RV1S9231A

R08DS0219EJ0200
Rev.2.00
Oct. 02, 2025

2.5 A OUTPUT CURRENT, HIGH CMTI, IGBT GATE DRIVE,
5-PIN SSOP WITH 8.2mm CREEPAGE DISTANCE (LSSO5) PHOTOCOUPLER

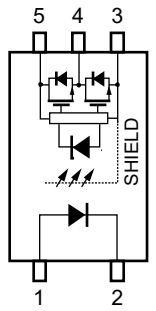
DESCRIPTION

The RV1S9231A is an optically coupled isolator containing an AlGaAs LED on the input side and a photodiode, a signal processing circuit and power MOSFETs on the output side on one chip.
The RV1S9231A is designed specifically for high common mode transient immunity (CMTI) and high switching speed. It is suitable for driving IGBTs.

FEATURES

- Small and long creepage (8.2 mm MIN, LSSO5)
- Large peak output current (2.5 A MAX., 2.0 A MIN.)
- High speed switching (t_{PLH}, t_{PHL} = 175 ns MAX.)
- UVLO (Under Voltage Lock Out) protection with hysteresis
- High common mode transient immunity ($|CM_H|$, $|CM_L|$ = 50 kV/μs MIN.)
- Operating ambient temperature (125 °C MAX.)
- High isolation voltage (BV = 5 000 Vr.m.s.)
- Embossed tape product : RV1S9231ACCSP-10Yx#KC0 : 3 500 pcs/reel
- Pb-free product
- Safety standard
  - UL : UL1577, Double protection
  - CSA : CAN/CSA-C22.2 No.62368-1, Reinforced insulation
  - VDE : DIN EN IEC 60747-5-5 (Option)

PIN CONNECTION
(Top View)



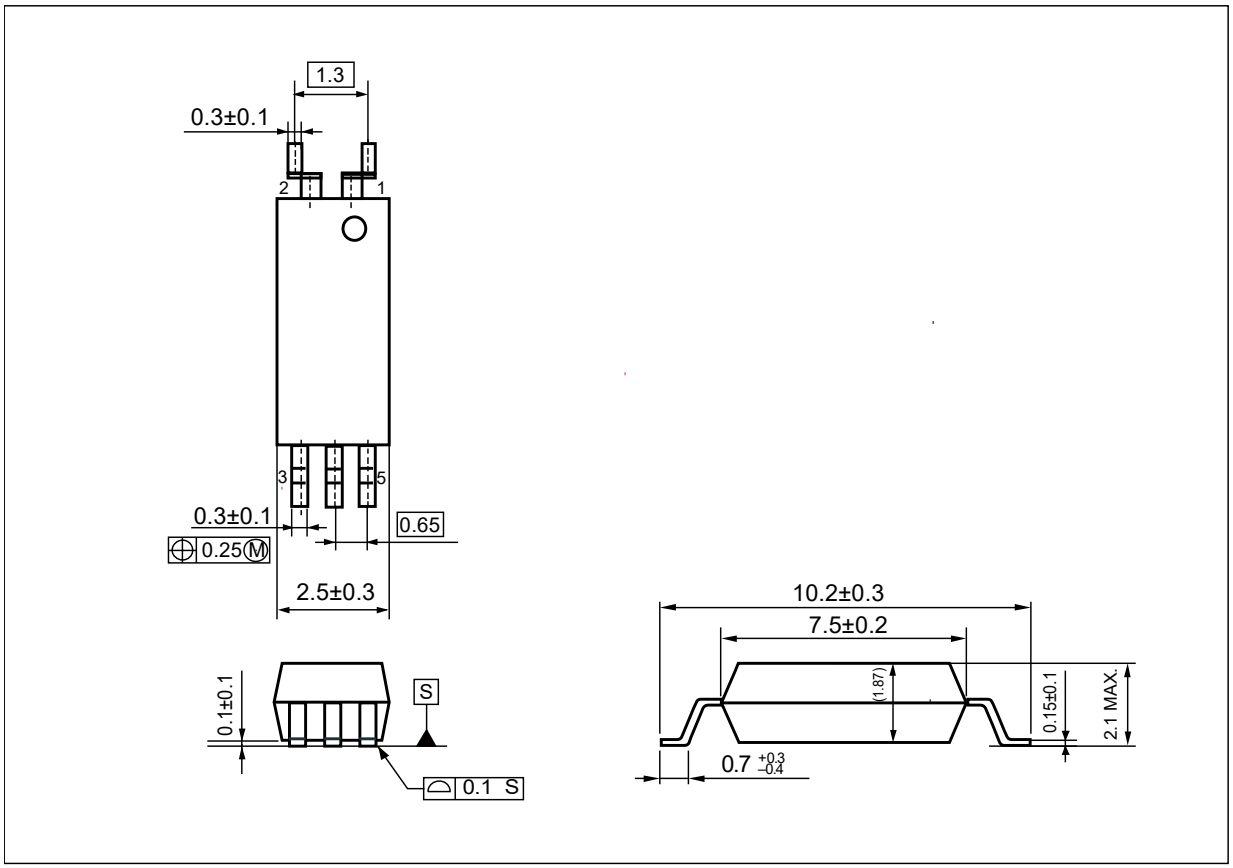
1. Anode
2. Cathode
3. V_{EE}
4. V_O
5. V_{CC}

APPLICATIONS

IGBT Gate Driver
Industrial inverter
AC Servo

Start of mass production
Feb.2021

PACKAGE DIMENSIONS (UNIT: mm)

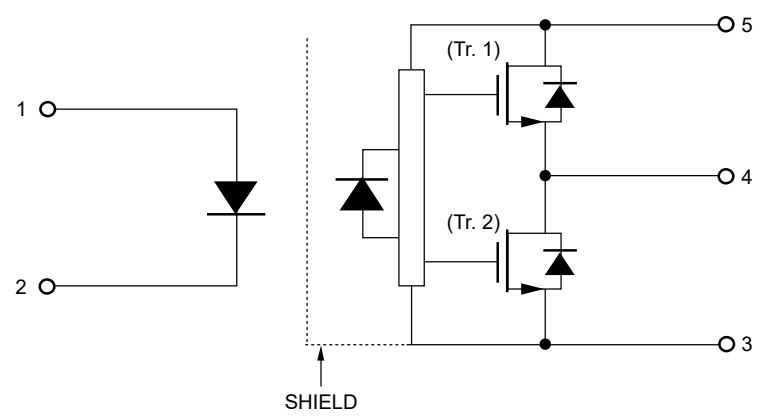


Weight :0.075g（TYP.）

PHOTOCOUPLER CONSTRUCTION

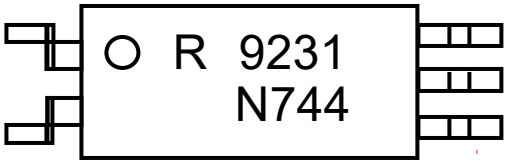
Parameter	MIN.
Air Distance	8.2 mm
Creepage Distance	8.2 mm
Isolation Distance	0.15 mm

BLOCK DIAGRAM



Input	LED	Tr. 1	Tr. 2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

MARKING EXAMPLE



R		An initial of “Renesas”
9231		Product Part Number＊
○		No.1 pin Mark
N744	N	Rank Code
	744	Assembly Lot
	7	Last one-digit of Assembly Year
	44	Weekly Serial Code

＊） Applicable type numbers listed below

RV1S 9231 ACCSP-10Yx

Marking type number. ”RV1S”and “ACCSP-10Yx” are omitted from original type number.

ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number *1
RV1S9231ACCSP -10YC	RV1S9231ACCSP -10YC#SC0	Pb-Free and Halogen Free (Ni/Pd/Au)	Embossed Tape 20 pcs	UL, CSA Approved	RV1S9231A
	RV1S9231ACCSP -10YC#KC0		Embossed Tape 3 500 pcs/reel		
RV1S9231ACCSP -10YV	RV1S9231ACCSP -10YV#SC0		Embossed Tape 20 pcs	UL, CSA, VDE Approved	
	RV1S9231ACCSP -10YV#KC0		Embossed Tape 3 500 pcs/reel		

Notes: *1. For the application of the safety standard, the following part number should be used.

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

Parameter		Symbol	Ratings	Unit
Diode	Forward Current	I_F	20	mA
	Peak Transient Forward Current (Pulse Width < 1 us)	$I_{F\ (TRAN)}$	1.0	A
	Reverse Voltage	V_R	5	V
	Power Dissipation *1	P_D	45	mW
Detector	High Level Peak Output Current *2	$I_{OH\ (PEAK)}$	−2.5	A
	Low Level Peak Output Current *2	$I_{OL\ (PEAK)}$	2.5	A
	Supply Voltage	$V_{CC} - V_{EE}$	0 to 35	V
	Output Voltage	V_O	0 to V_{CC}	V
	Power Dissipation *3	Pc	250	mW
Isolation Voltage *4		BV	5 000	Vr.m.s.
Operating Frequency		f	200	kHz
Operating Ambient Temperature		T_A	−40 to +125	°C
Storage Temperature		T_{stg}	−40 to +150	°C

Notes: *1. Reduced to 1.2 mW/°C at T_A = 110 °C or more.
*2. Maximum pulse width = 10 µs, Maximum duty cycle = 0.5 %
*3. Reduced to 3.9 mW/°C at T_A = 90 °C or more.
*4. AC voltage for 1 minute at T_A = 25 °C, RH = 60 % between input and output.
Pins 1-2 shorted together, 3-5 shorted together.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	$V_{CC} - V_{EE}$	15		30	V
Forward Current (ON)	$I_{F\ (ON)}$	8	10	12	mA
Forward Voltage (OFF)	$V_{F\ (OFF)}$	−2		0.8	V
Operating Ambient Temperature	T_A	−40		125	°C

ELECTRICAL CHARACTERISTICS (at RECOMMENDED OPERATING CONDITIONS, V_{EE} = GND, unless otherwise specified)

Parameter		Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit
Diode	Forward Voltage	V_F	I_F = 10 mA, T_A = 25 °C	1.35	1.56	1.75	V
	Reverse Current	I_R	V_R = 3 V, T_A = 25 °C			10	μA
	Input Capacitance	C_t	V_F = 0 V, f = 1 MHz, T_A = 25 °C		30		pF
Detector	High Level Output Current	I_{OH}	V_O = (V_{CC} − 4 V) *2, *5		−2.2	−0.5	A
			V_O = (V_{CC} − 15 V) *3, *5			−2.0	
	Low Level Output Current	I_{OL}	V_O = (V_{EE} + 2.5 V) *2, *5	0.5	1.8		A
			V_O = (V_{EE} + 15 V) *3, *5	2.0			
	High Level Output Voltage	V_{OH}	I_O = −100 mA *4	V_{CC} − 3.0V	V_{CC} − 1.3V		V
	Low Level Output Voltage	V_{OL}	I_O = 100 mA		0.2	0.5	V
	High Level Supply Current	I_{CCH}	V_O = Open, I_F = 10 mA *5		1.6	2.2	mA
	Low Level Supply Current	I_{CCL}	V_O = Open, V_F = 0 to 0.8 V *5		1.5	2.2	mA
	UVLO Threshold	V_{UVLO+}	V_O > 5 V, I_F = 10 mA	10.8	12.5	13.4	V
		V_{UVLO-}		9.5	11.2	12.5	
	UVLO Hysteresis	$UVLO_{HYS}$		0.4	1.3		
Coupled	Threshold Input Current (L → H)	I_{FLH}	I_O = 0 mA, V_O > 5 V *5		2.6	5.2	mA
	Threshold Input Voltage (H → L)	V_{FHL}	I_O = 0 mA, V_O < 5 V	0.8			V

Notes: *1. Typical values at T_A = 25 °C, V_{CC} − V_{EE} = 30 V.

*2. Maximum pulse width = 50 μs, Maximum duty cycle = 0.5 %.

*3. Maximum pulse width = 10 μs, Maximum duty cycle = 0.2 %.

*4. V_{OH} is measured with the pulse load current in this testing (Maximum pulse width = 2 ms, Maximum duty cycle = 20 %).

*5. The polarity of the current flowing from the external circuit to the RV1S9231A is positive.

SWITCHING CHARACTERISTICS (at RECOMMENDED OPERATING CONDITIONS, V_{EE} = GND, unless otherwise specified)

Parameter	Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit
Propagation Delay Time (L → H)	t_{PLH}	R_g = 10 Ω, C_g = 10 nF, f = 10 kHz, Duty Cycle = 50 %, I_F = 10 mA		80	175	ns
Propagation Delay Time (H → L)	t_{PHL}			105	175	ns
Pulse Width Distortion	PWD = $\lvert t_{PHL} - t_{PLH} \rvert$			25	75	ns
Propagation Delay Difference Between Any Two Parts	PDD = $t_{PHL} - t_{PLH}$		−90		90	ns
Rise Time	t_r			40		ns
Fall Time	t_f			40		ns
Common Mode Transient Immunity at High Level Output	$\lvert CM_H \rvert$	T_A = 25 °C, I_F = 10 mA, V_{CC} = 30 V, V_{CM} = 1.5 kV	50			kV/μs
Common Mode Transient Immunity at Low Level Output	$\lvert CM_L \rvert$	T_A = 25 °C, I_F = 0 mA, V_{CC} = 30 V, V_{CM} = 1.5 kV	50			kV/μs

Notes: *1. Typical values at T_A = 25 °C, V_{CC} - V_{EE} = 30 V.

TEST CIRCUIT

Fig. 1 I_{OH} Test Circuit

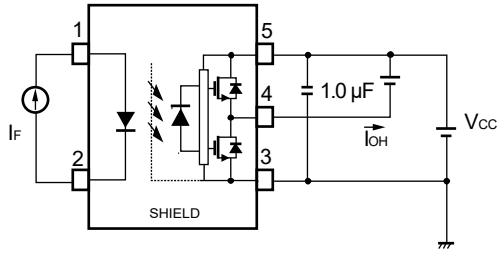


Fig. 2 I_{OL} Test Circuit

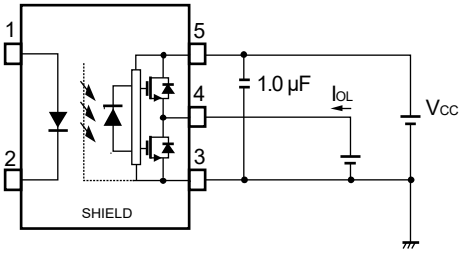


Fig. 3 V_{OH} Test Circuit

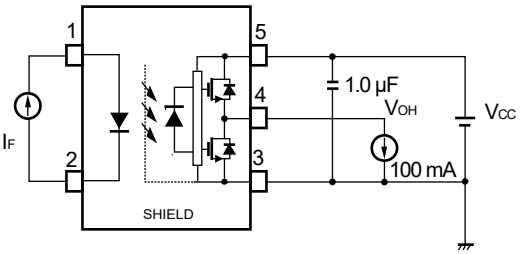


Fig. 4 V_{OL} Test Circuit

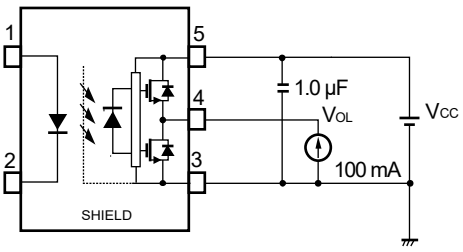


Fig. 5 I_{CCH}/I_{CCL} Test Circuit

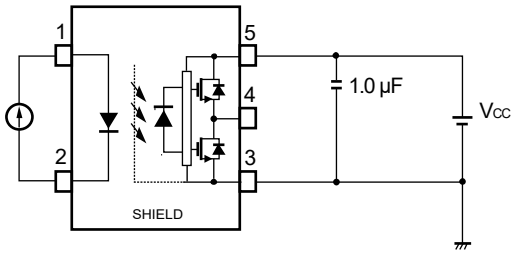


Fig. 6 UVLO Test Circuit

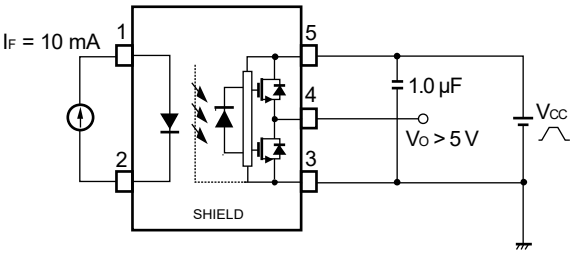


Fig.7 I_{FLH} Test Circuit

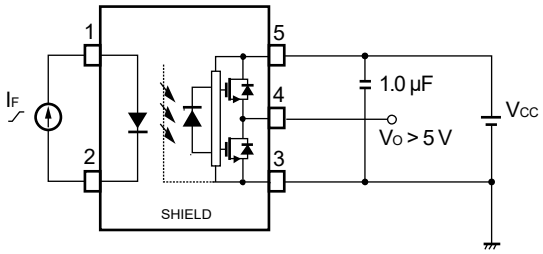


Fig. 8 t_{PLH}, t_{PHL}, t_r, t_f Test Circuit and Wave Forms

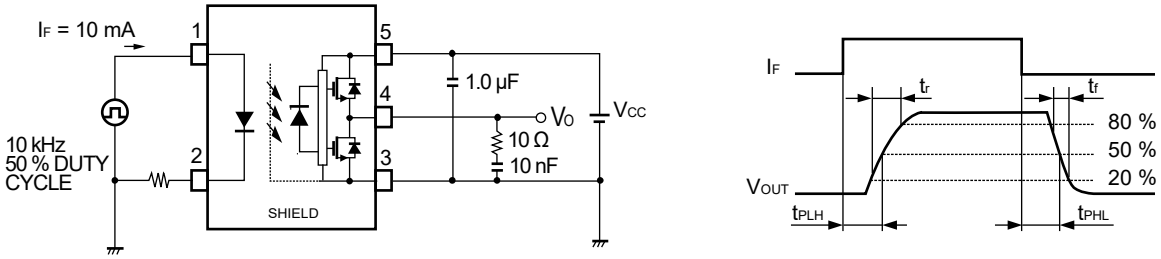
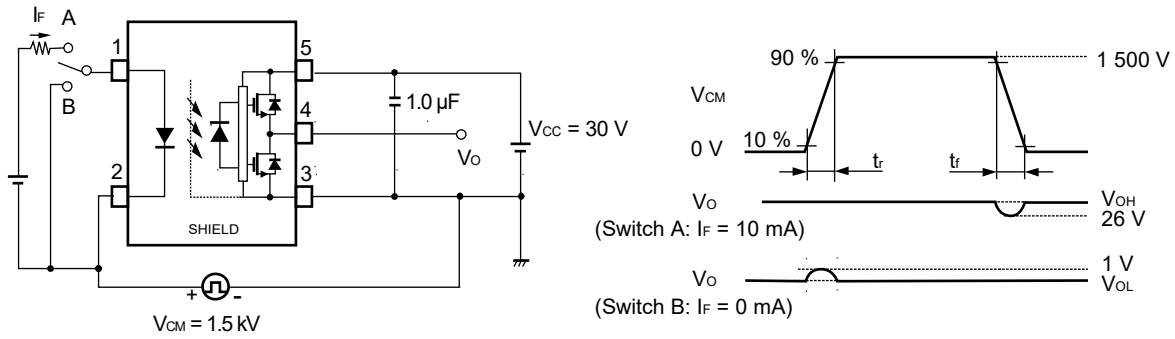
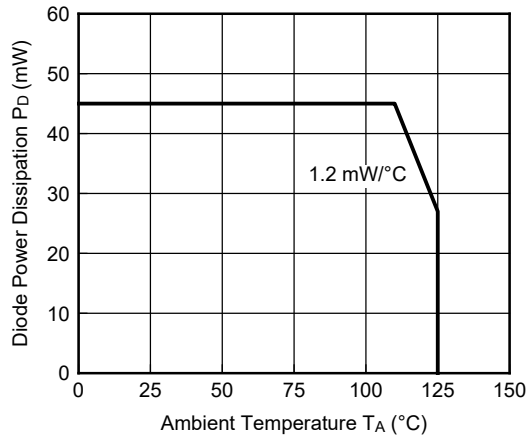


Fig. 9 CMTI Test Circuit and Wave Forms

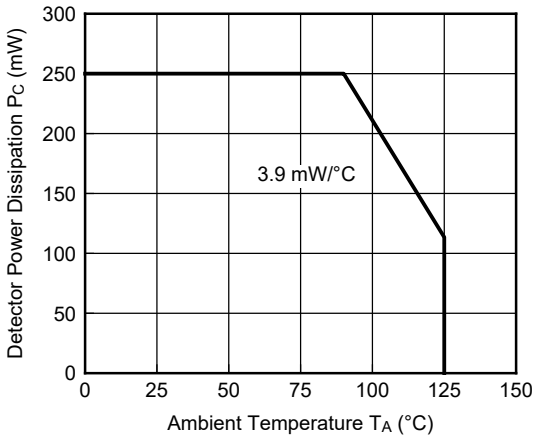


TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise specified)

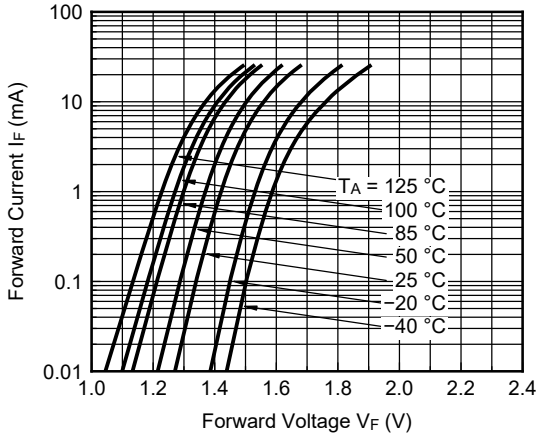
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



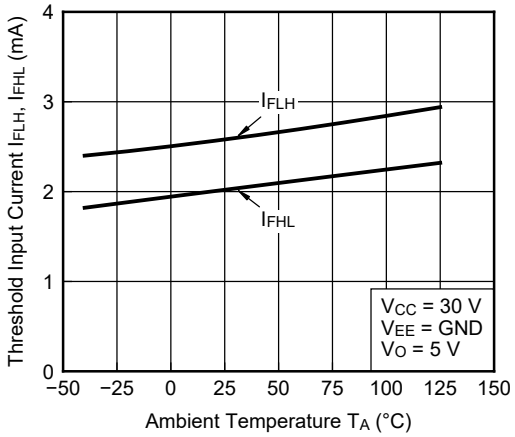
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



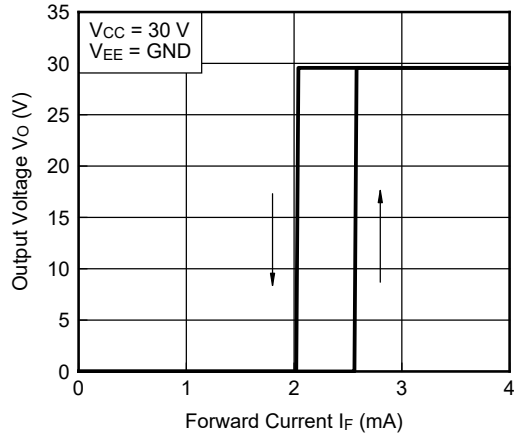
FORWARD CURRENT vs. FORWARD VOLTAGE



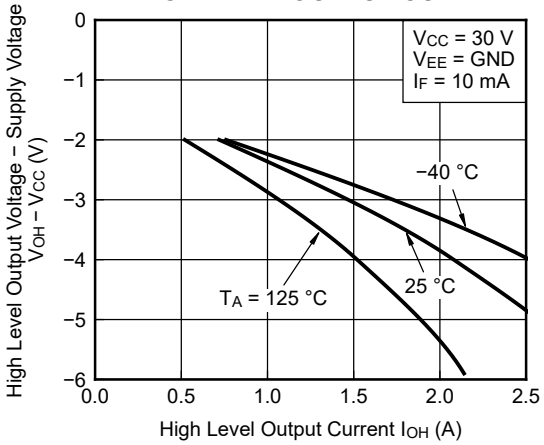
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



OUTPUT VOLTAGE vs. FORWARD CURRENT



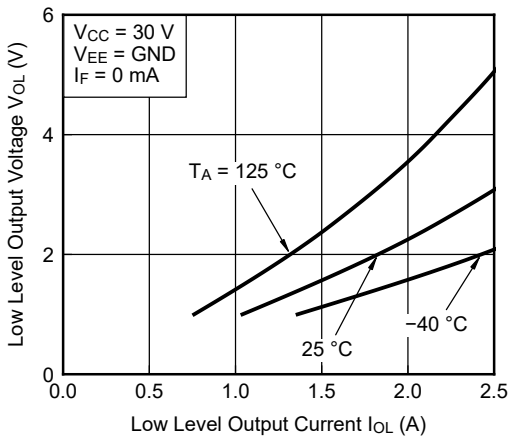
HIGH LEVEL OUTPUT VOLTAGE − SUPPLY VOLTAG vs. HIGH LEVEL OUTPUT CURRENT



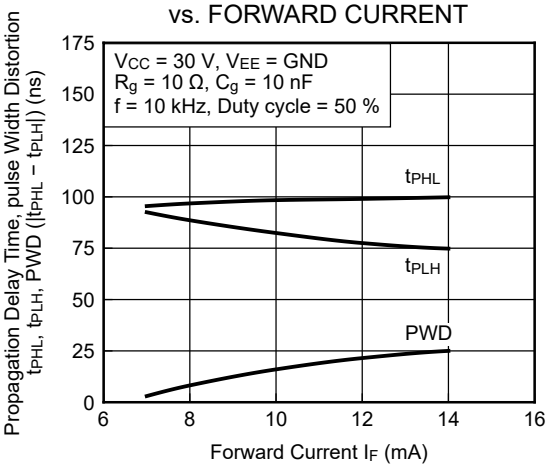
Remark The graphs indicate nominal characteristics.

TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise specified)

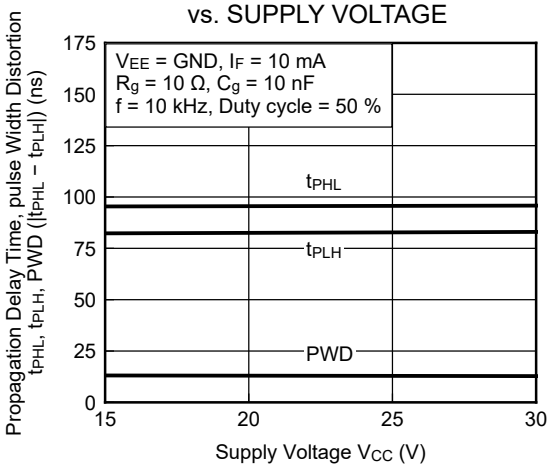
LOW LEVEL OUTPUT VOLTAGE vs. LOW LEVEL OUTPUT CURRENT



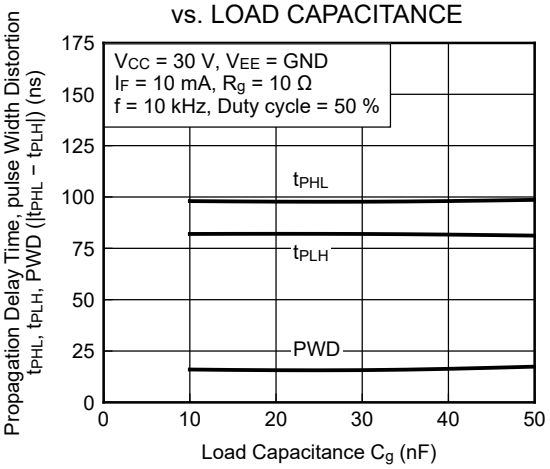
PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. FORWARD CURRENT



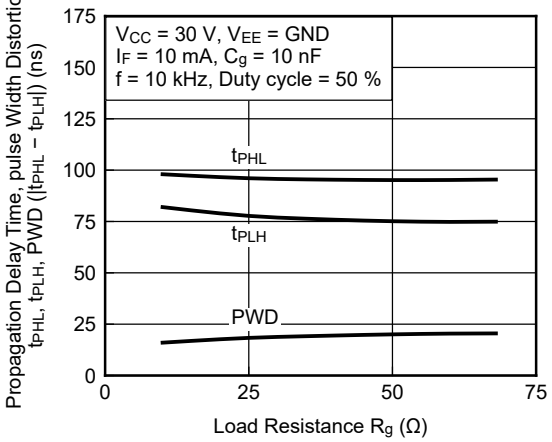
PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. SUPPLY VOLTAGE



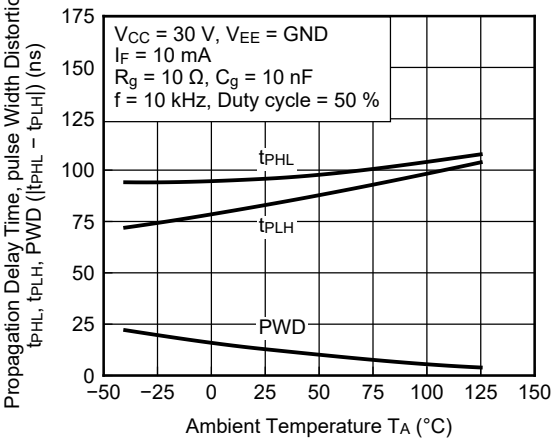
PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. LOAD CAPACITANCE



PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. LOAD RESISTANCE



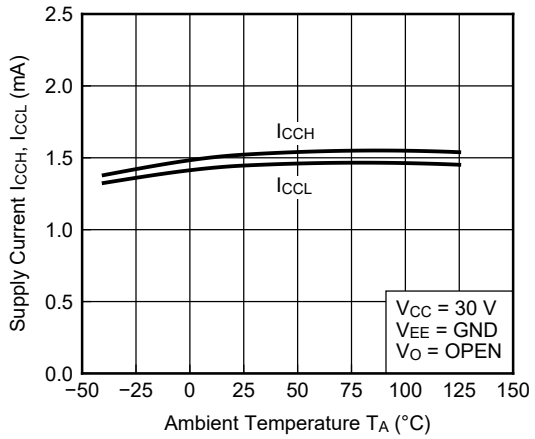
PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE



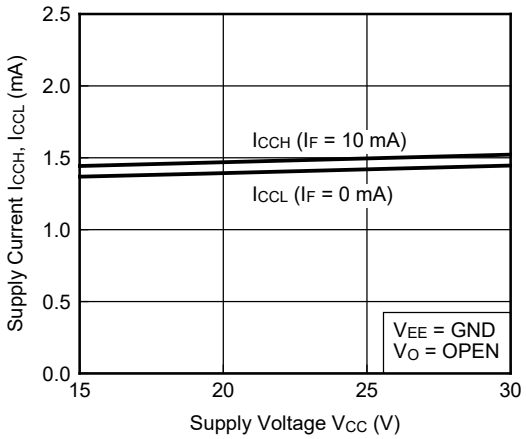
Remark The graphs indicate nominal characteristics.

TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise specified)

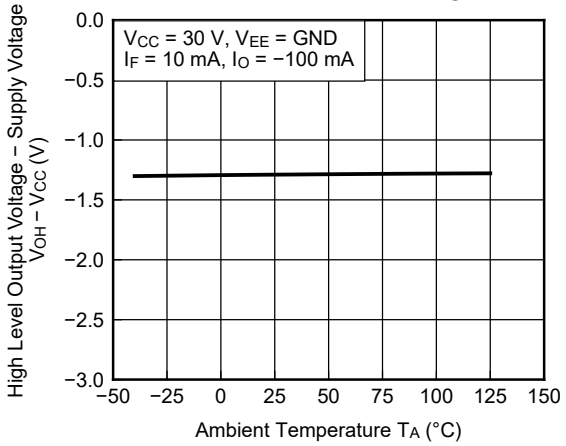
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



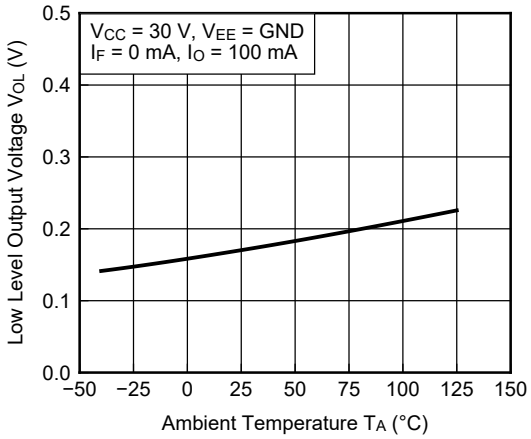
SUPPLY CURRENT vs. SUPPLY VOLTAGE



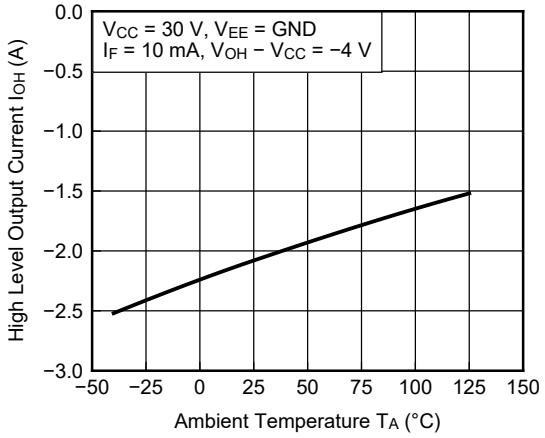
HIGH LEVEL OUTPUT VOLTAGE − SUPPLY VOLTAGE vs. AMBIENT TEMPERATURE



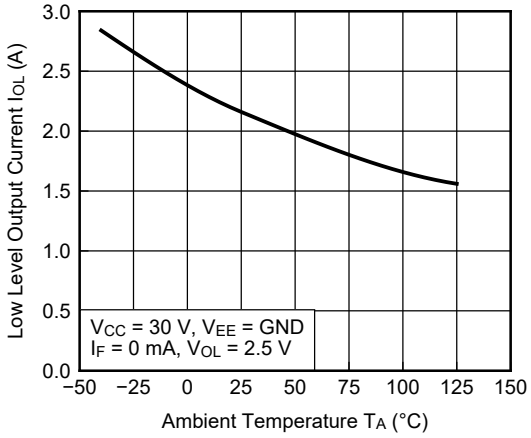
LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



HIGH LEVEL OUTPUT CURRENT vs. AMBIENT TEMPERATURE

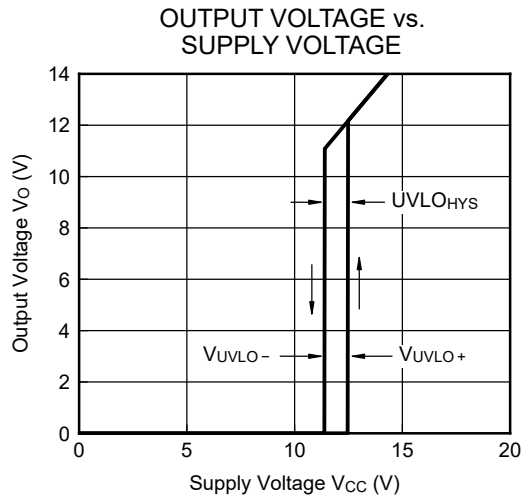


LOW LEVEL OUTPUT CURRENT vs. AMBIENT TEMPERATURE



Remark The graphs indicate nominal characteristics.

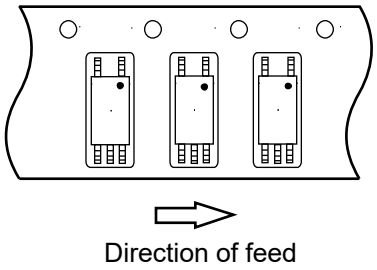
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise specified)



Remark The graphs indicate nominal characteristics.

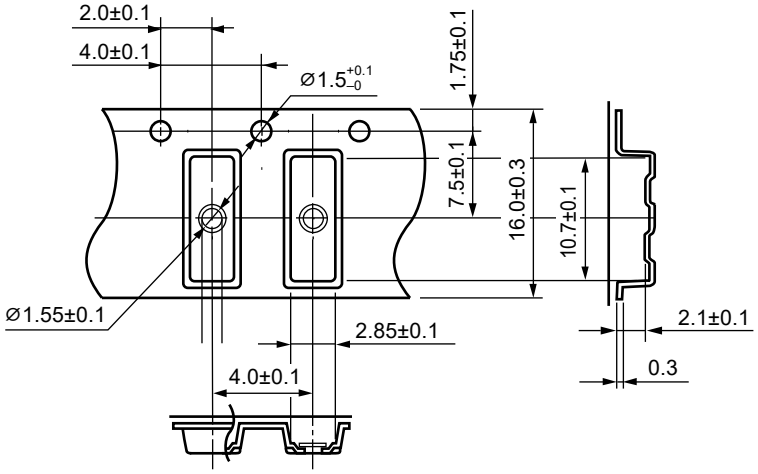
TAPING SPECIFICATIONS (UNIT : mm)

Tape Direction



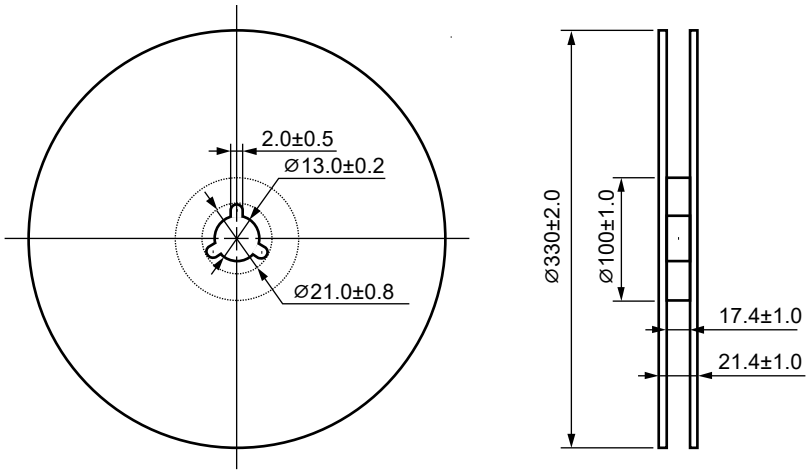
Outline and Dimensions (Tape)

(Unit : mm)



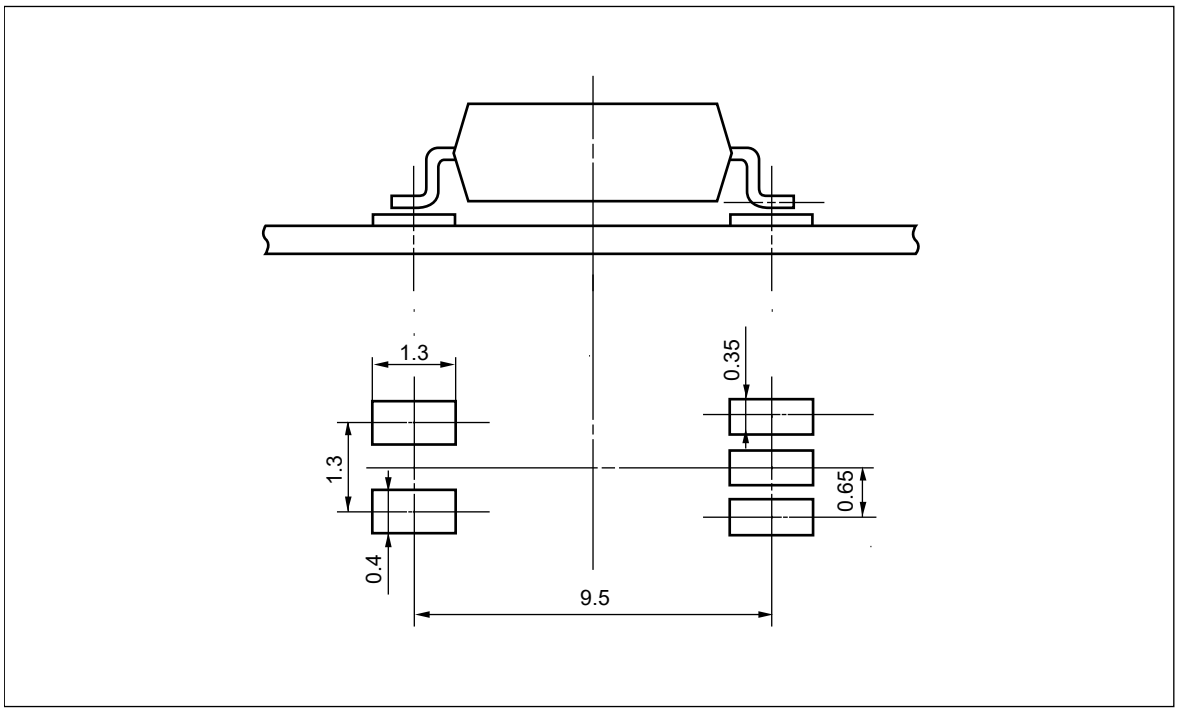
Outline and Dimensions (Reel)

(Unit : mm)



Packing: 3 500 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT：mm)

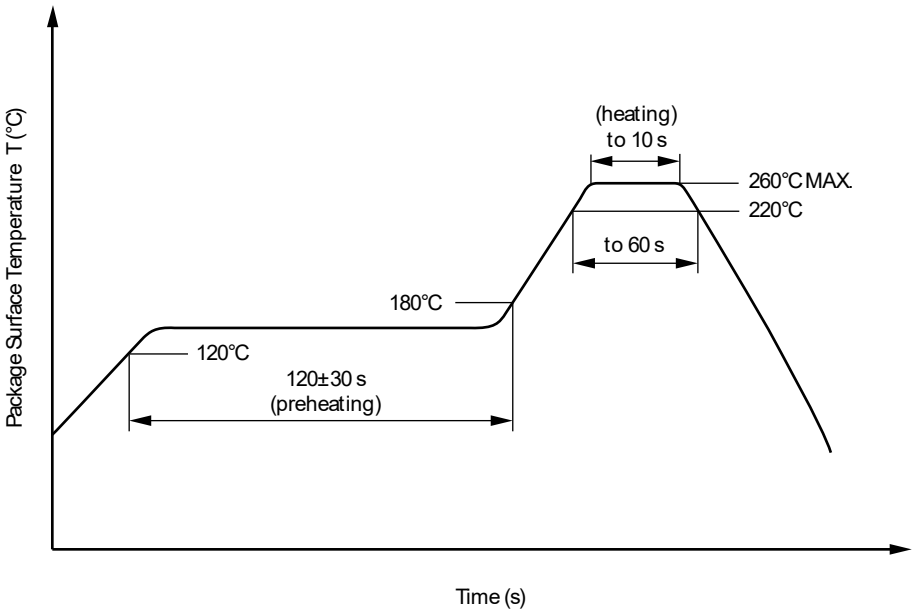


Remark All dimensions in this figure must be evaluated before use.

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 s or less
   - Time of temperature higher than 220 °C 60 s 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 s 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 at startup, the output transistor may enter the on state, even if the voltage is within the absolute maximum ratings.

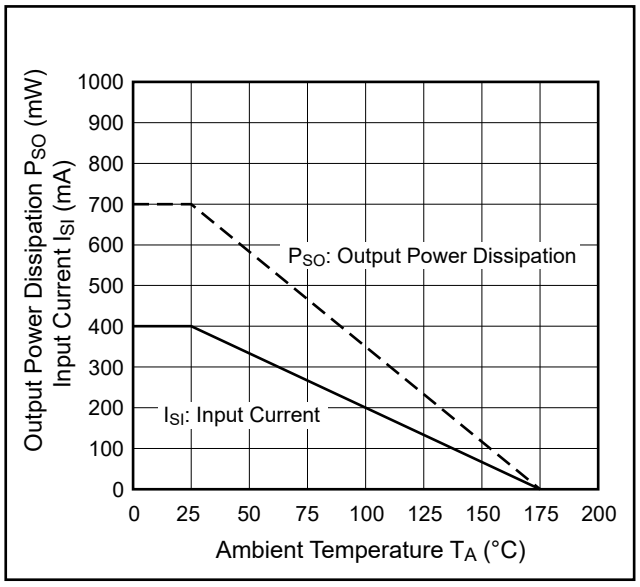
USAGE CAUTIONS

1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. Board designing
   (1) By-pass capacitor of more than 1.0 μF is used between V_{CC} and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.
   (2) When designing the printed wiring board, ensure that the pattern of the IGBT collectors/emitters is not too close to the input block pattern of the photocoupler.
   If the pattern is too close to the input block and coupling occurs, a sudden fluctuation in the voltage on the IGBT output side might affect the photocoupler's LED input, leading to malfunction or degradation of characteristics.
   (If the pattern needs to be close to the input block, to prevent the LED from lighting during the off state due to the abovementioned coupling, design the input-side circuit so that the bias of the LED is reversed, within the range of the recommended operating conditions, and be sure to thoroughly evaluate operation.)
3. Make sure the rise/fall time of the forward current is 0.5 μs or less.
4. In order to avoid malfunctions, make sure the rise/fall slope of the supply voltage is 3 V/μs or less.
5. Avoid storage at a high temperature and high humidity.

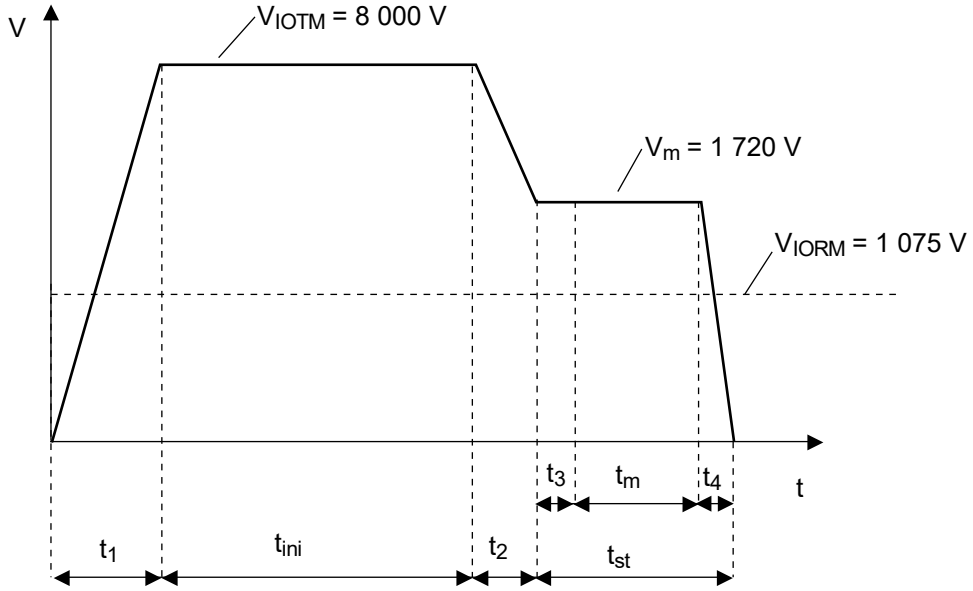
SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Rating	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		40/125/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $V_m = 1.6 \times V_{IORM.}$, $q_{pd} < 5$ pC	 V_{IORM} V_m	 1 075 1 720	 V_{peak} V_{peak}
Test voltage (partial discharge test, procedure b for all devices) $V_m = 1.875 \times V_{IORM.}$, $q_{pd} < 5$ pC	V_m	2 016	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	400	
Material group (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))		II	
Storage temperature range	T_{stg}	−40 to +150	°C
Operating temperature range	T_A	−40 to +125	°C
Isolation resistance, minimum value V_{I-O} = 500 V dc, T_A = 25 °C V_{I-O} = 500 V dc, T_A = maximum temperature of rating, at least 100 °C	 R_{I-O} MIN. R_{I-O} MIN.	 10^{12} 10^{11}	 Ω Ω
Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve) Maximum ambient temperature Maximum input current Maximum output power dissipation Isolation resistance, minimum value at V_{I-O} = 500 V dc, $T_A = T_S$	 T_S I_{SI} P_{SO} R_{I-O} MIN.	 175 400 700 10^9	 °C mA mW Ω

Dependence of maximum safety ratings on ambient temperature

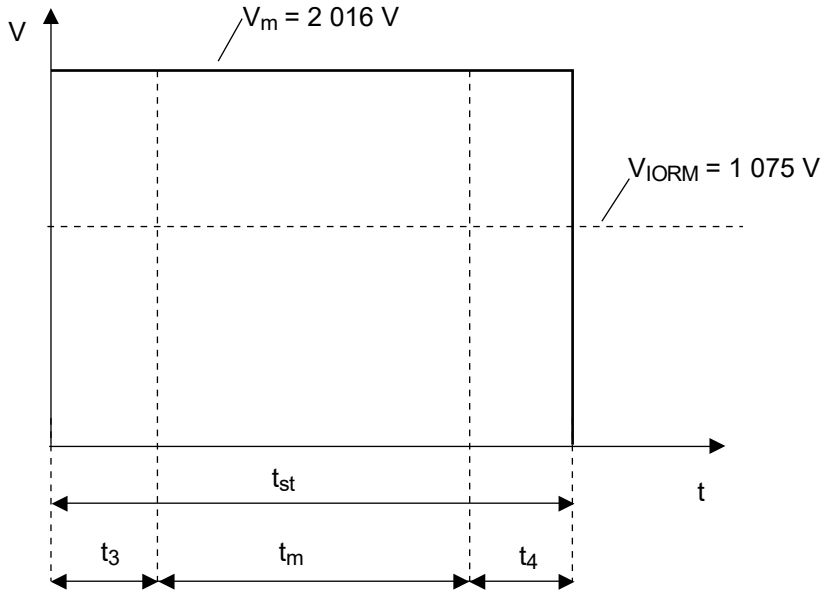


Method a) Destructive Test, Type and Sample Test



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

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



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

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