

### 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

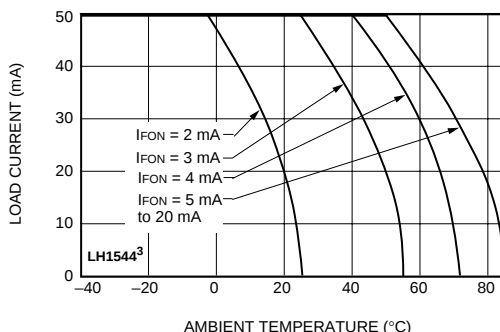
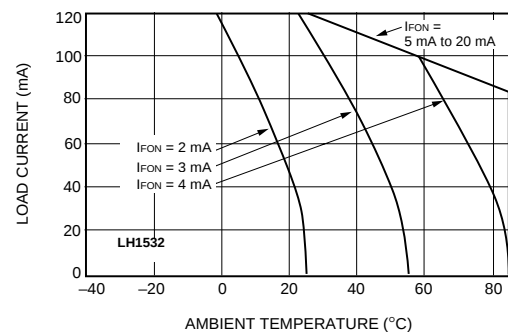
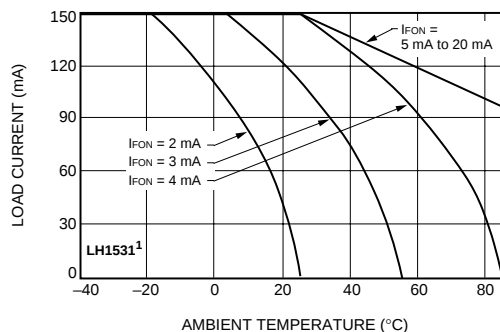
device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to Absolute Maximum Ratings for extended periods of time can adversely affect reliability.

| Parameter                                                               | Symbol            | Test Conditions                    | LH1531      | LH1532      | LH1544      | Units              |
|-------------------------------------------------------------------------|-------------------|------------------------------------|-------------|-------------|-------------|--------------------|
| Ambient Operating Temperature Range                                     | $T_A$             | —                                  | -40 to +85  | -40 to +85  | -40 to + 85 | $^{\circ}\text{C}$ |
| Storage Temperature Range                                               | $T_{\text{stg}}$  | —                                  | -40 to +150 | -40 to +150 | -40 to +150 | $^{\circ}\text{C}$ |
| Pin Soldering Temperature                                               | $T_S$             | $t=10\text{ s max}$                | 260         | 260         | 260         | $^{\circ}\text{C}$ |
| Input/Output Isolation Test Voltage                                     | $V_{\text{ISO}}$  | $t=1\text{ Sec}$                   | 5300        | 5300        | 5300        | Vrms               |
| Pole-to-Pole Isolation Voltage (S1 to S2)†                              | —                 | Dry air, dust free, at sea level   | 1600        | 1600        | 1600        | V                  |
| LED Continuous Forward Current                                          | $I_F$             | —                                  | 50          | 50          | 50          | mA                 |
| LED Reverse Voltage                                                     | $V_R$             | $I_R \leq 10\text{ }\mu\text{A}$   | 8           | 8           | 8           | V                  |
| dc or Peak ac Load Voltage                                              | $V_L$             | $I_L \leq 50\text{ }\mu\text{A}$   | 350         | 350         | 200         | V                  |
| Continuous dc Load Current<br>One Pole Operating<br>Two Poles Operating | $I_L$             | —                                  | 150<br>110  | 120<br>110  | 55<br>40    | mA<br>mA           |
| Peak Load Current                                                       | $I_P$             | $t=100\text{ ms}$<br>(single shot) | 400         | *           | 100         | mA                 |
| Output Power Dissipation (continuous)                                   | $P_{\text{DISS}}$ | —                                  | 600         | 600         | 600         | mW                 |

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

† Breakdown occurs between the output pins external to the package.

### SSR Recommended Operating Conditions



# 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 purposes only and are not part of the testing requirements.

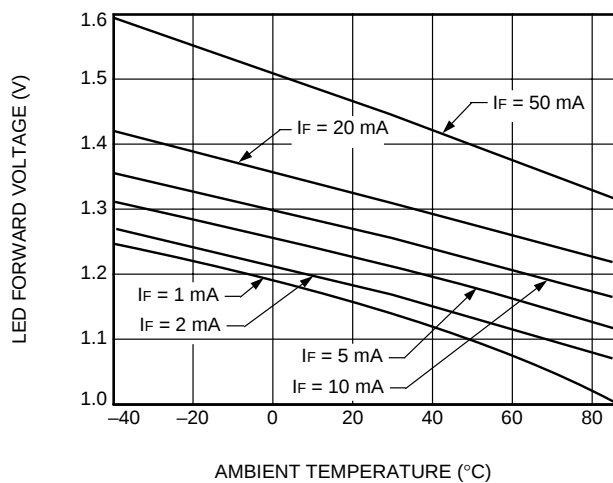
|          | Parameter                               | Symbol            | Test Conditions                                | Values         | LH1531               | LH1532 | LH1544 | Units |   |
|----------|-----------------------------------------|-------------------|------------------------------------------------|----------------|----------------------|--------|--------|-------|---|
| INPUT    | LED Forward Current for Switch Turn-on  | I <sub>Fon</sub>  | I <sub>L</sub> =100 mA<br>t=10 ms              | Min            | —                    | —      | —      | mA    |   |
|          |                                         |                   |                                                | Typ            | 1.0                  | 1.0    | 0.9    | mA    |   |
|          |                                         |                   |                                                | Max            | 2.0                  | 2.0    | 2.0    | mA    |   |
|          | LED Forward Current for Switch Turn-off | I <sub>Foff</sub> | —                                              | Min            | 0.2                  | 0.2    | 0.2    | mA    |   |
|          |                                         |                   |                                                | Typ            | 0.9                  | 0.9    | 0.8    | mA    |   |
|          |                                         |                   |                                                | Max            | —                    | —      | —      | mA    |   |
|          | LED Forward Voltage                     | V <sub>F</sub>    | I <sub>F</sub> =10 mA                          | V <sub>L</sub> | ±                    | 300    | 300    | 150   | V |
|          |                                         |                   |                                                | Min            | 1.15                 | 1.15   | 1.10*  | V     |   |
|          |                                         |                   |                                                | Typ            | 1.26                 | 1.26   | 1.19*  | V     |   |
|          |                                         |                   |                                                | Max            | 1.45                 | 1.45   | 1.45*  | V     |   |
| OUTPUT   | ON-resistance                           | R <sub>ON</sub>   | I <sub>F</sub> =5 mA<br>I <sub>L</sub> =50 mA  | Min            | 12                   | 12     | 70     | Ω     |   |
|          |                                         |                   |                                                | Typ            | 18                   | 20     | 110    | Ω     |   |
|          |                                         |                   |                                                | Max            | 25                   | 25     | 160    | Ω     |   |
|          | OFF-resistance                          | R <sub>OFF</sub>  | I <sub>F</sub> =0 mA<br>V <sub>L</sub> =±100 V | Min            | 0.5                  | 0.5    | 0.5    | GΩ    |   |
|          |                                         |                   |                                                | Typ            | 5000                 | 5000   | 10000  | GΩ    |   |
|          |                                         |                   |                                                | Max            | —                    | —      | —      | GΩ    |   |
|          | ON-state Voltage                        | —                 | I <sub>L</sub> =1 mA                           | Min            | —                    | —      | —      | V     |   |
|          |                                         |                   |                                                | Typ            | —                    | —      | —      | V     |   |
|          |                                         |                   |                                                | Max            | —                    | —      | —      | V     |   |
|          |                                         |                   | I <sub>L</sub> =90 mA<br>t=10 ms               | Min            | —                    | —      | —      | V     |   |
|          |                                         |                   |                                                | Typ            | —                    | —      | —      | V     |   |
|          |                                         |                   |                                                | Max            | —                    | —      | —      | V     |   |
|          | Current Limit                           | I <sub>LMT</sub>  | I <sub>F</sub> =5 mA<br>t=5 ms                 | Min            | —                    | 170    | —      | mA    |   |
|          |                                         |                   |                                                | Typ            | —                    | 210    | —      | mA    |   |
|          |                                         |                   |                                                | Max            | —                    | 250    | —      | mA    |   |
|          |                                         |                   |                                                | V <sub>L</sub> | ±                    | —      | 6      | —     | V |
|          | Off-state Leakage Current               | —                 | I <sub>F</sub> =0 mA<br>V <sub>L</sub> =±100 V | Min            | —                    | —      | —      | nA    |   |
|          |                                         |                   |                                                | Typ            | 0.02                 | 0.02   | 0.01   | nA    |   |
|          |                                         |                   |                                                | Max            | 200                  | 200    | 200    | nA    |   |
|          |                                         |                   | I <sub>F</sub> =0 mA                           | Min            | —                    | —      | —      | μA    |   |
|          |                                         |                   |                                                | Typ            | —                    | —      | —      | μA    |   |
|          |                                         |                   |                                                | Max            | 1.0                  | 1.0    | 1.0    | μA    |   |
|          | Output Capacitance                      | —                 | I <sub>F</sub> =0 mA<br>V <sub>L</sub> =1 V    | V <sub>L</sub> | ±                    | 350    | 350    | 200   | V |
|          |                                         |                   |                                                | Min            | —                    | —      | —      | pF    |   |
|          |                                         |                   |                                                | Typ            | 55                   | 55     | 0      | pF    |   |
|          |                                         |                   |                                                |                |                      |        | Max    | —     | — |
|          |                                         |                   | I <sub>F</sub> =0 mA<br>V <sub>L</sub> =50 V   | Min            | —                    | —      | —      | pF    |   |
|          |                                         |                   |                                                | Typ            | 10                   | 10     | 0.5    | pF    |   |
|          |                                         |                   |                                                | Max            | —                    | —      | —      | pF    |   |
|          |                                         |                   | Pole-to-pole Capacitance (S1 to S2)            | —              | I <sub>F</sub> =5 mA | Min    | —      | —     | — |
|          | Typ                                     | 0.5               |                                                |                |                      | 0.5    | 0.5    | pF    |   |
|          | Max                                     | —                 |                                                |                |                      | —      | —      | pF    |   |
|          | Switch Offset                           | —                 | I <sub>F</sub> =5 mA                           | Min            | —                    | —      | —      | μV    |   |
| Typ      |                                         |                   |                                                | 0.15           | 0.15                 | 0.1    | μV     |       |   |
| Max      |                                         |                   |                                                | —              | —                    | —      | μV     |       |   |
| TRANSFER | Input/Output Capacitance                | C <sub>ISO</sub>  | V <sub>ISO</sub> =1 V                          | Min            | —                    | —      | —      | pF    |   |
|          |                                         |                   |                                                | Typ            | 1.1                  | 1.1    | 1.1    | pF    |   |
|          |                                         |                   |                                                | Max            | —                    | —      | —      | pF    |   |
|          | Turn-on Time                            | t <sub>on</sub>   | I <sub>F</sub> =5 mA<br>I <sub>L</sub> =50 mA  | Min            | —                    | —      | —      | ms    |   |
|          |                                         |                   |                                                | Typ            | 0.5†                 | 1.4    | 0.13‡  | ms    |   |
|          |                                         |                   |                                                | Max            | 1.0†                 | 2.5    | 0.25‡  | ms    |   |
|          | Turn-off Time                           | t <sub>off</sub>  | I <sub>F</sub> =5 mA<br>I <sub>L</sub> =50 mA  | Min            | —                    | —      | —      | ms    |   |
|          |                                         |                   |                                                | Typ            | 0.5†                 | 0.7    | 0.06‡  | ms    |   |
|          |                                         |                   |                                                | Max            | 1.0†                 | 2.5    | 0.25‡  | ms    |   |

\*  $I_F=5\text{ mA}$ , †  $I_F=10\text{ mA}$ , ‡  $I_L=12.5\text{ mA}$

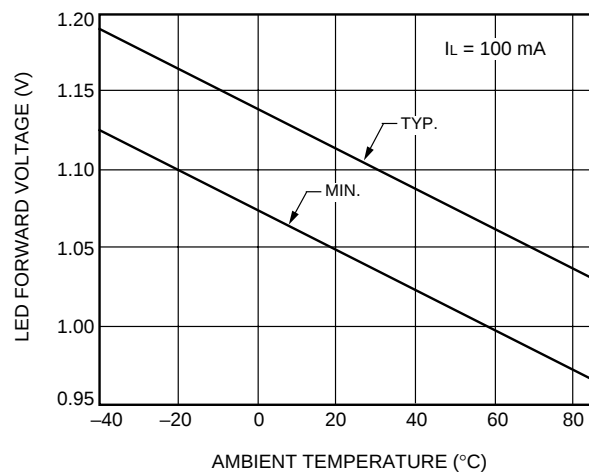
The following information refers to the SSR Recommended Operation Conditions on the previous page.

- 1) Both relays on with equal load currents. For single relay operation, refer to the LH1530 Recommended Operating Conditions graph.
- 2) Both relays on with equal load currents. For single relay operation, refer to the LH1540 Recommended Operating Conditions graph.
- 3) Single relay operation.

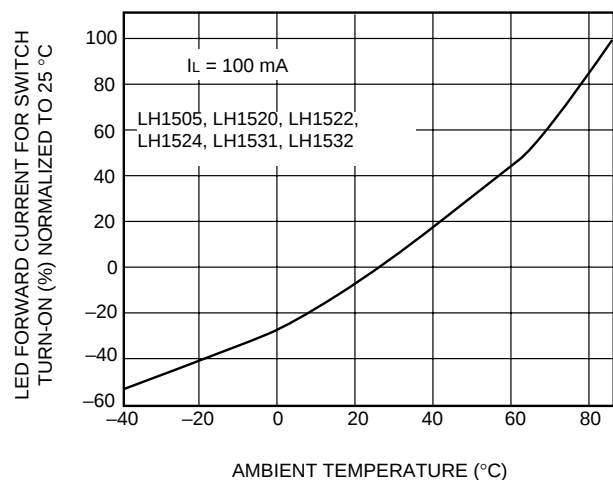
### A. LED Voltage vs. Temperature



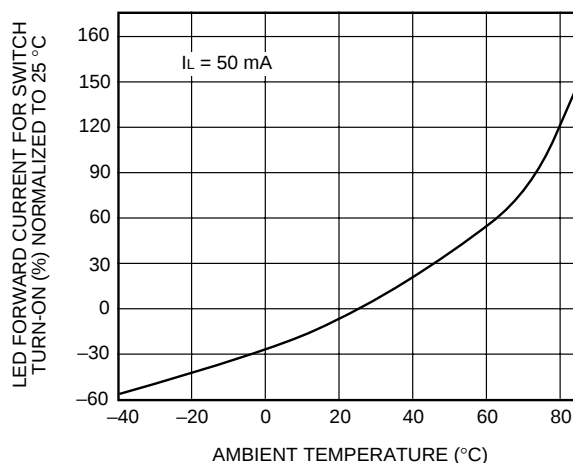
### B. LED Dropout Voltage vs. Temperature



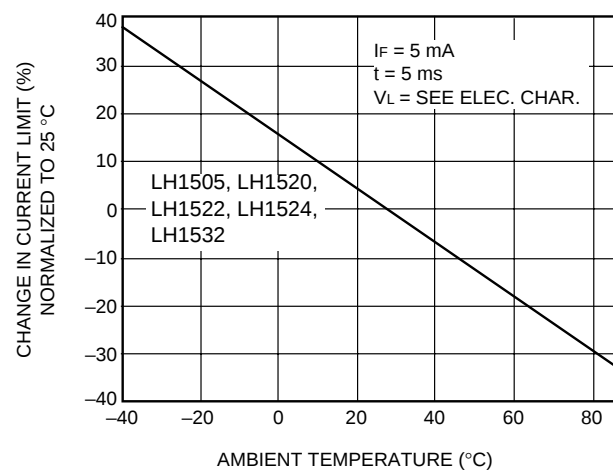
### C. LED Current for Switch Turn-On vs. Temperature



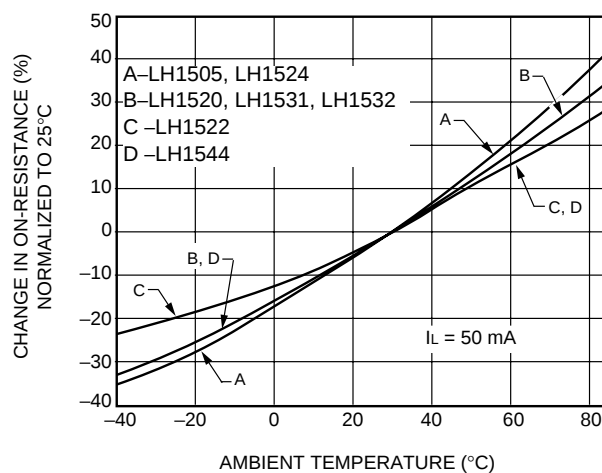
### D. LED Current for Switch Turn-On vs. Temperature (LH1544)



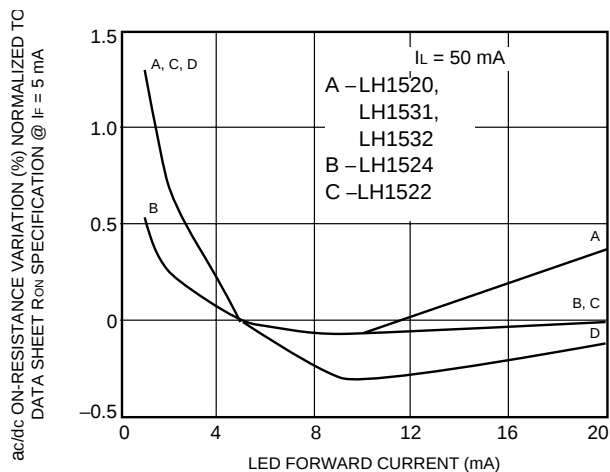
### E. Current Limit vs. Temperature



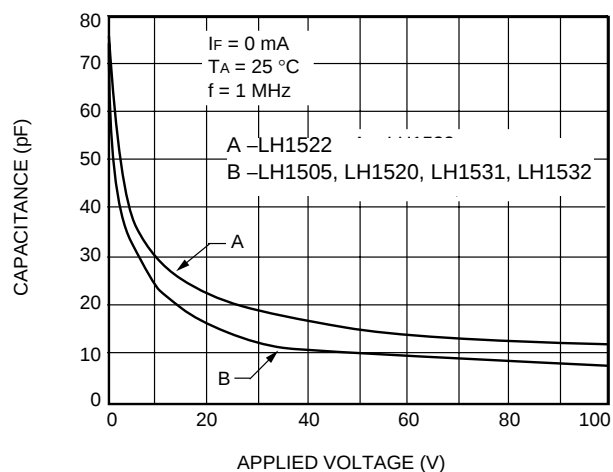
### F. ON-Resistance vs. Temperature



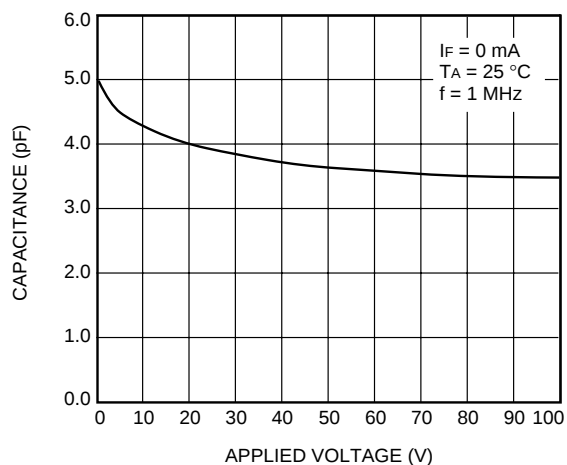
### A. Variation in ON-Resistance vs. LED Current



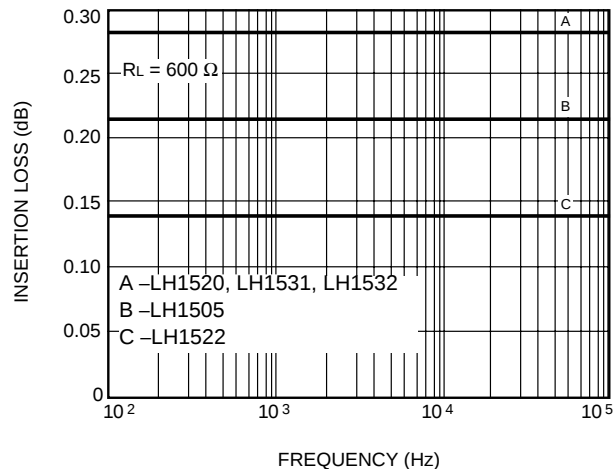
### B. Switch Capacitance vs. Applied Voltage



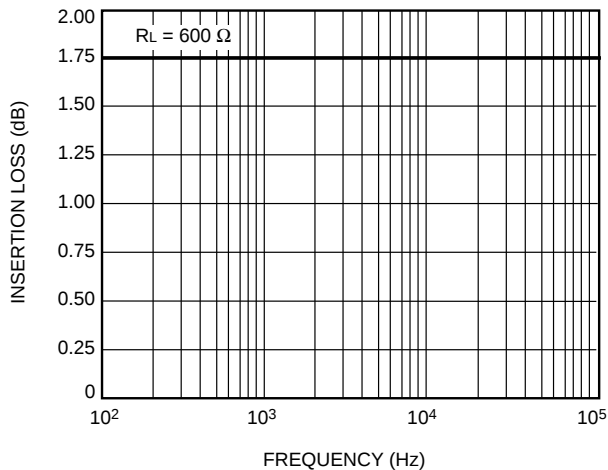
### C. Switch Capacitance vs. Applied Voltage (LH1544)



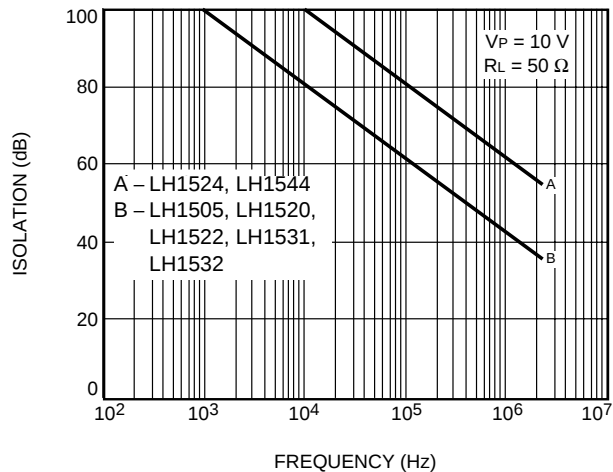
### D. Insertion Loss vs. Frequency



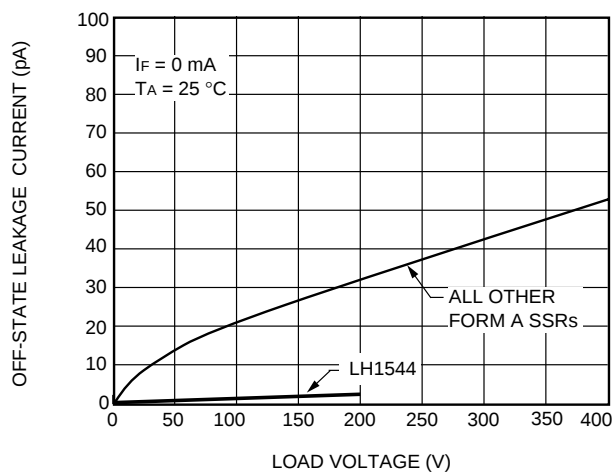
### E. Insertion Loss vs. Frequency (LH1544)



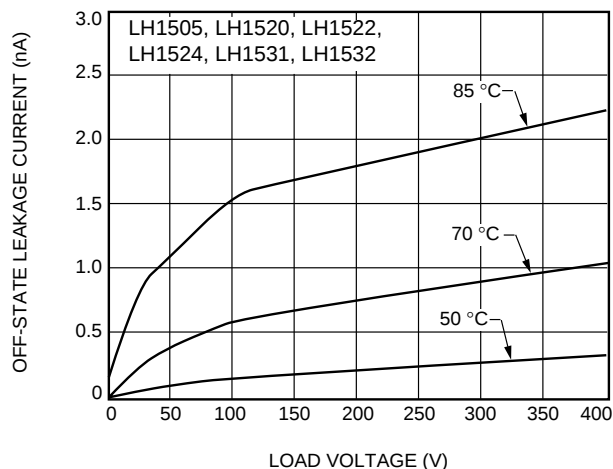
### F. Output Isolation



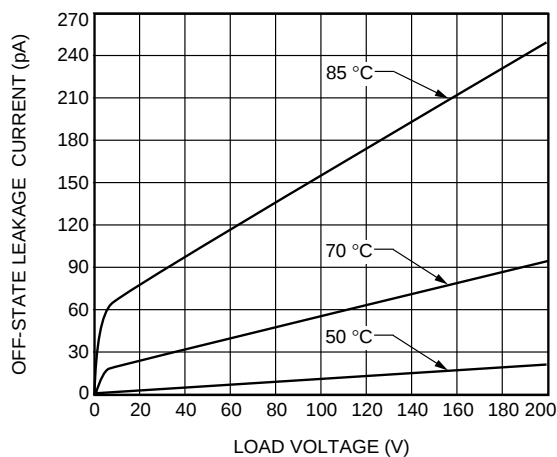
### A. Leakage Current vs. Applied Voltage



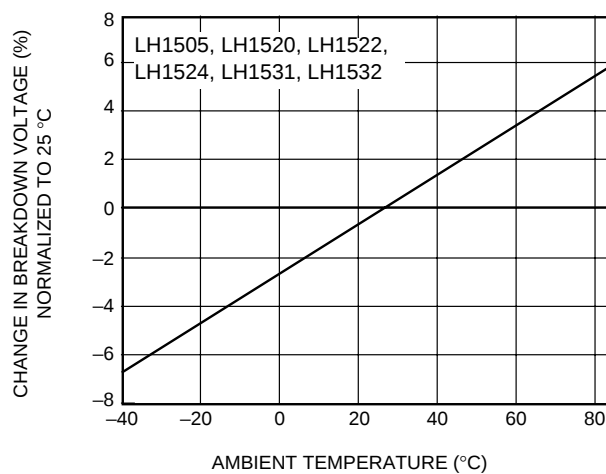
### B. Leakage Current vs. Applied Voltage at Elevated Temperatures



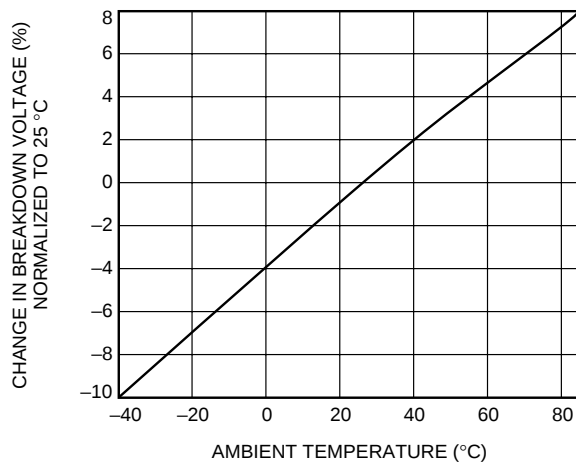
### C. Leakage Current vs. Applied Voltage at Elevated Temperatures (LH1544)



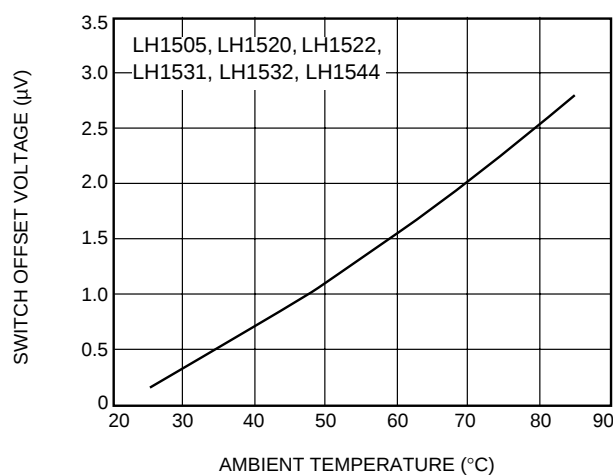
### D. Switch Breakdown Voltage vs. Temperature



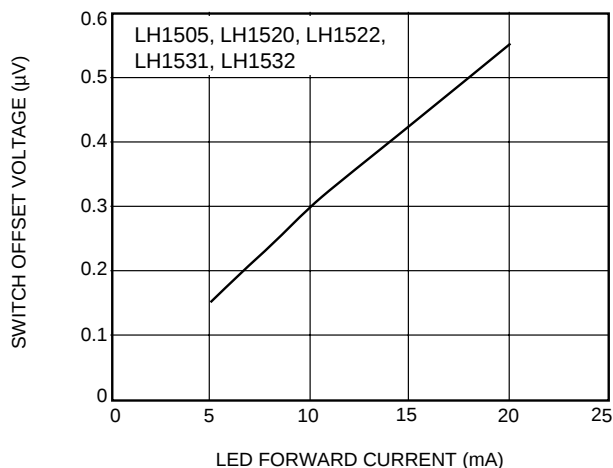
### E. Switch Breakdown Voltage vs. Temperature (LH1544)



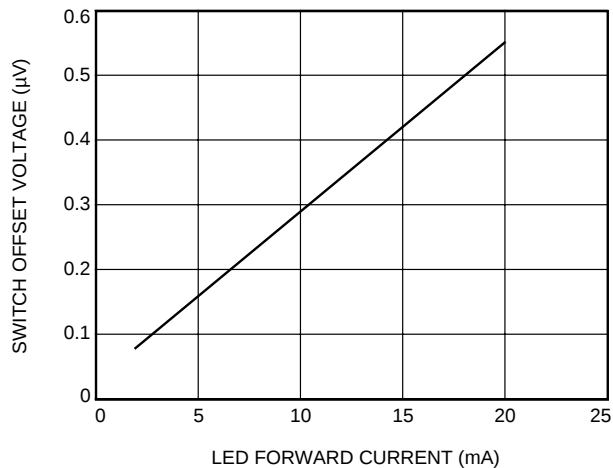
### F. Switch Offset Voltage vs. Temperature



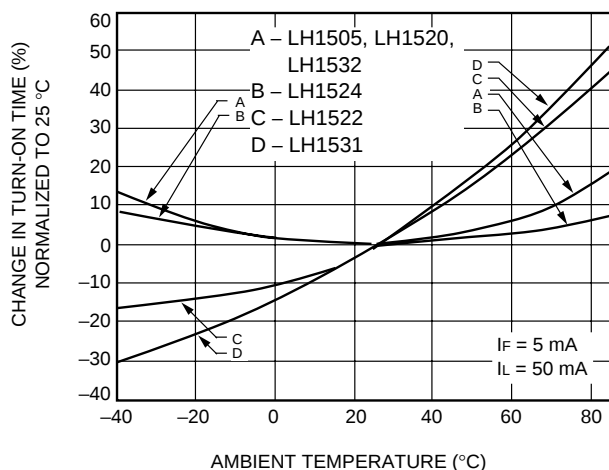
**A. Switch Offset Voltage vs. LED Current**



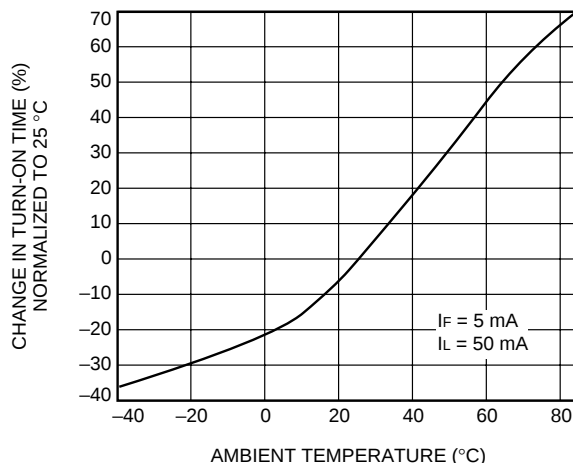
**B. Switch Offset Voltage vs. LED Current (LH1544)**



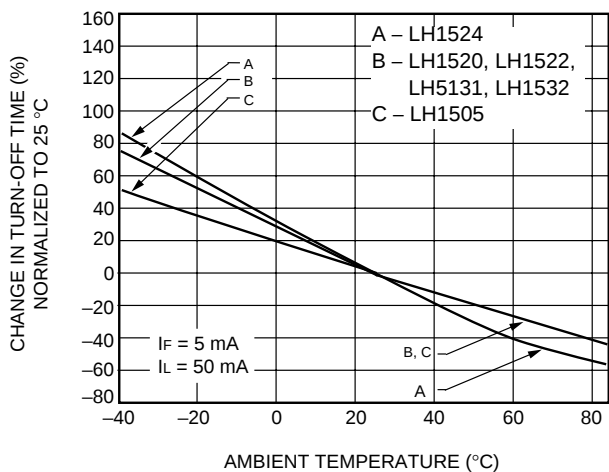
**C. Turn-On Time vs. Temperature**



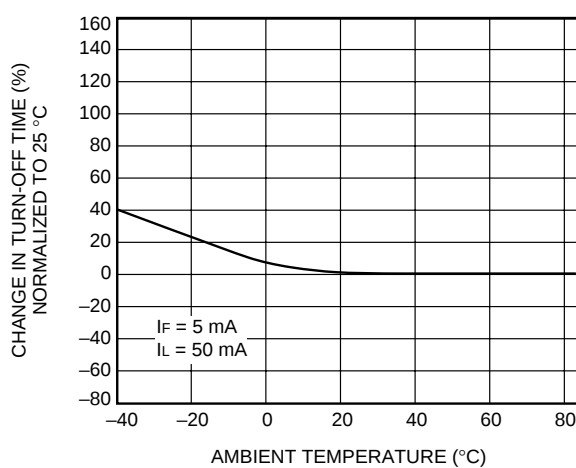
**D. Turn-On Time vs. Temperature (LH1544)**



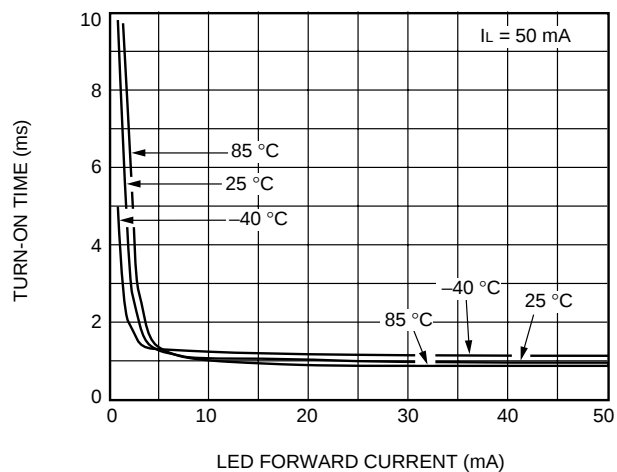
**E. Turn-Off Time vs. Temperature**



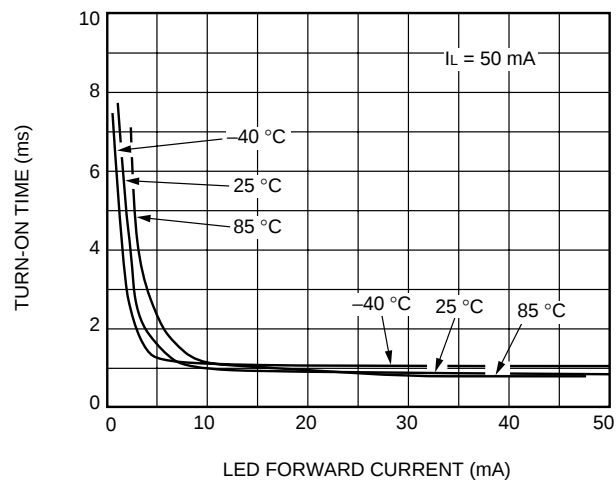
**F. Turn-Off Time vs. Temperature (LH1544)**



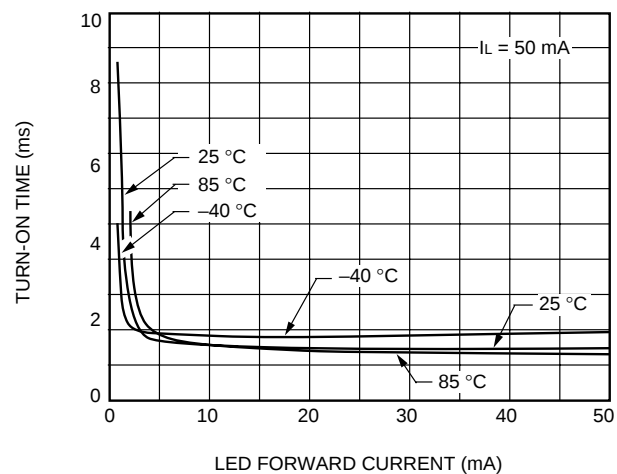
**A. Turn-On Time vs. LED Current (LH1505, LH1520, LH1532)**



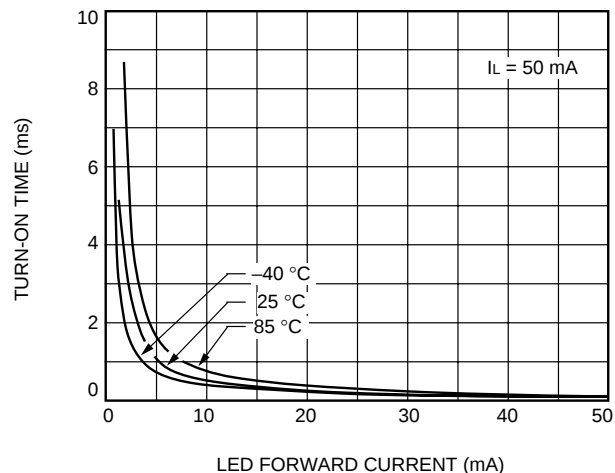
**B. Turn-On Time vs. LED Current (LH1522)**



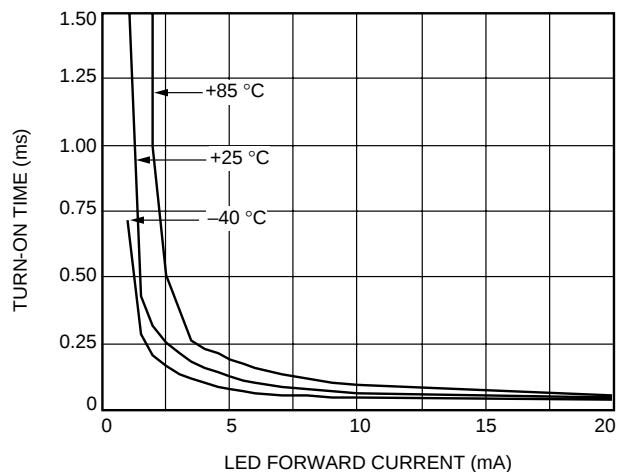
**C. Turn-On Time vs. LED Current (LH1524)**



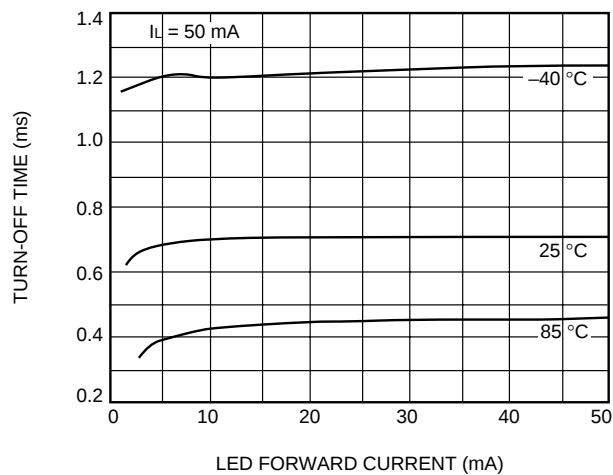
**D. Turn-On Time vs. LED Current**



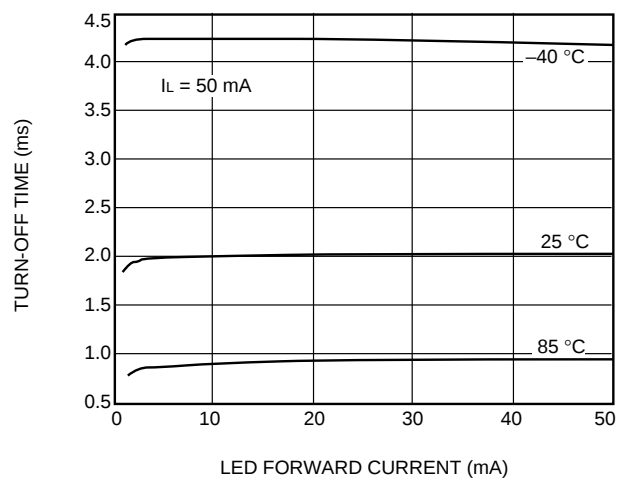
**E. Turn-On Time vs. LED Current (LH1544)**



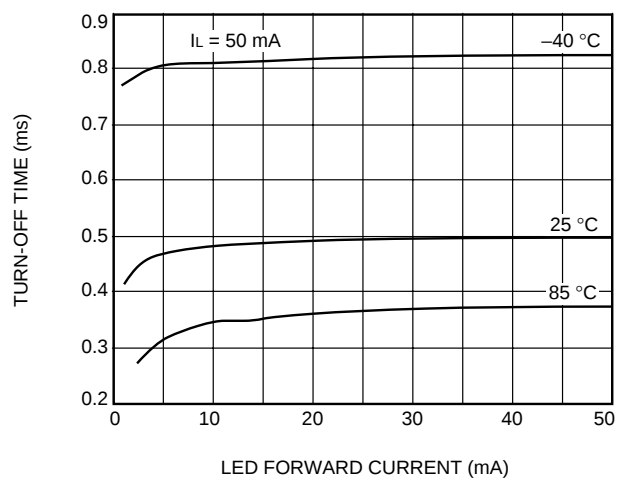
**F. Turn-Off Time vs. LED Current (LH1505, LH1520, LH1522, LH1532)**



**A. Turn-Off Time vs. LED Current (LH1524)**



**B. Turn-Off Time vs. LED Current (LH1531)**



**C. Turn-Off Time vs. LED Current (LH1544)**

