

## Load Switch with Level-Shift

### PRODUCT SUMMARY

| $V_{DS2}$ (V) | $R_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A) |
|---------------|---------------------------|-----------|
| 4.5 to 20     | 0.075 at $V_{IN} = 10$ V  | $\pm 2.3$ |
|               | 0.120 at $V_{IN} = 5.0$ V | $\pm 1.9$ |
|               | 0.145 at $V_{IN} = 4.5$ V | $\pm 1.7$ |

### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- 4.5 V Rated
- ESD Protected: 3000 V
- 105 m $\Omega$  Low  $R_{DS(on)}$  TrenchFET®
- 4.5 V to 20 V Input
- 1.5 V to 8 V Logic Level Control
- Low Profile, Small Footprint TSOP-6 Package
- 3000 V ESD Protection On Input Switch,  $V_{ON/OFF}$
- Adjustable Slew-Rate
- Compliant to RoHS Directive 2002/95/EC



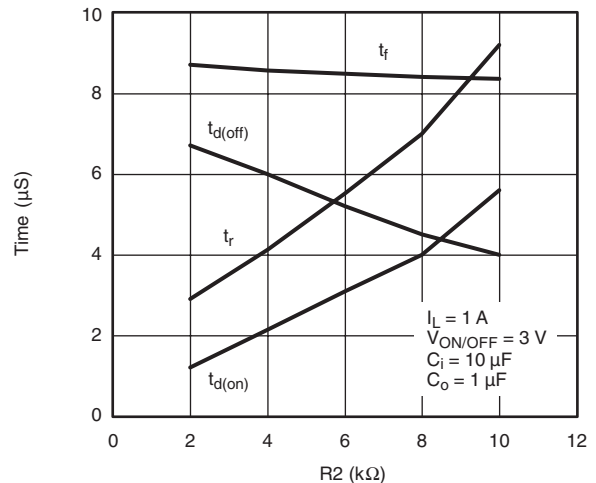
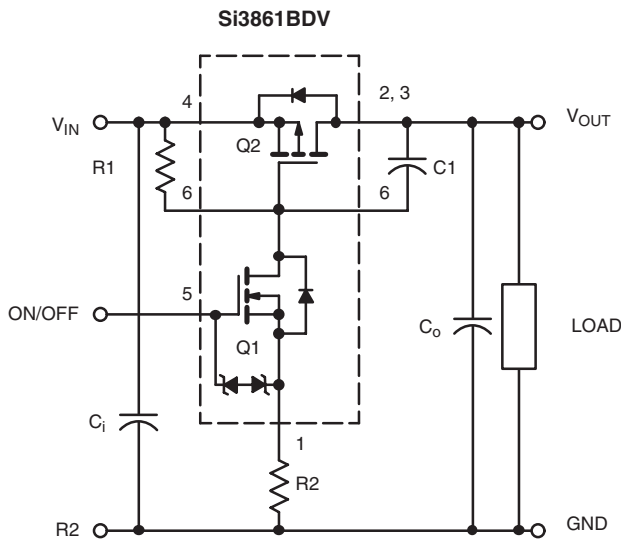
**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

### DESCRIPTION

The Si3861BDV 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 Si3861BDV 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  $V_{IN}/R1$  combinations See Typical Characteristics

### COMPONENTS

|    |                            |                                         |
|----|----------------------------|-----------------------------------------|
| R1 | Pull-Up Resistor           | Typical 10 k $\Omega$ to 1 m $\Omega$ * |
| R2 | Optional Slew-Rate Control | Typical 0 to 100 k $\Omega$ *           |
| C1 | Optional Slew-Rate Control | Typical 1000 pF                         |

#### Note:

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

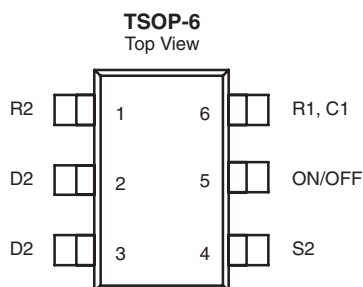
The Si3861BDV is ideally suited for high-side load switching in portable applications. The integrated N-Channel level-shift device saves space by reducing external components. The slew rate is set externally so that rise-times can be tailored to different load types.

## Si3861BDV

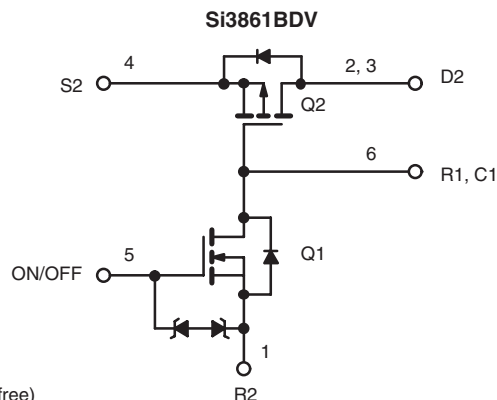
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## FUNCTIONAL BLOCK DIAGRAM



Ordering Information: Si3861BDV-T1-E3 (Lead (Pb)-free)  
Si3861BDV-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS  $T_A = 25^\circ\text{C}$ , unless otherwise noted

| Parameter                                                          | Symbol                     | Limit       | Unit             |
|--------------------------------------------------------------------|----------------------------|-------------|------------------|
| Input Voltage                                                      | $V_{IN}$                   | 20          | V                |
| ON/OFF Voltage                                                     | $V_{ON/OFF}$               | 8           |                  |
| Load Current                                                       | Continuous <sup>a, b</sup> | $\pm 2.3$   | A                |
|                                                                    | Pulsed <sup>b, c</sup>     | $\pm 4$     |                  |
| Continuous Intrinsic Diode Conduction <sup>a</sup>                 | $I_S$                      | - 1         |                  |
| Maximum Power Dissipation <sup>a</sup>                             | $P_D$                      | 0.83        | W                |
| Operating Junction and Storage Temperature Range                   | $T_J, T_{stg}$             | - 55 to 150 | $^\circ\text{C}$ |
| ESD Rating, MIL-STD-883D Human Body Model (100 pF, 1500 $\Omega$ ) | ESD                        | 3           | kV               |

## THERMAL RESISTANCE RATINGS

| Parameter                                                     | Symbol     | Typical | Maximum | Unit               |
|---------------------------------------------------------------|------------|---------|---------|--------------------|
| Maximum Junction-to-Ambient (Continuous Current) <sup>a</sup> | $R_{thJA}$ | 120     | 150     | $^\circ\text{C/W}$ |
| Maximum Junction-to-Foot (Q2)                                 | $R_{thJF}$ | 60      | 80      |                    |

SPECIFICATIONS  $T_J = 25^\circ\text{C}$ , unless otherwise noted

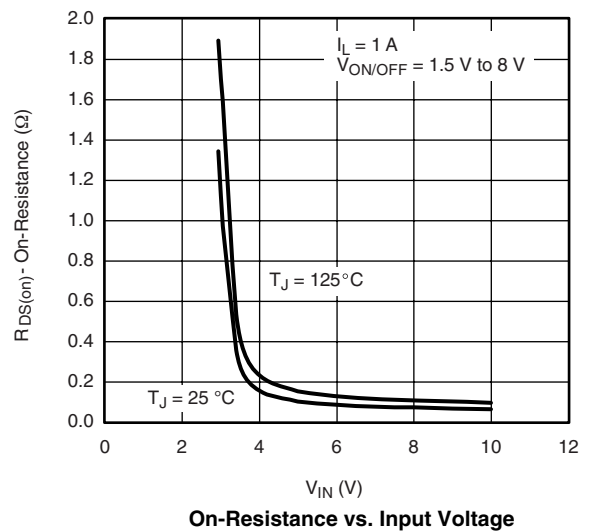
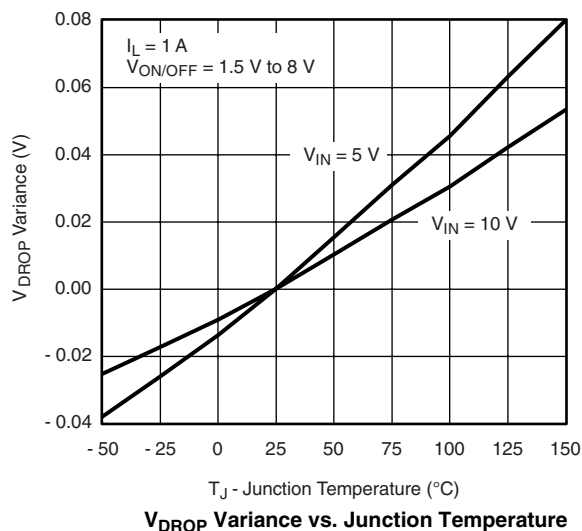
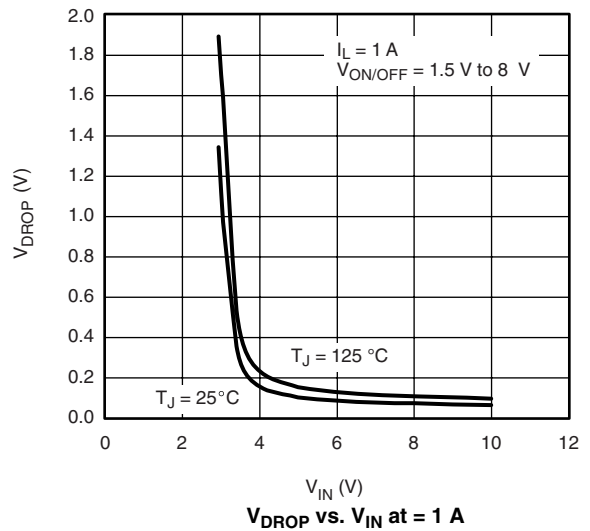
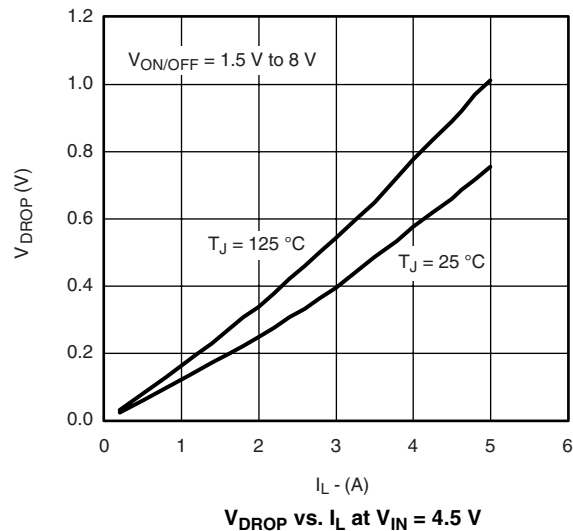
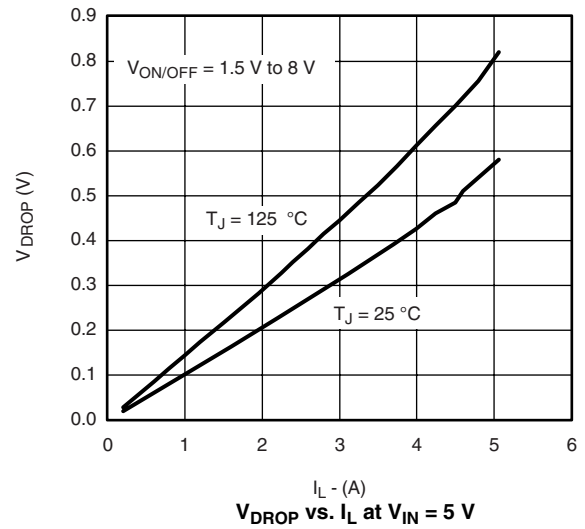
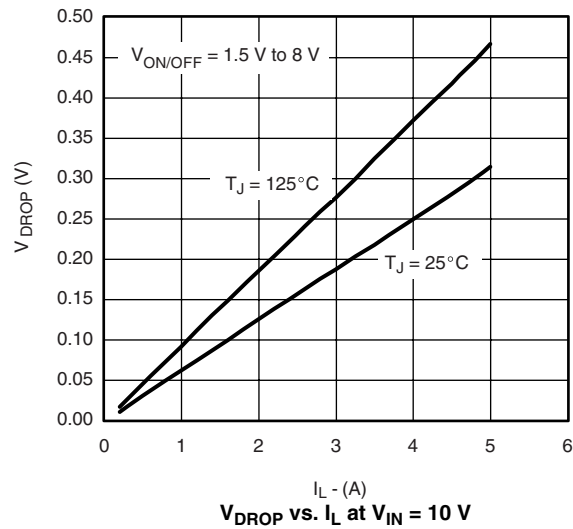
| Parameter                          | Symbol       | Test Conditions                                                                 | Min.                    | Typ.  | Max.  | Unit          |
|------------------------------------|--------------|---------------------------------------------------------------------------------|-------------------------|-------|-------|---------------|
| <b>OFF Characteristics</b>         |              |                                                                                 |                         |       |       |               |
| Reverse Leakage Current            | $I_{FL}$     | $V_{IN} = 30\text{ V}, V_{ON/OFF} = 0\text{ V}$                                 |                         |       | 1     | $\mu\text{A}$ |
| Diode Forward Voltage              | $V_{SD}$     | $I_S = -1\text{ A}$                                                             |                         | - 0.8 | - 1   | V             |
| <b>ON Characteristics</b>          |              |                                                                                 |                         |       |       |               |
| Input Voltage Range                | $V_{IN}$     |                                                                                 | 4.5                     |       | 20    | V             |
| On-Resistance (P-Channel) at 1 A   | $R_{DS(on)}$ | $V_{ON/OFF} = 1.5\text{ V}, I_D = 1\text{ A}$                                   | $V_{IN} = 10\text{ V}$  | 0.060 | 0.075 | $\Omega$      |
|                                    |              |                                                                                 | $V_{IN} = 5.0\text{ V}$ | 0.096 | 0.120 |               |
|                                    |              |                                                                                 | $V_{IN} = 4.5\text{ V}$ | 0.115 | 0.145 |               |
| On-State (P-Channel) Drain-Current | $I_{D(on)}$  | $V_{IN-OUT} \leq 0.2\text{ V}, V_{IN} = 10\text{ V}, V_{ON/OFF} = 1.5\text{ V}$ | 1                       |       |       | A             |
|                                    |              | $V_{IN-OUT} \leq 0.3\text{ V}, V_{IN} = 5\text{ V}, V_{ON/OFF} = 1.5\text{ V}$  | 1                       |       |       |               |

Notes:

a. Surface Mounted on FR4 board.

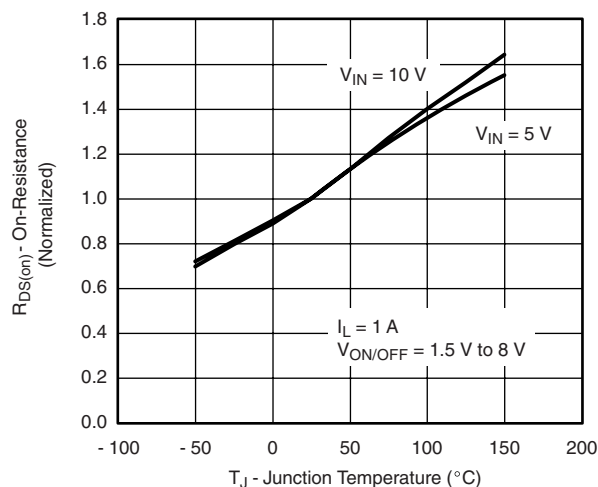
b.  $V_{IN} = 12\text{ V}$ ,  $V_{ON/OFF} = 8\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .c. Pulse test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

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.

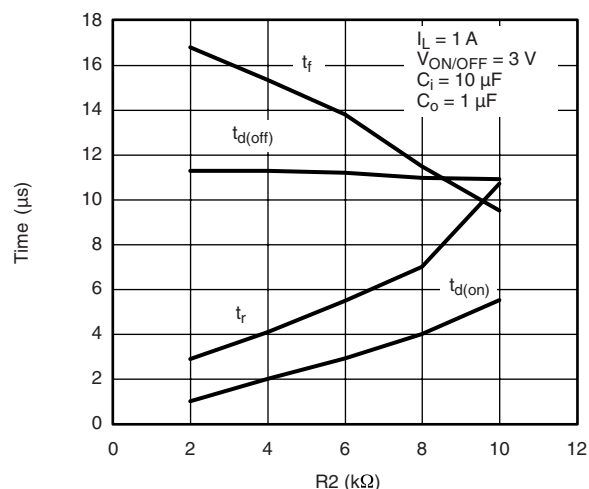

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted


## Si3861BDV

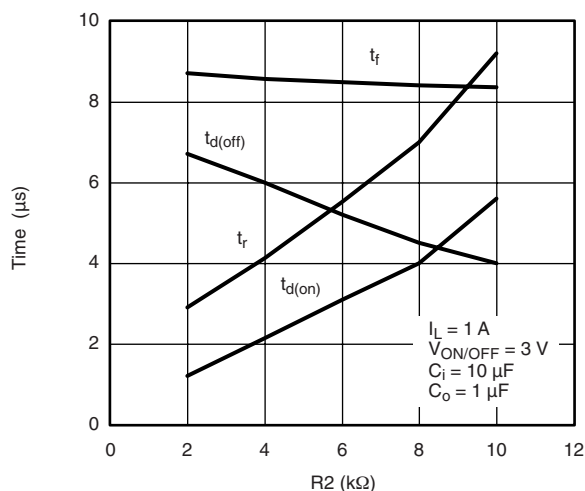
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**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

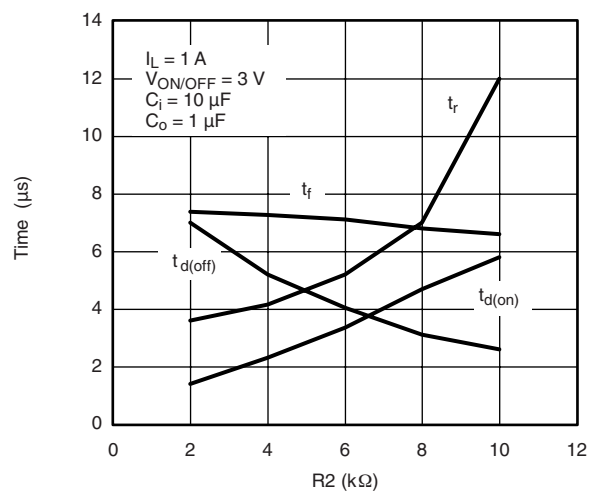
**Normalized On-Resistance  
vs. Junction Temperature**



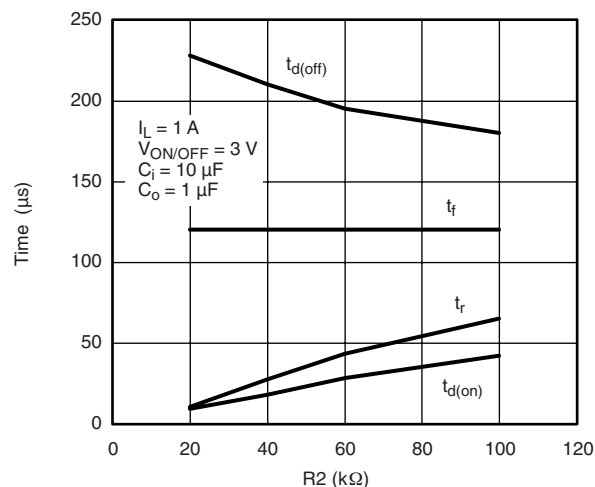
**Switching Variation  
 $R_2$  at  $V_{IN} = 10\text{ V}$ ,  $R_1 = 20\text{ k}\Omega$**



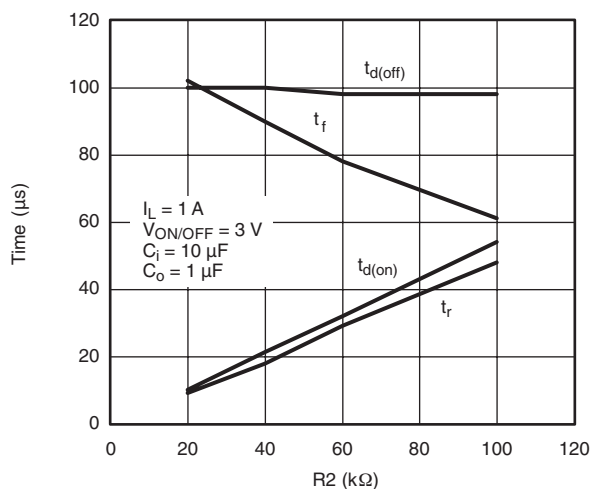
**Switching Variation  
 $R_2$  at  $V_{IN} = 5\text{ V}$ ,  $R_1 = 20\text{ k}\Omega$**



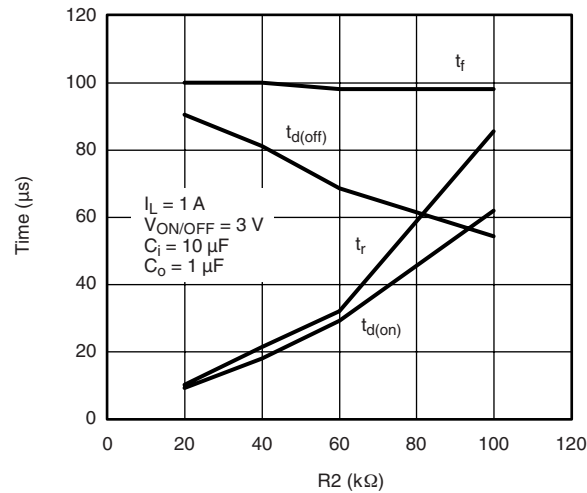
**Switching Variation  
 $R_2$  at  $V_{IN} = 4.5\text{ V}$ ,  $R_1 = 20\text{ k}\Omega$**



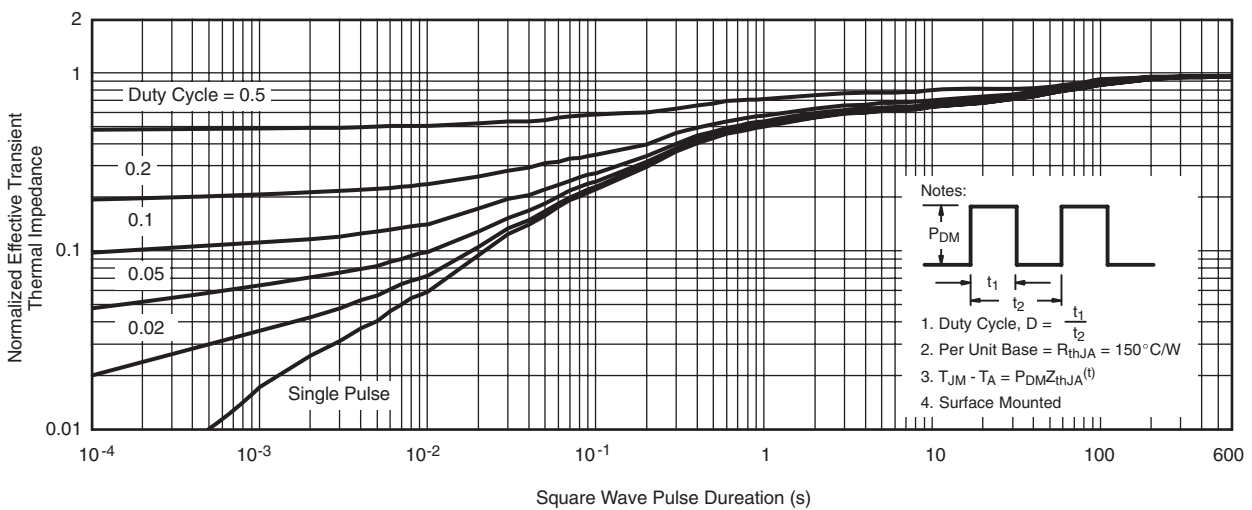
**Switching Variation  
 $R_2$  at  $V_{IN} = 10\text{ V}$ ,  $R_1 = 300\text{ k}\Omega$**



**Switching Variation  
 $R_2$  at  $V_{IN} = 5\text{ V}$ ,  $R_1 = 300\text{ k}\Omega$**


**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted


**Switching Variation**  
 $R2 \text{ at } V_{\text{IN}} = 4.5 \text{ V}, R1 = 300 \text{ k}\Omega$



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