300mA CMOS Dual LDO Regulator

HALOGEN FREE LEAD FREE™ RoHS Compliance

FEATURES

- **Two outputs with guaranteed 300mA peak output current**
- **Low dropout voltages of 210mV typical at 300mA**
- **Stable with ceramic output capacitors**
- **Independent enable pins**
- **Under voltage lockout**
- **No-load ground current of 100µA typical**
- **Full-load ground current of 160µA typical**
- **±1.0% output voltage initial accuracy**
- **±2.0% accuracy over temperature**
- **"Zero" current shutdown mode**
- **Fold-back current limit and thermal protection**
- **TSOT-23 6-lead, 0.8mm height package**

APPLICATIONS

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

DESCRIPTION

The 300mA CMOS Dual LDO CAT6221 combines in a single TSOT-23 6-lead package two low dropout regulators (LDO), each with its own enable pin.

The regulator outputs drive loads up to 300mA. By design, the dual LDO provides fast response time during load current and line voltage changes.

Each LDO is optimized for low noise and high crosstalk isolation. With zero shut down current and a low quiescent current of 100µA, the dual LDO is ideal for battery-operated devices with supply voltage from 2.3V to 5.5V.

The dual LDO offers 1% initial accuracy and very low dropout voltage, typical 210mV at 300mA. Stable operation is provided with small 1µF ceramic output capacitors, reducing required board space and component cost.

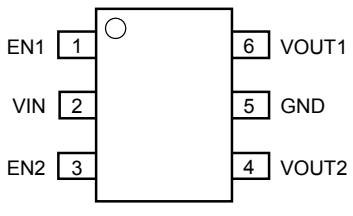
Other features include fold-back current limit and thermal protection.

The dual LDO is available in the tiny 6-lead TSOT-23 package with a maximum height of 0.8mm.

For Ordering Information details, see page 10.

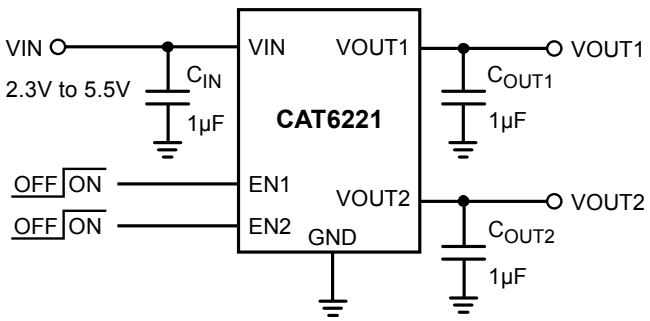
PIN CONFIGURATION

6-Lead TSOT-23
(0.8mm height)



Top View

TYPICAL APPLICATION CIRCUIT



PIN DESCRIPTIONS

Pin #	Name	Function
1	EN1	Enable input (active high) for VOUT1.
2	VIN	Supply voltage input.
3	EN2	Enable input (active high) for VOUT2.
4	VOUT2	LDO Output Voltage 2.
5	GND	Ground reference.
6	VOUT1	LDO Output Voltage 1.

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.

EN1 & 2 are the enable control logic (active high) for the regulator outputs.

VOUT1 & 2 are the LDO regulator outputs. A small 1µF ceramic bypass capacitor is required between the VOUT pins and ground. For better transient response, its value can be increased to 4.7µF.

The capacitor should be located near the device. For the TSOT23 6-lead package, a continuous 300mA output current for both LDOs may turn-on the thermal protection.

BLOCK DIAGRAM

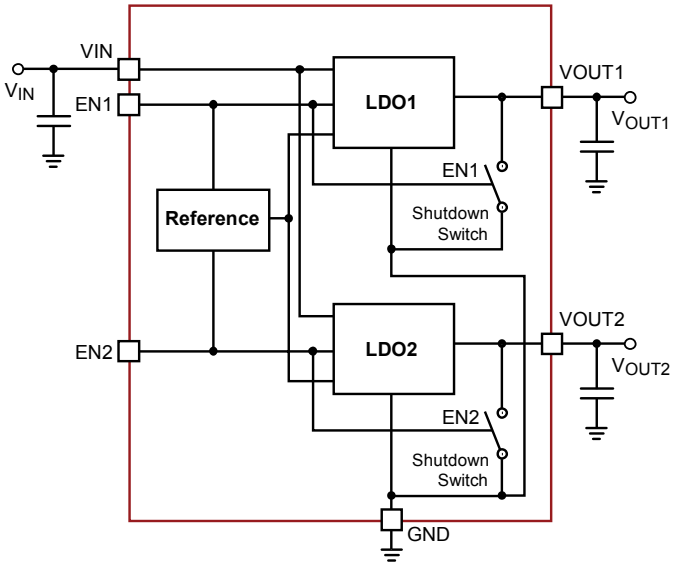


Figure 2. CAT6221 Functional Block Diagram

On each output, 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.

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 (TSOT23), θ_{JA}	235	°C/W

Typical application circuit with external components are 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.

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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	-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 300 mA		0.9	1.5	%
					2	
V_{DROP}	Dropout Voltage (2)	I_{OUT} = 300mA		210	280	mV
					350	
I_{GND}	Ground Current	Both LDOs Enabled I_{OUT} = 0µA		100	140	µA
					170	
		Both LDOs Enabled I_{OUT} = 300mA		160		
		One LDO Enabled I_{OUT} = 0µA		55	75	
					90	
		One LDO Enabled I_{OUT} = 300mA		85		
I_{GND-SD}	Shutdown Ground Current	V_{EN} < 0.4V			2	µA
					4	
PSRR	Power Supply Rejection Ratio	f = 1kHz		60		dB
		f = 20kHz		45		
I_{SC}	Output short circuit current limit	V_{OUT} = 0V		130		mA
T_{ON}	Turn-On Time			150		µs
e_N	Output Noise Voltage (3)	BW = 10Hz to 100kHz		95		µVrms
R_{OUT-SH}	Shutdown Switch Resistance			250		Ω
$V_{IN-UVLO}$	Under voltage lockout threshold			2.15		V
ESR	C_{OUT} equivalent series resistance		5		500	mΩ
Enable Input (EN1, EN2)						
V_{HI}	Logic High Level	V_{IN} = 2.3 to 5.5V	**1.8**			V
V_{LO}	Logic Low Level	V_{IN} = 2.3 to 5.5V			**0.4**	V
I_{EN}	Enable Input Current	V_{EN} = 0.4V		0.05	**1**	µA
		V_{EN} = V_{IN}		0.1	**1**	
Thermal Protection						
T_{SD}	Thermal Shutdown			160		ºC
T_{HYS}	Thermal Hysteresis			10		ºC

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Notes:

(1) Specification for 2.8V output version unless specified otherwise.

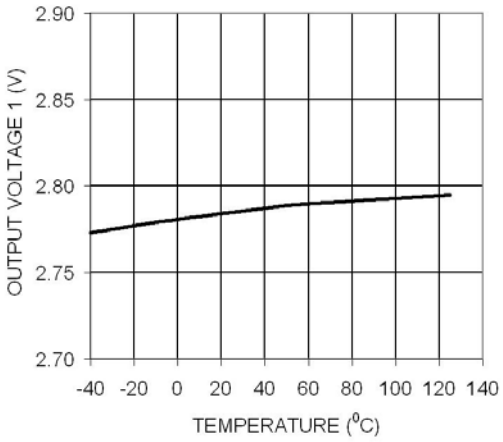
(2) Dropout voltage is defined as the input-to-output differential at which the output voltage drops 2% below its nominal value measured at 1V differential. During test, the input voltage stays always above the minimum 2.3V.

(3) Specification for 1.8V output version.

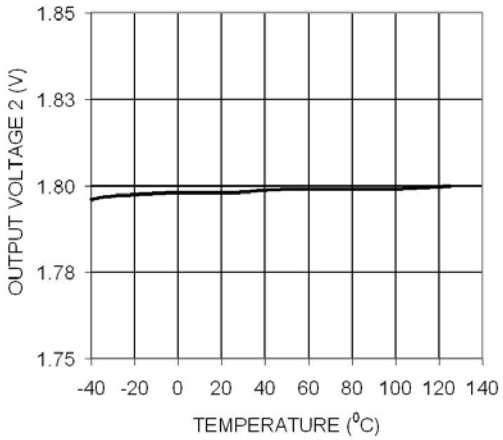
TYPICAL CHARACTERISTICS (shown for 2.8V/1.8V outputs version)

V_{IN} = 3.8V, I_{OUT} = 100µA, EN1 = EN2 = V_{IN}, C_{IN} = C_{OUT} = 1µF, T_A = 25°C unless otherwise specified.

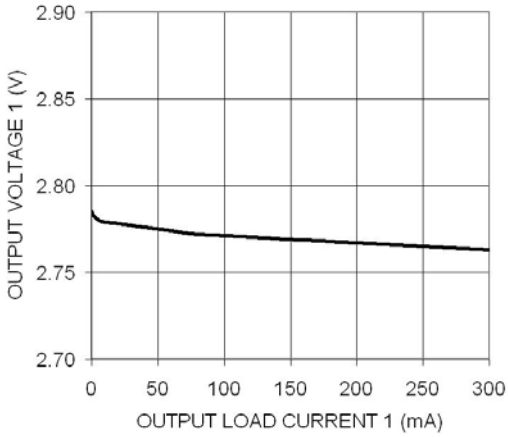
Output Voltage 1 vs. Temperature



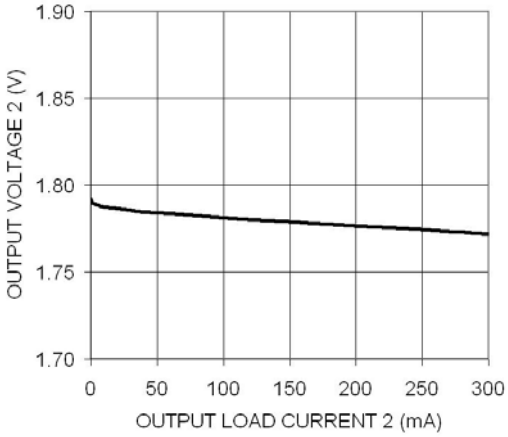
Output Voltage 2 vs. Temperature



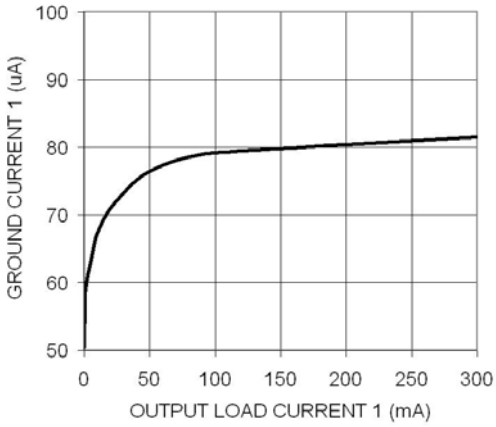
Load Regulation VOUT1



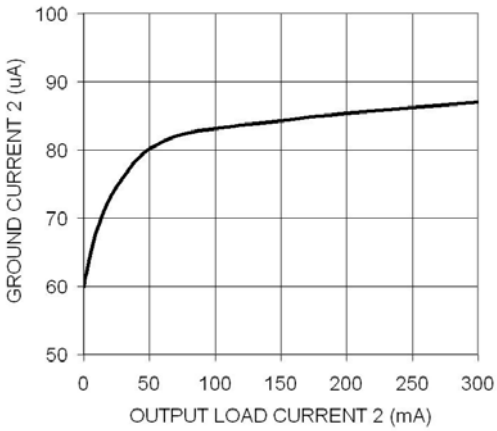
Load Regulation VOUT2



Ground Current (EN2 = GND)



Ground Current (EN1 = GND)

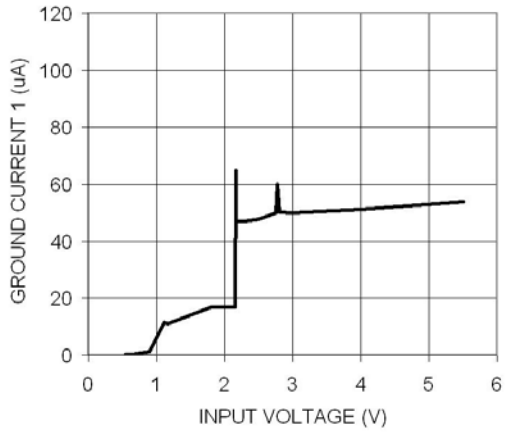


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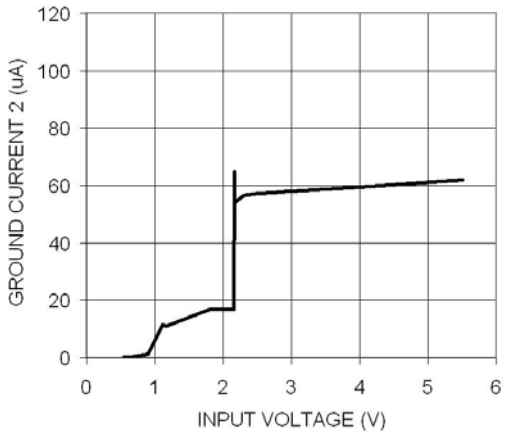
TYPICAL CHARACTERISTICS (shown for 2.8V/1.8V outputs option)

V_{IN} = 3.8V, I_{OUT} = 100µA, EN1 = EN2 = V_{IN}, C_{IN} = C_{OUT} = 1µF, T_A = 25°C unless otherwise specified.

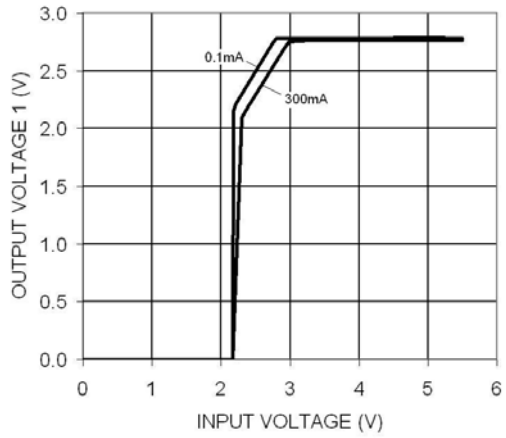
Ground Current (EN2 = GND)



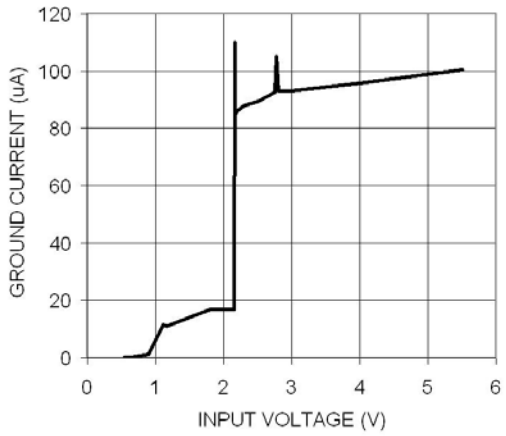
Ground Current (EN1 = GND)



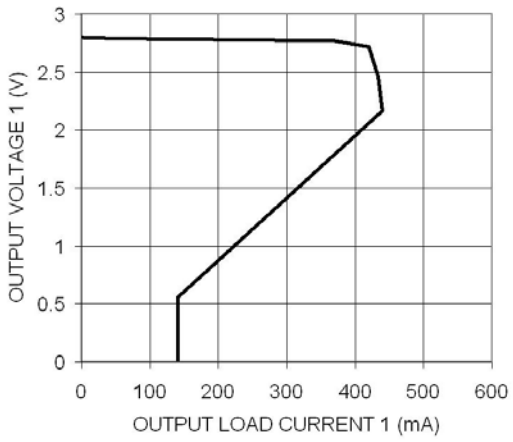
Output 1 Dropout Characteristics



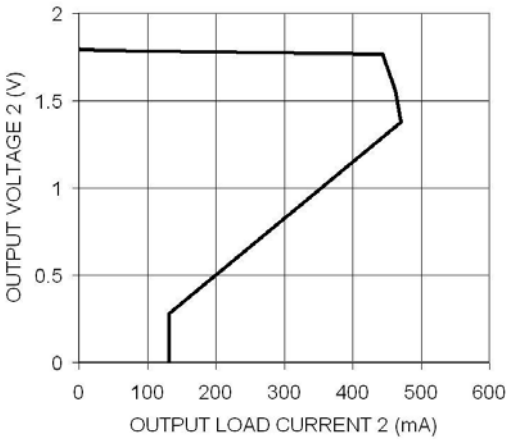
Ground Current vs. Input Voltage



Output Voltage 1 vs. Load Current 1



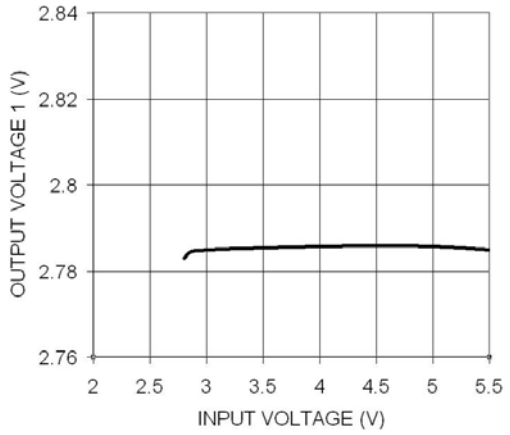
Output Voltage 2 vs. Load Current 2



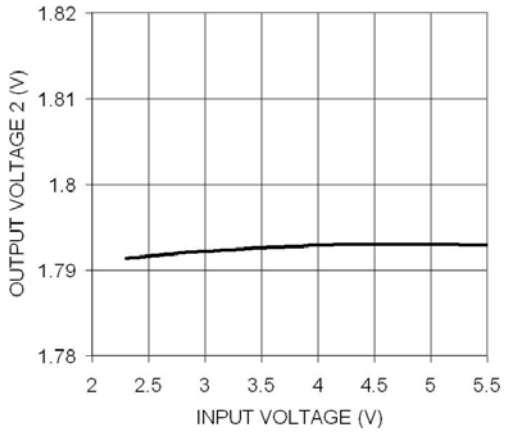
TYPICAL CHARACTERISTICS (shown for 2.8V/1.8V outputs option)

V_{IN} = 3.8V, I_{OUT} = 100µA, EN1 = EN2 = V_{IN}, C_{IN} = C_{OUT} = 1µF, T_A = 25°C unless otherwise specified.

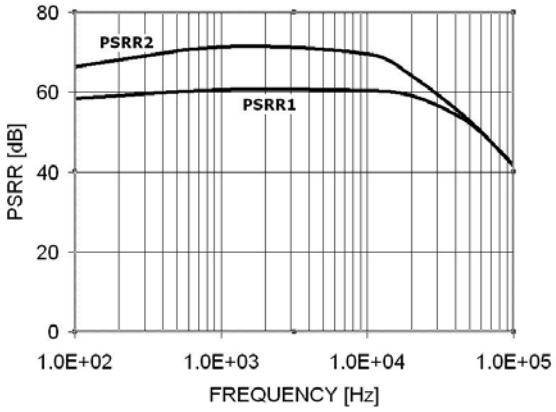
Line Regulation VOUT1



Line Regulation VOUT2



PSRR 1 & 2 vs. Frequency (30mA Load)



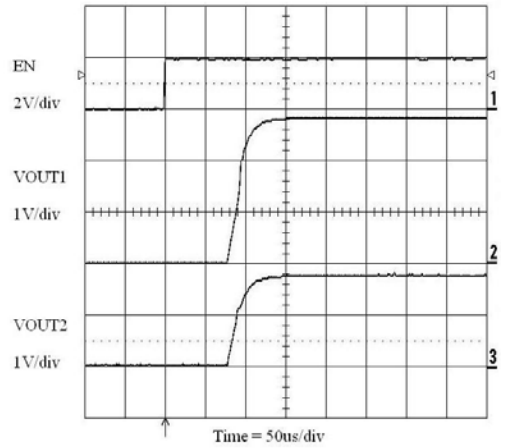
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TRANSIENT CHARACTERISTICS (shown for 2.8V/1.8V outputs option)

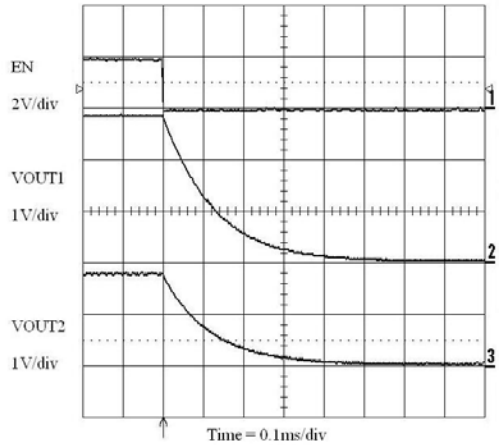
V_{IN} = 3.8V, I_{OUT} = 100µA, EN1 = EN2 = V_{IN}, C_{IN} = C_{OUT} = 1µF, T_A = 25°C unless otherwise specified.

Note: All transient characteristics are generated using the evaluation board CAT6221EVAL1.

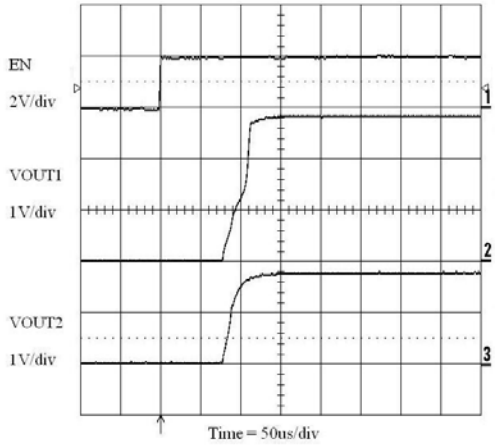
Enable Turn-On (100µA Loads)



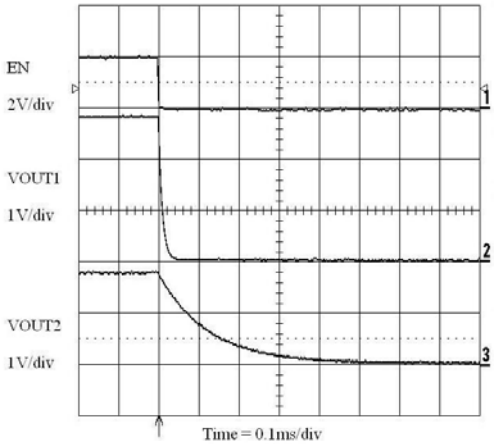
Enable Turn-Off (100µA Loads)



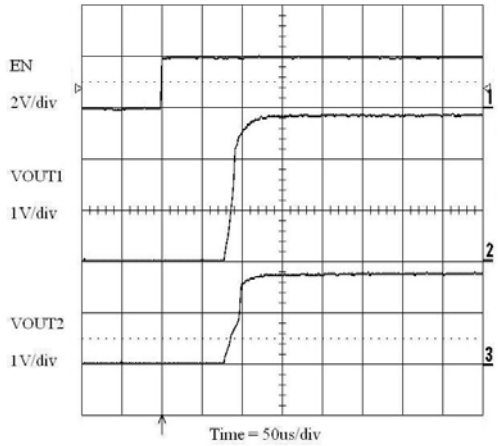
Enable Turn-On (300mA/100µA Loads)



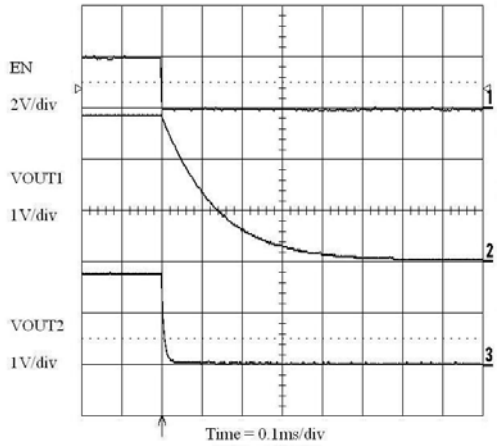
Enable Turn-Off (300mA/100µA Loads)



Enable Turn-On (100µA/300mA Loads)



Enable Turn-Off (100µA/300mA Loads)

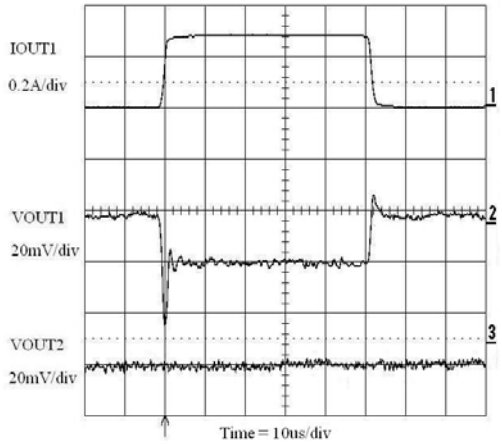


TRANSIENT CHARACTERISTICS (shown for 2.8V/1.8V outputs option)

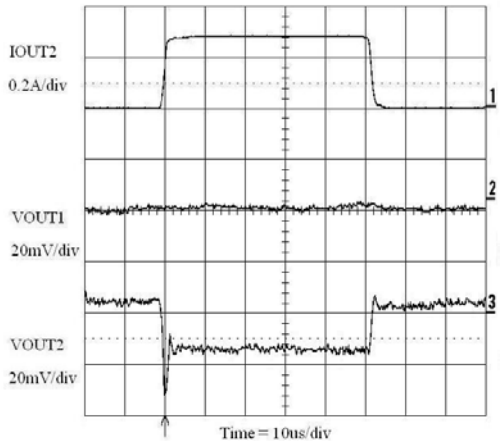
V_{IN} = 3.8V, I_{OUT} = 100µA, EN1 = EN2 = V_{IN}, C_{IN} = C_{OUT} = 1µF, T_A = 25°C unless otherwise specified.

Note: All transient characteristics are generated using the evaluation board CAT6221EVAL1.

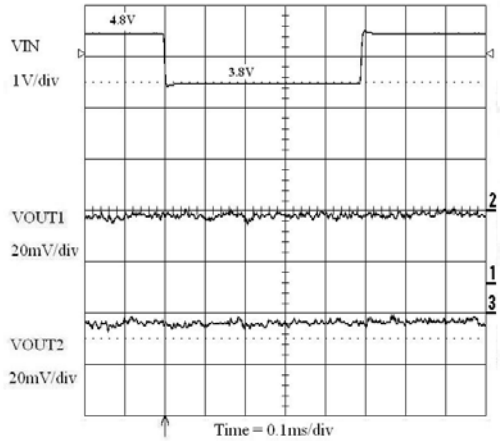
VOUT1 Load Transient Response (0.1 to 300mA)



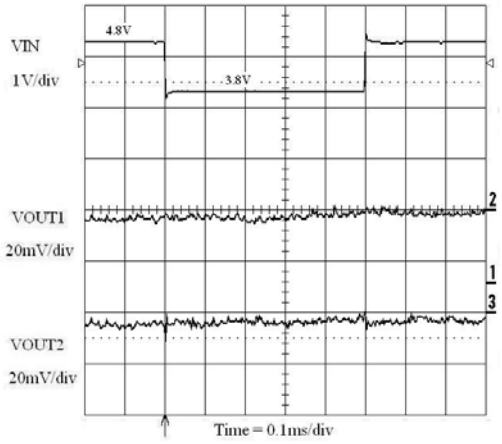
VOUT2 Load Transient Response (0.1 to 300mA)



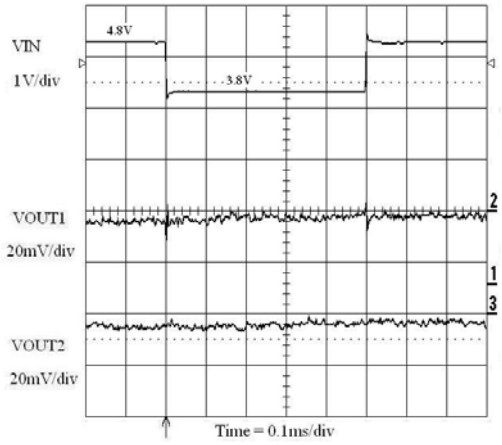
Line Transient Response (0.1mA Loads)



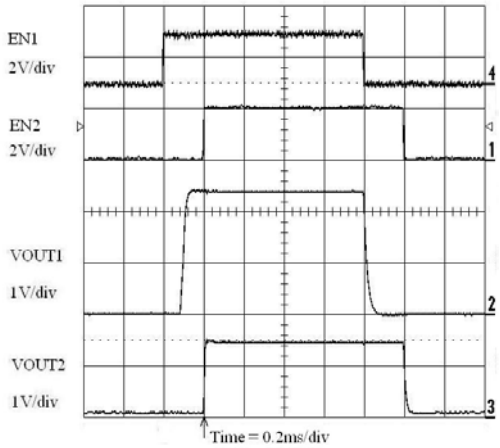
Line Transient Response (0.1/100mA Loads)



Line Transient Response (100/0.1mA Loads)



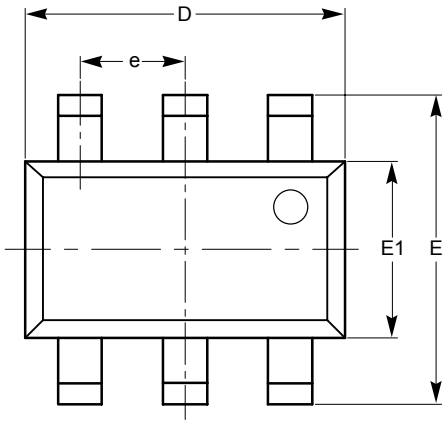
Separate Enable Operation (100mA Loads)



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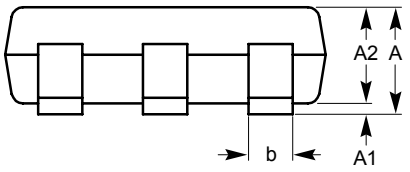
PACKAGE OUTLINE DRAWING

TSOT-23 6-Lead 0.8mm (TD)[1][2]

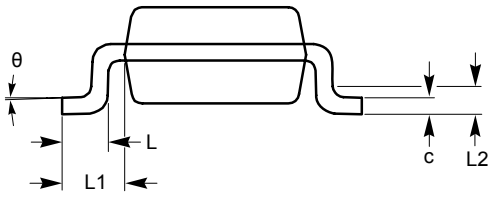


TOP VIEW

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	0°		8°



SIDE VIEW



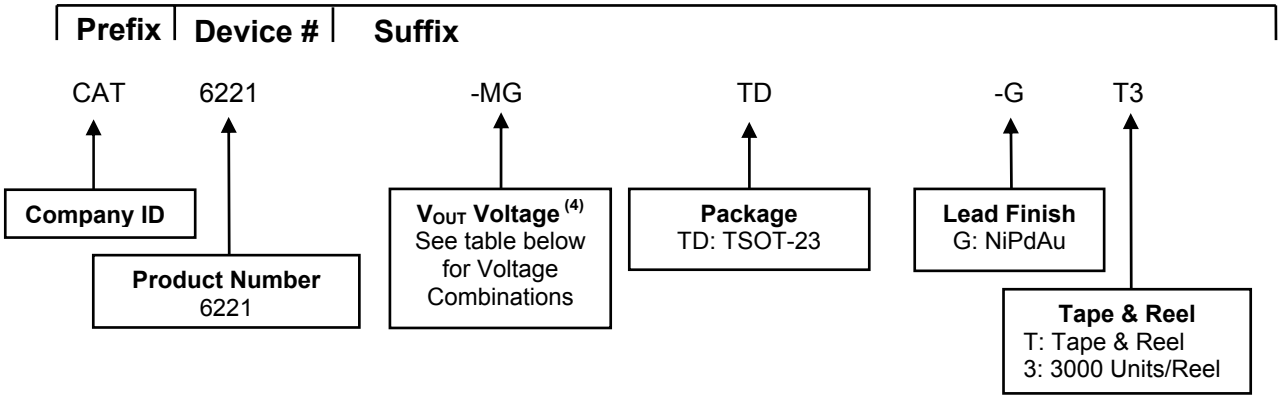
END VIEW

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-193.

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EXAMPLE OF ORDERING INFORMATION



Part Number	V_{OUT} Voltage Combination(4)	Package	Quantity per Reel
CAT6221-JFTD-G	2.5V / 1.5V	TSOT-23	3000
CAT6221-JGTD-G	2.5V / 1.8V	TSOT-23	3000
CAT6221-JLTD-G	2.5V / 2.7V	TSOT-23	3000
CAT6221-JPTD-G	2.5V / 3.0V	TSOT-23	3000
CAT6221-MFTD-G	2.8V / 1.5V	TSOT-23	3000
CAT6221-MGTD-G	2.8V / 1.8V	TSOT-23	3000
CAT6221-MLTD-G	2.8V / 2.7V	TSOT-23	3000
CAT6221-MPTD-G	2.8V / 3.0V	TSOT-23	3000
CAT6221-PFTD-G	3.0V / 1.5V	TSOT-23	3000
CAT6221-PGTD-G	3.0V / 1.8V	TSOT-23	3000
CAT6221-PLTD-G	3.0V / 2.7V	TSOT-23	3000
CAT6221-PPTD-G	3.0V / 3.0V	TSOT-23	3000
CAT6221-SFTD-G	3.3V / 1.5V	TSOT-23	3000
CAT6221-SGTD-G	3.3V / 1.8V	TSOT-23	3000
CAT6221-SLTD-G	3.3V / 2.7V	TSOT-23	3000
CAT6221-SPTD-G	3.3V / 3.0V	TSOT-23	3000

Notes:

(1) All packages are RoHS-compliant (Lead-free, Halogen-free).

(2) The standard lead finish is NiPdAu pre-plated (PPF) lead frames.

(3) The device used in the above example is a CAT6221-MGTD-GT3 (V_{OUT1} = 2.8V, V_{OUT2} = 1.8V, in a TSOT-23 package, NiPdAu, Tape and Reel).

(4) For other voltage combinations, please contact your nearest Catalyst Semiconductor Sales office.

(5) Top marking for CAT6221 is T3YM (Y = Year, M = Month).

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REVISION HISTORY

Date	Rev.	Reason
10/10/2007	A	Initial Release

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Catalyst Semiconductor, Inc.
Corporate Headquarters
2975 Stender Way
Santa Clara, CA 95054
Phone: 408.542.1000
Fax: 408.542.1200
www.catsemi.com

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