150mA CMOS LDO Regulator

HALOGEN FREE LEAD FREE™ RoHS Compliance

FEATURES

- **Guaranteed 150mA output current**
- **Low dropout voltage of 90mV typical at 150mA**
- **Stable with 1µF ceramic output capacitor**
- **External 10nF bypass capacitor for low noise**
- **Quick-start feature**
- **No-load ground current of 55µA typical**
- **Full-load ground current of 80µA typical**
- **±1.0% initial accuracy (V_{OUT} ≥ 2.0V)**
- **±2.0% accuracy over temperature (V_{OUT} ≥ 2.0V)**
- **"Zero" current shutdown mode**
- **Current limit and Under voltage lockout**
- **Thermal protection**
- **5-lead TSOT-23 package**

APPLICATIONS

- **Cellular phones**
- **Battery-powered devices**
- **Consumer Electronics**

For Ordering Information details, see page 9.

DESCRIPTION

The CAT6217 is a 150mA CMOS low dropout regulator that provides fast response time during load current and line voltage changes.

The quick-start feature allows the use of an external bypass capacitor to reduce the overall output noise without affecting the turn-on time of just 150µs.

With zero shutdown current and low ground current of 55µA typical, the CAT6217 is ideal for battery-operated devices with supply voltages from 2.3V to 5.5V. An internal under voltage lockout circuit disables the output at supply voltages under 2.1V typical.

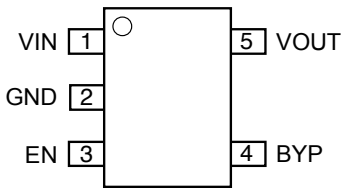
The CAT6217 offers 1% initial accuracy and low dropout voltage, 90mV typical at 150mA. Stable operation is provided with a 1µF ceramic capacitor, reducing required board space and component cost.

Other features include output short-circuit current limit and thermal protection.

The device is available in the low profile (1mm max height) 5-lead TSOT-23 package.

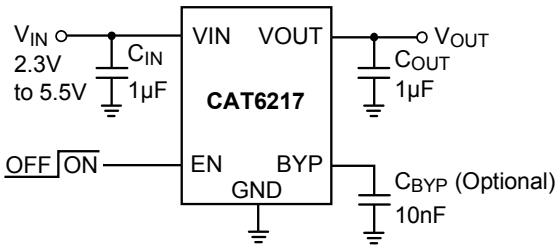
PIN CONFIGURATION

TSOT-23 5-Lead
(1mm height)



Top View

TYPICAL APPLICATION CIRCUIT



PIN DESCRIPTIONS

Pin #	Name	Function
1	VIN	Supply voltage input.
2	GND	Ground reference.
3	EN	Enable input (active high); a 2.5MΩ pull-down resistor is provided.
4	BYP	Optional bypass capacitor connection for noise reduction and PSRR enhancing.
5	VOUT	LDO Output Voltage.

BLOCK DIAGRAM

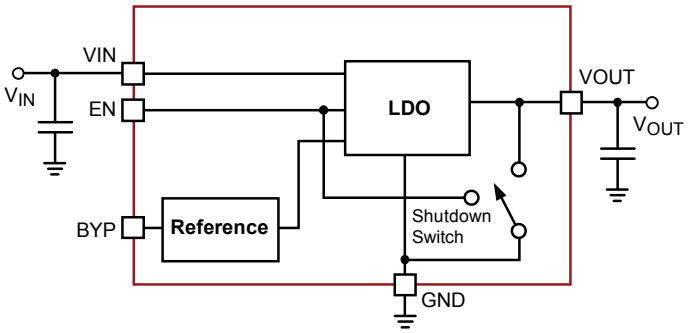


Figure 2. CAT6217 Functional Block Diagram

PIN FUNCTION

VIN is the supply pin for the LDO. A small 1µF ceramic bypass capacitor is required between the V_{IN} pin and ground near the device. When using longer connections to the power supply, C_{IN} value can be increased without limit. The operating input voltage range is from 2.3V to 5.5V.

EN is the enable control logic (active high) for the regulator output. It has a 2.5MΩ pull-down resistor, which assures that if EN pin is left open, the circuit is disabled.

VOUT is the LDO regulator output. A small 1µF ceramic bypass capacitor is required between the V_{OUT} pin and ground for stability. For better transient response, its value can be increased to 4.7µF. The capacitor should be located near the device. ESR domain is 5mΩ to 500mΩ. V_{OUT} can deliver a maximum guaranteed current of 150mA. A 250Ω internal shutdown switch discharges the output capacitor in the no-load condition.

GND is the ground reference for the LDO. The pin must be connected to the ground plane on the PCB.

BYP is the reference bypass pin. An optional 0.01µF capacitor can be connected between BYP pin and GND to reduce the output noise and enhance the PSRR at high frequency.

ABSOLUTE MAXIMUM RATINGS (1)

Parameter	Rating	Unit
V_{IN}	0 to 6.5	V
V_{EN}, V_{OUT}	-0.3 to V_{IN}+0.3	V
Junction Temperature, T_J	+150	°C
Power Dissipation, P_D	Internally Limited (2)	mW
Storage Temperature Range, T_S	-65 to +150	°C
Lead Temperature (soldering, 5 sec.)	260	°C
ESD Rating (Human Body Model)	3	kV

RECOMMENDED OPERATING CONDITIONS (3)

Parameter	Range	Unit
V_{IN}	2.3 to 5.5	V
V_{EN}	0 to V_{IN}	V
Junction Temperature Range, T_J	-40 to +125	°C
Package Thermal Resistance (SOT23-5), θ_{JA}	235	°C/W

Typical application circuit with external components is shown on page 1.

Notes:

(1) Exceeding maximum rating may damage the device

(2) The maximum allowable power dissipation at any T_A (ambient temperature) is $P_{Dmax} = (T_{Jmax} - T_A)/\theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown.

(3) The device is not guaranteed to work outside its operating rating.

Electrical Operating Characteristics (1)

V_{IN} = V_{OUT} + 1.0V, V_{EN} = High, I_{OUT} = 100µA, C_{IN} = C_{OUT} = 1µF, ambient temperature of 25ºC (over recommended operating conditions unless specified otherwise). **Bold numbers** apply for the entire junction temperature range.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OUT-ACC}$	Output Voltage Accuracy	Initial accuracy for $V_{OUT} \geq 2.0V$ (4)	-1.0		+1.0	%
			-2.0		**+2.0**	
TC_{OUT}	Output Voltage Temp. Coefficient			40		ppm/ºC
V_{R-LINE}	Line Regulation	V_{IN} = V_{OUT} + 1.0V to 5.5V	-0.2	±0.1	+0.2	%/V
			-0.4		**+0.4**	
V_{R-LOAD}	Load Regulation	I_{OUT} = 100µA to 150 mA		0.6	1.0	%
					1.3	
V_{DROP}	Dropout Voltage (2)	I_{OUT} = 150mA		90	125	mV
					150	
I_{GND}	Ground Current	I_{OUT} = 0µA		55	75	µA
					90	
		I_{OUT} = 150mA		80		
I_{GND-SD}	Shutdown Ground Current	V_{EN} < 0.4V			1	µA
					2	
PSRR	Power Supply Rejection Ratio	f = 1kHz, C_{BYP} = 10nF		64		dB
		f = 20kHz, C_{BYP} = 10nF		54		
I_{SC}	Output short circuit current limit	V_{OUT} = 0V		350		mA
T_{ON}	Turn-On Time	C_{BYP} = 10nF		150		µs
e_N	Output Noise Voltage (3)	BW = 10Hz to 100kHz		45		µVrms
R_{OUT-SH}	Shutdown Switch Resistance			250		Ω
R_{EN}	Enable pull-down resistor			2.5		MΩ
V_{UVLO}	Under-voltage lock out (UVLO) threshold			2.1		V
ESR	C_{OUT} equivalent series resistance		5		500	mΩ
Enable Input						
V_{HI}	Logic High Level	V_{IN} = 2.3 to 5.5V	**1.8**			V
		V_{IN} = 2.3 to 5.5V, 0ºC to +125ºC junction temperature	1.6			
V_{LO}	Logic Low Level	V_{IN} = 2.3 to 5.5V			**0.4**	V
I_{EN}	Enable Input Current	V_{EN} = 0.4V		0.15	**1**	µA
		V_{EN} = V_{IN}		1.5	**4**	
Thermal Protection						
T_{SD}	Thermal Shutdown			160		ºC
T_{HYS}	Thermal Hysteresis			10		ºC

Notes:

(1 Specification for 2.85V output version unless specified otherwise.

(2) Dropout voltage is defined as the input-to-output differential at which the output voltage drops 2% below its nominal value measured at 1V differential. During test, the input voltage stays always above the minimum 2.3V.

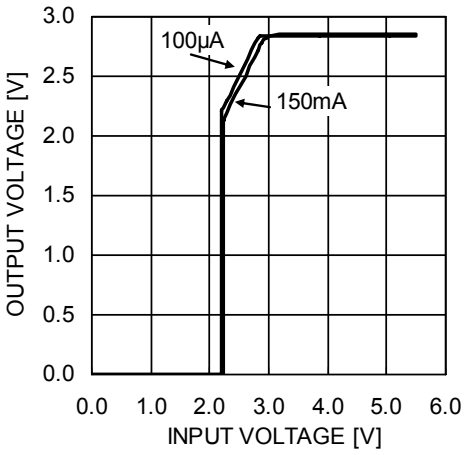
(3) Specification for 1.8V output version.

(4) For V_{OUT} < 2.0V, the initial accuracy is ±2% and across temperature ±3%.

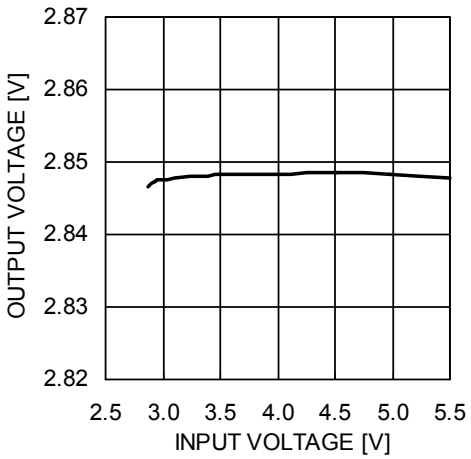
TYPICAL CHARACTERISTICS (shown for 2.85V output version)

V_{IN} = 3.85V, I_{OUT} = 100µA, C_{IN} = C_{OUT} = 1µF, C_{BYP} = 10nF, T_A = 25°C unless otherwise specified.

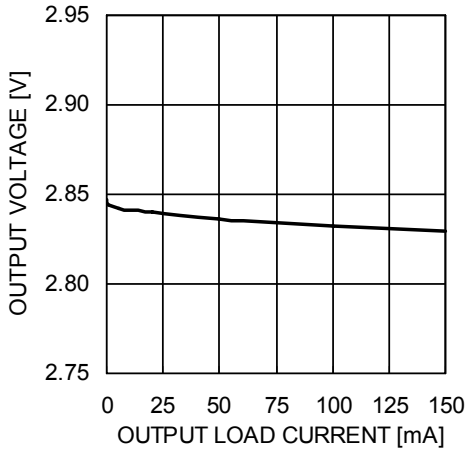
Dropout Characteristics



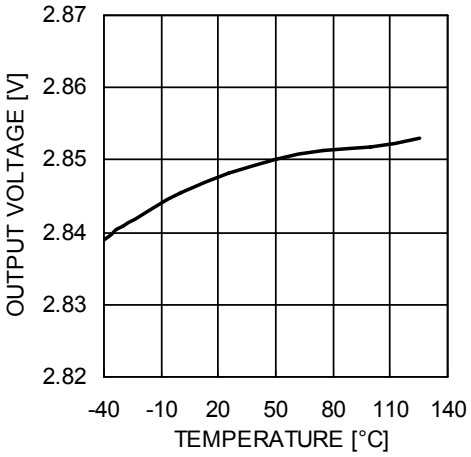
Line Regulation



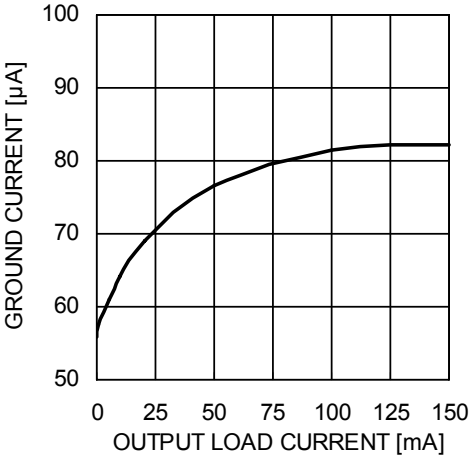
Load Regulation



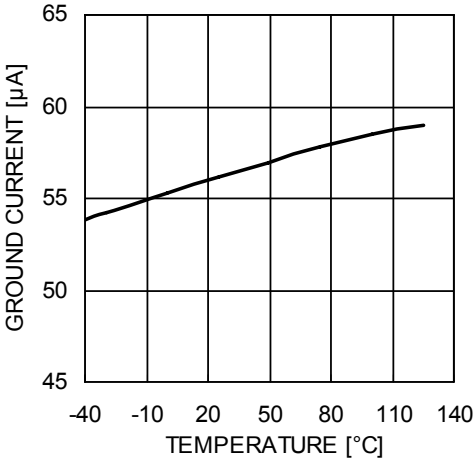
Output Voltage vs. Temperature



Ground Current vs. Load Current



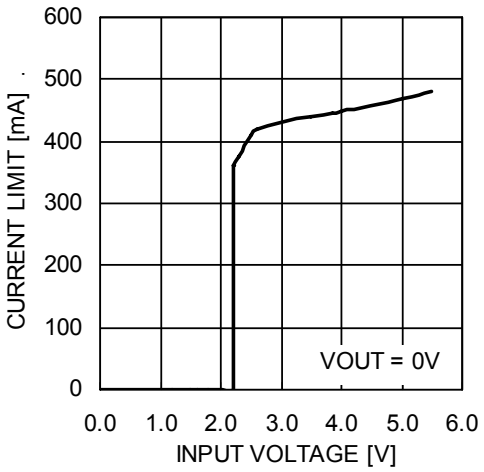
Ground Current vs. Temperature



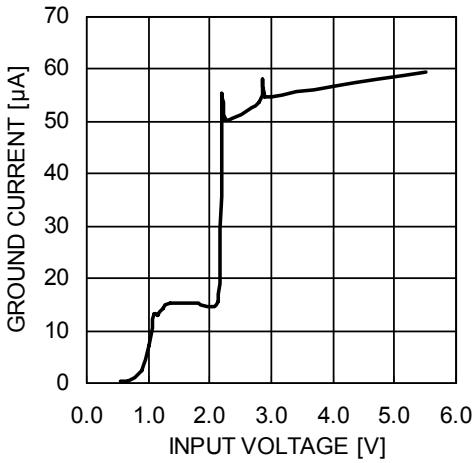
TYPICAL CHARACTERISTICS (shown for 2.85V output option)

V_{IN} = 3.85V, I_{OUT} = 100µA, C_{IN} = C_{OUT} = 1µF, C_{BYP} = 10nF, T_A = 25°C unless otherwise specified.

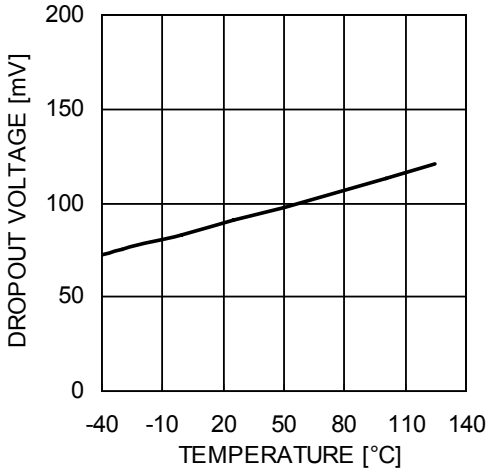
Output Short-Circuit Current Limit



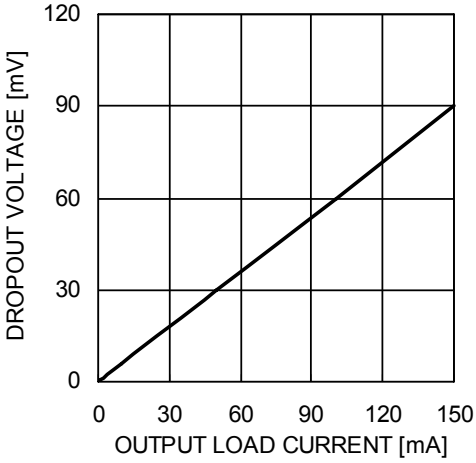
Ground Current vs. Input Voltage



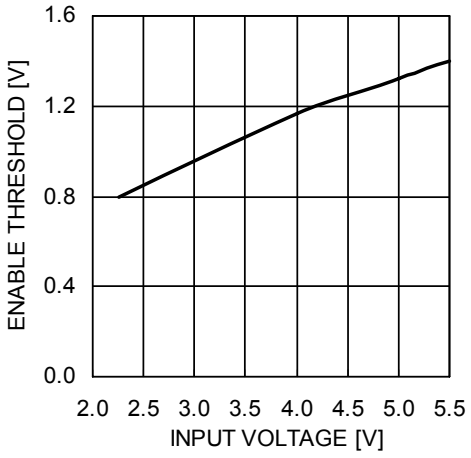
Dropout vs. Temperature (150mA Load)



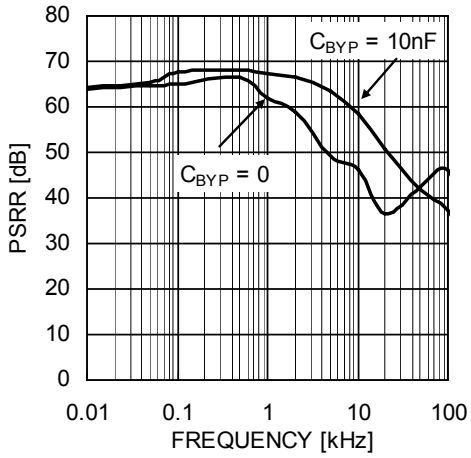
Dropout vs. Load Current



Enable Threshold vs. Input Voltage



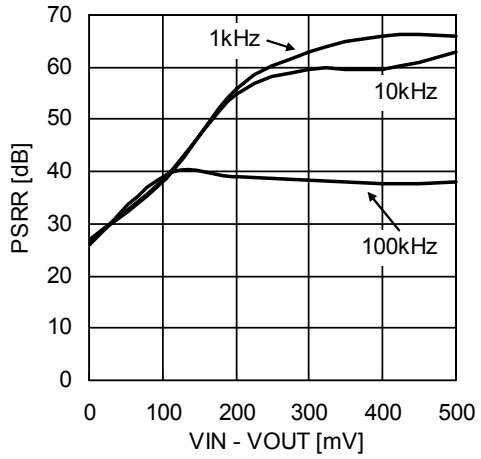
PSRR vs. Frequency (10mA Load)



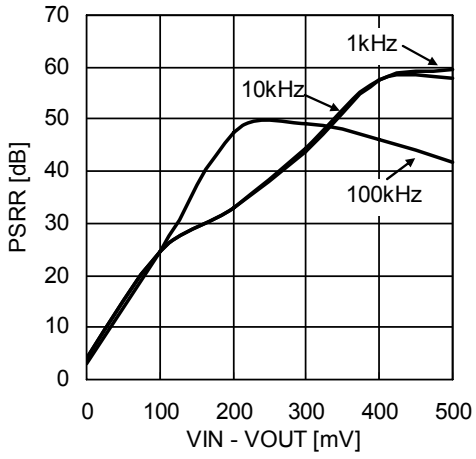
TYPICAL CHARACTERISTICS (shown for 2.85V output option)

V_{IN} = 3.85V, I_{OUT} = 100µA, C_{IN} = C_{OUT} = 1µF, C_{BYP} = 10nF, T_A = 25°C unless otherwise specified.

PSRR (30mA Load)



PSRR (150mA Load)

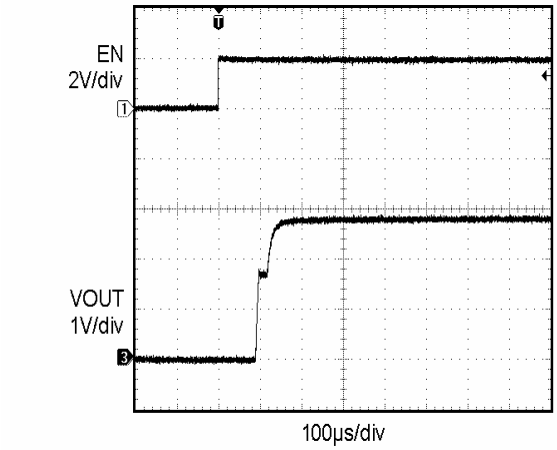


TRANSIENT CHARACTERISTICS (shown for 2.85V output option)

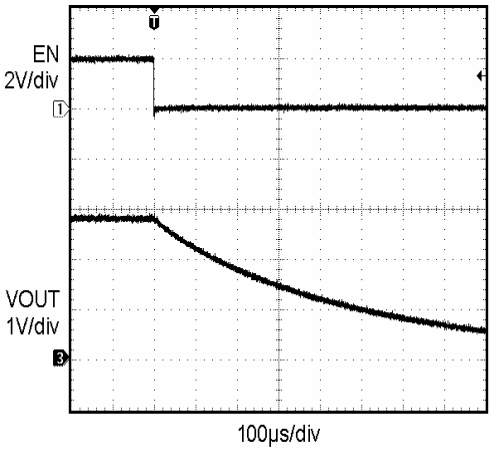
V_{IN} = 3.85V, I_{OUT} = 100µA, C_{IN} = C_{OUT} = 1µF, C_{BYP} = 10nF, T_A = 25°C unless otherwise specified.

Note: All transient characteristics are generated using the evaluation board CAT621XEVAL1.

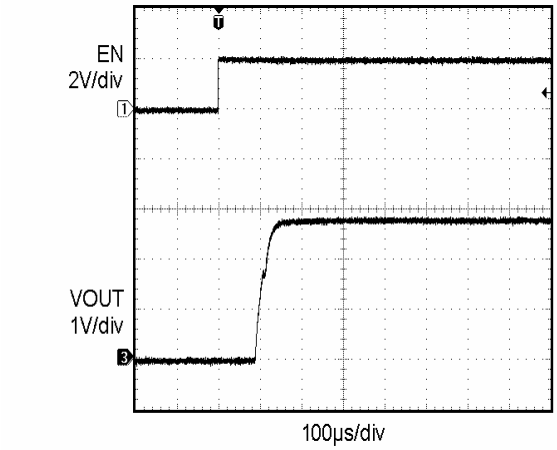
Enable Turn-On (100µA Load)



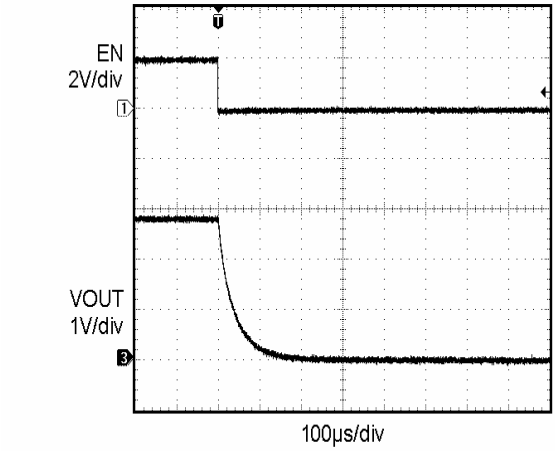
Enable Turn-Off (100µA Load)



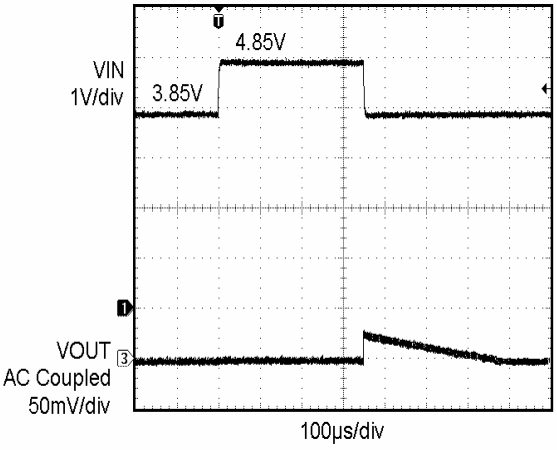
Enable Turn-On (150mA Load)



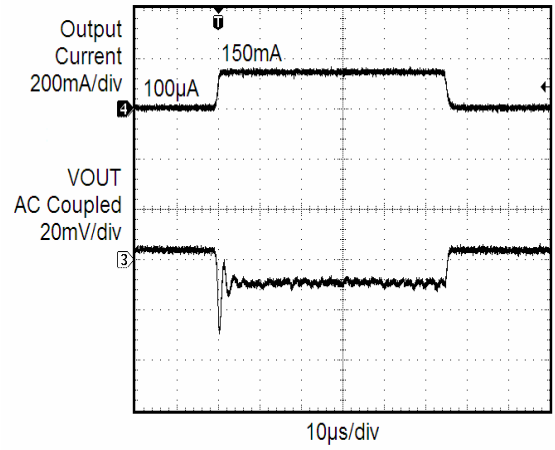
Enable Turn-Off (150mA Load)



Line Transient Response (3.85V to 4.85V)

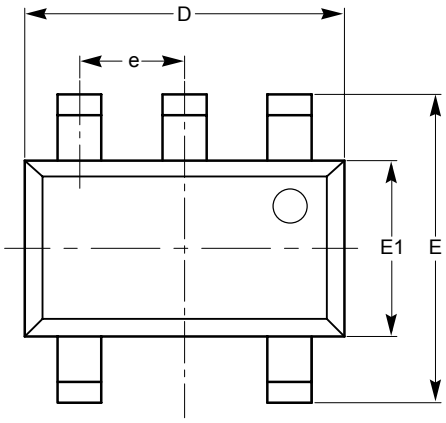


Load Transient Response (0.1mA to 150mA)



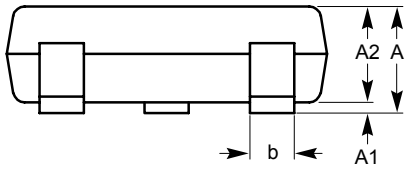
PACKAGE OUTLINE DRAWING

TSOT-23 5-Lead (TD) [(1)(2)]

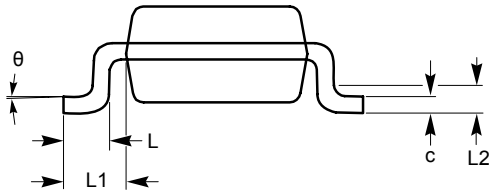


TOP VIEW

SYMBOL	MIN	NOM	MAX
A			1.00
A1	0.01	0.05	0.10
A2	0.80	0.87	0.90
b	0.30		0.45
c	0.12	0.15	0.20
D		2.90 BSC	
E		2.80 BSC	
E1		1.60 BSC	
e		0.95 TYP	
L	0.30	0.40	0.50
L1		0.60 REF	
L2		0.25 BSC	
θ	0º		8º



SIDE VIEW

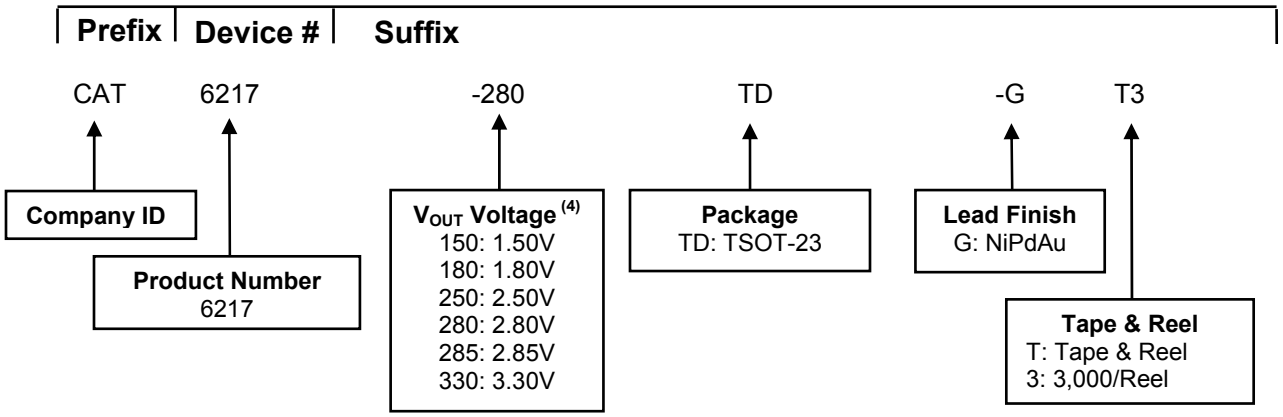


END VIEW

For current Tape and Reel information, download the PDF file from: http://www.catsemi.com/documents/tapeandreel.pdf.

Notes:
(1) All dimensions are in millimeters. Angles in degrees.
(2) Complies with JEDEC standard MO-229.

EXAMPLE OF ORDERING INFORMATION



Ordering Number	V_{OUT} Voltage	Package	Quantity per Reel
CAT6217-150TD-GT3	1.50V	TSOT-23	3,000
CAT6217-180TD-GT3	1.80V	TSOT-23	3,000
CAT6217-250TD-GT3	2.50V	TSOT-23	3,000
CAT6217-280TD-GT3	2.80V	TSOT-23	3,000
CAT6217-285TD-GT3 (4)	2.85V	TSOT-23	3,000
CAT6217-330TD-GT3 (4)	3.30V	TSOT-23	3,000

For Product Top Mark Codes, click here:
http://www.catsemi.com/techsupport/producttopmark.asp

Notes:
(1) All packages are RoHS-compliant (Lead-free, Halogen-free).
(2) The standard finish is NiPdAu.
(3) The device used in the above example is a CAT6217-280TD-GT3 (V_{OUT} = 2.80V, in a TSOT-23 package, NiPdAu, Tape and Reel, 3,000/Reel).
(4) Standard voltages are 1.50V, 1.80V, 2.50V, 2.80V. For other voltage options, please contact your nearest Catalyst Semiconductor Sales office.
(5) Top marking for CAT6217 is RT.

REVISION HISTORY

Date	Rev.	Reason
21-Jun-07	A	Preliminary Revision
07-Nov-07	B	Update Package Outline Drawing Update Example of Ordering Information Change Document Number from MD-4011 to MD-10011
08-Feb-08	C	Update Electrical Operating Characteristics
22-May-08	D	Add link to Top Mark Codes

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Revision: D
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