

GS2813

300mA High PSRR Low Dropout Voltage Linear Regulators

Product Description

The GS2813 is a low dropout and low noise linear regulator with high ripple rejection ratio and fast turn-on time. GS2813 is available in two types, fixed output voltage type and adjustable output voltage type. It has fixed output voltage ranging from 1.2V to 4.8V.

The GS2813 includes a voltage reference unit, an error amplifier, resistor net for voltage setting, a current limit circuit and a chip enable circuit. These ICs perform with low dropout voltage and a chip enable function (SOT-23, SOT-23-5L, SC82-4L and TDFN1.6x1.6-6L package only).

The GS2813 works well with low ESR ceramic capacitors, suitable for portable RF and wireless battery-powered applications with stringent space requirements and demanding performance. It also offers ultra low noise output and has low quiescent current.

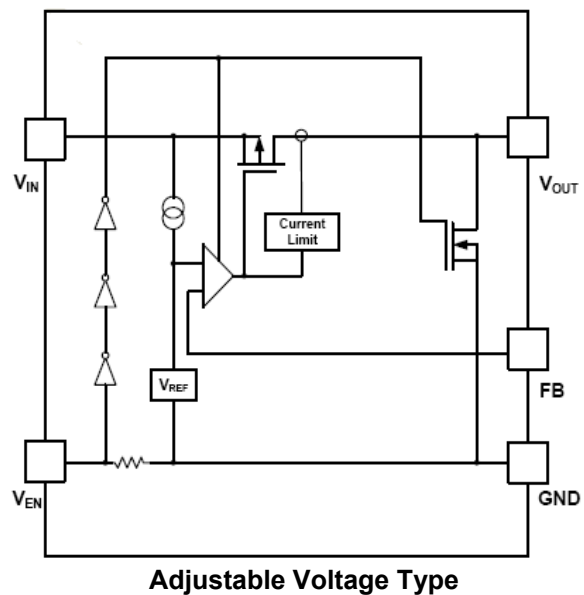
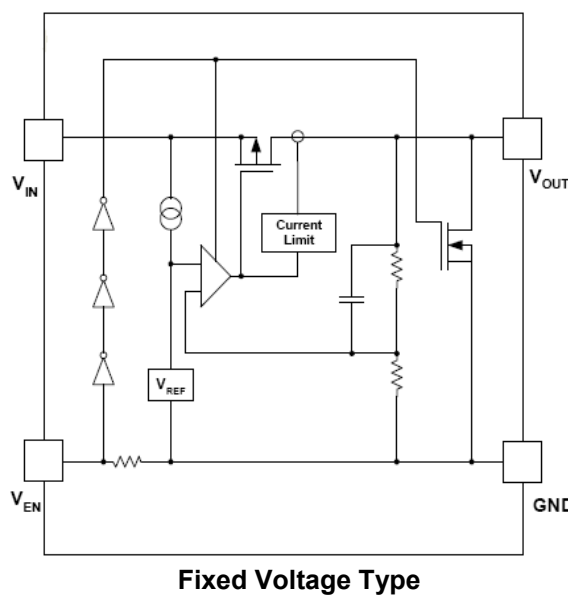
Features

- Input Voltage Range: 2.0V to 6V
- Reference Voltage: 0.8V
- Low Dropout Voltage: 0.22V at 150mA (Typ)
- Output Current: 300mA
- High Ripple Rejection: 65dB (Typ) (f=10kHz)
- Excellent Line Regulation: 0.01% / V (Typ)
- Output Voltage Accuracy: $\pm 2.0\%$
- Low Supply Current: 25 μ A (Typ)
- Standby Current: 0.01 μ A (Typ)
- Over Current Protection
- Fixed Output Voltage: 1.2V to 4.8V
- Ultra Fast Transient Response
- Miniature Packages: SOT-23, SOT-23-5L, SC82-4L and TDFN1.6x1.6-6L
- RoHS Compliant, 100%Pb & Halogen Free

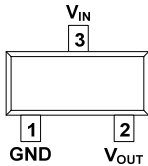
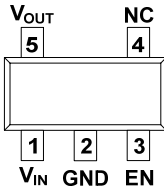
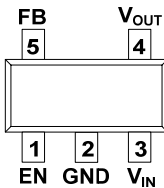
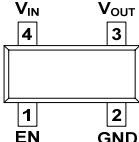
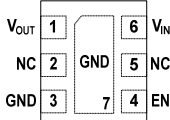
Applications

- Battery-Powered Equipment
- Portable Communication Equipment
- DSC
- Hand-Held Instruments

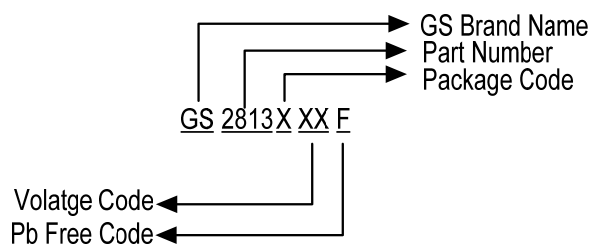
Block Diagram



Packages & Pin Assignments

SOT-23 (Fixed)	SOT-23-5L (Fixed)	SOT-23-5L (ADJ)
		
SC82-4L (Fixed)	TDFN1.6x1.6-6L (Fixed)	
		
Pin Name	Function	
NC	No Connect.	
EN	Enable Input. Pulling this pin below 0.4V turn the regulator off, reducing the quiescent current to a fraction of its operating value. The device will be enabled if this pin is left open. Connect to V _{IN} if not being used.	
GND	Ground Pin.	
V _{IN}	Power Supply Input.	
V _{OUT}	The pin is the power output of the device.	
FB	For the adjustable versions of the GS2813LF. This is the input to the error amplifier. The ADJ reference voltage is 0.8V referenced to ground.	

Ordering Information

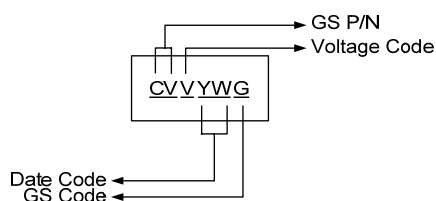


SOT-23 (Fixed)	SOT-23-5L (Fixed)	Output Voltage
GS2813Z12F	GS2813L12F	1.2V
GS2813Z13F	GS2813L13F	1.3V
GS2813Z15F	GS2813L15F	1.5V
GS2813Z18F	GS2813L18F	1.8V
GS2813Z19F	GS2813L19F	1.9V
GS2813Z25F	GS2813L25F	2.5V
GS2813Z27F	GS2813L27F	2.7V
GS2813Z28F	GS2813L28F	2.8V
GS2813Z30F	GS2813L30F	3.0V
GS2813Z33F	GS2813L33F	3.3V
-	GS2813L36F	3.6V

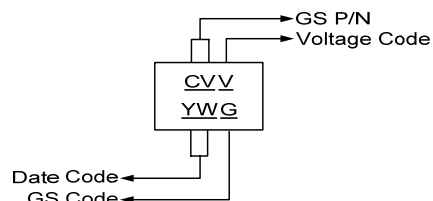
Ordering Information (continue)

SOT-23-5L (ADJ)	SC82-4L (Fixed)	TDFN1.6x1.6-6L (Fixed)	Output Voltage
GS2813LF	-	-	Adjustable
-	GS2813H12F	GS2813F12F	1.2V
-	GS2813H15F	GS2813F15F	1.5V
-	GS2813H18F	GS2813F18F	1.8V
-	GS2813H25F	GS2813F25F	2.5V
-	GS2813H28F	GS2813F28F	2.8V
-	GS2813H30F	GS2813F30F	3.0V
-	GS2813H33F	GS2813F33F	3.3V

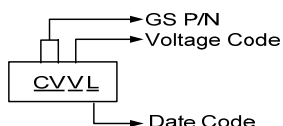
Marking Information



Others (Z/L Type)



TDFN1.6x1.6-6L (F Type)



SC82-4L(H Type)

SOT-23(Fixed)	SOT-23-5L	Marking	Output Voltage
-	GS2813LF	CVA _{YWG}	Adjustable
GS2813Z12F	GS2813L12F	CVD _{YWG}	1.2V
GS2813Z13F	GS2813L13F	CVC _{YWG}	1.3V
GS2813Z15F	GS2813L15F	CVG _{YWG}	1.5V
GS2813Z18F	GS2813L18F	CVF _{YWG}	1.8V
GS2813Z19F	GS2813L19F	CVE _{YWG}	1.9V
GS2813Z25F	GS2813L25F	CVH _{YWG}	2.5V
GS2813Z27F	GS2813L27F	CVK _{YWG}	2.7V
GS2813Z28F	GS2813L28F	CVJ _{YWG}	2.8V
GS2813Z30F	GS2813L30F	CVQ _{YWG}	3.0V
GS2813Z33F	GS2813L33F	CVR _{YWG}	3.3V
-	GS2813L36F	CVS _{YWG}	3.6V

TDFN1.6x1.6-6L(Fixed)	Marking	SC82-4L (Fixed)	Marking	Output Voltage
GS2813F12F	CVD _{YWG}	GS2813H12F	CVDL	1.2V
GS2813F15F	CVG _{YWG}	GS2813H15F	CVGL	1.5V
GS2813F18F	CVF _{YWG}	GS2813H18F	CVFL	1.8V
GS2813F25F	CVH _{YWG}	GS2813H25F	CVHL	2.5V
GS2813F28F	CVJ _{YWG}	GS2813H28F	CVJL	2.8V
GS2813F30F	CVQ _{YWG}	GS2813H30F	CVQL	3.0V
GS2813F33F	CVR _{YWG}	GS2813H33F	CVRL	3.3V

Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Max	Units
V _{IN}	Power Supply Voltage	6.5	V
I _{OUT}	Output Current	300	mA
V _{EN}	Enable Voltage	6.5	V
P _D	Power Dissipation(Note 4)	SOT-23	280
		SOT-23-5L	300
		SC82-4L	250
		TDFN1.6x1.6-6L	600
T _{STG}	Storage Temperature Accuracy	-65 to 150	°C
T _J	Maximum Junction Temperature	125	°C
T _{LEAD}	Lead Temperature(soldering) 5sec.	260	°C
θ _{JA}	Thermal Resistance Junction to Ambient (Note 3)	SOT-23	357
		SOT-23-5L	310
		SC82-4L	400
		TDFN1.6x1.6-6L	170
θ _{JC}	Thermal Resistance Junction to Case (Note 3)	SOT-23	100
		SOT-23-5L	100
		SC82-4L	120
		TDFN1.6x1.6-6L	60
HBM	ESD Rating(Human Body Model) (Note 2)	2	KV
MM	ESD Rating(Machine Model) (Note 2)	200	V
Recommended Operating Conditions (Note 5)			
V _{IN}	Power Supply Voltage	6.0	V
V _{EN}	Enable Voltage	-0.3V to V _{IN}	V
T _J	Operating Junction Temperature Range	-40 to 125	°C
T _{OPA}	Operating Ambient Temperature Range	-40 to 85	°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:Thermal Resistance is specified with approximately 1 square of 1 oz copper.

Note 4:Thermal Resistance is specified with the component mounted on a low effective thermal conductivity test board in free air at T_A=25°C.

Note 5:The device is not guaranteed to function outside its operating conditions.

Electrical Characteristics

(Unless otherwise specified $V_{IN}=V_{OUT}+1V$, $T_A=25^{\circ}C$)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage		2		6	V
ΔV_{OUT}	Output Voltage Accuracy	$I_{OUT}=1mA$	-2		2	%
V_{REF}	Reference Voltage Range	$I_{OUT}=1mA$	0.784	0.8	0.816	V
I_Q	Quiescent Current	No Load		25		μA
$I_{standby}$	Standby Current	$V_{EN}=GND$		0.01	1	μA
V_{DROP}	Dropout Voltage (Note 6)	$I_{OUT} = 150mA$ (Fixed Voltage)	$V_{OUT}<1.5V$			1000
			$1.5V \leq V_{OUT} \leq 2.0V$		450	700
			$2.1V \leq V_{OUT} \leq 4.8V$		250	500
		$I_{OUT} = 150mA$ (ADJ Voltage)	$V_{OUT}<1.5V$			1000
			$V_{OUT}=1.5V$		480	700
			$V_{OUT}=1.6V$		460	650
			$V_{OUT}=1.7V$		440	600
			$1.8V \leq V_{OUT} \leq 2.0V$		420	550
			$2.1V \leq V_{OUT} \leq 2.7V$		280	500
			$2.8V \leq V_{OUT} \leq 4.8V$		220	350
						mV
ΔV_{LINE}	Line regulation	$V_{OUT}>1.7V$, $V_{IN}=(V_{OUT}+0.5V)$ to 6V $V_{OUT}\leq 1.7V$, $V_{IN}=2.2V$ to 6V $I_{OUT}=1mA$		0.01	0.2	%/V
ΔV_{LOAD}	Load Regulation	$I_{OUT}=1mA$ to 150mA		0.005	0.015	%/mA
I_{LIM}	Current Limit		400			mA
PSRR	Ripple Rejection	$f=10KHz$ Ripple=0.3V _{P-P} $V_{OUT}>1.7V$, $V_{IN}-V_{OUT}=1.0V$ $V_{OUT}\leq 1.7V$, $V_{IN}-V_{OUT}=1.2V$ $I_{OUT}=10mA$		65		dB
$\frac{\Delta V_{OUT}}{\Delta T}$	Output Voltage Temperature Coefficient	$I_{OUT}=1mA$, $-40^{\circ}C \leq T_J \leq 85^{\circ}C$		± 100		ppm/ $^{\circ}C$
R_{PD}	EN Pull-Down Resistance		0.7	2.0	8.0	$M\Omega$
$V_{EN(HI)}$	EN Input High Voltage		1.2		V_{IN}	V
$V_{EN(LO)}$	EN Input Low Voltage				0.4	V
$I_{EN(HI)}$	EN Pin Current	$V_{EN}=V_{IN}$		0.01	1	μA
eN	Output Noise Voltage	BW=10Hz to 100KHz, $C_O=1\mu F$		100		μV_{rms}
R_{LOW}	On Resistance for Auto Discharge	$V_{EN}=0V$		60		Ω

Note 6: Dropout voltage is tested by reducing input voltage until the output drops 2% below its nominal value.

Application Information

Introduction

The GS2813 requires input and output decoupling capacitors. The device is specifically designed for portable applications requiring minimum board space and smallest components. These capacitors must be correctly selected for good performance (see Capacitor Characteristics Section). Please note that linear regulators with a low dropout voltage have high internal loop gains which require care in guarding against oscillation caused by insufficient decoupling capacitance.

Input Capacitor

An input capacitance of $1\mu\text{F}$ is required between the device input pin and ground directly (the amount of the capacitance may be increased without limit). The input capacitor must be located less than 1cm from the device to assure input stability. A lower ESR capacitor allows the use of less capacitance, ceramic capacitor can be mixed in parallel, but the total equivalent input capacitance ESR must be defined as above for stable operation. There are no requirements for the ESR on the input capacitor, but tolerance and temperature coefficient must be considered when selecting the capacitor to ensure the capacitance will be $1\mu\text{F}$ over the entire operating temperature range.

Output Capacitor

The GS2813 is designed specifically to work with very small ceramic output capacitors. A ceramic capacitor (temperature characteristics X7R, X5R) in $1\mu\text{F}$ is suitable for the GS2813 application. The recommended minimum capacitance for the device is $1\mu\text{F}$ (X5R or X7R dielectric ceramic), between V_{OUT} and GND for stability, but it may be increased without limit. Higher capacitance values help to improve transient. The output capacitor's ESR is critical because it forms a zero to provide phase lead which is required for loop stability.

Enable Function

The GS2813 is shut down by pulling the EN pin low, and turned on by driving the input high. If the shutdown feature is not required, the EN pin should be tied to V_{IN} to keep the regulator on at all times.

Thermal Considerations

The GS2813 series can provide a current of up to 300mA over the full operating junction temperature range. However, the maximum output current must be debated at higher ambient temperature to ensure the junction temperature does not exceed 125°C . With all possible conditions, the junction temperature must be within the range specified under operating conditions. Power dissipation can be calculated based on the output current and the voltage drop across regulator. Since the GS2813 is a linear regulator, its power dissipation is always given by:

$$P = I_{\text{OUT}} (V_{\text{IN}} - V_{\text{OUT}})$$

The maximum power dissipation is given by:

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

Typical Applications

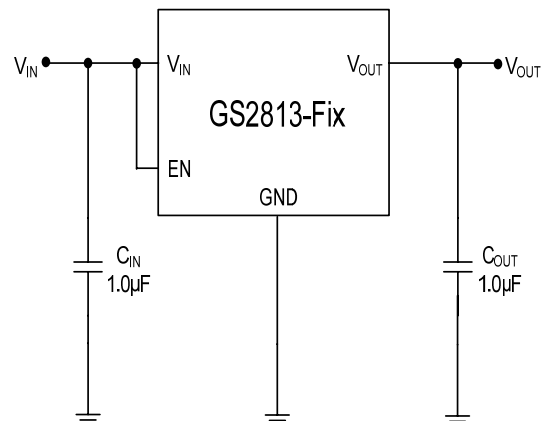


Figure1. Fixed Voltage Operation

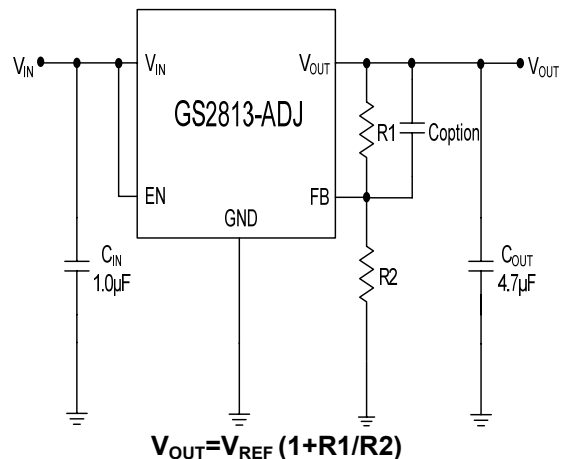
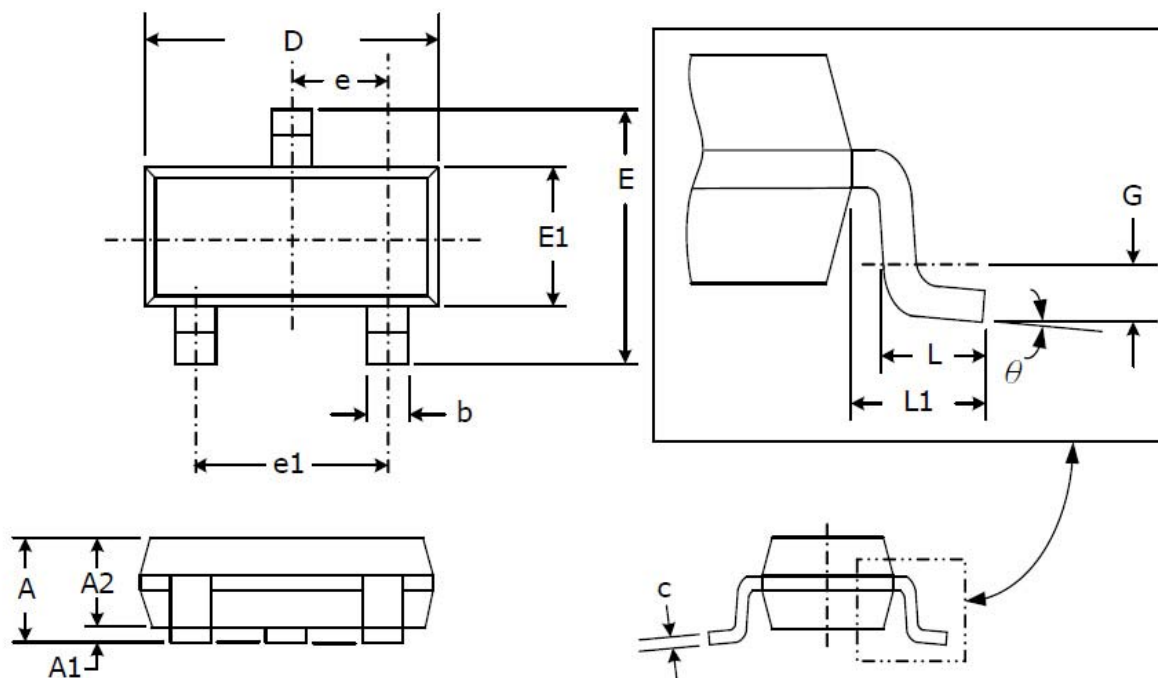


Figure2. ADJ Voltage Operation

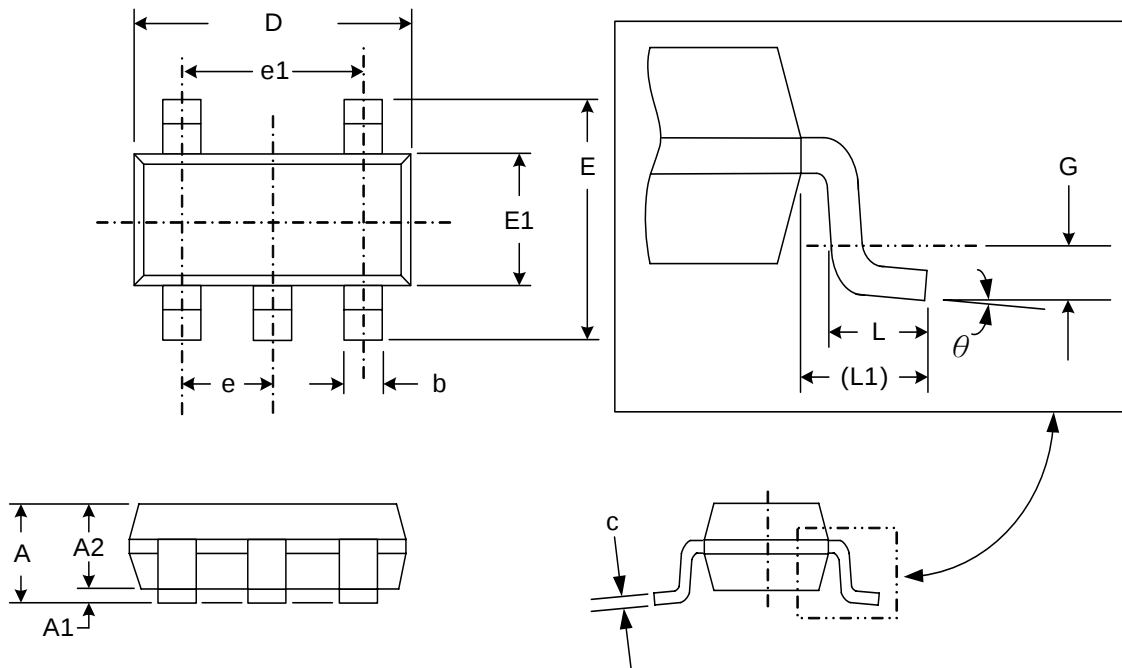
Package Dimension

SOT-23



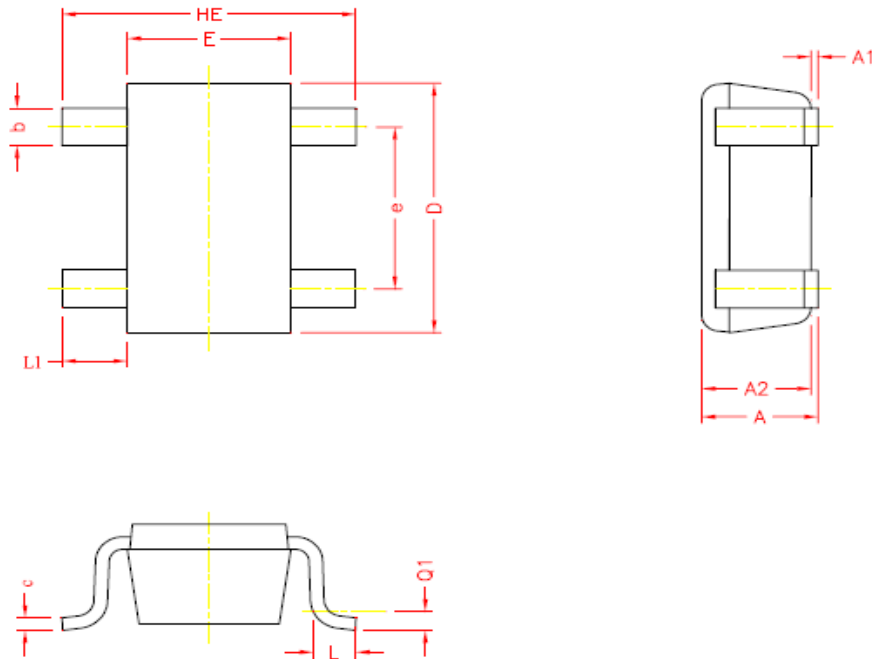
Dimensions				
SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	0.75	1.17	0.030	0.046
A1	0.05	0.15	0.002	0.006
A2	0.70	1.02	0.028	0.040
b	0.30	0.50	0.012	0.020
c	0.08	0.20	0.003	0.008
D	2.80	3.04	0.110	0.120
E	2.10	2.90	0.083	0.114
E1	1.20	1.40	0.047	0.055
e	0.95 (TYP)		0.037 (TYP)	
e1	1.90 (TYP)		0.075 (TYP)	
L	0.40	0.60	0.016	0.024
L1	0.54 (TYP)		0.021 (TYP)	
G	0.25 (TYP)		0.010 (TYP)	
θ	0°	8°	0°	8°

SOT-23-5L



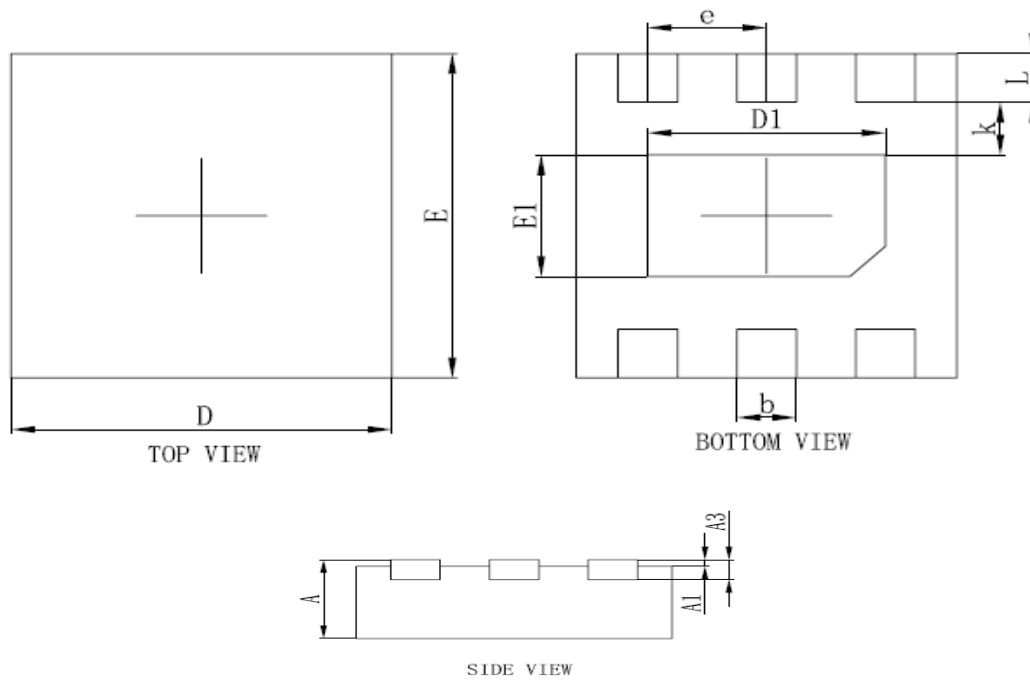
Dimensions				
SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	0.95	1.45	0.037	0.057
A1	0.05	0.15	0.002	0.006
A2	0.90	1.30	0.035	0.051
b	0.30	0.50	0.012	0.020
c	0.08	0.20	0.003	0.008
D	2.80	3.00	0.110	0.118
E	2.60	3.00	0.102	0.118
E1	1.50	1.70	0.059	0.067
e	0.95 (TYP)		0.037 (TYP)	
e1	1.90 (TYP)		0.075 (TYP)	
L	0.35	0.55	0.014	0.022
L1	0.60 (TYP)		0.024 (TYP)	
G	0.25 (TYP)		0.010 (TYP)	
θ	0°	8°	0°	8°

SC-82-4L PLASTIC PACKAGE



Dimensions				
SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	0.80	1.00	0.032	0.039
A1	0.00	0.10	0.000	0.004
A2	0.70	0.90	0.028	0.035
D	1.80	2.20	0.071	0.087
E	1.15	1.35	0.045	0.053
HE	2.00	2.30	0.079	0.091
L1	0.48 (REF.)		0.019 (REF.)	
L	0.15	0.45	0.006	0.018
b	0.25	0.40	0.010	0.016
c	0.10	0.25	0.004	0.010
e	1.30 (REF.)		0.051 (REF.)	
Q1	0.15 (REF.)		0.006 (REF.)	

TDFN1.6x1.6-6L



Dimensions				
SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	0.450/0.550	0.550/0.650	0.018/0.022	0.022/0.026
A1	0.000	0.050	0.000	0.002
A3	0.152REF.		0.006REF.	
D	1.550	1.650	0.061	0.065
E	1.550	1.650	0.061	0.065
E1	0.550	0.650	0.022	0.026
D1	0.950	1.050	0.037	0.041
b	0.200	0.300	0.008	0.012
k	0.200MIN.		0.008REF.	
e	0.500BSC.		0.020BSC.	
L	0.164	0.316	0.006	0.012

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