

Features

- Low Supply Current ~ 45uA (per circuit)
- Low Shutdown Current ~0.1uA (Typ.)
- Output Current ~150mA
- High Power Supply Rejection Ratio ~75db@1KHz
- 2~5.5V Operation
- $\pm 1.0\%$ Initial Voltage Accuracy
- Low Temperature Drift Coefficient ~50ppm/°C
- Line Regulation ~0.02%/V(Typ.)
- Low ESR Capacitor ~1uF ceramic capacitor
- WDFN6-1.6x1.6、TDFN6-1.8x2 and SOT-23-6 package
- Green Product (RoHS, Lead-Free, Halogen-Free Compliant)

Applications

- Portable communication equipment
- Notebook Computer
- Battery Powered Systems

General Description

The GS7128 is a CMOS linear regulator. It is featuring ultra-high power supply rejection ratio, low output voltage noise, low dropout voltage, low quiescent current and fast transient response. It guarantees delivery of 150mA output current, and supports preset 1.2V, 1.3V, 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.3V output voltage versions.

Based on its low quiescent current consumption and its less than 1uA shutdown mode, the GS7128 is ideal for battery- powered applications. The high power supply rejection ratio of the GS7128 holds well for low input voltages typically encountered in battery- operated systems. The regulator is stable with small ceramic capacitive loads (1uF typical).

Typical Application

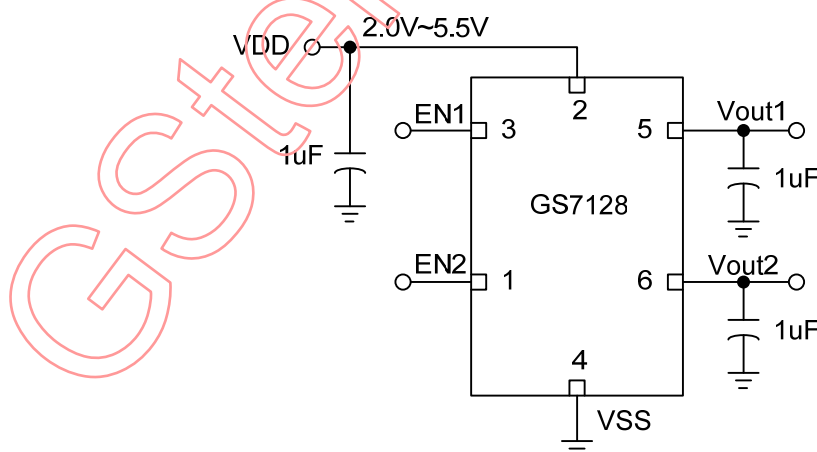


Figure 1 Typical Application of GS7128

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Function Block Diagram

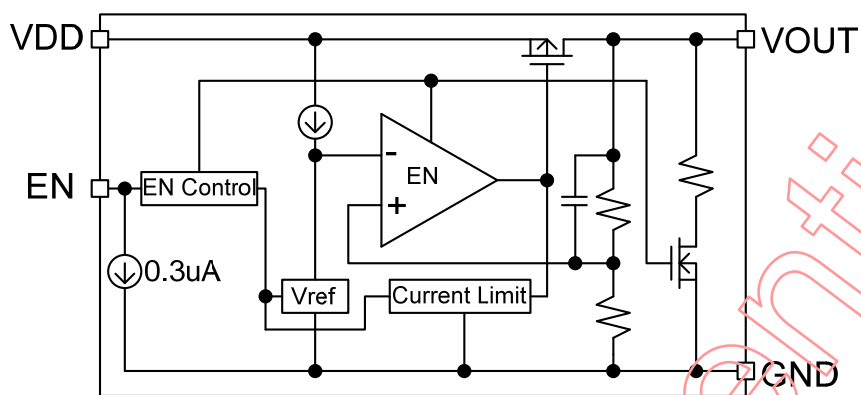


Figure 2(a) with auto discharge function (GS7128)

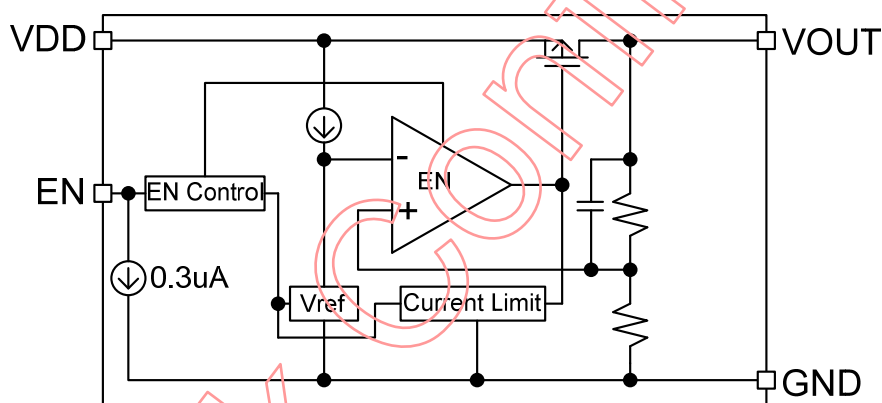
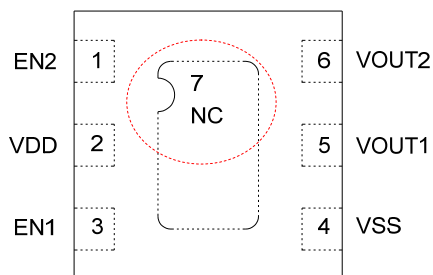


Figure 2(b) without auto discharge function (GS7128A)

Figure 2 Function Block Diagram

Pin Configuration



“Pin7 do not connect to other wires or land patterns”

Figure 3a WDFN6-1.6x1.6 Package

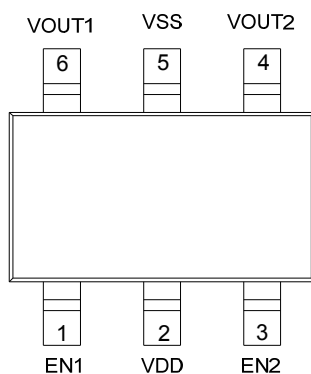


Figure 3b SOT-23-6 Package

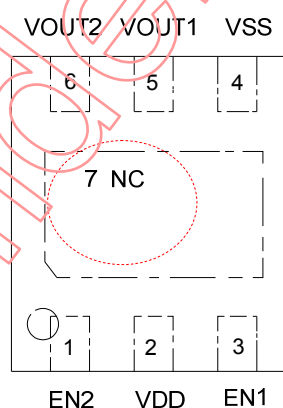
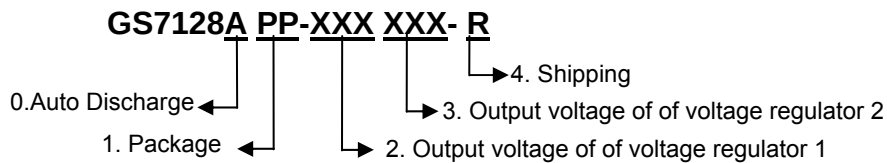


Figure 3c TDFN6-1.8x2 package

Pin Descriptions

No			Name	I/O type	Description
WDFN6-1.6x1.6	SOT-23-6	TDFN6-1.8x2			
1	3	1	EN2	I	Enable Pin 2
2	2	2	VDD	I	Input Voltage Pin
3	1	3	EN1	I	Enable Pin 1
4	5	4	VSS	I/O	Ground pin
5	6	5	VOUT1	O	Output Voltage Pin1
6	4	6	VOUT2	O	Output Voltage Pin2
7		7	NC		NC pin

Ordering Information



No	Item	Contents
0	Auto Discharge	Unmarked: Auto Discharge A: Without Auto Discharge
1	Package	UD:WDFN6-1.6x1.6 ST: SOT-23-6 TD:TDFN6-1.8x2
2	Output voltage of of voltage regulator 1	1P2: 1.2V, 1P3: 1.3V, 1P5: 1.5V, 1P8: 1.8V, 2P5: 2.5V, 2P8: 2.8V, 3P0: 3.0V, 3P3: 3.3V
3	Output voltage of of voltage regulator 2	1P2: 1.2V, 1P3: 1.3V, 1P5: 1.5V, 1P8: 1.8V, 2P5: 2.5V, 2P8: 2.8V, 3P0: 3.0V, 3P3: 3.3V
4	Shipping	R: Tape & Reel

Example: GS7128 SOT-23-6 1.8V and 2.8V Tape & Reel ordering information is "GS7128ST-1P82P8-R"

Absolute Maximum Rating (Note 1)

Parameter	Symbol	Limits	Units
V _{IN} to GND	V _{IN}	-0.3 < V _{IN} < 6	V
V _{EN} to GND	V _{EN}	-0.3 < V _{EN} < 6	V
Output Voltage	V _{OUT}	-0.3 < V _{OUT} < V _{IN} +0.3	V
Output Current	I _{OUT}	150	mA
Package Power Dissipation at T _a ≤ 25°C	P _{D_WDFN6-1.6x1.6}	560	mW
Package Power Dissipation at T _a ≤ 25°C	P _{D_SOT-23-6}	420	mW
Package Power Dissipation at T _A ≤ 25°C	P _{D_TDFN6-1.8x2}	880	mW
Junction Temperature	T _J	- 45 ~ 150	°C
Storage Temperature	T _{STG}	- 65 ~ 150	°C
Lead Temperature (Soldering) 10S	T _{LEAD}	260	°C
ESD (Human Body Mode) (Note 2)	V _{ESD_HBM}	2K	V
ESD (Machine Mode) (Note 2)	V _{ESD_MM}	200	V

Thermal Information (Note 3)

Parameter	Symbol	Limits	Units
Thermal Resistance Junction to Ambient	$\theta_{JA_WDFN6-1.6 \times 1.6}$	179	°C/W
Thermal Resistance Junction to Ambient	$\theta_{JA_SOT-23-6}$	238	°C/W
Thermal Resistance Junction to Ambient	$\theta_{JA_TDFN6-1.8 \times 2}$	114	°C/W

Recommend Operating Condition (Note 4)

Parameter	Symbol	Limits	Units
VIN to GND	V_{IN}	2.0 to 5.5	V
Junction Temperature	T_J	-40 ~ 125	°C
Ambient Temperature	T_A	-40 ~ 85	°C

Electrical Characteristics

($V_{IN} = V_{OUT} + 1V$, $T_A = T_J = 25^\circ C$, $C_{IN} = C_L = 1\mu F$, $I_{OUT} = 1mA$, unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Voltage Section						
Supply Voltage	V_{IN}		2.0		5.5	V
Supply Current (per circuit)	I_{VIN}	Unload		45	60	uA
Standby Current	I_{STBY}	$V_{EN}=0$ or $V_{EN}=V_{IN}$		0.1	1	uA
EN Input Current	I_{EN}	$V_{EN}=5.5V$		0.3		uA
Output Current	I_{OUT}	$V_{DD} \geq V_{OUT} + 1V$	150			mA
Output Section						
Output Voltage	V_{OUT}	$T_A = 25^\circ C$	$V_{OUT} > 2.0V$	x0.99		x1.01 V
			$V_{OUT} \leq 2.0V$	-20		20 mV
		$T_A = -40^\circ C$ to $+85^\circ C$	$V_{OUT} > 2.0V$	x0.985		x1.015 V
			$V_{OUT} \leq 2.0V$	-30		30 mV
Dropout Voltage (Note 5)	V_{DROP}	$I_{OUT} = 100mA$	$V_{OUT} = 1.2V$		0.44	V
			$V_{OUT} = 1.5V$		0.31	
			$V_{OUT} = 2.5V$		0.17	
			$V_{OUT} = 2.8V$		0.15	
			$V_{OUT} = 3.3V$		0.13	
Line Regulation	ΔV_{LNR}	$V_{IN} = V_{OUT} + 0.5V$ to $5.5V$, $I_{OUT} = 1mA$		0.05	0.20	%/V

Load Regulation	ΔV_{LDR}	$V_{IN} = V_{OUT} + 1V$, $I_{OUT} = 1mA \text{ to } 150mA$		20	40	mV
Ripple Rejection Rate	PSRR	$V_{IN} = \text{MAX}\{V_{OUT} + 1.0V, 3V\}$, Ripple 0.2Vp-p, $I_{OUT} = 30mA$, $f = 1KHz$		75		dB
Limit Current	I_{LIMIT}	$V_{IN} = 3.5V$		260		mA
Short Current	I_{SHORT}	$V_{OUT} = 0V$, $V_{IN} = 3.5V$		50		mA
EN Input Voltage High	V_{ENH}		1.2			V
EN Input Voltage Low	V_{ENL}				0.3	V
CL Auto-Discharge Resistance (GS7128) (Note 6)	Rdischg	$V_{IN} = 4.0V$, ($V_{EN} = 0V$ or $V_{EN} = V_{IN}$)		267		Ω
Temperature Drift	$\Delta V_{OUT} / \Delta T_A$	$I_{OUT} = 1mA$, $T_A = -40^\circ C \text{ to } +85^\circ C$		50		ppm/ $^\circ C$

Note 1. Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2. Devices are ESD sensitive. Handling precaution recommended.

Note 3. θ_{JA} is measured in the natural convection at $T_A = 25^\circ C$ on a high effective thermal conductivity test board (4 Layers, 2S2P) of JEDEC 51-7 thermal measurement standard.

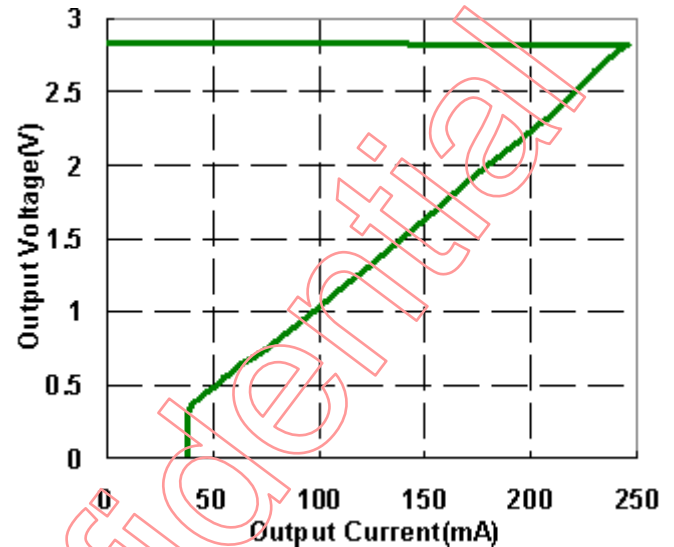
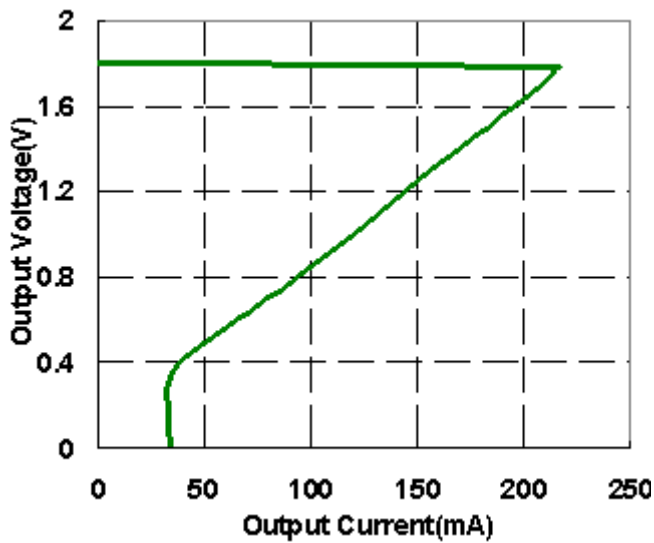
Note 4. The device is not guaranteed to function outside its operating conditions.

Note 5. The dropout voltage is defined as $V_{IN} - V_{OUT}$, which is measured when V_{OUT} is 98%* V_{OUT} .

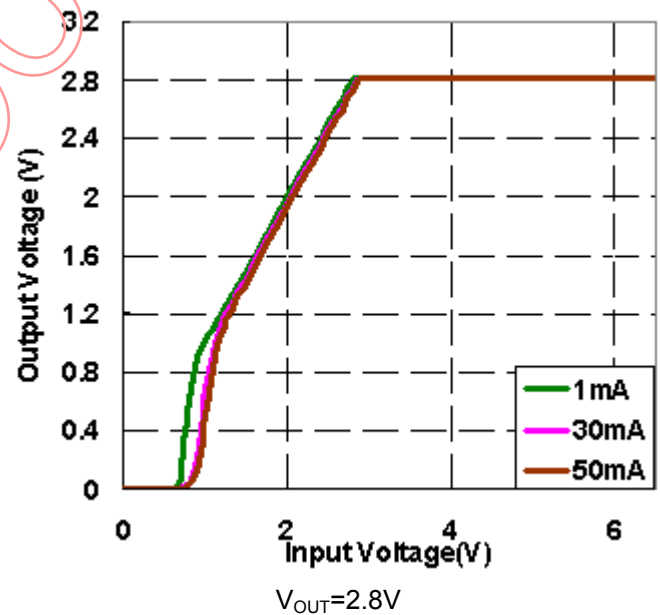
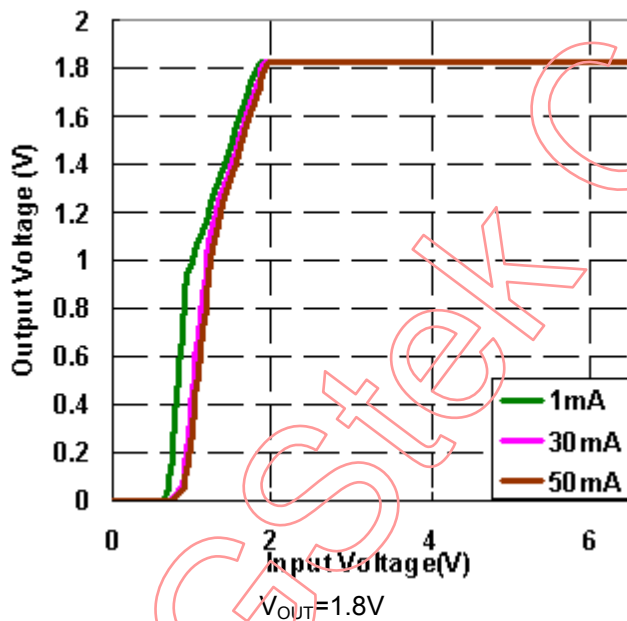
Note 6. GS7128: with auto discharge function, GS7128A: without auto discharge function.

Typical Characteristics

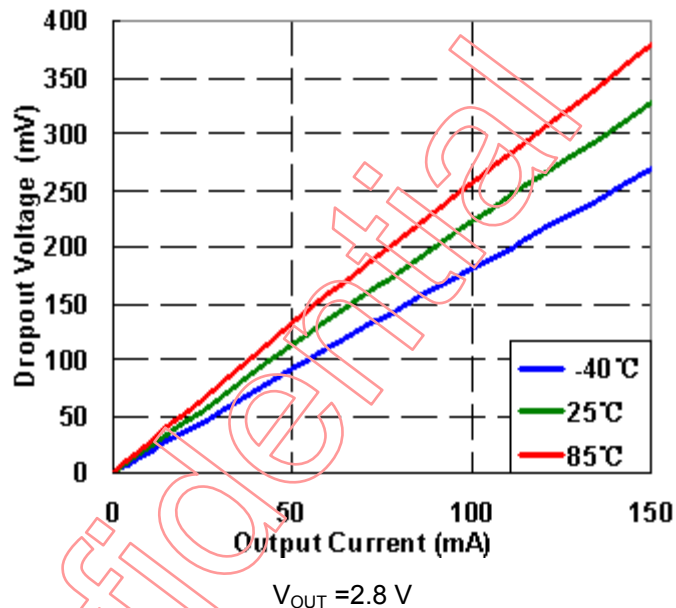
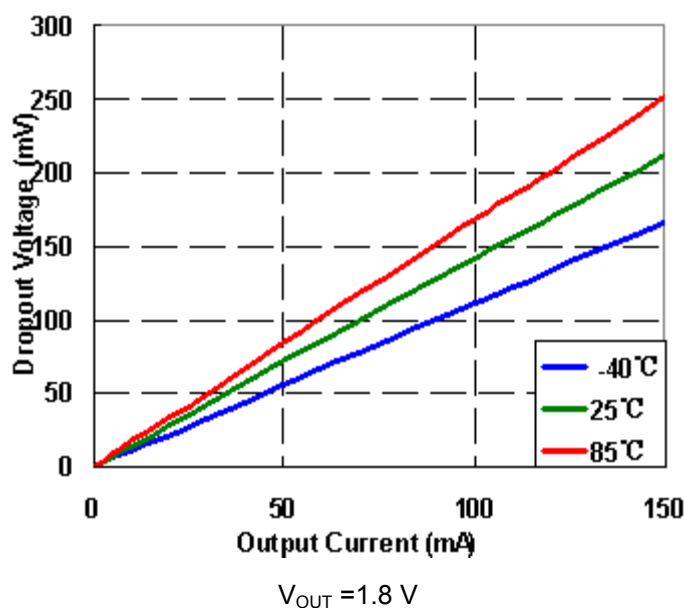
Output Voltage vs. Output Current (C1=1.0uF, C2=1.0uF, Temp=25°C)



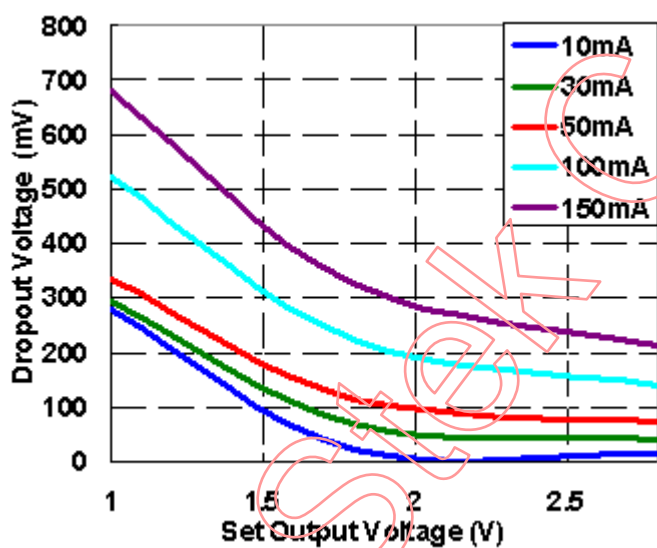
Output Voltage vs. Input Voltage (C1=1.0uF, C2=1.0uF, Temp=25°C)



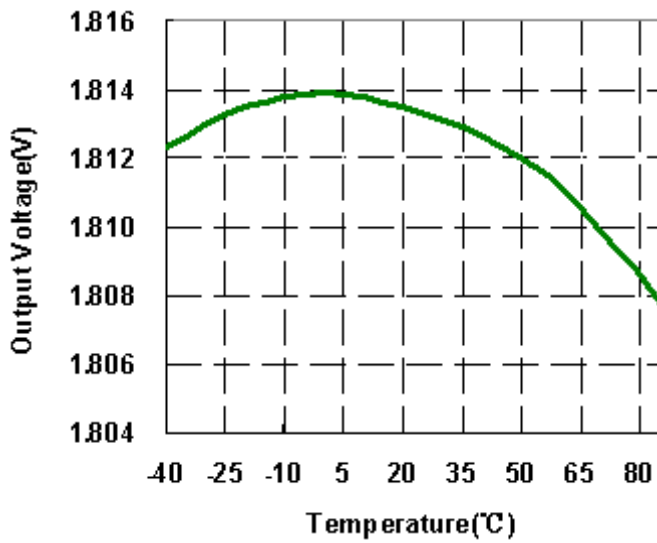
Dropout Voltage vs. Output Current (C1=1.0uF, C2=1.0uF, Temp=25°C)



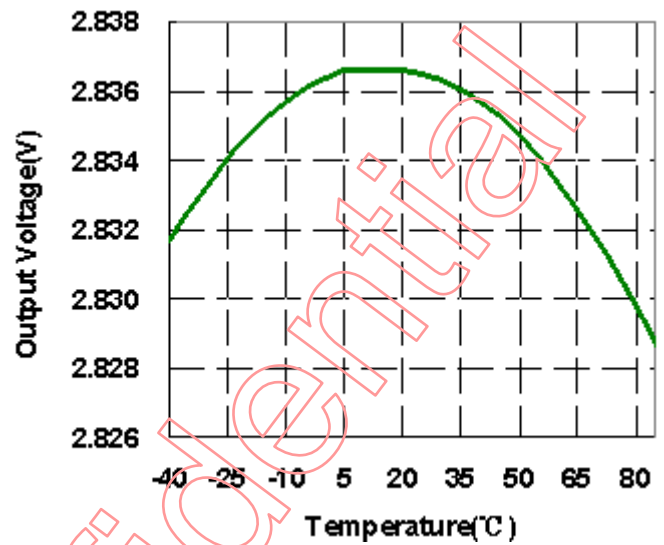
Dropout Voltage vs. Set Output Voltage (C1=1.0uF, C2=1.0uF, Temp=25°C)



Output Voltage vs. Temperature (C1=1.0uF, C2=1.0uF, Iout=0mA)

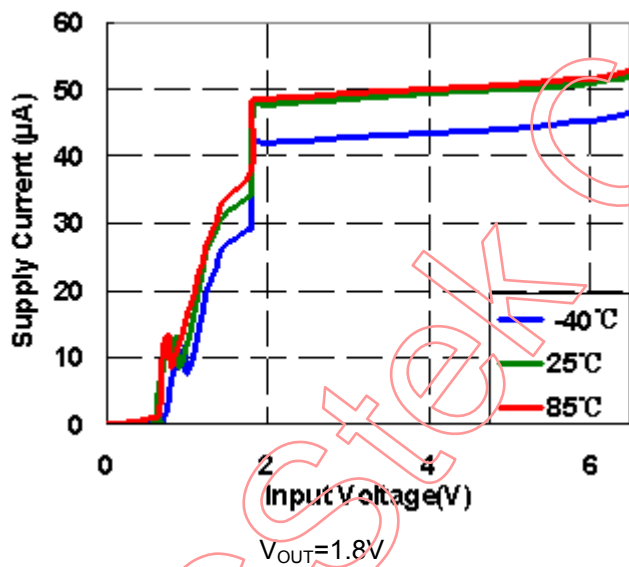


V_{OUT}=1.8 V, V_{DD}=2.8V

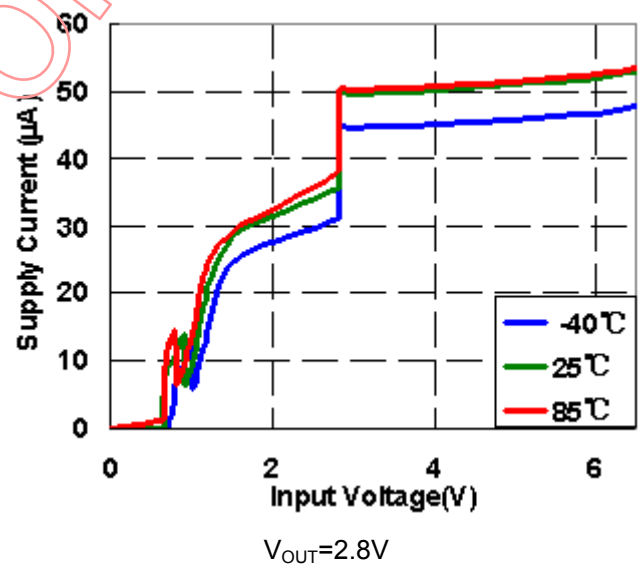


V_{OUT}=2.8V, V_{DD}=3.8V

Current Consumption vs. Input Voltage (C1=1.0uF, C2=1.0uF, Iout=0mA)

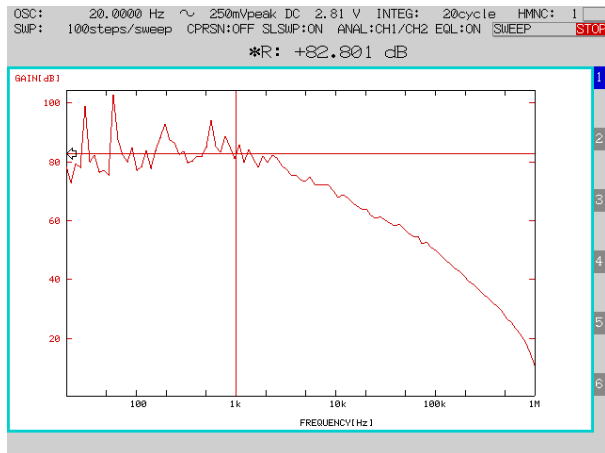


V_{OUT}=1.8V

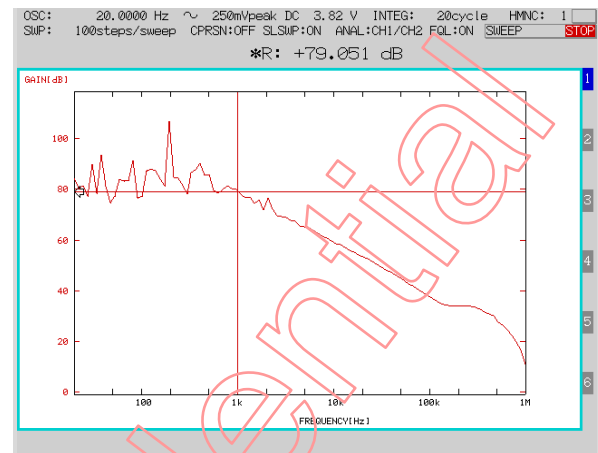


V_{OUT}=2.8V

Ripple Rejection ($C1=1.0\mu F$, $C2=1.0\mu F$, $I_{OUT}=1mA$, $Temp=25^{\circ}C$)



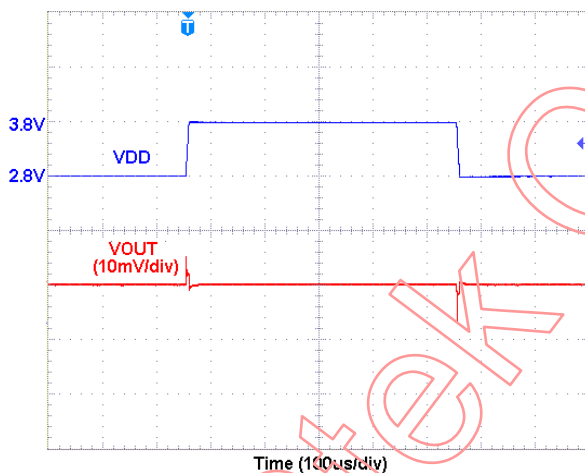
$V_{OUT}=1.8V, V_{DD}=2.8V$



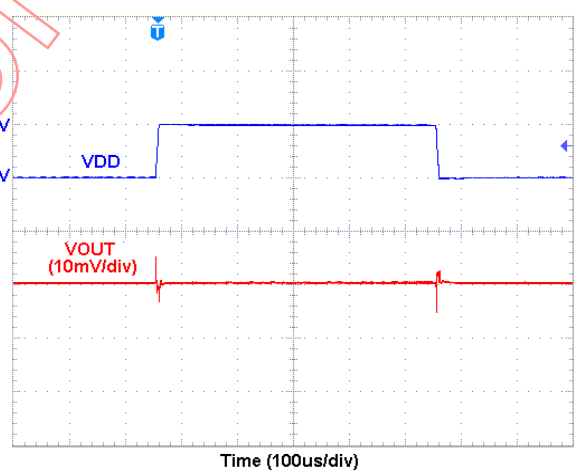
$V_{OUT}=2.8V, V_{DD}=3.8V$

Transient Response Characteristics when Input Common to Vr1 and Vr2 ($C1=1.0\mu F$, $C2=1.0\mu F$,

$I_{OUT}=30mA$, $Temp=25^{\circ}C$, $t_{r/f}=5.0\mu s$)

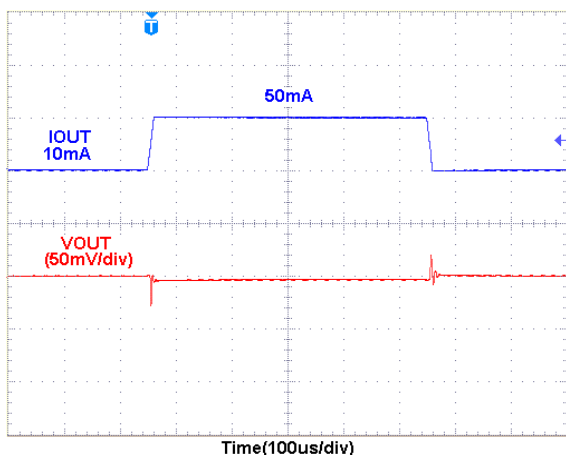


$V_{OUT}=1.8V, V_{DD}=2.8V \sim 3.8V \sim 2.8V$

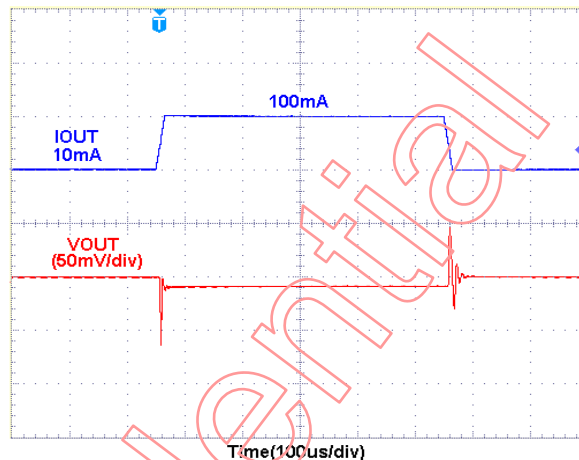


$V_{OUT}=2.8V, V_{DD}=3.8V \sim 4.8V \sim 3.8V$

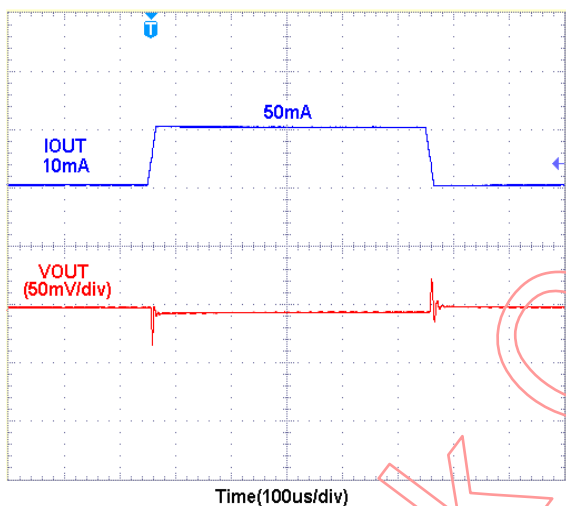
Transient Response Characteristics of load (C1=1.0uF, C2=1.0uF, Temp=25°C, tr=tf=5.0us)



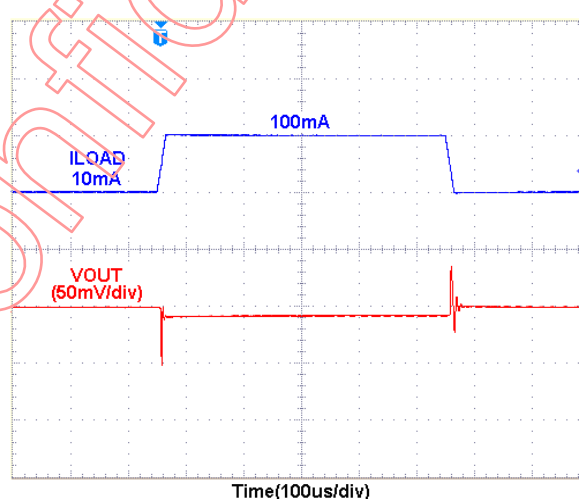
$V_{OUT} = 1.8V$, $V_{DD} = 2.8V$



$V_{OUT} = 1.8V$, $V_{DD} = 2.8V$

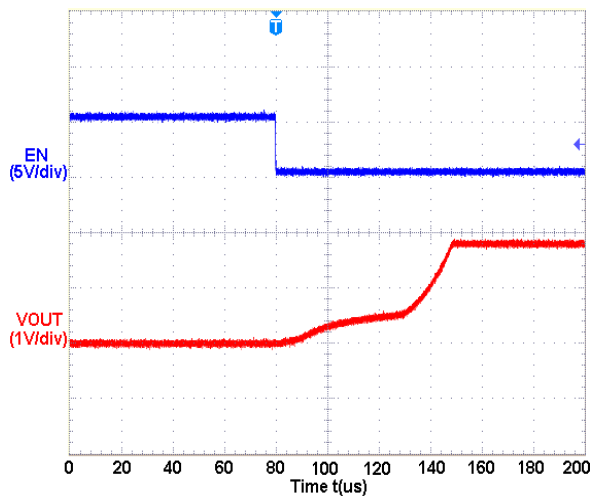


$V_{OUT} = 2.8V$, $V_{DD} = 3.8V$

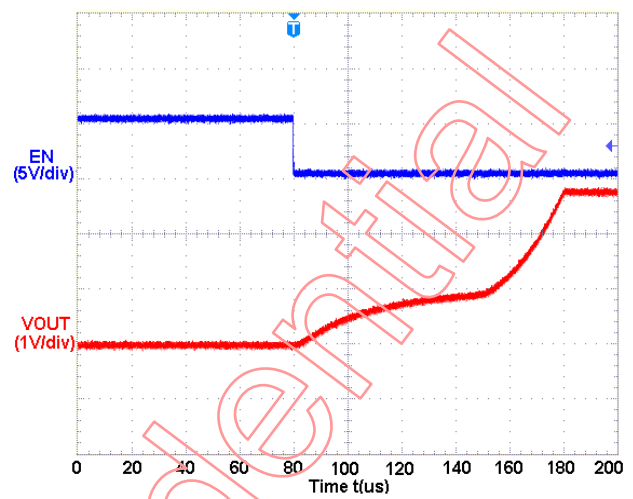


$V_{OUT} = 2.8V$, $V_{DD} = 3.8V$

Transient Response Characteristics of ON/OFF Pin ($C_1=1.0\mu\text{F}$, $C_2=1.0\mu\text{F}$, Temp= 25°C)

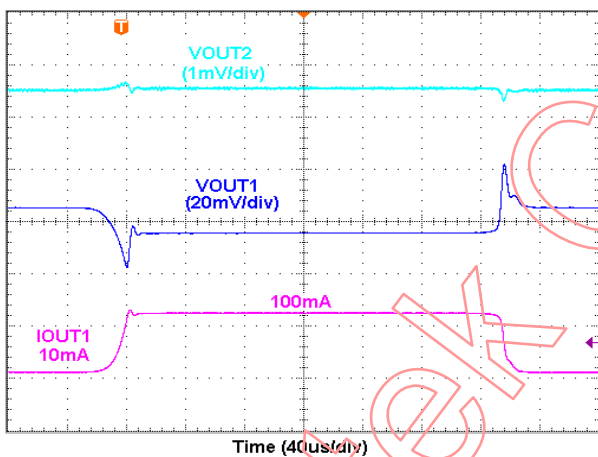


$V_{\text{OUT}}=1.8\text{V}$, $V_{\text{DD}}=2.8\text{V}$, $I_{\text{OUT}}=100\text{mA}$



$V_{\text{OUT}}=2.8\text{V}$, $V_{\text{DD}}=3.8\text{V}$, $I_{\text{OUT}}=100\text{mA}$

Transient Response Characteristics of Load's Mutual Interference ($C_1=1.0\mu\text{F}$, $C_2=1.0\mu\text{F}$, Temp= 25°C)



$I_{\text{OUT1}}=10\text{mA}\sim 100\text{mA}\sim 10\text{mA}$, $I_{\text{OUT2}}=0\text{mA}$, $V_{\text{OUT1}}=2.8\text{V}$,
 $V_{\text{OUT2}}=1.8\text{V}$, $V_{\text{DD}}=3.8\text{V}$, $t_r=t_f=5.0\mu\text{s}$

Application Information

Enable

The GS7128 has two enable pins. When the EN pin is set to the power-off level, the entire internal circuit stops operating, and the built-in P-channel MOS output transistor between the VDD and VOUT pin is turned off, in order to reduce the current consumption significantly. The VOUT pin is set to the VSS level. Note that the current consumption increases when a voltage of 0.3V to 1.2V is applied to the en pin.

Current Limit

The GS7128 contains an independent current limit and short circuit current protection to prevent unexpected applications. The current limit monitors and controls the pass transistor's gate voltage, limiting the output current to higher than 250mA typical. When the output voltage is less than 0.4V, the short circuit current protection starts the current fold back function and maintains the loading current 36mA. The output can be shorted to ground indefinitely without damaging the part.

Output Capacitor

The GS7128 is specifically designed to employ ceramic output capacitors as low as 1uF (X7R). The ceramic capacitors offer significant cost and space savings, along with high frequency noise filtering. Place the capacitors physically as close as possible to the device with wide and direct PCB traces.

Ceramic capacitors have different temperature characteristics and bias characteristics which depend on their dimensions and manufacturers. If the setting voltage is 2.5V or more and the capacitor's dimensions for V_{OUT} equal to 1.0mm

by 0.5mm or smaller than that, the capacitance value might be extremely low. As a result, the capacitance might be much less than expected value. In such cases, the operation might be unstable at low temperature (-25°C or less). In that case, use a larger capacity, or a large dimensions' capacitor. (For example 1.6mm by 0.8mm)

Input Capacitor

Good bypassing is recommended from input to ground to help improve AC performance. A 1uF (X7R) input capacitor or greater located as close as possible to the IC is recommended. Place the capacitors physically as close as possible to the device with wide and direct PCB traces.

Power Dissipation and Layout Considerations

Excessive power dissipation may cause thermal overload, and hence the increase of the IC junction temperature beyond a safe operating level. For continuous operation, it is highly recommended to keep the junction temperature below the maximum operation junction temperature 125°C for maximum reliability.

The relationship between θ_{JA} and $T_{J(MAX)}$ can be calculated as:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

Where $T_{J(MAX)}$ is the maximum operation junction temperature 125°C, T_A is the ambient temperature and the θ_{JA} is the junction to ambient thermal resistance.

The power dissipation definition in device is:

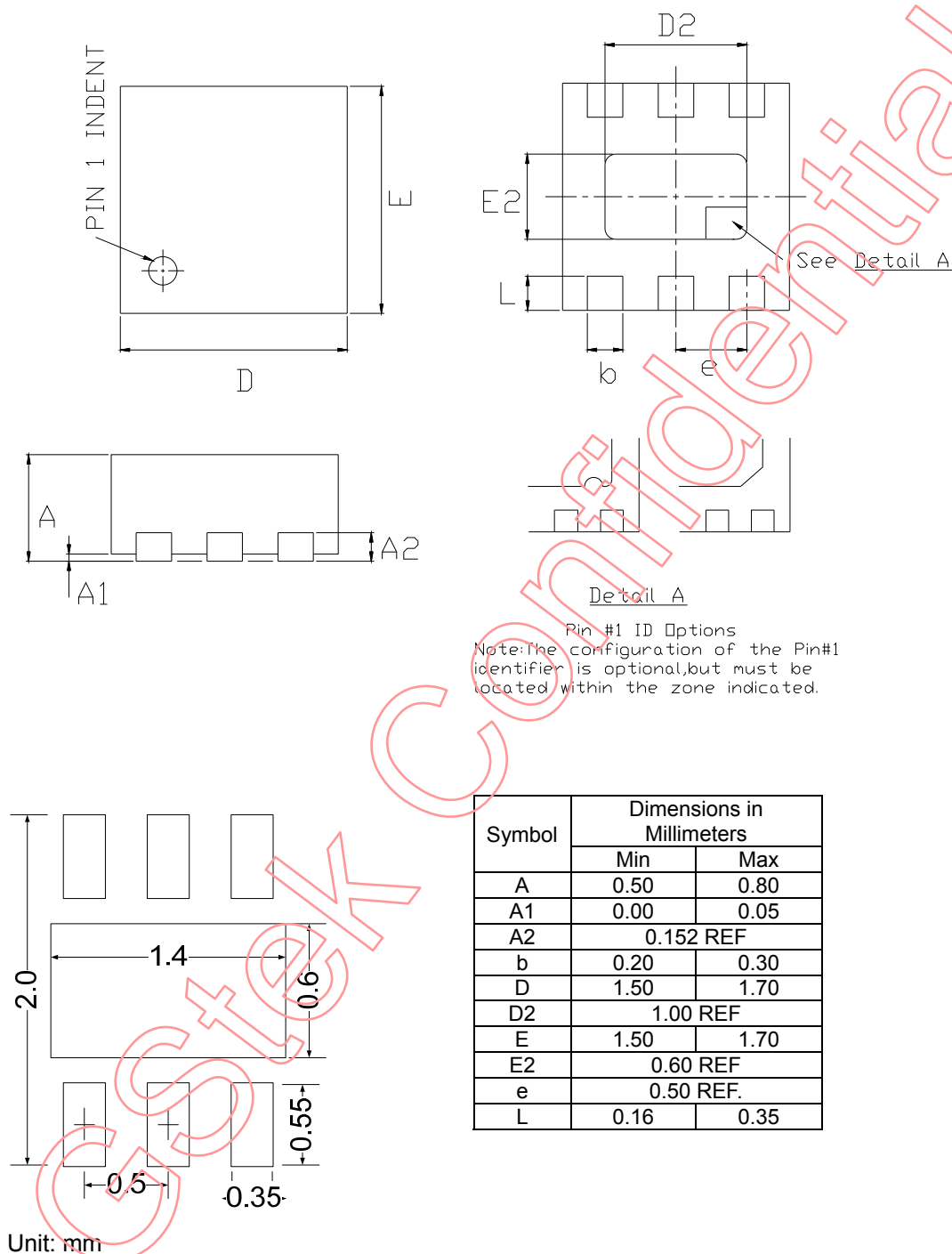
$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{DD} \times I_Q$$

As the above equations indicate, it is desirable to work ICs whose θ_{JA} values are small such that $T_{J(MAX)}$ does not increase strongly with P_D . To

avoid thermally overloading the GS7128, refrain from exceeding the absolute maximum junction temperature rating of 150°C under continuous operating condition. Overstressing the regulator with high loading currents and elevated input-to-output differential voltages can increase the IC die temperature significantly.

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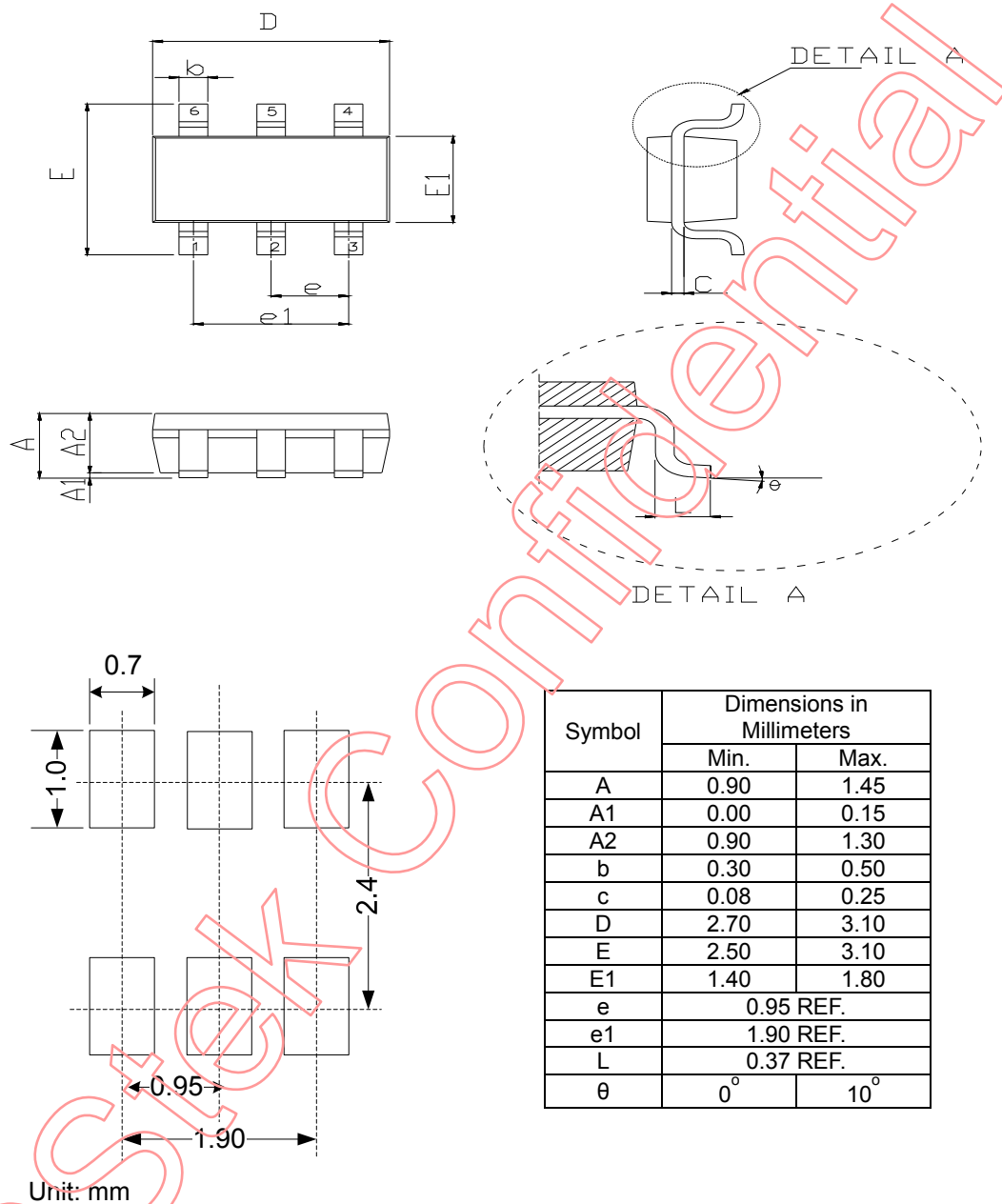
Package Dimensions, wDFN6-1.6x1.6



Note

- 1.Min.: Minimum dimension specified.
- 2.Max.: Maximum dimension specified.
- 3.REF.: Reference. Normal/Regular dimension specified for reference.

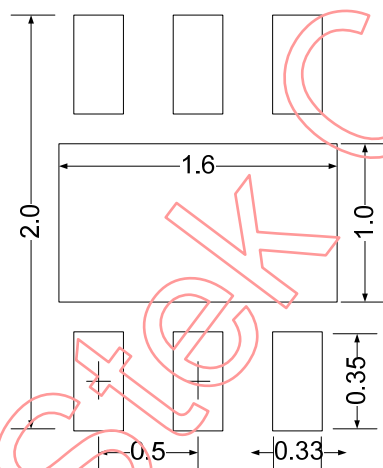
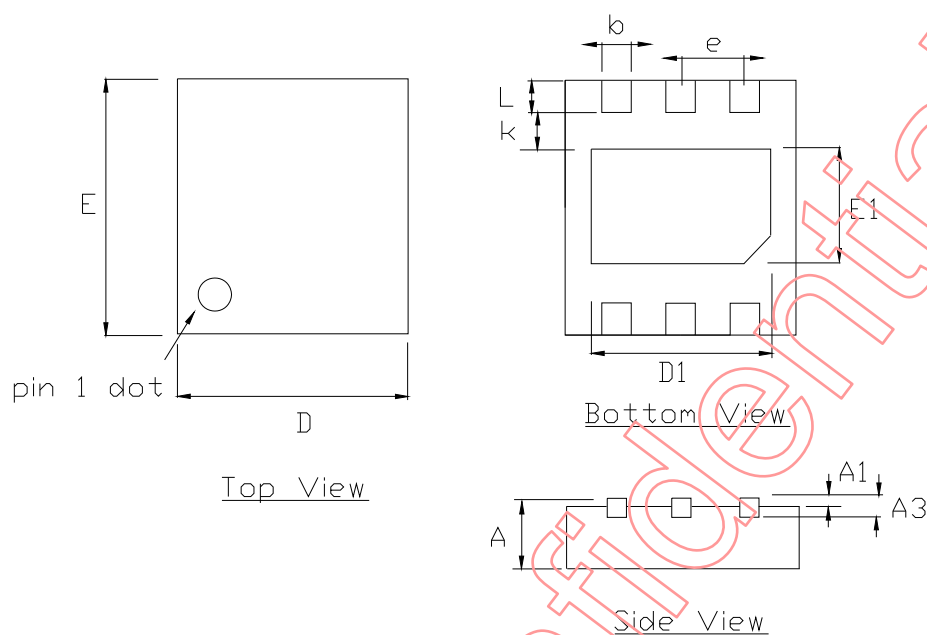
Package Dimensions, SOT-23-6



Note

- 1.Min.: Minimum dimension specified.
- 2.Max.: Maximum dimension specified.
- 3.REF.: Reference. Normal/Regular dimension specified for reference.

Package Dimensions, TDFN6-1.8x2



Unit: mm

Symbol	Dimensions in Millimeters	
	Min.	Max.
A	0.45	0.55
A1	0.00	0.05
A3	0.15 REF.	
D	1.72	1.88
D1	1.30	1.50
E	1.92	2.08
E1	0.80	1.00
k	0.20 Min.	
b	0.18	0.30
e	0.50 REF.	
L	0.17	0.33

Note

1. Min.: Minimum dimension specified.
2. Max.: Maximum dimension specified.
3. REF.: Reference. Normal/Regular dimension specified for reference.

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