

QUAD/OCTAL 6BIT D/A CONVERTER  
CMOS LSI

DESCRIPTION

$\mu$ PD6325 Serie are 6 bit D/A Converter for control volumn, brightness, contrast, color or tone of TV set. The data are transferring serially from micro-computer.

$\mu$ PD6325 Serie Line-up	QUAD D/A	OCTAL D/A
D/A output is consist of Emitter follower buffer	$\mu$ PD6325C, 6325G	$\mu$ PD6326C
Non buffer output	$\mu$ PD6335C, 6335G	$\mu$ PD6336C

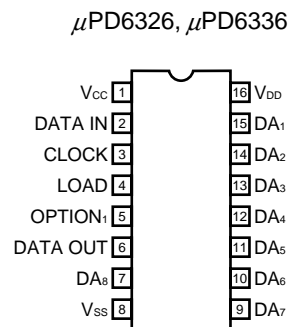
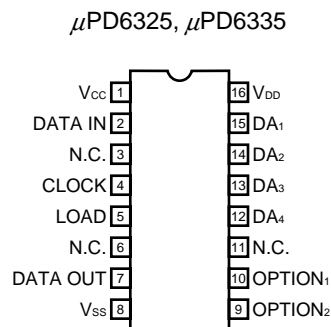
FEATURES

- R-2R ladder D/A
- Serial Data input (DATA IN, CLOCK, LOAD)
- Power supply voltage of interface is 5 V (Vcc) and D/A reference voltage is free (Vcc to 15 V).

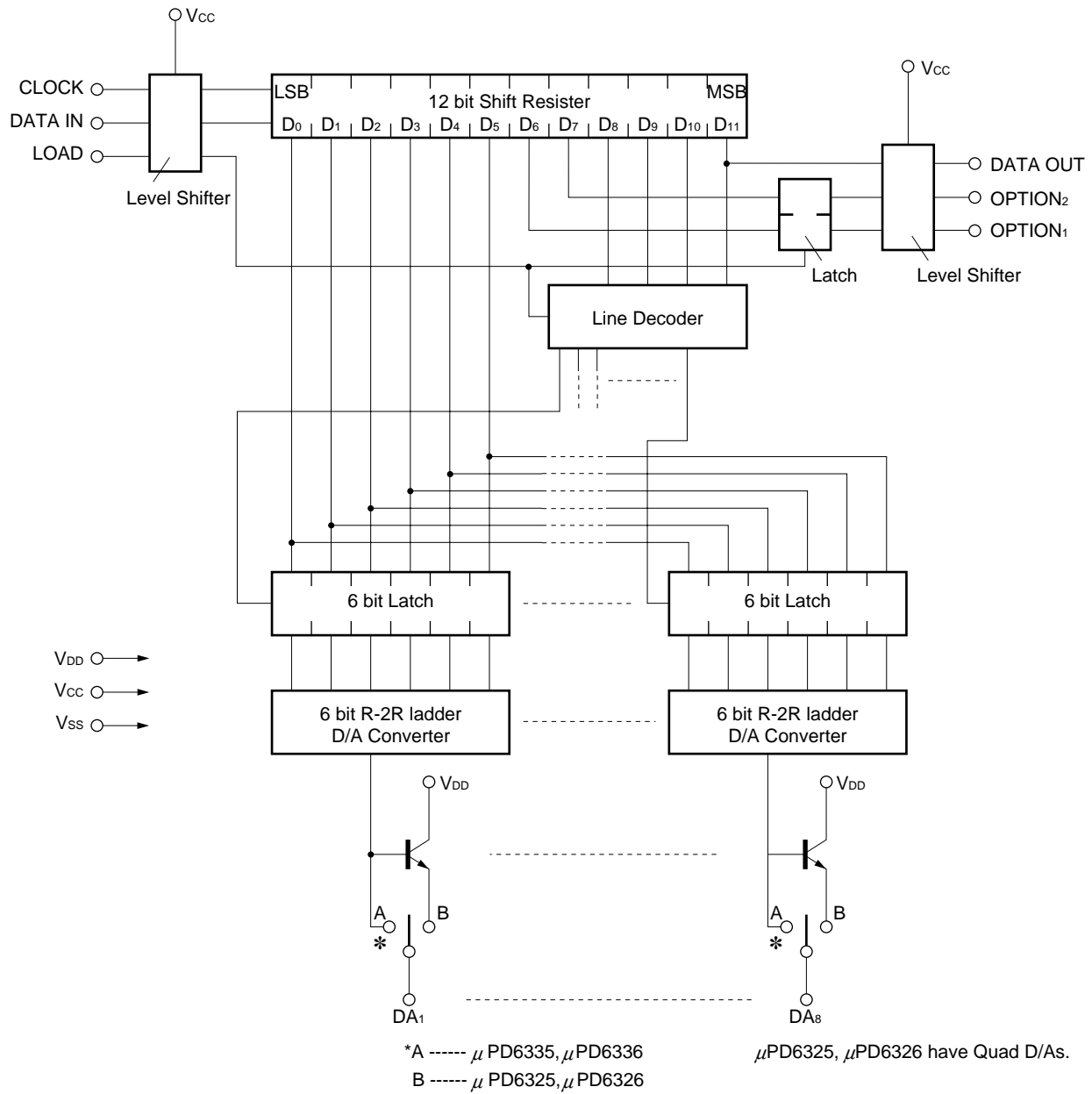
ORDERING INFORMATION

Part No.	Package
$\mu$ PD6325C	16-pin plastic DIP (300 mil)
$\mu$ PD6325G	16-pin plastic SOP (300 mil)
$\mu$ PD6326C	16-pin plastic DIP (300 mil)
$\mu$ PD6335C	16-pin plastic DIP (300 mil)
$\mu$ PD6335G	16-pin plastic SOP (300 mil)
$\mu$ PD6336C	16-pin plastic DIP (300 mil)

PIN CONNECTION DIAGRAM (Top View)



BLOCK DIAGRAM



PIN CONFIGURATION

Pin No.		Symbol	Pin Name	Function
$\mu$ PD 6325 6335	$\mu$ PD 6326 6336			
1	1	V <sub>CC</sub>	Interface Power Supply	This pin is used to interface with the control IC (ex. micro processor). Supply the voltage high level of the control IC.
2	2	DATA IN	Serial Data Input	Control data input terminal. Data is read in synchronization with the clocks input to the CLOCK terminal.
4	3	CLOCK	Shift Clock Input	Data read clock input terminal. The Data input to the DATA IN terminal is read at the leading edge of the clock.
5	4	LOAD	Load Pulse Input	This terminal is used to input Load signals after inputting serial data. 12 bit data is read after leading edge of a pulse input to the LOAD terminal.
7	6	DATA OUT	Serial Data Output	Serial data output terminal. The final stage data of 12 bit shift register appears on this terminal in synchronization with shift clock.
8	8	V <sub>SS</sub>	Ground	System ground.
9	–	OPTION <sub>2</sub>	Expansion Output Port	D <sub>7</sub> the data of the shift register appears on this terminal. (Only $\mu$ PD6325 and $\mu$ PD6335)
10	5	OPTION <sub>1</sub>	Expansion Output Port	D <sub>6</sub> the data of the shift register appears on this terminal.
–	7	DA <sub>8</sub>	Analog Output Channel 8	Analog Output
–	9	DA <sub>7</sub>	Analog Output Channel 7	Analog Output
–	10	DA <sub>6</sub>	Analog Output Channel 6	Analog Output
–	11	DA <sub>5</sub>	Analog Output Channel 5	Analog Output
12	12	DA <sub>4</sub>	Analog Output Channel 4	Analog Output
13	13	DA <sub>3</sub>	Analog Output Channel 3	Analog Output
14	14	DA <sub>2</sub>	Analog Output Channel 2	Analog Output
15	15	DA <sub>1</sub>	Analog Output Channel 1	Analog Output
16	16	V <sub>DD</sub>	Power Supply	Reference Voltage for D/A converters. Analog output voltage range is GND to V <sub>DD</sub> .

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25 °C)**

Supply Voltage	V <sub>DD</sub> , V <sub>CC</sub>	-0.5 to +18, V <sub>CC</sub> ≤ V <sub>DD</sub>	V
Output Voltage	V <sub>OUT</sub>	-0.5 to V <sub>DD</sub> +0.5	V
Input Voltage	V <sub>IN</sub>	-0.5 to V <sub>CC</sub> +0.5	V
Input Current	I <sub>IN</sub>	10	mA
Emitter Follower Current	I <sub>OE</sub>	10	mA
Power Dissipation	P <sub>D</sub>	500*/200**	mW
Operating Temperature	T <sub>A</sub>	-40 to +85	°C
Storage Temperature	T <sub>stg</sub>	-65 to +125	°C

\*DIP

\*\*SOP

**RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Supply Voltage	V <sub>DD</sub>	V <sub>CC</sub>		15	V	V <sub>CC</sub> ≤ V <sub>DD</sub>
Supply Voltage of Interface	V <sub>CC</sub>	4.5	5.0	5.5	V	V <sub>CC</sub> ≤ V <sub>DD</sub>
Low Level Input Voltage	V <sub>IL</sub>			0.8	V	V <sub>CC</sub> = 5 V, V <sub>DD</sub> = 5 to 15 V
High Level Input Voltage	V <sub>IH</sub>	3.5			V	V <sub>CC</sub> = 5 V, V <sub>DD</sub> = 5 to 15 V
Only μPD6325 & μPD6326						
Emitter Follower Power Dissipation 1	P <sub>E</sub> /unit			5	mW	T <sub>A</sub> = 85 °C
Emitter Follower Power Dissipation 2	P <sub>E</sub> /unit			15	mW	T <sub>A</sub> = 70 °C
Emitter Follower Power Dissipation 3	P <sub>E</sub> total			25	mW	T <sub>A</sub> = 85 °C
Emitter Follower Power Dissipation 4	P <sub>E</sub> total			75	mW	T <sub>A</sub> = 70 °C
TIMING CONDITIONS (T <sub>A</sub> = -40 to +85 °C, V <sub>SS</sub> = 0 V, V <sub>CC</sub> = 5 V, V <sub>DD</sub> = V <sub>CC</sub> to 15 V)						
CLOCK High Level Width	t <sub>CH</sub>	4.0			μS	
CLOCK Low Level Width	t <sub>CL</sub>	10.0			μS	
CLOCK Rise Time	t <sub>cr</sub>			1.0	μS	
CLOCK Fall Time	t <sub>cf</sub>			1.0	μS	
DATA IN Setup Time	t <sub>Dsetup</sub>	2			μS	
DATA IN Hold Time	t <sub>Dhold</sub>	10			μS	
Pulse Width, LOAD High	t <sub>W(Load)</sub>	4			μS	
LOAD Lead Time	t <sub>Lead</sub>	10			μS	
LOAD Lag Time	t <sub>Llag</sub>	10			μS	

**ELECTRICAL CHARACTERISTICS**

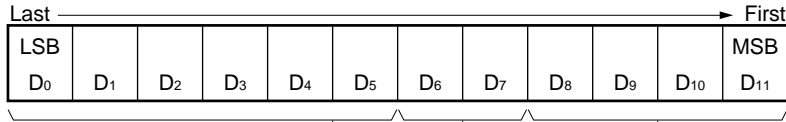
( $T_A = -40$  to  $+85^\circ\text{C}$ ,  $V_{SS} = 0$  V,  $V_{CC} = 4.5$  to  $5.5$  V,  $V_{DD} = V_{CC}$  to  $15$  V)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Current Consumption	$I_{DD}$			15	mA	No Load, for $\mu$ PD6326, 6336
Current Consumption	$I_{DD}$			10	mA	No Load, for $\mu$ PD6325, 6335
Current Consumption of Interface	$I_{CC}$			10	$\mu$ A	No Load of DATA OUT, Static Consumption
Input Leak Current	$I_{LEAK}$			$\pm 1$	$\mu$ A	$V_{IN} = V_{CC}$ or $V_{SS}$
DATA OUT High Level Output Voltage	$I_{OH}$	-100			$\mu$ A	$V_{OH} = V_{DD} - 0.5$ V
DATA OUT Low Level Output Voltage	$I_{OL}$	100			$\mu$ A	$V_{OL} = 0.5$ V
Emitter Follower Leak Current	$I_{OLEAK}$			20	$\mu$ A	for $\mu$ PD6325, 6326
Settling Time	$t_{DA\ set}$			10	$\mu$ s	<b>Note</b>

**Note**  $\mu$ PD6325, 6326:  $R_L = 20$  k $\Omega$ ,  $C_L = 50$  pF  
 $\mu$ PD6335, 6336: No Load.

DATA CONFIGURATION

Data Length is 12 bit.



D/A output CONTROL BIT

D <sub>11</sub>	D <sub>10</sub>	D <sub>9</sub>	D <sub>8</sub>	Select D/A	Target device
0	0	0	0	Don't Care	μPD6325, 6326 μPD6335, 6336
0	0	0	1	DA <sub>1</sub>	μPD6325, 6326 μPD6335, 6336
0	0	1	0	DA <sub>2</sub>	μPD6325, 6326 μPD6335, 6336
0	0	1	1	DA <sub>3</sub>	μPD6325, 6326 μPD6335, 6336
0	1	0	0	DA <sub>4</sub>	μPD6325, 6326 μPD6335, 6336
0	1	0	1	DA <sub>5</sub>	μPD6326 μPD6336
0	1	1	0	DA <sub>6</sub>	μPD6326 μPD6336
0	1	1	1	DA <sub>7</sub>	μPD6326 μPD6336
1	0	0	0	DA <sub>8</sub>	μPD6326 μPD6336
1	×	×	×	Don't Care	μPD6325, 6326 μPD6335, 6336

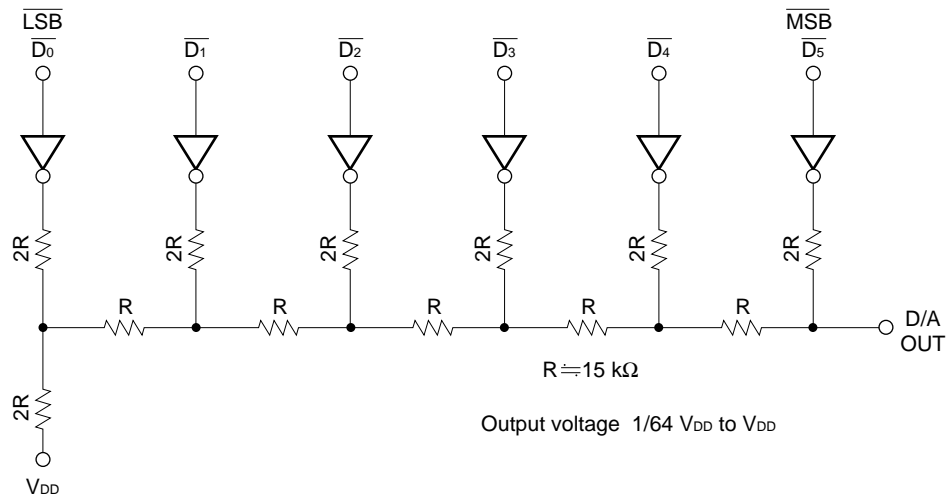
OPTION output CONTROL BIT

D <sub>7</sub>	D <sub>6</sub>	OPTION <sub>1</sub> out.	OPTION <sub>2</sub> out.	Note
0	0	L	L	OPTION2 is only μPD6325, 6326
0	1	H	L	OPTION2 is only μPD6325, 6326
1	0	L	H	OPTION2 is only μPD6325, 6326
1	1	H	H	OPTION2 is only μPD6325, 6326

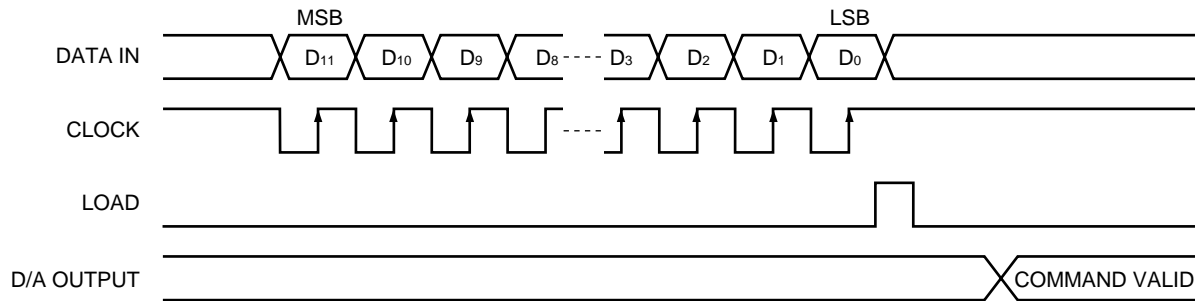
D/A Output Voltage CONTROL BIT

D <sub>5</sub>	D <sub>4</sub>	D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>	Output Voltage
0	0	0	0	0	0	≡ V <sub>DD</sub> /64
0	0	0	0	0	1	≡ 2 x V <sub>DD</sub> /64
0	0	0	0	1	0	≡ 3 x V <sub>DD</sub> /64
0	0	0	0	1	1	≡ 4 x V <sub>DD</sub> /64
⋮	⋮	⋮	⋮	⋮	⋮	⋮
1	1	1	1	1	0	≡ 63 x V <sub>DD</sub> /64
1	1	1	1	1	1	≡ V <sub>DD</sub>

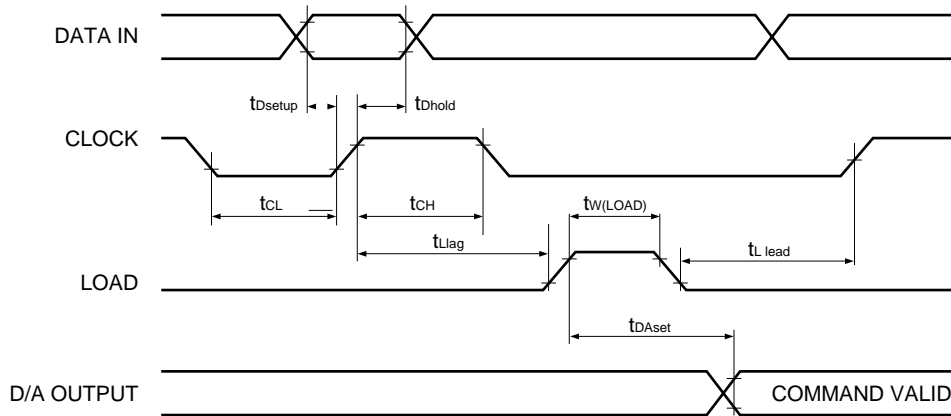
EQUIVALENT CIRCUIT OF 6 bit D/A



TIMING CHART

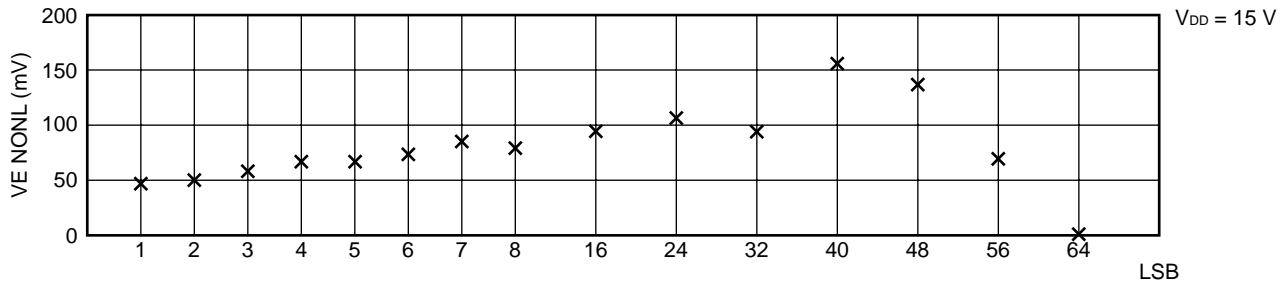
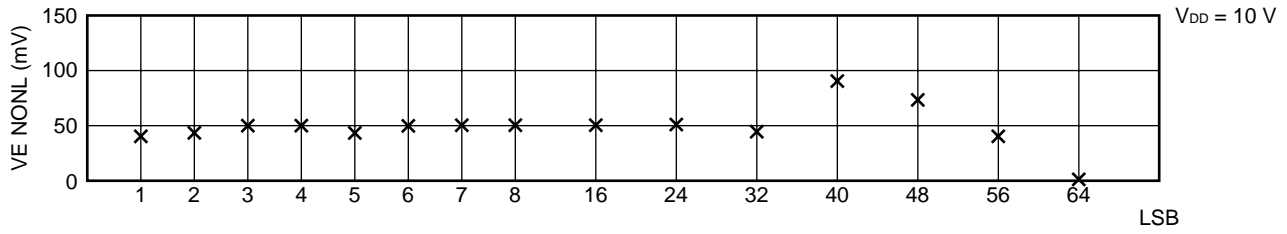
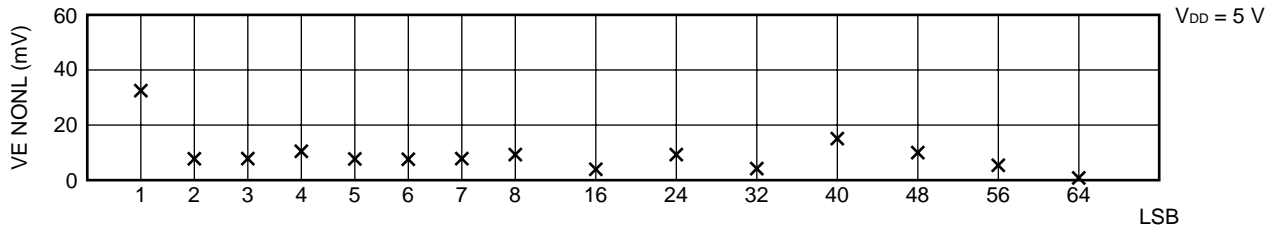


Data is loaded when LOAD is high level.

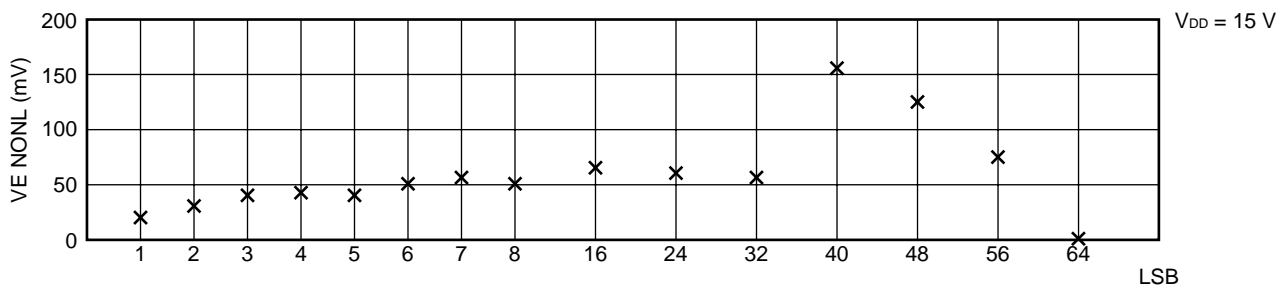
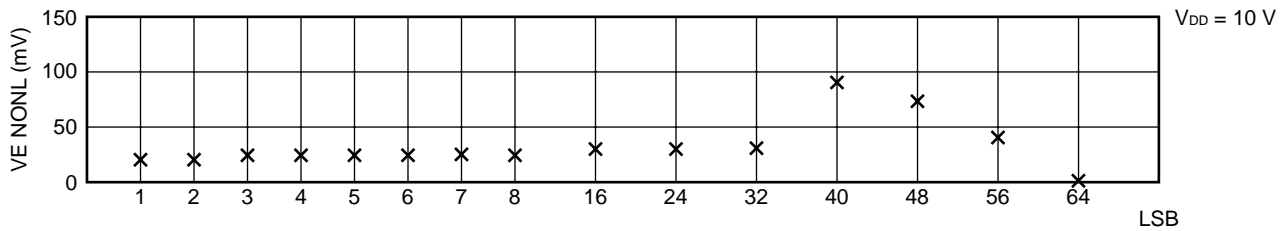
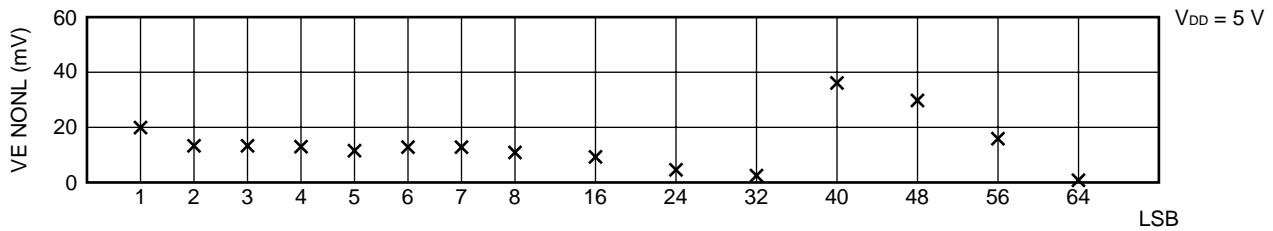


LINIARITY OF D/A OUTPUT ( $\mu$ PD6335, 6336) (TYP.)

• $T_A = -40\text{ }^\circ\text{C}$

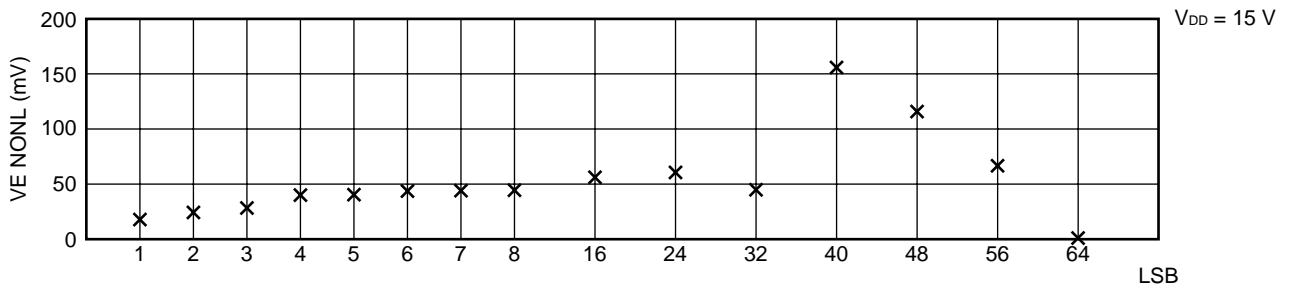
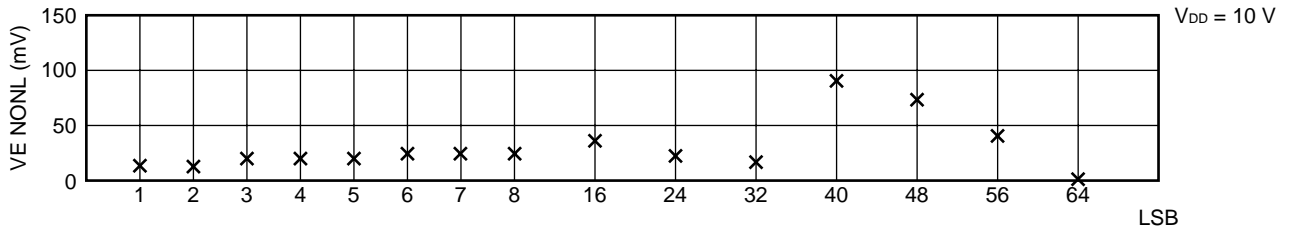
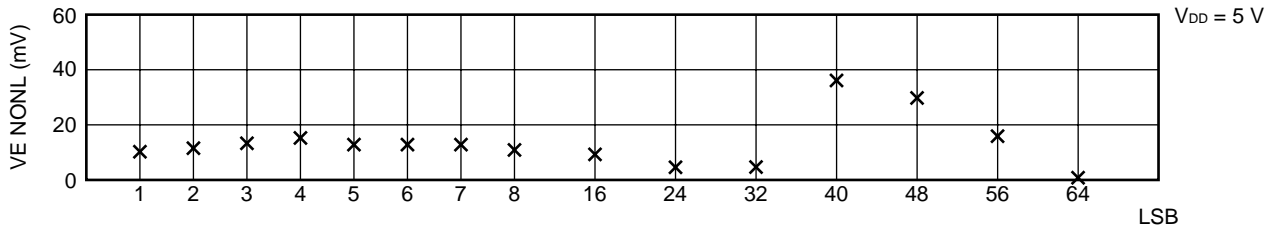


• $T_A = 25\text{ }^\circ\text{C}$





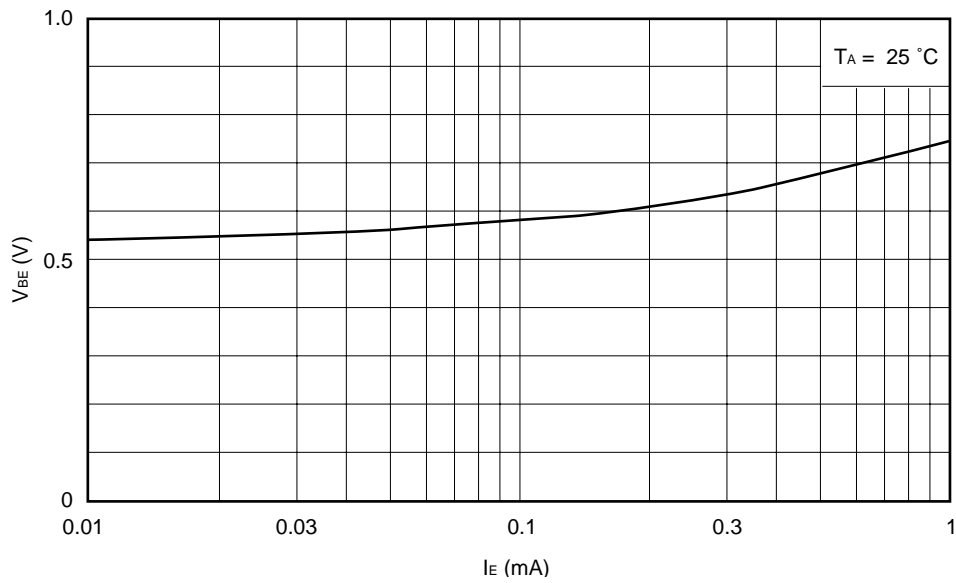
• $T_A = 85^\circ C$



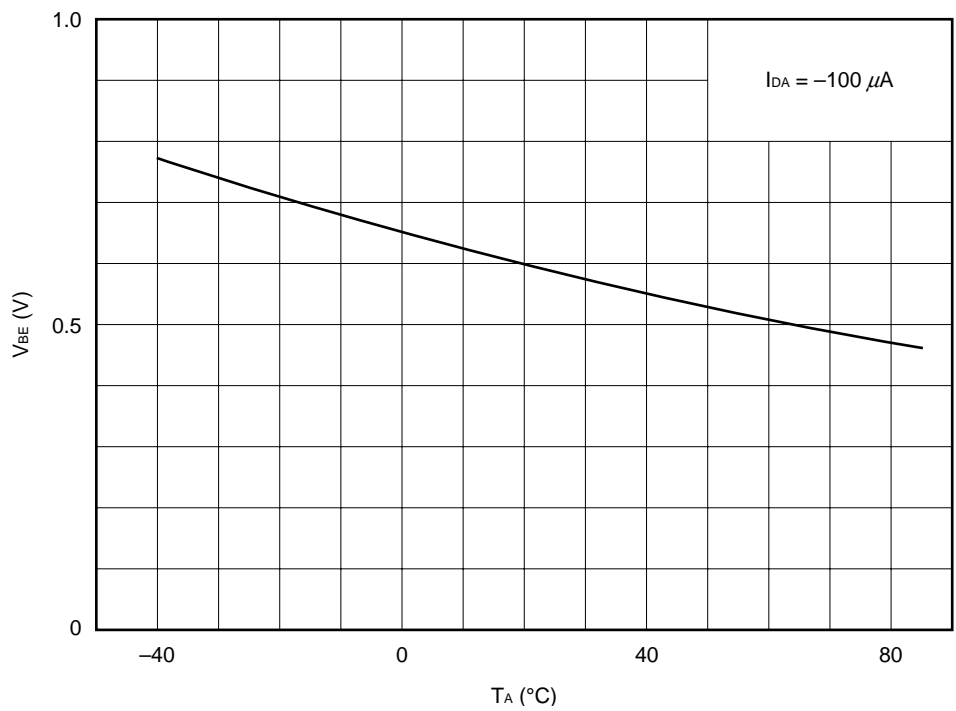
\*  $VE\ NONL = (MEASUREMENT\ VALUE) - (IDEAL\ VALUE)$

Characteristics of Emitter follower buffer ( $\mu$ PD6325, 6326)

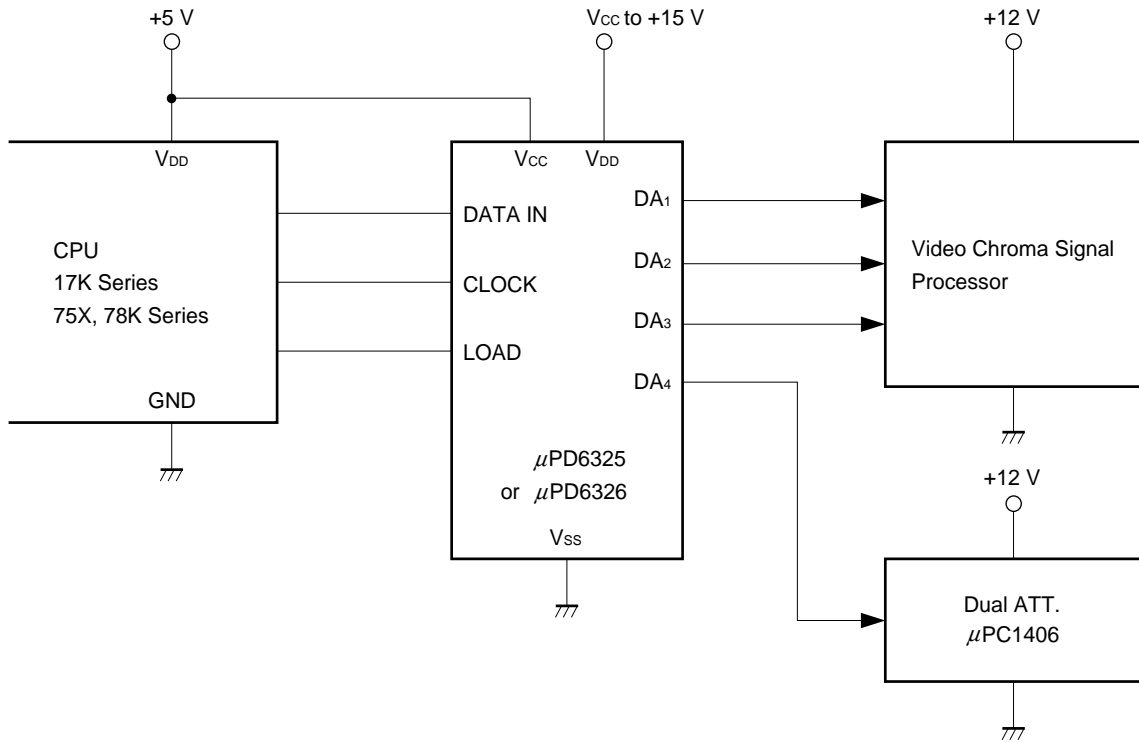
(1)  $V_{BE} - I_E$  (including R-2R's resistor)



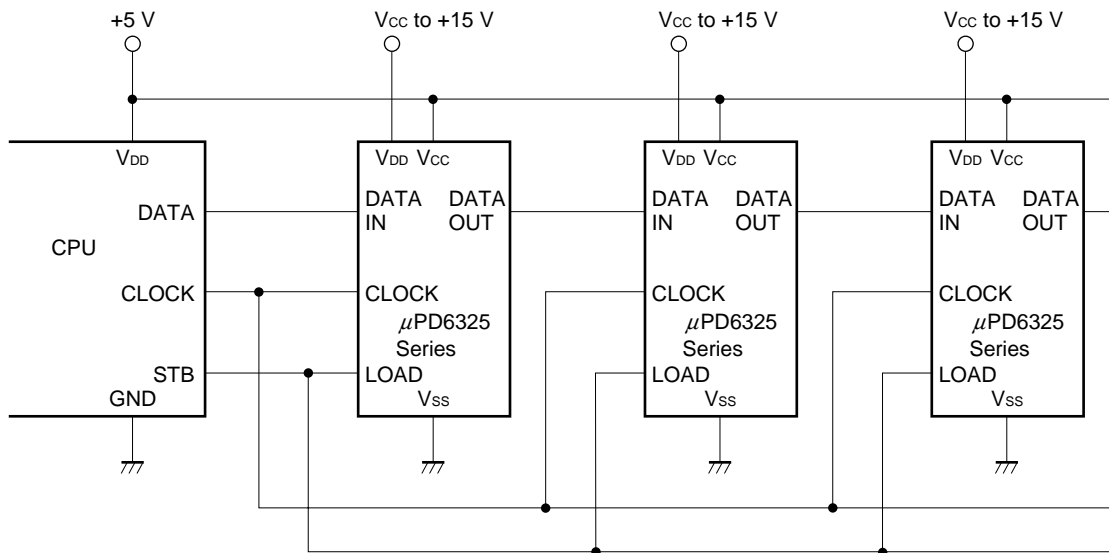
(2)  $V_{BE} - T_A$



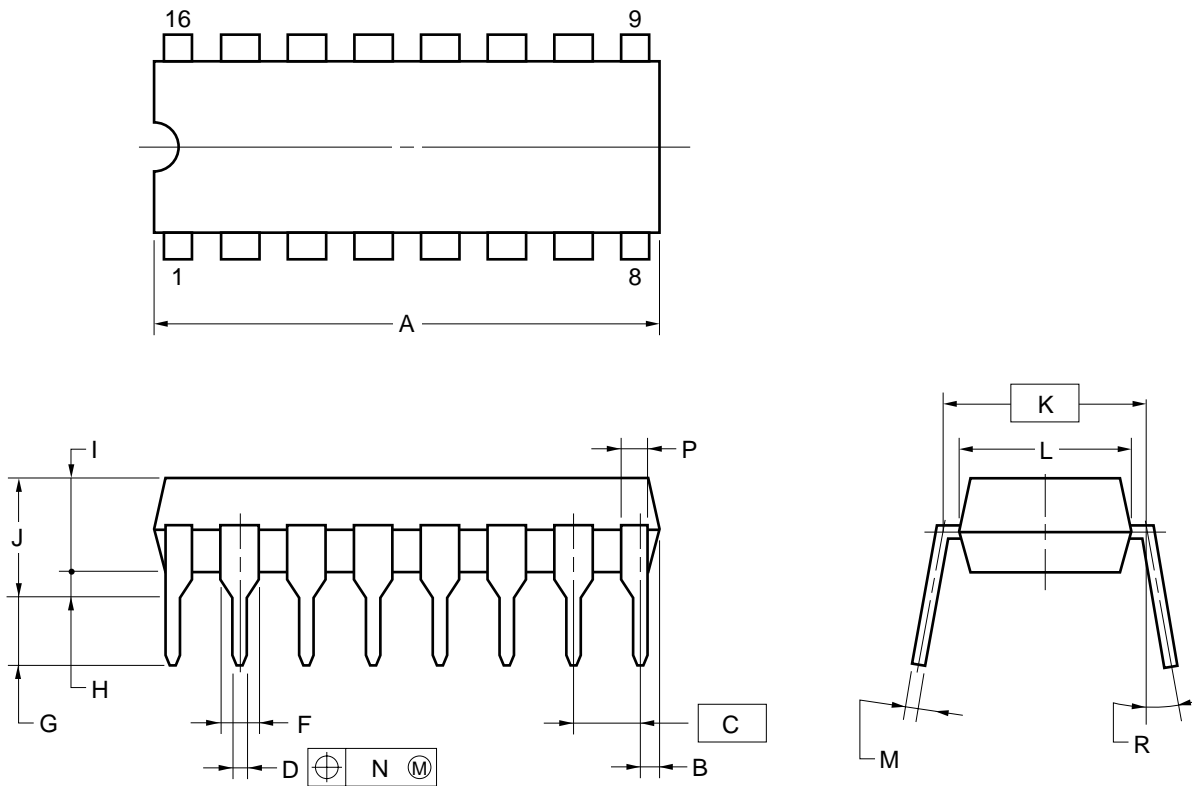
APPLICATION FOR TV SET



APPLICATION FOR CASCADE CONNECTING



16PIN PLASTIC DIP (300 mil)



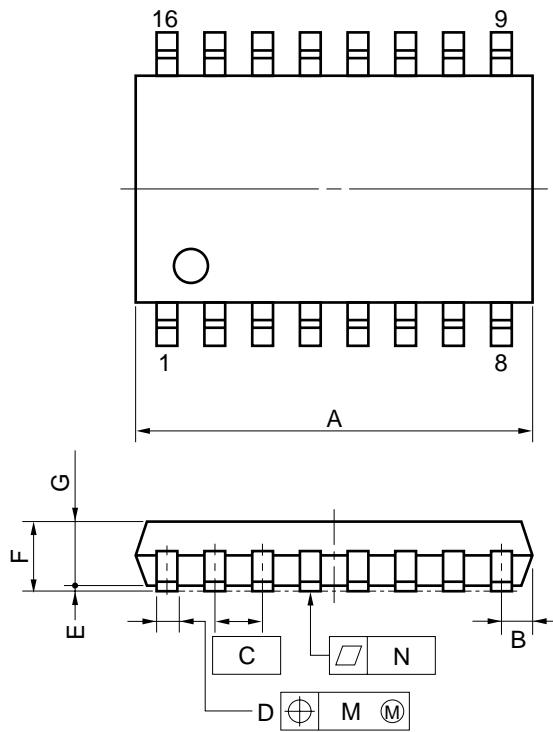
NOTES

- 1) Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.
- 2) Item "K" to center of leads when formed parallel.

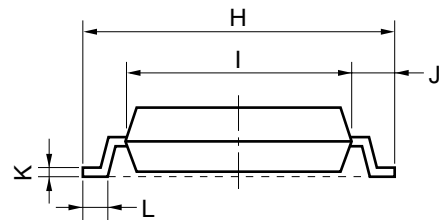
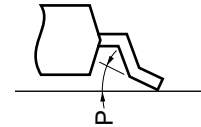
ITEM	MILLIMETERS	INCHES
A	20.32 MAX.	0.800 MAX.
B	1.27 MAX.	0.050 MAX.
C	2.54 (T.P.)	0.100 (T.P.)
D	0.50±0.10	0.020 <sup>+0.004</sup> <sub>-0.005</sub>
F	1.2 MIN.	0.047 MIN.
G	3.5±0.3	0.138±0.012
H	0.51 MIN.	0.020 MIN.
I	4.31 MAX.	0.170 MAX.
J	5.08 MAX.	0.200 MAX.
K	7.62 (T.P.)	0.300 (T.P.)
L	6.4	0.252
M	0.25 <sup>+0.10</sup> <sub>-0.05</sub>	0.010 <sup>+0.004</sup> <sub>-0.003</sub>
N	0.25	0.01
P	1.0 MIN.	0.039 MIN.
R	0~15°	0~15°

P16C-100-300A,C-1

16 PIN PLASTIC SOP (300 mil)



detail of lead end



NOTE

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	10.46 MAX.	0.412 MAX.
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	0.40 <sup>+0.10</sup> <sub>-0.05</sub>	0.016 <sup>+0.004</sup> <sub>-0.003</sub>
E	0.1±0.1	0.004±0.004
F	1.8 MAX.	0.071 MAX.
G	1.55	0.061
H	7.7±0.3	0.303±0.012
I	5.6	0.220
J	1.1	0.043
K	0.20 <sup>+0.10</sup> <sub>-0.05</sub>	0.008 <sup>+0.004</sup> <sub>-0.002</sub>
L	0.6±0.2	0.024 <sup>+0.008</sup> <sub>-0.009</sub>
M	0.12	0.005
N	0.10	0.004
P	3° <sup>+7°</sup> <sub>-3°</sub>	3° <sup>+7°</sup> <sub>-3°</sub>

P16GM-50-300B-4

## REFERENCE

Document Name	Document No.
NEC semiconductor device reliability/quality control system	IEI-1212
Quality grade on NEC semiconductor devices	C11531E
Semiconductor device mounting technology manual	C10535E
Semiconductor device package manual	C10943X
Guide to quality assurance for semiconductor devices	MEI-1202
Semiconductor selection guide	X10679E

[MEMO]

[MEMO]

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