

# FDG6331L

## Integrated Load Switch

### General Description

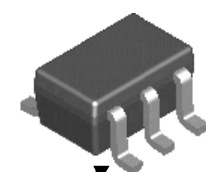
This device is particularly suited for compact power management in portable electronic equipment where 2.5V to 8V input and 0.8A output current capability are needed. This load switch integrates a small N-Channel power MOSFET (Q1) that drives a large P-Channel power MOSFET (Q2) in one tiny SC70-6 package.

### Applications

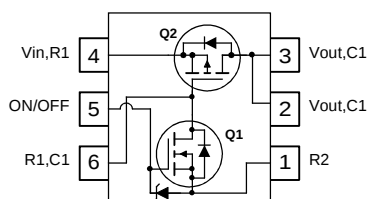
- Power management
- Load switch

### Features

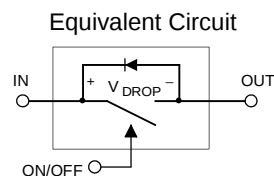
- $-0.8\text{ A}$ ,  $-8\text{ V}$ .  $R_{DS(ON)} = 260\text{ m}\Omega$  @  $V_{GS} = -4.5\text{ V}$   
 $R_{DS(ON)} = 330\text{ m}\Omega$  @  $V_{GS} = -2.5\text{ V}$   
 $R_{DS(ON)} = 450\text{ m}\Omega$  @  $V_{GS} = -1.8\text{ V}$
- Control MOSFET (Q1) includes Zener protection for ESD ruggedness (>6KV Human body model)
- High performance trench technology for extremely low  $R_{DS(ON)}$
- Compact industry standard SC70-6 surface mount package



SC70-6



See Application Circuit



### Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol         | Parameter                                        | Ratings         | Units            |
|----------------|--------------------------------------------------|-----------------|------------------|
| $V_{IN}$       | Gate-Source Voltage (Q2)                         | $\pm 8$         | V                |
| $V_{ON/OFF}$   | Gate-Source Voltage (Q1)                         | $-0.5$ to $8$   | V                |
| $I_{Load}$     | Load Current – Continuous (Note 2)               | $-0.8$          | A                |
|                | – Pulsed (Note 2)                                | $-2.4$          |                  |
| $P_D$          | Maximum Power Dissipation (Note 1)               | $0.3$           | W                |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | $-55$ to $+150$ | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |                                                   |     |                    |
|-----------------|---------------------------------------------------|-----|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 415 | $^\circ\text{C/W}$ |
|-----------------|---------------------------------------------------|-----|--------------------|

### Package Marking and Ordering Information

| Device Marking | Device   | Reel Size | Tape width | Quantity   |
|----------------|----------|-----------|------------|------------|
| .31            | FDG6331L | 7"        | 8mm        | 3000 units |

**Electrical Characteristics** $T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

**Off Characteristics**

|            |                                 |                                                             |   |  |      |               |
|------------|---------------------------------|-------------------------------------------------------------|---|--|------|---------------|
| $BV_{IN}$  | Vin Breakdown Voltage           | $V_{ON/OFF} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$ | 8 |  |      | V             |
| $I_{Load}$ | Zero Gate Voltage Drain Current | $V_{IN} = -6.4\text{ V}$ , $V_{ON/OFF} = 0\text{ V}$        |   |  | -1   | $\mu\text{A}$ |
| $I_{FL}$   | Leakage Current, Forward        | $V_{ON/OFF} = 0\text{ V}$ , $V_{IN} = 8\text{ V}$           |   |  | 100  | nA            |
| $I_{RL}$   | Leakage Current, Reverse        | $V_{ON/OFF} = 0\text{ V}$ , $V_{IN} = -8\text{ V}$          |   |  | -100 | nA            |

**On Characteristics** (Note 2)

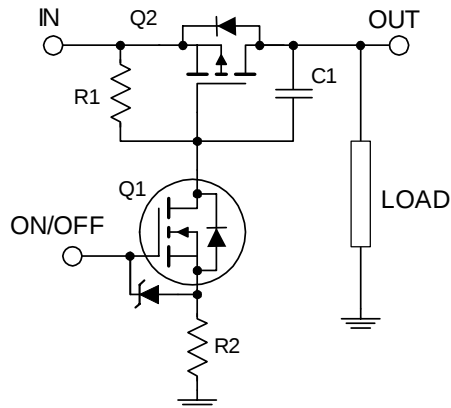
|                  |                                        |                                                         |     |     |     |                  |
|------------------|----------------------------------------|---------------------------------------------------------|-----|-----|-----|------------------|
| $V_{ON/OFF(th)}$ | Gate Threshold Voltage                 | $V_{IN} = V_{ON/OFF}$ , $I_D = -250\text{ }\mu\text{A}$ | 0.4 | 0.9 | 1.5 | V                |
| $R_{DS(on)}$     | Static Drain-Source On-Resistance (Q2) | $V_{IN} = 4.5\text{ V}$ , $I_D = -0.8\text{ A}$         |     | 155 | 260 | $\text{m}\Omega$ |
|                  |                                        | $V_{IN} = 2.5\text{ V}$ , $I_D = -0.7\text{ A}$         |     | 193 | 330 |                  |
|                  |                                        | $V_{IN} = 1.8\text{ V}$ , $I_D = -0.6\text{ A}$         |     | 248 | 450 |                  |
| $R_{DS(on)}$     | Static Drain-Source On-Resistance (Q1) | $V_{IN} = 4.5\text{ V}$ , $I_D = 0.4\text{ A}$          |     | 310 | 400 | $\text{m}\Omega$ |
|                  |                                        | $V_{IN} = 2.7\text{ V}$ , $I_D = 0.2\text{ A}$          |     | 380 | 500 |                  |

**Drain-Source Diode Characteristics and Maximum Ratings**

|          |                                                       |                                                             |  |  |       |   |
|----------|-------------------------------------------------------|-------------------------------------------------------------|--|--|-------|---|
| $I_S$    | Maximum Continuous Drain-Source Diode Forward Current |                                                             |  |  | -0.25 | A |
| $V_{SD}$ | Drain-Source Diode Forward Voltage                    | $V_{ON/OFF} = 0\text{ V}$ , $I_S = -0.25\text{ A}$ (Note 2) |  |  | -1.2  | V |

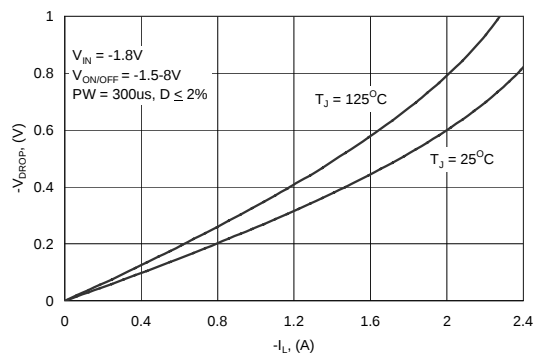
## Notes:

- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.
- Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty Cycle < 2.0%.

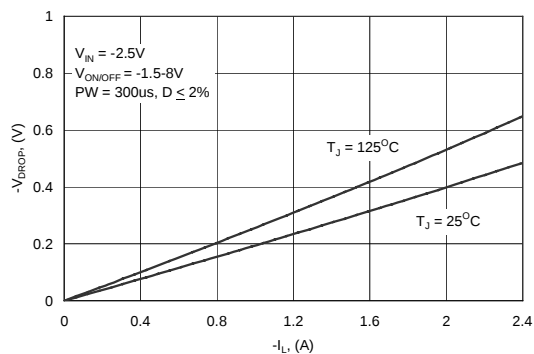
**FDG6331L Load Switch Application Circuit****External Component Recommendation:**

For additional in-rush current control, R2 and C1 can be added. For more information, see application note AN1030.

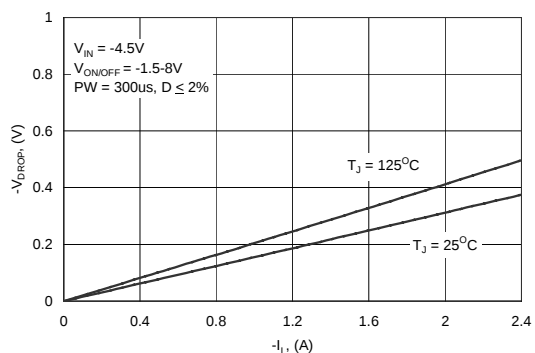
## Typical Characteristics



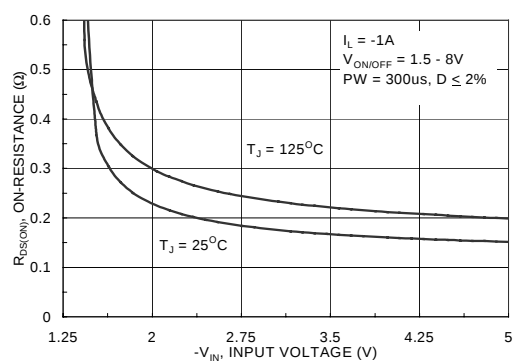
**Figure 1. Conduction Voltage Drop Variation with Load Current.**



**Figure 2. Conduction Voltage Drop Variation with Load Current.**



**Figure 3. Conduction Voltage Drop Variation with Load Current.**



**Figure 4. On-Resistance Variation With Input Voltage**

## TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

|                                   |                                  |                                  |                           |
|-----------------------------------|----------------------------------|----------------------------------|---------------------------|
| ACE <sup>x</sup> <sup>TM</sup>    | FAST <sup>®</sup>                | PACMAN <sup>TM</sup>             | SuperSOT <sup>TM</sup> -3 |
| Bottomless <sup>TM</sup>          | FAST <sup>r</sup> <sup>TM</sup>  | POP <sup>TM</sup>                | SuperSOT <sup>TM</sup> -6 |
| CoolFET <sup>TM</sup>             | GlobalOptoisolator <sup>TM</sup> | PowerTrench <sup>®</sup>         | SuperSOT <sup>TM</sup> -8 |
| CROSSVOLT <sup>TM</sup>           | GTO <sup>TM</sup>                | QFET <sup>TM</sup>               | SyncFET <sup>TM</sup>     |
| DenseTrench <sup>TM</sup>         | HiSeC <sup>TM</sup>              | QS <sup>TM</sup>                 | TinyLogic <sup>TM</sup>   |
| DOME <sup>TM</sup>                | ISOPLANAR <sup>TM</sup>          | QT Optoelectronics <sup>TM</sup> | UHC <sup>TM</sup>         |
| EcoSPARK <sup>TM</sup>            | LittleFET <sup>TM</sup>          | Quiet Series <sup>TM</sup>       | UltraFET <sup>®</sup>     |
| E <sup>2</sup> CMOS <sup>TM</sup> | MicroFET <sup>TM</sup>           | SILENT SWITCHER <sup>®</sup>     | VCX <sup>TM</sup>         |
| EnSigna <sup>TM</sup>             | MICROWIRE <sup>TM</sup>          | SMART START <sup>TM</sup>        |                           |
| FACT <sup>TM</sup>                | OPTOLOGIC <sup>TM</sup>          | Star* Power <sup>TM</sup>        |                           |
| FACT Quiet Series <sup>TM</sup>   | OPTOPLANAR <sup>TM</sup>         | Stealth <sup>TM</sup>            |                           |

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

## LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

| Datasheet Identification | Product Status         | Definition                                                                                                                                                                                                            |
|--------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advance Information      | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.                                                                                    |
| Preliminary              | First Production       | This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
| No Identification Needed | Full Production        | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.                                                       |
| Obsolete                 | Not In Production      | This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.                                                   |