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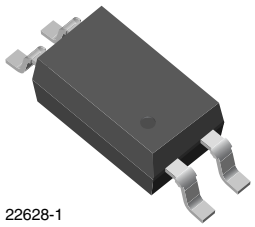
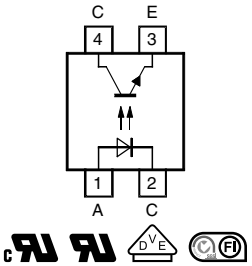
Optocoupler, Phototransistor Output, Single Channel, Half Pitch Mini-Flat Package





FEATURES

- Low profile package (half pitch)
- AC isolation test voltage 3750 V_{RMS}
- Low coupling capacitance of typical 0.3 pF
- Current transfer ratio (CTR) selected into groups
- Low temperature coefficient of CTR
- Wide ambient temperature range
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

DESCRIPTION

The TCMT110. series consist of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4 pin package.

The elements are mounted on one leadframe providing a fixed distance between input and output for highest safety requirements.

APPLICATIONS

- Programmable logic controllers
- Modems
- Answering machines
- General applications

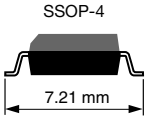
AGENCY APPROVALS

- UL1577, file no. E76222, double protection
- cUL component acceptance service no. 5A, double protection
- DIN EN 60747-5-5 (VDE 0884-5)
- FIMKO: FI EN 60950-1:2006
- BSI: BS EN60065:2002
  BS EN60950-1:2006
- CQC GB 8898-2011, GB 4943.1-2011 (suitable for installation altitude below 2000 m)

ORDERING INFORMATION

T	C	M	T	1	1	0	#

PART NUMBER



AGENCY CERTIFIED/ PACKAGE	CTR (%)									
	5 mA	10 mA				5 mA				
UL, cUL, FIMKO, BSI, VDE	50 to 600	40 to 80	63 to 125	100 to 200	160 to 320	50 to 150	100 to 300	80 to 160	130 to 260	200 to 400
SSOP-4	TCMT1100	TCMT1101	TCMT1102	TCMT1103	TCMT1104	TCMT1105	TCMT1106	TCMT1107	TCMT1108	TCMT1109

Note

- 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	6	V
Forward current		I_F	60	mA
Forward surge current	$t_p \leq 10$ µs	I_{FSM}	1.5	A
Power dissipation		P_{diss}	100	mW
Junction temperature		T_j	125	°C
OUTPUT				
Collector emitter voltage		V_{CEO}	70	V
Emitter collector voltage		V_{ECO}	7	V
Collector current		I_C	50	mA
Collector peak current	$t_p/T = 0.5$, $t_p \leq 10$ ms	I_{CM}	100	mA
Power dissipation		P_{diss}	150	mW
Junction temperature		T_j	125	°C
COUPLER				
AC isolation test voltage (RMS)	Related to standard climate 23/50 DIN 50014	V_{ISO}	3750	V_{RMS}
Total power dissipation		P_{tot}	250	mW
Operating ambient temperature range		T_{amb}	- 40 to + 100	°C
Storage temperature range		T_{stg}	- 40 to + 125	°C
Soldering temperature [1]		T_{sld}	260	°C

Notes

- 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.

(1) Refer to reflow profile for soldering conditions for surface mounted devices. Also refer to “Assembly Instructions” (www.vishay.com/doc?80054).

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Forward voltage	I_F = 50 mA	V_F		1.35	1.6	V
Junction capacitance	V_R = 0, f = 1 MHz	C_j		8		pF
OUTPUT						
Collector emitter voltage	I_C = 100 µA	V_{CEO}	70			V
Emitter collector voltage	I_E = 100 µA	V_{ECO}	7			V
Collector dark current	V_{CE} = 20 V, I_F = 0 A	I_{CEO}			100	nA
COUPLER						
Collector emitter saturation voltage	I_F = 10 mA, I_C = 1 mA	V_{CEsat}			0.3	V
Cut-off frequency	V_{CE} = 5 V, I_F = 10 mA, R_L = 100 Ω	f_c		100		kHz
Coupling capacitance	f = 1 MHz	C_k		0.3		pF

Note

- 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.

CURRENT TRANSFER RATIO (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
I_C/I_F	V_{CE} = 5 V, I_F = 5 mA	TCMT1100	CTR	50		600	%
	V_{CE} = 5 V, I_F = 10 mA	TCMT1101	CTR	40		80	%
		TCMT1102	CTR	63		125	%
		TCMT1103	CTR	100		200	%
		TCMT1104	CTR	160		320	%
	V_{CE} = 5 V, I_F = 5 mA	TCMT1105	CTR	50		150	%
		TCMT1106	CTR	100		300	%
		TCMT1107	CTR	80		160	%
		TCMT1108	CTR	130		260	%
		TCMT1109	CTR	200		400	%

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Delay time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 1)	t_d		4.0		µs
Rise time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 1)	t_r		5.5		µs
Fall time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 1)	t_f		7.0		µs
Storage time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 1)	t_s		1.5		µs
Turn-on time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 1)	t_{on}		9.5		µs
Turn-off time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 1)	t_{off}		8.5		µs
Turn-on time	V_S = 5 V, I_F = 10 mA, R_L = 1 kΩ, (see figure 2)	t_{on}		3.0		µs
Turn-off time	V_S = 5 V, I_F = 10 mA, R_L = 1 kΩ, (see figure 2)	t_{off}		20.0		µs

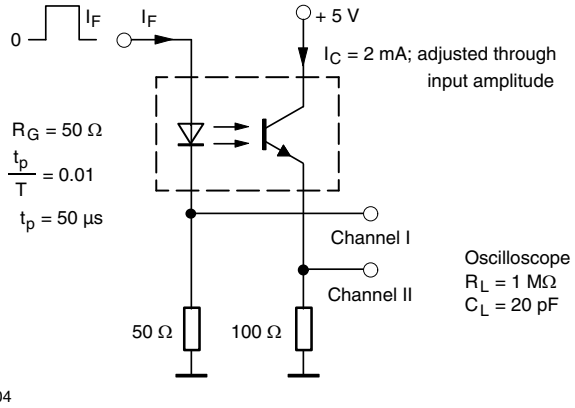


Fig. 1 - Test Circuit, Non-Saturated Operation

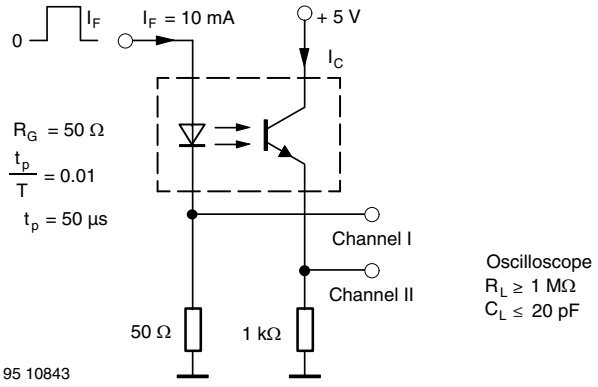


Fig. 2 - Test Circuit, Saturated Operation

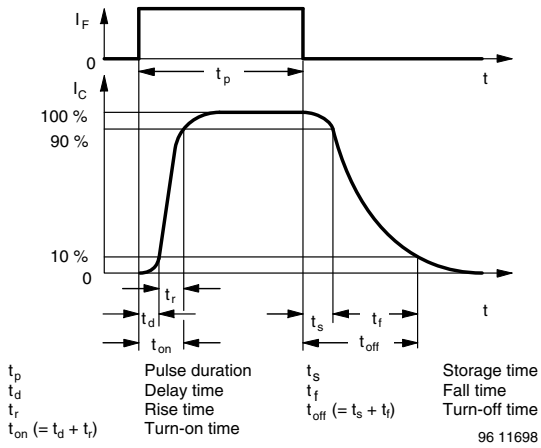


Fig. 3 - Switching Times

SAFETY AND INSULATION RATINGS				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification (according to IEC 68 part 1)			40/110/21	
Comparative tracking index		CTI	175	
Maximum rated withstanding isolation voltage	t = 1 min	V_{ISO}	3750	V_{RMS}
Maximum transient isolation voltage		V_{IOTM}	6000	V
Maximum repetitive peak isolation voltage		V_{IORM}	707	V
Apparent charge test voltage (method A)	V_{IORM} x 1.6 = V_{PR}, type and sample test, t_m = 60 s, partial discharge < 5 pC	V_{PR}	1132	V_{peak}
Apparent Charge Test Voltage (method B)	V_{IORM} x 1.875 = V_{PR}, 100 % production test with t_m = 1 s, partial discharge < 5 pC	V_{PR}	1326	V_{peak}
Isolation resistance	V_{IO} = 500 V_{DC}, T_{amb} = 100 °C	R_{IO}	10^{11}	Ω
Isolation resistance (under fault conditions)	V_{IO} = 500 V_{DC}, T_{amb} = T_{SI}	R_{IO}	10^{9}	Ω
Output safety power		P_{SO}	350	mW
Input safety current		I_{SI}	150	mA
Input safety temperature		T_{SI}	175	°C

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.

SAFETY AND INSULATION RATINGS						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Creepage distance			5			mm
Clearance distance			5			mm
Insulation thickness, reinforced rated	per IEC60950 2.10.5.1		0.4			mm

Note

- As per IEC 60747-5-2, § 7.4.3.8.1, 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)

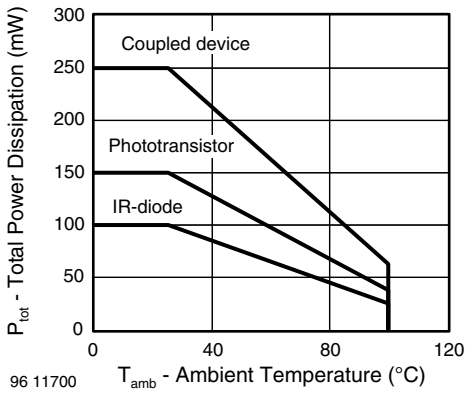


Fig. 4 - Total Power Dissipation vs. Ambient Temperature

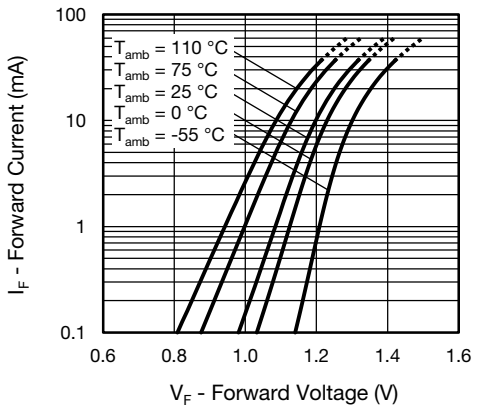


Fig. 5 - Forward Voltage vs. Forward Current

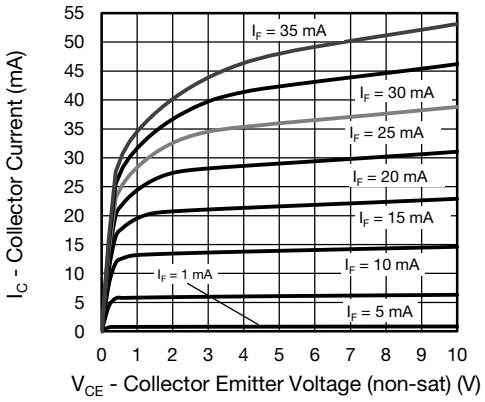


Fig. 6 - Collector Current vs. Collector Emitter Voltage

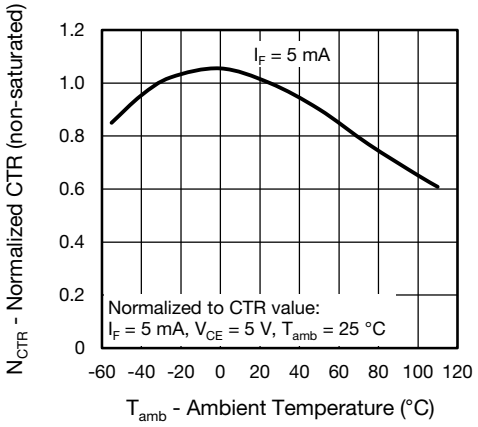


Fig. 9 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

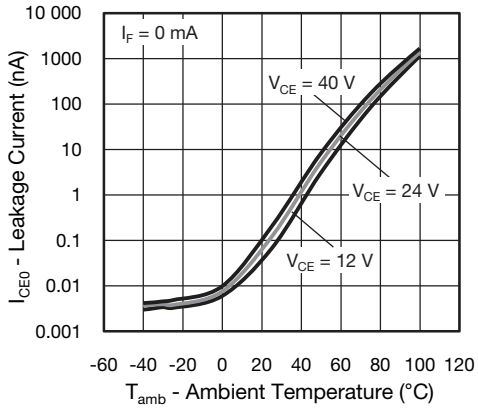


Fig. 7 - Leakage Current vs. Ambient Temperature

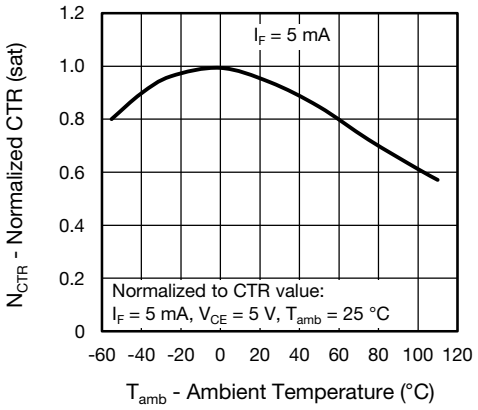


Fig. 10 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

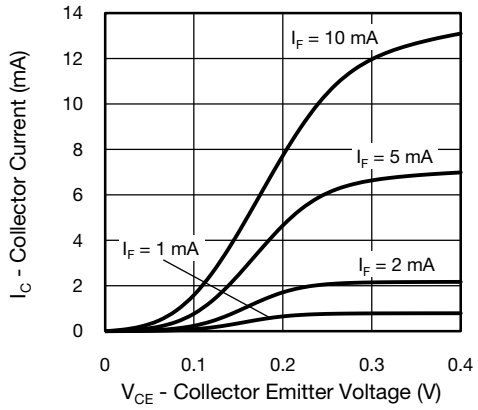


Fig. 8 - Collector Current vs. Collector Emitter Voltage

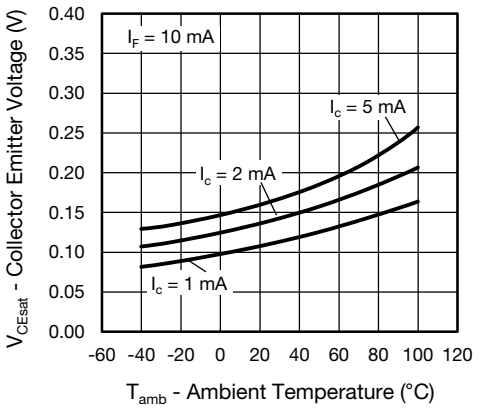


Fig. 11 - Collector Emitter Voltage vs. Ambient Temperature

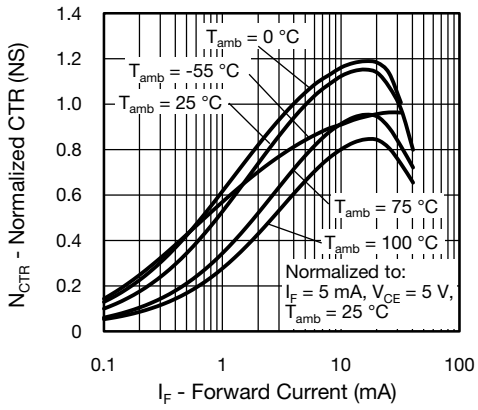


Fig. 12 - Normalized CTR (non-saturated) vs. Forward Current

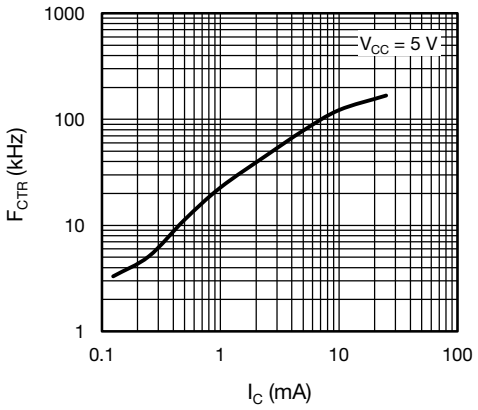


Fig. 15 - F_{CTR} vs. Collector Current

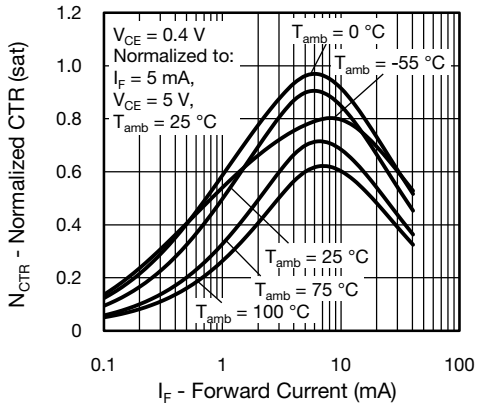


Fig. 13 - Normalized CTR (saturated) vs. Forward Current

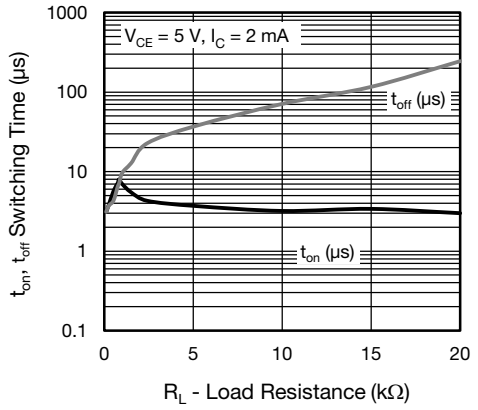


Fig. 16 - Switching Time vs. Load Resistance

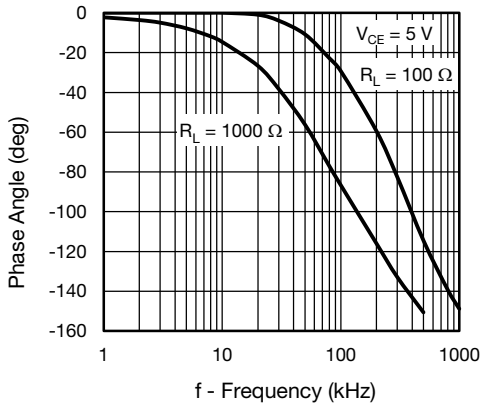
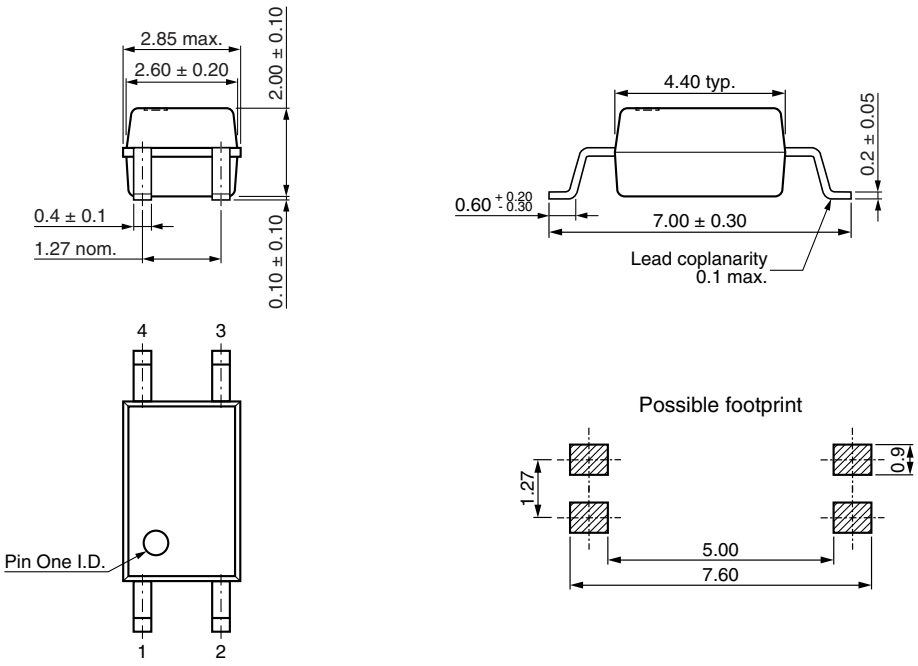
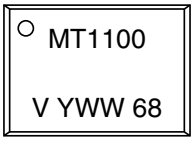


Fig. 14 - F_{CTR} vs. Phase Angle

PACKAGE DIMENSIONS in millimeters



PACKAGE MARKING (example)



TAPE AND REEL PACKAGING in millimeters

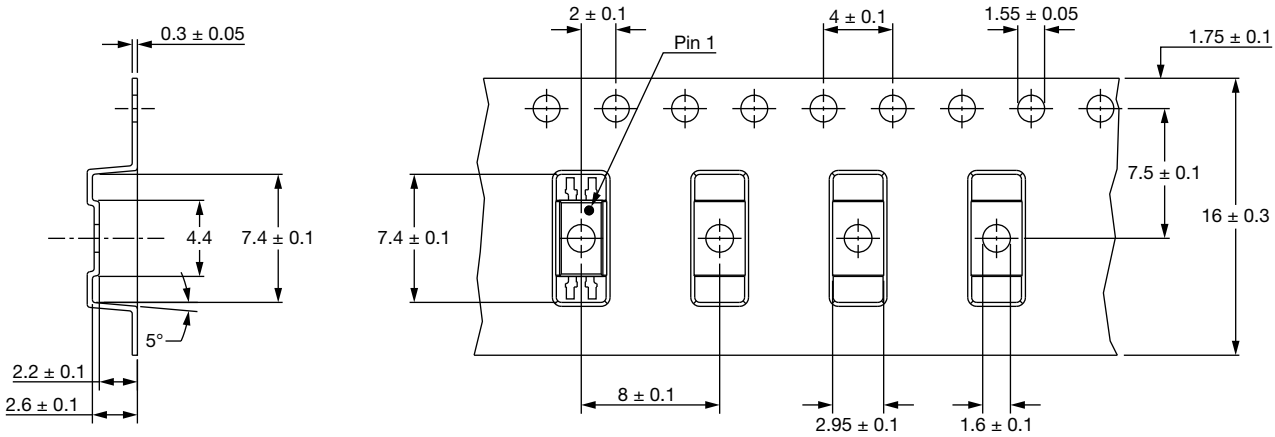


Fig. 17

SOLDER PROFILES

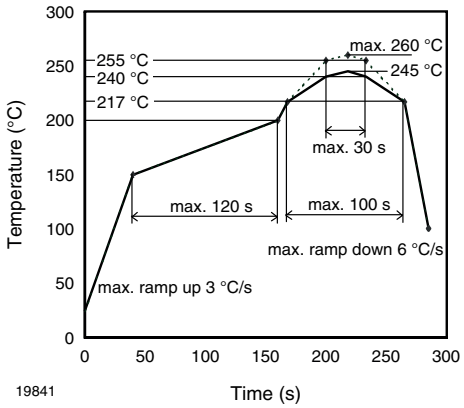


Fig. 18 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

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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