300 mA High Performance Low-Dropout Linear Regulator

Features

- Input voltage range: 1.4V to 5.5V
- Fixed outputs of 1.1V, 1.2V, 1.5V, 1.8V, 2.5V, 2.8V, 2.85V, 3.0V, 3.1V, 3.3V
- Rated output current: 300mA
- Quiescent current: typical 50μA
- Typical 0.1μA shutdown current
- Typical 310mV dropout voltage (I_{OUT}=300mA, 1.8V output)
- Power supply rejection ratio: typical 90dB (I_{OUT}=30mA, freq=1kHz, 1.8V output)
- Noise: typical 33μVrms (I_{OUT}=30mA, BW=10Hz to 100kHz, 1.8V output)
- Built-in output short protection: typical 120mA when output short to ground
- DFN 1mmX1mmX0.37mm-4L package and SOT 23-5L package

General Description

AW37030YXXX is a low dropout voltage regulator featuring low ON resistance, high PSRR, low Noise, good load/line transient response and smooth soft-start.

AW37030YXXX integrates current limit, short circuit protection, thermal shutdown, sufficiently protecting IC from being damaged.

AW37030YXXX is designed to work with a 1μF or more input ceramic capacitor and a 1μF or more output ceramic capacitor. The low power dissipation and good dynamic response make AW37030YXXX very suitable for hand-held communication equipment. Tiny package makes high density mounting of the IC on boards possible.

Applications

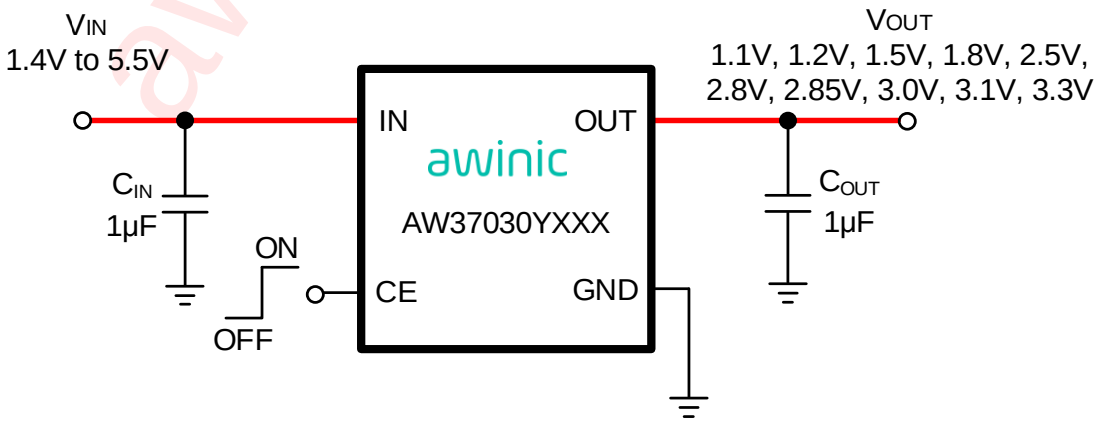
Battery-powered equipment

Smart phone

Digital camera

STB

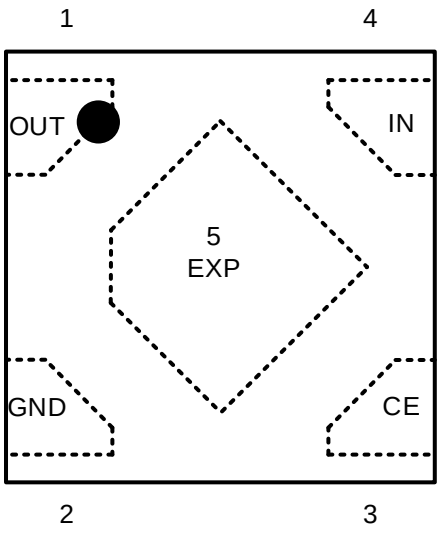
Typical Application Circuit



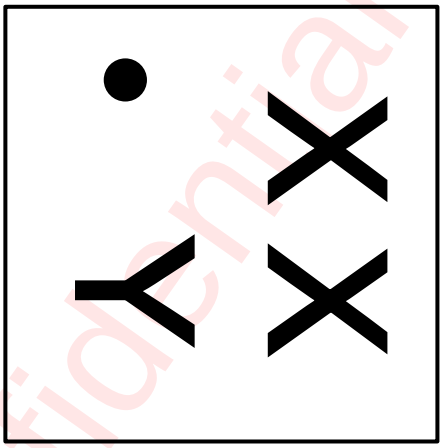
Pin Configuration And Top Mark

DFN 1mmX1mm-4L

AW37030YXXXDNR
(Top View)



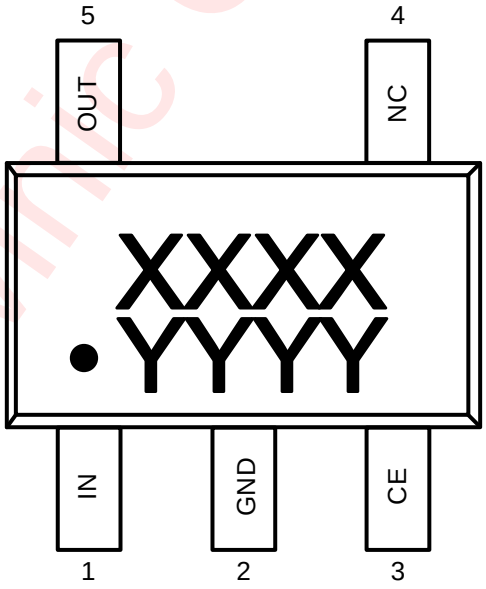
AW37030YXXXDNR Marking
(Top View)



XX – AW37030YXXXDNR
Y – Production Tracing Code

SOT 23-5L

AW37030YXXXSTR Marking
(Top View)



XXXX – AW37030YXXXSTR
YYYY – Production Tracing Code

Pin Definition

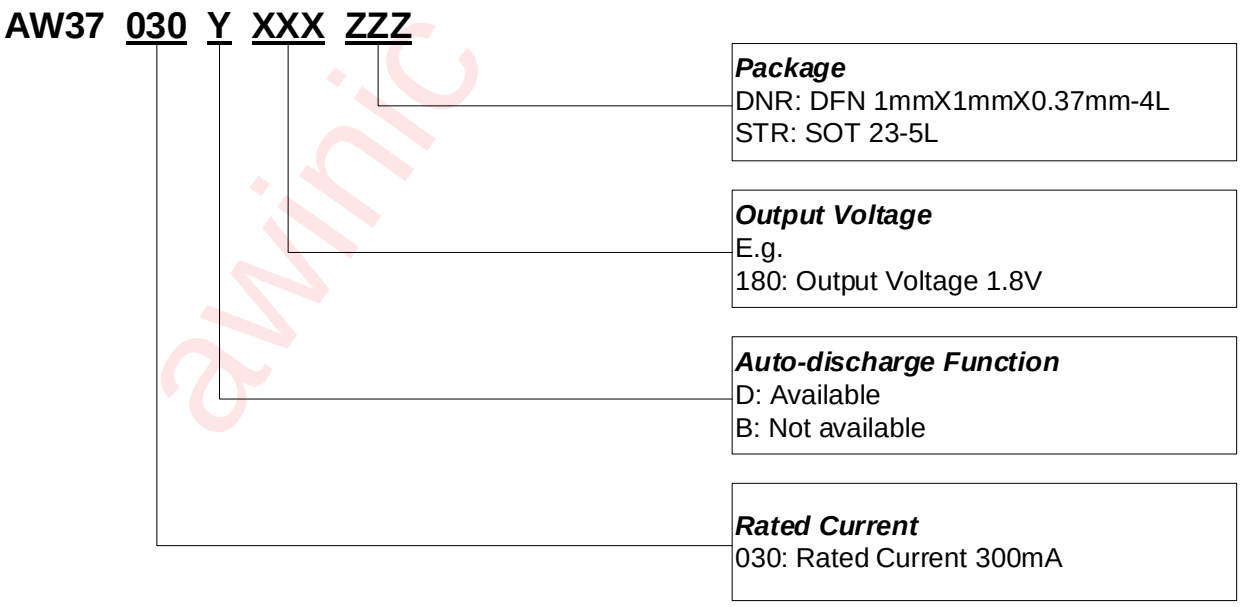
DFN 1mmX1mm-4L

No.	NAME	DESCRIPTION
1	OUT	Regulated output voltage pin. Put a 1μF or more ceramic capacitor at the output pin.
2	GND	Ground.
3	CE	Chip enable pin. Built-in 140nA pull-down current. (High Active)
4	IN	Input supply pin. Put a 1μF or more bypass capacitor at the power supply.
5	EXP	Expose pad should be tied to ground plane for better power dissipation.

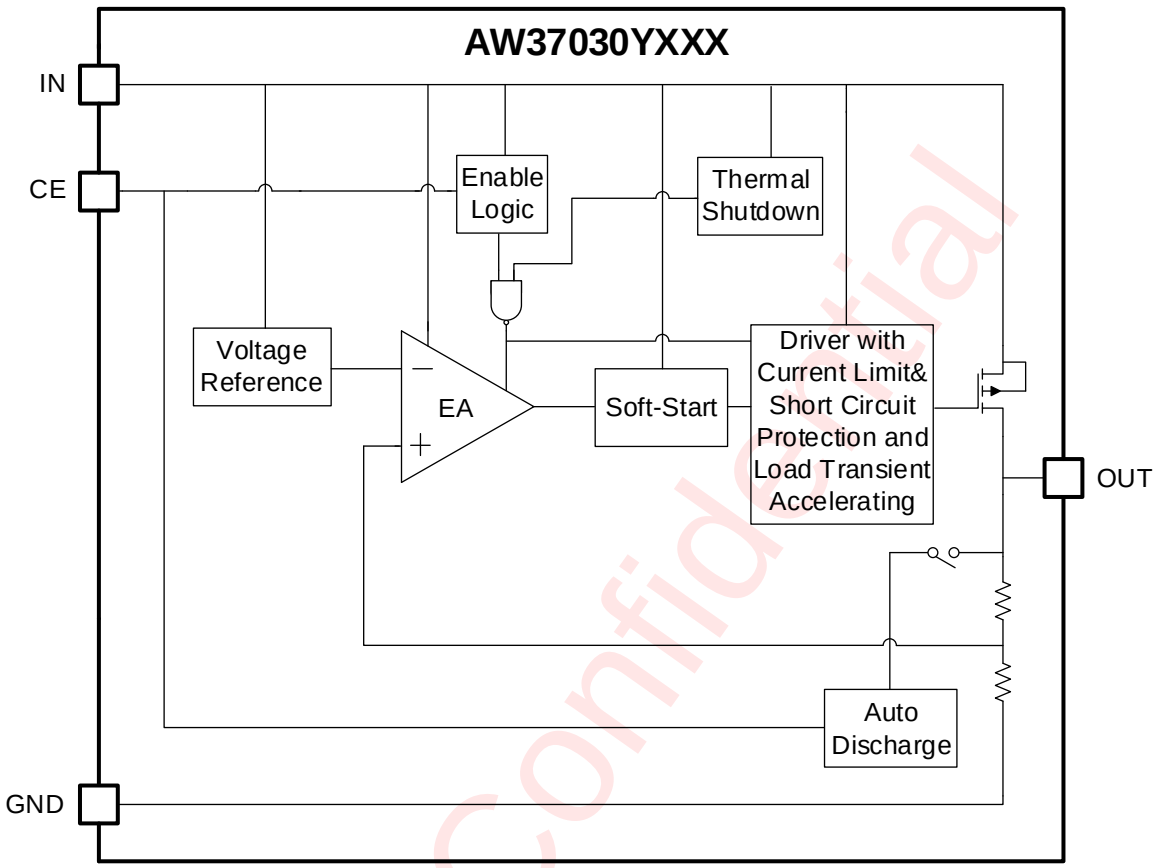
SOT 23-5L

No.	NAME	DESCRIPTION
1	IN	Input supply pin. Put a 1μF or more bypass capacitor at the power supply.
2	GND	Ground.
3	CE	Chip enable pin. Built-in 140nA pull-down current. (High Active)
4	NC	Not connected.
5	OUT	Regulated output voltage pin. Put a 1μF or more ceramic capacitor at the output pin.

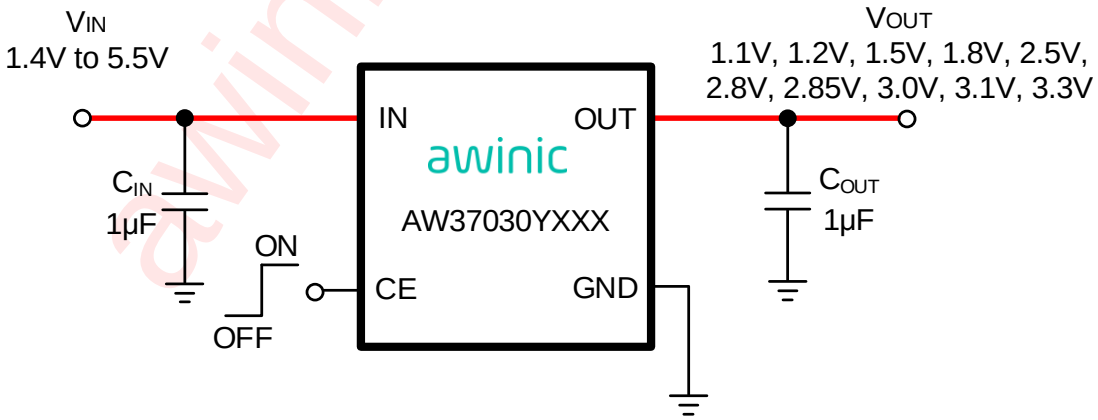
Name Rule



Functional Block Diagram



Typical Application Circuits



AW37030YXXX Application Circuit

Notice for typical application circuits:

Capacitance of C_{IN} and C_{OUT} should be 1μF or more.

Ordering Information

Part Number	Temperature	Package	Marking	Moisture Sensitivity Level	Environmental Information	Delivery Form
AW37030D110DNR	-40°C～85°C	DFN 1mmX1mm -4L	VE	MSL1	ROHS+HF	3000 units/ Tape and Reel
AW37030D120DNR	-40°C～85°C	DFN 1mmX1mm -4L	SE	MSL1	ROHS+HF	3000 units/ Tape and Reel
AW37030D150DNR	-40°C～85°C	DFN 1mmX1mm -4L	CR	MSL1	ROHS+HF	3000 units/ Tape and Reel
AW37030D180DNR	-40°C～85°C	DFN 1mmX1mm -4L	HL	MSL1	ROHS+HF	3000 units/ Tape and Reel
AW37030D250DNR	-40°C～85°C	DFN 1mmX1mm -4L	J4	MSL1	ROHS+HF	3000 units/ Tape and Reel
AW37030D280DNR	-40°C～85°C	DFN 1mmX1mm -4L	ZJ	MSL1	ROHS+HF	3000 units/ Tape and Reel
AW37030D285DNR	-40°C～85°C	DFN 1mmX1mm -4L	2V	MSL1	ROHS+HF	3000 units/ Tape and Reel
AW37030D300DNR	-40°C～85°C	DFN 1mmX1mm -4L	VA	MSL1	ROHS+HF	3000 units/ Tape and Reel
AW37030D310DNR	-40°C～85°C	DFN 1mmX1mm -4L	RJ	MSL1	ROHS+HF	3000 units/ Tape and Reel
AW37030D330DNR	-40°C～85°C	DFN 1mmX1mm -4L	PP	MSL1	ROHS+HF	3000 units/ Tape and Reel
AW37030D110STR	-40°C～85°C	SOT 23-5L	75PY	MSL3	ROHS+HF	3000 units/ Tape and Reel
AW37030D120STR	-40°C～85°C	SOT 23-5L	VGML	MSL3	ROHS+HF	3000 units/ Tape and Reel
AW37030D150STR	-40°C～85°C	SOT 23-5L	ZUM4	MSL3	ROHS+HF	3000 units/ Tape and Reel

Ordering Information (Continued)

Part Number	Temperature	Package	Marking	Moisture Sensitivity Level	Environmental Information	Delivery Form
AW37030D180STR	-40°C～85°C	SOT 23-5L	5HGC	MSL3	ROHS+HF	3000 units/ Tape and Reel
AW37030D250STR	-40°C～85°C	SOT 23-5L	K2FA	MSL3	ROHS+HF	3000 units/ Tape and Reel
AW37030D280STR	-40°C～85°C	SOT 23-5L	JGLU	MSL3	ROHS+HF	3000 units/ Tape and Reel
AW37030D285STR	-40°C～85°C	SOT 23-5L	TKRW	MSL3	ROHS+HF	3000 units/ Tape and Reel
AW37030D300STR	-40°C～85°C	SOT 23-5L	N02F	MSL3	ROHS+HF	3000 units/ Tape and Reel
AW37030D310STR	-40°C～85°C	SOT 23-5L	2JSX	MSL3	ROHS+HF	3000 units/ Tape and Reel
AW37030D330STR	-40°C～85°C	SOT 23-5L	BB3G	MSL3	ROHS+HF	3000 units/ Tape and Reel

Absolute Maximum Ratings(NOTE1)

PARAMETERS		RANGE
Input voltage range		-0.3V to 6.5V
Enable control voltage range		-0.3V to 6.5V
Output voltage range		-0.3V to VIN+0.3V, max. 6.5V
Maximum operating junction temperature T_{JMAX}		150°C
Recommended operating junction temperature T_{JREC}		-40°C to 125°C
Operating free-air temperature range		-40°C to 85°C
Storage temperature T_{STG}		-65°C to 150°C
Lead temperature (soldering 10 seconds)		260°C
Junction-to-ambient thermal resistance θ_{JA} (NOTE2)	DFN 1mmX1mm-4L	228.6°C/W
	SOT 23-5L	179.3°C/W
Maximum power consumption	DFN 1mmX1mm-4L	550mW
	SOT 23-5L	700mW
ESD		
HBM (Human body model)(NOTE3)		±2kV
CDM(Charged device model) (NOTE4)		±1.5kV
Latch-Up		
Latch-Up(NOTE5)		+IT：200mA - IT：-200mA

NOTE1: Conditions out of those ranges listed in "absolute maximum ratings" may cause permanent damages to the device. In spite of the limits above, functional operation conditions of the device should within the ranges listed in "recommended operating conditions". Exposure to absolute-maximum-rated conditions for prolonged periods may affect device reliability.

NOTE2: Thermal resistance from junction to ambient follows JEDEC 2S2P standards, and is highly dependent on PCB layout.

NOTE3: All pins. Test Condition: ESDA/JEDEC JS-001-2018.

NOTE4: All pins. Test Condition: ESDA/JEDEC JS-002-2018.

NOTE5: Test Condition: JESD78E.

Electrical Characteristics

V_{IN}=$V_{OUT(SET)}$+1V, V_{CE}>1V, I_{OUT}=1mA, C_{IN}=C_{OUT}=1μF, T_A=25°C (unless otherwise noted)

PARAMETER		TEST CONDITION		MIN	TYP	MAX	UNIT
V_{IN}	Input Voltage Range			1.4		5.5	V
V_{OUT_ACC}	Output Voltage Accuracy	T_A=25°C		-1		1	%
		-40°C ≤T_A≤85°C		-2		2	
$LOAD_{Reg}$	Load Regulation	1mA≤I_{OUT}≤300mA			1	20	mV
$LINE_{Reg}$	Line Regulation	$V_{OUT(SET)}$+0.5V≤V_{IN} ≤5.5V			1	5	mV
$V_{dropout}$	Dropout Voltage	I_{OUT}=300mA, When V_{OUT} falls 100mV below $V_{OUT(SET)}$	$V_{OUT(SET)}$=1.1V		680		mV
			$V_{OUT(SET)}$=1.2V		576		
			$V_{OUT(SET)}$=1.8V		310		
			$V_{OUT(SET)}$=2.5V		203		
			$V_{OUT(SET)}$=2.8V		184		
			$V_{OUT(SET)}$=3.0V		175		
			$V_{OUT(SET)}$=3.3V		158		
I_{SD}	Shutdown Current	V_{CE}<0.4V			0.1	1	μA
I_Q	Quiescent Current	I_{OUT}=0mA			50	100	μA
V_{CEH}	CE Input Voltage “H”	-40°C ≤T_A≤85°C		1			V
V_{CEL}	CE Input Voltage “L”	-40°C ≤T_A≤85°C				0.4	V
PSRR	Power Supply Ripple Rejection	I_{OUT}=30mA, f=1kHz $V_{OUT(SET)}$=1.8V			90		dB
V_N	Output Voltage Noise	I_{OUT}=30mA BW=10Hz to 100kHz	$V_{OUT(SET)}$=1.1V		21		μVrms
			$V_{OUT(SET)}$=1.8V		33		
			$V_{OUT(SET)}$=3.3V		46		
I_{CL}	Output Current Limit	V_{OUT}=90%*$V_{OUT(SET)}$		300			mA
I_{SC}	Short Current Limit	V_{OUT}<10%*$V_{OUT(SET)}$			120		mA
VTC	Output Voltage Temperature Coefficient	-40°C ≤T_A≤85°C			±40		ppm/°C
R_{DISC}	Auto Discharge Resistance	V_{IN}=4V, V_{CE}<0.4V, V_{OUT}=2.8V			130		Ω
I_{CE}	CE Pull Down Current				140		nA
T_{SDH}	Thermal Shutdown Threshold	Temperature Rising			160		°C
T_{SDL}	Thermal Shutdown Reset Threshold	Temperature Falling			130		°C

Typical Characteristics

V_{IN}=$V_{OUT(SET)}$+1V, V_{CE}>1V, I_{OUT}=1mA, C_{IN}=C_{OUT}=1μF, T_A=25°C, In Typical Application Circuit, unless otherwise noted.

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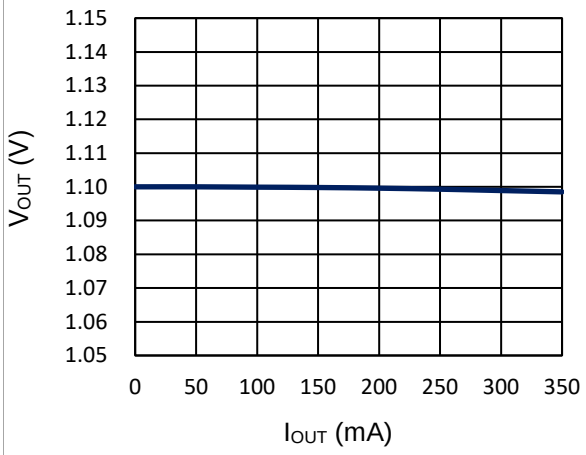
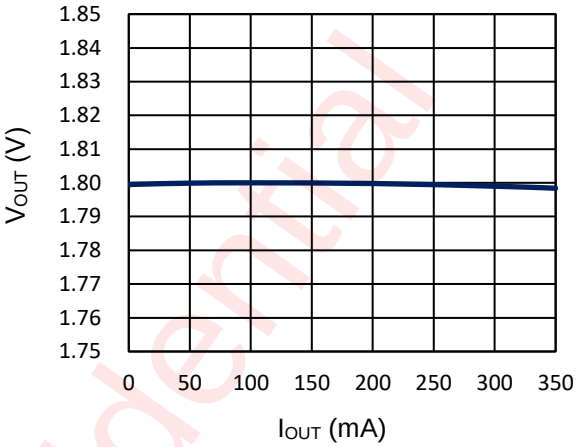


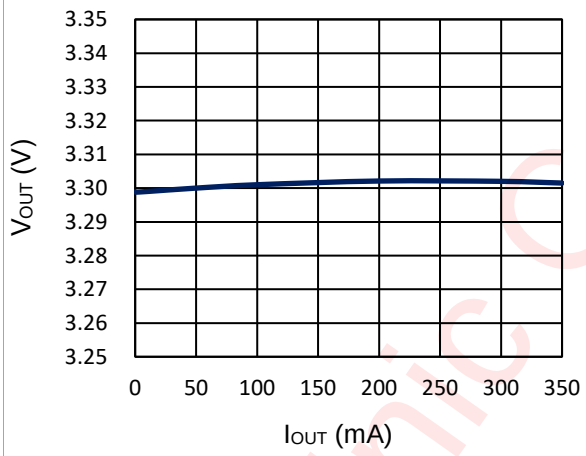
Output Voltage vs Output Current

AW37030D180



Output Voltage vs Output Current

AW37030D330



Output Voltage vs Output Current

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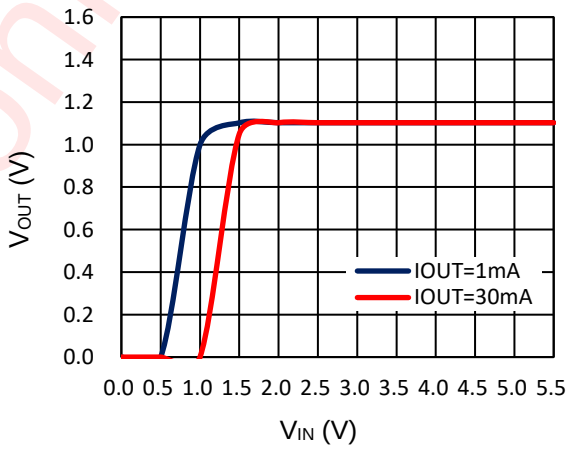

Output Voltage vs Input Voltage

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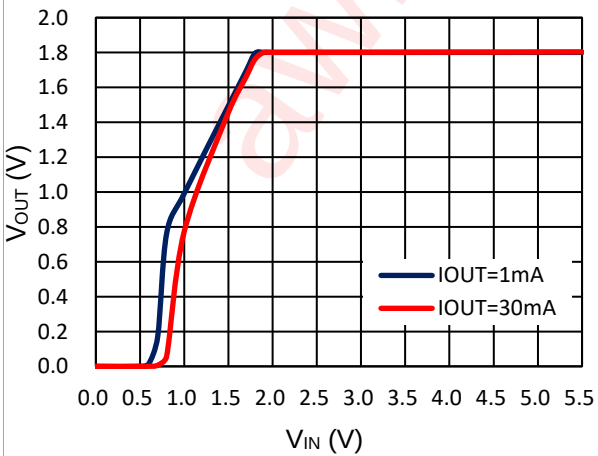

Output Voltage vs Input Voltage

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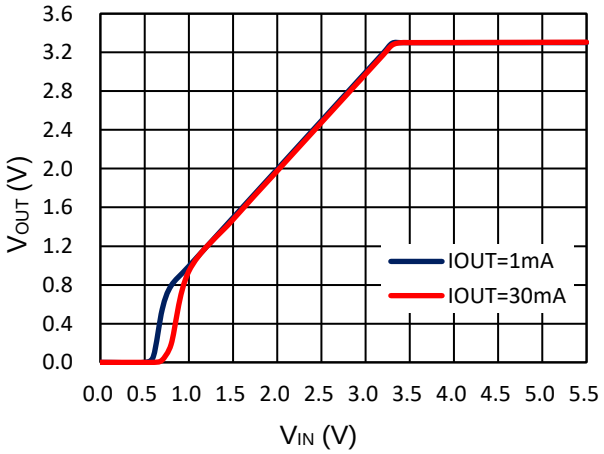

Output Voltage vs Input Voltage

Typical Characteristics (Continued)

$V_{IN}=V_{OUT(SET)}$+1V, V_{CE}>1V, I_{OUT}=1mA, $C_{IN}=C_{OUT}$=1μF, T_A=25°C, In Typical Application Circuit, unless otherwise noted.

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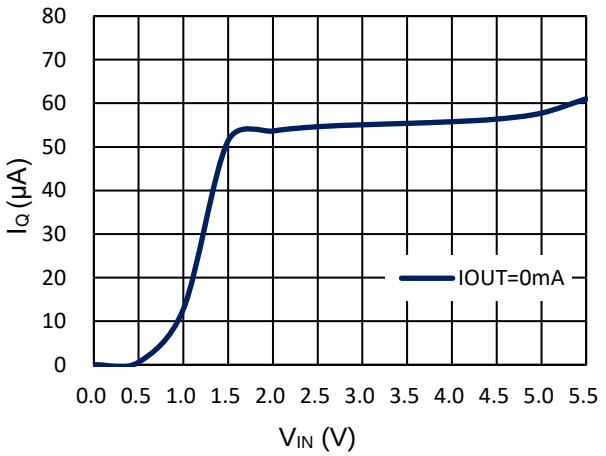

Quiescent Current vs Input Voltage

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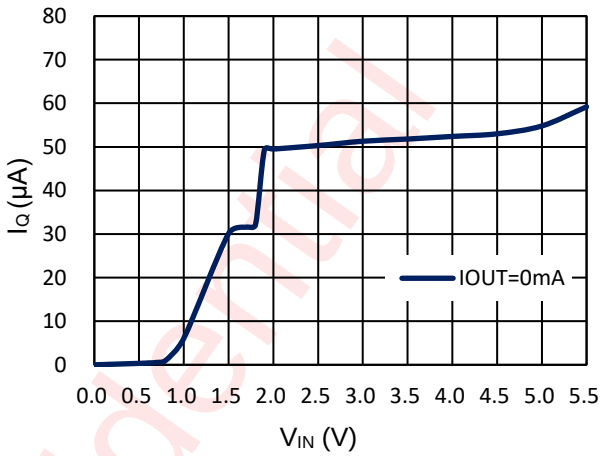

Quiescent Current vs Input Voltage

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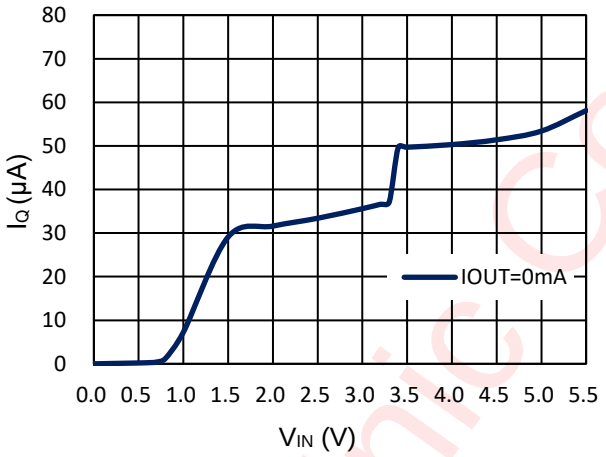

Quiescent Current vs Input Voltage

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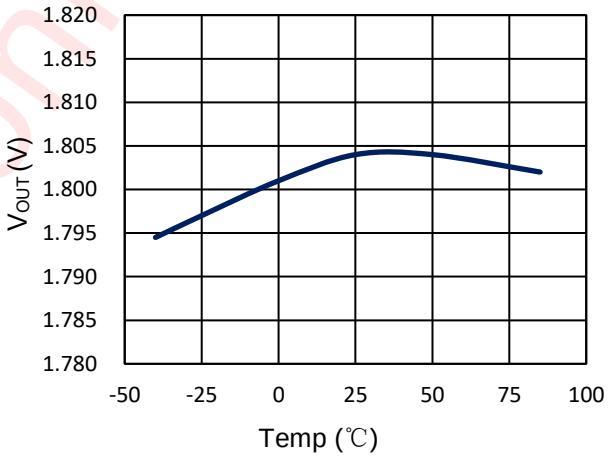

Output Voltage vs Temperature

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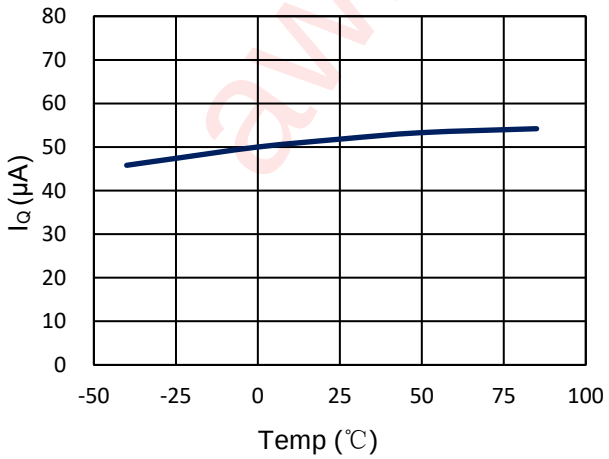

Quiescent Current vs Temperature

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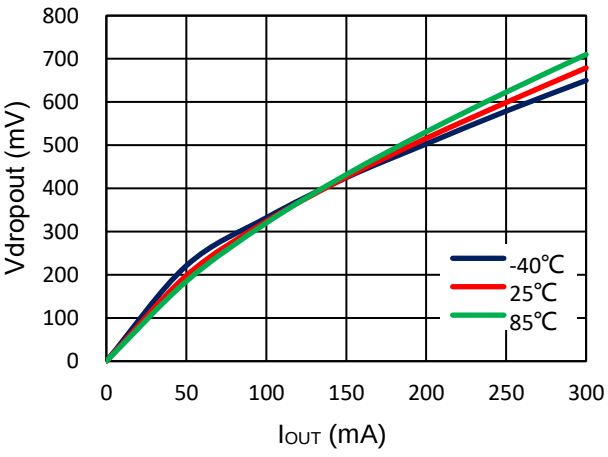

Dropout Voltage vs Output Current

Typical Characteristics (Continued)

$V_{IN}=V_{OUT(SET)}+1V$, $V_{CE}>1V$, $I_{OUT}=1mA$, $C_{IN}=C_{OUT}=1\mu F$, $T_A=25°C$, In Typical Application Circuit, unless otherwise noted.

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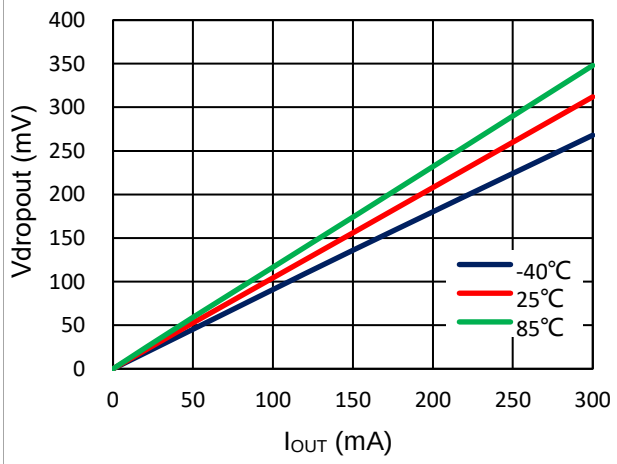

Dropout Voltage vs Output Current

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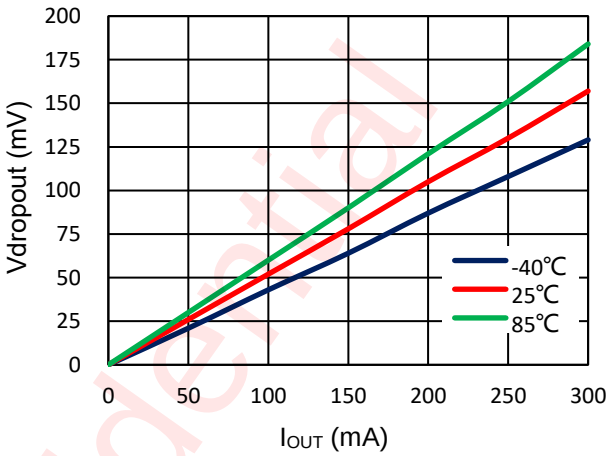

Dropout Voltage vs Output Current

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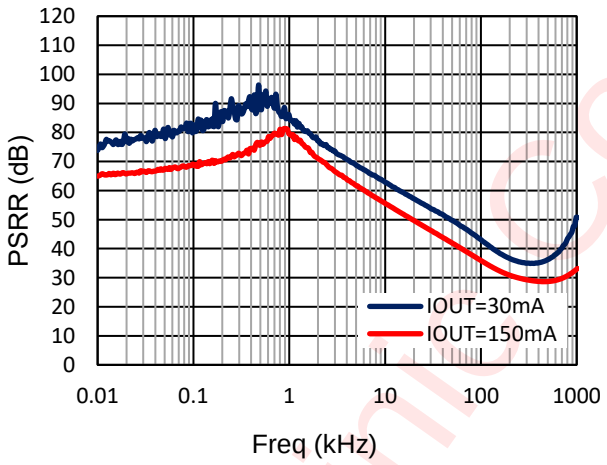

PSRR vs Frequency

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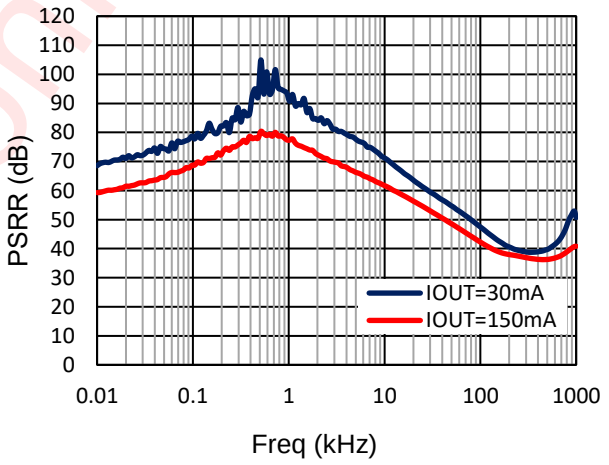

PSRR vs Frequency

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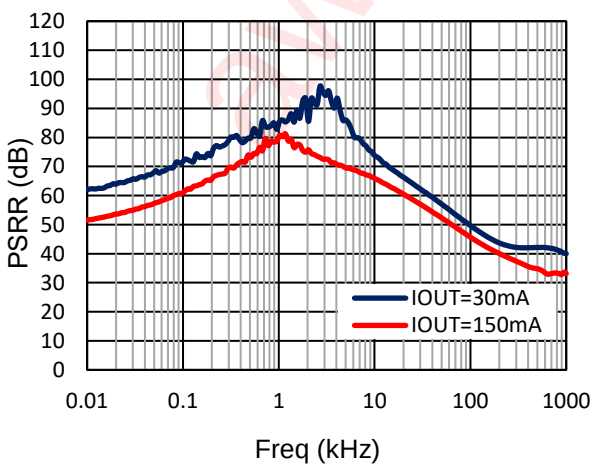

PSRR vs Frequency

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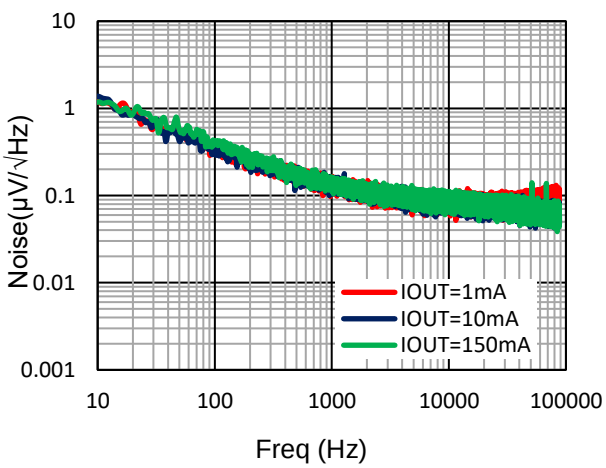

Output Spectral Noise Density

Typical Characteristics (Continued)

$V_{IN}=V_{OUT(SET)}+1V$, $V_{CE}>1V$, $I_{OUT}=1mA$, $C_{IN}=C_{OUT}=1\mu F$, $T_A=25°C$, In Typical Application Circuit, unless otherwise noted.

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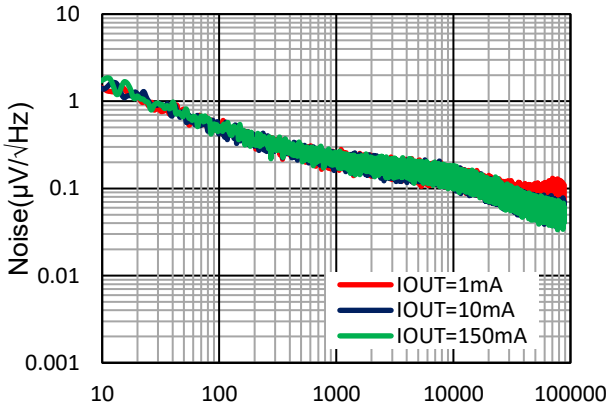

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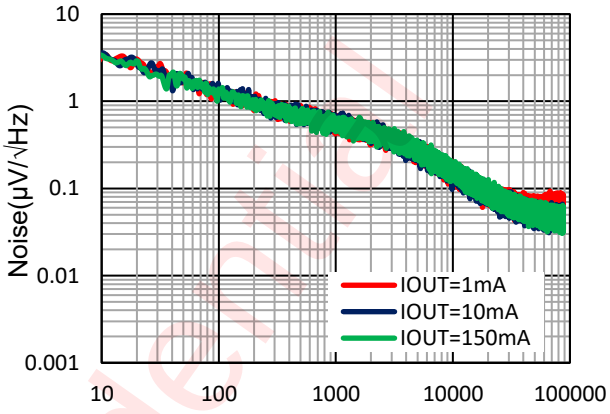

Output Spectral Noise Density

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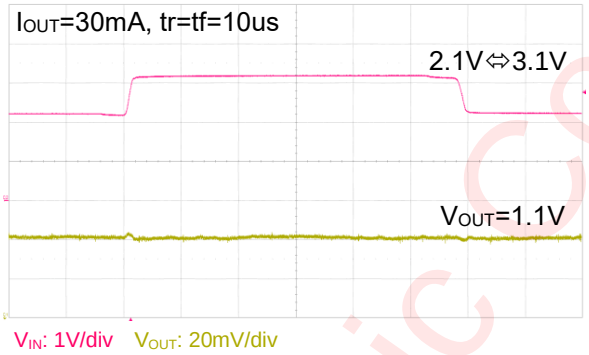
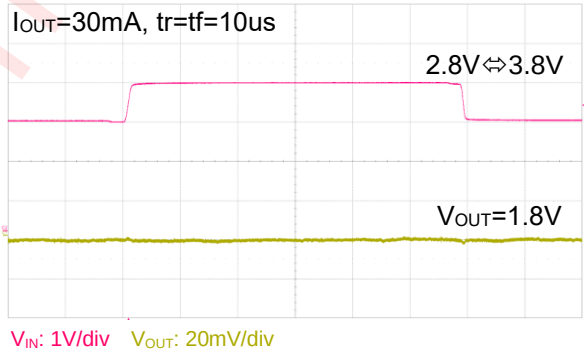


Time(50us/div)

Input Transient Response

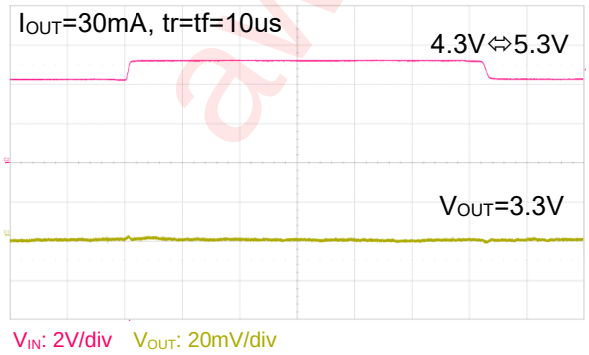
AW37030D180



Time(50us/div)

Input Transient Response

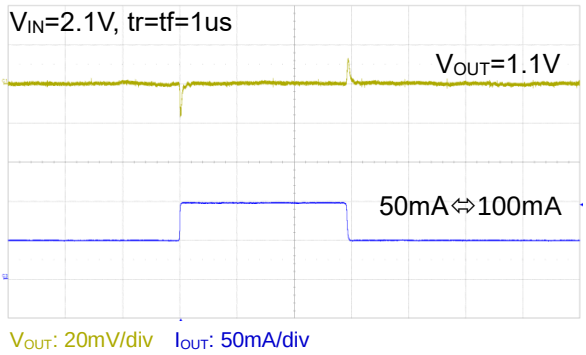
AW37030D330



Time(50us/div)

Input Transient Response

AW37030D110



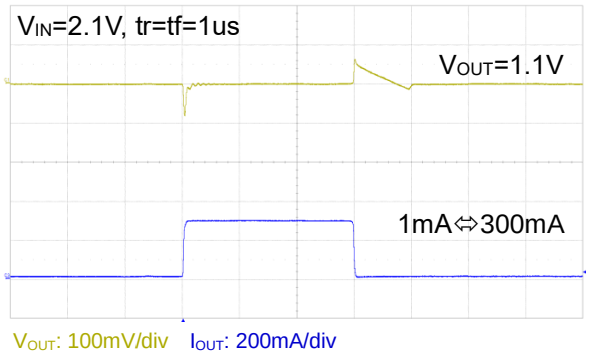
Time(50us/div)

Load Transient Response

Typical Characteristics (Continued)

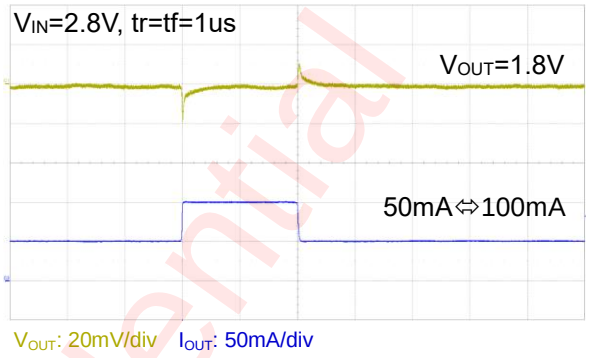
$V_{IN}=V_{OUT(SET)}+1V$, $V_{CE}>1V$, $I_{OUT}=1mA$, $C_{IN}=C_{OUT}=1\mu F$, $T_A=25°C$, In Typical Application Circuit, unless otherwise noted.

AW37030D110



Load Transient Response

AW37030D180



Load Transient Response

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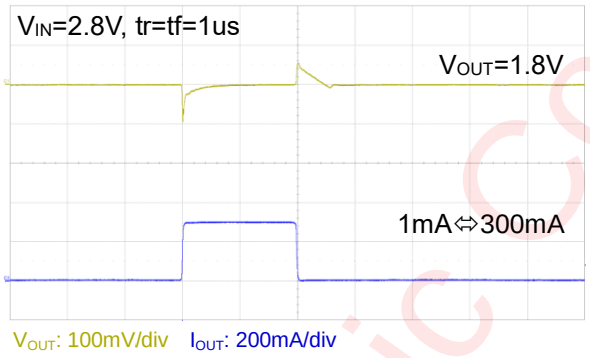

Load Transient Response

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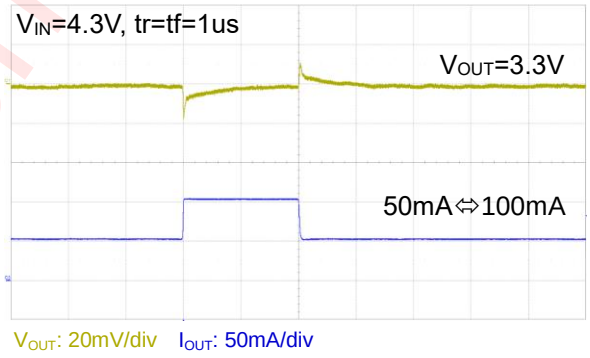

Load Transient Response

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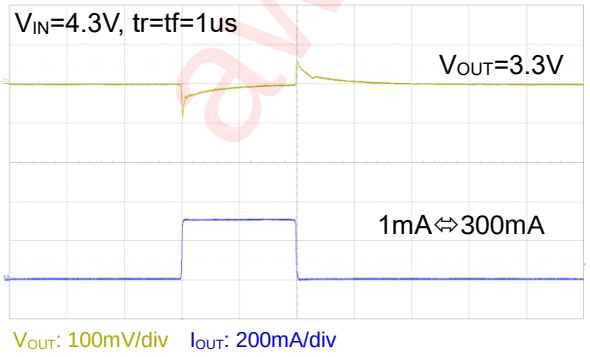

Load Transient Response

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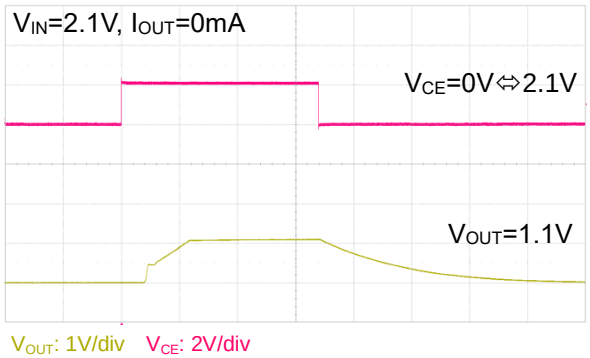
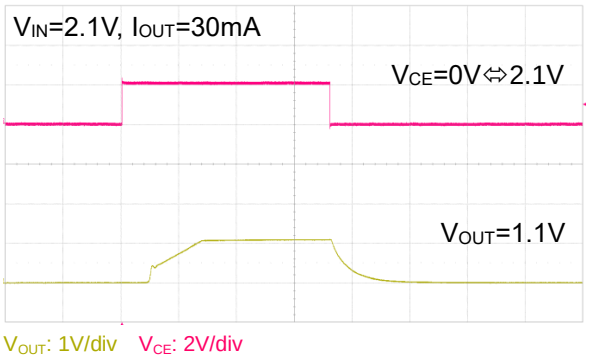


Turn On&Off Speed with CE pin

Typical Characteristics (Continued)

$V_{IN}=V_{OUT(SET)}+1V$, $V_{CE}>1V$, $I_{OUT}=1mA$, $C_{IN}=C_{OUT}=1\mu F$, $T_A=25°C$, In Typical Application Circuit, unless otherwise noted.

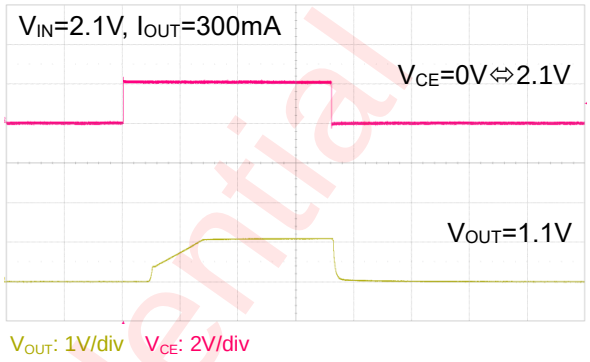
AW37030D110



Time(100us/div)

Turn On&Off Speed with CE pin

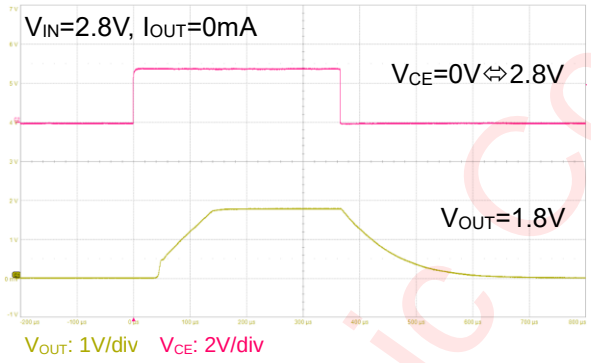
AW37030D110



Time(100us/div)

Turn On&Off Speed with CE pin

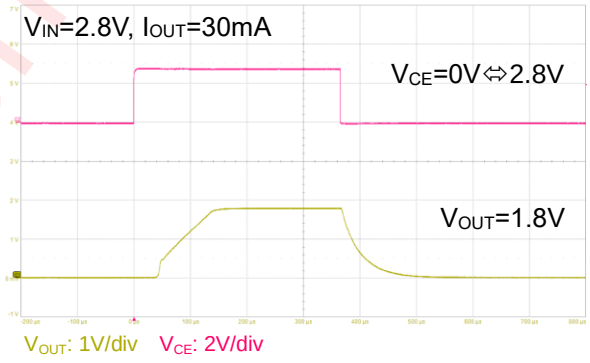
AW37030D180



Time(100us/div)

Turn On&Off Speed with CE pin

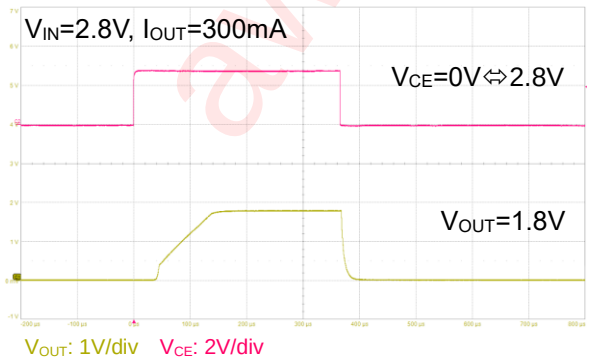
AW37030D180



Time(100us/div)

Turn On&Off Speed with CE pin

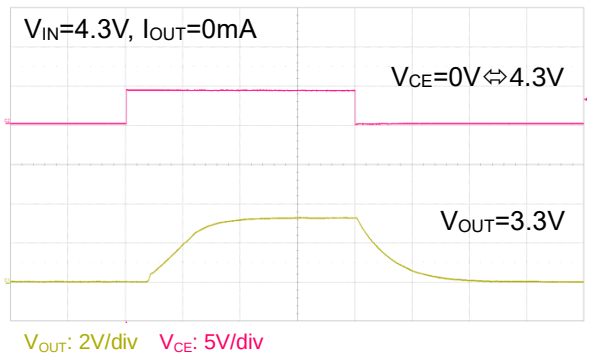
AW37030D180



Time(100us/div)

Turn On&Off Speed with CE pin

AW37030D330



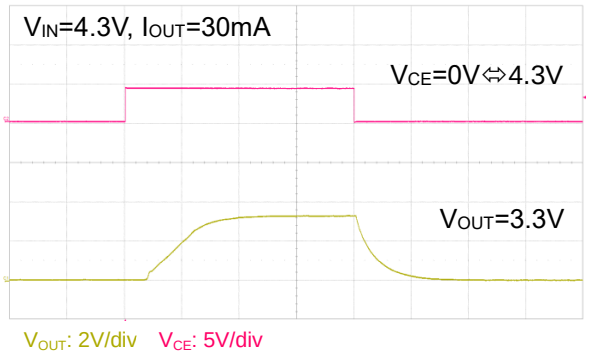
Time(100us/div)

Turn On&Off Speed with CE pin

Typical Characteristics (Continued)

$V_{IN}=V_{OUT(SET)}+1V$, $V_{CE}>1V$, $I_{OUT}=1mA$, $C_{IN}=C_{OUT}=1\mu F$, $T_A=25°C$, In Typical Application Circuit, unless otherwise noted.

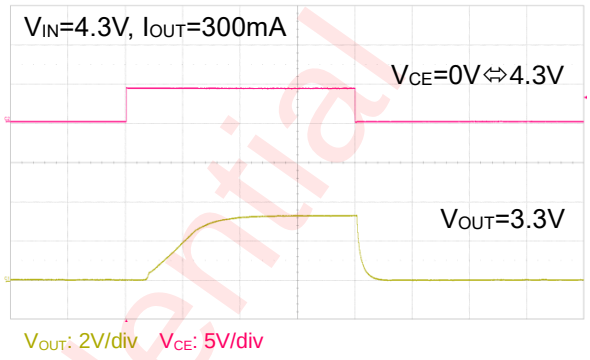
AW37030D330



Time(100us/div)

Turn On&Off Speed with CE pin

AW37030D330



Time(100us/div)

Turn On&Off Speed with CE pin

Detailed Functional Description

AW37030YXXX is a low dropout voltage regulator. After powered on, with CE pin assertion, feedback voltage signal from the integrated resistor network and a voltage related to the voltage reference are transmit to positive input terminal and negative input terminal of an error amplifier (EA) respectively. The output signal of EA is used to control the open-state of power MOSFET. After soft-start, feedback voltage signal compares with the established reference voltage, making output voltage stable and accurate. AW37030YXXX integrates function of load transient accelerating, making LDO obtain excellent dynamic load transient response performance.

Enable Operation

AW37030YXXX uses CE pin to realize enable operation. Applying proper value of voltage to CE pin can make IC enable/disable.

If the voltage of CE pin is less than 0.4V, AW37030YXXX is guaranteed to be disabled. In this state, function modules of IC and power MOSFET are turned off. And the auto discharge function is enabled making output discharge through a on-state NMOSFET to Ground. In disable state, AW37030YXXX only consumes a typical 10nA current.

If the voltage of CE pin is more than 1V, AW37030YXXX is guaranteed to be enabled. In this state, the auto discharge function is disabled, and AW37030YXXX regulates output voltage to the designed value of voltage.

A 140nA pull down current to Ground is built-in at CE pin, making sure that the IC is disabled when CE pin floats. If Enable function is not required, CE pin should be connected directly to IN pin.

Output Current Limit

AW37030YXXX integrates output current limit function, protecting IC from excessive current.

When the load is excessively heavy, AW37030YXXX limits the current flowing through the IC to a typical 500mA current. This value is specially designed, so that IC is protected properly and the output capability of 300mA is not influenced either.

Meanwhile, AW37030YXXX integrates a 120mA fold-back current limit function, lowering the system dissipation when output overload or short to Ground.

Thermal Shutdown

AW37030YXXX integrates thermal shutdown function, protect IC from excessively high temperature.

When the chip temperature exceeds 160°C, AW37030YXXX detects it as an over-temperature event, triggering thermal shutdown, which will turn off the main function module, including power MOSFET. This inhibits increase of chip's temperature. IC would keep the protection-state on until the chip's temperature falls below to 130°C. At this moment, the over-temperature protection-state is released, IC resumes to work again.The hysteresis avoids IC's turning off and on frequently around the the Thermal Shutdown threshold.

Auto Discharge

AW37030YXXX makes output voltage discharge quickly when in CE disable state or thermal shutdown state, benefit from integrating auto discharge function. Auto discharge function is implemented by integrated a NMOSFET of typical 130Ω Rdson route from Output to Ground, and the route is get through in CE disable state or thermal shutdown state. This feature prevents residual charge voltage on the output capacitor, which may impact proper power up of the system connected to the converter. It should be noted that auto discharge function is optional according to different specs.

Application Information

Capacitors Selection

IN pin: Input Capacitor C_{IN}

AW37030YXXX advises to use a 1μF or more X5R or X7R ceramic capacitor at IN pin as shown in Typical Application Circuit.

OUT pin: Output Capacitor C_{OUT}

AW37030YXXX advises to use a 1μF or more X5R or X7R ceramic capacitor at OUT pin as shown in Typical Application Circuit.

Recommended Components List

Component	PART No.	DESCRIPTION	MFR	TYP.	UNIT
C_{IN}	GRM155R61A105KE15	10V, X5R, 0402	MURATA	1	μF
C_{OUT}	GRM155R61A105KE15	10V, X5R, 0402	MURATA	1	μF

PCB Layout Consideration

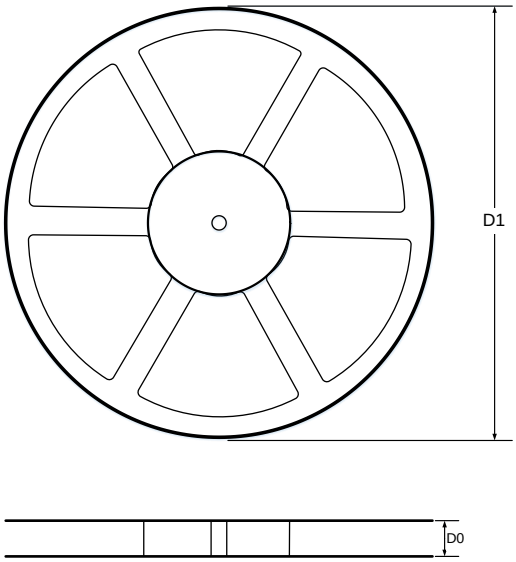
The performance of a power source circuit using this device is highly dependent on a peripheral circuit. To obtain the optimal performance, a peripheral component or the device mounted on PCB should not exceed its rated voltage, rated current or rated power. When designing a peripheral circuit, guidelines below for PCB layout of AW37030YXXX should be obeyed:

1. All peripheral components should be placed as close to the chip as possible. C_{IN} and C_{OUT} should be close to IN and OUT pins respectively. Avoid connecting device and chip pins with two different layers of copper, use the same layer of copper instead.
2. IN and OUT pin are the large current input and output of the chip, make IN, OUT, and meanwhile GND lines sufficient.
3. The connection lines between the planes of C_{IN} or C_{OUT} and respective chip pin should be as short and wide as possible, to reduce noise and EMI interference, or it may cause noise pickup or unstable operation.
4. The exposed plane of chip and GND pins must be connected to the large-area ground layer of PCB directly, meanwhile place sufficient vias below the exposed plane. Thus we can decrease the thermal resistor on the board to optimize heat-diffusion performance.

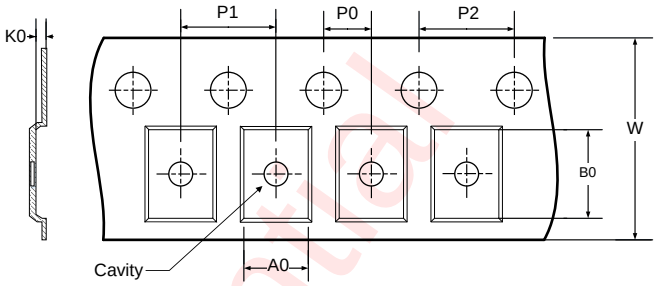
Tape And Reel Information

DFN 1mmX1mm-4L

REEL DIMENSIONS

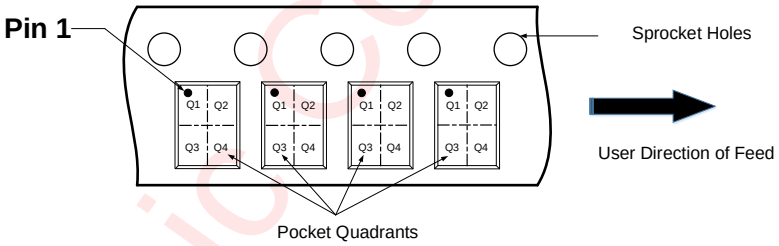


TAPE DIMENSIONS



A0：Dimension designed to accommodate the component width
B0：Dimension designed to accommodate the component length
K0：Dimension designed to accommodate the component thickness
W：Overall width of the carrier tape
P0：Pitch between successive cavity centers and sprocket hole
P1：Pitch between successive cavity centers
P2：Pitch between sprocket hole
D1：Reel Diameter
D0：Reel Width

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



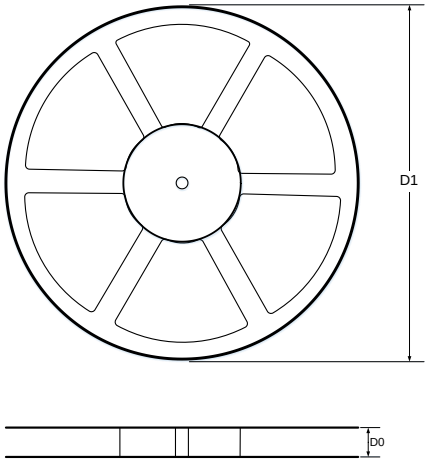
DIMENSIONS AND PIN1 ORIENTATION

D1 (mm)	D0 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
178	8.4	1.14	1.17	0.56	2	4	4	8	Q1

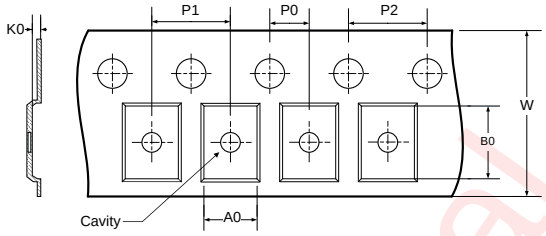
All dimensions are nominal

SOT 23-5L

REEL DIMENSIONS



TAPE DIMENSIONS



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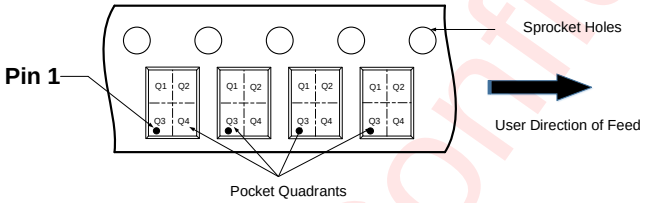


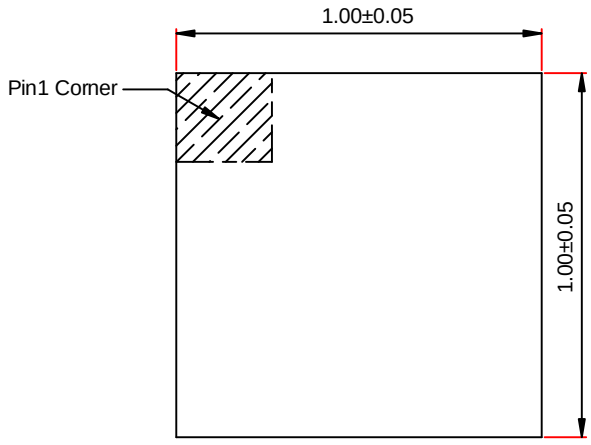
DIMENSIONS AND PIN1 ORIENTATION

D1 (mm)	D0 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
178	8.4	3.3	3.2	1.4	2	4	4	8	Q3

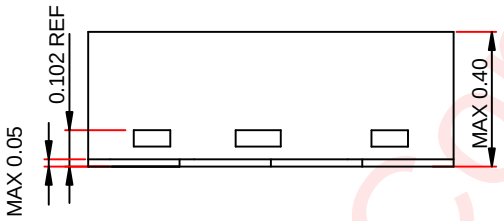
All dimensions are nominal

Package Description

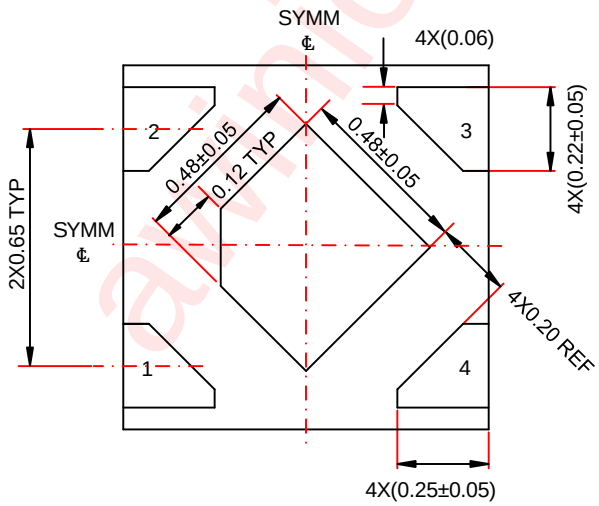
DFN 1mmX1mm-4L



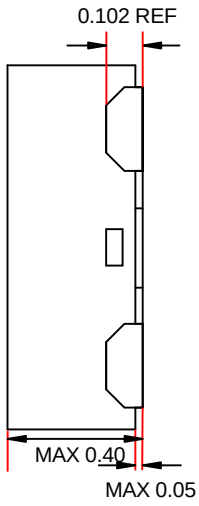
Top View



Side View



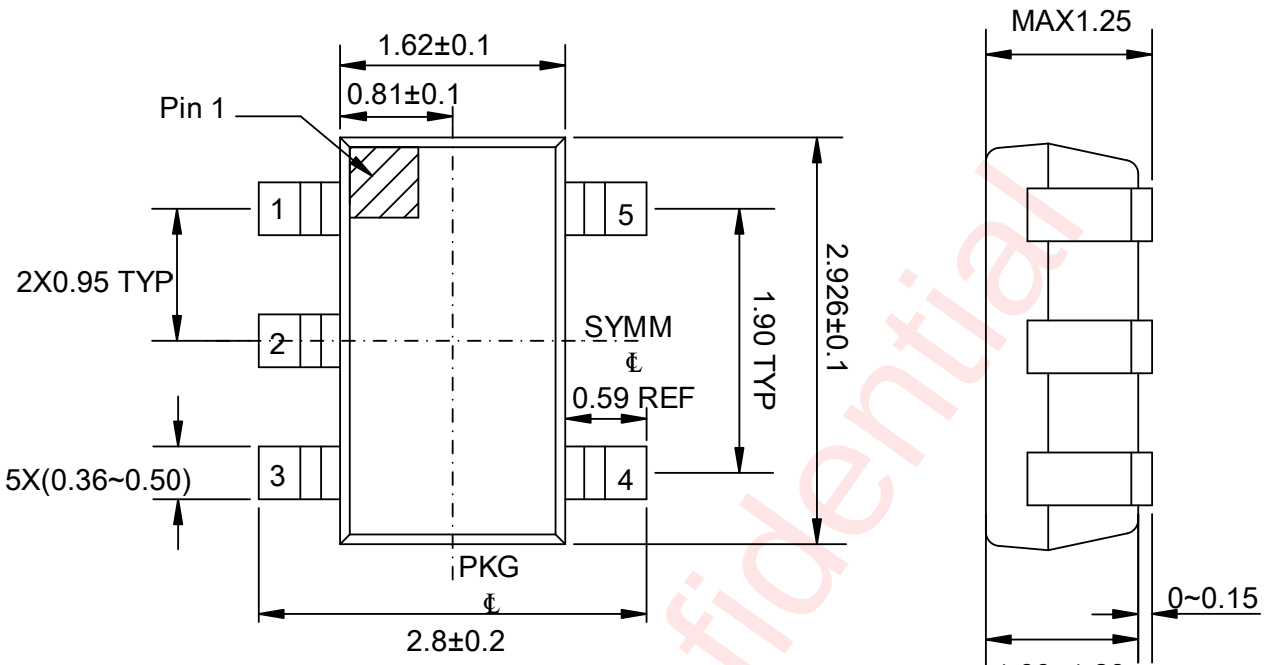
Bottom View



Side View

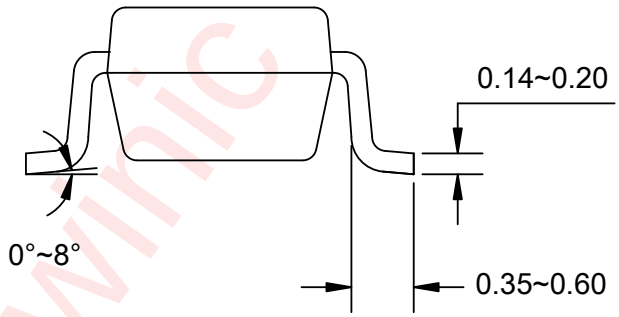
Unit:mm

SOT 23-5L



Top View

Side View

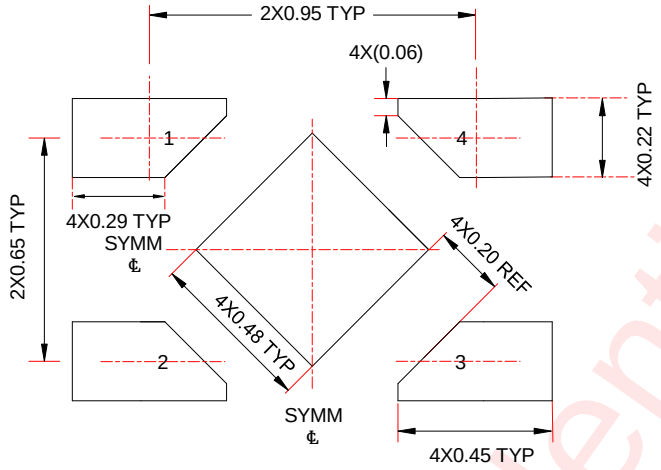


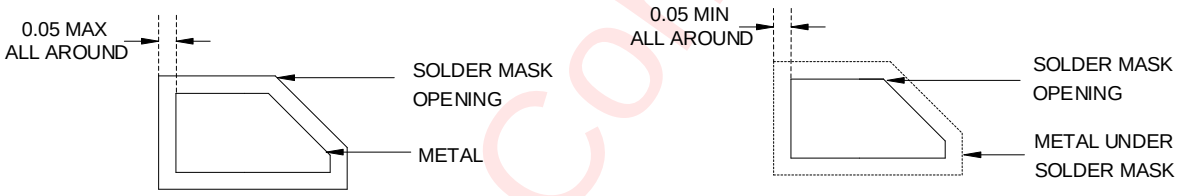
Side View

Unit: mm

Land Pattern Data

DFN 1mmX1mm-4L



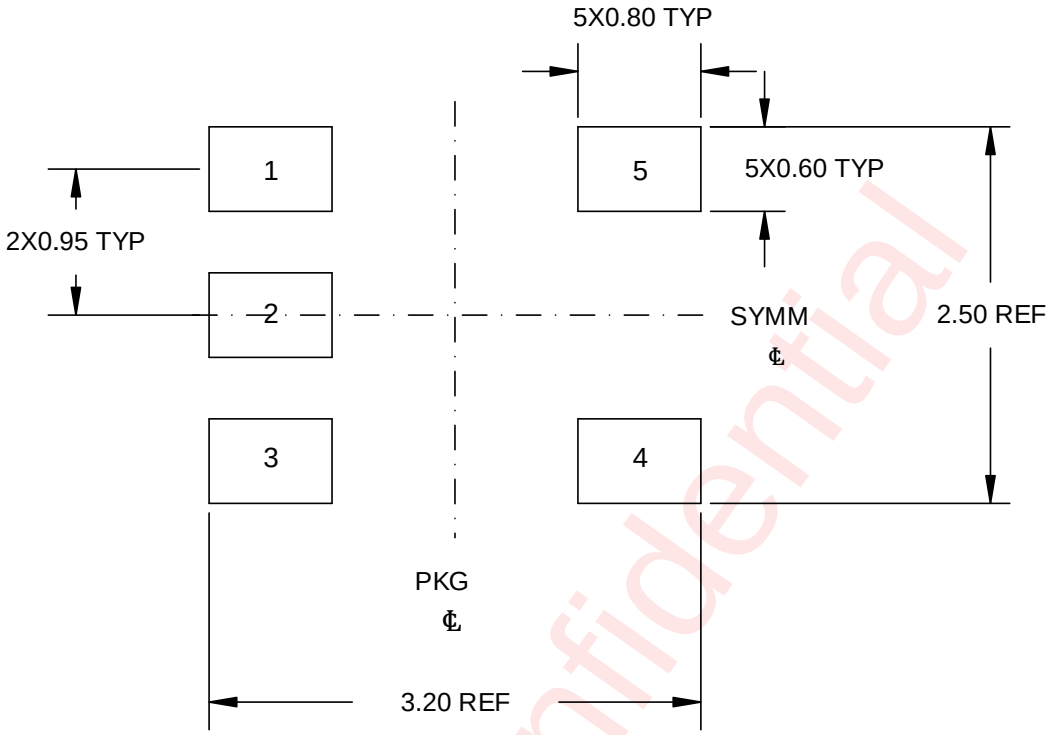


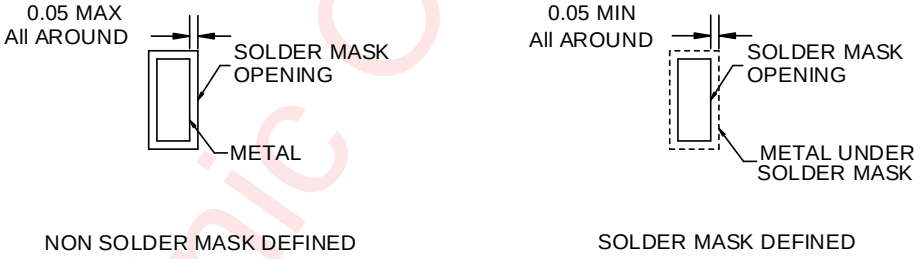
NON SOLDER MASK DEFINED

SOLDER MASK DEFINED

UNIT : mm

SOT 23-5L





NON SOLDER MASK DEFINED

SOLDER MASK DEFINED

Unit: mm

Revision History

Version	Date	Change Record
V1.0	Jan. 2020	Officially released
V1.1	Nov. 2020	V_{OUT_ACC} at T_A=25℃ change to ±1%; $LOAD_{REG}$ MAX change to 20mV; I_Q MAX change to 100μA
V1.2	Jan. 2021	Add V_{OUT} of 1.2V and 2.5V
V1.3	Jan. 2021	Add Maximum power consumption and Inrush Current
V1.4	Mar. 2021	Add test waves of 1.2V; Add name rule; Add V_{OUT} of 1.1V and 1.5V; Add wave of Output Spectral Noise Density
V1.5	Apr. 2021	Add SOT 23-5L package
V1.6	Jul. 2021	Add V_{OUT} of 2.85V and 3.1V; Remove test waves of 1.2V and add electical characteristics of 1.1V

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