DIO7910
300 mA, Ultra-Low Noise, Low-I_Q LDO

Features

- Operating input voltage range: 1.6 V to 5.5 V
- Output voltage range: 0.8 V to 3.3 V
- Output current: 300 mA
- Ultra-low quiescent current: 25 μA typ.
- Dropout voltage : 170 mV at I_{OUT} = 300 mA, V_{OUT} = 2.8 V
- PSRR: 75 dB at 1 kHz, I_{OUT} = 20 mA
- Output voltage tolerance: ±1%
- Stable with ceramic capacitors 1 μF
- Thermal-overload protection
- Short-circuit protection
- Quick output discharge:
  DIO7910A: available
  DIO7910B: not available
- Available in small DFN1*1-4, SOT23-5, DFN0.8*0.8-4, SC70-5, and DFN2*2-6 packages
- These devices are Pb−free, halogen free / BFR free, and RoHS compliant

Applications

- MP3/MP4 players
- Cellphones, radiophones, digital cameras
- Bluetooth, wireless handsets
- Others portable electronics devices

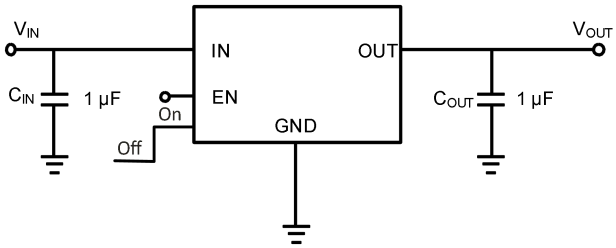
Descriptions

The DIO7910 series is a high-accuracy, low-noise, high-speed, high-PSRR, and low-dropout CMOS linear regulator with high ripple rejection. The devices offer a new level of cost-effective performance in cellular phones, laptop and notebook computers, and other portable devices.

The DIO7910 has the fold-back maximum output current that depends on the output voltage. So the current limit functions both as a short-circuit protection and as an output current limiter.

The device is available in DFN1*1-4, SOT23-5, DFN0.8*0.8-4, SC70-5, and DFN2*2-6 packages.

Typical Applications



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Ordering Information

Ordering Part No.	Top Marking	MSL	RoHS	T_A	Package	
DIO7910AaaST5	KAXYW	3	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO7910AaaEN4	YWKX	1	Green	-40 to 125°C	DFN1*1-4	Tape & Reel,10000
DIO7910AaaCN4	D	1	Green	-40 to 125°C	DFN0.8*0.8-4	Tape & Reel, 5000
DIO7910AaaSC5	YWKX	3	Green	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO7910AaaDN6	DVAX	3	Green	-40 to 125°C	DFN2*2-6	Tape & Reel, 3000
DIO7910BaaST5	KBXYW	3	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO7910BaaEN4	YWVX	1	Green	-40 to 125°C	DFN1*1-4	Tape & Reel,10000
DIO7910BaaCN4	D	1	Green	-40 to 125°C	DFN0.8*0.8-4	Tape & Reel, 5000
DIO7910BaaSC5	YWVX	3	Green	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO7910BaaDN6	DVBX	3	Green	-40 to 125°C	DFN2*2-6	Tape & Reel, 3000

Output Voltage Options

Option Code "aa"	08	09	10	11	12	13	35	15	18	25	27	28	30	33
Voltage	0.8 V	0.9 V	1.0 V	1.1 V	1.2 V	1.3 V	1.35 V	1.5 V	1.8 V	2.5 V	2.7 V	2.8 V	3.0 V	3.3 V

Marking Definition: KAXYW/YWKX/D/DVAX/KBXYW/YWVX/DVBX

KAXYW	KA: product code; X: voltage code; Y: year code; W: week code
YWKX	Y: year code; W: week code; K: product code; X: voltage code
D	D: product code
DVAX	DVA: product code; X: voltage code
KBXYW	KB: product code; X: voltage code; Y: year code; W: week code
YWVX	Y: year code; W: week code; V: product code; X: voltage code
DVBX	DVB: product code; X: voltage code

Voltage Code

Option Code "X"	D	B	E	C	F	S	Y	G	H	J	X	K	M	N
Voltage	0.8 V	0.9 V	1.0 V	1.1 V	1.2 V	1.3 V	1.35 V	1.5 V	1.8 V	2.5 V	2.7 V	2.8 V	3.0 V	3.3 V

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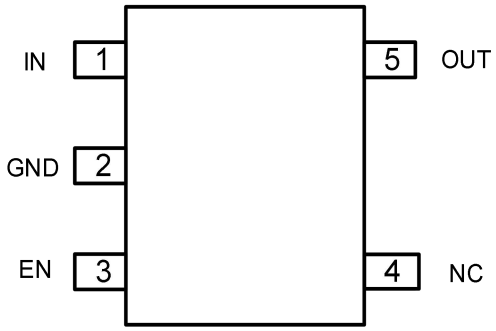
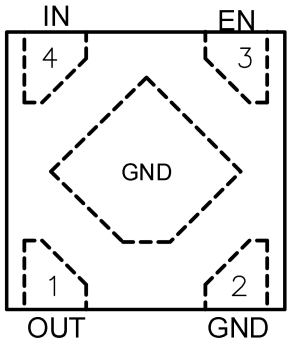
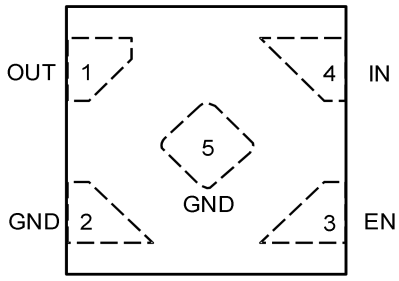
Pin Assignments



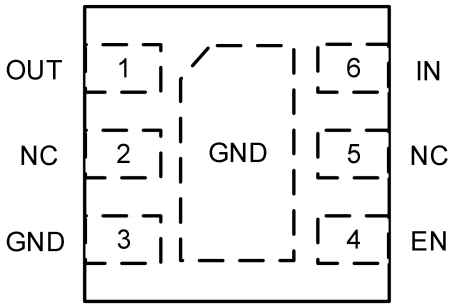
SOT23-5/SC70-5



DFN1*1-4



DFN0.8*0.8-4



DFN2*2-6

Figure 1. Pin assignment (Top view)

Pin Definitions

Pin Name	Description
OUT	Output voltage pin.
EN	Enable pin. This pin has a 100 nA pull-down current source. Connect to logic “High” for normal operation.
GND	Power supply ground.
IN	Input voltage pin.
NC	No connection.

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Absolute Maximum Ratings

Exceeding the maximum ratings listed under Absolute Maximum Ratings when designing is likely to damage the device permanently. Do not design to the maximum limits because long-time exposure to them might impact the device's reliability. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Rating	Unit
V_{IN}	Input voltage	-0.3 to 6.5	V
V_{OUT}	Output voltage	-0.3 to V_{IN}	V
V_{EN}	Chip enable input voltage	-0.3 to V_{IN}	V
I_{OUT}	Output current	300	mA
T_L	Lead temperature range	260	°C
$T_{J(MAX)}$	Operating junction temperature	150	°C
T_{STG}	Storage temperature	-65 to 150	°C
ESD	HBM: JESD22-A114	±8000	V

Recommend Operating Ratings

Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter		Rating	Unit
V_{CC}	Operating supply voltage		1.6 to 5.5	V
T_A	Ambient temperature range		-40 to 125	°C
$R_{\theta JA}$	Junction-to-ambient thermal resistance	SOT23-5	150	°C/W
		DFN1*1-4	250	
		DFN0.8*0.8-4	400	
		SC70-5	307.6	
		DFN2*2-6	96.6	

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Electrical Characteristics

V_{IN} = V_{OUT} + 1 V, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1.0 μF, T_A = -40°C to 125°C , typical values are at T_A = 25°C, unless otherwise specified.

Symbol	Parameter	Condition		Min	Typ	Max	Unit
V_{IN}	Input voltage			1.6		5.5	V
V_{OUT}(1)	Output voltage			0.8		3.3	V
	Output accuracy	V_{OUT} < 2 V, T_A = 25°C		-20		20	mV
		V_{OUT} ≥ 2 V, T_A = 25°C		-1		1	%
I_{LIM}	Output current limit	V_{OUT} = 90% $V_{OUT(NOM)}$			480		mA
V_{DO}	Dropout voltage	V_{OUT} = 0.95 x $V_{OUT(NOM)}$, I_{OUT} = 300 mA	$V_{OUT(NOM)}$ = 0.8 V		950		mV
			$V_{OUT(NOM)}$ = 1.2 V		650		
			$V_{OUT(NOM)}$ = 1.3 V		460		
			$V_{OUT(NOM)}$ = 1.8 V		280		
			$V_{OUT(NOM)}$ = 2.5 V		200		
			$V_{OUT(NOM)}$ = 2.8 V		170		
			$V_{OUT(NOM)}$ = 3.0 V		160		
			$V_{OUT(NOM)}$ = 3.3 V		150		
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line regulation	($V_{OUT(NOM)}$ + 1.0 V) ≤ V_{IN} ≤ 5.5 V			0.02		%/V
$\triangle V_{OUT}$	Load regulation	I_{OUT} = 0 mA to 350 mA, T_A = 25°C				40	mV
I_Q	Quiescent current	No load			25		μA
I_{SC}	Short circuit current	V_{OUT} = 0 V			220		mA
I_{SHDN}	Shut-down current	V_{EN} = 0 V, V_{IN} = 5.5 V			0.1		μA
PSRR	Power supply rejection rate	I_{OUT} = 20 mA	f = 100 Hz		80		dB
			f = 1 kHz		75		dB
			f = 10 kHz		70		dB
			f = 100 kHz		60		dB
			f = 1 MHz		45		dB
V_{IH}	EN pin threshold voltage	EN logic high voltage		1			V
V_{IL}		EN logic low voltage				0.4	V
I_{EN}	EN pull-down current	V_{EN} = 5.5 V			0.1		μA
e_n	Output voltage noise	f = 10 Hz to 100 kHz, V_{OUT} = 1.8 V, I_{OUT} = 1 mA			50		μV_{RMS}
T_{SD}	Thermal shutdown threshold	Shutdown, temperature increasing	I_{OUT} = 1 mA		175		°C
		Reset, temperature decreasing			145		

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R_{DISCH}	Output discharge resistance	V_{EN} ≤ 0.2 V, V_{IN} = 5 V（only DIO7910A）		100		Ω
t_{ON}	Turn-on time	From assertion of V_{EN} to V_{OUT} = 90% $V_{OUT(NOM)}$		120		μs

Note:

(1) It is not recommended to use at 125°C without load.

(2) Specifications subject to change without notice.

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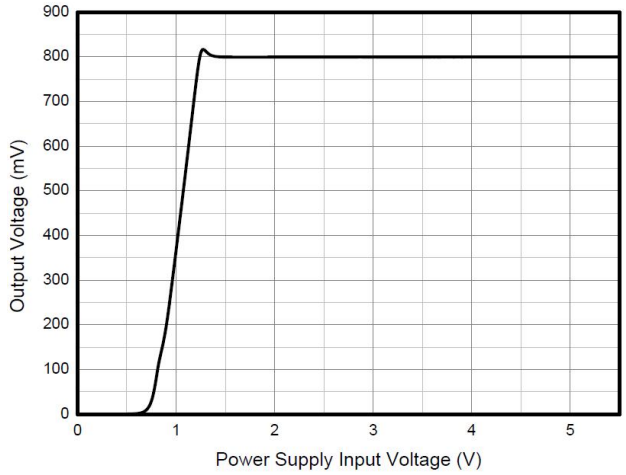
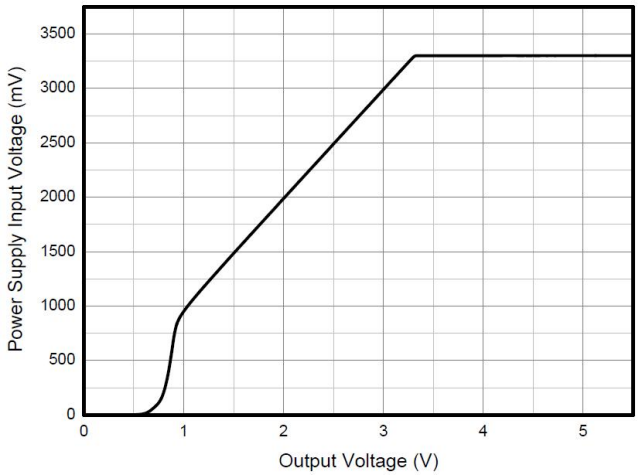
Typical Performance Characteristics



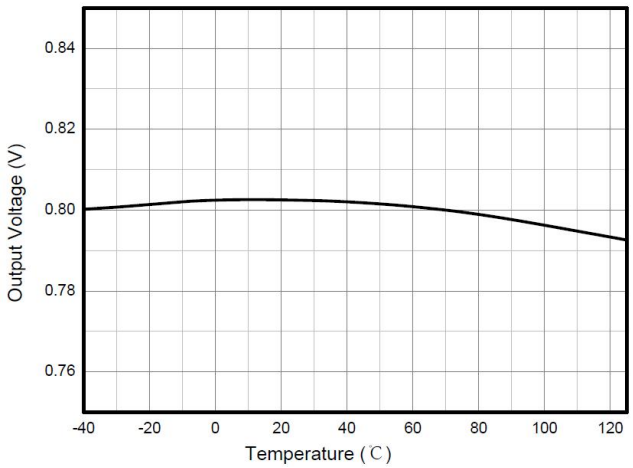
C_{IN} = C_{OUT} = 1 µF, I_{OUT} = 1 mA, V_{OUT} = 0.8 V

Figure 2. Output voltage vs. Input voltage



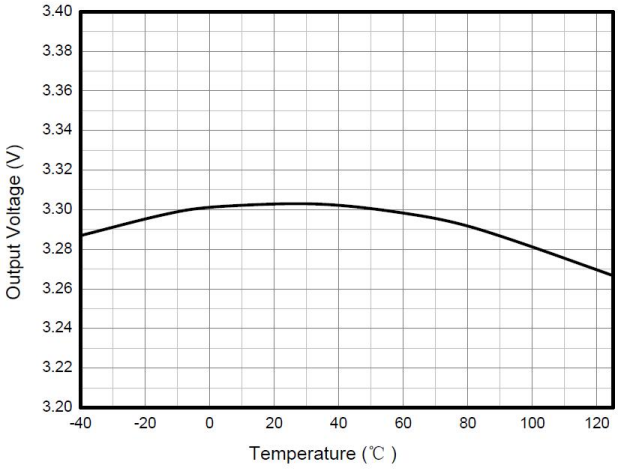
C_{IN} = C_{OUT} = 1 µF, I_{OUT} = 1 mA, V_{OUT} = 3.3 V

Figure 3. Input voltage vs. Output voltage



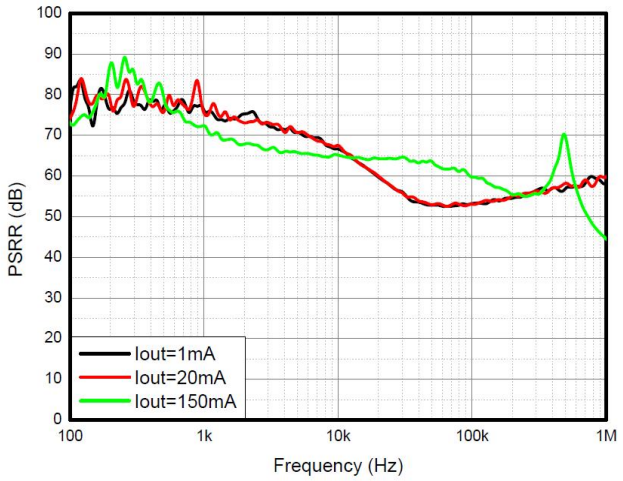
V_{OUT} = 0.8 V, C_{IN} = C_{OUT} = 1 µF, I_{OUT} = 1 mA

Figure 4. Output voltage vs. Temperature



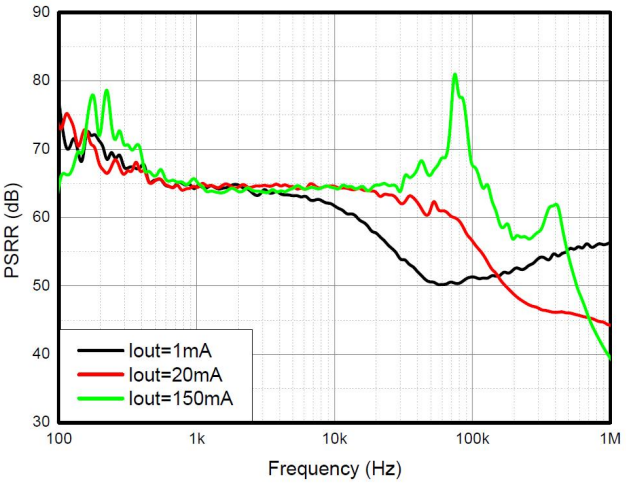
V_{OUT} = 3.3 V, C_{IN} = C_{OUT} = 1 µF, I_{OUT} = 1 mA

Figure 5. Output voltage vs. Temperature



C_{OUT} = 1 µF, V_{IN} = (2.5 V + 200 mVpp), V_{OUT} = 0.8 V

Figure 6. PSRR vs. Frequency



C_{OUT} = 1 µF, V_{IN} = (4.3 V + 200 mVpp), V_{OUT} = 3.3 V

Figure 7. PSRR vs. Frequency

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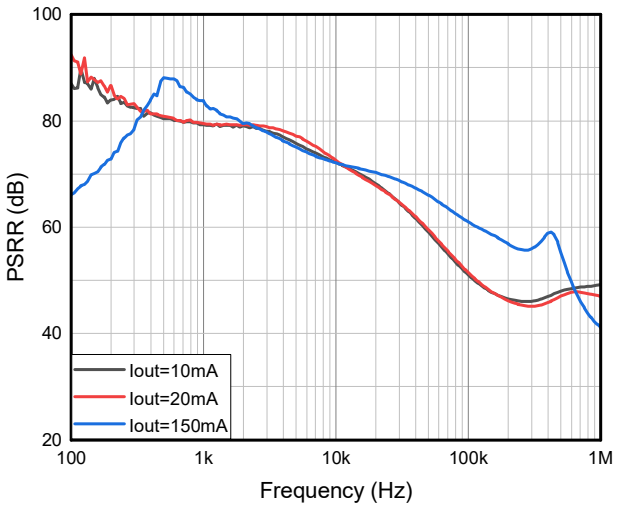
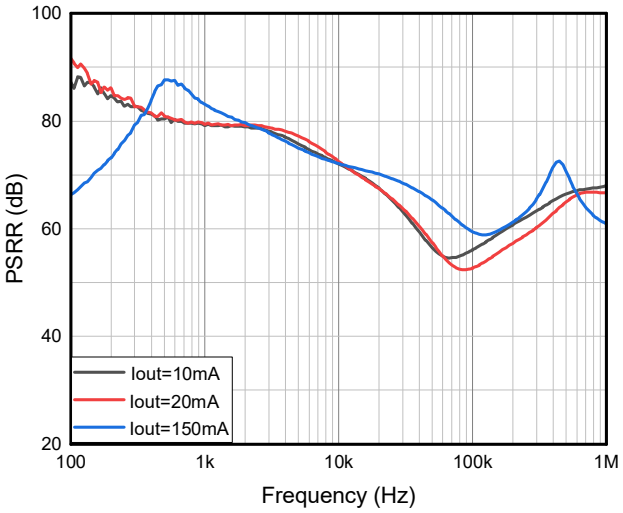


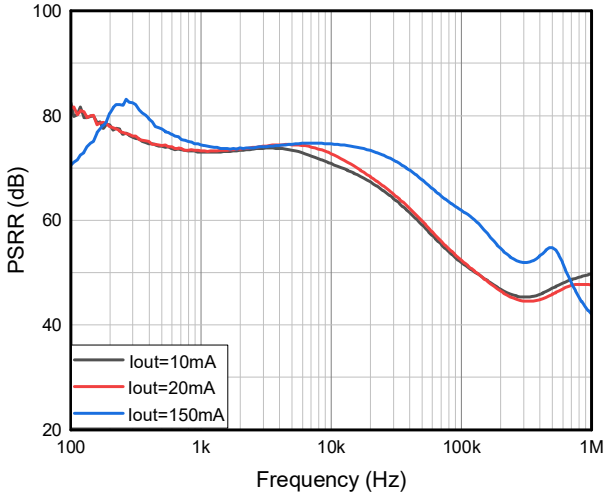
C_{OUT} = 1 µF, V_{IN} = (3 V + 500 mV_{PP}), V_{OUT} = 1.1 V

Figure 8. PSRR vs. Frequency



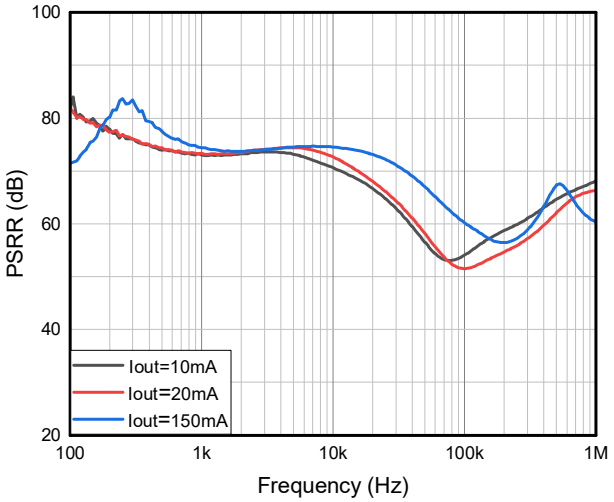
C_{OUT}=10 µF, V_{IN} = (3 V + 500 mV_{PP}), V_{OUT} = 1.1 V

Figure 9. PSRR vs. Frequency



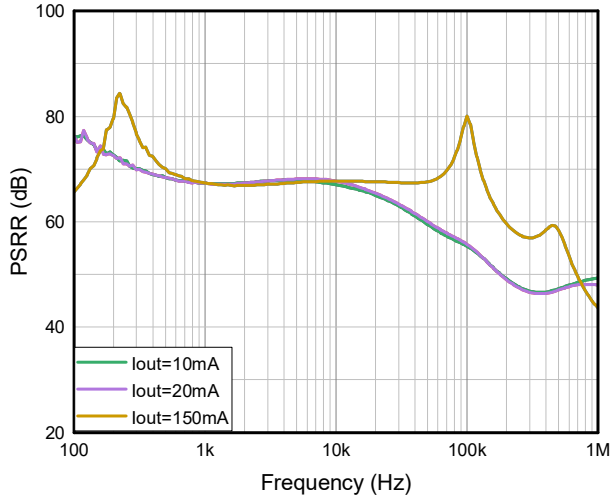
C_{OUT} = 1 µF, V_{IN} = (2.8 V + 500 mV_{PP}), V_{OUT} = 1.8 V

Figure 10. PSRR vs. Frequency



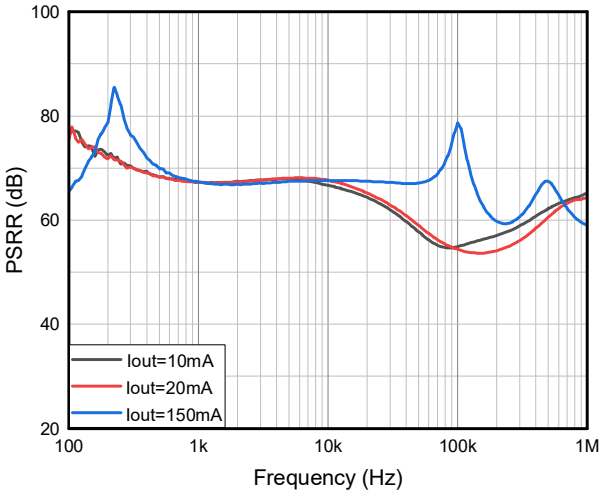
C_{OUT} =10 µF, V_{IN} = (2.8 V + 500 mV_{PP}), V_{OUT} = 1.8 V

Figure 11. PSRR vs. Frequency



C_{OUT} = 1 µF, V_{IN} = (3.8 V + 500 mV_{PP}), V_{OUT} = 2.8 V

Figure 12. PSRR vs. Frequency



C_{OUT} = 10 µF, V_{IN} = (3.8 V + 500 mV_{PP}), V_{OUT} = 2.8 V

Figure 13. PSRR vs. Frequency

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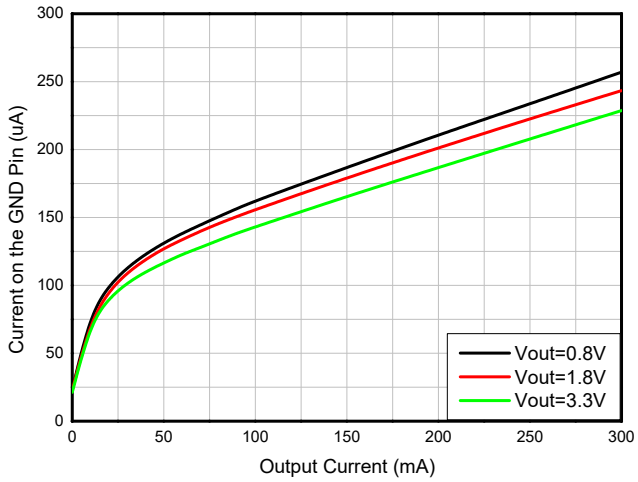
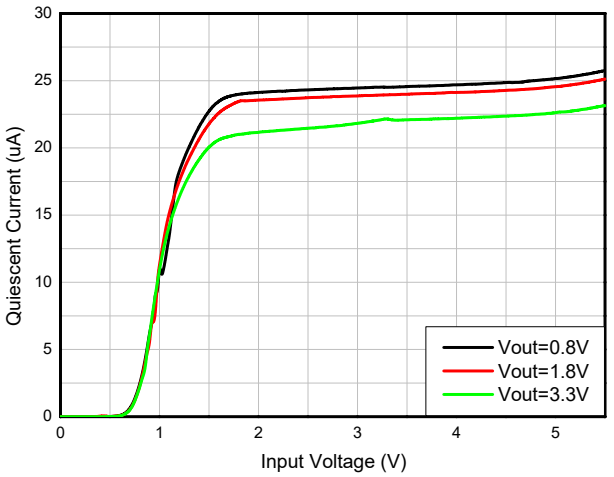


C_{OUT} = 1 µF, V_{IN} = (V_{OUT} + 1 V) or 2.5 V whichever is higher

Figure 14. Current on the GND pin vs. Output current



C_{OUT} = 1 µF, I_{OUT} = 0 mA

Figure 15. Quiescent current vs. Input voltage

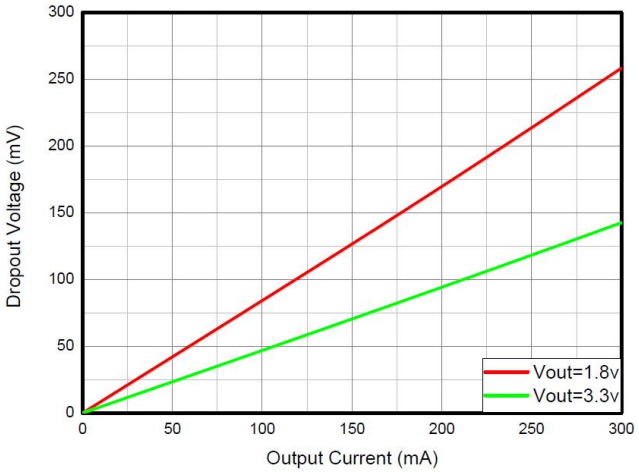
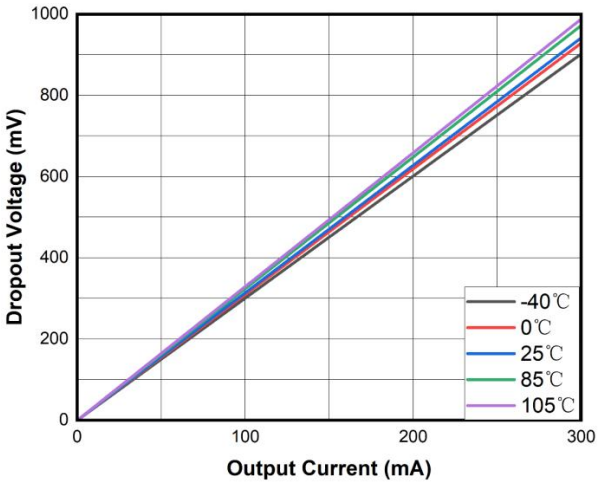
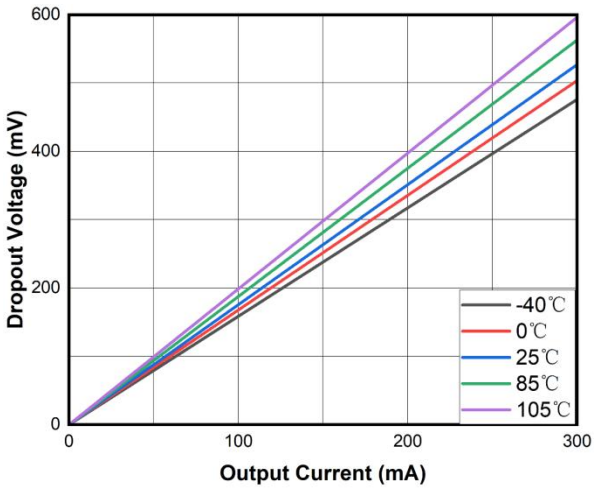


Figure 16. Dropout voltage vs. Output current



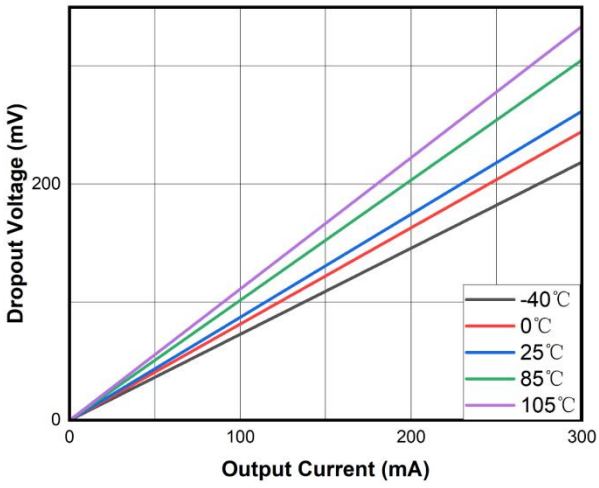
V_{OUT} = 0.8 V, I_L = 300 mA, V_{EN} = 1 V

Figure 17. Dropout voltage vs. Output current



V_{OUT} = 1.2 V, I_L = 300 mA, V_{EN} = 1 V

Figure 18. Dropout voltage vs. Output current



V_{OUT} = 1.8 V, I_L = 300 mA, V_{EN} = 1 V

Figure 19. Dropout voltage vs. Output current

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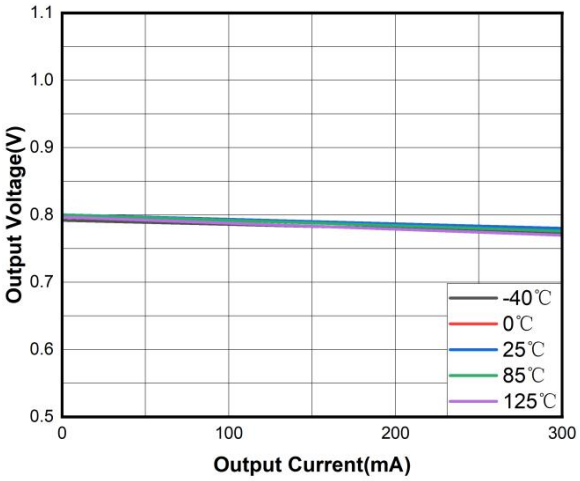
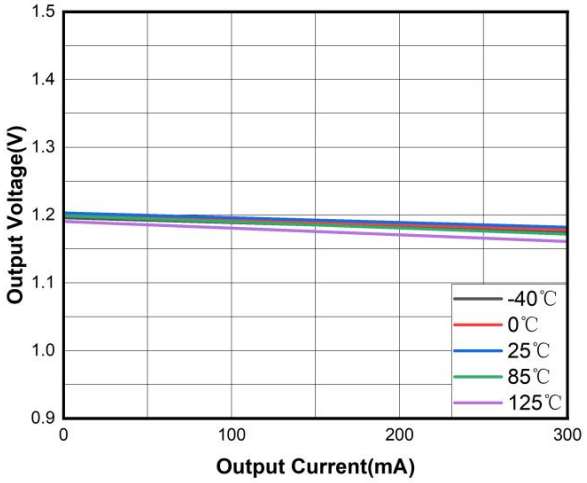


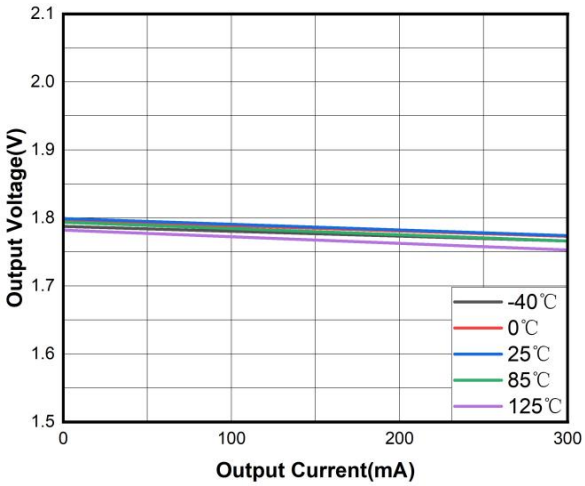
V_{IN} = 2.5 V, V_{OUT} = 0.8 V, V_{EN} = 1 V

Figure 20. Load regulation vs. Output current



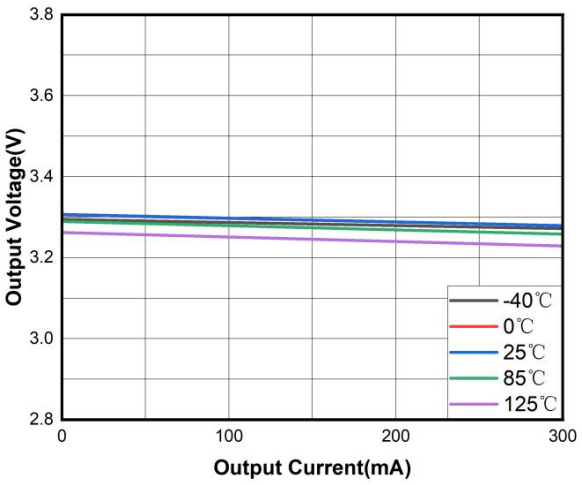
V_{IN} = 2.5 V, V_{OUT} = 1.2 V, V_{EN} = 1 V

Figure 21. Load regulation vs. Output current



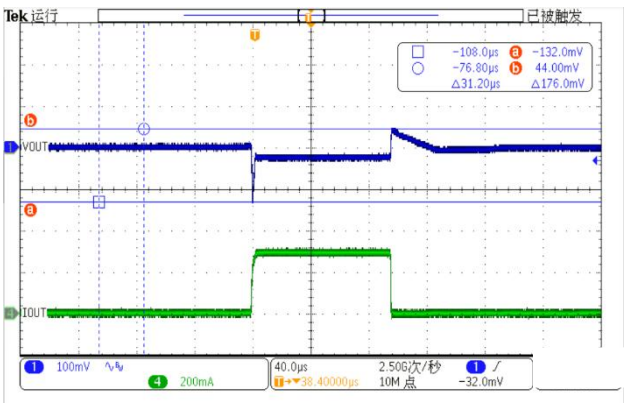
V_{IN} = 2.8 V, V_{OUT} = 1.8 V, V_{EN} = 1 V

Figure 22. Load regulation vs. Output current



V_{IN} = 4.3 V, V_{OUT} = 3.3 V, V_{EN} = 1 V

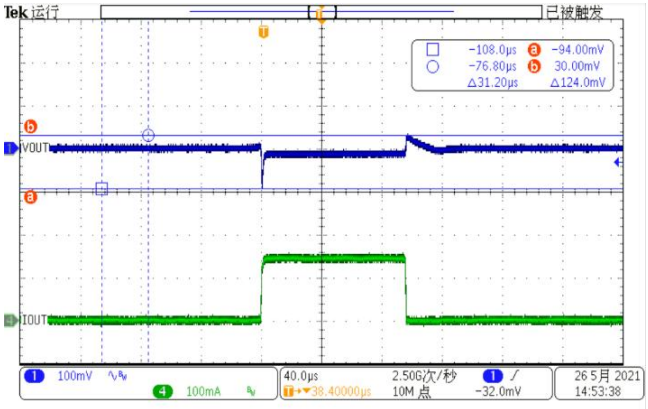
Figure 23. Load regulation vs. Output current



V_{IN} = 2.5 V, V_{OUT} = 0.8 V, C_{IN} = C_{OUT} = 1 µF

Figure 24. Load transient response

at load step from 1 mA to 300 mA, V_{OUT} = 0.8 V



V_{IN} = 2.5 V, V_{OUT} = 0.8 V, C_{IN} = C_{OUT} = 1 µF

Figure 25. Load transient response

at load step from 1 mA to 150 mA, V_{OUT} = 0.8 V

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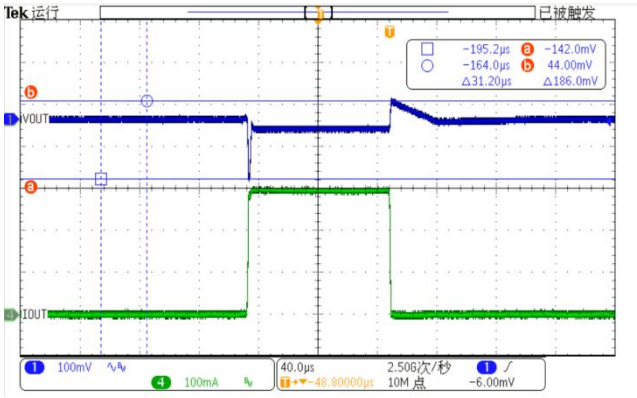
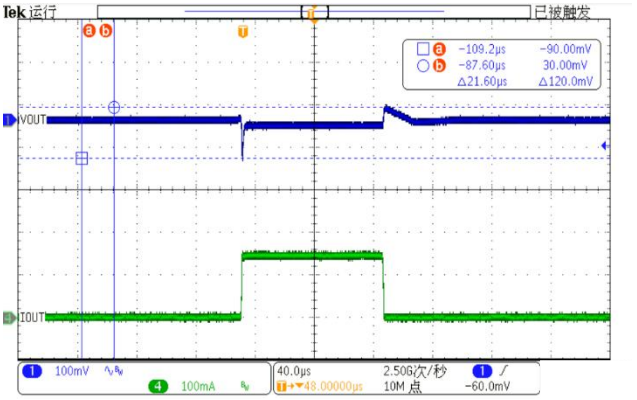


V_{IN} = 4.3 V, V_{OUT} = 3.3 V, C_{IN} = C_{OUT} = 1 µF

Figure 26. Load transient response

at load step from 1 mA to 300 mA, V_{OUT} = 3.3 V



V_{IN} = 4.3 V, V_{OUT} = 3.3 V, C_{IN} = C_{OUT} = 1 µF

Figure 27. Load transient response

at load step from 1 mA to 150 mA, V_{OUT} = 3.3 V

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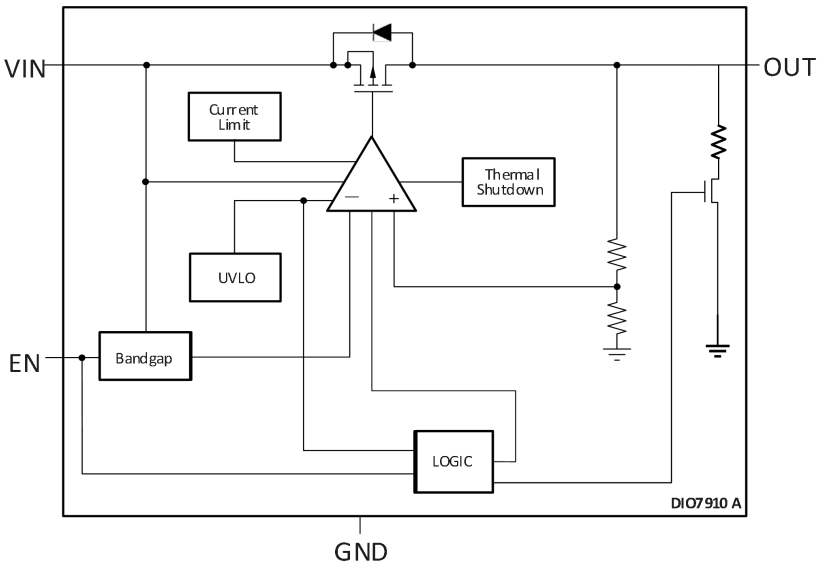
Function Description

Overview

The DIO7910 series of LDO linear regulators is low quiescent current devices with excellent line and load transient performance. These LDOs are designed for power-sensitive applications. A precision bandgap and error amplifier provide overall ±1% accuracy. Low output noise, very high PSRR, and low dropout voltage make this series of devices ideal for most battery-operated handheld equipment. All device versions have integrated thermal shutdown, and current limit.

Block diagram



Internal current limit

The DIO7910 internal current limit helps to protect the regulator during fault conditions. During the current limit, the output sources a fixed amount of current that is largely independent of the output voltage. In such a case, the output voltage is not regulated and $V_{OUT} = I_{CL} \times R_{LOAD}$. The PMOS pass transistor dissipates $(V_{IN} – V_{OUT}) \times I_{CL}$ until the thermal shutdown is triggered and the device turns off. As the device cools down, it is turned on by the internal thermal shutdown circuit. If the fault condition continues, the device cycles between the current limit and thermal shutdown.

Shut down

The enable pin (EN) is active high. The device is enabled when the voltage at the EN pin goes above 1 V. The device is turned off when the EN pin is held at less than 0.4 V. When shutdown capability is not required, EN can be connected to the IN pin.

Dropout voltage

The DIO7910 uses a PMOS pass transistor to achieve low dropout. When $(V_{IN} – V_{OUT})$ is less than the dropout voltage (V_{DO}), the PMOS pass device is in the linear region of operation and the input-to-output resistance is the $R_{DS(on)}$ of the PMOS pass element. V_{DO} scales approximately with the output current because the PMOS device behaves as a resistor in dropout.

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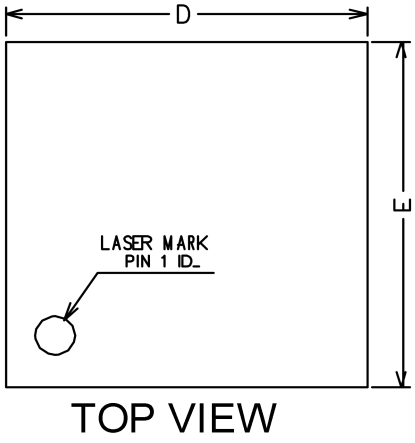
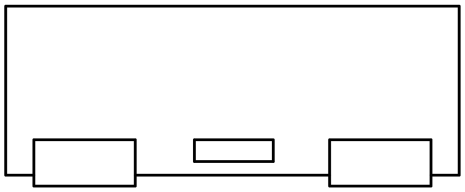
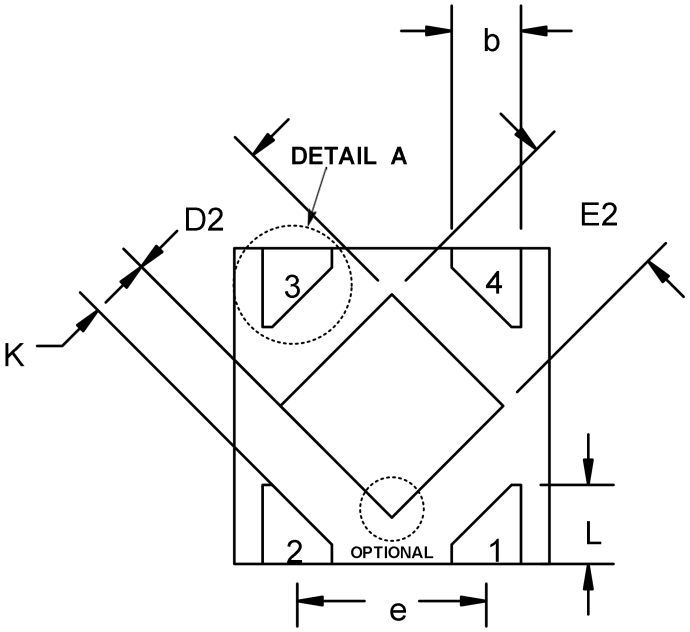
Physical Dimensions: DFN 1*1-4



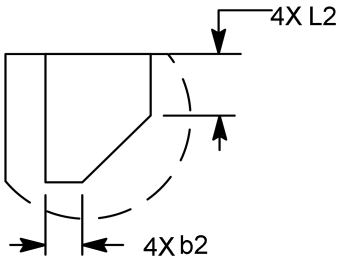
TOP VIEW



SIDE VIEW

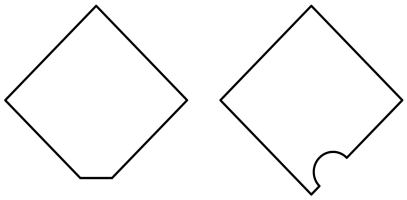


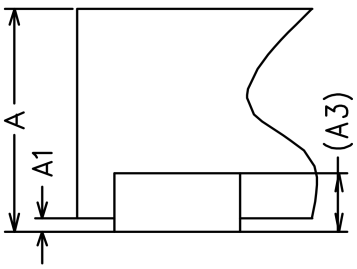
BOTTOM VIEW

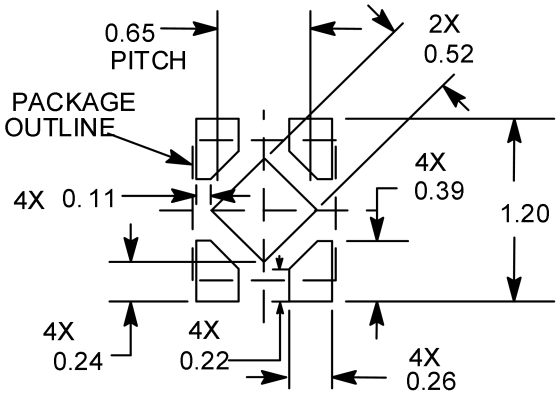


DETAIL A

Two options:







RECOMMENDED LAND PATTERN (Unit: mm)

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Physical Dimensions: DFN 1*1-4

Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.34	0.37	0.40
A1	0	0.02	0.05
A3		0.10 REF	
b	0.17	0.22	0.27
D	0.95	1.00	1.05
E	0.95	1.00	1.05
D2	0.43	0.48	0.53
E2	0.43	0.48	0.53
L	0.20	0.25	0.30
e	0.60	0.65	0.70
K	0.15	-	-
L2	0.07	0.12	0.17
b2	0.02	-	0.12

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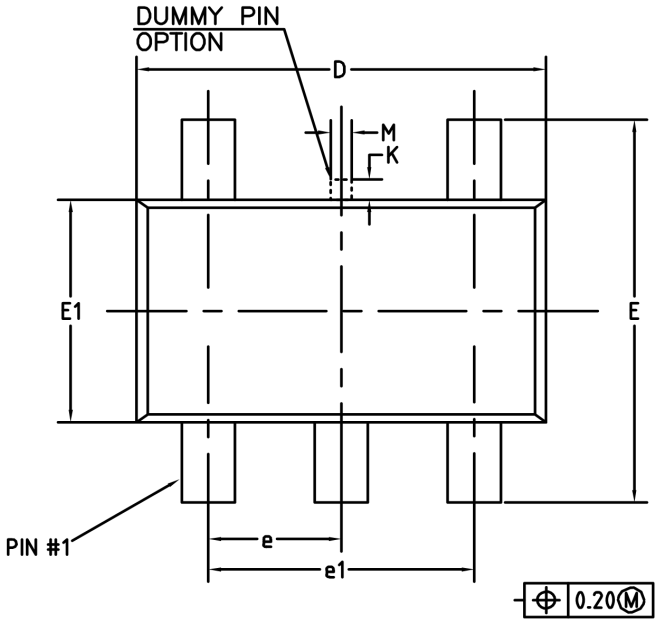
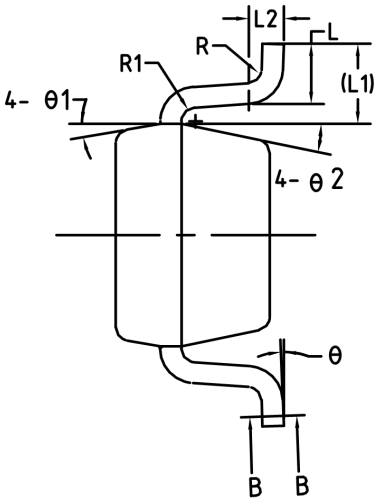
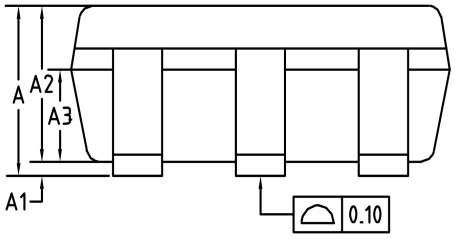
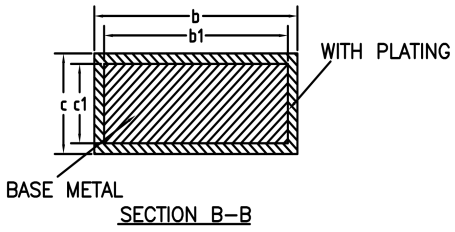
Physical Dimensions: SOT23-5









Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Typ**	**Max**
A	-	-	1.25
A1	0	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	-	0.45
b1	0.35	0.38	0.41
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e 1	1.80	1.90	2.00
K	0	-	0.25
L	0.30	0.40	0.60
L1	0.59 REF		
L2	0.25 BSC		
M	0.10	0.15	0.25
R	0.05	-	0.20
R1	0.05	-	0.20
Θ	0°	-	8°
Θ1	8°	10°	12°
Θ2	10°	12°	14°

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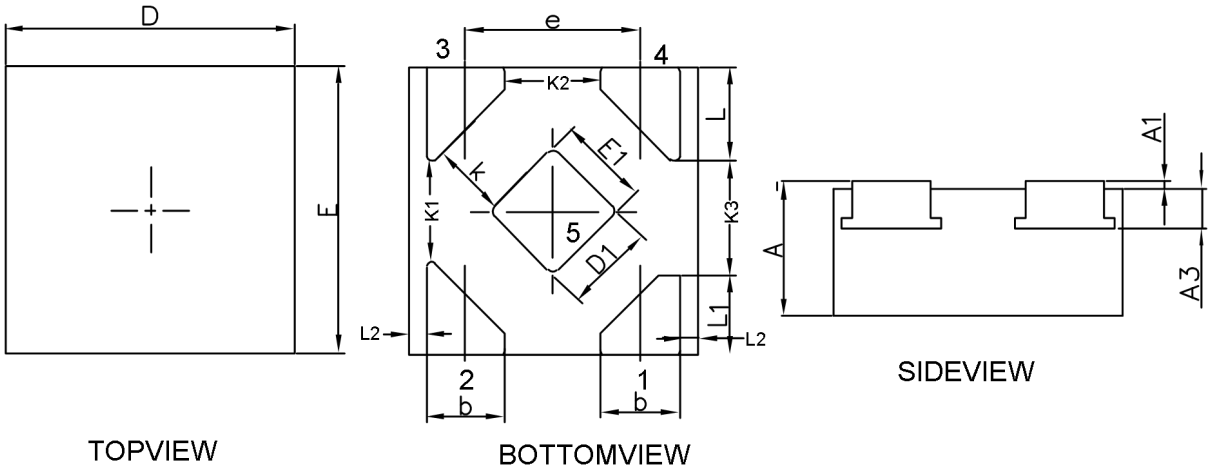
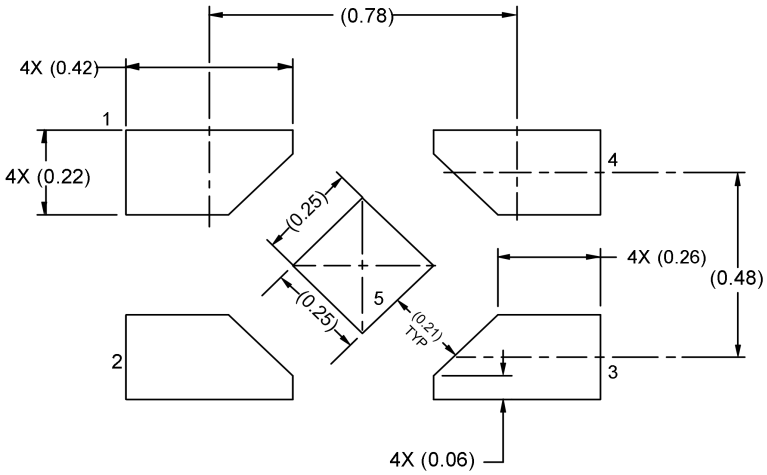
Physical Dimensions: DFN0.8*0.8-4





RECOMMENDED LAND PATTERN (Unit: mm)

Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.320	0.375	0.400
A1	0.000	0.020	0.050
A3		0.110 REF	
D	0.750	0.800	0.850
E	0.750	0.800	0.850
D1	0.200	0.250	0.300
E1	0.200	0.250	0.300
K		0.210 TYP	
K1		0.270 TYP	
K2		0.260 TYP	
K3		0.315 TYP	
b	0.170	0.220	0.270
e		0.480 TYP	
L	0.210	0.265	0.320
L1	0.170	0.220	0.270
L2		0.050 TYP	

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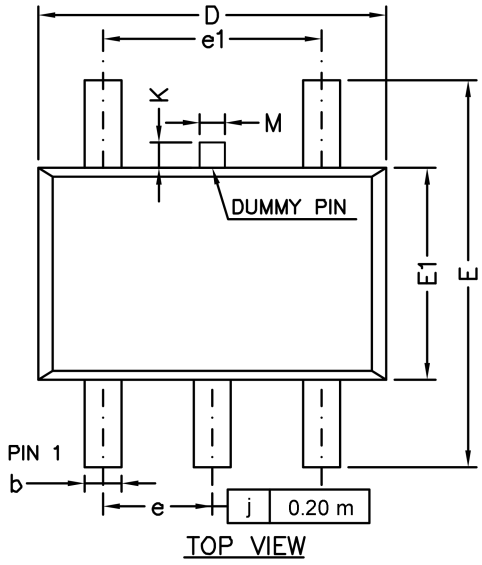
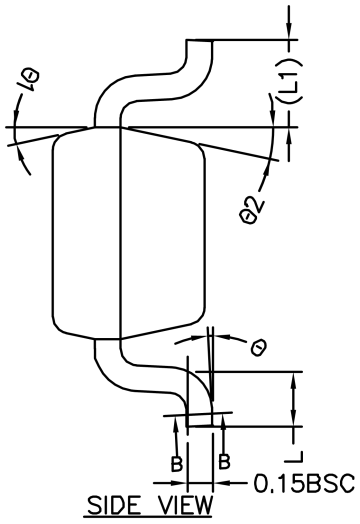
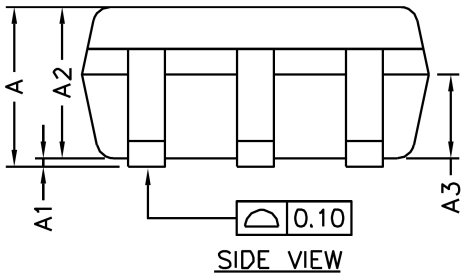
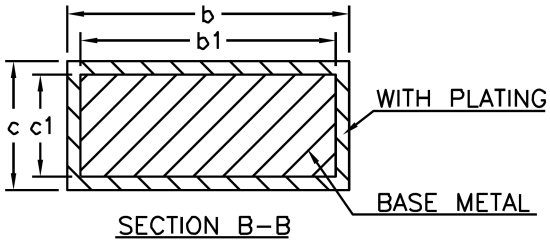
Physical Dimensions: SC70-5









Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.80	-	1.10
A1	0	-	0.10
A2	0.80	0.90	1.00
A3	0.40	0.50	0.60
b	0.17	-	0.30
b1	0.17	0.22	0.25
c	0.12	-	0.20
c1	0.12	0.15	0.16
D	2.02	2.07	2.12
E	2.20	2.30	2.40
E1	1.21	1.26	1.31
e	0.60	0.65	0.70
e1	1.20	1.30	1.40
L	0.26	0.33	0.46
L1	0.52 REF		
M	0.10	0.15	0.20
K	0	-	0.20
Θ	0°	-	8°
Θ1	10°	12°	14°
Θ2	10°	12°	14°

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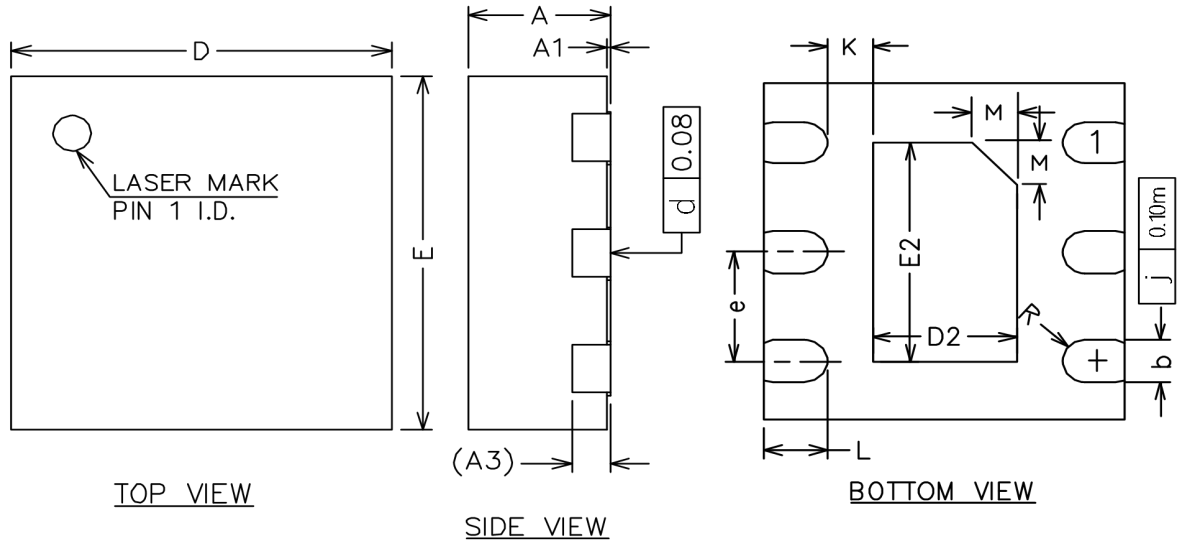
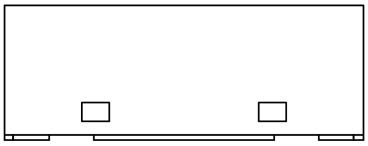
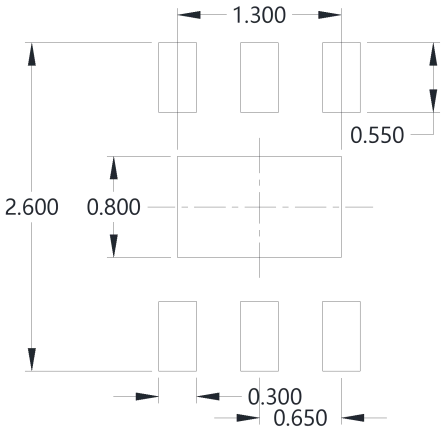
Physical Dimensions: DFN2*2-6





SIDE VIEW

Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3		0.20 REF	
b	0.20	0.25	0.30
D	1.90	2.00	2.10
E	1.90	2.00	2.10
D2	0.70	0.80	0.90
E2	1.20	1.30	1.40
e	0.55	0.65	0.75
K	0.15	0.25	0.35
L	0.30	0.35	0.40
M		0.25 REF	
R		0.13 REF	



RECOMMENDED LAND PATTERN (Unit:mm)

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