

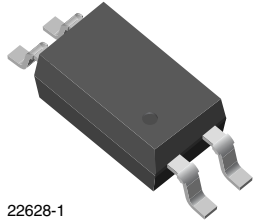


**THE DATASHEET OF  
TCMT1110**

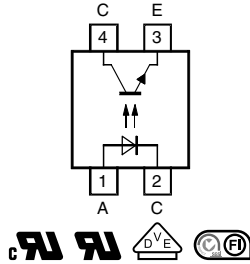




# Optocoupler, Phototransistor Output, Single Channel, Half Pitch Mini-Flat Package



22628-1



### 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

### DESCRIPTION

The TCMT111X series consist of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4 pin package.

### 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;">1</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, BSI, VDE	50 to 600	100 to 200	100 to 300	80 to 160	130 to 260	200 to 400		
SSOP-4	TCMT1110	TCMT1113	TCMT1116	TCMT1117	TCMT1118	TCMT1119		

ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		V <sub>R</sub>	6	V
Forward current		I <sub>F</sub>	50	mA
Forward surge current	t <sub>p</sub> ≤ 10 μs	I <sub>FSM</sub>	1.5	A
Power dissipation		P <sub>diss</sub>	80	mW
Junction temperature		T <sub>j</sub>	125	°C



ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<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>				
Total power dissipation		$P_{tot}$	230	mW
Operating ambient temperature range		$T_{amb}$	-40 to +110	$^{\circ}\text{C}$
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> Wave soldering three cycles are allowed. Also refer to "Assembly Instructions" ([www.vishay.com/doc?80054](http://www.vishay.com/doc?80054)).

ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward voltage	$I_F = 5\text{ mA}$	$V_F$	-	1.08	1.4	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	$V_{CE} = 20\text{ V}, I_F = 0$	$I_{CEO}$	-	-	100	nA
<b>COUPLER</b>						
Collector emitter saturation voltage	$I_F = 10\text{ mA}, I_C = 1\text{ mA}$	$V_{CEsat}$	-	0.1	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 ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
$I_C/I_F$	$V_{CE} = 5\text{ V}, I_F = 5\text{ mA}$	TCMT1110	CTR	50	-	600	%
	$V_{CE} = 5\text{ V}, I_F = 10\text{ mA}$	TCMT1113	CTR	100	-	200	%
		TCMT1114	CTR	160	-	320	%
	$V_{CE} = 5\text{ V}, I_F = 5\text{ mA}$	TCMT1117	CTR	80	-	160	%
		TCMT1118	CTR	130	-	260	%
		TCMT1119	CTR	200	-	400	%

SWITCHING CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Delay time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see figure 1)	$t_d$	-	4	-	$\mu\text{s}$
Rise time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see figure 1)	$t_r$	-	5.5	-	$\mu\text{s}$
Fall time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see figure 1)	$t_f$	-	7	-	$\mu\text{s}$
Storage time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see figure 1)	$t_s$	-	1.5	-	$\mu\text{s}$
Turn-on time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see figure 1)	$t_{on}$	-	9.5	-	$\mu\text{s}$
Turn-off time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see figure 1)	$t_{off}$	-	8	-	$\mu\text{s}$
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	-	$\mu\text{s}$
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	-	$\mu\text{s}$

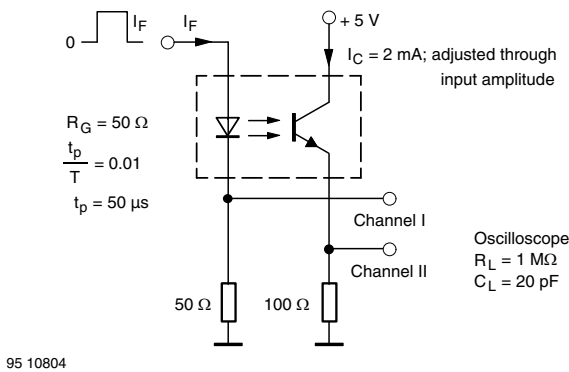


Fig. 1 - Test Circuit, Non-Saturated Operation

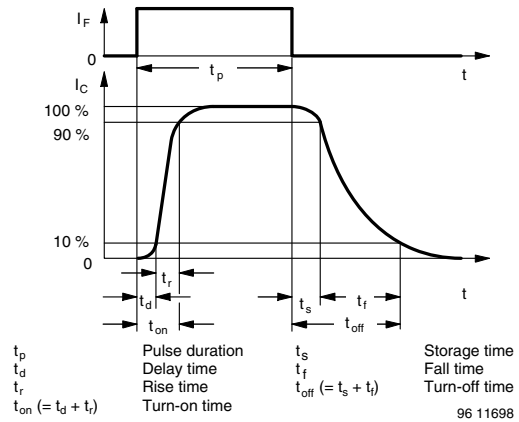


Fig. 3 - Switching Times

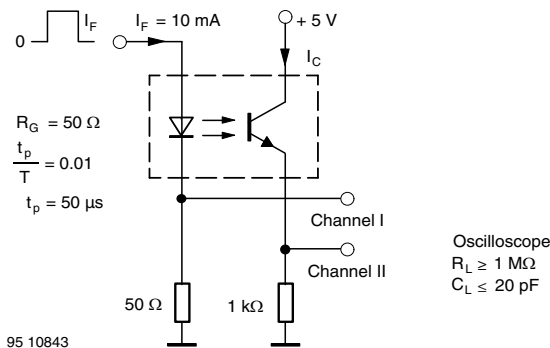


Fig. 2 - Test Circuit, Saturated Operation

SAFETY AND INSULATION RATINGS				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification (according to IEC 68 part 1)			55/110/21	
Comparative tracking index		CTI	175	
Maximum rated withstanding isolation voltage	40 % to 60 % RH, AC test of 1 min	$V_{ISO}$	3750	$V_{RMS}$
Maximum transient isolation voltage		$V_{IOTM}$	6000	V
Maximum repetitive peak isolation voltage		$V_{IORM}$	707	V
Insulation resistance	$V_{IO} = 500 \text{ V}, T_{amb} = 100 \text{ }^\circ\text{C}$	$R_{IO}$	$10^{11}$	$\Omega$
Isolation resistance (under fault conditions)	$V_{IO} = 500 \text{ V}, T_{amb} = T_{SI}$	$R_{IO}$	$10^9$	$\Omega$
Output safety power		$P_{SO}$	350	mW
Input safety current		$I_{SI}$	200	mA
Input safety temperature		$T_{SI}$	175	$^\circ\text{C}$
Apparent charge test voltage (method A)	$V_{IORM} \times 1.6 = V_{PR}$ , type and sample test $t_m = 60 \text{ s}$ , partial discharge < 5 pC	$V_{PR}$	1132	$V_{peak}$
Apparent charge test voltage (method B)	$V_{IORM} \times 1.875 = V_{PR}$ , 100 % production test with $t_m = 1 \text{ s}$ , partial discharge < 5 pC	$V_{PR}$	1326	$V_{peak}$
Creepage distance			$\geq 5$	mm
Clearance distance			$\geq 5$	mm
Insulation thickness		DTI	$\geq 0.4$	mm
Environment (pollution degree in accordance to DIN VDE 0109)			2	

**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** ( $T_{amb} = 25 \text{ }^\circ\text{C}$ , unless otherwise specified)

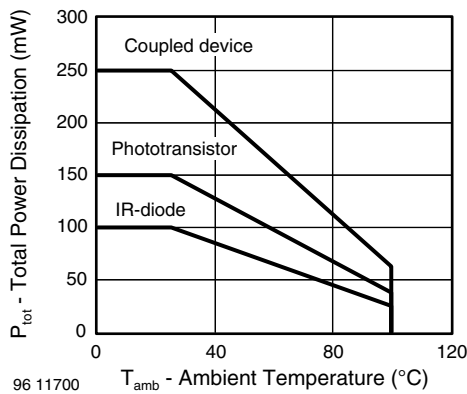


Fig. 4 - Total Power Dissipation vs. Ambient Temperature

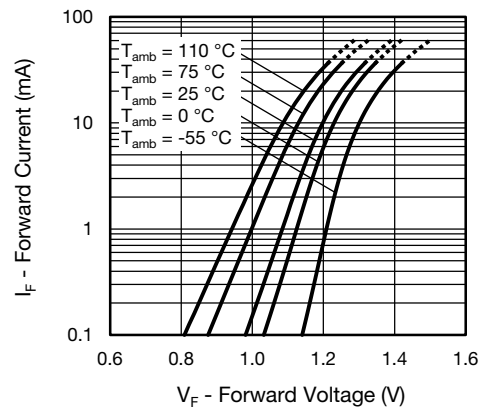


Fig. 5 - Forward Voltage vs. Forward Current

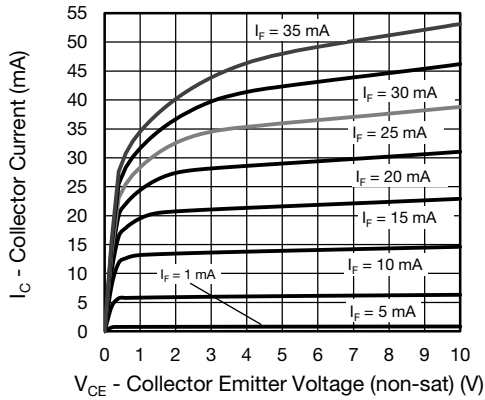


Fig. 6 - Collector Current vs. Collector Emitter Voltage

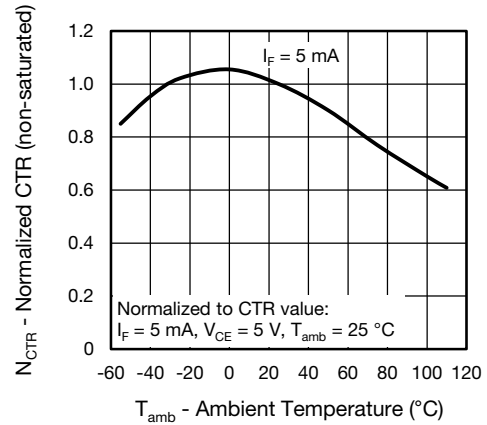


Fig. 9 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

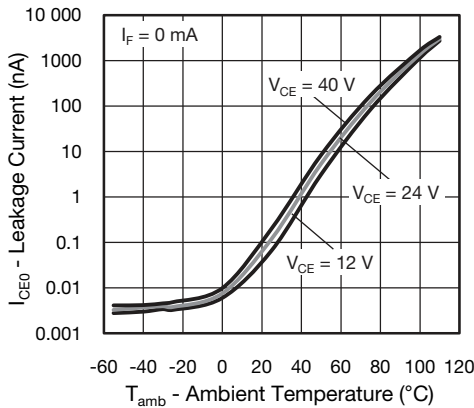


Fig. 7 - Leakage Current vs. Ambient Temperature

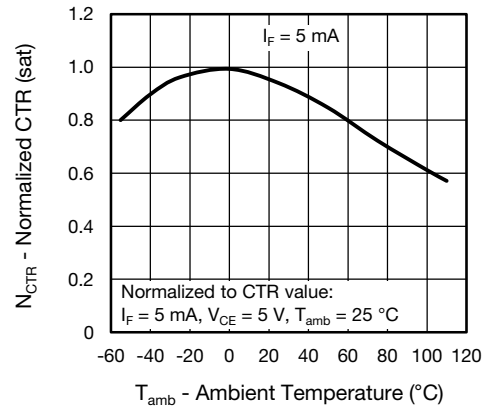


Fig. 10 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

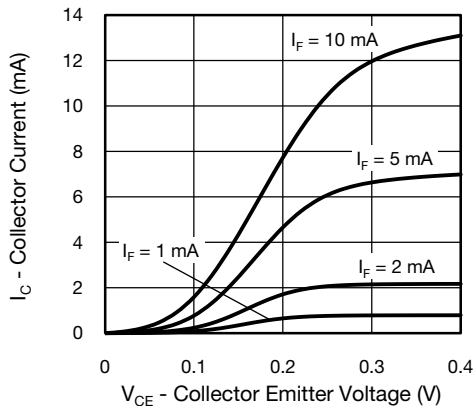


Fig. 8 - Collector Current vs. Collector Emitter Voltage

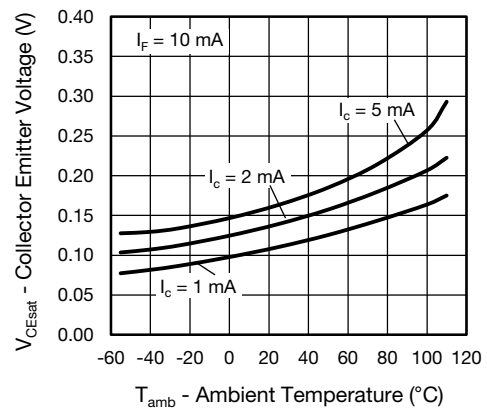


Fig. 11 - Collector Emitter Voltage vs. Ambient Temperature

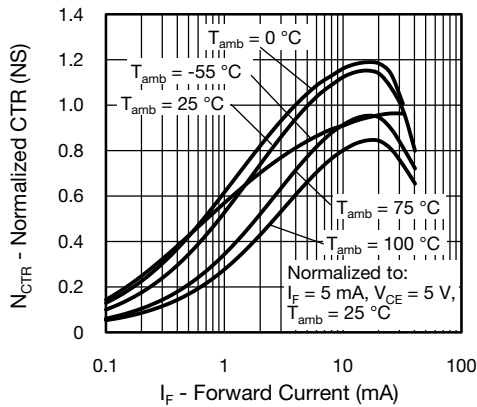


Fig. 12 - Normalized CTR (non-saturated) vs. Forward Current

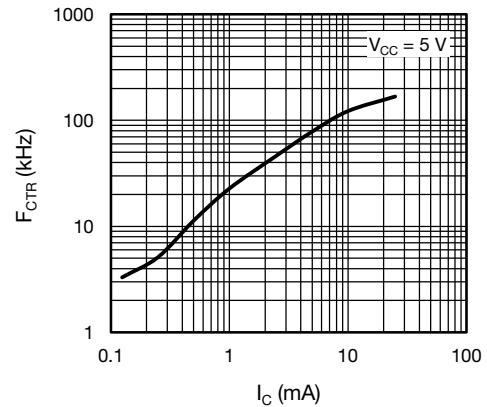


Fig. 15 -  $F_{CTR}$  vs. Collector Current

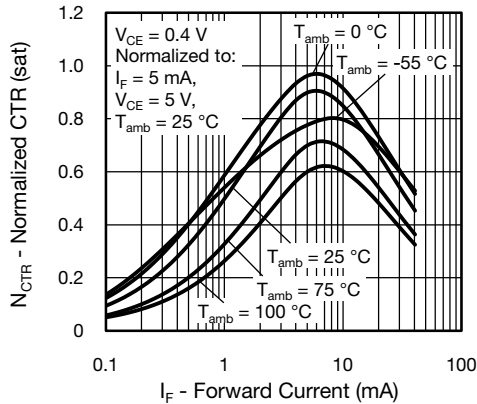


Fig. 13 - Normalized CTR (saturated) vs. Forward Current

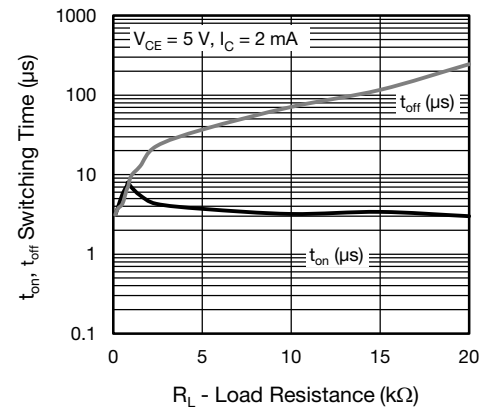


Fig. 16 - Switching Time vs. Load Resistance

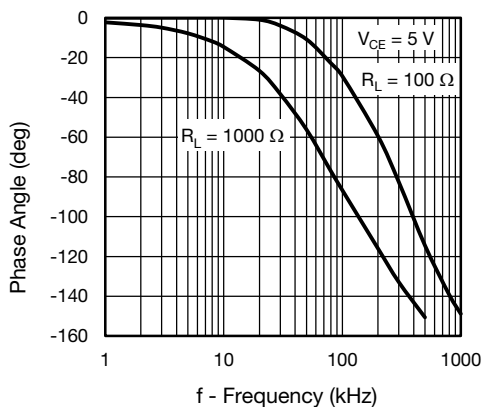
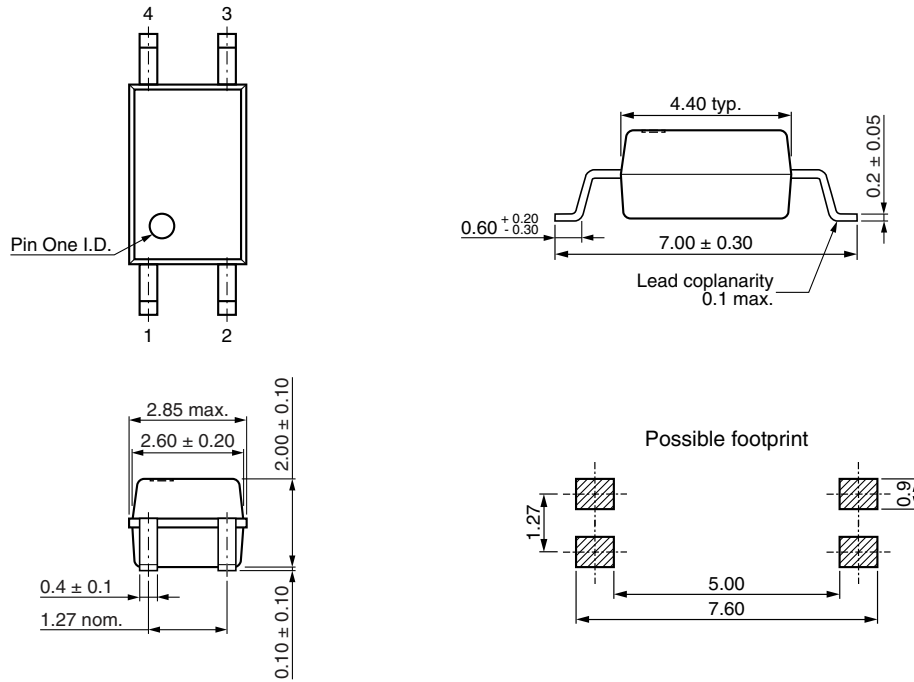


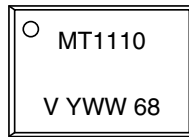
Fig. 14 -  $F_{CTR}$  vs. Phase Angle



**PACKAGE DIMENSIONS** in millimeters



**PACKAGE MARKING** (example of TCMT1110)



**PACKAGING INFORMATION (TAPE AND REEL) in millimeters**

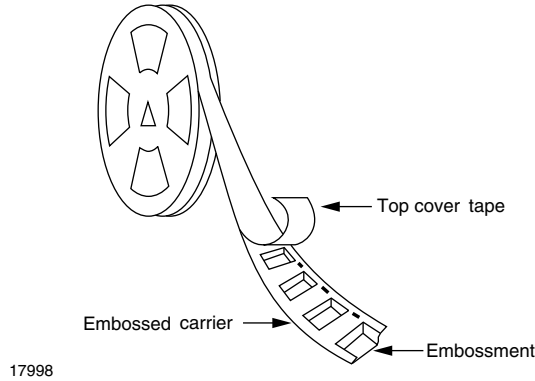


Fig. 17 - Tape and Reel Shipping Medium

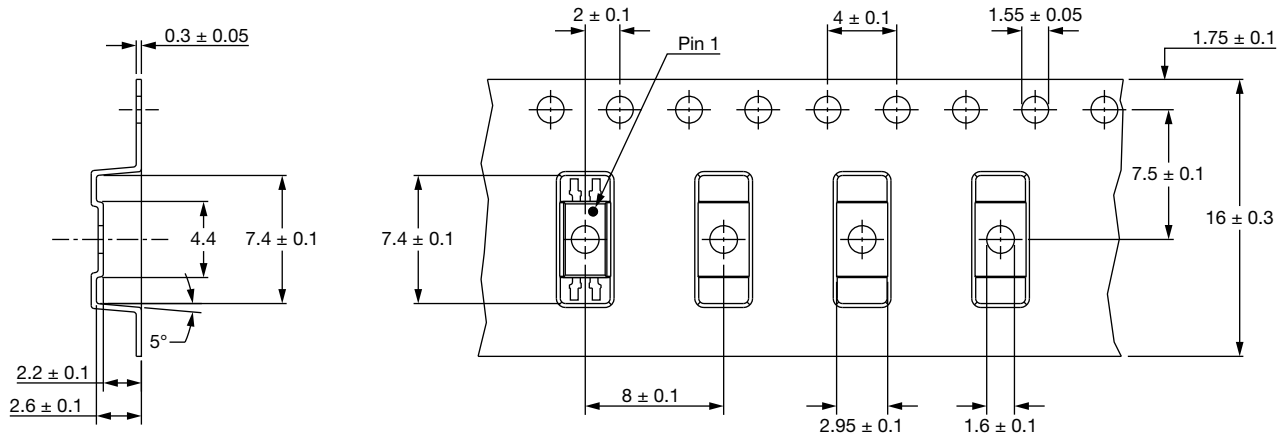


Fig. 18 - Tape and Reel Packing (3000 parts per reel)

**SOLDER PROFILES**

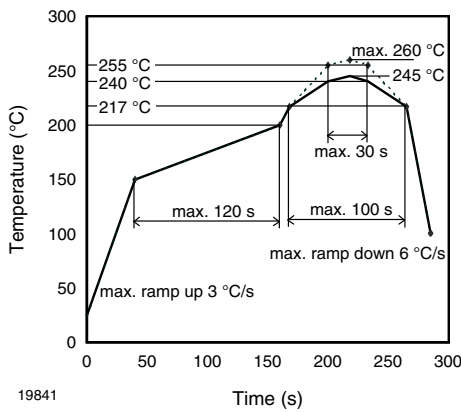


Fig. 19 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2  
 Floor life: unlimited  
 Conditions:  $T_{\text{amb}} < 30^\circ\text{C}$ , RH < 85 %  
 Moisture sensitivity level 1, according to J-STD-020



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