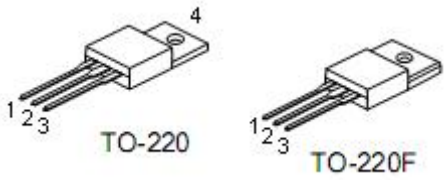
1. Description

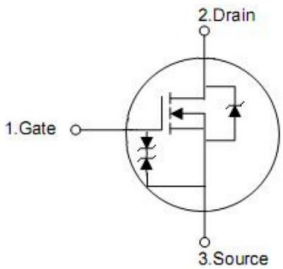
The KNX6140S N-Channel enhancement mode silicon gate power MOSFET is designed for high voltage, high speed power switching applications such as switching regulators, switching converters, solenoid, motor drivers,relay drivers.

2. Features

- 11A, 400V, $R_{DS(on)typ.}$ = 0.53Ω@V_{GS} = 10 V
- Low gate charge (typical 15.7nC)
- High ruggedness
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

3. Pin configuration





Pin	Function
1	Gate
2	Drain
3	Source
4	Drain

4.Ordering Information

Part Number	Package	Brand
KNF6140S	TO-220F	KIA
KNP6140S	TO-220	KIA

5. Absolute maximum ratings

(T_C=25 ºC , unless otherwise specified)

Parameter		Symbol	KNP6140S	KNF6140S	Units
Drain-source voltage		V_{DSS}	400		V
Gate-source voltage		V_{GSS}	±30		V
Drain currenet continuous	T_c=25°C	I_D	11	11*	A
	T_c=100°C		6.6	6.6*	A
Drain current pulsed [1]		I_{DM}	44	44*	A
Avalanche energy	Repetitive [1]	E_{AR}	19.50		mJ
	Single pulse [2]	E_{AS}	365		mJ
Avalanche Current [1]		I_{AR}	11		A
Peak diode recovery dv/dt [3]		dv/dt	4.5		V/ns
Total power dissipation	T_c=25°C	P_D	194.5	40.2	W
	Derate above 25°C		1.55	0.32	W/°C
Operating and Storage Temperature Range		$T_{J,}T_{STG}$	-55~+150		°C
Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		T_L	300		°C
Gate Source ESD (HBM – C = 100pF, R = 1.5KΩ)		$V_{ESD(G-S)}$	2500		V

*Drain current limited by maximum junction temperature.

6. Thermal characteristics

Parameter	Symbol	KNP6140S	KNF6140S	Unit
Thermal resistance,Junction-to-case	$R_{\theta JC}$	0.65	3.15	ºC/W
Thermal Resistance, Case-to-Sink Typ.	$R_{\theta JS}$	0.5	-	ºC/W
Thermal resistance,Junction-to-ambient	$R_{\theta JA}$	62.5	62.5	ºC/W

7. Electrical characteristics

(T_J=25°C,unless otherwise notes)

Parameter		Symbol	Conditions	Min	Typ	Max	Unit
Off Characteristics							
Drain-source breakdown voltage		BV_{DSS}	V_{GS}=0V,I_D=250μA	400	-	-	V
Zero gate voltage drain current		I_{DSS}	V_{DS}=400V ,V_{GS}=0V	-	-	1	μA
			V_{DS}=320V ,T_C=125 ºC	-	-	10	μA
Gate-body leakage current	Forward [6]	I_{GSS}	V_{GS}=20V,V_{DS}=0V	-	-	1	nA
	Reverse [6]		V_{GS}=-20V,V_{DS}=0V	-	-	-1	nA
Breakdown voltage temperature		$\Delta BV_{DSS}/\Delta T_J$	I_D=250μA,Referenced to 25ºC	-	0.4	-	V/ºC
On characteristics							
Gate threshold voltage		$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Static drain-source on-resistance		$R_{DS(on)}$	V_{GS}=10V,I_D=5A	-	530	640	mΩ
Forward Transconductance[4]		g_{FS}	V_{DS} = 40 V, I_D = 5 A	-	8	-	S
Dynamic characteristics							
Input capacitance		C_{iss}	V_{DS}=25V,V_{GS}=0V,f=1.0MHz	-	980	-	pF
Output capacitance		C_{oss}		-	140	-	pF
Reverse transfer capacitance		C_{rss}		-	2.6	-	pF
Switching characteristics							
Turn-on delay time		$t_{d(on)}$	V_{DD}=200V,I_D=11A,R_G=20Ω[4.5]	-	33.5	-	ns
Rise time		t_r		-	31.5	-	ns
Turn-off delay time		$t_{d(off)}$		-	83	-	ns
Fall time		t_f		-	56	-	ns
Total gate charge		Q_g	V_{DS}=320V,I_D=11A,V_{GS}=10V[4.5]	-	15.7	-	nC
Gate-source charge		Q_{gs}		-	4.6	-	nC
Gate-drain charge		Q_{gd}		-	4.5	-	nC
Drain-source diode characteristics and maximum rating							
Drain-source diode forward voltage		V_{SD}	V_{GS}=0V,I_{SD}=11A	-	-	1.4	V
Continuous Drain-source current		I_S		-	-	11	A
Pulsed Drain-source current		I_{SM}		-	-	44	A
Reverse recovery time		t_{rr}	V_{GS}=0V,I_S=11A, dIF / dt = 100 A/us	-	430	-	ns
Reverse recovery charge[4]		Q_{rr}		-	3.8	-	μC

Notes:1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 5.5 mH, I_{AS} = 11A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 11A, di/dt ≤100A/us, V_{DD} ≤BV_{DSS}, Starting T_J = 25°C
4. Pulse Test : Pulse width ≤ 300us, Duty cycle ≤2%
5. Essentially independent of operating temperature
6. V_{GS} =± 30 V, V_{DS} = 0 V，I_{GSS} ≤2uA， Starting T_J = 25°C

8. Test circuits and waveforms

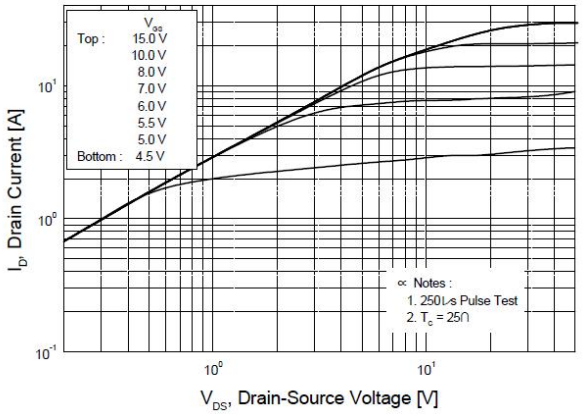


Figure 1. On-Region Characteristics

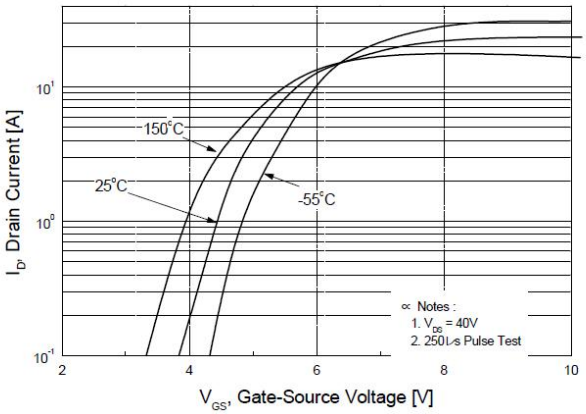


Figure 2. Transfer Characteristics

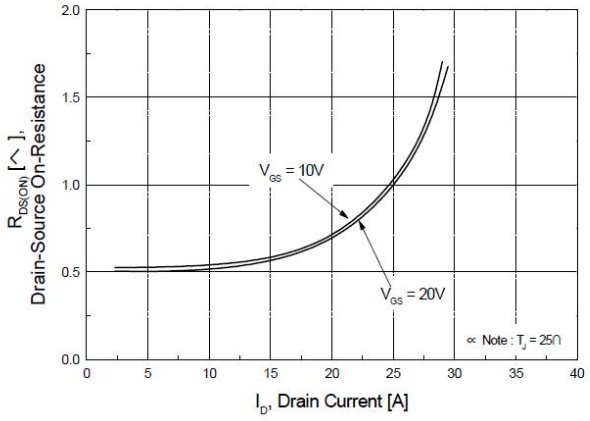


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

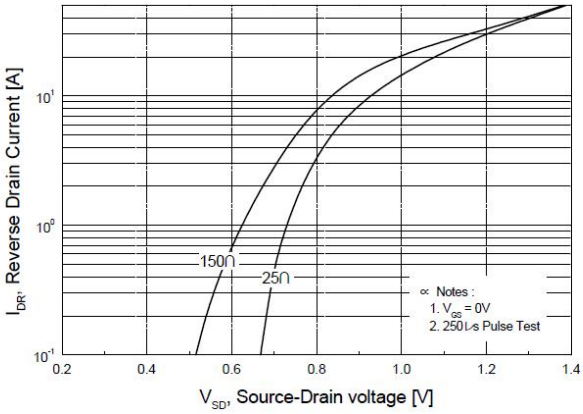


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

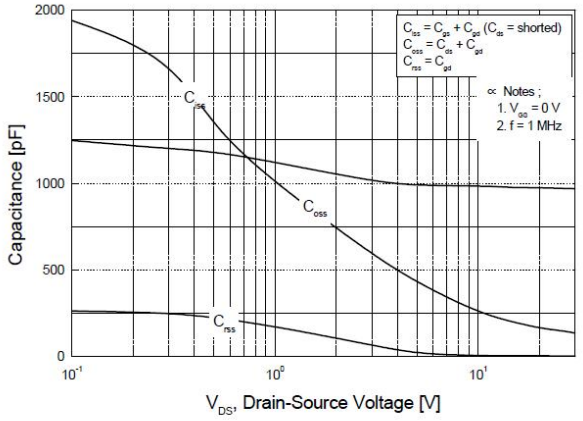


Figure 5. Capacitance Characteristics

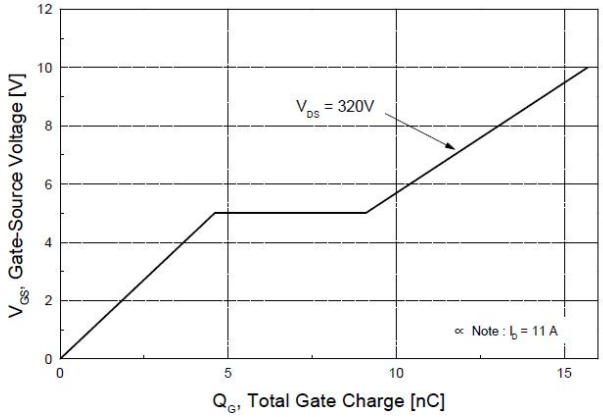


Figure 6. Gate Charge Characteristics

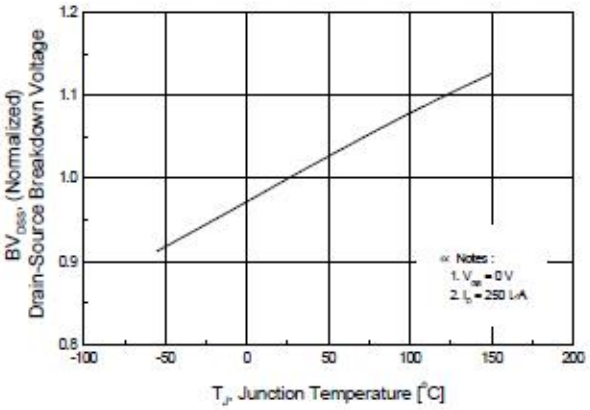


Figure 7. Breakdown Voltage Variation vs Temperature

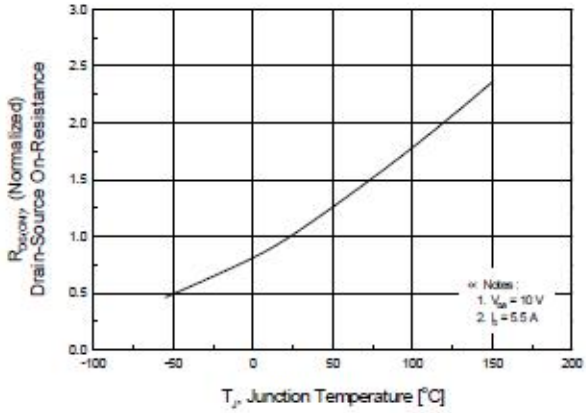


Figure 8. On-Resistance Variation vs Temperature

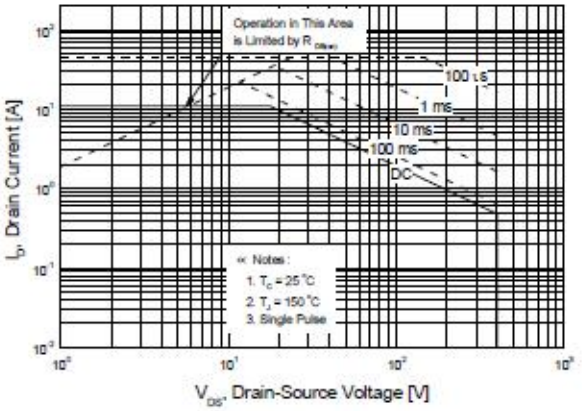


Figure 9-1. Maximum Safe Operating Area for KNP6140S

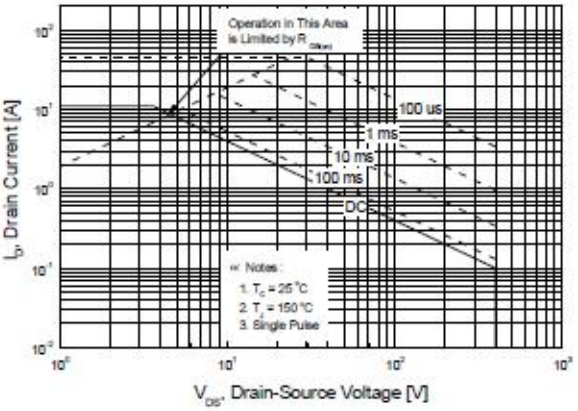


Figure 9-2. Maximum Safe Operating Area for KNF6140S

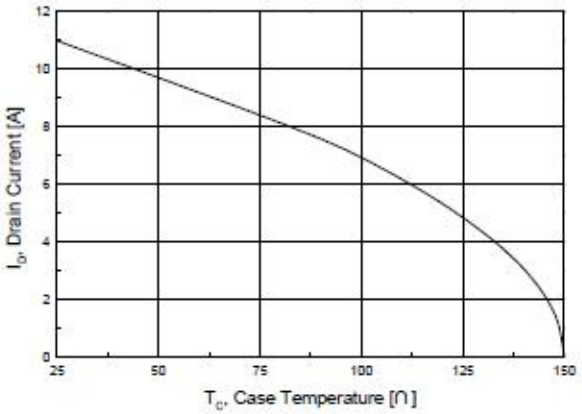


Figure 10. Maximum Drain Current vs Case Temperature

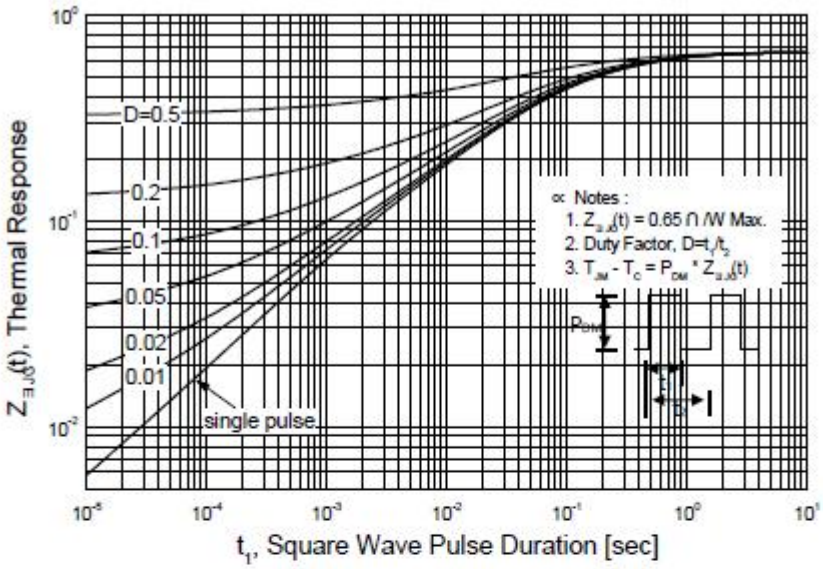


Figure 11-1. Transient Thermal Response Curve for KNP6140S

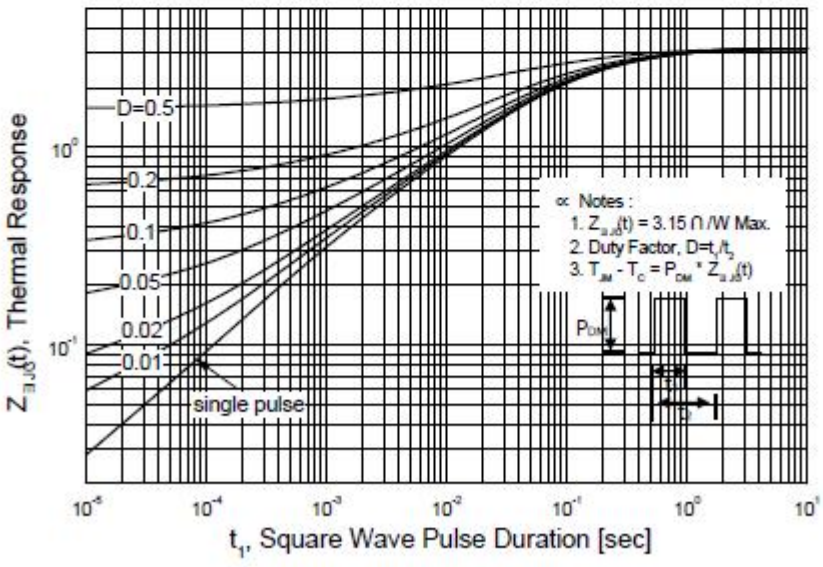


Figure 11-2. Transient Thermal Response Curve for KNF6140S