

#### FEATURES

- Current Limit Protection
- I/O Isolation, 5300 V<sub>RMS</sub>
- Typical R<sub>ON</sub> 10 Ω
- Load Voltage 200 V
- Load Current 140 mA
- High Surge Capability
- Linear, AC/DC Operation
- Clean Bounce Free Switching
- Low Power Consumption
- High Reliability Monolithic Receptor
- SMD Lead Available on Tape and Reel

#### AGENCY APPROVALS

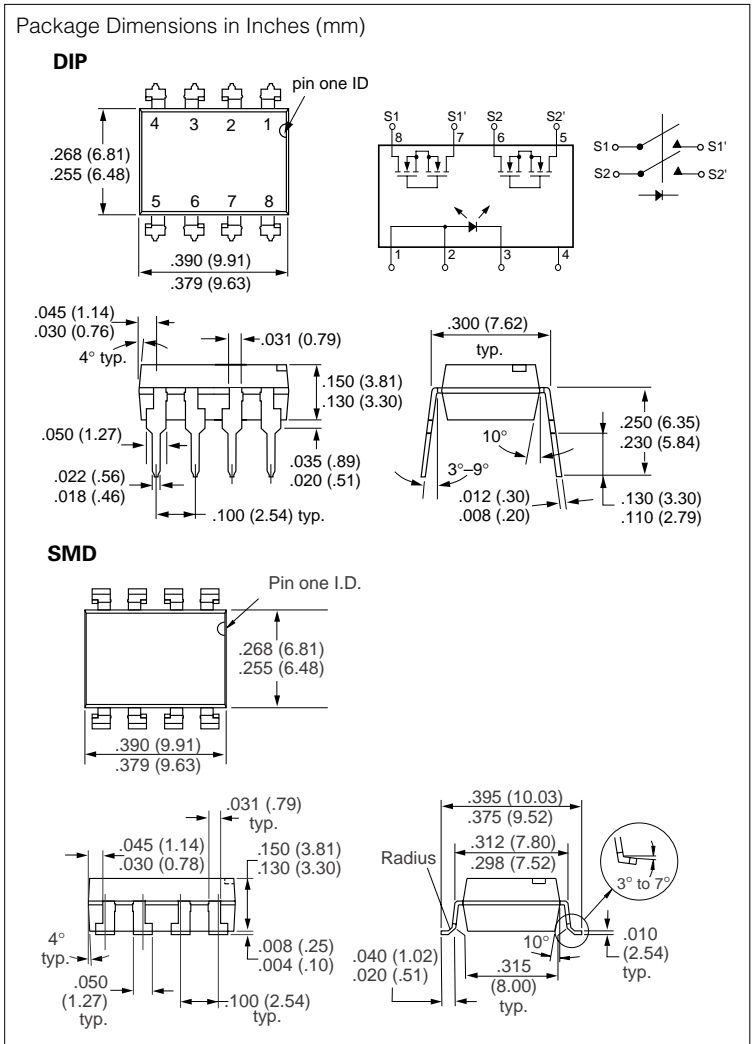
- UL – File No. E52744
- CSA – Certification 093751
- VDE 0884 Approval

#### APPLICATIONS

- General Telecom Switching
  - On/off Hook Control
  - Ring Delay
  - Dial Pulse
  - Ground Start
  - Ground Fault Protection
- Instrumentation
- Industrial Controls

#### DESCRIPTION

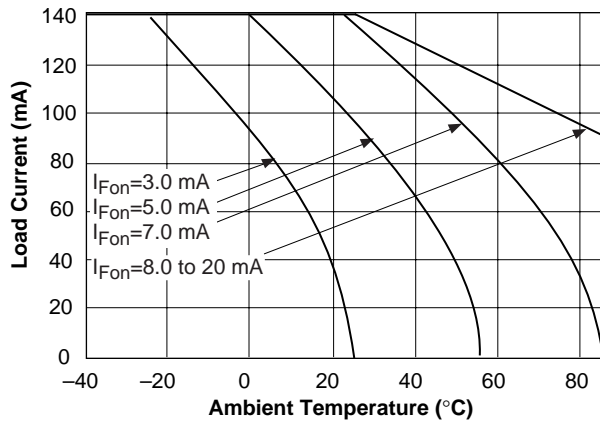
The LH1513 relays are DPST normally open switches (2 Form A) that can replace electromechanical relays in many applications. The relays are constructed using a GaAlAs LED for actuation control and an integrated monolithic die for the switch output. The die, fabricated in a high-voltage dielectrically isolated technology, is comprised of a photodiode array, switch control circuitry, and DMOS switches. In addition, these relays employ current-limiting circuitry, enabling them to pass FCC 68.302 and other regulatory voltage surge requirements when overvoltage protection is provided.



#### Part Identification

Part Number	Description
LH1513AB	8-pin DIP, Tubes
LH1513AAC	8-pin SMD, Gullwing, Tubes
LH1513AACTR	8-pin SMD, Gullwing, Tape and Reel

## Recommended Operating Conditions



## Absolute Maximum Ratings, $T_A=25^\circ\text{C}$

Stresses in excess of the Absolute Maximum Ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to maximum rating conditions for extended periods can adversely affect device reliability.

Ambient Temperature Range ( $T_A$ )	.....	-40 to +85°C
Storage Temperature Range ( $T_{stg}$ )	.....	-40 to +150°C
Pin Soldering Temperature (t=10 s max) ( $T_S$ )	.....	260°C
Input/Output Isolation Voltage ( $V_{ISO}$ )	.....	5300 V <sub>RMS</sub>
Pole-to-Pole Isolation Voltage (S1 to S2)	.....	500 V
LED Continuous Forward Current ( $I_F$ )	.....	50 mA
LED Reverse Voltage ( $I_F \leq 10 \mu\text{A}$ ) ( $V_R$ )	.....	8.0 V
DC or Peak AC Load Voltage ( $I_L \leq 50 \mu\text{A}$ ) ( $V_L$ )	.....	200 V
Continuous DC Load Current ( $I_L$ )		
One Pole Operating	.....	200 mA
Two Poles Operating	.....	140 mA
Peak Load Current (t=100 ms) (single shot) ( $I_P$ )	..... †	
Output Power Dissipation (continuous) ( $P_{DISS}$ )	.....	600 mW

† Refer to Current Limit Performance Application Note for a discussion on relay operation during transient currents.

## Electrical Characteristics, $T_A=25^\circ\text{C}$

Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluations. Typical values are for information only and are not part of the testing requirements.

Parameter	Sym.	Min.	Typ.	Max.	Units	Test Conditions
<b>Input</b>						
LED Forward Current, Switch Turn-on	$I_{Fon}$	—	2.0	3.0	mA	$I_L=100 \text{ mA}$ , t=10 ms
LED Forward Current, Switch Turn-off	$I_{Foff}$	0.2	0.8	—	mA	$V_L \pm 150 \text{ V}$
LED Forward Voltage	$V_F$	1.15	1.26	1.45	V	$I_F=10 \text{ mA}$
<b>Output</b>						
ON-resistance	$R_{ON}$	6.0	10	15	$\Omega$	$I_F=5.0 \text{ mA}$ , $I_L=50 \text{ mA}$
Pole-to-Pole ON-resistance Matching (S1 to S2)	—	—	0.1	1.0	$\Delta\Omega$	$I_F=5.0 \text{ mA}$ , $I_L=50 \text{ mA}$
OFF-resistance	$R_{OFF}$	0.5	5000	—	G $\Omega$	$I_F=0 \text{ mA}$ , $V_L=\pm 100 \text{ V}$
Current Limit	$I_{LMT}$	300	360	460	mA	$I_F=5.0 \text{ mA}$ , t=5.0 ms $V_L \pm 5.0 \text{ V}$
Off-state Leakage Current	—	—	0.02	200	nA	$I_F=0 \text{ mA}$ , $V_L=\pm 100 \text{ V}$
			—	1.0	$\mu\text{A}$	$I_F=0 \text{ mA}$ , $V_L=\pm 200 \text{ V}$
Output Capacitance	—	—	60	—	pF	$I_F=0 \text{ mA}$ , $V_L=1.0 \text{ V}$
			15	—	pF	$I_F=0 \text{ mA}$ , $V_L=50 \text{ V}$
Pole-to-Pole Capacitance (S1 to S2)	—	—	3.0	—	pF	$I_F=0 \text{ mA}$
			4.0	—	pF	$I_F=5.0 \text{ mA}$
Switch Offset	—	—	0.15	—	V	$I_F=5.0 \text{ mA}$
<b>Transfer</b>						
Input/Output Capacitance	$C_{ISO}$	—	1.1	—	pF	$V_{ISO}=1.0 \text{ V}$
Turn-on Time	$t_{on}$	—	1.6	2.5	ms	$I_F=10.0 \text{ mA}$ , $I_L=50 \text{ mA}$
Turn-off Time	$t_{off}$	—	0.65	2.5	ms	$I_F=10.0 \text{ mA}$ , $I_L=50 \text{ mA}$

Typical Performance Characteristics

Figure 1. LED Voltage vs. Temperature

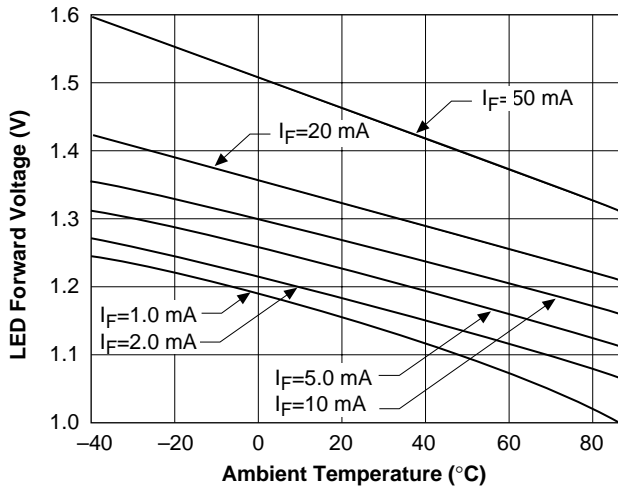


Figure 4. LED Dropout Voltage vs. Temperature

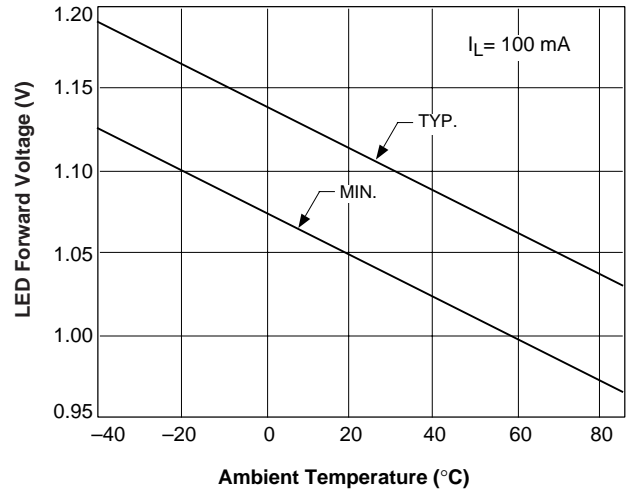


Figure 2. LED Current for Switch Turn-on vs. Temperature

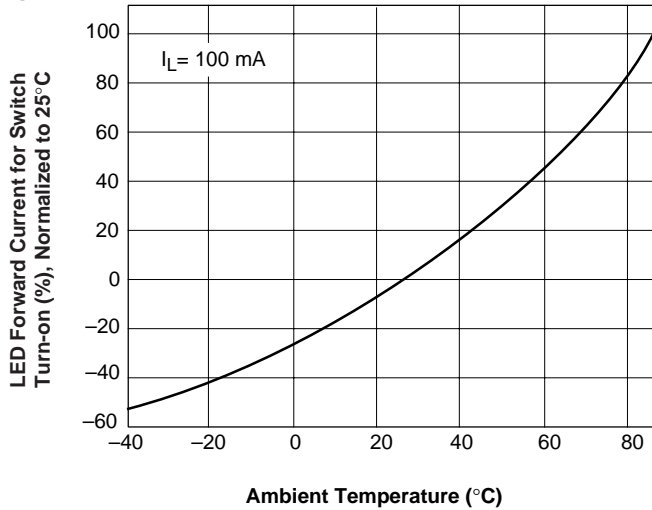


Figure 5. Current Limit vs. Temperature

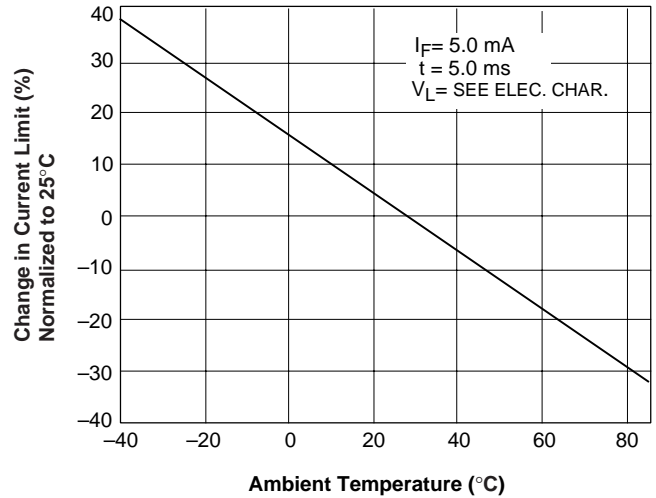


Figure 3. On-resistance vs. Temperature

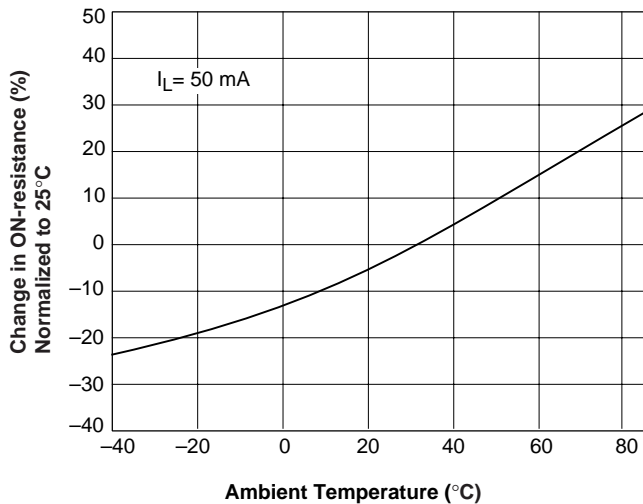
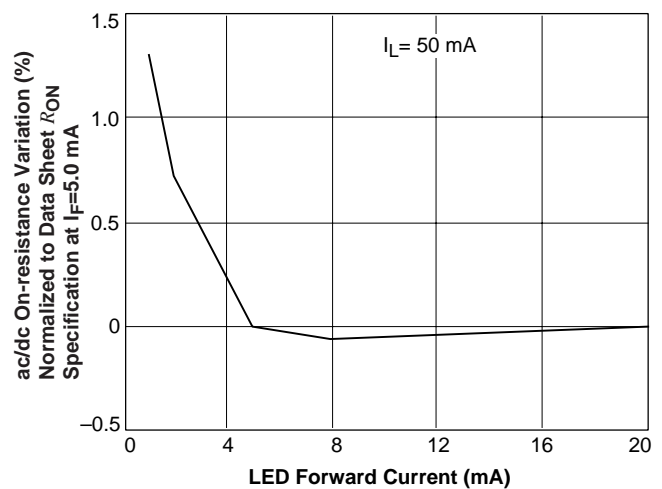
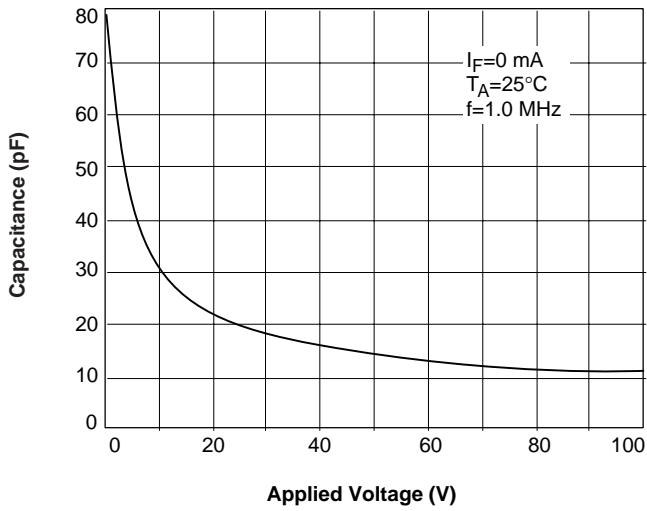


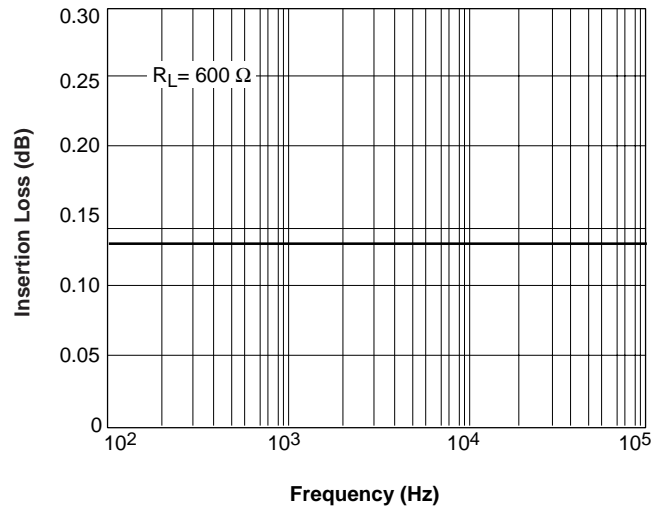
Figure 6. Variation in On-resistance vs. LED Current



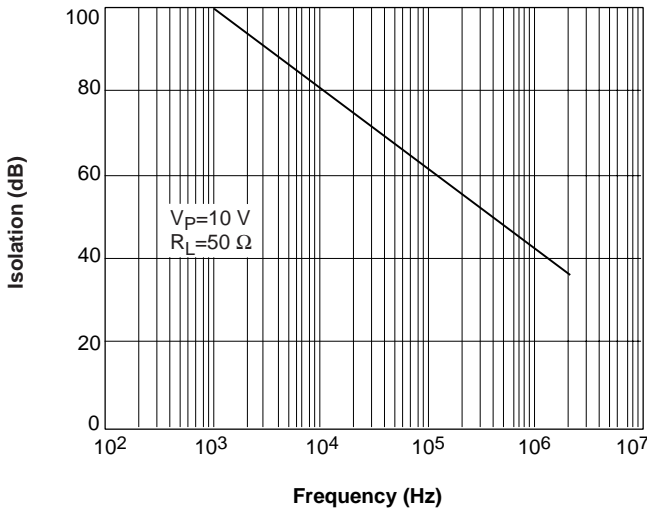
**Figure 7. Switch Capacitance vs. Applied Voltage**



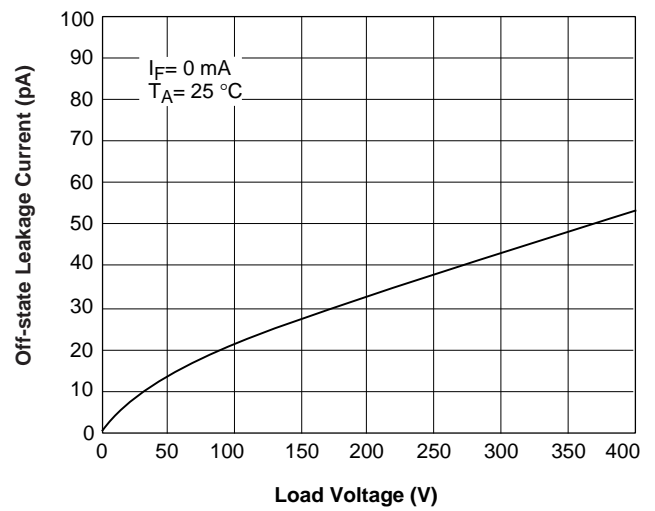
**Figure 10. Insertion Loss vs. Frequency**



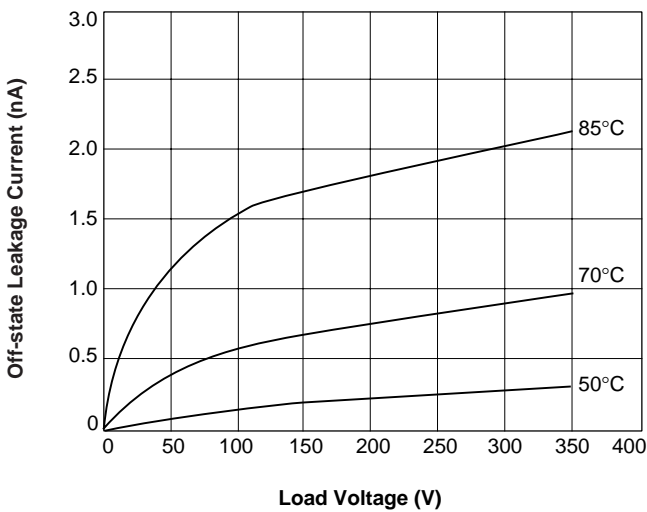
**Figure 8. Output Isolation**



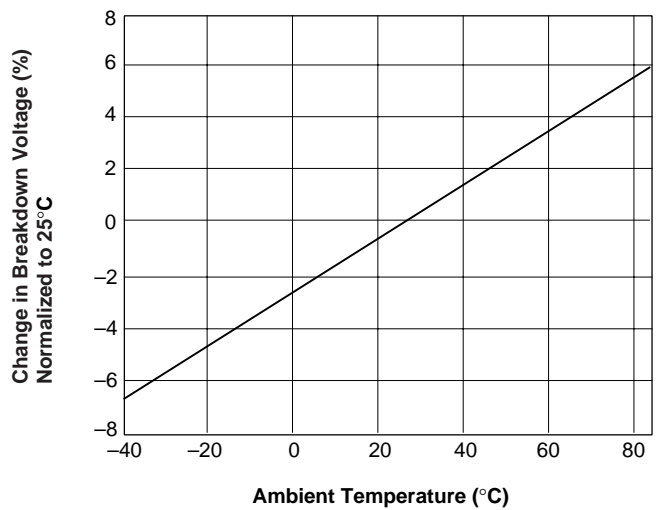
**Figure 11. Leakage Current vs. Applied Voltage**



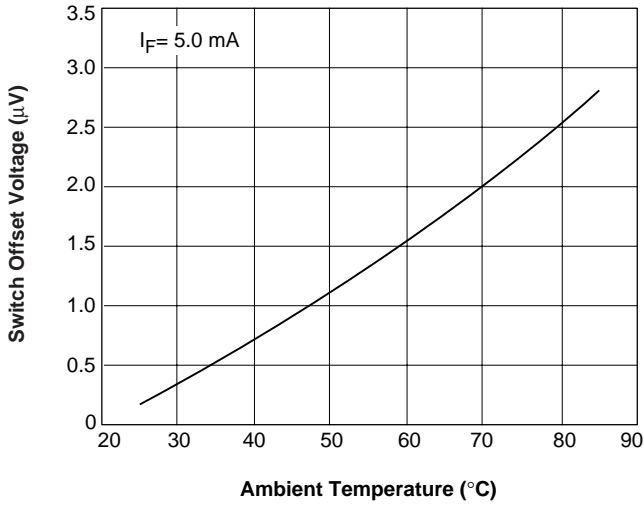
**Figure 9. Leakage Current vs. Applied Voltage at Elevated Temperatures**



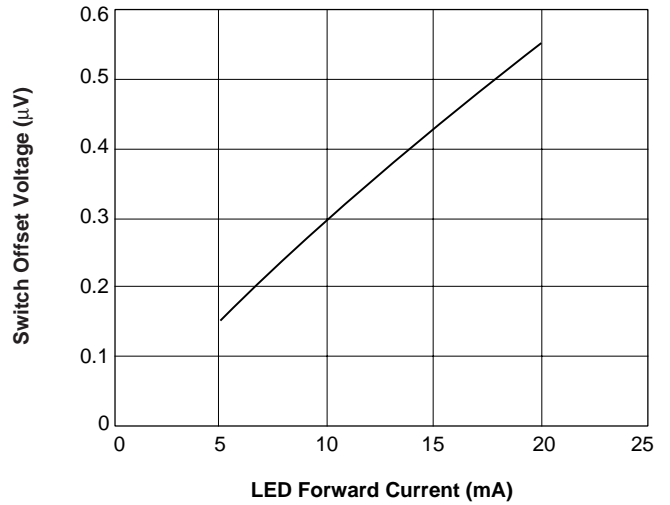
**Figure 12. Switch Breakdown Voltage vs. Temperature**



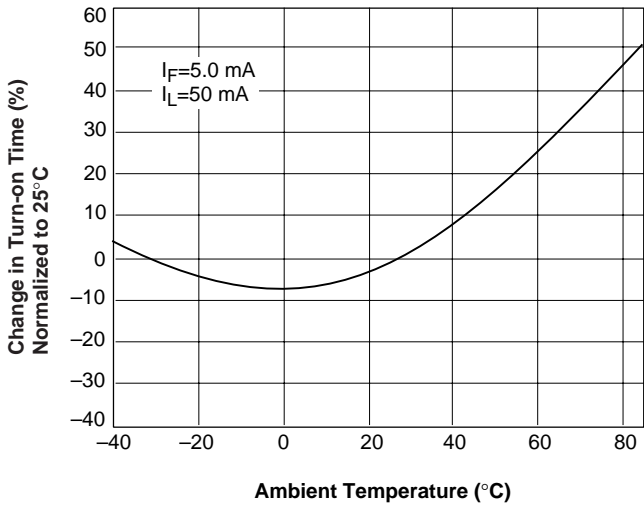
**Figure 13. Switch Offset Voltage vs. Temperature**



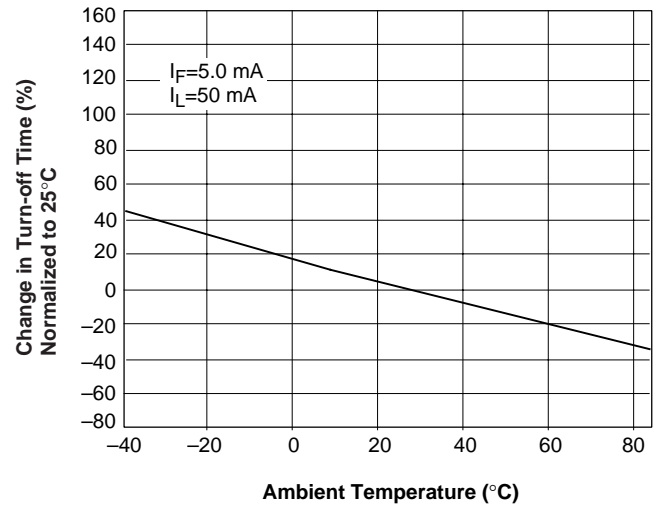
**Figure 16. Switch Offset Voltage vs. LED Current**



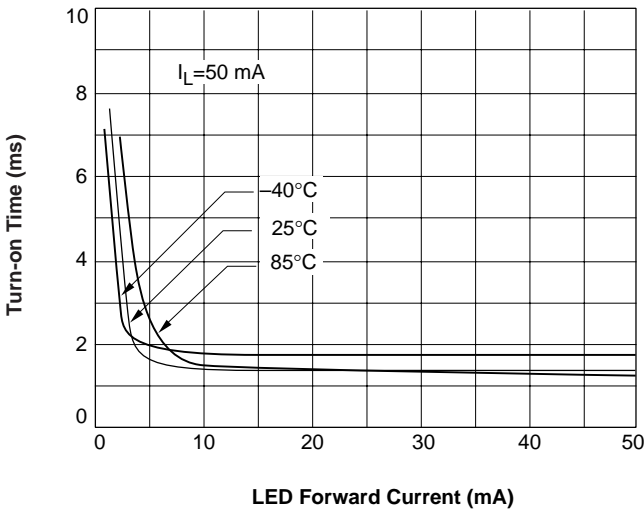
**Figure 14. Turn-on Time vs. Temperature**



**Figure 17. Turn-off Time vs. Temperature**



**Figure 15. Turn-on Time vs. LED Current**



**Figure 18. Turn-off Time vs. LED Current**

