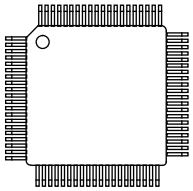
MC141516

LCD Backplane Driver
CMOS

The MC141516 is a high voltage passive LCD Backplane driver. It is a low power silicon-gate CMOS LCD driver chip which consists of 64 backplane driving outputs for 64 MUX or lower LCD panel. The MC141516 is a companion chip of MC141518 (Segment driver).

It has an LCD timing generator which serves the same purpose as the LCD timing generator in a Motorola microcomputer MC68HC05L11. If these drivers are used with MC68HC05L11, its internal LCD timing generator can be disabled. Necessary timing signals are input from MC68HC05L11. Otherwise, the driver's internal LCD timing generator can be activated to provide timing signals for system synchronization.

- Operation Supply Voltage Range-
  Logic (V_{DD}): 2.7V to 5.5V
  Backplane drivers (V_{LCD}):6.0V to 13V
- Operation Temperature Range: -20 to 70˚C
- 64 LCD blackplane driving signals
- Driving Duty Cycle (MUX): 1/32 to 1/64
- Optional 32,48 or 64 multiplex ratio if the on-chip RC oscillator is used
- Optional multiplex ratio from 32 to 64 with MC68HC05L11
- 80-pin TQFP (Thin Quad Flat Package)



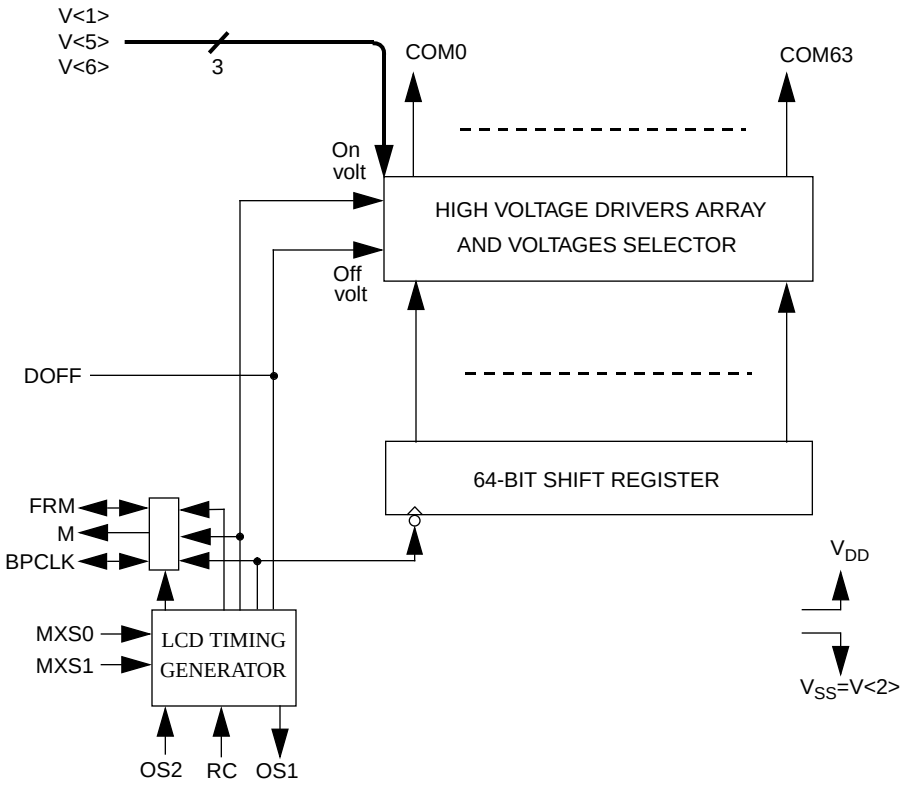
MC141516FJ
TQFP

MCC141516
DIE

ORDERING INFORMATION

MC141516FJ	TQFP
MCC141516	DIE

Block Diagram



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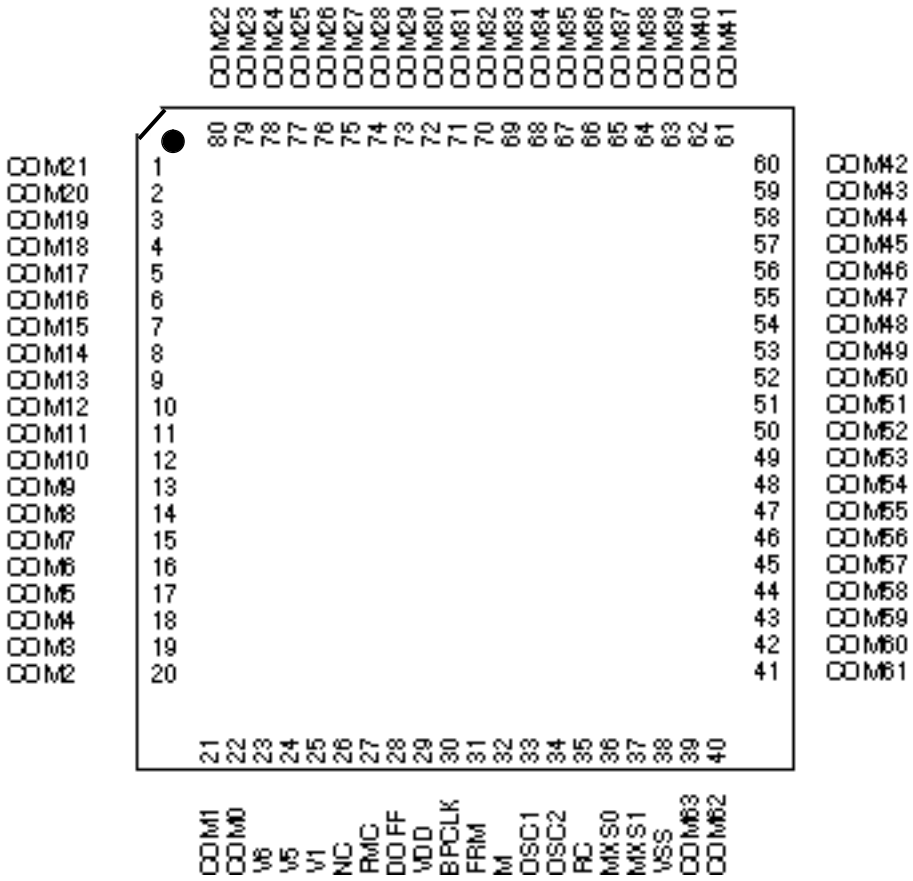
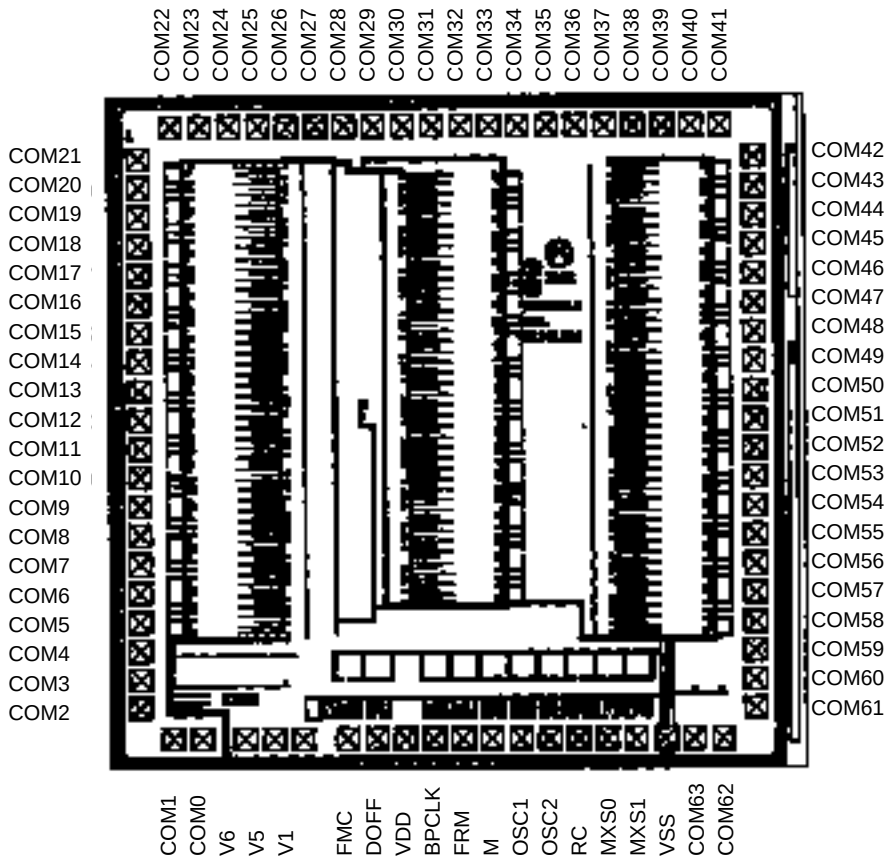


MC141516FJ Pin Assignment



MCC141516 Pad Assignment

MAXIMUM RATINGS* (Voltages Reference to V_{SS}, T_A=25 C)

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage	-0.3 to + 7.0	V
V<1>		V_{SS} -0.3 to V_{SS} +15	V
V_{in}	Input Voltage	V_{SS} -0.3 to V_{DD} +0.3	V
I	Current Drain Per Pin Excluding VDD and Vss	25	mA
T_A	Operating Temperature Range	-20 to +70	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.

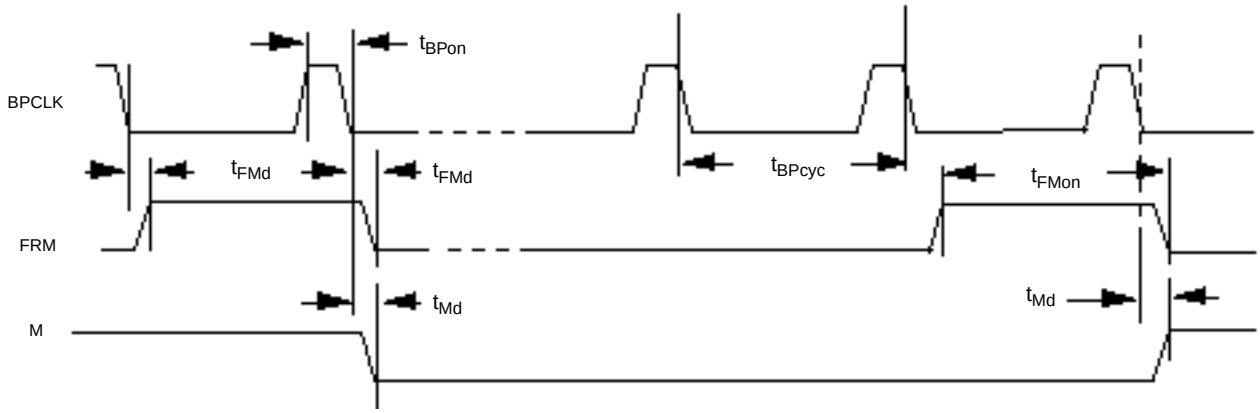
The device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions to be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that Vin and Vout be constrained to the range V_{SS} < or = (Vin or Vout) < or = V_{DD}. Reliability of operation is enhanced if unused input is 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.

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS}, T_A=25 C, V_{DD}=5.0V, V<1>=13V)

Symbol	Parameter		Min	Max	Unit
V_{IH}	Input High Voltage	BPCLK, FRM, M, DOFF	0.7xV_{DD}	V_{DD}	V
V_{IL}	Input Low Voltage	BPCLK, FRM, M, DOFF	V_{SS}	0.3xV_{DD}	V
C_{in}	Capacitance	BPCLK, FRM, M, DOFF	-	8	pF
	Operating Voltages				
V_{DD}	Supply Voltage (referenced to VSS)		2.7	5.5	V
V<1>	LCD Voltage (referenced to VSS)		6.0	13	V
I_{in}	Input Current (Oscillator OFF)	BPCLK, FRM, M, DOFF, MXS0, MXS1	-	±1	uA
V_{OL}	Output Low Voltage (Oscillator ON)	M, FRM, BPCLK	-	0.2xV_{DD}	V
V_{OH}	Output High Voltage (Oscillator ON)	M, FRM, BCLK	0.8xV_{DD}	-	V
I_{OL}	Output Low Current (Oscillator ON)	M, FRM, BCLK (V_{OL}=0.5V)	-	-100	uA
I_{OH}	Output High Current (Oscillator ON)	M, FRM, BCLK (V_{OH}=4.5V)	100	-	uA
	Operating supply current VDD (VDD=5V, V<1>=13V)				
I_{DP1}	Dynamic Mode (Oscillator ON, BPCLK=4KHz)		-	32	uA
I_{DP2}	(Oscillator OFF, BPCLK=4KHz)		-	5	uA
I_{SB}	Standby Mode		-	2	uA
	Operating supply current V<1> (V<1>=13V)				
I_{LDP}	Display Mode		-	8	uA
I_{LSB}	Standby Mode		-	4.0	uA

AC ELECTRICAL CHARACTERISTICS (V_{CC}=5.0V +/-5%, V_{SS}=0, V<1>=13V, T_A=25 C)

Symbol	Parameter	Min	Max	Unit
t_{BPon}	BPCLK Pulse On Time	61	-	us
t_{BPcyc}	BPCLK Cycle Period	122	-	us
t_{FMd}	Frame Delay Time	5	30	us
t_{FMon}	Frame Pulse On Time	122	-	us
t_{Md}	M Pulse Delay Time	0	30	us



MC141516 Timing Diagram

V_{DD} AND V_{SS}

Power is supplied to the driver using these two pins. VDD is power and VSS is ground.

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

These input pins provide the voltage levels for the backplane driver and are connected to the V<1>, V<5>, V<6> of the voltages generator as in Figure 2 of the MC141518 Segment driver Product Specification.

DOFF

It is an active-high input for turning off the LCD. If DOFF is set, all high voltage outputs will be turned to high impedance. DOFF will also suppress the on-chip RC oscillator from oscillation when the LCD timing generator is enabled.

OSC1, OSC2, RC

These pins provide connections for external circuitry to the on-chip RC oscillator for frequency selection. The on-chip RC oscillator is part of the internal LCD timing generator. Output of this oscillator will be fed out as BPCLK and further divided down internally to produce signals FRM and M if the LCD timing generator is enabled.

MXS1, MXS0

These pins can be hardwired to select different mux ratios. Table 1 shows the combinations of these signals and their corresponding mux ratios. These four combinations provide selections for 32,48 and 64 mux ratio and a disable state. Except for the disabled state, all other selections will enable the LCD timing generator. With DOFF clear, the periodic signal from the on-chip RC oscillator is fed to the whole LCD system as the BPCLK. BPCLK will then be further divided down through the LCD timing generator to produce signals FRM and M for the whole LCD system.

MXS1, MXS0	MUX RATIO
0,0	DISABLE
0,1	32
1,0	48
1,1	64

Table 1: The Selections of MUX Ratio using MXS1 and MXS0

BPCLK

It is either an input pin connecting to signal BPCLK of the microcomputer MC68HC05L11 or an output pin supplying the synchronization pulse BPCLK to segment drivers. If the LCD timer generator is disabled, this pin is assumed to be input.

FRM

It is either an input pin connecting to signal FRM of the microcomputer MC68HC05L11 or an output pin supplying the synchronization pulse FRM to segment drivers. If the LCD timer generator is disabled, the status of this pin is input.

M

This is an output pin providing the necessary modulation signal to shape up the class B LCD waveform (see Fig.3, Product Specification of MC141518). It is a signal with 50% duty cycle and its frequency is half of FRM.

COM0-COM63

These are the high voltage outputs of the backplane driver which are connected to the common lines of the LCD panel. These high voltage drivers are high impedance if DOFF is set. See Fig.3 “Product Specification of MC141518” for these high voltage outputs waveform.

FMC

This is a test pin. This pin should be left open in application.

INTRODUCTION

The backplane driver can support multiplex ratio of a LCD system from 32 to 64. Three signals that need to be varied as a result of different mux ratio are BPCLK, FRM and M. The first two can be imported externally (if the microprocessor MC68HC05L11 is used) or the backplane driver generates them internally. In case of internal generation, user has to design the on-chip RC oscillator circuit producing a frequency with respect to desirable mux ratio.

VOLTAGES SELECTOR consists of switching circuit to select appropriate voltage levels from external voltage divider. See Fig.2, Product Specification of the segment driver MC141518.

64 BIT SHIFT REGISTER samples FRM and shift at the falling edge of BPCLK.

HIGH VOLTAGE DRIVERS ARRAY is a row of high voltage drivers which outputs are connecting to the backplane (or common) lines of the LCD panel. The waveform of these drivers are shown as Com(1) or Com(2) in Fig. 3, the Product Specification of the segment driver MC141518.

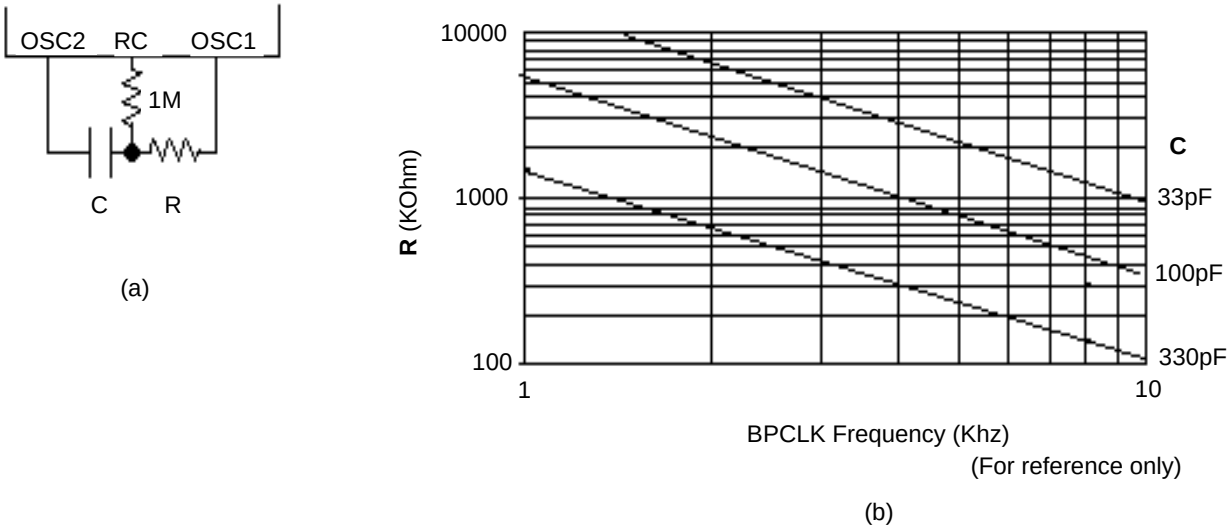
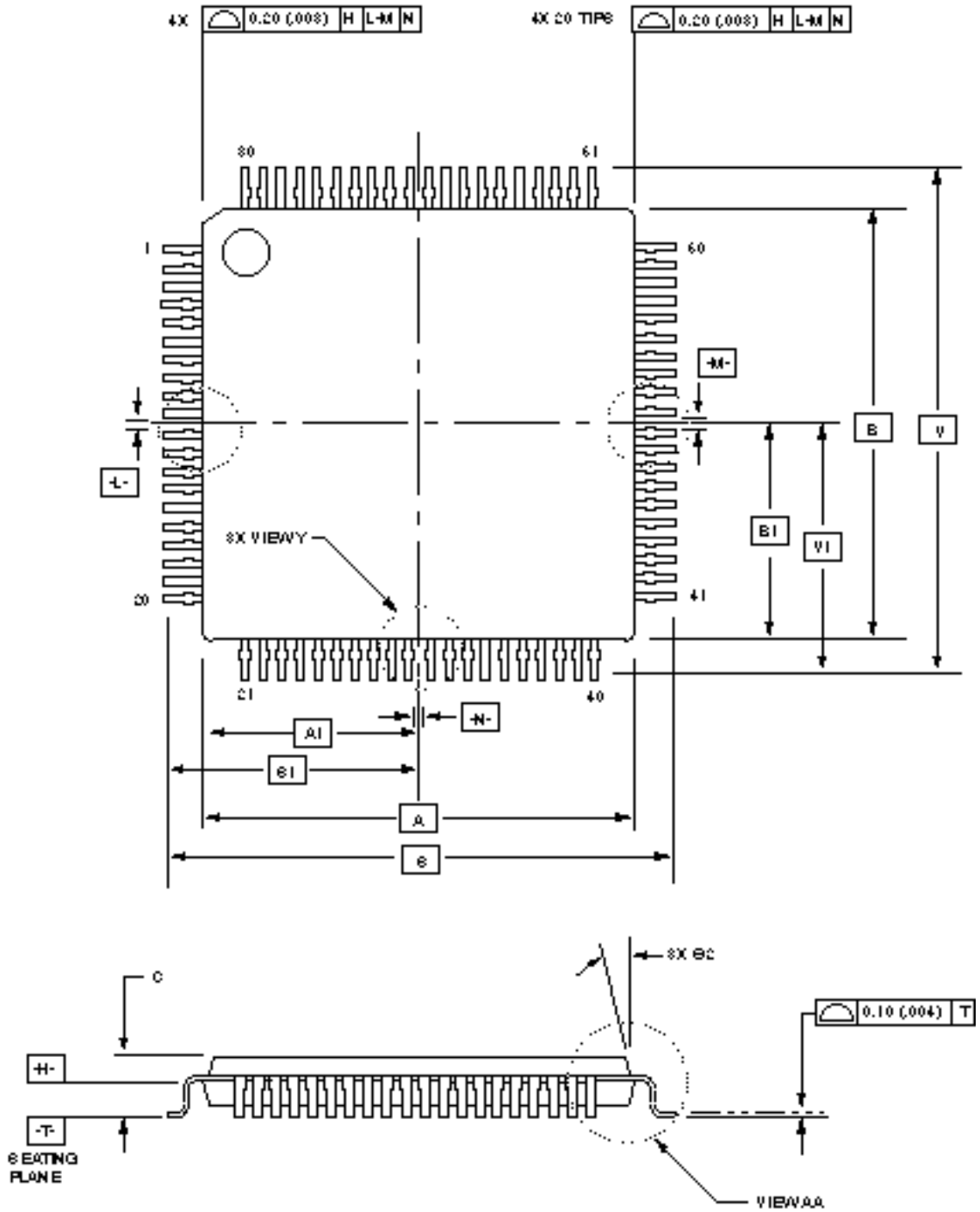


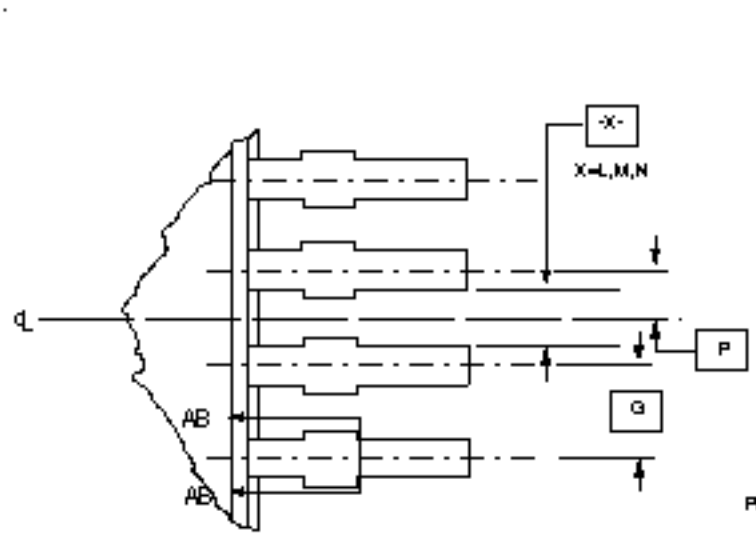
Figure 1. (a) the external circuit to the on-chip RC oscillator and its (b) frequency relationship with the external resistor and capacitor.

PACKAGE DIMENSIONS

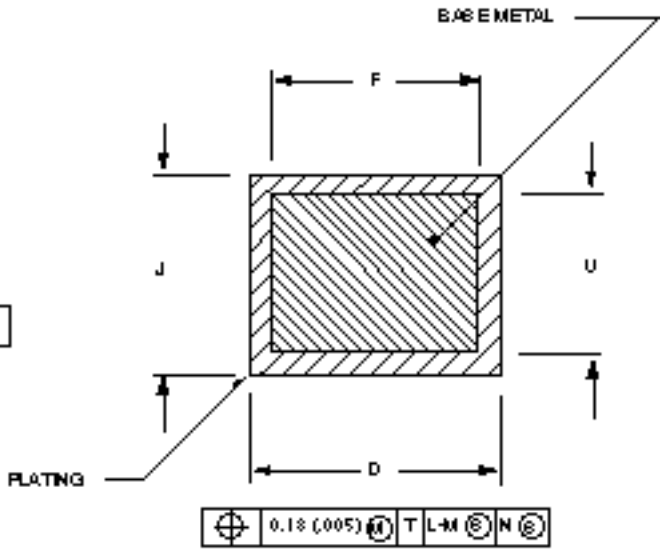
MC141516FJ
TQFP PACKAGE DIMENSION
(DO NOT SCALE THIS DRAWING)



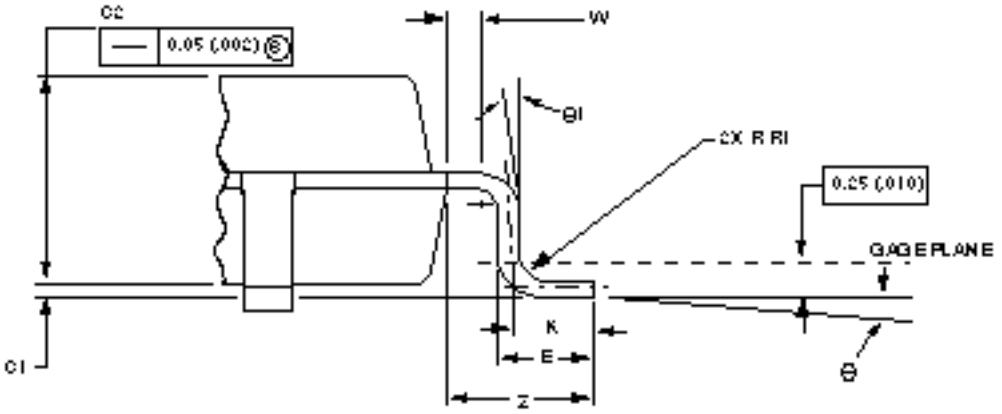
MC141516FJ
TQFP PACKAGE DIMENSION
(DO NOT SCALE THIS DRAWING)



VIEW Y



SECTION AB - AB
ROTATED 90° CLOCKWISE



VIEW AA

MC141516FJ TQFP PACKAGE DIMENSION

	Millimeters		Inches			Millimeters		Inches	
Dim	**Min**	**Max**	**Min**	**Max**	**Dim**	**Min**	**Max**	**Min**	**Max**
A	14.00	BSC	.551	BSC	K	0.50	REF	.020	REF
A1	7.00	BSC	.276	BSC	P	0.325	BSC	.013	REF
B	14.00	BSC	.551	BSC	R1	0.09	0.20	.004	.008
B1	7.00	BSC	.276	BSC	S	16.00	BSC	.630	BSC
C	---	1.74	---	.069	S1	8.00	BSC	.013	BSC
C1	0.04	0.24	.002	.009	U	0.09	0.16	.004	.006
C2	1.30	1.50	.051	.059	V	16.00	BSC	.630	BSC
D	0.22	0.38	.009	.015	V1	8.00	BSC	.315	BSC
E	0.40	0.75	.016	.030	W	0.20	REF	.008	REF
F	0.17	0.33	.007	.013	Z	1.00	REF	.039	REF
G	0.65	BSC	.026	BSC	θ	0°	10°	0°	10°
J	0.09	0.27	.004	.011	θ1	0°	---	0°	---
					θ2	9°	14°	9°	14°

NOTES:

1. Dimensions and tolerancing per ANSI Y14.5M, 1982.

2. Controlling dimension: millimeter.

3. Datum plane -H- is located at bottom of lead and is coincident with the lead where the lead exits the plastic body at the bottom of the parting line.

4. Datums -L- , -M- and -N- to be determined at datum plane -H- .

5. Dimensions S and V to be determined at seating plane -T- .

6. Dimensions A and B do not include mold protrusion. Allowable protrusion is 0.25(.010) per side. Dimensions A and B do include mold mismatch and are determined at datum plane -H- .

7. Dimension D does not include dambar protrusion. dambar protrusion shall not cause the lead width to exceed 0.46 (.018). Minimum space between protrusion and adjacent lead or protrusion 0.07 (.003).

MCC141516 PAD COORDINATES: (UNIT: UM)

PIN NAME	X	Y	PIN NAME	X	Y
COM1	-1330.0	-1481.5	COM61	1489.5	-1331.5
COM0	-1190.0	-1481.5	COM60	1489.5	-1191.5
V6	-982.0	-1481.5	COM59	1489.5	-1051.5
V5	-842.0	-1481.5	COM58	1489.5	-911.5
V1	-702.0	-1481.5	COM57	1489.5	-771.5
FMC	-490.0	-1481.5	COM56	1489.5	-631.5
DOFF	-350.0	-1481.5	COM55	1489.5	-491.5
V_{DD}	-210.0	-1481.5	COM54	1489.5	-351.5
BPCLK	-70.0	-1481.5	COM53	1489.5	-211.5
FRM	70.0	-1481.5	COM52	1489.5	-71.5
M	210.0	-1481.5	COM51	1489.5	68.5
OSC1	350.0	-1481.5	COM50	1489.5	208.5
OSC2	490.0	-1481.5	COM49	1489.5	348.5
RC	630.0	-1481.5	COM48	1489.5	488.5
MXS0	770.0	-1481.5	COM47	1489.5	628.5
MXS1	910.0	-1481.5	COM46	1489.5	768.5
V_{SS}	1050.0	-1481.5	COM45	1489.5	908.5
COM63	1190.0	-1481.5	COM44	1489.5	1048.5
COM62	1330.0	-1481.5	COM43	1489.5	1188.5
			COM42	1489.5	1328.5

PIN NAME	**X**	**Y**	**PIN NAME**	**X**	**Y**
COM2	-1489.5	-1331.5	COM22	-1330.0	1481.0
COM3	-1489.5	-1191.5	COM23	-1190.0	1481.0
COM4	-1489.5	-1051.5	COM24	-1050.0	1481.0
COM5	-1489.5	-911.5	COM25	-910.0	1481.0
COM6	-1489.5	-771.5	COM26	-770.0	1481.0
COM7	-1489.5	-631.5	COM27	-630.0	1481.0
COM8	-1489.5	-491.5	COM28	-490.0	1481.0
COM9	-1489.5	-351.5	COM29	-350.0	1481.0
COM10	-1489.5	-211.5	COM30	-210.0	1481.0
COM11	-1489.5	-71.5	COM31	-70.0	1481.0
COM12	-1489.5	68.5	COM32	70.0	1481.0
COM13	-1489.5	208.5	COM33	210.0	1481.0
COM14	-1489.5	348.5	COM34	350.0	1481.0
COM15	-1489.5	488.5	COM35	490.0	1481.0
COM16	-1489.5	628.5	COM36	630.0	1481.0
COM17	-1489.5	768.5	COM37	770.0	1481.0
COM18	-1489.5	908.5	COM38	910.0	1481.0
COM19	-1489.5	1048.5	COM39	1050.0	1481.0
COM20	-1489.5	1188.5	COM40	1190.0	1481.0
COM21	-1489.5	1328.5	COM41	1330.0	1481.0

Die Size: 134.0 x 132.5 mil^2
Note: 1 mil ~ 25.4μm