

# MC3488A

## Dual EIA-423/EIA-232D Line Driver

The MC3488A dual is single-ended line driver has been designed to satisfy the requirements of EIA standards EIA-423 and EIA-232D, as well as CCITT X.26, X.28 and Federal Standard FIDS1030. It is suitable for use where signal wave shaping is desired and the output load resistance is greater than 450 Ω. Output slew rates are adjustable from 1.0 μs to 100 μs by a single external resistor. Output level and slew rate are insensitive to power supply variations. Input undershoot diodes limit transients below ground and output current limiting is provided in both output states.

The MC3488A has a standard 1.5 V input logic threshold for TTL or NMOS compatibility.

### Features

- PNP Buffered Inputs to Minimize Input Loading
- Short Circuit Protection
- Adjustable Slew Rate Limiting
- MC3488A Equivalent to 9636A
- Output Levels and Slew Rates are Insensitive to Power Supply Voltages
- No External Blocking Diode Required for V<sub>EE</sub> Supply
- Second Source μA9636A
- Pb-Free Packages are Available



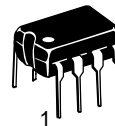
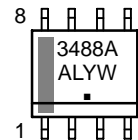
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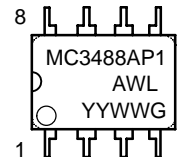
### MARKING DIAGRAMS



SOIC-8  
D SUFFIX  
CASE 751



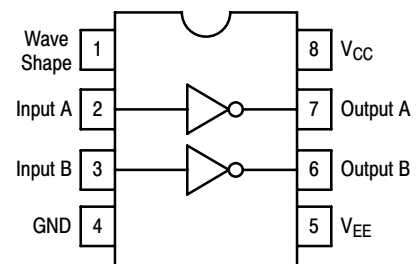
PDIP-8  
P1 SUFFIX  
CASE 626



A = Assembly Location  
L, WL = Wafer Lot  
Y, YY = Year  
W, WW = Work Week  
▪ or G = Pb-Free Package

(Note: Microdot may be in either location)

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

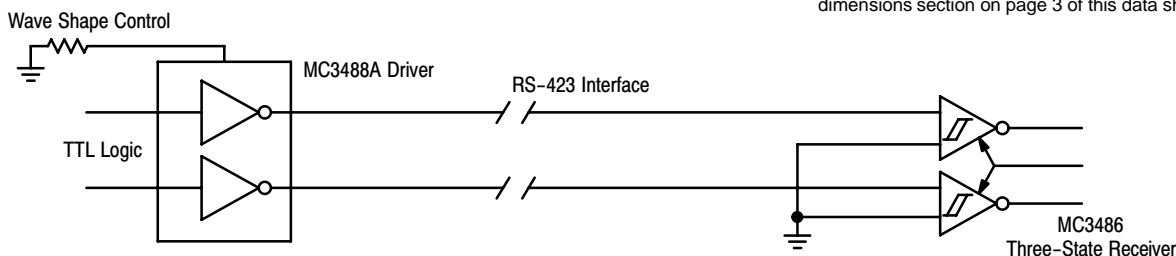


Figure 1. Simplified Application

# MC3488A

## MAXIMUM RATINGS (Note 1)

Rating	Symbol	Value	Unit
Power Supply Voltages	$V_{CC}$ $V_{EE}$	+ 15 – 15	V
Output Current	Source Sink $I_{O+}$ $I_{O-}$	+ 150 – 150	mA
Operating Ambient Temperature	$T_A$	0 to + 70	°C
Junction Temperature Range	$T_J$	150	°C
Storage Temperature Range	$T_{stg}$	– 65 to + 150	°C

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.

1. Devices should not be operated at these values. The "Electrical Characteristics" provide conditions for actual device operation.

## RECOMMENDED OPERATING CONDITIONS

Characteristic	Symbol	Min	Typ	Max	Unit
Power Supply Voltages	$V_{CC}$ $V_{EE}$	10.8 – 13.2	12 – 12	13.2 – 10.8	V
Operating Temperature Range	$T_A$	0	25	70	°C
Wave Shaping Resistor	$R_{WS}$	10	–	1000	k $\Omega$

## TARGET ELECTRICAL CHARACTERISTICS (Unless otherwise noted, specifications apply over recommended operating conditions)

Characteristic	Symbol	Min	Typ	Max	Unit
Input Voltage – Low Logic State	$V_{IL}$	–	–	0.8	V
Input Voltage – High Logic State	$V_{IH}$	2.0	–	–	V
Input Current – Low Logic State ( $V_{IL} = 0.4$ V)	$I_{IL}$	– 80	–	–	$\mu$ A
Input Current – High Logic State ( $V_{IH} = 2.4$ V) ( $V_{IH} = 5.5$ V)	$I_{IH1}$ $I_{IH2}$	– –	– –	10 100	$\mu$ A
Input Clamp Diode Voltage ( $I_{IK} = -15$ mA)	$V_{IK}$	– 1.5	–	–	V
Output Voltage – Low Logic State ( $R_L = \infty$ ), EIA–423 ( $R_L = 3.0$ k $\Omega$ ), EIA–232D ( $R_L = 450$ $\Omega$ ), EIA–423	$V_{OL}$	– 6.0 – 6.0 – 6.0	– – –	– 5.0 – 5.0 – 4.0	V
Output Voltage – High Logic State ( $R_L = \infty$ ), EIA–423 ( $R_L = 3.0$ k $\Omega$ ), EIA–232D ( $R_L = 450$ $\Omega$ ), EIA–423	$V_{OH}$	5.0 5.0 4.0	– – –	6.0 6.0 6.0	V
Output Resistance ( $R_L \geq 450$ $\Omega$ )	$R_O$	–	25	50	$\Omega$
Output Short–Circuit Current (Note 2) ( $V_{in} = V_{out} = 0$ V) ( $V_{in} = V_{IH(Min)}$ , $V_{out} = 0$ V)	$I_{OSH}$ $I_{OSL}$	– 150 + 15	– –	– 15 + 150	mA
Output Leakage Current (Note 3) ( $V_{CC} = V_{EE} = 0$ V, $-6.0$ V $\leq V_o \leq 6.0$ V)	$I_{ox}$	– 100	–	100	$\mu$ A
Power Supply Currents ( $R_W = 100$ k $\Omega$ , $R_L = \infty$ , $V_{IL} \leq V_{in} \leq V_{IH}$ )	$I_{CC}$ $I_{EE}$	– – 18	– –	+ 18 –	mA

2. One output shorted at a time.  
3. No  $V_{EE}$  diode required.

# MC3488A

**TRANSITION TIMES** (Unless otherwise noted,  $C_L = 30$  pF,  $f = 1.0$  kHz,  $V_{CC} = -V_{EE} = 12.0$  V  $\pm$  10%,  $T_A = 25^\circ\text{C}$ ,  $R_L = 450$   $\Omega$ . Transition times measured 10% to 90% and 90% to 10%)

Characteristic	Symbol	Min	Typ	Max	Unit
Transition Time, Low-to-High State Output ( $R_W = 10$ k $\Omega$ ) ( $R_W = 100$ k $\Omega$ ) ( $R_W = 500$ k $\Omega$ ) ( $R_W = 1000$ k $\Omega$ )	$t_{TLH}$	0.8 8.0 40 80		1.4 14 70 140	$\mu\text{s}$
Transition Time, High-to-Low State Output ( $R_W = 10$ k $\Omega$ ) ( $R_W = 100$ k $\Omega$ ) ( $R_W = 500$ k $\Omega$ ) ( $R_W = 1000$ k $\Omega$ )	$t_{THL}$	0.8 8.0 40 80		1.4 14 70 140	$\mu\text{s}$

## ORDERING INFORMATION

Device	Operating Temperature Range	Package	Shipping <sup>†</sup>
MC3488AD	$T_A = 0$ to $+70^\circ\text{C}$	SOIC-8	98 Units / Rail
MC3488ADG		SOIC-8 (Pb-Free)	98 Units / Rail
MC3488ADR2		SOIC-8	1000 / Tape & Reel
MC3488ADR2G		SOIC-8 (Pb-Free)	1000 / Tape & Reel
MC3488AP1		PDIP-8	50 Units / Rail
MC3488AP1G		PDIP-8 (Pb-Free)	50 Units / Rail

<sup>†</sup>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.

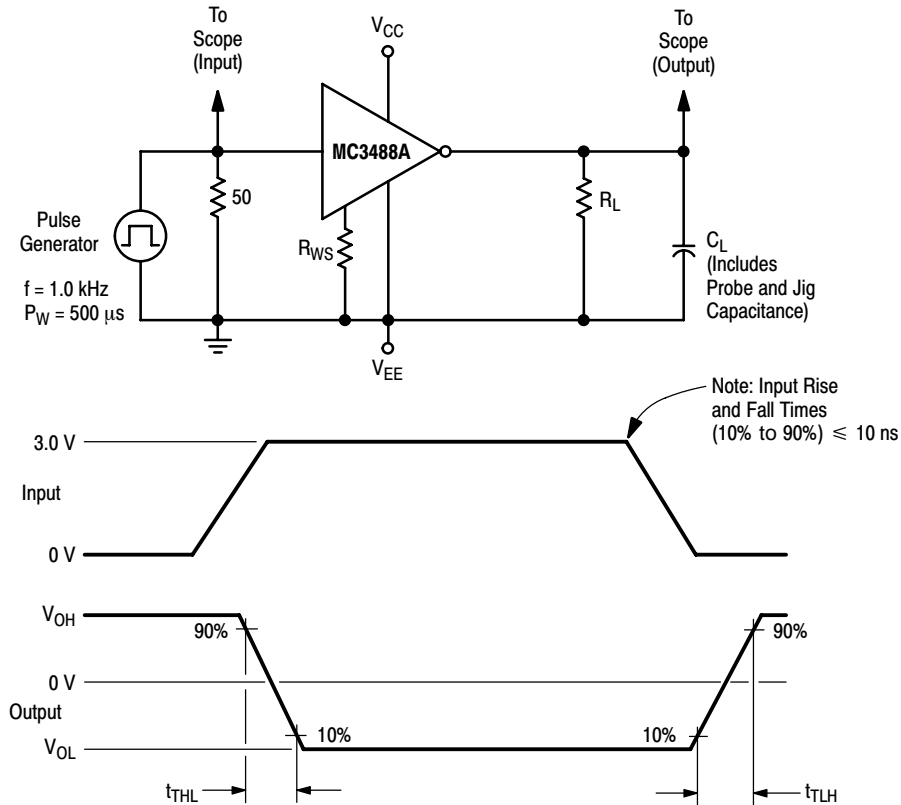
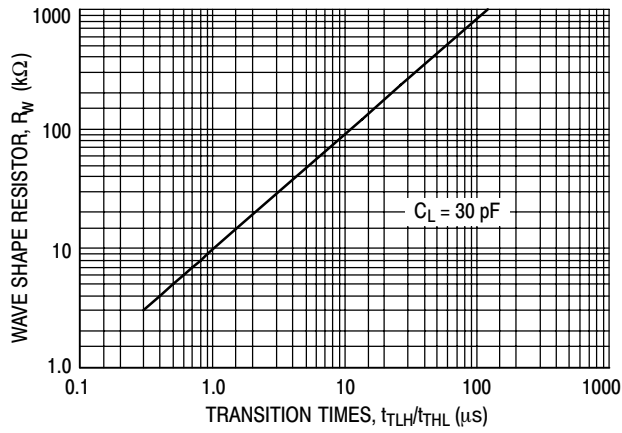
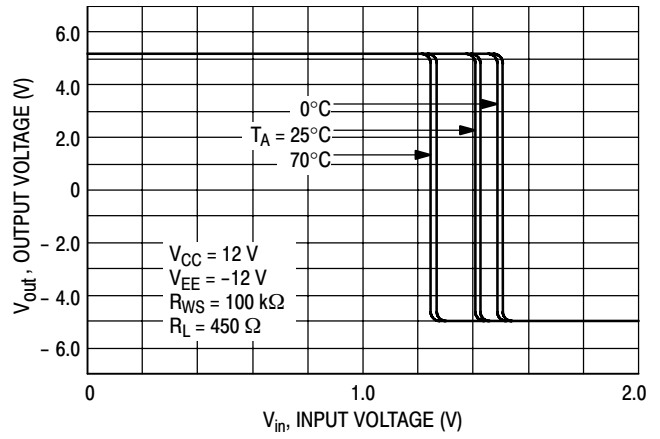


Figure 2. Test Circuit and Waveforms for Transition Times

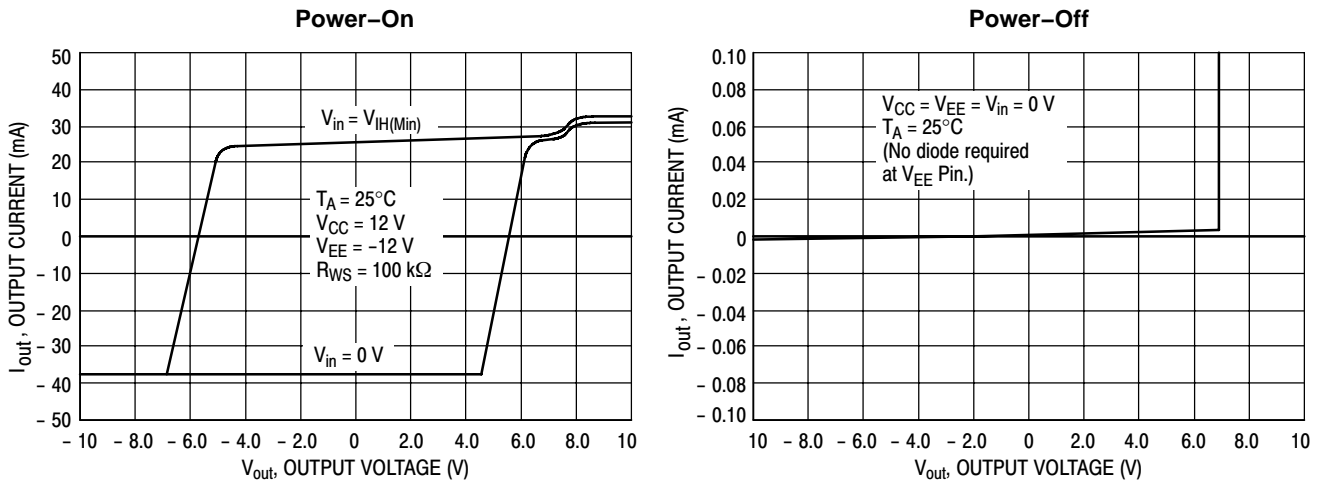
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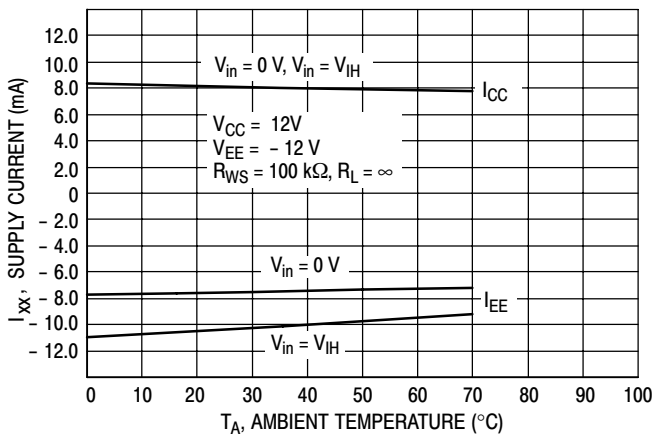
**Figure 3. Output Transition Times versus Wave Shape Resistor Value**



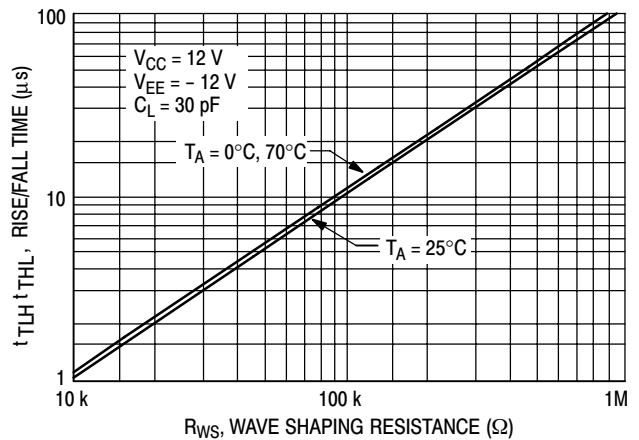
**Figure 4. Input/Output Characteristics versus Temperature**



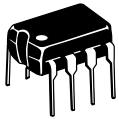
**Figure 5. Output Current versus Output Voltage**



**Figure 6. Supply Current versus Temperature**



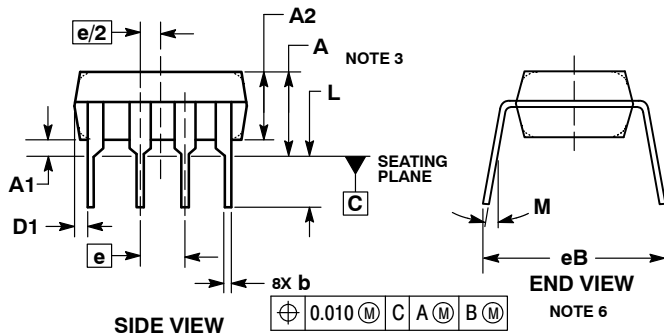
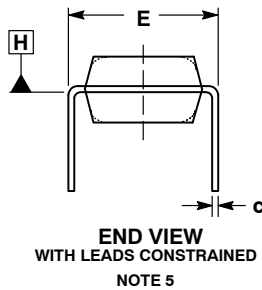
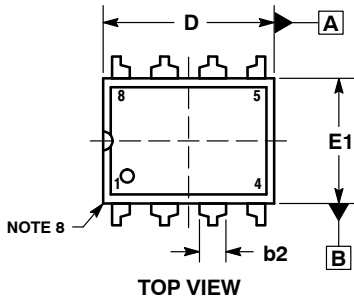
**Figure 7. Rise/Fall Time versus R\_ws**



SCALE 1:1

PDIP-8  
CASE 626-05  
ISSUE P

DATE 22 APR 2015

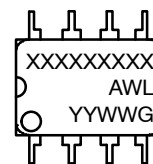


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. DIMENSIONS A, A1 AND L ARE MEASURED WITH THE PACKAGE 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	0.355	0.400	9.02	10.16
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\*



- XXXX = 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. Some products may not follow the Generic Marking.

STYLE 1:

- PIN 1. AC IN
- 2. DC + IN
- 3. DC - IN
- 4. AC IN
- 5. GROUND
- 6. OUTPUT
- 7. AUXILIARY
- 8. V<sub>CC</sub>

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SCALE 1:1

SOIC-8 NB  
CASE 751-07  
ISSUE AK

DATE 16 FEB 2011



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
  6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

SOLDERING FOOTPRINT\*



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

GENERIC MARKING DIAGRAM\*



XXXXXX = Specific Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
▪ = Pb-Free Package

XXXXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = 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. Some products may not follow the Generic Marking.

STYLES ON PAGE 2

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**SOIC-8 NB**  
**CASE 751-07**  
**ISSUE AK**

DATE 16 FEB 2011

- |  |   |   |   |
|--|---|---|---|
| <p><b>STYLE 1:</b><br/>         PIN 1. EMITTER<br/>         2. COLLECTOR<br/>         3. COLLECTOR<br/>         4. EMITTER<br/>         5. EMITTER<br/>         6. BASE<br/>         7. BASE<br/>         8. EMITTER</p>   | <p><b>STYLE 2:</b><br/>         PIN 1. COLLECTOR, DIE, #1<br/>         2. COLLECTOR, #1<br/>         3. COLLECTOR, #2<br/>         4. COLLECTOR, #2<br/>         5. BASE, #2<br/>         6. EMITTER, #2<br/>         7. BASE, #1<br/>         8. EMITTER, #1</p>               | <p><b>STYLE 3:</b><br/>         PIN 1. DRAIN, DIE #1<br/>         2. DRAIN, #1<br/>         3. DRAIN, #2<br/>         4. DRAIN, #2<br/>         5. GATE, #2<br/>         6. SOURCE, #2<br/>         7. GATE, #1<br/>         8. SOURCE, #1</p>                            | <p><b>STYLE 4:</b><br/>         PIN 1. ANODE<br/>         2. ANODE<br/>         3. ANODE<br/>         4. ANODE<br/>         5. ANODE<br/>         6. ANODE<br/>         7. ANODE<br/>         8. COMMON CATHODE</p>   |
| <p><b>STYLE 5:</b><br/>         PIN 1. DRAIN<br/>         2. DRAIN<br/>         3. DRAIN<br/>         4. DRAIN<br/>         5. GATE<br/>         6. GATE<br/>         7. SOURCE<br/>         8. SOURCE</p>   | <p><b>STYLE 6:</b><br/>         PIN 1. SOURCE<br/>         2. DRAIN<br/>         3. DRAIN<br/>         4. SOURCE<br/>         5. SOURCE<br/>         6. GATE<br/>         7. GATE<br/>         8. SOURCE</p>  | <p><b>STYLE 7:</b><br/>         PIN 1. INPUT<br/>         2. EXTERNAL BYPASS<br/>         3. THIRD STAGE SOURCE<br/>         4. GROUND<br/>         5. DRAIN<br/>         6. GATE 3<br/>         7. SECOND STAGE Vd<br/>         8. FIRST STAGE Vd</p>                    | <p><b>STYLE 8:</b><br/>         PIN 1. COLLECTOR, DIE #1<br/>         2. BASE, #1<br/>         3. BASE, #2<br/>         4. COLLECTOR, #2<br/>         5. COLLECTOR, #2<br/>         6. EMITTER, #2<br/>         7. EMITTER, #1<br/>         8. COLLECTOR, #1</p>                              |
| <p><b>STYLE 9:</b><br/>         PIN 1. EMITTER, COMMON<br/>         2. COLLECTOR, DIE #1<br/>         3. COLLECTOR, DIE #2<br/>         4. EMITTER, COMMON<br/>         5. EMITTER, COMMON<br/>         6. BASE, DIE #2<br/>         7. BASE, DIE #1<br/>         8. EMITTER, COMMON</p> | <p><b>STYLE 10:</b><br/>         PIN 1. GROUND<br/>         2. BIAS 1<br/>         3. OUTPUT<br/>         4. GROUND<br/>         5. GROUND<br/>         6. BIAS 2<br/>         7. INPUT<br/>         8. GROUND</p>  | <p><b>STYLE 11:</b><br/>         PIN 1. SOURCE 1<br/>         2. GATE 1<br/>         3. SOURCE 2<br/>         4. GATE 2<br/>         5. DRAIN 2<br/>         6. DRAIN 2<br/>         7. DRAIN 1<br/>         8. DRAIN 1</p>   | <p><b>STYLE 12:</b><br/>         PIN 1. SOURCE<br/>         2. SOURCE<br/>         3. SOURCE<br/>         4. GATE<br/>         5. DRAIN<br/>         6. DRAIN<br/>         7. DRAIN<br/>         8. DRAIN</p>   |
| <p><b>STYLE 13:</b><br/>         PIN 1. N.C.<br/>         2. SOURCE<br/>         3. SOURCE<br/>         4. GATE<br/>         5. DRAIN<br/>         6. DRAIN<br/>         7. DRAIN<br/>         8. DRAIN</p>  | <p><b>STYLE 14:</b><br/>         PIN 1. N-SOURCE<br/>         2. N-GATE<br/>         3. P-SOURCE<br/>         4. P-GATE<br/>         5. P-DRAIN<br/>         6. P-DRAIN<br/>         7. N-DRAIN<br/>         8. N-DRAIN</p>   | <p><b>STYLE 15:</b><br/>         PIN 1. ANODE 1<br/>         2. ANODE 1<br/>         3. ANODE 1<br/>         4. ANODE 1<br/>         5. CATHODE, COMMON<br/>         6. CATHODE, COMMON<br/>         7. CATHODE, COMMON<br/>         8. CATHODE, COMMON</p>               | <p><b>STYLE 16:</b><br/>         PIN 1. EMITTER, DIE #1<br/>         2. BASE, DIE #1<br/>         3. EMITTER, DIE #2<br/>         4. BASE, DIE #2<br/>         5. COLLECTOR, DIE #2<br/>         6. COLLECTOR, DIE #2<br/>         7. COLLECTOR, DIE #1<br/>         8. COLLECTOR, DIE #1</p> |
| <p><b>STYLE 17:</b><br/>         PIN 1. VCC<br/>         2. V2OUT<br/>         3. V1OUT<br/>         4. TXE<br/>         5. RXE<br/>         6. VEE<br/>         7. GND<br/>         8. ACC</p>  | <p><b>STYLE 18:</b><br/>         PIN 1. ANODE<br/>         2. ANODE<br/>         3. SOURCE<br/>         4. GATE<br/>         5. DRAIN<br/>         6. DRAIN<br/>         7. CATHODE<br/>         8. CATHODE</p>   | <p><b>STYLE 19:</b><br/>         PIN 1. SOURCE 1<br/>         2. GATE 1<br/>         3. SOURCE 2<br/>         4. GATE 2<br/>         5. DRAIN 2<br/>         6. MIRROR 2<br/>         7. DRAIN 1<br/>         8. MIRROR 1</p>   | <p><b>STYLE 20:</b><br/>         PIN 1. SOURCE (N)<br/>         2. GATE (N)<br/>         3. SOURCE (P)<br/>         4. GATE (P)<br/>         5. DRAIN<br/>         6. DRAIN<br/>         7. DRAIN<br/>         8. DRAIN</p>   |
| <p><b>STYLE 21:</b><br/>         PIN 1. CATHODE 1<br/>         2. CATHODE 2<br/>         3. CATHODE 3<br/>         4. CATHODE 4<br/>         5. CATHODE 5<br/>         6. COMMON ANODE<br/>         7. COMMON ANODE<br/>         8. CATHODE 6</p>  | <p><b>STYLE 22:</b><br/>         PIN 1. I/O LINE 1<br/>         2. COMMON CATHODE/VCC<br/>         3. COMMON CATHODE/VCC<br/>         4. I/O LINE 3<br/>         5. COMMON ANODE/GND<br/>         6. I/O LINE 4<br/>         7. I/O LINE 5<br/>         8. COMMON ANODE/GND</p> | <p><b>STYLE 23:</b><br/>         PIN 1. LINE 1 IN<br/>         2. COMMON ANODE/GND<br/>         3. COMMON ANODE/GND<br/>         4. LINE 2 IN<br/>         5. LINE 2 OUT<br/>         6. COMMON ANODE/GND<br/>         7. COMMON ANODE/GND<br/>         8. LINE 1 OUT</p> | <p><b>STYLE 24:</b><br/>         PIN 1. BASE<br/>         2. EMITTER<br/>         3. COLLECTOR/ANODE<br/>         4. COLLECTOR/ANODE<br/>         5. CATHODE<br/>         6. CATHODE<br/>         7. COLLECTOR/ANODE<br/>         8. COLLECTOR/ANODE</p>                                      |
| <p><b>STYLE 25:</b><br/>         PIN 1. VIN<br/>         2. N/C<br/>         3. REXT<br/>         4. GND<br/>         5. IOUT<br/>         6. IOUT<br/>         7. IOUT<br/>         8. IOUT</p>   | <p><b>STYLE 26:</b><br/>         PIN 1. GND<br/>         2. dv/dt<br/>         3. ENABLE<br/>         4. ILIMIT<br/>         5. SOURCE<br/>         6. SOURCE<br/>         7. SOURCE<br/>         8. VCC</p>  | <p><b>STYLE 27:</b><br/>         PIN 1. ILIMIT<br/>         2. OVLO<br/>         3. UVLO<br/>         4. INPUT+<br/>         5. SOURCE<br/>         6. SOURCE<br/>         7. SOURCE<br/>         8. DRAIN</p>  | <p><b>STYLE 28:</b><br/>         PIN 1. SW_TO_GND<br/>         2. DASIC OFF<br/>         3. DASIC_SW_DET<br/>         4. GND<br/>         5. V_MON<br/>         6. VBULK<br/>         7. VBULK<br/>         8. VIN</p>  |
| <p><b>STYLE 29:</b><br/>         PIN 1. BASE, DIE #1<br/>         2. EMITTER, #1<br/>         3. BASE, #2<br/>         4. EMITTER, #2<br/>         5. COLLECTOR, #2<br/>         6. COLLECTOR, #2<br/>         7. COLLECTOR, #1<br/>         8. COLLECTOR, #1</p>                        | <p><b>STYLE 30:</b><br/>         PIN 1. DRAIN 1<br/>         2. DRAIN 1<br/>         3. GATE 2<br/>         4. SOURCE 2<br/>         5. SOURCE 1/DRAIN 2<br/>         6. SOURCE 1/DRAIN 2<br/>         7. SOURCE 1/DRAIN 2<br/>         8. GATE 1</p>                           |   |   |

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