

SPS

KA5L0380R

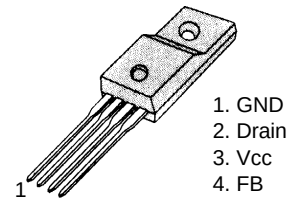
The SPS product family is specially designed for an off-line SMPS with minimal external components. The SPS consist of high voltage power SENSEFET® and current mode PWM IC.

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.

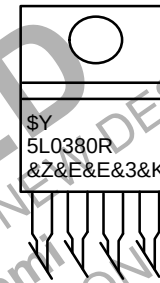
Features

- Precision Fixed Operating Frequency (50 kHz)
- Low Start-Up Current (Typ. 100 mA)
- Pulse By Pulse Current Limiting
- Over Current Protection
- Over Voltage Protection (Min. 25 V)
- Internal Thermal Shutdown Function
- Under Voltage Lockout
- Internal High Voltage Sense FET
- Auto-Restart Mode
- This is a Pb-Free Device



TO-220F-4L
CASE 340BK

MARKING DIAGRAM



\$Y	= onsemi Logo
5L0380R	= Specific Device Code
&Z	= Assembly Plant Code
&E	= Designates Space
&3	= 3-Digit Date Code
&K	= Lot Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 10 of this data sheet.

The diagram illustrates a 100W MOSFET power supply circuit with various protection features. The circuit is powered by a 27V source and includes a feedback loop for regulation. Key components and features include:

- Power MOSFET Stage:** A MOSFET (SenseFET) is used for power conversion, with its drain connected to the output and its gate driven by a 14V source. A sense resistor (R_{sense}) is placed in the source path.
- Protection Circuits:**
 - OVP (Over Voltage Protection):** Monitors the output voltage and triggers a shutdown if it exceeds a set point.
 - UVLO (Under Voltage Lock Out):** Ensures the MOSFET is not driven if the input voltage is too low.
 - VREF and INTERNAL BIAS:** Provides a stable reference voltage for the feedback loop.
 - Good Logic:** A logic block that coordinates the protection and feedback signals.
 - VOLTAGE LIMIT CIRCUIT:** A diode-based circuit that limits the output voltage.
 - OSC (Oscillator):** Generates a clock signal (CLK) for the feedback loop.
 - LEB (Leading Edge Blanking):** A circuit that prevents false triggering of the OVP during the initial transient of the output voltage.
 - Shut down Latch:** A latch that maintains the shutdown state until a reset is received.
 - Power-on Reset / Auto-restart:** A circuit that resets the system after a shutdown.
 - 1us Window open circuit:** A timing window for the auto-restart feature.
 - TSD (Thermal Shutdown):** A temperature sensor that triggers a shutdown if the MOSFET temperature exceeds a safe limit.
 - OCP (Over Current Protection):** Monitors the MOSFET current and triggers a shutdown if it exceeds a set point.
- Feedback Loop:** A feedback network consisting of a diode, a resistor (R), and an op-amp (OVP) that compares the output voltage to the V_{REF} and generates a feedback signal.
- Components:** The circuit includes a 27V source, a 15V/9V source, a 7.5V source, a 14V source, a 5uA current source, a 1mA current source, a 2.5R resistor, a 1us timing window, and a 100W MOSFET.

ABSOLUTE MAXIMUM RATINGS

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

- 2

KA5L0380R

ELECTRICAL CHARACTERISTICS (SFET PART) ($T_a = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0\text{ V}, I_D = 50\text{ }\mu\text{A}$	800	–	–	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = \text{Max.}, \text{Rating}, V_{GS} = 0\text{ V}$	–	–	250	μA
		$V_{DS} = 0.8\text{ Max.}, \text{Rating}, V_{GS} = 0\text{ V}, T_C = 125^\circ\text{C}$	–	–	1000	μA
Static Drain-Source On Resistance (Note 5)	$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 0.5\text{ A}$	–	4	5	Ω
Forward Transconductance (Note 5)	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 0.5\text{ A}$	1.5	2.5	–	S
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	–	779	–	pF
Output Capacitance	C_{oss}		–	75.6	–	
Reverse Transfer Capacitance	C_{rss}		–	24.9	–	
Turn Off Delay Time	$t_{d(on)}$	$V_{DD} = 0.5 BV_{DSS}, I_D = 1.0\text{ A}$ (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	$V_{GS} = 10\text{ V}, I_D = 1.0\text{ A}, V_{DS} = 0.5 BV_{DSS}$ (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	–	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

5. Pulse test: Pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

KA5L0380R

ELECTRICAL CHARACTERISTICS (CONTROL PART) ($T_a = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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REFERENCE SECTION

Output Voltage (Note 6)	V_{ref}	$T_a = 25^\circ\text{C}$	4.80	5.00	5.20	V
Temperature Stability (Note 6, Note 7)	$V_{ref}/\Delta T$	$-25^\circ\text{C} \leq T_a \leq +85^\circ\text{C}$	–	0.3	0.6	mV/ $^\circ\text{C}$

OSCILLATOR SECTION

Initial Accuracy	F_{OSC}	$T_a = 25^\circ\text{C}$	45	50	55	kHz
Frequency Change with Temperature (Note 7)	$\Delta F/\Delta T$	$-25^\circ\text{C} \leq T_a \leq +85^\circ\text{C}$	–	± 5	± 10	%

PWM SECTION

Maximum Duty Cycle	D_{max}	–	74	77	80	%
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FEEDBACK SECTION

Feedback Source Current	I_{FB}	$T_a = 25^\circ\text{C}$, $0\text{ V} \leq V_{fb} \leq 3\text{ V}$	0.7	0.9	1.1	mA
Shutdown Delay Current	I_{delay}	$T_a = 25^\circ\text{C}$, $5\text{ V} \leq V_{fb} \leq V_{SD}$	4	5	6	μA

OVER CURRENT PROTECTION SECTION

Over Current Protection	$I_L(\text{max})$	Max. Inductor current	1.89	2.15	2.41	A
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UVLO SECTION

Start Threshold Voltage	$V_{th(H)}$	–	8.4	9	9.6	V
Minimum Operating Voltage	$V_{th(L)}$	After turn on	14	15	16	V

TOTAL STANDBY CURRENT SECTION

Start Current	I_{ST}	$V_{CC} = 14\text{ V}$	–	0.1	0.17	mA
Operating Supply Current (Control Part Only)	I_{OPR}	$V_{CC} \leq 28$	–	7	12	mA

SHUTDOWN SECTION

Shutdown Feedback Voltage	V_{SD}	$V_{fb} \geq 6.5\text{ V}$	6.9	7.5	8.1	V
Thermal Shutdown Temperature (T_J) (Note 6)	T_{SD}	–	140	160	–	$^\circ\text{C}$
Over Voltage Protection	V_{OVP}	$V_{CC} \geq 24\text{ V}$	25	27	29	V

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

6. These parameters, although guaranteed, are not 100% tested in production.

7. These parameters, although guaranteed, are tested in EDS (wafer test) process.

TYPICAL PERFORMANCE CHARACTERISTICS (SFET part)

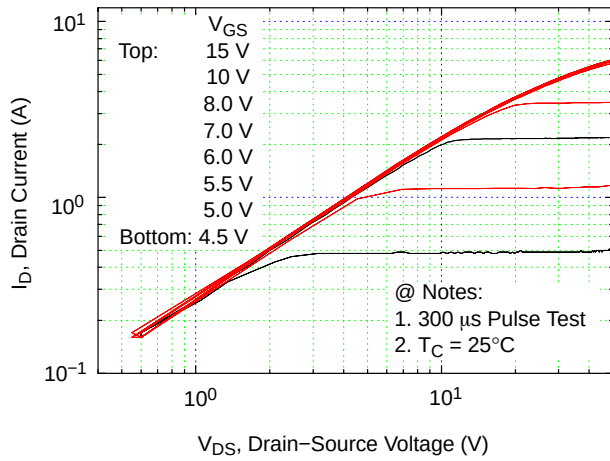


Figure 2. Output Characteristics

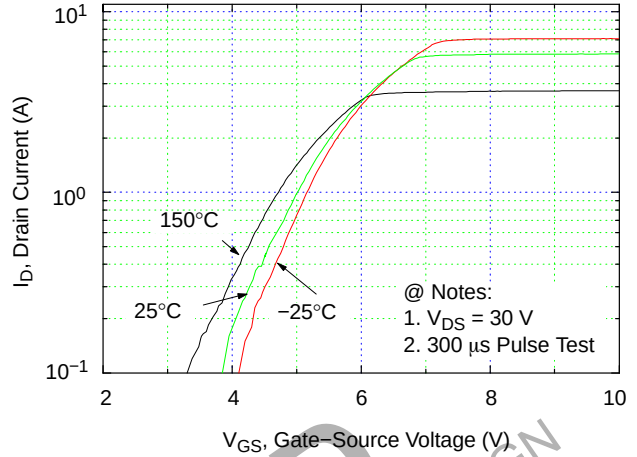


Figure 3. Transfer Characteristics

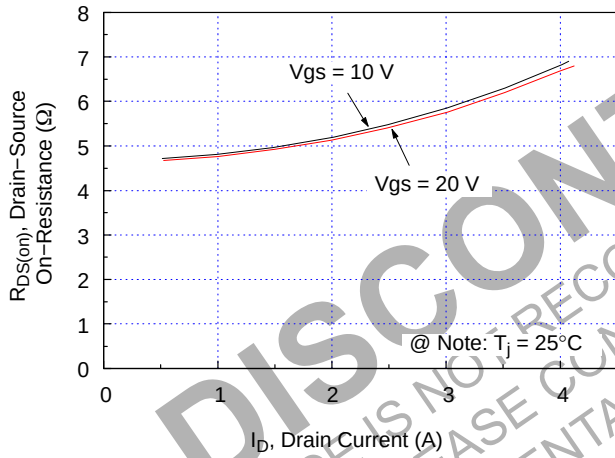


Figure 4. On-Resistance vs. Drain Current

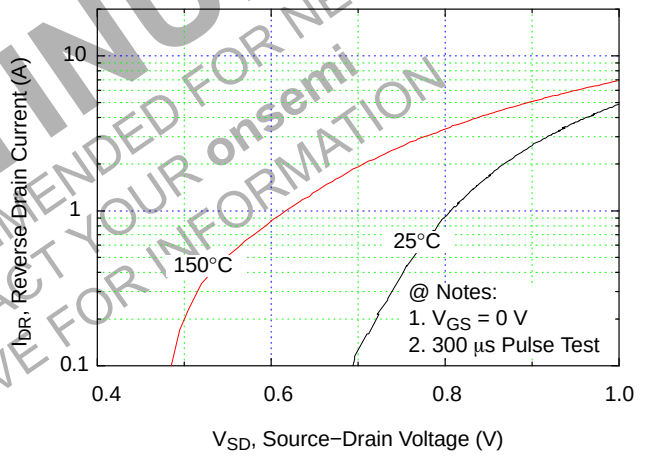


Figure 5. Source-Drain Diode Forward Voltage

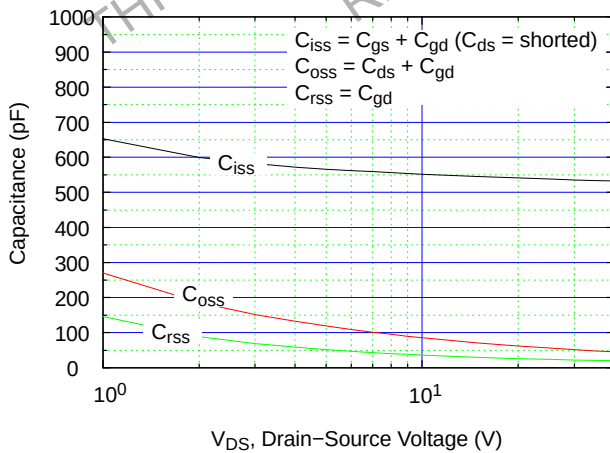


Figure 6. Capacitance vs. Drain-Source Voltage

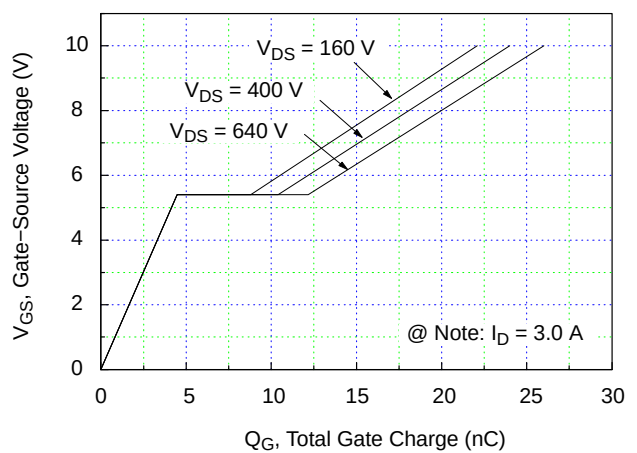


Figure 7. Gate Charge vs. Gate-Source Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

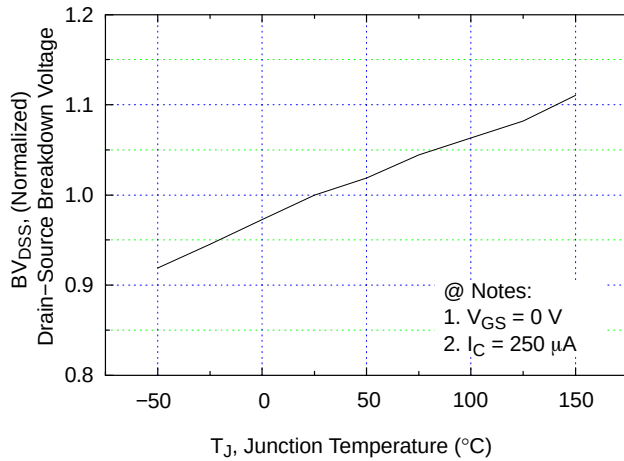


Figure 8. Breakdown Voltage vs. Temperature

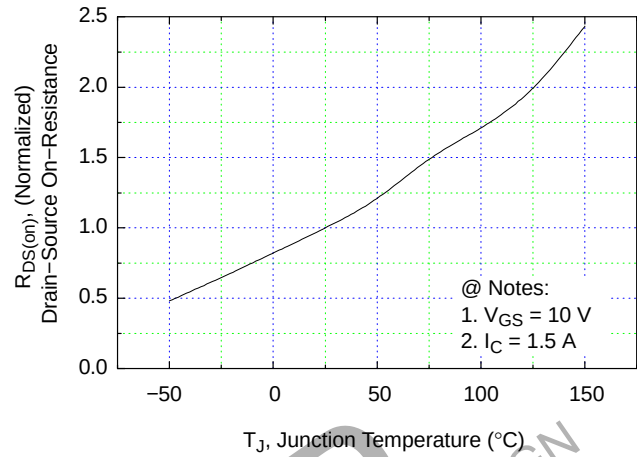


Figure 9. On-Resistance vs. Temperature

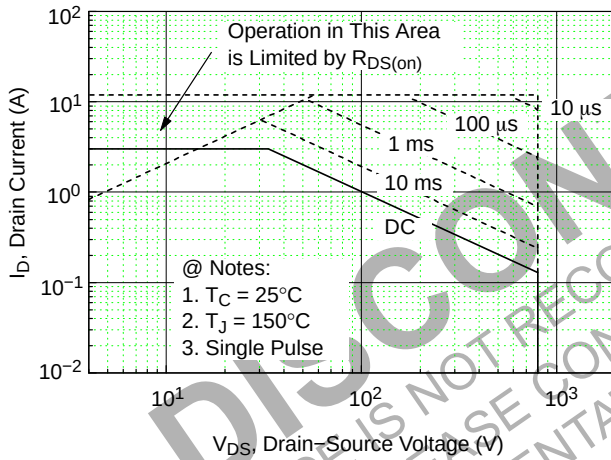


Figure 10. Max. Safe Operating Area

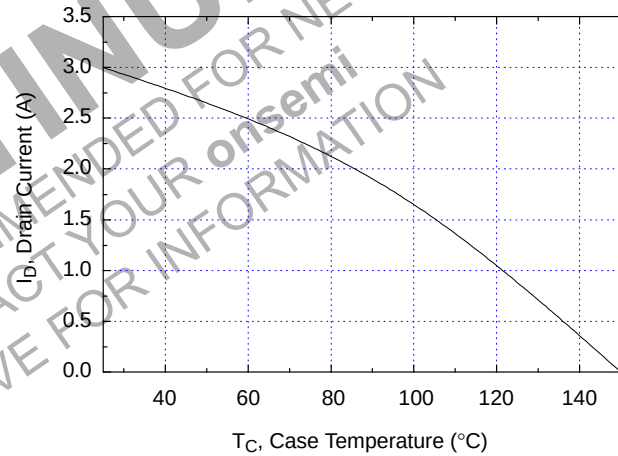


Figure 11. Max. Drain Current vs. Case Temperature

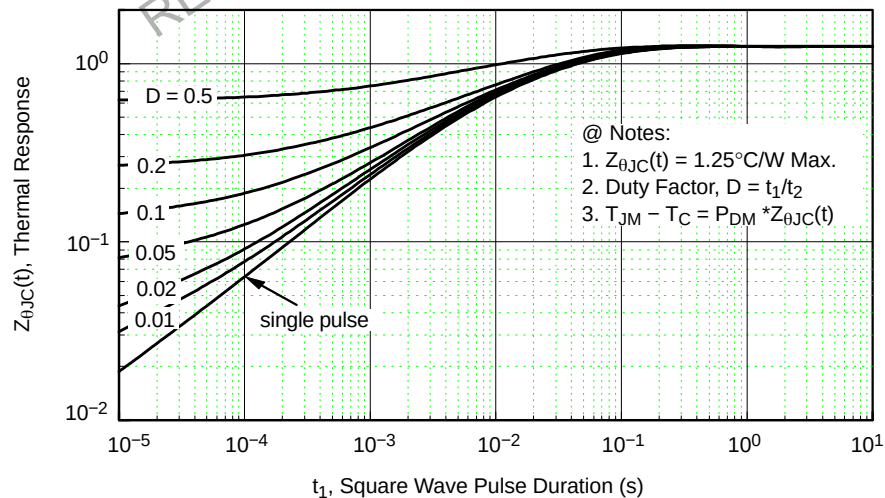


Figure 12. Thermal Response

TYPICAL PERFORMANCE CHARACTERISTICS (Control part)

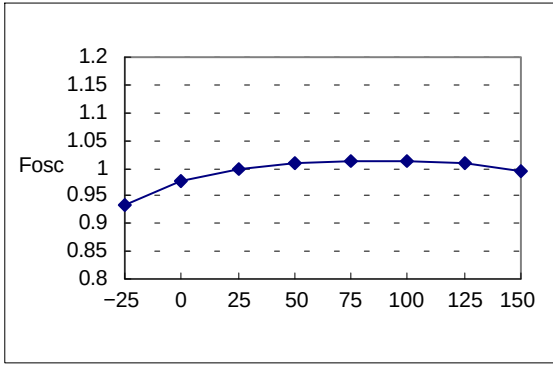


Figure 13. Operating Frequency

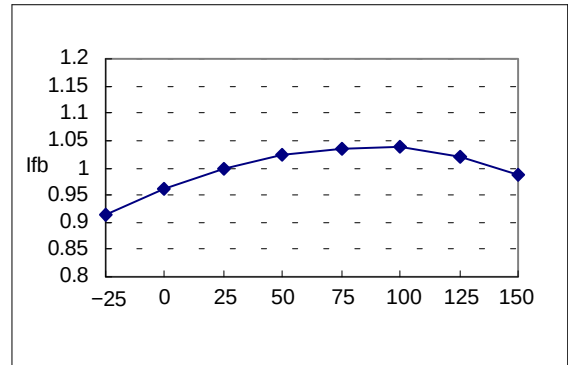


Figure 14. Feedback Source Current

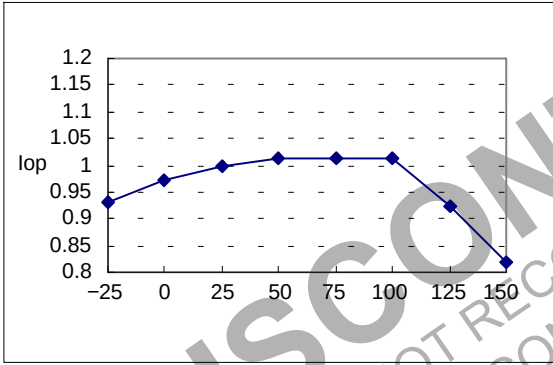


Figure 15. Operating Current

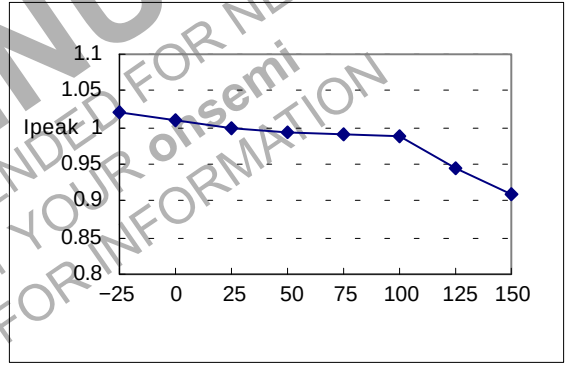


Figure 16. Max Inductor Current

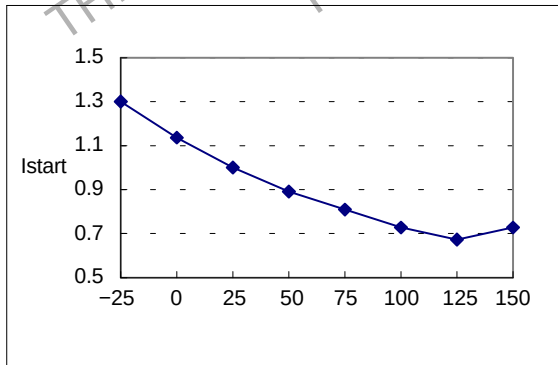


Figure 17. Start Up Current

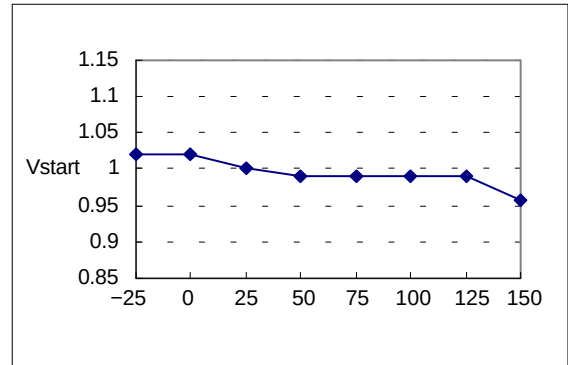


Figure 18. Start Threshold Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

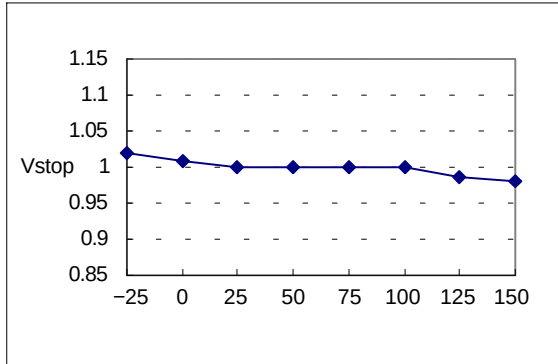
(These characteristic graphs are normalized at $T_a = 25^\circ\text{C}$)

Figure 19. Stop Threshold Voltage

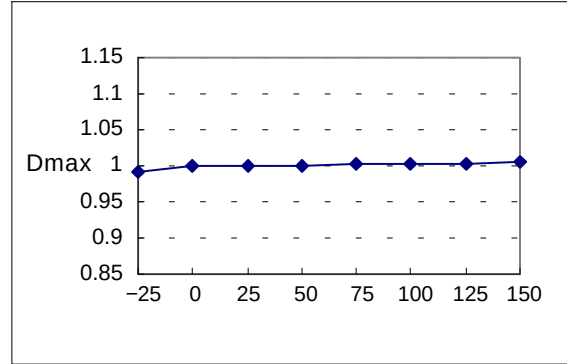


Figure 20. Maximum Duty Cycle

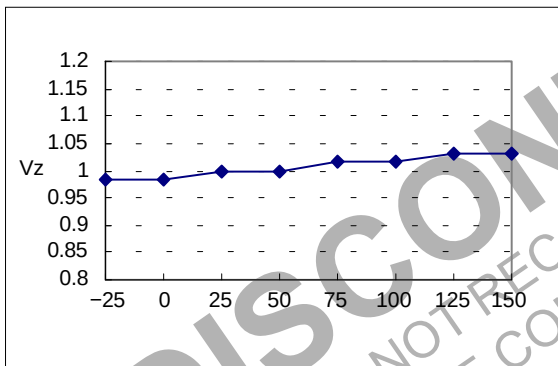


Figure 21. Vcc Zener Voltage

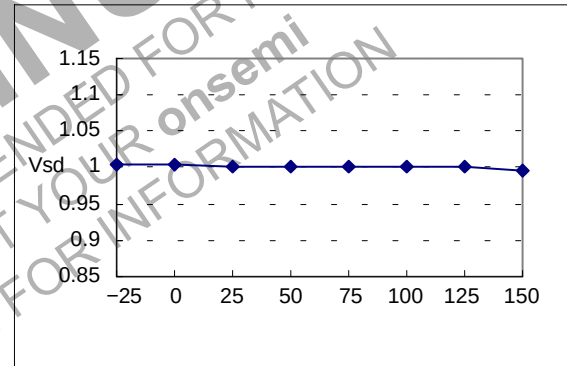


Figure 22. Shutdown Feedback Voltage

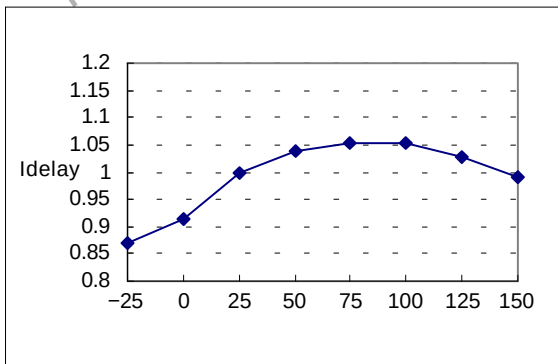


Figure 23. Shutdown Delay Current

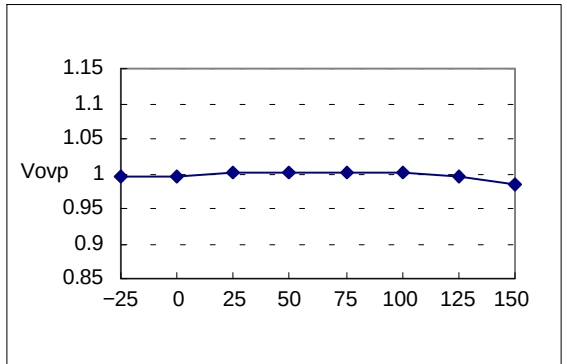


Figure 24. Over Voltage Protection

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

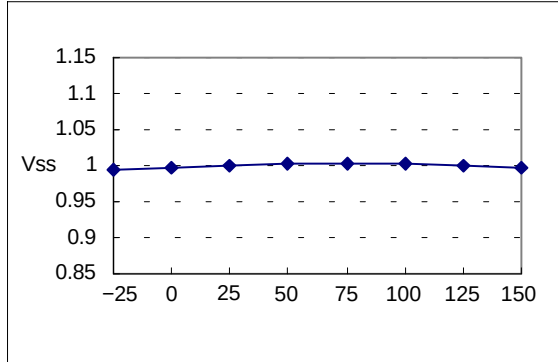
(These characteristic graphs are normalized at $T_a = 25^\circ\text{C}$)

Figure 25. Soft Start Voltage

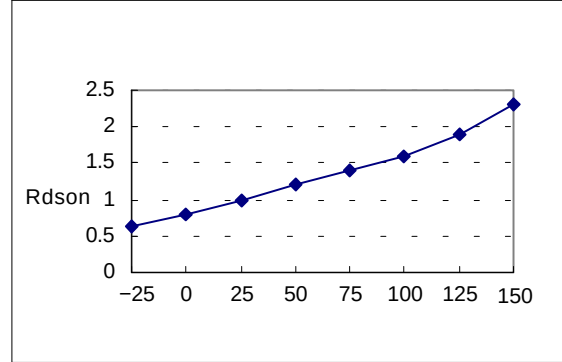


Figure 26. Drain Source Turn-On Resistance

DISCONTINUED
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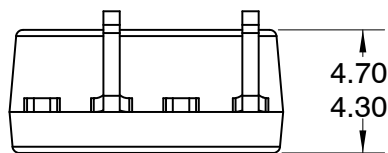
ORDERING INFORMATION

Device	Operating Temperature Range	Package	Packing Method
KA5L0380R	-25 to +85°C	TO-220F-4L (Pb-Free)	Tube

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DATE 31 AUG 2016



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 E. PIN 2 CONNECTS TO DAP

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