

Auto Grade Precision Voltage Supervisor with Programmable Watchdog Timer

Features

- Qualified for Automotive Applications
 - AEC-Q100 Grade 1, T_A : -40°C to $+125^{\circ}\text{C}$
- Wide-Supply Voltage Range: 1.6 V to 5.5 V
- Low Supply Current $I_{DD} = 10\ \mu\text{A}$ (Typical)
- Programmable Watchdog Timeout
- Precision Undervoltage Monitoring
 - Support Common Rails from 1.8 V to 5.0 V
 - 1% Voltage Threshold Accuracy
- Programmable Watchdog Timeout
- Manual reset input $\overline{\text{MR}}$
- Watchdog Enable/Disable
- Open-drain Active Low $\overline{\text{RESET}}$ and $\overline{\text{WDO}}$ Output
- Green Product, DFN3x3-8 Package

Applications

- Automotive Cabin
- T-box
- Radar
- BCM
- Infotainment

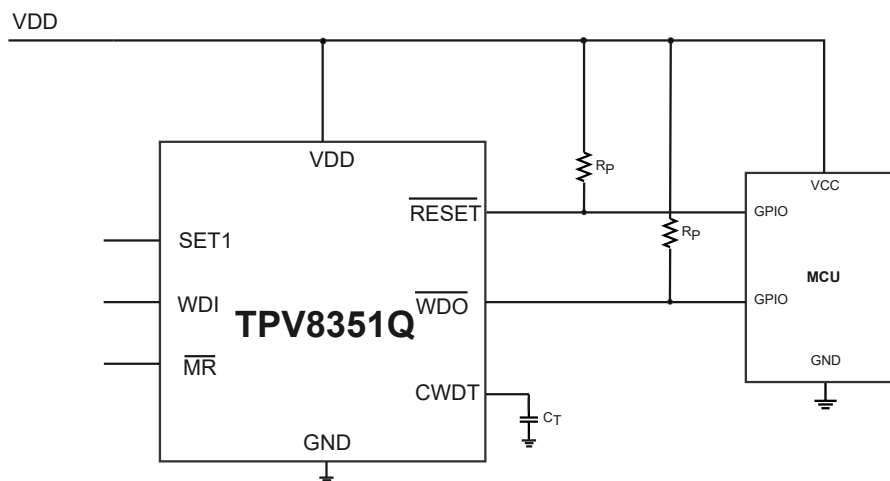
Description

The TPV8351Q is an auto-grade precision supervisor with a programmable watchdog timer. It monitors a voltage rail from 1.8 V to 5 V for undervoltage on the VDD pin. It can achieve 1% monitor accuracy, which is ideal for tight tolerance system. The TPV8351Q $\overline{\text{RESET}}$ delay time features factory-programmed fixed timing with high precision.

The TPV8351Q includes a programmable watchdog timer. The watchdog timeout period can be set by factory-programmed settings or by an external capacitor. The watchdog can be disabled via the SET1 pin. When an undesired watchdog timeout occurs, the $\overline{\text{WDO}}$ asserts low for the reset delay time.

The TPV8351Q is available in a DFN3x3-8 package with wettable flanks for easy optical inspection. It features a manual reset input ($\overline{\text{MR}}$) for external reset initiation.

Typical Application Circuit



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Watchdog Timer****Table of Contents**

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**Auto Grade Precision Voltage Supervisor with Programmable
Watchdog Timer****Product Family Table**

Order Number	Under Voltage Threshold (V_{IT_UV})	Nominal Monitored Voltage	Marking
TPV8351VQ-DFCR-S ⁽¹⁾	1.615 V	1.8 V	51VQ
TPV8351WQ-DFCR-S ⁽¹⁾	1.67 V	1.8 V	51WQ
TPV8351ZQ-DFCR-S ⁽¹⁾	2.33 V	2.5 V	51ZQ
TPV8351RQ-DFCR-S ⁽¹⁾	2.64 V	3 V	51RQ
TPV8351PQ-DFCR-S ⁽¹⁾	2.79 V	3 V	51PQ
TPV8351OQ-DFCR-S ⁽¹⁾	2.88 V	3 V	51OQ
TPV8351SQ-DFCR-S ⁽¹⁾	2.94 V	3.3 V	51SQ
TPV8351TQ-DFCR-S	3.07 V	3.3 V	51TQ
TPV8351NQ-DFCR-S ⁽¹⁾	3.17 V	3.3 V	51NQ
TPV8351MQ-DFCR-S ⁽¹⁾	4.4 V	5 V	51MQ
TPV8351LQ-DFCR-S ⁽¹⁾	4.65 V	5 V	51LQ
TPV8351KQ-DFCR-S ⁽¹⁾	4.8 V	5 V	51KQ

(1) For future products, contact the 3PEAK factory for more information and samples.

Revision History

Date	Revision	Notes
2025-12-18	Rev.A.0	Released version
2026-05-19	Rev.A.1	Changed the Pin 1 Quadrant from Q1 to Q2.

Auto Grade Precision Voltage Supervisor with Programmable Watchdog Timer

Pin Configuration and Functions

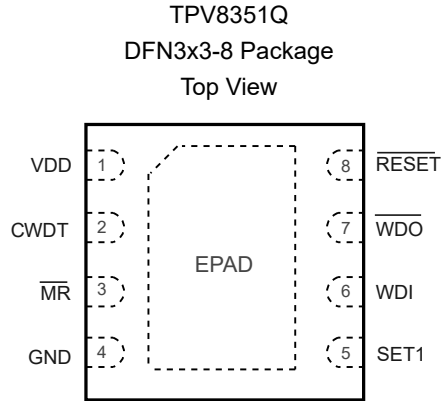


Table 1. Pin Functions: TPV8351Q

Pin	Name	I/O	Description
1	VDD	P	Supply Voltage. A 0.1- μ F ceramic capacitor was placed as close as to the VDD pin.
2	CWDT	I	Watchdog Timeout Program Pin. Connecting this pin to VDD through a 10 k Ω resistor or leaving it open results in fixed watchdog timeout times. Connecting this pin to ground referenced capacitor gives a user-programmable watchdog timeout.
3	$\overline{\text{MR}}$	I	Manual reset pin. A logical low on this pin issues a RESET. This pin is internally pulled up. RESET remains low for the fixed reset delay time after $\overline{\text{MR}}$ is deserted (high).
4	GND	G	Ground. This pin should be connected to the ground reference.
5	SET1	I	Logic input. Grounding the SET1 pin disables the watchdog timer; setting it to logic high enables the watchdog to operate normally.
6	WDI	I	Watchdog input. A falling edge must occur at this pin before the watchdog timeout (t_{WD}) expires in order for $\overline{\text{WDO}}$ not to assert. When the watchdog is disabled, WDI cannot be left unconnected and must be driven to either VDD or GND.
7	$\overline{\text{WDO}}$	O	Watchdog output. This pin is an active low open-drain output. Connect this pin to VDD through a 1-k Ω to 10-k Ω resistor. When a watchdog timeout occurs, $\overline{\text{WDO}}$ goes low for the reset delay time.
8	$\overline{\text{RESET}}$	O	RESET Output. This pin is an active low open-drain output. Connect this pin to VDD through a 1k Ω to 100k Ω resistor. It is driven to a low impedance state when VDD goes below the undervoltage threshold (V_{IT_UV}). $\overline{\text{RESET}}$ will keep low for the fixed reset delay time after VDD rises above the undervoltage threshold plus hysteresis.
-	EPAD ⁽¹⁾		Exposed Pad.

(1) The EPAD of the DFN3X3-8 is recommended to be connected to GND.

**Auto Grade Precision Voltage Supervisor with Programmable
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Specifications**Absolute Maximum Ratings**

Parameter		Min	Max	Unit
Supply Voltage	VDD to GND	-0.3	5.5	V
Output Voltage	RESET, WDO to GND	-0.3	5.5	V
Other Voltage	CWDT, MR, WDI, SET1 to GND	-0.3	5.5	V
Output Current	RESET, WDO		20	mA
T _J	Maximum Junction Temperature		150	°C
T _A	Operating Temperature Range	-40	125	°C
T _{STG}	Storage Temperature Range	-65	150	°C
T _L	Lead Temperature (Soldering 10 sec)		300	°C

- (1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.
- (2) This data was taken with the JEDEC low effective thermal conductivity test board.
- (3) This data was taken with the JEDEC standard multilayer test boards.

ESD, Electrostatic Discharge Protection

Parameter		Condition	Minimum Level	Unit
HBM	Human Body Model ESD	AEC Q100-002	±2	kV
CDM	Charged Device Model ESD	AEC Q100-011	±1	kV

Thermal Information

Package Type	θ _{JA}	θ _{JB}	θ _{JC-top}	Unit
DFN3x3-8	54	24.1	85.4	°C/W

Auto Grade Precision Voltage Supervisor with Programmable Watchdog Timer

Electrical Characteristics

All test conditions: $V_{DD} = 5\text{ V}$, $T_A = -40^\circ\text{C}$ to 125°C , unless otherwise noted. Typical values are at $T_A = 25^\circ\text{C}$.

Parameter		Conditions	Min	Typ	Max	Unit
V_{DD}	Supply Voltage Range		1.6		5.5	V
I_{DD}	Quiescent Current	$V_{DD} = 5.5\text{ V}$, $\overline{\text{RESET}}$ not asserted		10	19	μA
V_{POR}	Power-on Reset Voltage		0.25		0.6	V
V_{IT_UV}	Under-voltage Threshold	TPV8351VQ		1.615		V
		TPV8351WQ		1.67		V
		TPV8351ZQ		2.33		V
		TPV8351RQ		2.64		V
		TPV8351PQ		2.79		V
		TPV8351OQ		2.88		V
		TPV8351SQ		2.94		V
		TPV8351TQ		3.07		V
		TPV8351NQ		3.17		V
		TPV8351MQ		4.40		V
		TPV8351LQ		4.65		V
		TPV8351KQ		4.80		V
$V_{IT_UV_ERR}$	Negative-going Input Threshold Accuracy	$-40^\circ\text{C} < T_A < 125^\circ\text{C}$	-1		1	%
$V_{IT_UV_HYS}$	Hysteresis on V_{IT}			0.5		%
I_{CWD}	CWD Pin Charge Current	$CWD = 0.5\text{ V}$	300	370	470	nA
V_{CWD}	CWD Pin Threshold Voltage		1.182	1.197	1.211	V
V_{OL}	Output Low Voltage of $\overline{\text{RESET}}$ Pin, $\overline{\text{WDO}}$	$1.6\text{ V} < V_{DD} < 5\text{ V}$, $I_{SINK} = 3.0\text{ mA}$			0.4	V
I_D	$\overline{\text{RESET}}$, $\overline{\text{WDO}}$ Output Leakage Current	$V_{DD} = 1.6\text{ V}$, $V_{\overline{\text{RESET}}} = V_{\overline{\text{WDO}}} = 5.5\text{ V}$			1	μA
V_{IL}	$\overline{\text{MR}}$, SET1 logic low input				0.25	V
V_{IH}	$\overline{\text{MR}}$, SET1 logic high input		0.8			V
V_{IL_WDI}	WDI Logic Low Input				$0.3V_{DD}$	V
V_{IH_WDI}	WDI Logic High Input		$0.8V_{DD}$			V
t_{RST}	$\overline{\text{RESET}}$ Delay Time		170	200	230	ms
t_{RST_DEL}	V_{DD} to $\overline{\text{RESET}}$ Deglitch Time	$V_{DD} = V_{IT_UV} - 2.5\%$		50		μs
I_{MR}	$\overline{\text{MR}}$ Pin Idle Current	$V_{MR} = 0\text{ V}$	250	620	950	nA
t_{MR_GEL}	$\overline{\text{MR}}$ to $\overline{\text{RESET}}$ Delay	$V_{IH} = 0.7 V_{DD}$, $V_{IL} = 0.3 V_{DD}$		200		ns
t_{WDT}	Watchdog Timerout	CWDT = Open	SET1 = 0	Watchdog disabled		
			SET1 = 1	1.36	1.6	1.84
						s

**Auto Grade Precision Voltage Supervisor with Programmable
Watchdog Timer**

Parameter			Conditions	Min	Typ	Max	Unit
		CT = 10kΩ to VDD	SET1 = 0	Watchdog disabled			
			SET1 = 1	170	200	230	ms
t _{WDI_PW}	WDI Pulse Width				50		ns
t _{WDI_GEL}	WDI to $\overline{\text{WDO}}$ Delay				50		ns

Auto Grade Precision Voltage Supervisor with Programmable Watchdog Timer

Typical Performance Characteristics

All test conditions: $V_{DD} = 5\text{ V}$, $T_A = +25^\circ\text{C}$, unless otherwise noted.

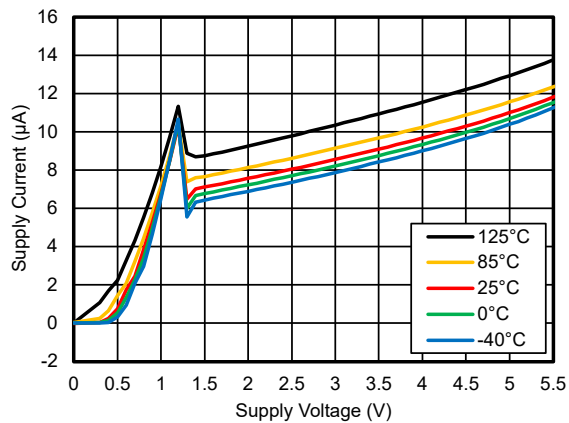


Figure 1. Supply Current vs. Supply Voltage

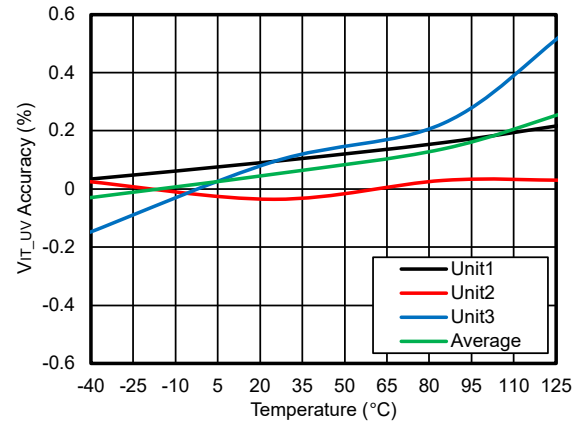


Figure 2. V_{IT_UV} Accuracy vs. Temperature

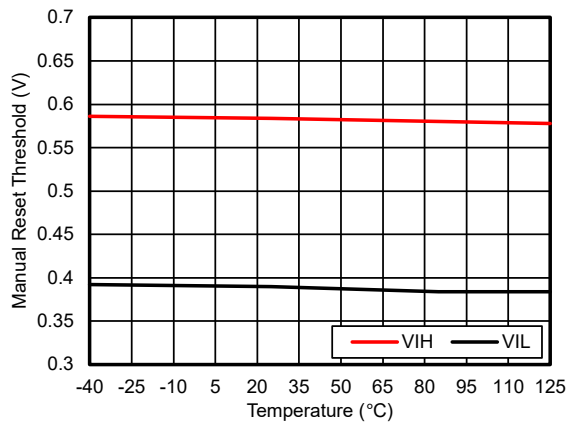


Figure 3. Manual Reset Threshold vs. Temperature

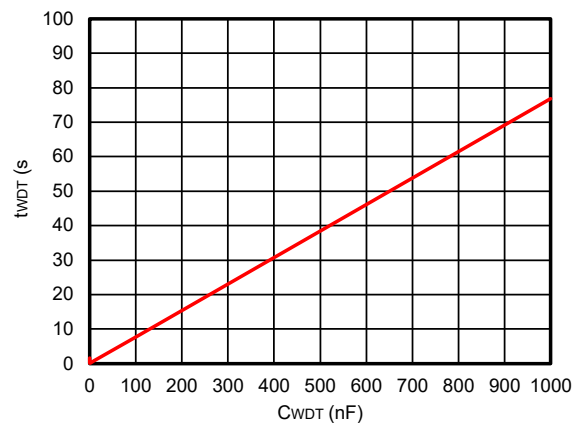


Figure 4. t_{WDT} vs. C_{WDT}

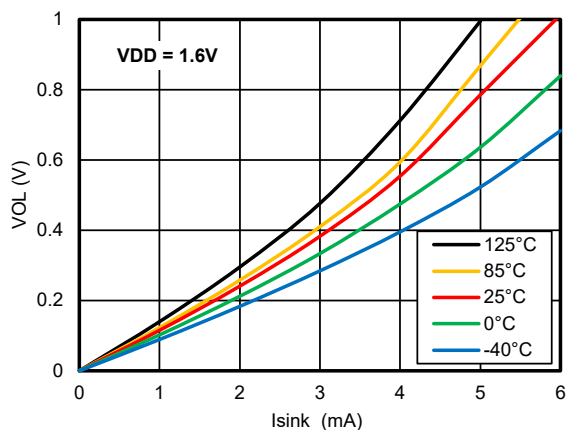


Figure 5. Output Low Voltage vs. Sink Current

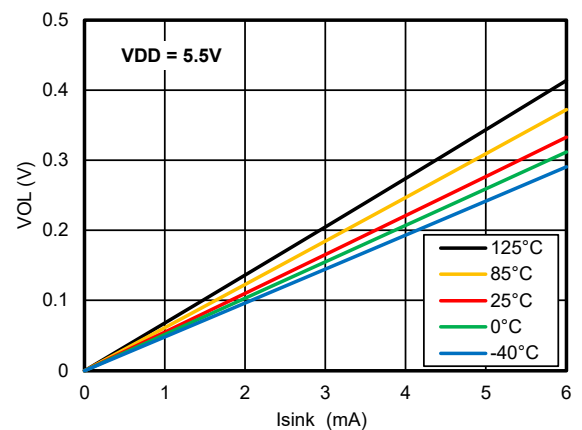


Figure 6. Output Low Voltage vs. Sink Current

Auto Grade Precision Voltage Supervisor with Programmable Watchdog Timer

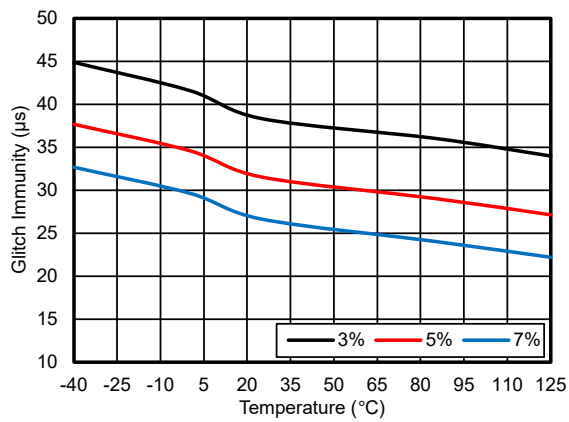


Figure 7. Glitch Immunity vs. Temperature

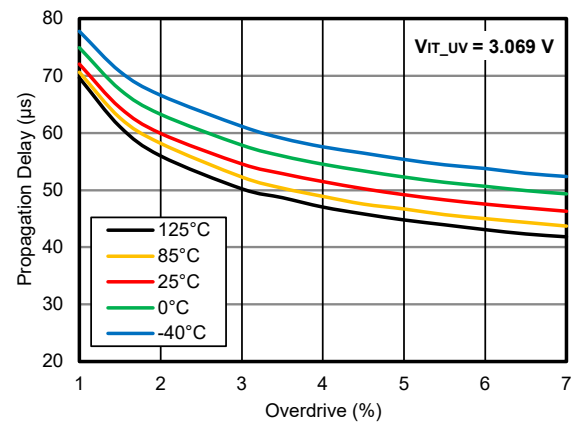


Figure 8. Propagation Delay vs. Overdrive

Auto Grade Precision Voltage Supervisor with Programmable Watchdog Timer

Detailed Description

Overview

The TPV8351Q is an auto-grade precision supervisor with a programmable watchdog timer. It monitors a voltage rail from 1.8 V to 5 V for undervoltage on the VDD pin. It can achieve 1% monitor accuracy, which is ideal for tight tolerance system. The TPV8351Q $\overline{\text{RESET}}$ delay time features factory-programmed fixed timing with high precision.

The TPV8351Q includes a programmable watchdog timer. The watchdog timeout period can be set by factory-programmed settings or by an external capacitor. The watchdog can be disabled via the SET1 pin. When an undesired watchdog timeout occurs, the $\overline{\text{WDO}}$ asserts low for the reset delay time.

The TPV8351Q is available in a DFN3x3-8 package with wettable flanks for easy optical inspection. It features a manual reset input ($\overline{\text{MR}}$) for external reset initiation.

Functional Block Diagram

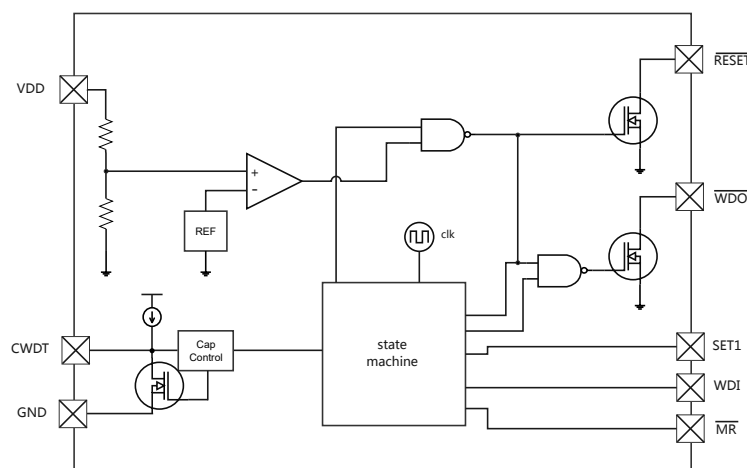


Figure 9. Functional Block Diagram

Feature Description

RESET Output

The reset threshold voltage is factory-set for undervoltage monitoring of the VDD rail. The VDD pin detects the monitored voltage; if the voltage on this pin drops below the undervoltage threshold (V_{IT_UV}), the $\overline{\text{RESET}}$ signal is asserted.

The TPV8351Q features an active-low open-drain output that needs to be pulled up to the correct pull-up voltage rail through a 1 k Ω to 100 k Ω pull-up resistor. If the $\overline{\text{RESET}}$ signal is asserted, it is guaranteed to be logic low. After the VDD voltage recovers to $V_{IT_UV} + V_{HYS}$, the $\overline{\text{RESET}}$ pin is deasserted to logic high after the fixed reset delay time (t_{RST}).

A logical low on the $\overline{\text{MR}}$ pin also issues a $\overline{\text{RESET}}$. After $\overline{\text{MR}}$ is deasserted (high) and VDD rises above $V_{IT_UV} + V_{HYS}$, the $\overline{\text{RESET}}$ signal is deasserted to logic high after the reset delay time (t_{RST}).

Auto Grade Precision Voltage Supervisor with Programmable Watchdog Timer

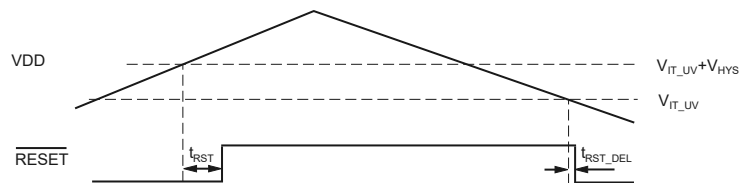


Figure 10. Reset Timing

RESET Delay Time

The $\overline{\text{RESET}}$ delay time (t_{RST}) is factory-programmed with a fixed value, typical 200ms. This delay time is consistent when triggered by undervoltage on the VDD pin or a logical low on the $\overline{\text{MR}}$ pin. After the trigger condition is cleared (VDD rises above $V_{\text{IT_UV}}+V_{\text{HYS}}$ or $\overline{\text{MR}}$ is deasserted to high), the $\overline{\text{RESET}}$ pin remains low for the fixed delay time before deasserting.

Watchdog

The TPV8351Q features a programmable watchdog timer. The WDI pulse must be issued before the watchdog timeout (t_{WDT}) expires to prevent WDO from asserting. The t_{WDT} can be set in three ways: one is connecting C_{WDT} to VDD through a 10-k Ω pullup resistor, in this way, the t_{WDT} is set to 200ms (typical); the second way is leaving C_{WDT} floating, in this way, the t_{WDT} is set to 1600ms (typical); the third way is connecting C_{WDT} to GND through a capacitor, in this way, the TPV8351Q provides programmable watchdog timeout.

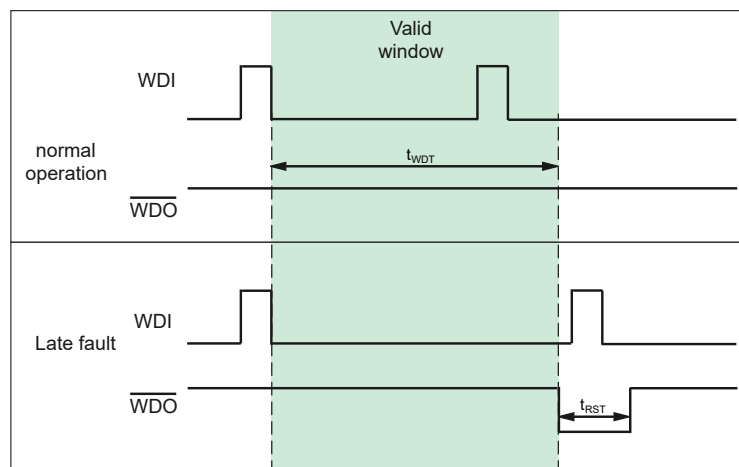


Figure 11. Watchdog Timing

The t_{WDT} under a given capacitor value is calculated using the following equations, where C_{WDT} is in nanofarads, and t_{WDT} is in milliseconds. Two timing options are available: standard timing and extended timing:

$$t_{\text{WDT(standard)}} = 3.23 \times C_{\text{WDT}} + 0.381 \quad (1)$$

$$t_{\text{WDT(extended)}} = 77.4 \times C_{\text{WDT}} + 55 \quad (2)$$

The watchdog can be enabled or disabled via the SET1 pin: grounding SET1 disables the watchdog (WDI is ignored) and setting SET1 to logic high enables normal operation. When the watchdog goes from disabled to enabled, there is a 150 μ s transition period during which the device does not respond to pulses on WDI. After this period, the device begins to respond to changes on WDI. When the watchdog is disabled, WDI cannot be left unconnected and must be driven to either VDD or GND to avoid increased supply current.

**Auto Grade Precision Voltage Supervisor with Programmable
Watchdog Timer****Enable Watchdog**

The TPV8351Q features the ability to enable and disable the watchdog timer. When the watchdog goes from disable to enable, there is a 150 μ s transition period during which the device doesn't respond to a pulse on WDI. After this time, the device begins to respond changes on WDI. When the watchdog is disabled, the $\overline{\text{WDO}}$ is high impedance.

Auto Grade Precision Voltage Supervisor with Programmable Watchdog Timer

Application and Implementation

Note

Information in the following application sections is not part of the 3PEAK's component specification and 3PEAK does not warrant its accuracy or completeness. 3PEAK's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

Application Information

Figure 12 shows the application circuit of TPV8351Q with the reset threshold voltage set by the factory.

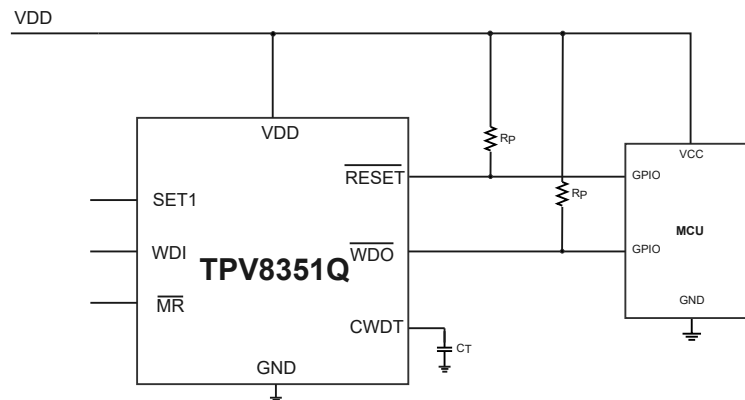
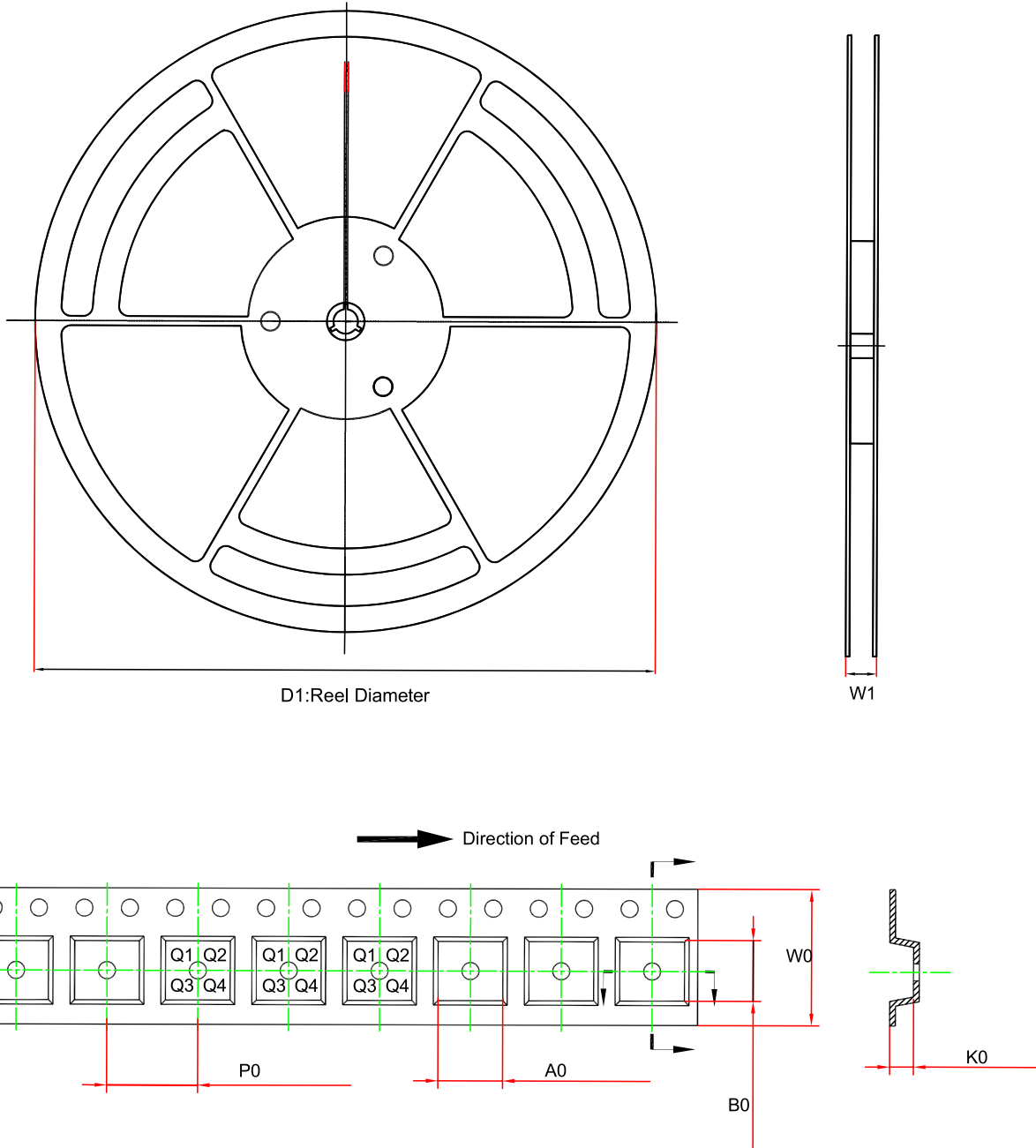


Figure 12. TPV8351Q Fixed Version Typical Application Circuit

Auto Grade Precision Voltage Supervisor with Programmable Watchdog Timer

Tape and Reel Information



Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPV8351TQ-DFCR-S	DFN3x3-8	330	17.6	3.3	3.3	1.1	8	12	Q2

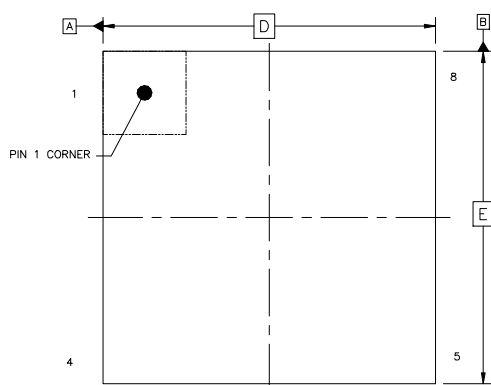
Auto Grade Precision Voltage Supervisor with Programmable Watchdog Timer

Package Outline Dimensions

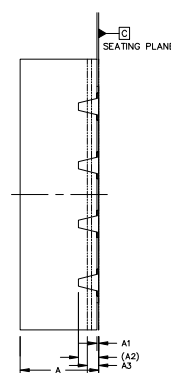
DFN3X3-8-WET-H

Package Outline Dimensions

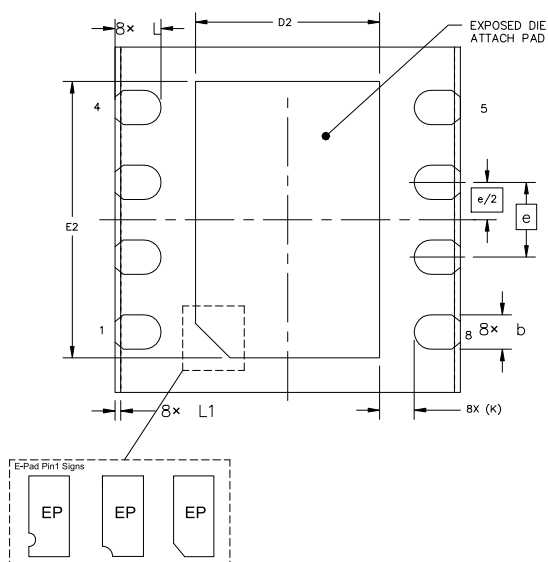
DFC(DFN3X3-8-WET-H)



TOP VIEW



SIDE VIEW



BOTTOM VIEW

NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.
3. The many types of E-pad Pin1 signs may appear in the product.

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.800	0.900	0.031	0.035
A1	0.000	0.050	0.000	0.002
A2	0.150	0.250	0.006	0.010
A3	0.080	0.180	0.003	0.007
D	2.900	3.100	0.114	0.122
D2	1.500	1.700	0.059	0.067
E	2.900	3.100	0.114	0.122
b	0.250	0.350	0.010	0.014
E2	2.300	2.500	0.091	0.098
e	0.650 BSC		0.026 BSC	
L	0.350	0.450	0.014	0.018
L1	0.010	0.090	0.0004	0.004
K	0.300 REF		0.012 REF	

Auto Grade Precision Voltage Supervisor with Programmable Watchdog Timer**Order Information**

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPV8351VQ-DFCR-S ⁽¹⁾	-40 to 125°C	DFN3x3-8	51VQ	3	Tape and Reel, 4000	Green
TPV8351WQ-DFCR-S ⁽¹⁾	-40 to 125°C	DFN3x3-8	51WQ	3	Tape and Reel, 4000	Green
TPV8351ZQ-DFCR-S ⁽¹⁾	-40 to 125°C	DFN3x3-8	51ZQ	3	Tape and Reel, 4000	Green
TPV8351RQ-DFCR-S ⁽¹⁾	-40 to 125°C	DFN3x3-8	51RQ	3	Tape and Reel, 4000	Green
TPV8351PQ-DFCR-S ⁽¹⁾	-40 to 125°C	DFN3x3-8	51PQ	3	Tape and Reel, 4000	Green
TPV8351OQ-DFCR-S ⁽¹⁾	-40 to 125°C	DFN3x3-8	51OQ	3	Tape and Reel, 4000	Green
TPV8351SQ-DFCR-S ⁽¹⁾	-40 to 125°C	DFN3x3-8	51SQ	3	Tape and Reel, 4000	Green
TPV8351TQ-DFCR-S	-40 to 125°C	DFN3x3-8	51TQ	3	Tape and Reel, 4000	Green
TPV8351NQ-DFCR-S ⁽¹⁾	-40 to 125°C	DFN3x3-8	51NQ	3	Tape and Reel, 4000	Green
TPV8351MQ-DFCR-S ⁽¹⁾	-40 to 125°C	DFN3x3-8	51MQ	3	Tape and Reel, 4000	Green
TPV8351LQ-DFCR-S ⁽¹⁾	-40 to 125°C	DFN3x3-8	51LQ	3	Tape and Reel, 4000	Green
TPV8351KQ-DFCR-S ⁽¹⁾	-40 to 125°C	DFN3x3-8	51KQ	3	Tape and Reel, 4000	Green

(1) For future products, contact the 3PEAK factory for more information and samples.

Green: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

**Auto Grade Precision Voltage Supervisor with Programmable
Watchdog Timer****IMPORTANT NOTICE AND DISCLAIMER**

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Watchdog Timer**

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