

# M62353P/FP/GP

## 8-bit 8ch D/A Converter with Buffer Amplifiers

REJ03D0870-0300

Rev.3.00

Mar 25, 2008

### Description

The M62353 is an integrated circuit semiconductor of CMOS structure with 8 channels of built-in D/A converters with output buffer operational amplifiers.

The 3-wire serial interface method is used for the transfer format of digital data to allow connection with microcomputer with minimum wiring.

It is able to cascading serial use with DO terminal.

The output buffer operational amplifier operates in the whole voltage range from power supply to ground for both input/output.

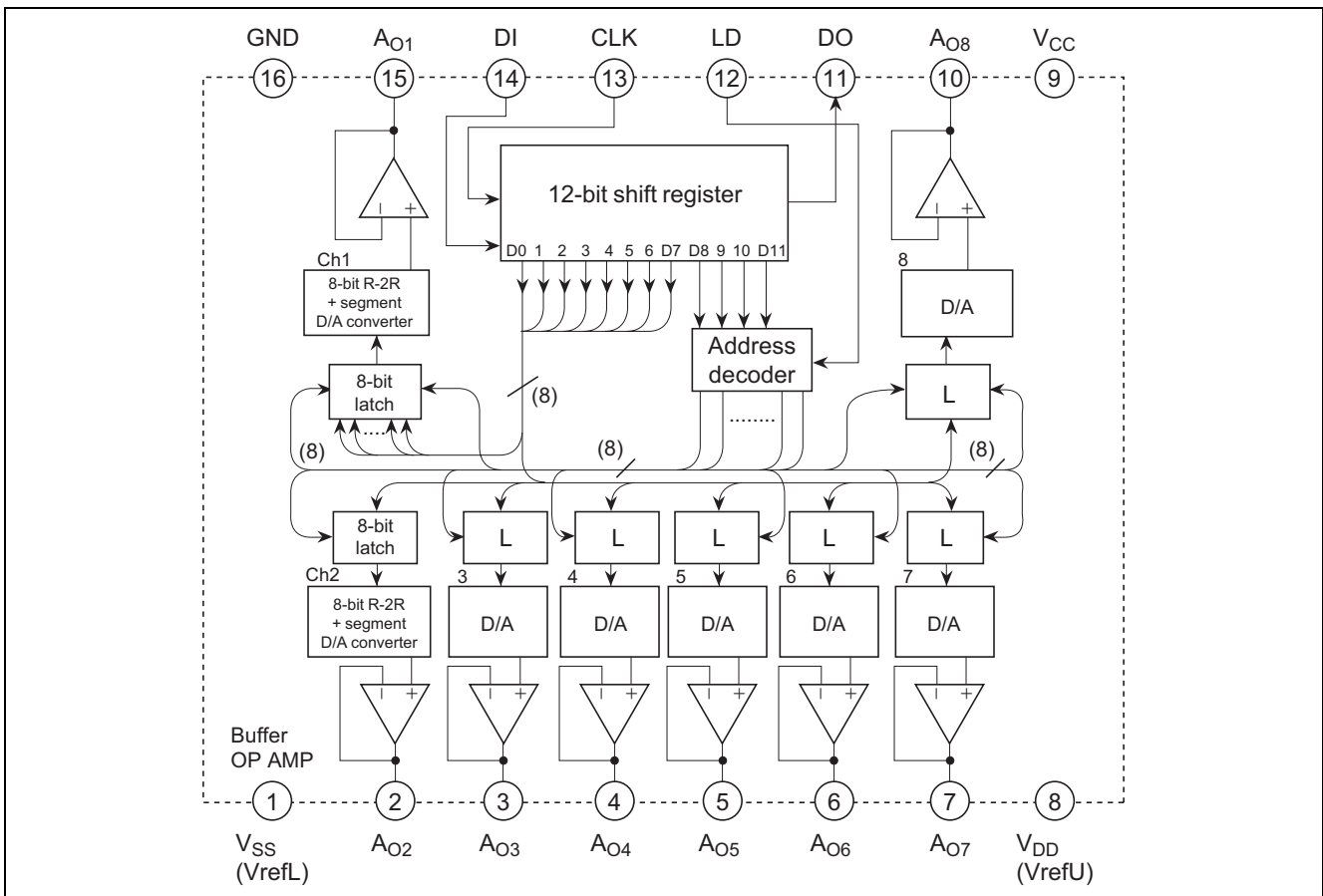
### Features

- 12-bit serial data input (3-wire serial data transfer method)
- Highly stable output buffer operational amplifier allow operation in the all voltage range from power supply to ground.

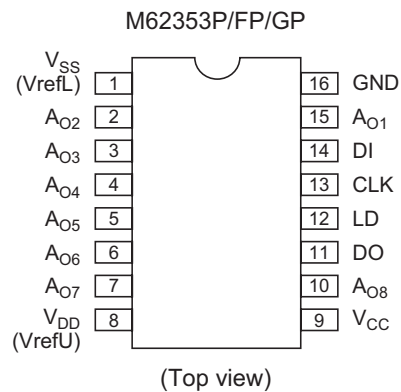
### Application

Adjustment/control of industrial or home-use electronic equipment, such as VTR camera, VTR set, TV, and CRT display.

### Block Diagram



## Pin Arrangement

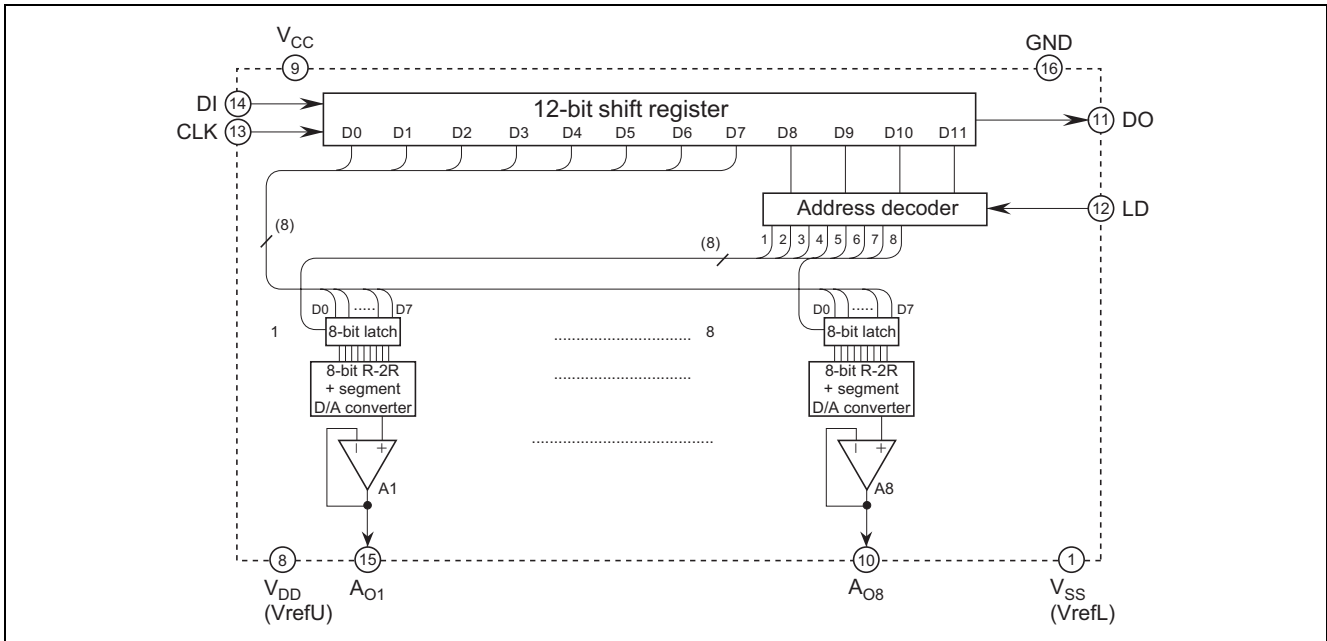


Outline: PRDP0016AA-A (16P4)  
 PRSP0016DE-A (16P2N-A)  
 PLSP0016JA-A (16P2E-A)

## Pin Description

Pin No.	Pin Name	Function
14	DI	Serial data input terminal
11	DO	Serial data output terminal
13	CLK	Serial clock input terminal
12	LD	LD terminal input high level then latch circuit data load
15	A <sub>O1</sub>	8-bit D/A converter output terminal
2	A <sub>O2</sub>	
3	A <sub>O3</sub>	
4	A <sub>O4</sub>	
5	A <sub>O5</sub>	
6	A <sub>O6</sub>	
7	A <sub>O7</sub>	
10	A <sub>O8</sub>	
9	V <sub>CC</sub>	Power supply terminal
16	GND	Digital and analog common GND
8	V <sub>DD</sub>	D/A converter upper reference voltage input terminal
1	V <sub>SS</sub>	D/A converter lower reference voltage input terminal

### Block Diagram for Explanation of Terminals



### Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply voltage	V <sub>CC</sub>	-0.3 to +7.0	V
D/A converter upper reference voltage	V <sub>DD</sub>	-0.3 to +7.0	V
Input voltage	V <sub>IN</sub>	-0.3 to V <sub>CC</sub> + 0.3	V
Output voltage	V <sub>O</sub>	-0.3 to V <sub>CC</sub> + 0.3	V
Power dissipation	P <sub>d</sub>	450 (P) / 300 (FP) / 150 (GP)	mW
Operating temperature	T <sub>opr</sub>	-20 to +85	°C
Storage temperature	T <sub>stg</sub>	-40 to +125	°C

## Electrical Characteristics

### Digital Part

( $V_{CC}$ ,  $V_{refU} = +5\text{ V} \pm 10\%$ ,  $V_{CC} \geq V_{refU}$ , GND,  $V_{refL} = 0\text{ V}$ ,  $T_a = -20^\circ\text{C}$  to  $+85^\circ\text{C}$ , unless otherwise noted.)

Item	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
Supply voltage	$V_{CC}$	4.5	5.0	5.5	V	
Circuit current	$I_{CC}$	—	1.0	2.5	mA	CLK = 1 MHz operation $I_{OA} = 0\ \mu\text{A}$
Input leak current	$I_{ILK}$	-10	—	10	$\mu\text{A}$	$V_{IN} = 0$ to $V_{CC}$
Input low voltage	$V_{IL}$	—	—	$0.2 V_{CC}$	V	
Input high voltage	$V_{IH}$	$0.8 V_{CC}$	—	—	V	
Output low voltage	$V_{OL}$	—	—	0.4	V	$I_{OL} = 2.5\text{ mA}$
Output high voltage	$V_{OH}$	$V_{CC} - 0.4$	—	—	V	$I_{OH} = -400\ \mu\text{A}$

### Analog Part

( $V_{CC}$ ,  $V_{refU} = +5\text{ V} \pm 10\%$ ,  $V_{CC} \geq V_{refU}$ ,  $T_a = -20^\circ\text{C}$  to  $+85^\circ\text{C}$ , unless otherwise noted.)

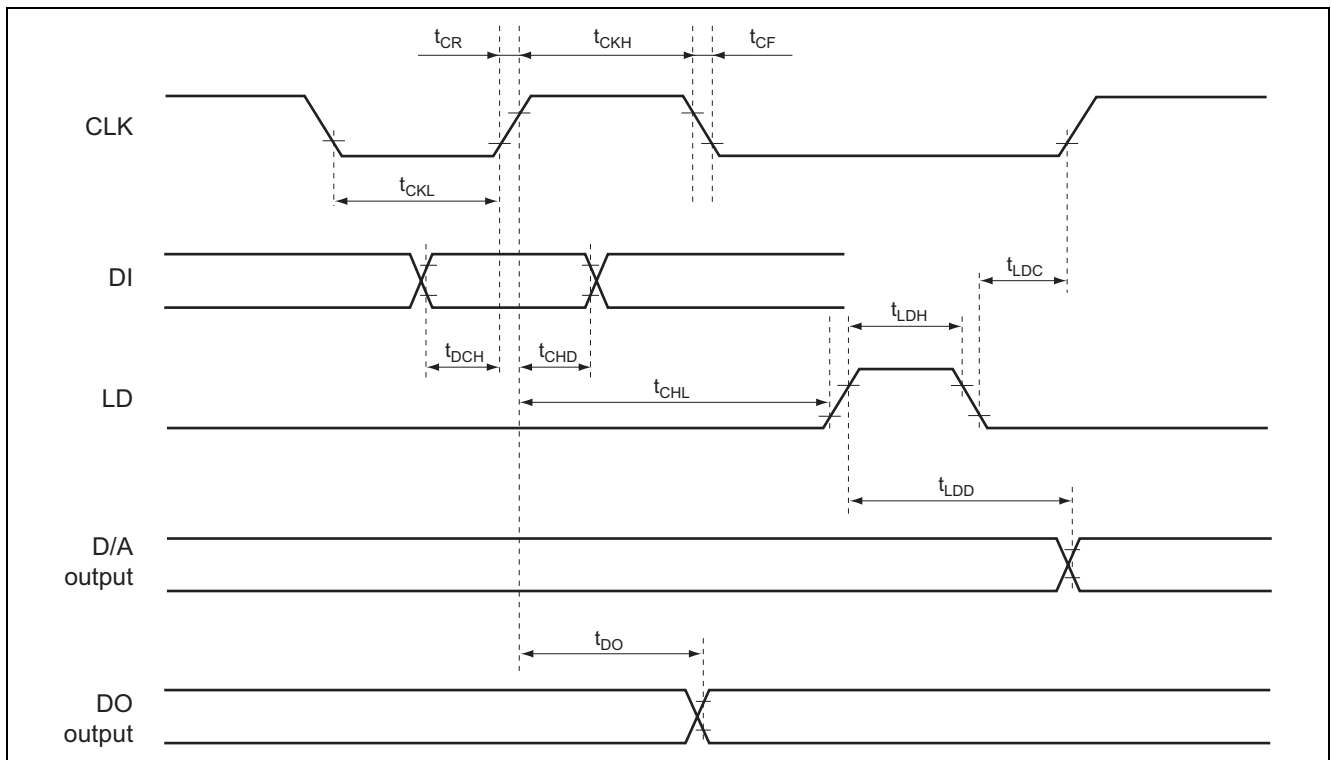
Item	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
Current dissipation	$I_{DD}$	—	0.9	1.7	mA	$V_{refU} = 5\text{ V}$ , $V_{refL} = 0\text{ V}$ Data condition; at maximum current
D/A converter upper reference voltage range	$V_{DD}$	3.5	—	$V_{CC}$	V	The output dose not necessarily be the value within the reference voltage setting range. The output value is determined by the buffer amplifier output voltage range ( $V_{AO}$ )
D/A converter lower reference voltage range	$V_{SS}$	GND	—	$V_{CC} - 3.5$	V	
Buffer amplifier output voltage range	$V_{AO}$	0.1	—	$V_{CC} - 0.1$	V	$I_{OA} = \pm 100\ \mu\text{A}$
		0.2	—	$V_{CC} - 0.2$		$I_{OA} = \pm 500\ \mu\text{A}$
Buffer amplifier output drive range	$I_{AO}$	-1	—	1	mA	Upper side saturation voltage = 0.3 V Lower side saturation voltage = 0.2 V
Differential nonlinearity error	$S_{DL}$	-1.0	—	1.0	LSB	$V_{refU} = 4.79\text{ V}$ $V_{refL} = 0.95\text{ V}$
Nonlinearity error	$S_L$	-1.5	—	1.5	LSB	$V_{CC} = 5.5\text{ V}$ (15 mV/LSB)
Zero code error	$S_{ZERO}$	-2	—	2	LSB	Without load ( $I_{AO} = \pm 0\ \mu\text{A}$ )
Full scale error	$S_{FULL}$	-2	—	2	LSB	
Output capacitive load	$C_O$	—	—	0.1	$\mu\text{F}$	
Buffer amplifier output impedance	$R_O$	—	5	—	$\Omega$	

## AC Characteristics

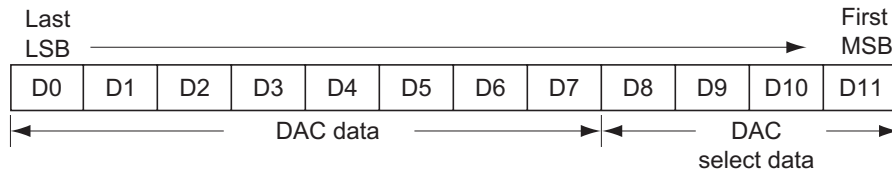
( $V_{CC}$ ,  $V_{refU} = +5\text{ V} \pm 10\%$ ,  $V_{CC} \geq V_{refU}$ ,  $GND$ ,  $V_{refL} = 0\text{ V}$ ,  $T_a = -20$  to  $+85^\circ\text{C}$ , unless otherwise noted.)

Item	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
Clock "L" pulse width	$t_{CKL}$	200	—	—	ns	
Clock "H" pulse width	$t_{CKH}$	200	—	—	ns	
Clock rise time	$t_{CR}$	—	—	200	ns	
Clock fall time	$t_{CF}$	—	—	200	ns	
Data setup time	$t_{DCH}$	30	—	—	ns	
Data hold time	$t_{CHD}$	60	—	—	ns	
LD setup time	$t_{CHL}$	200	—	—	ns	
LD hold time	$t_{LDC}$	100	—	—	ns	
LD "H" pulse width	$t_{LDH}$	100	—	—	ns	
Data output delay time	$t_{DO}$	70	—	350	ns	$C_L \leq 100\text{ pF}$
D/A output setting time	$t_{LDD}$	—	—	300	$\mu\text{s}$	$C_L \leq 100\text{ pF}$ $V_{AO}: 0.5 \leftrightarrow 4.5\text{ V}$ The time until the output becomes the final value of 1/2 LSB

## Timing Chart



## Digital Data Format



### DAC Data

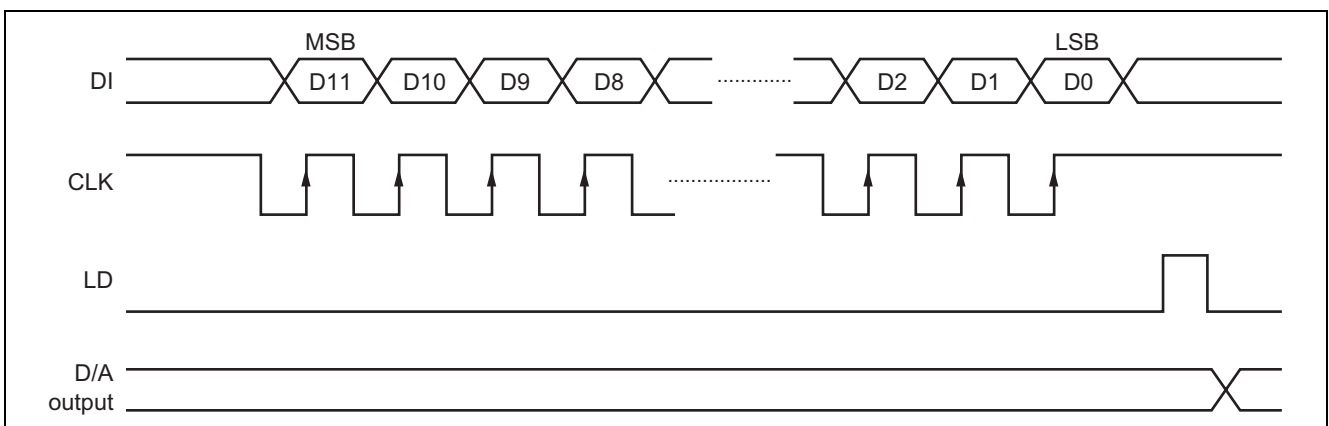
D0	D1	D2	D3	D4	D5	D6	D7	D/A Output
0	0	0	0	0	0	0	0	$(V_{refU} - V_{refL}) / 256 \times 1 + V_{refL}$
1	0	0	0	0	0	0	0	$(V_{refU} - V_{refL}) / 256 \times 2 + V_{refL}$
0	1	0	0	0	0	0	0	$(V_{refU} - V_{refL}) / 256 \times 3 + V_{refL}$
1	1	0	0	0	0	0	0	$(V_{refU} - V_{refL}) / 256 \times 4 + V_{refL}$
:	:	:	:	:	:	:	:	:
0	1	1	1	1	1	1	1	$(V_{refU} - V_{refL}) / 256 \times 255 + V_{refL}$
1	1	1	1	1	1	1	1	$V_{refU}$

Note:  $V_{refU} = V_{DD}$ ,  $V_{refL} = V_{SS}$

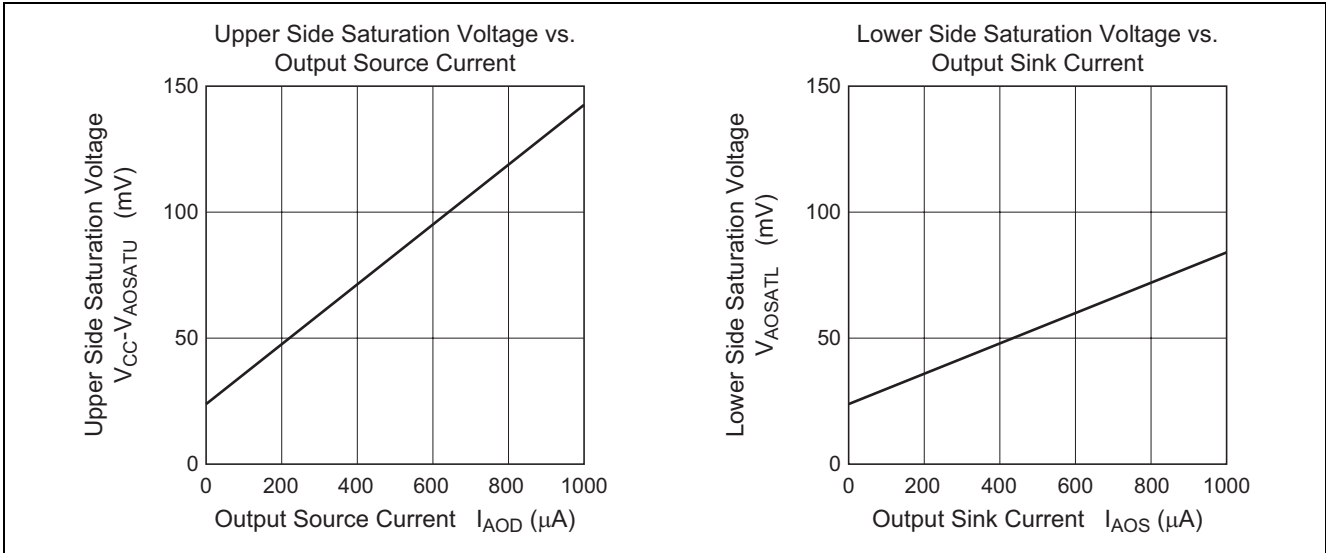
### DAC Select Data

D8	D9	D10	D11	DAC Selection
0	0	0	0	Don't care
0	0	0	1	A <sub>01</sub> select
0	0	1	0	A <sub>02</sub> select
0	0	1	1	A <sub>03</sub> select
0	1	0	0	A <sub>04</sub> select
0	1	0	1	A <sub>05</sub> select
0	1	1	0	A <sub>06</sub> select
0	1	1	1	A <sub>07</sub> select
1	0	0	0	A <sub>08</sub> select
1	0	0	1	Don't care
1	0	1	0	Don't care
1	0	1	1	Don't care
1	1	0	0	Don't care
1	1	0	1	Don't care
1	1	1	0	Don't care
1	1	1	1	Don't care

### Timing Chart (Model)

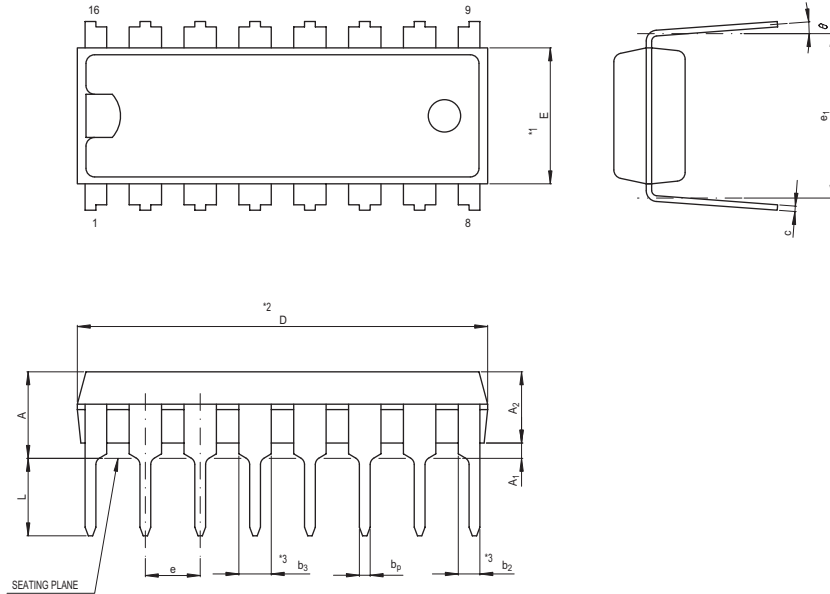


Typical Characteristics



Package Dimensions

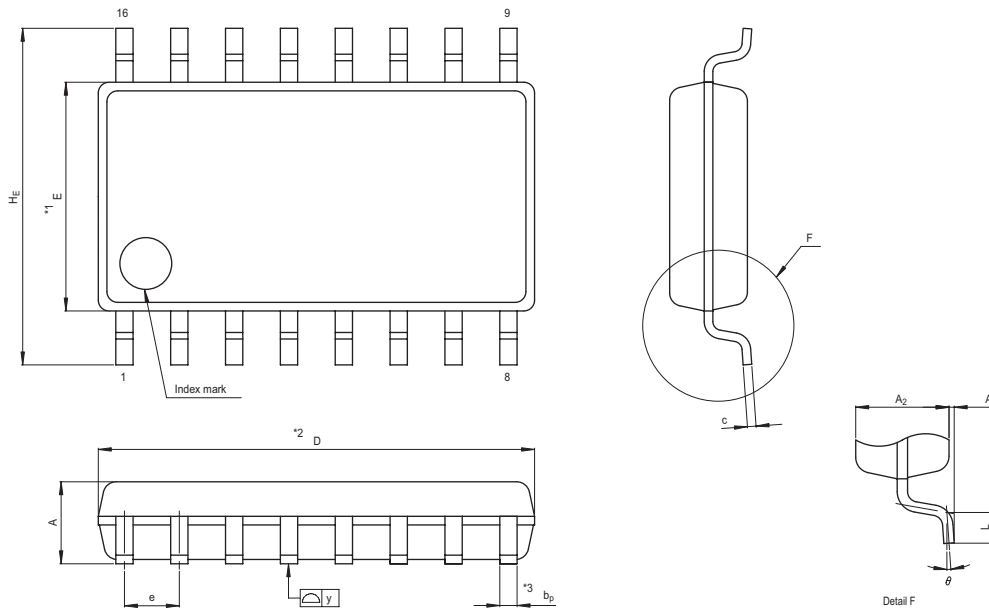
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP16-6.3x19-2.54	PRDP0016AA-A	16P4	1.0g



NOTE)  
 1. DIMENSIONS \*\*1\* AND \*\*2\* DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION \*\*3\* DOES NOT INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
e <sub>1</sub>	7.32	7.62	7.92
D	18.8	19.0	19.2
E	6.15	6.3	6.45
A	—	—	4.5
A <sub>1</sub>	0.51	—	—
A <sub>2</sub>	—	3.3	—
b <sub>p</sub>	0.4	0.5	0.6
b <sub>2</sub>	0.9	1.0	1.3
b <sub>3</sub>	1.4	1.5	1.8
c	0.22	0.27	0.34
θ	0°	—	15°
e	2.29	2.54	2.79
L	3.0	—	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP16-5.3x10.1-1.27	PRSP0016DE-A	16P2N-A	0.2g



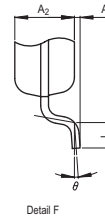
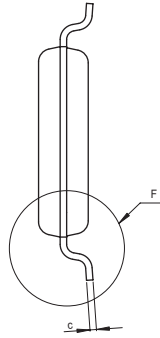
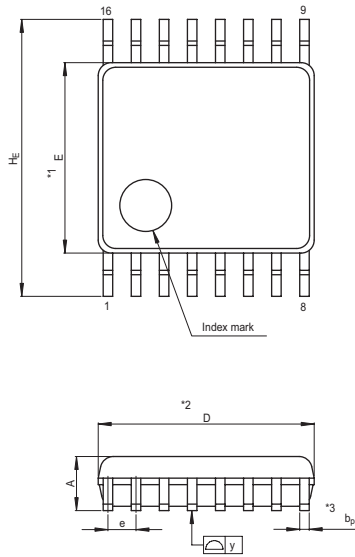
NOTE)  
 1. DIMENSIONS \*\*1\* AND \*\*2\* DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION \*\*3\* DOES NOT INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	10.0	10.1	10.2
E	5.2	5.3	5.4
A <sub>2</sub>	—	1.8	—
A <sub>1</sub>	0	0.1	0.2
A	—	—	2.1
b <sub>p</sub>	0.35	0.4	0.5
c	0.18	0.2	0.25
θ	0°	—	8°
H <sub>E</sub>	7.5	7.8	8.1
e	1.12	1.27	1.42
y	—	—	0.1
L	0.4	0.6	0.8



# M62353P/FP/GP

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-LSSOP16-4.4x5-0.65	PLSP0016JA-A	16P2E-A	0.06g



NOTE)  
 1. DIMENSIONS \*\*1\* AND \*\*2\*  
 DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION \*\*3\* DOES NOT  
 INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	4.9	5.0	5.1
E	4.3	4.4	4.5
A <sub>2</sub>	—	1.15	—
A	—	—	1.45
A <sub>1</sub>	0	0.1	0.2
b <sub>p</sub>	0.17	0.22	0.32
c	0.13	0.15	0.2
θ	0°	—	10°
H <sub>E</sub>	6.2	6.4	6.6
e	0.53	0.65	0.77
y	—	—	0.10
L	0.3	0.5	0.7

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