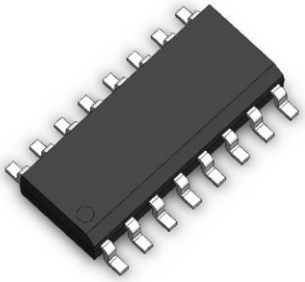
# WLN2003A

## HIGH VOLTAGE, HIGH CURRENT DARLINGTON TRANSISTOR ARRAYS

## Description

The WLN2003A are high voltage, high current Darlington arrays each containing seven open collector common emitter pairs. Each pair is rated at 500mA. Suppression diodes are included for inductive load driving, the inputs and outputs are pinned in opposition to simplify board layout.



SOP-16

## Features

- ESD Capability：8KV(HBM)
- 500mA Rated Collector Current (Single Output)
- High Voltage Outputs: 50V
- Output Clamp Diodes
- Inputs Compatible with Popular Logic Types (5V TTL,CMOS)
- Relay Driver Applications

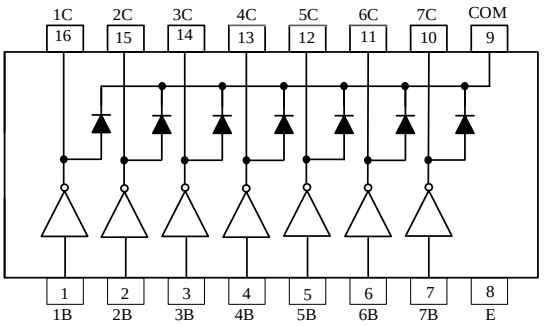
## Mechanical Characteristics

- JEDEC SOP-16 package
- Marking: Marking Code
- Packaging: Tape and Reel
- RoHS Compliant & HF
- Device meets MSL3 requirement

## Applications

- Solenoids
- Relays
- DC motors
- LED displays
- Filament lamps
- Thermal print-heads
- High-power buffers

## Functional Diagram

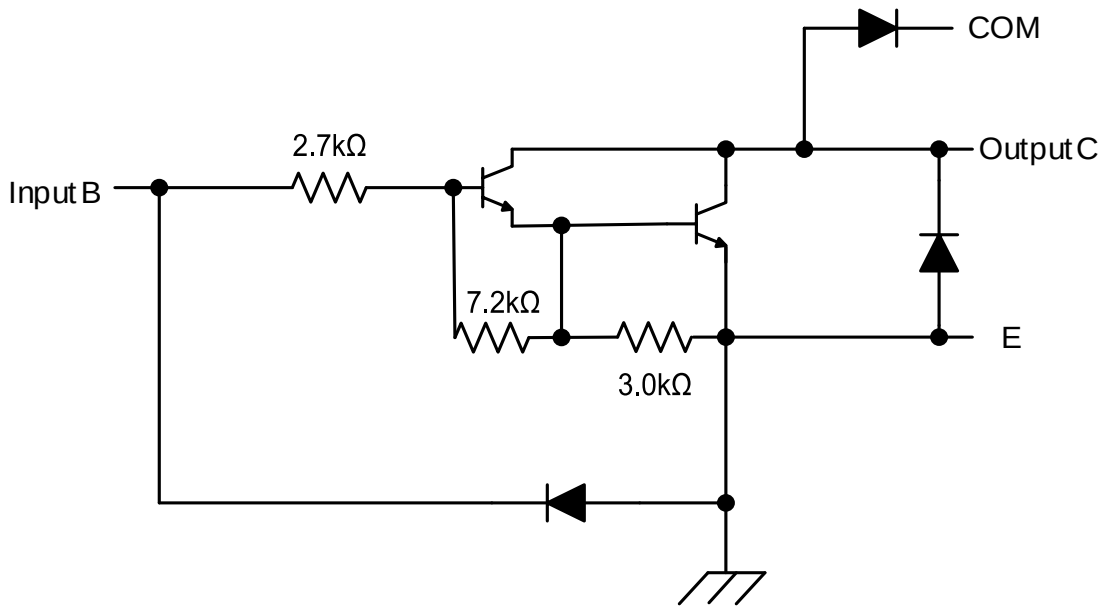



SOP-16 (Top View)

## Pin Descriptions

| Pin Number | Pin Name | Function |
|---|---|---|
| 1 | 1B | Input Pair 1 |
| 2 | 2B | Input Pair 2 |
| 3 | 3B | Input Pair 3 |
| 4 | 4B | Input Pair 4 |
| 5 | 5B | Input Pair 5 |
| 6 | 6B | Input Pair 6 |
| 7 | 7B | Input Pair 7 |
| 8 | E | Common Emitter (Ground) |
| 9 | COM | Common Clamp Diodes |
| 10 | 7C | Output Pair 7 |
| 11 | 6C | Output Pair 6 |
| 12 | 5C | Output Pair 5 |
| 13 | 4C | Output Pair 4 |
| 14 | 3C | Output Pair 3 |
| 15 | 2C | Output Pair 2 |
| 16 | 1C | Output Pair 1 |

## Functional Block Diagram



## Absolute Maximum Ratings (Note 1) (@$T_A$ = +25°C, unless otherwise specified.)

| Symbol | Parameter | Rating | Unit |
|---|---|---|---|
| $V_{CC}$ | Collector to Emitter Voltage | 50 | V |
| $V_R$ | Clamp Diode Reverse Voltage (Note 2) | 50 | V |
| $V_I$ | Input Voltage (Note 2) | 30 | V |
| $I_{CP}$ | Peak Collector Current | 500 | mA |
| $I_{OK}$ | Output Clamp Current | 500 | mA |
| $I_{TE}$ | Total Emitter Current | -2.5 | A |
| $\theta_{JA}$ | Thermal Resistance Junction-to-Ambient (Note 3) | 63.0 | °C/W |
| $\theta_{JC}$ | Thermal Resistance Junction-to-Case (Note 4) | 12.0 | °C/W |
| $P_D$ | Power Dissipation(Note 5) | 1.38 | W |
| $T_J$ | Junction Temperature | +150 | °C |
| $T_{STG}$ | Storage Temperature | -65 to +150 | °C |

Notes:
1. Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only. 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.
2. All voltage values are with respect to the emitter/substrate terminal E, unless otherwise noted.
3. Maximum power dissipation is a function of $T_J(max)$, $\theta_{JA}$ 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.
4. Maximum power dissipation is a function of $T_J(max)$, $\theta_{JC}$ and $T_A$. The maximum allowable power dissipation at any allowable ambient 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. On PCB (Test Board: JEDEC 2s2p)

## Recommended Operating Conditions

| Symbol | Parameter | MIN | MAX | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Collector to Emitter Voltage | - | 50 | V |
| $T_A$ | Operating Ambient Temperature | -40 | +105 | °C |

## Switching Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Parameter | | Test Figure | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation Delay Time, Low to High Level Output | 9 | - | 0.25 | 1 | μs |
| $t_{PHL}$ | Propagation Delay Time, High to Low Level Output | 9 | - | 0.25 | 1 | μs |
| $V_{OH}$ | High Level Output Voltage after Switching | 9 ($V_S$ = 50V, $I_O$ = 300mA) | $V_S$-20 | - | - | mV |

## Switching Characteristics (@TA = -40 to +105°C, unless otherwise specified.)

| Parameter | | Test Figure | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation Delay Time, Low to High Level Output | 9 | - | 1 | 10 | μs |
| $t_{PHL}$ | Propagation Delay Time, High to Low Level Output | 9 | - | 1 | 10 | μs |
| $V_{OH}$ | High Level Output Voltage after Switching | 9 ($V_S$ = 50V, $I_O$ = 300mA) | $V_S$-50 | - | - | mV |

## Electrical Characteristics (Cont.) (@TA = +25°C, unless otherwise specified.)

| Parameter | | Test Figure | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| $V_{I(ON)}$ | On State Input Voltage | 6 | $V_{CE}$ = 2V | $I_C$ = 200mA | - | - | 2.4 | V |
| | | | | $I_C$ = 250mA | - | - | 2.7 | |
| | | | | $I_C$ = 300mA | - | - | 3 | |
| $V_{CE(SAT)}$ | Collector Emitter Saturation Voltage | 5 | $I_I$ = 250μA, $I_C$ = 100mA | | - | 0.9 | 1.1 | V |
| | | | $I_I$ = 350μA, $I_C$ = 200mA | | - | 1 | 1.3 | |
| | | | $I_I$ = 500μA, $I_C$ = 350mA | | - | 1.2 | 1.6 | |
| $V_F$ | Clamp Forward Voltage | 8 | $I_F$ = 350mA | | - | 1.7 | 2 | V |
| Hfe | DC Current Transfer Ratio | 5 | Vce=2V，Ic=350mA | | 1000 | | | |
| $I_{CEX}$ | Collector Cut-off Current | 1 | $V_{CE}$ = 50V, $I_I$ = 0 | | - | - | 50 | μA |
| | | 2 | $V_{CE}$ = 50V, $T_A$ = +105°C | $I_I$ = 0 | - | - | 100 | |
| $I_{I(OFF)}$ | Off State Input Current | 3 | $V_{CE}$ = 50V, $I_C$ = 500μA | | 50 | 65 | - | μA |
| $I_I$ | Input Current | 4 | $V_I$ = 3.85V | | - | 0.93 | 1.35 | mA |
| $I_R$ | Clamp Reverse Current | 7 | $V_R$ = 50V | $T_A$ = +105°C | - | - | 100 | μA |
| | | - | | - | - | - | 50 | |
| $C_I$ | Input Capacitance | - | $V_I$ = 0, f = 1MHz | | - | 15 | 25 | pF |

## Electrical Characteristics (Cont.) (@TA = -40°C to +105°C, unless otherwise specified.)

| Parameter | | Test Figure | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| $V_{I(ON)}$ | On State Input Voltage | 6 | $V_{CE}$ = 2V | $I_C$ = 200mA | - | - | 2.7 | V |
| | | | | $I_C$ = 250mA | - | - | 2.9 | |
| | | | | $I_C$ = 300mA | - | - | 3 | |
| $V_{CE(SAT)}$ | Collector Emitter Saturation Voltage | 5 | $I_I$ = 250μA, $I_C$ = 100mA | | - | 0.9 | 1.2 | V |
| | | | $I_I$ = 350μA, $I_C$ = 200mA | | - | 1 | 1.4 | |
| | | | $I_I$ = 500μA, $I_C$ = 350mA | | - | 1.2 | 1.7 | |
| $V_F$ | Clamp Forward Voltage | 8 | $I_F$ = 350mA | | - | 1.7 | 2.2 | V |
| $I_{CEX}$ | Collector Cut-off Current | 1 | $V_{CE}$ = 50V, $I_I$ = 0 | | - | - | 100 | μA |
| $I_{I(OFF)}$ | Off State Input Current | 3 | $V_{CE}$ = 50V, $I_C$ = 500μA | | 30 | 65 | - | μA |
| $I_I$ | Input Current | 4 | $V_I$ = 3.85V | | - | 0.93 | 1.35 | mA |
| $I_R$ | Clamp Reverse Current | 7 | $V_R$ = 50V | | - | - | 100 | μA |
| $C_I$ | Input Capacitance | - | $V_I$ = 0, f = 1MHz | | - | 15 | 25 | pF |

## Parameter Measurement Circuits

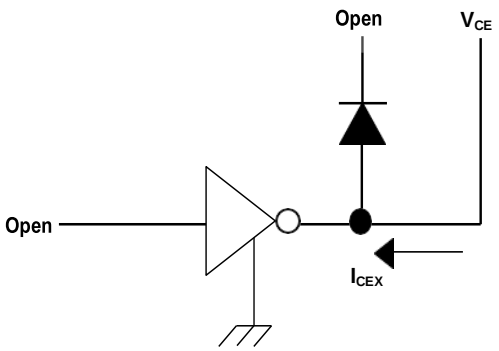



Fig.1 $I_{CEX}$ Test Circuit

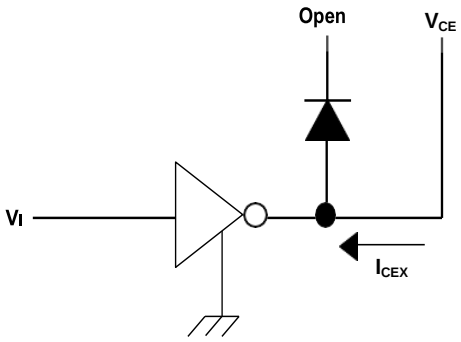



Fig.2 $I_{CEX}$ Test Circuit

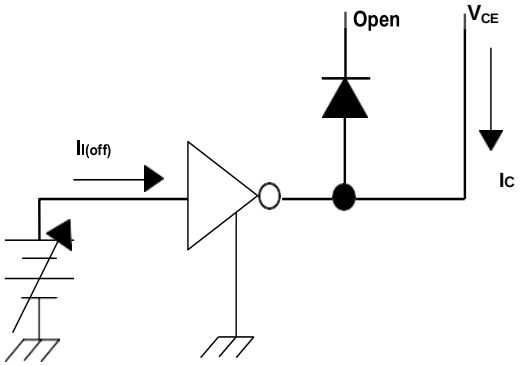



Fig.3 $I_{I(off)}$ Test Circuit

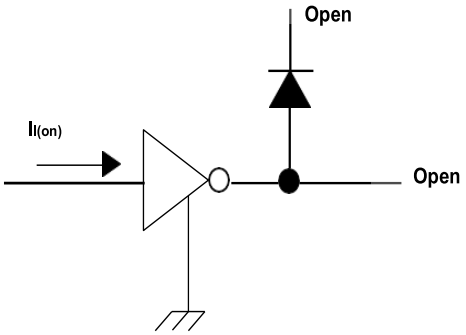



Fig.4 $I_I$ Test Circuit

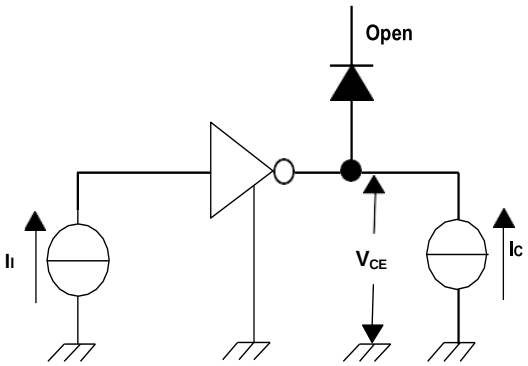



Fig.5 $h_{FE}$, $V_{CE(sat)}$ Test Circuit

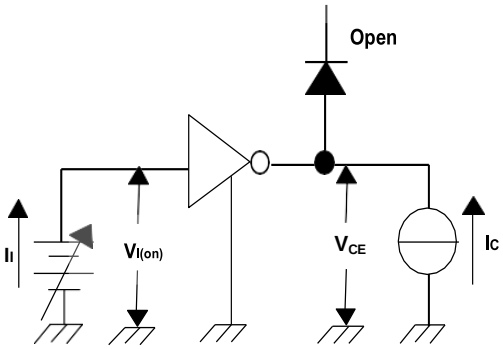



Fig.6 $V_{I(on)}$ Test Circuit

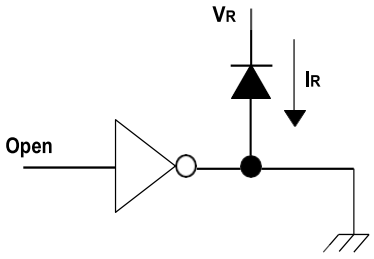



Fig.7 $I_R$ Test Circuit

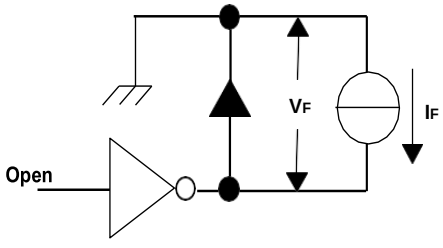



Fig.8 $V_F$ Test Circuit

## Parameter Measurement Circuits (Cont.)

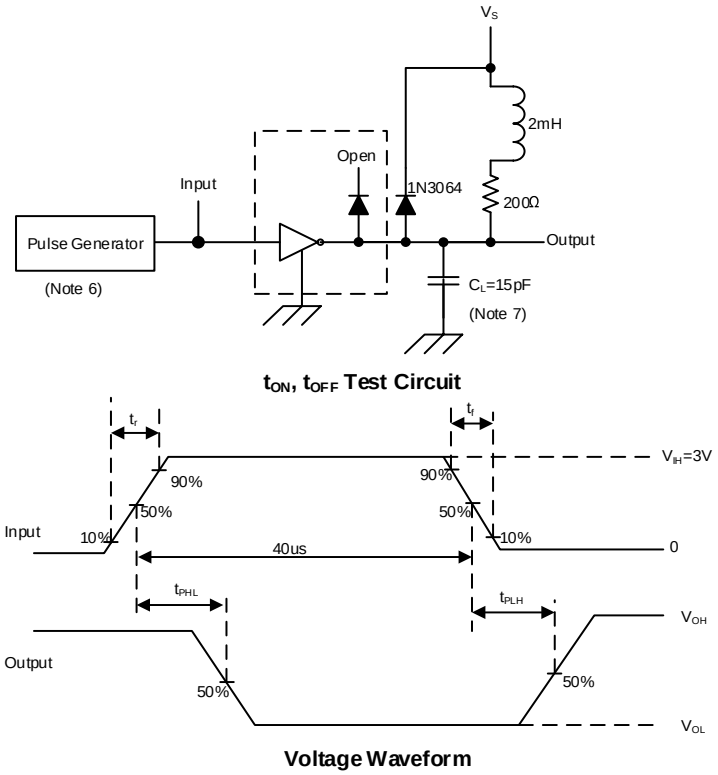



**Fig. 9 Latch-Up Test Circuit and Voltage Waveform**

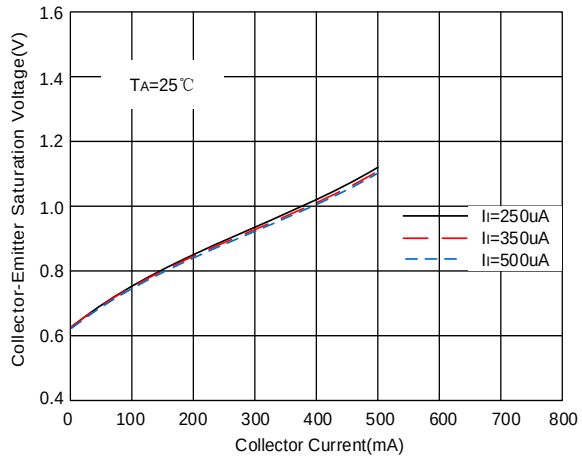
Notes:

6 The pulse generator has the following characteristics: Pulse Width = 12.5Hz, output impedance 50Ω, tr ≤ 5ns, tr ≤ 10ns.

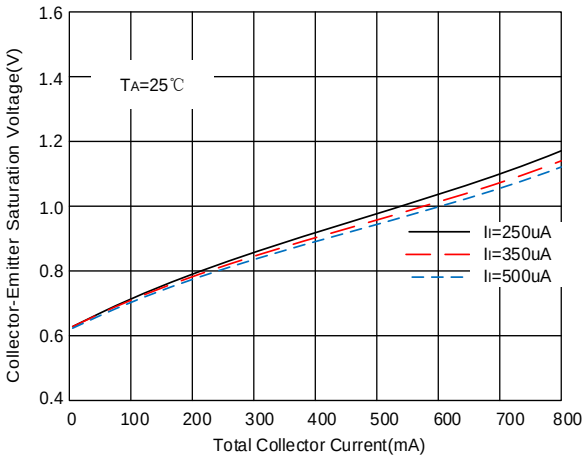
7 $C_L$ includes prove and jig capacitance.

# Typical Performance Characteristics

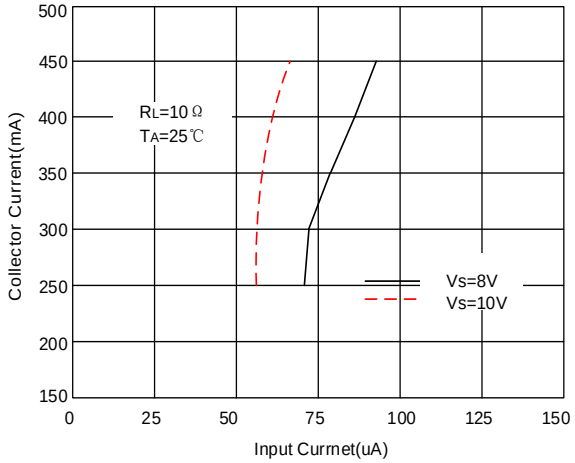
**Collector-Emitter Saturation Voltage vs. Collector Current (One Darlington)**



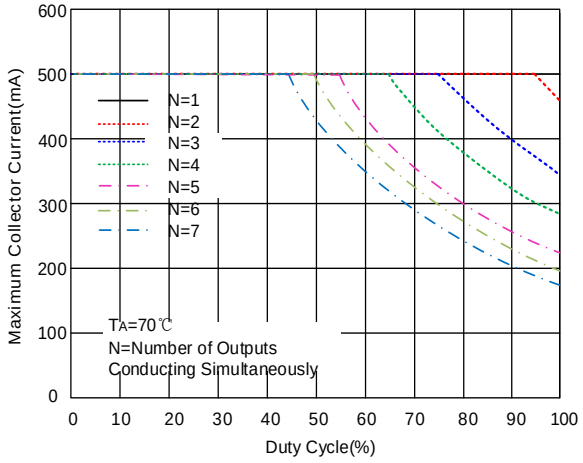

**Collector-Emitter Saturation Voltage vs. Collector Current (Two Darlington in Parallel)**



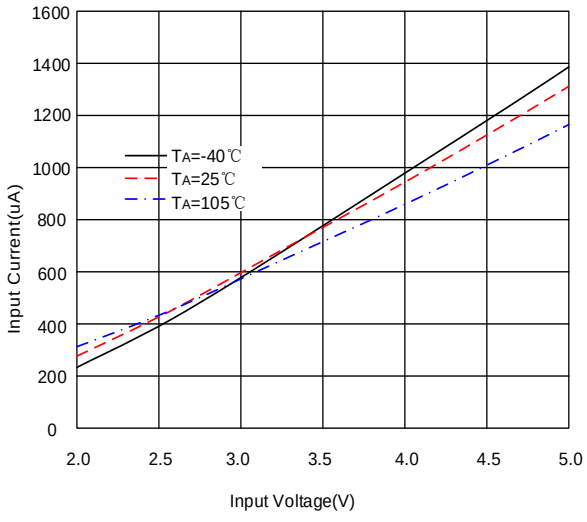

**Collector Current vs. Input Current**



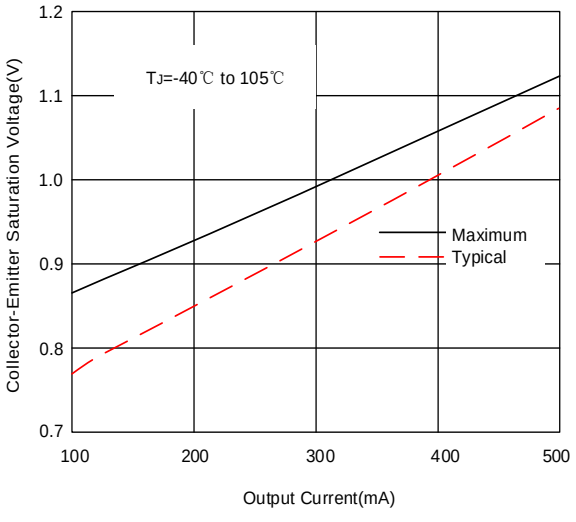

**Maximum Collector Current vs. Duty Cycle**



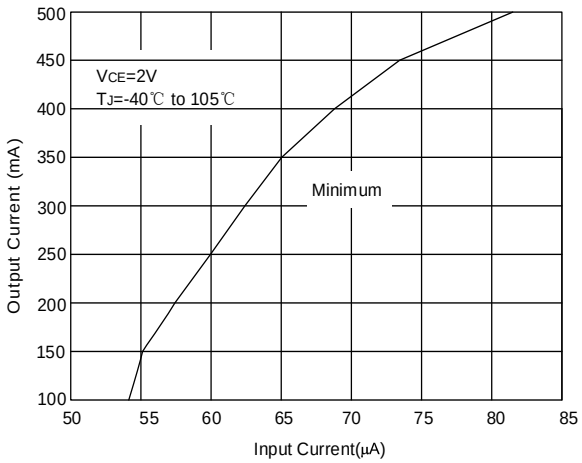

**Input Current vs. Input Voltage**




**Collector-Emitter Saturation Voltage vs. Output Current**

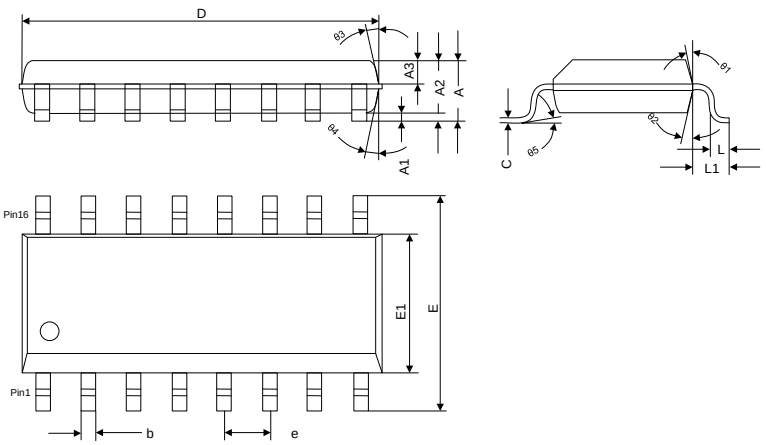


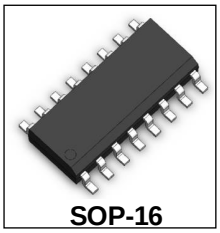
**Output Current vs. Input Current**



# Outline Drawing – SOP-16

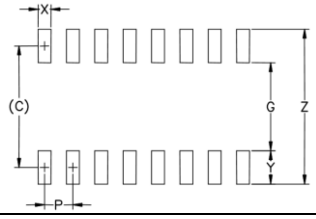
## PACKAGE OUTLINE



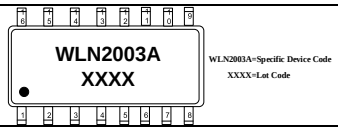

| Symbol | MILLIMETERS | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | - | - | 1.75 |
| A1 | 0.10 | 0.15 | 0.225 |
| A2 | 1.30 | 1.45 | 1.50 |
| A3 | 0.60 | 0.65 | 0.70 |
| b | 0.33 | - | 0.47 |
| c | 0.2 | - | 0.24 |
| D | 9.50 | 9.90 | 10.05 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.80 | 3.90 | 4.00 |
| e | 1.27 BSC | | |
| L | 0.50 | 0.60 | 0.80 |
| L1 | 1.10 BSC | | |
| θ1 | 8° | - | 15° |
| θ2 | 8° | - | 15° |
| θ3 | 8° | - | 15° |
| θ4 | 8° | - | 15° |
| θ5 | 0° | - | 8° |

## Soldering Footprint




| DIM | MILLIMETERS |
|---|---|
| C | 5.60 |
| G | 3.80 |
| P | 1.27 |
| X | 0.47 |
| Y | 1.8 |
| Z | 7.40 |

# Marking Codes

| Part Number | WLN2003A |
|---|---|
| Marking Code |  |



# Package Information

Qty：2.5k/Reel

## CONTACT INFORMATION

No.1001, Shiwan(7) Road, Pudong District, Shanghai, P.R.China.201207
Tel: 86-21-68969993 Fax: 86-21-50757680 Email: market@way-on.com
WAYON website: **http://www.way-on.com**

For additional information, please contact your local Sales Representative.

WAYON ® is registered trademark of Wayon Corporation.

*Specifications are subject to change without notice.*
*The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.*
*Users should verify actual device performance in their specific applications.*