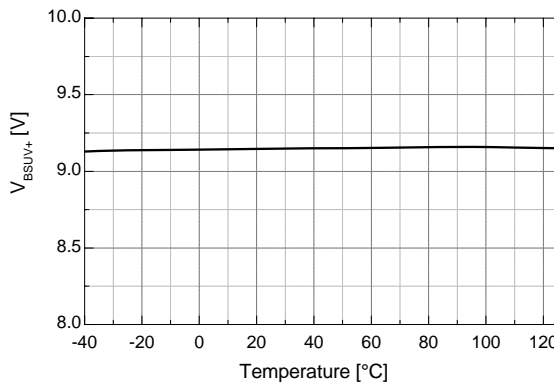


Figure 20. V<sub>BS</sub> UVLO+ vs. Temperature

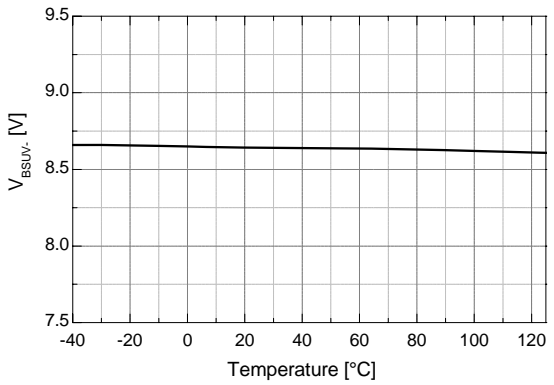


Figure 21. V<sub>BS</sub> UVLO- vs. Temperature

Typical Characteristics (Continued)

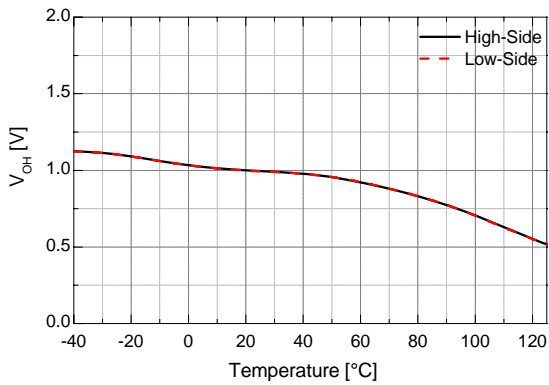


Figure 22. High-Level Output Voltage vs. Temperature

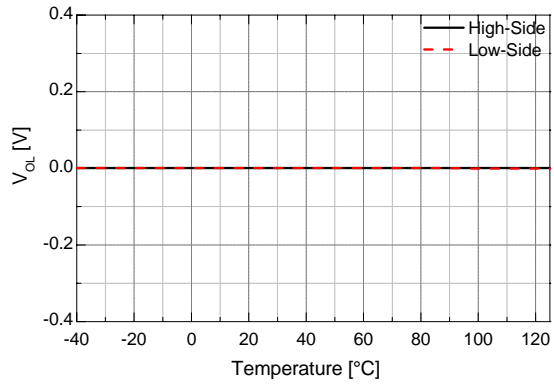


Figure 23. Low-Level Output Voltage vs. Temperature

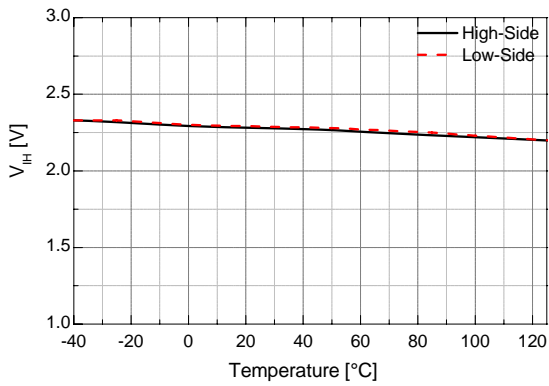


Figure 24. Logic High Input Voltage vs. Temperature

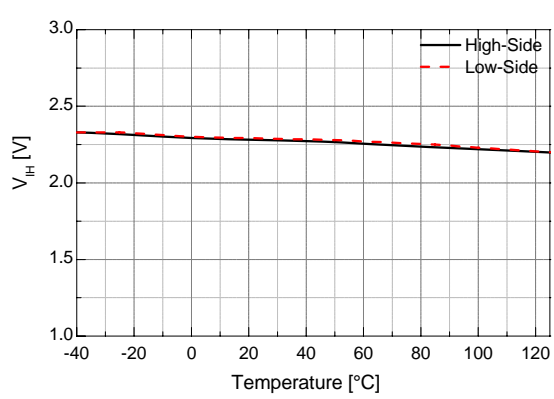


Figure 25. Logic Low Input Voltage vs. Temperature

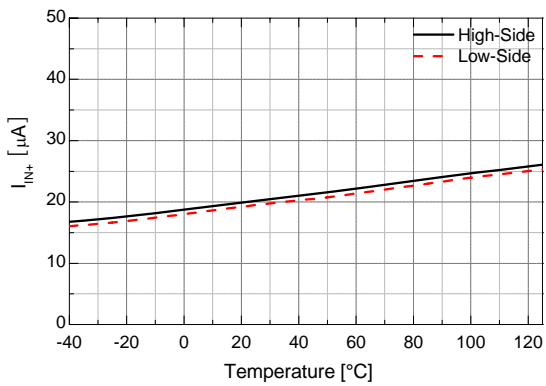


Figure 26. Logic Input High Bias Current vs. Temperature

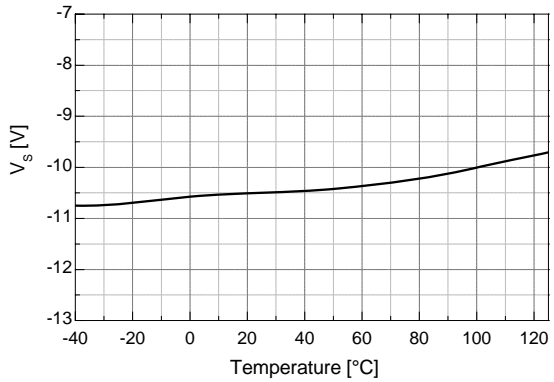


Figure 27. Allowable Negative  $V_S$  Voltage vs. Temperature

Typical Characteristics (Continued)

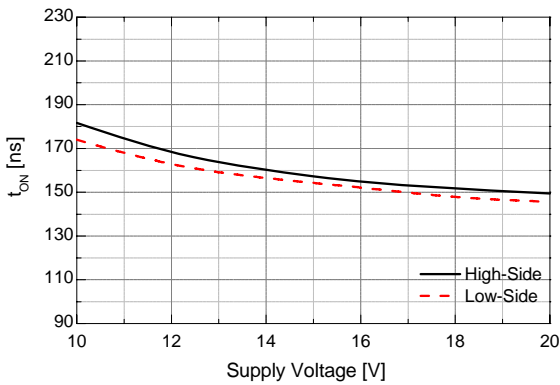


Figure 28. Turn-On Propagation Delay vs. Supply Voltage

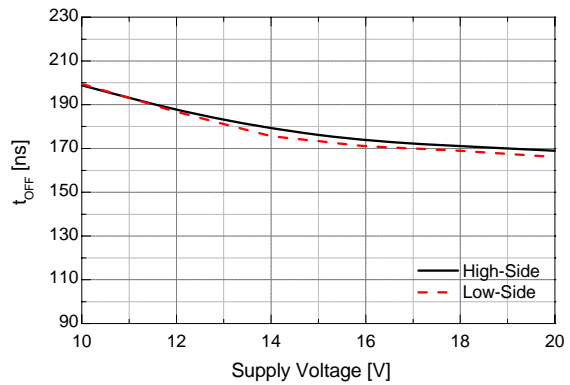


Figure 29. Turn-Off Propagation Delay vs. Supply Voltage

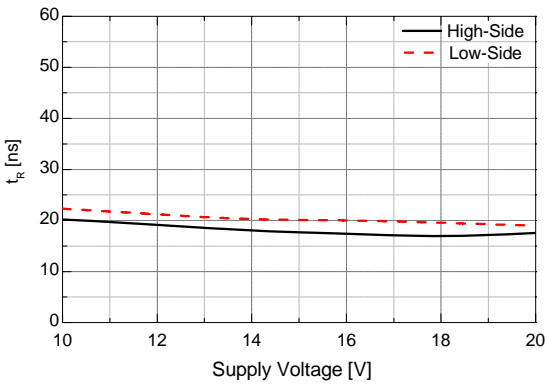


Figure 30. Turn-On Rise Time vs. Supply Voltage

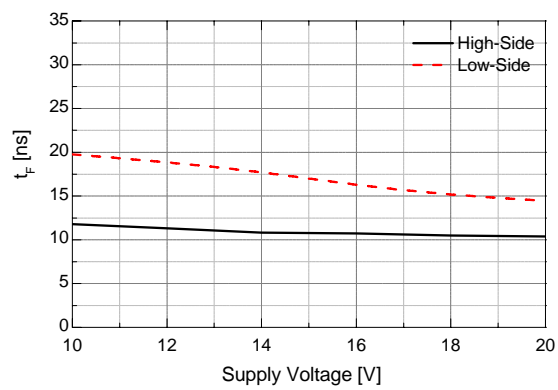


Figure 31. Turn-Off Fall Time vs. Supply Voltage

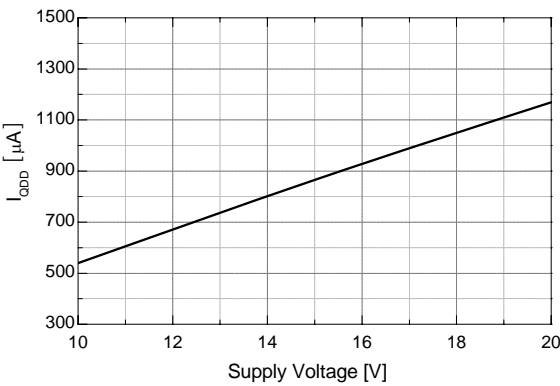


Figure 32. Quiescent  $V_{DD}$  Supply Current vs. Supply Voltage

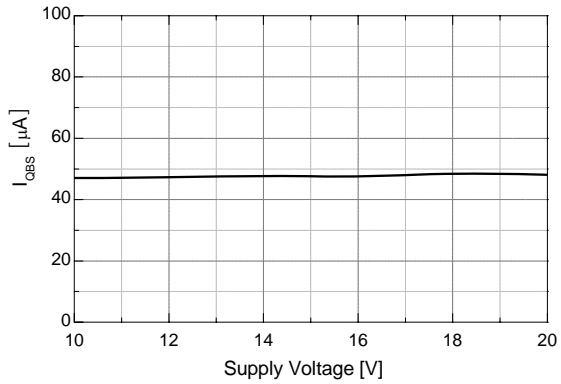


Figure 33. Quiescent  $V_{BS}$  Supply Current vs. Supply Voltage

Typical Characteristics (Continued)

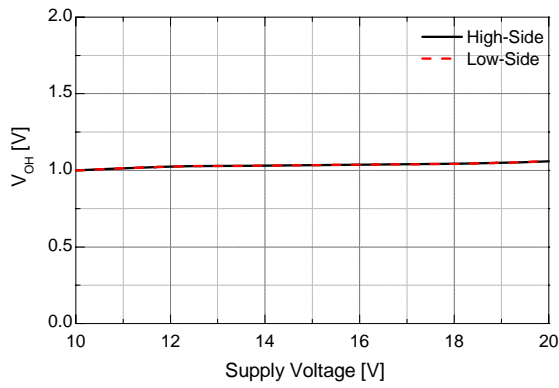


Figure 34. High-Level Output Voltage vs. Supply Voltage

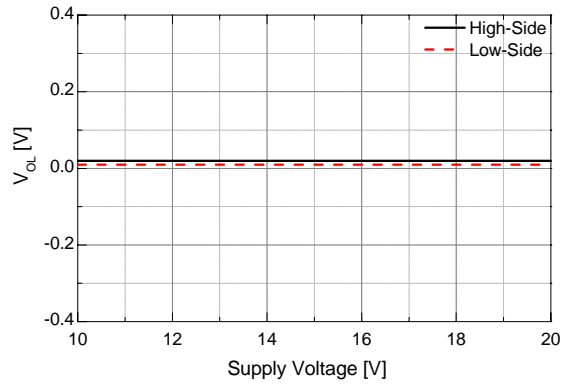


Figure 35. Low-Level Output Voltage vs. Supply Voltage

### Switching Time Definitions

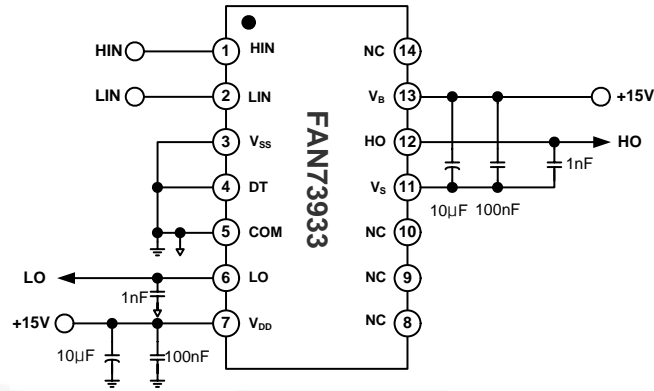


Figure 36. Switching Time Test Circuit

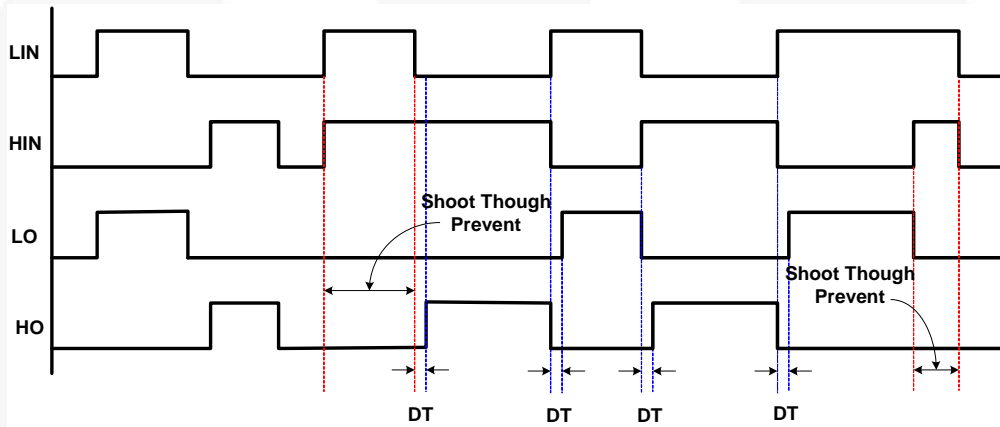


Figure 37. Input/Output Timing Diagram

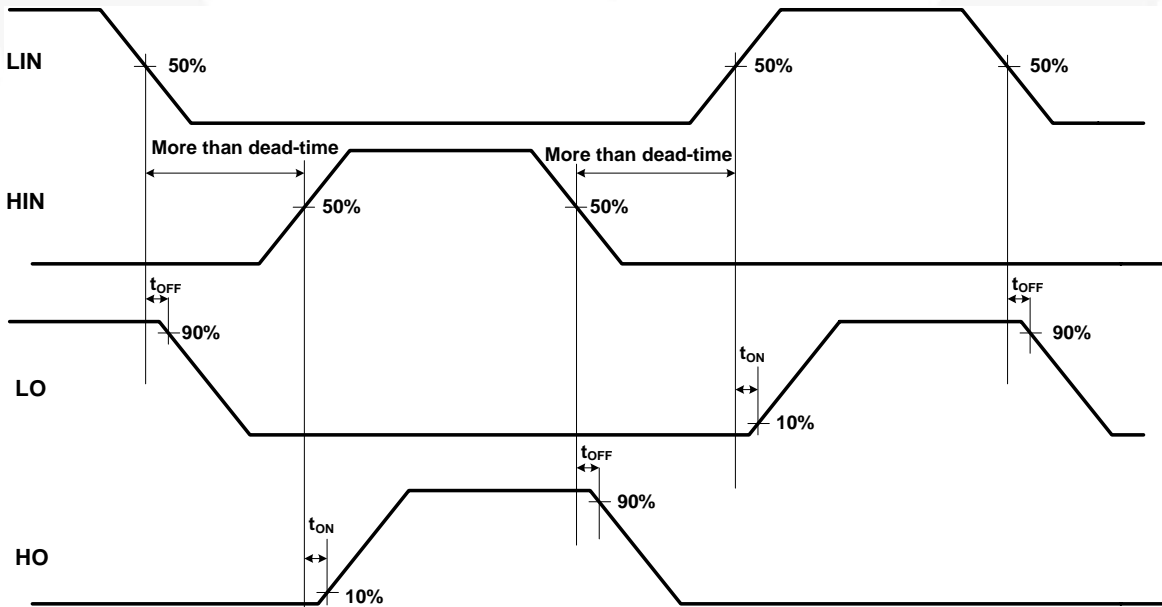


Figure 38. Switching Time Waveform Definitions

## Application Information

### Negative $V_S$ Transient

The bootstrap circuit has the advantage of being simple and low cost, but has some limitations. The biggest difficulty with this circuit is the negative voltage present at the emitter of the high-side switching device when the high-side switch is turned off in half-bridge applications.

If the high-side switch, Q1, turns-off while the load current is flowing to an inductive load; a current commutation occurs from high-side switch, Q1, to the diode, D2, in parallel with the low-side switch of the same inverter leg. Then the negative voltage present at the emitter of the high-side switching device, just before the freewheeling diode, D2, starts clamping, causes load current to suddenly flow to the low-side freewheeling diode, D2, as shown in Figure 39.

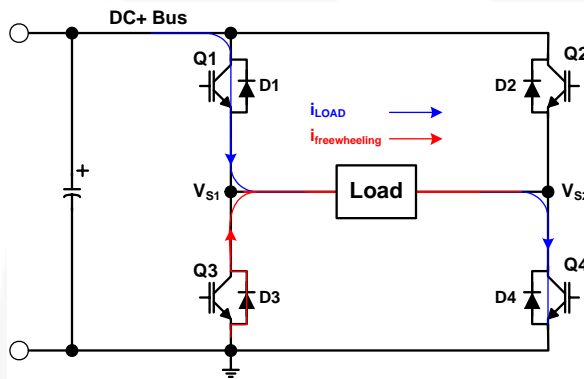


Figure 39. Half-Bridge Application Circuits

This negative voltage can be trouble for the gate driver's output stage. There is the possibility to develop an over-voltage condition of the bootstrap capacitor, input signal missing, and latch-up problems because it directly affects the source  $V_S$  pin of the gate driver, as shown in Figure 40. This undershoot voltage is called "negative  $V_S$  transient".

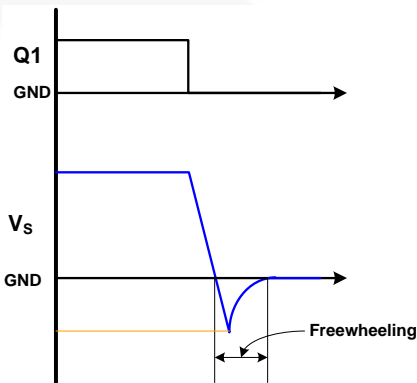


Figure 40.  $V_S$  Waveforms During Q1 Turn-Off

Figure 41. and Figure 42. show the commutation of the load current between the high-side switch, Q1, and low-side freewheeling diode, D3, in same inverter leg. The parasitic inductances in the inverter circuit from the die wire bonding to the PCB tracks are jumped together in  $L_C$  and  $L_E$  for each IGBT. When the high-side switch, Q1, and low-side switch, Q4, are turned on; the  $V_{S1}$  node is below DC+ voltage by the voltage drops associated with the power switch and the parasitic inductances of the circuit due to load current is flows from Q1 and Q4, as shown in Figure 41. When the high-side switch, Q1, is turned off and Q4 remains turned on, the load current to flows the low-side freewheeling diode, D3, due to the inductive load connected to  $V_{S1}$  as shown in Figure 42. The current flows from ground (which is connected to the COM pin of the gate driver) to the load and the negative voltage present at the emitter of the high-side switching device.

In this case, the COM pin of the gate driver is at a higher potential than the  $V_S$  pin due to the voltage drops associated with freewheeling diode, D3, and parasitic elements,  $L_{C3}$  and  $L_{E3}$ .

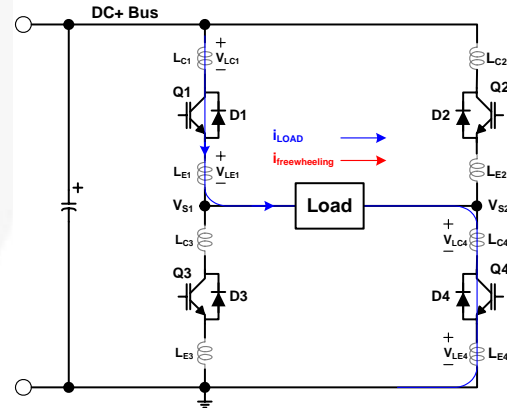


Figure 41. Q1 and Q4 Turn-On

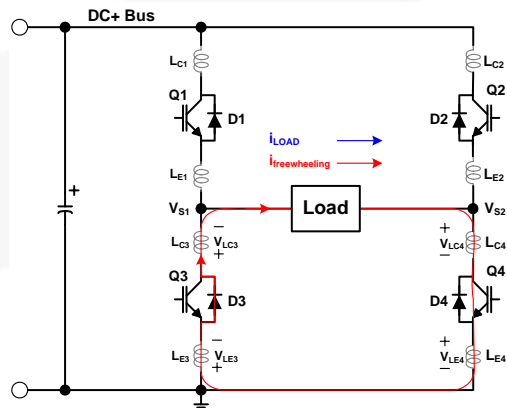
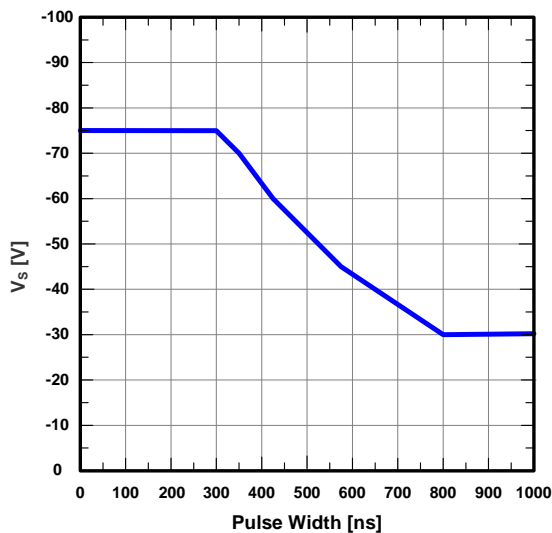


Figure 42. Q1 Turn-Off and D3 Conducting

The FAN73933 has a negative  $V_S$  transient performance curve, as shown in Figure 43.



**Figure 43. Negative  $V_S$  Transient Characteristic**

Even though the FAN73933 has been shown able to handle these negative  $V_S$  transient conditions, it is strongly recommended that the circuit designer limit the negative  $V_S$  transient as much as possible by careful PCB layout to minimize the value of parasitic elements and component use. The amplitude of negative  $V_S$  voltage is proportional to the parasitic inductances and the turn-off speed,  $di/dt$ , of the switching device.

## General Guidelines

### Printed Circuit Board Layout

The layout recommended for minimized parasitic elements is as follows:

- Direct tracks between switches with no loops or deviation.
- Avoid interconnect links. These can add significant inductance.
- Reduce the effect of lead-inductance by lowering package height above the PCB.
- Consider co-locating both power switches to reduce track length.
- To minimize noise coupling, the ground plane should not be placed under or near the high-voltage floating side.
- To reduce the EM coupling and improve the power switch turn-on/off performance, the gate drive loops must be reduced as much as possible.

## Placement of Components

The recommended selection of component is as follows:

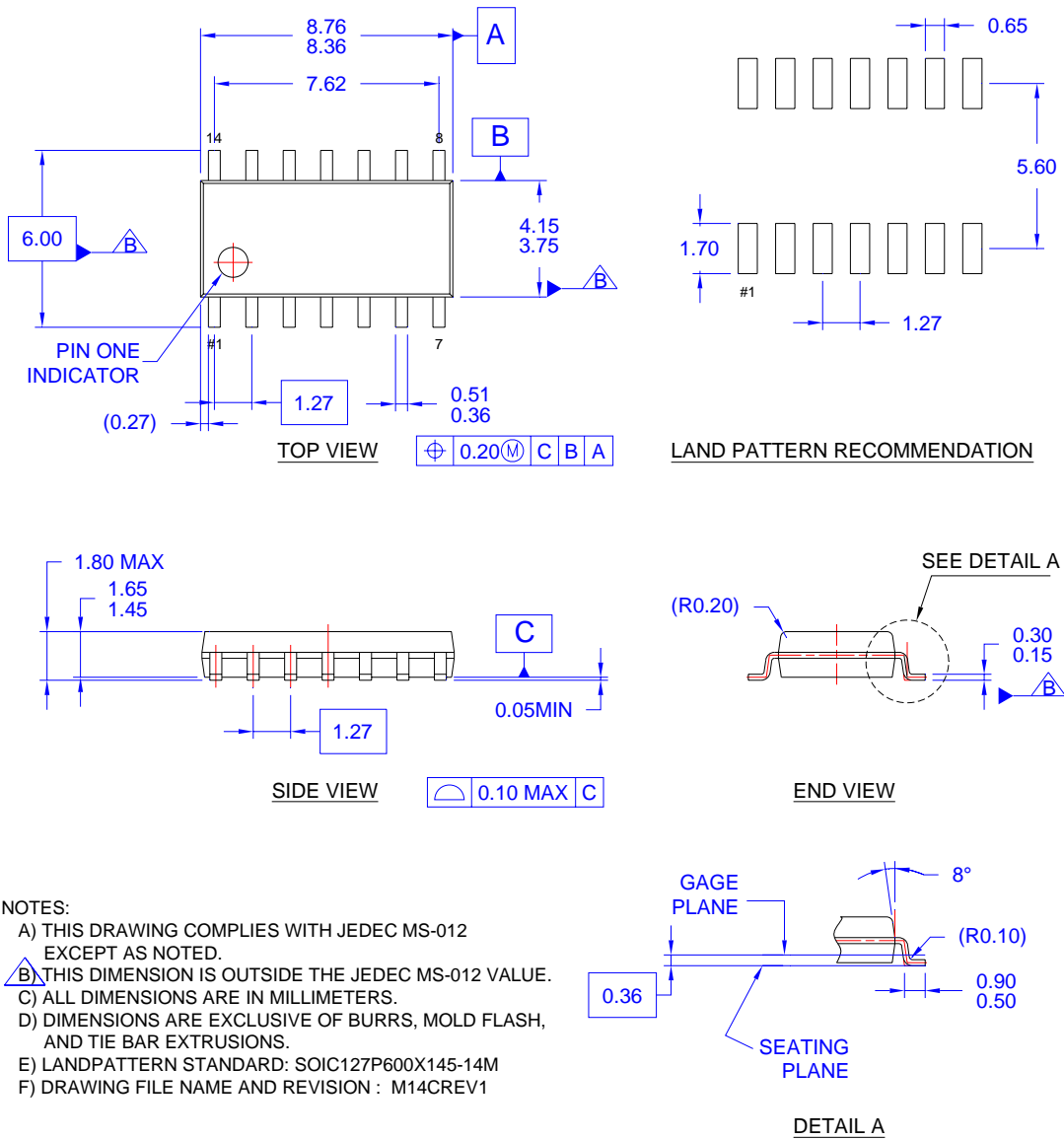
- Place a bypass capacitor between the  $V_{DD}$  and  $V_{SS}$  pins. A ceramic  $1\mu\text{F}$  capacitor is suitable for most applications. This component should be placed as close as possible to the pins to reduce parasitic elements.
- The bypass capacitor from  $V_{CC}$  to COM supports both the low-side driver and bootstrap capacitor recharge. A value at least ten times higher than the bootstrap capacitor is recommended.
- The bootstrap resistor,  $R_{BOOT}$ , must be considered in sizing the bootstrap resistance and the current developed during initial bootstrap charge. If the resistor is needed in series with the bootstrap diode, verify that  $V_B$  does not fall below COM (ground). Recommended use is typically  $5 \sim 10\Omega$ , which increases the  $V_{BS}$  time constant. If the voltage drop of the bootstrap resistor and diode is too high or the circuit topology does not allow a sufficient charging time, a fast recovery or ultra-fast recovery diode can be used.
- The bootstrap capacitor,  $C_{BOOT}$ , uses a low-ESR capacitor, such as a ceramic capacitor.

It is strongly recommended that the placement of components is as follows:

- Place components tied to the floating voltage pins ( $V_B$  and  $V_S$ ) near the respective high-voltage portions of the device and the FAN73933. NC (not connected) pins in this package maximize the distance between the high-voltage and low-voltage pins (see Figure 3).
- Place and route for bypass capacitors and gate resistors as close as possible to gate drive IC.
- Locate the bootstrap diode,  $D_{BOOT}$ , as close as possible to bootstrap capacitor,  $C_{BOOT}$ .
- The bootstrap diode must use a lower forward voltage drop and minimal switching time as soon as possible for fast recovery or ultra-fast diode.



### Physical Dimensions



**Figure 44. 14-Lead, Small Outline Integrated Circuit (SOIC), Non-JEDEC, .150 Inch Narrow Body, 225SOP**

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:  
<http://www.fairchildsemi.com/packaging/>.



**TRADEMARKS**

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

- |                          |                          |                                       |  |
|--------------------------|--------------------------|---------------------------------------|--|
| AccuPower™               | FlashWriter®*            | Power-SPM™                            | <p>SYSTEM GENERAL®<br/>The Power Franchise®</p> <p>the power franchise</p> <p>TinyBoost™</p> <p>TinyBuck™</p> <p>TinyCalc™</p> <p>TinyLogic®</p> <p>TINYOPTO™</p> <p>TinyPower™</p> <p>TinyPWM™</p> <p>TinyWire™</p> <p>TriFault Detect™</p> <p>TRUECURRENT™*</p> <p>µSerDes™</p> <p>SerDes™</p> <p>UHC®</p> <p>Ultra FRFET™</p> <p>UniFET™</p> <p>Vcx™</p> <p>VisualMax™</p> <p>Xs™</p> |
| Auto-SPM™                | FPST™                    | PowerTrench®                          |  |
| Build it Now™            | F-PFST™                  | PowerXS™                              |  |
| CorePLUS™                | FRFET®                   | Programmable Active Droop™            |  |
| CorePOWER™               | Global Power Resource SM | QFET®                                 |  |
| CROSSVOLT™               | Green FPS™               | QS™                                   |  |
| CTL™                     | Green FPS™ e-Series™     | Quiet Series™                         |  |
| Current Transfer Logic™  | Gmax™                    | RapidConfigure™                       |  |
| DEUXPEED®                | GTO™                     | ™                                     |  |
| Dual Cool™               | IntelliMAX™              | Saving our world, 1mW/W/KW at a time™ |  |
| EcoSPARK®                | ISOPLANAR™               | SignalWise™                           |  |
| EfficientMax™            | MegaBuck™                | SmartMax™                             |  |
| EZSWITCH™*               | MICROCOUPLER™            | SMART START™                          |  |
| ™*                       | MicroFET™                | SPM®                                  |  |
| ™                        | MicroPak™                | STEALTH™                              |  |
| Fairchild®               | MillerDrive™             | SuperFET™                             |  |
| Fairchild Semiconductor® | MotionMax™               | SuperSOT™-3                           |  |
| FACT Quiet Series™       | Motion-SPM™              | SuperSOT™-6                           |  |
| FACT™                    | OPTOLOGIC®               | SuperSOT™-8                           |  |
| FAST®                    | OPTOPLANAR®              | SupreMOS™                             |  |
| FastvCore™               | ™                        | SyncFET™                              |  |
| FETBench™                | PDP SPM™                 | Sync-Lock™                            |  |

\* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

**DISCLAIMER**

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

**LIFE SUPPORT POLICY**

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

**ANTI-COUNTERFEITING POLICY**

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, [www.fairchildsemi.com](http://www.fairchildsemi.com), under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

**PRODUCT STATUS DEFINITIONS**

**Definition of Terms**

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I45

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local  
Sales Representative