

Features

- Floating channel designed for bootstrap operation
- Fully operational to +200 V
- Tolerant to negative transient voltage – dV/dt immune
- Gate drive supply range from 10 V to 20 V
- Undervoltage lockout
- 3.3 V, 5 V, and 15 V logic compatible
- Cross-conduction prevention logic
- Internally set deadtime
- High-side output in phase with input
- Shutdown input turns off both channels
- Matched propagation delay for both channels
- RoHS Compliant
- Automotive qualified*

Typical Applications

- Motor/Pump Drives
- DC-DC Converters

Product Summary

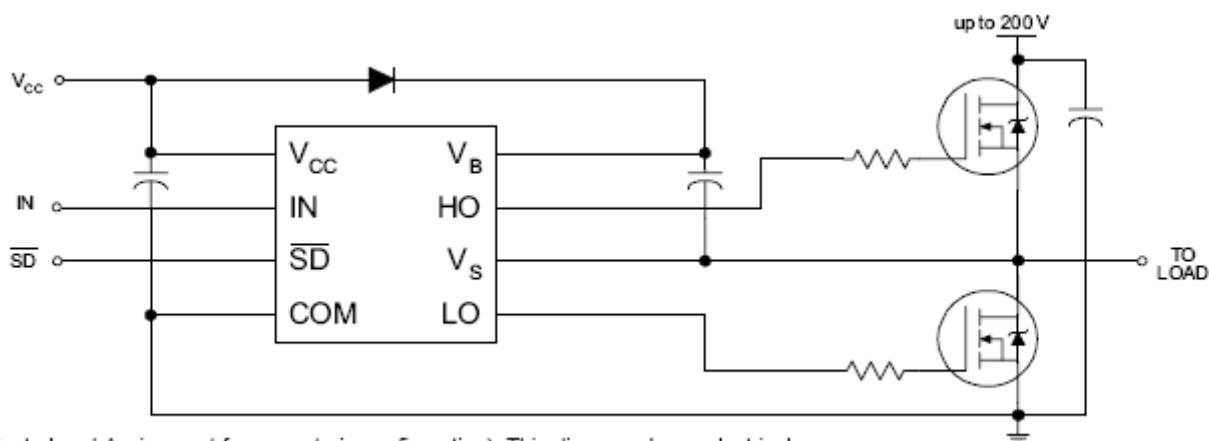
V_{OFFSET}	$\leq 200\text{V}$
V_{OUT}	10 – 20V
$I_{\text{O+}} \& I_{\text{O-}}$ (typical)	130mA & 270mA
$t_{\text{ON}} \& t_{\text{OFF}}$ (typical)	680 ns/150 ns
Deadtime (typical)	520 ns

Package Options



8-Lead SOIC

Typical Connection Diagram



(Refer to Lead Assignment for correct pin configuration). This diagram shows electrical connections only. Please refer to our Application Notes and DesignTips for proper circuit board layout.

Table of Contents	Page
Description	3
Qualification Information	4
Absolute Maximum Ratings	5
Recommended Operating Conditions	5
Static Electrical Characteristics	6
Dynamic Electrical Characteristics	6
Functional Block Diagram	7
Input/Output Pin Equivalent Circuit Diagram	7
Lead Definitions	8
Lead Assignments	8
Application Information and Additional Details	9
Parameter Temperature Trends	10 - 12
Package Details	12
Tape and Reel Detail	13
Part Marking Information	14
Ordering Information	14
Important Notice	15

Description

The AUIRS2004S is a high voltage, high speed power MOSFET and IGBT driver with dependent high and low side referenced output channels. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The logic input is compatible with standard CMOS or LSTTL output, down to 3.3V logic. The output drivers feature a high pulse current buffer stage designed for minimum driver cross-conduction. The floating channel can be used to drive N-channel power MOSFET or IGBT in the high side configuration which operates from 10V to 200 volts.

Qualification Information[†]

Qualification Level		Automotive (per AEC-Q100 ^{††})
		Comments: This family of ICs has passed an Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.
Moisture Sensitivity Level		MSL3 ^{†††} 260°C (per IPC/JEDEC J-STD-020)
ESD	Machine Model	Class M2 (+/-200V) (per AEC-Q100-003)
	Human Body Model	Class H1C (+/-2000V) (per AEC-Q100-002)
	Charged Device Model	Class C4 (+/-1000V) (per AEC-Q100-011)
IC Latch-Up Test		Class II, Level B ^{††††} (per AEC-Q100-004)
RoHS Compliant		Yes

† Qualification standards can be found at International Rectifier's web site <http://www.irf.com/>

†† Exceptions to AEC-Q100 requirements are noted in the qualification report.

††† Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information.

†††† LIN and HIN stressed to +/-20mA

Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which permanent damage to the device may occur. These are stress ratings only, functional operation of the device at these or any other condition beyond those indicated in the “Recommended Operating Condition” is not implied. Exposure to absolute maximum-rated conditions for extended periods may affect device reliability. All voltage parameters are absolute voltages referenced to COM unless otherwise stated in the table. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

Symbol	Definition	Min.	Max.	Units
V_B	High Side Floating Supply Voltage	-0.3	225	V
V_S	High Side Floating Offset Voltage	$V_B - 20$	$V_B + 0.3$	
V_{HO}	High Side Floating Output Voltage	$V_S - 0.3$	$V_B + 0.3$	
V_{CC}	Low Side and Logic Fixed Supply Voltage	-0.3	25	
V_{LO}	Low Side Output Voltage	-0.3	$V_{CC} + 0.3$	
V_{IN}	Logic Input Voltage ($IN, \overline{SD}$)	$V_{SS} - 0.3$	$V_{CC} + 0.3$	
dV_S/dt	Allowable Offset Supply Voltage Transient	—	50	V/ns
P_D	Package Power Dissipation @ $T_A \leq +25\text{ }^\circ\text{C}$	—	0.625	W
R_{thJA}	Thermal Resistance, Junction to Ambient	—	200	$^\circ\text{C/W}$
T_J	Junction Temperature	—	150	$^\circ\text{C}$
T_S	Storage Temperature	-55	150	
T_L	Lead Temperature (soldering, 10 seconds)	—	300	

Recommended Operating Conditions

The Input/Output logic timing diagram is shown in figure 1. For proper operation the device should be used within the recommended conditions. All voltage parameters are absolute voltage referenced to COM. The V_S offset rating is tested with all supplies biased at 15 V differential.

Symbol	Definition	Min.	Max.	Units
V_B	High Side Floating Supply Voltage	$V_S + 10$	$V_S + 20$	V
V_S	Static High side floating offset voltage	Note1	200	
V_{HO}	High Side Floating Output Voltage	V_S	V_B	
V_{CC}	Low Side and Logic Fixed Supply Voltage	10	20	
V_{LO}	Low Side Output Voltage	0	V_{CC}	
V_{IN}	Logic Input Voltage ($IN \text{ \& } \overline{SD}$)	0	V_{CC}	
T_A	Ambient temperature	-40	125	$^\circ\text{C}$

Note 1: Logic operational for V_S of -5 V to +200 V. Logic state held for V_S of -5 V to $-V_{BS}$.

Dynamic Electrical Characteristics

Unless otherwise noted, these specifications apply for an operating junction temperature range of $-40^{\circ}\text{C} \leq T_j \leq 125^{\circ}\text{C}$ with bias conditions of V_{BIAS} ($V_{\text{CC}}, V_{\text{BS}}$) = 15 V, $C_L = 1000 \text{ pF}$.

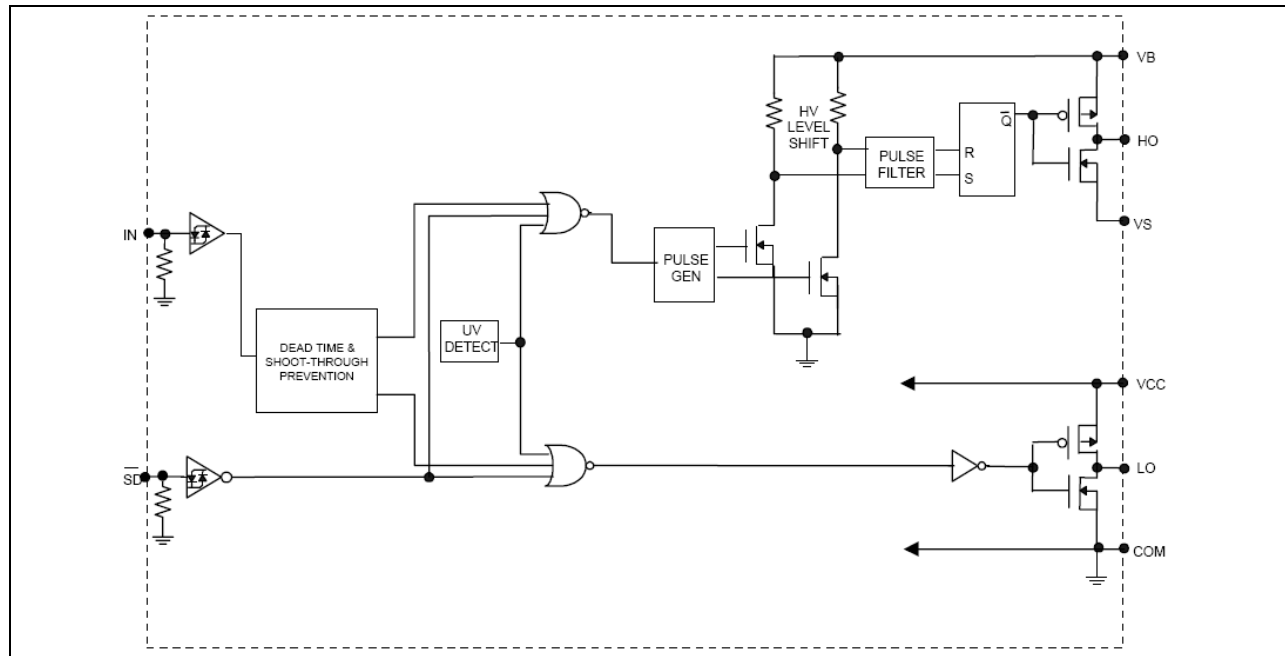
Symbol	Definition	Min	Typ	Max	Units	Test Conditions
t_{on}	Turn-on propagation delay	--	680	880	ns	$V_S = 0 \text{ V}$
t_{off}	Turn-off propagation delay	--	150	220		$V_S = 200 \text{ V}$
t_r	Turn-on rise time	—	160	220		
t_f	Turn-off fall time	—	70	170		
DT_{25}	Deadtime, LS turn-off to HS turn-on & HS turn-on to LS turn-off	400	520	650		$T_j = 25^{\circ}\text{C}$
DT	Deadtime, LS turn-off to HS turn-on & HS turn-on to LS turn-off	400	---	800		
MT_{25}	Delay matching HS & LS turn-on/off	—	—	80		$T_j = 25^{\circ}\text{C}$
MT	Delay matching HS & LS turn-on/off	—	—	150		

Static Electrical Characteristics

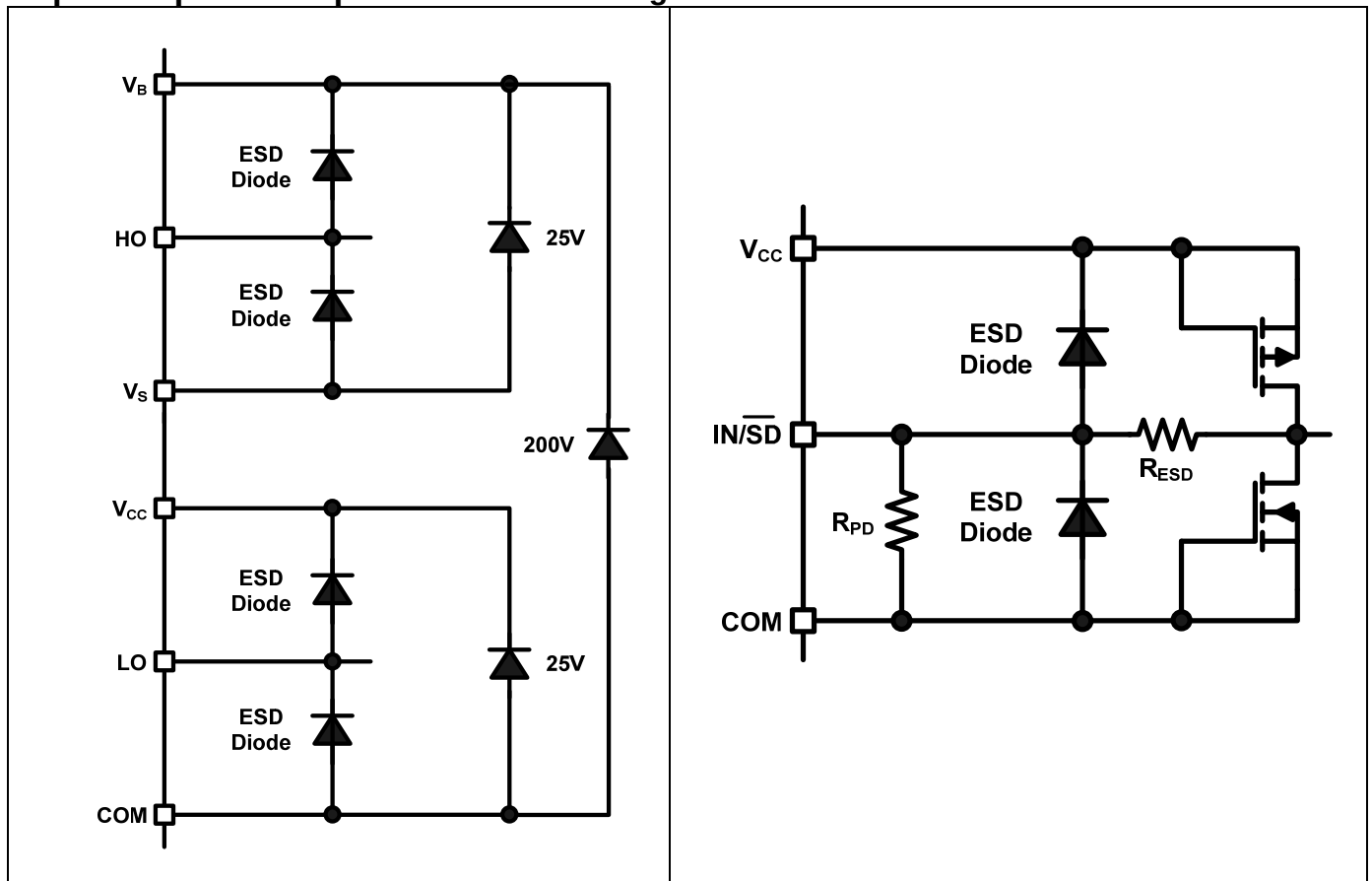
Unless otherwise noted, these specifications apply for an operating junction temperature range of $-40^{\circ}\text{C} \leq T_j \leq 125^{\circ}\text{C}$ with bias conditions of V_{BIAS} ($V_{\text{CC}}, V_{\text{BS}}$) = 15 V. The V_{IN} , V_{TH} and I_{IN} parameters are referenced to COM. The V_O and I_O parameters are referenced to COM and are applicable to the respective output leads: HO or LO.

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
V_{IH}	Logic "1" (HO) & Logic "0" (LO) input Voltage	2.5	—	--	V	$V_{\text{CC}} = 10 \text{ V to } 20 \text{ V}$
V_{IL}	Logic "0" (HO) & Logic "1" (LO) input Voltage	---	—	0.8		
$V_{\text{SD,TH+}}$	SD Input Positive Going Threshold	2.5	---	---		
$V_{\text{SD,TH-}}$	SD Input Negative Going Threshold	---	---	0.8		
V_{OH}	High Level Output Voltage, $V_{\text{BIAS}} - V_O$	—	0.05	0.2	μA	$I_O = 2 \text{ mA}$
V_{OL}	Low Level Output Voltage, V_O	—	0.02	0.1		
I_{LK}	Offset Supply Leakage Current	—	—	50		$V_B = V_S = 200 \text{ V}$
I_{QBS}	Quiescent V_{BS} Supply Current	—	30	55		$V_{\text{IN}} = 0 \text{ V or } 5 \text{ V}$
I_{QCC}	Quiescent V_{CC} Supply Current	—	150	270		$V_{\text{IN}} = 5 \text{ V}$
$I_{\text{IN+}}$	Logic "1" Input Bias Current	---	3	10		$V_{\text{IN}} = 0 \text{ V}$
$I_{\text{IN-}}$	Logic "0" Input Bias Current	---	---	5		SD pin = 5 V
$I_{\text{SD+}}$	Bias Current at SD pin, shut down disabled	---	3	10		SD pin = 0 V
$I_{\text{SD-}}$	Bias Current at SD pin, shut down enabled	---	---	5		
$V_{\text{CCUV+}}$	V_{CC} Supply Undervoltage Positive going Threshold	8	8.9	9.8	V	
$V_{\text{CCUV-}}$	V_{CC} Supply Undervoltage Negative Going Threshold	7.4	8.2	9		
$I_{\text{O+}}$	Output High Short Circuit Pulsed Current	130	290	---	mA	$V_O = 0 \text{ V},$ $PW \leq 10 \mu\text{s}$
$I_{\text{O-}}$	Output Low Short Circuit Pulsed Current	270	600	---		$V_O = 15 \text{ V},$ $PW \leq 10 \mu\text{s}$

Functional Block Diagram



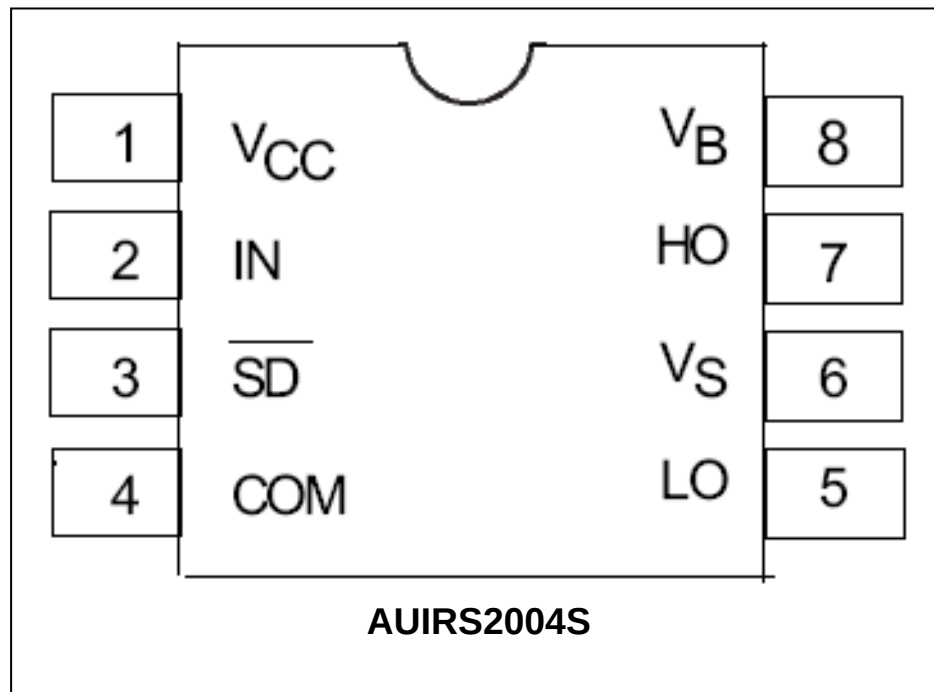
Input/Output Pin Equivalent Circuit Diagrams: AUIRS2004



Lead Definitions

Symbol	Description
IN	Logic input for high side and low side gate driver outputs (HO and LO), in phase with HO
SD	Logic input for shutdown
V _B	High side floating supply
HO	High side gate drive output
V _S	High side floating supply return
V _{CC}	Low side and logic fixed supply
LO	Low side gate drive output
COM	Low side return

Lead Assignments



Application Information and Additional Details

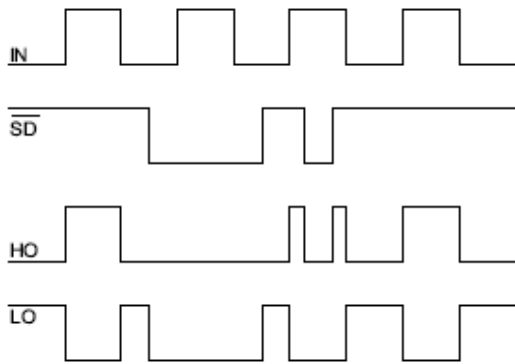


Figure 1: Input/Output Timing Diagram

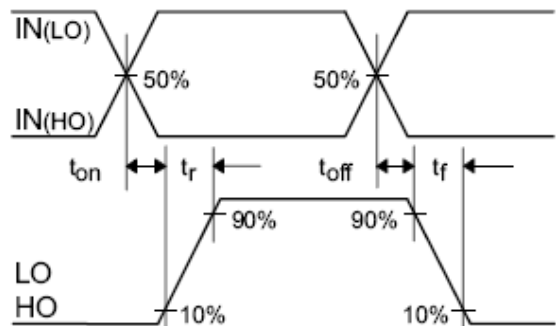


Figure 2: Switching Time Waveform Definitions

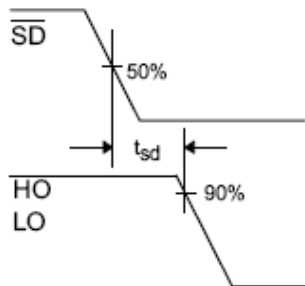


Figure3: Shutdown Waveform Definitions

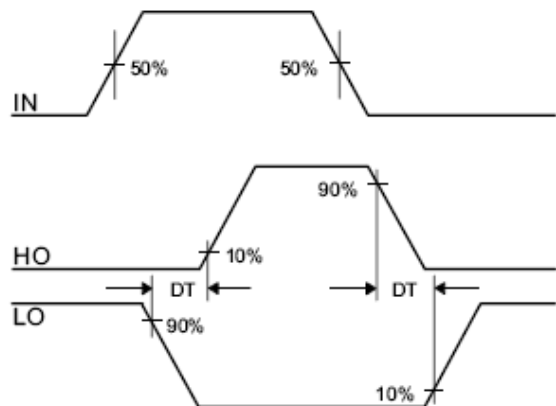


Figure 4: Deadtime Waveform Definitions

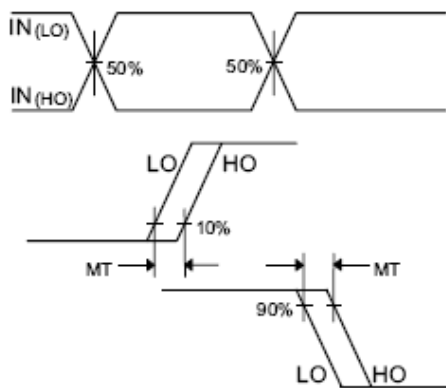


Figure 5: Delay Matching Waveform Definitions

Parameter Temperature Trends

Figures illustrated in this chapter provide information on the experimental performance of the AUIRS2004S HVIC. The line plotted in each figure is generated from actual lab data. A large number of individual samples were tested at three temperatures (-40 °C, 25 °C, and 125 °C) in order to generate the experimental curve. The line consists of three data points (one data point at each of the tested temperatures) that have been connected together to illustrate the understood trend. The individual data points on the Typ. curve were determined by calculating the averaged experimental value of the parameter (for a given temperature).

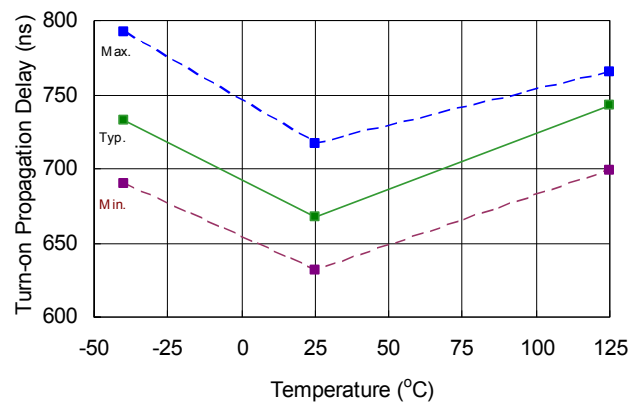


Figure 6: T_{ON} vs. temperature

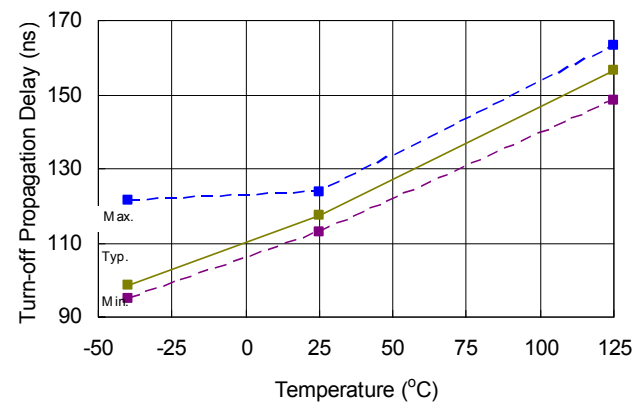


Figure 7: T_{OFF} vs. temperature

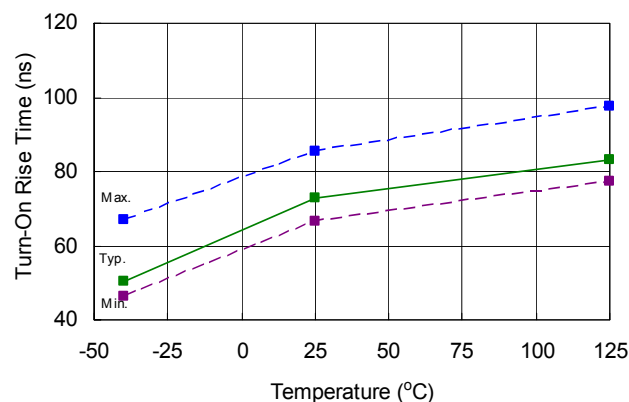


Figure 8: T_R vs. temperature

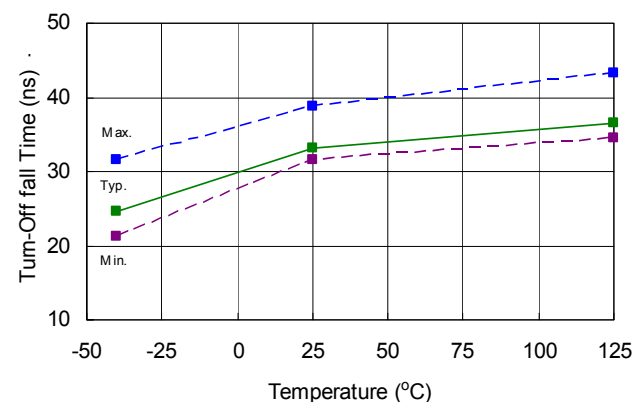


Figure 9: T_F vs. temperature

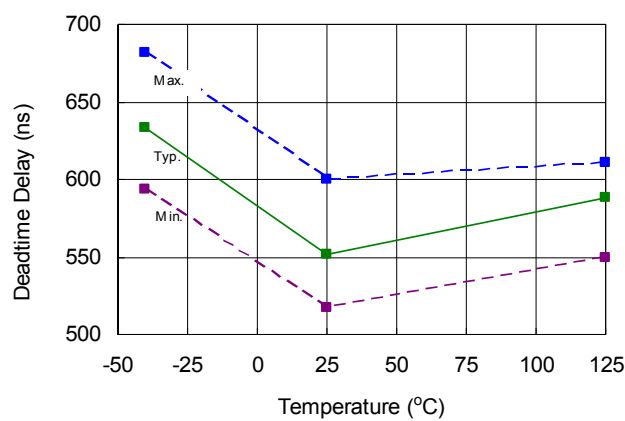


Figure 10: Deadtime vs. temperature

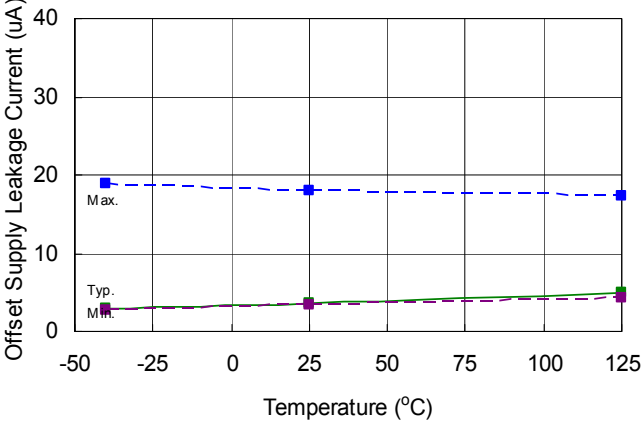


Figure 11: Offset Leakage Current vs. temperature

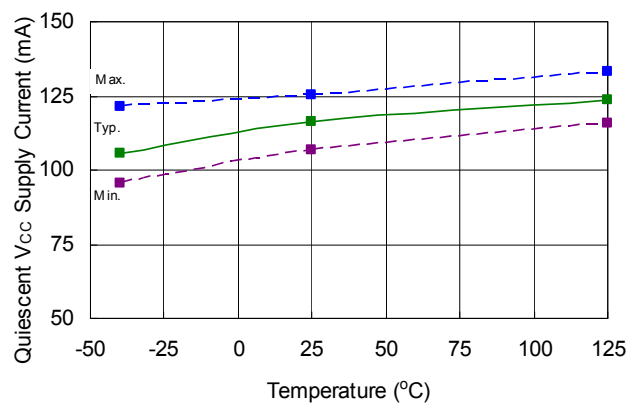


Figure 12: V_{CC} Supply Current vs. Temperature

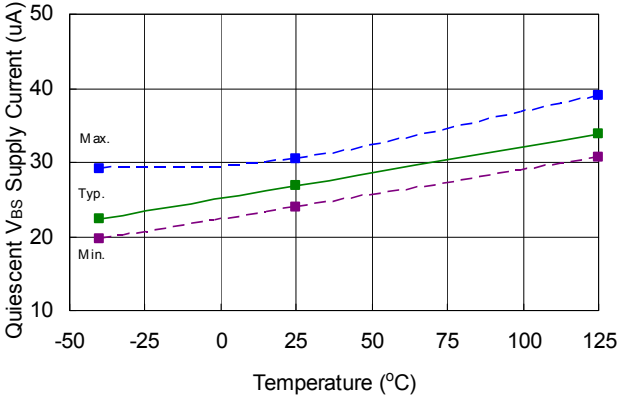


Figure 13: V_{BS} Supply Current vs. temperature

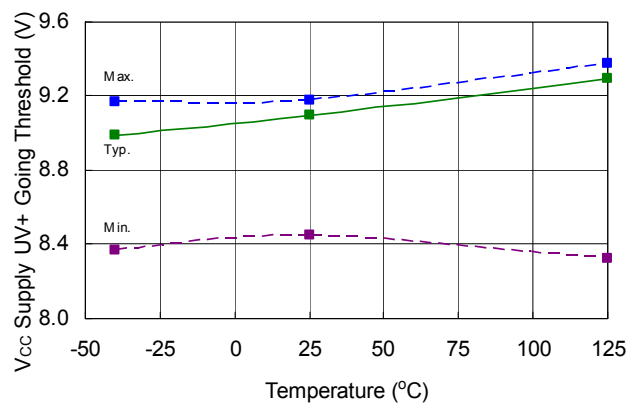


Figure 14: V_{CCUV+} vs. temperature

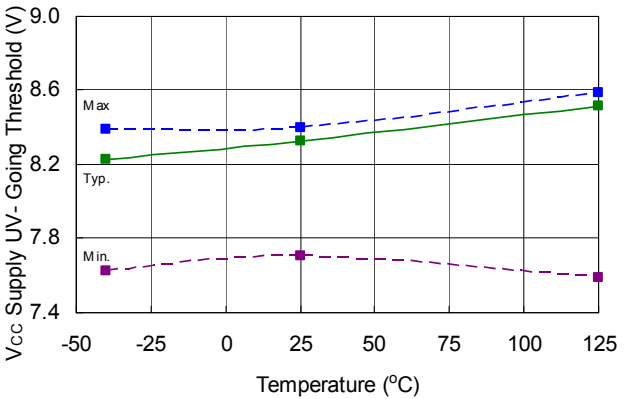


Figure 15: V_{CCUV-} vs. temperature

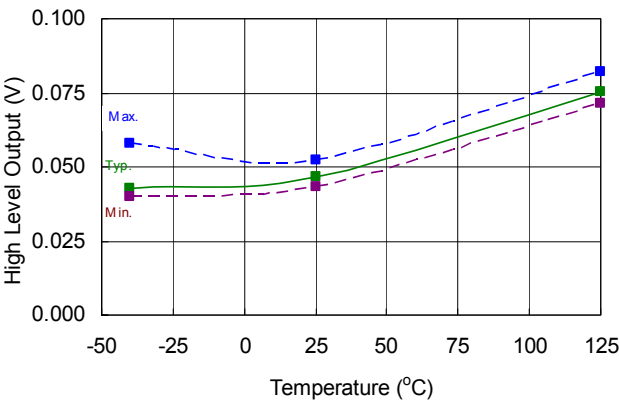


Figure 16: V_{OH} ($I_O = 2mA$) vs. temperature

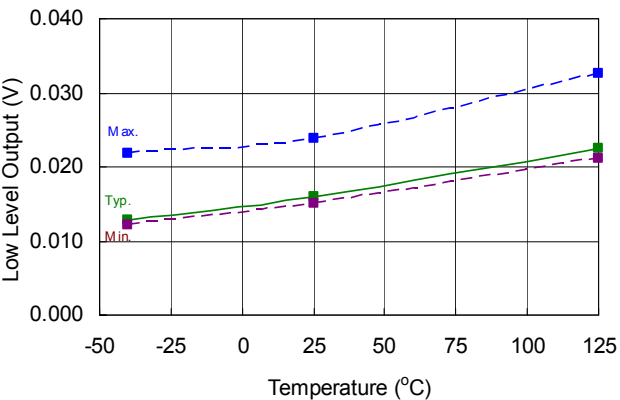
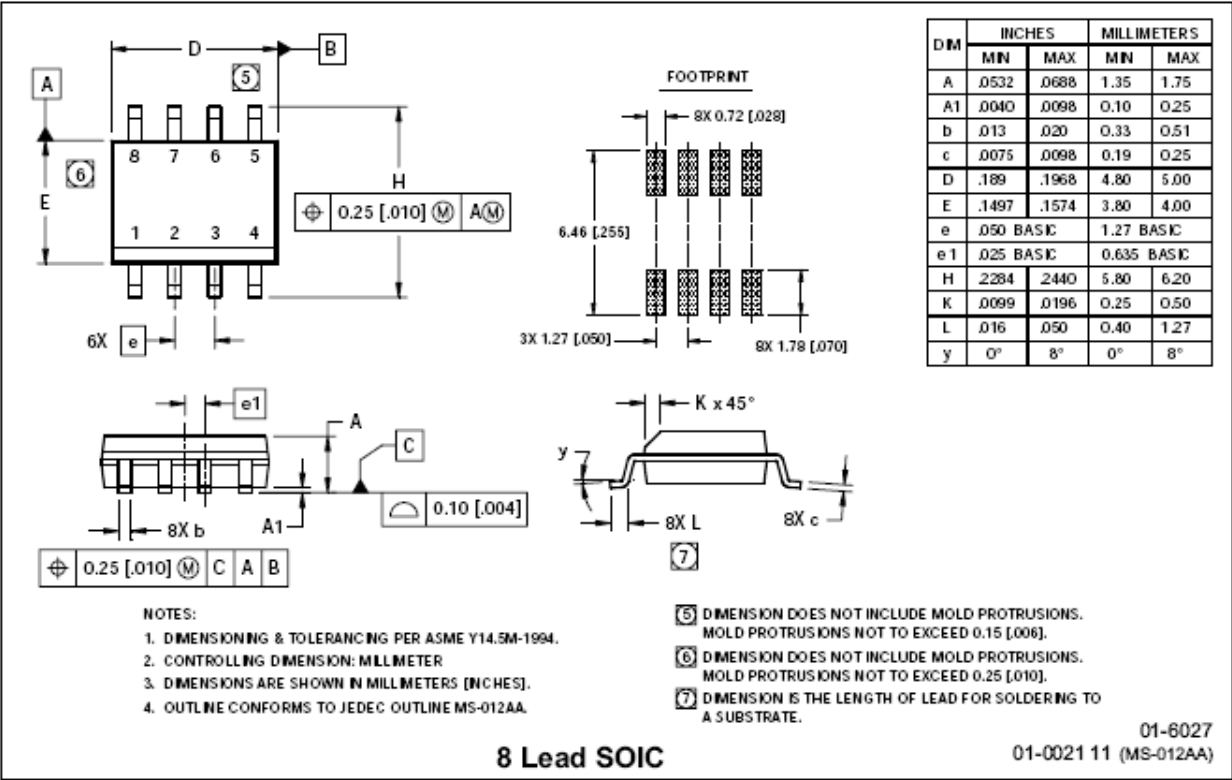
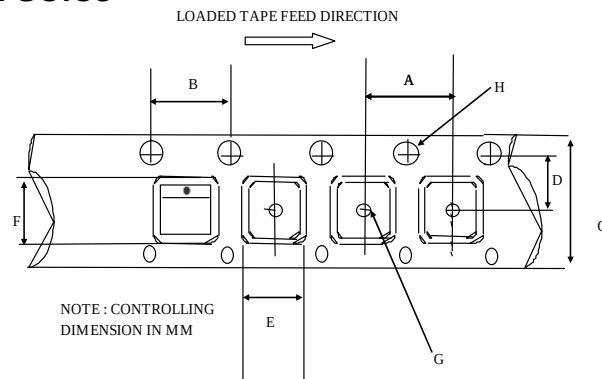


Figure 17: V_{OL} ($I_O = 2mA$) vs. temperature

Case Outlines

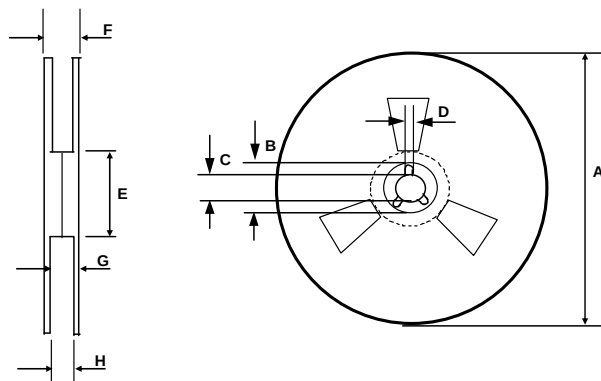


Tape and Reel Details: SOIC8



CARRIER TAPE DIMENSION FOR 44PLCC

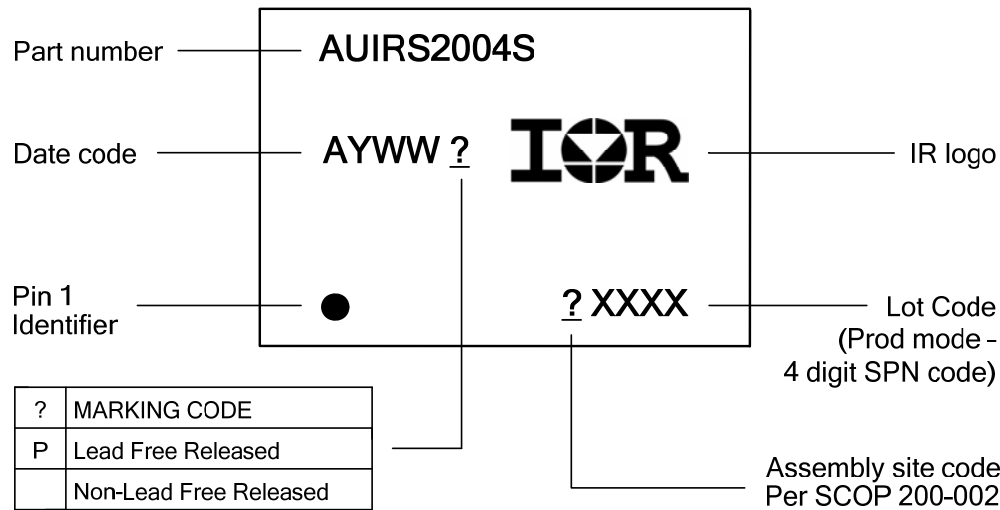
Code	Metric		Imperial	
	Min	Max	Min	Max
A	23.90	24.10	0.94	0.948
B	3.90	4.10	0.153	0.161
C	31.70	32.30	1.248	1.271
D	14.10	14.30	0.555	0.562
E	17.90	18.10	0.704	0.712
F	17.90	18.10	0.704	0.712
G	2.00	n/a	0.078	n/a
H	1.50	1.60	0.059	0.062



REEL DIMENSIONS FOR 44PLCC

Code	Metric		Imperial	
	Min	Max	Min	Max
A	329.60	330.25	12.976	13.001
B	20.95	21.45	0.824	0.844
C	12.80	13.20	0.503	0.519
D	1.95	2.45	0.767	0.096
E	98.00	102.00	3.858	4.015
F	n/a	38.4	n/a	1.511
G	34.7	35.8	1.366	1.409
H	32.6	33.1	1.283	1.303

Part Marking Information



Ordering Information

Base Part Number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRS2004S	SOIC8	Tube/Bulk	95	AUIRS2004S
		Tape and Reel	2500	AUIRS2004STR

IMPORTANT NOTICE

Unless specifically designated for the automotive market, International Rectifier Corporation and its subsidiaries (IR) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or services without notice. Part numbers designated with the "AU" prefix follow automotive industry and / or customer specific requirements with regards to product discontinuance and process change notification. All products are sold subject to IR's terms and conditions of sale supplied at the time of order acknowledgment.

IR warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with IR's standard warranty. Testing and other quality control techniques are used to the extent IR deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

IR assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using IR components. To minimize the risks with customer products and applications, customers should provide adequate design and operating safeguards.

Reproduction of IR information in IR data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alterations is an unfair and deceptive business practice. IR is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of IR products or serviced with statements different from or beyond the parameters stated by IR for that product or service voids all express and any implied warranties for the associated IR product or service and is an unfair and deceptive business practice. IR is not responsible or liable for any such statements.

IR products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or in other applications intended to support or sustain life, or in any other application in which the failure of the IR product could create a situation where personal injury or death may occur. Should Buyer purchase or use IR products for any such unintended or unauthorized application, Buyer shall indemnify and hold International Rectifier 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 IR was negligent regarding the design or manufacture of the product.

IR products are neither designed nor intended for use in military/aerospace applications or environments unless the IR products are specifically designated by IR as military-grade or "enhanced plastic." Only products designated by IR as military-grade meet military specifications. Buyers acknowledge and agree that any such use of IR products which IR has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

IR products are neither designed nor intended for use in automotive applications or environments unless the specific IR products are designated by IR as compliant with ISO/TS 16949 requirements and bear a part number including the designation "AU". Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, IR will not be responsible for any failure to meet such requirements.

For technical support, please contact IR's Technical Assistance Center
<http://www.irf.com/technical-info/>

WORLD HEADQUARTERS:
233 Kansas St., El Segundo, California 90245
Tel: (310) 252-7105

Revision History

Date	Comment
Jul. 30, 2010	Converted from industrial datasheet
Aug. 30, 2010	Update qualification ESD/LU class
Aug. 31, 2010	Changed Deadtime typical to 700ns on 1 st page, TON max to 880, MT max to 150, 60, DT min to 400, typ to 600. Added tri-temp graph, I/O equivalent circuit. Modified block diagram, SD pull up now.
Sep. 19, 2010	Typ Deadtime back to 520ns; DTmax=650ns at 25°C; DTmax=800ns; MT max to 150ns, (60ns at 25°C). ISD+ and ISD- parameters added to specify SD input impedance.
Sep. 28, 2010	Updated MT ₂₅ to 80; updated block diagram and SD pin I/O circuit
Sep. 30, 2010	ISD+ and ISD- parameters exchanged because SD is pull down.
Oct. 14, 2010	Typ application section filled up
Oct. 19, 2010	Update reflow temp to 260C
Nov. 2, 2010	Changed 1 st page header. Minor update characteristics table format and corrected SD pin lead definition