

PHOTOCOUPLER

PS9303L,PS9303L2

1 Mbps TOTEM POLE OUTPUT TYPE HIGH CMR, IPM DRIVER 6-PIN SDIP PHOTOCOUPLER

-NEPOC Series-

DESCRIPTION

The PS9303L and PS9303L2 are optical coupled high-speed, totem pole output (active high output type) isolators containing a GaAlAs LED on the input side and a photodiode and a signal processing circuit on the output side on one chip.

The PS9303L and PS9303L2 are specified high CMR and pulse width distortion with operating temperature. It is suitable for IPM drive.

The PS9303L is lead bending type (Gull-wing) for surface mounting.

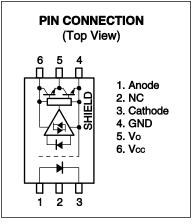
The PS9303L2 is lead bending type for long creepage distance (Gull-wing) for surface mount.

FEATURES

- High common mode transient immunity (CMH, CML = $\pm 15 \text{ kV}/\mu\text{s MIN.}$)
- · Half size of 8-pin DIP
- Pulse width distortion (| tplh tphl | = 350 ns MAX.)
- High-speed (1 Mbps)
- High isolation voltage (BV = 5 000 Vr.m.s.)
- Totem pole output (Active High Output Type)
- <R> Ordering number of tape product: PS9303L-E3, PS9303L2-E3: 2 000 pcs/reel
 - Pb-Free product
- <R> Safety standards
 - UL approved: No. E72422
 - CSA approved: No. CA 101391 (CA5A, CAN/CSA-C22.2 60065, 60950)
 - DIN EN60747-5-2 (VDE0884 Part2) approved: No. 40024069 (Option)

APPLICATIONS

- · IPM Driver
- General purpose inverter



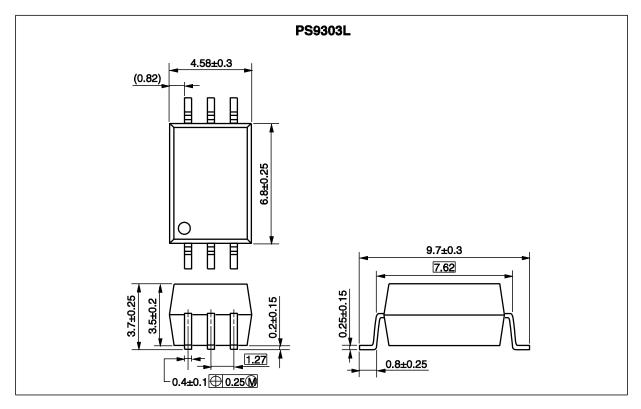
TRUTH TABLE

LED	Output
ON	Н
OFF	L

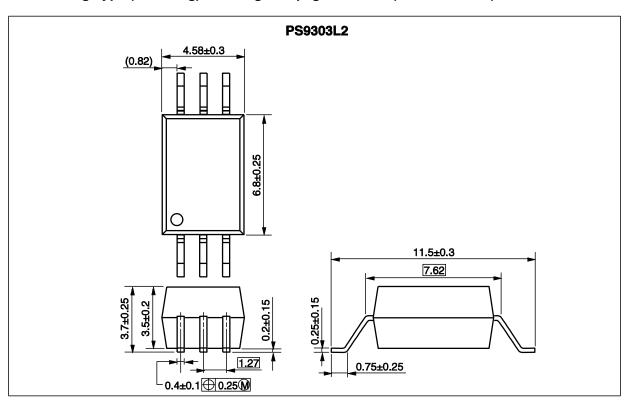
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PACKAGE DIMENSIONS (UNIT: mm)

Lead Bending Type (Gull-wing) For Surface Mount



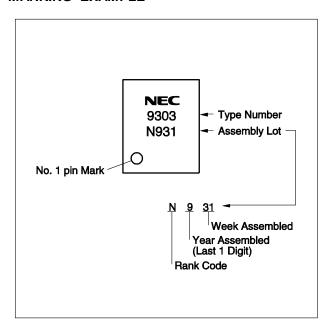
Lead Bending Type (Gull-wing) For Long Creepage Distance (Surface Mount)



PHOTOCOUPLER CONSTRUCTION

Parameter	PS9303L	PS9303L2
Air Distance (MIN.)	7 mm	8 mm
Outer Creepage Distance (MIN.)	7 mm	8 mm
Isolation Distance (MIN.)	0.4 mm	0.4 mm

<R> MARKING EXAMPLE



ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number*1
PS9303L	PS9303L-AX	Pb-Free	20 pcs (Tape 20 pcs cut)	Standard products	PS9303L
PS9303L-E3	PS9303L-E3-AX	(Ni/Pd/Au)	Embossed Tape 2 000 pcs/reel	(UL, CSA approved)	
PS9303L2	PS9303L2-AX		20 pcs (Tape 20 pcs cut)		PS9303L2
PS9303L2-E3	PS9303L2-E3-AX		Embossed Tape 2 000 pcs/reel		
PS9303L-V	PS9303L-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2	PS9303L
PS9303L-V-E3	PS9303L-V-E3-AX		Embossed Tape 2 000 pcs/reel	(VDE0884 Part2)	
PS9303L2-V	PS9303L2-V-AX		20 pcs (Tape 20 pcs cut)	Approved (Option)	PS9303L2
PS9303L2-V-E3	PS9303L2-V-E3-AX		Embossed Tape 2 000 pcs/reel		

^{*1} For the application of the Safety Standard, following part number should be used.

ABSOLUTE MAXIMUM RATINGS (TA = 25°C, unless otherwise specified)

	Parameter	Symbol	Ratings	Unit
Diode	Forward Current*1	lF	20	mA
	Reverse Voltage	Vr	5	V
Detecto r	Supply Voltage	Vcc	−0.5 to +25	V
	Output Voltage	Vo	-0.5 to +25	V
	Output Current	lo	25	mA
	Power Dissipation*2	Pc	210	mW
Isolation	Voltage ^{⁺3}	BV	5 000	Vr.m.s.
Operating Ambient Temperature		Та	-40 to +100	°C
Storage Temperature		Tstg	-55 to +125	°C

^{*1} Reduced to 0.33 mA/ $^{\circ}$ C at T_A = 70 $^{\circ}$ C or more.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	Vcc	4.5	15	20	V
Output Voltage	Vo	0		20	V
Input Current (ON)	IF (ON)	6		10	mA
Input Voltage (OFF)	VF (OFF)	0		0.8	V

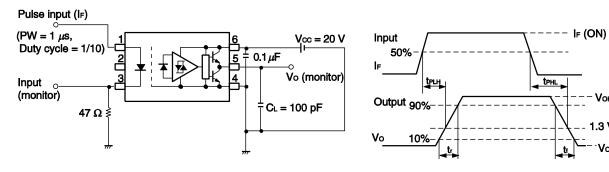
^{*2} Reduced to $4.0 \text{ mW/}^{\circ}\text{C}$ at $T_A = 70^{\circ}\text{C}$ or more.

^{*3} AC voltage for 1 minute at $T_A = 25$ °C, RH = 60% between input and output. Pins 1-3 shorted together, 4-6 shorted together.

ELECTRICAL CHARACTERISTICS ($T_A = -40$ to $+100^{\circ}$ C, $V_{CC} = 4.5$ to 20 V, unless otherwise specified)

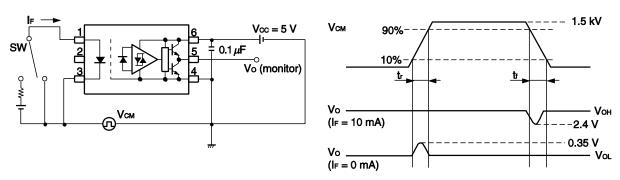
	Parameter	Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit
Diode	Forward Voltage	VF	IF = 10 mA, T _A = 25°C	1.2	1.6	1.9	V
	Reverse Current	IR	VR = 3 V, TA = 25°C			10	μA
	Terminal Capacitance	Ct	V = 0 V, f = 1 MHz, T _A = 25°C		30		pF
Detector	High Level Output Voltage	Vон	Vcc = 5 V, Io = -3.5 mA, IF = 10 mA	2.4	3.5		V
			Vcc = 20 V, Io = -3.5 mA, IF = 10 mA	17.4	18.1		
	Low Level Output Voltage*2	Vol	Io = 3.5 mA, V _F = 0 V		0.1	0.35	V
	High Level Supply Current	Іссн	Vcc = 5 V, I _F = 10 mA		1.6	2.7	mA
			Vcc = 20 V, IF = 10 mA		1.8	3	
	Low Level Supply Current	Iccl	Vcc = 5 V, V _F = 0 V		2.7	3.7	mA
			Vcc = 20 V, V _F = 0 V		2.9	4	
	High Level Output Short Circuit Current	Іоѕн	Vcc = 20 V, Vo = GND, I _F = 10 mA	-7	-40		mA
	Low Level Output Short Circuit Current	losL	Vcc = Vo = 20 V, V _F = 0 V	7	40		mA
Coupled	Threshold Input Current	IFLH	Vcc = 5 V, Vo > 2.4 V, Io = -3.5 mA		2.4	5	mA
	Isolation Resistance	R⊦o	Vio = 500 Vdc, RH = 60%, Ta = 25°C	10 ¹²			Ω
	Isolation Capacitance	Сьо	V = 0 V, f = 1 MHz, T _A = 25°C		0.6		pF
	Propagation Delay Time $(H \rightarrow L)^{*3}$	t PHL	$Vcc = 20 \text{ V}, C_L = 100 \text{ pF},$ $I_F = 10 \rightarrow 0 \text{ mA}, V_{THHL} = 1.3 \text{ V}$	50	185	550	ns
	Propagation Delay Time (L → H)*3	tрLн	$Vcc = 20 \text{ V}, CL = 100 \text{ pF},$ $IF = 0 \rightarrow 10 \text{ mA}, VTHLH = 1.3 \text{ V}$	50	240	500	ns
	Pulse Width Distortion (PWD)	tplh-tphl	Vcc = 20 V, CL = 100 pF, IF = 10 ↔ 0 mA		55	350	ns
	Rise Time (10-90%)*3	tr	$Vcc = 20 \text{ V}, C_L = 100 \text{ pF},$ $I_F = 0 \rightarrow 10 \text{ mA}$		120		ns
	Fall Time (90-10%)*3	t _f	$Vcc = 20 \text{ V}, C_L = 100 \text{ pF},$ $I_F = 10 \rightarrow 0 \text{ mA}$		90		ns
	Common Mode Transient Immunity at High Level Output*4	СМн	Vcc = 5 V, T _A = 25°C, I _F = 10 mA, Vc _M = 1.5 kV, V _{O (MIN.)} = 2.4 V	15			kV/µs
	Common Mode Transient Immunity at Low Level Output*4	CML	Vcc = 5 V, Ta = 25°C, IF = 0 mA, Vcm = 1.5 kV, Vo (MAX) = 0.35 V	15			kV/μs

- *1 Typical values at T_A = 25°C.
- *2 Because Vo of 2.4 V may be output when the LED current is not input and when output supply of Vcc = 4.5 V or less, it is important to confirm the characteristics (operation with the power supply on and off) during design, before using this device.
- *3 Test circuit for propagation delay time



Remark CL includes probe and stray wiring capacitance.

*4 Test circuit for common mode transient immunity

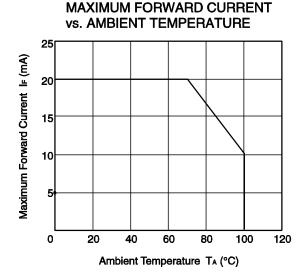


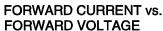
Remark CL includes probe and stray wiring capacitance.

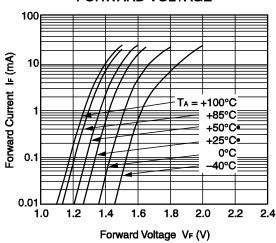
<R> USAGE CAUTIONS

- 1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
- 2. By-pass capacitor of more than 0.1 μ F is used between Vcc and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.
- 3. Pin 2 (which is an NC*1 pin) can either be connected directly to the GND pin on the LED side or left open. Unconnected pins should not be used as a bypass for signals or for any other similar purpose because this may degrade the internal noise environment of the device.
 - *1 NC: Non-connection (No connection)
- 4. Avoid storage at a high temperature and high humidity.

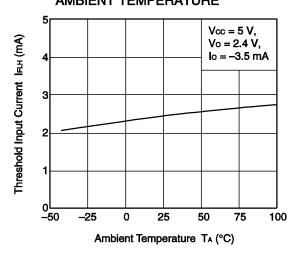
<R> TYPICAL CHARACTERISTICS (T_A = 25℃, unless otherwise specified)



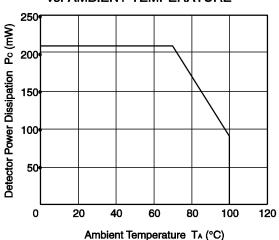




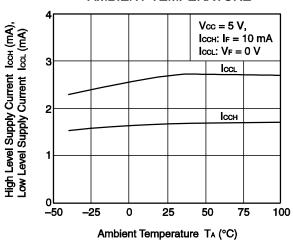
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



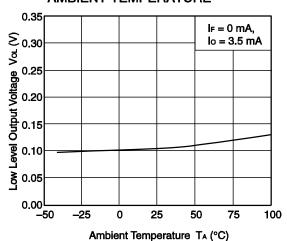
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



SUPPLY CURRENT vs. AMBIENT TEMPERATURE

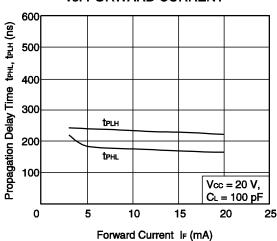


LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

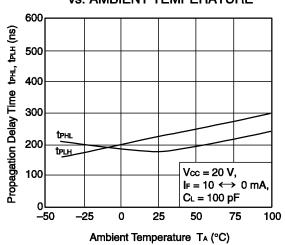


Remark The graphs indicate nominal characteristics.

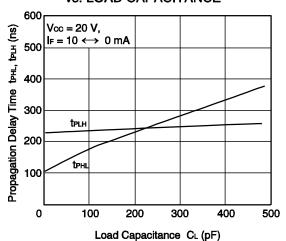
PROPAGATION DELAY TIME vs. FORWARD CURRENT



PROPAGATION DELAY TIME• vs. AMBIENT TEMPERATURE

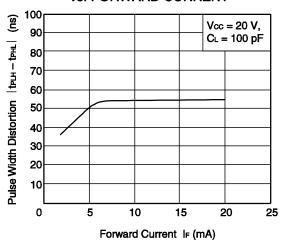


PROPAGATION DELAY TIME vs. LOAD CAPACITANCE

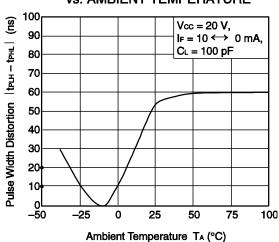


Remark The graphs indicate nominal characteristics.

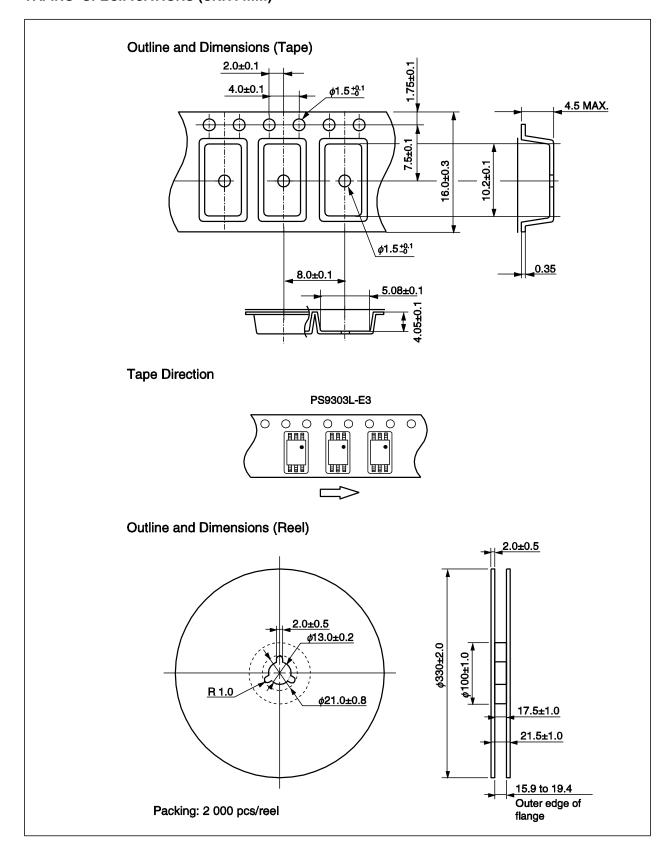
PULSE WIDTH DISTORTION vs. FORWARD CURRENT

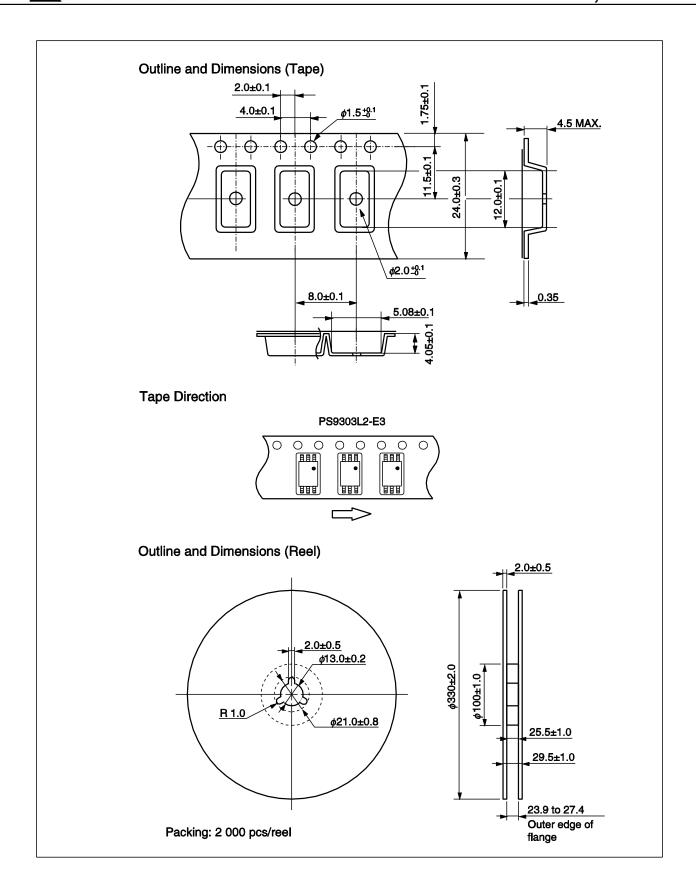


PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE

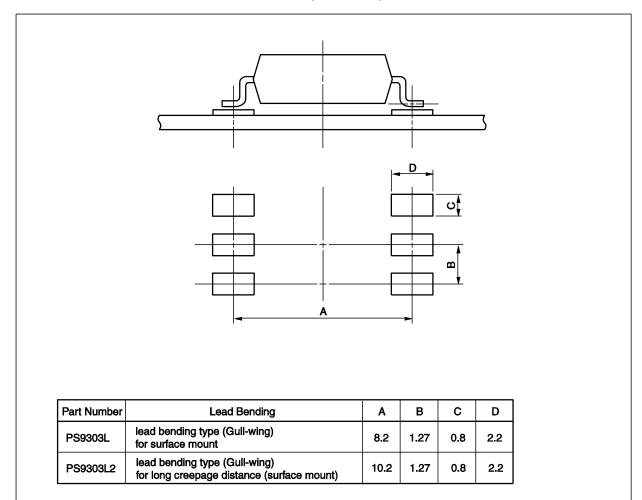


<R> TAPING SPECIFICATIONS (UNIT: mm)





<R> RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



<R> NOTES ON HANDLING

1. Recommended soldering conditions

(1) Infrared reflow soldering

Peak reflow temperature
 260°C or below (package surface temperature)

Time of peak reflow temperature
 Time of temperature higher than 220°C
 60 seconds or less

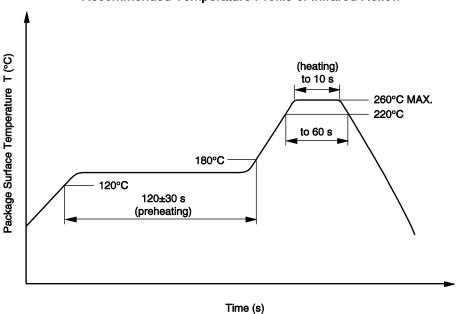
• Time to preheat temperature from 120 to 180°C 120±30 s

Number of reflows
 Three

Flux
 Rosin flux containing small amount of chlorine (The flux with a

maximum chlorine content of 0.2 Wt% is recommended.)

Recommended Temperature Profile of Infrared Reflow



(2) Wave soldering

• Temperature 260°C or below (molten solder temperature)

• Time 10 seconds or less

• Preheating conditions 120°C or below (package surface temperature)

Number of times
 One (Allowed to be dipped in solder including plastic mold portion.)

• Flux Rosin flux containing small amount of chlorine (The flux with a maximum chlorine

content of 0.2 Wt% is recommended.)

(3) Soldering by soldering iron

Peak temperature (lead part temperature) 350°C or below
 Time (each pins) 3 seconds or less

• Flux Rosin flux containing small amount of chlorine (The flux with a

maximum chlorine content of 0.2 Wt% is recommended.)

(a) Soldering of leads should be made at the point 1.5 to 2.0 mm from the root of the lead.

(b) Please be sure that the temperature of the package would not be heated over 100°C.

(4) Cautions

• Fluxes

Avoid removing the residual flux with freon-based and chlorine-based cleaning solvent.

2. Cautions regarding noise

Be aware that when voltage is applied suddenly between the photocoupler's input and output or between Vcc and GND at startup, the output side may enter the on state, even if the voltage is within the absolute maximum ratings.

<R> SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Spec.	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		40/100/21	
Dielectric strength		4.400	
maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.5 \times U_{DRM}, P_d < 5 pC$	Uiorm Upr	1 130 1 695	V _{peak} V _{peak}
Test voltage (partial discharge test, procedure b for all devices) $U_{pr} = 1.875 \times U_{\text{IORM}}, P_d < 5 pC$	Upr	2 119	V _{peak}
Highest permissible overvoltage	Utr	8 000	V_{peak}
Degree of pollution (DIN EN 60664-1 VDE0110 Part 1)		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303 Part 11))	CTI	175	
Material group (DIN EN 60664-1 VDE0110 Part 1)		III a	
Storage temperature range	Tstg	-55 to +125	C
Operating temperature range	TA	-40 to +100	C
Isolation resistance, minimum value $V_{IO} = 500 \text{ V dc at T}_A = 25 \text{ C}$ $V_{IO} = 500 \text{ V dc at T}_A \text{ MAX. at least } 100 \text{ C}$	Ris MIN. Ris MIN.	10 ¹² 10 ¹¹	Ω Ω
Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve)			
Package temperature	Tsi	175	${\mathfrak C}$
Current (input current I _F , Psi = 0) Power (output or total power dissipation) Isolation resistance	Isi Psi	400 700	mA mW
Vio = 500 V dc at T _A = Tsi	Ris MIN.	10 ⁹	Ω

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M8E0904E

Caution

GaAs Products

This product uses gallium arsenide (GaAs).

GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.

- Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below.
 - Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials.
- Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal.
- Do not burn, destroy, cut, crush, or chemically dissolve the product.
- Do not lick the product or in any way allow it to enter the mouth.