Integrated Circuits

ULN2061L/M THROUGH ULN2075B/LB

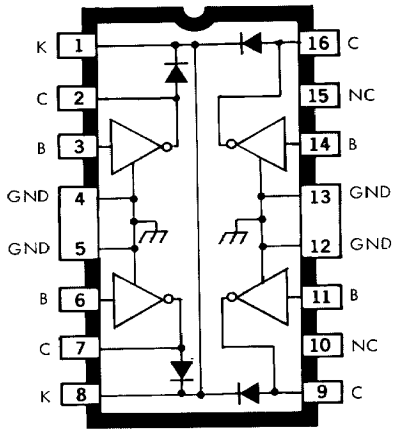
Data Sheet 29305D

IECQ MFG. APPROVAL

DESC LINE CERTIFICATION

1.5 A DARLINGTON SWITCHES

ULN2064B



DWG. NO. A-9765A

High-voltage, high-current Darlington arrays ULN2061L/M through ULN2075B/LB are designed for interface between low-level logic and a variety of peripheral loads such as relays, solenoids, dc and stepper motors, multiplexed LED and incandescent displays, heaters, and similar loads. Output OFF voltage ratings of 50 V and 80 V are available. In the DIP, the quad drivers can drive resistive loads to 480 watts (1.5 A x 80 V, 26% duty cycle). For inductive loads, sustaining voltages of 35 V and 50 V at 100 mA are specified.

Dual-driver arrays ULN2061L/M and the higher-voltage ULN2062L/M are used for common-emitter (externally connected) or emitter-follower applications. They are supplied in 8-pin plastic mini-DIPs (suffix M) and surface-mountable SOICs (suffix L).

Quad drivers ULN2064B/LB, ULN2065B/LB, ULN2068B/LB, and ULN2069B/LB are intended for use with TTL, low-speed TTL, and 5 V MOS logic. The ULN2065B/LB and ULN2069B/LB are selected for the 80 V minimum output breakdown specification. The ULN2068B/LB and ULN2069B/LB have pre-driver stages and are recommended for applications requiring high gain (low input-current loading). Isolated Darlington arrays ULN2074B/LB and ULN2075B/LB are identical to the ULN2064B/LB and ULN2065NB/LB except for the isolated Darlington pinout and the deletion of suppression diodes. These switches are for emitter-follower applications. Quad-driver arrays are supplied with heat-sink contact tabs in 16-pin plastic DIPs (suffix B) and 20-lead surface-mountable wide-body SOICs (suffix LB).

ABSOLUTE MAXIMUM RATINGS at +25°C Free-Air Temperature for Any One Driver (unless other noted)

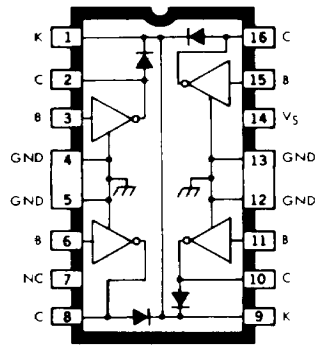
Output Voltage, V_{CEX} . . . . . **See Guide**
Output Sustaining Voltage, $V_{CE(SUS)}$ . . . . . **See Guide**
Output Current, I_{OUT} (Note 1) . . . . . **1.75 A**
Input Voltage, V_{IN} (Note 2) . . . . **See Guide**
Input Current, I_B (Note 3) . . . . . **25 mA**
Supply Voltage, V_S (ULN2068/69B/LB) . **10 V**
Total Package Power Dissipation . . . . . **See Graph**
Operating Temperature Range, T_A . . . . . **–20°C to +85°C**
Storage Temperature Range, T_S . . . . . **–55°C to –150°C**

1. Allowable combinations of output current, number of outputs conducting, and duty cycle are shown on following pages.
2. Input voltage is referenced to the substrate (no connection to other pins) for the ULN2061/62L/M and ULN2074/75B/LB, reference is ground for all other types.
3. Input current may be limited by maximum allowable input voltage.

FEATURES

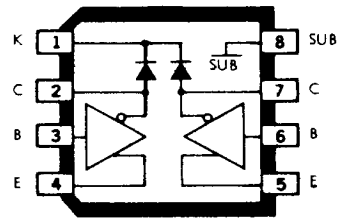
- TTL, DTL, MOS, CMOS Compatible Inputs
- Transient-Protected Outputs
- Loads to 480 Watts
- Heat-Sink Contact Tabs on Quad Arrays

ULN2068/69B



Dwg. No. A-10,310

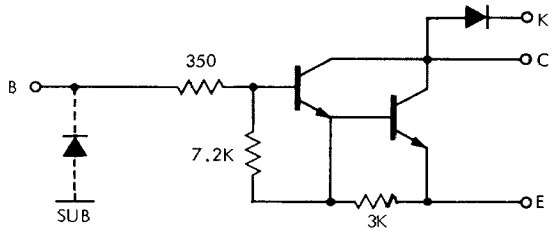
ULN2061/62L



SPRAGUE SEMICONDUCTOR GROUP

SERIES ULN2061L/M THROUGH ULN2075B/LB
1.5 A DARLINGTON SWITCHES

PARTIAL SCHEMATIC



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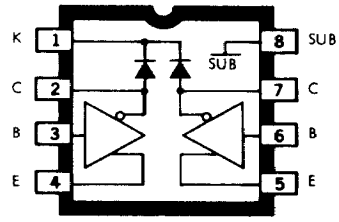
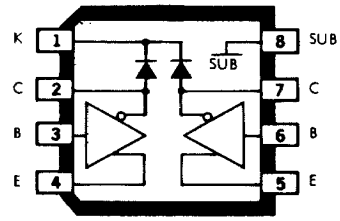
ULN2061/62M



Dwg. No. A-10,230A

ULN2061/62L



ELECTRICAL CHARACTERISTICS AT +25°C (unless otherwise noted)

Characteristic	Symbol	Test Fig.	Applicable Devices*	Test Conditions	Limits Min.	Limits Max.	Limits Units
Output Leakage Current	I_{CEX}	1	ULN2061	V_{CE} = 50 V	—	100	µA
				V_{CE} = 50 V, T_A = 70°C	—	500	µA
			ULN2062	V_{CE} = 80 V	—	100	µA
				V_{CE} = 80 V, T_A = 70°C	—	500	µA
Output Sustaining Voltage	$V_{CE(SUS)}$	2	ULN2061	I_c = 100 mA, V_{IN} = 0.4 V	35	—	V
			ULN2062	I_C = 100 mA, V_{IN} = 0.4 V	50	—	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	3	Both	I_C = 500 mA, I_B = 625 µA	—	1.1	V
				I_C = 750 mA, I_B = 935 µA	—	1.2	V
				I_C = 1.0 A, I_B = 1.25 µA	—	1.3	V
				I_C = 1.25 A**, I_B = 2.0 mA	—	1.4	V
			ULN2062	I_C = 1.5A**, I_B = 2.25 mA	—	1.5	V
Input Current	$I_{IN(ON)}$	4	Both	V_{IN} = 2.4 V	1.4	4.3	mA
				V_{IN} = 3.75 V	3.3	9.6	mA
Input Voltage	$V_{IN(ON)}$	5	Both	V_{CE} = 2.0 V, I_C = 1.0 A	—	2.0	V
			ULN2061	V_{CE} = 2.0 V, I_C = 1.25 A**	—	2.5	V
			ULN2062	V_{CE} = 2.0 V, I_C = 1.5 A**	—	2.5	V
Turn-On Delay	t_{PLH}	—	Both	0.5 E_{in} to 0.5 E_{out}	—	1.0	µs
Turn-Off Delay	t_{PHL}	—	Both	0.5 E_{in} to 0.5 E_{out}	—	1.5	µs
Clamp Diode Leakage Current	I_R	6	ULN2061	V_R = 50 V	—	50	µA
				V_R = 50 V, T_A = 70° C	—	100	µA
			ULN2062	V_R = 80 V	—	50	µA
				V_R = 80 V, T_A = 70°C	—	100	µA
Clamp Diode Forward Voltage	V_F	7	Both	I_F = 1.0 A	—	1.75	V
				I_F = 1.5 A	—	2.0	V

** Pulse-Test

*Complete part number includes suffix to identify package style: L – SOIC, M – 8-pin mini-DIP.

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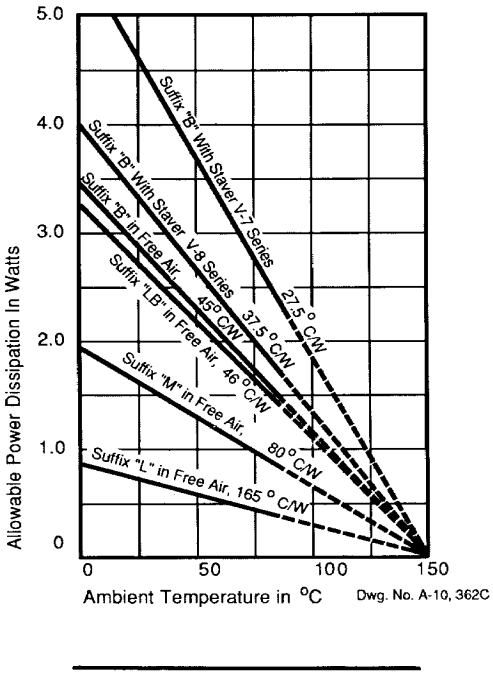


SELECTION GUIDE

Part Number*	Max. V_{CEX}	Min. $V_{CE(SUS)}$	Max. V_{IN}	Application
ULN2061L/M	50 V	35 V	30 V	TTL, DTL, Schottky TTL, and 5 V CMOS
ULN2062L/M	80 V	50 V	60 V	
ULN2064B/LB	50 V	35 V	15 V	TTL, DTL, Schottky TTL, and 5 V CMOS
ULN2065B/LB	80 V	50 V	15 V	
ULN2068B/LB	50 V	35 V	15 V	TTL, DTL, Schottky TTL, and 5 V CMOS
ULN2069B/LB	80 V	50 V	15 V	
ULN2074B/LB	50 V	35 V	30 V	General Purpose
ULN2075B/LB	80 V	50 V	60 V	

*Suffixes 'L' and 'LB' are SOICs, 'B' and 'M' are DIPs.

TEST FIGURES

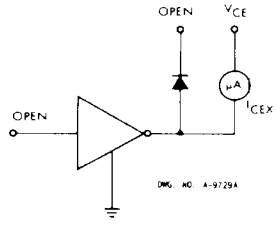


FIGURE 1

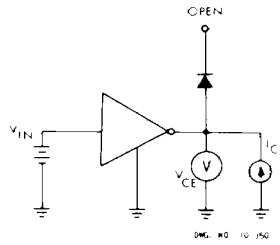


FIGURE 2

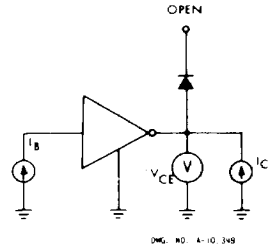


FIGURE 3

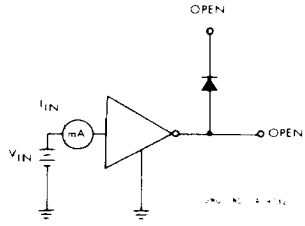


FIGURE 4

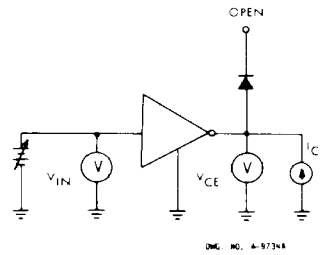


FIGURE 5

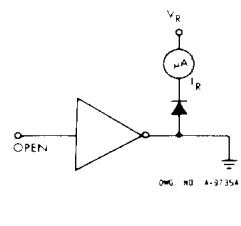


FIGURE 6

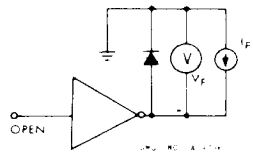


FIGURE 7

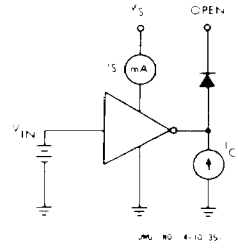
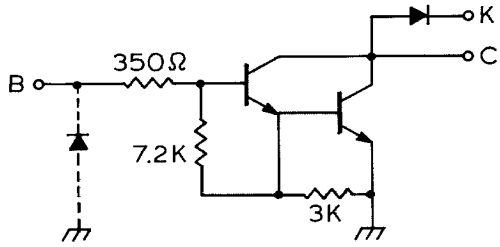


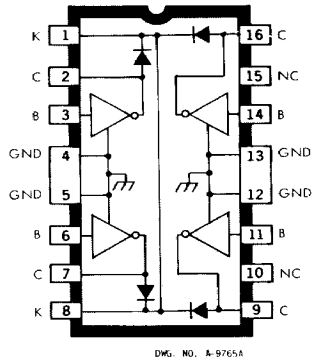
FIGURE 8

PARTIAL SCHEMATIC



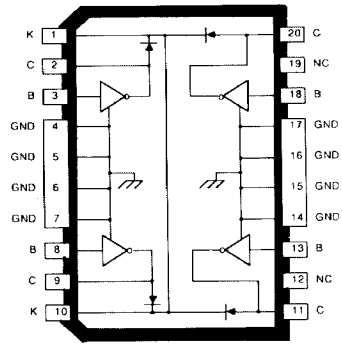
Dwg. No. A 10,353C

ULN 2064/65B



DWG. NO. A-9765A

ULN 2064/65LB



ELECTRICAL CHARACTERISTICS AT ± 25°C (unless otherwise noted)

Characteristic	Symbol	Test Fig.	Applicable Devices*	Test Conditions	Limits		
					Min.	Max.	Units
Output Leakage Current	I_{CEX}	1	ULN2064	V_{CE} = 50 V	—	100	µA
				V_{CE} = 50 V, T_A = 70°C	—	500	µA
			ULN2065	V_{CE} = 80 V	—	100	µA
				V_{CE} = 80 V, T_A = 70°C	—	500	µA
Output Sustaining Voltage	$V_{CE(SUS)}$	2	ULN2064	I_C = 100 mA, V_{IN} = 0.4 V	35	—	V
			ULN2065	I_C = 100 mA, V_{IN} = 0.4 V	50	—	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	3	Both	I_C = 500 mA, I_B = 625 µA	—	1.1	V
				I_C = 750 mA, I_B = 935 µA	—	1.2	V
				I_C = 1.0 A, I_B = 1.25 µA	—	1.3	V
				I_C = 1.25 A, I_B = 2.0 mA	—	1.4	V
			ULN2065	I_C = 1.5 A, I_B = 2.25 mA	—	1.5	V
Input Current	$I_{IN(ON)}$	4	Both	V_{IN} = 2.4 V	1.4	4.3	mA
				V_{IN} = 3.75 V	3.3	9.6	mA
Input Voltage	$V_{IN(ON)}$	5	Both	V_{CE} = 2.0 V, I_C = 1.0 A	—	2.0	V
			ULN2064	V_{CE} = 2.0 V, I_C = 1.25 A	—	2.5	V
			ULN2065	V_{CE} = 2.0 V, I_C = 1.5 A	—	2.5	V
Turn-On Delay	t_{PLH}	—	Both	0.5 E_{in} to 0.5 E_{out}	—	1.0	µs
Turn-Off Delay	t_{PHL}	—	Both	0.5 E_{in} to 0.5 E_{out}	—	1.5	µs
Clamp Diode Leakage Current	I_R	6	ULN2064	V_R = 50 V	—	50	µA
				V_R = 50 V, T_A = 70° C	—	100	µA
			ULN2065	V_R = 80 V	—	50	µA
				V_R = 80 V, T_A = 70°C	—	100	µA
Clamp Diode Forward Voltage	V_F	7	Both	I_F = 1.0 A	—	1.75	V
				I_F = 1.5 A	—	2.0	V

*Complete part number includes suffix to identify package style: B = DIP with heat sink tabs, LB = SOIC with heat sink tabs.

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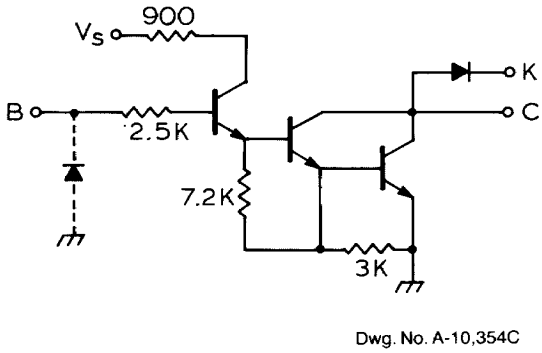
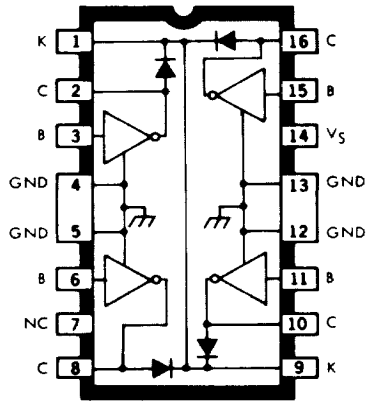
PARTIAL SCHEMATIC



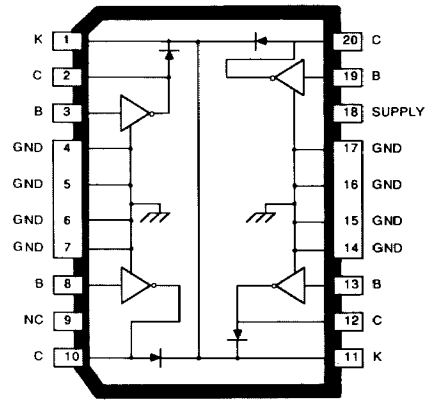
Dwg. No. A-10,354C

ULN2068/69B



Dwg. No. A-10,310

ULN2068 69LB



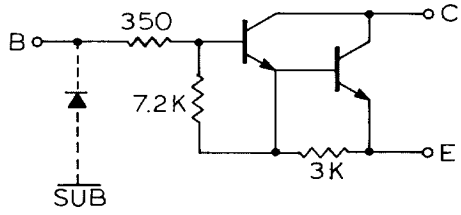
ELECTRICAL CHARACTERISTICS AT +25°C, V_S = 50V (unless otherwise noted)

Characteristic	Symbol	Test Fig.	Applicable Devices	Test Conditions	Limits Min.	Limits Max.	Limits Units
Output Leakage Current	I_{CEX}	1	ULN2068	V_{CE} = 50 V	—	100	µA
				V_{CE} = 50 V, T_A = 70°C	—	500	µA
			ULN2069	V_{CE} = 80 V	—	100	µA
				V_{CE} = 80 V, T_A = 70°C	—	500	µA
Output Sustaining Voltage	$V_{CE(SUS)}$	2	ULN2068	I_C = 100 mA, V_{IN} = 0.4 V	35	—	V
			ULN2069	I_C = 100 mA, V_{In} = 0.4 V	50	—	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	3	Both	I_C = 500 mA, I_{IN} = 2.75 V	—	1.1	V
				I_C = 750 mA, I_{IN} = 2.75 V	—	1.2	V
				I_C = 1.0 A, I_{IN} = 2.75 V	—	1.3	V
				I_C = 1.25 A, I_{IN} = 2.75 V	—	1.4	V
			ULN2069	I_C = 1.5 A, I_{IN} = 2.75 V	—	1.5	V
Input Current	$I_{IN(ON)}$	4	Both	V_{IN} = 2.75 V	—	550	µA
				V_{IN} = 3.75 V	—	1000	µA
Input Voltage	$V_{IN(ON)}$	5	ULN2068	V_{CE} = 2.0 V, I_C = 1.25 A	—	2.75	V
			ULN2069	V_{CE} = 2.0 V, I_C = 1.5 A	—	2.75	V
Supply Current	I_S	8	Both	I_C = 500 mA, V_{IN} = 2.75 V	—	6.0	mA
Turn-On Delay	t_{PLH}	—	Both	0.5 E_{in} to 0.5 E_{out}	—	1.0	µs
Turn-Off Delay	t_{PHL}	—	Both	0.5 E_{in} to 0.5 E_{out}, I_C = 1.25 A	—	1.5	µs
Clamp Diode Leakage Current	I_R	6	ULN2068	V_R = 50 V	—	50	µA
				V_R = 50 V, T_A = 70° C	—	100	µA
			ULN2069	V_R = 80 V	—	50	µA
				V_R = 80 V, T_A = 70°C	—	100	µA
Clamp Diode Forward Voltage	V_F	7	Both	I_F = 1.0 A	—	1.75	V
				I_F = 1.5 A	—	2.0	V

*Complete part number includes suffix to identify package style: B = DIP with heat sink tabs, LB = SOIC with heat sink tabs.

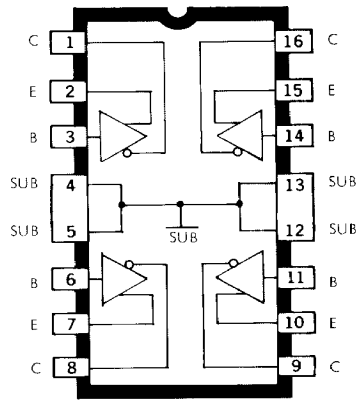
SERIES ULN2061L/M THROUGH ULN2075B/LB
1.5 A DARLINGTON SWITCHES

PARTIAL SCHEMATIC



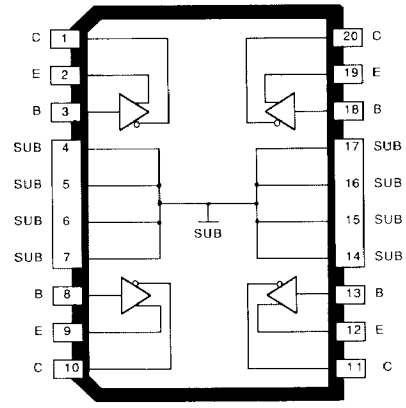
Dwg. No. A-10,355B

ULN2074/75B



DWG. NO. A-9706A

ULN2074/75LB



ELECTRICAL CHARACTERISTICS AT +25°C (unless otherwise noted)

Characteristic	Symbol	Test Fig.	Applicable Devices	Test Conditions	Limits Min.	Limits Max.	Limits Units
Output Leakage Current	I_{CEX}	1	ULN2074	V_{CE} = 50 V	—	100	µA
				V_{CE} = 50 V, T_A = 70°C	—	500	µA
			ULN2075	V_{CE} = 80 V	—	100	µA
				V_{CE} = 80 V, T_A = 70°C	—	500	µA
Output Sustaining Voltage	$V_{CE(SUS)}$	2	ULN2074	I_C = 100 mA, V_{IN} = 0.4 V	35	—	V
			ULN2075	I_C = 100 mA, V_{In} = 0.4 V	50	—	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	3	Both	I_C = 500 mA, I_B = 625 µA	—	1.1	V
				I_C = 750 mA, I_B = 935 µA	—	1.2	V
				I_C = 1.0 A, I_B = 1.25 mA	—	1.3	V
				I_C = 1.25 A, I_B = 2.0 mA	—	1.4	V
			ULN2075	I_C = 1.5 A, I_B = 2.25 mA	—	1.5	V
Input Current	$I_{IN(ON)}$	4	Both	V_{IN} = 2.4 V	1.4	4.3	mA
				V_{IN} = 3.75 V	3.3	9.6	mA
Input Voltage	$V_{IN(ON)}$	5	Both	V_{CE} = 2.0 V, I_C = 1.0 A	—	2.0	V
			ULN2074	V_{CE} = 2.0 V, I_C = 1.25 A	—	2.5	V
			ULN2075	V_{CE} = 2.0 V, I_C = 1.5 A	—	2.5	V
Turn-On Delay	t_{PLH}	—	Both	0.5 E_{in} to 0.5 E_{out}	—	1.0	µs
Turn-Off Delay	t_{PHL}	—	Both	0.5 E_{in} to 0.5 E_{out}	—	1.5	µs

*Complete part number includes suffix to identify package style: B DIP with heat sink tabs, LB SOIC with heat sink tabs.

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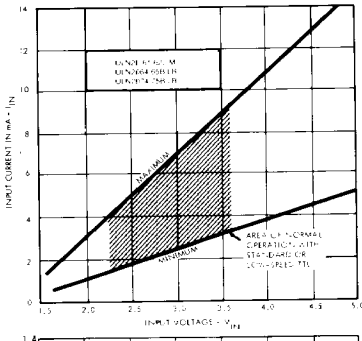
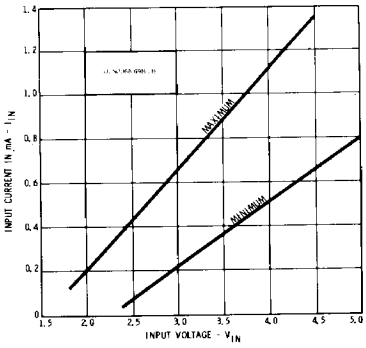
Worcester, Massachusetts 01615-0036 (508) 853-5000

INPUT CURRENT AS A FUNCTION OF INPUT VOLTAGE AT +25°C

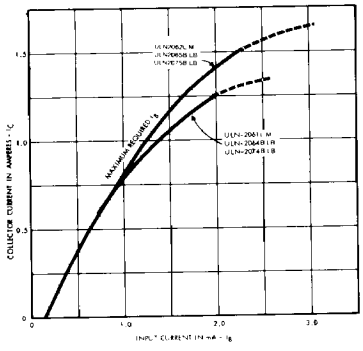


Dwg. No. A-10,363C

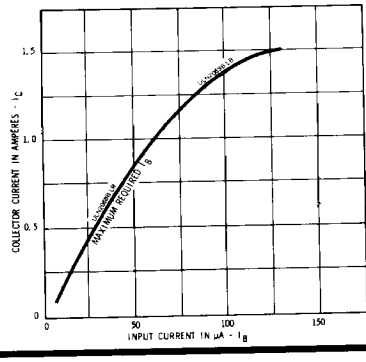


Dwg. No. A-12,306A

COLLECTOR CURRENT AS A FUNCTION OF INPUT CURRENT AT +25° C

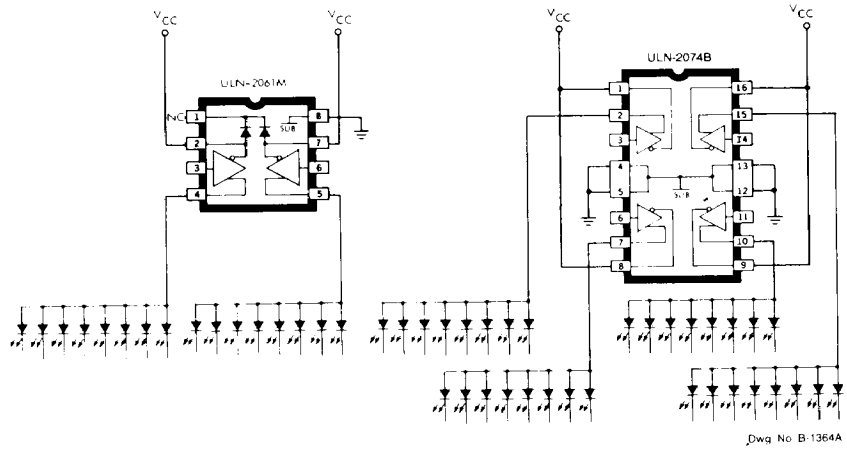


Dwg. No. A-10,358C



Dwg. No. A-12,306A

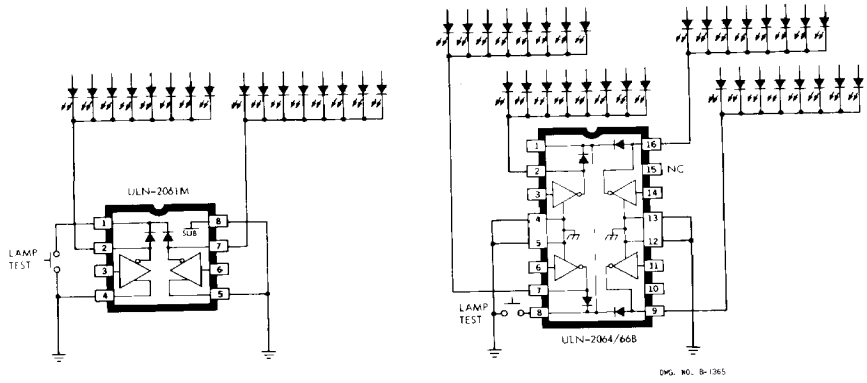
TYPICAL APPLICATIONS



Dwg. No. B-1364A

COMMON-ANODE LED DRIVERS

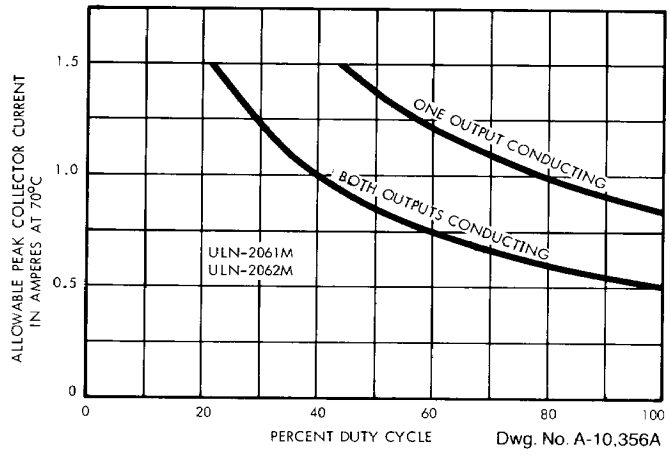
(Series UDN2980A/EP/LW devices can be used in similar applications at currents of up to 500 mA)



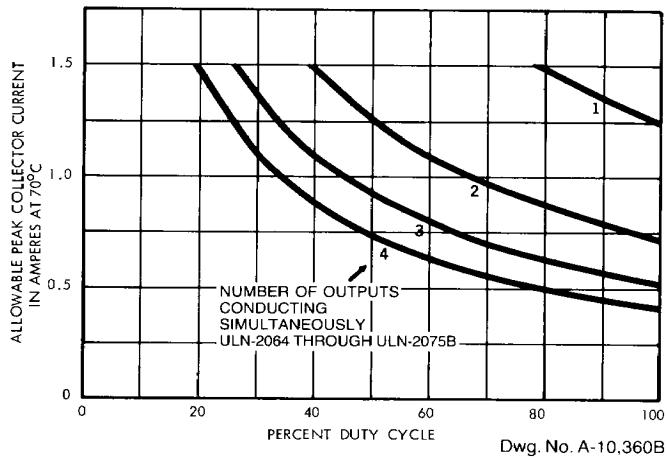
COMMON-CATHODE LED DRIVERS

(Type ULN2068B/LB is also applicable)

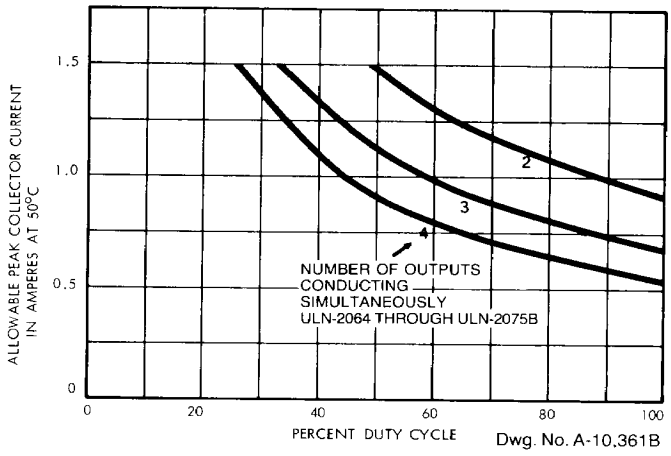
PEAK COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE
(Dual In-Line Packaged Devices)



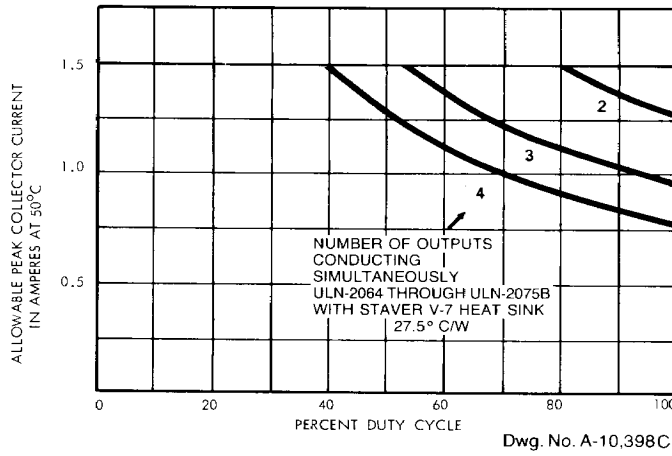
Dwg. No. A-10,356A



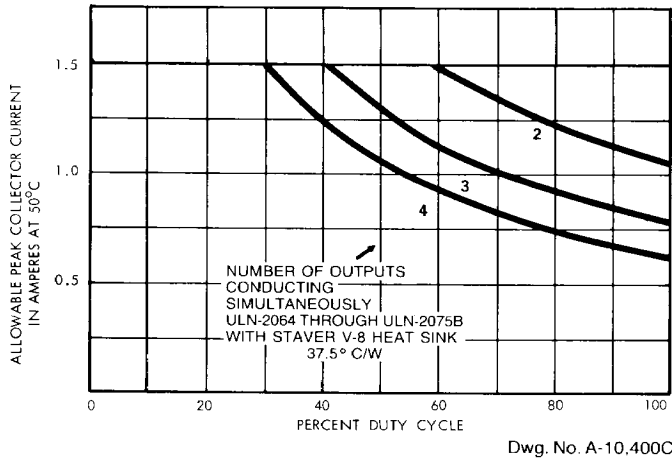
Dwg. No. A-10,360B



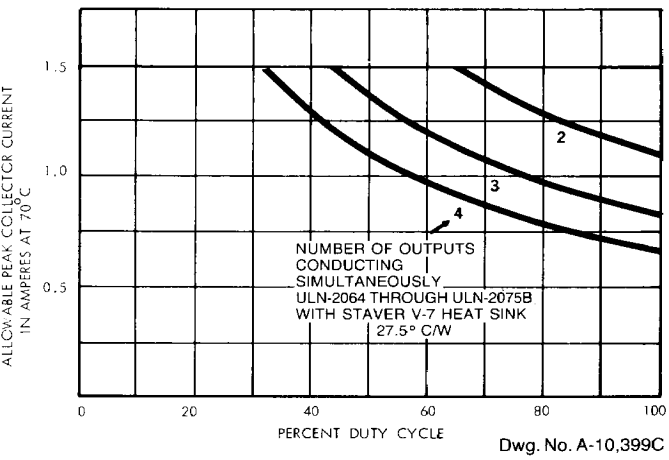
Dwg. No. A-10,361B



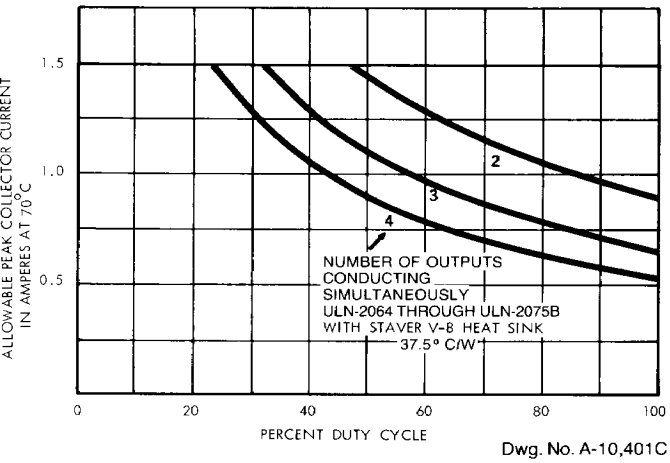
Dwg. No. A-10,398C



Dwg. No. A-10,400C

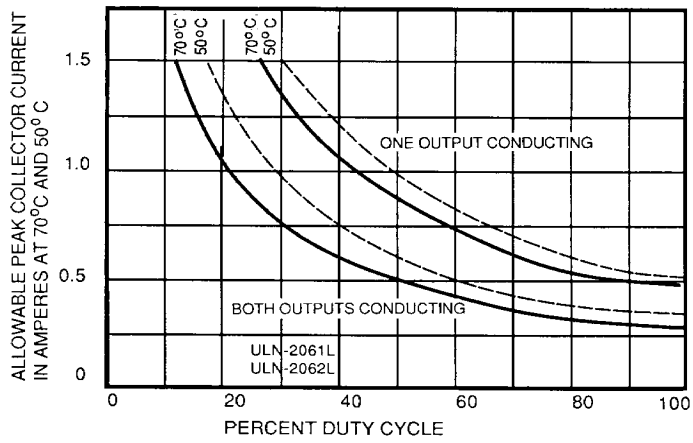


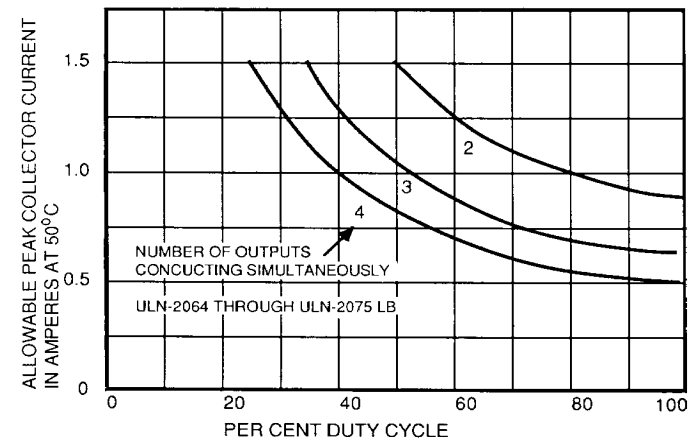
Dwg. No. A-10,399C

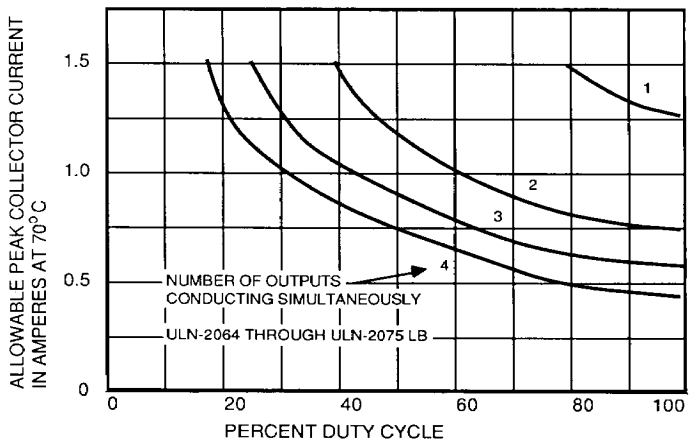


Dwg. No. A-10,401C

PEAK COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE (Small Outline Packaged Devices)



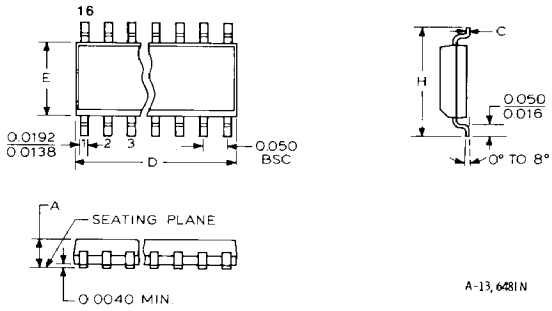




SERIES ULN2061L/M THROUGH ULN2075B/LB
1.5 A DARLINGTON SWITCHES

PLASTIC SOIC

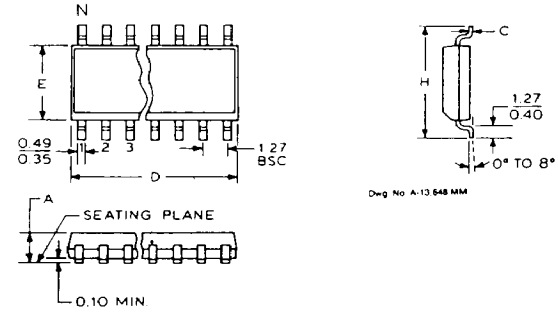
DIMENSIONS IN INCHES (BASED ON 1 mm = 0.03937")



A-13, 648 IN

N	Leads Pkg. Designator	8 L	20 LB
A	Seated Height	0.0532 0.0688	0.0926 0.1043
C	Lead Thickness	0.0075 0.0098	0.0091 0.0125
D	Body Length	0.1890 0.1968	0.4961 0.5118
E	Body Width	0.1497 0.1574	0.2914 0.2992
H	Overall Width	0.2284 0.2440	0.394 0.419
Notes	(Leads Affected)		2 (4-7,14-17)

DIMENSIONS IN MILLIMETERS

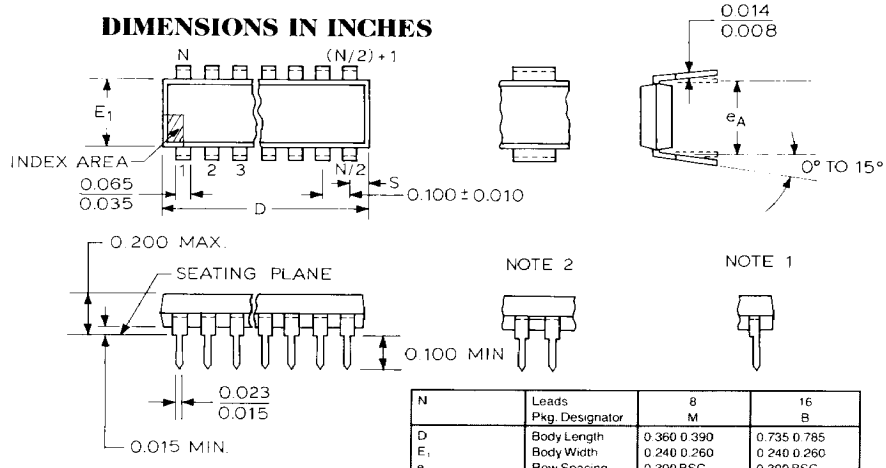


Dwg No. A-13 648 MM

N	Leads Pkg. Designator	8 L	20 LB
A	Seated Height	1.35 1.75	2.35 2.65
C	Lead Thickness	0.19 0.25	0.23 0.32
D	Body Length	4.80 5.00	12.60 13.00
E	Body Width	3.80 4.00	7.40 7.60
H	Overall Width	5.80 6.20	10.0 10.65
Notes	(Leads Affected)	—	2 (4-7,14-17)

PLASTIC DIP

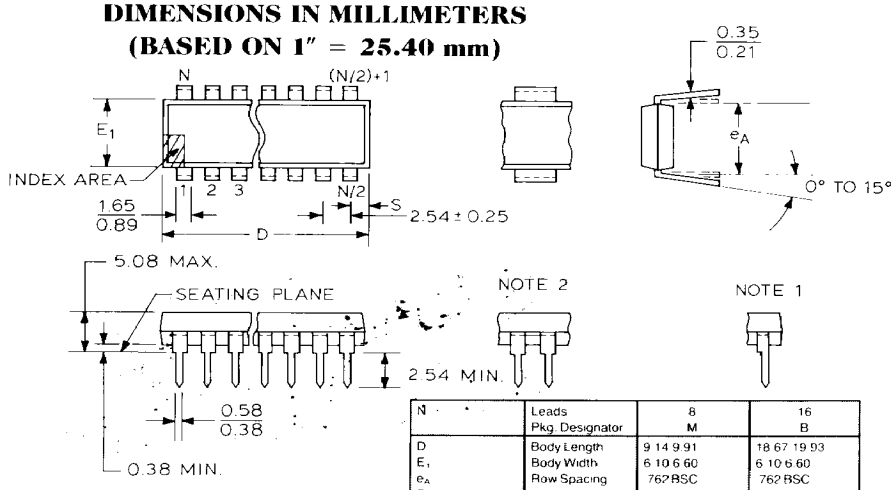
DIMENSIONS IN INCHES



A-13, 642 IN

N	Leads Pkg. Designator	8 M	16 B
D	Body Length	0.360 0.390	0.735 0.785
E_1	Body Width	0.240 0.260	0.240 0.260
e_A	Row Spacing	0.300 BSC	0.300 BSC
S	Lead CL to End	0.040 REF	0.025 REF
Notes	(Leads Affected)	1 (1, 4, 5, 8)	1 (1, 8, 9, 16) 2 (4, 5, 12, 13)

DIMENSIONS IN MILLIMETERS (BASED ON 1" = 25.40 mm)



A-13, 642MM

N	Leads Pkg. Designator	8 M	16 B
D	Body Length	9.14 9.91	18.67 19.93
E_1	Body Width	6.10 6.60	6.10 6.60
e_A	Row Spacing	7.62 BSC	7.62 BSC
S	Lead CL to End	1.02 REF	0.64 REF
Notes	(Leads Affected)	1 (1, 4, 5, 8)	1 (1, 8, 9, 16) 2 (4, 5, 12, 13)

1. Leads 1, N/2, (N/2) + 1, and N may be half-leads at vendor's option.
2. Webbed lead frame. Leads indicated are internally one piece.

In the construction of the components described, the full intent of the specification will be met. The Sprague Electric Company, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products. Components made under military approvals will be in accordance with the approval requirements.

The information included herein is believed to be accurate and reliable. However, the Sprague Electric Company assumes no responsibility for its use; nor for any infringements of patents or other rights of third parties which may result from its use.

A. Dimensions shown as ____/____ are Min./Max.
B. Lead thickness is measured at seating plane or below.
C. Lead spacing tolerance is non-cumulative.
D. Exact body and lead configuration at vendor's option within limits shown.
E. Leads missing from their designated positions shall also be counted when numbering leads.
F. Lead gauge plane is 0.030" (7.62 mm) max. below seating plane.

SPRAGUE

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Worcester, Massachusetts 01615-0036 (508) 853-5000

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