

# Complementary MOSFET

ELM35602KA-S

## General Description

ELM35602KA-S uses advanced trench technology to provide excellent  $R_{ds(on)}$  and low gate charge.

## Features

- |  |   |
|--|---|
| N-channel                                | P-channel                               |
| • $V_{ds}=30V$                           | $V_{ds}=-30V$                           |
| • $I_d=8A$                               | $I_d=-6A$                               |
| • $R_{ds(on)} < 25m\Omega (V_{gs}=10V)$  | $R_{ds(on)} < 45m\Omega (V_{gs}=-10V)$  |
| • $R_{ds(on)} < 37m\Omega (V_{gs}=4.5V)$ | $R_{ds(on)} < 80m\Omega (V_{gs}=-4.5V)$ |

## Maximum Absolute Ratings

Parameter	Symbol	N-ch (Max.)	P-ch (Max.)	Unit	Note
Drain-source voltage	$V_{ds}$	30	-30	V	
Gate-source voltage	$V_{gs}$	$\pm 20$	$\pm 20$	V	
Continuous drain current	$I_d$	$T_a=25^\circ C$	8.0	-6.0	A
		$T_a=70^\circ C$	6.5	-4.8	
Pulsed drain current	$I_{dm}$	50	-50	A	1
Power dissipation	$P_d$	$T_a=25^\circ C$	3.0	3.0	W
		$T_a=70^\circ C$	2.1	2.1	
Junction and storage temperature range	$T_j, T_{stg}$	-55 to 150	-55 to 150	$^\circ C$	

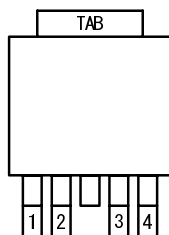
## Thermal Characteristics

Parameter	Symbol	Device	Typ.	Max.	Unit	Note
Maximum junction-to-ambient	$R\theta_{ja}$	N-ch		42	$^\circ C/W$	
Maximum junction-to-case	$R\theta_{jc}$	N-ch		6	$^\circ C/W$	
Maximum junction-to-ambient	$R\theta_{ja}$	P-ch		42	$^\circ C/W$	
Maximum junction-to-case	$R\theta_{jc}$	P-ch		6	$^\circ C/W$	

1. Pulse width limited by maximum junction temperature.
2. Duty cycle  $\leq 1\%$ .

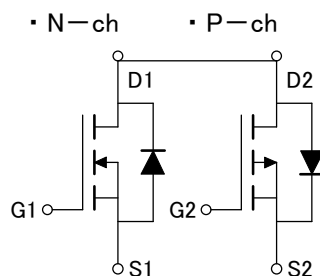
## Pin Configuration

TO-252-4 (TOP VIEW)



Pin No.	Pin name
1	SOURCE1
2	GATE1
3	SOURCE2
4	GATE2
TAB	DRAIN1/DRAIN2

## Circuit



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### ■ Electrical Characteristics (N-ch)

T<sub>a</sub>=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
<b>STATIC PARAMETERS</b>							
Drain-source breakdown voltage	BV <sub>dss</sub>	I <sub>d</sub> =250 μA, V <sub>gs</sub> =0V	30			V	
Zero gate voltage drain current	I <sub>dss</sub>	V <sub>ds</sub> =24V, V <sub>gs</sub> =0V			1	μA	
		V <sub>ds</sub> =20V, V <sub>gs</sub> =0V, T <sub>j</sub> =55°C			10		
Gate-body leakage current	I <sub>gss</sub>	V <sub>ds</sub> =0V, V <sub>gs</sub> =±20V			±100	nA	
Gate threshold voltage	V <sub>gs(th)</sub>	V <sub>ds</sub> =V <sub>gs</sub> , I <sub>d</sub> =250 μA	1.0	1.5	2.5	V	
On state drain current	I <sub>d(on)</sub>	V <sub>gs</sub> =10V, V <sub>ds</sub> =5V	50			A	1
Static drain-source on-resistance	R <sub>ds(on)</sub>	V <sub>gs</sub> =10V, I <sub>d</sub> =8A		18	25	mΩ	1
		V <sub>gs</sub> =4.5V, I <sub>d</sub> =7A		25	37		
Forward transconductance	G <sub>fs</sub>	V <sub>ds</sub> =10V, I <sub>d</sub> =8A		19		S	1
Diode forward voltage	V <sub>sd</sub>	I <sub>f</sub> =3A, V <sub>gs</sub> =0V			1.3	V	1
<b>DYNAMIC PARAMETERS</b>							
Input capacitance	C <sub>iss</sub>	V <sub>gs</sub> =0V, V <sub>ds</sub> =10V, f=1MHz		790		pF	
Output capacitance	C <sub>oss</sub>			175		pF	
Reverse transfer capacitance	C <sub>rss</sub>			65		pF	
<b>SWITCHING PARAMETERS</b>							
Total gate charge	Q <sub>g</sub>	V <sub>gs</sub> =10V, V <sub>ds</sub> =15V, I <sub>d</sub> =8A		16.0		nC	2
Gate-source charge	Q <sub>gs</sub>			2.5		nC	2
Gate-drain charge	Q <sub>gd</sub>			2.1		nC	2
Turn-on delay time	t <sub>d(on)</sub>	V <sub>gs</sub> =10V, V <sub>ds</sub> =10V, I <sub>d</sub> ≅1A R <sub>gen</sub> =6 Ω		2.2	4.4	ns	2
Turn-on rise time	t <sub>r</sub>			7.5	15.0	ns	2
Turn-off delay time	t <sub>d(off)</sub>			11.8	21.3	ns	2
Turn-off fall time	t <sub>f</sub>			3.7	7.4	ns	2
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>f</sub> =8A, dI/dt=100A/μs		42		ns	
Body diode reverse recovery charge	Q <sub>rr</sub>			30		nC	

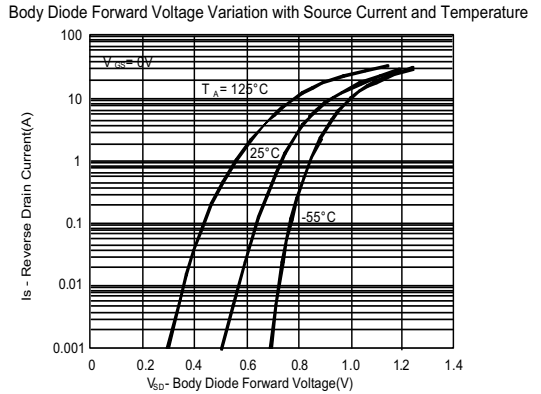
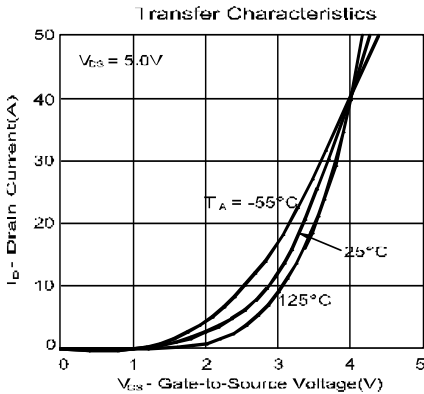
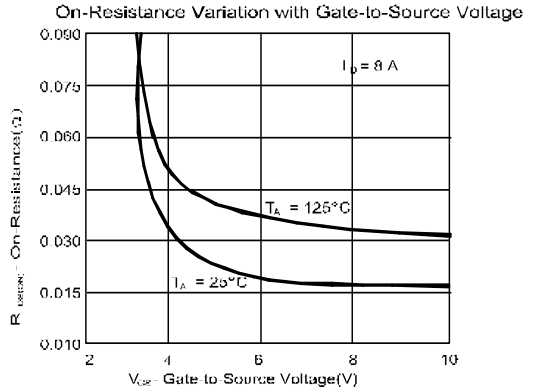
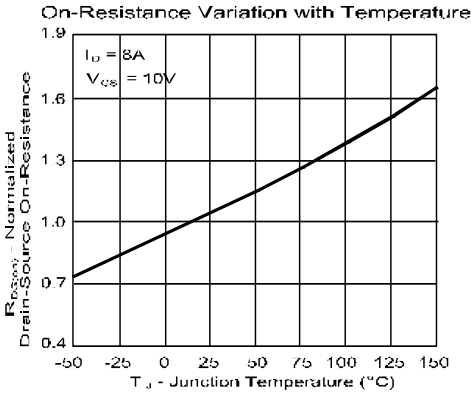
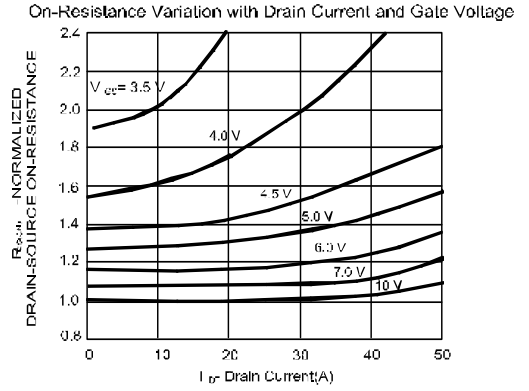
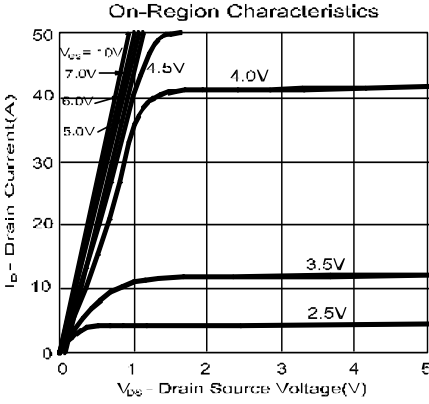
#### NOTE :

1. Pulse test : Pulse width ≤ 300 μsec, duty cycle ≤ 2%.
2. Independent of operating temperature.
3. Pulse width limited by maximum junction temperature.

# Complementary MOSFET

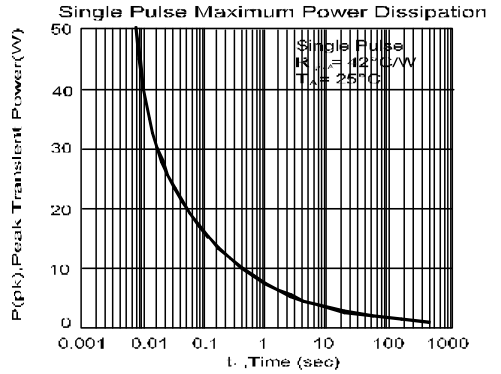
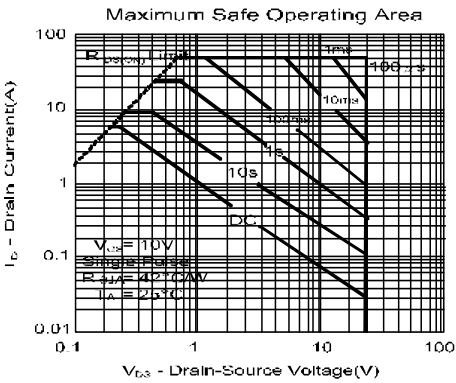
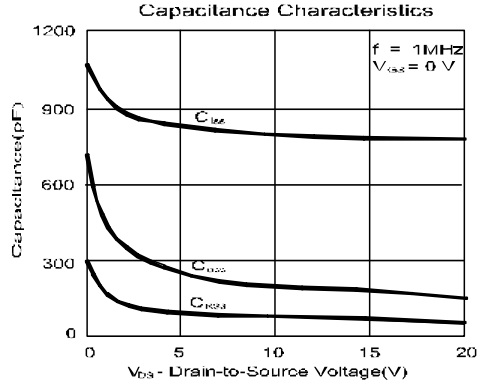
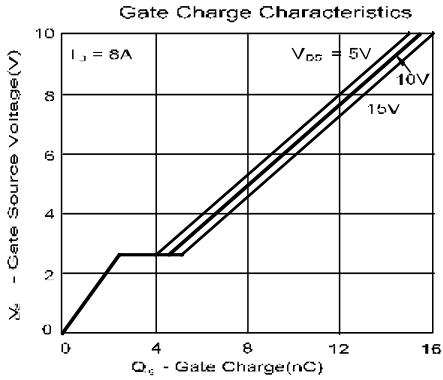
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## Typical Electrical and Thermal Characteristics (N-ch)



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### ■ Electrical Characteristics (P-ch)

T<sub>a</sub>=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
<b>STATIC PARAMETERS</b>							
Drain-source breakdown voltage	BV <sub>dss</sub>	I <sub>d</sub> =-250μA, V <sub>gs</sub> =0V	-30			V	
Zero gate voltage drain current	I <sub>dss</sub>	V <sub>ds</sub> =-24V, V <sub>gs</sub> =0V			-1	μA	
		V <sub>ds</sub> =-20V, V <sub>gs</sub> =0V, T <sub>j</sub> =55°C			-10		
Gate-body leakage current	I <sub>gss</sub>	V <sub>ds</sub> =0V, V <sub>gs</sub> =±20V			±100	nA	
Gate threshold voltage	V <sub>gs(th)</sub>	V <sub>ds</sub> =V <sub>gs</sub> , I <sub>d</sub> =-250μA	-1.0	-1.5	-2.5	V	
On state drain current	I <sub>d(on)</sub>	V <sub>gs</sub> =-10V, V <sub>ds</sub> =-5V	-50			A	1
Static drain-source on-resistance	R <sub>ds(on)</sub>	V <sub>gs</sub> =-10V, I <sub>d</sub> =-6A		34	45	mΩ	1
		V <sub>gs</sub> =-4.5V, I <sub>d</sub> =-5A		58	80		
Forward transconductance	G <sub>fs</sub>	V <sub>ds</sub> =-10V, I <sub>d</sub> =-6A		11		S	1
Diode forward voltage	V <sub>sd</sub>	I <sub>f</sub> =-3A, V <sub>gs</sub> =0V			-1.3	V	1
<b>DYNAMIC PARAMETERS</b>							
Input capacitance	C <sub>iss</sub>	V <sub>gs</sub> =0V, V <sub>ds</sub> =-10V, f=1MHz		690		pF	
Output capacitance	C <sub>oss</sub>			310		pF	
Reverse transfer capacitance	C <sub>rss</sub>			75		pF	
<b>SWITCHING PARAMETERS</b>							
Total gate charge	Q <sub>g</sub>	V <sub>gs</sub> =-10V, V <sub>ds</sub> =-15V I <sub>d</sub> =-6A		14.0		nC	2
Gate-source charge	Q <sub>gs</sub>			2.2		nC	2
Gate-drain charge	Q <sub>gd</sub>			1.9		nC	2
Turn-on delay time	t <sub>d(on)</sub>	V <sub>gs</sub> =-10V, V <sub>ds</sub> =-10V I <sub>d</sub> ≅-1A, R <sub>gen</sub> =6Ω		6.7	13.4	ns	2
Turn-on rise time	t <sub>r</sub>			9.7	19.4	ns	2
Turn-off delay time	t <sub>d(off)</sub>			19.8	35.6	ns	2
Turn-off fall time	t <sub>f</sub>			12.3	22.2	ns	2
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>f</sub> =-6A, dI/dt=100A/μs		55		ns	
Body diode reverse recovery charge	Q <sub>rr</sub>			52		nC	

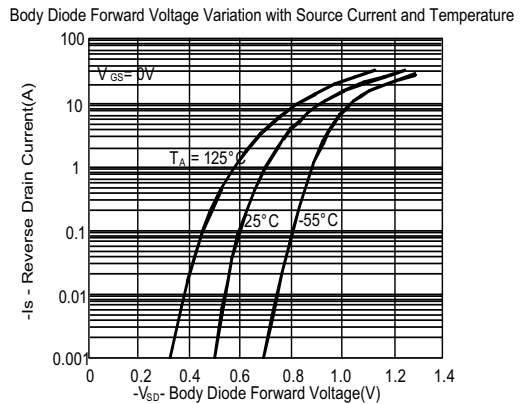
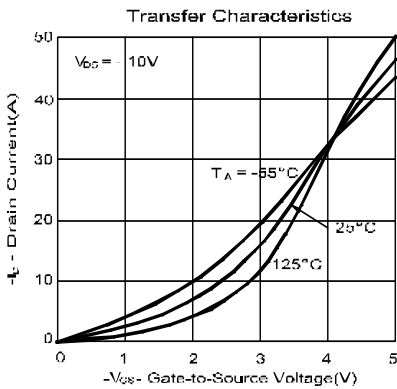
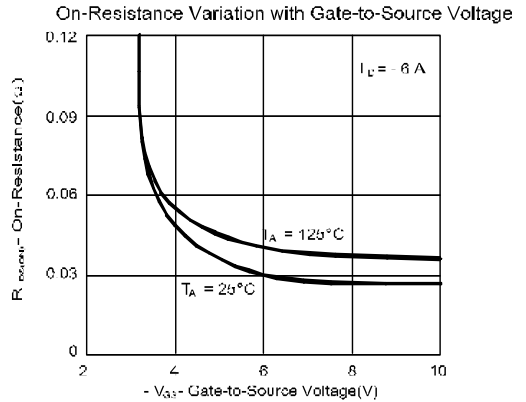
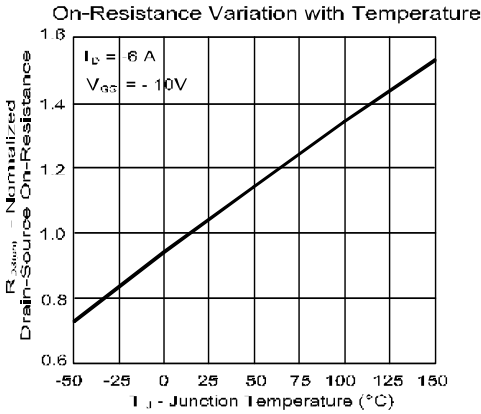
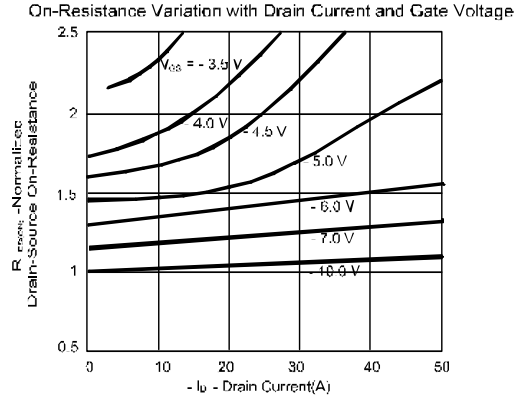
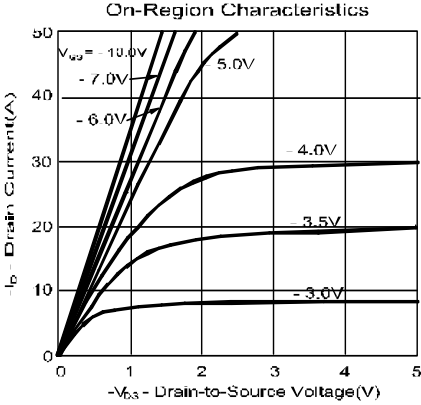
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