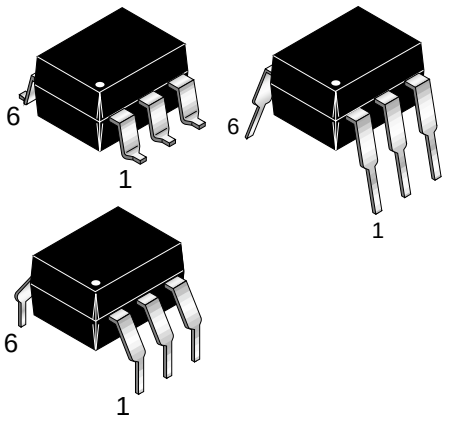
FAIRCHILD
SEMICONDUCTOR®

PHOTOTRANSISTOR OPTOCOUPLERS

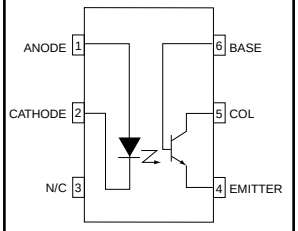
H11AG1 **H11AG2** **H11AG3**

DESCRIPTION

The H11AG series consists of a Gallium-Aluminum-Arsenide IRED emitting diode coupled with a silicon phototransistor in a dual in-line package. This device provides the unique feature of the high current transfer ratio at both low output voltage and low input current. This makes it ideal for use in low power logic circuits, telecommunications equipment and portable electronics isolation applications.



SCHEMATIC



FEATURES

- High efficiency low degradation liquid epitaxial IRED
- Logic level compatible, input and output currents, with CMOS and LS/TTL
- High DC current transfer ratio at low input currents
- Underwriters Laboratory (UL) recognized File #E90700

APPLICATIONS

- CMOS driven solid state reliability
- Telephone ring detector
- Digital logic isolation

ABSOLUTE MAXIMUM RATINGS

Parameters	Symbol	Device	Value	Units
TOTAL DEVICE Storage Temperature	T_{STG}	All	-55 to +150	°C
Operating Temperature	T_{OPR}	All	-55 to +100	°C
Lead Solder Temperature	T_{SOL}	All	260 for 10 sec	°C
Total Device Power Dissipation @ 25°C (LED plus detector)	P_D	All	260	mW
Derate Linearly From 25°C			3.5	mW/°C
EMITTER Continuous Forward Current	I_F	All	50	mA
Reverse Voltage	V_R	All	6	V
Forward Current - Peak (1 µs pulse, 300 pps)	I_F(pk)	All	3.0	A
LED Power Dissipation 25°C Ambient	P_D	All	75	mW
Derate Linearly From 25°C			1.0	mW/°C
DETECTOR Detector Power Dissipation @ 25°C	P_D	All	150	mW
Derate Linearly from 25°C			2.0	mW/°C
Continuous Collector Current		All	50	mA

ELECTRICAL CHARACTERISTICS (T_A = 0-70°C Unless otherwise specified.)

INDIVIDUAL COMPONENT CHARACTERISTICS

Parameters	Test Conditions	Symbol	Device	Min	Typ	Max	Units
EMITTER							
Input Forward Voltage	I_F = 1 mA	V_F	All			1.5	V
Reverse Leakage Current	V_R = 5 V, T_A = 25°C	I_R	All			10	µA
	V_R = 5 V, T_A = 70°C	I_R	All			100	µA
Capacitance	V = 0, f = 1.0 MHz	C_J	All			100	pF
DETECTOR							
Breakdown Voltage							
Collector to Emitter	I_C = 1.0 mA, I_F = 0	BV_{CEO}	All	30			V
Collector to Base	I_C = 100 µA, I_F = 0	BV_{CBO}	All	70			V
Emitter to Collector	I_C = 100 µA, I_F = 0	BV_{ECO}	All	7			V
Leakage Current							
Collector to Emitter	V_{CE} = 10 V, I_F = 0	I_{CEO}	All		5	10	µA
Capacitance	V_{CE} = 10 V, f = 1 MHz	C_{CE}	All		2		pF

ISOLATION CHARACTERISTICS

Parameters	Test Conditions	Symbol	Min	Typ	Max	Units
Input-Output Isolation Voltage	$I_{I-O} \leq 1$ µA, t = 1 min.	V_{ISO}	5300			Vac(rms)

TRANSFER CHARACTERISTICS (T_A = 25°C Unless otherwise specified.)

DC Characteristics	Test Conditions	Symbol	Device	Min	Typ	Max	Units
Current Transfer Ratio	I_F = 1 mA, V_{CE} = 5 V	CTR	H11AG1	300			%
			H11AG2	200			
			H11AG3	100			
	I_F = 1 mA, V_{CE} = 0.6 V	CTR	H11AG1	100			
			H11AG2	50			
			H11AG3	20			
	I_F = 0.2 mA, V_{CE} = 1.5 V	CTR	H11AG1	100			
			H11AG2	50			
Saturation Voltage	I_F = 2.0 mA, I_C = 0.5 mA	$V_{CE(SAT)}$	All			.40	V
AC Characteristics	**Test Conditions**	**Symbol**	**Device**	**Min**	**Typ**	**Max**	**Units**
Non-Saturated Switching Times							
Turn-On Time	R_L = 100 Ω, I_F = 1 mA, V_{CC} = 5 V	t_{on}	All		5		µS
Turn-Off Time	R_L = 100 Ω, I_F = 1 mA, V_{CC} = 5 V	t_{off}	All		5		µS

Figure 1. LED Forward Voltage vs. Forward Current

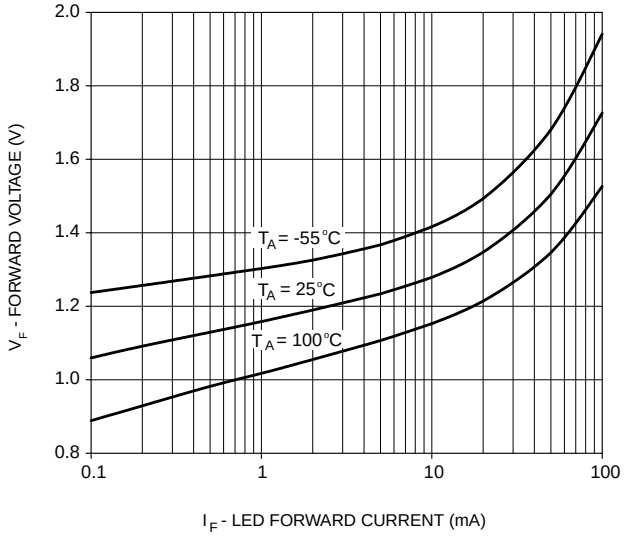


Figure 2. Normalized Current Transfer Ratio vs. Forward Current

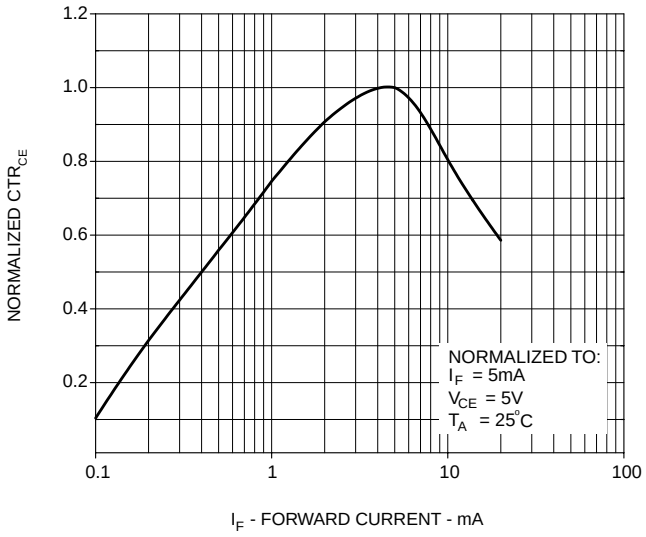


Figure 3. Normalized CTR vs. Temperature

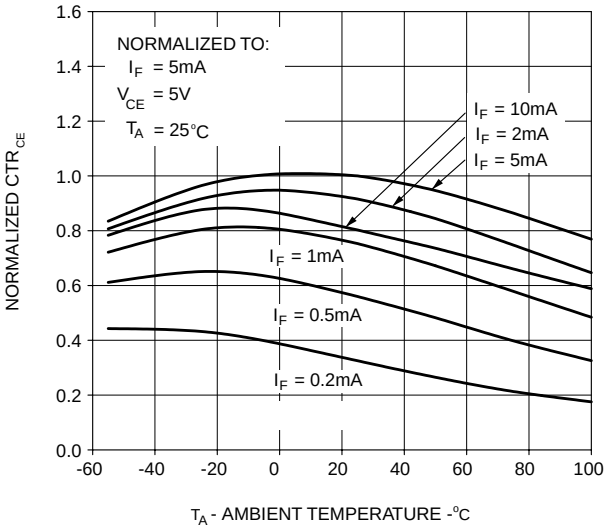


Figure 4. Normalized Collector vs. Collector - Emitter Voltage

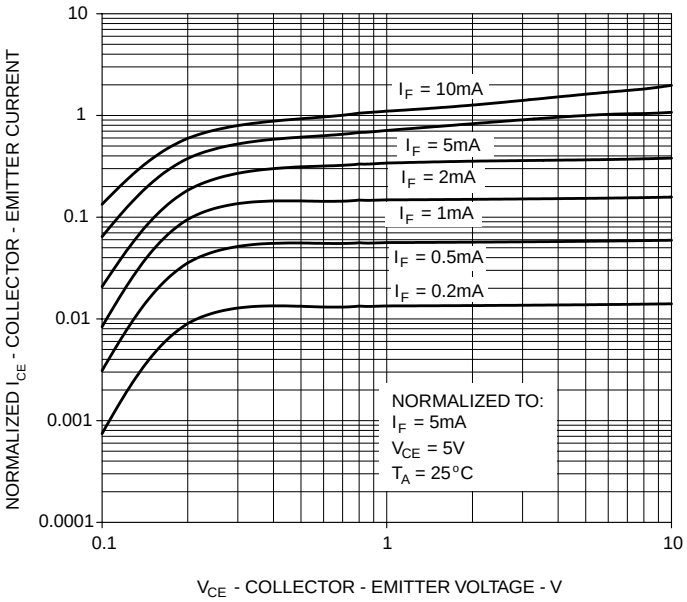


Figure 5. Normalized Collector Base Photocurrent Ratio vs. Forward Current

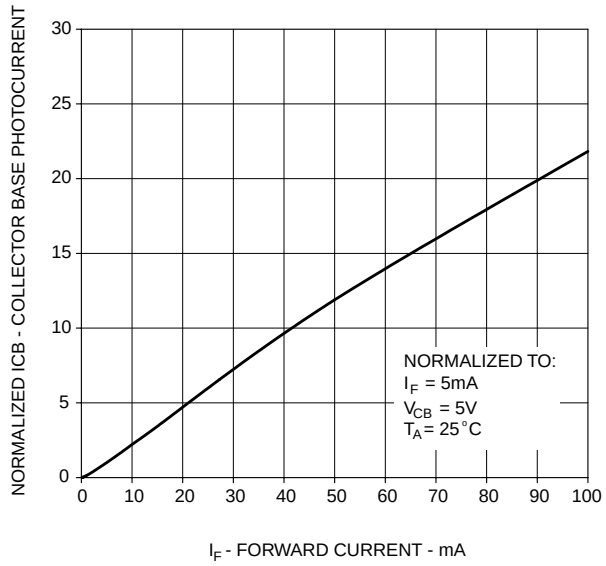


Figure 6. Normalized Collector - Base Current vs. Temperature

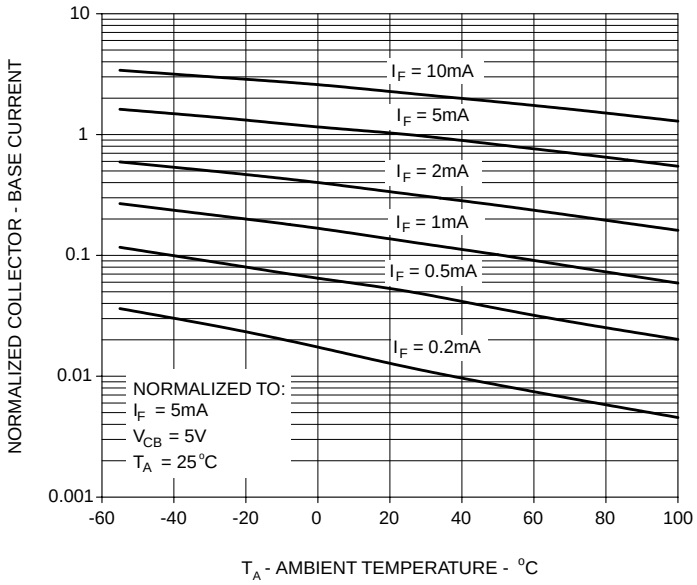
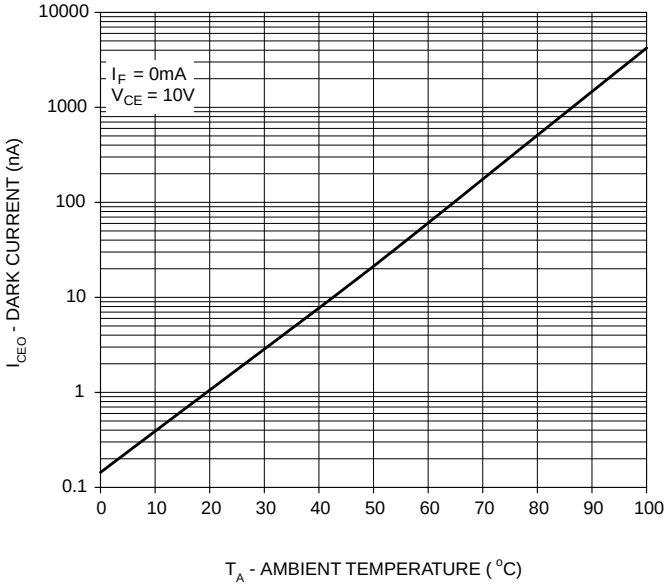


Figure 7. Collector-Emitter Dark Current vs. Ambient Temperature



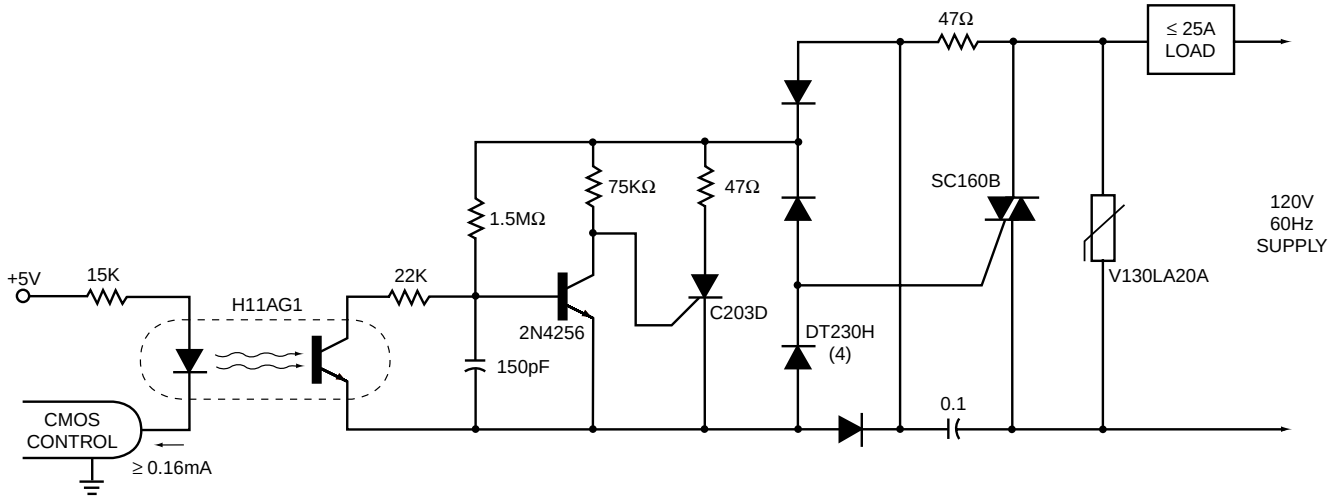
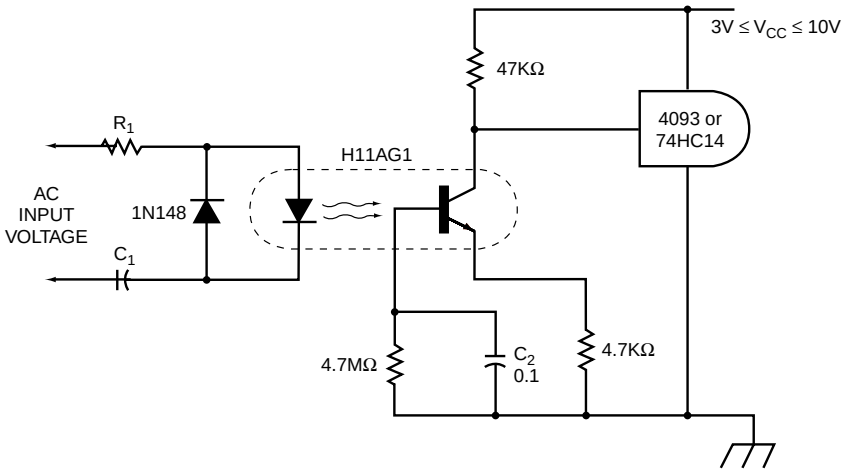


Figure 8. CMOS Input, 3KW, Zero Voltage Switching Solid State Relay

The H11AG1's superior performance at low input currents allows standard CMOS logic circuits to directly operate a 25A solid state relay. Circuit operation is as follows: power switching is provided by the SC160B, 25A triac. Its gate is controlled by the C203B via the DT230H rectifier bridge. The C203B turn-on is inhibited by the 2N4256 when line voltage is above 12V and/or the H11AG is off. False trigger and dv/dt protection are provided by the combination of the MOV® varistor and RC snubber network.



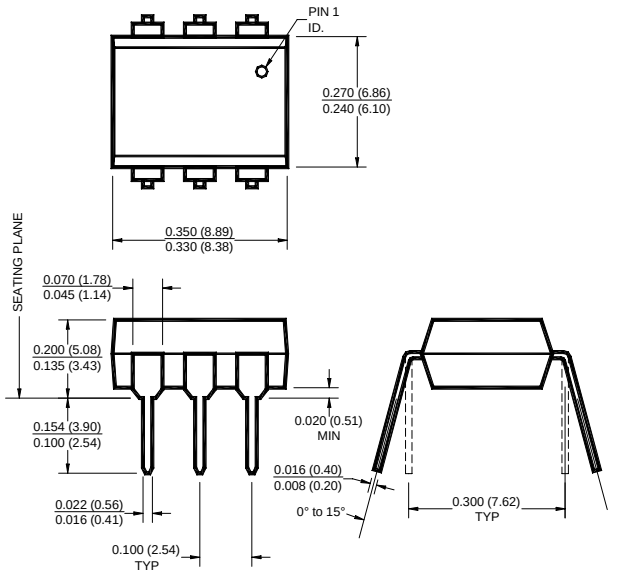
INPUT	R_1	C_1	Z
40-90 VRMS 20 Hz	75 K 1/10 W	0.1 µF 100 V	109K
95-135 VRMS 60 Hz	180 K 1/10 W	12 ηF 200 V	285K
200-280 VRMS 50/60 Hz	390 K 1/4 W	6.80 ηF 400 V	550K

DC component of input voltage is ignored due to C1

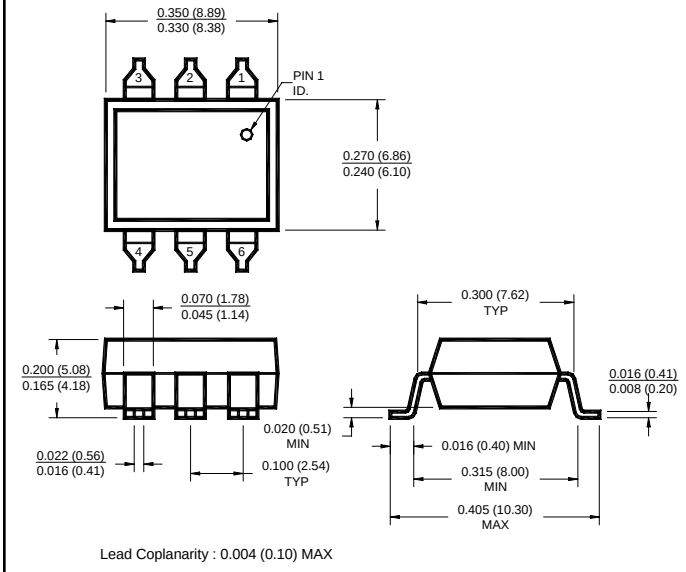
Figure 9. Telephone Ring Detector/A.C. Line CMOS Input Isolator

The H11AG1 uses less input power than the neon bulb traditionally used to monitor telephone and line voltages. Additionally. response time can be tailored to ignore telephone dial tap, switching transients and other undesired signals by modifying the value of C2. The high impedance to line voltage also can simply board layout spacing requirements.

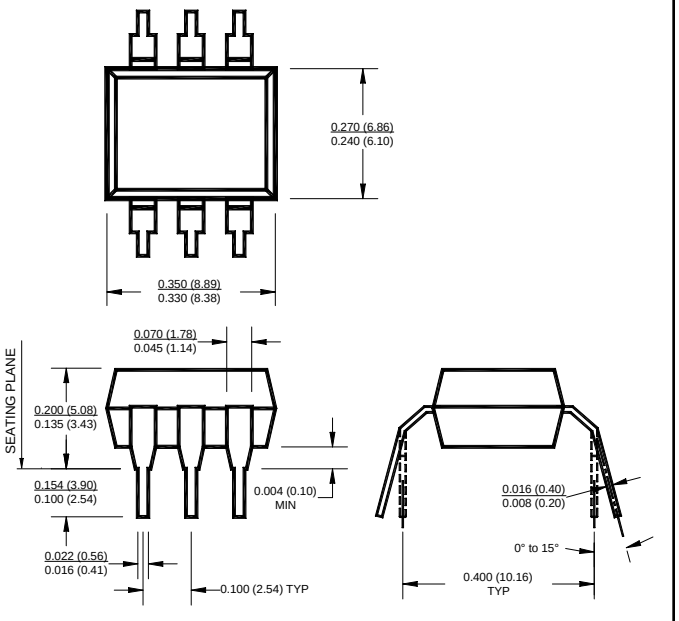
Package Dimensions (Through Hole)



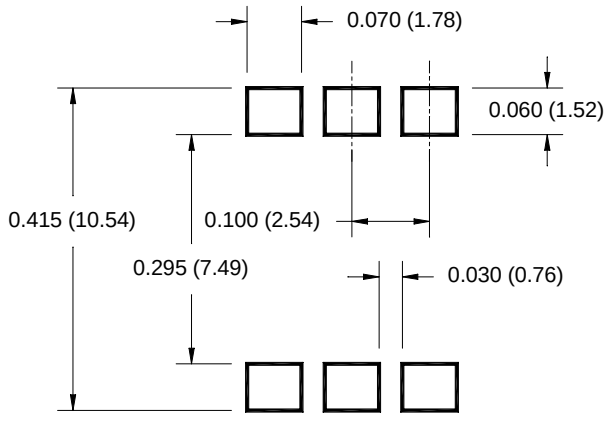
Package Dimensions (Surface Mount)



Package Dimensions (0.4”Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform

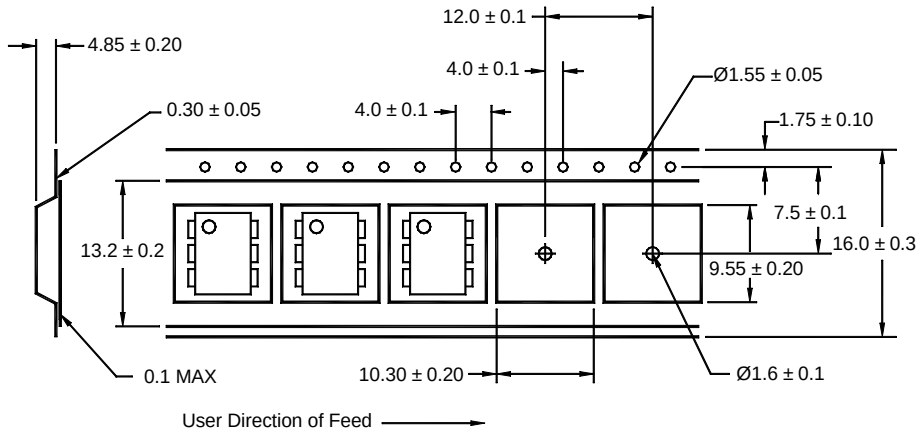


NOTE

All dimensions are in inches (millimeters)

Option	Order Entry Identifier	Description
S	.S	Surface Mount Lead Bend
SD	.SD	Surface Mount; Tape and reel
W	.W	0.4” Lead Spacing
300	.300	VDE 0884
300W	.300W	VDE 0884, 0.4” Lead Spacing
3S	.3S	VDE 0884, Surface Mount
3SD	.3SD	VDE 0884, Surface Mount, Tape & Reel

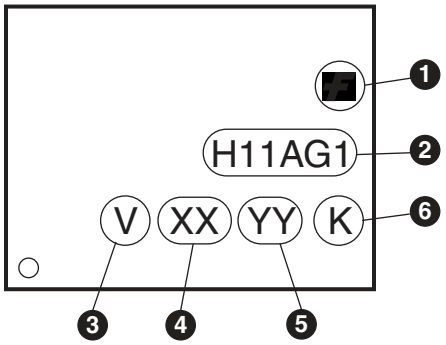
Carrier Tape Specifications (“D” Taping Orientation)



NOTE

All dimensions are millimeters

MARKING INFORMATION



Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	Two digit year code, e.g., ‘03’
5	Two digit work week ranging from ‘01’ to ‘53’
6	Assembly package code

Reflow Profile (Black Package, No Suffix)