

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

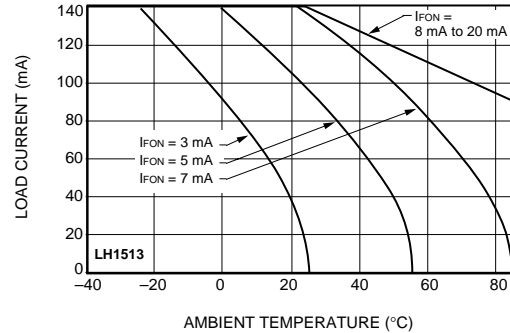
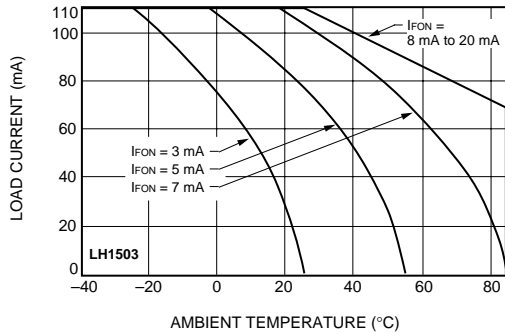
Stresses in excess of the Absolute Maximum Ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the

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	LH1503	LH1513	Units
Ambient Operating Temperature Range	T_A	—	-40 to +85	-40 to +85	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	—	-40 to +150	-40 to +150	$^\circ\text{C}$
Pin Soldering Temperature	T_S	$t=10\text{ s max}$	260	260	$^\circ\text{C}$
Input/Output Isolation Voltage	V_{ISO}	—	3750	3750	Vrms
Pole-to-Pole Isolation Voltage (S1 to S2)	—	—	500	500	V
LED Continuous Forward Current	I_F	—	50	50	mA
LED Reverse Voltage	V_R	$I_R \leq 10\ \mu\text{A}$	8	8	V
dc or Peak ac Load Voltage	V_L	$I_L \leq 50\ \mu\text{A}$	350	200	V
Continuous dc Load Current One Pole Operating Two Poles Operating	I_L	—	150 110	200 140	mA mA
Peak Load Current	I_P	$t=100\text{ ms}$ (single shot)	*	*	mA
Output Power Dissipation (continuous)	P_{DISS}	—	600	600	mW

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

Recommended Operating Conditions



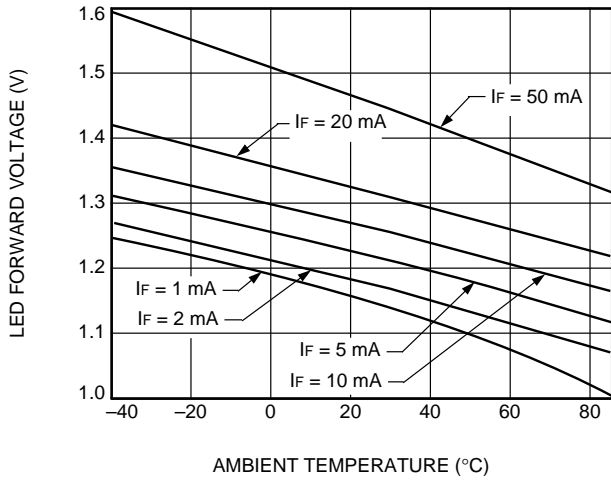
Electrical Characteristics $T_A=25^\circ\text{C}$

Minimum and maximum values are testing requirements. Typical values are characteristics of the device

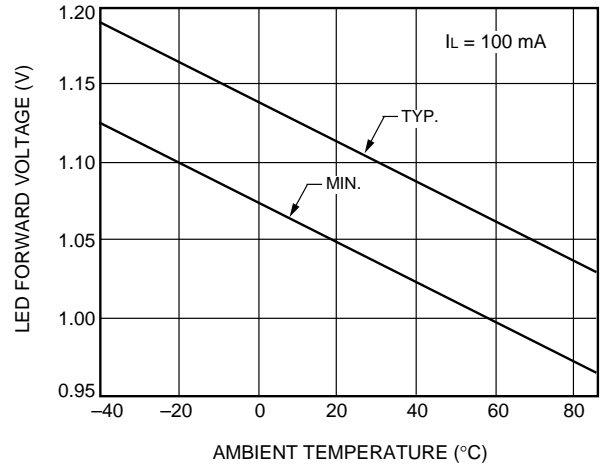
and are the result of engineering evaluations. Typical values are for information purposes only and are not part of the testing requirements.

	Parameter	Symbol	Test Conditions	Values	LH1503	LH1513	Units	
INPUT	LED Forward Current for Switch Turn-on	I_{Fon}	$I_L=100\text{ mA}$ $t=10\text{ ms}$	Min	—	—	mA	
				Typ	2.0	2.0	mA	
				Max	3.0	3.0	mA	
	LED Forward Current or Switch Turn-off	I_{Foff}	—	Min	0.2	0.2	mA	
				Typ	1.8	1.8	mA	
				Max	—	—	mA	
	LED Forward Voltage	V_F	$I_F=10\text{ mA}$	V_L	\pm	300	150	V
				Min	1.15	1.15	V	
				Typ	1.26	1.26	V	
			Max	1.45	1.45	V		
			Min	12	6	Ω		
			Typ	20	10	Ω		
OUTPUT	ON-resistance	R_{ON}	$I_F=5\text{ mA}$ $I_L=50\text{ mA}$	Max	25	15	Ω	
				Min	—	—	$\Delta\Omega$	
				Typ	0.2	0.1	$\Delta\Omega$	
	Pole-to-pole ON-resistance Matching (S1 to S2)	—	$I_F=5\text{ mA}$ $I_L=50\text{ mA}$	Max	2.0	1.0	$\Delta\Omega$	
				Min	0.5	0.5	$G\Omega$	
				Typ	5000	5000	$G\Omega$	
	OFF-resistance	R_{OFF}	$I_F=0\text{ mA}$ $V_L=\pm 100\text{ V}$	Max	—	—	$G\Omega$	
				Min	230	300	mA	
				Typ	270	360	mA	
Current Limit	I_{LMT}	$I_F=5\text{ mA}$ $t=5\text{ ms}$	Max	370	460	mA		
			Min	—	—	nA		
			Typ	0.02	0.02	nA		
Off-state Leakage Current	—	$I_F=0\text{ mA}$ $V_L=\pm 100\text{ V}$	Max	200	200	nA		
			Min	—	—	μA		
			Typ	—	—	μA		
			Max	1.0	1.0	μA		
			Min	—	—	V		
			Typ	350	200	V		
Output Capacitance	—	$I_F=0\text{ mA}$ $V_L=1\text{ V}$	Max	—	—	pF		
			Min	—	—	pF		
			Typ	55	60	pF		
			Max	—	—	pF		
			Min	—	—	pF		
			Typ	10	15	pF		
Pole-to-pole Capacitance (S1 to S2)	—	$I_F=0\text{ mA}$	Max	—	—	pF		
			Min	—	—	pF		
			Typ	3.0	3.0	pF		
			Max	—	—	pF		
			Min	—	—	pF		
			Typ	4.0	4.0	pF		
Switch Offset	—	$I_F=5\text{ mA}$	Max	—	—	μV		
			Min	—	—	μV		
			Typ	0.15	0.15	μV		
TRANSFER	Input/Output Capacitance	C_{ISO}	$V_{ISO}=1\text{ V}$	Max	—	—	pF	
				Min	—	—	pF	
				Typ	1.1	1.1	pF	
	Turn-on Time	t_{on}	$I_F=10\text{ mA}$ $I_L=50\text{ mA}$	Max	—	—	ms	
				Min	—	—	ms	
				Typ	1.6	1.6	ms	
	Turn-off Time	t_{off}	$I_F=10\text{ mA}$ $I_L=50\text{ mA}$	Max	—	—	ms	
				Min	—	—	ms	
				Typ	0.65	0.65	ms	
				Max	2.5	2.5	ms	

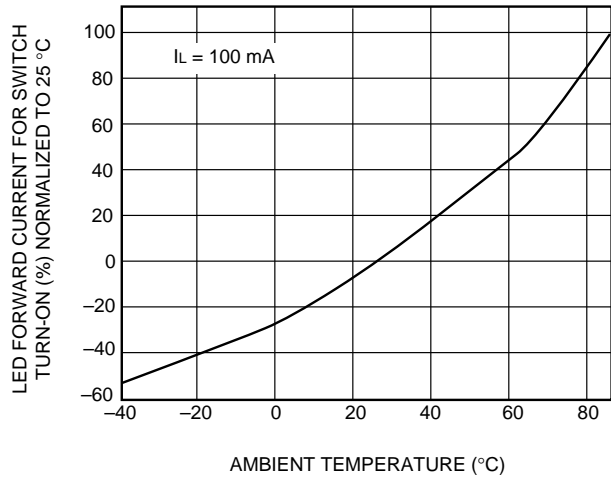
A. LED Voltage vs. Temperature



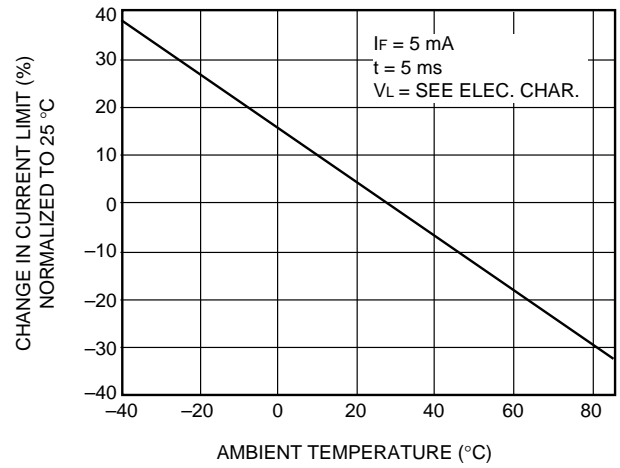
B. LED Dropout Voltage vs. Temperature



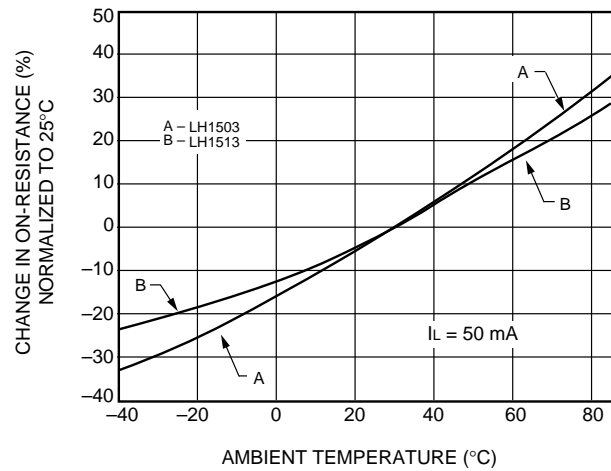
C. LED Current for Switch Turn-On vs. Temperature



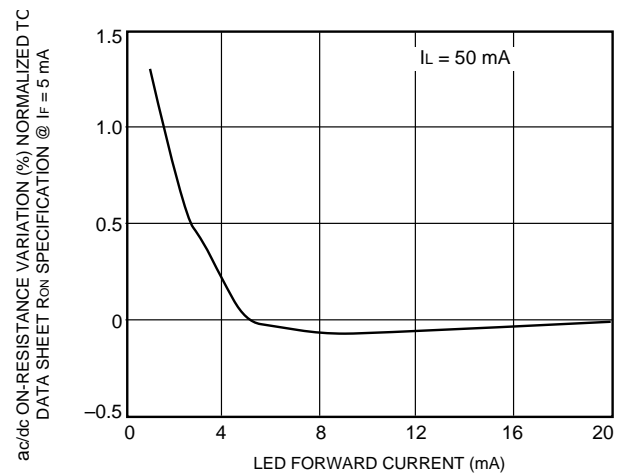
D. Current Limit vs. Temperature



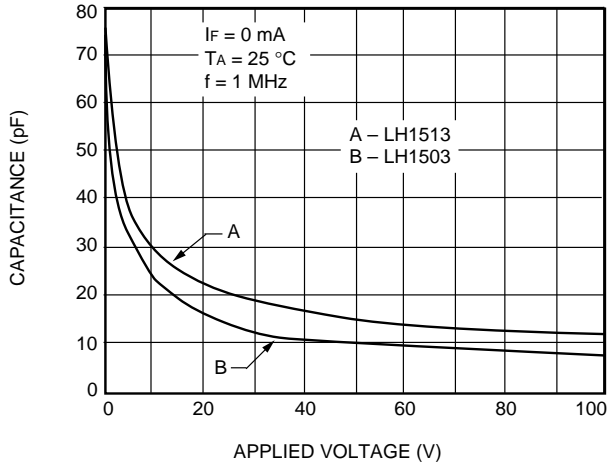
E. ON-Resistance vs. Temperature



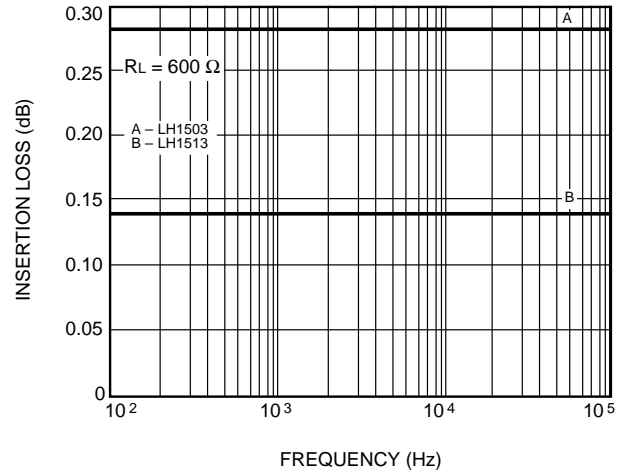
F. Variation in ON-Resistance vs. LED Current



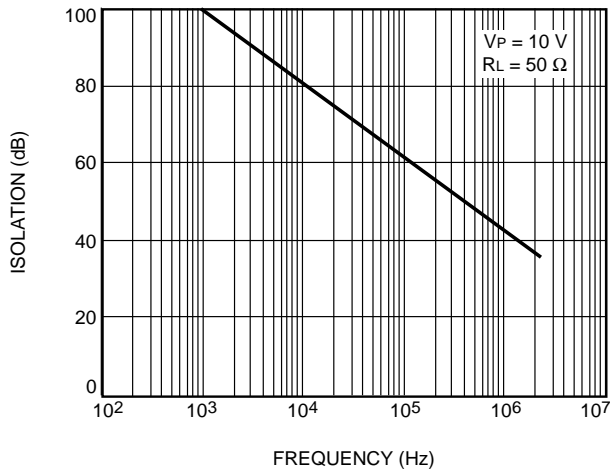
A. Switch Capacitance vs. Applied Voltage



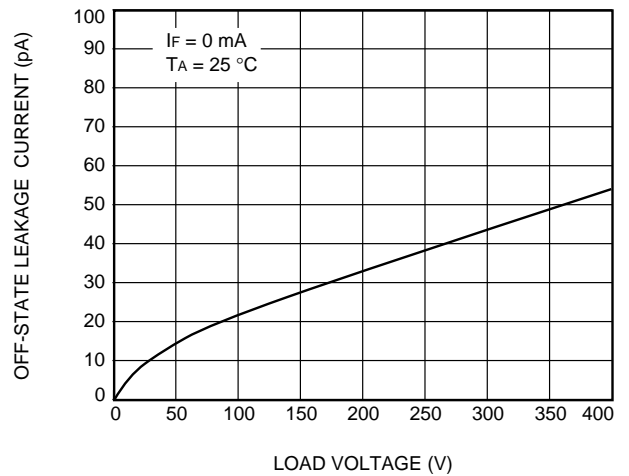
B. Insertion Loss vs. Frequency



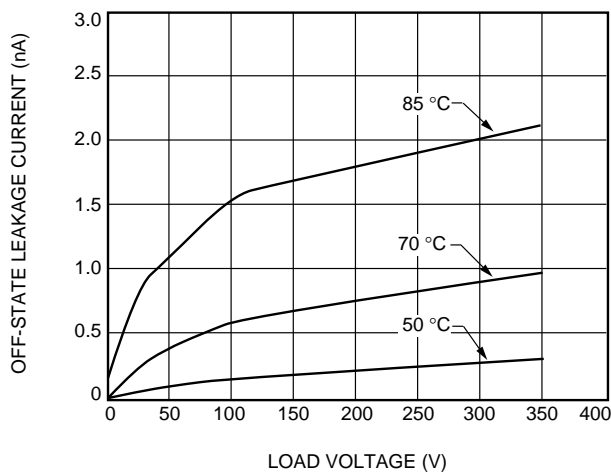
C. Output Isolation



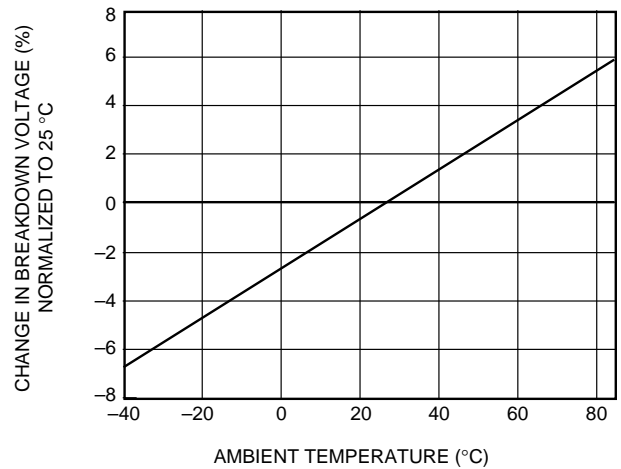
D. Leakage Current vs. Applied Voltage



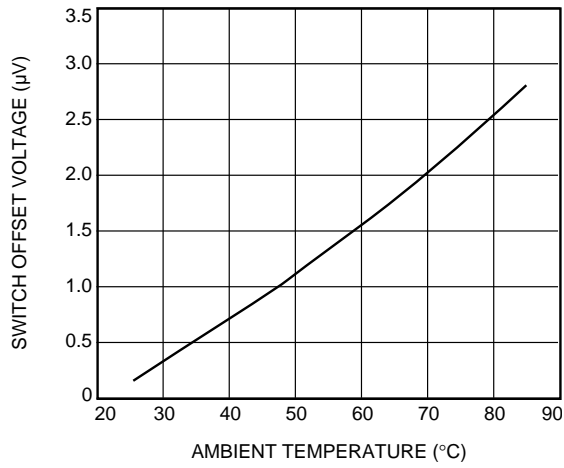
E. Leakage Current vs. Applied Voltage at Elevated Temperatures



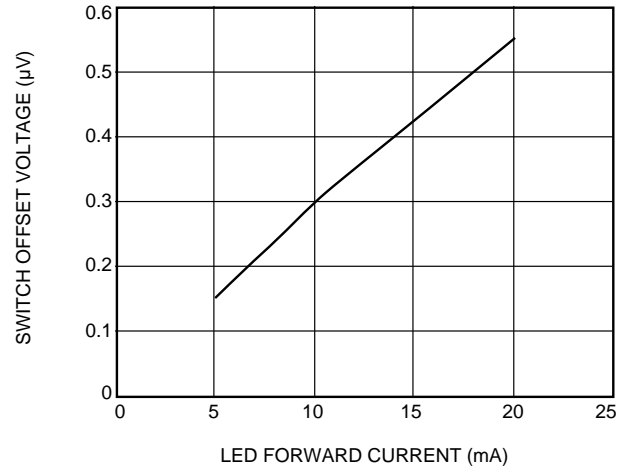
F. Switch Breakdown Voltage vs. Temperature



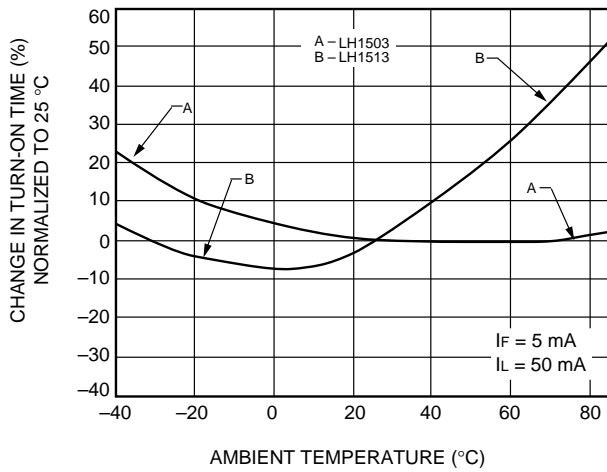
A. Switch Offset Voltage vs. Temperature



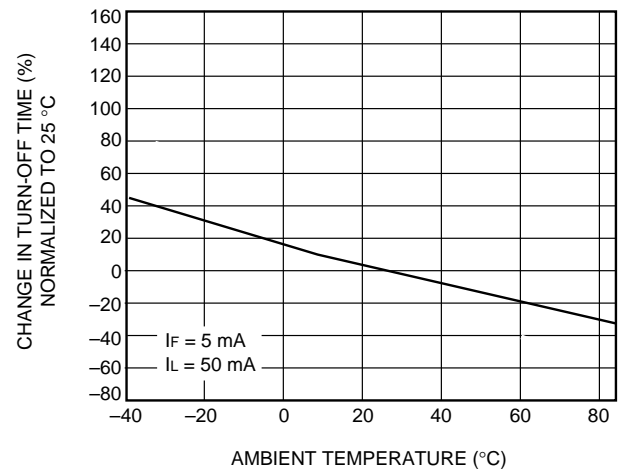
B. Switch Offset Voltage vs. LED Current



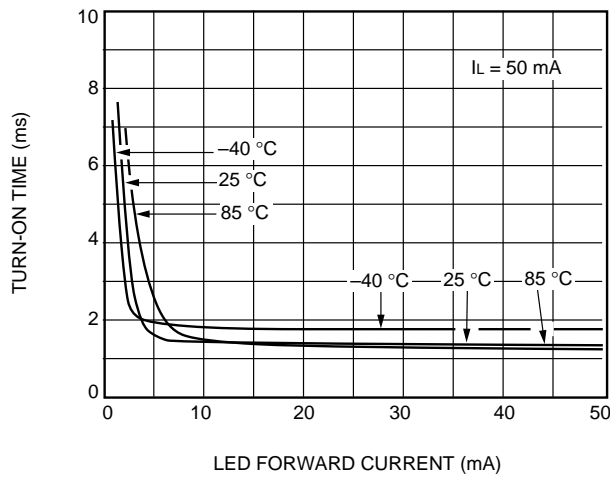
C. Turn-On Time vs. Temperature



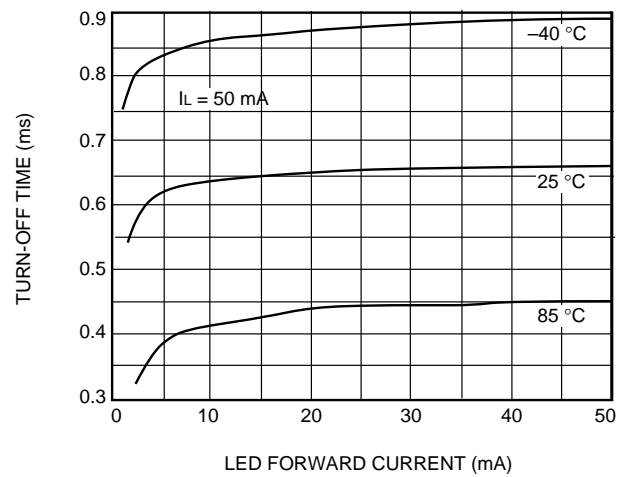
D. Turn-Off Time vs. Temperature



E. Turn-On Time vs. LED Current



F. Turn-Off Time vs. LED Current



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

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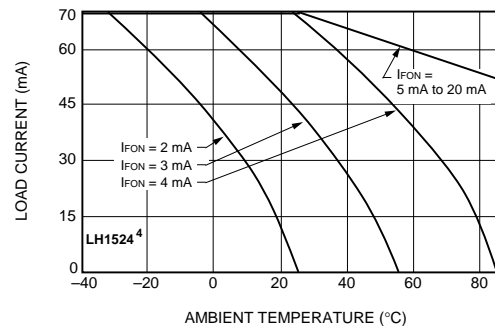
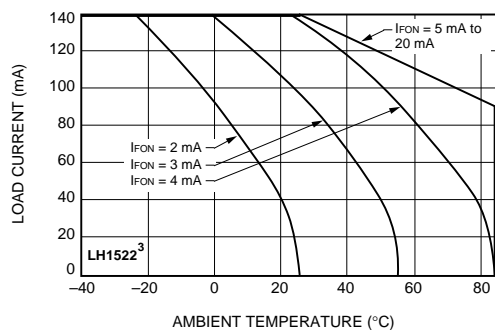
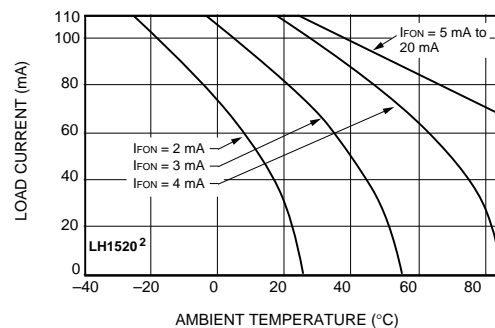
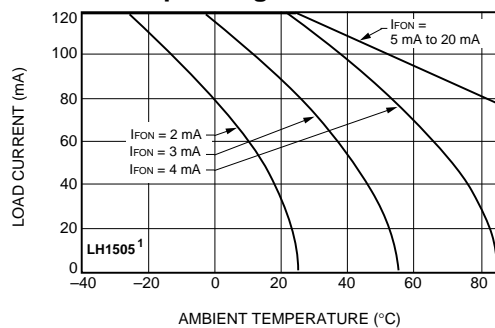
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Parameter	Symbol	Test Conditions	LH1505	LH1520	LH1522	LH1524	Units
Ambient Operating Temperature Range	T_A	—	-40 to +85	-40 to +85	-40 to +85	-40 to +85	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	—	-40 to +150	-40 to +150	-40 to +150	-40 to +150	$^\circ\text{C}$
Pin Soldering Temperature	T_S	$t=10\text{ s max}$	260	260	260	260	$^\circ\text{C}$
Input/Output Isolation Test Voltage	V_{ISO}	$t=1\text{ s}$ $I_{\text{ISO}}=10\ \mu\text{A max}$	5300	5300	5300	5300	Vrms
Pole-to-Pole Isolation Voltage (S1 to S2) [†]	—	Dry air, dust free, at sea level	1600	1600	1600	1600	V
LED Continuous Forward Current	I_F	—	50	50	50	50	mA
LED Reverse Voltage	V_R	$I_R \leq 10\ \mu\text{A}$	8	8	8	8	V
dc or Peak ac Load Voltage	V_L	$I_L \leq 50\ \mu\text{A}$	250	350	200	400	V
Continuous dc Load Current: One pole operating	I_L	—	130	150	200	95	mA
Two poles operating			120	110	140	70	mA
Peak Load Current	I_P	$t=100\text{ ms}$ (single shot)	*	*	*	*	mA
Output Power Dissipation (continuous)	P_{DISS}	—	600	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

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	LH1505	LH1520	LH1522	LH1524	Units		
INPUT	LED Forward Current for Switch Turn-on	I_{Fon}	$I_L=100\text{ mA}$ $t=10\text{ ms}$	Min	—	—	—	—	mA		
				Typ	1.0	1.0	1.0	0.5	mA		
				Max	2.0	2.0	2.0	2.0	mA		
	LED Forward Current for Switch Turn-off	I_{Foff}	—	Min	0.2	0.2	0.2	0.1	mA		
				Typ	0.9	1.1	1.1	0.4	mA		
				Max	—	—	—	—	mA		
	LED Forward Voltage	V_F	$I_F=10\text{ mA}$	V_L	\pm	200	300	150	350	V	
				Min	1.15	1.15	1.15	1.15	V		
				Typ	1.26	1.26	1.26	1.26	V		
OUTPUT	ON-resistance	R_{ON}	$I_F=5\text{ mA}$ $I_L=50\text{ mA}$	Min	10	12	6	12*	Ω		
				Typ	15	20	10	23*	Ω		
				Max	20	25	15	34*	Ω		
	OFF-resistance	R_{OFF}	$I_F=0\text{ mA}$ $V_L=\pm 100\text{ V}$	Min	0.5	0.5	0.5	0.5	G Ω		
				Typ	5000	5000	5000	5000	G Ω		
				Max	—	—	—	—	G Ω		
	ON-state Voltage	—	$I_L=1\text{ mA}$	Min	—	—	—	1.2	V		
				Typ	—	—	—	1.4	V		
				Max	—	—	—	1.8	V		
$I_L=90\text{ mA}$ $t=10\text{ ms}$			Min	—	—	—	3.0	V			
			Typ	—	—	—	3.6	V			
			Max	—	—	—	5.0	V			
Current Limit	I_{LMT}	$I_F=5\text{ mA}$ $t=5\text{ ms}$	Min	170	230	300	150	mA			
			Typ	200	270	360	210	mA			
			Max	280	370	460	270	mA			
Off-state Leakage Current	—	$I_F=0\text{ mA}$ $V_L=\pm 100\text{ V}$	V_L	\pm	6	6	5	11	V		
			Min	—	—	—	—	nA			
			Typ	0.02	0.02	0.02	0.02	nA			
		$I_F=0\text{ mA}$	Min	—	—	—	—	μA			
			Typ	—	—	—	—	μA			
			Max	1.0	1.0	1.0	1.0	μA			
		Output Capacitance	—	$I_F=0\text{ mA}$ $V_L=1\text{ V}$	V_L	\pm	250	350	200	400	V
					Min	—	—	—	—	pF	
					Typ	55	55	60	2.5	pF	
$I_F=0\text{ mA}$ $V_L=50\text{ V}$	Min			—	—	—	—	pF			
	Typ			10	10	15	2.0	pF			
	Max			—	—	—	—	pF			
Pole-to-pole Capacitance (S1 to S2)	—	$I_F=5\text{ mA}$	Min	—	—	—	—	pF			
			Typ	0.5	0.5	0.5	0.5	pF			
			Max	—	—	—	—	pF			
Switch Offset	—	$I_F=5\text{ mA}$	Min	—	—	—	—	μV			
			Typ	0.15	0.15	0.15	—	μV			
			Max	—	—	—	—	μV			
TRANSFER	Input/Output Capacitance	C_{ISO}	$V_{ISO}=1\text{ V}$	Min	—	—	—	—	pF		
				Typ	1.1	1.1	1.1	1.1	pF		
				Max	—	—	—	—	pF		
	Turn-on Time	t_{on}	$I_F=5\text{ mA}$ $I_L=50\text{ mA}$	Min	—	—	—	—	ms		
				Typ	1.4†	1.4	1.0†	1.6	ms		
				Max	4.0†	2.0	2.0†	5.0	ms		
	Turn-off Time	t_{off}	$I_F=5\text{ mA}$ $I_L=50\text{ mA}$	Min	—	—	—	—	ms		
				Typ	0.7†	0.7	0.7†	2.0	ms		
				Max	4.0†	2.0	2.0†	5.0	ms		

* $R_{ON}=V(50\text{ mA}) - V(20\text{ mA})/30\text{ mA}$, † $I_L=100\text{ mA}$, ‡ $I_F=10\text{ mA}$.

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

- 1) Both relays on with equal load currents. For single relay operation, refer to the LH1518 Recommended Operating Conditions graph.
- 2) Both relays on with equal load currents. For single relay operation, refer to the LH1500 Recommended Operating Conditions graph.
- 3) Both relays on with equal load currents. For single relay operation, refer to the LH1510 Recommended Operating Conditions graph.
- 4) Both relays on with equal load currents. For single relay operation, refer to the LH1504 Recommended Operating Conditions graph.