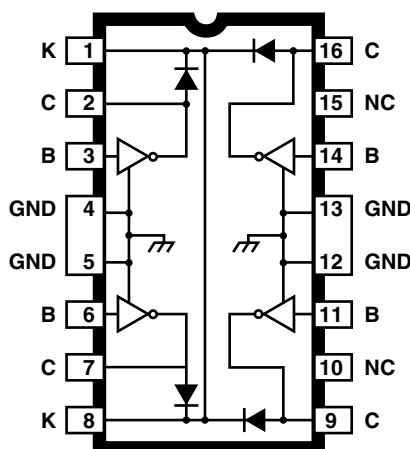


2064 THRU 2069

Data Sheet
29305H†

QUAD 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}	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').

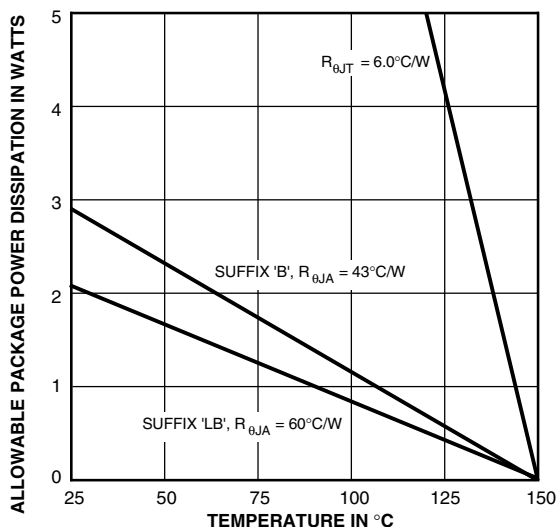
FEATURES

- 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., **ULN2064B**.

2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

SELECTION GUIDE



Dwg. GP-049-3

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

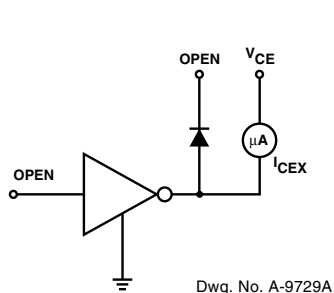


FIGURE 1

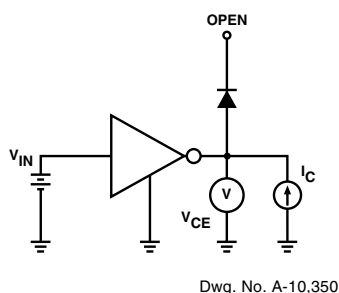


FIGURE 2

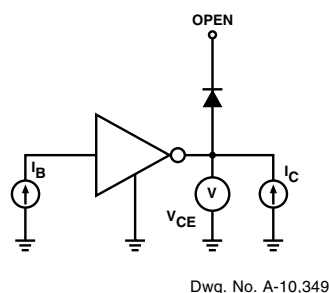


FIGURE 3

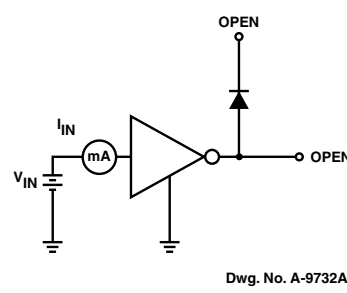


FIGURE 4

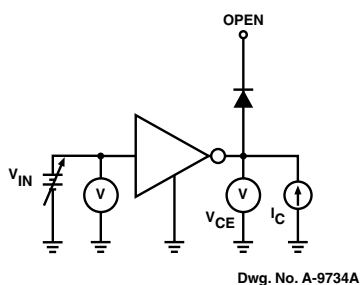


FIGURE 5

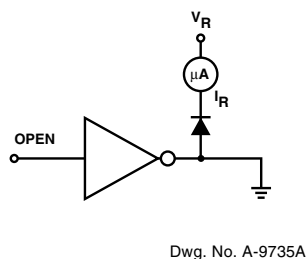


FIGURE 6

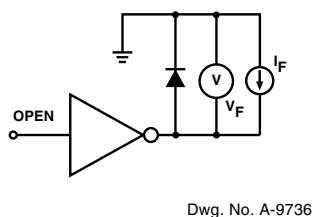


FIGURE 7

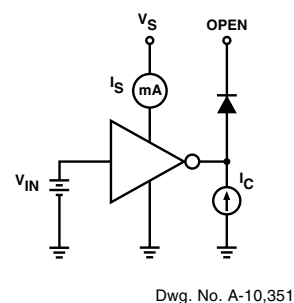
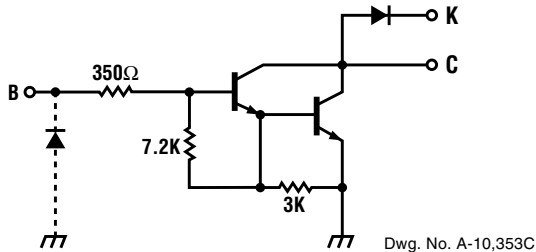
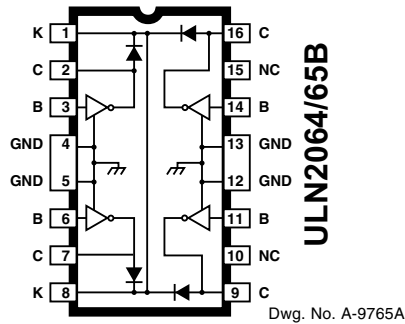
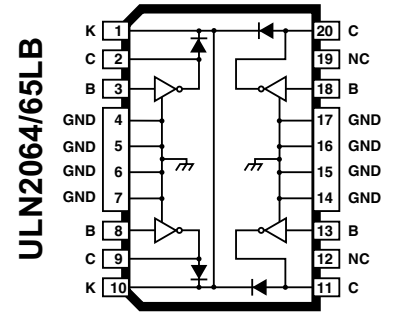


FIGURE 8

2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

PARTIAL SCHEMATIC



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

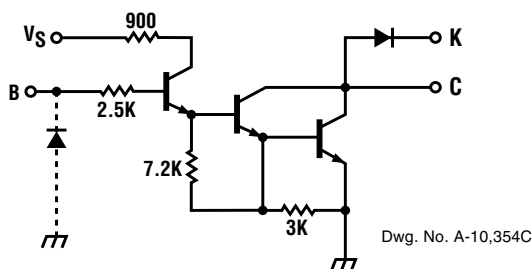
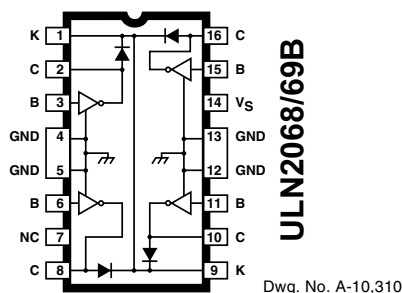
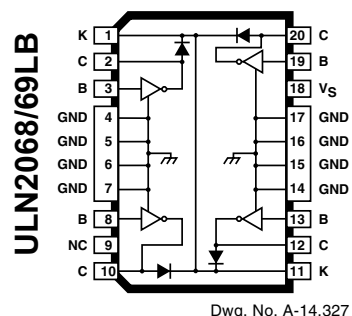
Characteristic	Symbol	Test Fig.	Applicable Devices	Test Conditions	Limits		
					Min.	Max.	Units
Output Leakage Current	I_{CEX}	1	ULN2064B/LB	$V_{CE} = 50 \text{ V}$	—	100	μA
				$V_{CE} = 50 \text{ V}, T_A = 70^\circ\text{C}$	—	500	μA
			ULN2065B/LB	$V_{CE} = 80 \text{ V}$	—	100	μA
				$V_{CE} = 80 \text{ V}, T_A = 70^\circ\text{C}$	—	500	μA
Output Sustaining Voltage	$V_{CE(SUS)}$	2	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	$0.5 E_{in} \text{ to } 0.5 E_{out}$	—	1.0	μs
Turn-Off Delay	t_{PHL}	—	All	$0.5 E_{in} \text{ to } 0.5 E_{out}$	—	1.5	μs
Clamp Diode Leakage Current	I_R	6	ULN2064B/LB	$V_R = 50 \text{ V}$	—	50	μA
				$V_R = 50 \text{ V}, T_A = 70^\circ\text{C}$	—	100	μA
			ULN2065B/LB	$V_R = 80 \text{ V}$	—	50	μA
				$V_R = 80 \text{ V}, T_A = 70^\circ\text{C}$	—	100	μA
Clamp Diode Forward Voltage	V_F	7	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

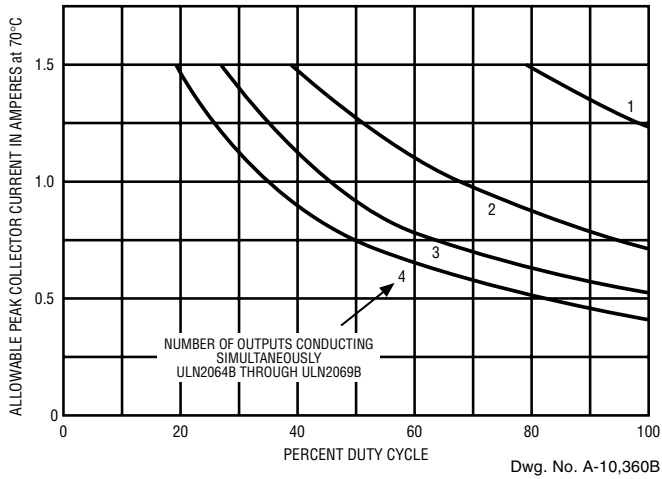
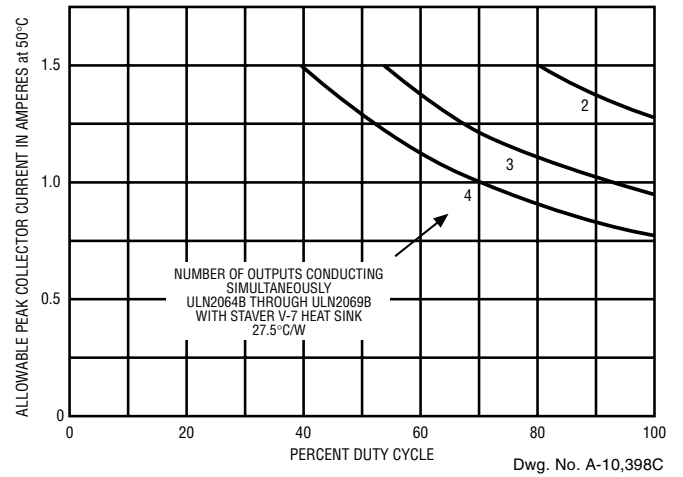
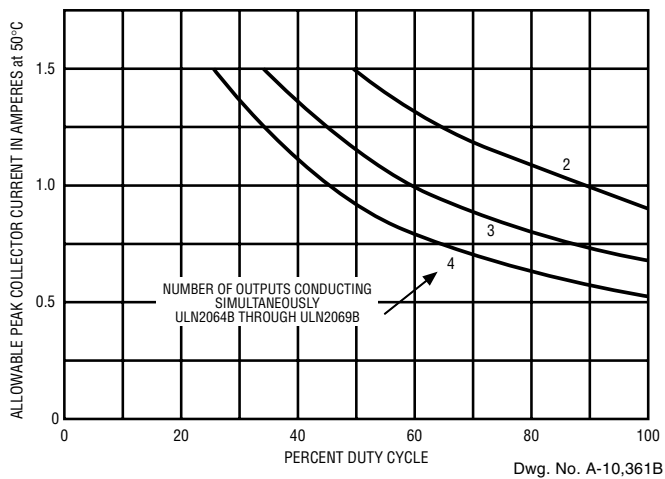
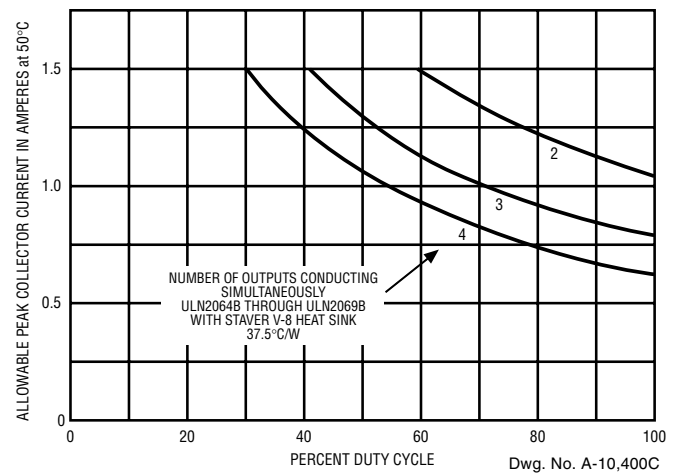


ELECTRICAL CHARACTERISTICS at +25°C, $V_S = 5.0$ V (unless otherwise noted).

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

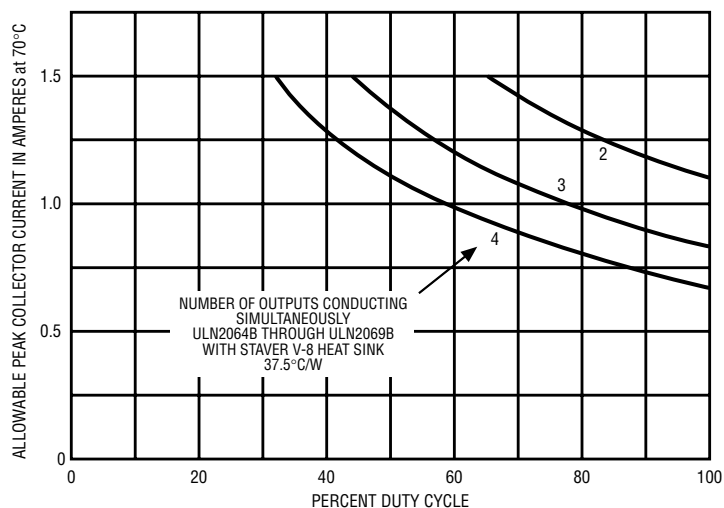
2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

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

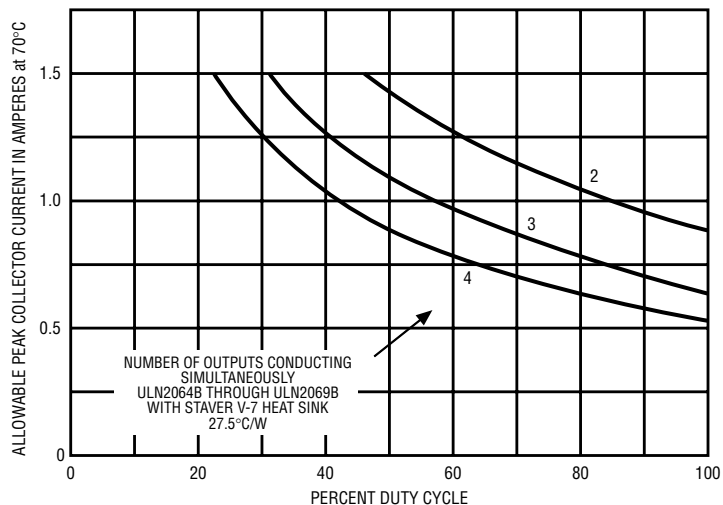


2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

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

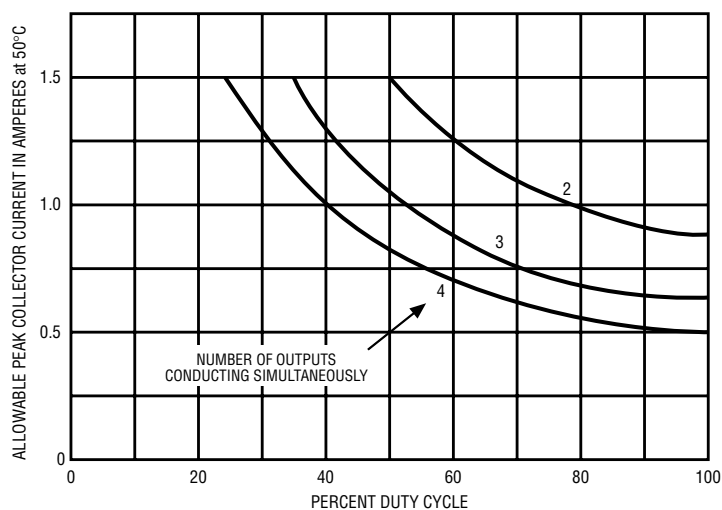


Dwg. No. A-10,399C

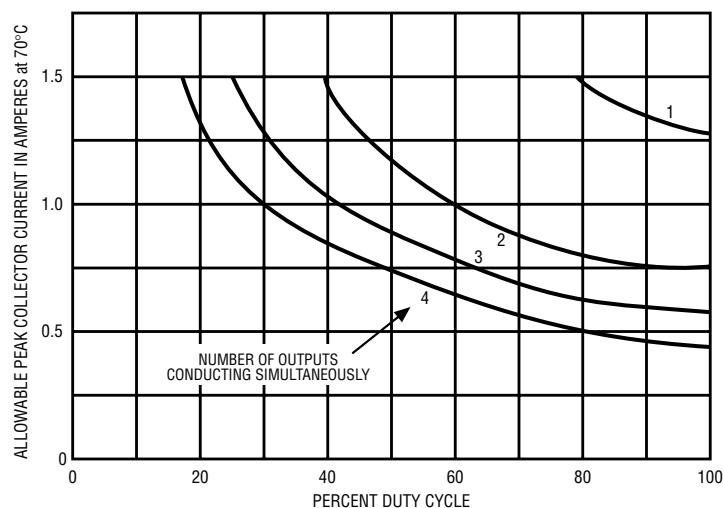


Dwg. No. A-10,401C

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



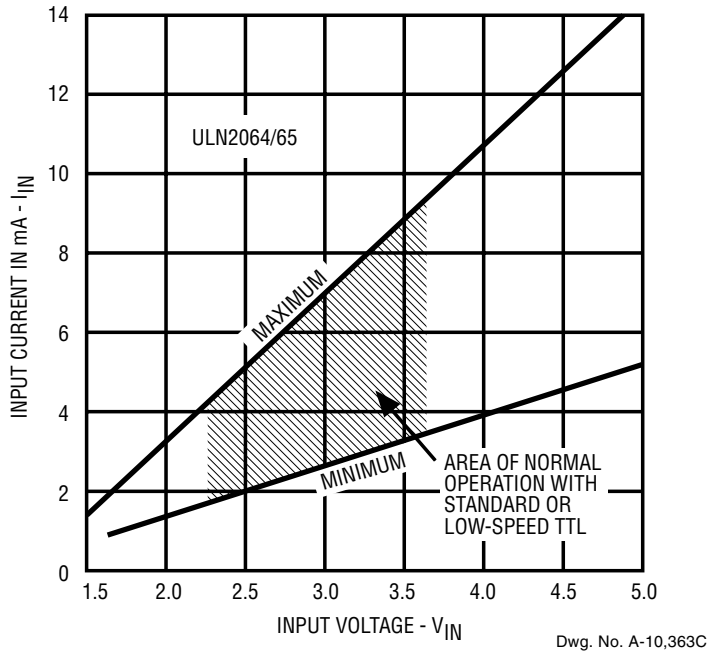
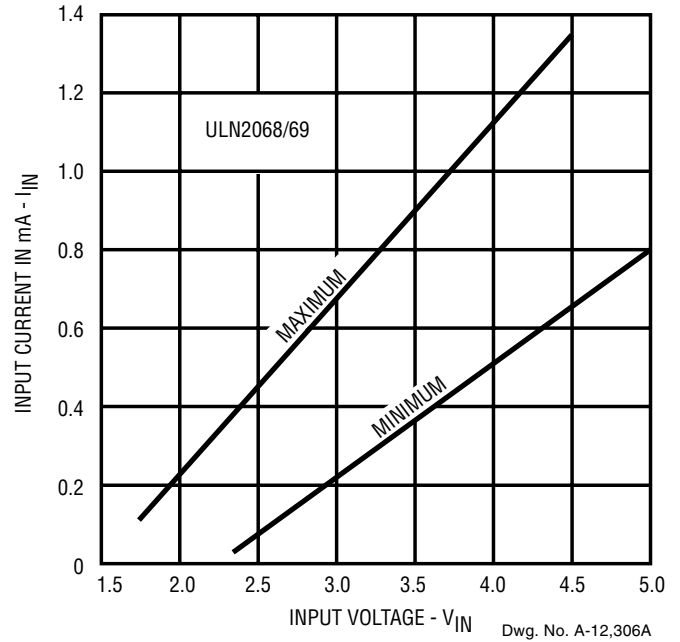
Dwg. GP-045



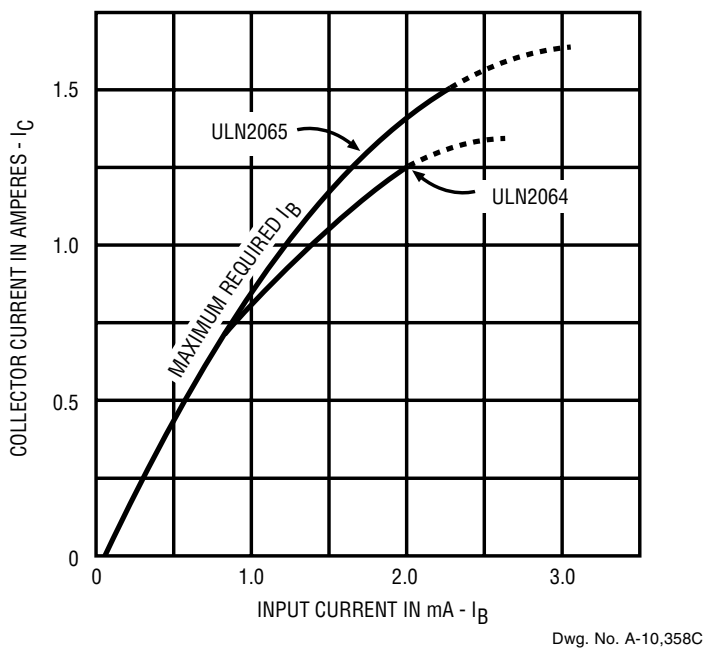
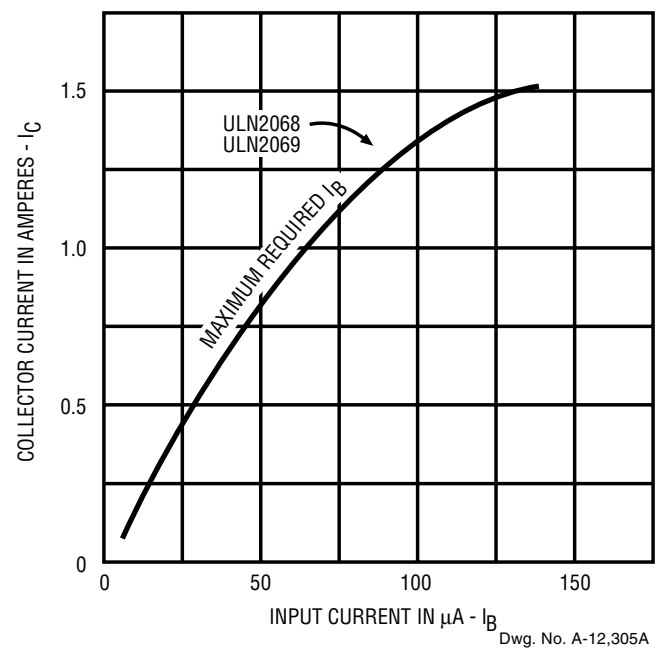
Dwg. GP-045-1

2064 THRU 2069
QUAD 1.5 A DARLINGTON
SWITCHES

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

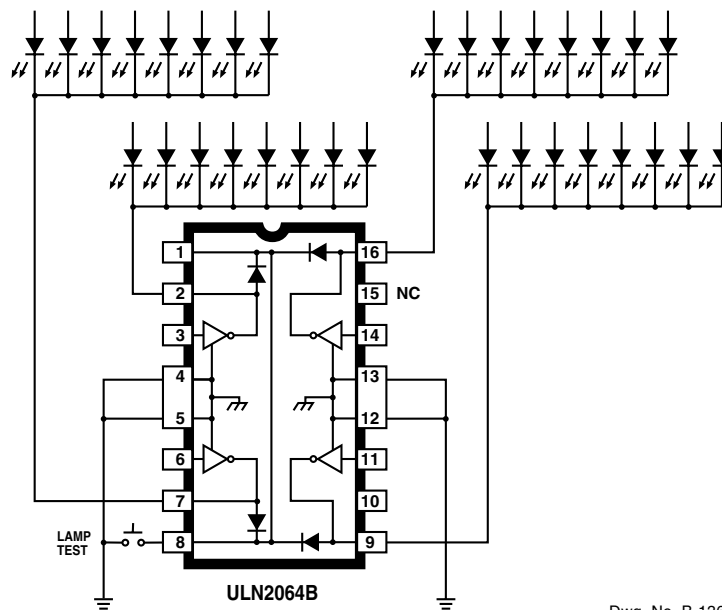


COLLECTOR CURRENT AS A FUNCTION OF INPUT CURRENT AT +25°C



2064 THRU 2069
QUAD 1.5 A DARLINGTON
SWITCHES

TYPICAL APPLICATION



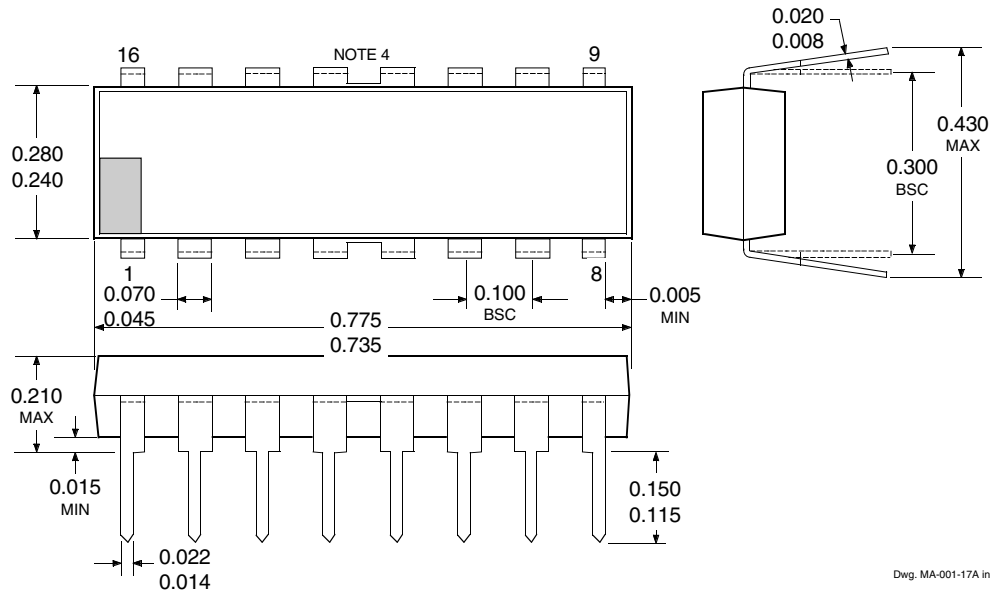
Dwg. No. B-1365

COMMON-CATHODE LED DRIVERS
 (Types ULN2068B and ULN2068LB are also applicable)

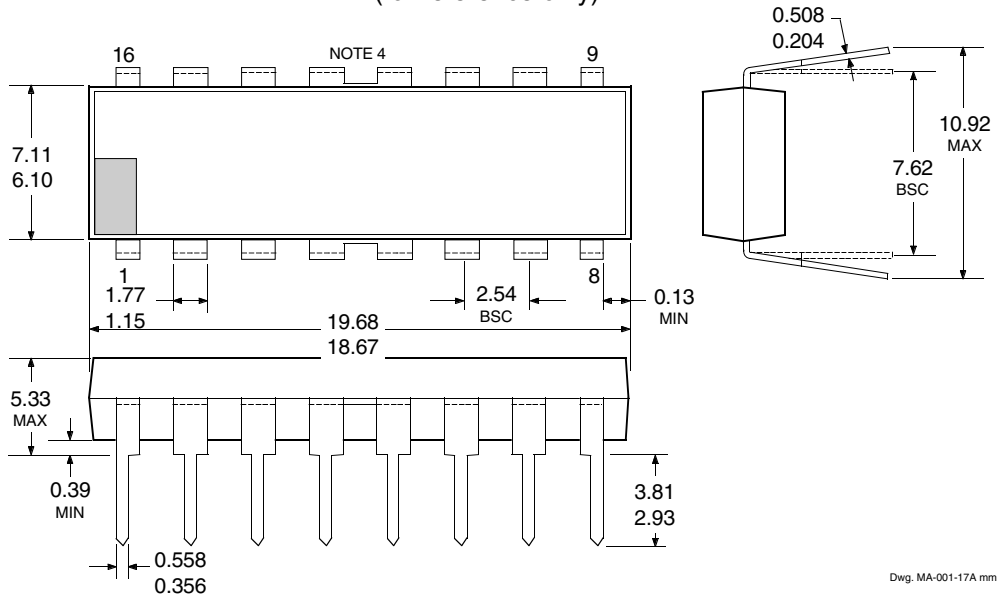
2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

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.

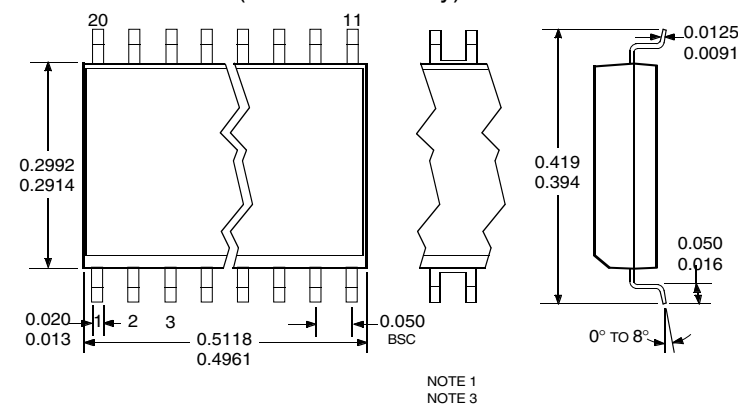
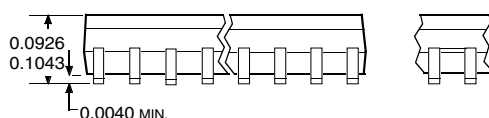
2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

ULN2064LB, ULN2065LB, ULN2068LB, and ULN2069LB

(add "TR" to part number for tape and reel)

Dimensions in Inches

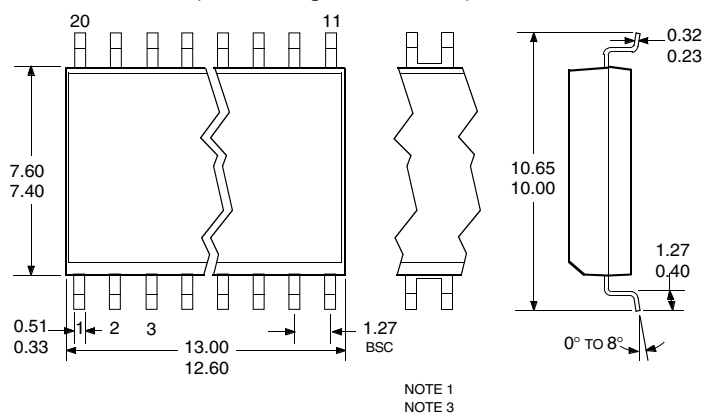
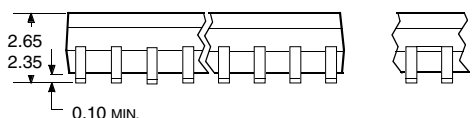
(for reference only)



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

The products described here are manufactured under one or more U.S. patents or U.S. patents pending.

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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
250	50	8	addressable decoder/driver			DMOS	—	6259
	50	8	—	X	—	DMOS	—	6273
	50	8	X	X	—	DMOS	—	6595
	135	7	—	—	X	—	—	7003
300	45	1	—	Hall sensor/driver	X	—	X	5140
	50	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	—	—	2804
	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
	95	8	—	—	X	—	—	2823
	95	8	—	—	X	—	—	2824
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
900	14	2	—	Hall sensor/driver	X	saturated	X	3625
	26	2	—	Hall sensor/driver	X	saturated	X	3626
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
	50	4	—	—	X	—	—	2064 and 2068
1500	80	4	—	—	X	—	—	2065 and 2069
1800	50	4	—	—	X	—	—	2544
	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
	80	4	—	—	X	—	—	2879

* 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.