MC1413, MC1413B, NCV1413B

High Voltage, High Current Darlington Transistor Arrays

The seven NPN Darlington connected transistors in these arrays are well suited for driving lamps, relays, or printer hammers in a variety of industrial and consumer applications. Their high breakdown voltage and internal suppression diodes insure freedom from problems associated with inductive loads. Peak inrush currents to 500 mA permit them to drive incandescent lamps.

The MC1413, B with a 2.7 kΩ series input resistor is well suited for systems utilizing a 5.0 V TTL or CMOS Logic.

Features
- Pb−Free Packages are Available*
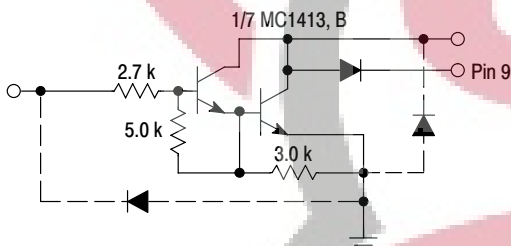- NCV Prefix for Automotive and Other Applications Requiring Site and Control Changes

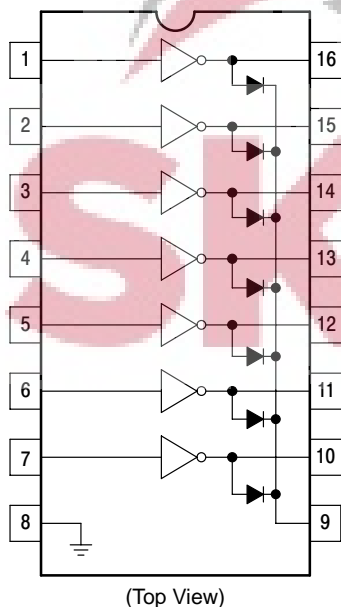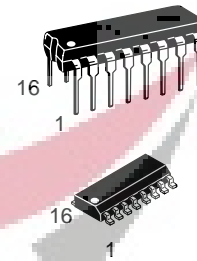**Figure 1. Representative Schematic Diagram**

(Top View)

Figure 2. PIN CONNECTIONS

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ORDERING INFORMATION

Device	Package	Shipping†
MC1413D	SOIC−16	48 Units/Rail
MC1413DG	SOIC−16 (Pb−Free)	48 Units/Tube
MC1413DR2	SOIC−16	2500 Tape & Reel
MC1413DR2G	SOIC−16 (Pb−Free)	2500 Tape & Reel
MC1413P	PDIP−16	25 Units/Rail
MC1413PG	PDIP−16 (Pb−Free)	25 Units/Rail
MC1413BD	SOIC−16	48 Units/Rail
MC1413BDG	SOIC−16 (Pb−Free)	48 Units/Rail
MC1413BDR2	SOIC−16	2500 Tape & Reel
MC1413BDR2G	SOIC−16 (Pb−Free)	2500 Tape & Reel
MC1413BP	PDIP−16	25 Units/Rail
MC1413BPG	PDIP−16 (Pb−Free)	25 Units/Rail
NCV1413BDR2	SOIC−16	2500 Tape & Reel
NCV1413BDR2G	SOIC−16 (Pb−Free)	2500 Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

DEVICE MARKING INFORMATION
See general marking information in the device marking section on page 5 of this data sheet.

MC1413, MC1413B, NCV1413B

MAXIMUM RATINGS ($T_A = 25°C$, and rating apply to any one device in the package, unless otherwise noted.)

Rating	Symbol	Value	Unit
Output Voltage	V_O	50	V
Input Voltage	V_I	30	V
Collector Current – Continuous	I_C	500	mA
Base Current – Continuous	I_B	25	mA
Operating Ambient Temperature Range MC1413 MC1413B NCV1413B	T_A	 −20 to +85 −40 to +85 −40 to +125	°C
Storage Temperature Range	T_{stg}	−55 to +150	°C
Junction Temperature	T_J	150	°C
Thermal Resistance, Junction–to–Ambient Case 648, P Suffix Case 751B, D Suffix	$R_{θJA}$	 67 100	°C/W
Thermal Resistance, Junction–to–Case Case 648, P Suffix Case 751B, D Suffix	$R_{θJC}$	 22 20	°C/W
Electrostatic Discharge Sensitivity (ESD) Human Body Model (HBM) Machine Model (MM) Charged Device Model (CDM)	ESD	 2000 400 1500	V

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

MC1413, MC1413B, NCV1413B

ELECTRICAL CHARACTERISTICS (T_A = 25°C, unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
Output Leakage Current (V_O = 50 V, T_A = +85°C) All Types (V_O = 50 V, T_A = +25°C) All Types		I_{CEX}	– –	– –	100 50	µA
Collector–Emitter Saturation Voltage (I_C = 350 mA, I_B = 500 µA) All Types (I_C = 200 mA, I_B = 350 µA) All Types (I_C = 100 mA, I_B = 250 µA) All Types		$V_{CE(sat)}$	– – –	1.1 0.95 0.85	1.6 1.3 1.1	V
Input Current – On Condition (V_I = 3.85 V) MC1413, B		$I_{I(on)}$	–	0.93	1.35	mA
Input Voltage – On Condition (V_{CE} = 2.0 V, I_C = 200 mA) MC1413, B (V_{CE} = 2.0 V, I_C = 250 mA) MC1413, B (V_{CE} = 2.0 V, I_C = 300 mA) MC1413, B		$V_{I(on)}$	– – –	– – –	2.4 2.7 3.0	V
Input Current – Off Condition All Types (I_C = 500 µA, T_A = 85°C)		$I_{I(off)}$	50	100	–	µA
DC Current Gain (V_{CE} = 2.0 V, I_C = 350 mA)		h_{FE}	1000	–	–	–
Input Capacitance		C_I	–	15	30	pF
Turn–On Delay Time (50% E_I to 50% E_O)		t_{on}	–	0.25	1.0	µs
Turn–Off Delay Time (50% E_I to 50% E_O)		t_{off}	–	0.25	1.0	µs
Clamp Diode Leakage Current T_A = +25°C (V_R = 50 V) T_A = +85°C		I_R	– –	– –	50 100	µA
Clamp Diode Forward Voltage (I_F = 350 mA)		V_F	–	1.5	2.0	V

NOTE: NCV1413B T_{low} = –40°C, T_{high} = +125°C. Guaranteed by design. NCV prefix is for automotive and other applications requiring site and change control.

MC1413, MC1413B, NCV1413B

TYPICAL PERFORMANCE CURVES – $T_A = 25°C$
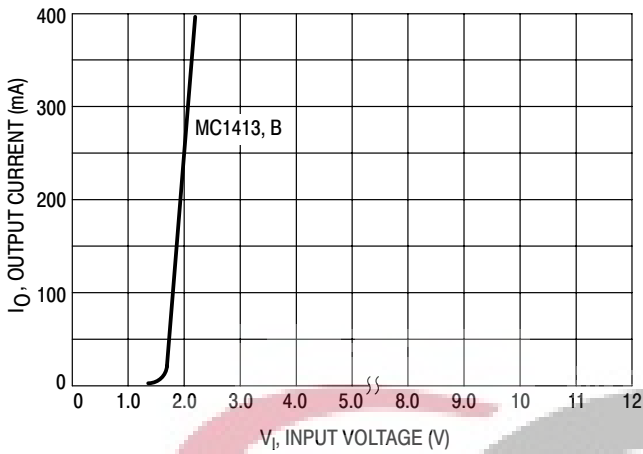
Figure 3. Output Current versus Input Voltage
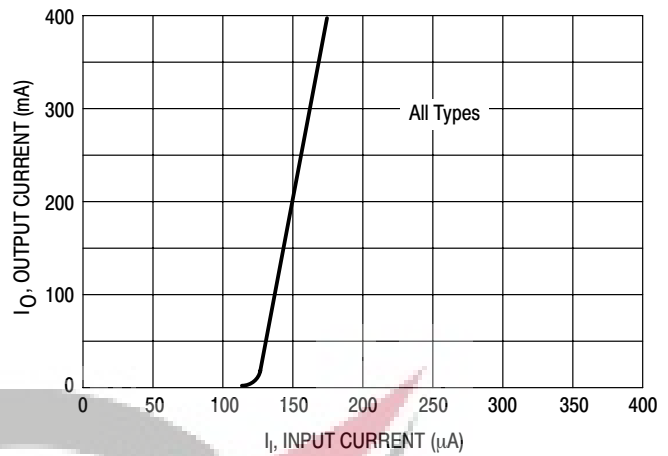
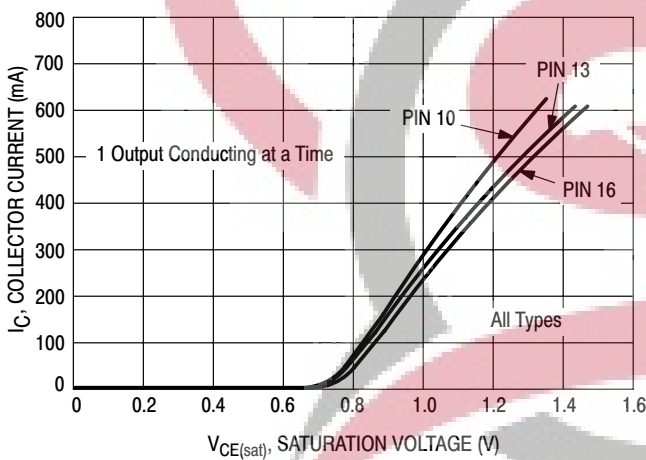Figure 4. Output Current versus Input Current

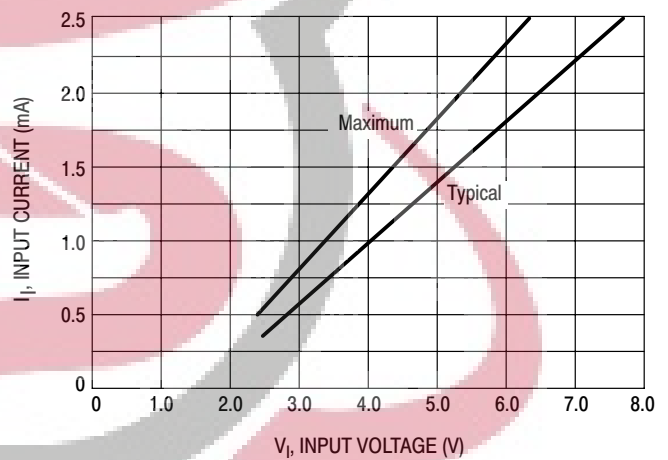Figure 5. Typical Output Characteristics
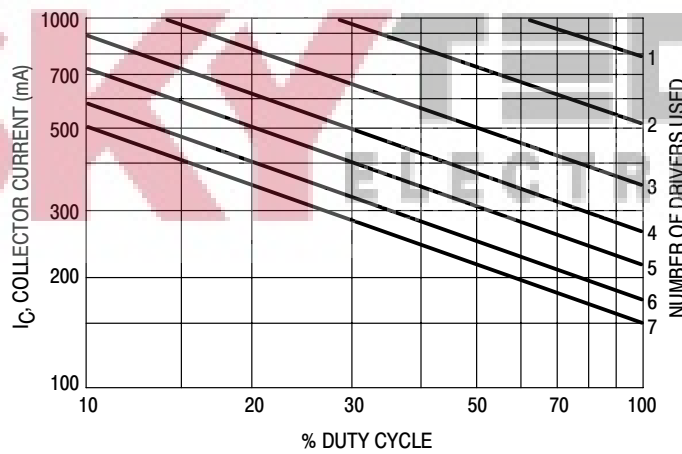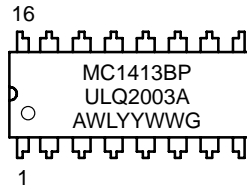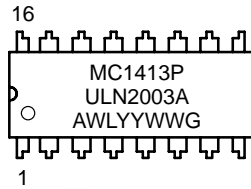

Figure 6. Input Characteristics – MC1413, B

Figure 7. Maximum Collector Current
versus Duty Cycle
(and Number of Drivers in Use)

MC1413, MC1413B, NCV1413B

MARKING DIAGRAMS

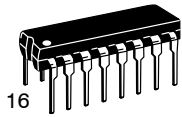**PDIP−16**
P SUFFIX
CASE 648

16

MC1413P
ULN2003A
AWLYYWWG

1

16

MC1413BP
ULQ2003A
AWLYYWWG

1

SOIC−16
D SUFFIX
CASE 751B

16

MC1413DG
AWLYWW

1

16

MC1413BDG
AWLYWW

1

16

NCV1413BDG
AWLYWW

1
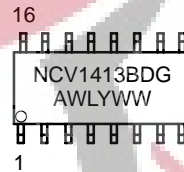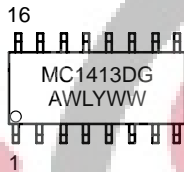
A = Assembly Location
WL = Wafer Lot
YY, Y = Year
WW = Work Week
G = Pb−Free Package

PDIP−16
CASE 648−08
ISSUE V

DATE 22 APR 2015

SCALE 1:1

16
1

D   A

16   9
E1
1   8
b2   B
NOTE 8
TOP VIEW

H
E
c

END VIEW
WITH LEADS CONSTRAINED
NOTE 5

e/2
A2
A   NOTE 3
L

A1
D1
e
C   SEATING PLANE

16X b

⊕ 0.010 Ⓜ C A Ⓜ B Ⓜ

SIDE VIEW

M
eB
END VIEW
NOTE 6
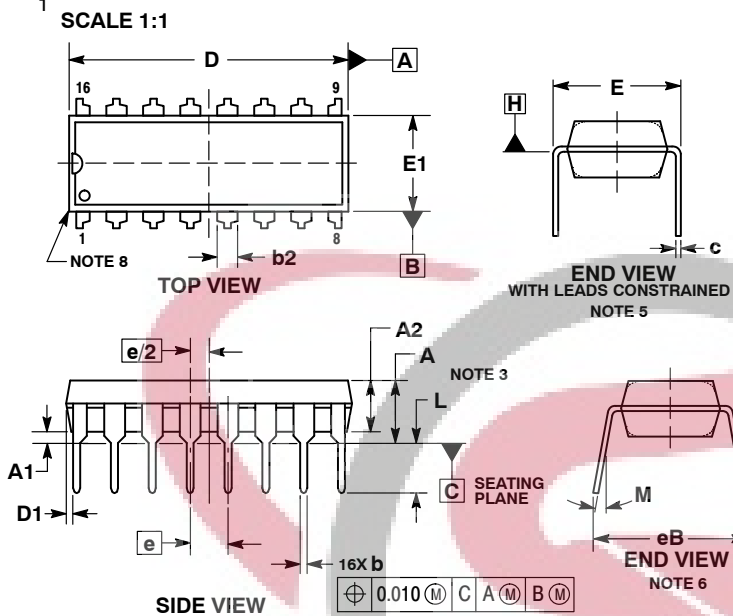
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. DIMENSIONS A, A1 AND L ARE MEASURED WITH THE PACK-AGE SEATED IN JEDEC SEATING PLANE GAUGE GS−3.
4. DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 0.10 INCH.
5. DIMENSION E IS MEASURED AT A POINT 0.015 BELOW DATUM PLANE H WITH THE LEADS CONSTRAINED PERPENDICULAR TO DATUM C.
6. DIMENSION eB IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
7. DATUM PLANE H IS COINCIDENT WITH THE BOTTOM OF THE LEADS, WHERE THE LEADS EXIT THE BODY.
8. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	−−−−	0.210	−−−	5.33
A1	0.015	−−−−−	0.38	−−−
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.35	0.56
b2	0.060 TYP		1.52 TYP	
C	0.008	0.014	0.20	0.36
D	0.735	0.775	18.67	19.69
D1	0.005	−−−−−	0.13	−−−
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.100 BSC		2.54 BSC	
eB	−−−−−	0.430	−−−	10.92
L	0.115	0.150	2.92	3.81
M	−−−−−	10°	−−−	10°

GENERIC
MARKING DIAGRAM*

16

XXXXXXXXXXX
XXXXXXXXXXX
AWLYYWWG

1

XXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week
G = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot " ▪", may or may not be present.

STYLE 1:
PIN 1. CATHODE
2. CATHODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE
7. CATHODE
8. CATHODE
9. ANODE
10. ANODE
11. ANODE
12. ANODE
13. ANODE
14. ANODE
15. ANODE
16. ANODE

STYLE 2:
PIN 1. COMMON DRAIN
2. COMMON DRAIN
3. COMMON DRAIN
4. COMMON DRAIN
5. COMMON DRAIN
6. COMMON DRAIN
7. COMMON DRAIN
8. COMMON DRAIN
9. GATE
10. SOURCE
11. GATE
12. SOURCE
13. GATE
14. SOURCE
15. GATE
16. SOURCE

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

SOIC−16
CASE 751B−05
ISSUE K

DATE 29 DEC 2006

SCALE 1:1

−A−

−B− **P 8 PL**

⊕ | 0.25 (0.010) Ⓜ | B Ⓢ

K

C

−T− SEATING PLANE

D 16 PL

⊕ | 0.25 (0.010) Ⓜ | T | B Ⓢ | A Ⓢ

R X 45°

F

M

J

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0 °	7 °	0 °	7 °
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

STYLE 1:
PIN 1. COLLECTOR
2. BASE
3. EMITTER
4. NO CONNECTION
5. EMITTER
6. BASE
7. COLLECTOR
8. COLLECTOR
9. BASE
10. EMITTER
11. NO CONNECTION
12. EMITTER
13. BASE
14. COLLECTOR
15. EMITTER
16. COLLECTOR

STYLE 2:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION
4. CATHODE
5. CATHODE
6. NO CONNECTION
7. ANODE
8. CATHODE
9. CATHODE
10. ANODE
11. NO CONNECTION
12. CATHODE
13. CATHODE
14. NO CONNECTION
15. ANODE
16. CATHODE

STYLE 3:
PIN 1. COLLECTOR, DYE #1
2. BASE, #1
3. EMITTER, #1
4. COLLECTOR, #1
5. COLLECTOR, #2
6. BASE, #2
7. EMITTER, #2
8. COLLECTOR, #2
9. COLLECTOR, #3
10. BASE, #3
11. EMITTER, #3
12. COLLECTOR, #3
13. COLLECTOR, #4
14. BASE, #4
15. EMITTER, #4
16. COLLECTOR, #4

STYLE 4:
PIN 1. COLLECTOR, DYE #1
2. COLLECTOR, #1
3. COLLECTOR, #2
4. COLLECTOR, #2
5. COLLECTOR, #3
6. COLLECTOR, #3
7. COLLECTOR, #4
8. COLLECTOR, #4
9. BASE, #4
10. EMITTER, #4
11. BASE, #3
12. EMITTER, #3
13. BASE, #2
14. EMITTER, #2
15. BASE, #1
16. EMITTER, #1

STYLE 5:
PIN 1. DRAIN, DYE #1
2. DRAIN, #1
3. DRAIN, #2
4. DRAIN, #2
5. DRAIN, #3
6. DRAIN, #3
7. DRAIN, #4
8. DRAIN, #4
9. GATE, #4
10. SOURCE, #4
11. GATE, #3
12. SOURCE, #3
13. GATE, #2
14. SOURCE, #2
15. GATE, #1
16. SOURCE, #1

STYLE 6:
PIN 1. CATHODE
2. CATHODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE
7. CATHODE
8. CATHODE
9. ANODE
10. ANODE
11. ANODE
12. ANODE
13. ANODE
14. ANODE
15. ANODE
16. ANODE

STYLE 7:
PIN 1. SOURCE N-CH
2. COMMON DRAIN (OUTPUT)
3. COMMON DRAIN (OUTPUT)
4. GATE P-CH
5. COMMON DRAIN (OUTPUT)
6. COMMON DRAIN (OUTPUT)
7. COMMON DRAIN (OUTPUT)
8. SOURCE P-CH
9. SOURCE P-CH
10. COMMON DRAIN (OUTPUT)
11. COMMON DRAIN (OUTPUT)
12. COMMON DRAIN (OUTPUT)
13. GATE N-CH
14. COMMON DRAIN (OUTPUT)
15. COMMON DRAIN (OUTPUT)
16. SOURCE N-CH

SOLDERING FOOTPRINT

8X
6.40

16X 1.12

16X 0.58

1.27 PITCH

DIMENSIONS: MILLIMETERS

PUBLICATION ORDERING INFORMATION

◊