SGM2045
300mA, Low V_{IN}, Ultra-Low Noise and High PSRR Linear Regulator

GENERAL DESCRIPTION

The SGM2045 is an ultra-low noise linear regulator capable of supplying 300mA output current. The device also provides wide output voltage range from 0.6V up to 4.2V and high PSRR. Due to low quiescent current, the SGM2045 is suitable for battery-powered devices such as smartphones and tablets. The device is designed to work with a 1μF input and a 1μF output ceramic capacitors.

The SGM2045 is available in Green XTDFN-1×1-4L and WLCSP-0.64×0.64-4B-A packages. It operates over an operating temperature range of -40℃ to +125℃.

APPLICATIONS

Battery-Powered Equipment
Smartphones and Tablets
Digital Cameras
Smoke Detectors
Portable Medical Equipment
RF, PLL, VCO and Clock Power Supplies
Battery-Powered Wireless IoT Modules

FEATURES

- **Operating Input Voltage Range: 1.1V to 5.5V**
- **Fixed Output Voltage Option: 0.6V to 4.2V**
- **Ultra-Low Noise: 9.5μV_{RMS} (TYP)**
- **Ultra-Low Quiescent Current: 15μA (TYP)**
- **Standby Current: 0.03μA (TYP)**
- **High PSRR: 92dB (TYP) at 1kHz**
- **Low Dropout Voltage:**
  - **100mV (TYP) at 300mA when V_{OUT} = 1.8V (XTDFN-1×1-4L)**
  - **80mV (TYP) at 300mA when V_{OUT} = 1.8V (WLCSP-0.64×0.64-4B-A)**
- **Output Short-Circuit Protection**
- **Over-Temperature Protection**
- **Fast Load Transient Response**
- **Stable with 1μF Small Case Size Ceramic Capacitors**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green XTDFN-1×1-4L and WLCSP-0.64×0.64-4B-A Packages**

TYPICAL APPLICATION

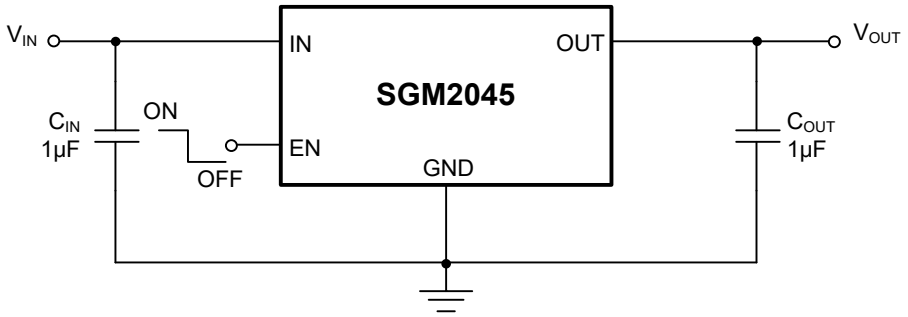
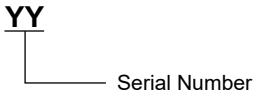


Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2045-0.60	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-0.60XXDH4G/TR	08	Tape and Reel, 10000
SGM2045-0.75	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-0.75XXDH4G/TR	09	Tape and Reel, 10000
SGM2045-0.80	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-0.80XXDH4G/TR	10	Tape and Reel, 10000
SGM2045-0.85	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-0.85XXDH4G/TR	11	Tape and Reel, 10000
SGM2045-1.00	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-1.00XXDH4G/TR	12	Tape and Reel, 10000
SGM2045-1.05	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-1.05XXDH4G/TR	13	Tape and Reel, 10000
SGM2045-1.10	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-1.10XXDH4G/TR	15	Tape and Reel, 10000
SGM2045-1.20	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-1.20XXDH4G/TR	16	Tape and Reel, 10000
SGM2045-1.50	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-1.50XXDH4G/TR	MC	Tape and Reel, 10000
SGM2045-1.80	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-1.80XXDH4G/TR	17	Tape and Reel, 10000
SGM2045-2.50	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-2.50XXDH4G/TR	18	Tape and Reel, 10000
SGM2045-2.80	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-2.80XXDH4G/TR	19	Tape and Reel, 10000
SGM2045-3.00	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-3.00XXDH4G/TR	20	Tape and Reel, 10000
SGM2045-3.30	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-3.30XXDH4G/TR	21	Tape and Reel, 10000
SGM2045-4.20	XTDFN-1×1-4L	-40℃ to +125℃	SGM2045-4.20XXDH4G/TR	22	Tape and Reel, 10000
SGM2045-0.60	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-0.60XG/TR	J1	Tape and Reel, 5000
SGM2045-0.80	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-0.80XG/TR	J2	Tape and Reel, 5000
SGM2045-0.85	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-0.85XG/TR	J4	Tape and Reel, 5000
SGM2045-1.00	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-1.00XG/TR	J5	Tape and Reel, 5000
SGM2045-1.05	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-1.05XG/TR	JA	Tape and Reel, 5000
SGM2045-1.10	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-1.10XG/TR	JD	Tape and Reel, 5000
SGM2045-1.20	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-1.20XG/TR	K9	Tape and Reel, 5000
SGM2045-1.75	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-1.75XG/TR	1P	Tape and Reel, 5000
SGM2045-1.80	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-1.80XG/TR	KA	Tape and Reel, 5000
SGM2045-1.825	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-1.825XG/TR	4N	Tape and Reel, 5000
SGM2045-2.50	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-2.50XG/TR	KB	Tape and Reel, 5000
SGM2045-2.80	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-2.80XG/TR	KD	Tape and Reel, 5000
SGM2045-3.00	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-3.00XG/TR	KF	Tape and Reel, 5000
SGM2045-3.30	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-3.30XG/TR	L2	Tape and Reel, 5000
SGM2045-4.20	WLCSP-0.64×0.64-4B-A	-40℃ to +125℃	SGM2045-4.20XG/TR	L4	Tape and Reel, 5000

MARKING INFORMATION



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
OUT to GND ..... -0.3V to (V_{IN} + 0.3V)
EN to GND ..... -0.3V to 6V
Package Thermal Resistance
XTDFN-1×1-4L, θ_{JA} ..... 242℃/W
XTDFN-1×1-4L, θ_{JB} ..... 107℃/W
XTDFN-1×1-4L, θ_{JC} ..... 238℃/W
WLCSP-0.64×0.64-4B-A, θ_{JA} ..... 285℃/W
WLCSP-0.64×0.64-4B-A, θ_{JB} ..... 50℃/W
WLCSP-0.64×0.64-4B-A, θ_{JC} ..... 116℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 8000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range ..... 1.1V to 5.5V
Enable Input Voltage Range ..... 0V to 5.5V
Input Effective Capacitance, C_{IN} ..... 0.1μF (MIN)
Output Effective Capacitance, C_{OUT} ..... 0.5μF to 200μF
Operating Junction Temperature Range ..... -40℃ to +125℃

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

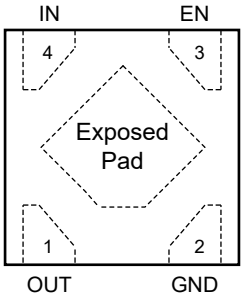
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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.

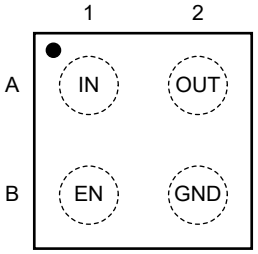
PIN CONFIGURATIONS

(TOP VIEW)



XTDFN-1×1-4L

(TOP VIEW)



WLCSP-0.64×0.64-4B-A

PIN DESCRIPTION

PIN		NAME	FUNCTION
XTDFN-1×1-4L	WLCSP-0.64×0.64-4B-A		
1	A2	OUT	Regulated Output Voltage Pin. It is recommended to use an output capacitor with effective capacitance in the range of 0.5μF to 200μF. The capacitor should be located very close to this pin.
2	B2	GND	Ground.
3	B1	EN	Enable Pin. Driving EN high to turn on the regulator. Driving EN low to turn off the regulator. For automatic startup, connect EN pin to IN pin.
4	A1	IN	Input Voltage Supply Pin. Bypass with a 1μF capacitor to GND.
Exposed Pad	—	GND	Exposed Pad. Connect it to a large ground plane to maximize thermal performance; not intended as an electrical connection point.

ELECTRICAL CHARACTERISTICS

(V_{IN} = ($V_{OUT(NOM)}$ + 0.3V) or 1.1V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 1μF, T_J = -40℃ to +125℃, typical values are at T_J = +25℃, unless otherwise noted.)

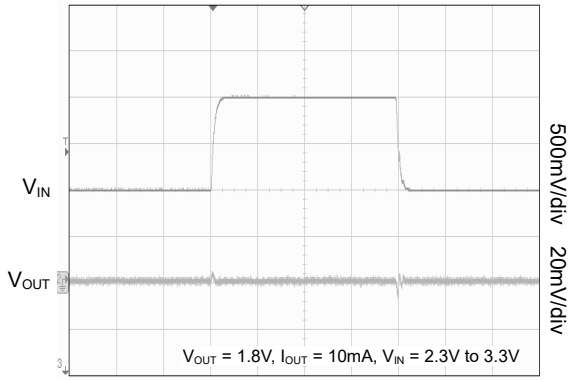
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage Range	V_{IN}	I_{OUT} = 60mA		1.1		5.5	V
		I_{OUT} = 100mA		1.2		5.5	
		I_{OUT} = 200mA		1.3		5.5	
		I_{OUT} = 300mA		1.4		5.5	
Output Voltage Accuracy	V_{OUT}	V_{IN} = ($V_{OUT(NOM)}$ + 0.3V) to 5.5V, I_{OUT} = 0.1mA to 300mA, T_J = +25℃		-1		1	%
		V_{IN} = ($V_{OUT(NOM)}$ + 0.3V) to 5.5V, I_{OUT} = 0.1mA to 300mA		-2.5		2.5	
Line Regulation	ΔV_{LNR}	V_{IN} = ($V_{OUT(NOM)}$ + 0.3V) to 5.5V, I_{OUT} = 0.1mA			0.05	2.5	mV
Load Regulation	$\Delta V_{LDR}/V_{OUT}$	I_{OUT} = 0.1mA to 300mA			0.4	10	mV/V
Output Current Limit	I_{LIMIT}	V_{OUT} = 90% × $V_{OUT(NOM)}$, V_{IN} = ($V_{OUT(NOM)}$ + 0.3V) or 1.4V	T_J = -20℃ to +125℃	300	600		mA
			T_J = -40℃ to +125℃	260	600		
Short-Circuit Current	I_{SHORT}	V_{OUT} = 0V			380		mA
Quiescent Current	I_Q	I_{OUT} = 0mA			15	40	μA
Dropout Voltage (1)	V_{DROP}	I_{OUT} = 60mA	1.05V ≤ $V_{OUT(NOM)}$ < 1.2V		65	110	mV
		I_{OUT} = 100mA	1.05V ≤ $V_{OUT(NOM)}$ < 1.2V		100	160	
			1.2V ≤ $V_{OUT(NOM)}$ < 1.5V		185	260	
		I_{OUT} = 200mA	1.05V ≤ $V_{OUT(NOM)}$ < 1.2V		260	360	
			1.2V ≤ $V_{OUT(NOM)}$ < 1.5V		65	110	
		I_{OUT} = 300mA	1.05V ≤ $V_{OUT(NOM)}$ < 1.2V		125	210	
			1.2V ≤ $V_{OUT(NOM)}$ < 1.5V		185	300	
			1.5V ≤ $V_{OUT(NOM)}$ < 1.8V		125	220	
		I_{OUT} = 300mA, XTDFN-1×1-4L	1.8V ≤ $V_{OUT(NOM)}$ < 2.8V		100	190	
			2.8V ≤ $V_{OUT(NOM)}$ ≤ 4.2V		70	150	
		I_{OUT} = 300mA, WLCSP-0.64×0.64-4B-A	1.8V ≤ $V_{OUT(NOM)}$ < 2.8V		80	130	
			2.8V ≤ $V_{OUT(NOM)}$ ≤ 4.2V		50	120	
EN Input Threshold	V_{IH}	V_{IN} = 1.1V to 5.5V		0.7			V
	V_{IL}					0.3	
EN Pull-Down Current	I_{EN}	V_{EN} = V_{IN} = 5.5V			0.03	1	μA
Shutdown Current	I_{SHDN}	V_{EN} = 0V, V_{IN} = 5.5V			0.03	2	μA
Turn-On Time	t_{ON}	From EN rising from 0V to V_{IN} to 90% × $V_{OUT(NOM)}$, no load			100	240	μs
Power Supply Rejection Ratio	PSRR	I_{OUT} = 20mA, V_{IN} = $V_{OUT(NOM)}$ + 1V	f = 100Hz		90		dB
			f = 1kHz		92		
			f = 10kHz		80		
			f = 100kHz		55		
Output Voltage Noise	e_n	f = 10Hz to 100kHz, I_{OUT} = 20mA			9.5		μV_{RMS}
Output Discharge Resistance	R_{DIS}	V_{EN} = 0V, V_{OUT} = 0.2V, V_{IN} = 3.3V			60		Ω
Thermal Shutdown Temperature	T_{SHDN}				160		℃
Thermal Shutdown Hysteresis	ΔT_{SHDN}				20		℃

NOTE:
1. Dropout voltage is characterized when V_{OUT} falls 50mV below $V_{OUT(NOM)}$.

TYPICAL PERFORMANCE CHARACTERISTICS

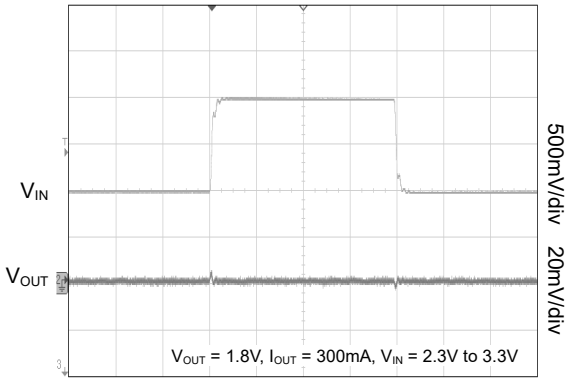
T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 0.3V) or 1.1V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 1μF, unless otherwise noted.

Line Transient Response



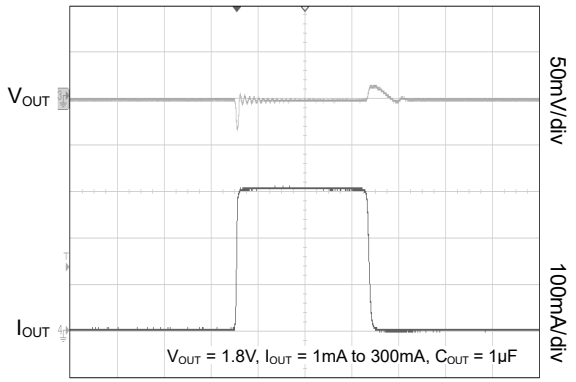
Time (20μs/div)

Line Transient Response



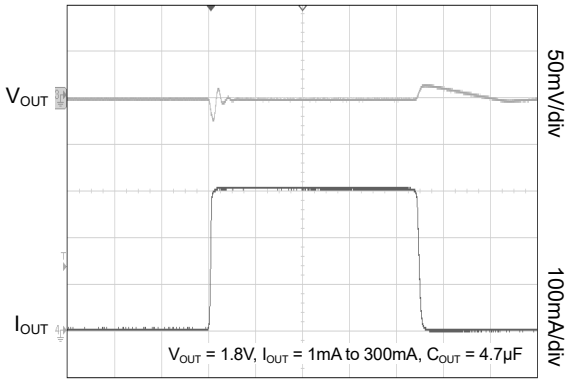
Time (20μs/div)

Load Transient Response



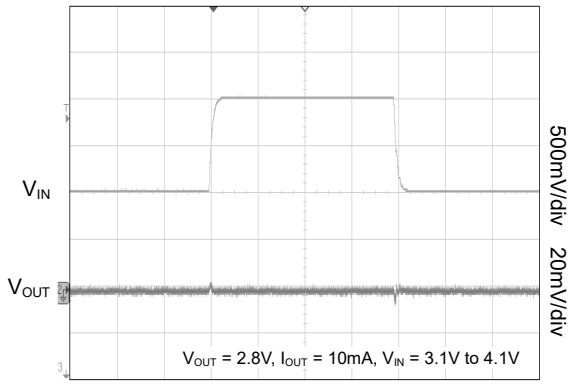
Time (10μs/div)

Load Transient Response



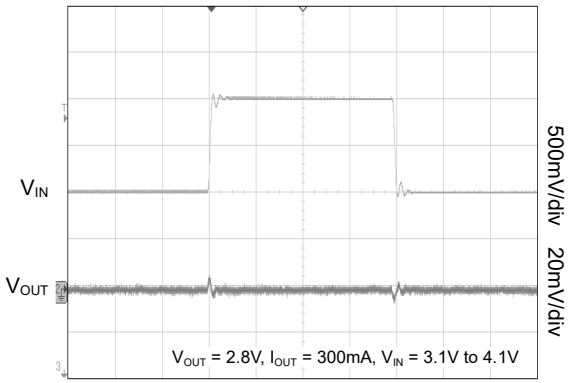
Time (10μs/div)

Line Transient Response



Time (20μs/div)

Line Transient Response

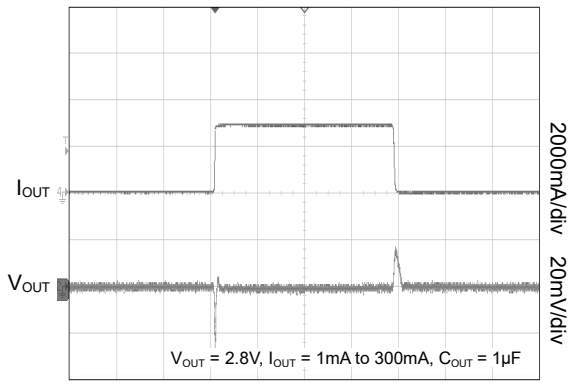


Time (20μs/div)

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

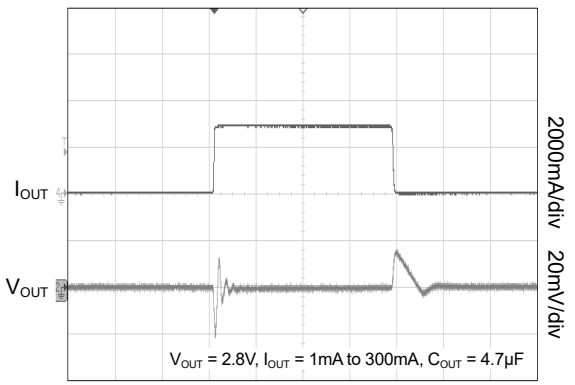
T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 0.3V) or 1.1V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 1μF, unless otherwise noted.

Load Transient Response



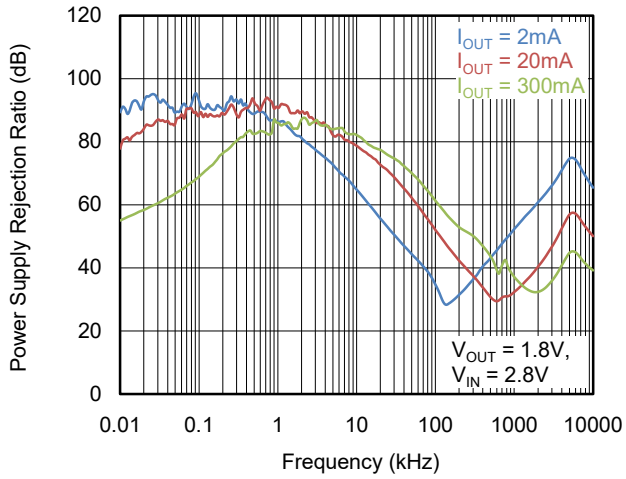
Time (20μs/div)

Load Transient Response

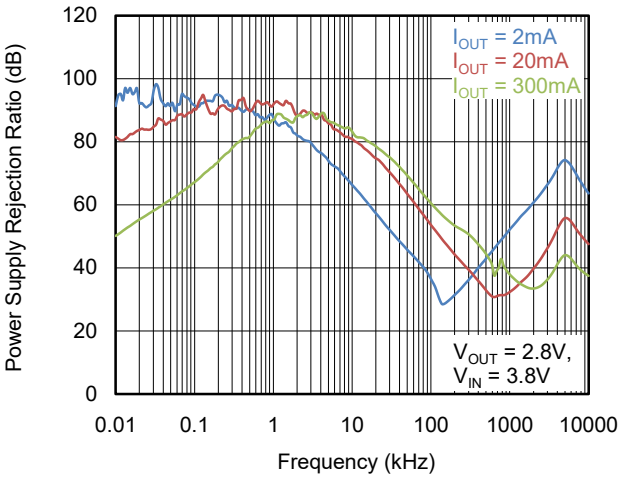


Time (20μs/div)

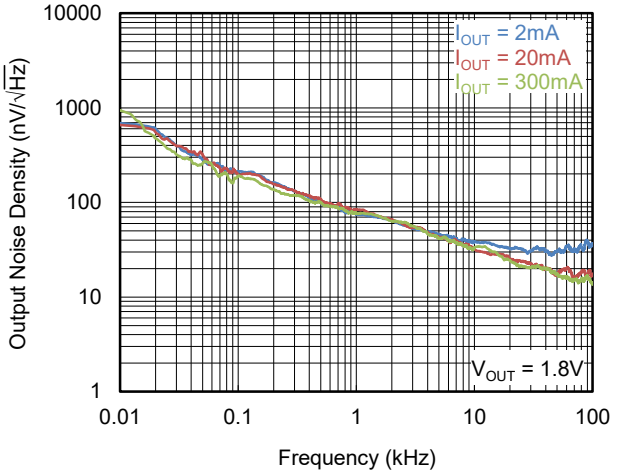
Power Supply Rejection Ratio vs. Frequency



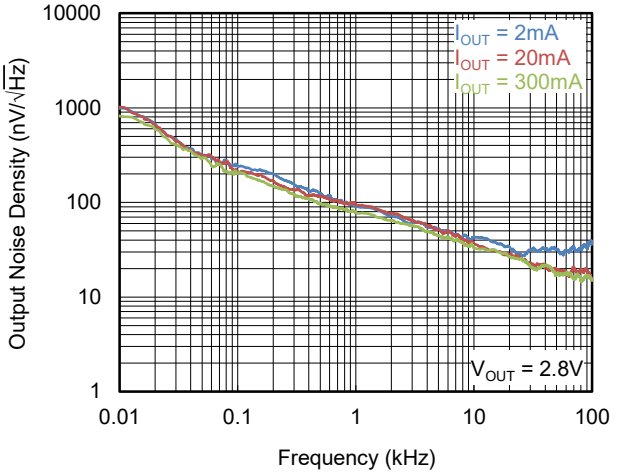
Power Supply Rejection Ratio vs. Frequency



Output Noise Density vs. Frequency



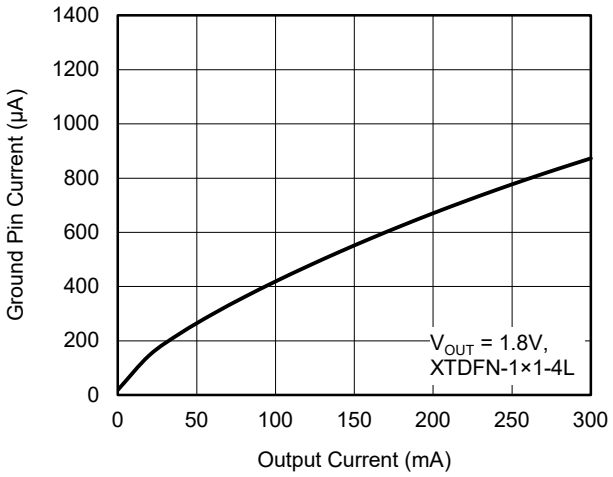
Output Noise Density vs. Frequency



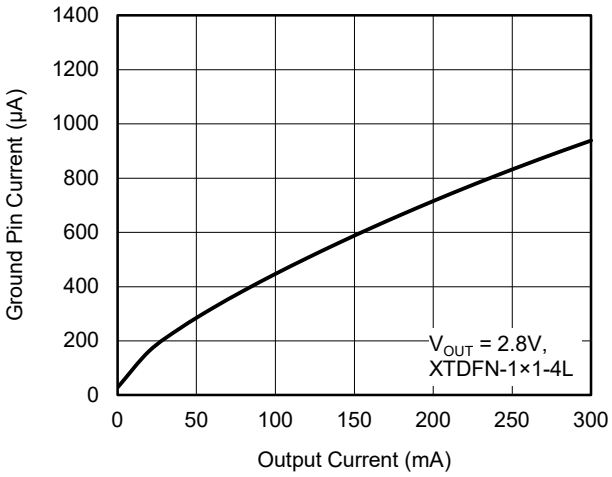
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 0.3V) or 1.1V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 1μF, unless otherwise noted.

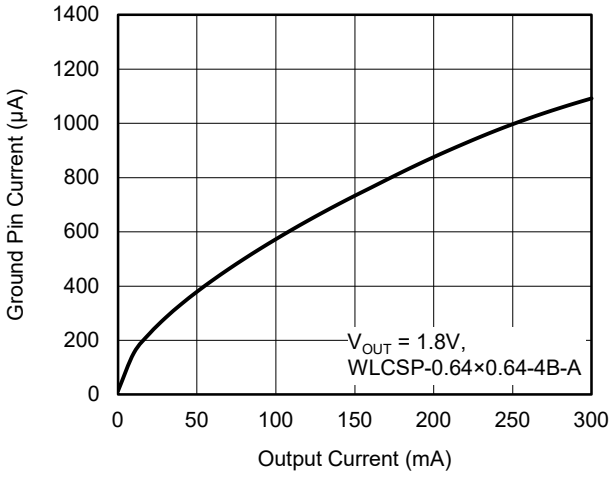
Ground Pin Current vs. Output Current



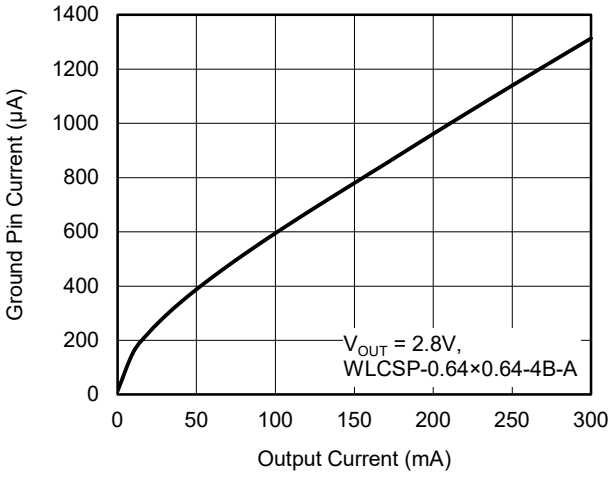
Ground Pin Current vs. Output Current



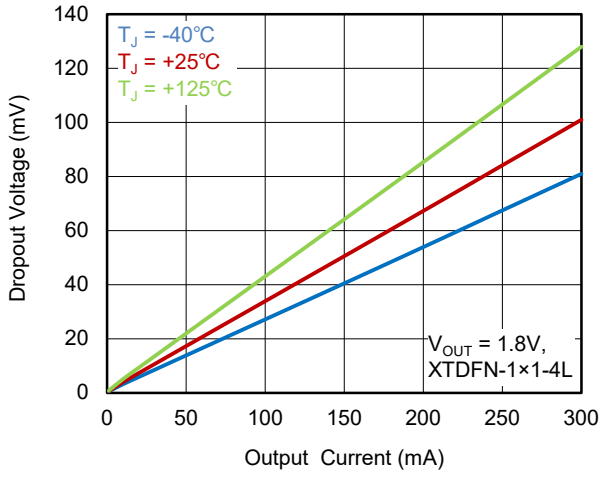
Ground Pin Current vs. Output Current



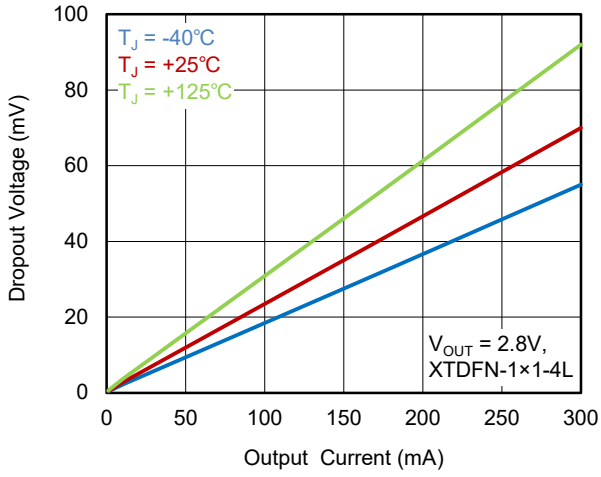
Ground Pin Current vs. Output Current



Dropout Voltage vs. Output Current



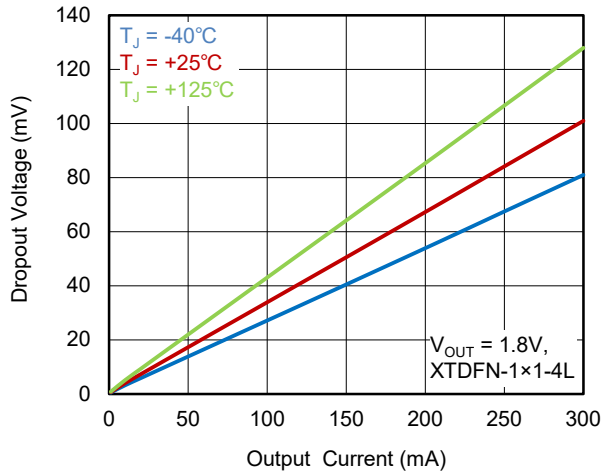
Dropout Voltage vs. Output Current



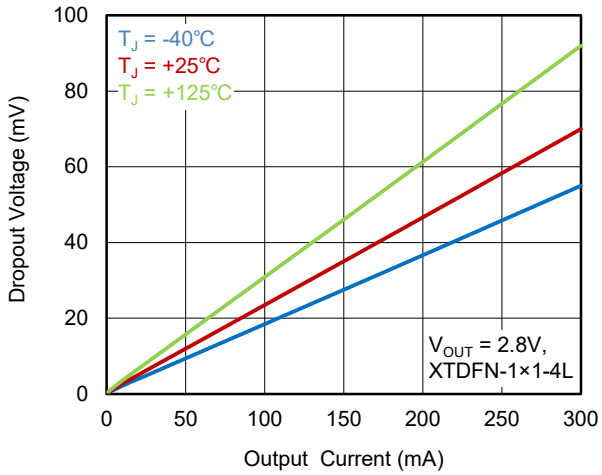
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 0.3V) or 1.1V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 1μF, unless otherwise noted.

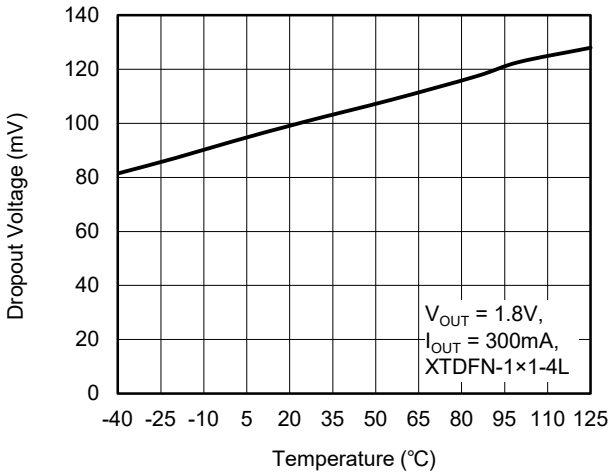
Dropout Voltage vs. Output Current



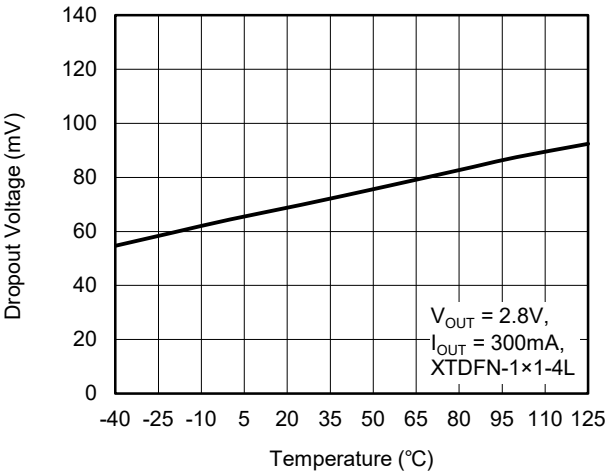
Dropout Voltage vs. Output Current



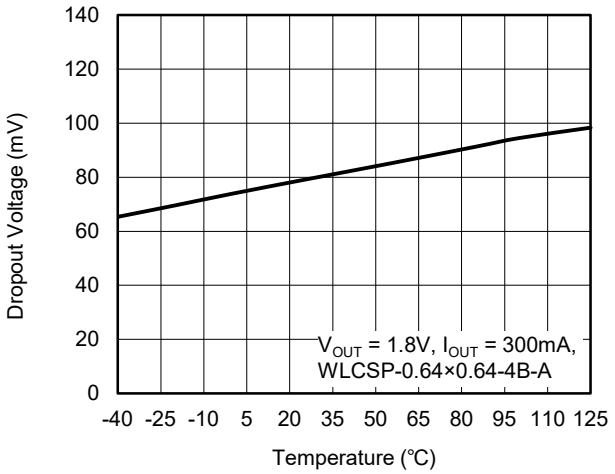
Dropout Voltage vs. Temperature



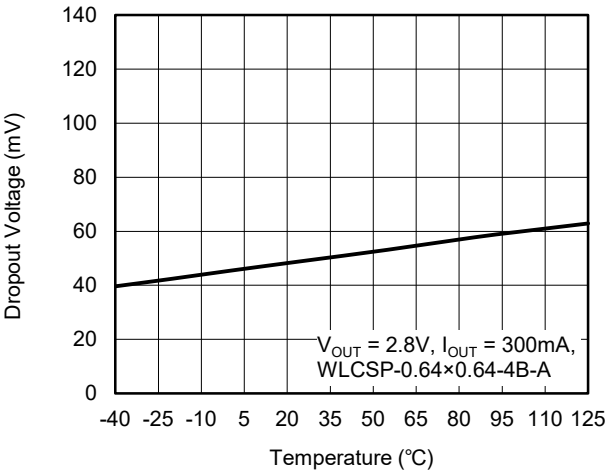
Dropout Voltage vs. Temperature



Dropout Voltage vs. Temperature



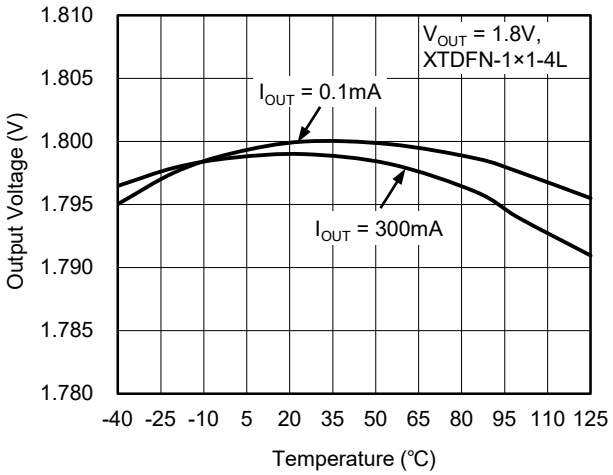
Dropout Voltage vs. Temperature



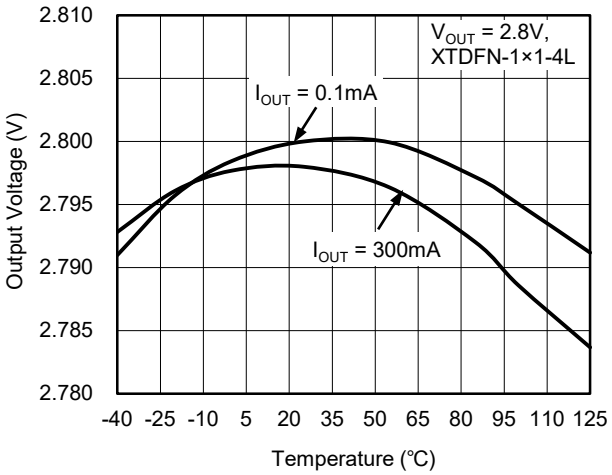
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 0.3V) or 1.1V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 1μF, unless otherwise noted.

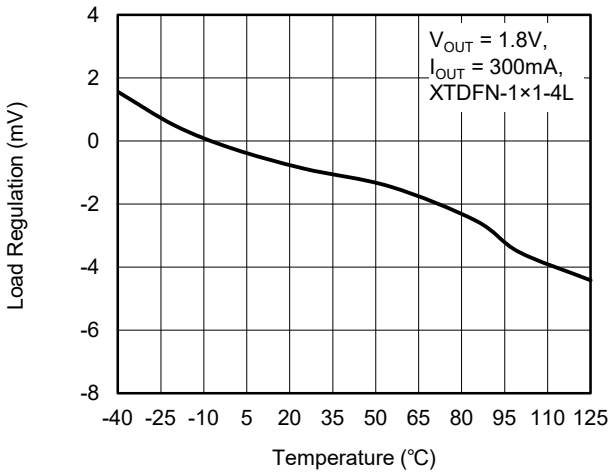
Output Voltage vs. Temperature



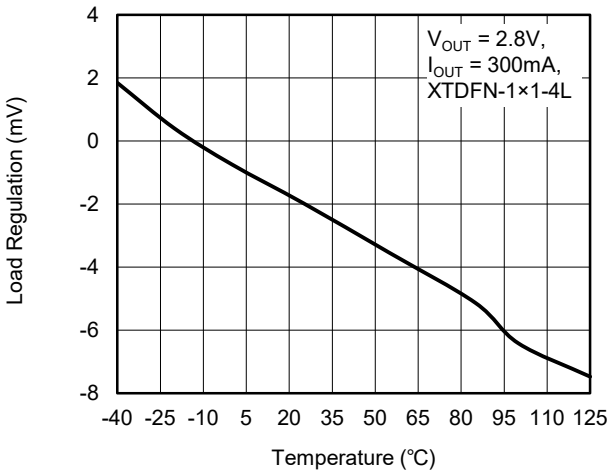
Output Voltage vs. Temperature



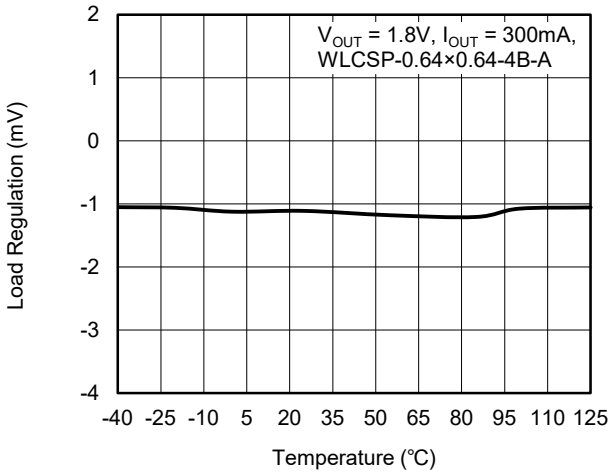
Load Regulation vs. Temperature



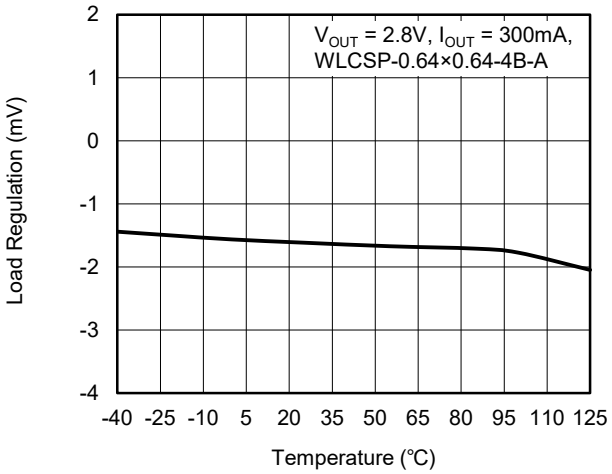
Load Regulation vs. Temperature



Load Regulation vs. Temperature



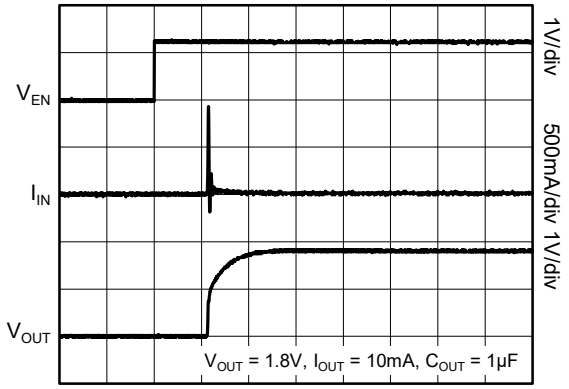
Load Regulation vs. Temperature



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

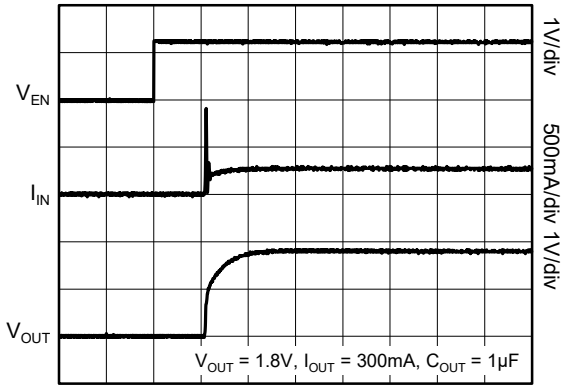
T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 0.3V) or 1.1V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 1μF, unless otherwise noted.

Enable Turn-On Response



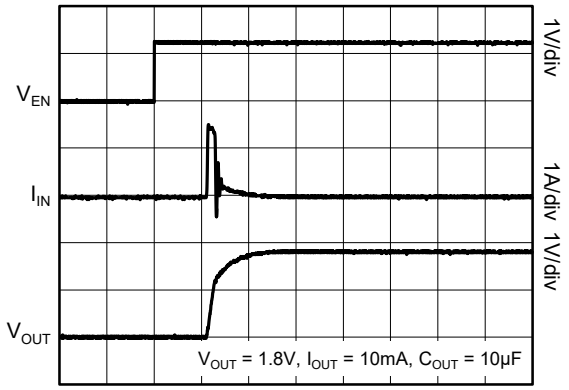
Time (50μs/div)

Enable Turn-On Response



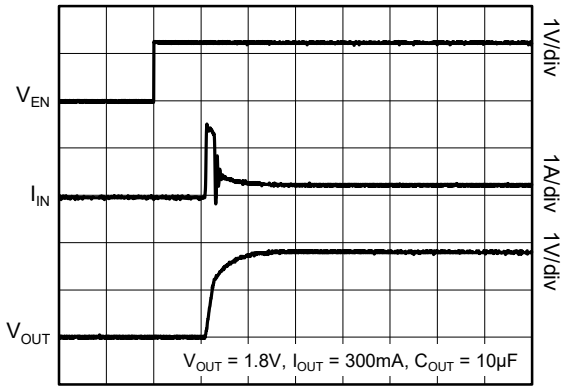
Time (50μs/div)

Enable Turn-On Response



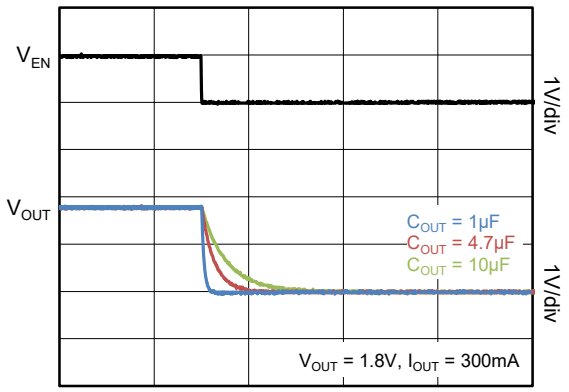
Time (50μs/div)

Enable Turn-On Response



Time (50μs/div)

Enable Turn-Off Response



Time (200μs/div)

FUNCTIONAL BLOCK DIAGRAM

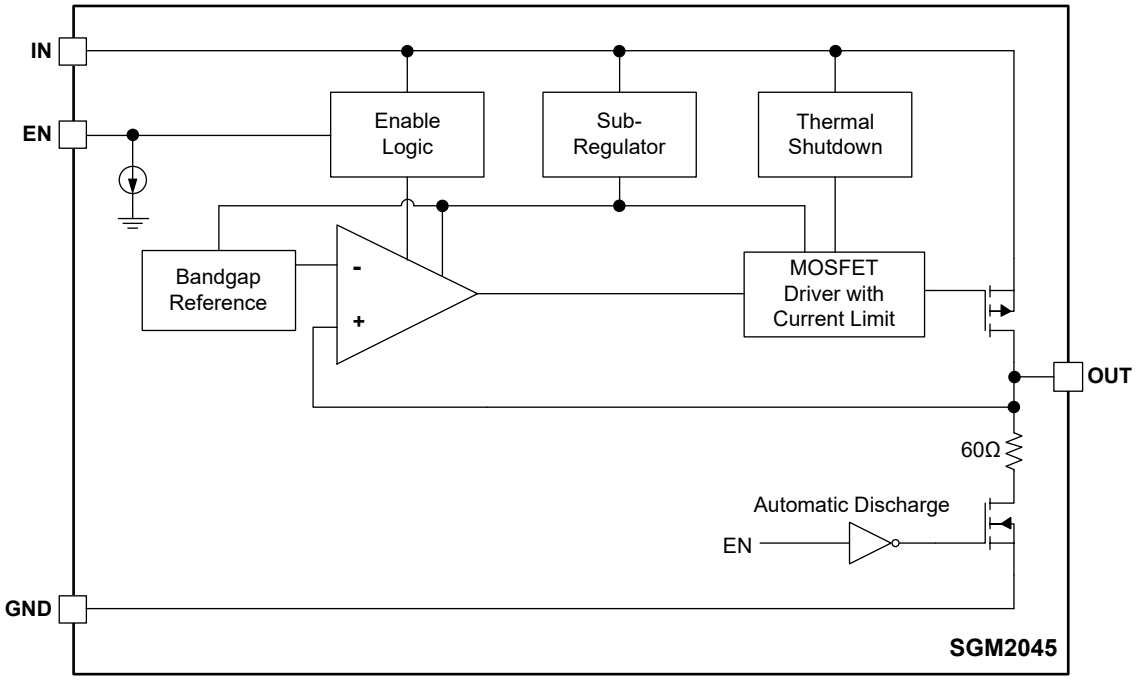


Figure 2. Block Diagram

APPLICATION INFORMATION

The SGM2045 is a 300mA, low input voltage, ultra-low noise and low dropout regulator designed to meet the requirements of low voltage RF applications and high performance analog circuits. The SGM2045 device provides very high PSRR and excellent dynamic response. In connection with low quiescent current this device is well suitable for battery-powered applications such as cell phones, tablets and etc. The SGM2045 is fully protected in case of current overload, output short-circuit and overheating.

Input Capacitor Selection (C_{IN})

The input capacitor is necessary to be connected as close as possible for ensuring the device stability. The X7R or X5R capacitor should be used for reliable performance over temperature range. The value of the input capacitor should be 0.1μF or greater to ensure the best dynamic performance. This capacitor will provide a low impedance path for unwanted AC signals or noise modulated onto constant input voltage. There is no requirement for the ESR of the input capacitor, but it is recommended to use ceramic capacitors for their low ESR and ESL. A good input capacitor will limit the influence of input trace inductance and source resistance during sudden load current changes.

Enable Operation

The SGM2045 uses the EN pin to enable/disable its device and to deactivate/activate the output automatic discharge function.

If the EN pin voltage is lower than 0.3V, the device is guaranteed to be disabled. The pass transistor is turned off so that there is virtually no current flow between the IN and OUT pins. The output automatic discharge transistor is active so that the output voltage V_{OUT} is pulled to GND through a 60Ω resistor. In the disable state, the device consumes as low as 0.03μA (TYP) from the V_{IN}.

If the EN pin voltage is higher than 0.7V, the device is guaranteed to be enabled. The SGM2045 regulates the output voltage and the output automatic discharge transistor is turned off.

The EN pin has an internal pull-down current source with a typical value of 0.03μA which ensures that the device is turned off when the EN pin is not connected. In the case where the EN function isn't required, the EN pin should be tied directly to the IN pin.

Output Current Limit

Output current is internally limited within the IC to a 600mA (TYP). The SGM2045 will source this amount of current measured with a voltage drop on the 90% of the nominal V_{OUT}. If the output voltage is directly shorted to ground (V_{OUT} = 0V), the short-circuit protection will limit the output current to 380mA (TYP). The current limit and short-circuit protection will work properly over whole temperature range and also input voltage range. There is no limitation for the short-circuit duration.

Power Dissipation

As power dissipated in the SGM2045 increases, it might become necessary to provide some thermal relief. The maximum power dissipation supported by the device is dependent upon board design and layout. Mounting pad configuration on the PCB, the board material and the ambient temperature affect the junction temperature rise rate of the part.

Reverse Current

The PMOS pass transistor has an inherent body diode which will be forward biased in the case that $V_{OUT} > V_{IN}$. Due to this fact, in cases where the extended reverse current condition can be anticipated the device may require additional external protection.

Power Supply Rejection Ratio

The SGM2045 provides very high power supply rejection ratio. If desired, the PSRR at higher frequencies in the range from 100kHz to 10MHz can be tuned by the selection of C_{OUT} capacitor and proper PCB layout.

Turn-On Time

The turn-on time is defined as the time period from EN assertion to the point in which V_{OUT} will reach 90% of its nominal value.

PCB Layout Recommendations

To obtain good transient performance and good regulation characteristics, place input and output capacitors close to the device pins and make the PCB traces wide. In order to minimize the solution size, use 0402 or 0201 capacitors with appropriate capacity. Larger copper area connected to the pins will also improve the device thermal resistance. Exposed pad can be tied to the GND pin to improve power dissipation and lower device temperature.

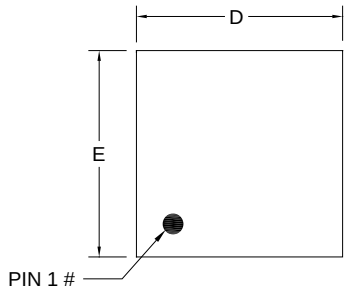
REVISION HISTORY

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

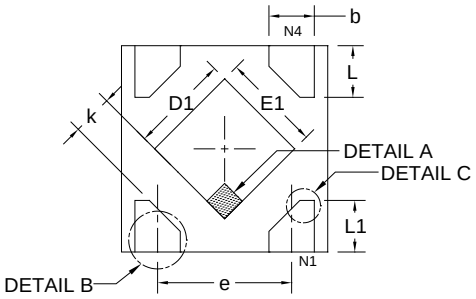
Changes from Original (SEPTEMBER 2021) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

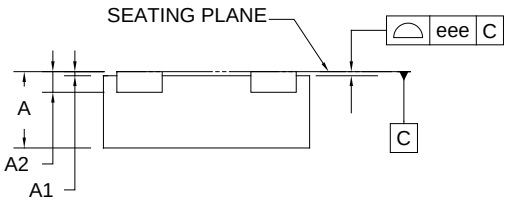
XTDFN-1×1-4L



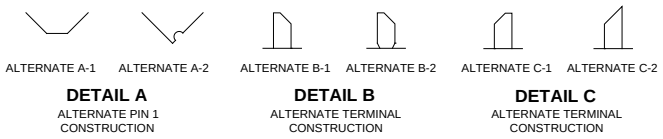
TOP VIEW



BOTTOM VIEW



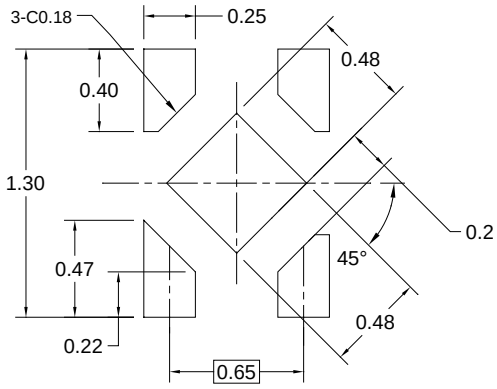
SIDE VIEW



DETAIL A
ALTERNATE PIN 1 CONSTRUCTION

DETAIL B
ALTERNATE TERMINAL CONSTRUCTION

DETAIL C
ALTERNATE TERMINAL CONSTRUCTION



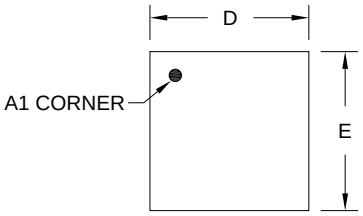
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	0.340	0.370	0.400
A1	0.000	0.020	0.050
A2	0.100 REF		
b	0.170	-	0.300
D	0.950	1.000	1.050
E	0.950	1.000	1.050
D1	0.430	0.480	0.530
E1	0.430	0.480	0.530
L	0.200	0.250	0.300
L1	0.200	-	0.370
e	0.650 BSC		
k	0.150	-	-
eee	-	0.050	-

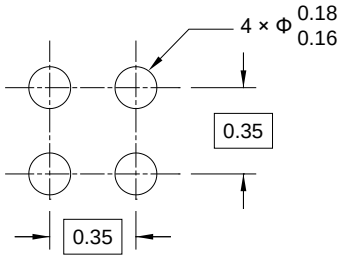
NOTE: This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

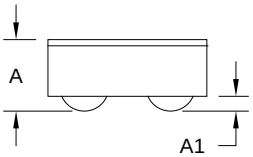
WLCSP-0.64×0.64-4B-A



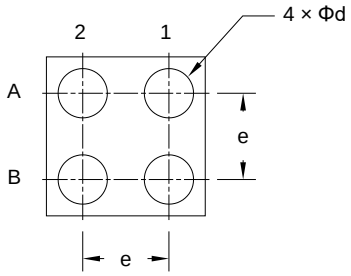
TOP VIEW



RECOMMENDED LAND PATTERN (Unit: mm)



SIDE VIEW



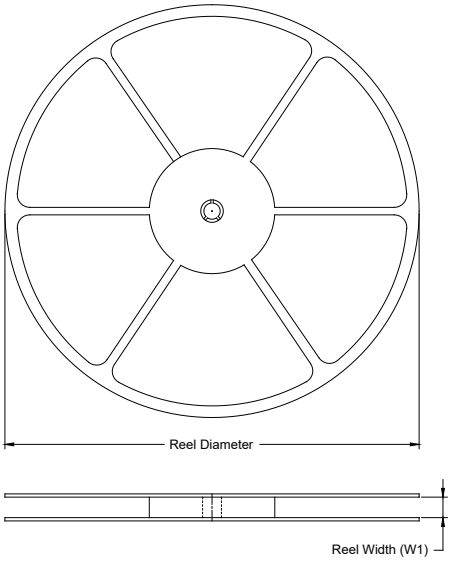
BOTTOM VIEW

Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	0.262	0.290	0.318
A1	0.050	0.060	0.070
D	0.620	0.645	0.670
E	0.620	0.645	0.670
d	0.190	0.200	0.210
e	0.350 BSC		

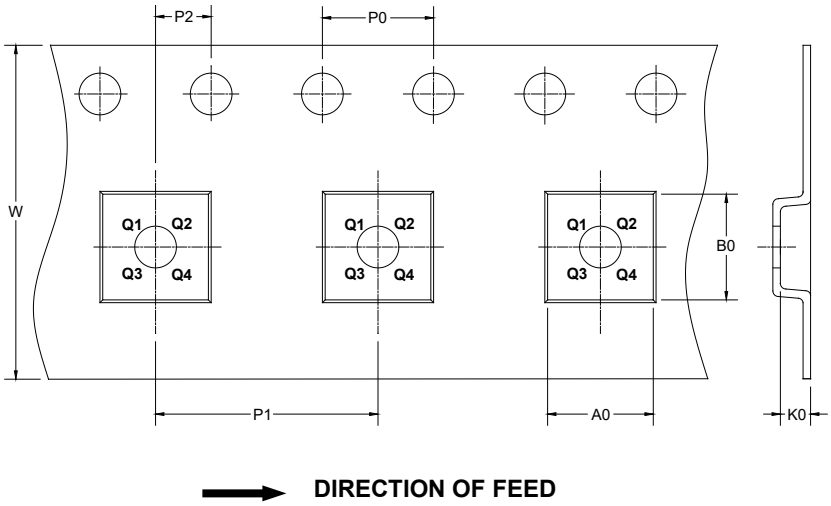
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



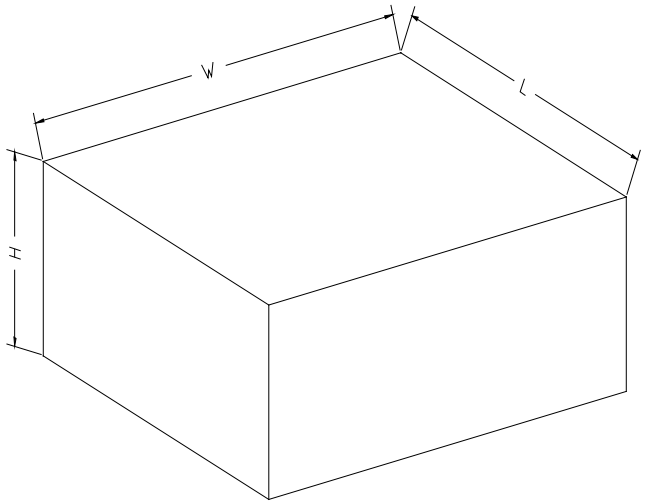
NOTE: The picture is only for reference. Please make the object as the standard.

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
XTDFN-1×1-4L	7″	9.5	1.16	1.16	0.50	4.0	2.0	2.0	8.0	Q1
WLCSP-0.64×0.64-4B-A	7″	9.5	0.74	0.74	0.37	4.0	4.0	2.0	8.0	Q1

DD0001

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