

## SERIES ULS-2800H AND ULS-2800R

### HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAYS

**MIL-STD-883 Compliant**

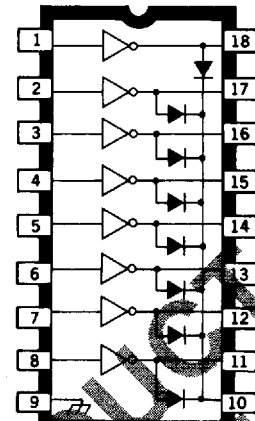
**FEATURES**

- TTL, DTL, PMOS, or CMOS Compatible Inputs
- Peak Output Current to 600 mA
- Transient-Protected Outputs
- Side-Brazed Hermetic Package
- Cer-DIP Hermetic Package
- High-Reliability Screening to MIL-STD-883, Class B
- -55°C to +125°C Temperature Range

**D**ESIGNED TO SERVE as interface between low-level logic circuitry and high-power loads, Series ULS-2800H and ULS-2800R arrays consist of eight silicon NPN Darlington power drivers on a common monolithic substrate. They are ideally suited to driving relays, solenoids, lamps, and other devices in high-reliability military or aerospace applications with up to 3 A output current per package.

These devices are screened to MIL-STD-883, Class B and are supplied in either the popular glass/metal side-brazed 18-pin hermetic package (suffix 'H') or ceramic/glass cer-DIP hermetic package (suffix 'R'). Both package styles conform to the dimensional requirements of MIL-M-38510 and are rated for operation over the full military temperature range of -55°C to +125°C. Reverse-bias burn-in and 100% high-reliability screening are standard.

The 30 integrated circuits described in this bulletin permit the circuit designer to select the optimal device for any application. In addition to the two package styles, there are five input characteristics, two output-voltage ratings, and two output-current ratings. The appropriate part for specific applications can be determined from the Device Part Number Designation chart. All units have open-collector outputs and on-chip diodes for inductive-load transient suppression.



Dwg. No. A-11-22

**Device Part Number Designation**

|               |        |        |        |
|---------------|--------|--------|--------|
| $V_{CE(MAX)}$ | 50 V   | 50 V   | 95 V   |
| $I_{C(MAX)}$  | 500 mA | 600 mA | 500 mA |

|                               | Part Number |           |           |
|-------------------------------|-------------|-----------|-----------|
| General Purpose<br>PMOS, CMOS | ULS-2801*   | ULS-2811* | ULS-2821* |
| 14-25 V<br>PMOS               | ULS-2802*   | ULS-2812* | ULS-2822* |
| 5 V<br>TTL, CMOS              | ULS-2803*   | ULS-2813* | ULS-2823* |
| 6-15 V<br>CMOS, PMOS          | ULS-2804*   | ULS-2814* | ULS-2824* |
| High-Output<br>TTL            | ULS-2805*   | ULS-2815* | ULS-2825* |

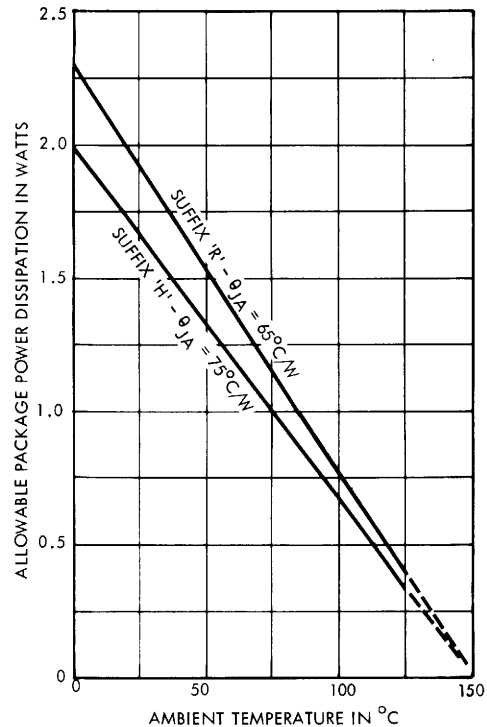
\*Complete part number includes a final letter to indicate package (H = glass/metal side-brazed, R = ceramic/glass cer-DIP)

# SERIES ULS-2800H AND ULS-2800R HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAYS

## ABSOLUTE MAXIMUM RATINGS

|                                    |                 |
|------------------------------------|-----------------|
| Output Voltage, $V_{CE}$           |                 |
| (ULS-280X*, ULS-281X*)             | 50 V            |
| (ULS-282X*)                        | 95 V            |
| Input Voltage, $V_{IN}$            |                 |
| (ULS-28X2, X3, X4*)                | 30 V            |
| (ULS-28X5*)                        | 15 V            |
| Peak Output Current, $I_{OUT}$     |                 |
| (ULS-280X*, ULS-282X*)             | 500 mA          |
| (ULS-281X*)                        | 600 mA          |
| Ground Terminal Current, $I_{GND}$ | 3.0 A           |
| Continuous Input Current, $I_{IN}$ | 25 mA           |
| Power Dissipation, $P_D$           |                 |
| (one Darlington pair)              | 1.0 W           |
| (total package)                    | See Graph       |
| Operating Temperature Range, $T_A$ | -55°C to +125°C |
| Storage Temperature Range, $T_S$   | -65°C to +150°C |

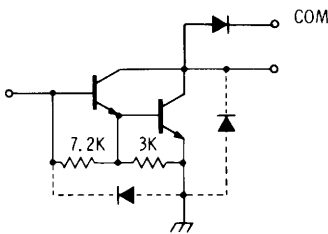
## ALLOWABLE PACKAGE POWER DISSIPATION



Dwg. No. A-10,879A

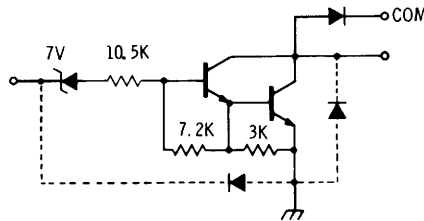
## PARTIAL SCHEMATICS

**ULS-28X1\***  
(Each Driver)



Dwg. No. A-9595

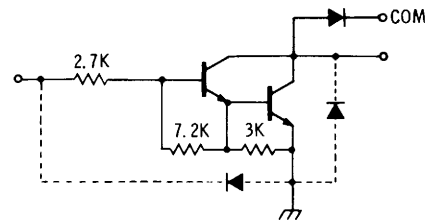
**ULS-28X2\***  
(Each Driver)



DWG. No. A-9650

Dwg. No. A-9650

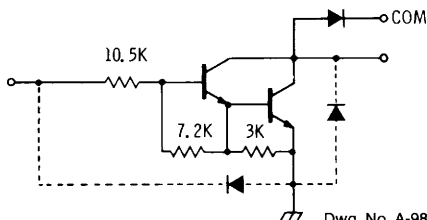
**ULS-28X3\***  
(Each Driver)



DWG. No. A-9651

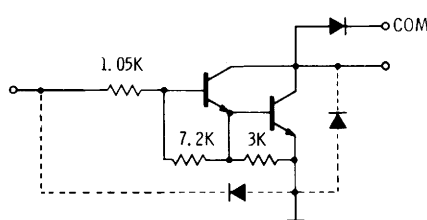
Dwg. No. A-9651

**ULS-28X4\***  
(Each Driver)



Dwg. No. A-9898A

**ULS-28X5\***  
(Each Driver)



Dwg. No. A-10,228

*\*Complete part number includes a final letter to indicate package (H = glass/metal side-brazed, R = ceramic/glass cer-DIP). X = digit to identify specific device. Specification or limit shown applies to family of devices with remaining digits as shown.*

**SERIES ULS-2800H AND ULS-2800R**

**ELECTRICAL CHARACTERISTICS over operating temperature range (unless otherwise noted)**

| Characteristic                       | Symbol  | Applicable Devices                                  | Test Conditions                                     |  |      | Limits |      |      |               |
|--------------------------------------|---|---|---|--|------|--------|------|------|---------------|
|                                      |   |   | Temp.   | Voltage/Current                                      | Fig. | Min.   | Typ. | Max. | Units         |
| Output Leakage Current               | $I_{CEX}$   | All   |   | $V_{CE} = 50\text{ V}$                               | 1A   | —      | —    | 100  | $\mu\text{A}$ |
|                                      |   | ULS-2802*   |   | $V_{CE} = 50\text{ V}, V_{IN} = 6\text{ V}$          | 1B   | —      | —    | 500  | $\mu\text{A}$ |
|                                      |   | ULS-2804*   |   | $V_{CE} = 50\text{ V}, V_{IN} = 1\text{ V}$          | 1B   | —      | —    | 500  | $\mu\text{A}$ |
| Collector-Emitter Saturation Voltage | $V_{CE(SAT)}$                                       | All   | - 55°C  | $I_C = 350\text{ mA}, I_B = 850\ \mu\text{A}$        | 2    | —      | 1.6  | 1.8  | V             |
|                                      |   |   |   | $I_C = 200\text{ mA}, I_B = 550\ \mu\text{A}$        | 2    | —      | 1.3  | 1.5  | V             |
|                                      |   |   |   | $I_C = 100\text{ mA}, I_B = 350\ \mu\text{A}$        | 2    | —      | 1.1  | 1.3  | V             |
|                                      |   |   | + 25°C  | $I_C = 350\text{ mA}, I_B = 500\ \mu\text{A}$        | 2    | —      | 1.25 | 1.6  | V             |
|                                      |   |   |   | $I_C = 200\text{ mA}, I_B = 350\ \mu\text{A}$        | 2    | —      | 1.1  | 1.3  | V             |
|                                      |   |   |   | $I_C = 100\text{ mA}, I_B = 250\ \mu\text{A}$        | 2    | —      | 0.9  | 1.1  | V             |
|                                      |   |   | + 125°C   | $I_C = 350\text{ mA}\dagger, I_B = 500\ \mu\text{A}$ | 2    | —      | 1.6  | 1.8  | V             |
|                                      |   |   |   | $I_C = 200\text{ mA}, I_B = 350\ \mu\text{A}$        | 2    | —      | 1.3  | 1.5  | V             |
|                                      |   |   |   | $I_C = 100\text{ mA}, I_B = 250\ \mu\text{A}$        | 2    | —      | 1.1  | 1.3  | V             |
| Input Current                        | $I_{IN(ON)}$  | ULS-2802*   |   | $V_{IN} = 17\text{ V}$                               | 3    | 480    | 850  | 1300 | $\mu\text{A}$ |
|                                      |   | ULS-2803*   |   | $V_{IN} = 3.85\text{ V}$                             | 3    | 650    | 930  | 1350 | $\mu\text{A}$ |
|                                      |   | ULS-2804*   |   | $V_{IN} = 5.0\text{ V}$                              | 3    | 240    | 350  | 500  | $\mu\text{A}$ |
|                                      |   |   |   | $V_{IN} = 12\text{ V}$                               | 3    | 650    | 1000 | 1450 | $\mu\text{A}$ |
|                                      |   | ULS-2805*   |   | $V_{IN} = 3.0\text{ V}$                              | 3    | —      | 1500 | 2400 | $\mu\text{A}$ |
| Input Voltage                        | $V_{IN(OFF)}$                                       | All   | + 125°C   | $I_C = 500\ \mu\text{A}$                             | 4    | 25     | 50   | —    | $\mu\text{A}$ |
|                                      |   | ULS-2802*   | - 55°C  | $V_{CE} = 2.0\text{ V}, I_C = 300\text{ mA}$         | 5    | —      | —    | 18   | V             |
| + 125°C                              | $V_{CE} = 2.0\text{ V}, I_C = 300\text{ mA}$        |   |   | 5  | —    | —      | 13   | V    |               |
| ULS-2803*                            | - 55°C  |   | $V_{CE} = 2.0\text{ V}, I_C = 200\text{ mA}$        | 5  | —    | —      | 3.3  | V    |               |
|                                      |   |   | $V_{CE} = 2.0\text{ V}, I_C = 250\text{ mA}$        | 5  | —    | —      | 3.6  | V    |               |
|                                      |   |   | $V_{CE} = 2.0\text{ V}, I_C = 300\text{ mA}$        | 5  | —    | —      | 3.9  | V    |               |
| + 125°C                              | $V_{CE} = 2.0\text{ V}, I_C = 200\text{ mA}\dagger$ |   | 5   | —  | —    | 2.4    | V    |      |               |
|                                      | $V_{CE} = 2.0\text{ V}, I_C = 250\text{ mA}\dagger$ |   | 5   | —  | —    | 2.7    | V    |      |               |
|                                      | $V_{CE} = 2.0\text{ V}, I_C = 300\text{ mA}\dagger$ |   | 5   | —  | —    | 3.0    | V    |      |               |
| ULS-2804*                            | - 55°C  |   | $V_{CE} = 2.0\text{ V}, I_C = 125\text{ mA}$        | 5  | —    | —      | 6.0  | V    |               |
|                                      |   |   | $V_{CE} = 2.0\text{ V}, I_C = 200\text{ mA}$        | 5  | —    | —      | 8.0  | V    |               |
|                                      |   |   | $V_{CE} = 2.0\text{ V}, I_C = 275\text{ mA}$        | 5  | —    | —      | 10   | V    |               |
|                                      | + 125°C   |   | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}$        | 5  | —    | —      | 12   | V    |               |
|                                      |   |   | $V_{CE} = 2.0\text{ V}, I_C = 125\text{ mA}$        | 5  | —    | —      | 5.0  | V    |               |
|                                      |   |   | $V_{CE} = 2.0\text{ V}, I_C = 200\text{ mA}\dagger$ | 5  | —    | —      | 6.0  | V    |               |
| ULS-2805*                            | - 55°C  |   | $V_{CE} = 2.0\text{ V}, I_C = 275\text{ mA}\dagger$ | 5  | —    | —      | 7.0  | V    |               |
|                                      |   | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}\dagger$ | 5   | —  | —    | 8.0    | V    |      |               |
|                                      |   | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}\dagger$ | 5   | —  | —    | 3.0    | V    |      |               |
| D-C Forward Current Transfer Ratio   | $h_{FE}$  | ULS2801*  | - 55°C  | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}$         | 2    | 500    | —    | —    | —             |
|                                      |   |   | + 25°C  | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}$         | 2    | 1000   | —    | —    | —             |
| Turn-On Delay                        | $t_{PLH}$   | All   | + 25°C  |  | 8    | —      | 250  | 1000 | ns            |
| Turn-Off Delay                       | $t_{PHL}$   | All   | + 25°C  |  | 8    | —      | 250  | 1000 | ns            |
| Clamp Diode Leakage Current          | $I_R$   | All   |   | $V_R = 50\text{ V}$                                  | 6    | —      | —    | 50   | $\mu\text{A}$ |
| Clamp Diode Forward Voltage          | $V_f$   | All   |   | $I_f = 350\text{ mA}\dagger$                         | 7    | —      | 1.7  | 2.0  | V             |

\*Complete part number includes a final letter to indicate package (H = glass/metal side-braced, R = ceramic/glass cer-DIP).

Note 1: All limits stated apply to the complete Darlington series except as specified for a single device type.

Note 2: The  $I_{IN(OFF)}$  current limit guarantees against partial turn-on of the output.

Note 3: The  $V_{IN(ON)}$  voltage limit guarantees a minimum output sink current per the specified test conditions.

†Pulse Test,  $t_p \leq 1\ \mu\text{s}$ , see graph.

**SERIES ULS-2800H AND ULS-2800R  
HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAYS**

**SERIES ULS-2810H AND ULS-2810R**

**ELECTRICAL CHARACTERISTICS over operating temperature range (unless otherwise noted)**

| Characteristic                       | Symbol        | Applicable Devices | Test Conditions |  |      | Limits |      |      |               |
|--------------------------------------|---------------|--------------------|-----------------|--|------|--------|------|------|---------------|
|                                      |               |                    | Temp.           | Voltage/Current                                      | Fig. | Min.   | Typ. | Max. | Units         |
| Output Leakage Current               | $I_{CEX}$     | All                |                 | $V_{CE} = 50\text{ V}$                               | 1A   | —      | —    | 100  | $\mu\text{A}$ |
|                                      |               | ULS-2812*          |                 | $V_{CE} = 50\text{ V}, V_{IN} = 6\text{ V}$          | 1B   | —      | —    | 500  | $\mu\text{A}$ |
|                                      |               | ULS-2814*          |                 | $V_{CE} = 50\text{ V}, V_{IN} = 1\text{ V}$          | 1B   | —      | —    | 500  | $\mu\text{A}$ |
| Collector-Emitter Saturation Voltage | $V_{CE(SAT)}$ | All                | -55°C           | $I_C = 500\text{ mA}, I_B = 1100\ \mu\text{A}$       | 2    | —      | 1.8  | 2.1  | V             |
|                                      |               |                    |                 | $I_C = 350\text{ mA}, I_B = 850\ \mu\text{A}$        | 2    | —      | 1.6  | 1.8  | V             |
|                                      |               |                    |                 | $I_C = 200\text{ mA}, I_B = 550\ \mu\text{A}$        | 2    | —      | 1.3  | 1.5  | V             |
|                                      |               |                    | +25°C           | $I_C = 500\text{ mA}, I_B = 600\ \mu\text{A}$        | 2    | —      | 1.7  | 1.9  | V             |
|                                      |               |                    |                 | $I_C = 350\text{ mA}, I_B = 500\ \mu\text{A}$        | 2    | —      | 1.25 | 1.6  | V             |
|                                      |               |                    |                 | $I_C = 200\text{ mA}, I_B = 350\ \mu\text{A}$        | 2    | —      | 1.1  | 1.3  | V             |
|                                      |               |                    | +125°C          | $I_C = 500\text{ mA}\dagger, I_B = 600\ \mu\text{A}$ | 2    | —      | 1.8  | 2.1  | V             |
|                                      |               |                    |                 | $I_C = 350\text{ mA}\dagger, I_B = 500\ \mu\text{A}$ | 2    | —      | 1.6  | 1.8  | V             |
|                                      |               |                    |                 | $I_C = 200\text{ mA}, I_B = 350\ \mu\text{A}$        | 2    | —      | 1.3  | 1.5  | V             |
| Input Current                        | $I_{IN(ON)}$  | ULS-2812*          |                 | $V_{IN} = 17\text{ V}$                               | 3    | 480    | 850  | 1300 | $\mu\text{A}$ |
|                                      |               | ULS-2813*          |                 | $V_{IN} = 3.85\text{ V}$                             | 3    | 650    | 930  | 1350 | $\mu\text{A}$ |
|                                      |               | ULS-2814*          |                 | $V_{IN} = 5.0\text{ V}$                              | 3    | 240    | 350  | 500  | $\mu\text{A}$ |
|                                      |               |                    |                 | $V_{IN} = 12\text{ V}$                               | 3    | 650    | 1000 | 1450 | $\mu\text{A}$ |
|                                      |               | ULS-2815*          |                 | $V_{IN} = 3.0\text{ V}$                              | 3    | —      | 1500 | 2400 | $\mu\text{A}$ |
|                                      | $I_{IN(OFF)}$ | All                | +125°C          | $I_C = 500\ \mu\text{A}$                             | 4    | 25     | 50   | —    | $\mu\text{A}$ |
| Input Voltage                        | $V_{IN(ON)}$  | ULS-2812*          | -55°C           | $V_{CE} = 2.0\text{ V}, I_C = 500\text{ mA}$         | 5    | —      | —    | 23.5 | V             |
|                                      |               |                    | +125°C          | $V_{CE} = 2.0\text{ V}, I_C = 500\text{ mA}$         | 5    | —      | —    | 17   | V             |
|                                      |               | ULS-2013*          | -55°C           | $V_{CE} = 2.0\text{ V}, I_C = 250\text{ mA}$         | 5    | —      | —    | 3.6  | V             |
|                                      |               |                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 300\text{ mA}$         | 5    | —      | —    | 3.9  | V             |
|                                      |               |                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 500\text{ mA}$         | 5    | —      | —    | 6.0  | V             |
|                                      |               |                    | +125°C          | $V_{CE} = 2.0\text{ V}, I_C = 250\text{ mA}\dagger$  | 5    | —      | —    | 2.7  | V             |
|                                      |               |                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 300\text{ mA}\dagger$  | 5    | —      | —    | 3.0  | V             |
|                                      |               |                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 500\text{ mA}\dagger$  | 5    | —      | —    | 3.5  | V             |
|                                      |               | ULS-2814*          | -55°C           | $V_{CE} = 2.0\text{ V}, I_C = 275\text{ mA}$         | 5    | —      | —    | 10   | V             |
|                                      |               |                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}$         | 5    | —      | —    | 12   | V             |
|                                      |               |                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 500\text{ mA}$         | 5    | —      | —    | 17   | V             |
|                                      |               |                    | +125°C          | $V_{CE} = 2.0\text{ V}, I_C = 275\text{ mA}\dagger$  | 5    | —      | —    | 7.0  | V             |
|                                      |               |                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}\dagger$  | 5    | —      | —    | 8.0  | V             |
|                                      |               |                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 500\text{ mA}\dagger$  | 5    | —      | —    | 9.5  | V             |
|                                      |               | ULS-2815*          | -55°C           | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}$         | 5    | —      | —    | 3.0  | V             |
|                                      |               |                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 500\text{ mA}$         | 5    | —      | —    | 3.5  | V             |
|                                      |               |                    | +125°C          | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}\dagger$  | 5    | —      | —    | 2.4  | V             |
|                                      |               |                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 500\text{ mA}\dagger$  | 5    | —      | —    | 2.6  | V             |
| D-C Forward Current Transfer Ratio   | $h_{FE}$      | ULS-2811*          | -55°C           | $V_{CE} = 2.0\text{ V}, I_C = 500\text{ mA}$         | 2    | 450    | —    | —    | —             |
|                                      |               |                    | +25°C           | $V_{CE} = 2.0\text{ V}, I_C = 500\text{ mA}$         | 2    | 900    | —    | —    | —             |
| Turn-On Delay                        | $t_{PLH}$     | All                | +25°C           |  | 8    | —      | 250  | 1000 | ns            |
| Turn-Off Delay                       | $t_{PHL}$     | All                | +25°C           |  | 8    | —      | 250  | 1000 | ns            |
| Clamp Diode Leakage Current          | $I_R$         | All                |                 | $V_R = 50\text{ V}$                                  | 6    | —      | —    | 50   | $\mu\text{A}$ |
| Clamp Diode Forward Voltage          | $V_f$         | All                |                 | $I_f = 350\text{ mA}\dagger$                         | 7    | —      | 1.7  | 2.0  | V             |
|                                      |               |                    |                 | $I_f = 500\text{ mA}\dagger$                         | 7    | —      | —    | 2.5  | V             |

\*Complete part number includes a final letter to indicate package (H = glass/metal side-brazed, R = ceramic/glass cer-DIP).

Note 1: All limits stated apply to the complete Darlington series except as specified for a single device type.

Note 2: The  $I_{IN(OFF)}$  current limit guarantees against partial turn-on of the output.

Note 3: The  $V_{IN(ON)}$  voltage limit guarantees a minimum output sink current per the specified test conditions.

†Pulse Test,  $t_p \leq 1\ \mu\text{s}$ , see graph.

**SERIES ULS-2820H AND ULS-2820R**  
**ELECTRICAL CHARACTERISTICS over operating temperature range (unless otherwise noted)**

| Characteristic                       | Symbol        | Applicable Devices                 | Test Conditions |  |        | Limits  |      |      |               |     |   |
|--------------------------------------|---------------|------------------------------------|-----------------|--|--------|---|------|------|---------------|-----|---|
|                                      |               |                                    | Temp.           | Voltage/Current                                      | Fig.   | Min.  | Typ. | Max. | Units         |     |   |
| Output Leakage Current               | $I_{CEX}$     | All                                |                 | $V_{CE} = 95\text{ V}$                               | 1A     | —   | —    | 100  | $\mu\text{A}$ |     |   |
|                                      |               | ULS-2822*                          |                 | $V_{CE} = 95\text{ V}, V_{IN} = 6\text{ V}$          | 1B     | —   | —    | 500  | $\mu\text{A}$ |     |   |
|                                      |               | ULS-2824*                          | 25°C            | $V_{CE} = 95\text{ V}, V_{IN} = 1\text{ V}$          | 1B     | —   | —    | 500  | $\mu\text{A}$ |     |   |
|                                      |               |                                    | +125°C          | $V_{CE} = 95\text{ V}, V_{IN} = 0.5\text{ V}$        | 1B     | —   | —    | 500  | $\mu\text{A}$ |     |   |
| Collector-Emitter Saturation Voltage | $V_{CE(SAT)}$ | All                                | -55°C           | $I_C = 350\text{ mA}, I_B = 850\ \mu\text{A}$        | 2      | —   | 1.6  | 1.8  | V             |     |   |
|                                      |               |                                    |                 | $I_C = 200\text{ mA}, I_B = 550\ \mu\text{A}$        | 2      | —   | 1.3  | 1.5  | V             |     |   |
|                                      |               |                                    |                 | $I_C = 100\text{ mA}, I_B = 350\ \mu\text{A}$        | 2      | —   | 1.1  | 1.3  | V             |     |   |
|                                      |               |                                    | +25°C           | $I_C = 350\text{ mA}, I_B = 500\ \mu\text{A}$        | 2      | —   | 1.25 | 1.6  | V             |     |   |
|                                      |               |                                    |                 | $I_C = 200\text{ mA}, I_B = 350\ \mu\text{A}$        | 2      | —   | 1.1  | 1.3  | V             |     |   |
|                                      |               |                                    |                 | $I_C = 100\text{ mA}, I_B = 250\ \mu\text{A}$        | 2      | —   | 0.9  | 1.1  | V             |     |   |
|                                      |               |                                    | +125°C          | $I_C = 350\text{ mA}\dagger, I_B = 500\ \mu\text{A}$ | 2      | —   | 1.6  | 1.8  | V             |     |   |
|                                      |               |                                    |                 | $I_C = 200\text{ mA}, I_B = 350\ \mu\text{A}$        | 2      | —   | 1.3  | 1.5  | V             |     |   |
|                                      |               |                                    |                 | $I_C = 100\text{ mA}, I_B = 250\ \mu\text{A}$        | 2      | —   | 1.1  | 1.3  | V             |     |   |
|                                      |               |                                    |                 |  |        |   |      |      |               |     |   |
| Input Current                        | $I_{IN(ON)}$  | ULS-2822*                          |                 | $V_{IN} = 17\text{ V}$                               | 3      | 480   | 850  | 1300 | $\mu\text{A}$ |     |   |
|                                      |               | ULS-2823*                          |                 | $V_{IN} = 3.85\text{ V}$                             | 3      | 650   | 930  | 1350 | $\mu\text{A}$ |     |   |
|                                      |               | ULS-2824*                          |                 | $V_{IN} = 5.0\text{ V}$                              | 3      | 240   | 350  | 500  | $\mu\text{A}$ |     |   |
|                                      |               |                                    |                 | $V_{IN} = 12\text{ V}$                               | 3      | 650   | 1000 | 1450 | $\mu\text{A}$ |     |   |
|                                      |               | ULS-2825*                          |                 | $V_{IN} = 3.0\text{ V}$                              | 3      | —   | 1500 | 2400 | $\mu\text{A}$ |     |   |
|                                      | $I_{IN(OFF)}$ | All                                | +125°C          | $I_C = 500\ \mu\text{A}$                             | 4      | 20  | 50   | —    | $\mu\text{A}$ |     |   |
| Input Voltage                        | $V_{IN(ON)}$  | ULS-2822*                          | -55°C           | $V_{CE} = 2.0\text{ V}, I_C = 300\text{ mA}$         | 5      | —   | —    | 18   | V             |     |   |
|                                      |               |                                    | +125°C          | $V_{CE} = 2.0\text{ V}, I_C = 300\text{ mA}$         | 5      | —   | —    | 13   | V             |     |   |
|                                      |               | ULS-2823*                          | -55°C           | $V_{CE} = 2.0\text{ V}, I_C = 200\text{ mA}$         | 5      | —   | —    | 3.3  | V             |     |   |
|                                      |               |                                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 250\text{ mA}$         | 5      | —   | —    | 3.6  | V             |     |   |
|                                      |               |                                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 300\text{ mA}$         | 5      | —   | —    | 3.9  | V             |     |   |
|                                      |               |                                    | +125°C          | $V_{CE} = 2.0\text{ V}, I_C = 200\text{ mA}\dagger$  | 5      | —   | —    | 2.4  | V             |     |   |
|                                      |               |                                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 250\text{ mA}\dagger$  | 5      | —   | —    | 2.7  | V             |     |   |
|                                      |               |                                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 300\text{ mA}\dagger$  | 5      | —   | —    | 3.0  | V             |     |   |
|                                      |               | ULS-2824*                          | -55°C           | $V_{CE} = 2.0\text{ V}, I_C = 125\text{ mA}$         | 5      | —   | —    | 6.0  | V             |     |   |
|                                      |               |                                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 200\text{ mA}$         | 5      | —   | —    | 8.0  | V             |     |   |
|                                      |               |                                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 275\text{ mA}$         | 5      | —   | —    | 10   | V             |     |   |
|                                      |               |                                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}$         | 5      | —   | —    | 12   | V             |     |   |
|                                      |               |                                    | +125°C          | $V_{CE} = 2.0\text{ V}, I_C = 125\text{ mA}$         | 5      | —   | —    | 5.0  | V             |     |   |
|                                      |               |                                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 200\text{ mA}\dagger$  | 5      | —   | —    | 6.0  | V             |     |   |
|                                      |               |                                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 275\text{ mA}\dagger$  | 5      | —   | —    | 7.0  | V             |     |   |
|                                      |               |                                    |                 | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}\dagger$  | 5      | —   | —    | 8.0  | V             |     |   |
|                                      |               |                                    |                 | ULS-2825*  | -55°C  | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}$        | 5    | —    | —             | 3.0 | V |
|                                      |               |                                    |                 |  | +125°C | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}\dagger$ | 5    | —    | —             | 2.4 | V |
|                                      |               | D-C Forward Current Transfer Ratio | $h_{FE}$        | ULS2821*   | -55°C  | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}$        | 2    | 500  | —             | —   | — |
|                                      |               |                                    |                 |  | +25°C  | $V_{CE} = 2.0\text{ V}, I_C = 350\text{ mA}$        | 2    | 1000 | —             | —   | — |
| Turn-On Delay                        | $t_{PLH}$     | All                                | +25°C           |  | 8      | —   | 250  | 1000 | ns            |     |   |
| Turn-Off Delay                       | $t_{PHL}$     | All                                | +25°C           |  | 8      | —   | 250  | 1000 | ns            |     |   |
| Clamp Diode Leakage Current          | $I_R$         | All                                |                 | $V_R = 95\text{ V}$                                  | 6      | —   | —    | 50   | $\mu\text{A}$ |     |   |
| Clamp Diode Forward Voltage          | $V_f$         | All                                |                 | $I_f = 350\text{ mA}\dagger$                         | 7      | —   | 1.7  | 2.0  | V             |     |   |

\*Complete part number includes a final letter to indicate package (H = glass/metal side-brazed, R = ceramic/glass cer-DIP).

Note 1: All limits stated apply to the complete Darlington series except as specified for a single device type.

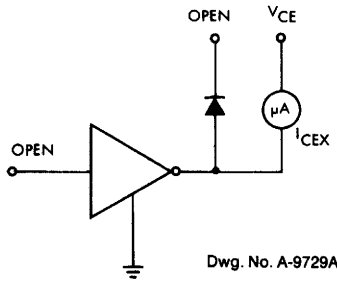
Note 2: The  $I_{IN(OFF)}$  current limit guarantees against partial turn-on of the output.

Note 3: The  $V_{IN(ON)}$  voltage limit guarantees a minimum output sink current per the specified test conditions.

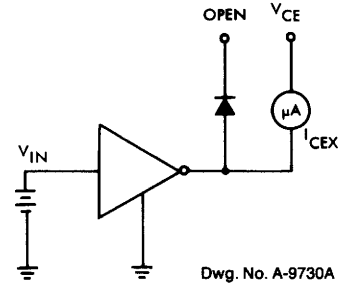
†Pulse Test,  $t_p \leq 1\ \mu\text{s}$ , see graph.

**SERIES ULS-2800H AND ULS-2800R  
HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAYS**

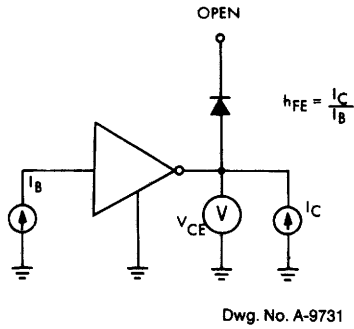
**TEST FIGURES**



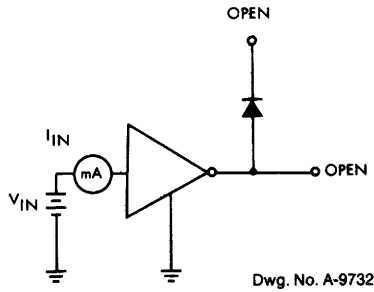
**FIGURE 1A**



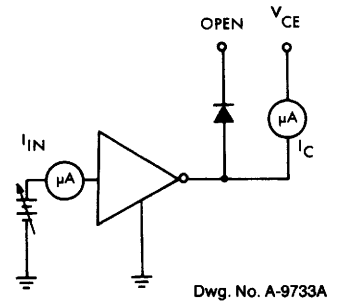
**FIGURE 1B**



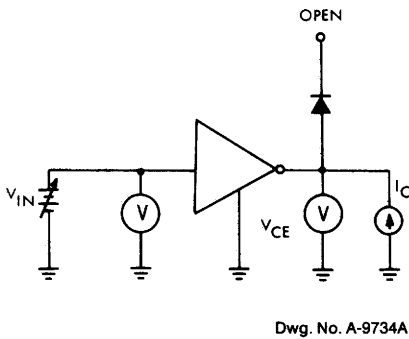
**FIGURE 2**



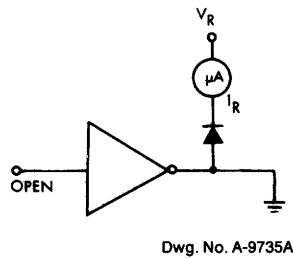
**FIGURE 3**



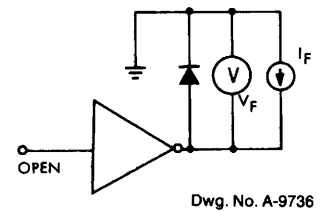
**FIGURE 4**



**FIGURE 5**



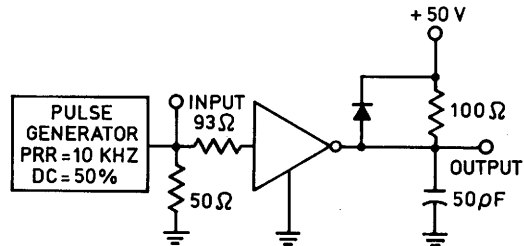
**FIGURE 6**



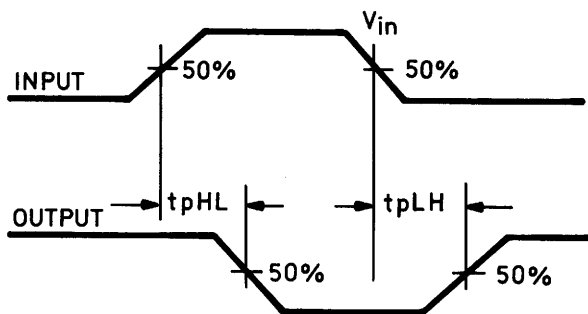
**FIGURE 7**

**SERIES ULS-2800H AND ULS-2800R  
HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAYS**

|           | $V_{in}$ |
|-----------|----------|
| ULS-28X1* | 3.5 V    |
| ULS-28X2* | 13 V     |
| ULS-28X3* | 3.5 V    |
| ULS-28X4* | 12 V     |
| ULS-28X5* | 3.5 V    |



Dwg. No. A-13,273

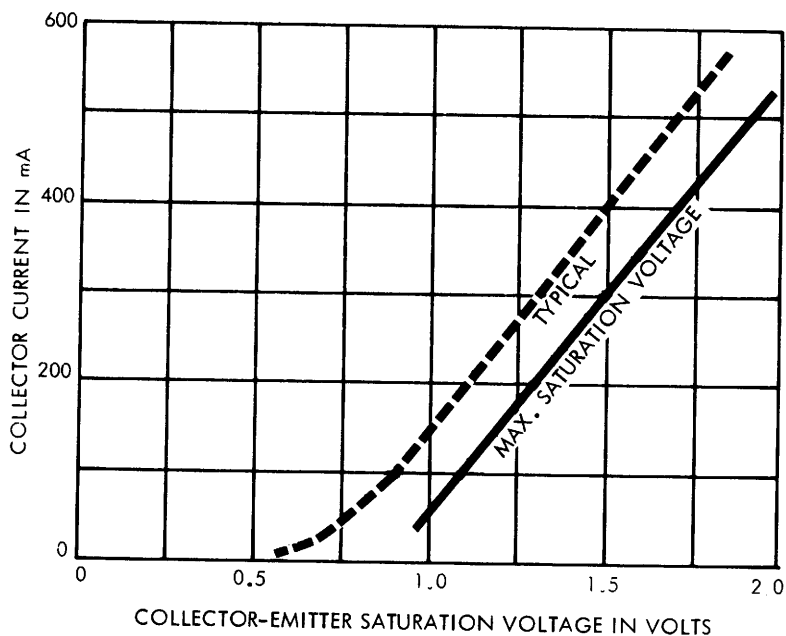


Dwg. No. A-13,272

\* Complete part number includes a final letter to indicate package.  
X = Digit to identify specific device. Specification shown applies to family of devices with remaining digits as shown.

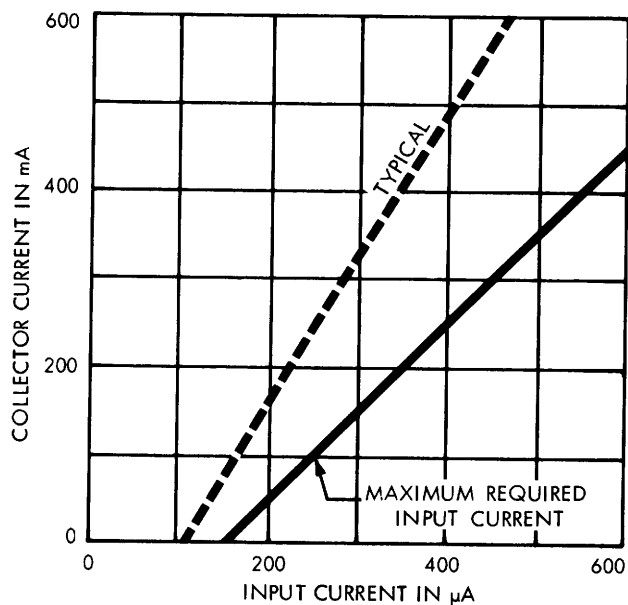
**FIGURE 8**

**COLLECTOR CURRENT AS A FUNCTION OF SATURATION VOLTAGE**



Dwg. No. A-9754C

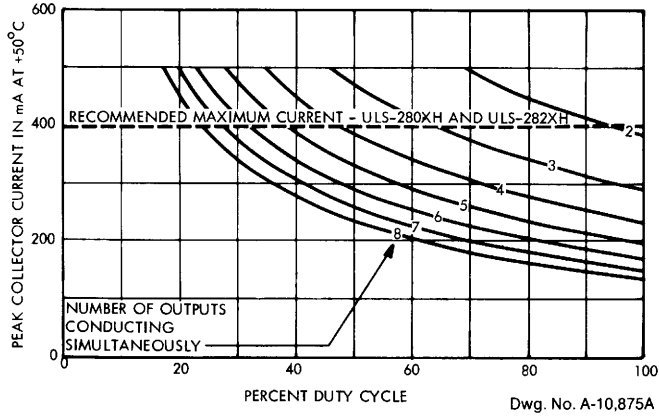
**COLLECTOR CURRENT AS A FUNCTION OF INPUT CURRENT**



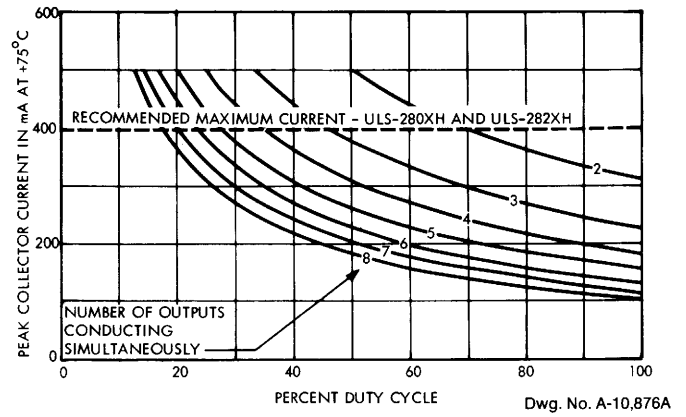
Dwg. No. A-10,872B

**SERIES ULS-2800H**

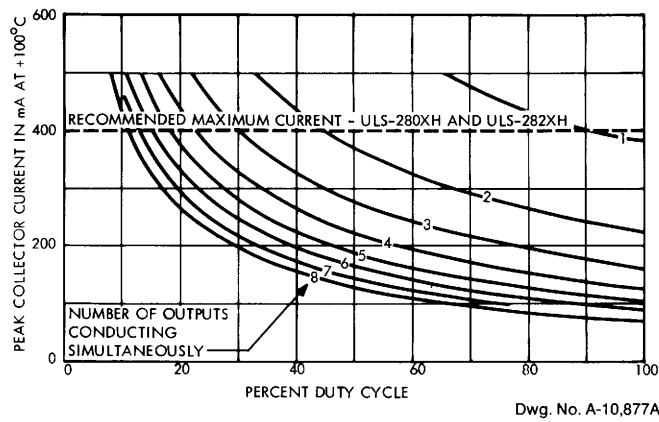
**PEAK COLLECTOR CURRENT  
AS A FUNCTION OF DUTY CYCLE AT +50°C**



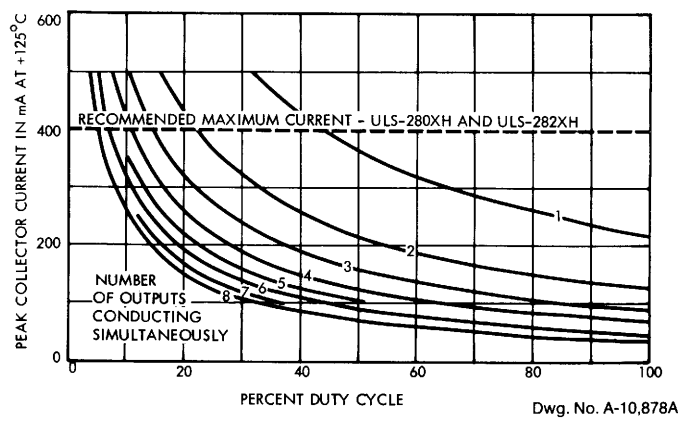
**PEAK COLLECTOR CURRENT  
AS A FUNCTION OF DUTY CYCLE AT +75°C**



**PEAK COLLECTOR CURRENT  
AS A FUNCTION OF DUTY CYCLE AT +100°C**



**PEAK COLLECTOR CURRENT  
AS A FUNCTION OF DUTY CYCLE AT +125°C**

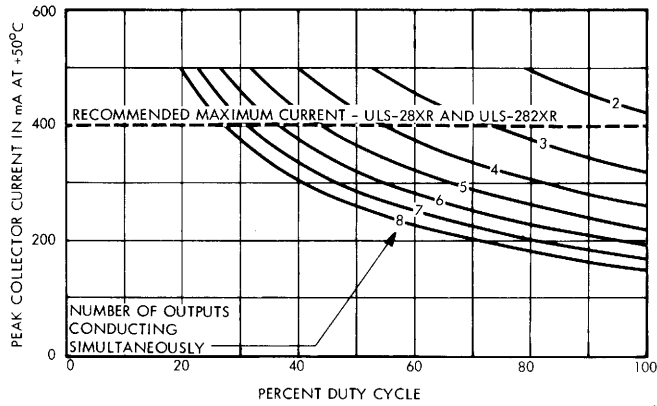


*X = digit to identify specific device. Specification or limit shown applies to family of devices with remaining digits as shown.*



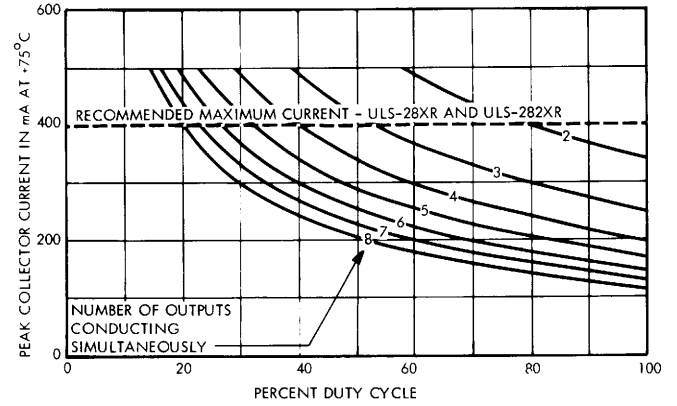
**SERIES ULS-2800R**

**PEAK COLLECTOR CURRENT  
AS A FUNCTION OF DUTY CYCLE AT +50°C**



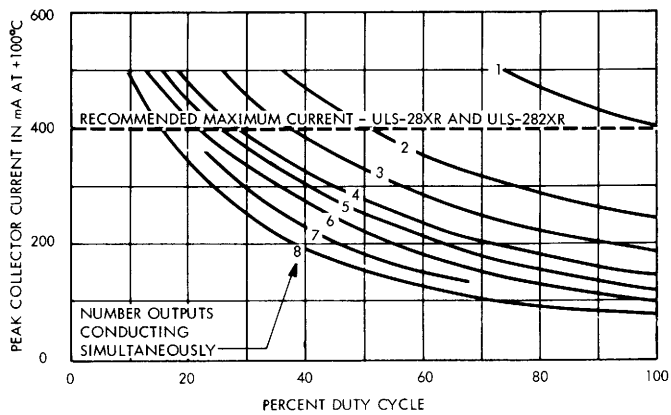
Dwg. No. A-10,870A

**PEAK COLLECTOR CURRENT  
AS A FUNCTION OF DUTY CYCLE AT +75°C**



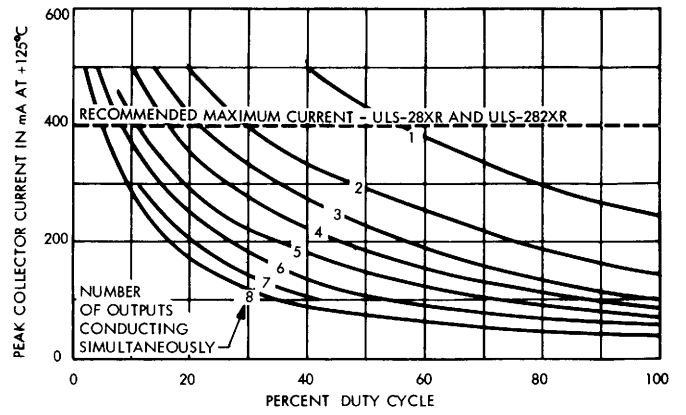
Dwg. No. A-10,871A

**PEAK COLLECTOR CURRENT  
AS A FUNCTION OF DUTY CYCLE AT +100°C**



Dwg. No. A-12,466

**PEAK COLLECTOR CURRENT  
AS A FUNCTION OF DUTY CYCLE AT +125°C**

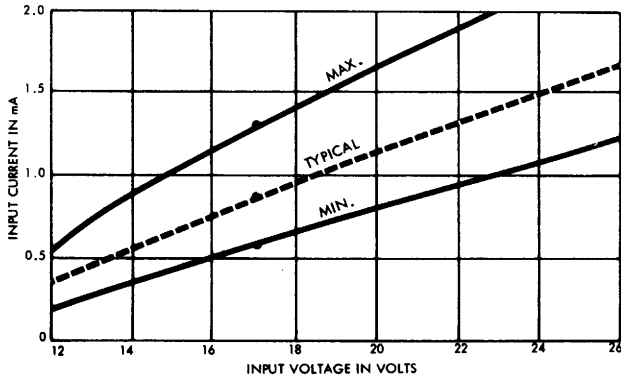


Dwg. No. A-12,467

*X = digit to identify specific device. Specification or limit shown applies to family of devices with remaining digits as shown.*

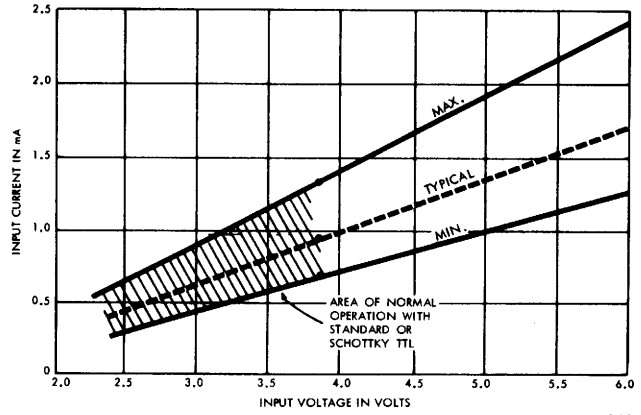
**INPUT CURRENT AS A FUNCTION OF INPUT VOLTAGE**

**ULS-28X2**



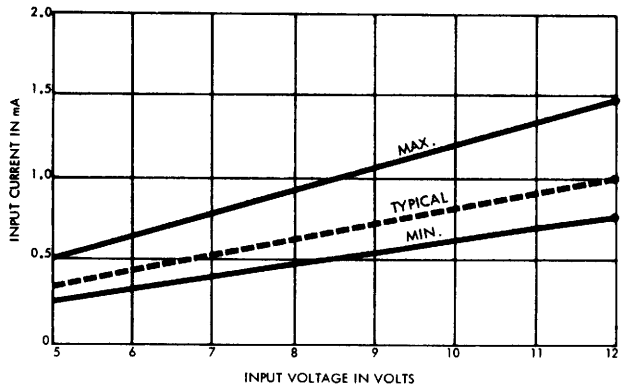
Dwg. No. A-10,225A

**ULS-28X3**



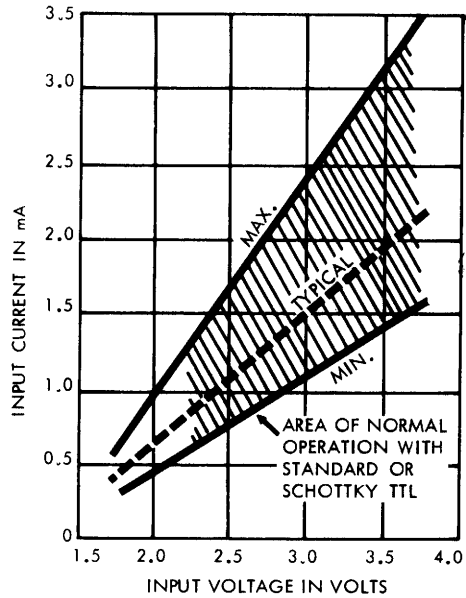
Dwg. No. A-10,224A

**ULS-28X4**



Dwg. No. A-10,226A

**ULS-28X5**

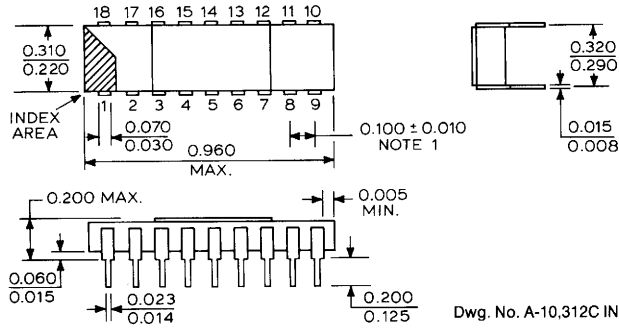


Dwg. No. A-10,874A

*X = digit to identify specific device. Specification or limit shown applies to family of devices with remaining digits as shown.*

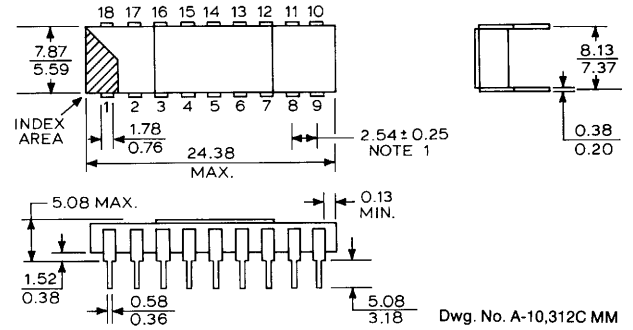
## HERMETIC GLASS/METAL 'H' PACKAGE

### DIMENSIONS IN INCHES



### DIMENSIONS IN MILLIMETERS

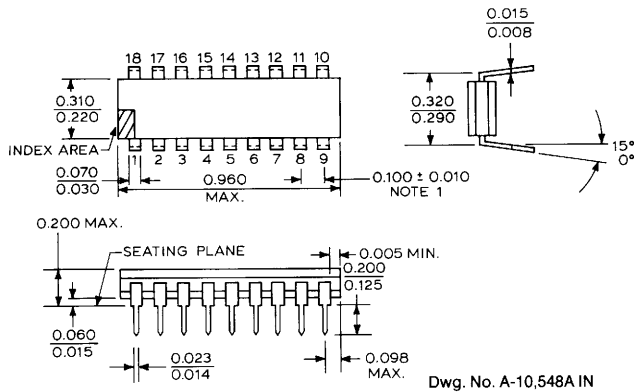
Based on 1" = 25.4 mm



This package conforms to military specification MIL-M-38510, case outline D-6, configuration 3. Devices using this package are marked to indicate compliance to the latest issue of MIL-STD-883. For example: ULS2801H-883.

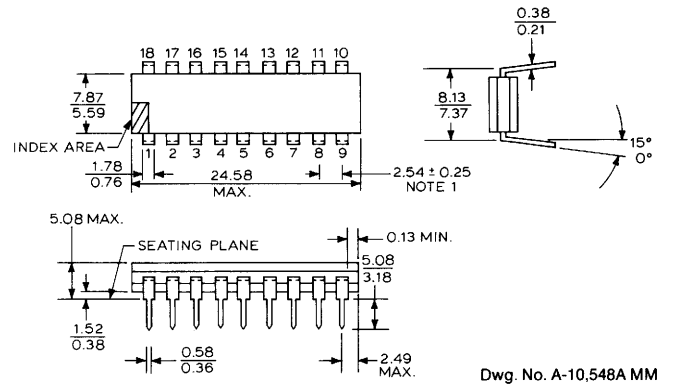
## HERMETIC CERAMIC/GLASS 'R' PACKAGE

### DIMENSIONS IN INCHES



### DIMENSIONS IN MILLIMETERS

Based on 1" = 25.4 mm



This package conforms to military specification MIL-M-38510, case outline D-6, configuration 1. Devices using this package are marked to indicate compliance to the latest issue of MIL-STD-883. For example: ULS2803R-883.

#### NOTES:

1. Lead spacing tolerance is non-cumulative.
2. Exact body and lead configuration at vendor's option within limits shown.
3. Lead gauge plane is 0.030 in. (0.76 mm) max. below seating plane.

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Tel. 617/449-6162

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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.

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