



# MPCM601 Series

## SOP5, 10Mbit/s High Speed Logic Gate Photo Coupler

### ■ Features

- High isolation 3750 VRMS
- DC input with logic gate output
- Operating temperature range - 55 °C to 100 °C
- REACH compliance
- Halogen free
- MSL class 1
- Regulatory Approvals
  - UL - UL1577
  - VDE - EN60747-5-5(VDE0884-5)
  - CQC – GB4943.1, GB8898

### ■ Applications

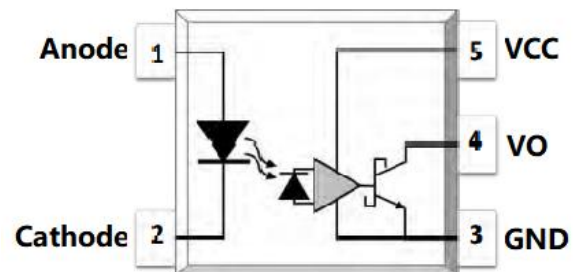
- Ground loop elimination
- LSTTL to TTL, LSTTL or CMOS
- Line receiver, data transmission
- Data multiplexing
- Switching power supply
- Pulse transformer replacement
- Computer-peripheral interface

### ■ Description

The MPCM601 series combine an AlGaAs infrared emitting diode as the emitter which is optically coupled to a silicon high speed integrated photo-detector logic gate with a strobable output in a plastic SOP5 package.

With the robust coplanar double mold structure, MPCM601 series provide the most stable isolation feature.

### ■ Schematic





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### ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT	Note
<b>INPUT</b>				
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	
Enable Voltage	$V_E$	VCC+0.5	V	
Input Power Dissipation	$P_I$	100	mW	
<b>OUTPUT</b>				
Supply Voltage	$V_{CC}$	7	V	
Output Voltage	$V_O$	7	V	
Output Current	$I_O$	50	mA	
Output Power Dissipation	$P_O$	85	mW	
<b>COMMON</b>				
Total Power Dissipation	$P_{tot}$	200	mW	
Isolation Voltage	$V_{iso}$	3750	V <sub>rms</sub>	3
Operating Temperature	$T_{opr}$	-55~100	°C	
Storage Temperature	$T_{stg}$	-55~125	°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



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### RECOMMENDED OPERATION CONDITIONS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating Temperature	TA	-40	100	°C
Supply Voltage	VCC	2.7	3.6	V
	VCC	4.5	5.5	V
Low Level Input Current	IFL	0	250	μA
High Level Input Current	IFH	5	15	mA
Low Level Enable Voltage	VEL	0	0.8	V
High Level Enable Voltage	VEH	2	VCC	V
Output Pull-up Resistor	RL	330	4k	Ω
Fan Out (at RL=1kΩ per channel)	N	-	5	TTL Loads

### ELECTRICAL OPTICAL CHARACTERISTICS at Ta=25°C

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
<b>INPUT</b>							
Forward Voltage	V <sub>F</sub>	-	1.38	1.8	V	I <sub>F</sub> =10mA	
Reverse Current	I <sub>R</sub>	-	-	10	μA	V <sub>R</sub> =5V	
Input Capacitance	C <sub>in</sub>	-	13	-	pF	V=0, f=1MHz	
<b>OUTPUT</b>							
High Level Supply Current	I <sub>CCH</sub>	-	6.3	10	mA	I <sub>F</sub> =0mA, V <sub>E</sub> =0.5V, V <sub>CC</sub> =5.5V	
Low Level Supply Current	I <sub>CCL</sub>	-	8.3	13	mA	I <sub>F</sub> =10mA, V <sub>CC</sub> =5.5V	
<b>TRANSFER CHARACTERISTICS (Ta=-40 to 85°C)</b>							
High Level Output Current	I <sub>OH</sub>	-	0.73	100	μA	V <sub>CC</sub> =5.5V, V <sub>O</sub> =5.5V, I <sub>F</sub> =250μA, V <sub>E</sub> =2.0V	
Low Level Output Voltage	V <sub>OL</sub>	-	0.28	0.6	V	V <sub>CC</sub> =5.5V, I <sub>F</sub> =5mA, V <sub>E</sub> =2.0V, I <sub>CL</sub> =13mA	
Input Threshold Current	I <sub>FT</sub>	-	2.5	5	mA	V <sub>CC</sub> =5.5V, V <sub>O</sub> =0.6V, V <sub>E</sub> =2.0V, I <sub>OL</sub> =13mA	
Isolation Resistance	R <sub>iso</sub>	10 <sup>12</sup>	10 <sup>14</sup>	-	Ω	DC500V, 40 ~ 60% R.H.	
Floating Capacitance	C <sub>IO</sub>	-	1.0	-	pF	V=0, f=1MHz	



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### ELECTRICAL OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
SWITCHING CHARACTERISTICS (Ta=-40 to 85°C, V <sub>CC</sub> =5V, I <sub>F</sub> =7.5mA unless specified otherwise)							
Propagation Delay Time to Output Low Level	TPHL	-	35	75	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω, Ta=25°C	Fig.23
Propagation Delay Time to Output High Level	TPLH	-	40	75	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω, Ta=25°C	Fig.23
Pulse Width Distortion	TPHL-TPLH	-	5	35	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	Fig.23
Rise Time	tr	-	27	-	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	Fig.23
Fall Time	tf	-	7	-	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	Fig.23
Common Mode Transient Immunity at Logic High	CMH	10000	-	-	V/μs	I <sub>F</sub> = 7.5mA , V <sub>OH</sub> =2.0V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =400Vp-p	Fig.24
Common Mode Transient Immunity at Logic Low	CML	10000	-	-	V/μs	I <sub>F</sub> = 0mA , V <sub>OH</sub> =0.8V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =400Vp-p	Fig.24



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ELECTRICAL OPTICAL CHARACTERISTICS at Ta=25°C							
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
INPUT							
Forward Voltage	V <sub>F</sub>	-	1.38	1.8	V	I <sub>F</sub> =10mA	
Reverse Current	I <sub>R</sub>	-	-	10	μA	V <sub>R</sub> =5V	
Input Capacitance	C <sub>in</sub>	-	13	-	pF	V=0, f=1MHz	
OUTPUT							
High Level Supply Current	I <sub>CCH</sub>	-	4.3	10	mA	I <sub>F</sub> =0mA, V <sub>E</sub> =0.5V, V <sub>CC</sub> =3.3V	
Low Level Supply Current	I <sub>CCL</sub>	-	6.4	13	mA	I <sub>F</sub> =10mA, V <sub>CC</sub> =3.3V	
TRANSFER CHARACTERISTICS (Ta=-40 to 85°C)							
High Level Output Current	I <sub>OH</sub>	-	4.1	100	μA	V <sub>CC</sub> =3.3V, V <sub>O</sub> =3.3V, I <sub>F</sub> =250μA, V <sub>E</sub> =2.0V	
Low Level Output Voltage	V <sub>OL</sub>	-	0.29	0.6	V	V <sub>CC</sub> =3.3V, I <sub>F</sub> =5mA, V <sub>E</sub> =2.0V, I <sub>CL</sub> =13mA	
Input Threshold Current	I <sub>FT</sub>	-	2.2	5	mA	V <sub>CC</sub> =3.3V, V <sub>O</sub> =0.6V, V <sub>E</sub> =2.0V, I <sub>OL</sub> =13mA	
Isolation Resistance	R <sub>iso</sub>	10 <sup>12</sup>	10 <sup>14</sup>	-	Ω	DC500V, 40 ~ 60% R.H.	
Floating Capacitance	C <sub>IO</sub>	-	1.0	-	pF	V=0, f=1MHz	



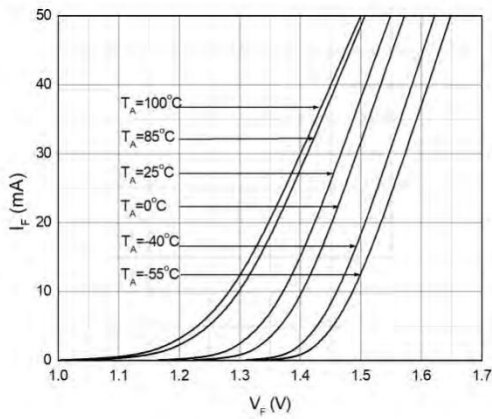
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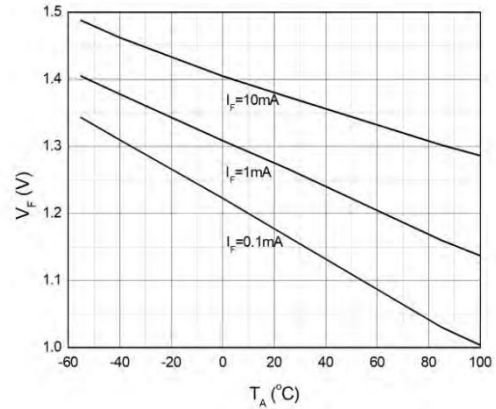
### ELECTRICAL OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
SWITCHING CHARACTERISTICS (Ta=-40 to 85°C, V <sub>CC</sub> =3.3V, I <sub>F</sub> =7.5mA unless specified otherwise)							
Propagation Delay Time to Output Low Level	TPHL	-	35	75	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω, Ta=25°C	Fig.23
Propagation Delay Time to Output High Level	TPLH	-	47	75	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω, Ta=25°C	Fig.23
Pulse Width Distortion	TPHL-TPLH	-	12	35	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	Fig.23
Rise Time	tr	-	30	-	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	Fig.23
Fall Time	tf	-	8.5	-	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	Fig.23
Common Mode Transient Immunity at Logic High	CMH	10000	-	-	V/μs	I <sub>F</sub> = 7.5mA , V <sub>OH</sub> =2.0V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =400Vp-p	Fig.24
Common Mode Transient Immunity at Logic Low	CML	10000	-	-	V/μs	I <sub>F</sub> = 0mA , V <sub>OH</sub> =0.8V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =400Vp-p	Fig.24

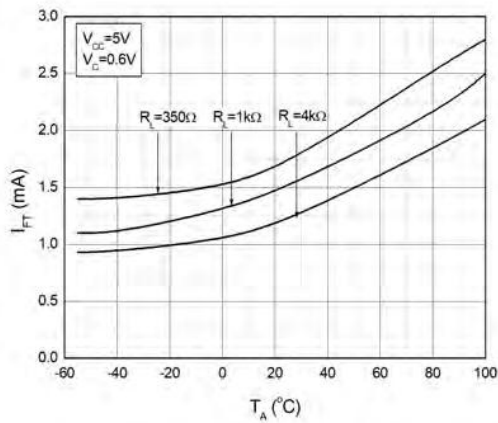
### CHARACTERISTIC CURVES



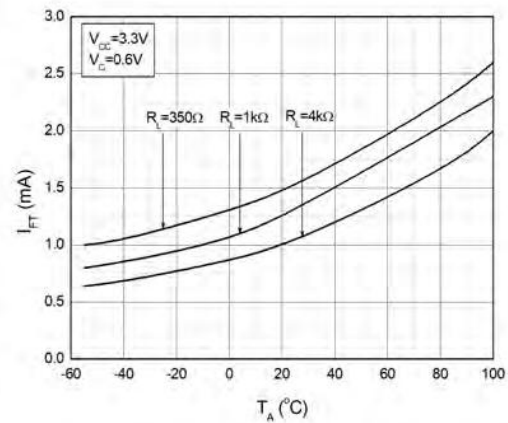
**Fig.1 Forward Current vs. Forward Voltage**



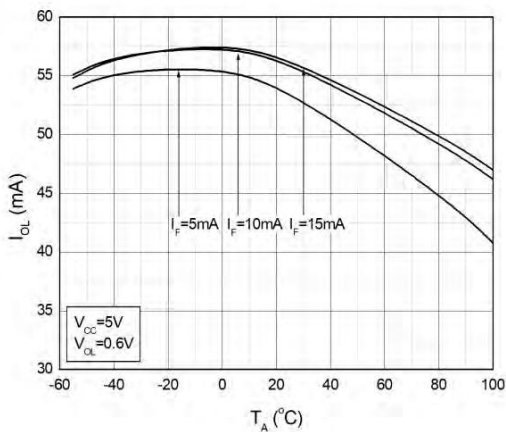
**Fig.2 Forward Voltage vs. Ambient Temperature**



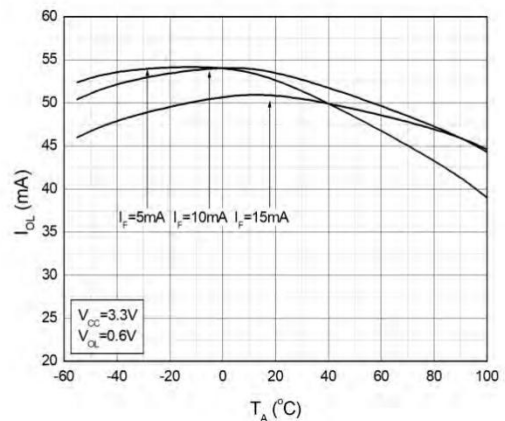
**Fig.3 Input Threshold Current vs. Ambient Temperature**



**Fig.4 Input Threshold Current vs. Ambient Temperature**

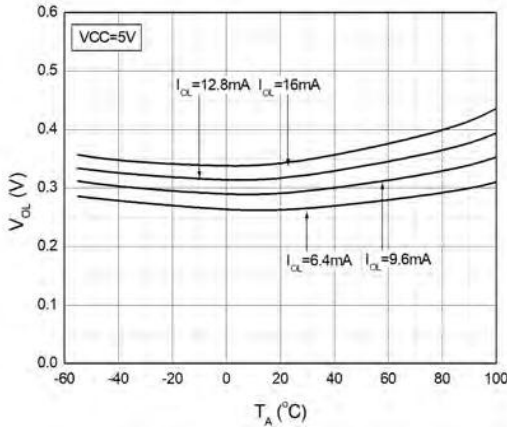


**Fig.5 Low Level Output Current vs. Ambient Temperature**

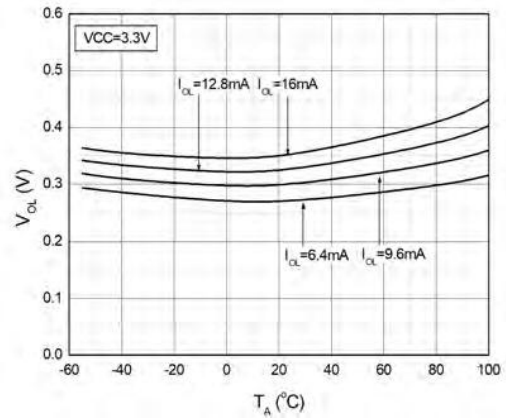


**Fig.6 Low Level Output Current vs. Ambient Temperature**

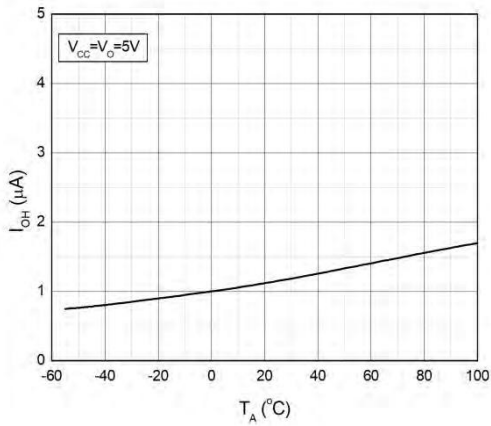
### CHARACTERISTIC CURVES



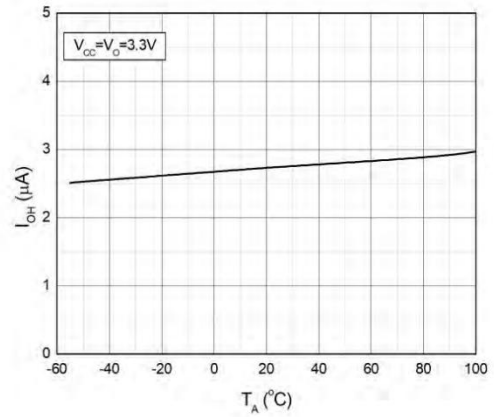
**Fig.7 Low Level Output Voltage vs. Ambient Temperature**



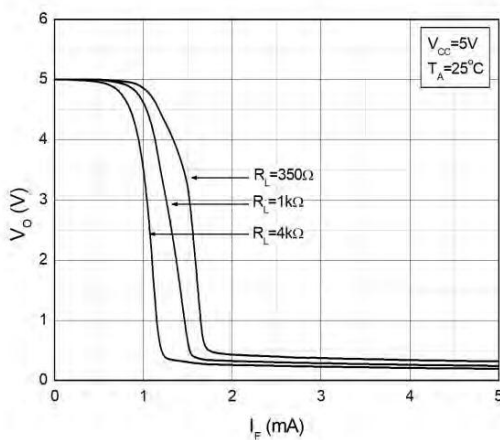
**Fig.8 Low Level Output Voltage vs. Ambient Temperature**



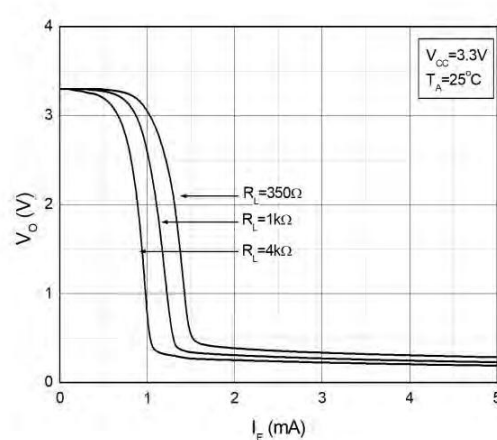
**Fig.9 High Level Output Current vs. Ambient Temperature**



**Fig.10 High Level Output Current vs. Ambient Temperature**



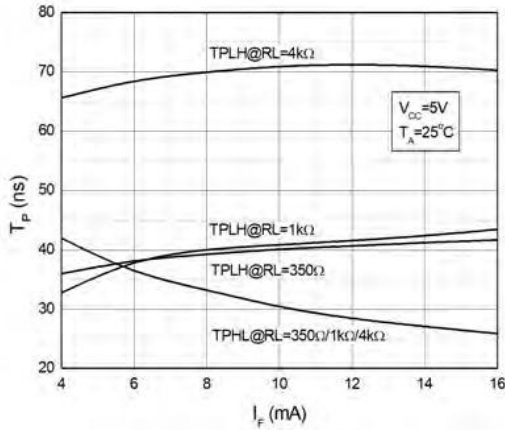
**Fig.11 Output Voltage vs. Forward Current**



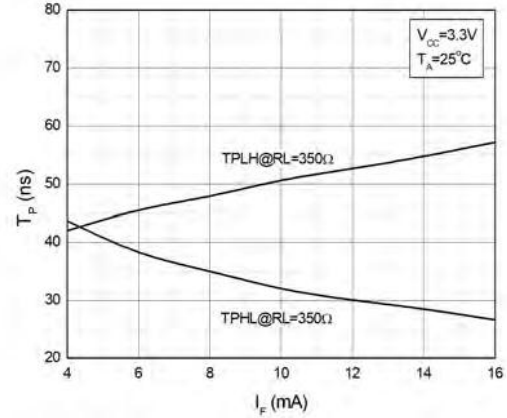
**Fig.12 Output Voltage vs. Forward Current**



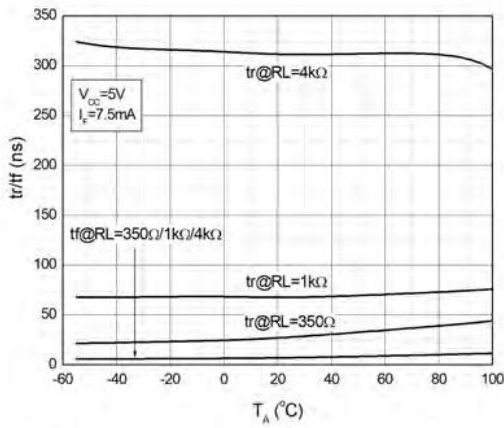
### CHARACTERISTIC CURVES



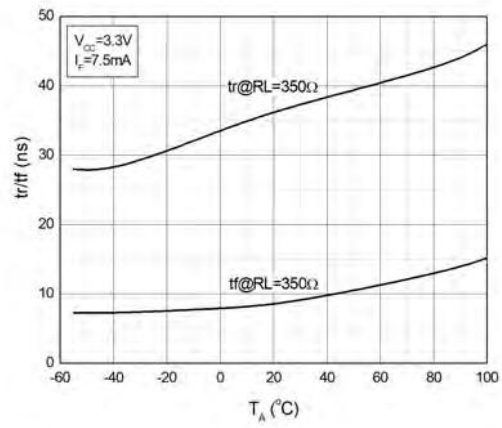
**Fig.13 Propagation Delay vs. Forward Current**



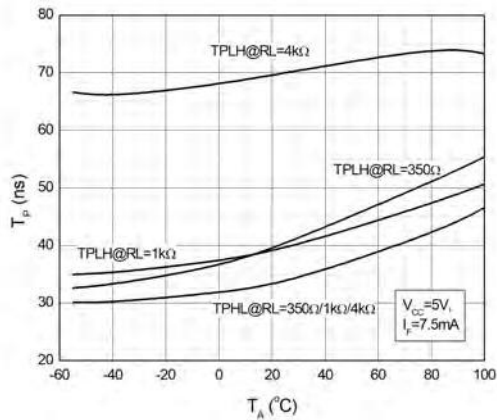
**Fig.14 Propagation Delay vs. Forward Current**



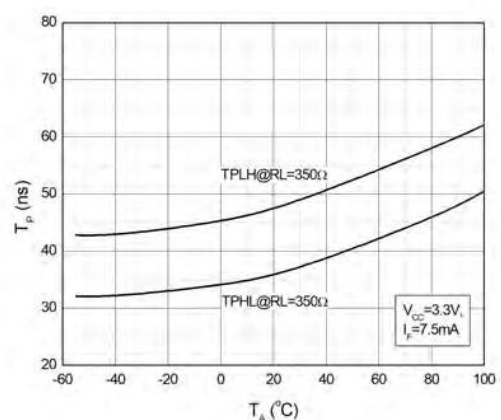
**Fig.15 Rise and Fall Time vs. Ambient Temperature**



**Fig.16 Rise and Fall Time vs. Ambient Temperature**



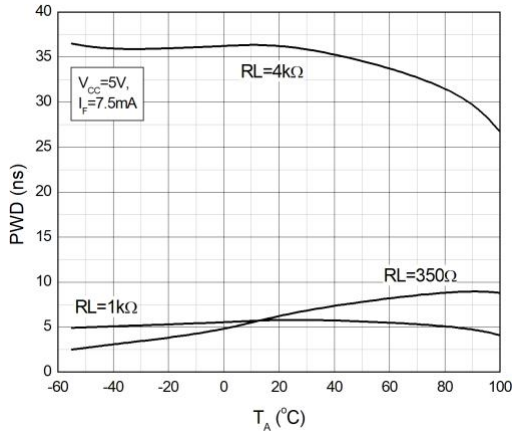
**Fig.17 Propagation Delay vs. Ambient Temperature**



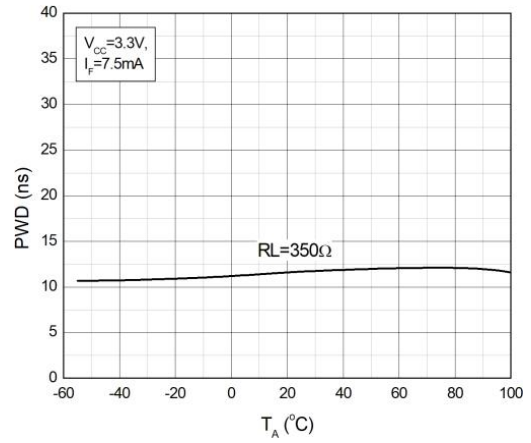
**Fig.18 Propagation Delay vs. Ambient Temperature**

### CHARACTERISTIC CURVES

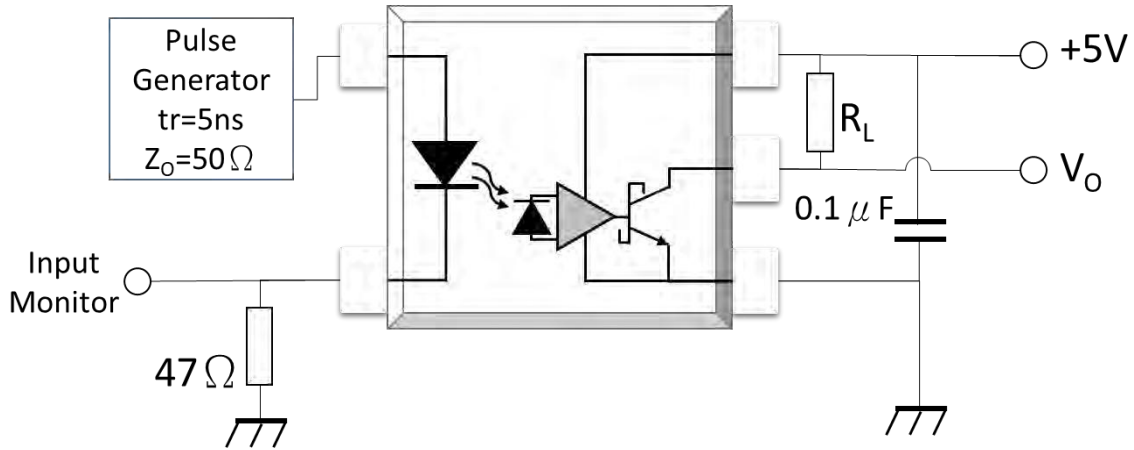
**Fig.19 Pulse Width Distortion vs. Ambient Temperature**



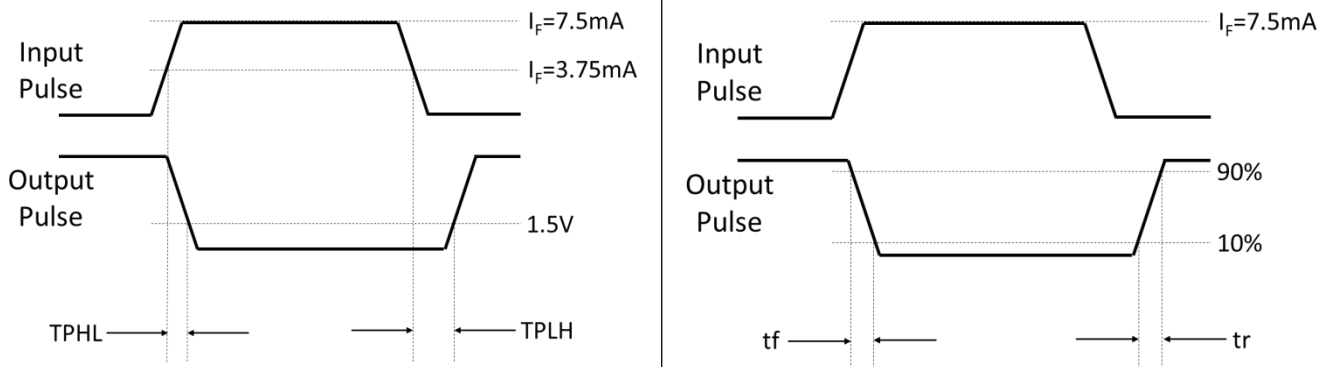
**Fig.20 Pulse Width Distortion vs. Ambient Temperature**



**TEST CIRCUITS**

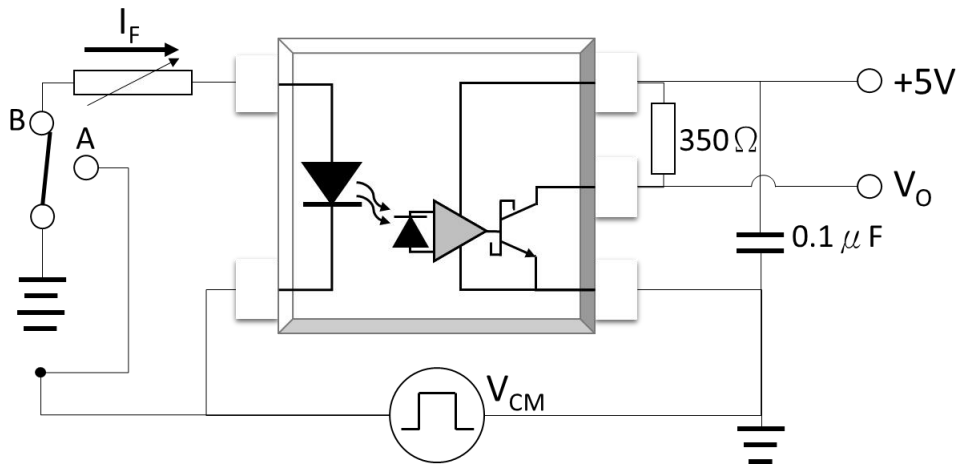


**Fig.23 Test Circuits for TPHL, TPLH, tr, tf**

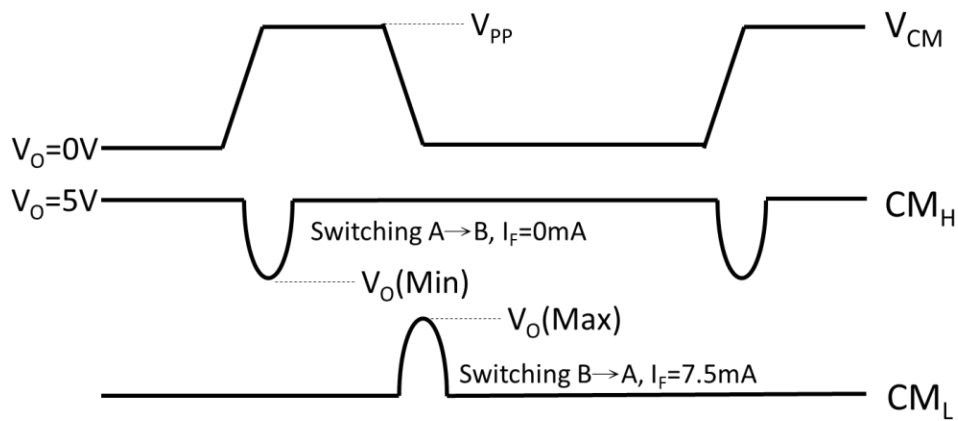


**Fig.24 Waveforms of TPHL, TPLH, tr, tf**

**TEST CIRCUITS**

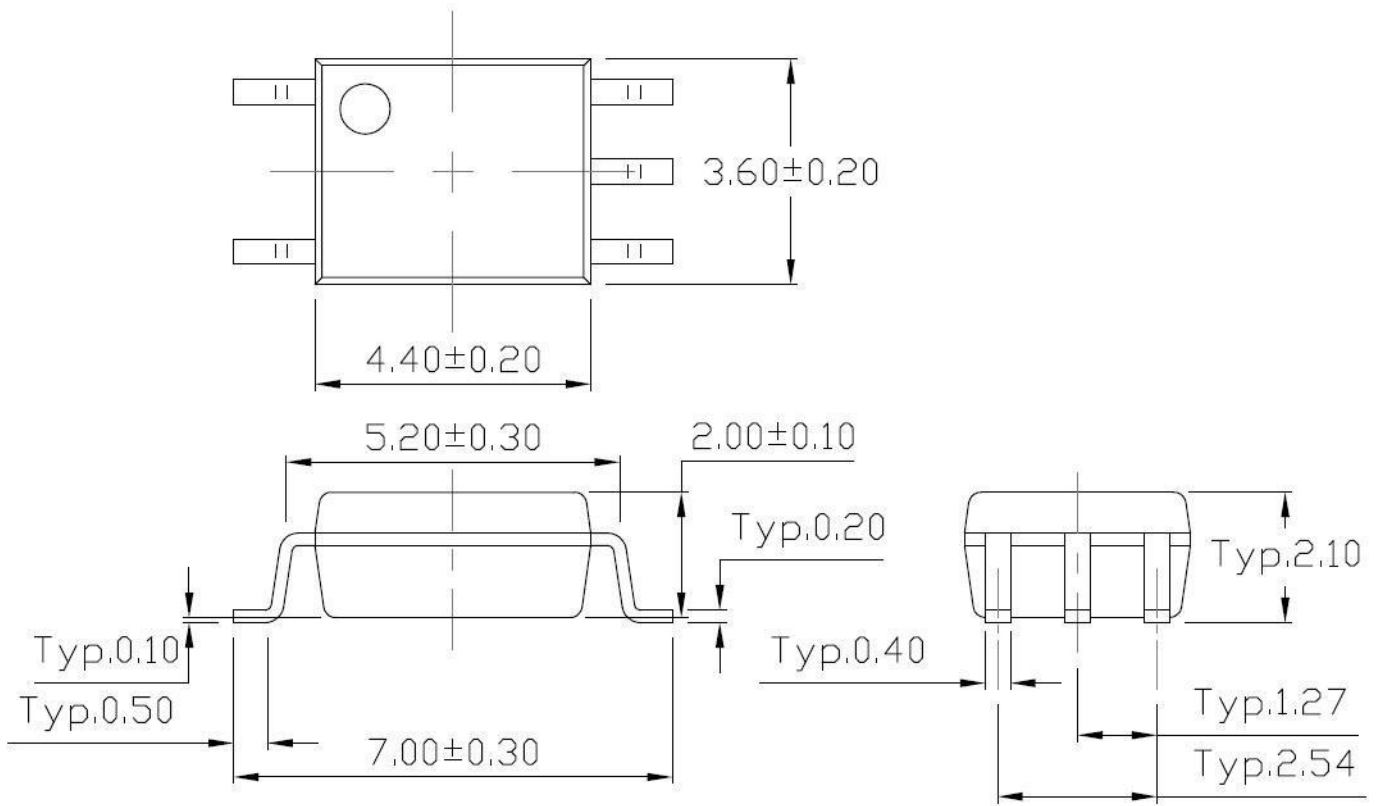


**Fig.25 Test Circuits for Common Mode Transient Immunity**

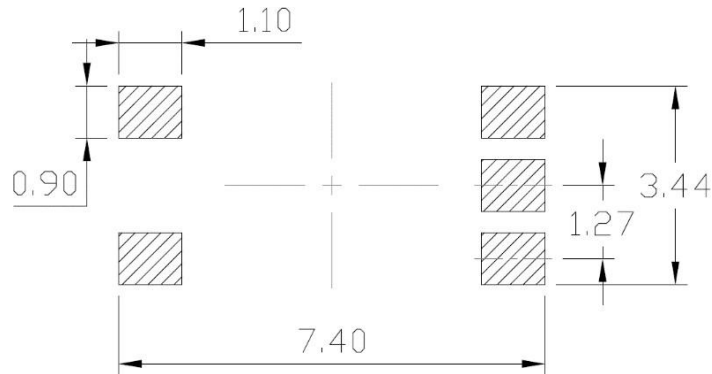


**Fig.26 Waveforms of Common Mode Transient Immunity**

**PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)**

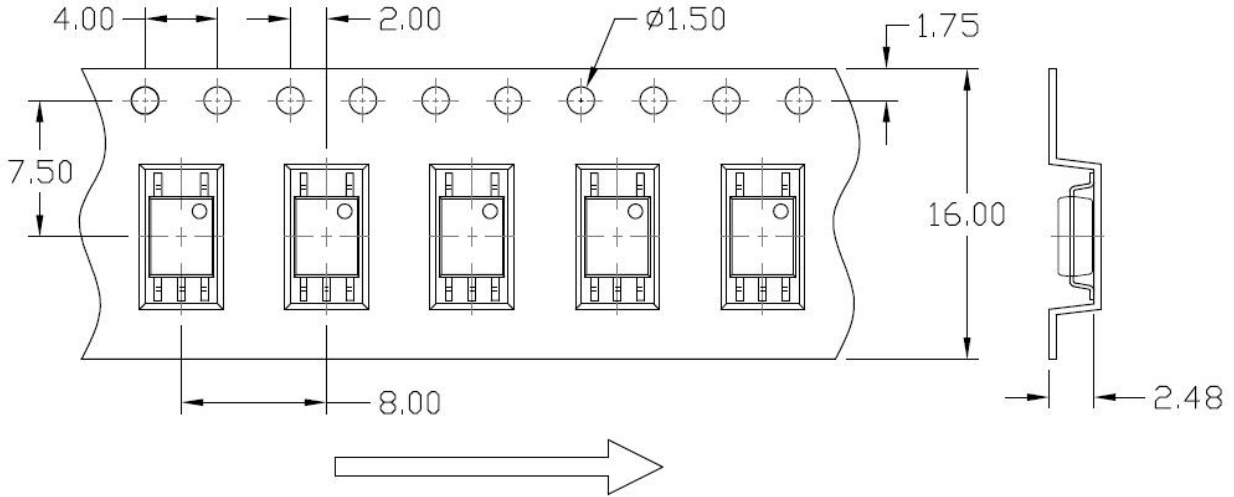


**Recommended Solder Mask (Dimensions in mm unless otherwise stated)**

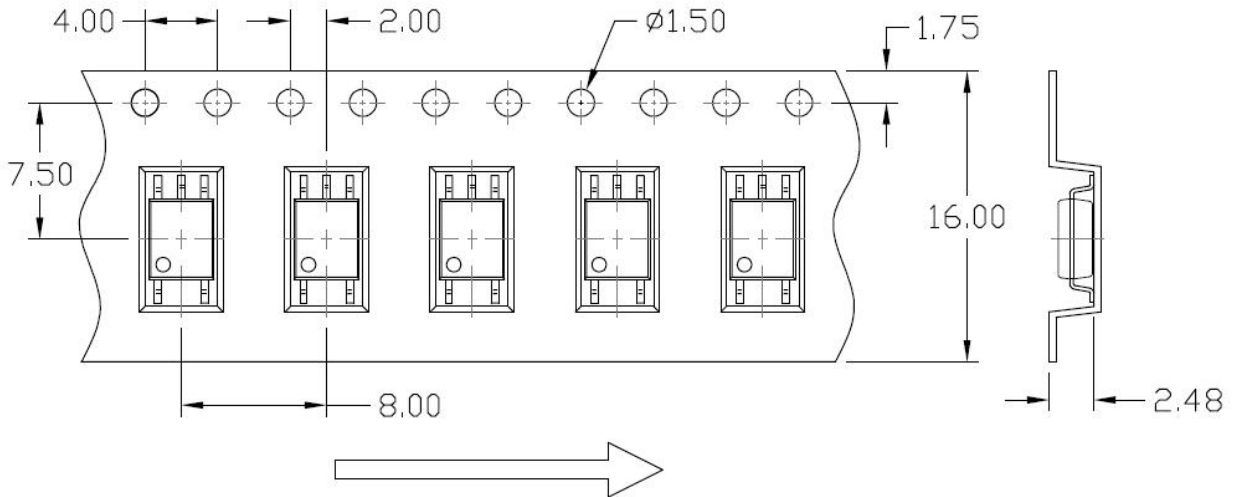


**CARRIER TAPE SPECIFICATIONS (Dimensions in mm unless otherwise stated)**

**Option T1**



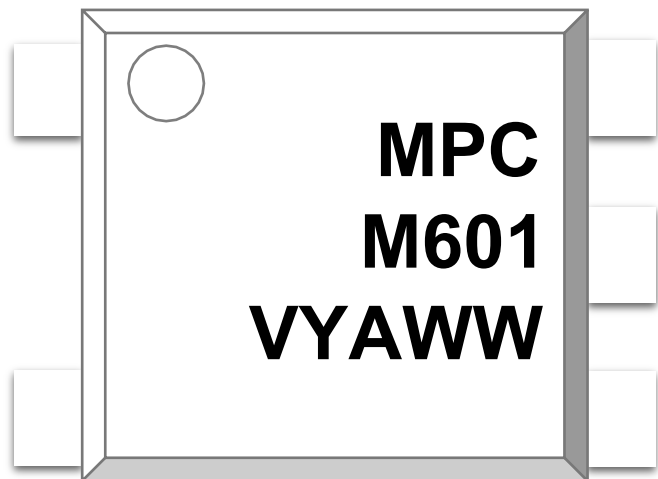
**Option T2**





**ORDERING AND MARKING INFORMATION**

**MARKING INFORMATION**



**MPC** : Company Abbr.  
**M601** : Part Number  
**V** : VDE Option  
**Y** : Fiscal Year  
**A** : Manufacturing Code  
**WW** : Work Week

**ORDERING INFORMATION**

**MPCM601(Z)-GV**

MPC – Company Abbr.

M601 – Part Number

Z – Tape and Reel Option (T1/T2)

G – Material Option (G: Green, None: Non-Green)

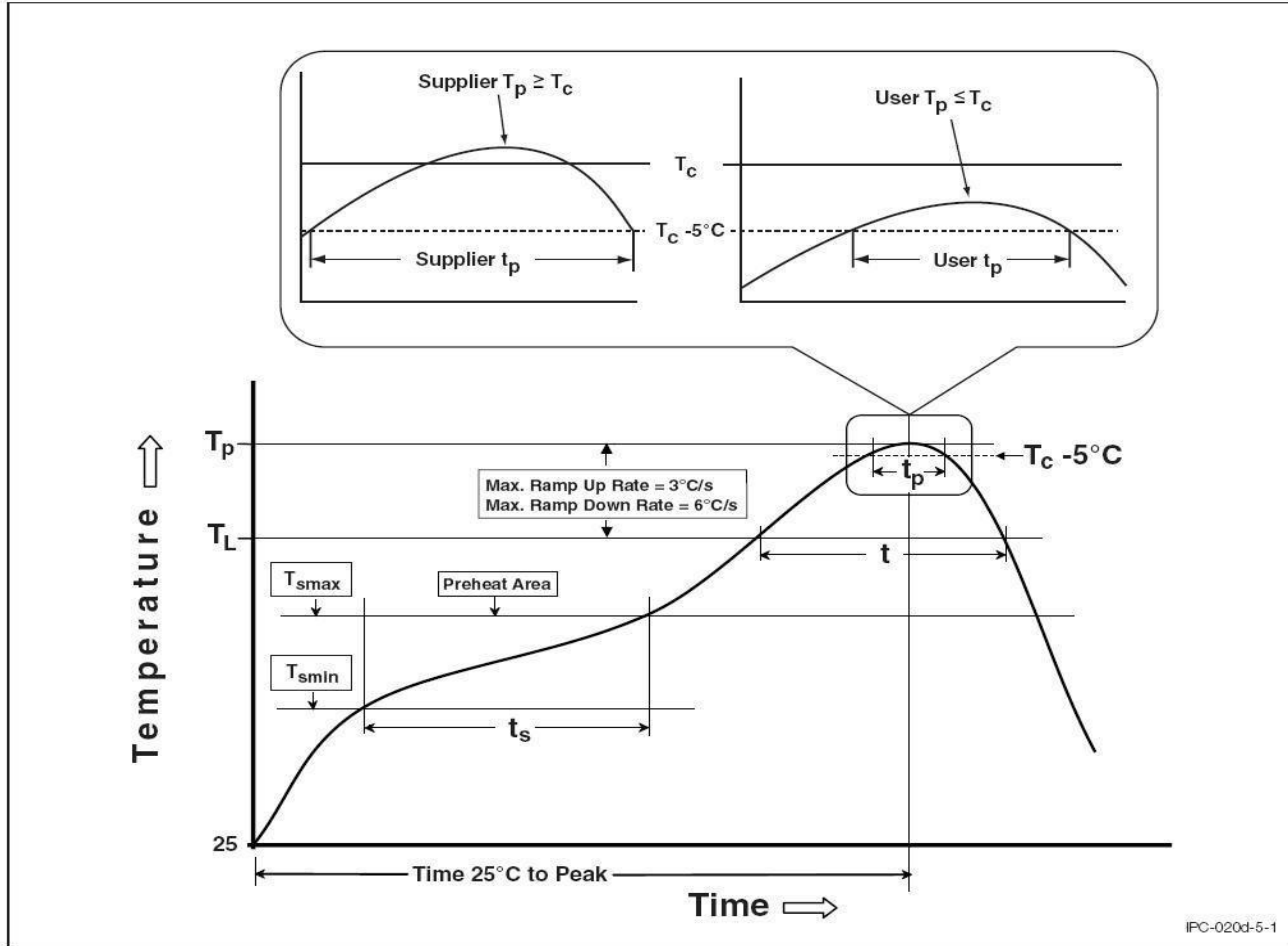
V – VDE Option (V or None)

**PACKING QUANTITY**

Option	Description	Quantity
T1	Surface Mount Lead Forming – With Option 1 Taping	3000Units/Reel
T2	Surface Mount Lead Forming – With Option 2 Taping	3000Units/Reel

### REFLOW INFORMATION

#### REFLOW PROFILE



Profile Feature	Sn-Pb Assembly Profile	Pb-Free Assembly Profile
Temperature Min. (T <sub>smin</sub> )	100	150°C
Temperature Max. (T <sub>smax</sub> )	150	200°C
Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> )	60-120 seconds	60-120 seconds
Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )	3°C/second max.	3°C/second max.
Liquidous Temperature (T <sub>L</sub> )	183°C	217°C
Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )	60 – 150 seconds	60 – 150 seconds
Peak Body Package Temperature	235°C +0°C / -5°C	260°C +0°C / -5°C
Time (t <sub>P</sub> ) within 5°C of 260°C	20 seconds	30 seconds
Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )	6°C/second max	6°C/second max
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.





**DISCLAIMER**

- Our company is continually improving the quality, reliability, function and design. Our company reserves the right to make changes without further notices.
- The characteristic curves shown in this datasheet are representing typical performance which are not guaranteed.
- 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.
- Immerge unit's body in solder paste is not recommended.
- Discoloration might be occurred on the package surface after soldering, reflow or long-time use. It neither impacts the performance nor reliability.

■ **Revision History**

<b>Version</b>	<b>Date</b>	<b>Subjects (major changes since last revision)</b>
1.0	2018-12-21	Datasheet Complete