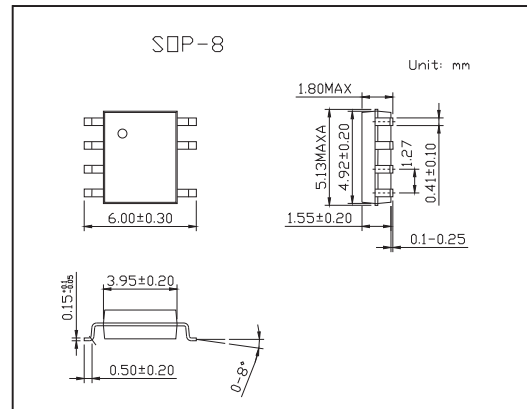


TOPSwitch -GX Family Extended Power, Design Flexible, EcoSmart, Integrated Off-line Switcher

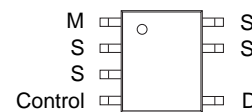
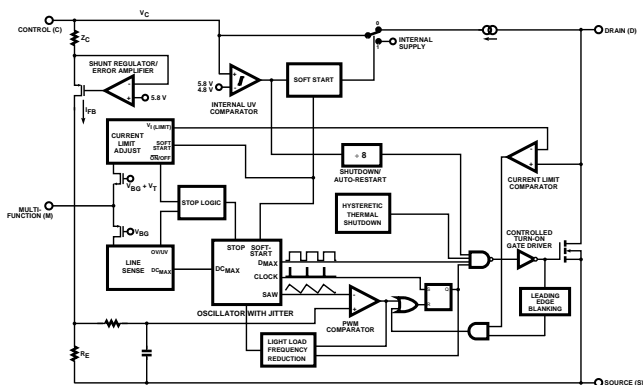
TOP250

■ Features

- Extended power range to 290 W
- Features eliminate or reduce cost of external components
- Fully integrated soft-start for minimum stress/overshoot
- Externally programmable accurate current limit
- Wider duty cycle for more power, smaller input capacitor
- Line under-voltage (UV) detection: no turn off glitches
- Line overvoltage (OV) shutdown extends line surge limit
- Line feed forward with maximum duty cycle (DCMAX) reduction rejects line ripple and limits DCMAX at high line
- Frequency jittering reduces EMI and EMI filtering costs
- Regulates to zero load without dummy loading
- 132 kHz frequency reduces transformer/power supply size
- Half frequency option in Y/R/F packages for video applications
- Hysteretic thermal shutdown for automatic fault recovery
- Large thermal hysteresis prevents PC board overheating



■ Functional Block Diagram



■ Absolute Maximum Ratings $T_a = 25^\circ\text{C}$

Parameter	Symbol	Rating	Unit
DRAIN Voltage	V_D	-0.3 to 700	V
DRAIN Peak Current	I_D	10.08	A
CONTROL Voltage	V_{CON}	- 0.3 V to 9	V
CONTROL Current	I_{CON}	100	mA
Thermal Resistance Junction-Ambient	$R_{\theta JA}$	45	$^\circ\text{C}/\text{W}$
Junction Operating Temperature	T_j	-40 to 150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to 150	$^\circ\text{C}$

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■ Electrical Characteristics ($T_j = -40$ to 125 °C, SOURCE = 0 V, unless otherwise specified)

Parameter	Symbol	Test conditons	Min	Typ	Max	Unit
Output Frequency (average)	f _{OSC}	I _C = 3 mA, T _J = 25 °C (FREQUENCY Pin Connected to SOURCE)	124	132	140	kHz
		I _C = 3 mA, T _J = 25 °C (FREQUENCY Pin Connected to CONTROL)	61.5	66	70.5	
Duty Cycle at ONSET of Frequency Reduction	DC(ONSET)	I _C = I _{CD1} + 0.4 mA		10		%
Switching Frequency near 0% Duty Cycle	f _{OSC} (DMIN)	132 kHz Operation 66 kHz Operation		30 15		kHz
Frequency Jitter Deviation	Δf	132 kHz Operation 66 kHz Operation		± 4 ± 2		kHz
Frequency Jitter Modulation Rate	f _M			250		Hz
Maximum Duty Cycle (I _L ≤ I _{L(DC)} or I _M ≤ I _{M(DC)}) (I _L or I _M = 190 μA)	DC _{MAX}	I _C = I _{CD1}	75	78	83	%
			28	38	50	
Soft Start Time	t _{SOFT}	T _J = 25 °C; DC _{MIN} to DC _{MAX}		10	15	ms
PWM Gain	DC _{reg}	I _C = 4 mA; T _J = 25 °C	-28	-23	-18	%/mA
PWM Gain Temperature Drift				-0.01		%/mA/°C
External Bias Current	I _B		1.7	2.7	4.2	mA
CONTROL Current at 0% Duty Cycle	I _{C(OFF)}			7.3	8.5	mA
Dynamic Impedance	Z _C	I _C = 4 mA; T _J = 25 °C	10	15	22	Ω
Dynamic Impedance Temperature Drift				0.18		%/°C
Control Pin Internal Filter Pole				7		kHz
Control Pin Charging Current	I _{C(CH)}	V _C = 0 V	-5.0	-3.5	-2.0	mA
		V _C = 5 V	-3.0	-1.8	-0.6	
Charging Current Temperature Drift				0.5		%/°C
Auto-restart Upper Threshold Voltage	V _{C(AR)U}			5.8		V
Auto-restart Lower Threshold Voltage	V _{C(AR)L}		4.5	4.8	5.1	V
Auto-restart Hysteresis Voltage	V _{C(AR)hyst}		0.8	1.0		v
Auto-restart Duty Cycle	DC(AR)			4	8	%
Auto-restart Frequency	f(AR)			1.0		Hz
Line Under-Voltage Threshold Current and Hysteresis (M or L Pin)	I _{UV}	Threshold Hysteresis	44	50 30	54	μA
Line Over-Voltage or Remote ON/OFF Threshold Current and Hysteresis (M or L Pin)	I _{OV}	Threshold Hysteresis	210	225 8	240	μA
L Pin Voltage Threshold	V _{L(TH)}		0.5	1.0	1.6	V
Remote ON/OFF Negative Threshold Current and Hysteresis (M or X Pin)	I _{REM(N)}	Threshold Hysteresis	-35	-27 5	-20	μA
L or M Pin Short Circuit Current	I _{L(SC)} or I _{M(SC)}	V _L , V _M = V _C	300	400	520	μA
X or M Pin Short Circuit Current	I _{X(SC)} or I _{M(SC)}	V _X , V _M = 0 V	-300	-240	-180	μA
L or M Pin Voltage (Positive Current)	V _L , V _M	I _L or I _M = 50 μA	1.9	2.5	3.0	V
		I _L or I _M = 225 μA	2.3	2.9	3.3	
X Pin Voltage (Negative Current)	V _X	I _X = -50 μA	1.26	1.33	1.4	V
		I _X = -150 μA	1.18	1.24	1.3	
M Pin Voltage (Negative Current)	V _M	I _X = -50 μA	1.24	1.31	1.39	V
		I _X = -150 μA	1.13	1.19	1.25	

TOP250

■ Electrical Characteristics (T_j = -40 to 125 °C, SOURCE = 0 V, unless otherwise specified)

Maximum Duty Cycle Reduction Onset Threshold Current	I _{L(DC)} or I _{M(DC)}		40	60	75	μA
Maximum Duty Cycle Reduction Slope		I _L > I _{L(DC)} or I _M > I _{M(DC)}		0.25		%/μA
Remote OFF DRAIN Supply Current (X, L or M Pin Floating)	I _{D(RMT)}	V _{DRAIN} = 150 V		0.6	1.0	mA
L or M Pin Shorted to CONTROL				1.0	1.6	
Remote ON Delay	t _{R(ON)}	From Remote On to Drain Turn-On		2.5		μs
Remote OFF Setup Time	t _{R(OFF)}	Minimum Time Before Drain Turn-On to Disable Cycle		2.5		μs
FREQUENCY Pin Threshold Voltage	V _F			2.9		V
FREQUENCY Pin Input Current	I _F	V _F = V _C	10	40	100	μA
Self Protection Current Limit	I _{LIMIT}	Internal di/dt=1260 mA/μs	5.859	6.3	6.741	A
Initial Current Limit	I _{INIT}	≤ 85 VAC (Rectified Line Input)	0.75 x I _{LIMIT(MIN)}			A
		265 VAC (Rectified Line Input)	0.75 x I _{LIMIT(MIN)}			
Leading Edge Blanking Time	t _{LEB}	I _C = 4 mA; T _J = 25 °C		220		ns
Current Limit Delay	t _{IL(D)}	I _C = 4 mA		100		ns
Thermal Shutdown Temperature			130	140	150	°C
Thermal Shutdown Hysteresis				75		°C
Power-up Reset Threshold Voltage	V _{C(RESET)}	S1 Open	1.75	3.0	4.25	V
ON-State Resistance	R _{DS(ON)}	I _D = 700 mA	T _J = 25 °C	1.1	1.28	Ω
			T _J = 100 °C	1.85	2.15	
Off-State Current	I _{DSS}	V _L , V _M = Floating; I _C = 4mA V _{DS} = 560 V; T _J = 125 °C			470	μA
Breakdown Voltage	BV _{DSS}	V _L , V _M = Floating; I _C = 4mA I _D = 100 μA; T _J = 25 °C	700			V
Rise Time	t _R	Measured in a Typical Flyback Converter Application		100		ns
Fall Time	t _F			50		ns
DRAIN Supply Voltage			36			V
Shunt Regulator Voltage	V _{C(SHUNT)}	I _C = 4 mA	5.6	5.85	6.1	V
Shunt Regulator Temperature Drift	I _{CD1}			±50		ppm/°C
Control Supply/ Discharge Current	I _{CD1}	Output MOSFET Enabled V _L , V _M = 0 V	1.3	2.4	3.65	mA
	I _{CD2}	Output MOSFET Disabled V _L , V _M = 0 V	0.3	0.6	1.3	

■ Marking

Marking	TOP250
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■ Typical Application Circuit

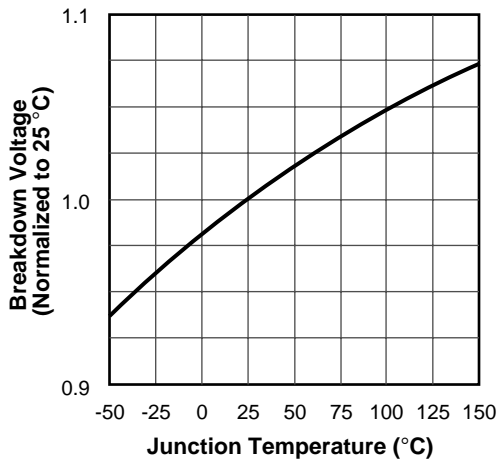


Figure 1. Breakdown Voltage vs. Temperature.

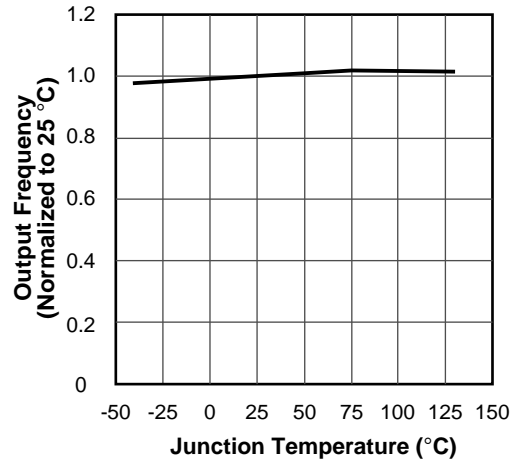


Figure 2. Frequency vs. Temperature.

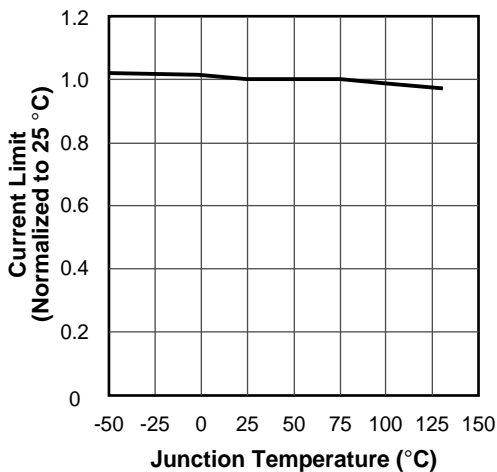


Figure 3. Internal Current Limit vs. Temperature.

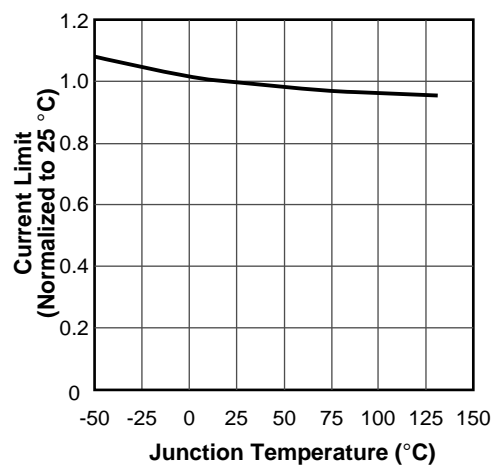


Figure 4. External Current Limit vs. Temperature with $R_{IL} = 12\text{ k}\Omega$.

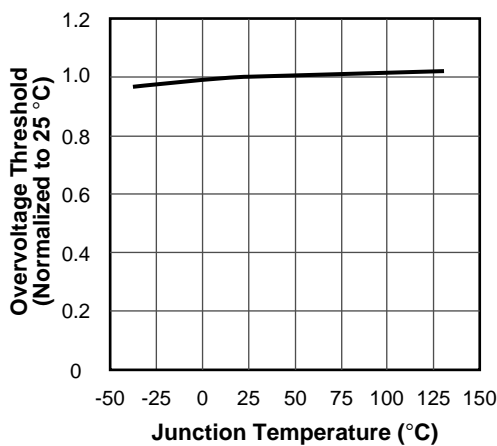


Figure 5. Overvoltage Threshold vs. Temperature.

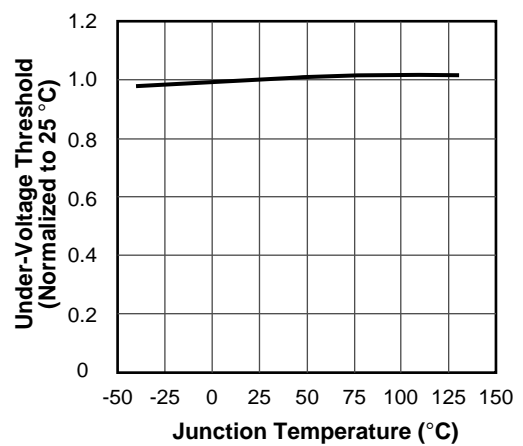


Figure 6. Under-Voltage Threshold vs. Temperature.

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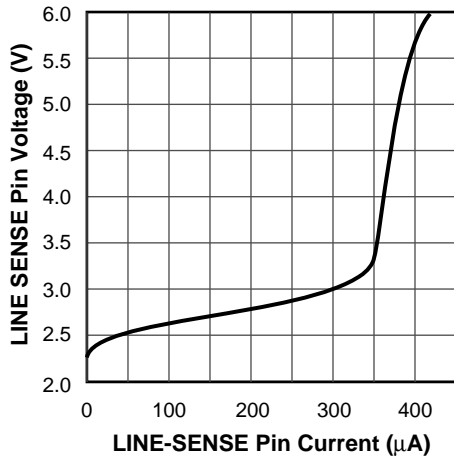


Figure 7. LINE-SENSE Pin Voltage vs. Current.

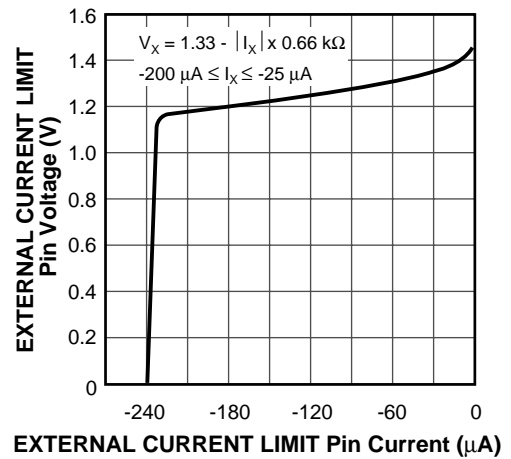


Figure 8. EXTERNAL CURRENT LIMIT Pin Voltage vs. Current.

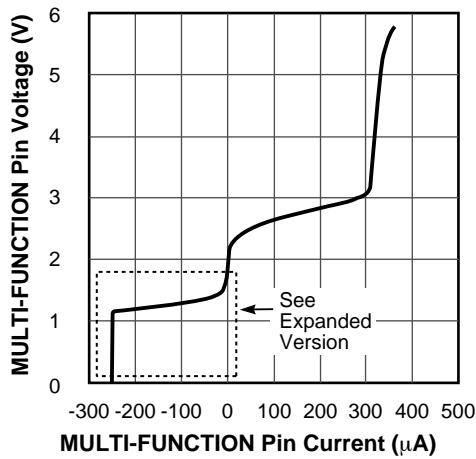


Figure 9. MULTI-FUNCTION Pin Voltage vs. Current.

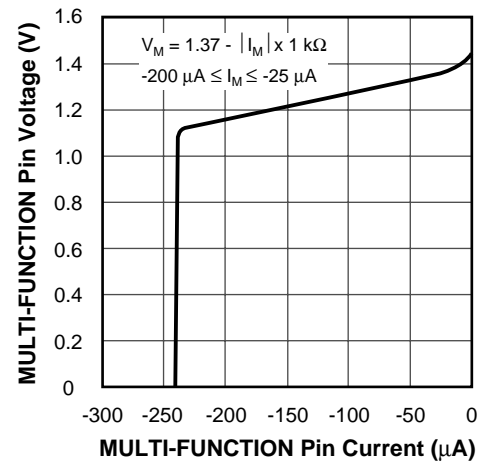


Figure 10. MULTI-FUNCTION Pin Voltage vs. Current (Expanded).

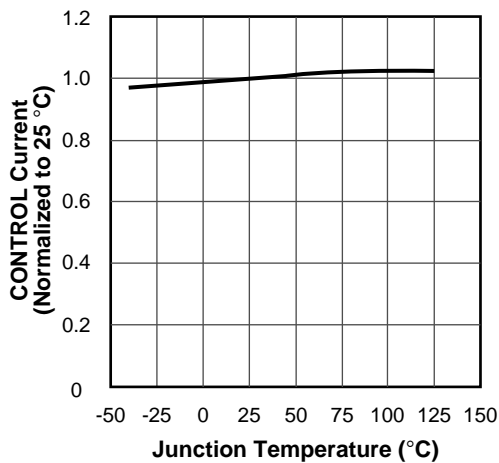


Figure 11. Control Current Out at 0% Duty Cycle vs. Temperature.

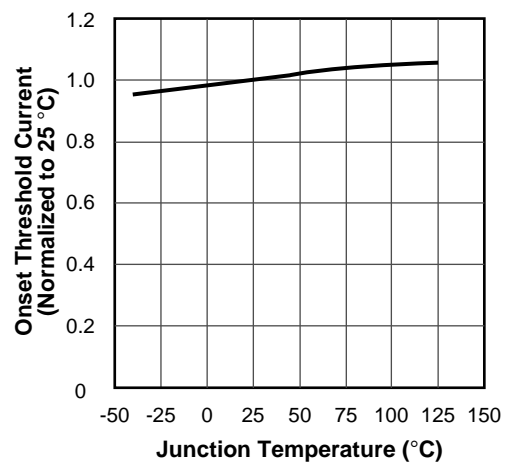


Figure 12. Max. Duty Cycle Reduction Onset Threshold Current vs. Temperature.

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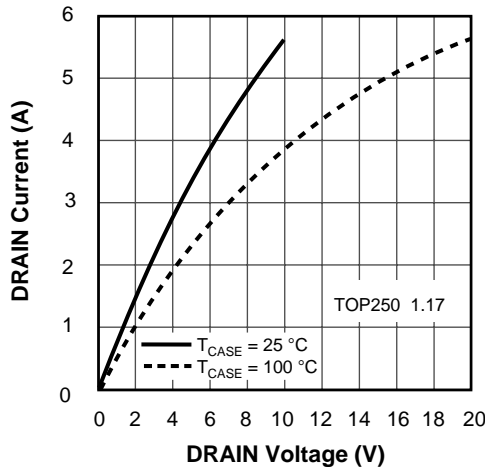


Figure 13. Output Characteristics.

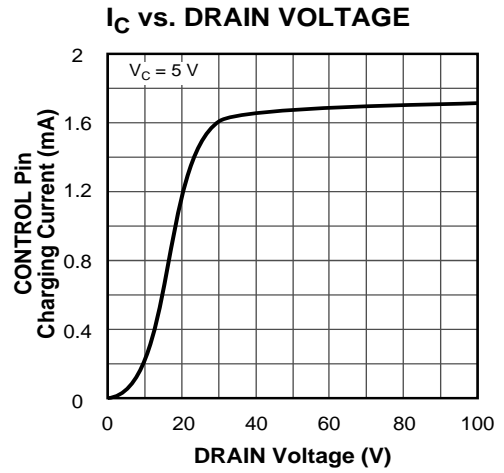


Figure 14. I_C vs. DRAIN Voltage.

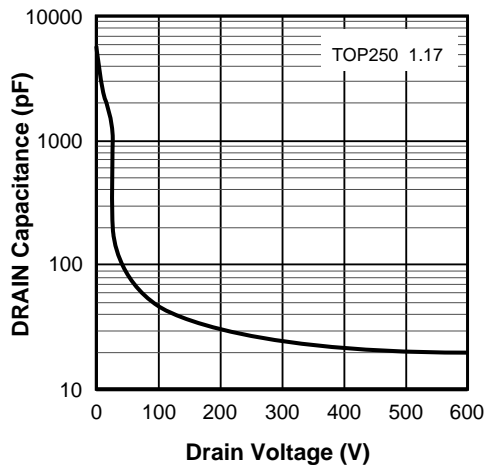


Figure 15. C_{OSS} vs. DRAIN Voltage.

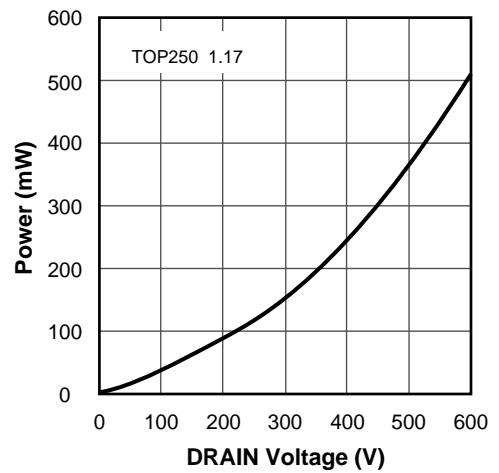


Figure 16. DRAIN Capacitance Power.

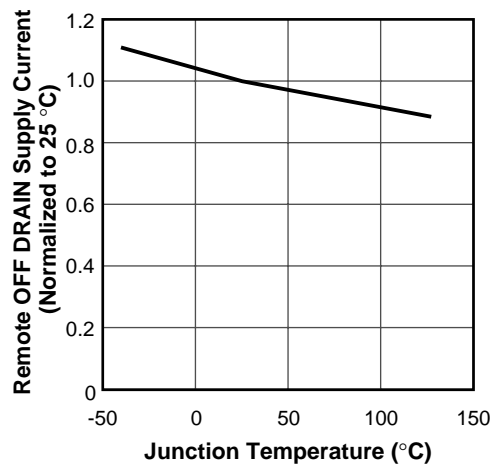


Figure 17. Remote OFF DRAIN Supply Current vs. Temperature.