KA5H0380R/KA5M0380R/KA5L0380R

SPS

Features

- Precision fixed operating frequency (100/67/50kHz)
- Low start-up current(typ. 100uA)
- Pulse by pulse current limiting
- Over current protection
- Over voltage protecton (Min. 25V)
- Internal thermal shutdown function
- Under voltage lockout
- Internal high voltage sense FET
- Auto-restart mode

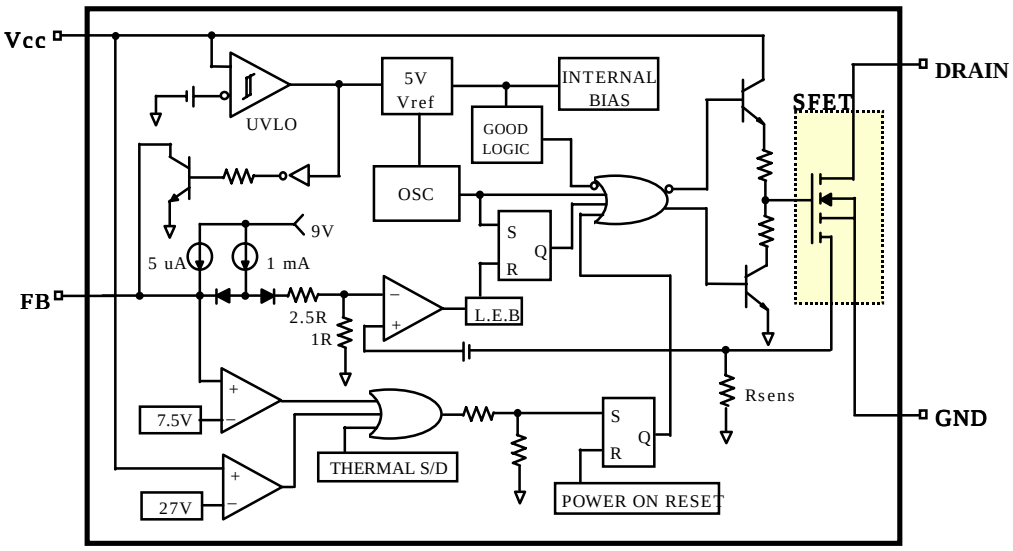
Description

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 loopcompensation 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.

TO-220F-4L

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

Internal Block Diagram



Rev. .5.0

Absolute Maximum Ratings

Characteristic	Symbol	Value	Unit
Drain-source (GND) voltage [1]	VDSS	800	V
Drain-Gate voltage (R_{GS}=1MΩ)	VDGR	800	V
Gate-source (GND) voltage	VGS	±30	V
Drain current pulsed [2]	IDM	12	A_{DC}
Single pulsed avalanche energy [3]	EAS	95	mJ
Avalanche current [4]	IAS	10	A
Continuous drain current (T_C=25°C)	ID	3.0	A_{DC}
Continuous drain current (T_C=100°C)	ID	2.1	A_{DC}
Supply voltage	VCC	30	V
Analog input voltage range	VFB	–0.3 to V_{SD}	V
Total power dissipation	PD (watt H/S)	35	W
	Derating	0.28	W/°C
Operating temperature	TOPR	–25 to +85	°C
Storage temperature	TSTG	–55 to +150	°C

Notes:

1. Tj=25°C to 150°C
2. Repetitive rating: Pulse width limited by maximum junction temperature
3. L=51mH, starting Tj=25°C
4. L=13μH, starting 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	–	–	250	μA
		V_{DS}=0.8Max., Rating, V_{GS}=0V, T_C=125°C	–	–	1000	μA
Static drain-source on resistance (note)	$R_{DS(ON)}$	V_{GS}=10V, I_D=0.5A	–	4	5	Ω
Forward transconductance (note)	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=1MHz	–	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 ≤ 300μS, duty ≤ 2%

$S = \frac{1}{R}$

Electrical Charcteristics (SFET part) (Continued)

(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	FOSC	**KA5H0380R**	90	100	110	kHz
Initial accuracy	FOSC	**KA5M0380R**	61	67	73	kHz
Initial accuracy	FOSC	**KA5L0380R**	45	50	55	kHz
Frequency change with temperature (2)		–25°C≤Ta≤+85°C	–	±5	±10	%
PWM SECTION						
Maximum duty cycle	Dmax	**KA5H0380R**	62	67	72	%
Maximum duty cycle	Dmax	**KA5M0380R** **KA5L0380R**	72	77	82	%
FEEDBACK SECTION						
Feedback source current	IFB	Ta=25°C, 0V≤Vfb≤3V	0.7	0.9	1.1	mA
Shutdown delay current	Idelay	Ta=25°C, 5V≤Vfb≤VSD	4	5	6	μA
OVER CURRENT PROTECTION SECTION						
Over current protection	IL(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	IST	VCC=14V	–	0.1	0.17	mA
Operating supply current (control part only)	IOPR	VCC≤28	–	7	12	mA
SHUTDOWN SECTION						
Shutdown Feedback voltage	VSD	Vfb≥6.5V	6.9	7.5	8.1	V
Thermal shutdown temperature (Tj) (1)	TSD	–	140	160	–	°C
Over voltage protection	VOVP	VCC≥24V	25	27	29	V

NOTE:

1. These parameters, although guaranteed, are not 100% tested in production
2. These parameters, although guaranteed, are tested in EDS(water test) process

Typical Performance Characteristics

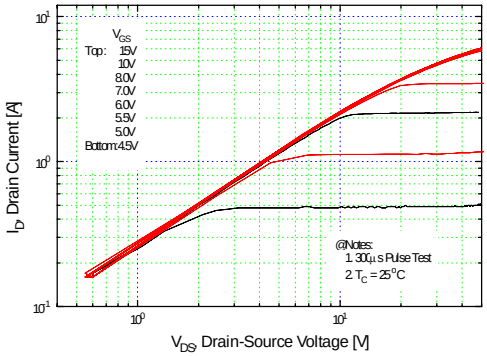


Figure 1. Output Characteristics

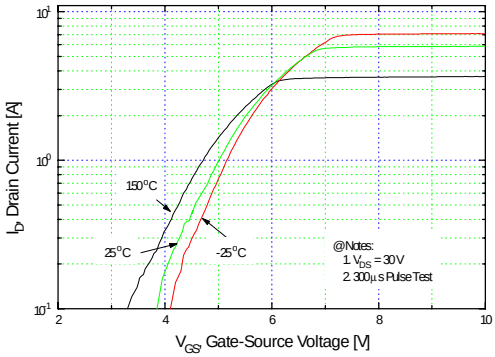


Figure 2. Thansfer Characteristics

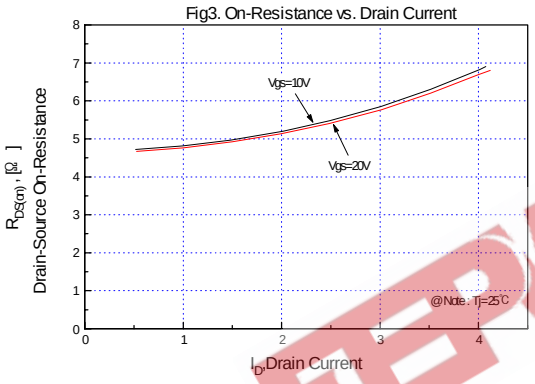


Figure 3. On-Resistance vs. Drain Current

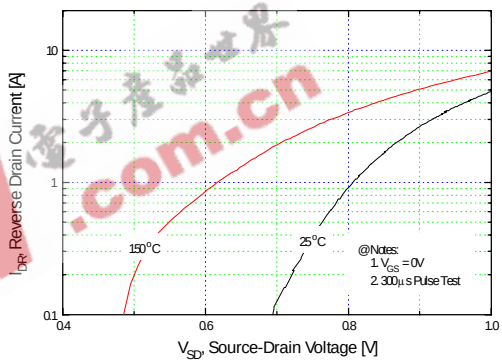


Figure 4. Source-Drain Diode Forward Voltage

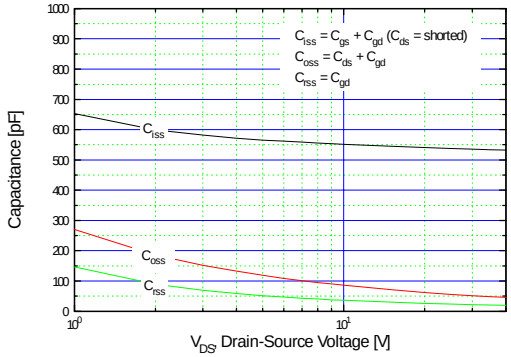


Figure 5. Capacitance vs. Drain-Source Voltage

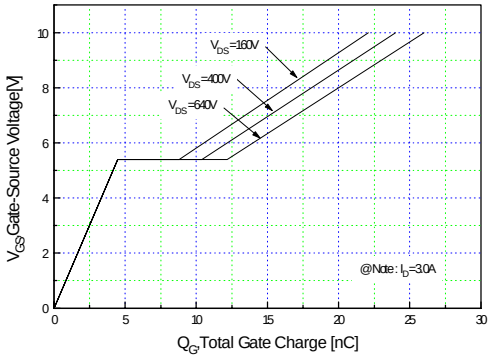


Figure 6. Gate Charge vs. Gate-Source Voltage

typical performance characteristics (continued)

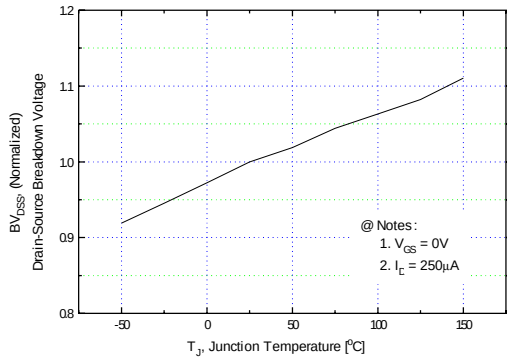


Figure 7. Breakdown Voltage vs. Temperature

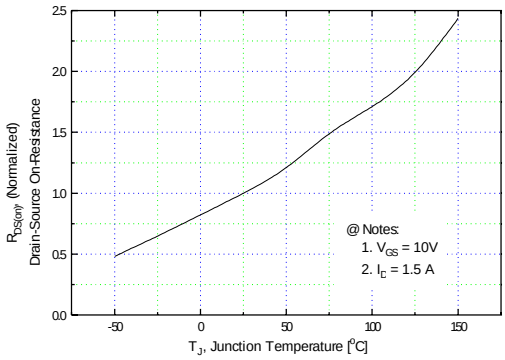


Figure 8. On-Resistance vs. Temperature

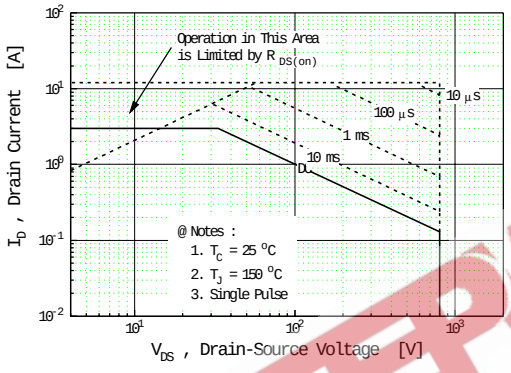


Figure 9. Max. Safe Operating Area

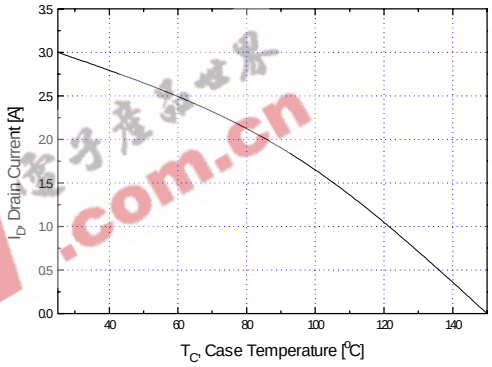


Figure 10. Max. Drain Current vs. Case Temperature

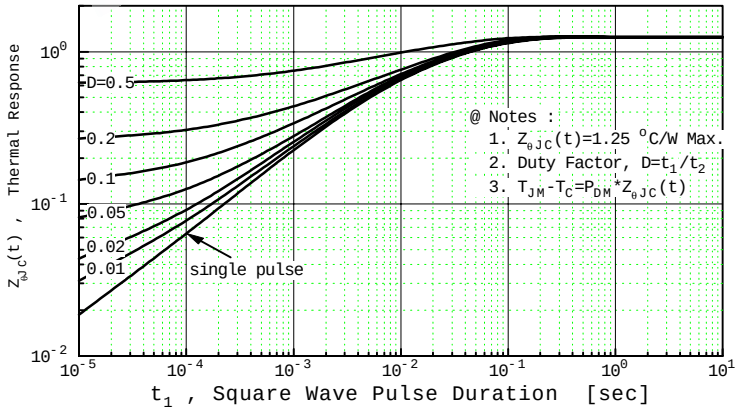


Figure 11. Thermal Response

typical performance characteristics (control part)

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

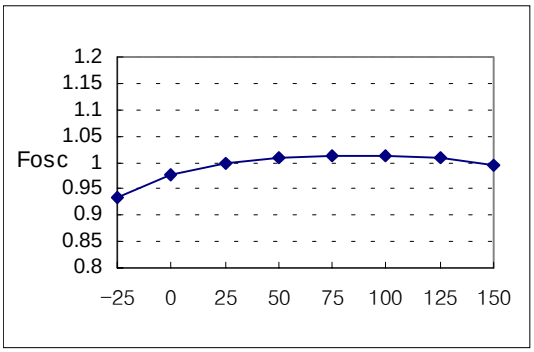


Figure 1. Operating Frequency

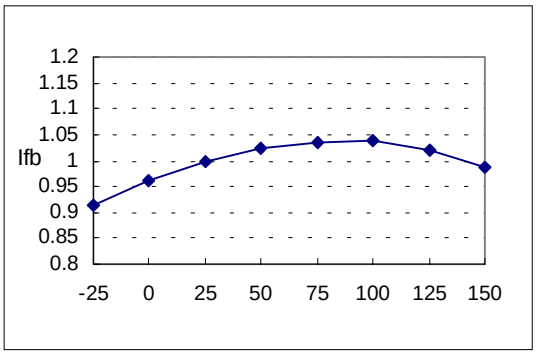


Figure 2. Feedback Source Current

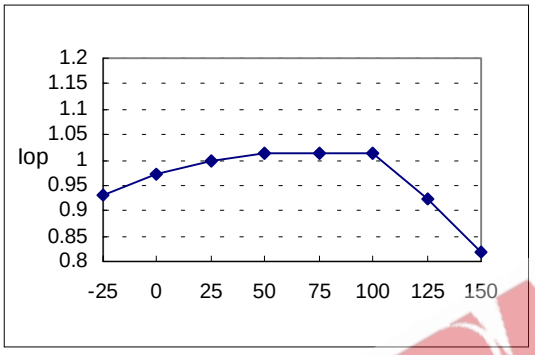


Figure 3. Operating Current

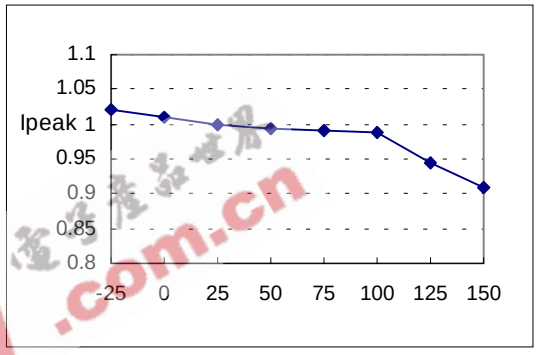


Figure 4. Max Inductor Current

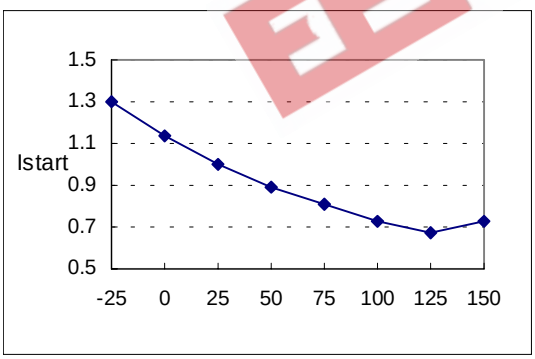


Figure 5. Start up Current

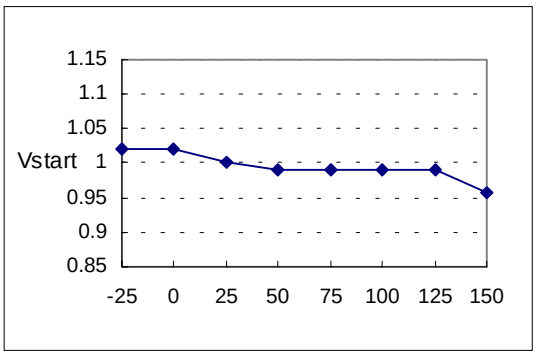


Figure 6. Start Threshold Voltage

typical performance characteristics (continued)

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

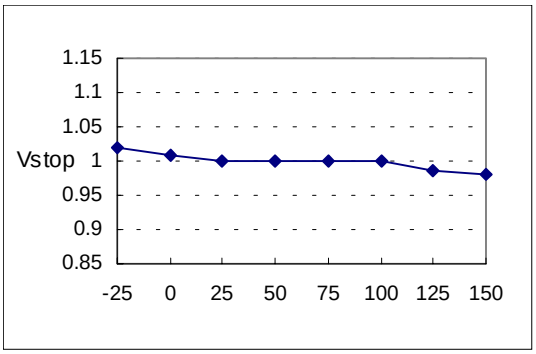


Figure 7. Stop Threshold Voltage

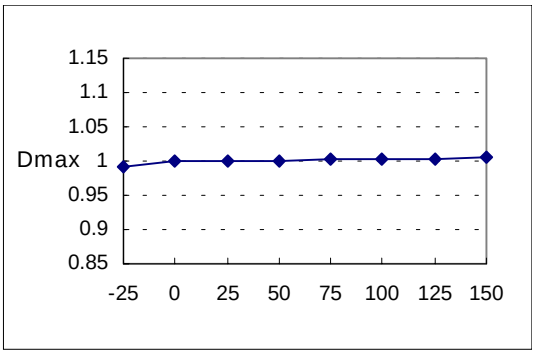


Figure 8. Maximum Duty Cycle

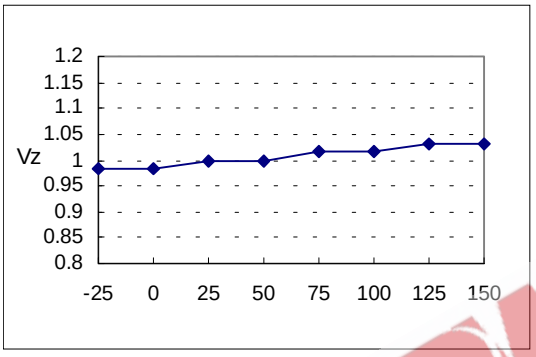


Figure 9. V_{CC} Zener Voltage

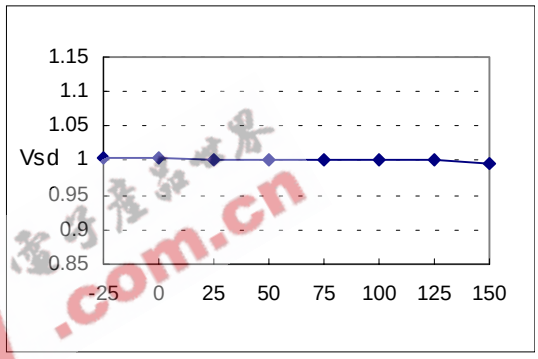


Figure 10. Shutdown Feedback Voltage

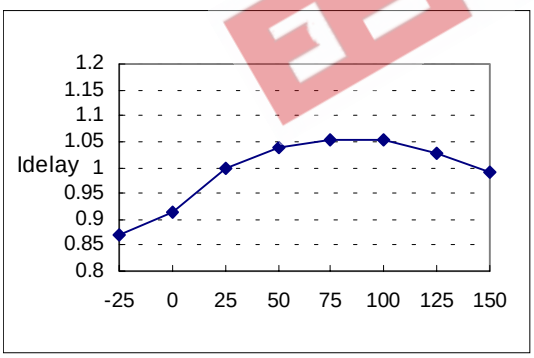


Figure 11. Shutdown Delay Current

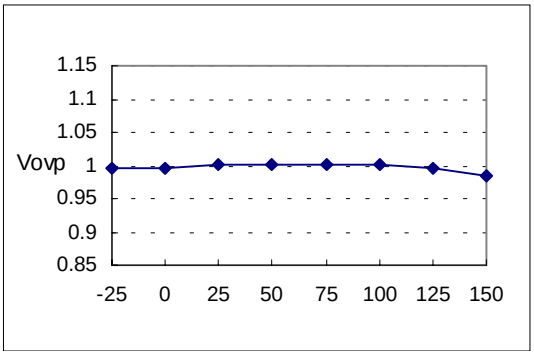


Figure 12. Over Voltage Protection

typical performance characteristics (continued)

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

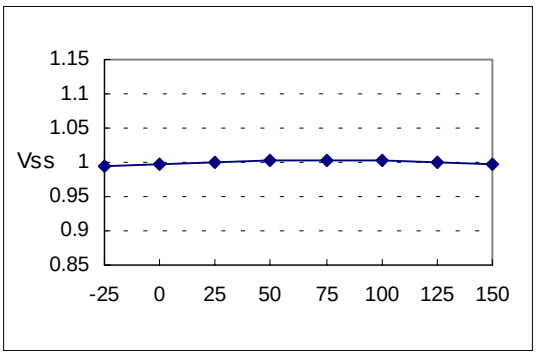


Figure13. Soft Start Voltage

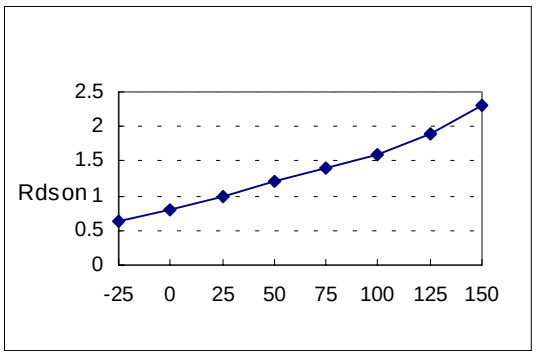
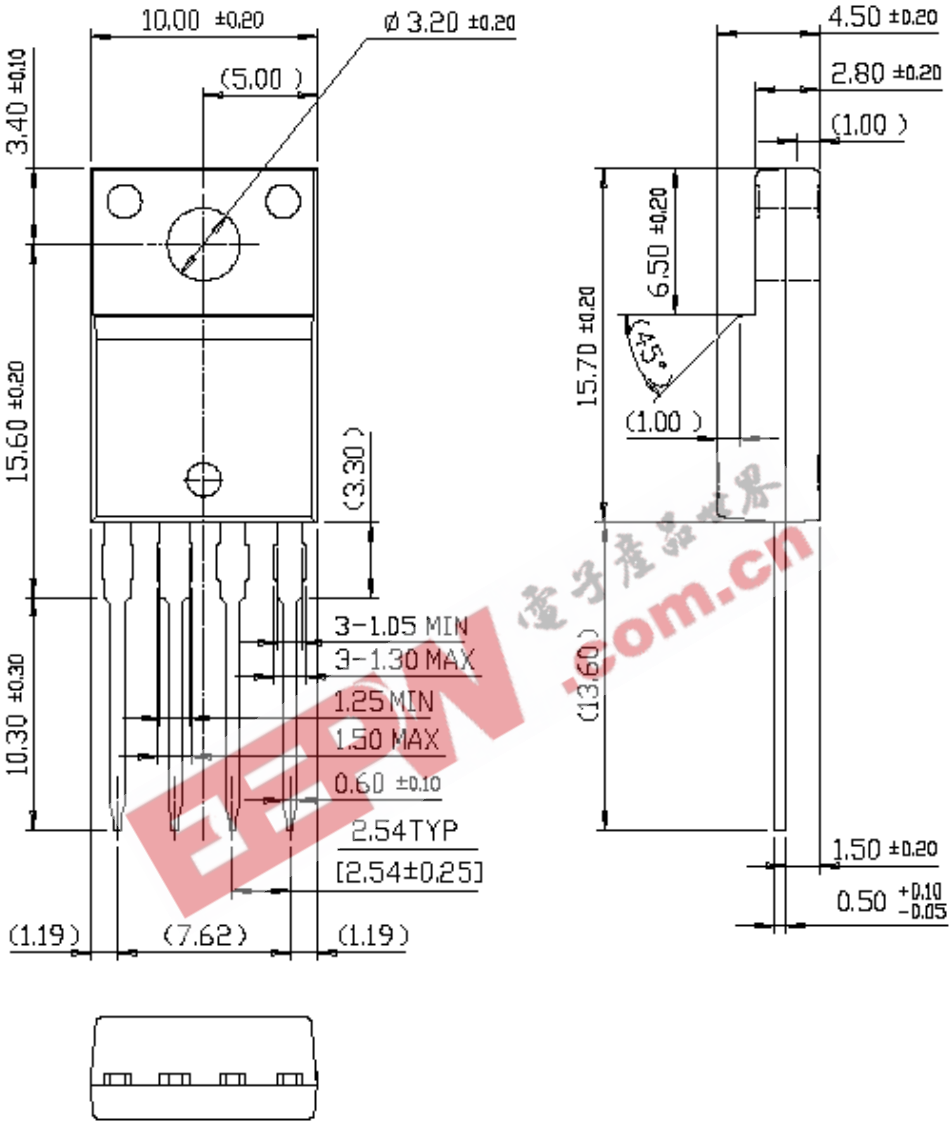


Figure 14. Drain Source Turn-on Resistance

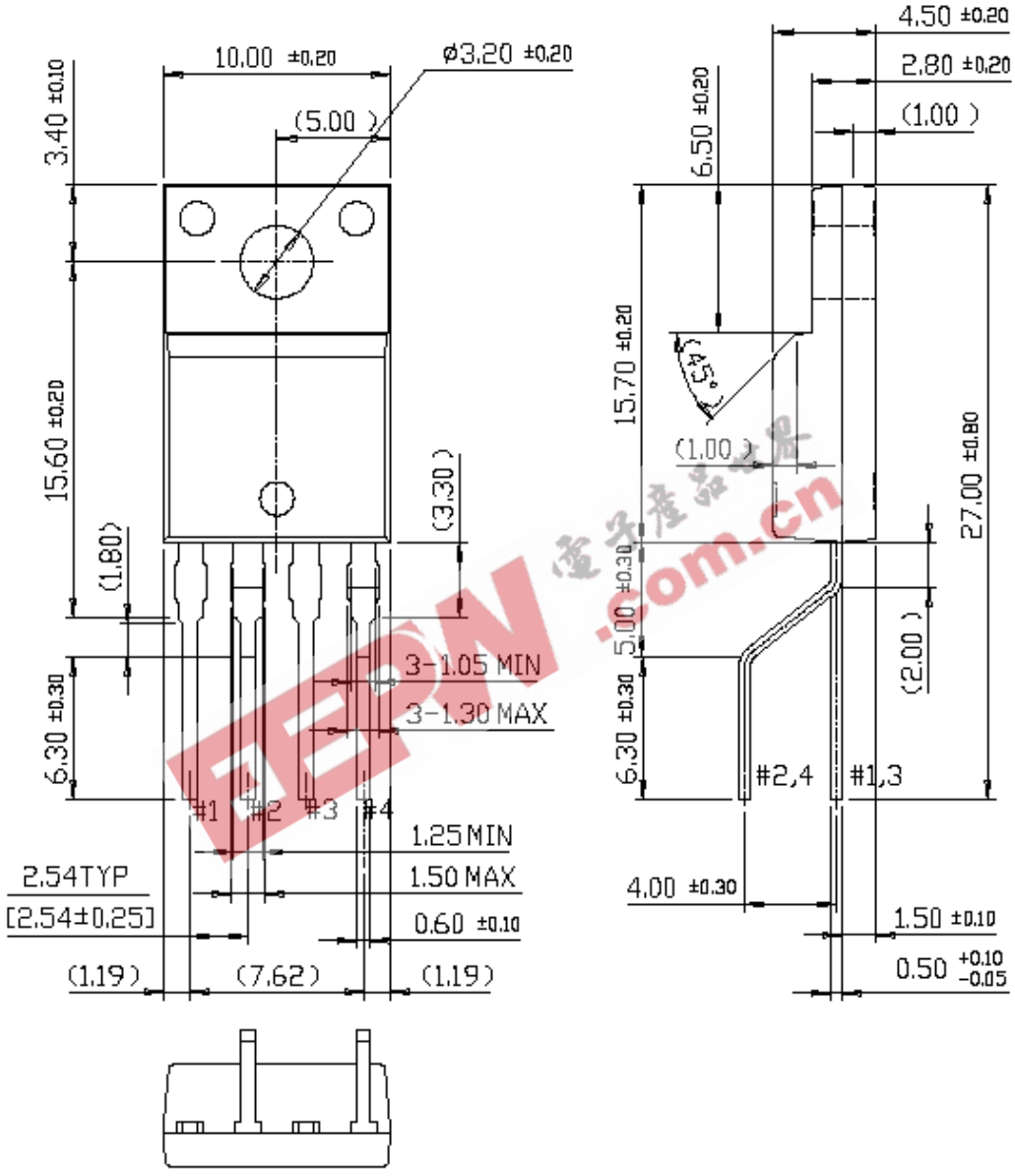
Package Dimensions

TO-220F-4L



Package Dimensions (Continued)

TO-220F-4L (Forming)



Ordering Information

Product Number	Package	Rating	Operating Temperature
KA5H0380R-TU	TO-220F-4L	800V, 3A	-25°C to +85°C
KA5H0380R-YDTU	TO-220F-4L(Forming)		
KA5M0380R-TU	TO-220F-4L	800V, 3A	-25°C to +85°C
KA5M0380R-YDTU	TO-220F-4L(Forming)		
KA5L0380R-TU	TO-220F-4L	800V, 3A	-25°C to +85°C
KA5L0380R-YDTU	TO-220F-4L(Forming)		

TU : Non forming Type
YDTU :forming Type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