ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, ULQ2004A 技术资料、百科信息、热点资讯,精彩尽在鼎好! HIGH-VOLTAGE HIGH-CURRENT

The ULN2001A is obsolete and is no longer supplied.

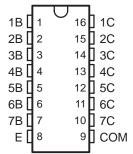
DARLINGTON TRANSISTOR ARRAY
SLRS027G - DECEMBER 1976 - REVISED JUNE 2004

- 500-mA-Rated Collector Current (Single Output)
- High-Voltage Outputs . . . 50 V
- Output Clamp Diodes
- Inputs Compatible With Various Types of Logic
- Relay-Driver Applications

description/ordering information

The ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, and ULQ2004A are high-voltage, high-current Darlington transistor arrays. Each consists of seven npn Darlington pairs that feature high-voltage outputs

ULN2001A . . . D OR N PACKAGE
ULN2002A . . . N PACKAGE
ULN2003A . . . D, N, NS, OR PW PACKAGE
ULN2004A . . . D, N, OR NS PACKAGE
ULQ2003A, ULQ2004A . . . D OR N PACKAGE
(TOP VIEW)



with common-cathode clamp diodes for switching inductive loads. The collector-current rating of a single Darlington pair is 500 mA. The Darlington pairs can be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers. For 100-V (otherwise interchangeable) versions of the ULN2003A and ULN2004A, see the SN75468 and SN75469, respectively.

ORDERING INFORMATION

TA	PACK	AGET	ORDERABLE PART NUMBER	TOP-SIDE MARKING
			ULN2002AN	ULN2002AN
	PDIP (N)	Tube of 25	ULN2003AN	ULN2003AN
			ULN2004AN	ULN2004AN
–20°C to 70°C		Tube of 40	ULN2003AD	LUNIOGGA
	0010 (D)	Reel of 2500	ULN2003ADR	ULN2003A
	SOIC (D)	Tube of 40	ULN2004AD	LII NI000 4A
		Reel of 2500	ULN2004ADR	ULN2004A
	00D (NO)	B 1 - (0000	ULN2003ANSR	ULN2003A
	SOP (NS)	Reel of 2000	ULN2004ANSR	ULN2004A
	TOOOD (DIA)	Tube of 90	ULN2003APW	LINIOGGA
	TSSOP (PW)	Reel of 2000	ULN2003APWR	UN2003A
	DDID (41)	T. 1. 105	ULQ2003AN	ULQ2003A
	PDIP (N)	Tube of 25	ULQ2004AN	ULQ2004AN
-40°C to 85°C		Tube of 40	ULQ2003AD	ULQ2003A
	2010 (D)	Reel of 2500	ULQ2003ADR	ULQ2003A
	SOIC (D)	Tube of 40	ULQ2004AD	ULQ2004A
		Reel of 2500	ULQ2004ADR	ULQ2004A

[†] Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, ULQ2004A

HIGH-VOLTAGE HIGH-CURRENT OF ARRAY

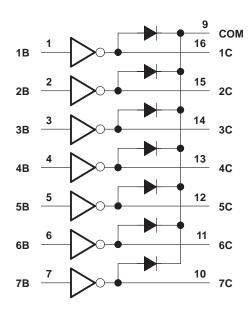
SLRS027G - DECEMBER 1976 - REVISED JUNE 2004

The ULN2001A is obsolete and is no longer supplied.

description/ordering information (continued)

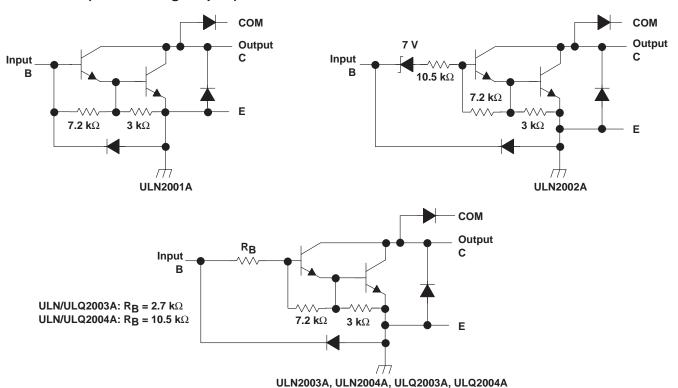
The ULN2001A is a general-purpose array and can be used with TTL and CMOS technologies. The ULN2002A is designed specifically for use with 14-V to 25-V PMOS devices. Each input of this device has a Zener diode and resistor in series to control the input current to a safe limit. The ULN2003A and ULQ2003A have a 2.7-k Ω series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices. The ULN2004A and ULQ2004A have a 10.5-k Ω series base resistor to allow operation directly from CMOS devices that use supply voltages of 6 V to 15 V. The required input current of the ULN/ULQ2004A is below that of the ULN/ULQ2003A, and the required voltage is less than that required by the ULN2002A.

logic diagram





schematics (each Darlington pair)



All resistor values shown are nominal.

ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, ULQ2004A HIGH-VOLTAGE HIGH-CURRENT

SLRS027G - DECEMBER 1976 - REVISED JUNE 2004

DARLINGTON TRANSISTOR ARRAY

The ULN2001A is obsolete and is no longer supplied.

absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)†

Collector-emitter voltage	50 V
Clamp diode reverse voltage (see Note 1)	
Input voltage, V _I (see Note 1)	30 V
Peak collector current (see Figures 14 and 15)	500 mA
Output clamp current, IOK	500 mA
Total emitter-terminal current	–2.5 A
Operating free-air temperature range, TA, ULN200xA	–20°C to 70°C
ULQ200xA	
ULQ200xAT	–40°C to 105°C
Package thermal impedance, θ_{JA} (see Notes 2 and 3): D pack	age 73°C/W
N pack	age 67°C/W
NS pac	kage 64°C/W
PW pag	ckage 108°C/W
Package thermal impedance, θ_{JC} (see Notes 4 and 5): D pack	age 36°C/W
N pack	age 54°C/W
Operating virtual junction temperature, T _J	150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	3 260°C
Storage temperature range, T _{stg}	–65°C to 150°C

[†] Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. All voltage values are with respect to the emitter/substrate terminal E, unless otherwise noted.

- 2. Maximum power dissipation is a function of $T_J(max)$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
- 3. The package thermal impedance is calculated in accordance with JESD 51-7.
- 4. Maximum power dissipation is a function of $T_J(max)$, θ_{JC} , and T_C . The maximum allowable power dissipation at any allowable case temperature is $P_D = (T_J(max) T_C)/\theta_{JC}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
- 5. The package thermal impedance is calculated in accordance with MIL-STD-883.

electrical characteristics, $T_A = 25^{\circ}C$ (unless otherwise noted)

	24244555	TEST		NETIONS	UI	N2001	A	UL	N2002	A	LINUT
	PARAMETER	FIGURE TEST CONDITIONS		MIN	TYP	MAX	MIN	TYP	MAX	UNIT	
V _{I(on)}	On-state input voltage	6	V _{CE} = 2 V,	IC = 300 mA						13	V
			$I_{\parallel} = 250 \mu A$,	I _C = 100 mA		0.9	1.1		0.9	1.1	
V _{CE(sat)}	Collector-emitter saturation voltage	5	$I_{I} = 350 \mu A$	$I_C = 200 \text{ mA}$		1	1.3		1	1.3	V
, ,	Saturation voltage		$I_I = 500 \mu A$,	$I_C = 350 \text{ mA}$		1.2	1.6		1.2	1.6	
٧F	Clamp forward voltage	8	I _F = 350 mA			1.7	2		1.7	2	V
		1	V _{CE} = 50 V,	I _I = 0			50			50	
ICEX	Collector cutoff current		V _{CE} = 50 V,	I _I = 0			100			100	μΑ
		2	T _A = 70°C	V _I = 6 V						500	
I _{I(off)}	Off-state input current	3	V _{CE} = 50 V, T _A = 70°C	I _C = 500 μA,	50	65		50	65		μΑ
Ιį	Input current	4	V _I = 17 V						0.82	1.25	mA
		_	$V_R = 50 V$	T _A = 70°C			100			100	
^I R	Clamp reverse current	7	V _R = 50 V				50			50	μΑ
h _{FE}	Static forward-current transfer ratio	5	V _{CE} = 2 V,	I _C = 350 mA	1000						
Ci	Input capacitance		$V_{I} = 0$,	f = 1 MHz		15	25		15	25	pF



ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, ULQ2004A **HIGH-VOLTAGE HIGH-CURRENT** DARLINGTON TRANSISTOR ARRAY SLRS027G - DECEMBER 1976 - REVISED JUNE 2004

The ULN2001A is obsolete and is no longer supplied.

electrical characteristics, $T_A = 25^{\circ}C$ (unless otherwise noted) (continued)

DADAMETED		TEST			ULN2003A			UL			
	PARAMETER	FIGURE	IESI CO	NDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				I _C = 125 mA						5	
				I _C = 200 mA			2.4			6	
.,	0		.,	$I_C = 250 \text{ mA}$			2.7				.,
V _{I(on)}	On-state input voltage	6	V _{CE} = 2 V	$I_C = 275 \text{ mA}$						7	V
				I _C = 300 mA			3				
				I _C = 350 mA						8	
			I _I = 250 μA,	I _C = 100 mA		0.9	1.1		0.9	1.1	
VCE(sat)	Collector-emitter saturation voltage	5	I _I = 350 μA,	I _C = 200 mA		1	1.3		1	1.3	V
-(Saturation voltage		I _I = 500 μA,	I _C = 350 mA		1.2	1.6		1.2	1.6	
		1	$V_{CE} = 50 \text{ V},$	I _I = 0			50			50	
ICEX	Collector cutoff current	_	V _{CE} = 50 V,	I _I = 0			100			100	μА
		2	T _A = 70°C	V _I = 1 V						500	
٧F	Clamp forward voltage	8	I _F = 350 mA			1.7	2		1.7	2	V
I _{I(off)}	Off-state input current	3	V _{CE} = 50 V, T _A = 70°C	$I_C = 500 \mu A$,	50	65		50	65		μΑ
			V _I = 3.85 V			0.93	1.35				
l _i	Input current	4	V _I = 5 V						0.35	0.5	mA
			V _I = 12 V						1	1.45	
		_	V _R = 50 V				50			50	
IR	Clamp reverse current	7	$V_R = 50 V$,	T _A = 70°C			100			100	μΑ
Ci	Input capacitance		$V_{I} = 0$,	f = 1 MHz		15	25		15	25	pF

ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, ULQ2004A HIGH-VOLTAGE HIGH-CURRENT

HIGH-VOLTAGE HIGH-CURRENT DARLINGTON TRANSISTOR ARRAY SLRS027G - DECEMBER 1976 - REVISED JUNE 2004

The ULN2001A is obsolete and is no longer supplied.

electrical characteristics over recommended operating conditions (unless otherwise noted)

	242445752	TEST		NEITIONS	UL	Q2003/	4	UL	Q2004	4	
	PARAMETER	FIGURE	TEST CONDITIONS		MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				I _C = 125 mA						5	
				$I_C = 200 \text{ mA}$			2.7			6	
.,	On-state input voltage		., .,	$I_C = 250 \text{ mA}$			2.9				.,
V _{I(on)}		6	V _{CE} = 2 V	I _C = 275 mA						7	V
				I _C = 300 mA			3				
				I _C = 350 mA						8	
			Ι _Ι = 250 μΑ,	I _C = 100 mA		0.9	1.2		0.9	1.1	
VCE(sat)	Collector-emitter saturation voltage	5	Ι _Ι = 350 μΑ,	I _C = 200 mA		1	1.4		1	1.3	V
(111)	Saturation voltage		$I_{I} = 500 \mu A$,	$I_C = 350 \text{ mA}$		1.2	1.7		1.2	1.6	
		1	$V_{CE} = 50 \text{ V},$	I _I = 0			100			50	
ICEX	Collector cutoff current	_	., 50.1/	I _I = 0						100	μΑ
		2	V _{CE} = 50 V	V _I = 1 V						500	
٧F	Clamp forward voltage	8	$I_F = 350 \text{ mA}$			1.7	2.3		1.7	2	V
I _{I(off)}	Off-state input current	3	V _{CE} = 50 V,	I _C = 500 μA		65		50	65		μΑ
			V _I = 3.85 V			0.93	1.35				
Ц	Input current	4	V _I = 5 V						0.35	0.5	mA
			V _I = 12 V						1	1.45	
	Claren navana aum : : 1	7	$V_R = 50 V$,	T _A = 25°C			100			50	
I _R	Clamp reverse current	7	V _R = 50 V				100			100	μΑ
C _i	Input capacitance		$V_{I} = 0$,	f = 1 MHz		15	25	_	15	25	pF

switching characteristics, $T_A = 25^{\circ}C$

	PARAMETER	TEST CONDITIONS	ULN2001A ULN2003A	UNIT		
			MIN	TYP	MAX	
tPLH	Propagation delay time, low- to high-level output	See Figure 9		0.25	1	μs
tPHL	Propagation delay time, high- to low-level output	See Figure 9		0.25	1	μs
Vон	High-level output voltage after switching	$V_S = 50 \text{ V}, \qquad I_O \approx 300 \text{ mA},$ See Figure 10	V _S -20		·	mV

switching characteristics over recommended operating conditions (unless otherwise noted)

	DADAMETER		ULQ2003			
	PARAMETER	TEST CONDITIONS	MIN TYP MAX		UNIT	
^t PLH	Propagation delay time, low- to high-level output	See Figure 9		1	10	μs
tPHL	Propagation delay time, high- to low-level output	See Figure 9		1	10	μs
Vон	High-level output voltage after switching	$V_S = 50 \text{ V}, \qquad I_O \approx 300 \text{ mA},$ See Figure 10	V _S -500			mV



PARAMETER MEASUREMENT INFORMATION

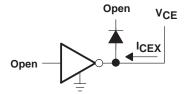


Figure 1. I_{CEX} Test Circuit

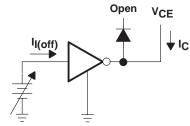
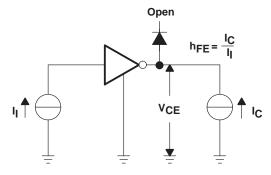


Figure 3. I_{I(off)} Test Circuit



NOTE: I_I is fixed for measuring $V_{\text{CE(sat)}}$, variable for measuring h_{FE}.

Figure 5. hFE, VCE(sat) Test Circuit

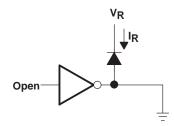


Figure 7. IR Test Circuit

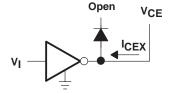


Figure 2. I_{CEX} Test Circuit

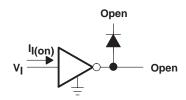


Figure 4. I_I Test Circuit

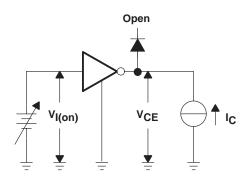


Figure 6. V_{I(on)} Test Circuit

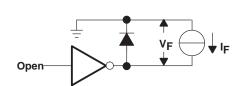


Figure 8. V_F Test Circuit

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PARAMETER MEASUREMENT INFORMATION

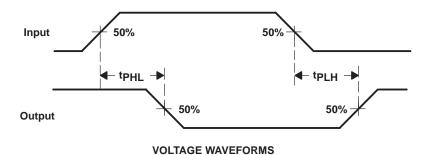
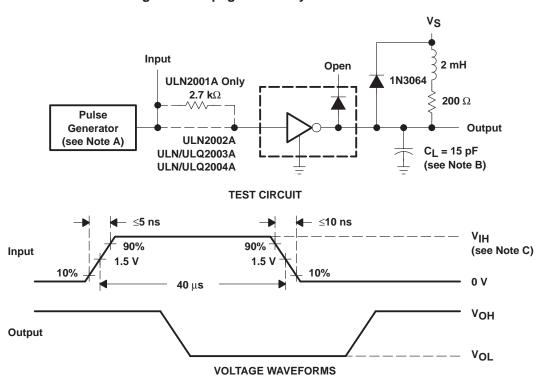


Figure 9. Propagation Delay-Time Waveforms



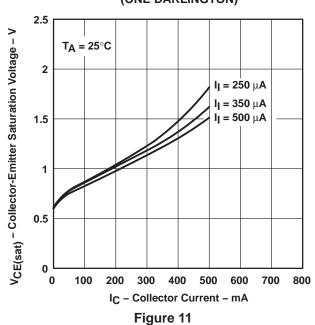
- NOTES: A. The pulse generator has the following characteristics: PRR = 12.5 kHz, $Z_O = 50 \Omega$.
 - B. C_L includes probe and jig capacitance.
 - C. For testing the ULN2001A, the ULN2003A, and the ULQ2003A, V_{IH} = 3 V; for the ULN2002A, V_{IH} = 13 V; for the ULN2004A and the ULQ2004A, V_{IH} = 8 V.

Figure 10. Latch-Up Test Circuit and Voltage Waveforms

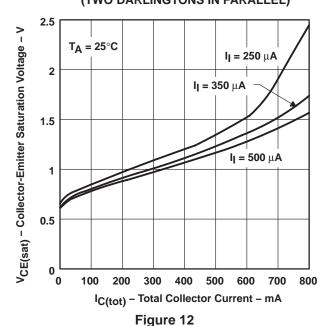


TYPICAL CHARACTERISTICS

COLLECTOR-EMITTER
SATURATION VOLTAGE
vs
COLLECTOR CURRENT
(ONE DARLINGTON)



COLLECTOR-EMITTER
SATURATION VOLTAGE
vs
TOTAL COLLECTOR CURRENT
(TWO DARLINGTONS IN PARALLEL)



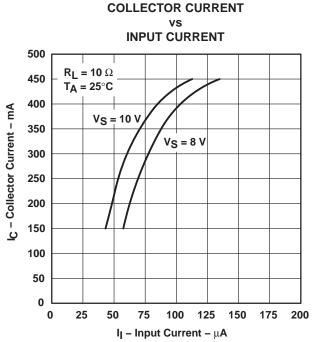


Figure 13

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THERMAL INFORMATION

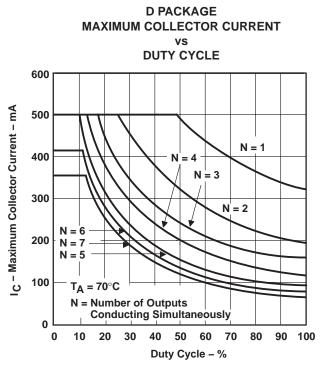


Figure 14

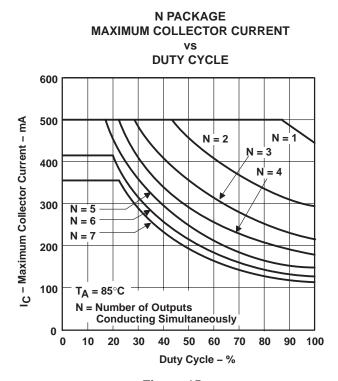


Figure 15

APPLICATION INFORMATION

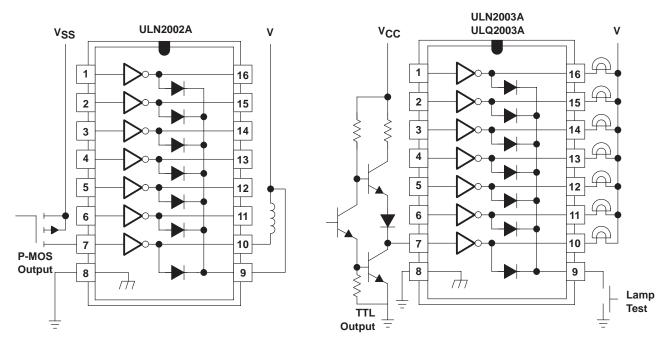


Figure 16. P-MOS to Load

Figure 17. TTL to Load

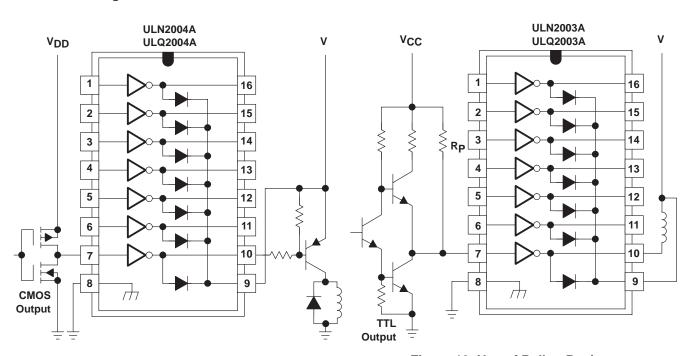


Figure 18. Buffer for Higher Current Loads

Figure 19. Use of Pullup Resistors to Increase Drive Current





PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	e Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
ULN2001AD	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
ULN2001ADR	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
ULN2001AN	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
ULN2002AD	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
ULN2002AN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
ULN2002ANE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
ULN2003AD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003ADE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003ADG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003ADR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003ADRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003ADRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003AJ	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
ULN2003AN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
ULN2003ANE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
ULN2003ANSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003ANSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003ANSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003APW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003APWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003APWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003APWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003APWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2003APWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2004AD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2004ADE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2004ADG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM





com 22-Aug-2007

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Packag Qty	e Eco Plan ⁽²⁾	Lead/Ball Finis	h MSL Peak Temp ⁽³⁾
ULN2004ADR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2004ADRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2004ADRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2004AN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
ULN2004ANE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
ULN2004ANSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULN2004ANSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULQ2003AD	NRND	SOIC	D	16	40	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR Level-1-235C-UNLIM
ULQ2003ADG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULQ2003ADR	NRND	SOIC	D	16	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR Level-1-235C-UNLIM
ULQ2003ADRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULQ2003AN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
ULQ2004AD	NRND	SOIC	D	16	40	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR Level-1-235C-UNLIM
ULQ2004ADG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULQ2004ADR	NRND	SOIC	D	16	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR Level-1-235C-UNLIM
ULQ2004ADRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
ULQ2004AN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)



PACKAGE OPTION ADDENDUM

22-Aug-2007

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

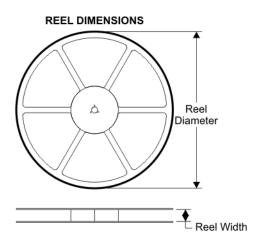
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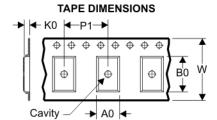
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22-Sep-2007

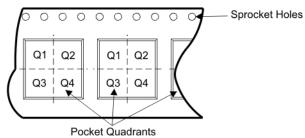
TAPE AND REEL BOX INFORMATION





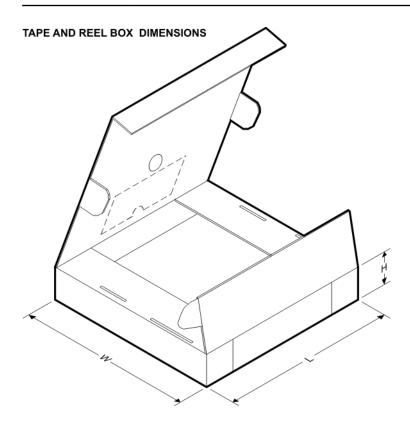
	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Device	Package	Pins	Site	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
ULN2003ADR	D	16	SITE 27	330	16	6.5	10.3	2.1	8	16	Q1
ULN2003ADR	D	16	SITE 41	330	16	6.5	10.3	2.1	8	16	Q1
ULN2003ANSR	NS	16	SITE 41	330	16	8.2	10.5	2.5	12	16	Q1
ULN2003APWR	PW	16	SITE 41	330	12	7.0	5.6	1.6	8	12	Q1
ULN2004ADR	D	16	SITE 27	330	16	6.5	10.3	2.1	8	16	Q1
ULN2004ADR	D	16	SITE 41	330	16	6.5	10.3	2.1	8	16	Q1
ULN2004ANSR	NS	16	SITE 41	330	16	8.2	10.5	2.5	12	16	Q1





Device	Package	Pins	Site	Length (mm)	Width (mm)	Height (mm)
ULN2003ADR	D	16	SITE 27	342.9	336.6	0.0
ULN2003ADR	D	16	SITE 41	346.0	346.0	0.0
ULN2003ANSR	NS	16	SITE 41	346.0	346.0	0.0
ULN2003APWR	PW	16	SITE 41	346.0	346.0	0.0
ULN2004ADR	D	16	SITE 27	342.9	336.6	0.0
ULN2004ADR	D	16	SITE 41	346.0	346.0	0.0
ULN2004ANSR	NS	16	SITE 41	346.0	346.0	0.0

14 LEADS SHOWN



- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package is hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
- E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN

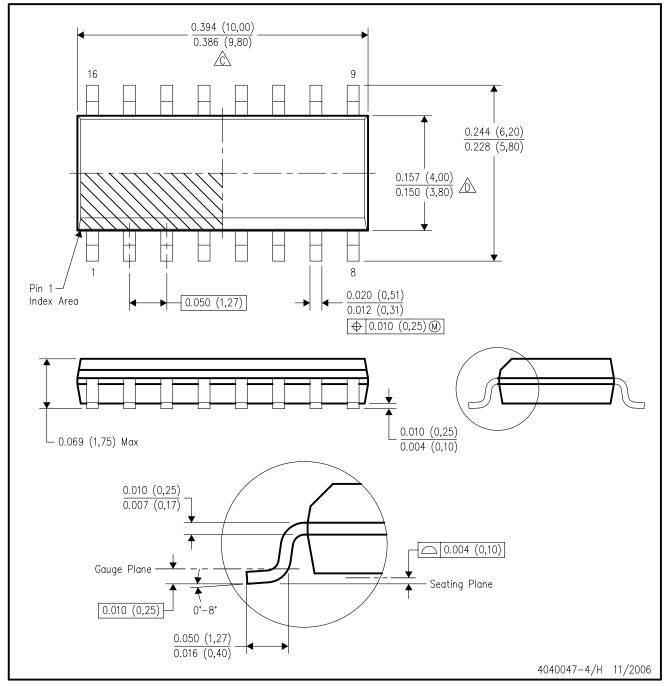


- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
- The 20 pin end lead shoulder width is a vendor option, either half or full width.



D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
- Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
- E. Reference JEDEC MS-012 variation AC.



MECHANICAL DATA

NS (R-PDSO-G**)

14-PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.



PW (R-PDSO-G**)

14 PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



NOTES: A. All linear dimensions are in millimeters.

B. This drawing is subject to change without notice.

C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.

D. Falls within JEDEC MO-153

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