

PS2381-1

R08DS0134EJ0300

Rev.3.00

4-PIN LSOP PHOTOCOUPLER OPERATING AMBIENT TEMPERATURE 115 °C

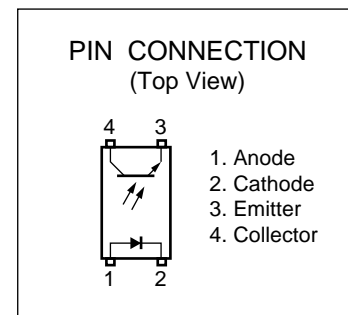
Oct. 27, 2023

DESCRIPTION

The PS2381-1 is an optically coupled isolator containing a GaAs light emitting diode and an NPN silicon phototransistor. This package is mounted in a plastic 4-pin LSOP (Long Mini-Flat Small Outline Package) for high density applications. The package has shield effect to cut off ambient light.

FEATURES

- Operating ambient temperature: 115 °C
- Isolation distance (0.4 mm MIN.)
- High isolation voltage (BV = 5 000 Vr.m.s.)
- 4-pin LSOP (Long Mini-Flat Small Outline Package) type
- High-speed switching ($t_r = 4 \mu s$ TYP., $t_f = 5 \mu s$ TYP.)
- Embossed tape product: PS2381-1-F3: 3 000 pcs/reel
- Pb-free product
- Safety standards
 - UL approved: UL 1577, Double protection
 - CSA approved: CAN/CSA-C22.2 No. 62368-1, Reinforced insulation
 - SEMKO approved: EN 62368-1, IEC 62368-1, Reinforced insulation
 - CQC approved: GB4943.1, Reinforced insulation
 - VDE approved: DIN EN IEC 60747-5-5 (Option)

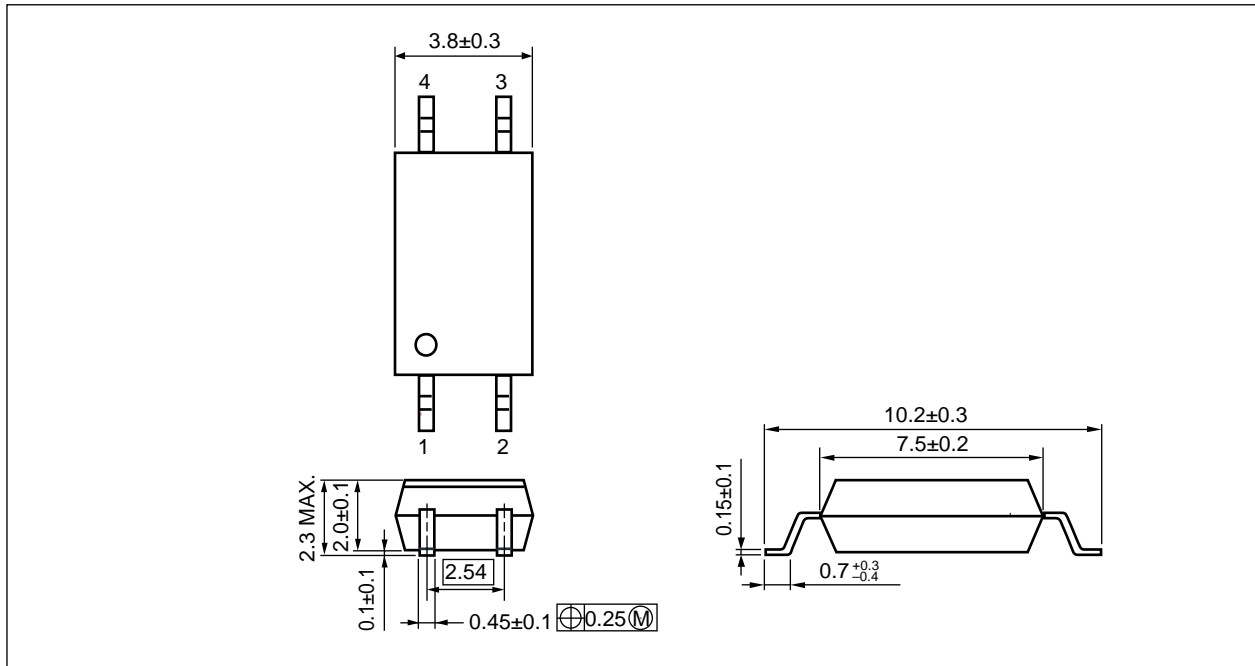


APPLICATIONS

- Power supply
- FA/OA equipment

Start of mass production
Jan.2010

PACKAGE DIMENSIONS (Unit: mm)

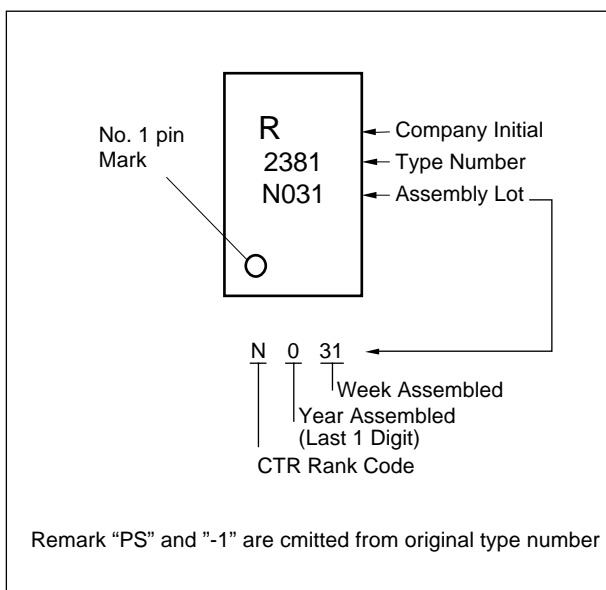


Weight (4-pin LSOP) : 0.11 g (TYP.)

PHOTOCOUPLER CONSTRUCTION

Parameter	Unit (MIN.)
Air Distance	8
Creepage Distance	8
Isolation Distance	0.4

MARKING EXAMPLE



ORDERING INFORMATION

Part Number	Order Number *1	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number *2
PS2381-1	PS2381-1Y-AX	Pb-Free and Halogen Free	Embossed Tape 20 pcs	Standard Products (UL, CSA, SEMKO, CQC Approved)	PS2381-1
PS2381-1-F3	PS2381-1Y-F3-AX		Embossed Tape 3 000 pcs/reel		
PS2381-1-V	PS2381-1Y-V-AX		Embossed Tape 20 pcs	UL, CSA, SEMKO, CQC, VDE Approved	
PS2381-1-V-F3	PS2381-1Y-V-F3-AX		Embossed Tape 3 000 pcs/reel		

Notes: *1. When specifying CTR rank, please add "/CTR rank" after Order Number.

ex. L rank : PS2381-1Y-AX/L

*2. For the application of the safety standard, the following part number should be used.

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

Parameter		Symbol	Ratings	Unit
Diode	Forward Current (DC)	I_F	60	mA
	Reverse Voltage	V_R	6	V
	Power Dissipation Derating ^{*1}	$\Delta P_D/^{\circ}\text{C}$	1.0	mW/ $^{\circ}\text{C}$
	Power Dissipation	P_D	100	mW
	Peak Forward Current ^{*2}	I_{FP}	1.5	A
Transistor	Collector to Emitter Voltage	V_{CEO}	80	V
	Emitter to Collector Voltage	V_{ECO}	7	V
	Collector Current	I_C	50	mA
	Power Dissipation Derating ^{*1}	$\Delta P_C/^{\circ}\text{C}$	1.5	mW/ $^{\circ}\text{C}$
	Power Dissipation	P_C	150	mW
Isolation Voltage ^{*3}		BV	5 000	Vr.m.s.
Total Power Dissipation		P_T	250	mW
Operating Ambient Temperature		T_A	-40 to +115	$^{\circ}\text{C}$
Storage Temperature		T_{stg}	-40 to +125	$^{\circ}\text{C}$

Notes: *1. Derating from $T_A = 25\text{ }^{\circ}\text{C}$.

*2. PW = 100 μs , Duty Cycle = 1 %

*3. AC voltage for 1 minute at $T_A = 25\text{ }^{\circ}\text{C}$, RH = 60 % between input and output.
Pins 1-2 shorted together, 3-4 shorted together.

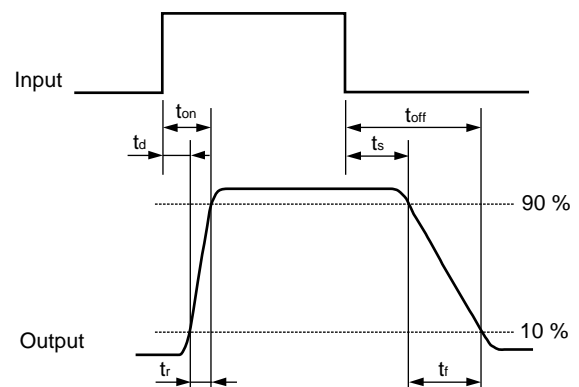
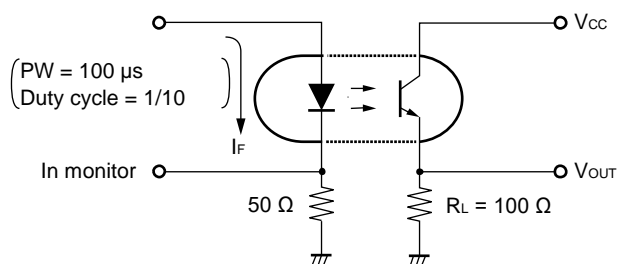
ELECTRICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$)

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	V_F	$I_F = 5\text{ mA}$		1.1	1.4	V
	Reverse Current	I_R	$V_R = 5\text{ V}$			5	μA
	Terminal Capacitance	C_i	$V = 0\text{ V}, f = 1\text{ MHz}$		15		pF
Transistor	Collector to Emitter Dark Current	I_{CEO}	$I_F = 0\text{ mA}, V_{CE} = 24\text{ V}$			100	nA
Coupled	Current Transfer Ratio (I_C/I_F) *1	CTR	$I_F = 5\text{ mA}, V_{CE} = 5\text{ V}$	50	100	400	%
			$I_F = 1\text{ mA}, V_{CE} = 5\text{ V}$	10	50		
	Collector Saturation Voltage	$V_{CE(sat)}$	$I_F = 10\text{ mA}, I_C = 2\text{ mA}$			0.3	V
	Isolation Resistance	R_{I-O}	$V_{I-O} = 1\text{ kV}_{DC}$	10^{11}			Ω
	Isolation Capacitance	C_{I-O}	$V = 0\text{ V}, f = 1\text{ MHz}$		0.4		pF
	Rise Time *2	t_r	$V_{CC} = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\text{ }\Omega$		4		μs
	Fall Time *2	t_f			5		

Notes: *1. CTR rank

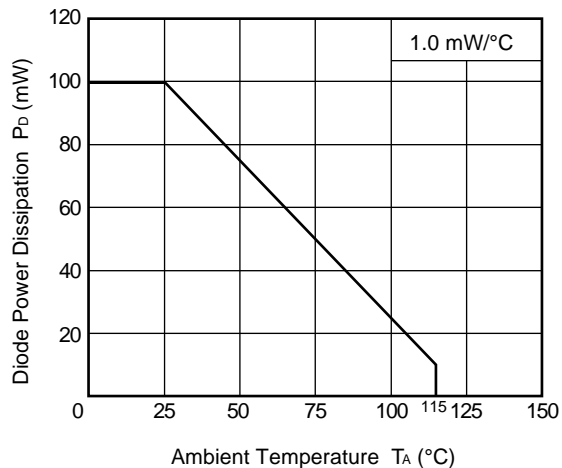
CTR rank	CTR (%)	Conditions
W	130 to 260	$I_F = 5\text{ mA}, V_{CE} = 5\text{ V}$
	26 to	$I_F = 1\text{ mA}, V_{CE} = 5\text{ V}$
L	100 to 300	$I_F = 5\text{ mA}, V_{CE} = 5\text{ V}$
	20 to	$I_F = 1\text{ mA}, V_{CE} = 5\text{ V}$
M	50 to 150	$I_F = 5\text{ mA}, V_{CE} = 5\text{ V}$
	10 to	$I_F = 1\text{ mA}, V_{CE} = 5\text{ V}$
N	50 to 400	$I_F = 5\text{ mA}, V_{CE} = 5\text{ V}$
	10 to	$I_F = 1\text{ mA}, V_{CE} = 5\text{ V}$

*2. Test circuit for switching time

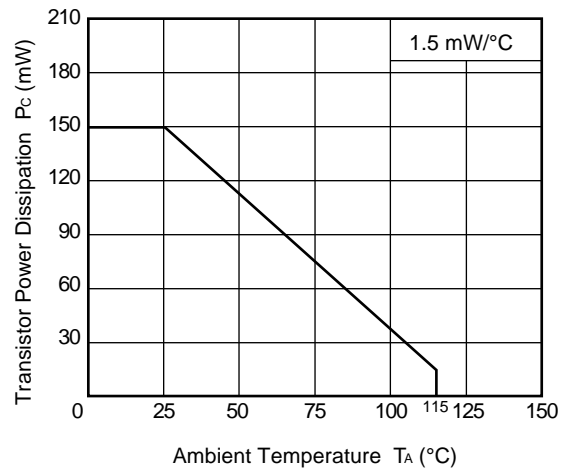


TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

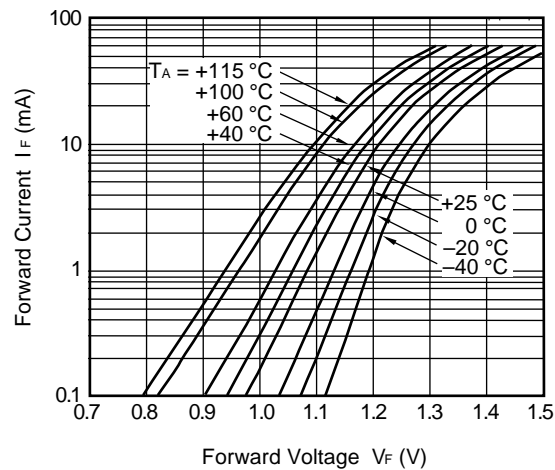
DIODE POWER DISSIPATION vs.
AMBIENT TEMPERATURE



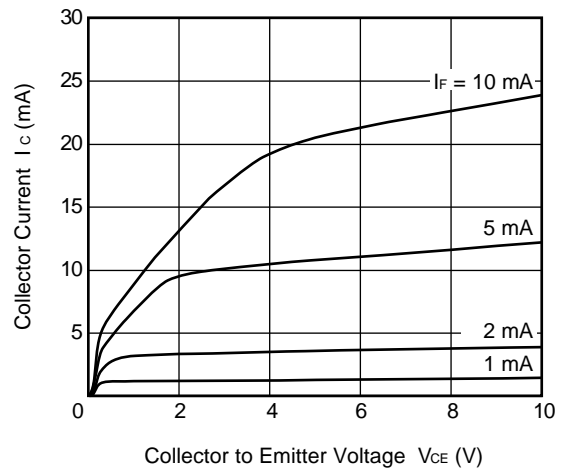
TRANSISTOR POWER DISSIPATION vs.
AMBIENT TEMPERATURE



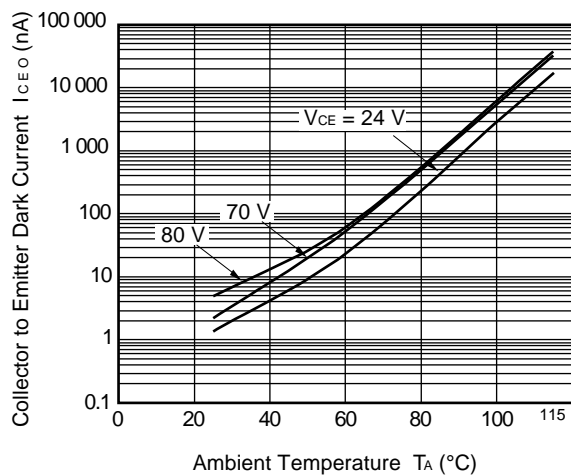
FORWARD CURRENT vs.
FORWARD VOLTAGE



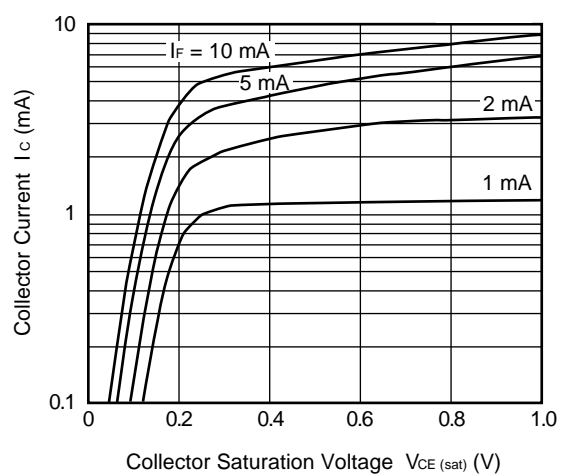
COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



COLLECTOR TO EMITTER DARK
CURRENT vs. AMBIENT TEMPERATURE

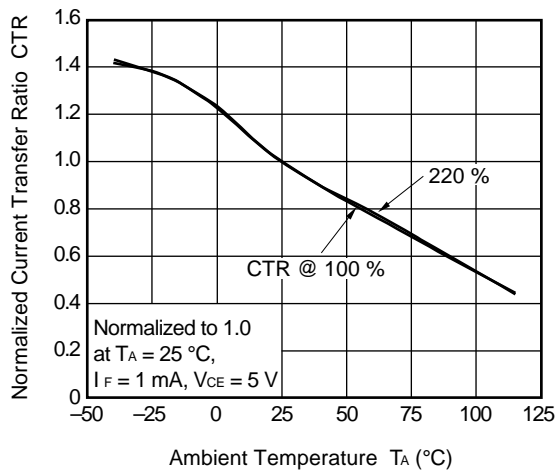


COLLECTOR CURRENT vs.
COLLECTOR SATURATION VOLTAGE

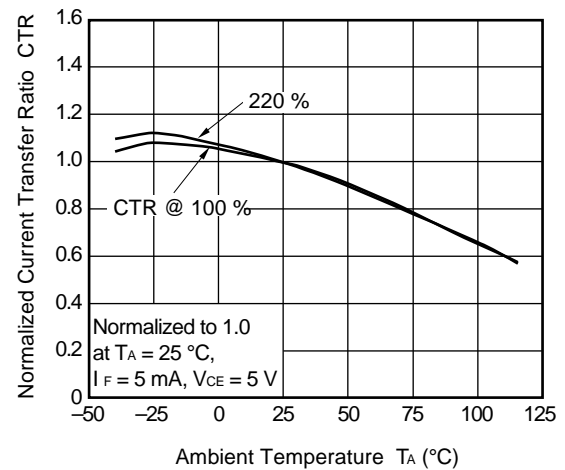


Remark The graphs indicate nominal characteristics.

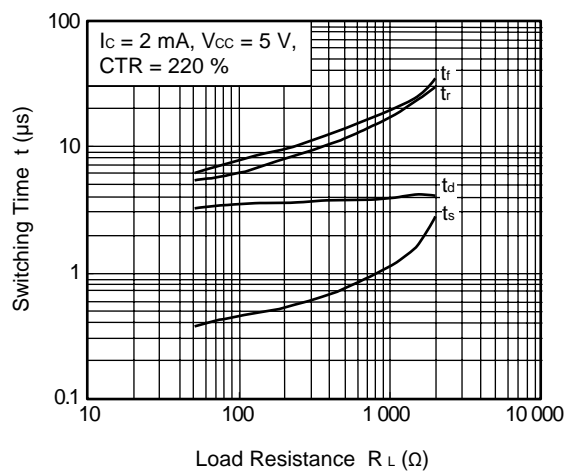
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



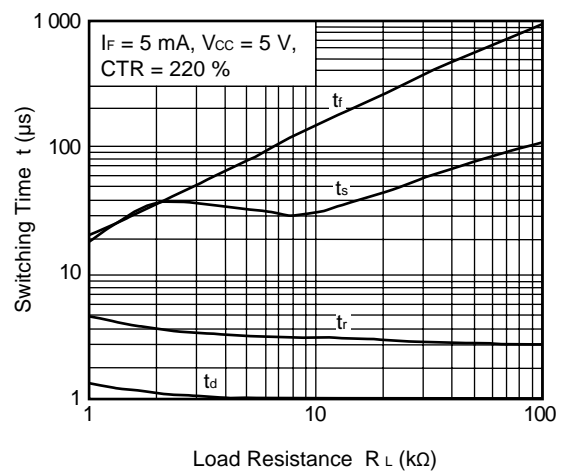
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



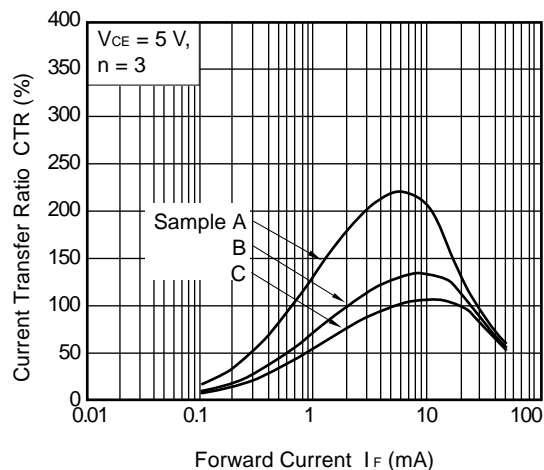
SWITCHING TIME vs. LOAD RESISTANCE



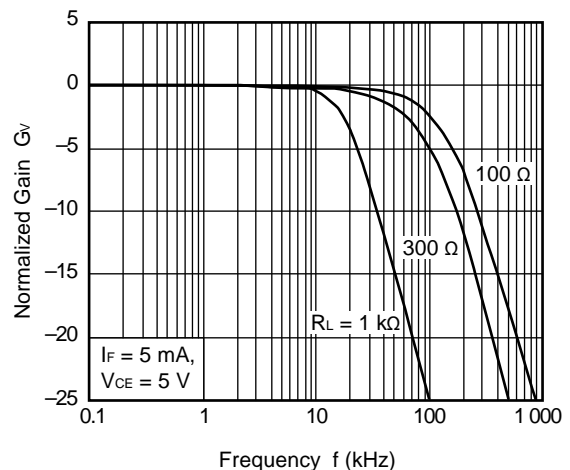
SWITCHING TIME vs. LOAD RESISTANCE



CURRENT TRANSFER RATIO vs. FORWARD CURRENT



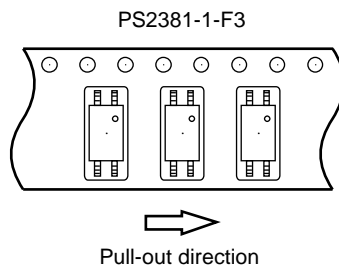
FREQUENCY RESPONSE



Remark The graphs indicate nominal characteristics.

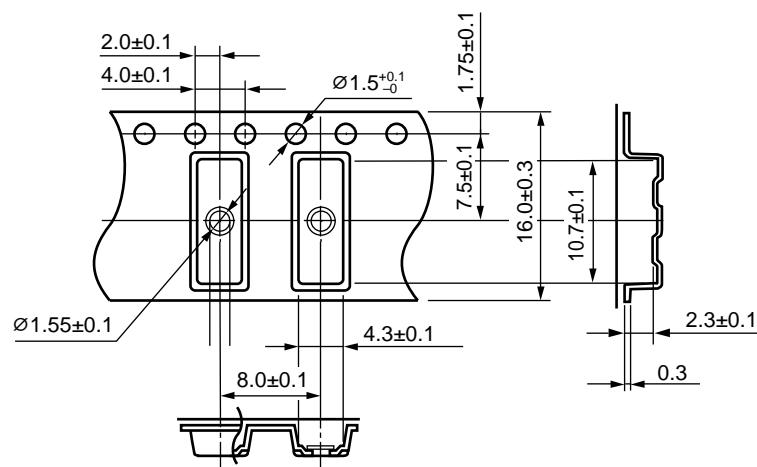
TAPING SPECIFICATIONS (UNIT: mm)

Tape Direction



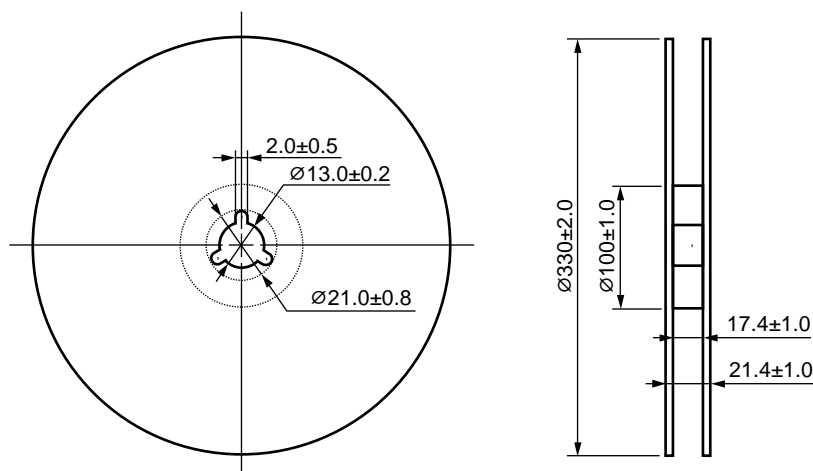
Outline and Dimensions (Tape)

Unit : mm

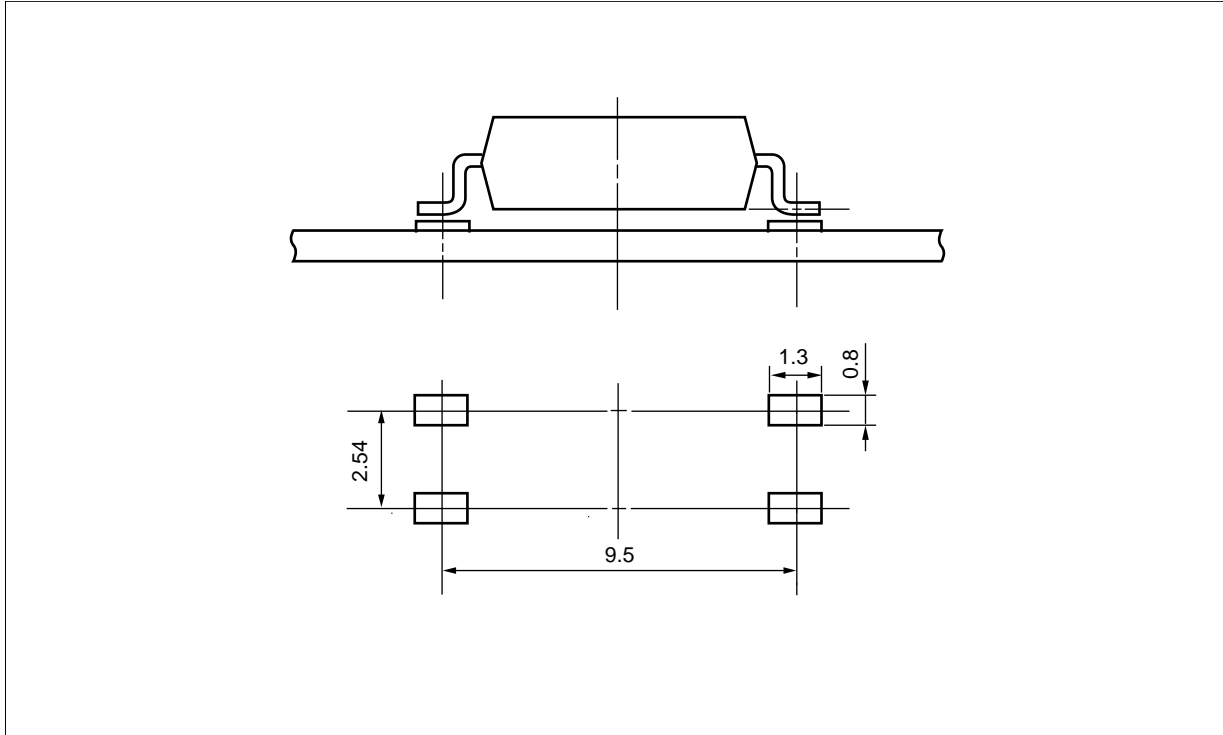


Outline and Dimensions (Reel)

Unit : mm



Packing: 3 000 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)

Remark All dimensions in this figure must be evaluated before use.

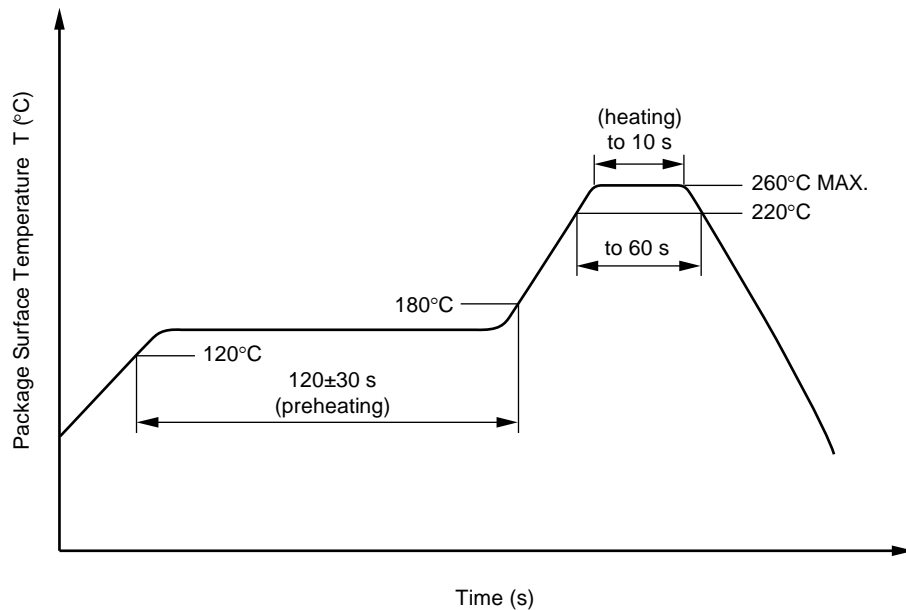
NOTES ON HANDLING

1. Recommended soldering conditions

(1) Infrared reflow soldering

- Peak reflow temperature 260 °C or below (package surface temperature)
- Time of peak reflow temperature 10 seconds or less
- 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 (per one side) 3 s or less
- Flux Rosin flux containing small amount of chlorine
(The flux with a maximum chlorine content of 0.2 Wt% is recommended.)
- Place 1.5 to 2.0 mm or more away from the root of the lead

(4) Cautions

- Flux cleaning Avoid cleaning with Freon- or halogen-based (chlorinated etc.) solvents.
- Fixing/Coating Do not use fixing agents or coatings containing halogen-based substances

2. Cautions regarding noise

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

3. Measurement conditions of current transfer ratios (CTR), which differ according to photocoupler

Check the setting values before use, since the forward current conditions at CTR measurement differ according to product.

When using products other than at the specified forward current, the characteristics curves may differ from the standard curves due to CTR value variations or the like. Therefore, check the characteristics under the actual operating conditions and thoroughly take variations or the like into consideration before use.

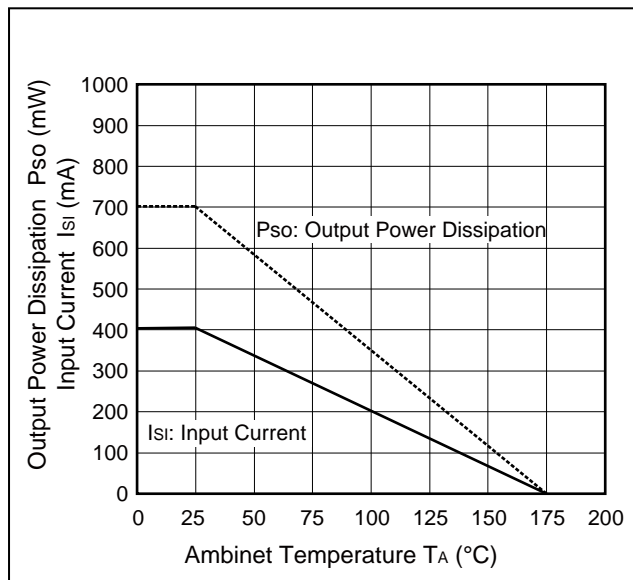
USAGE CAUTIONS

1. Protect against static electricity when handling.
2. Avoid storage at a high temperature and high humidity.
3. Avoid cleaning with Freon based or halogen-based (chlorinated etc.) solvents.
4. Do not use fixing agents or coatings containing halogen-based substances.

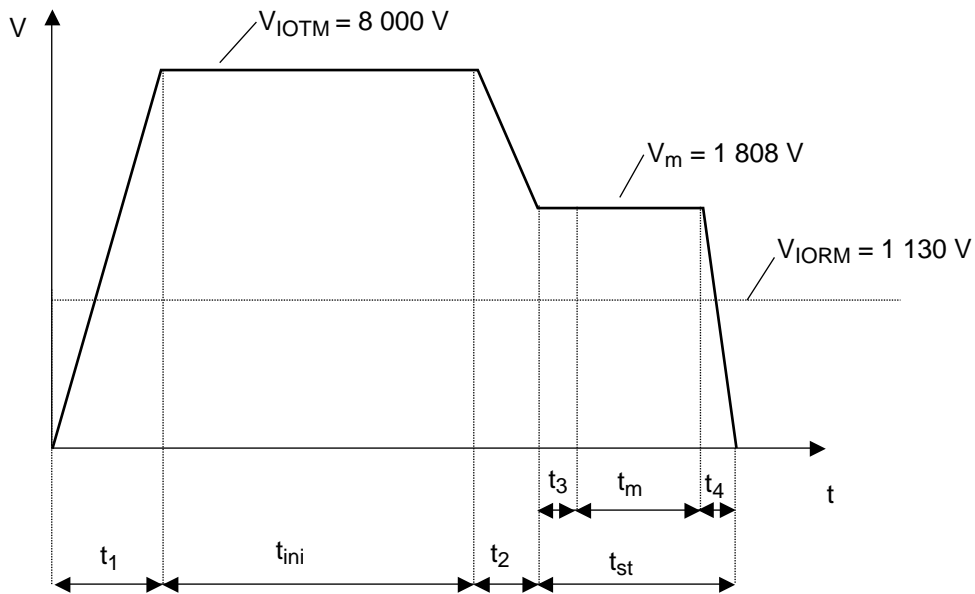
SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Rating	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		40/115/21	
Dielectric strength			
maximum operating isolation voltage	V_{IORM}	1 130	V_{peak}
Test voltage (partial discharge test, procedure a for type test and random test) $V_m = 1.6 \times V_{IORM}$, $q_{pd} < 5 \text{ pC}$	V_m	1 808	V_{peak}
Test voltage (partial discharge test, procedure b for all devices) $V_m = 1.875 \times V_{IORM}$, $q_{pd} < 5 \text{ pC}$	V_m	2 119	V_{peak}
Highest permissible overvoltage	V_{IOTM}	8 000	V_{peak}
Degree of pollution (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303-11))	CTI	175	
Material group (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))		III a	
Storage temperature range	T_{stg}	-40 to +125	°C
Operating temperature range	T_A	-40 to +115	°C
Isolation resistance, minimum value $V_{I-O} = 500 \text{ V dc}$, $T_A = 25 \text{ °C}$	$R_{I-O} \text{ MIN.}$	10^{12}	Ω
$V_{I-O} = 500 \text{ V dc}$, $T_A = \text{maximum temperature of rating, at least } 100 \text{ °C}$	$R_{I-O} \text{ MIN.}$	10^{11}	Ω
Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve)			
Maximum ambient temperature	T_S	175	°C
Maximum input current	I_{SI}	400	mA
Maximum output power dissipation	P_{SO}	700	mW
Isolation resistance, minimum value at $V_{I-O} = 500 \text{ V dc}$, $T_A = T_S$	$R_{I-O} \text{ MIN.}$	10^9	Ω

Dependence of maximum safety ratings with package temperature

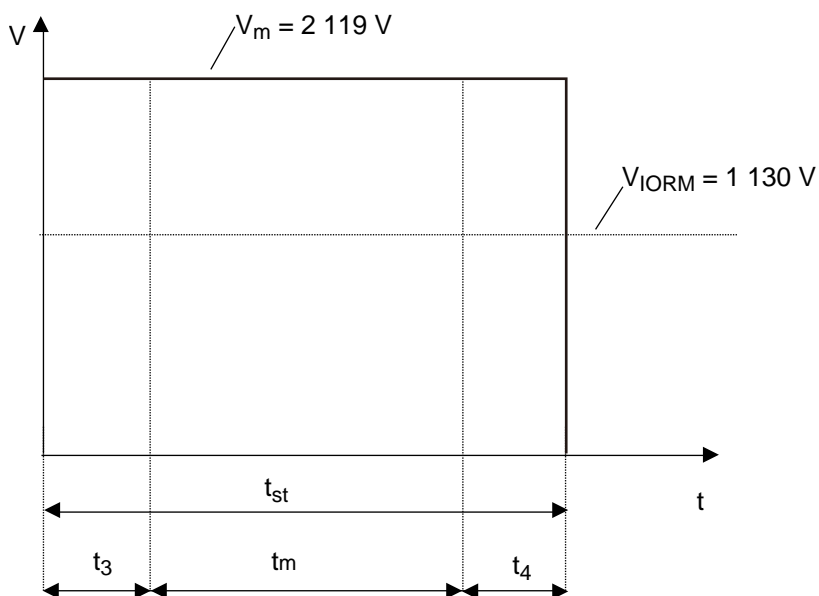


Method a) Destructive Test, Type and Sample Test



$t_1, t_2 = 1 \text{ to } 10 \text{ sec}$
 $t_3, t_4 = 1 \text{ sec}$
 $t_m = 10 \text{ sec}$
 $t_{st} = 12 \text{ sec}$
 $t_{ini} = 60 \text{ sec}$

Method b) Non-destructive Test, 100% Production Test



$t_3, t_4 = 0.1 \text{ sec}$
 $t_m = 1.0 \text{ sec}$
 $t_{st} = 1.2 \text{ sec}$

Caution	GaAs Products	<p>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.</p> <ul style="list-style-type: none">• 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.<ol style="list-style-type: none">1. 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.2. 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.
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