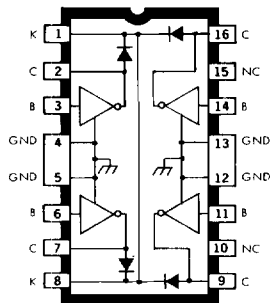


2061 THRU 2069

1.5 A DARLINGTON SWITCHES

ULN2064/65B



Dwg. No. A-9765A

ABSOLUTE MAXIMUM RATINGS at +25°C Free-Air Temperature for Any One Driver (unless otherwise 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 (ULN2068B/LB & 2069B)	10 V
Total Package Power Dissipation, P_D	See Graph
Operating Temperature Range, (Note 4), T_A	-20°C to +85°C
Storage Temperature Range, T_S	-55°C to -150°C

- Allowable combinations of output current, number of outputs conducting, and duty cycle are shown on following pages.
- Input voltage is referenced to the substrate (no connection to other pins) for the ULN2061/62M, reference is ground for all other types.
- Input current may be limited by maximum allowable input voltage.
- The ULN2065B and ULN2068B are also available for operation between -40°C and +85°C. Change third character from 'N' to 'Q'.

High-voltage, high-current Darlington arrays ULN2061M through ULN2069B are designed for interface between low-level logic and a variety of peripheral loads such as relays, solenoids, dc and stepper motors, magnetic print hammers, 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 ULN2061M and the higher-voltage ULN2062M are used for common-emitter (externally connected) or emitter-follower applications. They are supplied in 8-pin plastic mini-DIPs.

Quad drivers ULN2064B/LB, ULN2065B, ULN2068B/LB, and ULN2069B are intended for use with TTL, low-speed TTL, and 5 V MOS logic. The ULN2065B and ULN2069B are selected for the 80 V minimum output breakdown specification. The ULN2068B/LB and ULN2069B have pre-driver stages and are recommended for applications requiring high gain (low input-current loading). 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).

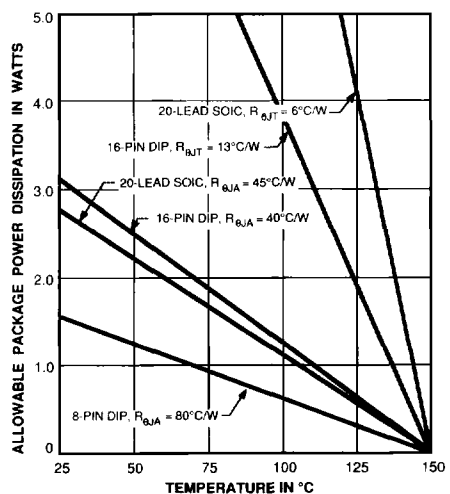
FEATURES

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

Always order by complete part number, e.g., **ULN2061M**. See matrix on next page. Note that all devices are not available in all package types.

2061 THRU 2069

1.5 A DARLINGTON SWITCHES



Dwg. GP-027

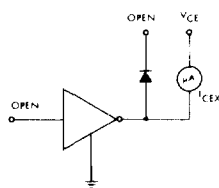
SELECTION GUIDE

Part Number*	Max. V_{CEX}	Min. $V_{CE(SUS)}$	Max. V_{IN}	Application
ULN2061M	50 V	35 V	30 V	TTL, DTL, Schottky TTL, and 5 V CMOS
ULN2062M	80 V	50 V	60 V	
ULN2064B	50 V	35 V	15 V	TTL, DTL, Schottky TTL, and 5 V CMOS
ULN2064LB	50 V	35 V	15 V	
ULN2065B†	80 V	50 V	15 V	TTL, DTL, Schottky TTL, and 5 V CMOS
ULN2068B†	50 V	35 V	15 V	
ULN2068LB	50 V	35 V	15 V	
ULN2069B	80 V	50 V	15 V	

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

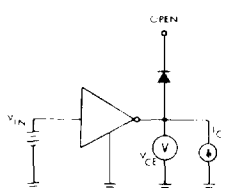
† These devices are also available for operation between -40°C and $+85^{\circ}\text{C}$. To order, change third character from 'N' to 'Q'.

TEST FIGURES



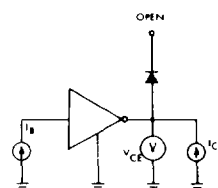
Dwg. No. A-9729A

FIGURE 1



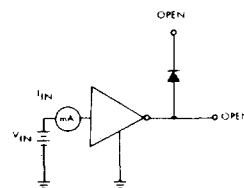
Dwg. No. A-10,350

FIGURE 2



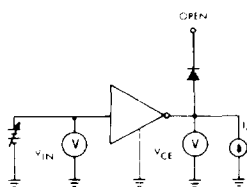
Dwg. No. A-10,349

FIGURE 3



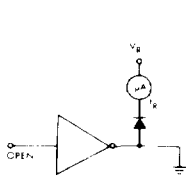
Dwg. No. A-9732

FIGURE 4



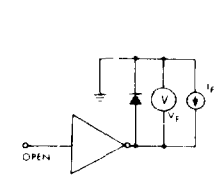
Dwg. No. A-9734A

FIGURE 5



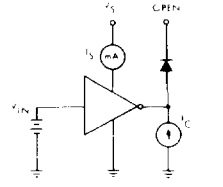
Dwg. No. A-9735A

FIGURE 6



Dwg. No. A-9736

FIGURE 7



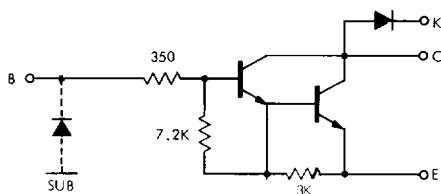
Dwg. No. A-10,351

FIGURE 8

2061 THRU 2069

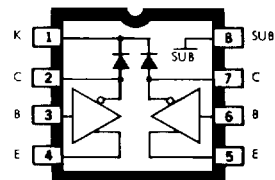
1.5 A DARLINGTON SWITCHES

PARTIAL SCHEMATIC



Dwg. No. A-10,352B

ULN2061/62M



Dwg. No. A-10,230A

ELECTRICAL CHARACTERISTICS at +25°C (unless otherwise noted).

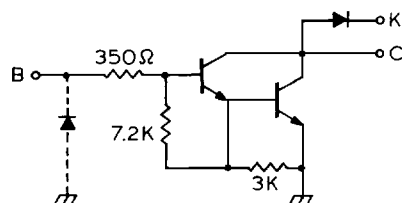
Characteristic	Symbol	Test Fig.	Applicable Devices	Test Conditions	Limits		
					Min.	Max.	Units
Output Leakage Current	I_{CEX}	1	ULN2061M	$V_{CE} = 50 \text{ V}$	—	100	μA
				$V_{CE} = 50 \text{ V}, T_A = 70^\circ\text{C}$	—	500	μA
			ULN2062M	$V_{CE} = 80 \text{ V}$	—	100	μA
				$V_{CE} = 80 \text{ V}, T_A = 70^\circ\text{C}$	—	500	μA
Output Sustaining Voltage	$V_{CE(SUS)}$	2	ULN2061M	$I_C = 100 \text{ mA}, V_{IN} = 0.4 \text{ V}$	35	—	V
			ULN2062M	$I_C = 100 \text{ mA}, V_{IN} = 0.4 \text{ V}$	50	—	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	3	Both	$I_C = 500 \text{ mA}, I_B = 625 \mu\text{A}$	—	1.1	V
				$I_C = 750 \text{ mA}, I_B = 935 \mu\text{A}$	—	1.2	V
				$I_C = 1.0 \text{ A}, I_B = 1.25 \text{ mA}$	—	1.3	V
				$I_C = 1.25 \text{ A}^{**}, I_B = 2.0 \text{ mA}$	—	1.4	V
			ULN2062M	$I_C = 1.5 \text{ A}^{**}, I_B = 2.25 \text{ mA}$	—	1.5	V
Input Current	$I_{IN(ON)}$	4	Both	$V_{IN} = 2.4 \text{ V}$	1.4	4.3	mA
				$V_{IN} = 3.75 \text{ V}$	3.3	9.6	mA
Input Voltage	$V_{IN(ON)}$	5	Both	$V_{CE} = 2.0 \text{ V}, I_C = 1.0 \text{ A}$	—	2.0	V
			ULN2061M	$V_{CE} = 2.0 \text{ V}, I_C = 1.25 \text{ A}^{**}$	—	2.5	V
			ULN2062M	$V_{CE} = 2.0 \text{ V}, I_C = 1.5 \text{ A}^{**}$	—	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	ULN2061M	$V_R = 50 \text{ V}$	—	50	μA
				$V_R = 50 \text{ V}, T_A = 70^\circ\text{C}$	—	100	μA
			ULN2062M	$V_R = 80 \text{ V}$	—	50	μA
				$V_R = 80 \text{ V}, T_A = 70^\circ\text{C}$	—	100	μA
Clamp Diode Forward Voltage	V_F	7	Both	$I_F = 1.0 \text{ A}$	—	1.75	V
				$I_F = 1.5 \text{ A}$	—	2.0	V

**Pulse-Test

2061 THRU 2069

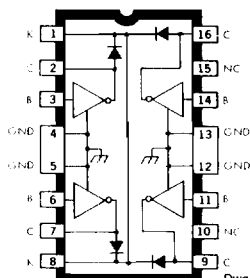
1.5 A DARLINGTON SWITCHES

PARTIAL SCHEMATIC



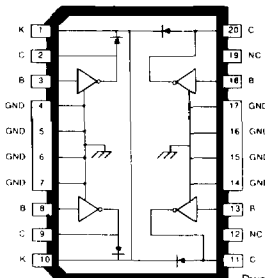
Dwg. No. A-10,353C

ULN2064/65B



Dwg. No. A-9765A

ULN2064LB



Dwg. No. A-14,326

ELECTRICAL CHARACTERISTICS at +25°C (unless otherwise noted).

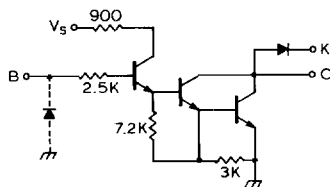
Characteristic	Symbol	Test Fig.	Applicable Devices	Test Conditions	Limits		
					Min.	Max.	Units
Output Leakage Current	I_{CEX}	1	ULN2064*	$V_{CE} = 50 \text{ V}$	—	100	μA
				$V_{CE} = 50 \text{ V}, T_A = 70^\circ\text{C}$	—	500	μA
			ULN2065B	$V_{CE} = 80 \text{ V}$	—	100	μA
				$V_{CE} = 80 \text{ V}, T_A = 70^\circ\text{C}$	—	500	μA
Output Sustaining Voltage	$V_{CE(SUS)}$	2	ULN2064*	$I_C = 100 \text{ mA}, V_{IN} = 0.4 \text{ V}$	35	—	V
			ULN2065B	$I_C = 100 \text{ mA}, V_{IN} = 0.4 \text{ V}$	50	—	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	3	Both	$I_C = 500 \text{ mA}, I_B = 625 \mu\text{A}$	—	1.1	V
				$I_C = 750 \text{ mA}, I_B = 935 \mu\text{A}$	—	1.2	V
				$I_C = 1.0 \text{ A}, I_B = 1.25 \text{ mA}$	—	1.3	V
				$I_C = 1.25 \text{ A}, I_B = 2.0 \text{ mA}$	—	1.4	V
			ULN2065B	$I_C = 1.5 \text{ A}, I_B = 2.25 \text{ mA}$	—	1.5	V
Input Current	$I_{IN(ON)}$	4	Both	$V_{IN} = 2.4 \text{ V}$	1.4	4.3	mA
				$V_{IN} = 3.75 \text{ V}$	3.3	9.6	mA
Input Voltage	$V_{IN(ON)}$	5	Both	$V_{CE} = 2.0 \text{ V}, I_C = 1.0 \text{ A}$	—	2.0	V
			ULN2064*	$V_{CE} = 2.0 \text{ V}, I_C = 1.25 \text{ A}$	—	2.5	V
			ULN2065B	$V_{CE} = 2.0 \text{ V}, I_C = 1.5 \text{ A}$	—	2.5	V
Turn-On Delay	t_{PLH}	—	Both	$0.5 E_{in} \text{ to } 0.5 E_{out}$	—	1.0	μs
Turn-Off Delay	t_{PHL}	—	Both	$0.5 E_{in} \text{ to } 0.5 E_{out}$	—	1.5	μs
Clamp Diode Leakage Current	I_R	6	ULN2064*	$V_R = 50 \text{ V}$	—	50	μA
				$V_R = 50 \text{ V}, T_A = 70^\circ\text{C}$	—	100	μA
			ULN2065B	$V_R = 80 \text{ V}$	—	50	μA
				$V_R = 80 \text{ V}, T_A = 70^\circ\text{C}$	—	100	μA
Clamp Diode Forward Voltage	V_F	7	Both	$I_F = 1.0 \text{ A}$	—	1.75	V
				$I_F = 1.5 \text{ A}$	—	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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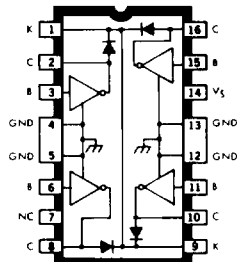
1.5 A DARLINGTON SWITCHES

PARTIAL SCHEMATIC



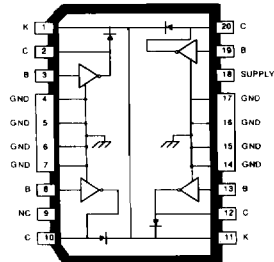
Dwg. No. A-10,354C

ULN2068/69B



Dwg. No. A-10,310

ULN2068LB



Dwg. No. A-14,327

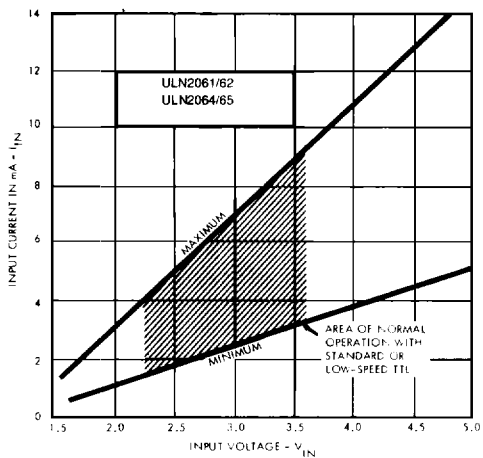
ELECTRICAL CHARACTERISTICS at +25°C, $V_S = 5.0$ V (unless otherwise noted).

Characteristic	Symbol	Test Fig.	Applicable Devices	Test Conditions	Limits		
					Min.	Max.	Units
Output Leakage Current	I_{CEX}	1	ULN2068*	$V_{CE} = 50$ V	—	100	μ A
				$V_{CE} = 50$ V, $T_A = 70^\circ\text{C}$	—	500	μ A
			ULN2069B	$V_{CE} = 80$ V	—	100	μ A
				$V_{CE} = 80$ V, $T_A = 70^\circ\text{C}$	—	500	μ A
Output Sustaining Voltage	$V_{CE(SUS)}$	2	ULN2068*	$I_C = 100$ mA, $V_{IN} = 0.4$ V	35	—	V
			ULN2069B	$I_C = 100$ mA, $V_{IN} = 0.4$ V	50	—	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	3	Both	$I_C = 500$ mA, $V_{IN} = 2.75$ V	—	1.1	V
				$I_C = 750$ mA, $V_{IN} = 2.75$ V	—	1.2	V
				$I_C = 1.0$ A, $V_{IN} = 2.75$ V	—	1.3	V
				$I_C = 1.25$ A, $V_{IN} = 2.75$ V	—	1.4	V
			ULN2069B	$I_C = 1.5$ A, $V_{IN} = 2.75$ V	—	1.5	V
Input Current	$I_{IN(ON)}$	4	Both	$V_{IN} = 2.75$ V	—	550	μ A
				$V_{IN} = 3.75$ V	—	1000	μ A
Input Voltage	$V_{IN(ON)}$	5	ULN2068*	$V_{CE} = 2.0$ V, $I_C = 1.25$ A	—	2.75	V
			ULN2069B	$V_{CE} = 2.0$ 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	μ s
Turn-Off Delay	t_{PHL}	—	Both	$0.5 E_{in}$ to $0.5 E_{out}$, $I_C = 1.25$ A	—	1.5	μ s
Clamp Diode Leakage Current	I_R	6	ULN2068*	$V_R = 50$ V	—	50	μ A
				$V_R = 50$ V, $T_A = 70^\circ\text{C}$	—	100	μ A
			ULN2069B	$V_R = 80$ V	—	50	μ A
				$V_R = 80$ V, $T_A = 70^\circ\text{C}$	—	100	μ A
Clamp Diode Forward Voltage	V_F	7	Both	$I_F = 1.0$ A	—	1.75	V
				$I_F = 1.5$ A	—	2.0	V

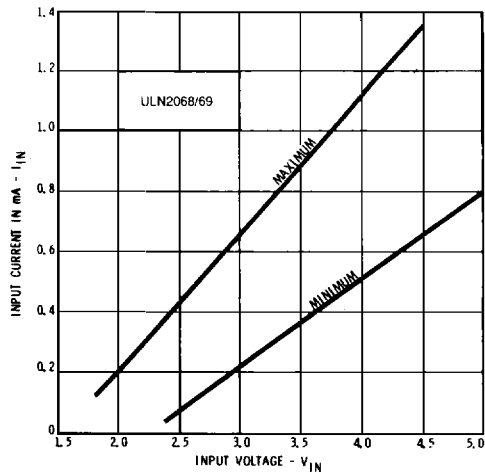
*Complete part number includes suffix to identify package style: B = DIP with heat sink tabs, LB = SOIC with heat sink tabs.

2061 THRU 2069 1.5 A DARLINGTON SWITCHES

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

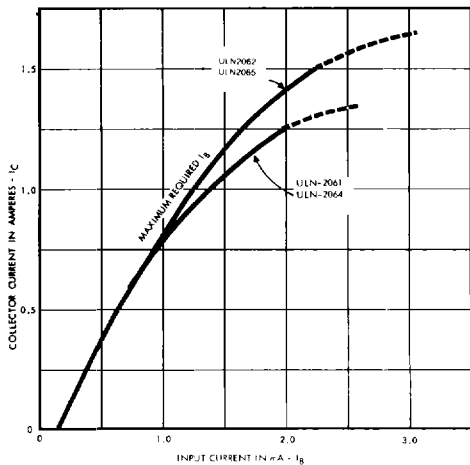


Dwg. No. A-10.363C

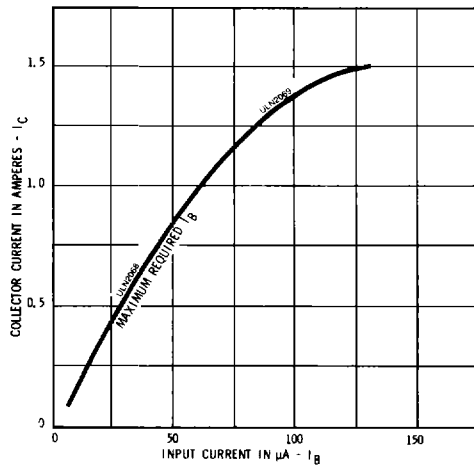


Dwg. No. A-12.306A

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



Dwg. No. A-10.358C

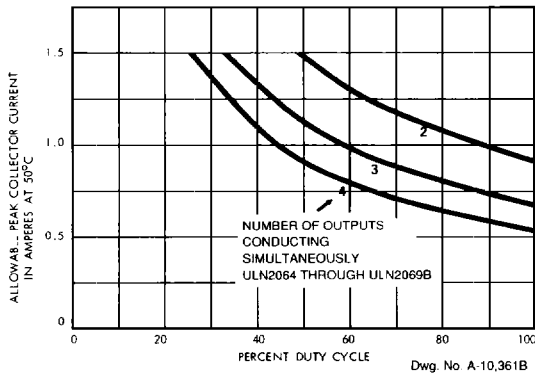
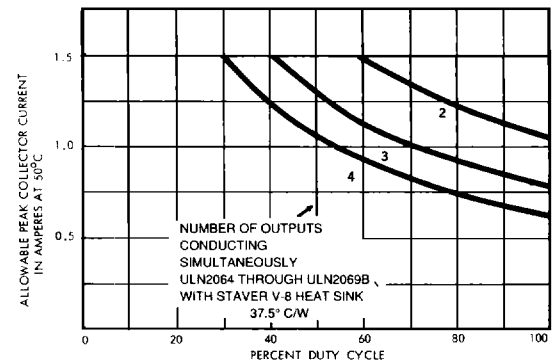
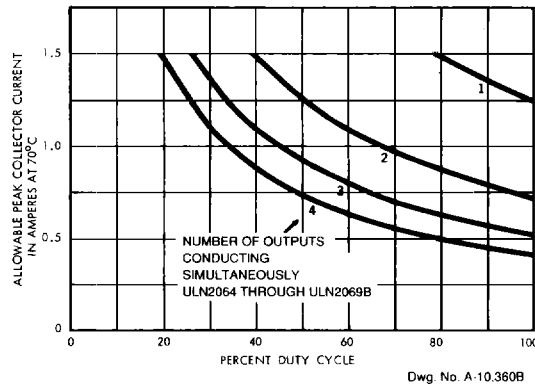
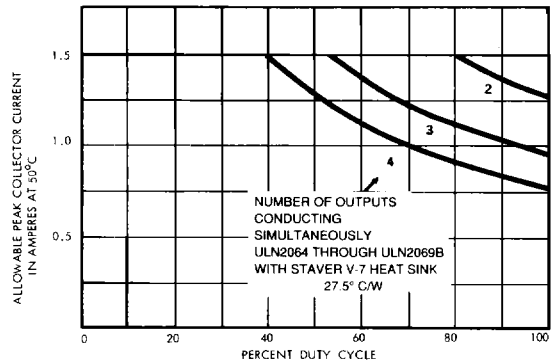
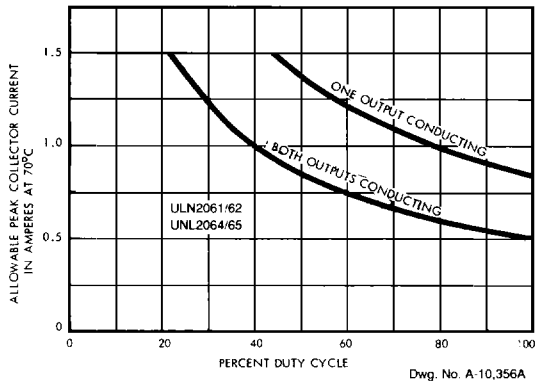


Dwg. No. A-12.306A

2061 THRU 2069

1.5 A DARLINGTON SWITCHES

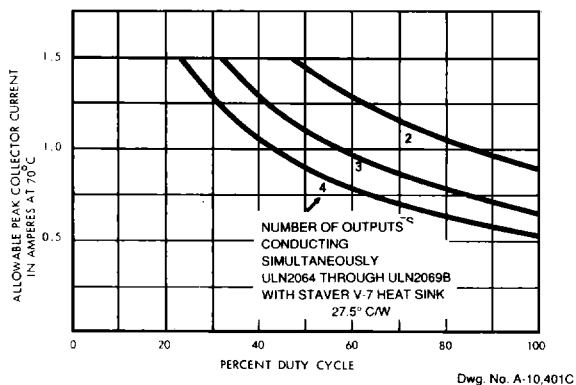
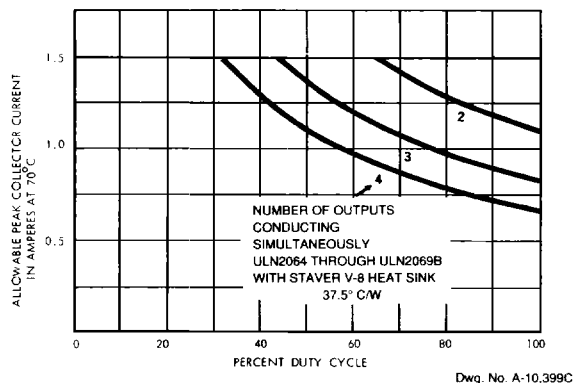
PEAK COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE (DUAL IN-LINE PACKAGED DEVICES)



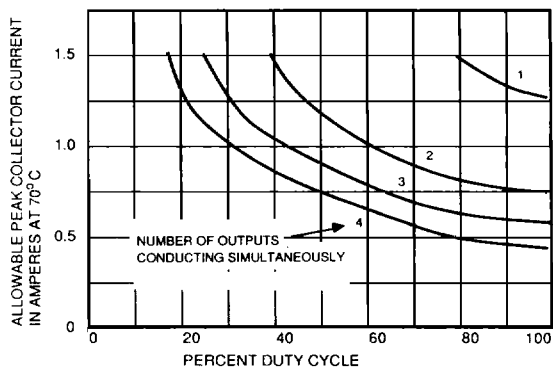
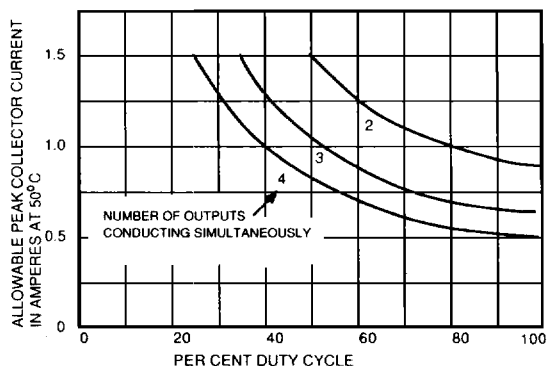
2061 THRU 2069

1.5 A DARLINGTON SWITCHES

PEAK COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE (DUAL IN-LINE PACKAGED DEVICES, cont'd)



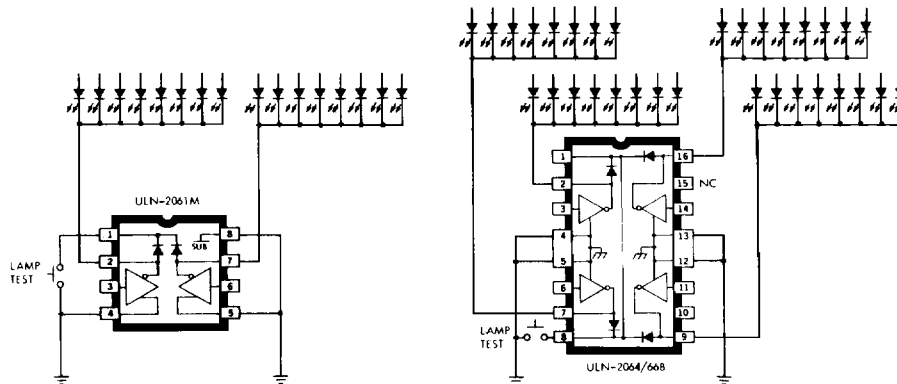
(ULN2064LB and ULN2068LB only)



2061 THRU 2069

1.5 A DARLINGTON SWITCHES

TYPICAL APPLICATION



Dwg. No. B-1365

COMMON-CATHODE LED DRIVERS

(Type ULN2068B/LB is also applicable)