POSITIVE FIXED VOLTAGE REGULATOR

DESCRIPTION

The SG7800A/SG7800 series of positive regulators offer self contained, fixed-voltage capability with up to 1.5A of load current and input voltage up to 50V (SG7800A series only). These units feature a unique on-chip trimming system to set the output voltages to within±1.5% of nominal on the SG7800A series,±2.0% on the SG7800 series. The SG7800A versions also offer much improved line and load regulation characteristics. Utilizing an improved Bandgap reference design, problems have been eliminated that are normally associated with the Zener diode references, such as drift in output voltage and large changes in the line and load regulation.

All protective features of thermal shutdown, current limiting, and safe-area control have been designed into these units and since these regulators require only a small output capacitor for satisfactory performance, ease of application is assured.

Although designed as fixed-voltage regulators, the output voltage can be increased through the use of a simple voltage divider. The low quiescent drain current of the device insures good regulation when this method is used.

Product is available in hermetically sealed TO-257, TO-3, TO39 and LCC packages.

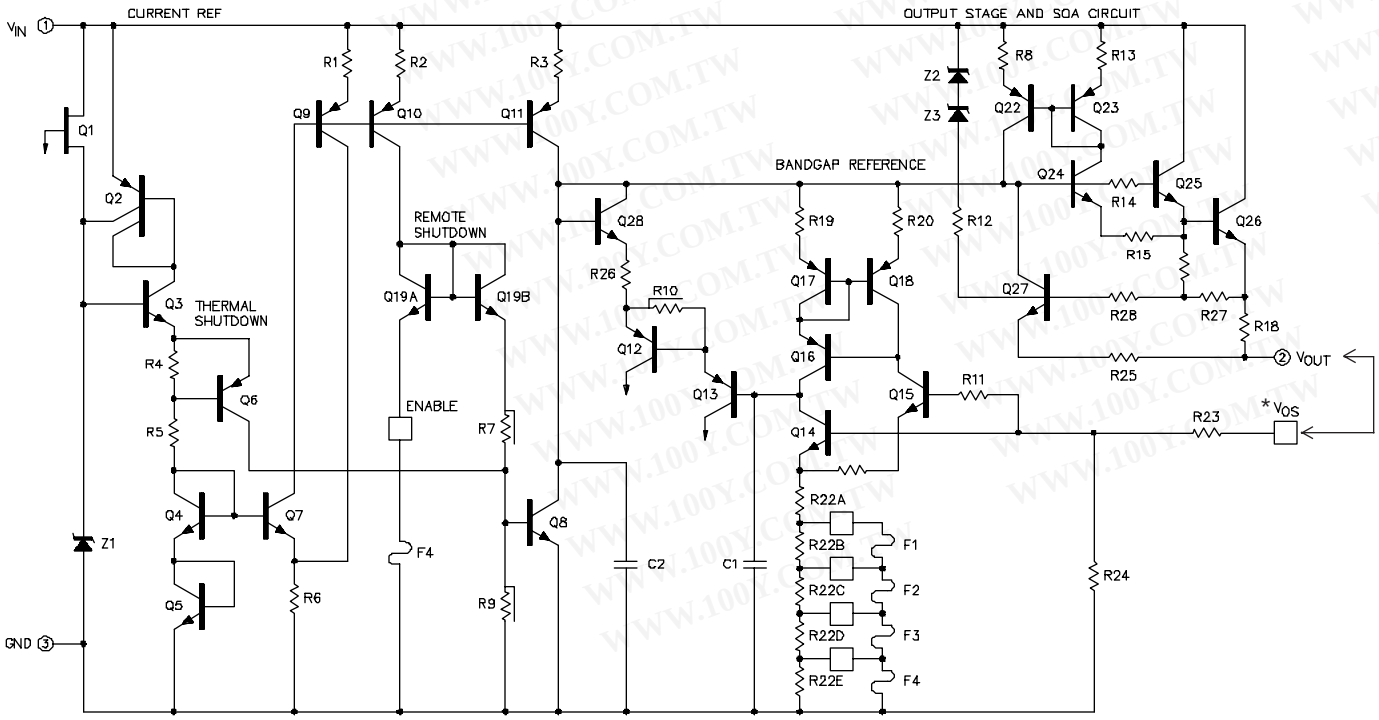
FEATURES

- **Output voltage set internally to ±1.5% on SG7800A**
- **Input voltage range to 50V max. on SG7800A**
- **Two volt input-output differential**
- **Excellent line and load regulation**
- **Foldback current limiting**
- **Thermal overload protection**
- **Voltages available: 5V, 12V, 15V**
- **Available in surface mount package**

HIGH RELIABILITY FEATURES - SG7800A/7800

- **Available to MIL-STD - 883**
- **MIL-M38510/10702BXA - JAN7805T**
- **MIL-M38510/10703BXA - JAN7812T**
- **MIL-M38510/10704BXA - JAN7815T**
- **MIL-M38510/10706BYA - JAN7805K**
- **MIL-M38510/10707BYA - JAN7812K**
- **MIL-M38510/10708BYA - JAN7815K**
- **Radiation data available**
- **LMI level "S" processing available**

SCHEMATIC DIAGRAM



* For normal operation the (V_{OS}) sense pin must be externally connected to the load.

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ABSOLUTE MAXIMUM RATINGS (Note 1)

Device Output Voltage	Input Voltage	Input Voltage (transient) (Note 3)	Input Voltage Differential (Output shorted to ground)
5V	35V	50V	35V
12V	35V	50V	35V
15V	35V	50V	35V

Operating Junction Temperature
Hermetic (K, T, IG & L - Packages) ..... 150°C

Storage Temperature Range ..... -65°C to 150°C
Lead Temperature (Soldering, 10 Seconds) ..... 300°C

Note 1. Values beyond which damage may occur.

THERMAL DATA

K Package:
Thermal Resistance-Junction to Case, θ_{JC} ..... 3.0°C/W
Thermal Resistance-Junction to Ambient, θ_{JA} ..... 35°C/W
T Package:
Thermal Resistance-Junction to Case, θ_{JC} ..... 15°C/W
Thermal Resistance-Junction to Ambient, θ_{JA} ..... 120°C/W
IG Package:
Thermal Resistance-Junction to Case, θ_{JC} ..... 3.5°C/W
Thermal Resistance-Junction to Ambient, θ_{JA} ..... 42°C/W
L Package:
Thermal Resistance-Junction to Case, θ_{JC} ..... 35°C/W
Thermal Resistance-Junction to Ambient, θ_{JA} ..... 120°C/W

Note A. Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.
Note B. The above numbers for θ_{JC} are maximums for the limiting thermal resistance of the package in a standard mounting configuration. The θ_{JA} numbers are meant to be guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.

RECOMMENDED OPERATING CONDITIONS (Note 2)

Operating Junction Temperature Range:
SG7800A/SG7800 ..... -55°C to 150°C

Note 2. Range over which the device is functional.

CHARACTERISTIC CURVES

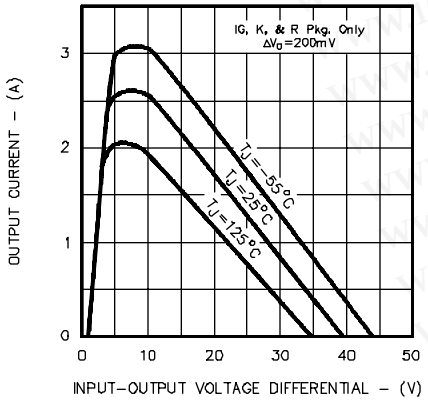


FIGURE 1.
PEAK OUTPUT CURRENT
VS. INPUT - OUTPUT DIFFERENTIAL

Note 3. Operation at high input voltages is dependent upon load current. When load current is less than 5mA, output will rise out of regulation as input-oiutput differential icreases beyond 30V. Note also from Figure 1, that maximum load current is reduced at high voltages. The 50V input rating of the SG140A series refers to ability to withstnd high line or transient conditions without damage. Since the regulator's maximum current capability is reduced, the output may fall out of regulation at high input voltages under nominal loading.

CHARACTERISTIC CURVES (continued)

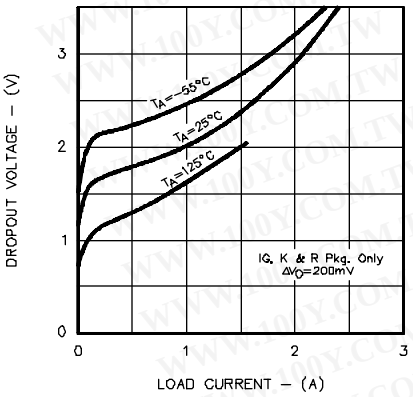


FIGURE 2.
MINIMUM INPUT - OUTPUT VOLTAGE VS. LOAD CURRENT

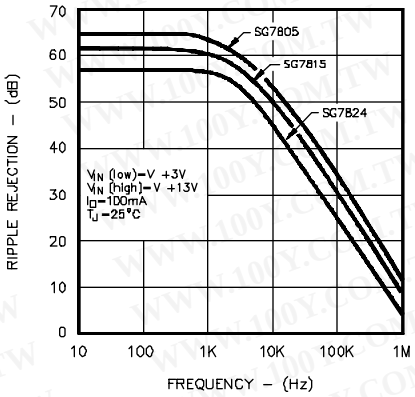


FIGURE 3.
RIPPLE REJECTION VS. FREQUENCY

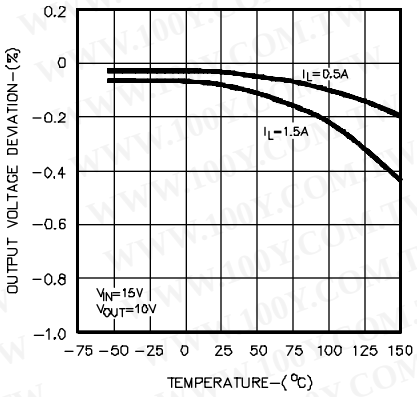
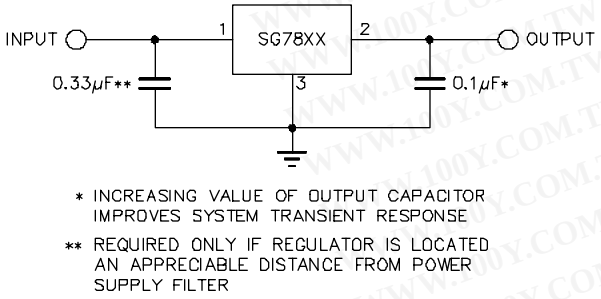


FIGURE 4.
TEMPERATURE COEFFICIENT OF OUTPUT VOLTAGE

APPLICATIONS



* INCREASING VALUE OF OUTPUT CAPACITOR IMPROVES SYSTEM TRANSIENT RESPONSE

** REQUIRED ONLY IF REGULATOR IS LOCATED AN APPRECIABLE DISTANCE FROM POWER SUPPLY FILTER

FIGURE 5 - FIXED OUTPUT REGULATOR

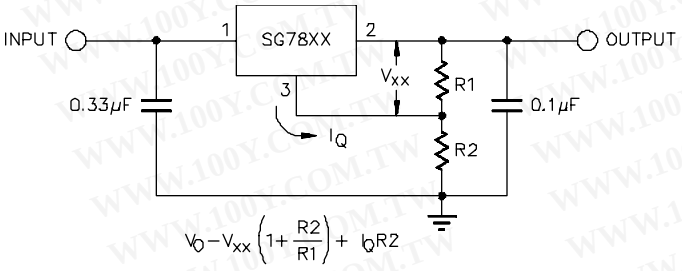


FIGURE 6 - CIRCUIT FOR INCREASING OUTPUT VOLTAGE

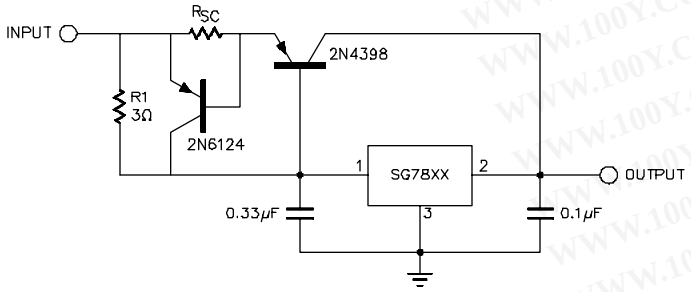


FIGURE 7 - HIGH OUTPUT CURRENT, SHORT CIRCUIT PROTECTED

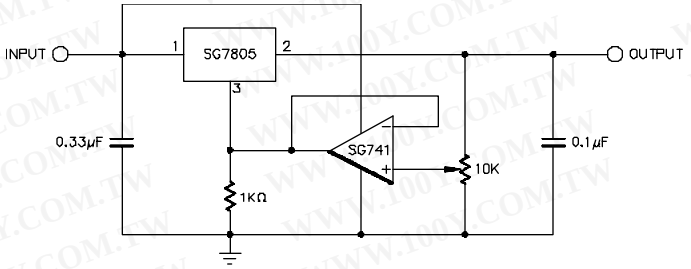


FIGURE 8 - ADJUSTABLE OUTPUT REGULATOR, 7V to 30V

ELECTRICAL SPECIFICATIONS (Note 1)

(Unless otherwise specified, these specifications apply over the operating ambient temperatures for SG7805A/SG7805 with -55°C ≤ T_A ≤ 150°C, V_{IN} = 10V, I_O = 500mA for the K and IG -Power Packages-, I_O = 100mA for the T and L packages, C_{IN} = 0.33µF, and C_{OUT} = 0.1µF. Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

SG7805A/SG7805

Parameter	Test Conditions	SG7805A			SG7805			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Output Voltage	T_J = 25°C	4.92	5.00	5.08	4.80	5.00	5.20	V
Line Regulation (Note 1)	V_{IN} = 7.5V to 20V, T_J = 25°C		5	25		5	50	mV
	V_{IN} = 8V to 12V, T_J = 25°C		2	12		2	25	mV
Load Regulation (Note 1)	Power Pkgs: I_O = 5mA to 1.5A, T_J = 25°C		15	50		15	50	mV
	I_O = 250mA to 750mA, T_J = 25°C		5	25		5	25	mV
	T - Pkg: I_O = 5mA to 500mA, T_J = 25°C		5	25		20	25	mV
Total Output Voltage	V_{IN} =8V to 20V							
Tolerance	Power Pkgs: I_O = 5mA to 1.0A, P ≤ 20W	4.85	5.00	5.15	4.65	5.00	5.35	V
	T - Pkg: I_O = 5mA to 500mA, P ≤ 2W	4.85	5.00	5.15	4.65	5.00	5.35	V
Quiescent Current	Over Temperature Range			7			7	mA
	T_J = 25°C		4	6		4	6	mA
Quiescent Current Change	With Line: V_{IN} = 8V to 25V			0.8			0.8	mA
	With Load: I_O = 5mA to 1.0A (Power Pkgs.)			0.5			0.5	mA
	I_O = 5mA to 500mA (T)			0.5			0.5	mA
Dropout Voltage	ΔV_O = 100mV, T_J = 25°C							
	Power Pkgs: I_O = 1.0A, T - Pkg: I_O = 500mA		2	2.5		2	2.5	V
Peak Output Current	Power Pkgs: V_{IN} = 10V, T_J = 25°C	1.5	2.0	3.3	1.5	2.0	3.3	A
	T - Pkg: V_{IN} = 10V, T_J = 25°C	0.5	1.0	2.0	0.5	1.0	2.0	A
Short Circuit Current	Power Pkgs: V_{IN} = 35V, T_J = 25°C			1.2			1.2	A
	T - Pkg: V_{IN} = 35V, T_J = 25°C			0.7			0.7	A
Ripple Rejection	ΔV_{IN} = 10V, f = 120Hz, T_J = 25°C	68			68			dB
Output Noise Voltage (rms)	f = 10Hz to 100KHz (Note 2)			40			40	µV/V
Long Term Stability	1000hrs. at T_J = 125°C		20			20		mV
Thermal Shutdown	I_O = 5mA		175			175		°C

Note 1. All regulation tests are made at constant junction temperature with low duty cycle testing.
2. This test is guaranteed but is not tested in production.

ELECTRICAL SPECIFICATIONS (Note 1)

(Unless otherwise specified, these specifications apply over the operating ambient temperatures for SG7812A/SG7812 with -55°C ≤ T_A ≤ 150°C, V_{IN} = 19V, I_O = 500mA for the K and IG -Power Packages-, I_O = 100mA for the T and L packages, C_{IN} = 0.33µF, and C_{OUT} = 0.1µF. Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

SG7812A/SG7812

Parameter	Test Conditions	SG7812A			SG7812			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Output Voltage	T_J = 25°C	11.8	12.0	12.2	11.5	12.0	12.5	V
Line Regulation (Note 1)	V_{IN} = 14.5V to 30V, T_J = 25°C		12	60		12	120	mV
	V_{IN} = 16V to 22V, T_J = 25°C		6	30		6	60	mV
Load Regulation (Note 1)	Power Pkgs: I_O = 5mA to 1.5A, T_J = 25°C		28	80		28	120	mV
	I_O = 250mA to 750mA, T_J = 25°C		10	40		10	60	mV
	T - Pkg: I_O = 5mA to 500mA, T_J = 25°C		10	40		10	60	mV
Total Output Voltage	V_{IN} = 15.5V to 27V							
Tolerance	Power Pkgs: I_O = 5mA to 1.0A, P ≤ 20W	11.7	12.0	12.3	11.4	12.0	12.6	V
	T - Pkg: I_O = 5mA to 500mA, P ≤ 2W	11.7	12.0	12.3	11.4	12.0	12.6	V
Quiescent Current	Over Temperature Range			7			7	mA
	T_J = 25°C		4	6		4	6	mA
Quiescent Current Change	With Line: V_{IN} = 15V to 30V			0.8			0.8	mA
	With Load: I_O = 5mA to 1.0A (Power Pkgs.)			0.5			0.5	mA
	I_O = 5mA to 500mA (T)			0.5			0.5	mA
Dropout Voltage	ΔV_O = 100mV, T_J = 25°C							
	Power Pkgs: I_O = 1.0A, T - Pkg: I_O = 500mA		2	2.5		2	2.5	V
Peak Output Current	Power Pkgs: T_J = 25°C	1.5	2.0	3.3	1.5	2.0	3.3	A
	T - Pkg: T_J = 25°C	0.5	1.0	1.7	0.5	1.0	1.7	A
Short Circuit Current	Power Pkgs: V_{IN} = 35V, T_J = 25°C			1.2			1.2	A
	T - Pkg: V_{IN} = 35V, T_J = 25°C			0.7			0.7	A
Ripple Rejection	ΔV_{IN} = 10V, f = 120Hz, T_J = 25°C	61			61			dB
Output Noise Voltage (rms)	f = 10Hz to 100KHz (Note 2)			40			40	µV/V
Long Term Stability	1000hrs. at T_J = 125°C		48			48		mV
Thermal Shutdown	I_O = 5mA		175			175		°C

Note 1. All regulation tests are made at constant junction temperature with low duty cycle testing.
2. This test is guaranteed but is not tested in production.

ELECTRICAL SPECIFICATIONS (Note 1)

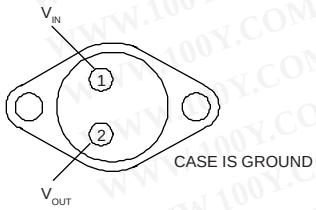
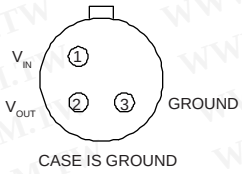
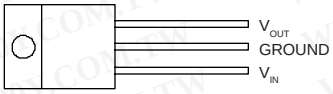
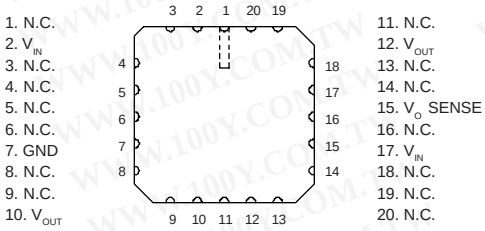
(Unless otherwise specified, these specifications apply over the operating ambient temperatures for SG7815A/SG7815 with -55°C ≤ T_A ≤ 150°C, V_{IN} = 23V, I_O = 500mA for the K and IG -Power Packages-, I_O = 100mA for the T and L packages, C_{IN} = 0.33µF, and C_{OUT} = 0.1µF. Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

SG7815A/SG7815

Parameter	Test Conditions	SG7815A			SG7815			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Output Voltage	T_J = 25°C	14.8	15.0	15.2	14.4	15.0	15.6	V
Line Regulation (Note 1)	V_{IN} = 17.5V to 30V, T_J = 25°C		15	75		15	150	mV
	V_{IN} = 20V to 26V, T_J = 25°C		8	40		8	75	mV
Load Regulation (Note 1)	Power Pkgs: I_O = 5mA to 1.5A, T_J = 25°C		30	100		30	150	mV
	I_O = 250mA to 750mA, T_J = 25°C		12	50		12	75	mV
	T - Pkg: I_O = 5mA to 500mA, T_J = 25°C		12	50		12	75	mV
Total Output Voltage	V_{IN} = 18.5V to 30V							
Tolerance	Power Pkgs: I_O = 5mA to 1.0A, P ≤ 20W	14.6	15.0	15.4	14.3	15.0	15.7	V
	T - Pkg: I_O = 5mA to 500mA, P ≤ 2W	14.6	15.0	15.4	14.3	15.0	15.7	V
Quiescent Current	Over Temperature Range			7			7	mA
	T_J = 25°C		4	6		4	6	mA
Quiescent Current Change	With Line: V_{IN} = 18.5V to 30V			0.8			0.8	mA
	With Load: I_O = 5mA to 1.0A (Power Pkgs.)			0.5			0.5	mA
	I_O = 5mA to 500mA (T)			0.5			0.5	mA
Dropout Voltage	ΔV_O = 100mV, T_J = 25°C							
	Power Pkgs: I_O = 1.0A, T - Pkg: I_O = 500mA		2	2.5		2	2.5	V
Peak Output Current	Power Pkgs: T_J = 25°C	1.5	2.2	3.3	1.5	2.2	3.3	A
	T - Pkg: T_J = 25°C	0.5	0.9	1.7	0.5	0.9	1.7	A
Short Circuit Current	Power Pkgs: V_{IN} = 35V, T_J = 25°C			1.2			1.2	A
	T - Pkg: V_{IN} = 35V, T_J = 25°C			0.7			0.7	A
Ripple Rejection	ΔV_{IN} = 10V, f = 120Hz, T_J = 25°C	60			60			dB
Output Noise Voltage (rms)	f = 10Hz to 100KHz (Note 2)			40			40	µV/V
Long Term Stability	1000hrs. at T_J = 125°C		60			60		mV
Thermal Shutdown	I_O = 5mA		175			175		°C

Note 1. All regulation tests are made at constant junction temperature with low duty cycle testing.
2. This test is guaranteed but is not tested in production.

CONNECTION DIAGRAMS & ORDERING INFORMATION (See Notes Below)

Package	Part No.	Ambient Temperature Range	Connection Diagram
3-TERMINAL TO-3 METAL CAN K-PACKAGE	SG78XXAK/883B	-55°C to 125°C	
	SG7805AK/DESC	-55°C to 125°C	
	SG7812AK/DESC	-55°C to 125°C	
	SG7815AK/DESC	-55°C to 125°C	
	SG78XXAK	-55°C to 125°C	
	SG78XXK/883B	-55°C to 125°C	
	JAN7805K	-55°C to 125°C	
	JAN7812K	-55°C to 125°C	
	JAN7815K	-55°C to 125°C	
	SG78XXK	-55°C to 125°C	
	SG78XXK	0°C to 125°C	
3-PIN TO-39 METAL CAN T-PACKAGE	SG78XXAT/883B	-55°C to 125°C	
	SG7805AT/DESC	-55°C to 125°C	
	SG7812AT/DESC	-55°C to 125°C	
	SG7815AT/DESC	-55°C to 125°C	
	SG78XXAT	-55°C to 125°C	
	SG78XXT/883B	-55°C to 125°C	
	JAN7805T	-55°C to 125°C	
	JAN7812T	-55°C to 125°C	
	JAN7815T	-55°C to 125°C	
	SG78XXT	-55°C to 125°C	
3-PIN HERMETIC TO-257 IG-PACKAGE (Isolated)	SG78XXAIG/883B	-55°C to 125°C	
	SG7805AIG/DESC	-55°C to 125°C	
	SG7812AIG/DESC	-55°C to 125°C	
	SG7815AIG/DESC	-55°C to 125°C	
	SG78XXAIG	-55°C to 125°C	
	SG78XXIG/883B	-55°C to 125°C	
	SG78XXIG	-55°C to 125°C	
20-PIN CERAMIC LEADLESS CHIP CARRIER L- PACKAGE	SG7805AL/DESC	-55°C to 125°C	(See Notes 5 & 6) 
	SG7812AL/DESC	-55°C to 125°C	
	SG7815AL/DESC	-55°C to 125°C	
	SG78XXL/883B	-55°C to 125°C	

Note 1. Contact factory for JAN and DESC product availability.
2. All parts are viewed from the top.
3. "XX" to be replaced by output voltage of specific fixed regulator.
4. Some products will be available in hermetic flat pack (F). Consult factory for price and availability.
5. Both inputs and outputs must be externally connected together at the device terminals.
6. For normal operation, the V_O SENSE pin must be externally connected to the load.