Complementary MOSFET

ELM35600KA-S

■General Description

ELM35600KA-S uses advanced trench technology to provide excellent Rds(on) and low gate charge.

■Features

N-channel	P-channel
• Vds=60V	Vds=−60V
• Id=5A	Id=−4A
• Rds(on) < 58mΩ(Vgs=10V)	Rds(on) < 90mΩ(Vgs=−10V)
• Rds(on) < 85mΩ(Vgs=4.5V)	Rds(on) < 135mΩ(Vgs=−4.5V)

■Maximum Absolute Ratings

Parameter		Symbol	N-ch (Max.)	P-ch (Max.)	Unit	Note
Drain-source voltage		Vds	60	−60	V	
Gate-source voltage		Vgs	±20	±20	V	
Continuous drain current	Ta=25℃	Id	5	−4	A	
	Ta=70℃		4	−3		
Pulsed drain current		Idm	40	−30	A	1
Power dissipation	Ta=25℃	Pd	3.0	3.0	W	
	Ta=70℃		2.1	2.1		
Junction and storage temperature range		Tj,Tstg	-55 to 150	-55 to 150	℃	

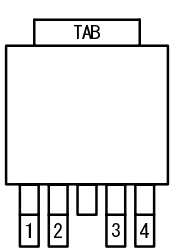
■Thermal Characteristics

Parameter		Symbol	Device	Typ.	Max.	Unit	Note
Maximum junction-to-ambient		Rθja	N-ch		42	℃/W	
Maximum junction−to−case		Rθjc	N-ch		6	℃/W	
Maximum junction-to-ambient		Rθja	P-ch		42	℃/W	
Maximum junction−to−case		Rθjc	P-ch		6	℃/W	

1. Pulse width limited by maximum junction temperature.
2. Duty cycle ≤ 1%.

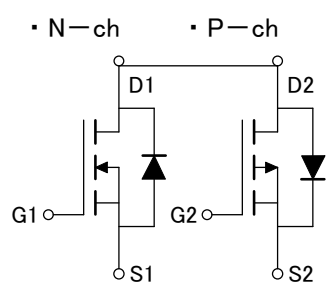
■Pin Configuration

TO-252-4 (TOP VIEW)



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

■Circuit



■Electrical Characteristics (N-ch)

Ta=25℃

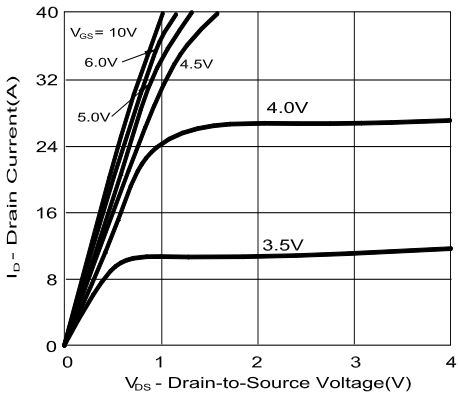
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
STATIC PARAMETERS							
Drain-source breakdown voltage	BVdss	Id=250μA, Vgs=0V	60			V	
Zero gate voltage drain current	Idss	Vds=48V, Vgs=0V			1	μA	
		Vds=40V, Vgs=0V, Tj=55℃			10		
Gate-body leakage current	Igss	Vds=0V, Vgs=±20V			±100	nA	
Gate threshold voltage	Vgs(th)	Vds=Vgs, Id=250μA	1.0	1.5	2.5	V	
On state drain current	Id(on)	Vgs=10V, Vds=5V	40			A	1
Static drain-source on-resistance	Rds(on)	Vgs=10V, Id=5A		42	58	mΩ	1
		Vgs=4.5V, Id=4A		55	85		
Forward transconductance	Gfs	Vds=10V, Id=5A		14		S	1
Diode forward voltage	Vsd	If=5A, Vgs=0V			1.2	V	1
DYNAMIC PARAMETERS							
Input capacitance	Ciss	Vgs=0V, Vds=30V, f=1MHz		650		pF	
Output capacitance	Coss			80		pF	
Reverse transfer capacitance	Crss			35		pF	
SWITCHING PARAMETERS							
Total gate charge	Qg	Vgs=10V, Vds=30V, Id=5A		12.0	16.0	nC	2
Gate-source charge	Qgs			2.4		nC	2
Gate-drain charge	Qgd			2.6		nC	2
Turn-on delay time	td(on)	Vgs=10V, Vds=30V, Id≅1A Rgen=6Ω		11	20	ns	2
Turn-on rise time	tr			8	18	ns	2
Turn-off delay time	td(off)			19	35	ns	2
Turn-off fall time	tf			6	15	ns	2
Body diode reverse recovery time	trr	If=5A, dI/dt=100A/μs		42		ns	
Body diode reverse recovery charge	Qrr			30		nC	

NOTE :

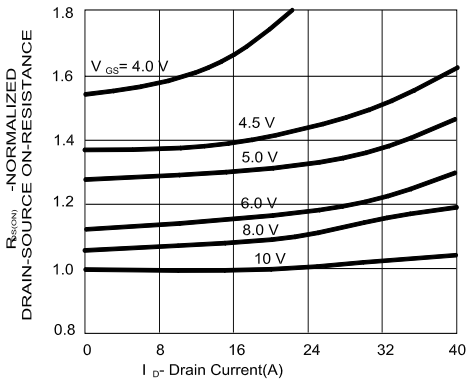
1. Pulse test : Pulse width ≤ 300μsec, duty cycle ≤ 2%.
2. Independent of operating temperature.
3. Pulse width limited by maximum junction temperature.

■Typical Electrical and Thermal Characteristics (N-ch)

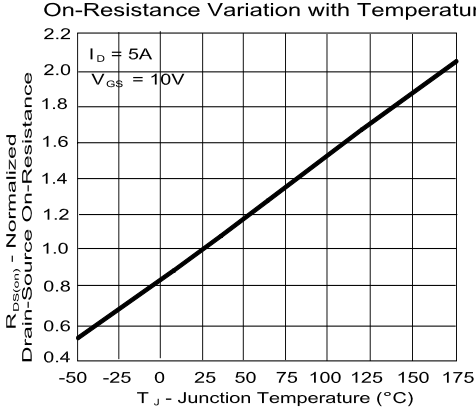
On-Region Characteristics



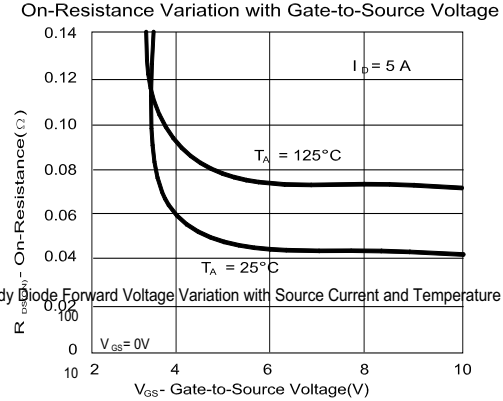
On-Resistance Variation with Drain Current and Gate Voltage



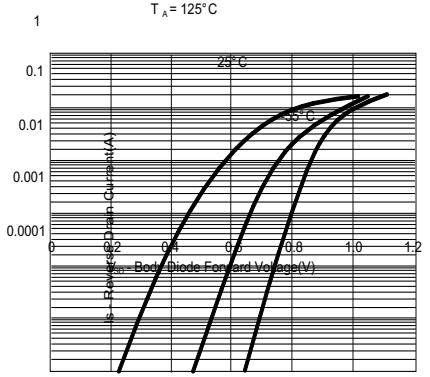
On-Resistance Variation with Temperature



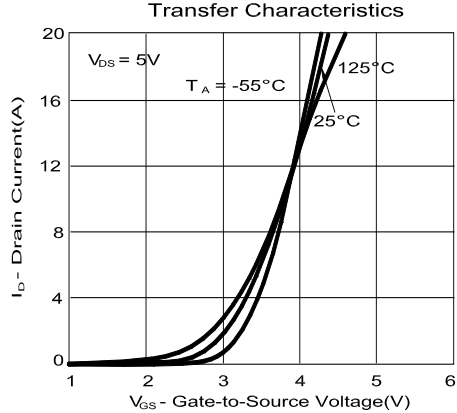
On-Resistance Variation with Gate-to-Source Voltage

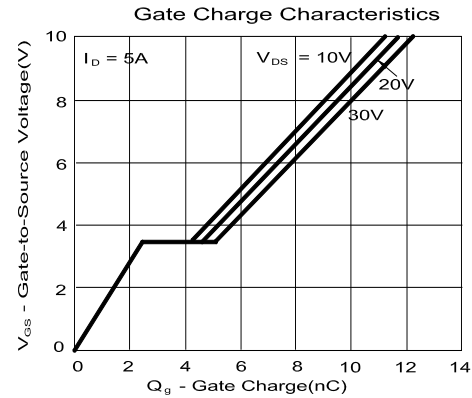


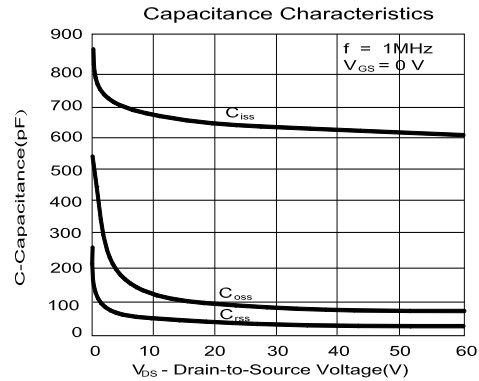
Body Diode Forward Voltage Variation with Source Current and Temperature

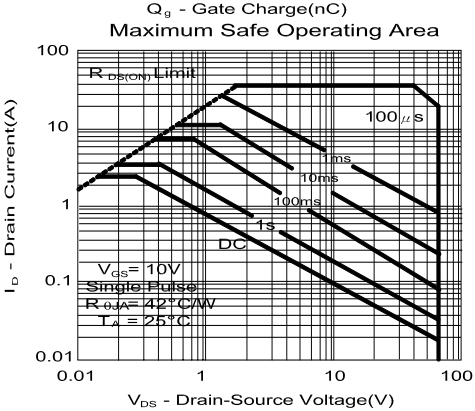


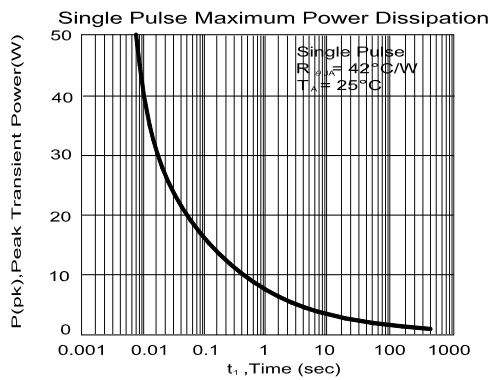
Transfer Characteristics




Gate Charge Characteristics
I_D = 5A
V_{DS} = 10V
20V
30V
V_{GS} - Gate-to-Source Voltage(V)
Q_g - Gate Charge(nC)


Capacitance Characteristics
f = 1MHz
V_{GS} = 0 V
C_{iss}
C_{oss}
C_{rss}
C-Capacitance(pF)
V_{DS} - Drain-to-Source Voltage(V)


Maximum Safe Operating Area
$R_{DS(ON)}$ Limit
100μs
1ms
10ms
100ms
1s
DC
V_{GS}= 10V
Single Pulse
$R_{\theta JA}$= 42°C/W
T_A = 25°C
I_D - Drain Current(A)
V_{DS} - Drain-Source Voltage(V)


Single Pulse Maximum Power Dissipation
Single Pulse
$R_{\theta JA}$= 42°C/W
T_A = 25°C
P(pk),Peak Transient Power(W)
t_1 ,Time (sec)

■Electrical Characteristics (P-ch)

Ta=25℃

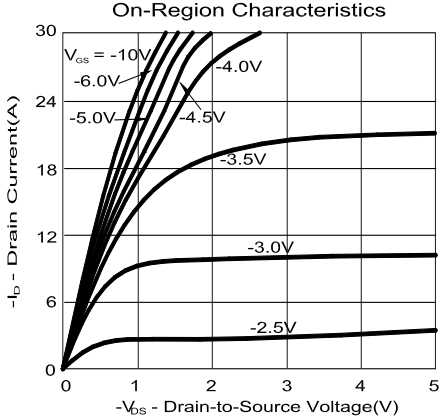
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
STATIC PARAMETERS							
Drain-source breakdown voltage	BVdss	Id=-250μA, Vgs=0V	-60			V	
Zero gate voltage drain current	Idss	Vds=-48V, Vgs=0V			-1	μA	
		Vds=-40V, Vgs=0V, Tj=55℃			-10		
Gate-body leakage current	Igss	Vds=0V, Vgs=±20V			±100	nA	
Gate threshold voltage	Vgs(th)	Vds=Vgs, Id=-250μA	-1.0	-1.5	-2.5	V	
On state drain current	Id(on)	Vgs=-10V, Vds=-5V	-30			A	1
Static drain-source on-resistance	Rds(on)	Vgs=-10V, Id=-4A		70	90	mΩ	1
		Vgs=-4.5V, Id=-3A		100	135		
Forward transconductance	Gfs	Vds=-5V, Id=-4A		9		S	1
Diode forward voltage	Vsd	If=-4A, Vgs=0V			-1.2	V	1
DYNAMIC PARAMETERS							
Input capacitance	Ciss	Vgs=0V, Vds=-30V, f=1MHz		630		pF	
Output capacitance	Coss			81		pF	
Reverse transfer capacitance	Crss			33		pF	
SWITCHING PARAMETERS							
Total gate charge	Qg	Vgs=-10V, Vds=-30V Id=-4A		11.0	15.0	nC	2
Gate-source charge	Qgs			2.1		nC	2
Gate-drain charge	Qgd			2.5		nC	2
Turn-on delay time	td(on)	Vgs=-10V, Vds=-30V Id≅-1A, Rgen=6Ω		6	13	ns	2
Turn-on rise time	tr			8	18	ns	2
Turn-off delay time	td(off)			17	31	ns	2
Turn-off fall time	tf			11	20	ns	2
Body diode reverse recovery time	trr	If=-4A, dI/dt=100A/μs		55		ns	
Body diode reverse recovery charge	Qrr			52		nC	

NOTE :

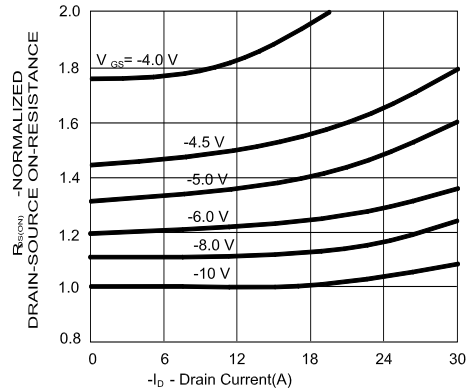
1. Pulse test : Pulse width ≤ 300μsec, duty cycle ≤ 2%.
2. Independent of operating temperature.
3. Pulse width limited by maximum junction temperature.

■Typical Electrical and Thermal Characteristics (P-ch)

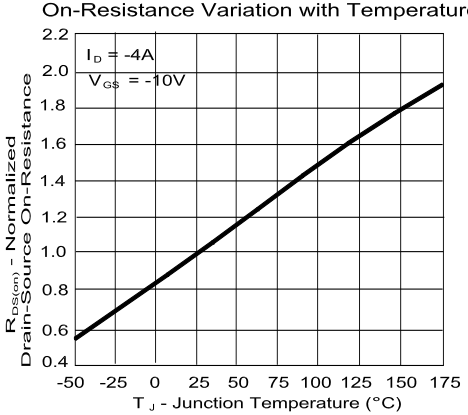
On-Region Characteristics



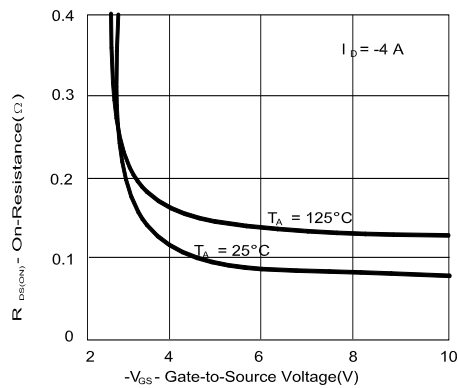
On-Resistance Variation with Drain Current and Gate Voltage



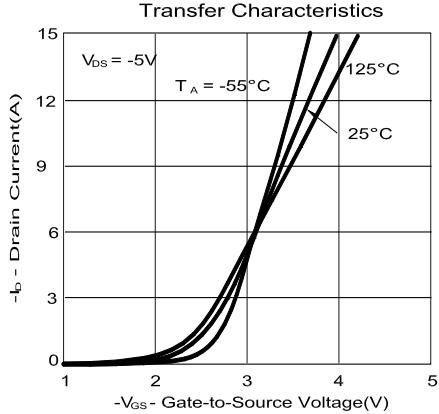
On-Resistance Variation with Temperature



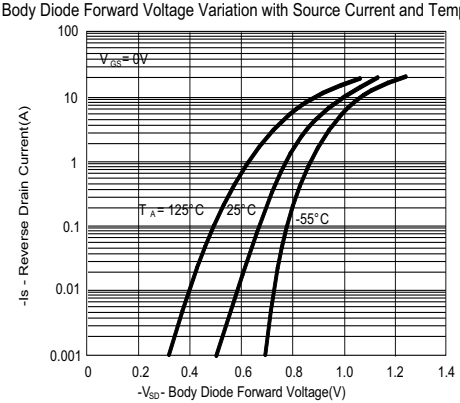
On-Resistance Variation with Gate-to-Source Voltage



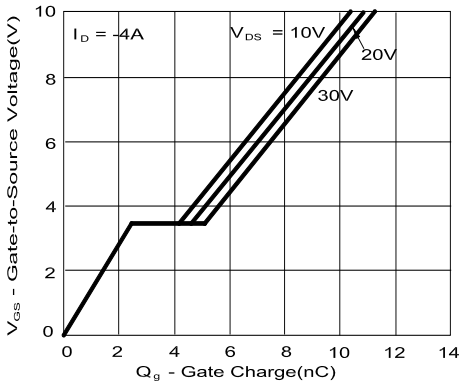
Transfer Characteristics



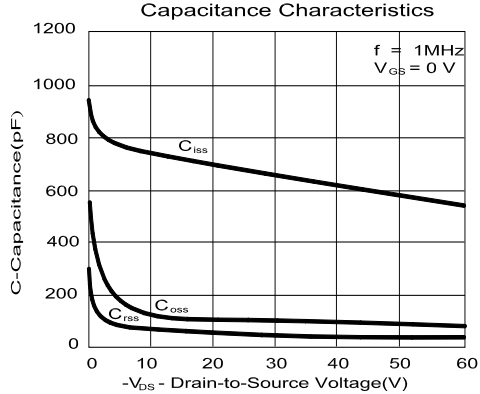
Body Diode Forward Voltage Variation with Source Current and Temperature



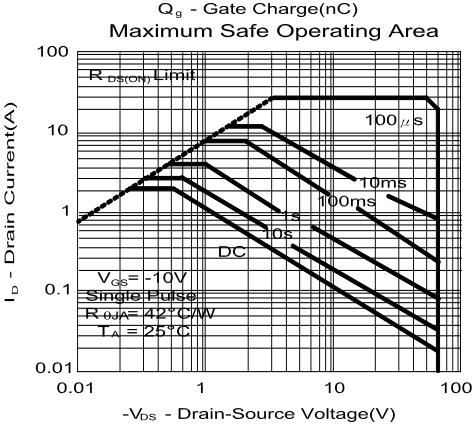
Gate Charge Characteristics



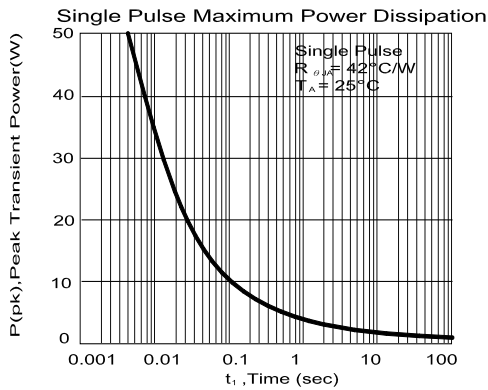
Capacitance Characteristics



Maximum Safe Operating Area



Single Pulse Maximum Power Dissipation



Transient Thermal Response Curve