

Features

- Fixed Output Voltage:
 - 1.25 V, 2.048 V, 2.5 V, 3 V, 3.3 V, and 4.096 V
- High Initial Accuracy and Low Temperature Coefficient
 - Max 0.2%
 - 30 ppm/°C at -40°C to 85°C
 - 50 ppm/°C at -40°C to 125°C
- Operation from -40°C to 125°C
- Low Output Noise: 50 µVpp of TPR3525
- Quiescent Current: 210 µA
- Stable with 0.1-µF to 10-µF Capacitive Loads

Applications

- Power
- Instrumentation
- Industry

Description

The TPR35 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.

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Product Family Table

Order Number	Output Voltage (V)	Package
TPR3512-S3TR	1.25	SOT23G-3
TPR3520-S3TR	2.048	SOT23G-3
TPR3525-S3TR	2.5	SOT23G-3
TPR3530-S3TR	3	SOT23G-3
TPR3533-S3TR	3.3	SOT23G-3
TPR3540-S3TR	4.096	SOT23G-3

Revision History

Date	Revision	Notes
2020-09-10	Rev.A.0	Initial version.
2021-11-24	Rev.A.1	<ol style="list-style-type: none">Updated the ESD Rating.Added the Tape and Reel Information.
2022-05-31	Rev.A.2	<ol style="list-style-type: none">Added the Recommended Operating Conditions.Added the item of ISC, short-circuit current, in the Electrical Characteristics.Added the typical value of Long-term stability.Corrected test conditions in the Electrical Characteristics table.
2022-07-22	Rev.A.3	<ol style="list-style-type: none">Corrected the information in the Feature.Added figures in the Typical Performance Characteristics table.
2024-10-23	Rev.A.4	<ol style="list-style-type: none">Updated to a new datasheet format.Added Pin function description.

Pin Configuration and Functions

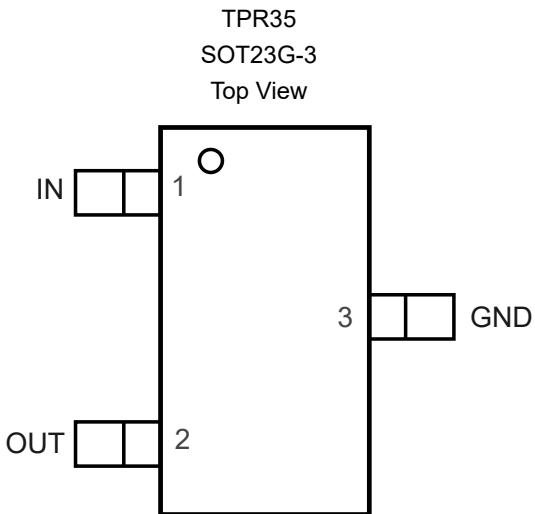


Table 1. Pin Functions: TPR35

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
I _{OUT}	Output Current	-20	20	mA
T _J	Junction Temperature Range	-40	125	°C

Thermal Information

Package Type	θ _{JA}	θ _{JC}	Unit
SOT23G-3	250	81	°C/W
QFN1.5X1.5-8	80	40	°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
TPR3512						
V_{OUT}	Output Voltage			1.25		V
	Initial Accuracy		-0.2		0.2	%
	Output Voltage Noise	$f = 0.1\text{ Hz to }10\text{ Hz}$		25		μVpp
TPR3520						
V_{OUT}	Output Voltage			2.048		V
	Initial Accuracy		-0.2		0.2	%
	Output Voltage Noise	$f = 0.1\text{ Hz to }10\text{ Hz}$		40		μVpp
TPR3525						
V_{OUT}	Output Voltage			2.5		V
	Initial Accuracy		-0.2		0.2	%
	Output Voltage Noise	$f = 0.1\text{ Hz to }10\text{ Hz}$		50		μVpp
TPR3530						
V_{OUT}	Output Voltage			3		V
	Initial Accuracy		-0.2		0.2	%
	Output Voltage Noise	$f = 0.1\text{ Hz to }10\text{ Hz}$		60		μVpp
TPR3533						
V_{OUT}	Output Voltage			3.3		V
	Initial Accuracy		-0.2		0.2	%
	Output Voltage Noise	$f = 0.1\text{ Hz to }10\text{ Hz}$		66		μVpp
TPR3540						
V_{OUT}	Output Voltage			4.096		V
	Initial Accuracy		-0.2		0.2	%
	Output Voltage Noise	$f = 0.1\text{ Hz to }10\text{ Hz}$		80		μVpp
TPR3512, TPR3520, TPR3525, TPR3530, TPR3533, TPR3540, Power Supply						
V_{IN}	Supply Voltage	TPR3512	2.1		5.5	V
		All parts except the TPR3512, $I_{LOAD} = \pm 1\text{ mA}$	$V_{OUT} + 0.05$		5.5	V
I_q	Quiescent Current			150	210	μA
		$T_A = -40\text{ to }125^\circ\text{C}$			250	μA
	Minimum Dropout Voltage	$I_{LOAD} = \pm 1\text{ mA, all parts except the TPR3512}$	$T_A = 25^\circ\text{C}$	25	50	mV
			$T_A = 0\text{ to }70^\circ\text{C}$		50	mV
			$T_A = -40\text{ to }125^\circ\text{C}$		100	mV

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		I _{LOAD} = ±5 mA, all parts except the TPR3512	T _A = 25°C		200	mV
			T _A = -40 to 125°C		250	mV
TPR3512, TPR3520, TPR3525, TPR3530, TPR3533, TPR3540, Reference Output						
	Output Voltage Temperature Drift	T _A = -40 to 85°C		10	30	ppm/°C
		T _A = -40 to 125°C		20	50	
	Line Regulation, TPR3512	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 to 125°C	-85		85	ppm/V
	Line Regulation, TPR35xx except the TPR3512	V _{IN} = V _{OUT} + 300 mV to 5.5 V	-50		50	ppm/V
			T _A = -40 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 to 125°C	-30	30	ppm/mA
	Long-Term Stability	0 to 1,000 hours, T _A = 25°C		200		ppm
		1,000 to 2,000 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 TPR3512 is 2.1 V.

Typical Performance Characteristics – TPR3525

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

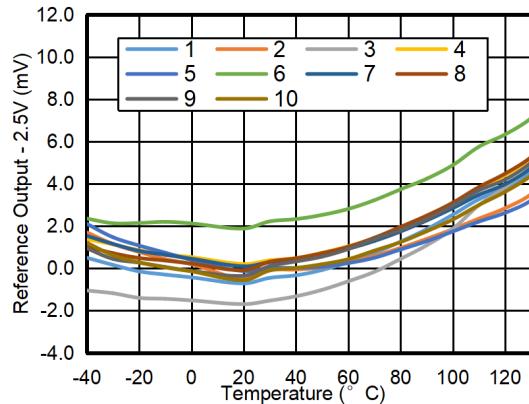


Figure 1. V_{OUT} vs. Temperature, 10-pcs Samples, $V_{\text{IN}} = 5$ V, $C_{\text{IN}} = 1 \mu\text{F}$, $C_{\text{OUT}} = 1 \mu\text{F}$

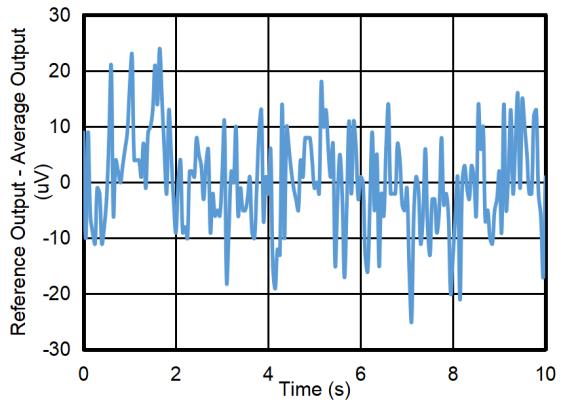


Figure 2. 0.1-Hz to 10-Hz Voltage Noise, $V_{\text{IN}} = 5$ V, $C_{\text{IN}} = 1 \mu\text{F}$, $C_{\text{OUT}} = 1 \mu\text{F}$

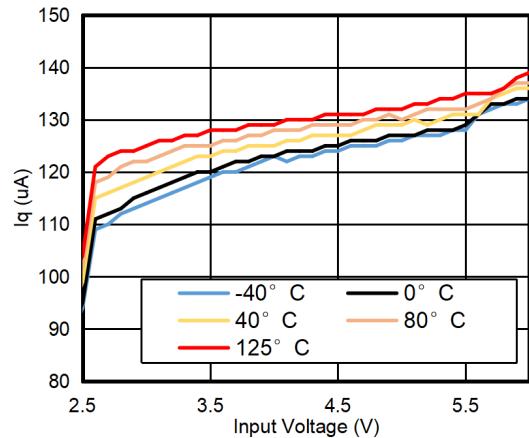


Figure 3. I_q vs. Input Voltage

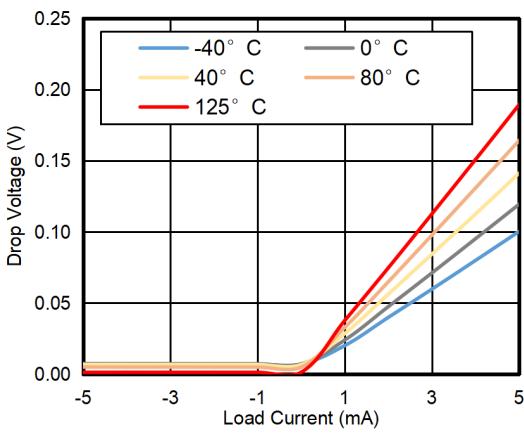


Figure 4. Drop Voltage vs. Load Current

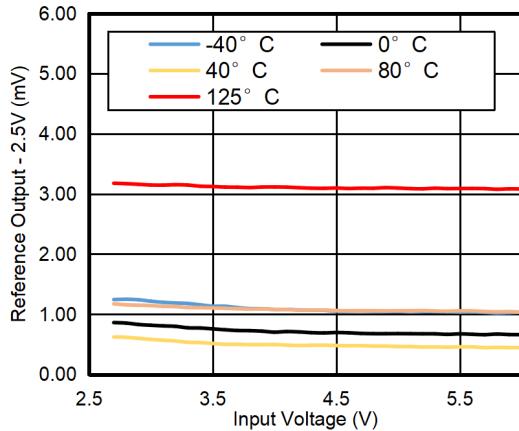


Figure 5. Output Voltage vs. Input Voltage

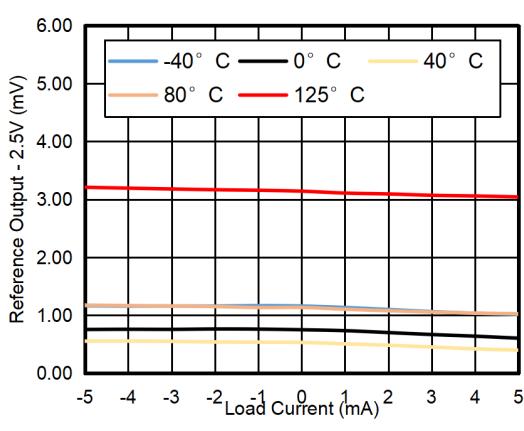


Figure 6. Output Voltage vs. Load Current

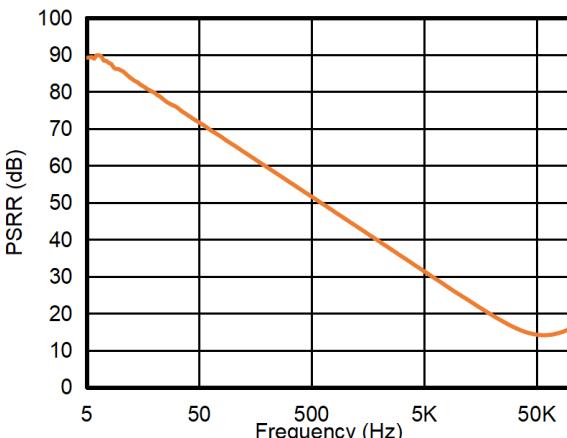


Figure 7. PSRR vs. Frequency

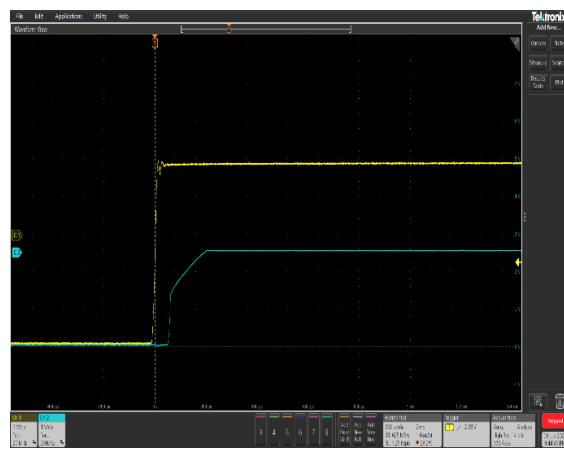


Figure 8. Step Response, $V_{IN} = 5$ V, $C_{IN} = 1 \mu\text{F}$, $C_{OUT} = 0.1 \mu\text{F}$, 200 $\mu\text{s}/\text{div}$

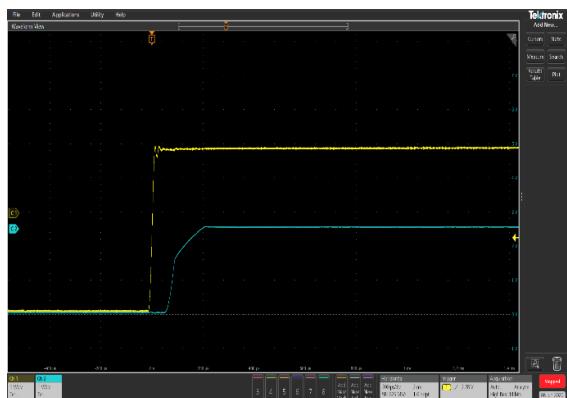


Figure 9. Step Response, $V_{IN} = 5$ V, $C_{IN} = 1 \mu\text{F}$, $C_{OUT} = 1 \mu\text{F}$, 200 $\mu\text{s}/\text{div}$

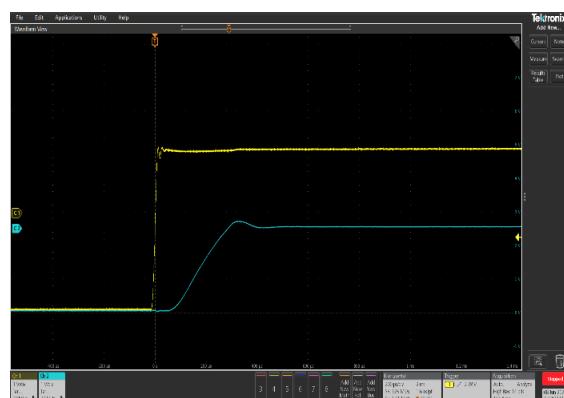


Figure 10. Step Response, $V_{IN} = 5$ V, $C_{IN} = 1 \mu\text{F}$, $C_{OUT} = 10 \mu\text{F}$, 200 $\mu\text{s}/\text{div}$



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



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

Voltage Reference


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



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

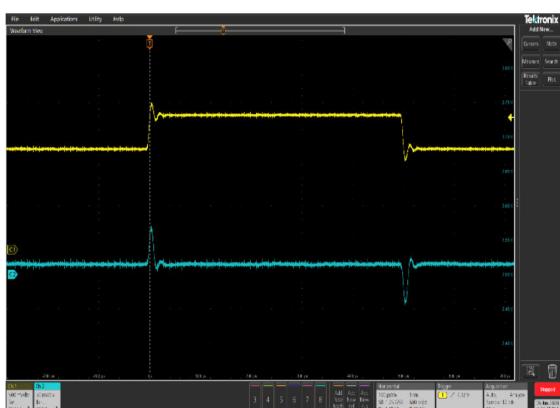


Figure 15. Line Transient, 500-mV Step, $C_{IN} = 1 \mu\text{F}$, $C_{OUT} = 1 \mu\text{F}$, 50 mV/div

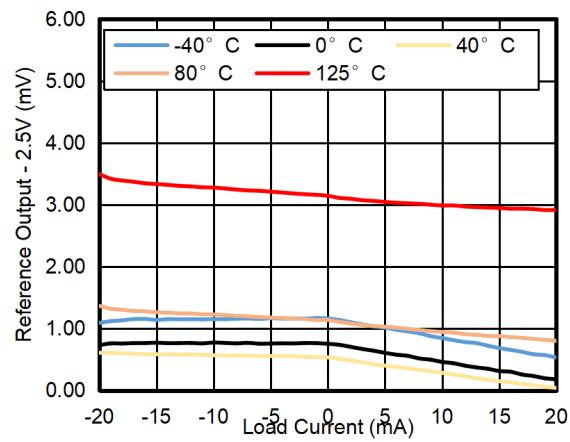
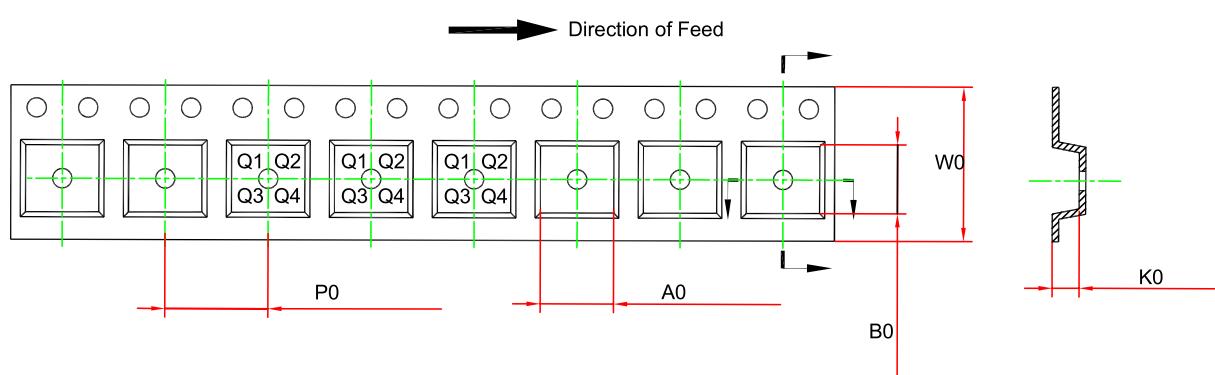
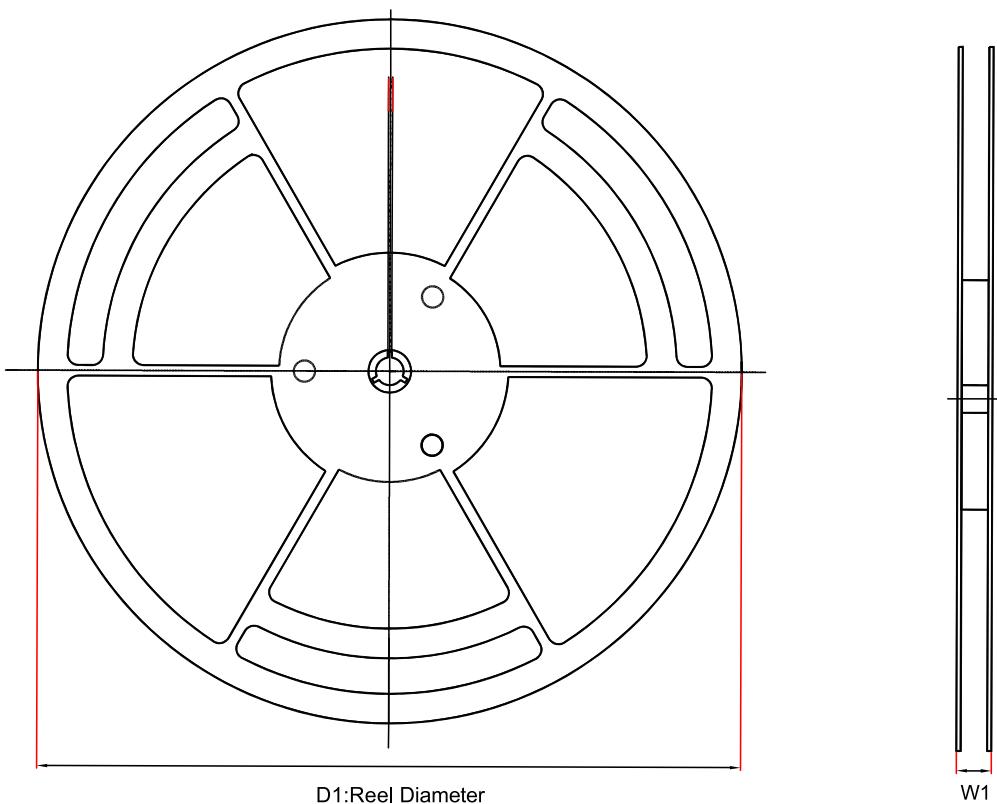


Figure 16. Output Voltage vs. Load Current

Tape and Reel Information

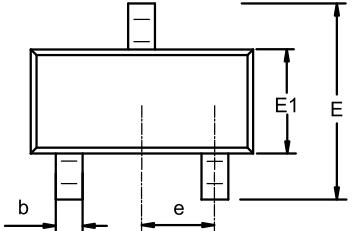
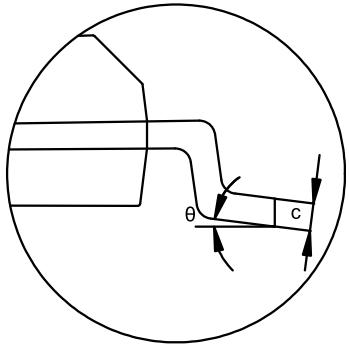
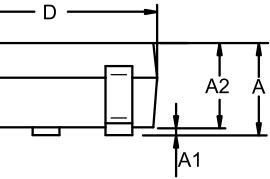
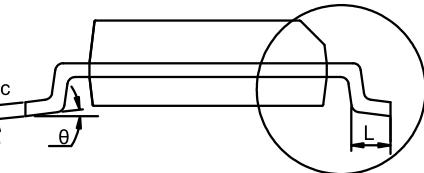


Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPR35xx-S3TR	SOT23G-3	178	12.1	3.15	2.77	1.22	4.0	8.0	Q3

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

Package Outline Dimensions

SOT23G-3

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	0.300	0.500	0.012	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.

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPR3512-S3TR	-40 to 125°C	SOT23G-3	R3A	3	Tape and Reel, 3,000	Green
TPR3520-S3TR	-40 to 125°C	SOT23G-3	R3B	3	Tape and Reel, 3,000	Green
TPR3525-S3TR	-40 to 125°C	SOT23G-3	R3C	3	Tape and Reel, 3,000	Green
TPR3530-S3TR	-40 to 125°C	SOT23G-3	R3D	3	Tape and Reel, 3,000	Green
TPR3533-S3TR	-40 to 125°C	SOT23G-3	R3E	3	Tape and Reel, 3,000	Green
TPR3540-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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