

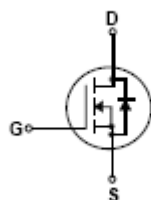
## 1. Description

This Power MOSFET is produced using KIA advanced Super-Junction technology. This advanced technology has been especially tailored to minimize conduction loss, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for AC/DC power conversion in switching mode operation for higher efficiency.

## 2. Features

- n  $R_{DS(on)}=0.34\Omega @ V_{GS} = 10\text{ V}$
- n Low gate charge ( typical 33 nC)
- n High ruggedness
- n Fast switching
- n 100% avalanche tested
- n Improved dv/dt capability

## 3. Pin configuration



Pin	Function
1	Gate
2	Drain
3	Source

## 4. Absolute maximum ratings

( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted)

Parameter	Symbol	Ratings	Units
Drain-source voltage	$V_{DSS}$	600	V
Drain current	$I_D$	$T_C=25\text{ }^\circ\text{C}$	11*
		$T_C=100\text{ }^\circ\text{C}$	6.7*
Drain current (note1)	$I_{DM}$	30*	A
Gate-source Voltage	$V_{GSS}$	$\pm 30$	V
Single pulsed avalanche energy (note2)	$E_{AS}$	132	mJ
Avalanche current (note1)	$I_{AR}$	2.1	A
Repetitive avalanche energy (note1)	$E_{AR}$	65	mJ
Peak diode recovery dv/dt (note 3)	dv/dt	5.0	V/ns
Power dissipation	$P_D$	$T_C=25\text{ }^\circ\text{C}$	125
		Derate above $25\text{ }^\circ\text{C}$	1.0
Operating and storage temperature range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$
Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	$T_L$	300	$^\circ\text{C}$

\* Drain current limited by maximum junction temperature.

## 5. Thermal characteristics

Parameter	Symbol	60R380DS	Units
Thermal resistance, junction-to-case	$R_{\theta JC}$	0.6	$^\circ\text{C/W}$
Thermal resistance, case-to-sink Typ.	$R_{\theta CS}$	1.0	$^\circ\text{C/W}$
Thermal resistance, junction-to-ambient	$R_{\theta JA}$	62	$^\circ\text{C/W}$

## 6. Electrical characteristics

(T<sub>C</sub>=25°C, unless otherwise notes)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
<b>Off characteristics</b>						
Drain-source breakdown voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	600	-	-	V
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> =600V, V <sub>GS</sub> =0V	-	-	1	μA
		V <sub>DS</sub> =480V, T <sub>C</sub> =125°C	-	-	10	μA
Gate-body leakage current	Forward	I <sub>GSS</sub>	-	-	100	nA
	Reverse				-100	nA
Breakdown voltage temperature coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> =250μA Referenced to 25°C	-	0.6	-	V/°C
<b>On characteristics</b>						
Gate threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.5	-	4.5	V
Static drain-source on-resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =5.5A	-	0.34	0.38	Ω
Forward transconductance	g <sub>FS</sub>	V <sub>DS</sub> =40V, I <sub>D</sub> =5.5A (note4)	-	16	-	S
<b>Dynamic characteristics</b>						
Input capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz	-	680	-	pF
Output capacitance	C <sub>OSS</sub>		-	140	-	pF
Reverse transfer capacitance	C <sub>RSS</sub>		-	5	-	pF
<b>Switching characteristics</b>						
Turn-on delay time	t <sub>D(ON)</sub>	V <sub>DD</sub> =400V, I <sub>D</sub> =5.5A, R <sub>G</sub> =20Ω (note4, 5)	-	26	-	ns
Rise time	t <sub>R</sub>		-	60	-	ns
Turn-off delay time	t <sub>D(OFF)</sub>		-	75	-	ns
Fall time	t <sub>F</sub>		-	44	-	ns
Total gate charge	Q <sub>G</sub>	V <sub>DS</sub> =480V, I <sub>D</sub> =11A, V <sub>GS</sub> =10V (note4, 5)	-	33	-	nC
Gate-source charge	Q <sub>GS</sub>		-	4	-	nC
Gate-drain charge	Q <sub>GD</sub>		-	4.2	-	nC
<b>Drain-source diode characteristics and maximum ratings</b>						
Maximum continuous drain-source diode forward current	I <sub>S</sub>		-	-	11	A
Maximum pulsed drain-source diode forward current	I <sub>SM</sub>		-	-	30	A
Drain-source diode forward voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =11A	-	-	1.5	V
Reverse recovery time	t <sub>RR</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =11A, di <sub>F</sub> /dt=100A/μs (note 4)	-	270	-	ns
Reverse recovery charge	Q <sub>RR</sub>		-	3.3	-	μC

- Note: 1. Repetitive rating : pulse width limited by maximum junction temperature  
2. I<sub>AS</sub> = 2.1A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C  
3. I<sub>SD</sub> ≤ 10A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C  
4. Pulse test : pulse width ≤ 300μs, duty cycle ≤ 2%  
5. Essentially independent of operating temperature

7. Test circuits and waveforms

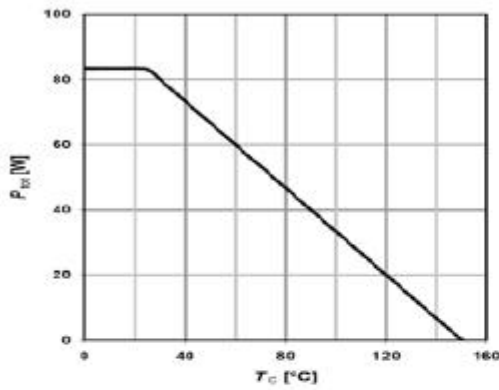


Figure 1. Power Dissipation for TO-251, TO-252

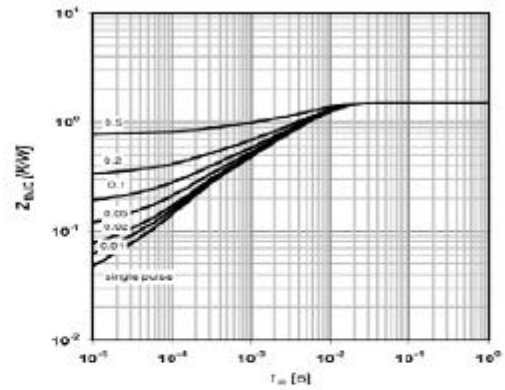


Figure 2. Transient Thermal Response Curve for TO-251, TO-252

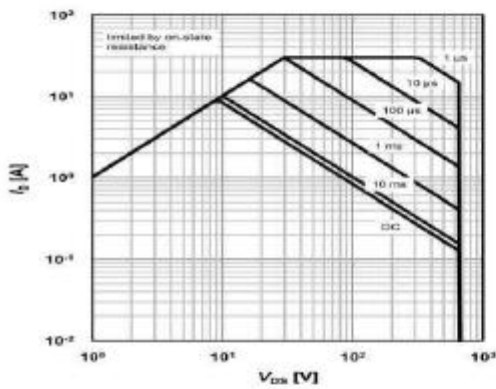


Figure 3. Maximum Safe Operating Area for TO-251, TO-252 @ 25°C

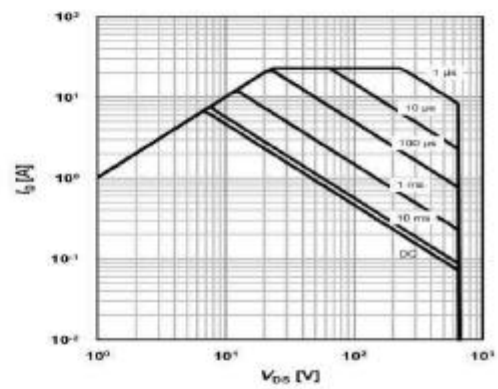


Figure 4. Maximum Safe Operating Area for TO-251, TO-252 @ 80°C

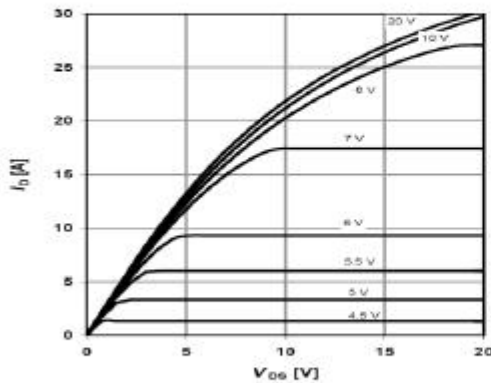


Figure 5. Output Characteristics @ 25°C

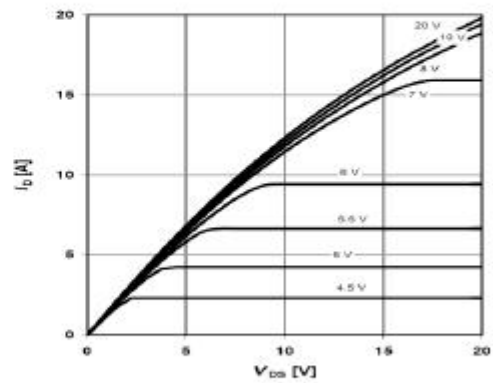


Figure 6. Output Characteristics @ 125°C

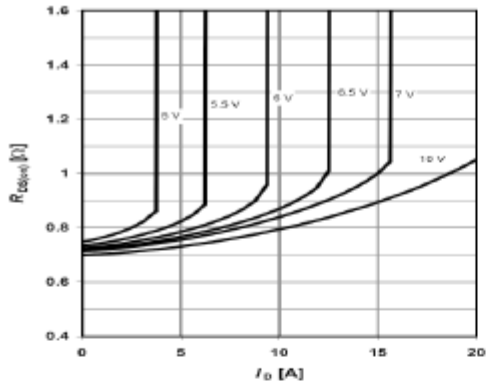


Figure 7. On-Resistance Variation vs Drain Current and Gate Voltage @ 125°C

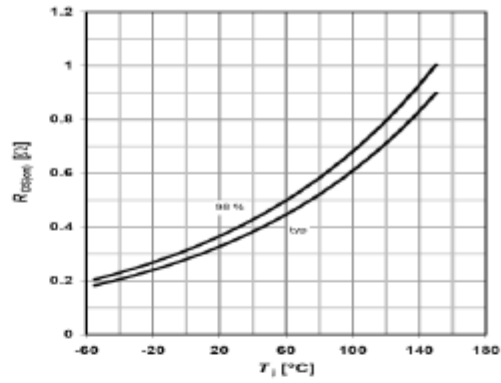


Figure 8. On-Resistance Variation vs Temperature

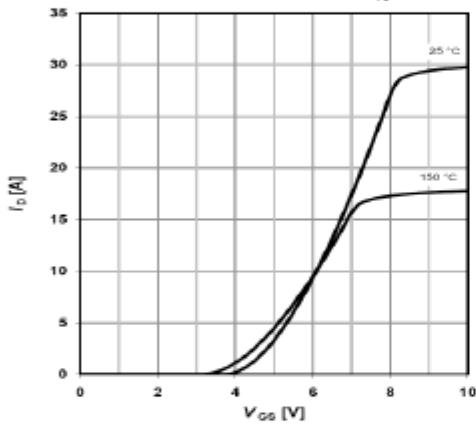


Figure 9. Transfer characteristics

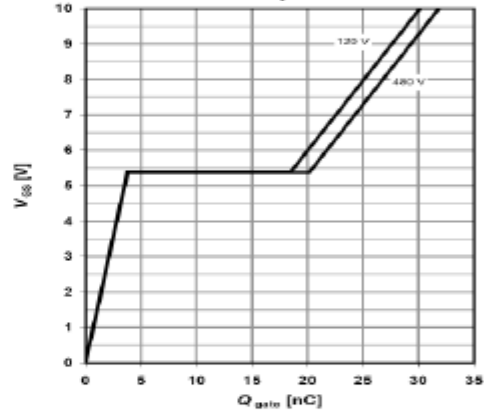


Figure 10. Gate charge

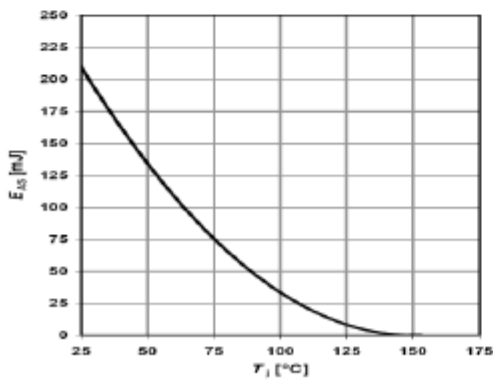


Figure 11. Avalanche Energy Characteristics

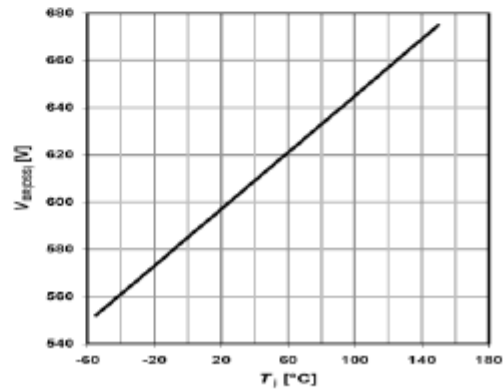


Figure 12. Breakdown Voltage Variation vs Temperature

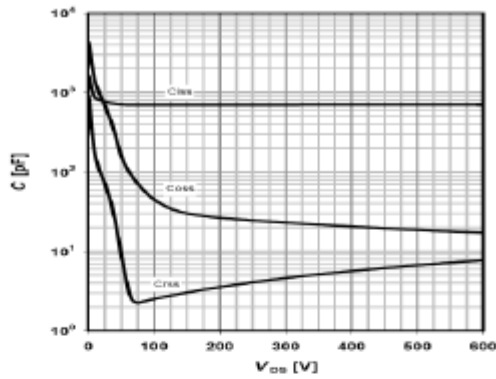


Figure 13. Capacitance Characteristics

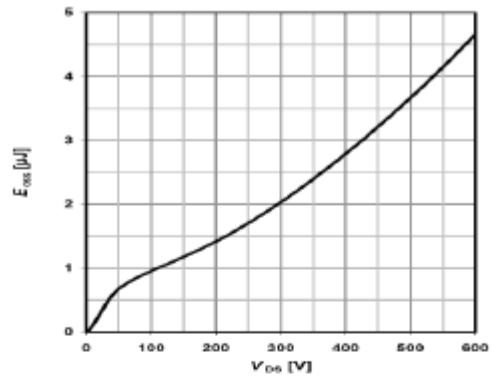


Figure 14. On-Resistance Variation vs Temperature

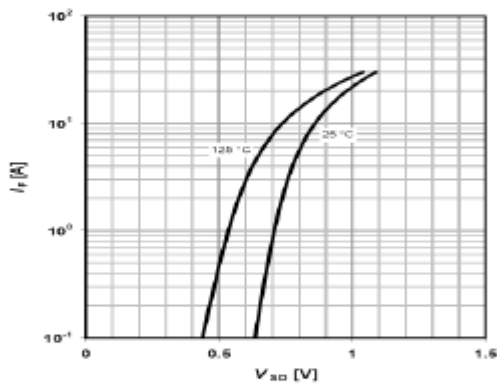
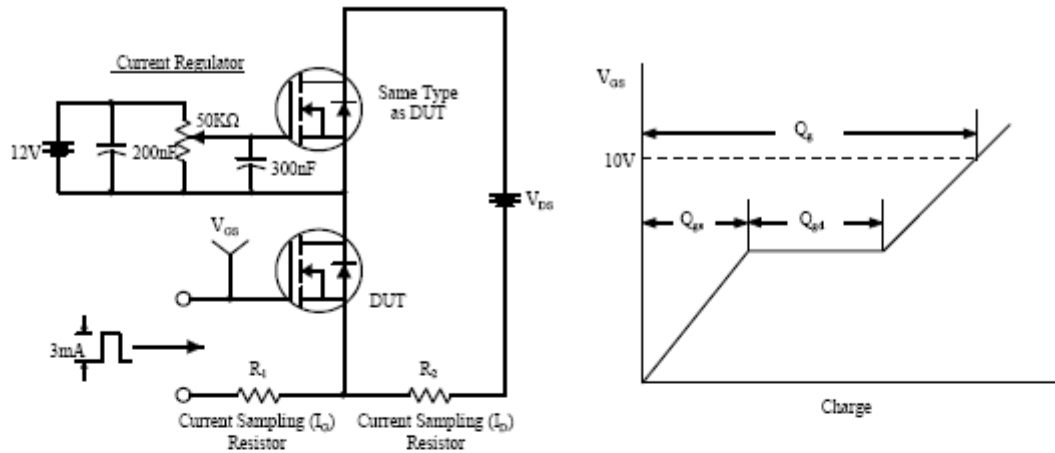
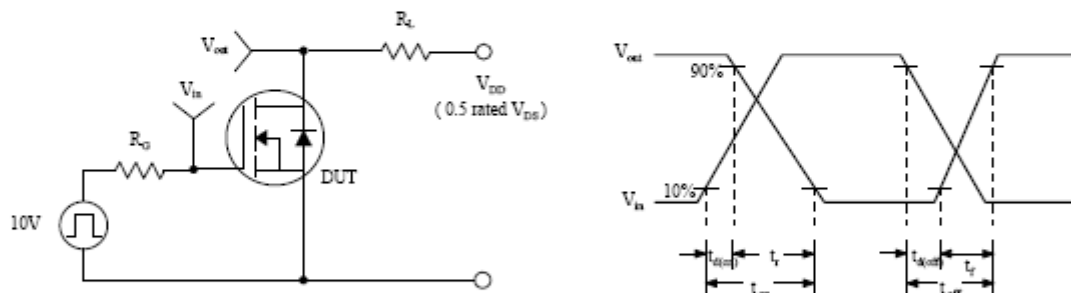


Figure 15. Body Diode Forward Voltage Variation with Source Current and Temperature

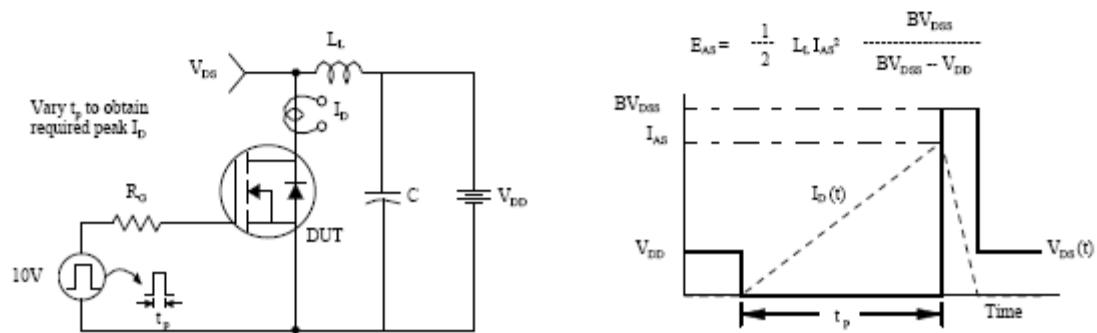
**Gate Charge Test Circuit & Waveform**



**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**



**Peak Diode Recovery dv/dt Test Circuit & Waveforms**

