



Preliminary

# KA5L0380R

S P S

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.

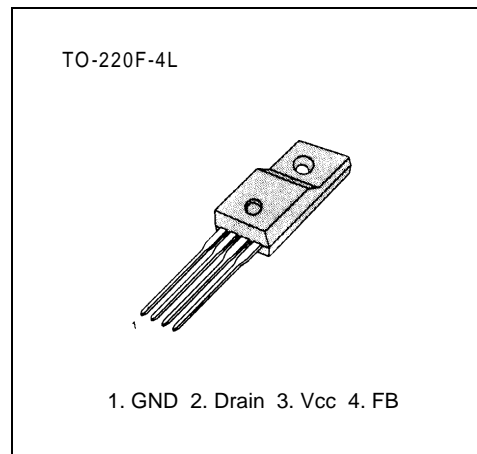
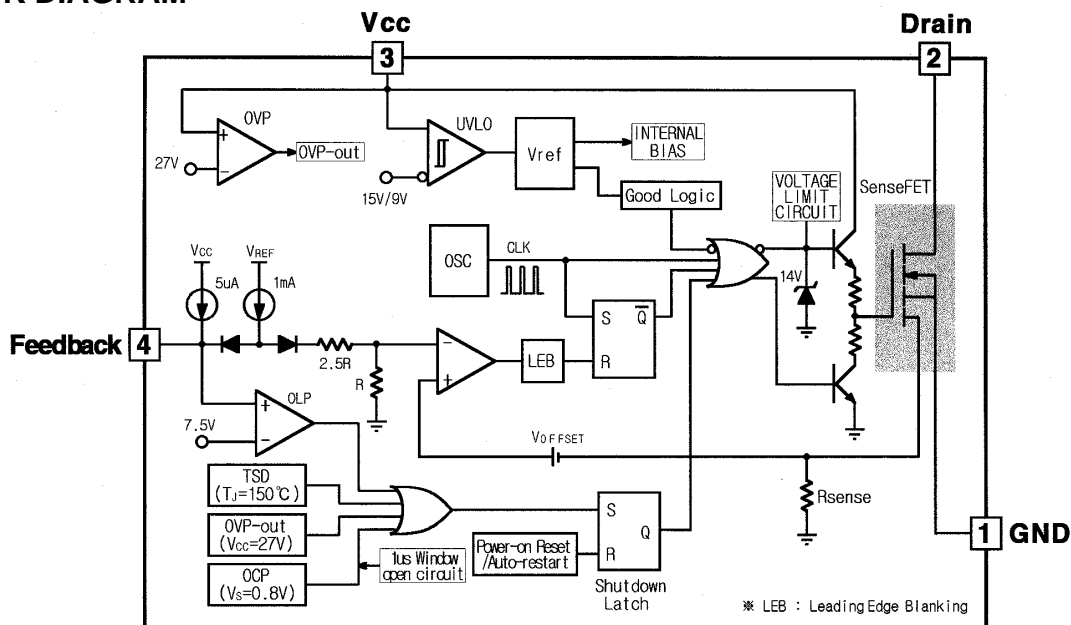
Included PWM controller features integrated fixed frequency oscillator, under voltage lock-out, leading edge blanking, optimized gate turn-on/turn-off driver, thermal shutdown protection, over voltage protection, and temperature compensated precision current sources for loop compensation and fault protection circuitry. Compared to discrete MOSFET and PWM controller or RCC 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 (50kHz)
- Low start-up current (Typ. 100mA)
- Pulse by pulse current limiting
- Over current protection
- Over voltage protection (Min. 25V)
- Internal thermal shutdown function
- Under voltage lockout
- Internal high voltage sense FET
- Auto-restart mode

## BLOCK DIAGRAM



## ORDERING INFORMATION

Device	Package	Topr (°C)
KA5L0380R	TO-220F-4L	-25°C to +85°C

**ABSOLUTE MAXIMUM RATINGS**

Characteristic	Symbol	Value	Unit
Drain-source (GND) voltage <sup>(1)</sup>	V <sub>DSS</sub>	800	V
Drain-Gate voltage (R <sub>GS</sub> =1MΩ)	V <sub>DGR</sub>	800	V
Gate-source (GND) voltage	V <sub>GS</sub>	±30	V
Drain current pulsed <sup>(2)</sup>	I <sub>DM</sub>	12	A <sub>DC</sub>
Single pulsed avalanche energy <sup>(3)</sup>	E <sub>AS</sub>	95	mJ
Avalanche current <sup>(4)</sup>	I <sub>AS</sub>	–	A
Continuous drain current (T <sub>C</sub> =25°C)	I <sub>D</sub>	3.0	A <sub>DC</sub>
Continuous drain current (T <sub>C</sub> =100°C)	I <sub>D</sub>	2.1	A <sub>DC</sub>
Supply voltage	V <sub>CC</sub>	30	V
Analog input voltage range	V <sub>FB</sub>	–0.3 to V <sub>SD</sub>	V
Total power dissipation	P <sub>D</sub> (wt H/S)	35	W
	Derating	0.28	W/°C
Operating temperature	T <sub>OPR</sub>	–25 to +85	°C
Storage temperature	T <sub>STG</sub>	–55 to +150	°C

**NOTES:**

1. T<sub>j</sub>=25°C to 150°C
2. Repetitive rating: Pulse width limited by maximum junction temperature
3. L=51mH, starting T<sub>j</sub>=25°C
4. L=13uH, starting T<sub>j</sub>=25°C

## ELECTRICAL CHARACTERISTICS (SFET part)

(Ta=25°C unless otherwise specified)

Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=50\mu A$	800	–	–	V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=\text{Max.}, \text{Rating}, V_{GS}=0V$	–	–	250	$\mu A$
		$V_{DS}=0.8\text{Max.}, \text{Rating}, V_{GS}=0V, T_C=125^\circ C$	–	–	1000	$\mu A$
Static drain-source on resistance <sup>(note)</sup>	$R_{DS(ON)}$	$V_{GS}=10V, I_D=0.5A$	–	4	5	$\Omega$
Forward transconductance <sup>(note)</sup>	$g_{fs}$	$V_{DS}=50V, I_D=0.5A$	1.5	2.5	–	S
Input capacitance	$C_{iss}$	$V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$	–	779	–	pF
Output capacitance	$C_{oss}$		–	75.6	–	
Reverse transfer capacitance	$C_{rss}$		–	24.9	–	
Turn on delay time	$t_{d(on)}$	$V_{DD}=0.5BV_{DSS}, I_D=1.0A$ (MOSFET switching time are essentially independent of operating temperature)	–	40	–	nS
Rise time	$t_r$		–	95	–	
Turn off delay time	$t_{d(off)}$		–	150	–	
Fall time	$t_f$		–	60	–	
Total gate charge (gate-source+gate-drain)	$Q_g$	$V_{GS}=10V, I_D=1.0A, V_{DS}=0.5BV_{DSS}$ (MOSFET switching time are essentially independent of operating temperature)	–	–	34	nC
Gate-source charge	$Q_{gs}$		–	7.2	–	
Gate-drain (Miller) charge	$Q_{gd}$		–	12.1	–	

**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
<b>REFERENCE SECTION</b>						
Output voltage <sup>(1)</sup>	Vref	Ta=25°C	4.80	5.00	5.20	V
Temperature Stability <sup>(1)(2)</sup>	Vref/ΔT	-25°C≤Ta≤+85°C	-	0.3	0.6	mV/°C
<b>OSCILLATOR SECTION</b>						
Initial accuracy	F <sub>OSC</sub>	Ta=25°C	45	50	55	kHz
Frequency change with temperature <sup>(2)</sup>	ΔF/ΔT	-25°C≤Ta≤+85°C	-	±5	±10	%
<b>PWM SECTION</b>						
Maximum duty cycle	Dmax	-	74	77	80	%
<b>FEEDBACK SECTION</b>						
Feedback source current	I <sub>FB</sub>	Ta=25°C, 0V≤Vfb≤3V	0.7	0.9	1.1	mA
Shutdown delay current	I <sub>delay</sub>	Ta=25°C, 5V≤Vfb≤V <sub>SD</sub>	4	5	6	μA
<b>OVER CURRENT PROTECTION SECTION</b>						
Over current protection	I <sub>L</sub> (max)	Max. inductor current	1.89	2.15	2.41	A
<b>UVLO SECTION</b>						
Start threshold voltage	V <sub>th</sub> (H)	-	8.4	9	9.6	V
Minimum operating voltage	V <sub>th</sub> (L)	After turn on	14	15	16	V
<b>TOTAL STANDBY CURRENT SECTION</b>						
Start current	I <sub>ST</sub>	V <sub>CC</sub> =14V	-	0.1	0.17	mA
Operating supply current (control part only)	I <sub>OPR</sub>	V <sub>CC</sub> ≤28	-	7	12	mA
<b>SHUTDOWN SECTION</b>						
Shutdown Feedback voltage	V <sub>SD</sub>	Vfb≥6.5V	6.9	7.5	8.1	V
Thermal shutdown temperature (Tj) <sup>(1)</sup>	T <sub>SD</sub>	-	140	160	-	°C
Over voltage protection	V <sub>OVP</sub>	V <sub>CC</sub> ≥24V	25	27	29	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 (SFET part)

Fig 1. Output Characteristics

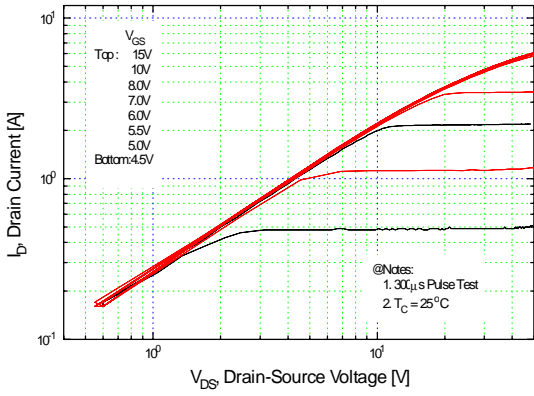


Fig. 2 Transfer Characteristics

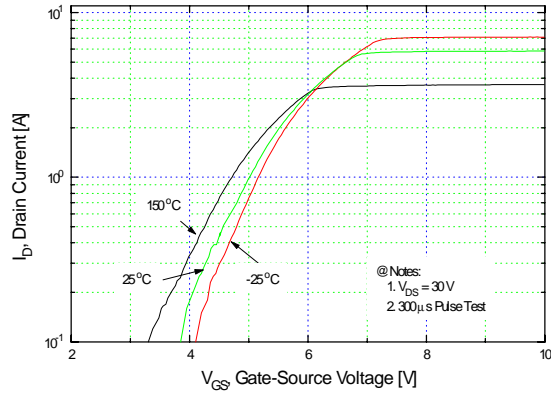


Fig. 3 On-Resistance vs. Drain Current

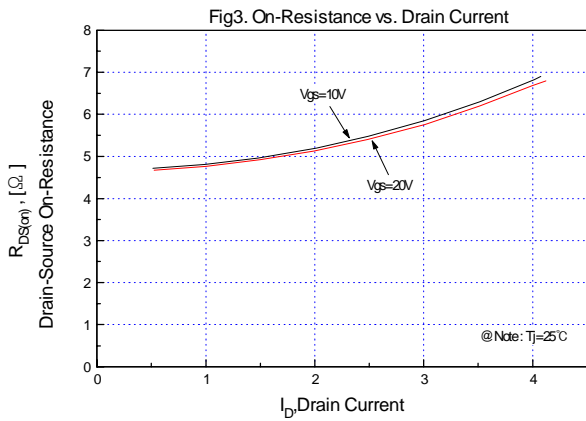


Fig. 4 Source-Drain Diode Forward Voltage

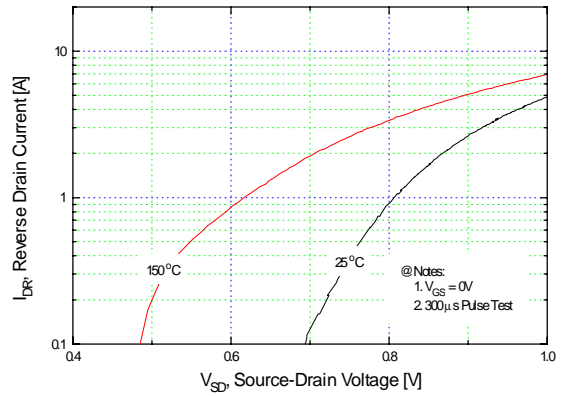


Fig.5 Capacitance vs. Drain-Source Voltage

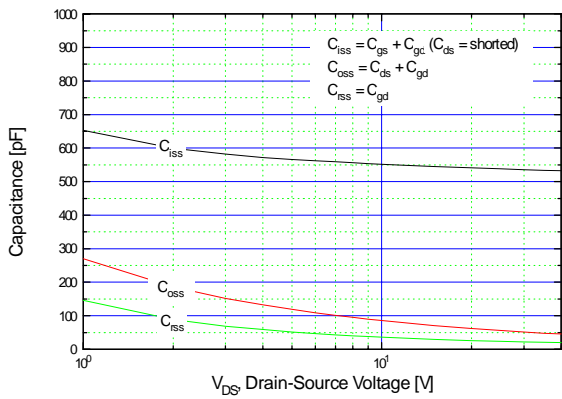
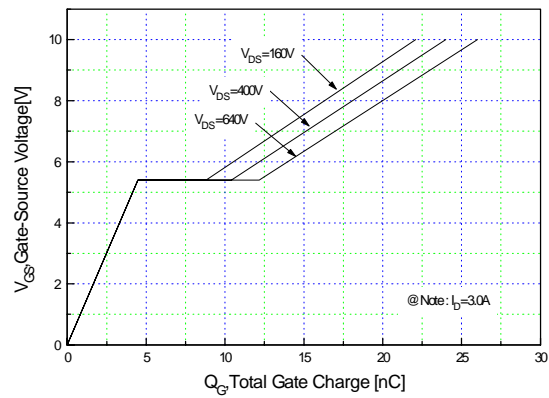


Fig. 6 Gate Charge vs. Gate-Source Voltage



TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

Fig. 7 Breakdown Voltage vs. Temperature

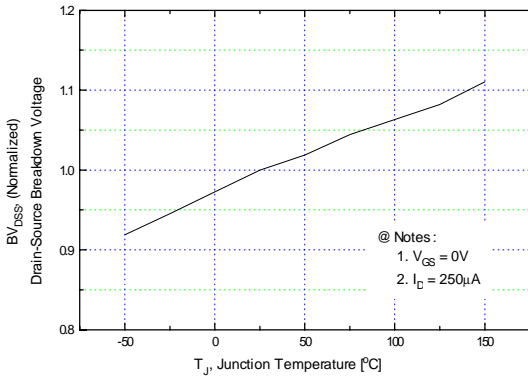


Fig. 8 On-Resistance vs. Temperature

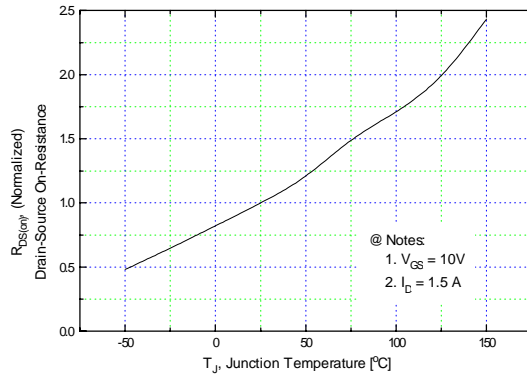


Fig. 9 Max. Safe Operating Area

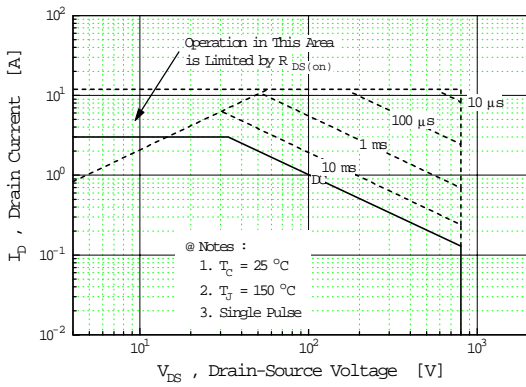


Fig. 10 Max. Drain Current vs. Case Temperature

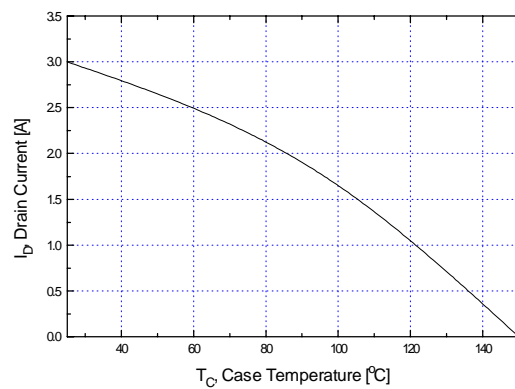
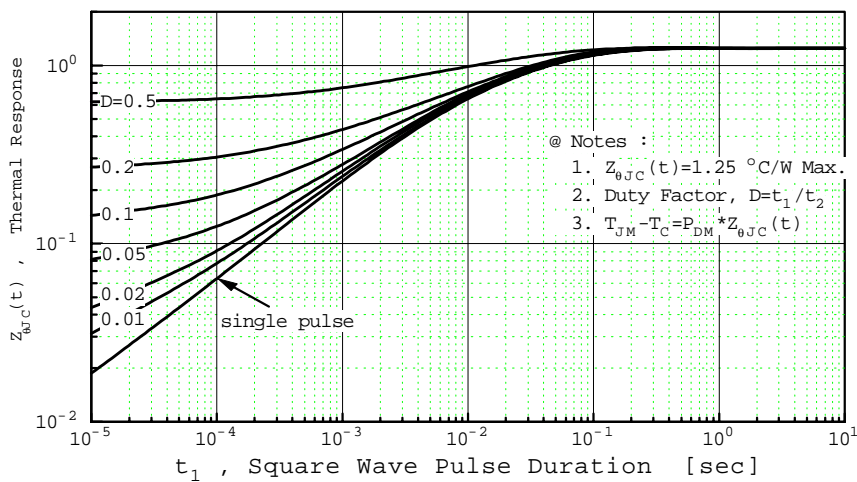
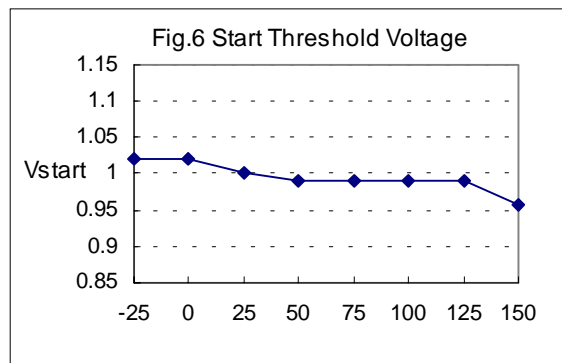
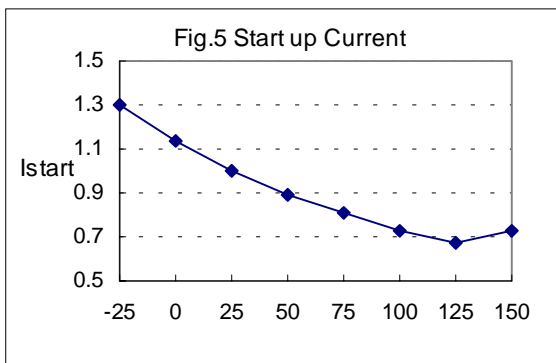
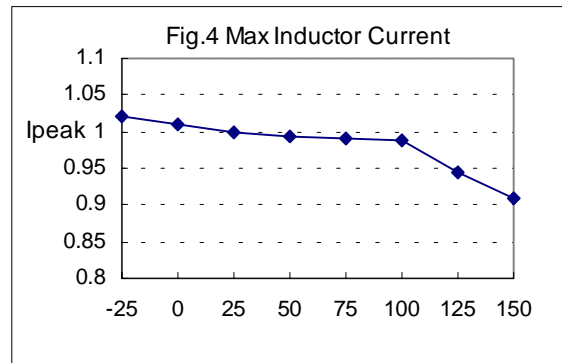
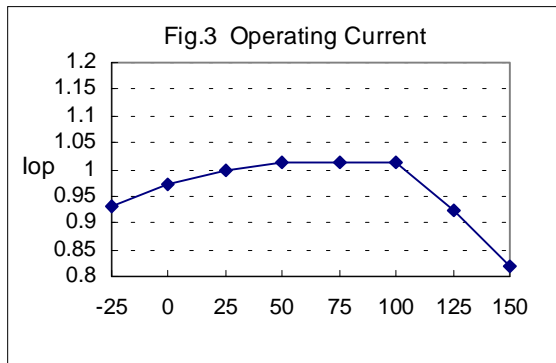
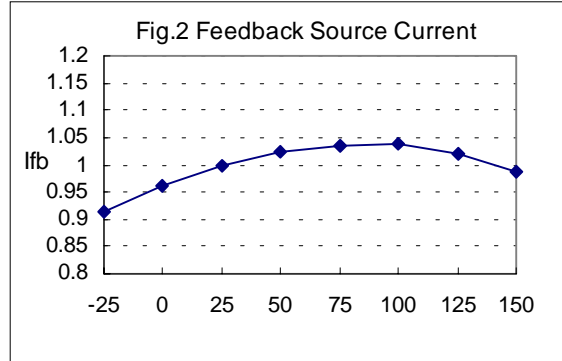
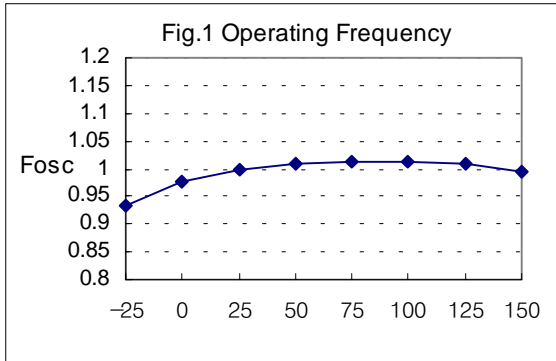


Fig. 11 Thermal Response

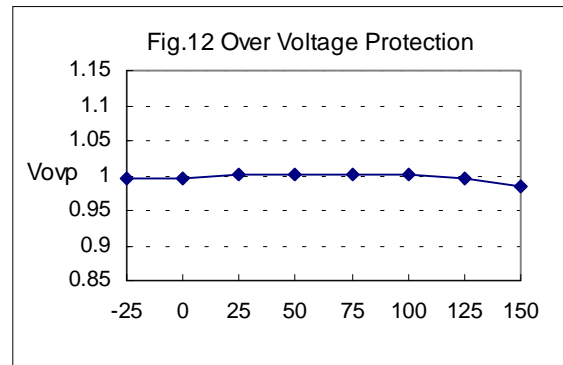
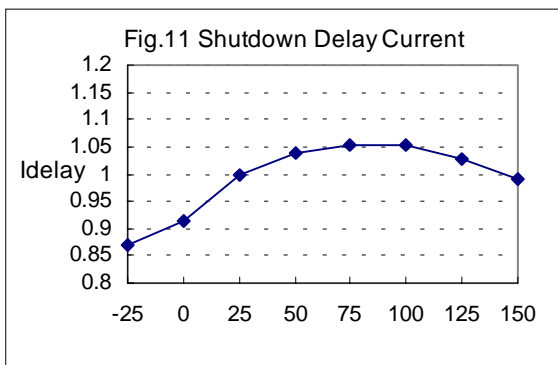
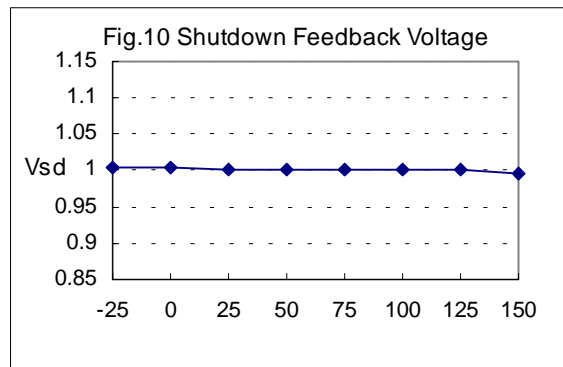
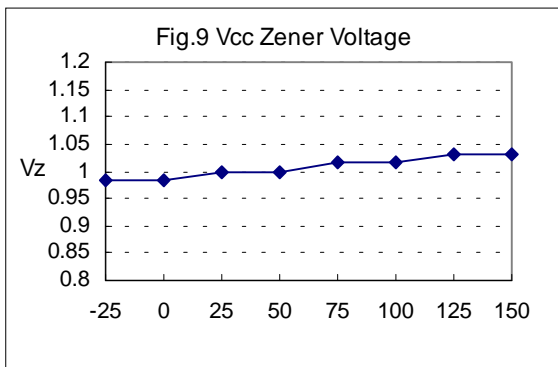
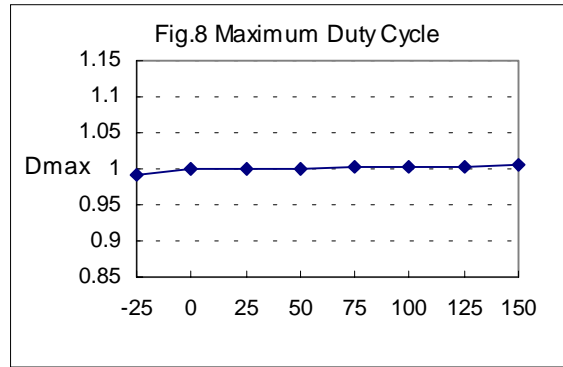
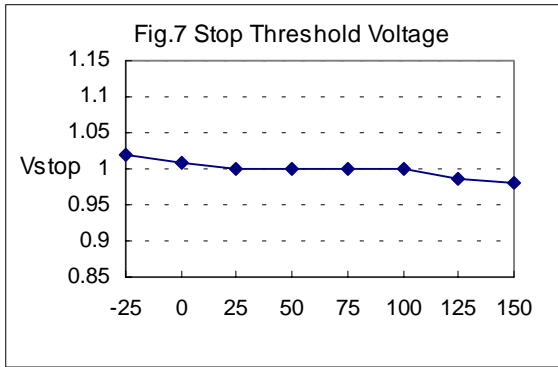


TYPICAL PERFORMANCE CHARACTERISTICS (Control part)



TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

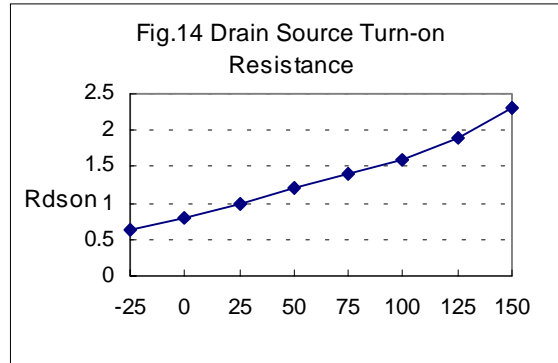
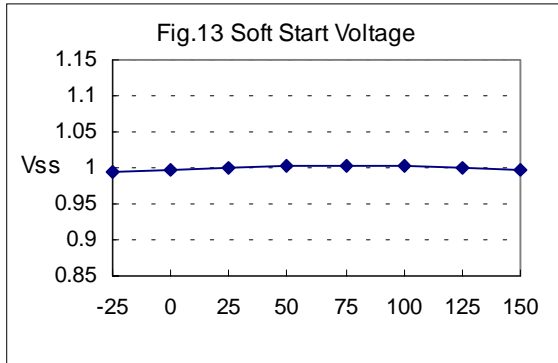
(These characteristic graphs are normalized at Ta=25°C)





**TYPICAL PERFORMANCE CHARACTERISTICS (Continued)**

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



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