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**California Eastern Laboratories**

**2016**



APPLICATION BASED  
**OPTOCOUPLER**  
DESIGN GUIDE

[www.cel.com](http://www.cel.com)

**RENESAS**

## Solutions as Easy as 1-2-3

Quickly select the right optocoupler for your application. We made it as simple as **1-2-3** regardless if you are a seasoned engineer or novice.

Simply follow the steps below to find your optocoupler solution:

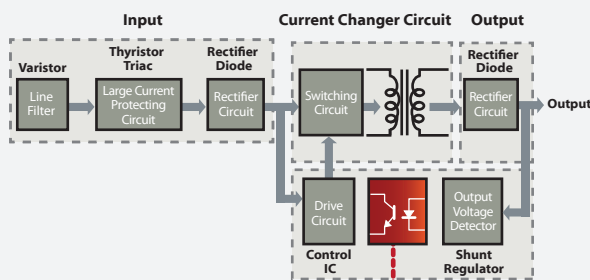
1. Select your application.
2. Look at the block diagram. Follow the corresponding color coded tables. (See reference tables on back page for series specs.)
3. Answer the questions in the block diagram to determine an orderable part. Visit [www.cel.com/Optocouplers](http://www.cel.com/Optocouplers) for a detailed datasheet.

## What is your Application?

- ▶ [Switch Mode Power Supply](#)
- ▶ [Factory Automation](#)
- ▶ [Motor Drive and Control](#)
- ▶ [Power Over Ethernet \(PoE\)](#)
- ▶ [Power Line Communication \(PLC\)](#)
- ▶ [Smart Meters](#)
- ▶ [Solar Power](#)

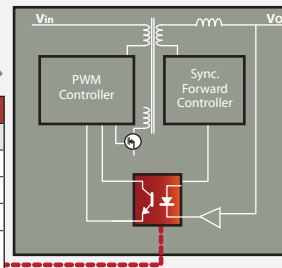
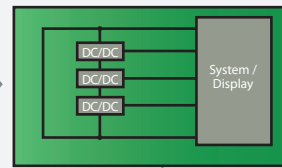
## Choose your Application:

### Switch Mode Power Supply AC to DC Converter

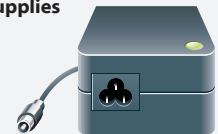


Feedback Control Circuit & DC / DC Converter			
Isolation Voltage	Package	Family	Table
5Kv.r.m.s.	DIP 4	PS25xx	1
5Kv.r.m.s.	LSOP 4	PS2381	2
3.75Kv.r.m.s.	SOP 4	PS27xx	3
2.5Kv.r.m.s. isolation, 3.75Kv.r.m.s. for PS2861B	SSOP 4	PS28xx	4
2.5Kv.r.m.s.	Mini Flat 4	PS2911	6

#### Data Communication



#### Power Supplies



#### Communication Line

Speed	Package	Family	Table
1 Mb/s Analog	DIP 8	PS8501	5

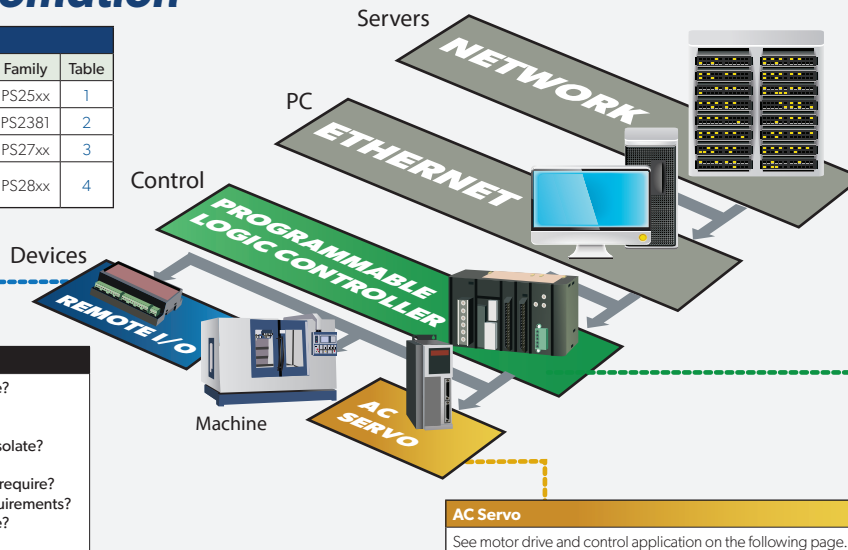
#### DC to DC Converter

#### Questions ?

- What Isolation Voltage do you require?
- SMT or Through Hole Package?
- What Operating Temperature do you require?
- What Current Transfer Ratio (CTR) do you require?
- What are your creepage distance requirements?
- What Safety Standards do you require? (UL, VDE, etc.)

### Factory Automation

Remote I/O			
Isolation Voltage	Package	Family	Table
5Kv.r.m.s.	DIP 4	PS25xx	1
5Kv.r.m.s.	LSOP 4	PS2381	2
3.75Kv.r.m.s.	SOP 4	PS27xx	3
2.5Kv.r.m.s. isolation, 3.75Kv.r.m.s. for PS2861B	SSOP 4	PS28xx	4



Programmable Logic Controller Input/Output Isolation			
Isolation Voltage	Package	Family	Table
2.5Kv.r.m.s.	SSOP 4	PS28xx	4
1.5Kv.r.m.s.	SSOP 12	PS2841-4x	4
3.75Kv.r.m.s.	SOP 4	PS27xx	3
5Kv.r.m.s.	SOP 4	PS25xx	1

Programmable Logic Controller Communication Isolation			
Speed	Package	Family	Table
1 Mb/s Analog	SOP 5	PS8101	5
1 Mb/s Digital	SOP 5	PS9122	5
10 Mb/s Digital	SOP 5	PS9124	5
10 Mb/s Digital	SOP 8	PS9817A	5
10 Mb/s Digital	SDIP 6	PS9324	5
10 Mb/s Digital	LSDIP 8	PS9924	5
15 Mb/s Digital	SOP 5	PS9121	5
	SOP 5	PS9123	
	SOP 8	PS9821	
10 Mb/s Digital	DIP 8	PS9587	5

#### Questions ?

- What Isolation Voltage do you require?
- What Transfer Speed do you require?
- SMT or Through Hole Package?
- How many channels do you need to isolate? (1, 2 or 4 per package)
- What Operating Temperature do you require?
- What are your creepage distance requirements?
- What Safety Standards do you require? (UL, VDE, etc.)

AC Servo  
See motor drive and control application on the following page.

# Motor Driven and Control

Machine Tools

Pumps

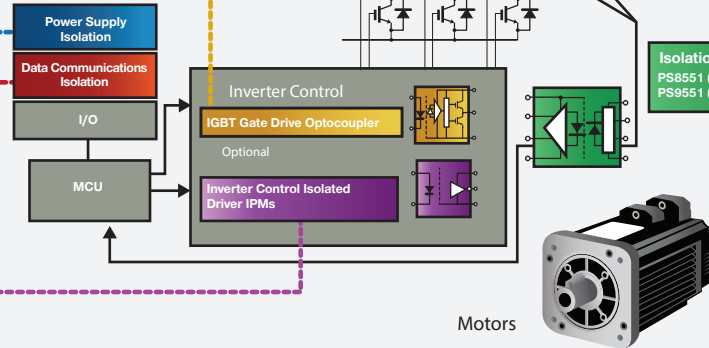
Inverter/ AC Servo

Power Supply Isolation			
Isolation Voltage	Package	Family	Table
3.75KVr.m.s.	SOP 4	PS27xx	3
2.5KVr.m.s. isolation, 3.75KVr.m.s. for PS2861B	SSOP 4	PS28xx	4

Inverter Control Isolated Gate Driving of MOSFETs and IGBTs			
I <sub>o</sub> peak (A)	Package	Family	Table
2.5	LSDIP 8	PS9905	7
0.6	SDIP 6	PS9307A	7
2.5	SDIP 8	PS9331	7
2.5	DIP 8	PS9531	7
2.5	SO16	PS9402	7

Data Communication Isolation			
Speed	Package	Family	Table
10 Mb/s Digital	SOP 5	PS9124	5
10 Mb/s Digital	SDIP 6	PS9324	5
10 Mb/s Digital	SOP 8	PS9817A	5
10 Mb/s Digital	LSDIP 8	PS9924	5

Inverter Control Isolated Driving of IPMs			
Speed	Package	Family	Table
5 Mb/s Digital	SDIP 6	PS9309	8
1 Mb/s Digital	SDIP 6	PS9303	8
1 Mb/s Digital	SOP 5	PS9113	8
1 Mb/s Digital	SDIP 6	PS9313	8
1 Mb/s Digital	DIP 8	PS9513	8

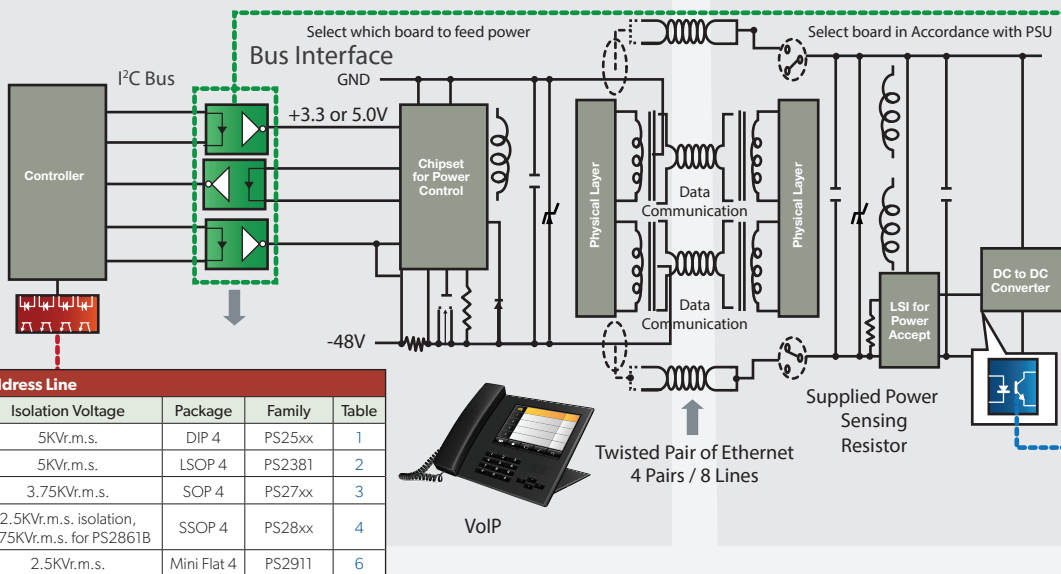


Isolation Amplifier for feedback control			
Isolation Voltage	Package	Family	Table
5KVr.m.s.	SDIP 8	PS8551A	9
5KVr.m.s.	SDIP 8	PS9551A	10

Isolation Amplifier  
PS8551 (Analog Type)  
PS9551 (Digital Type)

- Questions ?**
- What Isolation Voltage do you require?
  - What Transfer Speed do you require?
  - SMT or Through Hole Package?
  - How many channels do you need to isolate? (1,2 or 4 per package)
  - What Operating Temperature do you require?
  - What are your creepage distance requirements?
  - What Safety Standards do you require? (UL, VDE, etc.)

# PoE (Power Over Ethernet)



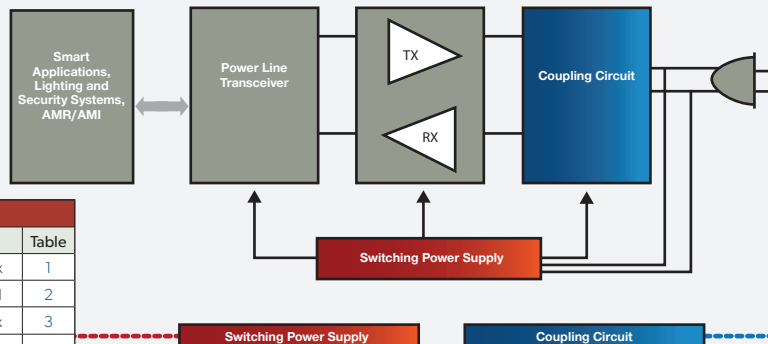
Address Line			
Isolation Voltage	Package	Family	Table
5KVr.m.s.	DIP 4	PS25xx	1
5KVr.m.s.	LSOP 4	PS2381	2
3.75KVr.m.s.	SOP 4	PS27xx	3
2.5KVr.m.s. isolation, 3.75KVr.m.s. for PS2861B	SSOP 4	PS28xx	4
2.5KVr.m.s.	Mini Flat 4	PS2911	6

- Questions ?**
- What Isolation Voltage do you require?
  - What Transfer Speed do you require?
  - SMT or Through Hole Package?
  - How many channels do you need to isolate? (1,2 or 4 per package)
  - What Operating Temperature do you require?
  - What are your creepage distance requirements?
  - What Safety Standards do you require? (UL, VDE, etc.)

I2C Bus			
Speed	Package	Family	Table
1 Mb/s Analog	SOP 8	PS8802	5
1 Mb/s Digital	SOP 5 SOP 8	PS9122 PS9822	5
15 Mb/s Digital	SOP 5 SOP 5 SOP 8	PS9121 PS9123 PS9821	5

Feedback for DC to DC Converter			
Isolation Voltage	Package	Family	Table
5KVr.m.s.	DIP 4	PS25xx	1
5KVr.m.s.	LSOP 4	PS2381	2
3.75KVr.m.s.	SOP 4	PS27xx	3
2.5KVr.m.s. isolation, 3.75KVr.m.s. for PS2861B	SSOP 4	PS28xx	4
2.5KVr.m.s.	Mini Flat 4	PS2911	6

# PLC (Power Line Communication)



Switching Power Supply			
Isolation Voltage	Package	Family	Table
5KVr.m.s.	DIP 4	PS25xx	1
5KVr.m.s.	LSOP 4	PS2381	2
3.75KVr.m.s.	SOP 4	PS27xx	3
2.5KVr.m.s. isolation, 3.75KVr.m.s. for PS2861B	SSOP 4	PS28xx	4
2.5KVr.m.s.	Mini Flat 4	PS2911	6

- Questions ?**
- What Isolation Voltage do you require?
  - What Transfer Speed do you require?
  - SMT or Through Hole Package?
  - What is your Operating Voltage?
  - What Operating Temperature do you require?
  - What are your creepage distance requirements?
  - What Safety Standards do you require? (UL, VDE, etc.)

Coupling Circuit			
Vcc	Package	Family	Table
3.3V & 5V	SOP 5	PS9124	5
5V	SOP 5	PS9123	5
5V	SOP 8	PS9817A	5
3.3V	SOP 8	PS9821	5

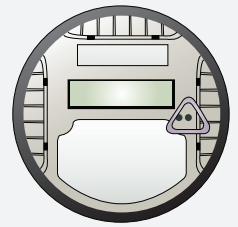
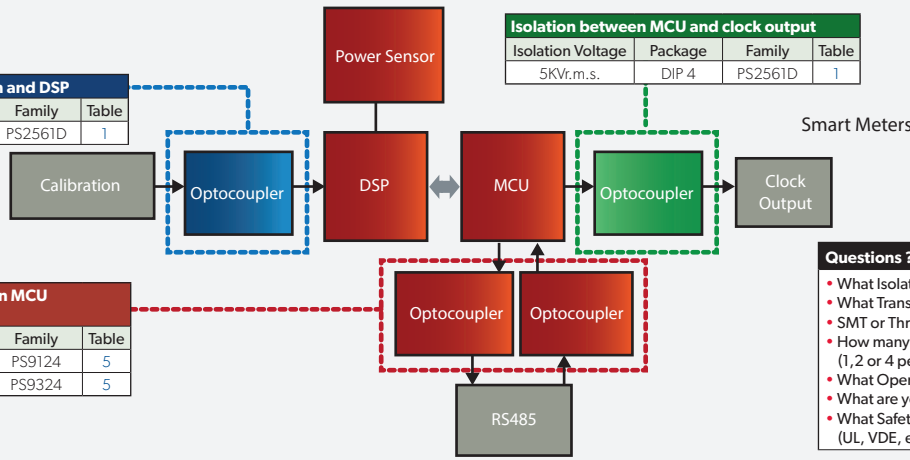


# Smart Meters

Isolation between Calibration and DSP			
Isolation Voltage	Package	Family	Table
5Kv.r.m.s.	DIP 4	PS2561D	1

Isolation between MCU and clock output			
Isolation Voltage	Package	Family	Table
5Kv.r.m.s.	DIP 4	PS2561D	1

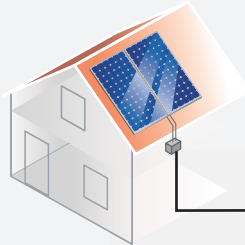
High Speed Isolation between MCU and RS485			
Speed	Package	Family	Table
10 Mb/s Digital	SOP 5	PS9124	5
10 Mb/s Digital	SDIP 6	PS9324	5



- Questions ?**
- What Isolation Voltage do you require?
  - What Transfer Speed do you require?
  - SMT or Through Hole Package?
  - How many channels do you need to isolate? (1,2 or 4 per package)
  - What Operating Temperature do you require?
  - What are your creepage distance requirements?
  - What Safety Standards do you require? (UL, VDE, etc.)

# Solar Power

Home System  
Solar Cell



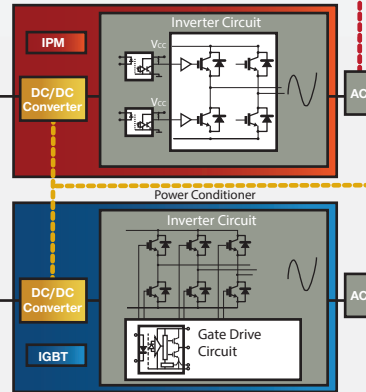
Plant / Building  
System



IPM Driver			
Isolation Voltage	Package	Family	Table
3.75Kv.r.m.s.	SOP 5	PS9113	8
5Kv.r.m.s.	DIP 8	PS9513	8

Feedback Control Circuit in DC/DC Converter			
Isolation Voltage	Package	Family	Table
5Kv.r.m.s.	DIP 4	PS2561D	1

IGBT Gate Driver			
I <sub>o</sub> peak (A)	Package	Family	Table
2.5	DIP 8	PS9905	7
0.6	SDIP 6	PS9307A	7
2.5	SDIP 8	PS9331	7
2.5	DIP 8	PS9531	7
0.6	DIP 8	PS9506	7



- Questions ?**
- What Isolation Voltage do you require?
  - What Transfer Speed do you require?
  - SMT or Through Hole Package?
  - How many channels do you need to isolate? (1,2 or 4 per package)
  - What Operating Temperature do you require?
  - What are your creepage distance requirements?
  - What Safety Standards do you require? (UL, VDE, etc.)

# Part Numbering System

Note: This diagram is intended to explain existing part numbers and is not to be used to create part numbers since NOT all combinations are available.



Package Style	
No.	Description
23	4 Pin LSOP (Pin pitch 2.54 mm)
25	4 Pin to16 DIP Multi Type
27	4 Pin to16 SOP (Pin pitch 2.54 mm)
28	4 Pin or 16 SSOP (Pin pitch 1.27 mm)
29	4 Pin Mini Flat (Pin pitch 1.27 mm)
81	SOP5 (Analog Output)
83	6 Pin SDIP (Analog Output)
85	8 Pin DIP (Hi-Speed Analog Output)
88	SO8 (Analog Output)
91	SOP5 (Digital Output)
93	6 Pin SDIP (Digital Output)
94	SO16 (Hi-Speed / Hi-Function)
95	8 Pin DIP (Hi-Speed / Hi-Function)
98	SO8 (Digital Output)
99	8 Pin DIP (Long Creepage Distance 14 mm)

- Options
- 23
  - 25
  - 27
  - 28
  - 29
  - 81
  - 83
  - 85
  - 88
  - 91
  - 93
  - 94
  - 95
  - 98
  - 99

ID Number

Options

A B C D F

Options

Lead Bend

Options

1 2 4

Options

V = VDE

Options

Tape/Reel

Options

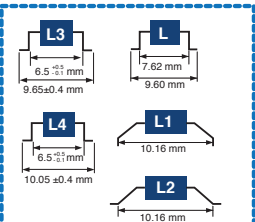
CTR Rank

(See Datasheet)

Options

Lead Finish

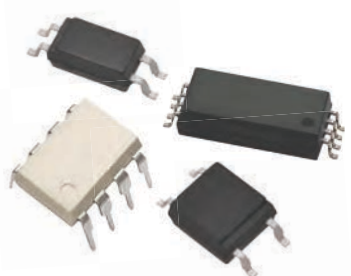
Letter	Description
A	Die shrunk
B	High Temperature
C	Die Shrunken High V <sub>CEO</sub>
D	New Process
F	New Process



Tape and Reel	
Options	Description
E3	Reel
F3	Larger Reel

Lead Finish	
Options	Description
None	Standard Finish
A	Pb-Free Finish
AX	NiPdAu Finish

Channel Type	
No.	Description
1	1-Channel Type
2	2-Channel Type
4	4-Channel Type



# Reference Tables

Bold\* = Focus Products

Table 1	Root Part	Input	Output	Operating Temperature Range (°C)	V <sub>CEO</sub> Max (V)	I <sub>F</sub> Max (mA)	CTR (%)	CTR Rank Available	Comments
	<b>PS2561D*</b>	<b>DC</b>	<b>Standard</b>	<b>-55 to +110</b>	<b>80</b>	<b>40</b>	<b>50-400</b>	<b>Yes</b>	<b>Low cost version of PS2561B, PS2501 and PS2501A, High temp</b>
	PS2514	DC	Standard	-55 to +100	40	30	50-200	Yes	Standard
	PS2561F	DC	Standard	-55 to +110	80	30	300-600	No	Low cost version of PS2501-I-K, High temp

Table 2	Root Part	Input	Output	Operating Temperature Range (°C)	V <sub>CEO</sub> Max (V)	I <sub>F</sub> Max (mA)	CTR (%)	CTR Rank Available	Comments
	<b>PS2381*</b>	<b>DC</b>	<b>Standard</b>	<b>-40 to +115</b>	<b>80</b>	<b>60</b>	<b>50-450</b>	<b>Yes</b>	<b>Stretched package, high temp operation</b>

Table 3	Root Part	Input	Output	Operating Temperature Range (°C)	V <sub>CEO</sub> Max (V)	I <sub>F</sub> Max (mA)	CTR (%)	CTR Rank Available	Comments
	<b>PS2761B*</b>	<b>DC</b>	<b>Standard</b>	<b>-55 to +110</b>	<b>70</b>	<b>25</b>	<b>50-400</b>	<b>Yes</b>	<b>High temp, low cost version of PS2701 and PS2701A</b>
	PS2711	DC	Standard	-55 to +100	40	50	100-400	Yes	Low Input Current
	PS2701A	DC	Standard	-55 to +100	70	30	50-300	Yes	Low cost version of PS2701
	PS2705A	AC	Standard	-55 to +100	80	±30	50-300	Yes	AC Input

Table 4	Root Part	Input	Output	Operating Temperature Range (°C)	V <sub>CEO</sub> Max (V)	I <sub>F</sub> Max (mA)	CTR (%)	CTR Rank Available	Comments
	<b>PS2801C*</b>	<b>DC</b>	<b>Standard</b>	<b>-55 to +100</b>	<b>80</b>	<b>30</b>	<b>50-400</b>	<b>Yes</b>	<b>Low cost version of PS2801</b>
	PS2861B	DC	Standard	-55 to +110	70	50	50-400	No	High temp version of PS2801 and PS2801C
	PS2811	DC	Standard	-55 to +100	40	50	100-400	Yes	Low Input Current
	PS2805C	AC	Standard	-55 to +100	80	±30	50-400	Yes	AC input
	PS2841-4x	x=A common cathode x=B common anode	Common Collector	-40 to +100	70	20	100-400	No	Ultra SSOP, quad channel with 12 leads

Table 5	Root Part	Type	Speed	Operating Temperature Range (°C)	Package	Isolation Voltage (Vr.m.s.)	CMR (KV/μS)	V <sub>CC</sub> Max (V)	V <sub>CC</sub> TYP (V)	Comments
	<b>PS8501*</b>	<b>High Speed / High Function</b>	<b>1 Mbps</b>	<b>-55 to +100</b>	<b>8 pin DIP</b>	<b>5K</b>	<b>-</b>	<b>35</b>	<b>-</b>	<b>8mm creepage, 8 pin DIP</b>
	<b>PS9122*</b>	<b>High Speed / High Function</b>	<b>1 Mbps</b>	<b>-40 to +100</b>	<b>5 pin SOP</b>	<b>3.75K</b>	<b>±15</b>	<b>7</b>	<b>3.3 or 5</b>	<b>3.3V &amp; 5V versions, Open Collector</b>
	<b>PS9124*</b>	<b>High Speed / High Function</b>	<b>10 Mbps</b>	<b>-40 to +100</b>	<b>5 pin SOP</b>	<b>3.75K</b>	<b>±15</b>	<b>7</b>	<b>3.3 or 5</b>	<b>3.3V &amp; 5V versions, Low Distortion</b>
	<b>PS9821*</b>	<b>High Speed / High Function</b>	<b>15 Mbps</b>	<b>-40 to +85</b>	<b>SO8</b>	<b>2.5K</b>	<b>±15</b>	<b>7</b>	<b>3.3</b>	<b>3.3V, Low Distortion</b>
	<b>PS9324L/L2*</b>	<b>High Speed / High Function</b>	<b>10 Mbps</b>	<b>-40 to +110</b>	<b>6 pin SDIP</b>	<b>5k</b>	<b>±15</b>	<b>7</b>	<b>3.3 or 5</b>	<b>3.3V &amp; 5V versions, Open Collector, Low Distortion</b>
	<b>PS9123*</b>	<b>High Speed / High Function</b>	<b>15 Mbps</b>	<b>-40 to +100</b>	<b>5 pin SOP</b>	<b>3.75K</b>	<b>±15</b>	<b>7</b>	<b>5</b>	<b>Totem Pole Output, Low Distortion</b>
	PS8101	High Speed / High Function	1 Mbps	-55 to +100	5 pin SOP	3.75K	±15	35	-	High CMR analog output
	PS9924	High Speed / High Function	10 Mbps	-40 to +100	LSDIP	7.5K	±15	7	3.3 or 5	3.3V & 5V, 14mm creepage
	PS8802	High Speed / High Function	10 Mbps	-55 to +100	SO8	2.5K	±10	35	5	High CMR analog output
	PS9822	High Speed / High Function	1 Mbps	-40 to +100	SO8	2.5K	±20	7	3.3 or 5	3.3V & 5V versions, Open Collector
	PS9121	High Speed / High Function	15 Mbps	-40 to +85	5 pin SOP	3.75K	±15	7	3.3	3.3V, Low Distortion
	PS9817A	High Speed / High Function	10 Mbps	-40 to +85	SO8	2.5K	±15	7	5	5V, Low Distortion
	PS9317	High Speed / High Function	10 Mbps	-40 to +85	6 pin SDIP	5K	±15	7	5	8mm creepage, 6 pin SDIP
	PS9587	High Speed / High Function	10 Mbps	-40 to +85	8 pin DIP	5K	±15	7	5	8mm creepage, 8 pin DIP
	PS9851	High Speed / High Function	15 Mbps	-40 to +100	SO8	2.5K	±10	5.5	5	5V, 100°C max operating temp

Table 6	Root Part	Input	Output	Operating Temperature Range (°C)	V <sub>CEO</sub> Max (V)	I <sub>F</sub> Max (mA)	CTR (%)	CTR Rank Available	Comments
	<b>PS2911*</b>	<b>DC</b>	<b>Standard</b>	<b>-55 to +100</b>	<b>40</b>	<b>50</b>	<b>100 - 400</b>	<b>Yes</b>	<b>Ultra small flat-lead package</b>

Table 7	Root Part	Input	t <sub>PLH</sub> / t <sub>PHL</sub> (μS)	Operating Temperature Range (°C)	Isolation Voltage (Vr.m.s.)	I <sub>F</sub> Max (mA)	CMR (KV/μS)	V <sub>CC</sub> Max (V)	Comments
	<b>PS9905*</b>	<b>DC</b>	<b>0.25</b>	<b>-40 to +110</b>	<b>7.5K</b>	<b>25</b>	<b>±25</b>	<b>30</b>	<b>14mm Long creepage, 8 pin LSDIP</b>
	<b>PS9307A*</b>	<b>DC</b>	<b>0.150</b>	<b>-40 to +125</b>	<b>5K</b>	<b>25</b>	<b>±50</b>	<b>35</b>	<b>6 pin SDIP</b>
	<b>PS9531*</b>	<b>DC</b>	<b>0.175</b>	<b>-40 to +125</b>	<b>5K</b>	<b>25</b>	<b>±50</b>	<b>35</b>	<b>UVLO (Under Voltage Lock Out) protection with hysteresis</b>
	<b>PS9402*</b>	<b>DC</b>	<b>0.2</b>	<b>-40 to +110</b>	<b>5K</b>	<b>25</b>	<b>±25</b>	<b>33</b>	<b>Fault detection (desaturation detection, UVLO protection and active Miller clamping)</b>
	PS9506	DC	0.4	-40 to +110	5K	25	±25	30	8mm creepage option available
	PS9331	DC	0.175	-40 to +125	5K	25	±50	33	UVLO (Under Voltage Lock Out) protection with hysteresis

Table 8	Root Part	Input	t <sub>PLH</sub> / t <sub>PHL</sub> (nS)	Operating Temperature Range (°C)	Isolation Voltage (Vr.m.s.)	I <sub>F</sub> Max (mA)	CMR (KV/μS)	V <sub>CC</sub> Max (V)	Comments
	<b>PS9309*</b>	<b>DC</b>	<b>250/250</b>	<b>-40 to +110</b>	<b>5K</b>	<b>20</b>	<b>±15</b>	<b>20</b>	<b>5 Mbps Totem Pole output type, 6 pin SDIP, IPM driver</b>
	PS9303	DC	500/550	-40 to +110	5K	20	±15	25	1 Mbps Totem Pole output type, 6 pin SDIP, IPM driver
	PS9113	DC	750/500	-40 to +110	3.75K	25	±15	25	1 Mbps, open collector output, 5 pin SOP (SO5) IPM driver
	PS9313	DC	750/500	-40 to +110	5K	25	±15	25	1 Mbps, open collector output, 8mm creepage 6 pin SDIP IPM driver
	PS9513	DC	750/500	-40 to +100	5K	30	±15	25	1 Mbps, open collector output, 8mm creepage 8 pin DIP IPM driver

Table 9	Root Part	Operating Temperature Range (°C)	Bandwidth TYP (kHz)	Input Supply <sup>DD1</sup> Max (mA)	Output Supply <sup>DD2</sup> Max (mA)	Gain v/v TYP	Gain Error (%)	CMR (KV/μS)	Comments
	<b>PS8551A*</b>	<b>-40 to +105</b>	<b>100</b>	<b>16</b>	<b>16</b>	<b>8</b>	<b>±1</b>	<b>±10</b>	<b>High CMR analog output isolation amplifier</b>

Table 10	Root Part	Operating Temperature Range (°C)	V <sub>CC</sub> Max (V)	V <sub>CC</sub> Range Recommended (V)	Input Supply <sup>DD1</sup> Max (mA)	Output Supply <sup>DD2</sup> Max (mA)	ENOB (Bits Min)	Output Clock Frequency (MHz Typ)	Comments
	PS9551A	-40 to +105	5.5	4.5 to 5.5	18	15	10	10	High CMR digital output isolation amplifier, sigma-delta modulator



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