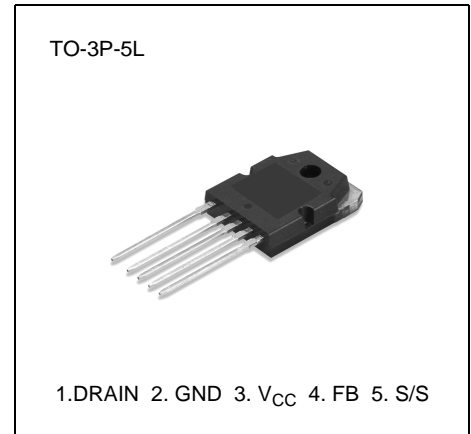


SPS

The SPS product family is specially designed for an off-line SMPS with minimal external components. The SPS consist of high voltage power SenseFET and current mode PWM IC. Included PWM controller features integrated fixed 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 sources 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 design in either a flyback converter or a forward converter.



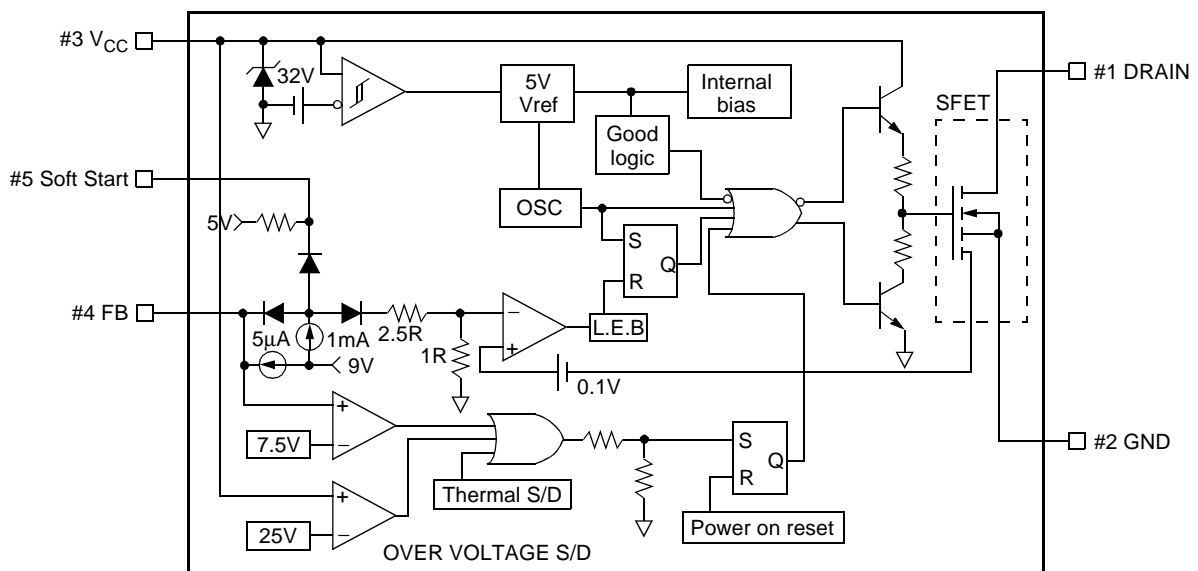
FEATURES

- Precision fixed operating frequency (70kHz)
- Pulse by pulse over current limiting
- Over Current Protection
- Over Voltage Protection (Min. 23V)
- Internal thermal shutdown function
- Under voltage lockout
- Internal high voltage sense FET
- Autorestart
- Soft start

ORDERING INFORMATION

Device	Package	Operating Temperature
KA1M0965R	TO-3P-5L	-25°C to +85°C

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Drain-source (GND) voltage ⁽¹⁾	V_{DSS}	650	V
Drain-Gate voltage ($R_{GS}=1M\Omega$)	V_{DGR}	650	V
Gate-source (GND) voltage	V_{GS}	± 30	V
Drain current pulsed ⁽²⁾	I_{DM}	36.0	A_{DC}
Single pulsed avalanche energy ⁽³⁾	E_{AS}	950	mJ
Avalanche current ⁽⁴⁾	I_{AS}	–	A
Continuous drain current ($T_C=25^\circ C$)	I_D	9.0	A_{DC}
Continuous drain current ($T_C=100^\circ C$)	I_D	5.8	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)	170	W
	Derating	1.33	$W/^\circ C$
Operating temperature	T_{OPR}	-25 to $+85$	$^\circ C$
Storage temperature	T_{STG}	-55 to $+150$	$^\circ C$

NOTES:

- $T_j=25^\circ C$ to $150^\circ C$
- Repetitive rating: Pulse width limited by maximum junction temperature
- $L=20mH$, $V_{DD}=50V$, $R_G=27\Omega$, starting $T_j=25^\circ C$

ELECTRICAL CHARACTERISTICS (SFET part)

(Ta=25°C unless otherwise specified)

Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	$V_{GS}=0V, I_D=50\mu A$	650	–	–	V
Zero gate voltage drain current	I_{DSS}	$V_{DS}=\text{Max.}, \text{Rating}, V_{GS}=0V$	–	–	50	μA
		$V_{DS}=0.8\text{Max.}, \text{Rating}, V_{GS}=0V, T_C=125^\circ C$	–	–	200	μA
Static drain-source on resistance ^(note)	$R_{DS(ON)}$	$V_{GS}=10V, I_D=4.5A$	–	0.96	1.2	Ω
Forward transconductance ^(note)	gfs	$V_{DS}=15V, I_D=4.5A$	5.0	–	–	mho
Input capacitance	C_{iss}	$V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$	–	1750	–	μF
Output capacitance	C_{oss}		–	190	–	
Reverse transfer capacitance	C_{rss}		–	78	–	
Turn on delay time	td(on)	$V_{DD}=0.5BV_{DSS}, I_D=9.0A$ (MOSFET switching time are essentially independent of operating temperature)	–	20	50	nS
Rise time	tr		–	23	55	
Turn off delay time	td(off)		–	85	180	
Fall time	tf		–	30	70	
Total gate charge (gate-source+gate-drain)	Qg	$V_{GS}=10V, I_D=9.0A, V_{DS}=0.5BV_{DSS}$ (MOSFET switching time are essentially independent of operating temperature)	–	74	75	nC
Gate-source charge	Qgs		–	12	–	
Gate-drain (Miller) charge	Qgd		–	35.4	–	

NOTE: Pulse test: Pulse width $\leq 300\mu S$, duty cycle $\leq 2\%$

ELECTRICAL CHARACTERISTICS (Control part)

(Ta=25°C unless otherwise specified)

Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit
REFERENCE SECTION						
Output voltage ⁽¹⁾	V _{ref}	Ta=25°C	4.80	5.00	5.20	V
Temperature Stability ⁽¹⁾⁽²⁾	V _{ref} /ΔT	-25°C≤Ta≤+85°C	-	0.3	0.6	mV/°C
OSCILLATOR SECTION						
Initial accuracy	F _{OSC}	Ta=25°C	61	67	73	kHz
Frequency change with temperature ⁽²⁾	ΔF/ΔT	-25°C≤Ta≤+85°C	-	±5	±10	%
PWM SECTION						
Maximum duty cycle	D _{max}	-	74	77	80	%
FEEDBACK SECTION						
Feedback source current	I _{FB}	Ta=25°C, 0V≤V _{fb} ≤3V	0.7	0.9	1.1	mA
Shutdown delay current	I _{delay}	Ta=25°C, 5V≤V _{fb} ≤V _{SD}	4.0	5.0	6.0	μA
OVER CURRENT PROTECTION SECTION						
Over current protection	I _L (max)	Max. inductor current	5.28	6.00	6.72	A
UVLO SECTION						
Start threshold voltage	V _{th} (H)	-	14	15	16	V
Minimum operating voltage	V _{th} (L)	After turn on	9	10	11	V
TOTAL STANDBY CURRENT SECTION						
Start current	I _{ST}	V _{CC} =14V	0.1	0.3	0.45	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 (T _j) ⁽¹⁾	T _{SD}	-	140	160	-	°C
Over voltage protection voltage	V _{OVp}	-	23	25	28	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

TYPICAL PERFORMANCE CHARACTERISTICS

(These characteristic graphs are normalized at $T_a=25^\circ\text{C}$)

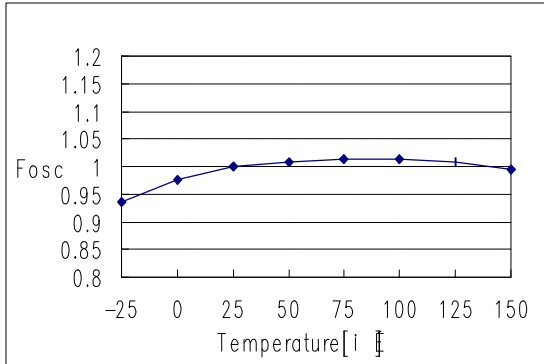


Figure 1. Operating Frequency

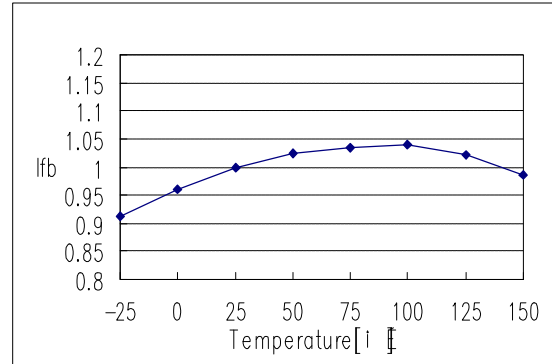


Figure 2. Feedback Source Current

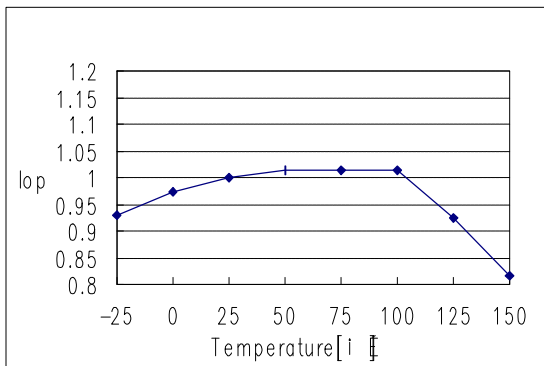


Figure 3. Operating Current

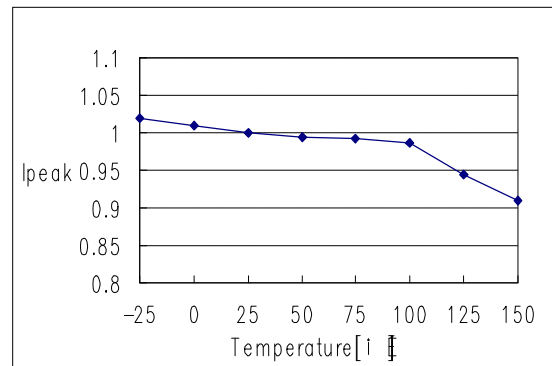


Figure 4. Max. Inductor Current

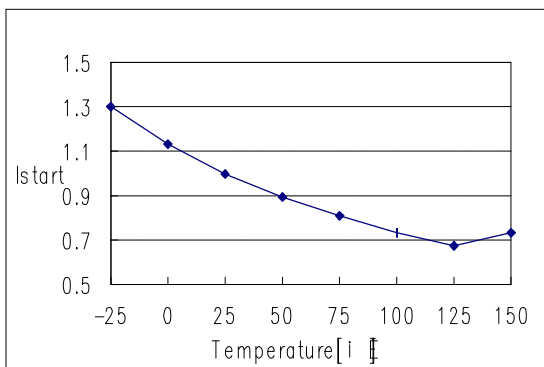


Figure 5. Start up Current

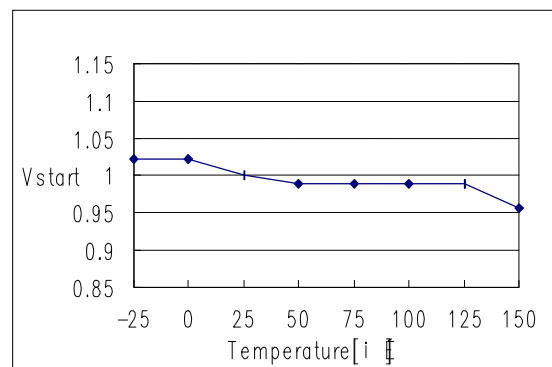


Figure 6. Start Threshold Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(These characteristic graphs are normalized at $T_a=25^\circ\text{C}$)

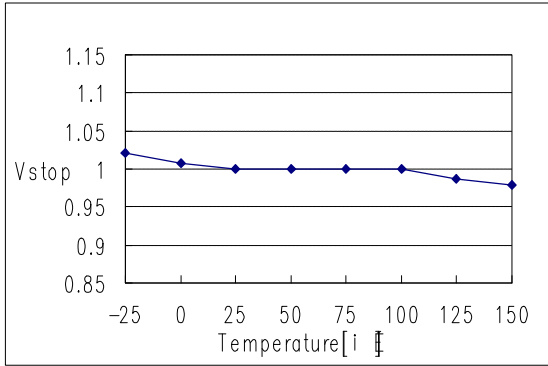


Figure 7. Stop Threshold Voltage

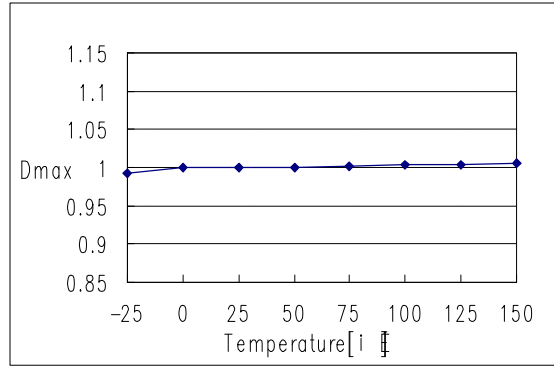


Figure 8. Maximum Duty Cycle

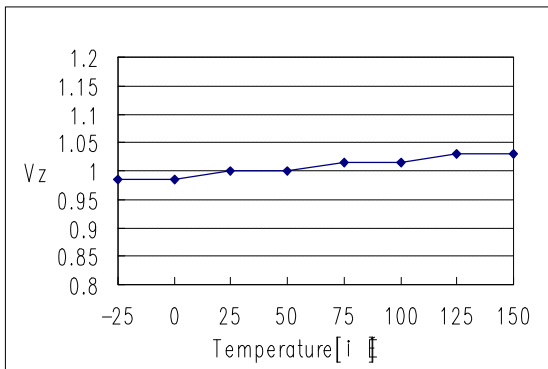


Figure 9. V_{CC} Zener Voltage

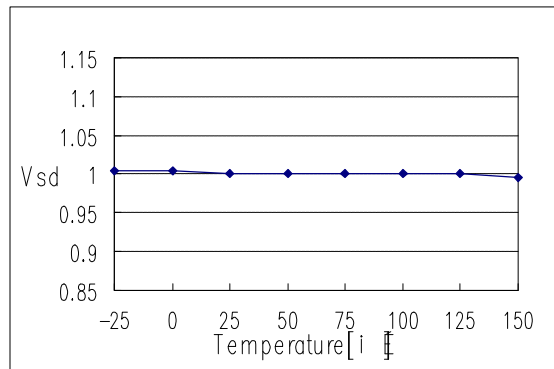


Figure 10. Shutdown Feedback Voltage

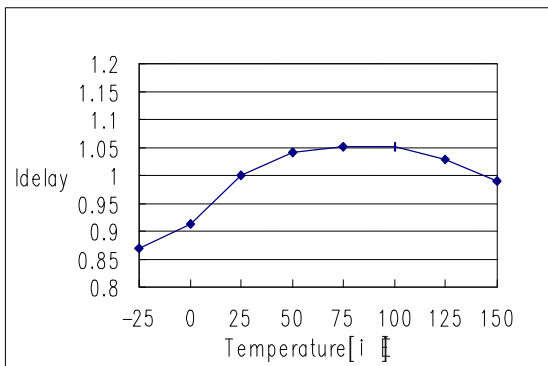


Figure 11. Shutdown Delay Current

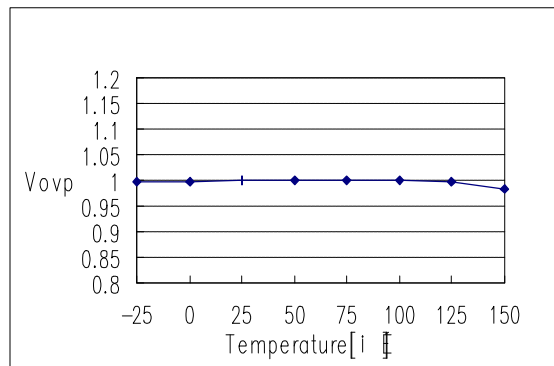


Figure 12. Over Voltage Protection

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(These characteristic graphs are normalized at $T_a=25^\circ\text{C}$)

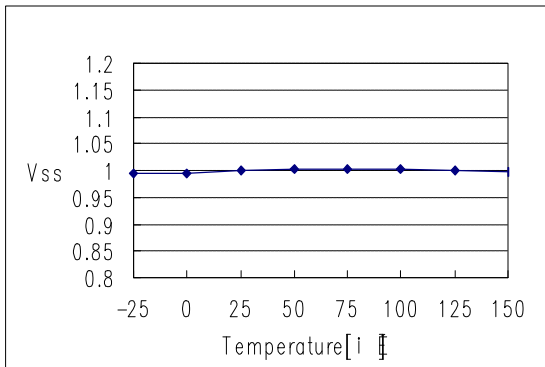


Figure 13. Soft Start Voltage

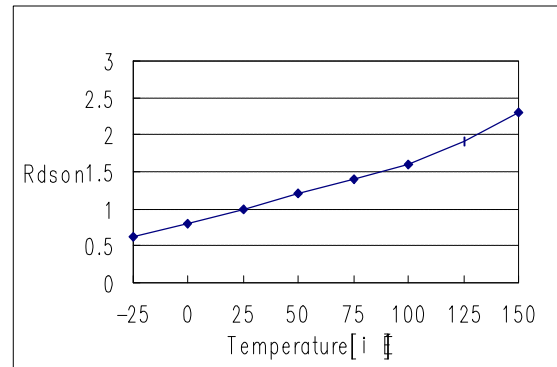


Figure 14. Drain Source Turn-on Resistance

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