

Integrated Solution for Position Detection

1 Product Description

The MT5201 supports both 2-wire & 3-wire applications for all kinds of position detection sensor.

The MT5201 is an IC which can process all kinds of position sensor signals. It integrates LDO, signal processing module, driver and protection module.

The MT5201DT-NPN & MT5201DT-PNP fix the output mode internally.

The MT5201 provides DFN2*3-8L for surface mount (MSL1), RoHS compliant.

2 Features

- 4.2~30V Operating Vcc Range
- Operating Frequency: 20KHz
- -30V Reversed Power Supply Protection
- -30V Reversed Output Protection
- Output Over-Current Protection ($\pm 350\text{mA}$)
- Short Circuit Protection
- $-40^{\circ}\text{C}\sim 105^{\circ}\text{C}$ Operating Temperature
- Input Signal Threshold Selection
- Package Option: DFN2*3-8L
- RoHS Compliant: (EU)2015/863

3 Product Overview of MT5201

Part No.	Description
MT5201DT-NPN	DFN2*3-8L, tape & reel (3000pcs/bag)
MT5201DT-PNP	DFN2*3-8L, tape & reel (3000pcs/bag)

Remark:

The marking of MT5201DT-NPN is 5201N

The marking of MT5201DT-PNP is 5201P

4 Applications

- Coil Position Sensor
- Photoelectric Position Sensor

5. Pin Configuration and Functions

No.	Name	Description
1	VCC	Power Supply
2	V _{LDO}	LDO Output
3	VN	Input-
4	OUT	Output
5	GND	Ground
6	LED	LED Output
7	SEL	Threshold Selection
8	VP	Input+

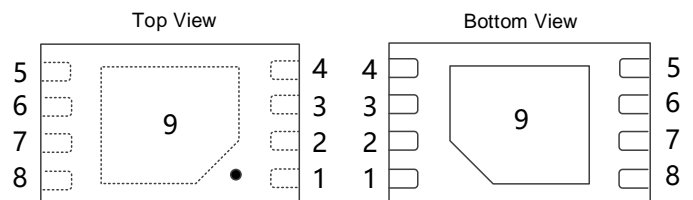


Figure.1 Pin Configuration & Functions

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Reversion History

1	1.0 Version	Originally Version
2	1.1 Version	Update the Electrical Specifications
3	1.2 Version	Update the Electrical Specifications

6 Functional Block Diagram

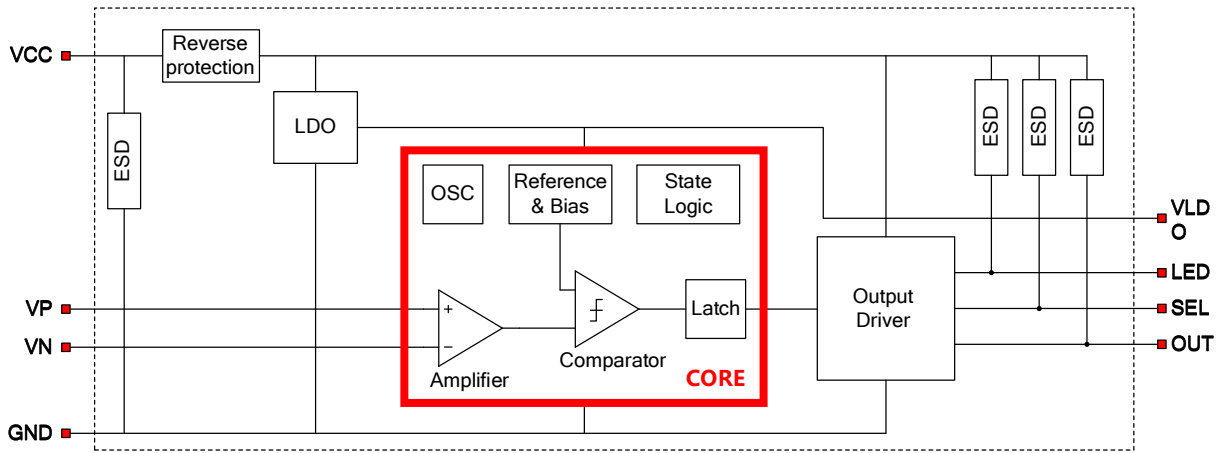


Figure.2 Functional Block Diagram

7 Electrical and Magnetic Characteristics

7.1 Absolute Maximum Ratings

Absolute maximum ratings are limited values to be applied individually, and beyond which the serviceability of the circuit may be impaired. Functional operability is not necessarily implied. Exposure to absolute maximum rating conditions for an extended period of time may affect device reliability. All voltages listed are referenced to GND.

Symbol	Parameters	Min	Max	Units
V _{CC}	Supply Voltage	-30	36	V
V _{OUT}	Output Voltage	-30	36	V
I _{OUT}	Continuous Output Current	-500	500	mA
V _{IN}	VN & VP & SEL Voltage	-0.7	5.5	V
V _{LED}	LED Output Voltage	-0.7	36	V
V _{LDO}	LDO Voltage	2	5.5	V
I _{LDO}	LDO Output Current	-	50	mA
T _A	Operating Ambient Temperature	-40	105	°C
T _S	Storage Temperature	-50	150	°C

7.2 ESD Ratings

Symbol	Reference	Values	Unit	
V _{ESD}	Human-body model (HBM)	AEC-Q100-002	4000	V
	Charged-device model (CDM)	AEC-Q100-011	1000	V

7.3 Electrical Specifications

At $T_A = -40 \sim 105 \text{ }^\circ\text{C}$, $V_{CC} = 4.2\text{V} \sim 30\text{V}$ (unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
V_{CC}	Supply Voltage		4.2	-	30	V
I_{IN}	VN & VP Input Current	$-0.7\text{V} \leq VP \ \& \ VN < V_{CC} + 0.5\text{V}$	-	-	0.01	mA
		$V_{CC} + 0.5\text{V} \leq VP \ \& \ VN \leq 5.5\text{V}$	-	-	2	mA
I_{CC}	Supply Current	$V_{CC} = 24\text{V}; VP - VN < V_{DIF(OFF)}$	-	80	100	μA
V_{SAT}	Output Saturation Voltage @ 3-Wire	$V_{CC} = 24\text{V}; I_{OUT} = 200\text{mA}; VP - VN > V_{DIF(ON)}; \text{MT5201DT-NPN}$	-	-	0.6	V
		$V_{CC} = 24\text{V}; I_{OUT} = -200\text{mA}; VP - VN > V_{DIF(ON)}; \text{MT5201DT-PNP}$	$V_{CC} - 0.6$	-	-	
I_{OCP}	Output Over-current Protection Limit	$V_{CC} = 24\text{V}; VP - VN > V_{DIF(ON)}; \text{MT5201DT-NPN}$	-	350	-	mA
		$V_{CC} = 24\text{V}; VP - VN > V_{DIF(ON)}; \text{MT5201DT-PNP}$	-	-350	-	
I_{OFF}	Output Leakage Current	$VP - VN < V_{DIF(OFF)}; V_{OUT} = 24\text{V}; \text{MT5201DT-NPN}$	-	-	10	μA
		$VP - VN < V_{DIF(OFF)}; V_{CC} = 24\text{V}; \text{MT5201DT-PNP}$	-10	-	-	
I_{LED}	LED Pin Output Current	$VP - VN > V_{DIF(ON)}$	-0.8	-0.6	-0.4	mA
F_{SW}	Switching Frequency	$V_{CC} = 24\text{V}$	-	20	-	KHz
T_R	Output Fall Time	$V_{CC} = 24\text{V}; \text{MT5201DT-NPN, 3-Wire}$	-	-	10	μs
T_F	Output Rise Time	$V_{CC} = 24\text{V}; \text{MT5201DT-PNP, 3-Wire}$	-	-	10	μs
T_{PO}	Power on Time		-	-	1	ms
T_{OCPD}	Output Over-current Protection Delay Time;		-	-	0.2	ms
T_{OCPR}	Output Over-current Protection Recovery Time		-	-	200	ms
T_{OTPR}	Over Temperature Protection Point	Junction Temperature	-	140	-	$^\circ\text{C}$
T_{OTRC}	Over Temperature Recovery Point	Junction Temperature	-	130	-	$^\circ\text{C}$

At $T_A = -40 \sim 105 \text{ }^\circ\text{C}$, $V_{CC} = 4.2\text{V} \sim 30\text{V}$ (unless otherwise specified), $-0.7\text{V} \leq V_P \text{ \& } V_N < V_{CC} + 0.5\text{V}$

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
$V_{DIF1(ON)}$	Differential Input Voltage (on) Level1	SEL Floating, $V_P - V_N > V_{DIF(ON)}$, I_{LED} & Output On	600	670	740	mV
$V_{DIF1(OFF)}$	Differential Input Voltage (off) Level1	SEL Floating, $V_P - V_N < V_{DIF(OFF)}$, I_{LED} & Output Off	450	520	590	mV
$V_{DIF2(ON)}$	Differential Input Voltage (on) Level2	SEL=Low, $V_P - V_N > V_{DIF(ON)}$, I_{LED} Output On	170	240	310	mV
$V_{DIF2(OFF)}$	Differential Input Voltage (off) Level2	SEL=Low, $V_P - V_N < V_{DIF(OFF)}$, I_{LED} Output Off	120	190	260	mV
V_{LDO}	LDO Output Voltage	$I_{LDO} < 5\text{mA}$, $V_{CC} \geq 5\text{V}$	-	4.5 ⁽¹⁾	-	V
I_{LDO}	LDO Output Current		-	-	15	mA

▪ Note(1): If $V_{CC} \leq 4.5\text{V}$, $V_{LDO} = V_{CC}$

7.4 Typical Output Waveform

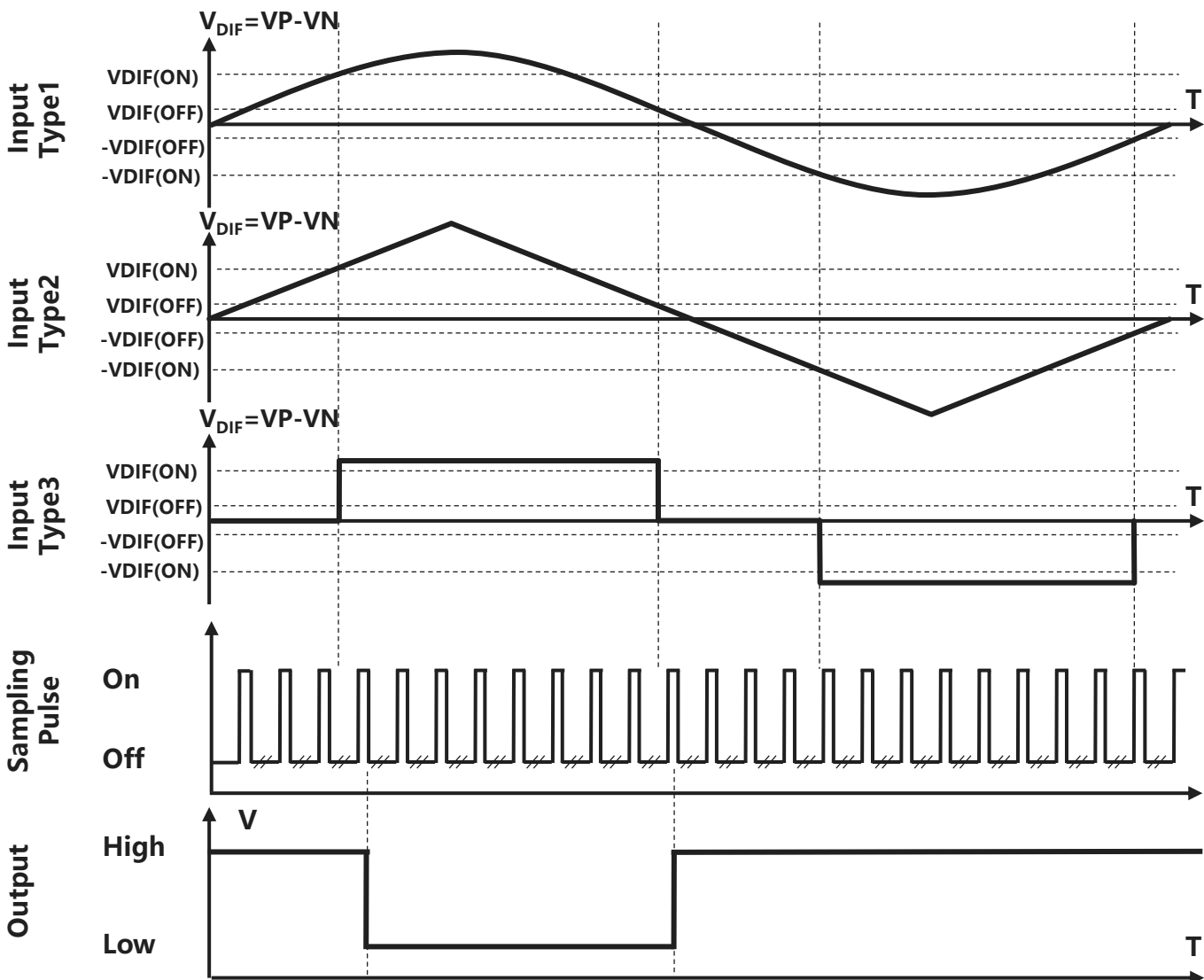


Figure.3 Digital Output vs. Input Signal & Sampling Pulse (Pull-up loading)

▪ Note: $V_P - V_N > V_{DIF(ON)}$, output driver ON ($V_{out} = \text{Low}$) ; $V_P - V_N < V_{DIF(OFF)}$, output driver OFF ($V_{out} = \text{High}$)

8 Typical Application Circuit

8.1 2-Wire Applications

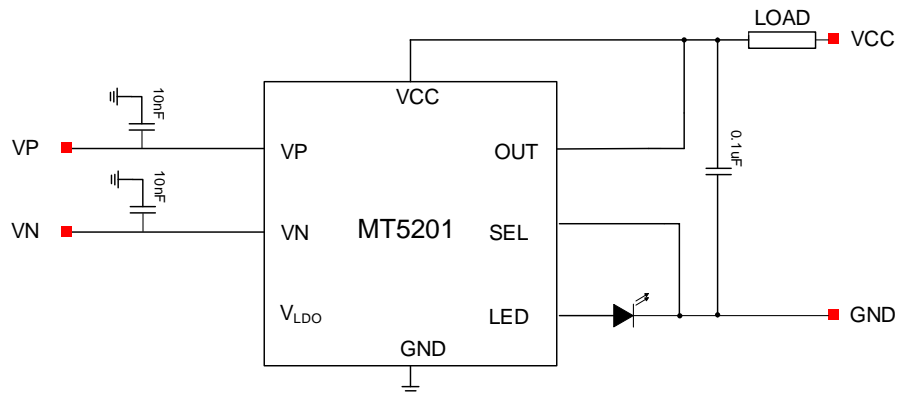


Figure.4 2-wire application circuit with pull-down loading @ V_{DIF2}

8.2 3-Wire Applications

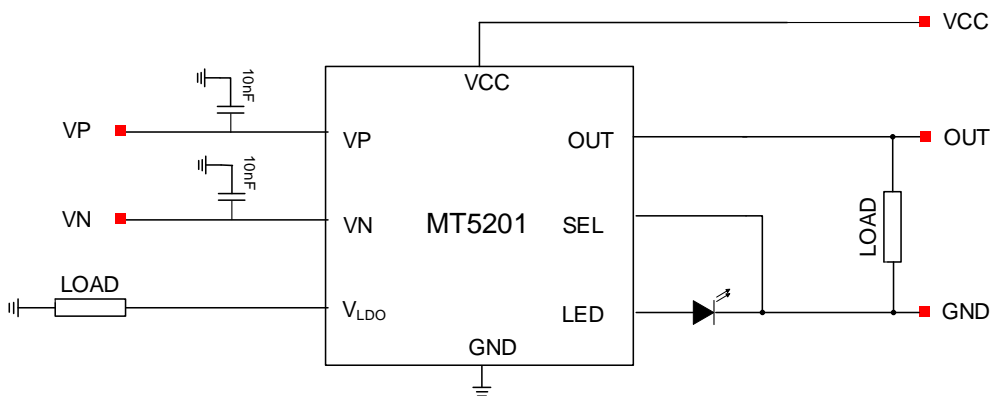


Figure.5 3-wire application circuit with pull-down loading (MT5201DT-PNP) @ V_{DIF2}

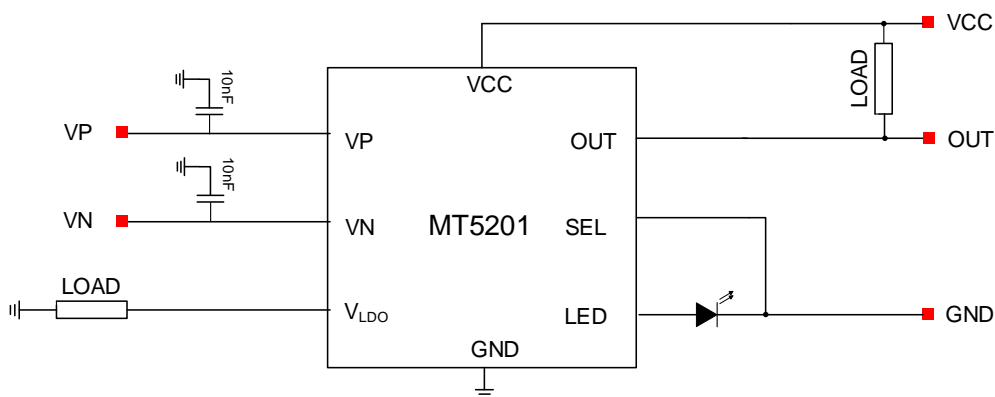


Figure.6 3-wire application circuit with pull-up loading (MT5201DT-NPN) @ V_{DIF2}

9 Characteristic Performance

VOP/VRP vs. Temperature (level I)

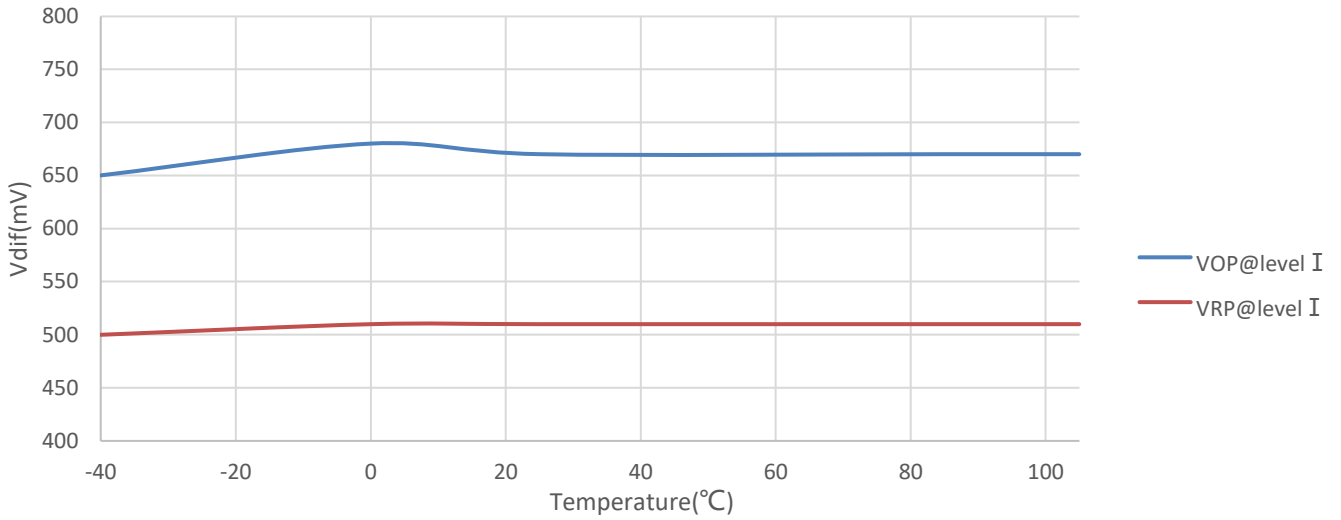


Figure.7 $V_{DIF(ON)}$ & $V_{DIF(OFF)}$ vs Temperature (Level1)

VOP/VRP vs. Temperature (level II)

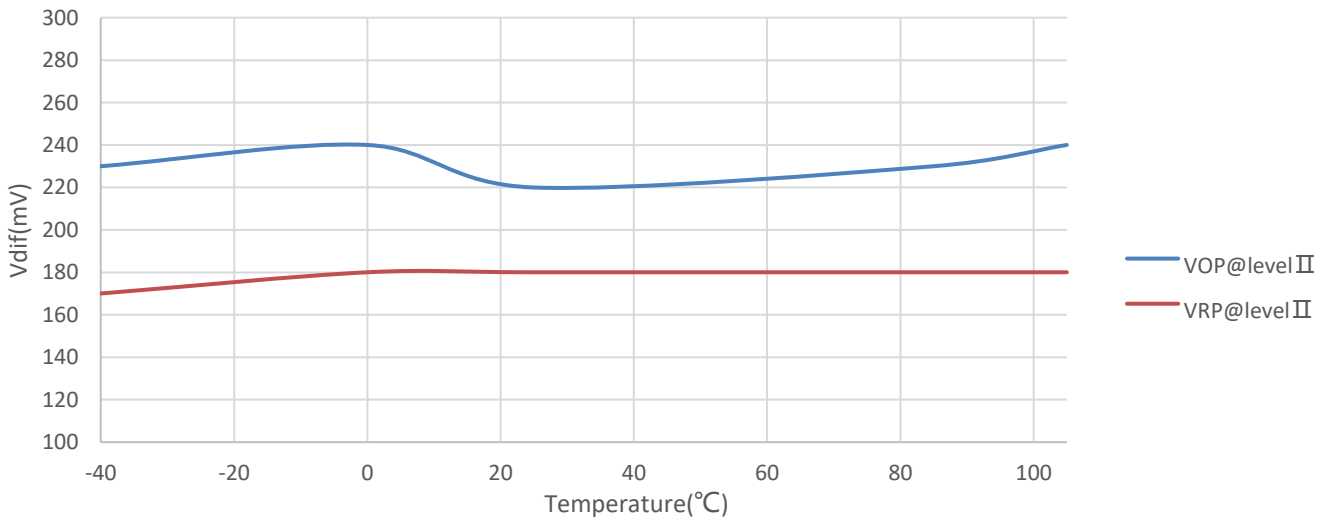


Figure.8 $V_{DIF(ON)}$ & $V_{DIF(OFF)}$ vs Temperature (Level2)

9 Characteristic Performance (Continued)

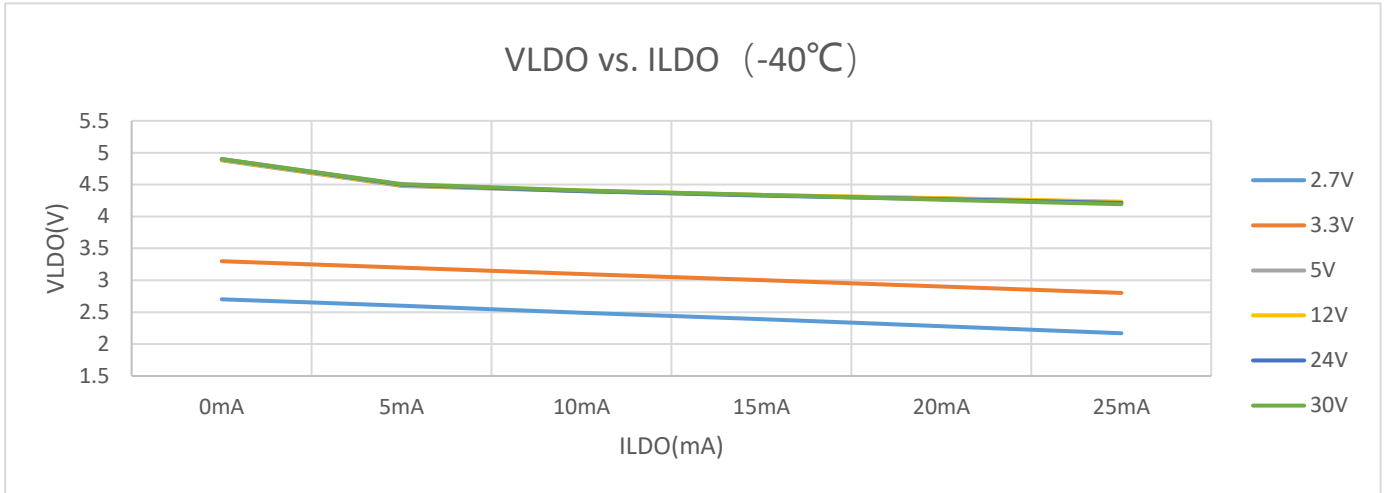


Figure.9 LDO Output Voltage & LDO Output Current vs. Supply Voltage @ -40°C

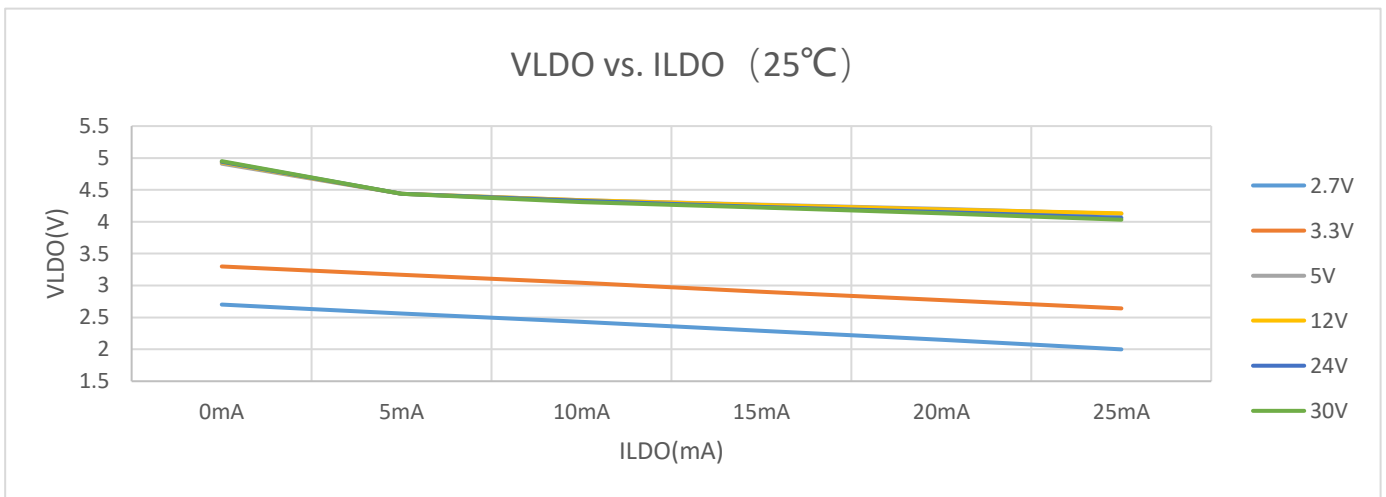


Figure.10 LDO Output Voltage & LDO Output Current vs. Supply Voltage @ 25°C

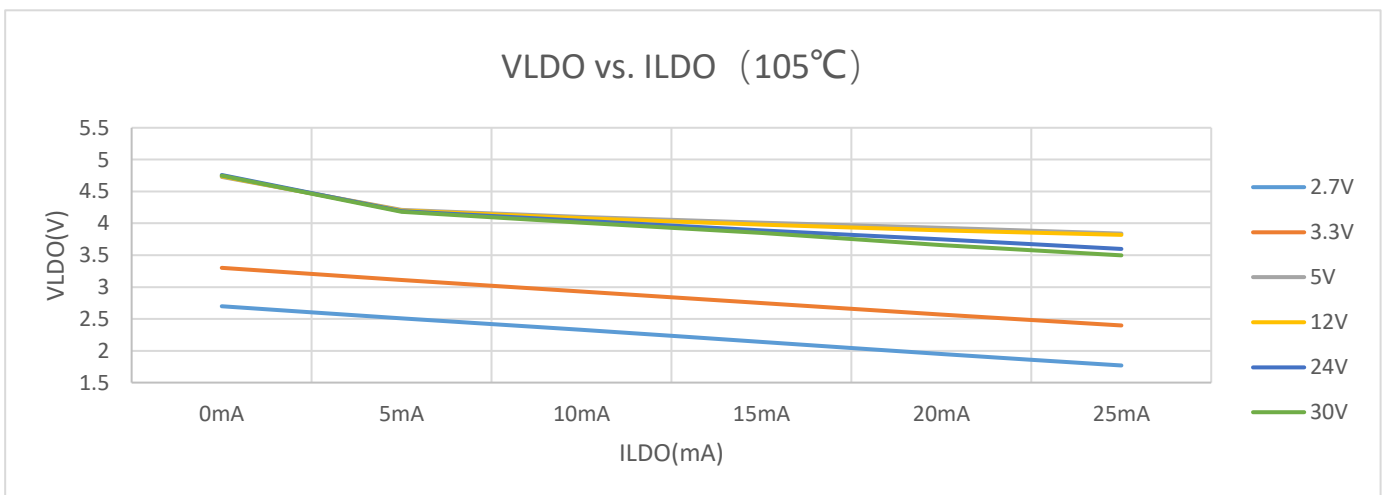


Figure.11 LDO Output Voltage & LDO Output Current vs. Supply Voltage @ 105°C

10 Package Material Information (For Reference Only – Not for Tooling Use)

10.1 DFN 2*3 8L Package Information

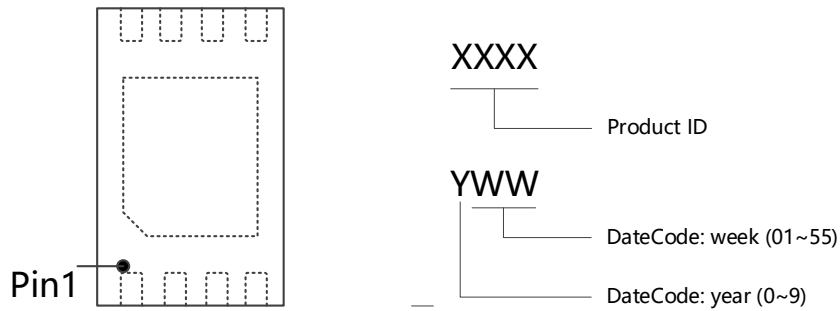


Figure.12 DFN 2*3 8L Chip Marking Spec

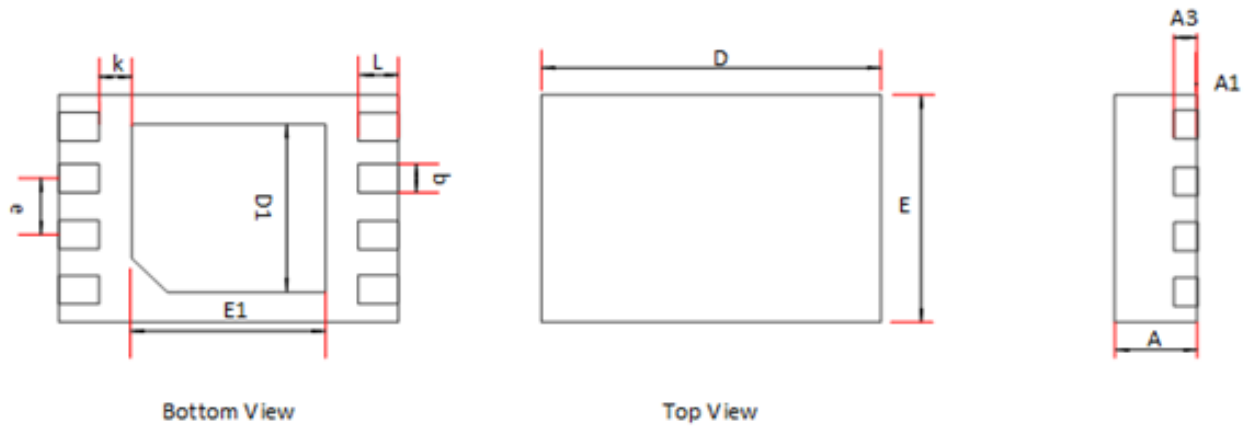


Figure.13 DFN 2*3 8L Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203 REF		0.008 REF	
D	2.950	3.050	0.116	0.120
E	1.950	2.050	0.077	0.081
D1	1.400	1.600	0.055	0.063
E1	1.600	1.800	0.063	0.071
b	0.200	0.300	0.008	0.012
e	0.500 TYP		0.020 TYP	
k	0.200 MIN		0.008 MIN	
L	0.300	0.400	0.012	0.016

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