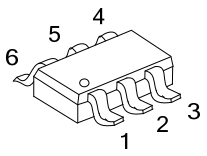
GF4146

CMOS IC

GROUND FAULT INTERRUPTER



SOT-26

■ 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
* Meets UL 943B Requirements
* Ideal for 120V or 220V Systems

■ ORDERING INFORMATION

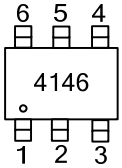
Ordering Number		Package	Packing
Lead Free	Halogen Free		
GF4146L-AG6-R	GF4146G-AG6-R	SOT-26	Tape Reel

GF414G-AG6-R

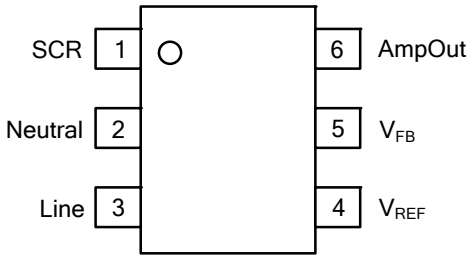
(1)Packing Type
(2)Package Type
(3)Green Package

(1) R: Tape Reel
(2) AG6: SOT-26
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



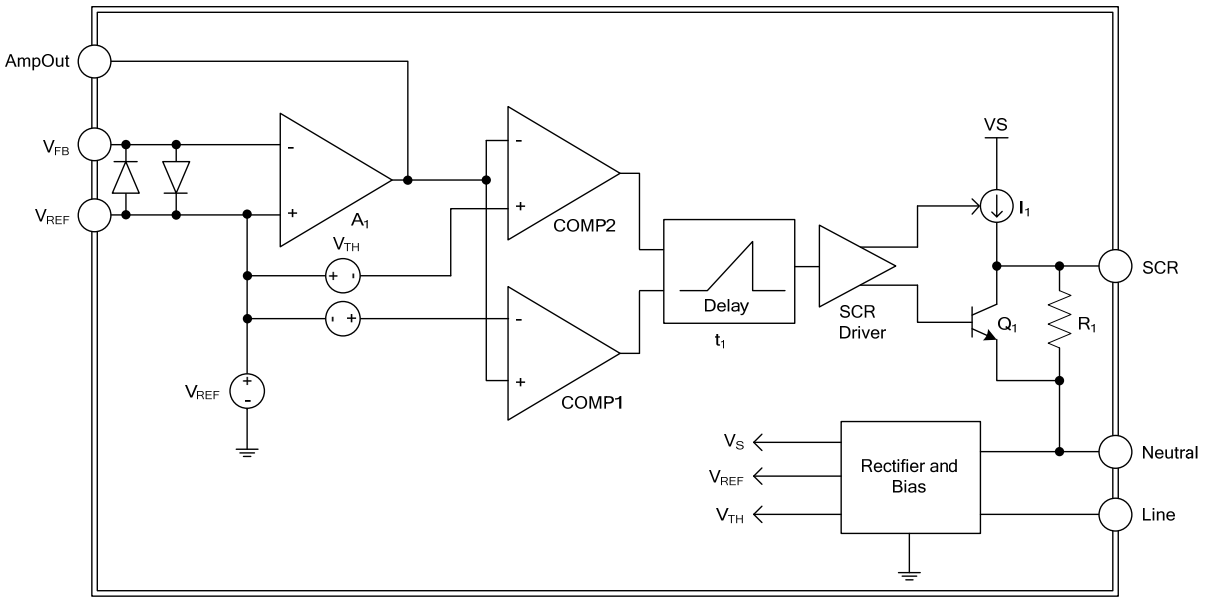
■ PIN CONFIGURATION



■ 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

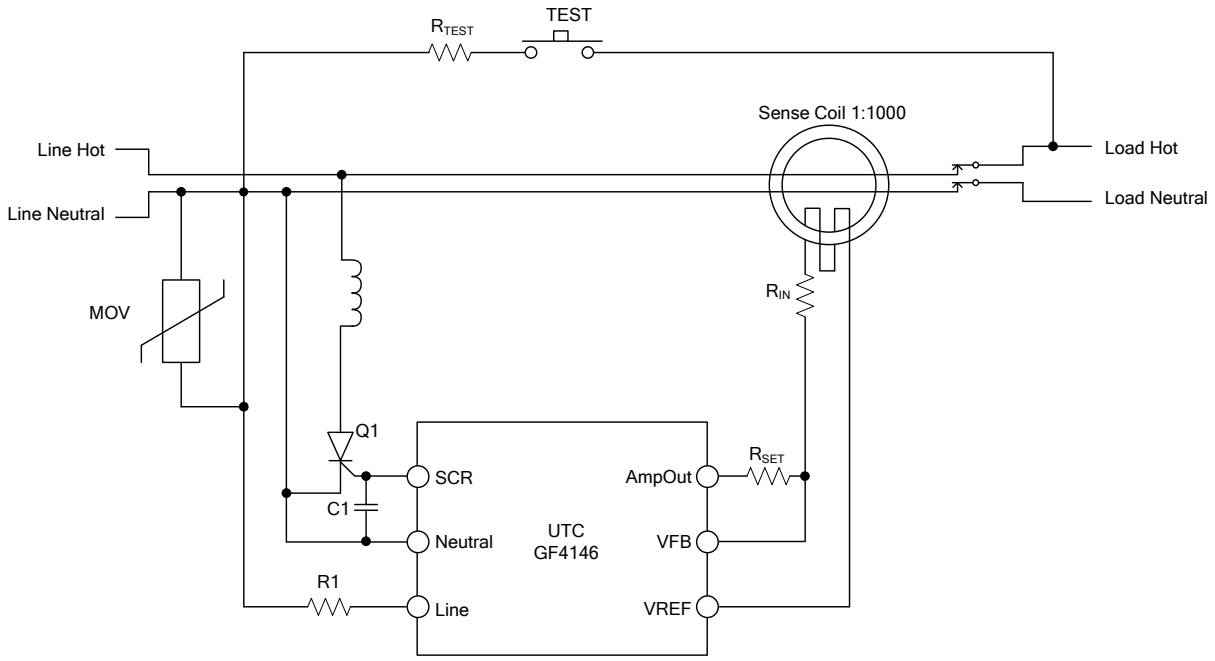
PARAMETER		SYMBOL	RATINGS	UNIT
Supply Current		I_{CC}	15	mA
Supply Voltage		V_{CC}	16	V
	All other pins		-0.8 ~ 15	V
Storage Temperature Range		T_{STG}	-65 ~ +150	°C

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°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	400	450	μA
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}=511KΩ, R_{IN}=500Ω	-450	0	450	μV
Amplifier Input Offset	I_{OS}	Design Value	-50	0	50	nA
Amplifier DC Gain	G	Design Value		100		dB
Amplifier Gain Bandwidth (Note 5)	f_{GBW}	Design Value		1.5		MHz
Amplifier Positive Voltage Swing	V_{SW+}	AmpOut to V_{REF}, I_{FAULT}=10μA	4.0			V
Amplifier Negative Voltage Swing	V_{SW-}	V_{REF} to AmpOut, I_{FAULT}=-10μA	4.0			V
Amplifier Current Sink	I_{SINK}	AmpOut=V_{REF}+3V, V_{FB}=V_{REF}+100mV	400			μA
Amplifier Current Source	I_{SRL}	AmpOut=V_{REF}-3V, V_{FB}=V_{REF}-100mV	400			μA
Delay Filter	t_d	Delay from COMP1 Trip to SCR, Low to High	0.75	1.00	1.25	ms
SCR Output Resistance	R_{OUT}	SCR to Neutral=250mV, AmpOut=V_{REF}		0.5	1.0	KΩ
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	500		μA

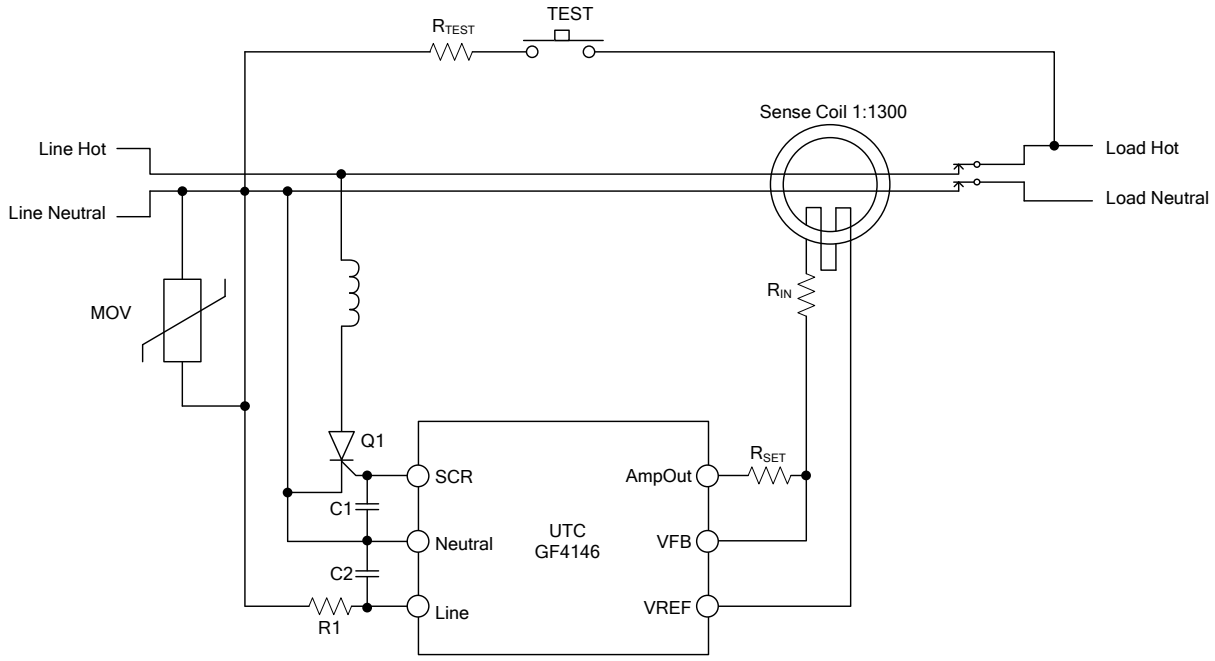
■ TYPICAL APPLICATION CIRCUIT



120/220V_{AC} ALCI Application (Note 2)

Typical Values
R1: 91KΩ (Wattage Determined by Maximum V_{AC})
R_{TEST}: 15KΩ R_{IN}: 470Ω
R_{SET}: 511KΩ (Note 1) 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_{AC} RCD Application (Note 4)

Typical Values
R1: 174KΩ (Wattage Determined by Maximum V_{AC}) R_{SET}: 324KΩ (Note 3) C1: 22nF
R_{TEST}: 15KΩ R_{IN}: 470Ω 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.