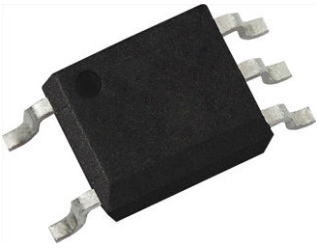
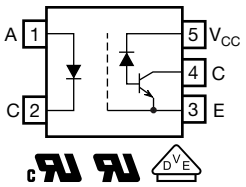
High Speed Coupler, 1 MBd





FEATURES

- Optimized propagation delay for minimum pulse width distortion
- 1 MBd high speed
- Very high CMTI of 50 kV/µs
- Wide voltage supply range
- Open collector output
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

DESCRIPTION

The VOM453 high speed optocoupler consists of a GaAlAs infrared emitting diode, optically coupled with an integrated photo detector and a high speed transistor. The photo detector is junction isolated from the transistor. The open collector output allows to adjust the load conditions when interfacing with different logic systems such as TTL, CMOS, etc.

The VOM453 has a shield on the detector chip to reject and minimize high input to output common mode transient voltages.

APPLICATIONS

- Logic ground and noise isolation
- Analog signal ground isolation
- Digital data bus systems
- Microcontroller interface

AGENCY APPROVALS

- UL (pending)
- cUL (pending)
- DIN EN 60747-5-5 (VDE 0884-5), available with option 1 (pending)

ORDERING INFORMATION

V	O	M	4	5	3	T

PART NUMBER

AGENCY CERTIFIED / PACKAGE	
UL, cUL	
SOP-5	VOM453T

Notes

- For additional information on the available options refer to option information
- The product is available only on tape and reel

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	5	V
Average input forward current		I_F	25	mA
Peak input forward current	50 % duty cycle, 1 ms pulse width	$I_{F(peak)}$	50	mA
Surge input forward current	$t_p \leq 1$ µs, 300 pulses/s	I_{FSM}	1	A
Power dissipation	$T_{amb} \leq 70$ °C	P_{diss}	45	mW
OUTPUT				
Supply voltage		V_S	-0.5 to +30	V
Output voltage		V_O	-0.5 to +20	V
Output current		I_O	8	mA
Peak output current		$I_{O(peak)}$	16	mA
Power dissipation	$T_{amb} \leq 70$ °C	P_{diss}	100	mW
COUPLER				
Storage temperature range		T_{stg}	-55 to +125	°C
Ambient temperature range		T_{amb}	-55 to +100	°C
Junction temperature		T_j	100	°C
Soldering temperature	t < 10 s max.		260	°C

Note

- Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

ELECTRICAL CHARACTERISTICS (T_{amb} = 0 °C to +70 °C; typical values are at T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Input forward voltage	I_F = 16 mA, T_{amb} = 25 °C	V_F	1.2	1.35	1.8	V
Input reverse current	V_R = 5 V	I_R	-	-	10	µA
Input capacitance	f = 1 MHz, V_F = 0 V, T_{amb} = 25 °C	C_{IN}	-	24.5	-	pF
OUTPUT						
Logic low supply current	I_F = 16 mA, V_O = open, V_{CC} = 15 V	I_{CCL}	-	209	-	µA
Logic high supply current	I_F = 0 mA, V_O = open, V_{CC} = 15 V, T_{amb} = 25 °C	I_{CCH}	-	0.15	1	µA
Logic low output voltage	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 3 mA, T_{amb} = 25 °C	V_{OL}	-	0.2	0.4	V
	I_F = 16 mA, V_{CC} = 15 V, I_O = 2.4 mA, T_{amb} = 25 °C	V_{OL}	-	-	0.5	V
Logic high output current	I_F = 0 mA, V_O = V_{CC} = 5.5 V, T_{amb} = 25 °C	I_{OH}	-	0.04	0.5	µA
	I_F = 0 mA, V_O = V_{CC} = 15 V, T_{amb} = 25 °C	I_{OH}	-	0.04	1	µA
COUPLER						
Capacitance (input-output)	f = 1 MHz, T_{amb} = 25 °C	C_{IO}	-	1	-	pF

Notes

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements. All typical values are measured at T_{amb} = 25 °C.

CURRENT TRANSFER RATIO (T_{amb} = 0 °C to +70 °C; typical values are at T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Current transfer ratio [1]	I_F = 16 mA, V_O = 0.5 V, V_{CC} = 4.5 V, T_{amb} = 25 °C	CTR	15	38	-	%
	I_F = 16 mA, V_O = 0.4 V, V_{CC} = 4.5 V, T_{amb} = 25 °C		20	36	50	

Note

[1] Current transfer ratio in percent equals the ratio of output collector current (I_O) to the forward LED input current (I_F) times 100.

SWITCHING CHARACTERISTICS

(T_{amb} = 0 °C to +70 °C; typical values are at T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Propagation delay time to logic low at output (1)	I_F = 16 mA, V_{CC} = 5 V, R_L = 1.9 kΩ, C_L = 15 pF, T_{amb} = 25 °C	t_{PHL}	-	0.185	0.8	µs
	I_F = 16 mA, V_{CC} = 5 V, R_L = 1.9 kΩ, C_L = 15 pF		-	-	0.8	µs
Propagation delay time to logic high at output (1)	I_F = 16 mA, V_{CC} = 5 V, R_L = 1.9 kΩ, C_L = 15 pF, T_{amb} = 25 °C	t_{PLH}	-	0.185	0.8	µs
	I_F = 16 mA, V_{CC} = 5 V, R_L = 1.9 kΩ, C_L = 15 pF		-	-	0.8	µs

Note

(2) The 1.9 kΩ load represents 1 TTL unit load of 1.6 mA and the 5.6 kΩ pull-up resistor.

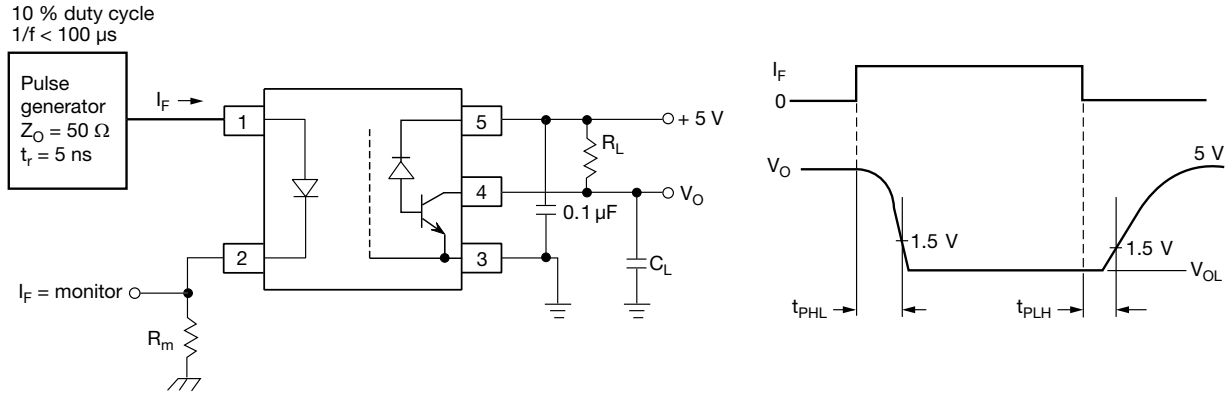


Fig. 1 - Test Circuit for Switching Times

COMMON MODE TRANSIENT IMMUNITY

(T_{amb} = 0 °C to +70 °C; typical values are at T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Common mode transient immunity at logic high level output (see Fig. 2) (1)(2)	I_F = 0 mA, R_L = 1.9 kΩ, C_L = 15 pF, V_{CM} = 1500 V_{P-P}	$\|CM_H\|$	50 000	-	-	V/µs
Common mode transient immunity at logic low level output (see Fig. 2) (1)(2)	I_F = 16 mA, R_L = 1.9 kΩ, C_L = 15 pF, V_{CM} = 1500 V_{P-P}	$\|CM_L\|$	50 000	-	-	V/µs

Notes

(1) Common mode transient immunity in a logic high level is the maximum tolerable (positive) dV_{CM}/dt on the leading edge of the common mode pulse (V_{CM}) to assure that the output will remain in a logic high state (i.e., V_O > 2 V). Common mode transient immunity in a logic low level the maximum tolerable (negative) dV_{CM}/dt on the trailing edge of the common mode pulse signal (V_{CM} to assure that the output will remain in logic low state, i.e., V_O > 0.8 V).

(2) The 1.9 kΩ load represents 1 TTL unit load of 1.6 mA and the 5.6 kΩ pull-up resistor.

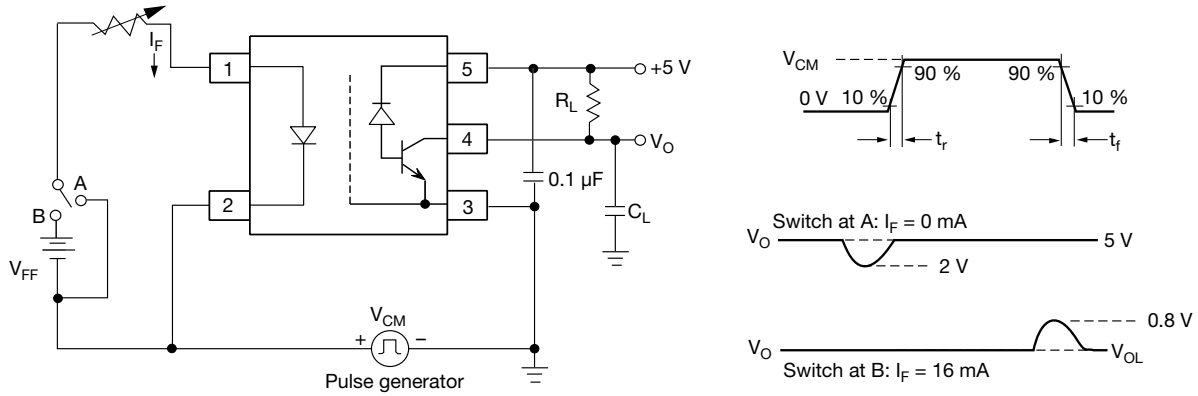


Fig. 2 - Test Circuit for Transient Immunity and Typical Waveforms

SAFETY AND INSULATION RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification	According to IEC 68 part 1		55 / 100 / 21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, t = 1 min	V_{ISO}	3750	V_{RMS}
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V_{IOTM}	6000	V_{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V_{IORM}	707	V_{peak}
Isolation resistance	T_{amb} = 25 °C, V_{IO} = 500 V	R_{IO}	≥ 10^{12}	Ω
	T_{amb} = 100 °C, V_{IO} = 500 V	R_{IO}	≥ 10^{11}	Ω
Output safety power		P_{SO}	100	mW
Input safety current		I_{SI}	25	mA
Input safety temperature		T_S	150	°C
Creepage distance			≥ 5	mm
Clearance distance			≥ 5	mm
Insulation thickness		DTI	≥ 0.1	mm

Note

- As per IEC 60747-5-5, § 7.4.3.8.2, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

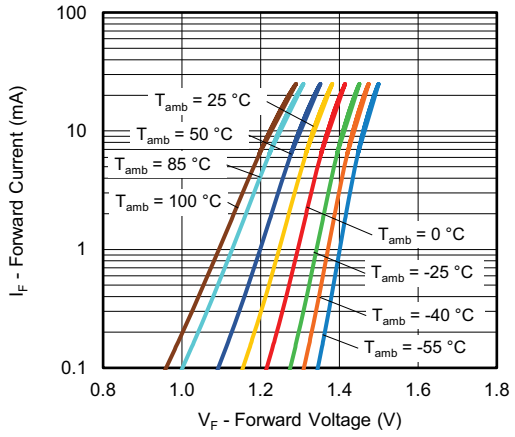


Fig. 3 - Forward Current vs. Forward Voltage

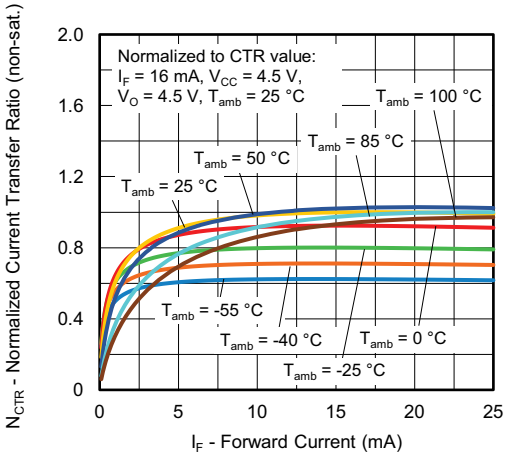


Fig. 4 - Normalized Current Transfer Ratio (non-saturated) vs. Forward Current

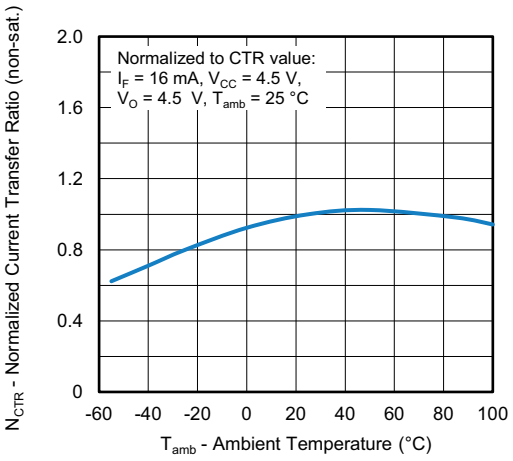


Fig. 5 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

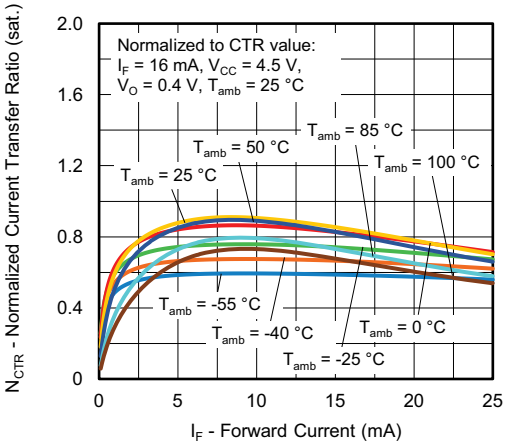


Fig. 6 - Normalized Current Transfer Ratio (saturated) vs. Forward Current

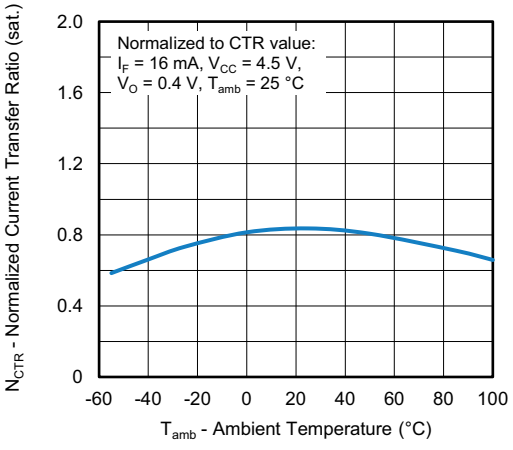


Fig. 7 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

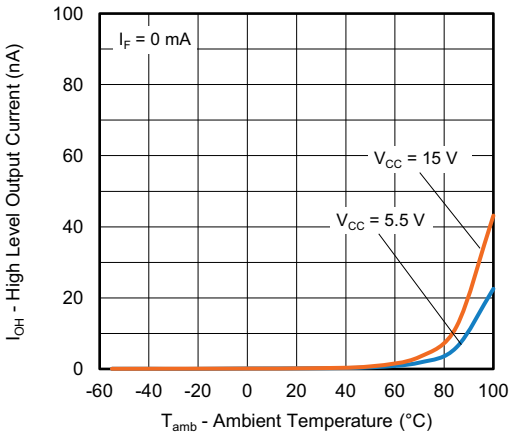


Fig. 8 - High Level Output Current vs. Ambient Temperature

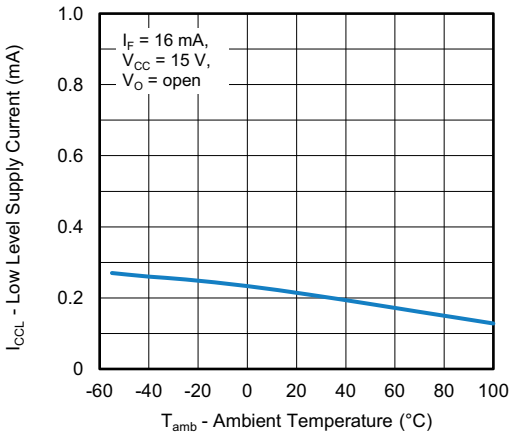


Fig. 9 - Low Level Supply Current vs. Ambient Temperature

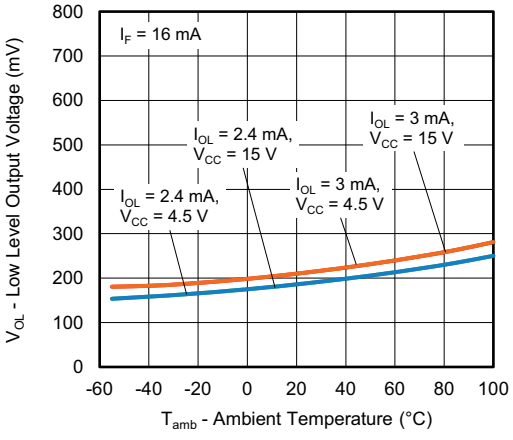


Fig. 10 - Low Level Output Voltage vs. Ambient Temperature

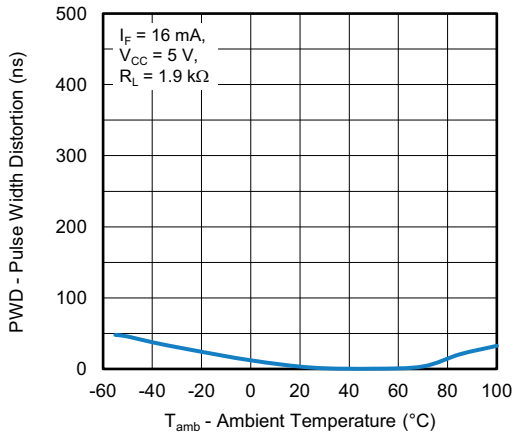


Fig. 11 - Pulse Width Distortion vs. Ambient Temperature

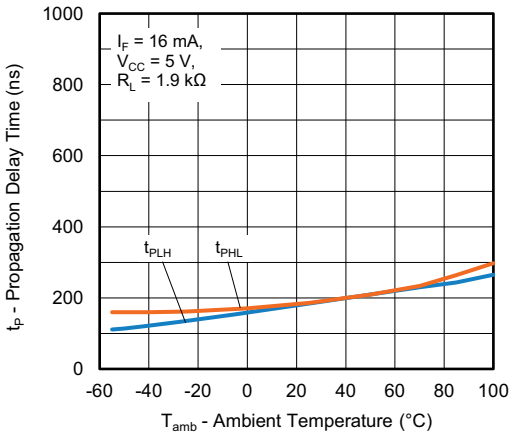
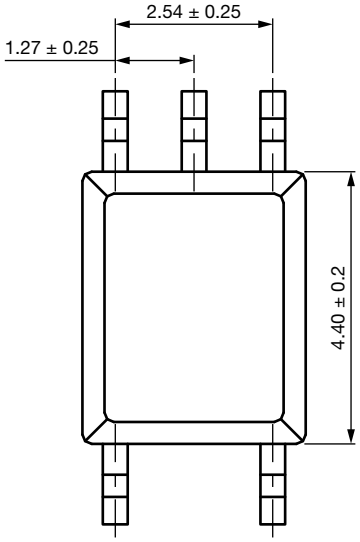
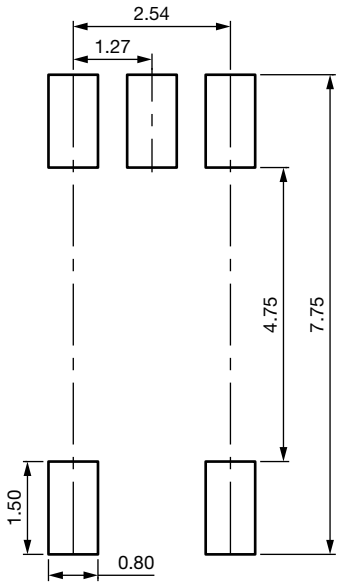


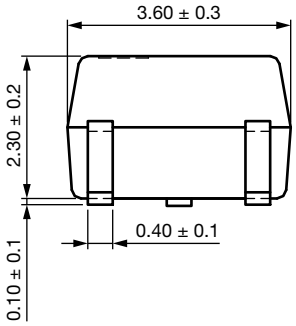
Fig. 12 - Propagation Delay Time vs. Ambient Temperature

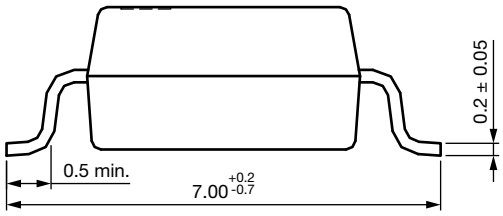
PACKAGE DIMENSIONS (in millimeters)





Land pattern recommendation





PACKAGE MARKING

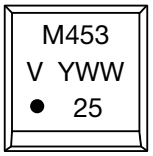


Fig. 13 - Example of VOM453T

Notes

- "YWW" is the date code marking (Y = year code, WW = week code)
- VDE logo is not part of the package marking
- Tape and reel suffix (T) is not part of the package marking

PACKING INFORMATION (tape and reel)

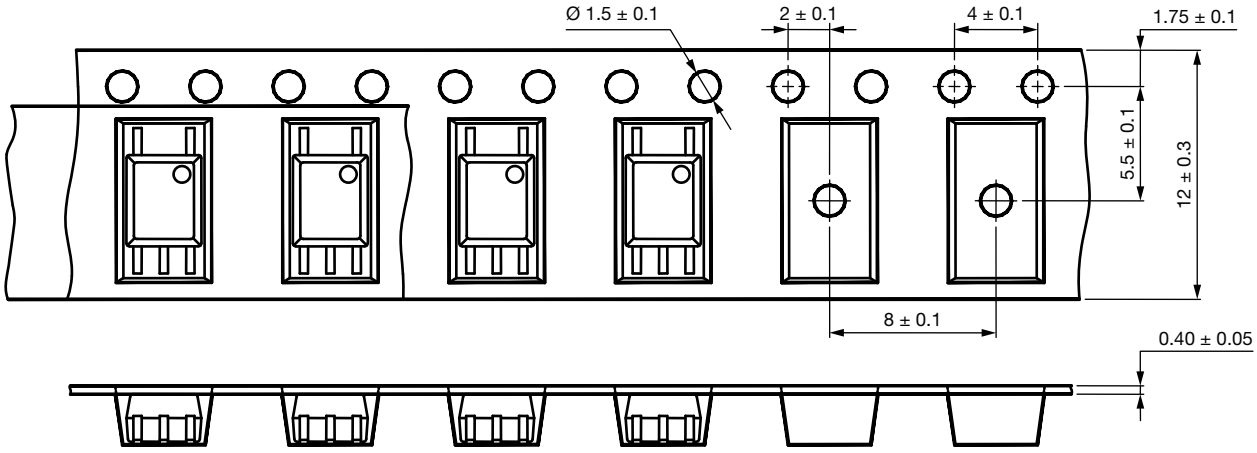


Fig. 14 - Tape and Reel Packing (3000 pieces on reel)

SOLDER PROFILES

IR Reflow Soldering (JEDEC® J-STD-020C compliant)

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

PROFILE ITEM	CONDITIONS
Preheat	
- Temperature minimum ($T_{S\ min.}$)	150 °C
- Temperature maximum ($T_{S\ max.}$)	200 °C
- Time (min. to max.) (t_S)	90 s ± 30 s
Soldering zone	
- Temperature (T_L)	217 °C
- Time (t_L)	60 s
Peak temperature (T_p)	260 °C
Ramp-up rate	3 °C/s max.
Ramp-down rate	3 °C/s to 6 °C/s

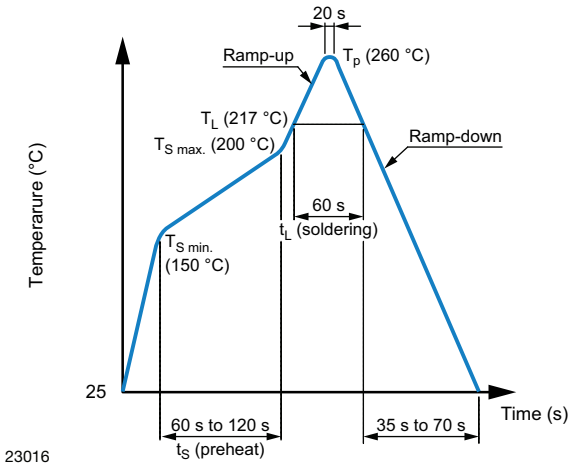


Fig. 15

Wave Soldering (JEDEC JESD22-A111 compliant)

One time soldering is recommended within the condition of temperature.

Temperature: 260 °C + 0 °C / - 5 °C

Time: 10 s

Preheat temperature: 25 °C to 140 °C

Preheat time: 30 s to 80 s

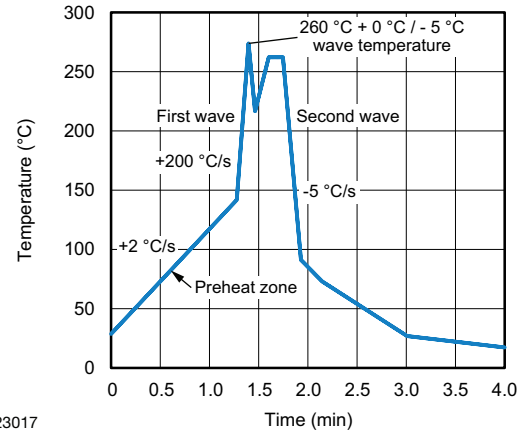


Fig. 16

Hand Soldering by Soldering Iron

Allow single lead soldering in every single process. One time soldering is recommended.

Temperature: 380 °C + 0 °C / - 5 °C

Time: 3 s max.

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions: T_{amb} < 30 °C, RH < 85 %

Moisture sensitivity level 1, according to J-STD-020

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