500mA, Micropower, VLDO Linear Regulator

UM1770Y-xx *SOT89-5*
UM1770DA-xx *DFN6 2.0×2.0*

General Description

The UM1770 series are VLDO (very low dropout) linear regulators designed for low power portable applications. Typical output noise is only 90μV_{RMS} (Fixed Output, V_{OUT}=1.0V) and maximum dropout is just 320mV at the load current of 500mA.The internal P-channel MOSFET pass transistor requires no base current, allowing the device to draw only 250μA during normal operation at the maximum load current of 500mA.
Other features include high output voltage accuracy, excellent transient response, under voltage lockout, stability with ultra low ESR ceramic capacitors as small as 1μF, short-circuit and thermal overload protection and output current limiting.
The UM1770Y-xx series are available in SOT89-5 package and the UM1770DA-xx series are available in a low profile DFN6 2.0×2.0 package.

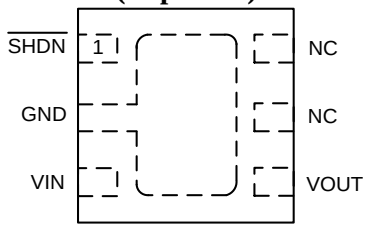
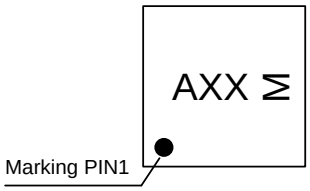
Applications

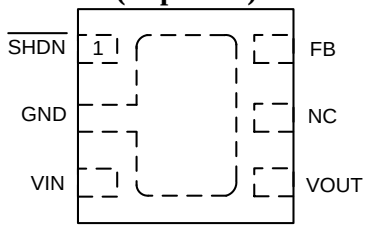
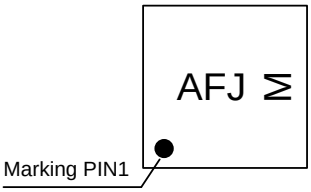
- Bluetooth/802.11 Cards
- PDAs and Notebook Computers
- Portable Instruments and Battery-Powered Systems
- Cellular Phones

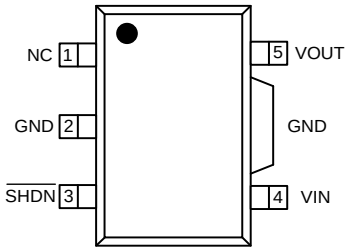
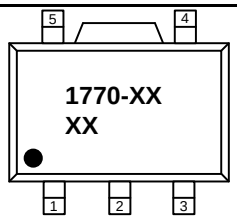
Features

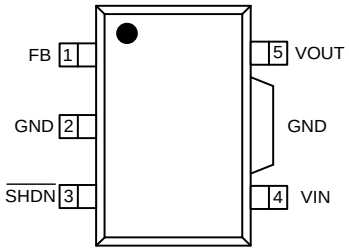
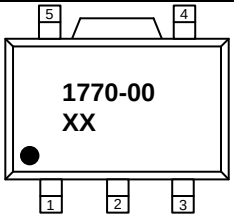
- Very Low Dropout: 320mV(max) at 500mA
- Maximum Input Voltage: 6.0V
- Low Noise (10Hz to 100kHz):
  90μV_{RMS} (Fixed Output, V_{OUT}=1.0V);
  60μV_{RMS} (Adjustable Output, V_{OUT}=1.0V);
  194μV_{RMS} (Adjustable Output, V_{OUT}=3.3V);
  305μV_{RMS} (Adjustable Output, V_{OUT}=5.0V)
- ±2% Voltage Accuracy at 500mA
- Fast Transient Response
- Under Voltage Lockout
- Fixed Output Voltage of UM1770Y/DA-xx: 1.0V to 4.0V with 0.1V Interval
- Adjustable Output Voltage of UM1770Y/DA-00: 1.0V to 5.0V
- Output Current Limit
- Stable with 1μF Output Capacitor
- Short-Circuit and Thermal Overload Protection
- Low Profile SOT89-5 and DFN6 2.0×2.0 Packages

Pin Configurations **Top View**

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<td>(Top View)

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M: Month Code
UM1770DA-xx
DFN6 2.0×2.0</td>
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<td>(Top View)

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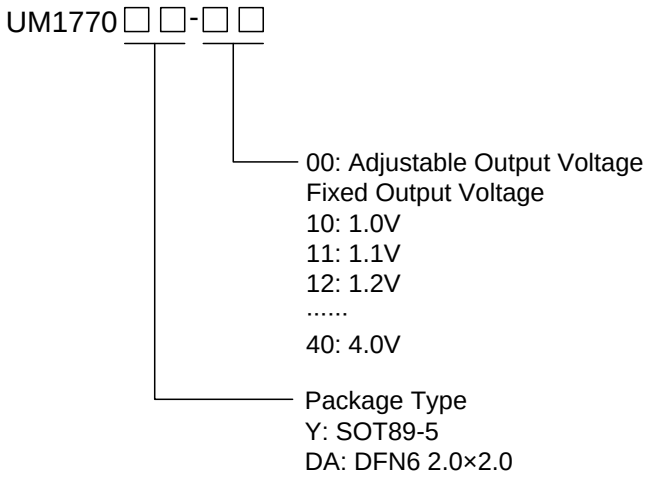
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SOT89-5</td>
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Pin Description

Pin Number (Fixed V_{OUT})		Pin Number (Adjustable V_{OUT})		Symbol	Function
DFN6 2.0×2.0	SOT89-5	DFN6 2.0×2.0	SOT89-5		
1	3	1	3	$\overline{SHDN}$	Shutdown Input: High=Active LDO, Low=Shutdown LDO
2	2	2	2	GND	Ground
3	4	3	4	VIN	Power Supply
4	5	4	5	VOUT	Voltage Regulated Output
5, 6	1	5	-	NC	Not Connected
-	-	6	1	FB	Output Voltage Feedback

Naming Information



Ordering Information

Part Number	Output Voltage	Packaging Type	Marking Code	Shipping Qty
UM1770Y-00	ADJ	SOT89-5	1770-00	1000pcs/7Inch Tape & Reel
UM1770Y-10	1.0V		1770-10	
UM1770Y-11	1.1V		1770-11	
UM1770Y-12	1.2V		1770-12	
UM1770Y-13	1.3V		1770-13	
UM1770Y-14	1.4V		1770-14	
UM1770Y-15	1.5V		1770-15	
UM1770Y-16	1.6V		1770-16	
UM1770Y-17	1.7V		1770-17	
UM1770Y-18	1.8V		1770-18	
UM1770Y-19	1.9V		1770-19	
UM1770Y-20	2.0V		1770-20	
UM1770Y-21	2.1V		1770-21	
UM1770Y-22	2.2V		1770-22	
UM1770Y-23	2.3V		1770-23	
UM1770Y-24	2.4V		1770-24	
UM1770Y-25	2.5V		1770-25	
UM1770Y-26	2.6V		1770-26	
UM1770Y-27	2.7V		1770-27	
UM1770Y-28	2.8V		1770-28	
UM1770Y-29	2.9V		1770-29	
UM1770Y-30	3.0V		1770-30	
UM1770Y-31	3.1V		1770-31	
UM1770Y-32	3.2V		1770-32	
UM1770Y-33	3.3V		1770-33	
UM1770Y-34	3.4V		1770-34	
UM1770Y-35	3.5V		1770-35	
UM1770Y-36	3.6V		1770-36	
UM1770Y-37	3.7V		1770-37	
UM1770Y-38	3.8V		1770-38	
UM1770Y-39	3.9V		1770-39	
UM1770Y-40	4.0V		1770-40	

Ordering Information (Continued)

Part Number	Output Voltage	Packaging Type	Marking Code	Shipping Qty
UM1770DA-00	ADJ	DFN6 2.0×2.0	AFJ	3000pcs/7Inch Tape & Reel
UM1770DA-10	1.0V		AAS	
UM1770DA-11	1.1V		AAT	
UM1770DA-12	1.2V		AAC	
UM1770DA-13	1.3V		AAD	
UM1770DA-14	1.4V		AAU	
UM1770DA-15	1.5V		AAJ	
UM1770DA-16	1.6V		AFE	
UM1770DA-17	1.7V		AFF	
UM1770DA-18	1.8V		AAK	
UM1770DA-19	1.9V		AFG	
UM1770DA-20	2.0V		AFH	
UM1770DA-21	2.1V		AFK	
UM1770DA-22	2.2V		AFL	
UM1770DA-23	2.3V		AFN	
UM1770DA-24	2.4V		AFP	
UM1770DA-25	2.5V		AAN	
UM1770DA-26	2.6V		AFQ	
UM1770DA-27	2.7V		AFR	
UM1770DA-28	2.8V		AAQ	
UM1770DA-29	2.9V		AFS	
UM1770DA-30	3.0V		AAR	
UM1770DA-31	3.1V		AFT	
UM1770DA-32	3.2V		AFU	
UM1770DA-33	3.3V		AAV	
UM1770DA-34	3.4V		AFV	
UM1770DA-35	3.5V		AAZ	
UM1770DA-36	3.6V		AFZ	
UM1770DA-37	3.7V		AGL	
UM1770DA-38	3.8V		AGN	
UM1770DA-39	3.9V		AGP	
UM1770DA-40	4.0V		AGQ	

Absolute Maximum Ratings (Note 1)

Symbol	Parameter		Value	Unit
V_{IN}	Supply Voltage on IN Pin		-0.3 to +7.5	V
$V_{\overline{SHDN}}$	Voltage on $\overline{SHDN}$ Pin		-0.3 to +7.5	V
V_{OUT}	Voltage on OUT Pin		-0.3 to +7.5	V
V_{FB}	Voltage on FB Pin		-0.3 to +7.5	V
T_J	Operating Junction Temperature (Notes 2, 3)		-40 to +125	℃
T_{STG}	Storage Temperature Range		-65 to +150	℃
T_L	Lead Temperature for Soldering 10 seconds		+300	℃
P_D (Notes 4)	Power Dissipation@25℃	DFN6 2.0×2.0	0.9	W
		SOT89-5	1.5	
θ_{JA}	Package Thermal Resistance	DFN6 2.0×2.0	110	℃/W
		SOT89-5	66	

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Note 2: The UM1770 is tested and specified under pulse load conditions such that $T_J \approx T_A$. Specifications over the –40℃ to 125℃ operating junction temperature range are assured by design, characterization and correlation with statistical process controls.

Note 3: This IC includes over-temperature protection that is intended to protect the device during momentary overload conditions. Junction temperature will exceed 125℃ when over-temperature protection is active. Continuous operation above the specified maximum operating junction temperature may impair device reliability.

Note 4: The maximum allowable power dissipation of 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.

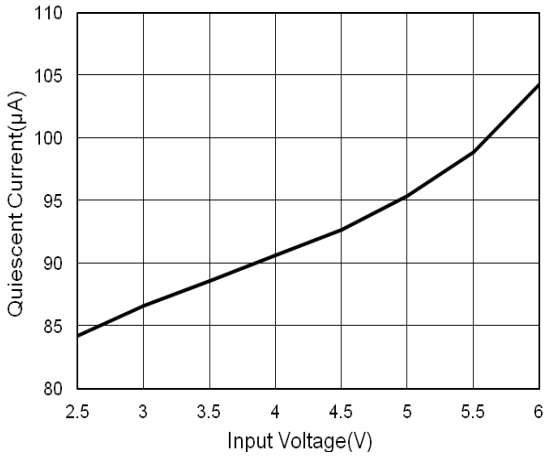
Electrical Characteristics

Over recommended operating free-air temperature range (unless otherwise noted)

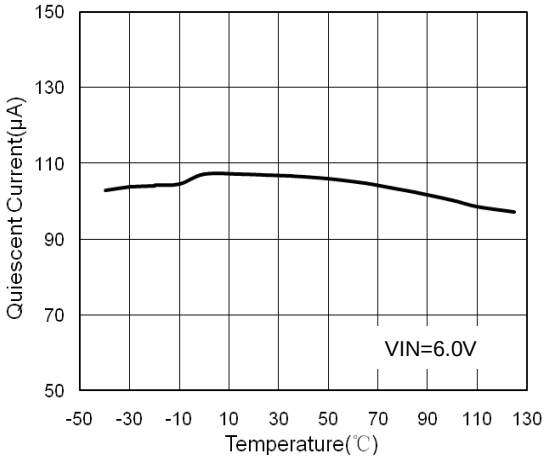
Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_{IN}	Input Voltage Range			2.5		6.0	V
V_{UVLO}	Input Under Voltage Lockout	V_{IN} falling		1.8		2.4	V
I_Q	Operating Quiescent Current	V_{IN}=4.2V, I_{OUT}=0mA			92	140	μA
		V_{IN}=4.2V, I_{OUT}=500mA			250	300	
$I_{\overline{SHDN}}$	Shutdown Leakage Current					1	μA
I_{OUT}	Output Current			500			mA
	Output Voltage Accuracy	1mA≤I_{OUT}≤500mA, T_A=-25℃		-2		+2	%
ΔV_{DO}	Dropout Voltage	I_{OUT}=500mA，2.5V≤V_{OUT}			220	320	mV
I_{LIMT}	Output Current Limit	V_{IN}≥2.5V		700			mA
t	Startup Time Response	R_L=68Ω, C_{OUT}=1μF			40		μs
V_{IL}	$\overline{SHDN}$ Input Low Voltage	2.5V≤V_{IN}≤6.0V				0.4	V
V_{IH}	$\overline{SHDN}$ Input High Voltage	2.5V≤V_{IN}≤6.0V		2.0			V
	$\overline{SHDN}$ Input Current	$\overline{SHDN}$=V_{IN} or GND		-1		+1	μA
T_{SHDN}	Thermal-Shutdown Temperature				160		℃
ΔT_{SHDN}	Thermal-Shutdown Hysteresis				25		℃
	Line Regulation	V_{OUT}+1V≤V_{IN}≤6.0V (2.5V≤V_{IN}) I_{OUT}=10mA			0.09		%/V
	Load Regulation	V_{IN}=V_{OUT}+1V (2.5V≤V_{IN}) 1mA≤I_{OUT}≤500mA			0.2		%
	Output Voltage Noise	10Hz to 100kHz, C_{IN}=1.0μF, I_{OUT}=100mA	Fixed Output, V_{OUT}=1.0V		90		μV_{RMS}
			Adjustable Output, V_{OUT}=1.0V		60		
			Adjustable Output, V_{OUT}=3.3V		194		
			Adjustable Output, V_{OUT}=5.0V		305		
PSRR	Power Supply Ripple Rejection	V_{IN}=V_{OUT}+1V I_{OUT}=10mA	f=100Hz	65			dB
			f=1kHz	60			
			f=10kHz	45			

Typical Characteristics (shown for 1.1V output option)
(C_{IN}=1.0μF, C_{OUT} = 1.0μF, T_A = 25℃, unless otherwise specified.)

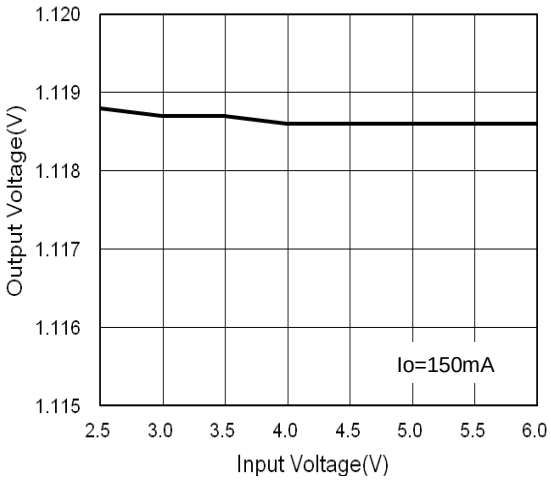
Quiescent Current vs Input Voltage



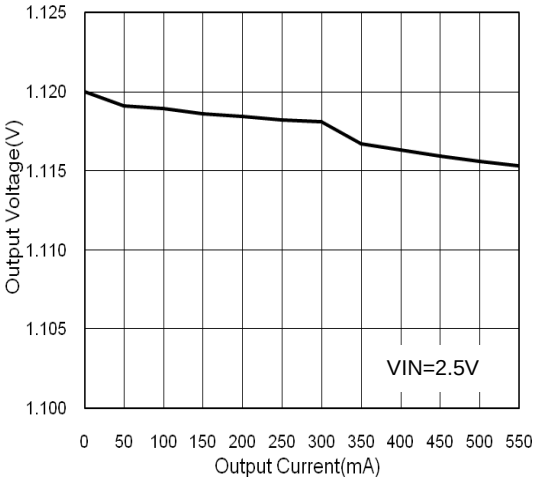
Quiescent Current vs Temperature



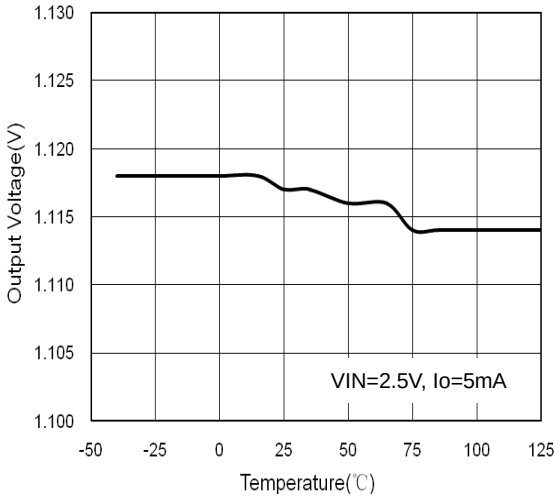
Output Voltage vs Input Voltage



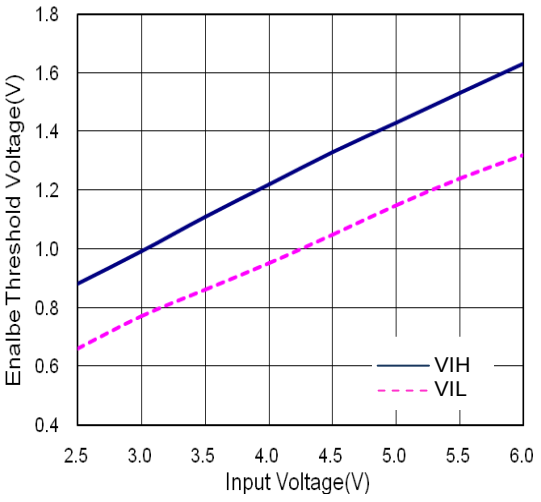
Output Voltage vs Output Current



Output Voltage vs Temperature

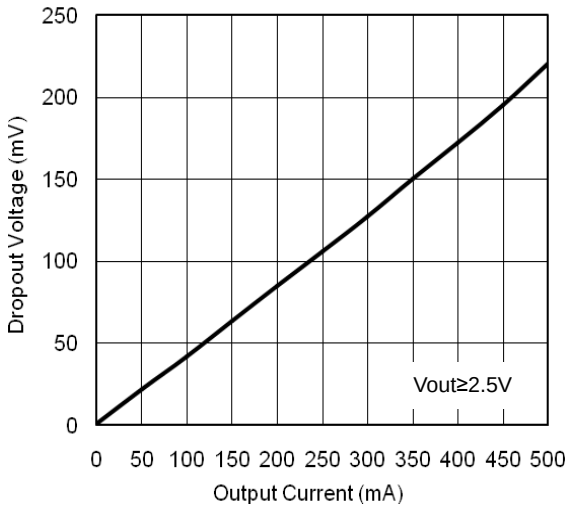


Enable Threshold Voltage vs Input Voltage

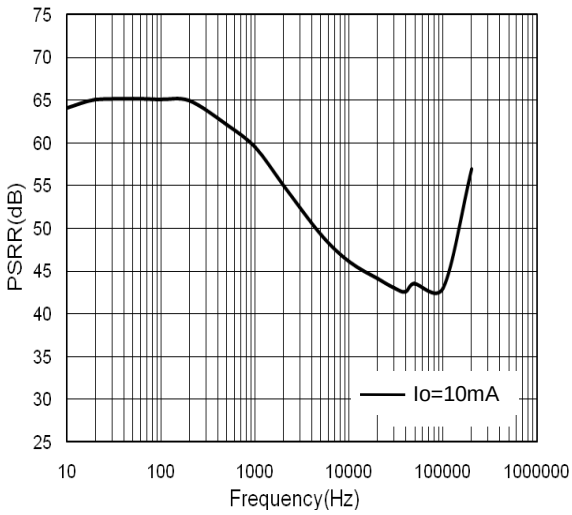


Typical Characteristics (shown for 1.1V output option) (Continued)
(C_{IN}=1.0μF, C_{OUT} = 1.0μF, T_A = 25℃, unless otherwise specified.)

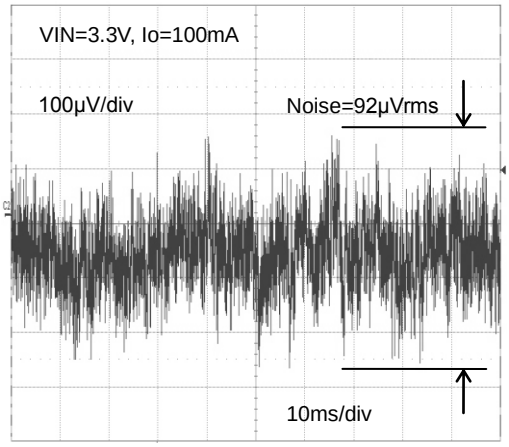
Dropout Voltage vs Output Current



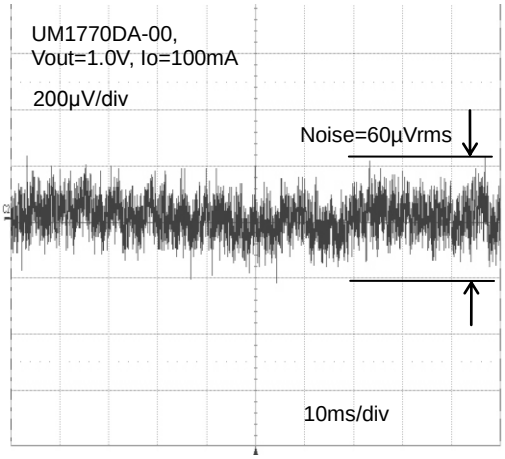
PSRR vs Frequency



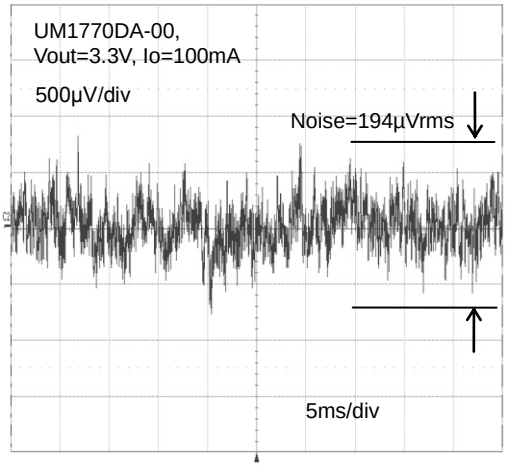
Noise



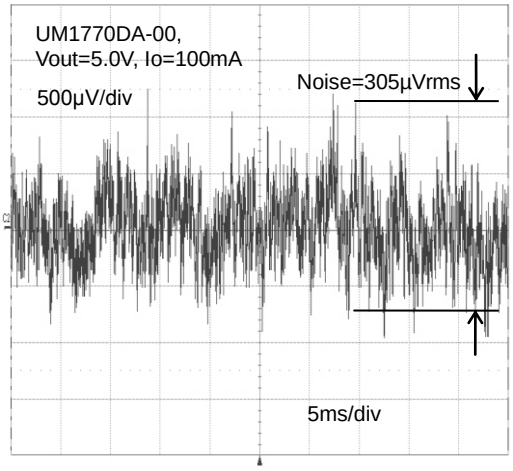
Noise



Noise

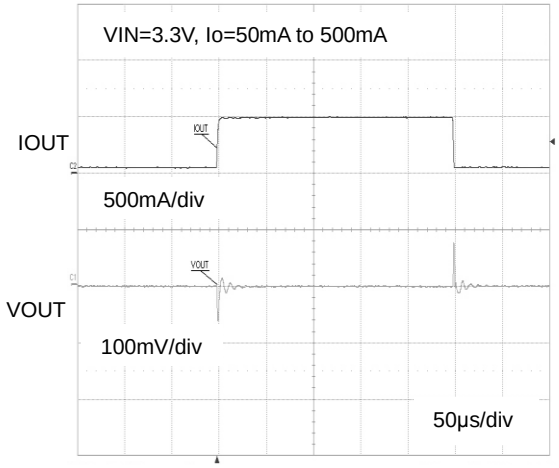


Noise

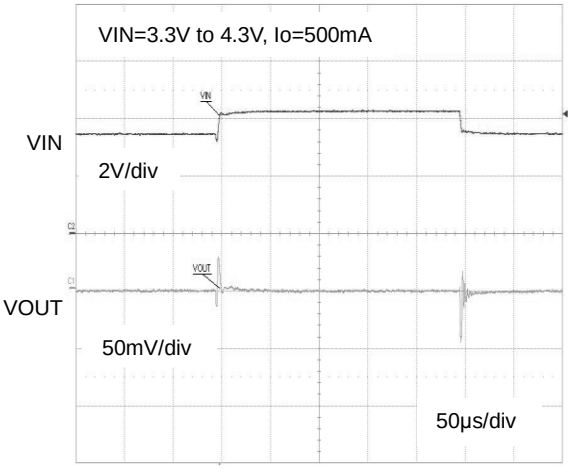


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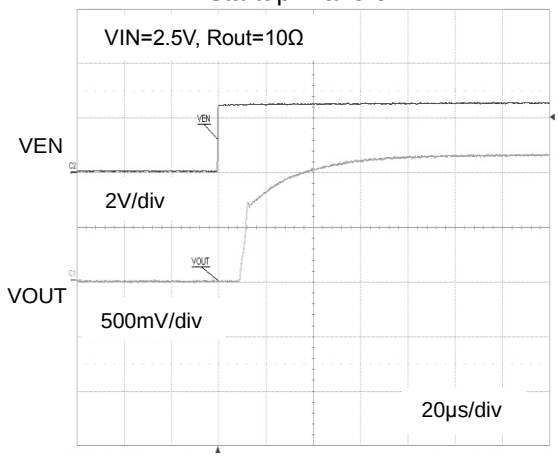
Load Transient Response



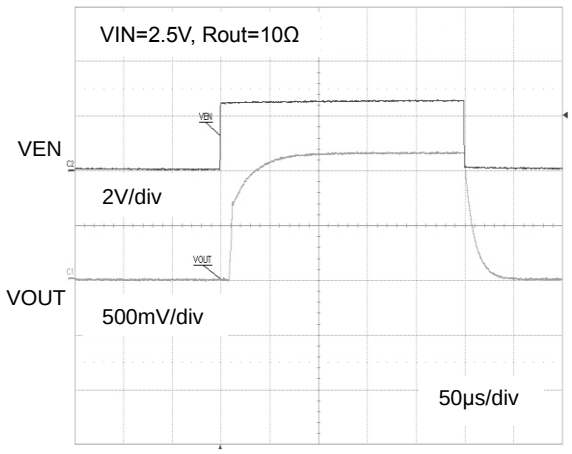
Line Transient Response



Startup Waveform



Shutdown Waveform



Pin Function

$\overline{\text{SHDN}}$: Shutdown, Active Low. This pin is used to put the UM1770 into shutdown. The $\overline{\text{SHDN}}$ pin cannot be left floating and must be tied to the input pin if not used.
GND: Ground and Heat Sink. Solder to a ground plane or large pad to maximize heat dissipation.
VIN: Power for UM1770 and Load. Power is supplied to the devices through the IN pin. The IN pin should be locally bypassed to ground if the UM1770 series are more than a few inches away from another source of bulk capacitance.
VOUT: Voltage Regulated Output. The OUT pin supplies power to the load. A minimum output capacitor of 1μF is required to ensure stability. Larger output capacitors may be required for applications with large transient loads to limit peak voltage transients.
NC: Not Connected.
FB: Output voltage feedback. This terminal is used to set the output voltage.

Output Voltage Setting

The output voltage of the UM1770 adjustable regulator is programmed using an external resistor divider as shown in Figure 2. The output voltage is calculated using:

$$V_{OUT} = V_{FB}\left(1+\frac{R1}{R2}\right)$$

Where: V_{FB} = 1.00V (Typ) (the internal reference voltage)
Resistors R1 and R2 should be chosen for approximately 3-5μA divider current. Lower value resistors can be used but offer no inherent advantage and waste more power. Higher values should be avoided, as leakage currents at FB increase the output voltage error. The recommended design procedure is to choose R2 = 200kΩ to set the divider current at 5μA and then calculate R1 using:

$$R1 = \left(\frac{V_{OUT}}{V_{FB}} - 1\right) \times R2$$

Where: V_{FB} = 1.00V (Typ).

Typical Application Circuit

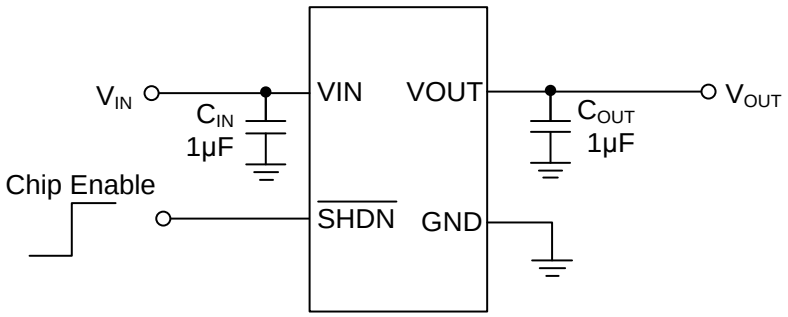


Figure 1. Fixed Output Voltage Application Circuit

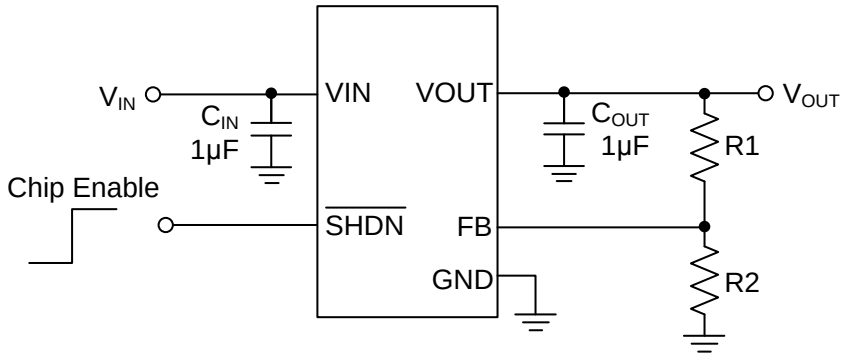
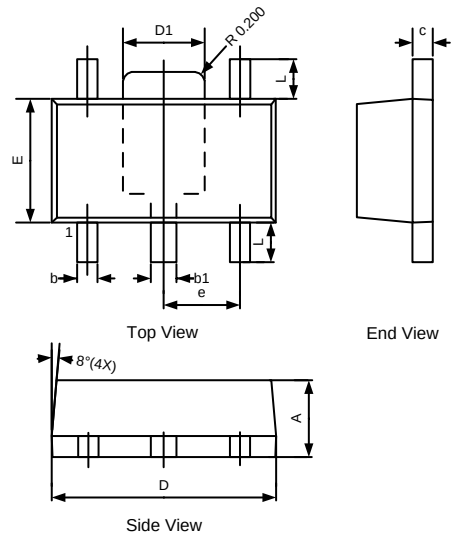


Figure 2. Adjustable Output Voltage Application Circuit

Package Information

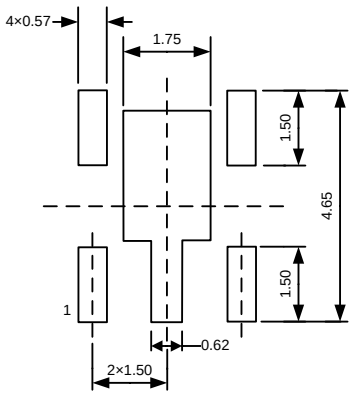
UM1770Y-xx SOT89-5

Outline Drawing



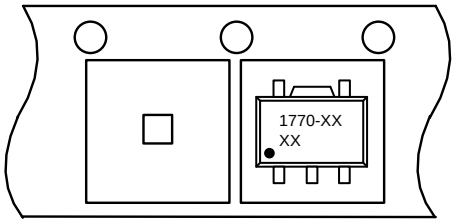
DIMENSIONS				
Symbol	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.40	1.60	0.056	0.064
c	0.35	0.44	0.014	0.018
D	4.40	4.60	0.176	0.184
E	2.35	2.60	0.094	0.104
D1	1.40	1.83	0.056	0.073
b	0.35	0.54	0.014	0.022
b1	0.40	0.62	0.016	0.025
e	1.50TYP		0.060TYP	
L	0.65	1.10	0.026	0.044

Land Pattern



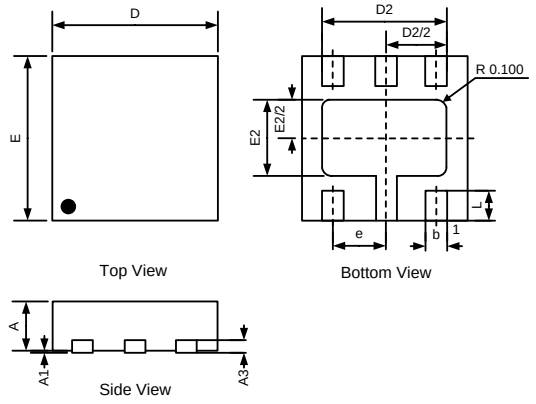
NOTES:
1. Compound dimension: 4.50×2.48;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



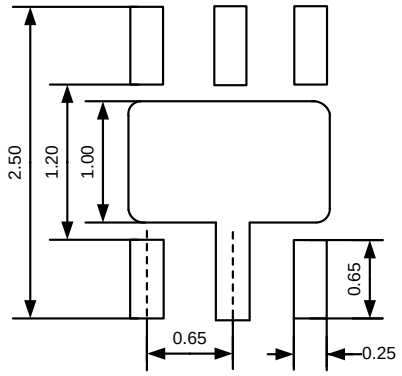
UM1770DA-xx DFN6 2.0×2.0

Outline Drawing



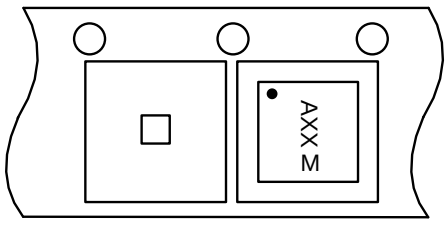
DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	0.57	0.60	0.63	0.023	0.024	0.025
A1	0.00	0.03	0.05	0.000	0.001	0.002
A3	0.15TYP			0.006TYP		
b	0.20	0.25	0.30	0.008	0.010	0.012
D	1.95	2.00	2.075	0.078	0.080	0.083
D2	1.45	1.55	1.65	0.058	0.062	0.066
E	1.95	2.00	2.075	0.078	0.080	0.083
E2	0.76	0.86	0.96	0.030	0.034	0.038
e	0.65TYP			0.026TYP		
L	0.30	0.35	0.40	0.012	0.014	0.016

Land Pattern



NOTES:
1. Compound dimension: 2.00×2.00;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



IMPORTANT NOTICE

The information in this document has been carefully reviewed and is believed to be accurate. Nonetheless, this document is subject to change without notice. Union assumes no responsibility for any inaccuracies that may be contained in this document, and makes no commitment to update or to keep current the contained information, or to notify a person or organization of any update. Union reserves the right to make changes, at any time, in order to improve reliability, function or design and to attempt to supply the best product possible.

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