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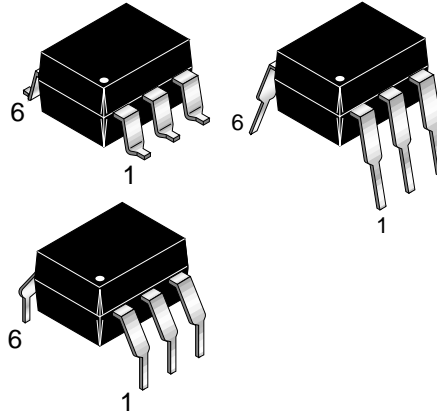
**DESCRIPTION**

The 4N39 and 4N40 have a gallium-arsenide infrared emitting diode optically coupled with a light activated silicon controlled rectifier in a dual in-line package.

**4N39 4N40**

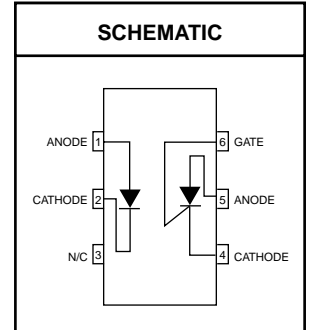
**FEATURES**

- 10 A, T<sup>2</sup>L compatible, solid state relay
- 25 W logic indicator lamp driver
- 400 V symmetrical transistor coupler
- Underwriters Laboratory (UL) recognized — File #E90700



**APPLICATIONS**

- Low power logic circuits
- Telecommunications equipment
- Portable electronics
- Solid state relays
- Interfacing coupling systems of different potentials and impedances.



Parameter	Symbol	Device	Value	Units
<b>TOTAL DEVICE</b>				
*Storage Temperature	T <sub>STG</sub>	All	-55 to +150	°C
*Operating Temperature	T <sub>OPR</sub>	All	-55 to +100	°C
*Lead Solder Temperature	T <sub>SOL</sub>	All	260 for 10 sec	°C
*Total Device Power Dissipation (-55°C to 50 °C) Derate above 50°C	P <sub>D</sub>	All	450	mW
			9.0	mW/°C
<b>EMITTER</b>				
*Continuous Forward Current	I <sub>F</sub>	All	60	mA
*Reverse Voltage	V <sub>R</sub>	All	6	V
*Forward Current - Peak (300 μs, 2% Duty Cycle)	I <sub>F(pk)</sub>	All	1.0	A
*LED Power Dissipation (-55°C to 50 °C) Derate above 50°C	P <sub>D</sub>	All	100	mW
			2.0	mW/°C
<b>DETECTOR</b>				
*Off-State And Reverse Voltage		4N39	200	V
		4N40	400	V
*Peak Reverse Gate Voltage			6	V
*Direct On-State Current			300	mA
*Surge On-State Current (100 μs)			10	A
*Peak Gate Current			10	mA
*Detector Power Dissipation (-55°C to 50°C) Derate above 50°C	P <sub>D</sub>	All	400	mW
			8.0	mW/°C

Note

- \* Indicates JEDEC Registered Data
- \*\* Typical values at T<sub>A</sub> = 25°C

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  Unless otherwise specified.)

**INDIVIDUAL COMPONENT CHARACTERISTICS**

Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
<b>EMITTER</b>							
Input Forward Voltage	$I_F = 10 \text{ mA}$	$V_F$	All		1.1	1.5	V
Reverse Leakage Current	$V_R = 3 \text{ V}$	$I_R$	All			10	$\mu\text{A}$
Capacitance	$V_F = 0 \text{ V}, f = 1.0 \text{ MHz}$	$C_J$	All		50		pF
<b>DETECTOR</b>							
Peak Off-State Voltage	$R_{GK} = 10 \text{ k}\Omega, T_A = 100^\circ\text{C}$	$V_{DM}$	4N39	200			V
			4N40	400			
Peak Reverse Voltage	$T_A = 100^\circ\text{C}$	$V_{RM}$	4N39	200			V
			4N40	400			
On-State Voltage	$I_T = 300 \text{ mA}$	$V_T$	All			1.3	V
Off-State Current	$V_{DM} = 200 \text{ V}, T_A = 100^\circ\text{C},$ $I_F = 0 \text{ mA}, R_{GK} = 10 \text{ k}\Omega$	$I_{DM}$	4N39			50	$\mu\text{A}$
			4N40			150	
Reverse Current	$V_R = 200 \text{ V}, T_A = 100^\circ\text{C}, I_F = 0 \text{ mA}$	$I_R$	4N39			50	$\mu\text{A}$
			4N40			150	
Holding Current	$V_{FX} = 50 \text{ V}, R_{GK} = 27 \text{ k}\Omega$	$I_H$	All			1.0	mA

**TRANSFER CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  Unless otherwise specified.)

Characteristics	Test Conditions	Symbol	Device	Min	Typ**	Max	Units
*Input Current to Trigger	$V_{AK} = 50 \text{ V}, R_{GK} = 10 \text{ k}\Omega$	$I_{FT}$	4N39			30	mA
	$V_{AK} = 100 \text{ V}, R_{GK} = 27 \text{ k}\Omega$		4N40			14	
*Turn-On Time	$V_{AK} = 50 \text{ V}, I_F = 30 \text{ mA}$ $R_{GK} = 10 \text{ k}\Omega, R_L = 200 \Omega$	$t_{on}$	ALL			50	$\mu\text{A}$
Package Capacitance (input to output)	$f = 1 \text{ MHz}$ Input to Output Voltage = 0	$C_{I-O}$	ALL			2	pF
Coupled dv/dt, input to output (figure 13)		dV/dt	ALL	500			V/ $\mu\text{S}$

**ISOLATION CHARACTERISTICS**

Characteristic	Test Conditions	Symbol	Min	Typ**	Max	Units
*Input-Output Isolation Voltage	( $I_{I-O} \leq 1 \mu\text{A}, V_{rms}, t = 1 \text{ min.}$ )	$V_{ISO}$	5300			Vac(rms)
*Isolation Resistance	( $V_{I-O} = 500 \text{ VDC}$ )	$R_{ISO}$	$10^{11}$			$\Omega$
Isolation Capacitance	( $V_{I-O} = \emptyset, f = 1 \text{ MHz}$ )	$C_{ISO}$		0.8		pf

Note

\* Indicates JEDEC Registered Data

\*\* Typical values at  $T_A = 25^\circ\text{C}$

**4N39 4N40**

Figure 1. Input Current To Trigger vs. Anode-Cathode Voltage

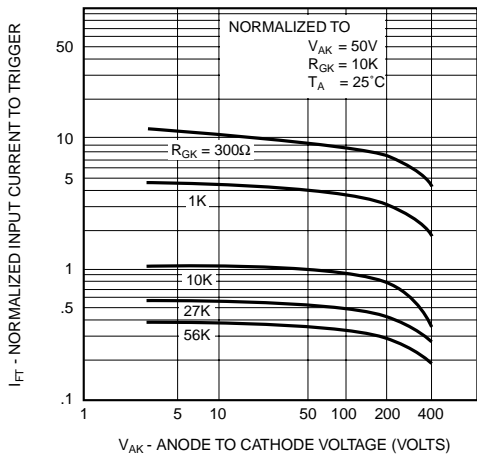


Figure 2. Input Current To Trigger vs. Temperature

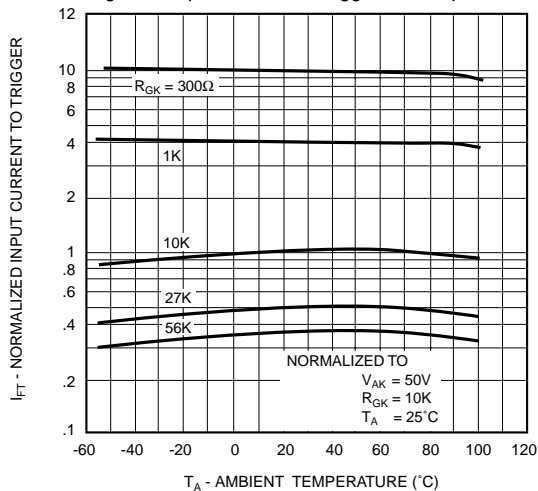


Figure 3. Input Current To Trigger Distribution vs. Temperature

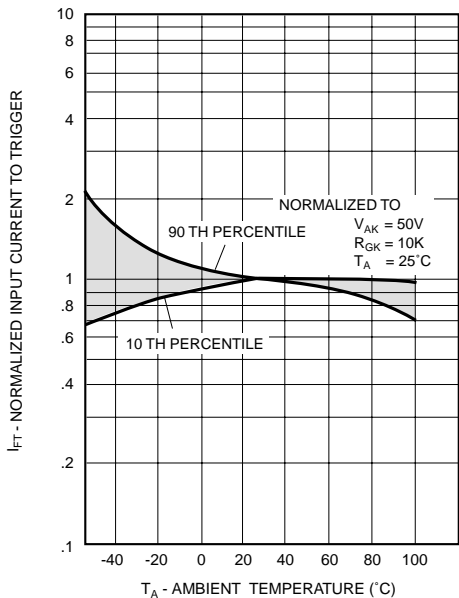


Figure 4. Input Current To Trigger vs. Pluse Width

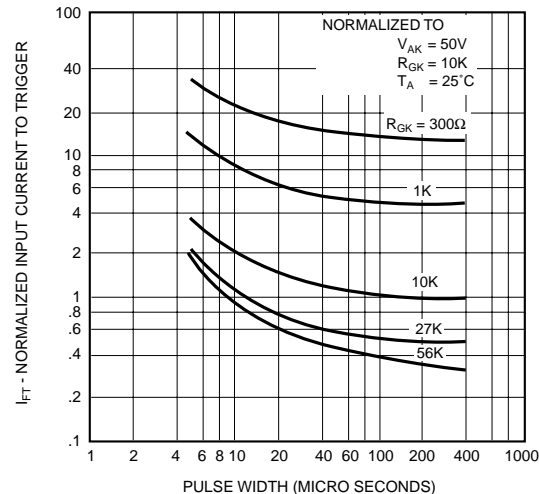


Figure 5. Turn-On Time vs. Input Current

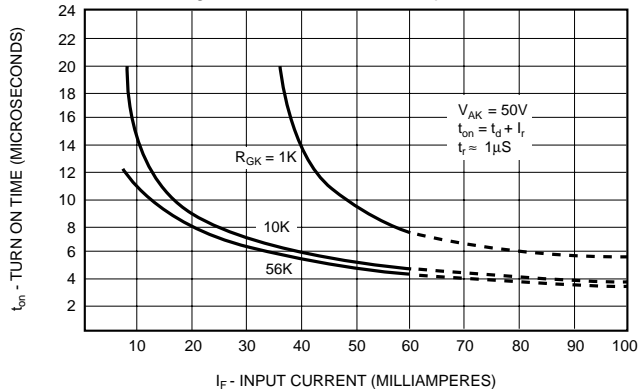
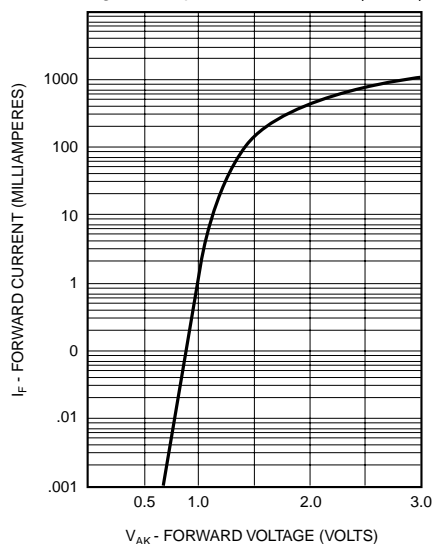


Figure 6. Input Characteristics  $I_F$  vs.  $V_F$



**4N39 4N40**

Figure 7. Holding Current vs. Temperature

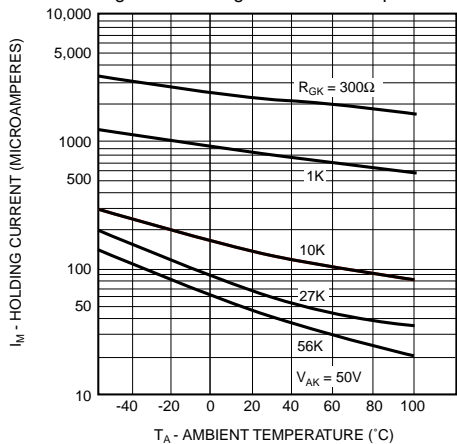


Figure 8. Maximum Transient Thermal Impedance

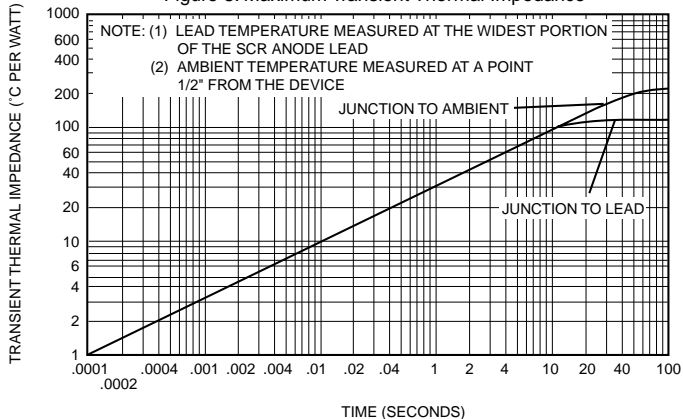


Figure 9. Off-State Forward Current vs. Temperature

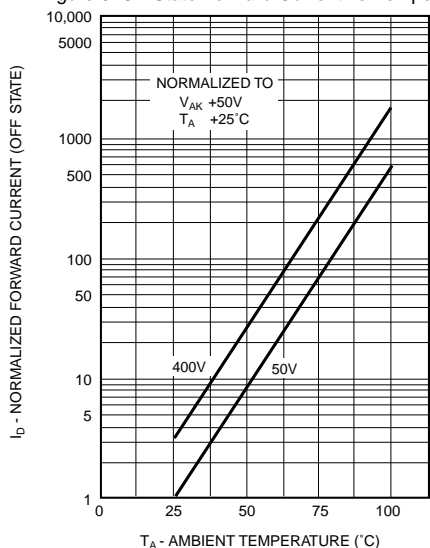


Figure 10. On-State Current vs. Maximum Allowable Temperature

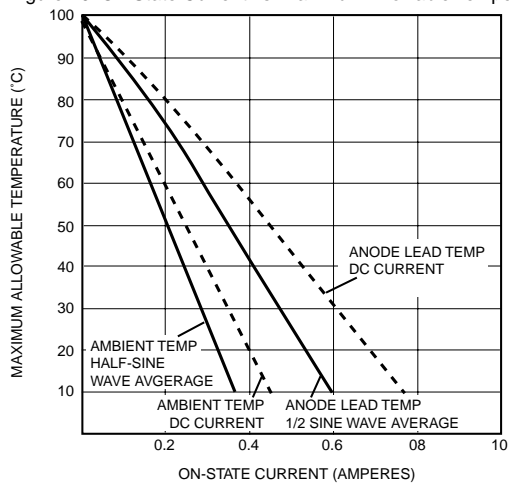


Figure 11. dv/dt vs. Temperature

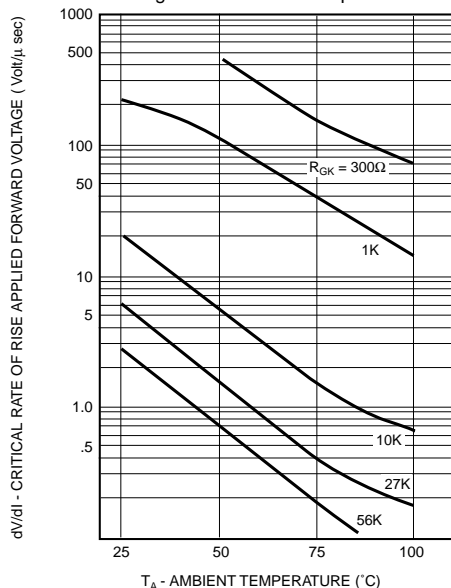
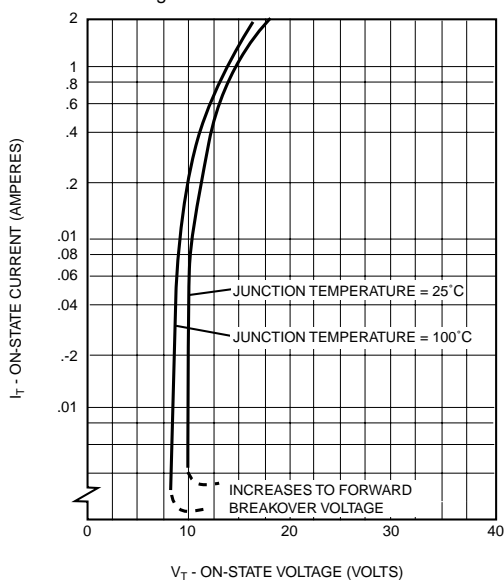
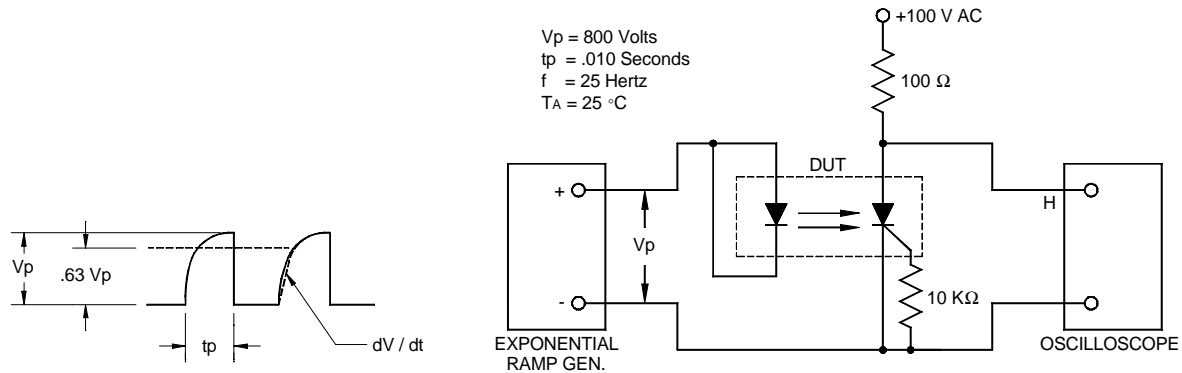


Figure 12. On-State Characteristics



**4N39 4N40**

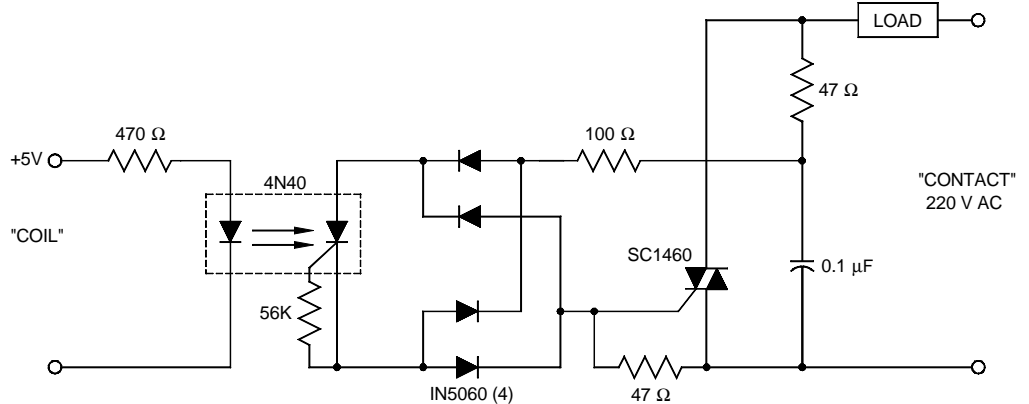


**Fig. 13 Coupled dv/dt - Test Circuit**

**TYPICAL APPLICATIONS**

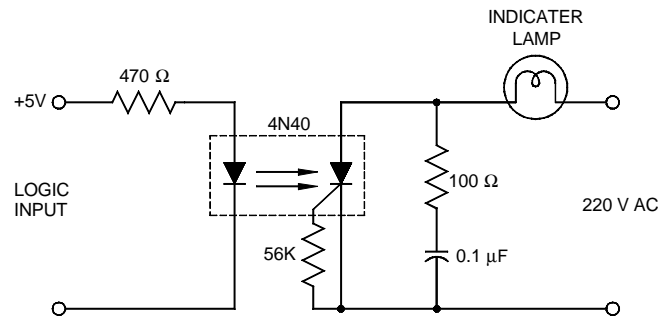
**10A, T<sup>2</sup>L COMPATIBLE, SOLID STATE RELAY**

Use of the 4N40 for high sensitivity, 5300 V isolation capability, provides this highly reliable solid state relay design. This design is compatible with 74, 74S and 74H series T<sup>2</sup>L logic systems inputs and 220V AC loads up to 10A.



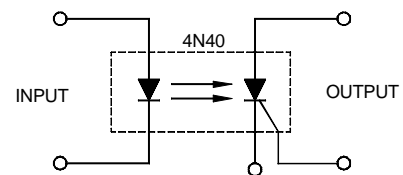
**25W, LOGIC INDICATOR LAMP DRIVER**

The high surge capability and non-reactive input characteristics of the 4N40 allow it to directly couple, without buffers, T<sup>2</sup>L and DTL logic to indicator alarm devices, without danger of introducing noise and logic glitches.



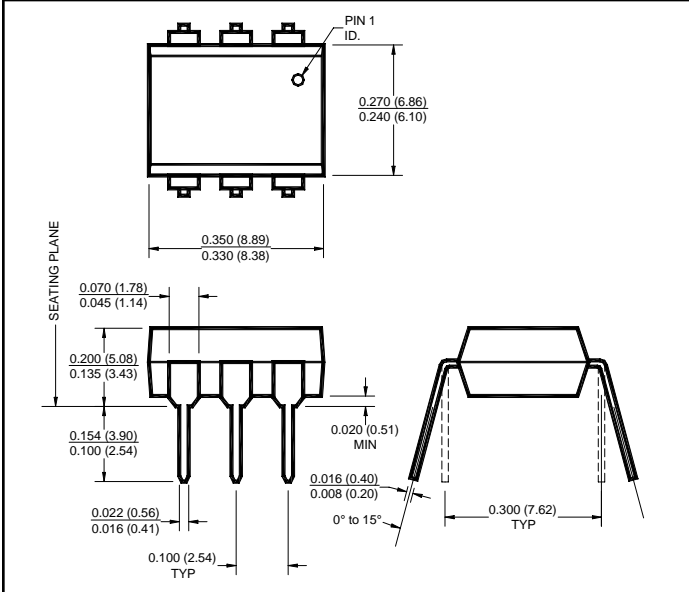
**400V SYMMETRICAL TRANSISTOR COUPLER**

Use of the high voltage PNP portion of the 4N40 provides a 400V transistor capable of conducting positive and negative signals with current transfer ratios of over 1%. This function is useful in remote instrumentation, high voltage power supplies and test equipment. Care should be taken not to exceed the 40mW power dissipation rating when used at high voltages.

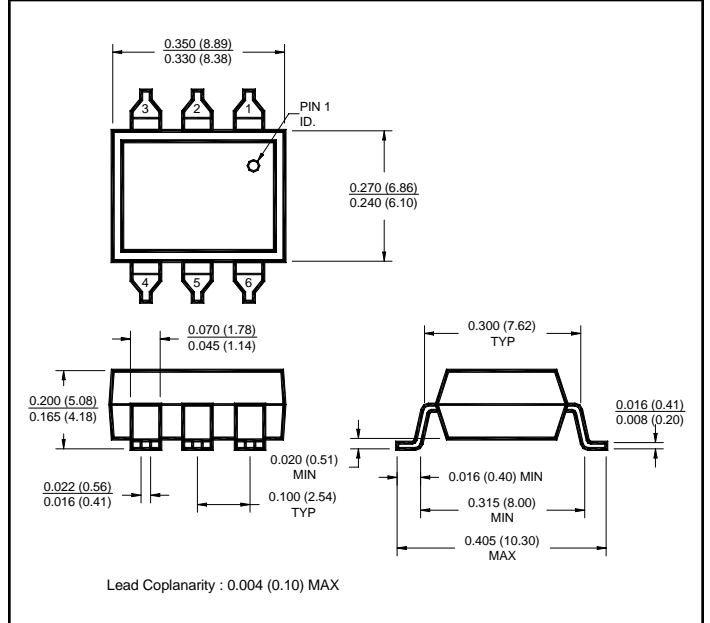


**4N39 4N40**

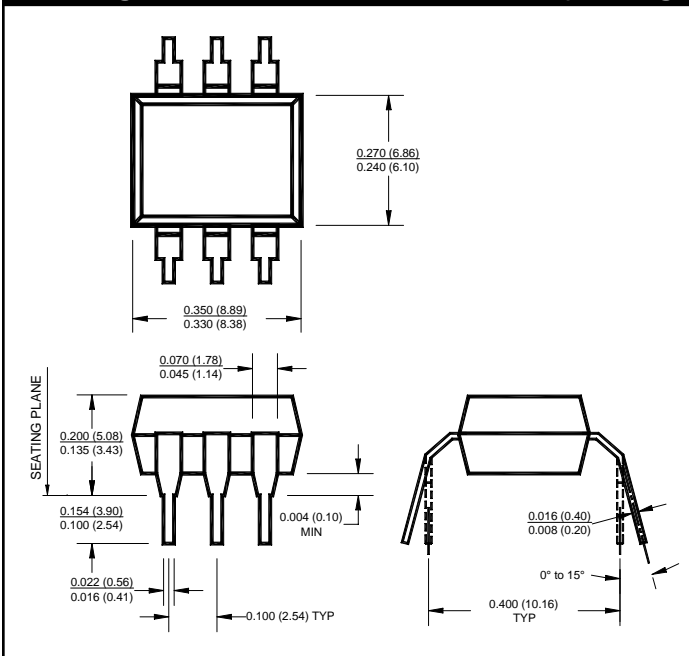
**Package Dimensions (Through Hole)**



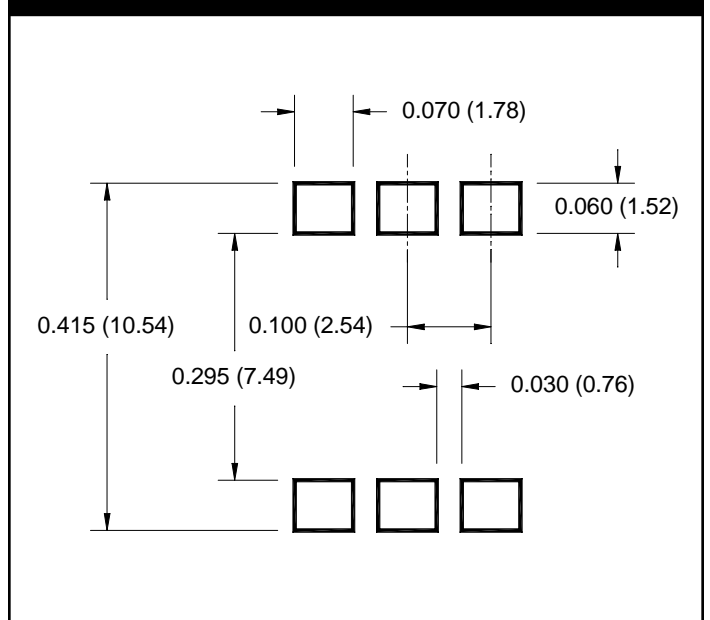
**Package Dimensions (Surface Mount)**



**Package Dimensions (0.4" Lead Spacing)**



**Recommended Pad Layout for Surface Mount Leadform**



**NOTE**

All dimensions are in inches (millimeters)





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