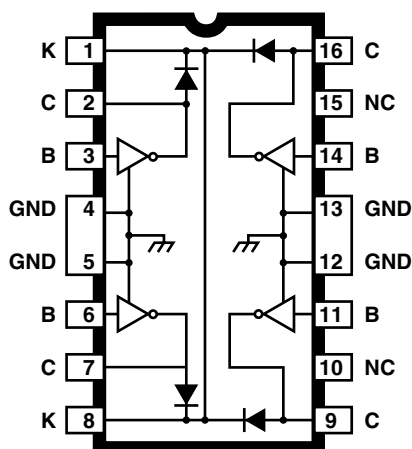


# 2064 THRU 2069

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,<br>$V_{CE(SUS)}$ .....     | 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,<br>$V_S$ (ULN2068B/LB & 2069B/LB) ... | 10 V            |
| Total Package Power Dissipation,<br>$P_D$ .....       | See Graph       |
| Operating Temperature Range,<br>$T_A$ .....           | -20°C to +85°C  |
| Storage Temperature Range,<br>$T_S$ .....             | -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').

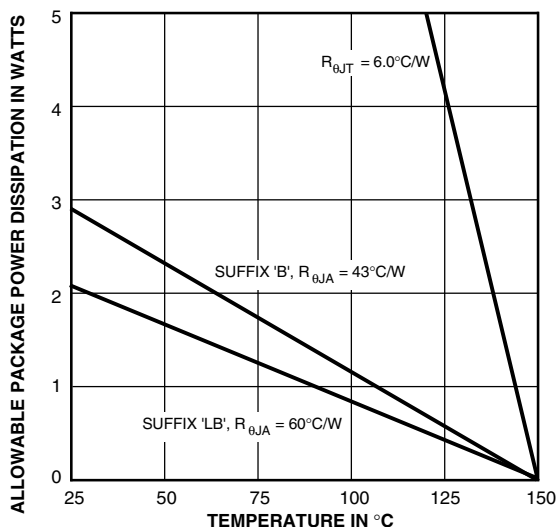
### FEATURES

- 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<br>ULN2064LB | 50 V           | 35 V               | 15 V          | TTL, DTL, Schottky TTL, and 5 V CMOS |
| ULN2065B<br>ULN2065LB | 80 V           | 50 V               | 15 V          |                                      |
| ULN2068B<br>ULN2068LB | 50 V           | 35 V               | 15 V          | TTL, DTL, Schottky TTL, and 5 V CMOS |
| ULN2069B<br>ULN2069LB | 80 V           | 50 V               | 15 V          |                                      |

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

## TEST FIGURES

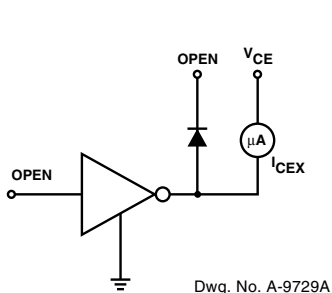


FIGURE 1

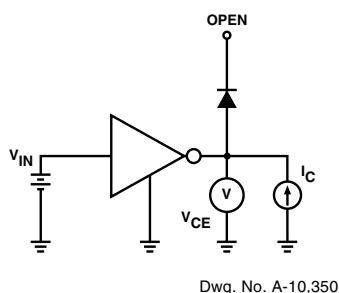


FIGURE 2

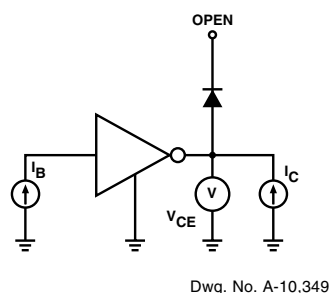


FIGURE 3

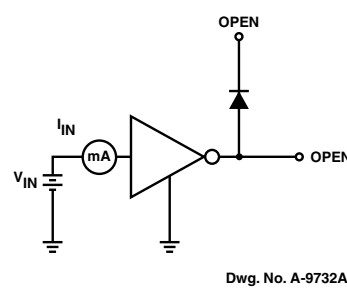


FIGURE 4

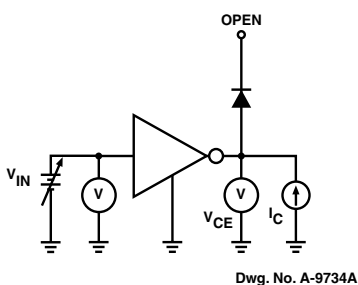


FIGURE 5

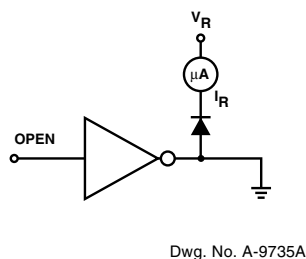


FIGURE 6

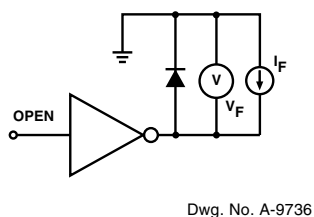


FIGURE 7

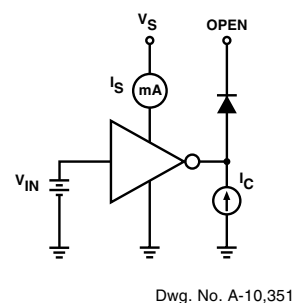
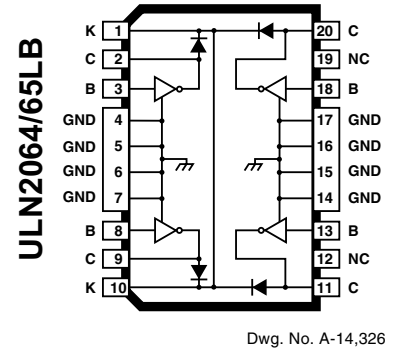
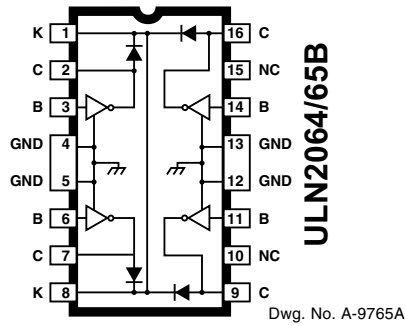
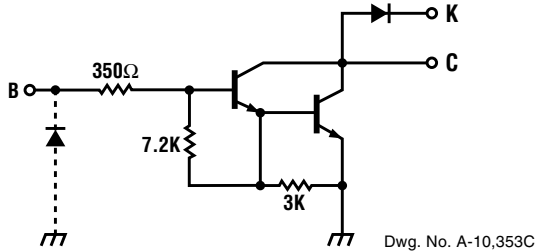


FIGURE 8

# 2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

## PARTIAL SCHEMATIC



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

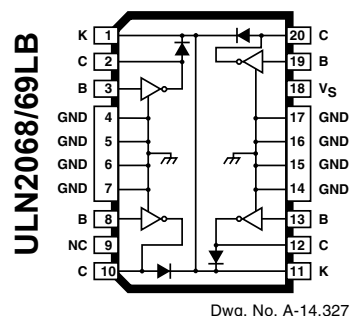
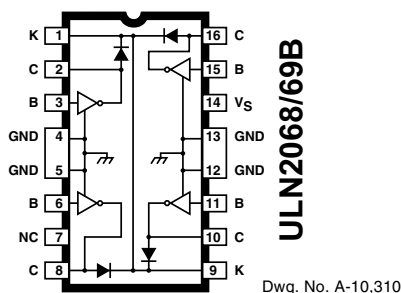
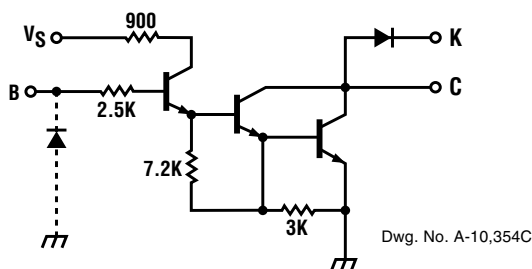
| Characteristic                       | Symbol        | Test Fig. | Applicable Devices | Test Conditions                                 | Limits |      |               |
|--------------------------------------|---------------|-----------|--------------------|-------------------------------------------------|--------|------|---------------|
|                                      |               |           |                    |                                                 | Min.   | Max. | Units         |
| Output Leakage Current               | $I_{CEX}$     | 1         | ULN2064B/LB        | $V_{CE} = 50 \text{ V}$                         | —      | 100  | $\mu\text{A}$ |
|                                      |               |           |                    | $V_{CE} = 50 \text{ V}, T_A = 70^\circ\text{C}$ | —      | 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                | $0.5 E_{in} \text{ to } 0.5 E_{out}$            | —      | 1.0  | $\mu\text{s}$ |
| Turn-Off Delay                       | $t_{PHL}$     | —         | All                | $0.5 E_{in} \text{ to } 0.5 E_{out}$            | —      | 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

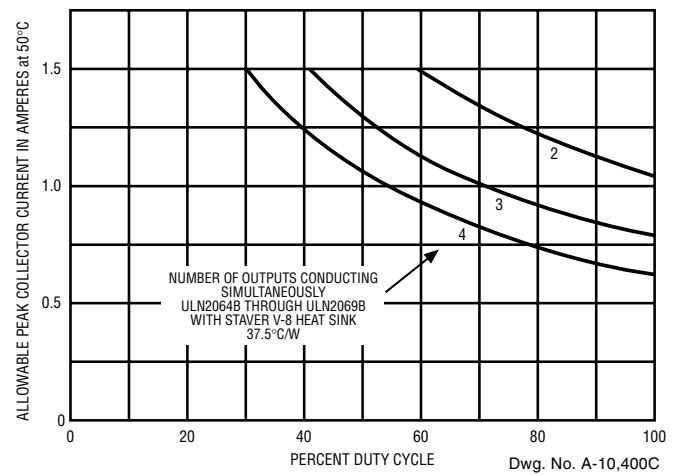
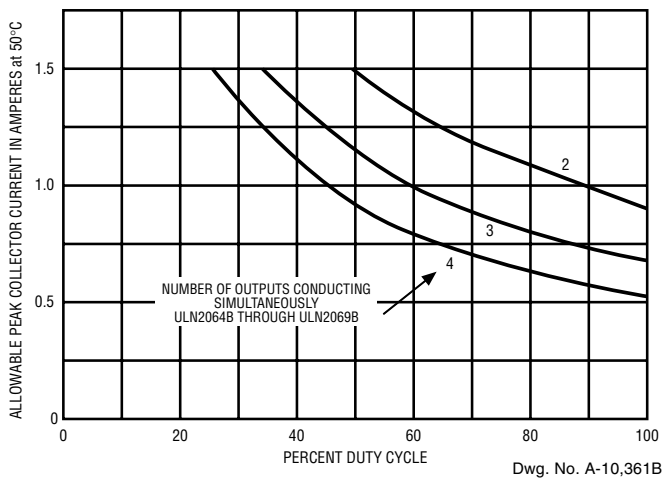
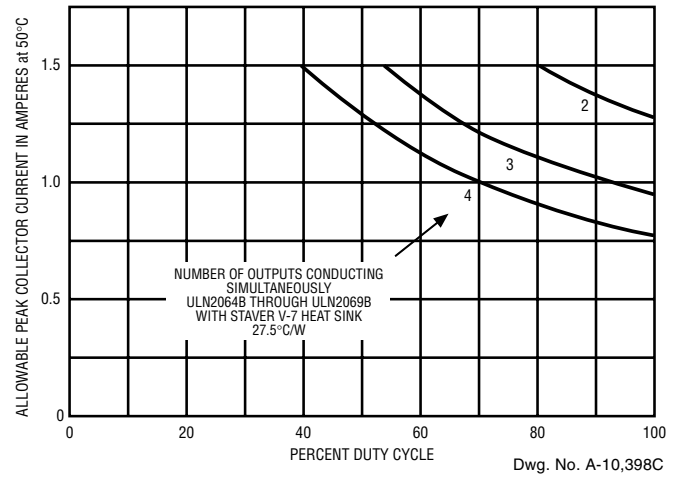
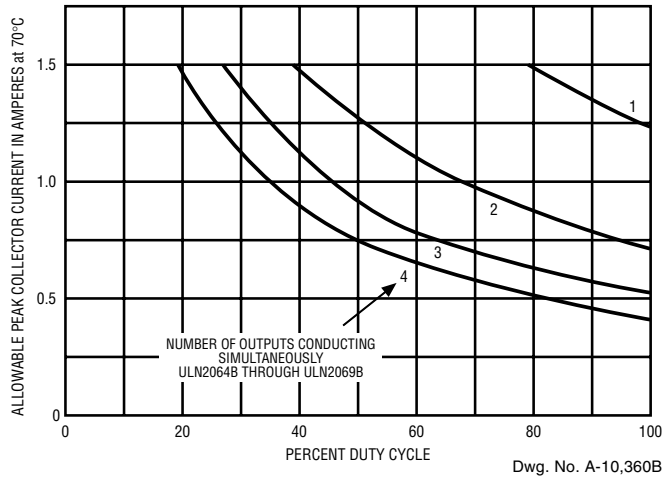


**ELECTRICAL CHARACTERISTICS at +25°C,  $V_S = 5.0$  V (unless otherwise noted).**

| 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  | $\mu$ A |
|                                      |               |           |                    | $V_{CE} = 50$ V, $T_A = 70^\circ\text{C}$      | —      | 500  | $\mu$ A |
|                                      |               |           | ULN2069B/LB        | $V_{CE} = 80$ V                                | —      | 100  | $\mu$ A |
|                                      |               |           |                    | $V_{CE} = 80$ V, $T_A = 70^\circ\text{C}$      | —      | 500  | $\mu$ 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  | $\mu$ A |
|                                      |               |           |                    | $V_{IN} = 3.75$ V                              | —      | 1000 | $\mu$ 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  | $\mu$ s |
| Turn-Off Delay                       | $t_{PHL}$     | —         | All                | $0.5 E_{in}$ to $0.5 E_{out}$ , $I_C = 1.25$ A | —      | 1.5  | $\mu$ s |
| Clamp Diode Leakage Current          | $I_R$         | 6         | ULN2068B/LB        | $V_R = 50$ V                                   | —      | 50   | $\mu$ A |
|                                      |               |           |                    | $V_R = 50$ V, $T_A = 70^\circ\text{C}$         | —      | 100  | $\mu$ A |
|                                      |               |           | ULN2069B/LB        | $V_R = 80$ V                                   | —      | 50   | $\mu$ A |
|                                      |               |           |                    | $V_R = 80$ V, $T_A = 70^\circ\text{C}$         | —      | 100  | $\mu$ 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       |

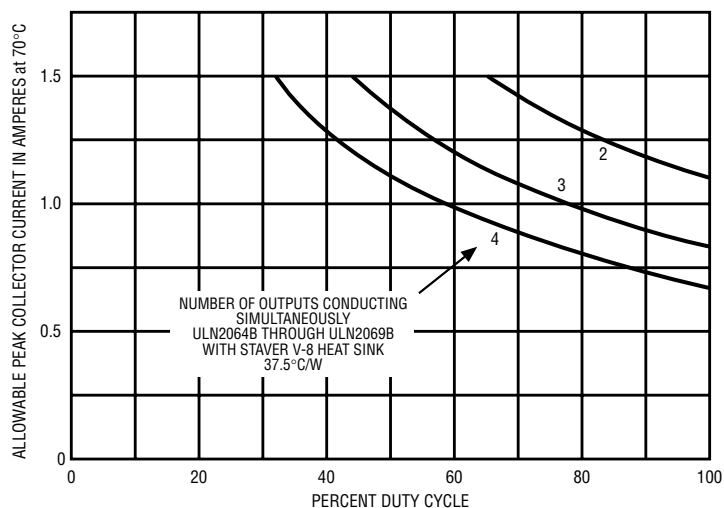
# 2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

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

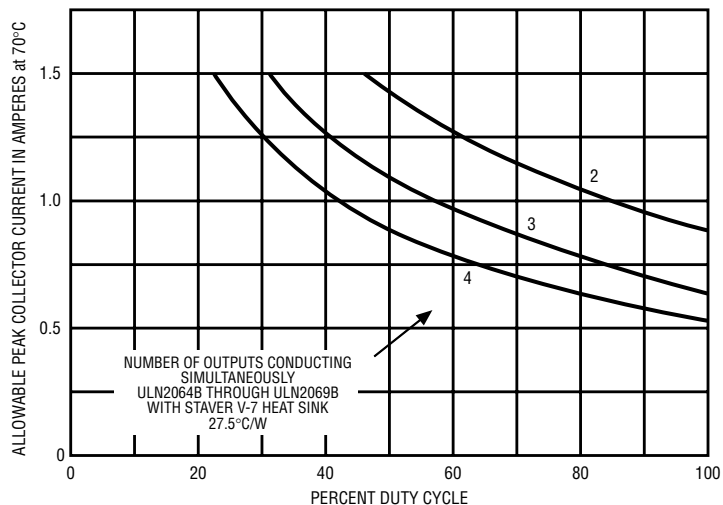


# 2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

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

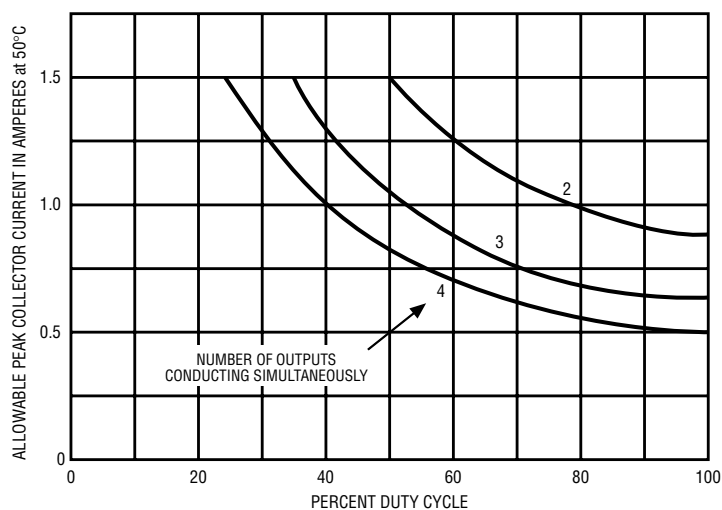


Dwg. No. A-10,399C

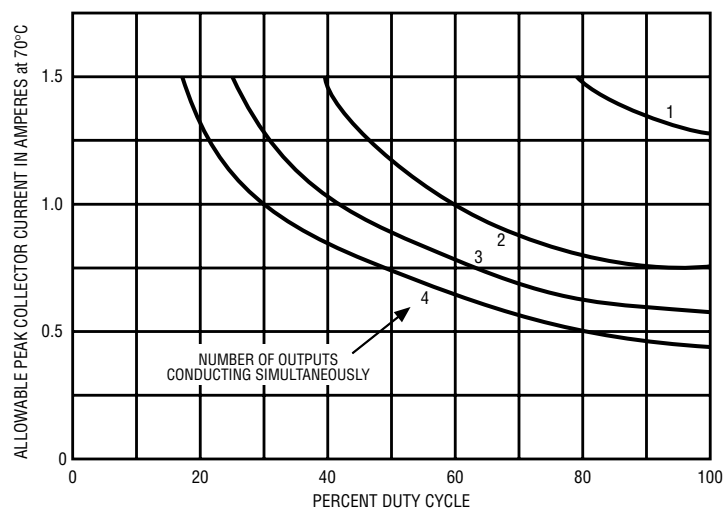


Dwg. No. A-10,401C

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



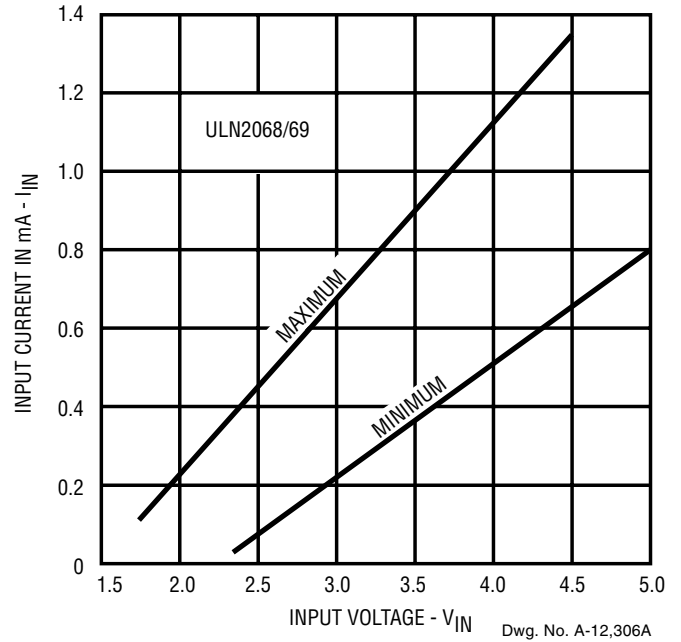
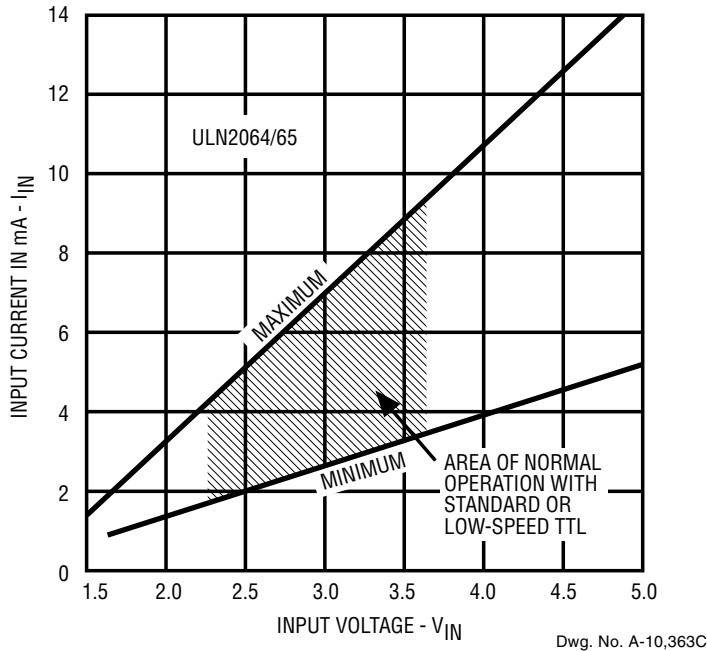
Dwg. GP-045



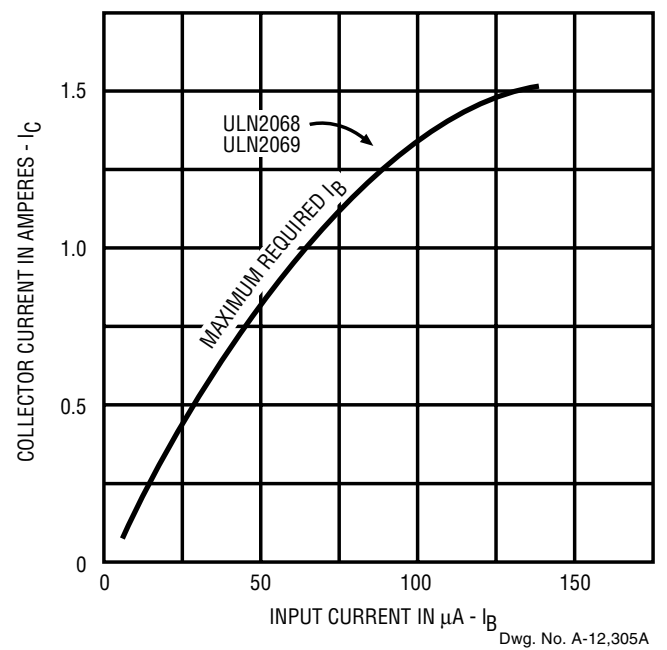
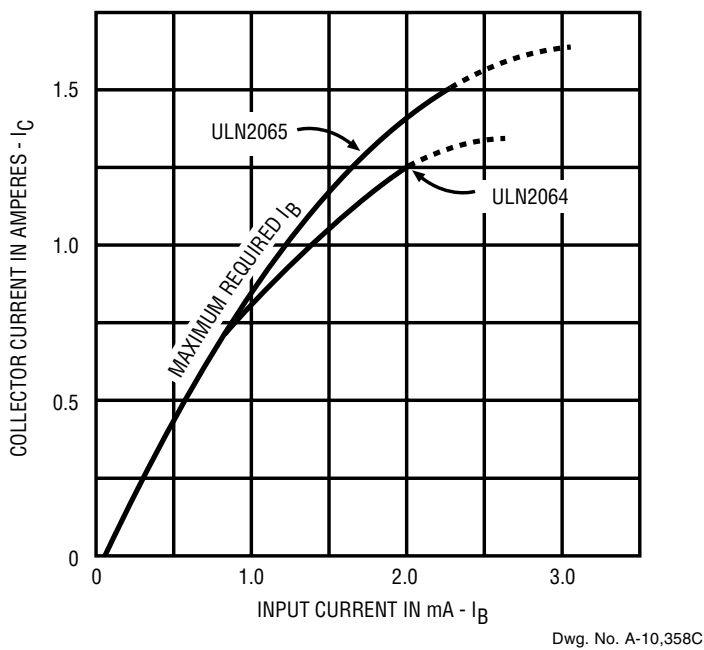
Dwg. GP-045-1

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

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

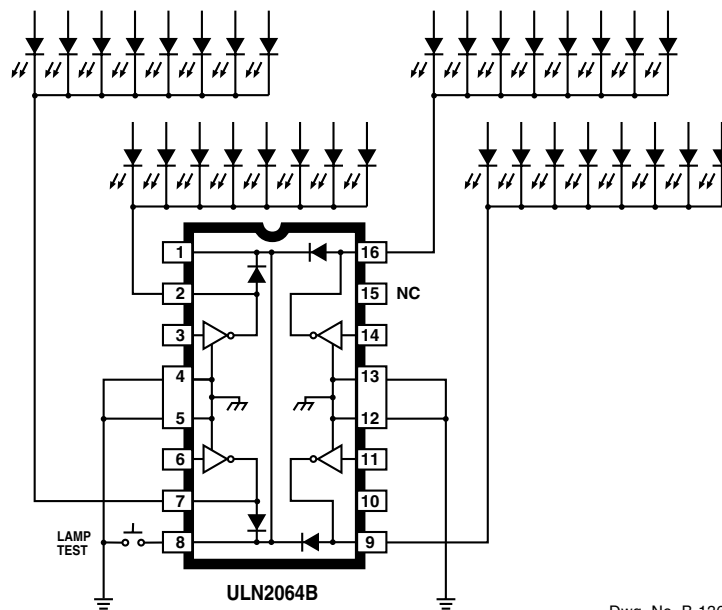


**COLLECTOR CURRENT AS A FUNCTION OF INPUT CURRENT AT +25°C**



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

**TYPICAL APPLICATION**



Dwg. No. B-1365

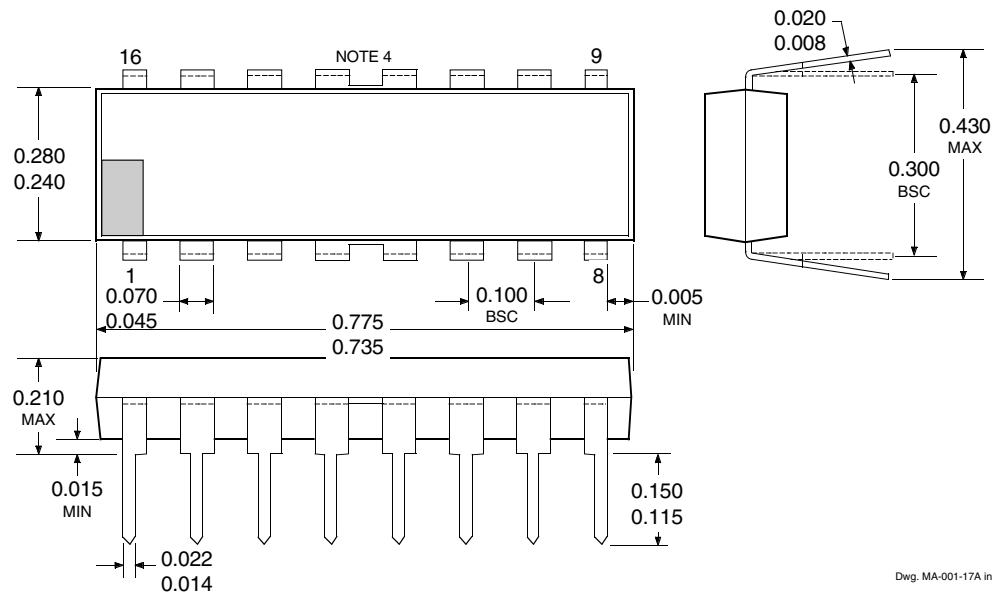
**COMMON-CATHODE LED DRIVERS**  
 (Types ULN2068B and ULN2068LB are also applicable)



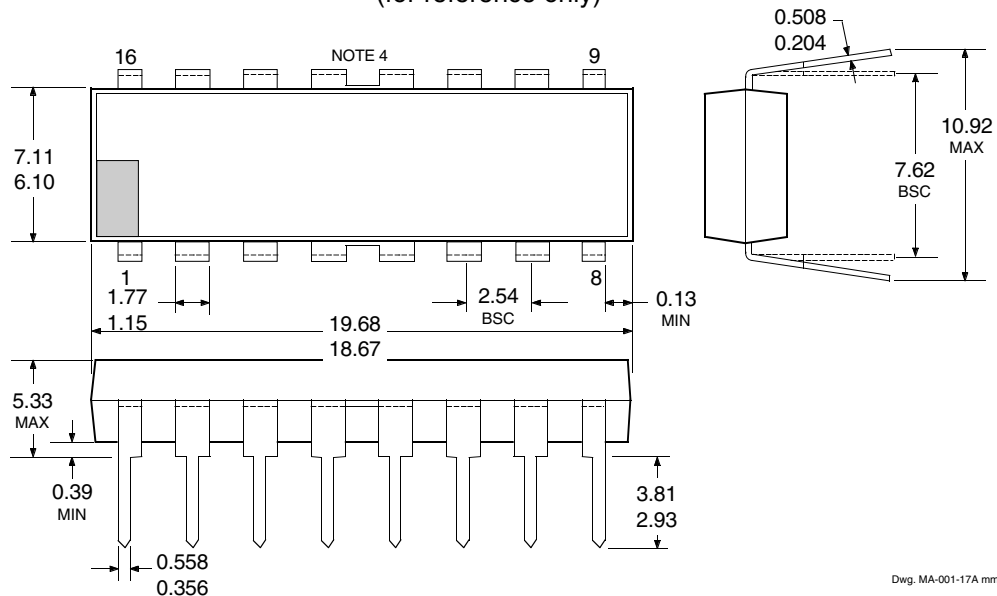
# 2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

## 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.

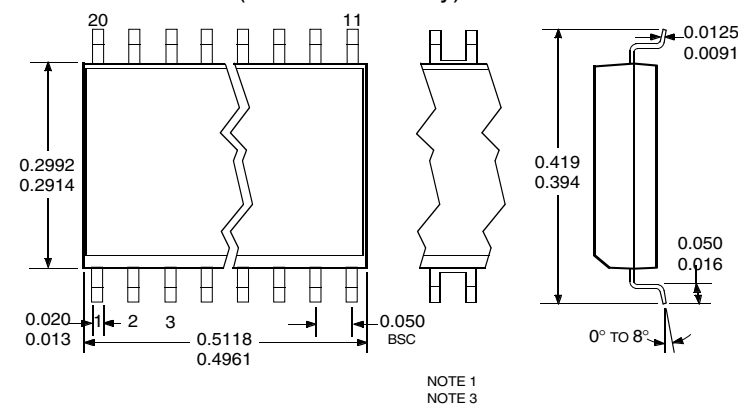
# 2064 THRU 2069 QUAD 1.5 A DARLINGTON SWITCHES

## ULN2064LB, ULN2065LB, ULN2068LB, and ULN2069LB

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

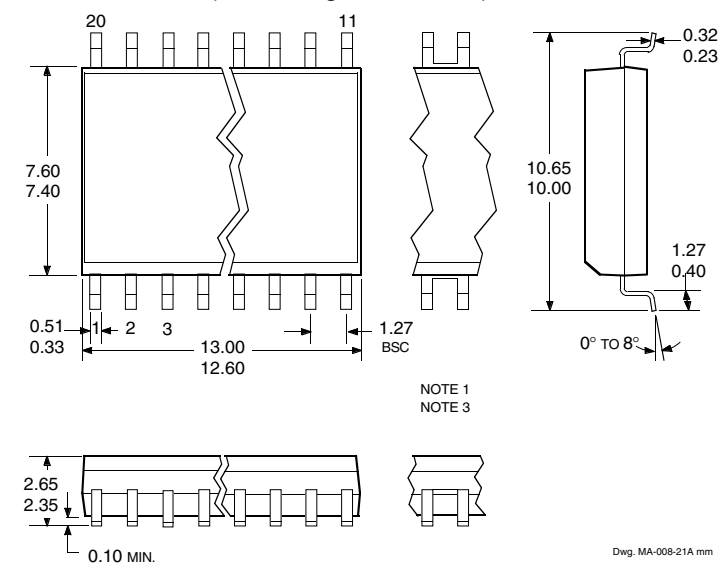
### Dimensions in Inches

(for reference only)



### Dimensions in Millimeters

(controlling dimensions)



- 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 <sup>†</sup> |
|------------------|-----|----|-----------------------------------|--------------------|-------------|------------------|---------------------|--------------------------|
| 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.