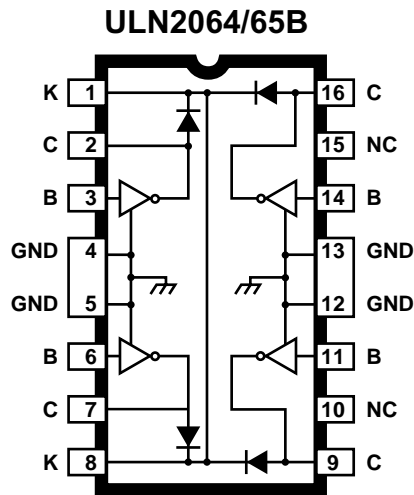


# 2064 THRU 2069

Data Sheet  
29305H†

## QUAD 1.5 A DARLINGTON SWITCHES



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, $V_{IN}$ .....	See Guide
Input Current, $I_B$ (Note 2) .....	25 mA
Supply Voltage, $V_S$ (ULN2068B/LB & 2069B/LB) ...	10 V
Total Package Power Dissipation, $P_D$ .....	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 the following pages.
2. Input current may be limited by maximum allowable input voltage.

High-voltage, high-current Darlington arrays ULN2064B/LB through ULN2069B/LB 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. These 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.

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). 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

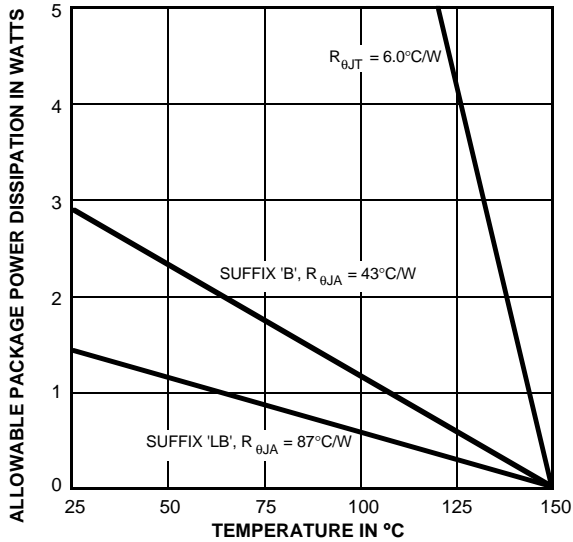
- TTL, DTL, MOS, CMOS Compatible Inputs
- Transient-Protected Outputs
- Loads to 480 Watts
- Heat-Sink Contact Tabs
- Automotive Capable

Always order by complete part number, e.g., **ULN2068B**.



# 2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

## SELECTION GUIDE



Dwg. GP-049-3A

Part Number*	Max. $V_{CEX}$	Min. $V_{CE(SUS)}$	Max. $V_{IN}$	Application
ULN2064B ULN2064LB	50 V	35 V	15 V	TTL, DTL, Schottky TTL, and 5 V CMOS
ULN2065B ULN2065LB	80 V	50 V	15 V	
ULN2068B ULN2068LB	50 V	35 V	15 V	TTL, DTL, Schottky TTL, and 5 V CMOS
ULN2069B ULN2069LB	80 V	50 V	15 V	

\* Suffix 'B' is a 16-pin DIP; 'LB' is a 20-lead SOIC.

## TEST FIGURES

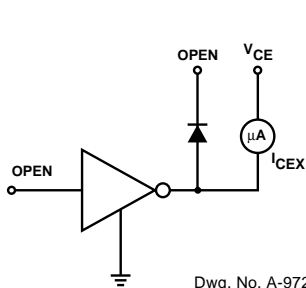


FIGURE 1

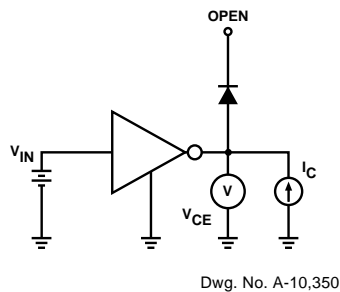


FIGURE 2

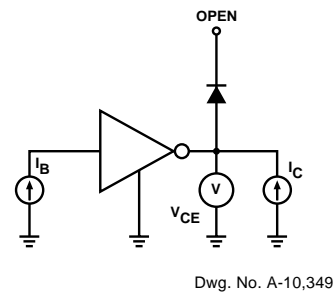


FIGURE 3

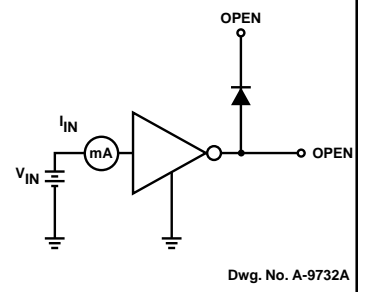


FIGURE 4

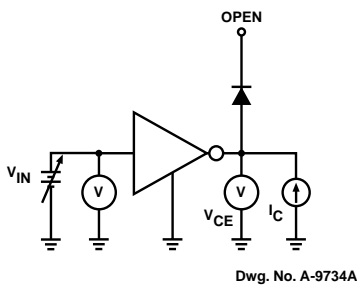


FIGURE 5

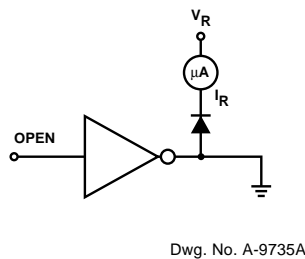


FIGURE 6

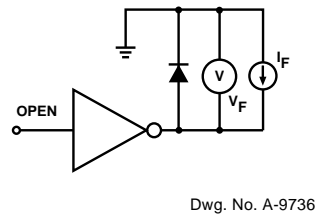


FIGURE 7

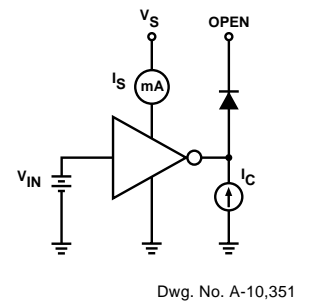
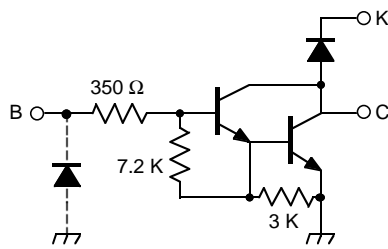


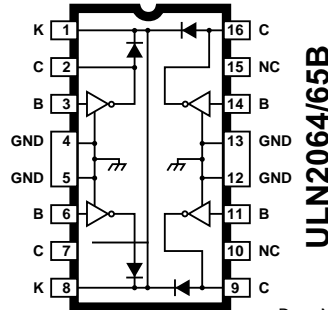
FIGURE 8

# 2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

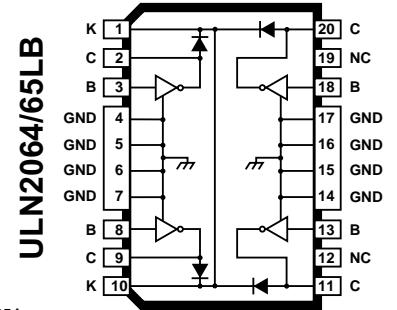
## PARTIAL SCHEMATIC



Dwg. FP-052



Dwg. No. A-9765A



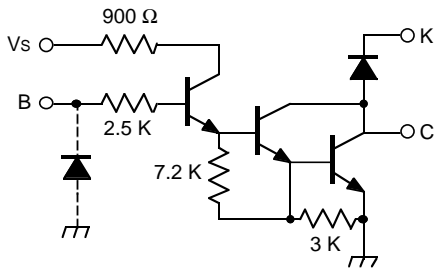
Dwg. No. A-14,326

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

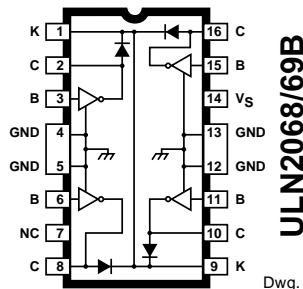
Characteristic	Symbol	Test Fig.	Applicable Devices	Test Conditions	Limits		
					Min.	Max.	Units
Output Leakage Current	$I_{CEX}$	1	ULN2064B/LB	$V_{CE} = 50 \text{ V}$	—	100	$\mu\text{A}$
				$V_{CE} = 50 \text{ V}, T_A = 70^\circ\text{C}$	—	500	$\mu\text{A}$
			ULN2065B/LB	$V_{CE} = 80 \text{ V}$	—	100	$\mu\text{A}$
				$V_{CE} = 80 \text{ V}, T_A = 70^\circ\text{C}$	—	500	$\mu\text{A}$
Output Sustaining Voltage	$V_{CE(SUS)}$	2	ULN2064B/LB	$I_C = 100 \text{ mA}, V_{IN} = 0.4 \text{ V}$	35	—	V
			ULN2065B/LB	$I_C = 100 \text{ mA}, V_{IN} = 0.4 \text{ V}$	50	—	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	3	All	$I_C = 500 \text{ mA}, I_B = 625 \mu\text{A}$	—	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/LB	$I_C = 1.5 \text{ A}, I_B = 2.25 \text{ mA}$	—	1.5	V
Input Current	$I_{IN(ON)}$	4	All	$V_{IN} = 2.4 \text{ V}$	1.4	4.3	mA
				$V_{IN} = 3.75 \text{ V}$	3.3	9.6	mA
Input Voltage	$V_{IN(ON)}$	5	All	$V_{CE} = 2.0 \text{ V}, I_C = 1.0 \text{ A}$	—	2.0	V
			ULN2064B/LB	$V_{CE} = 2.0 \text{ V}, I_C = 1.25 \text{ A}$	—	2.5	V
			ULN2065B/LB	$V_{CE} = 2.0 \text{ V}, I_C = 1.5 \text{ A}$	—	2.5	V
Turn-On Delay	$t_{PLH}$	—	All	$0.5 E_{in}$ to $0.5 E_{out}$	—	1.0	$\mu\text{s}$
Turn-Off Delay	$t_{PHL}$	—	All	$0.5 E_{in}$ to $0.5 E_{out}$	—	1.5	$\mu\text{s}$
Clamp Diode Leakage Current	$I_R$	6	ULN2064B/LB	$V_R = 50 \text{ V}$	—	50	$\mu\text{A}$
				$V_R = 50 \text{ V}, T_A = 70^\circ\text{C}$	—	100	$\mu\text{A}$
			ULN2065B/LB	$V_R = 80 \text{ V}$	—	50	$\mu\text{A}$
				$V_R = 80 \text{ V}, T_A = 70^\circ\text{C}$	—	100	$\mu\text{A}$
Clamp Diode Forward Voltage	$V_F$	7	All	$I_F = 1.0 \text{ A}$	—	1.75	V
				$I_F = 1.5 \text{ A}$	—	2.0	V

# 2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

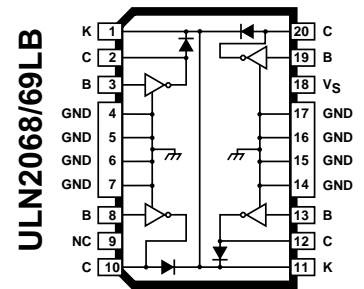
## PARTIAL SCHEMATIC



Dwg. FP-052-1



Dwg. No. A-10,310



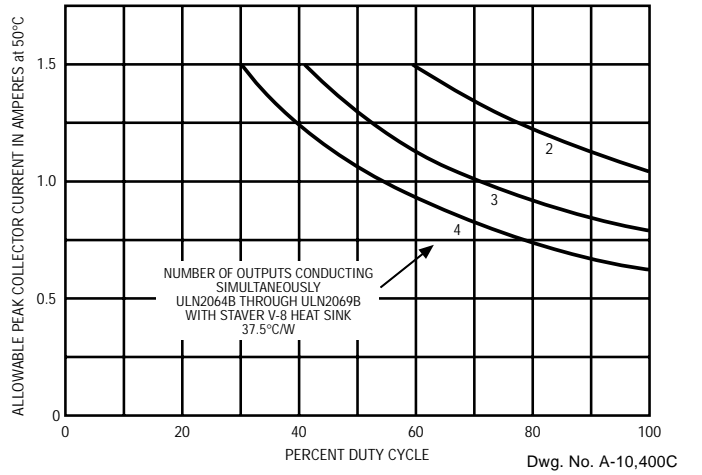
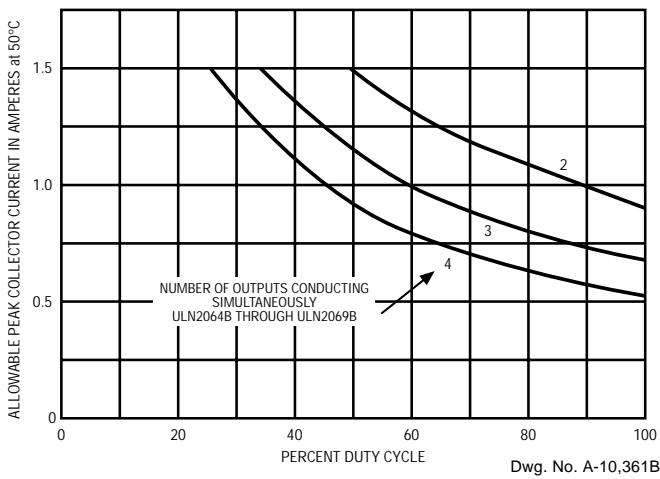
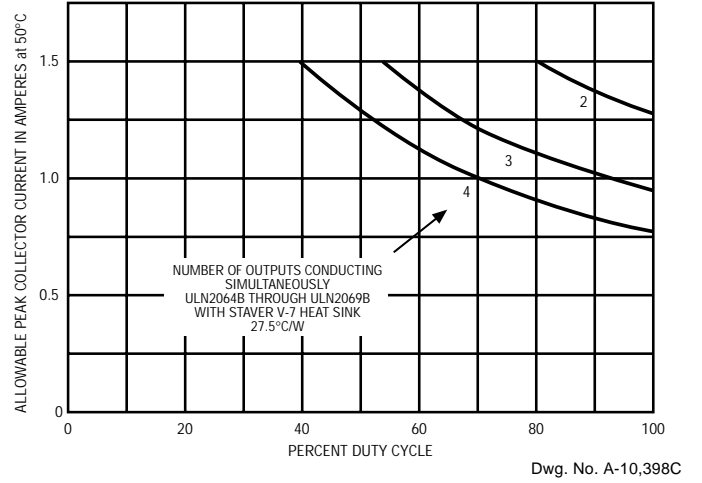
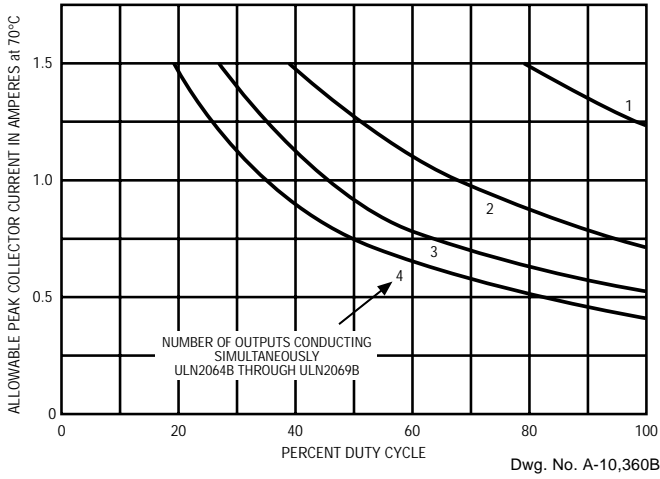
Dwg. No. A-14,327

## ELECTRICAL CHARACTERISTICS at +25°C, $V_S = 5.0\text{ V}$ (unless otherwise noted).

Characteristic	Symbol	Test Fig.	Applicable Devices	Test Conditions	Limits		
					Min.	Max.	Units
Output Leakage Current	$I_{CEX}$	1	ULN2068B/LB	$V_{CE} = 50\text{ V}$	—	100	$\mu\text{A}$
				$V_{CE} = 50\text{ V}, T_A = 70^\circ\text{C}$	—	500	$\mu\text{A}$
			ULN2069B/LB	$V_{CE} = 80\text{ V}$	—	100	$\mu\text{A}$
				$V_{CE} = 80\text{ V}, T_A = 70^\circ\text{C}$	—	500	$\mu\text{A}$
Output Sustaining Voltage	$V_{CE(SUS)}$	2	ULN2068B/LB	$I_C = 100\text{ mA}, V_{IN} = 0.4\text{ V}$	35	—	V
			ULN2069B/LB	$I_C = 100\text{ mA}, V_{IN} = 0.4\text{ V}$	50	—	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	3	All	$I_C = 500\text{ mA}, V_{IN} = 2.75\text{ V}$	—	1.1	V
				$I_C = 750\text{ mA}, V_{IN} = 2.75\text{ V}$	—	1.2	V
				$I_C = 1.0\text{ A}, V_{IN} = 2.75\text{ V}$	—	1.3	V
				$I_C = 1.25\text{ A}, V_{IN} = 2.75\text{ V}$	—	1.4	V
			ULN2069B/LB	$I_C = 1.5\text{ A}, V_{IN} = 2.75\text{ V}$	—	1.5	V
Input Current	$I_{IN(ON)}$	4	All	$V_{IN} = 2.75\text{ V}$	—	550	$\mu\text{A}$
				$V_{IN} = 3.75\text{ V}$	—	1000	$\mu\text{A}$
Input Voltage	$V_{IN(ON)}$	5	ULN2068B/LB	$V_{CE} = 2.0\text{ V}, I_C = 1.25\text{ A}$	—	2.75	V
			ULN2069B	$V_{CE} = 2.0\text{ V}, I_C = 1.5\text{ A}$	—	2.75	V
Supply Current	$I_S$	8	All	$I_C = 500\text{ mA}, V_{IN} = 2.75\text{ V}$	—	6.0	mA
Turn-On Delay	$t_{PLH}$	—	All	$0.5 E_{in}$ to $0.5 E_{out}$	—	1.0	$\mu\text{s}$
Turn-Off Delay	$t_{PHL}$	—	All	$0.5 E_{in}$ to $0.5 E_{out}, I_C = 1.25\text{ A}$	—	1.5	$\mu\text{s}$
Clamp Diode Leakage Current	$I_R$	6	ULN2068B/LB	$V_R = 50\text{ V}$	—	50	$\mu\text{A}$
				$V_R = 50\text{ V}, T_A = 70^\circ\text{C}$	—	100	$\mu\text{A}$
			ULN2069B/LB	$V_R = 80\text{ V}$	—	50	$\mu\text{A}$
				$V_R = 80\text{ V}, T_A = 70^\circ\text{C}$	—	100	$\mu\text{A}$
Clamp Diode Forward Voltage	$V_F$	7	All	$I_F = 1.0\text{ A}$	—	1.75	V
				$I_F = 1.5\text{ A}$	—	2.0	V

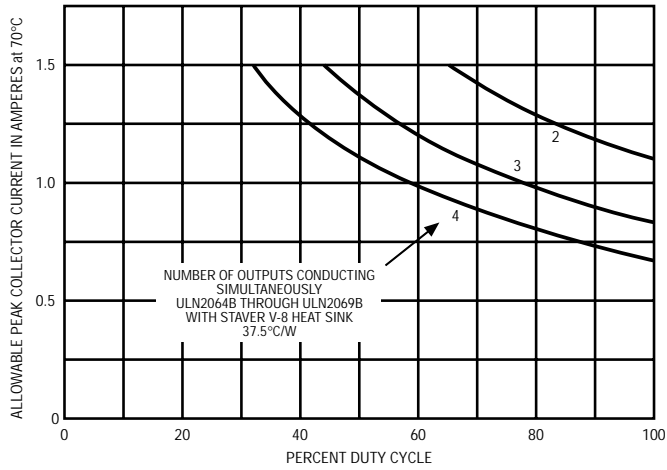
# 2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

## PEAK COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE (Dual in-line packaged devices)

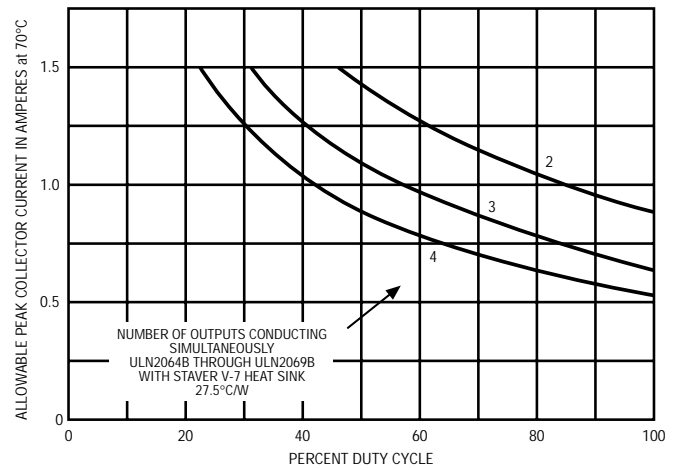


# 2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

## PEAK COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE (Dual in-line packaged devices)

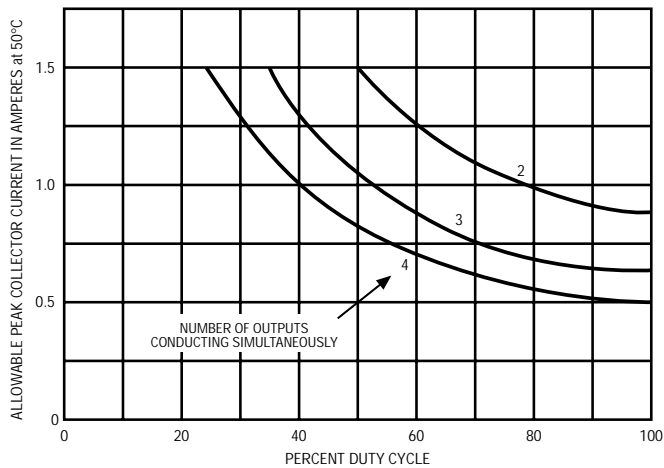


Dwg. No. A-10,399C

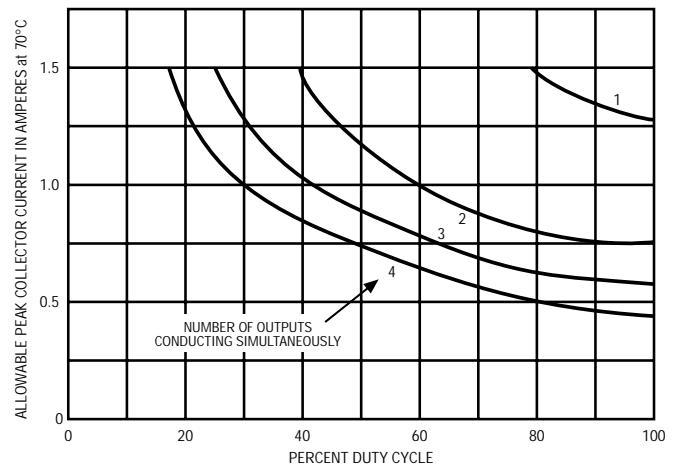


Dwg. No. A-10,401C

## PEAK COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE (SOIC packaged devices)



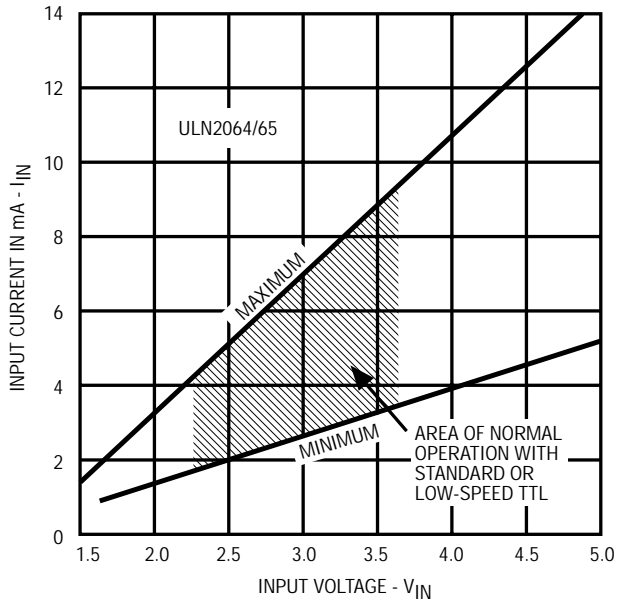
Dwg. GP-045



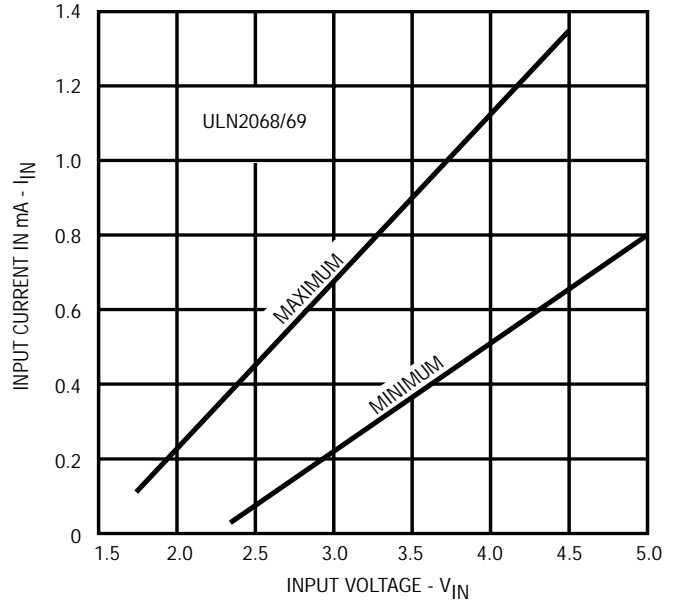
Dwg. GP-045-1

# 2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

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

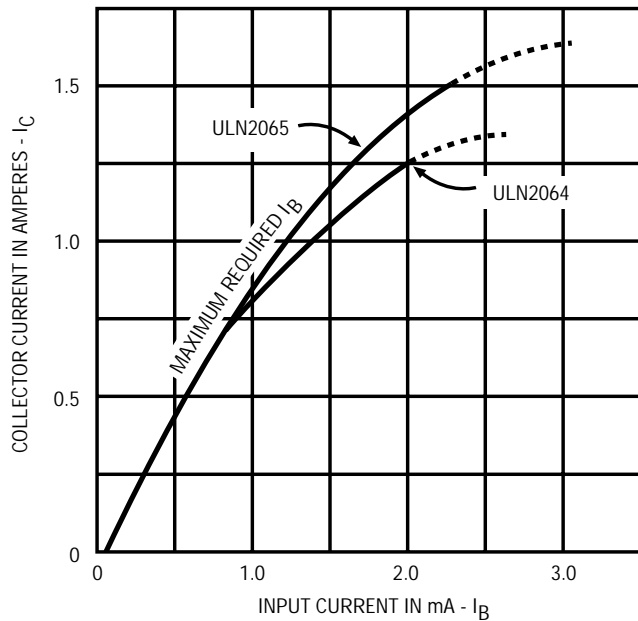


Dwg. No. A-10,363C

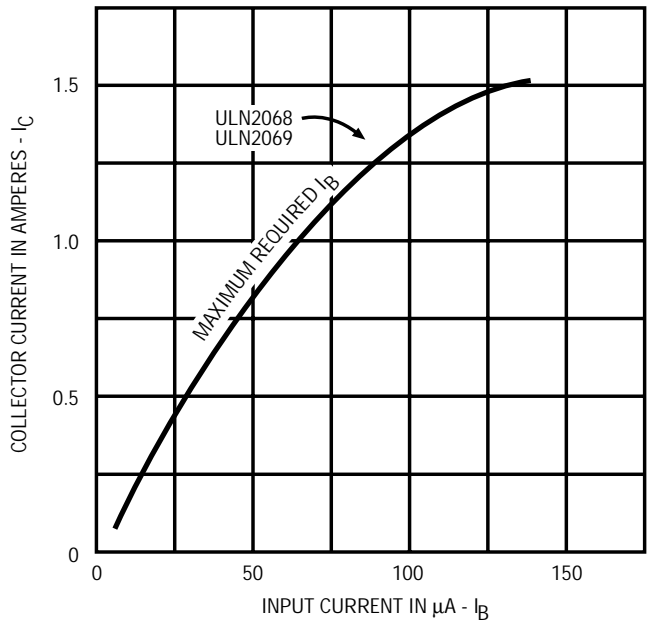


Dwg. No. A-12,306A

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



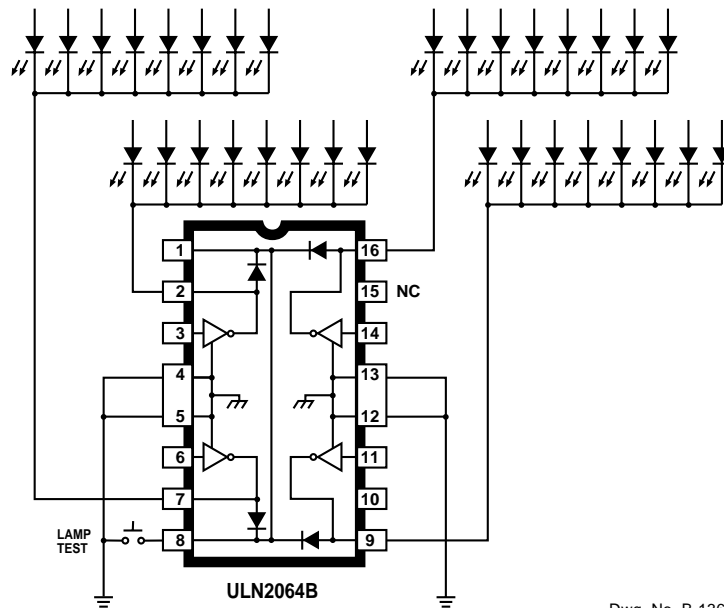
Dwg. No. A-10,358C



Dwg. No. A-12,305A

**2064 THRU 2069**  
**QUAD 1.5 A DARLINGTON**  
**SWITCHES**

**TYPICAL APPLICATION**



Dwg. No. B-1365

**COMMON-CATHODE LED DRIVERS**

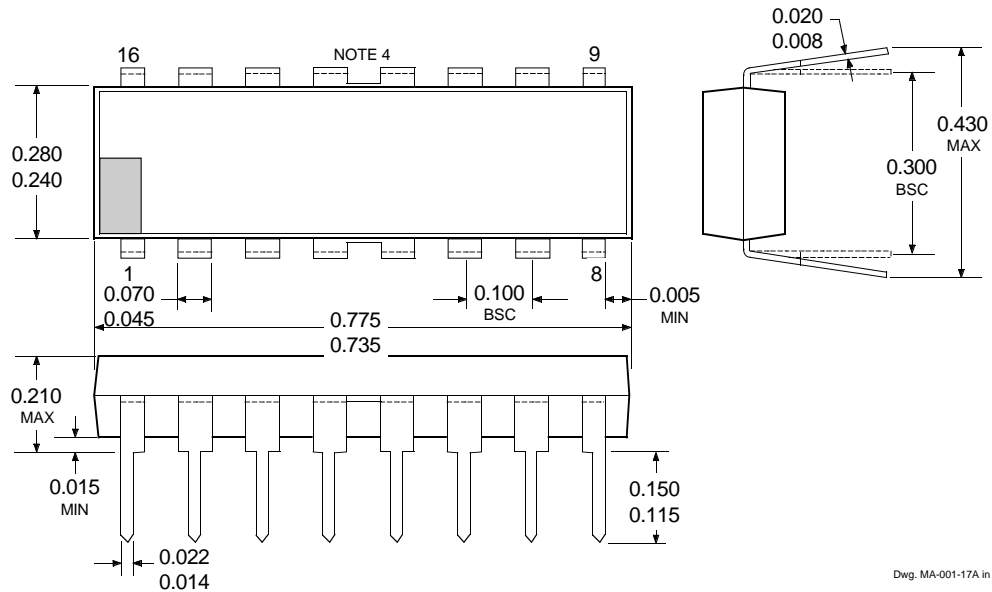
(Types ULN2065B, ULN2065LB, ULN2068B, and ULN2068LB are also applicable)



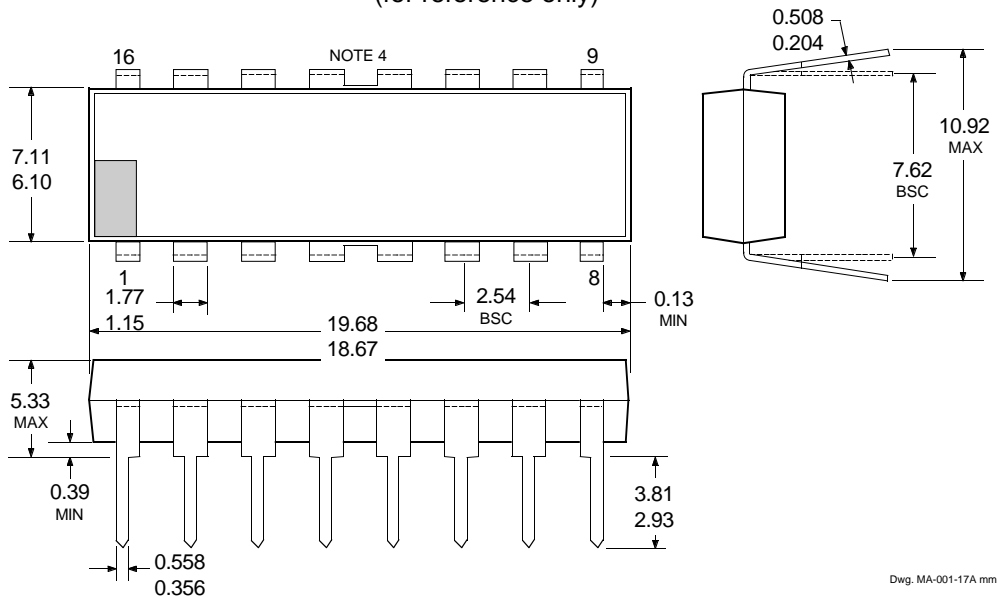
# 2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

## ULN2064B, ULN2065B, ULN2068B, and ULN2069B

### Dimensions in Inches (controlling dimensions)



### Dimensions in Millimeters (for reference only)

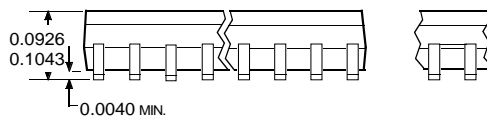
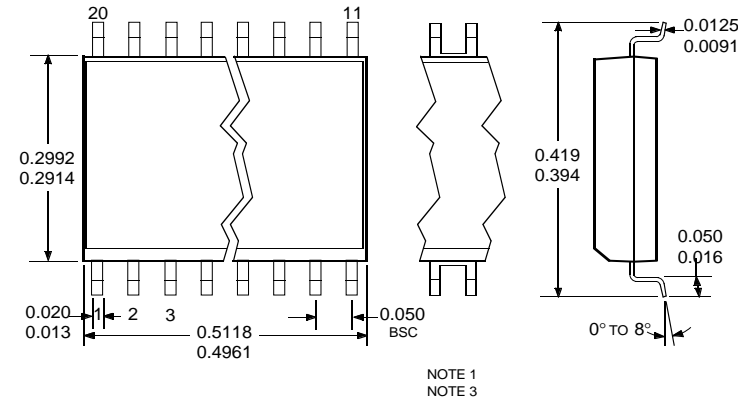


- NOTES:
1. Exact body and lead configuration at vendor's option within limits shown.
  2. Lead spacing tolerance is non-cumulative.
  3. Lead thickness is measured at seating plane or below.
  4. Webbed lead frame. Leads 4, 5, 12, and 13 are internally one piece.
  5. Supplied in standard sticks/tubes of 25 devices.

**2064 THRU 2069**  
**QUAD 1.5 A DARLINGTON**  
**SWITCHES**

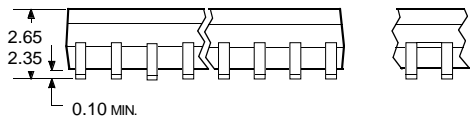
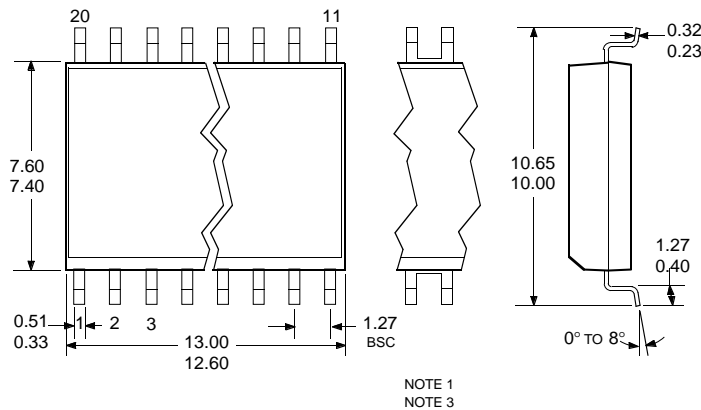
**ULN2064LB, ULN2065LB, ULN2068LB, and ULN2069LB**  
 (add "TR" to part number for tape and reel)

**Dimensions in Inches**  
 (for reference only)



Dwg. MA-008-21A in

**Dimensions in Millimeters**  
 (controlling dimensions)



Dwg. MA-008-21A mm

- NOTES:
1. Exact body and lead configuration at vendor's option within limits shown.
  2. Lead spacing tolerance is non-cumulative.
  3. Webbed lead frame. Leads 4 through 7 and 14 through 17 are internally one piece.
  4. Lead thickness is measured at seating plane or below.
  5. Supplied in standard sticks/tubes of 37 devices or add "TR" to part number for tape and reel.

**2064 THRU 2069**  
**QUAD 1.5 A DARLINGTON**  
**SWITCHES**

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**2064 THRU 2069**  
**QUAD 1.5 A DARLINGTON**  
**SWITCHES**

**POWER SINK DRIVERS**

IN ORDER OF 1) OUTPUT CURRENT, 2) OUTPUT VOLTAGE, 3) NUMBER OF DRIVERS

Output Ratings *			Features					Part Number †	
mA	V	#	Serial Input	Latched Drivers	Diode Clamp	Outputs	Internal Protection		
75	17	8	X	X	–	constant current	–	6275	
	17	16	X	X	–	constant current	–	6276	
100	20	8	–	–	–	saturated	–	2595	
	30	32	X	X	–	–	–	5833	
	40	32	X	X	–	saturated	–	5832	
	50	8	addressable decoder/driver			–	DMOS	–	6B259
	50	8	–	X	–	DMOS	–	6B273	
50	8	X	X	–	DMOS	–	6B595		
120	24	8	X	X	–	constant current	–	6277	
250	50	8	addressable decoder/driver			–	DMOS	–	6259
	50	8	–	X	–	DMOS	–	6273	
	50	8	X	X	–	DMOS	–	6595	
50	8	8	–	–	X	saturated	–	2596	
	60	4	–	–	X	saturated	X	2557	
350	50	4	–	X	X	–	–	5800	
	50	7	–	–	X	–	–	2003	
	50	7	–	–	X	–	–	2004	
	50	8	–	–	X	–	–	2803	
	50	8	–	X	X	–	–	5801	
	50	8	X	X	–	–	–	5821	
	50	8	X	X	X	–	–	5841	
	50	8	addressable decoder/driver			–	DMOS	–	6A259
	50	8	X	X	–	DMOS	–	6A595	
	80	8	X	X	–	–	–	5822	
	80	8	X	X	X	–	–	5842	
	95	7	–	–	X	–	–	2023	
	95	7	–	–	X	–	–	2024	
450	30	28	dual 4- to 14-line decoder/driver			–	–	6817	
600	60	4	–	–	–	saturated	X	2547	
	60	4	–	–	X	saturated	X	2549 and 2559	
700	60	4	–	–	X	saturated	X	2543	
750	50	8	–	–	X	saturated	–	2597	
1000	46	4	stepper motor controller/driver			MOS	–	7024 and 7029	
1200	46	4	microstepping controller/driver			MOS	–	7042	
1250	50	4	stepper motor translator/driver			–	X	5804	
1800	50	4	–	–	X	–	–	2540	
3000	46	4	stepper motor controller/driver			MOS	–	7026	
	46	4	microstepping controller/driver			MOS	–	7044	
4000	50	4	–	–	X	–	–	2878	

\* Current is maximum specified test condition, voltage is maximum rating. See specification for sustaining voltage limits or over-current protection voltage limits.

† Complete part number includes additional characters to indicate operating temperature range and package style.