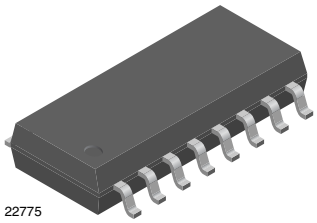
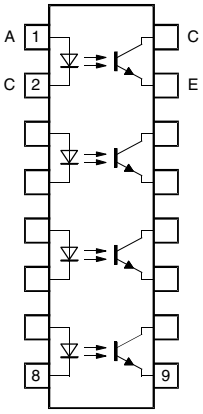
Optocoupler, Phototransistor Output, Quad Channel, Half Pitch Mini-Flat Package





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

HALOGEN FREE GREEN (5-2008)

APPLICATIONS

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

DESCRIPTION

The TCMT410. series consist of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 16 pin (quad channel) package.

AGENCY APPROVALS

Safety application model number covering all products in this datasheet is TCMT4100. This model number should be used when consulting safety agency documents.

- UL1577, file no. E76222, double protection
- cUL, accordance to CSA component acceptance service no. 5A, double protection
- DIN EN 60747-5-5 (VDE 0884-5)
- FIMKO EN 60950-1
- CQC GB4943.1-2011 and GB8898-2011 (suitable for installation altitude below 2000 m)

ORDERING INFORMATION

T	C	M	T	4	1	0	#

PART NUMBER

SSOP-16

AGENCY CERTIFIED/PACKAGE	CTR (%)	
	5 mA	
UL, cUL, FIMKO, BSI, VDE, CQC	**50 to 600**	**100 to 300**
SSOP-16, quad channel	TCMT4100	TCMT4106
SSOP-16, quad channel	TCMT4100T0 (1)	-

Notes

- Available only on tape and reel.

(1) Product is rotated 180° in tape and reel cavity.

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 per channel		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	TCMT4100	CTR	50	-	600	%
		TCMT4106	CTR	100	-	300	%

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	-	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	-	µs
Turn-off time	V_S = 5 V, I_F = 10 mA, R_L = 1 kΩ, (see figure 2)	t_{off}	-	20	-	µs

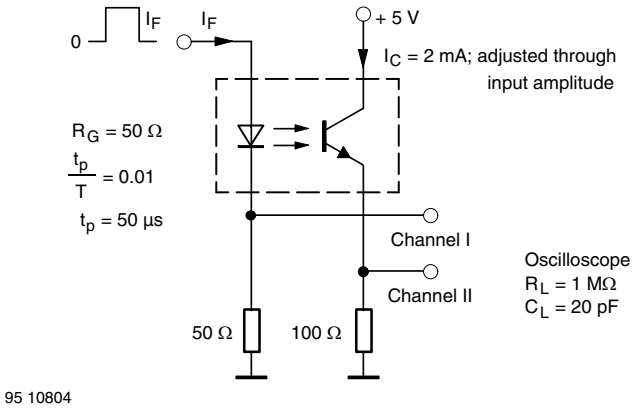


Fig. 1 - Test Circuit, Non-Saturated Operation

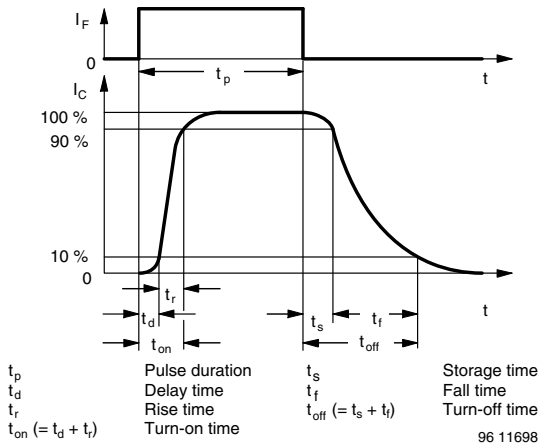


Fig. 3 - Switching Times

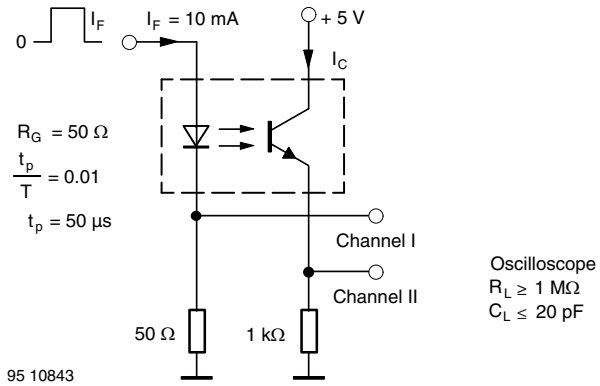


Fig. 2 - Test Circuit, Saturated Operation

SAFETY AND INSULATION RATINGS				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification	According to IEC 68 part 1		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}	265	mW
Input safety current		I_{SI}	130	mA
Input safety temperature		T_{SI}	150	°C
Creepage distance			≥ 5	mm
Clearance distance			≥ 5	mm
Insulation thickness, reinforced rated	Per IEC 60950 2.10.5.1	DTI	≥ 0.4	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)

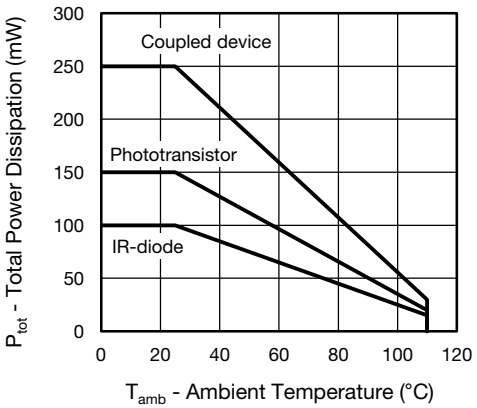


Fig. 4 - Total Power Dissipation vs. Ambient Temperature

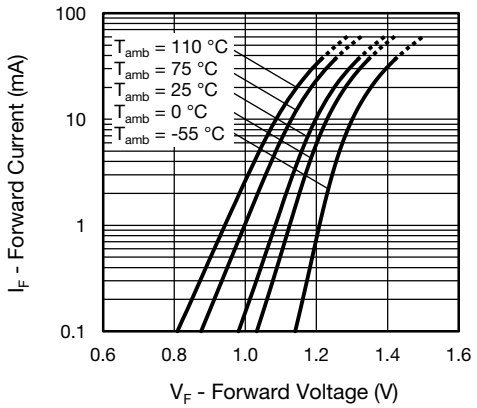


Fig. 5 - Forward Voltage vs. Forward Current

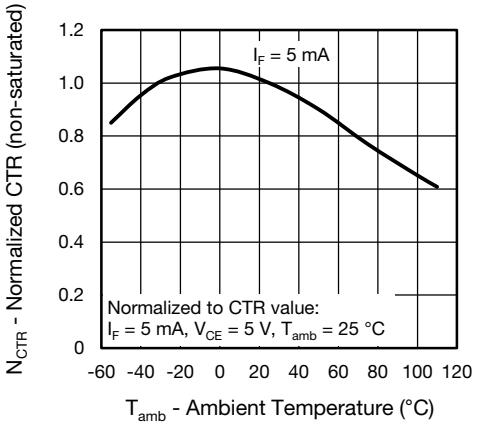


Fig. 6 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

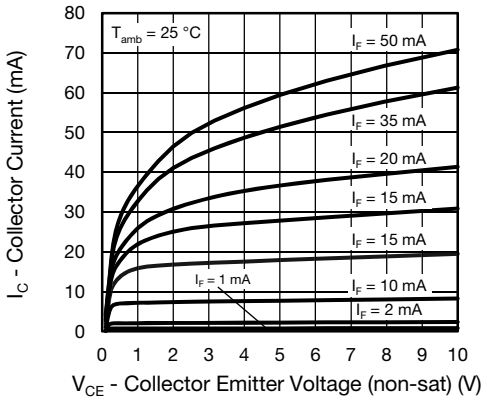


Fig. 9 - Collector Current vs. Collector Emitter Voltage (non-saturated)

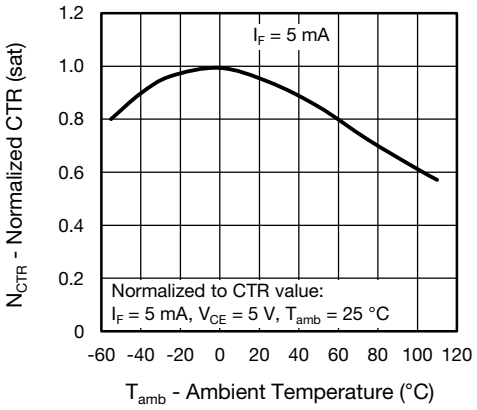


Fig. 7 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

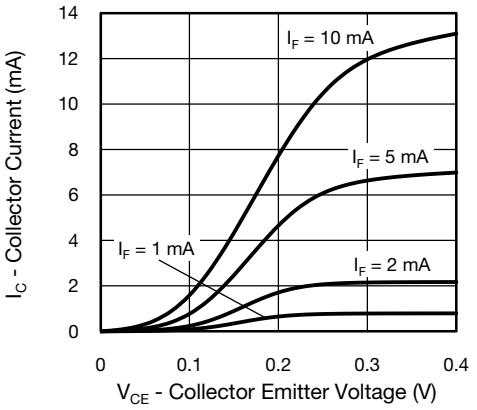


Fig. 10 - Collector Current vs. Collector Emitter Voltage (saturated)

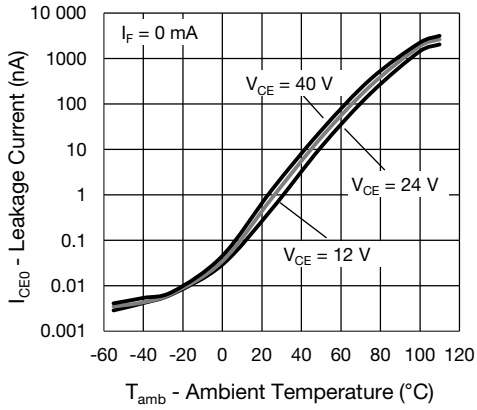


Fig. 8 - Collector Dark Current vs. Ambient Temperature

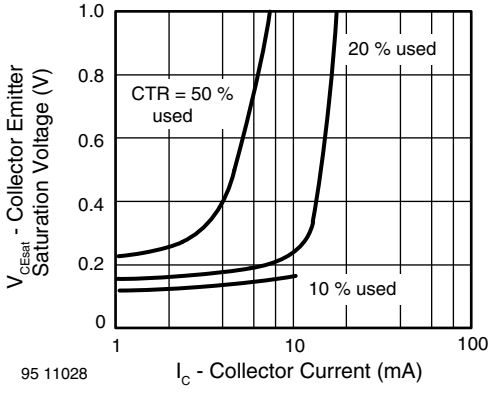


Fig. 11 - Collector Emitter Saturated Voltage vs. Collector Current

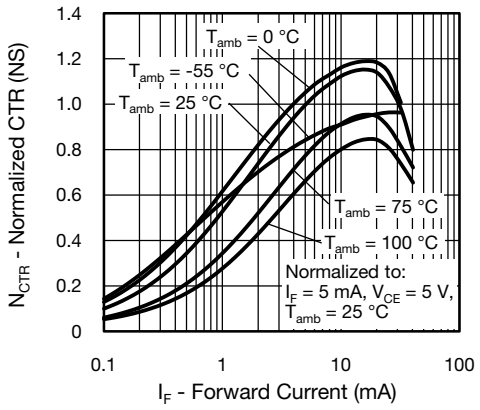


Fig. 12 - Normalized CTR (non-saturated) vs. Forward Current

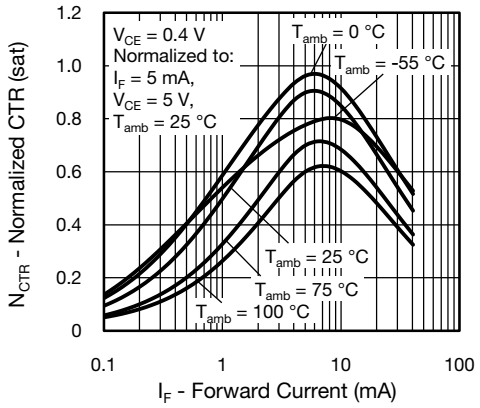


Fig. 13 - Normalized CTR (saturated) vs. Forward Current

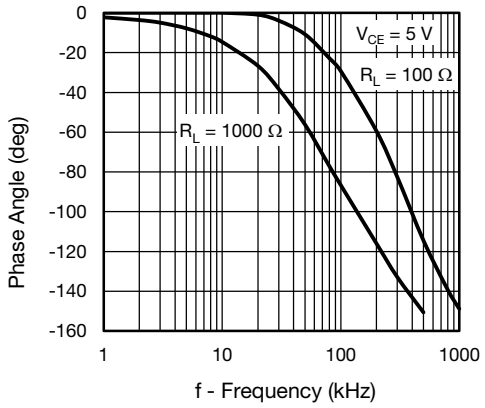


Fig. 14 - Phase Angle vs. Frequency

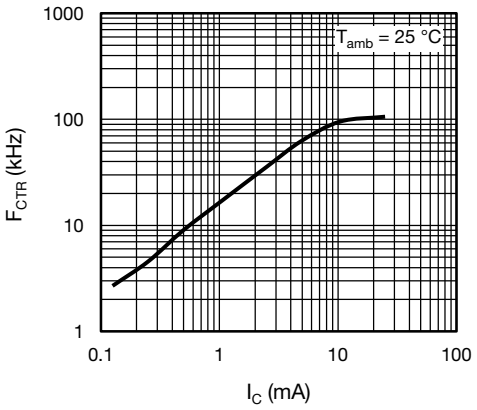


Fig. 15 - F_{CTR} vs. Collector Current

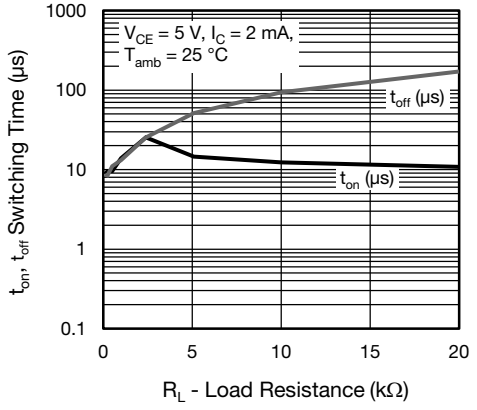


Fig. 16 - Switching Time vs. Load Resistance

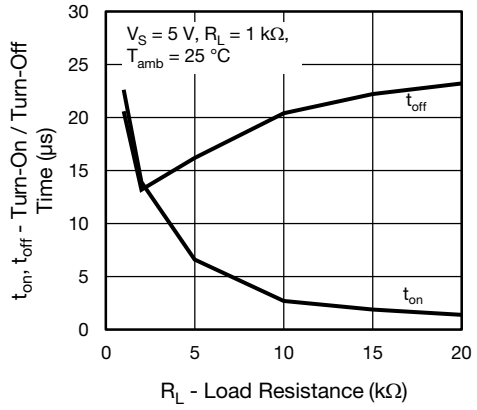


Fig. 17 - Turn-On / Turn-Off Time vs. Load Resistance

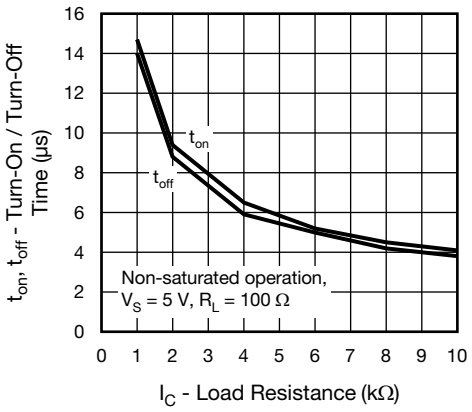
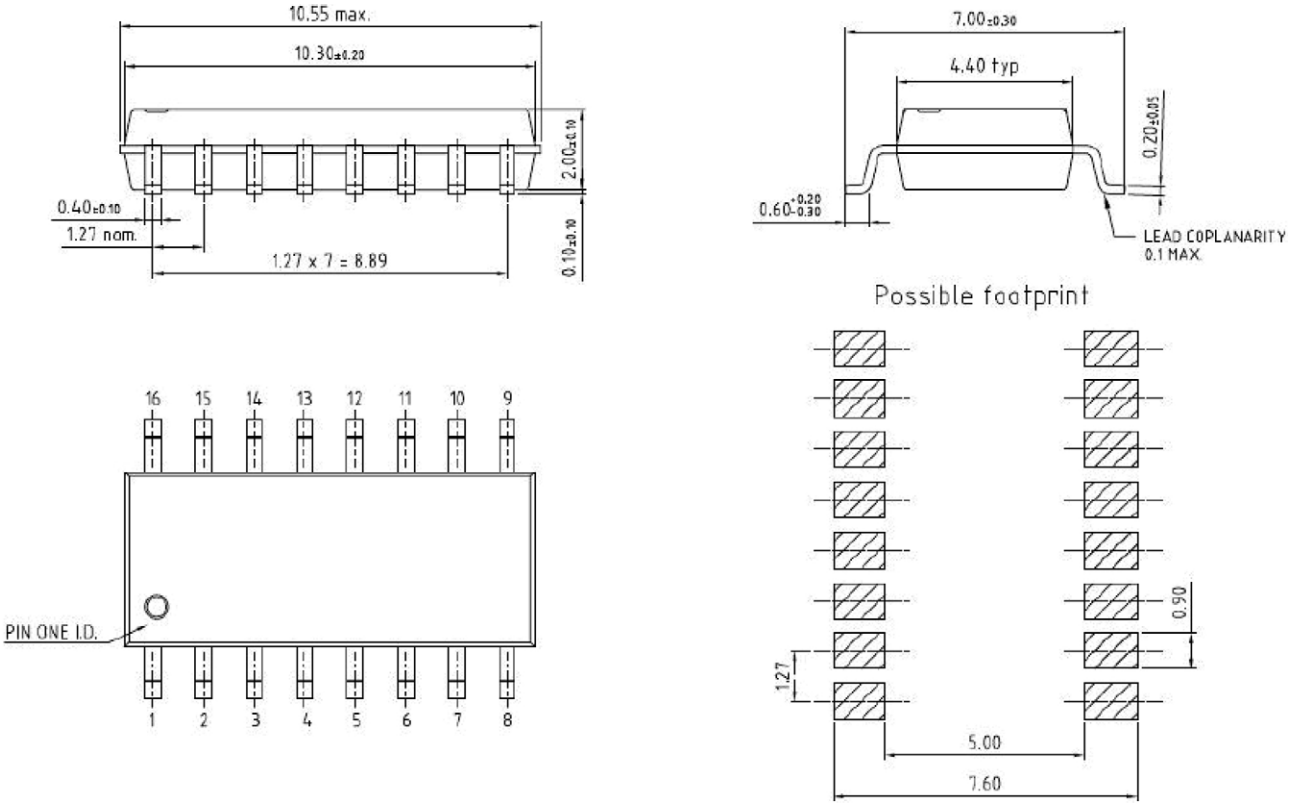
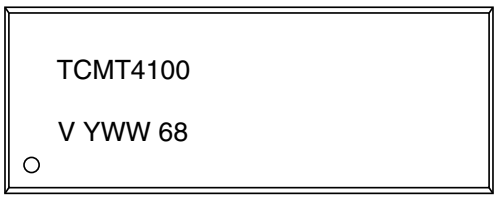


Fig. 18 - Switching Time vs. Load Resistance

PACKAGE DIMENSIONS (in millimeters)



PACKAGE MARKING (example)



TAPE AND REEL PACKAGING FOR TCMT410X SERIES (in millimeters)

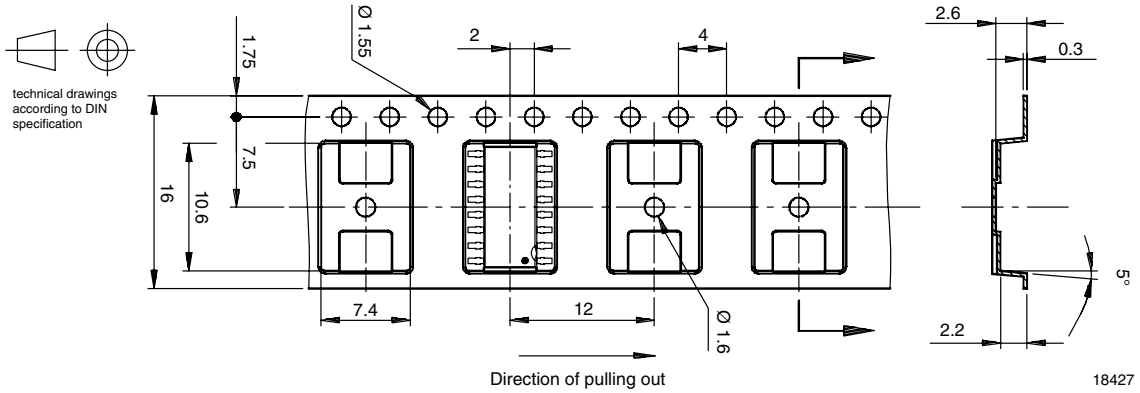


Fig. 19 - 2000 pcs/reel

TAPE AND REEL PACKAGING FOR TCMT410XT0 SERIES (in millimeters)

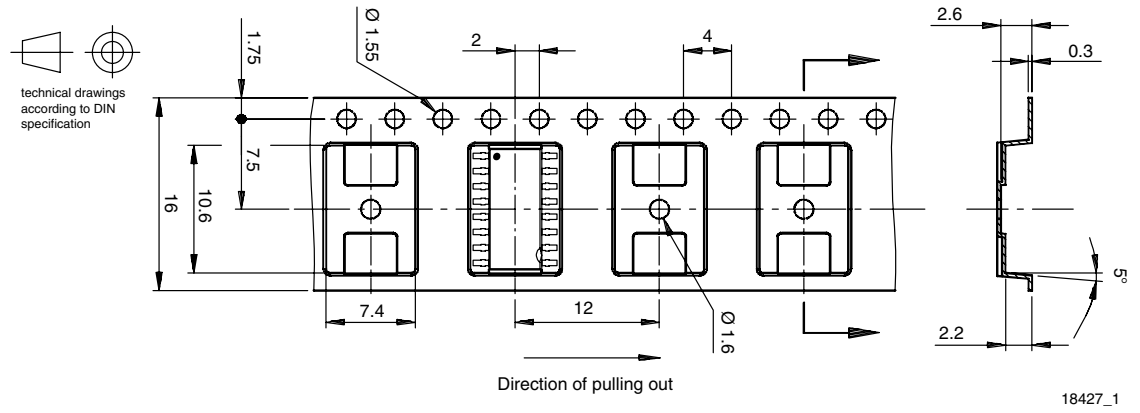


Fig. 20 - 2000 pcs/reel

SOLDER PROFILE

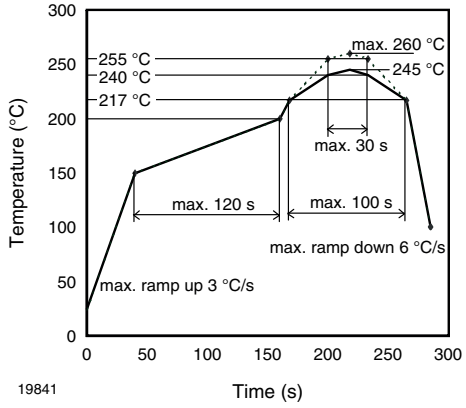


Fig. 21 - Lead (Pb)-free Reflow Solder Profile
according to J-STD-020

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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