

## Ultra-Low On-Resistance Bidirectional Battery Switch

### General Description

The ET3153 bidirectional battery switch features reverse blocking capability to isolate the battery from the system. The internal switch features ultra-low 6m $\Omega$  (Typ) on-resistance and operates from a 2.3V to 5.5V input voltage range, making this device ideal as a battery-disconnect switch for high-capacity battery applications. The slew-rate controlled switch is also ideal for a large load capacitor as well as high-current load switching applications.

The device is available in an ultra-small WLCSP12 package. The tiny, low-profile package is suitable for space-limited portable device applications.

The device operates over the -40 °C to +85 °C extended temperature range.

### Features

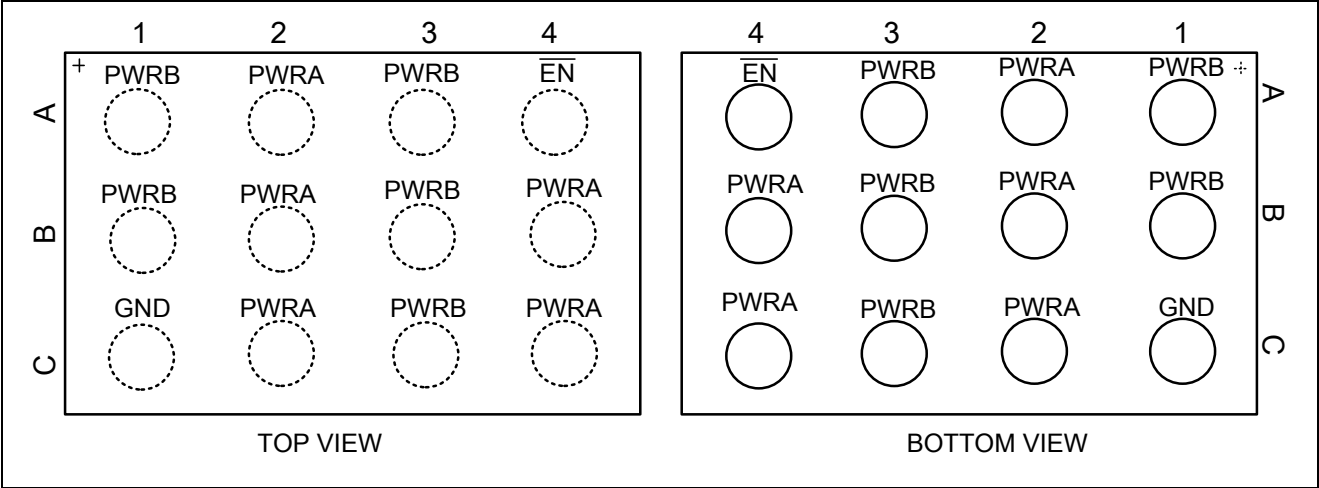
- Efficient System Battery Switch
- Wide Input Voltage Range from 2.3V to 5.5V
- Low Quiescent Current Lower than 1uA
- Typical R<sub>DS(ON)</sub> is 6m $\Omega$  Typical at 3.6V
- Integrated Pull-down and Logic Buffer Circuits
- Part No. and Package

| Part No. | Package                            |
|----------|------------------------------------|
| ET3153   | WLCSP12 (1.4mm ×1.8mm,0.4mm pitch) |

### Application

- Tablet PC Battery Switches
- Smart phone Battery Switches
- Battery Isolators

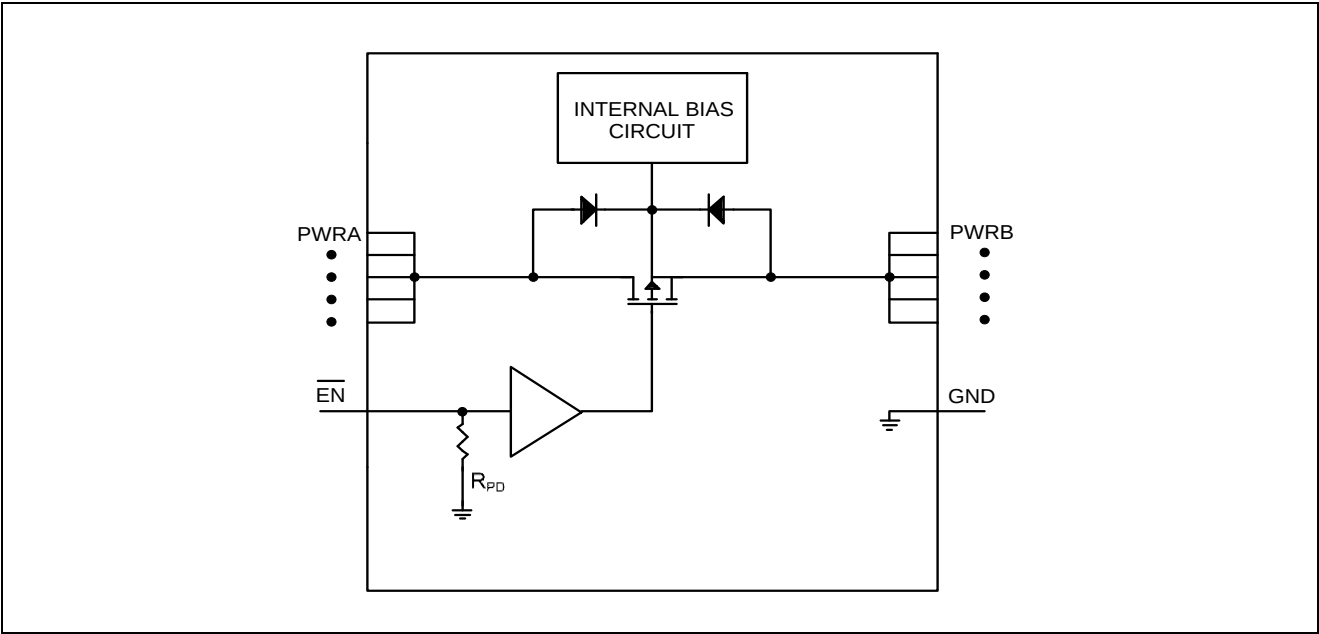
Pin Configuration



Pin Function

| Pin No.           | Pin Name               | Description                                                                               |
|-------------------|------------------------|-------------------------------------------------------------------------------------------|
| A1, A3, B1,B3, C3 | PWRB                   | Power I/O                                                                                 |
| A2, B2, B4,C2, C4 | PWRA                   | Power I/O                                                                                 |
| A4                | $\overline{\text{EN}}$ | Active-Low Enable Input.<br>Drive $\overline{\text{EN}}$ low level to turn on the switch. |
| C1                | GND                    | Ground                                                                                    |

Block Diagram



# ET3153

## Functional Description

The ET3153 is a bidirectional switch with ultra-low 6m $\Omega$  (Typ) on-resistance and reverse-current blocking capability. The device has low quiescent current and operates from a 2.3V to 5.5V input voltage range, making this device ideal as a battery-disconnect switch for high-capacity battery applications. The slew-rate controlled switch is also ideal for a large load capacitor as well as high-current load switching applications.

## Reverse-Current Blocking

The bidirectional FET switch prevents current flowing from either power input to the other when the switch is disabled.

## $\overline{\text{EN}}$ Input

The switch position is controlled by an  $\overline{\text{EN}}$  active-low logic input. The switch is on when  $\overline{\text{EN}}$  is logic-low and off when  $\overline{\text{EN}}$  is logic-high.  $\overline{\text{EN}}$  is internally pulled down to ground by RPD.

## Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

| Parameter                                                               |                                    | Value                     | Unit                        |
|-------------------------------------------------------------------------|------------------------------------|---------------------------|-----------------------------|
| PWRA, PWRB Input Voltage                                                |                                    | -0.3 to 7.0               | V                           |
| Enable( $\overline{\text{EN}}$ ) Input Voltage                          |                                    | -0.3 to 7.0               |                             |
| Maximum Continuous Switch Current ( $I_{\text{MAX}}$ ) <sup>(3)</sup>   |                                    | $\pm 6.0$                 | A                           |
| Maximum Repetitive Pulsed Current (1ms, 20 % Duty Cycle) <sup>(3)</sup> |                                    | $\pm 12.0$                |                             |
| ESD/Electrostatic Discharge Capability                                  | Human Body Model, JESD22-A114      | $\pm 4.0$                 | KV                          |
|                                                                         | Charged Device Model, JESD22-C101  | $\pm 2.0$                 |                             |
|                                                                         | ESD Withstand Voltage IEC61000-4-2 | $\pm 8.0(\text{Contact})$ |                             |
| Junction Temperature ( $T_J$ )                                          |                                    | -40 to 150                | $^{\circ}\text{C}$          |
| Thermal Resistance ( $\theta_{JA}$ ) <sup>(1)</sup>                     |                                    | 73                        | $^{\circ}\text{C}/\text{W}$ |
| Power Dissipation ( $P_D$ ) <sup>(2)</sup>                              |                                    | 1100                      | mW                          |

**Note1.** Device mounted with all leads and power pad soldered or welded to PC board.

**Note2.** Derate 14mW/ $^{\circ}\text{C}$  above +70 $^{\circ}\text{C}$

**Note3.**  $T_A = 25^{\circ}\text{C}$ .

## Electrical Characteristics

$V_{PWRA}$ ,  $V_{PWRB}$  = 2.3V to 5.5V;  $T_A$  = -40°C to +85°C, unless otherwise noted.

Typical values are at  $V_{PWRA}$ ,  $V_{PWRB}$  = 4.2V;  $C_{PWRA}$ ,  $C_{PWRB}$  = 0.1μF;  $T_A$  = +25°C <sup>(4)</sup>

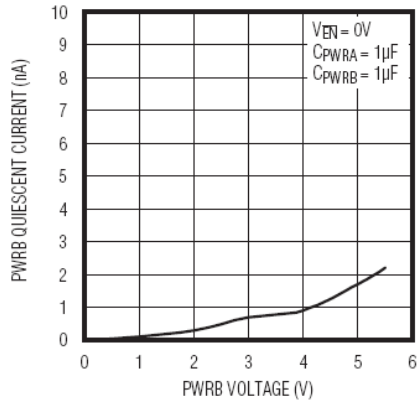
| Symbol                   | Parameter                                               | Conditions                                                                                                                              | Min | Typ | Max | Unit |
|--------------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| $V_{PWRA}$<br>$V_{PWRB}$ | Operating Voltage                                       |                                                                                                                                         | 2.3 |     | 5.5 | V    |
| $I_{PWRA}$<br>$I_{PWRB}$ | Quiescent Current                                       | $V_{\overline{EN}} = 0.4V$ , no load                                                                                                    |     |     | 1   | μA   |
|                          | Transient Supply Current                                | $\overline{EN}$ from high to low or low to high                                                                                         |     | 30  |     | μA   |
| $I_{SHDN}$               | Shutdown Current                                        | $V_{\overline{EN}} = 5.5V$ ,<br>( $V_{PWRA} = 5.5V$ , $V_{PWRB} = \text{open}$ )<br>or ( $V_{PWRB} = 5.5V$ , $V_{PWRA} = \text{open}$ ) |     |     | 1   | μA   |
| $R_{ON}$                 | On-Resistance Between<br>PWRA and PWRB                  | $I_{LOAD} = 100mA$ , $T_A = +25^\circ C$<br>$V_{PWRA} = 3.3V$ , $V_{PWRB} = 3.3V$                                                       |     | 6   | 10  | mΩ   |
| $V_{IH}$                 | $\overline{EN}$ Input Logic-High Voltage <sup>(5)</sup> |                                                                                                                                         | 1.6 |     |     | V    |
| $V_{IL}$                 | $\overline{EN}$ Input Logic-Low Voltage <sup>(5)</sup>  |                                                                                                                                         |     |     | 0.4 | V    |
| $R_{PD}$                 | $\overline{EN}$ Internal Pull-down Resistor             |                                                                                                                                         |     | 500 | 700 | kΩ   |
| $t_{ON}$                 | Turn-On Time                                            | Time from $\overline{EN}$ high-to-low signal<br>to $V_{PWRB/A} = 90\%$ of $V_{PWRA/B}$ ,<br>$R_{LOAD} = 100\Omega$                      |     | 3   |     | ms   |
| $t_{OFF}$                | Turn-Off Time                                           | Time from $\overline{EN}$ low-to-high signal<br>to $V_{PWRB/A} = 10\%$ of $V_{PWRA/B}$ ,<br>$R_{LOAD} = 100\Omega$                      |     | 3   |     | ms   |

**Note4.** All devices are 100% production tested at  $T_A = +25^\circ C$ . Specifications over the operating temperature range are guaranteed by design.

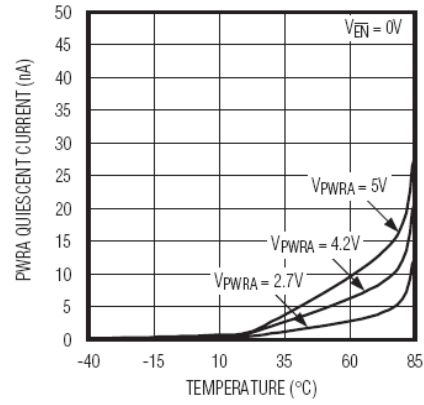
**Note5.**  $\overline{EN}$  rising effective typical voltage is 1.2V, falling effective typical voltage is 0.7V.

## Typical Operating Characteristics

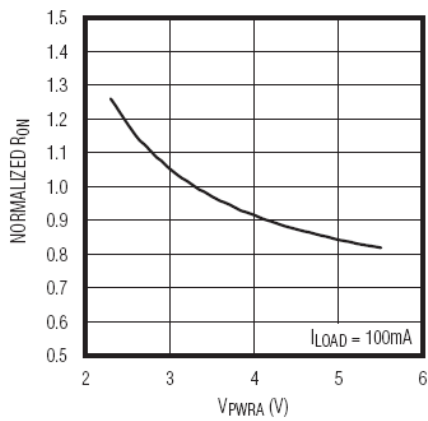
( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)



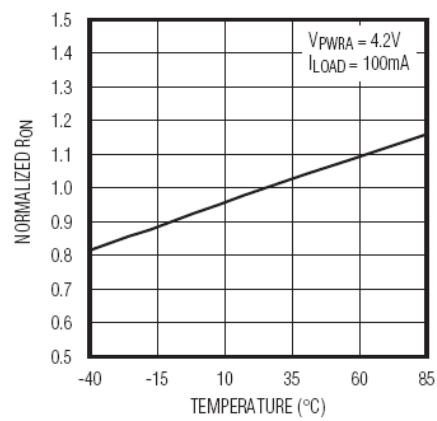
$I_Q$  vs. Supply Voltage



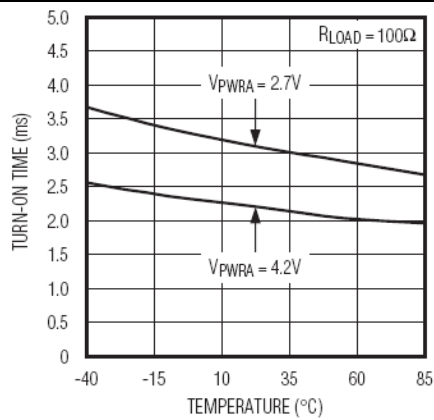
$I_Q$  vs. Temperature



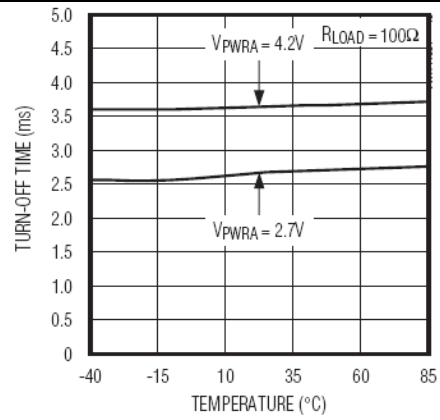
On-Resistance vs. Supply Voltage



On-Resistance vs. Temperature



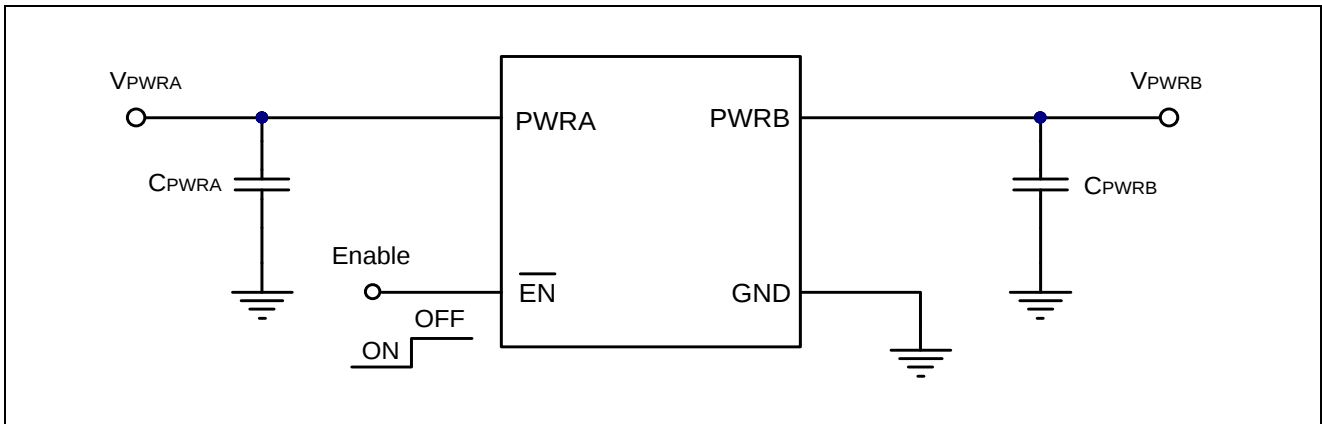
Switch Turn On-Time vs. Temperature



Switch Turn Off-Time vs. Temperature

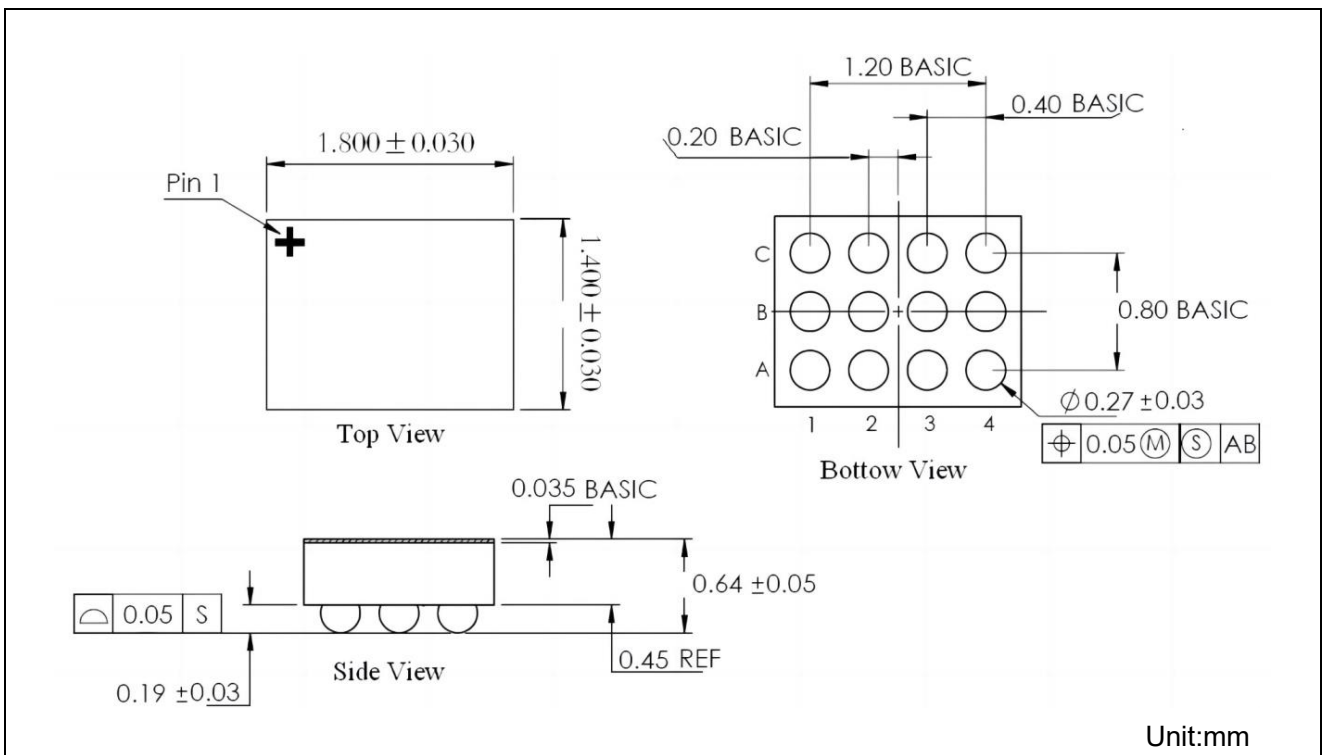
# ET3153

## Application Circuits



\*: This electric circuit only supplies for reference.

## Package Dimension



# ET3153

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**Revision History and Checking Table**

| Version | Date       | Revision Item                                                                                              | Modifier     | Function & Spec Checking | Package & Tape Checking |
|---------|------------|------------------------------------------------------------------------------------------------------------|--------------|--------------------------|-------------------------|
| 1.0     | 2013-5-27  | Original version                                                                                           | Wu Xiang Jun | Wu Xiang Jun             | Zhu Jun Li              |
| 1.1     | 2016-05-19 | Detail the EN VIH/VIL                                                                                      | Wang Fang    | Wang Fang                | Zhu Jun Li              |
| 1.2     | 2016-07-19 | Add ' Maximum Repetitive Pulsed Current (1ms,20% Duty Cycle):12A' on page 3<br>Modify application circuits | Wu Xiang Jun | Wu Xiang Jun             | Zhu Jun Li              |
| 1.3     | 2018-01-05 | Change the AMR value from 6.5V to 7V                                                                       | Wu Xiang Jun | Wu Xiang Jun             | Jenna Liu               |
| 1.4     | 2020-03-13 | Document formalize                                                                                         | Shib         | Shib                     | Liuju                   |
| 1.5     | 2022-10-29 | Update Typeset                                                                                             | Shib         | Shib                     | Liuju                   |