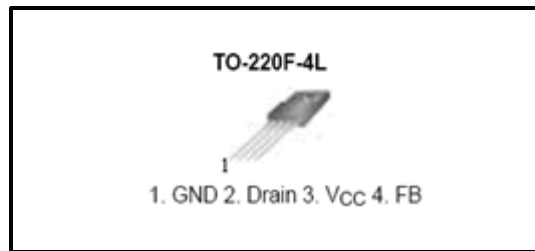**SemiHow**
Know-How for Semiconductor

SPGP0280A
(SEMIHOW POWER SWITCH)

FEATURES

❑ Variable frequency operation
❑ Low Start-up Current(Typ.100uA)
❑ Pulse by Pulse Current Limiting
❑ Over Current Protection
❑ Over Voltage Protection (Min. 20)
❑ Internal Thermal Shutdown Function
❑ Under Voltage Lockout
❑ Internal High Voltage Sense FET
❑ Auto-Restart Mode
❑ Frequency Modulation for low EMI
❑ Advanced Burst-Mode Operation

APPLICATION

❑ SMPS for STB, SVR, DVD & DVCD
❑ SMPS for Printer, Facsimile & Scanner
❑ Adaptor

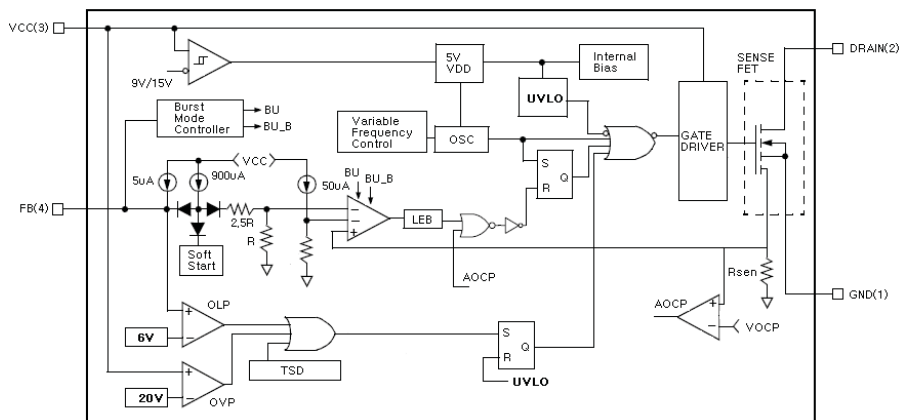TO-220F-4L

1. GND 2. Drain 3. VCC 4. FB

DESCRIPTION

The SemiHow Power Switch product family is specially designed for an off-line SMPS with minimal external components.

The SemiHow Power Switch consists of a high voltage power SenseFET and a current mode PWM IC.

 It has a basic platform well suited for the cost effective design in either a flyback converter

INTERNAL BLOCK DIAGRAM

Absolute Maximum Ratings

Ta=25°C, unless otherwise specified

Symbol	Parameter		Value	Units
V_{DSS}	Drain-Source Voltage		800	V
I_D	Drain Current – Continuous ($T_C = 25\,°C$)		2.0	A
	Drain Current – Continuous ($T_C = 100\,°C$)		1.3	A
I_{DM}	Drain Current – Pulsed (Note 1)		8	A
V_{GS}	Gate-Source Voltage		±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		90	mJ
$V_{CC(MAX)}$	Maximum Supply voltage		20	V
V_{FB}	Analog Input Voltage Range		-0.3 To V_{SD}	V
P_D	Power Dissipation ($T_C = 25\,°C$)		35	W
	- Derate above 25 °C		0.28	W/°C
T_J	Operating Junction Temperature		+160	°C
T_A	Operating Ambient Temperature		-25 to +85	°C
T_{STG}	Storage Temperature Range		-55 to +150	°C

Notes :

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L=51mH, I_{AS}=2.0A, V_{DD}=50V, R_G=25Ω, Starting T_J =25°C

Electrical Characteristics (SenseFET Part)

Ta=25°C, unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
On Characteristics						
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10$ V, $I_D = 1.0$ A	--	5.6	7.0	Ω
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0$ V, $I_D = 50$ μA	800	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 800$ V, $V_{GS} = 0$ V	--	--	250	μA
		$V_{DS} = 640$ V, $T_C = 125℃$	--	--	1000	μA
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25$ V, $V_{GS} = 0$ V, f = 1.0 MHz	--	480	620	pF
C_{oss}	Output Capacitance		--	45	60	pF
C_{rss}	Reverse Transfer Capacitance		--	8.5	11.0	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Time	$V_{DS} = 400$ V, $I_D = 2.0$ A, $R_G = 25$ Ω	--	20	--	ns
T_r	Turn-On Rise Time		--	30	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	45	--	ns
t_f	Turn-Off Fall Time		--	30	--	ns
Q_g	Total Gate Charge	$V_{DS} = 400$V, $I_D = 2.0$ A, $V_{GS} = 10$ V	--	12	16	nC
Q_{gs}	Gate-Source Charge		--	3.0	--	nC
Q_{gd}	Gate-Drain Charge		--	4.5	--	nC

Notes :

1. Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%

2. $S = \dfrac{1}{R}$

Electrical Characteristics (Control Part)

Ta=25°C, unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
UVLO Section						
V_{START}	Start Threshold Voltage	V_{FB} = GND	14	15	16	V
V_{STOP}	Stop Threshold Voltage	V_{FB} = GND	8.4	9	9.6	V
Oscillator Section						
F_{OSC}	Initial Accuracy		57	64	71	KHz
--	Frequency Change With Temperature (Note 2)	-25°C $\leq$ Ta $\leq$ +85°C	--	±5	±10	%
D_{MAX}	Maximum Duty Cycle		73	77	82	%
FEEDBACK Section						
I_{FB}	Feedback Source Current	Ta=25°C, 0V<Vfb<3V	0.7	0.9	1.1	mA
V_{SD}	Shutdown Feedback Voltage	Vfb>6.5V	5.4	6	6.6	V
I_{delay}	Shutdown Delay Current	Ta=25°C, 5VδVfbδVSD	4	5	6	mA
Reference Section						
V_{REF}	Reference Output Voltage (Note 1)	Ta=25°C	4.8	5	5.2	V
Vref/ΔT	Temperature Stability (Note 1 , 2)	-25°C $\leq$ Ta $\leq$ +85°C	--	0.3	0.6	mV/°C
I_{OVER}	Peak Current Limit	Max. inductor current	1.05	1.2	1.34	A
Protection Section						
V_{OVP}	Over Voltage Protection	VCC > 20V	20	--	23	V
T_{SD}	Thermal Shutdown Temperature (Tj) (Note 1)	--	140	160	--	°C
Protection Section						
I_{START}	Start-up Current	VCC = 14V	--	100	170	μA
I_{OP}	Operating Supply Current (Control Part Only)	VCC < 20V	--	3	6	mA

Notes :
1. These parameters, although guaranteed, are not 100% tested in production
2. These parameters, although guaranteed, are tested in EDS(water test) process
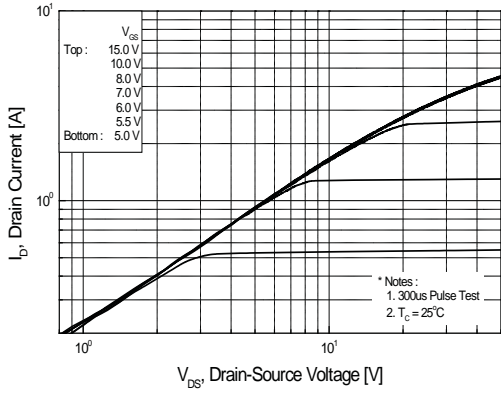
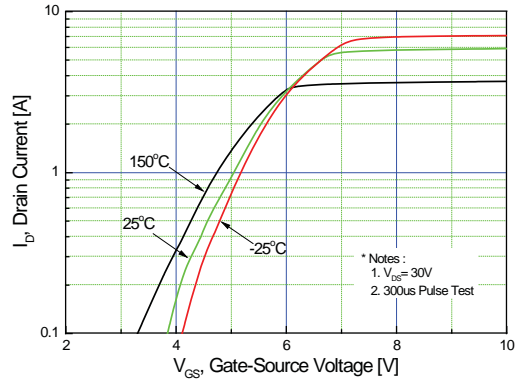# Typical Characteristics (SenseFET Part)

Figure 1. On Region Characteristics
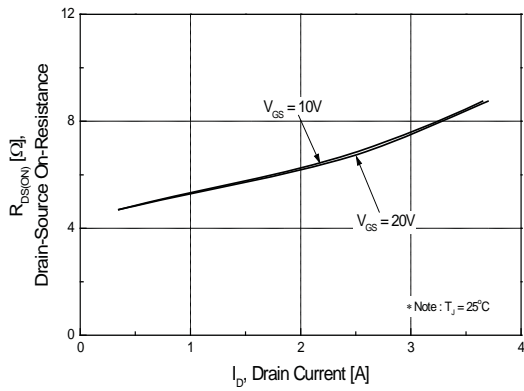

Figure 2. Transfer Characteristics

Figure 3. On Resistance Variation vs Drain Current and Gate Voltage
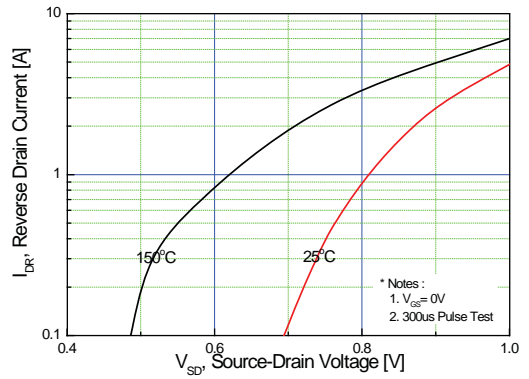

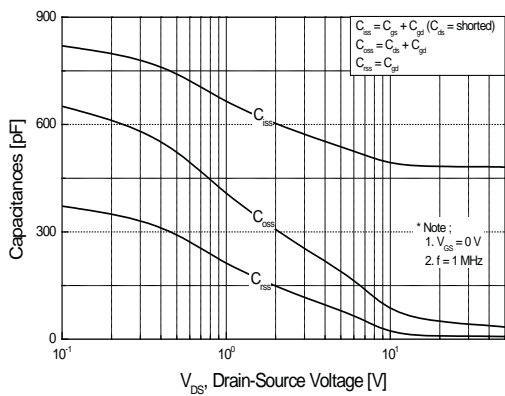**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**
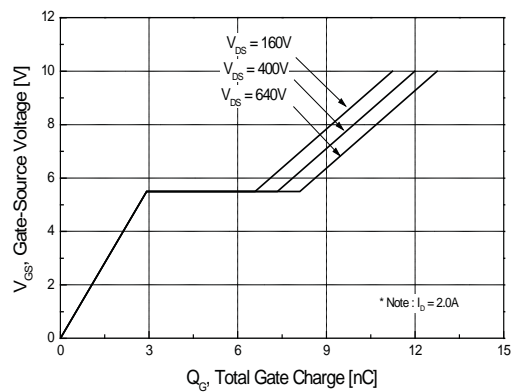

Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics
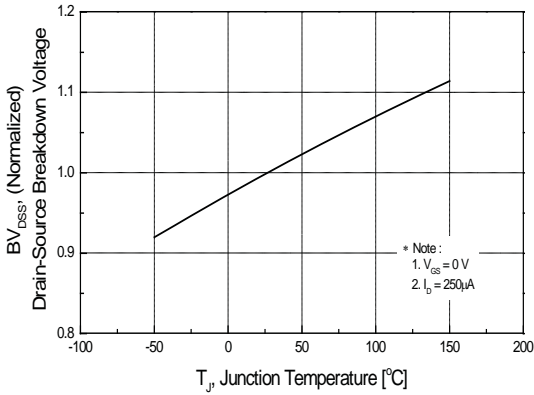
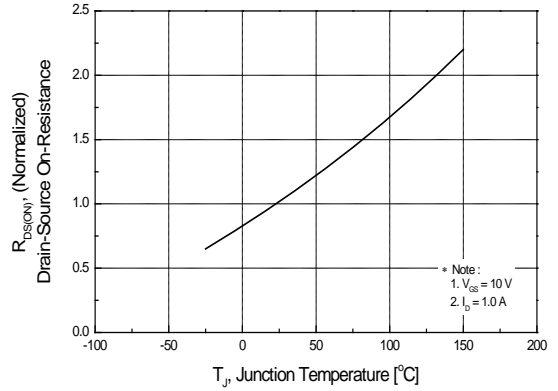# Typical Characteristics (SenseFET Part) (continued)

Figure 7. Breakdown Voltage Variation vs Temperature

* Note :
1. $V_{GS} = 0$ V
2. $I_D = 250\mu A$

Figure 8. On-Resistance Variation vs Temperature

* Note :
1. $V_{GS} = 10$ V
2. $I_D = 1.0$ A

Figure 9. Maximum Safe Operating Area

Operation in This Area is Limited by $R_{DS(on)}$

100 μs
1 ms
10 ms
100 ms
DC

*Notes :
1. $T_C = 25$ °C
2. $T_J = 150$ °C
3. Single Pulse

Figure 10. Maximum Drain Current vs Case Temperature

Figure 11. Transient Thermal Response Curve

D=0.5
0.2
0.1
0.05
0.02
0.01
single pulse

* Notes :
1. $Z_{\theta JC}(t) = 3.57$ °C/W Max.
2. Duty Factor, $D = t_1/t_2$
3. $T_{JM} - T_C = P_{DM} * Z_{\theta JC}(t)$

Typical Performance Characteristics (Control Part) (continued)

(These characteristic graphs are normalized at Ta=25°C)

Figure 1. Operating Frequency

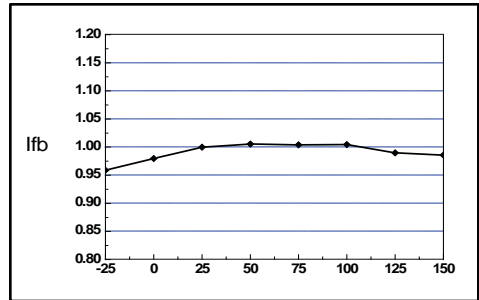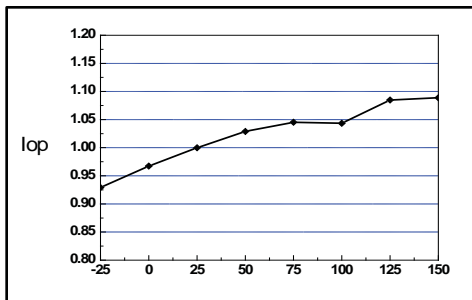**Figure 2. Feedback Source Current**
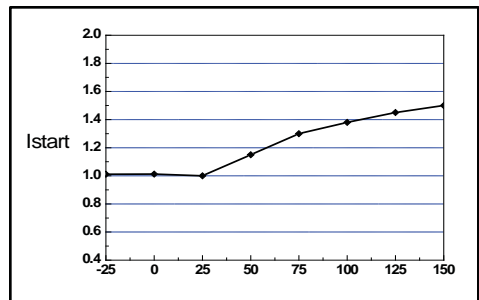

Figure 3. Operating Supply Current

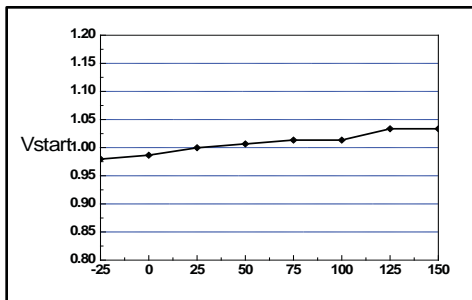**Figure 4. Start up Current**

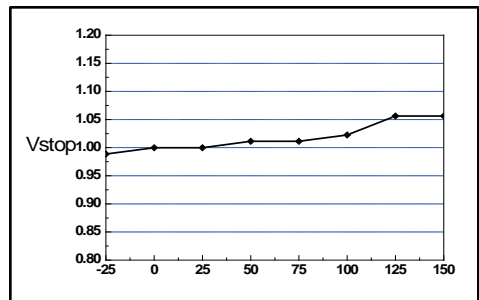**Figure 5. Start Threshold Voltage**

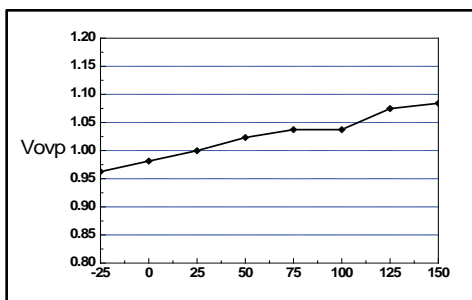
Figure 6. Stop Threshold Voltage

Figure 7. Over Voltage Protection

Package Dimension

TO-220F-4L