To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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RENESAS

OMPOUND FIELD EFFECT POWER TRANSISTOR
μPA1601

MONOLITHIC POWER MOS FET ARRAY

DESCRIPTION

The μPA1601 is Monolithic N-channel Power MOS FET Array that built in 7 circuits and resistance designed for LED, Relay, Thermal Head, and so on.

FEATURES

- Direct driving is possible by standard Logic IC or Microcomputer. (4 V driving is possible)
- Output Voltage: V_O = 30 V MAX.
  Output Current: I_O = 500 mA MAX.
- R_{on} = 3 Ω TYP. at: I_O = 150 mA, V_I = 4 V
- Large Operation Temperature: –40 to +85 °C

ORDERING INFORMATION

Part Number	Package	Quality Grade
μPA1601CX	16-Pin DIP	Standard
μPA1601GS	16-Pin SOP	Standard

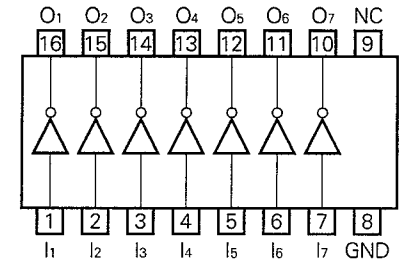
Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

Output Voltage	$V_{O(DC)}$	30	V
Output Peak Voltage*	$V_{O(peak)}$	50	V
Input Voltage	V_I	–0.5 to +20	V
Output Current (DC)	$I_{O(DC)}$	430	mA/unit
Output Current (pulse)**	$I_{O(pulse)}$	500	mA/unit
Input Current	I_I	±10	mA/unit
Total Power Dissipation	P_T	1.0	W/PKG
Operating Temperature	T_{opt}	–40 to +85	°C
Storage Temperature	T_{stg}	–55 to +150	°C

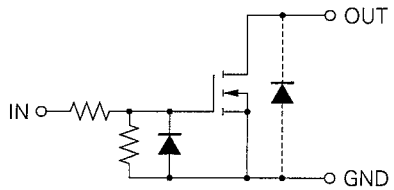
* PW ≦ 10 ms, Duty Cycle ≦ 10 %
** PW ≦ 10 ms, Duty Cycle ≦ 30 %

CONNECTION DIAGRAM



I : Input
O : Output

Equivalent Circuits (1 unit)



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Date Published March 1994 M
Printed in Japan

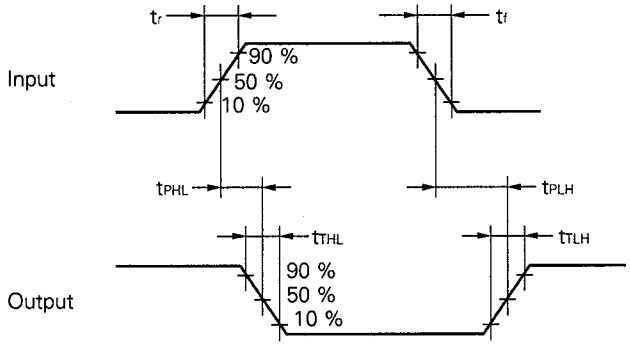
RECOMMENDED OPERATING CONDITIONS (T_a = −40 to +85 °C)

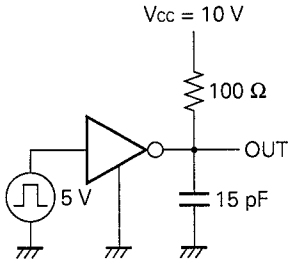
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Output Voltage	$V_{O(DC)}$			24	V	
Output Current	I_O			270	mA/unit	DC, 1 circuit
	$I_{O(pulse)}$			200	mA/unit	PW ≦ 10 ms, Duty Cycle ≦ 25 %, 7 circuits
Input Voltage	V_I	0		15	V	
High-Level Input Voltage	V_{IH}	2			V	
Low-Level Input Voltage	V_{IL}			0.8	V	

ELECTRICAL CHARACTERISTICS (T_a = 25 °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Output Leakage Current	$I_{O(OFF)}$			10	μA	V_I = 0, V_O = 30 V
Output On-state Resistance	R_{on}		3	5.3	Ω	V_I = 4 V, I_O = 150 mA
Output On-state Voltage	$V_{O(ON)1}$			0.2	V	V_I = 5 V, I_O = 10 mA
	$V_{O(ON)2}$			0.8	V	V_I = 5 V, I_O = 150 mA
Input Voltage	$V_{I(OFF)}$			0.8	V	V_O = 50 V, I_O = 100 μA
	$V_{I(ON)1}$	2			V	V_O = 0.8 V, I_O = 1 mA
	$V_{I(ON)2}$	4			V	V_O = 0.8 V, I_O = 150 mA
Input Current	I_{IH}			2	mA	V_I = 20 V, V_O = 0 V
	I_{IL}			−1	μA	V_I = 0 V, V_O = 50 V
Input Capacitance	C_{iss}		15		pF	V_I = 0 V V_O = 10 V f = 1 MHz
Output Capacitance	C_{oss}		18		pF	
Reverse Transfer Capacitance	C_{rss}		34		pF	
Delay Time	t_{PHL}		10		ns	V_{CC} = 10 V, R_L = 100 Ω C_L = 15 pF t_r, t_f ≦ 5 ns See Fig. 1
	t_{PLH}		110		ns	
Rise Time	t_{TLH}		90		ns	
Fall Time	t_{THL}		20		ns	

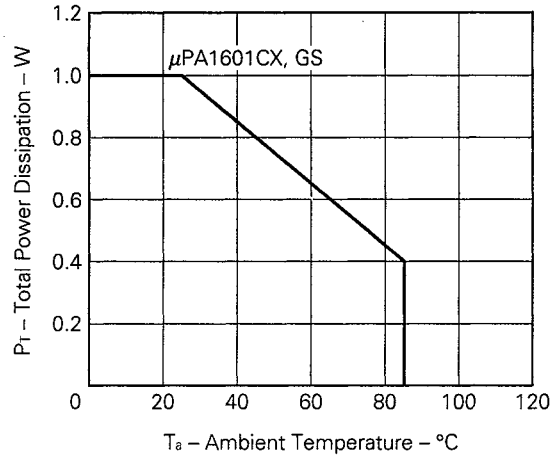
Fig. 1 Switching Wave Forms and Test Circuits



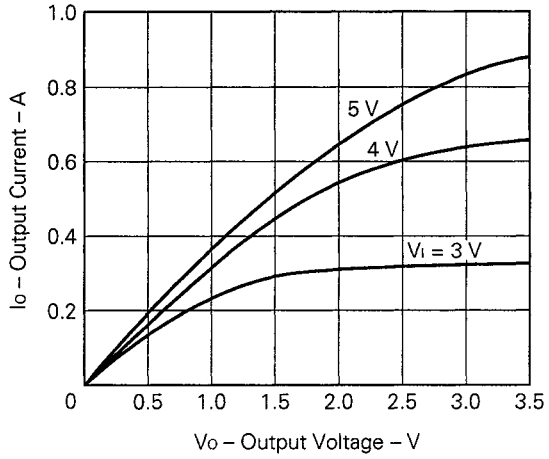


TYPICAL CHARACTERISTICS (T_a = 25 °C)

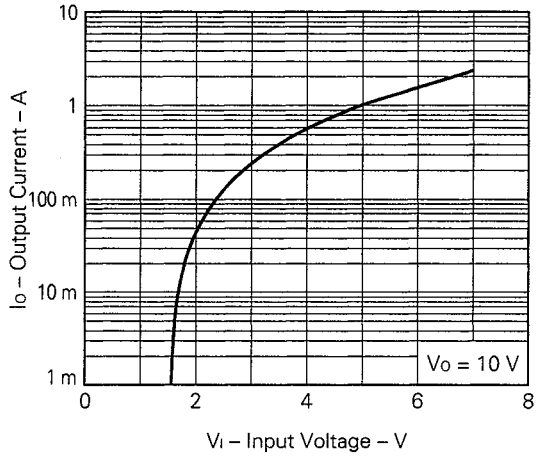
P_T – T_a Characteristic



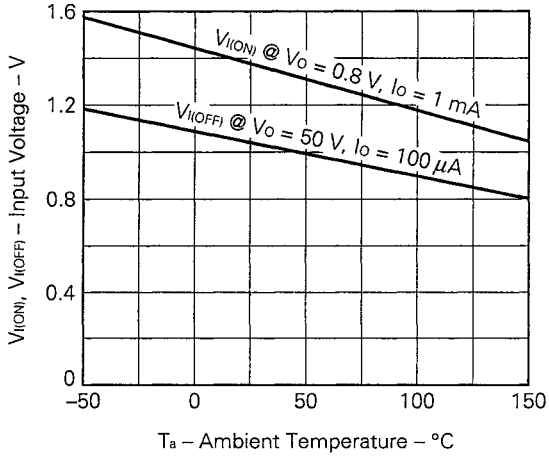
I_O – V_O Characteristic



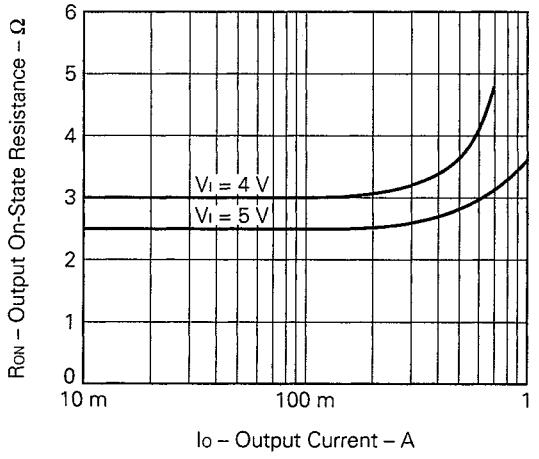
I_O – V_I Characteristic



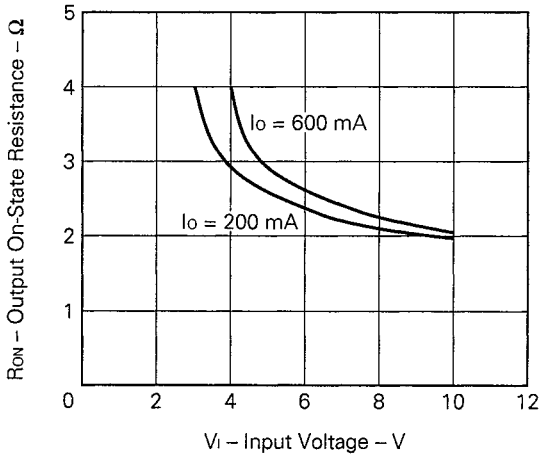
$V_{I(ON)}$, $V_{I(OFF)}$ – T_a Characteristic



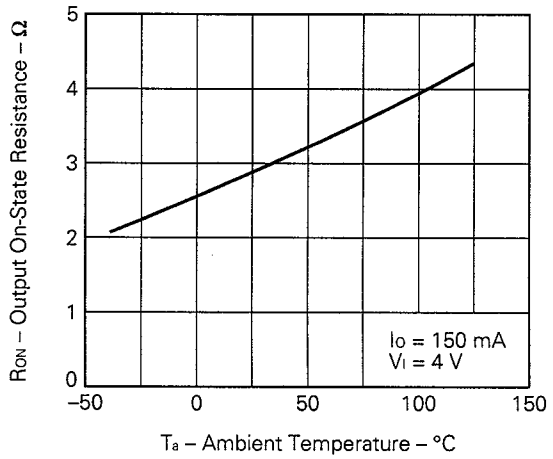
R_{ON} – I_O Characteristic



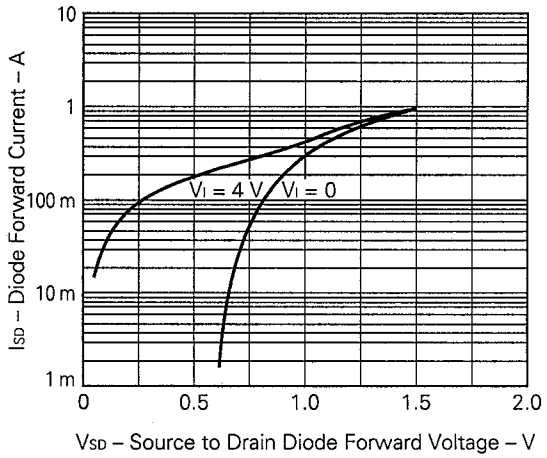
R_{ON} – V_I Characteristic



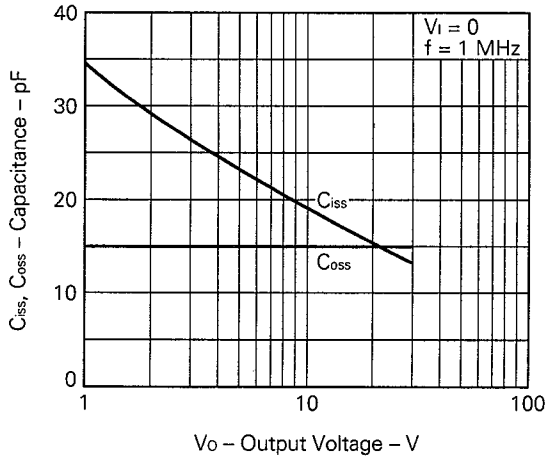
R_{ON} – T_a Characteristic



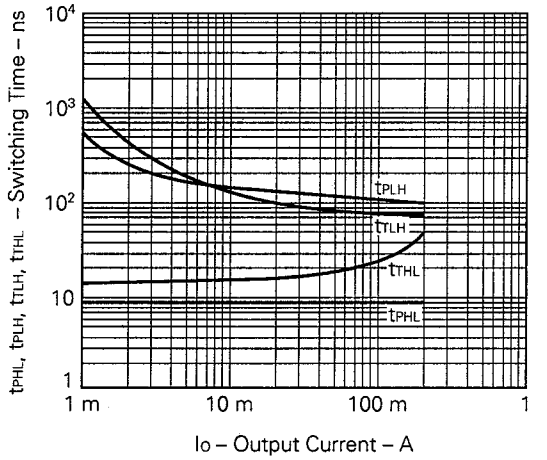
I_{SD} – V_{SD} Characteristic



C_{iss}, C_{oss} – V_O Characteristic



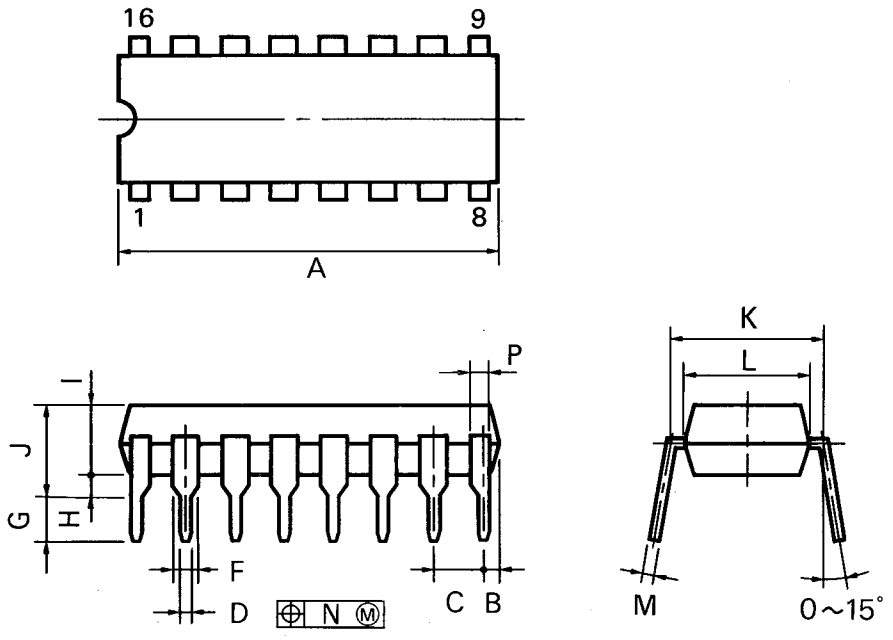
t_{PHL}, t_{PLH}, t_{THL}, t_{TLH} – I_O Characteristic



PACKAGE DIMENSIONS

• μPA1601CX

16PIN PLASTIC DIP (300 mil)



P16C-100-300A,C

NOTES

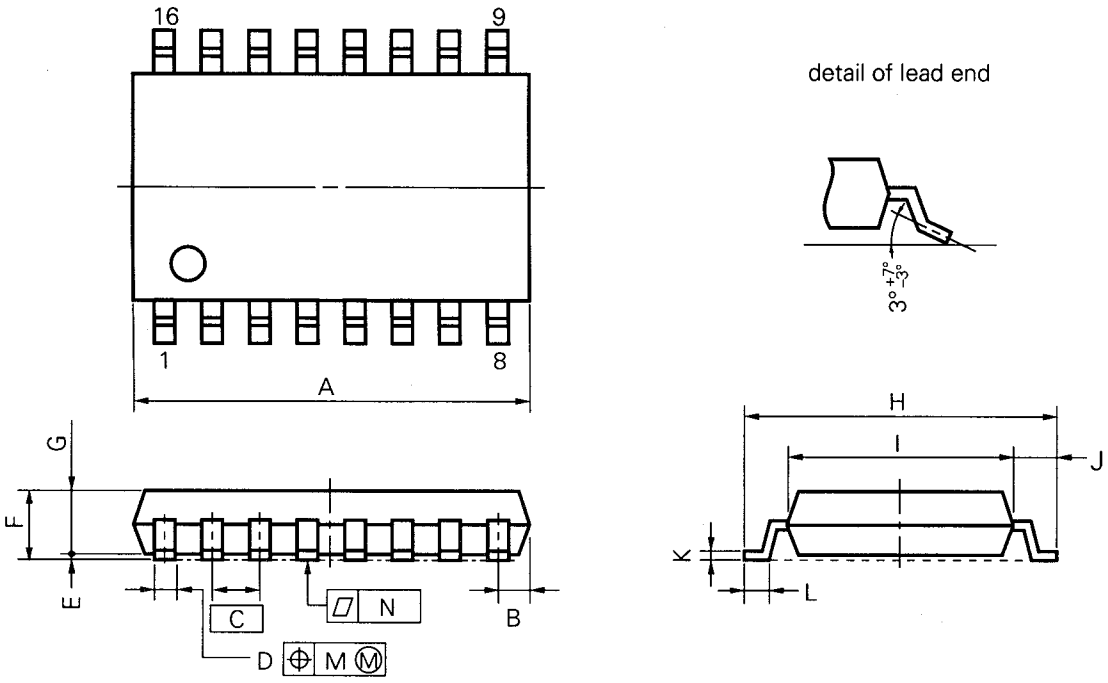
1) Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.

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	$0.50^{\pm 0.10}$	$0.020^{+0.004}_{-0.005}$
F	1.2 MIN.	0.047 MIN.
G	$3.5^{\pm 0.3}$	$0.138^{\pm 0.012}$
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.

• μPA1601GS

16 PIN PLASTIC SOP (300 mil)



P16GM-50-300B-3

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

RECOMMENDED SOLDERING CONDITIONS

The following conditions (see table below) must be set when soldering this product.

Please consult with our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

TYPES OF SURFACE MOUNT DEVICE

For more details, refer to our document "SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL" (IEI-1207).

μPA1601GS

Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak package's surface temperature: 235 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow process: Inside of 2 times, Exposure limit*: None	IR35-00-1
VPS	Peak package's surface temperature: 215 °C or below, Reflow time: 40 seconds or below (200 °C or higher), Number of reflow process: Inside of 2 times, Exposure limit*: None	VP15-00-2
Wave soldering	Solder temperature: 260 °C or below, Flow time: 10 seconds or below, Number of flow process: 1, Exposure Limit*: None	WS60-00

*: Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65 % or less.

Note: Do not apply more than a single process at once, except for "Partial heating method".

TYPES OF THROUGH HOLE MOUNT DEVICE

μPA1601CX

Soldering process	Soldering conditions	Symbol
Wave soldering	Solder temperature: 260 °C or below, Flow time: 10 seconds or below	

Reference

Document name	Document No.
Quality control of NEC semiconductors devices.	TEI-1202
Quality control guide of semiconductors devices.	MEI-1202
Assembly manual of semiconductors devices.	IEI-1207
Semiconductor device package manual	IEI-1213
SMD surface mount technology manual	IEI-1207

[MEMO]

M4 92.6