WP7450-AT

Reverse Polarity Protection Controller

1. General Description

The WP7450-AT is an automotive-compliant ideal diode controller which operates in conjunction with an external N-channel MOSFET as a low loss reverse polarity protection solution.

The WP7450-AT supports wide input voltage range from 3.2V to 65V and can control many DC rail voltage such as 12V, 24V or higher automotive battery systems. The 3.2V input voltage meets severe cold crank requirements in automotive systems. The WP7450-AT withstands reverse voltage down to -65V and protects loads.

The WP7450-AT does not have reverse current blocking and is suitable for input reverse polarity protection of loads that can potentially deliver energy back to the input supply such as automotive body control module motor loads.

The WP7450-AT controller provides a charge pump gate drive for an external N-channel MOSFET. The high voltage rating of WP7450-AT helps to simplify the system designs for automotive ISO7637 protection. With the enable pin low, the controller is off and draws approximately 1μA of current thus offering low system current when put into sleep mode.

The WP7450-AT is available in TSOT23-8 green package.

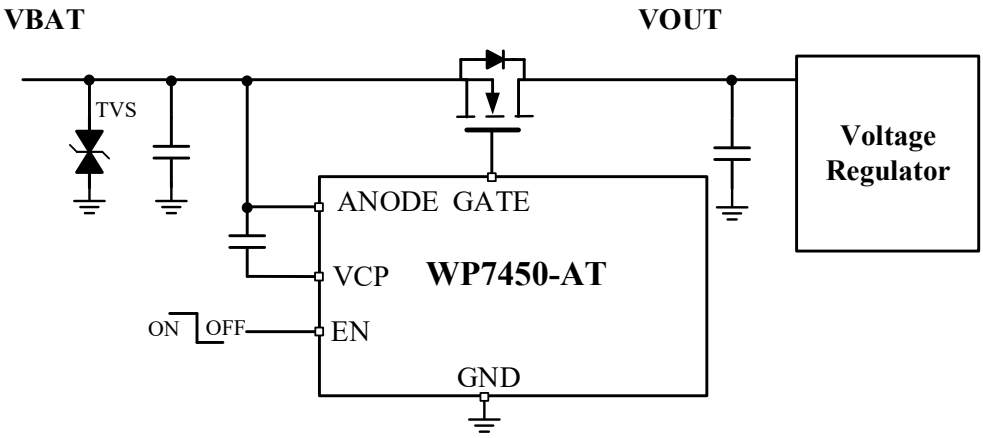
2. Features

- Input Voltage Range from 3.2V to 65V (3.9V Start-up)
- -65V Reverse Battery Voltage
- Charge Pump for External N-Channel Power MOSFET
- Low Shutdown Current of 1μA when Disabled
- Low Quiescent Current of 80μA when Enabled
- Active High Enable Operation
- ESD Protection 2kV of HBM and 1.5kV of CDM
- AEC-Q100 Qualification with Device Temperature Grade 1 (-40°C to +125°C)

3. Applications

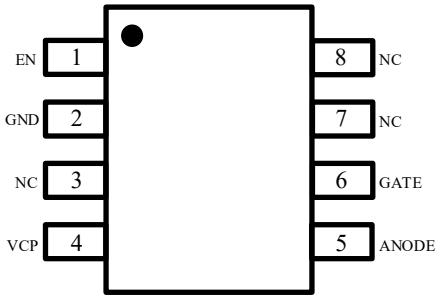
- Body electronics and lighting
- Automotive infotainment systems - digital cluster, head unit
- Automotive USB Hubs
- Industrial factory automation – PLC

4. Typical Application Circuit



5. Pin Configuration

(Top View)



TSOT23-8

6. Pin Description

PIN NUMBER	PIN NAME	I/O	PIN FUNCTION
1	EN	I	Enable pin. Active high.
2	GND	--	Ground pin.
3,7,8	NC	-	No connection.
4	VCP	O	Charge pump voltage output pin. Connects to external capacitor.
5	ANODE	I	Input supply and ANODE pin. Connects to the source of external MOSFET.
6	GATE	O	Gate driver out pin. Connects to gate of external MOSFET.

7. Absolute Maximum Ratings

Operating free-air temperature range (unless otherwise noted)[1]

SYMBOL	PARAMETER	RATINGS	UNIT
ANODE to GND	Input Voltage at ANODE	-65 to +65	V
EN to GND	ANODE>0V	-0.3 to +65	V
	ANODE ≤ 0V	ANODE to (65 + ANODE)	V
GATE to ANODE	Gate to ANODE Voltage	-0.3 to +15	V
VCP to ANODE	Charge Pump Voltage	-0.3 to +15	V
$T_{J(max)}$	Maximum Junction Temperature	-40 to +150	℃
T_{STG}	Storage Temperature	-40 to +150	℃
ESD(HBM)	Human Body ESD Protection	±2	kV
ESD(CDM)	Charged Device Model ESD Protection	±1.5	kV

NOTE1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

8. Recommended Operating Conditions

SYMBOL	PARAMETER	MIN	MAX	UNIT
ANODE to GND	Input Voltage at ANODE	-60	+60	V
EN to GND	Enable Pin	-60	+60	V
Anode Cap	Input Capacitor [2]	22	-	nF
VCP to Anode Cap	Charge Pump Capacitor [2]	0.1	-	uF
External MOSFET V_{GS} Max	Gate to Anode [2]	15	-	V
T_J	Operating Junction Temperature	-40	+125	℃

NOTE2: Refer to the typical application circuit.

9. Electrical Characteristics

(T_J = -40°C to +125℃, V_{ANODE} = 12V, C_{VCP} = 0.1μF, V_{EN} = 5.0V, typical values are at T_J = +25°C, unless otherwise specified.)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
ANODE Supply						
V_{ANODE}	Operating Input Voltage	-	4	-	60	V
V_{UVLO_ANODE}	ANODE UVLO Rising Threshold	V_{ANODE} Rising, V_{EN}=5V	-	-	3.9	V
	ANODE UVLO Falling Threshold	V_{ANODE} Falling, V_{EN}=5V	2.2	2.6	3.1	V
I_{ANODE_OFF}	Shutdown Supply Current	V_{EN}=0V	-	1	1.9	μA
I_{ANODE_Q}	Operating Quiescent Current	V_{EN}=5V	-	80	205	μA
EN Input						
V_{IL}	Enable Input Low Threshold	V_{EN} Falling, V_{ANODE}=12V	0.6	1.05	1.45	V
V_{IH}	Enable Input High Threshold	V_{EN} Rising, V_{ANODE}=12V	1.3	2.3	2.9	V
I_{EN}	Enable Sink Current	V_{ANODE}=12V, V_{EN}=12V	-	3	5	μA
Gate Drive						
I_{GATE}	Peak Source Current	V_{GATE}-V_{ANODE}=5V	3	11	-	mA
	Peak Sink Current	EN=High to Low V_{GATE}-V_{ANODE}=5V		1850		mA
R_{DIS}	Discharge Switch Resistance	EN=High to Low V_{GATE}-V_{ANODE}=100mV	0.4		4	Ω

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Charge Pump						
I_{VCP}	Charge Pump Source Current (Charge Pump On)	$V_{VCP} - V_{ANODE}$ = 7V	160	220	600	μA
	Charge Pump Sink Current (Charge Pump Off)	$V_{VCP} - V_{ANODE}$ = 14V	-	6	10	μA
V_{VCP}-V_{ANODE}	Charge Pump Voltage at V_{ANODE} = 3.2V	I_{VCP} ≤ 30μA	8	-	-	V
	Charge Pump Turn On Voltage		11	12	13	V
	Charge Pump Turn Off Voltage		12	13	14	V
V_{VCP_UVLO}	$V_{VCP} - V_{ANODE}$ UV Release at Rising Edge		5.8	6.6	7.7	V
	$V_{VCP} - V_{ANODE}$ UV Threshold at Falling Edge		4.6	5.4	6	V
Switching Characteristics						
t_{EN_DELAY}	Delay from Enable Switching High to Gate Turn On	$V_{VCP} > V_{VCP_UVLO}$	-	70	-	μs

10. Typical Performance Characteristics

(V_{ANODE} = 12V, V_{EN} = High, C_{VCP}=0.1μF, T_A=25℃, unless otherwise noted)

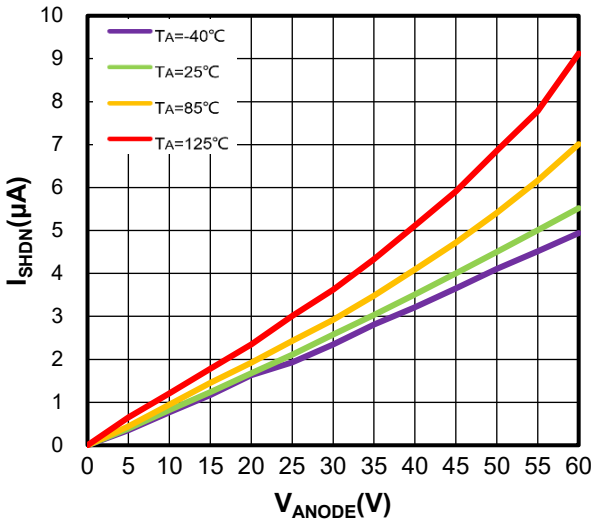


Figure 1. Shutdown Current vs. Input voltage

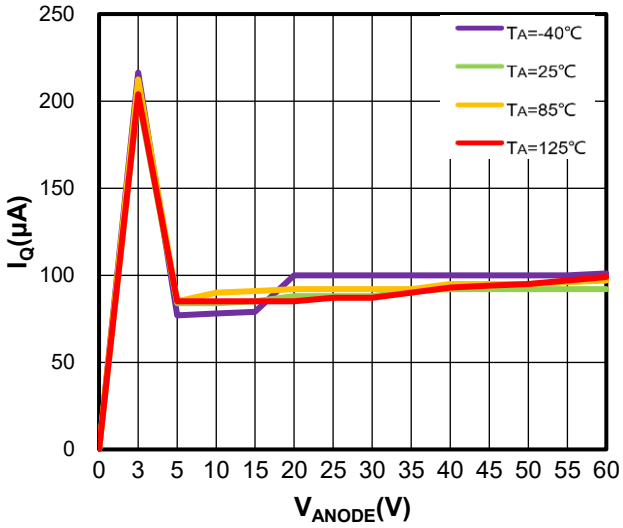


Figure 2. Quiescent Current vs. Input voltage

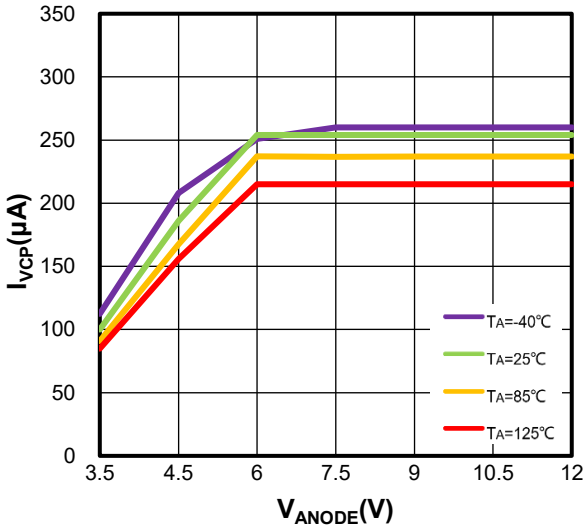


Figure 3. Charge pump Current vs. Input voltage at V_{VCP}=6V

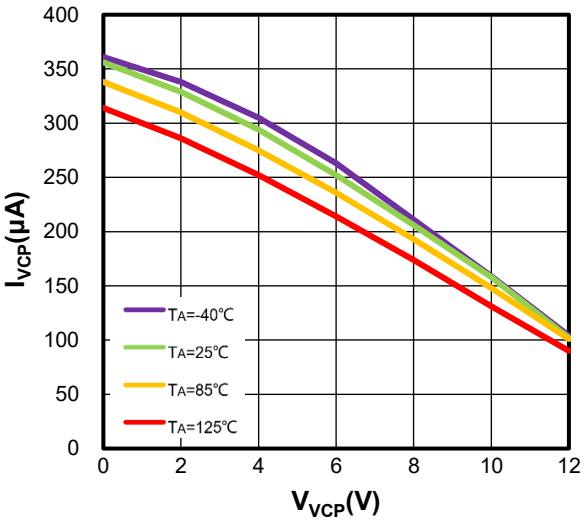


Figure 4. Charge pump V-I vs. Input voltage ≥12V

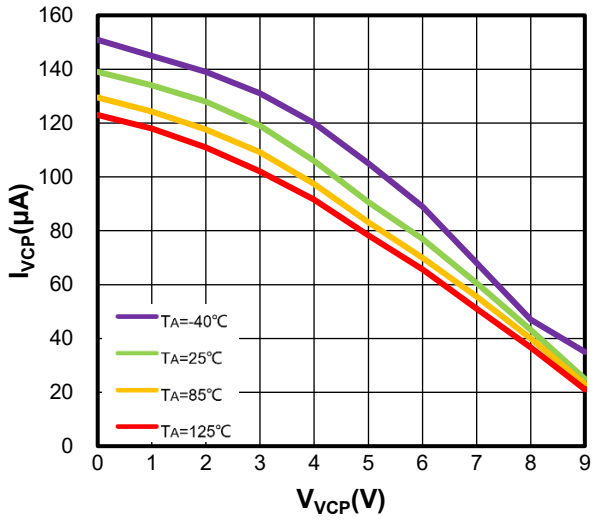


Figure 5. Charge pump V-I vs. Input voltage

=3.2V

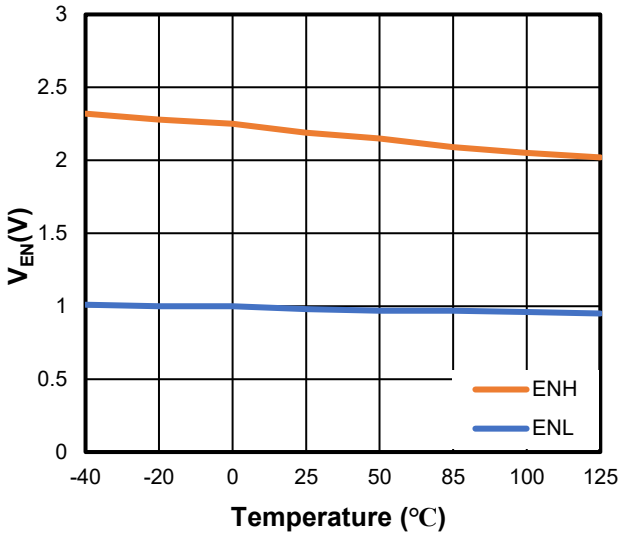


Figure 6. EN Threshold vs. Temperature

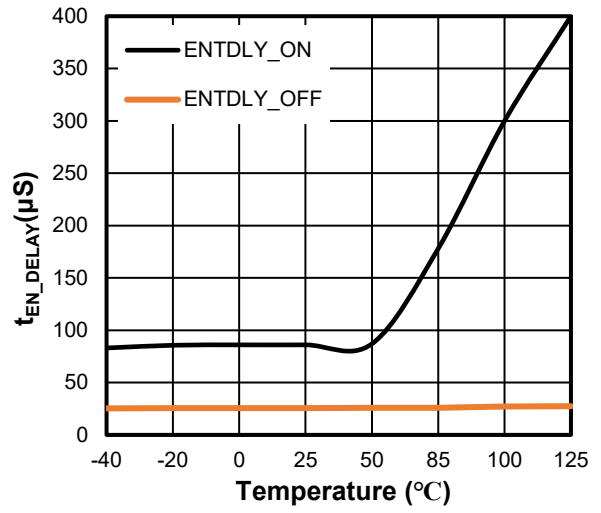


Figure 7. Enable to Gate Delay vs. Temperature

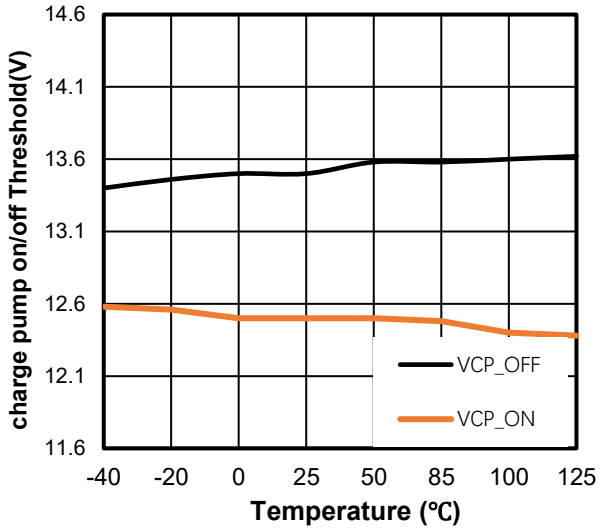


Figure 8. Enable to Gate Delay vs. Temperature

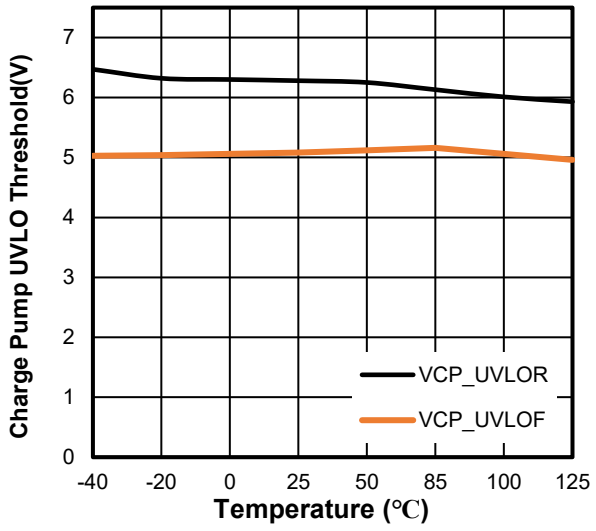


Figure 9. Charge Pump UVLO Threshold vs. Temperature

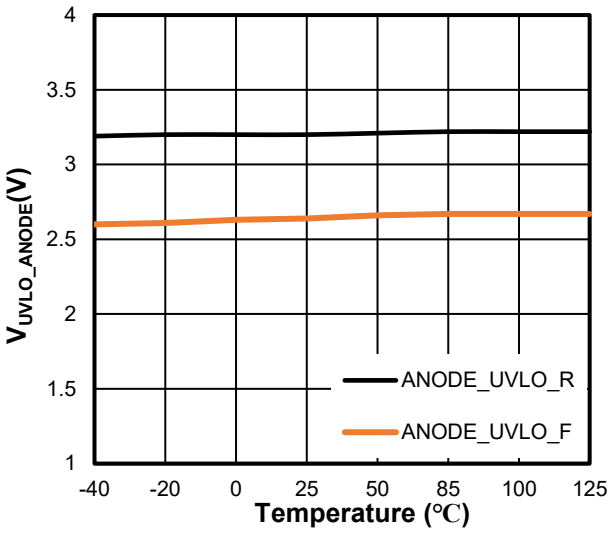
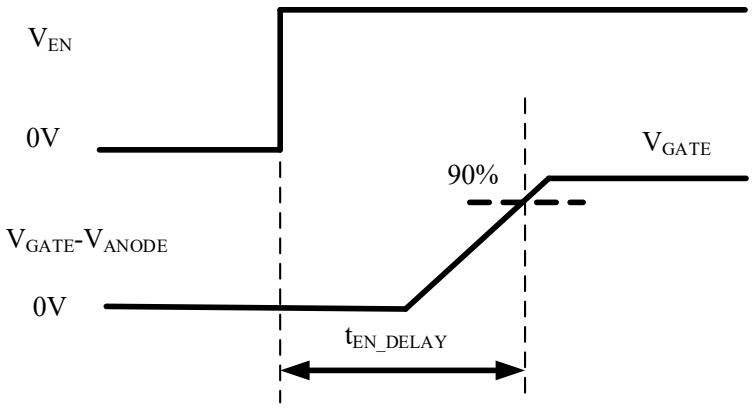


Figure 10. Input Undervoltage Lockout vs. Temperature

11. Switching Waveforms

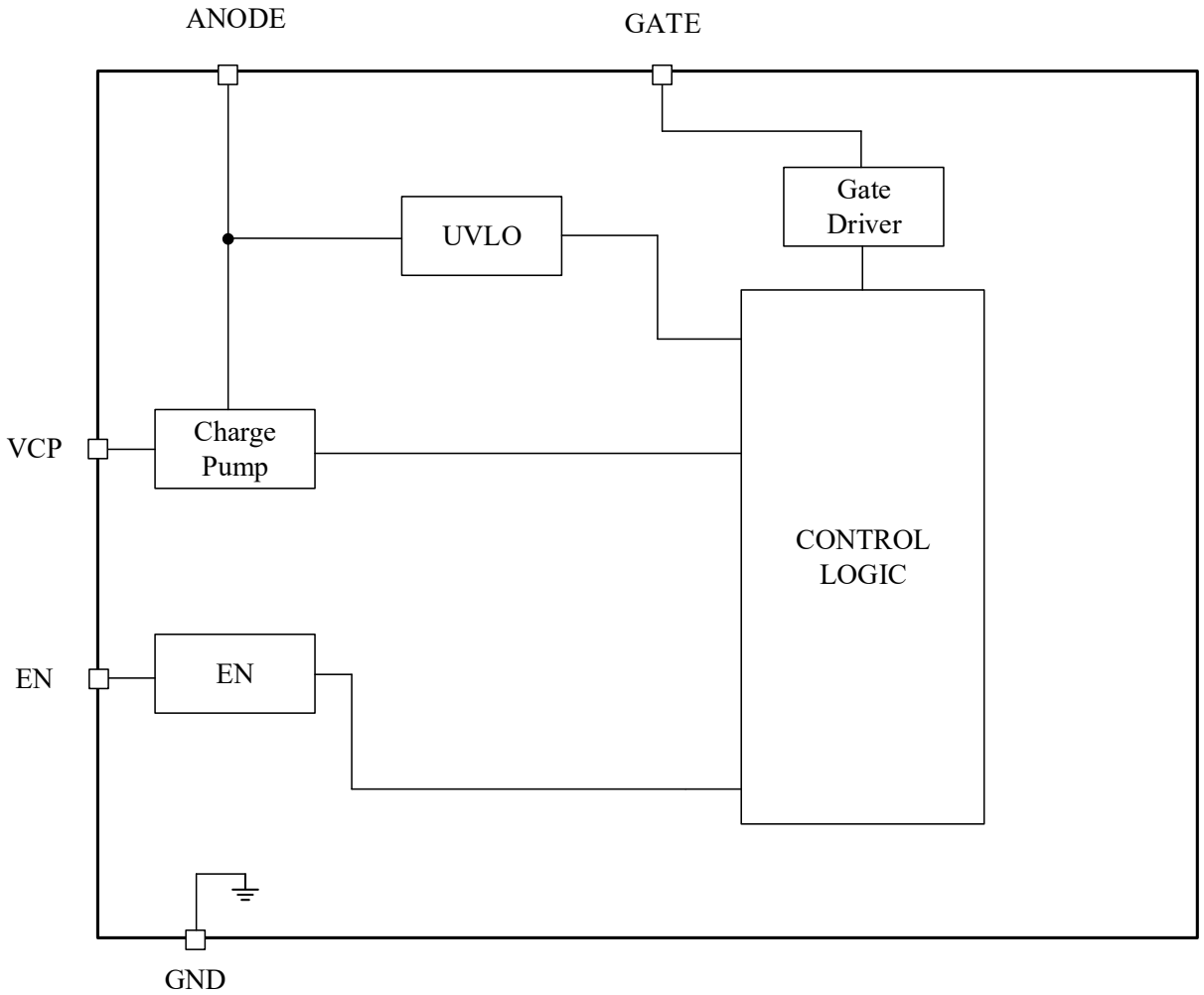


12. Function Description

12.1 Overview

The WP7450-AT controller has all the features necessary to implement an efficient and fast reverse polarity protection circuit. This easy-to-use reverse polarity protection controller is paired with an external N-channel MOSFET to replace other reverse polarity schemes such as a P-channel MOSFET. An internal charge pump is used to drive the external N-Channel MOSFET to a maximum gate drive voltage of approximately 15 V. An enable pin, EN is available to place the WP7450-AT in shutdown mode disabling the N-Channel MOSFET and minimizing the quiescent current.

12.2 Block Diagram



12.3 Feature Description

12.3.1 Input Voltage

The ANODE pin is used to power the internal circuitry of the WP7450-AT and typically draws 80μA when enabled and 1μA when disabled. If the ANODE pin voltage is greater than the UVLO rising threshold, then WP7450-AT operates in either shutdown mode or conduction mode in depending on the EN pin voltage. The voltage from ANODE to GND can withstand 65V to -65V, enabling the WP7450-AT to withstand negative voltage transients.

12.3.2 Charge Pump

The charge pump provides the voltage needed to drive the external N-channel MOSFET. An external charge pump capacitor between the VCP and ANODE pins provides energy to turn on the external MOSFET. In order for the charge pump to supply current to the external capacitor, the EN pin voltage must be above the specified input high threshold V_{IH}. When enabled, the charge current of the charge pump is typically 220μA. If the EN pin is pulled low, the charge pump remains disabled. Before enabling the internal gate driver, the voltage from VCP to ANODE must be higher than the V_{VCP_UVLO} (typically 6.6V) in order to ensure that the external MOSFET drive voltage is higher than its specified threshold voltage. Initial gate driver enable delay can be calculated with following formula

$$T_{DRV_EN} = 70\mu s + C_{VCP} \times \frac{V_{VCP_UVLO}}{220\mu A}$$

Where,

C_{VCP} is the charge pump capacitance connected across ANODE and VCP pins

V_{VCP_UVLO} = 6.6V (typical)

The charge pump remains enabled until the VCP to ANODE voltage reaches 13V, at which point the charge pump is disabled to reduce current consumption on the ANODE pin. The charge pump remains disabled until the VCP to ANODE voltage falls below 12V, at which point the charge pump is enabled. The voltage between VCP and ANODE continues to charge and discharge between 12V and 13V. The operating quiescent current of the WP7450-AT can be reduced by enabling and disabling the charge pump. When the charge pump is disabled, it has a typical quiescent current of 6μA.

12.3.3 Gate Driver

The gate driver is used to control the external N-Channel MOSFET by setting the appropriate GATE to ANODE voltage

Before the gate driver is enabled following three conditions must be achieved:

- The EN pin voltage must be greater than the specified input high voltage.
- The VCP to ANODE voltage must be greater than the under voltage lock out voltage.
- The ANODE voltage must be greater than V_{UVLO_ANODE} Rising threshold.

If the above conditions are not achieved, then the GATE pin is internally connected to the ANODE pin, assuring that the external MOSFET is disabled. Once these conditions are achieved the gate driver operates in the conduction mode enhancing the external MOSFET completely.

12.3.4 Enable

The EN pin allows for the gate driver to be either enabled or disabled by an external signal. If the EN pin voltage is greater than the rising threshold, the gate driver and charge pump are activated. If the EN pin voltage is lower than the input low threshold, the charge pump and gate driver are disabled, placing the WP7450-AT in shutdown mode. The EN pin can withstand a voltage as high as 65V and as low as -65V. This allows for the EN pin to be connected directly to the ANODE pin if enable functionality is not needed. In conditions where EN is left floating, the internal sink current of 3μA pulls EN pin low and disables the device.

12.3.5 Shutdown Mode

When the EN pin voltage falls below the specified input low threshold V_{IL}, both the gate driver and the charge pump are disabled The WP7450-AT will enter shutdown mode. In shutdown mode, the forward current through the external MOSFET can continue to be conducted by the body diode of the MOSFET. The WP7450-AT enters a low IQ operation with only 1μA of current at the ANODE pin.

12.3.6 Conduction Mode

For the WP7450-AT to operate in conduction mode the gate driver must be enabled as described in the *Gate Driver* section. If these conditions are achieved the GATE pin is internally connected to the VCP pin resulting in the GATE to ANODE voltage being approximately the same as the VCP to ANODE voltage. By connecting VCP to GATE the external MOSFET's $R_{DS(ON)}$ is minimized reducing the power loss of the external MOSFET when forward currents are large.

13. Application and Implementation

13.1 Reverse Battery Protection for Automotive Body Control Module Applications

Reverse-battery protection activates when battery terminals are incorrectly connected during jump start, vehicle maintenance or service because a connection error can damage the components in ECUs if they are not rated to handle reverse polarity. An N-channel MOSFET (N-FET) based reverse polarity protection solutions are becoming oblivious choice over discrete reverse-battery protection solutions like Schottky diodes and P-channel field-effect transistors (P-FETs) due to their better power and thermal efficiency and the comparatively smaller space they consume on a printed circuit board. Based on the application needs, reverse polarity protection solutions can be divided into two main categories

- Applications which need both input reverse polarity protection and reverse current blocking
- Applications which need only input reverse polarity protection and does not need reverse current blocking

Figure 13-1 provides an overview of these two reverse polarity protection solution categories. Typically for applications where output loads are DC/DC converters, voltage regulator followed by MCU/processors (Logic paths), input reverse polarity protection and reverse current blocking feature is required. For reverse polarity protection solution of the logic path ideal diode controllers such as WP7470-AT is a suitable device.

For the applications such as Body Control Module (BCM) load driving paths, input reverse polarity protection is required but reverse current blocking is not a must have feature. For reverse polarity protection solution of the BCM load driving paths, reverse polarity protection controllers such as WP7450-AT is a suitable device.

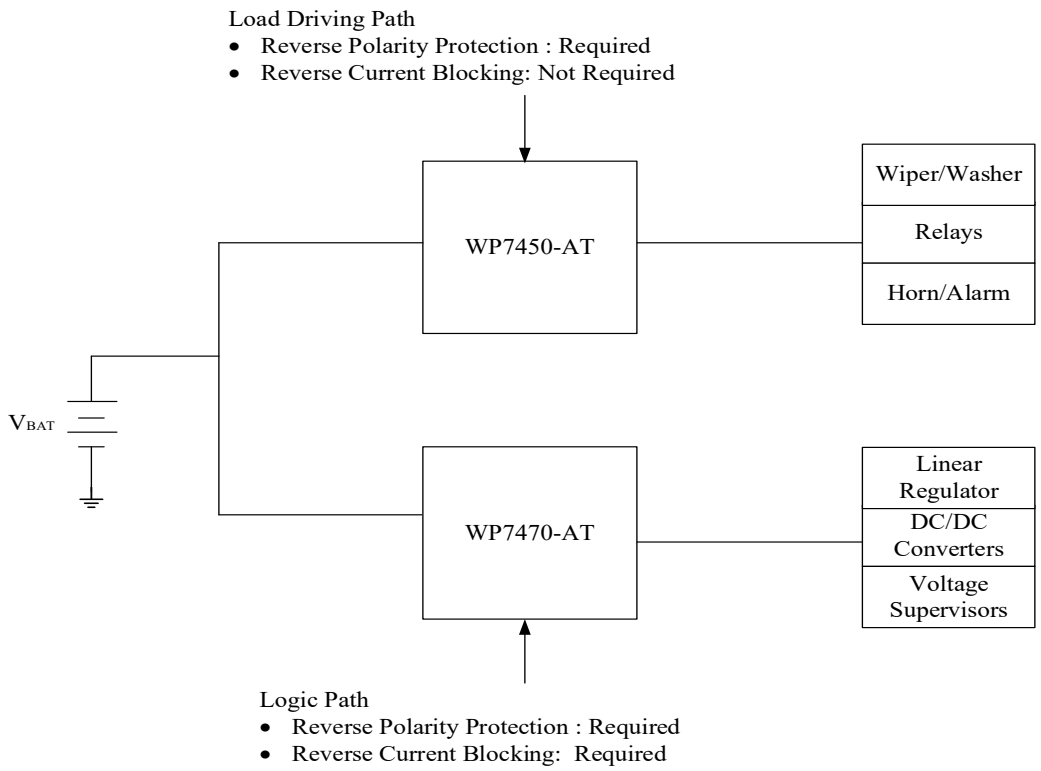


Figure 13-1. Typical Block Diagram for Automotive BCM Reverse Battery Protection Solution

For certain applications such as body control module load driving paths where output loads are inductive in nature such as wiper motor, door control module, it is required that reverse polarity protection device should provide protection against incorrect input polarity. However, it should not block reverse current from loads back to the battery. This is mainly required to avoid voltage overshoot which is caused when inductive loads are turned off. If reverse polarity protection device blocks the reverse current then there could be voltage overshoot caused due to inductive kick back or motor regenerative action and can damage parallel loads connected on the output of reverse polarity protection device. For certain specific loads such as wiper motor, a voltage overshoot is seen due to transformer effect when wiper motor speed is changed from fast speed to slow speed. WP7450-AT is designed to provide protection against input reverse polarity

for such applications where reverse current blocking is not required. Figure 13-2 shows typical application circuit of reverse polarity protection of body control module load driving paths.

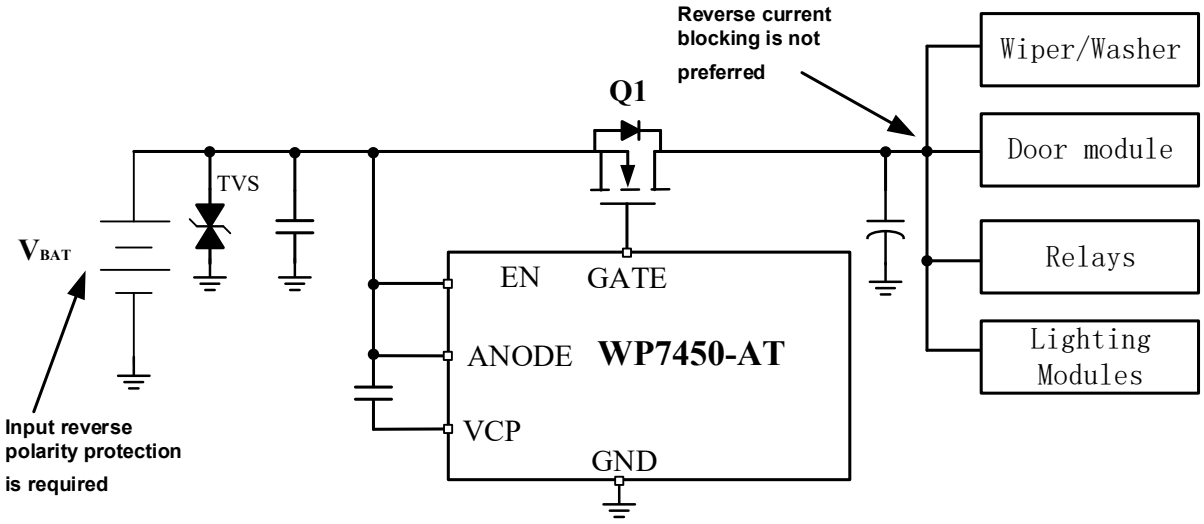


Figure 13-2. Typical Block Diagram of Reverse Battery Protection for Body Control Module Load Driving Path

13.2 Reverse Polarity Protection

P-FET based reverse polarity protection is a very commonly used scheme in industrial and automotive applications to achieve low insertion loss protection solution. A low loss reverse polarity protection solution can be realized using WP7450-AT with an external N-FET to replace P-FET based solution. WP7450-AT based reverse polarity protection solution offers better cold crank performance (low VIN operation) and smaller solution size compared to P-FET based solution. Figure 13-3 compares the performance benefits of WP7450-AT +N-FET over traditional P-FET based reverse polarity protection solution. As shown in Figure 13-3, for a given power level WP7450-AT+N-FET solution can be three times smaller than a similar power rated P-FET solution. Also as PFET is self-biased by simply pulling, its gate pin low and thus P-FET shows poorer cold crank performance (low VIN operation) compared to WP7450-AT. During severe cold crank where battery voltage falls below 4V, P-FET series resistance increase drastically as shown in Figure 13-3. This leads to higher voltage drop across the PFET. Also with higher gate to ANODE threshold (V_T) this can sometimes lead to system reset due to turning off of the P-FET. On the other side WP7450-AT has excellent severe cold crank performance. WP7450-AT keeps external FET completely enhanced even when input voltage falls to 3.2V during severe cold crank operation.

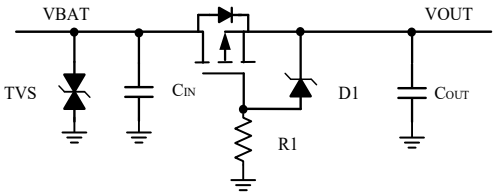
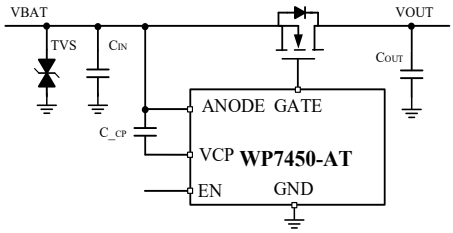
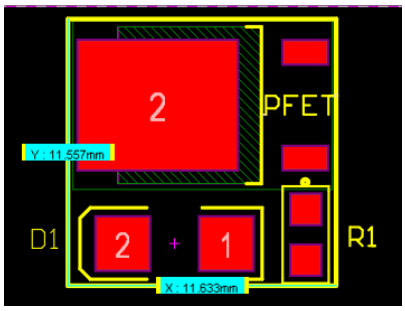
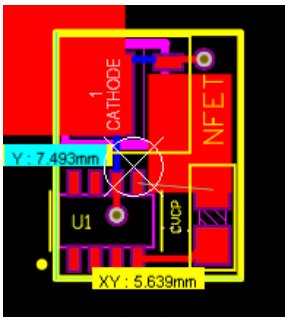
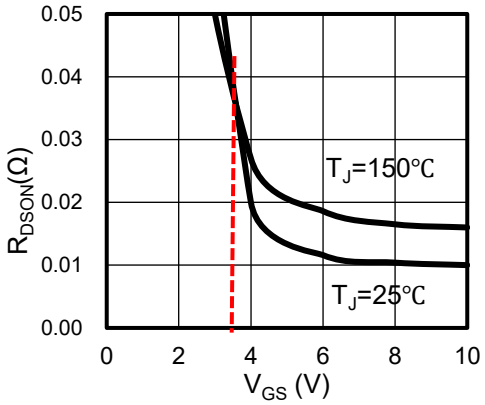
Parameter	P-FET	WP7450-AT + N-FET
Typical Application Diagram		
Solution Size (Load current >6A)	 11.557x11.633=134.44mm^2	 7.493x5.639=42.25mm^2
Low V_{IN} / Cold-Crank Performance		Better cold crank performance compared to PFET based solution. External N-FET remains fully enhanced even if input voltage falls to 3.2V.

Figure 13-3. Performance Comparison of P-FET and WP7450-AT Based Reverse Polarity Protection Solution

13.3 Application Information

The WP7450-AT is used with N-Channel MOSFET controller in a typical reverse polarity protection application. The schematic for the 12V battery protection application is shown in Figure 13-4 where the WP7450-AT is used to drive the MOSFET Q1 in series with a battery. The TVS is not required for the WP7450-AT to operate, but they are used to clamp the positive and negative voltage surges. The output capacitor COUT is recommended to protect the immediate output voltage collapse as a result of line disturbance.

13.3.1 Typical Application

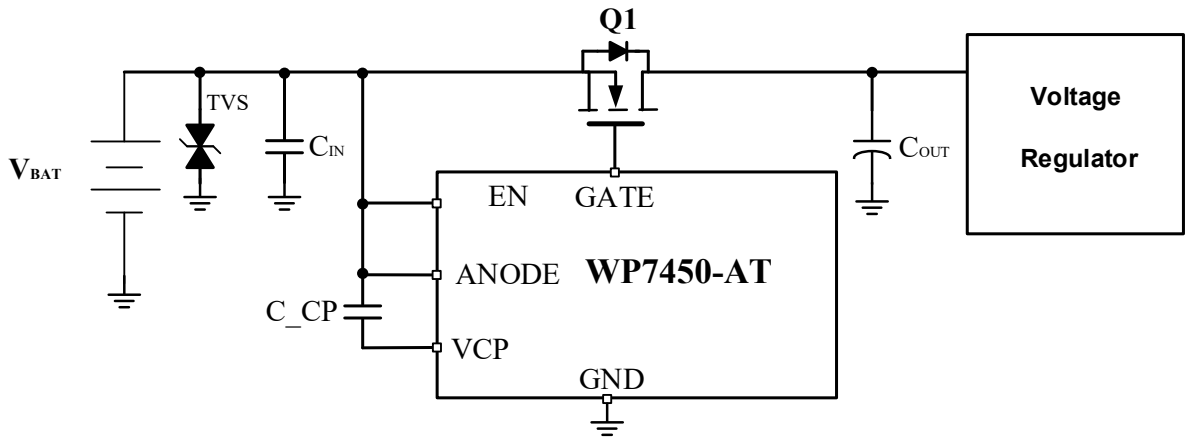


Figure 13-4. Typical Application Circuit

13.3.1.1 Design Requirements

A design example, with system design parameters listed in Table 13-1 is presented.

Table 13-1. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
Input voltage range	12V Battery, 12V Nominal with 3.2V Cold Crank and 35V Load Dump
Output voltage	3.2 V during Cold Crank to 35V Load Dump
Output current range	3A Nominal, 5A Maximum
Output capacitance	220μF Typical Output Capacitance
Automotive EMC Compliance	ISO 7637-2 and ISO 16750-2

13.3.1.2 Detailed Design Procedure

13.3.1.2.1 Design Considerations

- Input operating voltage range, including cold crank and load dump conditions
- Nominal load current and maximum load current

13.3.1.2.2 MOSFET Selection

The important MOSFET electrical parameters are the maximum continuous drain current ID, the maximum drain-to- ANODE voltage $V_{DS(MAX)}$, the maximum ANODE current through body diode and the drain-to-ANODE On resistance R_{DSON}.

The maximum continuous drain current, ID, rating must exceed the maximum continuous load current. The maximum drain-to-ANODE voltage, $V_{DS(MAX)}$, must be high enough to withstand the highest differential voltage seen in the application. This would include any anticipated fault conditions. It is recommended to use MOSFETs with voltage rating up to 60-V maximum with the WP7450-AT because ANODE pin maximum voltage rating is 65-V. The maximum V_{GS} WP7450-AT can drive is 13 V, so a MOSFET with 15-V minimum VGS rating should be selected. If a MOSFET with VGS rating < 15 V is selected, a Zener diode can be used to clamp V_{GS} to safe level.

During startup, inrush current flows through the body diode to charge the bulk hold-up capacitors at the output. The maximum ANODE current through the body diode must be higher than the inrush current that can be seen in the application.

To reduce the MOSFET conduction losses, lowest possible $R_{DS(ON)}$ is preferred.

Based on the design requirements, preferred MOSFET ratings are:

- 60V $V_{DS(MAX)}$ and ±20V $V_{GS(MAX)}$

WMQ058NV6LG4 MOSFET is selected to meet this 12V reverse battery protection design requirements and it is rated at:

- $V_{DS(MAX)}$= 65V and $V_{GS(MAX)}$=±20V
- $R_{DS(ON)}$ 4.7mΩ typical and 6.2mΩ maximum rated at 4.5V V_{GS} to ensure lower power dissipation across the FET

DMT6007LFG MOSFET is selected to meet this 12V reverse battery protection design requirements and it is rated at:

- $V_{DS(MAX)}$= 60V and $V_{GS(MAX)}$=±20V
- $R_{DS(ON)}$ 6.5mΩ typical and 8.5mΩ maximum rated at 4.5V V_{GS} to ensure lower power dissipation across the FET

Thermal resistance of the MOSFET should be considered against the expected maximum power dissipation in the MOSFET to ensure that the junction temperature (TJ) is well controlled.

13.3.1.2.3 Charge Pump C_CP and C_{IN}/C_{OUT}

Minimum required capacitance for charge pump VCP and input/output capacitance are:

- C_CP: Minimum 0.1µF is required; recommended value of VCP (µF) ≥ 10 x CISS (MOSFET) (µF)
- C_{IN}: Minimum 22nF of input capacitance
- C_{OUT}: Minimum 1µF of output capacitance.

13.3.1.3 TVS Selection for 12V Battery Protection Application

TVS diodes are used in automotive systems for protection against transients. In the 12V battery protection application circuit shown in Figure 13-5, a bidirectional TVS diode is used to protect from positive and negative transient voltages that occur during normal operation of the car and these transient voltage levels and pulses are specified in ISO 7637-2 and ISO 16750-2 standards.

There are two important specifications, breakdown voltage and clamping voltage of the TVS. Breakdown voltage is the voltage at which the TVS diode goes into avalanche similar to a Zener diode and is specified at a low current value typical 1mA, and the breakdown voltage should be higher than worst case steady state voltages seen in the system. The breakdown voltage of the TVS+ should be higher than jump start voltage (24V) and suppressed load dump voltage (35V) and less than the maximum ratings of WP7450-AT (65V). The breakdown voltage of TVS- should be beyond maximum reverse battery voltage(-16V), so that the TVS- is not damaged due to long time exposure to reverse connected battery.

Clamping voltage is the voltage the TVS diode clamps in high current pulse situations and this voltage is much higher than the breakdown voltage. TVS diodes are meant to clamp transient pulses and should not interfere with steady state operation.

The next criterion is that the absolute minimum rating of ANODE voltage of the WP7450-AT (–65V) and the maximum VDS rating MOSFET are not exceeded. In the design example, 60V rated MOSFET is chosen. SMBJ series of TVS' are rated up to 600W peak pulse power levels. This is sufficient for ISO 7637-2 pulses and suppressed load dump (ISO-16750-2 pulse B).

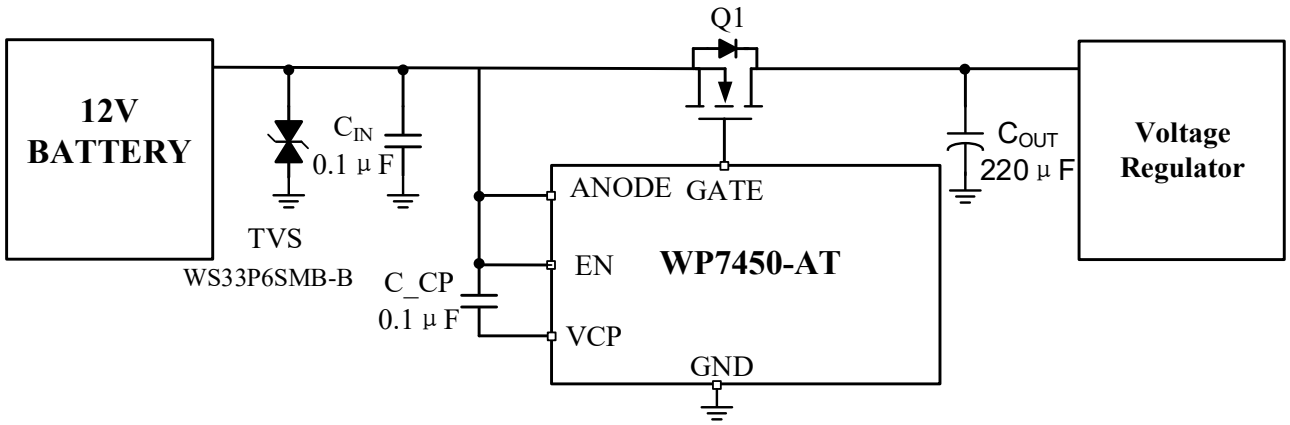


Figure 13-5. Typical 12V Battery Protection with Single Bidirectional TVS

13.3.1.4 TVS Selection for 24V Battery Protection Application

Typical 24V battery protection application circuit shown in Figure 13-6 uses two unidirectional TVS diodes to protect from positive and negative transient voltages

The breakdown voltage of the TVS+ should be higher than 48V jump start voltage, lower than the absolute maximum ratings of ANODE and EN pins of WP7450-AT (65V) and should withstand 65V suppressed load dump. The breakdown voltage of TVS- should be lower than maximum reverse battery voltage -32V, so that the TVS- is not damaged due to long time exposure to reverse connected battery.

Single bidirectional TVS cannot be used for 24V battery protection because breakdown voltage for TVS+ ≥ 48V, maximum negative clamping voltage is ≤ -65V. Two unidirectional TVS connected back-back needs to be used at the input. For positive side TVS+, WS58P6SMB with the breakdown voltage of 64.4V (minimum), 67.8V (typical) is recommended. For the negative side TVS-, WS26P6SMB with breakdown voltage close to 32V (to withstand maximum reverse battery voltage -32V) and maximum clamping voltage of 42.1V is recommended.

For 24V battery protection, a 75V rated MOSFET is recommended to be used along with WS26P6SMB and WS58P6SMB connected back-back at the input.

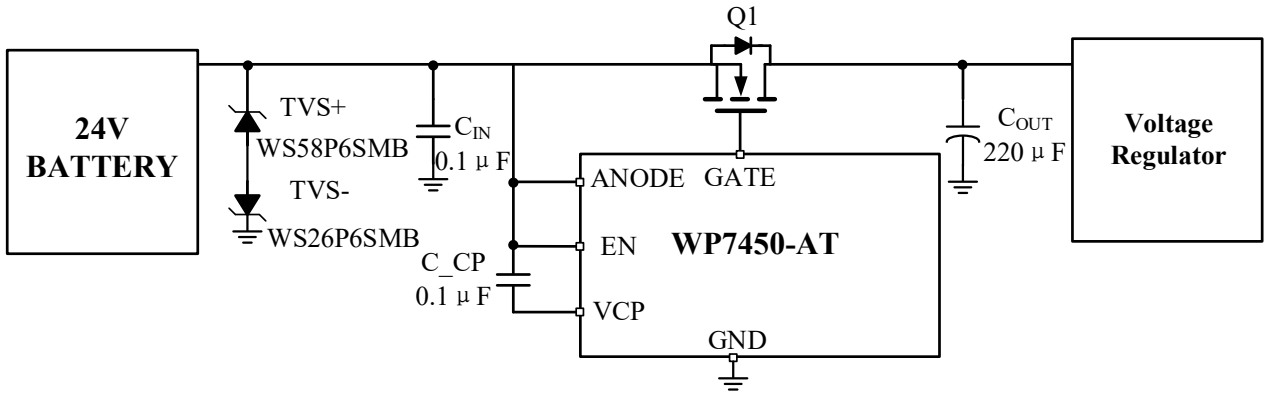


Figure 13-6. Typical 24V Battery Protection with Two Unidirectional TVS

13.3.1.5 Application Curves

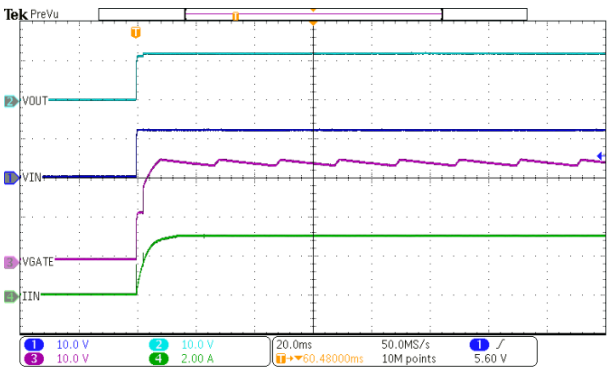


Figure 11. Start-up with 3A Load

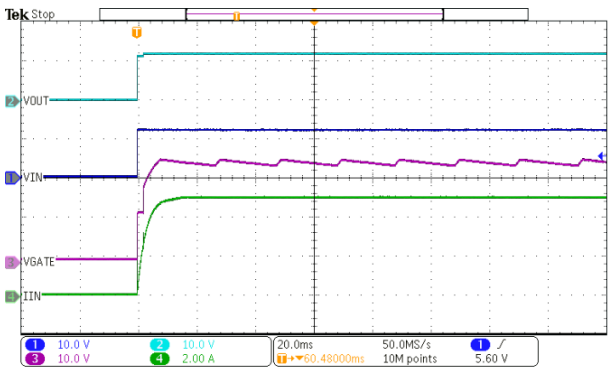


Figure 12. Start-up with 5A Load

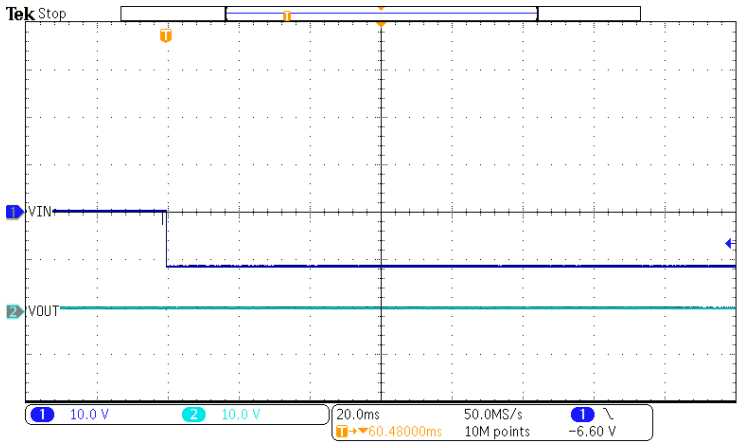


Figure 13. Startup with Input Reverse Voltage (-12V)

14. Evaluation Modules

Evaluation Modules (EVMs) are available to help evaluate initial circuit performance. You can contact us to get the evaluation module or schematic.

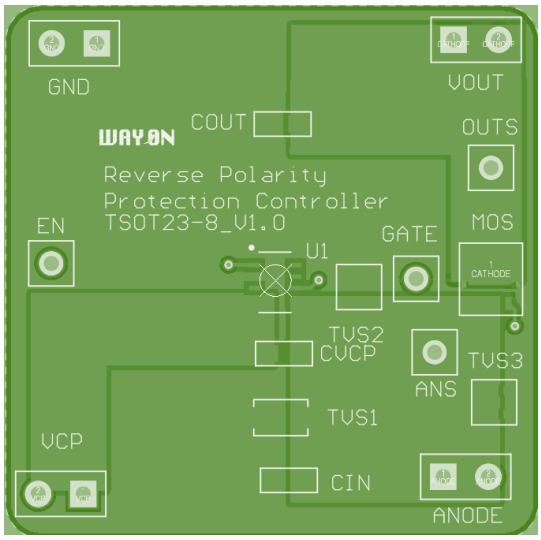
The module name is listed in the following table.

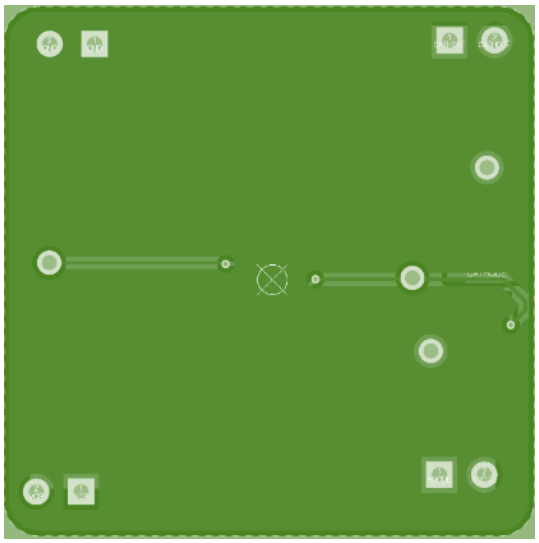
Name	Package	Evaluation Module
WP7450-B80R-AT	TSOT23-8	Reverse Polarity Protection Controller_TSOT23-8_V1.0

Layout Guidelines

- Connect ANODE and GATE pins of WP7450-AT close to the MOSFET's ANODE and GATE pins.
- The high current path of for this solution is through the MOSFET, therefore it is important to use thick traces for ANODE and drain of the MOSFET to minimize resistive losses.
- The charge pump capacitor across VCP and ANODE pins must be kept away from the MOSFET to lower the thermal effects on the capacitance value.
- The Gate pin of the WP7450-AT must be connected to the MOSFET gate with short trace. Avoid excessively thin and long running trace to the Gate Drive.

Layout Example





15. Naming Conventions

WP ABBB-CCC D -AT

WP: WAYON Protection IC;

A: Product Category –7: ideal diode

BBB: 450; series number

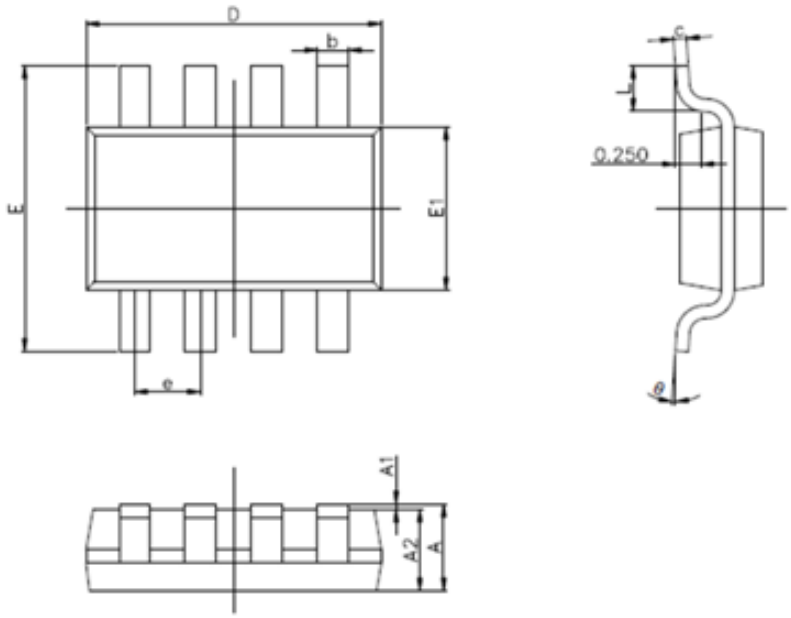
CCC: Package – B80: TSOT23-8

D: R-Reel

AT: Automotive

16. Package Information

TSOT 23-8



SYMBOL	DIMENSIONS IN MILLIMETERS	
	MIN	MAX
A	-	1.25
A1	0.00	0.10
A2	0.70	1.15
b	0.20	0.50
c	0.08	0.20
D	2.80	3.02
E	2.60	3.00
E1	1.50	1.70
e	0.65BSC	
L	0.30	0.60
Θ	0°	8°

17. Ordering Information

PART NUMBER	Op Temp (°C)	PACKAGE	PACKING QUANTITY	MARKING*
WP7450-B80R-AT	-40 to 125	TSOT23-8	3k/Reel	7450Q XXXX

* XXXX is variable.

Contact Information

No.1001, Shiwan(7) Road, Pudong District, Shanghai, P.R.China.201207
Tel: 86-21-50310888 Fax: 86-21-50757680 Email: market@way-on.com
WAYON website: http://www.way-on.com
For additional information, please contact your local Sales Representative.
WAYON® is registered trademark of Wayon Corporation.

Product Specification Statement

1.The product specification aims to provide users with a reference regarding various product parameters, performance, and usage. It presents certain aspects of the product's performance in graphical form and is intended solely for users to select product and make product comparisons, enabling users to better understand and evaluate the characteristics and advantages of the product. It does not constitute any commitment, warranty, or guarantee.

2.The product parameters described in the product specification are numerical values, characteristics, and functions obtained through actual testing or theoretical calculations of the product in an independent or ideal state. Due to the complexity of product applications and variations in test conditions and equipment, there may be slight fluctuations in parameter test values. WAYON shall not guarantee that the actual performance of the product when installed in the customer's system or equipment will be entirely consistent with the product specification, especially concerning dynamic parameters. It is recommended that users consult with professionals for product selection and system design. Users should also thoroughly validate and assess whether the actual parameters and performance when installed in their respective systems or equipment meet their requirements or expectations. Additionally, users should exercise caution in verifying product compatibility issues, and WAYON assumes no responsibility for the application of the product.

3.WAYON strives to provide accurate and up-to-date information to the best of our ability. However, due to technical, human, or other reasons, WAYON cannot guarantee that the information provided in the product specification is entirely accurate and error-free. WAYON shall not be held responsible for any losses or damages resulting from the use or reliance on any information in these product specifications. WAYON reserves the right to revise or update the product specification and the products at any time without prior notice, and the user's continued use of the product specification is considered an acceptance of these revisions and updates. Prior to purchasing and using the product, users should verify the above information with WAYON to ensure that the product specification is the most current, effective, and complete. If users are particularly concerned about product parameters, please consult WAYON in detail or request relevant product test reports. Any data not explicitly mentioned in the product specification shall be subject to separate agreement.

4.Users are advised to pay attention to the parameter limit values specified in the product specification and maintain a certain margin in design or application to ensure that the product does not exceed the parameter limit values defined in the product specification. This precaution should be taken to avoid exceeding one or more of the limit values, which may result in permanent irreversible damage to the product, ultimately affecting the quality and reliability of the system or equipment.

5.The design of the product is intended to meet civilian needs and is not guaranteed for use in harsh environments or precision equipment. It is not recommended for use in systems or equipment such as medical devices, aircraft, nuclear power, and similar systems, where failures in these systems or equipment could reasonably be expected to result in personal injury. WAYON shall assume no responsibility for any consequences resulting from such usage.

6.Users should also comply with relevant laws, regulations, policies, and standards when using the product specification. Users are responsible for the risks and liabilities arising from the use of the product specification and must ensure that it is not used for illegal purposes. Additionally, users should respect the intellectual property rights related to the product specification and refrain from infringing upon any third-party legal rights. WAYON shall assume no responsibility for any disputes or controversies arising from the above-mentioned issues in any form.