

POWER MANAGEMENT

Description

The SC1131/2/3/4 incorporates a high current low dropout linear regulator section together with a switching voltage-mode controller. This unique combination is well suited for high current low voltage power supply applications such as the Intel Pentium™ P55, AMD K6 and the Cyrix M2 processors. The SC113X was designed to reduce the number of components required to design a dual power supply for multivoltage processor applications.

Switching Controller Section: The switching control section is a voltage mode controller designed for high current, low voltage power supply applications. Key features include a temperature compensated voltage reference, triangular oscillator and an internally compensated transconductance error amplifier. The switching controller operates at a fixed frequency of 200kHz, providing an optimum compromise between size, efficiency and cost in the intended application areas.

Linear Section: The linear portion is a high performance positive voltage regulator designed for use in applications requiring “very low dropout performance” at 1.5, 3, 5 and 7.5 Amps. Additionally, the linear section provides excellent regulation over variations due to changes in line, load or temperature.

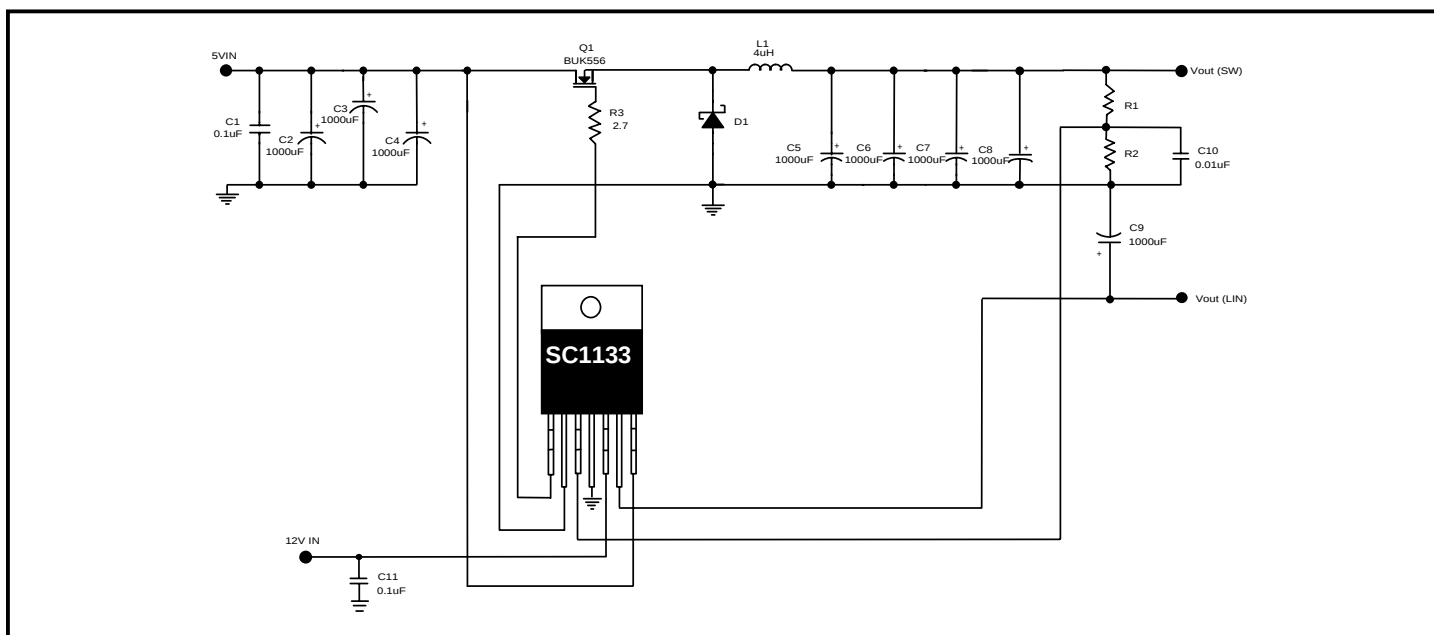
Features

- ◆ 85% typical efficiency for switching section
- ◆ Grounded tab
- ◆ 1.5, 2.5 or 3.3V @ 1% for linear section
- ◆ Thermal shutdown
- ◆ Internal short circuit protection (LDO)
- ◆ 7 pin TO-220 package

Applications

- ◆ Microprocessor supplies
- ◆ Modules supplies
- ◆ 1.3V to 3.5V power supplies
- ◆ Dual power supplies from 5V source

Typical Application Circuit



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Absolute Maximum Ratings

	V_{IN} to GND	-0.3V, 7V
	V_{CC} to GND	-0.3V, 15V
Operating Temperature	T_A	0°C to +70°C
Junction Operating Temperature	T_J	0°C to +125°C
Storage Temperature	T_S	-65°C to +125°C
Lead Soldering Temperature	T_L	260°C, 10 sec.
Thermal Resistance, Junction to Case	θ_{JC}	2°C/W
Thermal Resistance, Junction to Ambient	θ_{JA}	50°C/W

Electrical Characteristics

Switching Control Section

$V_{CC} = 12V$; $V_{IN} = 5.0V$; GND = P_{GND} = 0V; $V_{OUT} = 2.8V$. Per application circuit unless otherwise specified

Symbol	Parameter	Conditions	Temp	Min	Typ	Max	Units
I_{CC}	Total Quiescent Current	Linear out = No Load	25°C		15	25	mA
V_{REF}	Reference Voltage		25°C	1.238	1.250	1.263	V
			0-125°C	1.225	1.250	1.275	
Reg_{LOAD}	Load Regulation		25°C			1	%
Reg_{LINE}	Line Regulation		25°C		0.5		%
DH_{HI}	MOSFET Driver Source Voltage	$V_{CC} - DH$; $I_{DH} = 0.5A$	25°C		1.6		V
DH_{LOW}	MOSFET Driver Sink Voltage	$DH - P_{GND}$; $I_{DH} = 0.5A$	25°C		1.1		V
f_{OSC}	Oscillator Frequency		25°C	180	200	220	kHz
dc	Duty Cycle (maximum)		25°C	90	95		%

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Electrical Characteristics (Cont.)
Linear Section

$V_{CC} = 12V$; $V_{IN} = 5.0V$; $GND = P_{GND} = 0V$; $V_{OUT} = 3.3V$. Per application circuit unless otherwise specified.

Parameter	Symbol	V_{IN}	I_o	$T_J^{(4)}$	Min	Typ	Max	Units
Output Voltage Fixed Voltage Version	V_O	5V	0mA	25°C	-1%	V_{OUT}	+1%	V
				O.T.	-2%	V_{OUT}	+2%	
Reference Voltage Adj Voltage Version	V_{REF}	5V	10mA	25°C	1.238	1.250	1.262	V
				O.T.	1.225	1.250	1.275	
Line Regulation Fixed Voltage Version Adj Voltage Version	$REG_{(LINE)}$		0mA	25°C		0.005	0.2	%
				O.T.		0.035	0.2	
			10mA					
Load Regulation ⁽¹⁾	$REG_{(LOAD)}$	I_R		25°C		0.05	0.3	%
				O.T.		0.2	0.4	
Dropout Voltage ⁽²⁾	V_D			25°C		1		V
				O.T.		1.1	1.3	
Quiescent Current Fixed Voltage Version	I_Q	5V		O.T.		10	13	mA
Temperature Coefficient	T_C			O.T.		0.004	0.02	%/°C

NOTES:

(1) I_R = Rated load current per ordering information

(2) Minimum input/output voltage required to maintain 1% regulation

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Pin Configuration



Pin #	Pin Name	Function
1	DH	MOSFET Driver Output
2	P _{GND}	Switching Power Ground
3	V _O _{SENSE}	Error Amplifier Input (Switcher)
4	GND	Signal Ground
5	V _{CC}	+12V Input Voltage
6	V _{OUT}	V _{OUT} (Linerar Section)
7	V _{IN}	+5V Input Voltage

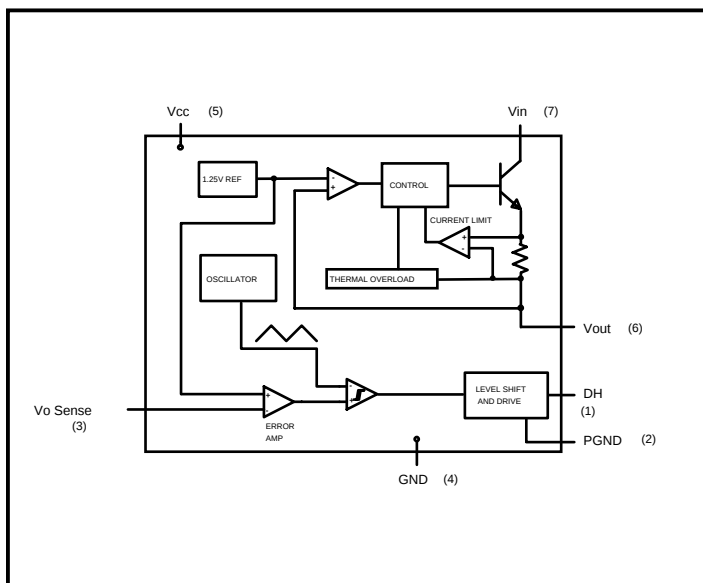
Ordering Information

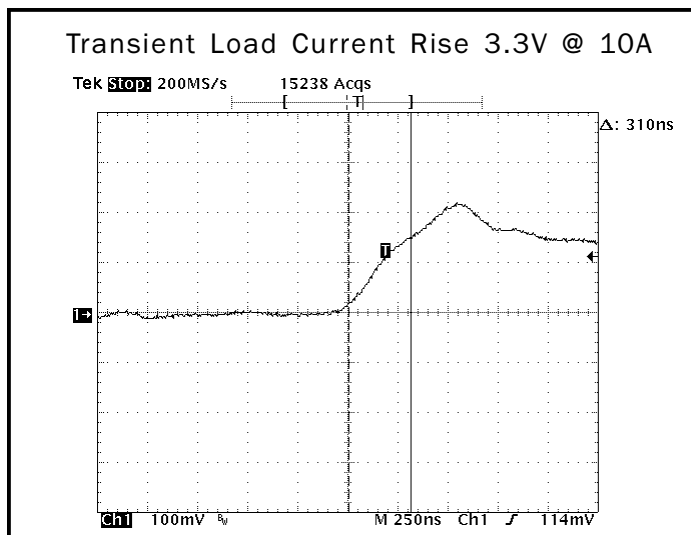
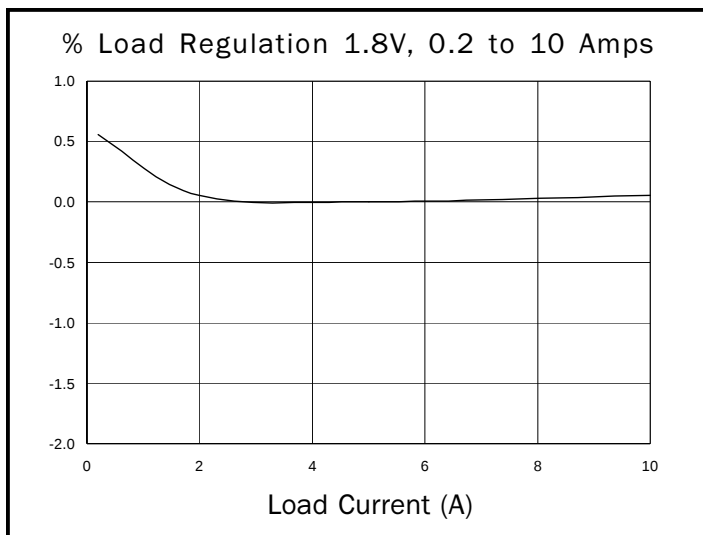
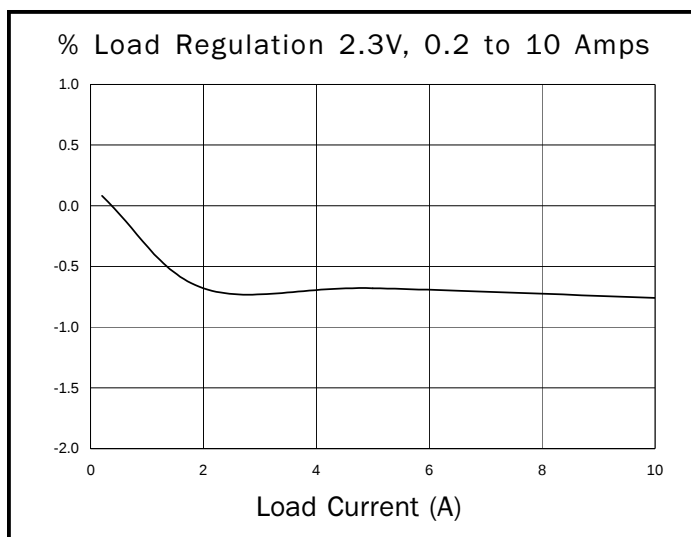
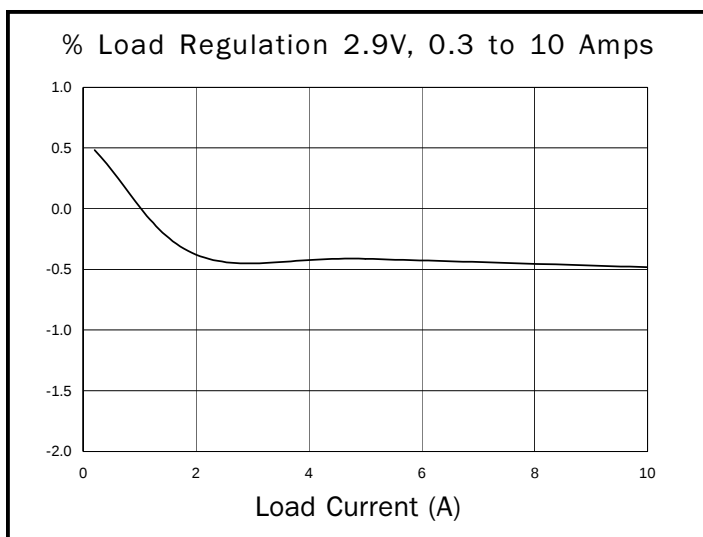
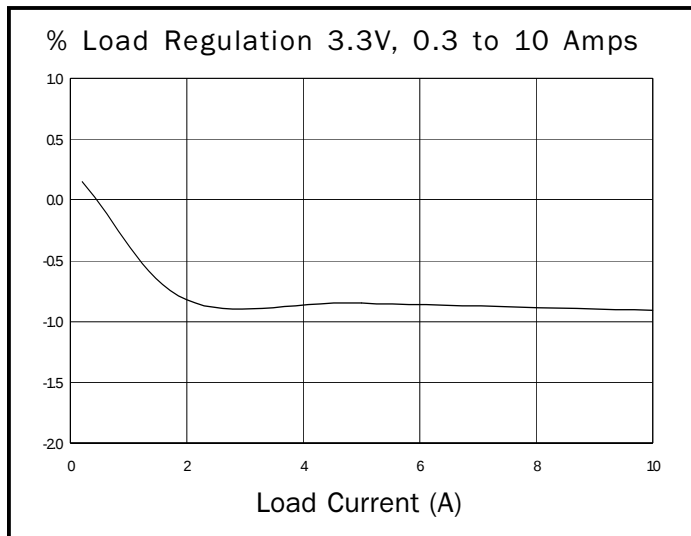
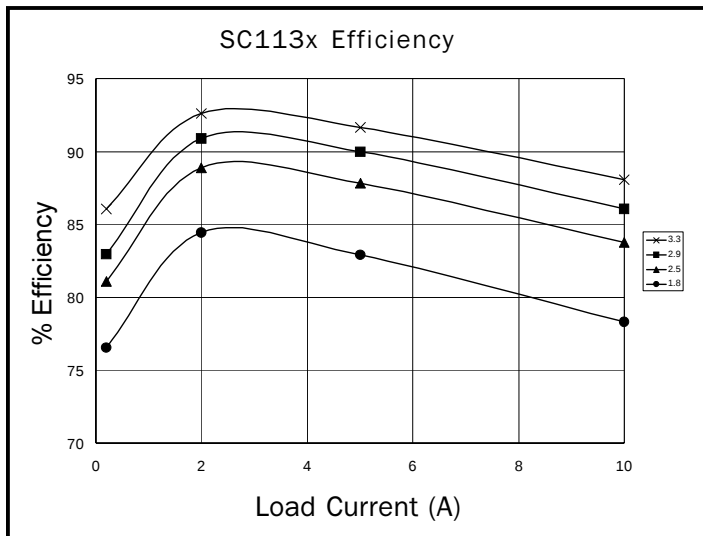
Part Number ⁽¹⁾	Package	Output Current
SC1131CT-XY	TO-220	1.5A
SC1132CT-XY	TO-220	3.0A
SC1133CT-XY	TO-220	5.0A
SC1134CT-XY	TO-220	7.5A

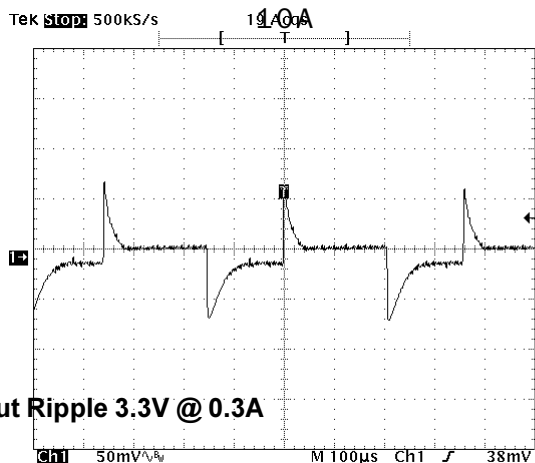
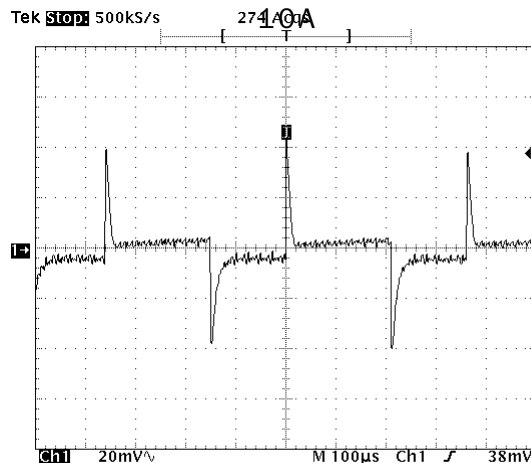
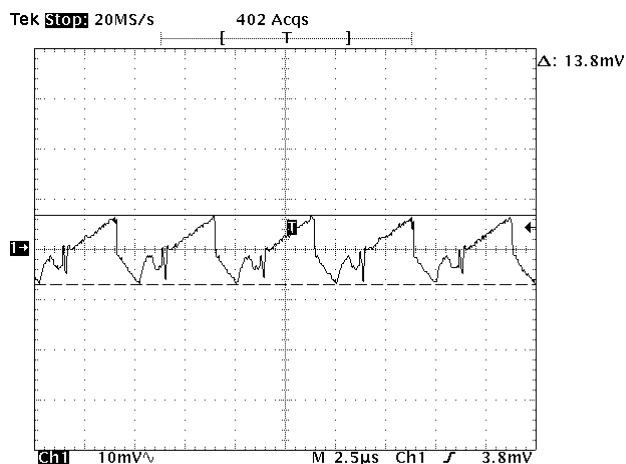
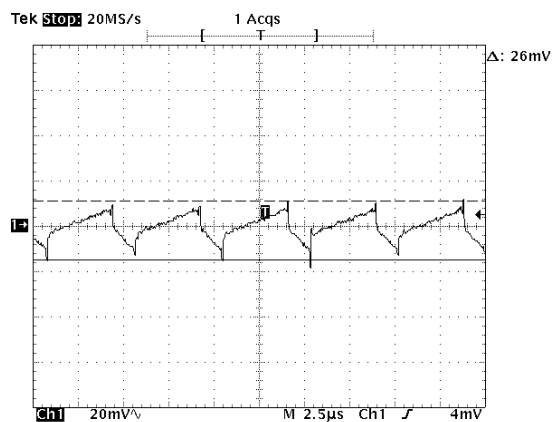
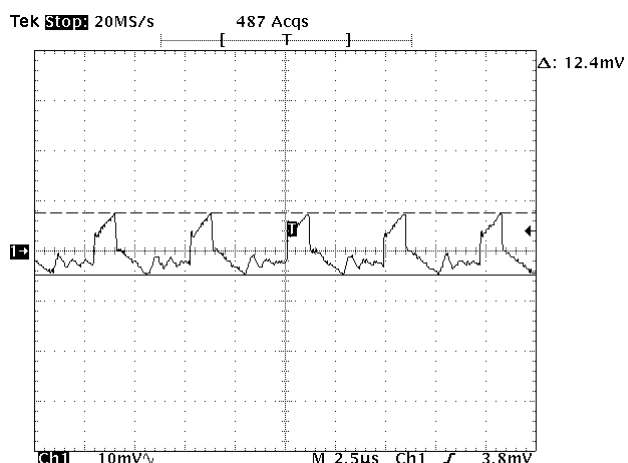
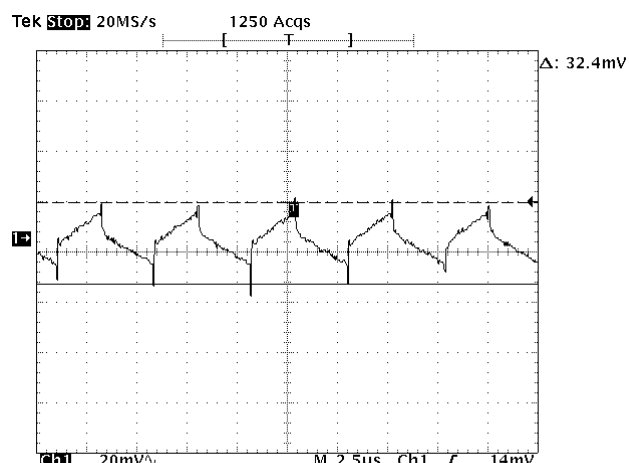
Note:

(1) Where XY denotes voltage options and lead configurations. Available voltages (X) are: 1.5V, 2.5V and 3.3V. Available lead configurations (Y) are dual bend (DB), single bend (SB) and straight leads (leave blank). Sample part number: SC1133CT-2.5DB.

Block Diagram

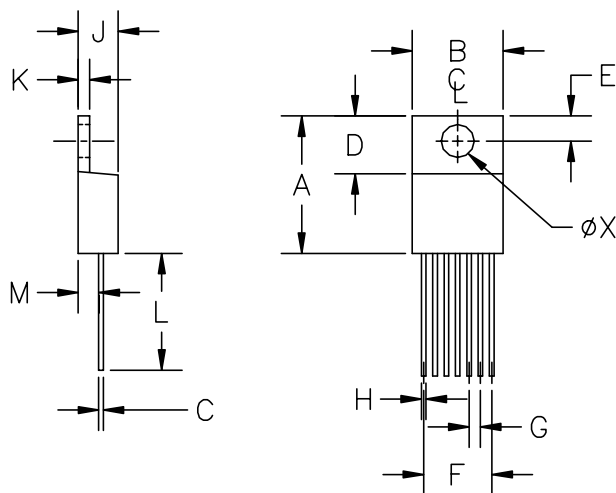


POWER MANAGEMENT
Typical Characteristics


POWER MANAGEMENT
Transient Voltage Response 3.3V From 0.3 to

Transient Voltage Response 1.8V From 0.2 to

Output Ripple 3.3V @ 0.3A

Output Ripple 1.8V @ 0.2A

Output Ripple 3.3V @ 10A

Output Ripple 1.8V @ 10A


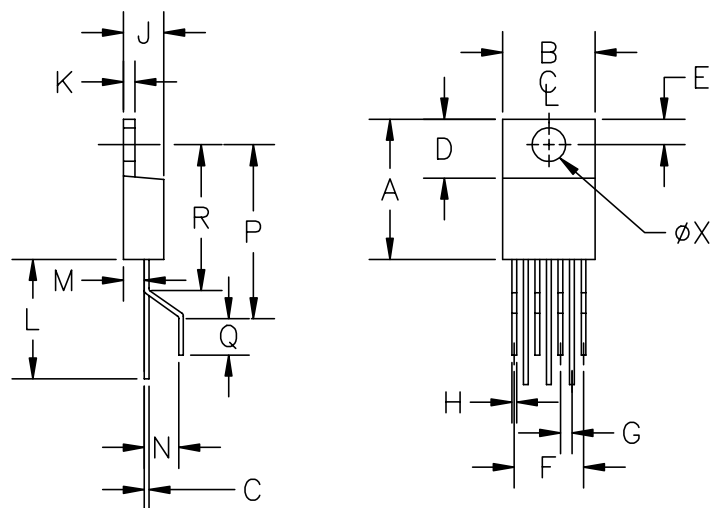
POWER MANAGEMENT
Evaluation Board Bill of Materials

Quantity	Reference	Part/Description	Vendor	Notes
1	C1, C11	0.1 μ F Ceramic	Various	
1	C10	0.01 μ F Ceramic	Various	
8	C2-C9	1000 μ F/6.3V	SANYO	MV-AX or equiv. LowESR
1	D1	32CTQ030	Various	16A, 30V Schottky, TO-220
1	L1	4 μ H		8 Turns 16AWG on MICROMETALS T50-52D core
1	Q1	BUK556	PHILIPS	Logic level FET, $\leq 22\text{m}\Omega$, 30V
1	U1	SC1133T-XY	SEMTECH	5A Linear Regulator with Switching Controller
1	R1	SMT 1%	Various	Value depends on V_{OUT}
1	R2	SMT 1%	Various	Value depends on V_{OUT}
1	R3	2.7 Ω 1/8W	Various	

Outline Drawing - TO-220 (Straight Lead)


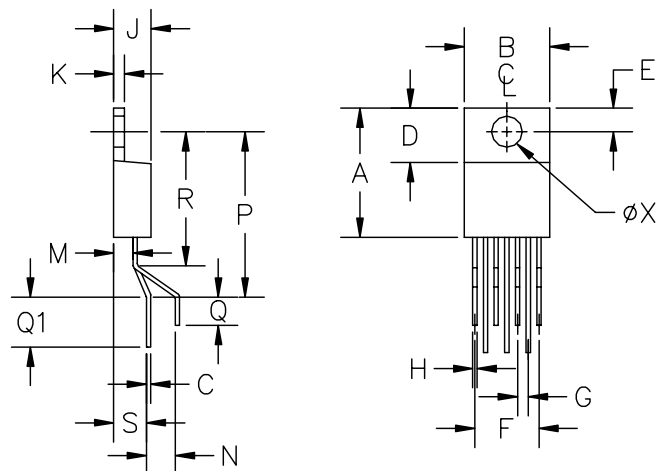
DIMENSIONS					
DIM ^N	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.590	.660	14.22	14.99	—
B	.385	.415	9.78	10.54	—
C	.015	.022	0.38	0.56	—
D	.234	.258	5.94	6.55	—
E	.103	.113	2.62	2.87	—
F	.295	.305	7.49	7.75	—
G	.045	.055	1.14	1.40	—
H	.023	.037	.058	0.94	—
J	.160	.190	4.06	4.83	—
K	.045	.055	1.14	1.40	—
L	.580	.640	13.72	14.22	—
M	.090	.115	2.29	2.92	—
ØX	.146	.156	3.71	3.96	—

① CONTROLLING DIMENSION : INCHES.

POWER MANAGEMENT
Outline Drawing - TO-220 (Single Bend Lead)


DIMENSIONS					
DIM ^N	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.560	.590	14.22	14.99	—
B	.385	.415	9.78	10.54	—
C	.015	.022	0.38	0.56	—
D	.234	.258	5.94	6.55	—
E	.103	.113	2.62	2.87	—
F	.295	.305	7.49	7.75	—
G	.045	.055	1.14	1.40	—
H	.023	.035	.058	0.89	—
J	.160	.190	4.06	4.83	—
K	.045	.055	1.14	1.40	—
L	.540	.560	13.72	14.22	—
M	.090	.115	2.29	2.92	—
N	.205	.225	5.21	5.72	—
P	.745	.765	18.92	19.43	—
Q	.155	.175	3.94	4.45	—
R	.605	.625	15.37	15.88	—
ØX	.146	.156	3.71	3.96	—

① CONTROLLING DIMENSION : INCHES.

Outline Drawing - TO-220 (Dual Bend Lead)


DIMENSIONS					
DIM ^N	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.560	.590	14.22	14.99	—
B	.385	.415	9.78	10.54	—
C	.015	.022	0.38	0.56	—
D	.234	.258	5.94	6.55	—
E	.103	.113	2.62	2.87	—
F	.295	.305	7.49	7.75	—
G	.045	.055	1.14	1.40	—
H	.023	.035	.058	0.89	—
J	.160	.190	4.06	4.83	—
K	.045	.055	1.14	1.40	—
M	.095	.115	2.413	2.921	—
N	.135	.165	3.429	4.191	—
P	.700	.728	17.78	18.49	—
Q	.152	.202	3.861	5.130	—
Q1	.260	.320	6.604	8.128	—
R	.620	—	15.75	—	TYP
S	.155	.190	3.937	4.826	—
ØX	.146	.156	3.71	3.96	—

① CONTROLLING DIMENSION : INCHES.

Contact Information

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