

## 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 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										
<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;">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, TCMT1107T3 <sup>(1)</sup>	TCMT1108	TCMT1109

### Notes

- Available only on tape and reel
- <sup>(1)</sup> Product is rotated 180° in tape and reel cavity



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>	60	mA
Forward surge current	t <sub>p</sub> ≤ 10 μs	I <sub>FSM</sub>	1.5	A
Power dissipation		P <sub>diss</sub>	100	mW
Junction temperature		T <sub>j</sub>	125	°C
<b>OUTPUT</b>				
Collector emitter voltage		V <sub>CEO</sub>	70	V
Emitter collector voltage		V <sub>ECO</sub>	7	V
Collector current		I <sub>C</sub>	50	mA
Collector peak current	t <sub>p</sub> /T = 0.5, t <sub>p</sub> ≤ 10 ms	I <sub>CM</sub>	100	mA
Power dissipation		P <sub>diss</sub>	150	mW
Junction temperature		T <sub>j</sub>	125	°C
<b>COUPLER</b>				
AC isolation test voltage (RMS)	Related to standard climate 23/50 DIN 50014	V <sub>ISO</sub>	3750	V <sub>RMS</sub>
Total power dissipation		P <sub>tot</sub>	250	mW
Operating ambient temperature range		T <sub>amb</sub>	-40 to +100	°C
Storage temperature range		T <sub>stg</sub>	-40 to +125	°C
Soldering temperature <sup>(1)</sup>		T <sub>slid</sub>	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
- <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))

ELECTRICAL CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward voltage	I <sub>F</sub> = 50 mA	V <sub>F</sub>	-	1.35	1.6	V
Junction capacitance	V <sub>R</sub> = 0, f = 1 MHz	C <sub>j</sub>	-	8		pF
<b>OUTPUT</b>						
Collector emitter voltage	I <sub>C</sub> = 100 μA	V <sub>CEO</sub>	70	-	-	V
Emitter collector voltage	I <sub>E</sub> = 100 μA	V <sub>ECO</sub>	7	-	-	V
Collector dark current	V <sub>CE</sub> = 20 V, I <sub>F</sub> = 0 A	I <sub>CEO</sub>	-	-	100	nA
<b>COUPLER</b>						
Collector emitter saturation voltage	I <sub>F</sub> = 10 mA, I <sub>C</sub> = 1 mA	V <sub>CEsat</sub>	-	-	0.3	V
Cut-off frequency	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 10 mA, R <sub>L</sub> = 100 Ω	f <sub>c</sub>	-	100	-	kHz
Coupling capacitance	f = 1 MHz	C <sub>k</sub>	-	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	%
	$V_{CE} = 5\text{ V}, I_F = 10\text{ mA}$	TCMT1101	CTR	40	-	80	%
		TCMT1102	CTR	63	-	125	%
		TCMT1103	CTR	100	-	200	%
		TCMT1104	CTR	160	-	320	%
	$V_{CE} = 5\text{ V}, I_F = 5\text{ mA}$	TCMT1105	CTR	50	-	150	%
		TCMT1106	CTR	100	-	300	%
		TCMT1107	CTR	80	-	160	%
		TCMT1108	CTR	130	-	260	%
TCMT1109		CTR	200	-	400	%	

SWITCHING CHARACTERISTICS ( $T_{amb} = 25^\circ\text{C}$ , 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

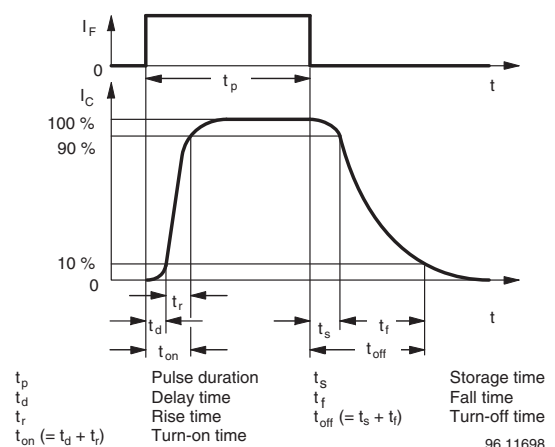
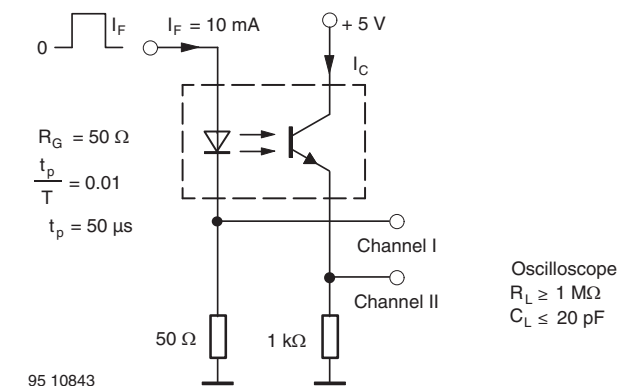


Fig. 3 - Switching Times



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	
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 <sub>ISO</sub>	3750	V <sub>RMS</sub>
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V <sub>IOTM</sub>	6000	V <sub>peak</sub>
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V <sub>IORM</sub>	707	V <sub>peak</sub>
Isolation resistance	T <sub>amb</sub> = 25 °C, V <sub>IO</sub> = 500 V	R <sub>IO</sub>	≥ 10 <sup>12</sup>	Ω
	T <sub>amb</sub> = 100 °C, V <sub>IO</sub> = 500 V		≥ 10 <sup>11</sup>	
	T <sub>amb</sub> = T <sub>S</sub> , V <sub>IO</sub> = 500 V		≥ 10 <sup>9</sup>	
Output safety power		P <sub>SO</sub>	350	mW
Input safety current		I <sub>SI</sub>	150	mA
Input safety temperature		T <sub>S</sub>	175	°C
Creepage distance			≥ 5	mm
Clearance distance			≥ 5	mm
Insulation thickness		DTI	≥ 0.4	mm
Input to output 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>
Input to output test voltage, method A	V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , 100 % sample test with t <sub>M</sub> = 10 s, partial discharge < 5 pC	V <sub>PR</sub>	1132	V <sub>peak</sub>

### 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

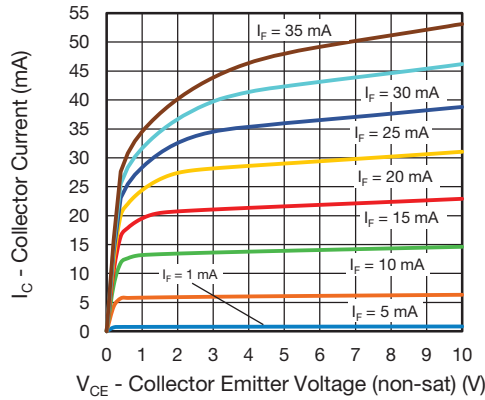


Fig. 6 - Collector Current vs. Collector Emitter Voltage

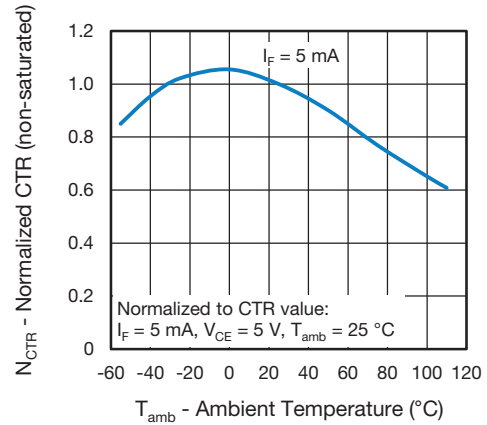


Fig. 9 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

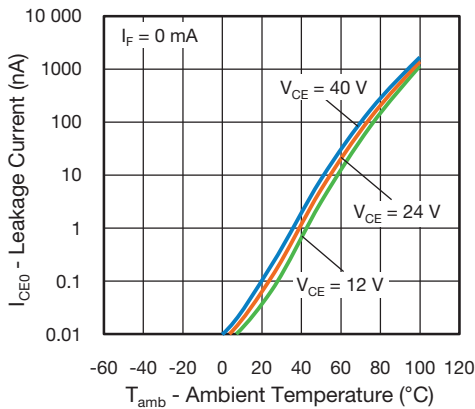


Fig. 7 - Leakage Current vs. Ambient Temperature

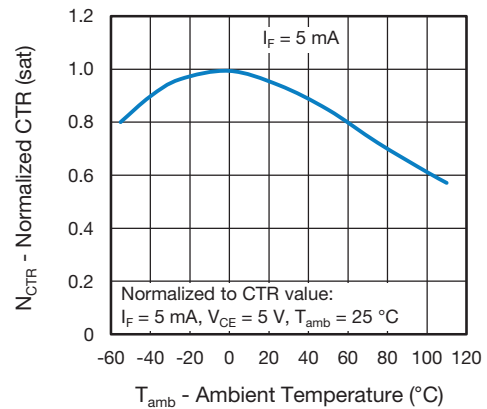


Fig. 10 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

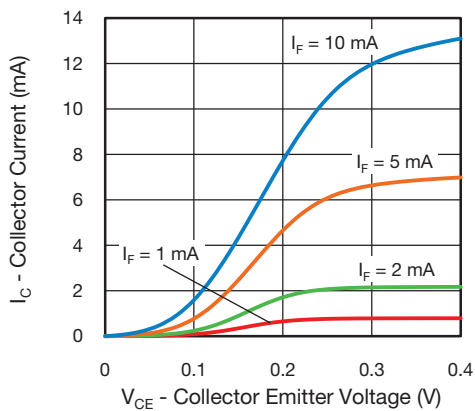


Fig. 8 - Collector Current vs. Collector Emitter Voltage

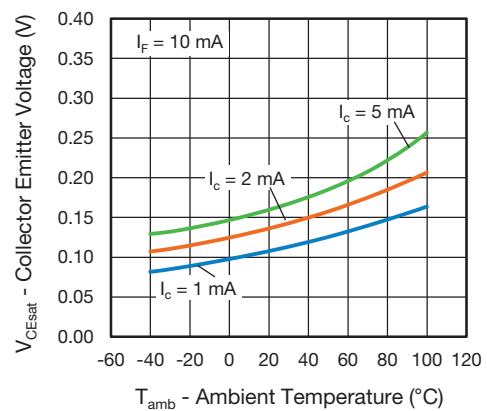


Fig. 11 - Collector Emitter Voltage vs. Ambient Temperature

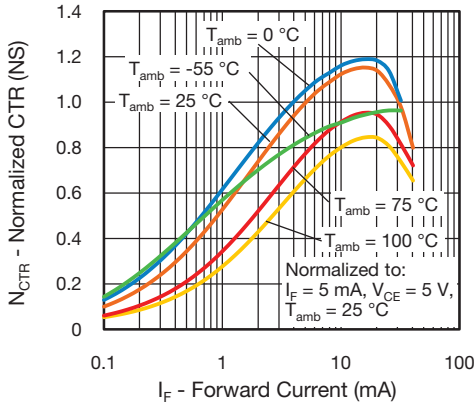


Fig. 12 - Normalized CTR (non-saturated) vs. Forward Current



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

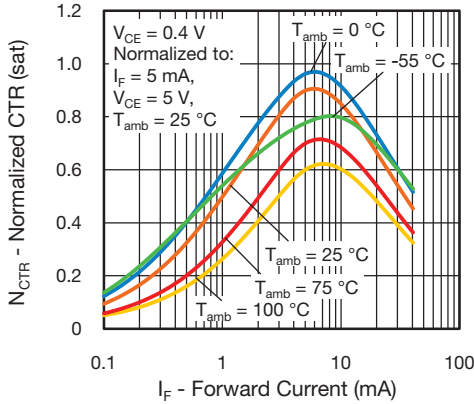


Fig. 13 - Normalized CTR (saturated) vs. Forward Current

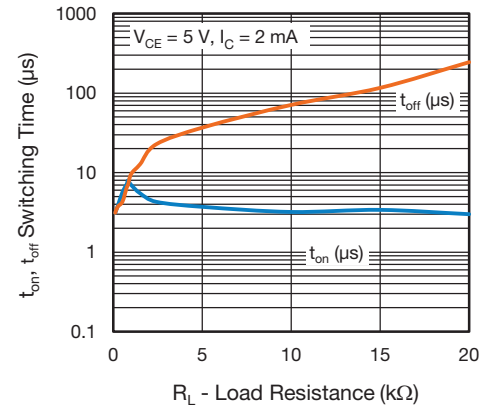


Fig. 16 - Switching Time vs. Load Resistance

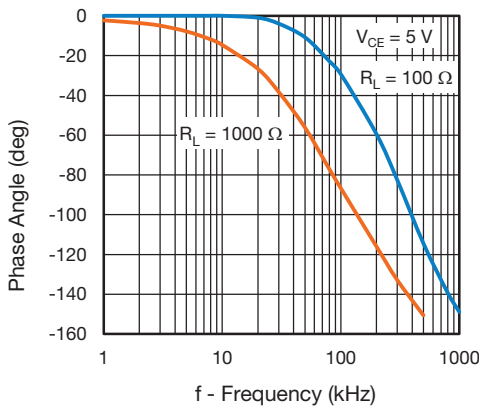
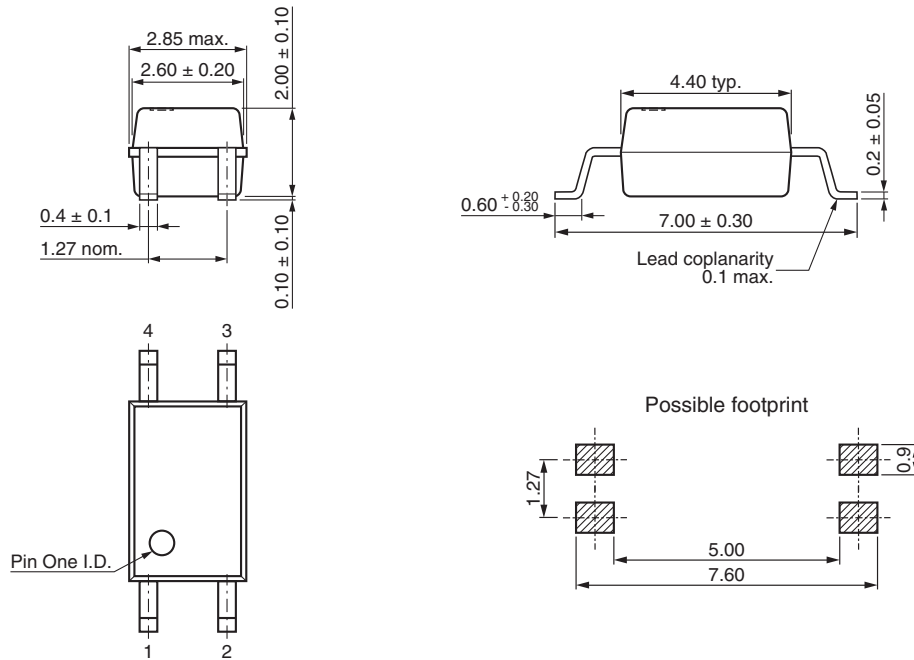


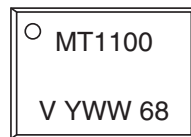
Fig. 14 -  $F_{CTR}$  vs. Phase Angle



**PACKAGE DIMENSIONS** in millimeters



**PACKAGE MARKING** (example)



**TAPE AND REEL PACKAGING** in millimeters

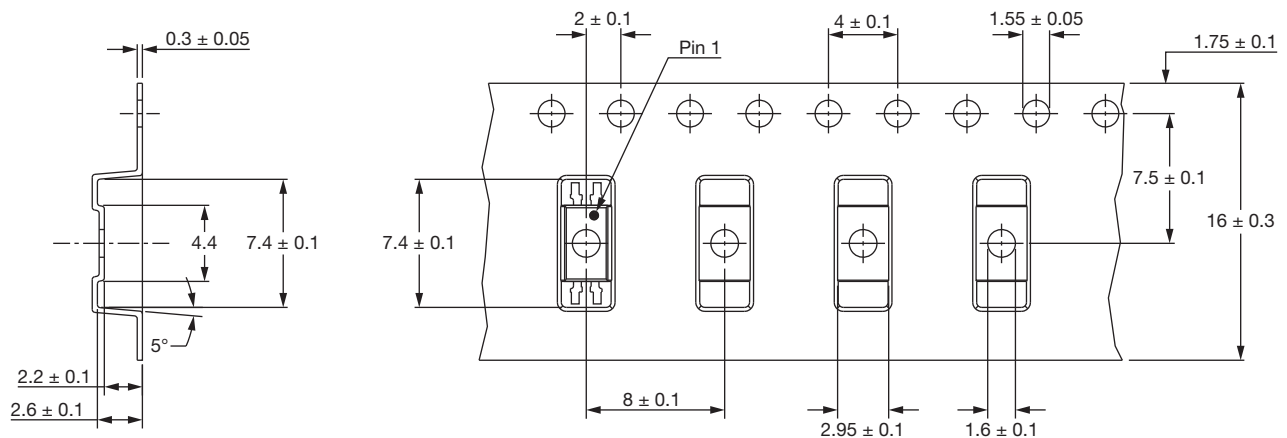
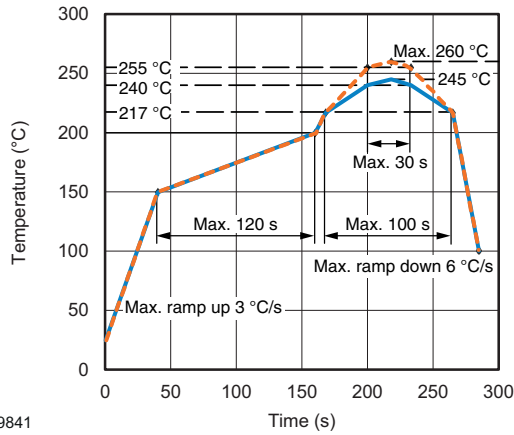


Fig. 17



## SOLDER PROFILES



19841

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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