Product Change Notice

(PCN Tracking Number: EE-QR-201208-04)

Version: 1.0

Customer:	All
Renesas Product Type:	Please refer to product list on page 2
Description of Change:	For the transistor output type photocoupler, the LED supplier is changed. Current: RSMC Shiga * / New:Outsource (long relationship with Renesas) *: Renesas Semiconductor Manufacturing Co., Ltd. For PS2381, the wire-bonding method is changed. Current: Bump bonding method / New: Reverse bonding method
Reason for Change:	LED supplier: Due to product line suspension at RSMC Shiga PS2381 bonding method: Standardization of bonding method
Identification:	The product itself cannot be identified, but it is possible to distinguish by the label printing contents of the inner box. (PN2 item) . Current: NS / New: LN
Schedules:	Sample: b/o Feb. 2021 (*Samples may be requested in units of 10 or 20 pcs)* Requested approval by: e/o March 2021 Shipment of new Parts: April 2021 onwards
Anticipated Impact:	Fit, Form & Function: No change Quality & Reliability: No change
Doc. No.:	EEQC-PCN-CR-20-0089
Internal Reference:	GET-12186

In case of any question, please contact:

INITIATOR	TITLE	E-mail	PHONE No.
Farhad Banihashemi	Staff Engineer	Farhad.Banihashemi@renesas.com	+49-211-6503-1844

Düsseldorf, 08 Dec. 2020

Customer Response:

(please fill in and return by e-mail, fax or mail)

☐ acknowledge
☐ acceptable
☐ inacceptable (pls. comment)
☐ not applicable

Company: _____

Name & Position: _____

Phone / Fax No.: _____

Note: Acknowledgement must be received by Renesas within 30 days or Renesas will consider the change as approved. If timely acknowledgement is provided by Customer, then Customer shall have 90 days from the date of receipt of this PCN in which to make any objections to the PCN. If Customer fails to make objections to this PCN within 90 days of the receipt of the PCN then Renesas will consider the PCN changes as approved. If customer cannot accept the PCN, they must provide Renesas with a last time buy demand and purchase order.

Comments:

_____

(Signature)

Product List:

PS2381	PS2701	PS2801	PS2911
PS2501	PS2701A	PS2801A	PS2913
PS2501A	PS2702	PS2801C	PS2915
PS2502	PS2703	PS2802	PS2933
PS2503	PS2705	PS2805	
PS2505	PS2705A	PS2805A	
PS2506	PS2706	PS2805C	
PS2514	PS2711	PS2806	
PS2533	PS2715	PS2811	
PS2535	PS2733	PS2815	
PS2561	PS2761B	PS2833	
PS2561A		PS2841	
PS2561B		PS2845	
PS2561D		PS2861B	
PS2561F			
PS2565			
PS2562			
PS2571			
PS2581			
PS2581A			

*New products (RV1S2211A, RV1S2281A, RV1S2285A) and PS2513 are not applicable

Product list & Representative Evaluation Products

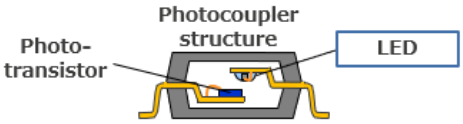
Red characters : Representative Evaluation Products

Shiga LED: 49 parts	OS LED (Two types of LEDs are used due to brightness necessity)	
	LED Type A: 44 parts	LED Type B: 5 parts
PS2501, PS2501A, PS2502, PS2503, PS2505, PS2506, PS2514, PS2561, PS2561A, PS2533, PS2535, PS2561B, PS2561D, PS2561F, PS2562, PS2565, PS2571, PS2581, PS2581A PS2701, PS2701A, PS2702, PS2703, PS2705, PS2705A, PS2706, PS2711, PS2715, PS2733, PS2761B PS2801, PS2801A, PS2801C, PS2802, PS2805, PS2805A, PS2805C, PS2806, PS2811, PS2815, PS2833, PS2841, PS2845, PS2861B PS2911, PS2913, PS2915, PS2933 PS2381	PS2501, PS2501A, PS2502, PS2503, PS2505, PS2506, PS2514, PS2561, PS2533, PS2535, PS2561B, PS2561F, PS2562, PS2565, PS2571, PS2581, PS2701, PS2701A, PS2702, PS2703, PS2705, PS2705A, PS2706, PS2711, PS2715, PS2733, PS2761B PS2801, PS2801A, PS2801C, PS2802, PS2805, PS2805A, PS2805C, PS2806, PS2811, PS2815, PS2833, PS2841, PS2845, PS2861B PS2913, PS2915, PS2933	PS2561A PS2561D PS2581A PS2911 PS2381

(Note) New products RV1S2211A, RV1S2281A and RV1S2285A are already used with Type A. PS2513 is already used with the same OS & other type. As a result of re-verification, PS2761B was able to secure the characteristics with Type A, therefore PS2761B uses Type A. PS2381 is changed (standardized) to the bonding method used in PS2xxx products other than PS2381.

Supplementary Information:

LED DIE CHANGING OUTLINE



■ Changing Point

The LED is to be changed from producing in Shiga/Renesas factory to **purchasing from Outsource (OS)**. The change object is only the LED of Transistor (Tr.)-output couplers (PS2xxx). (Except for RV1S2xxx and PS2513 which have already used the OS-LED.)

■ No Changing Points

Part numbers, Packages(Outer shape), Pin connections, Assembly OS, Isolation voltages, Creepage distances, Air distances, Absolute maximum ratings and Electrical characteristics are not changed. **No need to re-apply for safety standards.**

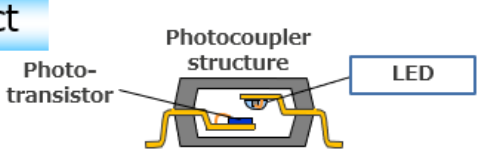
■ Technical insights

The key characteristics of Tr.-output couplers are the current transfer ratio, CTR, and the collector saturation voltage, VCE(SAT), whose characteristics depend on the phototransistor performance, and we test them for all shipment products both before/after the change. We believe that the risk in terms of the characteristics of the photocoupler due to the LED change is low.

The LED characteristics of Tr.-output couplers depend on the pn junction of semiconductor material. In this PCN, we selected same semiconductor material. Therefore we believe that the electrical characteristics of LEDs are almost the same before and after the change.

The lifetime of Tr.-output couplers depends on LED brightness degradation. By changing to the proven OS is used for the current IC output couplers and new Tr.-output coupler products, we will ensure the same level of reliability as the current products.

Concept of representative evaluation product



• Tr.-output photocoupler is a semiconductor device in which LED and phototransistor are resin-molded (packaged).

•This time, we will change the LED manufactured at our Shiga factory to purchase from the OS. There are no other changes to the phototransistor or resin (package).

•The main characteristics of LED are VF-IF (forward voltage-forward current) characteristics, and the reliability characteristics are affected by TA (ambient temperature), IF (forward current), and power dissipation of package .

•Therefore, based on the above concept, from the products which have the two types of OS LEDs (Type A and Type B) we selected each product with the strictest reliability characteristics as the representative evaluation product and evaluated them.

4M change point verification

Item	New LED（OS）	Current LED（Shiga）	Remarks
Overview	Outsource Purchase Wafer size : 2.5 inch equivalent	Shiga plant Manufacturing Wafer size : 2.5 inch equivalent	This outsource is proven OS for IC-output and new Tr.-output couplers.
Material (retailer / material) - Epitaxial wafer - Surface electrode - Back electrode	 - GaAs - Al series - Au series	 - GaAs - Al series - Au series	
Man	Outsource LED line worker	Shiga plant LED line worker	
Machine - Metallization - Grinding / Polishing	 Deposition Grinding	 Deposition Grinding	
Method	Next page	Next page	

Change point verification on Method

Process	New LED（OS）	Current LED（Shiga）	Check points	Check items
Surface electrode forming	Deposition	Deposition	Film thickness	-
Surface electrode check	Checking resistor	Checking resistor	Resistor value	Electrical characteristics of Photocoupler
				Bonding strength
Back side grinding	Grinding	Grinding	Wafer thickness	Mount strength
Back side electrode forming	Deposition	Deposition	Film thickness	-
Back side electrode check	Checking resistor	Checking resistor	Resistor value	Electrical characteristics of Photocoupler
				Mount strength
Dicing	1st Dicing	-	Dicing width	-
Electrical characteristics check	Electrical characteristics check	-	Electrical characteristics	Electrical characteristics of Photocoupler
Dicing	2nd Dicing	Dicing	Dicing width	-
In-Warehouse check	Appearance check	Appearance check	Appearance	-

PS2381 only（Bonding method changing）

Process	New LED（OS）	Current LED（Shiga）	Check points	Check items
Bonding	Reverse bonding	Bump bonding	Bonding strength	Bonding wire pull strength

Evaluation item

Evaluation item concerning process

Concerns	Influence to customers	Validation items
Characteristic change due to epitaxial growth, etc. change	Characteristic difference Variation in reliability	Electrical characteristics confirmation （VF、IR、ICEO、VCE(SAT)、CTR、Switching time） Reliability confirmation （TC、HAST、UHAST、HTOL、HTSL、ESD）
Assembling ability change due to electrode forming change, etc.	Characteristic difference Variation in reliability	Electrical characteristics confirmation （VF、IR、ICEO、VCE(SAT)、CTR、Switching time） Assembly confirmation （Mount strength, Bonding strength） Reliability confirmation （TC、HAST、UHAST、HTOL、HTSL、ESD）

Evaluation item concerning products

Concerns	Influence to customers	Validation items
Epitaxial growth change Electrode forming change	Characteristic difference	Electrical characteristics confirmation （VF、IR、ICEO、VCE(SAT)、CTR、Switching time）
	Variation in reliability	Reliability confirmation （TC、HAST、UHAST、HTOL、HTSL、ESD）

Validation results

Evaluation item concerning process

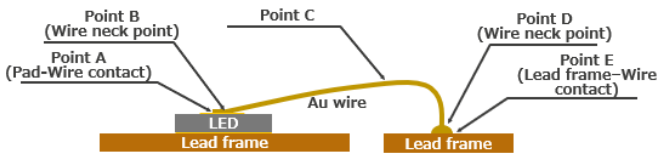
Influence to customers	Validation items	Validation result	Judgement
Characteristic difference & Variation in reliability due to epitaxial growth, etc. change	Electrical characteristics confirmation （VF、IR、ICEO、VCE(SAT)、CTR、Switching time） Reliability confirmation （TC、HAST、UHAST、HTOL、HTSL、ESD）	There is no difference in product characteristics and there is no problem with reliability.	○
Characteristic difference, Variation in reliability & Assembling ability change due to electrode forming change, etc.	Electrical characteristics confirmation （VF、IR、ICEO、VCE(SAT)、CTR、Switching time） Assembly confirmation （Mount strength, Bonding strength） Reliability confirmation （TC、HAST、UHAST、HTOL、HTSL、ESD）	There is no difference in product characteristics and assembly, and there is no problem with reliability.	○

Evaluation item concerning products

Influence to customers	Validation items	Validation result	Judgement
Characteristic difference & Variation in reliability	Electrical characteristics confirmation （VF、IR、ICEO、VCE(SAT)、CTR、Switching time）	There is no difference in product characteristics and assembly, and there is no problem with reliability.	○
	Reliability confirmation （TC、HAST、UHAST、HTOL、HTSL、ESD）	There is no difference in product characteristics and assembly, and there is no problem with reliability.	○

Validation results　Bonding wire pull strength・Mount strength

Items	Cpk		
	New LED（OS）		Current LED（Shiga）
Mount strength	Type-A	2.49	1.71
	Type-B	3.04	
Bonding wire pull strength	Type-A	3.13	2.92
	Type-B	3.31	

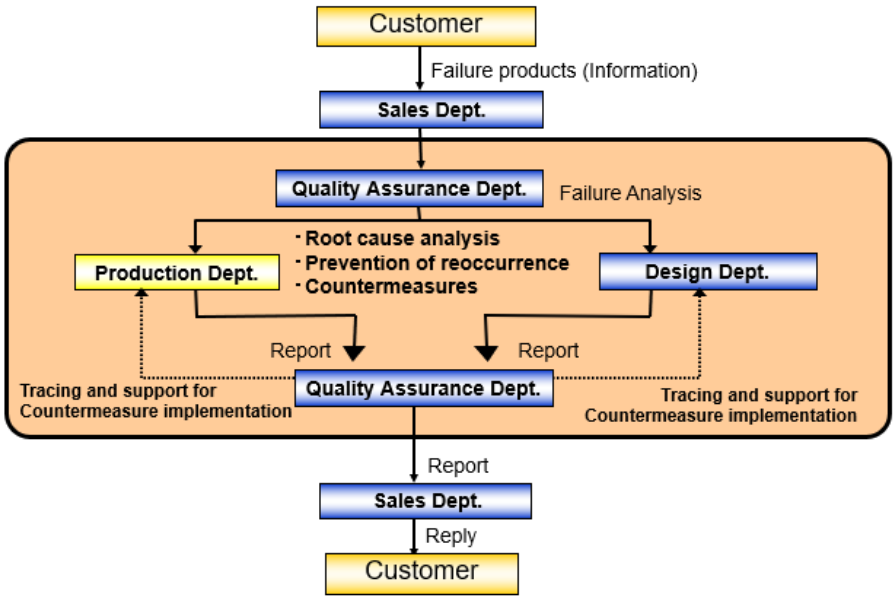


The wire breakage point is point C shown in the left figure for all samples.

The bonding wire pull strength and mount strength of the new LED (OS) ensure process capability (≧ 1.67). In addition, the wire break point is point C (break at the wire), therefore there is no problem.

Quality Assurance System

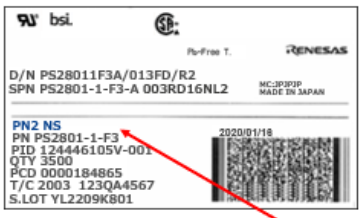
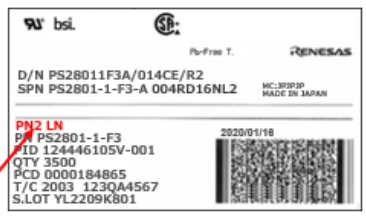
There is no change between before and after the PCN



Difference on label of New LED (OS) and Current LED (Shiga)

- **The item on the box label can be distinguished between New LED (OS) and Current LED (Shiga) products.**

  (Example) PS2801-1-F3

Shipping box	Box label
 Label on Box	Current LED (Shiga)  New LED (OS) product  **Different point :** **Current LED (Shiga) : PN2"NS"→ New LED (OS) : PN2"LN"**

PS2861B:

ABSOLUTE MAXIMUM RATINGS

(TA = 25℃, unless otherwise specified)

PARAMETER		Symbol	PS2861B Rating		Unit
			New LED (OS)	Current LED (Shiga)	
Diode	Forward Current(DC)	I_F	50	50	mA
	Reverse Voltage	V_R	6	6	V
	Power Dissipation Derating	ΔPD/℃	0.6	0.6	mW/℃
	Power Dissipation	P_D	60	60	mW
	Peak Forward Current*1	I_{FP1}	2.5	2.5	A
	Peak Forward Current*2	I_{FP2}	1.0	1.0	A
Transistor	Collector to Emitter Voltage	V_{CEO}	70	70	V
	Emitter to Collector Voltage	V_{ECO}	5	5	V
	Collector Current	Ic	50	50	mA
	Power Dissipation Derating	ΔPc/℃	1.2	1.2	mW/℃
	Power Dissipation	P_C	120	120	mW
Isolation Voltage*3		BV	3750	3750	Vr.m.s
Operating Ambient Temperature		T_A	-55~+110	-55~+110	℃
Storage Temperature		Tstg	-55~+150	-55~+150	℃

*1. PW = 10 μs, Duty Cycle = 1%
*2. PW = 100 μs, Duty Cycle = 1%
*3. AC voltage for 1 minute at TA = 25℃, RH = 60% between input and output Pins 1-2 shorted together, 3-4 shorted together

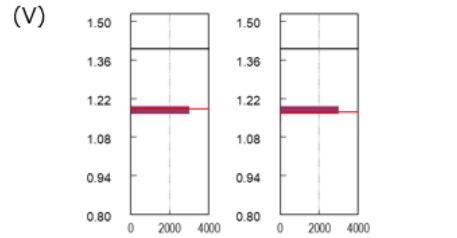
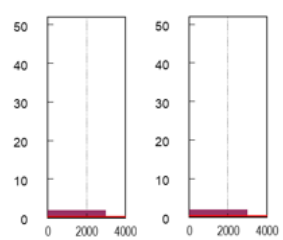
ELECTRICAL CHARACTERISTICS (TA = 25℃)

Parameter		Symbol	condition	PS2861B New LED (OS)			PS2861B Current LED (Shiga)			Unit
				MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Diode	Forward Voltage	V_F	I_F=5mA	–	1.1	1.4	–	1.1	1.4	V
	Reverse current	I_R	VR=5V	–	–	5	–	–	5	μA
	Terminal Capacitance	C_t	V=0V,f=1.0MHz	–	15	–	–	15	–	pF
Transistor	Collector to Emitter Dark Current	I_{CEO}	V_{CE}=24V, I_F=0mA	–	–	100	–	–	100	nA
Coupled	Current Transfer Ratio	CTR	I_F=5mA,V_{CE}=5V	50	150	300	50	150	300	%
			I_F=1mA,V_{CE}=5V	10	50	–	10	50	–	
	Collector Saturation Voltage	$V_{CE(sat)}$	I_F=10mA, I_C=2mA	–	–	0.3	–	–	0.3	V
	Isolation Resistance	R_{I-O}	V_{I-O}=1.0kVDC	10^{11}	–	–	10^{11}	–	–	Ω
	Isolation capacitance	C_{I-O}	V=0V,f=1.0MHz	–	0.4	–	–	0.4	–	pF
	Rise Time	tr	Vcc=5V,I_C=2mA RL=100Ω	–	4	–	–	4	–	μsec
	Fall Time	tf		–	5	–	–	5	–	
	Turn-on Time	ton		–	5	–	–	5	–	
	Turn-off Time	toff		–	5	–	–	5	–	

COMPARISON OF CHARACTERIS DISTRIBUTION

PS2861B

※These data are reference and are not guaranteed.

Parameter	V_F	I_R
Condition	I_F=5mA	V_R=5V
Standard	～ 1.4V	～ 5μA
Distribution		

	New LED(OS)	Current LED(Shiga)
N	3000	3000
Ave.	1.18	1.17
σ	0.002	0.003

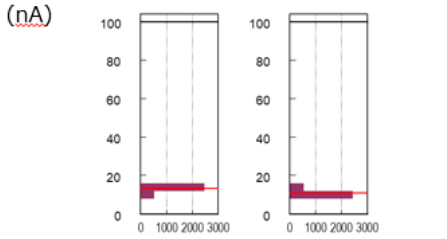
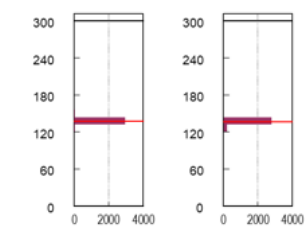
	New LED(OS)	Current LED(Shiga)
N	3000	3000
Ave.	0.275	0.373
σ	0.12	0.12

※Almost the same characteristic distribution is obtained before and after changing the LED.

COMPARISON OF CHARACTERIS DISTRIBUTION

PS2861B

※These data are reference and are not guaranteed.

Parameter	I_{CEO}	$V_{CE(sat)}$
Condition	V_{CE}=24V, I_F=0mA	I_F=10mA, I_C=2mA
Standard	～ 100nA	～ 300mV
Distribution		

	New LED(OS)	Current LED(Shiga)
N	3000	3000
Ave.	13.2	11.1
σ	1.26	1.48

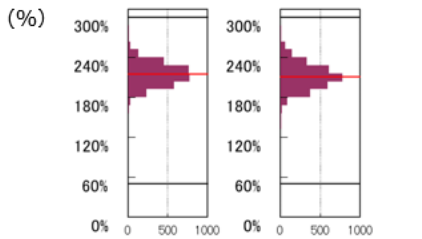
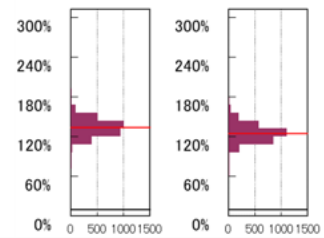
	New LED(OS)	Current LED(Shiga)
N	3000	3000
Ave.	138	136
σ	2.2	2.6

※Almost the same characteristic distribution is obtained before and after changing the LED.

COMPARISON OF CHARACTERIS DISTRIBUTION

PS2861B

※These data are reference and are not guaranteed.

Parameter	CTR	CTR
Condition	I_F=5mA, V_{CE}=5V	I_F=1mA, V_{CE}=5V
Standard	50～300%	10%～
Distribution		

	New LED(OS)	Current LED(Shiga)
N	3000	3000
Ave.	214	211
σ	16.3	18.8

	New LED(OS)	Current LED(Shiga)
N	3000	3000
Ave.	134	125
σ	12.6	12.9

※Almost the same characteristic distribution is obtained before and after changing the LED.

PS2861B Reliability Test Results

Photocoupler : Type A _ Representative : PS2861B (Current LED(Shiga) to New LED(OS))

No.	Item	Test Condition	Results	
			Number of Samples	Number of Failures
1	High Temperature Storage Life	Ta=150℃, 1000h	22	0
2	Temperature Humidity Bias ※	Ta=130℃, RH=85%, VCE=Rating Voltage, 96h	20	0
3	High Temperature Operating Life ※	Ta=110℃, IF=Rating Current, 1000h	20	0
4	Temperature Humidity Storage Life ※	Ta=130℃, RH=85%, 96h	22	0
5	Temperature Cycling ※	-55℃～150℃, 550cycles	22	0
6	Electrostatic discharge (HBM Method)	C=100pF, 1.5kΩ, 2000V	5	0
7	Electrostatic discharge (CDM Method)	500V	5	0
8	Solderability	245℃, 5s Wet area 95% or more	22	0
9	Resistance to Soldering Heat	260℃, 10s, 1time	22	0

※ Preconditioning : 125℃,24h→85℃,85%RH,168h→Reflow(260℃,10s,3times)

＜ Reliability Tests Criteria ＞(Ta=25℃)

Item	Conditions	Judgment criteria		Unit
		Min	Max	
VF	IF=5mA	-	1.4	V
IR	VR=5V	-	10	μA
ICEO	VCE=24V, IF=0mA	-	0.1	μA
VCE(sat)	IF=10mA, IC=2mA	-	0.3	V
ΔCTR	IF=5mA, VCE=5V	(Initial±50)		%

Estimated failure rate 10Fit (Ta=55℃, Ea=0.7eV, C.L.=60%)

PS2381:

ABSOLUTE MAXIMUM RATINGS

(TA = 25℃, unless otherwise specified)

PARAMETER		Symbol	PS2381 Rating		Unit
			New LED (OS)	Current LED (Shiga)	
Diode	Forward Current(DC)	I_F	60	60	mA
	Reverse Voltage	V_R	6	6	V
	Power Dissipation Derating	ΔPD/℃	1.0	1.0	mW/℃
	Power Dissipation	P_D	100	100	mW
	Peak Forward Current*1	I_{FP}	1.5	1.5	A
Transistor	Collector to Emitter Voltage	V_{CEO}	80	80	V
	Emitter to Collector Voltage	V_{ECO}	7	7	V
	Collector Current	Ic	50	50	mA
	Power Dissipation Derating	ΔPC/℃	1.5	1.5	mW/℃
	Power Dissipation	P_C	150	150	mW
Isolation Voltage*2		BV	5000	5000	Vr.m.s
Total Power Dissipation		P_T	250	250	mW
Operating Ambient Temperature		T_A	-40~+115	-40~+115	℃
Storage Temperature		Tstg	-40~+125	-40~+125	℃

*1. PW = 100 μs, Duty Cycle = 1%
*2. Ta=25℃,RH=60%、AC voltage for 1 minute at TA = 25℃, RH = 60% between input and output Pins 1-2 shorted together, 3-4 shorted together

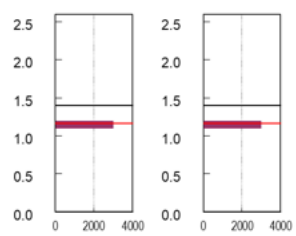
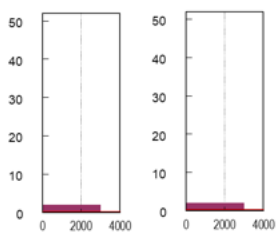
ELECTRICAL CHARACTERISTICS (TA = 25℃)

Parameter		Symbol	condition	PS2381 New LED (OS)			PS2381 Current LED (Shiga)			Unit
				MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Diode	Forward Voltage	V_F	I_F=5mA	–	1.1	1.4	–	1.1	1.4	V
	Reverse current	I_R	VR=5V	–	–	5	–	–	5	μA
	Terminal Capacitance	C_t	V=0V,f=1.0MHz	–	15	–	–	15	–	pF
Transistor	Collector to Emitter Dark Current	I_{CEO}	V_{CE}=24V,I_F=0mA	–	–	100	–	–	100	nA
Coupled	Current Transfer Ratio	CTR	I_F=5mA,V_{CE}=5V	50	100	400	50	100	400	%
			I_F=1mA,V_{CE}=5V	10	50	–	10	50	–	
	Collector Saturation Voltage	$V_{CE(sat)}$	I_F=10mA,I_c=2mA	–	–	0.3	–	–	0.3	V
	Isolation Resistance	R_{I-O}	V_{I-O}=1.0kVDC	10^{11}	–	–	10^{11}	–	–	Ω
	Isolation capacitance	C_{I-O}	V=0V,f=1.0MHz	–	0.4	–	–	0.4	–	pF
	Rise Time	tr	Vcc=5V,I_C=2mA RL=100Ω	–	4	–	–	4	–	μsec
	Fall Time	tf		–	5	–	–	5	–	μsec

COMPARISON OF CHARACTERIS DISTRIBUTION

PS2381

※These data are reference and are not guaranteed.

Parameter	V_F	I_R
Condition	I_F=5mA	V_R=5V
Standard	～ 1.4V	～ 5μA
Distribution	(V) 	(nA) 

	New LED(OS)	Current LED(Shiga)
N	3000	3000
Ave.	1.16	1.16
σ	0.1	0.2

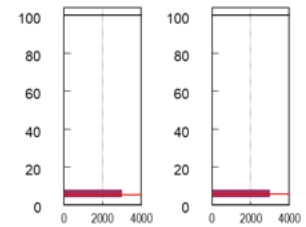
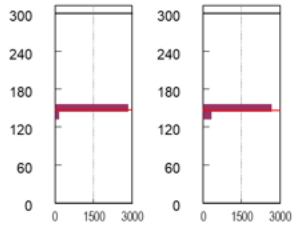
	New LED(OS)	Current LED(Shiga)
N	3000	3000
Ave.	0.17	0.19
σ	0.13	0.15

※Almost the same characteristic distribution is obtained before and after changing the LED.

COMPARISON OF CHARACTERIS DISTRIBUTION

PS2381

※These data are reference and are not guaranteed.

Parameter	I_{CEO}	$V_{CE(sat)}$
Condition	V_{CE}=24V, I_F=0mA	I_F=10mA, I_C=2mA
Standard	～ 100nA	～ 300mV
Distribution	(nA) 	(mV) 

	New LED(OS)	Current LED(Shiga)
N	3000	3000
Ave.	5.5	5.6
σ	0.16	0.44

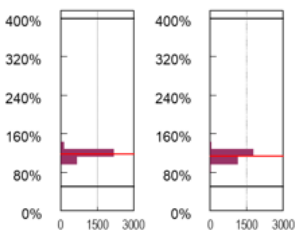
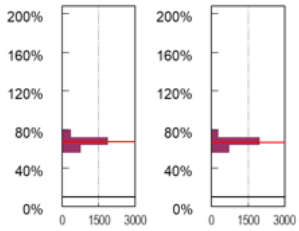
	New LED(OS)	Current LED(Shiga)
N	3000	3000
Ave.	147	146
σ	1.7	1.9

※Almost the same characteristic distribution is obtained before and after changing the LED.

COMPARISON OF CHARACTERIS DISTRIBUTION

PS2381

※These data are reference and are not guaranteed.

Parameter	CTR	CTR
Condition	I_F=5mA, V_{CE}=5V	I_F=1mA, V_{CE}=5V
Standard	50～400%	10%～
Distribution	(%) 	(%) 

	New LED(OS)	Current LED(Shiga)
N	3000	3000
Ave.	117	114
σ	6.3	6.1

	New LED(OS)	Current LED(Shiga)
N	3000	3000
Ave.	67	67
σ	4.1	4.0

※Almost the same characteristic distribution is obtained before and after changing the LED.

PS2381 Reliability Test Results

Photocoupler : Type B _ Representative : PS2381 (Current LED(Shiga) to New LED(OS))

No.	Item	Test Condition	Results	
			Number of Samples	Number of Failures
1	High Temperature Storage Life	Ta=150℃, 1000h	22	0
2	Temperature Humidity Bias ※	Ta=130℃, RH=85%, VCE=Rating Voltage, 96h	20	0
3	High Temperature Operating Life ※	Ta=115℃, IF=Rating Current, 1000h	20	0
4	Temperature Humidity Storage Life ※	Ta=130℃, RH=85%, 96h	22	0
5	Temperature Cycling ※	-40℃～125℃, 850cycles	22	0
6	Electrostatic discharge (HBM Method)	C=100pF, 1.5kΩ, 2000V	5	0
7	Electrostatic discharge (CDM Method)	500V	5	0
8	Solderability	245℃, 5s Wet area 95% or more	22	0
9	Resistance to Soldering Heat	260℃, 10s, 1time	22	0

※ Preconditioning : 125℃,24h→85℃,85%RH,168h→Reflow(260℃,10s,3times)

＜ Reliability Tests Criteria ＞(Ta=25℃)

Item	Conditions	Judgment criteria		Unit
		Min	Max	
VF	IF=5mA	-	1.4	V
IR	VR=5V	-	10	μA
ICEO	VCE=24V, IF=0mA	-	0.1	μA
VCE(sat)	IF=10mA, IC=2mA	-	0.3	V
ΔCTR	IF=5mA, VCE=5V	(Initial±50)		%

Estimated failure rate 10Fit (Ta=55℃, Ea=0.7eV, C.L.=60%)