TelCom Semiconductor, Inc.

APPLICATION NOTE 2

USING THE TELCOM TC54 VOLTAGE DETECTOR

INTRODUCTION

TelCom's TC54 series of voltage detectors are designed to supersede a variety of discrete comparator circuits and bipolar technology voltage detectors.

These voltage detectors are especially suited for application in battery powered systems because of their extremely low 1µA operating current. Each part is laser programmed to the desired trip point voltage over the range of 0.8V to 6.0V in 100mV steps. For complete design flexibility, complementary or open-drain output versions are available. TC54 package options include surface mount SOT-23 and SOT-89 or through-hole TO-92 types.

OPERATION

The TC54VN equivalent circuit is shown in Figure 1. The internal precision temperature-compensated reference and comparator circuit consistently monitor V_{IN} for an undervoltage condition. When such a condition occurs, the output is forced to the active (LOW) state and remains there until V_{IN} is once again within tolerance. As shown in the timing diagram of Figure 1, the output is forced active when $V_{IN} < (-V_{DET})$ (Where $(-V_{DET})$ is the threshold voltage) and returns HIGH when V_{IN} exceeds $(-V_{DET})$ plus 5% hysteresis (example: if $(-V_{DET}) = 2.0V$, the output will go HIGH when $V_{IN} > 2.1V$).

TC54 BLOCK DIAGRAM AND TIMING

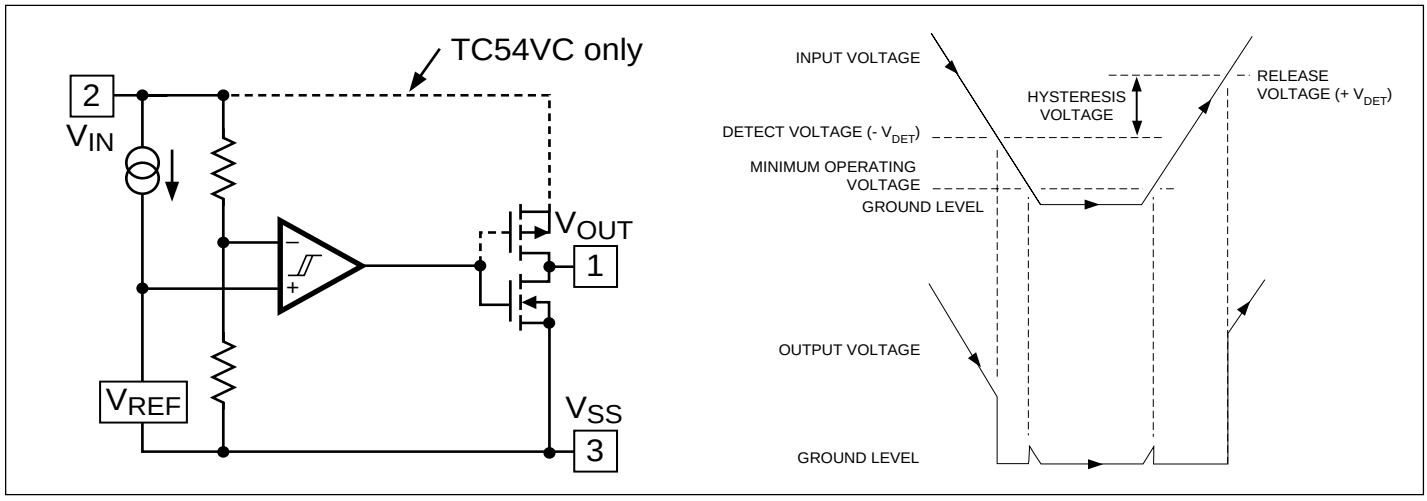

Figure 1.

TC54 AS A MICROPROCESSOR RESET GENERATOR

Following a power outage, microprocessors require a reset to get them back into their starting state. Commonly used simple Schmitt trigger/capacitor circuits are inadequate since they do not accurately monitor the power supply voltage tolerance. The TC54 series overcomes this problem with precise voltage detection. Figure 2 shows a reset circuit using a standard TC54 and external RC time constant, replacing bipolar integrated voltage detectors (see Table 1).

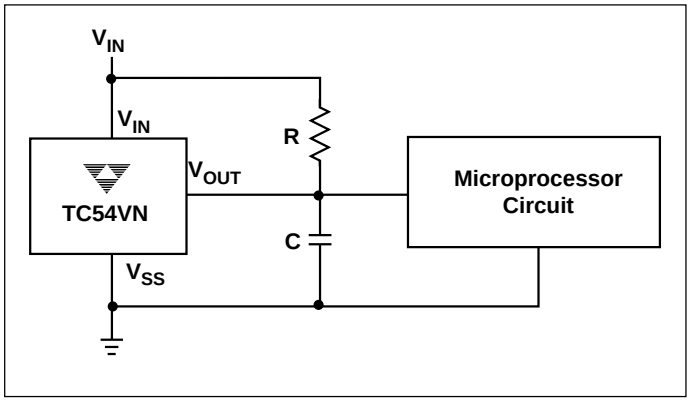

Figure 2. Microprocessor Reset Circuit using TC54 and External Delay

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Table 1. TC54 Cross Reference Listing

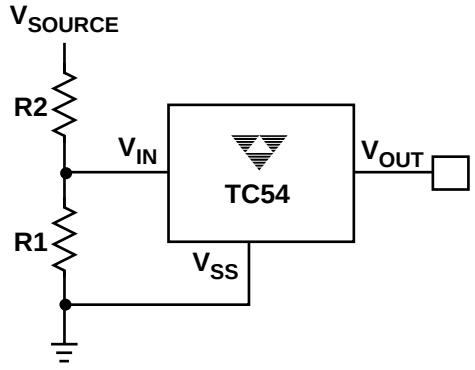
MFGR	PART#	TELCOM #	DESCRIPTION	TELCOM ATTRIBUTE
Motorola	MC33064P-5	TC54VN4502EZB	4.5V trip, -40 to +85C, TO-92	500 times less power
Motorola	MC34064P-5	TC54VN4502EZB	4.5V trip, 0 to +70C, TO-92	500 times less power
Motorola	MC34164P-3	TC54VN2702EZB	2.7V trip, 0 to +70C, TO-92	10 times less power
Motorola	MC34164P-5	TC54VN4302EZB	4.3V trip, 0 to +70C, TO-92	10 times less power
Motorola	MC33164P-3	TC54VN2702EZB	2.7V trip, -40 to +85C, TO-92	10 times less power
Motorola	MC33164P-5	TC54VN4302EZB	4.3V trip, -40 to +85C, TO-92	10 times less power
T.I.	TL7757ILP	TC54VN4502EZB	4.5V trip, -40 to +85C, TO-92	2000 times less power
T.I.	TL7757CLP	TC54VN4502EZB	4.5V trip, 0 to +70C, TO-92	2000 times less power

MODIFYING THE TRIP POINT, $-V_{DET}$

Although the TC54 has a pre-programmed V_{DET}, it is sometimes necessary to make adjustments during prototyping. This can be accomplished by connecting an external resistor divider to a TC54 which has a V_{DET} lower than that of V_{SOURCE} (Figure 3).

To maintain detector accuracy, the bleeder current through the divider should be significantly higher than the 1µA operating current required by the TC54. A reasonable value for this bleeder current is 100µA (100 times the 1µA required by the TC54). For example, if $(-V_{DET}) = 2V$ and the desired trip point is 2.5V, the value of R1 + R2 is 250K Ohms (2.5V/100µA). The value of R1 + R2 can be rounded to the nearest standard value and plugged into the equation of Figure 3 to calculate values for R1 and R2. 1% tolerance resistors are recommended.

OTHER APPLICATIONS



$$V_{SOURCE}\left(\frac{R1}{R1 + R2}\right) = (-V_{DET})$$

Where:
V_{SOURCE} = Voltage to be monitored
$(-V_{DET})$ = Threshold Voltage Setting of TC54
Note: In this example, V_{SOURCE} must be greater than $(-V_{DET})$

Figure 3. Modify trip point of TC54 using external resistor divider

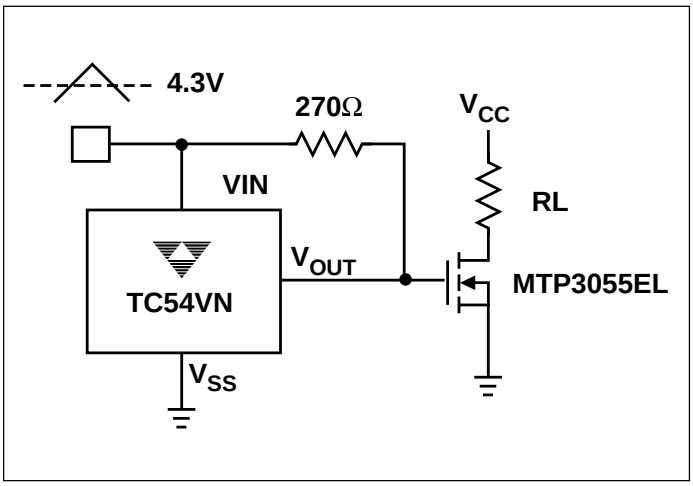


Figure 4. MOSFET low drive protection

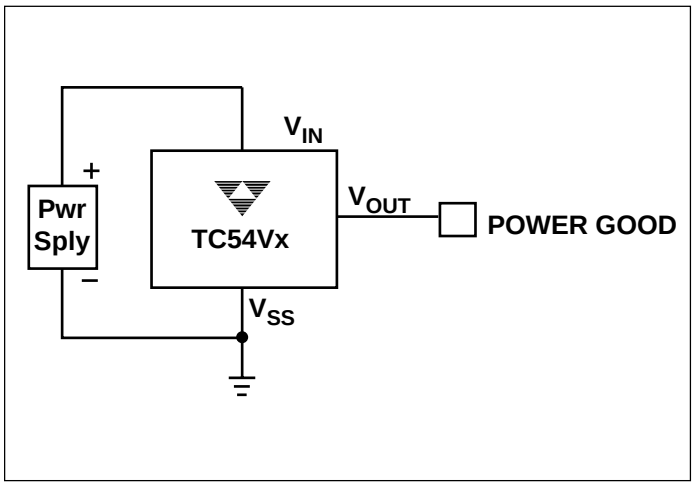


Figure 6. Power good monitor

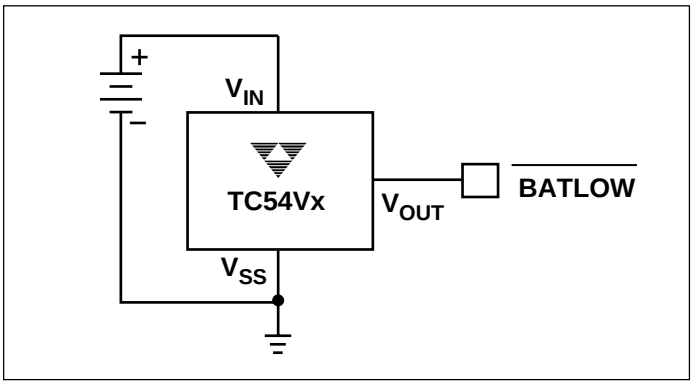


Figure 5. Battery voltage monitor

Low operating power and small physical size make the TC54 series ideal for many voltage detector applications, such as those shown below. Figure 4 shows a low-voltage gate drive protection circuit, which prevents overheating of the logic-level MOSFET due to insufficient gate voltage. When the input signal is below the threshold of the TC54VN, its output grounds the gate of the MOSFET. Figure 5 and 6 show the TC54 in conventional voltage monitoring applications.

Sales Offices

TelCom Semiconductor
1300 Terra Bella Avenue
P.O. Box 7267
Mountain View, CA 94039-7267
TEL: 650-968-9241
FAX: 650-967-1590
E-Mail: liter@c2smtp.telcom-semi.com

TelCom Semiconductor
Austin Product Center
9101 Burnet Rd. Suite 214
Austin, TX 78758
TEL: 512-873-7100
FAX: 512-873-8236

TelCom Semiconductor H.K. Ltd.
10 Sam Chuk Street, Ground Floor
San Po Kong, Kowloon
Hong Kong
TEL: 852-2324-0122
FAX: 852-2354-9957