LCD Backplane Drivers
CMOS

MC141512
MC141515

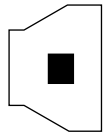
The MC141512 and MC141515 are high voltage passive LCD backplane driver chips. The MC141512 provides 80 high voltage LCD driving signals whereas the MC141515 provides 160 high voltage LCD driving signals.

They are companion chips to the MC141514 and MC141519 LCD segment driver for medium size LCD panels. All these chips are controlled by the MC68HC05L11 microcomputer.

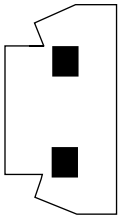
The MC141515T is the twin die version of the MC141512T.

See Application Note AN-HK-15.

- Operating Supply Voltage Range -
  - Control Logic (V_{DD} Pin): 2.7V to 5.5V
  - Backplane Drivers (V_{LCD} Pin): 10V to 25V
- Operating Temperature Range: -25 to 70˚C
- Direct Serial Data Interface with the MC68HC05L11
- MC141512 - 80 LCD Backplane Driving Signals
- MC141515 - 160 LCD Backplane Driving Signals
- 1:5 to 1:13 Bias
- Expansion to Higher Driver Count by Cascade
- Available in Three Forms:
  - TAB (Tape Automated Bonding), 91 Contacts - MC141512T1
    182 Contacts - MC141515T
  - Die Form Without Gold Bumps, 91 Pads with 4.3 mil Pads Pitch



MC141512T1
TAB



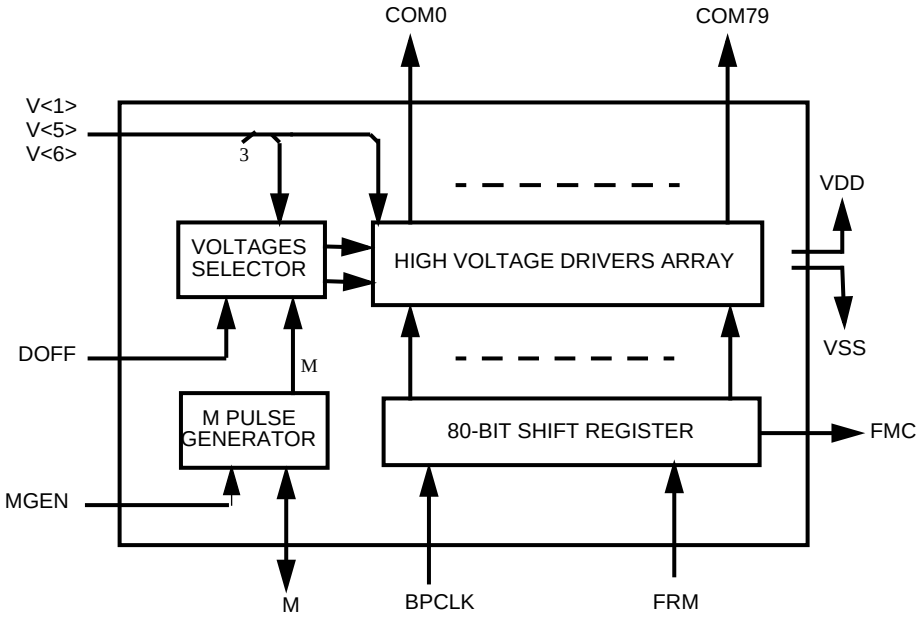
MC141515T
TAB

MCC141512
DIE

ORDERING INFORMATION

MC141512T1	TAB
MC141515T	TAB
MCC141512	BARE DIE

BLOCK DIAGRAM



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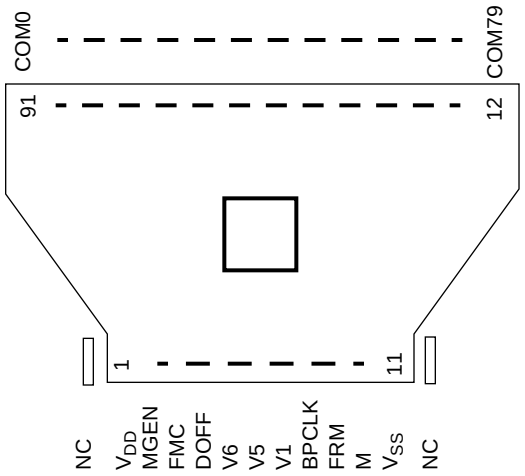
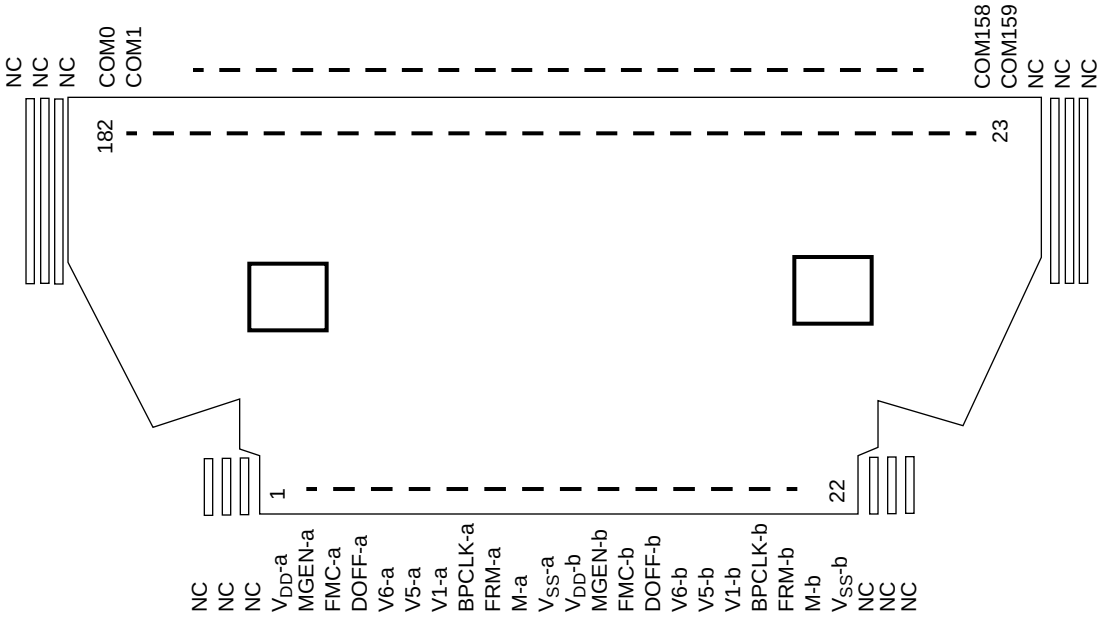
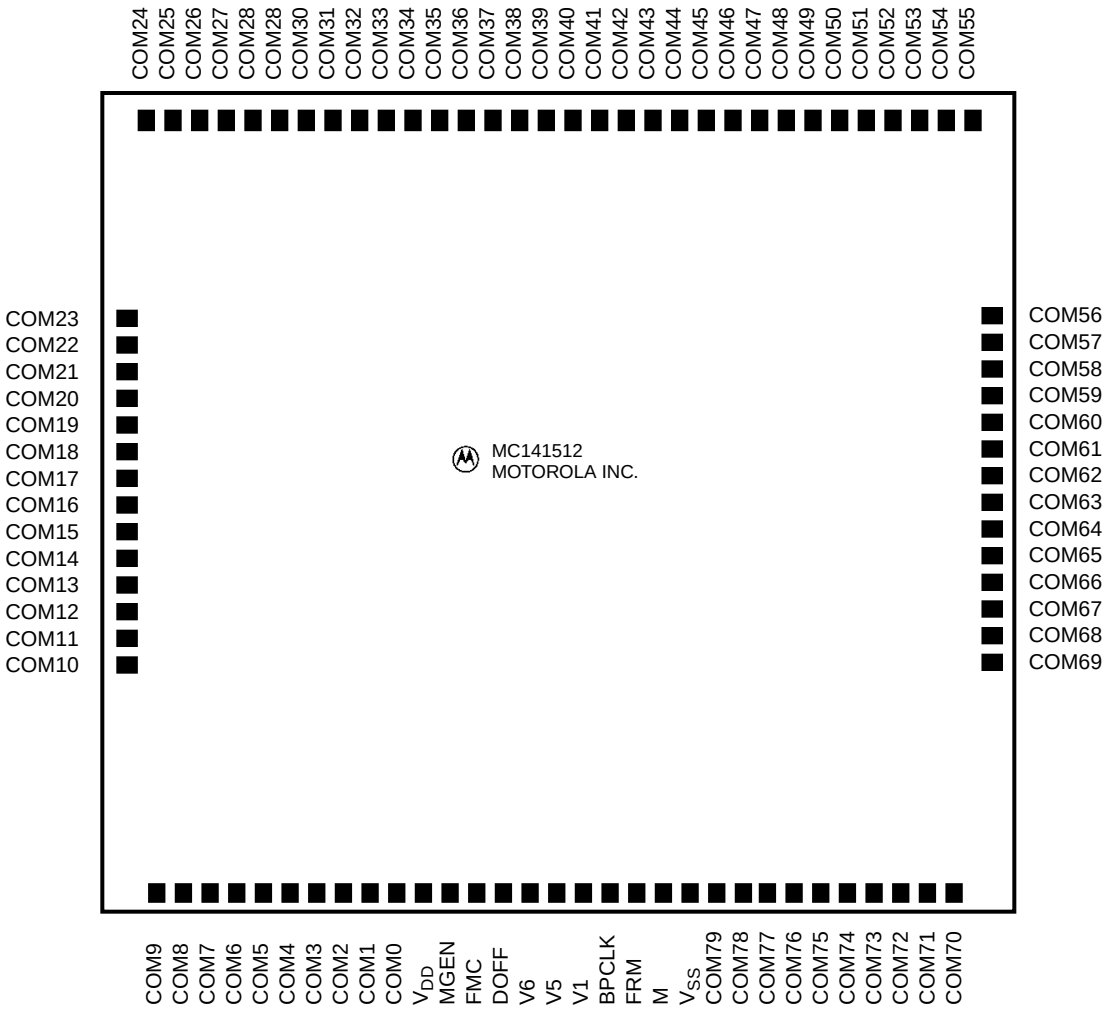


MC141512T1 TAB Package Contact Assignment (Copper View)



MC141515T TAB Package Contact Assignment (Copper View)



Chip Pad Assignment

MAXIMUM RATINGS*(Voltages Referenced to V_{SS})

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage	-0.3 to +7.0	V
$V_{<1>}$		-0.3 to +27.5	V
V_{in}	Input Voltage	-0.3 to V_{DD}+0.3	V
I	Current Drain Per Pin Excluding V_{DD} and V_{SS}	25	mA
T_A	Operating Temperature	-25 to +75	˚C
T_{stg}	Storage Temperature Range	-65 to +150	˚C

* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the limits in the Electrical Characteristics tables or Pin Description section.

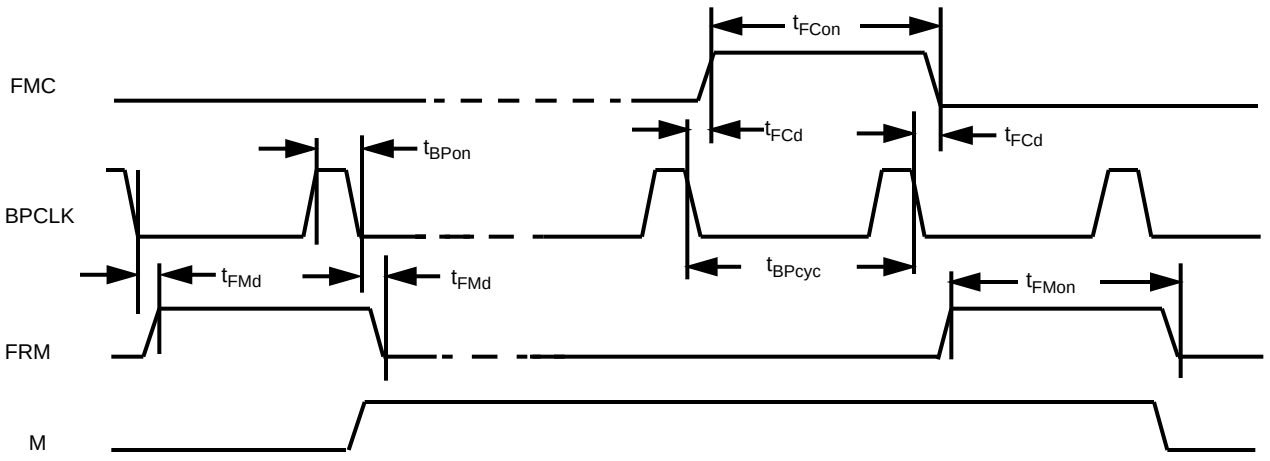
This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions to be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V_{in} and V_{out} be constrained to the range V_{SS} < or = (V_{in} or V_{out}) < or = V_{DD}. Reliability of operation is enhanced if unused input are connected to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}). Unused outputs must be left open. This device may be light sensitive. Caution should be taken to avoid exposure of this device to any light source during normal operation. This device is not radiation protected.

ELECTRICAL CHARACTERISTICS (Voltage Referenced to V_{SS}, V_{DD} = 5.0V, $V_{<1>}$ = 25V, T_A = -25 to 70˚C)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V_{DD} $V_{<1>}$	Supply Voltage Range LCD Supply Voltage Range	(Absolute value reference to V_{SS})	2.7 +10.0	- -	5.5 +25.0	V V
I_{DP}	Display Mode Supply Current (V_{DD} Pin)	BPCLK = 8KHz	-	1	10	uA
I_{SB}	Standby Mode Supply Current (V_{DD} Pin)	Using D_{ON} bit of the MCU	-	0.5	1	uA
I_{LDP}	Display Mode Supply Current ($V_{<1>}$ Pin)	BPCLK = 8KHz	-	3	10	uA
I_{LSB}	Standby Mode Supply Current ($V_{<1>}$ Pin)	BPCLK = 8KHz	-	0.5	1	uA
V_{OL} V_{OH}	Output Low Voltage Output High Voltage (M, FMC)	No Load	V_{SS} 0.8 x V_{DD}	- -	0.2 x V_{DD} V_{DD}	V V
V_{IH} V_{IL}	Input High Voltage Input Low Voltage (BPCLK, FRM, M, DOFF, FMC, MGEN)		0.7xV_{DD} V_{SS}	- -	V_{DD} 0.3xV_{DD}	V V
I_{in}	Input Current (BPCLK, FRM, M, DOFF, FMC, MGEN)		-	-	1	uA
C_{in}	Input Capacitance (BPCLK, FRM, M, DOFF, FMC)		-	-	8	pF
I_{OH} I_{OL}	Output High Current Output Low Current (M, FMC)	V_{OH}= 4.5V V_{OL}= 0.5V	+100 -	- -	- -100	uA uA

AC ELECTRICAL CHARACTERISTICS (V_{DD} = 2.7 - 5.0V, V_{SS} = 0V, T_A = 25˚C)

Symbol	Parameter	Min	Max	Unit
t_{FCon}	Carry Out Frame On Time	122	-	us
t_{FCd}	Carry Out Frame Delay Time	10	100	ns
t_{BPon}	BPCLK Pulse On Time	61	-	us
t_{BPcyc}	BPCLK Cycle Period	61	-	us
t_{FMd}	Frame Delay Time	10	100	ns
t_{FMon}	Frame Pulse On Time	122	-	us



Timing Diagram

PIN DESCRIPTIONS

V_{DD} AND V_{SS}

Power is supplied to the driver using these two pins. V_{DD} is power and V_{SS} is ground.

V<1>, V<5>, V<6>

These are the levels of voltage generated from an external voltages divider (Fig. 1).

DOFF

This is an output from MC68HC05L11 to signal the backplane driver to turn off LCD. If this signal is clear, the backplane driver will supply LCD with driving signal. If this signal is set, the backplane driver outputs will be high-impedanced and LCD display is disabled.

FRM

A periodic active high input to the backplane driver for frame timing synchronization which is connected to FRM of MC68HC05L11.

BPCLK

A periodic output from MC68HC05L11 to backplane driver for timing synchronization. The signal will affect the refreshing time of LCD display.

FMC

This is an output pin of backplane driver which is connected to the FRM of the next backplane driver in case of cascading.

M

This pin is for synchronization between the display driver. When MGEN is set, it will generate an M signal for synchronization. When MGEN is clear, it becomes an input pin and expecting a M signal from other device.

MGEN

An input which is used for program the M pin as an input or output. If MGEN is logic high, M acts as an output. If MGEN is logic low, M becomes an input.

COM 0 - 79

These are the high voltage outputs of the backplane driver which are connected to set of common lines of any LCD panel.

OPERATION OF LCD DRIVER

INTRODUCTION

The LCD backplane driver can support multiplex ratio of a LCD system up to 146 and cascading of more than one driver for expansion is possible. It can be set from 1:5 bias (for 16 mux) to 1:13 bias (for 146 mux), by the voltage divider ratio of Fig.1. The ratio of bias or the contrast ratio (a) is defined as

$$1 : \frac{4 \times R1 + R2}{R1} = 1 : a$$

As the multiplex ratio changes, the ratio of bias has to be changed accordingly. The ratio of bias relates to the multiplex ratio as

$$a = \overline{mux} + 1$$

To set up a multiplex ratio, please refer to MC68HC05L11 technical data Section 10.6.2.

VOLTAGES SELECTOR consists of switching circuit to select appropriate voltage levels from external voltage divider. (See Fig. 1).

80-BIT SHIFT REGISTER samples the FRM at the falling edge of BPCLK and shifts the sample to the left 80 times before exports to the next backplane driver through FMC.

HIGH VOLTAGE DRIVERS ARRAY is a row of high voltage drivers connecting to segment lines of any LCD panel. The output waveform of the high voltage driver is shown as Com(1) and Com(2)are shown in Figure 2.

POWER UP SYNCHRONIZATION is activated upon the receipt the first M pulse. The M pin of the backplane driver will act as an input when MGEN is connected to Low. When MGEN is Set, this backplane driver will be the master of the synchronization system. M pin will then supply a periodic signal for all LCD drivers.

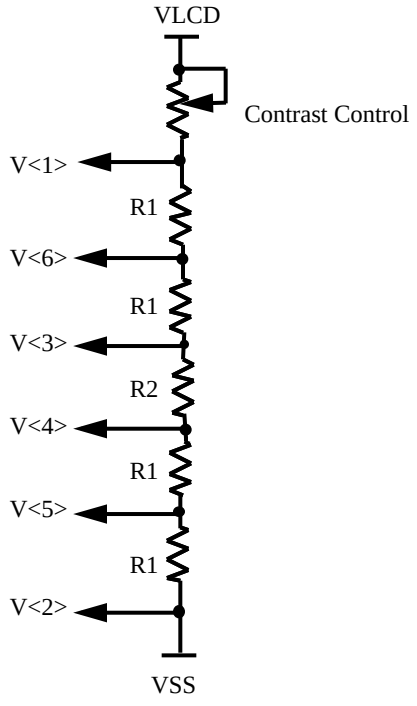


Figure 1. External Voltage Divider

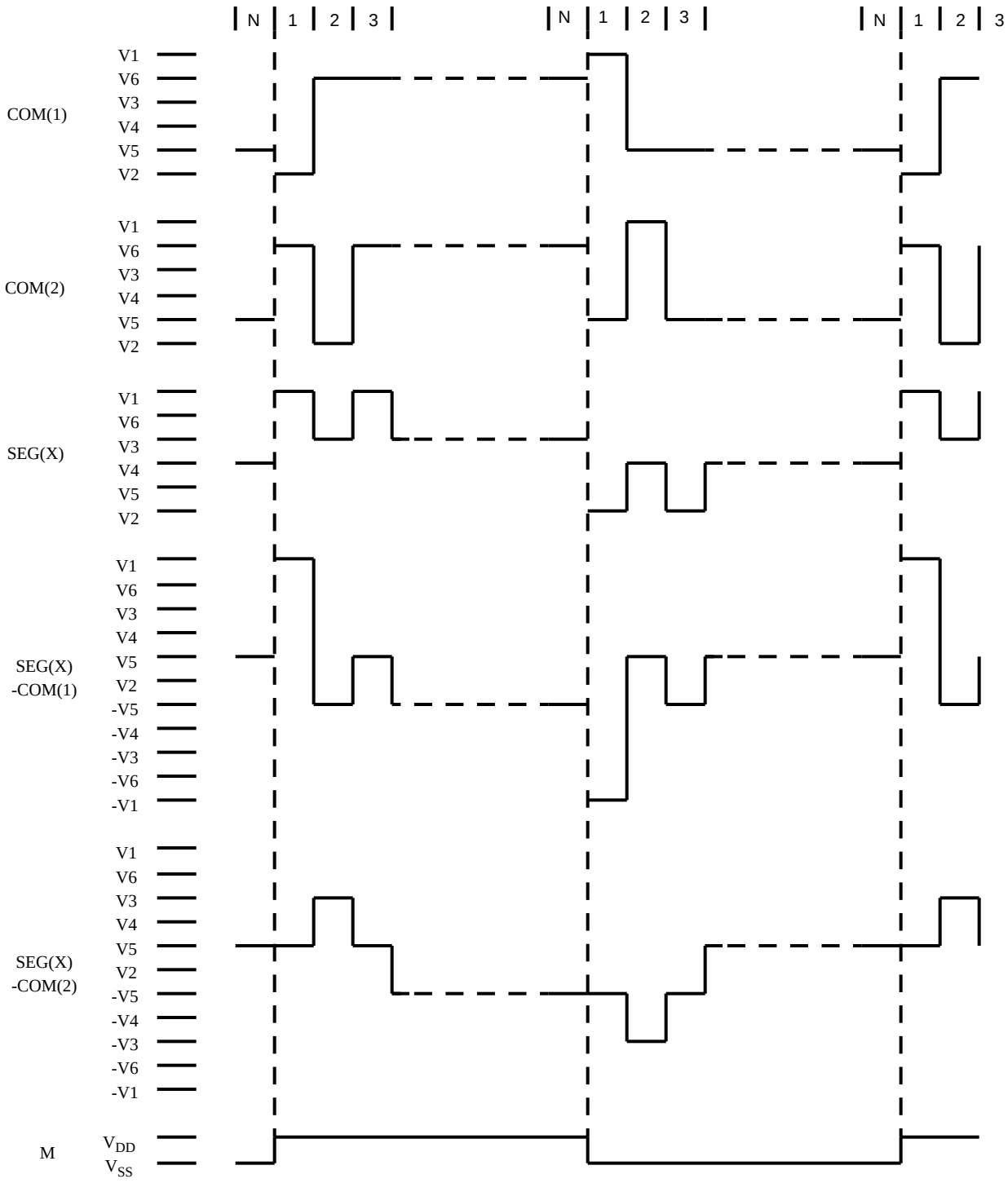
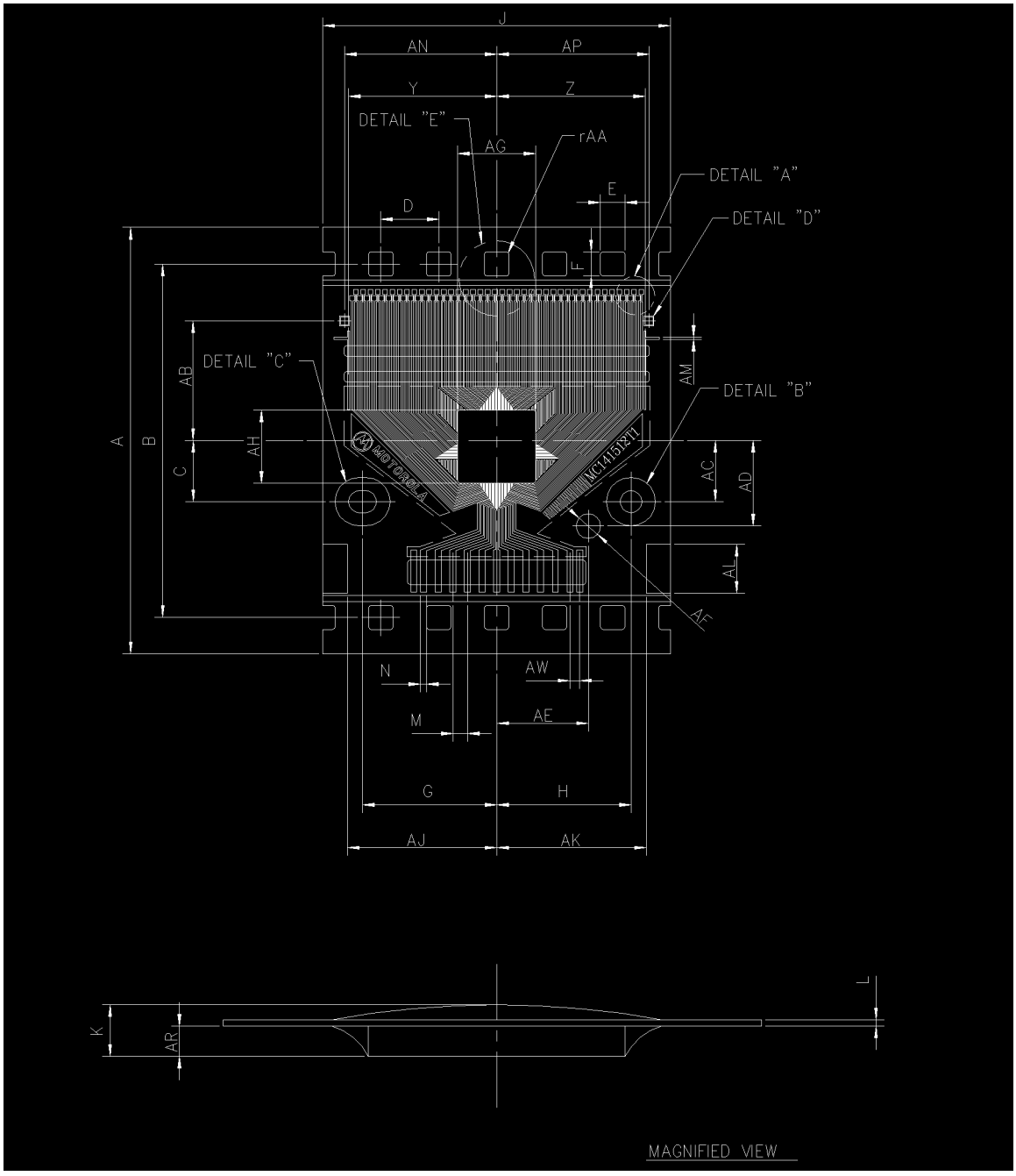


Figure 2. Driving Waveforms of 1:N Multiplex Ratio

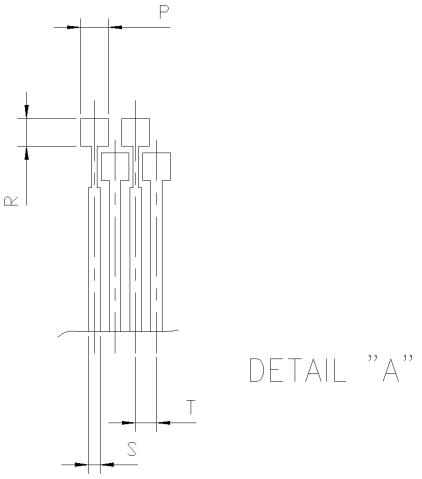
PACKAGE DIMENSIONS

MC141512T1
TAB PACKAGE DIMENSION
(DO NOT SCALE THIS DRAWING)

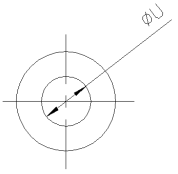


Reference : 98ASL00103A	Issue “A” released on 03/21/94

MC141512T1
TAB PACKAGE DIMENSION
(DO NOT SCALE THIS DRAWING)



DETAIL "A"



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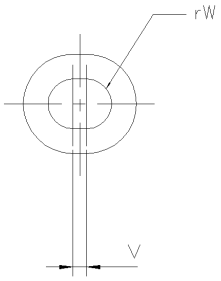
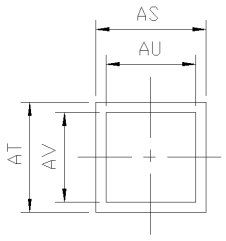
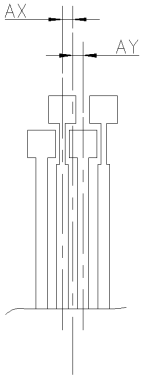


DETAIL "C"



DETAIL "D"



DETAIL "E"

Reference: 98ASL00103A	Issue "A" released on 03/21/94

MC141512T1 TAB PACKAGE DIMENSION

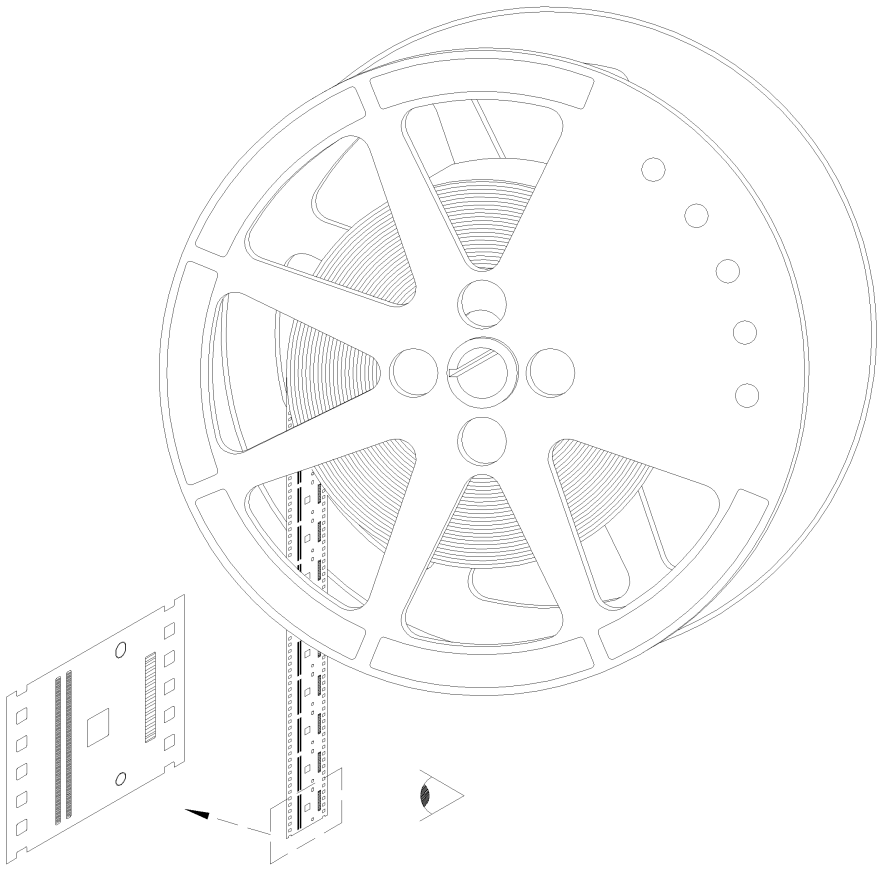
	Millimeters		Inches			Millimeters		Inches	
Dim	**Min**	**Max**	**Min**	**Max**	**Dim**	**Min**	**Max**	**Min**	**Max**
A	34.775	35.175	1.369	1.385	AE	7.000	8.000	0.2756	0.3150
B	28.907	29.017	1.138	1.142	AF	1.950	2.050	0.0768	0.0807
C	4.950	5.050	0.195	0.199	AG	-	6.410	-	0.2524
D	4.700	4.800	0.185	0.189	AH	-	5.968	-	0.2350
E	1.951	2.011	0.077	0.079	AJ	11.750	12.750	0.4626	0.5020
F	1.951	2.011	0.077	0.079	AK	11.750	12.750	0.4626	0.5020
G	10.950	11.050	0.431	0.435	AL	3.950	4.050	0.1555	0.1594
H	10.950	11.050	0.431	0.435	AM	0.150	0.190	0.0059	0.0075
J	28.00	29.000	1.102	1.142	AN	12.430	12.530	0.4894	0.4933
K	0.686	0.838	0.027	0.033	AP	12.430	12.530	0.4894	0.4933
L	0.0675	0.0825	0.0027	0.0032	AR	0.5794	0.6294	0.0228	0.0248
M	1.190	1.210	0.047	0.048	AS	0.750	0.850	0.0295	0.0335
N	0.480	0.520	0.019	0.020					
P	0.380	0.420	0.015	0.016					
R	0.380	0.420	0.015	0.016					
S	0.150	0.190	0.006	0.007					
T	0.290	0.310	0.011	0.012					
U	1.750	1.850	0.069	0.073					
V	0.480	0.520	0.019	0.020					
W	0.880	0.920	0.035	0.036					
Y	12.100	12.200	0.4764	0.4803					
Z	12.100	12.200	0.4764	0.4803					
AA	-	0.200	-	0.008					
AB	9.778	9.878	0.3850	0.3889					
AC	4.950	5.050	0.1949	0.1988					
AD	6.500	7.500	0.2559	0.2953					

NOTES:
1. Dimensioning and tolerancing per ANSI Y14.5M, 1982.
2. Controlling dimension: millimeter
3. Cu thickness: 1 oz
4. Tin plating thickness: 0.4µm

Reference: 98ASL00103A Issue “A” released on 03/21/94

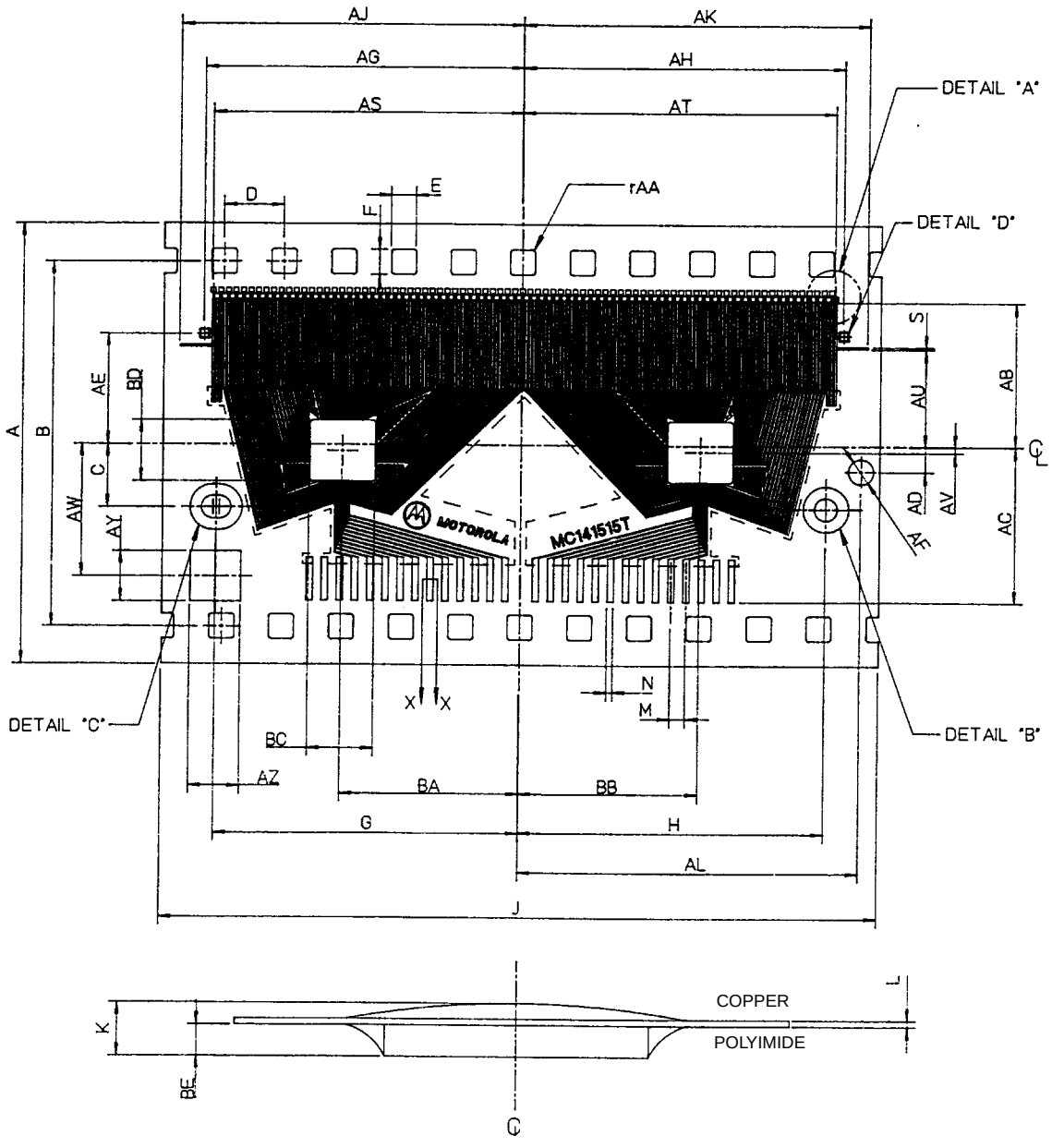
MC141512T1

TAB TAPE REEL ORIENTATION



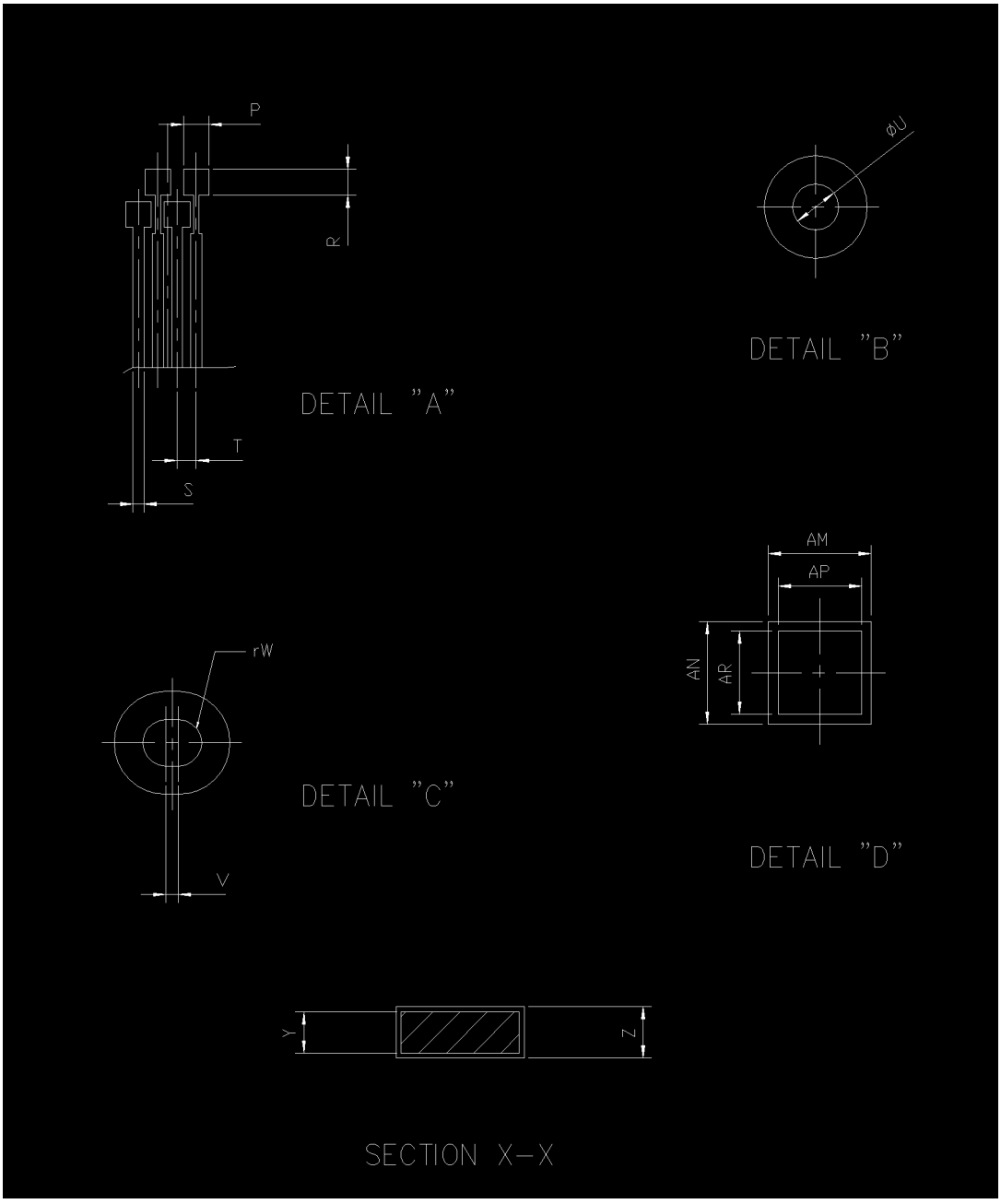
Reference: 98ASL00103A	Issue “A” released on 03/21/94

MC141515T
TAB PACKAGE DIMENSION
(DO NOT SCALE THIS DRAWING)



Reference: 98ASL00053A	Issue "A" released on 02/28/93

MC141515T
TAB PACKAGE DIMENSION
(DO NOT SCALE THIS DRAWING)



Reference: 98ASL00053A	Issue “A” released on 02/28/93

MC141515T TAB PACKAGE DIMENSION

	Millimeters		Inches			Millimeters		Inches	
Dim	**Min**	**Max**	**Min**	**Max**	**Dim**	**Min**	**Max**	**Min**	**Max**
A	34.775	35.175	1.3691	1.3848	AE	8.730	8.750	0.3437	0.3445
B	28.907	29.017	1.1381	1.1424	AF	1.950	2.050	0.0768	0.0807
C	4.950	5.050	0.1949	0.1988	AG	25.250	25.270	0.9941	0.9949
D	4.700	4.800	0.1850	0.1890	AH	25.550	25.570	1.0059	1.0067
E	1.951	2.011	0.0768	0.0792	AJ	27.135	27.235	1.0683	1.0722
F	1.951	2.011	0.0768	0.0792	AK	27.435	27.485	1.0801	1.0821
G	24.200	24.300	0.9528	0.9567	AL	26.950	27.050	1.0610	1.0650
H	24.200	24.300	0.9528	0.9567	AM	0.750	0.850	0.0295	0.0335
J	56.900	57.100	2.2402	2.2480	AN	0.75	0.850	0.0295	0.0335
K	0.686	0.838	0.0270	0.0330	AP	0.600	0.700	0.0236	0.0276
L	0.0675	0.0825	0.0027	0.0033	AR	0.600	0.700	0.0236	0.0276
M	1.190	1.210	0.0469	0.0476	AS	24.590	24.610	0.9681	0.9689
N	0.480	0.520	0.0189	0.0205	AT	24.890	24.910	0.9799	0.9807
P	0.380	0.420	0.0150	0.0165	AU	7.705	7.725	0.3034	0.3041
R	0.380	0.420	0.0150	0.0165	AV	0.450	0.550	0.0177	0.0217
S	0.150	0.190	0.3850	0.3890	AW	10.450	10.550	0.4114	0.4154
T	0.29	0.310	0.0114	0.0122	AY	3.95	4.050	0.1555	0.1595
U	1.780	1.820	0.0701	0.0717	AZ	3.95	4.050	0.1555	0.1595
V	0.480	0.520	0.0189	0.0205	BA	14.200	14.300	0.5591	0.5630
W	0.880	0.920	0.0347	0.0362	BB	14.200	14.300	0.5591	0.5630
Y	0.032	0.038	0.0013	0.0015	BC	-	6.410	-	0.2524
Z	0.032	0.038	0.0013	0.0015	BD	-	5.500	-	0.2165
AA	-	0.2	-	0.0079	BE	0.4326	0.5326	0.0170	0.0210
AB	11.300	11.500	0.4449	0.4527					
AC	12.300	12.500	0.4843	0.4921					
AD	1.950	2.050	0.0768	0.0807					

NOTES:
1. Dimensioning and tolerancing per ANSI Y14.5M, 1982.
2. Controlling dimension: millimeter
3. Recommended excise area Jx(AB+AC)

Reference: 98ASL00053A Issue “A” released on 02/28/93

MCC141512 PAD COORDINATES

(UNIT: um)

Pin Name	X	Y	Pin Name	X	Y	Pin Name	X	Y	Pin Name	X	Y
COM9	1687.50	1688.00	COM69	-1841.50	935.00	COM55	-1743.50	-1688.00	COM23	1841.50	-527.50
COM8	1575.00	1688.00	COM68	-1841.50	822.50	COM54	-1631.00	-1688.00	COM22	1841.50	-415.00
COM7	1462.50	1688.00	COM67	-1841.50	710.00	COM53	-1518.50	-1688.00	COM21	1841.50	-302.50
COM6	1350.00	1688.00	COM66	-1841.50	597.50	COM52	-1406.00	-1688.00	COM20	1841.50	-190.00
COM5	1237.50	1688.00	COM65	-1841.50	485.00	COM51	-1293.50	-1688.00	COM19	1841.50	-77.50
COM4	1125.00	1688.00	COM64	-1841.50	372.50	COM50	-1181.00	-1688.00	COM18	1841.50	35.00
COM3	1012.50	1688.00	COM63	-1841.50	260.00	COM49	-1068.50	-1688.00	COM17	1841.50	147.50
COM2	900.00	1688.00	COM62	-1841.50	147.50	COM48	-956.00	-1688.00	COM16	1841.50	260.00
COM1	787.50	1688.00	COM61	-1841.50	35.00	COM47	-843.50	-1688.00	COM15	1841.50	372.50
COM0	675.00	1688.00	COM60	-1841.50	-77.50	COM46	-731.00	-1688.00	COM14	1841.50	485.00
VDD	562.50	1688.00	COM59	-1841.50	-190.00	COM45	-618.50	-1688.00	COM13	1841.50	597.50
MGEN	450.00	1688.00	COM58	-1841.50	-302.50	COM44	-506.00	-1688.00	COM12	1841.50	710.00
FMC	337.50	1688.00	COM57	-1841.50	-415.00	COM43	-393.50	-1688.00	COM11	1841.50	822.50
DOFF	225.00	1688.00	COM56	-1841.50	-527.50	COM42	-281.00	-1688.00	COM10	1841.50	935.00
V6	112.50	1688.00				COM41	-168.50	-1688.00			
V5	0.00	1688.00				COM40	-56.00	-1688.00			
V1	-112.50	1688.00				COM39	56.50	-1688.00			
BPCLK	-225.00	1688.00				COM38	169.00	-1688.00			
FRM	-337.50	1688.00				COM37	281.50	-1688.00			
M	-450.00	1688.00				COM36	394.00	-1688.00			
VSS	-562.50	1688.00				COM35	506.50	-1688.00			
COM79	-675.00	1688.00				COM34	619.00	-1688.00			
COM78	-787.50	1688.00				COM33	731.50	-1688.00			
COM77	-900.00	1688.00				COM32	844.00	-1688.00			
COM76	-1012.50	1688.00				COM31	956.50	-1688.00			
COM75	-1125.00	1688.00				COM30	1069.00	-1688.00			
COM74	-1237.50	1688.00				COM29	1181.50	-1688.00			
COM73	-1350.00	1688.00				COM28	1294.00	-1688.00			
COM72	-1462.50	1688.00				COM27	1406.50	-1688.00			
COM71	-1575.00	1688.00				COM26	1519.00	-1688.00			
COM70	-1687.50	1688.00				COM25	1631.50	-1688.00			
						COM24	1744.00	-1688.00			

Die size : 158.0 x 148.5 mil^2
Pad pitch : 4.43 mil
Note : 1 mil ~ 25.4μm