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CT4504

High CMR, 1Mbit/s High Speed Optocoupler

Features

- High speed 1Mbit/s
- High isolation voltage between input and output (Viso=5000 Vrms)
- Guaranteed CTR performance from 0°C to 70°C
- Operating temperature range -55°C to 100°C
- RoHS and REACH Compliance
- MSL class 1
- Regulatory Approvals
  - ✓ UL - UL1577 (E364000)
  - ✓ VDE - EN60747-5-5(VDE0884-5)
  - ✓ CQC – GB4943.1, GB8898(14001104779)
  - ✓ IEC62368 (FI/41119)

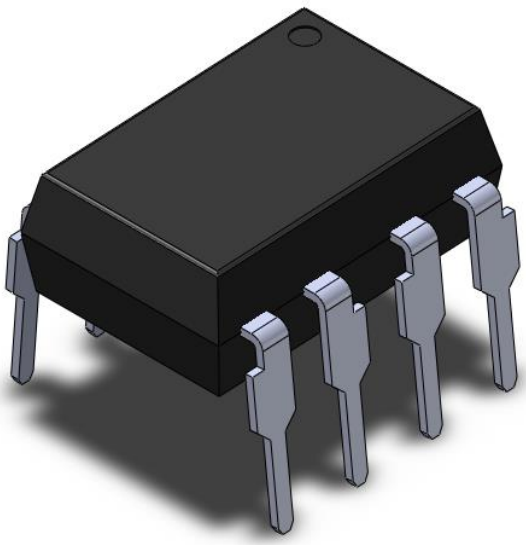
Description

The CT3120 consists of a LED optically coupled to an integrated circuit with a power output stage. This optocoupler is ideally suited for driving power IGBTs and MOSFETs used in motor control inverter applications. The high operating voltage range of the output stage provides the drive voltages required by gate-controlled devices.

Applications

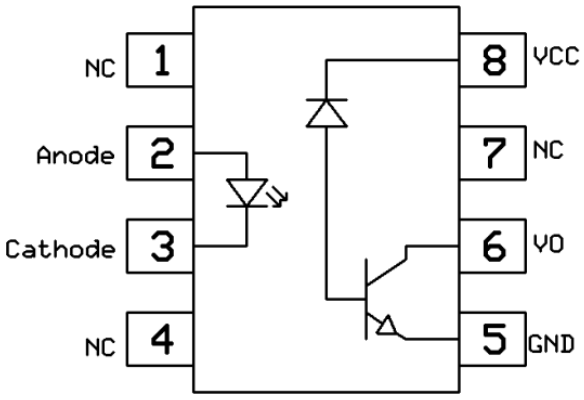
- Isolated IGBT/Power MOSFET gate drive
- Industrial Inverter
- AC brushless and DC motor drives
- Induction Heating

Package Outline



Note: Different lead forming options available. See package dimension.

Schematic



Absolute Maximum Ratings T_A = 25°C, unless otherwise specified

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. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameters	Ratings	Units	Notes
V_{ISO}	Isolation voltage (AC, 1 minute, 40 ~ 60% R.H.)	5000	V_{RMS}	
T_{OPR}	Operating temperature	-55 ~ +100	^0C	
T_{STG}	Storage temperature	-55 ~ +125	^0C	
T_{SOL}	Soldering temperature (For 10 seconds)	260	^0C	
Emitter				
I_F	Forward current	25	mA	
I_{FP}	Peak forward current (50% duty, 1ms P.W)	50	A	
$I_{F(TRANS)}$	Peak transient current (≤1μs P.W,300pps)	1	A	
V_R	Reverse voltage	5	V	
P_D	Power dissipation	45	mW	
Detector				
P_D	Power dissipation	250	mW	
V_{EBR}	Emitter-Base reverse voltage	5	V	
I_B	Base current	5	mA	
$I_{C(AVG)}$	Average Output current	8	mA	
$I_{C(Peak)}$	Peak Output current	16	mA	
V_{CC}	Supply voltage	0 to 30	V	

Electrical Characteristics *TA = 0 - 70°C (unless otherwise specified). Typical values are measured at TA = 250C and VCC=5V*

Emitter Characteristics

Symbol	*Parameters*	*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
V_F	Forward voltage	IF = 16mA	-	1.45	1.8	V	
V_R	Reverse Voltage	IR = 10μA	5.0	-	-	V	
$\Delta V_F/\Delta T_A$	Temperature coefficient of forward voltage	IF = 16mA	-	-1.8	-	mV/°C	

Detector Characteristics

Symbol	*Parameters*	*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
I_{OH}	Logic High Output Current	I_F=0mA, V_O=V_{CC}=5.5V, T_A=25°C	-	0.001	0.5	μA	
		I_F=0mA, V_O=V_{CC}=15V, T_A=25°C	-	0.01	1		
		I_F=0mA, V_O=V_{CC}=15V	-	-	50		
I_{CCL}	Logic Low Supply Current	V_F = 0 to 0.8V, V_O= Open	-	140	200	μA	
I_{CCH}	Logic High Supply Current	I_F=0mA, V_O=Open, V_{CC}=15V, T_A=25°C	-	0.01	1	μA	
		IF=0mA, VO=Open, VCC=15V	-	-	2		

Transfer Characteristics

Symbol	*Parameters*	*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
CTR	Current Transfer Ratio	I_F=16mA, V_O=0.4V, V_{CC}=4.5V, T_A=25°C	25	35	60	%	
		I_F=16mA, V_O=0.5V,V_{CC}=4.5V	21	40	-		
		I_F=12mA, V_O=0.4V, V_{CC}=4.5V, T_A=25°C	26	38	65		
		I_F=12mA, V_O=0.5V,V_{CC}=4.5V	22	43	-		
V_{OL}	Logic Low Output Voltage	I_F=16mA,I_O=4.0mA, V_{CC}=4.5V, T_A=25°C	-	0.2	0.4	V	
		I_F=16mA, I_O=3.3mA, V_{CC}=4.5V	-	-	0.5		

Electrical Characteristics *TA = 0 - 70°C (unless otherwise specified). Typical values are measured at TA = 250C and VCC=5V*

Switching Characteristics

Symbol	*Parameters*	*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
T_{PHL}	Propagation Delay Time Logic High to Logic Low	I_F=16mA, V_{CC}=5.0V, R_L=1.9kΩ, C_L=15pF, V_{THHL}=1.5V, T_A=25°C	-	0.24	0.3	µs	
		I_F=16mA, V_{CC}=5.0V, R_L=1.9kΩ, C_L=15pF,V_{THHL}=1.5V	-	0.24	0.5		
		I_F=12mA, V_{CC}=15.0V, R_L=20kΩ, C_L=100pF, V_{THHL}=1.5V, T_A=25°C	-	0.58	0.7		
		I_F=12mA, V_{CC}=15.0V, R_L=20kΩ, C_L=100pF, V_{THHL}=1.5V	-	-	1.0		
T_{PLH}	Propagation Delay Time Logic Low to Logic High	I_F=16mA, V_{CC}=5.0V, R_L=1.9kΩ, C_L=15pF, V_{THLH}=1.5V ,T_A=25°C	-	0.21	0.5	µs	
		I_F=16mA, V_{CC}=5.0V, R_L=1.9kΩ, C_L=15pF, V_{THLH}=1.5V	-	0.21	0.7		
		I_F=12mA, V_{CC}=15.0V, R_L=20kΩ, C_L=100pF, V_{THLH}=2.0V,T_A=25°C	-	0.76	1.1		
		I_F=12mA, V_{CC}=15.0V, R_L=20kΩ, C_L=100pF, V_{THLH}=2.0V	-	0.76	1.4		
T_{PLH}-T_{PHL}	Propagation Delay Difference	I_F=12mA, V_{CC}=15.0V, R_L=20kΩ, C_L=100pF,V_{THHL}=1.5V ,V_{THLH}=2.0V , T_A=25°C	-0.4	0.3	0.9	µs	
		I_F=12mA, V_{CC}=15.0V, R_L=20kΩ, C_L=100pF	-0.7	0.3	1.3		
CM_H	Common Mode Transient Immunity at Logic High	I_F = 0mA , V_{CM}=1.5kVp-p,V_{CC}=5V, R_L=1.9kΩ, C_L=15pF, T_A =25°C	15000	30000	-	V/µs	
		I_F = 0mA , V_{CM}=1.5kVp-p, V_{CC}=15V, R_L=20kΩ, C_L=100pF, T_A =25°C	15000	30000	-		
CM_L	Common Mode Transient Immunity at Logic Low	I_F = 12mA , V_{CM}=1.5kVp-p,V_{CC}=5V, R_L=1.9kΩ, C_L=15pF, T_A =25°C	15000	30000	-	V/µs	
		I_F = 16mA , V_{CM}=1.5kVp-p, V_{CC}=15V, R_L=20kΩ, C_L=100pF, T_A =25°C	15000	30000	-		

Typical Characteristic Curves *T_A = 25°C, unless otherwise specified*

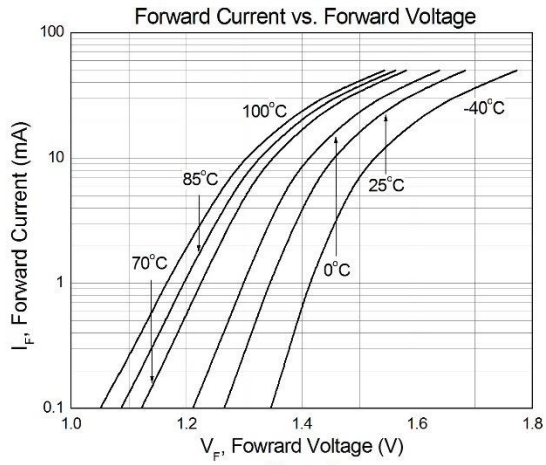


Figure 1

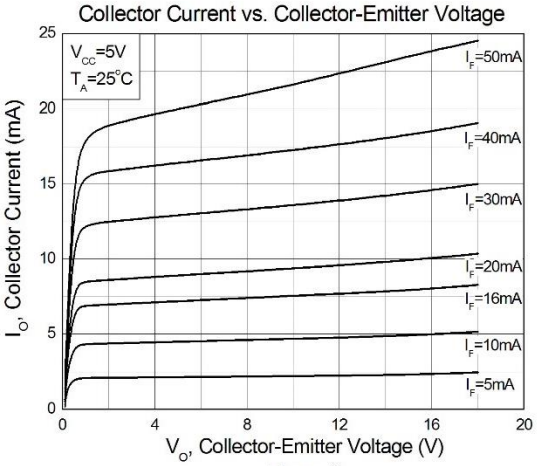


Figure 2

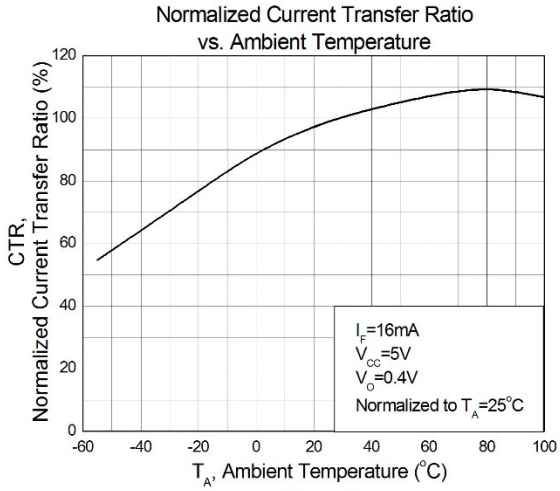


Figure 3

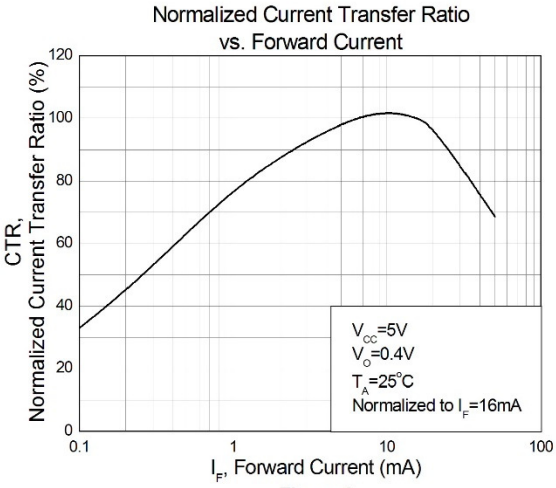
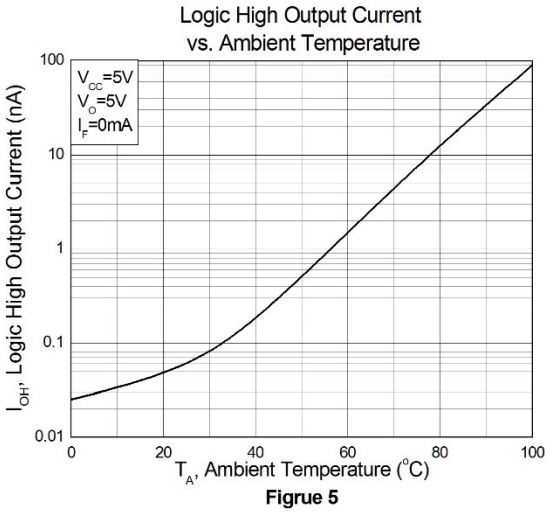


Figure 4



Figrue 5

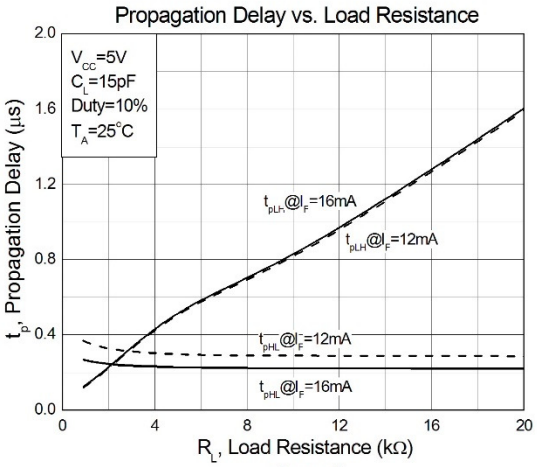


Figure 6

Typical Characteristic Curves *T_A = 25°C, unless otherwise specified*

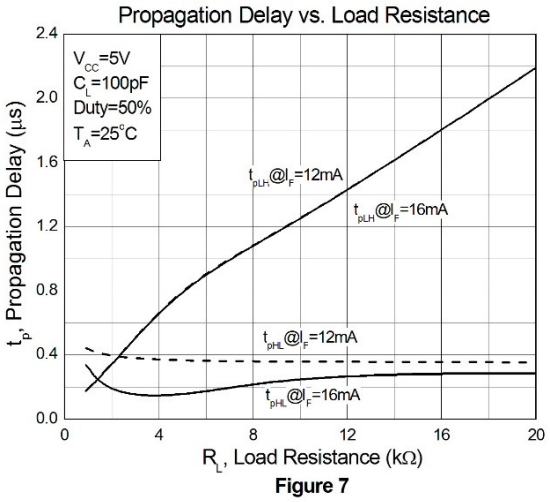


Figure 7

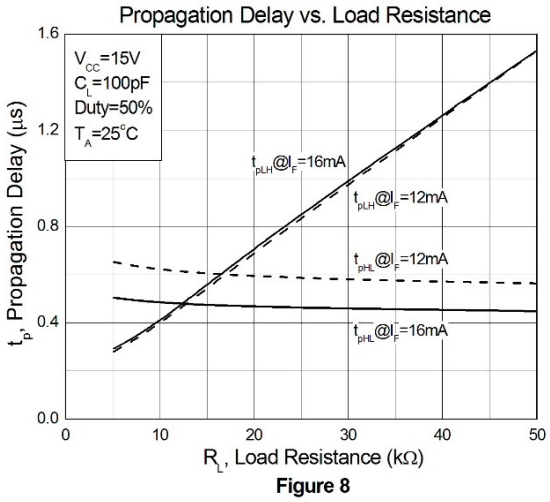


Figure 8

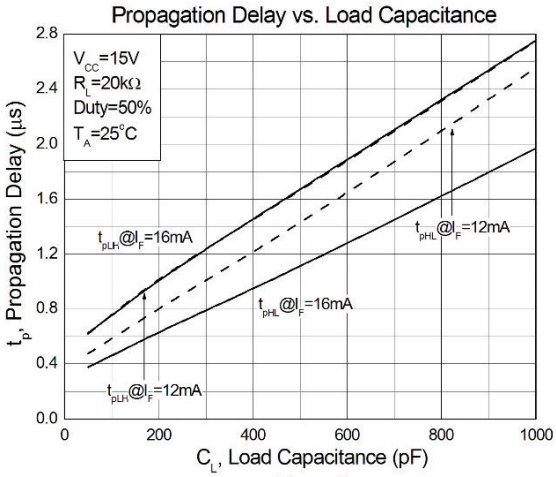


Figure 9

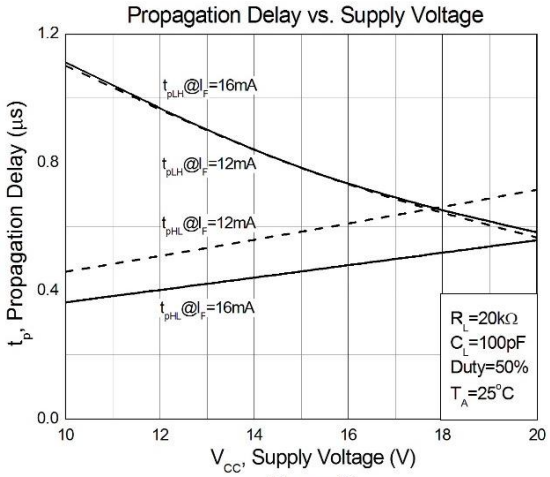


Figure 10

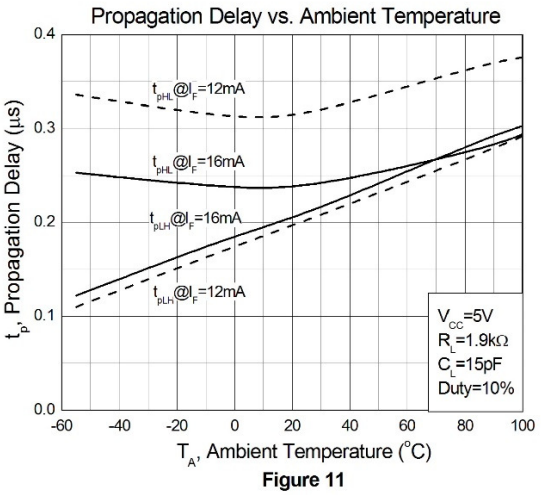


Figure 11

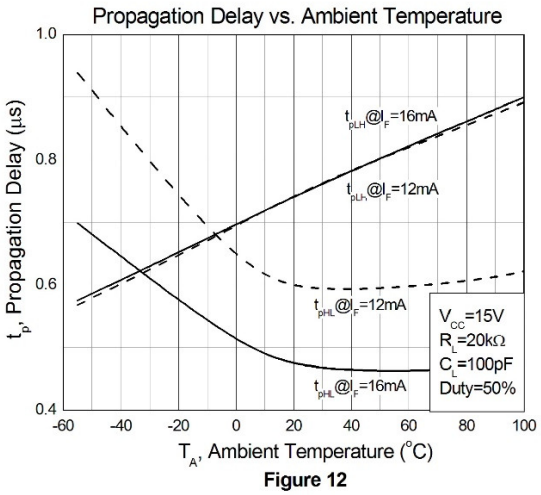


Figure 12

Test Circuits

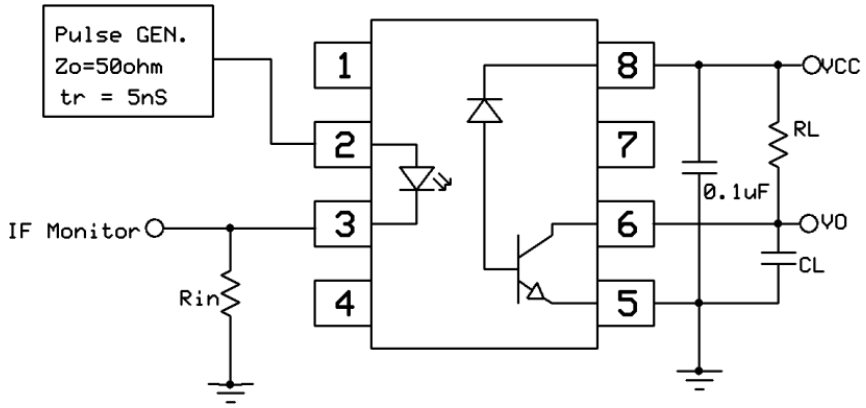


Figure 13: Switching Time Test Circuits

Test Circuits

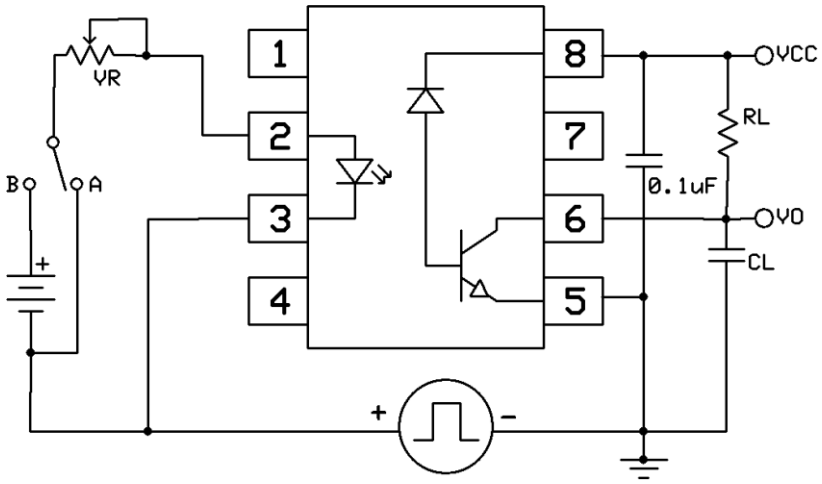
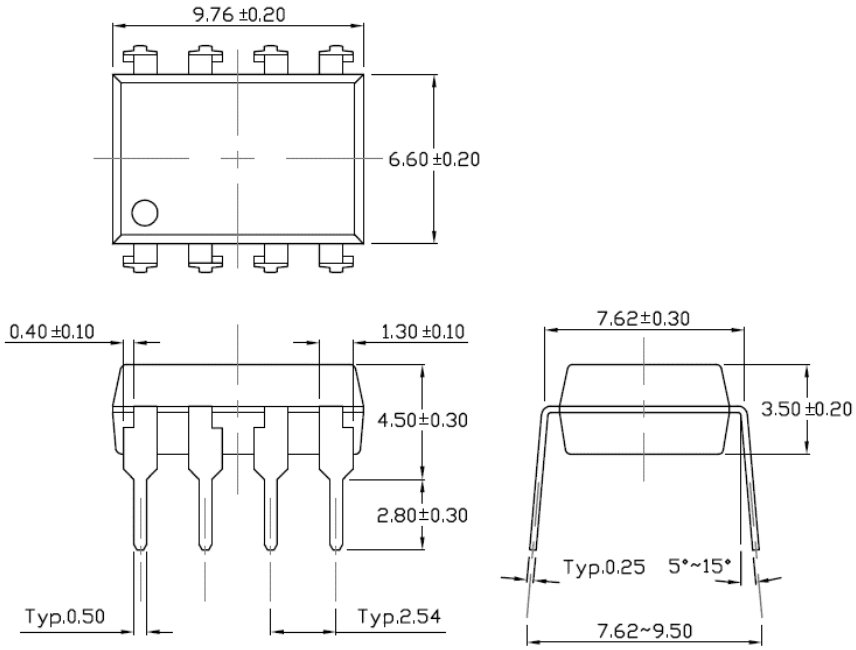


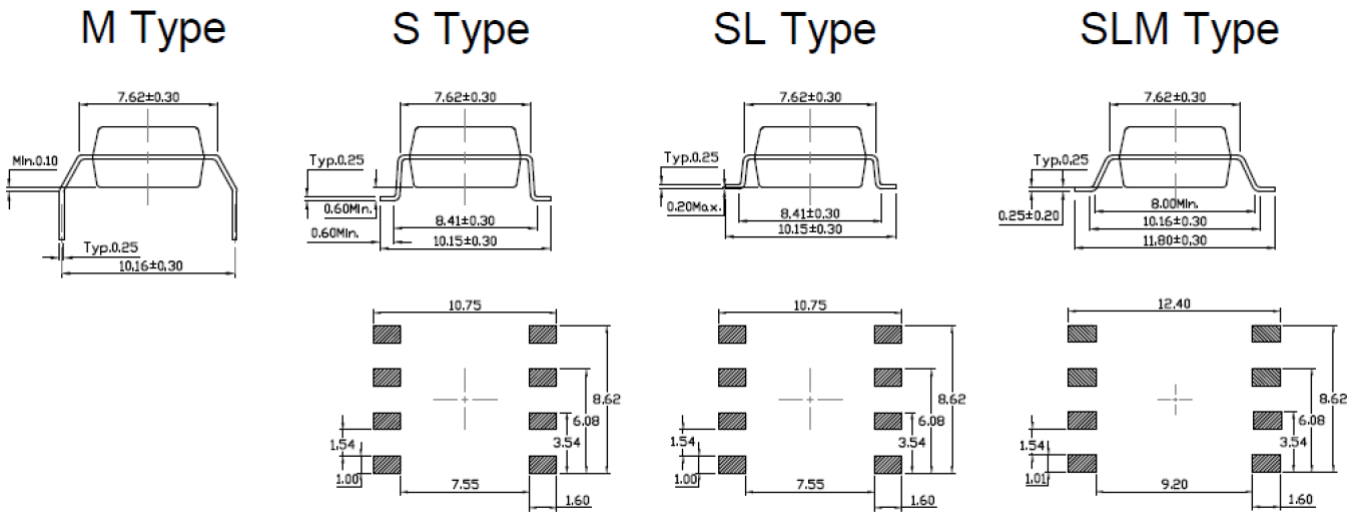
Figure 14: CMR Test Circuits

Package Dimension *Dimensions in mm unless otherwise stated*

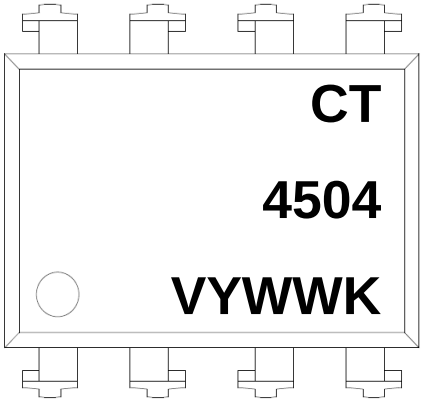
Standard DIP – Through Hole



Forming Option *Dimensions in mm unless otherwise stated*



Marking Information



Note:

CT : Denotes “CT Micro”
4504 : Part Number
V : VDE Safety Mark Option (Blank or V)
Y : One Digit Year Code
WW : Two Digit Work Week
K : Manufacturing Code

Ordering Information

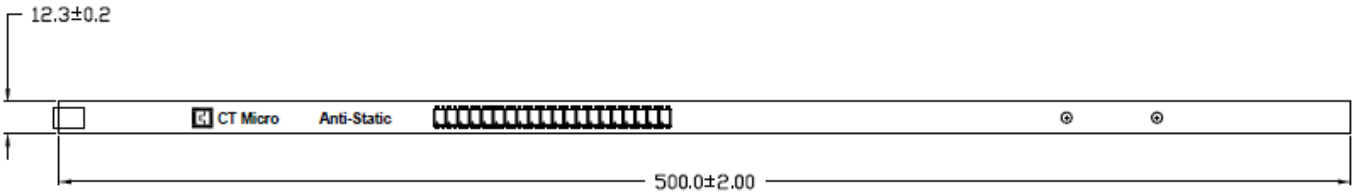
CT4504(V)(Y)(Z)

CT = Denotes “CT Micro”
4504 = Part Number
V = VDE Safety Mark Option (Blank or V)
Y = Lead Form Option (S, SL, M, SLM or none)
Z = Tape and Reel Option (Blank, T1 or T2)

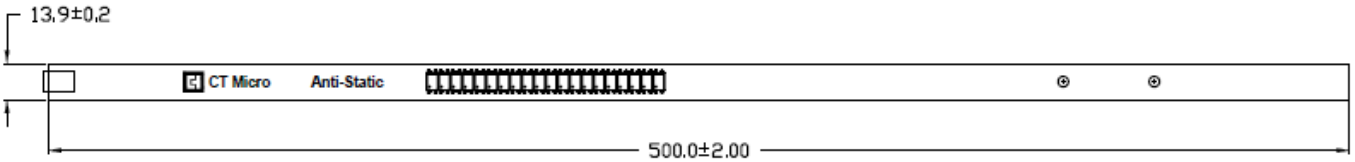
Option	***Description***	***Quantity***
None	Standard 8 Pin Dip	40 Units/Tube
M	Gullwing (400mil) Lead Forming	40 Units/Tube
S(T1)	Surface Mount Lead Forming – With Option 1 Taping	1000 Units/Reel
S(T2)	Surface Mount Lead Forming – With Option 2 Taping	1000 Units/Reel
SL(T1)	Surface Mount (Low Profile) Lead Forming– With Option 1 Taping	1000 Units/Reel
SL(T2)	Surface Mount (Low Profile) Lead Forming – With Option 2 Taping	1000 Units/Reel
SLM(T1)	Surface Mount (Gullwing) Lead Forming– With Option 1 Taping	1000 Units/Reel
SLM(T2)	Surface Mount (Gullwing) Lead Forming – With Option 2 Taping	1000 Units/Reel

Carrier Specifications *Dimensions in mm unless otherwise stated*

Tube Option Standard DIP

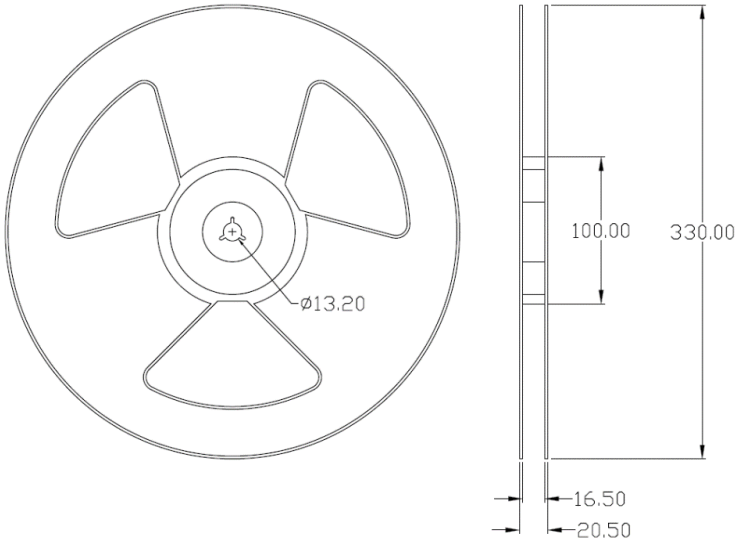


Tube Option M Type

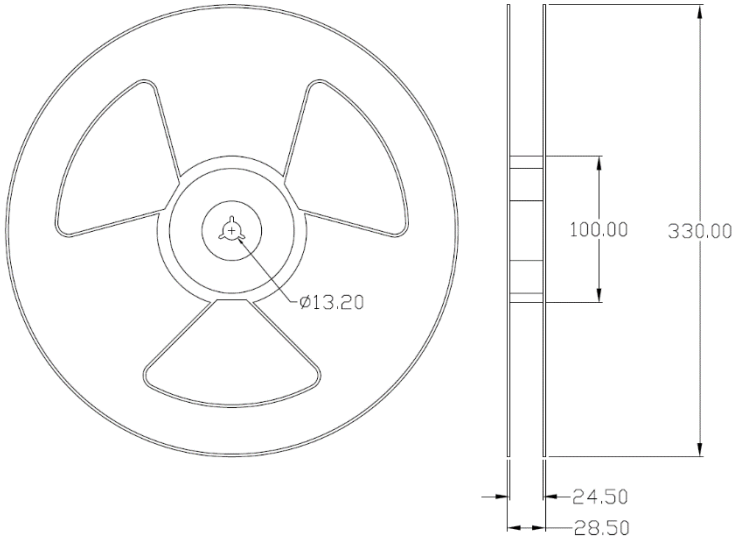


Reel Dimension *All dimensions are in mm, unless otherwise stated*

Option S(T1/T2) & SL(T1/T2)

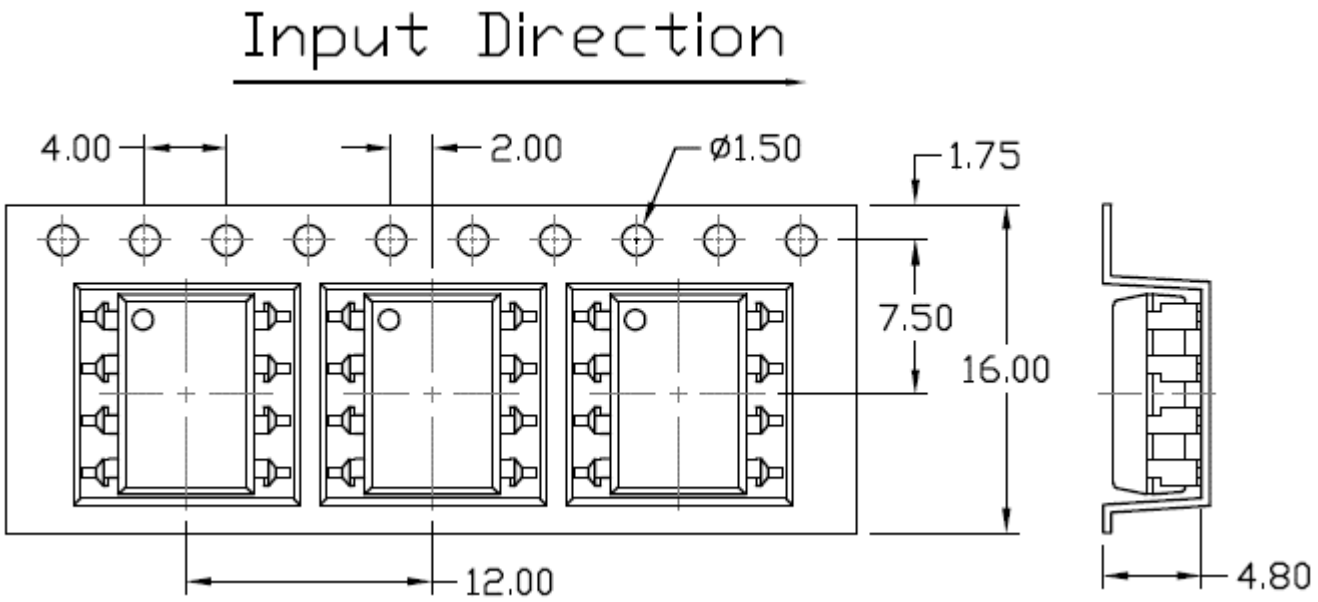


Option SLM(T1/T2)

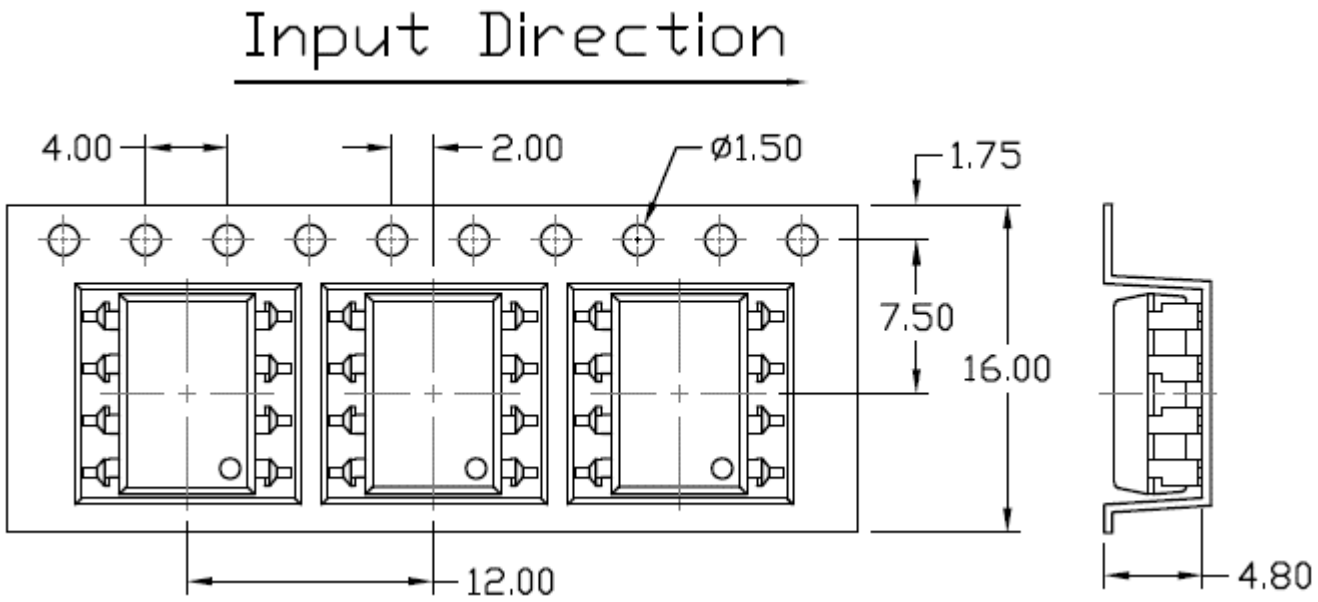


Carrier Tape Specifications *Dimensions in mm unless otherwise stated*

Option S(T1) & SL(T1)



Option S(T2) & SL(T2)

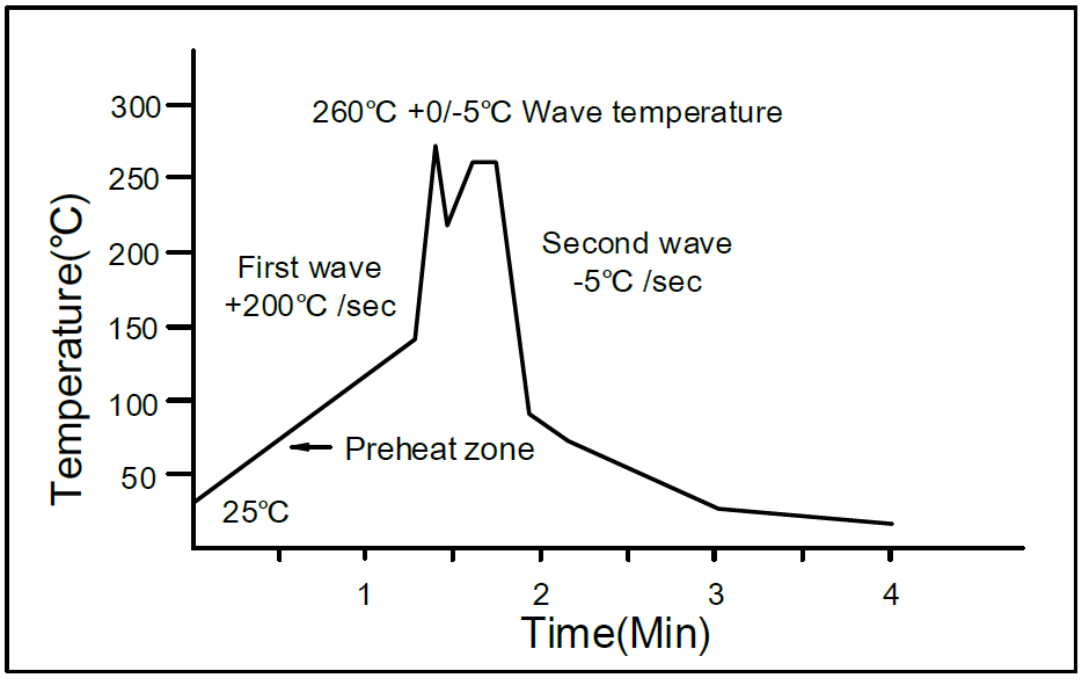


Solderability spec (Follow the JEDEC standard JESD22-B102)

Reflow Soldering: Immersed surface, other than the end of pin as cut-surface, must be covered by solder.
Solder-Bath: More than 95% of the electrode must be covered with solder.

Wave soldering (Follow the JEDEC standard JESD22-A111)

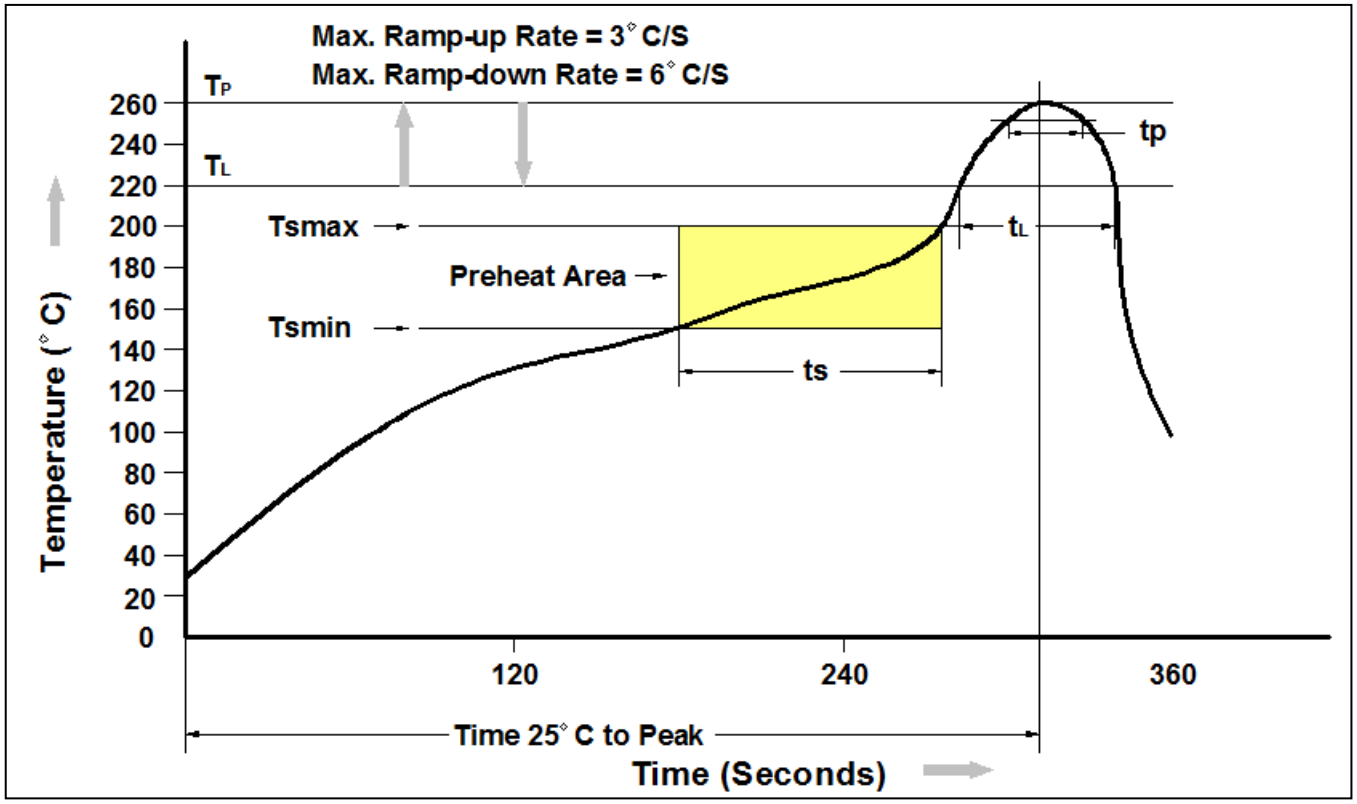
One time soldering is recommended within the condition of temperature.
Temperature: 260+0/-5˚C.
Time: 10 sec.
Preheat temperature: 25 to 140˚C.
Preheat time: 30 to 80 sec.



Iron soldering (Follow the standard MIL-STD 202G, Method 210F)

Allow single lead soldering in every single process.
One time soldering is recommended. Temperature: 350±10˚C
Time: 5 sec max.

Reflow Profile (Follow the JEDEC standard J-STD-020)



Profile Feature	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	150°C
Temperature Max. (Tsmax)	200°C
Time (ts) from (Tsmin to Tsmax)	60-120 seconds
Ramp-up Rate (t_L to t_P)	3°C/second max.
Liquidous Temperature (T_L)	217°C
Time (t_L) Maintained Above (T_L)	60 – 150 seconds
Peak Body Package Temperature	260°C +0°C / -5°C
Time (t_P) within 5°C of 260°C	30 seconds
Ramp-down Rate (T_P to T_L)	6°C/second max
Time 25°C to Peak Temperature	8 minutes max.

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2. *A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.*