

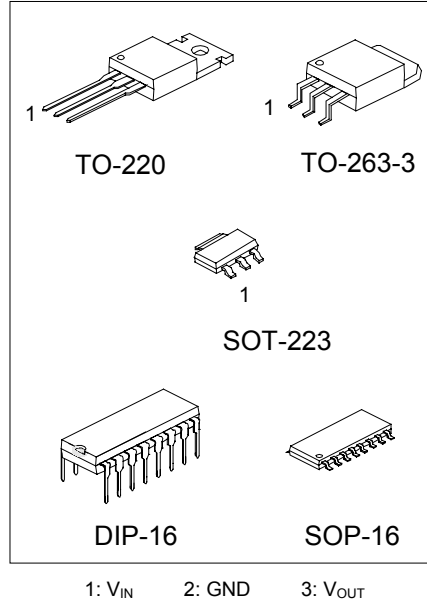
UTC LM2940 LINEAR INTEGRATED CIRCUIT

1A LOW-DROPOUT VOLTAGE REGULATOR

DESCRIPTION

The UTC LM2940 is a positive voltage regulator features the ability to source 1A of output current with a dropout voltage of typically 0.5V and a maximum of 1V over the entire temperature range. Furthermore, a quiescent current reduction circuit has been included which reduces the ground current when the differential between the input voltage and the output voltage exceeds approximately 3V. The quiescent current with 1A of output current and an input-output differential of 5V is therefore only 30mA. Higher quiescent currents only exist when the regulator is in the dropout mode ($V_{IN}-V_{OUT} \leq 3V$).

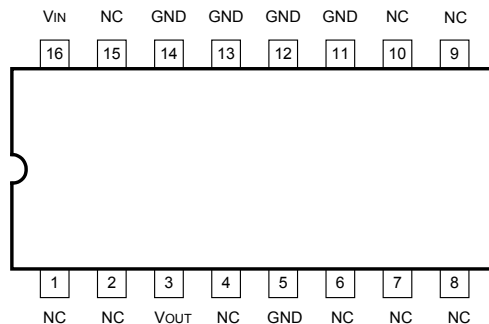
Designed also for vehicular applications, the UTC LM2940 is protected from reverse battery installations or 2-battery jumps. During line transients, such as load dump when the input voltage can momentarily exceed the specified maximum operating voltage, the regulator will automatically shut down to protect both the internal circuits and the load. The UTC LM2940 cannot be harmed by temporary mirror-image insertion. Familiar regulator features such as short circuit and thermal overload protection are also provided.



FEATURES

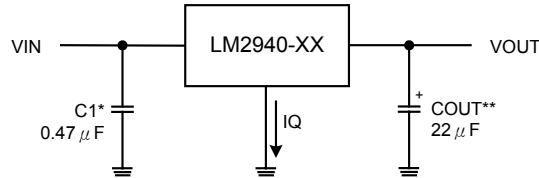
- *Dropout voltage typically 0.5V @ $I_o=1A$
- *Output current in excess of 1A
- *Output voltage trimmed before assembly
- *Reverse battery protection
- *Internal short circuit current limit
- *Mirror image insertion protection
- *P* Product Enhancement tested.

PIN CONFIGURATIONS (16 PIN)



UTC LM2940 LINEAR INTEGRATED CIRCUIT

TYPICAL APPLICATION



*Required if regulator is located far from power supply filter.

**C_{OUT} must be at least 22μF to maintain stability. May be increased without bound to maintain regulation during transients. Locate as close as possible to the regulator. This capacitor must be rated over the same operating temperature range as the regulator and the ESR is critical.

ABSOLUTE MAXIMUM RATINGS (Note 1)

PARAMETER	SYMBOL	VALUE	UNIT
Input Voltage	V _{IN}	26	V
Internal Power Dissipation (note 2)		Internally limited	
Operating temperature	T _{opr}		°C
TO-220/TO-263-3		-40 ~ +125	
SOT-223		-40 ~ +85	
DIP/SOP		-55 ~ +125	
Storage temperature	T _{stg}	-65 ~ +150	°C
Maximum Junction Temperature	T _j	150	°C
ESD Susceptibility (note 3)		2	kV

UTC LM2940-5.0V ELECTRICAL CHARACTERISTICS

(T_A=T_J=25°C, V_{IN}=V_O+5V, I_O=1A and C_O=22μF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V _O	6.25V ≤ V _{IN} ≤ 26V, 5mA ≤ I _O ≤ 1A	4.85	5.00	5.15	V
Line regulation	ΔV _O	V _O +2V ≤ V _{IN} ≤ 26V, I _O =5mA		20	50	mV
Load Regulation	ΔV _O	50mA ≤ I _O ≤ 1A		35	50	mV
Output Impedance	R _O	100 mADC and 20mArms, f _O =120Hz		35		mΩ
Quiescent Current	I _Q	V _O +2V ≤ V _{IN} ≤ 26V, I _O =5mA		10	15	mA
		V _{IN} = V _O +5V, I _O =1A		30	45	
Output Noise Voltage	V _{NOISE}	10Hz-100kHz, I _O =5mA		150		μVrms
Ripple Rejection	RR	f _O =120Hz, 1Vrms, I _O =100mA	60	72		dB
Long Term Stability				20		mV/ 1000Hr
Dropout Voltage	V _d	I _O =1A		0.5	0.8	V
		I _O =100mA		0.11	0.15	
Short Circuit Current	I _S	(note 4)	1.6	1.9		A
Maximum Line Transient	T _{IN}	R _O =100Ω, T _S ≤100ms	60	75		V
Reverse Polarity DC Input Voltage	V _{RIN}	R _O =100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V _{TRRI}	R _O =100Ω, T _S ≤100ms	-50	-75		V

UTC LM2940 LINEAR INTEGRATED CIRCUIT

UTC LM2940-8.0V ELECTRICAL CHARACTERISTICS

($T_A=T_J=25^\circ\text{C}$, $V_{IN}=V_O+5\text{V}$, $I_O=1\text{A}$ and $C_O=22\mu\text{F}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$9.4\text{V} \leq V_{IN} \leq 26\text{V}$, $5\text{mA} \leq I_O \leq 1\text{A}$	7.76	8.00	8.24	V
Line regulation	ΔV_O	$V_O+2\text{V} \leq V_{IN} \leq 26\text{V}$, $I_O=5\text{mA}$		20	80	mV
Load Regulation	ΔV_O	$50\text{mA} \leq I_O \leq 1\text{A}$		55	80	mV
Output Impedance	R_O	100 mADC and 20mA _{rms} , $f_o=120\text{Hz}$		55		m Ω
Quiescent Current	I_Q	$V_O+2\text{V} \leq V_{IN} \leq 26\text{V}$, $I_O=5\text{mA}$		10	15	mA
		$V_{IN}=V_O+5\text{V}$, $I_O=1\text{A}$		30	45	
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, $I_O=5\text{mA}$		240		μV_{rms}
Ripple Rejection	RR	$f_o=120\text{Hz}$, 1V _{rms} , $I_O=100\text{mA}$	54	66		dB
Long Term Stability				32		mV/ 1000Hr
Dropout Voltage	V_d	$I_O=1\text{A}$		0.5	0.8	V
		$I_O=100\text{mA}$		0.11	0.15	
Short Circuit Current	I_S	(note 4)	1.6	1.9		A
Maximum Line Transient	T_{IN}	$R_O=100\Omega$, $T \leq 100\text{ms}$	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	$R_O=100\Omega$	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	$R_O=100\Omega$, $T \leq 100\text{ms}$	-50	-75		V

UTC LM2940-9.0V ELECTRICAL CHARACTERISTICS

($T_A=T_J=25^\circ\text{C}$, $V_{IN}=V_O+5\text{V}$, $I_O=1\text{A}$ and $C_O=22\mu\text{F}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$10.5\text{V} \leq V_{IN} \leq 26\text{V}$, $5\text{mA} \leq I_O \leq 1\text{A}$	8.73	9.00	9.27	V
Line regulation	ΔV_O	$V_O+2\text{V} \leq V_{IN} \leq 26\text{V}$, $I_O=5\text{mA}$		20	90	mV
Load Regulation	ΔV_O	$50\text{mA} \leq I_O \leq 1\text{A}$		60	90	mV
Output Impedance	R_O	100 mADC and 20mA _{rms} , $f_o=120\text{Hz}$		60		m Ω
Quiescent Current	I_Q	$V_O+2\text{V} \leq V_{IN} \leq 26\text{V}$, $I_O=5\text{mA}$		10	15	mA
		$V_{IN}=V_O+5\text{V}$, $I_O=1\text{A}$		30	45	
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, $I_O=5\text{mA}$		270		μV_{rms}
Ripple Rejection	RR	$f_o=120\text{Hz}$, 1V _{rms} , $I_O=100\text{mA}$	52	64		dB
Long Term Stability				34		mV/ 1000Hr
Dropout Voltage	V_d	$I_O=1\text{A}$		0.5	0.8	V
		$I_O=100\text{mA}$		0.11	0.15	
Short Circuit Current	I_S	(note 4)	1.6	1.9		A
Maximum Line Transient	T_{IN}	$R_O=100\Omega$, $T \leq 100\text{ms}$	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	$R_O=100\Omega$	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	$R_O=100\Omega$, $T \leq 100\text{ms}$	-50	-75		V

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UTC LM2940-10V ELECTRICAL CHARACTERISTICS

($T_A=T_J=25^{\circ}\text{C}$, $V_{IN}=V_O+5\text{V}$, $I_O=1\text{A}$ and $C_O=22\mu\text{F}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$11.5\text{V} \leq V_{IN} \leq 26\text{V}$, $5\text{mA} \leq I_O \leq 1\text{A}$	9.70	10.00	10.30	V
Line regulation	ΔV_O	$V_O+2\text{V} \leq V_{IN} \leq 26\text{V}$, $I_O=5\text{mA}$		20	100	mV
Load Regulation	ΔV_O	$50\text{mA} \leq I_O \leq 1\text{A}$		65	100	mV
Output Impedance	R_O	100 mADC and 20mA _{rms} , $f_o=120\text{Hz}$		65		m Ω
Quiescent Current	I_Q	$V_O+2\text{V} \leq V_{IN} \leq 26\text{V}$, $I_O=5\text{mA}$		10	15	mA
		$V_{IN}=V_O+5\text{V}$, $I_O=1\text{A}$		30	45	
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, $I_O=5\text{mA}$		300		μV_{rms}
Ripple Rejection	RR	$f_o=120\text{Hz}$, 1V _{rms} , $I_O=100\text{mA}$	51	63		dB
Long Term Stability				36		mV/ 1000Hr
Dropout Voltage	V_d	$I_O=1\text{A}$		0.5	0.8	V
		$I_O=100\text{mA}$		0.11	0.15	
Short Circuit Current	I_S	(note 4)	1.6	1.9		A
Maximum Line Transient	T_{IN}	$R_O=100\Omega$, $T_s \leq 100\text{ms}$	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	$R_O=100\Omega$	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	$R_O=100\Omega$, $T_s \leq 100\text{ms}$	-50	-75		V

UTC LM2940-12V ELECTRICAL CHARACTERISTICS

($T_A=T_J=25^{\circ}\text{C}$, $V_{IN}=V_O+5\text{V}$, $I_O=1\text{A}$ and $C_O=22\mu\text{F}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$13.6\text{V} \leq V_{IN} \leq 26\text{V}$, $5\text{mA} \leq I_O \leq 1\text{A}$	11.64	12.00	12.36	V
Line regulation	ΔV_O	$V_O+2\text{V} \leq V_{IN} \leq 26\text{V}$, $I_O=5\text{mA}$		20	120	mV
Load Regulation	ΔV_O	$50\text{mA} \leq I_O \leq 1\text{A}$		55	120	mV
Output Impedance	R_O	100 mADC and 20mA _{rms} , $f_o=120\text{Hz}$		80		m Ω
Quiescent Current	I_Q	$V_O+2\text{V} \leq V_{IN} \leq 26\text{V}$, $I_O=5\text{mA}$		10	15	mA
		$V_{IN}=V_O+5\text{V}$, $I_O=1\text{A}$		30	45	
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, $I_O=5\text{mA}$		360		μV_{rms}
Ripple Rejection	RR	$f_o=120\text{Hz}$, 1V _{rms} , $I_O=100\text{mA}$	54	66		dB
Long Term Stability				48		mV/ 1000Hr
Dropout Voltage	V_d	$I_O=1\text{A}$		0.5	0.8	V
		$I_O=100\text{mA}$		0.11	0.15	
Short Circuit Current	I_S	(note 4)	1.6	1.9		A
Maximum Line Transient	T_{IN}	$R_O=100\Omega$, $T_s \leq 100\text{ms}$	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	$R_O=100\Omega$	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	$R_O=100\Omega$, $T_s \leq 100\text{ms}$	-50	-75		V

UTC LM2940 LINEAR INTEGRATED CIRCUIT

UTC LM2940-15V ELECTRICAL CHARACTERISTICS

($T_A=T_J=25^\circ\text{C}$, $V_{IN}=V_O+5\text{V}$, $I_O=1\text{A}$ and $C_O=22\mu\text{F}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$16.75\text{V} \leq V_{IN} \leq 26\text{V}$, $5\text{mA} \leq I_O \leq 1\text{A}$	14.55	15.00	15.45	V
Line regulation	ΔV_O	$V_O+2\text{V} \leq V_{IN} \leq 26\text{V}$, $I_O=5\text{mA}$		20	150	mV
Load Regulation	ΔV_O	$50\text{mA} \leq I_O \leq 1\text{A}$		70	150	mV
Output Impedance	R_O	100 mADC and 20mA _{rms} , $f_o=120\text{Hz}$		100		m Ω
Quiescent Current	I_Q	$V_O+2\text{V} \leq V_{IN} \leq 26\text{V}$, $I_O=5\text{mA}$		10	15	mA
		$V_{IN}=V_O+5\text{V}$, $I_O=1\text{A}$		30	45	
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, $I_O=5\text{mA}$		450		μV_{rms}
Ripple Rejection	RR	$f_o=120\text{Hz}$, 1V _{rms} , $I_O=100\text{mA}$	52	64		dB
Long Term Stability				60		mV/ 1000Hr
Dropout Voltage	V_d	$I_O=1\text{A}$		0.5	0.8	V
		$I_O=100\text{mA}$		0.11	0.15	
Short Circuit Current	I_S	(note 4)	1.6	1.9		A
Maximum Line Transient	T_{IN}	$R_O=100\Omega$, $T \leq 100\text{ms}$	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	$R_O=100\Omega$	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	$R_O=100\Omega$, $T \leq 100\text{ms}$	-50	-75		V

Note 1: Absolute Maximum Ratings are limits beyond which damage to the device may occur. Operating Conditions are conditions under which the device functions but the specifications might not be guaranteed. For guaranteed specifications and test conditions see the Electrical Characteristics.

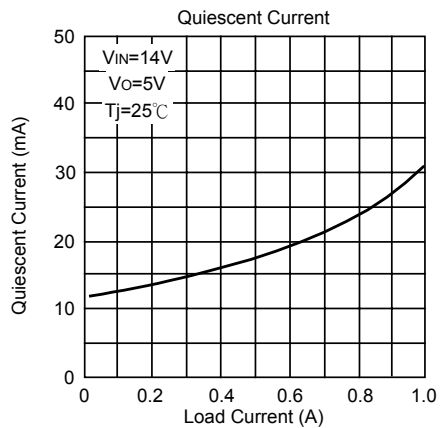
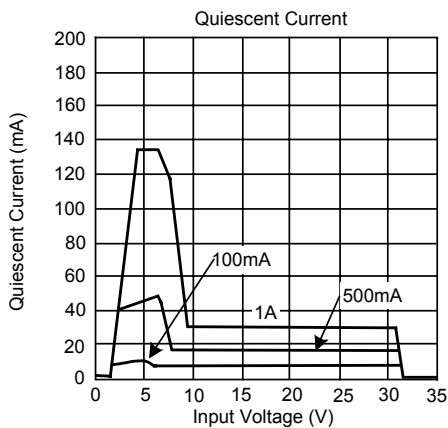
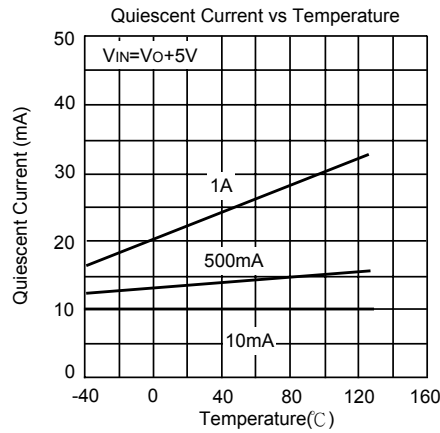
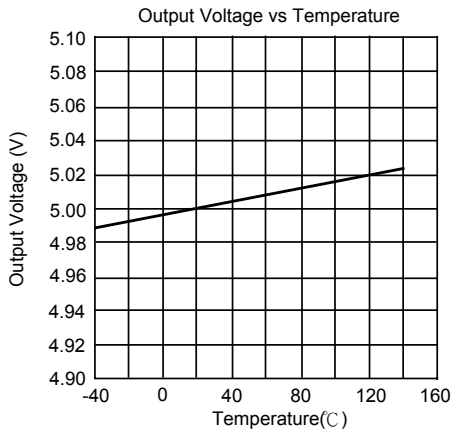
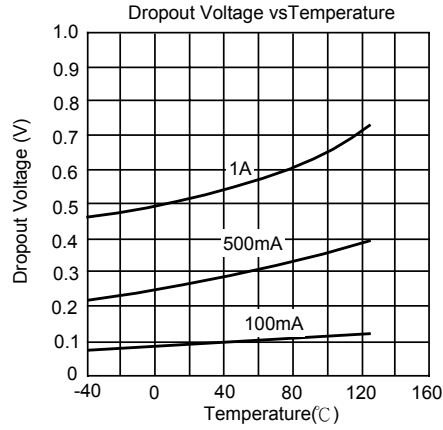
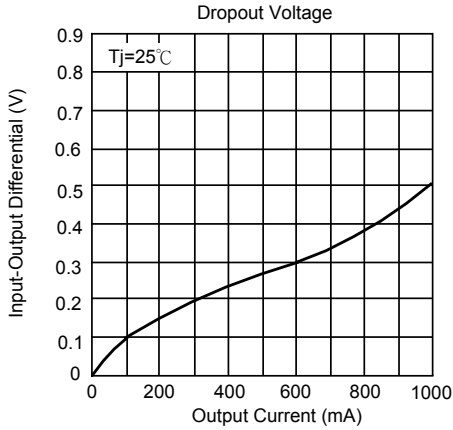
Note 2: The maximum allowable power dissipation is a function of the maximum junction temperature, T_J , the junction to ambient thermal resistance, θ_{JA} , and the ambient temperature, T_A . Exceeding the maximum allowable power dissipation will cause excessive die temperature, and the regulator will go into thermal shutdown. The value of θ_{JA} (for devices in still air with no heatsink) is 60°C/W for the TO-220 package, 80°C/W for the TO-263-3 package, and 174°C/W for SOT-223 package. The effective value of θ_{JA} can be reduced by using a heatsink.

Note 3: ESD rating is based on the human body model, 100pF discharged through 1.5k Ω .

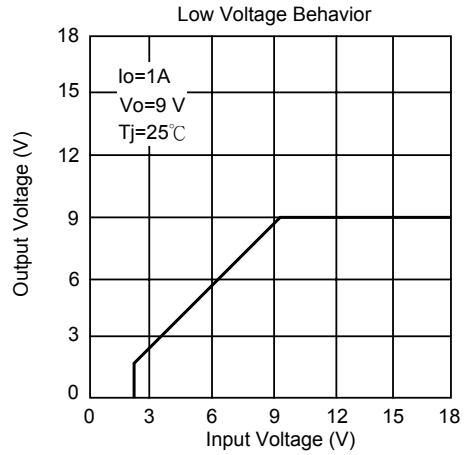
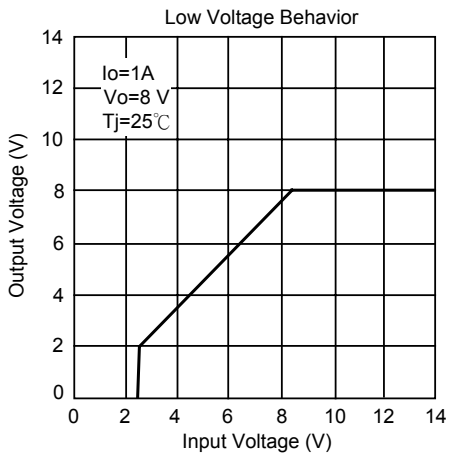
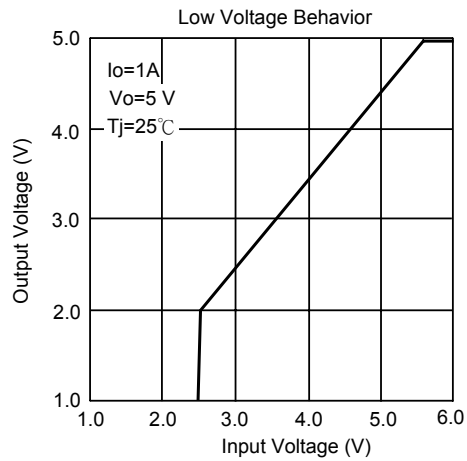
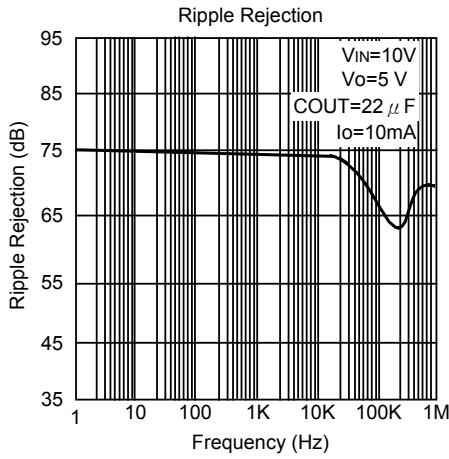
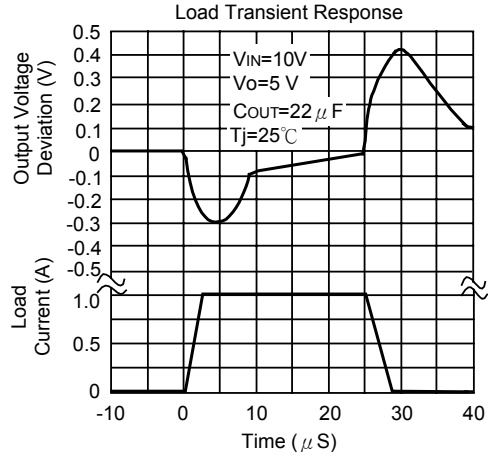
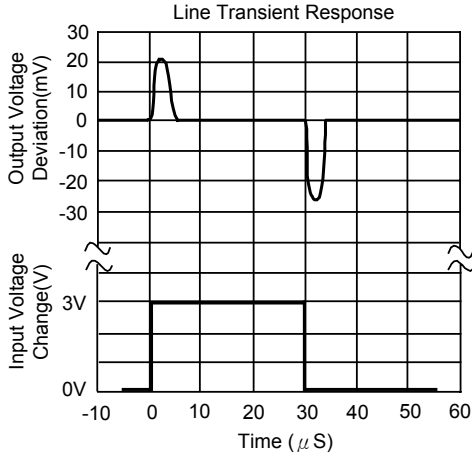
Note 4: Output current will decrease with increasing temperature but will not drop below 1A at the maximum specified temperature.

UTC LM2940 LINEAR INTEGRATED CIRCUIT

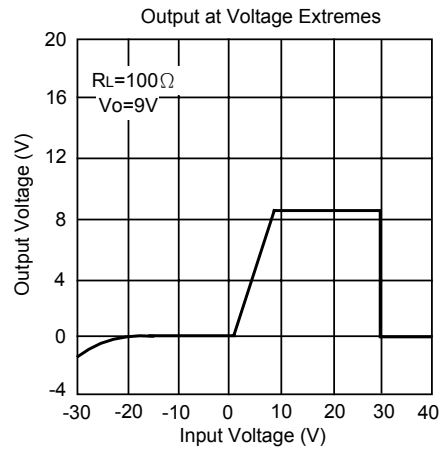
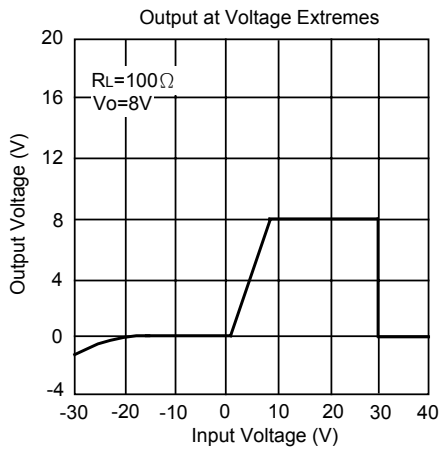
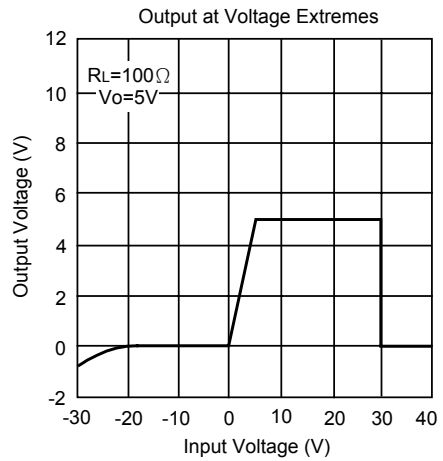
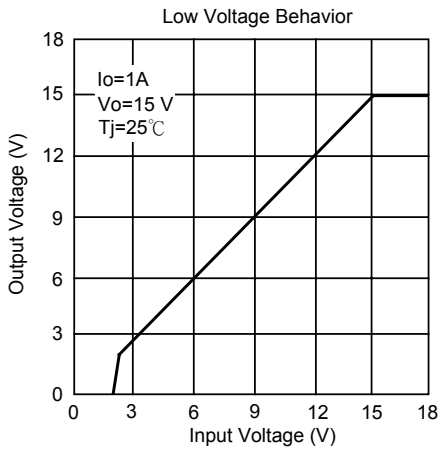
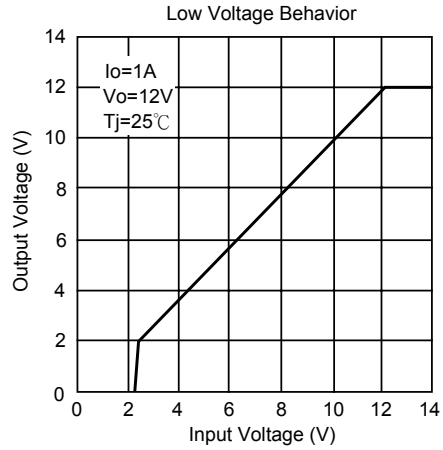
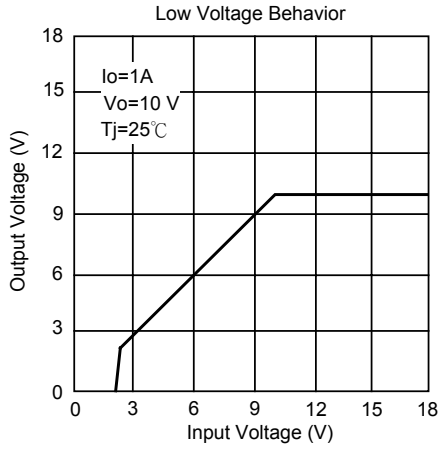
TYPICAL PERFORMANCE CHARACTERISTICS



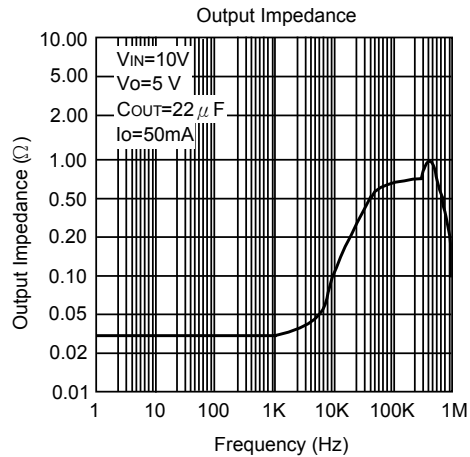
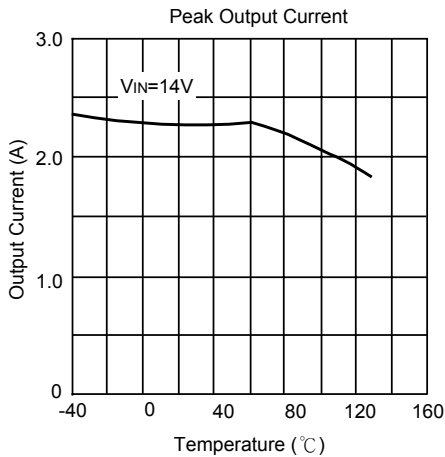
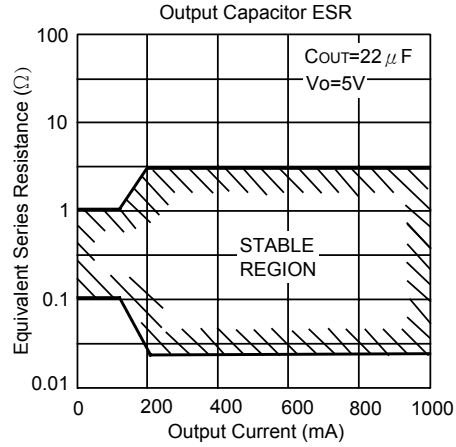
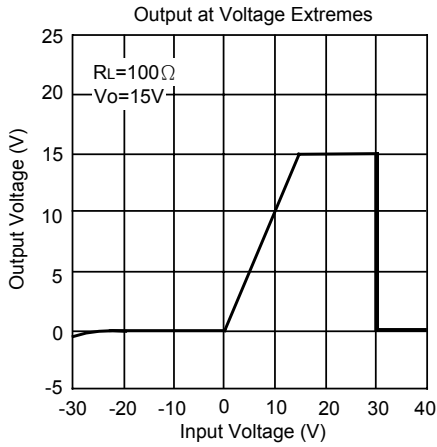
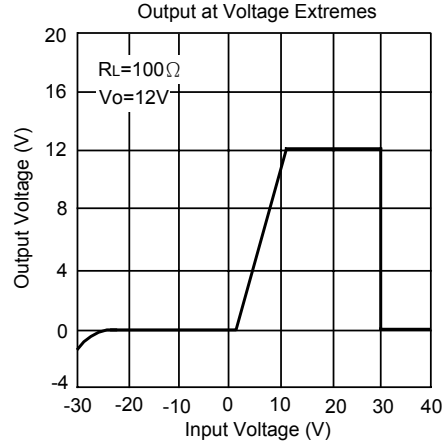
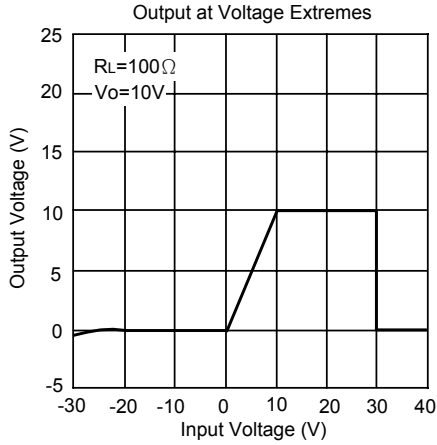
UTC LM2940 LINEAR INTEGRATED CIRCUIT



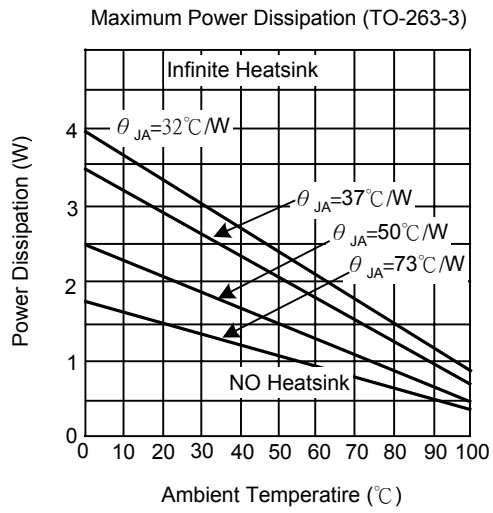
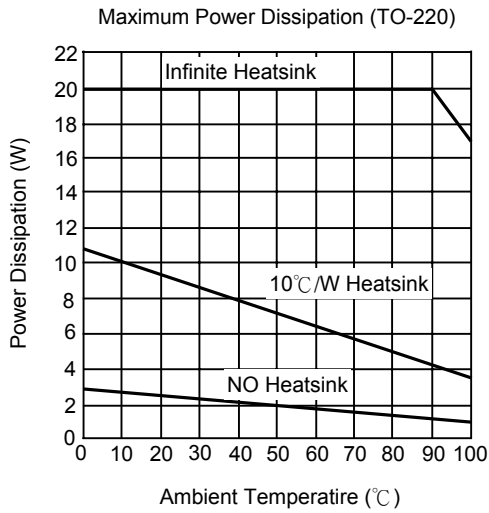
UTCLM2940 LINEAR INTEGRATED CIRCUIT



UTCLM2940 LINEAR INTEGRATED CIRCUIT



UTC LM2940 LINEAR INTEGRATED CIRCUIT



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