SPS

KA5L0380R

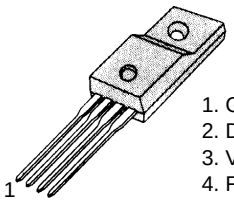
The SPS product family is specially designed for an off−line SMPS with minimal external components. The SPS consist of high voltage power SENSEFET® and current mode PWM IC.

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

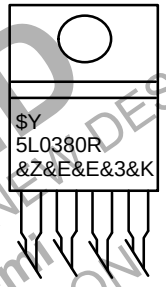
- Precision Fixed Operating Frequency (50 kHz)
- Low Start−Up Current (Typ. 100 mA)
- Pulse By Pulse Current Limiting
- Over Current Protection
- Over Voltage Protection (Min. 25 V)
- Internal Thermal Shutdown Function
- Under Voltage Lockout
- Internal High Voltage Sense FET
- Auto−Restart Mode
- This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



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

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.

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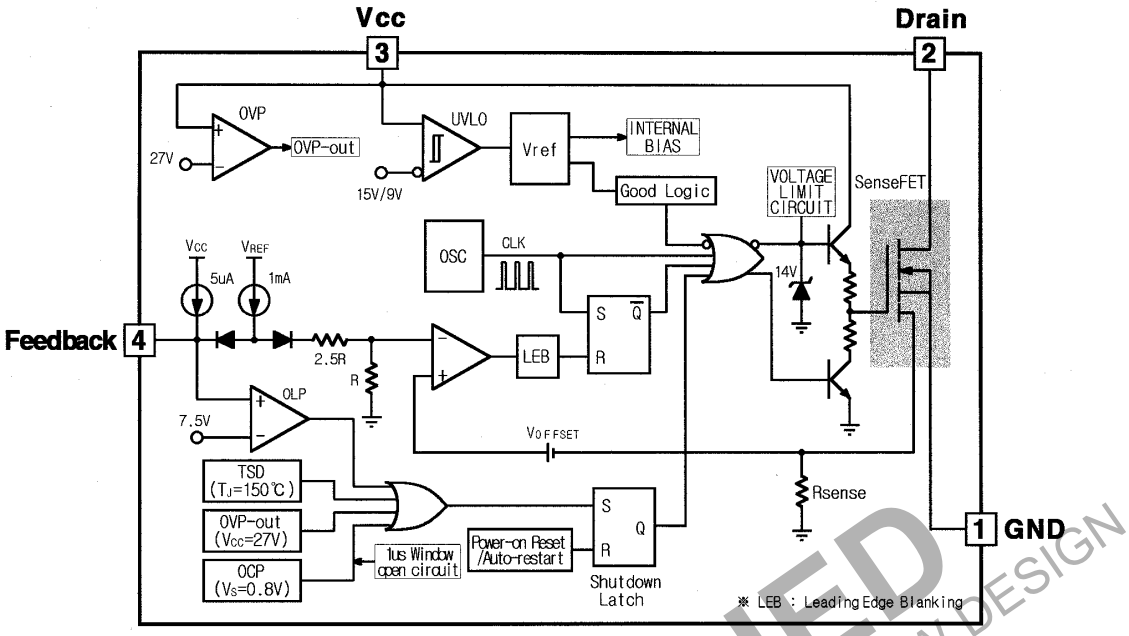


Figure 1. Block Diagram

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ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain−Source (GND) Voltage (Note 1)	V_{DSS}	800	V
Drain−Gate Voltage (R_{GS} = 1 MΩ)	V_{DGR}	800	V
Gate−Source (GND) Voltage	V_{GS}	±30	V
Drain Current Pulsed (Note 2)	I_{DM}	12	A_{DC}
Single Pulsed Avalanche Energy (Note 3)	E_{AS}	95	mJ
Avalanche Current (Note 4)	I_{AS}	−	A
Continuous Drain Current (T_C = 25°C)	I_D	3.0	A_{DC}
Continuous Drain Current (T_C = 100°C)	I_D	2.1	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 (wt H/S)	35	W
	Derating	0.28	W/°C
Operating Temperature	T_{OPR}	−25 to +85	°C
Storage Temperature	T_{STG}	−55 to +150	°C

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.

1. Tj = 25°C to 150°C
2. Repetitive rating: Pulse width limited by maximum junction temperature.
3. L = 51 mH, starting Tj = 25°C
4. L = 13 μH, starting Tj = 25°C

ELECTRICAL CHARACTERISTICS (SFET PART) (T_a = 25°C unless otherwise noted)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Drain−Source Breakdown Voltage	BV_{DSS}	V_{GS} = 0 V, I_D = 50 μA	800	−	−	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = Max., Rating, V_{GS} = 0 V	−	−	250	μA
		V_{DS} = 0.8 Max., Rating, V_{GS} = 0 V, T_C = 125°C	−	−	1000	μA
Static Drain−Source On Resistance (Note 5)	$R_{DS(ON)}$	V_{GS} = 10 V, I_D = 0.5 A	−	4	5	Ω
Forward Transconductance (Note 5)	gfs	V_{DS} = 50 V, I_D = 0.5 A	1.5	2.5	−	S
Input Capacitance	Ciss	V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	−	779	−	pF
Output Capacitance	Coss		−	75.6	−	
Reverse Transfer Capacitance	Crss		−	24.9	−	
Turn Off Delay Time	td(on)	V_{DD} = 0.5 BV_{DSS}, I_D = 1.0 A (MOSFET switching time are essentially independent of operating temperature)	−	40	−	ns
Rise Time	tr		−	95	−	
Turn Off Delay Time	td(off)		−	150	−	
Fall Time	tf		−	60	−	
Total Gate Charge (Gate−source + Gate−drain)	Qg	V_{GS} = 10 V, I_D = 1.0 A, V_{DS} = 0.5 BV_{DSS} (MOSFET switching time are essentially independent of operating temperature)	−	−	34	nC
Gate−Source Charge	Qgs		−	7.2	−	
Gate−Drain (Miller) Charge	Qgd		−	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 ≤ 300 μs, duty cycle ≤ 2%.

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ELECTRICAL CHARACTERISTICS (CONTROL PART) (T_a = 25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
REFERENCE SECTION						
Output Voltage (Note 6)	Vref	T_a = 25°C	4.80	5.00	5.20	V
Temperature Stability (Note 6, Note 7)	Vref/ΔT	−25°C ≤ Ta ≤ +85°C	−	0.3	0.6	mV/°C
OSCILLATOR SECTION						
Initial Accuracy	F_{OSC}	T_a = 25°C	45	50	55	kHz
Frequency Change with Temperature (Note 7)	ΔF/ΔT	−25°C ≤ Ta ≤ +85°C	−	±5	±10	%
PWM SECTION						
Maximum Duty Cycle	Dmax	−	74	77	80	%
FEEDBACK SECTION						
Feedback Source Current	I_{FB}	T_a = 25°C, 0 V ≤ Vfb ≤ 3 V	0.7	0.9	1.1	mA
Shutdown Delay Current	Idelay	T_a = 25°C, 5 V ≤ Vfb ≤ V_{SD}	4	5	6	μA
OVER CURRENT PROTECTION SECTION						
Over Current Protection	I_L(max)	Max. Inductor current	1.89	2.15	2.41	A
UVLO SECTION						
Start Threshold Voltage	Vth(H)	−	8.4	9	9.6	V
Minimum Operating Voltage	Vth(L)	After turn on	14	15	16	V
TOTAL STANDBY CURRENT SECTION						
Start Current	I_{ST}	V_{CC} = 14 V	−	0.1	0.17	mA
Operating Supply Current (Control Part Only)	I_{OPR}	V_{CC} ≤ 28	−	7	12	mA
SHUTDOWN SECTION						
Shutdown Feedback Voltage	V_{SD}	Vfb ≥ 6.5 V	6.9	7.5	8.1	V
Thermal Shutdown Temperature (Tj) (Note 6)	T_{SD}	−	140	160	−	°C
Over Voltage Protection	V_{OVP}	V_{CC} ≥ 24 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.

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TYPICAL PERFORMANCE CHARACTERISTICS (SFET part)

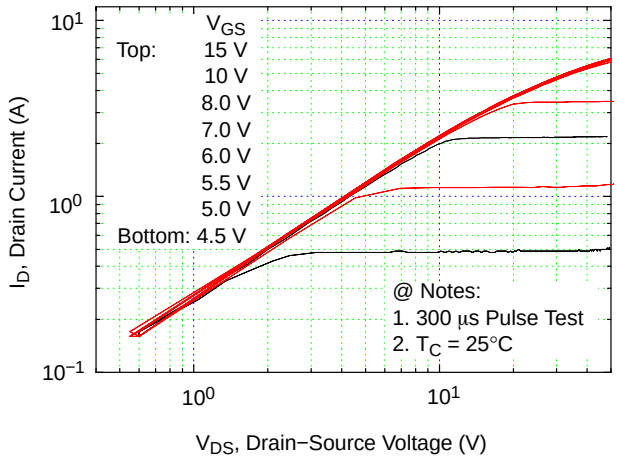


Figure 2. Output Characteristics

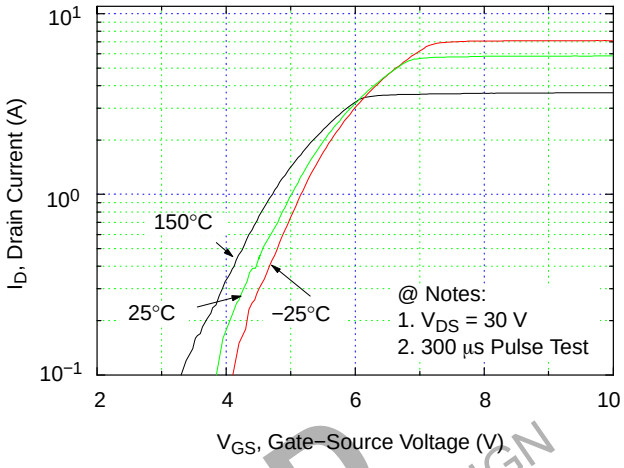


Figure 3. Transfer Characteristics

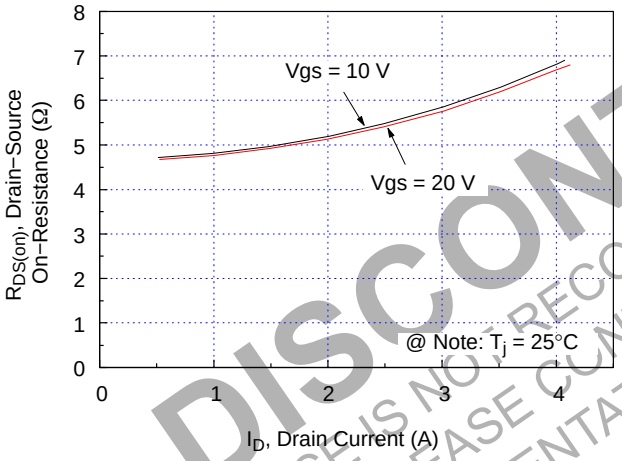


Figure 4. On−Resistance vs. Drain Current

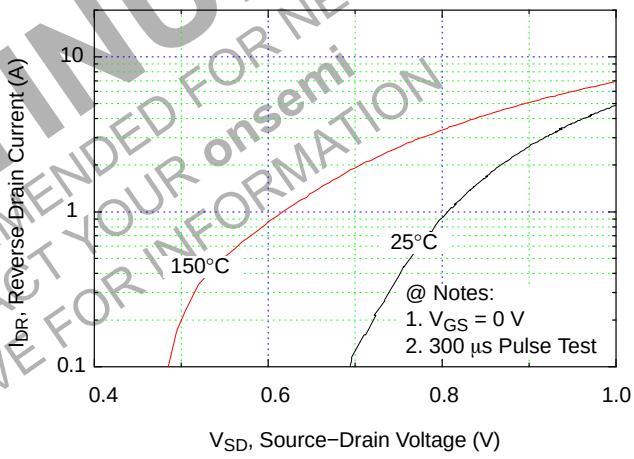


Figure 5. Source−Drain Diode Forward Voltage

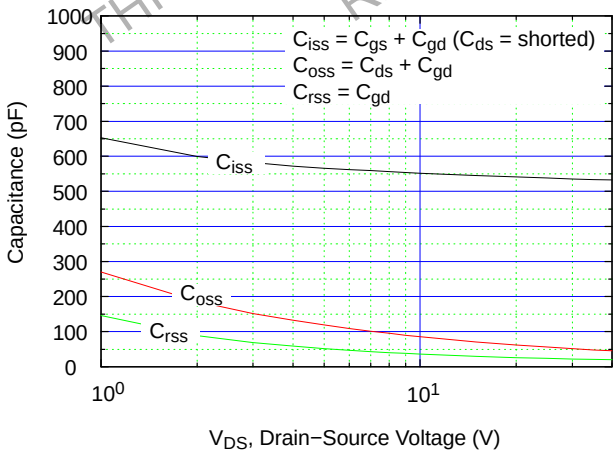


Figure 6. Capacitance vs. Drain−Source Voltage

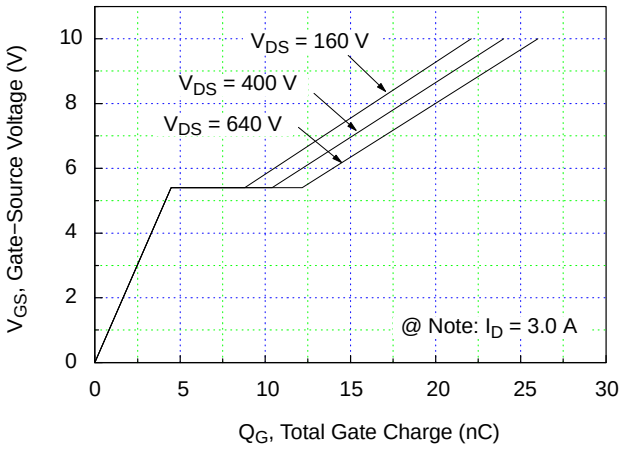


Figure 7. Gate Charge vs. Gate−Source Voltage

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TYPICAL PERFORMANCE CHARACTERISTICS (continued)

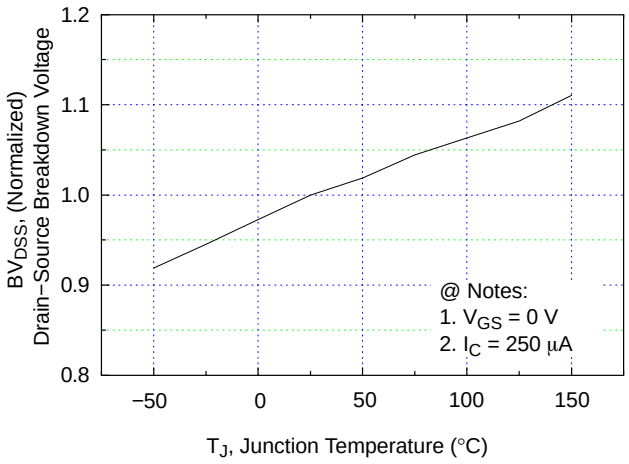


Figure 8. Breakdown Voltage vs. Temperature

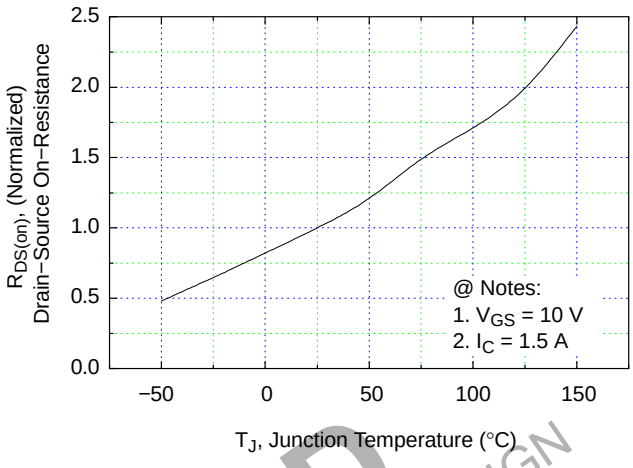


Figure 9. On−Resistance vs. Temperature

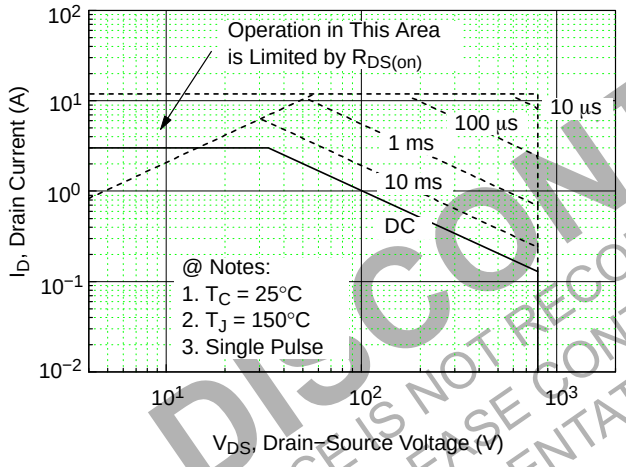


Figure 10. Max. Safe Operating Area

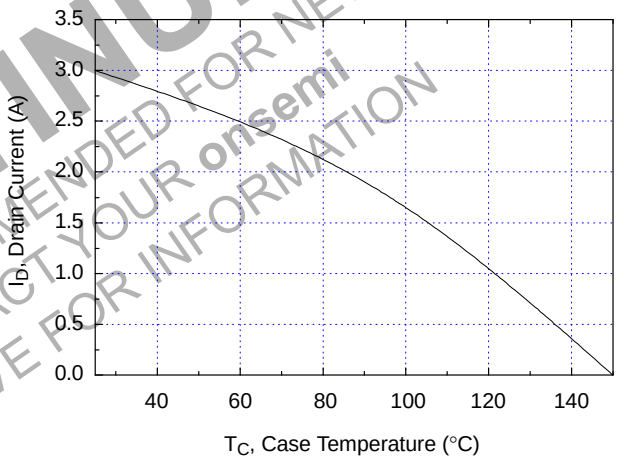


Figure 11. Max. Drain Current vs. Case Temperature

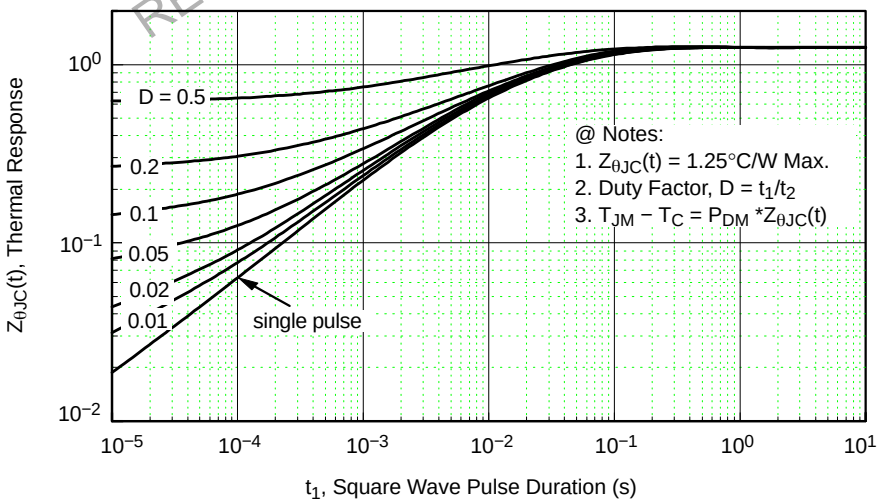


Figure 12. Thermal Response

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TYPICAL PERFORMANCE CHARACTERISTICS (Control part)

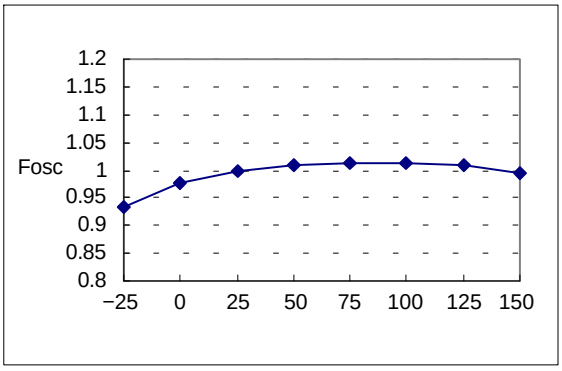


Figure 13. Operating Frequency

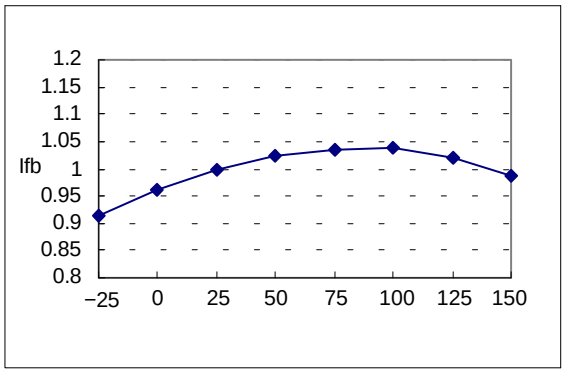


Figure 14. Feedback Source Current

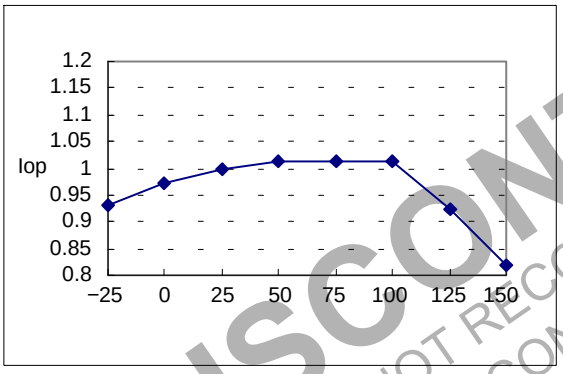


Figure 15. Operating Current

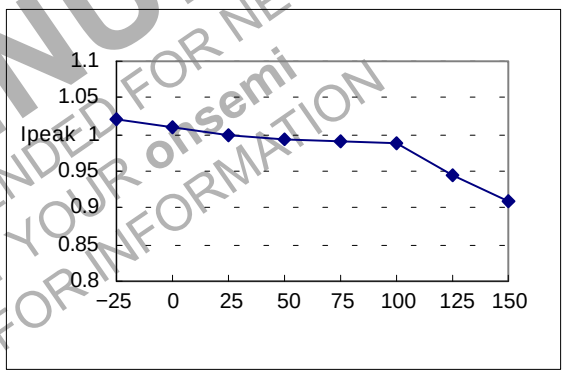


Figure 16. Max Inductor Current

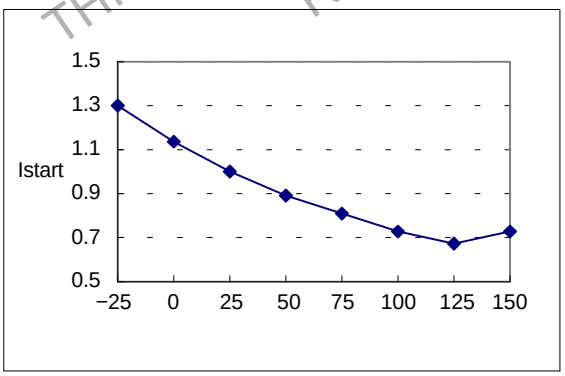


Figure 17. Start Up Current

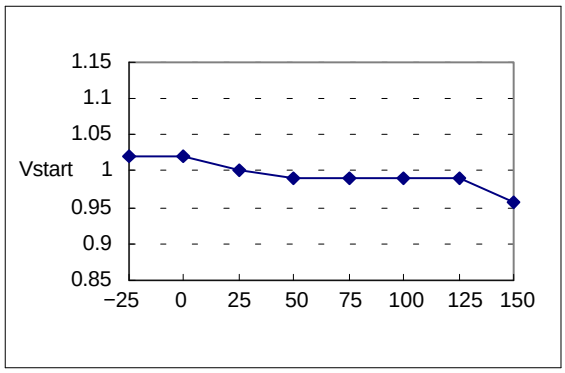


Figure 18. Start Threshold Voltage

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TYPICAL PERFORMANCE CHARACTERISTICS (continued)

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

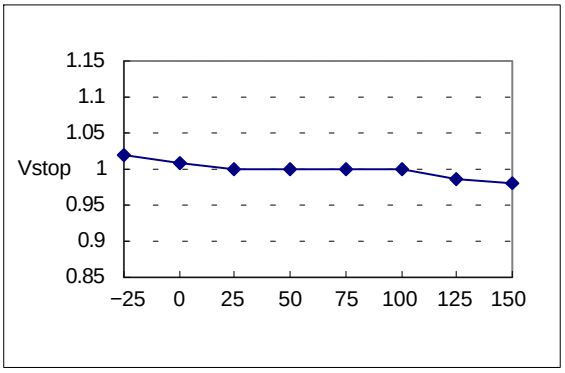


Figure 19. Stop Threshold Voltage

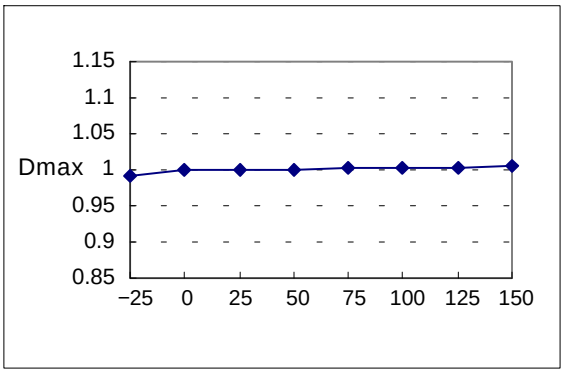


Figure 20. Maximum Duty Cycle

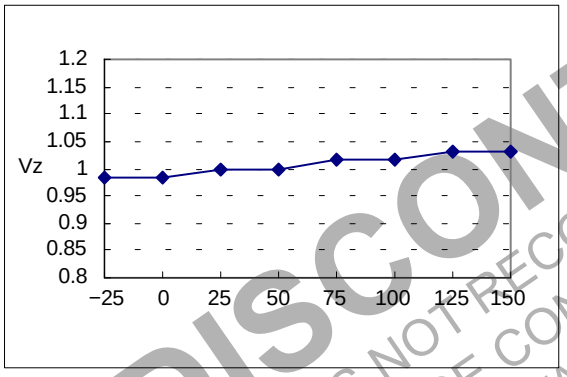


Figure 21. Vcc Zener Voltage

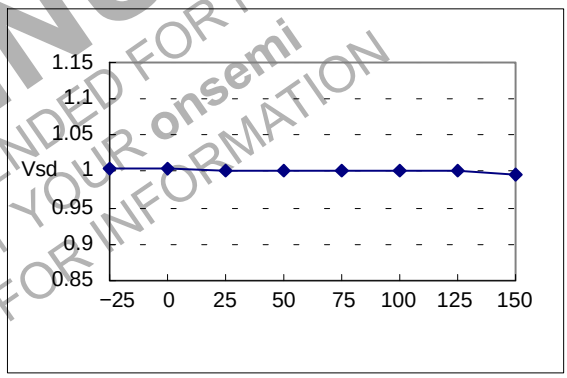


Figure 22. Shutdown Feedback Voltage

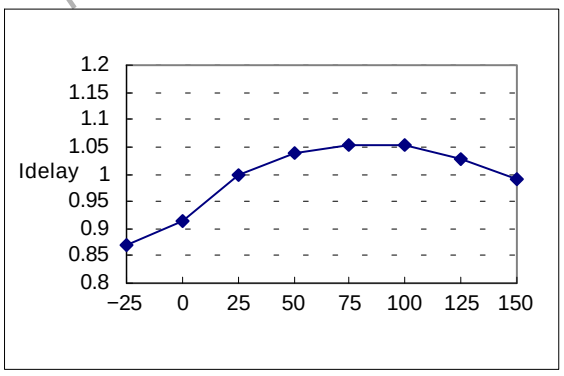


Figure 23. Shutdown Delay Current

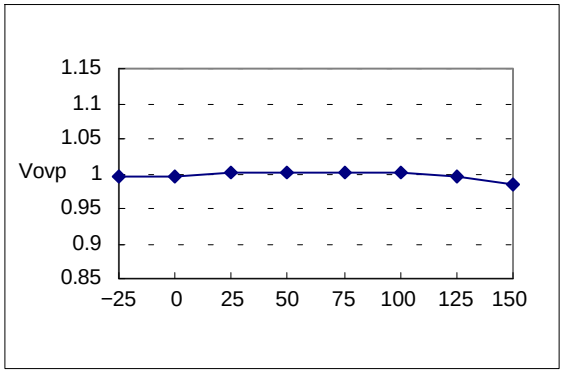


Figure 24. Over Voltage Protection

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TYPICAL PERFORMANCE CHARACTERISTICS (continued)

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

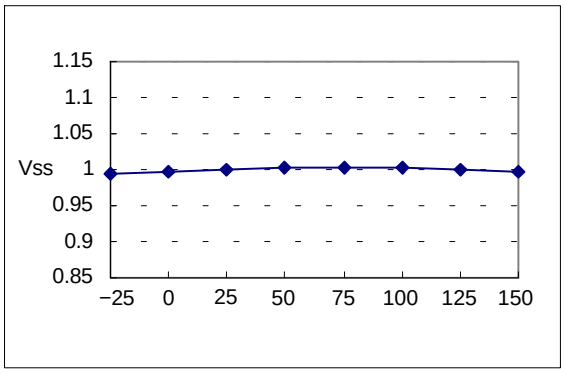


Figure 25. Soft Start Voltage

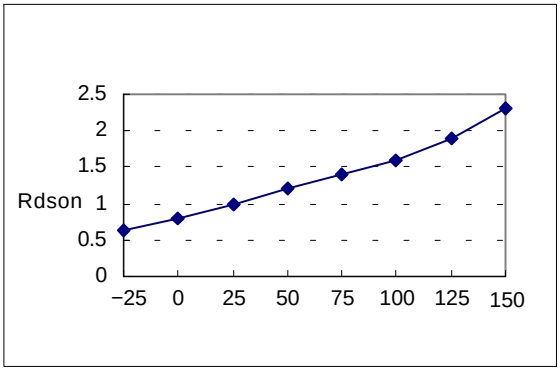


Figure 26. Drain Source Turn−On Resistance

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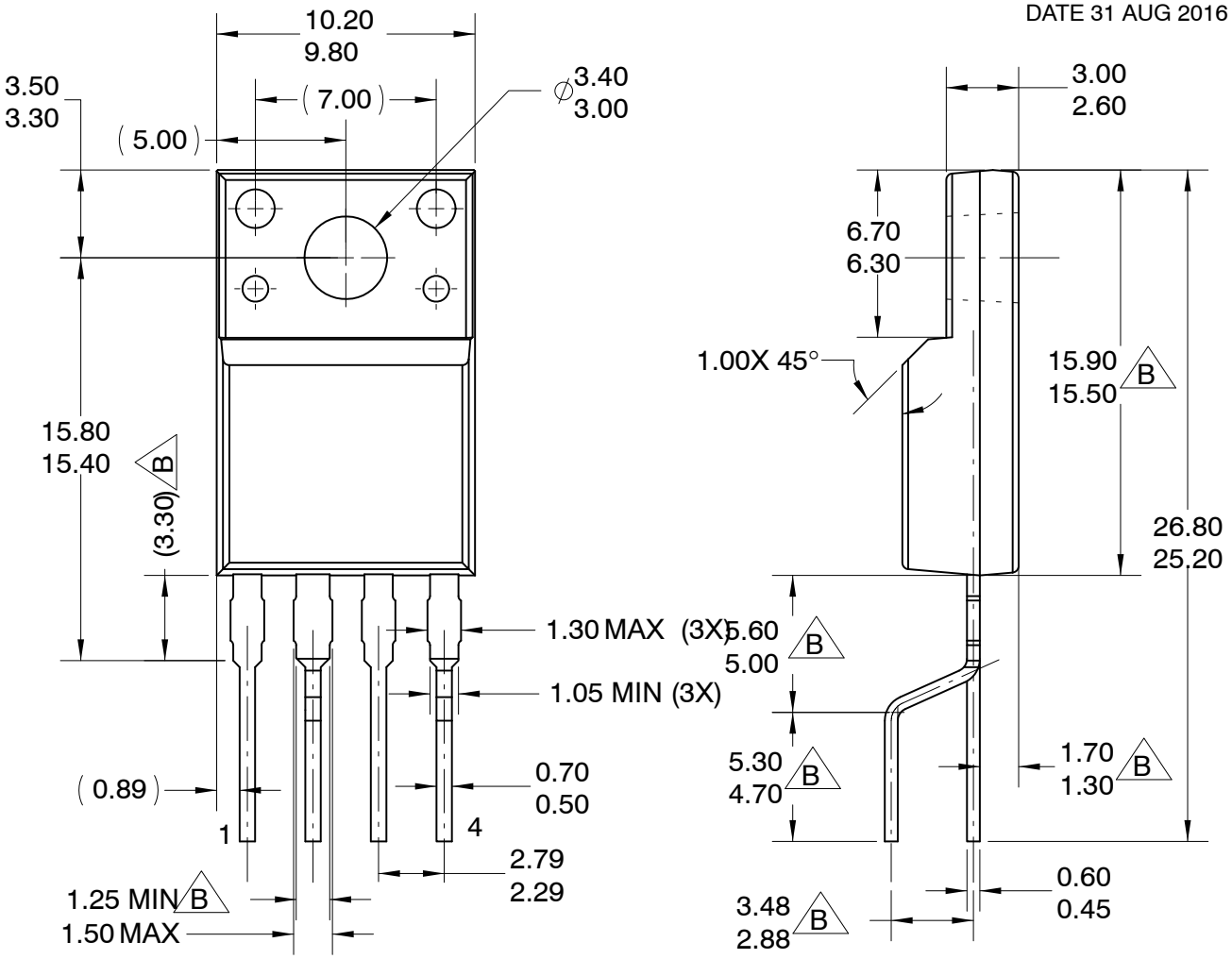
Device	Operating Temperature Range	Package	Packing Method
KA5L0380R	−25 to +85°C	TO−220F−4L (Pb−Free)	Tube

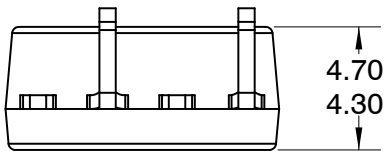
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TO−220 FULLPAK 4LD LF
CASE 340BK
ISSUE O

DATE 31 AUG 2016





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B DOES NOT COMPLY EIAJ STD. VALUE.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DIMENSIONS ARE EXCLUSIVE OF BURRS. MOLD FLASH AND TIE BAR PROTRUSIONS.
E. PIN 2 CONNECTS TO DAP.

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