M59350FP

Watchdog Timer IC
with Built-in 5 V Constant-Voltage Power Supply

REJ03F0016-0100Z
Rev.1.00
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Description

The M59350FP is an IC developed for use as a watchdog timer with a built-in 5 V constant-voltage power supply. It is provided with functions for power-on reset, constant voltage monitoring, and watchdog timer operation, and can be used as a power supply circuit for various systems. Because it employs a 15-pin flat package, it is ideal for compact system designs.

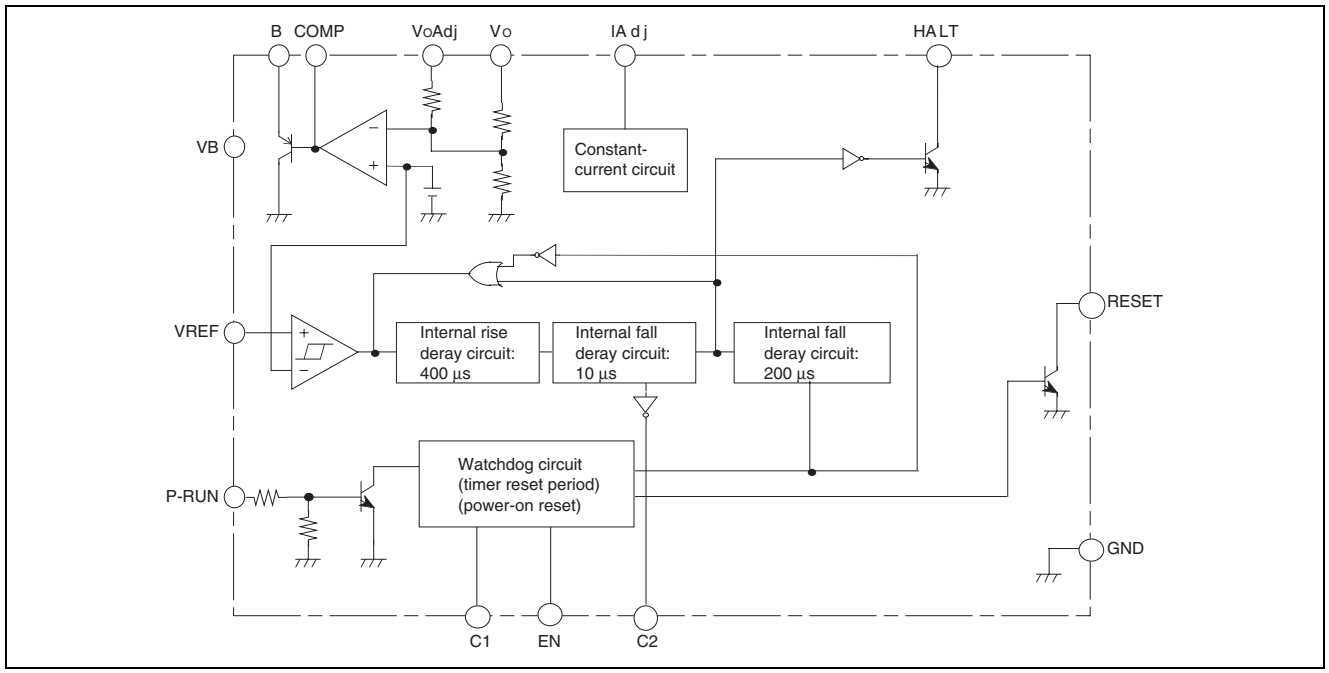
Features

- Built-in power-on reset circuit
- Built-in 5 V constant-voltage power supply
- Built-in 5 V constant-voltage power supply monitoring circuit
- Built-in watchdog timer circuit
- Compact flat package (SOP, 14P2N, 1.27 mm pitch)

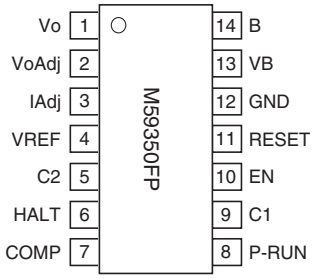
Application

- ECU power supply circuit for automotive use
- Other automotive applications

System Block Diagram



Pin Arrangement (top view)



Package: 14P2N-A

Pin Description

Pin no.	Pin symbol	Function
[1]	Vo	By connecting an external PNP transistor, pin [1] (VO): 5 V constant voltage output pin [1] (VO): PNP transistor collector connection pin [13] (VB): PNP transistor emitter + power supply connection pin [14] (B): PNP transistor base connection (pin [1]: grounded via capacitor (100 µF))
[13]	VB	
[14]	B	
[2]	VoAdj	By connecting a load, adjusts pin [1] (V) constant voltage: 5 V
[3]	IAdj	Sets charge/discharge current of capacitors to set time (C1, C2 within IC)
[4]	VREF	Monitors voltage, compares with set voltage to control pin [6] (HALT), pin [11] (RESET) output
[5]	C2	Delay time from decision that pin [4] (VREF) is "L" until pin [6] (HALT) outputs "L" is set through the grounding capacitance (when open, the IC Built-in capacitance results in a delay time of 10 µs)
[6]	HALT	Outputs pin [4] (VREF) voltage monitoring result
[7]	COMP	Pin for connection of constant-voltage power supply (Vo) phase compensation capacitance
[8]	P-RUN	Detects voltage and period of input clock signal, controls pin [11] (RESET) output
[9]	C1	Sets the power-on reset time (T3), watchdog time (T2), watchdog reset pulse width (T1) time through the grounding capacitance
[10]	EN	Halts the watchdog function on input of "L" level (open: H input fixed)
[11]	RESET	Outputs judgment result of pin [4] (VREF) voltage monitoring, pin [8] (P-RUN) input clock signal
[12]	GND	GND

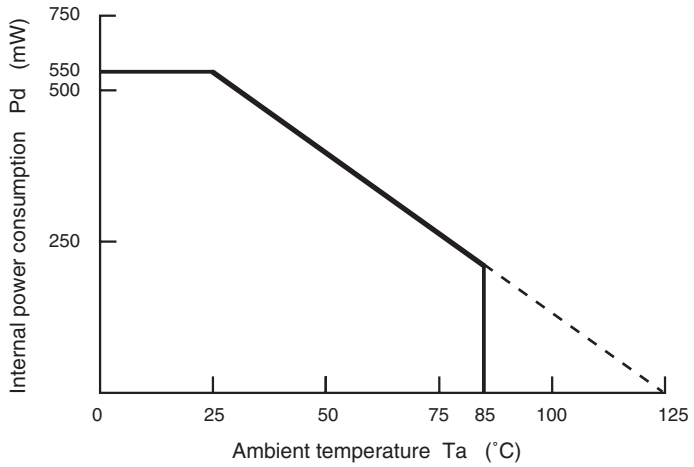
Absolute Maximum Ratings

(Unless otherwise specified, Ta = 25°C)

Pin no.	Symbol	Item	Test conditions	Ratings	Unit
[13]	V_B	Power supply voltage		–0.3 to 36	V
[13]	V_B	Power supply surge voltage	t ≤ 200 ms	–0.3 to 36.5	V
[14]	I_B	Bias current		30	mA
[6], [11]	V_{OUT}	Output voltage		–0.3 to 36	V
[6], [11]	I_{OUT}	Output current		10	mA
[8], [10]	V_{IN}	Input voltage		–0.3 to 16	V
[8], [10]	I_{IN}	Input current		–2.0 to 2.0	mA
	Pd	Power dissipation	Ta = 25°C	550	mW
	Topr	Operating temperature		–40 to +85	°C
	Tstg	Storage temperature		–55 to +125	°C

Note: All voltages are relative to the IC GND pin voltage (0 V). All current directions are positive when flowing into the IC (unmarked, or marked with a +), and are negative when flowing out (marked –).

Thermal Reduction Rate Curve (Maximum Rating)



Recommended Operating Conditions

(Unless otherwise specified, Ta=-40 to +85°C)

Pin No.	Symbol	Item	Conditions	Ratings	Unit
[13]	V_B	Power supply voltage		6 to 16	V
[1]	V_O	Output power supply voltage		4.5 to 5.5	V
[8], [10]	V_{IN}	Input voltage		0 to V_O	V
[8], [10]	V_{OUT}	Output voltage		0 to V_O	V

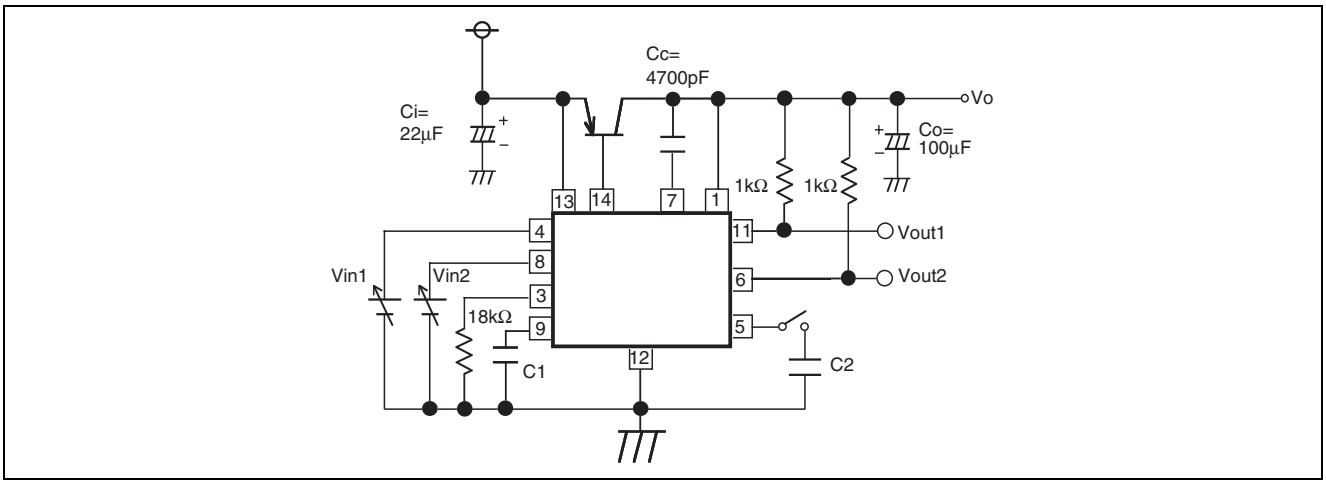
Electrical Characteristics

(Unless otherwise specified, Ta=-40 to +85°C, Io = 50 mA, Ci = 22 µF, Co = 100 µF, C1 = 0.47 µF, Cc = 4700 pF, RIAdj = 18 kΩ)

Symbol	Item	Measurement conditions	Units			Unit
			min.	typ.	max.	
IB	Bias current	Note1	—	9	20	mA
VO	Output voltage	Steady-state	4.75	5.0	5.25	V
VON		VoAdj pin grounded	5.2	5.5	6.0	V
Reg-IN	Input stability	Vcc = 7 to 36 V	—	0.1	0.2	%/V
Reg-L	Load stability	Io = 1 to 500 mA	—	40	200	mV
VREF	Reference voltage		1.200	1.265	1.330	V
ΔVTH1	Threshold voltage hysteresis	Note2: VTH1 set to 4.35 V	20	50	100	mV
IVREF	VREF input current		—	—	10	µA
VsatH	HALT output saturation voltage	IHALT = 5 mA	—	0.2	0.6	V
VsatR	RESET output saturation voltage	IRESET = 5 mA	—	0.2	0.6	V
ILHAL	HALT output leakage current	VHALT = 5 V	—	—	10	µA
ILR	RESET output leakage current	VRESET = 5 V	—	—	10	µA
VL-EN	ENL input voltage		—	—	0.6	V
IL-EN	ENL input current	VIN – EN = 0 V	—	–250	–500	µA
IIN-P	P-RUN input current	VIN – P = 5 V	100	200	400	µA
VIN-PH	P-RUN H input voltage		2.5	—		V
VIN-PL	P-RUN L input voltage		—	—	0.3	V
T1(RW)	Watchdog reset pulse width	C1 = 0.22 µF	0.23	0.46	0.69	ms
		C1 = 0.47 µF	0.5	1	1.5	ms
T2(RW)	Watchdog time (reset pulse interval)	C1 = 0.22 µF	7.3	14.6	21.9	ms
		C1 = 0.47 µF	15	30	45	ms
T3(R)	RESET output delay time (power-on reset time)	C1 = 0.22 µF	14.6	29.2	44.0	ms
		C1 = 0.47 µF	30	60	90	ms
T4(R)	RESET output delay time		75	200	450	µA
T5(H)	HALT output delay time		150	400	900	µA
T6(H)	HALT output delay time	C2: open	3	10	25	µA
		C2 = 4700 pF±10%	1	2	3	ms
VB-MIN	VB minimum operating voltage	Note3, Ta = 25°C	—	—	2.0	V
VO-MIN	Vo minimum operating voltage	Note4, Ta = 25°C	—	0.8	1.0	V
ID	Driving current	Note5, Ta = 40 to 85°C	8	—	—	mA

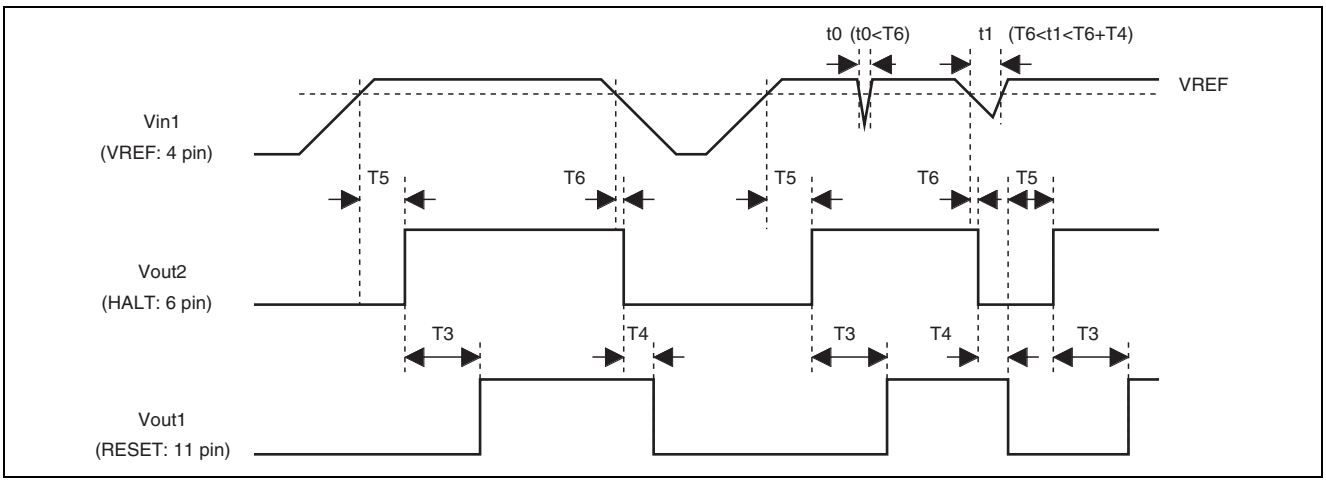
Notes:
1. The bias current IB is the sum of all currents flowing into the pins [1], [7], [13], [14].
2. VTH1 is the threshold voltage relative to VREF, and is set using an external resistance.
3. The minimum operating voltage of VB for the operation of various functions
4. The minimum operating voltage Vo at which the HALT output and RESET output can be held at L (when the HALT and RESET output pull-up resistance is 1 kΩ)
5. B (pin [14]) driving current capacity

Power Supply Monitoring/Watchdog Timer Timing Diagram



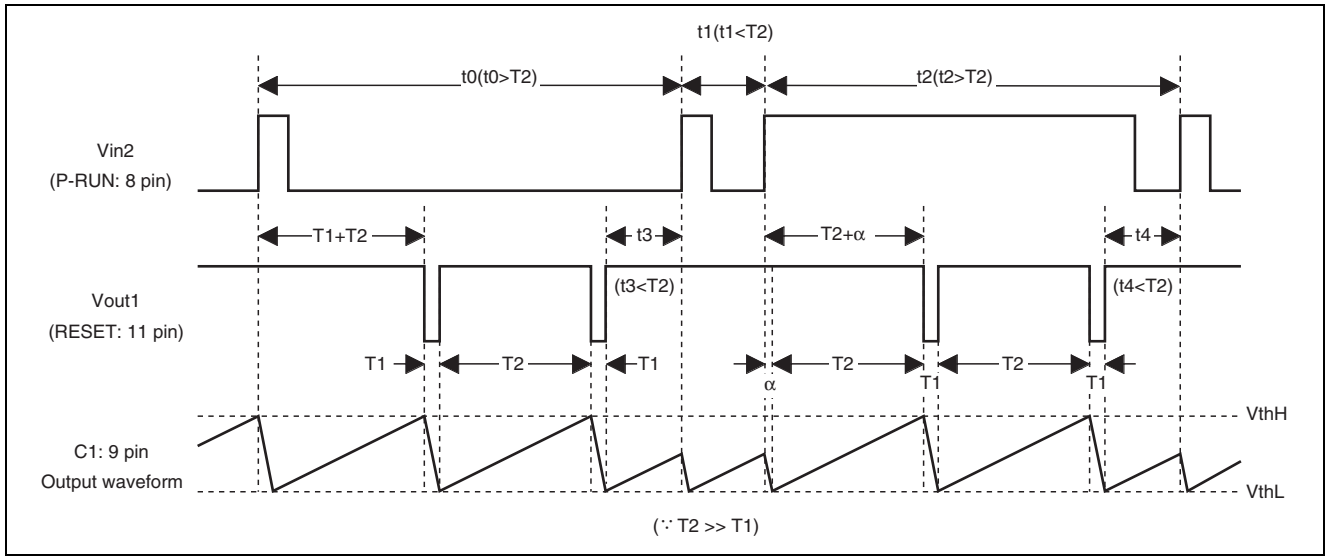
Power Supply Monitor Timing Diagram

(When a normal pulse is input to P-RUN (pin [8]))

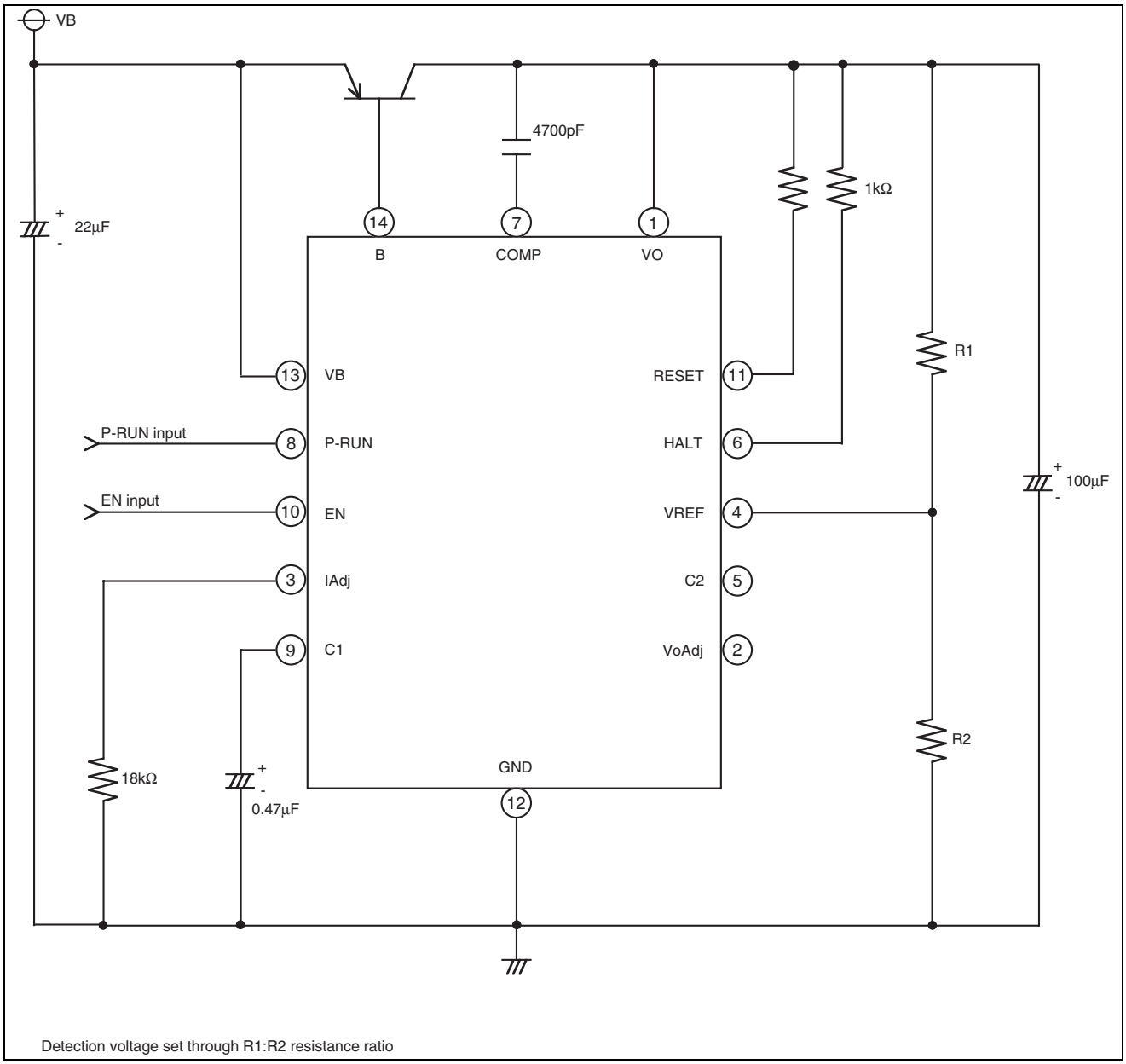


Watchdog Timer Timing Chart (H input to Vin1 (pin [4], VREF))

(When "L" is input to pin [10] (EN), watchdog function halted)

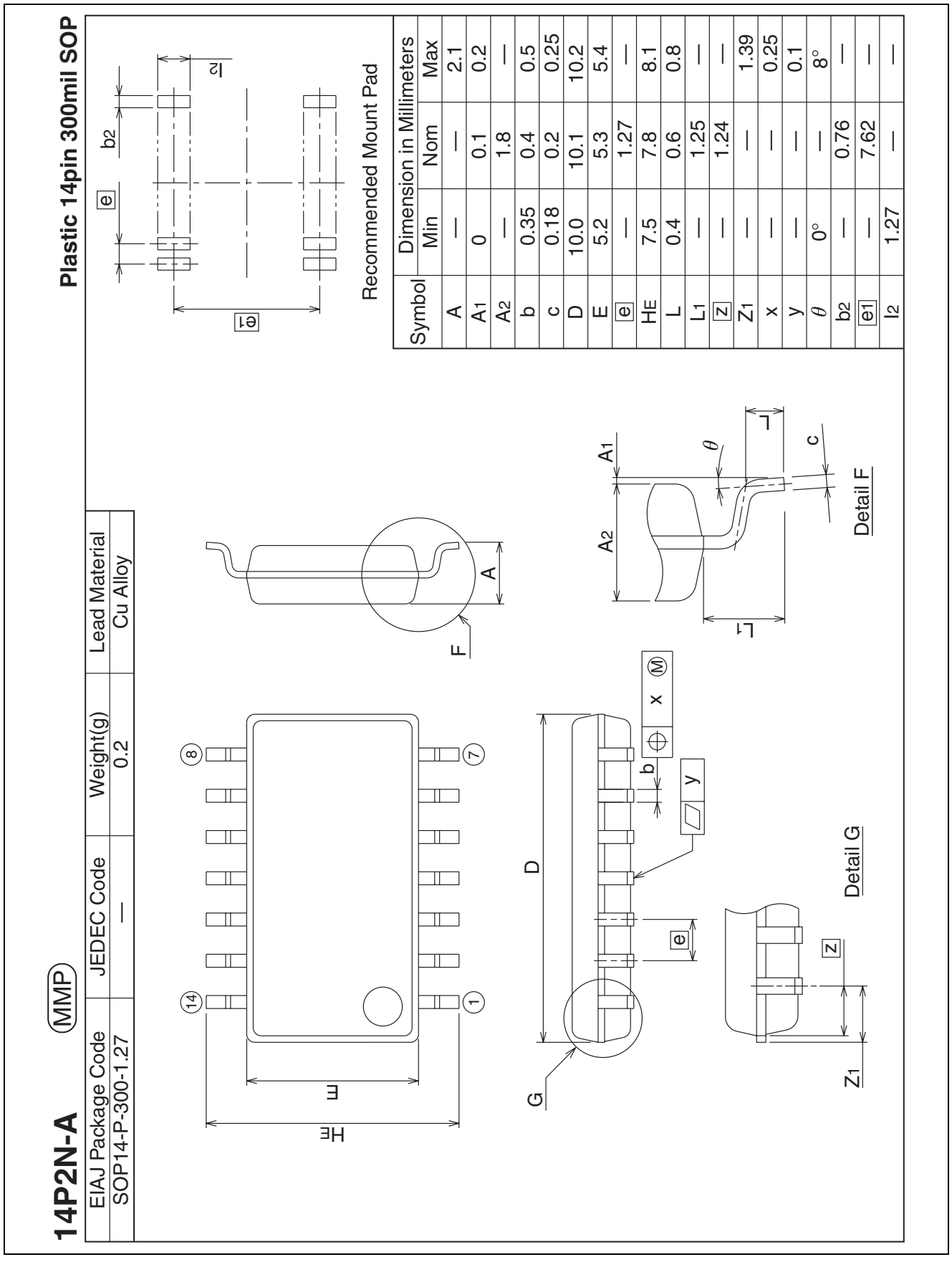


Application Example



Detection voltage set through R1:R2 resistance ratio

Package Dimensions



Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	—	—	2.1
A_1	0	0.1	0.2
A_2	—	1.8	—
b	0.35	0.4	0.5
c	0.18	0.2	0.25
D	10.0	10.1	10.2
E	5.2	5.3	5.4
e	—	1.27	—
H_E	7.5	7.8	8.1
L	0.4	0.6	0.8
L_1	—	1.25	—
z	—	1.24	—
Z_1	—	—	1.39
x	—	—	0.25
y	—	—	0.1
θ	0°	—	8°
b_2	—	0.76	—
e_1	—	7.62	—
l_2	1.27	—	—

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