



Description

The ULN2803A device is a 50 V, 500 mA Darlington transistor array. The device consists of eight NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of each Darlington pair is 500 mA. The Darlington pairs may be connected in parallel for higher current capability.

Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers. The ULN2803A device has a 2.7k Ω series base resistor for each Darlington pair for operation directly with TTL or 5V CMOS devices.

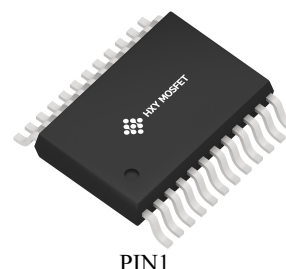
Features

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

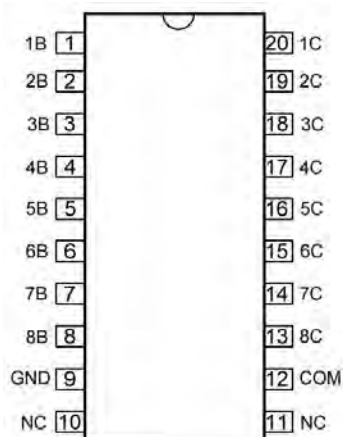
Ordering Information

Orderable Device	Package Type	Pins	Packing	Package Qty
ULN2803A	SSOP	24	Tape & Reel	3000
	TSSOP	20	Tape & Reel	3000
	QFN(4*4)	20	Tape & Reel	3000

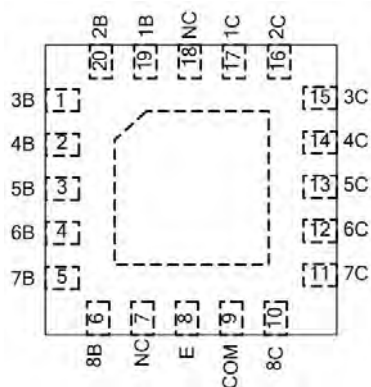
Pin Descriptio and Functional Diagram



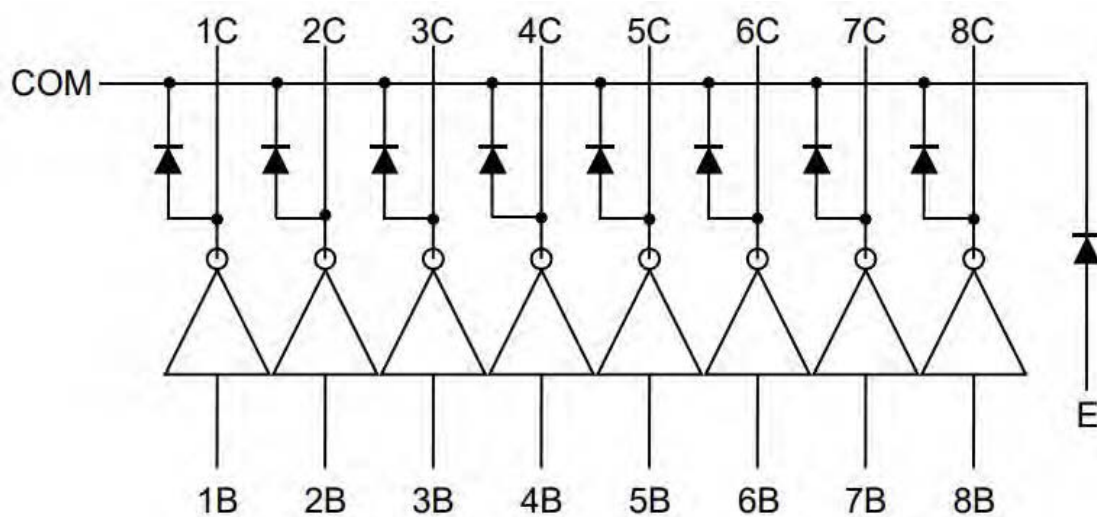
SSOP-24



TSSOP-20



QFN4X4-20



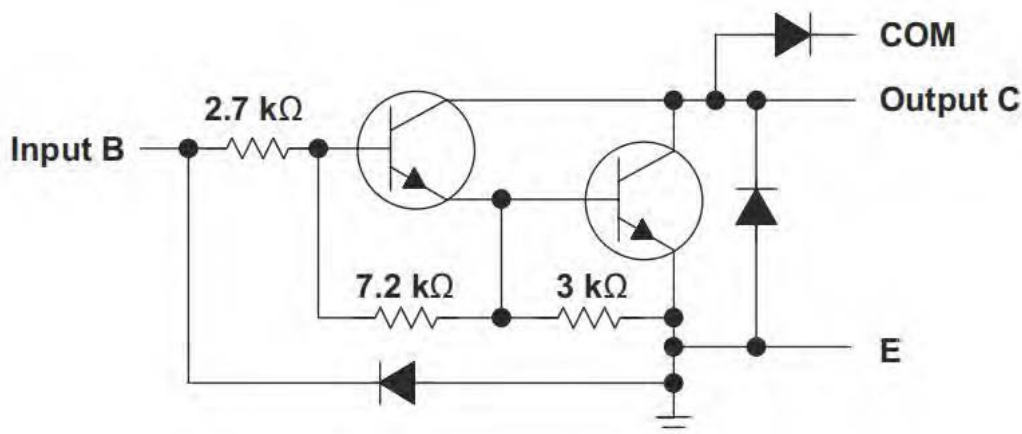
Functional Diagram



PIN No.			NAME	I/O	FUNCTION
QFN4X4-20	TSSOP-20	SSOP-24			
--	--	1	NC		No Connect Pin
--	--	2	NC		No Connect Pin
7	10	3	NC		No Connect Pin
19	1	4	1B	I	Channel 1 Darlington Base Input
20	2	5	2B	I	Channel 2 Darlington Base Input
1	3	6	3B	I	Channel 3 Darlington Base Input
2	4	7	4B	I	Channel 4 Darlington Base Input
3	5	8	5B	I	Channel 5 Darlington Base Input
4	6	9	6B	I	Channel 6 Darlington Base Input
5	7	10	7B	I	Channel 7 Darlington Base Input
6	8	11	8B	I	Channel 8 Darlington Base Input
8	9	12	GND/E		Common Emitter Shared by All Channels (typically tied to ground)
9	12	13	COM	I/O	Common Cathode Node for Flyback Diodes (required for inductive loads)
10	13	14	8C	O	Channel 8 Darlington Collector Output
11	14	15	7C	O	Channel 7 Darlington Collector Output
12	15	16	6C	O	Channel 6 Darlington Collector Output
13	16	17	5C	O	Channel 5 Darlington Collector Output
14	17	18	4C	O	Channel 4 Darlington Collector Output
15	18	19	3C	O	Channel 3 Darlington Collector Output
16	19	20	2C	O	Channel 2 Darlington Collector Output
17	20	21	1C	O	Channel 1 Darlington Collector Output
18	11	22	NC		No Connect Pin
--	--	23	NC		No Connect Pin
--	--	24	NC		No Connect Pin



Logic Diagram



Absolute Maximum Ratings

Symbol	Parameter	MIN	MAX	Unit
V_{CE}	Collector-Emitter Voltage		50	V
V_I	Input Voltage Range, All Inputs		30	V
Peak Collector Current			500	mA
P_D	Power Dissipation		500	mW
T_J	Junction Temperature		125	°C
T_{OP}	Operating Temperature	-40	85	°C

Absolute maximum ratings are those values beyond which the device could be permanently damaged, These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions.

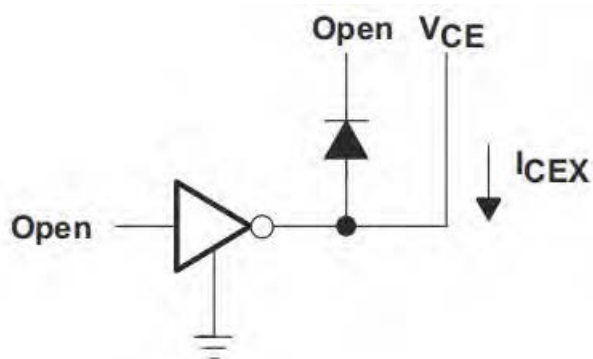
Electrical Characteristics

($T_a=25^{\circ}\text{C}$, voltages are referenced to VSS (ground=0V), unless otherwise specified)

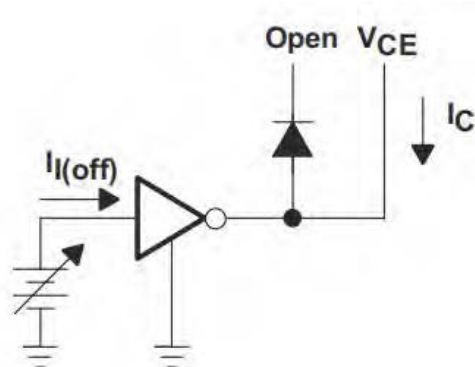
Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
I_{CEX}	Collector Cutoff Current	$V_{CE}=50\text{V}, I_I=0$	--	--	50	uA
$I_{I(off)}$	Off-state input current	$I_C=500\text{uA}$	50	80	--	uA
$I_{I(on)}$	Input Current	$V_I=3.85\text{V}$	--	0.9	--	mA
$V_{I(on)}$	On-state Input Voltage	$V_{CE}=2\text{V}, I_C=200\text{mA}$	--	1.8	2.4	V
		$V_{CE}=2\text{V}, I_C=250\text{mA}$	--	1.85	2.7	V
		$V_{CE}=2\text{V}, I_C=300\text{mA}$	--	1.9	3	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_I=250\text{uA}, I_C=100\text{mA}$	--	0.9	1.2	V
		$I_I=350\text{uA}, I_C=200\text{mA}$	--	1	1.3	V
		$I_I=500\text{uA}, I_C=350\text{mA}$	--	1.25	1.7	V
I_R	Clamp Diode Reverse Current	$V_R=50\text{V}$	--	--	50	uA
V_F	Clamp Diode Forward Voltage	$I_F=350\text{mA}$	--	1.3	2	V



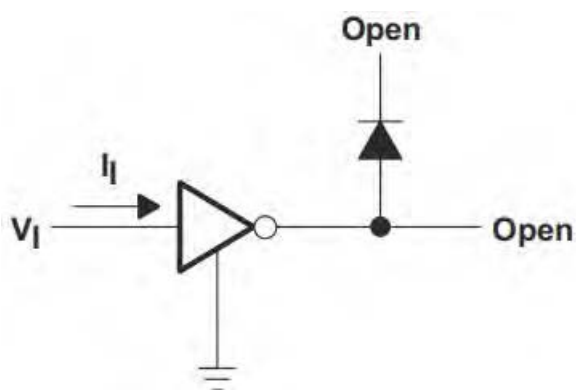
Parameter Measurement Information



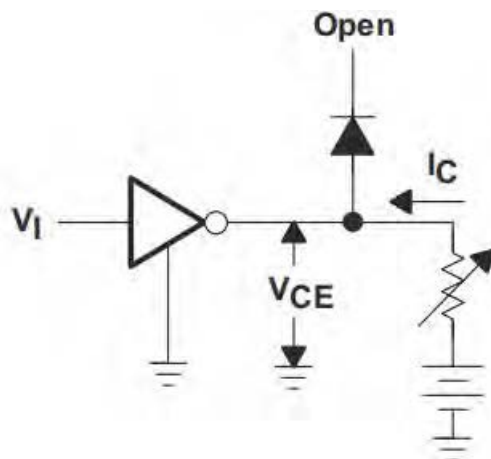
I_{CEX} Test Circuit



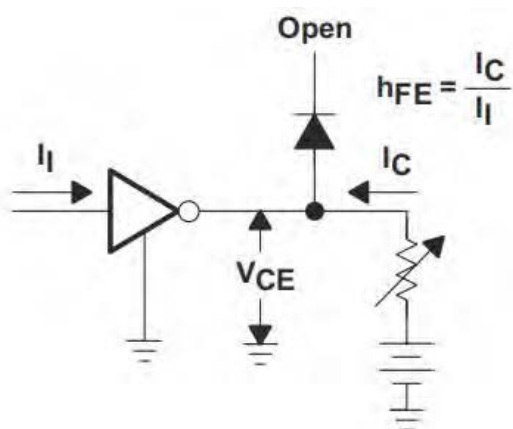
$I_{I(off)}$ Test Circuit



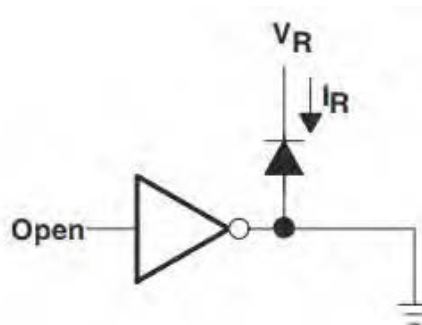
$I_{I(on)}$ Test Circuit



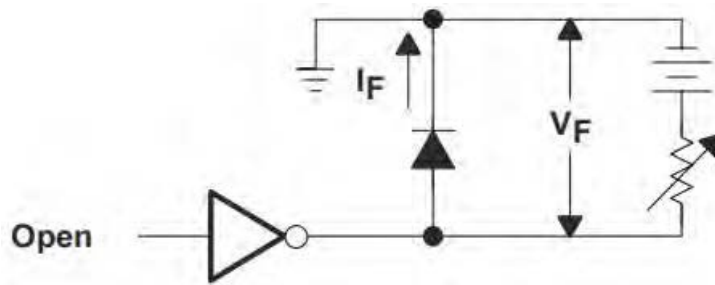
$V_{I(on)}$ Test Circuit



$V_{CE(sat)}$ Test Circuit



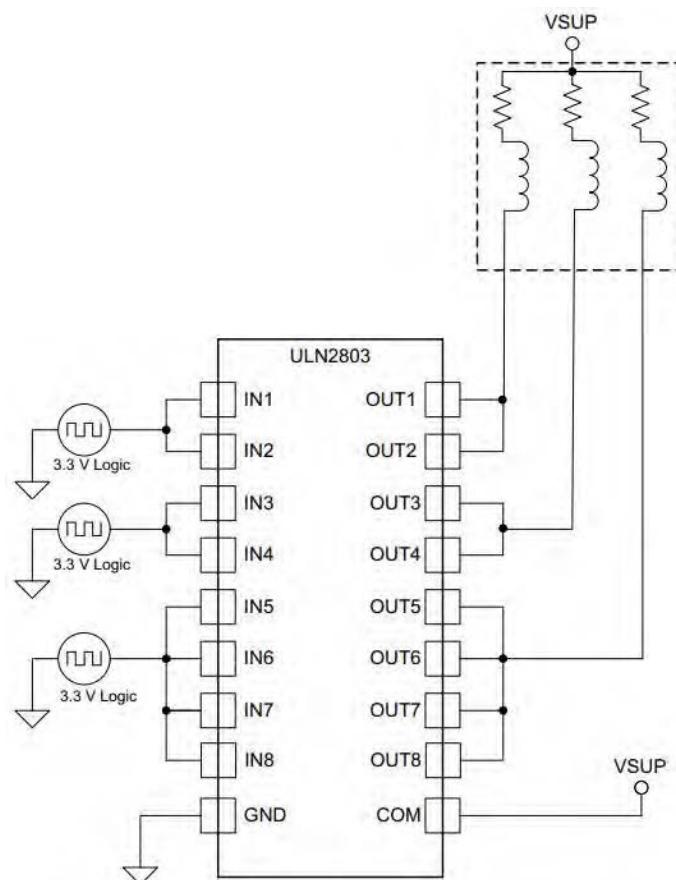
I_R Test Circuit



V_F Test Circuit

Applications information

ULN2803A is typically used to drive a high-voltage or current peripherals from an MCU or logic device that cannot tolerate these conditions. The following design is a common application of ULN2803A, driving inductive loads. This includes motors, solenoids, and relays. Each load type can be modeled by what is seen in Figure .

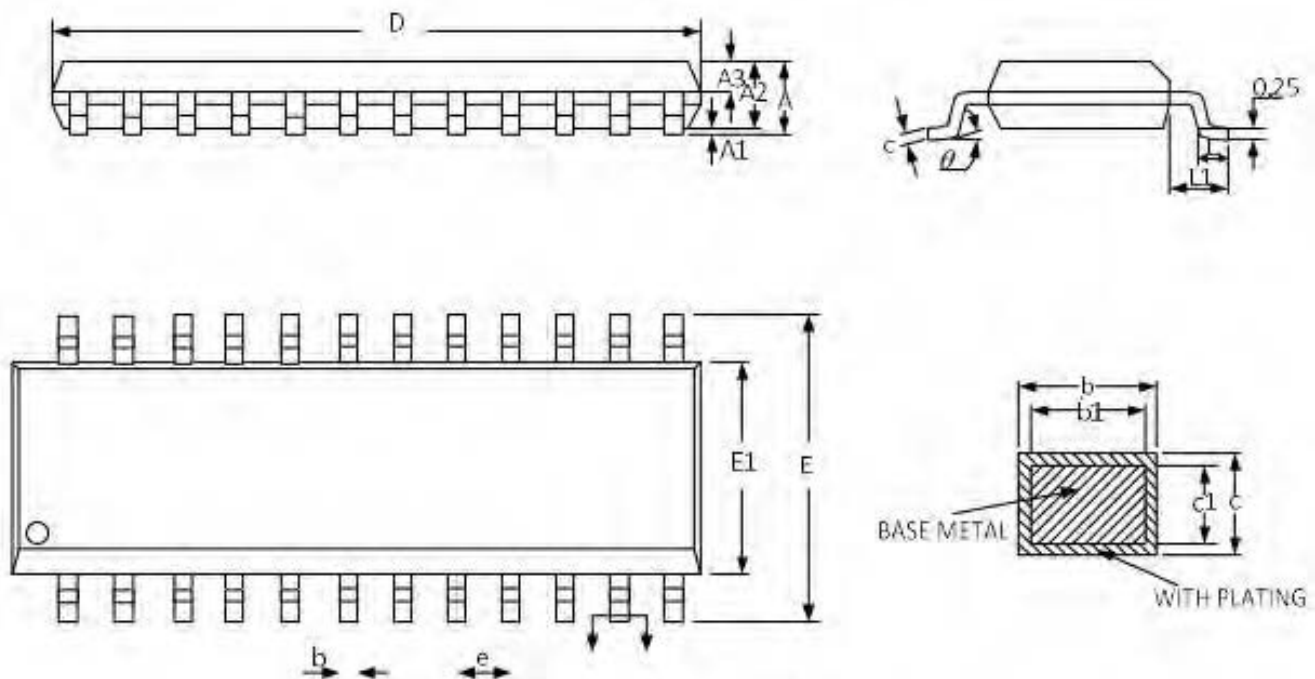


ULN2803A as inductive load drive



Outline Drawing

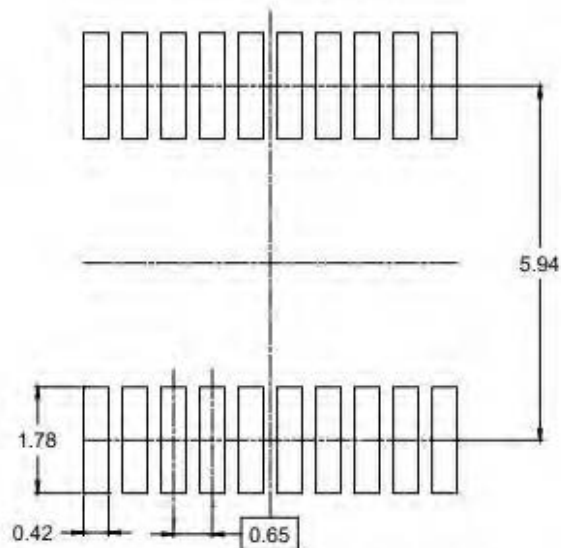
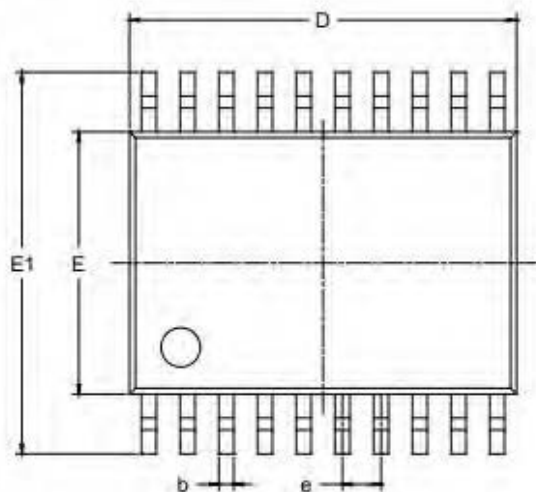
SSOP-24



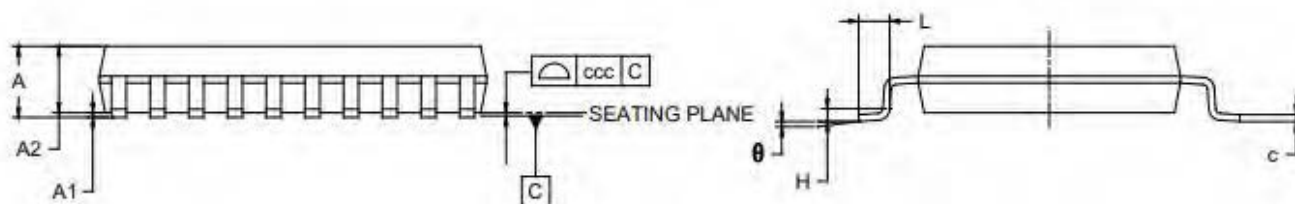
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	-	-	1.77
A1	0.08	0.18	0.28
A2	1.20	1.40	1.60
A3	0.55	0.65	0.75
b	0.23	-	0.33
b1	0.22	0.25	0.28
c	0.21	-	0.26
c1	0.19	0.20	0.21
D	8.45	8.65	8.85
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	0.635BSC		
L	0.50	0.65	0.80
L1	1.05BSC		
θ	0°	-	8°



TSSOP-20



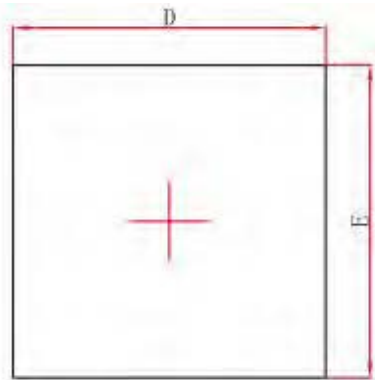
RECOMMENDED LAND PATTERN (Unit: mm)



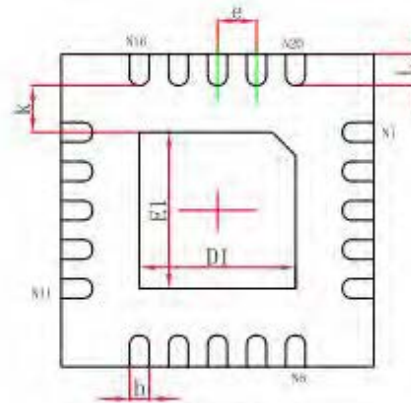
Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	-	-	1.200
A1	0.050	-	0.150
A2	0.800	-	1.050
b	0.190	-	0.300
c	0.090	-	0.200
D	6.400	-	6.600
E	4.300	-	4.500
E1	6.200	-	6.600
e	0.650 BSC		
L	0.450	-	0.750
H	0.250 TYP		
θ	0°	-	8°
CCC	0.100		



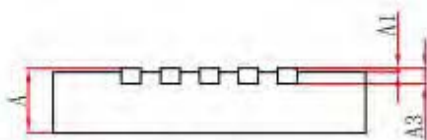
QFN4X4-20



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	3.900	4.100	0.154	0.161
E	3.900	4.100	0.154	0.161
D1	1.900	2.100	0.075	0.083
E1	1.900	2.100	0.075	0.083
k	0.600REF.		0.024REF.	
b	0.200	0.300	0.008	0.012
e	0.500BSC.		0.020BSC.	
L	0.300	0.500	0.012	0.020



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