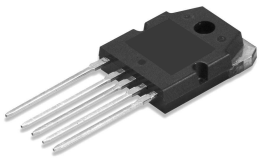
## SPS

The SPS product family is specially designed for an off line SMPS with minimal external component. The SPS consist of high voltage Power SenseFET and current mode PWM IC. Included control IC features a trimmed oscillator, under voltage lock out, leading edge blanking, optimized gate turn-on/turn-off driver, thermal shut down protection, over voltage protection, and temperature compensated precision current source for loop compensation and fault protection circuitry. Compared to discrete MOSFET and controller or RCC switching converter solution, a SPS can reduce total component count, design size, weight and at the same time increase efficiency, productivity and system reliability. It has a basic platform well suited for cost effective monitor power supply.

TO-3P-5L



1.DRAIN 2. GND 3. $V_{CC}$ 4. FB 5. Sync

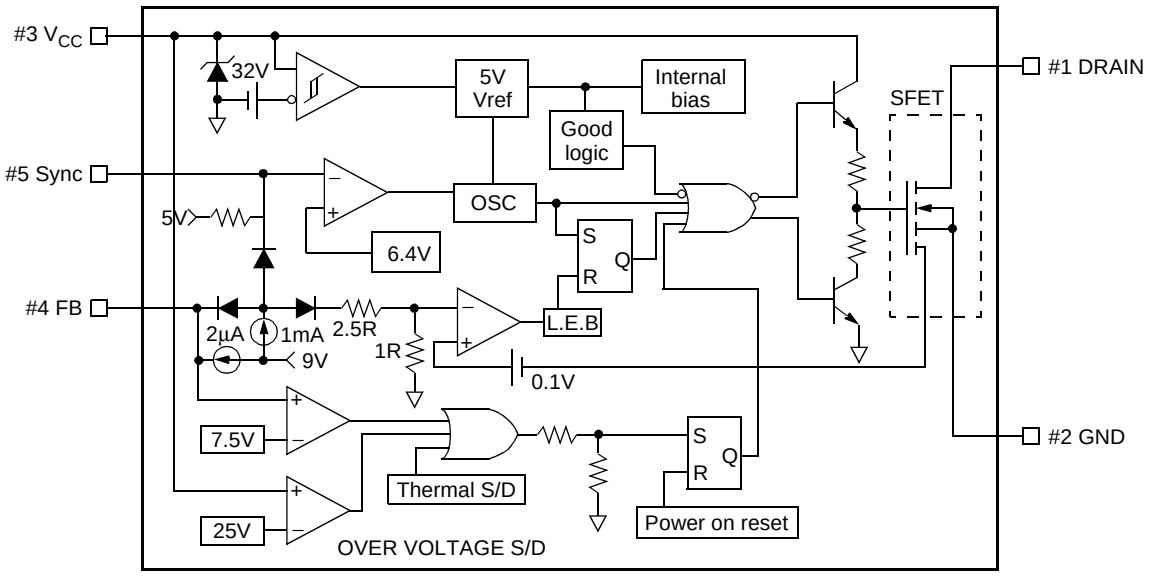
## FEATURES

- Wide operating frequency range up to 150kHz
- Pulse by pulse over current limiting
- Over load protection
- Over voltage protection (Min. 23V)
- Internal thermal shutdown function
- Under voltage lockout
- Internal high voltage sense FET
- External sync terminal
- Latch up Mode

## ORDERING INFORMATION

| Device | Package | Rating | Topr (°C) |
|---|---|---|---|
| KA2S0680 | TO-3P-5L | 800V, 6A | –25°C to +85°C |

## BLOCK DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Drain-source (GND) voltage (1) | $V_{DSS}$ | 800 | V |
| Drain-Gate voltage ($R_{GS}$=1MΩ) | $V_{DGR}$ | 800 | V |
| Gate-source (GND) voltage | $V_{GS}$ | ±30 | V |
| Drain current pulsed (2) | $I_{DM}$ | 24.0 | $A_{DC}$ |
| Single pulsed avalanche energy (3) | $E_{AS}$ | 455 | mJ |
| Avalanche current(4) | $I_{AS}$ | 20 | A |
| Continuous drain current ($T_C$=25°C) | $I_D$ | 6.0 | $A_{DC}$ |
| Continuous drain current ($T_C$=100°C) | $I_D$ | 4.0 | $A_{DC}$ |
| Supply voltage | $V_{CC}$ | 30 | V |
| Analog input voltage range | $V_{FB}$ | –0.3 to $V_{SD}$ | V |
| Total power dissipation | $P_D$ (watt H/S) | 150 | W |
| | Derating | 1.21 | W/°C |
| Operating temperature | $T_{OPR}$ | –25 to +85 | °C |
| Storage temperature | $T_{STG}$ | –55 to +150 | °C |

**NOTES:**

1. Tj=25°C to 150°C
2. Repetitive rating: Pulse width limited by maximum junction temperature
3. L=24mH, $V_{DD}$=50V, $R_G$=25Ω, starting Tj=25°C
4. L=13uH, $V_{DD}$=310V, Tj=25°C

## ELECTRICAL CHARACTERISTICS (SFET part)

(Ta=25°C unless otherwise specified)

| Characteristic | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Drain-source breakdown voltage | $BV_{DSS}$ | $V_{GS}$=0V, $I_D$=50μA | 800 | – | – | V |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=Max., Rating, $V_{GS}$=0V | – | – | 50 | μA |
| | | $V_{DS}$=0.8Max., Rating, $V_{GS}$=0V, $T_C$=125°C | – | – | 200 | μA |
| Static drain-source on resistance (note) | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=4.0A | – | 1.6 | 2.0 | Ω |
| Forward transconductance (note) | gfs | $V_{DS}$=15V, $I_D$=4.0A | 1.5 | 2.5 | – | mho |
| Input capacitance | Ciss | $V_{GS}$=0V, $V_{DS}$=25V, f=1MHz | – | 1600 | – | pF |
| Output capacitance | Coss | | – | 140 | – | |
| Reverse transfer capacitance | Crss | | – | 42 | – | |
| Turn on delay time | td(on) | $V_{DD}$=0.5$BV_{DSS}$, $I_D$=6.0A (MOSFET switching time are essentially independent of operating temperature) | – | 60 | – | nS |
| Rise time | tr | | – | 150 | – | |
| Turn off delay time | td(off) | | – | 300 | – | |
| Fall time | tf | | – | 130 | – | |
| Total gate charge (gate-source+gate-drain) | Qg | $V_{GS}$=10V, $I_D$=6.0A, $V_{DS}$=0.5$BV_{DSS}$ (MOSFET switching time are essentially independent of operating temperature) | – | 70 | – | nC |
| Gate-source charge | Qgs | | – | 16 | – | |
| Gate-drain (Miller) charge | Qgd | | – | 27 | – | |

**NOTE:** Pulse test: Pulse width ≤ 300μS, duty cycle ≤ 2%

## ELECTRICAL CHARACTERISTICS (Control part)

(Ta=25°C unless otherwise specified)

| Characteristic | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **REFERENCE SECTION** | | | | | | |
| Output voltage (1) | Vref | Ta=25°C | 4.80 | 5.00 | 5.20 | V |
| Temperature Stability (1)(2) | Vref/ΔT | −25°C≤Ta≤+85°C | – | 0.3 | 0.6 | mV/°C |
| **OSCILLATOR SECTION** | | | | | | |
| Initial accuracy | $F_{OSC}$ | Ta=25°C | 18 | 20 | 22 | kHz |
| Frequency change with temperature (2) | ΔF/ΔT | −25°C≤Ta≤+85°C | – | ±5 | ±10 | % |
| Sync threshold voltage (3) | $V_{SYTH}$ | Vfb=5V | 6.0 | 6.4 | 6.8 | V |
| **PWM SECTION** | | | | | | |
| Maximum duty cycle | Dmax | – | 92 | 95 | 98 | % |
| **FEEDBACK SECTION** | | | | | | |
| Feedback source current | $I_{FB}$ | Ta=25°C, Vfb=GND | 0.7 | 0.9 | 1.1 | mA |
| Shutdown delay current | Idelay | Ta=25°C, 5V≤Vfb≤$V_{SD}$ | 1.4 | 1.8 | 2.2 | μA |
| **OVER CURRENT PROTECTION SECTION** | | | | | | |
| Over current protection | $I_L$(max) | Max. inductor current | 3.52 | 4.00 | 4.48 | A |
| **UVLO SECTION** | | | | | | |
| Start threshold voltage | Vth(H) | – | 14 | 15 | 16 | V |
| Minimum operating voltage | Vth(L) | After turn on | 9 | 10 | 11 | V |
| **TOTAL STANDBY CURRENT SECTION** | | | | | | |
| Start current | $I_{ST}$ | $V_{CC}$=14V | 0.1 | 0.3 | 0.55 | mA |
| Operating supply current (control part only) | $I_{OPR}$ | Ta=25°C | 6 | 12 | 18 | mA |
| $V_{CC}$ zener voltage | $V_Z$ | $I_{CC}$=20mA | 30 | 32.5 | 35 | V |
| **SHUTDOWN SECTION** | | | | | | |
| Shutdown Feedback voltage | $V_{SD}$ | – | 6.9 | 7.5 | 8.1 | V |
| Thermal shutdown temperature (Tj) (1) | $T_{SD}$ | – | 140 | 160 | – | °C |
| Over voltage protection voltage | $V_{OVP}$ | – | 23 | 25 | 28 | V |
| **SOFT START SECTION** | | | | | | |
| Soft start current | $I_{SS}$ | Sync & S/S=GND | 0.8 | 1.0 | 1.2 | mA |
| Soft start voltage | $V_{SS}$ | $V_{FB}$=2V | 4.7 | 5.0 | 5.3 | V |

**NOTES:**

1. These parameters, although guaranteed, are not 100% tested in production
2. These parameters, although guaranteed, are tested in EDS (wafer test) process
3. The amplitude of the sync. pulse is recommended to be between 2V and 3V for stable sync. function.

## TYPICAL PERFORMANCE CHARACTERISTICS

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

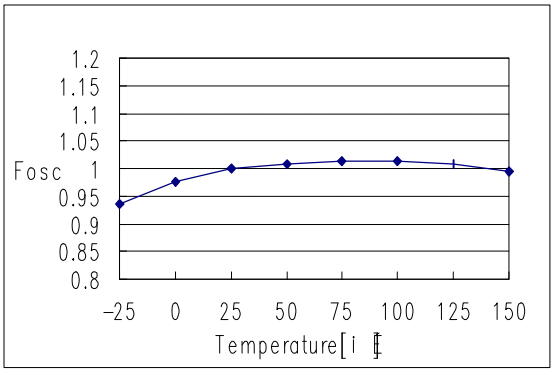



**Figure 1. Operating Frequency**

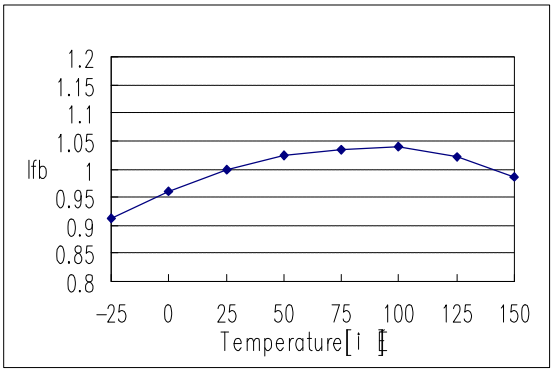



**Figure 2. Feedback Source Current**

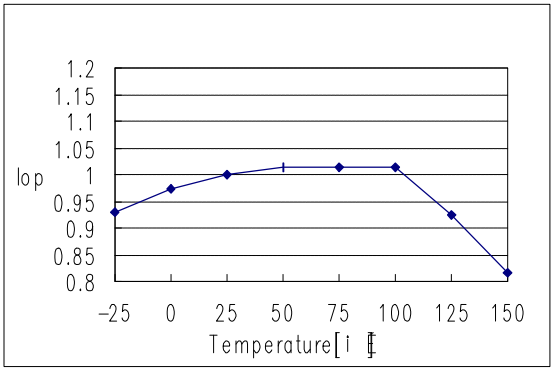



**Figure 3. Operating Current**

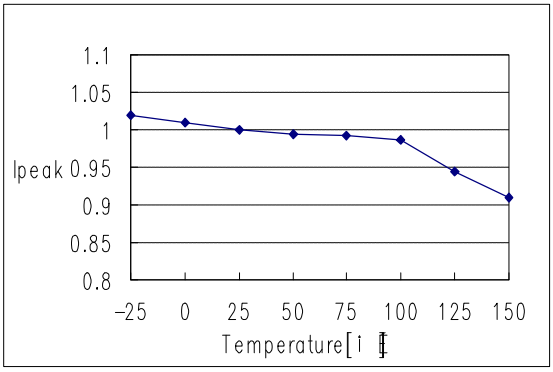



**Figure 4. Max. Inductor Current**

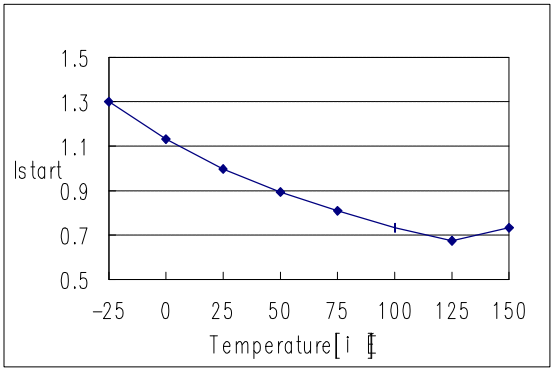



**Figure 5. Start up Current**

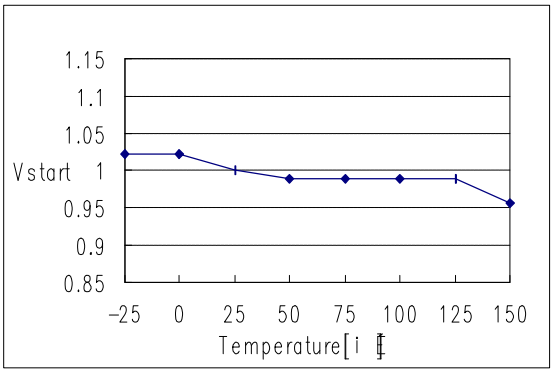



**Figure 6. Start Threshold Voltage**

## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

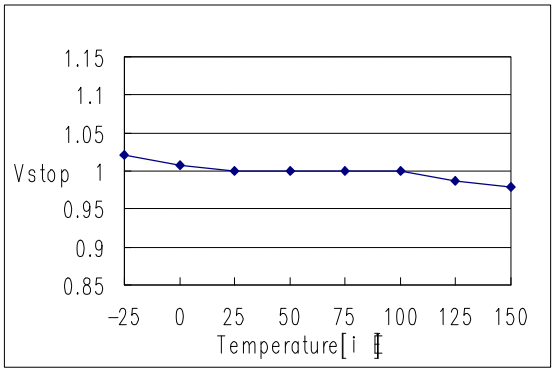



**Figure 7. Stop Threshold Voltage**

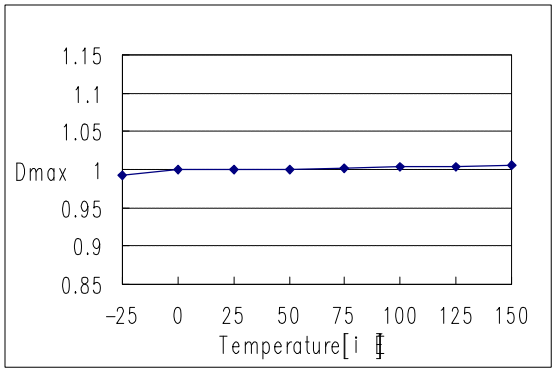



**Figure 8. Maximum Duty Cycle**

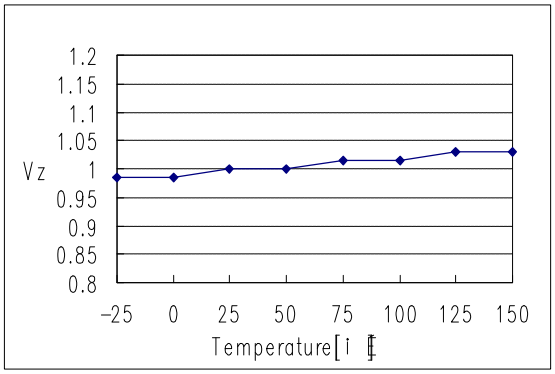



**Figure 9. $V_{CC}$ Zener Voltage**

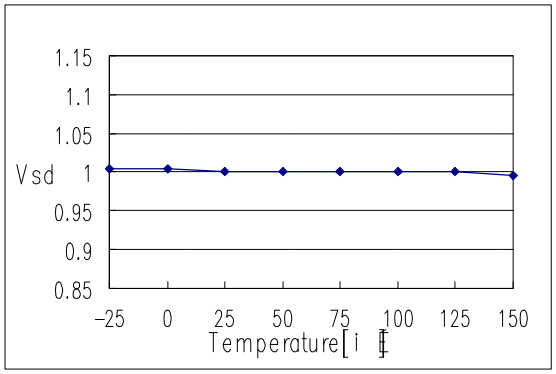



**Figure 10. Shutdown Feedback Voltage**

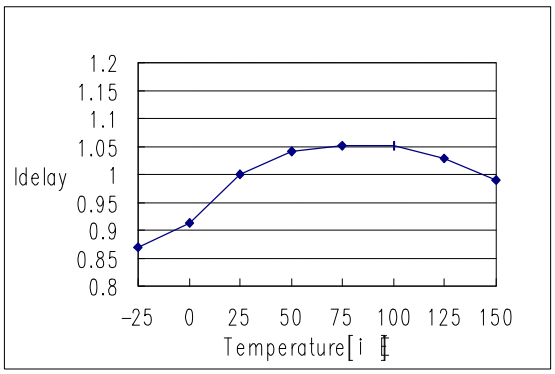



**Figure 11. Shutdown Delay Current**

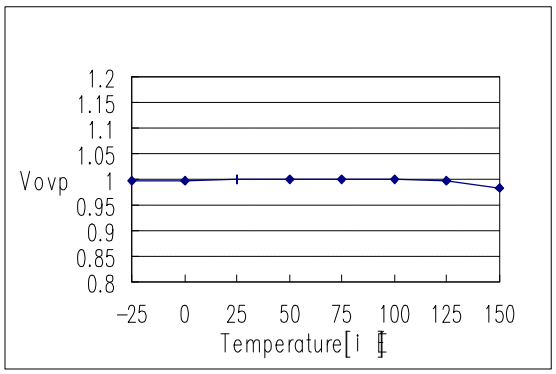



**Figure 12. Over Voltage Protection**

## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

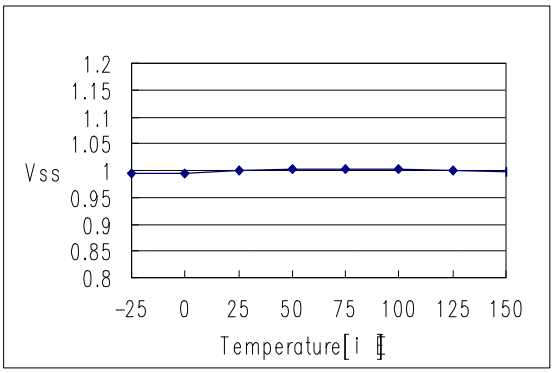



**Figure 13. Soft Start Voltage**

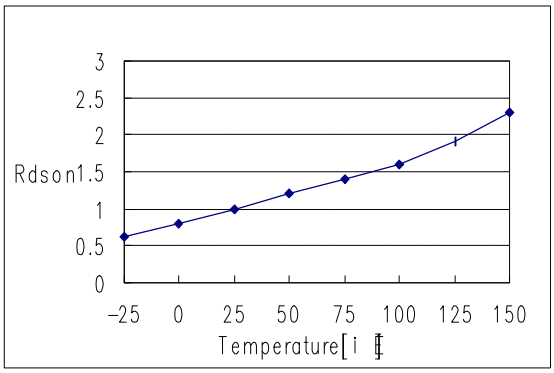



**Figure 14. Drain Source Turn-on Resistance**

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