

μ PD6325, μ PD6326, μ PD6335, μ PD6336

Phase-out/Discontinued

QUAD/OCTAL 6BIT D/A CONVERTER
CMOS LSI

DESCRIPTION

μ 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.

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

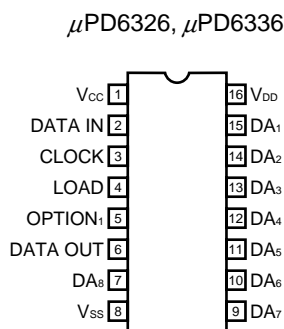
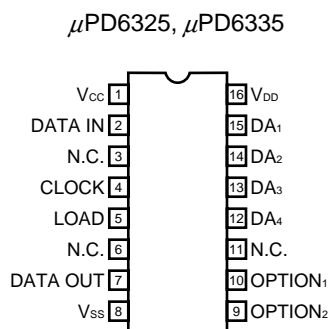
FEATURES

- 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).

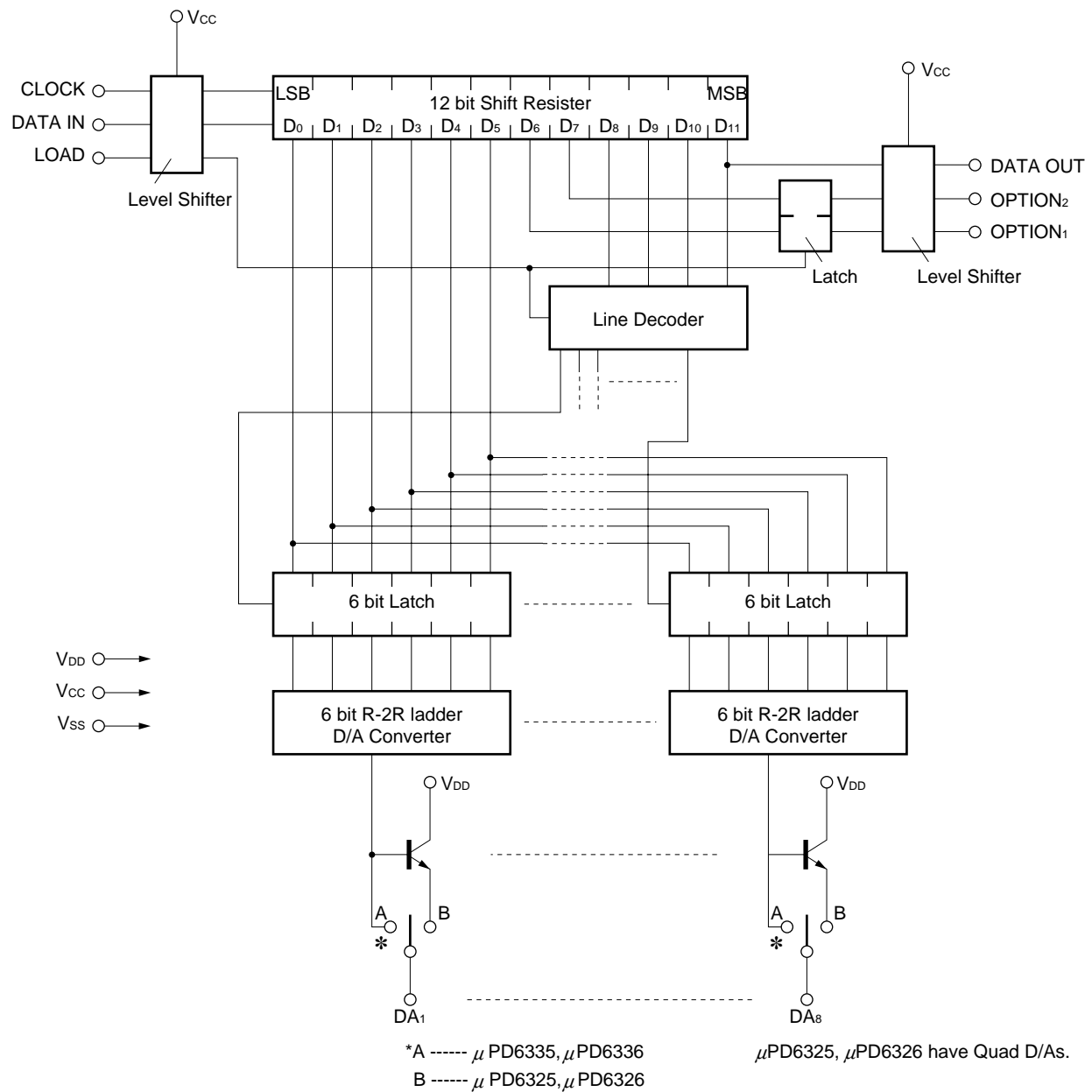
ORDERING INFORMATION

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

PIN CONNECTION DIAGRAM (Top View)



BLOCK DIAGRAM



PIN CONFIGURATION

Pin No.		Symbol	Pin Name	Function
μ PD 6325 6335	μ PD 6326 6336			
1	1	V _{CC}	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 _{SS}	Ground	System ground.
9	–	OPTION ₂	Expansion Output Port	D ₇ the data of the shift register appears on this terminal. (Only μ PD6325 and μ PD6335)
10	5	OPTION ₁	Expansion Output Port	D ₆ the data of the shift register appears on this terminal.
–	7	DA ₈	Analog Output Channel 8	Analog Output
–	9	DA ₇	Analog Output Channel 7	Analog Output
–	10	DA ₆	Analog Output Channel 6	Analog Output
–	11	DA ₅	Analog Output Channel 5	Analog Output
12	12	DA ₄	Analog Output Channel 4	Analog Output
13	13	DA ₃	Analog Output Channel 3	Analog Output
14	14	DA ₂	Analog Output Channel 2	Analog Output
15	15	DA ₁	Analog Output Channel 1	Analog Output
16	16	V _{DD}	Power Supply	Reference Voltage for D/A converters. Analog output voltage range is GND to V _{DD} .

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

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

*DIP

**SOP

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Supply Voltage	V _{DD}	V _{CC}		15	V	V _{CC} ≤ V _{DD}
Supply Voltage of Interface	V _{CC}	4.5	5.0	5.5	V	V _{CC} ≤ V _{DD}
Low Level Input Voltage	V _{IL}			0.8	V	V _{CC} = 5 V, V _{DD} = 5 to 15 V
High Level Input Voltage	V _{IH}	3.5			V	V _{CC} = 5 V, V _{DD} = 5 to 15 V
Only μ PD6325 & μ PD6326						
Emitter Follower Power Dissipation 1	P _E /unit			5	mW	T _A = 85 °C
Emitter Follower Power Dissipation 2	P _E /unit			15	mW	T _A = 70 °C
Emitter Follower Power Dissipation 3	P _E total			25	mW	T _A = 85 °C
Emitter Follower Power Dissipation 4	P _E total			75	mW	T _A = 70 °C
TIMING CONDITIONS (T _A = -40 to +85 °C, V _{SS} = 0 V, V _{CC} = 5 V, V _{DD} = V _{CC} to 15 V)						
CLOCK High Level Width	t _{CH}	4.0			μs	
CLOCK Low Level Width	t _{CL}	10.0			μs	
CLOCK Rise Time	t _{cr}			1.0	μs	
CLOCK Fall Time	t _{cf}			1.0	μs	
DATA IN Setup Time	t _{Dsetup}	2			μs	
DATA IN Hold Time	t _{Dhold}	10			μs	
Pulse Width, LOAD High	t _{W(Load)}	4			μs	
LOAD Lead Time	t _{Lead}	10			μs	
LOAD Lag Time	t _{Llag}	10			μs	

ELECTRICAL CHARACTERISTICS

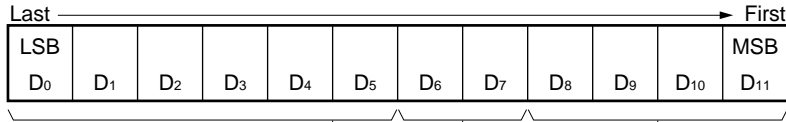
(T_A = -40 to +85°C, V_{SS} = 0 V, V_{CC} = 4.5 to 5.5 V, V_{DD} = V_{CC} to 15 V)

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

Note μ PD6325, 6326: R_L = 20 k Ω , C_L = 50 pF μ PD6335, 6336: No Load.

DATA CONFIGURATION

Data Length is 12 bit.



D/A output CONTROL BIT

D ₁₁	D ₁₀	D ₉	D ₈	Select D/A	Target device
0	0	0	0	Don't Care	μ PD6325, 6326 μ PD6335, 6336
0	0	0	1	DA ₁	μ PD6325, 6326 μ PD6335, 6336
0	0	1	0	DA ₂	μ PD6325, 6326 μ PD6335, 6336
0	0	1	1	DA ₃	μ PD6325, 6326 μ PD6335, 6336
0	1	0	0	DA ₄	μ PD6325, 6326 μ PD6335, 6336
0	1	0	1	DA ₅	μ PD6326 μ PD6336
0	1	1	0	DA ₆	μ PD6326 μ PD6336
0	1	1	1	DA ₇	μ PD6326 μ PD6336
1	0	0	0	DA ₈	μ PD6326 μ PD6336
1	×	×	×	Don't Care	μ PD6325, 6326 μ PD6335, 6336

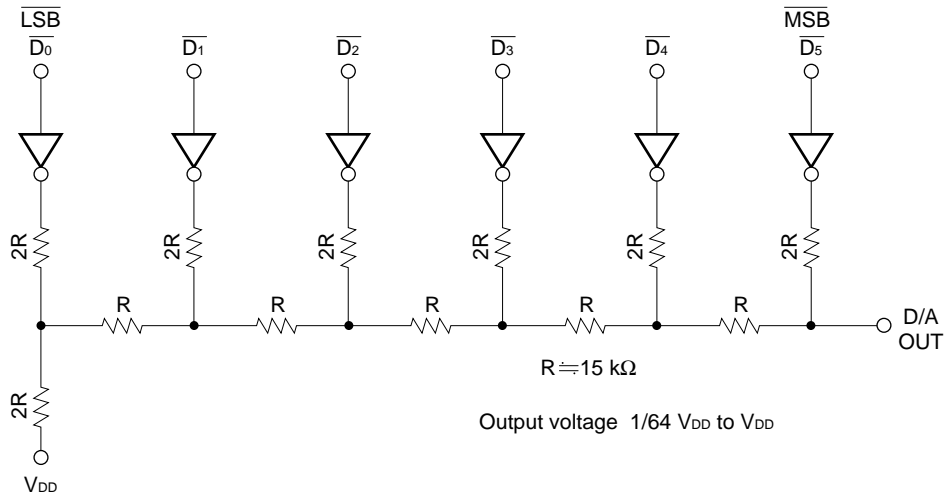
OPTION output CONTROL BIT

D ₇	D ₆	OPTION ₁ out.	OPTION ₂ out.	Note
0	0	L	L	OPTION2 is only μ PD6325, 6326
0	1	H	L	OPTION2 is only μ PD6325, 6326
1	0	L	H	OPTION2 is only μ PD6325, 6326
1	1	H	H	OPTION2 is only μ PD6325, 6326

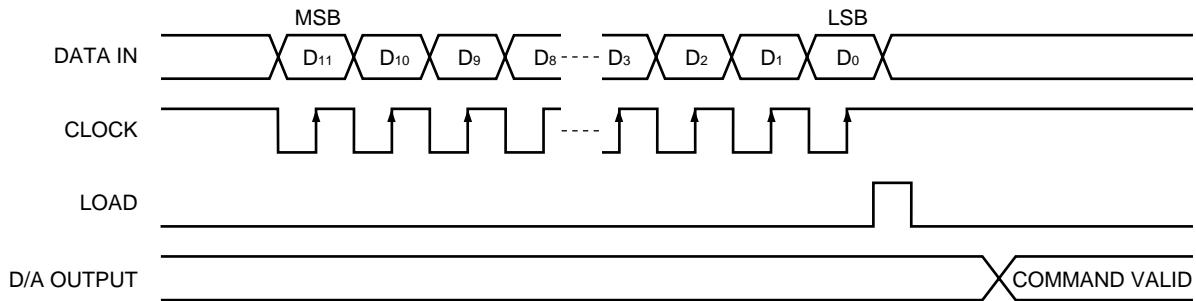
D/A Output Voltage CONTROL BIT

D ₅	D ₄	D ₃	D ₂	D ₁	D ₀	Output Voltage
0	0	0	0	0	0	$\hat{=}$ V _{DD} /64
0	0	0	0	0	1	$\hat{=}$ 2 x V _{DD} /64
0	0	0	0	1	0	$\hat{=}$ 3 x V _{DD} /64
0	0	0	0	1	1	$\hat{=}$ 4 x V _{DD} /64
⋮	⋮	⋮	⋮	⋮	⋮	⋮
1	1	1	1	1	0	$\hat{=}$ 63 x V _{DD} /64
1	1	1	1	1	1	$\hat{=}$ V _{DD}

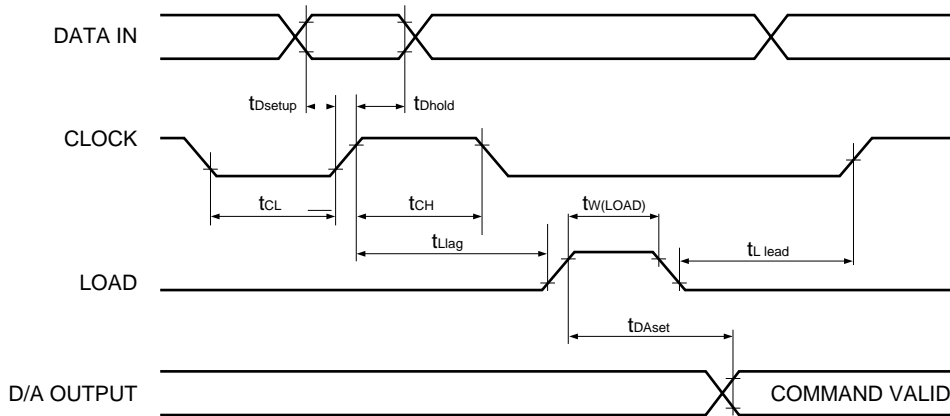
EQUIVALENT CIRCUIT OF 6 bit D/A



TIMING CHART

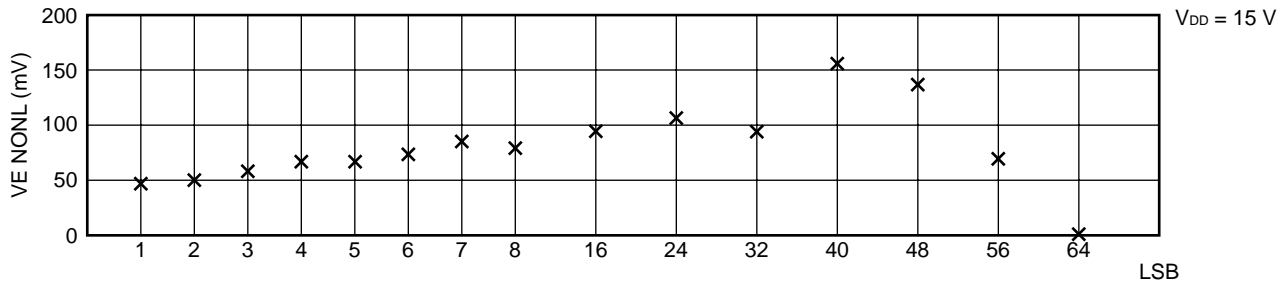
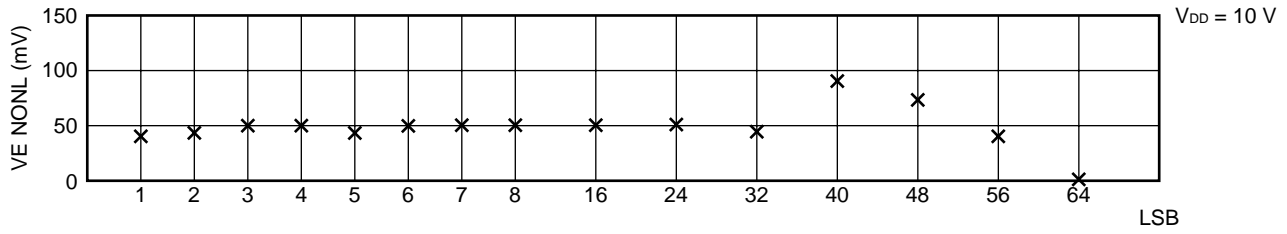
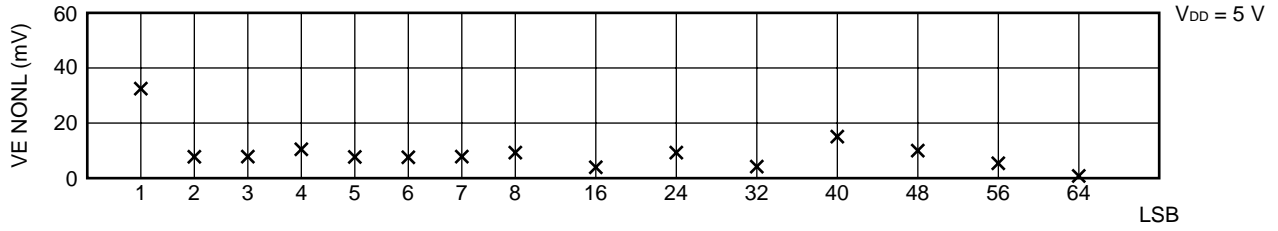


Data is loaded when LOAD is high level.

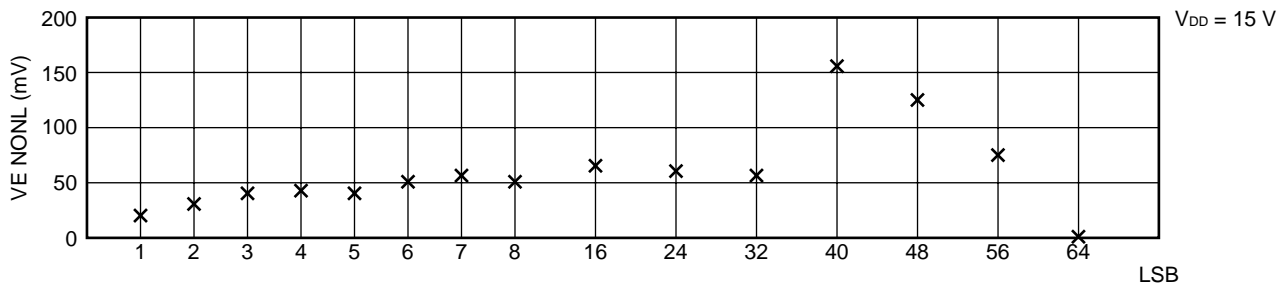
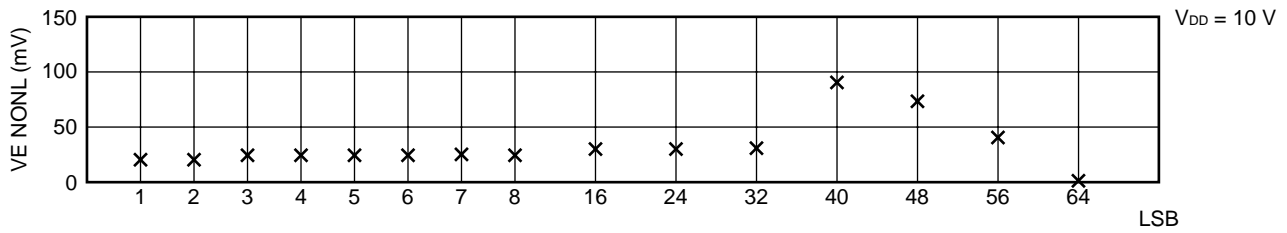
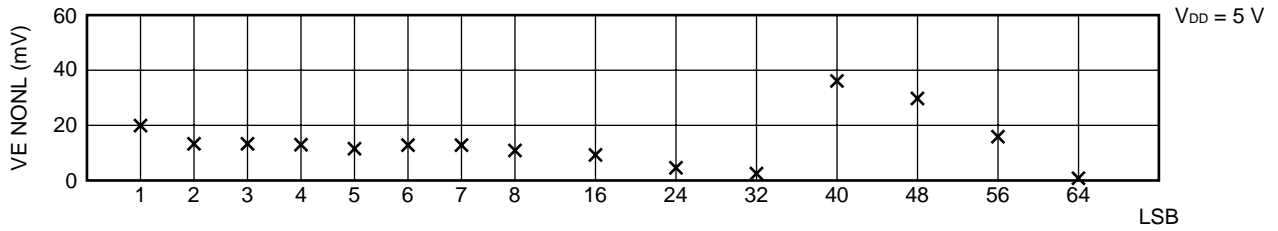


LINIARITY OF D/A OUTPUT (μ PD6335, 6336) (TYP.)

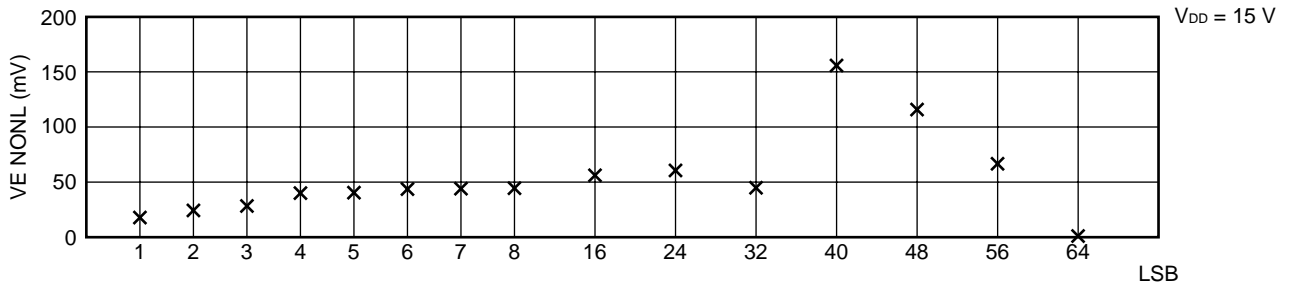
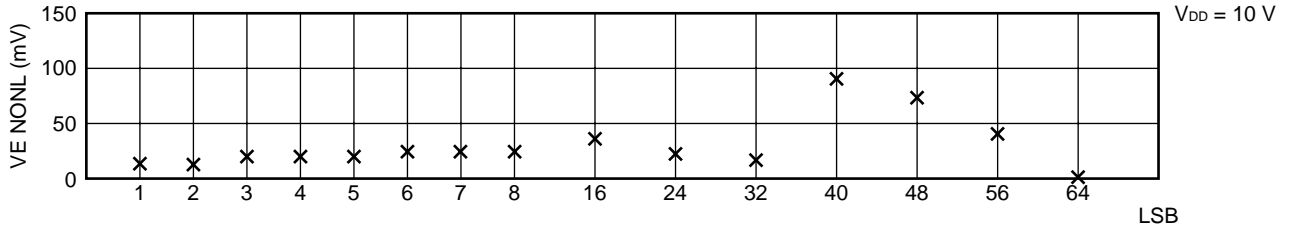
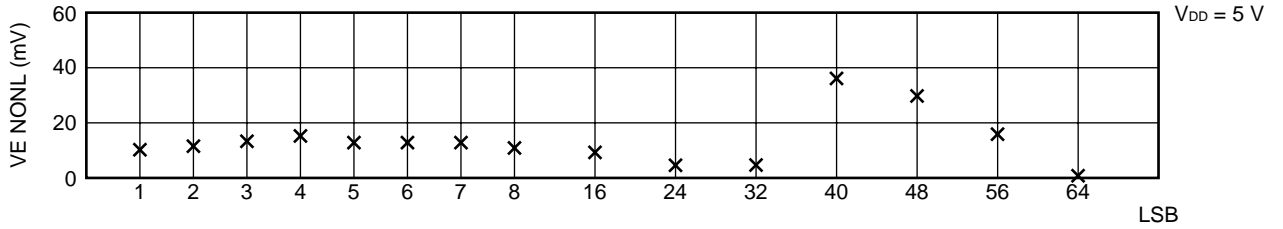
• $T_A = -40\text{ }^\circ\text{C}$



• $T_A = 25\text{ }^\circ\text{C}$



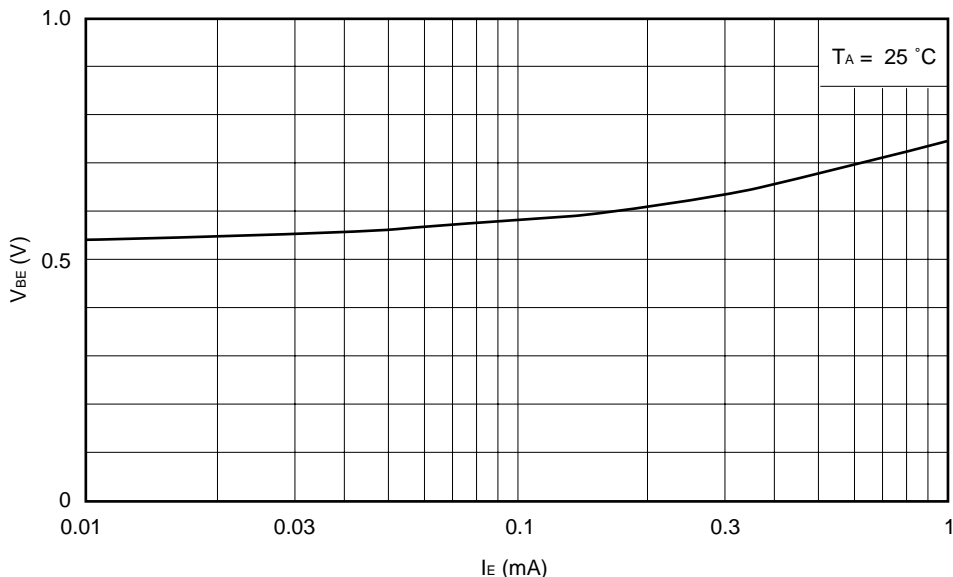
•T_A = 85 °C



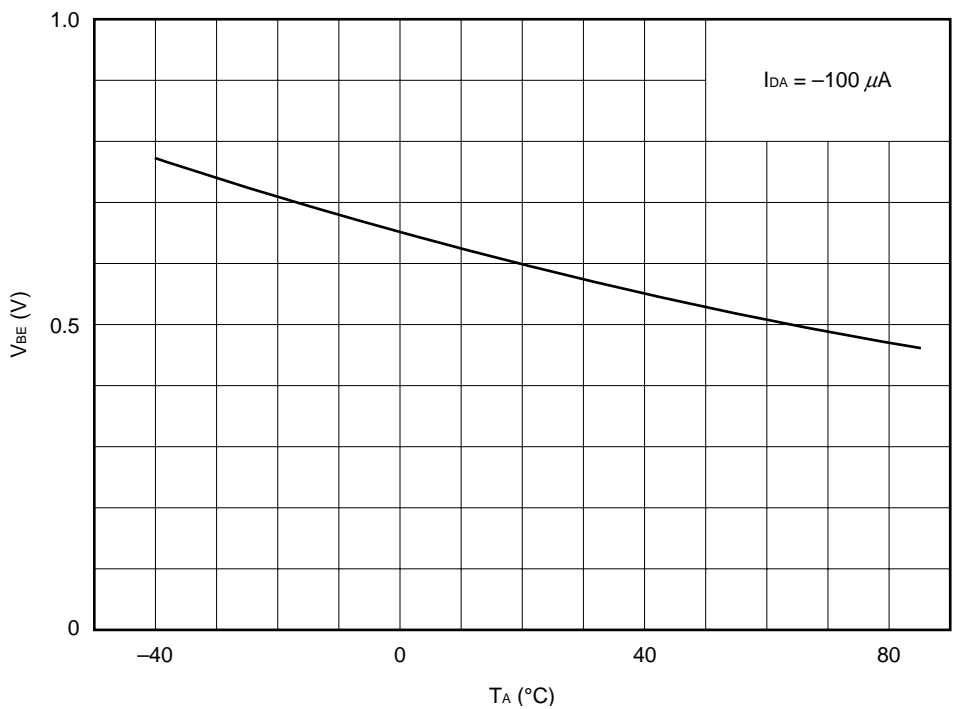
* VE NONL = (MEASUREMENT VALUE) – (IDEAL VALUE)

Characteristics of Emitter follower buffer (μ PD6325, 6326)

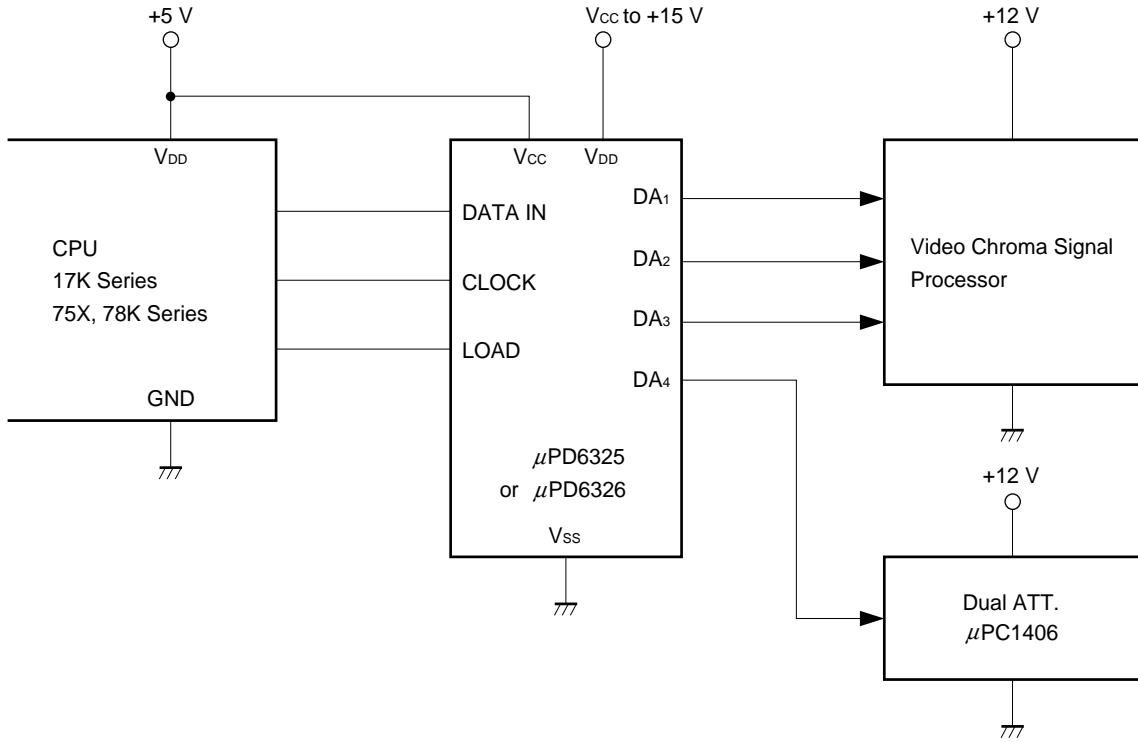
(1) $V_{BE} - I_E$ (including R-2R's resistor)



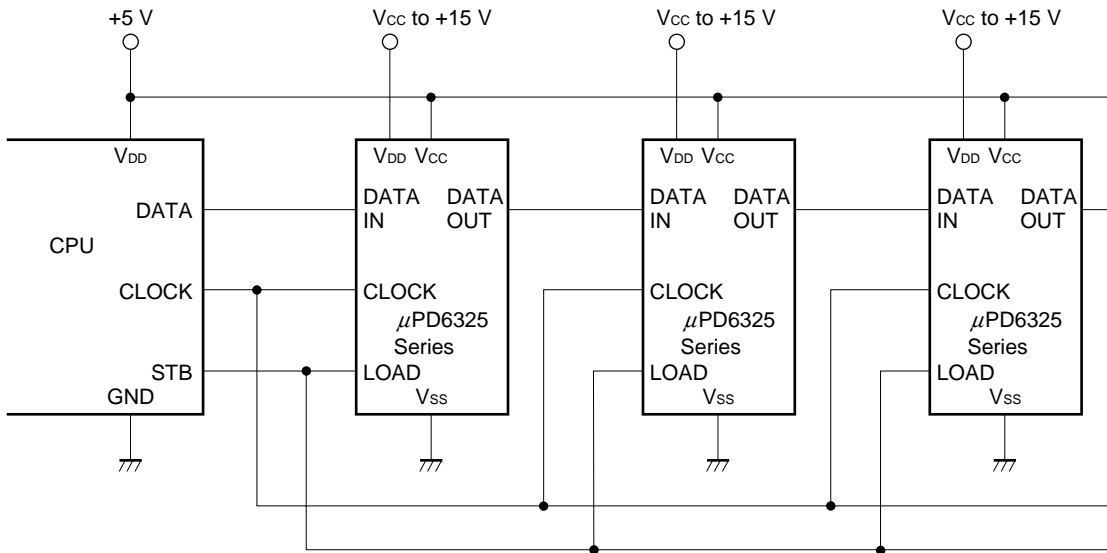
(2) $V_{BE} - T_A$



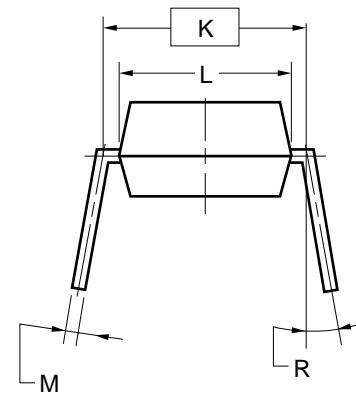
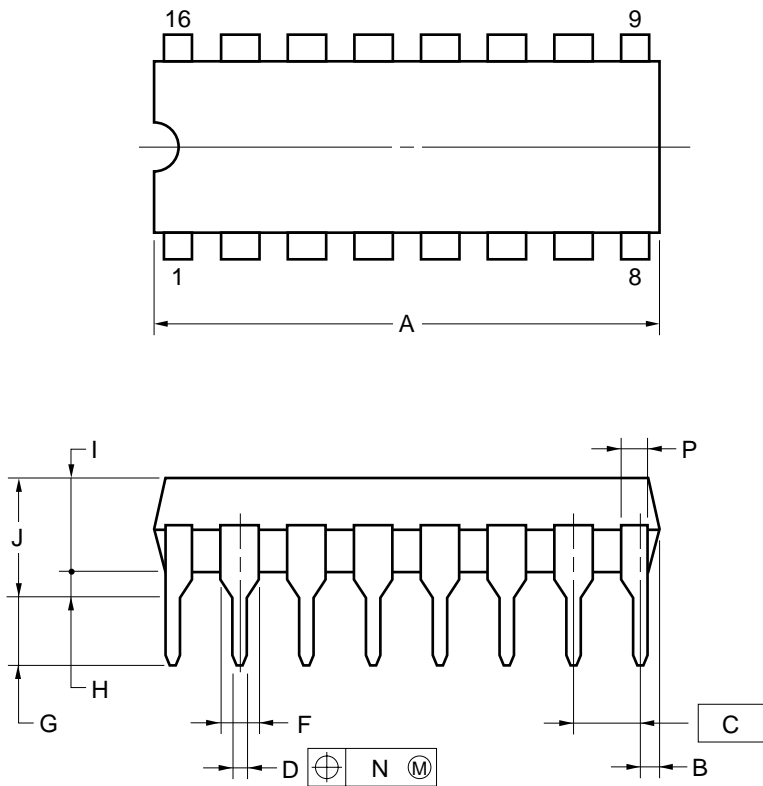
APPLICATION FOR TV SET



APPLICATION FOR CASCADE CONNECTING



16PIN PLASTIC DIP (300 mil)



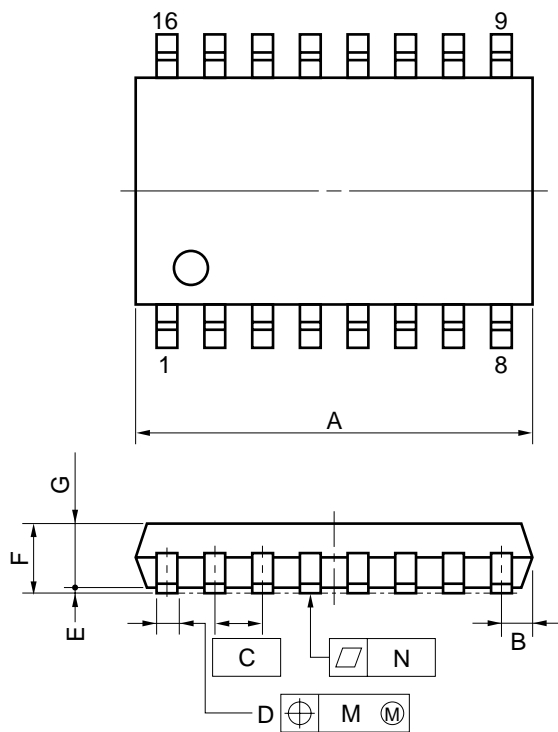
NOTES

- 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.

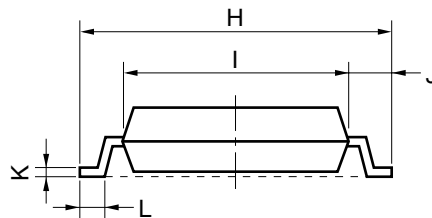
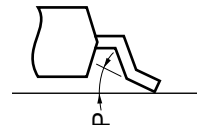
ITEM	MILLIMETERS	INCHES
A	20.32 MAX.	0.800 MAX.
B	1.27 MAX.	0.050 MAX.
C	2.54 (T.P.)	0.100 (T.P.)
D	0.50±0.10	0.020 ^{+0.004} _{-0.005}
F	1.2 MIN.	0.047 MIN.
G	3.5±0.3	0.138±0.012
H	0.51 MIN.	0.020 MIN.
I	4.31 MAX.	0.170 MAX.
J	5.08 MAX.	0.200 MAX.
K	7.62 (T.P.)	0.300 (T.P.)
L	6.4	0.252
M	0.25 ^{+0.10} _{-0.05}	0.010 ^{+0.004} _{-0.003}
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 ^{+0.10} _{-0.05}	0.016 ^{+0.004} _{-0.003}
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 ^{+0.10} _{-0.05}	0.008 ^{+0.004} _{-0.002}
L	0.6±0.2	0.024 ^{+0.008} _{-0.009}
M	0.12	0.005
N	0.10	0.004
P	3° ^{+7°} _{-3°}	3° ^{+7°} _{-3°}

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]

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.

M4 96.5