

Features

- Fixed Output Voltage:
 - 1.25 V, 2.048 V, 2.5 V, 3 V, 3.3 V, 4.096 V
- High Initial Accuracy and Low Temperature Coefficient:
 - Max 0.15%
 - 30 ppm/°C
- Operation Temperature Range: -40°C to 125°C
- Output Noise: 50 μ Vpp of TPR3325
- Quiescent Current: 180 μ A
- Stable with 0.1- μ F to 10- μ F Capacitive Loads
- Package Option:
 - SOT23G-3

Applications

- Power
- Instrumentation
- Industry

Description

The TPR33 is a voltage reference with guaranteed temperature stability over the entire operating temperature range. The temperature range is extended from -40 °C to +125 °C.

Typical Application Circuit

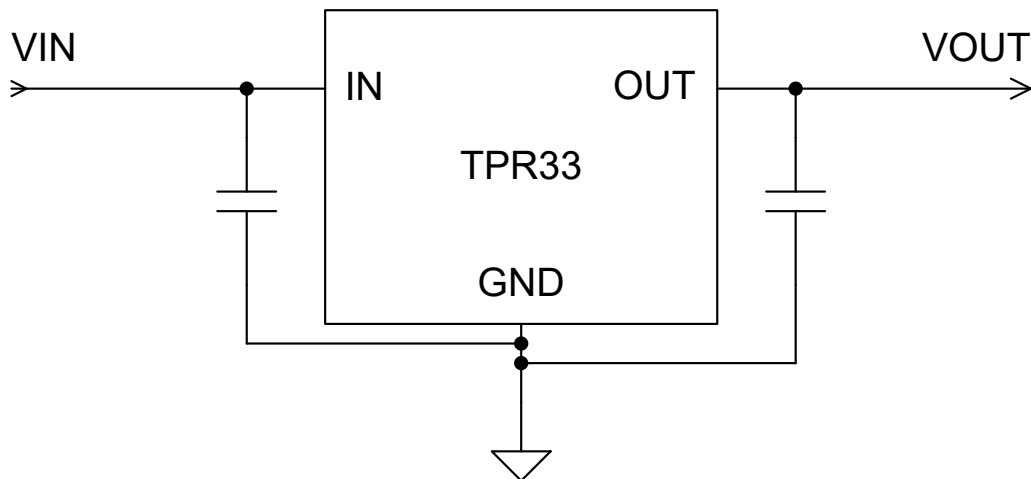


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Product Family Table

Order Number	Output Voltage (V)	Package
TPR3312-S3TR	1.25	SOT23G-3
TPR3320-S3TR	2.048	SOT23G-3
TPR3325-S3TR	2.5	SOT23G-3
TPR3330-S3TR	3	SOT23G-3
TPR3333-S3TR	3.3	SOT23G-3
TPR3340-S3TR	4.096	SOT23G-3

Revision History

Revision	Notes
Rev.Pre.0	Pre-released version.
Rev.Pre.1	Updated the limit.
Rev.Pre.2	Updated the voltage output.
Rev.A.0	Initial version.
Rev.A.1	1. Added the Tape and Reel Information. 2. Added the common condition in Electrical Characteristics: $V_S = 5\text{ V}$.
Rev.A.2	Updated the ESD Rating.
Rev.A.3	1. Added the typical value of long-term stability. 2. Corrected the test conditions in Electrical Characteristics table.
Rev.A.4	Removed the QFN1.5X1.5-8 package.
Rev.A.5	1. Updated to a new datasheet format. 2. Added Pin function description. 3. Added the Typical Application Circuit.

Pin Configuration and Functions

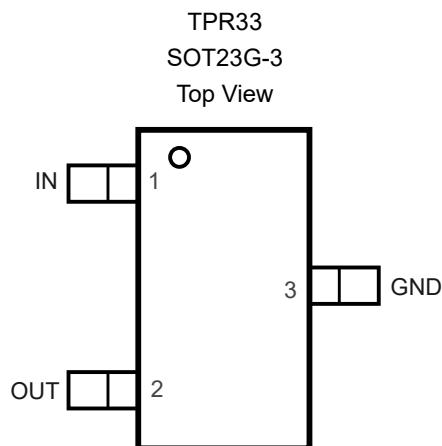


Table 1. Pin Functions: TPR33

Pin No.	Name	I/O	Description
1	IN	I	Supply voltage input pin.
2	OUT	O	Reference voltage output pin.
3	GND	—	Ground.

Specifications

Absolute Maximum Ratings ⁽¹⁾

Parameter		Min	Max	Unit
V _{IN}	Supply Voltage	-0.3	6.9	V
T _J	Junction Temperature Range	-40	150	°C
T _A	Operating Temperature Range	-40	125	°C
T _{STG}	Storage Temperature Range	-65	150	°C
T _L	Lead Temperature (Soldering 10 sec)		260	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

ESD, Electrostatic Discharge Protection

Symbol	Parameter	Condition	Minimum Level	Unit
HBM	Human Body Model ESD	ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±4	kV
CDM	Charged Device Model ESD	ANSI/ESDA/JEDEC JS-002 ⁽²⁾	±1.5	kV

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Recommended Operating Conditions

Parameter		Min	Max	Unit
V _{IN}	Supply Voltage	2.1	5.5	V
T _J	Junction Temperature Range	-40	125	°C

Thermal Information

Package Type	θ _{JA}	θ _{Jc}	Unit
SOT23G-3	250	81	°C/W

Electrical Characteristics

All test conditions: $V_{IN} = 5\text{ V}$, $T_A = +25^\circ\text{C}$, unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TPR3312						
V_{OUT}	Output Voltage			1.25		V
	Initial Accuracy		-0.15		0.15	%
	Output Voltage Noise	$f = 0.1\text{ Hz to }10\text{ Hz}$		25		μVpp
TPR3320						
V_{OUT}	Output Voltage			2.048		V
	Initial Accuracy		-0.15		0.15	%
	Output Voltage Noise	$f = 0.1\text{ Hz to }10\text{ Hz}$		40		μVpp
TPR3325						
V_{OUT}	Output Voltage			2.5		V
	Initial Accuracy		-0.15		0.15	%
	Output Voltage Noise	$f = 0.1\text{ Hz to }10\text{ Hz}$		50		μVpp
TPR3330						
V_{OUT}	Output Voltage			3.0		V
	Initial Accuracy		-0.15		0.15	%
	Output Voltage Noise	$f = 0.1\text{ Hz to }10\text{ Hz}$		60		μVpp
TPR3333						
V_{OUT}	Output Voltage			3.3		V
	Initial Accuracy		-0.15		0.15	%
	Output Voltage Noise	$f = 0.1\text{ Hz to }10\text{ Hz}$		66		μVpp
TPR3340						
V_{OUT}	Output Voltage			4.096		V
	Initial Accuracy		-0.15		0.15	%
	Output Voltage Noise	$f = 0.1\text{ Hz to }10\text{ Hz}$		80		μVpp
TPR3312, TPR3320, TPR3325, TPR3330, TPR3333, TPR3340, Power Supply						
V_{IN}	Supply Voltage	TPR3312	2.1		5.5	V
		All parts except TPR3312, $I_{LOAD} = \pm 1\text{ mA}$	$V_{OUT} + 0.05$		5.5	V
I_Q	Quiescent Current				180	μA
		$T_A = -40\text{ to }125^\circ\text{C}$			215	μA
	Minimum Dropout Voltage	$I_{LOAD} = \pm 1\text{ mA}$, all parts except TPR3312	$T_A = 25^\circ\text{C}$	25	50	mV
			$T_A = 0^\circ\text{C to }70^\circ\text{C}$		50	mV
			$T_A = -40^\circ\text{C to }125^\circ\text{C}$		100	mV

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$I_{LOAD} = \pm 5 \text{ mA}$, all parts except TPR3312	$T_A = 25^\circ\text{C}$		200	mV
			$T_A = -40^\circ\text{C}$ to 125°C		250	mV
TPR3312, TPR3320, TPR3325, TPR3330, TPR3333, TPR3340, Reference Output						
	Output Voltage Temperature Drift	$T_A = -40^\circ\text{C}$ to 85°C		10	20	ppm/ $^\circ\text{C}$
		$T_A = -40^\circ\text{C}$ to 125°C		15	30	
	Line Regulation, TPR3312	$V_{IN} = 2.1$ to $5.5 \text{ V}^{(1)}$	-65		65	ppm/V
		$V_{IN} = 2.1$ to $5.5 \text{ V}^{(1)}$, $T_A = -40^\circ\text{C}$ to 125°C	-85		85	ppm/V
	Line Regulation, TPR33xx except TPR3312	$V_{IN} = V_{OUT} + 300 \text{ mV}$ to 5.5 V	-50		50	ppm/V
			$T_A = -40^\circ\text{C}$ to 125°C		70	ppm/V
	Load Regulation	$V_{IN} = V_{OUT} + 300 \text{ mV}$, $I_{LOAD} = -5 \text{ mA}$ to $5 \text{ mA}^{(1)}$	-20		20	ppm/mA
			$T_A = -40^\circ\text{C}$ to 125°C		30	ppm/mA
	Long-Term Stability	0 to 1,000 hours, $T_A = 25^\circ\text{C}$		200		ppm
		1,000 to 2,000 hours, $T_A = 25^\circ\text{C}$		200		ppm
	Thermal Hysteresis			80		ppm
I_{SC}	Short-Circuit Current	Sourcing and sinking		50		mA
	Capacitive Load		0.1		10	μF
	Turn-on Settling Time	To 0.1% with $C_L = 1 \mu\text{F}$		500		μs

(1) The minimum supply voltage for the TPR3312 is 2.1 V.

Typical Performance Characteristics – TPR3325

All test conditions: $T_A = +25^\circ\text{C}$, unless otherwise noted.

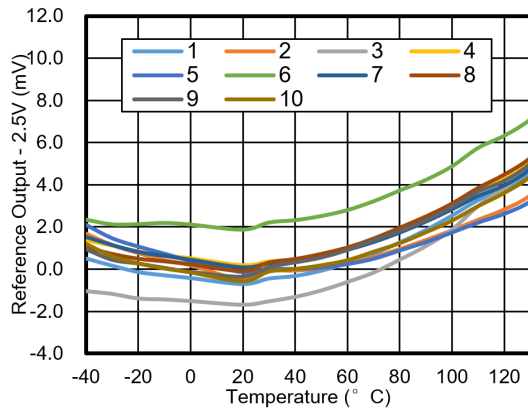


Figure 1. V_{OUT} vs. Temperature, 10-pcs Samples, $V_{IN} = 5$ V, $C_{IN} = 1\ \mu\text{F}$, $C_{OUT} = 1\ \mu\text{F}$

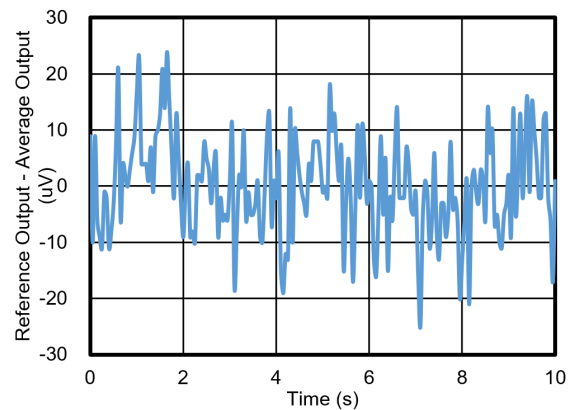


Figure 2. 0.1 to 10-Hz Voltage Noise, $V_{IN} = 5$ V, $C_{IN} = 1\ \mu\text{F}$, $C_{OUT} = 1\ \mu\text{F}$

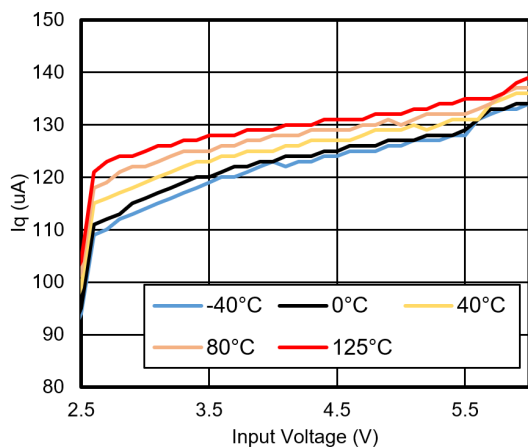


Figure 3. I_Q vs. Input Voltage

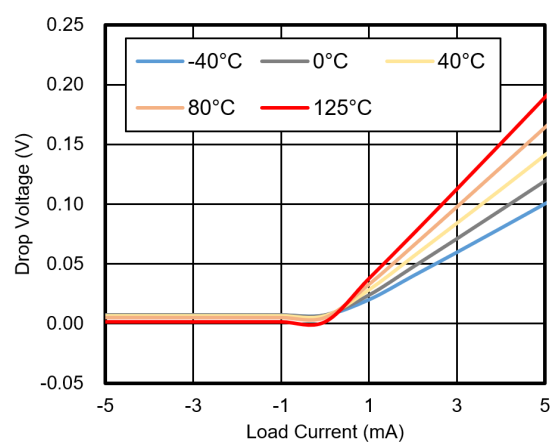


Figure 4. Drop Voltage vs. Load Current

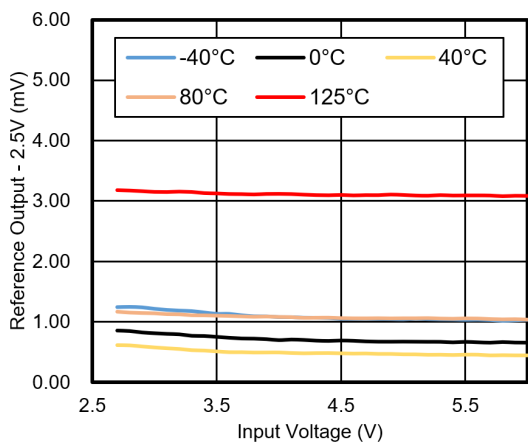


Figure 5. Output Voltage vs. Input Voltage

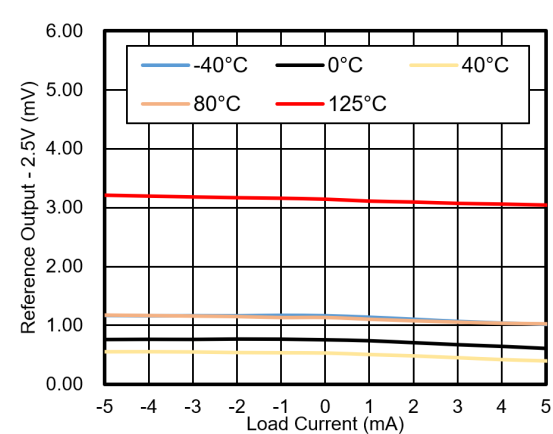


Figure 6. Output Voltage vs. Load Current

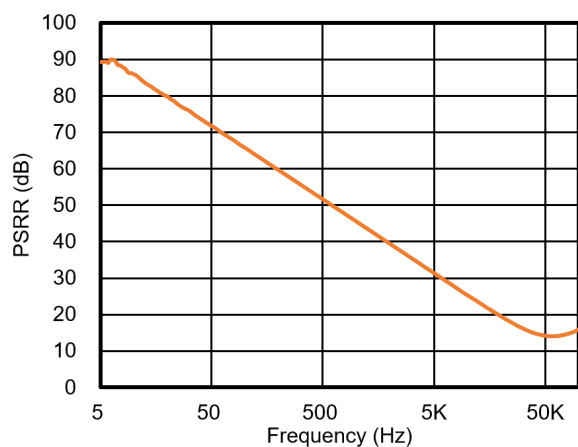


Figure 7. PSRR vs. Frequency

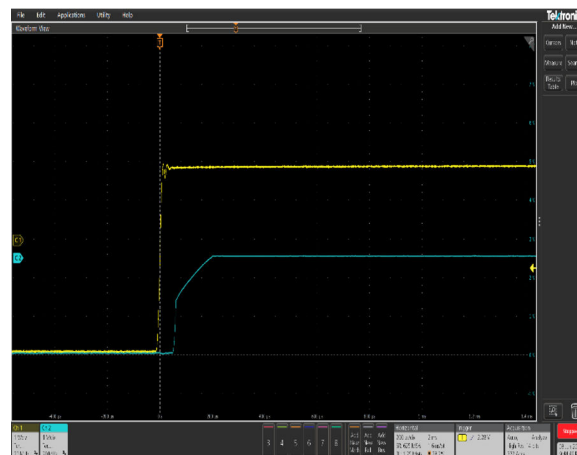
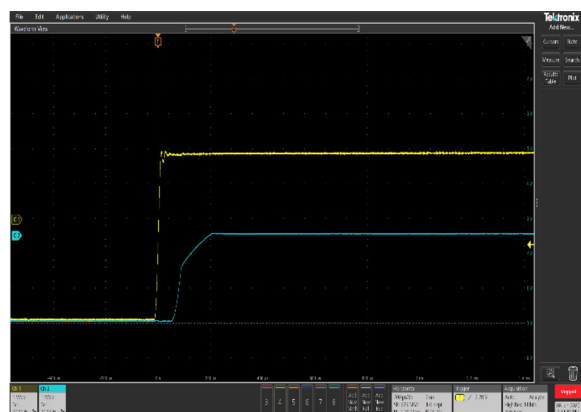
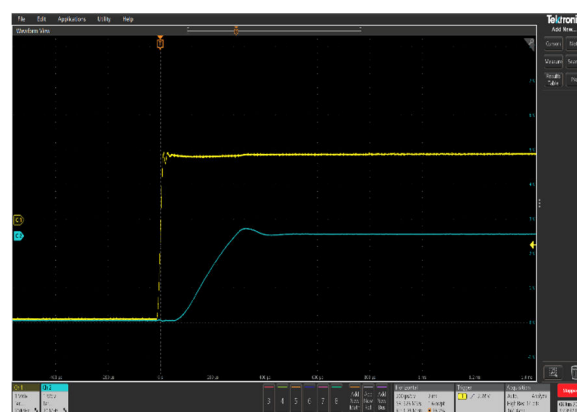

Figure 8. Step Response, $V_{IN} = 5\text{ V}$, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$, 200 $\mu\text{s/div}$

Figure 9. Step Response, $V_{IN} = 5\text{ V}$, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{OUT} = 1\text{ }\mu\text{F}$, 200 $\mu\text{s/div}$

Figure 10. Step Response, $V_{IN} = 5\text{ V}$, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{OUT} = 10\text{ }\mu\text{F}$, 200 $\mu\text{s/div}$

Figure 11. Load Transient, $\pm 5\text{ mA}$, $V_{IN} = 5\text{ V}$, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{OUT} = 1\text{ }\mu\text{F}$, 50 mV/div

Figure 12. Load Transient, $\pm 5\text{ mA}$, $V_{IN} = 2.8\text{ V}$, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{OUT} = 1\text{ }\mu\text{F}$, 50 mV/div



Figure 13. Load Transient, ± 2 mA, $V_{IN} = 5$ V, $C_{IN} = 1$ μ F, $C_{OUT} = 1$ μ F, 20 mV/div



Figure 14. Load Transient, ± 2 mA, $V_{IN} = 2.8$ V, $C_{IN} = 1$ μ F, $C_{OUT} = 1$ μ F, 20 mV/div

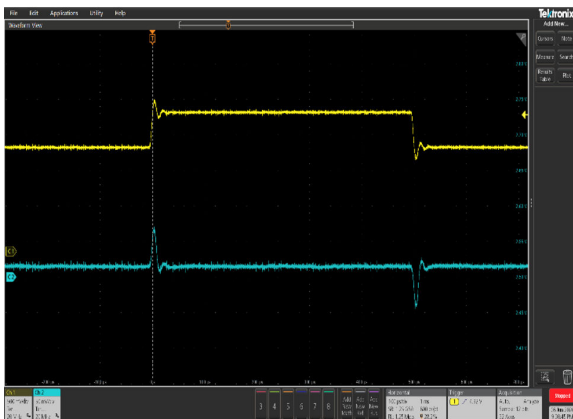
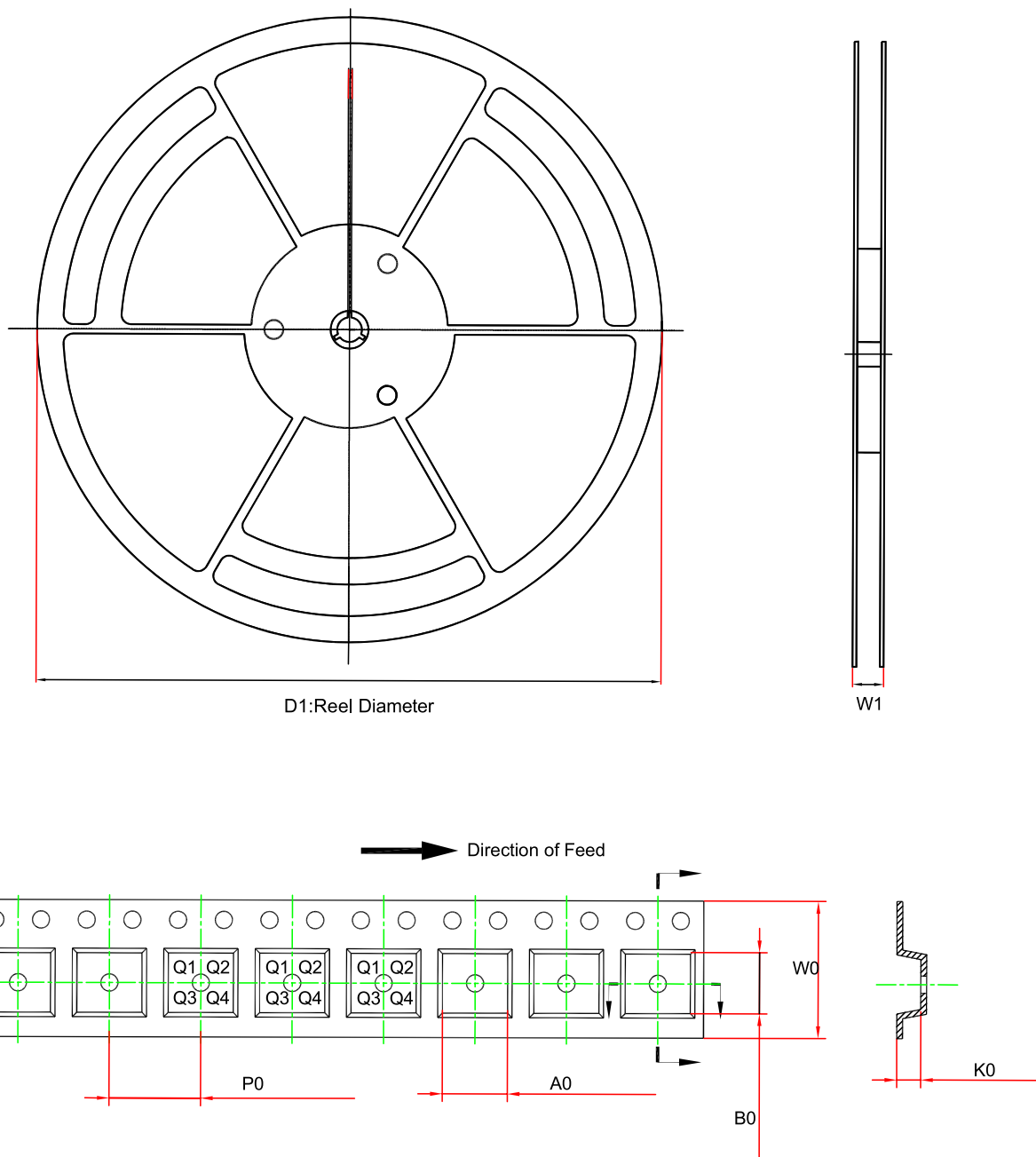


Figure 15. Line Transient, 500-mV Step, $C_{IN} = 1$ μ F, $C_{OUT} = 1$ μ F, 50 mV/div

Tape and Reel Information

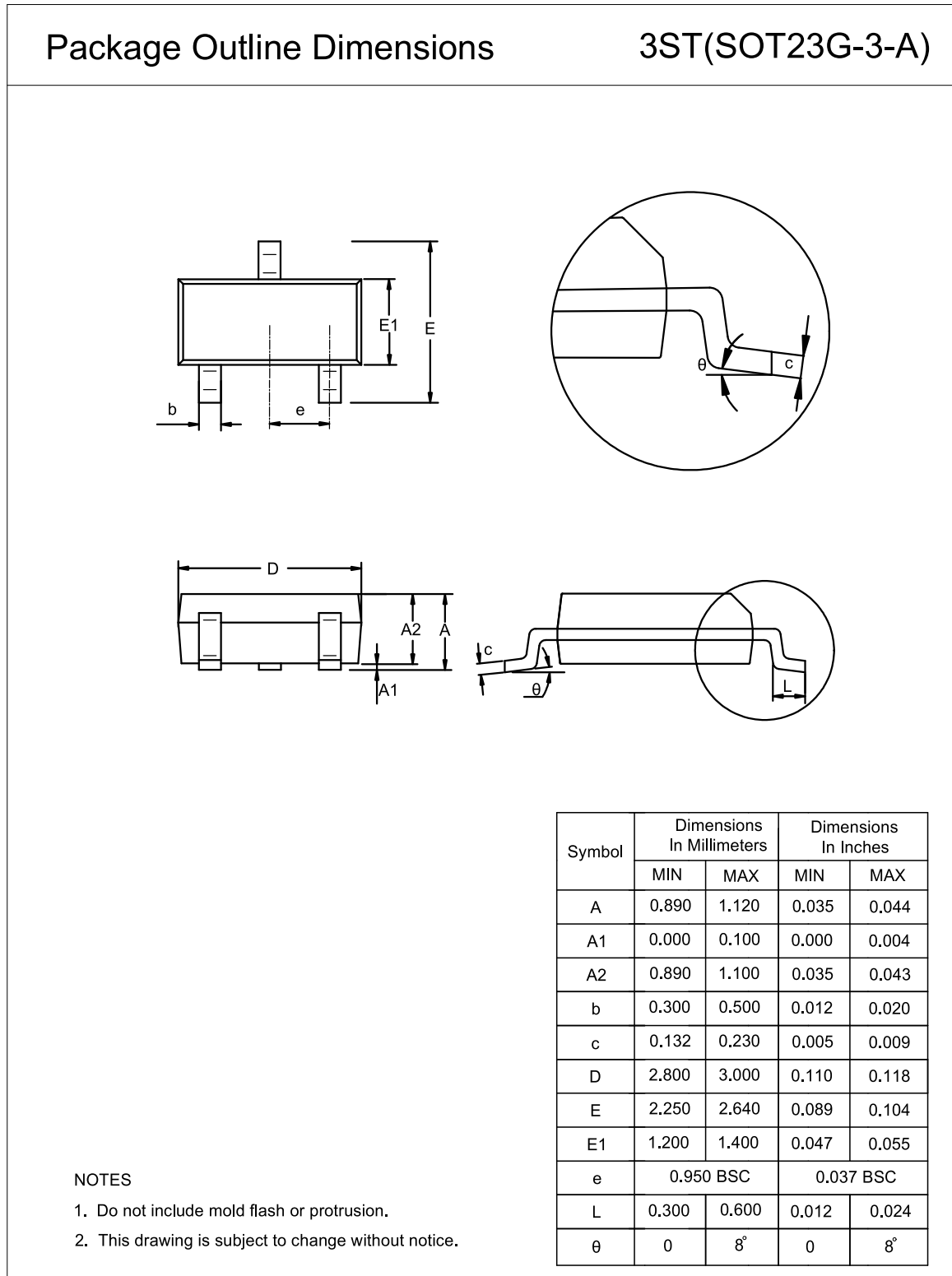


Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPR33xx-S3TR	SOT23G-3	178	12.1	3.15	2.77	1.22	4.0	8.0	Q3

(1) Output voltage, xx = 12 to 40.

Package Outline Dimensions

SOT23G-3



Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPR3312-S3TR	-40 to 125°C	SOT23G-3	R3A	3	Tape and Reel, 3,000	Green
TPR3320-S3TR	-40 to 125°C	SOT23G-3	R3B	3	Tape and Reel, 3,000	Green
TPR3325-S3TR	-40 to 125°C	SOT23G-3	R3C	3	Tape and Reel, 3,000	Green
TPR3330-S3TR	-40 to 125°C	SOT23G-3	R3D	3	Tape and Reel, 3,000	Green
TPR3333-S3TR	-40 to 125°C	SOT23G-3	R3E	3	Tape and Reel, 3,000	Green
TPR3340-S3TR	-40 to 125°C	SOT23G-3	R3F	3	Tape and Reel, 3,000	Green

Green: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

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