



## GF4146

CMOS IC

### GROUND FAULT INTERRUPTER

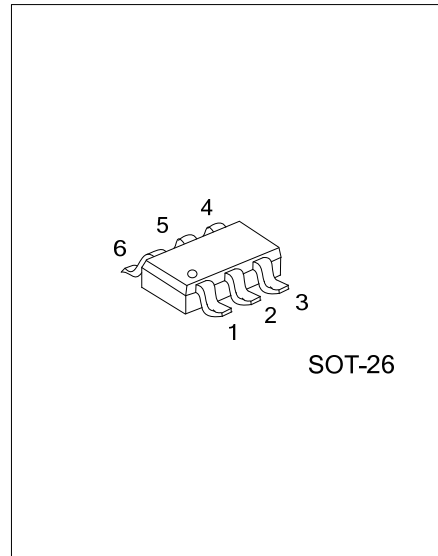
#### DESCRIPTION

The UTC **GF4146** is a two-wire low-power controller for Residual Current Devices (RCD) and AC outlet Appliance Leakage Circuit Interrupters (ALCI). The UTC **GF4146** detects hazardous grounding conditions and open circuits the line before a harmful shock occurs.

Internally, the UTC **GF4146** contains a diode rectifier, 12V shunt regulator using a precision temperature-compensated bandgap reference, precision low  $V_{OS}$  offset-sense amplifier, time delay noise filter, window-detection comparators, and a SCR driver. With the addition of a minimum number of external components, the UTC **GF4146** detects and protects against a hot-wire-to-ground fault.

The UTC **GF4146** circuitry has a built-in rectifier and shunt regulator that operates with a low quiescent current. This allows for a high-value, low-wattage-series supply resistor.

The internal temperature compensated shunt regulator, sense amplifier, and bias circuitry provide for precision ground-fault detection. The low  $V_{OS}$  offset-sense amplifier allows direct coupling of the sense coil to the amplifier's feedback signal. This eliminates the large 50/60Hz AC-coupling capacitor. The internal delay filter rejects high-frequency noise spikes common with inductive loads. This decreases false nuisance tripping. The internal SCR driver is temperature compensated and designed to satisfy the current requirements for a wide selection of external SCRs.



#### FEATURES

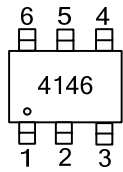
- \* For Two-Wire ALCI and RCD Applications
- \* Precision Sense Amplifier and Bandgap Reference
- \* Built-in AC Rectifier
- \* Direct DC Coupled to Sense Coil
- \* Low-Voltage SCR Disable
- \* Adjustable Sensitivity
- \* Built-in Noise Filter
- \* SCR Gate Driver
- \* Minimum External Components
- \* Ideal for 120V or 220V Systems

#### ORDERING INFORMATION

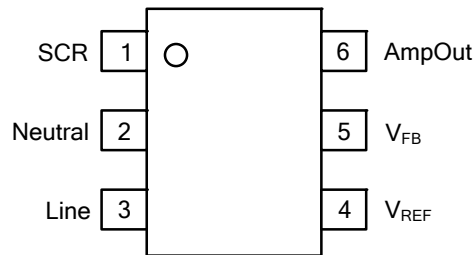
Ordering Number		Package	Packing
Lead Free	Halogen Free		
GF4146L-AG6-R	GF4146G-AG6-R	SOT-26	Tape Reel

<p>GF414G-AG6-R</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p>	<p>(1) R: Tape Reel (2) AG6: SOT-26 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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■ MARKING



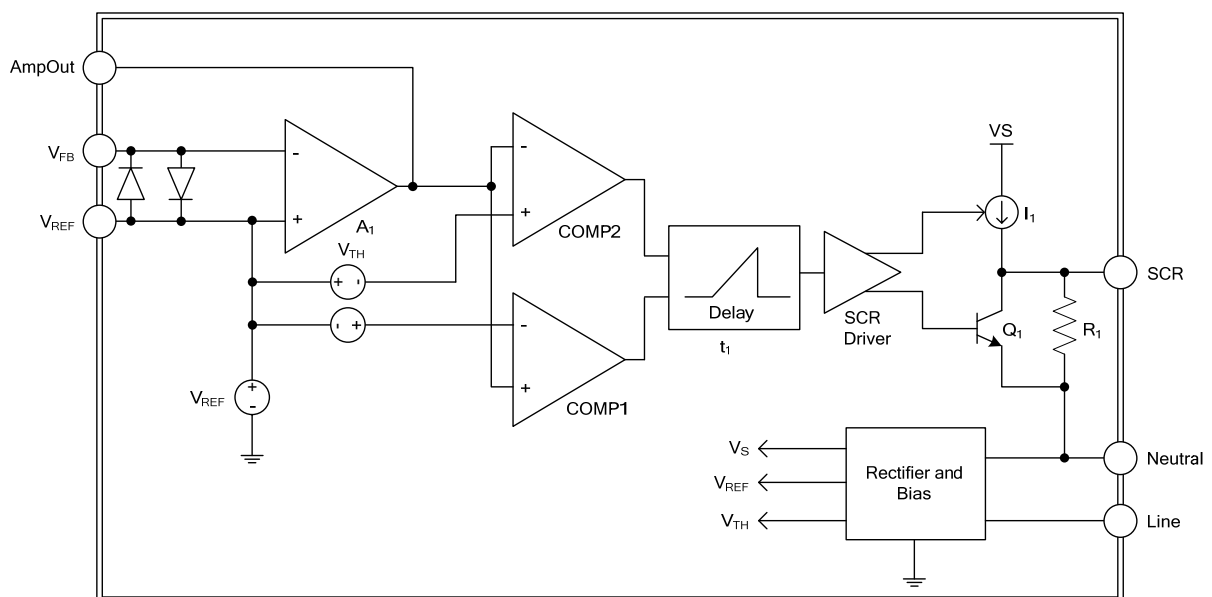
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	SCR	Gate drive for external SCR
2	Neutral	Supply input
3	Line	Supply input
4	$V_{REF}$	Non-inverting input for current-sense amplifier
5	$V_{FB}$	Inverting input for current-sense amplifier
6	AmpOut	External resistor sets the $I_{fault}$ sensitivity threshold connected to $V_{FB}$

■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATING

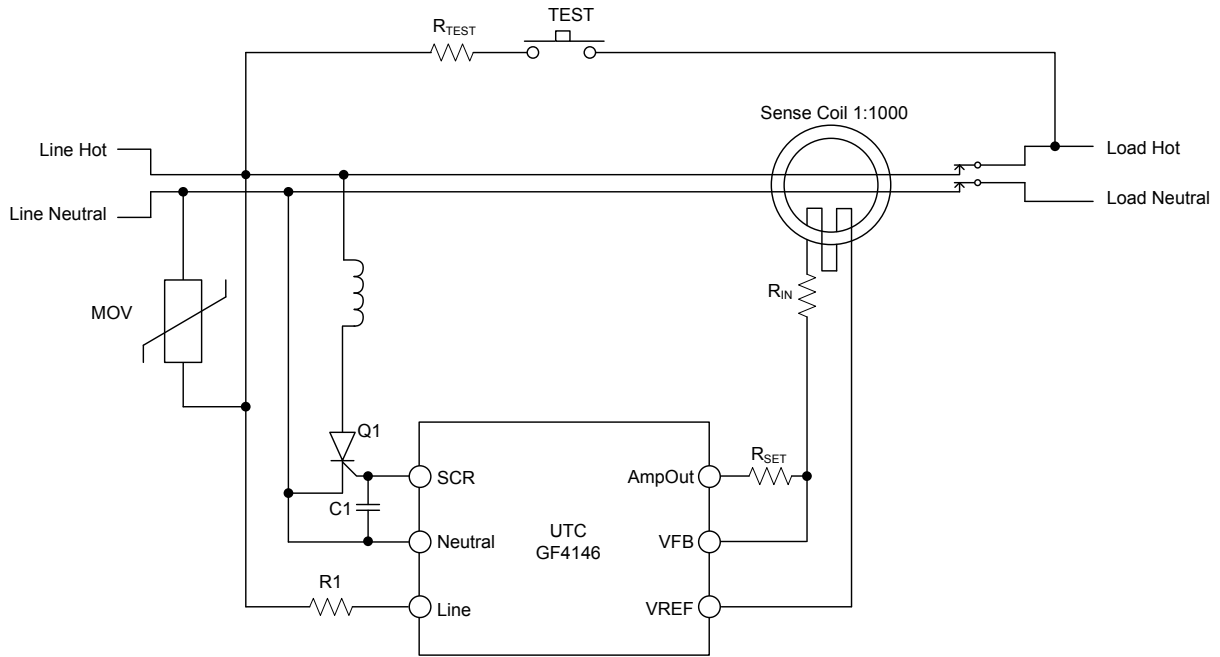
PARAMETER	SYMBOL	RATINGS	UNIT
Supply Current	$I_{CC}$	15	mA
Supply Voltage	All other pins	$V_{CC}$	16
			-0.8 ~ 15
Storage Temperature Range	$T_{STG}$	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

## ■ ELECTRICAL CHARACTERISTICS ( $I_{shunt}=1mA$ , $T_A=25^\circ C$ , Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Supply Shunt Regulator Voltage	$V_{REG}$	Line to Neutral	12.2	12.7	13.2	V
		Line to Neutral, $I_{shunt}=-2mA$	-0.9	-0.7		
Quiescent Current	$I_Q$	Line to Neutral=10V	350	450	550	$\mu A$
Reference Voltage	$V_{REF}$	$V_{REF}$ to Neutral	5.8	6.0	6.2	V
Trip Threshold	$V_{TH}$	AmpOut to $V_{REF}$	3.4	3.5	3.6	V
Amplifier Offset	$V_{OS}$	$R_{SET}=511K\Omega$ , $R_{IN}=500\Omega$	-450	0	450	$\mu V$
Amplifier Positive Voltage Swing	$V_{SW}$	AmpOut to $V_{REF}$ , $I_{FAULT}=10\mu A$	4.0			V
Amplifier Negative Voltage Swing	$V_{SW}$	$V_{REF}$ to AmpOut, $I_{FAULT}=-10\mu A$	4.0			V
Amplifier Current Sink	$I_{SINK}$	AmpOut= $V_{REF}+3V$ , $V_{FB}=V_{REF}+100mV$	400			$\mu A$
Amplifier Current Source	$I_{SRL}$	AmpOut= $V_{REF}-3V$ , $V_{FB}=V_{REF}-100mV$	400			$\mu A$
Delay Filter	$t_d$	Delay from COMP1 Trip to SCR, Low to High	1	1.35	1.7	ms
SCR Output Resistance	$R_{OUT}$	SCR to Neutral=250mV, AmpOut= $V_{REF}$		0.5	1.0	K $\Omega$
SCR Output Voltage	$V_{OUT}$	SCR to Neutral, AmpOut= $V_{REF}$		1	10	mV
		SCR to Neutral, AmpOut= $V_{REF}+4V$	2.5			V
SCR Output Current	$I_{OUT}$	SCR to Neutral=1V, AmpOut= $V_{REF}+4V$	350	600		$\mu A$

## ■ TYPICAL APPLICATION CIRCUIT



120/220V<sub>AC</sub> ALCI Application (Note 2)

**Typical Values**

R1: 91K $\Omega$  (Wattage Determined by Maximum V<sub>AC</sub>)

R<sub>TEST</sub>: 15K $\Omega$

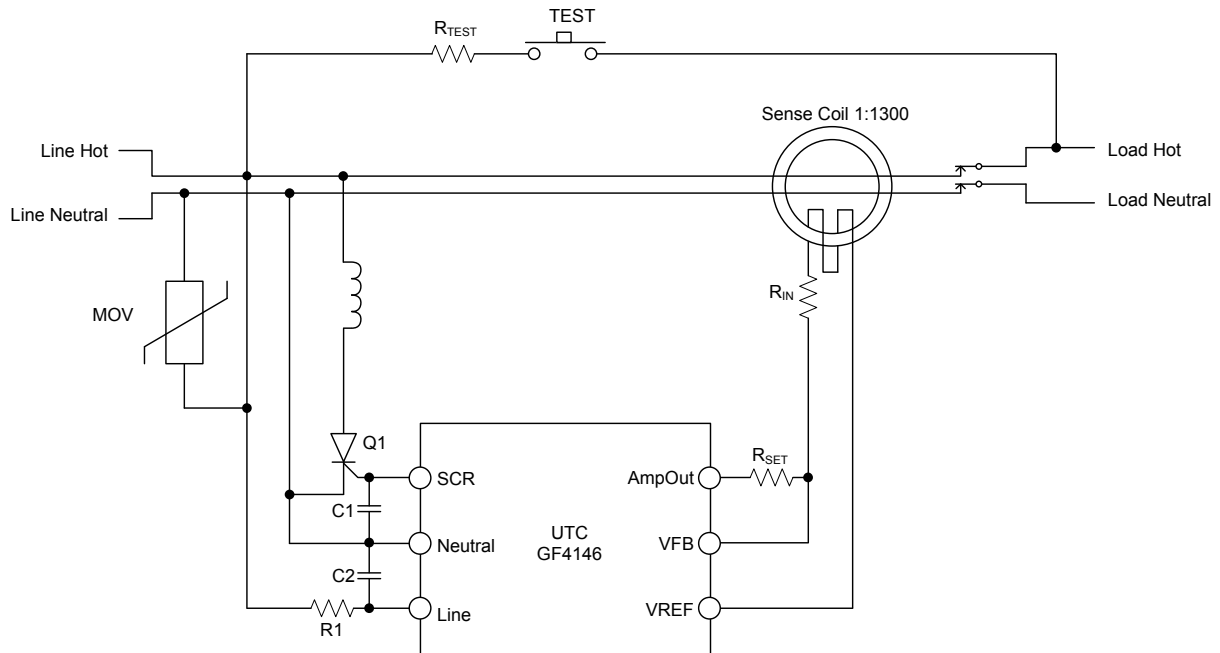
R<sub>SET</sub>: 511K $\Omega$  (Note 1)

R<sub>IN</sub>: 470 $\Omega$

C1: 22nF

Notes: 1. Value depends on sense-coil characteristics and application (value chosen for 5mA trip threshold).

2. Contract Fairchild for best application practices for nuisance tripping rejection.



220V<sub>AC</sub> RCD Application (Note 4)

**Typical Values**

R1: 174K $\Omega$  (Wattage Determined by Maximum V<sub>AC</sub>)

R<sub>TEST</sub>: 15K $\Omega$

R<sub>SET</sub>: 324K $\Omega$  (Note 3)

R<sub>IN</sub>: 470 $\Omega$

C1: 22nF

C2: 10nF

Notes: 3. Value depends on sense-coil characteristics and application (value chosen for 10mA trip threshold).

4. Contract Fairchild for best application practices for nuisance tripping rejection.

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