MPCS-3922 Series

SOP16, 4A Output Dual-Channel Gate Driver

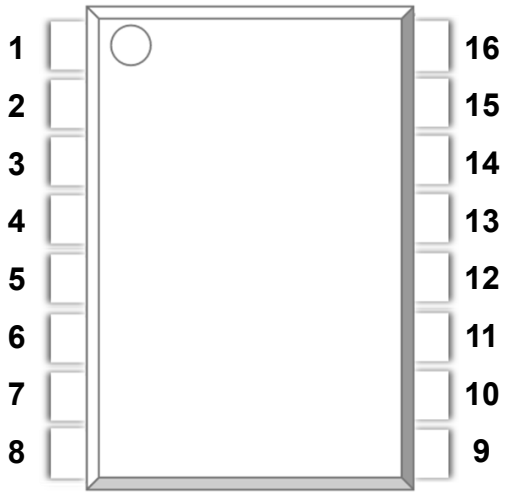
Description

The MPCS-3922 is isolated dual-channel gate drivers with 4A peak output current. It is designed to drive power MOSFETs, IGBTs, and SiC MOSFETs up to 5-MHz with well performanced propagation delay and pulse-width distortion.
The input is electrically isolated from the two output drivers by a 5.7-kVRMS reinforced isolation barrier, offering at least 50KV/us common-mode transient immunity (CMTI). The internal isolation between the two secondary-side drivers supports a maximum working voltage of 1500 VDC. Each driver can be configured as either two low-side drivers, two high-side drivers, or a half-bridge driver with adjustable dead time (DT). A disable pin will deactivate both outputs when set to high, while leaving it open or grounding it allows normal operation. As a safety feature, primary-side logic failures will force both outputs to a low state.

Applications

- Isolated converters in DC-DC and AC-DC power supplies
- AC and brushless DC motor drives
- Industrial inverters and Uninterruptible Power Supply (UPS)

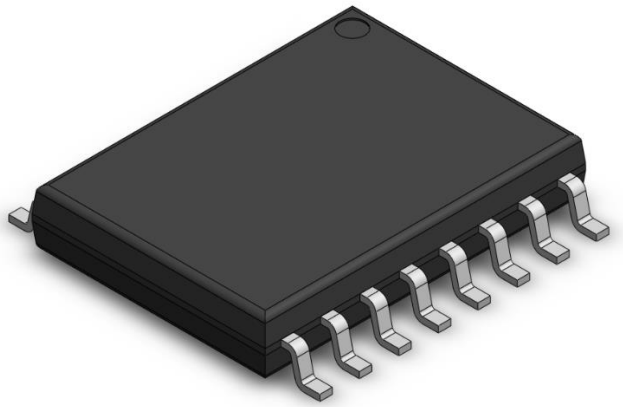
SCHEMATIC



PIN DEFINITION

1.IN_A	16.V_{DDA}
2.IN_B	15.OUT_A
3.V_{CCI}	14.V_{SSA}
4.GND	13.NC
5.DISABLE	12.NC
6.DT	11.V_{DDB}
7.NC	10.OUT_B
8.V_{CCI}	9. V_{SSB}

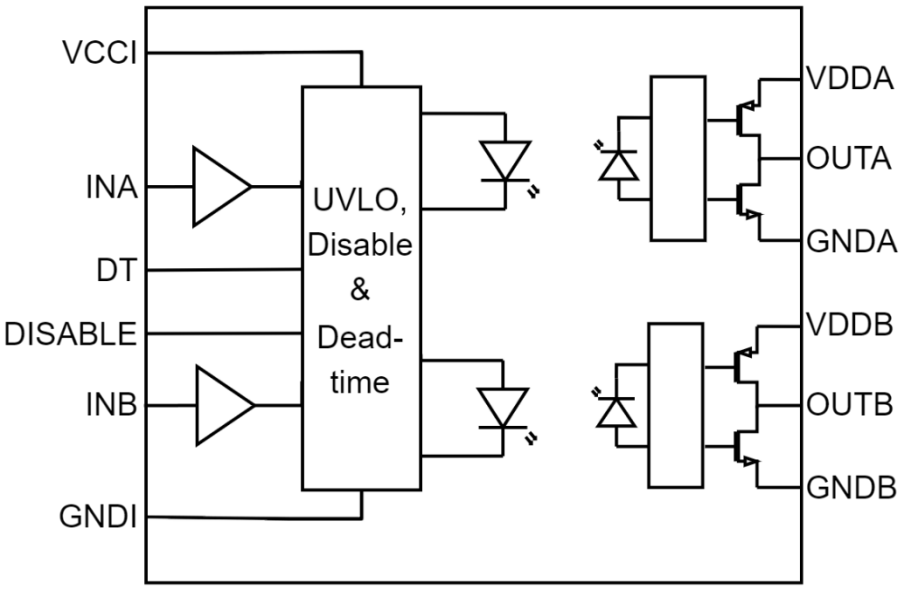
PACKAGE OUTLINE



Features

- dual low-side, dual high-side or half-bridge driver
- Operating temperature range –40 to +110°C
- Switching parameters:
  – 19ns typical propagation delay
  – 10ns minimum pulse width
  – 5ns maximum delay matching
  – 6ns maximum pulse-width distortion
- Common-mode transient immunity (CMTI) greater than 50KV/us
- 4A peak source, 4A peak sink output
- Available in SOP16 package
- 3V to 18V input VCCI range
- Up to 30V VDD output drive supply
- Programmable overlap and dead time
- Rejects input pulses and noise transients shorter than 5 ns
- Fast disable for power sequencing

Internal Circuit



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	NOTE
Storage Temperature	T_{stg}	-55	125	°C	
Operating Temperature	T_A	-40	110	°C	
Output IC Junction Temperature	T_J	-	125	°C	
Input Bias Pin Supply Voltage	VCCI to GND	-0.3	20	V	
Output Supply Voltage	(VDDA - VSSA) (VDDB - VSSB)	-0.3	30	V	
Output Voltage	OUTA to VSSA OUTB to VSSB	-0.3	V_{DDA} +0.3 V_{DDB} +0.3	V	
	OUTA to VSSA OUTB to VSSB Transient for 200 ns	-2	V_{DDA} +0.3 V_{DDB} +0.3	V	
Input Signal Voltage	INA, INB, DIS, DT To GND	-0.3	V_{CCI} +0.3	V	
	INA, INB Transient for 50 ns	-5	V_{CCI} +0.3	V	
Channel to Channel Voltage	VSSA - VSSB VSSB - VSSA	-	1500	V	

RECOMMENDED OPERATION CONDITIONS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Input Supply Voltage	VCCI	3	18	V
Output Bias Supply Voltage	VDDA, VDDB	15	30	V
Input Voltage	INA, INB, DIS, DT	0	V_{VCCI}	V
Operating Temperature	T_A	-40	110	°C

ELECTRICAL OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
SUPPLY CURRENTS							
VCCI quiescent current	I_{VCCI}	-	2.5	3	mA	V_{INA} = 0 V, V_{INB} = 0 V	
VDDA and VDDB quiescent current	I_{VDDA} I_{VDDB}	-	2	3	mA	V_{INA} = 0 V, V_{INB} = 0 V	
VCCI operating current	I_{VCCI}	-	2.5	3	mA	(f = 500 kHz) current per channel, C_{OUT} = 100 pF	
VDDA and VDDB operating current	I_{VDDA} I_{VDDB}	-	4	4.5	mA		
VCCI UVLO THRESHOLDS							
Rising threshold	V_{VCCI_ON}	2.5	2.8	2.9	V	-	
Falling threshold V_{CCI_OFF}	V_{VCCI_OFF}	2.35	2.55	2.7	V	-	
Threshold hysteresis	V_{VCCI_HYS}	-	0.25	-	V	-	
VDD UVLO THRESHOLDS							
Rising threshold VDDA_ON, VDDB_ON	V_{DDA_ON} V_{DDB_ON}	11.3	12.6	13.3	V	VO > 5V	
Falling threshold VDDA_OFF, VDDB_OFF	V_{DDA_OFF} V_{DDB_OFF}	9.8	11.1	11.8	V	VO < 5V	
Threshold hysteresis	V_{DDA_HYS} V_{DDB_HYS}	-	1.5	-	V	-	
INPUT CHANNEL CHARACTERISTICS							
Input high voltage	V_{INAH}, V_{INBH}, V_{DISH}	-	1.3	2	V	-	
Input low voltage	V_{INAL}, V_{INBL}, V_{DISL}	0.8	1.2	-	V	-	
Input hysteresis	V_{INA_HYS}, V_{INB_HYS}	-	0.1	-	V	-	

ELECTRICAL OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
OUTPUT CHARACTERISTICS							
Peak output source current	I_{OUTA+} I_{OUTB+}	3	-	-	A	VDD=30V, C_{VDD}=10uF VOUT=VDD-15V	
Peak output sink current	I_{OUTA-} I_{OUTB-}	3	-	-	A		
Output resistance at high state	R_{OUTA_H}, R_{OUTB_H}		2		Ω	I_{OUT} = –10 mA, T_A = 25°C, R_{OHA}, R_{OHB} do not represent drive pull-up performance	
Output resistance at low state	R_{OUTA_L} R_{OUTB_L}	-	1.6	-	Ω	I_{OUT} = –10 mA, T_A = 25°C	
Output voltage at high state	V_{OUTA_H} V_{OUTB_H}	29.8	-	-	V	V_{VDDA}, V_{VDDB} = 12 V, I_{OUT} = –10 mA, T_A = 25°C	
Output voltage at low state	V_{OUTA_L} V_{OUTB_L}	-	-	25	mV	V_{VDDA}, V_{VDDB} = 12 V, I_{OUT} = 10 mA, T_A = 25°C	
DEADTIME AND OVERLAP PROGRAMMING							
Dead time		Overlap determined by INA INB				Pull DT pin to VCCI	
		-	9.5	15	ns	DT pin is left open, min spec characterized only, tested for outliers	
		100	165	300	ns	R_{DT} = 20 kΩ	

Unless otherwise noted, V_{VCCI} = 3.3 V or 5 V, 0.1-µF capacitor from V_{CCI} to GND, V_{VDDA} = V_{VDDB} =30 V, 1-µF capacitor from V_{DDA} and V_{DDB} to V_{SSA} and V_{SSB}, T_A = –40°C to +125°C.

SWITCHING SPECIFICATION

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
Output rise time, 20% to 80% measured points	t_{RISE}	-	4.5	-	ns	C_{OUT} = 1.8nF	
Output fall time, 90% to 10% measured points	t_{FALL}	-	3.6	-	ns		
Propagation delay from INx to OUTx falling edges	t_{PDHL}	35	60	150	ns	-	
Propagation delay from INx to OUTx rising edges	t_{PDLH}	35	70	150	ns	-	
Pulse width distortion $\lvert t_{PDLH} - t_{PDHL} \rvert$	t_{PWD}	-	10	-	ns	-	
Propagation delays matching between V_{OUTA}, V_{OUTB}	t_{DM}	-	-	8	ns	f = 100 kHz	
V_{DDA}, V_{DDB} Power-up Delay Time: U_{VLO} Rise to OUT_A, OUT_B.	$t_{VDD+ to OUT}$	-	10	-	us	IN_A or IN_B tied to V_{CCI}	
Output High Level Common Mode Transient Immunity	|CMH|	-	75	-	kV/us	IN_A and IN_B both are tied to V_{CCI}; V_{CM}=1500V	
Output Low Level Common Mode Transient Immunity	|CML|	-	75	-	kV/us	IN_A and IN_B both are tied to GND; V_{CM}=1500V	

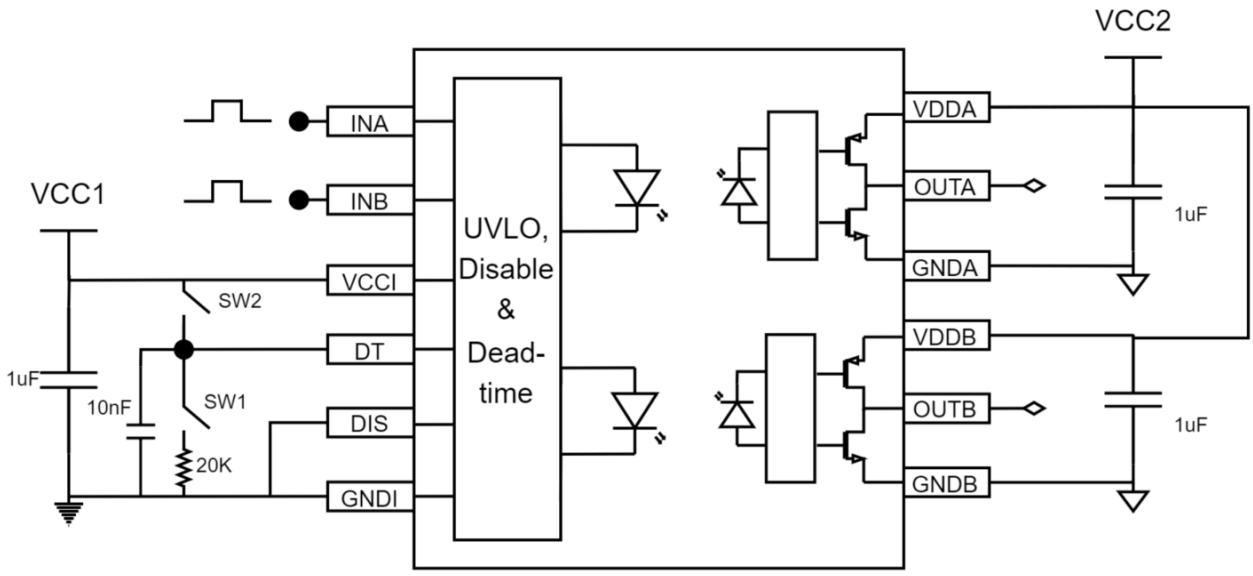
Unless otherwise noted, V_{VCCI} = 3.3 V or 5 V, 0.1-µF capacitor from V_{CCI} to GND, V_{VDDA} = V_{VDDB} = 12 V, 1-µF capacitor from V_{DDA} and V_{DDB} to V_{SSA} and V_{SSB}, T_A = –40°C to +125°C.

ISOLATION CHARACTERISTIC

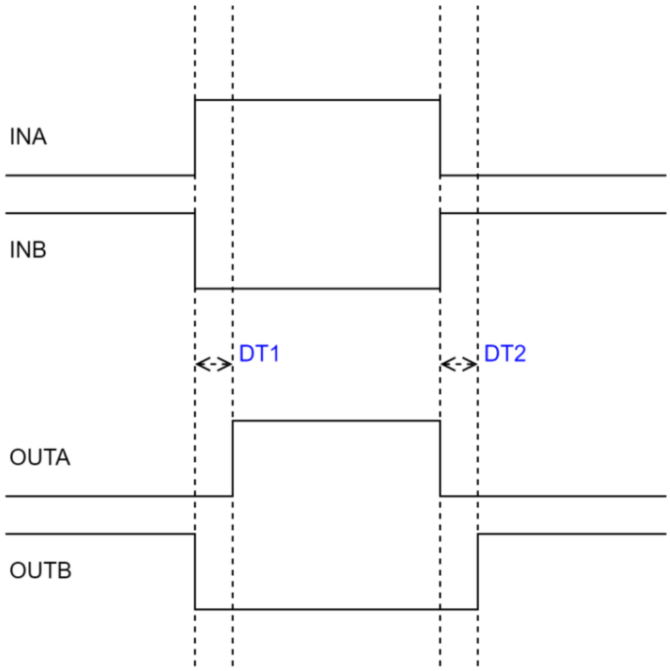
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
Withstand Insulation Test Voltage	V_{ISO}	5000	-	-	V	RH ≤ 40%-60%, t = 1min, T_A = 25 °C	
Input-Output Resistance	R_{I-O}	-	10^{12}	-	Ω	V_{I-O} = 500V DC	

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

Channel to Chanel Test Circuit



Dead Time Diagram



T_{RISE}, T_{FALL} Time Diagram

Fig.26 Propagation Delay Time Diagram

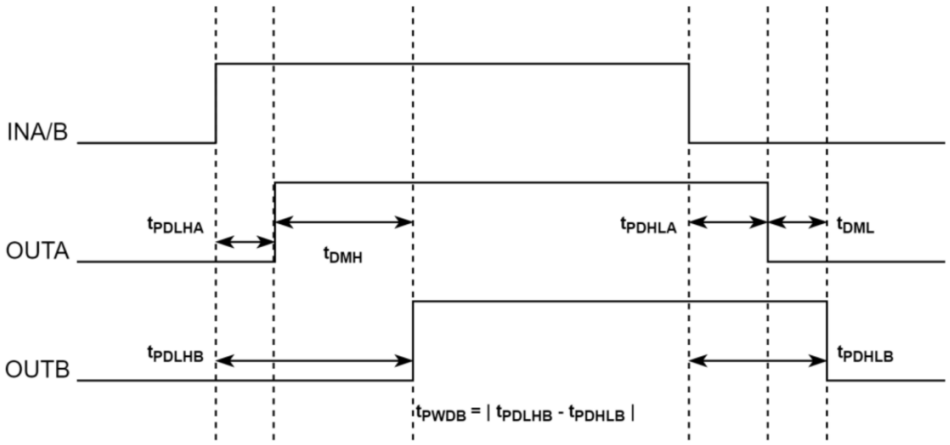
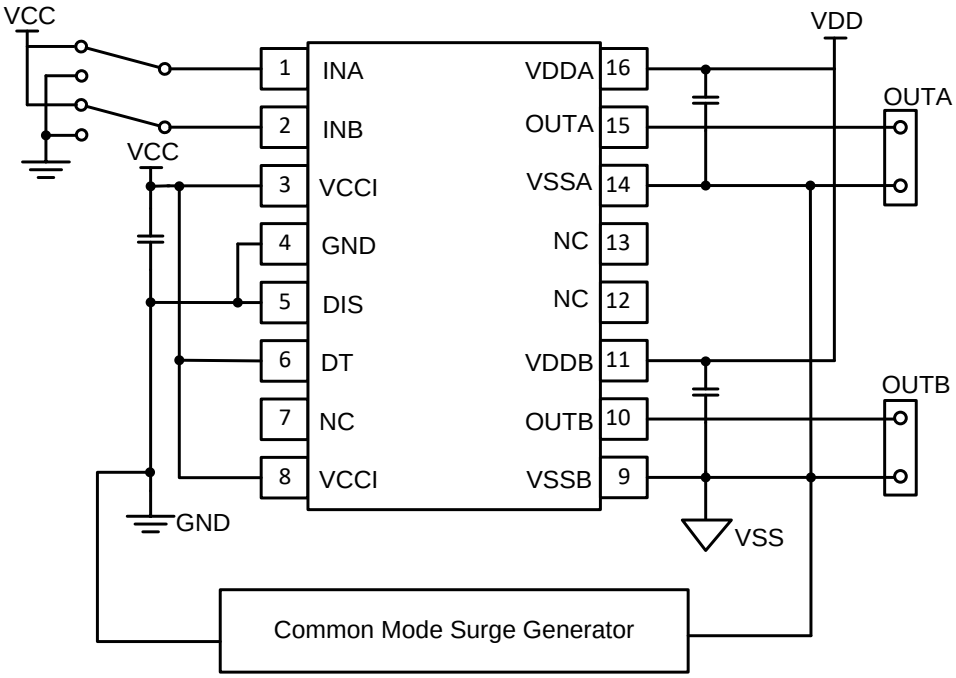
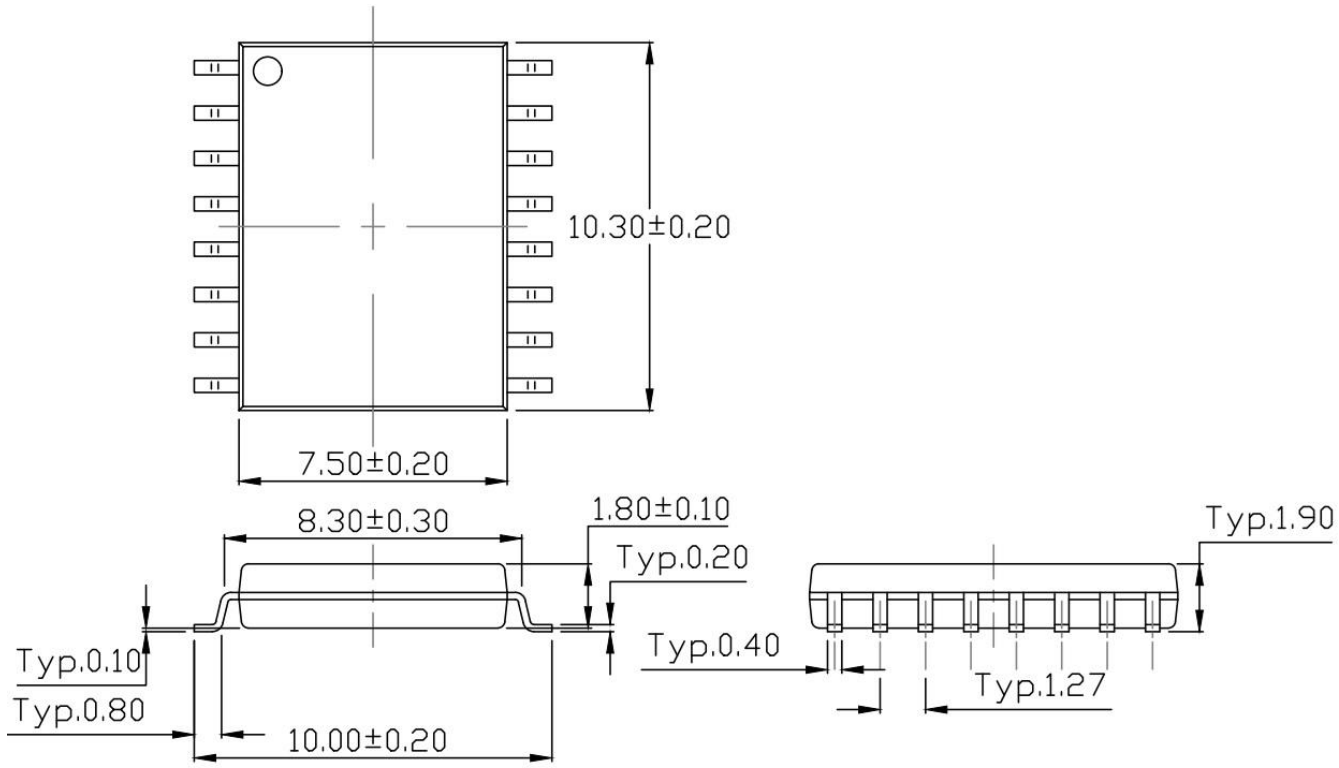


Fig.26 CMTI Testing Diagram

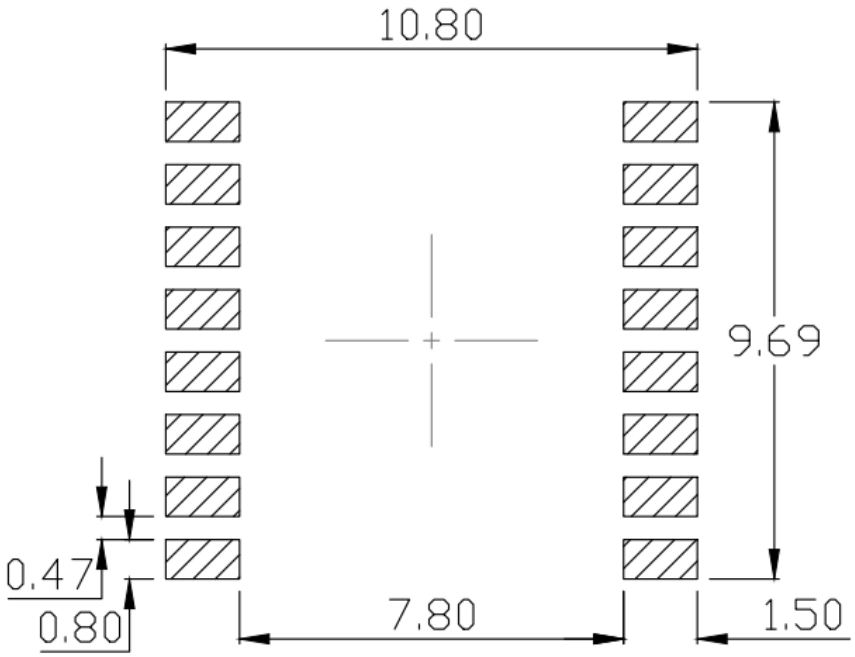


PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)



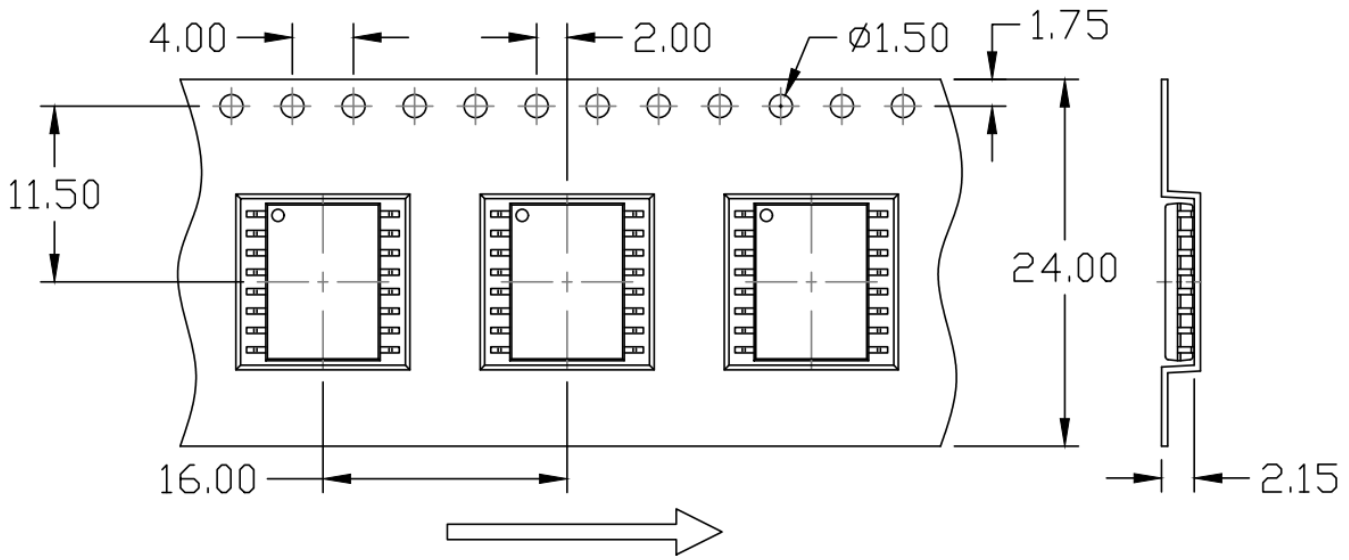
General Tolerance: +/-0.25mm

RECOMMENDED SOLDER MASK (Dimensions in mm unless otherwise stated)

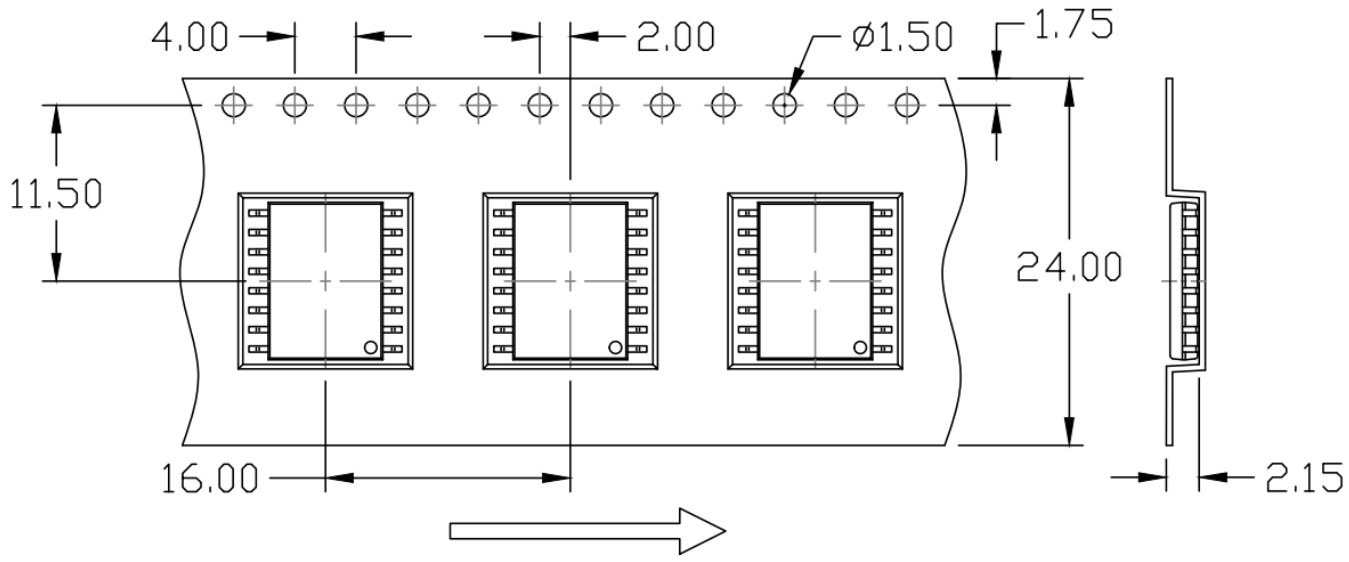


CARRIER TAPE SPECIFICATIONS (Dimensions in mm unless otherwise stated)

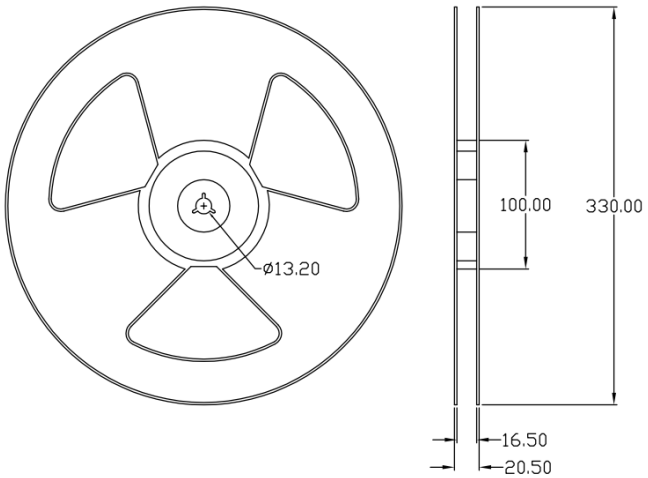
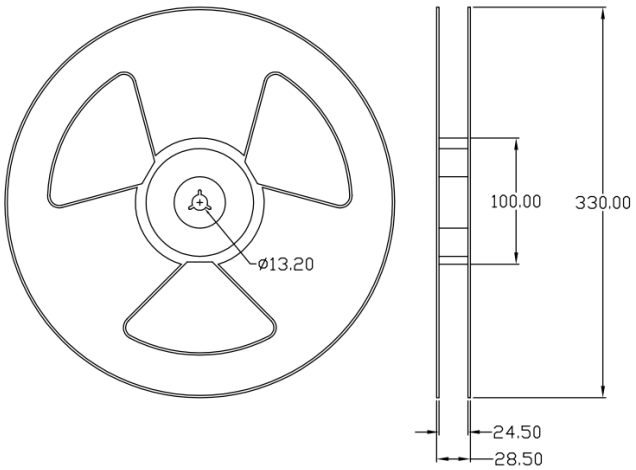
Option T1



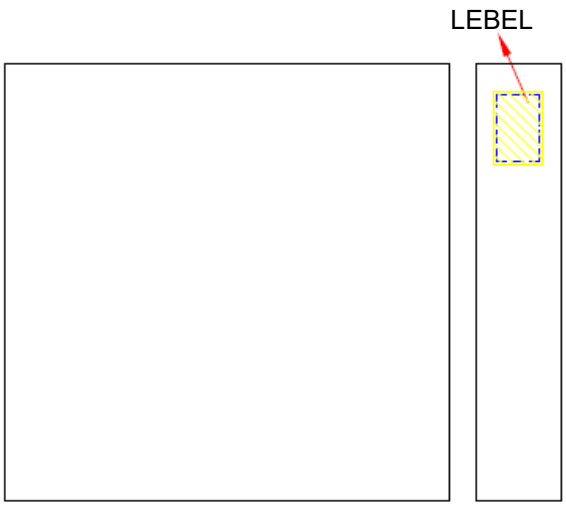
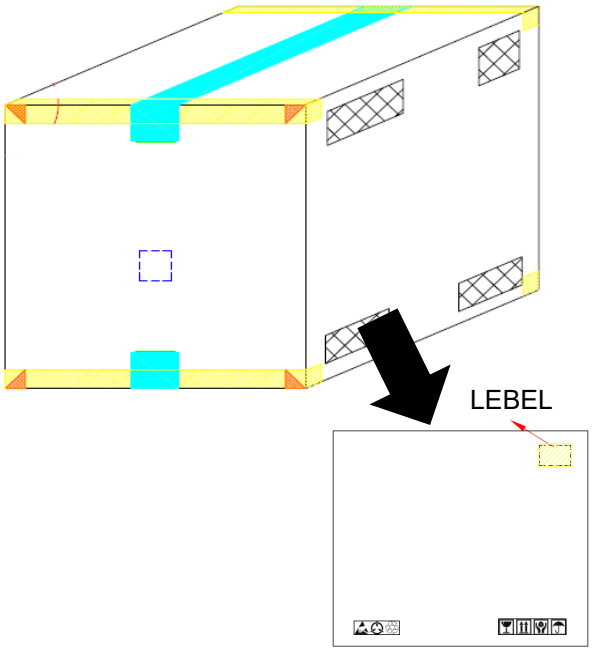
Option T2



REEL SPECIFICATIONS (Dimensions in mm unless otherwise stated)

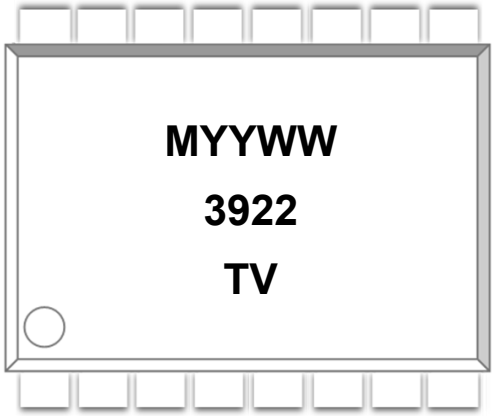
Surface Mount Lead Forming (P Type)	Surface Mount (Gullwing) Lead Forming (W Type)
	

BOX SPECIFICATIONS (Reel Type)

INNER BOX	OUTER BOX
	
L x W x H = 36cm x 36cm x 6.9cm	L x W x H = 45cm x 38cm x 38cm

ORDERING AND MARKING INFORMATION

MARKING INFORMATION



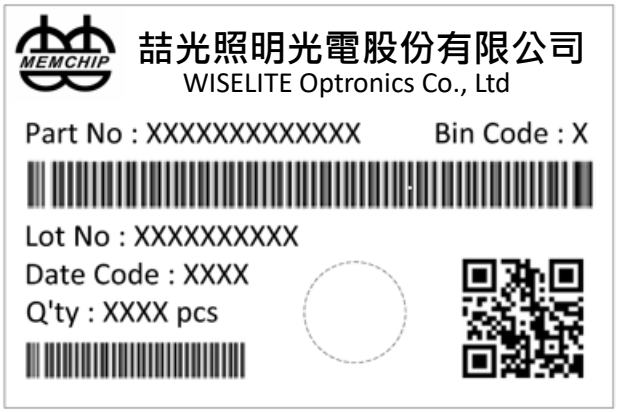
M : Company Abbr.
YY : Year date code
WW : 2-digit work week
3922 : Part Number
T or H : Factory identification mark
V : VDE Identification(Option)

ORDERING INFORMATION

MPCS-3922-ZV

MPC – Company Abbr.
S – Stack
3922 – Part Number
Z – Tape and Reel Option (T1/T2)
V –VDE Option (V or None)

LABEL INFORMATION

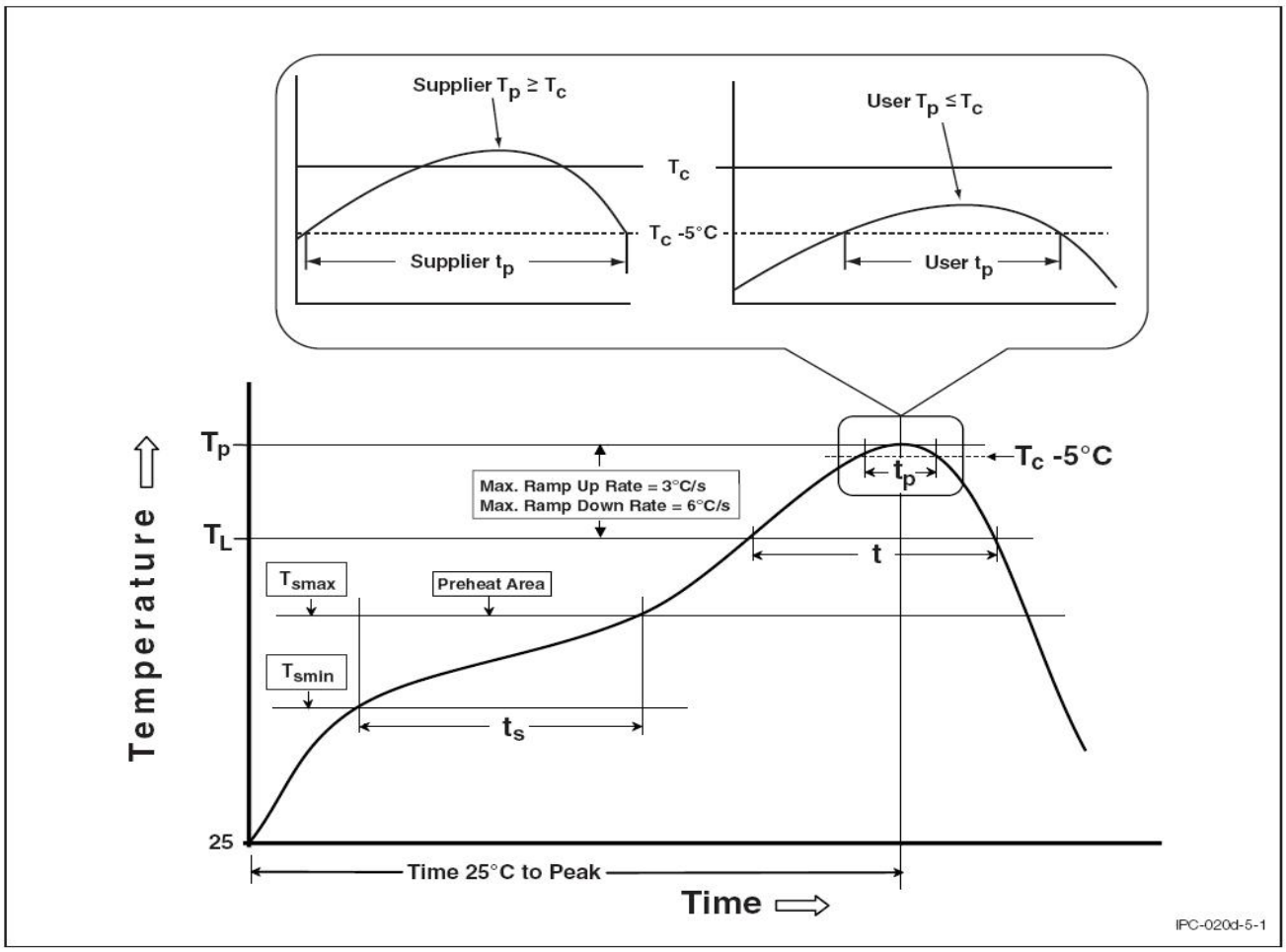


PACKING QUANTITY

Option	Quantity	Quantity – Inner box	Quantity – Outer box
T1/T2	1000 Units/Reel	2 Reels/Inner box	5 Inner box/Outer box = 10k Units

REFLOW INFORMATION

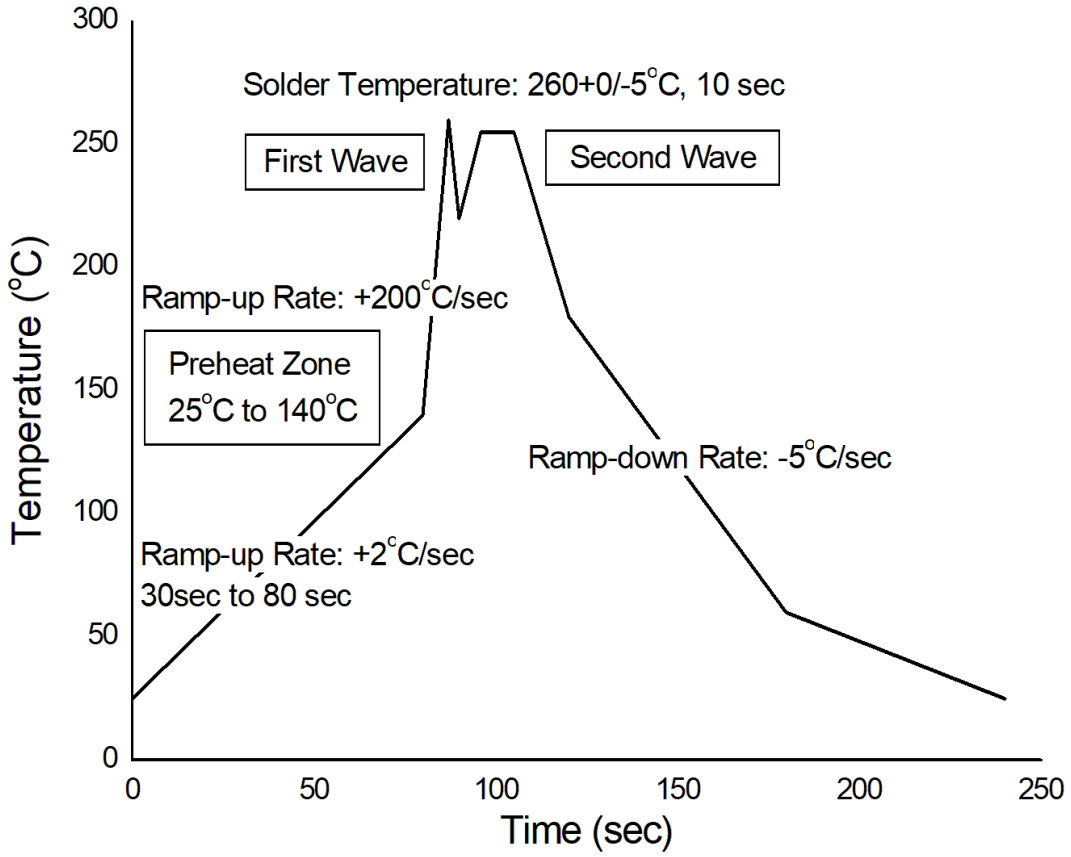
REFLOW PROFILE



Profile Feature	Sn-Pb Assembly Profile	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	100°C	150°C
Temperature Max. (Tsmax)	150°C	200°C
Time (ts) from (Tsmin to Tsmax)	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

- WISELITE is continually improving the quality, reliability, function and design. WISELITE 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, medical, life sustaining or lifesaving applications or any other application which can result in human injury or death.
- Please contact WISELITE 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 WISELITE'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.