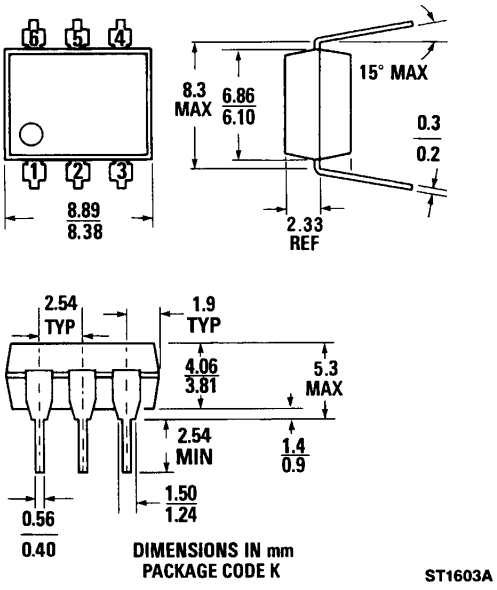
FAIRCHILD
SEMICONDUCTOR™

PHOTO FET OPTOCOUPLERS

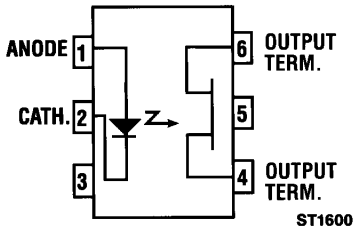
H11F1 H11F2 H11F3

PACKAGE DIMENSIONS



DIMENSIONS IN mm
PACKAGE CODE K

ST1603A



ST1600

Equivalent Circuit

DESCRIPTION

The H11F series has a gallium-aluminum-arsenide infrared emitting diode coupled to a symmetrical bilateral silicon photodetector. The detector is electrically isolated from the input and performs like an ideal isolated FET designed for distortion-free control of low level ac and dc analog signals. The H11F series devices are mounted in dual in-line packages.

FEATURES

As a remote variable resistor—
- ≤100 Ω to ≥300 MΩ
- ≥99.9% linearity
- ≤15 pF shunt capacitance
- ≥100 GΩ I/O isolation resistance

As an analog switch—
- Extremely low offset voltage
- 60 V pk-pk signal capability
- No charge injection or latchup
- t_{on}, t_{off} ≤15 μs
- Underwriters Laboratory (UL) recognized—File #E90700

APPLICATIONS

As a variable resistor—
- Isolated variable attenuator
- Automatic gain control
- Active filter fine tuning/band switching

As an analog switch—
- Isolated sample and hold circuit
- Multiplexed, optically isolated A/D conversion

ABSOLUTE MAXIMUM RATINGS

TOTAL PACKAGE

Storage temperature ..... −55°C to 150°C
Operating temperature ..... −55°C to 100°C
Lead solder temperature ..... 260°C for 10 sec

INPUT DIODE

Power dissipation (25°C ambient) ..... 100 mW
Derate linearly (above 25°C) ..... 1.33 mW/°C
Continuous forward current ..... 60 mA
Peak forward current (10μs pulse, 1% duty cycle) . 1 A
Reverse voltage ..... 6 V

DETECTOR

Power dissipation (at 25°C ambient) ..... 300 mW
Derate linearly (above 25°C ambient) ..... 4 mW/°C
Breakdown voltage (H11F1, H11F2) ..... ±30 V
Breakdown voltage (H11F3) ..... ±15 V
Continuous detector current ..... ±100 mA

ELECTRICAL CHARACTERISTICS (T_A=25° Unless Otherwise Specified)

INDIVIDUAL COMPONENT CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
INPUT DIODE						
Forward voltage	V_F		1.1	1.75	V	I_F=16 mA
Reverse current	I_R			10	μA	V_R=5 V
Capacitance	C_J		50		pF	V=0, f=1 MHz
OUTPUT DETECTOR (Either polarity)						
Breakdown voltage (H11F1, H11F2)	BV_{46}	30			V	I_C=10 μA, I_F=0
(H11F3)	BV_{46}	15			V	I_C=10 μA, I_F=0
Off-state dark current	I_{46}			50	nA	V_{46}=15 V, I_F=0
	I_{46}			50	μA	V_{46}=15 V, I_F=0, T_A=100°C
Off-state resistance	r_{46}	300			MΩ	V_{46}=15 V, I_F=0
Capacitance	C_{46}			15	pF	V_{46}=0, I_F=0, f=1 MHz

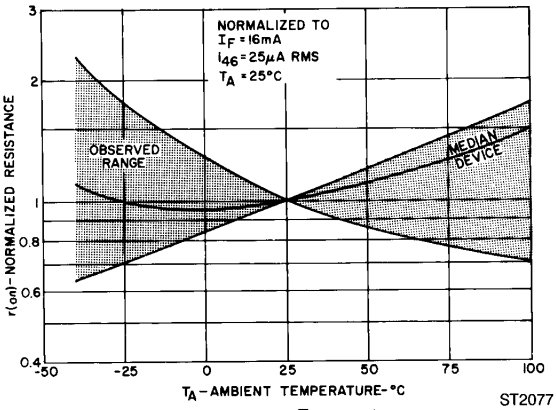
TRANSFER CHARACTERISTICS

CHARACTERISTIC		SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
On-state resistance	(H11F1)	r_{46}			200	Ω	I_F=16 mA, I_{46}=100 μA
	(H11F2)	r_{46}			330	Ω	I_F=16 mA, I_{46}=100 μA
	(H11F3)	r_{46}			470	Ω	I_F=16 mA, I_{46}=100 μA
On-state resistance	(H11F1)	r_{64}			200	Ω	I_F=16 mA, I_{64}=100 μA
	(H11F2)	r_{64}			330	Ω	I_F=16 mA, I_{64}=100 μA
	(H11F3)	r_{64}			470	Ω	I_F=16 mA, I_{64}=100 μA
Turn-on time		t_{on}			25	μs	I_F=16 mA, V_{46}=5 V, R_L=50 Ω
Turn-off time		t_{off}			25	μs	I_F=16 mA, V_{46}=5 V, R_L=50 Ω
Resistance, non-linearity and asymmetry					0.1	%	I_F=16 mA, R_L=50 Ω, V_{46}=5 V

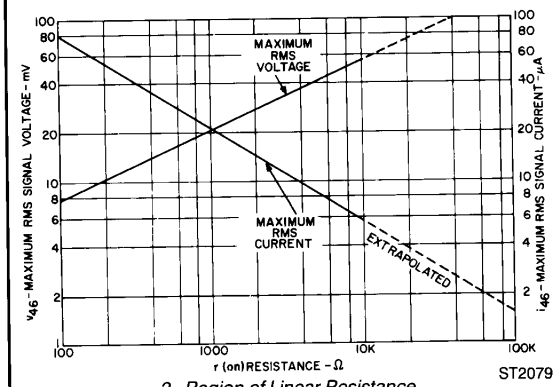
ISOLATION CHARACTERISTICS

Surge isolation voltage	V_{ISO}	7500		V_{Peak}	1 Minute
Surge isolation voltage	V_{ISO}	5300		V_{RMS}	1 Minute
Isolation resistance (input to output)		10^{11}		Ω	V_{IO}=0, f=1 MHz
Input to output capacitance			2	pF	V_{IO}=0, f=1 MHz

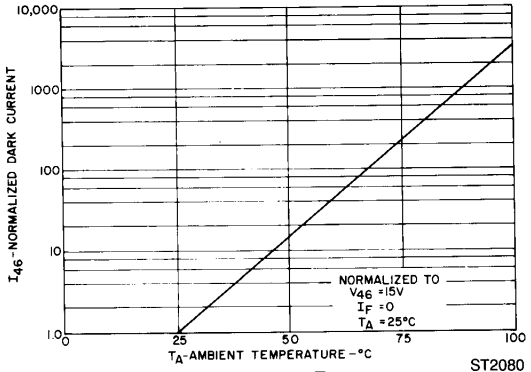
TYPICAL CHARACTERISTICS



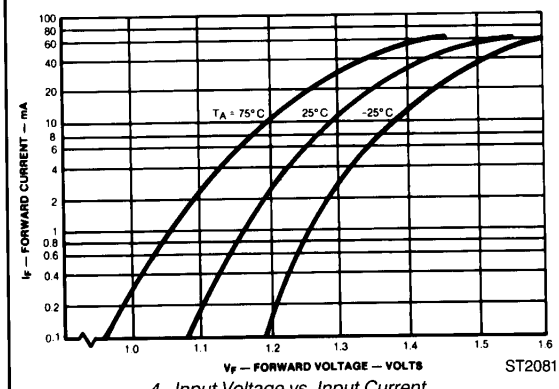
1. Resistance vs. Temperature



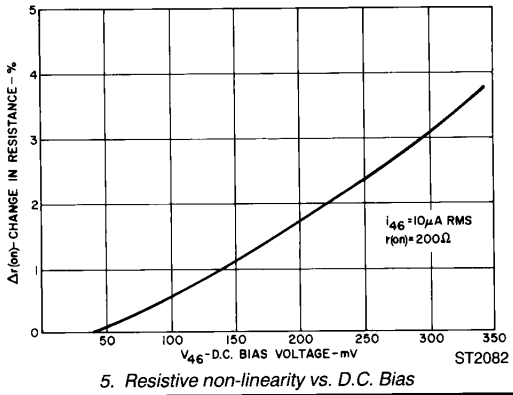
2. Region of Linear Resistance



3. Off-State Current vs. Temperature



4. Input Voltage vs. Input Current

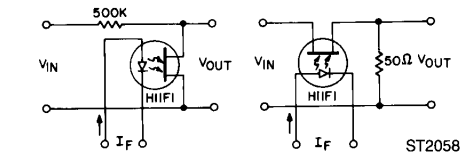


5. Resistive non-linearity vs. D.C. Bias

TYPICAL APPLICATIONS

AS A VARIABLE RESISTOR

ISOLATED VARIABLE ATTENUATORS



ST2058

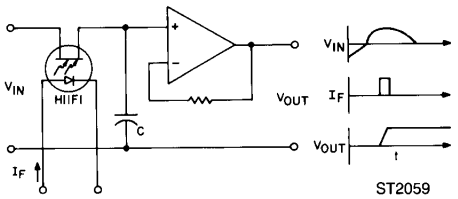
LOW FREQUENCY
@ 10KHz DYNAMIC RANGE ≈ 70db FOR $0 \leq I_F \leq 30mA$

HIGH FREQUENCY
@ 1MHz DYNAMIC RANGE ≈ 50db FOR $0 \leq I_F \leq 30mA$

Distortion free attenuation of low level A.C. signals is accomplished by varying the IRED current, I_F. Note the wide dynamic range and absence of coupling capacitors; D.C. level shifting or parasitic feedback to the controlling function.

AS AN ANALOG SIGNAL SWITCH

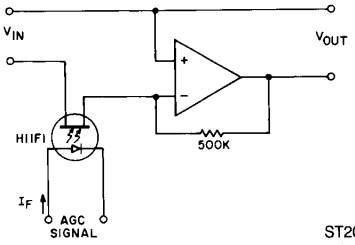
ISOLATED SAMPLE AND HOLD CIRCUIT



ST2059

Accuracy and range are improved over conventional FET switches because the H11F has no charge injection from the control signal. The H11F also provides switching of either polarity input signal up to 30V magnitude.

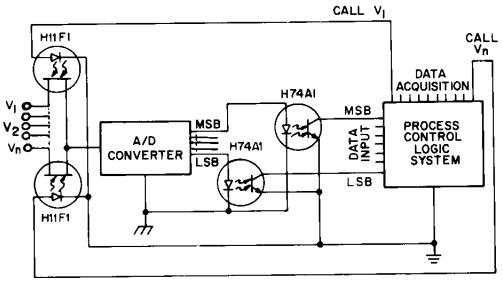
AUTOMATIC GAIN CONTROL



ST2060

This simple circuit provides over 70db of stable gain control for an AGC signal range of from 0 to 30mA. This basic circuit can be used to provide programmable fade and attack for electronic music.

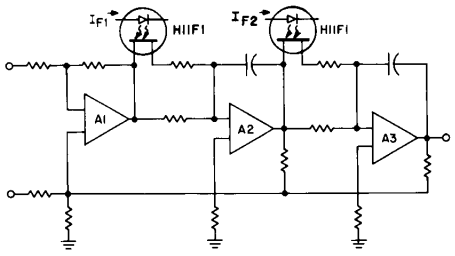
MULTIPLEXED, OPTICALLY-ISOLATED A/D CONVERSION



ST2061

The optical isolation, linearity and low offset voltage of the H11F allows the remote multiplexing of low level analog signals from such transducers as thermocouplers, Hall effect devices, strain gauges, etc. to a single A/D converter.

ACTIVE FILTER FINE TUNING/BAND SWITCHING

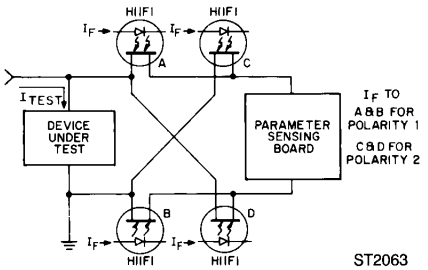


I_{F1} ADJUSTS f_1, I_{F2} ADJUSTS f_2

ST2062

The linearity of resistance and the low offset voltage of the H11F allows the remote tuning or band-switching of active filters without switching glitches or distortion. This schematic illustrates the concept, with current to the H11F1 IRED's controlling the filter's transfer characteristic.

TEST EQUIPMENT – KELVIN CONTACT POLARITY



ST2063

In many test equipment designs the auto polarity function uses reed relay contacts to switch the Kelvin Contact polarity. These reeds are normally one of the highest maintenance cost items due to sticking contacts and mechanical problems. The totally solid-state H11F eliminates these troubles while providing faster switching.

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