M54120P

LEVEL DETECTOR WITH DELAY CIRCUIT

T-75-53

DESCRIPTION

M54120P is a semiconductor integrated circuit with functions for use in a ground fault circuit interrupter-amplifiers having both high speed and inverse-time characteristics.

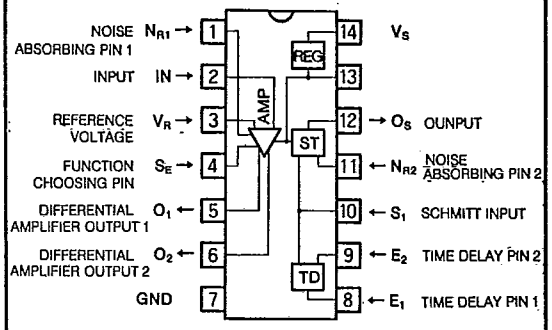
FEATURES

- Easily meets JIS C 8371 specifications
- Excellent temperature characteristics of input current sencitivity
- Need for few externally connected components makes unit economical
- Highly resistant to noise and surges
- Extremely good inverse-time characteristics
- Wide operating temperature range (T_a=−20~+75℃)

APPLICATION

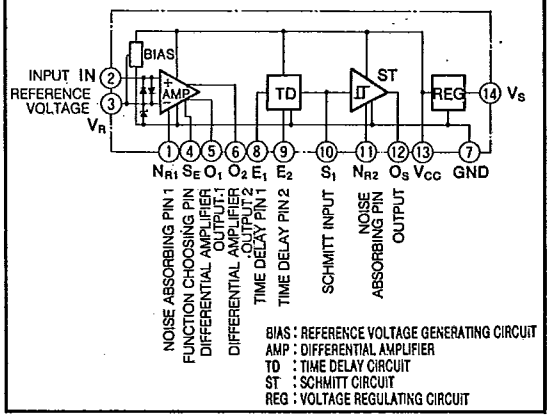
For use in inverse-time type ground fault circuit interrupters, high speed ground fault cirucit interrupter alarms, and other relay applications.

PIN CONFIGURATION (TOP VIEW)



Outline 14P4

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

For use in a ground fault circuit interrupter amplifier, this integrated circuit includes a differential amplifier circuit, a Schmitt circuit, a constant voltage circuit and a time delay. It is connected to the secondary of a zero current-transformer, which detects current leakage in the input side of the differential amplifier. The output signal of the differential amplifier, after passing through the time delay circuit, is integrated in an externally mounted capacitor. Having been delayed, long enough to satisfy the characteristics specified by JIS C 8371 for inverse-time type ground fault circuit interrupters, the signal is fed to the Schmitt circuit. As long as input voltage remains below the preset level the Schmitt circuit output is maintained at "L" level. When a current leakage larger than the preset amount is detected, the output becomes "H" level and the thyristor, located on the Schmitt circuit output, is driven. By by-passing the time delay circuit and feeding the output or the differential amplifier directly to the Schmitt circuit all JIS C 8371 specifications for a high-speed ground fault circuit interrupter can be met.

ABSOLUTE MAXIMUM RATINGS (T_a = −20~+75℃, unless otherwise noted)

Symbol	Parameter	Conditions	Limits	Unit
V_S	Supply voltage		24	V
V_{S1}	S_1 voltage		6.5	V
I_{IN}	IN current	Between IN−V_R	60	mA
I_{IN}	IN current	Between IN−GND	30	mA
I_{IN}	IN current	Between V_R−IN	−60	mA
I_{VR}	V_R current	Between V_R−IN	60	mA
I_{VR}	V_R current	Between V_R−GND	30	mA
I_{VR}	V_R current	Between IN−V_R	−60	mA
I_{SE}	S_E current	Between S_E−GND	10	mA
I_{SE}	S_E current	Between GND−S_E	−10	mA
I_{E1}	E_1 current	Between E_1−E_2	10	mA
I_{E2}	E_2 current	Between E_2−S_1	5	mA
I_{E2}	E_2 current	Between E_1−E_2	−10	mA
P_d	Power dissipation		500	mW
T_{opr}	Operating free-air ambient temperature range		−20~+75	℃
T_{stg}	Storage temperature range		−55~+125	℃

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RECOMMENDED OPERATING CONDITIONS (T_a = −20~+75℃, unless otherwise noted)

Symbol	Parameter	Limits			Unit
		Min	Typ	Max	
V_S	Supply voltage	18	20	22	V

ELECTRICAL CHARACTERISTICS (T_a = −20~+75℃, unless otherwise noted)

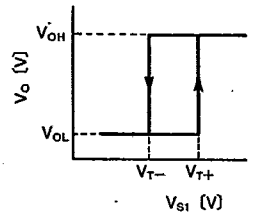
Symbol	Parameter	Test conditions	Temp (℃)	Limits			Unit	Test circuit
				Min	Typ*	Max		
V_{CC}	Supply voltage	V_R−V_I Connected, V_S = 18V		11.2	12.9	14.6	V	1
		V_R−V_I Connected, V_S = 22V						
V_{ODL}	"L" saturated output voltage	V_S = 22V, V_{IN} = 2.21V, V_{NRI} = 2.25V	−20			0.4	V	1
		V_S = 22V, V_{IN} = 1.96V, V_{NRI} = 2V	25			0.4	V	
		V_S = 22V, V_{IN} = 1.66V, V_{NRI} = 1.7V	75			0.4	V	
V_{OD1}	Differential amplifier output voltage 1	V_S = 20V, V_I−V_R = 30mV	−20	4.6		7.6	V	2
			25	4.1		6.8	V	
			75	3.3		6.3	V	
V_{OD2}	Differential amplifier output voltage 2	V_S = 20V, V_I−V_R = 60mV	−20	8.6		10.7	V	2
			25	8.2		10	V	
			75	7.3		9.4	V	
V_{T+}	Positive going threshold voltage (Note 1)	V_S = 20V	−20	1.52		2.2	V	3
			25	1.35		1.95	V	
			75	1.05		1.73	V	
V_{T-}	Negative going threshold voltage (Note 1)	V_S = 20V	−20	0.3		1.2	V	3
			25	0.2		1	V	
			75	0.05		0.95	V	
I_{T+}	"V_{T+}" Input current (Note 1)	V_S = 20V	25	5			μA	3
I_O	Output current	V_S = 18V, V_{SI} = 2V, V_O = 0.8V	−20	−0.7			mA	3
			25	−0.6			mA	
			75	−0.35			mA	
V_{IC}	Input clamping voltage	V_S = 20V, I_{IC} = 20mA		4.3		6.7	V	4
V_{IDC}	Differential input clamping voltage	I_{IDC} = 50mA		0.4		2.1	V	5
V_{ODC}	Output clamping voltage	V_S = 20V, S_E = GND, V_{IN}−V_{NRI} = 160mV	−20	7.8		10.4	V	1
			25	7.7		10.1	V	
			75	7.4		10	V	
V_{E2}	E_2 voltage	I_{E2} = 0.05mA, S_I = GND	−20	4.9		6.2	V	6
			25	5.05		6.25	V	
			75	5.1		6.4	V	
I_S	Power source current	V_S = 20V, V_R−V_I Connected	25	2	3.4	5.3	mA	7
V_{ODC2}	Output clamping voltage 2	V_S = 20V, S_E = GND, V_{IN}−V_{NRI} = 160mV	25	3.2		4.4	V	1

* : All typical values are at V_S = 20V, T_a = 25℃.

Note 1 : V_{T+}, V_{T-} are the voltages expressed in the chart at the right.

2 : When testing each parameter be sure to insert a 0.01μF capacitor between V_R (Pin 3) and GND (Pin 7).

3 : A 3.9k resistor is connected between pin IN and other pin V_I.



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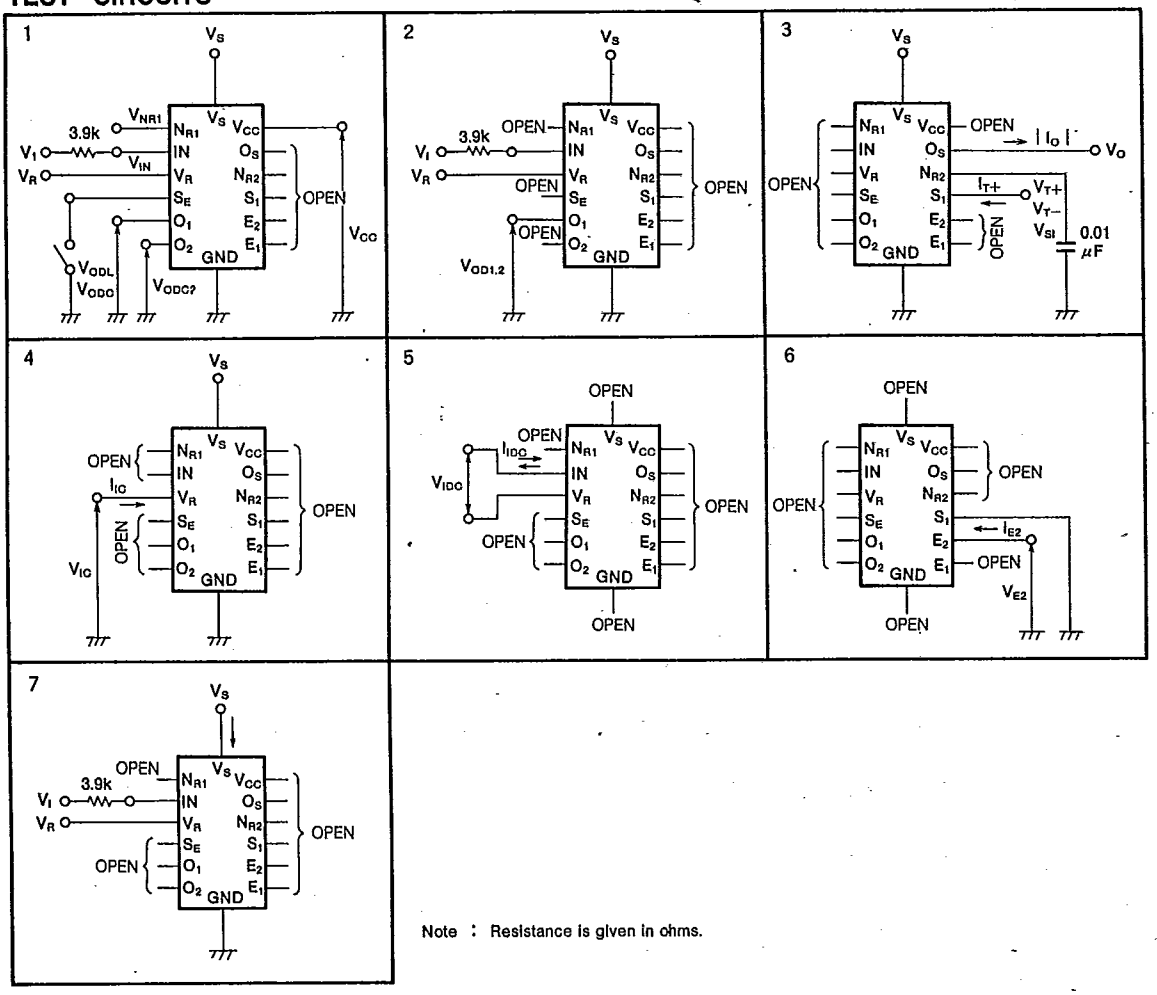
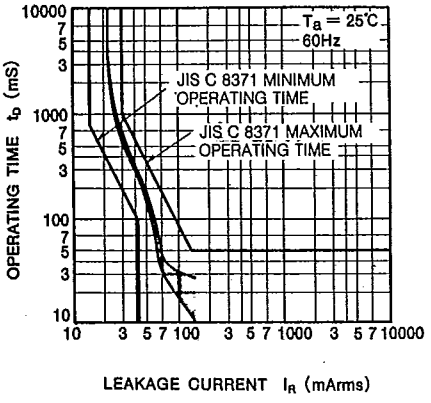
TEST CIRCUITS



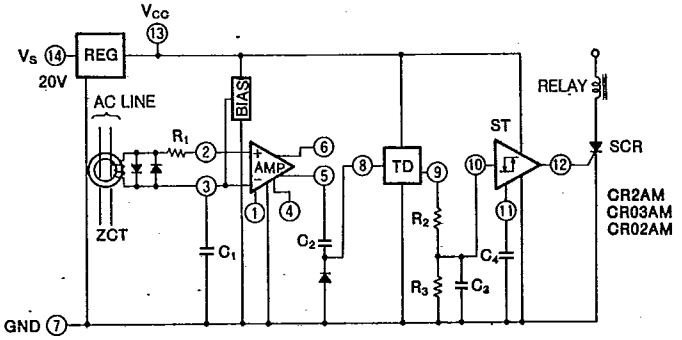
Note : Resistance is given in ohms.

OPERATING TIME VS LEAKAGE (INVERSE-TIME OPERATION)



APPLICATION EXAMPLE

INVERSE-TIME TYPE GROUND FAULT CIRCUIT INTERRUPTER UTILIZING THE M54120P



$R_1 = 3.9k\Omega$, $R_2 = 165k\Omega$, $R_3 = 2M\Omega$, $C_1 = 0.01\mu F$, $C_2 = 1\mu F$, $C_3 = 1\mu F$, $C_4 = 1\mu F$