Features

- Leadfree, RoHS compliant
- Automotive qualified
- One high side output and internal low side Vs recharge.
- CMOS Schmitt trigger inverted input with pull up resistor
- CMOS Schmitt trigger inverted reset with pull down resistor
- 5V compatible logic level inputs
- Immune to –Vs spike and tolerant to dVs/dt

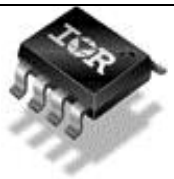
Typical Applications

- Common Rail Injections
- Diesel/Gasoline Direct Injections
- Solenoid Drivers
- Actuators and brushed DC motors

Product Summary

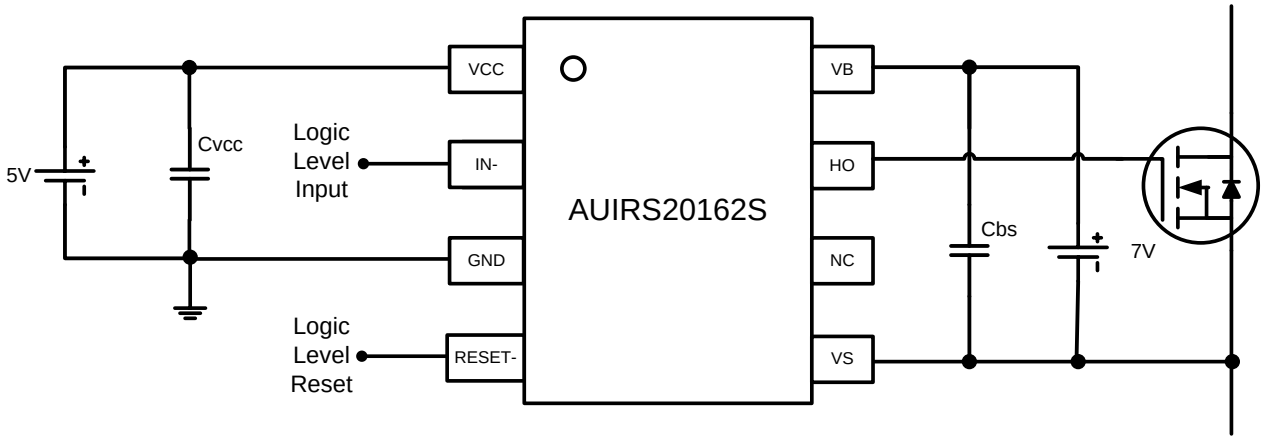
Topology	Low side input, high side driver with Vs recharge
V_{OFFSET}	150 V
V_{OUT}	4.4 V – 20 V
I_{o+} & I_{o-} (typical)	0.25 A
t_{ON} & t_{OFF} (typical)	150 ns
Deadtime DT_{ON} / DT_{OFF} (typical)	70ns / 6 us

Package Options



8 - Lead SOIC
AUIRS20162S

Typical Connection Diagram



Orderable Part Number	Package Type	Standard Pack		Note
		Form	Quantity	
AUIRS20162S(TR)	SOIC8	Tape and Reel	2500	

 © 2014 International Rectifier

Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which 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 GND 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_{BS}	High Side Floating Supply Voltage	-0.3	20	V
V_B	High Side Driver Output Stage Voltage, Neg. transient: 0.5 ms, external MOSFET off	-5.0	166	V
V_S	High Side Floating Supply Offset Voltage Neg. transient 0.4 µs	-8.0	150	V
V_{HO}	Output Voltage Gate Connection	V_S – 0.3	V_B + 0.3	V
V_{CC}	Supply Voltage	-0.3	20	V
V_{IN}	Input Voltage	-0.3	V_{CC} + 0.3	V
I_{IN}	Input Injection Current. Full function, no latch-up; (guaranteed by design). Test at 5V and 7V on Eng. Samples.	---	+1	mA
V_{RES}	Reset Input Voltage	-0.3	V_{CC} + 0.3	V
dV/dt	Allowable Offset Voltage Slew Rate	-50	50	V/nsec
Rth_{JA}	Thermal resistance, junction to ambient	-	200	°C/W
T_J	Junction Temperature	-55	150	ºC
T_S	Storage Temperature	-55	150	ºC

Recommended Operating Conditions

For proper operations the device should be used within the recommended conditions.

Symbol	Definition	Min.	Max.	Units
V_B †	High Side Driver Output Stage Voltage	V_S+4.4	V_S+20	V
V_S	High Side Floating Supply Offset Voltage	-3	150	V
V_{HO}	Output Gate Voltage	V_S	V_B	V
V_{CC} ††††	Supply Voltage	4.4	6.5	V
V_{IN}	Input Voltage	0	V_{CC}	V
V_{RES}	Reset Input Voltage	0	V_{CC}	V
Ta	Ambient Temperature	-40	125	ºC
f_s	Switching frequency †† (load: 50 Ohm, 2.5nF into V_S)	---	200	kHz
t_{inlow_min}	Minimum low input width †††	1000	---	ns
t_{inhigh_min}	Minimum high input width †††	60	---	ns

† Reset-logic functional for V_{BS} > 2V

†† Duty cycle = 0.5, V_{BS} = 7 V

††† Guaranteed by design. Pulse width below the specified values may be ignored. Output will either follow the input or will ignore it. No false output state is guaranteed when minimum input width is smaller than t_{in}.

†††† Logic operation functional for Vcc > 2.7V, see also table Table 1 on page 10.

 © 2014 International Rectifier

Electrical Characteristics

Unless otherwise specified, V_{CC} = 5V, V_{BS} = 7V, V_S = 0V, IN = 0V, RES = 5V, load R = 50Ω, C = 2.5nF. Unless otherwise noted, these specifications apply for an operating junction temperature range of -40°C ≤ Tj ≤ 125°C.

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
VCC Supply Characteristics						
V_{CCUV+}	V_{CC} Supply Undervoltage Positive Going Threshold			4.3	V	V_{CC} rising from 0V
V_{CCUV-}	V_{CC} Supply Undervoltage Negative Going Threshold	2.8				V_{CC} dropping from 5V
$V_{CCUVHYS}$	V_{CC} Supply Undervoltage Lockout Hysteresis	0.02	0.3	0.60		
t_{dUVCC}	Undervoltage Lockout Response Time	0.5		20	µsec	V_{CC} steps either from 6.5V to 2.7V or from 2.7V to 6.5V
I_{QCC}	V_{CC} Supply Current			400	uA	V_{CC} = 3.6V & 6.5V
V_{BS} Supply Characteristics						
V_{BSUV+}	V_{BS} Supply Undervoltage Positive Going Threshold			5.4	V	V_{BS} rising from 0V
V_{BSUV-}	V_{BS} Supply Undervoltage Negative Going Threshold	3.9				V_{BS} dropping from 5V
$V_{BSUVHYS}$	V_{BS} Supply Undervoltage Lockout Hysteresis	0.02	0.3	0.60		
t_{dUVBS}	Undervoltage Lockout Response Time	0.5		20	µsec	V_{BS} steps either from 6.5V to 2.7V or from 2.7V to 6.5V
I_{QBS1}	V_{BS} Supply Current			130	µA	static mode, V_{BS} = 7V, IN = 0V or 5V
I_{QBS2}	V_{BS} Supply Current			300	µA	static mode, V_{BS} = 16V, IN = 0V or 5V
ΔV_{BS} †	V_{BS} Drop Due to Output Turn-On			210	mV	V_{BS} = 7V, C_{BS} = 1µF, $t_{d_Igen-IN}$ = 3µsec, t_{TEST} = 100µsec, No load

† See also Fig. 4 and 5

 © 2014 International Rectifier

Electrical Characteristics

Unless otherwise specified, V_{CC} = 5V, V_{BS} = 7V, V_S = 0V, IN = 0V, RES = 5V, load R = 50Ω, C = 2.5nF. Unless otherwise noted, these specifications apply for an operating junction temperature range of -40°C ≤ Tj ≤ 125°C.

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
Gate Driver Characteristics						
I_{PKSo1}	Peak Output Source Current	120	250		mA	Tj = 25°C, ††
I_{PKSo2}	Peak Output Source Current	70			mA	††
I_{PKSo3}	Peak Output Source Current	250	500		mA	V_{BS} = 16V, Tj = 25°C††
I_{PKSo4}	Peak Output Source Current	150			mA	V_{BS} = 16V††
t_{r1}	Output Rise Time		0.2	0.4	µsec	Tj = 25°C
t_{r2}	Output Rise Time			0.5	µsec	
t_{r3}	Output Rise Time		0.1	0.2	µsec	V_{BS} = 16V, Tj = 25°C
t_{r4}	Output Rise Time			0.3	µsec	V_{BS} = 16V
I_{PKSi1}	Peak Output Sink Current	120	250		mA	IN = 5V, Tj = 25°C††
I_{PKSi2}	Peak Output Sink Current	70			mA	IN = 5V, ††
I_{PKSi3}	Peak Output Sink Current	250	500		mA	V_{BS} = 16V, IN = 5V, Tj = 25°C††
I_{PKSi4}	Peak Output Sink Current	150			mA	V_{BS} = 16V, IN = 5V††
t_{f1}	Output Fall Time		0.2	0.4	µsec	IN = 5V, Tj = 25°C
t_{f2}	Output Fall Time			0.5	µsec	IN = 5V
t_{f3}	Output Fall Time		0.1	0.2	µsec	V_{BS} = 16V, IN = 5V, Tj = 25°C
t_{f4}	Output Fall Time			0.3	µsec	V_{BS} = 16V, IN = 5V
t_{plh}	Input-to-Output Turn-On Propagation Delay (50% input level to 10% output level)		0.15	0.35	µsec	
t_{phl}	Input-to-Output Turn-Off Propagation Delay (50% input level to 90% output level)		0.15	0.35	µsec	
t_{phl_res}	RES-to-Output Turn-Off Propagation Delay (50% input level to 90% [t_{phl}] output levels)		0.15	0.35	µsec	
t_{plh_res}	RES-to-Output Turn-On Propagation Delay (50% input level to 10% [t_{plh}] output levels)		0.15	0.35	µsec	

†† :Peak Output Sink and Source Current tests are performed with the output shorted and therefore highly dissipative. Therefore, it is not recommended that this test be performed for longer than 10usec at a time.

 © 2014 International Rectifier

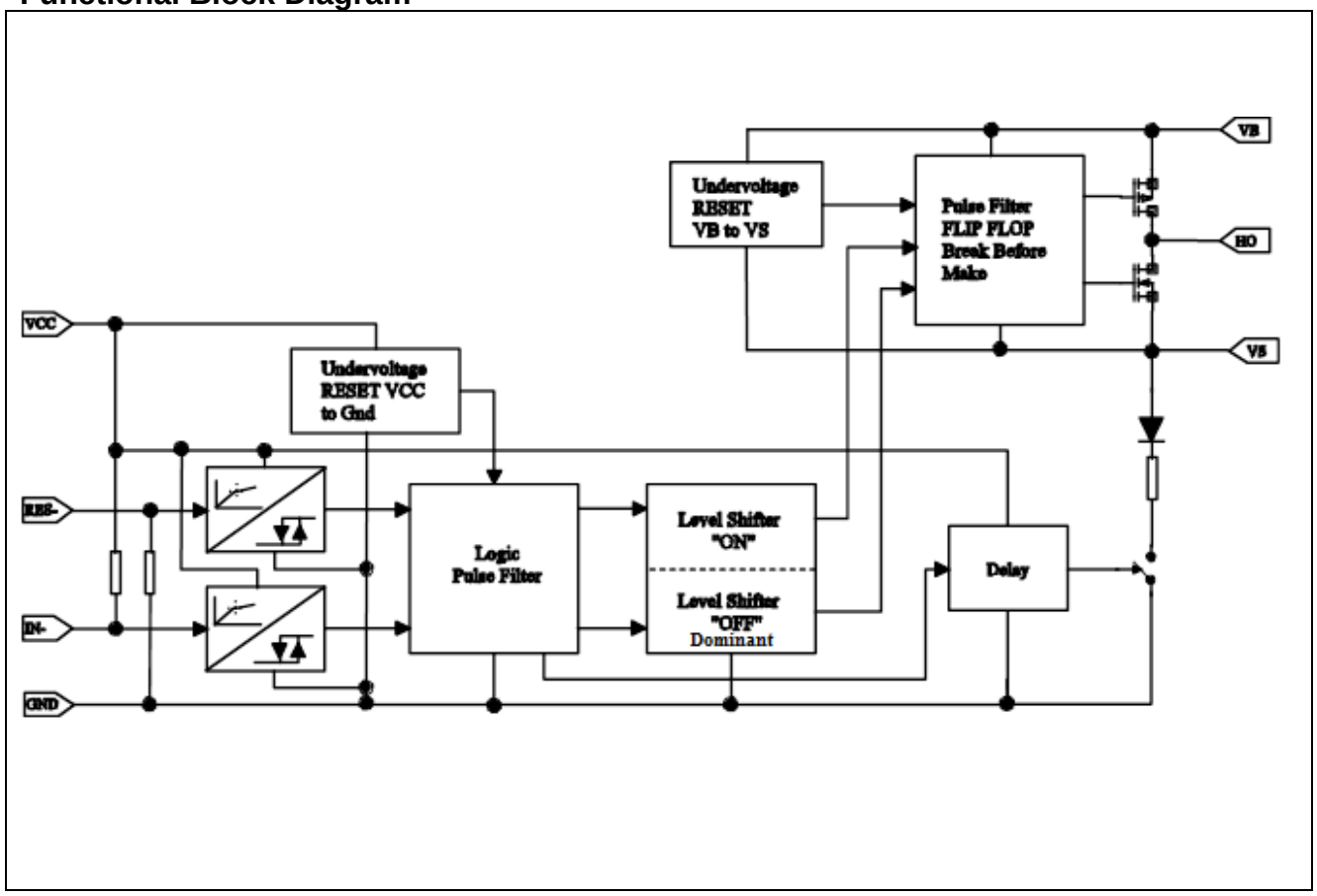
Electrical Characteristics

Unless otherwise specified, V_{CC} = 5V, V_{BS} = 7V, VS = 0V, IN = 0V, RES = 5V, load R = 50Ω, C = 2.5nF. Unless otherwise noted, these specifications apply for an operating junction temperature range of -40°C ≤ Tj ≤ 125°C.

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
Input Characteristics						
V_{INH}	High Logic Level Input Threshold	0.66* Vcc			V	V_{CC}=5V
V_{INL}	Low Logic Level Input Threshold			0.28* Vcc	V	V_{CC}=5V
R_{IN}	IN pull up Input Resistance	60	100	220	kΩ	
I_{IN}	High Logic Level Input Current			5	µA	V_{IN}= V_{CC}
V_{H_RES}	High Logic Level RES Input Threshold	0.66* Vcc			V	V_{CC} =5V
V_{L_RES}	Low Logic Level RES Input Threshold			0.28* Vcc	V	V_{CC} =5V
R_{RES}	RES pull down Input Resistance	60	100	220	kΩ	
I_{RES}	Low Logic Level Input Current			5	µA	V_{RES}=0
Recharge Characteristics						
t_{on_rech}	Recharge Transistor Turn-On Propagation Delay	3	6	9	µsec	V_S = 5V
t_{off_rech}	Recharge Transistor Turn-Off Propagation Delay		0.08	0.24	µsec	
V_{RECH}	Recharge Output Transistor On-State Voltage Drop			1.2	V	IS = 1mA, IN = 5V.
Deadtime Characteristics						
DT_{HOFF}	High Side Turn-Off to Recharge gate Turn-On	3	6	9	µsec	V_{CC} = 5V, V_{BS} = 7V
DT_{HON}	Recharge gate Turn-Off to High Side Turn-On	0.005	0.07	0.4	µsec	V_{CC} = 5V, V_{BS} = 7V

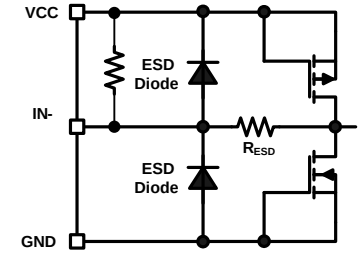
 © 2014 International Rectifier

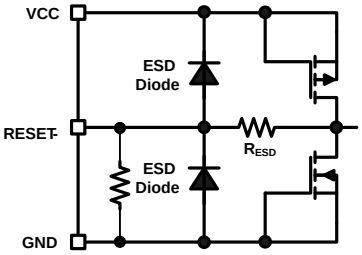
Functional Block Diagram

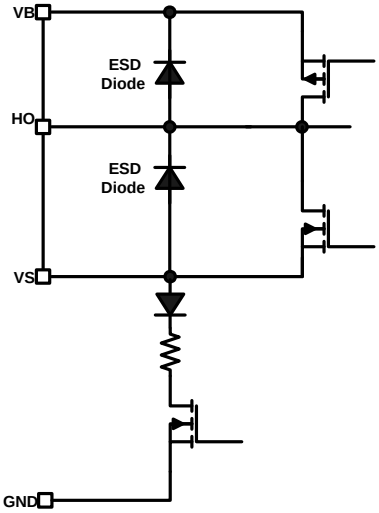


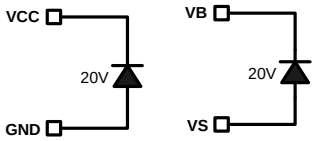
 © 2014 International Rectifier

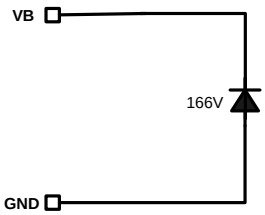
Input/Output Pin Equivalent Circuit Diagrams









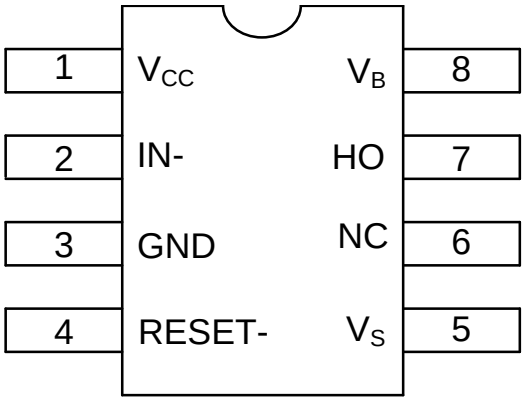


 © 2014 International Rectifier

Lead Definitions

Pin Number	Symbol	Pin description
1	V_{CC}	Driver Supply, typically 5.0V
2	IN-	Driver Control Signal Input (negative logic)
3	GND	Ground
4	RESET-	Driver Enable Signal Input (negative logic)
5	V_S	MOSFET Source Connection
6	NC	No Connection (no Bond-wire)
7	HO	MOSFET Gate Connection
8	V_B	Driver Output Stage Supply

Lead Assignments



8 Lead SOIC

 © 2014 International Rectifier

Application Information and Additional Details

The AUIRS20162S is a high voltage power MOSFET and IGBT high side driver with internal VS-to-GND recharge NMOS. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The logic input is compatible with standard 5V CMOS or LSTTL logic. The output driver features a 250mA high pulse current buffer stage. The channel can be used to drive an N-channel power MOSFET or IGBT in the high side configuration, which operates up to 150 volts above GND ground.

A Truth table for V_{CC}, V_{BS}, RESET, IN, H_O and RechFET is shown as follows.
This table is valid for voltages ranges defined in the recommended operating conditions section.

Supply voltages and thresholds		**Signals**		**Output Ho**	**Recharge Path**
V_{CC}	V_{BS}	RESET-	IN-		
$< V_{CCUV-}$	X	X	X	OFF	ON
$> V_{CCUV+}$	X	LOW	X	OFF	ON
$> V_{CCUV+}$	X	X	HIGH	OFF	ON
$> V_{CCUV+}$	$> V_{BSUV+}$	HIGH	LOW	ON	OFF
$> V_{CCUV+}$	$< V_{BSUV-}$	HIGH	LOW	OFF	OFF

Table 1: logic operation

Recharge Path = ON indicates that the recharge MOSFET is on.
Recharge Path = OFF indicates that the recharge MOSFET is off.

In the case that Vcc will be removed during operation, Ho will be turned off if the resulting dVcc/dt is slow enough to allow UVLO response time as defined in the td_{UVCC} parameter.
If Ho was low it will remain low.

 © 2014 International Rectifier

Timing Diagrams and Additional Information

Input / Output

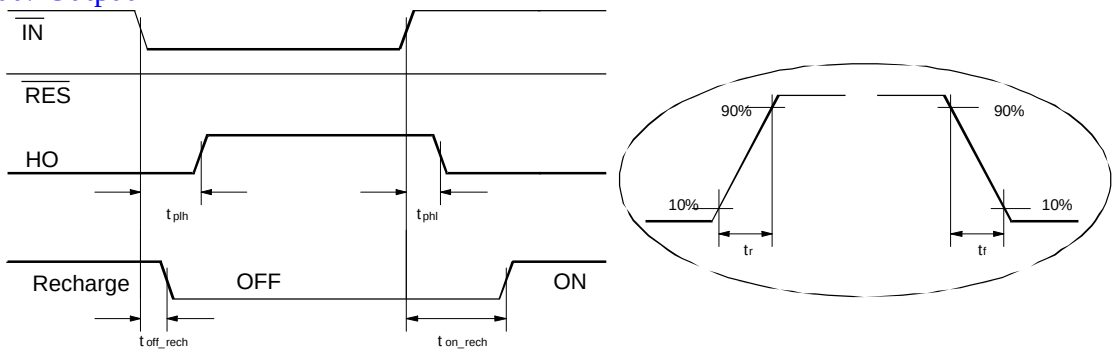


Figure 1: Input/Output Timing Diagram

Reset

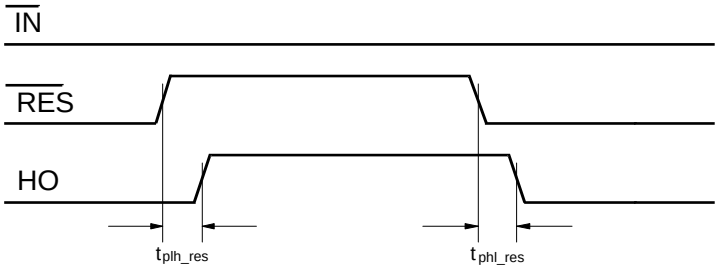


Figure 2: Reset Timing Diagram

Start-up

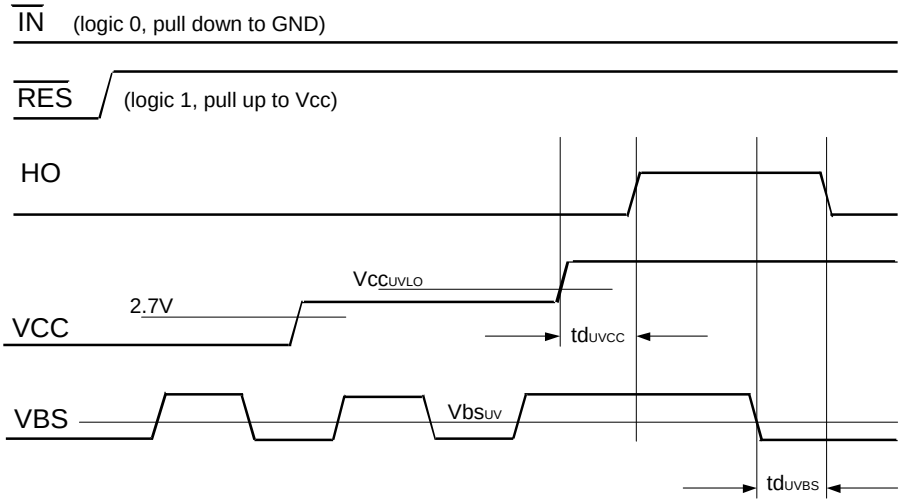


Figure 3: Start up Diagram

 © 2014 International Rectifier

VB Drop Voltage Test

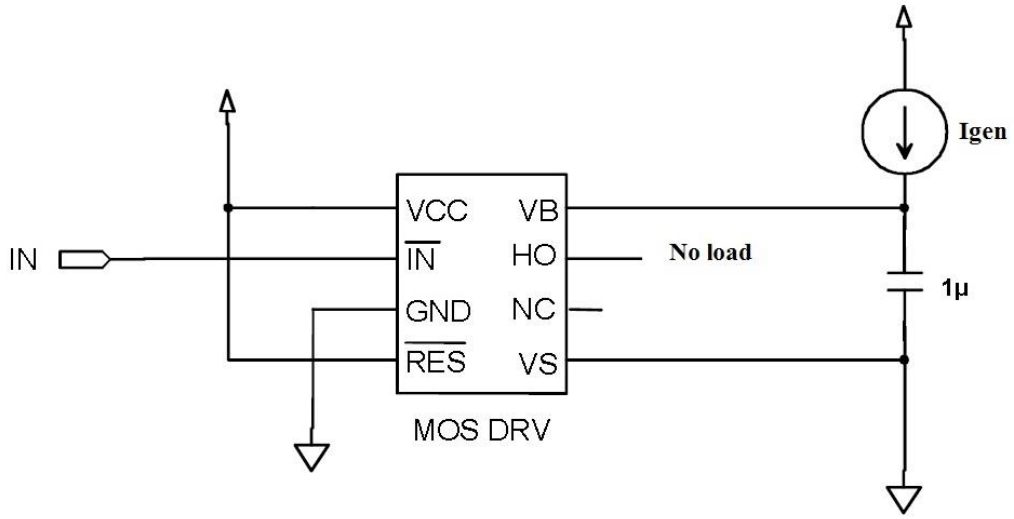
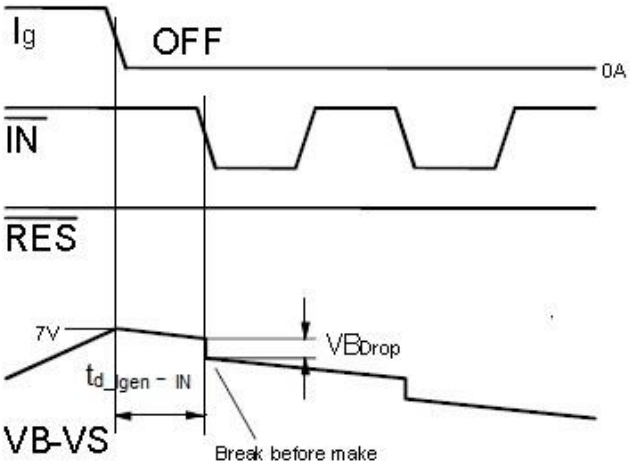


Figure 4: Vbs drop Voltage test



Vbs voltage drop due to the high side
section activation at no load

Figure 5: Vbs drop Voltage waveforms

 © 2014 International Rectifier

Performance Graphs

RESET Functionality Graph:

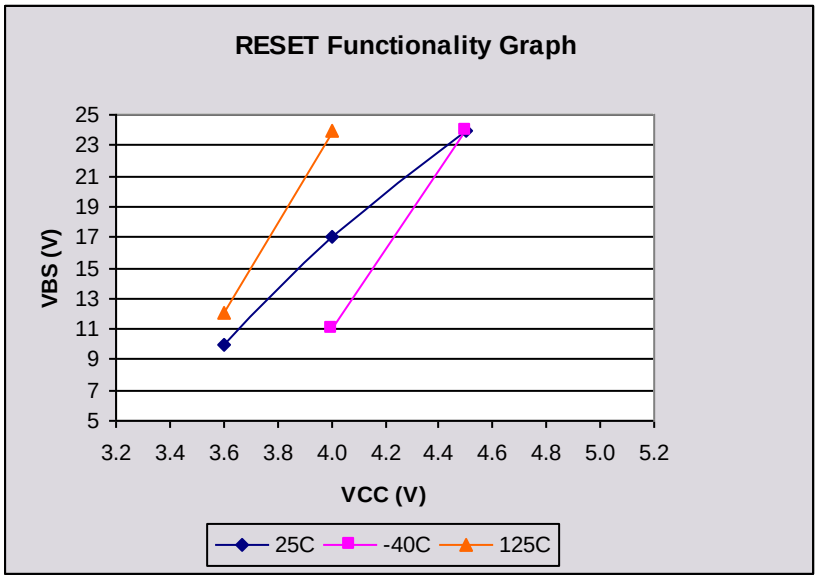


Figure 6-1

Figure 6. RESET Functionality:
This graph explains the functionality limitation as a function of V_{CC}, V_{BS} and temperature.
For each particular temperature and V_{CC}, the output is non-functional for any value of V_{BS} above the drawn curve. But for any value of V_{BS} below the curve the functionality is fine.

RESET Functional Diagram:

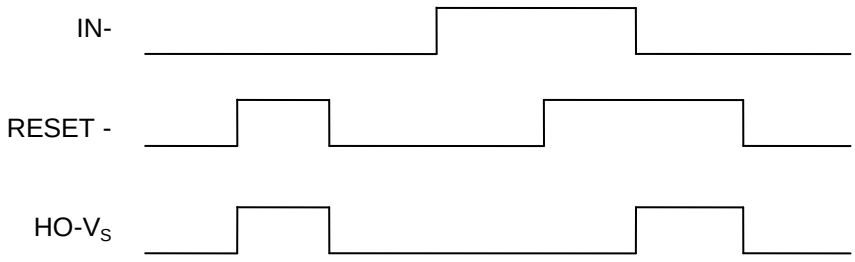


Figure 6-2

 © 2014 International Rectifier

Parameter Temperature Trends

Figures illustrated in this chapter provide information on the experimental performance of the AUIRS20162S 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 ºC, 25 ºC, and 125 ºC) 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).

Input and Reset Thresholds:

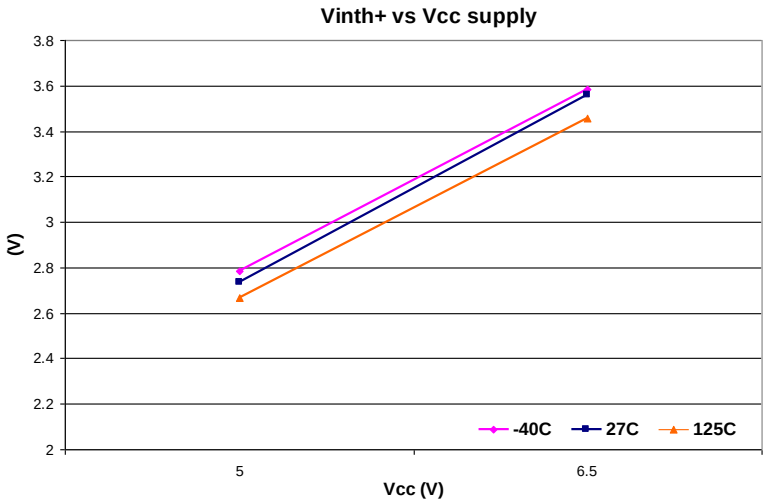


Figure 7-1: Positive Input and Reset Threshold Voltage Distribution Curves

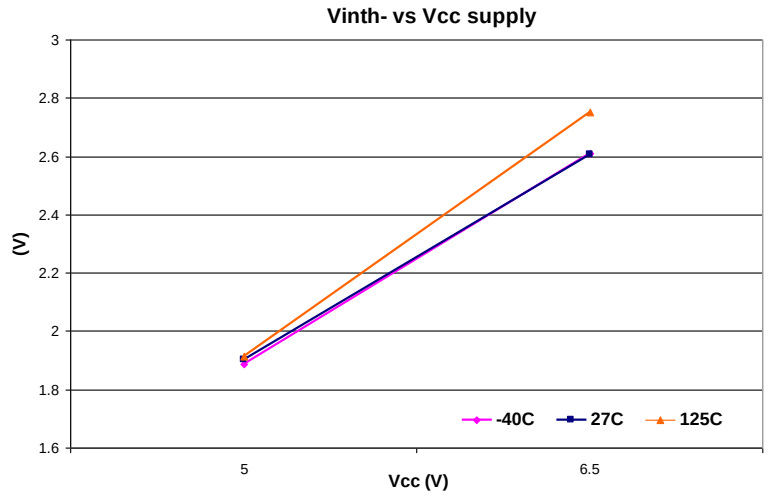


Figure 7-2: Negative Input and Reset Threshold Voltage Distribution Curves

 © 2014 International Rectifier

V_{BUV} Undervoltage Shutdown Threshold V_B:

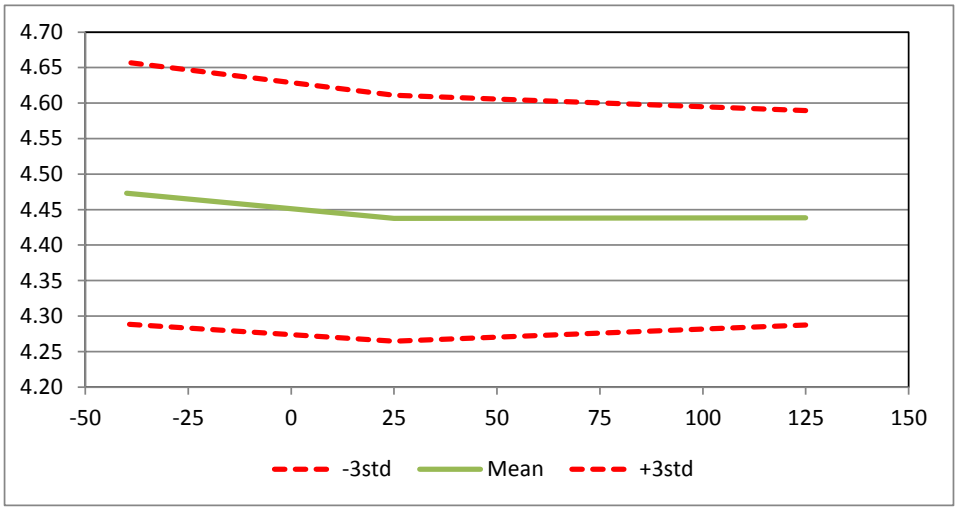


Figure 8-1: Negative going VBSUV- value vs. Temperature:

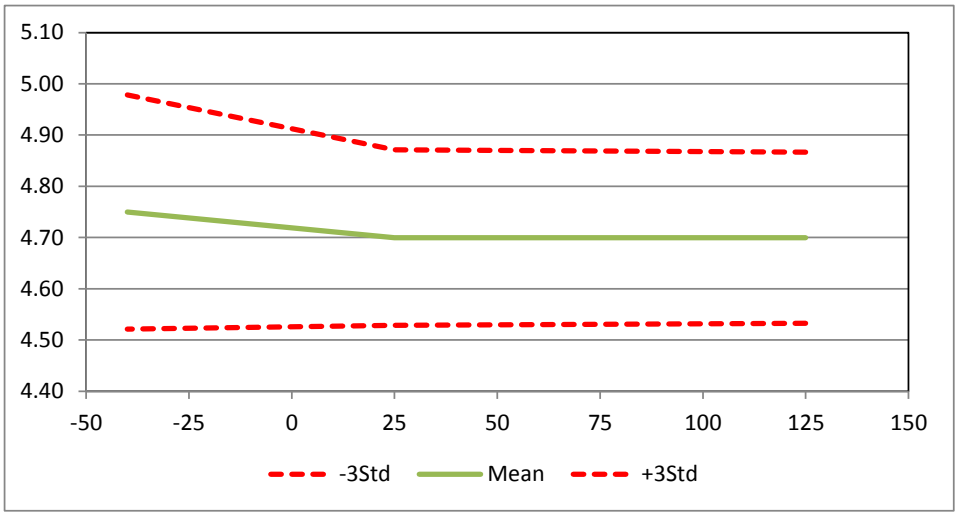


Figure 8-2: Positive going VBSUV+ Value vs. Temperature

 © 2014 International Rectifier

Input and Reset Impedance

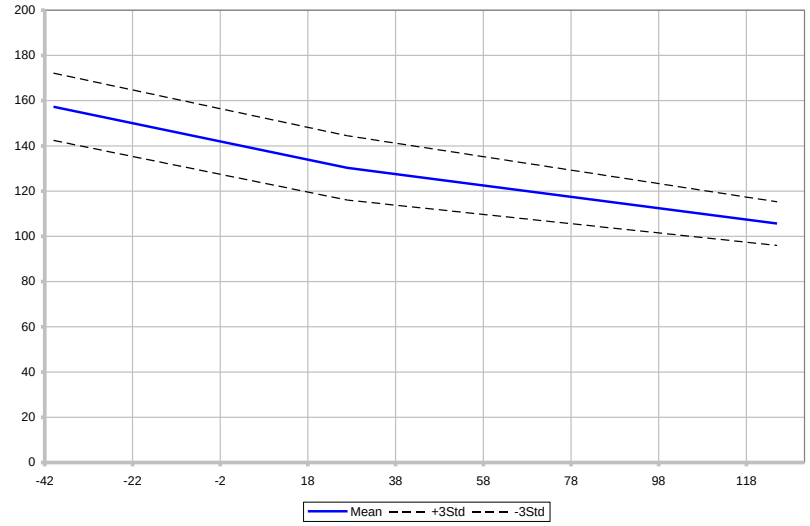


Figure 9: Input and Reset Impedance Distribution Curves vs. Temperature

Recharge FET I-V Curve

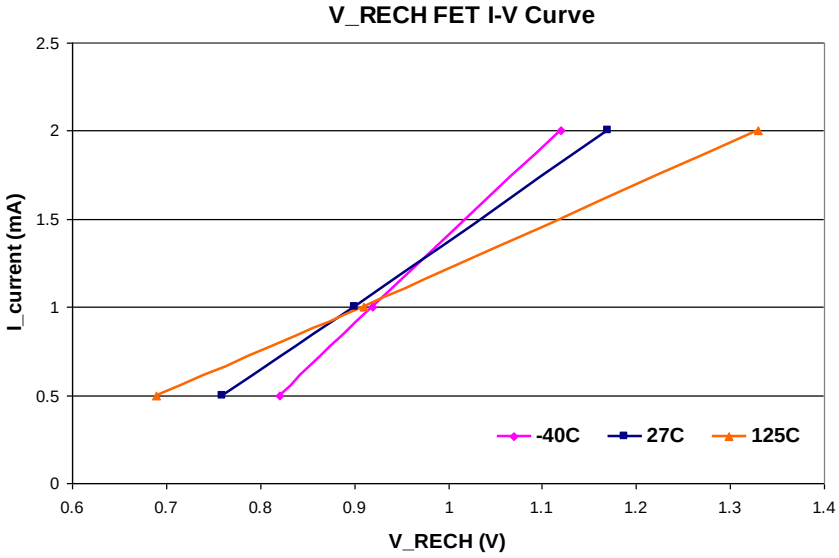
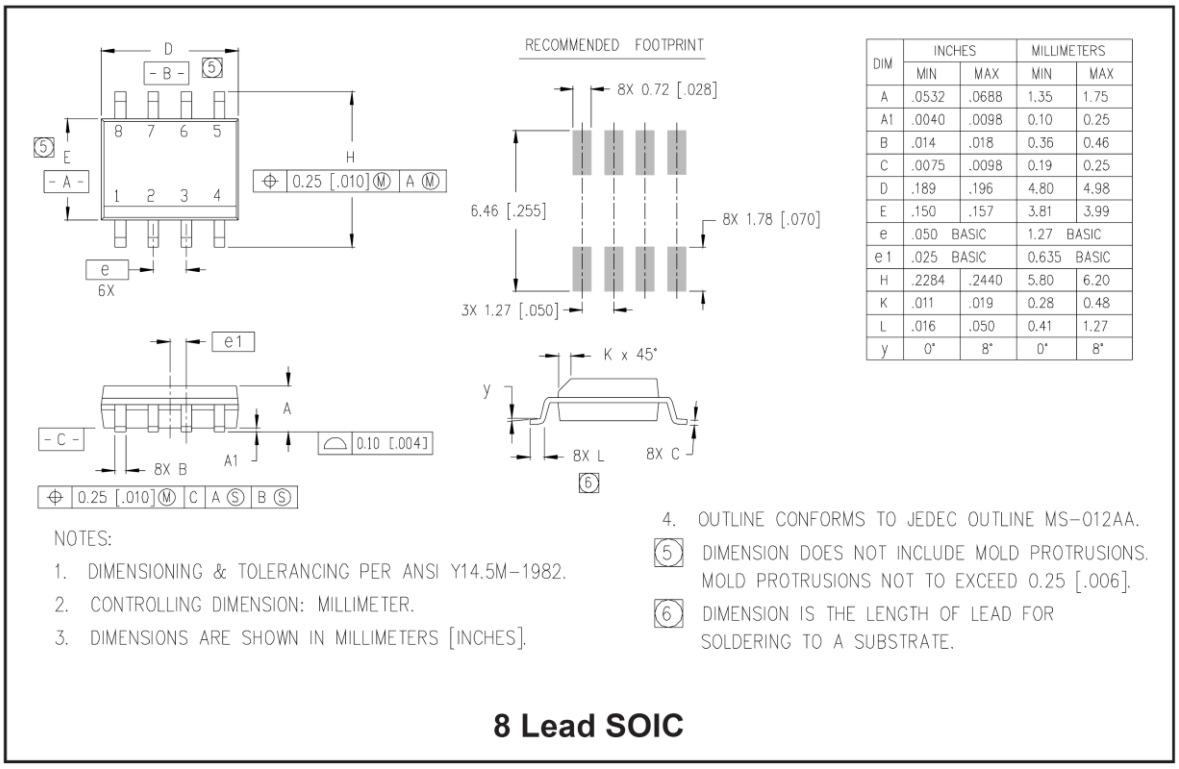


Figure 10: Recharge FET IV-Curve

 © 2014 International Rectifier

Package Details: SOIC8



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
B	.014	.018	0.36	0.46
C	.0075	.0098	0.19	0.25
D	.189	.196	4.80	4.98
E	.150	.157	3.81	3.99
e	.050 BASIC		1.27 BASIC	
e1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.011	.019	0.28	0.48
L	.016	.050	0.41	1.27
y	0°	8°	0°	8°

NOTES:

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M–1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS–012AA.

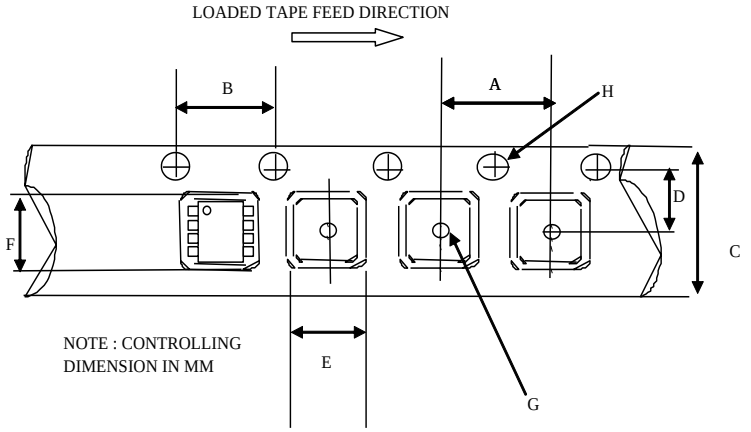
(5) DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 [.006].

(6) DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

8 Lead SOIC

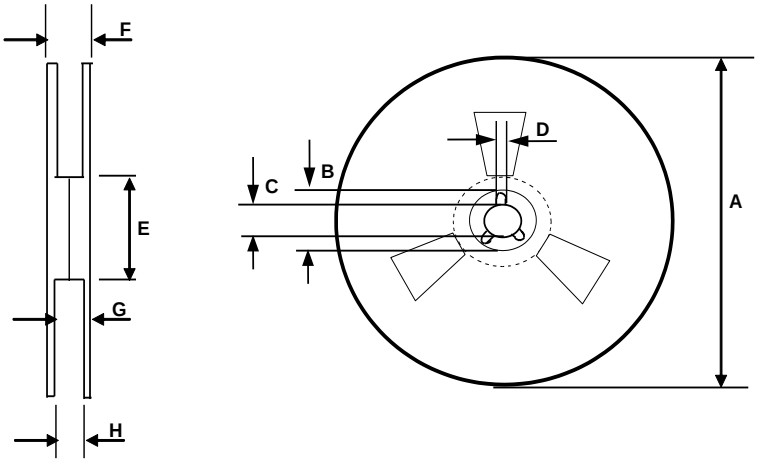
 © 2014 International Rectifier

Tape and Reel Details: SOIC8



CARRIER TAPE DIMENSION FOR 8SOICN

	Metric		Imperial	
Code	Min	Max	Min	Max
A	7.90	8.10	0.311	0.318
B	3.90	4.10	0.153	0.161
C	11.70	12.30	0.46	0.484
D	5.45	5.55	0.214	0.218
E	6.30	6.50	0.248	0.255
F	5.10	5.30	0.200	0.208
G	1.50	n/a	0.059	n/a
H	1.50	1.60	0.059	0.062

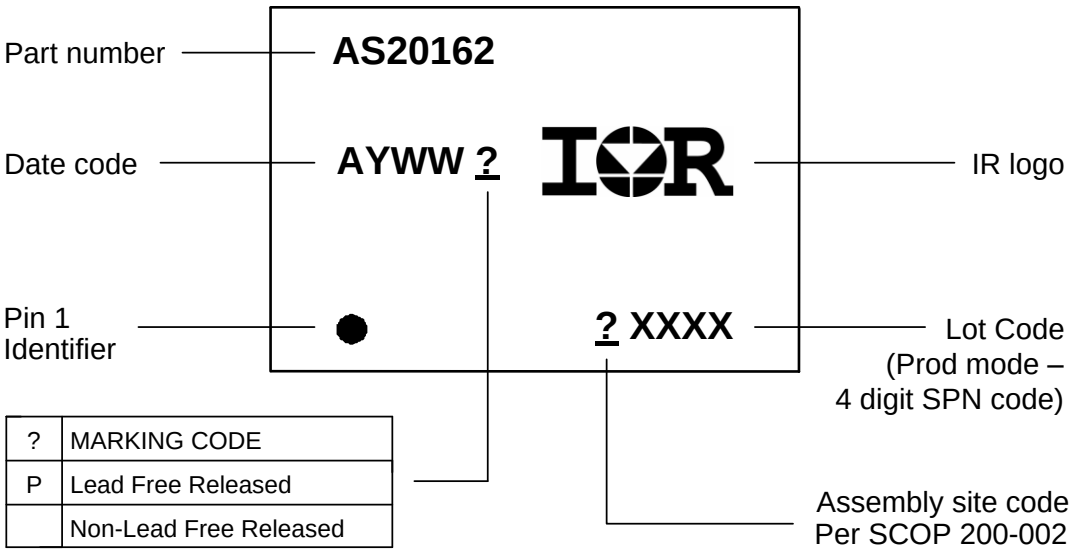


REEL DIMENSIONS FOR 8SOICN

	Metric		Imperial	
Code	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	18.40	n/a	0.724
G	14.50	17.10	0.570	0.673
H	12.40	14.40	0.488	0.566

 © 2014 International Rectifier

Part Marking Information



?	MARKING CODE
P	Lead Free Released
	Non-Lead Free Released

 © 2014 International Rectifier

Qualification Information[(Note1)]

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		SOIC8N	MSL3 260°C (Note2) (per IPC/JEDEC J-STD-020)
ESD	Machine Model	Class M1 (Pass +/-200 V) (per AEC-Q100-003)	
	Human Body Model	Class H1C (+/-2000V) (per AEC-Q100-002)	
	Charged Device Model	Class C4 (Pass +/-1000V) (per AEC-Q100-011)	
IC Latch-Up Test		Class II, Level A (per AEC-Q100-004)	
RoHS Compliant		Yes	

Note 1 Qualification standards can be found at International Rectifier's web site http://www.irf.com/

Note 2 Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information.

 © 2014 International Rectifier

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:
101 N. Sepulveda Blvd., El Segundo, California 90245
Tel: (310) 252-7105

 © 2014 International Rectifier