



## Gate Driver with VReg and Two Point Regulator

DATASHEET

- 60mA/120mA MIN GATE DRIVE
- TWO POINT REGULATOR FOR SWITCHING CHARGE PUMP SUPPLY
- 3.3V OR 5V VOLTAGE REGULATOR
- LOW STARTUP CURRENT
- UVLO PROTECTION
- 2kV ESD PROTECTION

### DESCRIPTION

TD220 is a solution for micro-controller based off-line applications. TD220 includes a two point regulator for power supply generation, a 3.3V (TD220) or 5V (TD221) linear regulator for the microcontroller supply, and a MOSFET driver.

### APPLICATIONS

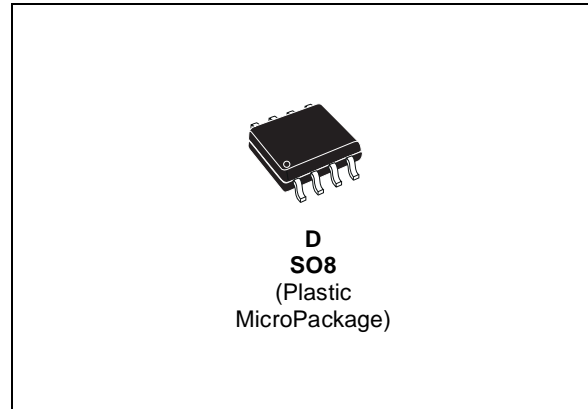
- $\mu$ C-BASED OFF-LINE APPLICATIONS

### ORDER CODE

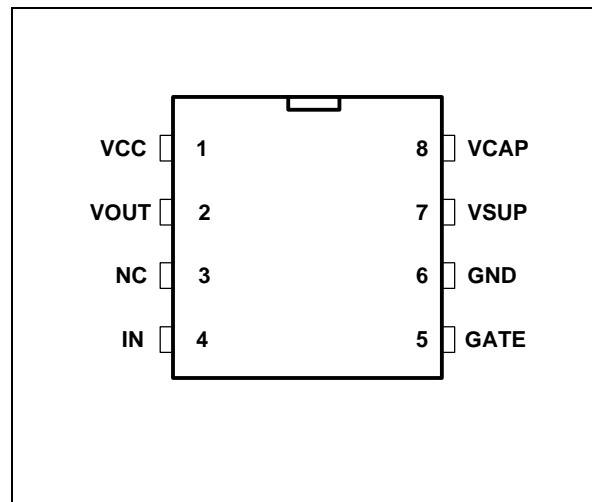
Part Number	Temperature Range	Package
		D
TD220I	-25, +125°C	•
TD221I	-25, +125°C	•

Note: D = Small Outline Package (SO) - also available in Tape & Reel (DT)

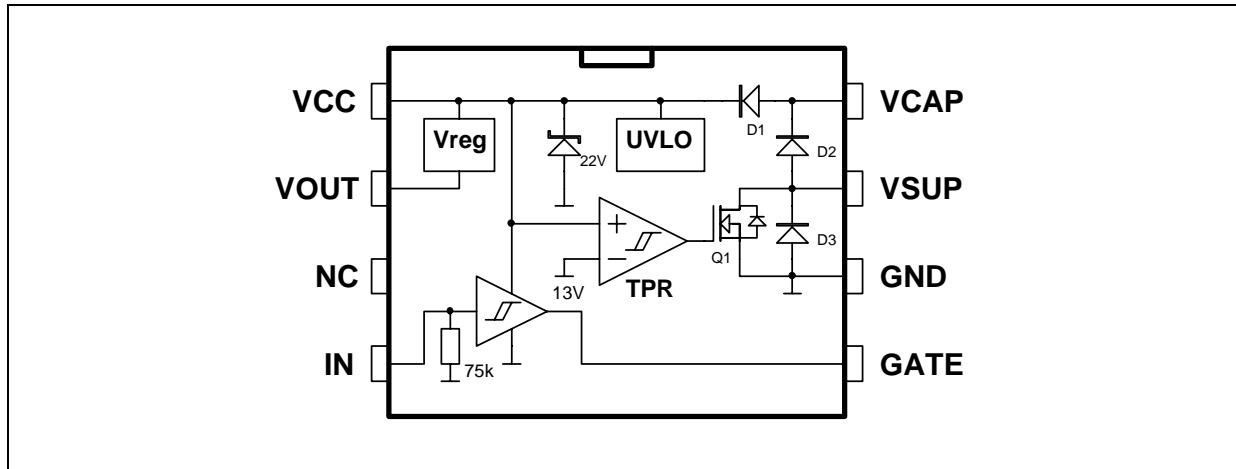
### Package Reference



### PIN CONNECTIONS (top view)



## 1 BLOCK DIAGRAM



## Pin Description

Name	Pin Number	Type	Function
VCC	1	Power supply	Supply capacitor and startup resistor
VOUT	2	Analog output	+3.3V (TD220) or +5V (TD221) voltage regulator
IN	4	Digital input	Input signal for gate drive
GATE	5	Analog output	Gate drive output
GND	6	Power supply	Signal ground
VSUP	7	Power supply	Charge pump input
VCAP	8	Power supply	Capacitor for charge pump

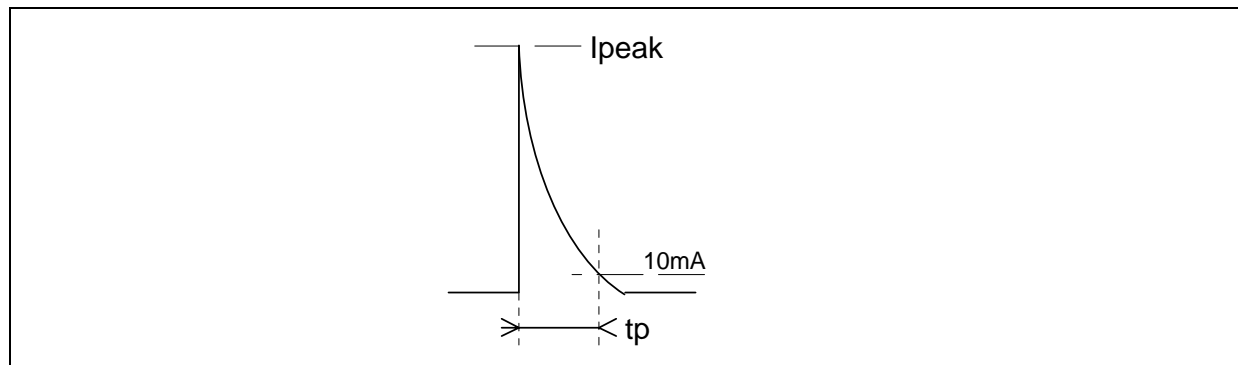
## 2 ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
<b>VCC</b>	DC Supply Voltage ( $I_{CC} < 5\text{mA}$ )	-0.3 to selflimit	V
<b>Vout</b>	Voltage on GATE and VCAP pins	-0.3 to VCC+0.3	V
<b>Vin</b>	Voltage on IN and VOUT pins	-0.3 to 7	V
<b>Isup</b>	Continuous current in VSUP pin	-200 to 200	mA
<b>Ipeak</b>	Peak current in VSUP pin ( $t_p \leq 1\mu\text{s}$ , $f \leq 150\text{kHz}$ , see waveform below)	-1.0 to 1.0	A
<b>Pd</b>	Power dissipation	500	mW
<b>Tstg</b>	Storage temperature	-55 to 150	°C
<b>Tj</b>	Maximum Junction Temperature	150	°C
<b>Rhja</b>	Thermal Resistance Junction-Ambient	150	°C/W
<b>Rhjc</b>	Thermal Resistance Junction-Case	40	°C/W
<b>ESD</b>	Electrostatic discharge (HBM)	2	kV

## OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
<b>VCC</b>	Supply Voltage	UVLO to 17	V
<b>Isup</b>	Continuous current in VSUP pin	0 to 200	mA
<b>Ipeak</b>	Peak current in VSUP pin ( $t_p \leq 1\mu\text{s}$ , $f \leq 150\text{kHz}$ , see waveform below)	-1.0 to 1.0	A
<b>Tj</b>	Junction Temperature	-25 to 125	°C

## Typical waveform of current in VSUP pin



### 3 ELECTRICAL CHARACTERISTICS

Tamb = 25°C, VCC=13V unless otherwise specified

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
<b>Supply</b>						
<b>Icc</b>	Supply current	no load at any pin, Vin<1V Tamb=25°C -25°C<Tj<125°C		0.7	1.0 1.2	mA mA
<b>Icc2</b>		1nF GATE load, 300kHz IN signal	4	5	6	mA
<b>Istby</b>	Standby current	UVLO active Tamb=25°C -25°C<Tj<125°C		160	230	μA μA
<b>Vclamp</b>	Clamp voltage	Icc<5mA	20	22	24	V
<b>Input</b>						
<b>Vton</b>	IN Turn-on Threshold Voltage		1.8		2.1	V
<b>Vtoff</b>	IN Turn-off Threshold Voltage		1.0		1.3	V
<b>Vh</b>	IN Hysteresis		0.5			V
<b>Iinpl</b>	IN Input current low	Vin<0.5V			20	μA
<b>Iinph</b>	IN Input current high	Vin=3.3V			100	μA
<b>Voltage regulator</b>						
<b>Vout</b>	Voltage reference	Iout=10mA TD220 TD221	3.20 4.85	3.30 5	3.40 5.15	V V
<b>RegLoad</b>		Load Regulation	Iout change from 10mA to 25mA			50
<b>Ipeak</b>	Peak output current	Vout=1V	100			mA
<b>dVout</b>	Temperature coefficient	Iout=10mA			250	ppm/°C
<b>Cout</b>	Allowed capacitive load - Note 1	Iout=10mA	0.1		1	μF
<b>Ileak</b>	Leakage current in UVLO state	Vout=1V			10	μA
<b>Vrip</b>	Ripple rejection - Note 1	f=100Hz	40			dB
		f=10kHz	20			dB
<b>Vnoise</b>	Noise voltage	100Hz<f<100kHz		1		mV
<b>tstartup</b>	Startup time (Vout>3.1V)	Cout=1μF			0.1	ms
<b>tsettle</b>	Settling time (1% final value)	Cout=1μF		2		ms
<b>Two Point Regulator (TPR)</b>						
<b>VTPROn</b>	Turn-on level				13.6	V
<b>VTPROff</b>	Turn-off level		12.4			V
<b>VTPRH</b>	Hysteresis	=VTPROn-VTPROff	0.23	0.29	0.35	V
<b>VF</b>	Forward voltage D1	IF=200mA			1.5	V

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
<b>Gate Output</b>						
<b>VOL</b>	Output low voltage	I <sub>gate</sub> =10mA			0.5	V
<b>VOH</b>	Output high voltage	I <sub>gate</sub> =-10mA	V <sub>CC</sub> -2.0			V
<b>Isink</b>	Output sink current	V <sub>gate</sub> =6V T <sub>j</sub> =25°C -25°C < T <sub>j</sub> < 125°C	120	300		mA mA
<b>Isrc</b>	Output source current	V <sub>gate</sub> =3V T <sub>j</sub> =25°C -25°C < T <sub>j</sub> < 125°C	60	150		mA mA
<b>VOL2</b>	Output low voltage in UVLO state	V <sub>cc</sub> =6V, I <sub>gate</sub> =1mA			2	V
<b>tgmin</b>	Minimum output pulse width <sup>1</sup>	C <sub>gate</sub> =10pF			80	ns
<b>tpd</b>	IN to GATE propagation delay			200		ns
<b>Under Voltage Lockout (UVLO)</b>						
<b>UVLOH</b>	UVLO top threshold				15	V
<b>UVLOL</b>	UVLO bottom threshold		7.8		8.7	V
<b>Vhyst</b>	UVLO Hysteresis	V <sub>hyst</sub> =UVLOH-UVLOL	5			V

1) Not 100% tested. Guaranteed by design.

4 TIMING DIAGRAMS

Fig. 1: Power up and power down

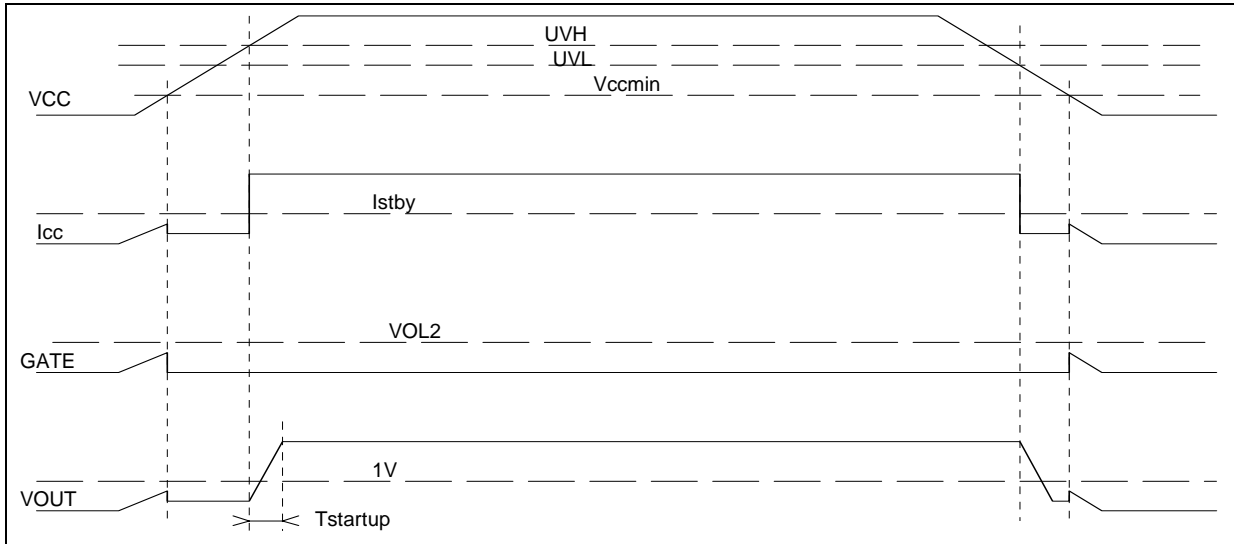
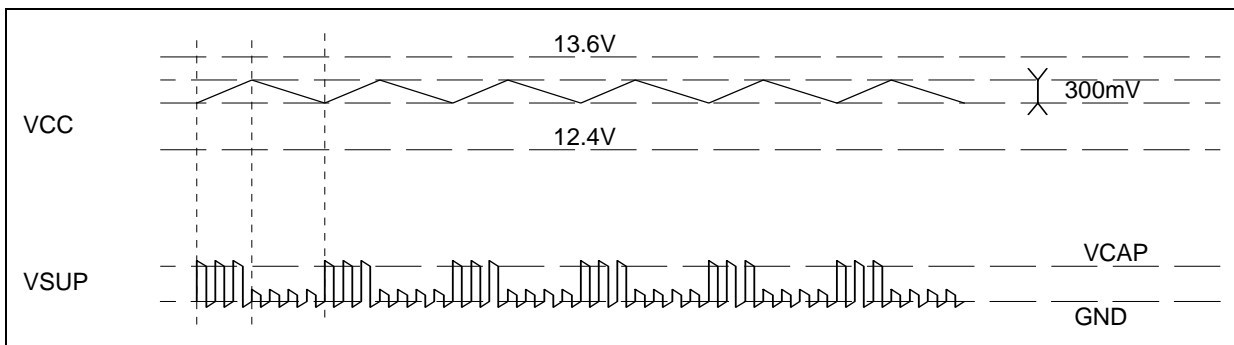
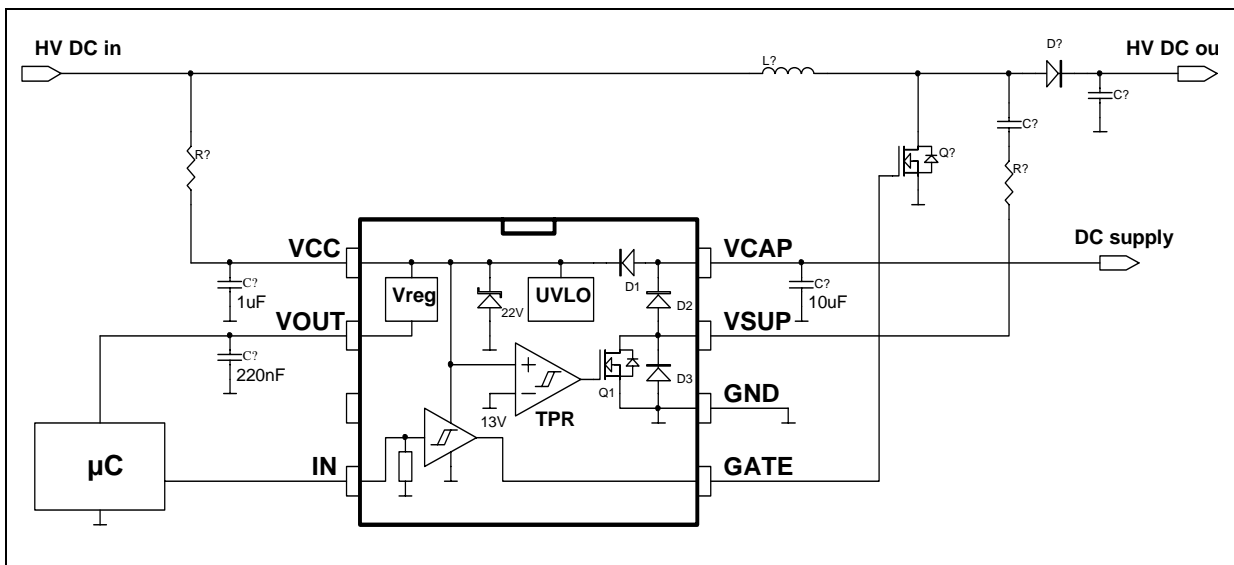


Fig. 2: Two point regulator



APPLICATION DIAGRAM



5 TYPICAL PERFORMANCE CURVES

Fig. 3: Supply Current vs Temperature

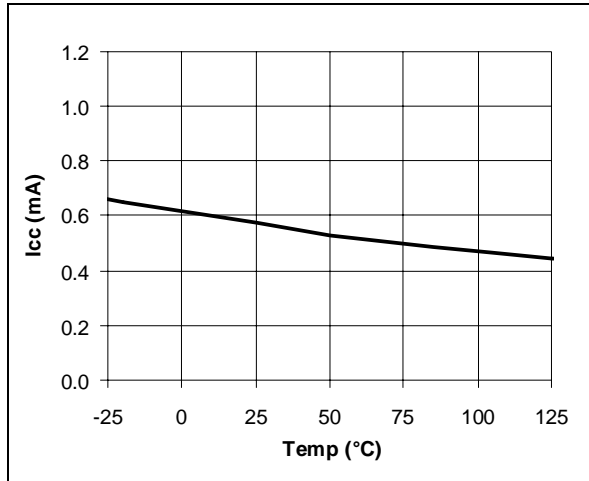


Fig. 6: Standby Current vs Temperature

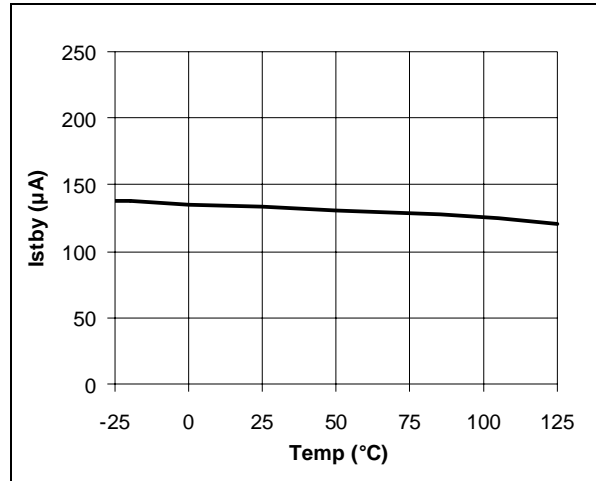


Fig. 4: Gate Drive Sink Current vs Temperature

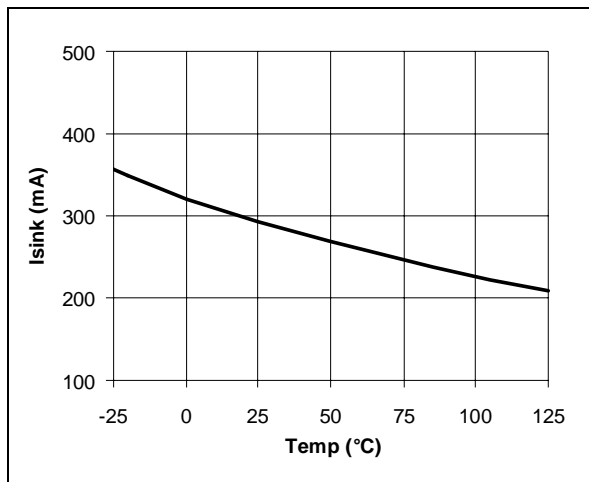


Fig. 7: Gate Drive Source Current vs Temp.

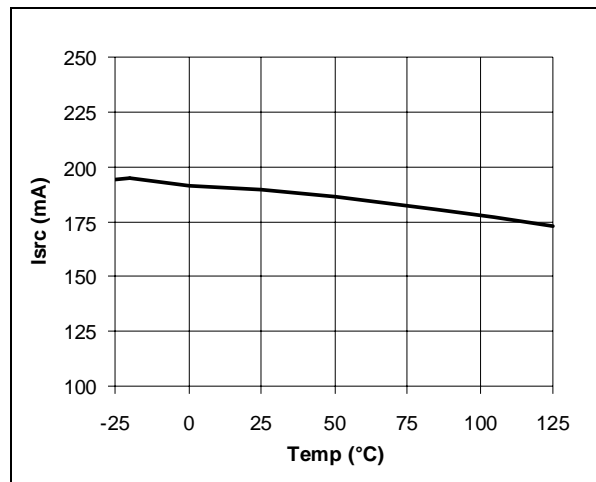
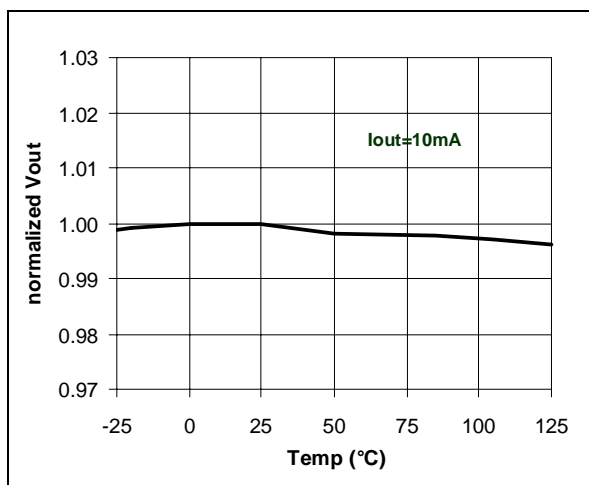


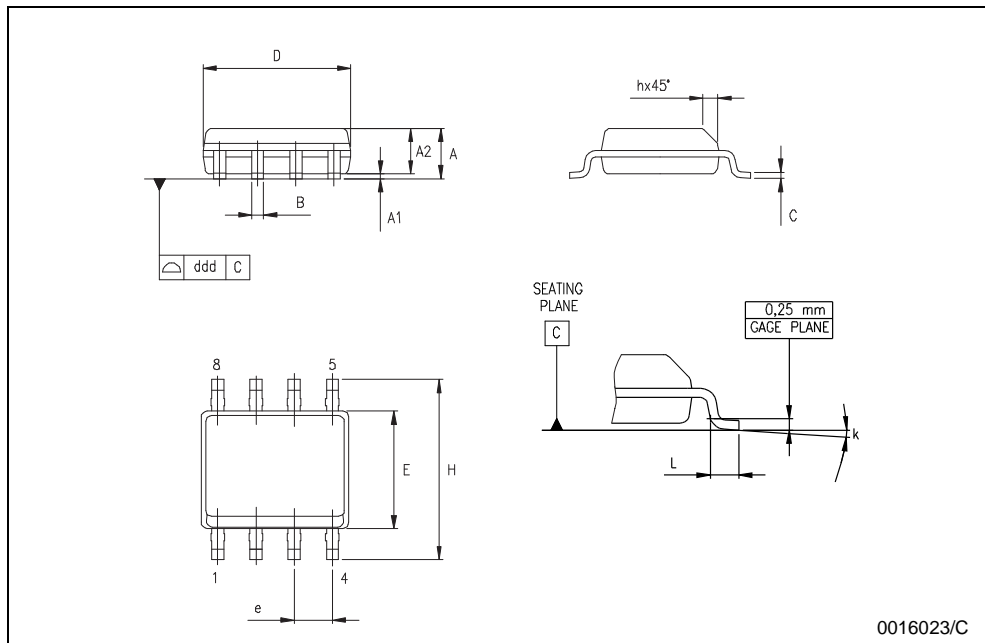
Fig. 5: Vreg Output Voltage vs Temperature



6 PACKAGE MECHANICAL DATA

**SO-8 MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	8° (max.)					
ddd			0.1			0.04



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