



SGM2035C

500mA, Ultra Low Dropout, Low Power, RF Linear Regulator

GENERAL DESCRIPTION

The SGM2035C is a low power and low dropout voltage linear regulator. It is capable of supplying 500mA output current with typical dropout voltage of only 250mV. The operating input voltage range is from 2.5V to 5.5V. The fixed output voltages are 2.8V, 3.0V and 3.3V.

Other features include logic-controlled shutdown mode, short-circuit current limit and thermal shutdown protection.

The SGM2035C is suitable for applications which need low power and low dropout voltage, such as MP3 players, palmtop computers, etc. Fixed or adjustable output voltage versions are provided.

The SGM2035C is available in Green UTDFN-1.6×1.6-6L and TDFN-2×2-6L packages. It operates over an ambient temperature range of -40°C to +85°C.

FEATURES

- **Operating Input Voltage Range: 2.5V to 5.5V**
- **Fixed Output Voltages: 2.8V, 3.0V and 3.3V**
- **Adjustable Output from 1.2V to 5.0V**
- **500mA Guaranteed Output Current**
- **High PSRR: 73dB (TYP) at 1kHz**
- **Ultra Low Dropout Voltage:
250mV (TYP) at 500mA**
- **Low Output Noise: 30μV_{RMS} (TYP)**
- **Thermal Shutdown Protection**
- **Output Current Limit**
- **Pull Down Resistor at EN Pin: 110kΩ**
- **1.8V Logic-Controlled Shutdown**
- **-40°C to +85°C Operating Temperature Range**
- **Available in Green UTDFN-1.6×1.6-6L and
TDFN-2×2-6L Packages**

APPLICATIONS

Modems
MP3 Players
Cellular Telephones
PCMCIA Cards
Palmtop Computers
Portable Electronics

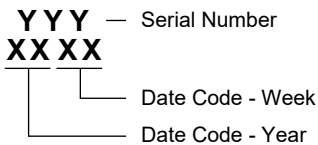
PACKAGE/ORDERING INFORMATION

MODEL	V _{OUT} (V)	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2035C-3.3	3.3V	TDFN-2×2-6L	-40°C to +85°C	SGM2035C-3.3YTDI6G/TR	SHA XXXX	Tape and Reel, 3000
SGM2035C-3.3	3.3V	UTDFN-1.6×1.6-6L	-40°C to +85°C	SGM2035C-3.3YUDN6G/TR	HBX	Tape and Reel, 3000
SGM2035C-3.0	3.0V	UTDFN-1.6×1.6-6L	-40°C to +85°C	SGM2035C-3.0YUDN6G/TR	TEX	Tape and Reel, 3000
SGM2035C-2.8	2.8V	UTDFN-1.6×1.6-6L	-40°C to +85°C	SGM2035C-2.8YUDN6G/TR	S0X	Tape and Reel, 3000
SGM2035C-ADJ	ADJ	UTDFN-1.6×1.6-6L	-40°C to +85°C	SGM2035C-ADJYUDN6G/TR	M7X	Tape and Reel, 3000

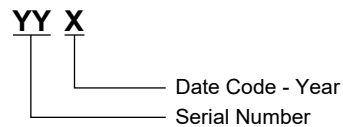
MARKING INFORMATION

NOTE: XXXX = Date Code, X = Date Code.

TDFN-2×2-6L



UTDFN-1.6×1.6-6L



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

IN to GND	-0.3V to 6V
Output Short-Circuit Duration.....	Infinite
EN to GND.....	-0.3V to (V _{IN} + 0.3V)
OUT, BP/FB to GND.....	-0.3V to (V _{IN} + 0.3V)
Power Dissipation, P _D @ T _A = +25°C	
TDFN-2×2-6L.....	0.91W
UTDFN-1.6×1.6-6L	0.88W
Package Thermal Resistance	
TDFN-2×2-6L, θ _{JA}	138°C/W
UTDFN-1.6×1.6-6L, θ _{JA}	142°C/W
Junction Temperature	+150°C
Storage Temperature Range.....	-65°C to +150°C
Lead Temperature (Soldering, 10s).....	+260°C
ESD Susceptibility	
HBM.....	4000V
MM.....	400V

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range-40°C to +85°C

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

ESD SENSITIVITY CAUTION

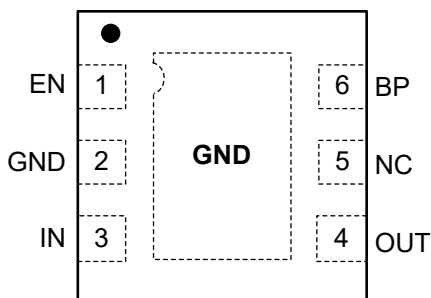
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

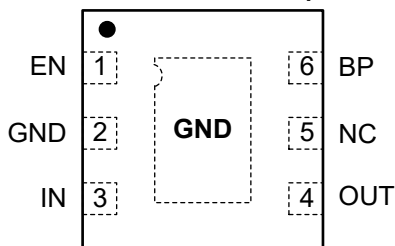
PIN CONFIGURATIONS

SGM2035C- Fixed Output



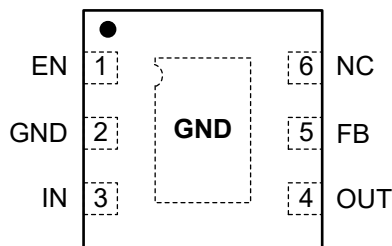
TDFN-2x2-6L

SGM2035C-Fixed Output



UTDFN-1.6x1.6-6L

SGM2035C-ADJ



UTDFN-1.6x1.6-6L

PIN DESCRIPTION

PIN		NAME	FUNCTION
TDFN-2x2-6L	UTDFN-1.6x1.6-6L		
1	1	EN	Enable Pin. Drive EN high to turn on the regulator. Drive EN low to turn off the regulator. The EN pin has an 110kΩ pull down resistor.
2	2	GND	Ground.
3	3	IN	Input Voltage Supply Pin. It is recommended to use a 1μF or larger ceramic capacitor from IN pin to ground.
4	4	OUT	Regulator Output Pin. It is recommended to use 1μF or larger ceramic capacitor from OUT pin to ground. The capacitor should be located very close to this pin.
5	5	NC	No Connection (fixed voltage version only).
-		FB	Feedback Voltage Input Pin. Connect this pin to the midpoint of an external resistor divider to adjust the output voltage. Place the resistors as close as possible to this pin.
6	6	BP	Reference-Noise Bypass Pin (fixed voltage version only). Bypass with an external capacitor C _{BP} can reduce output noise to very low level.
-		NC	No Connection (adjustable voltage version only).
Exposed Pad	Exposed Pad	GND	Exposed Pad. Connect it to GND internally. Connect it to a large ground plane to maximize thermal performance; this pad is not an electrical connection point.

ELECTRICAL CHARACTERISTICS

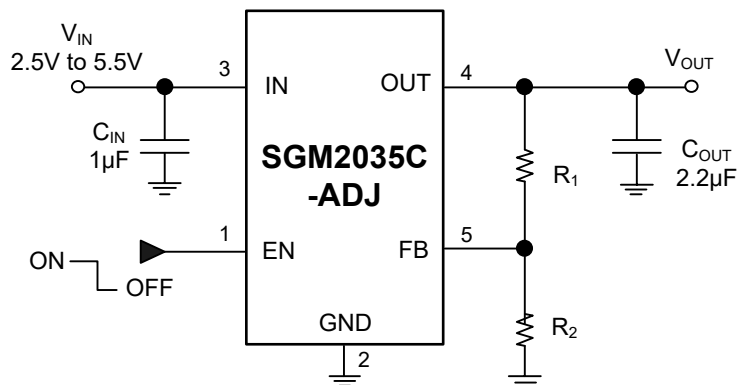
($V_{IN} = V_{OUT(NOMINAL)} + 0.5V$ or $2.5V$ (whichever is greater), Full = $-40^{\circ}C$ to $+85^{\circ}C$, unless otherwise noted. For SGM2035C-ADJ, $V_{OUT} = 3.3V$.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Voltage	V_{IN}		$+25^{\circ}C$	2.5		5.5	V
Output Voltage Accuracy		$I_{OUT} = 0.1mA$	$+25^{\circ}C$	-3		+3	%
Maximum Output Current			$+25^{\circ}C$	500			mA
Output Current Limit	I_{LIMIT}		$+25^{\circ}C$	510			mA
Ground Pin Current	I_Q	No Load, $V_{EN} = 2V$	$+25^{\circ}C$		115	220	μA
Dropout Voltage ⁽¹⁾		$I_{OUT} = 100mA$	$+25^{\circ}C$		50	90	mV
		$I_{OUT} = 300mA$			150	250	
		$I_{OUT} = 500mA$			250	400	
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	$V_{IN} = 2.5V$ to $5.5V$, $I_{OUT} = 1mA$	$+25^{\circ}C$		0.02	0.095	%/V
Load Regulation	$\frac{\Delta V_{OUT}}{\Delta I_{LOAD} \times V_{OUT}}$	$I_{OUT} = 0.1mA$ to $500mA$, $C_{OUT} = 1\mu F$	$+25^{\circ}C$		0.0025	0.0075	%/mA
Output Voltage Noise	e_n	$f = 10Hz$ to $100kHz$, $C_{BP} = 0.01\mu F$, $C_{OUT} = 10\mu F$	$+25^{\circ}C$		30		μV_{RMS}
Power Supply Rejection Ratio	PSRR	$C_{BP} = 0.1\mu F$, $I_{OUT} = 50mA$, $C_{OUT} = 1\mu F$, $V_{IN} = V_{OUT} + 1V$	$f = 217Hz$	$+25^{\circ}C$		77	dB
			$f = 1kHz$	$+25^{\circ}C$		73	dB
SHUTDOWN							
EN Input Threshold	V_{IH}	$V_{IN} = 2.5V$ to $5.5V$	Full	1.5			V
	V_{IL}		Full			0.3	
Pull Down Resistor	$R_{PULL\ DOWN}$		$+25^{\circ}C$		110		k Ω
Shutdown Supply Current	$I_{Q(SHDN)}$	$V_{EN} = 0.3V$	Full		0.01		μA
Shutdown Exit Delay ⁽²⁾		$C_{BP} = 0.01\mu F$, $C_{OUT} = 1\mu F$, No Load	$+25^{\circ}C$		30		μs
THERMAL PROTECTION							
Thermal Shutdown Temperature	T_{SHDN}				150		$^{\circ}C$
Thermal Shutdown Hysteresis	ΔT_{SHDN}				15		$^{\circ}C$

NOTES:

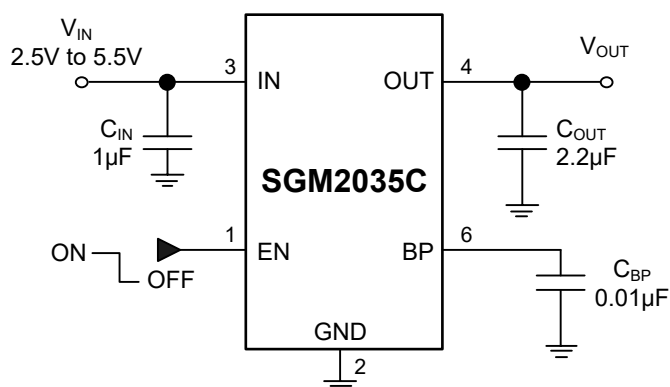
- The dropout voltage is defined as the difference between V_{IN} and V_{OUT} when V_{OUT} falls to $(V_{OUT(NOM)} - 100mV)$ for $V_{IN} = V_{OUT} + 0.5V$. (Only applicable for $V_{OUT} = +2.5V$ to $+5.0V$.)
- Time needed for V_{OUT} to reach 90% of final value.

TYPICAL APPLICATION CIRCUITS



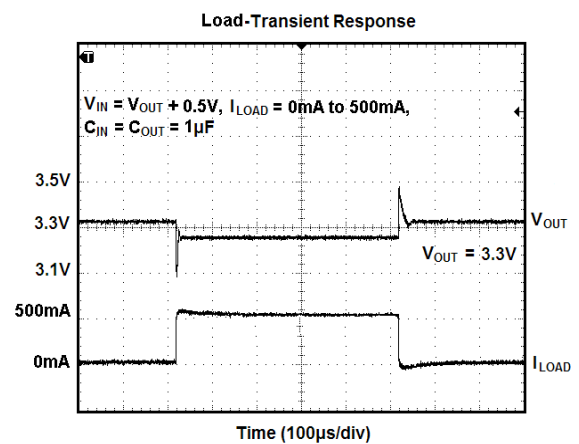
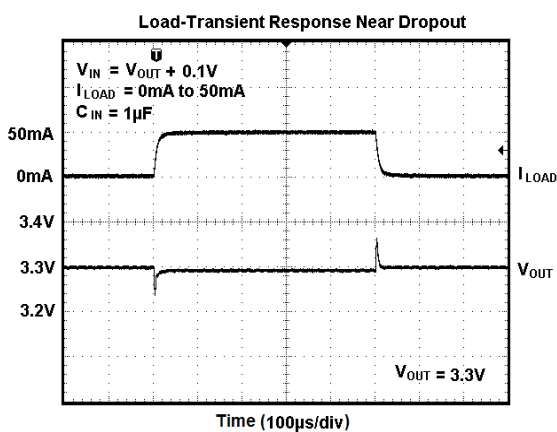
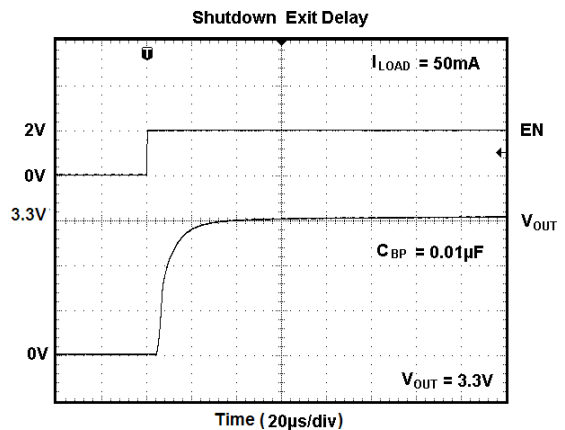
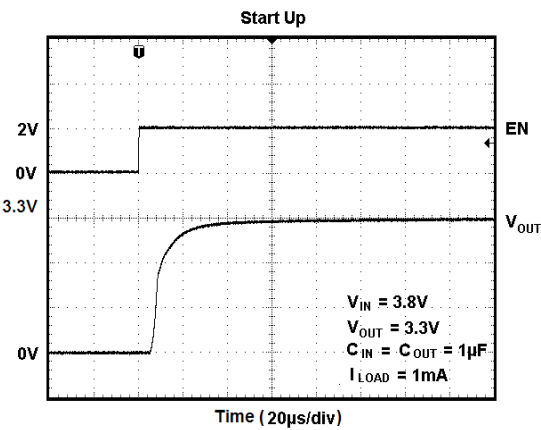
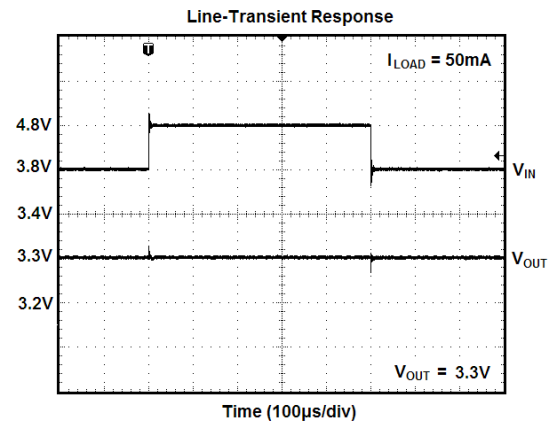
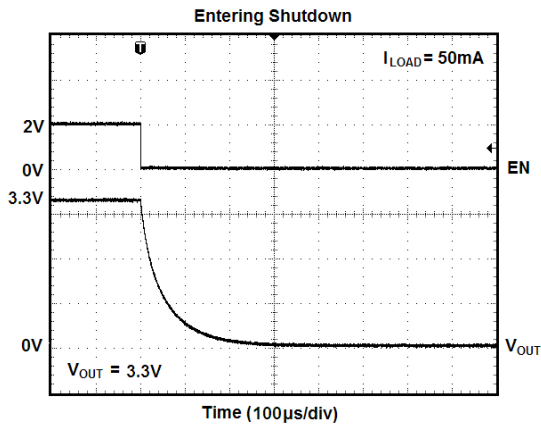
NOTE: Choose $R_2 = 47k\Omega$ to maintain a 26µA minimum load. Calculate the value for R_1 using the following equation:

$$R_1 = R_2 \times \left(\frac{V_{OUT}}{1.206V} - 1 \right)$$



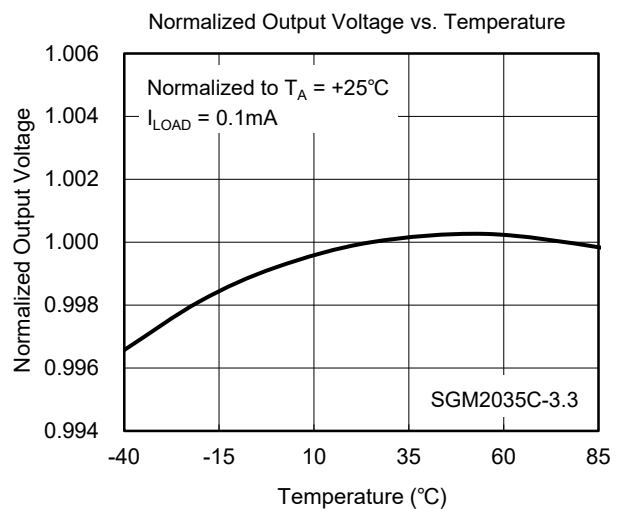
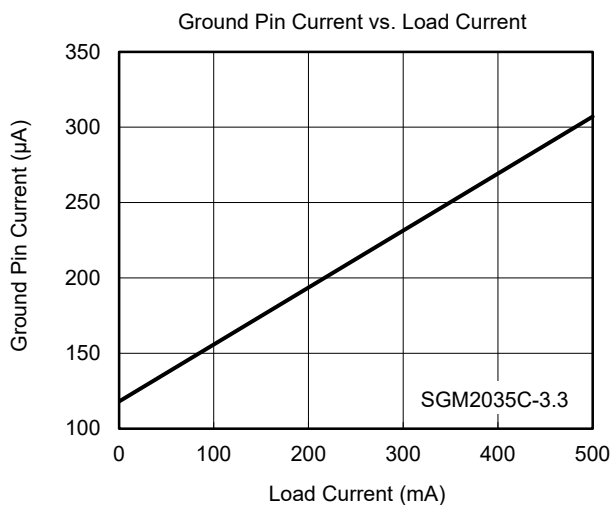
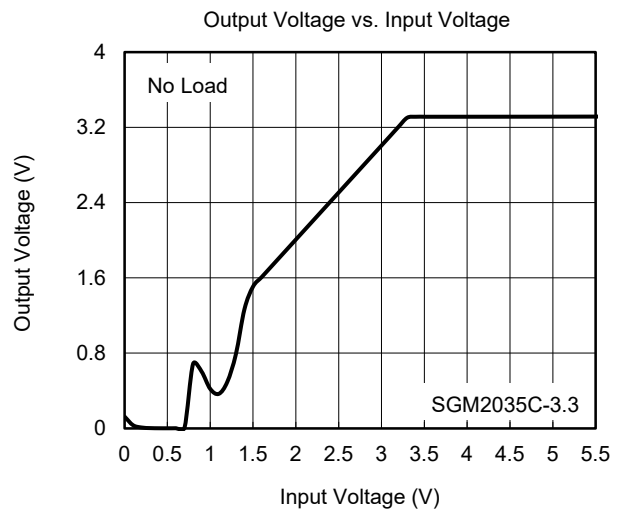
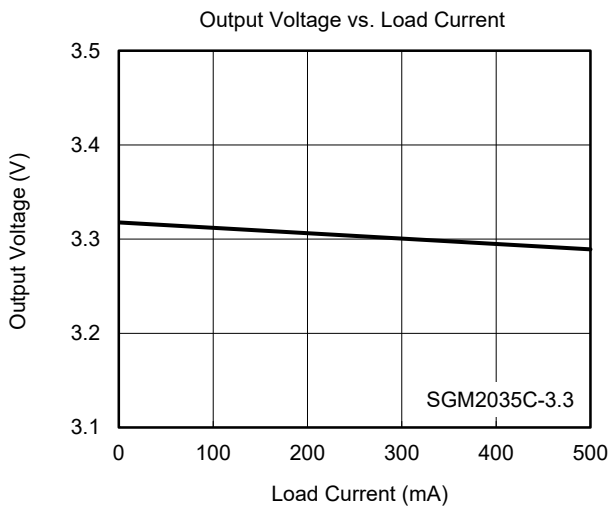
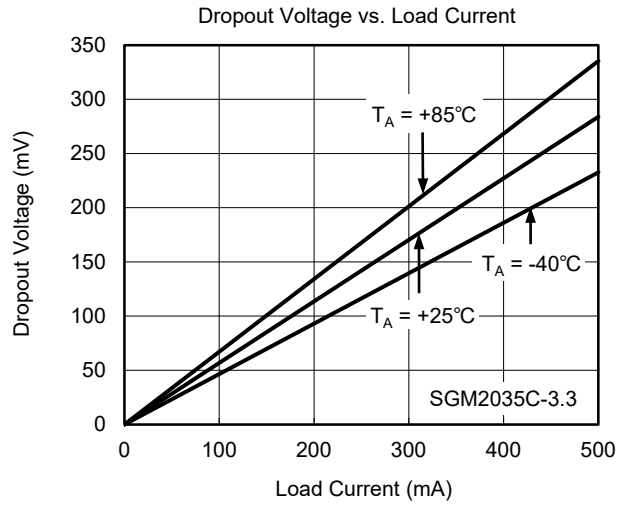
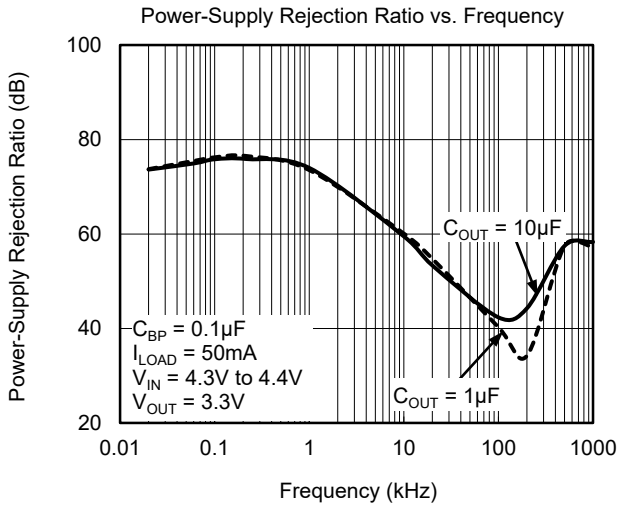
TYPICAL PERFORMANCE CHARACTERISTICS

$T_A = +25^\circ\text{C}$, $V_{IN} = V_{OUT(NOMINAL)} + 0.5\text{V}$ or 2.5V (whichever is greater), $C_{IN} = 1\mu\text{F}$, $C_{OUT} = 1\mu\text{F}$, $C_{BP} = 0.01\mu\text{F}$, unless otherwise noted.



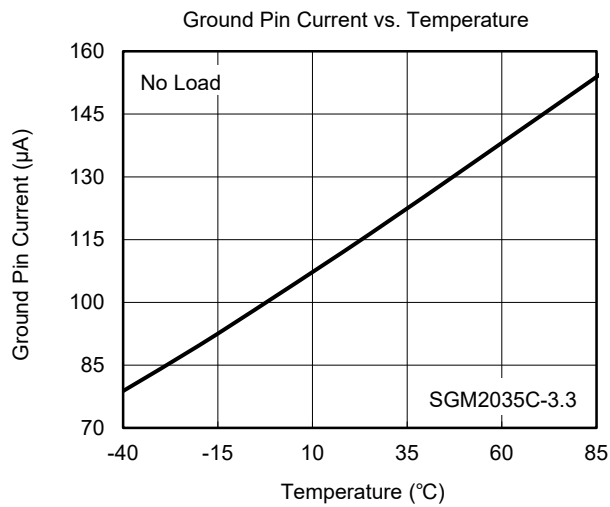
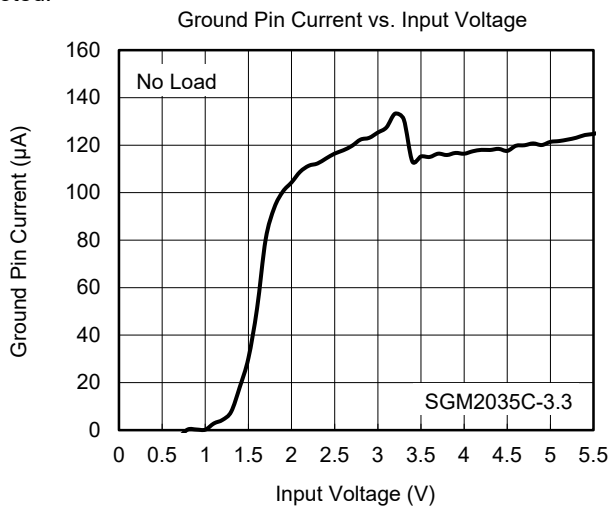
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_A = +25^\circ\text{C}$, $V_{IN} = V_{OUT(NOMINAL)} + 0.5\text{V}$ or 2.5V (whichever is greater), $C_{IN} = 1\mu\text{F}$, $C_{OUT} = 1\mu\text{F}$, $C_{BP} = 0.01\mu\text{F}$, unless otherwise noted.



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_A = +25^\circ\text{C}$, $V_{IN} = V_{OUT(NOMINAL)} + 0.5\text{V}$ or 2.5V (whichever is greater), $C_{IN} = 1\mu\text{F}$, $C_{OUT} = 1\mu\text{F}$, $C_{BP} = 0.01\mu\text{F}$, unless otherwise noted.



APPLICATION INFORMATION

The SGM2035C is a low power and low dropout LDO and provides 500mA output current. These features make the device a reliable solution to solve many challenging problems in the generation of clean and accurate power supply. The high performance also makes the SGM2035C useful in a variety of applications. The SGM2035C provides protection functions for output overload, output short-circuit condition and overheating.

Input Capacitor Selection (C_{IN})

The input decoupling capacitor is necessary to be connected as close as possible to the IN pin for ensuring the device stability. 1 μ F or larger X7R or X5R ceramic capacitor is selected to get good dynamic performance.

When V_{IN} is required to provide large current instantaneously, a large effective input capacitor is required. Multiple input capacitors can limit the input tracking inductance. Adding more input capacitors is available to restrict the ringing and to keep it below the device absolute maximum ratings.

Output Capacitor Selection (C_{OUT})

The output decoupling capacitor should be located as close as possible to the OUT pin. 1 μ F or larger X7R or X5R ceramic capacitor is selected to get good dynamic performance. The minimum effective capacitance of C_{OUT} that SGM2035C can remain stable is 0.5 μ F. For ceramic capacitor, temperature, DC bias and package size will change the effective capacitance, so enough margin of C_{OUT} must be considered in design. Larger capacitance and lower ESR C_{OUT} will help improve the load transient response and increase the high frequency PSRR.

Enable Control

The SGM2035C uses the EN pin to enable/disable its device.

When the EN pin voltage is lower than 0.3V, the device is in shutdown state. When the EN pin voltage is higher than 1.5V, the device is in active state. The output voltage is regulated to expected value.

Output Current Limit and Short-Circuit Protection

When overload events happen, the output current is internally limited to 510mA (MIN). When the OUT pin is shorted to ground, the short-circuit protection will limit the output current.

Thermal Shutdown

The SGM2035C can detect the temperature of die. When the die temperature exceeds the threshold value of thermal shutdown, the SGM2035C will be in shutdown state and it will remain in this state until the die temperature decreases to +135°C.

Power Dissipation (P_D)

Thermal protection limits power dissipation in the SGM2035C. When power dissipation on pass element ($P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$) is too much and the operating junction temperature exceeds +150°C, the OTP circuit starts the thermal shutdown function and turns the pass element off.

Therefore, thermal analysis for the chosen application is important to guarantee reliable performance over all conditions. To guarantee reliable operation, the junction temperature of the SGM2035C must not exceed +125°C.

The maximum allowable power dissipation depends on the thermal resistance of the IC package, the PCB layout, the rate of surrounding airflow, and the difference between the junction temperature and ambient temperature. The maximum power dissipation can be approximated using the following equation:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA} \quad (3)$$

where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction -to-ambient thermal resistance.

Layout Guidelines

To get good PSRR, low output noise and high transient response performance, the input and output bypass capacitors must be placed as close as possible to the IN pin and OUT pin separately. V_{IN} and V_{OUT} had better use separate ground planes and these ground planes are single point connected to the GND pin.

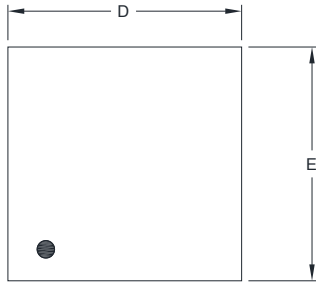
REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

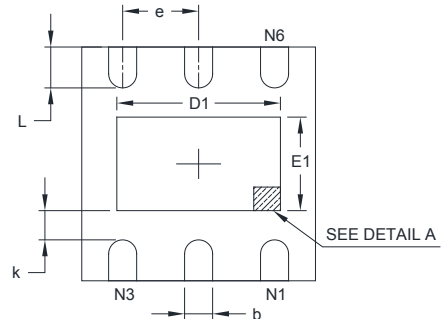
SEPTEMBER 2020 – REV.A.4 to REV.B	Page
Updated Absolute Maximum Ratings	2
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MAY 2016 – REV.A.3 to REV.A.4	Page
Changed Typical Performance Characteristics	8
<hr/>	
DECEMBER 2014 – REV.A.2 to REV.A.3	Page
Added SGM2035C-3.0	1, 2
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DECEMBER 2013 – REV.A.1 to REV.A.2	Page
Added SGM2035C-ADJ	3
Added SGM2035C-2.8	All
Updated Electrical Characteristics	5
Changed Typical Performance Characteristics	8, 9
Changed Absolute Maximum Ratings	2
<hr/>	
DECEMBER 2012 – REV.A to REV.A.1	Page
Updated Electrical Characteristics	5
<hr/>	
Changes from Original (AUGUST 2012) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

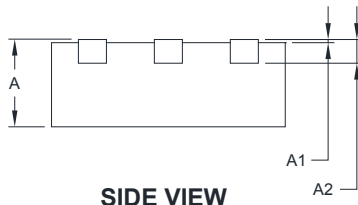
TDFN-2x2-6L



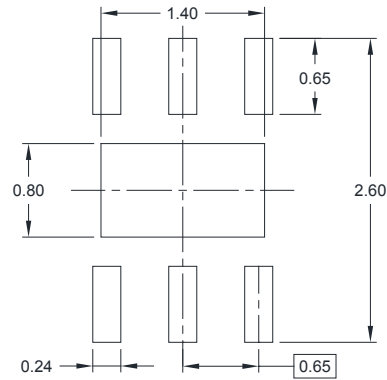
TOP VIEW



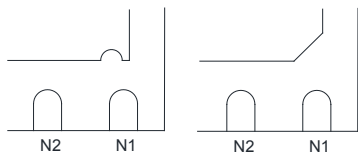
BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)



DETAIL A

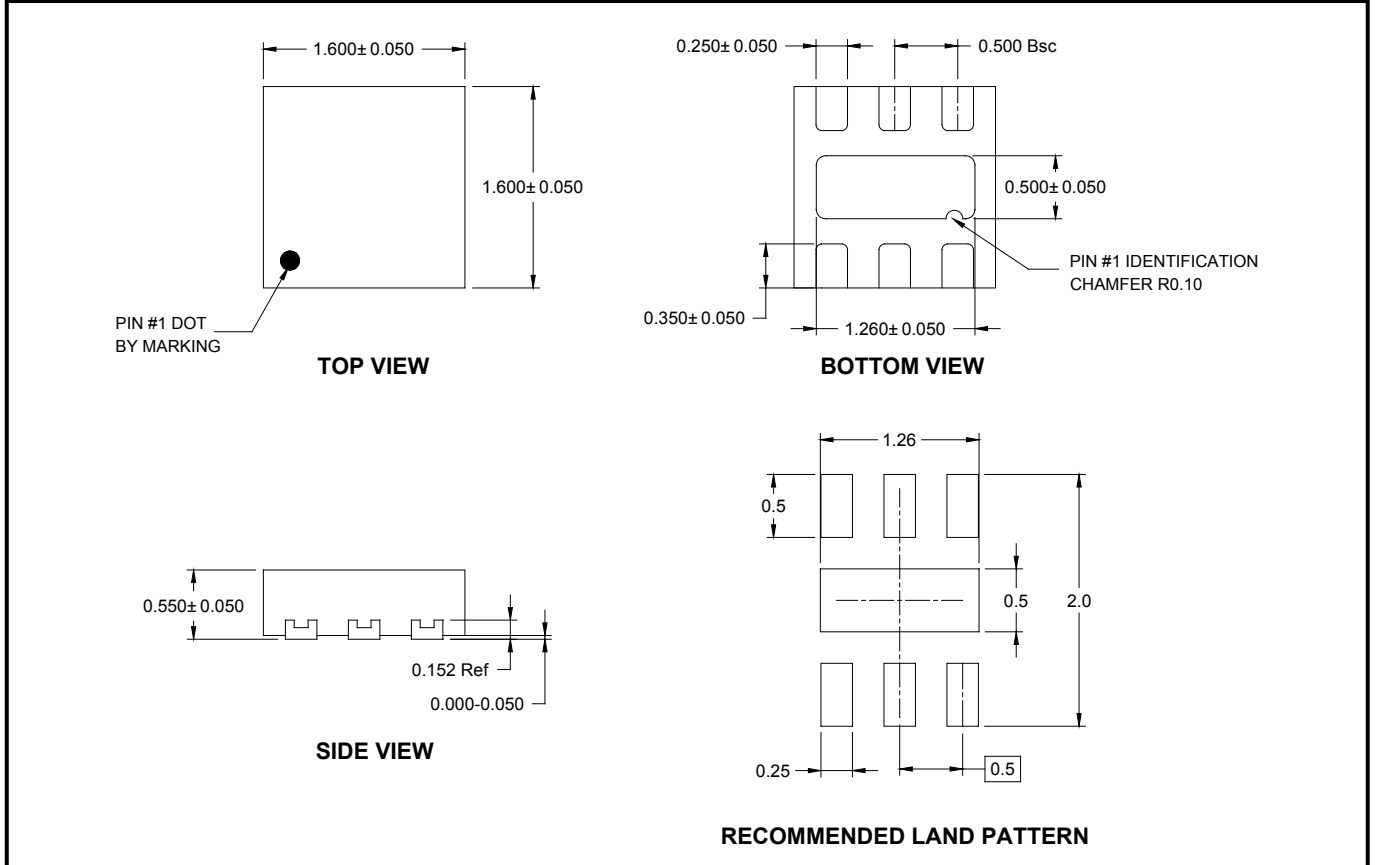
Pin #1 ID and Tie Bar Mark Options

NOTE: The configuration of the Pin #1 identifier is optional, but must be located within the zone indicated.

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
A2	0.203 REF		0.008 REF	
D	1.900	2.100	0.075	0.083
D1	1.100	1.450	0.043	0.057
E	1.900	2.100	0.075	0.083
E1	0.600	0.850	0.024	0.034
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.650 TYP		0.026 TYP	
L	0.250	0.450	0.010	0.018

PACKAGE OUTLINE DIMENSIONS

UTDFN-1.6×1.6-6L



NOTE: All linear dimensions are in millimeters.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
TDFN-2×2-6L	7"	9.5	2.30	2.30	1.10	4.0	4.0	2.0	8.0	Q1
UTDFN-1.6×1.6-6L	7"	9.0	1.78	1.78	0.69	4.0	4.0	2.0	8.0	Q1

DD0001

PACKAGE INFORMATION

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7" (Option)	368	227	224	8
7"	442	410	224	18

DD0002