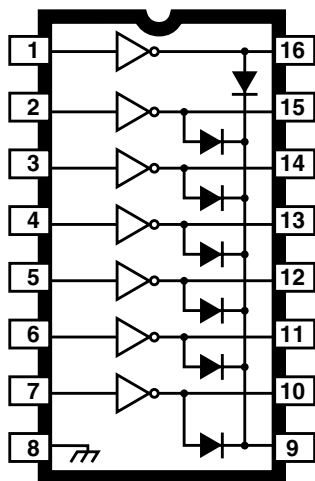


# 7003

Data Sheet  
29304.10A

## HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAY



Dwg. No. A-9594

Note the ULN7003A (DIP) and the ULN7003LW (SOIC) are electrically identical and share a common terminal number assignment.

### ABSOLUTE MAXIMUM RATINGS at $T_A = +25^\circ\text{C}$

Output Voltage, $V_{CEX}$	135 V
Output Sustaining Voltage, $V_{CE(sus)}$	90 V
Output Current, $I_C$	300 mA
Input Current, $I_{IN}$	25 mA
Package Power Dissipation, $P_D$	See Graph
Operating Temperature Range, $T_A$	$-20^\circ\text{C}$ to $+85^\circ\text{C}$
Storage Temperature Range, $T_S$	$-55^\circ\text{C}$ to $+150^\circ\text{C}$

Output current may be limited by duty cycle, number of drivers operating, ambient temperature, and heat sinking. Under any set of conditions, do not exceed the specified maximum current rating or a junction temperature of  $150^\circ\text{C}$ .

Integrating seven high-voltage, high-current npn Darlington into a monolithic power array, the ULN7003A AND ULN7003LW are designed for interfacing between TTL or CMOS logic and a variety of peripheral loads. The seven open-collector Darlington outputs are specified for 135 V minimum breakdown and 90 V minimum sustaining. Included are integral power diodes for switching inductive loads. Typical applications include relays, lamps, print heads and hammers, solenoids, and level shifting to power discretes.

The ULN7003A/LW include input current-limiting resistors compatible with the drive capabilities of TTL and (most) CMOS operating at a nominal logic supply of 5 V. Operation with 12 V CMOS may require additional input current limiting.

The high sustaining voltage rating of this power array makes it ideal for inductive load applications where Zener diode flyback techniques are used. The increased flyback voltage provides a much faster inductive load turn-off current decay that is especially useful with dc stepper motors, solenoids, and print heads.

Both devices are pinned with outputs opposite inputs to facilitate ease of circuit board layout. The ULN7003A is supplied in a 16-pin plastic dual in-line package with a copper lead frame to maximize device power dissipation capabilities. The ULN7003LW is furnished in a 16-lead small-outline wide-body package for surface-mount applications.

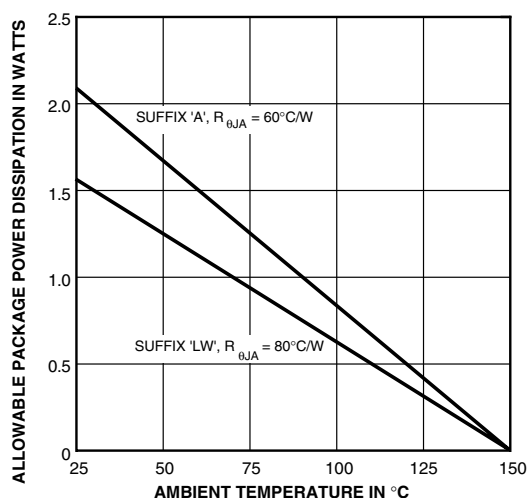
### FEATURES

- 135 V Minimum Output Breakdown
- 90 V Minimum Sustaining Voltage
- 300 mA Output Current
- Internal High-Current Clamp Diodes
- Logic-Compatible Inputs

Always order by complete part number:

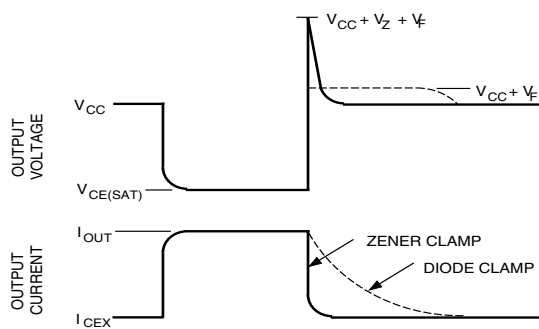
Part Number	Package
ULN7003A	16-Pin DIP
ULN7003LW	16-Lead SOIC

# 7003 HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAY



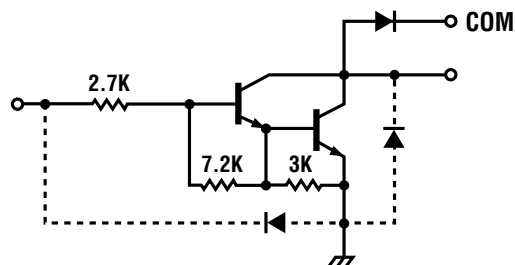
Dwg. GP-018B

A Zener diode can be used to increase the flyback voltage. This gives a much faster inductive load turn-OFF current decay. The maximum Zener voltage plus the load supply voltage plus the internal diode forward voltage must not exceed the device's rated sustaining voltage.



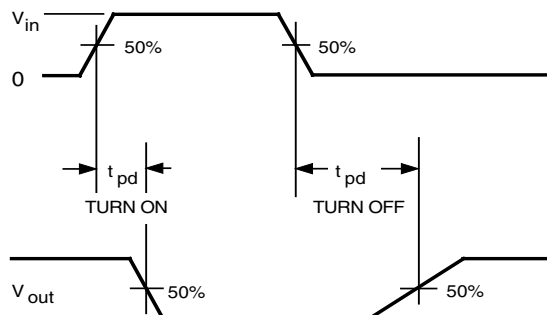
Dwg. WP-001

## PARTIAL SCHEMATIC (one of seven drivers)



Dwg. No. A-9651

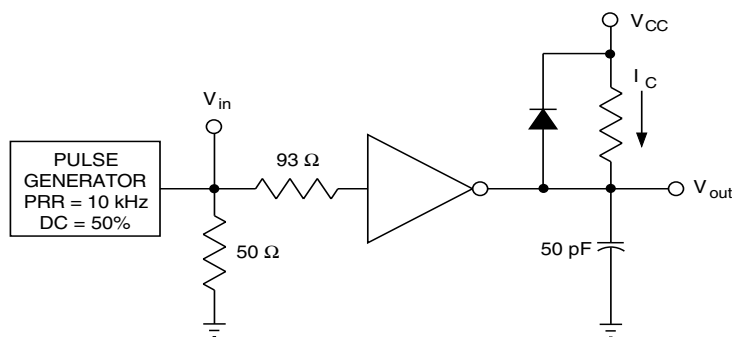
## SWITCHING DELAY TEST CIRCUIT



Dwg. WP-010

$V_{in} = 3.5 \text{ V for ULN7003A}$

Dwg. No. WP-010



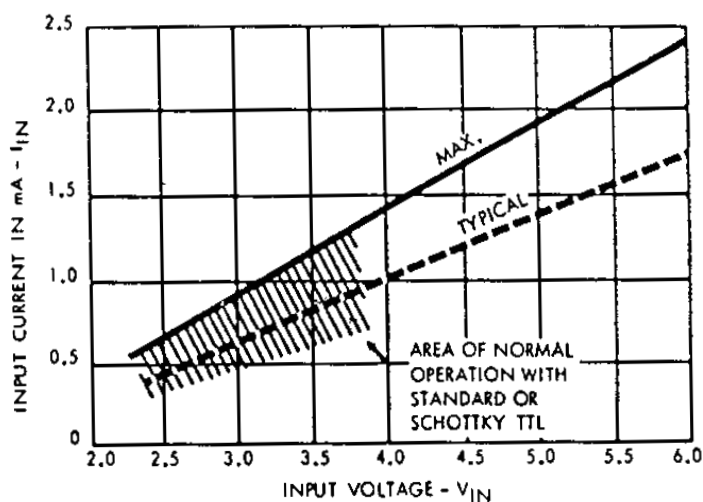
Dwg. EP-020

# 7003 HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAY

## ELECTRICAL CHARACTERISTICS at $T_A = +25^\circ\text{C}$ (unless otherwise noted).

Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units
Output Leakage Current	$I_{CEX}$	$V_{CE} = 135\text{ V}$	—	—	50	$\mu\text{A}$
		$V_{CE} = 135\text{ V}, T_A = +70^\circ\text{C}$	—	—	100	$\mu\text{A}$
Output Sustaining Voltage	$V_{CE(sus)}$	$I_C = 250\text{ mA}, L = 2\text{ mH}$	90	—	—	V
Output Saturation Voltage	$V_{CE(SAT)}$	$I_C = 100\text{ mA}, I_{IN} = 250\text{ }\mu\text{A}$	—	1.1	1.3	V
		$I_C = 250\text{ mA}, I_{IN} = 350\text{ }\mu\text{A}$	—	1.3	1.6	V
Input Current	$I_{IN(ON)}$	$V_{IN} = 3.85\text{ V}$	—	0.93	1.35	mA
	$I_{IN(OFF)}$	$I_C = 500\text{ }\mu\text{A}, T_A = +70^\circ\text{C}$	50	65	—	$\mu\text{A}$
Input Voltage	$V_{IN(ON)}$	$V_{CE} = 2.0\text{ V}, I_C = 200\text{ mA}$	—	—	2.4	V
		$V_{CE} = 2.0\text{ V}, I_C = 250\text{ mA}$	—	—	2.7	V
Input Capacitance	$C_{IN}$		—	15	25	pF
Switching Delay	$t_{pd}$	Turn On, $I_C = 250\text{ mA}$	—	0.05	1.0	$\mu\text{s}$
		Turn Off, $I_C = 250\text{ mA}$	—	0.5	1.0	$\mu\text{s}$
Clamp Diode Leakage Current	$I_R$	$V_R = 150\text{ V}$	—	—	50	$\mu\text{A}$
		$V_R = 150\text{ V}, T_A = +70^\circ\text{C}$	—	—	100	$\mu\text{A}$
Clamp Diode Forward Voltage	$V_F$	$I_F = 250\text{ mA}$	—	1.7	2.0	V

Typical Data is for design information only.

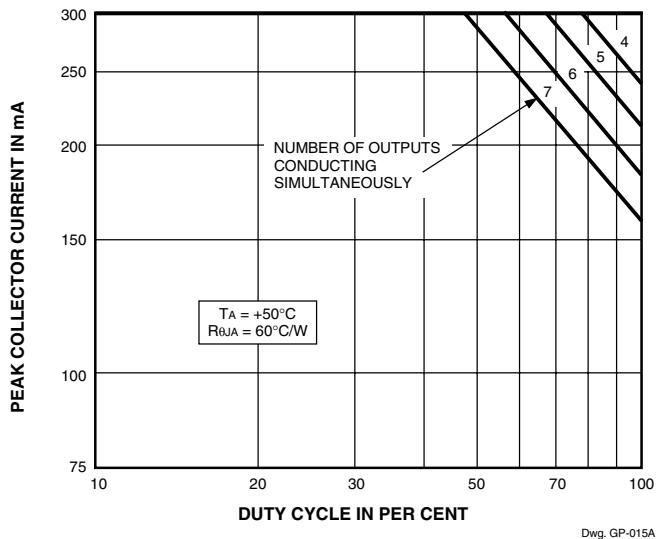


**TYPICAL INPUT CURRENT  
AS A FUNCTION OF INPUT VOLTAGE**  
at  $T_A = +25^\circ\text{C}$

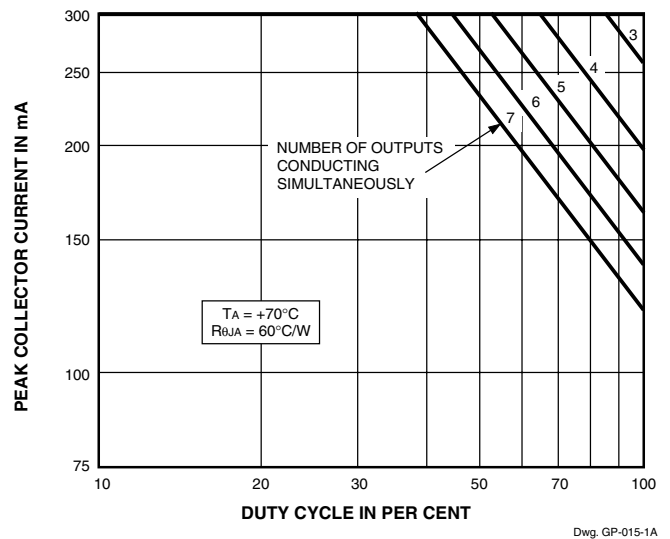
# 7003 HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAY

## ALLOWABLE PEAK COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE

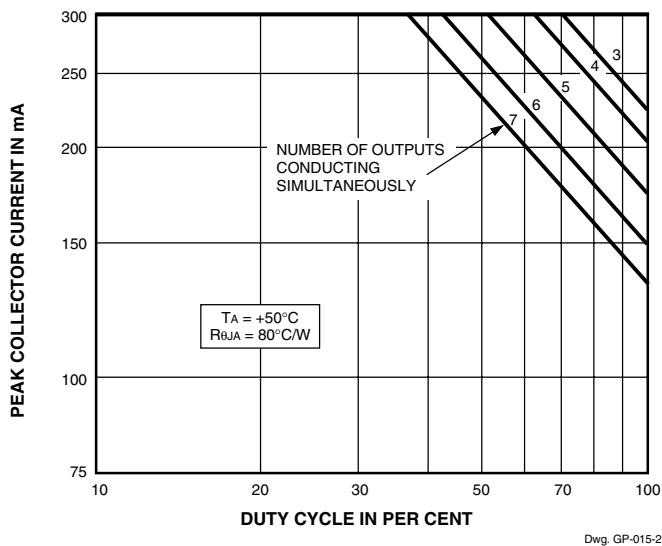
ULN7003A at  $T_A = +50^\circ\text{C}$



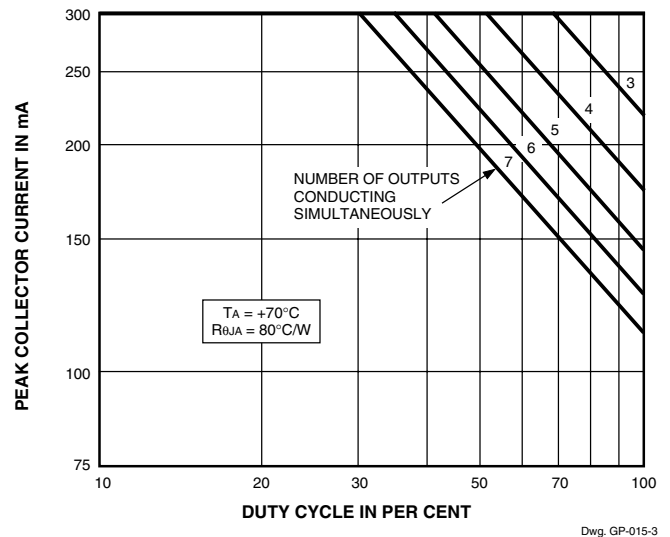
ULN7003A at  $T_A = +70^\circ\text{C}$



ULN7003LW at  $T_A = +50^\circ\text{C}$



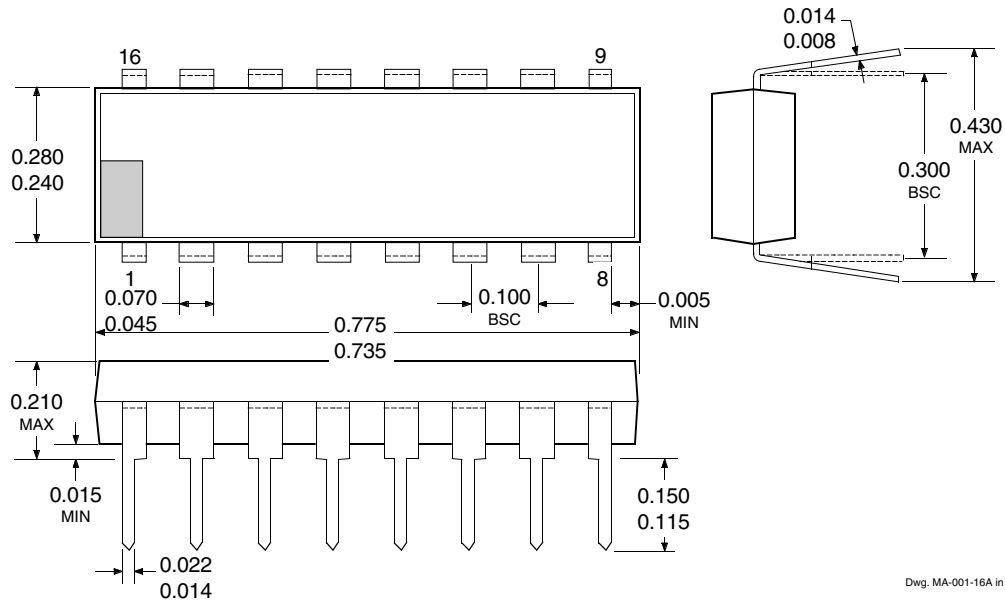
ULN7003LW at  $T_A = +70^\circ\text{C}$



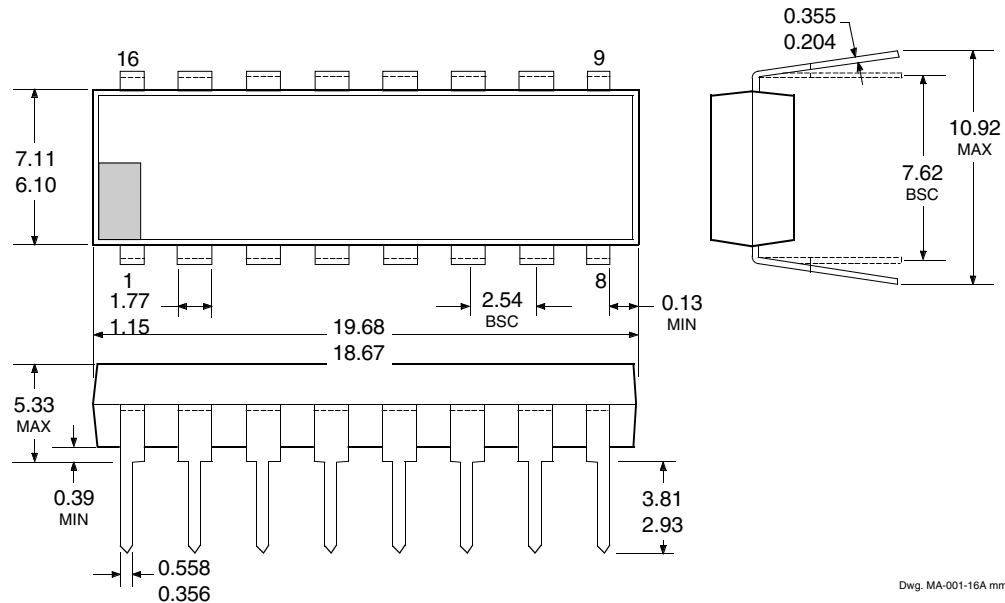
# 7003 HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAY

## ULN7003A

Dimensions in Inches  
(controlling dimensions)



Dimensions in Millimeters  
(for reference only)

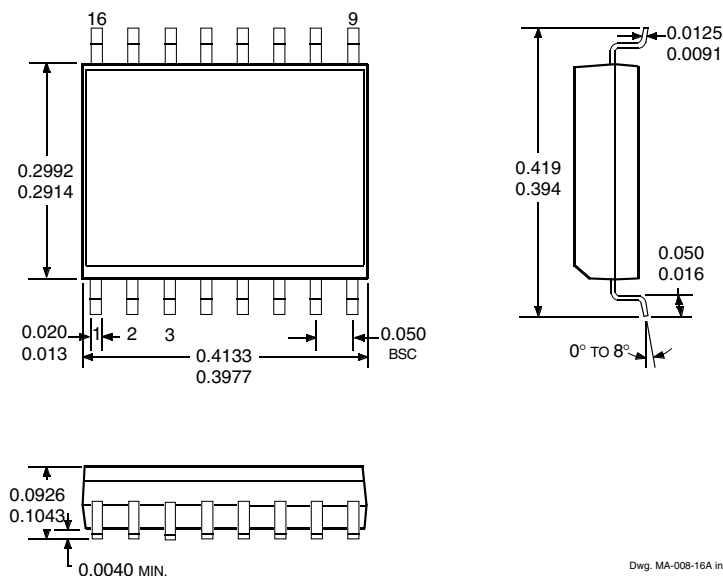


- NOTES:
1. Lead thickness is measured at seating plane or below.
  2. Lead spacing tolerance is non-cumulative.
  3. Exact body and lead configuration at vendor's option within limits shown.
  4. Supplied in standard sticks/tubes of 25 devices.

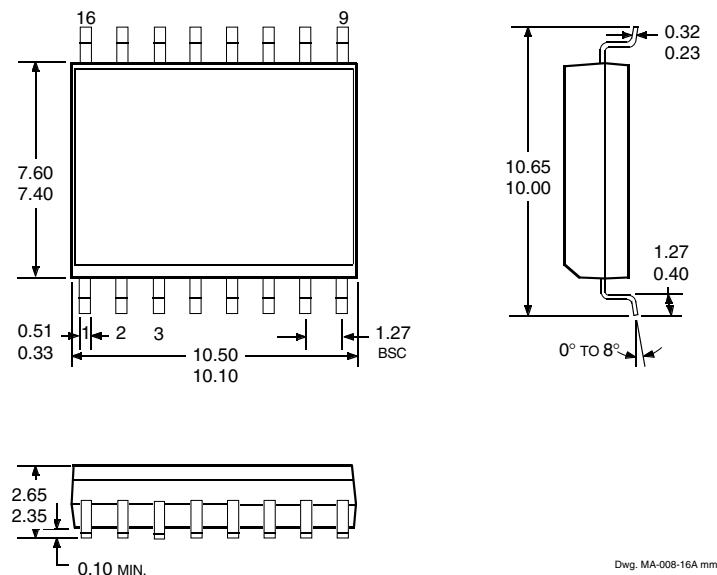
# 7003 HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAY

## ULN7003LW

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. Supplied in standard sticks/tubes of 47 devices or add "TR" to part number for tape and reel.

**7003**  
***HIGH-VOLTAGE,  
HIGH-CURRENT  
DARLINGTON ARRAY***

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**7003**  
**HIGH-VOLTAGE,**  
**HIGH-CURRENT**  
**DARLINGTON ARRAY**

***HIGH-VOLTAGE ( $\geq 60$  V) PERIPHERAL POWER  
AND DISPLAY DRIVERS***

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

Output Ratings*			Features					Part Number †
V	mA	#	Serial Input	Latched Drivers	Diode Clamp	Saturated Outputs	Internal Protection	
60	-25	8	—	X	—	—	—	5815
	-25	10	X	X	Active Pull-Down	—	—	5810-F and 6809/10
	-25	12	X	X	Active Pull-Down	—	—	5811 and 6811
	-25	20	X	X	Active Pull-Down	—	—	5812-F and 6812
	-25	32	X	X	Active Pull-Down	—	—	5818-F and 6818
	300	4	—	—	X	X	X	2557
	600	4	—	—	—	X	X	2547
	600	4	—	—	X	X	X	2549
	700	4	—	—	X	X	X	2559
	700	4	—	—	X	X	X	2543
	4000	4	—	—	X	—	—	2944
80	-350	8	—	—	X	—	—	2983 and 2984
	350	8	X	X	—	—	—	5822
	350	8	X	X	X	—	—	5842
	-350	8	X	X	X	—	—	5890
	1500	4	—	—	—	—	—	2065 and 2069
	4000	4	—	—	X	—	—	2879
85	-25	8	—	—	—	—	—	6118
95	300	7	—	—	X	—	—	2023
	300	8	—	—	X	—	—	2823
	350	7	—	—	X	—	—	2024
	350	8	—	—	X	—	—	2824

\* Current is maximum test condition; voltage is absolute maximum allowable.

Negative current is defined as coming out of (sourcing) the output.

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