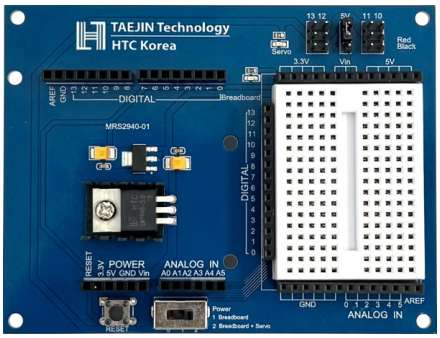
Education Shield Module for Arduino

FEATURES

- Recommended Vcc Voltage: DC 7V to 12V
- 17 row x 2 column breadboard
- Headers for power (Vin, 5 V, 3.3 V) Ground, Digital I/O and Analog In
- Onboard 5 V regulator supplies up to 1 A, great for robotics and animatronics applications
- Onboard 3.3 V regulator supplies up to 200 mA for project circuits and accessories, such as XBee modules
- 4 servo ports with power selection jumper for regulated 5 V or Vin (Arduino's supply voltage)
- 3-position power switch for power header only or power header + servo ports
- Reset button
- Compatible with Arduino Uno, Duemilanove, Mega



ORDERING INFORMATION

Part Number	MRS2940-01
Device	Education Shield Module for Arduino
Package	Assembled Module (102mm X 77mm)

APPLICATIONS

- Robotics and mobile robot platforms Embedded control
- Embedded control and automation systems
- Sensor interface and rapid prototyping projects

DESCRIPTION

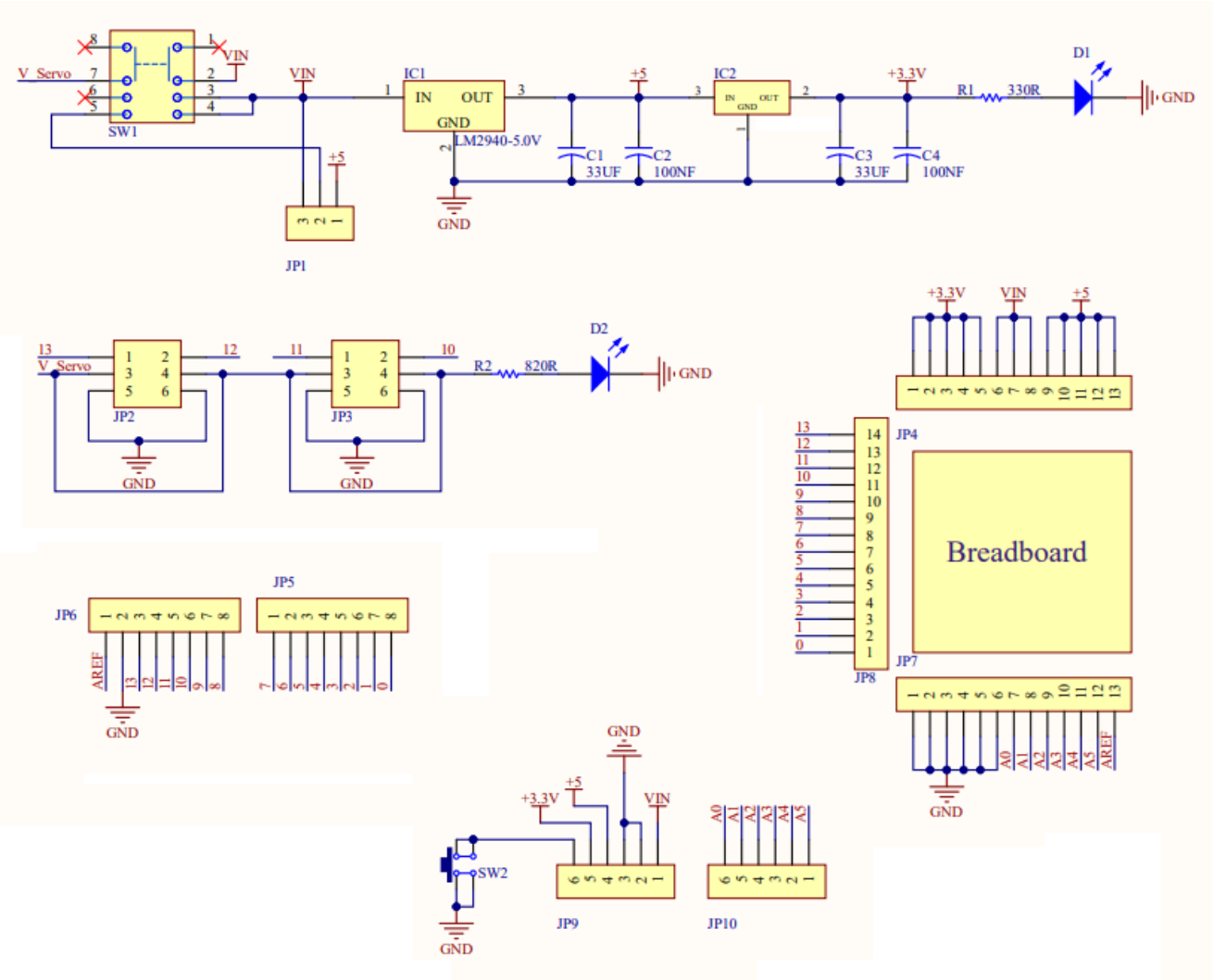
A versatile Arduino-compatible expansion shield featuring an onboard prototyping area, power management circuitry, and servo interfaces. Designed for rapid development of robotics, automation, and embedded control applications.

APPLICATION GUIDE

The shield can be mounted directly onto an Arduino-compatible controller board, allowing users to quickly connect sensors, actuators, and custom circuits through the onboard prototyping area and expansion headers for rapid system development and testing.

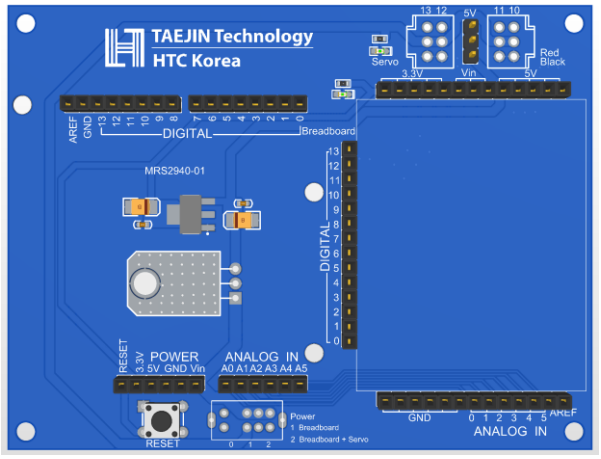
Education Shield Module for Arduino

SCHEMATICS



LAYOUT

Top



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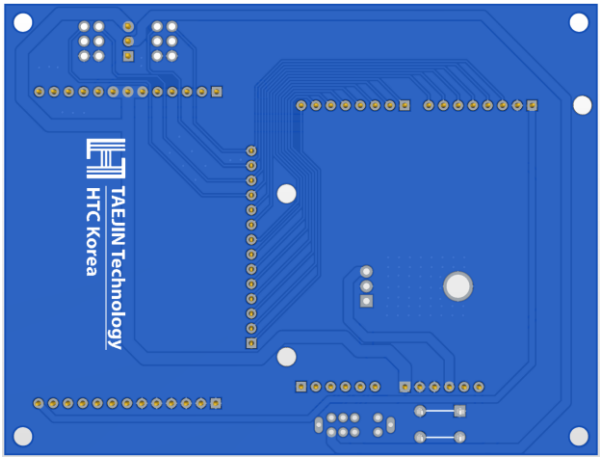
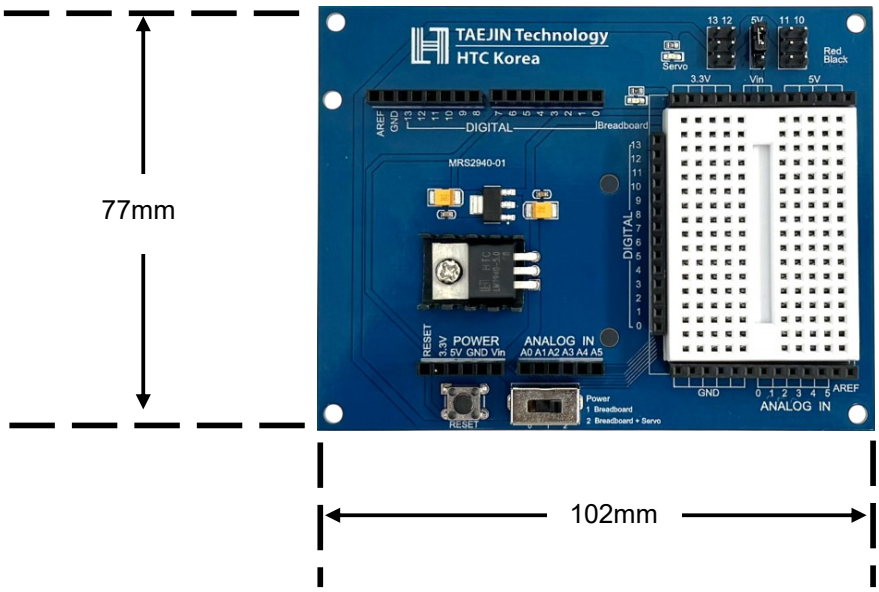
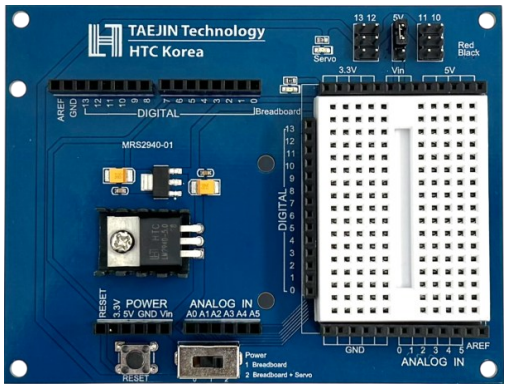


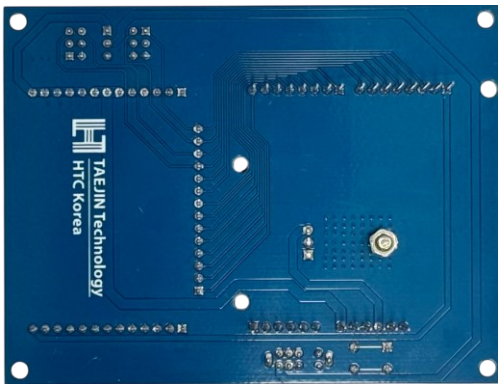
Education Shield Module for Arduino

SIZE INFORMATION

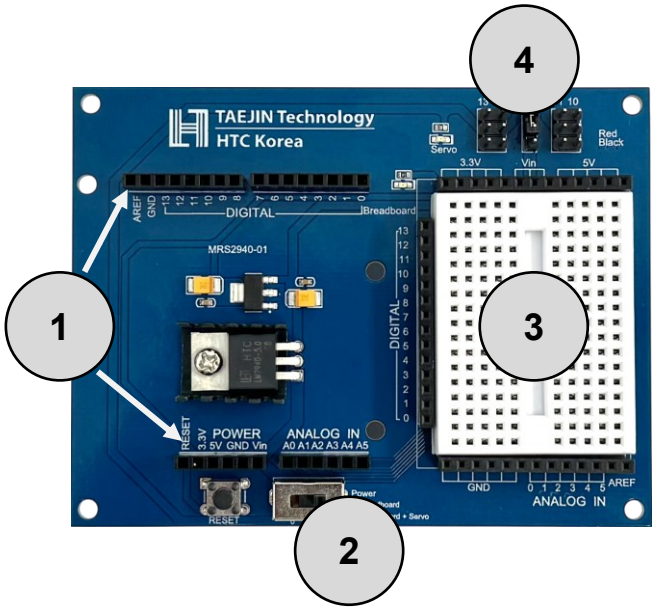


PRODUCT IMAGE





I/O PORT CONFIGURATION AND DESCRIPTION



Designator	Port Name	Port Description
1	Arduino Connect Header	Compatible with Arduino Uno, Duemilanove, Mega
2	Power Switch	1 : Breadboard 2 : Breadboard + Servo
3	Breadboard	17 row x 2 column Breadboard
4	Power Select Jumper	5V or VIN

REVISION NOTICE

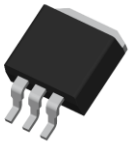
The description in this datasheet is subject to change without any notice to describe its electrical characteristics properly.

1A LOW DROPOUT REGULATOR LM2940

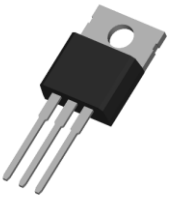
FEATURES

- Guaranteed Output Current of 1A
- Maximum Input Voltage 26V
- Low Dropout Voltage 400mV
- Low Ground Current
- Accurate 1% Guaranteed Tolerance
- Extremely Fast Transient Response
- Reverse Battery Protection
- Over-Temperature / Over-Current Protection
- Available in SOT-223-3L, TO-263-3L and TO-220-3L Package

SOT-223-3L



TO-263-3L



TO-220-3L

APPLICATION

- Battery Powered Equipment
- High-Efficiency “Green” Computer Systems
- Automotive Electronics
- High-Efficiency Linear Power Supplies
- High-Efficiency Post-Regulator For Switching Supply

ORDERING INFORMATION

Device	Package
LM2940S-X.X	SOT-223-3L
LM2940R-X.X	TO-263-3L
LM2940T-X.X	TO-220-3L

X.X = Output Voltage = 3.3V, 5.0V

DESCRIPTION

The LM2940 regulator features the ability to source 1A of output current with a dropout voltage of typically 0.4V and maximum of 0.63V over the entire temperature range. The device also finds applications in lower current, low dropout-critical systems, where their tiny dropout voltage and ground current values are important attributes. LM2940 is available as fixed 3.3V, 5.0V output voltages. The LM2940 is offered in a SOT-223-3L, TO-263-3L and TO-220-3L.

ABSOLUTE MAXIMUM RATINGS (Note 1)

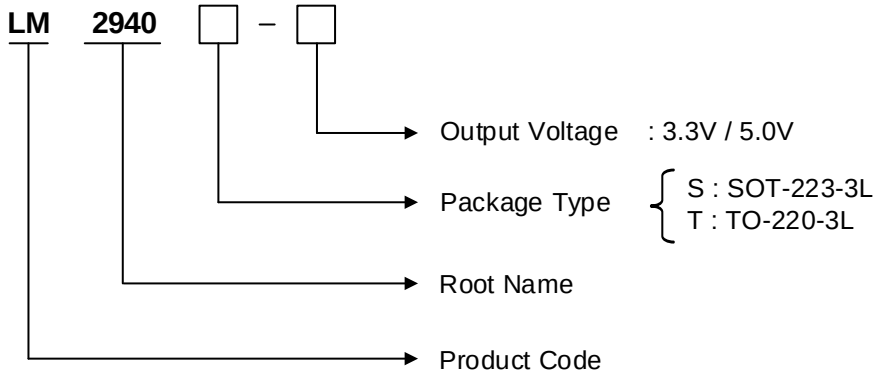
CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Input Supply Voltage (Survival)	V_{IN}	-20	30	V
Maximum Output Current	I_{OUT_MAX}	-	1	A
Lead Temperature	T_{SOL}	-	260	°C
Storage Temperature Range	T_{STG}	-65	150	°C
Operating Junction Temperature Range	T_{OPR}	-40	125	°C

RECOMMENDED OPERATING RATINGS (Note 2)

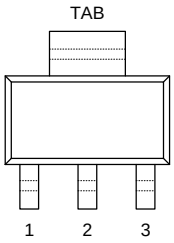
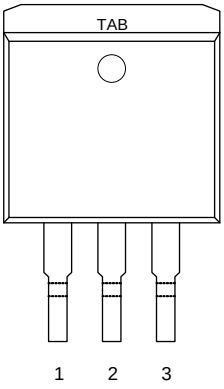
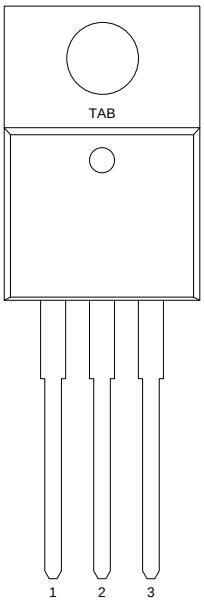
CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Input Supply Voltage	V_{IN}	-	26	V
Operating Junction Temperature Range	T_{OPR}	-40	85	°C

ORDERING INFORMATION

V_{OUT}	Package	Order No.	Supplied As	Status
3.3V	SOT-223-3L	LM2940S-3.3	Reel	Active
	TO-263-3L	LM2940R-3.3	Reel	Active
	TO-220-3L	LM2940T-3.3	Tube	Active
5.0V	SOT-223-3L	LM2940S-5.0	Reel	Active
	TO-263-3L	LM2940R-5.0	Reel	Active
	TO-220-3L	LM2940T-5.0	Tube	Active



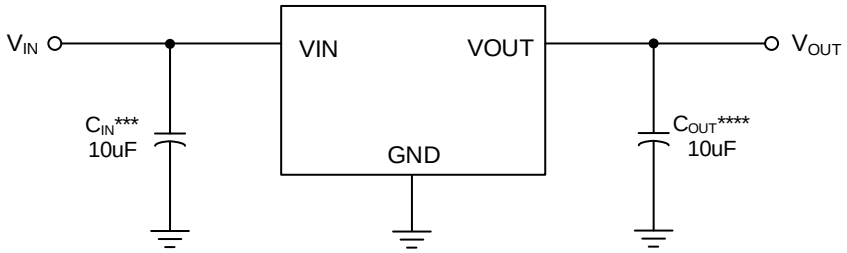
PIN CONFIGURATION

		
SOT-223	TO-263-3	TO-220

PIN DESCRIPTION

Pin No.	SOT-223-3L / TO-263-3L / TO-220-3L	
	Name	**Function**
1	VIN	Input Voltage
2	GND	Ground
3	VOUT	Output Voltage

TYPICAL CIRCUIT



* LM2940 can deliver a continuous current of 1A over the full operating temperature. However, the output current is limited by the restriction of power dissipation which differs from packages. A heat sink may be required depending on the maximum power dissipation and maximum ambient temperature of application. With respect to the applied package, the maximum output current of 1A may be still undeliverable.

** See Application Information.

*** C_{IN} : C_{IN} must be at least 1uF or large to maintain stability.

**** C_{OUT} : C_{OUT} must be at least 10uF or large to maintain stability.

ELECTRICAL CHARACTERISTICS (Note 3)

Limits in standard typeface are for T_J = 25°C, and limits in **boldface type** apply over the **full operating temperature range**. Unless otherwise specified: V_{IN} (Note 4) = $V_{O(NOM)}$ + 1V, I_{OUT} = 5 mA, C_{IN} = 10 µF, C_{OUT} = 10 µF

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage Tolerance	V_O	I_{OUT} = 5mA	-1	-	1	%
		5 mA ≤ I_{OUT} ≤ 1A, (V_{OUT}+1V) ≤ V_{IN} ≤ 26V	**-2**	-	**2**	%
Line Regulation	ΔV_{LINE}	I_{OUT} = 5mA, (V_{OUT}+1V) ≤ V_{IN} ≤ 26V	-	0.06	0.5	%
Load Regulation	ΔV_{LOAD}	V_{IN} = V_{OUT} +1V, 5 mA ≤ I_{OUT} ≤ 1A	-	0.2	1	%
Output Voltage Temperature Coefficient (Note 5)	ΔV_{OUT} /ΔT		-	-	100	ppm/°C
Dropout Voltage (Note 6)	V_{DROP}	I_{OUT} = 5mA	-	60	**180**	mV
		I_{OUT} = 100mA	-	170	-	mV
		I_{OUT} = 1A	-	400	**630**	mV
Ground Pin Current (Note 7)	I_{GND}	I_{OUT} = 5mA	-	250	**500**	µA
		I_{OUT} = 1A	-	16	**25**	mA
Ground Pin Current at Dropout	I_{GNDDO}	V_{IN} = 0.5V less than specified V_{OUT}, I_{OUT} = 5mA	-	1	-	mA
Current Limit	I_{CL}	V_{OUT} = 0V	-	1.5	-	A

Note 1. Exceeding the absolute maximum ratings may damage the device.

Note 2. The device is not guaranteed to function outside its operating ratings.

Note 3. Stresses listed as the absolute maximum ratings may cause permanent damage to the device. These are for stress ratings. Functional operating 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 possibly to affect device reliability.

Note 4. The minimum operating value for input voltage is equal to either ($V_{OUT,NOM}$ + V_{DROP}), whichever is greater.

Note 5. Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.

Note 6. Dropout voltage is defined as the minimum input to output differential voltage at which the output drops 1% below the nominal value.

Note 7. Ground current, or quiescent current, is the difference between input and output currents. It's defined by I_{GND} = I_{IN} - I_{OUT} under the given loading condition. The total current drawn from the supply is the sum of the load current plus the ground pin current.

APPLICATION INFORMATION

Maximum Output Current Capability

The LM2940 can deliver a continuous current of 1A over the full operating junction temperature range. However, the output current is limited by the restriction of power dissipation which differs from packages. A heat sink may be required depending on the maximum power dissipation and maximum ambient temperature of application. With respect to the applied package, the maximum output current of 1A may be still undeliverable due to the restriction of the power dissipation of LM2940. Under all possible conditions, the junction temperature must be within the range specified under operating conditions. The temperatures over the device are given by:

$$T_C = T_A + P_D \times \theta_{CA} \quad / \quad T_J = T_C + P_D \times \theta_{JC} \quad / \quad T_J = T_A + P_D \times \theta_{JA}$$

where T_J is the junction temperature, T_C is the case temperature, T_A is the ambient temperature, P_D is the total power dissipation of the device, θ_{CA} is the thermal resistance of case-to-ambient, θ_{JC} is the thermal resistance of junction-to-case, and θ_{JA} is the thermal resistance of junction to ambient. The total power dissipation of the device is given by:

$$P_D = P_{IN} - P_{OUT} = (V_{IN} \times I_{IN}) - (V_{OUT} \times I_{OUT})$$
$$= (V_{IN} \times (I_{OUT} + I_{GND})) - (V_{OUT} \times I_{OUT}) = (V_{IN} - V_{OUT}) \times I_{OUT} + (V_{IN} \times I_{GND})$$

where I_{GND} is the operating ground current of the device which is specified at the Electrical Characteristics. The maximum allowable temperature rise (T_{Rmax}) depends on the maximum ambient temperature (T_{Amax}) of the application, and the maximum allowable junction temperature (T_{Jmax}):

$$T_{Rmax} = T_{Jmax} - T_{Amax}$$

The maximum allowable value for junction-to-ambient thermal resistance, θ_{JA}, can be calculated using the formula:

$$\theta_{JA} = T_{Rmax} / P_D = (T_{Jmax} - T_{Amax}) / P_D$$

LM2940 is available in SOT-223-3L package. The thermal resistance depends on amount of copper area or heat sink, and on air flow. If the maximum allowable value of θ_{JA} calculated above is over 137°C/W for SOT-223 -3L package, no heat sink is needed since the package can dissipate enough heat to satisfy these requirements. If the value for allowable θ_{JA} falls near or below these limits, a heat sink or proper area of copper plane is required. In summary, the absolute maximum ratings of thermal resistances are as follow:

Absolute Maximum Ratings of Thermal Resistance

Characteristic	Symbol	Rating	Unit
Thermal Resistance Junction-To-Ambient / SOT-223-3L	$\theta_{JA\text{-}SOT\text{-}223\text{-}3L}$	137	°C/W
Thermal Resistance Junction-To-Ambient / SOT-263-3L	$\theta_{JA\text{-}SOT\text{-}263\text{-}3L}$	80	°C/W
Thermal Resistance Junction-To-Ambient / TO-220-3L	$\theta_{JA\text{-}TO\text{-}220\text{-}3L}$	70	°C/W

No heat sink / No air flow / No adjacent heat source / T_A=25°C

REVISION NOTICE

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1A L.D.O VOLTAGE REGULATOR LM1117GS

FEATURES

- Output Current up to 1A
- Dropout Voltage is 1.2V at Output current
- Three Terminal Adjustable(ADJ) or Fixed 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, and 5.0V
- Line Regulation typically at 0.1% typ.
- Load Regulation typically at 0.2% typ.
- Internal Current and Thermal Protection
- Surface Mount Package SOT-223-3L
- Moisture Sensitivity Level 3

SOT-223-3L

APPLICATIONS

- Active SCSI Terminators
- Portable/ Plan Top/ Notebook Computers
- High Efficiency Linear Regulators
- SMPS Post Regulators
- Mother B/D Clock Supplies
- Disk Drives
- Battery Chargers

ORDERING INFORMATION

Device	Package
LM1117GS-ADJ	SOT-223-3L
LM1117GS-x.x	

x.x: Output Voltage = 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, and 5.0V

DESCRIPTION

The LM1117GS is a low power positive-voltage regulator designed to meet 1A output current. This device is an excellent choice for use in battery-powered applications, as active terminators for the SCSI bus, and portable computers. The LM1117GS features very low quiescent current and very low dropout voltage of 1.2V at a full load and lower as output current decreases. LM1117GS is available as an adjustable or fixed 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, and 5.0V output voltages. The LM1117GS is offered in a 3-pin surface mount package SOT-223-3L. The output capacitor of 10μF or larger is needed for output stability of LM1117GS as required by most of the other regulator circuits.

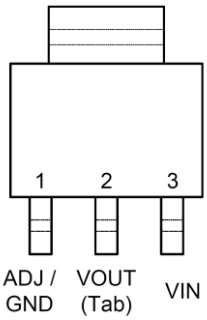
ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Input Supply Voltage	V_{IN}	-	20	V
Lead Temperature (Soldering, 10 seconds)	T_{SOL}	-	260	°C
Storage Temperature Range	T_{STG}	−65	150	°C
Operating Junction Temperature Range	T_{JOPR}	−40	125	°C

ORDERING INFORMATION

V_{OUT}	Package	Order No.	Supplied As	Status
ADJ	SOT-223-3L	LM1117GS-ADJ	Tape & Reel	Active
1.2V	SOT-223-3L	LM1117GS-1.2	Tape & Reel	Active
1.5V	SOT-223-3L	LM1117GS-1.5	Tape & Reel	Active
1.8V	SOT-223-3L	LM1117GS-1.8	Tape & Reel	Active
2.5V	SOT-223-3L	LM1117GS-2.5	Tape & Reel	Active
3.3V	SOT-223-3L	LM1117GS-3.3	Tape & Reel	Active
5.0V	SOT-223-3L	LM1117GS-5.0	Tape & Reel	Active

PIN CONFIGURATION



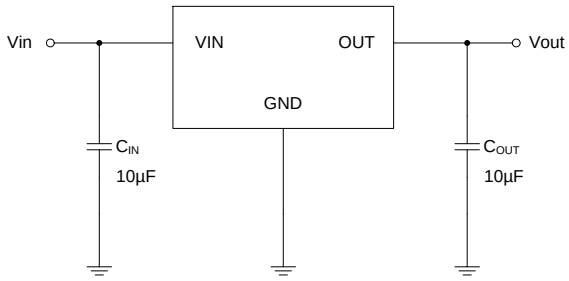
SOT-223-3L

PIN DESCRIPTION

Pin No.	Pin Name	Pin Function
1	ADJ / GND	Adjustable or Ground (Fixed Version)
2	VOUT	Output Voltage
3	VIN	Input Voltage

TYPICAL APPLICATION CIRCUITS

< Fixed Version>



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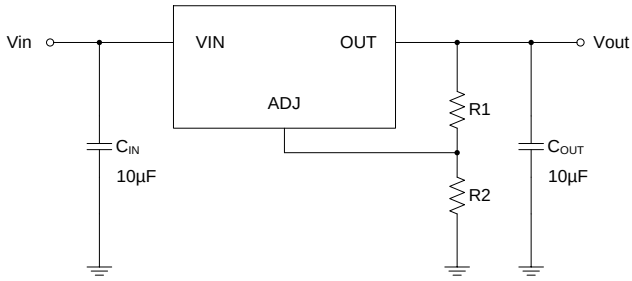


ELECTRICAL CHARACTERISTICS

For ADJ Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{REF}	Reference Voltage	V_{IN} = 5V, I_O = 10mA	1.238	1.250	1.262	V
V_{REF}	Reference Voltage	I_O = 10mA to 1A, V_{IN} - V_{REF} = 1.5V to 13.75V (T_J = -40°C ~ 125°C)	1.219		1.281	V
ΔV_{LINE}	Line Regulation	I_O = 10mA , V_{IN} - V_{REF} = 1.5V to 12V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 10mA to 1A, V_{IN} - V_{REF} = 2V		0.2	0.4	%
V_{IN}	Operating Input Voltage				12	V
I_{ADJ}	Adjustment pin Current	V_{IN} - V_{REF} = 1.5V to 12V, I_O = 100mA		50	120	µA
ΔI_{ADJ}	Adjustment Pin Current Change	V_{IN} - V_{REF} = 1.5V to 12V, I_O = 100mA to 1A		0.5	5	µA
$I_{O(MIN)}$	Minimum Load Current	V_{IN} = 5V, V_{REF} = 0V		2	7	mA
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 1A		5	10	mA
I_O	Current Limit	V_{IN} - V_{REF} = 5V	1000			mA
eN	Output Noise (%V_O)	B = 10Hz to 10kHz, T_J = 25°C		0.003		%
SVR	Supply Voltage Rejection	I_O = 1A, f = 120Hz, V_{IN} - V_{REF} = 3V, V_{RIPPLE} = 1V_{PP}	60	75		dB

For 1.2V Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output Voltage	V_{IN} = 2.7V, I_O = 10mA	1.176	1.200	1.224	V
V_O	Output Voltage	V_{IN} = 2.7V to 12V, I_O = 0mA to 1A (T_J = -40°C ~ 125°C)	1.152		1.248	V
ΔV_{LINE}	Line Regulation	I_O = 10mA , V_{IN} = 2.7V to 12V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 10mA to 1A, V_{IN} = 3.2V		0.2	0.4	%
V_{IN}	Operating Input Voltage				12	V
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 1A		5	10	mA
I_O	Current Limit	V_{IN} - V_O = 5V	1000			mA
eN	Output Noise (%V_O)	B = 10Hz to 10kHz, T_J = 25°C		0.003		%
SVR	Supply Voltage Rejection	I_O = 1A, f = 120Hz, V_{IN} - V_O = 1.5V, V_{RIPPLE} = 1V_{PP}	60	75		dB

For 1.5V Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output Voltage	V_{IN} = 3.0V, I_O = 10mA	1.485	1.5	1.515	V
V_O	Output Voltage	V_{IN} = 3.0V to 12V, I_O = 0mA to 1A (T_J = -40°C ~ 125°C)	1.470		1.530	V
ΔV_{LINE}	Line Regulation	I_O = 10mA , V_{IN} = 3.0V to 12V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 10mA to 1A, V_{IN} = 3.5V		0.2	0.4	%
V_{IN}	Operating Input Voltage				12	V
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 1A		5	10	mA
I_O	Current Limit	V_{IN} - V_O = 5V	1000			mA
eN	Output Noise(%V_O)	B = 10Hz to 10kHz, T_J = 25°C		100		µV
SVR	Supply Voltage Rejection	I_O = 1A, f = 120Hz, V_{IN} - V_O = 3V, V_{RIPPLE} = 1V_{PP}	60	75		dB

For 1.8V Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output Voltage	V_{IN} = 3.3V, I_O = 10mA	1.782	1.8	1.818	V
V_O	Output Voltage	V_{IN} = 3.3V to 12V, I_O = 0mA to 1A (T_J = -40°C ~ 125°C)	1.764		1.836	V
ΔV_{LINE}	Line Regulation	I_O = 10mA , V_{IN} = 3.3V to 12V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 10mA to 1A, V_{IN} = 3.8V		0.2	0.4	%
V_{IN}	Operating Input Voltage				12	V
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 1A		5	10	mA
I_O	Current Limit	V_{IN} - V_O = 5V	1000			mA
eN	Output Noise(%V_O)	B = 10Hz to 10kHz, T_J = 25°C		100		µV
SVR	Supply Voltage Rejection	I_O = 1A, f = 120Hz, V_{IN} - V_O = 3V, V_{RIPPLE} = 1V_{PP}	60	75		dB

For 2.5V Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output Voltage	V_{IN} = 4.0V, I_O = 10mA	2.475	2.5	2.525	V
V_O	Output Voltage	V_{IN} = 4.0V to 12V, I_O = 0mA to 1A (T_J = -40°C ~ 125°C)	2.450		2.550	V
ΔV_{LINE}	Line Regulation	I_O = 10mA , V_{IN} = 4.0V to 12V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 10mA to 1A, V_{IN} = 4.5V		0.2	0.4	%
V_{IN}	Operating Input Voltage				12	V
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 1A		5	10	mA
I_O	Current Limit	V_{IN} - V_O = 5V	1000			mA
eN	Output Noise(%V_O)	B = 10Hz to 10kHz, T_J = 25°C		100		µV
SVR	Supply Voltage Rejection	I_O = 1A, f = 120Hz, V_{IN} - V_O = 3V, V_{RIPPLE} = 1V_{PP}	60	75		dB

For 3.3V Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output Voltage	V_{IN} = 4.8V, I_O = 10mA	3.267	3.3	3.333	V
V_O	Output Voltage	V_{IN} = 4.8V to 12V, I_O = 0mA to 1A (T_J = -40°C ~ 125°C)	3.234		3.366	V
ΔV_{LINE}	Line Regulation	I_O = 10mA , V_{IN} = 4.8V to 12V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 10mA to 1A, V_{IN} = 5.3V		0.2	0.4	%
V_{IN}	Operating Input Voltage				12	V
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 1A		5	10	mA
I_O	Current Limit	V_{IN} - V_O = 5V	1000			mA
eN	Output Noise(%V_O)	B = 10Hz to 10kHz, T_J = 25°C		100		µV
SVR	Supply Voltage Rejection	I_O = 1A, f = 120Hz, V_{IN} - V_O = 3V, V_{RIPPLE} = 1V_{PP}	60	75		dB

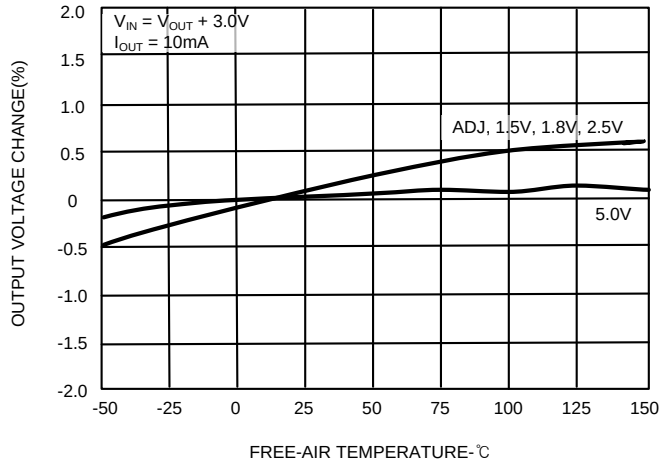
For 5.0V Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output Voltage	V_{IN} = 6.5V, I_O = 10mA	4.950	5.0	5.050	V
V_O	Output Voltage	V_{IN} = 6.5V to 15V, I_O = 0mA to 1A (T_J = -40°C ~ 125°C)	4.900		5.100	V
ΔV_{LINE}	Line Regulation	I_O = 10mA , V_{IN} = 6.5V to 15V		0.1	0.2	%
ΔV_{LOAD}	Load Regulation	I_O = 10mA to 1A, V_{IN} = 7.0V		0.2	0.4	%
V_{IN}	Operating Input Voltage				15	V
I_{GND}	Ground Pin Current	V_{IN} = V_O +1.5V I_O =10 mA to 1A		5	10	mA
I_O	Current Limit	V_{IN} - V_O = 5V	1000			mA
eN	Output Noise(%V_O)	B = 10Hz to 10kHz, T_J = 25°C		100		µV
SVR	Supply Voltage Rejection	I_O = 1A, f = 120Hz, V_{IN} - V_O = 3V, V_{RIPPLE} = $1V_{PP}$	60	75		dB

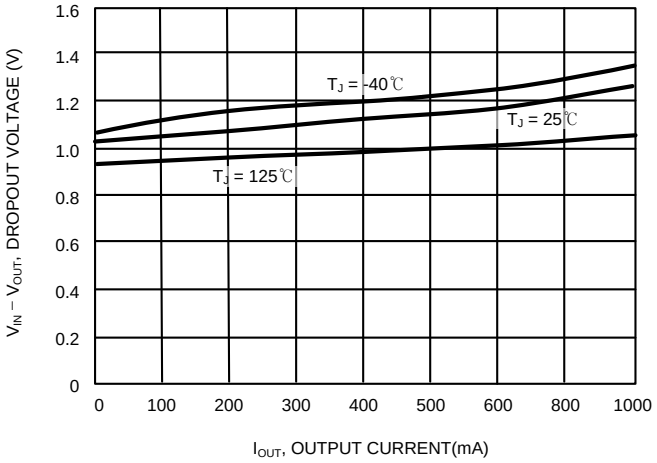
For All Output Voltage (T_J=25°C, C_{OUT} = 10µF unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_D	Dropout Voltage	I_O = 100mA		1.0	1.1	V
		I_O = 500mA		1.1	1.2	V
		I_O = 1A		1.2	1.3	V
	Temperature Stability			0.5		%
	Long Term Stability	1000 hrs, T_J = 125°C		0.3		%
	Thermal Regulation	T_A = 25°C 30ms Pulse		0.003		%/W
T_{SD}	Thermal Shutdown	Junction Temperature		165		°C
$T_{SD(HYS)}$	Thermal Shutdown Hysteresis			10		°C

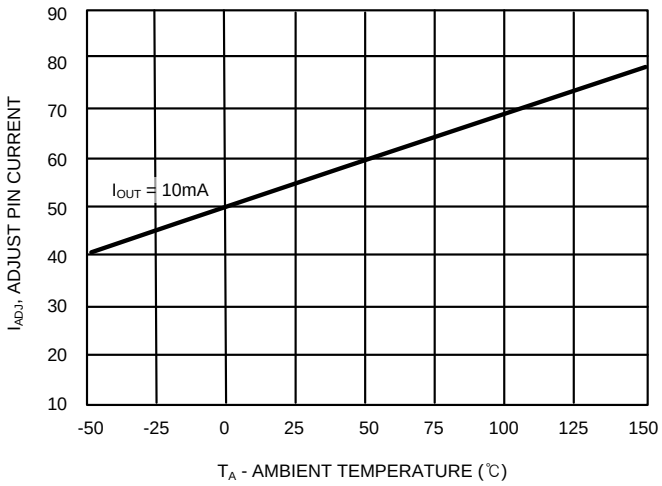
TYPICAL OPERATING CHARACTERISTICS



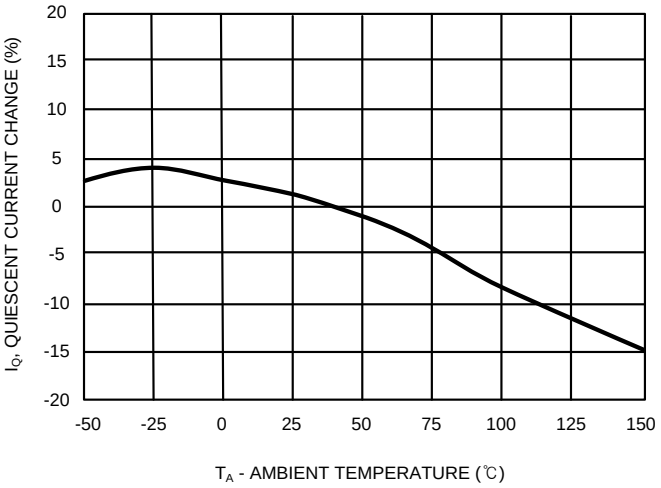
OUTPUT VOLTAGE CHANGE VS TEMPERATURE



DROPOUT VOLTAGE VS OUTPUT CURRENT



ADJ PIN CURRENT VS TEMPERATURE



QUIESCENT CURRENT CHANGE VS TEMPERATURE

APPLICATION CIRCUITS

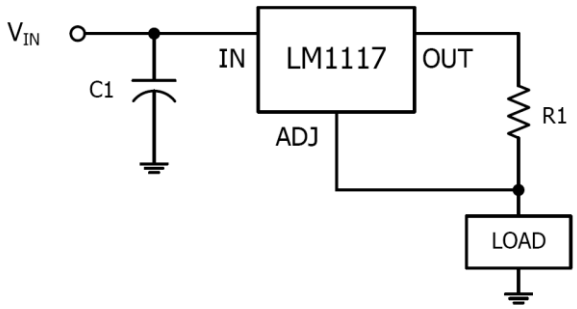


Fig.1 300mA Current Output

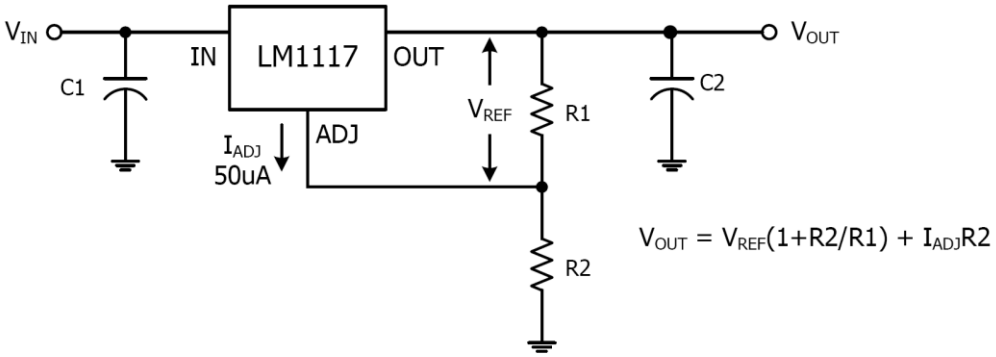


Fig.2 Typical Adjustable Regulator

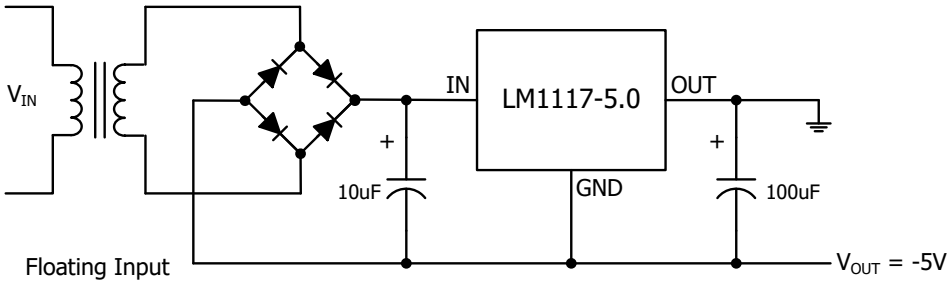


Fig.3 Negative Supply

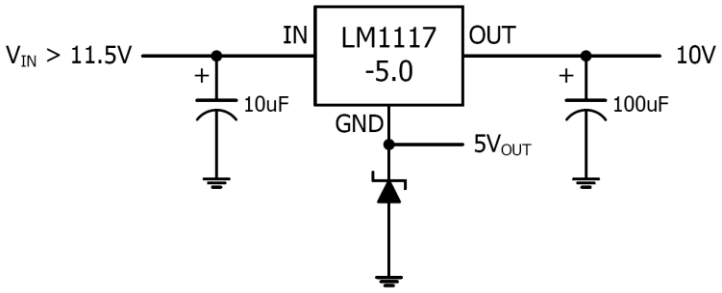


Fig.4 Voltage Regulator with Reference

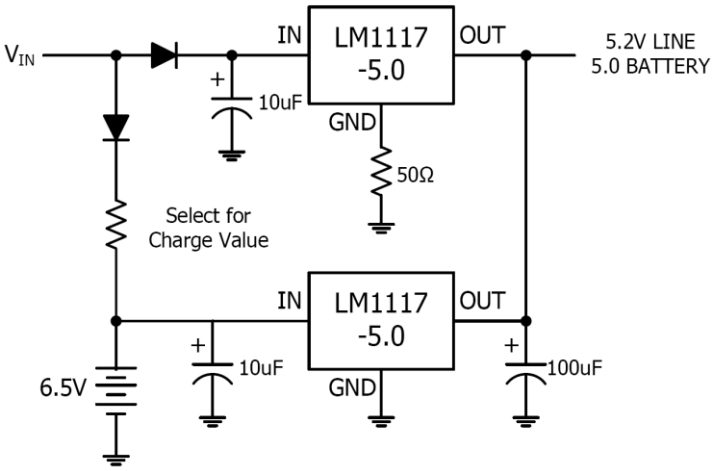


Fig.5 Battery Backed-up Regulated Supply

APPLICATION INFORMATION

The LM1117GS can deliver a continuous current of 1A over the full operating junction temperature range. However, the output current is limited by the restriction of power dissipation which differs from packages. A heat sink may be required depending on the maximum power dissipation and maximum ambient temperature of application. With respect to the applied package, the maximum output current of 1A may be still undeliverable due to the restriction of the power dissipation of LM1117GS. Under all possible conditions, the junction temperature must be within the range specified under operating conditions. The temperatures over the device are given by:

$$T_C = T_A + P_D \times \theta_{CA} \quad / \quad T_J = T_C + P_D \times \theta_{JC} \quad / \quad T_J = T_A + P_D \times \theta_{JA}$$

where T_J is the junction temperature, T_C is the case temperature, T_A is the ambient temperature, P_D is the total power dissipation of the device, θ_{CA} is the thermal resistance of case-to-ambient, θ_{JC} is the thermal resistance of junction-to-case, and θ_{JA} is the thermal resistance of junction to ambient. The total power dissipation of the device is given by:

$$P_D = P_{IN} - P_{OUT} = (V_{IN} \times I_{IN}) - (V_{OUT} \times I_{OUT})$$
$$= (V_{IN} \times (I_{OUT} + I_{GND})) - (V_{OUT} \times I_{OUT}) = (V_{IN} - V_{OUT}) \times I_{OUT} + (V_{IN} \times I_{GND})$$

where I_{GND} is the operating ground current of the device which is specified at the Electrical Characteristics. The maximum allowable temperature rise (T_{Rmax}) depends on the maximum ambient temperature (T_{Amax}) of the application, and the maximum allowable junction temperature (T_{Jmax}):

$$T_{Rmax} = T_{Jmax} - T_{Amax}$$

The maximum allowable value for junction-to-ambient thermal resistance, θ_{JA}, can be calculated using the formula:

$$\theta_{JA} = T_{Rmax} / P_D = (T_{Jmax} - T_{Amax}) / P_D$$

LM1117GS is available in SOT-223-3L packages. The thermal resistance depends on amount of copper area or heat sink, and on air flow. If the maximum allowable value of θ_{JA} calculated above is over 140°C/W for SOT-223-3L package, no heat sink is needed since the package can dissipate enough heat to satisfy these requirements. If the value for allowable θ_{JA} falls near or below these limits, a heat sink or proper area of copper plane is required. In summary, the absolute maximum ratings of thermal resistances are as follow:

Characteristic	Symbol	Rating	Unit
Thermal Resistance Junction-To-Ambient / SOT-223-3L	θ_{JA}-SOT-223	140	°C/W
Thermal Resistance Junction-To-Case / SOT-223-3L	θ_{JC}-SOT-223	18	°C/W

No heat sink / No air flow / No adjacent heat source / T_A=25°C

REVISION NOTICE

The description in this datasheet is subject to change without any notice to describe its electrical characteristics properly.