

# UTC M54123L LINEAR INTEGRATED CIRCUIT

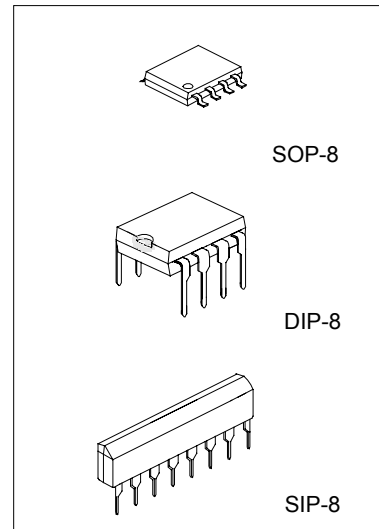
## EARTH LEAKAGE CURRENT DETECTOR

### DESCRIPTION

The UTC M54123L is a semiconductor integrated circuit with amplifier for a high-speed earth leakage circuit breaker.

### FEATURES

- \*Suitable for JIS C 8371
- \*Good temperature characteristics of input sensitivity current
- \*High input sensitivity ( $V_T=6.1\text{mV Typ.}$ )
- \*Low external component count
- \*High noise and surge-proof
- \*Low power dissipation ( $P_d=5\text{mW Typ.}$ ) and may be used both as 100V and 200V.
- \*Wide temperature range ( $T_a=-20\sim+80^\circ\text{C}$ )



### APPLICATION

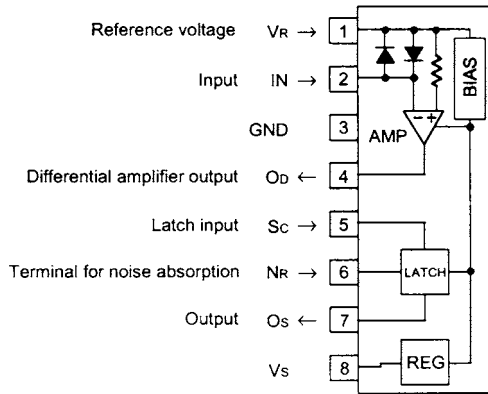
- \*High speed earth leakage circuit breaker.

### FUNCTION

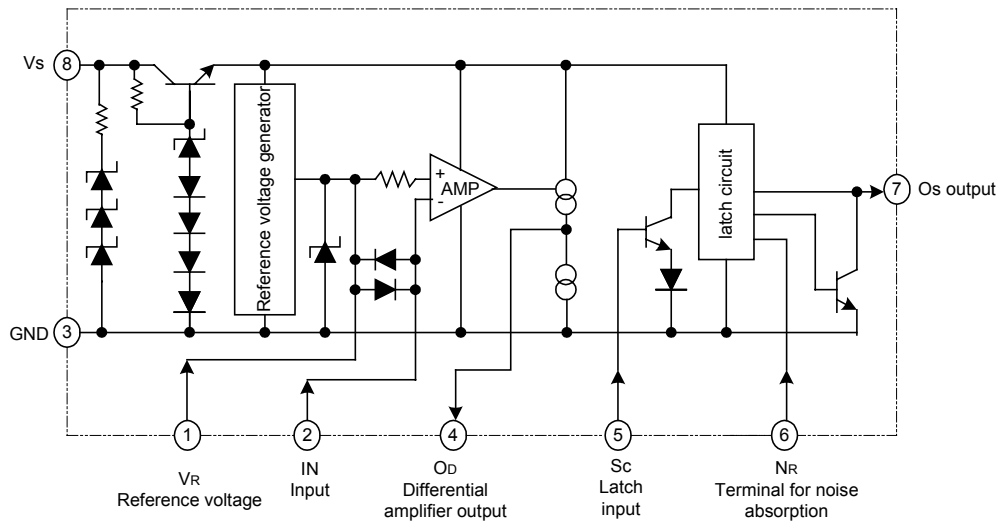
The UTC M54123L circuit for the amplifying parts of earth leakage circuit breaker consists of differential amplifier, latch circuit and voltage regulator. It is connected to the secondary side of the zero current transformer (ZCT) which detects leakage current in the both input of the differential amplifier. Signals amplified by differential amplifier are integrated by an external capacitor, and connects to the input terminal of latch circuit with output suitable for the characteristics of high- speed earth leakage circuit breaker. Latch circuit keeps low in the output till the input voltage reaches the fixed level, and output becomes high when the leakage current more than fixed flows. It drives a thyristor connected to the output terminal of latch circuit.

# UTCM54123L LINEAR INTEGRATED CIRCUIT

## PIN CONFIGURATIONS (TOP VIEW)



## BLOCK DIAGRAM



# UTCM54123L LINEAR INTEGRATED CIRCUIT

## ABSOLUTE MAXIMUM RATINGS (Ta=-20~80°C, unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNIT
Supply current	Is		8	mA
VR pin current	IVR	Between VR-IN (Note 1)	250	mA
		Between VR-GND	30	
		Between IN-VR(Note 1)	-250	
IN terminal current	IIN	Between IN-VR(Note 1)	250	mA
		Between IN-GND	30	
		Between VR-IN (Note 1)	-250	
Sc terminal current	Isc		5	mA
Power dissipation	Pd		200	mW
Operating temperature	Topr		-20 to +80	°C
Storage temperature	Tstg		-55 to +125	°C

Note 1: Current value between VR and IN, and between IN and VR is less than 1ms in the pulse width, and duty cycle is less than 12%, In applying AC current continuously, it is 100 mA in the off-state.

Remarks: GND terminal (pin 3 of the circuit is a basis of all the voltage except differential input clamp voltage of DC electrical characteristics, and direction of current is plus(no signal) in flowing into the circuit and is minus(-signal)in flowing out of it. Maximum value and minimum one are shown as absolute value. Please do not apply voltage whose standard is GND terminal in VR and IN pin.

## RECOMMENDED OPERATING CONDITIONS (Ta=-20~+80°C, unless otherwise noted)

PARAMETER	SYMBOL	LIMITS			UNIT
		MIN	TYP	MAX	
Supply Voltage when latch circuit is off-state	Is	12			V
External capacitor between Vs and GND	Cvs	1			μF
External capacitor between Os and GND	Cos			1	μF

## ELECTRICAL CHARACTERISTICS (Ta=-20~+80°C, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	LIMITS			UNIT		
			TEMPERATURE (°C)	TEST CIRCUIT	MIN		TYP*	MAX
Supply current	Is1	Vs=12V, VR-V1=30mV	-20	1		580	μA	
			25	1	400	530		
			80	1		480		
Trip voltage	VT	Vs=16V, VR-V1(Note2)	-20~+80	2	4	6.1	9	mV
Timed current1	ITD1	Vs=16V, VR-V1=30mV VOD=1.2V	25	3	-12		-30	μA
Timed current2	ITD2	Vs=16V, short circuit between VR and V1, VOD=0.8V	25	4	17		37	μA
Output current	Io	Vsc=1.4V, Vos=0.8V,	-20	5	-200			μA
			25	5	-100			
			80	5	-75			
Sc "ON" voltage (Note3)	VSC"ON"	Vs=16V	25	6	0.7		1.4	V
Sc input current	ISC"ON"	Vs=12V	25	7			5	μA
Output low-level current	Iosl	Vs=12V, Vosl=0.2V	-20~+80	8	200			μA
Input clamp voltage	Vic	Vs=12V, Iic=20mA	-20~+80	9	4.3		6.7	V

# UTCM54123L LINEAR INTEGRATED CIRCUIT

PARAMETER	SYMBOL	TEST CONDITIONS	LIMITS			UNIT		
			TEMPERATURE (°C)	TEST CIRCUIT	MIN		TYP*	MAX
Differential input clamp voltage	V <sub>IDC</sub>	I <sub>IDC</sub> =100mA	-20~+80	10	0.4		2	V
Maximum current voltage	V <sub>SM</sub>	I <sub>SM</sub> =7mA	25	11	20		28	V
Supply current 2(Note 4)	I <sub>S2</sub>	V <sub>R</sub> -V <sub>I</sub> , V <sub>OS</sub> =0.6V (Note 5)	-20~+80	12			900	μA
Latch circuit is off-state supply voltage (Note6)	V <sub>S</sub> "OFF"		25	13	0.5			V
Operating time (Note 7)	T <sub>ON</sub>	V <sub>S</sub> =16V, V <sub>R</sub> -V <sub>I</sub> =0.3V	25	14	2		4	ms

\*: Typical values are at Ta=25°C.

Note 2: When standard value of voltage (60Hz) between V<sub>R</sub> and V<sub>I</sub> is minimum, and output O<sub>S</sub> is low-level, or when standard value of voltage(60Hz)between V<sub>R</sub> and V<sub>I</sub> is maximum, and output O<sub>S</sub> is high-level, it is considered as a good one.

Note 3: When standard value of voltage V<sub>SC"ON"</sub> is minimum, and output O<sub>S</sub> is low-level, or when standard value of voltage V<sub>SC"ON"</sub> is maximum, and output O<sub>S</sub> is high-level, it is considered as a good one.

Note 4: Supply current 2 is necessary to keep high in output O<sub>S</sub>.

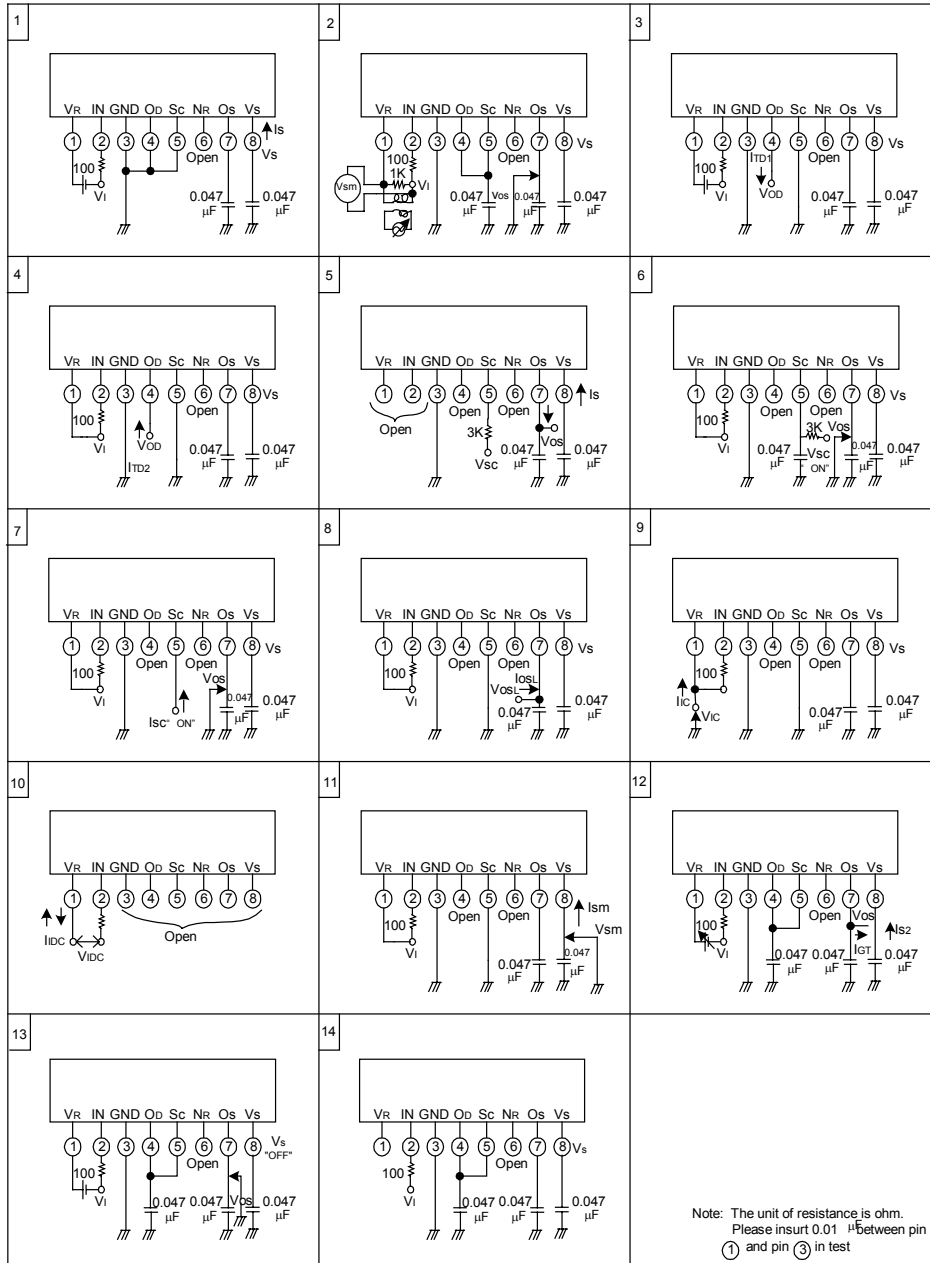
Note 5: After applying 30mV between V<sub>R</sub> and V<sub>I</sub> and shorting between them,it is considered as a good one if standard value of I<sub>GT</sub> flows out of output O<sub>S</sub>

Note 6: After supply voltage applies 12V and output O<sub>S</sub> is high-level,it is considered as a good one in the standard value of supply voltage and in the low-level of output O<sub>S</sub>.

Note 7: Operating time is a time from applying fixed input till operating latch circuit in 0.047μF between O<sub>D</sub> and GND.

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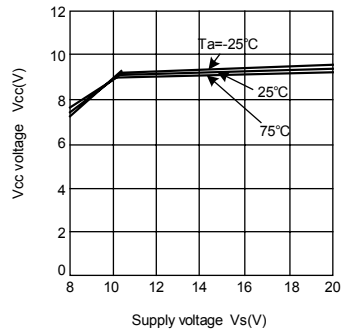
## TEST CIRCUIT



# UTCM54123L LINEAR INTEGRATED CIRCUIT

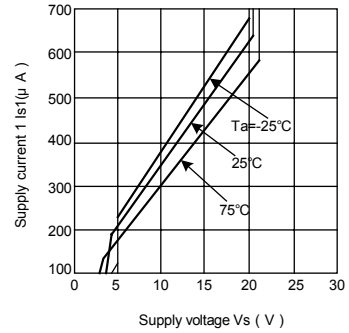
## TYPICAL CHARACTERISTICS

Vcc voltage vs. supply voltage

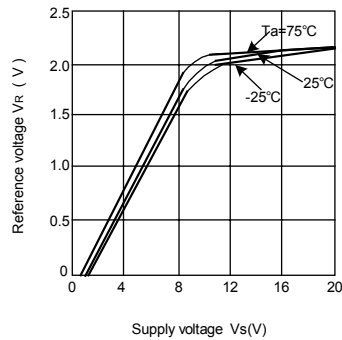


Vcc voltage generates by the constant voltage circuit in IC. This is measured not by M54123L but by a special element.

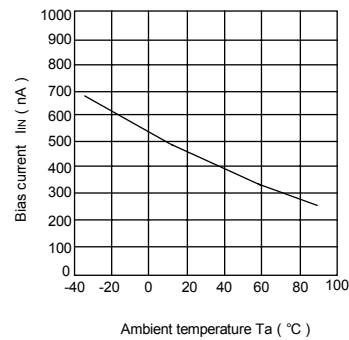
Supply current I1 vs. supply voltage



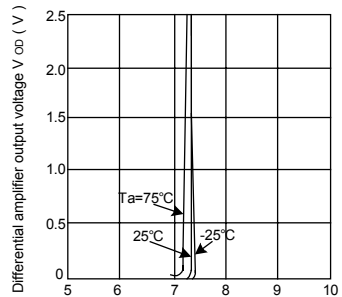
Reference voltage vs. supply voltage



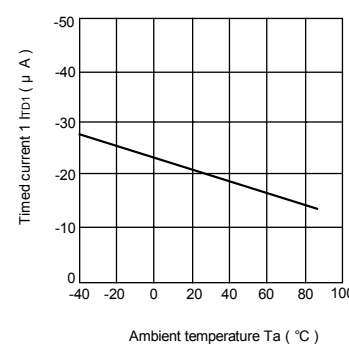
Bias current vs. ambient temperature



Differential amplifier output voltage vs. differential input voltage

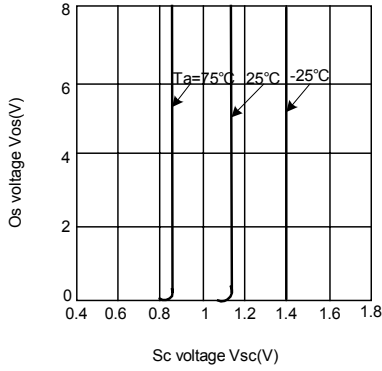


Timing current vs. ambient temperature

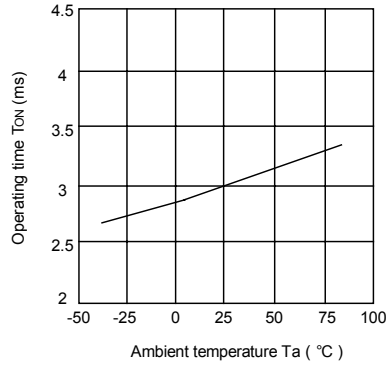


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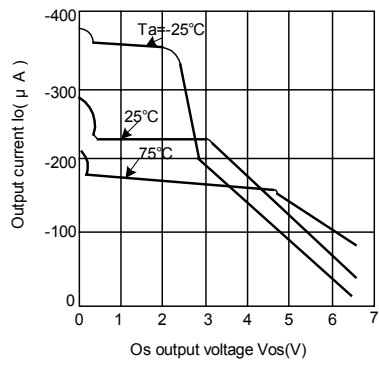
Os voltage vs.Sc voltage



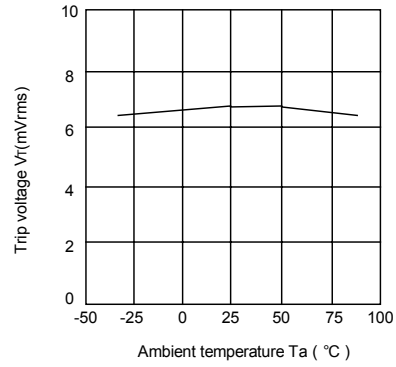
Operating time vs. ambient temperature



Output current vs. Os output voltage



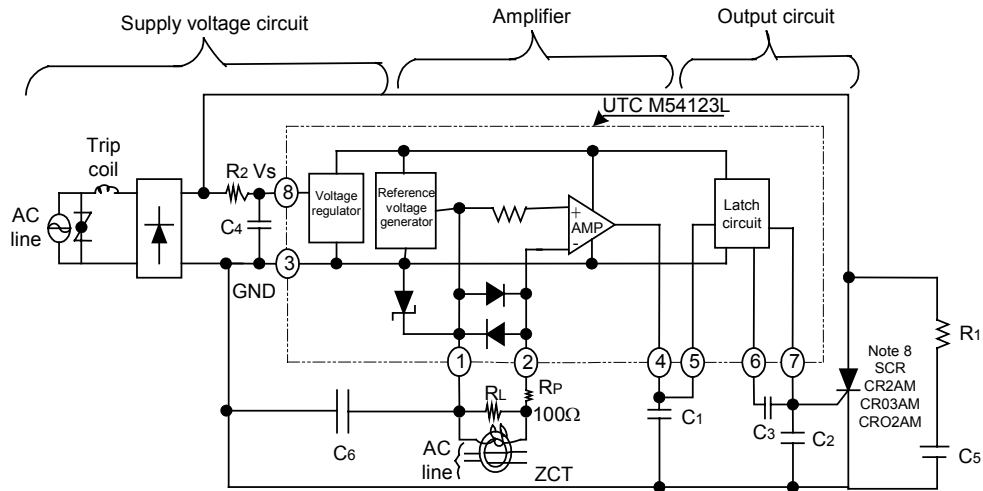
Trip voltage vs. ambient temperature



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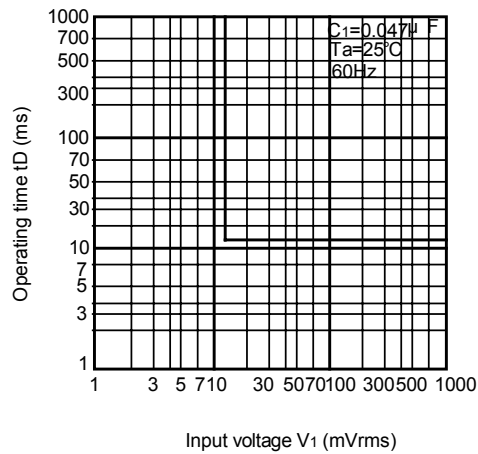
## APPLICATION CIRCUIT

HIGH-SPEED LEAKAGE CIRCUIT BREAKER WITH UTC M54123L



Note 8: Gate current must be selected.  
Please select voltage resistance by AC supply voltage

Operating time vs. input voltage





## UTCM54123L LINEAR INTEGRATED CIRCUIT

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Supply voltage circuit is connected as a previous diagram. Please decide constants R1, R2, C4, and C5 of a filter in order to keep at least 12V in Vs, when normal, supply current flows.

In this case, please connect C4 (more than 1  $\mu$ F) and C2 (less than 1  $\mu$ F). ZCT and load resistance R<sub>L</sub> of ZCT are connected between input pin 1 and 2. In this case protective resistance (Rp=100  $\Omega$ ) must be inserted. Sensitivity current is regulated by R<sub>L</sub>, and output of amplifier shows in pin 4. External capacitor C1 between pin 4 and GND is used for noise removal.

When large current is grounded in the primary side (AC line) of ZCT, the wave form in the secondary side of ZCT is distorted and some signals does not appear in the output of amplifier. So please connect a varistor or a diode (2 pcs) to ZCT in parallel.

Latch circuit is used to inspect the output level of amplifier and to supply gate current on the external SCR. When input pin becomes more than 1.1V (Typ.), latch circuit operate and supply gate current in the gate of SCR connected to the output pin 7. Pin 6 can be used in the open state, but please connect capacitor (about 0.047  $\mu$ F) between pin 6 and pin 7.

Capacitor C6 between pin 1 and GND is used to remove noise and is about 0.047  $\mu$ F.

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