Complementary MOSFET

ELM51016CA-S

■General Description

ELM51016CA-S uses advanced trench technology to provide excellent Rds(on) and low gate charge.

■Features

N-channel

- Vds=20V
- Id=0.6A
- Rds(on)=360mΩ(Vgs=4.5V)
- Rds(on)=420mΩ(Vgs=2.5V)
- Rds(on)=560mΩ(Vgs=1.8V)

P-channel

- Vds=-20V
- Id=-0.4A
- Rds(on)=620mΩ(Vgs=-4.5V)
- Rds(on)=860mΩ(Vgs=-2.5V)
- Rds(on)=1450mΩ(Vgs=-1.8V)

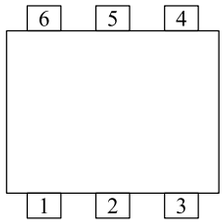
■Maximum Absolute Ratings

Ta=25°C. Unless otherwise noted.

Parameter		Symbol	N-ch (Max.)	P-ch (Max.)	Unit
Drain-source voltage		Vds	20	-20	V
Gate-source voltage		Vgs	±12	±12	V
Continuous drain current(Tj=150°C)	Ta=25°C	Id	0.6	-0.4	A
	Ta=70°C		0.4	-0.2	
Pulsed drain current		Idm	1.0	-1.0	A
Power dissipation	Tc=25°C	Pd	0.27	0.27	W
	Tc=70°C		0.16	0.16	
Operating junction temperature		Tj	-55 to 150	-55 to 150	°C
Storage temperature range		Tstg	-55 to 150	-55 to 150	°C

■Pin configuration

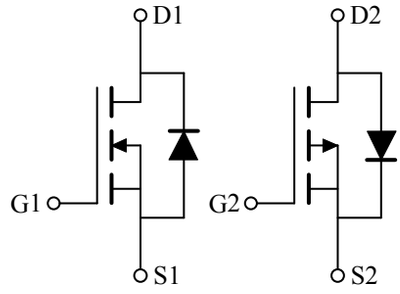
SOT-563(TOP VIEW)



Pin No.	Pin name
1	SOURCE1
2	GATE1
3	DRAIN2
4	SOURCE2
5	GATE2
6	DRAIN1

■Circuit

- N-ch
- P-ch

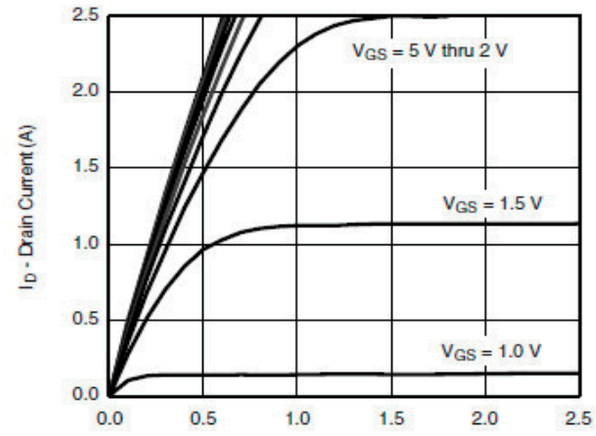


■Electrical Characteristics (N-ch)

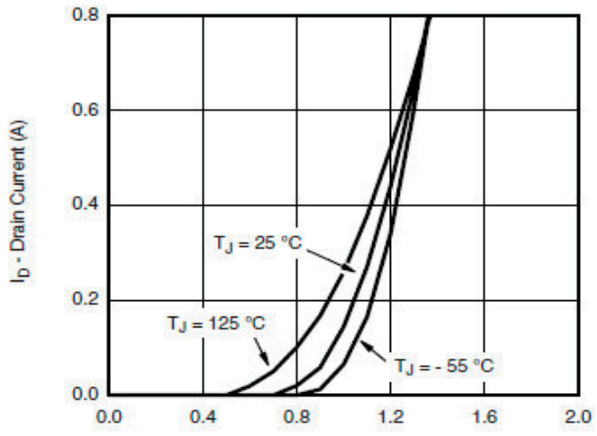
Ta=25°C. Unless otherwise noted.

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
STATIC PARAMETERS							
Drain-source breakdown voltage	BVdss	Id=250μA, Vgs=0V		20			V
Zero gate voltage drain current	Idss	Vds=20V, Vgs=0V				1	μA
			Ta=85°C			5	
Gate-body leakage current	Igss	Vds=0V, Vgs=±12V				±100	nA
Gate threshold voltage	Vgs(th)	Vds=Vgs, Id=250μA		0.4		1.0	V
On state drain current	Id(on)	Vgs=4.5V, Vds≥5V		0.7			A
Static drain-source on-resistance	Rds(on)	Vgs=4.5V, Id=0.6A			240	360	mΩ
		Vgs=2.5V, Id=0.5A			300	420	
		Vgs=1.8V, Id=0.4A			420	560	
Forward transconductance	Gfs	Vds=10V, Id=0.4A			1		S
Diode forward voltage	Vsd	Is=0.15A, Vgs=0V			0.8	1.2	V
Max.body-diode continuous current	Is					0.3	A
DYNAMIC PARAMETERS							
Input capacitance	Ciss	Vgs=0V, Vds=10V, f=1MHz			70		pF
Output capacitance	Coss				20		pF
Reverse transfer capacitance	Crss				8		pF
SWITCHING PARAMETERS							
Total gate charge	Qg	Vgs=4.5V, Vds=10V, Id≡0.6A			1.06	1.38	nC
Gate-source charge	Qgs				0.18		nC
Gate-drain charge	Qgd				0.32		nC
Turn-on delay time	td(on)	Vgs=4.5V, Vds=10V, Id≡0.5A RL=20Ω, Rgen=1Ω			18	26	ns
Turn-on rise time	tr				20	28	ns
Turn-off delay time	td(off)				70	110	ns
Turn-off fall time	tf				25	40	ns

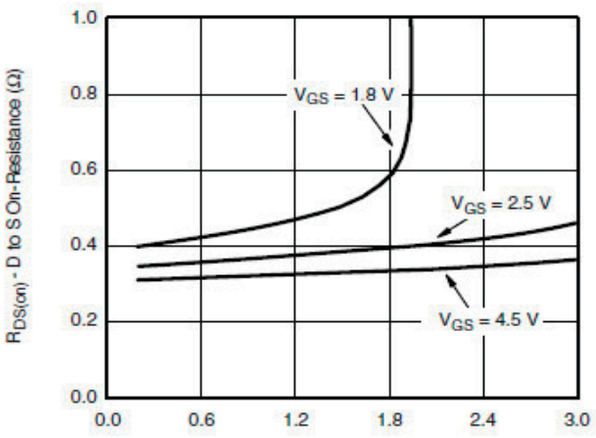
■Typical Electrical and Thermal Characteristics (N-ch)



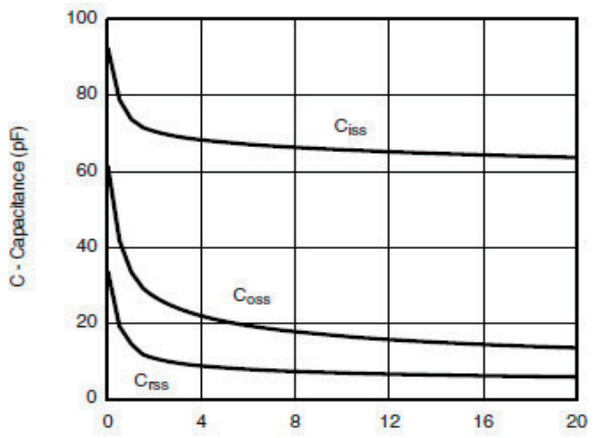
Output Characteristics



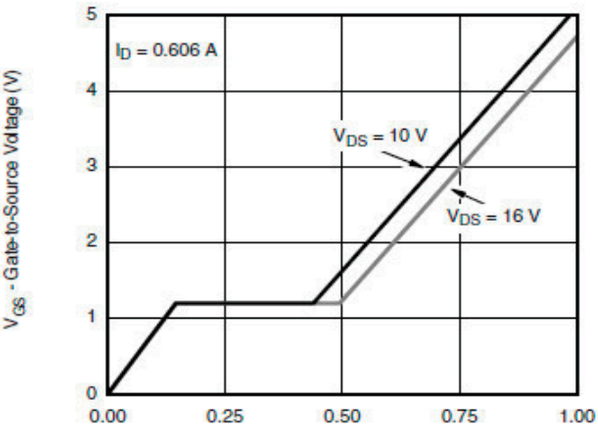
Transfer Characteristics



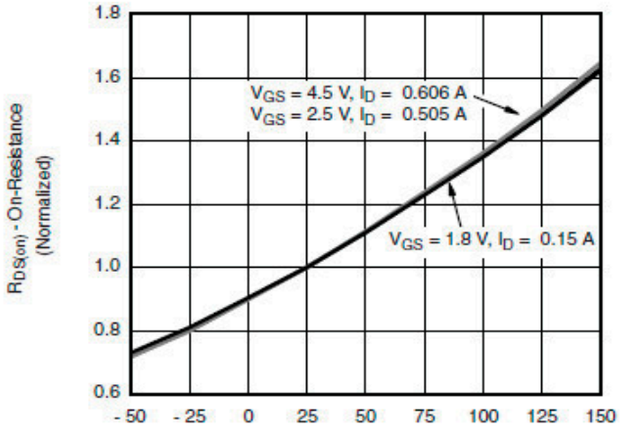
On-Resistance vs. Drain Current



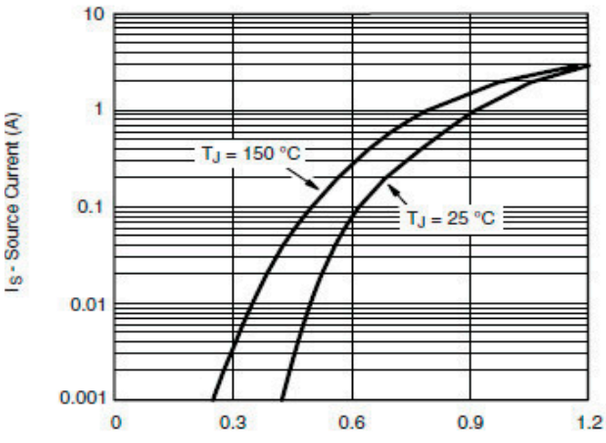
Capacitance



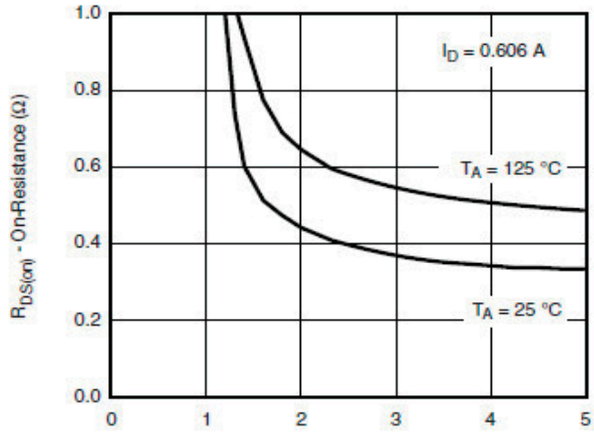
Gate Charge



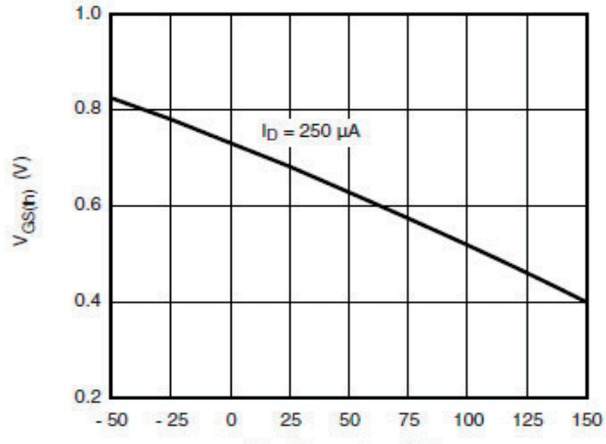
On-Resistance vs. Junction Temperature



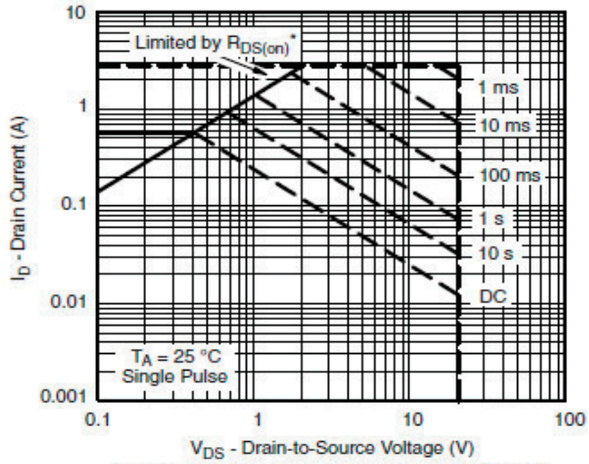
Source-Drain Diode Forward Voltage



$R_{DS(on)}$ vs. V_{GS} vs Temperature

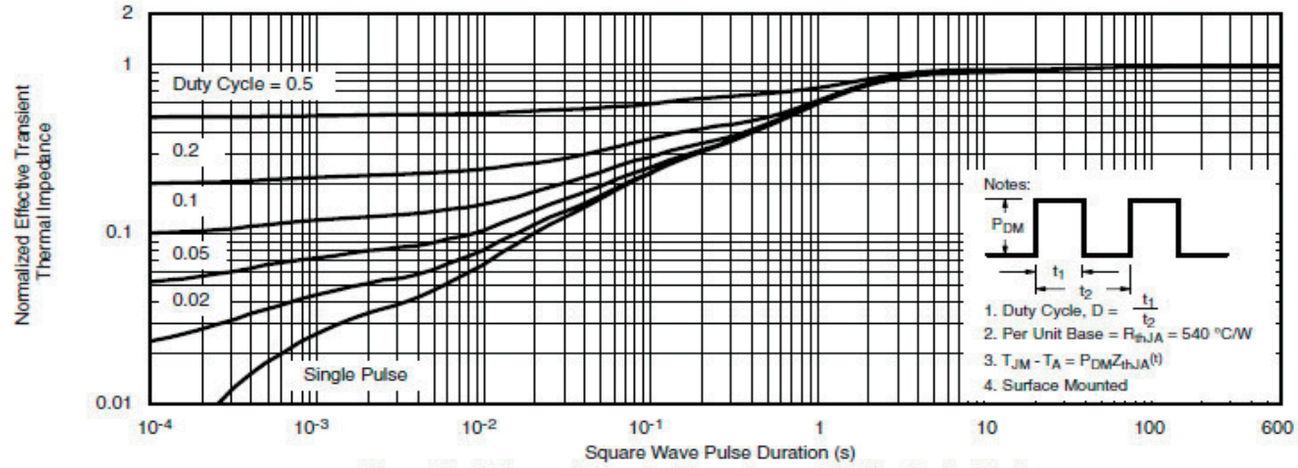


Threshold Voltage



* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

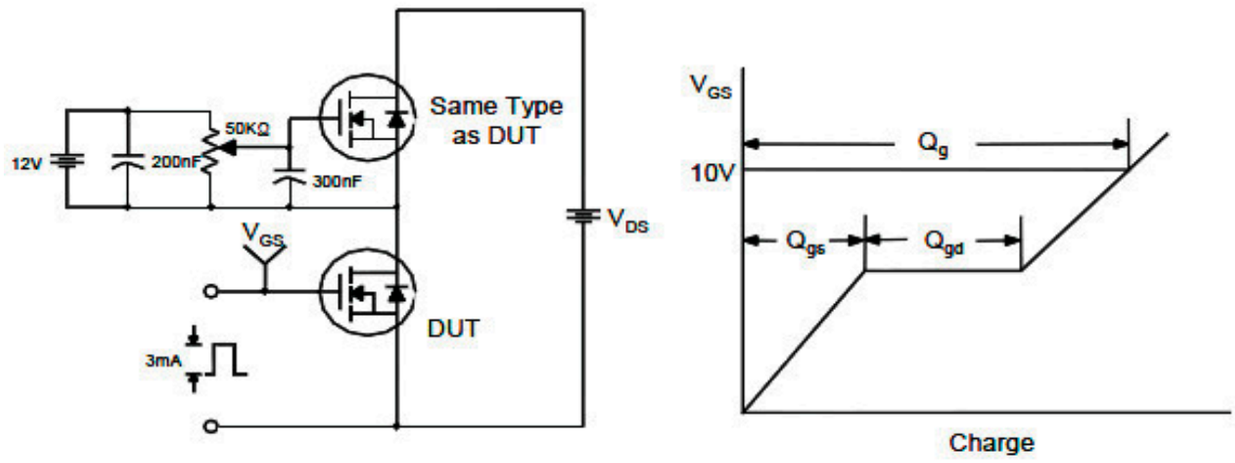
Safe Operating Area, Junction-to-Ambient



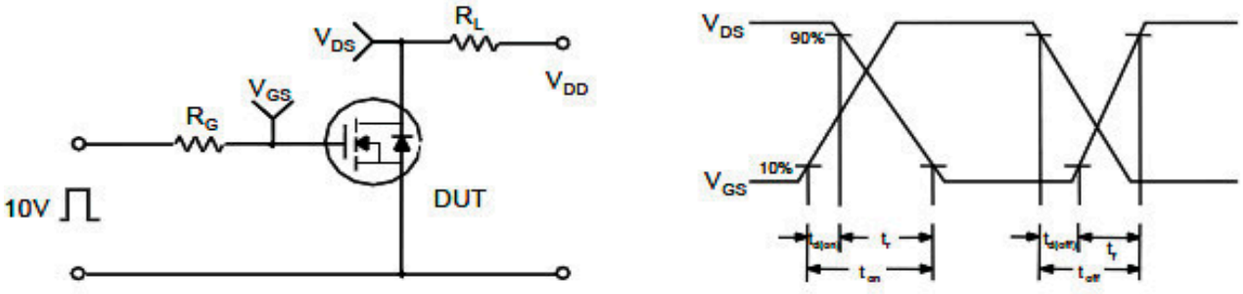
Normalized Thermal Transient Impedance, Junction-to-Ambient

■Test circuit and waveform **(N-ch)**

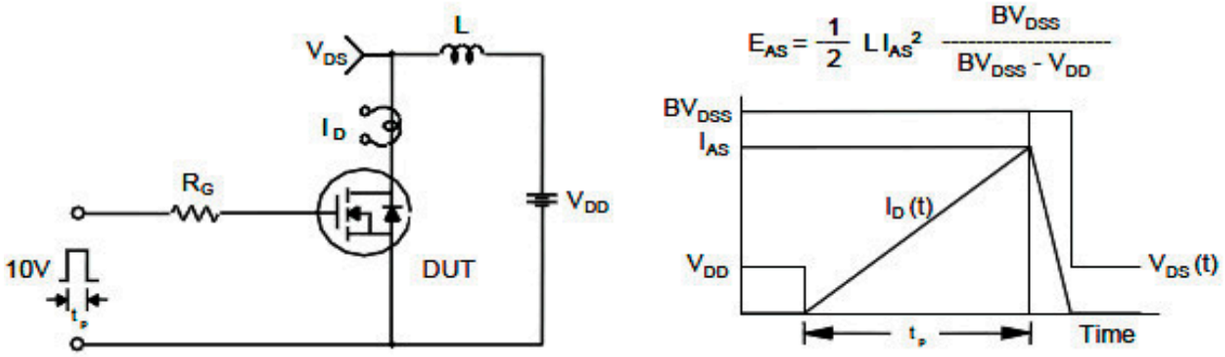
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

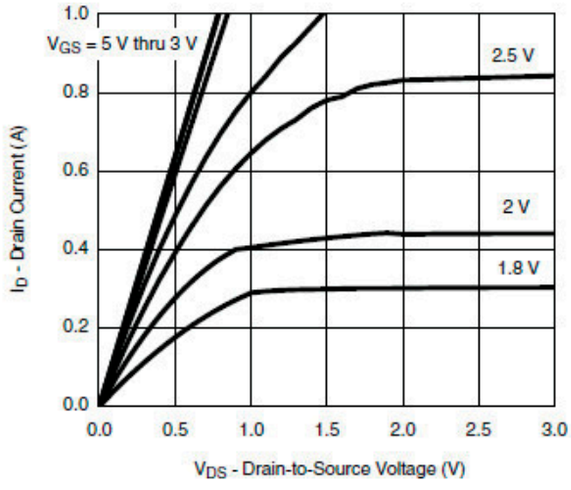


■Electrical Characteristics (P-ch)

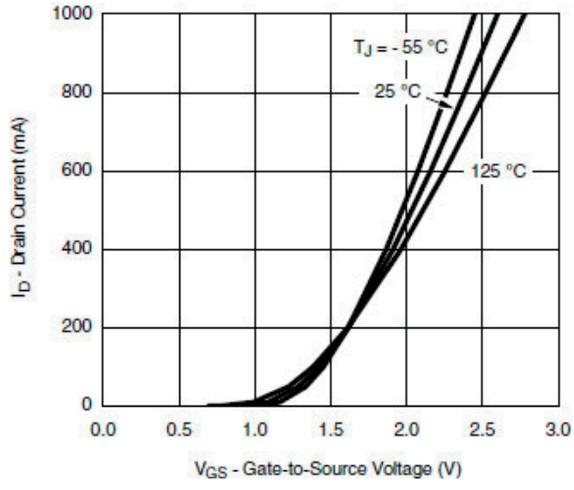
Ta=25°C. Unless otherwise noted.

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
STATIC PARAMETERS							
Drain-source breakdown voltage	BVdss	Id=-250μA, Vgs=0V		-20			V
Zero gate voltage drain current	Idss	Vds=-20V, Vgs=0V				-1	μA
			Ta=85°C			-5	
Gate-body leakage current	Igss	Vds=0V, Vgs=±12V				±100	nA
Gate threshold voltage	Vgs(th)	Vds=Vgs, Id=-250μA		-0.4		-1.0	V
On state drain current	Id(on)	Vgs=-4.5V, Vds≥-5V		-0.7			A
Static drain-source on-resistance	Rds(on)	Vgs=-4.5V, Id=-0.4A			500	620	mΩ
		Vgs=-2.5V, Id=-0.3A			700	860	
		Vgs=-1.8V, Id=-0.2A			1000	1450	
Forward transconductance	Gfs	Vds=-10V, Id=-0.4A			1		S
Diode forward voltage	Vsd	Is=-0.15A, Vgs=0V			-0.65	-1.20	V
Max. body-diode continuous current	Is					-0.3	A
DYNAMIC PARAMETERS							
Input capacitance	Ciss	Vgs=0V, Vds=-10V, f=1MHz			70	100	pF
Output capacitance	Coss				20		pF
Reverse transfer capacitance	Crss				10		pF
SWITCHING PARAMETERS							
Total gate charge	Qg	Vgs=-4.5V, Vds=-10V Id≡-0.25A			1.0	1.3	nC
Gate-source charge	Qgs				0.1		nC
Gate-drain charge	Qgd				0.3		nC
Turn-on delay time	td(on)	Vgs=-4.5V, Vds=-10V Id≡-0.2A, RL=30Ω Rgen=10Ω			10	15	ns
Turn-on rise time	tr				10	15	ns
Turn-off delay time	td(off)				40	60	ns
Turn-off fall time	tf				30	50	ns

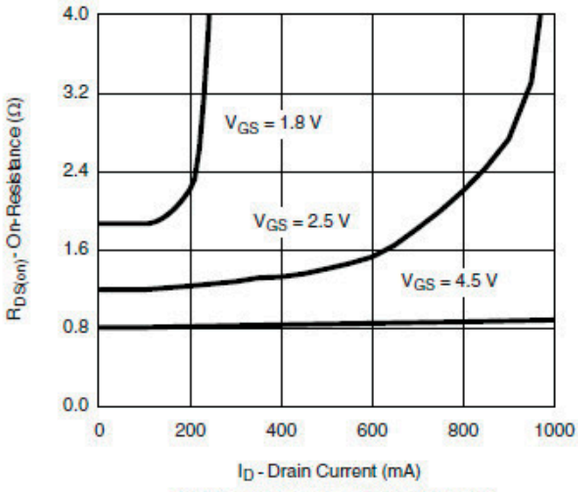
■Typical Electrical and Thermal Characteristics (P-ch)



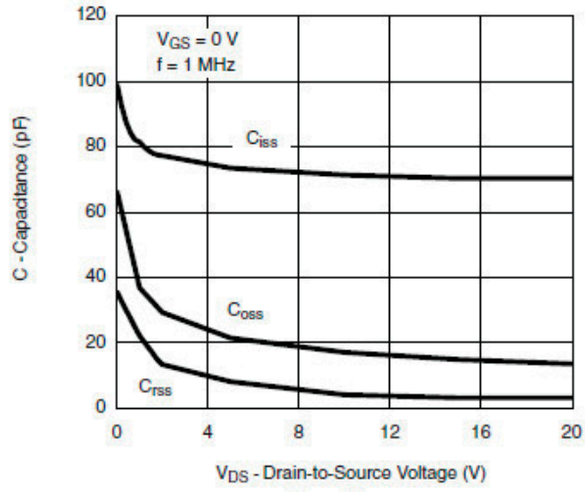
Output Characteristics



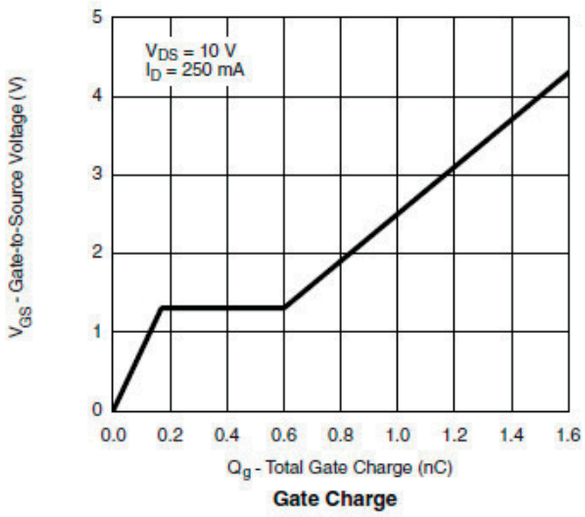
Transfer Characteristics



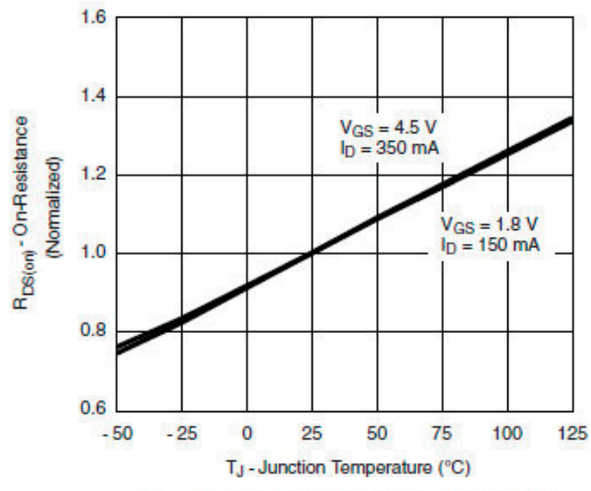
On-Resistance vs. Drain Current



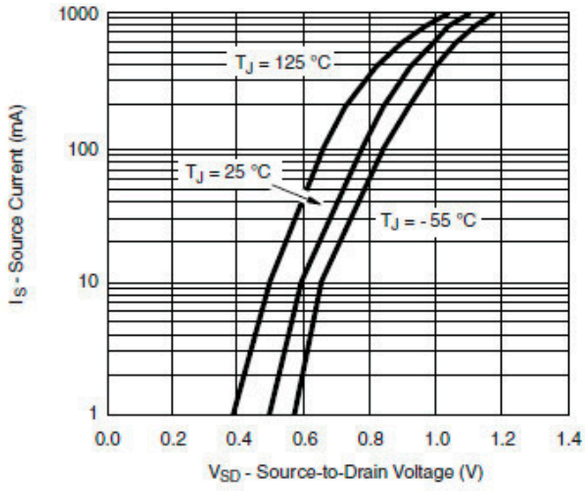
Capacitance



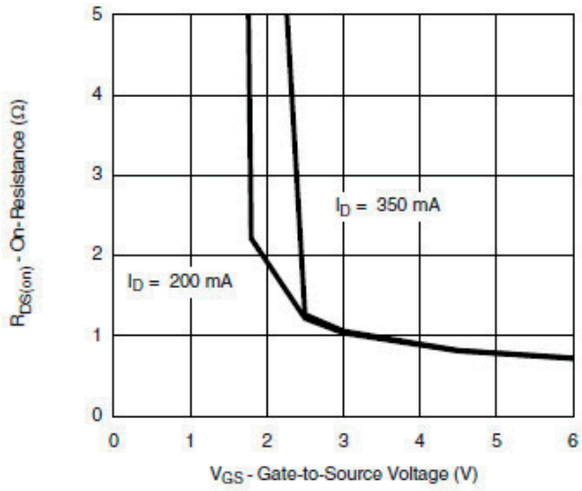
Gate Charge



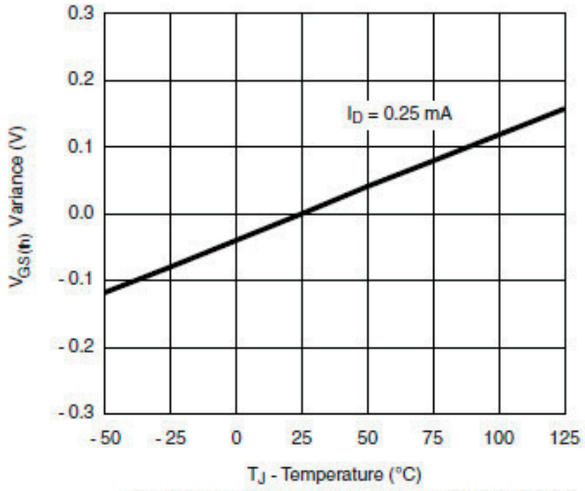
On-Resistance vs. Junction Temperature



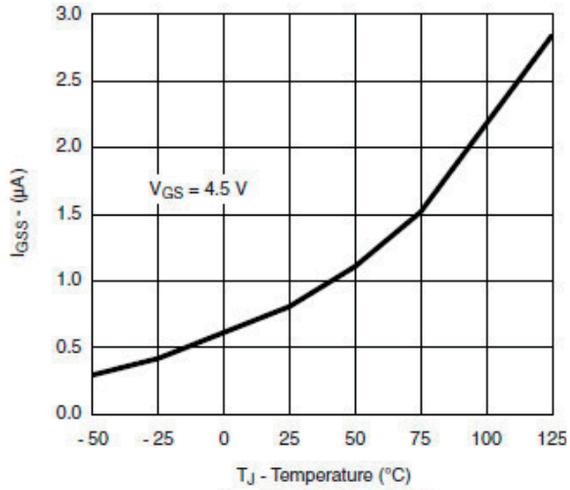
Source-Drain Diode Forward Voltage



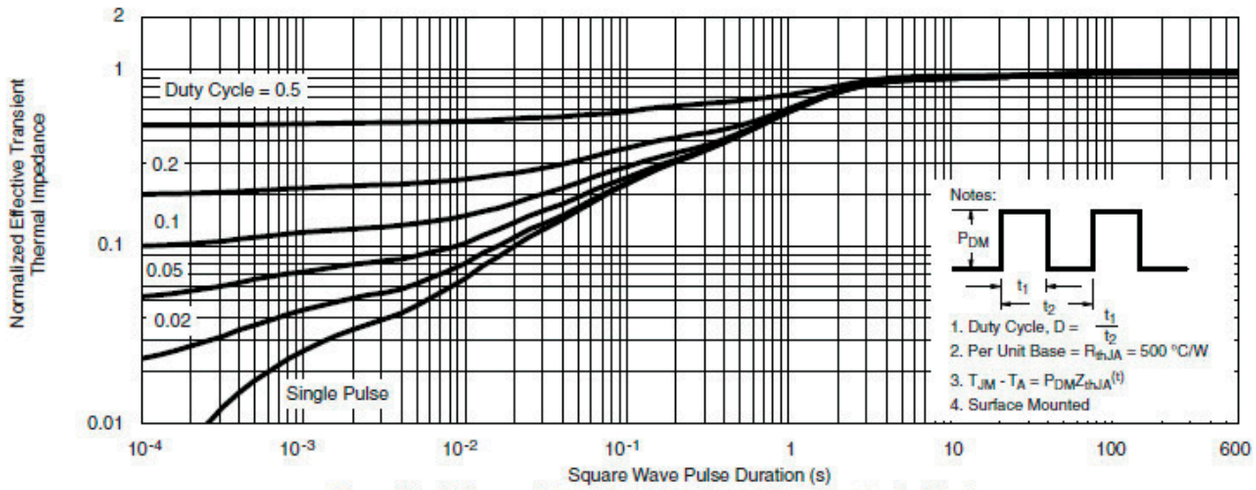
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage Variance vs. Temperature



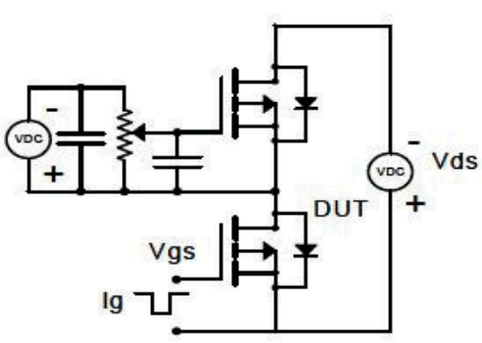
I_{GSS} vs. Temperature

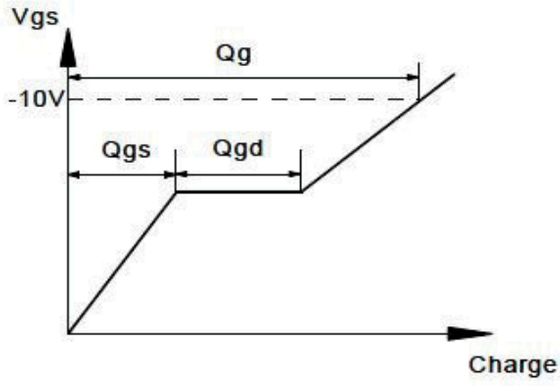


Normalized Thermal Transient Impedance, Junction-to-Ambient

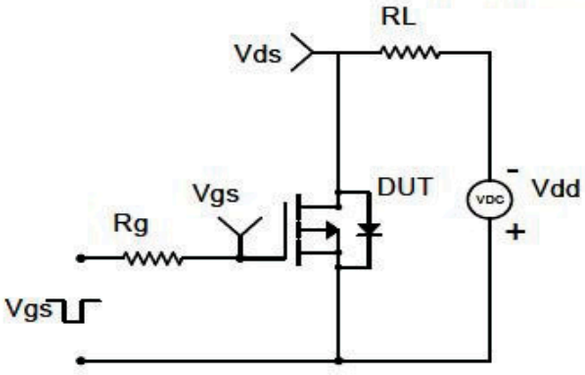
■Test circuit and waveform **(P-ch)**

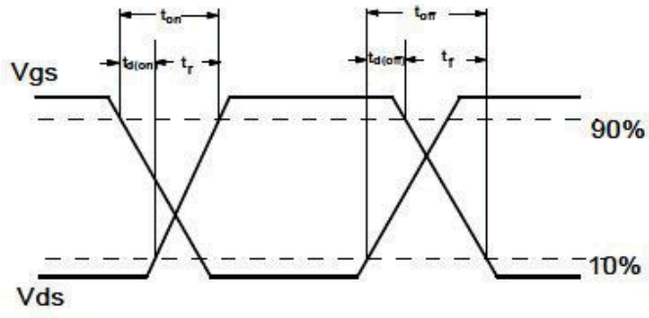
Gate Charge Test Circuit & Waveform





Resistive Switching Test Circuit & Waveforms





Diode Recovery Test Circuit & Waveforms