# ET3164 - 5.5V, 10A, 5.2mΩ On-Resistance Load Switch with Adjustable Rise Time

## General Description

The ET3164 is a single-channel load switch that provides a configurable rise time to minimize inrush current. The device contains an N-channel MOSFET that can operate over an input voltage range of 0.1 V to 5.5 V and can support a maximum continuous current of 10 A.

The switch is controlled by an enable pin (ON), which is capable of interfacing directly with low voltage GPIO signals ($V_{IH}$ = 0.8 V). The ET3164 device has an optional QOD pin for quick output discharge when switch is turned off, and the fall time ($t_F$) of the output can be adjusted through an external resistor. There is a Power Good (PG) signal on the device that indicates when the main MOSFET is fully turned on, which can be used to enable a downstream load. Integrated thermal shutdown ensures protection in high temperature environments. The ET3164 is available in a QFN10 package and is characterized for operation over the free-air temperature range of -40°C to +125°C.

## Features

- Input Operating Voltage Range ($V_{IN}$): 0.1V to 5.5V
- Single Supply Voltage Range ($V_{BIAS}$): 1.5V to 5.5V
- Maximum Continuous Current: 10A
- Low On-Resistance: 5.2mΩ (Typ)
- Open Drain Power Good (PG) Signal
- Adjustable Slew Rate Control
- Adjustable Quick Output Discharge (QOD)
- Thermal Shutdown
- Smart ON pin pull-down ($R_{ON\_PD}$)
  - ON ≥ $V_{IH}$ ($I_{ON}$): 25 nA (Typ)
  - ON ≤ $V_{IL}$ ($R_{ON\_PD}$): 500 kΩ (Typ)
- Low Power Consumption:
  - ON State ($I_Q$): 8 μA (Typ)
  - OFF State ($I_{SD}$): 0.1 μA (Typ)
- -40°C to +125°C Operating Temperature Range
- Part No. and Package

| Part No. | Package | MSL |
|---|---|---|
| ET3164 | QFN10 (1.50mm*2.00mm*0.55mm) | Level 1 |

## Applications

- Solid-State Drive (SSD)
- PC and Notebooks
- Industrial PC and Optical module

## Pin Configuration

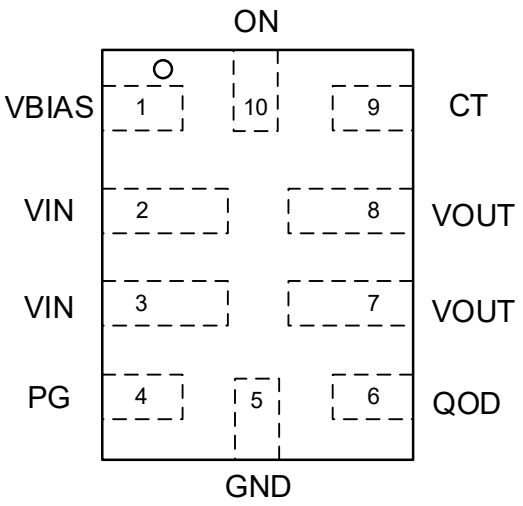



Figure 1. Top View

## Pin Function

| Pin | | Description |
|---|---|---|
| Name | No. | |
| VBIAS | 1 | Device Bias Supply. |
| VIN | 2,3 | Switch Input. |
| PG | 4 | Open drain power good signal, asserted high when the output is full load ready. |
| GND | 5 | Device Ground. |
| QOD | 6 | Quick Output Discharge Pin. |
| VOUT | 7,8 | Switch Output. |
| CT | 9 | Timing Pin, can control the slew rate of the output through a capacitor to GND. |
| ON | 10 | Enable Pin. |

## Block Diagram

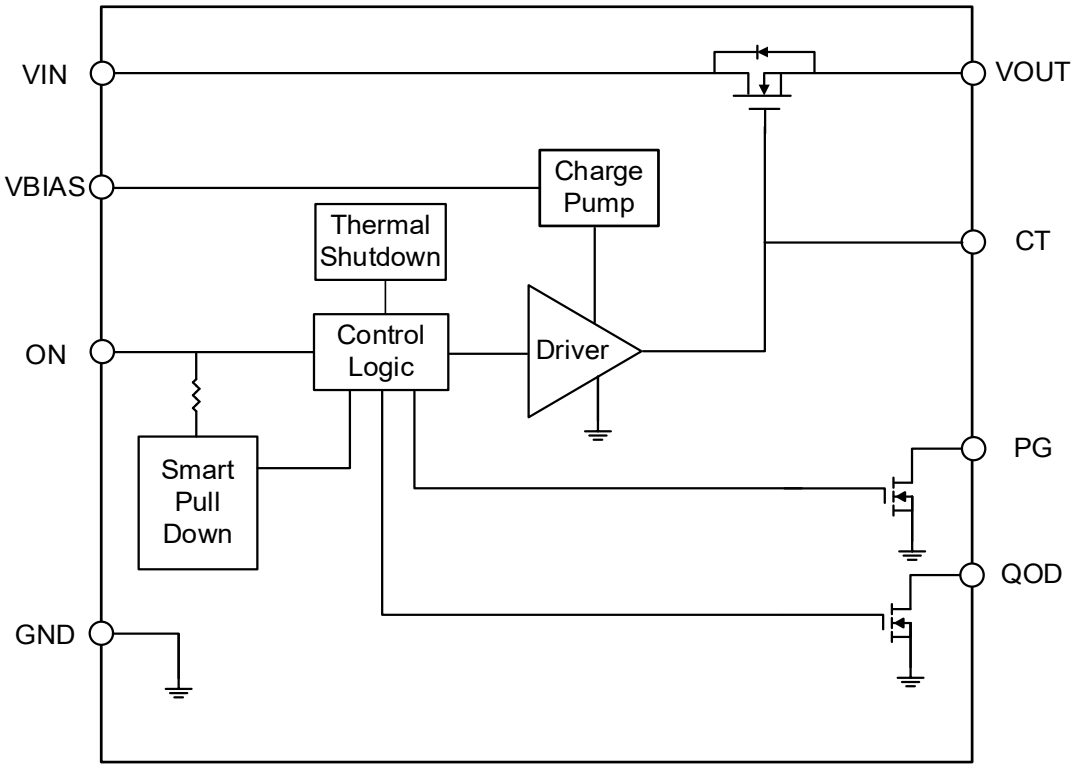



Figure 2. Block Diagram

## Detailed Description

### Overview

The ET3164 device is a single-channel load switch with a 5.2mΩ power MOSFET designed to operate up to 10A. The voltage range is 0.1V to 5.5V. A configurable rise time provides flexibility for power sequencing and minimizes inrush current for high capacitance loads.

The switch is controlled by an enable pin (ON), which is capable of interfacing directly with low voltage GPIO signals down to its $V_{IH}$ level of 0.8 V. The ET3164 device has an optional QOD pin for quick output discharge when switch is turned off, and the fall time ($t_F$) of the output can be adjusted through an external capacitor. There is a Power Good (PG) signal on the device that indicates when the main MOSFET is fully turned on and the on-resistance is at its final value.

## Feature Description

### ON and OFF Control

The ON pin controls the state of the switch. The ON pin is compatible with standard GPIO logic threshold so it can be used in a wide variety of applications. When the pin pull-high, the device enables, and when it is low, the device disables.

### Adjustable Slew Rate

A capacitor to GND on the CT pin sets the slew rate, and the higher the capacitance the lower the slew rate. The voltage on the CT pin can be as high as 15 V; therefore, the minimum voltage rating for the CT capacitor must be 30 V for optimal performance. Rise times for $V_{BIAS}$ = 5 V are shown below.

Table 1. Rise times for $V_{BIAS}$ = 5 V

| CT Capacitor | $V_{IN}$ = 5 V | $V_{IN}$ = 3.3 V | $V_{IN}$ = 1.8 V | $V_{IN}$ = 1.2 V | $V_{IN}$ = 0.8 V |
|---|---|---|---|---|---|
| 0 pF | 322us | 260us | 142us | 101us | 78us |
| 220 pF | 542us | 398us | 186us | 125us | 100us |
| 1000 pF | 1328us | 896us | 344us | 213us | 182us |
| 4700 pF | 4840us | 3080us | 1060us | 570us | 530us |

### Adjustable Quick Output Discharge

The device includes a QOD feature that can be configured in one of three ways:

1. QOD pin shorted to VOUT pin. Using this method, the discharge rate after the switch becomes disabled is controlled with the value of the internal resistance $R_{QOD}$. The value of this resistance is listed in the Electrical Characteristics table.

2. QOD pin connected to VOUT pin using an external resistor. After the switch becomes disabled, the discharge rate is controlled by the value of the total resistance of the QOD.

3. QOD pin is unused and left floating. Using this method, there is no quick output discharge functionality, and the output remains floating after the switch is disabled.

Fall time is dependent on the strength of the configured pulldown resistance on the output.

### Thermal Shutdown

When the device temperature reaches 150°C (Typical), the device shuts itself off to prevent thermal damage. After it cools off by about 20°C, the device turns back on. If the device is kept in a thermally stressful environment, then the device oscillates between these two states until it can keep its temperature below the thermal shutdown point.

### Power Good (PG) Signal

The device has a Power Good (PG) output signal to indicate the gate of the pass FET is driven high and the switch is on with the on-resistance close to its final value (full load ready). The signal is an active high and open drain output which can be connected to a voltage source through an external pullup resistor. This voltage source can be $V_{OUT}$ from the device or another external voltage. $V_{BIAS}$ is required for PG to have a valid output.

**Device Functional Modes**

The below table summarizes the device functional modes:

Table 2. Device Function

| ON | Fault Condition | VOUT State |
|---|---|---|
| L | N/A | Hi-Z |
| H | None | $V_{IN}$ (through $R_{ON}$) |
| X | Thermal shutdown | Hi-Z |

## Absolute Maximum Ratings

| Symbol | Parameters | Value | Unit |
|---|---|---|---|
| $V_{IN}$ | Input Voltage | -0.3-6 | V |
| $V_{BIAS}$ | Bias Supply Voltage | -0.3-6 | V |
| $V_{ON}$, $V_{PG}$, $V_{QOD}$ | Control Pin Voltage | -0.3-6 | V |
| $V_{CT}$ | Maximum CT Pin Voltage | 15 | V |
| $I_{MAX}$ | Maximum Output Current | 10 | A |
| $T_J$ | Maximum Junction Temperature | 150 | °C |
| $T_{STG}$ | Storage Temperature Range | -65 to 150 | °C |
| $V_{ESD}$ | ESD Human Body Model (JESD22−A114) | ±4000 | V |
| | ESD Charged Device Model (JESD22−C101) | ±2000 | |
| $I_{LU}$ | Latch-up Current (EIA/JESD78) | ±200 | mA |

## Thermal Characteristics

| Symbol | Parameters | Value | Unit |
|---|---|---|---|
| $R_{\theta JA}$ | Junction-to-Ambient Thermal Resistance | 120 | °C/W |
| $P_{D\_MAX}$ | Maximum Power Consumption | 1.0 | W |

## Recommended Operating Conditions

| Symbol | Parameters | Min | Max | Unit |
|---|---|---|---|---|
| $V_{IN}$ | Input Voltage | 0.1 | 5.5 | V |
| $V_{BIAS}$ | Bias Supply Voltage | 1.5 | 5.5 | V |
| $V_{IH}$ | ON Pin High Voltage Range | 0.8 | 5.5 | V |
| $V_{IL}$ | ON Pin Low Voltage Range | 0 | 0.35 | V |
| $V_{PG}$, $V_{QOD}$ | Control Pin Voltage | 0 | 5.5 | V |
| $T_A$ | Ambient Temperature Range | -40 | 125 | °C |

## Electrical Characteristics ($V_{BIAS}$=5V)

Over operating free-air temperature range, unless otherwise noted. Typical values are specified at 25°C and $V_{BIAS}$ = 5V, $V_{IN}$=5V.

| Symbol | Parameters | Test Conditions | $T_A$ | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Power Consumption** | | | | | | | |
| $I_{Q\_VBIAS}$ | $V_{BIAS}$ Quiescent Current | $V_{ON}$ > $V_{IH}$ | +25°C | | 8 | | uA |
| | | | -40°C to 85°C | | | 12 | uA |
| | | | -40°C to 125°C | | | 12 | uA |
| $I_{SD\_VBIAS}$ | $V_{BIAS}$ Shutdown Current | $V_{ON}$ = 0V | 25°C | | 0.1 | | uA |
| | | | -40°C to 85°C | | | 0.5 | uA |
| | | | -40°C to 125°C | | | 1 | uA |
| $I_{SD\_VIN}$ | $V_{IN}$ Shutdown Current | $V_{ON}$ = 0V | 25°C | | 0.1 | | uA |
| | | | -40°C to 85°C | | | 1 | uA |
| | | | -40°C to 125°C | | | 7 | uA |
| $I_{ON}$ | ON pin leakage | $V_{ON}$ = $V_{BIAS}$ | -40°C to 125°C | | 0.1 | | uA |
| **Performance** | | | | | | | |
| $R_{ON}$ | On-Resistance | $V_{IN}$= 5V, $I_{OUT}$= -1A | 25°C | | 5.2 | | mΩ |
| | | | -40°C to 85°C | | | 8 | mΩ |
| | | | -40°C to 125°C | | | 9 | mΩ |
| $R_{ON}$ | On-Resistance | $V_{IN}$= 3.3V, $I_{OUT}$= -1A | 25°C | | 5.2 | | mΩ |
| | | | -40°C to 85°C | | | 8 | mΩ |
| | | | -40°C to 125°C | | | 9 | mΩ |
| $R_{ON}$ | On-Resistance | $V_{IN}$= 1.8V, $I_{OUT}$= -1A | 25°C | | 5.2 | | mΩ |
| | | | -40°C to 85°C | | | 8 | mΩ |
| | | | -40°C to 125°C | | | 9 | mΩ |
| $R_{ON}$ | On-Resistance | $V_{IN}$= 1.2V, $I_{OUT}$= -1A | 25°C | | 5.2 | | mΩ |
| | | | -40°C to 85°C | | | 8 | mΩ |
| | | | -40°C to 125°C | | | 9 | mΩ |
| $R_{ON}$ | On-Resistance | $V_{IN}$= 0.8V, $I_{OUT}$= -1A | 25°C | | 5.2 | | mΩ |
| | | | -40°C to 85°C | | | 8 | mΩ |
| | | | -40°C to 125°C | | | 9 | mΩ |
| $R_{ON\_PD}$ | Smart Pull Down Resistance | | 25°C | | 500 | | kΩ |
| | | | -40°C to 125°C | | | 700 | kΩ |
| $R_{QOD}$ | QOD Resistance | | 25°C | | 55 | | Ω |
| | | | -40°C to 125°C | | | 70 | Ω |
| $V_{PG\_OL}$ | Power Good $V_{OL}$ | $I_{PG}$ = 1mA | -40°C to 125°C | | | 0.2 | V |
| **Protection** | | | | | | | |
| $T_{TSD}$ | Thermal Shutdown | | | 130 | 150 | 170 | °C |
| $T_{TSD\_HYS}$ | Thermal Shutdown Hysteresis | | | | 20 | | °C |

## Electrical Characteristics ($V_{BIAS}$=3.3V)

Over operating free-air temperature range, unless otherwise noted. Typical values are specified at 25°C and $V_{BIAS}$ = 3.3V, $V_{IN}$=3.3V.

| Symbol | Parameters | Test Conditions | $T_A$ | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Power Consumption** | | | | | | | |
| $I_{Q\_VBIAS}$ | $V_{BIAS}$ Quiescent Current | $V_{ON}$ > $V_{IH}$ | 25°C | | 8 | | uA |
| | | | -40°C to 85°C | | | 12 | uA |
| | | | -40°C to 125°C | | | 12 | uA |
| $I_{SD\_VBIAS}$ | $V_{BIAS}$ Shutdown Current | $V_{ON}$ = 0V | 25°C | | 0.1 | | uA |
| | | | -40°C to 85°C | | | 0.5 | uA |
| | | | -40°C to 125°C | | | 1 | uA |
| $I_{SD\_VIN}$ | $V_{IN}$ Shutdown Current | $V_{ON}$ = 0V | 25°C | | 0.1 | | uA |
| | | | -40°C to 85°C | | | 1 | uA |
| | | | -40°C to 125°C | | | 7 | uA |
| $I_{ON}$ | ON pin leakage | $V_{ON}$ = $V_{BIAS}$ | -40°C to 125°C | | 0.1 | | uA |
| **Performance** | | | | | | | |
| $R_{ON}$ | On-Resistance | $V_{IN}$=3.3V, $I_{OUT}$= -1A | 25°C | | 5.2 | | mΩ |
| | | | -40°C to 85°C | | | 8 | mΩ |
| | | | -40°C to 125°C | | | 9 | mΩ |
| $R_{ON}$ | On-Resistance | $V_{IN}$=1.8V, $I_{OUT}$= -1A | 25°C | | 5.2 | | mΩ |
| | | | -40°C to 85°C | | | 8 | mΩ |
| | | | -40°C to 125°C | | | 9 | mΩ |
| $R_{ON}$ | On-Resistance | $V_{IN}$=1.2V, $I_{OUT}$= -1A | 25°C | | 5.2 | | mΩ |
| | | | -40°C to 85°C | | | 8 | mΩ |
| | | | -40°C to 125°C | | | 9 | mΩ |
| $R_{ON}$ | On-Resistance | $V_{IN}$=0.8V, $I_{OUT}$= -1A | 25°C | | 5.2 | | mΩ |
| | | | -40°C to 85°C | | | 8 | mΩ |
| | | | -40°C to 125°C | | | 9 | mΩ |
| $R_{ON\_PD}$ | Smart Pull Down Resistance | | 25°C | | 500 | | kΩ |
| | | | -40°C to 125°C | | | 700 | kΩ |
| $R_{QOD}$ | QOD Resistance | | 25°C | | 55 | | Ω |
| | | | -40°C to 125°C | | | 70 | Ω |
| $V_{PG\_OL}$ | Power Good $V_{OL}$ | $I_{PG}$ = 1mA | -40°C to 125°C | | | 0.2 | V |
| **Protection** | | | | | | | |
| $T_{TSD}$ | Thermal Shutdown | | | 130 | 150 | 170 | °C |
| $T_{TSD\_HYS}$ | Thermal Shutdown Hysteresis | | | | 20 | | °C |

## Electrical Characteristics ($V_{BIAS}$=1.5V)

Over operating free-air temperature range, unless otherwise noted. Typical values are specified at 25°C and $V_{BIAS}$ = 1.5V, $V_{IN}$=1.5V.

| Symbol | Parameters | Test Conditions | $T_A$ | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Power Consumption** | | | | | | | |
| $I_{Q\_VBIAS}$ | $V_{BIAS}$ Quiescent Current | $V_{ON}$ > $V_{IH}$ | 25°C | | 8 | | uA |
| | | | -40°C to 85°C | | | 12 | uA |
| | | | -40°C to 125°C | | | 12 | uA |
| $I_{SD\_VBIAS}$ | $V_{BIAS}$ Shutdown Current | $V_{ON}$ = 0V | 25°C | | 0.1 | | uA |
| | | | -40°C to 85°C | | | 0.5 | uA |
| | | | -40°C to 125°C | | | 1 | uA |
| $I_{SD\_VIN}$ | $V_{IN}$ Shutdown Current | $V_{ON}$ = 0V | 25°C | | 0.1 | | uA |
| | | | -40°C to 85°C | | | 1 | uA |
| | | | -40°C to 125°C | | | 7 | uA |
| $I_{ON}$ | ON pin leakage | $V_{ON}$ = $V_{BIAS}$ | -40°C to 125°C | | 0.1 | | uA |
| **Performance** | | | | | | | |
| $R_{ON}$ | On-Resistance | $V_{IN}$=1.5V, $I_{OUT}$= -1A | 25°C | | 5.6 | | mΩ |
| | | | -40°C to 85°C | | | 8.5 | mΩ |
| | | | -40°C to 125°C | | | 9.5 | mΩ |
| $R_{ON}$ | On-Resistance | $V_{IN}$=1.2V, $I_{OUT}$= -1A | 25°C | | 5.6 | | mΩ |
| | | | -40°C to 85°C | | | 8.5 | mΩ |
| | | | -40°C to 125°C | | | 9.5 | mΩ |
| $R_{ON}$ | On-Resistance | $V_{IN}$=0.8V, $I_{OUT}$= -1A | 25°C | | 5.6 | | mΩ |
| | | | -40°C to 85°C | | | 8.5 | mΩ |
| | | | -40°C to 125°C | | | 9.5 | mΩ |
| $R_{ON\_PD}$ | Smart Pull Down Resistance | | 25°C | | 500 | | kΩ |
| | | | -40°C to 125°C | | | 700 | kΩ |
| $R_{QOD}$ | QOD Resistance | | 25°C | | 60 | | Ω |
| | | | -40°C to 125°C | | | 70 | Ω |
| $V_{PG\_OL}$ | Power Good $V_{OL}$ | $I_{PG}$ = 1mA | -40°C to 125°C | | | 0.2 | V |
| **Protection** | | | | | | | |
| $T_{TSD}$ | Thermal Shutdown | | | 130 | 150 | 170 | °C |
| $T_{TSD\_HYS}$ | Thermal Shutdown Hysteresis | | | | 20 | | °C |

## Switching Characteristics ($V_{BIAS}$=5V)

Over operating free-air temperature range, unless otherwise noted.

| Symbol | Parameters | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **$V_{IN}$=5V** | | | | | | |
| $t_{ON}$ | Turn ON time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 1650 | | us |
| $t_D$ | Delay time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 380 | | us |
| $t_R$ | Rise time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 1300 | | us |
| $t_{OFF}$ | Turn OFF time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 45 | | us |
| $t_F$ | Fall time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 1900 | | us |
| **$V_{IN}$=3.3V** | | | | | | |
| $t_{ON}$ | Turn ON time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 1250 | | us |
| $t_D$ | Delay time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 350 | | us |
| $t_R$ | Rise time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 860 | | us |
| $t_{OFF}$ | Turn OFF time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 56 | | us |
| $t_F$ | Fall time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 2200 | | us |
| **$V_{IN}$=1.8V** | | | | | | |
| $t_{ON}$ | Turn ON time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 700 | | us |
| $t_D$ | Delay time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 330 | | us |
| $t_R$ | Rise time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 360 | | us |
| $t_{OFF}$ | Turn OFF time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 65 | | us |
| $t_F$ | Fall time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 2200 | | us |
| **$V_{IN}$=1.2V** | | | | | | |
| $t_{ON}$ | Turn ON time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 550 | | us |
| $t_D$ | Delay time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 330 | | us |
| $t_R$ | Rise time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 210 | | us |
| $t_{OFF}$ | Turn OFF time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 65 | | us |
| $t_F$ | Fall time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 2100 | | us |
| **$V_{IN}$=0.8V** | | | | | | |
| $t_{ON}$ | Turn ON time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 510 | | us |
| $t_D$ | Delay time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 320 | | us |
| $t_R$ | Rise time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 185 | | us |
| $t_{OFF}$ | Turn OFF time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 65 | | us |
| $t_F$ | Fall time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 2000 | | us |

## Switching Characteristics ($V_{BIAS}$=3.3V)

Over operating free-air temperature range, unless otherwise noted.

| Symbol | Parameters | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **$V_{IN}$=3.3V** | | | | | | |
| $t_{ON}$ | Turn ON time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 1350 | | us |
| $t_D$ | Delay time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 520 | | us |
| $t_R$ | Rise time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 850 | | us |
| $t_{OFF}$ | Turn OFF time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 55 | | us |
| $t_F$ | Fall time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 2250 | | us |
| **$V_{IN}$=1.8V** | | | | | | |
| $t_{ON}$ | Turn ON time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 950 | | us |
| $t_D$ | Delay time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 480 | | us |
| $t_R$ | Rise time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 470 | | us |
| $t_{OFF}$ | Turn OFF time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 60 | | us |
| $t_F$ | Fall time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 2250 | | us |
| **$V_{IN}$=1.2V** | | | | | | |
| $t_{ON}$ | Turn ON time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 810 | | us |
| $t_D$ | Delay time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 480 | | us |
| $t_R$ | Rise time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 330 | | us |
| $t_{OFF}$ | Turn OFF time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 60 | | us |
| $t_F$ | Fall time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 2100 | | us |
| **$V_{IN}$=0.8V** | | | | | | |
| $t_{ON}$ | Turn ON time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 740 | | us |
| $t_D$ | Delay time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 470 | | us |
| $t_R$ | Rise time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 260 | | us |
| $t_{OFF}$ | Turn OFF time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 60 | | us |
| $t_F$ | Fall time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 2000 | | us |

## Switching Characteristics ($V_{BIAS}$=1.5V)

Over operating free-air temperature range, unless otherwise noted.

| Symbol | Parameters | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **$V_{IN}$=1.5V** | | | | | | |
| $t_{ON}$ | Turn ON time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 1140 | | us |
| $t_D$ | Delay time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 620 | | us |
| $t_R$ | Rise time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 520 | | us |
| $t_{OFF}$ | Turn OFF time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 60 | | us |
| $t_F$ | Fall time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 2200 | | us |
| **$V_{IN}$=1.2V** | | | | | | |
| $t_{ON}$ | Turn ON time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 1020 | | us |
| $t_D$ | Delay time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 610 | | us |
| $t_R$ | Rise time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 400 | | us |
| $t_{OFF}$ | Turn OFF time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 60 | | us |
| $t_F$ | Fall time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 2200 | | us |
| **$V_{IN}$=0.8V** | | | | | | |
| $t_{ON}$ | Turn ON time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 890 | | us |
| $t_D$ | Delay time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 600 | | us |
| $t_R$ | Rise time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 290 | | us |
| $t_{OFF}$ | Turn OFF time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 60 | | us |
| $t_F$ | Fall time | $R_L$ = 100Ω, $C_L$ = 10uF, CT = 1000pF | | 2100 | | us |

## Timing Diagram

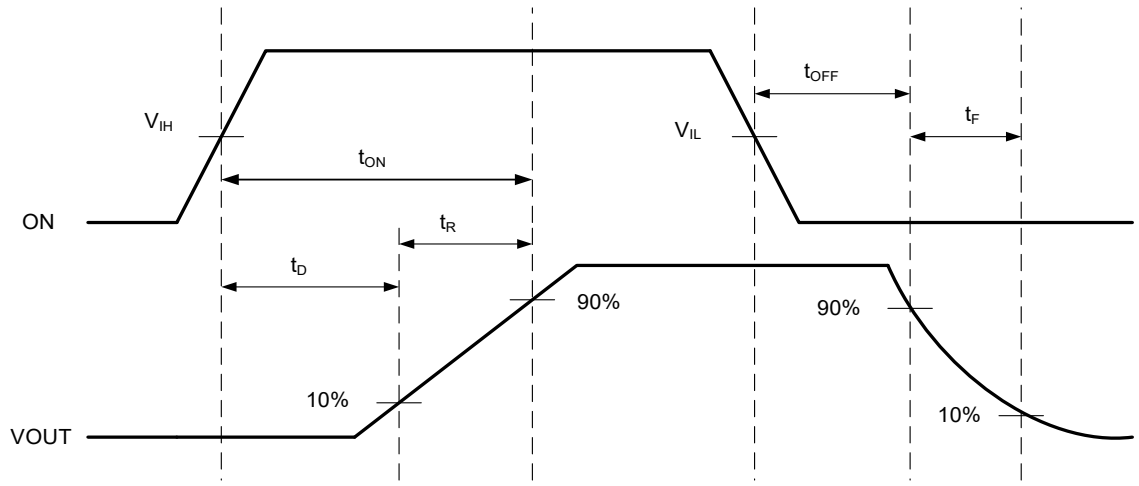



Figure 3. Timing Diagram

## Application Circuits

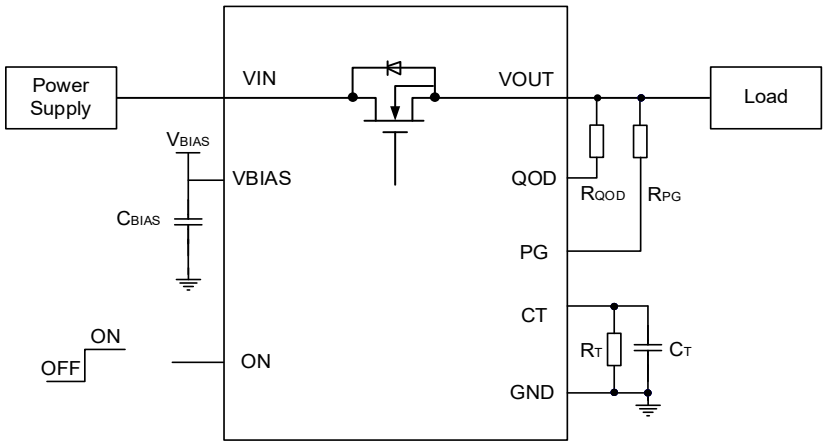
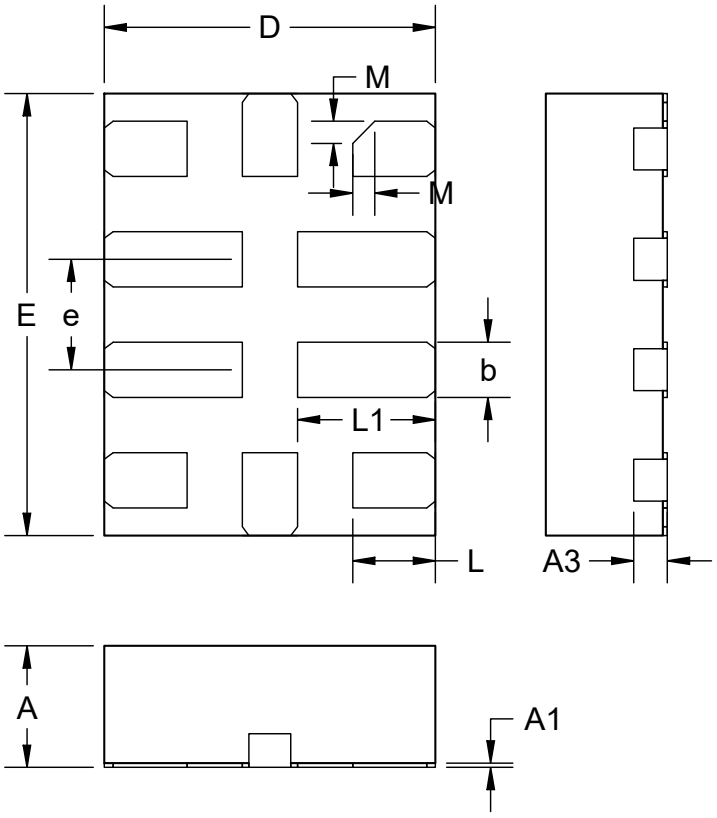



Figure 4. Reference Application Circuit

## Package Dimension

QFN-10

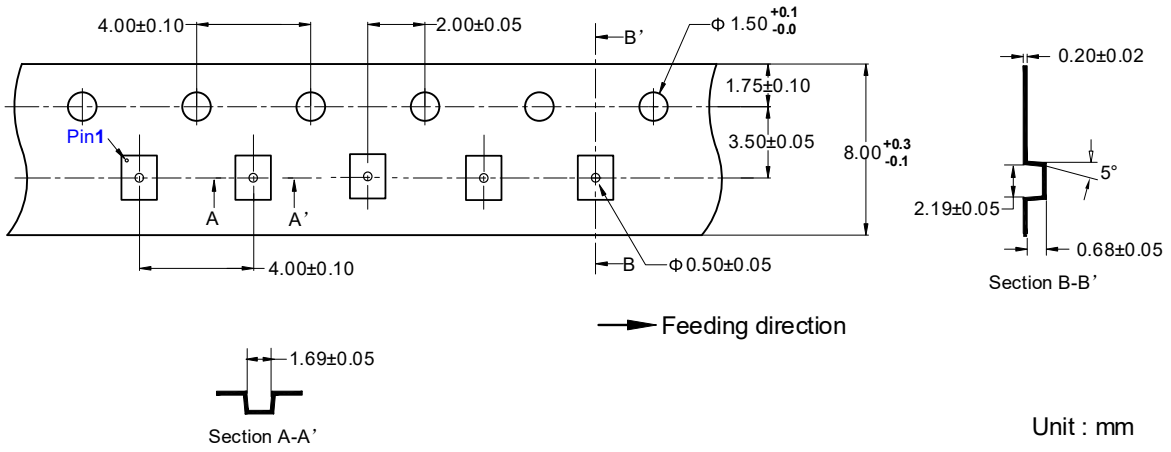



COMMON DIMENSIONS

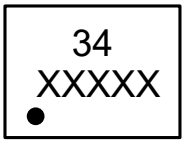
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 0.50 | 0.55 | 0.60 |
| A1 | 0.00 | 0.02 | 0.05 |
| A3 | | 0.152REF | |
| b | 0.20 | 0.25 | 0.30 |
| D | 1.40 | 1.50 | 1.60 |
| E | 1.90 | 2.00 | 2.10 |
| e | 0.40 | 0.50 | 0.60 |
| L | 0.275 | 0.375 | 0.475 |
| L1 | 0.525 | 0.625 | 0.725 |
| M | | 0.10REF | |

## Tape




## Marking




34 = Part Number (ET3164)

XXXXX = Tracking Number

## Revision History and Checking Table

| Version | Date | Revision Item | Modifier | Function & Spec Checking | Package & Tape Checking |
|---|---|---|---|---|---|
| 0.0 | 2023-11-14 | Initial Version | Zhujy | Marj | Liujy |
| 1.0 | 2024-03-15 | Update EC Table | Tugz | Zhujy | Liujy |