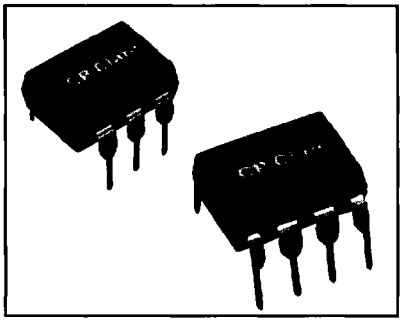
OptoMOS® Solid State Switches



DESCRIPTION

Single or dual output OptoMOS® solid state switches are part of CP Clare's growing family of solid state switching devices (Loads up to 400 volts AC or DC and currents up to 1 Amp). As replacements for form "A"/"B"/"C" or dual form "A"/"B" electromechanical relays, these devices use a proprietary photovoltaic circuit and MOSFET switching elements for reliable bounce-free switching operation. Complimentary output devices require no auxillary supply current to maintain an on-state condition.

FEATURES

- Small 6 and 8 pin DIP packages
- 2mW drive power (logic compatible)
- No moving parts
- Loads up to 400V AC/DC and 1 Amp (1P) or 170mA (2P)
- Expected life > 15 billion operations
- Arc-Free with no snubbing circuits
- 3750V_{RMS} input/output isolation
- FCC compatible
- No EMI/RFI generation
- Machine insertable, wave solderable
- Surface Mount and Tape & Reel version available
- UL recognized file #: E76270
- CSA certified file #: LR 43630-10
- VDE compatible
- BSI certified to:

  BS EN 60950: 1992
  (BS7002: 1992)
  Certificate #: 7344

  BS EN 41003: 1993
  Certificate #: 7344

APPLICATIONS

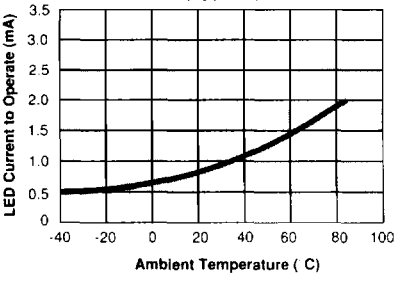
- Telecommunications
  - Telecom switching
  - Tip/Ring circuits
  - Modem switching (laptop, notebook, pocket size)
  - Hookswitch
  - Dial pulsing
  - Ground start
  - Ringer injection
- Instrumentation
  - Multiplexers
  - Data acquisition
  - Electronic switching
  - I/O subsystems
  - Meters (watt-hour, water, gas)
  - Medical equipment
- Security
- Aerospace
- Industrial controls

RATINGS (@ 25 C)

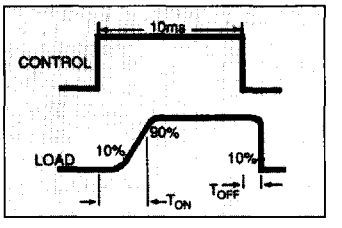
Parameter	Min	Typ	Max	Units
Input Power Dissipation	-	-	150[1]	mW
Input Control Current	-	-	100	mA
Peak (10ms)	-	-	1	A
Reverse Input Voltage	-	-	5	V
Total Power Dissipation	-	-	500[2]	mW
Capacitance				
Input to Output	-	3	-	pF
Isolation Voltage				
Input to Output	2500	-	-	V_{RMS}
"E" Suffix (optional)	3750	-	-	V_{RMS}
Operating Temperature	-40	-	+85	°C
Storage Temperature	-40	-	+125	°C
Soldering Temperature (10 Seconds Max)	-	-	+260	°C

[1]Derate Linearly 1.33 mW/°C [2]Derate Linearly 1.67 mW/°C

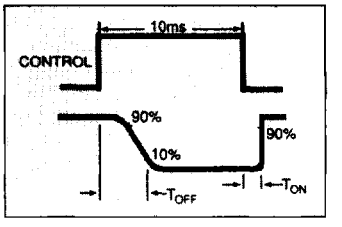
LED Operate Current vs. Ambient Temperature Characteristics (Typical)



Switching Characteristics of Normally Open (Form A) Devices



Switching Characteristics of Normally Closed (Form B) Devices



Note: For Mechanical Dimensions see pages 46-49.

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1 Form A Relays
Output Characteristics @ 25°C

PART NUMBER		PLA110	PLA140	PLA150	LCA110	LCA120	LCA125	LCA127	LCA710	OMA160	UNITS
Contact Form		1 Form A	1 Form A	1 Form A	1 Form A	1 Form A	1 Form A	1 Form A	1 Form A	1 Form A	
Load Voltage (Peak)		400	400	250	350	250	300	250	60	250	V
Load Current (Continuous)											
X-Configuration		150	250	170	120	170	170	170	1000	50	mA
Y-Configuration		210	350	300	200	300	300	300	1800	80	
Peak Load Current											
(10ms)	Max	400	500	500	350	400	400	400	5000	100	mA
On-Resistance											
@ Rated Load Current											
X-Configuration	Typ	15	6	5	23	12	10	8	0.3	50	Ω
	Max	22	8	7	35	20	16	10	0.5	100	
Y-Configuration	Typ	5	2	1	7	4	4	2	0.1	15	
	Max	7	3	2	10	6	5	3	0.15	30	
Off State Leakage Current											
@ Rated Load Voltage	Max	1	1	1	1	1	1	1	1	0.025	µA
Switching Times											
Control Current		5	5	5	2/5	5	5	5	10	10	mA
T_{ON}	Typ	0.4	0.6	0.8	1.2/1	1.2	1.2	3	1	0.085	ms
	Max	1	1.5	2.5	5/3	5	5	5	2.5	0.125	
T_{OFF}	Typ	0.1	0.1	0.1	1/1	1	1	2	0.06	0.050	ms
	Max	0.25	0.25	0.25	3/3	5	5	5	0.25	0.125	
Output Capacitance											
@ 50V, f=1MHz	Typ	35	110	110	25	50	50	110	220	5	pF

Input Characteristics @ 25°C

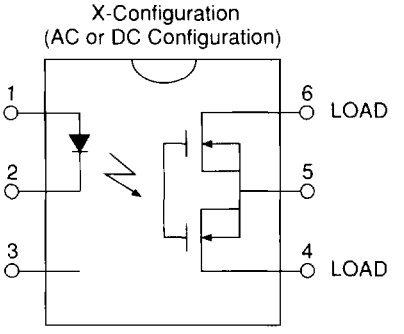
Input Control Current											
I_{LED}	Min	5	5	5	2	5	5	5	10	10	mA
	Max	100	100	100	100	100	100	100	100	100	
Input Dropout Current											
I_{LED}	Min	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	mA
	Typ	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	
Input Voltage Drop											
	Min	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	
V_F @ 5mA	Typ	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	V
	Max	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Reverse Input Voltage	Max	5	5	5	5	5	5	5	5	5	V
Reverse Input Current	Max	10	10	10	10	10	10	10	10	10	µA

Input to Output Capacitance	Typ	3	3	3	3	3	3	3	3	3	pF
Input to Output Isolation		2500	2500	2500	2500	2500	2500	2500	2500	2500	V_{RMS}
With "E" Suffix (optional)		3750	3750	3750	3750	3750	3750	3750	3750	3750	
Current Limiting[1] Version Available		Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	

[1]Current limiting typically adds 5Ω to the total on-resistance of the device.

1 Form B Relays
Output Characteristics @ 25°C

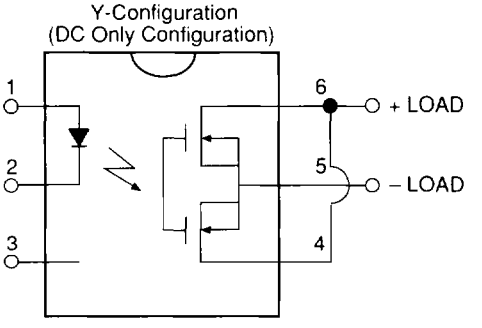
PART NUMBER		LCB110	LCB120	LCB127	UNITS
Contact Form		1 Form B	1 Form B	1 Form B	
Load Voltage (Peak)		350	250	250	V
Load Current (Continuous)					
X-Configuration		120	170	170	mA
Y-Configuration		200	300	300	
Peak Load Current					
(10ms)	Max	350	400	400	mA
On-Resistance					
@ Rated Load Current					
X-Configuration	Typ	23	16	8	Ω
	Max	35	20	10	
Y-Configuration	Typ	7	5	2	
	Max	10	6	3	
Off State Leakage Current					
@ Rated Load Voltage	Max	1	1	1	µA
Switching Times					
Control Current		5	5	5	mA
T_{ON}	Typ	0.5	1	2	ms
	Max	3	5	5	
T_{OFF}	Typ	0.7	1.2	3	ms
	Max	3	5	5	
Output Capacitance					
@ 50V, f=1MHz	Typ	25	50	100	pF



Pin Connections
1 + Control
2 – Control
3 Do not use
4 Load
5 Do not use
6 Load

Input Characteristics @ 25°C

Input Control Current					
I_{LED}	Min	5	5	5	mA
	Max	100	100	100	
Input Dropout Current					
I_{LED}	Min	0.4	0.4	0.4	mA
	Typ	0.7	0.7	0.7	
Input Voltage Drop					
	Min	0.9	0.9	0.9	V
V_F @ 5mA	Typ	1.2	1.2	1.2	
	Max	1.4	1.4	1.4	
Reverse Input Voltage	Max	5	5	5	V
Reverse Input Current	Max	10	10	10	µA



Pin Connections
1 + Control
2 – Control
3 Do not use
4 and 6 + Load
5 – Load

Input to Output Capacitance					
	Typ	3	3	3	pF
Input to Output Isolation		2500	2500	2500	V_{RMS}
With "E" Suffix (optional)		3750	3750	3750	
Current Limiting[1]					
Version Available		No	No	No	

[1]Current limiting typically adds 5Ω to the total on-resistance of the device.

2 Form A Relays
Output Characteristics @ 25°C

PART NUMBER		PAA110[2]	**PAA140[2]**	PAA150[2]	**LAA110[2]**	LAA120[2]	**LAA125[2]**	LAA127[2]	**OAA160[2]**	UNITS
Contact Form		2 Form A	**2 Form A**	2 Form A	**2 Form A**	2 Form A	**2 Form A**	2 Form A	**2 Form A**	
Load Voltage (Peak)		400	**400**	250	**350**	250	**300**	250	**250**	V
Load Current (Continuous)[3]		150	**250**	170	**120**	170	**170**	170	**50**	mA
Peak Load Current (10ms)	Max	400	**500**	500	**350**	400	**400**	400	**100**	mA
On-Resistance @ Rated Load Current	Typ	15	**6**	5	**23**	12	**10**	8	**50**	Ω
	Max	22	**8**	7	**35**	20	**16**	10	**100**	
Off State Leakage Current @ Rated Load Voltage	Max	1	**1**	1	**1**	1	**1**	1	**0.025**	µA
Switching Times										
Control Current		5	**5**	5	**5**	5	**5**	5	**10**	mA
T_{ON}	Typ	0.4	**0.6**	0.8	**0.7**	1.2	**1.2**	3	**0.085**	ms
	Max	1	**1.5**	2.5	**3**	5	**5**	5	**0.125**	
T_{OFF}	Typ	0.1	**0.1**	0.1	**0.5**	1	**1**	2	**0.050**	ms
	Max	0.25	**0.25**	0.25	**3**	5	**5**	5	**0.125**	
Output Capacitance @ 50V, f = 1MHz	Typ	35	**110**	110	**25**	50	**50**	110	**5**	pF

Input Characteristics @ 25°C

Input Control Current I_{LED}	Min	5	**5**	5	**5**	5	**5**	5	**10**	mA
	Max	100	**100**	100	**100**	100	**100**	100	**100**	
Input Dropout Current I_{LED}	Min	0.4	**0.4**	0.4	**0.4**	0.4	**0.4**	0.4	**0.4**	mA
	Typ	0.7	**0.7**	0.7	**0.7**	0.7	**0.7**	0.7	**0.7**	
Input Voltage Drop	Min	0.9	**0.9**	0.9	**0.9**	0.9	**0.9**	0.9	**0.9**	
V_F @ 5mA	Typ	1.2	**1.2**	1.2	**1.2**	1.2	**1.2**	1.2	**1.2**	V
	Max	1.4	**1.4**	1.4	**1.4**	1.4	**1.4**	1.4	**1.4**	
Reverse Input Voltage	Max	5	**5**	5	**5**	5	**5**	5	**5**	V
Reverse Input Current	Max	10	**10**	10	**10**	10	**10**	10	**10**	µA

Input to Output Capacitance	Typ	3	**3**	3	**3**	3	**3**	3	**3**	pF
Input to Output Isolation		2500	**2500**	2500	**2500**	2500	**2500**	2500	**2500**	V_{RMS}
With "E" Suffix (optional)		3750	**3750**	3750	**3750**	3750	**3750**	3750	**3750**	
Current Limiting[1] Version Available		Yes	**Yes**	Yes	**Yes**	Yes	**Yes**	Yes	**No**	

[1]Current limiting typically adds 5Ω to the total on-resistance of the device.
[2]Available in low profile flatpack (add "P" suffix).
[3]If both poles operate simultaneously load current derates so as not to exceed the package power dissipation value.

2 Form B / 1 Form B – 1 Form A / 1 Form C Relays
Output Characteristics @ 25°C

PART NUMBER		LBB110[2]	**LBB120[2]**	LBB127[2]	**LBA110[2]**	LBA120[2]	**LBA127[2]**	LCC110	**LCC120**	UNITS
Contact Form		2 Form B	**2 Form B**	2 Form B	**1 Form B 1 Form A**	1 Form B 1 Form A	**1 Form B 1 Form A**	1 Form C	**1 Form C**	
Load Voltage (Peak)		350	**250**	250	**350**	250	**250**	350	**250**	V
Load Current (Continuous)[3]		120	**170**	170	**120**	170	**170**	120	**170**	mA
Peak Load Current (10ms)	Max	350	**400**	400	**350**	400	**400**	350	**400**	mA
On-Resistance @ Rated Load Current	Typ	23	**16**	8	**23**	16	**8**	23	**16**	Ω
	Max	35	**20**	10	**35**	20	**10**	35	**20**	
Off State Leakage Current @ Rated Load Voltage	Max	1	**1**	1	**1**	1	**1**	1	**1**	µA
Switching Times										
Control Current		5	**5**	5	**5**	5	**5**	8	**10**	mA
T_{ON}	Typ	0.5	**1**	2	**-**	-	**-**	-	**-**	ms
	Max	3	**5**	5	**3**	5	**5**	4	**5**	
T_{OFF}	Typ	0.7	**1.2**	3	**-**	-	**-**	-	**-**	ms
	Max	3	**5**	5	**3**	5	**5**	4	**5**	
Output Capacitance @ 50V, f=1MHz	Typ	25	**50**	110	**25**	50	**110**	25	**50**	pF

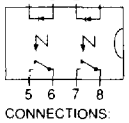
Input Characteristics @ 25°C

Input Control Current I_{LED}	Min	5	**5**	5	**5**	5	**5**	8	**10**	mA
	Max	100	**100**	100	**100**	100	**100**	100	**100**	
Input Dropout Current I_{LED}	Min	0.4	**0.4**	0.4	**0.4**	0.4	**0.4**	0.4	**0.4**	mA
	Typ	0.7	**0.7**	0.7	**0.7**	0.7	**0.7**	0.7	**0.7**	
Input Voltage Drop	Min	0.9	**0.9**	0.9	**0.9**	0.9	**0.9**	0.9	**0.9**	
V_F @ 5mA	Typ	1.2	**1.2**	1.2	**1.2**	1.2	**1.2**	1.2	**1.2**	V
	Max	1.4	**1.4**	1.4	**1.4**	1.4	**1.4**	1.4	**1.4**	
Reverse Input Voltage	Max	5	**5**	5	**5**	5	**5**	5	**5**	V
Reverse Input Current	Max	10	**10**	10	**10**	10	**10**	10	**10**	µA

Input to Output Capacitance	Typ	3	**3**	3	**3**	3	**3**	3	**3**	pF
Input to Output Isolation		2500	**2500**	2500	**2500**	2500	**2500**	2500	**2500**	V_{RMS}
With "E" Suffix (optional)		3750	**3750**	3750	**3750**	3750	**3750**	3750	**3750**	
Current Limiting[1] Version Available		No	**No**	No	**No Yes**	No Yes	**No Yes**	No	**No**	

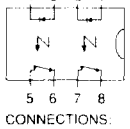
[1]Current limiting typically adds 5Ω to the total on-resistance of the device.
[2]Available in low profile flatpack (add "P" suffix).
[3]If both poles operate simultaneously load current derates so as not to exceed the package power dissipation value.

PAA/LAA/OAA



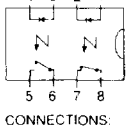
CONNECTIONS:
1,2 Control, Pole 1
3,4 Control, Pole 2
5,6 Normally-Open Pole 2
7,8 Normally-Open Pole 1

LBB



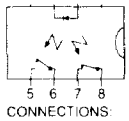
CONNECTIONS:
1,2 Control, Pole 1
3,4 Control, Pole 2
5,6 Normally Closed Pole 2
7,8 Normally-Closed Pole 1

LBA



CONNECTIONS:
1,2 Normally-Closed Control
3,4 Normally-Open Control
5,6 Normally-Open Pole
7,8 Normally-Closed Pole

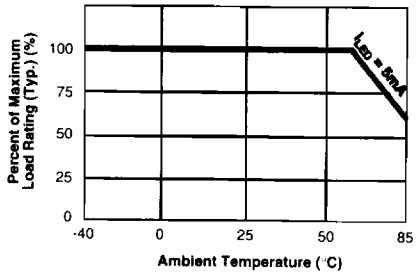
LCC



CONNECTIONS:
1,4 Do not Use
2,3 Control
5,6 Normally-Open Pole
7,8 Normally-Closed Pole

OptoMOS® Performance Data

1)



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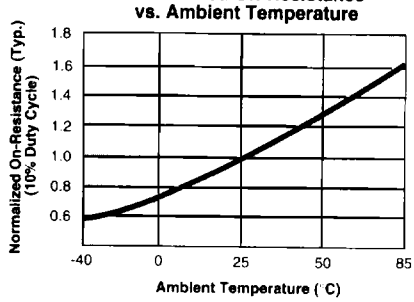

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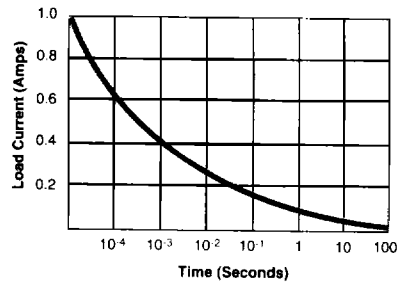

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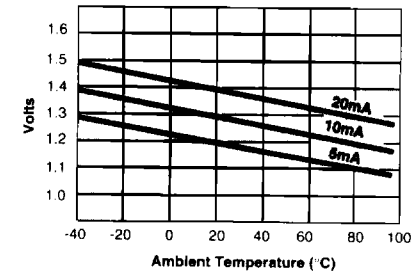

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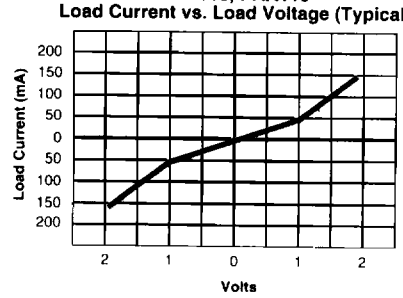

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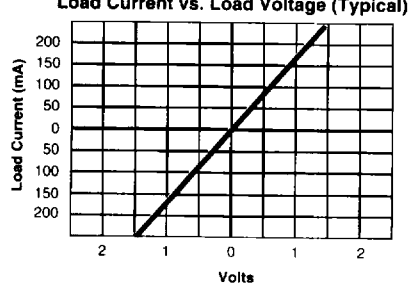

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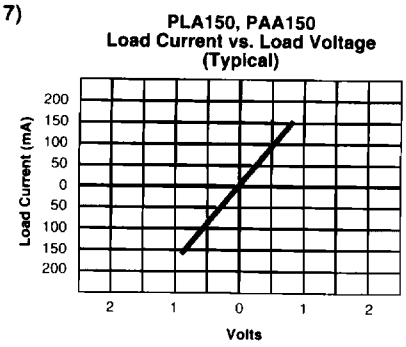

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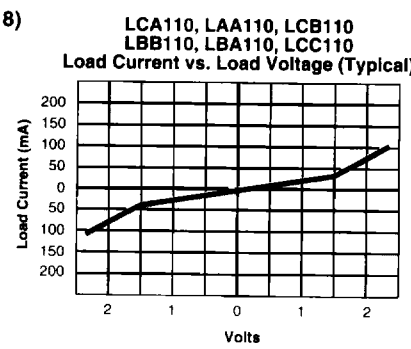

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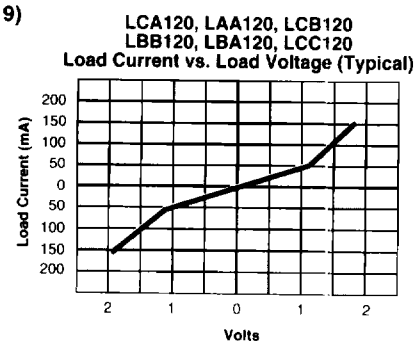

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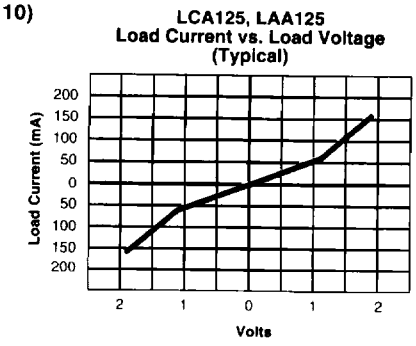
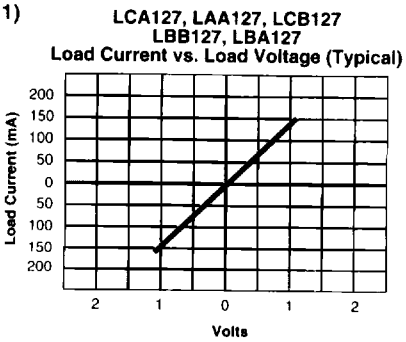


11)



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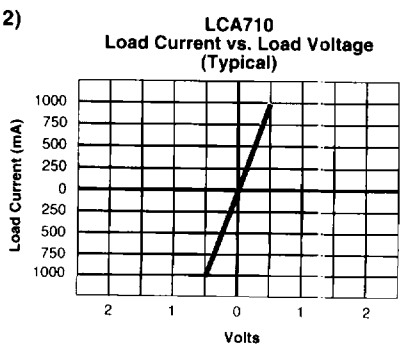

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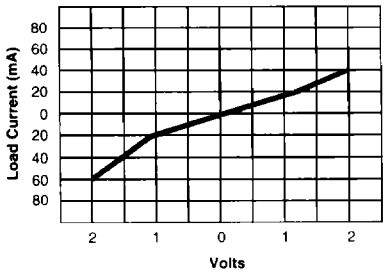
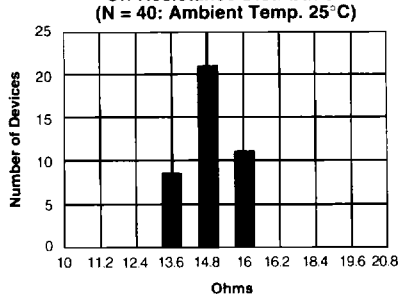
13)



14)



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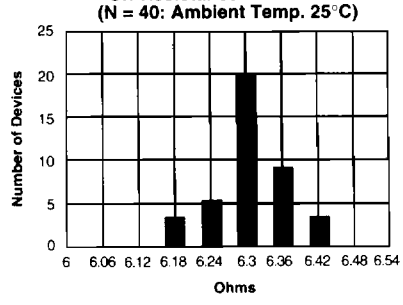

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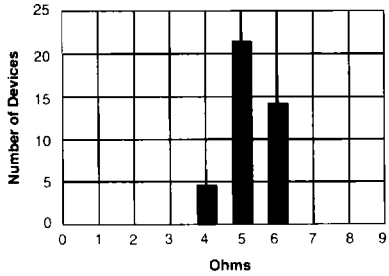

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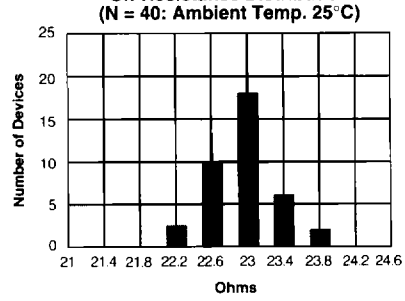
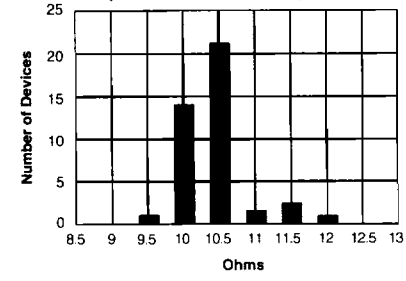


18)



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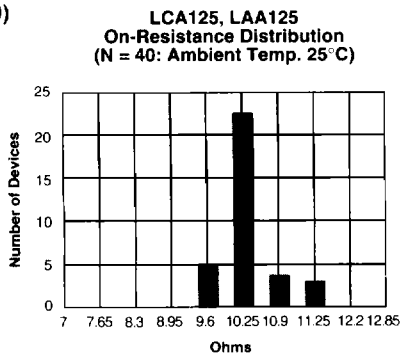

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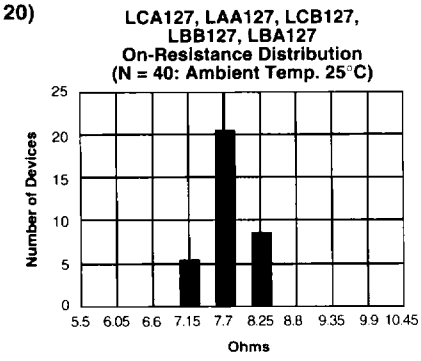

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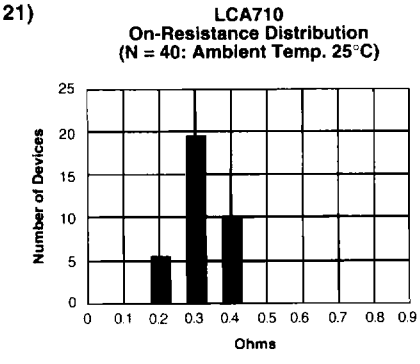

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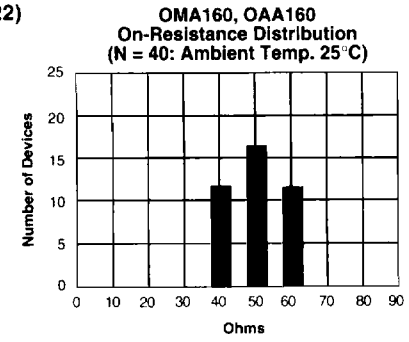

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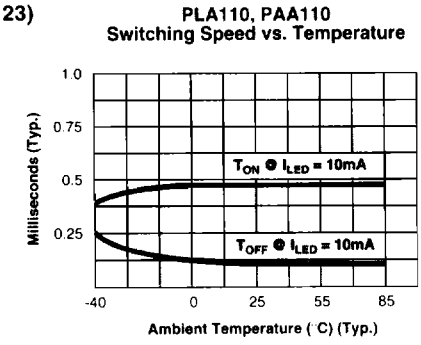

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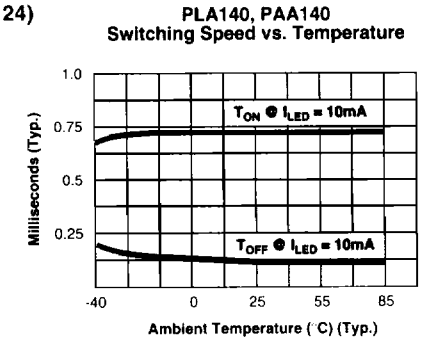

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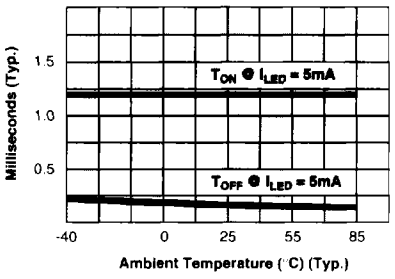
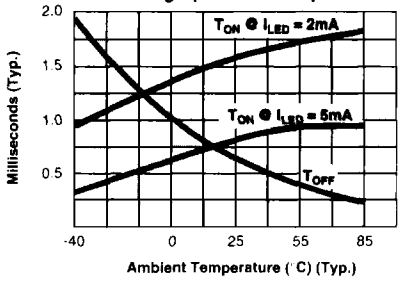
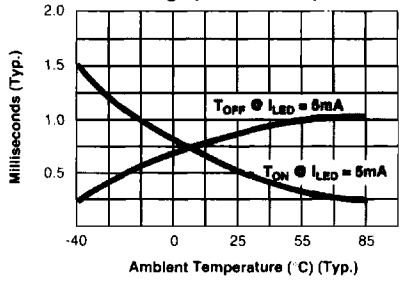
25) PLA150, PAA150
Switching Speed vs. Temperature



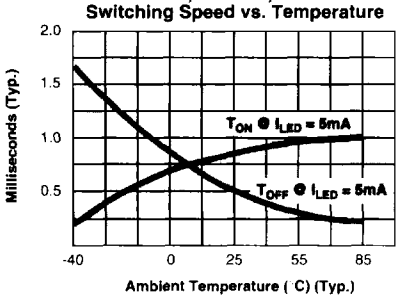
26) LCA110, LAA110
Switching Speed vs. Temperature



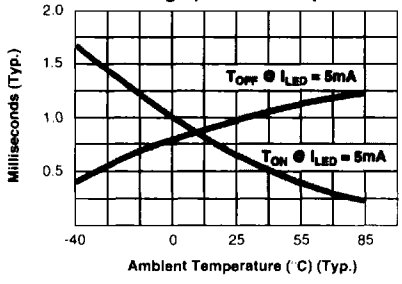
27) LCB110, LBB110
Switching Speed vs. Temperature



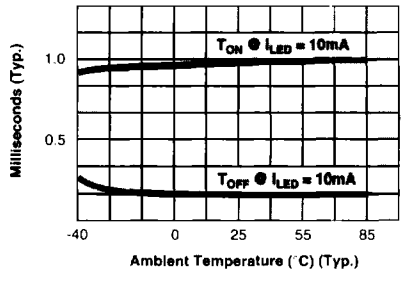
28) LCA120, LCA125, LCA127
LAA120, LAA125, LAA127
Switching Speed vs. Temperature



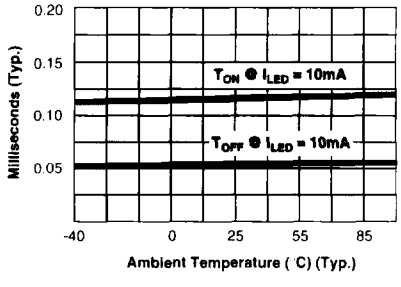
29) LCB120, LCB127
LBB120, LBB127
Switching Speed vs. Temperature



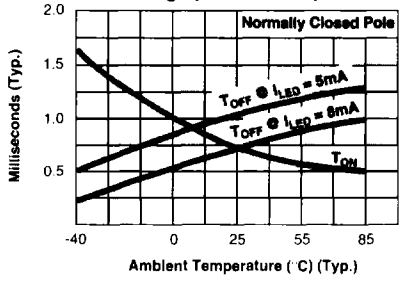
30) LCA710
Switching Speed vs. Temperature



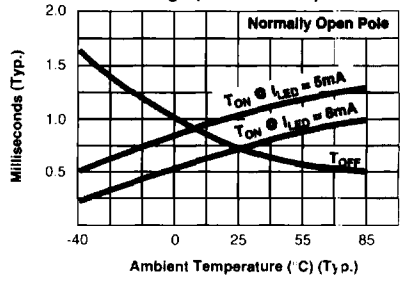
31) OMA160, OAA160
Switching Speed vs. Temperature



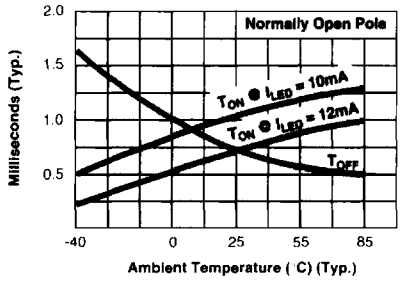
32) LBA110, LBA120, LBA127
Switching Speed vs. Temperature



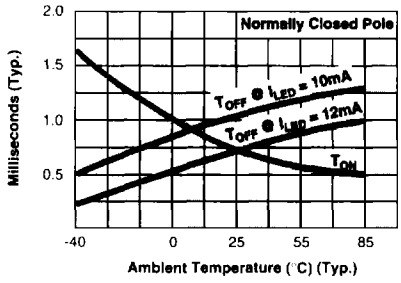
33) LBA110, LBA120, LBA127
Switching Speed vs. Temperature



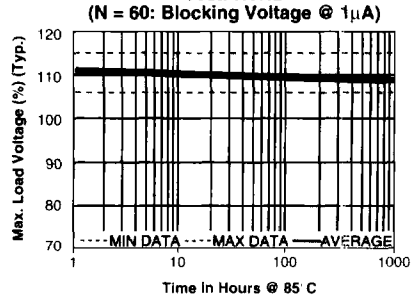
34) LCC110, LCC120
Switching Speed vs. Temperature



35) LCC110, LCC120
Switching Speed vs. Temperature



36) Blocking Voltage Stability
Test: HTRB
(N = 60: Blocking Voltage @ 1μA)



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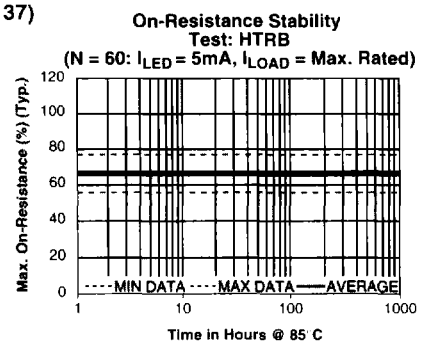
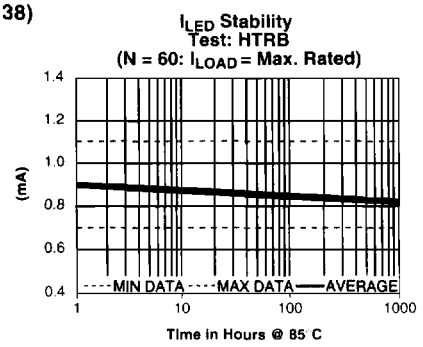
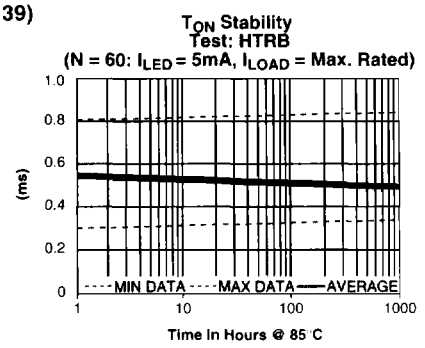
37)



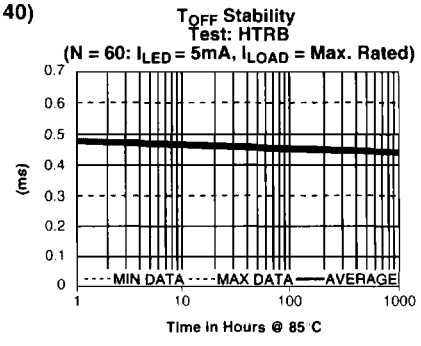
38)



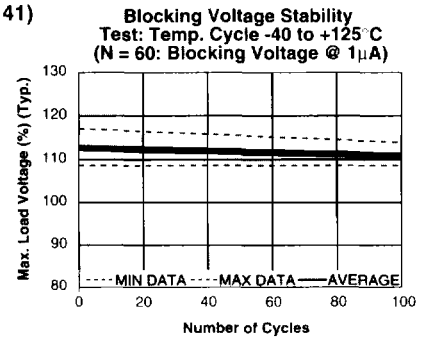
39)



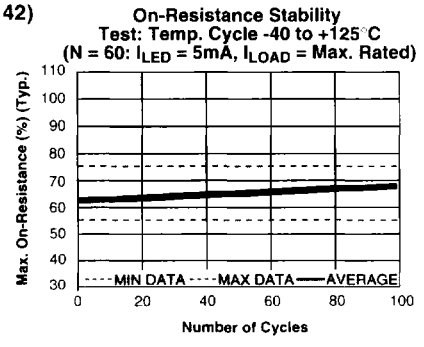
40)



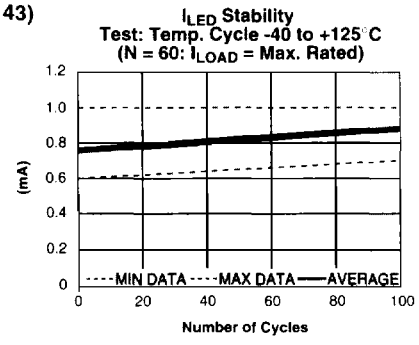
41)



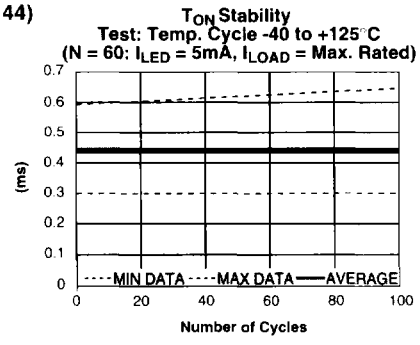
42)



43)



44)



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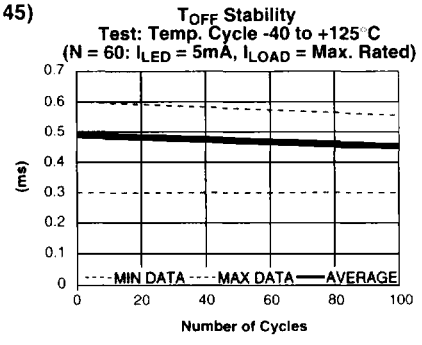
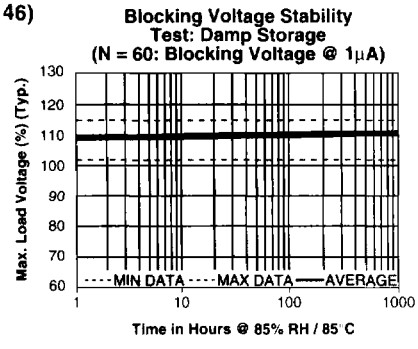


46)



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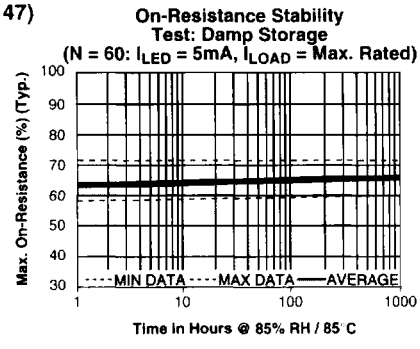
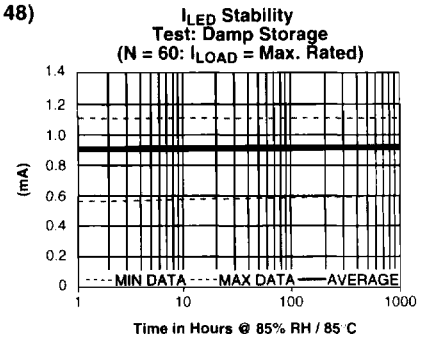


48)



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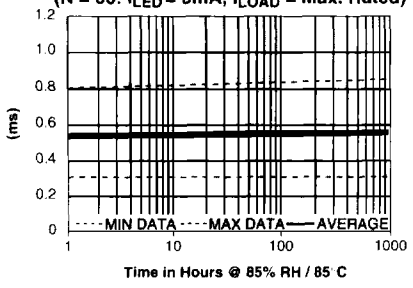
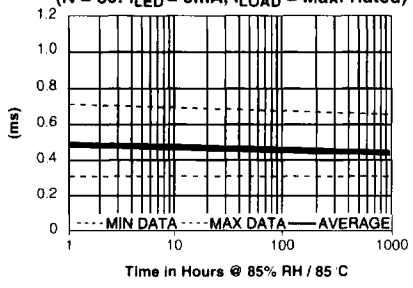
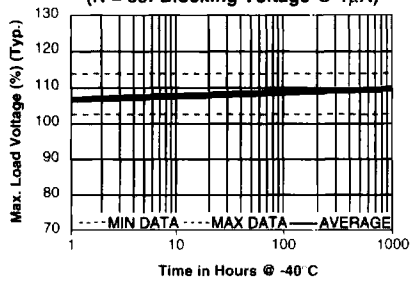
49) T_{ON} Stability
Test: Damp Storage
(N = 60: I_{LED} = 5mA, I_{LOAD} = Max. Rated)



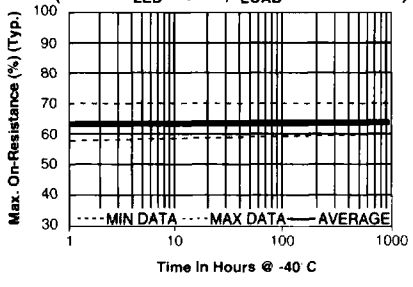
50) T_{OFF} Stability
Test: Damp Storage
(N = 60: I_{LED} = 5mA, I_{LOAD} = Max. Rated)



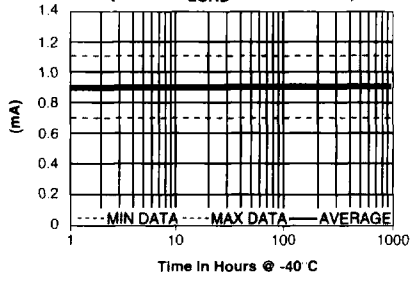
51) Blocking Voltage Stability
Test: Cold Storage
(N = 60: Blocking Voltage @ 1μA)



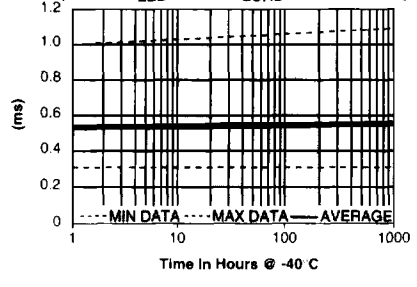
52) On-Resistance Stability
Test: Cold Storage
(N = 60: I_{LED} = 5mA, I_{LOAD} = Max. Rated)



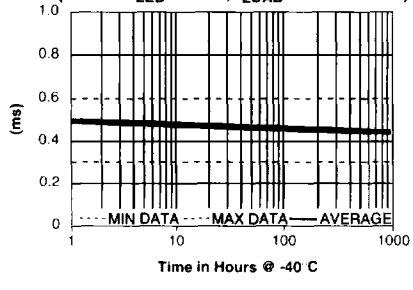
53) I_{LED} Stability
Test: Cold Storage
(N = 60: I_{LOAD} = Max. Rated)



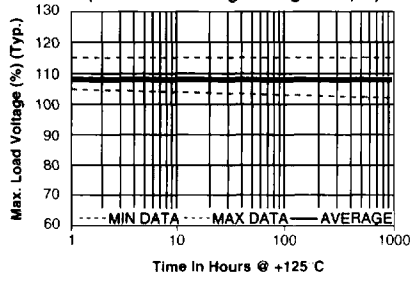
54) T_{ON} Stability
Test: Cold Storage
(N = 60: I_{LED} = 5mA, I_{LOAD} = Max. Rated)



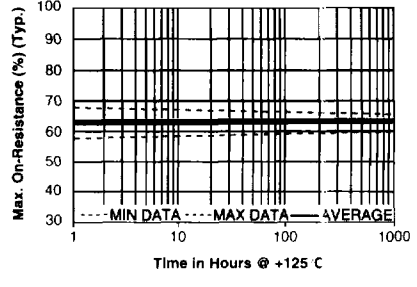
55) T_{OFF} Stability
Test: Cold Storage
(N = 60: I_{LED} = 5mA, I_{LOAD} = Max. Rated)



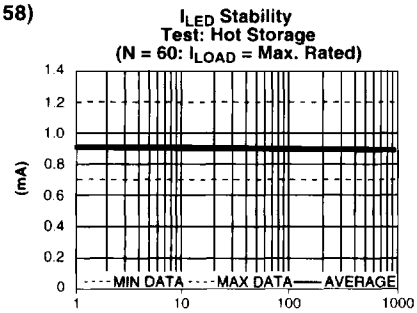
56) Blocking Voltage Stability
Test: Hot Storage
(N = 60: Blocking Voltage @ 1μA)



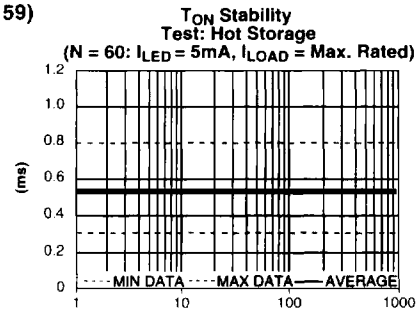
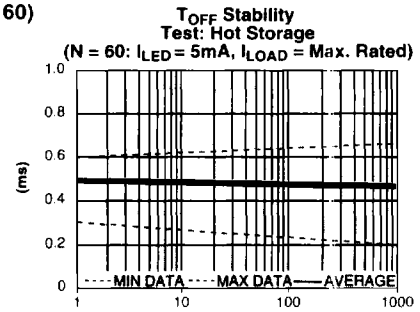
57) On-Resistance Stability
Test: Hot Storage
(N = 60: I_{LED} = 5mA, I_{LOAD} = Max. Rated)



58) I_{LED} Stability
Test: Hot Storage
(N = 60: I_{LOAD} = Max. Rated)



59) T_{ON} Stability
Test: Hot Storage
(N = 60: I_{LED} = 5mA, I_{LOAD} = Max. Rated)



60) T_{OFF} Stability
Test: Hot Storage
(N = 60: I_{LED} = 5mA, I_{LOAD} = Max. Rated)