

### Features

- Floating channel designed for bootstrap operation
- Fully operational to +600 V
- Tolerant to negative transient voltage – dV/dt immune
- Gate drive supply range from 10 V to 20 V
- Undervoltage lockout
- CMOS Schmitt-triggered inputs with pull-down
- Output in phase with input (IRS2123) or out of Phase with input (IRS2124)
- Leadfree, RoHS compliant

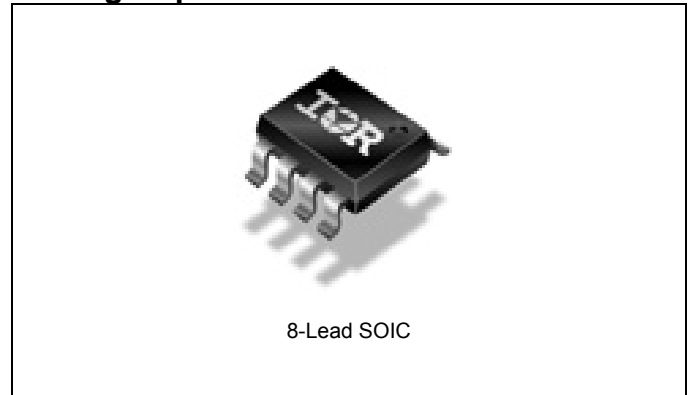
### Typical Applications

- General purpose single highside inverters

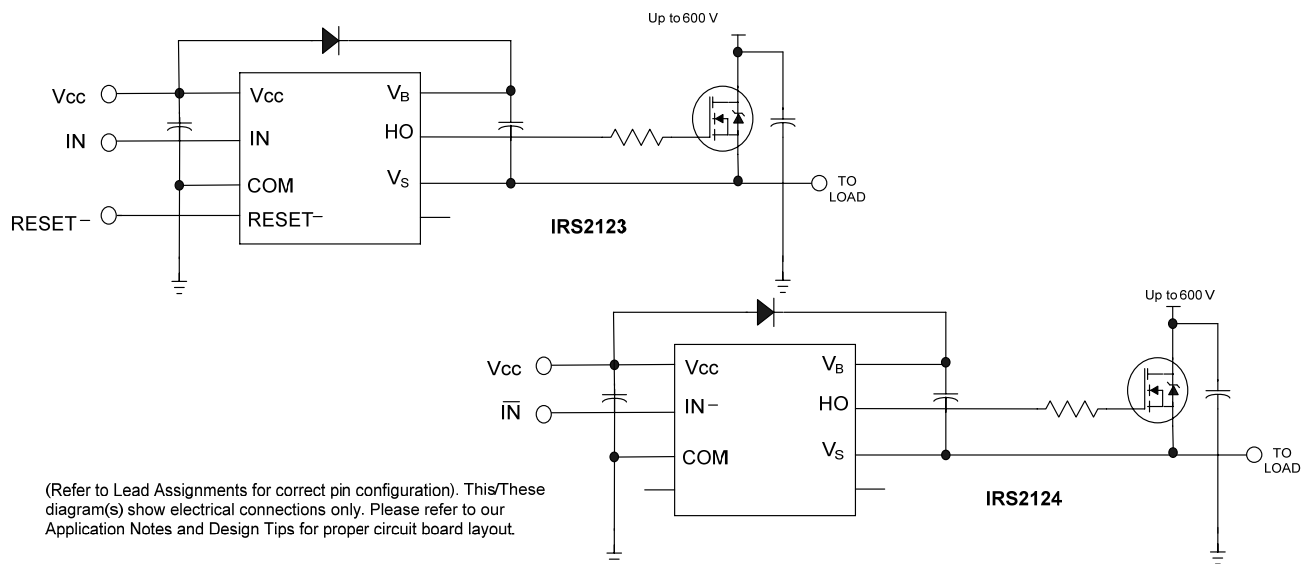
### Product Summary

Topology	Single highside
$V_{\text{OFFSET}}$	$\leq 600 \text{ V}$
$V_{\text{OUT}}$	10 V – 20 V
$I_{\text{O+}} \& I_{\text{O-}}$ (typical)	500 mA
$t_{\text{ON}} \& t_{\text{OFF}}$ (typical)	140 ns & 140 ns

### Package Options



### Typical Connection Diagram



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## **Description**

The IRS2123S/IRS2124S are high voltage, high speed power MOSFET and IGBT drivers. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The logic input is compatible with standard CMOS outputs. The output drivers feature a high pulse current buffer stage designed for minimum cross-conduction. The floating channel can be used to drive an N-channel power MOSFET or IGBT in the high- side configuration which operates up to 600 V.

**Qualification Information<sup>†</sup>**

<b>Qualification Level</b>		Industrial <sup>††</sup>
		Comments: This family of ICs has passed JEDEC's Industrial qualification. IR's Consumer qualification level is granted by extension of the higher Industrial level.
<b>Moisture Sensitivity Level</b>		MSL3 <sup>†††</sup> 260°C (per IPC/JEDEC J-STD-020)
<b>ESD</b>	Machine Model	Class B (per JEDEC standard JESD22-A115)
	Human Body Model	Class 2 (per EIA/JEDEC standard EIA/JESD22-A114)
<b>IC Latch-Up Test</b>		Class I, Level A (per JESD78)
<b>RoHS Compliant</b>		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 GND, all currents are defined positive into any lead. This is a stress only rating and operation of the device at these or any conditions exceeding those indicated in the operational sections of this specification is not implied

Symbol	Definition	Min.	Max.	Units
$V_{BS}$	High Side Floating Supply Voltage	-0.3	25	V
$V_B$	High Side Driver Output Stage Voltage	-0.3	625	V
$V_S$	High Side Floating Supply Offset Voltage	$V_B - 25$	$V_B + 0.3$	V
$V_{Ho}$	Output Voltage Gate Connection	$V_S - 0.3$	$V_B + 0.3$	V
$V_{CC}$	Supply Voltage	-0.3	25	V
$V_{IN}$	Input Voltage	-0.3	$V_{CC} + 0.3$	V
$V_{RES}$	Reset Input Voltage	-0.3	$V_{CC} + 0.3$	V
dV/dt	Allowable Offset Voltage Slew Rate	-50	50	V/nsec
$T_J$	Junction Temperature	-55	150	°C
$T_S$	Storage Temperature	-55	150	

### 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 -10V Transient 0.4 us	$V_S + 10$	$V_S + 20$	V
$V_S$	High Side Floating Supply Offset Voltage -25V Transient 0.4 $\mu$ s	†	600	V
$V_{Ho}$	Output Voltage Gate Connection	$V_S$	$V_B$	V
$V_{CC}$	Supply Voltage	10	20	V
$V_{IN}$	Input Voltage	0	$V_{CC}$	V
$V_{RES}$	Reset Input Voltage	0	$V_{CC}$	V
$T_A$	Ambient Temperature ( $f_s < 60\text{kHz}$ , $V_{BS} = 14\text{V}$ , $C_{load} = 2.5\text{nF}$ , $R = 50\text{Ohm}$ )	-40	125	°C

† Logic operational for  $V_S$  of -5 to +600 V. Logic state held for  $V_S$  of -5 V to  $-V_{BS}$ .  
 (Please refer to the Design Tip DT97-3 for more details).

**Static Electrical Characteristics**

$V_{BIAS}$  ( $V_{CC}$ ,  $V_{BS}$ ) = 15 V and  $T_A$  = 25°C unless otherwise specified. The  $V_{IL}$ ,  $V_{IH}$  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 and LO.

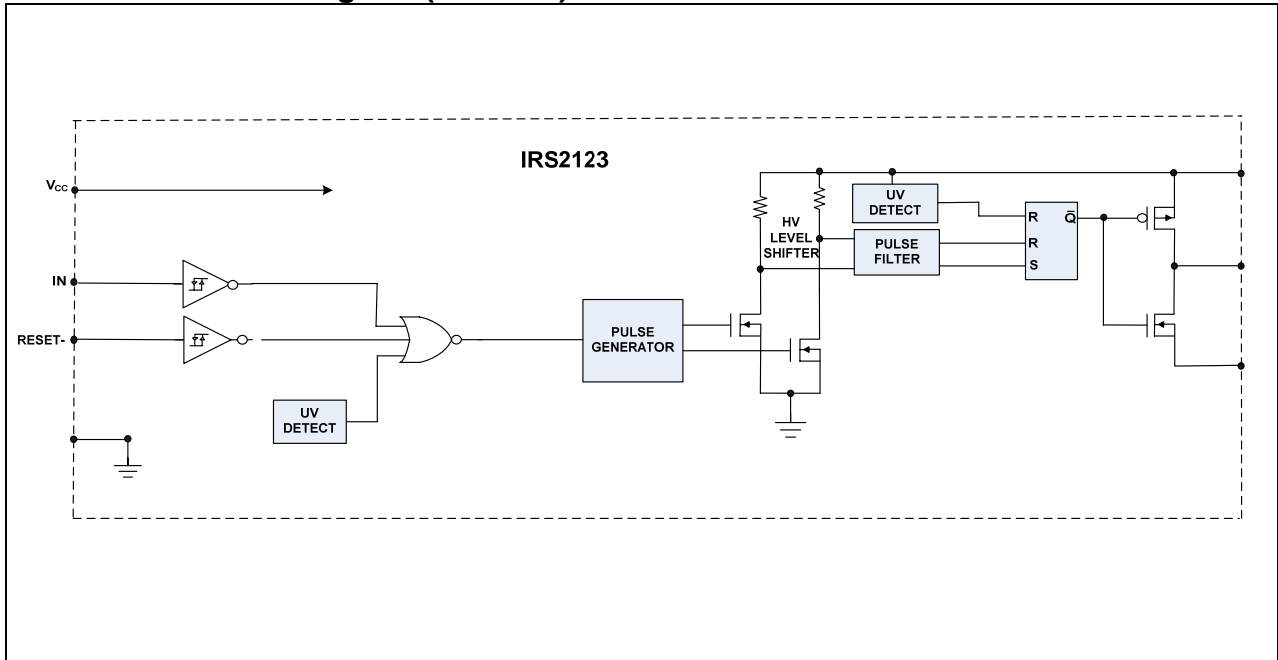
Symbol	Definition	Min	Typ	Max	Units	Test Conditions		
$V_{IH}$	Logic "1" input voltage	0.70	—	—	V			
	Logic "0" input voltage	* $V_{CC}$	—	—				
$V_{IL}$	Logic "0" input voltage	—	—	0.35				
	Logic "1" input voltage	—	—	* $V_{CC}$				
$V_{OH}$	High level output voltage, $V_{BIAS} - V_O$	—	—	2				$I_O = 10$ mA
$V_{OL}$	Low level output voltage, $V_O$	—	0.1	0.2				
$I_{LK}$	Offset supply leakage current	—	—	50	$\mu$ A	$V_B = V_S = 600$ V		
$I_{QBS}$	Quiescent $V_{BS}$ supply current	—	—	240		$V_{IN} = 0$ V or $V_{CC}$		
$I_{QCC}$	Quiescent $V_{CC}$ supply current	—	—	500		$V_{IN} = V_{CC}$		
$I_{IN+}$	Logic "1" input bias current	IRS2123	—	—		5.0	$V_{IN} = 0$ V	
		IRS2124	—	—			$V_{IN} = V_{CC}$	
$I_{IN-}$	Logic "0" input bias current	IRS2123	—	—		5.0	$V_{IN} = 0$ V	
		IRS2124	—	—	$V_{IN} = V_{CC}$			
$V_{BSUV+}$	$V_{BS}$ supply undervoltage positive going threshold	7.2	8.6	9.6	V			
$V_{BSUV-}$	$V_{BS}$ supply undervoltage negative going threshold	6.6	8.0	9.0				
$V_{CCUV+}$	$V_{CC}$ supply undervoltage positive going threshold	7.2	8.6	9.6				
$V_{CCUV-}$	$V_{CC}$ supply undervoltage negative going threshold	6.6	8.0	9.0				
$I_{O+}$	Output high short circuit pulsed current	250	500	—	mA	$V_O = 0$ V, $V_{IN} = \text{Logic "1"}$ $PW \leq 10$ $\mu$ s		
$I_{O-}$	Output low short circuit pulsed current	250	500	—		$V_O = 15$ V, $V_{IN} = \text{Logic "0"}$ $PW \leq 10$ $\mu$ s		

**Dynamic Electrical Characteristics**

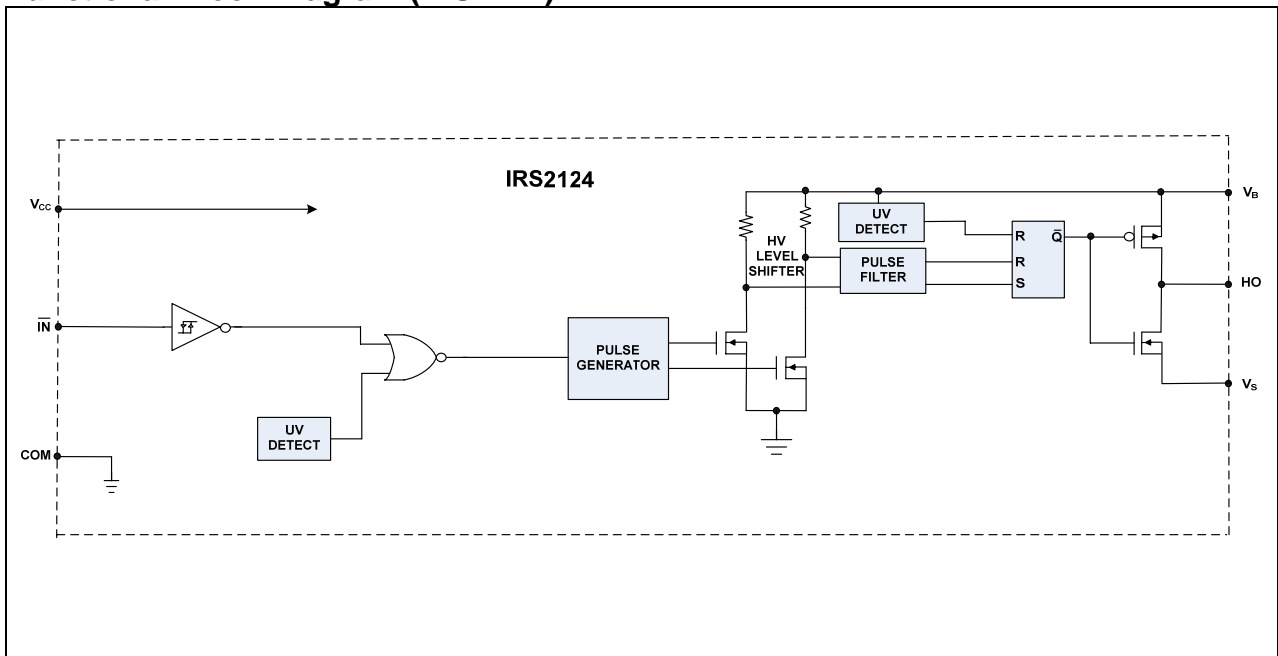
$V_{BIAS}$  ( $V_{CC}$ ,  $V_{BS}$ ) = 15 V,  $C_L$  = 1000 pF,  $T_A$  = 25°C unless otherwise specified. The dynamic electrical characteristics are measured using the test circuit shown in Fig. 3.

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
$t_{on}$	Turn-on propagation delay	—	140	240	ns	$V_S = 0$ V
$t_{off}$	Turn-off propagation delay	—	140	240		$V_S = 600$ V
$t_r$	Turn-on rise time	—	80	200		
$t_f$	Turn-off fall time	—	80	200		
$t_{RES}$	RESET to output turn off propagation delay (IRS2123 only)	—	170	300		

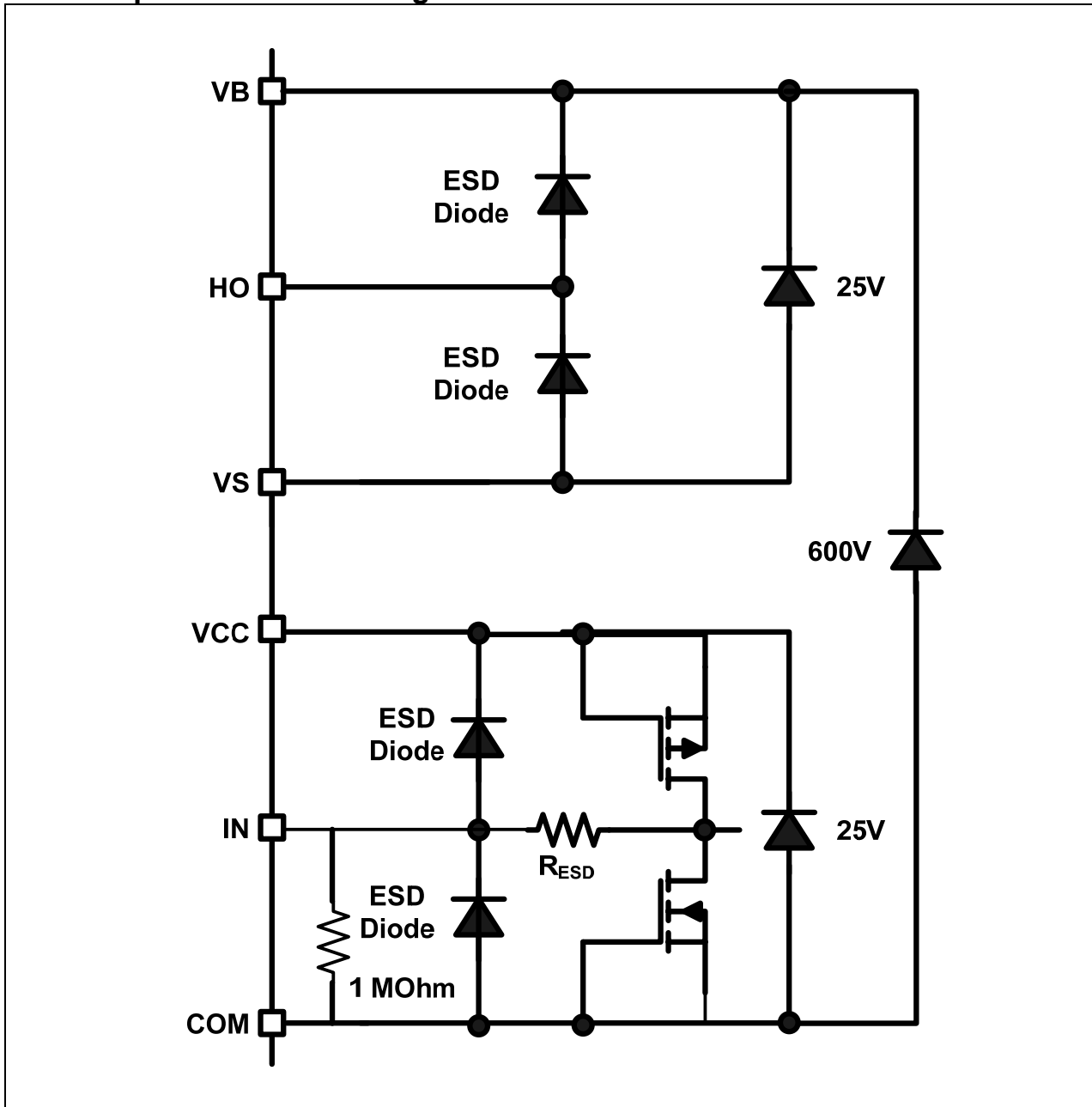
## Functional Block Diagram (IRS2123)



## Functional Block Diagram (IRS2124)



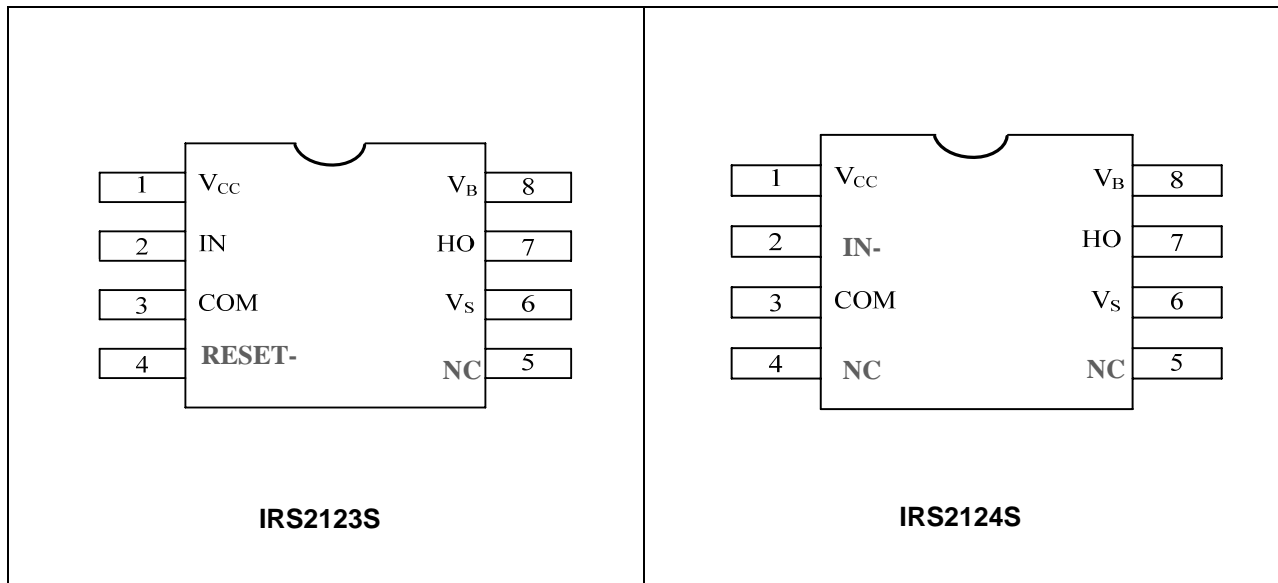
**I/O Pin Equivalent Circuit Diagram**





## Lead Definitions

Pin	Symbol	Pin description
1	V <sub>CC</sub>	Low side and logic fixed supply
2	IN IN-	Logic input for gate driver output (HO), in phase with HO (IRS2123) Logic input for gate driver output (HO), out of phase with HO (IRS2124)
3	COM	Logic Ground
4	RESET- NC	Driver Enable Signal Input (negative logic) (IRS2123) No connection (IRS2124)
5	NC	No connection
6	V <sub>S</sub>	High-side floating supply return
7	H <sub>O</sub>	High-side gate drive output
8	V <sub>B</sub>	High-side floating supply



**Application Information and Additional Details**

IRS2123 logic table for V<sub>CC</sub>, V<sub>BS</sub>, RESET, IN, and H<sub>O</sub>

V <sub>CC</sub>	V <sub>BS</sub>	RESET-	IN	H <sub>O</sub>
X	X	X	LOW	OFF
X	X	LOW	X	OFF
<V <sub>CC</sub> UVLO-	X	X	X	OFF
X	<V <sub>BS</sub> UVLO-	X	X	OFF
>V <sub>CC</sub> UVLO+	>V <sub>BS</sub> UVLO+	HIGH	HIGH	ON

RESET = HIGH indicates that high side NMOS is allowed to be turned on.

RESET = LOW indicates that high side NMOS is OFF.

IN = HIGH indicates that high side NMOS is on.

IN = LOW indicates that high side NMOS is off.

X = independent

IRS2124 logic table for V<sub>CC</sub>, V<sub>BS</sub>, RESET, IN, and H<sub>O</sub>

V <sub>CC</sub>	V <sub>BS</sub>	IN-	H <sub>O</sub>
X	X	HIGH	OFF
<V <sub>CC</sub> UVLO-	X	X	OFF
X	<V <sub>BS</sub> UVLO-	X	OFF
>V <sub>CC</sub> UVLO+	>V <sub>BS</sub> UVLO+	LOW	ON

IN- = HIGH indicates that high side NMOS is on.

IN- = LOW indicates that high side NMOS is off.

X = independent

## Parameter Temperature Trends

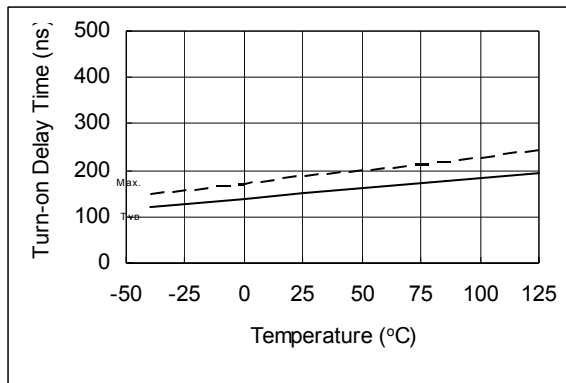


Figure 1A. Turn-on Delay Time vs. Temperature

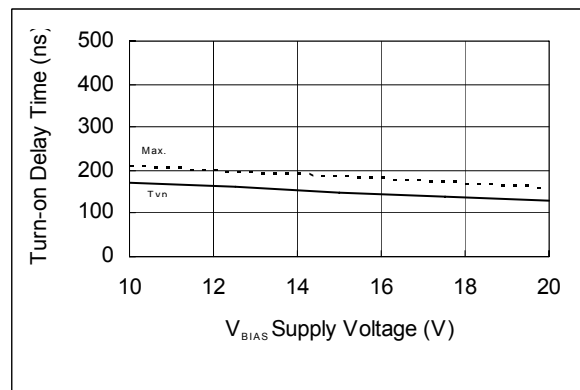


Figure 1B. Turn-on Delay Time vs. Supply Voltage

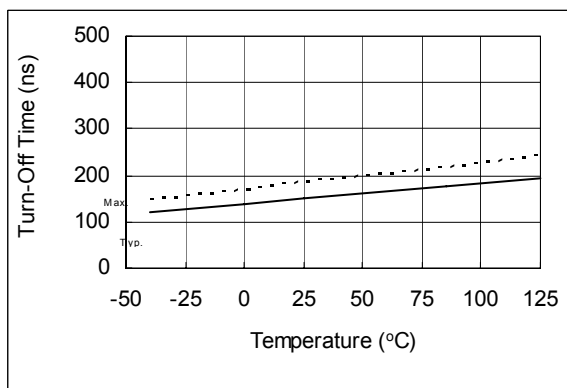


Figure 2A. Turn-Off Time vs. Temperature

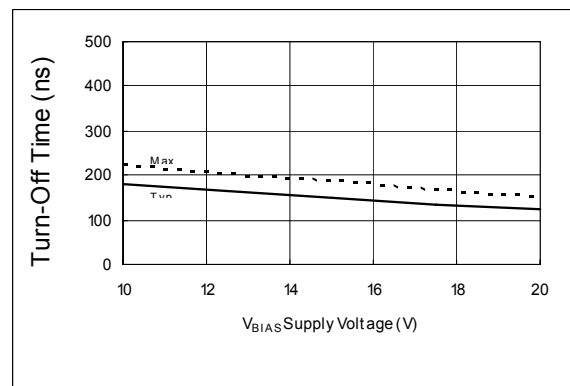


Figure 2B. Turn-Off Time vs. Supply Voltage

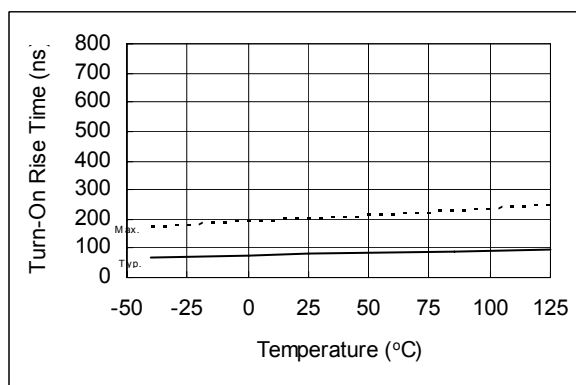


Figure 3A. Turn-On Rise Time (VBS=17V) vs. Temperature

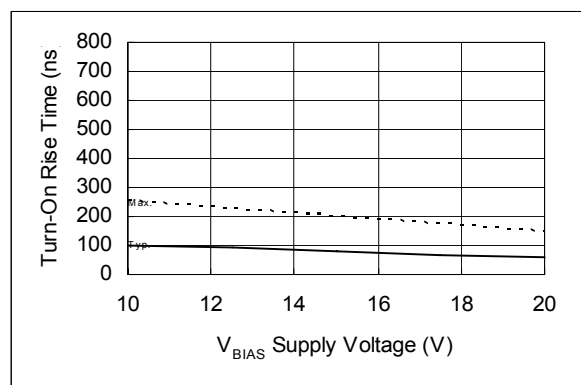


Figure 3B. Turn-On Rise Time (VBS=17V)

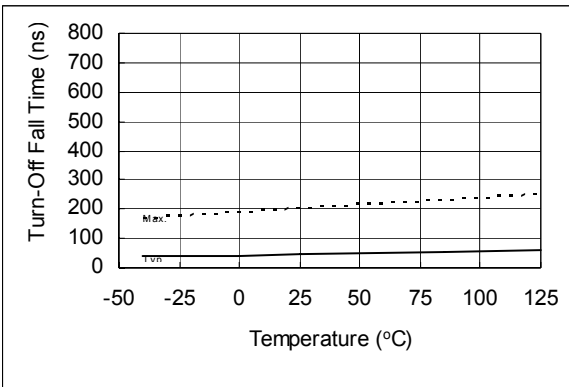


Figure 4A. Turn-Off Fall Time (VBS=17V) vs. Temperature

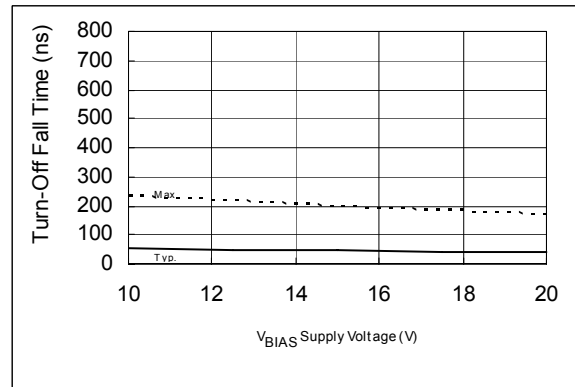


Figure 4B. Turn-Off Fall Time (VBS=17V) vs. Supply Voltage

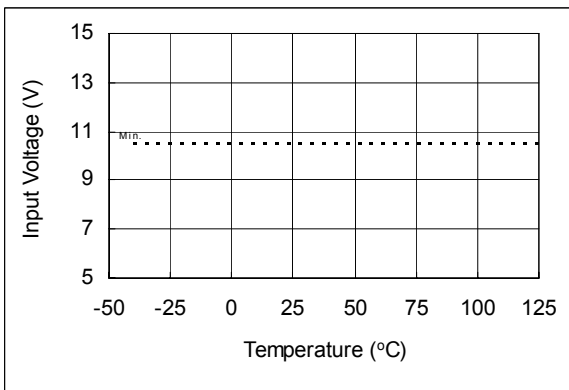


Figure 5A. Logic "1" Input Voltage vs. Temperature

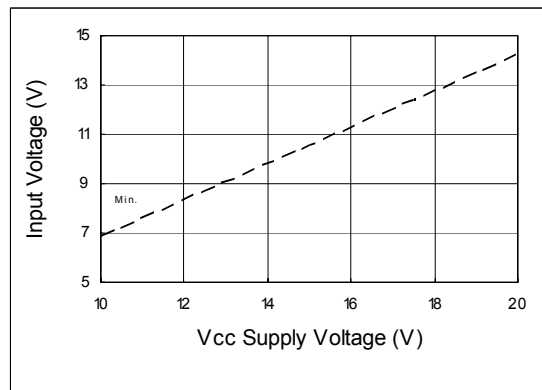


Figure 5B. Logic "1" Input Voltage vs. Supply Voltage

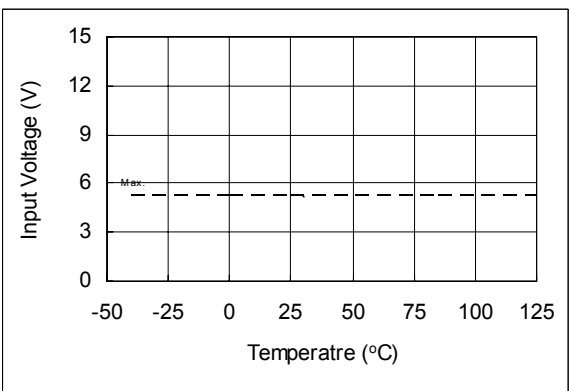


Figure 6A. Logic "0" Input Voltage vs. Temperature

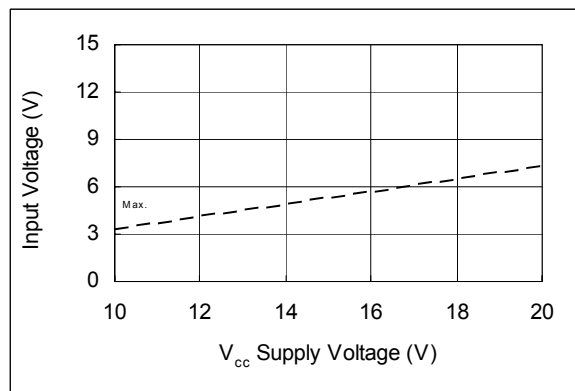


Figure 6B. Logic "0" Input Voltage vs. Supply Voltage

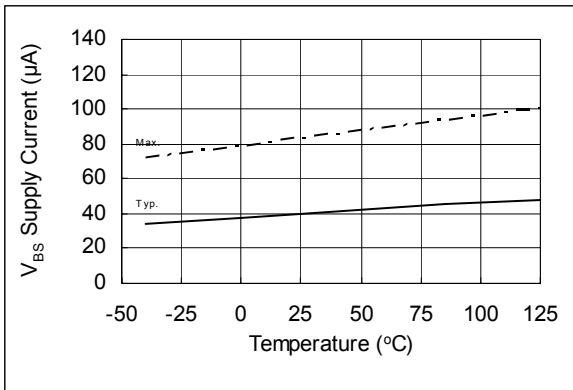


Figure 7A. VBS Supply Current vs. Temperature

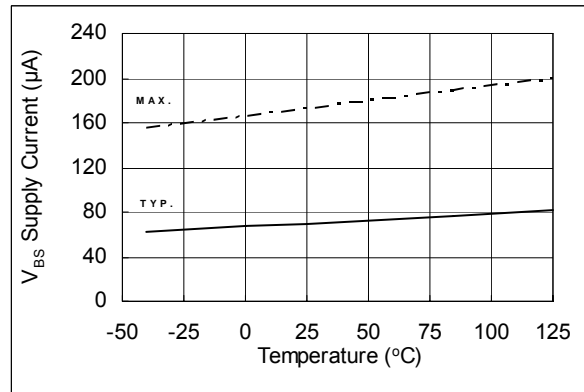


Figure 8A. VBS Supply Current vs. Temperature

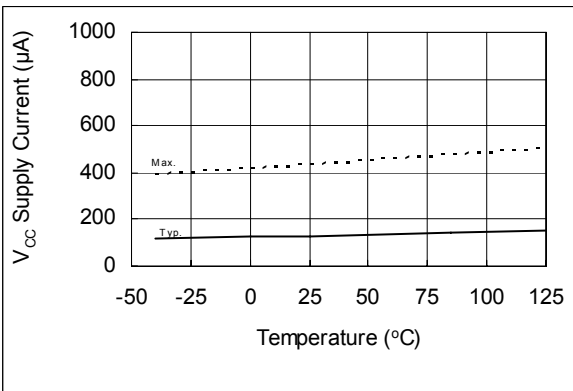


Figure 9A. Vcc Supply Current vs. Temperature

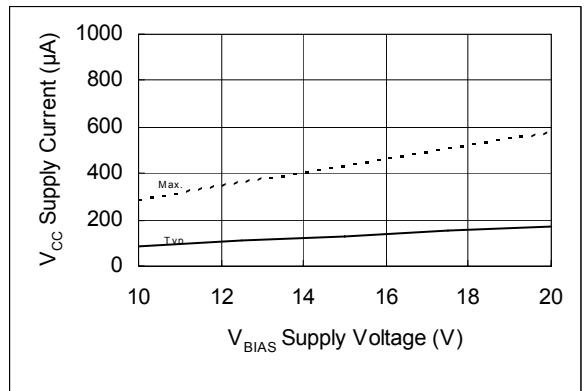


Figure 9B. Vcc Supply Current vs. Supply Voltage

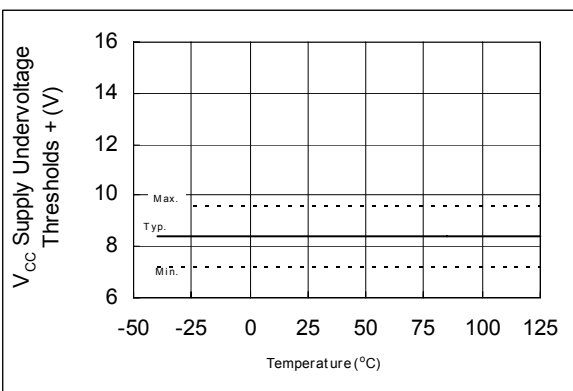


Figure 10A. Vcc Supply Undervoltage Threshold (+) vs. Temperature

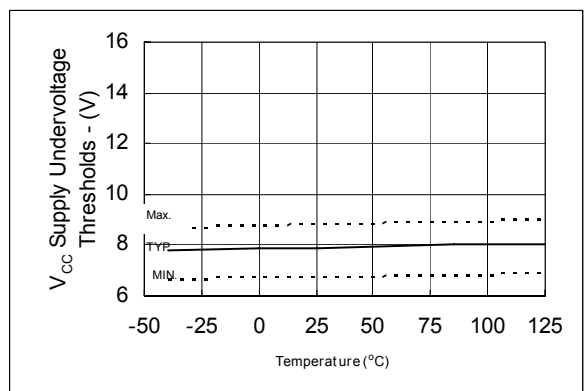


Figure 10B. Vcc Supply Undervoltage Threshold (-) vs. Temperature

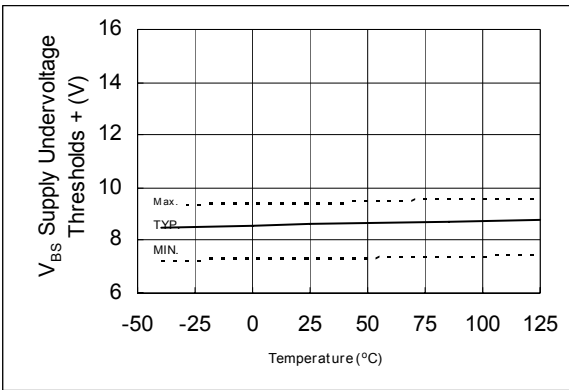


Figure 11A. VBS Supply Undervoltage Threshold (+) vs. Temperature

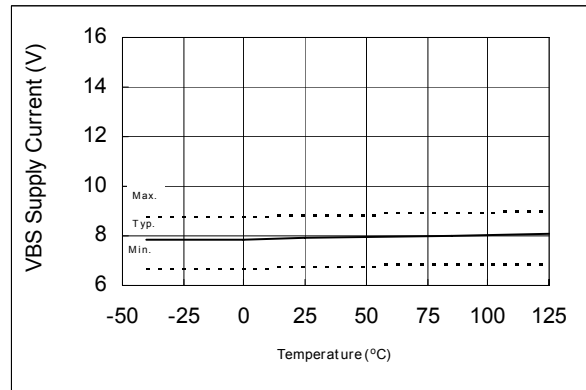


Figure 11B. VBS Supply Undervoltage Threshold (-) vs. Temperature

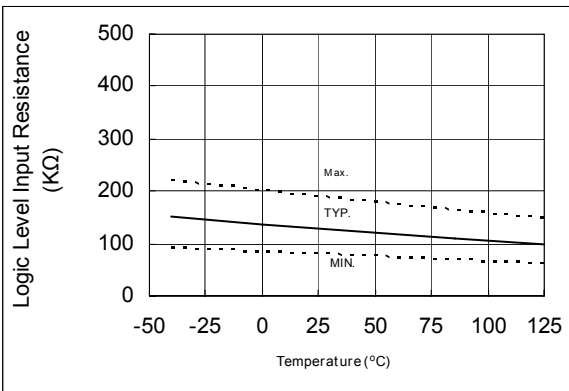


Figure 12. Logic Level Input Resistance vs. Temperature

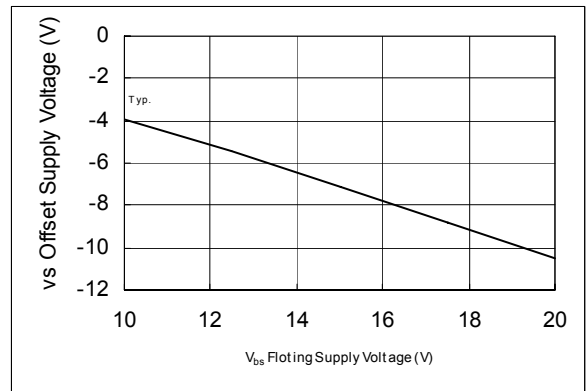
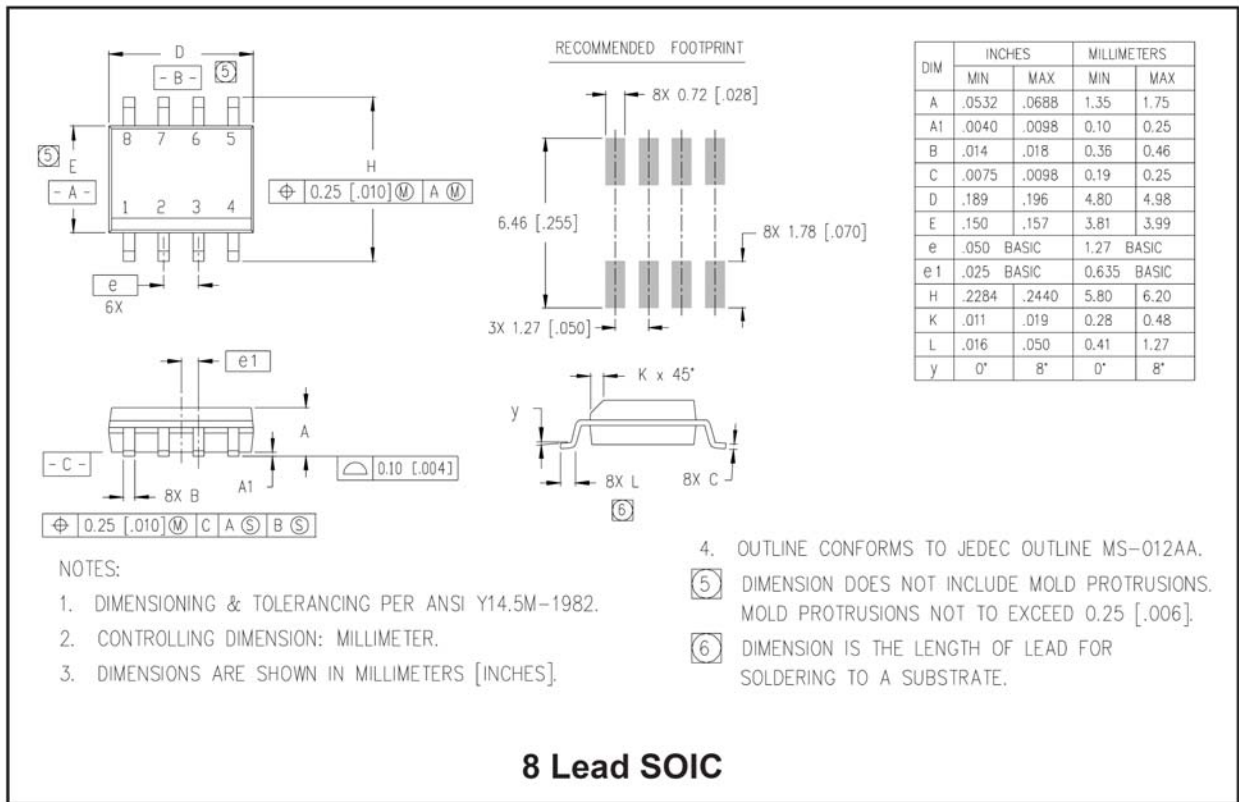
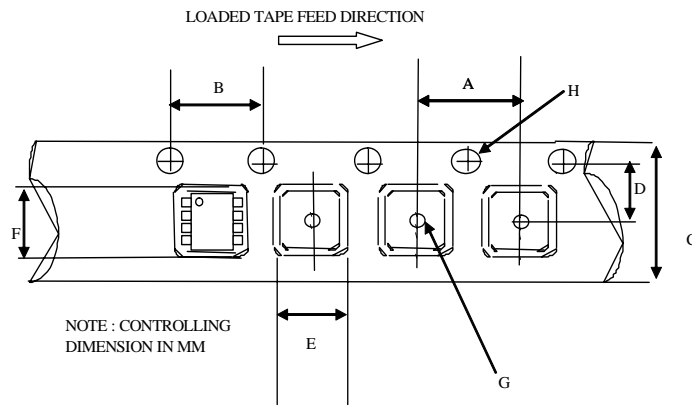


Figure 13. Maximum VS Negative Offset vs. Supply Voltage

**Package Details**

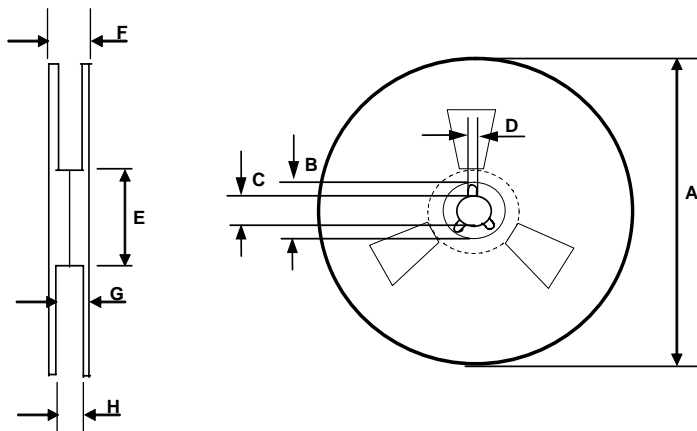


**Tape and Reel Details**



CARRIER TAPE DIMENSION FOR 8SOICN

Code	Metric		Imperial	
	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

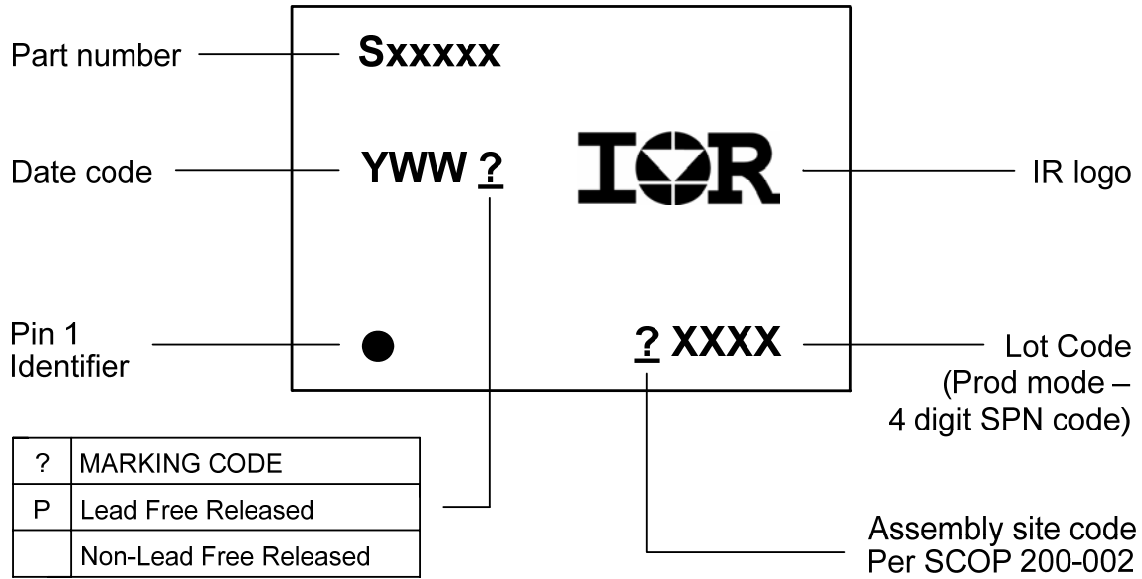


REEL DIMENSIONS FOR 8SOICN

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	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**



**Ordering Information**

Base Part Number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
IRS2123S	SOIC8	Tube/Bulk	95	IRS2123SPBF
		Tape and Reel	2500	IRS2123STRPBF
IRS2124S	SOIC8	Tube/Bulk	95	IRS2124SPBF
		Tape and Reel	2500	IRS2124STRPBF

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