CAT6221

300 mA CMOS Dual LDO Regulator

Description

The 300 mA 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 300 mA. 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 100 μA, the dual LDO is ideal for battery−operated devices with supply voltage from 2.3 V to 5.5 V.

The dual LDO offers 1% initial accuracy and very low dropout voltage, typical 210 mV at 300 mA. Stable operation is provided with small 1 μF 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 0.8 mm.

Features

- Two Outputs with Guaranteed 300 mA Peak Output Current
- Low Dropout Voltages of 210 mV Typical at 300 mA
- Stable with Ceramic Output Capacitors
- Independent Enable Pins
- Under Voltage Lockout
- No−load Ground Current of 100 μA Typical
- Full−load Ground Current of 160 μA Typical
- ±1.0% Output Voltage Initial Accuracy ($V_{OUT} \geq 2.0$ V)
- ±2.0% Accuracy Over Temperature ($V_{OUT} \geq 2.0$ V)
- “Zero” Current Shutdown Mode
- Fold−back Current Limit and Thermal Protection
- TSOT−23 6−lead, 0.8 mm Height Package
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- Cellular Phones
- Battery−powered Devices
- Consumer Electronics

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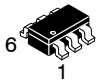
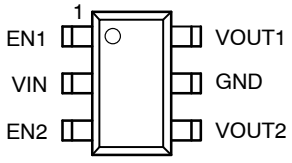


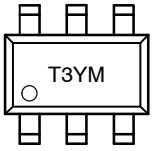
TSOT−23
TD SUFFIX
CASE 419AF

PIN CONNECTIONS



(Top View)

MARKING DIAGRAM



T3 = CAT6221 Device Code
Y = Production Year (last digit)
M = Production Month: 1 – 9, A, B, C

PIN FUNCTION

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.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 10 of this data sheet.

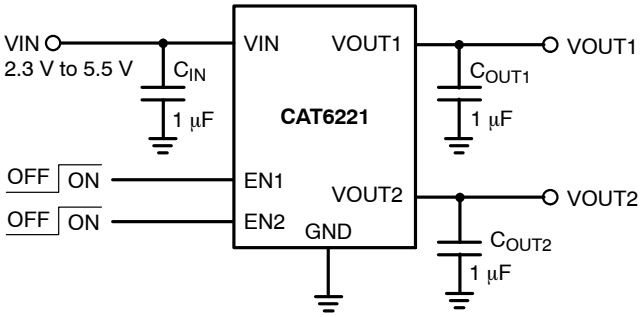


Figure 1. Typical Application Circuit

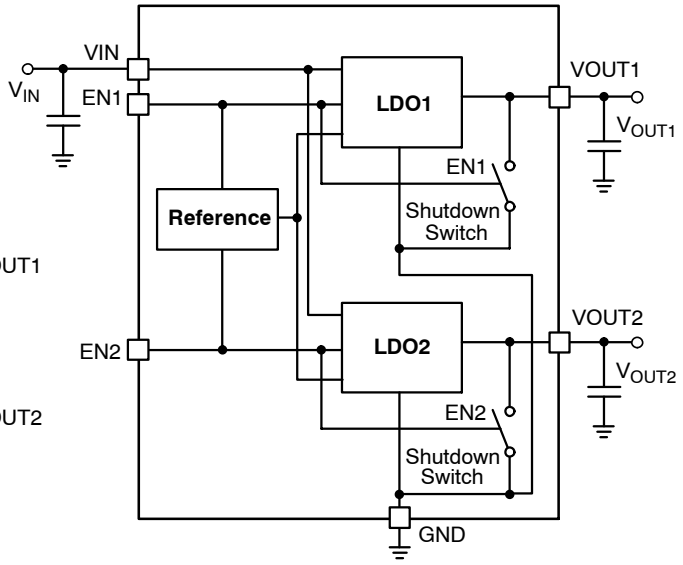


Figure 2. CAT6221 Functional Block Diagram

Pin Function

VIN is the supply pin for the LDO. A small 1 μF 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 2.3 V to 5.5 V.

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

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

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

On each output, a 250 Ω 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.

Table 1. ABSOLUTE MAXIMUM RATINGS

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 (Note 1)	mW
Storage Temperature Range, T_S	−65 to +150	°C
Lead Temperature (soldering, 5 sec.)	260	°C
ESD Rating (Human Body Model)	3	kV

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Table 2. RECOMMENDED OPERATING CONDITIONS (Note 2)

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

NOTE: Typical application circuit with external components is shown above.

1. 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.
2. The device is not guaranteed to work outside its operating rating.

Table 3. ELECTRICAL OPERATING CHARACTERISTICS (Note 3)
(V_{IN} = V_{OUT} + 1.0 V, V_{EN} = High, I_{OUT} = 100 μA, C_{IN} = C_{OUT} = 1 μF, ambient temperature of 25°C (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 (Note 4)	−1.0		+1.0	%
			−2.0		**+2.0**	
TC_{OUT}	Output Voltage Temp. Coefficient			40		ppm/°C
V_{R-LINE}	Line Regulation	V_{IN} = V_{OUT} + 1.0 V to 5.5 V	−0.2	±0.1	+0.2	%/V
			−0.4		**+0.4**	
V_{R-LOAD}	Load Regulation	I_{OUT} = 100 μA to 300 mA		0.9	1.5	%
					2	
V_{DROP}	Dropout Voltage (Note 5)	I_{OUT} = 300 mA		210	280	mV
					350	
I_{GND}	Ground Current	Both LDOs Enabled I_{OUT} = 0 μA		100	140	μA
					170	
		Both LDOs Enabled I_{OUT} = 300 mA		160		
		One LDO Enabled I_{OUT} = 0 μA		55	75	
					90	
		One LDO Enabled I_{OUT} = 300 mA		85		
I_{GND-SD}	Shutdown Ground Current	V_{EN} < 0.4 V			2	μA
					4	
PSRR	Power Supply Rejection Ratio	f = 1 kHz		60		dB
		f = 20 kHz		45		
I_{SC}	Output short circuit current limit	V_{OUT} = 0 V		130		mA
T_{ON}	Turn−On Time			150		μs
e_N	Output Noise Voltage (Note 6)	BW = 10 Hz to 100 kHz		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 5.5 V	**1.8**			V
V_{LO}	Logic Low Level	V_{IN} = 2.3 to 5.5 V			**0.4**	V
I_{EN}	Enable Input Current	V_{EN} = 0.4 V		0.05	**1**	μA
		V_{EN} = V_{IN}		0.1	**1**	
THERMAL PROTECTION						
T_{SD}	Thermal Shutdown			160		°C
T_{HYS}	Thermal Hysteresis			10		°C

3. Specification for 2.8 V output version unless specified otherwise.
4. For V_{OUT} < 2.0 V, the initial accuracy is ±2% and across temp is ±3%.
5. Dropout voltage is defined as the input−to−output differential at which the output voltage drops 2% below its nominal value measured at 1 V differential. During test, the input voltage stays always above the minimum 2.3 V.
6. Specification for 1.8 V output version.

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

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

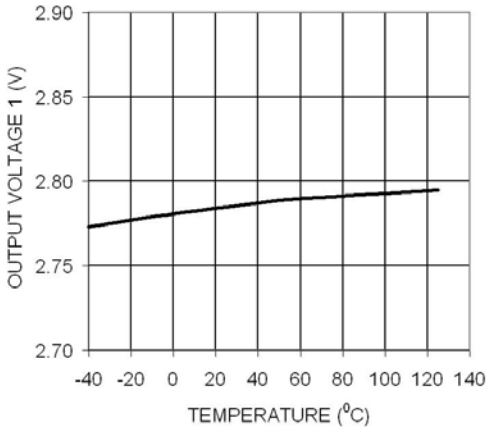


Figure 3. Output Voltage 1 vs. Temperature

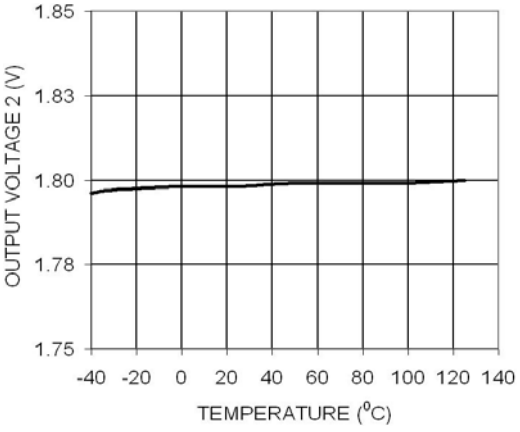


Figure 4. Output Voltage 2 vs. Temperature

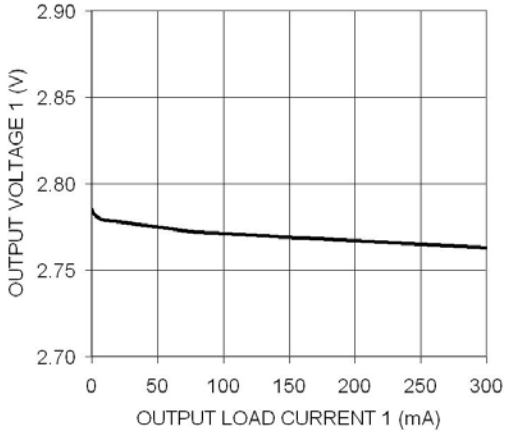


Figure 5. Load Regulation VOUT1

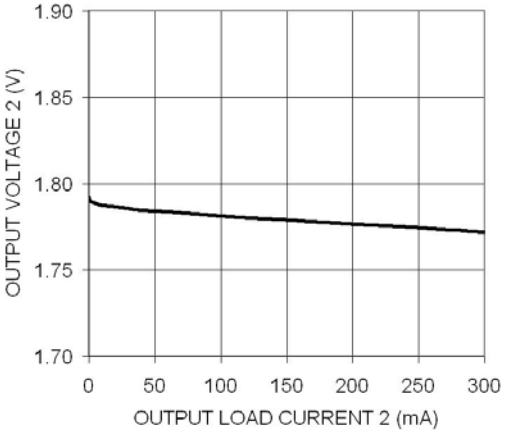


Figure 6. Load Regulation VOUT2

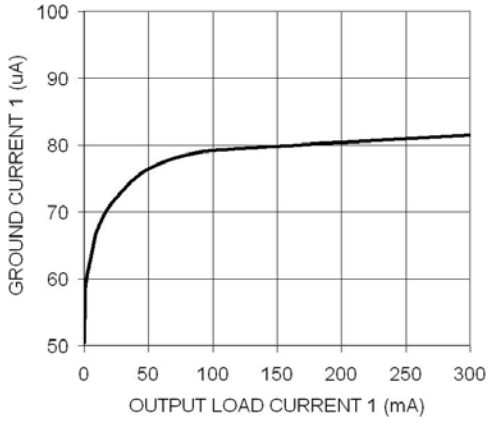


Figure 7. Ground Current (EN2 = GND)

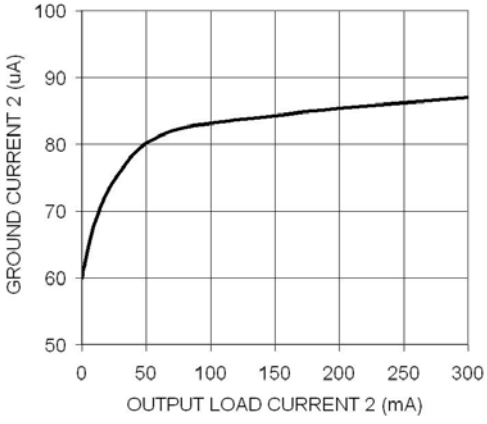


Figure 8. Ground Current (EN1 = GND)

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

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

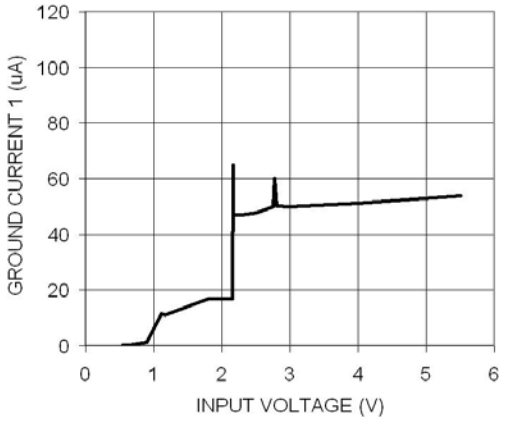


Figure 9. Ground Current (EN2 = GND)

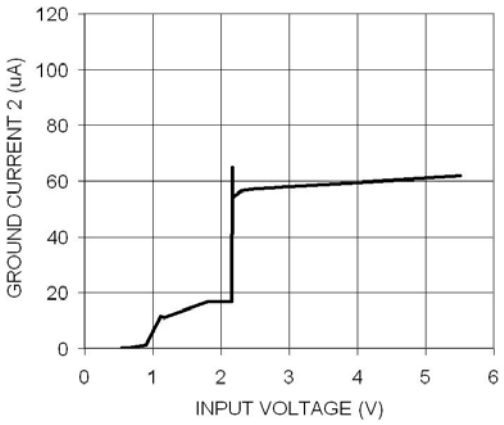


Figure 10. Ground Current (EN1 = GND)

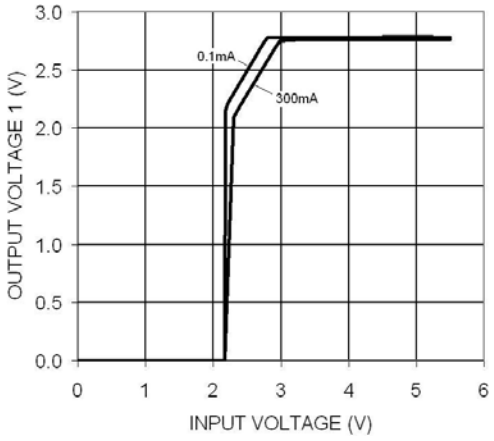


Figure 11. Output 1 Dropout Characteristics

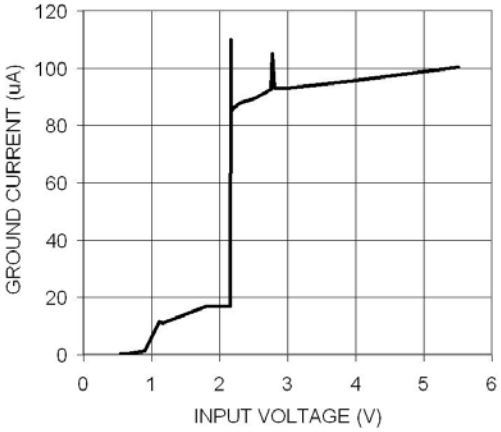


Figure 12. Ground Current vs. Input Voltage

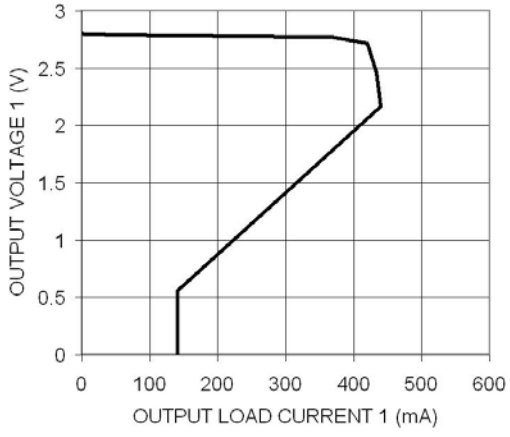


Figure 13. Output Voltage 1 vs. Load Current 1

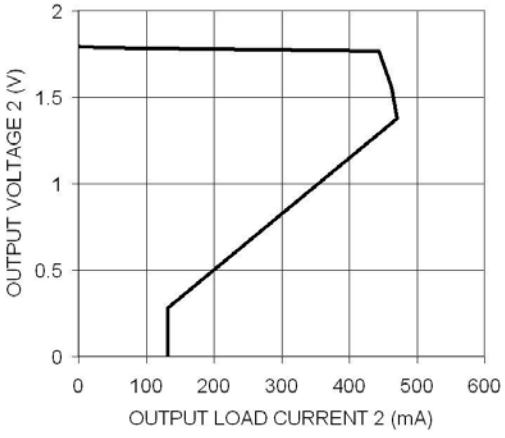


Figure 14. Output Voltage 2 vs. Load Current 2

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

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

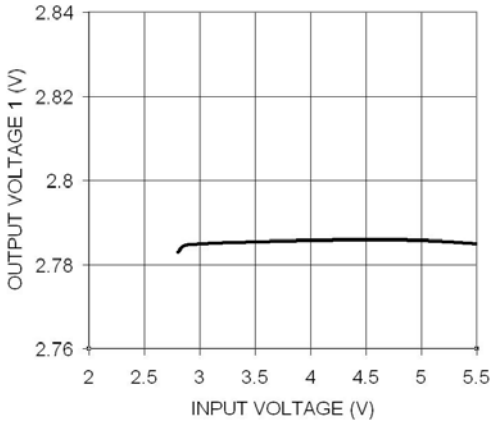


Figure 15. Line Regulation VOUT1

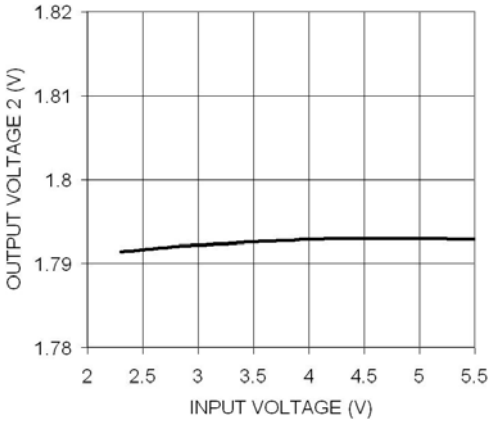


Figure 16. Line Regulation VOUT2

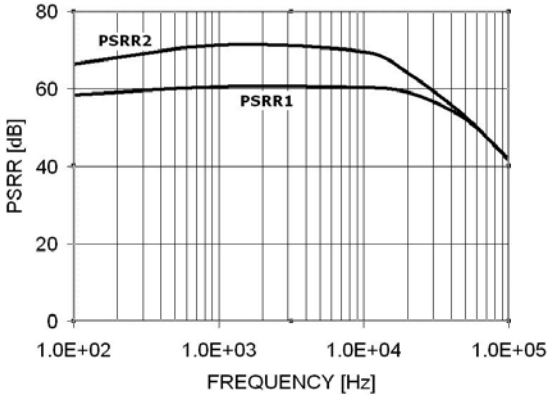


Figure 17. PSRR 1 & 2 vs. Frequency (30 mA Load)

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

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

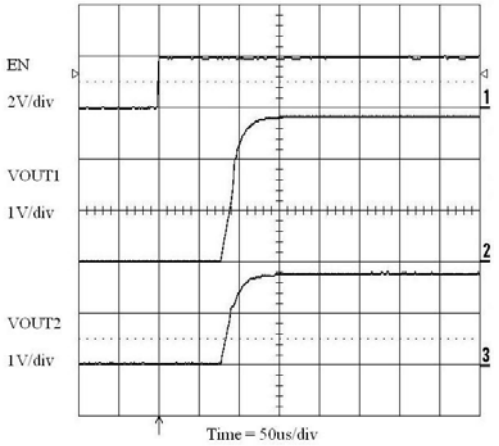


Figure 18. Enable Turn−on (100 μA Loads)

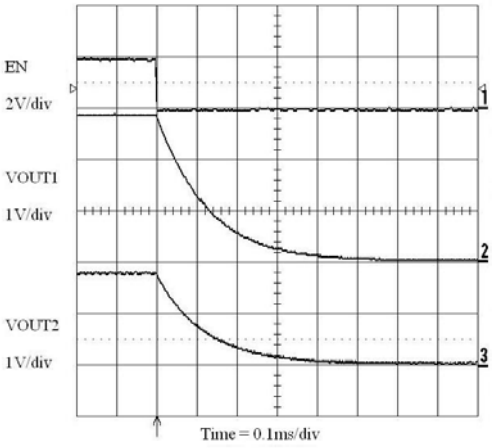


Figure 19. Enable Turn−off (100 μA Loads)

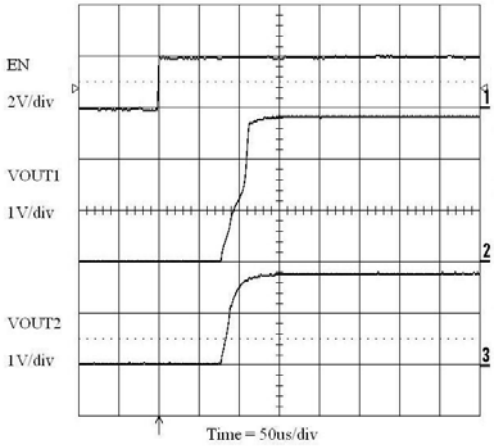


Figure 20. Enable Turn−on (300 mA/100 μA Loads)

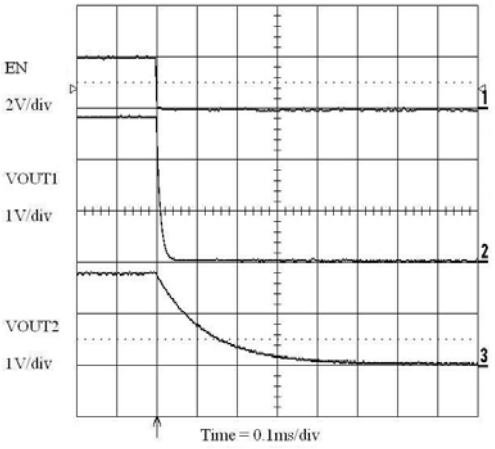


Figure 21. Enable Turn−off (300 mA/100 μA Loads)

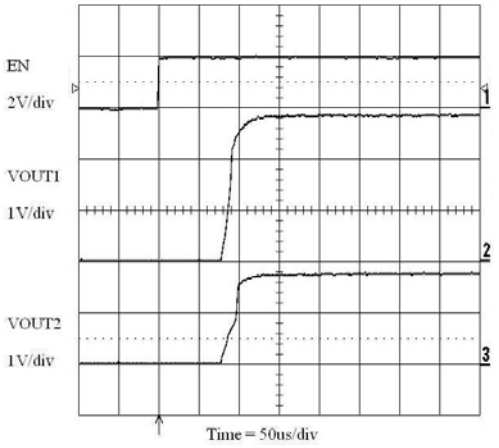


Figure 22. Enable Turn−on (100 μA/300 mA Loads)

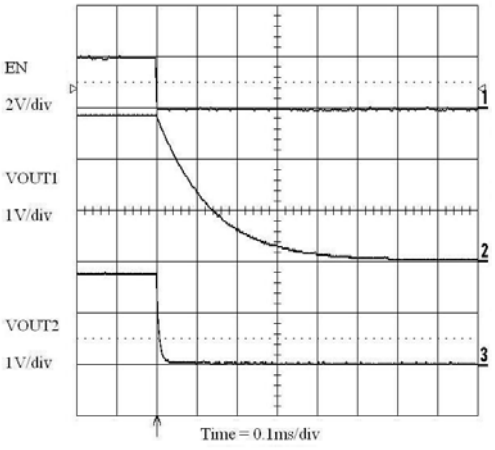


Figure 23. Enable Turn−off (100 μA/300 mA Loads)

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

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

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

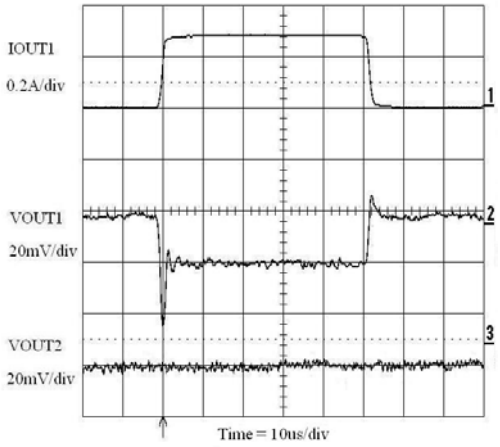


Figure 24. VOUT1 Load Transient Response (0.1 to 300 mA)

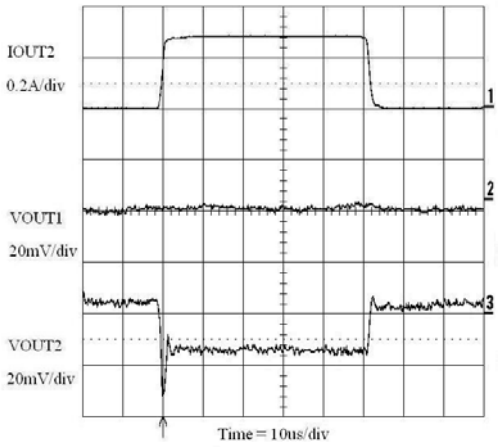


Figure 25. VOUT2 Load Transient Response (0.1 to 300 mA)

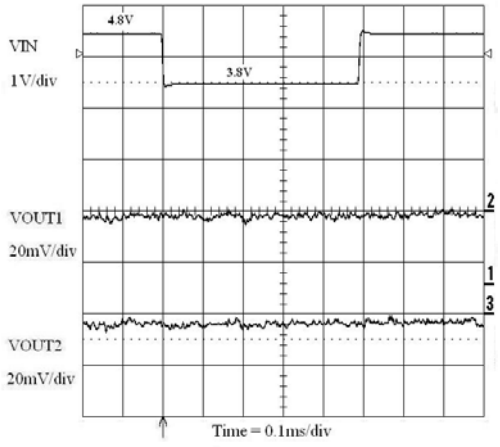


Figure 26. Line Transient Response (0.1 mA Loads)

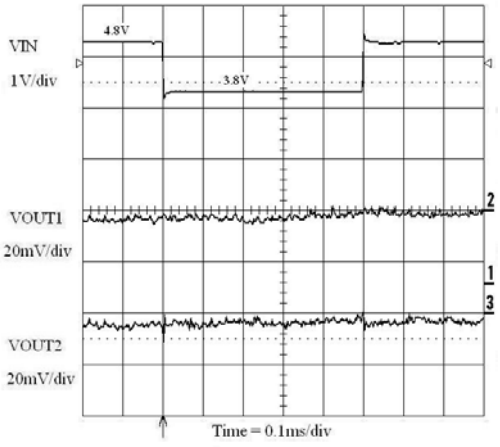


Figure 27. Line Transient Response (0.1/100 mA Loads)

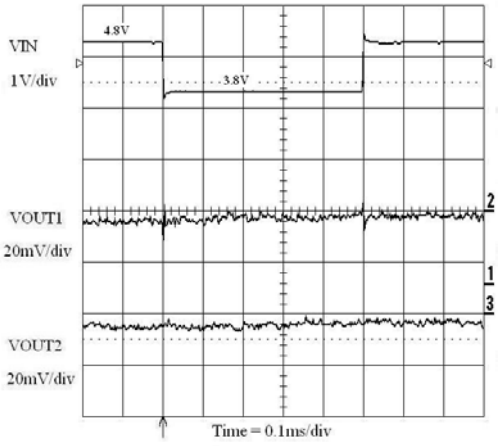


Figure 28. Line Transient Response (100/0.1 mA Loads)

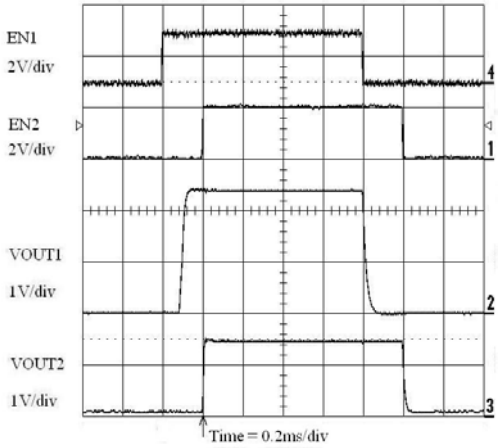
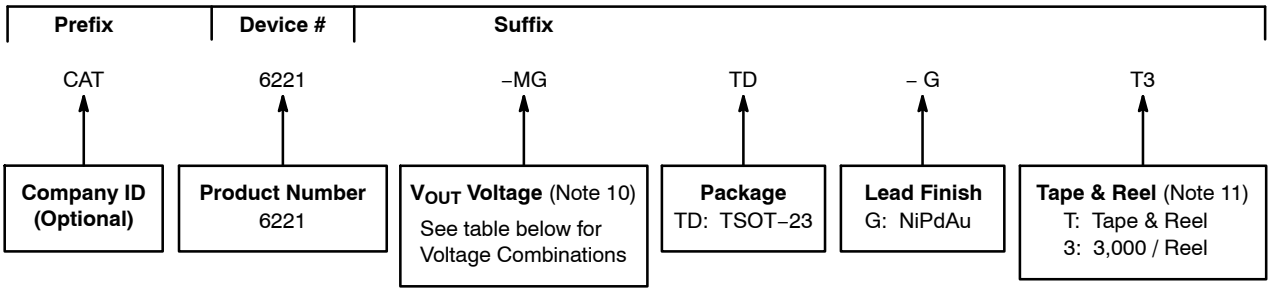


Figure 29. Separate Enable Operation (100 mA Loads)

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

Example of Ordering Information (Note 9)



ORDERING INFORMATION

Orderable Part Number	V_{OUT} Voltage V_{OUT1} / V_{OUT2}	Package	Shipping
CAT6221–JFTD–GT3	2.5 V / 1.5 V	TSOT–23	3,000 / Tape & Reel
CAT6221–JGTD–GT3	2.5 V / 1.8 V	TSOT–23	3,000 / Tape & Reel
CAT6221–JLTD–GT3	2.5 V / 2.7 V	TSOT–23	3,000 / Tape & Reel
CAT6221–JPTD–GT3	2.5 V / 3.0 V	TSOT–23	3,000 / Tape & Reel
CAT6221–MFTD–GT3	2.8 V / 1.5 V	TSOT–23	3,000 / Tape & Reel
CAT6221–MGTD–GT3	2.8 V / 1.8 V	TSOT–23	3,000 / Tape & Reel
CAT6221–MLTD–GT3	2.8 V / 2.7 V	TSOT–23	3,000 / Tape & Reel
CAT6221–MPTD–GT3	2.8 V / 3.0 V	TSOT–23	3,000 / Tape & Reel
CAT6221–PFTD–GT3	3.0 V / 1.5 V	TSOT–23	3,000 / Tape & Reel
CAT6221–PGTD–GT3	3.0 V / 1.8 V	TSOT–23	3,000 / Tape & Reel
CAT6221–PLTD–GT3	3.0 V / 2.7 V	TSOT–23	3,000 / Tape & Reel
CAT6221–PPTD–GT3	3.0 V / 3.0 V	TSOT–23	3,000 / Tape & Reel
CAT6221–SFTD–GT3	3.3 V / 1.5 V	TSOT–23	3,000 / Tape & Reel
CAT6221–SGTD–GT3	3.3 V / 1.8 V	TSOT–23	3,000 / Tape & Reel
CAT6221–SLTD–GT3	3.3 V / 2.7 V	TSOT–23	3,000 / Tape & Reel
CAT6221–SPTD–GT3	3.3 V / 3.0 V	TSOT–23	3,000 / Tape & Reel

7. All packages are RoHS–compliant (Lead–free, Halogen–free).
8. The standard finish is NiPdAu pre–plated (PPF) lead frames.
9. The device used in the above example is a CAT6221–MGTD–GT3 (V_{OUT1} = 2.8 V, V_{OUT2} = 1.8 V, in a TSOT–23 package, NiPdAu, Tape & Reel).
10. For other voltage options, please contact your nearest ON Semiconductor Sales office.
11. For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

TSOT−23, 6 LEAD
CASE 419AF−01
ISSUE O

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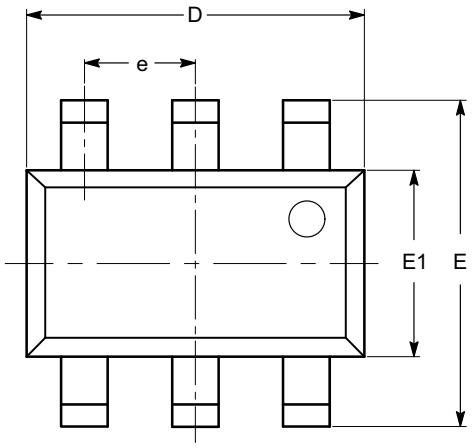
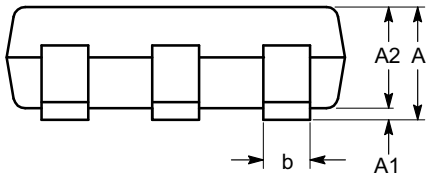
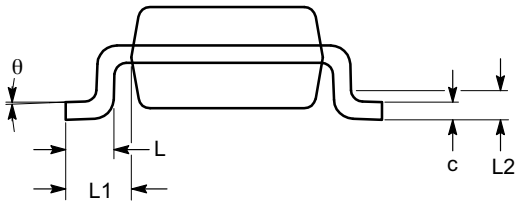


TOP VIEW

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

Notes:
(1) All dimensions are in millimeters. Angles in degrees.
(2) Complies with JEDEC MO-193.

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