

## Load Switch with Level-Shift

| PRODUCT SUMMARY      |                                 |                    |
|----------------------|---------------------------------|--------------------|
| V <sub>DS2</sub> (V) | r <sub>DS(on)</sub> (Ω)         | I <sub>D</sub> (A) |
| 4.5 to 20            | 0.105 @ V <sub>IN</sub> = 10 V  | ±2.3               |
|                      | 0.150 @ V <sub>IN</sub> = 5.0 V | ±1.9               |
|                      | 0.175 @ V <sub>IN</sub> = 4.5 V | ±1.7               |



**ESD Protected**  
**3000 V**  
**4.5-V Rated**

### FEATURES

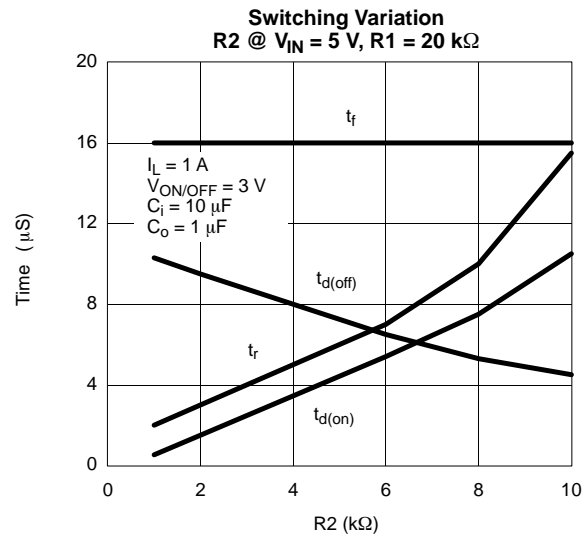
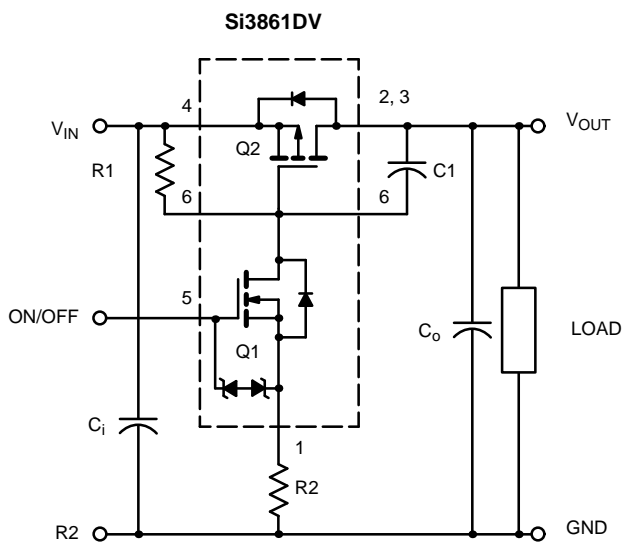
- 105-mΩ Low r<sub>DS(on)</sub> TrenchFET™
- 4.5 to 20-V Input
- 1.5 to 8 -V Logic Level Control
- Low Profile, Small Footprint TSOP-6 Package
- 3000-V ESD Protection On Input Switch, V<sub>ON/OFF</sub>
- Adjustable Slew-Rate

### DESCRIPTION

The Si3861DV includes a p- and n-channel MOSFET in a single TSOP-6 package. The low on-resistance p-channel TrenchFET® is tailored for use as a load switch. The n-channel, with an external resistor, can be used as a

level-shift to drive the p-channel load-switch. The n-channel MOSFET has internal ESD protection and can be driven by logic signals as low as 1.5-V. The Si3861DV operates on supply lines from 4.5 to 20-V, and can drive loads up to 2.3 A.

### APPLICATION CIRCUITS



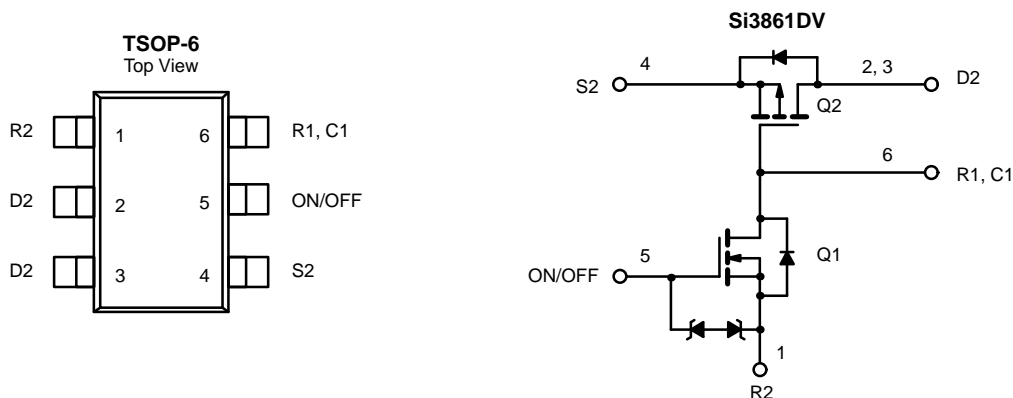
Note: For R2 switching variations with other V<sub>IN</sub>/R1 combinations See Typical Characteristics

| COMPONENTS |                            |                        |
|------------|----------------------------|------------------------|
| R1         | Pull-Up Resistor           | Typical 10 kΩ to 1 mΩ* |
| R2         | Optional Slew-Rate Control | Typical 0 to 100 kΩ*   |
| C1         | Optional Slew-Rate Control | Typical 1000 pF        |

\*Minimum R1 value should be at least 10 x R2 to ensure Q1 turn-on.

The Si3861DV is ideally suited for high-side load switching in portable applications. The integrated n-channel level-shift device saves space by reducing external components. The slew rate is set externally so that rise-times can be tailored to different load types.

**FUNCTIONAL BLOCK DIAGRAM**



**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25 °C UNLESS OTHERWISE NOTED)**

| Parameter  | Symbol                            | Limit                      | Unit  |
|--|-----------------------------------|----------------------------|-------|
| Input Voltage  | V <sub>IN</sub>                   | 20                         | V     |
| ON/OFF Voltage   | V <sub>ON/OFF</sub>               | 8                          |       |
| Load Current   | I <sub>L</sub>                    | Continuous <sup>a, b</sup> | ± 2.3 |
|  |                                   | Pulsed <sup>b, c</sup>     | ± 4   |
| Continuous Intrinsic Diode Conduction <sup>a</sup>         | I <sub>S</sub>                    | -1                         | A     |
| Maximum Power Dissipation <sup>a</sup>                     | P <sub>D</sub>                    | 0.83                       | W     |
| Operating Junction and Storage Temperature Range           | T <sub>J</sub> , T <sub>stg</sub> | -55 to 150                 | °C    |
| ESD Rating, MIL-STD-883D Human Body Model (100 pF, 1500 Ω) | ESD                               | 3                          | kV    |

**THERMAL RESISTANCE RATINGS**

| Parameter   | Symbol            | Typical | Maximum | Unit |
|---|-------------------|---------|---------|------|
| Maximum Junction-to-Ambient (continuous current) <sup>a</sup> | R <sub>thJA</sub> | 120     | 150     | °C/W |
| Maximum Junction-to-Foot (Q2)                                 | R <sub>thJC</sub> | 35      | 50      |      |

**SPECIFICATIONS (T<sub>J</sub> = 25 °C UNLESS OTHERWISE NOTED)**

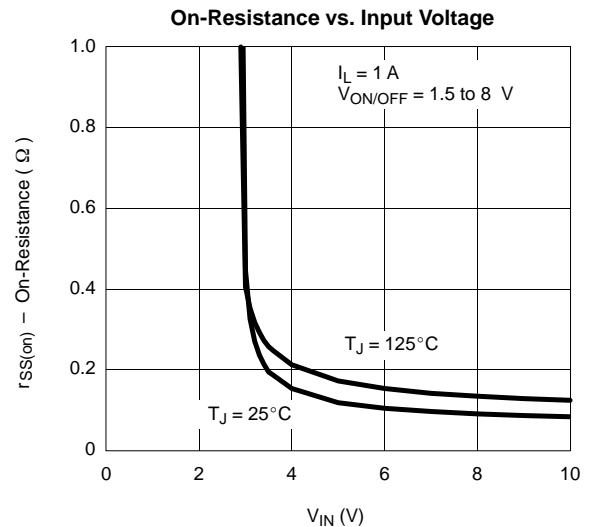
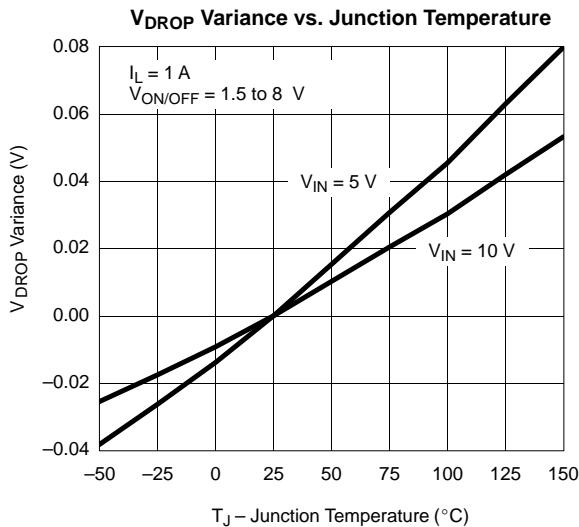
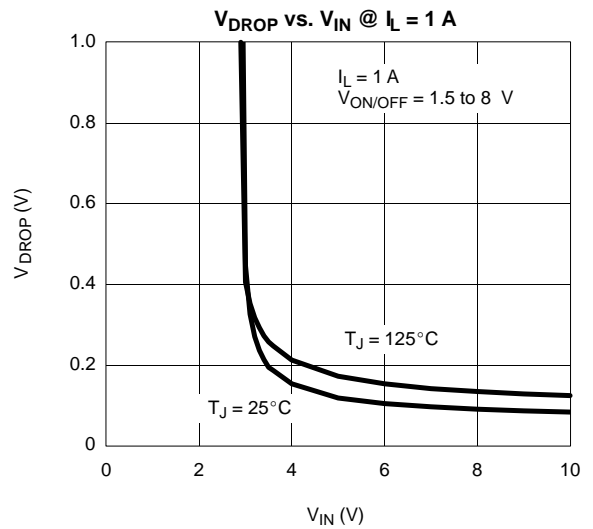
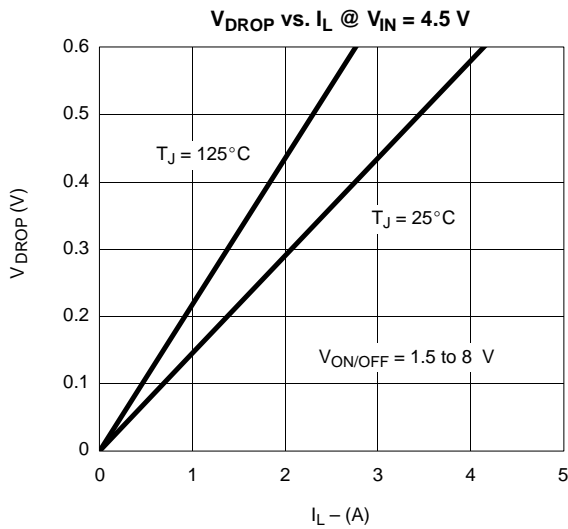
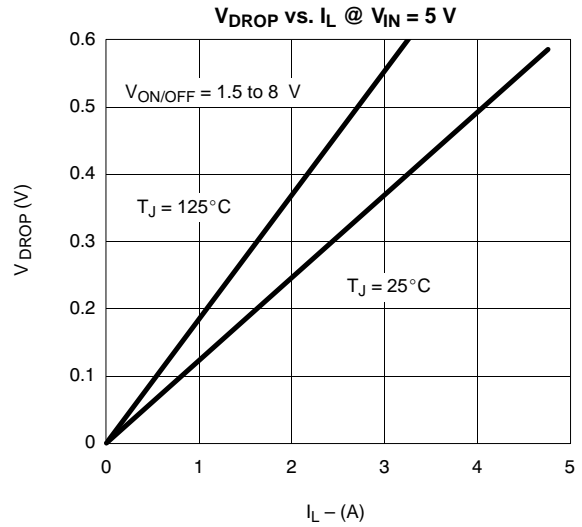
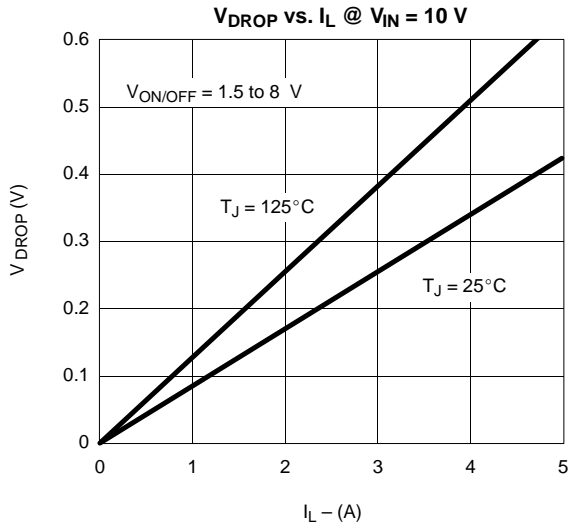
| Parameter                          | Symbol              | Test Condition   | Min                     | Typ  | Max   | Unit  |   |
|------------------------------------|---------------------|--|-------------------------|------|-------|-------|---|
| <b>OFF Characteristics</b>         |                     |  |                         |      |       |       |   |
| Reverse Leakage Current            | I <sub>FL</sub>     | V <sub>IN</sub> = 30 V, V <sub>ON/OFF</sub> = 0 V                                |                         |      | 1     | μA    |   |
| Diode Forward Voltage              | V <sub>SD</sub>     | I <sub>S</sub> = -1 A  |                         | -0.8 | -1    | V     |   |
| <b>ON Characteristics</b>          |                     |  |                         |      |       |       |   |
| Input Voltage Range                | V <sub>IN</sub>     |  | 4.5                     |      | 20    | V     |   |
| On-Resistance (p-channel) @ 1 A    | r <sub>DS(on)</sub> | V <sub>ON/OFF</sub> = 1.5 V<br>I <sub>D</sub> = 1 A                              | V <sub>IN</sub> = 10 V  |      | 0.085 | 0.105 | Ω |
|                                    |                     |  | V <sub>IN</sub> = 5.0 V |      | 0.123 | 0.150 |   |
|                                    |                     |  | V <sub>IN</sub> = 4.5 V |      | 0.145 | 0.175 |   |
| On-State (p-channel) Drain-Current | I <sub>D(on)</sub>  | V <sub>IN-OUT</sub> ≤ 0.2 V, V <sub>IN</sub> = 10 V, V <sub>ON/OFF</sub> = 1.5 V | 1                       |      |       | A     |   |
|                                    |                     | V <sub>IN-OUT</sub> ≤ 0.3 V, V <sub>IN</sub> = 5 V, V <sub>ON/OFF</sub> = 1.5 V  | 1                       |      |       |       |   |

Notes

- a. Surface Mounted on FR4 Board.
- b. V<sub>IN</sub> = 12, V<sub>ON/OFF</sub> = 8 V, T<sub>A</sub> = 25 °C.
- c. Pulse test: pulse width ≤ 300 μs, duty cycle ≤ 2%.



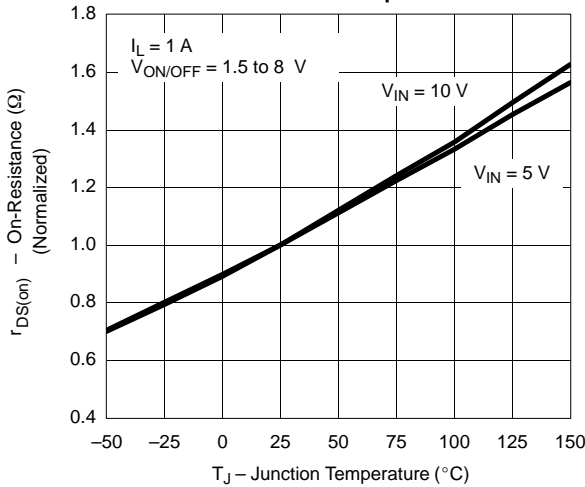
**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**



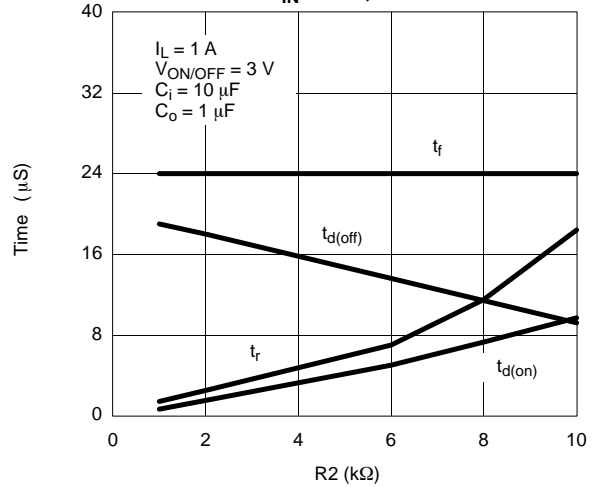


**TYPICAL CHARACTERISTICS (25 °C UNLESS NOTED)**

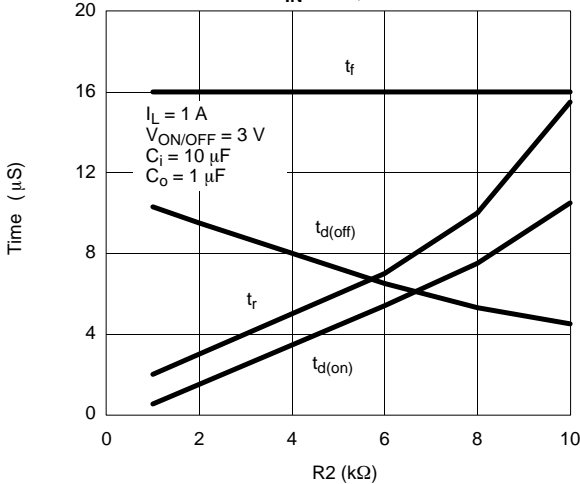
**Normalized On-Resistance vs. Junction Temperature**



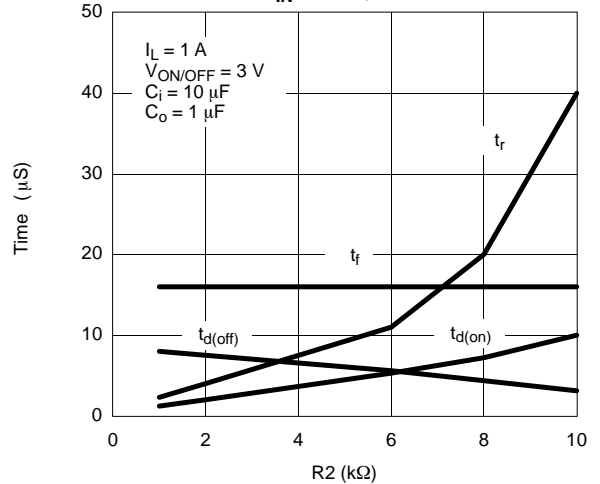
**Switching Variation R2 @ V\_IN = 10 V, R1 = 20 kΩ**



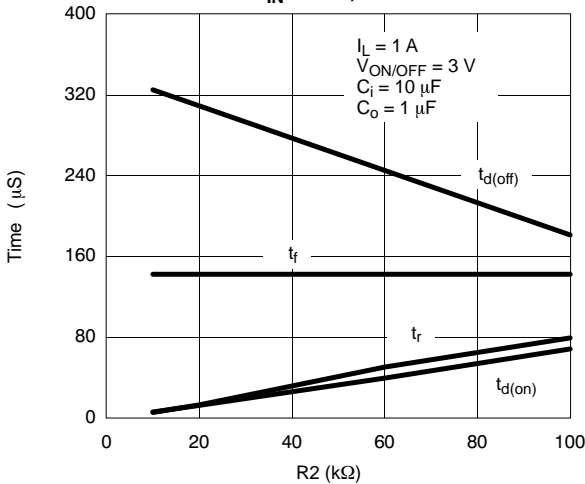
**Switching Variation R2 @ V\_IN = 5 V, R1 = 20 kΩ**



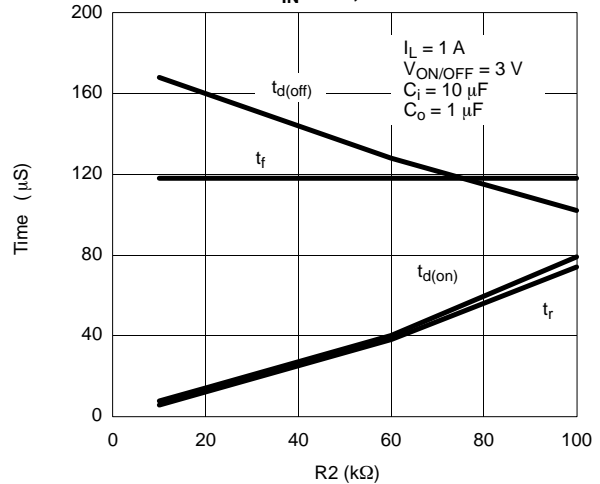
**Switching Variation R2 @ V\_IN = 4.5 V, R1 = 20 kΩ**



**Switching Variation R2 @ V\_IN = 10 V, R1 = 300 kΩ**

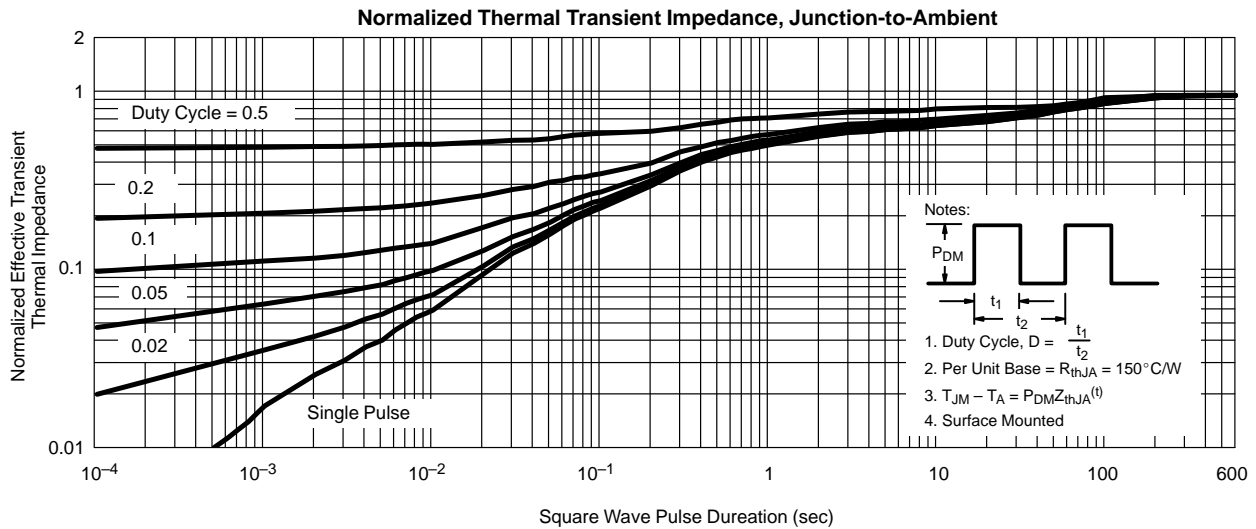
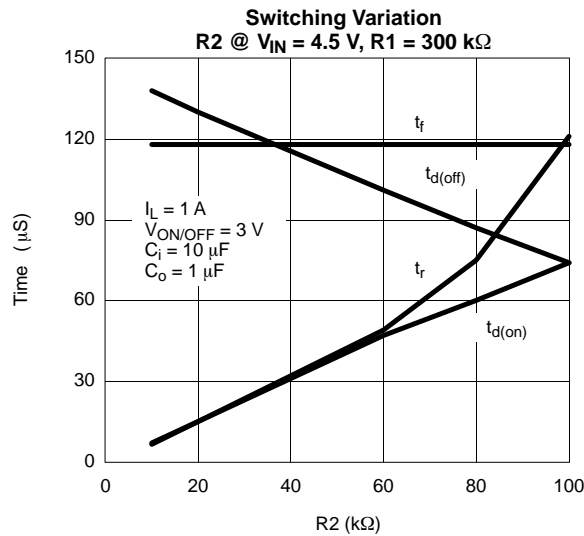


**Switching Variation R2 @ V\_IN = 5 V, R1 = 300 kΩ**





**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**





## Disclaimer

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