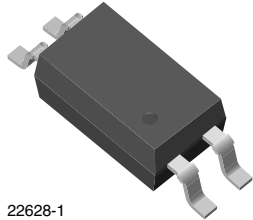
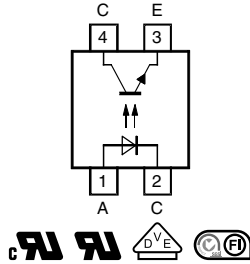


## Optocoupler, Phototransistor Output, Single Channel, Half Pitch Mini-Flat Package



22628-1



### 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.

### FEATURES

- Low profile package (half pitch)
- AC isolation test voltage 3750 V<sub>RMS</sub>
- 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](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT

### 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										
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">T</div> <div style="border: 1px solid black; padding: 2px 5px;">C</div> <div style="border: 1px solid black; padding: 2px 5px;">M</div> <div style="border: 1px solid black; padding: 2px 5px;">T</div> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">0</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> </div> <p style="text-align: center; margin-top: 5px;">PART NUMBER</p>										
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.



<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		$V_R$	6	V
Forward current		$I_F$	60	mA
Forward surge current	$t_p \leq 10\text{ }\mu\text{s}$	$I_{FSM}$	1.5	A
Power dissipation		$P_{diss}$	100	mW
Junction temperature		$T_j$	125	$^{\circ}\text{C}$
<b>OUTPUT</b>				
Collector emitter voltage		$V_{CEO}$	70	V
Emitter collector voltage		$V_{ECO}$	7	V
Collector current		$I_C$	50	mA
Collector peak current	$t_p/T = 0.5, t_p \leq 10\text{ ms}$	$I_{CM}$	100	mA
Power dissipation		$P_{diss}$	150	mW
Junction temperature		$T_j$	125	$^{\circ}\text{C}$
<b>COUPLER</b>				
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	$^{\circ}\text{C}$
Storage temperature range		$T_{stg}$	- 40 to + 125	$^{\circ}\text{C}$
Soldering temperature <sup>(1)</sup>		$T_{sld}$	260	$^{\circ}\text{C}$

**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.
- <sup>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices. Also refer to "Assembly Instructions" ([www.vishay.com/doc?80054](http://www.vishay.com/doc?80054)).

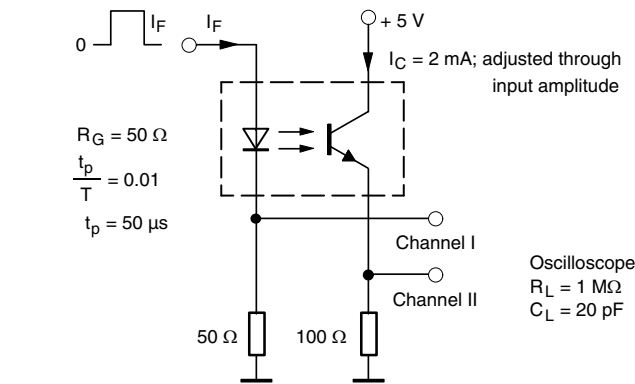
<b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward voltage	$I_F = 50\text{ mA}$	$V_F$		1.35	1.6	V
Junction capacitance	$V_R = 0, f = 1\text{ MHz}$	$C_j$		8		pF
<b>OUTPUT</b>						
Collector emitter voltage	$I_C = 100\text{ }\mu\text{A}$	$V_{CEO}$	70			V
Emitter collector voltage	$I_E = 100\text{ }\mu\text{A}$	$V_{ECO}$	7			V
Collector dark current	$V_{CE} = 20\text{ V}, I_F = 0\text{ A}$	$I_{CEO}$			100	nA
<b>COUPLER</b>						
Collector emitter saturation voltage	$I_F = 10\text{ mA}, I_C = 1\text{ mA}$	$V_{CEsat}$			0.3	V
Cut-off frequency	$V_{CE} = 5\text{ V}, I_F = 10\text{ mA}, R_L = 100\text{ }\Omega$	$f_c$		100		kHz
Coupling capacitance	$f = 1\text{ MHz}$	$C_k$		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 ( $T_{amb} = 25^\circ\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
$I_C/I_F$	$V_{CE} = 5\text{ V}, I_F = 5\text{ mA}$	TCMT1100	CTR	50		600	%
		TCMT1101	CTR	40		80	%
		TCMT1102	CTR	63		125	%
	$V_{CE} = 5\text{ V}, I_F = 10\text{ mA}$	TCMT1103	CTR	100		200	%
		TCMT1104	CTR	160		320	%
		TCMT1105	CTR	50		150	%
	$V_{CE} = 5\text{ V}, I_F = 5\text{ mA}$	TCMT1106	CTR	100		300	%
		TCMT1107	CTR	80		160	%
		TCMT1108	CTR	130		260	%
TCMT1109	CTR	200		400	%		

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



95 10804  
Fig. 1 - Test Circuit, Non-Saturated Operation

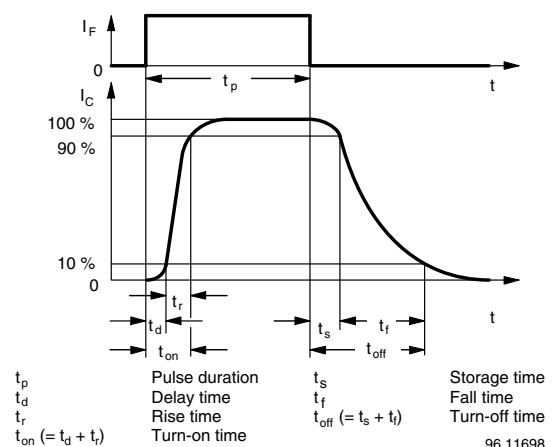
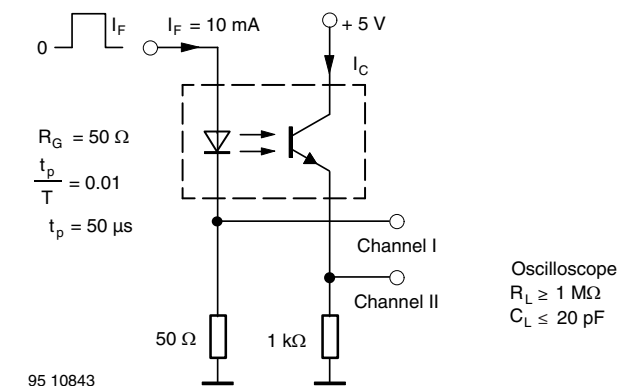


Fig. 3 - Switching Times



95 10843  
Fig. 2 - Test Circuit, Saturated Operation

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 <sub>ISO</sub>	3750	V <sub>RMS</sub>
Maximum transient isolation voltage		V <sub>IOTM</sub>	6000	V
Maximum repetitive peak isolation voltage		V <sub>IORM</sub>	707	V
Apparent charge test voltage (method A)	V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , type and sample test, t <sub>m</sub> = 60 s, partial discharge < 5 pC	V <sub>PR</sub>	1132	V <sub>peak</sub>
Apparent Charge Test Voltage (method B)	V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100 % production test with t <sub>m</sub> = 1 s, partial discharge < 5 pC	V <sub>PR</sub>	1326	V <sub>peak</sub>
Isolation resistance	V <sub>IO</sub> = 500 V <sub>DC</sub> , T <sub>amb</sub> = 100 °C	R <sub>IO</sub>	10 <sup>11</sup>	Ω
Isolation resistance (under fault conditions)	V <sub>IO</sub> = 500 V <sub>DC</sub> , T <sub>amb</sub> = T <sub>SI</sub>	R <sub>IO</sub>	10 <sup>9</sup>	Ω
Output safety power		P <sub>SO</sub>	350	mW
Input safety current		I <sub>SI</sub>	150	mA
Input safety temperature		T <sub>SI</sub>	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<sub>amb</sub> = 25 °C, unless otherwise specified)

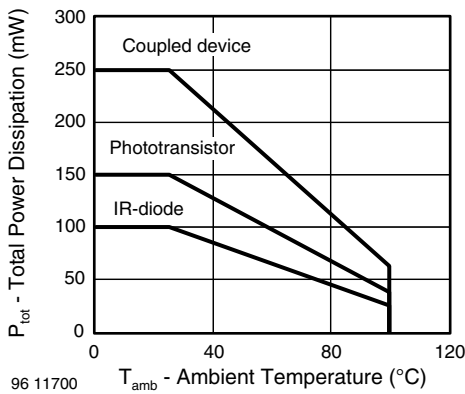


Fig. 4 - Total Power Dissipation vs. Ambient Temperature

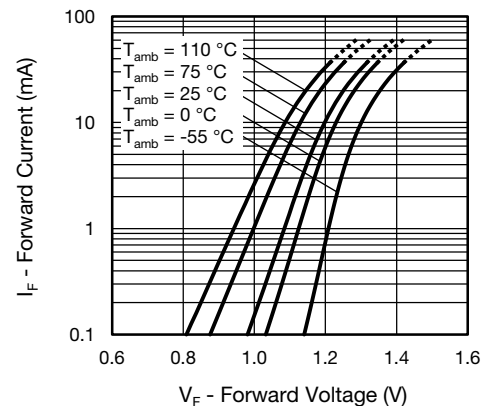


Fig. 5 - Forward Voltage vs. Forward Current

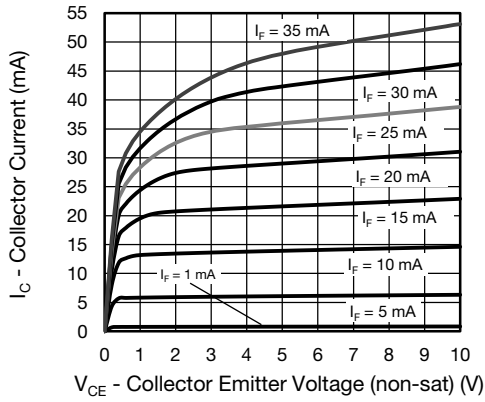


Fig. 6 - Collector Current vs. Collector Emitter Voltage

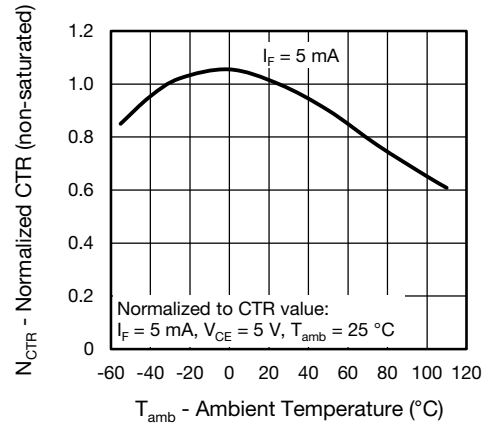


Fig. 9 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

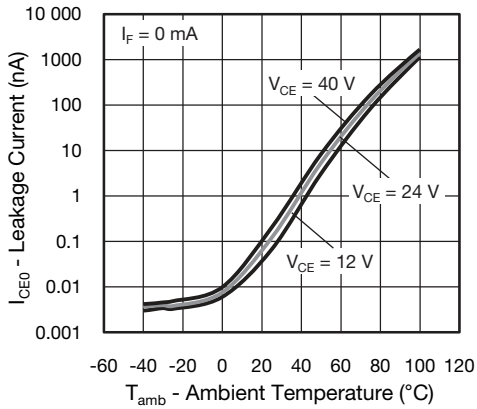


Fig. 7 - Leakage Current vs. Ambient Temperature

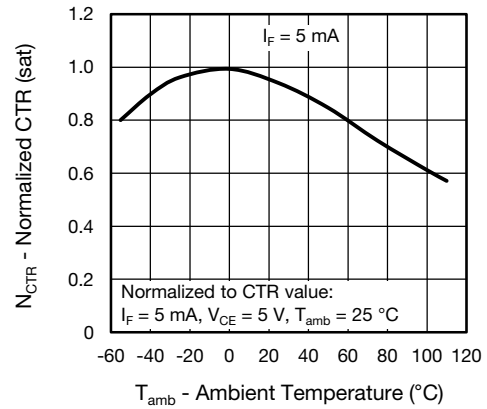


Fig. 10 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

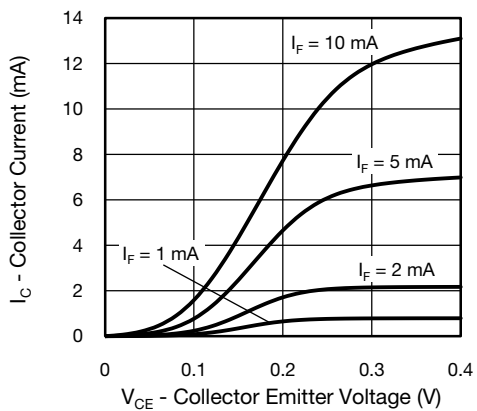


Fig. 8 - Collector Current vs. Collector Emitter Voltage

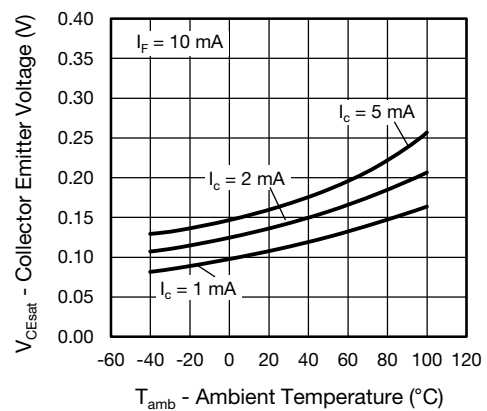


Fig. 11 - Collector Emitter Voltage vs. Ambient Temperature

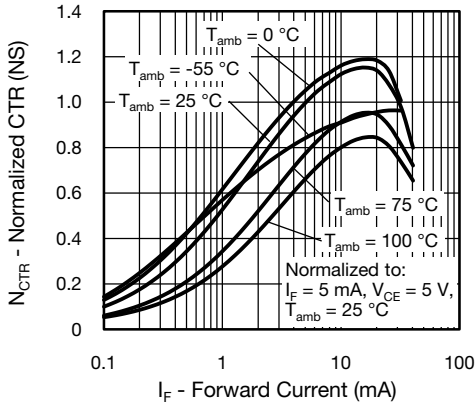


Fig. 12 - Normalized CTR (non-saturated) vs. Forward Current

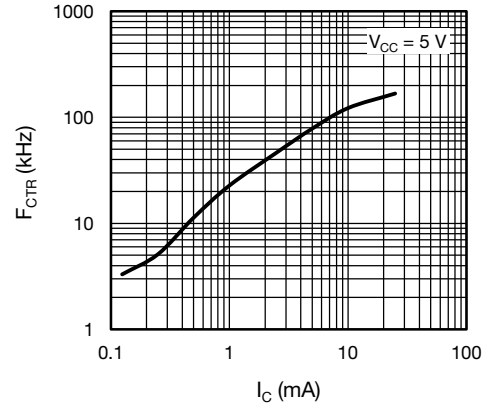


Fig. 15 -  $F_{CTR}$  vs. Collector Current

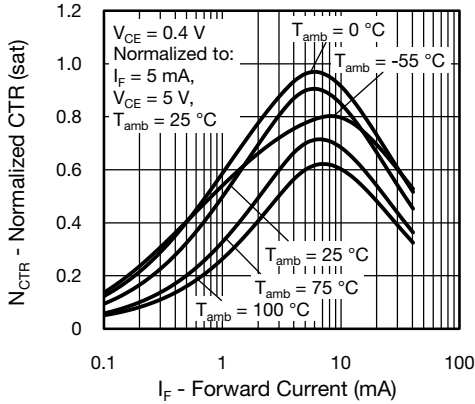


Fig. 13 - Normalized CTR (saturated) vs. Forward Current

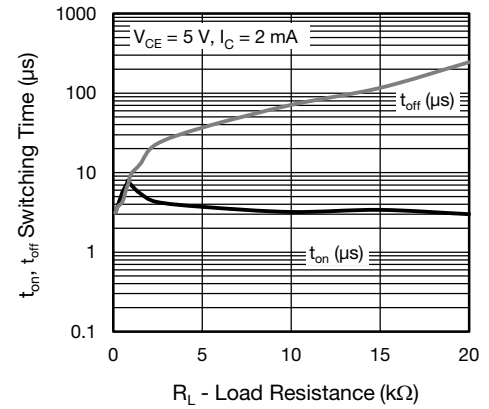


Fig. 16 - Switching Time vs. Load Resistance

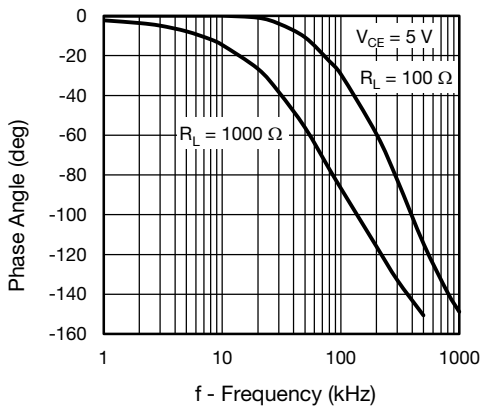
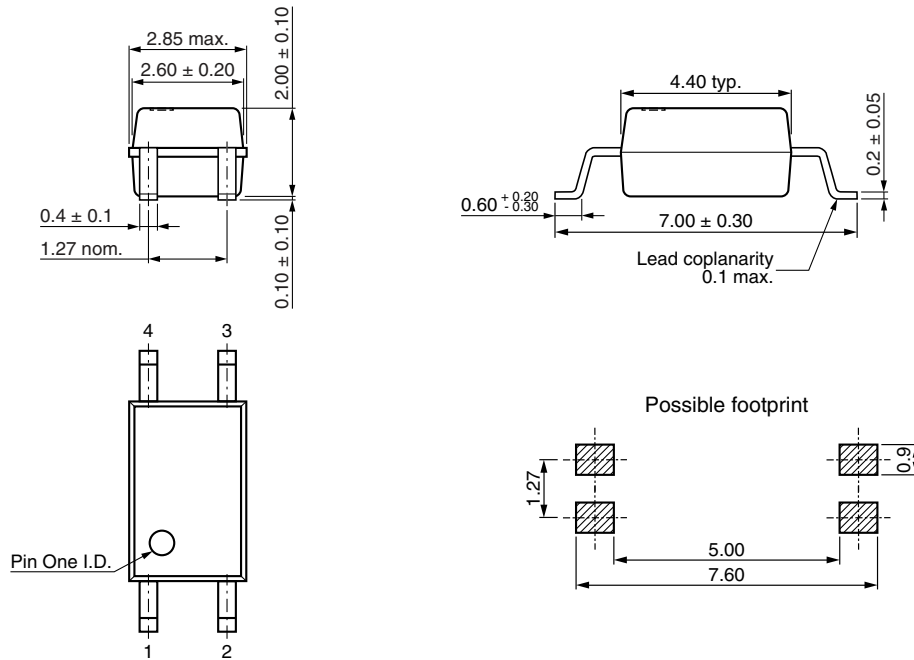


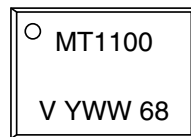
Fig. 14 -  $F_{CTR}$  vs. Phase Angle



**PACKAGE DIMENSIONS** in millimeters



**PACKAGE MARKING** (example)



**TAPE AND REEL PACKAGING** in millimeters

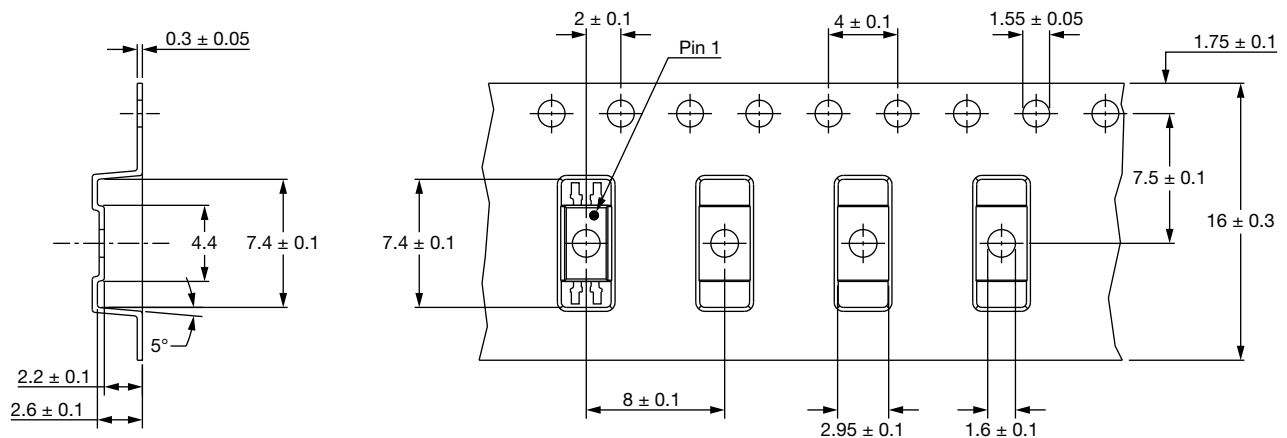


Fig. 17

**SOLDER PROFILES**

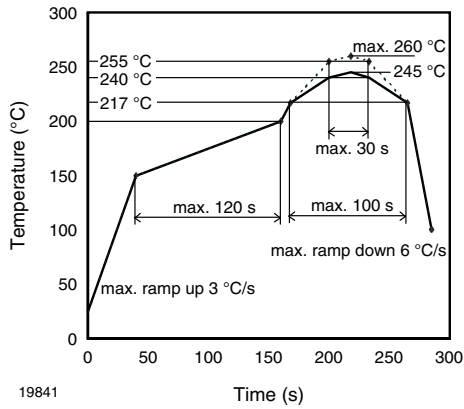


Fig. 18 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2

Floor life: unlimited

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

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





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