International
IOR Rectifier

July 13, 2009

Automotive Grade AUIR2085S

HIGH SPEED, 100V, SELF OSCILLATING 50% DUTY CYCLE, HALF-BRIDGE DRIVER

Features

- Simple primary side control solution to enable half-bridge DC-Bus Converters for 48V distributed systems with reduced component count and board space
- Integrated 50% duty cycle oscillator & half-bridge driver IC in a single SO-8 package
- Programmable switching frequency with up to 500kHz max per channel
- +/- 1A drive current capability optimized for low charge MOSFETs
- Adjustable dead-time 50ns – 200ns
- Floating channel designed for bootstrap operation up to +100Vdc
- High and low side pulse width matching to +/- 25ns
- Adjustable overcurrent protection
- Undervoltage lockout and internal soft start
- Leadfree, RoHS compliant
- Automotive qualified*

Typical Applications

- DC-DC Converters
- HEV Auxiliary Converter
- Battery Management Converters

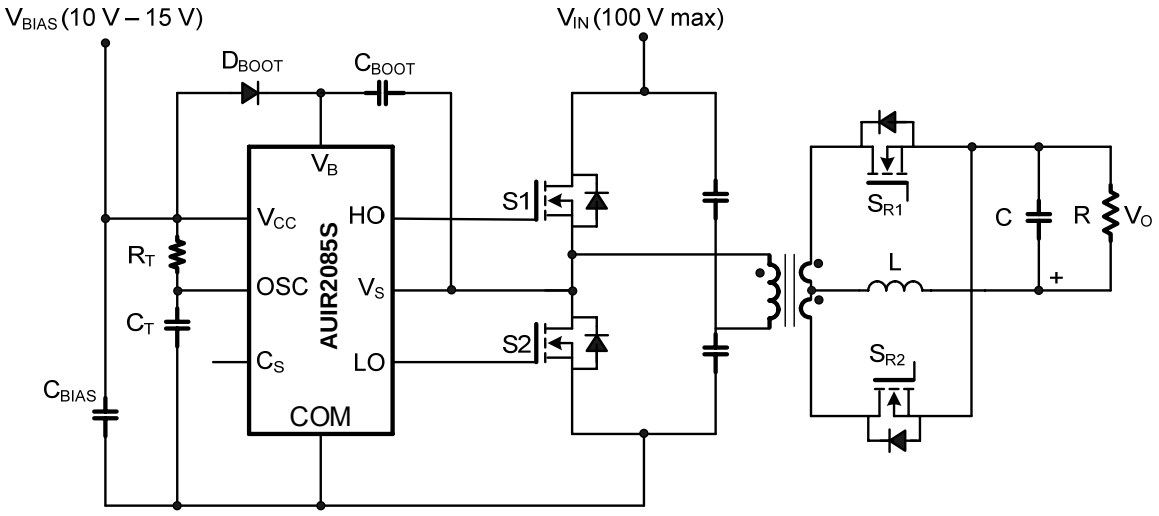
Product Summary

Topology	Half-Bridge
V_{OFFSET}	≤ 100 V
I_{o+} & I_{o-} (typical)	1.0A & 1.0A
f_{OSC} (max)	500kHz
Deadtime	50ns – 200ns
HO/LO Pulse Matching	+/- 25ns

Package Options

8 - Lead SOIC
AUIR2085S

Typical Connection Diagram



* Qualification standards can be found on IR's web site www.irf.com

Description

The AUIR2085S is a self oscillating half-bridge driver IC with 50% duty cycle ideally suited for 36V – 75V half-bridge DC-bus converters.

This product is also suitable for push-pull converters without restriction on input voltage.

Each channel frequency is equal to $f_{OSC,}$ which can be set by selecting R_T & $C_{T,}$ where $f_{OSC} = 1/(2*R_T.C_T)$.

Dead-time can be controlled through proper selection of C_T and can range from 50ns to 200ns.

Internal soft-start increases the pulse width during power up and maintains pulse width matching for the high and low outputs throughout the start up cycle.

Typically soft-start duty cycle varies beginning from 5-10% ramping up to about 50% over 1000 cycles.

The AUIR2085S initiates a soft start at power up and after every overcurrent condition. Undervoltage lockout prevents operation if V_{CC} is less than 7.5V.

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		SOIC8N	MSL3††† 260°C (per IPC/JEDEC J-STD-020)
ESD	Machine Model	Class M3 (per AEC-Q100-003)	
	Human Body Model	Class H2 (per AEC-Q100-002)	
	Charged Device Model	Class C5 (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.

Absolute Maximum Ratings

Absolute Maximum Ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to COM. 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	150	V
V_{CC}	Low side supply voltage	—	25	
V_S	High side floating supply offset voltage	V_B - 25	V_B + 0.3	
V_{HO}	High side floating output voltage	V_B - 0.3	V_B + 0.3	
V_{LO}	Low side output voltage	-0.3	V_{CC} + 0.3	
OSC	OSC pin voltage	-0.3	V_{CC} + 0.3	
V_{CS}	C_S pin voltage	-0.3	V_{CC} + 0.3	
dVs/dt	Allowable offset voltage slew rate	—	50	V/ns
I_{CC}	Supply current	—	20	mA
P_D	Package power dissipation @ TA ≤ 25°C	—	0.625	W
Rth_{JA}	Thermal resistance, junction to ambient	—	200	°C/W
T_J	Junction temperature	—	150	°C
T_S	Storage temperature	-55	150	
T_L	Lead temperature (soldering, 10 seconds)	—	300	

Recommended Operating Conditions

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

Symbol	Definition	Min.	Max.	Units
V_B	High side floating supply voltage	V_S + 10	V_S + 15	V
V_S	Steady state high side floating supply offset voltage	-5 (†)	100	
V_{CC}	Supply voltage	10	15	
I_{CC}	Supply current	—	5	mA
R_T	Timing resistor	10	100	kΩ
C_T	Timing capacitor	47	470	pF
f_{osc}	Operating frequency (per channel)	—	500	kHz
T_A	Ambient temperature	-40	125	°C

† Care should be taken to avoid output switching conditions where the V_S node flies inductively below ground by more than 5V.

Dynamic Electrical Characteristics

V_{CC} = V_{BS} = 12V, C_{LOAD} = 1000pF, and T_A = 25°C unless otherwise specified.

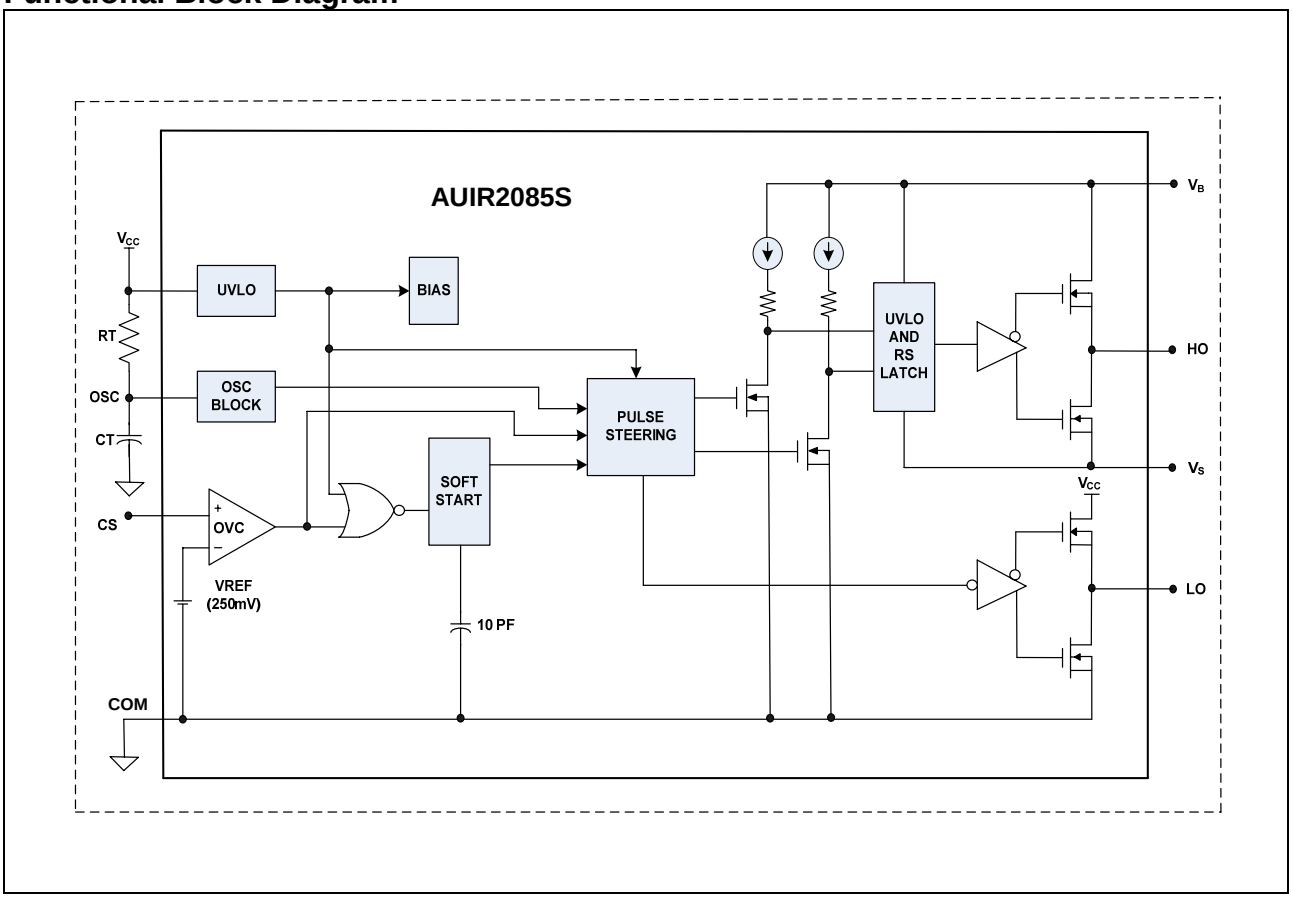
Symbol	Definition	Min	Typ	Max	Units	Test Conditions
t_r	Turn-on rise time	—	40	60	ns	V_S = 0V
t_f	Turn-off fall time	—	20	30		
f_{OSC}	Per channel output frequency	500	—	—	kHz	C_T = 100pF, R_T = 10kΩ
t_{DT}	HO/LO output dead time	50	—	—	ns	
t_{DCS}	Overcurrent shut down delay	—	200	—		Pulse on C_S
PM	HO/LO pulse width mismatch	-25	—	25		V_S = 0V ~ 100V

Static Electrical Characteristics

V_{CC} = V_{BS} = 12V, C_{LOAD} = 1000pF, and T_A = 25°C unless otherwise specified.

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
V_{OH}	High level output voltage, V_{CC} or V_{BS} – V_O	—	—	1.5	V	
V_{OL}	Low level output voltage	—	—	0.1		
I_{leak}	Offset supply leakage current	—	—	50	µA	
I_{QBS}	Quiescent V_{BS} supply current	—	—	150		
I_{QCC}	Quiescent V_{CC} supply current	—	—	1.5	mA	
V_{CS+}	Overcurrent shutdown threshold	250	300	350	mV	
V_{CS-}	Overcurrent shutdown threshold	150	200	250	mV	
V_{CCUV+}	Undervoltage positive going threshold	6.8	7.3	7.8	V	
V_{CCUV-}	Undervoltage negative going threshold	6.3	6.8	7.3		
V_{BSUV+}	High side undervoltage positive going threshold	6.8	7.3	7.8		
V_{BSUV-}	High side undervoltage negative going threshold	6.3	6.8	7.3		
I_{O+}	Output high short circuit current	—	1.0	—	A	
I_{O-}	Output low short circuit current	—	1.0	—		

Functional Block Diagram



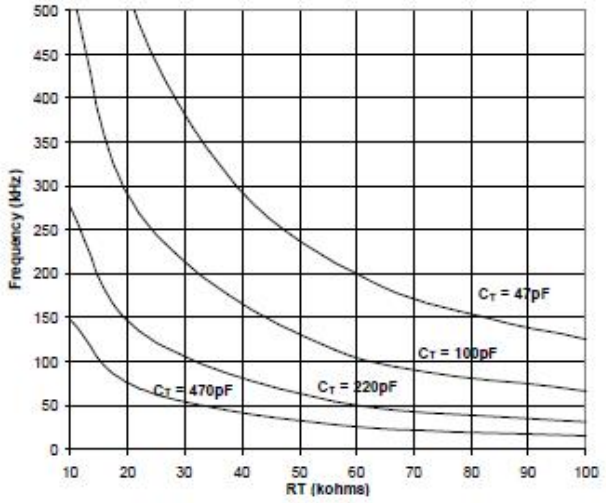


Fig. 1 Typical Output Frequency (-25°C to 125°C)

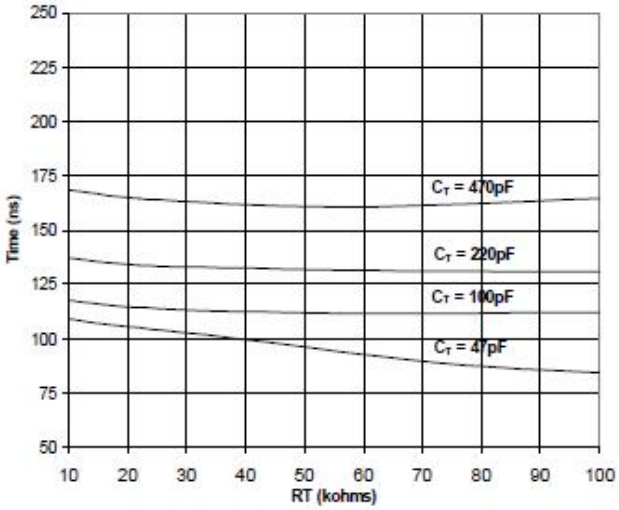


Fig. 2 Typical Dead Time (@25°C)

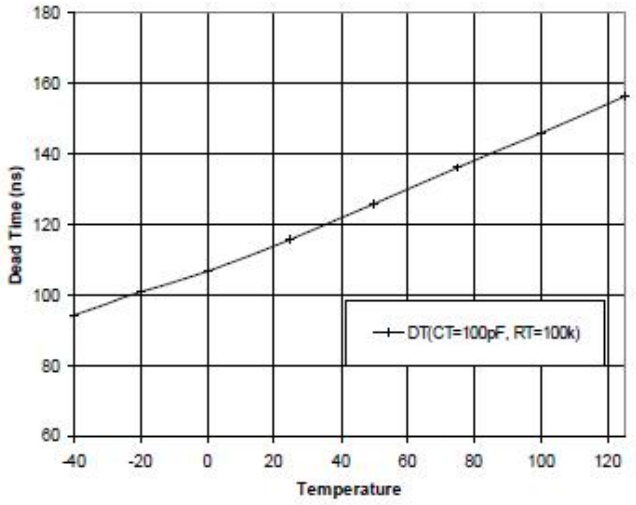
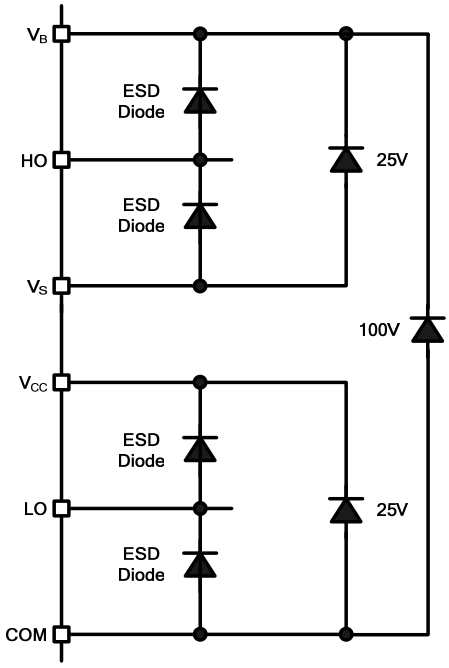
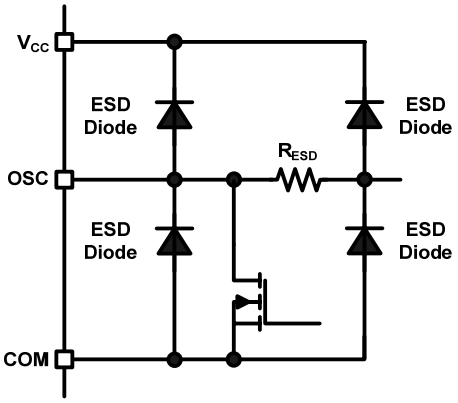
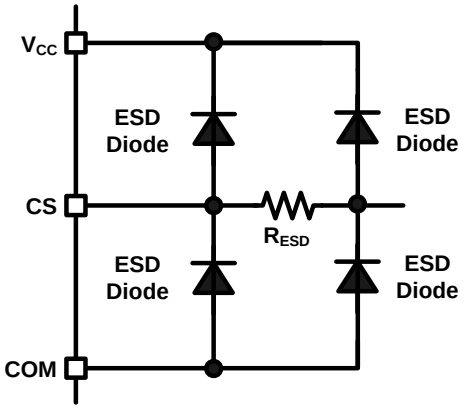


Fig. 3 Typical Dead Time vs Temperature

Input/Output Pin Equivalent Circuit Diagrams



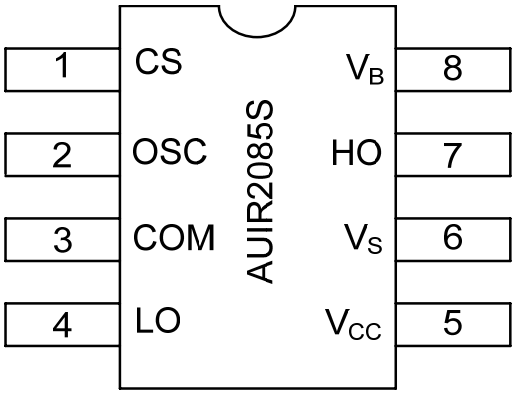




Lead Definitions

PIN	Symbol	Description
1	CS	Current sense input
2	OSC	Oscillator pin
3	COM	Logic supply return
4	LO	Low side output
5	V_{CC}	Logic supply
6	V_S	Floating supply return
7	HO	High side output
8	V_B	High side floating supply

Lead Assignments



Pin Descriptions

Cs: The input pin to the overcurrent comparator. Exceeding the overcurrent threshold value specified in "Static Electrical Parameters" Section will terminate output pulses and start a new soft start cycle as soon as the voltage on the pin reduce below the threshold value.

OSC: The oscillator-programming pin. Only two components are required to program the internal oscillator frequency: a resistor connected between the V_{CC} pin and the OSC pin, and a capacitor connected from the OSC to COM. The approximate oscillator frequency is determined by the following simple formula:

$$f_{OSC} = 1 / (2 \cdot R_T \cdot C_T)$$

Where frequency is in Hertz (Hz), RT resistance in Ohms (Ω) and CT capacitance in Farads (F). The recommended range of timing resistors is between 10kΩ and 100kΩ and range of time capacitances is between 47pF and 470pF. The timing resistors less than 10kΩ should be avoided. The value of the timing capacitor determines the amount of dead time between the two output drivers: lower the CT, shorter the dead time and vice versa. It is not recommended to use a timing capacitor below 47pF, for best performance keep the timing components physically as close as possible to the AUIR2085S. Separated ground and V_{CC} traces to the timing components are encouraged.

COM: Signal ground and power ground for all functions. Due to high current and high frequency operation, a low impedance circuit board ground plane is highly recommended.

HO, LO: High side and low side gate drive pins. The high and low side drivers can directly drive the gate of a power MOSFET. The drivers are capable of 1A peak source and sink currents. It is recommended that the high and low drive pins be very close to the gates of the high side and low side MOSFETs to prevent any delay and distortion of the drive signals.

V_B: The high side power input connection. The high side supply is derived from a bootstrap circuit using a low-leakage Schottky diode and a ceramic capacitor. To prevent noise, the Schottky diode and bypass capacitor should be very close to the AUIR2085S.

V_S: The high side power return connection. V_S should be connected directly to the source terminal of high side MOSFET with a trace as short as possible.

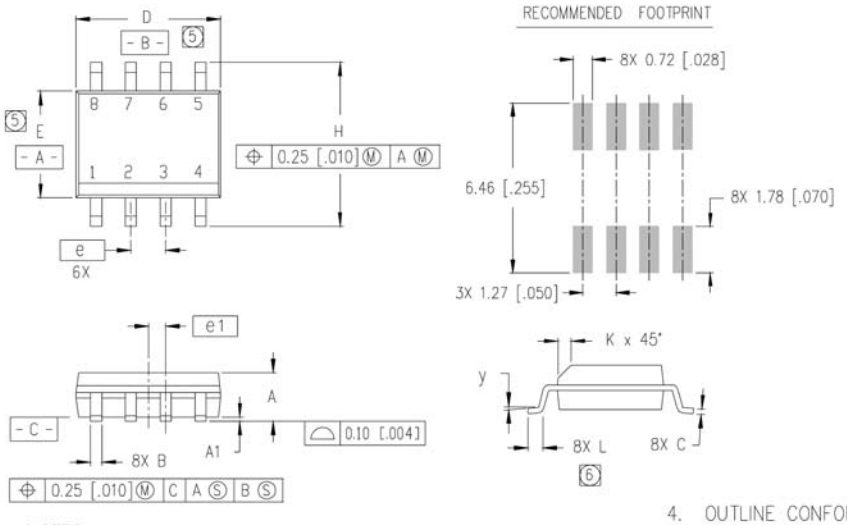
V_{CC}: The IC bias input connection for the device. Although the quiescent V_{CC} current is very low, total supply current will be higher, depending on the gate charge of the MOSFETs connected to the HO and LO pins, and the programmed oscillator frequency, total V_{CC} current is the sum of quiescent V_{CC} current and the average current at HO and LO. Knowing the operating frequency and the MOSFET gate charge (Qg) at selected V_{CC} voltage, the average current can be calculated from:

$$Iave = 2 \times Qg \times f_{OSC}$$

To prevent noise problem, a bypass ceramic capacitor connected to V_{CC} and COM should be placed as close as possible to the AUIR2085S.

AUIR2085S has an under voltage lookout feature for the IC bias supply, V_{CC}. The minimum voltage required on V_{CC} to make sure that IC will work within specifications must be higher than 8.5V (10V minimum V_{CC} is recommended to prevent asymmetrical gates signal on HO and LO pins that are expected when V_{CC} is between 7.5V and 8.5V).

Package Details:



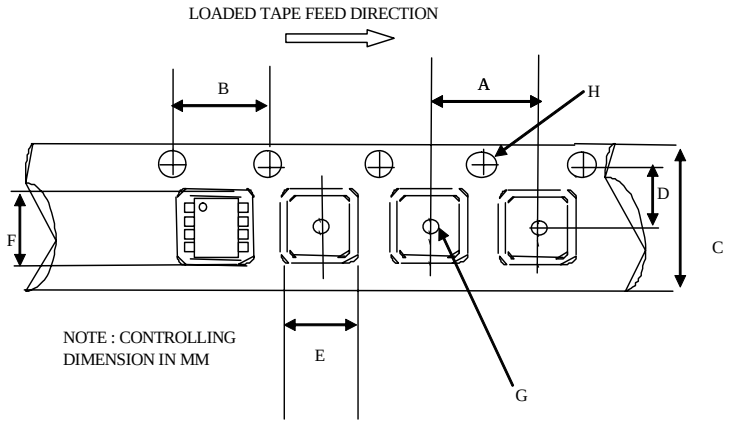
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
B	.014	.018	0.36	0.46
C	.0075	.0098	0.19	0.25
D	.189	.196	4.80	4.98
E	.150	.157	3.81	3.99
e	.050 BASIC		1.27 BASIC	
e1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.011	.019	0.28	0.48
L	.016	.050	0.41	1.27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

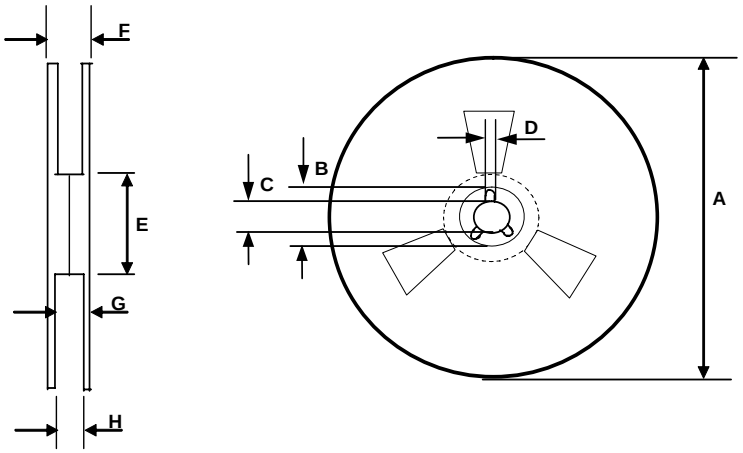
8 Lead SOIC

Tape and Reel Details:



CARRIER TAPE DIMENSION FOR 8SOICN

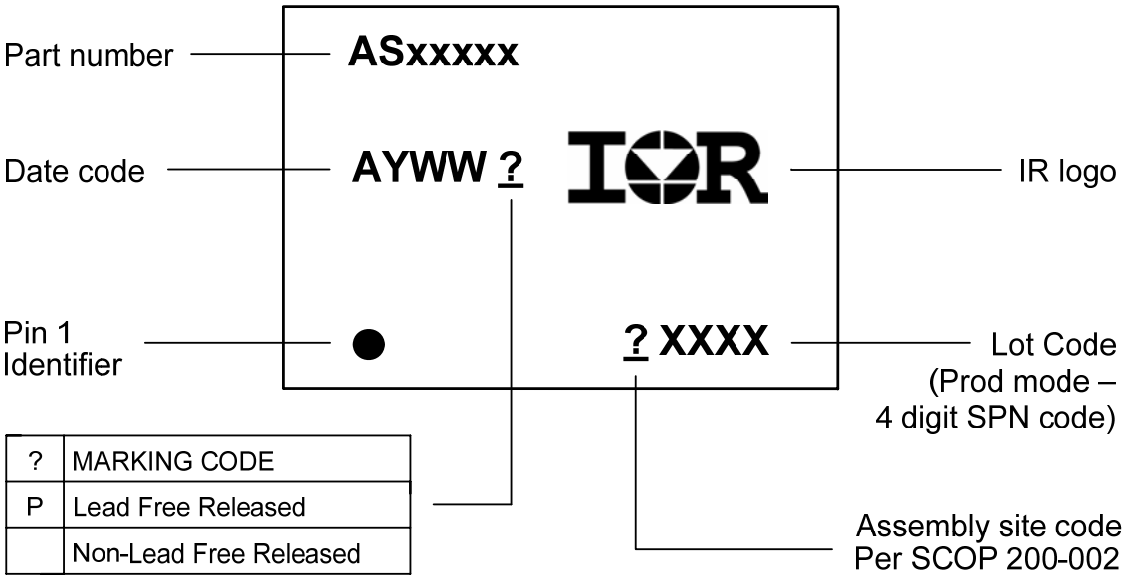
	Metric		Imperial	
Code	Min	Max	Min	Max
A	7.90	8.10	0.311	0.318
B	3.90	4.10	0.153	0.161
C	11.70	12.30	0.46	0.484
D	5.45	5.55	0.214	0.218
E	6.30	6.50	0.248	0.255
F	5.10	5.30	0.200	0.208
G	1.50	n/a	0.059	n/a
H	1.50	1.60	0.059	0.062



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

Part Marking Information



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

Ordering Information

Base Part Number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIR2085S	SOIC8	Tube/Bulk	95	AUIR2085S
		Tape and Reel	2500	AUIR2085STR

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

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Revision History