To our customers,

Old Company Name in Catalogs and Other Documents

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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

MOS INTEGRATED CIRCUIT

μPD166104

DUAL N-CANNEL LOW SIDE INTELLIGENT POWER DEVICE

The μPD166104 is a high voltage, dual output, and N-cannel low side intelligent power device with built-in overheat protection and overcurrent limitation circuits. It protects itself by shutting down or limiting current when it detects overheat or overcurrent. Output MOS shut down is restarted automatically by cooling of the chip temperature.

FEATURES

- High voltage dual output low side driver
- Built-in overcurrent limitation circuits and overheat protection circuits
  - Shuts down by overheat detection
  - Restarts automatically after cooling
- Built-in dynamic clamping circuit (100 V Min.)
- Low on-state resistance
- Small 20-pin SOP package

ORDERING INFORMATION

Part Number	Lead plating	Packing	Package	Remark
μPD166104GS-E1-AZ	Sn-Bi	Tape 2500 p/reel	20-pin plastic SOP (7.62 mm (300))	Lead-free product
μPD166104GS-E2-AZ	Sn-Bi	Tape 2500 p/reel	20-pin plastic SOP (7.62 mm (300))	Lead-free product

QUALITY GRADE

Part Number	Quality Grade
μPD166104GS-E1-AZ	Special
μPD166104GS-E2-AZ	Special

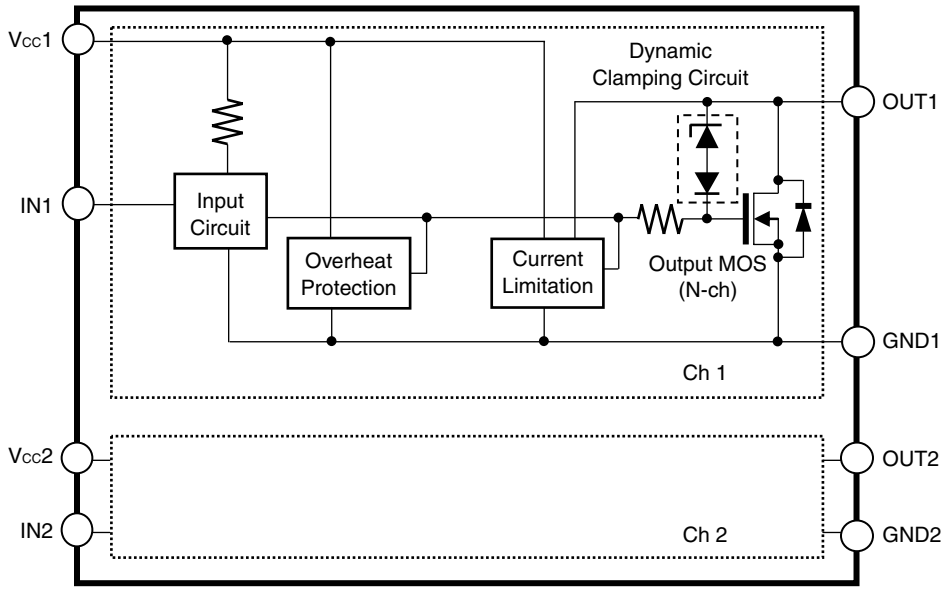
Please refer to "Quality Grades on NEC Semiconductor Devices" (Document No. C11531E) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

APPLICATION

- Injector driver

Document No. S18753EJ1V0DS00 (1st edition)
Date Published June 2007 NS
Printed in Japan

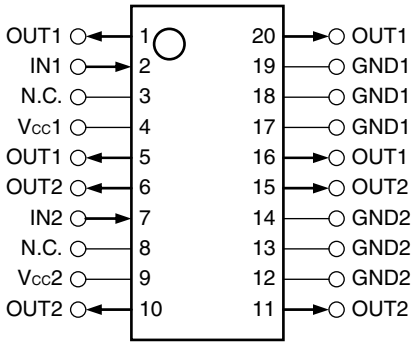
BLOCK DIAGRAM



PIN CONFIGURATION

- **20-pin plastic SOP (7.62 mm (300))**

Top View



Pin Name

Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
1	OUT1	6	OUT2	11	OUT2	16	OUT1
2	IN1	7	IN2	12	GND2	17	GND1
3	N.C.	8	N.C.	13	GND2	18	GND1
4	Vcc1	9	Vcc2	14	GND2	19	GND1
5	OUT1	10	OUT2	15	OUT2	20	OUT1

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Rating	Unit
Input voltage	V_{IN}		–1.5 to +7	V
Power supply voltage	$V_{CC}1$		–0.5 to +18	V
	$V_{CC}2$	1 s	35	V
Output voltage	V_{OUT}	Except the clamping voltage at the flyback time	100	V
Output current	$I_{O\,(DC)}$	V_{IN} = 5 V, DC	SELF LIMITED	A/ch
Power dissipation	P_D	Ta = 25 °C, both channels are ON [Note]	2.5	W
Channel temperature	Tch		150	°C
Storage temperature	Tstg		–55 to +150	°C

Note When mounted on 50 mm x 50 mm x 1.5 mm epoxy PCB FR4 substrate with 600 mm^2 x 70 μm copper foil.

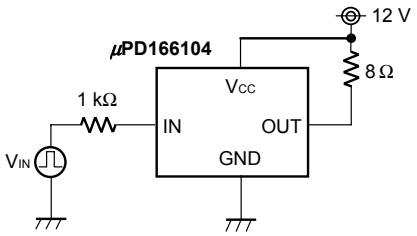
Caution Product quality may suffer if the absolute maximum rating is exceeded even momentarily for any parameters. That is, the absolute maximum ratings are rated values at which the product is on the verge of suffering physical damage, and therefore the product must be used under conditions that ensure that the absolute maximum ratings are not exceeded.

The ratings and conditions indicated for DC characteristics and AC characteristics represent the quality assurance range during normal operation.

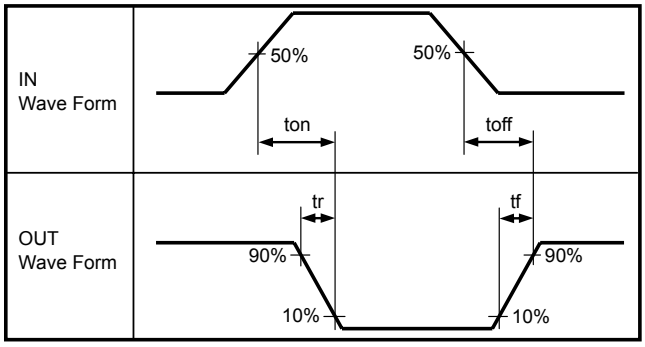
ELECTRICAL SPECIFICATIONS (V_{CC} = 5 to 18 V, Tch = –40 to 150 °C, unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
High level input voltage	V_{IH}	Rin = 1 kΩ, V_{DS} = 0.3 V, I_O = 1.4 A	3.0			V
Low level input voltage	V_{IL}	Rin = 1 kΩ, V_{DS} = 20 V, I_O = 1 mA			1.5	V
High level input current	I_{IH}	V_{IN} = 5.5 V, V_{DS} = 0 V			300	μA
Low level input current	I_{IL}	V_{IN} = 0 V, V_{DS} = 20 V	–10		+10	μA
Power supply current	$I_{CC}1$	V_{CC} = 16 V, ON condition			10.0	mA/ch
	$I_{CC}2$	V_{CC} = 16 V, OFF condition			10.0	mA/ch
Output ON state resistance	$R_{DS}(on)1$	I_o = 1.4 A, Tch = 25 °C, V_{IN} = V_{IH}, V_{CC} = 16 V		64	91	mΩ
	$R_{DS}(on)2$	I_o = 1.4 A, Tch = 150 °C, V_{IN} = V_{IH}, V_{cc} = 16 V		107	146	mΩ
Turn on time	ton	V_{IN} = 0→5 V, Rin = 1 kΩ, RL = 8 Ω, V_{CC} = 12 V, Tch = 0 to 150 °C	3.5		35	μs
Rise time	tr				35	μs
Turn off time	toff	V_{IN} = 5→0 V, Rin = 1 kΩ, RL = 8 Ω, V_{CC} = 12 V, Tch = 0 to 150 °C			30	μs
Fall time	tf				15	μs
Output leak current	I_{DSS}	V_{IN} = 0 V, V_{DS} = 18 V			350	μA
Clamp voltage	V_{OUT}	I_O = 10 mA, Tch = 25 °C, V_{IN} = 0 V	100		130	V
Temperature characteristics of clamp voltage	ΔV_Z	I_O = 1.4 A, V_{IN} = V_{IL}, L = 1mH		130		mV/°C
Overheat detection temperature	T_{HI}		150			°C
Current limitation	I_{LIM}		1.7			A

Switching mesurement circuit



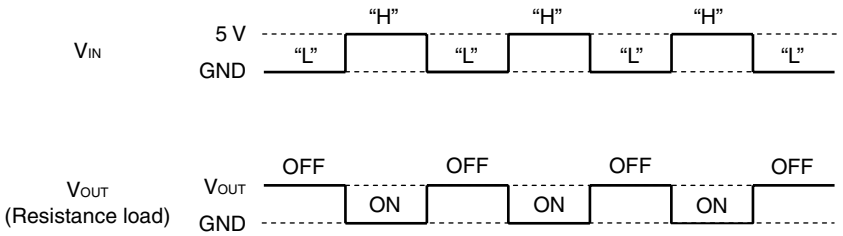
Switching measurement waveform



• Input circuit (On/Off control)

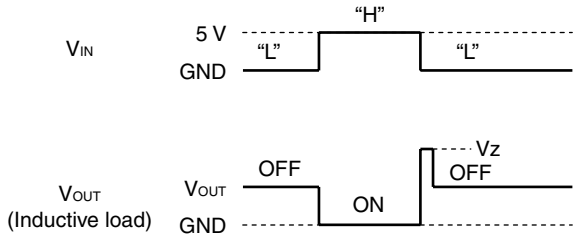
Output MOS turns on when the high-level input voltage (3.0 V or more) is applied to IN terminal.

Output MOS turns off when the low-level input voltage (1.5 V or less) is applied to IN terminal.



• Dynamic clamp circuit

This circuit is for protection of output and other circuits from the overvoltage by back electromotive force when inductive load turns off. The clamp diode is connected between drain and gate of output. Output voltage is clamped by this circuit when the voltage of the OUT terminal exceeded the output clamping voltage.



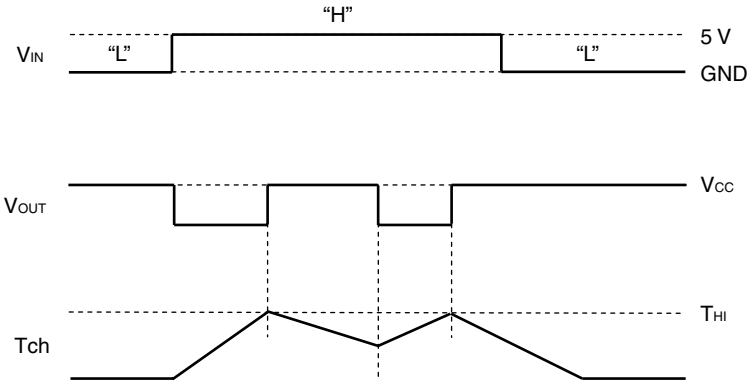
• Current limitation circuit

This circuit prevents destruction from the overcurrent when the short-circuit occurs. When the overcurrent flows to the OUT terminal such as short-circuit condition, the output current is limited.

Power supply voltage to OUT terminal should be 18 V or less when the short-circuit occurs.

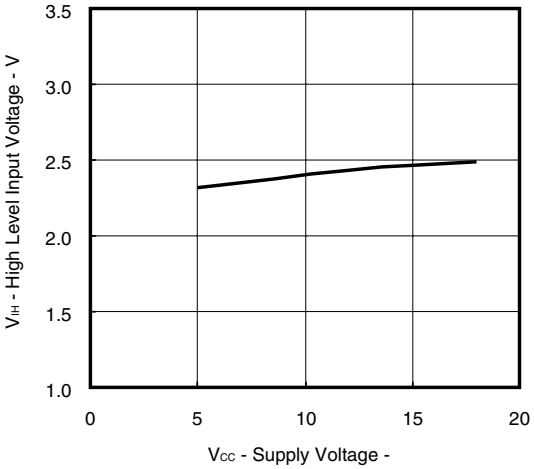
• Overheat protection circuit

This circuit prevents destruction from overheat. The channel temperature of the output is monitored and the output is shut down when overheat is detected. Output restarts automatically after the channel cooled down.

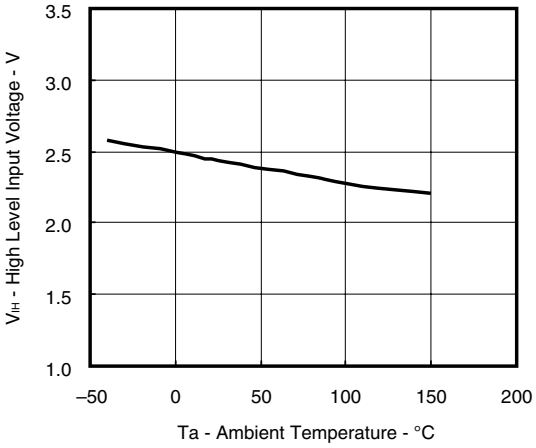


TYPICAL CHARACTERISTICS

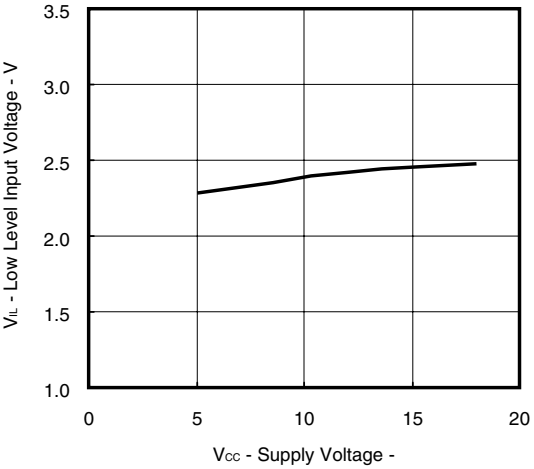
HIGH LEVEL INPUT VOLTAGE vs.
SUPPLY VOLTAGE



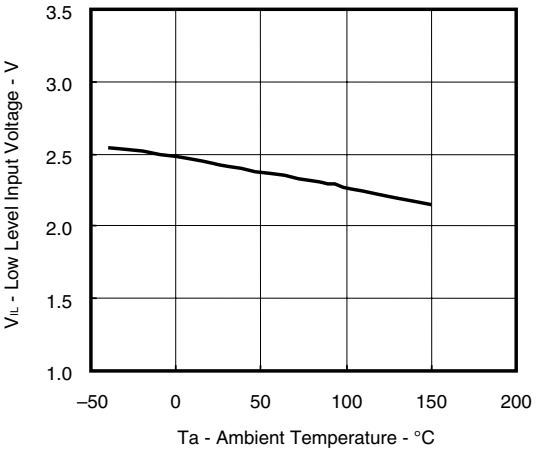
HIGH LEVEL INPUT VOLTAGE vs.
AMBIENT TEMPERATURE



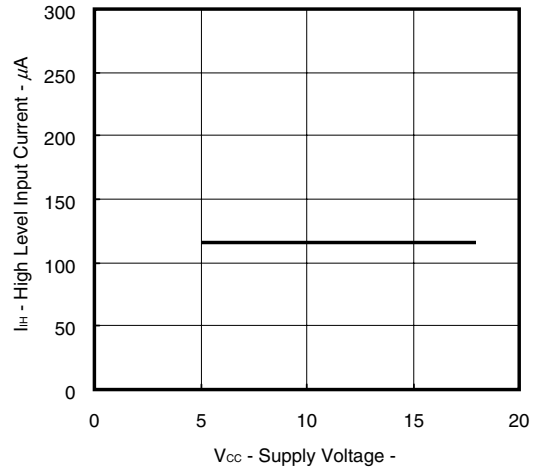
LOW LEVEL INPUT VOLTAGE vs.
SUPPLY VOLTAGE



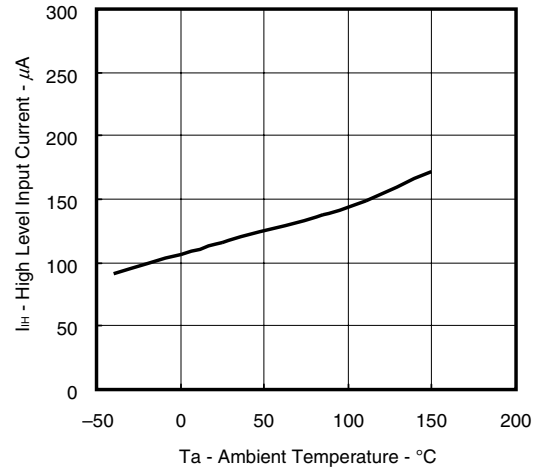
LOW LEVEL INPUT VOLTAGE vs.
AMBIENT TEMPERATURE



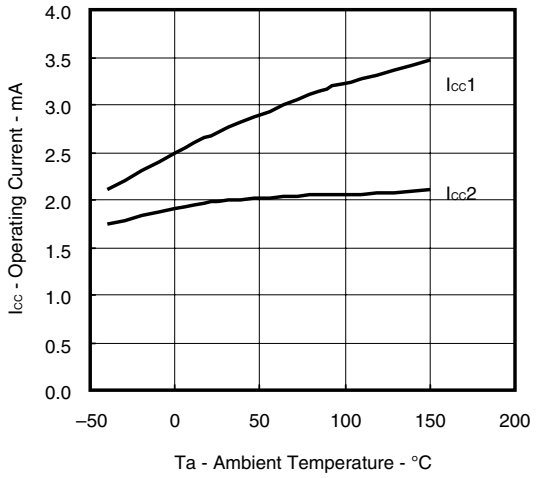
HIGH LEVEL INPUT CURRENT vs.
SUPPLY VOLTAGE



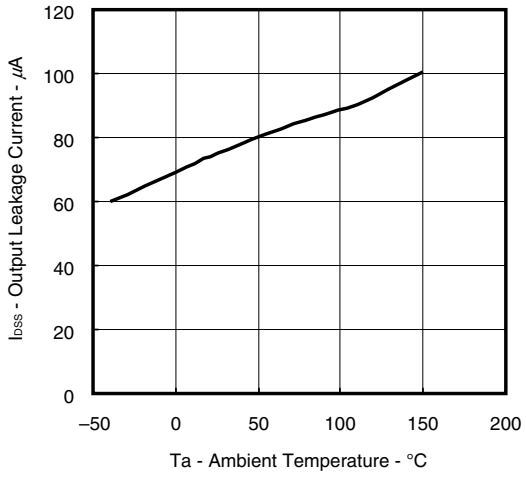
HIGH LEVEL INPUT CURRENT vs.
AMBIENT TEMPERATURE



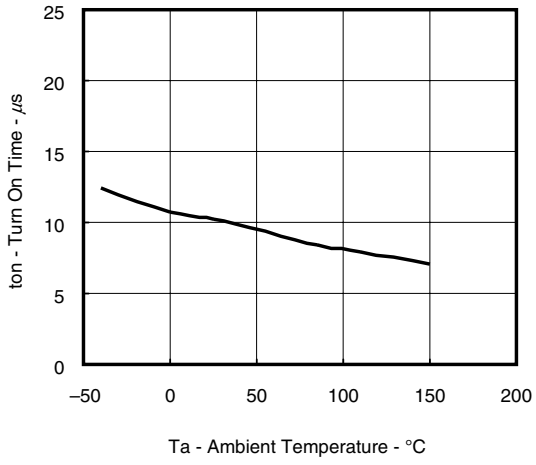
OPERATING CURRENT vs.
AMBIENT TENPERATURE



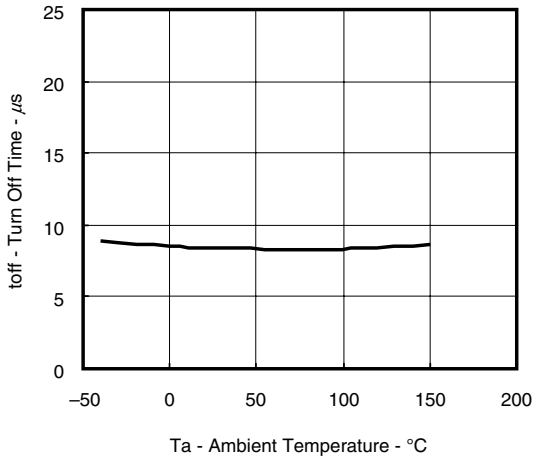
OUTPUT LEAKAGE CURRENT vs.
AMBIENT TEMPERATURE



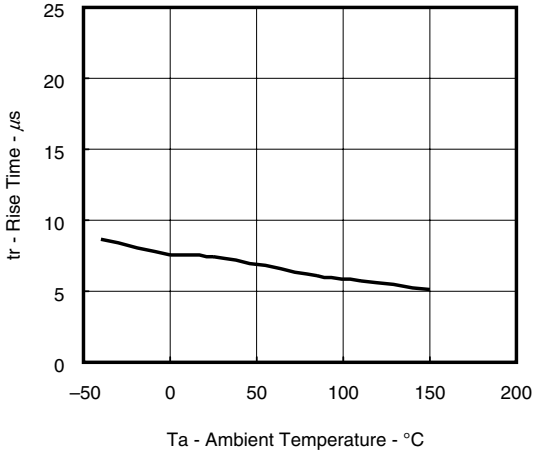
TURN ON TIME vs.
AMBIENT TEMPERATURE



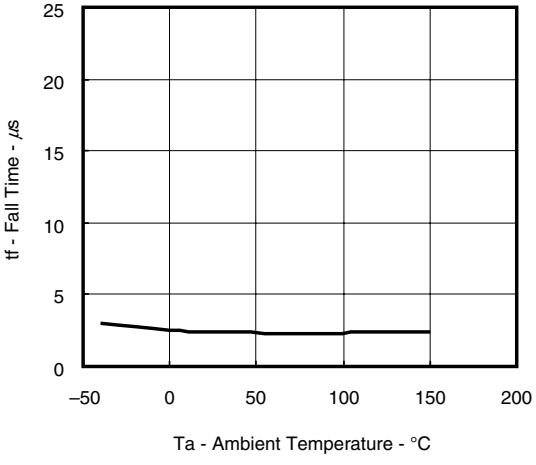
TURN OFF TIME vs.
AMBIENT TEMPERATURE



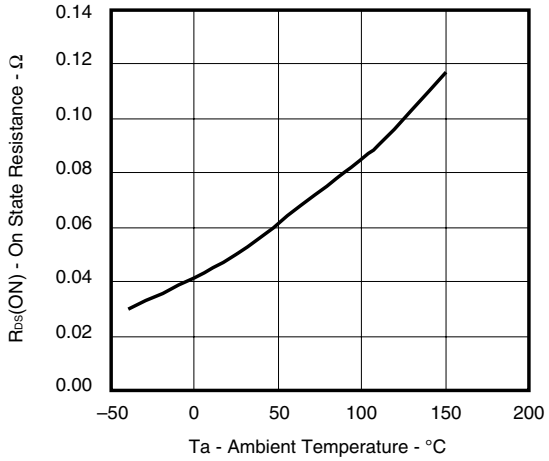
RISE TIME vs.
AMBIENT TEMPERATURE



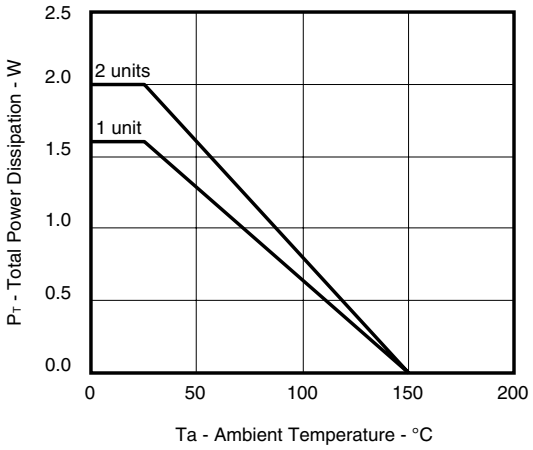
FALL TIME vs.
AMBIENT TEMPERATURE



ON STATE RESISTANCE vs.
AMBIENT TEMPERATURE

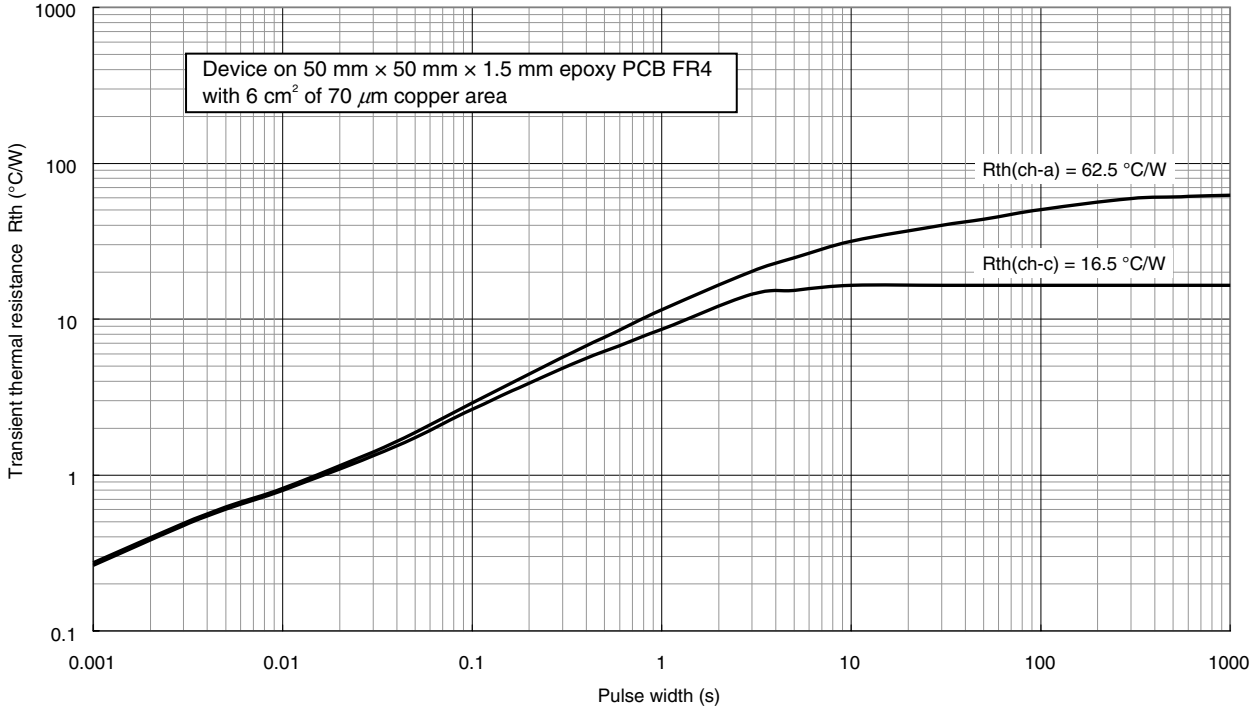


TOTAL POWER DISSIPATION vs.
AMBIENT TEMPERATURE

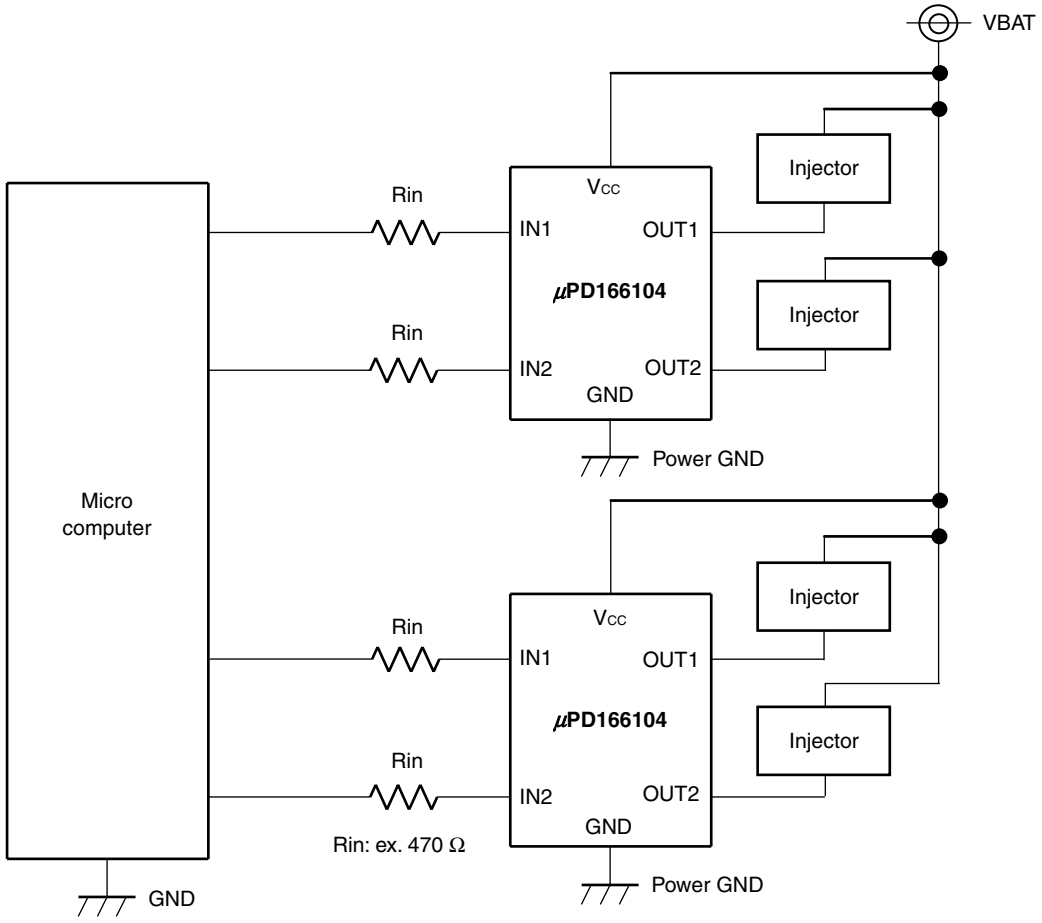


TRANSIENT THERMAL RESISTANCE CHARACTERISTICS

TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



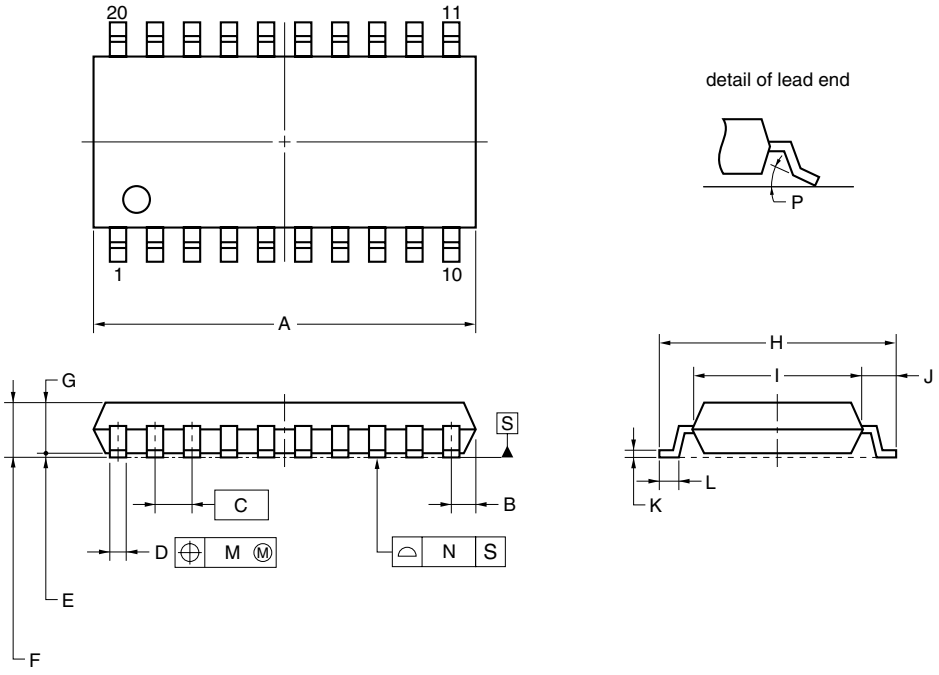
APPLICATION EXAMPLE



Caution This application circuit is example and not intended for use in actual mass production design.

PACKAGE DRAWING

20-PIN PLASTIC SOP (7.62 mm (300))



NOTE

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

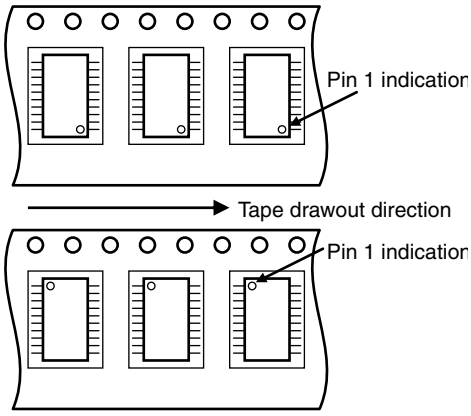
ITEM	MILLIMETERS
A	12.7±0.3
B	0.78 MAX.
C	1.27 (T.P.)
D	$0.42^{+0.08}_{-0.07}$
E	0.1±0.1
F	1.8 MAX.
G	1.55±0.05
H	7.7±0.3
I	5.6±0.2
J	1.1
K	$0.22^{+0.08}_{-0.07}$
L	0.6±0.2
M	0.12
N	0.10
P	$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$

P20GM-50-300B, C-7

TAPING INFORMATION

There are two types (E1, E2) of directions of the device in the career tape.

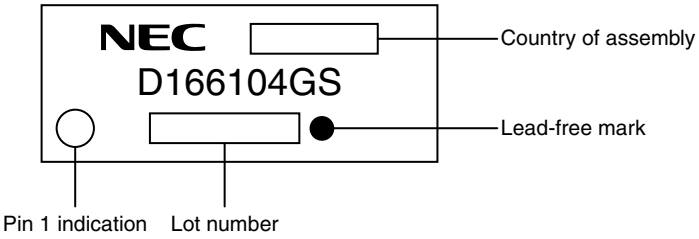
E1: Pin 1 of the device faces toward the open end of the tape, away from the reel



E2: Pin 1 of the device faces away from the open end of the tape, toward the reel

MARKING INFORMATION

This figure indicates the marking items and arrangement. However, details of the letterform, the size and the position aren't indicated.



RECOMMENDED SOLDERING CONDITIONS

The μPD166104 should be soldered and mounted under the following recommended conditions.

For soldering methods and conditions other than those recommended below, contact an NEC Electronics sales representative.

For technical information, see the following website.

Semiconductor Device Mount Manual (http://www.necel.com/pkg/en/mount/index.html)

- μPD166104GS-E1-AZ: 20-pin plastic SOP (7.62 mm (300))
- μPD166104GS-E2-AZ: 20-pin plastic SOP (7.62 mm (300))

Soldering Method	Soldering Conditions	Symbol
Infrared reflow	Peak package's surface temperature: 260 °C, Reflow time: 60 seconds or less (220 °C or higher), Maximum allowable number of reflow processes: 3, Exposure limit [Note]: 7 days (10 to 72 hours pre-backing is required at 125C° afterwards), Flux: Rosin flux with low chlorine (0.2 Wt% or below) recommended. <Caution> Non-heat-resistant trays, such as magazine and taping trays, cannot be baked before unpacking.	IR60-107-3
Partial heating method	Pin temperature: 350°C or below, Heat time: 3 seconds or less (per each side of the device) , Flux: Rosin flux with low chlorine (0.2 Wt% or below) recommended.	–

Note The Maximum number of days during which the product can be stored at a temperature of 5 to 25°C and a relative humidity of 20 to 65% after dry-pack package is opened.

[MEMO]

[MEMO]

[MEMO]

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