

R2A20131SP

R03DS0032EJ0200

Rev.2.00

Mar 05, 2012

Continuous Conduction Mode PFC Control IC

Description

The R2A20131 is power factor correction control IC of continuous conduction mode.

The R2A20131 is built in Load Tracing Boost, Brownout, Over Voltage Protection, Over Current Protection, FeedBack loop Open detection and Power Good Function.

Load tracing boost function bring improvement of efficiency at light load with few external parts.

The feedback loop open detection, and over current protection are built in the R2A20131, and can constitute a power supply system of high reliability with few external parts.

Power Good Function monitors PFC output voltage and can adjust no-good level.

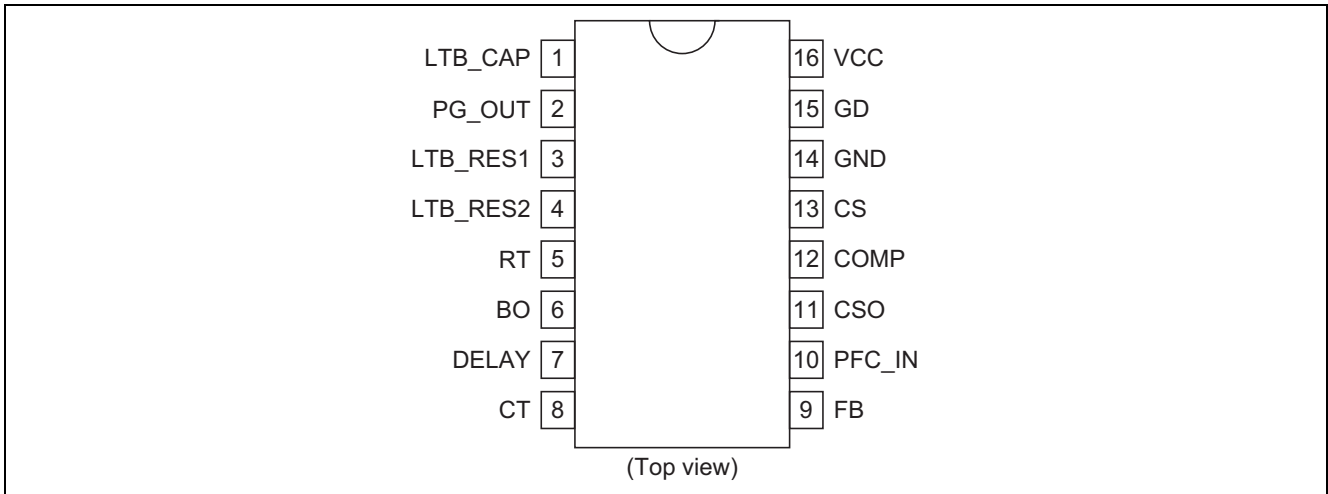
Features

- Absolute Maximum Ratings
 - Supply voltage V_{cc} : 24 V
 - Operating junction temperature T_{jopr} : -40 to +150°C
- Electrical Characteristics
 - Error amplifier reference voltage V_{fb} : $2.51\text{ V} \pm 1.5\%$
 - UVLO operation start voltage V_{uvlh} : $10.5\text{ V} \pm 0.7\text{ V}$
 - UVLO operation shutdown voltage V_{uvll} : $9.3\text{ V} \pm 0.5\text{ V}$
 - UVLO hysteresis voltage H_{ysuvl} : $1.2\text{ V} \pm 0.5\text{ V}$
- Functions
 - Boost converter control with continuous conduction mode
 - Load Tracing Boost (LTB) function: V_{out} is decreased at light load and AC 100 V system.
 - Brownout function
 - Over Voltage Protection
 - Feedback loop Open detection
 - Over Current Protection
 - Power good information (Open drain output)
 - Package: Pb-free SOP-16
This Device uses Halogen-Free Molding Compound

Ordering Information

Part No.	Package Name	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
R2A20131SP#W0	—	PRSP0016DH-B	SP	W (2,000 pcs/reel)

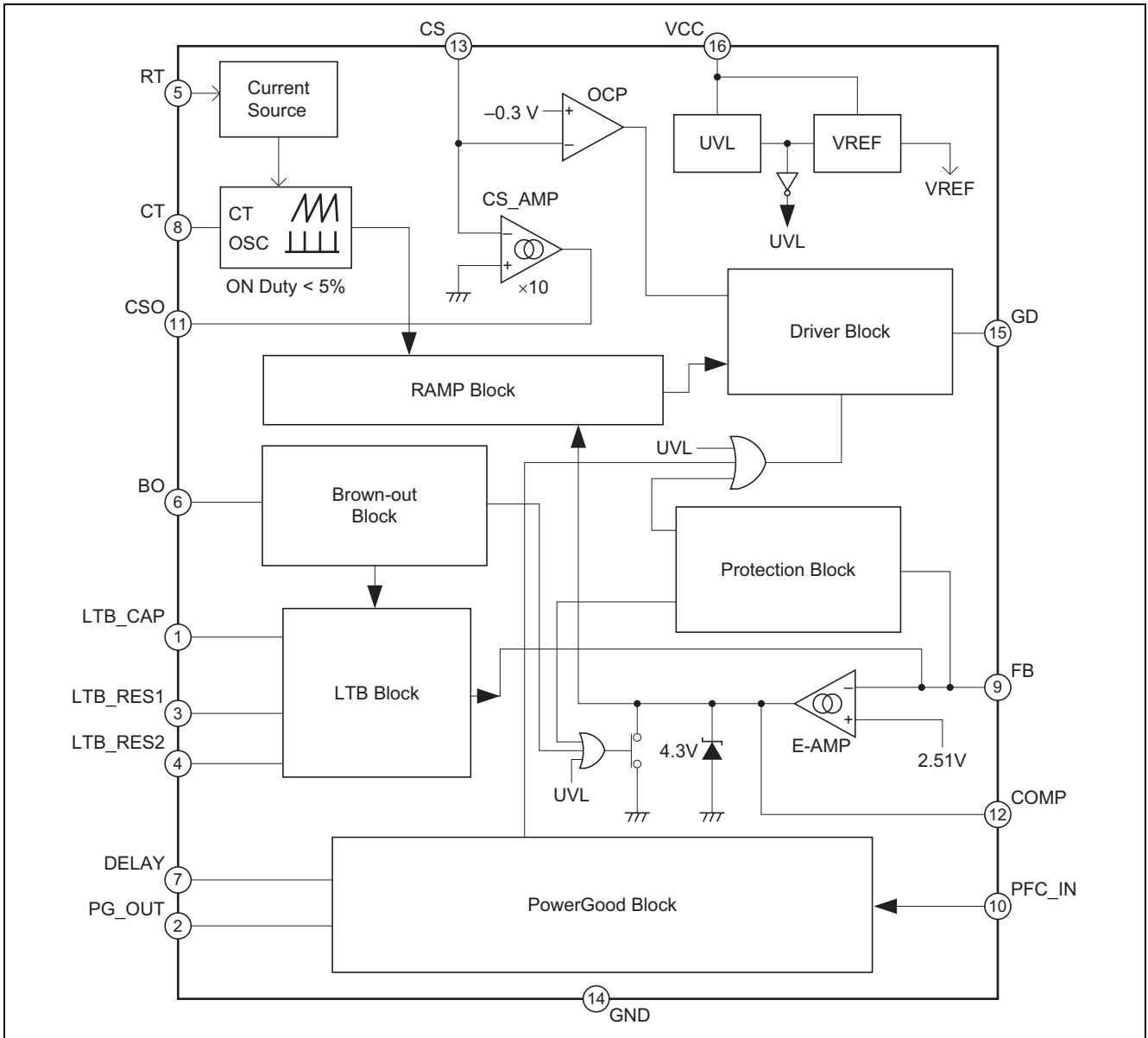
Pin Arrangement



Pin Functions

Pin No.	Pin Name	Input/Output	Function
1	LTB_CAP	Input	Load tracing boost stability capacitor connection terminal
2	PG_OUT	Output	Power Good Output terminal for house keeping
3	LTB_RES1	Output	Load tracing boost adjust resistor connection terminal1
4	LTB_RES2	Output	Load tracing boost adjust resistor connection terminal2
5	RT	Input/Output	Oscillator frequency setting and internal bias current setting terminal
6	BO	Input	Brownout input terminal
7	DELAY	Input/Output	PG_OUT ON Delay adjustable terminal
8	CT	Output	Oscillator frequency setting terminal
9	FB	Input	Error amplifier input terminal
10	PFC_IN	Input	Power Good detection terminal
11	CSO	Output	Current amplifier output terminal
12	COMP	Output	Error amplifier output terminal
13	CS	Input	Current detection terminal
14	GND	—	Ground
15	GD	Output	Power MOSFET drive terminal
16	VCC	Input	Supply voltage terminal

Block Diagram



Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit	Note
Supply voltage	VCC	-0.3 to +24	V	
GD sink current	Isnk-gd	1.2	A	3
GD source current	Isrc-gd	-0.8	A	3
GD DC sink current	Idc-snk-gd	0.12	A	
GD DC source current	Idc-src-gd	-80	mA	
CS terminal voltage	Vt-cs	-5 to +0.3	V	
BO terminal current	Ibom	300	μA	
RT terminal current	Irt	-200	μA	
COMP terminal current	Icomp	±1	mA	
LTB_RES terminal current	Iltb_res	-100	μA	
PG_OUT terminal current	Ipg_out	25	mA	
Terminal voltage	Vt-group	-0.3 to +5.5	V	4
Terminal voltage2	Vt-group2	-0.3 to VCC	V	5
Terminal voltage3	Vt-group3	-0.3 to +24	V	6
Power dissipation	Pt	1	W	7
Operating junction temperature	Tj-opr	-40 to +150	°C	
Storage temperature	Tstg	-55 to +150	°C	

- Notes:
1. Rated voltages are with reference to the GND terminal.
 2. For rated currents, inflow to the IC is indicated by (+), and outflow by (-).
 3. Shows the transient current when driving a capacitive load.
 4. This is the rated voltage for the following pins:
FB, COMP, BO, RT, CT, LTB_CAP, LTB_RES1, LTB_RES2, CSO, PFC_IN, DELAY
 5. This is the rated voltage for the following pin:
GD
 6. This is the rated voltage for the following pin:
PG_OUT
 7. In case of R2A20131SP (SOP): $\theta_{ja} = 120^{\circ}\text{C/W}$
This value is a thing mounting on $40 \times 40 \times 1.6$ [mm], a glass epoxy board of wiring density 10%.

Electrical Characteristics

(Ta = 25°C, VCC = 12 V, RT = 33 kΩ, PFC_IN = GND, CT = 470 pF, CS = GND, FB = COMP, BO = 4 V, LTB_RES1 = 33 kΩ, LTB_RES2 = 33 kΩ)

	Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Supply	UVLO turn-on threshold	Vuvlh	9.8	10.5	11.2	V	
	UVLO turn-off threshold	Vuvll	8.8	9.3	9.8	V	
	UVLO hysteresis	Hysuvl	0.7	1.2	1.7	V	
	Standby current	Istby	—	100	180	μA	VCC = 8.9 V
	Operating current	Icc	—	2.5	4	mA	
Brownout	BO threshold voltage	Vbo	1.35	1.40	1.45	V	
	BO pin hysteresis current	Ibo	(3.3) ×0.92	(3.3)	(3.3) ×1.08	μA	BO = 1 V, RT = 33 kΩ
	BO pin current	Ibo2	0.05	0.15	0.4	μA	BO = 2 V
Error amplifier	Feedback voltage	Vfb	2.472	2.51	2.548	V	FB-COMP short
	Input bias current	Ifb	-0.4	-0.15	-0.05	μA	Measured pin: FB FB = 3 V
	Open loop gain	Av	—	50	—	dB	*1
	Upper clamp voltage	Vclamp_comp	4.0	4.3	—	V	FB = 2.0 V COMP: Open
	Low voltage	Vl-comp	—	0.1	0.3	V	FB = 3.0 V COMP: Open
	Transconductance	gm	100	180	270	μs	FB = 2.5 V COMP: 2.5 V
Oscillator	Initial accuracy	fGD	58.5	65	71.5	kHz	Measured pin: GD
	fout temperature stability	dfout/dTa	—	±0.1	—	%/°C	Ta = -40 to 125°C *1
	fout voltage stability	fout-line	-1.5	0.5	1.5	%	VCC = 12 V to 18 V
	RT voltage	Vrt	1.595	1.65	1.705	V	
Over current protection	OCP threshold voltage	Vocp	-0.315	-0.3	-0.285	V	
	CS bias current	Ics	-130	-100	-60	μA	Measured pin: CS
Current AMP	CSO output voltage	V-cso	0.8	1	1.2	V	CS = -0.1 V
Load tracing boost	Source current	Iltb	(-21.2) ×1.05	(-21.2)	(-21.2) ×0.95	μA	BO = 2V, LTB_CAP = 0 V FB = 2.5 V, PFC_IN = 3 V Measure pin: FB
	High threshold voltage	Vltb-hi	3.2	3.6	4.0	V	Measured pin: BO
	Low threshold voltage	Vltb-lo	2.9	3.2	3.5	V	
POWER GOOD function	PFC_IN threshold voltage 1	Vpfc_in1	2.42	2.5	2.58	V	
	PFC_IN hysteresis current	Ipfc_in1	(-10) ×1.08	(-10)	(-10) ×0.92	μA	PFC_IN = 3 V, RT = 33 kΩ
	PFC_IN current	Ipfc_in2	-0.4	-0.15	-0.05	μA	PFC_IN = 2 V
	PG OUT leak current	Ipgh	—	—	5	μA	PFC_IN = GND VPG_OUT = 5 V
	PG OUT low voltage	Vpgl	—	—	0.4	V	PFC_IN = 3 V PG OUT sink current = 20 mA

Note: *1 Design spec

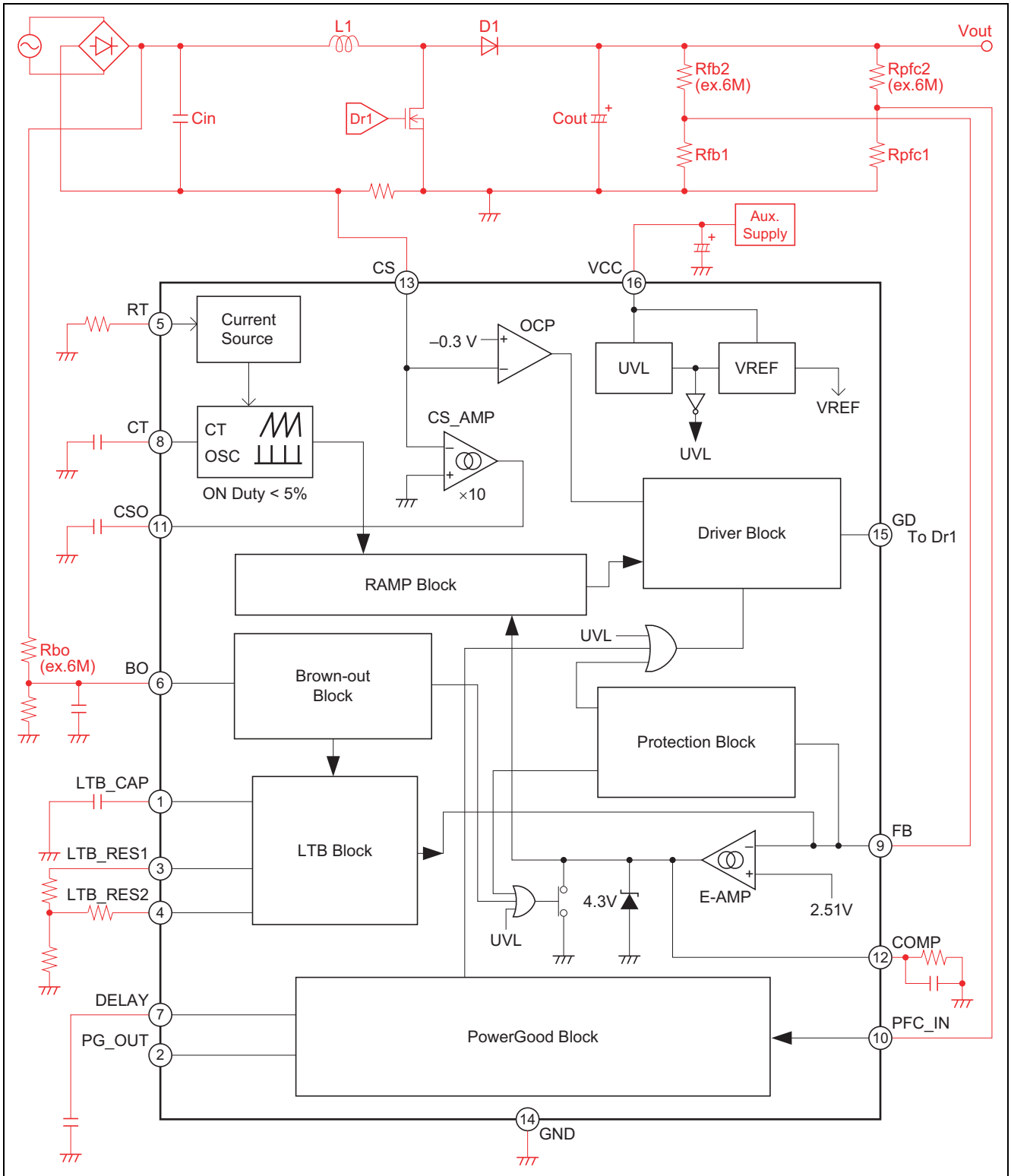
Electrical Characteristics (cont.)

(Ta = 25°C, VCC = 12 V, RT = 33 kΩ, PFC_IN = GND, CT = 470 pF, CS = GND, FB = COMP, BO = 4 V, LTB_RES1 = 33 kΩ, LTB_RES2 = 33 kΩ)

Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Gate drive	Gate drive rise time	tr-gd	—	30	100	ns	GD: 1.2 V to 10.8 V CL = 1000 pF
	Gate drive fall time	tf-gd	—	30	100	ns	GD: 10.8 V to 1.2 V CL = 1000 pF
	Gate drive low voltage	Vol1-gd	—	0.02	0.1	V	Isink = 2 mA
		Vol2-gd	—	0.01	0.2	V	Isink = 1 mA, VCC = 5 V
	Gate drive high voltage	Voh-gd	11.5	11.9	—	V	Isource = -2 mA
	Maximum duty	Dmax	90	95	98	%	COMP: Open, FB = 2 V CSO = GND
Minimum duty	Dmin	—	—	0	%	FB = 2.5 V COMP: GND	
Over voltage protection	OVP threshold voltage	Vovp	VFB× 1.065	VFB× 1.080	VFB× 1.095	V	COMP = 2.5 V
	OVP hysteresis	Hys-ovp	50	100	150	mV	COMP = 2.5 V
	FB low detect threshold voltage	Vfblow	0.25	0.3	0.35	V	COMP = 2.5 V
PG on delay	DELAY threshold voltage	Vdelay	2.85	3	3.15	V	PFC-IN = 3 V
	DELAY charge current	Ichrg-delay	-7	-5	-3	μA	DELAY = 2.5 V, PFC-IN = 3 V

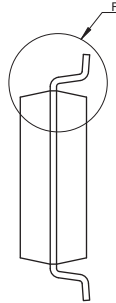
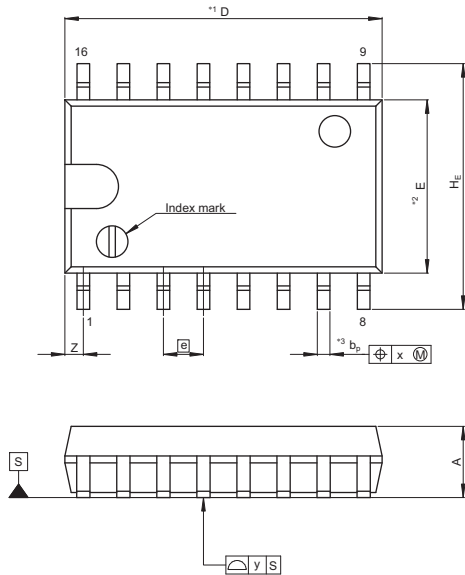
Note: *1 Design spec

System Diagram

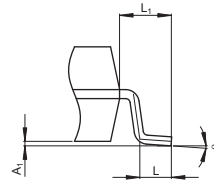
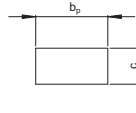


Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP16-5.5x10.06-1.27	PRSP0016DH-B	FP-16DAV	0.24g



Terminal cross section
(Ni/Pd/Au plating)



Detail F

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

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	10.06	10.5
E	—	5.50	—
A ₂	—	—	—
A ₁	0.00	0.10	0.20
A	—	—	2.20
b _p	0.34	0.40	0.46
b ₁	—	—	—
c	0.15	0.20	0.25
c ₁	—	—	—
θ	0°	—	8°
H _E	7.50	7.80	8.00
[e]	—	1.27	—
x	—	—	0.12
y	—	—	0.15
Z	—	—	0.80
L	0.50	0.70	0.90
L ₁	—	1.15	—

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