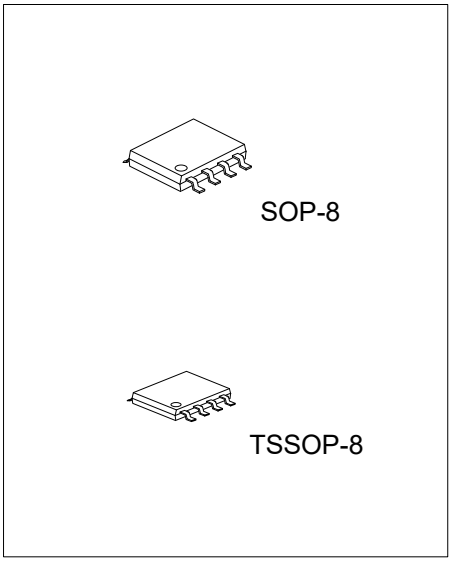
SWITCHING REGULATOR CONTROLLER(LOW VOLTAGE)



■ DESCRIPTION

The UTC **L2800** which is incorporating a soft start function and short circuit detection function is a single-channel switching regulator control IC and is made for low voltage applications. Because the device has a low minimum operating voltage of 1.8V, so it is ideal for the power supply of battery-operated electronic equipment.

■ FEATURES

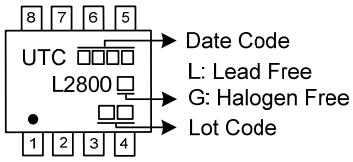
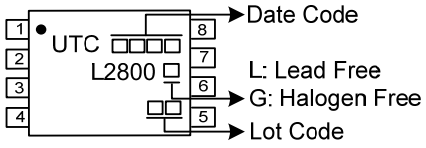
*Wide supply voltage operating range: 1.8V~15V
*Low current consumption: Typically 5.5mA in operation,1μA or less in stand-by
*High speed operation is possible: Maximum 1MHz
*The error amplifier gain is set inside the IC, so peripheral components are minimized.
*Incorporates a soft start circuit.
*Incorporates a timer-latch type short circuit detection circuit (SCP).
*Totem-pole type output with adjustable on/off current (for NPN transistors)
*Incorporates a stand-by function.

■ ORDERING INFORMATION

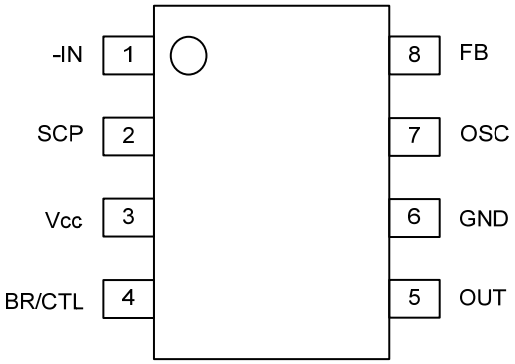
Ordering Number		Package	Packing
Lead Free	Halogen Free		
L2800L-S08-T	L2800G-S08-T	SOP-8	Tube
L2800L-S08-R	L2800G-S08-R	SOP-8	Tape Reel
L2800L-P08-T	L2800G-P08-T	TSSOP-8	Tube
L2800L-P08-R	L2800G-P08-R	TSSOP-8	Tape Reel

L2800G-S08-T (1)Packing Type (2)Package Type (3)Green Package	(1) T: Tube, R: Tape Reel (2) S08: SOP-8, P08: TSSOP-8 (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

SOP-8	TSSOP-8
	

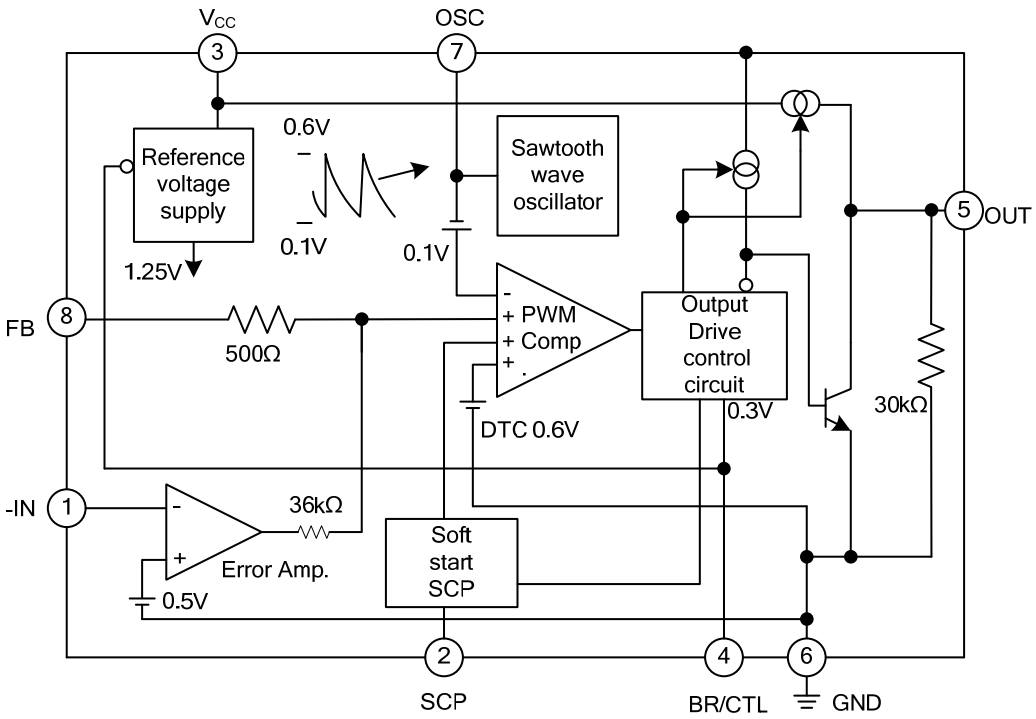
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	SYMBOL	I/O	DESCRIPTION
1	-IN	I	Error amplifier inverting input pin
2	SCP	-	Soft start and SCP setting capacitor connection pin
3	V_{CC}	-	Power supply pin
4	BR/CTL	I	Output current setting and control pin
5	OUT	O	Totem-pole type output pin
6	GND	-	Ground pin
7	OSC	-	Capacitor and resistor connection pin for setting the oscillation frequency
8	FB	O	Error amplifier output pin

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (T_A=25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Power Supply Voltage		V_{CC}	16	V
Output Source Current		I_O^+	-50	mA
Output Sink Current		I_O^-	50	mA
Power Dissipation (Note 2)	SOP-8	P_D	570	mW
	TSSOP-8		580	mW
Storage Temperature		T_{STG}	-55 ~ +125	°C
Operating Temperature		T_{OPR}	-30 ~ +85	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. When mounted on a 10cm square double-sided epoxy board.

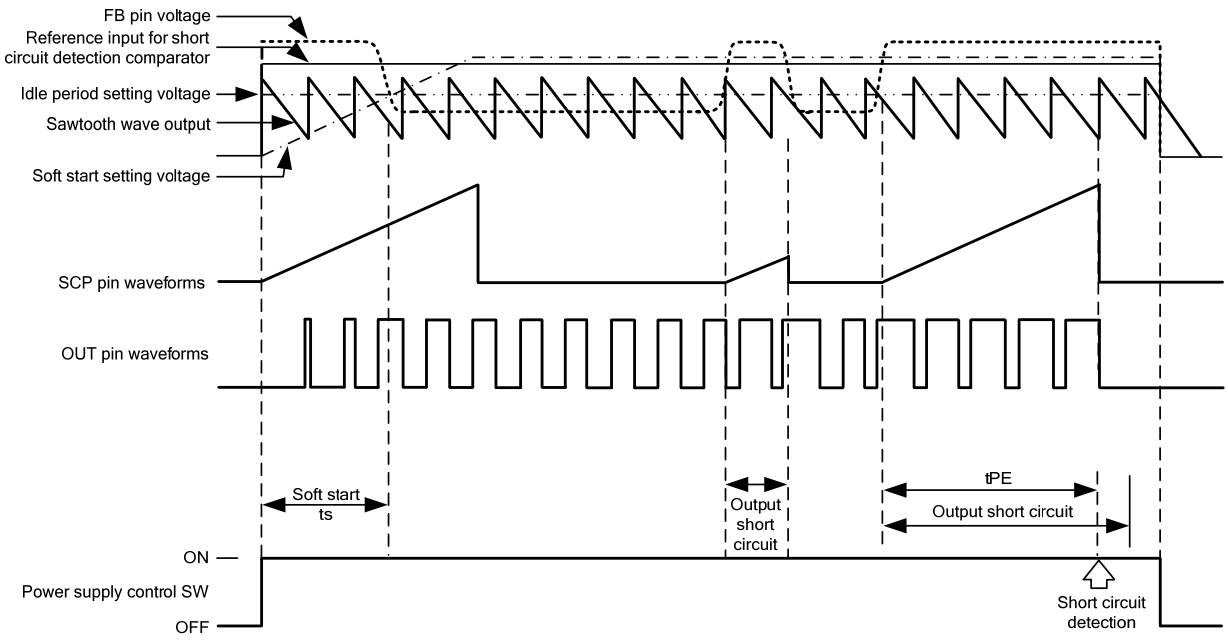
■ RECOMMENDED OPERATING CONDITIONS (T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Power Supply Voltage	V_{CC}	1.8		15	V
Error Amplifier Input Voltage	V_I	-0.2		1.0	V
BR/CTL Pin Input Voltage	V_{BR}	-0.2		V_{CC}	V
Output Source Current	I_O^+	-40			mA
Output Sink Current	I_O^-			40	mA
SCP Pin Capacitance	C_{PE}		0.1		μF
Phase Compensation Capacitance	C_P		0.1		μF
Output Current Setting Resistance	R_B	150	390	5000	Ω
Timing Resistance	R_T	1.0	3.0	10.0	kΩ
Timing Capacitance	C_T	100	270	10000	pF
Oscillation Frequency	f_{OSC}	10	500	1000	kHz
Operating Temperature	T_{OPR}	-30	+25	+85	°C

■ ELECTRICAL CHARACTERISTICS (V_{CC}=+2V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
CIRCUIT TO PREVENT MALFUNCITION AT LOW INPUT OLTAGE (U.V.L.O)						
Reset Voltage	V_R				0.9	V
Threshold Voltage	V_{TH}		1.1	1.3	1.5	V
Soft Start						
Charging Current	I_{CS}	V_{SCP}=0V	-1.5	-1.0	-0.7	μA
Voltage at soft start completion	V_{TS}		0.7	0.8	0.9	V
Short Circuit Detection(S.C.P.)						
Charging Current	I_{CPC}	V_{SCP}=0V	-1.5	-1.0	-0.7	μA
Threshold Voltage	V_{TPC}		0.7	0.8	0.9	V
SAWTOOTH WAVE OSCILLATOR(OSC)						
Oscillation Frequency	f_{OSC}	R_T=3.0kΩ, C_T=270pF	400	500	600	kHz
Frequency Input Stability	f_{DV}	V_{CC}=2V ~ 15V		2	10	%
Frequency Variation With Temperature	f_{DT}	T_A=-30°C ~ +85°C		5		%
ERROR AMPLIFIER						
Input Threshold Voltage	V_T	V_{FB}=450mV	480	500	520	mV
V_T Input Stability	V_{TDV}	V_{CC}=2V ~ 15V		5	20	mV
V_T Variation With Temperature	V_{TDT}	T_A= -30°C ~ +85°C		1		%
Input Bias Current	I_B	V_{IN}=0V	-1.0	-0.2	1.0	μA
Voltage Gain	Av		70	100	145	V/V
Frequency Bandwidth	BW	A_V=0dB		6		MHz
Maximum Output Voltage Range	V_{OM}^+		0.78	0.87		V
	V_{OM}^-			0.05	0.2	V
Output Source Current	I_{OM}^+	V_{FB}=0.45V		-40	-24	μA
Output Sink Current	I_{OM}^-		24	40		μA
IDLE PERIOD ADJUSTMENT SECTION						
Maximum Duty Cycle	t_{DUTY}	R_T=3.0kΩ, C_T=270pF, V_{FB}=0.8V	65	75	85	%
OUTPUT SECTION						
Output Voltage	V_{OH1}	R_B=390Ω, I_O=-15mA	1.0	1.2		V
	V_{OH2}	R_B=750Ω, V_{CC}=1.8V, Io= -10mA	0.8	1.0		V
	V_{OL1}	R_B=390Ω, I_O=15mA		0.1	0.2	V
	V_{OL2}	R_B=750Ω, V_{CC}=1.8V, Io=10mA		0.1	0.2	V
Output Source Current	I_O^+	R_B=390Ω, V_O=0.9V		-30	-20	mA
Output Sink Current	I_O^-	R_B=390Ω, V_O=0.3V	30	60		mA
Pull Down Resistance	R_O		20	30	40	kΩ
OUTPUT CURRENT SETTING SECTION/CONTROL SECTION						
Pin Voltage	V_{BR}	R_B=390Ω	0.2	0.3	0.4	V
Input Off Condition	I_{OFF}		-20		0	μA
Input On Condition	I_{ON}				-45	μA
Pin Current Range	I_{BR}		-1.8		-0.1	mA
ENTIRE DEVICE						
Stand-by Current	I_{CCS}	BR/CTL pin open or V_{CC}			1	μA
Average Supply Current	I_{CC}	R_B=390Ω		5.5	9.3	mA

■ DIAGRAM



■ HOW TO SET THE TIME CONSTANT FOR SHORT CIRCUIT DETECTION AND SOFT START

1. SHORT CIRCUIT PROTECTION

Te error amplifier output (FB pin) is fixed at VOM^+ and capacitor C_{PE} starts charging i the switching regulator output suddenly drops due to load effect. The output pin is set low and the SCP pin stays low when the voltage at the SCP pin reaches approximately 0.8V.

As the protection circuit operates, by resetting the power supply the circuit will be restored.

•Short circuit detection time

$t_{PE}[S] \fallingdotseq 0.8 \times C_{PE}[\mu F]$

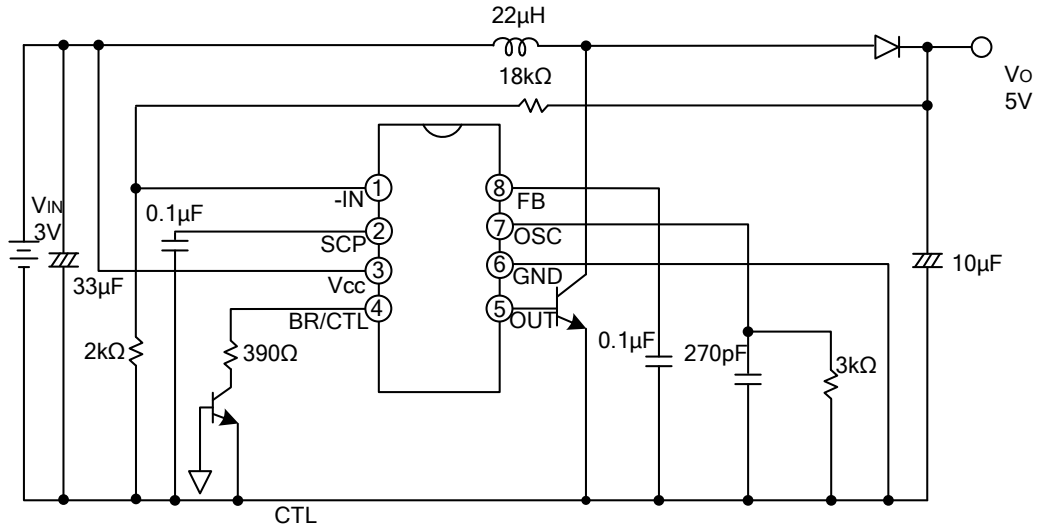
2. SOFT START

Once power on, the capacitor C_{PE} which is connected to the SCP pin starts charging.The soft start setting voltage is compared by the PWM comparator as the voltage's proportion at the SCP pin with the sawtooth waveform. The comparison controls the OUT pin's ON duty,which is causing the soft start operation. During the time for completion of soft start operation, the SCP pin's voltage stays low, but the soft start setting voltage stays high, and the circuit then enters the output short circuit detection wait state.

Soft start time (until the output ON duty reaches approximately 50%)

$ts[S] \fallingdotseq 0.35 \times C_{PE}[\mu F]$

■ APPLICATION EXAMPLE



■ TYPICAL CHARACTERISTICS

OSC Pin Voltage vs. Output Pin Voltage