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 μVpp of TPR3325
- Quiescent Current: 180 μA
- Stable with 0.1 to 10-μF Capacitive Loads
- Qualified for Automotive Applications with AEC-Q100 Reliability Test (SOT23G-3 Package)
- Package Options:
  - SOT23G-3
  - QFN1.5X1.5-8

Applications

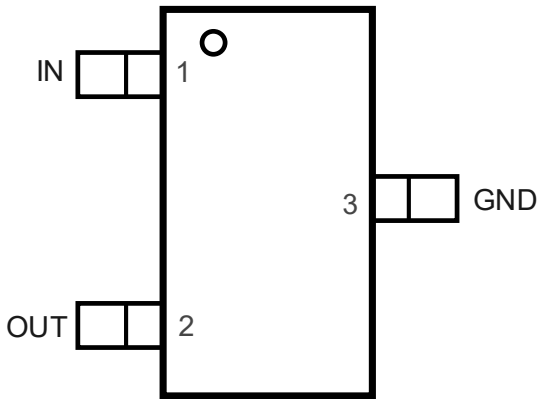
- Power
- Instrumentation
- Industry

Description

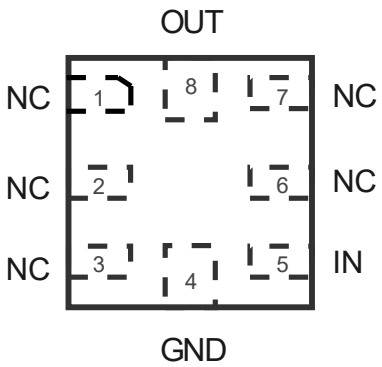
The TPR33-S is a voltage reference with guaranteed temperature stability over the entire operating temperature range. The temperature range is extended from −40 °C to +125 °C.

Pin Configuration

TPR33-S
SOT23G-3 Package
Top View



TPR33-S
QFN1.5X1.5-8 Package
Top View



Product Family Table

Order Number	Output Voltage (V)	AEC-Q100 Reliability Test	Package
TPR3312-S3TR-S	1.25	Pass	SOT23G-3
TPR3320-S3TR-S	2.048	Pass	SOT23G-3
TPR3325-S3TR-S	2.5	Pass	SOT23G-3
TPR3330-S3TR-S	3	Pass	SOT23G-3
TPR3333-S3TR-S	3.3	Pass	SOT23G-3
TPR3340-S3TR-S	4.096	Pass	SOT23G-3
TPR3312-QF11R-S	1.25	-	QFN1.5X1.5-8
TPR3320-QF11R-S	2.048	-	QFN1.5X1.5-8
TPR3325-QF11R-S	2.5	-	QFN1.5X1.5-8
TPR3330-QF11R-S	3	-	QFN1.5X1.5-8
TPR3333-QF11R-S	3.3	-	QFN1.5X1.5-8
TPR3340-QF11R-S	4.096	-	QFN1.5X1.5-8

Table of Contents

Revision History

Revision	Notes
Rev.Pre.0	Pre-Release version.
Rev.Pre.1	Updated Limit.
Rev.Pre.2	Updated Voltage Output.
Rev.A.0	Initial Version.
Rev.A.1	1. Added Tape and Reel Information. 2. Add common condition in electrical characteristics: V_S = 5 V.
Rev.A.2	Updated ESD Rating.
Rev.A.3	1. Added typical value of Long-term stability. 2. Corrected test conditions in Electrical Characteristics table.
Rev.A.4	Updated SOT23G-3 Package Products with Qualified for Automotive Applications with AEC-Q100 Reliability Test.

Specifications

Absolute Maximum Ratings

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
QFN 1.5X1.5-8	80	40	°C/W

Electrical Characteristics

All test conditions: V_{IN} = 5 V, T_A = +25°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 Hz to 10 Hz		25		μVpp
TPR3320						
V_{OUT}	Output Voltage			2.048		V
	Initial Accuracy		−0.15		0.15	%
	Output Voltage Noise	f = 0.1 Hz to 10 Hz		40		μVpp
TPR3325						
V_{OUT}	Output Voltage			2.5		V
	Initial Accuracy		−0.15		0.15	%
	Output Voltage Noise	f = 0.1 Hz to 10 Hz		50		μVpp
TPR3330						
V_{OUT}	Output Voltage			3.0		V
	Initial Accuracy		−0.15		0.15	%
	Output Voltage Noise	f = 0.1 Hz to 10 Hz		60		μVpp
TPR3333						
V_{OUT}	Output Voltage			3.3		V
	Initial Accuracy		−0.15		0.15	%
	Output Voltage Noise	f = 0.1 Hz to 10 Hz		66		μVpp
TPR3340						
V_{OUT}	Output Voltage			4.096		V
	Initial Accuracy		−0.15		0.15	%
	Output Voltage Noise	f = 0.1 Hz to 10 Hz		80		μVpp

Electrical Characteristics (Continued)

All test conditions: V_{IN} = 5 V, T_A = +25°C, unless otherwise noted.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
TPR3312, TPR3320, TPR3325, TPR3330, TPR3333, TPR3340, Power Supply							
V_{IN}	Supply Voltage	TPR3312		2.1		5.5	V
		All parts except TPR3312, I_{LOAD} = ±1 mA		V_{OUT} + 0.05		5.5	V
I_q	Quiescent Current					180	µA
		T_A = −40 to 125°C				215	µA
	Minimum Dropout Voltage	I_{LOAD} = ±1 mA, all parts except TPR3312	T_A = 25°C		25	50	mV
			T_A = 0°C to 70°C			50	mV
			T_A = −40°C to 125°C			100	mV
		I_{LOAD} = ±5 mA, all parts except TPR3312	T_A = 25°C			200	mV
			T_A = −40°C to 125°C			250	mV
TPR3312, TPR3320, TPR3325, TPR3330, TPR3333, TPR3340, Reference Output							
	Output Voltage Temperature Drift	T_A = −40°C to 85°C			10	20	ppm/°C
		T_A = −40°C to 125°C			15	30	
	Line Regulation, TPR3312	V_{IN} = 2.1 to 5.5 V(1)		−65		65	ppm/V
		V_{IN} = 2.1 to 5.5 V(1), T_A = −40°C to 125°C		−85		85	ppm/V
	Line Regulation, TPR33XX except for TPR3312	V_{IN} = V_{OUT} + 300 mV to 5.5 V		−50		50	ppm/V
			T_A = −40°C to 125°C	−70		70	ppm/V
	Load Regulation	V_{IN} = V_{OUT} + 300 mV, I_{LOAD} = −5 to 5 mA(1)		−20		20	ppm/mA
			T_A = −40°C to 125°C	−30		30	ppm/mA
	Long Term Stability	0 to 1000 hours, T_A = 25°C			200		ppm
		1000 to 2000 hours, T_A = 25°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 µF			500		µs

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

Typical Performance Characteristics – TPR3325

All test conditions: T_A = +25°C, unless otherwise noted.

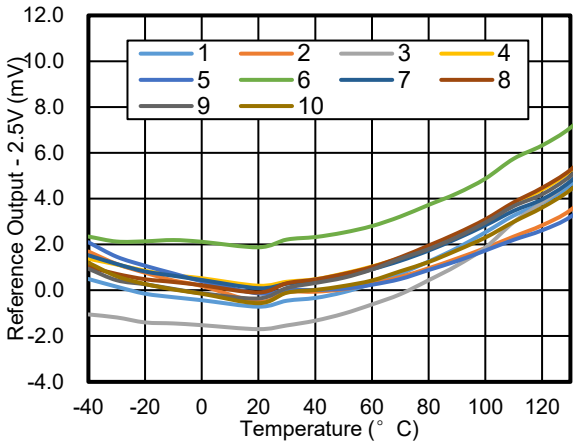


Figure 1. V_{OUT} vs. Temperature, 10 pcs Samples, V_{IN} = 5 V, C_{IN} = 1 µF, C_{OUT} = 1 µF

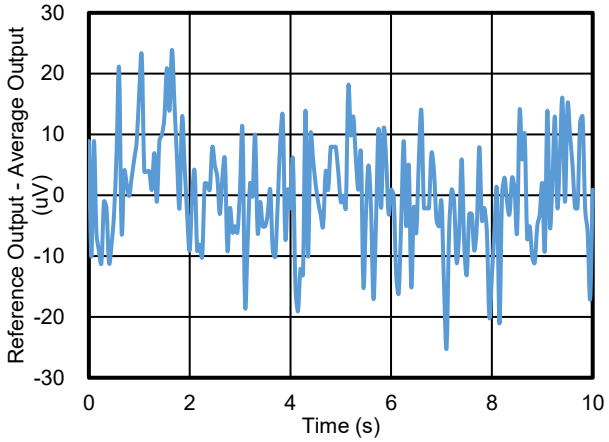


Figure 2. 0.1 to 10-Hz Voltage Noise, V_{IN} = 5 V, C_{IN} = 1 µF, C_{OUT} = 1 µF

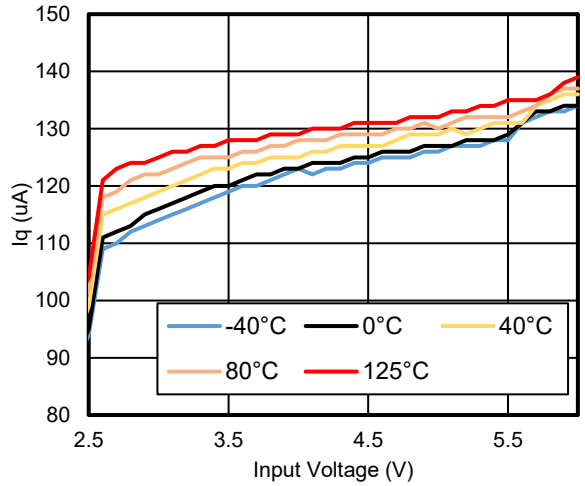


Figure 3. Iq vs. Input Voltage

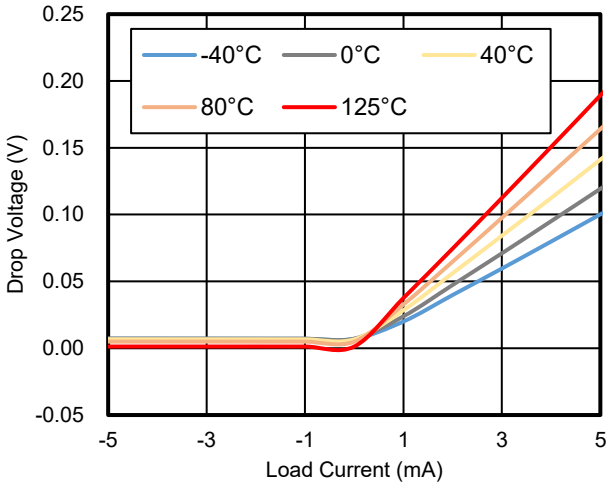


Figure 4. Drop Voltage vs. Load Current

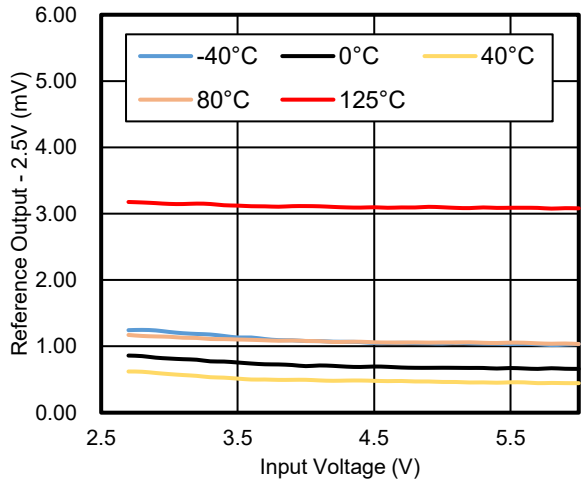


Figure 5. Output Voltage vs. Input Voltage

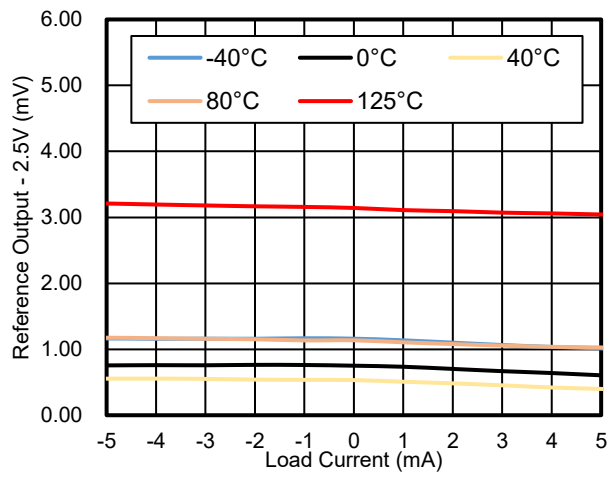


Figure 6. Output Voltage vs. Load Current

Typical Performance Characteristics – TPR3325 (Continued)

All test conditions: T_A = +25°C, unless otherwise noted.

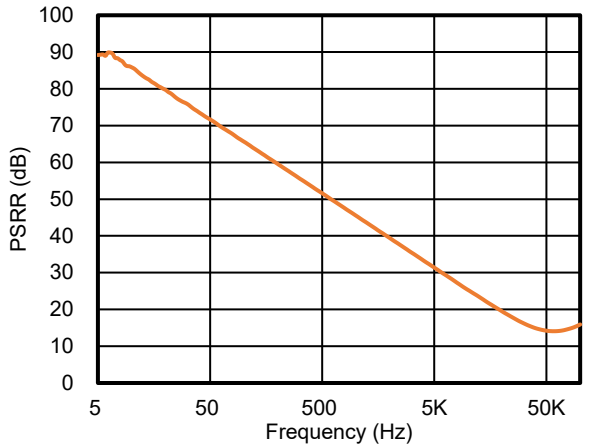


Figure 7. PSRR vs. Frequency

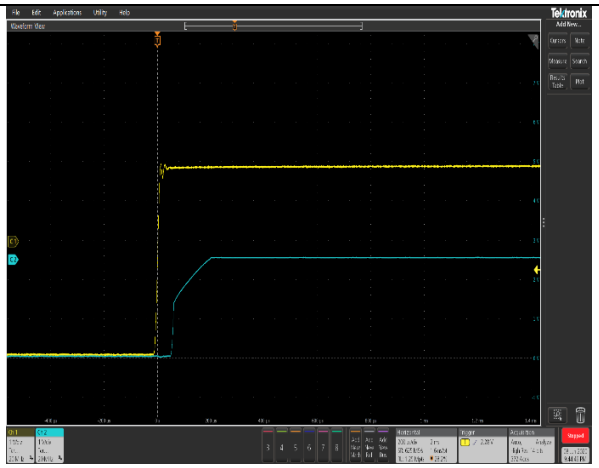


Figure 8. Step Response, V_{IN} = 5 V, C_{IN} = 1 µF, C_{OUT} = 0.1 µF, 200 µs/div

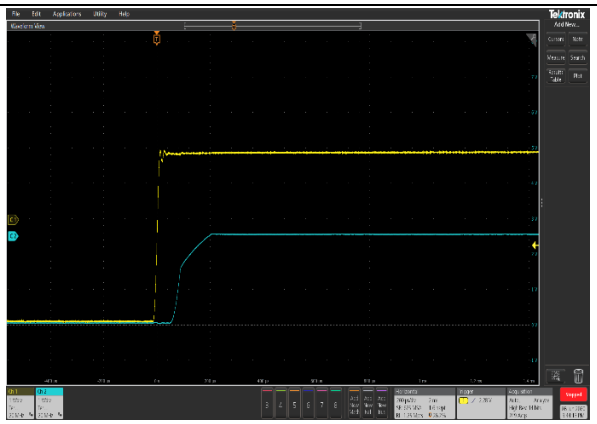


Figure 9. Step Response, V_{IN} = 5 V, C_{IN} = 1 µF, C_{OUT} = 1 µF, 200 µs/div

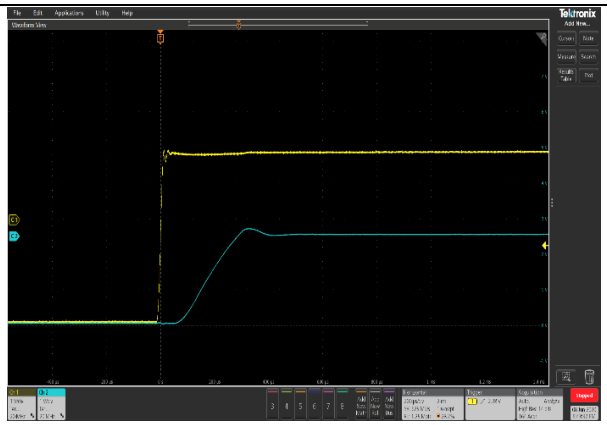


Figure 10. Step Response, V_{IN} = 5 V, V_{IN} = 5 V, C_{IN} = 1 µF, C_{OUT} = 10 µF, 200 µs/div

Figure 11. Load Transient, ±5 mA, V_{IN} = 5 V, C_{IN} = 1 µF, C_{OUT} = 1 µF, 50 mV/div

Figure 12. Load Transient, ±5 mA, V_{IN} = 2.8 V, C_{IN} = 1 µF, C_{OUT} = 1 µF, 50 mV/div

Typical Performance Characteristics – TPR3325 (Continued)

All test conditions: T_A = +25°C, unless otherwise noted.

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

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

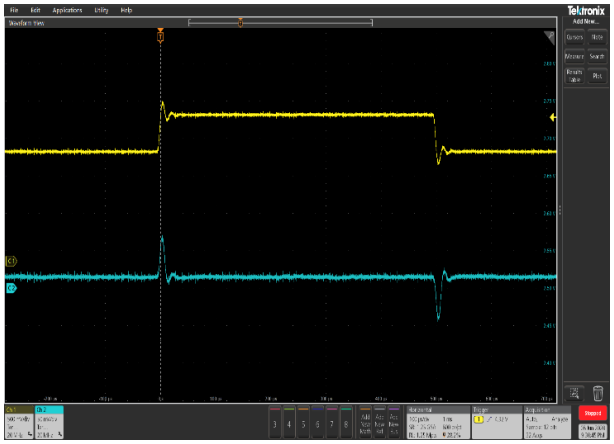
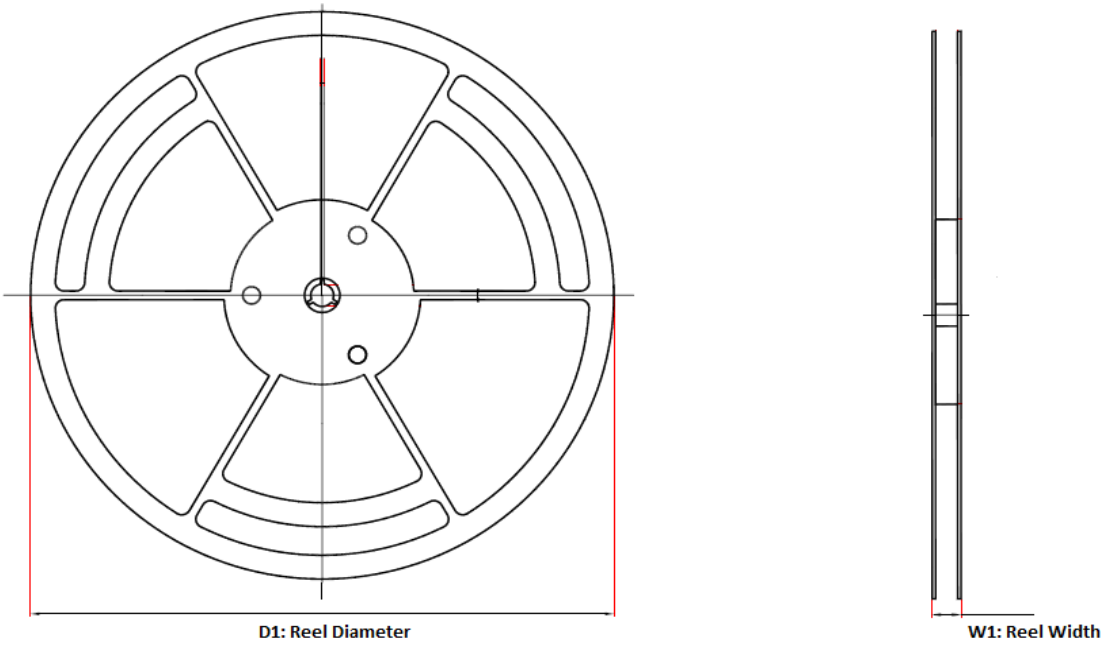


Figure 15. Line Transient, 500 mV Step, C_{IN} = 1 µF, C_{OUT} = 1 µF, 50 mV/div

Tape and Reel Information



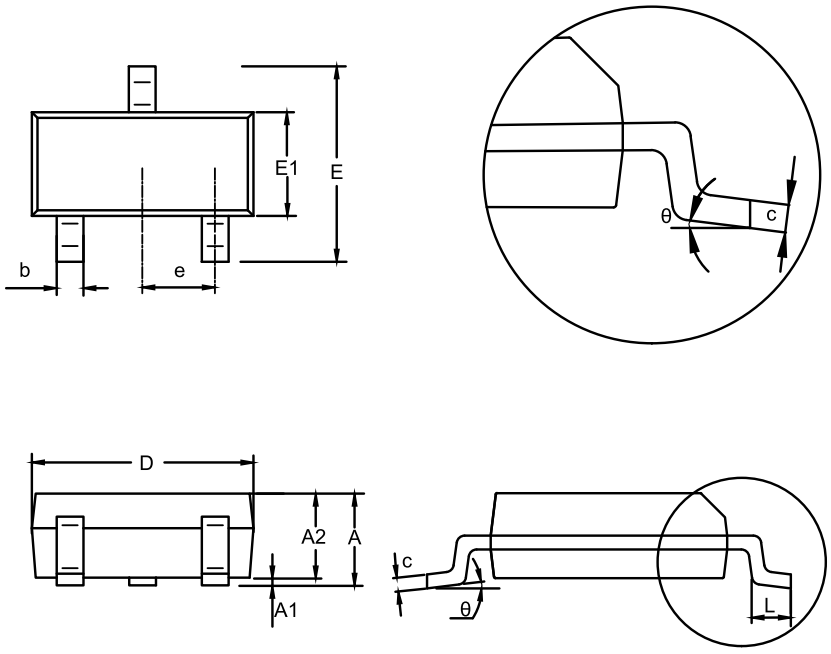
Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPR33xx-S3TR-S	SOT23G-3	178	12.1	3.15	2.77	1.22	4.0	8.0	Q3
TPR33xx-QF11R-S	QFN1.5X1.5-8	180	12.3	1.7	1.7	0.8	4.0	8.0	Q2

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

Package Outline Dimensions

SOT23G-3

Package Outline Dimensions 3ST(SOT23G-3-A)



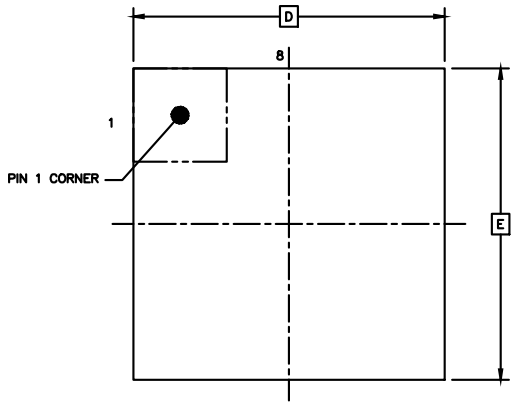
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.890	1.120	0.035	0.044
A1	0.000	0.100	0.000	0.004
A2	0.890	1.100	0.035	0.043
b	0.280	0.500	0.011	0.020
c	0.132	0.230	0.005	0.009
D	2.800	3.000	0.110	0.118
E	2.250	2.640	0.089	0.104
E1	1.200	1.400	0.047	0.055
e	0.950 BSC		0.037 BSC	
L	0.300	0.600	0.012	0.024
θ	0	8°	0	8°

NOTES

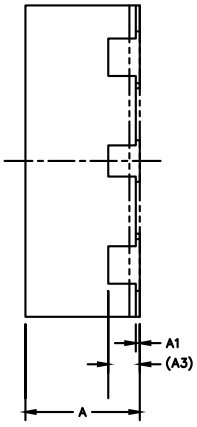
1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

QFN1.5X1.5-8

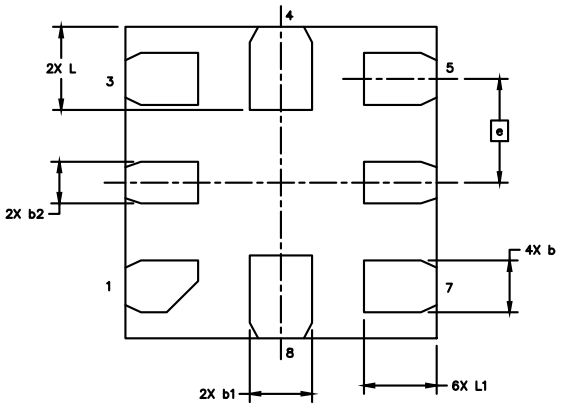
Package Outline Dimensions QFR(QFN1.5X1.5-8-A)



TOP VIEW



SIDE VIEW



BOTTOM VIEW

NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
b	0.200	0.300	0.008	0.012
b1	0.250	0.350	0.010	0.014
b2	0.150	0.250	0.006	0.010
A3	0.152 REF		0.006 REF	
D	1.500 BSC		0.059 REF	
E	1.500 BSC		0.059 REF	
e	0.500 BSC		0.020 BSC	
L	0.350	0.450	0.014	0.018
L1	0.300	0.400	0.012	0.016

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPR3312-S3TR-S	−40 to 125°C	SOT23G-3	R3A	MSL3	3,000	Green
TPR3320-S3TR-S	−40 to 125°C	SOT23G-3	R3B	MSL3	3,000	Green
TPR3325-S3TR-S	−40 to 125°C	SOT23G-3	R3C	MSL3	3,000	Green
TPR3330-S3TR-S	−40 to 125°C	SOT23G-3	R3D	MSL3	3,000	Green
TPR3333-S3TR-S	−40 to 125°C	SOT23G-3	R3E	MSL3	3,000	Green
TPR3340-S3TR-S	−40 to 125°C	SOT23G-3	R3F	MSL3	3,000	Green
TPR3312-QF11R-S	−40 to 125°C	QFN1.5X1.5-8	3A	MSL3	3,000	Green
TPR3320-QF11R-S (1)	−40 to 125°C	QFN1.5X1.5-8	3B	MSL3	3,000	Green
TPR3325-QF11R-S	−40 to 125°C	QFN1.5X1.5-8	3C	MSL3	3,000	Green
TPR3330-QF11R-S	−40 to 125°C	QFN1.5X1.5-8	3D	MSL3	3,000	Green
TPR3333-QF11R-S (1)	−40 to 125°C	QFN1.5X1.5-8	3E	MSL3	3,000	Green
TPR3340-QF11R-S (1)	−40 to 125°C	QFN1.5X1.5-8	3F	MSL3	3,000	Green

(1) For future products, contact the 3PEAK factory for more information and samples.

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