

Description

The 6N138 and 6N139 series combine an AlGaAs infrared emitting diode as the emitter which is optically coupled to a silicon high speed photo darlington transistor in a plastic DIP8 package with different lead forming options. A separate design between photodiode and darlington transistor reduces the base-collector capacitance of the input transistor which improves the speed by several orders of magnitude over conventional phototransistor optocouplers.

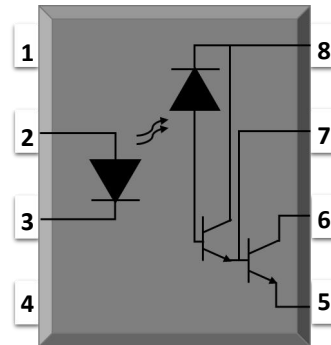
Features

- High isolation 5000 VRMS
- DC input with logic gate output
- Operating temperature range - 55 °C to 100 °C
- REACH compliance
- Halogen free (Optional)
- MSL class 1

Applications

- Low current line receivers
- Current loop receivers
- Out interface to CMOS-LSTTL-TTL
- Pulse transformer replacement
- Computer-peripheral interface

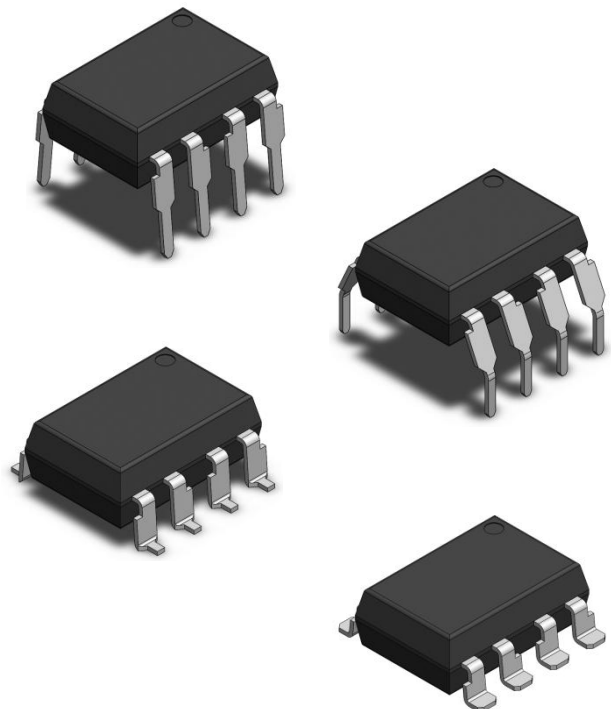
SCHEMATIC



PIN DEFINITION

1.NC	8.VCC
2.Anode	7.VB
3.Cathode	6.VO
4.NC	5.GND

OUTLINE



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT	Note
INPUT				
Forward Current	I_F	25	mA	
Peak Forward Current	I_{FP}	50	mA	1
Peak Transient Current	$I_{F(trans)}$	1	A	2
Reverse Voltage	V_R	5	V	
Input Power Dissipation	P_I	100	mW	
OUTPUT				
Supply Voltage	V_{CC}	-0.5~18	V	
Output Voltage	V_O	-0.5~18	V	
Output Current	I_O	60	mA	
Emitter-Base Reverse Voltage	V_{EBR}	0.5	V	
Output Power Dissipation	P_O	100	mW	
COMMON				
Total Power Dissipation	P_{tot}	200	mW	
Isolation Voltage	V_{iso}	5000	V _{rms}	3
Operating Temperature	T_{opr}	-55~100	°C	
Storage Temperature	T_{stg}	-55~150	°C	
Soldering Temperature	T_{sol}	260	°C	4

Note 1. 50% duty, 1ms P.W

Note 2. $\leq 1\mu s$ P.W, 300pps

Note 3. AC For 1 Minute, R.H. = 40 ~ 60%

Note 4. For 10 seconds

ELECTRICAL OPTICAL CHARACTERISTICS

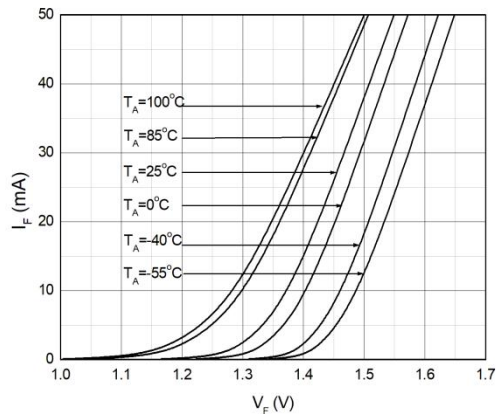
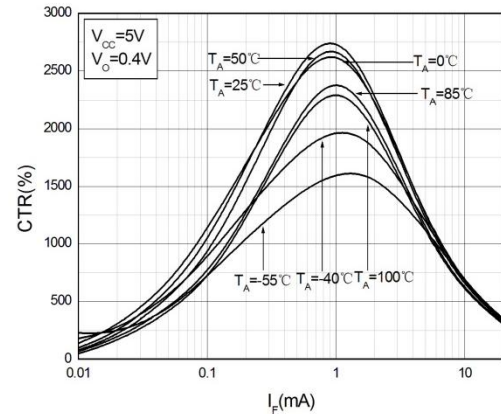
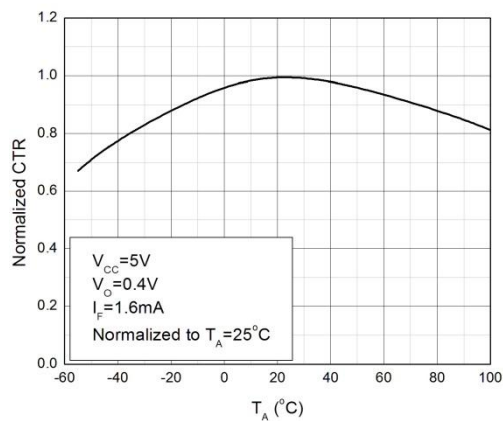
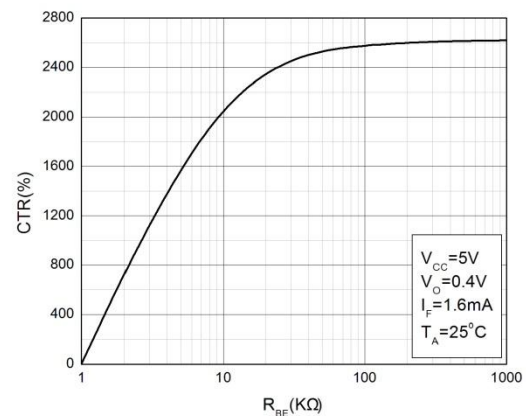
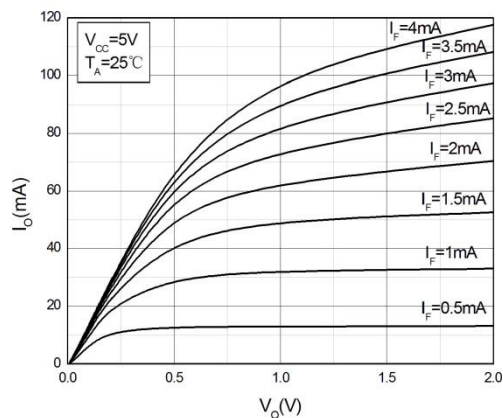
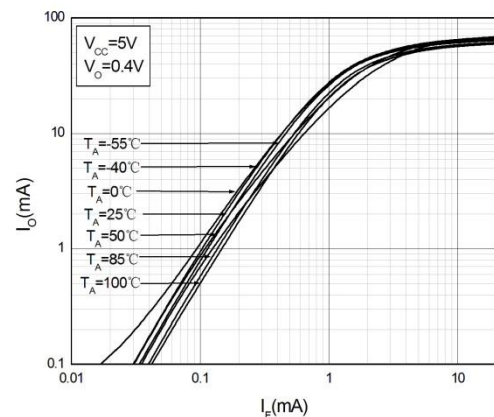
PARAMETER		SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION	NOTE
INPUT(at Ta=0 to 70°C , unless specified otherwise)								
Forward Voltage		V _F	-	1.28	1.7	V	I _F =1.6mA	
Reverse Current		I _R	-	-	10	μA	V _R =5V	
Input Capacitance		C _{in}	-	60	-	pF	V=0, f=1MHz	
OUTPUT(at Ta=0 to 70°C , unless specified otherwise)								
High Level Supply Current		I _{CCH}	-	0.05	10	μA	I _F =0mA, V _O =Open, V _{CC} =18V	
Low Level Supply Current		I _{CCL}	-	0.6	1.5	mA	I _F =1.6mA, V _O =Open, V _{CC} =18V	
Logic High Output Current	6N138	I _{OH}	-	0.01	100	μA	I _F =0mA, V _O =V _{CC} =18V,	
	6N139		-	-	250	μA		
TRANSFER CHARACTERISTICS(at Ta=0 to 70°C , unless specified otherwise)								
Current Transfer Ratio	6N139	CTR	400	2500	-	%	I _F = 0.5mA ,V _O = 0.4V, V _{CC} =4.5V	
			500	2600	-		I _F = 1.6mA ,V _O = 0.4V, V _{CC} =4.5V	
	6N138		300	2600	-			
Logic Low Output Voltage	6N139	V _{OL}	-	0.04	0.4	V	I _F = 0.5mA ,I _O = 2mA, V _{CC} =4.5V	
			-	0.07	0.4		I _F = 1.6mA ,I _O = 8mA, V _{CC} =4.5V	
			-	0.11	0.4		I _F = 5mA ,I _O = 15mA, V _{CC} =4.5V	
			-	0.15	0.4		I _F = 12mA ,I _O = 24mA, V _{CC} =4.5V	
	6N138		-	0.05	0.4		I _F = 1.6mA ,I _O = 4.8mA, V _{CC} =4.5V	
Isolation Resistance		R _{iso}	10^12	10^14	-	Ω	DC500V, 40 ~ 60% R.H.	
Floating Capacitance		C _{IO}	-	0.3	1	pF	V=0, f=1MHz	

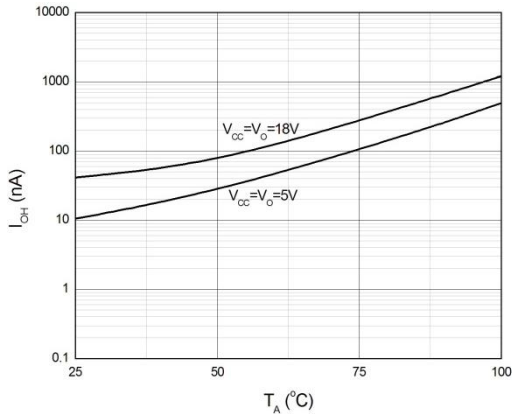
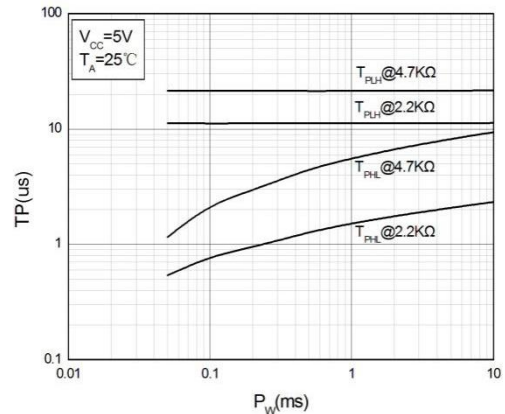
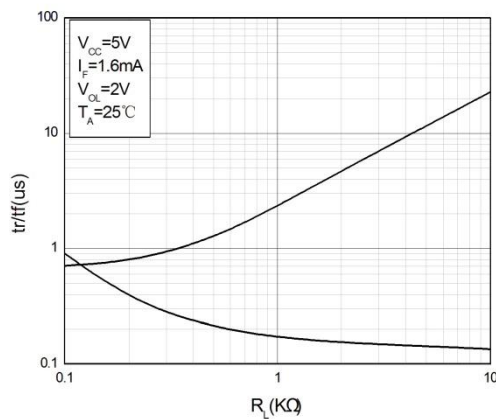
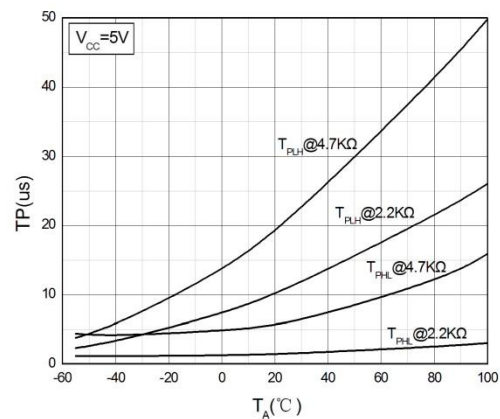
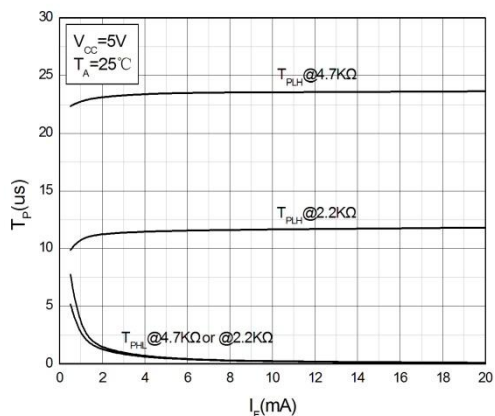
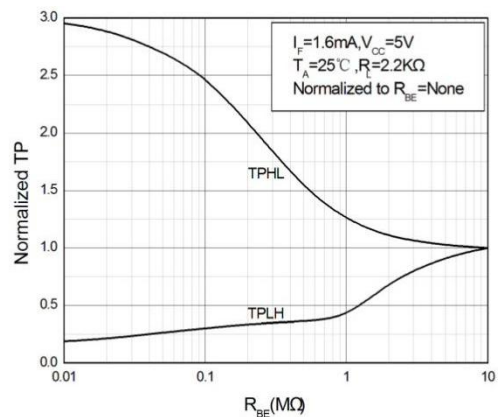
ELECTRICAL OPTICAL CHARACTERISTICS

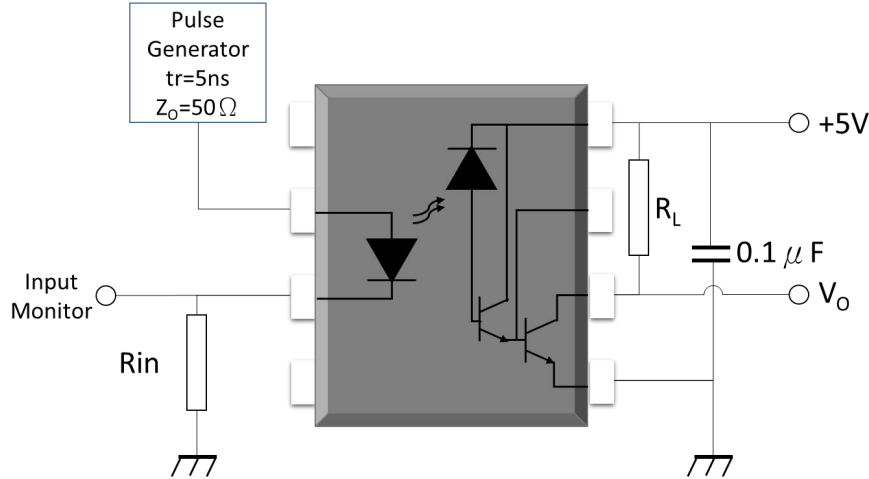
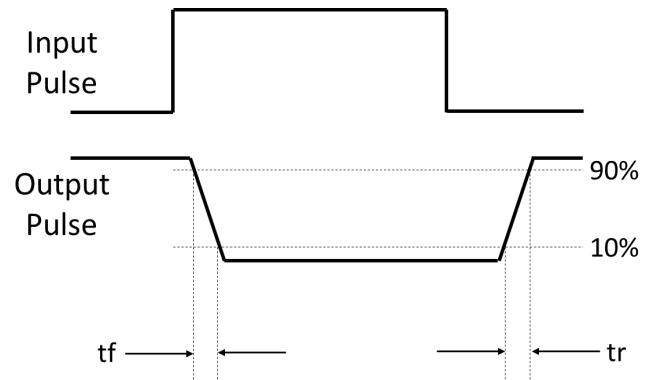
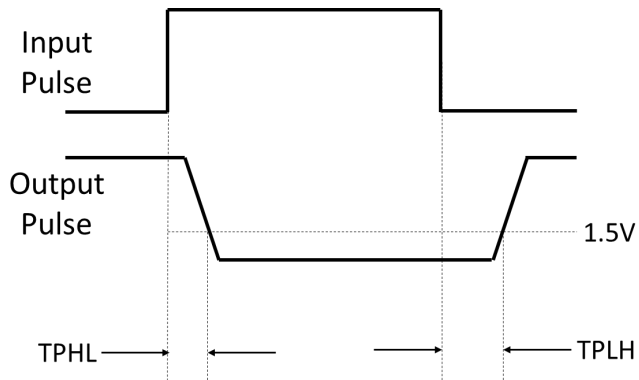
PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION	NOTE
TRANSFER CHARACTERISTICS(at Ta=0 to 70°C , unless specified otherwise)							
Current Transfer Ratio	6N139	CTR	400	2500	-	%	$I_F = 0.5\text{mA}, V_O = 0.4\text{V}, V_{CC}=4.5\text{V}$
			500	2600	-		$I_F = 1.6\text{mA}, V_O = 0.4\text{V}, V_{CC}=4.5\text{V}$
	6N138		300	2600	-		
Logic Low Output Voltage	6N139	V_{OL}	-	0.04	0.4	V	$I_F = 0.5\text{mA}, I_O = 2\text{mA}, V_{CC}=5\text{V}$
			-	0.07	0.4		$I_F = 1.6\text{mA}, I_O = 8\text{mA}, V_{CC}=4.5\text{V}$
			-	0.11	0.4		$I_F = 5\text{mA}, I_O = 15\text{mA}, V_{CC}=4.5\text{V}$
			-	0.15	0.4		$I_F = 12\text{mA}, I_O = 24\text{mA}, V_{CC}=4.5\text{V}$
	6N138		-	0.05	0.4		$I_F = 1.6\text{mA}, I_O = 4.8\text{mA}, V_{CC}=4.5\text{V}$
Isolation Resistance	Riso	10^{12}	10^{14}	-	Ω	DC500V, 40 ~ 60% R.H.	
Floating Capacitance	C_{IO}	-	0.3	1	pF	V=0, f=1MHz	

ELECTRICAL OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION	NOTE
SWITCHING CHARACTERISTICS(at Ta=0 to 70°C,V _{CC} =5V, unless specified otherwise)							
Propagation Delay Time to Logic Low	6N139	TPHL	-	5	25	I _F = 0.5mA,R _L =4.7kΩ, T _A =25°C	Fig.13
			-	-	30	I _F = 0.5mA,R _L =4.7kΩ	
			-	0.2	1	I _F = 12mA,R _L =270Ω, T _A =25°C	
			-	-	2	I _F = 12mA,R _L =270Ω	
	6N138	TPHL	-	1.4	10	I _F = 1.6mA,R _L =2.2kΩ, T _A =25°C	
			-	-	15	I _F = 1.6mA,R _L =2.2kΩ	
Propagation Delay Time to Logic High	6N139	TPLH	-	22	60	I _F = 0.5mA,R _L =4.7kΩ, T _A =25°C	Fig.13
			-	-	90	I _F = 0.5mA,R _L =4.7kΩ	
			-	2.1	7	I _F = 12mA,R _L =270Ω, T _A =25°C	
			-	-	10	I _F = 12mA,R _L =270Ω	
	6N138	TPLH	-	10.7	35	I _F = 1.6mA,R _L =2.2kΩ, T _A =25°C	
			-	-	50	I _F = 1.6mA,R _L =2.2kΩ	
Common Mode Transient Immunity at Logic High	6N139	CM _H	1000	-	-	I _F = 0mA , V _{CM} =10Vpp, R _L =2.2kΩ, T _A =25°C	Fig.15
	6N138		1000	-	-		
Common Mode Transient Immunity at Logic Low	6N139	CM _L	1000	-	-	I _F = 1.6mA , V _{CM} =10Vpp, R _L =2.2kΩ, T _A =25°C	Fig.15
	6N138		1000	-	-		

CHARACTERISTIC CURVES**Fig.1 Forward Current
vs. Forward Voltage****Fig.2 Current Transfer Ratio
vs. Forward Current****Fig.3 Normalized Current Transfer Ratio
vs. Ambient Temperature****Fig.4 Current Transfer Ratio
vs. Base-Emitter Resistance****Fig.5 Low Level Output Current
vs. Output Voltage****Fig.6 Low Level Output Current
vs. Forward Current**

CHARACTERISTIC CURVES**Fig.7 High Level Output Current
vs. Ambient Temperature****Fig.8 Propagation Delay
vs. Pulse Width****Fig.9 Rise and Fall Time
vs. Load Resistance****Fig.10 Propagation Delay
vs. Ambient Temperature****Fig.11 Propagation Delay
vs. Forward Current****Fig.12 Propagation Delay
vs. Base-Emitter Resistance**

TEST CIRCUITS**Fig.13 Test Circuits for TPHL, TPLH, tr, tf****Fig.14 Waveforms of TPHL, TPLH, tr, tf**

TEST CIRCUITS

Fig.15 Test Circuits for Common Mode Transient Immunity

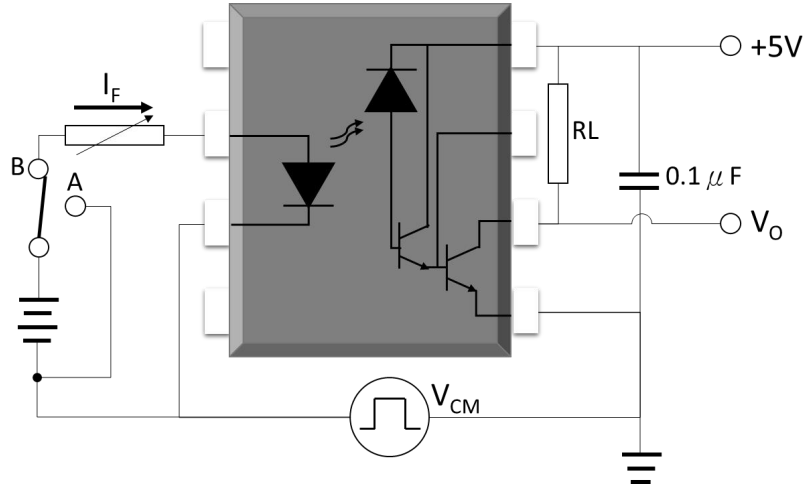
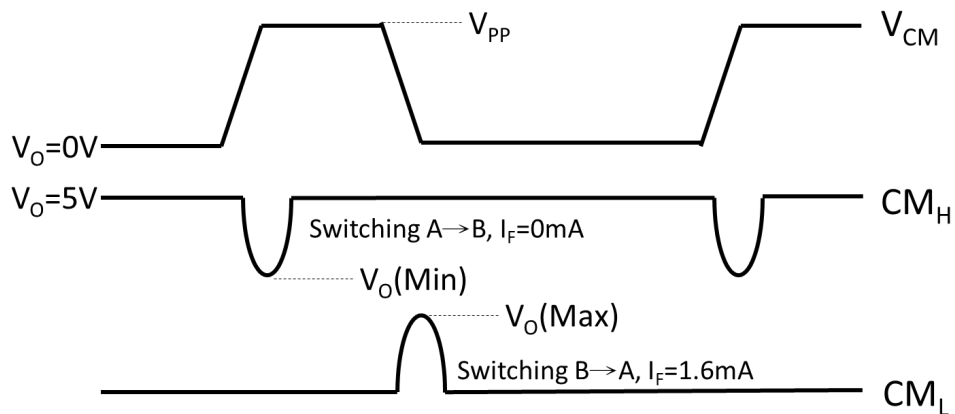
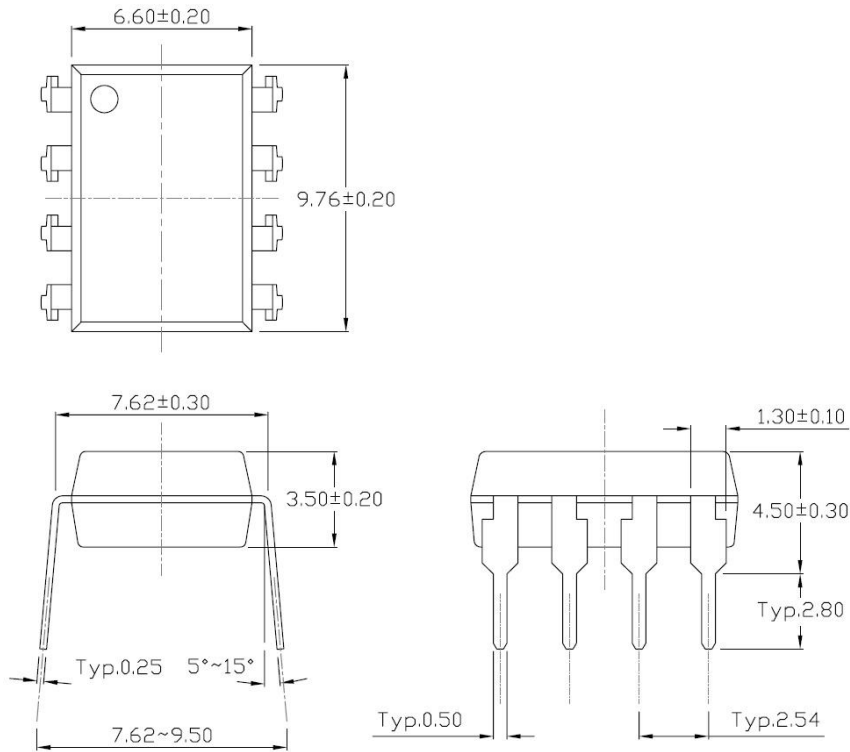
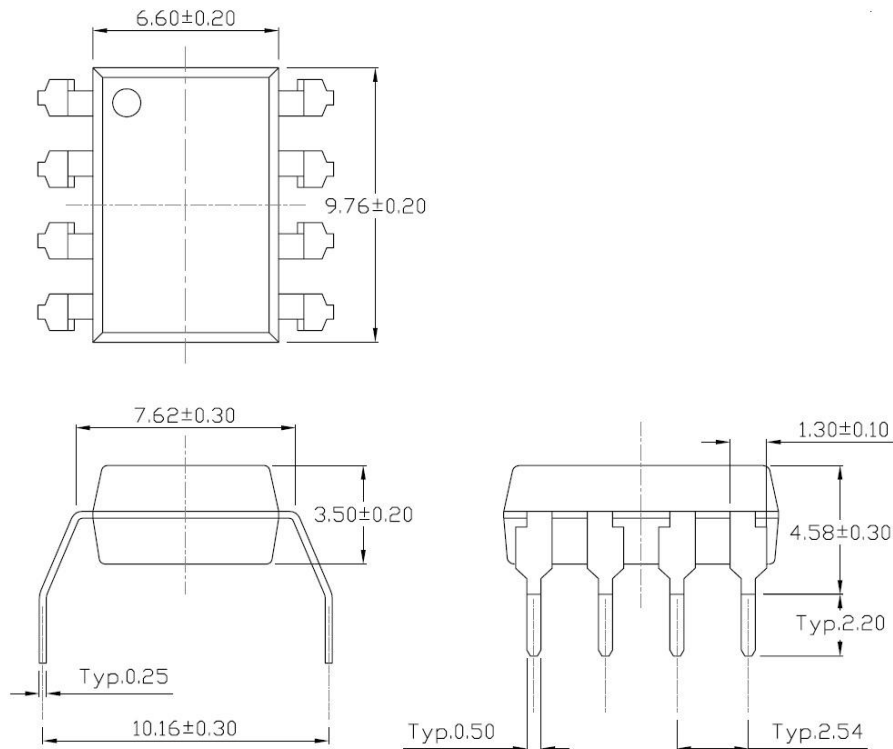
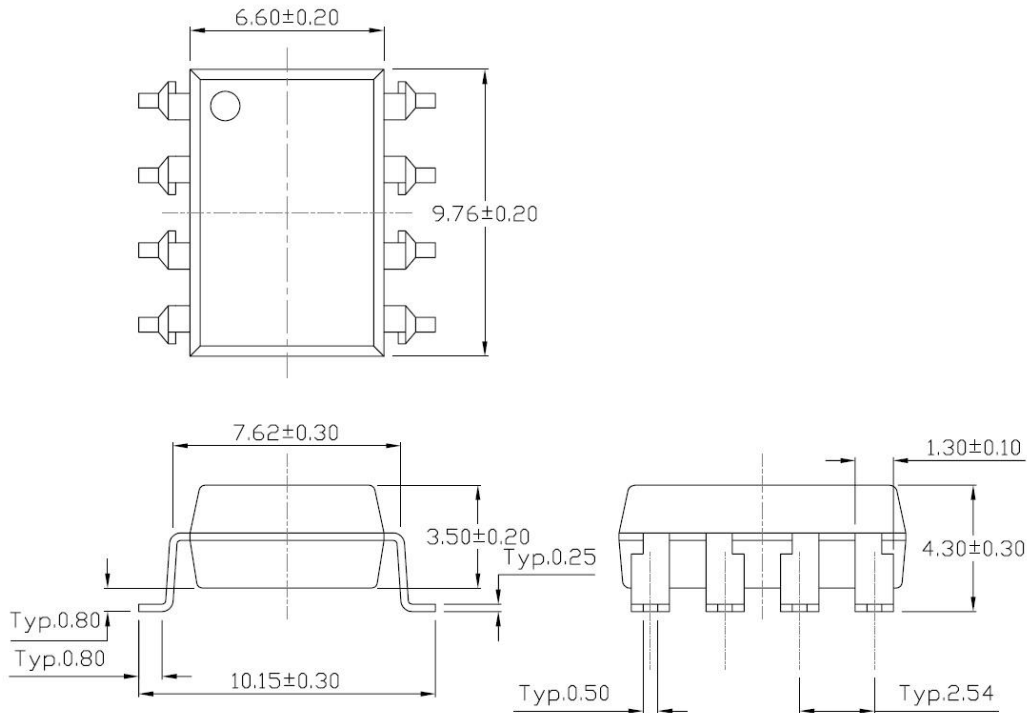
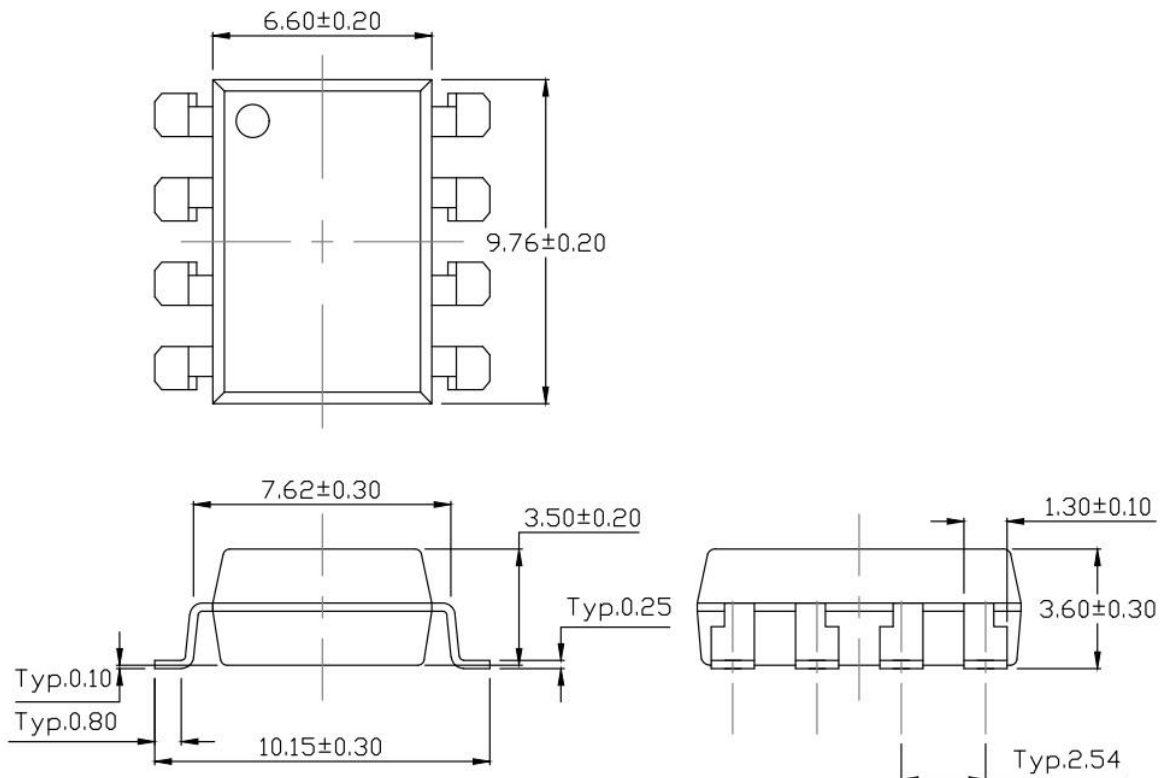


Fig.16 Waveforms of Common Mode Transient Immunity

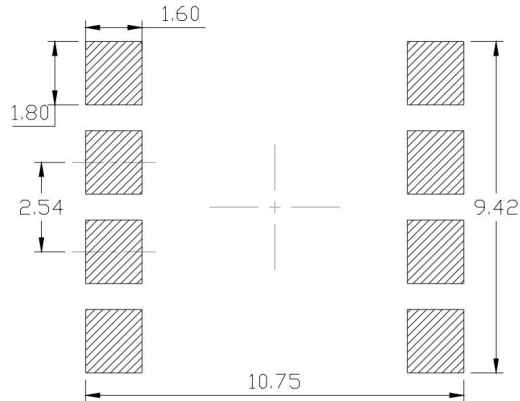


PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)**Standard DIP – Through Hole (DIP Type)****Gullwing (400mil) Lead Forming – Through Hole (M Type)**

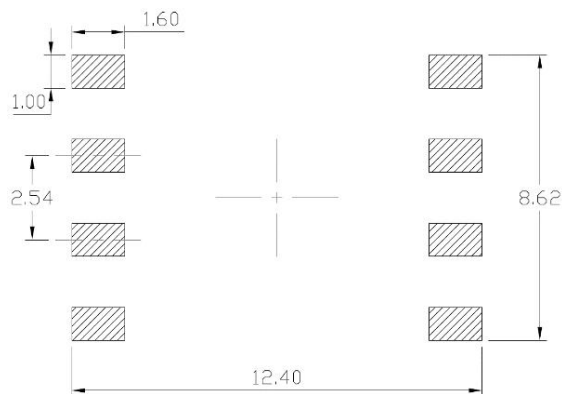
PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)**Surface Mount Lead Forming (S Type)****Surface Mount (Low Profile) Lead Forming (SL Type)**

Recommended Solder Mask (Dimensions in mm unless otherwise stated)

Surface Mount Lead Forming & Surface Mount (Low Profile) Lead Forming

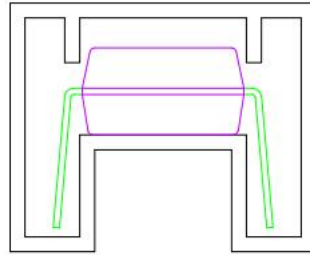
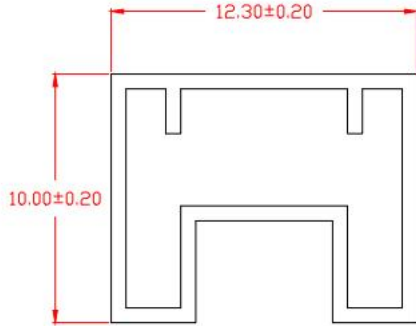


Surface Mount (Gullwing) Lead Forming

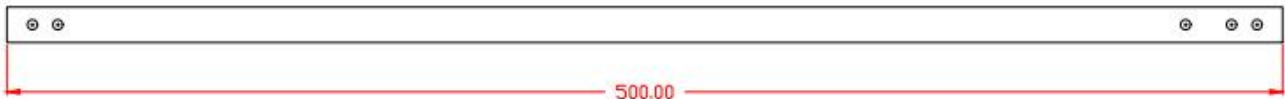
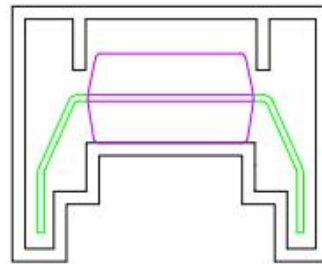
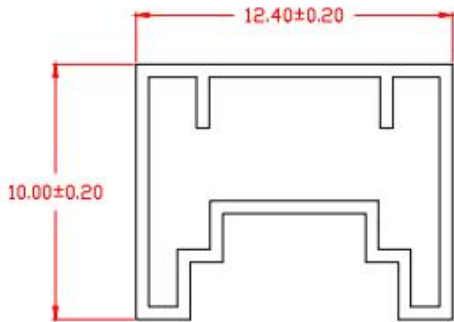


TUBE SPECIFICATIONS (Dimensions in mm unless otherwise stated)

Standard DIP

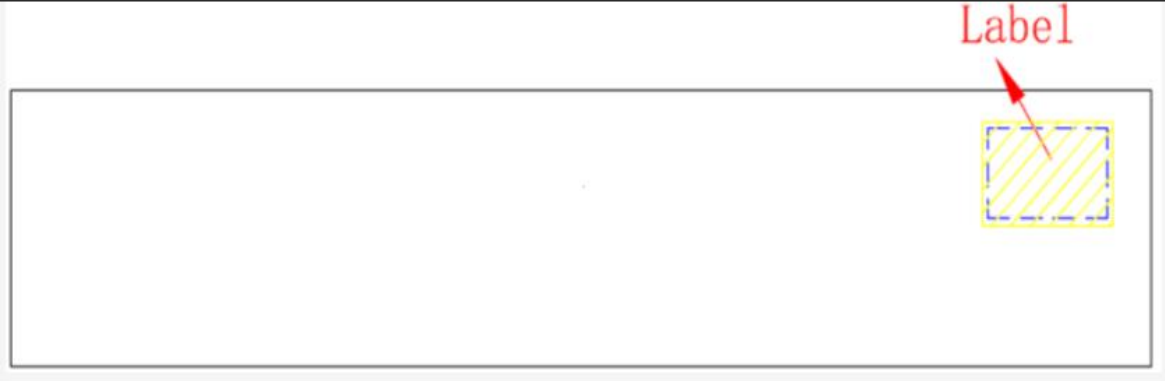


Option M



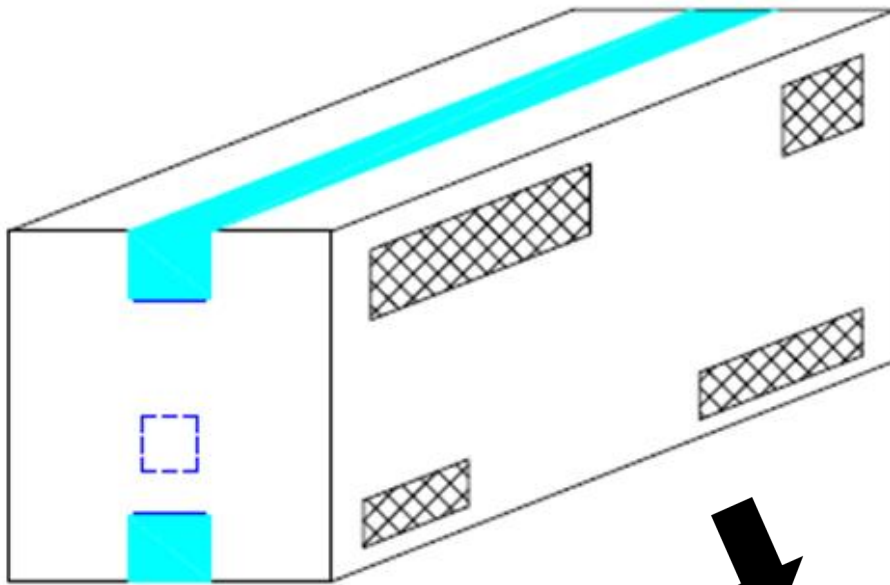
BOX SPECIFICATIONS (Tube Type)

Inner Box



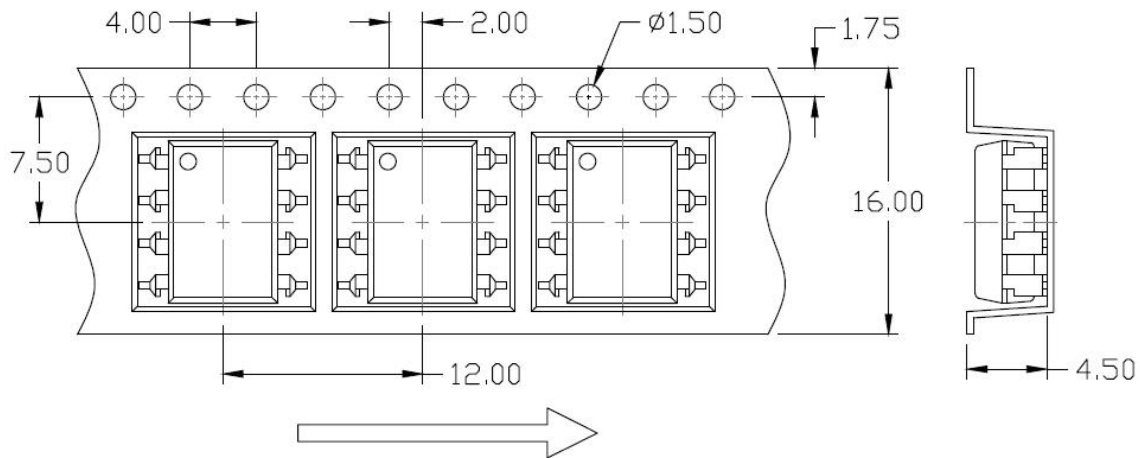
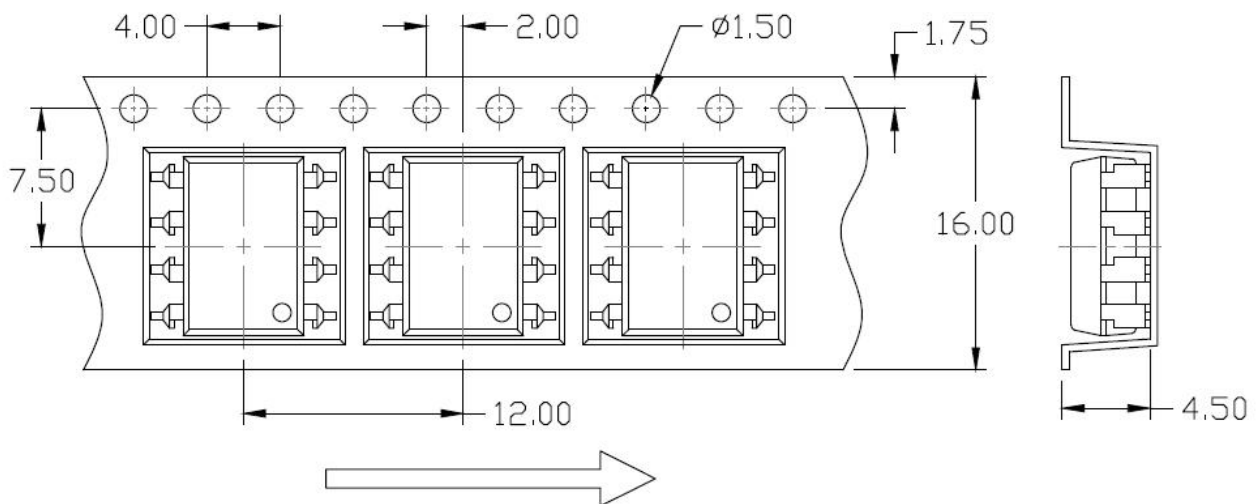
L x W x H = 52.5cm x 10.7cm x 4.7cm

Outer Box



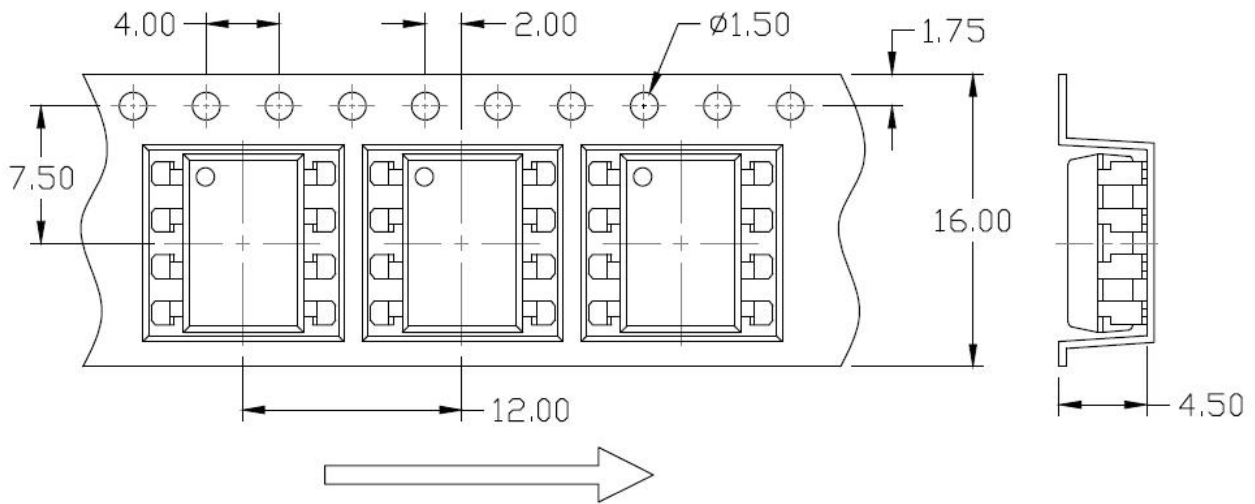
L x W x H = 53.5cm x 23.5cm x 25.5cm



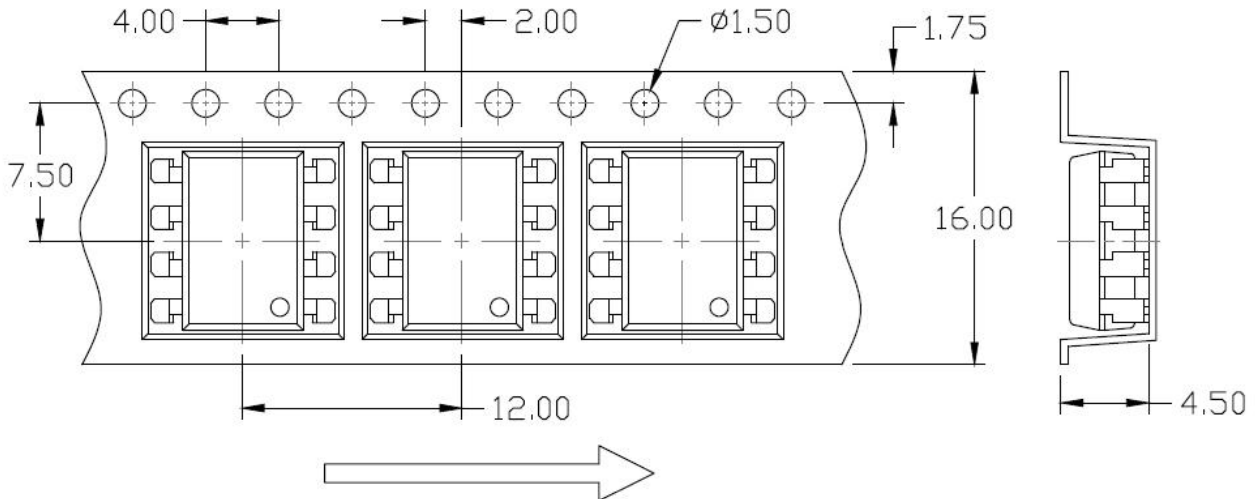
Carrier Tape Specifications (Dimensions in mm unless otherwise stated)**Option S(T1)****Option S(T2)**

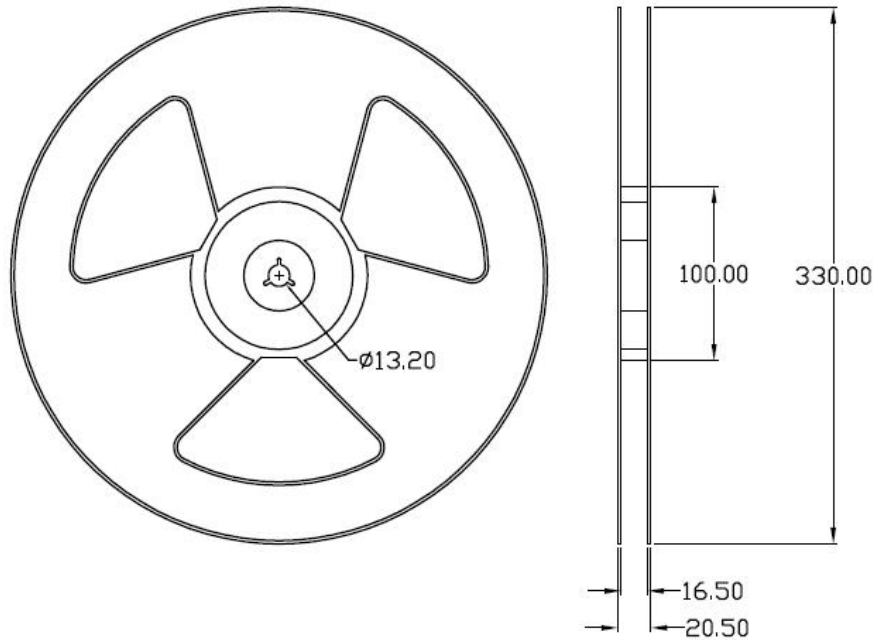
Carrier Tape Specifications (Dimensions in mm unless otherwise stated)

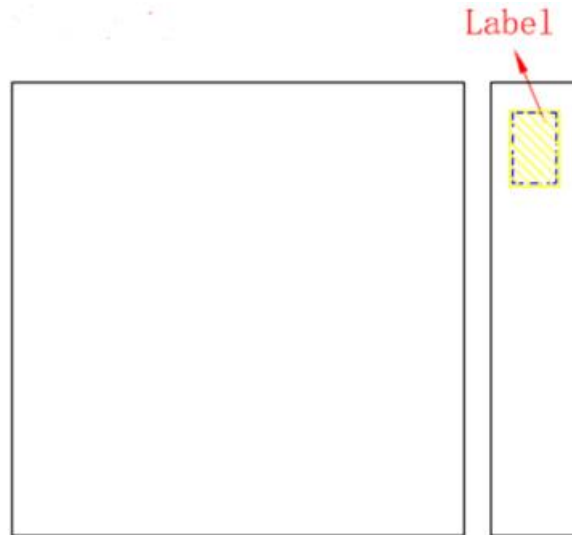
Option SL(T1)



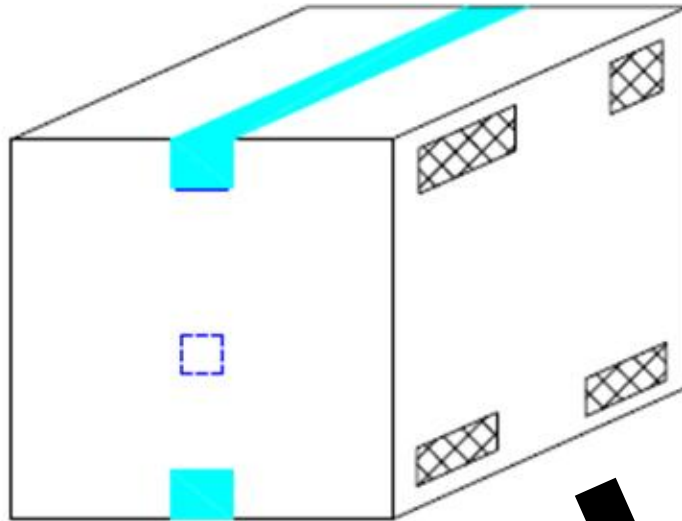
Option SL(T2)



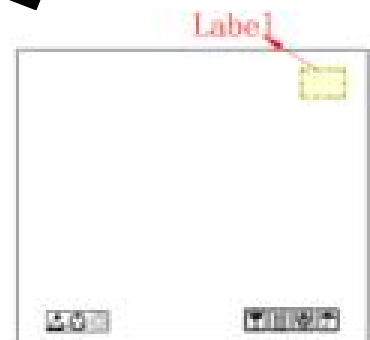
REEL SPECIFICATIONS (Dimensions in mm unless otherwise stated)**Option S & Option SL**

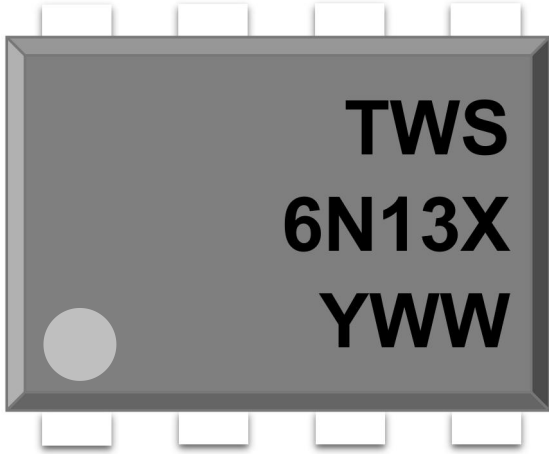
BOX SPECIFICATIONS (Reel Type)**Inner Box**

- L x W x H = 36cm x 36cm x 6.9cm

Outer Box

- Option1: L x W x H = 45cm x 38cm x 38cm
- Option2: L x W x H = 39cm x 38cm x 38cm



ORDERING AND MARKING INFORMATION**MARKING INFORMATION**

TWS : Company Abbr.
6N13X : Part Number
Y : Fiscal Year
WW : Work Week

ORDERING INFORMATION**6N13X(Y)(Z)-G**

6N13X – Part Number (X=8 or 9)

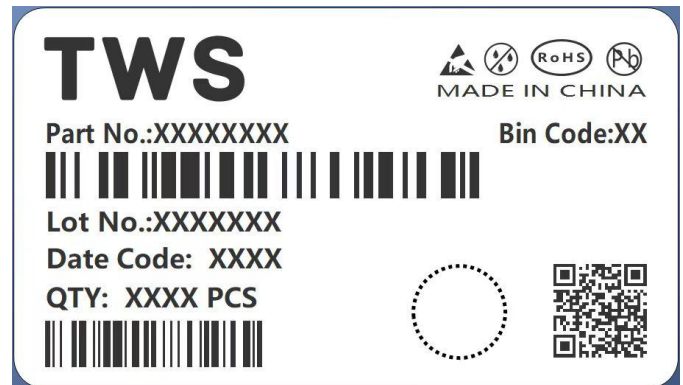
Y – Lead Form Option

(M/S/SL/None)

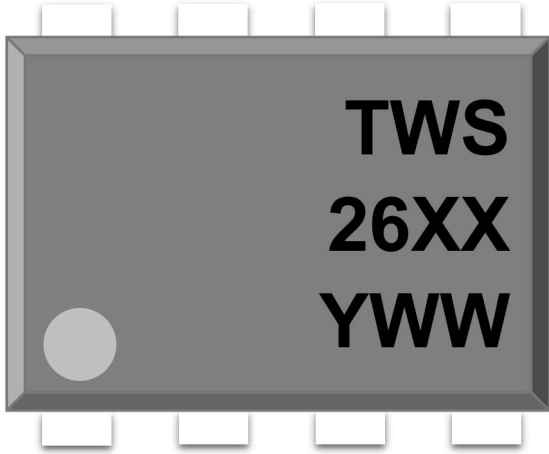
Z – Tape and Reel Option (T1/T2)

G – Material Option

(G: Green, None: Non-Green)

LABEL INFORMATION**PACKING QUANTITY**

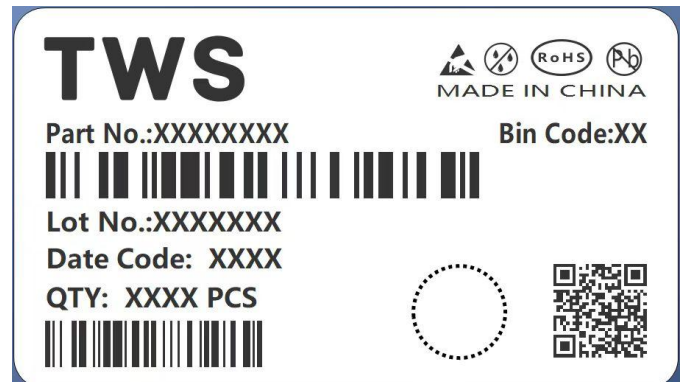
Option	Quantity	Quantity – Inner box	Quantity – Outer box
None	45 Units/Tube	32 Tubes/Inner box	10 Inner box/Outer box = 14.4k Units
M	45 Units/Tube	32 Tubes/Inner box	10 Inner box/Outer box = 14.4k Units
S(T1)	1000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 15k Units
S(T2)	1000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 15k Units
SL(T1)	1000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 15k Units
SL(T2)	1000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 15k Units

ORDERING AND MARKING INFORMATION**MARKING INFORMATION**

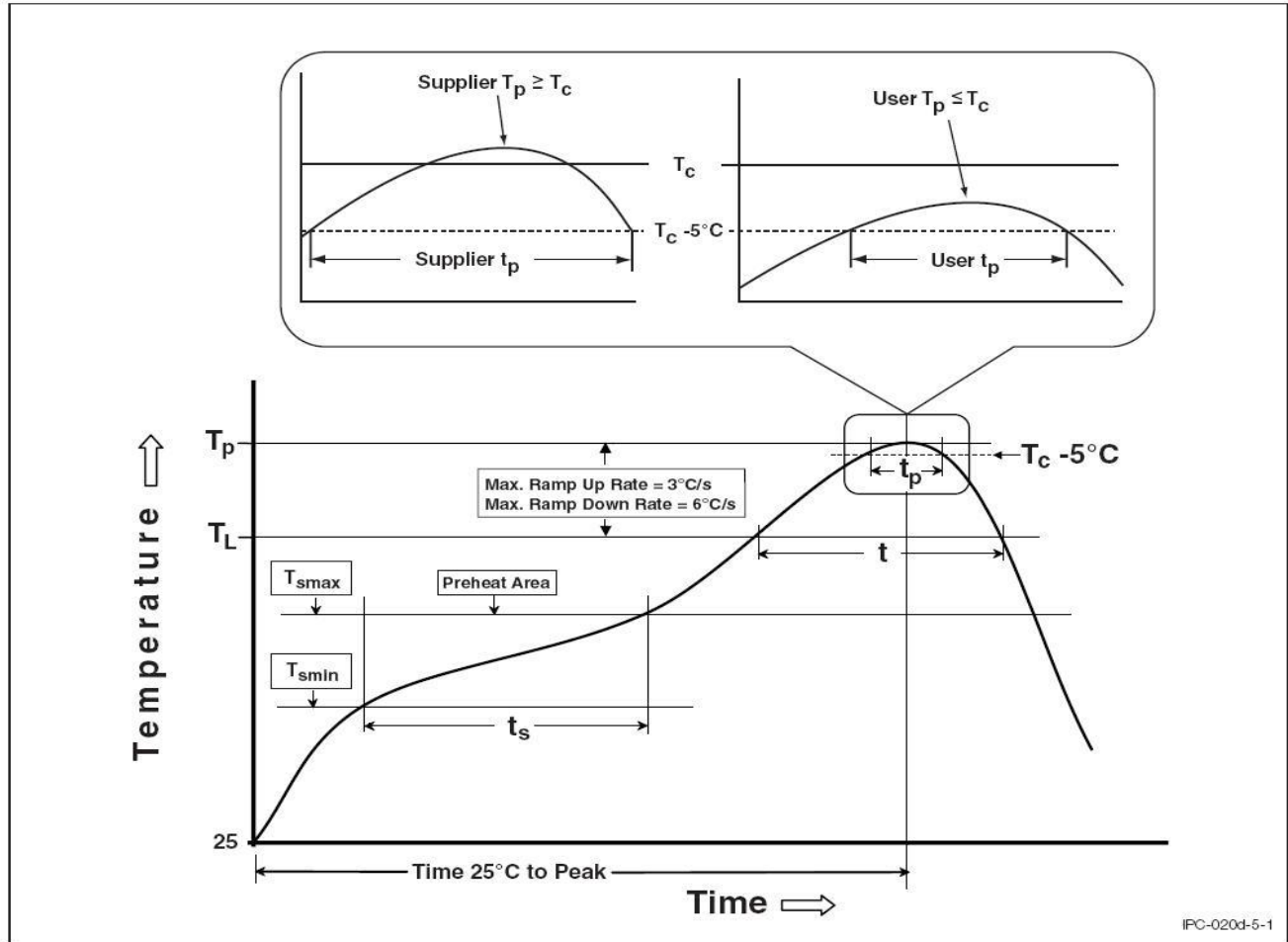
TWS : Company Abbr.
26XX : Part Number & Rank
Y : Fiscal Year
WW : Work Week

ORDERING INFORMATION**TWS26XX(Y)(Z)-G**

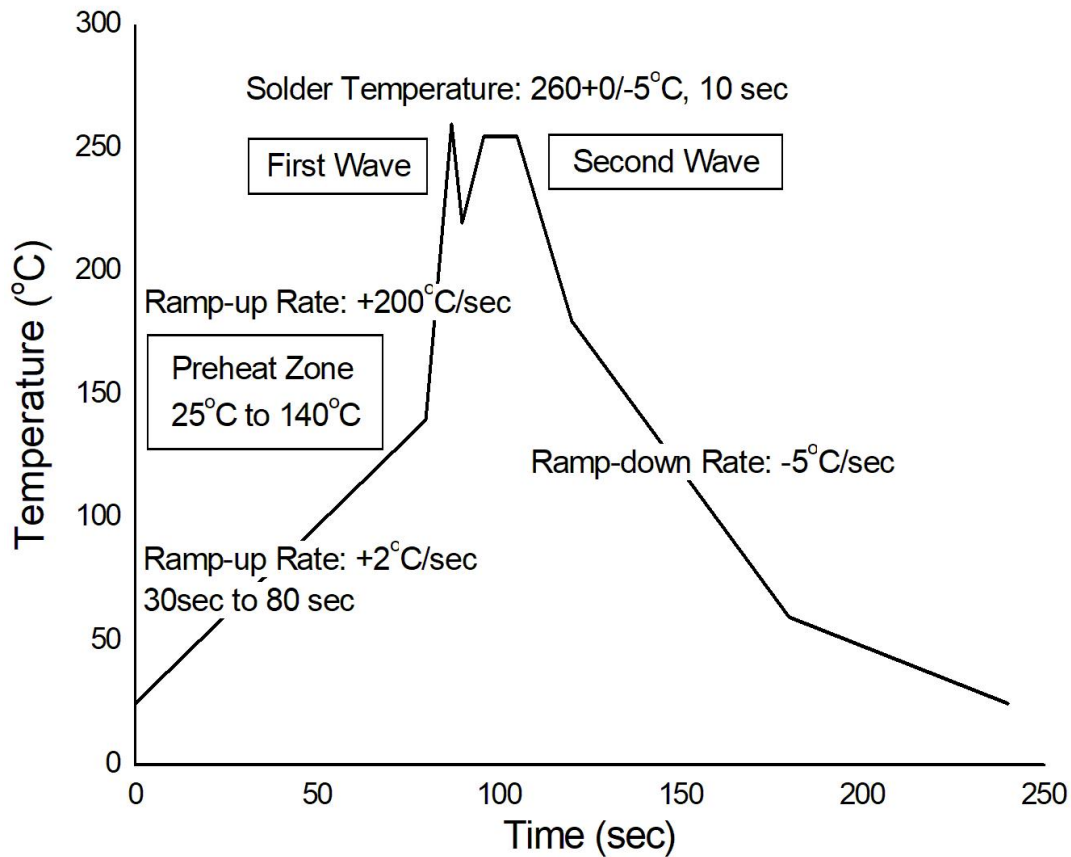
TWS – Company Abbr.
 26XX – Rank (X=01 or 11)
 Y – Lead Form Option
 (M/S/SL/None)
 Z – Tape and Reel Option (T1/T2)
 G – Material Option
 (G: Green, None: Non-Green)

LABEL INFORMATION**PACKING QUANTITY**

Option	Quantity	Quantity – Inner box	Quantity – Outer box
None	45 Units/Tube	32 Tubes/Inner box	10 Inner box/Outer box = 14.4k Units
M	45 Units/Tube	32 Tubes/Inner box	10 Inner box/Outer box = 14.4k Units
S(T1)	1000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 15k Units
S(T2)	1000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 15k Units
SL(T1)	1000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 15k Units
SL(T2)	1000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 15k Units

REFLOW INFORMATION**REFLOW PROFILE**

Profile Feature	Sn-Pb Assembly Profile	Pb-Free Assembly Profile
Temperature Min. (Tsmmin)	100	150°C
Temperature Max. (Tsmmax)	150	200°C
Time (ts) from (Tsmmin to Tsmmax)	60-120 seconds	60-120 seconds
Ramp-up Rate (tL to tP)	3°C/second max.	3°C/second max.
Liquidous Temperature (TL)	183°C	217°C
Time (tL) Maintained Above (TL)	60 – 150 seconds	60 – 150 seconds
Peak Body Package Temperature	235°C +0°C / -5°C	260°C +0°C / -5°C
Time (tp) within 5°C of 260°C	20 seconds	30 seconds
Ramp-down Rate (TP to TL)	6°C/second max	6°C/second max
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

TEMPERATURE PROFILE OF SOLDERING**WAVE SOLDERING (JESD22-A111 COMPLIANT)****HAND SOLDERING BY SOLDERING IRON**

Soldering Temperature	380±0/-5°C
Soldering Time	3 sec max.

- One time soldering is recommended for all soldering method.
- Do not solder more than three times for IR reflow soldering.

DISCLAIMER

- TWS is continually improving the quality, reliability, function and design. TWS reserves the right to make changes without further notices.
- The characteristic curves shown in this datasheet are representing typical performance which are not guaranteed.
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- This product is not intended to be used for military, aircraft, automotive, medical, life sustaining or lifesaving applications or any other application which can result in human injury or death.
- Please contact TWS sales agent for special application request.
- Immerge unit's body in solder paste is not recommended.
- Parameters provided in datasheets may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated in each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify TWS's terms and conditions of purchase, including but not limited to the warranty expressed therein.
- Discoloration might be occurred on the package surface after soldering, reflow or long-time use. It neither impacts the performance nor reliability.