This datasheet is under modification and could not be completed in time for this CD-ROM. Before designing in, please be so kind as to contact your nearest OKI office or representative. The revised datasheet will be included in the next CD-ROM issue. Please also watch our web sites for further announcements. We sincerely apologise for any inconveniences.

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OKI Semiconductor

This version: Jan. 1998
Previous version: Mar. 1996

MSM64155A/64155AL

Built-in Melody Circuit and LCD Driver 4-Bit Microcontroller

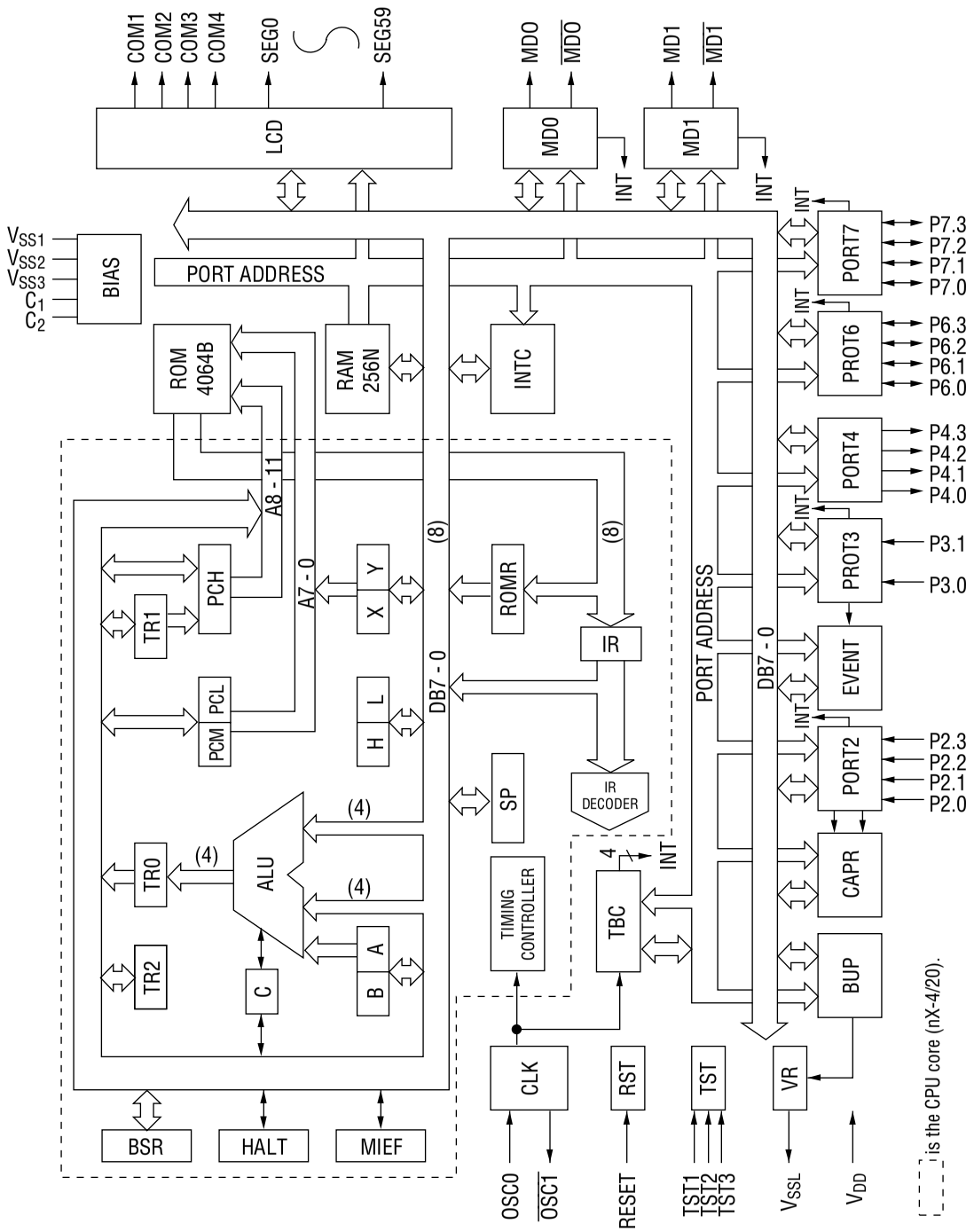
GENERAL DESCRIPTION

The MSM64155A (1.5 V)/64155AL (3.0 V) is a 4-bit microcontroller that incorporates an nX-4/20 CPU core. The MSM64155A family offers a built-in 256-nibble data memory, 4-Kbyte program memory, melody output, LCD driver, and other functions.

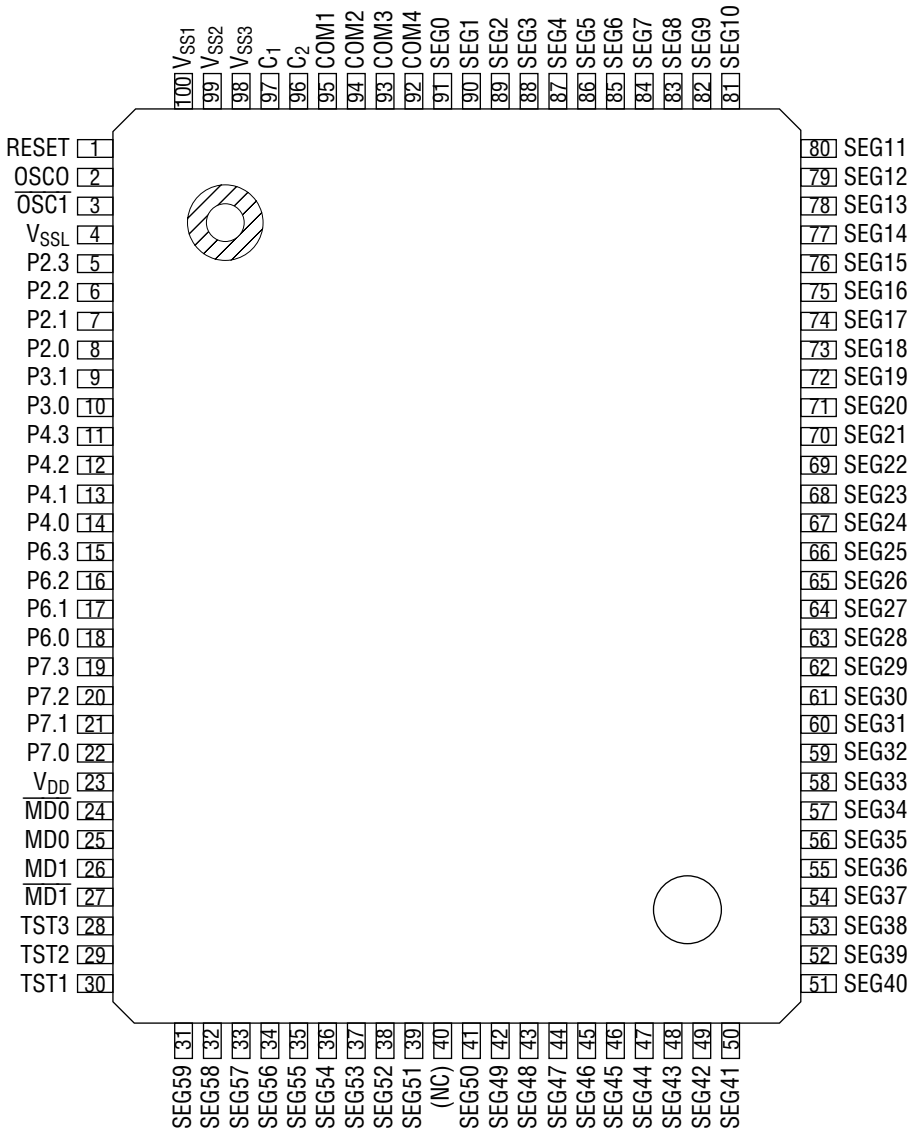
FEATURES

- Operating range
  - Operating voltage : 1.5 V/3.0 V
  - Operating temperature : –40 to +70 °C
  - Operating frequency : 32.768 kHz crystal oscillation
    Approx. 32 kHz RC oscillation
  - Current consumption (TYP.) : 0.9 µA (3.0 V at HALT mode)
- Minimum instruction execution time : 91 µs
- General memory space : 4064 bytes
- Local memory space : 256 nibbles
- LCD driver : 64
  Common driver × 4
  Segment driver × 60
  1/4 duty, 1/3 bias; 240 segments (60 × 4)
  1/3 duty, 1/3 bias; 180 segments (60 × 3)
- I/O port
  - Input-output port : 2 ports × 4 bits (open-drain output/CMOS output selectable; pull-down resistor input selectable)
  - Input port : 1 port × 2 bits (A pull-down resistor input can be selected)
    1 port × 4 bits (pull-down resistor input)
  - Output port : 1 port × 4 bits (CMOS output)
- Counter : 1 channel
- Melody output : 2
- Interrupts : 10 sources
  External 4, time base 4, melody 2
- Package:
  100-pin plastic QFP (QFP100-P-1420-0.65-BK) : (Product name : MSM64155A-×××GS-BK, MSM64155AL-×××GS-BK)
  Chip
  ××× indicates the code number.
- OTP version : MSM64P155/64P155L
  (The power polarity and operating voltage of the MSM64P155/64P155L are different from the MSM64155A/64155AL. For details, refer to the MSM64P155 User's Manual.)

BLOCK DIAGRAM



PIN CONFIGURATION (TOP VIEW)



NC: No-connection pin

100-Pin Plastic QFP

PIN DESCRIPTIONS

Basic Functions

Function	Pin	Pad	Symbol	Type	Description
Power Supply	23	21	V_{DD}	—	Digital supply voltage(0 V)
	100	97	V_{SS1}	—	Digital negative supply voltage (1.5 V operation) Bias output for LCD driver (3.0 V operation)
	99	96	V_{SS2}	—	Digital negative supply voltage (3.0 V operation) Bias output for LCD driver (1.5 V operation)
	98	95	V_{SS3}	—	Bias output for LCD driver (–4.5 V)
	97	94	C_1	—	For connection to capacitors that generate bias for the LCD driver
	96	93	C_2	—	
	4	2	V_{SSL}	—	Negative supply voltage pin for internal logic (internally generated constant voltage)
Oscillation	2	99	OSC0	I	Clock oscillation pins: Quartz oscillator (32.768 kHz) and capacitor (10 pF to 30 pF) or resistor (1 MΩ) are connected.
	3	1	$\overline{OSC1}$	O	
Test	30	28	TST1	I	Input pins for test
	29	27	TST2	I	
	28	26	TST3	I	
RESET	1	98	RESET	I	System reset input : When this pin switches from "L" to "H", the internal status is initialized and instructions start executing from address 000H. The pin has a built-in pull-down resistor which pulls the signal down to V_{SS1} or V_{SS2}.

Basic Functions (Continued)

Function	Pin	Pad	Symbol	Type	Description
Ports	8	6	P2.0	I	4-bit input port (port 2) : Select between pull-down resistor input and high impedance input for each bit with the port 2 control register (P2CON). When configured for secondary functions, an external interrupt and capture circuit trigger input are allocated. If P2.0 to P2.3 are set to "H" level, the IC enters system reset mode.
	7	5	P2.1		
	6	4	P2.2		
	5	3	P2.3		
	10	8	P3.0	I	2-bit input port (port 3) : Select between pull-down resistor input and high impedance input with the port 3 control register (P3CON). When configured for a secondary function, an external interrupt is allocated to P3.0 and an event counter is allocated to P3.1.
	9	7	P3.1		
	14	12	P4.0	O	4-bit output port (port 4) : 4-bit CMOS output port.
	13	11	P4.1		
	12	10	P4.2		
	11	9	P4.3		
	18	16	P6.0	I/O	4-bit input-output port (port 6) : Select between input and output, between pull-down resistor input and high impedance input, and between open-drain output and CMOS output with the port 6 control register (P6CON). When configured for a secondary function, an external interrupt is allocated.
	17	15	P6.1		
	16	14	P6.2		
	15	13	P6.3		
	22	20	P7.0	I/O	4-bit input-output port (port 7) : Select between input and output, between pull-down resistor input and high impedance input, and between open-drain output and CMOS output with the port 7 control register (P7CON). When configured for a secondary function, an external interrupt is allocated.
	21	19	P7.1		
	20	18	P7.2		
	19	17	P7.3		
Melody Drivers	25	23	MD0	O	Output pin of melody driver 0.
	24	22	$\overline{\text{MD0}}$	O	Negative-phase output pin of MD0 output.
	26	24	MD1	O	Output pin of melody driver 1.
	27	25	$\overline{\text{MD1}}$	O	Negative-phase output pin of MD1 output.
LCD Drivers	95	92	COM1	O	LCD common signal output pins.
	94	91	COM2	O	
	93	90	COM3	O	
	92	89	COM4	O	

Basic Functions (Continued)

Function	Pin	Pad	Symbol	Type	Description
LCD Drivers	91	88	SEG0	O	LCD segment signal output pins.
	90	87	SEG1	O	
	89	86	SEG2	O	
	88	85	SEG3	O	
	87	84	SEG4	O	
	86	83	SEG5	O	
	85	82	SEG6	O	
	84	81	SEG7	O	
	83	80	SEG8	O	
	82	79	SEG9	O	
	81	78	SEG10	O	
	80	77	SEG11	O	
	79	76	SEG12	O	
	78	75	SEG13	O	
	77	74	SEG14	O	
	76	73	SEG15	O	
	75	72	SEG16	O	
	74	71	SEG17	O	
	73	70	SEG18	O	
	72	69	SEG19	O	
	71	68	SEG20	O	
	70	67	SEG21	O	
	69	66	SEG22	O	
	68	65	SEG23	O	
	67	64	SEG24	O	
	66	63	SEG25	O	
	65	62	SEG26	O	
	64	61	SEG27	O	
	63	60	SEG28	O	
	62	59	SEG29	O	
	61	58	SEG30	O	
	60	57	SEG31	O	
	59	56	SEG32	O	
	58	55	SEG33	O	
	57	54	SEG34	O	
	56	53	SEG35	O	
	55	52	SEG36	O	
	54	51	SEG37	O	
	53	50	SEG38	O	
	52	49	SEG39	O	

Secondary Functions

Function	Pin	Pad	Symbol	Type	Description
LCD Drivers	51	48	SEG40	O	LCD segment signal output pins.
	50	47	SEG41	O	
	49	46	SEG42	O	
	48	45	SEG43	O	
	47	44	SEG44	O	
	46	43	SEG45	O	
	45	42	SEG46	O	
	44	41	SEG47	O	
	43	40	SEG48	O	
	42	39	SEG49	O	
	41	38	SEG50	O	
	39	37	SEG51	O	
	38	36	SEG52	O	
	37	35	SEG53	O	
	36	34	SEG54	O	
	35	33	SEG55	O	
	34	32	SEG56	O	
	33	31	SEG57	O	
	32	30	SEG58	O	
	31	29	SEG59	O	

Secondary Functions (Continued)

Function	Pin	Pad	Symbol	Type	Description
External Interrupts	8	6	P2.0	I	P2.0 to P2.3 secondary functions : These are level-triggered external interrupt input pins. Select interrupt enable/disable for each bit with the P2 interrupt enable register (P21E). If P2.0 to P2.3 pins are set to "H" level for a minimum of 2 seconds, the device enters system reset mode. P2.0, P2.1 secondary functions : trigger input pins for capture circuit.
	7	5	P2.1		
	6	4	P2.2		
	5	3	P2.3		
	10	8	P3.0	I	P3.0 secondary functions : This is an input pin for external interrupt. This pin can receive an interrupt at a rising edge, a falling edge, or at both rising and falling edges.
	18	16	P6.0	I	P6.0 to P6.3 secondary functions : These are level-triggered external interrupt input pins.
	17	15	P6.1		
	16	14	P6.2		
	15	13	P6.3		
	22	20	P7.0	I	P7.0 to P7.3 secondary functions : These are level-triggered external interrupt input pins.
	21	19	P7.1		
	20	18	P7.2		
	19	17	P7.3		
Event Counter Input	9	7	P3.1	I	P3.1 secondary functions : input port for event counter

Connections of Unused Pins

Symbol	Recommended Pin Connection
TST1 to 3	Open
P2.0 to P2.3	"L" level or open
P3.0 to P3.1	"L" level or open
P4.0 to P4.3	Open
P6.0 to P6.3	For input setting : "L" level or open (Initial value is an input mode.) For output setting : Open
P7.0 to P7.3	For input setting : "L" level or open (Initial value is an input mode.) For output setting : Open
MD0, $\overline{MD0}$ MD1, $\overline{MD1}$	Open
COM1 to 4	Open
SEG0 to 59	Open

ABSOLUTE MAXIMUM RATINGS

1.5 V Operation (MSM64155A)

(V_{DD}=0 V)

Parameter	Symbol	Condition	Rating	Unit
Power Supply Voltage 1	V_{SS1}	Ta=25°C	–2.0 to +0.3	V
Power Supply Voltage 2	V_{SS2}	Ta=25°C	–4.0 to +0.3	V
Power Supply Voltage 3	V_{SS3}	Ta=25°C	–5.5 to +0.3	V
Power Supply Voltage 4	V_{SSL}	Ta=25°C	–2.0 to +0.3	V
Input Voltage 1	V_{IN1}	V_{SS1} input, Ta=25°C	V_{SS1} –0.3 to +0.3	V
Input Voltage 2	V_{IN2}	V_{SSL} input, Ta=25°C	V_{SSL} –0.3 to +0.3	V
Output Voltage 1	V_{OUT1}	V_{SS1} input, Ta=25°C	V_{SS1} –0.3 to +0.3	V
Output Voltage 2	V_{OUT2}	V_{SS2} input, Ta=25°C	V_{SS2} –0.3 to +0.3	V
Output Voltage 3	V_{OUT3}	V_{SS3} input, Ta=25°C	V_{SS3} –0.3 to +0.3	V
Output Voltage 4	V_{OUT4}	V_{SSL} input, Ta=25°C	V_{SSL} –0.3 to +0.3	V
Storage Temperature	T_{STG}	—	–55 to +125	°C

RECOMMENDED OPERATING CONDITIONS

1.5 V Operation (MSM64155A)

(V_{DD}=0 V)

Parameter	Symbol	Condition	Range	Unit
Operating Temperature	T_{op}	—	–40 to +70	°C
Operating Voltage	V_{SS1}	BUPF="0"	–1.7 to –1.25	V
		BUPF="1"	–1.7 to –1.15	
Crystal Oscillator Frequency	f_{XT}	—	30 to 35	kHz
CROSC External Resistance	R_{OS}	—	1 M±10%	Ω

ELECTRICAL CHARACTERISTICS

1.5 V Operation (MSM64155A)

DC Characteristics

(V_{DD}=0 V, V_{SS1}=–1.5 V, Ta=–40 to +70°C unless otherwise specified.)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Measuring Circuit
V_{SS2} Voltage	V_{SS2}	Ca, Cb, C_{12}=0.1 µF +100% –20%, Ta=–40 to +60°C, BUPF="0"	–3.2	–3.0	–2.8	V	1
		Ca, Cb, C_{12}=0.1 µF +100% –20%, Ta=–40 to +70°C, BUPF="0"	–3.2	–3.0	–2.7		
		Ca, Cb, C_{12}=0.1 µF +100% –20%, Ta=–40 to +60°C, BUPF="1"	–3.2	–3.0	–2.5		
		Ca, Cb, C_{12}=0.2 µF +100% –20%, Ta=–40 to +70°C, BUPF="1"	–3.2	–3.0	–2.3		
V_{SS3} Voltage	V_{SS3}	Ca, Cb, C_{12}=0.1 µF +100% –20%, Ta=–40 to +60°C, BUPF="0"	–4.7	–4.5	–4.2	V	1'
		Ca, Cb, C_{12}=0.1 µF +100% –20%, Ta=–40 to +70°C, BUPF="0"	–4.7	–4.5	–4.0		
		Ca, Cb, C_{12}=0.1 µF +100% –20%, Ta=–40 to +60°C, BUPF="1"	–4.7	–4.5	–3.9		
		Ca, Cb, C_{12}=0.2 µF +100% –20%, Ta=–40 to +70°C, BUPF="1"	–4.7	–4.5	–3.7		
V_{SSL} Voltage	V_{SSL}	BUPF="0"	–1.5	–1.3	–0.6	V	
		BUPF="1"	–1.9	–1.3	–0.6		
XTOSC Oscillation Start Voltage	V_{STA}	Within 5 seconds after oscillation starts	—	—	–1.45	V	1
XTOSC Oscillation Hold Voltage	V_{HOLD}	—	—	—	–1.15	V	
XTOSC External Capacitance	CG	—	10	—	30	pF	
XTOSC Internal Capacitance	CD	—	10	15	20	pF	
CROSC Oscillation Frequency	f_{CR}	R_{OS} = 1MΩ	15	40	75	kHz	1'

Notes: 1. "XTOSC" indicates the 32.768 kHz crystal oscillation circuit.
2. "CROSC" indicates the 32 kHz RC oscillation circuit.

DC Characteristics

• 32.768 kHz crystal oscillation

(V_{DD}=0 V, V_{SS1}=–1.5 V, Ta=–40 to +70°C unless otherwise specified.)

Parameter	Symbol	Condition		Min.	Typ.	Max.	Unit	Measuring Circuit
Current Consumption 1	I_{DD1}	CPU in HALT state BUPF="0"	Ta=–40 to +40°C	—	2	6	µA	1
			Ta=+40 to +70°C	—	2	40	µA	
Current Consumption 1	I_{DD1}	CPU in HALT state BUPF="1"	Ta=–40 to +40°C	—	3	10	µA	
			Ta=+40 to +70°C	—	3	50	µA	
Current Consumption 2	I_{DD2}	CPU in operation state BUPF="0"	Ta=–40 to +40°C	—	6	15	µA	
			Ta=+40 to +70°C	—	6	50	µA	
Current Consumption 2	I_{DD2}	CPU in operation state BUPF="1"	Ta=–40 to +40°C	—	10	25	µA	
			Ta=+40 to +70°C	—	10	60	µA	

• RC oscillation

(V_{DD}=0 V, V_{SS1}=–1.5 V, R_{OS}=1 MΩ, Ta=–40 to +70°C unless otherwise specified.)

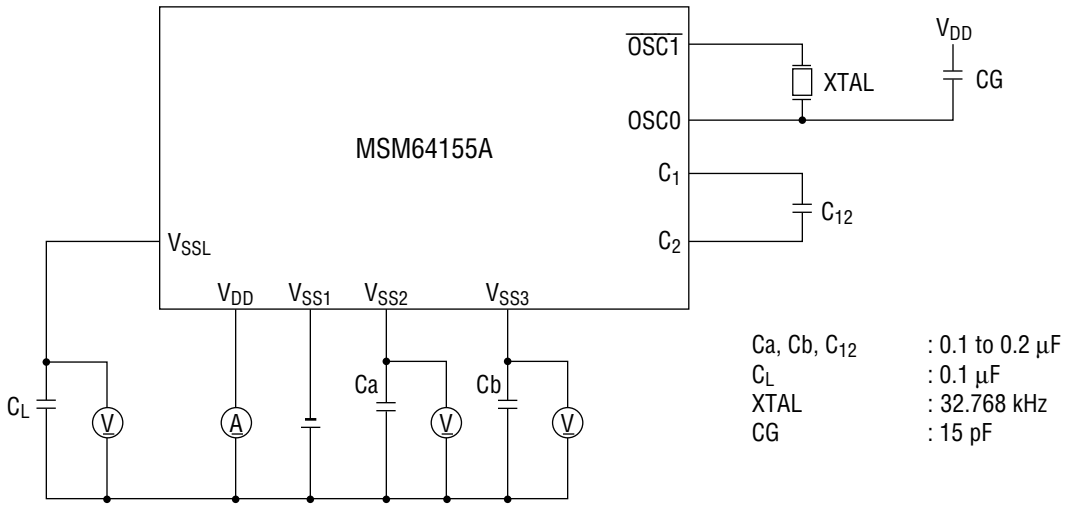
Parameter	Symbol	Condition		Min.	Typ.	Max.	Unit	Measuring Circuit
Current Consumption 1	I_{DD1}	CPU in HALT state BUPF="0"	Ta=–40 to +40°C	—	3	10	µA	1'
			Ta=+40 to +70°C	—	3	45	µA	
Current Consumption 1	I_{DD1}	CPU in HALT state BUPF="1"	Ta=–40 to +40°C	—	6	15	µA	
			Ta=+40 to +70°C	—	6	50	µA	
Current Consumption 2	I_{DD2}	CPU in operation state BUPF="0"	Ta=–40 to +40°C	—	7	20	µA	
			Ta=+40 to +70°C	—	7	50	µA	
Current Consumption 2	I_{DD2}	CPU in operation state BUPF="1"	Ta=–40 to +40°C	—	15	30	µA	
			Ta=+40 to +70°C	—	15	70	µA	

DC Characteristics

(V_{DD}=0 V, V_{SS1}=V_{SSL}=–1.5 V, V_{SS2}=–3.0 V, V_{SS3}=–4.5 V,
Ta=–40 to +70°C unless otherwise specified.)

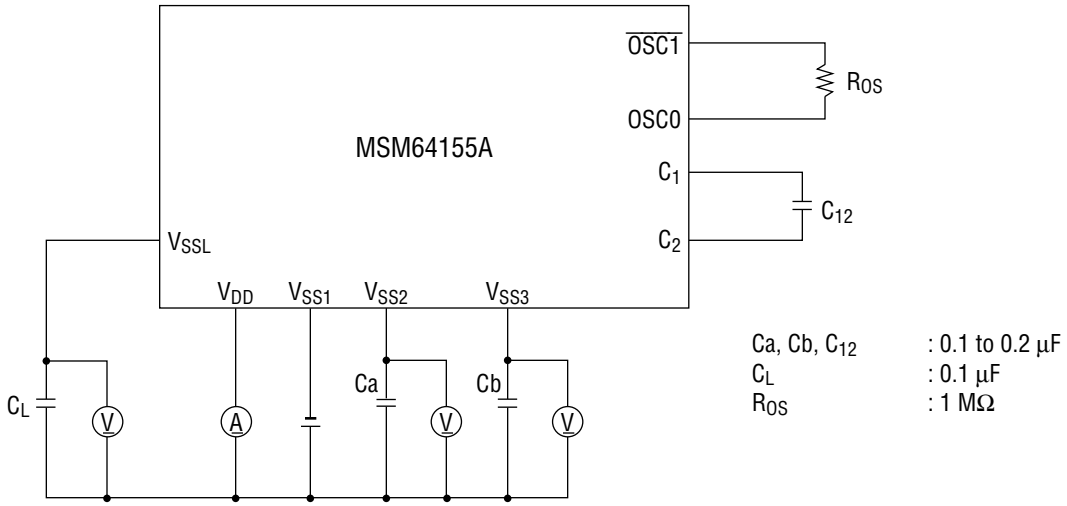
Parameter (Pin Name)	Symbol	Condition	Min.	Typ.	Max.	Unit	Measuring Circuit
Output Current 1 (P4.0 to P4.3) (MD0, $\overline{MD0}$) (MD1, $\overline{MD1}$)	I_{OH1}	V_{OH1}=–0.5 V	–2.0	–0.6	–0.1	mA	2
	I_{OL1}	V_{OL1}=V_{SS1}+0.5 V	0.1	0.6	2.0	mA	
Output Current 2 (SEG0 to SEG59) (COM1 to COM4)	I_{OH2}	V_{OH2}=–0.2 V (V_{DD} level)	—	—	–4	µA	
	I_{OMH2}	V_{OMH2}=V_{SS1}+0.2 V (V_{SS1} level)	4	—	—	µA	
	I_{OMH2S}	V_{OMH2S}=V_{SS1}–0.2 V (V_{SS1} level)	—	—	–4	µA	
	I_{OML2}	V_{OML2}=V_{SS2}+0.2 V (V_{SS2} level)	4	—	—	µA	
	I_{OML2S}	V_{OML2S}=V_{SS2}–0.2 V (V_{SS2} level)	—	—	–4	µA	
	I_{OL2}	V_{OL2}=V_{SS3}+0.2 V (V_{SS3} level)	4	—	—	µA	
Output Current 3 (P6.0 to P6.3) (P7.0 to P7.3)	I_{OH3}	V_{OH3}=–0.5 V	–5.0	–2.1	–0.3	mA	
	I_{OL3}	V_{OL3}=V_{SS1}+0.5 V	0.1	0.7	2.0	mA	
Output Leakage Current (P4.0 to P4.3) (P6.0 to P6.3) (P7.0 to P7.3)	I_{OOH}	V_{OH}=V_{DD}	—	—	0.3	µA	
	I_{OOL}	V_{OL}=V_{SS1}	–0.3	—	—	µA	
Input Current 1 (P2.0 to P2.3) (P3.0 to P3.1) (P6.0 to P6.3) (P7.0 to P7.3)	I_{IH1}	V_{IH1}=V_{DD} (when pulled down)	1	20	100	µA	3
	I_{IH1Z}	V_{IH1}=V_{DD} (at high impedance)	0	—	1	µA	
	I_{IL1}	V_{IL1}=V_{SS1}	–1	—	0	µA	
Input Current 2 (TST1, TST2, TST3)	I_{IH2}	V_{IH2}=V_{DD}	0.3	0.75	1.5	mA	
	I_{IL2}	V_{IL2}=V_{SS1}	–1	—	0	µA	
Input Current 3 (RESET)	I_{IH3}	V_{IH3}=V_{DD}	15	40	100	µA	
	I_{IL3}	V_{IL3}=V_{SS1}	–1	—	0	µA	
Input Voltage 1 (P2.0 to P2.3) (P3.0 to P3.1) (P6.0 to P6.3) (P7.0 to P7.3) (TST1, TST2, TST3) (RESET)	V_{IH1}	—	–0.3	—	0	V	4
	V_{IL1}	—	–1.5	—	–1.2	V	

Measuring circuit 1



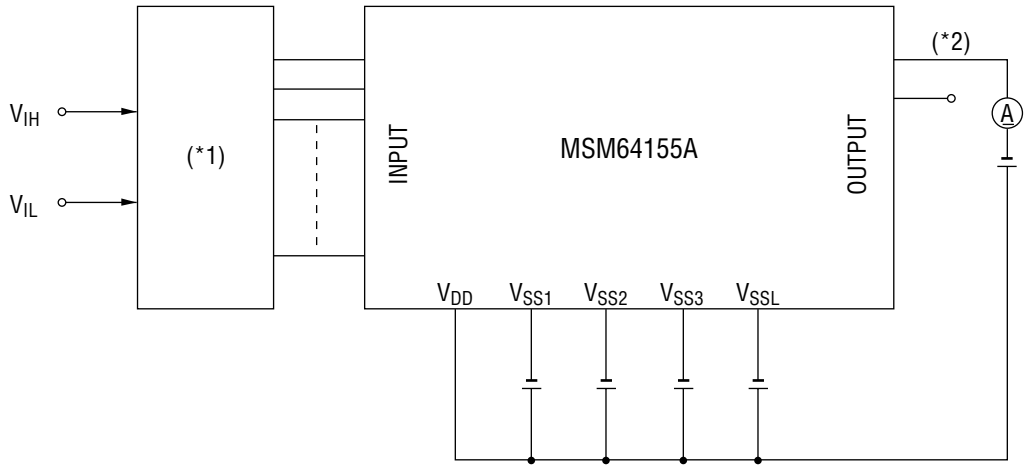
Ca, Cb, C_{12}	: 0.1 to 0.2 µF
C_L	: 0.1 µF
XTAL	: 32.768 kHz
CG	: 15 pF

Measuring circuit 1'

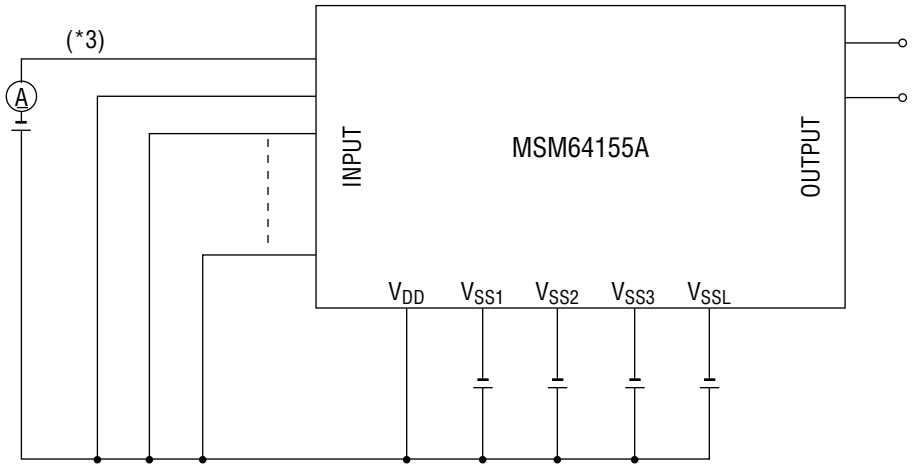


Ca, Cb, C_{12}	: 0.1 to 0.2 µF
C_L	: 0.1 µF
R_{OS}	: 1 MΩ

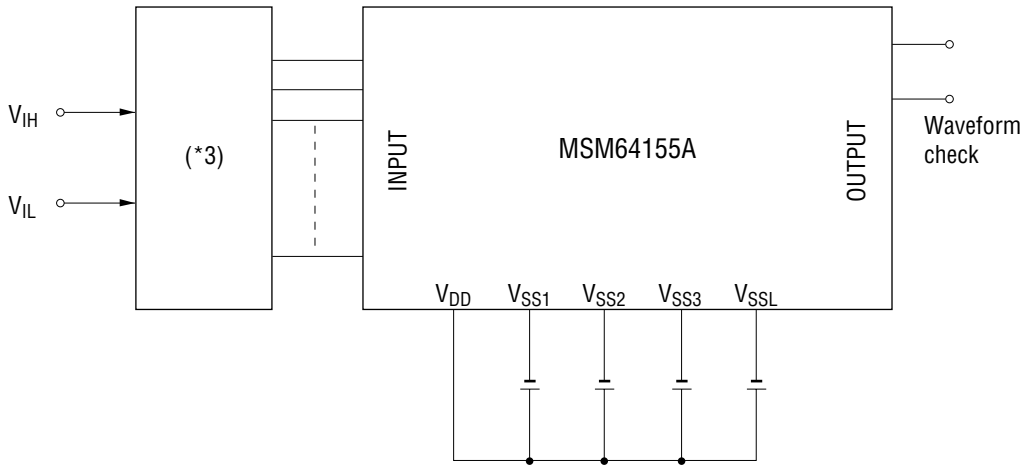
Measuring circuit 2



Measuring circuit 3



Measuring circuit 4



* 1 Input logic is set to the designated state.
* 2 Measurement is repeated for the designated output pins.
* 3 Measurement is repeated for the designated input pins.

ABSOLUTE MAXIMUM RATINGS

3.0 V Operation (MSM64155AL)

(V_{DD}=0 V)

Parameter	Symbol	Condition	Rating	Unit
Power Supply Voltage 1	V_{SS1}	Ta=25°C	–2.0 to +0.3	V
Power Supply Voltage 2	V_{SS2}	Ta=25°C	–4.0 to +0.3	V
Power Supply Voltage 3	V_{SS3}	Ta=25°C	–5.5 to +0.3	V
Power Supply Voltage 4	V_{SSL}	Ta=25°C	–4.0 to +0.3	V
Input Voltage 1	V_{IN1}	V_{SS2} input, Ta=25°C	V_{SS2} –0.3 to +0.3	V
Input Voltage 2	V_{IN2}	V_{SSL} input, Ta=25°C	V_{SSL} –0.3 to +0.3	V
Output Voltage 1	V_{OUT1}	V_{SS2} input, Ta=25°C	V_{SS2} –0.3 to +0.3	V
Output Voltage 2	V_{OUT2}	V_{SS3} input, Ta=25°C	V_{SS3} –0.3 to +0.3	V
Output Voltage 3	V_{OUT3}	V_{SSL} input, Ta=25°C	V_{SSL} –0.3 to +0.3	V
Storage Temperature	T_{STG}	—	–55 to +125	°C

RECOMMENDED OPERATING CONDITIONS

3.0 V Operation (MSM64155AL)

(V_{DD}=0 V)

Parameter	Symbol	Condition	Range	Unit
Operating Temperature	T_{op}	—	–40 to +70	°C
Operating Voltage	V_{SS2}	BUPF="0"	–3.5 to –2.5	V
		BUPF="1"	–3.5 to –2.0	
Crystal Oscillator Frequency	f_{XT}	—	30 to 66	kHz
CROSC External Resistance	R_{OS}	—	1 M±10%	Ω

ELECTRICAL CHARACTERISTICS

3.0 V Operation (MSM64155AL)

DC Characteristics

(V_{DD}=0 V, V_{SS2}=–3.0 V, Ta=–40 to +70°C unless otherwise specified.)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Measuring Circuit
V_{SS1} Voltage	V_{SS1}	Ca, Cb, C_{12}=0.1 µF $^{+100\%}_{-20\%}$	–1.7	–1.5	–1.3	V	1 1'
V_{SS3} Voltage	V_{SS3}	Ca, Cb, C_{12}=0.1 µF $^{+100\%}_{-20\%}$	–4.7	–4.5	–4.2	V	
V_{SSL} Voltage	V_{SSL}	BUPF="0"	–1.5	–1.3	–0.6	V	
		BUPF="1"	–1.9	–1.3	–0.6		
XTOSC Oscillation Start Voltage	V_{STA}	Within 5 seconds after oscillation starts	—	—	–2.5	V	1
XTOSC Oscillation Hold Voltage	V_{HOLD}	—	—	—	–2.0	V	
XTOSC External Capacitance	CG	—	10	—	30	pF	
XTOSC Internal Capacitance	CD	—	10	15	20	pF	
CROSC Oscillation Frequency	f_{CR}	R_{OS}=1 MΩ	15	40	75	kHz	1'

Notes: 1. "XTOSC" indicates the 32.768 kHz crystal oscillation circuit.
2. "CROSC indicates the 32 kHz RC oscillation circuit.

DC Characteristics

• 32.768 kHz crystal oscillation

(V_{DD}=0 V, V_{SS2}=–3.0 V, Ta=–40 to +70°C unless otherwise specified.)

Parameter	Symbol	Condition		Min.	Typ.	Max.	Unit	Measuring Circuit
Current Consumption 1	I_{DD1}	CPU in HALT state BUPF="0"	Ta=–40 to +40°C	—	0.9	4.5	µA	1
			Ta=+40 to +70°C	—	0.9	30	µA	
Current Consumption 1	I_{DD1}	CPU in HALT state BUPF="1"	Ta=–40 to +40°C	—	1.5	6	µA	
			Ta=+40 to +70°C	—	1.5	40	µA	
Current Consumption 2	I_{DD2}	CPU in operation state BUPF="0"	Ta=–40 to +40°C	—	3	10	µA	
			Ta=+40 to +70°C	—	3	40	µA	
Current Consumption 2	I_{DD2}	CPU in operation state BUPF="1"	Ta=–40 to +40°C	—	5	15	µA	
			Ta=+40 to +70°C	—	5	50	µA	

• RC oscillation

(V_{DD}=0 V, V_{SS2}=–3.0 V, R_{OS}=1 MΩ, Ta=–40 to +70°C unless otherwise specified.)

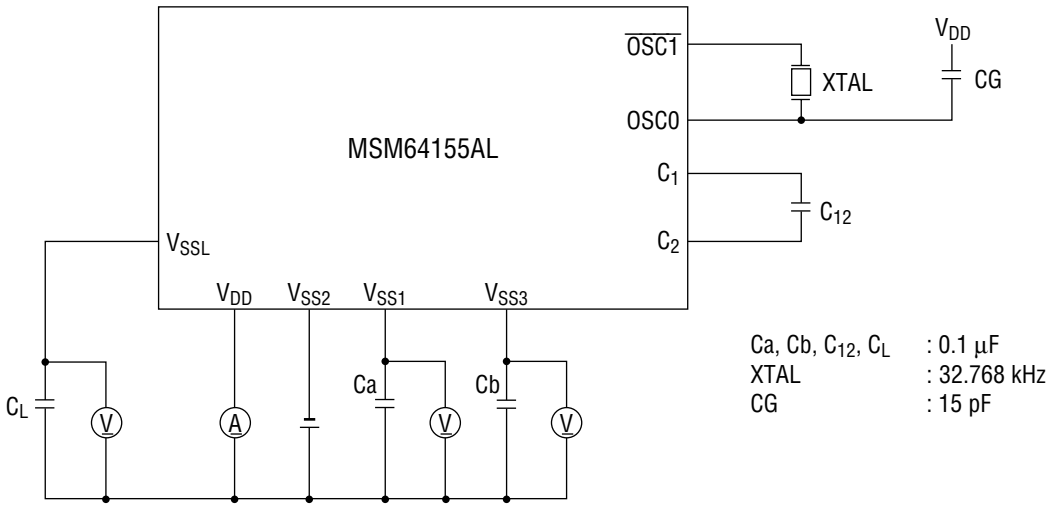
Parameter	Symbol	Condition		Min.	Typ.	Max.	Unit	Measuring Circuit
Current Consumption 1	I_{DD1}	CPU in HALT state BUPF="0"	Ta=–40 to +40°C	—	1.5	6	µA	1'
			Ta=+40 to +70°C	—	1.5	40	µA	
Current Consumption 1	I_{DD1}	CPU in HALT state BUPF="1"	Ta=–40 to +40°C	—	3	10	µA	
			Ta=+40 to +70°C	—	3	50	µA	
Current Consumption 2	I_{DD2}	CPU in operation state BUPF="0"	Ta=–40 to +40°C	—	4	12	µA	
			Ta=+40 to +70°C	—	4	50	µA	
Current Consumption 2	I_{DD2}	CPU in operation state BUPF="1"	Ta=–40 to +40°C	—	8	25	µA	
			Ta=+40 to +70°C	—	8	60	µA	

DC Characteristics

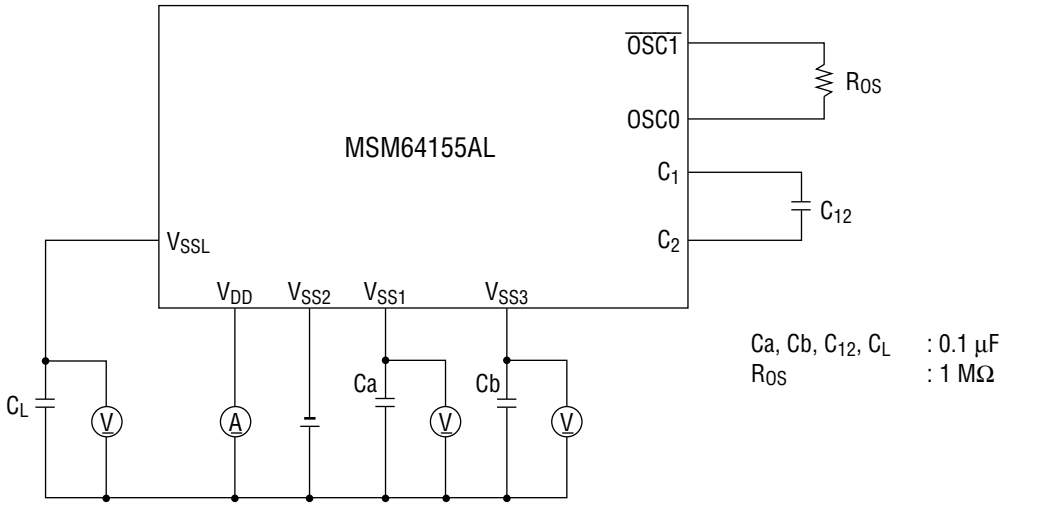
(V_{DD}=0 V, V_{SS1}=V_{SSL}=–1.5 V, V_{SS2}=–3.0 V, V_{SS3}=–4.5 V, Ta=–40 to +70°C unless otherwise specified.)

Parameter (Pin Name)	Symbol	Condition	Min.	Typ.	Max.	Unit	Measuring Circuit
Output Current 1 (P4.0 to P4.3) (MD0, $\overline{MD0}$) (MD1, $\overline{MD1}$)	I_{OH1}	V_{OH1}=–0.5 V	–6	–1.8	–0.7	mA	2
	I_{OL1}	V_{OL1}=V_{SS2}+0.5 V	0.7	1.8	6	mA	
Output Current 2 (SEG0 to SEG59) (COM1 to COM4)	I_{OH2}	V_{OH2}=–0.2 V (V_{DD} level)	—	—	–4	µA	
	I_{OMH2}	V_{OMH2}=V_{SS1}+0.2 V (V_{SS1} level)	4	—	—	µA	
	I_{OMH2S}	V_{OMH2S}=V_{SS1}–0.2 V (V_{SS1} level)	—	—	–4	µA	
	I_{OML2}	V_{OML2}=V_{SS2}+0.2 V (V_{SS2} level)	4	—	—	µA	
	I_{OML2S}	V_{OML2S}=V_{SS2}–0.2 V (V_{SS2} level)	—	—	–4	µA	
	I_{OL2}	V_{OL2}=V_{SS3}+0.2 V (V_{SS3} level)	4	—	—	µA	
Output Current 3 (P6.0 to P6.3) (P7.0 to P7.3)	I_{OH3}	V_{OH3}=–0.5 V	–18	–6	–2	mA	
	I_{OL3}	V_{OL3}=V_{SS2}+0.5 V	0.7	1.6	6.0	mA	
Output Leakage Current (P4.0 to P4.3) (P6.0 to P6.3) (P7.0 to P7.3)	I_{OOH}	V_{OH}=V_{DD}	—	—	0.3	µA	
	I_{OOL}	V_{OL}=V_{SS2}	–0.3	—	—	µA	
Input Current 1 (P2.0 to P2.3) (P3.0 to P3.1) (P6.0 to P6.3) (P7.0 to P7.3)	I_{IH1}	V_{IH1}=V_{DD} (when pulled down)	50	100	300	µA	3
	I_{IH1Z}	V_{IH1}=V_{DD} (at high impedance)	0	—	1	µA	
	I_{IL1}	V_{IL1}=V_{SS2}	–1	—	0	µA	
Input Current 2 (TST1, TST2, TST3)	I_{IH2}	V_{IH2}=V_{DD}	0.75	1.5	3	mA	
	I_{IL2}	V_{IL2}=V_{SS2}	–1	—	0	µA	
Input Current 3 (RESET)	I_{IH3}	V_{IH3}=V_{DD}	40	80	200	µA	
	I_{IL3}	V_{IL3}=V_{SS2}	–1	—	0	mA	
Input Voltage 1 (P2.0 to P2.3) (P3.0 to P3.1) (P6.0 to P6.3) (P7.0 to P7.3) (TST1, TST2, TST3) (RESET)	V_{IH1}	—	–0.6	—	0	V	4
	V_{IL1}	—	–3.0	—	–2.4	V	

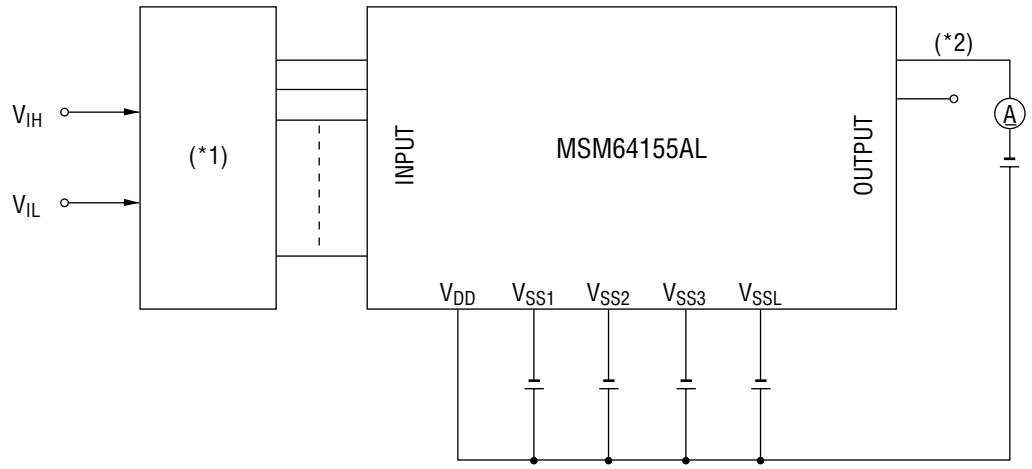
Measuring circuit 1



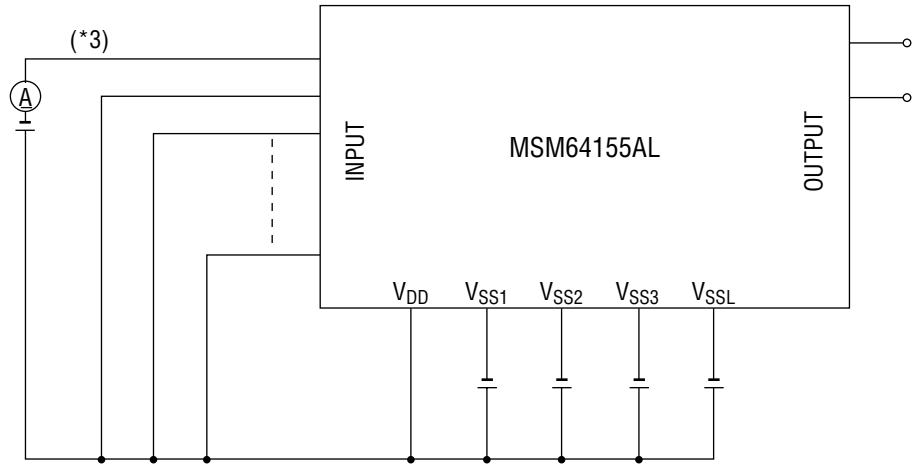
Measuring circuit 1'



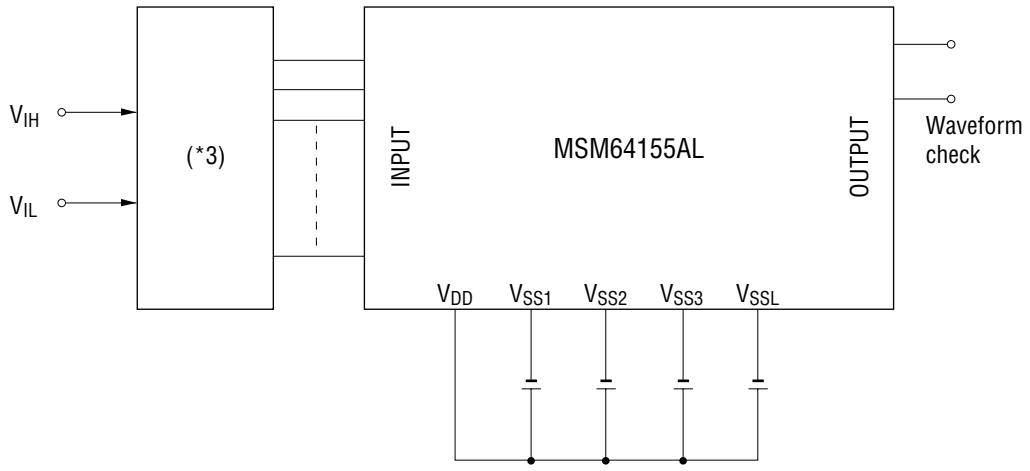
Measuring circuit 2



Measuring circuit 3



Measuring circuit 4

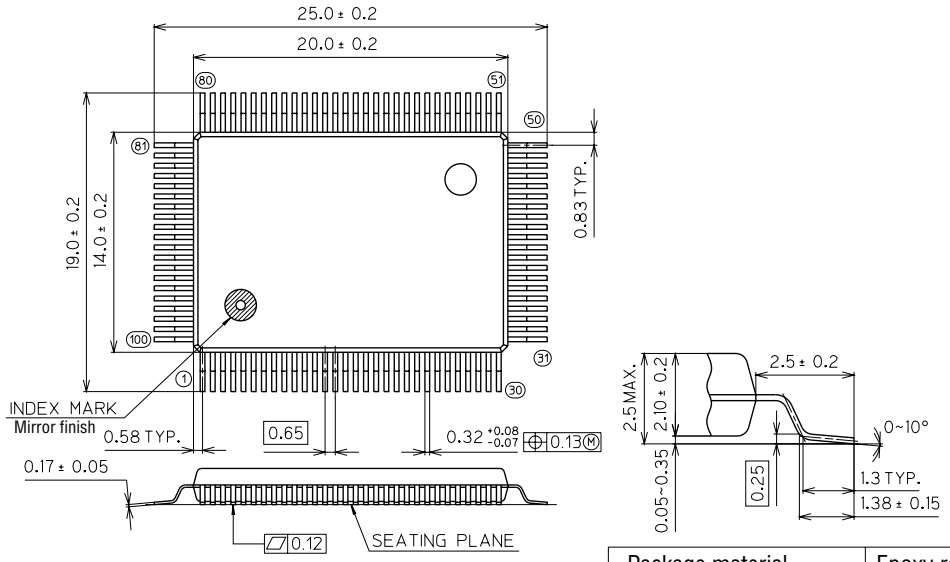


* 1 Input logic is set to the designated state.
* 2 Measurement is repeated for the designated output pins.
* 3 Measurement is repeated for the designated input pins.

PACKAGE DIMENSIONS

(Unit : mm)

QFP100-P-1420-0.65-BK



Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating
Solder plate thickness	5 μm or more
Package weight (g)	1.29 TYP.

Notes for Mounting the Surface Mount Type Package

The SOP, QFP, TSOP, SOJ, QFJ (PLCC), SHP and BGA are surface mount type packages, which are very susceptible to heat in reflow mounting and humidity absorbed in storage.
Therefore, before you perform reflow mounting, contact Oki's responsible sales person for the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).