



**Description**

The SDN137 consists of a high efficient AlGaAs Light Emitting Diode and a high speed optical detector. This design provides excellent AC and DC isolation between the input and output sides of the Optocoupler.

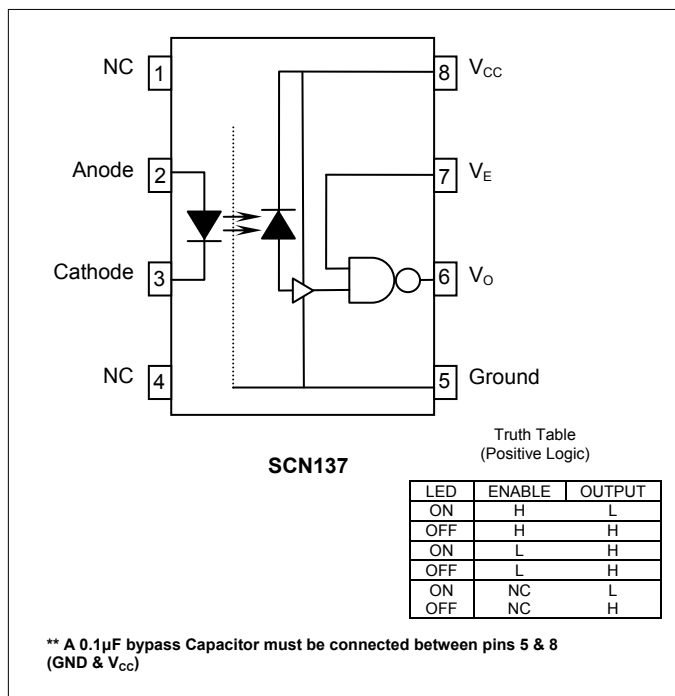
The output of the optical detector features an open collector Schottky clamped transistor. The enable function allows the optical detector to be strobed. The internal shield ensures high common mode transient immunity. A guaranteed common mode transient immunity is up to 15,000V/μS.

The SDN137 comes standard in an 8 pin DIP package.

**Applications**

- High Speed Logic Ground Isolation
- Replace Slower Speed Optocouplers
- Line Receivers
- Power Transistor Isolation
- Pulse Transformer Replacement
- Switch Mode Power Supplies
- Digital Fieldbus Isolation
- Ground Isolation – Analog Signals

**Schematic Diagram**



**Features**

- TTL Compatible
- High Bit Rate: 10MBd
- High CMR Performance (15kV/μS)
- High Isolation Voltage (5000V<sub>RMS</sub>)
- High Common Mode Interference Immunity
- RoHS / Pb-Free / REACH Compliant

**Agency Approvals**

UL / C-UL: File # E201932  
VDE: File # 40035191 (EN 60747-5-2)

**Absolute Maximum Ratings**

The values indicated are absolute stress ratings. Functional operation of the device is not implied at these or any conditions in excess of those defined in electrical characteristics section of this document. Exposure to absolute Maximum Ratings may cause permanent damage to the device and may adversely affect reliability.

Storage Temperature	.....-55 to +125°C
Operating Temperature	.....-40 to +85°C
Continuous Input Current	.....40mA
Transient Input Current	.....400mA
Reverse Input Control Voltage	.....5V
Max Enable Input Voltage (V <sub>E</sub> )	.....5V
Max Enable Input Current (I <sub>E</sub> )	.....5mA
Input Power Dissipation	.....40mW
Max Supply Voltage (V <sub>CC</sub> )	.....7V
Max Output Collector Current (I <sub>O</sub> )	.....50mA
Max Output Collector Voltage (V <sub>O</sub> )	.....7V
Output Power Dissipation	.....85mW

**Ordering Information**

Part Number	Description
SDN137	8 pin DIP, (50/Tube)
SDN137-H	0.40" (10.16mm) Lead Spacing (VDE0884)
SDN137-S	8 pin SMD, (50/Tube)
SDN137-STR	8 pin SMD, Tape and Reel (1000/Reel)

**NOTE: Suffixes listed above are not included in marking on device for part number identification**

**Electrical Characteristics,  $T_A = 25^\circ\text{C}$  (unless otherwise specified)**

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
<b>Input Specifications</b>						
Input Forward Voltage	$V_F$	-	1.36	1.70	V	$I_F = 10\text{mA}$
Input Forward Voltage Temp Coefficient	$\Delta V_F/\Delta T$	-	-1.5	-	mV/ $^\circ\text{C}$	$I_F = 10\text{mA}$
Input Reverse Voltage	$BV_R$	5	-	-	V	$I_R = 10\mu\text{A}$
Input Threshold Current	$I_{TH}$	-	1.1	5	mA	$V_E=2\text{V}, V_{CC}=5.5\text{V}, I_{OL}(\text{sinking})=13\text{mA}$
Input Capacitance	$C_{IN}$	-	34	-	pF	$f=1\text{MHz}, V_F=0\text{V}$
<b>Output Specifications, <math>V_{CC} = 5\text{V}</math> (unless otherwise specified)</b>						
High Level Supply Current	$I_{CCH}$	-	7.4	10	mA	$V_E=0.5\text{V}, V_{CC}=5.5\text{V}, I_F=0\text{mA}$
Low Level Supply Current	$I_{CCL}$	-	10	13	mA	$V_E=0.5\text{V}, V_{CC}=5.5\text{V}, I_F=10\text{mA}$
High Level Enable Current	$I_{EH}$	-	-0.6	-1.6	mA	$V_E=2\text{V}$
Low Level Enable Current	$I_{EL}$	-	-0.9	-1.6	mA	$V_E=0.5\text{V}$
High Level Enable Voltage	$V_{EH}$	2	-	-	V	
Low Level Enable Voltage	$V_{EL}$	-	-	0.8		
High Level Output Current	$I_{OH}$	-	-	100	$\mu\text{A}$	$V_E=2\text{V}, V_{CC}=5.5\text{V}, V_O=5.5\text{V}, I_F=250\mu\text{A}$
Low Level Output Voltage	$V_{OL}$	-	0.28	0.60	V	$V_E=2\text{V}, V_{CC}=5.5\text{V}, I_F=5\text{mA}$ $I_{OL}(\text{sinking})=13\text{mA}$
<b>Switching Specifications, <math>V_{CC} = 5\text{V}, I_F=7.5\text{mA}</math> (unless otherwise specified)</b>						
Propagation Delay Time to Low Output Level	$t_{PHL}$	25	35	100	nS	$R_L=350\Omega, C_L=15\text{pF}$
Propagation Delay Time to High Output Level	$t_{PLH}$	25	45	100	nS	$R_L=350\Omega, C_L=15\text{pF}$
Pulse Width Distortion	$ t_{PLH} - t_{PHL} $	-	10	35	nS	$R_L=350\Omega, C_L=15\text{pF}$
Propagation Delay Skew	$t_{PSK}$	-	8	40	nS	$R_L=350\Omega, C_L=15\text{pF}$
Output Rise Time (10% - 90%)	$t_r$	-	20	-	nS	$R_L=350\Omega, C_L=15\text{pF}$
Output Fall Time (90% - 10%)	$t_f$	-	8	-	nS	$R_L=350\Omega, C_L=15\text{pF}$
Propagation Delay Time of enable from $V_{EH}$ to $V_{EL}$	$t_{ELH}$	-	22	-	nS	$R_L=350\Omega, C_L=15\text{pF}, V_{EL}=0\text{V}, V_{EH}=3\text{V}$
Propagation Delay Time of enable from $V_{EL}$ to $V_{EH}$	$t_{EHL}$	-	12	-	nS	$R_L=350\Omega, C_L=15\text{pF}, V_{EL}=0\text{V}, V_{EH}=3\text{V}$
Logic High Common Mode Transient Immunity	$ CM_H $	5,000	-	-	V/ $\mu\text{S}$	$ V_{CM} =20\text{V}, V_{CC}=5\text{V}, I_F=0\text{mA}, V_{O(\text{MIN})}=2\text{V}, R_L=350\Omega$
Logic Low Common Mode Transient Immunity	$ CM_L $	5,000	-	-	V/ $\mu\text{S}$	$ V_{CM} =20\text{V}, V_{CC}=5\text{V}, I_F=7.5\text{mA}, V_{O(\text{MIN})}=0\text{V}, R_L=350\Omega$

**Electrical Characteristics, continued...**  $T_A = 25^\circ\text{C}$  (unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
<b>Isolation Specifications</b>						
Input-Output Insulation Leakage Current	$I_{I-O}$	-	-	1.0	$\mu\text{A}$	45% RH, $t=5\text{s}$ , $V_{I-O}=3\text{kV}$
Withstand Insulation Test Voltage	$V_{ISO}$	5000	-	-	$V_{RMS}$	RH $\leq$ 50%, $t=1\text{min}$
Input-Output Resistance	$R_{I-O}$	-	$10^{12}$	-	$\Omega$	$V_{I-O} = 500V_{DC}$
Input-Output Capacitance	$C_{I-O}$	-	1.0	-	pF	$f=1\text{MHz}$

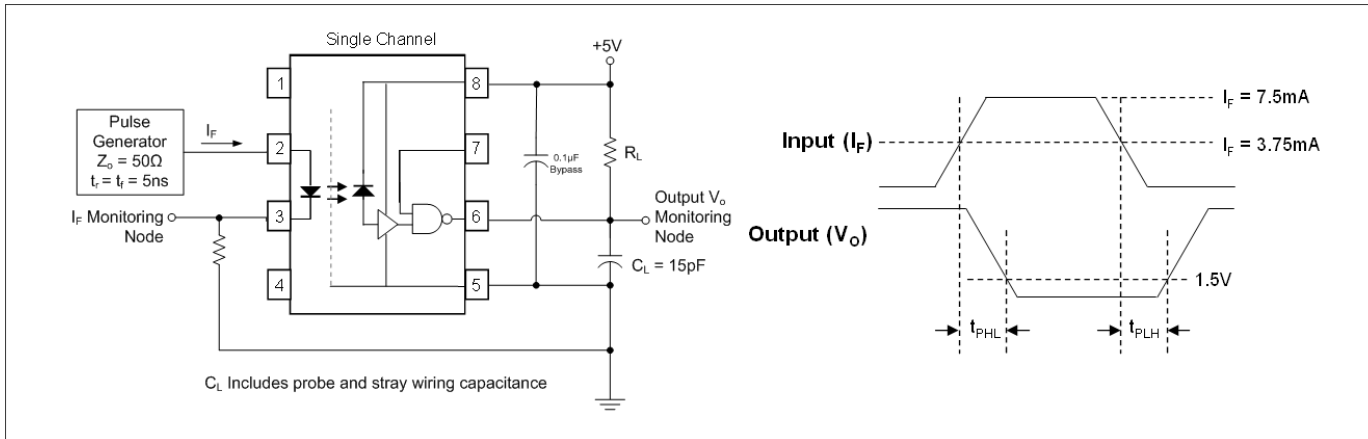
**Notes**

1. A 0.1 $\mu\text{F}$  or bigger bypass capacitor for  $V_{CC}$  is needed as shown in Figure 1
2. Peaking driving circuit may be used to speed up the LED. The peak drive current of LED may go up to 50mA and maximum pulse width 50ns, as long as average current doesn't exceed 20mA.
3.  $t_{PLH}$  (propagation delay) is measured from the 3.75 mA point on the falling edge of the input pulse to the 1.5 V point on the rising edge of the output pulse.
4.  $t_{PHL}$  (propagation delay) is measured from the 3.75 mA point on the rising edge of the input pulse to the 1.5 V point on the falling edge of the output pulse.
5. The  $t_{ELH}$  enable propagation delay is measured from the 1.5 V point on the falling edge of the enable input pulse to the 1.5 V point on the rising edge of the output pulse.
6. The  $t_{EHL}$  enable propagation delay is measured from the 1.5 V point on the rising edge of the enable input pulse to the 1.5 V point on the falling edge of the output pulse.
7.  $CM_H$  is the maximum tolerable rate of rise of the common mode voltage to assure that the output will remain in a high logic state (i.e.,  $V_O > 2.0\text{V}$ ).
8.  $CM_L$  is the maximum tolerable rate of fall of the common mode voltage to assure that the output will remain in a low logic state (i.e.,  $V_O < 0.8\text{V}$ ).
9. No external pull up is required for a high logic state on the enable input. If the enable pin is not used, tying it to  $V_{CC}$ .
10. Device is considered a two-terminal device: pins 1, 2, 3, and 4 shorted together, and pins 5, 6, 7, and 8 shorted together.
11. In accordance with UL1577, each optocoupler is proof tested by applying an insulation test voltage 3000  $V_{RMS}$  for one second (leakage current less than 5  $\mu\text{A}$ ). This test is performed before the 100% production test for partial discharge
12. In accordance with UL 1577, each optocoupler is proof tested by applying an insulation test voltage 6000  $V_{RMS}$  for one second (leakage current less than 5  $\mu\text{A}$ ). This test is performed before the 100% production test for partial discharge

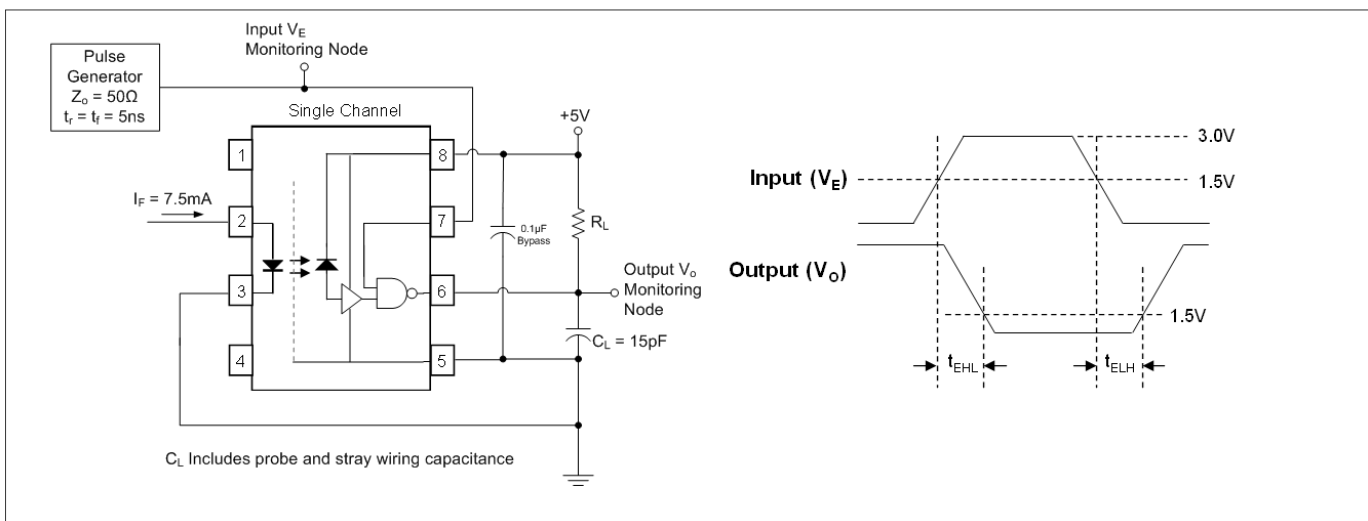
**Recommended Operating Conditions,  $T_A = 25^\circ\text{C}$**  (unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Operating Temperature	$^\circ\text{C}$	-40	-	85	$^\circ\text{C}$	
Supply Voltage	$V_{CC}$	4.5	-	5.5	V	
Low Level Input Current	$I_{FL}$	0	-	250	$\mu\text{A}$	
High Level Input Current	$I_{FH}$	5	-	15	mA	
Low Level Enable Voltage	$V_{EL}$	0	-	0.8	V	
High Level Enable Voltage	$V_{EH}$	2	-	$V_{CC}$	V	
Output Pull Up Resistor	$R_L$	330	-	4k	$\Omega$	
Fan Out	N	-	-	5	-	$R_L = 1\text{k}\Omega$

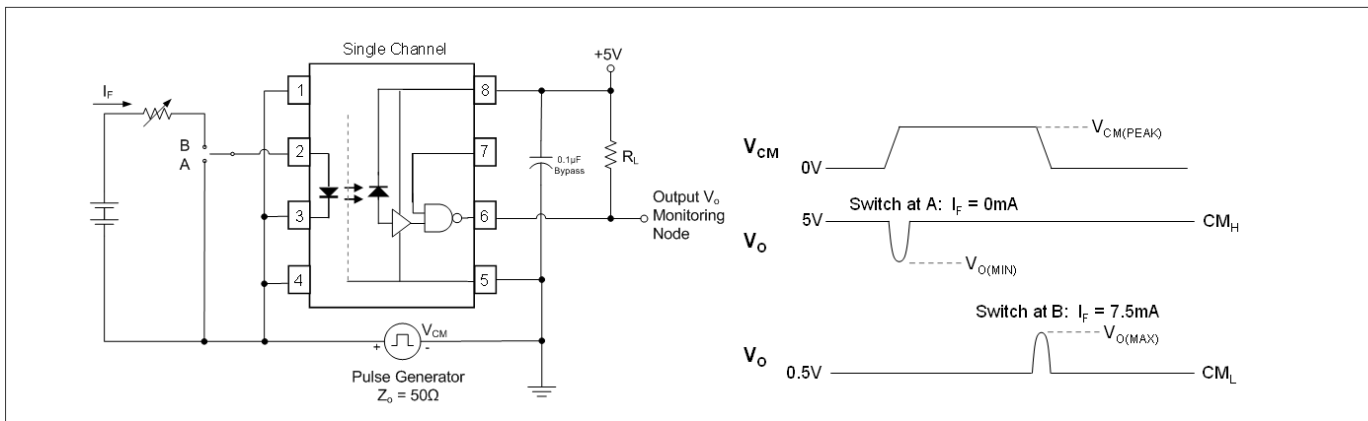
**SDN137 Electrical Test Circuits**



**Figure 1:** Single Channel Test Circuit for  $t_{PHL}$  and  $t_{PLH}$



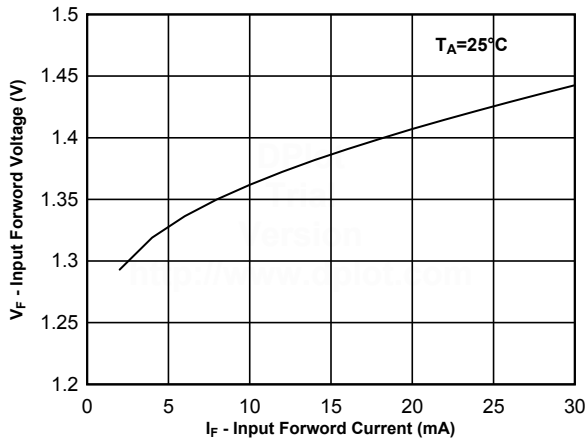
**Figure 2:** Single Channel Test Circuit for  $t_{EHL}$  and  $t_{ELH}$



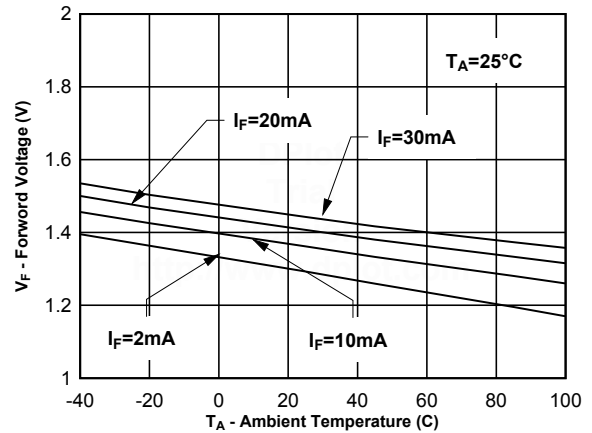
**Figure 3:** Single Channel Test Circuit for Common Mode Transient Immunity

**SDN137 Performance & Characteristics Plots,  $T_A = 25^\circ\text{C}$  (unless otherwise specified)**

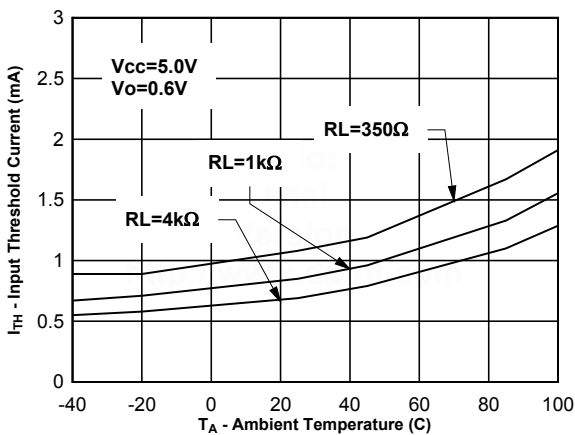
**Figure 4: Input Diode Forward Characteristics**



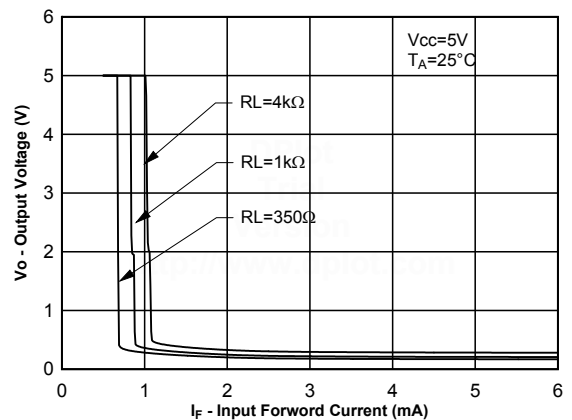
**Figure 5: Input Diode Forward Voltage vs. Temperature**



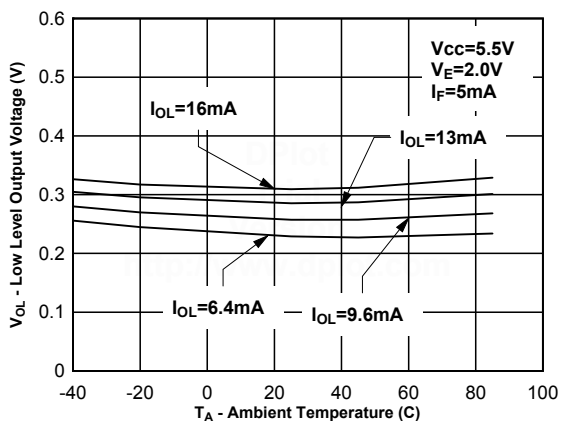
**Figure 6: Input Diode Threshold Current vs. Temperature**



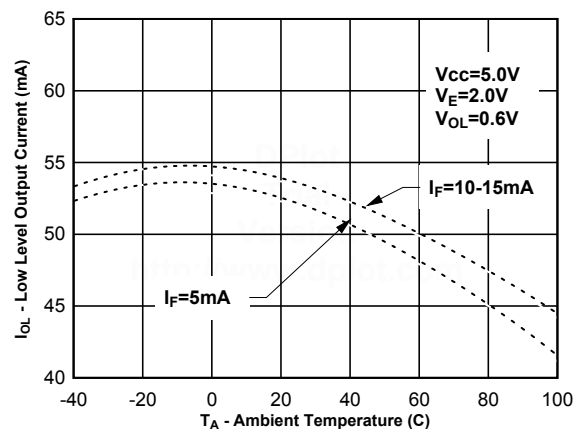
**Figure 7: Output Voltage vs. Input Forward Current**

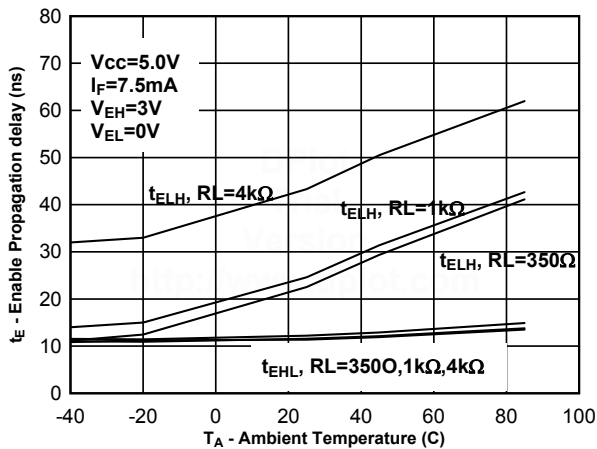
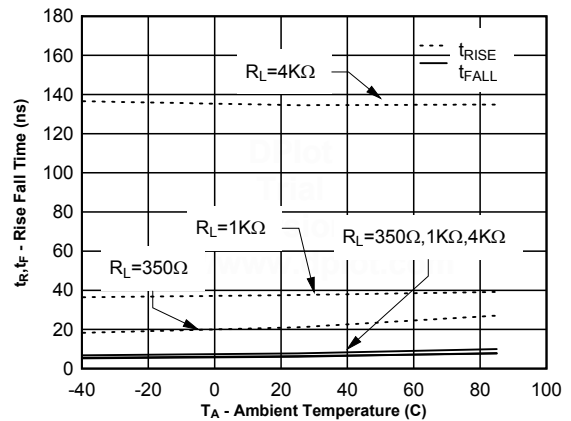
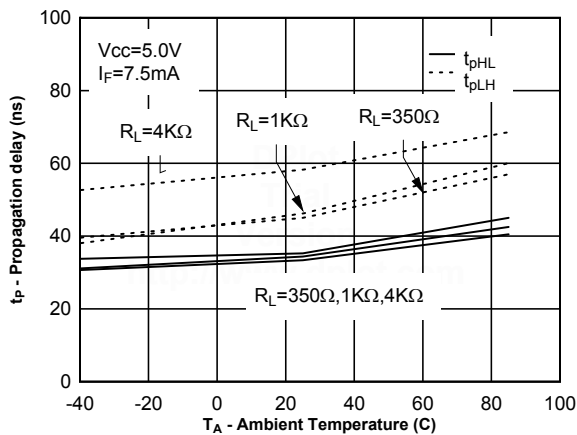
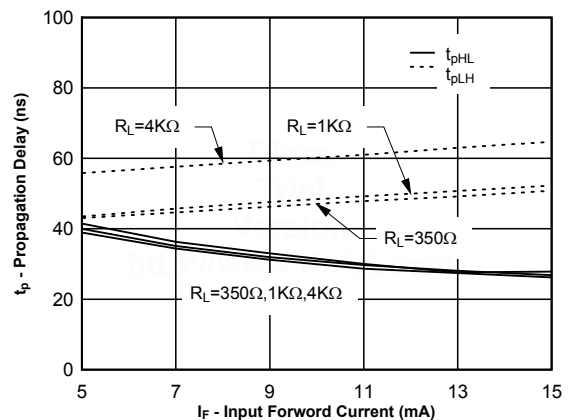
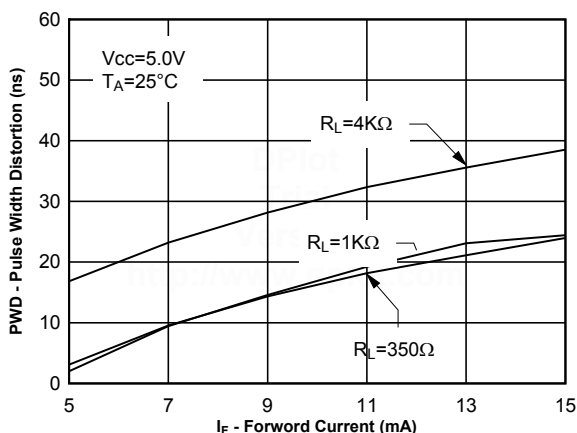
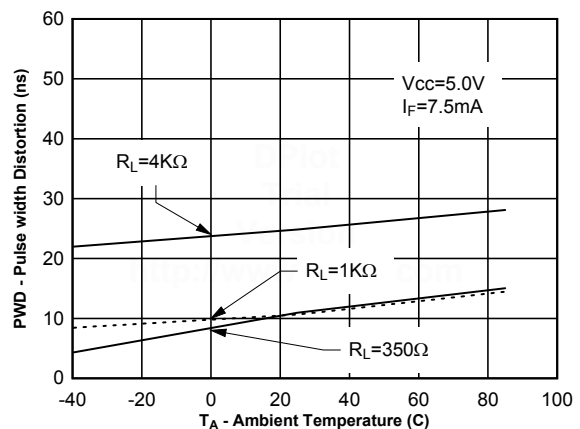


**Figure 8: Low Level Output Voltage vs. Temperature**



**Figure 9: Low Level Output Current vs. Temperature**



**SDN137 Performance & Characteristics Plots,  $T_A = 25^\circ\text{C}$  (unless otherwise specified)**
**Figure 10: Enable Propagation Delay vs. Temperature**

**Figure 11: Rise and Fall Time vs. Temperature**

**Figure 12: Propagation Delay Time vs. Temperature**

**Figure 13: Propagation Delay vs. Input Forward Current**

**Figure 14: Pulse Width Distortion vs. Input Forward Current**

**Figure 15: Pulse Width Distortion vs. Temperature**


**SDN137 Solder Reflow Temperature Profile Recommendations**
**(1) Infrared Reflow:**

Refer to the following figure as an example of an optimal temperature profile for single occurrence infrared reflow. Soldering process should not exceed temperature or time limits expressed herein. Surface temperature of device package should not exceed 250°C:

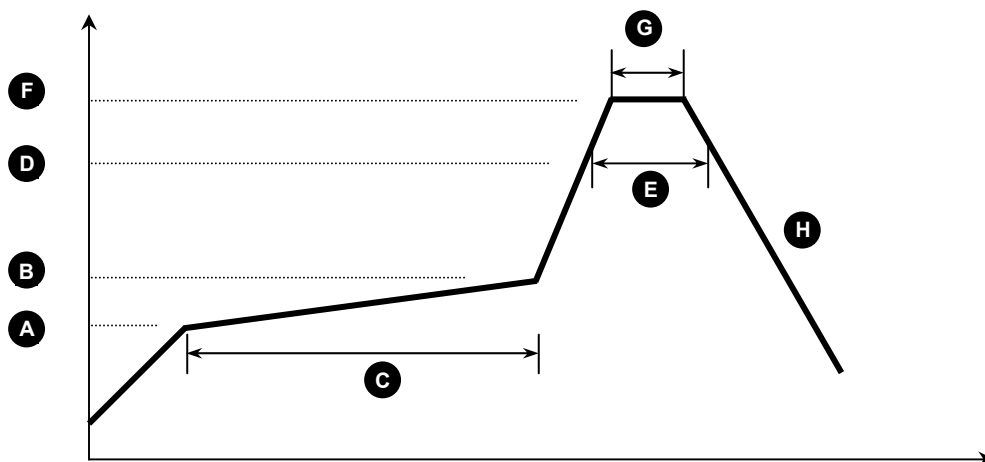


Figure 16

Process Step	Description	Parameter
A	Preheat Start Temperature (°C)	150°C
B	Preheat Finish Temperature (°C)	180°C
C	Preheat Time (s)	90 - 120s
D	Melting Temperature (°C)	230°C
E	Time above Melting Temperature (s)	30s
F	Peak Temperature, at Terminal (°C)	260°C
G	Dwell Time at Peak Temperature (s)	10s
H	Cool-down (°C/s)	<6°C/s

**(2) Wave Solder:**

Maximum Temperature: 260°C (at terminal)  
 Maximum Time: 10s  
 Pre-heating: 100 - 150°C (30 - 90s)  
 Single Occurrence

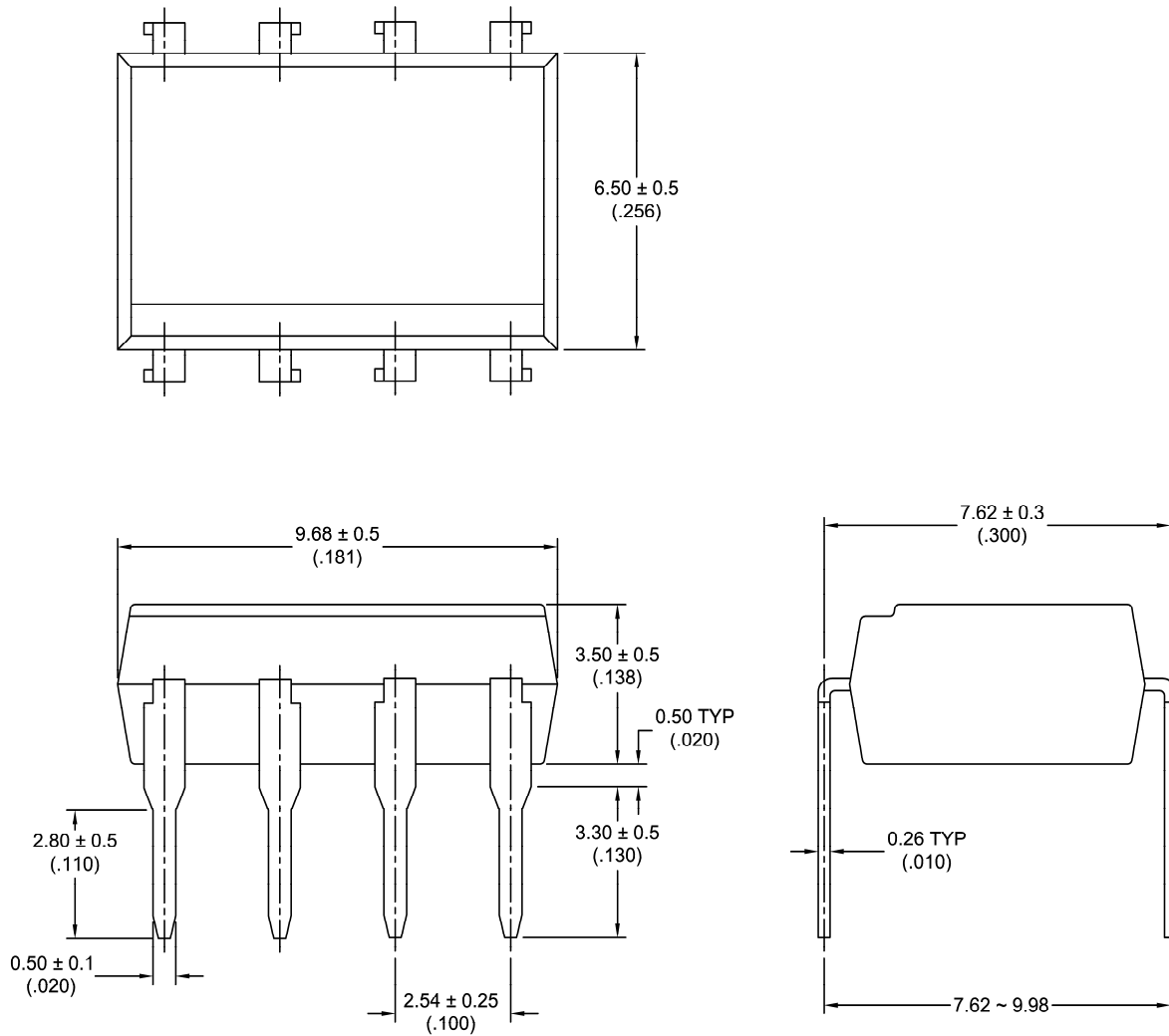
**(3) Hand Solder:**

Maximum Temperature: 350°C (at tip of soldering iron)  
 Maximum Time: 3s  
 Single Occurrence

**SDN137 Package Dimensions**

8 PIN DIP Package

**Note:** All dimensions in millimeters [mm] with inches in parenthesis ( )

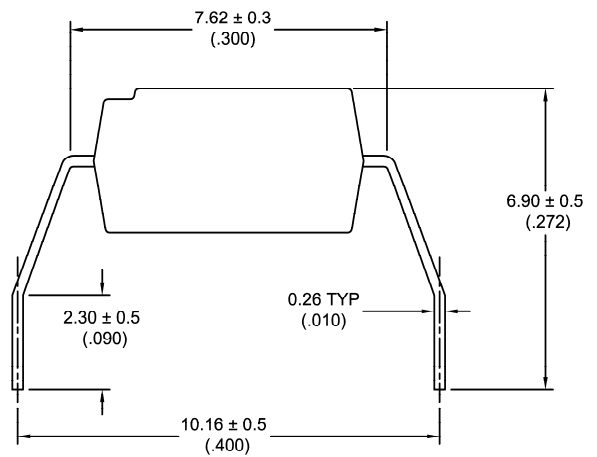
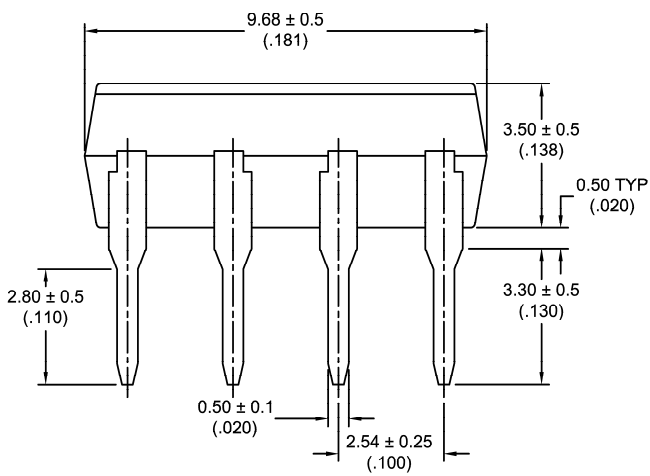
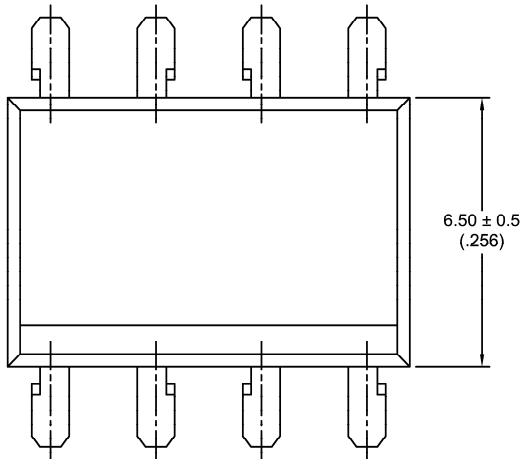




**SDN137 Package Dimensions**

8 PIN WIDE Lead Space Package (-H)

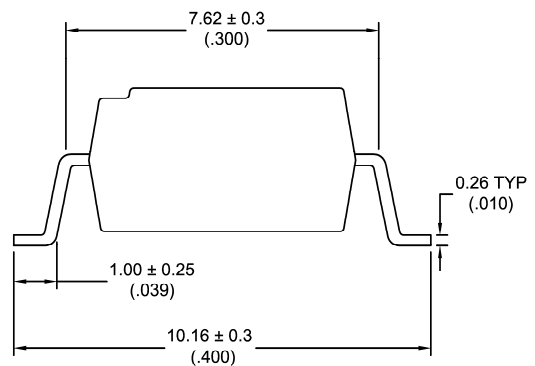
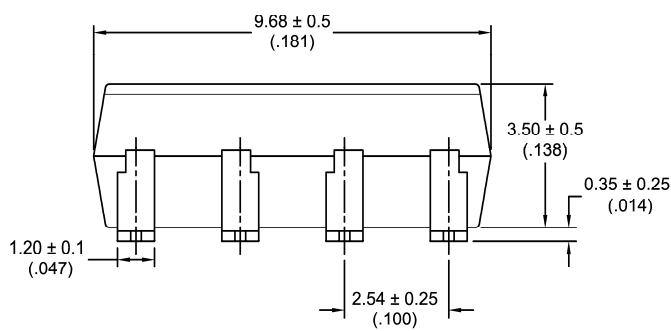
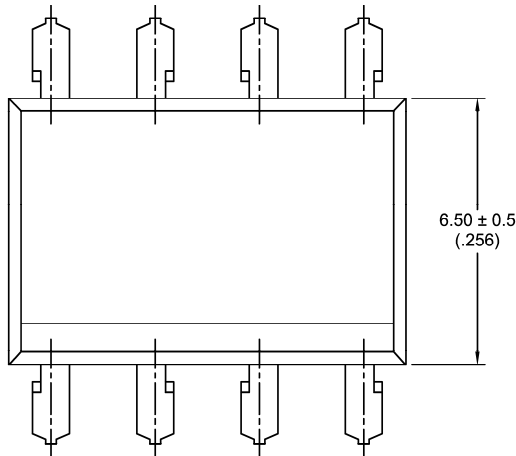
**Note:** All dimensions in millimeters [mm] with inches in parenthesis ( )

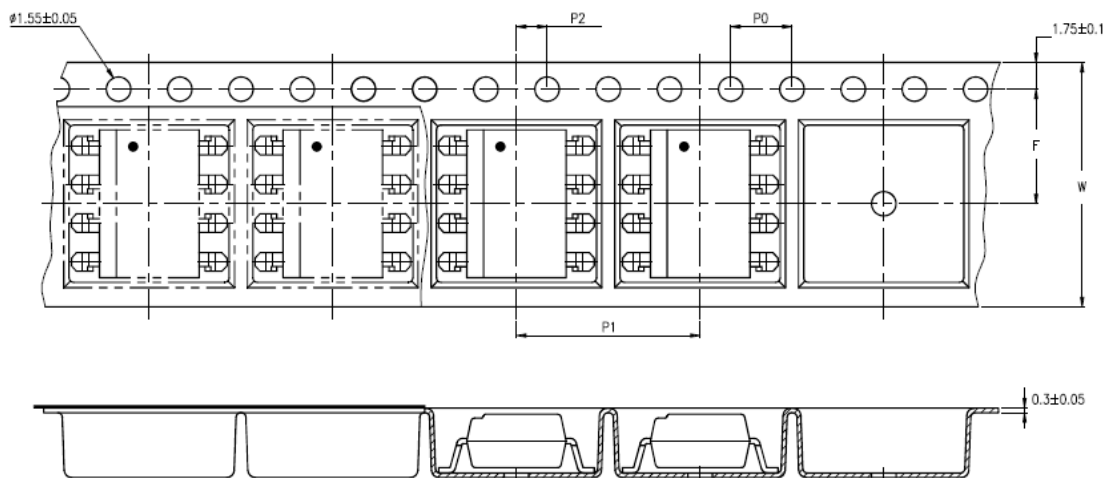


**SDN137 Package Dimensions**

8 PIN SMD Surface Mount Package (-S)

**Note:** All dimensions in millimeters [mm] with inches in parenthesis ( )



**SDN137 Packaging Specifications**
*Tape & Reel Specifications (T&R)*
**Note:** All dimensions in millimeters [mm] with inches in parenthesis ( )


Specification	Symbol	Dimensions, mm ( inches )
Tape Width	W	16 ± 0.3 ( 0.63 )
Sprocket Hole Pitch	P0	4 ± 0.1 ( 0.15 )
Compartment Location	F P2	7.5 ± 0.1 ( 0.295 ) 2 ± 0.1 ( 0.079 )
Compartment Pitch	P1	12 ± 0.1 ( 0.472 )

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